

2013 Harley-Davidson Dyna Models Service Manual

99481-13A

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IMPORTANT NOTICE

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

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

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

Harley-Davidson Motor Company

2013 Harley-Davidson Dyna Models Service Manual

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2013 Harley-Davidson Dyna Models Service Manual (99481-13A)

Please clip out and mail to:
Service Communications Department
Harley-Davidson Motor Company
P.O. Box 653
Milwaukee, WI USA 53201

NOTES

ABOUT THIS MANUAL

GENERAL

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 SERVICE MANUAL

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

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

Use the TABLE OF CONTENTS (which follows this FOREWORD) and the INDEX (at the back of this manual) to quickly locate subjects. 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 E.1 GLOSSARY for a list of acronyms, abbreviations and definitions.

PREPARATION FOR SERVICE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

⚠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 interim 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.

WARNINGS 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, and is placed in italic type. It is recommended that you take special notice of these items.

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

⚠WARNING

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

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

Kent-Moore Products

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

LOCTITE Sealing and THREADLOCKING Products

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

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

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

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NOTES

FASTENER TORQUE VALUES 1.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Axle adjuster	120-144 **in-lbs**	13.6-16.3 Nm	1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection/Tighten after axle is tightened.
Axle nut, rear	95-105 ft-lbs	128.8-142.4 Nm	1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection
Battery terminal fastener	60-72 **in-lbs**	6.8-8.1 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm	1.5 MAINTENANCE SCHEDULE, General
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm	1.20 BATTERY MAINTENANCE, Installation and Connection
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm	1.20 BATTERY MAINTENANCE, Installation and Connection
Brake manifold fastener	36-60 **in-lbs**	4.0-6.8 Nm	1.18 STEERING HEAD BEARINGS, Adjustment
Brake pad pin/bridge bolt, front caliper	15-16 ft-lbs	20.3-22.6 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Caliper, front, mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Clutch adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch cable adjustment jamnut	120 **in-lbs**	13.6 Nm	1.11 CLUTCH, Adjustment
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant/Torque sequence
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Fork clamp stem nut	70-80 ft-lbs	95-108.5 Nm	1.18 STEERING HEAD BEARINGS, Adjustment
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	1.5 MAINTENANCE SCHEDULE, General
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	1.13 THROTTLE CABLES, Cable Inspection, Lubrication and Adjustment
Headlamp horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	1.22 HEADLAMP ALIGNMENT, Adjustment: All Models Except FLD
Headlamp vertical adjusting nut	25-30 ft-lbs	33.9-40.7 Nm	1.22 HEADLAMP ALIGNMENT, Adjustment: All Models Except FLD

FASTENER	TORQUE VALUE		NOTES
Master cylinder cover screw torque: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder cover screw torque: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir cover screws: rear cover, including ABS	6-8 **in-lbs**	0.7-0.9 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Pad pin, rear caliper	80-120 **in-lbs**	9.0-13.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.5 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Rear caliper fasteners	16-20 ft-lbs	21.7-27.1 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.5 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.17 SPARK PLUGS, Inspection
Spoke nipple	55 **in-lbs**	6.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Spoke nipple	55 **in-lbs**	6.2 Nm	1.8 TIRES AND WHEELS, Wheel Spokes
Transmission dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Checking Transmission Lubricant
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission filler plug/dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Upper nacelle fasteners	84-120 **in-lbs**	9.5-13.5 Nm	1.18 STEERING HEAD BEARINGS, Adjustment

GENERAL 1.2

SERVICING A NEW MOTORCYCLE

⚠WARNING

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

Perform necessary set-up tasks before customer delivery. See applicable model year predelivery 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 head bolts 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.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and discs for wear.
5. Cables for fraying, crimping and free operation.
6. Engine oil and transmission fluid levels.
7. 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. (00466c)

Always use blocking or proper stands to support the part that has been hoisted. If a part cannot be removed, verify that all bolts and attaching hardware have been removed. 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 threadlocking 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.
- Clear 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 check 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 threadlocking agent.

If it has a threadlocking 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 threadlocking product. Install and tighten the fastener to specification.

If the fastener does not use a threadlocking 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 from becoming lost during a repair procedure. However, hardened steel parts 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. Magnetized parts in the engine can retain these fragments, potentially causing accelerated engine wear and damage.

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

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 preapplied threadlocking agents when fastener replacement is recommended. When re-using 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 loose 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 keeping 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

⚠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)

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

Part Protection

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

Cleaning Process

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

Rust or Corrosion Removal

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

Bearings

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.

⚠WARNING

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 a 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 lids 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 AND OIL 1.3

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 making air entrapment and pressurization a possibility.

Table 1-1. Octane Ratings

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

GASOLINE BLENDS

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

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.
- The only octane booster Harley-Davidson recommends is SCREAMIN' EAGLE SUPER OCTANE BOOST (available only in the U.S.). This is the only octane booster that has been extensively tested and approved for use with Harley-Davidson engines and 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 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. (00357c)

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. Always use the proper grade of oil for the lowest temperature expected before the next scheduled 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 1-2. Recommended Engine Oils

TYPE	VISCOSITY	RATING	LOWEST AMBIENT TEMPERATURE	COLD WEATHER STARTS BELOW 50 °F (10 °C)
Screamin' Eagle SYN 3 Full Synthetic Motorcycle Lubricant	SAE 20W50	HD 360	Above 30 °F (-1 °C)	Excellent
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 20W50	HD 360	Above 40 °F (4 °C)	Good
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 50	HD 360	Above 60 °F (16 °C)	Poor
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 60	HD 360	Above 80 °F (27 °C)	Poor
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 10W40	HD 360	Below 40 °F (4 °C)	Excellent

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.

BULB REQUIREMENTS 1.4

GENERAL

Use the table to identify the bulb location and part number. Refer to Table 1-3.

NOTE

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

Table 1-3. Bulb Chart

LAMP	DESCRIPTION	BULBS REQUIRED	CURRENT DRAW (AMPERAGE)	H-D PART NUMBER
Headlamp	High beam/low beam (domestic FXDF)	2	5.0/4.58	69838-08
	High beam/low beam (international FXDF)	2	5.0/4.58	68881-01
	High beam/low beam (all other models)	1	5.0/4.58	68329-03
	Position lamp (international)	1	0.32	53436-97
Turn signal lamp	Front/running	2	2.25/0.59	68168-89A
	Front international	2	1.75	68163-84
	Rear turn/tail/stop (domestic and Canada FXDB, FXDBP, FXDWG)	2	2.25/0.59	68168-89A
	Rear turn/tail/stop (international FXDB/FXDBP/FXDBA)	Illuminated with LEDs. Replace entire assembly upon failure.		
	Rear (domestic FLD)	2	2.25	68572-64B
	Rear (other models)	2	1.75	68163-84
Tail and stop lamp	Tail/stop lamp (Canada FXDB, FXDBP, international and Canada FXDWG)	Illuminated with LEDs. Replace entire assembly upon failure.		
	Tail/stop lamp (all other models)	1	0.59/2.10	68167-04
Instrument panel indicators	Illuminated with LEDs. Replace entire assembly upon failure.			
Fuel gauge	All models use an LED built into the gauge.			

MAINTENANCE SCHEDULE 1.5

GENERAL

FASTENER	TORQUE VALUE	
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm
Clutch adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm
Transmission dipstick	25-75 **in-lbs**	2.8-8.5 Nm
Spoke nipple	55 **in-lbs**	6.2 Nm
Master cylinder cover screw torque: front cover	12-15 **in-lbs**	1.4-1.7 Nm
Master cylinder cover screw torque: rear cover	6-8 **in-lbs**	0.7-0.9 Nm
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm
Spark plug	12-18 ft-lbs	16.3-24.4 Nm
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm

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.

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.

Table 1-4. Regular Service Intervals: 2013 Dyna Models

ITEM SERVICED	PROCEDURE	1000 MI 1600 KM	5000 MI 8000 KM	10000 MI 16000 KM	15000 MI 24000 KM	20000 MI 32000 KM	25000 MI 40000 KM	30000 MI 48000 KM	35000 MI 56000 KM	40000 MI 64000 KM	45000 MI 72000 KM	50000 MI 80000 KM	NOTES
Engine oil and filter	Replace	X	X	X	X	X	X	X	X	X	X	X	3, 7
Brake system	Inspect for leaks, contact or abrasion	X	X	X	X	X	X	X	X	X	X	X	1, 3
Air cleaner	Inspect, service as required		X	X	X	X	X	X	X	X	X	X	7
Tires	Check pressure, inspect tread	X	X	X	X	X	X	X	X	X	X	X	3
Wheel spokes (if equipped)	Check tightness	X	X			X					X		1, 5, 7
Primary chaincase lubricant	Replace	X		X		X		X		X		X	7
Transmission lubricant	Replace	X				X				X			7
Clutch	Check adjustment	X	X	X	X	X	X	X	X	X	X	X	1, 7
Drive belt and sprockets	Inspect, adjust belt	X	X	X	X	X	X	X	X	X	X	X	1
Throttle, brake and clutch controls	Check, adjust and lubricate	X	X	X	X	X	X	X	X	X	X	X	1
Jiffy stand	Inspect and lubricate	X		X		X		X		X		X	1
Fuel, lines and fittings	Inspect for leaks, contact or abrasion	X	X	X	X	X	X	X	X	X	X	X	1, 3
Fuel filter		Replace every 100,000 mi (160,000 km).											1
Brake fluid	Inspect sight glass	X	X	X	X	X	X	X	X	X	X	X	4
Brake pads and discs	Inspect for wear	X	X	X	X	X	X	X	X	X	X	X	

Table 1-4. Regular Service Intervals: 2013 Dyna Models

ITEM SERVICED	PROCEDURE	1000 MI 1600 KM	5000 MI 8000 KM	10000 MI 16000 KM	15000 MI 24000 KM	20000 MI 32000 KM	25000 MI 40000 KM	30000 MI 48000 KM	35000 MI 56000 KM	40000 MI 64000 KM	45000 MI 72000 KM	50000 MI 80000 KM	NOTES
Spark plugs	Replace							X					6
Electrical equipment and switches	Check operation	X	X	X	X	X	X	X	X	X	X	X	
Front forks	Rebuild											X	1, 8
Steering head bearings	Adjust	X		X		X		X		X		X	1, 2
Windshield bushings (if applicable)	Inspect			X		X		X		X		X	1
Critical fasteners	Check tightness	X		X		X		X		X		X	1
Engine mounts and stabilizer links	Inspect			X		X		X		X		X	1
Battery		Check battery and clean connections annually.											
Exhaust system	Inspect for leaks, cracks, and loose or missing fasteners or heat shields	X	X	X	X	X	X	X	X	X	X	X	3, 7
Road test	Verify component and system functions	X	X	X	X	X	X	X	X	X	X	X	
NOTES:	1. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified. 2. Disassemble, lubricate and inspect every 30,000 mi (48,000 km). 3. Perform annually or at specified intervals, whichever comes first. 4. Replace DOT 4 hydraulic brake fluid and flush system every two (2) years. 5. 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. 6. Perform every two years or at specified intervals, whichever comes first. 7. 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/go traffic or poor fuel quality). 8. Disassemble, inspect, rebuild forks and replace fork oil every 50,000 mi (80,000 km).												

Table 1-5. Quick Reference Maintenance Chart

ITEM SERVICED	SPECIFICATION	DATA
Engine oil and filter	Drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
	Oil capacity **	3 qt (2.4 L)
	Filter	Hand-tighten 1/2-3/4 turn after gasket contact
Primary chain lubricant	Lubricant capacity	32 oz. (0.95 L)
	Primary chaincase drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
Clutch adjustment	Free play at adjuster screw	1/2-1 turn
	Adjuster screw locknut torque	72-120 **in-lbs** (8.1-13.6 Nm)
	Free play at hand lever	1/16-1/8 in (1.6-3.2 mm)
	Clutch inspection cover torque	84-108 **in-lbs** (9.5-12.2 Nm)
Transmission lubricant	Lubricant level	Dipstick between ADD and FULL marks with motorcycle on jiffy stand and dipstick screwed in until O-ring contacts case.
	Lubricant type and capacity *	FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION or SYN3 20W50 OIL Maximum 32 oz (0.95 L)
	Transmission drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
	Dipstick torque	25-75 **in-lbs** (2.8-8.5 Nm)

Table 1-5. Quick Reference Maintenance Chart

ITEM SERVICED	SPECIFICATION	DATA
Tire condition and pressure	Pressure with or without passenger All except FXDF, FLD	Front: 30 psi (207 kPa) Rear: 40 psi (276 kPa)
	Pressure with or without passenger FXDWG	Front: 38 psi (262 kPa) Rear: 40 psi (276 kPa)
	Pressure with or without passenger FXDF, FLD	Front: 36 psi (248 kPa) Rear: 40 psi (276 kPa)
	Wear	Replace tire if 1/32 in (0.8 mm) or less of tread pattern remains
Wheel spokes	Spoke nipple torque	55 **in-lbs** (6.2 Nm)
Brake fluid reservoir level (Inspect sight glass. If fluid is low, remove reservoir cover and re-inspect.) Visual inspection on FLD is acceptable.	Type	DOT 4 hydraulic brake fluid
	Proper fluid level	Front:1/8-3/8 in (3.2-9.5 mm) below gasket surface Rear: 1/4-1/2 in (6.4-12.7 mm)
	Master cylinder cover screw torque: front	12-15 **in-lbs** (1.4-1.7 Nm)
	Master cylinder cover screw torque: rear	6-8 **in-lbs** (0.7-0.9 Nm)
Brake pad linings and discs	Minimum brake pad thickness	0.04 in (1.02 mm)
	Minimum brake disc thickness	See stamp on side of disc
Drive belt	Upward measurement force applied at midpoint of bottom of belt strand	10 lb. (4.5 kg)
	With motorcycle resting on jiffy stand without rider or luggage	1/4-5/16 in (6.4-7.9 mm)
	Vehicle upright with rear wheel in air	5/16-3/8 in (7.9-9.5 mm)
Air cleaner	Air cleaner cover bracket screw torque	40-60 **in-lbs** (4.5-6.8 Nm)
	Air cleaner cover screw torque	36-60 **in-lbs** (4.1-6.8 Nm)
	ADHESIVE for air cleaner cover screw	LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Clutch and throttle cables	LUBRICANT	HARLEY LUBE
	Hand control module housing screw torque	35-45 **in-lbs** (4.0-5.1 Nm)
Spark plugs	Type	HD-6R12
	Gap	0.038-0.043 in (0.97-1.09 mm)
	Torque	12-18 ft-lbs (16.3-24.4 Nm)
Engine idle speed	Idle speed	950-1050 RPM
Front fork oil	Amount	See 2.16 FRONT FORK.
	Type	TYPE 'E' HYDRAULIC FORK OIL
Battery	Battery terminal torque	60-70 **in-lbs** (6.8-7.9 Nm)

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

Table 1-6. Lubricants, Greases, Sealants

ITEM	PART NUMBER	PACKAGE
3M 847 Adhesive	021200-19718 *	5 oz tube
3M General Purpose Adhesive Remover		15 oz. aerosol
Anti-Seize Lubricant	98960-97	1 oz squeeze tube
CCI #20 Brake Grease	42830-05	squeeze packet (included in master cylinder rebuild kit)
DOT 4 Brake Fluid	99953-99A	12 oz bottle
Dow Corning Moly 44 Grease	94674-99	2 cc packet
Electrical Contact Lubricant	99861-02	1 oz squeeze tube
Formula+ Transmission and Primary Chaincase Lubricant	99851-05	1 qt bottle
G40M Brake Grease	42820-04	squeeze packet
Genuine Harley-Davidson Extended Life Antifreeze and Coolant	99822-02	1 gal container
Genuine Harley-Davidson H-D 360 20W50 Motorcycle Oil	99816-2050/00QT	1 qt bottle
Harley-Davidson Adhesive (Griplock)	99839-95	10 g tube
Harley-Davidson High Performance Sealant - Gray	99650-02	1.9 oz squeeze tube
Harley-Davidson Leather Dressing	98261-91V	6 oz can
Harley-Davidson Seal Grease	11300005	1 oz tube
Harley Lube	94968-09	1/4 oz needle dispenser
Hylomar Gasket and Thread Sealant	99653-85	3.5 oz tube
Loctite 222 Low Strength Threadlocker and Sealant (purple)	99811-97	6 mL tube
Loctite 243 Medium Strength Threadlocker and Sealant (blue)	99642-97	6 mL tube
	11100005	50 mL bottle
Loctite 246 Medium Strength/High Temperature Threadlocker (blue)		
Loctite 262 High Strength Threadlocker and Sealant (red)	94759-99	6 mL tube
	11100006	50 mL bottle
Loctite 411 Prism Instant Adhesive		
Loctite 420 Super Bonder Adhesive		
Loctite 565 Thread Sealant	99818-97	6 mL tube
Loctite 770 Prism Primer		
Loctite 7649 Cleaner/Primer	98968-99	1.75 oz bottle
RTV Silicone Sealer	99650-02	1.9 oz tube
Screamin' Eagle Assembly Lube	94971-09	4 oz bottle
Screamin' Eagle SYN3 Full Synthetic Motorcycle Lubricant 20W50	99824-03/00QT	1 qt bottle
Special Purpose Grease	99857-97A	14 oz cartridge
Type "E" Hydraulic Fork Oil	62600026	16 oz bottle
Wheel Bearing Grease	99855-89	1 lb can
	99856-92	14 oz cartridge
* Not a Harley-Davidson part number		

ENGINE OIL AND FILTER 1.6

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)

Check engine oil level:

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

Type of Oil

Use the proper grade of oil for the lowest temperature expected before the next oil change. For information regarding winter needs, Refer to Table 1-2 and see 1.3 FUEL AND OIL.

If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include CF-4, CG-4, CH-4 and CI-4. The preferred viscosities for the diesel engine oils, in descending order, are 20W50, 15W40 and 10W40. At the first opportunity, see a Harley-Davidson dealer to change back to 100 percent Harley-Davidson oil.

Checking with Cold Engine

1. See Figure 1-1. Unscrew and remove engine oil filler cap with attached dipstick. Wipe dipstick clean.
2. Install filler cap. Turn filler cap clockwise until it stops.
3. See Figure 1-2. Again, unscrew and remove filler cap and check oil level on dipstick. If oil level in pan is below lower mark on dipstick, add enough Harley-Davidson oil to bring level up between lower mark (1) and cold check level (2) on dipstick.

NOTE

Be sure to clean oil from dipstick threads. If oil is present on dipstick threads, it can weep past dipstick O-ring. This condition may be incorrectly diagnosed as an oil leak.

4. Replace filler cap and screw in securely.

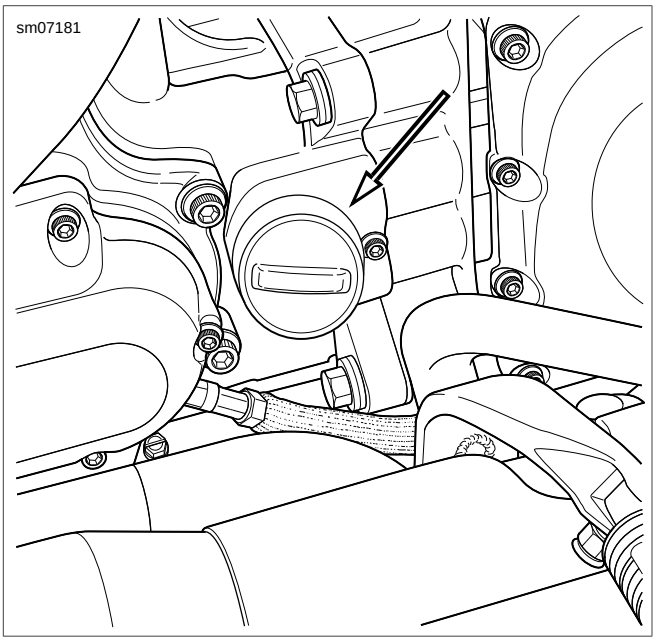
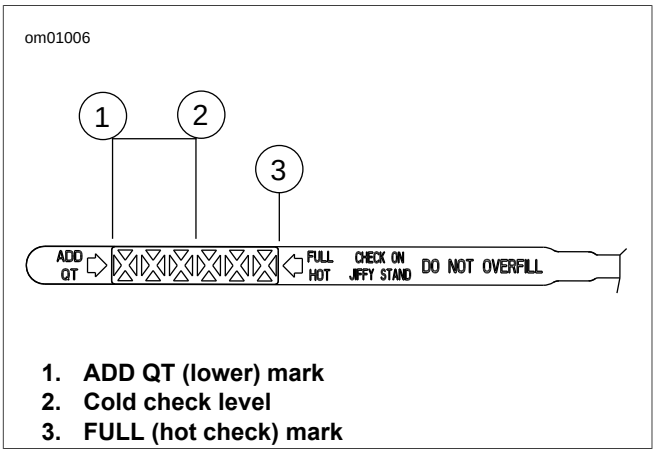


Figure 1-1. Checking Engine Oil Level



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

Figure 1-2. Engine Oil Dipstick

Checking with Warm Engine

Ride motorcycle until engine is warmed up to operating temperature, then do the following.

1. Idle motorcycle on jiffy stand for 1-2 minutes.
   a. Shut motorcycle off and with motorcycle leaning on jiffy stand on level ground.
   b. Unscrew and remove engine oil filler cap with attached dipstick.
   c. Wipe dipstick clean.

NOTE

Be sure to clean oil from dipstick threads. If oil is present on dipstick threads, it can weep past dipstick O-ring. This condition may be incorrectly diagnosed as an oil leak.

2. Install filler cap. Turn filler cap clockwise until it stops.
   a. See Figure 1-2. Again, unscrew and remove filler cap and check oil level on dipstick.
   b. If oil level in pan is below lower mark on dipstick, add enough Harley-Davidson oil to bring level up between lower mark (1) and cold check level (2) on dipstick.
   c. Replace filler cap and screw in securely.
   d. Add oil, if required, to FULL mark (3). Do not overfill.

CHANGING OIL AND FILTER

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

FASTENER	TORQUE VALUE	
Drain plug, engine	14-21 ft-lbs	19.0-28.5 Nm

NOTES

- *If the motorcycle is ridden hard, under dusty conditions, or in cold weather, it is recommended that the oil and filter be changed more often.*
- *All Dyna models are shipped from the factory with SAE 20W50 Harley-Davidson 360 Motor Oil.*
- *All Dyna models come equipped from the factory with a premium 5 micron synthetic media oil filter, chrome or black. These are the only recommended replacement filters.*

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. Unscrew and remove engine oil filler cap with attached dipstick.
3. See Figure 1-3. Remove the engine oil drain plug with O-ring. Allow oil to drain into a suitable container.

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 mount flange of any old gasket material.

NOTE

On vehicles equipped with forward controls, shift linkage may have to be removed to provide enough clearance to remove and install oil filter.

5. See Figure 1-5. Lube the gasket on **new** oil filter with engine oil and install **new** 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 pan drain plug (1).
   a. Inspect O-ring for tears or damage. Replace if required. Wipe any foreign material from plug.
   b. Install O-ring and drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
7. Fill oil pan with the correct amount of oil. Use the proper grade of oil for the lowest temperature expected before next oil change. Refer to Table 1-2.
   a. Use 2.5 qt (2.4 L) of engine oil for a wet capacity refill.
   b. Use 3.0 qt (2.7 L) for a dry capacity refill.

   NOTE

   Use wet capacity for engines that have just had the oil drained. Use dry capacity for engines that have been disassembled, cleaned in solvent and dried.
8. Check engine oil level using cold check procedure.
9. Start engine and carefully check for oil leaks around drain plug and oil filter.
10. Check engine oil level using warm check procedure.

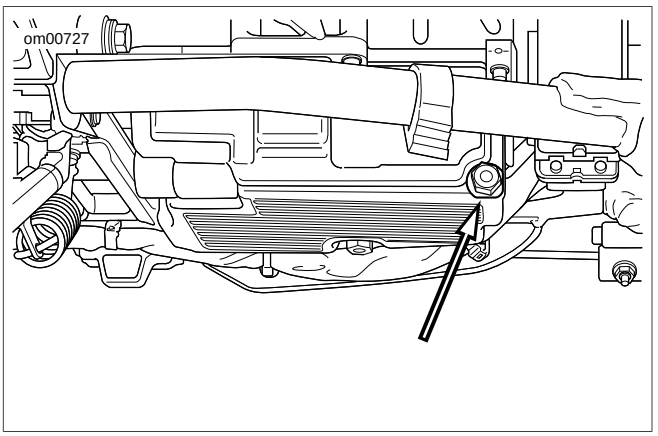


Figure 1-3. Engine Oil Drain Plug (Oil Pan Under Transmission, View From Left Side of Vehicle)

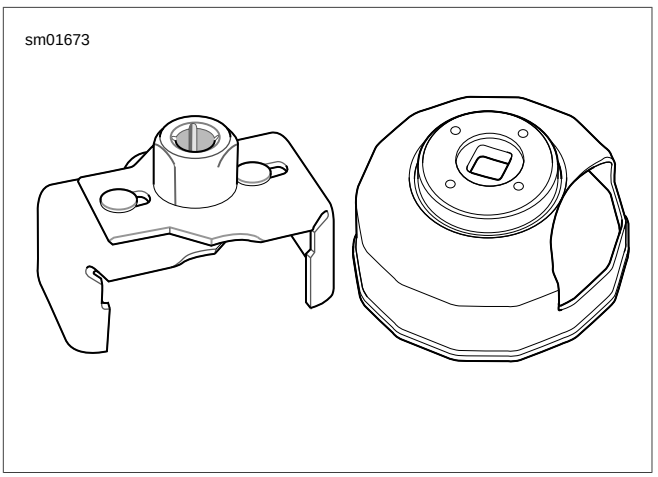


Figure 1-4. Oil Filter Wrenches

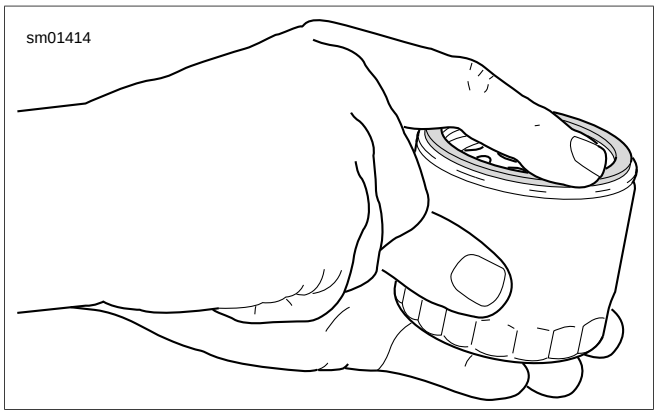


Figure 1-5. Lubricating New Oil Filter Gasket

AIR CLEANER AND EXHAUST SYSTEM 1.7

REMOVAL

1. See Figure 1-6. Remove screw (1) and air cleaner cover (2).
2. See Figure 1-7. Gently pull both breather tubes (1) from the element.
3. Slide clip-nut (2) to the left to allow access to third screw. Remove three screws (3), bracket (4) and filter element (5).
4. Replace the filter element if damaged or if filter media cannot be adequately cleaned.
5. Gently pull the breather tubes from the breather bolts on the backplate.

⚠WARNING

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

⚠WARNING

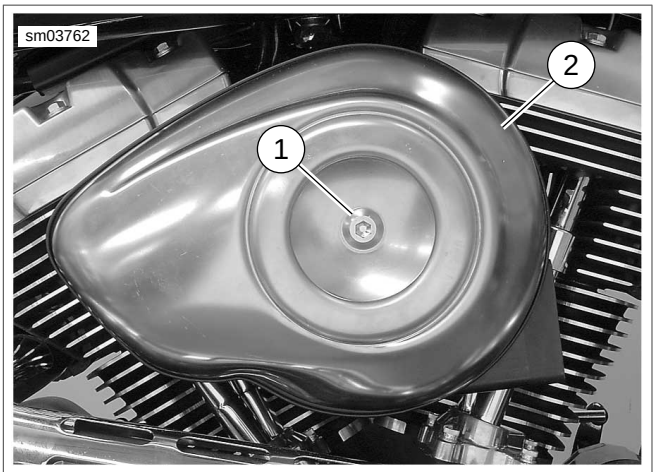
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

6. Clean filter element.
   a. Wash the paper/wire mesh air filter element and breather tubes in lukewarm water with a mild detergent. Do not strike filter element on a hard surface to dislodge dirt.
   b. Allow filter 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.
7. Inspect seal ring on cover for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
8. Inspect breather tubes for damage. Replace as necessary.

NOTES

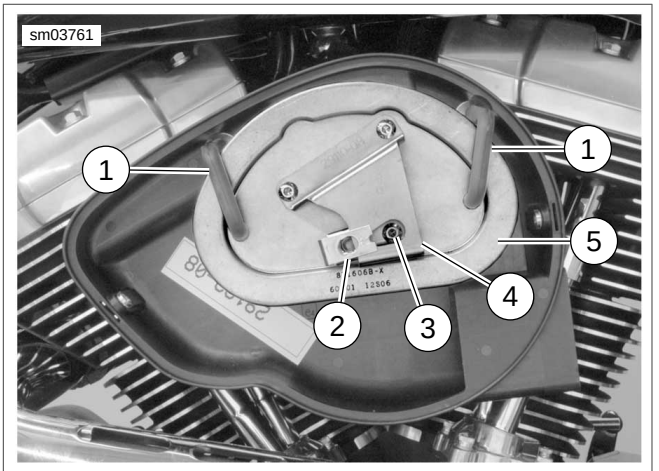
- *The breather tubes allow crankcase vapors to be directed into the air filter element. By providing effective recirculation of crankcase vapor, the tubes serve to eliminate the pollutants normally discharged from the crankcase.*
- *Air cleaner mounting without installation of the breather tubes, or with breather tubes that are not air-tight, allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards. This also negatively affects the engine's breather system as it causes the umbrella valve to flutter.*

9. Wipe inside of air cleaner cover and backplate with damp cloth to remove dust.
10. **California Models Only:** make sure trap door swings freely.



1. **Cover screw**
2. **Air cleaner cover**

Figure 1-6. Air Cleaner Cover



1. **Breather tubes**
2. **Clip-nut**
3. **Screw (3)**
4. **Bracket**
5. **Filter element**

Figure 1-7. Air Cleaner Element

INSTALLATION

FASTENER	TORQUE VALUE	
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm

1. See Figure 1-8. Position **new** gasket on filter element. Make sure gasket holes are aligned with screw holes.

2. See Figure 1-7. Attach breather tubes (1) to breather screws on backplate.
3. Install air filter element (5) and bracket (4) using three screws (3). Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). Slide clip-nut (2) to the right and into place.
4. Insert breather tubes (1) into holes in filter element.
5. See Figure 1-6. Install air cleaner 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 and tighten screw to 36-60 **in-lbs** (4.1-6.8 Nm).

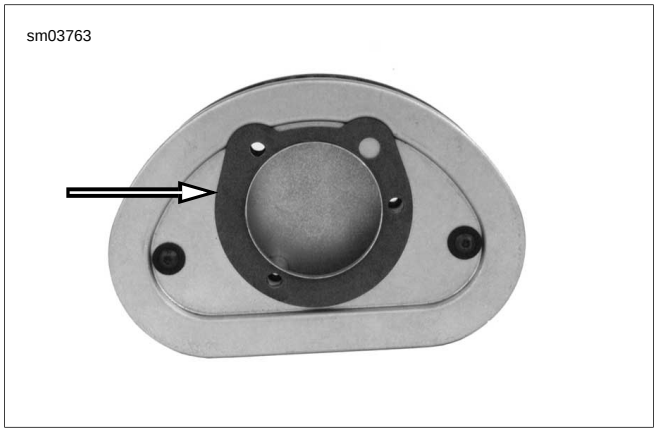


Figure 1-8. Element Gasket

EXHAUST SYSTEM LEAK CHECK

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

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

Exhaust System Leakage

If an exhaust system leak is evident at a muffler or header pipe connection, disassemble and clean all mating surfaces. See 4.15 EXHAUST SYSTEM.

- Replace any damaged components and assemble.
- If leak continues, disassemble and apply Permatex Ultra Copper or LOCTITE 5920 FLANGE SEALANT. If not available, use an equivalent oxygen sensor/catalyst-safe alternative.
- Assemble components. Wipe off any excess sealant.
- Follow sealant product instructions and allow adequate curing time before operating vehicle.

TIRES AND WHEELS 1.8

TIRES

NOTES

- *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 1-7 can reduce ABS performance.*

⚠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)

NOTES

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

Check tire pressure and tread:

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

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

⚠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 tire pressures when tires are cold. Compare results to Table 1-7.

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 1-7. Specified Tires

MODEL	MOUNT	SIZE (in)	SPECIFIED TIRE	PRESSURE (COLD)	
				psi	kPa
FXDB, FXDBP, FXDC, FXDL, FXDBA	Front	19	Michelin Scorcher "31" 100/90B19	30	206
	Rear	17	Michelin Scorcher "31" 160/70B17	40	276
FXDF	Front	16	Dunlop D427F 130/90B16	36	248
	Rear	16	Dunlop D427 180/70B16	40	276
FXDWG	Front	21	Michelin Scorcher "31" 80/90-21	38	262
	Rear	17	Michelin Scorcher "31" 180/60B17	40	276
FLD	Front	18	Dunlop D402F 130/70B18	36	248
	Rear	17	Dunlop D401 160/70B17	40	276

TIRE REPLACEMENT

⚠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

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.

Dunlop

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

See Figure 1-10. Tread wear indicator bars appear on Dunlop tire tread surfaces when 1/32 in. (0.8 mm) or less tire tread remains. Always remove tires from service before they reach the tread wear indicator bars.

Michelin

See Figure 1-11. Michelin Man on Michelin tire tread side (next to sidewall) pinpoints location of wear bar indicators. Always remove tires from service before they reach the tread wear indicator bars.

See Figure 1-12. Tread wear indicator bars appear on Michelin tire tread surfaces when 1/32 in. (0.8 mm) or less tire tread remains.

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

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

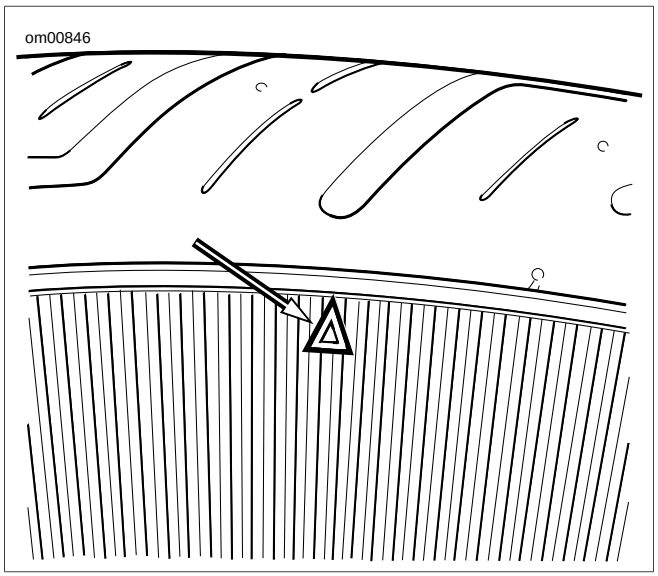


Figure 1-9. Dunlop Sidewall Tire Wear Bar Locator

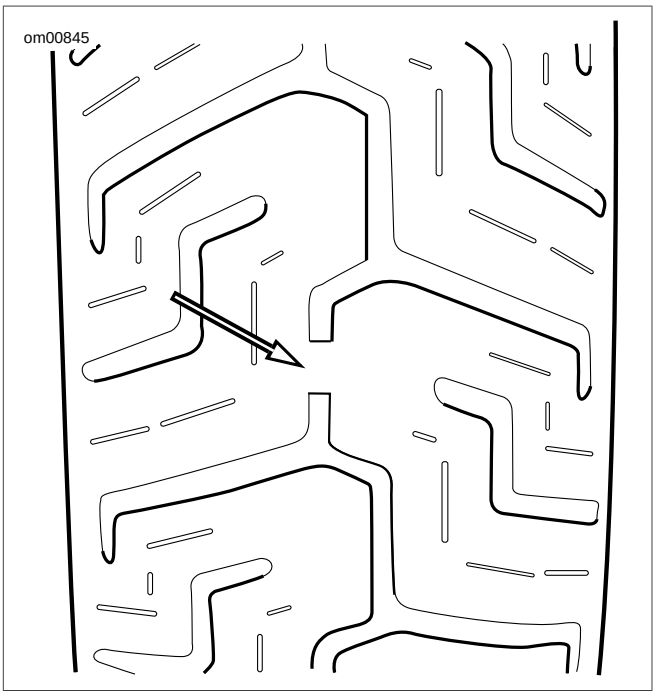


Figure 1-10. Dunlop Tire Wear Bar Appearance

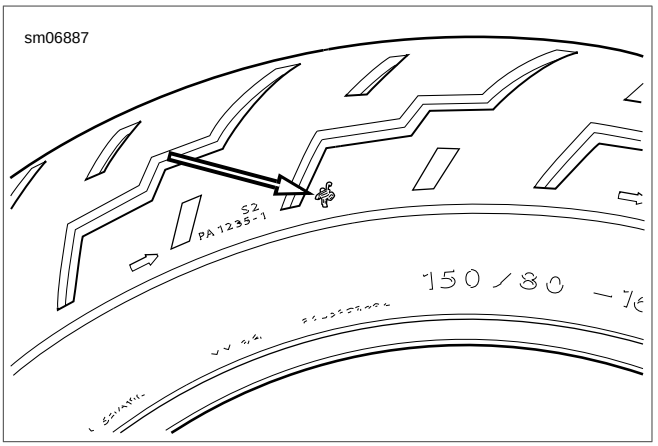


Figure 1-11. Tread Wear Indicator: Michelin Tires

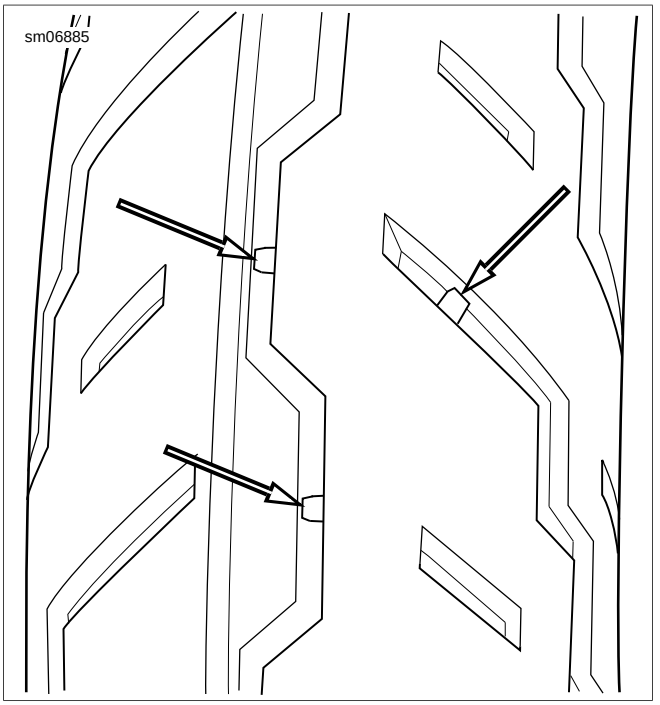


Figure 1-12. Michelin Tire Wear Bar Appearance

WHEEL BEARINGS

NOTE

Replace bearings in sets only. See 2.6 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

PART NUMBER	TOOL NAME
HD-48985	SPOKE TORQUE WRENCH
HD-94681-80	SPOKE NIPPLE WRENCH

FASTENER	TORQUE VALUE	
Spoke nipple	55 **in-lbs**	6.2 Nm

⚠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 over tighten spoke nipples. Protruding spoke nipples can damage rim seal, resulting in rapid tire deflation, which could cause death or serious injury. (00611b)

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 crossmembers, 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 1-13. 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 1-13. Starting with the first group of spokes, loosen spoke (1) using SPOKE NIPPLE WRENCH (Part No. HD-94681-80) 1/4 turn.

2. Using SPOKE TORQUE WRENCH (Part No. HD-48985) tighten spoke (1) to the value listed in Table 1-8.
   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 then 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, make sure to use the original 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 then 1/4 turn past alignment mark.
7. True the wheel. See 2.8 CHECKING AND TRUING WHEELS.

Table 1-8. Spoke Nipple Torque Specification

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

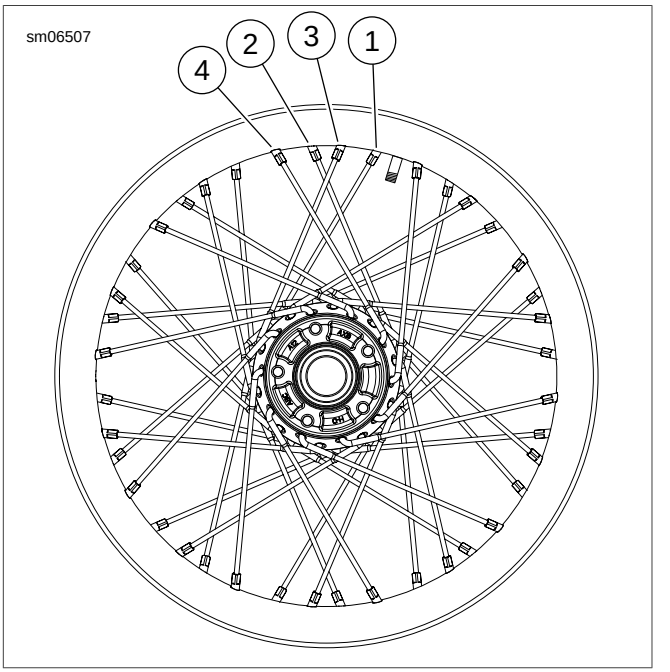


Figure 1-13. Tightening Laced Wheels (typical)

PRIMARY CHAINCASE LUBRICANT 1.9

GENERAL

All models have an automatic chain tensioner. For primary chain service procedures, see 5.4 DRIVE COMPONENTS.

CHANGING PRIMARY CHAINCASE LUBRICANT

FASTENER	TORQUE VALUE	
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm
Battery terminal fastener	60-72 **in-lbs**	6.8-8.1 Nm

1. Run motorcycle until engine is at normal operating temperature.

NOTICE

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

WARNING

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

2. See Figure 1-14. Drain lubricant into suitable container.
3. Clean drain plug. If plug has accumulated a lot of debris, inspect the condition of chaincase components.
4. Install **new** O-ring on drain plug.
5. Install drain plug into primary chaincase cover. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).

WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

6. Disconnect negative battery cable.
7. See Figure 1-15. Remove screws with 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 1-9.

Table 1-9. Primary Chaincase Lubricant Refill Capacity

ITEM	CAPACITY
Primary chaincase lubricant	32 oz (0.95 L) wet
	40 oz (1.18 L) dry

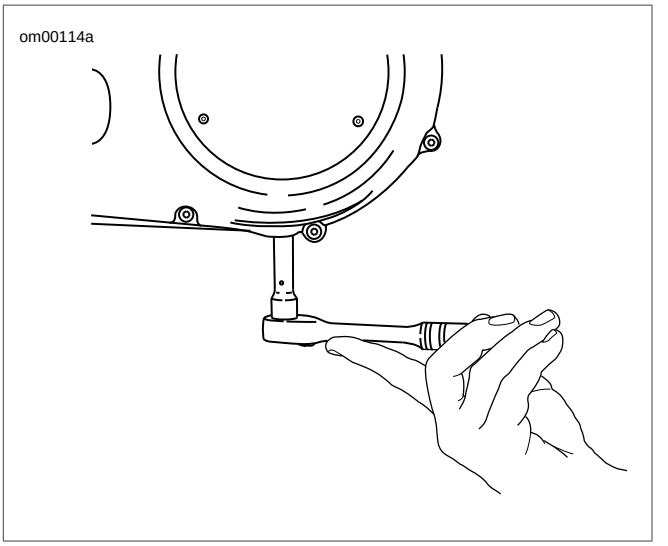
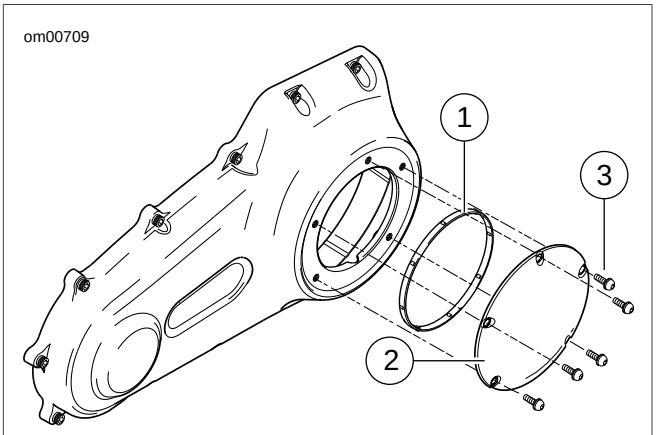


Figure 1-14. Removal/Installation of Chaincase Drain Plug



1. **Seal**
2. **Clutch inspection cover**
3. **Screw with captive washer (5)**

Figure 1-15. Clutch Cover

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 1-15. Position **new** seal (1) in groove in clutch inspection cover. Press each of the nubs on seal into the groove.
    c. Secure inspection cover with screws with captive washers (3).
    d. See Figure 1-16. Tighten in sequence shown to 84-108 **in-lbs** (9.5-12.2 Nm).
12. Connect battery negative cable. Tighten to 60-72 **in-lbs** (6.8-8.1 Nm)

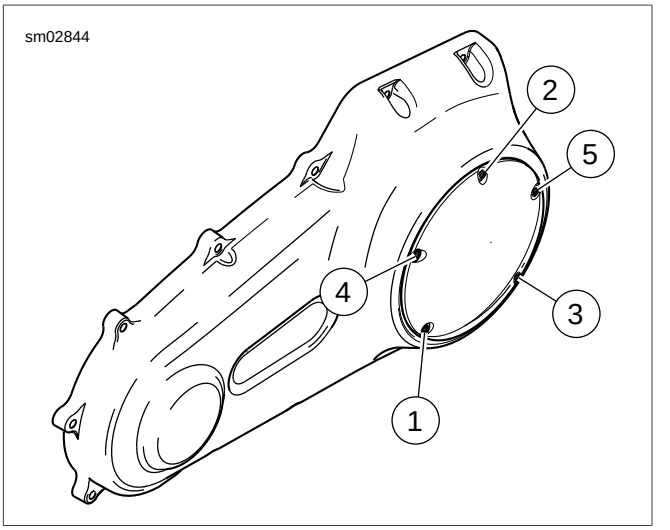


Figure 1-16. Clutch Cover Torque Sequence

TRANSMISSION LUBRICANT 1.10

CHECKING TRANSMISSION LUBRICANT

FASTENER	TORQUE VALUE	
Transmission dipstick	25-75 **in-lbs**	2.8-8.5 Nm

1. Park the motorcycle on a level surface on the jiffy stand.
2. Turn the engine OFF.

NOTE

Wait a few moments before checking the level to settle the lubricant.

3. See Figure 1-17. Remove the transmission lubricant dipstick. Wipe the dipstick clean.
4. Thread dipstick in until the O-ring makes contact with the case. Do not tighten.
5. Remove the dipstick. See Figure 1-18. The level should be between the ADD and FULL marks. Add lubricant if necessary.
6. Install dipstick. Tighten to 25-75 **in-lbs** (2.8-8.5 Nm).

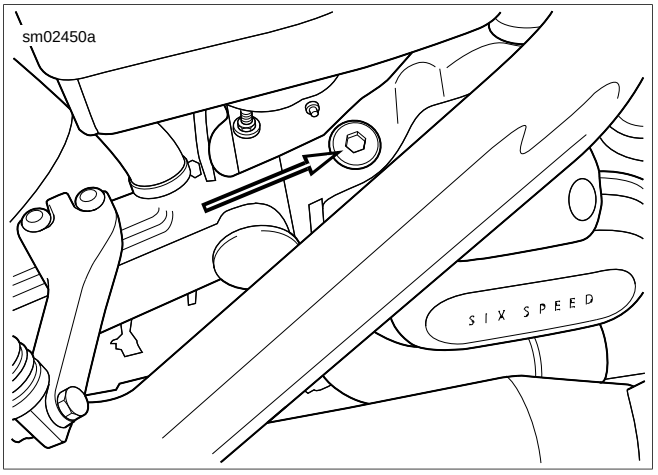
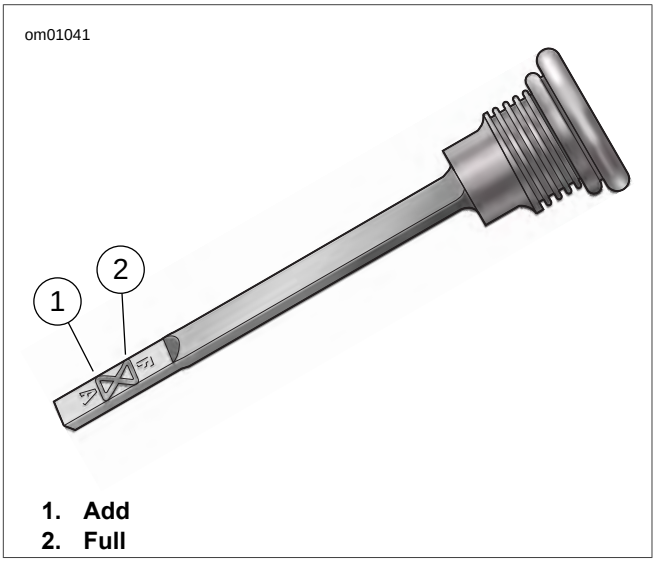


Figure 1-17. Transmission Dipstick Location



1. **Add**
2. **Full**

Figure 1-18. Transmission Dipstick Lubricant Level

Table 1-10. Recommended Lubricant

LUBRICANT	REFILL QUANTITY *
FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICANT or SCREAMIN' EAGLE SYN3 FULL SYNTHETIC MOTORCYCLE LUBRICANT 20W50	28 oz (0.83 L)
*Approximate. Check and add as needed to bring level within specification.	

CHANGING TRANSMISSION LUBRICANT

FASTENER	TORQUE VALUE	
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm
Transmission filler plug/dipstick	25-75 **in-lbs**	2.8-8.5 Nm

1. See Figure 1-17. Remove transmission filler plug/dipstick.

NOTICE

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

⚠WARNING

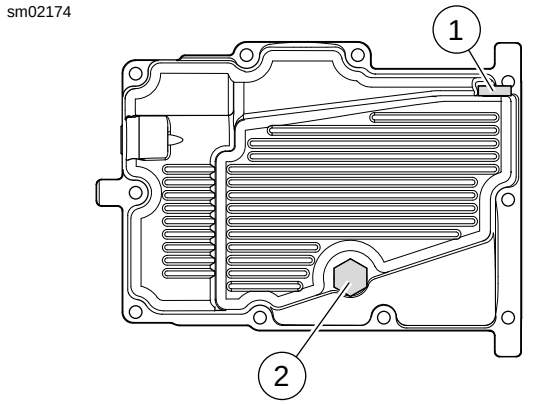
Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)

2. See Figure 1-19. Remove transmission drain plug. Drain lubricant into a suitable container.
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)

4. Install drain plug with O-ring. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Do not over-tighten.
5. Fill the transmission with 28 oz (0.83 L) of recommended Harley-Davidson lubricant. Refer to Table 1-10.
6. Check lubricant level and add enough lubricant to bring the level between the A(dd) and F(ull) 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).



1. **Engine oil drain plug and O-ring**
2. **Transmission drain plug**

Figure 1-19. Oil Pan

CLUTCH 1.11

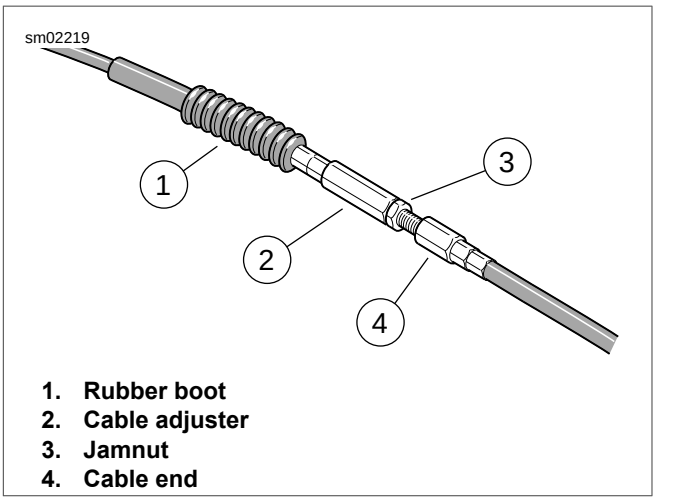
ADJUSTMENT

FASTENER	TORQUE VALUE	
Clutch jamnut	72-120 **in-lbs**	8.1-13.6 Nm
Clutch cable adjustment jamnut	120 **in-lbs**	13.6 Nm
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm

NOTE

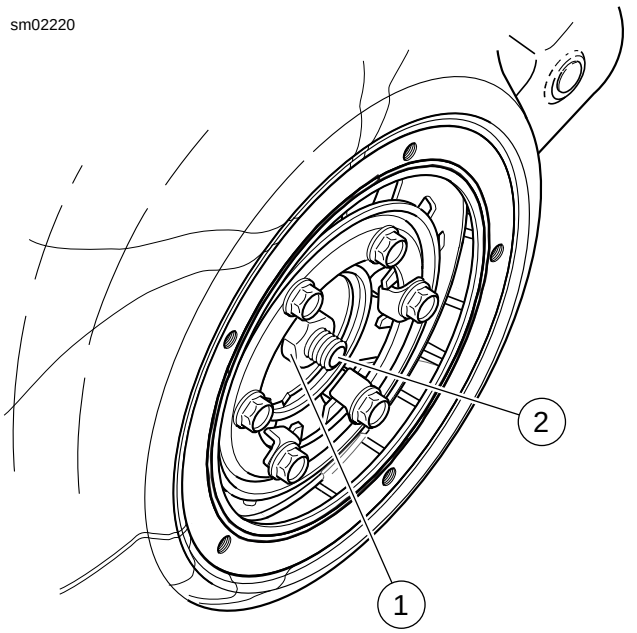
Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the powertrain temperature increases. If adjuster screw is adjusted with powertrain hot, clutch slippage could occur when powertrain has cooled.

1. Support motorcycle upright and level.
2. Remove five TORX screws with captive washers to detach clutch inspection cover from primary chaincase cover.
3. Remove and discard clutch inspection cover seal.
4. See Figure 1-20. Add free play to cable:
   a. Slide rubber boot (1) off cable adjuster.
   b. Holding cable adjuster (2) with wrench, loosen jamnut (3) using another wrench.
   c. Turn cable adjuster (2) until there is a large amount of free play at clutch hand lever.
5. See Figure 1-21. 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 1-22. 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. Hold adjuster with 1/2 in wrench. Using 9/16 in wrench, tighten jamnut against cable adjuster to 120 **in-lbs** (13.6 Nm). Cover cable adjuster mechanism with rubber boot.
10. Install clutch inspection cover and seal. Install seal as follows:
    a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase.
    b. See Figure 1-15. Position seal (1) in groove in primary chaincase cover and press each of the nubs on seal into the groove. The nubs will hold seal in position.
    c. See Figure 1-16. Insert screw with captive washer through clutch inspection cover and carefully thread it into the top cover screw hole.
    d. Start the remaining four screws with captive washers.
    e. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) following torque sequence shown in Figure 1-16.



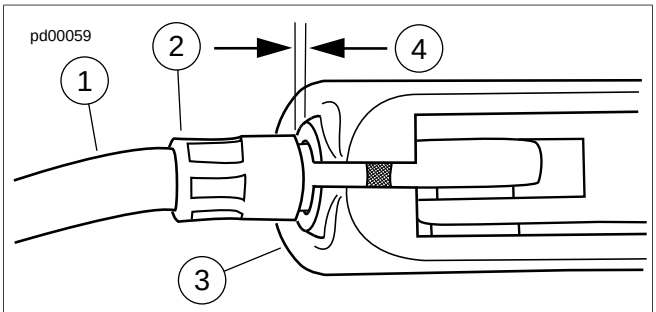
1. **Rubber boot**
2. **Cable adjuster**
3. **Jamnut**
4. **Cable end**

Figure 1-20. Clutch Cable Adjuster



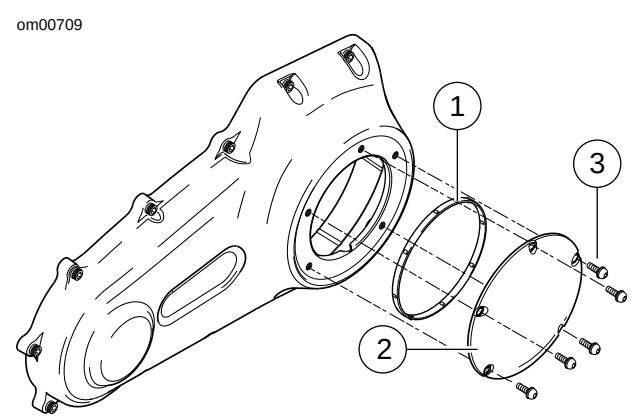
1. Jamnut
2. Clutch adjuster screw

Figure 1-21. Clutch Adjuster Screw



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

Figure 1-22. Clutch Cable Free Play



1. Seal
2. Clutch inspection cover
3. Screw with captive washer (5)

Figure 1-23. Clutch Cover

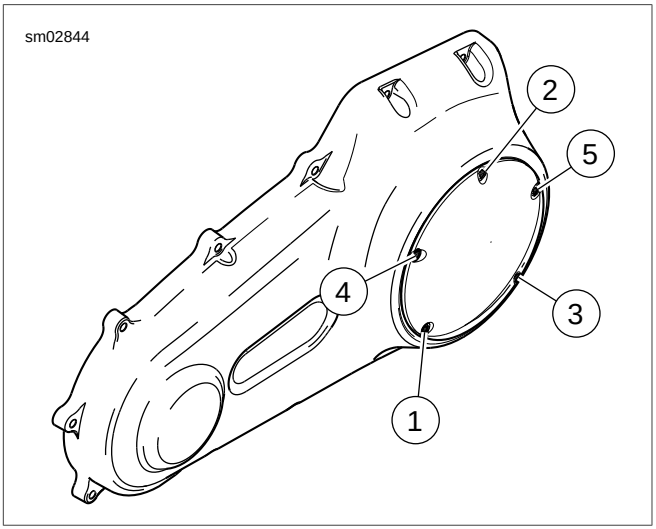


Figure 1-24. Clutch Cover Torque Sequence

DRIVE BELT AND SPROCKETS 1.12

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

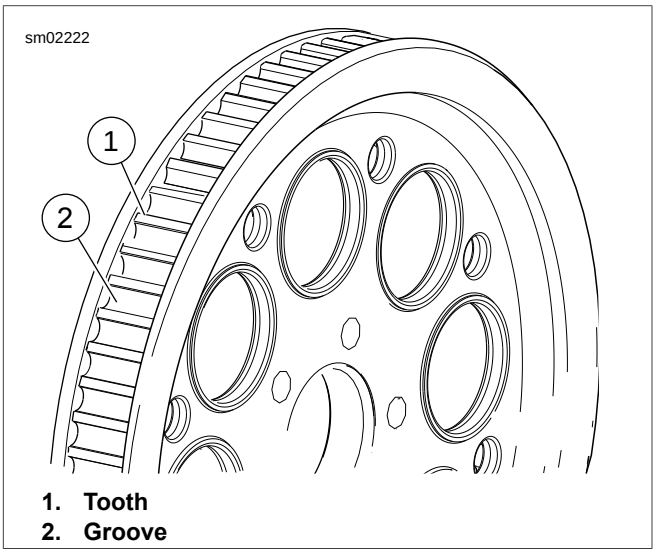
If chrome chips or gouges to rear sprocket are large enough to be harmful, they will leave a pattern on the belt face.

1. See Figure 1-25. 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.



1. Tooth
2. Groove

Figure 1-25. Rear Sprocket

Drive Belt

See Figure 1-26. Inspect drive belt for:

- Cuts or unusual wear patterns.
- Outside edge bevelling (8). Some bevelling is common, but it indicates that sprockets are misaligned.
- Outside ribbed surface for signs of stone puncture (7). If cracks 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.

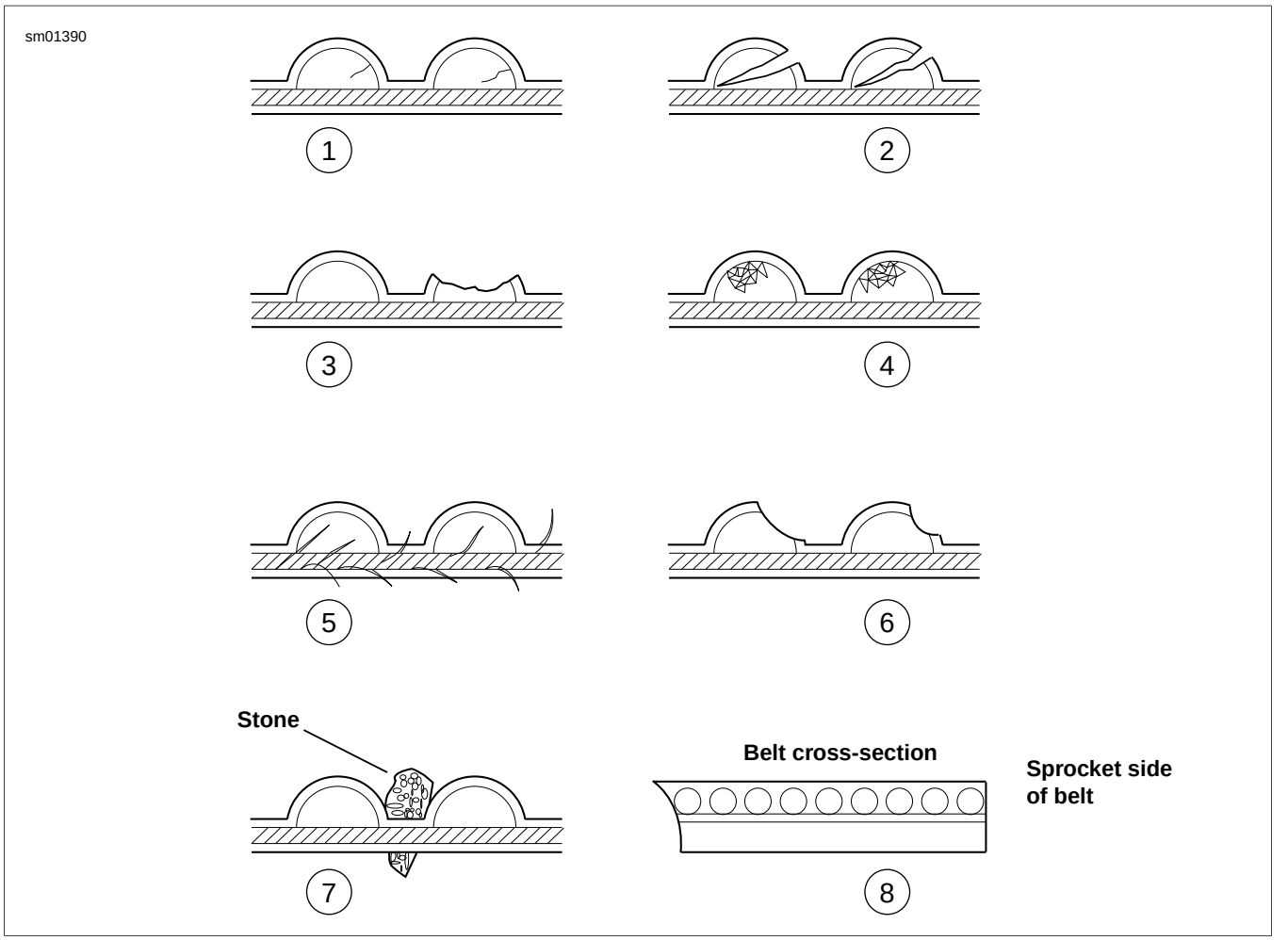


Figure 1-26. Drive Belt Wear Patterns

Table 1-11. Drive Belt Wear Analysis

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

CHECKING BELT DEFLECTION

PART NUMBER	TOOL NAME
HD-35381-B	H-D BELT TENSION GAUGE

Check drive belt deflection:

- as part of the pre-ride inspection
- at every scheduled service interval

When checking belt deflection:

- Set belt tension at loosest point in belt.
- Measure belt deflection with motorcycle cold and on jiffy stand, or with rear wheel in the air.
- Shift transmission into NEUTRAL.

1. See Figure 1-27. Obtain H-D BELT TENSION GAUGE (Part No. HD-35381-B).

NOTE

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

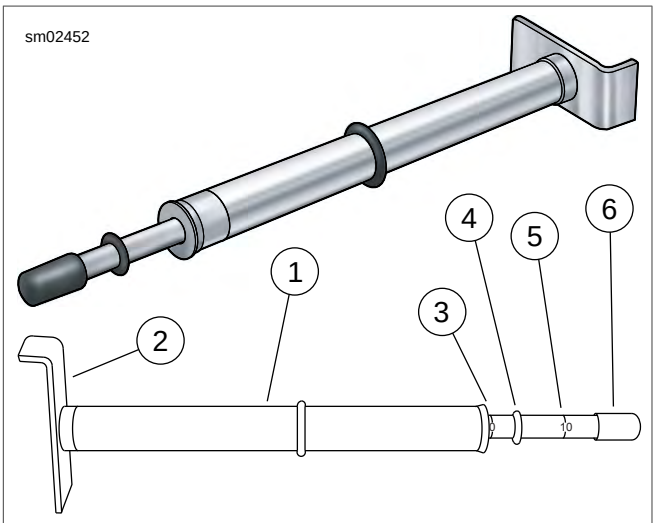
2. To use the belt tension gauge:
   a. Slide O-ring (4) toward 0 lbs (0 kg) mark (3).
   b. Fit belt cradle (item (2) in Figure 1-27) against bottom of drive belt half-way between drive pulleys (item (3) in Figure 1-28).
   c. Press upward on knob (6) until O-ring slides down to 10 lbs (4.5 kg) mark (5).
3. See Figure 1-29. Measure belt deflection as viewed through belt deflection viewing window (2) while holding gauge steady. Deflection graduations (3) are 1/8 in (3.2 mm) apart.
4. Measure belt deflection several times, each time with belt moved (by rotating rear wheel) to a different position on sprockets.
5. Compare drive belt deflection with specifications listed in Table 1-12.

NOTE

Do not rely on feel for the proper deflection as this typically results in belts which are under tensioned. Always use H-D BELT TENSION GAUGE (Part No. HD-35381-B) to determine the 10 lb. (4.5 kg) deflection force. Loose belts will fail due to ratcheting (jumping a tooth) which causes tensile cord crimping and breakage.

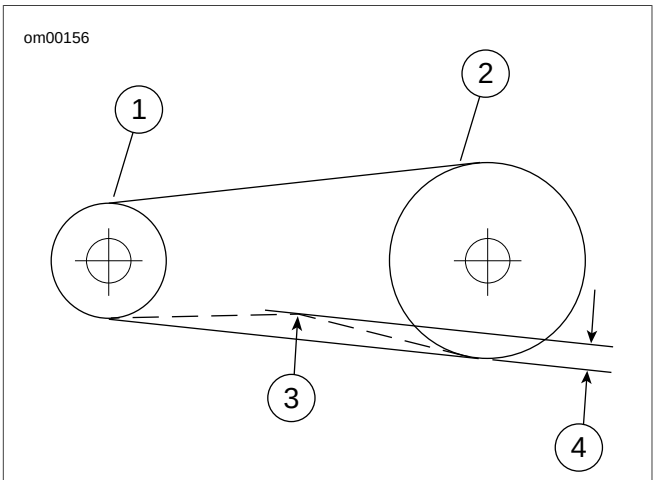
Table 1-12. Drive Belt Deflection

	IN.	MM
With motorcycle on jiffy stand without rider or luggage	1/4-5/16	6.4-7.9
Vehicle upright with rear wheel in air	5/16-3/8	7.9-9.5



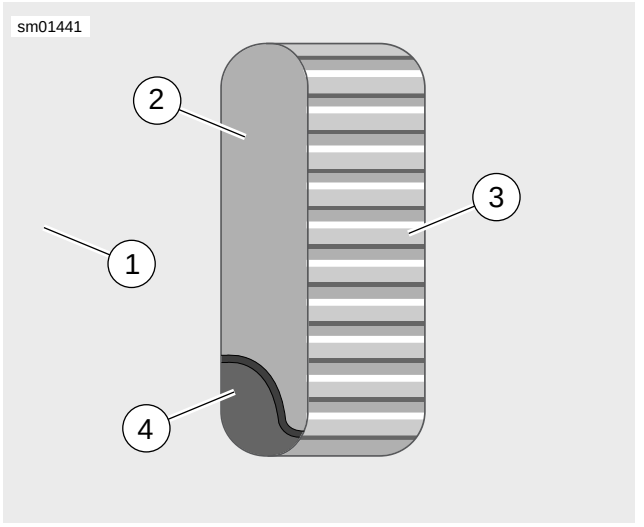
1. **Belt tension gauge**
2. **Belt cradle**
3. **0 lbs (0 kg) mark**
4. **O-ring**
5. **10 lbs (4.5 kg) mark**
6. **Knob**

Figure 1-27. Belt Tension Gauge



1. **Transmission sprocket**
2. **Rear wheel sprocket**
3. **Force**
4. **Deflection of belt**

Figure 1-28. Check Belt Deflection



1. **Debris deflector**
2. **Belt deflection viewing window**
3. **Drive belt deflection graduations**
4. **Drive belt**

Figure 1-29. Belt Deflection Window

ADJUSTING BELT DEFLECTION

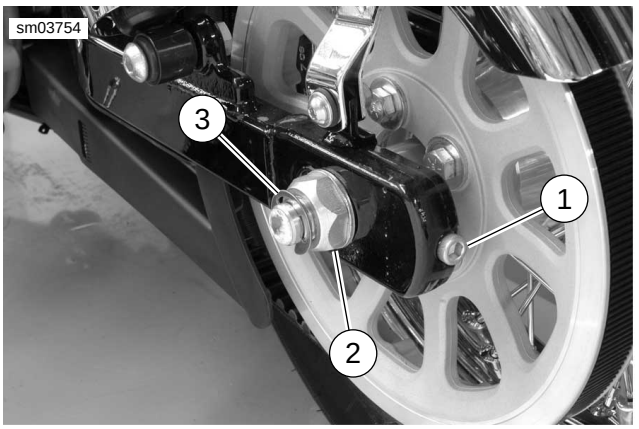
FASTENER	TORQUE VALUE	
Axle nut, rear	95-105 ft-lbs	128.8-142.4 Nm
Axle adjuster	120-144 **in-lbs**	13.6-16.3 Nm

1. See Figure 1-30. Remove retaining ring (3) and loosen axle nut (2).
2. Adjust belt tension by turning the axle adjusters (1) an equal number of turns to keep the wheel aligned until the specification in Table 1-12 is achieved.
3. Install retaining ring (3).
4. Tighten axle nut (2) to 95-105 ft-lbs (128.8-142.4 Nm).
5. Tighten axle adjusters to 120-144 **in-lbs** (13.6-16.3 Nm).
6. Verify rear wheel alignment. See 2.9 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)

7. Check wheel bearing end play. See 2.6 SEALED WHEEL BEARINGS.



1. **Axle adjuster**
2. **Axle nut**
3. **Retaining ring**

Figure 1-30. Axle Adjusters (Left Side Shown)

THROTTLE CABLES 1.13

CABLE INSPECTION, LUBRICATION AND ADJUSTMENT

FASTENER	TORQUE VALUE	
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm

Inspection and Lubrication

1. See Figure 1-31. Remove two screws (1) to separate the upper handlebar module housing from the lower housing.
2. Unhook each ferrule 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 and 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 the 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

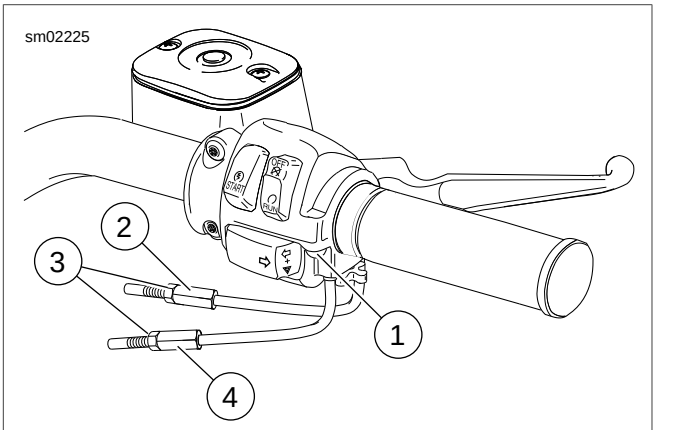
Before starting engine, be sure throttle control will snap back to idle position when released. A throttle control that prevents engine from automatically returning to idle can lead to loss of control, which could result in death or serious injury. (00390a)

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)

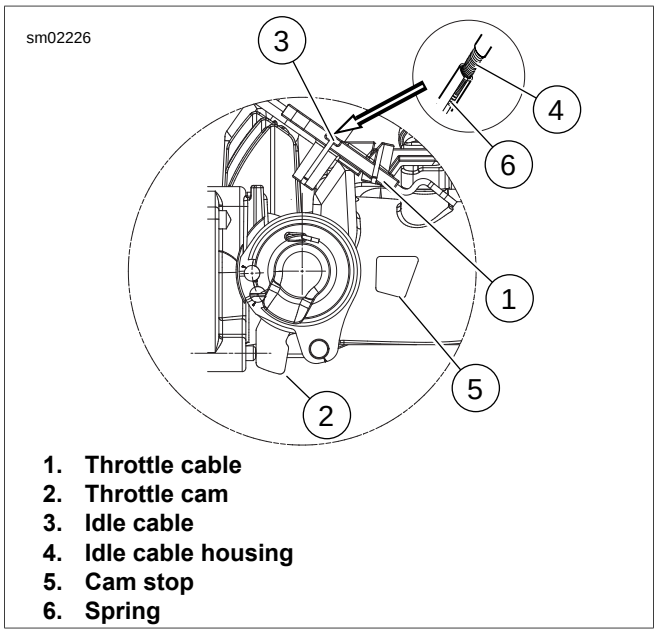
Adjust throttle cables:

1. See Figure 1-31. 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 1-32. 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.



1. **Screw (2)**
2. **Throttle cable adjuster**
3. **Jamnut (2)**
4. **Idle cable adjuster**

Figure 1-31. Throttle Cable Adjusters



1. **Throttle cable**
2. **Throttle cam**
3. **Idle cable**
4. **Idle cable housing**
5. **Cam stop**
6. **Spring**

Figure 1-32. Induction Module Cable Connection

CABLE AND CHASSIS LUBRICATION 1.14

GENERAL

Inspect and lubricate the following items according to1.5 MAINTENANCE SCHEDULE.

- Front brake hand lever
- Clutch hand lever
- Throttle control cables
- Throttle control grip sleeve
- Clutch cable
- Foot shift lever pivot (if applicable)
- Rear brake lever pivot
- Steering head bearings
- Jiffy stand

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

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 2.33 JIFFY STAND.

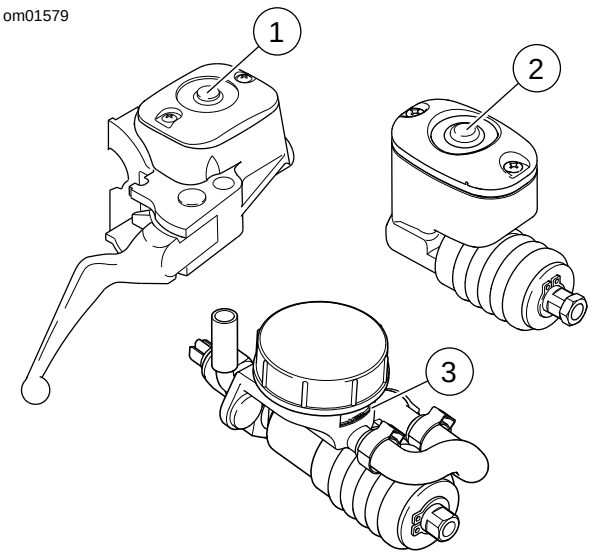
FLUID INSPECTION

1. Lean vehicle on the jiffy stand on a flat, level surface.
2. **Front brake:** Turn handlebar so front brake master cylinder is approximately level.

NOTE

All ABS equipped models except FLD have a remote brake fluid reservoir. Always inspect remote reservoir when present for proper fluid level.

3. See Figure 1-33. View reservoir sight glass and verify fluid presence. Sight glass should appear dark if fluid is present.
4. If sight glass is not dark, check brake system for fluid leaks. Check that brake pads are properly installed and not worn beyond service wear limits. Perform any necessary repairs. See 1.16 BRAKE PADS AND DISCS.
5. Remove master cylinder reservoir cover (front or rear as appropriate) and verify fluid level. If necessary, add DOT 4 BRAKE FLUID to reservoir. Replace cover. See 2.14 BLEEDING BRAKES.
6. Front brake hand lever and rear brake foot pedal must have a firm feel when applied. If not, bleed system using only DOT 4 BRAKE FLUID. See 2.14 BLEEDING BRAKES.



1. **Sight glass, front master cylinder reservoir**
2. **Sight glass, rear master cylinder reservoir (non-ABS models and all FLD)**
3. **Brake fluid level, rear (ABS models except FLD)**

Figure 1-33. Brake Fluid Master Cylinders

REAR PEDAL HEIGHT

The rear brake pedal should not require adjustment. If minor pedal height adjustment is desired:

1. See Figure 1-34. Brake rod (5) is threaded into pushrod (3) in rear brake master cylinder (1), and locked in place with jamnut (4). Loosen jamnut.

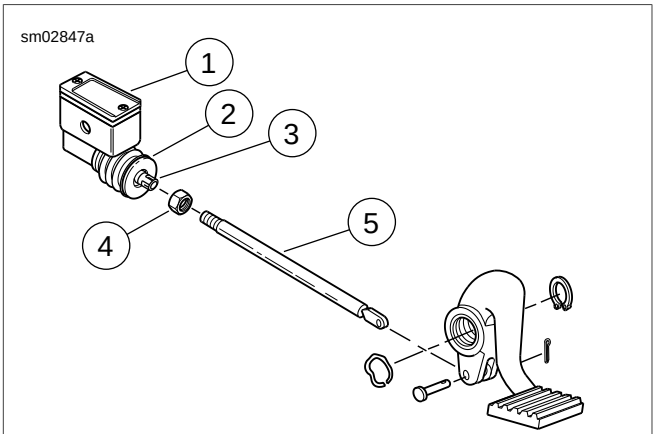
⚠WARNING

When adjusting brake control rod, never allow more than nine threads to be exposed between control rod and jam nut. If more than nine threads are exposed, brake rod can come apart resulting in loss of rear brake, which could cause death or serious injury. (00306c)

2. Use an open-end wrench on the pushrod flats and turn the pushrod in the direction which will correct pedal height. When correct pedal height is obtained, tighten jamnut.
3. Verify that water drain hole in rubber boot (2) faces downward.

NOTE

Brake pedal free play is built into master cylinder and no adjustment is required. When pedal is pushed down with hand, a small amount of free play must be felt.



1. **Rear brake master cylinder**
2. **Rubber boot**
3. **Pushrod**
4. **Jamnut**
5. **Brake rod**

Figure 1-34. Rear Brake Pedal Height (Typical)

BRAKE LINES INSPECTION

Inspect brake lines for leaks, contact or abrasion. Refer to Table 1-13.

Table 1-13. Brake Line Inspection

LINE TYPE	INSPECTION	REMEDY
Steel lines	No marks	OK/Monitor
	Slight mark in paint or plating*	
	Copper colored-paint/plating worn off*	
	Silver colored base material-no noticeable feel of wear*	
	Silver colored base material-noticeable feel of wear*	Replace
	Brake fluid leak or other damage	
Rubber hose	No marks	OK/Monitor
	Slight dent or flattening of ribs*	
	Worn to bottom of ribs	Replace
	Brake fluid leak or other damage	
Protective cover (steel, rubber, plastic or braided)	No marks	OK/Monitor
	Slight dent in covering*	
	Slight dent or flattening of plastic covering*	
	Worn or cut-through covering-exposed brake line material	Replace
	Brake fluid leak or other damage	
* If there is line contact, reposition the line. If base material is visible, prevent corrosion with touch-up paint.		

BRAKE PADS AND DISCS 1.16

INSPECTION

Check brake pads and discs:

- at every scheduled service interval
- whenever components are removed during service procedures

Brake Pads

⚠CAUTION

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

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)

⚠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)

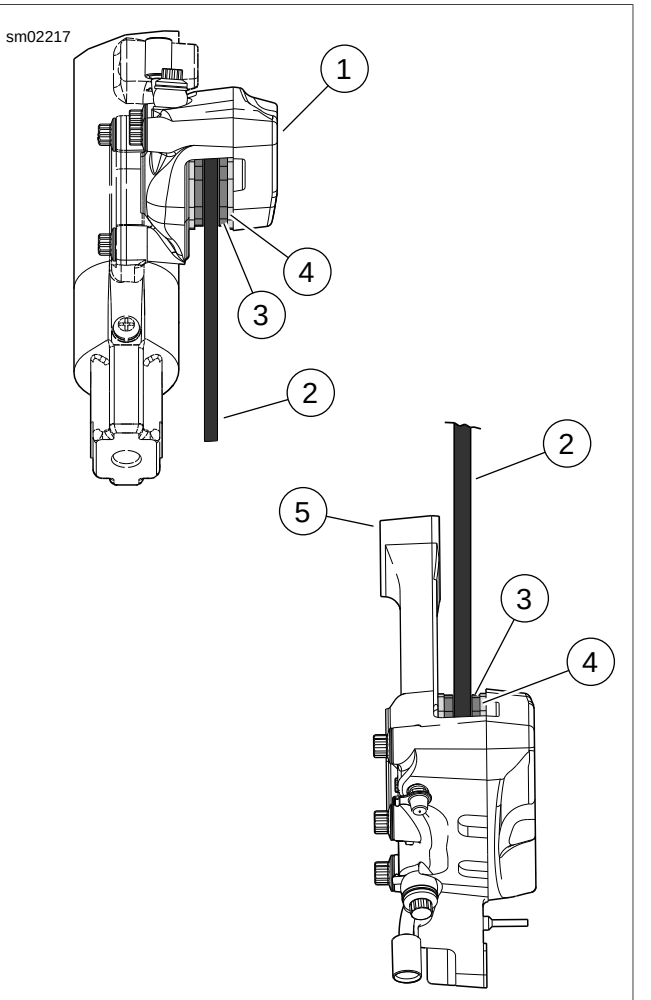
See Figure 1-35. Replace brake pads (3) if brake pad friction material on either the front or rear caliper is worn to 0.04 in (1.02 mm) or less above the backing plate (4). Always replace both pads in a caliper as a set. See 1.16 BRAKE PADS AND DISCS, Brake Pad Replacement.

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.



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

Figure 1-35. Brake Pad Inspection

BRAKE PAD REPLACEMENT

FASTENER	TORQUE VALUE	
Pad pin, rear caliper	80-120 **in-lbs**	9.0-13.5 Nm
Rear caliper fasteners	16-20 ft-lbs	21.7-27.1 Nm
Master cylinder reservoir cover screws: rear cover, including ABS	6-8 **in-lbs**	0.7-0.9 Nm
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm
Caliper, front, mounting bolt	28-38 ft-lbs	38.0-51.5 Nm
Brake pad pin/bridge bolt, front caliper	15-16 ft-lbs	20.3-22.6 Nm
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm

Rear Brake Caliper

1. **FLD Models:** Remove right saddlebag.
2. **ABS equipped:** Remove cable strap securing wheel speed sensor cable to rear brake hose at caliper.
3. See Figure 1-36. Loosen, but do not remove pad pin (metric) (6).
4. Remove mounting bolt (4) and slider pin (3). Pull rear caliper away from brake disc.
5. Remove pad pin and brake pads.

NOTE

Loosening the reservoir cap will allow air to escape and help prevent contamination. It will also help prevent fluid from squirting out of the reservoir if the pistons are retracted too quickly.

6. Loosen rear master cylinder reservoir cap.

NOTE

As the pistons are pushed back into the caliper, fluid level may rise above the available space. Fluid may have to be removed to allow for this.

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

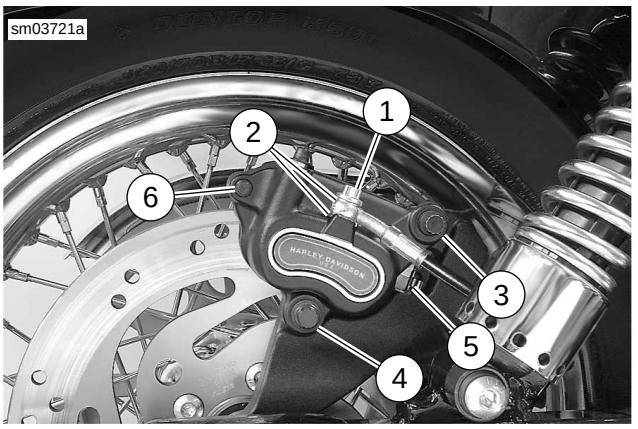
⚠WARNING

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, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace pin.
9. Inspect torque clip. Replace if worn or damaged.
10. Inspect anti-rattle spring. Replace if worn or damaged.
11. Install **new** brake pads and pad pin. Tab must engage clip in caliper housing. Tighten pad pin to 80-120 **in-lbs** (9.0-13.5 Nm).
12. Install caliper. Install mounting bolt (4) and slider pin (3). Tighten to 16-20 ft-lbs (21.7-27.1 Nm).
13. **If ABS equipped:** 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. (00279a)



1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Slider pin**
4. **Mounting bolt**
5. **Tab slot**
6. **Pad pin**

Figure 1-36. Rear Caliper

14. Pump brake pedal to move pistons out until both brake pads contact rotor.
15. Check brake fluid level in master cylinder. Fill to proper level if necessary using DOT 4 BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 6-8 **in-lbs** (0.7-0.9 Nm).
16. **FLD Models:** Install right saddlebag.

⚠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)

17. Test brake system.
    a. Turn ignition switch ON. Pump brake pedal to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See 2.14 BLEEDING BRAKES.

NOTE

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

Front Brake Caliper

1. Remove the front master cylinder reservoir cap.

2. See Figure 1-37. Loosen, but do not remove pad pin/bridge bolt (3) (metric).
3. Remove both caliper mounting bolts (1, 2) (metric). Detach caliper from front forks and brake disc.

NOTE

As the pistons are pushed back into the caliper, fluid level may rise above the recommended 1/8-3/8 in (3.2-9.5 mm) below the gasket surface. Fluid may need to be removed to allow for this.

4. Pry the pads back to force all four caliper pistons into their bores.

NOTE

The brake pads have tabs that are clipped onto the pad springs. Disengage the tabs from the pad springs as you remove the pads.

5. With the pistons retracted, remove the pad pin/bridge bolt and remove brake pads.
6. Inspect pad pin/bridge bolt 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 is more than 0.015 in. (0.38 mm), replace the pad pin/bridge bolt.

⚠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)

NOTES

- *See Figure 1-38. Verify the pad spring tabs (1) on brake pad engage the pad springs in the pistons.*
- *If the directional tab (2) does not face down when caliper is installed, brake noise may develop.*

7. Install **new** pads into caliper. The directional tab (2) must face down when caliper is installed.

NOTE

If ABS equipped, follow instructions and procedures. See C.2 ABS MODULE.

8. Loosely install the center pad pin/bridge bolt.
9. Attach caliper to front fork.
   a. See Figure 1-37. Place caliper over brake disc with bleeder valve facing upward.
   b. Loosely install long mounting bolt (1) (metric) into upper hole on fork leg.
   c. Install short mounting bolt (2) (metric) into lower hole on fork leg. Tighten to 28-38 ft-lbs (38.0-51.5 Nm).
   d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   e. Final tighten center pad pin/bridge bolt (3) to 15-16 ft-lbs (20.3-22.6 Nm).
10. Pump brake hand lever to move pistons out 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 brake fluid level in master cylinder. Fill to proper level if necessary using D.O.T. 4 BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 12-15 **in-lbs** (1.4-1.7 Nm).

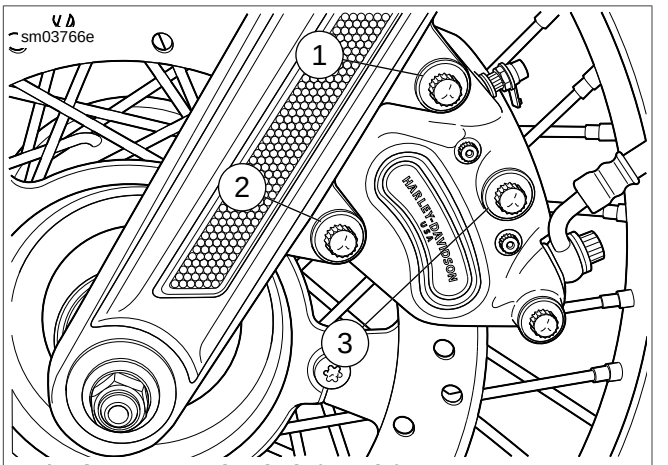
⚠WARNING

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

12. 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. See 2.14 BLEEDING BRAKES.

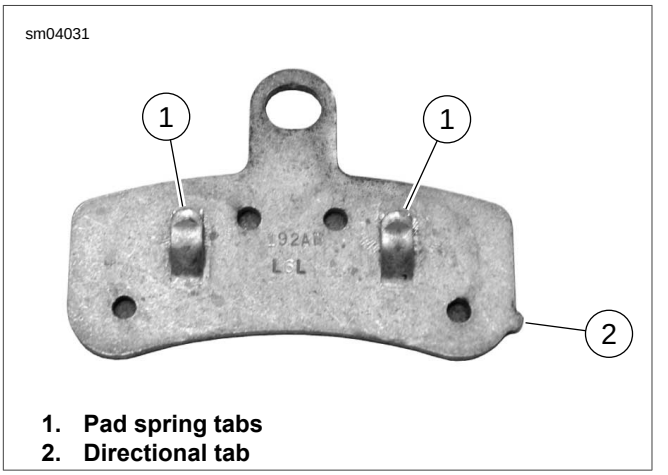
NOTE

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



1. **Long mounting bolt (metric)**
2. **Short mounting bolt (metric)**
3. **Pad pin, bridge bolt (metric)**

Figure 1-37. Front Brake Caliper (Left Side Shown)



1. **Pad spring tabs**
2. **Directional tab**

Figure 1-38. Front Brake Pad

SPARK PLUGS 1.17

INSPECTION

FASTENER	TORQUE VALUE	
Spark plug	12-18 ft-lbs	16.3-24.4 Nm

⚠WARNING

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

1. After the engine has cooled to room temperature, disconnect cables from both spark plugs.
2. Remove spark plugs. If a plug has eroded electrodes, heavy deposits or a cracked insulator, discard it.
3. See Figure 1-39. Compare your observations of the plug deposits with the descriptions provided below.
   a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip indicates an oil fouled plug. This condition may be caused by worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.
   b. A dry, fluffy or sooty black deposit indicates an air-fuel mixture that is too rich.
   c. A light brown, glassy deposit indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes. This is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.
   d. A plug with a white, yellow, tan or rusty brown powdery deposit indicates balanced combustion. Clean off spark plug deposits at regular intervals.

⚠WARNING

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

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

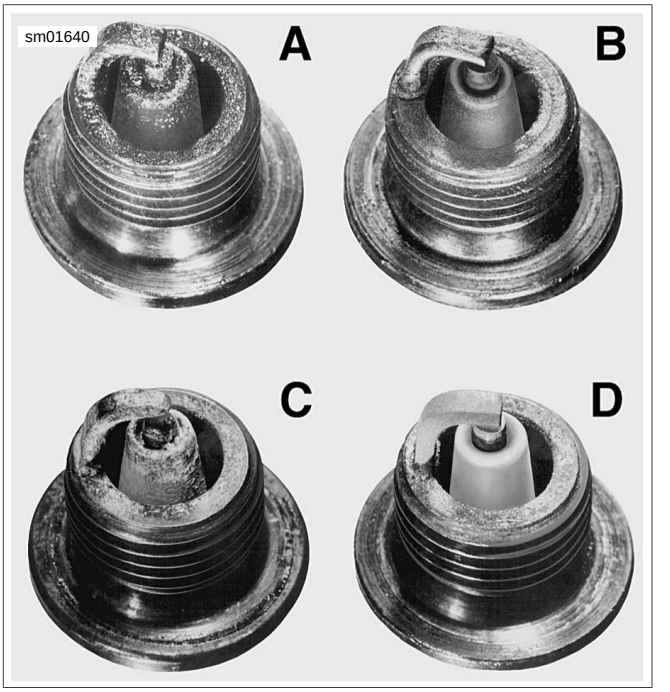


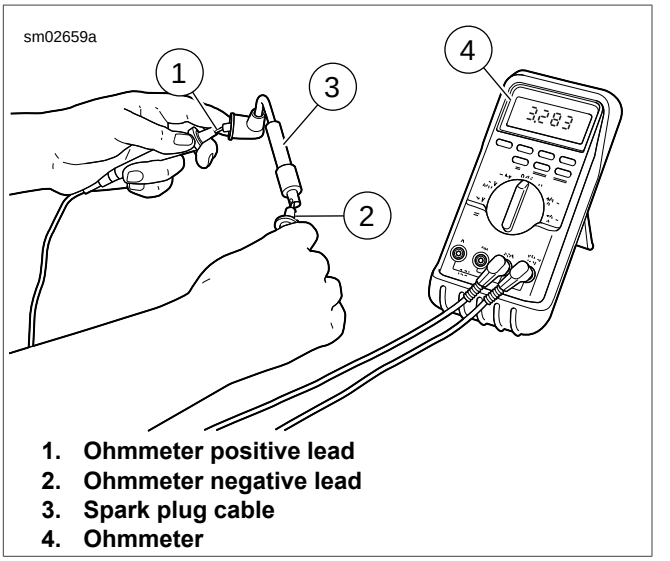
Figure 1-39. Typical Spark Plug Deposits

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.
2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.
3. See Figure 1-40. Check spark plug cable resistance with an ohmmeter. Replace cables not meeting resistance specifications. Refer to Table 1-14.

Table 1-14. Spark Plug Cable Resistance Values: Dyna

DESCRIPTION	LENGTH		RESISTANCE VALUE (OHMS)
	In.	mm	
Front cable	19.00	483	4720-12,920
Rear cable	7.25	184	1813-5000



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

Figure 1-40. Testing Resistance

STEERING HEAD BEARINGS 1.18

ADJUSTMENT

PART NUMBER	TOOL NAME
HD-41494	HUBCAP REMOVER AND INSTALLER
HD-50651	FORK NUT SOCKET

FASTENER	TORQUE VALUE	
Fork clamp stem nut	70-80 ft-lbs	95-108.5 Nm
Fork clamp pinch bolts: lower	30-35 ft-lbs	40.7-47.5 Nm
Brake manifold fastener	36-60 **in-lbs**	4.0-6.8 Nm
Upper nacelle fasteners	84-120 **in-lbs**	9.5-13.5 Nm

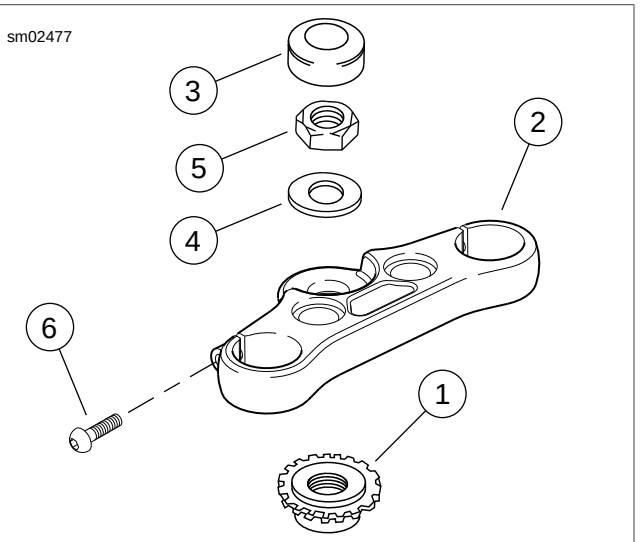
Bearing Adjustment (Fall-Away)

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

NOTE

ABS equipped: *Remove fastener securing the brake line manifold to the lower fork bracket. Also, remove anchor securing brake lines to frame on the right side behind the steering head.*

2. Remove all accessory weight, such as a windshield, that may influence the way the front fork swings.
3. Disconnect the clutch cable from the handlebar.
4. Loosen, but do not remove the two fasteners at the rear of the upper headlight nacelle. This will allow the upper nacelle to float loosely.
5. Remove anchor for throttle cables.
6. **ABS equipped:** Remove the anchor securing the brake lines to the frame on the right side near the anchor for the throttle cables.
7. Place a suitable marking material, such as masking tape, over the fender tip.
8. 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.
9. Check steering head bearing tension.
   a. Tap the fender on one side until the front fork begins to fall-away by itself. Label this point on the marking material.
   b. Repeat the previous step in the other direction.
   c. Measure distance between marks.
10. The distance between the fall-away marks must be 3.0-4.5 in (76.2-114.3 mm). Adjust bearings if outside of service range.
11. See Figure 1-41. With HUBCAP REMOVER AND INSTALLER (Part No. HD-41494) unscrew and remove stem cap (3).
12. Using FORK NUT SOCKET (Part No. HD-50651) loosen fork stem nut (5).
13. Loosen lower fork clamp pinch bolts.



1. **Star nut**
2. **Upper fork clamp**
3. **Stem cap**
4. **Hardened flat washer**
5. **Stem nut**
6. **Pinch bolt (2)**

Figure 1-41. Steering Head Components

14. Tighten or loosen the star nut (1) until the measurement is within limits.
   a. If the distance is more than 4.5 in. (114.3 mm), turn the adjuster nut counterclockwise to loosen.
   b. If the distance is less than 3.0 in. (76.2 mm), turn the adjuster nut clockwise to tighten.
15. Install stem nut. Tighten to 70-80 ft-lbs (95-108.5 Nm).
16. Check fall-away. If it is 3.0-4.5 in. (76.2-114.3 mm), tighten lower fork clamp pinch bolts to 30-35 ft-lbs (40.7-47.5 Nm).
17. Repeat the fall-away procedure to be sure the adjustment is correct.
18. if removed, attach brake line manifold onto lower fork clamp. Tighten fastener to 36-60 **in-lbs** (4.0-6.8 Nm).
19. Tighten the upper nacelle bolts to 84-120 **in-lbs** (9.5-13.5 Nm)
20. Install **new** anchors in right side of main frame for throttle cables.
21. **ABS equipped:** Install brake lines.
22. Install and adjust clutch cable.

⚠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

Brakes are a critical safety component. Contact a Harley-Davidson dealer for brake repair or replacement. Improperly serviced brakes can adversely affect brake performance, which could result in death or serious injury. (00054a)

23. Test ride.

LUBRICATION

Use Special Purpose Grease every 30,000 mile (48,280 km) service interval. For steering head bearing lubrication, see 2.17 STEERING HEAD.

CRITICAL FASTENERS 1.19

INSPECTION

Checking Fastener Torque

Inspect critical fasteners at the scheduled service intervals. Replace any damaged or missing fasteners.

1. Attempt to turn the fastener using a torque wrench set to the minimum torque specification for that fastener. Refer to Table 1-15.
   a. If the fastener does not rotate, the fastener torque has been maintained. No further attention is necessary.
   b. If the fastener rotates, remove it to determine if it has a locking agent.
   c. If it has a locking agent, clean all locking material from the threaded hole. Replace the fastener with a **new** one or clean the original fastener threads and apply the appropriate locking agent (see appropriate procedure).
   d. Install fastener. Tighten to specification.
2. If the fastener does not have a locking agent, install fastener. Tighten to specification.

Table 1-15. Critical Fasteners: Dyna

SYSTEM	FASTENER	TORQUE	
Hand controls	Upper and lower switch housing screws	35-45 **in-lbs**	3.9-5.1 Nm
	Clutch lever handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
	Master cylinder handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
Brakes	Banjo bolts	17-22 ft-lbs	23.1-29.9 Nm
	Front brake caliper mounting bolts	28-38 ft-lbs	38.0-51.5 Nm
	Front brake pad pin/bridge bolt	15-16 ft-lbs	20.3-22.6 Nm
	Rear brake caliper mounting bolts	16-20 ft-lbs	21.7-27.0 Nm
	Rear brake pad pin	80-120 **in-lbs**	9.0-13.6 Nm
	Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm
	Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm
	Reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm
	Reservoir cover screws: rear cover, this includes ABS	6-8 **in-lbs**	0.7-0.9 Nm
	Rear master cylinder mounting nut	30-40 ft-lbs	40.7-54.2 Nm
Axle nuts	Front axle	62-67 ft-lbs	84.1-90.1 Nm
	Rear axle	95-105 ft-lbs	128.1-142.4 Nm
Front fork	Lower fork pinch bolts	30-35 ft-lbs	40.7-47.5 Nm
	Lower front slider (axle) pinch bolt, FLD only (right side)	18-22 ft-lbs	24.4-30.0 Nm
	Axle cap fasteners, all models except FLD	132-180 **in-lbs**	14.9-20.3 Nm
	Upper bracket pinch bolts	30-35 ft-lbs	40.7-47.5 Nm
	Handlebar clamp mounting screw	144-192 **in-lbs**	16.3-21.7 Nm
Exhaust	Exhaust bracket bolt	15-19 ft-lbs	20.3-25.8 Nm
ABS	Banjo bolts (EHCU only)	16-20 ft-lbs	21.7-27 Nm
	Brake line tube nuts/ABS	13-16 ft-lbs	17.6-21.7 Nm

BATTERY MAINTENANCE 1.20

GENERAL

⚠WARNING

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

⚠WARNING

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

⚠WARNING

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

NOTICE

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)

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 1.20 BATTERY MAINTENANCE, Charging Battery. For testing information, see the electrical diagnostic manual.

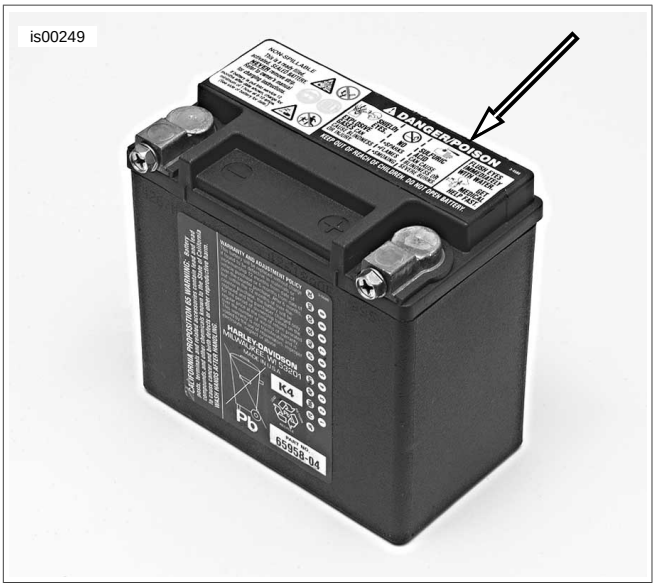
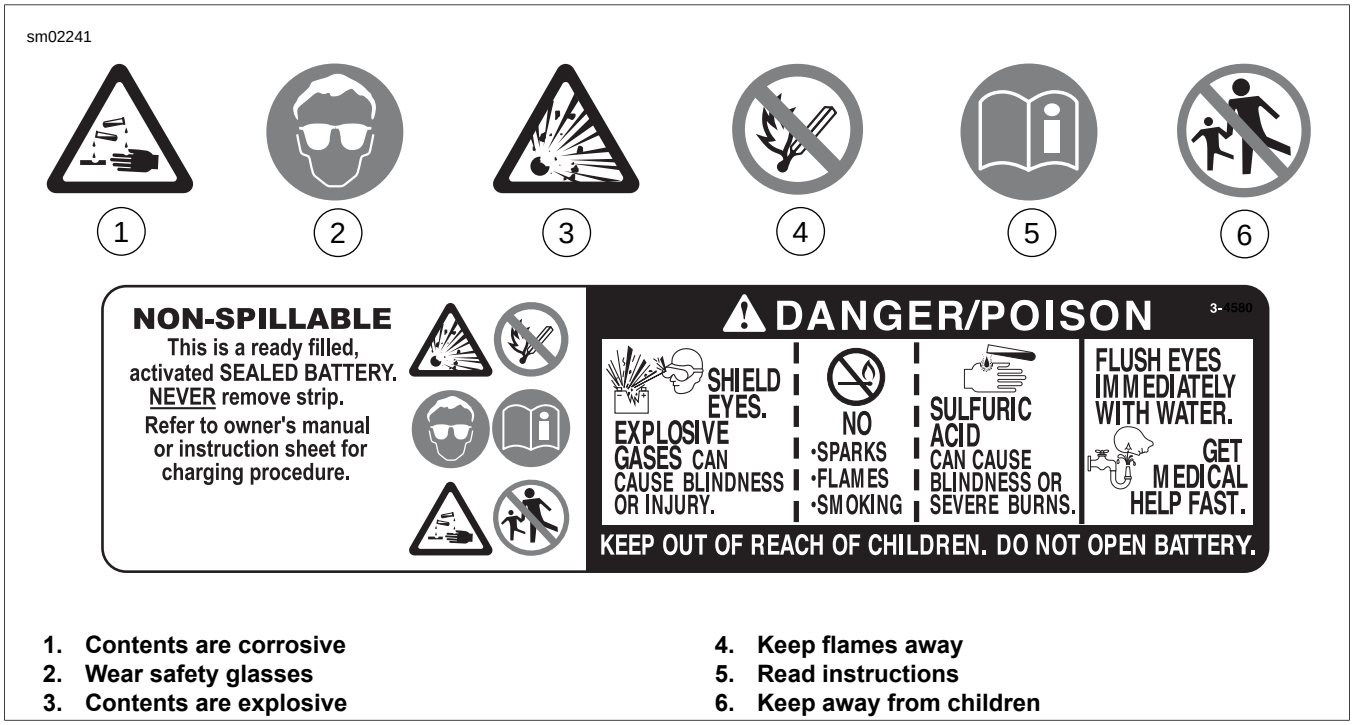


Figure 1-42. AGM Battery with Warning Label



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

Figure 1-43. Battery Warning Label

Table 1-16. Antidotes for Battery Acid

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

CLEANING AND INSPECTION

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)

Voltmeter Test

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 1-17.

Table 1-17. Voltmeter Test For Battery Charge Conditions

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

CHARGING BATTERY

Safety Precautions

An automatic, constant monitoring battery charger/tender with a charging rate of 5 amps or less at less than 14.6 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. (00413b)

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

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.*

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)

NOTICE

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

2. Connect red battery charger lead to the positive terminal 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 to the negative terminal of the battery.
5. Disconnect the red battery charger lead to 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.

DISCONNECTION AND REMOVAL

NOTE

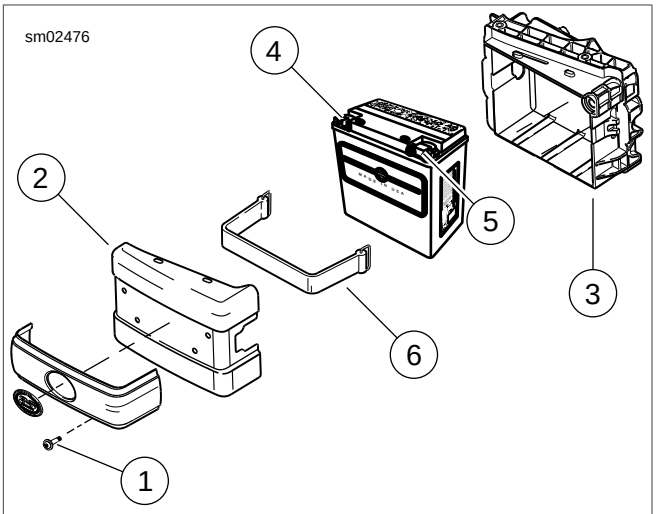
To verify proper installation, make note of battery cable routing and locations before removal.

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. See Figure 1-44. Remove lower fastener (1).
3. Pivot cover (2) outward and lift to disengage slots on cover from projections on battery tray (3).
4. Unthread and remove battery negative cable from negative battery terminal (4).
5. Unbolt and remove battery positive cable from positive (+) battery terminal (5).
6. Remove battery strap (6).
7. Remove battery from tray.



1. **Screw**
2. **Cover**
3. **Battery tray**
4. **Negative battery terminal**
5. **Positive battery terminal**
6. **Battery strap**

Figure 1-44. Battery Assembly

STORAGE

PART NUMBER	TOOL NAME
99863-01A	GLOBAL BATTERY CHARGER

WARNING

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

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 GLOBAL BATTERY CHARGER, 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.

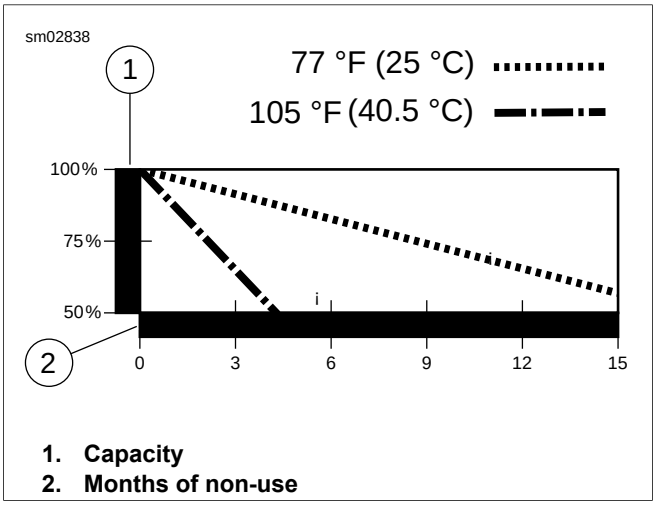
See Figure 1-45. A battery that is removed from the vehicle is affected by self-discharge. A battery that is stored in the vehicle is affected by self-discharge and, more significantly, by parasitic loads. A parasitic load is caused by things like diode leakage or maintaining computer memory with the 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 the GLOBAL BATTERY CHARGER (Part No. 99863-01A) to maintain battery charge for extended periods of time without risk of overcharging or boiling.



1. **Capacity**
2. **Months of non-use**

Figure 1-45. Battery Self-Discharge Rate

INSTALLATION AND CONNECTION

FASTENER	TORQUE VALUE	
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm

NOTICE

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

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)

NOTE

Check that battery is fully charged before installation.

1. See Figure 1-44. With battery terminals facing outward, place battery in battery tray and install battery strap.
2. Insert fastener through battery positive cable terminal and into threaded hole of battery positive (+) terminal (5). Tighten fastener to 60-70 **in-lbs** (6.8-7.9 Nm). Place battery terminal cover over positive battery terminal.
3. Insert fastener through battery negative cable terminal into threaded hole of battery negative (-) terminal (4). Tighten fastener to 60-70 **in-lbs** (6.8-7.9 Nm).
4. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.
5. Place slots on battery cover (2) on projections on battery tray (3). Install screw (1) to secure cover.

WARNING

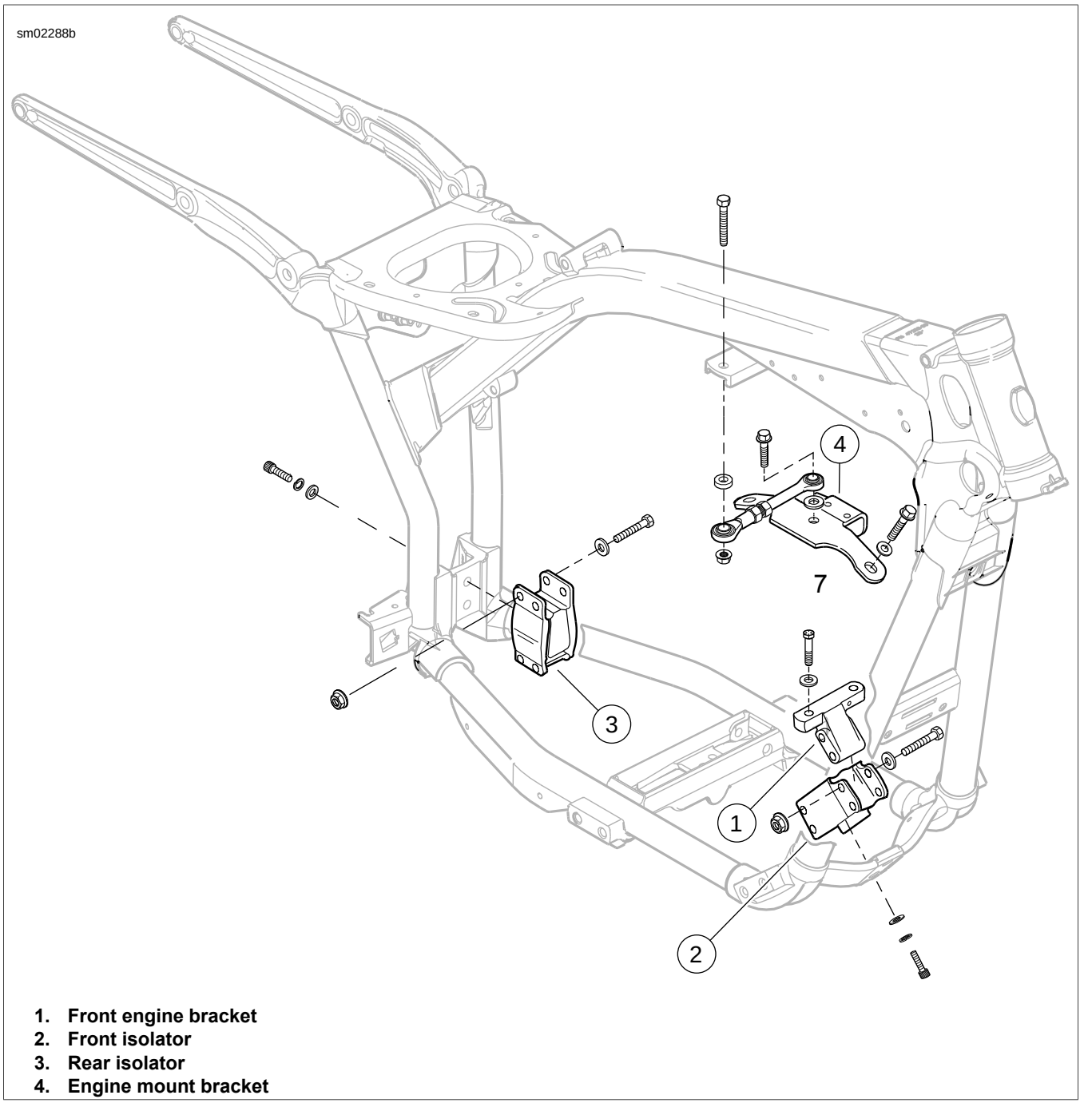
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

6. Install seat.

ENGINE MOUNTS 1.21

INSPECTION

1. See Figure 1-46. Check for cracks or tears in the isolator rubber.
2. Check stabilizer links for wear.
3. Check that all engine mount bolts are tight.
4. Check that all engine mount rivets are not sheared.
5. Check that the mounts are supporting the weight of the motor.
6. Check that a minimum of 0.030 in (0.76 mm) clearance exists between engine bracket (1) and engine isolator (2).



1. **Front engine bracket**
2. **Front isolator**
3. **Rear isolator**
4. **Engine mount bracket**

Figure 1-46. Engine Mounts

HEADLAMP ALIGNMENT 1.22

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. (00030b)

NOTE

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

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

NOTE

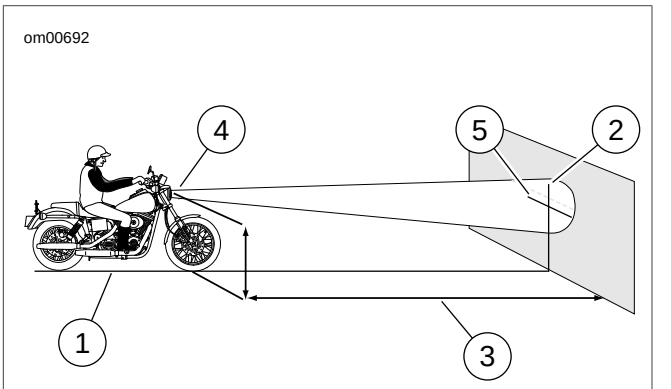
Choose a wall in minimum light.

4. See Figure 1-47. 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 1-47. 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.



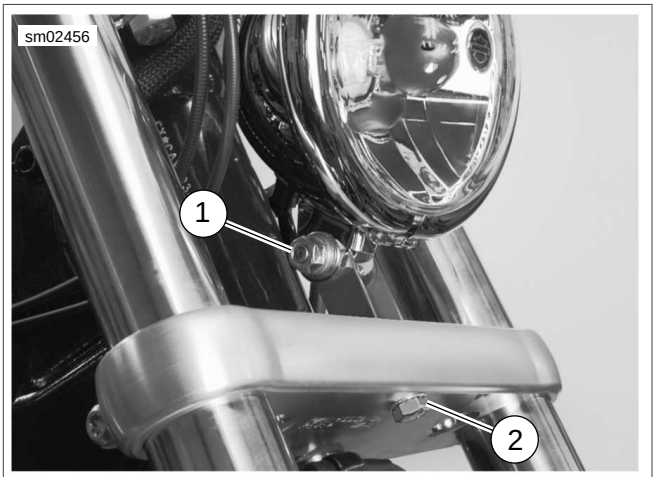
1. **Perpendicular line**
2. **Vertical line**
3. **25 ft (7.6 meters)**
4. **High beam bulb centerline**
5. **Horizontal line 2.1 in (53.3 mm) lower than bulb centerline**

Figure 1-47. Checking Headlamp Alignment

ADJUSTMENT: ALL MODELS EXCEPT FLD

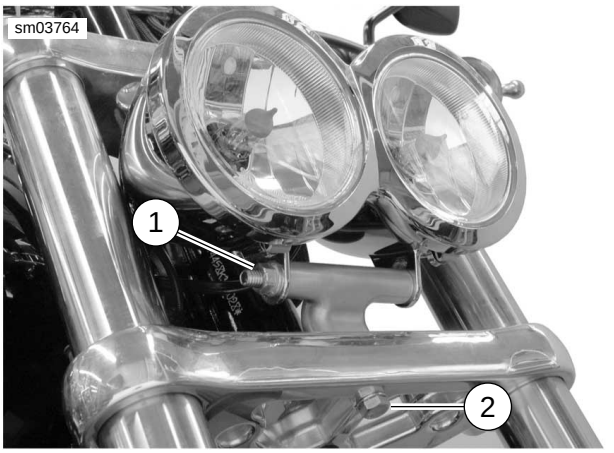
FASTENER	TORQUE VALUE	
Headlamp horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm
Headlamp vertical adjusting nut	25-30 ft-lbs	33.9-40.7 Nm

1. See Figure 1-48 or Figure 1-49. Loosen horizontal adjusting bolt (2) to adjust headlamp beam side to side. Tighten bolt to 25-30 ft-lbs (33.9-40.7 Nm).
2. Loosen vertical adjusting nut (1) to adjust headlamp beam up or down. Tighten nut to 25-30 ft-lbs (33.9-40.7 Nm).



1. **Vertical adjusting nut**
2. **Horizontal adjusting bolt**

Figure 1-48. Headlamp Adjustments: Single Bulb



1. **Vertical adjusting nut**
2. **Horizontal adjusting bolt**

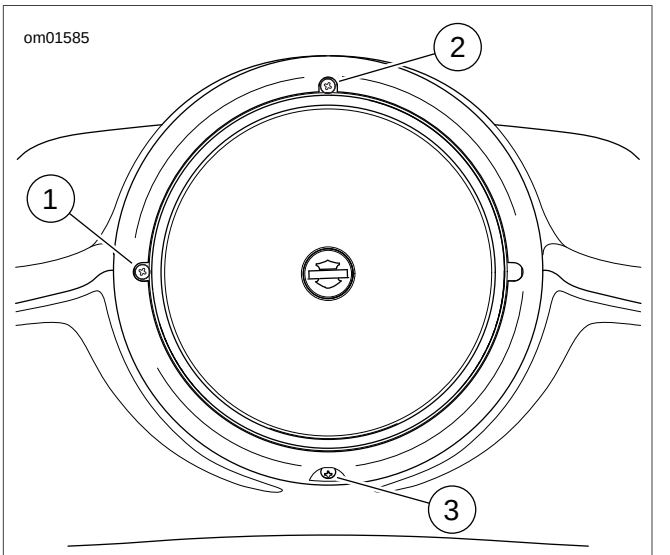
Figure 1-49. Headlamp Adjustments: Dual Bulb

ADJUSTMENT: FLD MODELS

NOTE

Headlamp adjustment can be performed without removing the headlamp trim ring.

1. See Figure 1-50. Using adjuster slots in trim ring, insert Phillips screwdriver between headlamp trim ring and rubber gasket.
   a. **Horizontal:** Turn the horizontal adjusting screw to adjust light beam left and right.
   b. **Vertical:** Turn the vertical adjusting screw to adjust light beam up and down.
2. Adjust the light beam until it is centered as shown in Figure 1-47.



1. **Horizontal adjuster**
2. **Vertical adjuster**
3. **Headlamp door screw**

Figure 1-50. Headlamp: FLD Model

SUSPENSION ADJUSTMENTS 1.23

SHOCK ABSORBER PRELOAD ADJUSTMENT

PART NUMBER	TOOL NAME
94448-82B	SHOCK ADJUSTMENT SPANNER
HD-94700-52C	SHOCK ADJUSTMENT SPANNER

Adjust the shock absorber spring preload for the total load. Increase preload for heavy loads. Reduce preload for lighter loads.

⚠WARNING

Adjust both shock absorbers equally. Improper adjustment can adversely affect stability and handling, which could result in death or serious injury. (00036b)

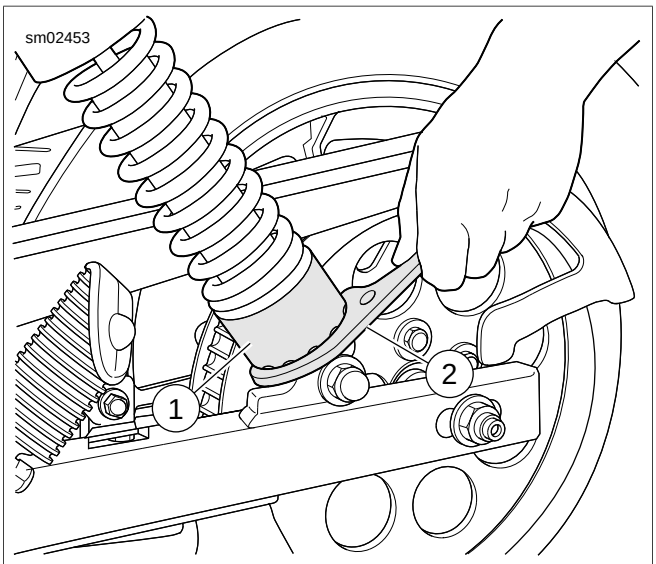
NOTICE

Do not turn the shock absorber adjustment collar clockwise beyond adjustment setting 5. Doing so may result in equipment damage. (00166b)

NOTE

Some models have a cover over the preload cam. Insert the teeth on the shock adjustment spanner into the holes in the cover.

See Figure 1-51. Using SHOCK ADJUSTMENT SPANNER (Part No. 94448-82B) or SHOCK ADJUSTMENT SPANNER (Part No. HD-94700-52C), turn the preload cam counterclockwise until it stops. Counting one at the stop position, turn the spanner clockwise and count each position to specification. Refer to Table 1-18 (FLD) or Table 1-19 (other models).



1. **Preload cam cover**
2. **Spanner**

Figure 1-51. Shock Absorber Preload Adjustment

Table 1-18. Recommended Shock Preload: FLD

LOAD[1]	POSITION[2]
Less than 190 lb (86 kg)	1
190-240 lb (86-109 kg)	2
240-290 lb (109-132 kg)	3
290-340 lb (132-154 kg)	4
340 lb (154 kg) to maximum added weight allowed. Refer to Table 2-3.	5

1. **Passenger/Cargo:** For every 35 lb (16 kg) of cargo or passenger weight, increase preload one position. Do not exceed the maximum added weight allowed.
2. See Figure 1-52.

Table 1-19. Recommended Shock Preload: Dyna Models Except FLD

LOAD[1]	POSITION[2]	
	FXDF, FXDL	FXDC, FXDWG, FXDB, FXDBA, FXDBP
Less than 135 lb (60 kg)	1	1
135-165 lb (60-75 kg)	1	2
165-195 lb (75-89 kg)	2	3
195-225 lb (89-102 kg)	3	4
225-255 lb (102-116 kg)	4	5
255 lb (116 kg) to maximum added weight allowed. Refer to Table 2-3.	5	5

1. Add the weight of the rider, passenger, riding gear, accessories and cargo.
2. See Figure 1-52.

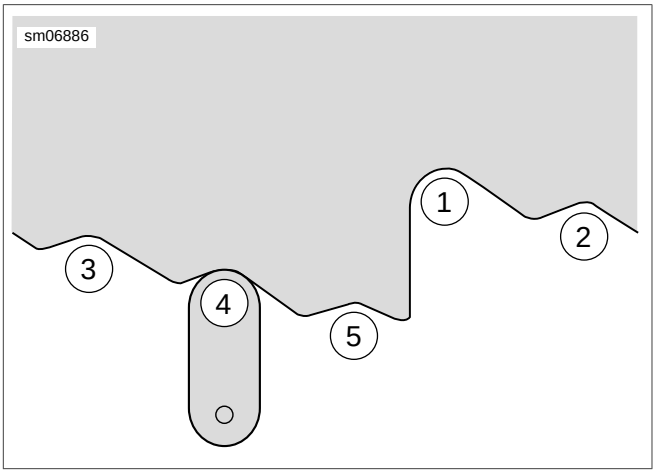


Figure 1-52. Shock Preload Cam Positions

STORAGE 1.24

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. (00003a)

⚠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)

1. Prepare the fuel system by filling fuel tank and adding a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions.
2. Run motorcycle until engine is at normal operating temperature. Stop the engine and change the engine oil and filter.
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.
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. 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. See 1.8 TIRES AND WHEELS.
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 the battery from the vehicle. Charge the 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 1.20 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 or light canvas. Plastic materials that do not breathe promote the formation of condensation which leads to corrosion.

REMOVAL FROM STORAGE

⚠WARNING

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

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

TROUBLESHOOTING 1.25

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 ON position.
2. Engine run switch in OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay, or solenoid faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch, slipping.
6. TSM/TSSM/HFSM Bank Angle Sensor tripped and ignition switch not cycled OFF then ON.

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).

NOTE

For cold weather starts, always disengage clutch.

5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Loose wire connection at coil, battery or ECM connector.
7. Ignition timing incorrect due to faulty coil, ECM or sensors (MAP, CKP and/or TSM/TSSM/HFSM).

Starts Hard

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

NOTE

For cold weather starts, always disengage clutch.

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

Starts But Runs Irregularly or Misses

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

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 sensors (MAP and/or CKP).

Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow over engine.
3. Heavy carbon deposit.
4. Ignition timing retarded due to faulty sensor(s): Manifold Absolute Pressure (MAP) and/or Crank Position (CKP).
5. Leaking valve.

Valve Train Noise

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

Excessive Vibration

1. Insufficient front engine mount clearance to engine bracket minimum 0.030 in. (0.762 mm) clearance.
2. Wheels and/or tires worn or damaged.
3. Engine/transmission/rear wheel not aligned properly.
4. Primary chain badly worn or links tight as a result of insufficient lubrication or not being properly aligned.
5. Engine to transmission mounting bolts loose.
6. Ignition timing advanced due to faulty sensor inputs (MAP and/or CKP)/poorly tuned engine.
7. Internal engine problem.
8. damaged frame.

Check Engine Light Illuminates During Operation

Fault detected. For diagnostic information see the electrical diagnostic manual.

LUBRICATION SYSTEM

Oil Does Not Return To Oil Pan

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

Engine Uses Too Much Oil Or Smokes Excessively

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

Engine Leaks Oil From Cases, Pushrods, Hoses, Etc.

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

Low Oil Pressure

1. Oil pan 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.

High Oil Pressure

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

ELECTRICAL SYSTEM

NOTE

For diagnostic information see the electrical diagnostic manual.

Alternator Does Not Charge

1. Voltage regulator module not grounded.
2. Engine ground wire loose or 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 end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
2. Damaged tire(s) or improper front-rear tire combination.
3. Irregular or peaked front tire tread wear.
4. Incorrect tire pressure.
5. Shock absorber not functioning normally.
6. Loose wheel axle nuts. Tighten to recommended torque specification.
7. Excessive wheel hub bearing play.
8. Rear wheel out of alignment with frame and front wheel.
9. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
10. Loose spokes (laced wheel vehicles only).
11. Tire and wheel unbalanced.
12. Rims and tires out-of-round or eccentric with hub.
13. Rims and tires out-of-true sideways.
14. Rear fork pivot.

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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NOTES

FASTENER TORQUE VALUES 2.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Axle cap fastener: Rear, All but FLD	132-180 **in-lbs**	14.9-20.3 Nm	2.4 FRONT WHEEL, Installation
Axle nut: Front	62-67 ft-lbs	84.1-90.9 Nm	2.4 FRONT WHEEL, Installation
Axle pinch bolt: Front FLD only	18-22 ft-lbs	24.4-29.9 Nm	2.4 FRONT WHEEL, Installation
Banjo bolt to front master cylinder	17-22 ft-lbs	23.1-29.9 Nm	2.10 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Banjo bolt to rear master cylinder	17-22 ft-lbs	23.1-29.9 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation
Battery terminal screw: all models	60-70 **in-lbs**	6.8-7.9 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Bottom brake caliper mounting bolt: Front	28-38 ft-lbs	38.0-51.5 Nm	2.4 FRONT WHEEL, Installation
Bracket, saddlebag theft prevention: FLD	24-36 **in-lbs**	2.7-4.1 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	2.11 FRONT BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.11 FRONT BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.13 REAR BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.14 BLEEDING BRAKES, Procedure
Brake caliper bridge bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.11 FRONT BRAKE CALIPER, Assembly
Brake caliper mounting bolt, rear	120-168 **in-lbs**	13.6-18.9 Nm	2.13 REAR BRAKE CALIPER, Installation
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm	2.5 REAR WHEEL, Assembly
Brake disc screws: front cast wheel	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL, Assembly
Brake disc screws: front laced wheel	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL, Assembly
Brake manifold to lower fork: FLD models	36-48 **in-lbs**	4.0-5.4 Nm	2.17 STEERING HEAD, Installation: FLD
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	2.13 REAR BRAKE CALIPER, Assembly
Control module housing screw	35-45 **in-lbs**	4.0-5.1 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Control module housing screw	35-45 **in-lbs**	4.0-5.1 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Damper cartridge screw	132-216 **in-lbs**	14.9-24.4 Nm	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm	2.5 REAR WHEEL, Installation
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm	2.19 DEBRIS DEFLECTOR, Installation
Dual disc brake disc screws: front cast wheel (FXDF)	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL, Assembly
Engine mount flange nut	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Footrest mounting screws and nuts	84-108 **in-lbs**	9.5-12.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Mid Controls
Footrest mounting screws and nuts	84-108 **in-lbs**	9.5-12.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Forward Controls
Footrest support mounting screws	30-40 ft-lbs	40.7-54.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Mid Controls

FASTENER	TORQUE VALUE		NOTES
Footrest support mounting screws	30-40 ft-lbs	40.7-54.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Mid Controls
Footrest support mounting screws	32-37 ft-lbs	43.4-50.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Forward Controls
Footrest support mounting screws	32-37 ft-lbs	43.4-50.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Forward Controls
Fork stem nut: FLD models	70-80 ft-lbs	94.9-108.4 Nm	2.17 STEERING HEAD, Installation: FLD
Fork tube caps	22-59 ft-lbs	30-80 Nm	2.16 FRONT FORK, Assembly
Fork tube caps	22-59 ft-lbs	30-80 Nm	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
Front and rear isolator mounting bolts to frame	22-27 ft-lbs	29.9-36.6 Nm	2.9 VEHICLE ALIGNMENT, Inspection
Front axle cap fastener: All but FLD	132-180 **in-lbs**	14.9-20.3 Nm	2.4 FRONT WHEEL, Installation
Front belt guard fastener	120-180 **in-lbs**	13.6-20.3 Nm	2.18 BELT GUARD, Installation
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.11 FRONT BRAKE CALIPER, Installation
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.11 FRONT BRAKE CALIPER, Installation
Front caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.11 FRONT BRAKE CALIPER, Installation
Front engine bracket bolts to engine	25-32 ft-lbs	34.0-43.3 Nm	2.34 ENGINE MOUNTS, Installation
Front fender nuts: All models	15-21 ft-lbs	20.3-28.5 Nm	2.26 FRONT FENDER, Installation
Front fork seat pipe screw	132-216 **in-lbs**	14.9-24.4 Nm	2.16 FRONT FORK, Assembly
Front isolator mounting bolts to frame	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Front isolator mounting bolts to front engine bracket	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Front isolator mounting bolts to front engine bracket	18-22 ft-lbs	24.4-29.9 Nm	2.9 VEHICLE ALIGNMENT, Inspection
Front master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	2.14 BLEEDING BRAKES, Procedure
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	2.10 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation
Hand control module screws	35-45 **in-lbs**	4.0-5.1 Nm	2.20 THROTTLE CONTROL, Assembly/Installation
Handlebar master cylinder clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	2.10 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation
Handlebar riser bolts: FLD	30-40 ft-lbs	40.6-54.0 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Handlebar riser bolts: FLD models	30-40 ft-lbs	40.6-54.0 Nm	2.17 STEERING HEAD, Installation: FLD
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Handlebar riser fastener: FXDB/P/A final tightening	30-40 ft-lbs	40.7-54.2 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Handlebar riser fastener: FXDF, FXDWG, final tightening	30-40 ft-lbs	40.7-54.2 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Headlight to nacelle: FLD	7-10 **in-lbs**	0.8-1.1 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Headlight to nacelle: FLD models	7-10 **in-lbs**	0.8-1.1 Nm	2.17 STEERING HEAD, Installation: FLD
Jiffy stand sensor screw	96-144 **in-lbs**	10.8-16.3 Nm	2.33 JIFFY STAND, Jiffy Stand Sensor: HDI Models

FASTENER	TORQUE VALUE		NOTES
locknut, fork tube cap	13-16.6 ft-lbs	17.5-22.5 Nm	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
Lower nacelle fasteners: FLD	84-120 **in-lbs**	9.5-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Lower nacelle fasteners: FLD models	84-120 **in-lbs**	9.5-13.5 Nm	2.17 STEERING HEAD, Installation: FLD
Master cylinder mounting nut, rear	30-40 ft-lbs	40.7-54.2 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.10 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.11 FRONT BRAKE CALIPER, Installation
Master cylinder reservoir rear cover screws: FLD (ABS and non-ABS) and all other non-ABS models	6-8 **in-lbs**	0.68-0.90 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation
Negative battery fastener: All Models	60-70 **in-lbs**	6.8-7.9 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Passenger footrest screw and nut	84-108 **in-lbs**	9.5-12.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Passenger Footrests: All models except FXDF)
Passenger footrest support mounting screw	25-35 ft-lbs	33.9-47.4 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Passenger Footrests: All models except FXDF)
Pinch bolts: All models except FLD	30-35 ft-lbs	41-48 Nm	2.16 FRONT FORK, Installation
Pivot shaft nut	70-77 ft-lbs	95.0-104.5 Nm	2.22 REAR FORK, Installation
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm	2.5 REAR WHEEL, Installation
Rear belt guard fastener	120-180 **in-lbs**	13.6-20.3 Nm	2.18 BELT GUARD, Installation
Rear caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.13 REAR BRAKE CALIPER, Installation
Rear fender cover front screw: All models	12-18 ft-lbs	16.3-24.4 Nm	2.35 SAREE GUARD: INDIA MODELS, Replacement
Rear fender cover rear screw: All models	12-18 ft-lbs	16.3-24.4 Nm	2.35 SAREE GUARD: INDIA MODELS, Replacement
Rear fender cover screw: FXDF	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDF
Rear fender screw: FLD	30-37 ft-lbs	40.7-50.2 Nm	2.27 REAR FENDER, FLD/Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Rear fender screw: FXDB	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDB
Rear fender screw: FXDC and FXDL Models	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDC and FXDL
Rear fender screw: FXDWG	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDWG
Rear fork brake hose J-clip	40-60 **in-lbs**	4.5-6.8 Nm	2.22 REAR FORK, Assembly
Rear isolator mounting bolts to transmission case	22-27 ft-lbs	29.9-36.6 Nm	2.9 VEHICLE ALIGNMENT, Inspection
Rear isolator to frame bolts	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Rear master cylinder reservoir cover screws, non-ABS models	6-8 **in-lbs**	0.7-0.9 Nm	2.14 BLEEDING BRAKES, Procedure
Rear mount license plate bracket screws: FXDWG	30-40 **in-lbs**	3.4-4.5 Nm	2.27 REAR FENDER, FXDWG
Rear shock, lower screws: All models	30-40 ft-lbs	40.6-54.2 Nm	2.35 SAREE GUARD: INDIA MODELS, Replacement
Rear sprocket screws-final torque	77-83 ft-lbs	104.5-112.6 Nm	2.5 REAR WHEEL, Assembly
Rear sprocket screws-initial torque	60 ft-lbs	81.4 Nm	2.5 REAR WHEEL, Assembly

FASTENER	TORQUE VALUE		NOTES
Rider footboard bracket screws	32-37 ft-lbs	43.0-50.0 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Rider footboard pivot bolt nut	60-80 **in-lbs**	6.8-9.0 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Riser cover fastener: FXDC only	50-60 **in-lbs**	5.6-6.8 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Saddlebag inner/outer support screws: FLD	96-120 **in-lbs**	10.8-13.6 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag latch attaching screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag latch faceplate nut: FLD	7-17 **in-lbs**	0.8-1.9 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag latch faceplate screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag latch pivot screw: FLD	96-120 **in-lbs**	10.8-13.6 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag latch screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag lock screws: FLD	30-40 **in-lbs**	3.4-4.5 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag lower mount screws: FLD	96-120 **in-lbs**	10.8-13.6 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag lower mount spool: FLD	15-20 ft-lbs	20.3-27.1 Nm	2.27 REAR FENDER, FLD/Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Seat rear fastener: All Models	20-40 **in-lbs**	2.3-4.5 Nm	2.28 SEAT, Installation
Seat rear fastener: All Models except FXDWG	20-40 **in-lbs**	2.3-4.5 Nm	2.28 SEAT, Installation
Seat shoulder bolt: FXDWG	80-90 **in-lbs**	9.0-10.2 Nm	2.28 SEAT, Installation
Seat strap nut: FLD	60-90 **in-lbs**	6.8-10.2 Nm	2.27 REAR FENDER, FLD
Seat strap nut: FXDWG Only	60-90 **in-lbs**	6.78-10.17 Nm	2.28 SEAT, Installation
Shift rod fastener with acorn nut	96-144 **in-lbs**	10.8-16.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm	2.5 REAR WHEEL, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm	2.21 REAR SHOCK ABSORBERS, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm	2.5 REAR WHEEL, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm	2.21 REAR SHOCK ABSORBERS, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting stud nut, inner	75-85 ft-lbs	101.7-115.2 Nm	2.21 REAR SHOCK ABSORBERS, Installation
Side mount license plate bracket screws: FXDWG	84-180 **in-lbs**	9.5-20.3 Nm	2.27 REAR FENDER, FXDWG
Slider cover fasteners: FLD	60-120 **in-lbs**	6.8-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Speedometer cover fastener: FXDC only	50-60 **in-lbs**	5.6-6.8 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Spoke nipple	55 **in-lbs**	6.2 Nm	2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels
Tether assembly screws: FLD	8-12 **in-lbs**	0.9-1.4 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Top brake caliper mounting bolt: Front	28-38 ft-lbs	38.0-51.5 Nm	2.4 FRONT WHEEL, Installation
Upper and lower pinch bolts: FLD models	30-35 ft-lbs	40.6-47.5 Nm	2.17 STEERING HEAD, Installation: FLD

FASTENER	TORQUE VALUE		NOTES
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener: FXDB/P/A, FXDF, FXDWG, final tightening	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Upper handlebar clamp fastener: FXDB/P/A, initial tightening	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Upper handlebar clamp fastener: FXDB/P/A final tightening	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Upper nacelle fasteners: FLD	84-120 **in-lbs**	9.5-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Upper nacelle fasteners: FLD models	84-120 **in-lbs**	9.5-13.5 Nm	2.17 STEERING HEAD, Installation: FLD
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.15 TIRES, Installation
Valve stem nut, tube type	3-7 **in-lbs**	0.3-0.8 Nm	2.15 TIRES, Installation
Windshield docking hardware: FLD	84-120 **in-lbs**	9.5-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Windshield docking hardware: FLD models	84-120 **in-lbs**	9.5-13.5 Nm	2.17 STEERING HEAD, Installation: FLD
Windshield window screws: FLD	20-25 **in-lbs**	2.3-2.8 Nm	2.31 WINDSHIELD: FLD, Windshield Window

SPECIFICATIONS 2.2

SPECIFICATIONS

Chassis Specifications

Table 2-1. Dimensions

ITEM	FXDB/FXDBP*		FXDC		FXDF		FXDWG		FXDL		FLD		FXDBA	
	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
Length	92.8	2357	92.9	2360	91.7	2329	94.0	2388	92.5	2350	92.8	2357	94.3	2395
Overall width	37.5	953	38.9	988	35.0	889	37.2	945	36.2	920	37.7	958	36	915
Overall height	50.4	1280	48.5	1232	44.5	1130	47.8	1214	47.0	1195	55.5	1409	50.4	1280
Wheelbase	64.2	1631	64.2	1631	63.7	1618	68.3	1735	64.0	1625	62.8	1595	64	1625
Road clearance	4.9	125	4.6	117	4.9	125	4.2	107	4.9	125	4.3	110	4.4	110
Saddle height**	25.5	648	26.3	668	26.1	663	25.5	648	25.8	655	26.1	663	25.5	648

*Dimensions may vary for factory customized vehicles.
**With 180 lb (81.6 kg) rider on seat.

Table 2-2. Capacities

ITEM	FXDB, FXDBP, FXDL, FLD, FXDWG, FXDBA		FXDC, FXDF	
	U.S.	L	U.S.	L
Fuel tank (total)	4.7 gal	17.8	5.0 gal	18.9
Oil tank with filter	3.0 qt	2.8	3.0 qt	2.8
Transmission (approximate)	1.0 qt	0.95	1.0 qt	0.95
Primary chaincase (approximate)	1.0 qt	0.95	1.0 qt	0.95
Low fuel warning light on	0.9 gal	3.4	0.9 gal	3.4

Table 2-3. Weight

ITEM	FXDB/FXDBP*		FXDC		FXDF		FXDWG		FXDL		FLD		FXDBA	
	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
Running weight**	670	303.9	679	308.0	706	320.2	668	303.0	672	304.8	718	325.7	672	305
Maximum added weight allowed***	415	188.3	406	184.2	379	172.0	417	189.2	413	187.4	452	205.0	413	187.2
GVWR	1085	492.2	1085	492.2	1085	492.2	1085	492.2	1085	492.2	1170	530.7	1085	492.2
GAWR front	390	176.9	390	176.9	390	176.9	390	176.9	390	176.9	455	206.4	390	176.9
GAWR rear	695	315.3	695	315.3	695	315.3	695	315.3	695	315.3	794	360.2	695	315.3

*Vehicle weight may vary for factory customized vehicles.
**The total weight as delivered with all oil/fluids and approximately 90% of fuel.
***The total weight of accessories, cargo, riding gear, passenger and rider cannot 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. (00016f)

- 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.*

Tire Specifications

⚠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

- *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 2-7 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: T19 x 2.15 MT DOT. "T" indicates that the rim conforms to Tire and Rim Association standards. The "19" 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. "MT" designates the rim contour. "DOT" means that the rim meets Department of Transportation Federal Motor Vehicle Safety Standards.

Table 2-4. Tire Fitment-Tubeless Cast Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	RIM VALVE HOLE DIA.	TIRE SIZE
16 in. - Front	E16 x 3.00 MT	0.327 in.	Dunlop D427F 130/90B16 67H
18 in. - Front	T18 x 3.5 MT	0.45 in.	Dunlop D402F 130/70B18
19 in. - Front	T19 x 2.5 MT	0.327 in.	Michelin Scorcher "31" 100/90-19
16 in. - Rear	T16 x 5.0 MT	0.333 in.	Dunlop D427 180/70B16 77H
17 in. - Rear	T17 x 4.5 MT	0.327 in.	Michelin Scorcher "31" 160/70-17
17 in. - Rear	T17 x 4.5 MT	0.327 in.	Dunlop D401 160/70B17

Table 2-5. Tire Fitment-Tube Type Steel Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE CENTER VALVE TUBE	TIRE SIZE
19 in. - Front	T19 x 2.50 TLA	MJ/MM90-19 or 100/90-19	Michelin Scorcher "31" 100/90-19
21 in. - Front	T21 x 2.15 TLA	MH90-21 80/90-21	Michelin Scorcher "31" 80/90-21

Table 2-5. Tire Fitment-Tube Type Steel Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE CENTER VALVE TUBE	TIRE SIZE
17 in. - Rear (all but FXDWG)	T17 x 4.5 MT	150-160/70-17 or 160/70-17	Michelin Scorcher "31" 160/70-17
17 in. - Rear (FXDWG)	T17 x 4.5 MT	180/60B17	Michelin Scorcher "31" 180/60-17

Table 2-6. Tire Fitment - Tube Type Chrome Aluminum Profile Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE CENTER VALVE TUBE	TIRE SIZE
19 in. - Front	T19 x 2.50 MT	MJ/MM90-19 or 100/90-19	Michelin Scorcher "31" 100/90-19
17 in. - Rear	T17 x 4.5 MT	150-160/70-17	Michelin Scorcher "31" 160/70-17

Table 2-7. Specified Tires

MODEL	MOUNT	SIZE (in)	SPECIFIED TIRE	PRESSURE (COLD)	
				psi	kPa
FXDB, FXDBP, FXDC, FXDL, FXDBA	Front	19	Michelin Scorcher "31" 100/90B19	30	206
	Rear	17	Michelin Scorcher "31" 160/70B17	40	276
FXDF	Front	16	Dunlop D427F 130/90B16	36	248
	Rear	16	Dunlop D427 180/70B16	40	276
FXDWG	Front	21	Michelin Scorcher "31" 80/90-21	38	262
	Rear	17	Michelin Scorcher "31" 180/60B17	40	276
FLD	Front	18	Dunlop D402F 130/70B18	36	248
	Rear	17	Dunlop D401 160/70B17	40	276

VEHICLE IDENTIFICATION NUMBER (VIN) 2.3

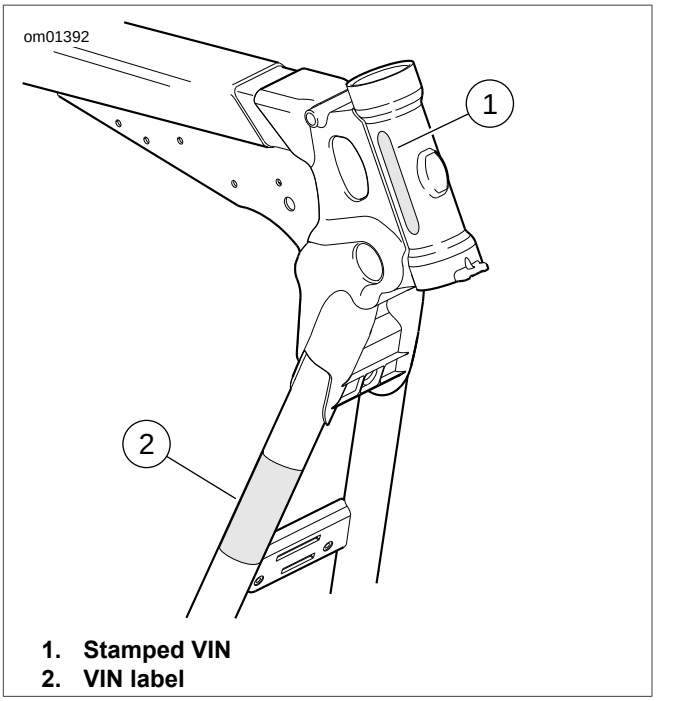
VEHICLE IDENTIFICATION NUMBER

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.



1. **Stamped VIN**
2. **VIN label**

Figure 2-1. VIN Locations

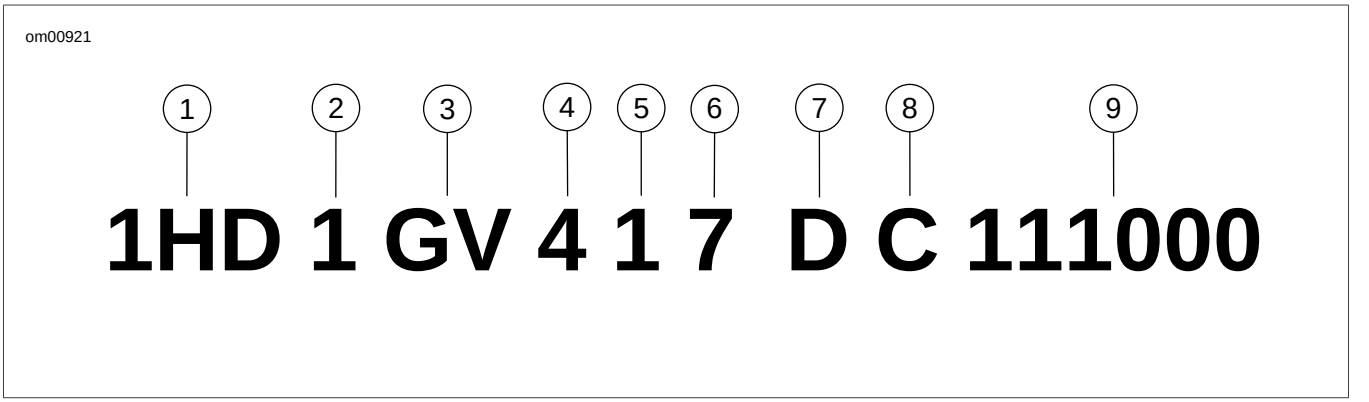


Figure 2-2. Typical Harley-Davidson VIN: 2013 Dyna Models

Table 2-8. Harley-Davidson VIN Breakdown: 2013 Dyna Models

POSITION	DESCRIPTION	POSSIBLE VALUES
1	World manufacturer identifier	1HD=Originally manufactured for sale **within** the United States 5HD=Originally manufactured for sale **outside** of theUnited States 932=Originally manufactured in and for sale only in Brazil market MEG=Originally manufactured in and for sale only in India market
2	Motorcycle type	1=Heavyweight motorcycle (901 cm^3 or larger)
3	Model	See VIN model table
4	Engine type	4=Twin Cam 96™, 1585 cm^3 air-cooled, fuel-injected M=Twin Cam 103™, 1690 cm^3 air-cooled, fuel-injected

Table 2-8. Harley-Davidson VIN Breakdown: 2013 Dyna Models

POSITION	DESCRIPTION	POSSIBLE VALUES	
5	Calibration/configuration, introduction	**Normal Introduction** 1=Domestic (DOM) 3=California (CAL) A=Canada (CAN) C=HDI E=Japan (JPN) G=Australia (AUS) J=Brazil (BRZ) L=Asia Pacific (APC) N=India (IND)	**Mid-year or Special Introduction** 2, 4=Domestic (DOM) 5, 6=California (CAL) B=Canada (CAN) D=HDI F=Japan (JPN) H=Australia (AUS) K=Brazil (BRZ) M=Asia Pacific (APC) P=India (IND)
6	VIN check digit	Can be 0-9 or X	
7	Model year	D=2013	
8	Assembly plant	C=Kansas City, MO U.S.A. D=H-D Brazil-Manaus, Brazil (CKD) N=Haryana India (Bawal District Rewari)	
9	Sequential number	Varies	

Table 2-9. VIN Model Codes: 2013 Dyna Models

CODE	MODEL	CODE	MODEL
GN	FXDL Dyna® Low Rider® (Japan only)	GY	FXDF Dyna® Fat Bob®
GP	FXDWG® Dyna Wide Glide®	GZ	FLD Dyna® Switchback
GX	FXDB Dyna® Street Bob®	VA	FXDBP Dyna® Street Bob® (factory custom)
GV	FXDC Dyna® Super Glide® Custom	VB	FXDBA Dyna® Street Bob® (factory custom)
	FXDC ANV Dyna® Super Glide® Custom 110th Anniversary Edition		

FRONT WHEEL 2.4

REMOVAL

NOTE

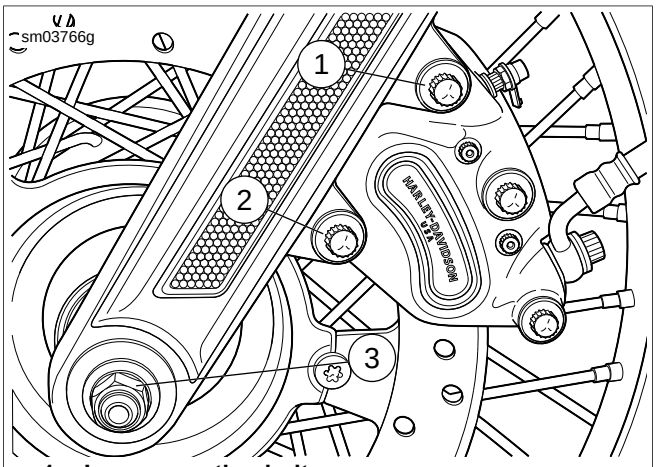
Take care when removing and installing wheel to prevent cosmetic damage to wheel. This is especially true with wheels that feature painted surfaces.

1. Block motorcycle underneath frame so front wheel is raised off the ground.
2. Inspect wheel bearing end play and service bearings if necessary. See 2.6 SEALED WHEEL BEARINGS.
3. See Figure 2-3. Remove mounting bolts (1, 2) and remove brake caliper. Support caliper using a rubber bungee cord.

NOTE

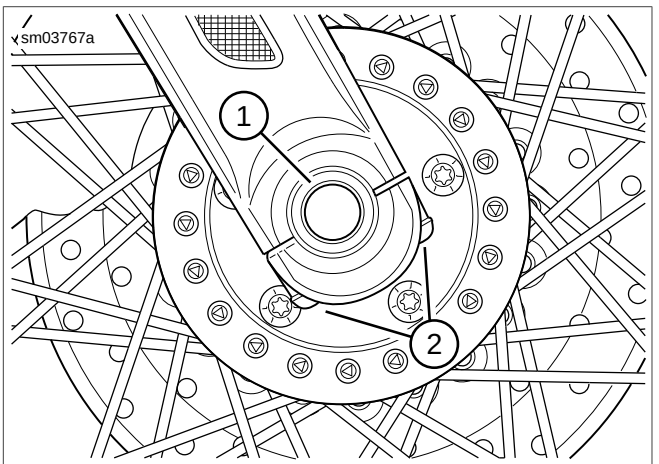
Do not operate front brake lever with the front wheel removed or the caliper piston may be forced out of piston bore. Reseating the piston requires disassembly of the caliper.

4. Remove axle nut and washer (3).
5. See Figure 2-4 or Figure 2-5. Loosen the slider cap screws (2) or pinch bolt (2) and pull the axle (1) free.
6. Remove wheel from forks.



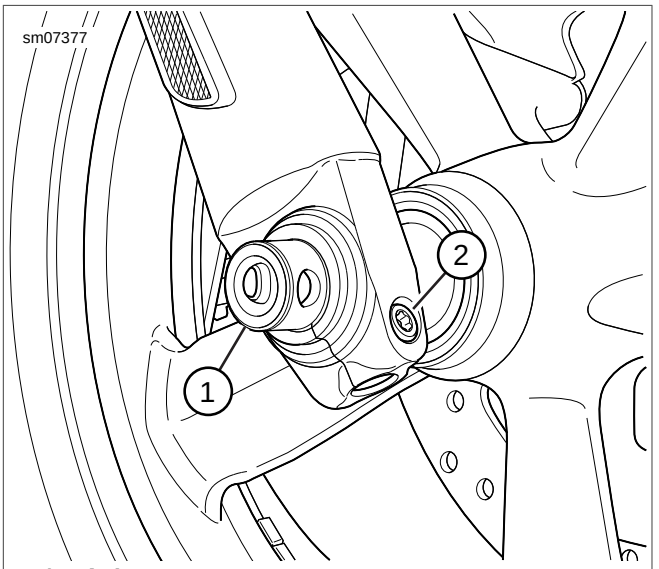
1. **Long mounting bolt**
2. **Short mounting bolt**
3. **Axle nut and washer**

Figure 2-3. Front Caliper and Axle Mounting (Left Side)



1. **Axle**
2. **Slider cap screws and washers**

Figure 2-4. Front Wheel Mounting: All but FLD (Right Side)



1. **Axle**
2. **Pinch bolt**

Figure 2-5. Front Wheel Mounting: FLD (Right Side)

DISASSEMBLY

NOTES

- *To service tire or valve stem assembly, see 2.15 TIRES.*
- *If motorcycle is equipped with ABS brakes, see C.2 ABS MODULE.*

Cast Wheel

1. See Figure 2-6. Remove right spacer (2) and left spacer (10) or wheel speed sensor (13).
2. If necessary, remove brake disc (6). On left side of wheel, remove five screws (15) to detach brake disc (6). Discard screws.

Cast Wheel, Dual Brakes

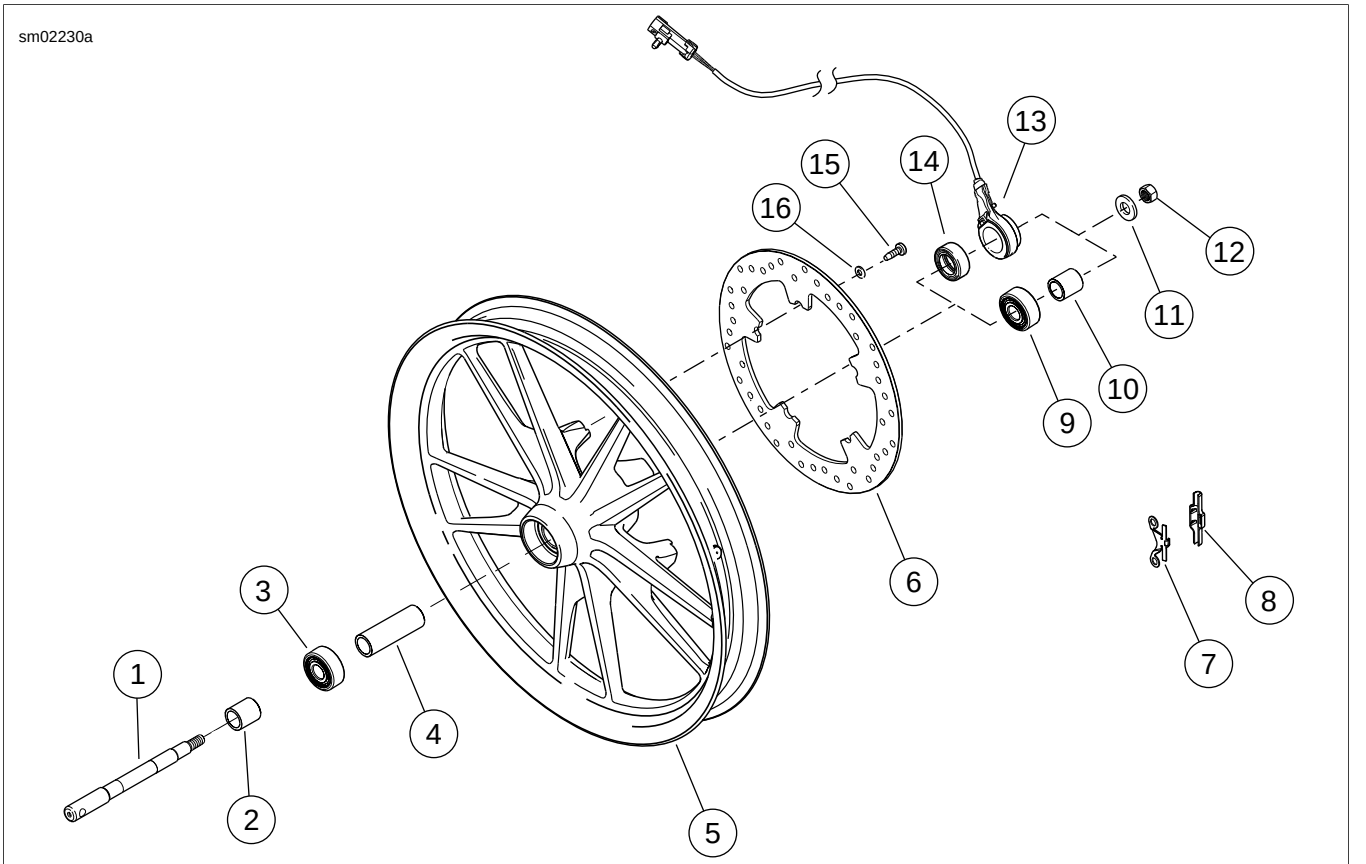
NOTE

Cast wheels do not use hub caps no matter the model.

1. See Figure 2-7. Remove right spacer (2) and left spacer (10) or wheel speed sensor (13).
2. If necessary, remove brake discs. Remove five screws (15) to detach each brake disc. Discard screws.

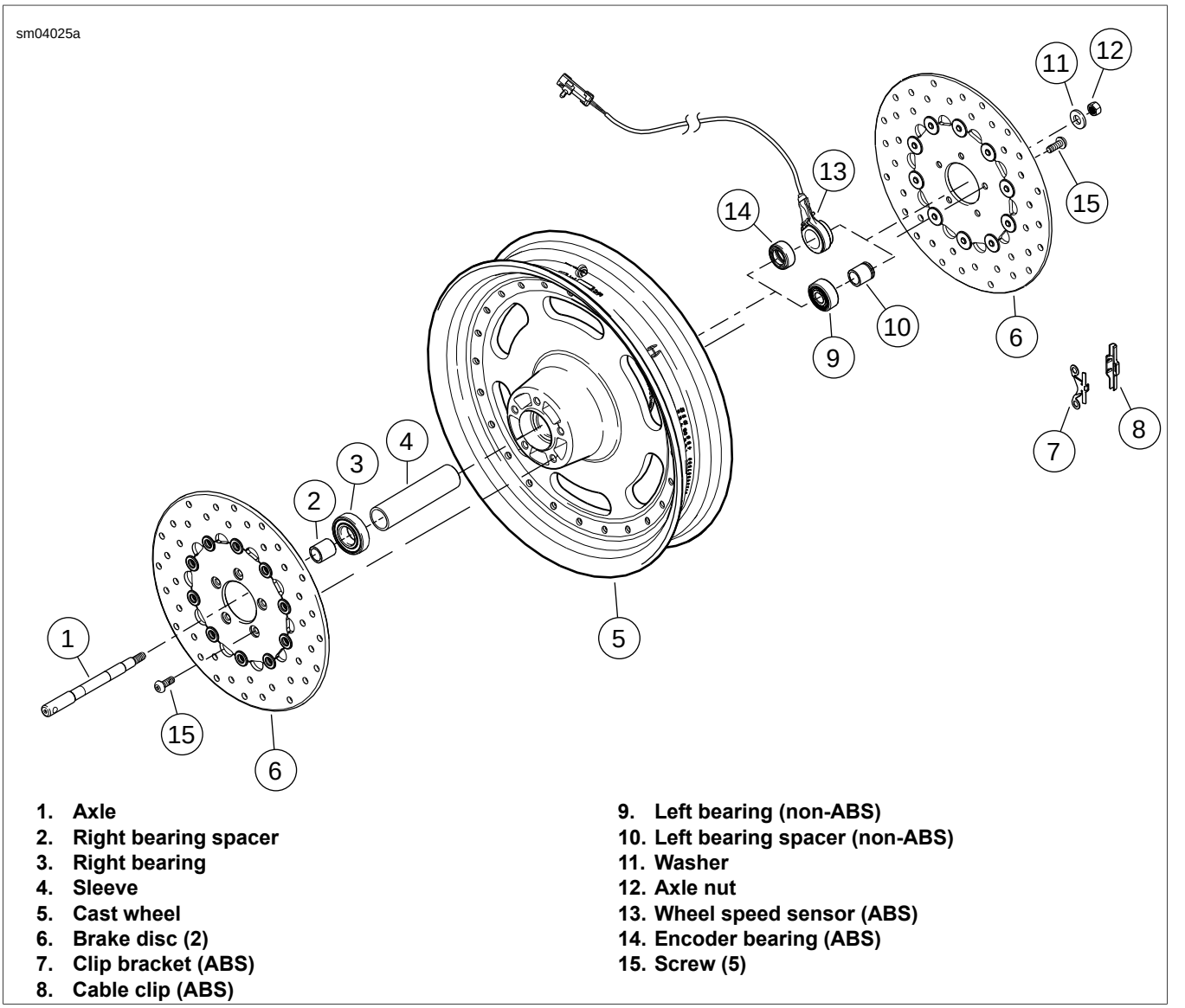
Laced Wheel

1. See Figure 2-8. Remove right spacer (2) and left spacer (10) or wheel speed sensor (13). If necessary, remove brake disc(s).
2. See Figure 2-9. On left side of wheel, remove five screws (15) to detach brake disc (6). Discard screws.



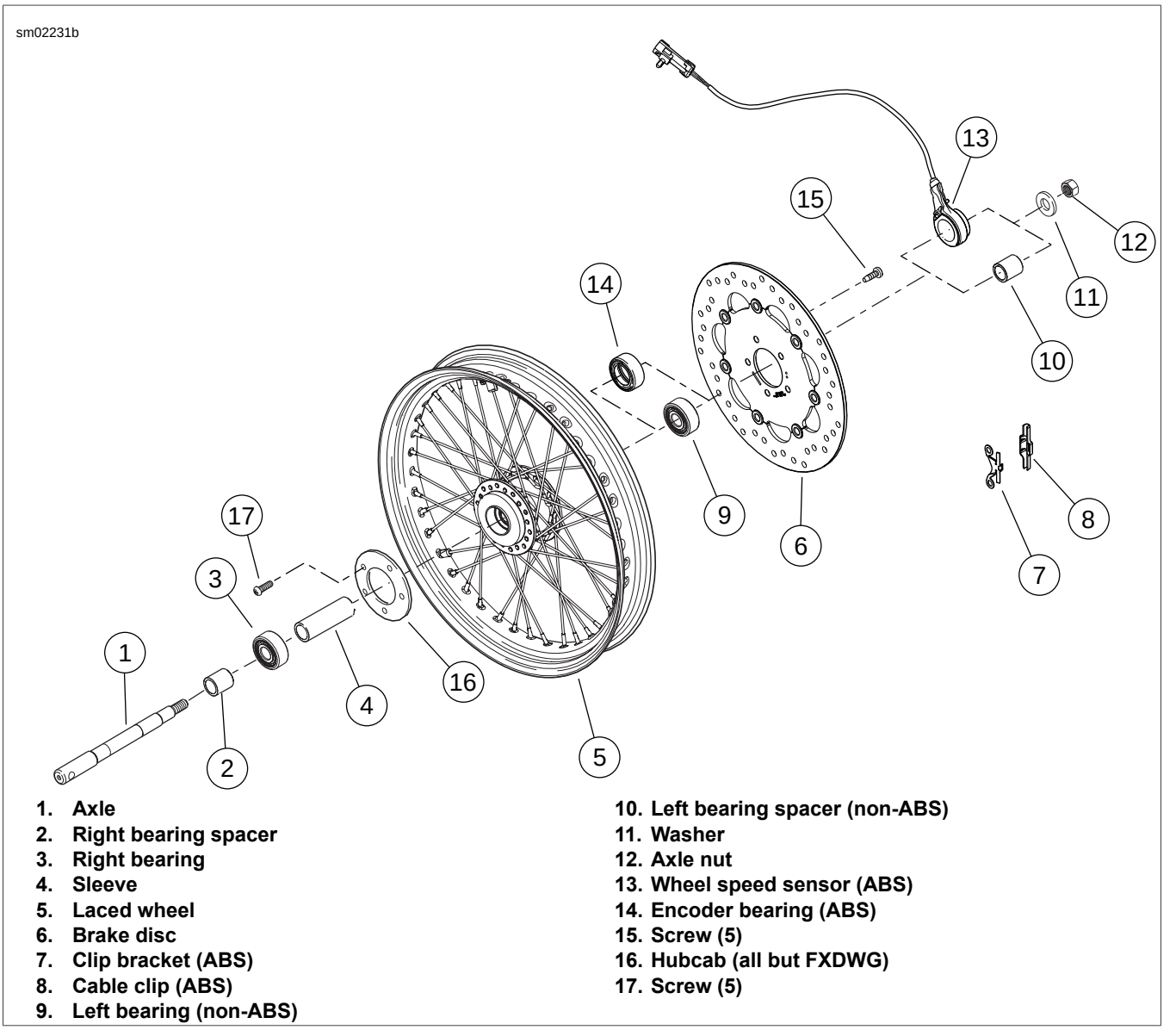
1. **Axle**
2. **Right bearing spacer**
3. **Right bearing**
4. **Sleeve**
5. **Cast wheel**
6. **Brake disc**
7. **Clip bracket (ABS)**
8. **Cable clip (ABS)**
9. **Left bearing (non-ABS)**
10. **Left bearing spacer (non-ABS)**
11. **Washer**
12. **Axle nut**
13. **Wheel speed sensor (ABS)**
14. **Encoder bearing (ABS)**
15. **Screw (5)**
16. **Washer (5)**

Figure 2-6. Cast Front Wheel



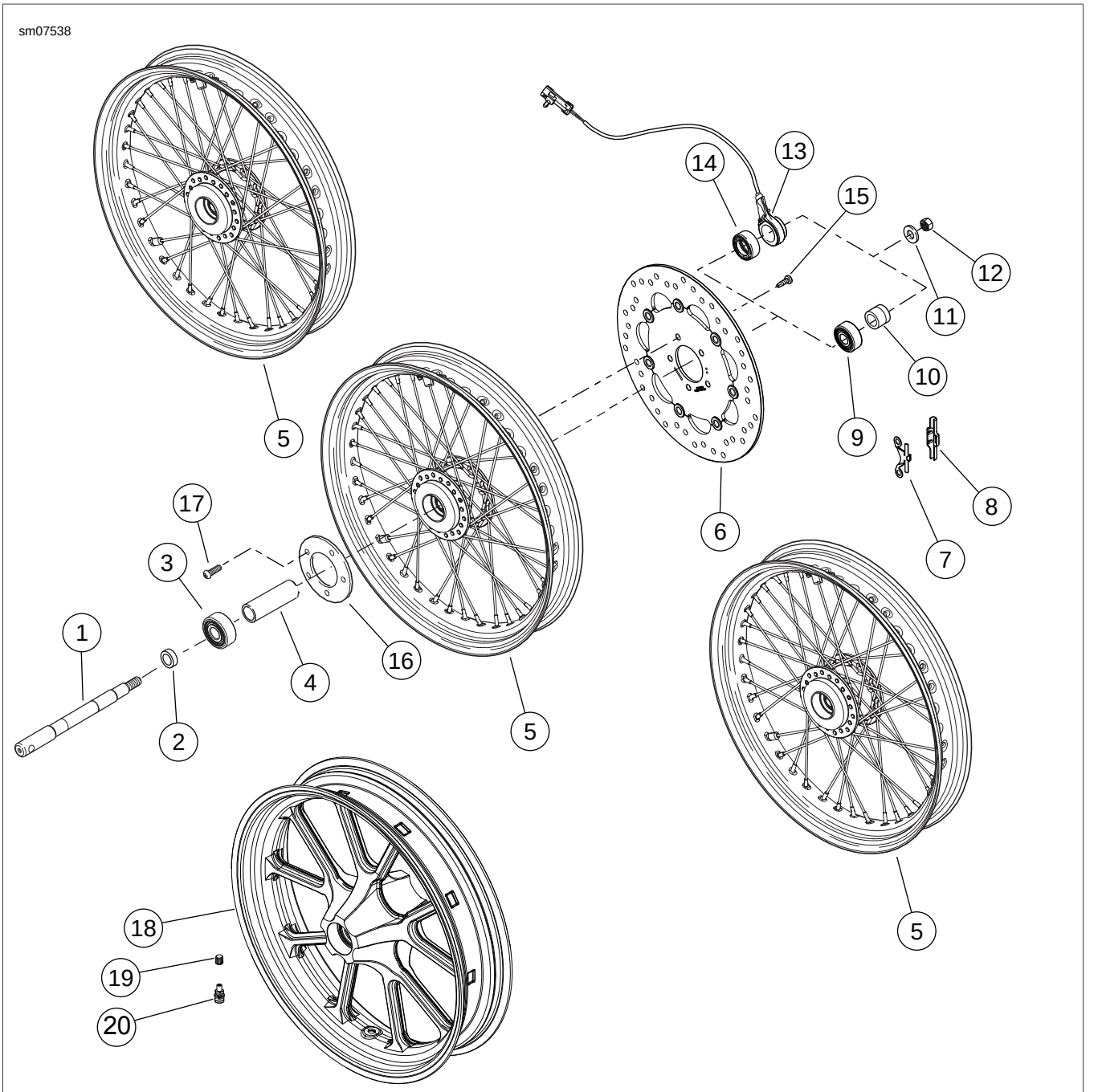
1. Axle
2. Right bearing spacer
3. Right bearing
4. Sleeve
5. Cast wheel
6. Brake disc (2)
7. Clip bracket (ABS)
8. Cable clip (ABS)
9. Left bearing (non-ABS)
10. Left bearing spacer (non-ABS)
11. Washer
12. Axle nut
13. Wheel speed sensor (ABS)
14. Encoder bearing (ABS)
15. Screw (5)

Figure 2-7. Cast Front Wheel (FXDF)



1. Axle
2. Right bearing spacer
3. Right bearing
4. Sleeve
5. Laced wheel
6. Brake disc
7. Clip bracket (ABS)
8. Cable clip (ABS)
9. Left bearing (non-ABS)
10. Left bearing spacer (non-ABS)
11. Washer
12. Axle nut
13. Wheel speed sensor (ABS)
14. Encoder bearing (ABS)
15. Screw (5)
16. Hubcab (all but FXDWG)
17. Screw (5)

Figure 2-8. Laced Front Wheel



1. Front axle
2. Bearing spacer, narrow
3. Roller bearing (2 non-ABS)
4. Hub spacer
5. Laced wheel assembly: 19 in FXDBP with red rim, black rim or chrome rim
6. Brake disc L.H.
7. Wheel Speed Sensor (WSS) Mounting Bracket (ABS)
8. WSS Clip (ABS)
9. Roller bearing (non-ABS)
10. Bearing spacer, wide
11. Washer
12. Nut
13. Wheel Speed Sensor (WSS)
14. Encoder bearing (1-ABS)
15. Screw (5)
16. Wheel hub cap: FXDC/FXDB (laced wheels only)
17. Screw (5)
18. Wheel assembly: 19 in FXDBP (cast)
19. Valve cap
20. Valve stem assembly with nut

Figure 2-9. FXDBP Front Wheel Options

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.

ASSEMBLY

FASTENER	TORQUE VALUE	
Brake disc screws: front cast wheel	16-24 ft-lbs	21.7-32.5 Nm
Dual disc brake disc screws: front cast wheel (FXDF)	16-24 ft-lbs	21.7-32.5 Nm
Brake disc screws: front laced wheel	16-24 ft-lbs	21.7-32.5 Nm

⚠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)

Cast Wheel

1. See Figure 2-6. If necessary, install brake disc (6). Verify that brake disc is clean.
2. On left side of wheel, install five **new** screws (15) and washers (16) to attach brake disc (6). Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
3. **FXDF:** Install second disc on right side of wheel. Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
4. Install right spacer (2) and wheel speed sensor (13) or left spacer (10) with largest chamfered end facing away from wheel.
5. Verify that wheel and tire are true. See 2.8 CHECKING AND TRUING WHEELS.

Laced Wheel

1. If hub and rim were disassembled, see 2.7 WHEEL LACING.
2. See Figure 2-8. If necessary, install brake disc (6). Verify that brake disc is clean.
3. On left side of wheel, install five **new** screws (3) to attach brake disc (6). Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
4. Install right spacer (2) and wheel speed sensor (13) or left spacer (10) with largest chamfered end facing away from wheel.
5. Verify that wheel and tire are true. See 2.8 CHECKING AND TRUING WHEELS.

INSTALLATION

FASTENER	TORQUE VALUE	
Axle nut: Front	62-67 ft-lbs	84.1-90.9 Nm
Axle cap fastener: Rear, All but FLD	132-180 **in-lbs**	14.9-20.3 Nm
Front axle cap fastener: All but FLD	132-180 **in-lbs**	14.9-20.3 Nm
Axle pinch bolt: Front FLD only	18-22 ft-lbs	24.4-29.9 Nm
Bottom brake caliper mounting bolt: Front	28-38 ft-lbs	38.0-51.5 Nm
Top brake caliper mounting bolt: Front	28-38 ft-lbs	38.0-51.5 Nm

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

NOTE

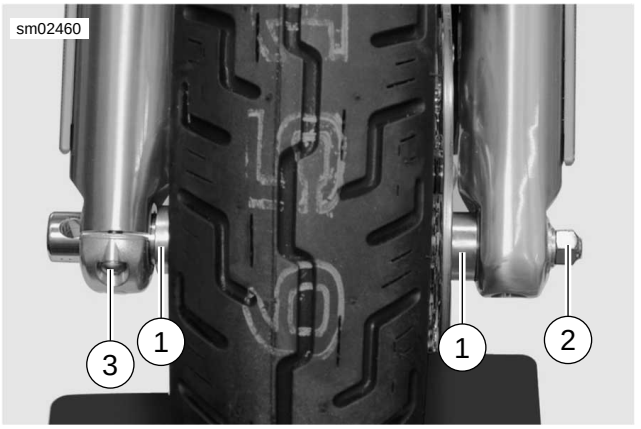
***If ABS equipped:** the WSS is located on the left side of the vehicle.*

2. See Figure 2-10. Place wheel into front fork and install axle. Verify that axle spacers (1) on right and left side are properly installed.
3. See Figure 2-11. Install slider cap with cast-in spacer (1) toward the rear of the vehicle on all models except FLD. Do not tighten fasteners at this time.
4. See Figure 2-13. **If ABS equipped:** rotate front wheel speed sensor counterclockwise until index pin makes contact with shoulder on left fork slider.
5. Install the washer, lockwasher, and axle nut. Tighten axle nut to 62-67 ft-lbs (84.1-90.9 Nm). Hold axle stationary with a steel rod or screwdriver inserted through hole on right end of axle while tightening.

NOTE

If the axle cap fasteners are properly tightened, there should be no gap at the rear of the axle cap.

6. Secure axle to front fork in the following manner:
   a. **All but FLD:** See Figure 2-11. Tighten rear axle cap fastener (2) to 132-180 **in-lbs** (14.9-20.3 Nm), then tighten front axle cap fastener (3) to 132-180 **in-lbs** (14.9-20.3 Nm).
   b. **FLD:** See Figure 2-12. Tighten front axle pinch bolt to 18-22 ft-lbs (24.4-29.9 Nm).



1. **Spacer (2)**
2. **Axle nut, lockwasher and washer**
3. **Slider cap fasteners**

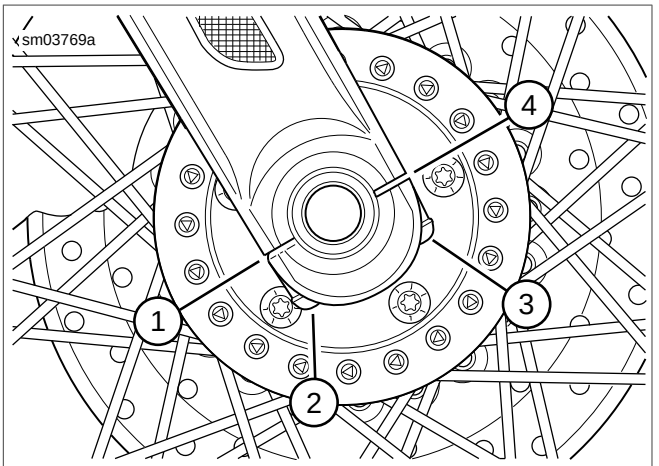
Figure 2-10. Front Axle Assembly

7. See Figure 2-3. Install the brake caliper to the fork leg.
   a. Loosely install long mounting bolt (1) (metric) into top hole on fork leg.
   b. Install short mounting bolt (2) (metric) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   c. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
8. **Dual caliper vehicles:** repeat this step for opposite side.

⚠WARNING

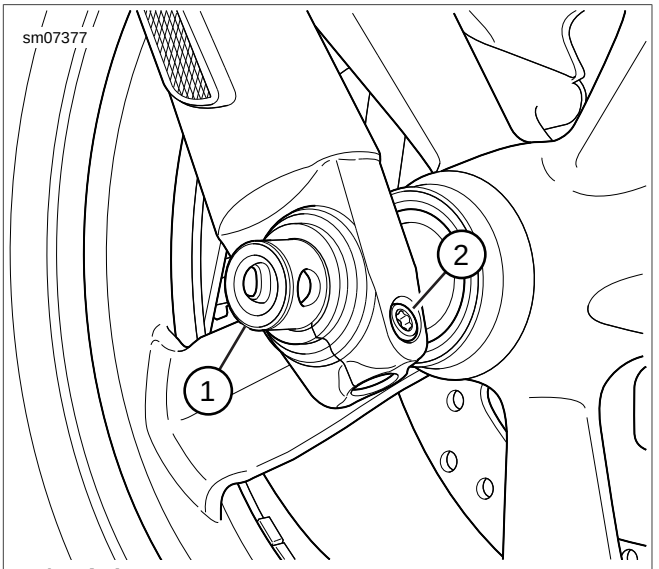
Whenever a wheel is installed and before moving the motorcycle, pump brakes to build brake system pressure. Insufficient pressure can adversely affect brake performance, which could result in death or serious injury. (00284a)

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



1. **Cast in spacer**
2. **Rear axle cap fastener**
3. **Front axle cap fastener**
4. **Gap**

Figure 2-11. Axle Cap Installation



1. **Axle**
2. **Pinch bolt**

Figure 2-12. Front Wheel Mounting: FLD (Right Side)

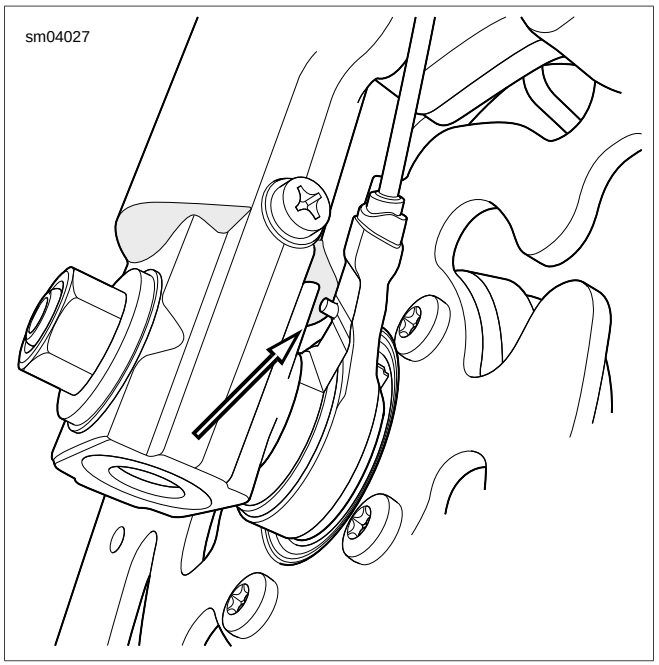


Figure 2-13. Front Wheel Speed Sensor Index Pin (ABS Models)

REAR WHEEL 2.5

REMOVAL

NOTES

- *Take care when removing and installing wheel to prevent cosmetic damage to wheel. This is especially true with wheels that feature painted surfaces.*
- ***Do not** remove sprocket or brake disc unless they are damaged and must be replaced.*

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
2. Remove three screws to detach the debris deflector from rear fork. See 2.19 DEBRIS DEFLECTOR.
3. Inspect wheel bearing end play and service bearings if necessary. See 2.6 SEALED WHEEL BEARINGS.
4. See Figure 2-14. Remove retaining ring (3), axle nut (2), and washer from left side of axle.
5. Loosen adjuster on each side several turns to remove belt tension.
6. See Figure 2-15. Loosen, but do not remove, left and right **upper** mounting nuts (1).
7. Remove left and right **lower** shock mounting screws (2).
8. Raise rear fork and re-position shocks to clear rear fork mounts. (Rear fork must be raised to allow axle to clear muffler when removed.)
9. Remove belt guard. See 2.18 BELT GUARD.

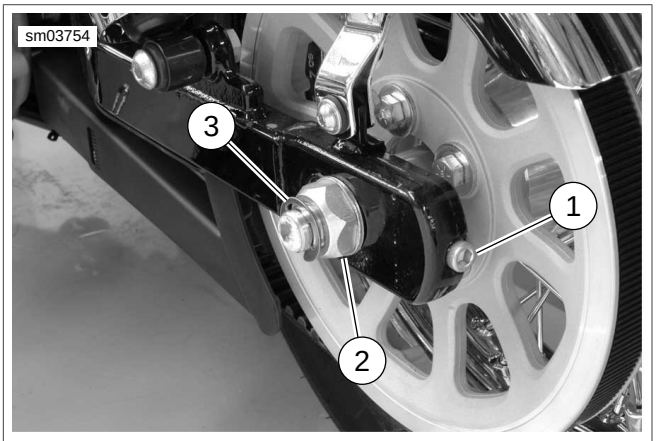
NOTE

Caliper to rear wheel clearance is minimal. To prevent damage to surfaces, be careful when removing caliper from rear fork.

10. Remove caliper assembly from caliper mount. Support caliper with an elastic cord. See 2.13 REAR BRAKE CALIPER.
11. Remove axle from wheel.
12. Move wheel forward and slip belt off sprocket.
13. Pull wheel and belt sprocket from rear fork.

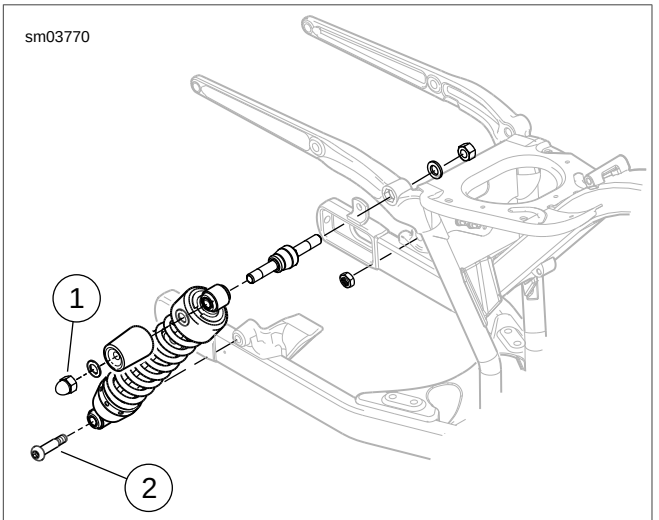
NOTE

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



1. **Axle adjuster**
2. **Axle nut**
3. **Retaining ring**

Figure 2-14. Axle Adjusters (Left Side Shown)



1. **Upper mounting nut (2)**
2. **Lower mounting screw (2)**

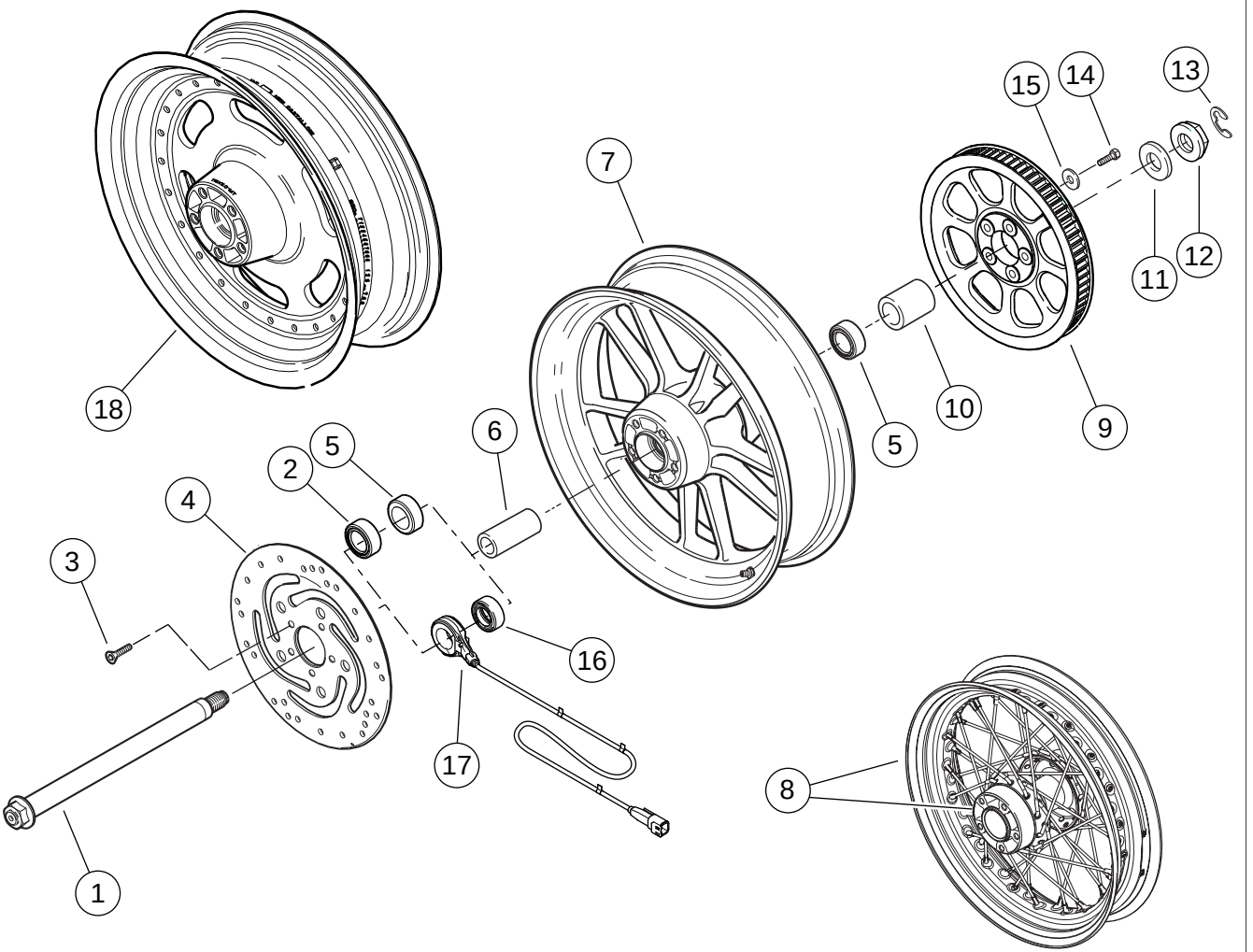
Figure 2-15. Rear Shock Mount

DISASSEMBLY

NOTE

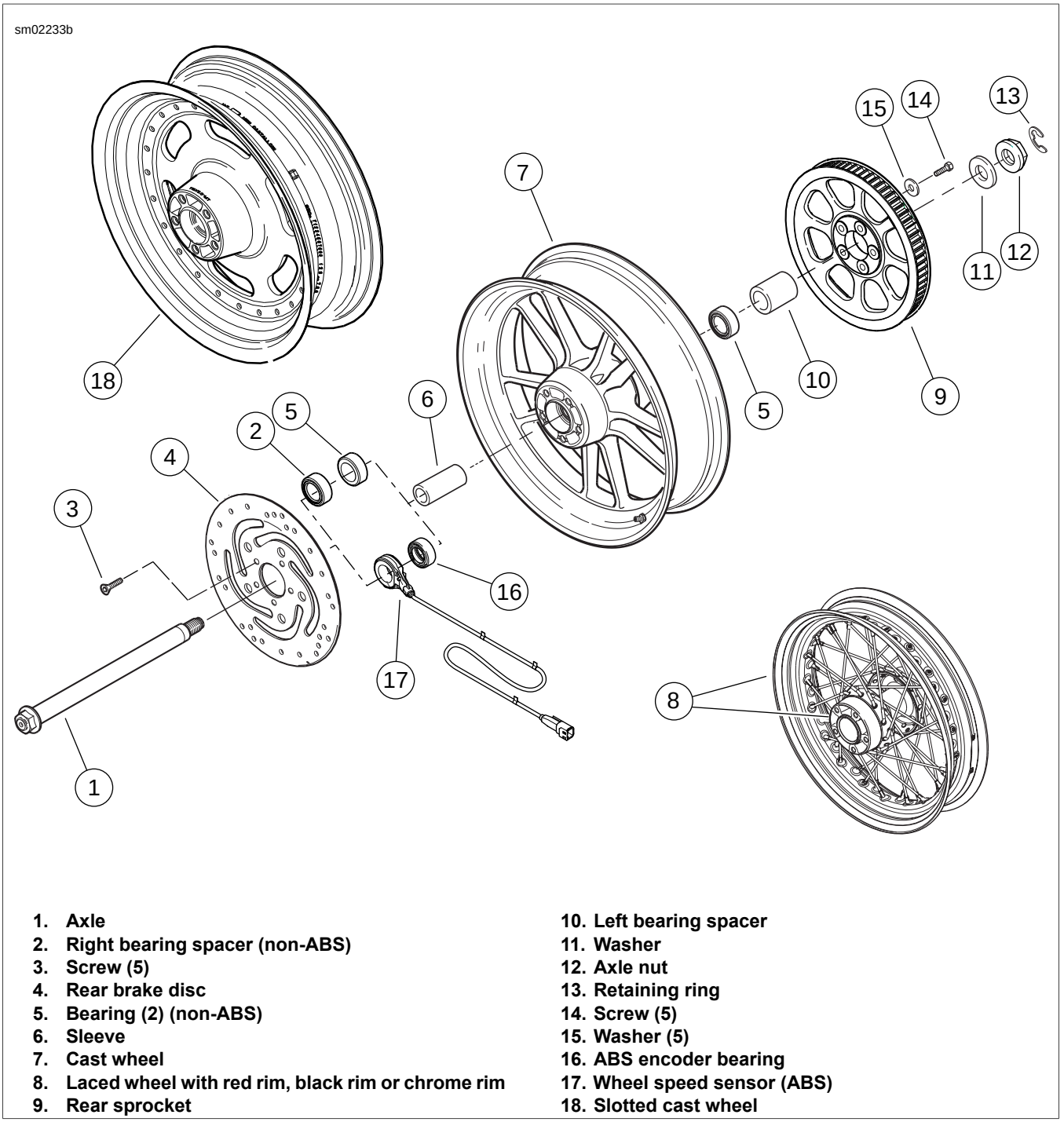
With the exception of the sprocket cover, component parts for cast and laced rear wheels are identical.

1. See Figure 2-16 or Figure 2-17. Remove right spacer (2) and left spacer (10) or wheel speed sensor (17).
2. If necessary, remove brake disc and/or rear sprocket.
   a. On left side of wheel, remove five screws (14) and washers (15) to detach rear sprocket (9). Discard screws.
   b. On right side of wheel, remove five screws (3) to remove rear brake disc (4). Discard screws.



1. Axle
2. Right bearing spacer (non-ABS)
3. Screw (5)
4. Rear brake disc
5. Bearing (2) (non-ABS)
6. Sleeve
7. Cast wheel
8. Laced wheel hub and rim
9. Rear sprocket
10. Left bearing spacer
11. Washer
12. Axle nut
13. Retaining ring
14. Screw (5)
15. Washer (5)
16. ABS encoder bearing (1)
17. Wheel speed sensor (ABS)
18. Slotted cast wheel

Figure 2-16. Rear Wheel/Hub



1. **Axle**
2. **Right bearing spacer (non-ABS)**
3. **Screw (5)**
4. **Rear brake disc**
5. **Bearing (2) (non-ABS)**
6. **Sleeve**
7. **Cast wheel**
8. **Laced wheel with red rim, black rim or chrome rim**
9. **Rear sprocket**
10. **Left bearing spacer**
11. **Washer**
12. **Axle nut**
13. **Retaining ring**
14. **Screw (5)**
15. **Washer (5)**
16. **ABS encoder bearing**
17. **Wheel speed sensor (ABS)**
18. **Slotted cast wheel**

Figure 2-17. FXDBP Rear Wheel Options

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

FASTENER	TORQUE VALUE	
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm
Rear sprocket screws-initial torque	60 ft-lbs	81.4 Nm
Rear sprocket screws-final torque	77-83 ft-lbs	104.5-112.6 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)

1. If hub and rim were disassembled, see 2.7 WHEEL LACING.
2. See Figure 2-16. Using **new** screws (3), install brake disc (4) on wheel if removed.
3. Tighten screws to 30-45 ft-lbs (40.7-61.0 Nm).
4. Using **new** screws (14), install rear sprocket (9) if removed.
5. Tighten screws to 60 ft-lbs (81.4 Nm). Then back screws off 180 degrees.
6. Final tighten screws to 77-83 ft-lbs (104.5-112.6 Nm).
7. Verify that wheel and tire are true. see 2.8 CHECKING AND TRUING WHEELS.

INSTALLATION

FASTENER	TORQUE VALUE	
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm

1. Apply a light coat of ANTI-SEIZE LUBRICANT to the axle, bearing bores and the bore of the inner sleeve.
2. Roll wheel into rear fork and position brake caliper mount between wheel and fork. Verify notch in caliper mount is engaged with tab on fork.
3. Slide drive belt over rear sprocket. Make sure brake disc is centered between brake pads.

NOTE

***ABS models:** See C.2 ABS MODULE and Figure 2-18 for proper wheel speed sensor orientation.*

4. Install axle:
   a. From right side, carefully insert axle through right rear fork, spacer (non-ABS) or wheel speed sensor (ABS), and rear caliper bracket.
   b. Continue sliding axle through wheel hub sleeve, rear sprocket, left spacer and left rear fork.

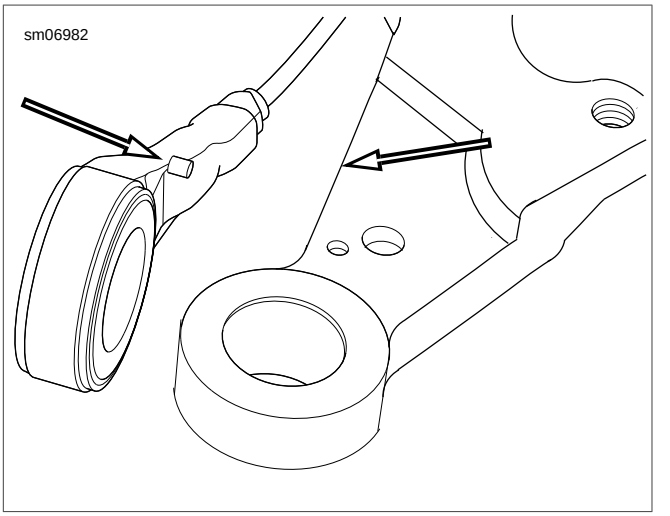


Figure 2-18. Rear Wheel Speed Sensor Index Pin (ABS Equipped)

NOTE

Caliper to rear wheel clearance is minimal. To prevent damage to surfaces, be careful when installing caliper.

5. Install caliper assembly to rear fork. See 2.13 REAR BRAKE CALIPER.
6. Install brake pads and retaining pin. See 1.16 BRAKE PADS AND DISCS.
7. See Figure 2-15. Attach rear shocks.
   a. Apply two or three drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of lower shock mounting screws (2).
   b. Lift rear fork and install both shock absorbers with lower shock mounting screws (2).
   c. Tighten upper shock nuts to 30-40 ft-lbs (40.7-54.2 Nm).
   d. Tighten lower shock fasteners to 30-40 ft-lbs (40.7-54.2 Nm).

⚠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)

⚠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. (00408e)

8. See Figure 2-14. Install washer and axle nut (2) on left side of axle.
   a. Tighten axle nut to 95-105 ft-lbs (128.8-142.4 Nm).
   b. Install retaining ring (3).

9. Install debris deflector using three screws. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). See 2.19 DEBRIS DEFLECTOR.
10. Install belt guard. See 2.18 BELT GUARD.

⚠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)

11. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
12. Verify correct axle alignment. See 2.9 VEHICLE ALIGNMENT.
13. Check belt deflection. See 1.12 DRIVE BELT AND SPROCKETS.

SEALED WHEEL BEARINGS 2.6

INSPECTION

1. Block motorcycle underneath frame so that the wheel is raised off the ground.
2. Turn the wheel through several rotations.

NOTE

To prevent damage if ABS equipped, keep magnetic base dial indicator as far away from wheel speed sensor and ABS encoder bearing as possible.

3. See Figure 2-19. Mount a magnetic base dial indicator to the brake disc with the dial contact point on the end of the axle.
4. Move the wheel from side to side to check end play.
   a. Bearing passes inspection if the end play is less than 0.002 in. (0.051 mm).
   b. Replace the bearings if end play is not within specification, or if there is anything unusual.

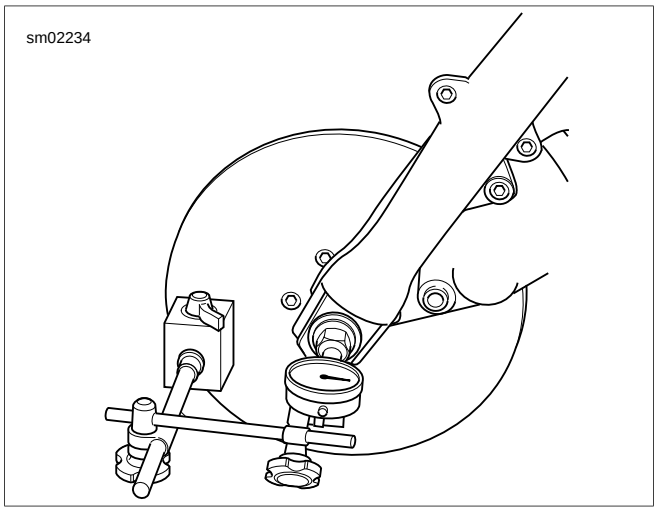


Figure 2-19. Wheel Bearing Inspection (Front Wheel Shown)

REMOVAL

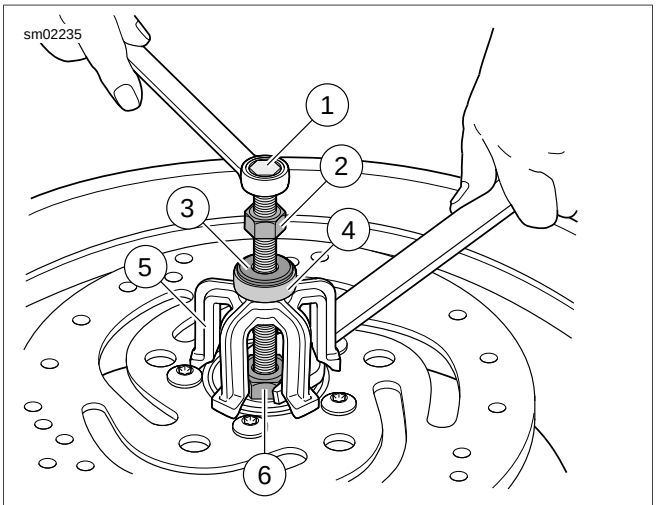
PART NUMBER	TOOL NAME
HD-44060-10	25 MM COLLET
HD-44060C	WHEEL BEARING INSTALLER/REMOVER

1. Remove wheel from motorcycle.
2. If present, remove hub plate from wheel on opposite side of front brake disc.

NOTES

- *See Figure 2-21. 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 and a standard bearing (black) on the opposite side. Select the appropriate bearing if the motorcycle is ABS equipped, or non-ABS equipped.*
- *Keep ABS encoder bearings away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage can occur.*

3. See Figure 2-20. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060C) and assemble using 25 MM COLLET (Part No. HD-44060-10) (6).
   a. Sparingly apply graphite lubricant to threads of forcing screw (1) to prolong service life and provide smooth operation.
   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 2-22. 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 2-20. Removal Tool

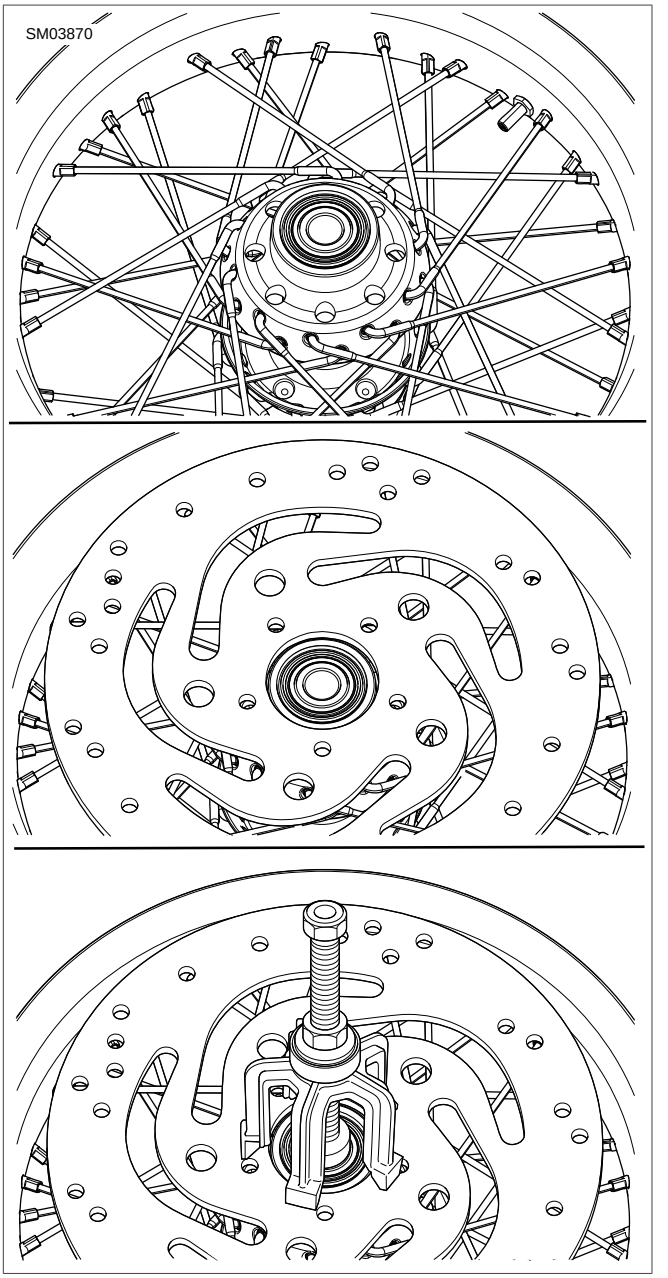
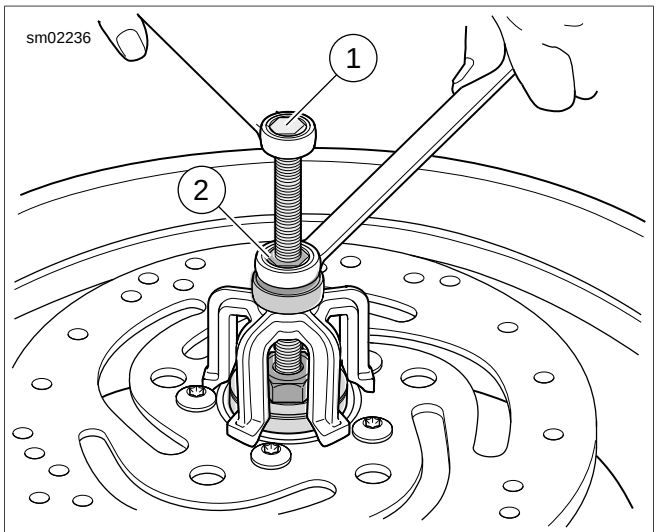


Figure 2-21. Brake Disk as Puller Aid



1. **Forcing screw**
2. **Nut**

Figure 2-22. Remove Bearing

INSTALLATION

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

NOTE

Install first bearing on primary brake disc side of hub. This side has one or two grooves cut into the disc mounting surface.

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 verify smooth operation.
   b. See Figure 2-23. Place threaded rod through support plate. Insert assembly through wheel.
   c. See Figure 2-24. Place the **new** bearing (6) on rod (1) with lettered side facing away from wheel centerline.
   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.

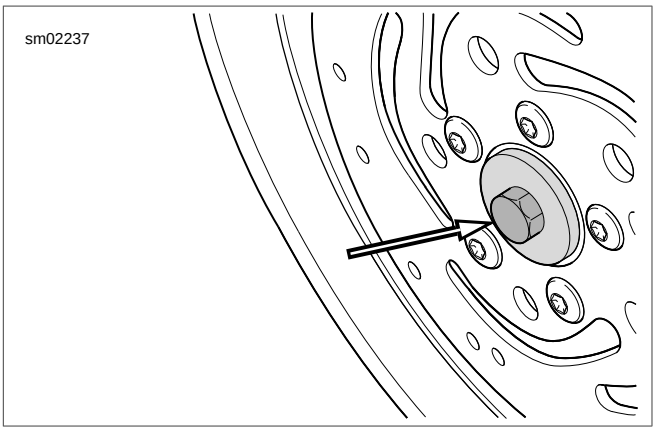
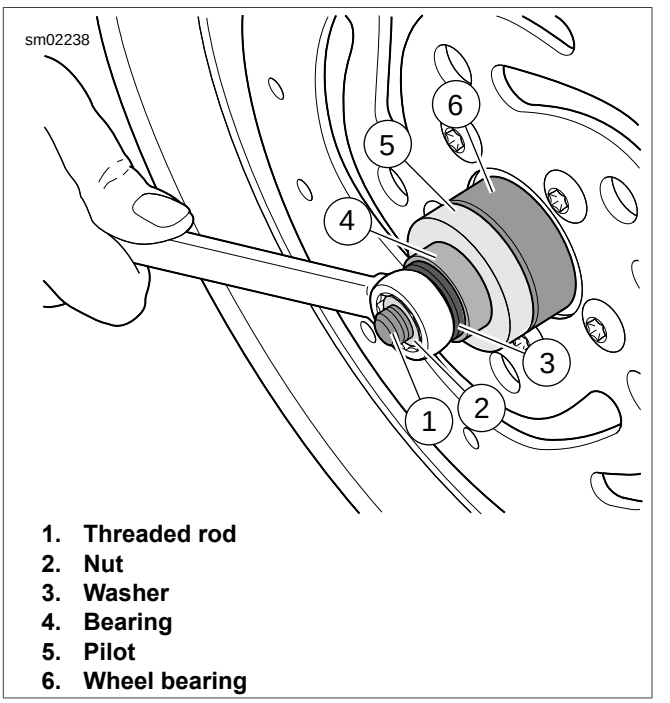
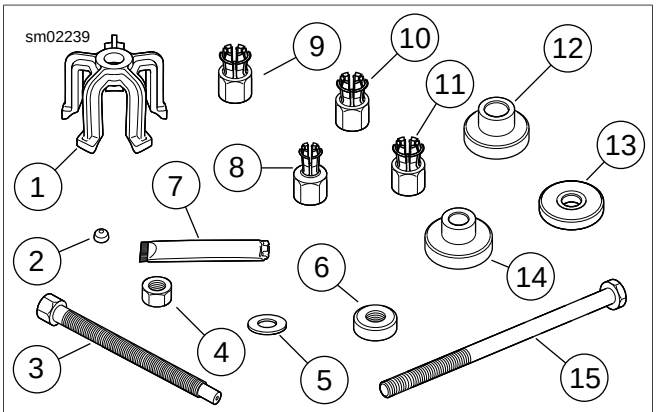


Figure 2-23. Installation Tool Support Plate



1. **Threaded rod**
2. **Nut**
3. **Washer**
4. **Bearing**
5. **Pilot**
6. **Wheel bearing**

Figure 2-24. Installing Bearing



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-23444A)**
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. 280856)**

Figure 2-25. Wheel Bearing Installer/Remover Components

NOTES

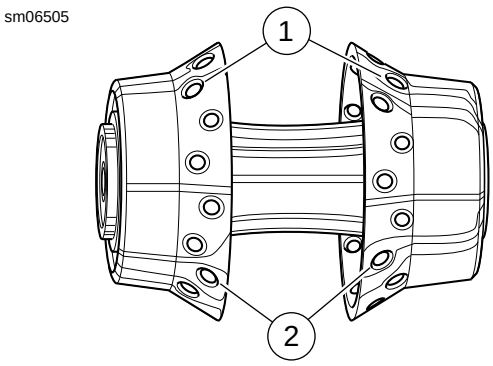
- *Parts 1-7 are common to removal and installation.*
- *Parts 8-10 are used for removal only.*
- *Parts 11-15 are used for installation only.*

WHEEL LACING 2.7

WHEEL LACING: ANGLE FLANGE HUB

NOTES

- *See Figure 2-26. 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.*



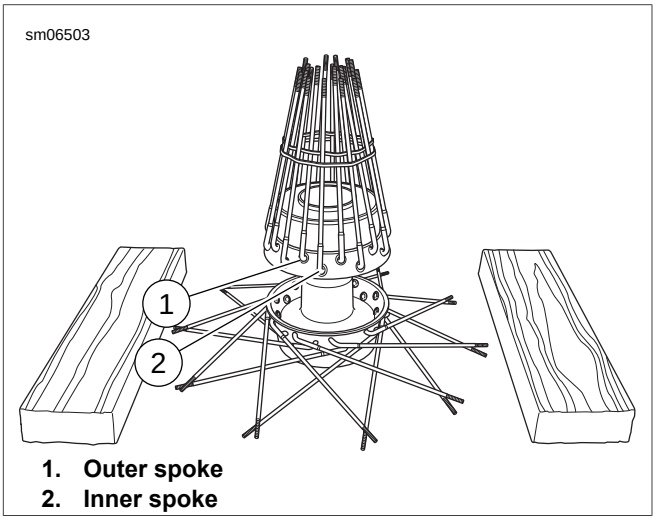
1. **Outer spoke hole**
2. **Inner spoke hole**

Figure 2-26. Angle Flange Hub

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 2-27. 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.



1. **Outer spoke**
2. **Inner spoke**

Figure 2-27. Spokes Gathered

7. Install lower flange outer spokes and loosely install spoke nipples:
   a. **Rim with side valve hole:** See Figure 2-28. Start at the valve stem hole (1).
   b. **Rim with center valve hole:** See Figure 2-29. 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 2.8 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.

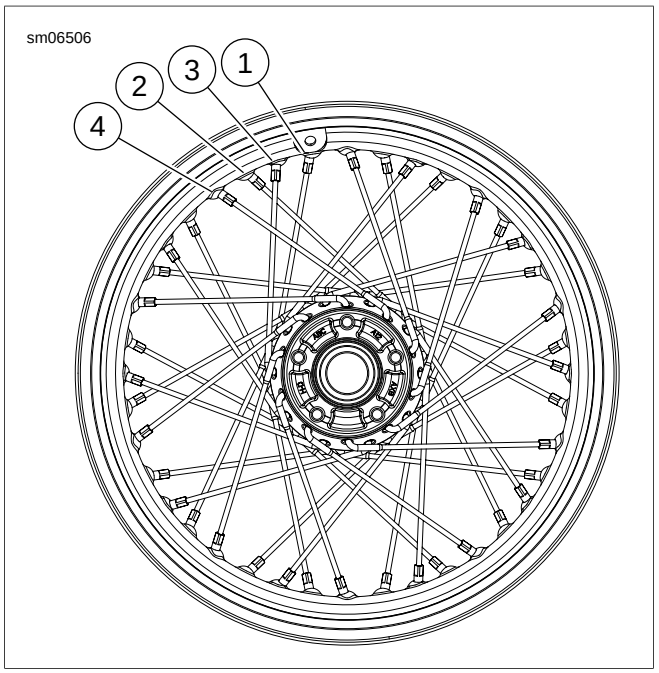


Figure 2-28. Side Valve Rim

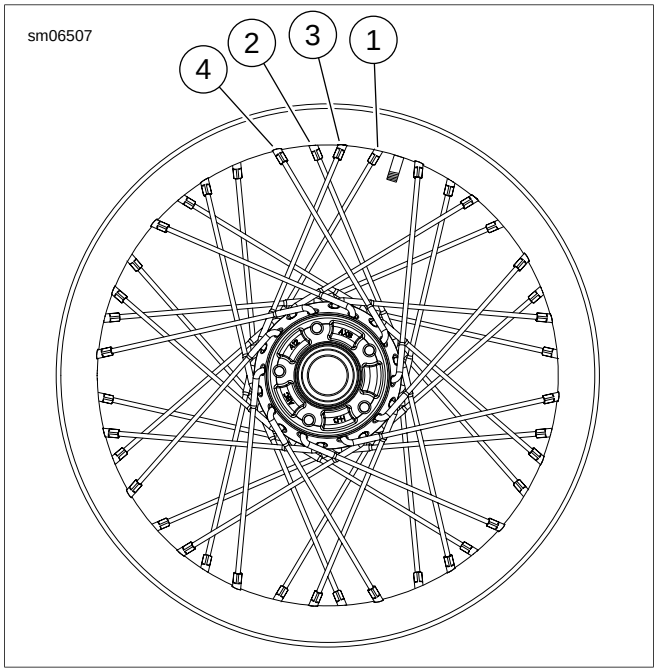


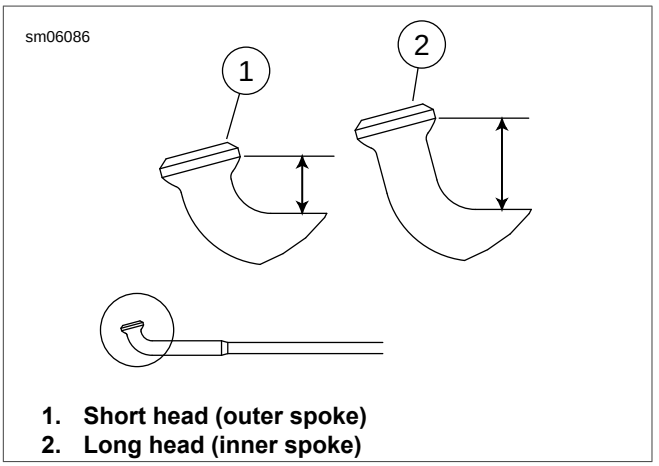
Figure 2-29. Center Valve Rim

WHEEL LACING: STRAIGHT FLANGE HUB, SINGLE HOLE CIRCLE

NOTES

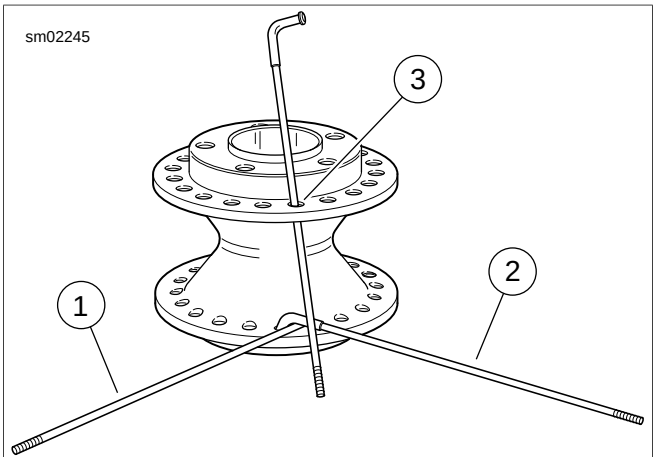
- *See Figure 2-31. This procedure is valid for laced wheels that use a straight flange, single spoke hole circle hub regardless of rim style or diameter.*
- *The primary brake side of the hub has one or two grooves cut into the disc mounting surface.*

1. See Figure 2-35. Divide spokes into inner and outer groups.
   a. Inner spokes (2) have long heads.
   b. Outer spokes (1) have short heads.
2. Lubricate all spoke threads and nipple shoulders with tire mounting lubricant.
3. See Figure 2-31. Place hub on bench with the primary brake disc side up. Insert one outer spoke (1) (short head) into any bottom flange hole and swing it clockwise. Insert an inner spoke (2) (long head) in the next hole counter-clockwise from the outer spoke. Swing the inner spoke counterclockwise over the outer spoke.
4. Find the hole (3) in the upper flange directly above the two spokes and insert a long head inner spoke. Insert all remaining spokes in the upper flange, alternating the inner and outer spokes.
5. Flip the hub (primary brake side down) and install remaining spokes, again alternating inner and outer spokes.
6. See Figure 2-32. Group all spokes on the upper flange into two bundles of equal numbers and secure each group with throttle grips.



1. **Short head (outer spoke)**
2. **Long head (inner spoke)**

Figure 2-30. Spoke Heads



1. **Outer spoke (short head)**
2. **Inner spoke (long head)**
3. **Hole directly above two spokes**

Figure 2-31. Lacing Single Row Wheel Hub

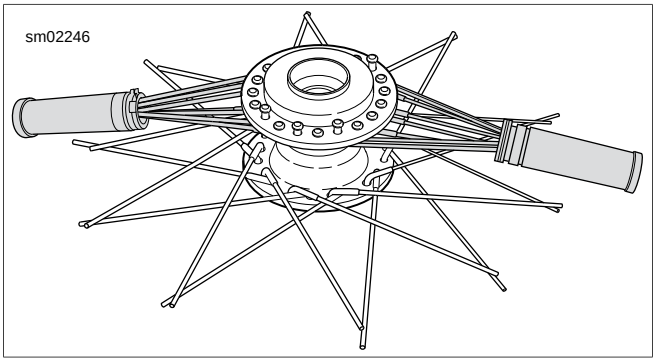


Figure 2-32. Bundling Top Spokes

7. Angle all lower flange spokes as far as they will go without overlapping a LIKE spoke (inner must not cross inner; outer must not cross outer):
   a. Outer spokes (short head) clockwise.
   b. Inner spokes (long head) counterclockwise. All inner spokes lay over outer spokes.
8. Support the rim on wooden blocks approximately 0.75 in (19 mm) thick.
9. Place the hub and spoke assembly into the rim and centered in the rim.

NOTE

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

10. See Figure 2-33. Beginning with the 2nd hole counterclockwise (1) from valve stem hole, install lower flange outer spokes (short head) in every 4th hole. Loosely install spoke nipples.

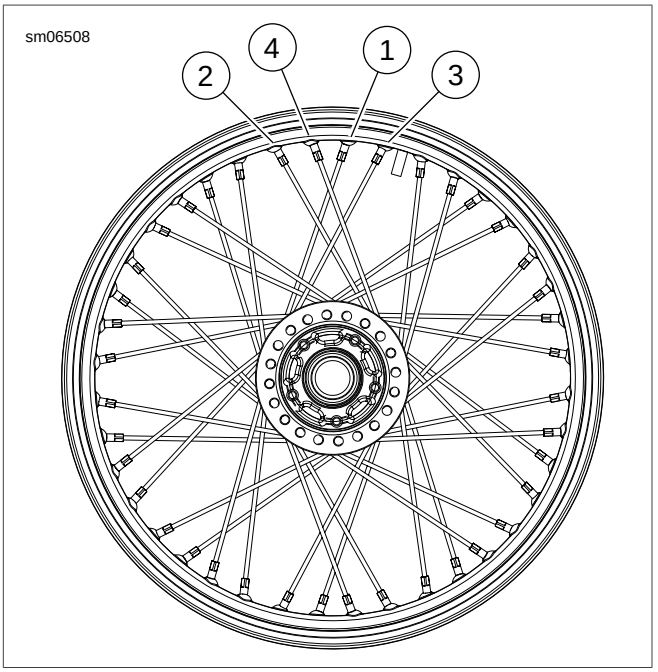


Figure 2-33. Flat Flange Hub, Single Row

11. Beginning with 4th hole counterclockwise (2) from valve stem hole, install lower flange inner spokes (long head) in every 4th hole. Loosely install spoke nipples. Each inner spoke will cross four outer spokes.
12. See Figure 2-34. Carefully release each top bundle and fan the spokes around the rim edge.

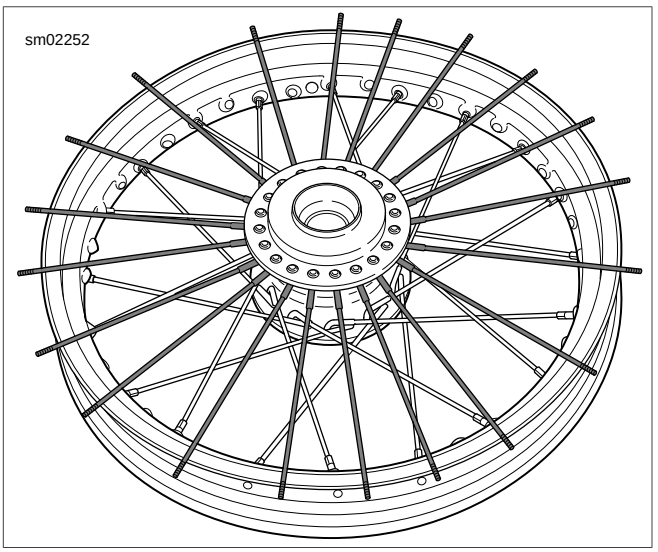


Figure 2-34. Fanning Top Flange Spokes

13. Rotate all the upper flange inner spokes (long head) clockwise, one at a time, leaving the outer spokes (short head) resting on the rim.

NOTE

Be sure outer spokes do not fall under the inner spoke and become trapped.

14. See Figure 2-33. Beginning with the first hole counterclockwise (3) from valve stem hole, install upper flange inner spokes (long head) in every 4th hole.

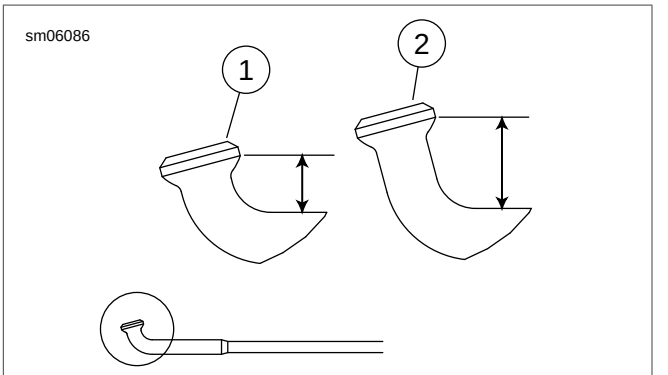
15. Rotate outer spokes (short head) counterclockwise and install in the remaining holes (4) in the rim.
16. Verify spoke heads are seated. See 2.8 CHECKING AND TRUING WHEELS.
    a. Evenly hand-tighten spoke nipples until snug.
    b. Only tighten until slack is removed.
    c. Proper torque will be applied when the wheel is trued.
    d. Adjust offset and true the wheel.

WHEEL LACING: STRAIGHT FLANGE HUB, DUAL HOLE CIRCLE

NOTES

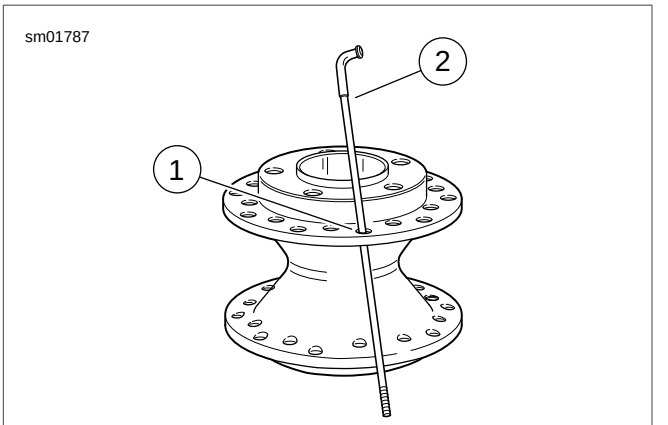
- *See Figure 2-36. This procedure is valid for 40-spoke wheels that use a straight flange, dual spoke hole circle hub regardless of rim style or diameter.*
- *The primary brake side of the hub has one or two grooves cut into the disc mounting surface.*

1. See Figure 2-35. Divide spokes into inner and outer groups.
    a. Inner spokes (2) have long heads.
    b. Outer spokes (1) have short heads.
2. Lubricate all spoke threads and nipple shoulders with tire mounting lubricant.
3. Place hub on bench with the primary brake disc side up.
4. Install first two spokes:
    a. See Figure 2-36. Insert one outer spoke (short head) into any upper flange outer hole. Swing it counterclockwise.
    b. Insert an inner spoke (long head) in the next hole counterclockwise from the outer spoke.
    c. Swing the inner spoke clockwise under the outer spoke.
5. Insert all remaining spokes in the upper flange, alternating the inner and outer spokes.
6. Flip the wheel hub (primary brake side down) and install remaining spokes in the same manner, again alternating inner and outer spokes.
7. See Figure 2-37. Group all spokes on the upper flange into two bundles of ten. Secure each group with throttle grips.



1. Short head (outer spoke)
2. Long head (inner spoke)

Figure 2-35. Spoke Heads



1. Outer spoke hole
2. Outer spoke (short head)

Figure 2-36. Lacing Dual Row Wheel Hub

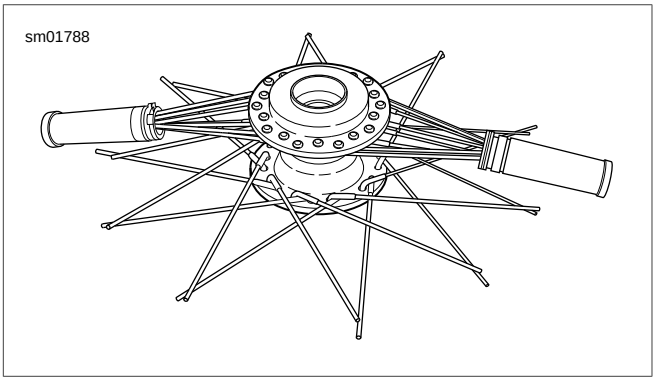


Figure 2-37. Bundling Top Spokes

8. Angle all lower flange spokes as far as they will go without overlapping a LIKE spoke (inner must not cross inner; outer must not cross outer):
    a. Outer spokes (short head) clockwise.
    b. Inner spokes (long head) counterclockwise. All inner spokes lay over outer spokes.
9. Support the rim on wooden blocks approximately 0.75 in (19 mm) thick.

10. Place the hub and spoke assembly into the rim and centered in the rim.

NOTE

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

11. See Figure 2-38. Beginning with the 1st hole counterclockwise (1) from valve stem hole, install lower flange outer spokes (short head) in every 4th hole. Loosely install spoke nipples.

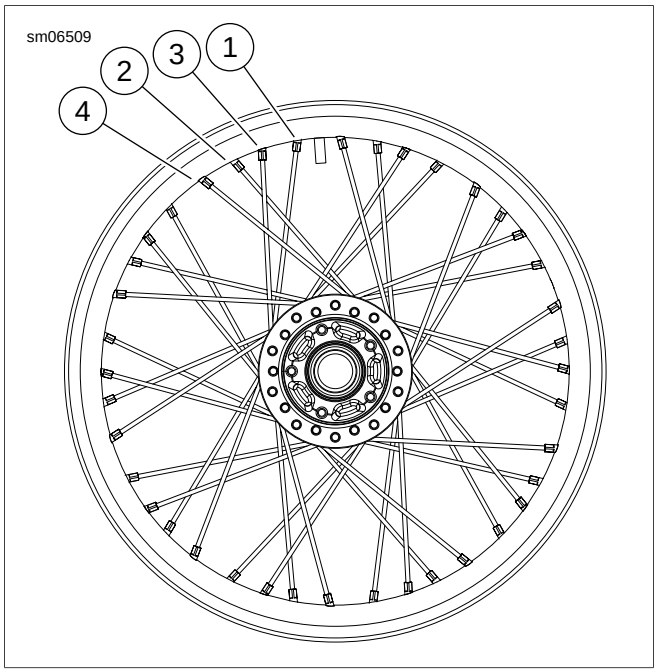


Figure 2-38. Flat Flange Hub, Dual Row

12. Beginning with 3rd hole counterclockwise (2) from valve stem hole, install lower flange inner spokes (long head) in every 4th hole. Loosely install spoke nipples. Each inner spoke will cross four outer spokes.

13. See Figure 2-39. Carefully release each top bundle and fan the spokes around the rim edge.

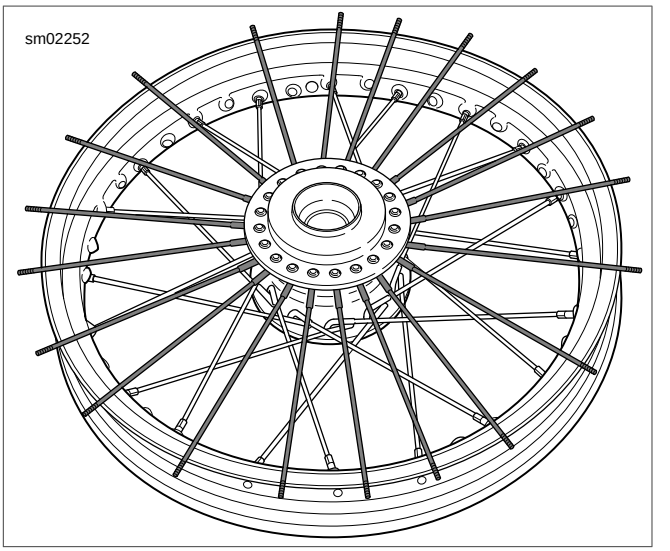


Figure 2-39. Fanning Top Flange Spokes

14. Rotate all the upper flange inner spokes (long head) clockwise, one at a time, leaving the outer spokes (short head) resting on the rim.

NOTE

Be sure outer spokes do not fall under the inner spoke and become trapped.

15. See Figure 2-38. Beginning with the 2nd hole counterclockwise (3) from valve stem hole, install upper flange inner spokes (long head) in every 4th hole.

16. Rotate outer spokes (short head) counterclockwise. Install in the remaining holes (4) in the rim.

17. Verify spoke heads are seated. See 2.8 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.

CHECKING AND TRUING WHEELS 2.8

GENERAL

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

Laced wheels having excess runout can be trued. 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 2.6 SEALED WHEEL BEARINGS, Inspection.

CHECKING WHEEL RUNOUT

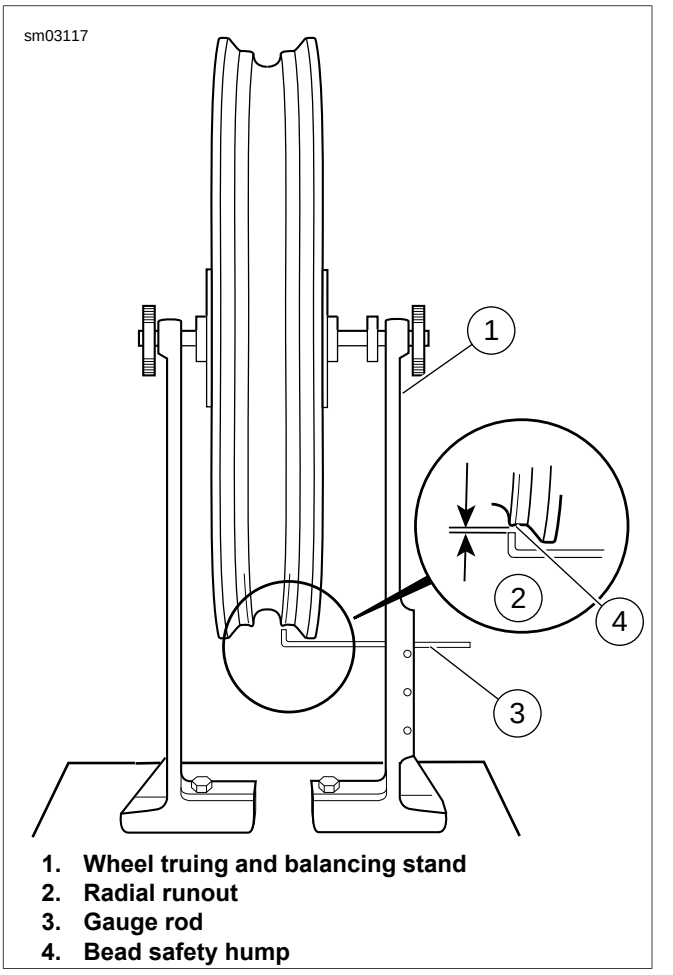
PART NUMBER	TOOL NAME
HD-99500-80	WHEEL TRUING AND BALANCING STAND

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

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

Checking Radial Runout

1. See Figure 2-40. 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).



1. **Wheel truing and balancing stand**
2. **Radial runout**
3. **Gauge rod**
4. **Bead safety hump**

Figure 2-40. Checking Radial Runout

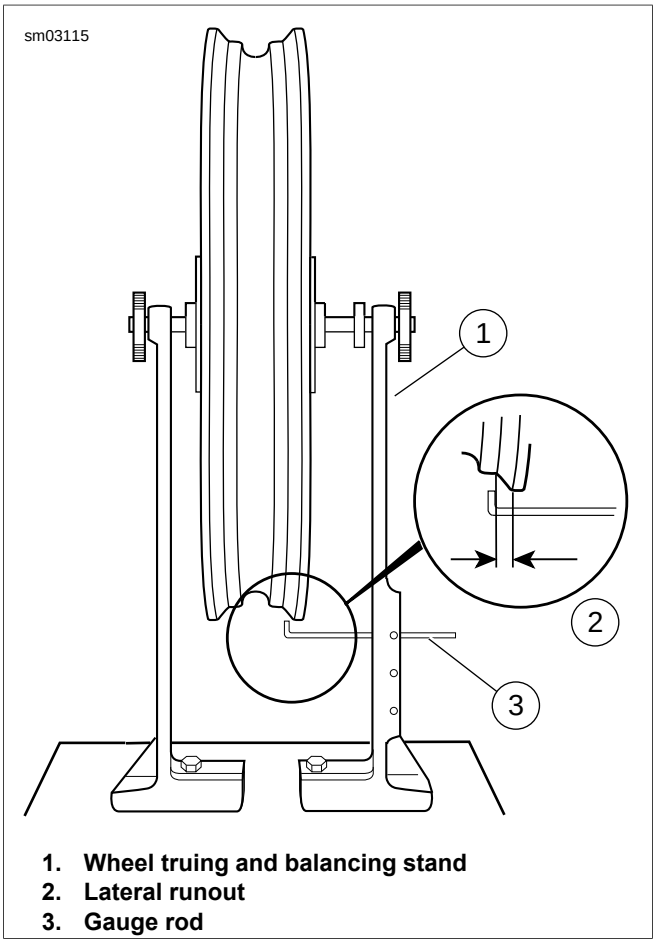
Checking Lateral Runout

1. See Figure 2-41. 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).



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

Figure 2-41. Checking Lateral Runout

LACED WHEEL RIM OFFSET

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

1. See Figure 2-42. 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.

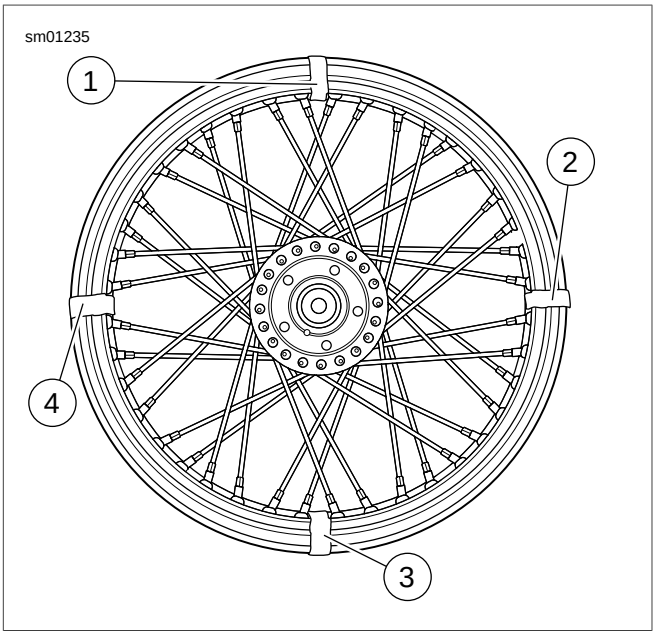


Figure 2-42. Marking Spoke Groups

2. See Figure 2-43. 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 2-44. Measure the distance from the straightedge to the location shown, based on rim design, to determine distance A. Refer to Table 2-10.

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 flat 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 2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels.

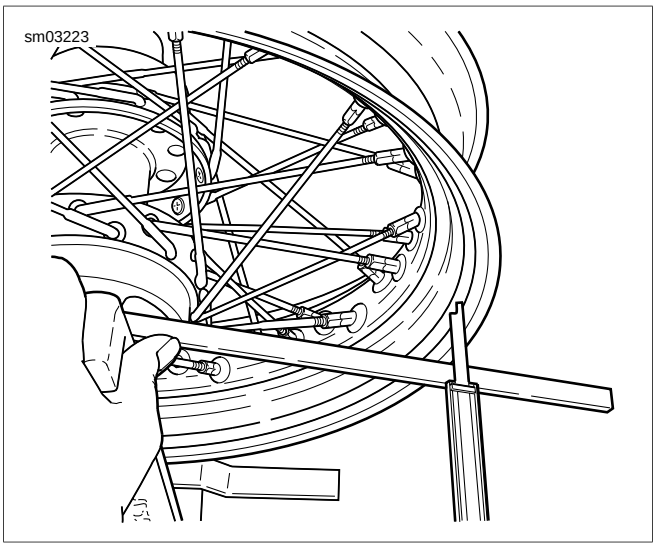
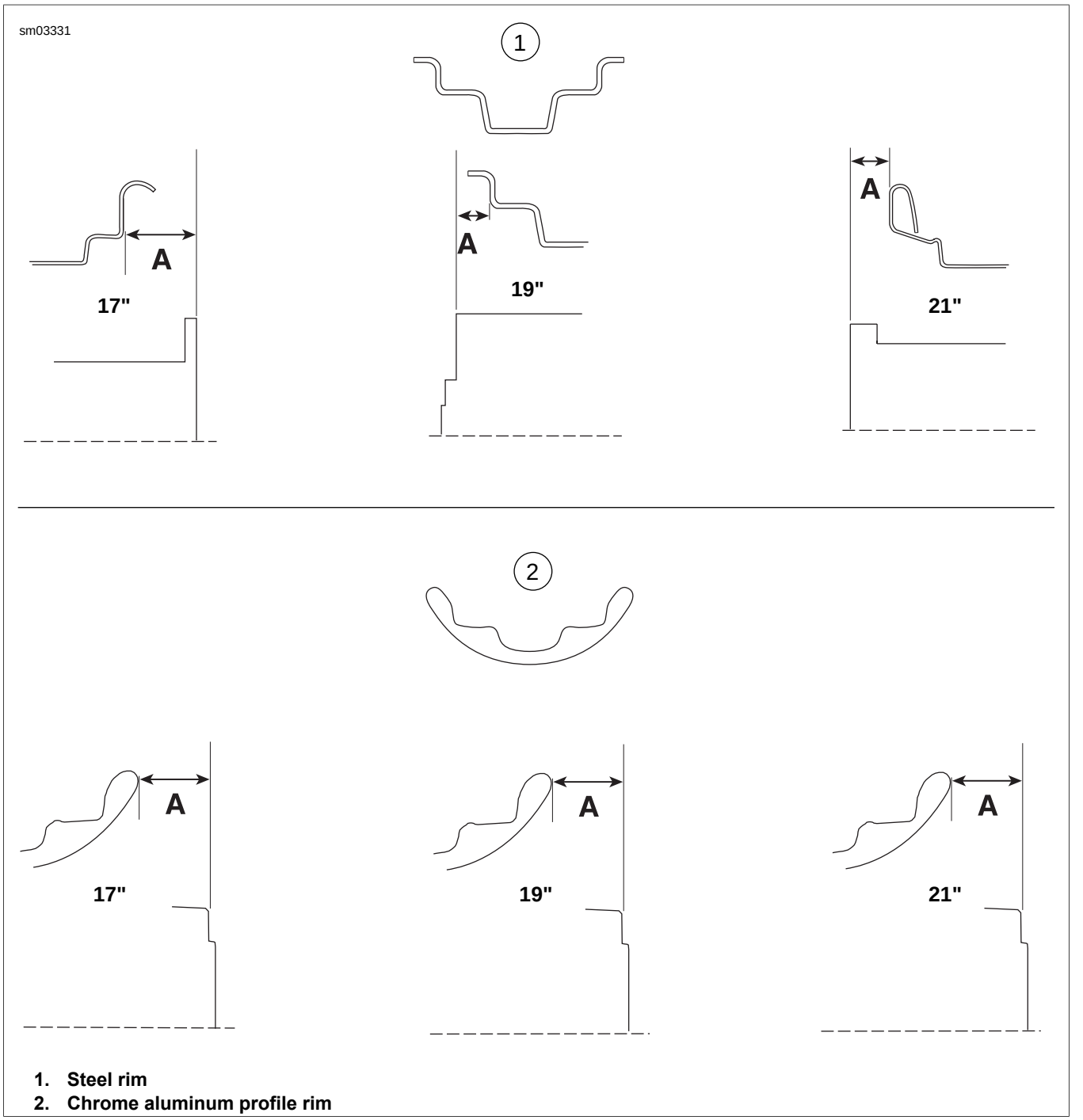


Figure 2-43. Checking Wheel Hub Offset Dimension (typical)

Table 2-10. Laced Wheel Hub Offset Dimensions

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



1. Steel rim
2. Chrome aluminum profile rim

Figure 2-44. Laced Wheel Hub Offset Dimensions

TRUING LACED WHEELS

PART NUMBER	TOOL NAME
HD-48985	SPOKE TORQUE WRENCH
HD-94681-80	SPOKE NIPPLE WRENCH
HD-99500-80	WHEEL TRUING STAND

FASTENER	TORQUE VALUE	
Spoke nipple	55 **in-lbs**	6.2 Nm

NOTES

- *Dial indicators are more accurate than gauge rods.*
- *Radial truing should be performed before lateral truing.*

Radial Runout

1. See Figure 2-45. With the wheel mounted in WHEEL TRUING STAND (Part No. HD-99500-80), adjust the truing stand gauge (3) near to the rim's 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.

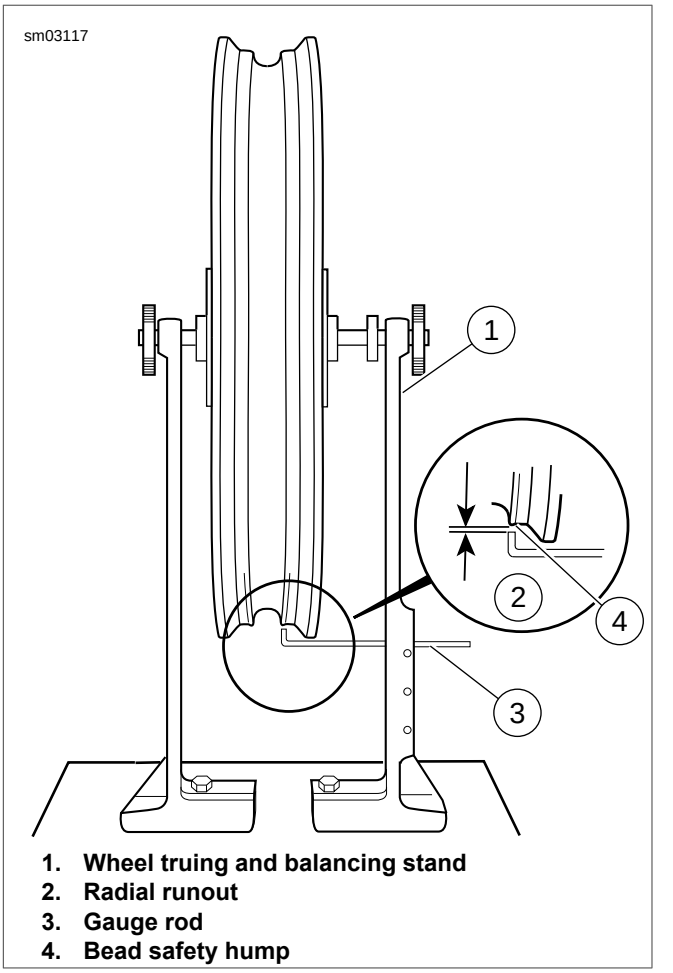
NOTES

- *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 2-11.
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. (00286a)



1. **Wheel truing and balancing stand**
2. **Radial runout**
3. **Gauge rod**
4. **Bead safety hump**

Figure 2-45. Checking Radial Runout

Table 2-11. Spoke Nipple Torque Specification

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

Lateral Runout

NOTE

Dial indicators are more accurate than gauge rods.

1. See Figure 2-46. With the wheel mounted in WHEEL TRUING 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.

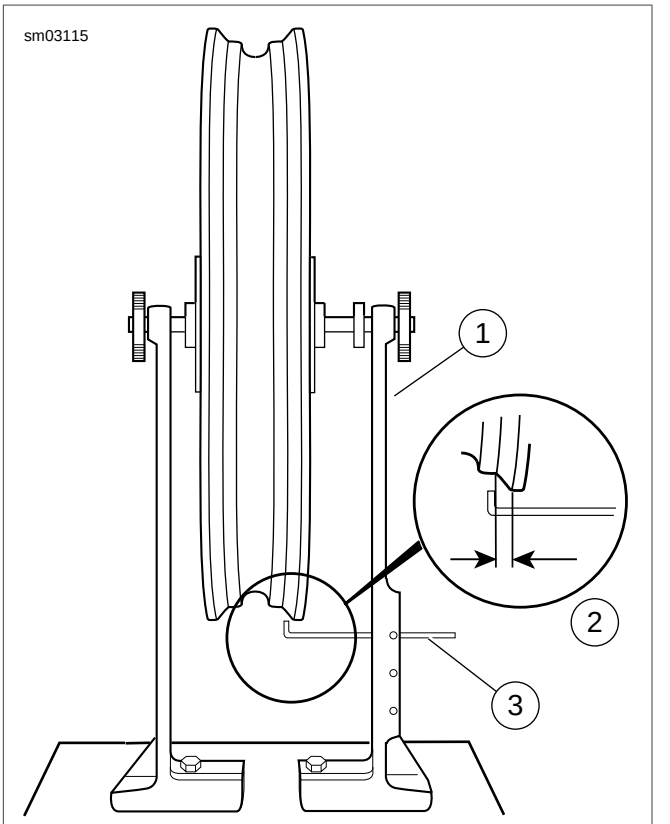
NOTES

- *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 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 all spoke nipples are tightened to the specification. Refer to Table 2-11.
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.



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

Figure 2-46. Checking Lateral Runout

VEHICLE ALIGNMENT 2.9

INSPECTION

PART NUMBER	TOOL NAME
HD-48856-A	AXLE ALIGNMENT PLUG SET

FASTENER	TORQUE VALUE	
Front isolator mounting bolts to front engine bracket	18-22 ft-lbs	24.4-29.9 Nm
Rear isolator mounting bolts to transmission case	22-27 ft-lbs	29.9-36.6 Nm
Front and rear isolator mounting bolts to frame	22-27 ft-lbs	29.9-36.6 Nm

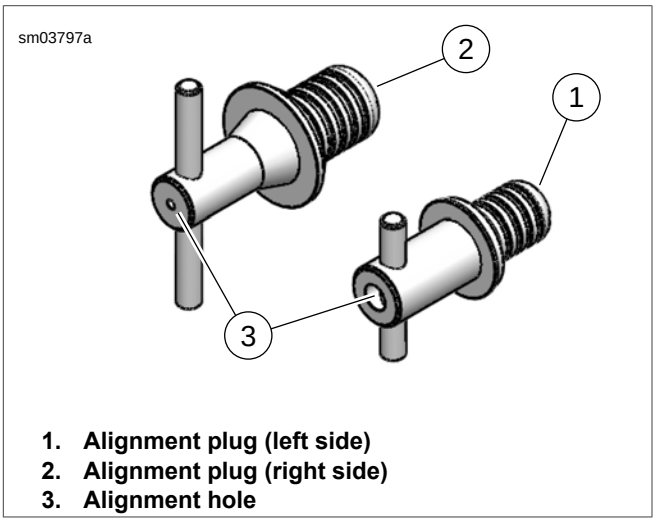
WARNING

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 2.8 CHECKING AND TRUING WHEELS.
2. Check steering head bearing adjustment and adjust if necessary. See 1.18 STEERING HEAD BEARINGS.
3. Create an alignment tool. See Figure 2-49. To verify accurate measurements, obtain a piece of 1/8 in. (3.2 mm) aluminum welding rod 12.25 in (311 mm) long.
   a. Grind one end down to a blunt point.
   b. With a pliers, bend the rod 90 degrees as shown.
   c. Place a snug fitting O-ring or cable strap on the rod to act as a slide measurement indicator.
4. Block motorcycle underneath frame so rear wheel is raised off the ground.
5. Obtain AXLE ALIGNMENT PLUG SET (Part No. HD-48856-A). See Figure 2-47. Insert axle alignment plugs (1, 2) into left and right ends of rear axle.
6. See Figure 2-48. Measure the wheel alignment. With the blunt point of the alignment tool inserted in the rear fork pilot hole:
   a. Slide the O-ring along the tool until it is aligned with the center of the alignment plug as shown.
   b. Measure and record distance from end of tool to O-ring.
   c. Repeat for the other side.



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

Figure 2-47. Axle Alignment Plugs

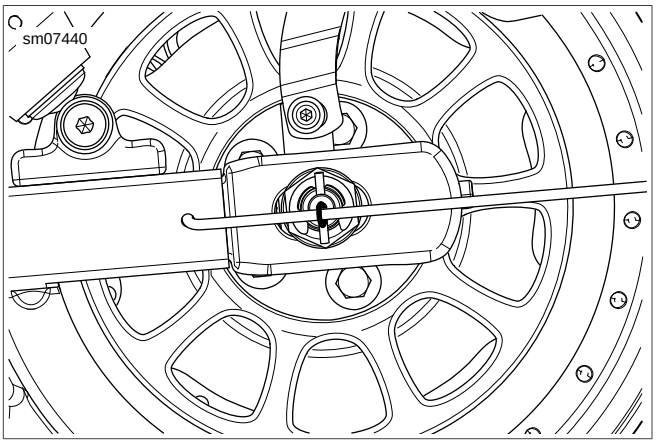
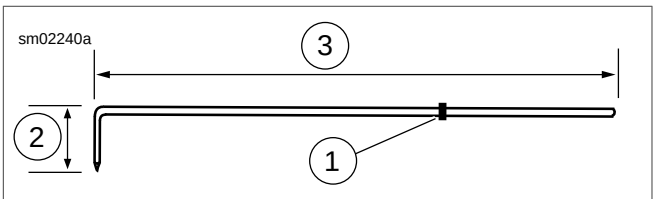


Figure 2-48. Measuring Alignment

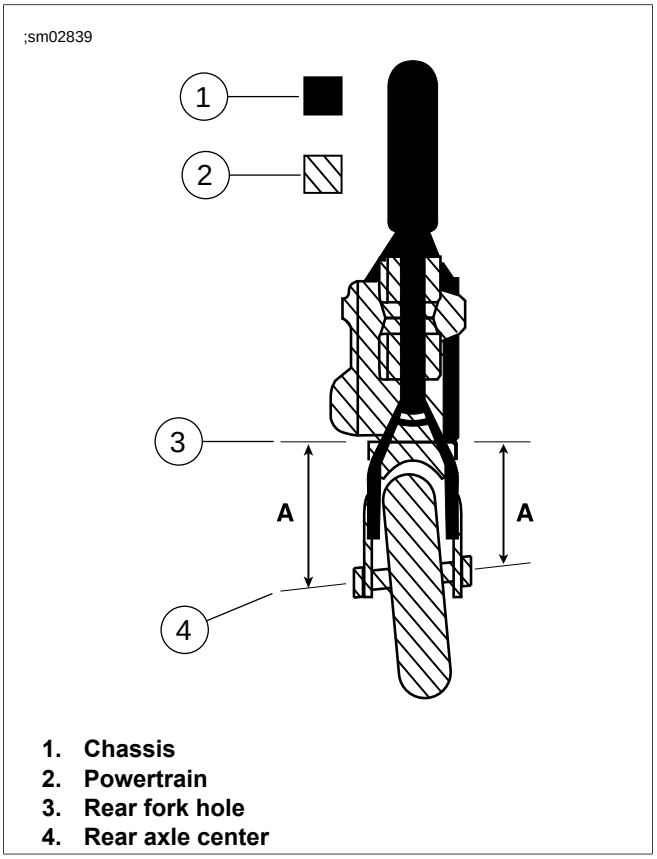


1. **O-ring**
2. **2.25 in (57 mm)**
3. **12.25 in (311 mm)**

Figure 2-49. Alignment Tool

7. See Figure 2-50. Left and right measurements must be equal within 1/32 in (0.8 mm). Use axle adjusters to adjust within specifications.
8. See Figure 2-51. Remove the bolt (2) which attaches the top stabilizer link (1) to the engine mounting bracket.

9. Position front wheel so brake disc is vertical using an inclinometer. If possible, use a digital inclinometer for the best accuracy.



1. **Chassis**
2. **Powertrain**
3. **Rear fork hole**
4. **Rear axle center**

Figure 2-50. Adjust Axle Adjusters until A = A

NOTES

- *Place motorcycle upright and level with exhaust system installed before proceeding.*
- *Only adjust stabilizer link on end with threads showing. Adjusting or loosening other end will tear the isolator.*
- *There should be 0.250 in (6.4 mm) minimum clearance between the fuel tank tunnel and the head of the left stabilizer link mounting bolt.*

10. Loosen jamnut (3) on stabilizer link. Adjust the stabilizer so that the bolt removed in previous step can be reinstalled without pushing the engine to the right or left. Tighten jamnut.
11. Check the rear brake disc with the inclinometer to verify that it is parallel to the front brake disc.
12. If the rear brake disc is not parallel to the front brake disc, adjust the top stabilizer link until the rear brake is parallel to within 1 degree of the front brake disc's position.
13. If you cannot adjust the front and rear brake discs to within 1 degree, inspect the frame, front fork and/or rear fork for damage.

⚠WARNING

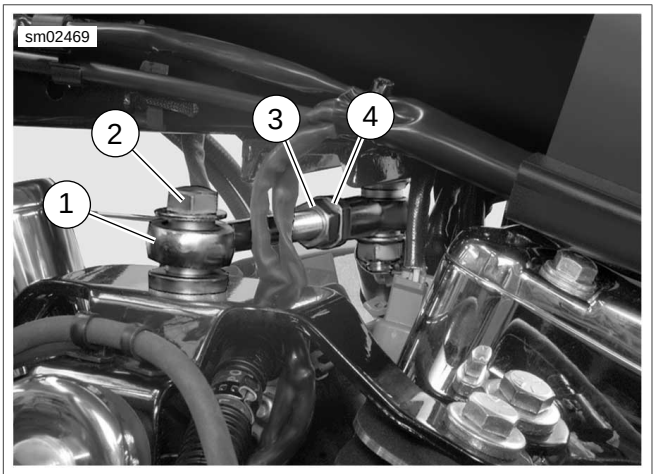
To prevent damage to fuel tank and possible fire or explosion, which could cause death or serious injury, maintain clearance specified in service manual between fuel tank and head of left stabilizing link mounting bolt. (00262a)

14. If you have to adjust the top stabilizer link more than five full turns to bring the brake discs to specification, again inspect the frame, front fork and/or rear fork for damage.
15. Tighten the stabilizer jamnut (3).

NOTE

Maximum range for stabilizer link adjustment is five full turns. If necessary, use the following steps to adjust for excessive vibration.

16. Be sure the transmission is in neutral.
17. Loosen, but do not remove, ALL the mounting bolts on the engine isolators and start the engine. Let the engine run for approximately 5 seconds. This will center the mounts on the frame and power train assembly.
18. Tighten isolator mounting bolts in sequence as follows:
    a. Tighten front isolator mounting bolts to front engine bracket to 18-22 ft-lbs (24.4-29.9 Nm).
    b. Tighten rear isolator mounting bolts to transmission case to 22-27 ft-lbs (29.9-36.6 Nm).
    c. Tighten front and rear isolator mounting bolts to frame to 22-27 ft-lbs (29.9-36.6 Nm).



1. **Top stabilizer link**
2. **Bolt**
3. **Jamnut**
4. **Adjusting stud (nut)**

Figure 2-51. Top Stabilizer

FRONT BRAKE MASTER CYLINDER 2.10

GENERAL

⚠WARNING

Do not use parts from single caliper repair kits (9/16 inch bore) on dual caliper models. Likewise, do not use parts from dual caliper repair kits (11/16 inch bore) on single caliper models. Using incorrect parts can cause brake failure, which could result in death or serious injury. (00278a)

⚠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)

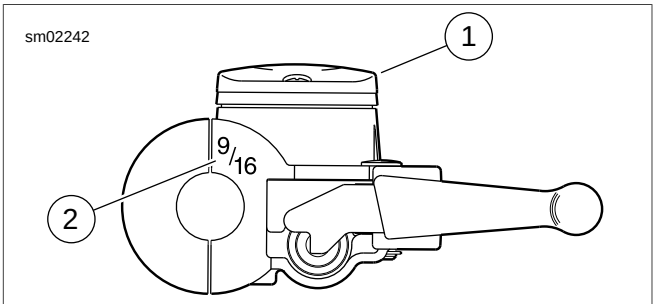
NOTICE

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)

See Figure 2-52. Master cylinders designed for single disc (one caliper) operation have a 9/16 in. (14.3 mm) bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket.



1. Single disc master cylinder
2. Bore stamp size

Figure 2-52. Bore Size

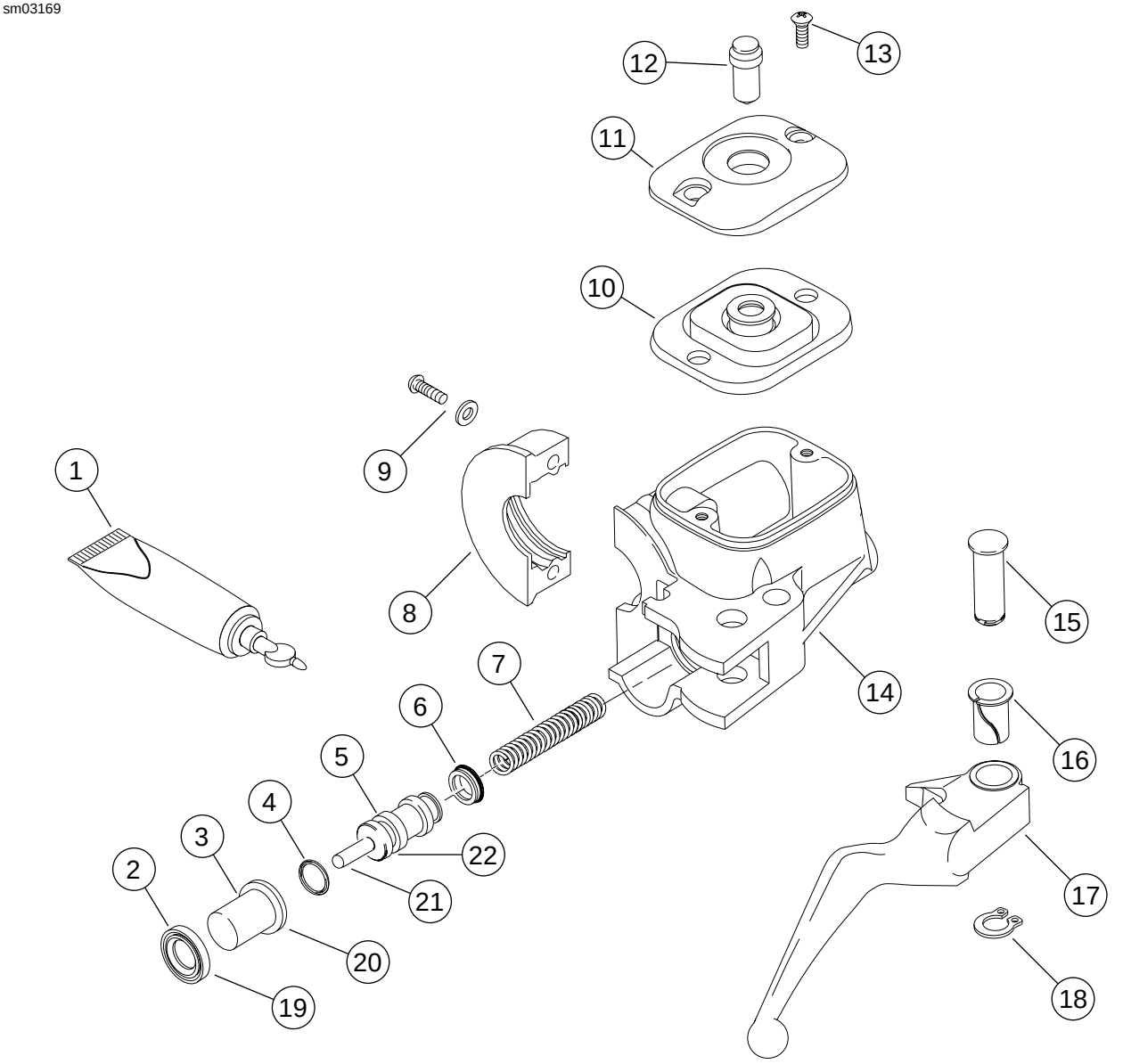
REMOVAL AND DISASSEMBLY

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.



1. **Lubricant**
2. **Wiper**
3. **Piston cap**
4. **O-ring**
5. **Piston**
6. **Primary cup**
7. **Spring**
8. **Handlebar clamp**
9. **TORX screw and washer (2)**
10. **Gasket**
11. **Cover**
12. **Site glass**
13. **Screw (2)**
14. **Master cylinder reservoir**
15. **Pivot pin**
16. **Bushing**
17. **Brake hand lever**
18. **Retaining ring**
19. **Flat side**
20. **Shoulder**
21. **Pin**
22. **O-ring groove**

Figure 2-53. Front Brake Master Cylinder

3. See Figure 2-53. Loosen both switch housing clamp screws. Remove the two screws with flat washers (9) to detach the handlebar clamp (8) from the master cylinder reservoir (14).
4. Remove retaining ring (18) from pivot pin groove at bottom of master cylinder bracket.
5. Remove pivot pin (15) and brake hand lever (17).
6. Carefully remove wiper (2) with pick or similar tool.
7. Remove piston cap (3).
8. Remove piston (5) with O-ring (4) and primary cup (6).
9. Remove spring (7).

10. Remove both screws (13), cover (11) and the cover gasket (10).

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 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. Carefully inspect all parts for wear or damage. Replace as 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 housing if any damage is noted.
5. Carefully inspect the cover gasket for damage. Replace as necessary.

ASSEMBLY AND INSTALLATION

FASTENER	TORQUE VALUE	
Handlebar master cylinder clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm
Banjo bolt to front master cylinder	17-22 ft-lbs	23.1-29.9 Nm
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm

NOTE

*Always reassemble the master cylinder using **new** parts from the correct repair kit.*

1. See Figure 2-53. Fit O-ring (4) into groove on outboard side of piston (5) (pin side).
2. Fit primary cup (6) over lip on inboard side of piston, so that closed side (smaller OD) contacts shoulder.
3. Coat piston bore of master cylinder reservoir with special lubricant (1) supplied in the service parts kit. Also apply the lubricant to OD of installed O-ring (4) and primary cup (6).
4. Insert spring (7) into piston bore, so that it seats against counterbore (recess) at bottom.
5. Slide piston over spring.
6. Fit wiper (2) over piston cap (3) so that flat side of wiper contacts cap shoulder.
7. Fit piston cap over piston pin (5).
8. Press down on wiper until it contacts the counterbore. Larger OD of wiper must be completely seated in groove on outlet side of piston bore.
9. Install the master cylinder reservoir cover (11). Secure with two screws, but do not tighten at this time.
10. Align hole in brake hand lever (17) with hole in master cylinder bracket. From the top of the assembly, slide pivot pin (15) through bracket and 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)

11. Install **new** retaining ring (18) in pivot pin groove. Verify that retaining ring is completely seated in groove.
12. See Figure 2-54. Position the brake lever/master cylinder assembly inboard of the module housing assembly, engaging the tab (2) on the lower module housing (1) in the groove (3) at the top of the brake lever bracket (4).
13. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two screws (with flat washers). Position hand lever and controls for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm).

NOTE

Always tighten the lower module housing screw first. Any gap between the upper and lower housings should be at the front of the housing.

14. Tighten module housing screws to 35-45 **in-lbs** (4.0-5.1 Nm).

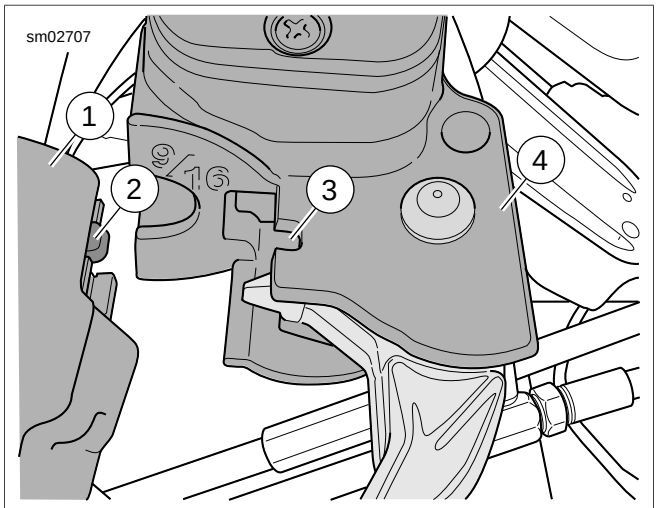
NOTICE

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

15. Start banjo bolt (with **new** sealing washers) to secure brake line fitting to master cylinder reservoir. Tighten banjo bolt to 17-22 ft-lbs (23.1-29.9 Nm).

⚠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. (00504c)



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

Figure 2-54. Attach Master Cylinder to Right Handlebar Switches

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.

16. Remove the master cylinder reservoir cover. Stand motorcycle up so master cylinder is level. Add brake fluid to master cylinder reservoir until fluid level is 1/8-3/8 in (3.2-9.5 mm) from the top.

NOTE

Use only DOT 4 BRAKE FLUID from a sealed container.

⚠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

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)

17. Bleed front brake system. See 2.14 BLEEDING BRAKES.
18. Verify proper operation of the master cylinder relief port. Actuate the brake hand lever. A slight spurt of fluid will break the fluid surface in the reservoir compartment if all internal components are working properly.
19. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/8-3/8 in (3.2-9.5 mm) from the top.
20. Install the master cylinder reservoir cover and gasket. Tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
21. With the Ignition/Light Key Switch turned to IGNITION, actuate the front brake hand lever to verify operation of the brake lamp.

⚠WARNING

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

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

NOTE

The sight glass allows a visual check of the brake fluid level without having to remove the master cylinder reservoir cover. The sight glass is dark when the reservoir is full and lightens as the fluid level drops.

FRONT BRAKE CALIPER 2.11

REMOVAL

NOTE

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

⚠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)

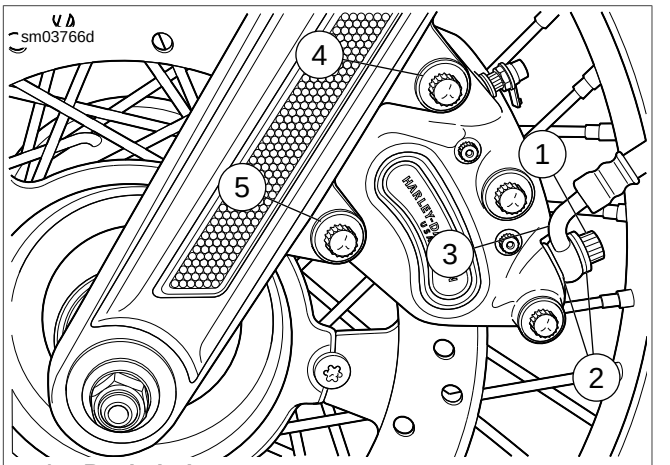
NOTICE

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)

1. See Figure 2-55. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach front brake line (3) from caliper. Discard washers.
2. Remove the upper (4) and lower (5) mounting bolts (metric). Lift caliper upward to remove from brake disc.



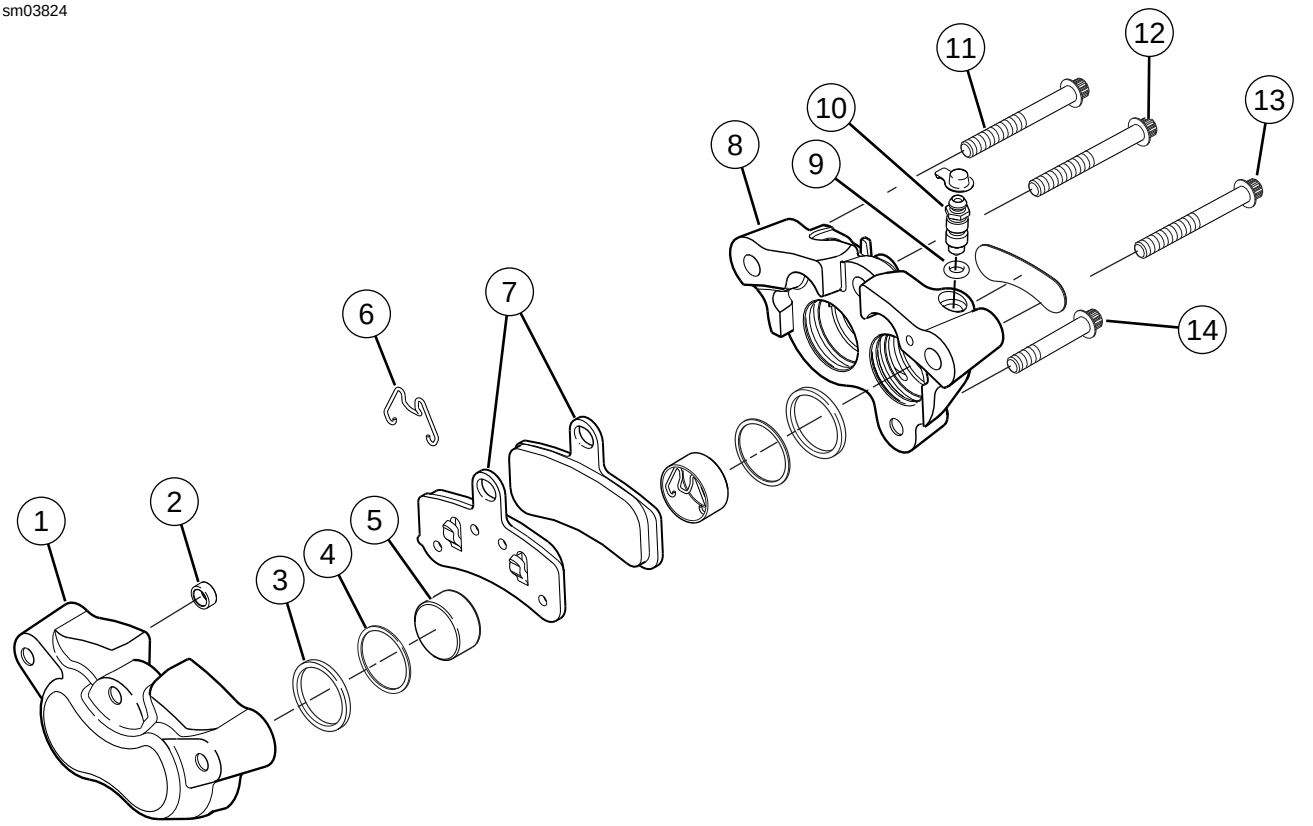
1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Brake line**
4. **Upper mounting bolt (long)**
5. **Lower mounting bolt (short)**

Figure 2-55. Front Caliper

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-48649	FRONT BRAKE CALIPER PISTON REMOVER

1. See Figure 2-56. Remove bridge bolt/pad pin (12) (metric), brake pads (7) and bridge bolt (11) (metric) to separate caliper housings (1, 8).



1. **Inner caliper housing**
2. **Crossover seal**
3. **Square seal (4)**
4. **Wiper (4)**
5. **Piston (4)**
6. **Anti-rattle spring (4)**
7. **Brake pads (2)**
8. **Outer caliper housing**
9. **O-ring**
10. **Bleeder valve**
11. **Bridge bolt**
12. **Bridge bolt/pad pin**
13. **Upper mounting bolt (long)**
14. **Lower mounting bolt (short)**

Figure 2-56. Front Brake Caliper

2. If necessary, remove bleeder valve (10).

⚠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. See Figure 2-57 and Figure 2-58. Remove pistons.
   a. Place FRONT BRAKE CALIPER PISTON REMOVER (Part No. HD-48649) (3) between caliper housings.

   NOTE

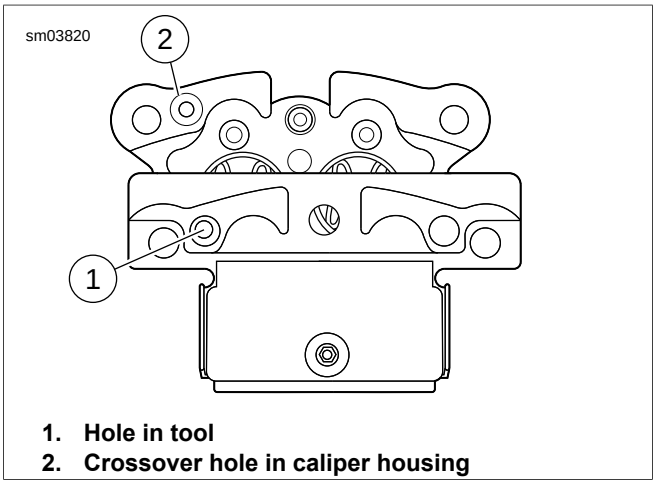
   Verify the hole in the tool (1) aligns with the crossover holes (2) in the caliper housings.

   b. Insert two bridge bolts (2) (metric) and tighten securely.
   c. If the bleeder valve was removed, install finger-tight.
   d. Apply **low pressure** compressed air to banjo bolt hole (1) to remove pistons from caliper bores. Listen for all four pistons to "pop" against the tool.
   e. Remove bridge bolts and remove tool.
4. Wiggle pistons from caliper bores to completely remove.
5. If necessary, remove pad springs from each piston.

NOTICE

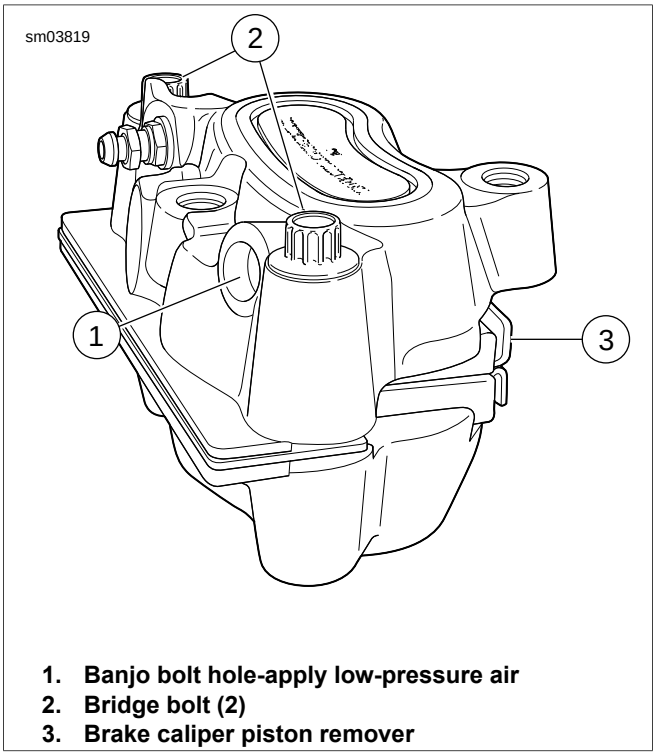
Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (00529d)

6. See Figure 2-59. Remove and discard crossover seal (1) from inside caliper housing.
7. Using a wooden toothpick (2), remove a wiper (3) and square seal (4) from each caliper bore. Discard all removed parts.



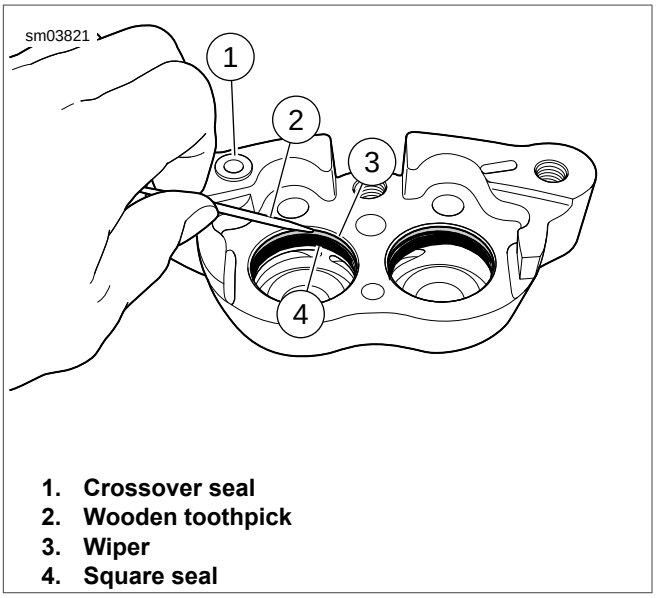
1. **Hole in tool**
2. **Crossover hole in caliper housing**

Figure 2-57. Installing Tool



1. **Banjo bolt hole-apply low-pressure air**
2. **Bridge bolt (2)**
3. **Brake caliper piston remover**

Figure 2-58. Removing Pistons



1. **Crossover seal**
2. **Wooden toothpick**
3. **Wiper**
4. **Square seal**

Figure 2-59. Wipers and Seals

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)

⚠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, worn, or corroded.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect caliper piston bore. Do not hone bore. If bore should show pitting or corrosion, replace caliper.
   c. 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.
   d. Always replace wipers, square seals and crossover seal 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

FASTENER	TORQUE VALUE	
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm
Brake caliper bridge bolt, front	28-38 ft-lbs	38.0-51.5 Nm
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm

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 prior to assembly using a light coat of G.E. VERSILUBE #G322 L SILICONE GREASE (marked "Piston Lube") from 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 seals and wipers.

NOTICE

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

2. See Figure 2-56. Install a **new** square seal (3) and a **new** wiper (4) into each piston bore. Use a wooden toothpick to aid installation, if needed.
3. See Figure 2-60. Install pad spring (2) in each piston. Verify spring is securely installed in the groove in the piston.
4. Turn the piston so the pad spring (2) is oriented as shown. Carefully insert pistons, by hand, into bores of both caliper housings. Press pistons squarely into place until they bottom in the bores. If installation shows resistance, remove piston and check that seals and wipers are properly installed.
5. Place a **new** crossover seal (1) on inside caliper housing.
6. Assemble caliper housings.
   a. Install bleeder valve and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
   b. Verify that **new** crossover seal is installed on inside caliper housing.
   c. See Figure 2-56. Mate inside and outside caliper housings using bridge bolt (11) and upper mounting bolt (long) (13) (metric).
   d. Tighten bridge bolt to 28-38 ft-lbs (38.0-51.5 Nm).

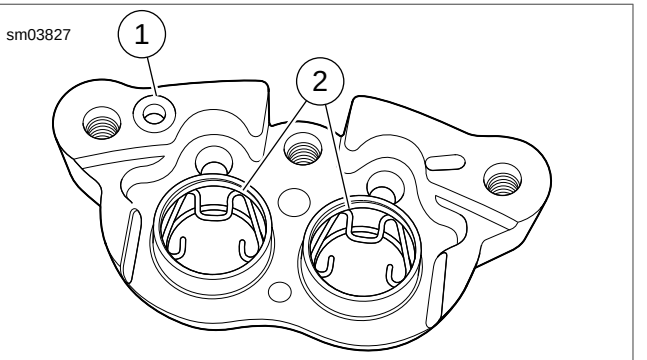
⚠WARNING

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

NOTES

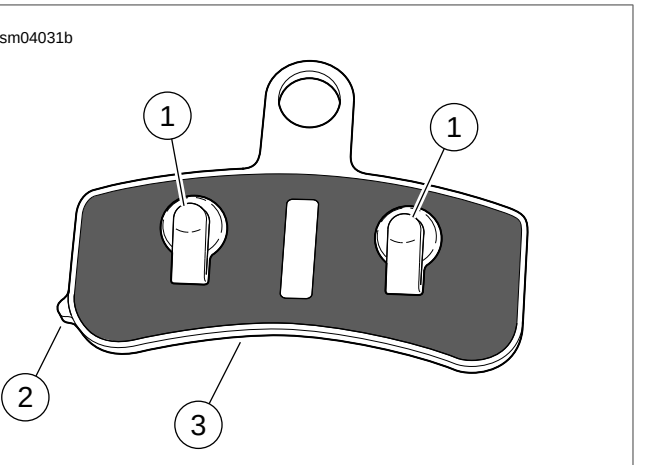
- *See Figure 2-61. Verify the pad spring tabs (1) on brake pad engage the pad springs in the pistons.*
- *If the directional tab (2) does not face down when caliper is installed, brake noise may develop.*

7. Install **new** pads into caliper. The directional tab (2) must face down when caliper is installed.
8. See Figure 2-56. Install pad pin/bridge bolt (12) (metric). Tighten to 15-16 ft-lbs (20.3-22.6 Nm).



1. **Crossover seal**
2. **Pad springs**

Figure 2-60. Front Caliper Pad Springs



1. **Pad spring tabs**
2. **Directional tab**
3. **Front brake pad**

Figure 2-61. Front Brake Pad

INSTALLATION

FASTENER	TORQUE VALUE	
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm
Front caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm

1. See Figure 2-62. Attach caliper to fork leg.
   a. Place caliper over brake disc with bleeder valve facing upwards.

   NOTE

   ***ABS equipped vehicles**: install wheel speed sensor cable retainer when installing caliper to front fork.*

   b. Loosely install upper mounting bolt (4) (metric) into top hole on fork leg.
   c. Install lower mounting bolt (5) (metric) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).

NOTICE

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 with DOT 4 BRAKE FLUID. Connect the brake line (3) to caliper using two **new** steel/rubber washers (2) and banjo bolt (1). Tighten to 17-22 ft-lbs (23.1-29.9 Nm).

⚠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)

3. Remove cover from front brake master cylinder. Fill master cylinder with DOT 4 BRAKE FLUID. Verify that fluid level is 1/8-3/8 in (3.2-9.5 mm) below top of reservoir with master cylinder in a level position.

⚠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)

⚠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)

4. Bleed brake system. See 2.14 BLEEDING BRAKES.

⚠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)

5. Verify proper operation of the master cylinder relief port. Actuate the brake lever with the cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
6. Install gasket and cover on master cylinder. Tighten cover screws to 12-15 **in-lbs** (1.4-1.7 Nm).

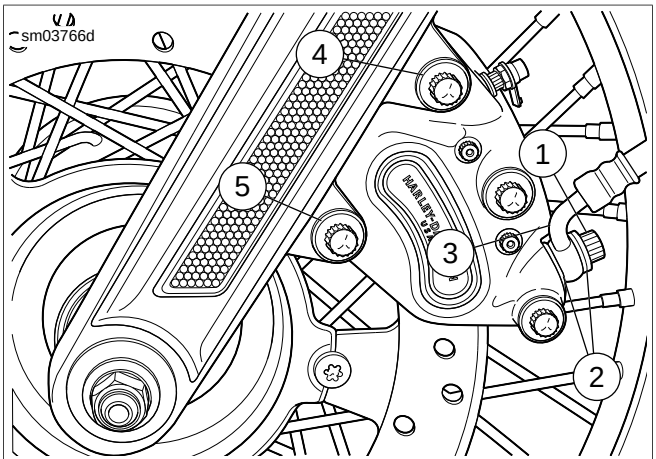
⚠WARNING

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

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. See 2.14 BLEEDING BRAKES.

NOTE

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



1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Brake line**
4. **Upper mounting bolt (long)**
5. **Lower mounting bolt (short)**

Figure 2-62. Front Caliper

REAR BRAKE MASTER CYLINDER 2.12

GENERAL

If the rear brake feels spongy or excessive pedal travel exists or the brake does not work at all, proceed to Inspection.

⚠CAUTION

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

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 KS62F assembly grease on caliper pistons and piston seals.*
- *Use only G40M BRAKE GREASE on the caliper pins and boots.*

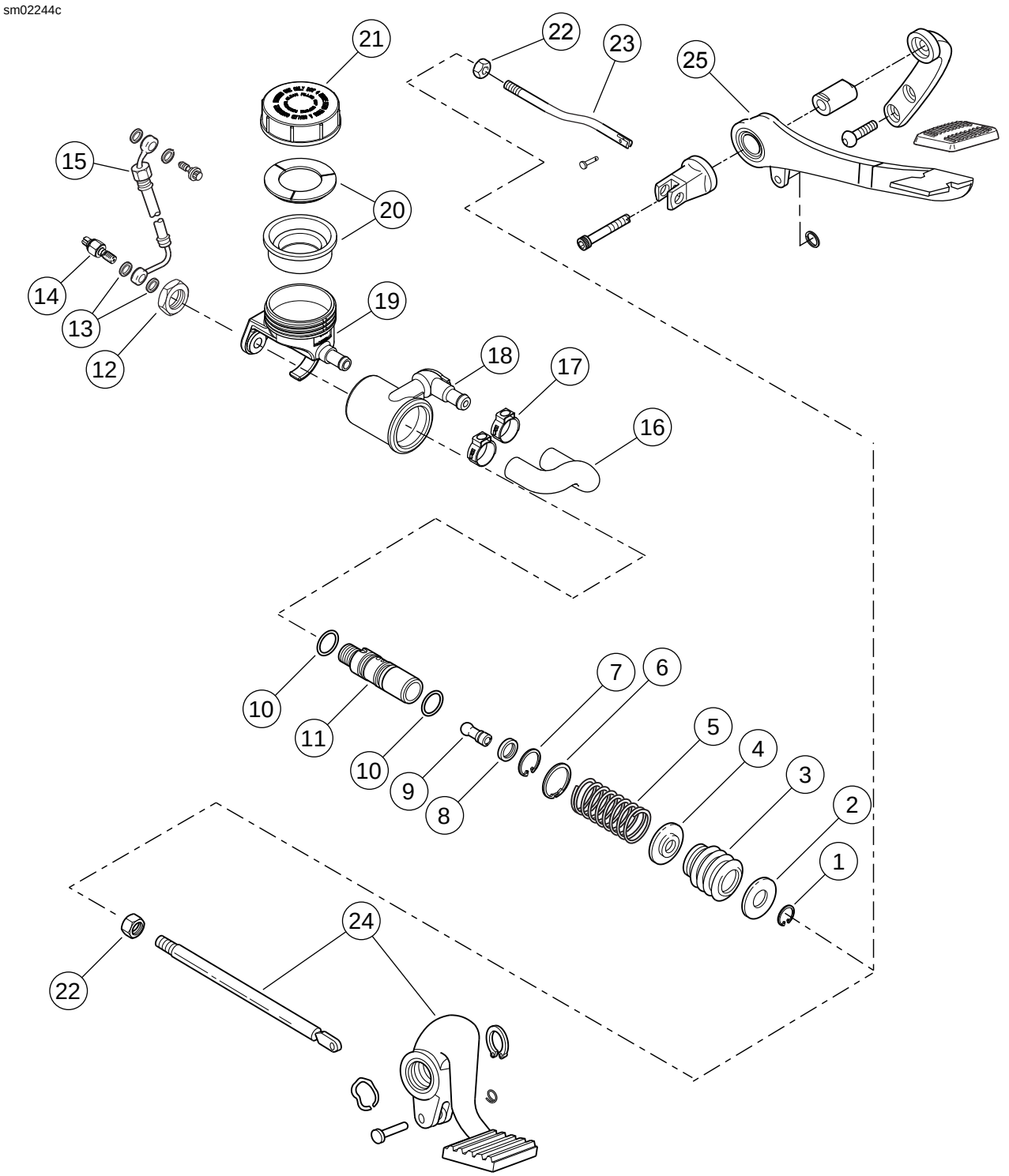
REMOVAL

1. See Figure 2-63 or Figure 2-64. Remove banjo bolt (14) and gaskets (13). Discard washers.
2. Remove master cylinder mounting jamnut (12).
3. Loosen jamnut (22) on threaded brake rod (23 or 24).
4. Unscrew pushrod (9) from brake rod.

NOTE

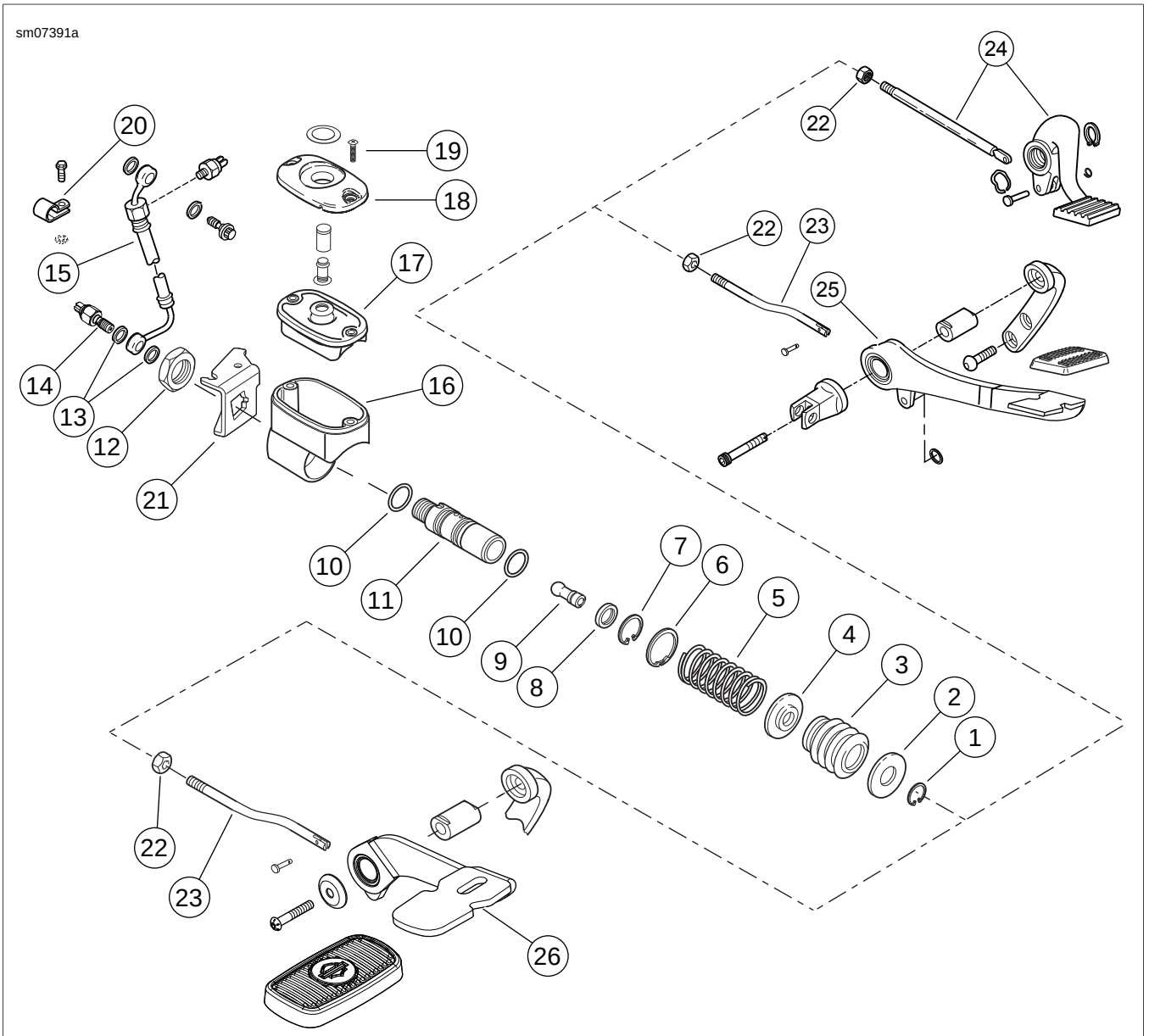
Use a wrench on pushrod flats if necessary.

5. Raise pedal to move master cylinder/reservoir forward and out of frame bracket.



1. Retaining ring
2. Washer
3. Boot
4. Retainer
5. Spring
6. Retaining ring
7. Retaining ring
8. Washer
9. Pushrod
10. Cartridge body O-ring (2)
11. Cartridge body
12. Jamnut
13. Gasket (2)
14. Banjo bolt
15. Brake line
16. Hose
17. Clamp (2)
18. Housing
19. Reservoir
20. Cover gasket assembly
21. Cap
22. Jamnut
23. Pushrod (FXDWG, FXDF)
24. Brake lever assembly (all but FXDWG, FXDF)
25. Brake pedal (FXDWG, FXDF)

Figure 2-63. Rear Brake Master Cylinder: All But FLD, ABS Only



1. **Retaining ring**
2. **Washer**
3. **Boot**
4. **Spring retainer**
5. **Spring**
6. **Retaining ring**
7. **Retaining ring**
8. **Washer**
9. **Pushrod**
10. **Cartridge body O-ring (2)**
11. **Cartridge body**
12. **Jamnut**
13. **Gasket (2)**
14. **Banjo bolt**
15. **Brake line**
16. **Reservoir**
17. **Cover gasket**
18. **Cover**
19. **Screw (2)**
20. **Frame**
21. **Clamp**
22. **Jamnut**
23. **Brake rod**
24. **Brake lever assembly (all but FXDWG, FXDF)**
25. **Brake pedal (FXDWG, FXDF)**
26. **Brake pedal (FLD)**

Figure 2-64. Rear Brake Master Cylinder: FLD (ABS and non-ABS) and All Other Non-ABS Models

DISASSEMBLY

1. Clean exterior of master cylinder/reservoir with a clean, nonflammable solvent. Lubricate all internal parts with lubricant provided in kit.
2. See Figure 2-63 or Figure 2-64. Thread banjo bolt (14) into the cartridge body (11).
3. Remove boot (3) from groove in master cylinder/reservoir. Set master cylinder/reservoir upright with banjo bolt resting on bench and push master cylinder/reservoir down and off the cartridge body.
4. Protect cartridge body from dirt or grease.

5. Press down on large washer (2) to compress spring (5), keep spring compressed and remove retaining ring (1) from groove in pushrod (9).
6. Carefully release spring and remove washer, boot, spring retainer (4) (inside boot) and spring.
7. Remove and discard retaining ring (7) from bore of cartridge body and remove pushrod and washer (8).

NOTE

Do not disassemble cartridge body (11). Cartridge body components are not sold separately. Replace cartridge body if piston seal leaks.

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 exterior of master cylinder/reservoir with a clean, nonflammable solvent. Lubricate all internal parts with lubricant provided in kit.
2. See Figure 2-63 or Figure 2-64. Inspect reservoir bore for scratches. Replace if scratches are present.
3. Check boot (3) for tears and replace if any exist.
4. Inspect threads on cartridge body (11), pushrod (9) and banjo bolt (14). Replace any part with damaged threads. Inspect spring for cracks or damaged coils - replace if any exist.
5. Carefully remove large O-rings (10) from cartridge body. Do not scratch O-ring grooves. Clean grooves with soft cotton cloth moistened with alcohol. Inspect grooves for scratches and dirt. Remove dirt or replace cartridge body if grooves are scratched.

ASSEMBLY

NOTICE

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

1. See Figure 2-63 or Figure 2-64. Lubricate O-rings (10) with DOT 4 BRAKE FLUID and install in O-ring grooves on cartridge body (11).
2. Lubricate bore of master cylinder/reservoir with DOT 4 BRAKE FLUID.
3. Insert cartridge body into reservoir. Using hand-pressure only, press cartridge body into adapter making sure notch on cartridge body engages lug inside bore of the adapter.
4. Thread banjo bolt (14) into cartridge body and stand master cylinder upright with banjo bolt resting on bench.
5. Place washer (8) on pushrod (9).
6. Place a **new** retaining ring (7) on pushrod. Insert ball-end of pushrod into piston. Push piston downward with pushrod until washer is properly seated in the cartridge bore.
7. Install the **new** retaining ring in groove inside cartridge bore. Make certain retaining ring is fully seated in groove.
8. Release downward pressure on pushrod and check that pushrod rotates freely.
9. Install retaining ring (6) in groove on cartridge body.
10. Install on pushrod, spring (5), spring retaining washer (4) (large cupped side toward spring), boot (3) with drain hole down, and washer (2).
11. Press down on washer and install retaining ring (1) in pushrod groove.
12. Seat sealing lip of boot into groove on master cylinder/reservoir adapter.

INSTALLATION

FASTENER	TORQUE VALUE	
Master cylinder mounting nut, rear	30-40 ft-lbs	40.7-54.2 Nm
Banjo bolt to rear master cylinder	17-22 ft-lbs	23.1-29.9 Nm
Master cylinder reservoir rear cover screws: FLD (ABS and non-ABS) and all other non-ABS models	6-8 **in-lbs**	0.68-0.90 Nm

1. See Figure 2-63 or Figure 2-64. Guide threaded end of master cylinder/reservoir through hole in frame bracket. Make sure the square body of the master cylinder/reservoir is engaged in the square hole of the mounting bracket.
2. Install jamnut (12) and tighten to 30-40 ft-lbs (40.7-54.2 Nm).
3. Thread pushrod (9) fully onto brake rod (23/24). Do not tighten jamnut (22) at this time.
4. Lubricate **new** steel/rubber washers (13) with DOT 4 BRAKE FLUID. Install brake line (15) using banjo bolt (14) and **new** steel/rubber washers (13). Position brake line and tighten banjo bolt to 17-22 ft-lbs (23.1-29.9 Nm).

WARNING

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

⚠WARNING

When adjusting brake control rod, never allow more than nine threads to be exposed between control rod and jam nut. If more than nine threads are exposed, brake rod can come apart resulting in loss of rear brake, which could cause death or serious injury. (00306c)

5. Tighten jamnut after adjustment. Make certain that no more than nine threads are visible on brake rod.
6. Verify that water drain hole in rubber boot (3) is positioned to bottom.

⚠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)

NOTE

Brake pedal freeplay is built into master cylinder and no adjustment is required. When pedal is pushed down with hand, a small amount of freeplay must be felt.

7. Bleed brake system. See 2.14 BLEEDING BRAKES.
8. **All ABS models but FLD:** See Figure 2-63. Install gasket assembly (20) and cap (21). Tighten cap securely.
9. **FLD (ABS and non-ABS) and all other non-ABS models:** See Figure 2-64. Install gasket (17) and cover (18) on master cylinder/reservoir. Tighten cover screws to 6-8 **in-lbs** (0.68-0.90 Nm).

⚠WARNING

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

10. Test brake system.
    a. Turn ignition switch ON. Pump brake pedal to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 2.14 BLEEDING BRAKES.

NOTE

See Figure 2-64. A sight glass in cover (18) enables the rider to visually check the brake fluid level without removing the master cylinder cover on all FLD ABS and Non-ABS Models and all Dyna Non-ABS Models. When the reservoir is full, the sight glass appears dark. As the fluid level drops, the glass appears lighter to indicate this condition to the rider.

REAR BRAKE CALIPER 2.13

REMOVAL

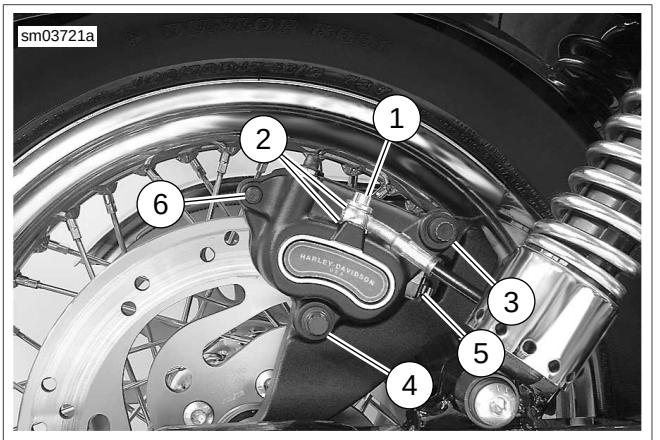
NOTE

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

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 2-65. 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.



1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Slider pin**
4. **Mounting bolt**
5. **Tab slot**
6. **Pad pin**

Figure 2-65. Rear Caliper

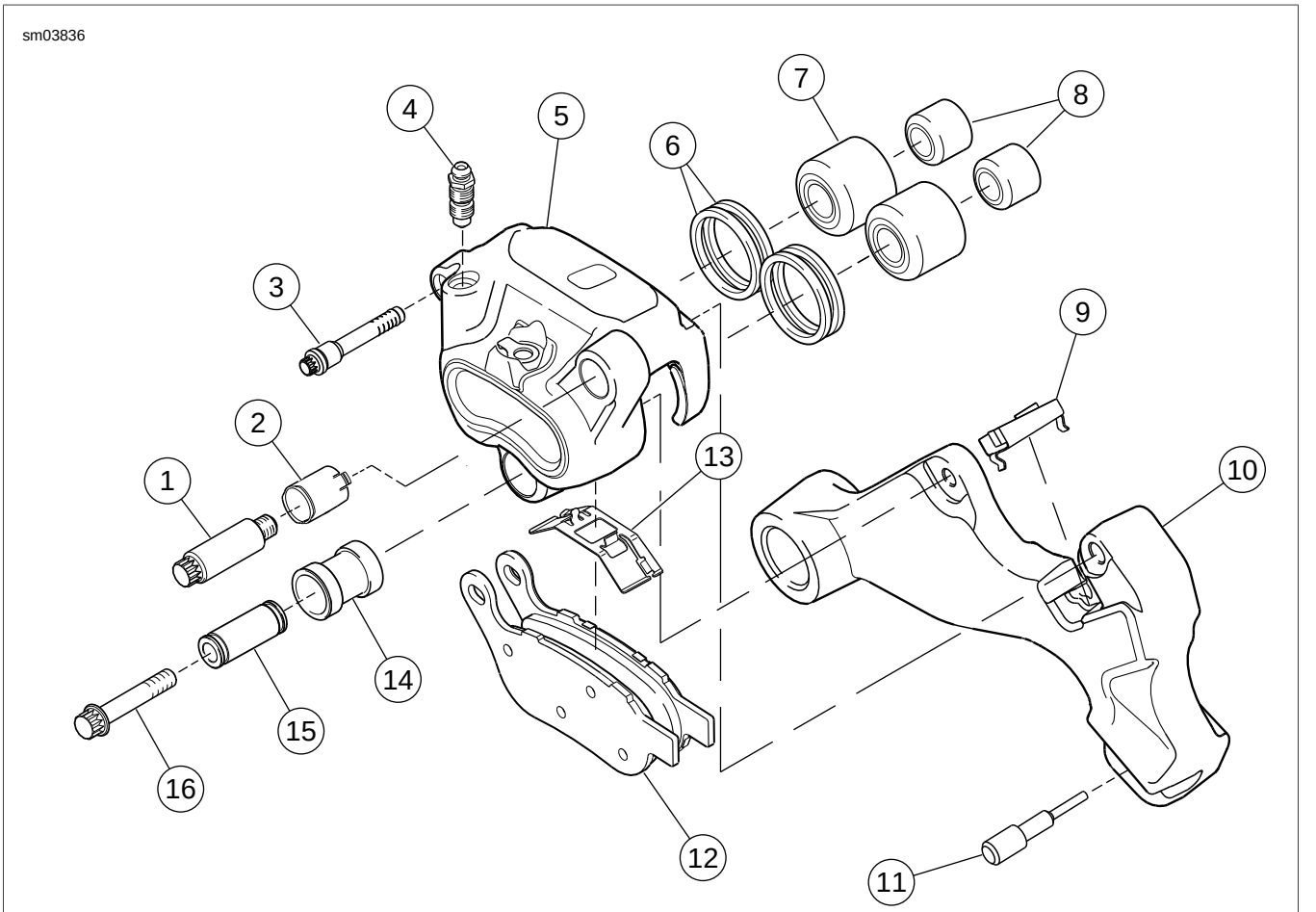
DISASSEMBLY

PART NUMBER	TOOL NAME
HD-48648	BRAKE CALIPER PISTON REMOVER

1. See Figure 2-66. Remove pad pin (3) and brake pads (12).
2. If necessary, remove bleeder valve (4).

NOTE

If phenolic insulators (8) are loose, remove from pistons.



1. **Slider pin**
2. **Bushing (upper)**
3. **Pad pin**
4. **Bleeder valve 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 2-66. Rear Brake Caliper

⚠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. (00530b)

NOTE

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

3. See Figure 2-67. 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

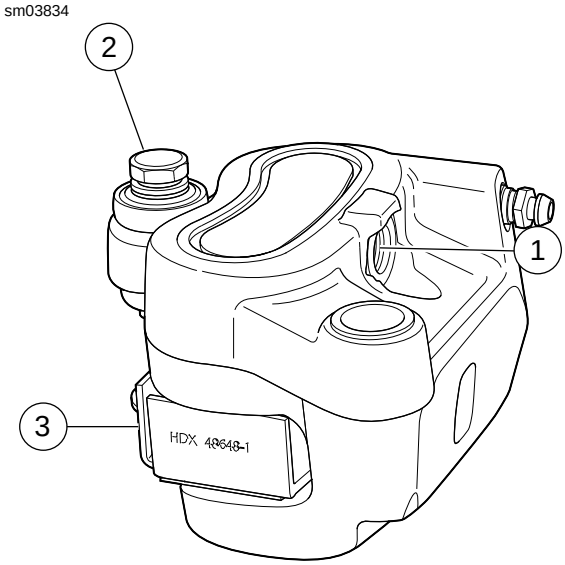
   Tool retaining bolt (2) is used only to keep tool from slipping out of the caliper during piston removal, and does not need to be tight. Do not use a wrench to tighten.

   b. If the bleeder valve 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 from caliper bores to completely remove.

NOTICE

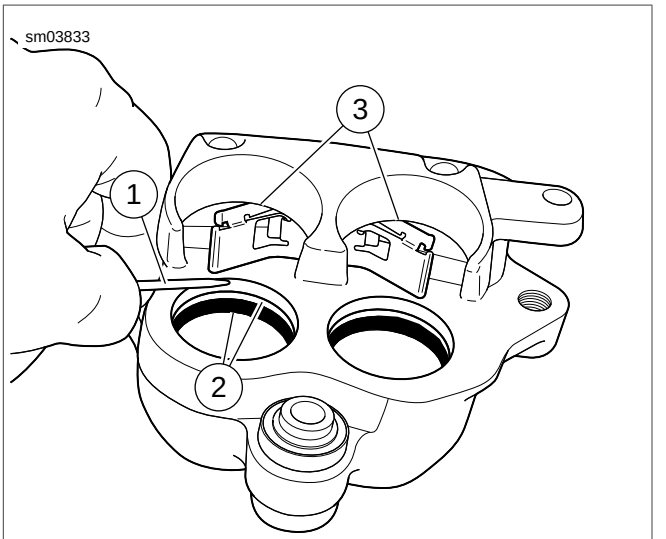
Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (00529d)

5. See Figure 2-68. 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.



1. **Banjo bolt hole-apply low-pressure air**
2. **Remover retaining bolt**
3. **Brake caliper piston remover (Part No. HD-48648)**

Figure 2-67. Removing Pistons



1. **Wooden toothpick**
2. **Square seal**
3. **Anti-rattle spring**

Figure 2-68. Seals and Spring

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)

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 2-66. Inspect rubber boot (14) for cracks and damage. Inspect bushing (15) 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

FASTENER	TORQUE VALUE	
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm

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 prior to assembly using a light coat of G.E. VERSILUBE #G322 L SILICONE GREASE (marked "Piston Lube") from 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 2-68. 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 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 2-66. Install bleeder valve (4) (with O-ring) in caliper housing, if removed, and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).

NOTE

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

6. Insert brake pads into caliper with friction material facing opening for brake disc.
7. Install pad pin (3) and 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 2-66.*

INSTALLATION

FASTENER	TORQUE VALUE	
Brake caliper mounting bolt, rear	120-168 **in-lbs**	13.6-18.9 Nm
Rear caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm

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 2-66. Verify torque clip (9) is in place in caliper mount.
3. See Figure 2-65. Install caliper with pads on caliper mount. Tighten slider pin (3) and mounting bolt (4) (metric) to 120-168 **in-lbs** (13.6-18.9 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).

⚠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)

5. Remove cover from rear brake master cylinder. Fill master cylinder with DOT 4 BRAKE FLUID. Verify that fluid level is 1/4-1/2 in (6.4-12.7 mm) below top of reservoir with master cylinder in a level position.

⚠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

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)

6. Bleed brake system. See 2.14 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)

7. 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. See 2.14 BLEEDING BRAKES.

NOTE

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

BLEEDING BRAKES 2.14

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)

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

PROCEDURE

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

FASTENER	TORQUE VALUE	
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm
Front master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm
Rear master cylinder reservoir cover screws, non-ABS models	6-8 **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 end in a clean container.
2. Position vehicle or handlebar so master cylinder reservoir is level.

NOTES

- *Wrap a clean shop cloth around the outside of the master cylinder reservoir to protect paint from brake fluid spills.*
- *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. Add brake fluid as necessary. Verify proper operation of the master cylinder relief port by actuating the brake pedal or lever. A slight spurt of fluid will break the fluid surface in the reservoir if internal components are working properly. Refer to Table 2-12.
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.

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 2-13. Install bleeder valve cap.

NOTE

Dual caliper brake system: *Repeat steps to bleed the second brake line and caliper.*

9. Check and fill reservoir to specified level.
10. 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, all models without remote reservoir, non-ABS models.** Install cover screws.
    c. Tighten to specification. Refer to Table 2-13.
11. **ABS equipped models:** Connect DIGITAL TECHNICIAN II (Part No. HD-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.

Table 2-12. Fluid Level

ITEM	SPECIFICATION
Front reservoir	1/8-3/8 in (3.2-9.5 mm) below gasket surface
Rear reservoir: Models without remote reservoir	1/4-1/2 in (6.4-12.7 mm) below gasket surface
Rear reservoir: Models with remote reservoir	Check range window

Table 2-13. Torque Specifications

COMPONENT	TORQUE
Bleeder	80-100 **in-lbs** (9.0-11.3 Nm)
Front cover	12-15 **in-lbs** (1.4-1.7 Nm)
Rear cover, models without remote reservoir, non-ABS models	6-8 **in-lbs** (0.7-0.9 Nm)

TIRES 2.15

GENERAL

⚠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

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)

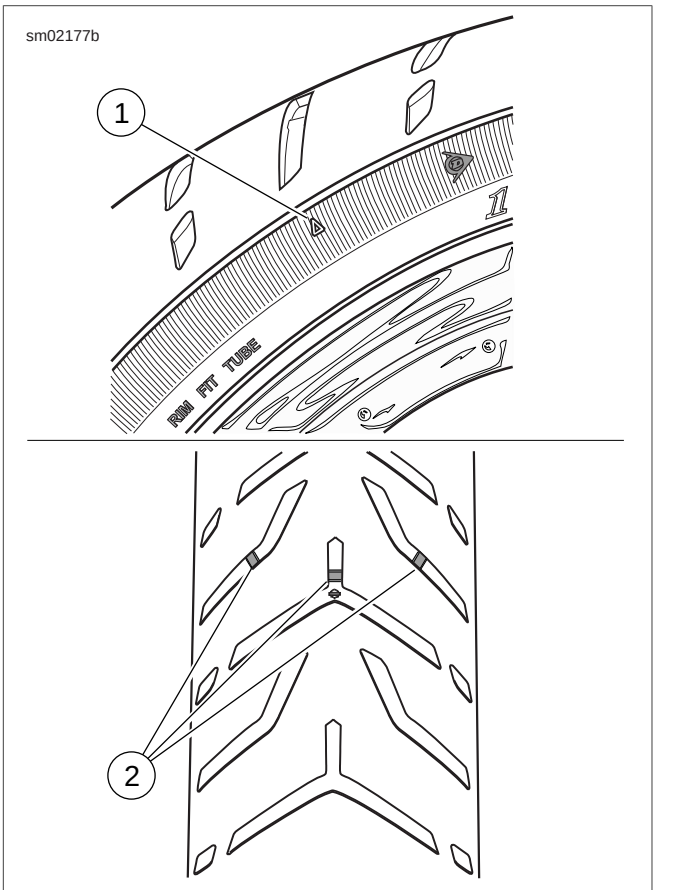
Always maintain proper tire pressure as specified in Table 2-7. Do not load tires beyond GAWR specified in Table 2-3. Under-inflated, over-inflated or overloaded tires can fail.

NOTES

- *Check runout on all wheels before installing a **new** tire. See 2.8 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 2-69. The tread wear indicator bars will appear on tire tread surfaces when 1/32 in (0.8 mm) or less of tread remains. Always remove tires from service before they reach the tread wear indicator bars.*

New tires are needed if any of the following conditions exist. See 1.8 TIRES AND WHEELS.

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



1. **Sidewall**
2. **Tread surface**

Figure 2-69. Tread Wear Indicators (Typical)

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. See 2.4 FRONT WHEEL, Removal or 2.5 REAR WHEEL, Removal.
2. Deflate tire.

NOTE

***Tube Type Wheels:** do not completely remove tire from rim to replace the tube only. Removing one side allows the tube to be replaced and allows for inspection of tire.*

3. Loosen both tire beads from rim flange. Use a bead breaker machine if available.
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 2.8 CHECKING AND TRUING WHEELS.
4. Inspect the tire for wear and damage.
5. Inspect tread depth. Replace worn tires.
6. Replace tube and rim seal prior to installing tire.

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)

7. Repair tread on tubeless tires if puncture is 1/4 in (6.4 mm) or smaller. Repairs must be made from inside the tire.
8. Always combine a patch and plug when repairing damaged tires.

INSTALLATION

FASTENER	TORQUE VALUE	
Valve stem nut, tube type	3-7 **in-lbs**	0.3-0.8 Nm
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm

WARNING

Harley-Davidson front and rear tires are not the same. Interchanging front and rear tires can cause tire failure, which could result in death or serious injury. (00026a)

WARNING

Do not exceed manufacturer's recommended pressure to seat beads. Exceeding recommended bead seat pressure can cause tire rim assembly to burst, which could result in death or serious injury. (00282a)

WARNING

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)

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

Some tires have arrows molded into the tire sidewall. These tires should be mounted on the rim with the arrow pointing in the direction of forward rotation. The colored dot on the sidewall is a balance mark. Locate this dot next to the valve stem hole.

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. (00023c)

NOTES

- *For correct tire and tube types, see 2.2 SPECIFICATIONS.*
- *Whenever a tube type tire is replaced, also replace the tube. Only patch inner tubes as an emergency measure. Replace a damaged or patched tube as soon as possible. Install **new** rim strips on all laced wheels.*

1. See Figure 2-70. On laced wheels, install a rim strip into the rim well. Make sure no spokes protrude through nipples, and be sure to align the valve stem hole in rim strip with valve stem hole in rim.
2. Install tube and tire.
3. Tighten the valve stem nut to 3-7 **in-lbs** (0.3-0.8 Nm).



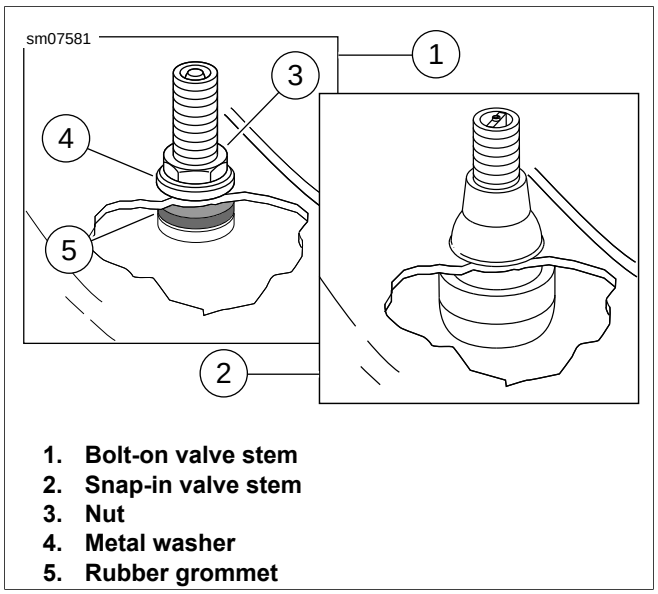
Figure 2-70. Installing Rim Strip

Tubeless Tires

WARNING

Only install original equipment tire valves and valve caps. A valve, or valve and cap combination, that is too long or too heavy can strike adjacent components and damage the valve, causing rapid tire deflation. Rapid tire deflation can cause loss of vehicle control, which could result in death or serious injury. (00281a)

1. See Figure 2-71. Replace damaged or leaking valve stems.
2. Install rubber grommet (5) on valve stem before tightening nut (3).
3. Insert valve stem into rim hole.
4. Install metal washer (4).
5. Install nut and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
6. Install tire.



1. **Bolt-on valve stem**
2. **Snap-in valve stem**
3. **Nut**
4. **Metal washer**
5. **Rubber grommet**

Figure 2-71. Tubeless Tire Valve Stems

CHECKING TIRE RUNOUT

Lateral Runout

1. Check tire pressure.
2. See Figure 2-72. Turn the wheel on the axle and measure tire lateral runout from a fixed point to a smooth area on the tire sidewall. Avoid measuring on raised letters or vents.
3. Tire lateral runout should not exceed 0.090 in (2.29 mm). If tire runout exceeds specification, remove tire from rim and check rim lateral runout. See 2.8 CHECKING AND TRUING WHEELS.
   a. If rim lateral runout is within specification, the tire is at fault and must be replaced.
   b. If rim lateral runout is not within specification, correct by adjusting selected spokes on laced wheels or replace cast wheels. See 2.8 CHECKING AND TRUING WHEELS.
4. Install the tire. Check tire lateral runout of replacement tire.

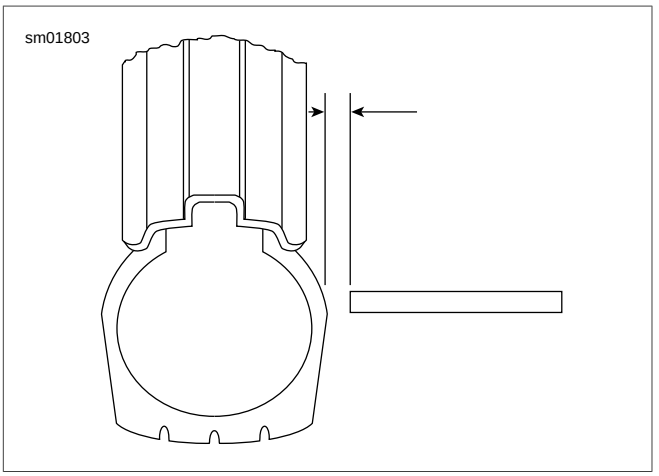


Figure 2-72. Checking Tire Lateral Runout

Radial Runout

1. Check tire pressure.
2. See Figure 2-73. 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 2.8 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 2.8 CHECKING AND TRUING WHEELS.
4. Install the tire. Check tire radial runout of replacement tire.

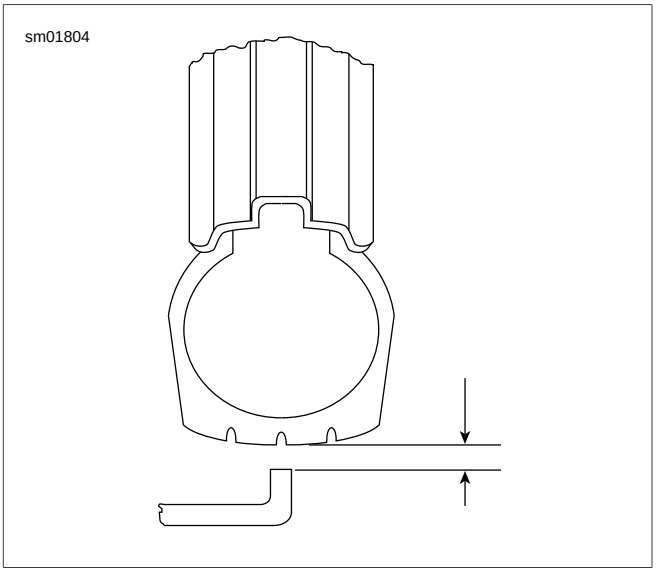


Figure 2-73. Checking Tire Radial Runout

WHEEL BALANCING

NOTE

Install tire after balancing. See See 2.4 FRONT WHEEL, Installation or 2.5 REAR WHEEL, Installation.

Static vs Dynamic

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

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

Weights

The maximum weight permissible to accomplish balance 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 (5 g) as compared to 0.25 oz (7 g) for lead. Weights are stamped for easy identification.

NOTES

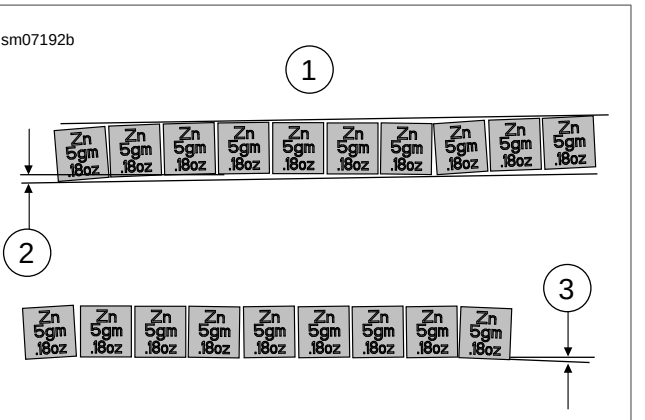
- *If adding more than 1.5 oz (43 g) of weight at one location, divide the amount so that half is applied to each side of rim.*
- *On cast wheels without a flat area near the bead, place the weights crosswise through the opening.*

1. See Figure 2-75. Place weights on a smooth surface of the wheel rim such that centrifugal force will help keep them in place. Make sure the area of application is completely clean, dry, and free of oil and grease.

NOTE

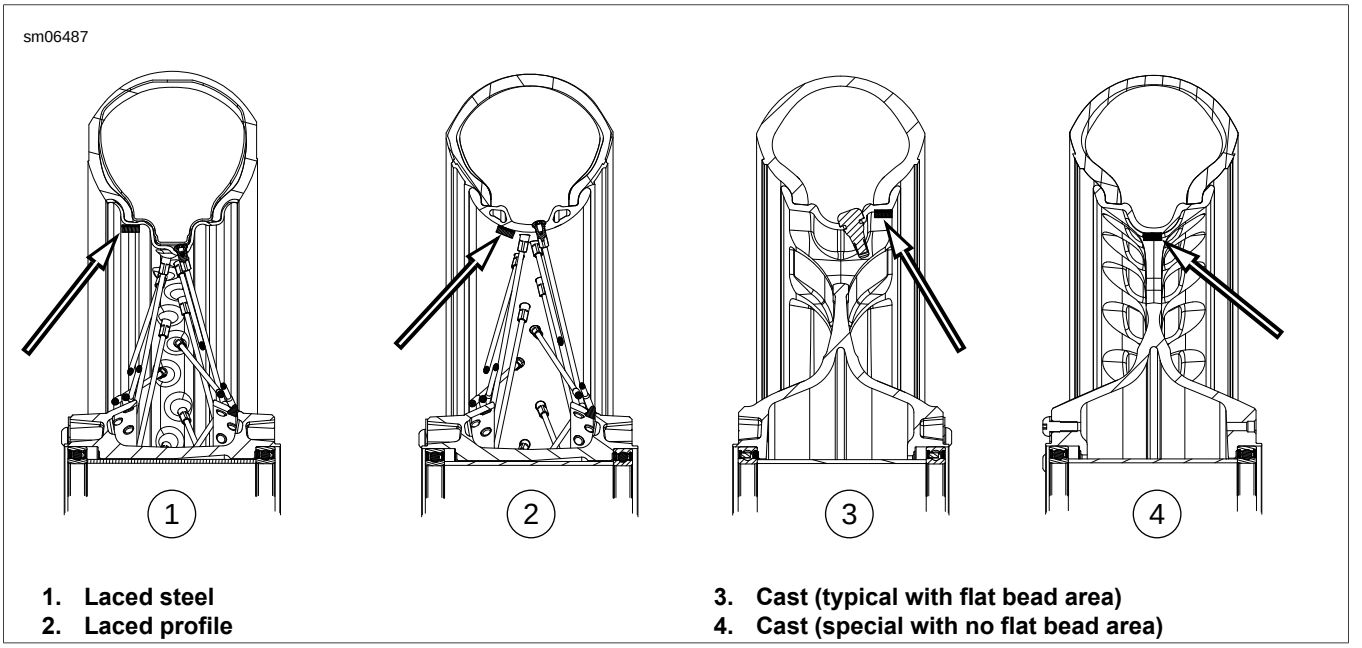
See Figure 2-74. When installing wheel weights, consider cosmetics. Keep snaking (1) within 0.040 in (1.02 mm) (2) of straight. Also keep the angle alignment of individual segments (3) within 3 degrees.

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



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

Figure 2-74. Weight Segment Alignment



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

Figure 2-75. Wheel Weight Placement

FRONT FORK 2.16

REMOVAL

1. Support motorcycle so front wheel is off floor and forks are fully extended.
2. Remove brake caliper and front wheel. See 2.4 FRONT WHEEL.
3. Remove front fender. See 2.26 FRONT FENDER.
4. Loosen, but do not remove, fork tube caps.
5. Loosen fork bracket pinch bolts. Remove left and right fork assemblies from fork brackets.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-41177	FORK HOLDING TOOL

1. See Figure 2-76. Clamp fork tube and slider assembly in FORK HOLDING TOOL (Part No. HD-41177) and mount in vise.

NOTES

- *This procedure is for all conventional front forks. For FLD cartridge style front fork see 2.16 FRONT FORK, Assembly.*
- *In next step, use a hex key wrench to loosen seat pipe screw.*

2. See Figure 2-78. While internal components are still under tension and less prone to rotate, break loose but do not completely unthread seat pipe screw.

NOTE

On right fork tube and slider assembly, remove axle holder to access seat pipe screw.

⚠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)

3. See Figure 2-79. Remove fork tube cap (7) and O-ring (6).
4. Remove the spring collar (8).
5. Remove from fork holding tool and invert fork over a suitable container. Allow fork to drain. Extend and retract slider several times to push oil out of internal components. The washer (5), and spring (4) will fall out of fork tube.
6. Clamp fork tube in holder. Mount fork holding tool horizontally in vise.
7. See Figure 2-77. Remove slider cover from slider by inserting brass drift into notch in slider and lightly tapping cover.
8. See Figure 2-79. Compress oil seal retaining ring (11) and remove retaining ring from groove in top of slider bore.
9. Remove seat pipe screw (20) and washer (19) from bottom of slider (16, 17). Retain the seat pipe screw and washer.
10. Withdraw slider from fork tube (1) until bushing guide (14) contacts bushing (24) on fork tube. Bushing guide is a slight interference fit in slider.
11. Using the slider as a slide hammer, hit the bushing with the bushing guide with a quick continuous stroke until slider is pulled free of the fork tube.
12. Drain the slider and allow the lower stop (15) to fall free.

NOTE

If replacing the slider only, further disassembly is not required. Proceed to fork assembly. See 2.16 FRONT FORK, Assembly.

13. If still attached to seat pipe, remove lower stop from the lower end of seat pipe.
14. Remove seat pipe (3) piston and ring assembly.
15. Remove rebound spring (2).
16. Remove oil seal (12), oil seal spacer (13), and bushing guide (14).
17. Repeat procedure for opposite side.

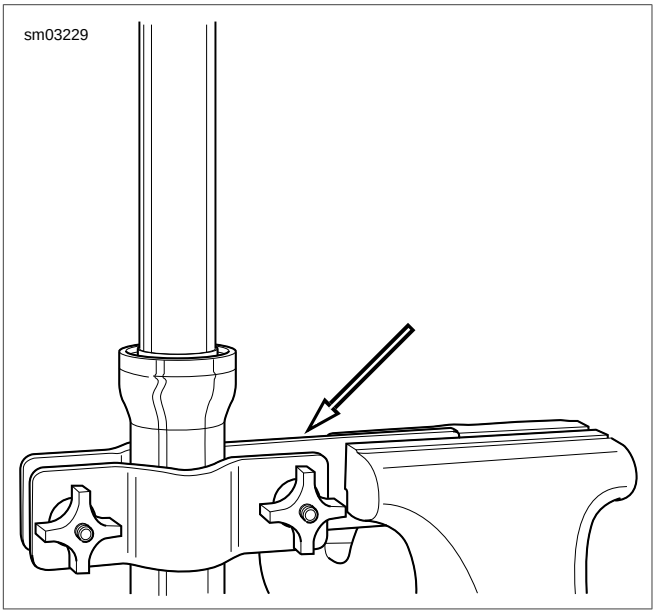


Figure 2-76. Fork Holding Tool (mounted vertically to slider)

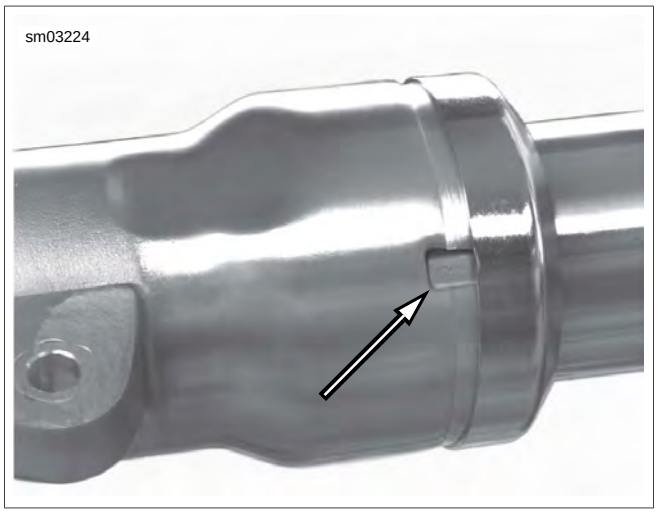
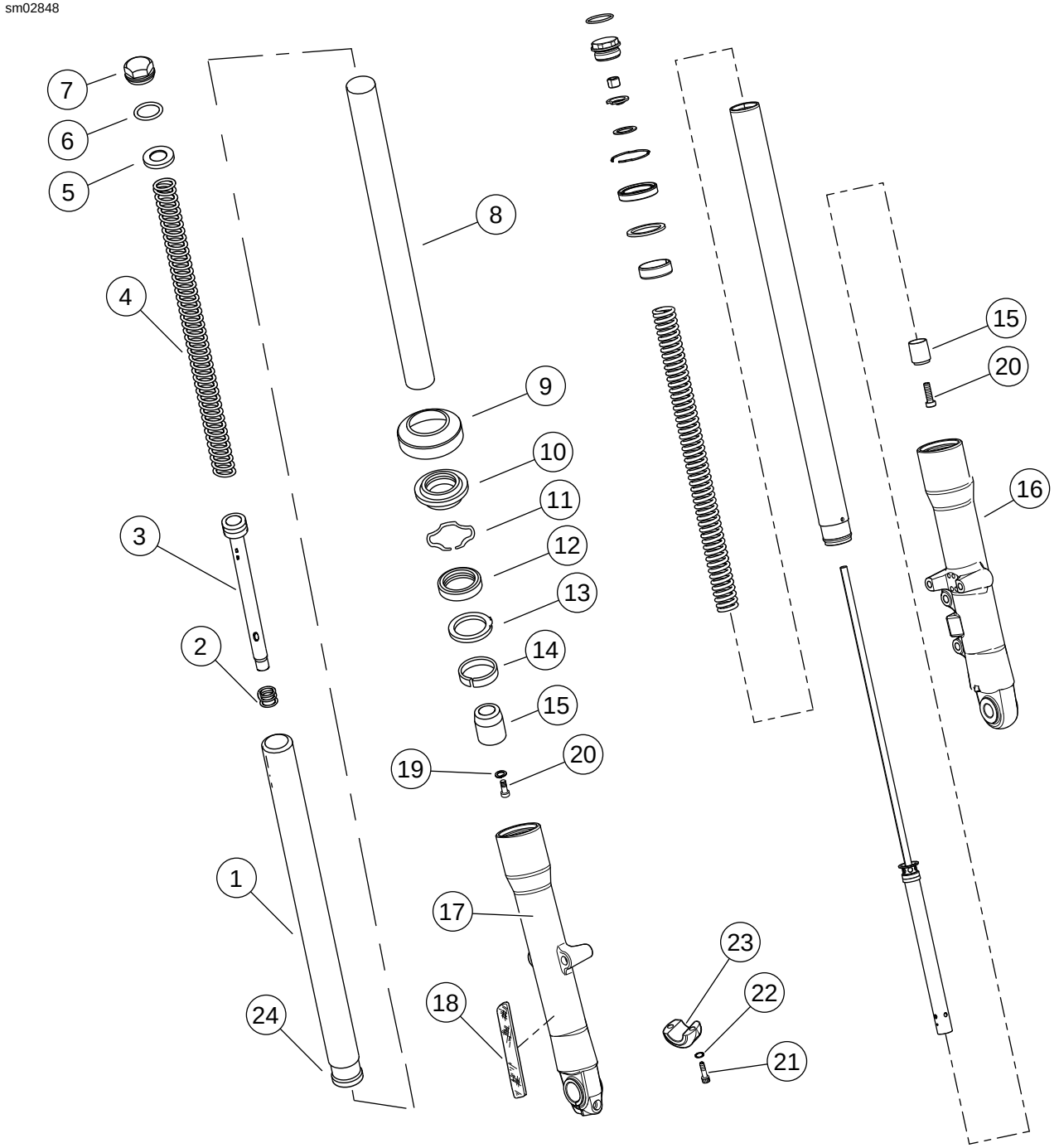


Figure 2-77. Notch in Slider



Figure 2-78. Seat Pipe Screw (right fork assembly)



1. Fork tube
2. Rebound spring
3. Seat pipe
4. Spring
5. Washer
6. O-ring
7. Fork tube cap
8. Spring collar
9. Slider cover
10. Dust seal
11. Oil seal retaining ring
12. Oil seal
13. Oil seal spacer
14. Bushing guide
15. Lower stop
16. Slider assembly (left)
17. Slider assembly (right)
18. Reflector
19. Washer
20. Seat pipe screw
21. Axle cap fastener
22. Lockwasher
23. Axle cap
24. Bushing

Figure 2-79. Front Fork

DISASSEMBLY: CARTRIDGE FORK (FLD, LEFT SIDE)

PART NUMBER	TOOL NAME
HD-41177	FORK TUBE HOLDER
HD-45966	FORK SPRING COMPRESSING TOOL
HD-45966-2	FORK SPRING COMPRESSING TOOL COLLAR

1. Remove fork assembly. See 2.17 STEERING HEAD, Removal: FLD.

NOTICE

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly. (00421b)

2. Clamp fork tube in FORK TUBE HOLDER (Part No. HD-41177) and mount in vise.

⚠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)

3. See Figure 2-80. Remove fork cap from fork tube.



1. **Fork tube cap**
2. **Hex nut**

Figure 2-80. Install Fork Tube Into Fork Holder

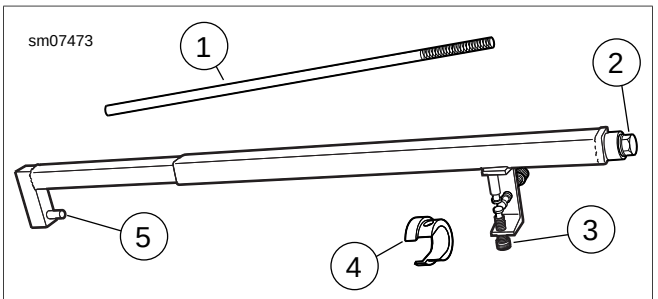
4. Pull up on fork slider to compress fork assembly. This causes damper rod to protrude from top of fork tube.
5. Holding locknut, remove fork tube cap from threaded end of damper rod. Remove O-ring from fork tube cap. Discard O-ring.
6. Remove fork assembly from FORK TUBE HOLDER (Part No. HD-41177). Turning fork upside down, drain fork oil into a suitable container.

7. See Figure 2-81. Obtain FORK SPRING COMPRESSING TOOL (Part No. HD-45966). Install as follows:
   a. Clamp tool in vise in a vertical position with length adjuster screw topside.
   b. Pull up on fork slider to compress fork assembly.
   c. Place hole at bottom of fork slider over post at bottom end of tool.
   d. With the smaller OD topside, place FORK SPRING COMPRESSING TOOL COLLAR (Part No. HD-45966-2) over locknut, spring seat and flat washer of fork assembly.

   NOTE

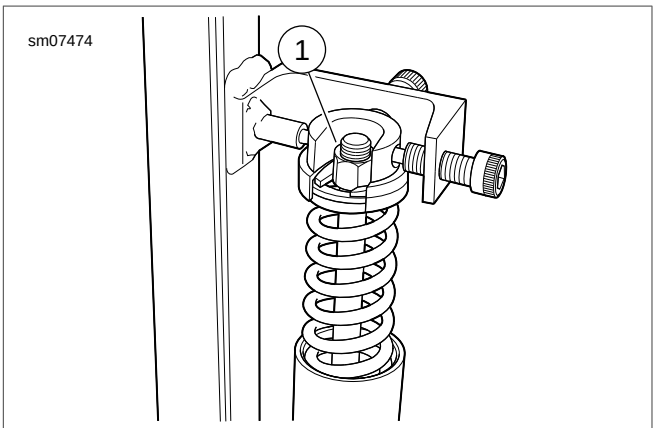
   Use only hand tools to turn length adjuster screw on fork spring compressing tool. Do not use an air impact wrench.

   e. Adjust tool as necessary until three retaining pins engage blind holes in spring compressor. Turn length adjuster screw counterclockwise to lengthen, clockwise to shorten.
   f. Turn retaining pins as necessary to lock position of spring compressor collar.
   g. Tighten length adjuster screw to compress spring.
8. Using deep socket, remove locknut from end of damper rod.



1. **Damper rod extension tool**
2. **Length adjustment screw**
3. **Retaining pin (3)**
4. **Spring compressor collar**
5. **Post**

Figure 2-81. Fork Spring Compressing Tool (HD-45966)



1. **Locknut**

Figure 2-82. Compress Fork Spring

9. Loosen length adjuster screw to release tension on fork spring. Loosen retaining pins and remove spring compressor collar. Remove spring seat and flat washer.
10. Remove fork assembly from tool. Remove fork spring from fork tube.
11. Obtain damper rod extension tool (part of FORK SPRING COMPRESSING TOOL (Part No. HD-45966)) shown in Figure 2-83. Thread extension tool onto end of damper rod.
12. See Figure 2-84. Turn fork assembly upside down over drain pan and slowly pump damper rod at least twenty times until rod moves freely.

    NOTE

    If only changing the fork oil, continue procedure at 2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side). If overhauling the fork assembly, continue with procedure.
13. Remove extension tool from damper rod. Install fork spring back into fork tube.
14. Place a clean shop rag on the floor, and turning fork assembly upside down, press end of spring against rag. While compressing spring to prevent rotation of damper cartridge, remove 6mm screw from end of fork slider. Use an air impact wrench for best results. Discard 6mm screw and copper crush washer.
15. Remove spring and damper cartridge from fork tube.

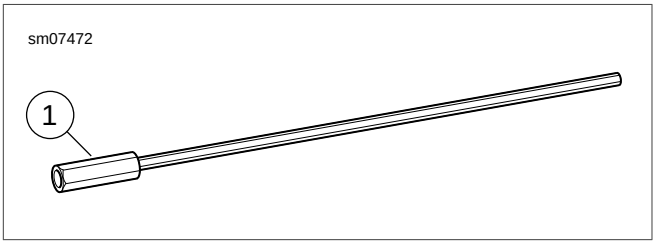


Figure 2-83. Damper Rod Extension Tool

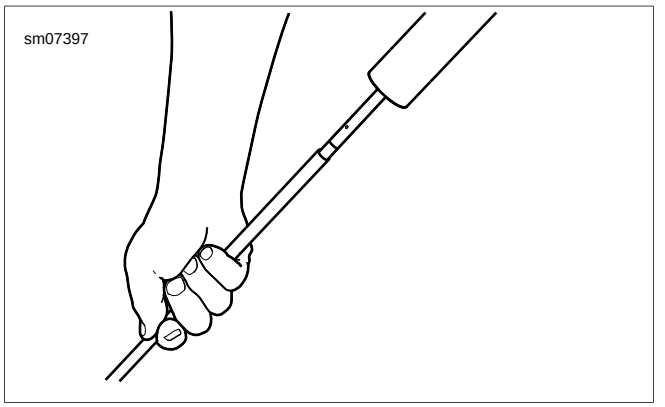


Figure 2-84. Pump Damper Rod Extension Tool

NOTE

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

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

NOTE

To overcome any resistance, use the fork tube as a slide hammer. Push fork tube into fork slider and then pull outward with moderate force. Repeat until fork tube separates from fork slider.

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

CLEANING AND INSPECTION

1. See Figure 2-79. Thoroughly clean and inspect each part. If inspection shows that any parts are bent or damaged, those parts should be repaired or replaced as necessary.
2. Inspect fork tube bushing (24) and bushing guide (14) and replace as required.
3. Always replace oil seals and O-rings.
4. **All except FLD:** Check slider cover (9) where it rubs on fork tube. The slider cover should present a good continuous seal and not show excessive wear.
5. **All except FLD:** Check the fork tube (1) where it rubs on slider cover. The tube should show a bright, shining surface, free of scoring or abrasions.
6. Replace damaged springs (4).
7. Replace bent or damaged fork tubes or sliders (16, 17).

ASSEMBLY

PART NUMBER	TOOL NAME
HD-41177	FORK HOLDING TOOL
HD-45305	FORK SEAL DRIVER
HD-59000A	PRO-LEVEL OIL GAUGE

FASTENER	TORQUE VALUE	
Front fork seat pipe screw	132-216 **in-lbs**	14.9-24.4 Nm
Fork tube caps	22-59 ft-lbs	30-80 Nm

NOTE

This procedure is for all conventional front forks. For FLD cartridge style front fork see 2.16 FRONT FORK, Disassembly: Cartridge Fork (FLD, Left Side).

1. See Figure 2-79. Insert seat pipe (3) with the rebound spring (2) into fork tube (1).
2. Slide bushing guide (14) down to bushing (24) on fork tube (1). Follow with oil seal spacer (13), oil seal (12), oil seal retaining ring (11), dust seal (10) and slider cover (9).
3. Install fork tube into FORK HOLDING TOOL (Part No. HD-41177) mounted horizontally in a vise.
4. Fit lower stop (15) onto seat pipe.
5. See Figure 2-85. Slide seat pipe back into fork tube until seat pipe is centered in tube.
6. See Figure 2-79. Gently install slider assembly (16, 17) onto slider tube and bushing (24).
7. Thread seat pipe screw (20) and washer (19) into seat pipe through bottom of slider assembly. Draw fastener into seat pipe but do not tighten.
8. Verify action of fork by sliding slider up and down fork tube.
9. Assemble the FORK SEAL DRIVER (Part No. HD-45305) over fork tube in front of oil seal.

NOTE

Chamfered lips on oil seal MUST face towards oil in fork.

10. See Figure 2-86. Holding fork seal driver (4) together, tap oil seal (3), spacer (2) and bushing guide (1) into slider bore.
11. See Figure 2-79. Install oil seal retaining ring (11) into groove in top of oil seal.
12. Push dust seal (10) against oil seal and stopper ring.
13. Rotate slider cover (9) to match any removal burrs to notch in slider and snap slider cover into place.
14. Move slider through its full range of travel several times to verify alignment. Then, pulling down on slide to apply downward force on rebound spring, apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) and tighten screw to 132-216 **in-lbs** (14.9-24.4 Nm).

15. Position fork tube vertically in fork holding tool. With slider tube compressed, fill the fork with TYPE "E" HYDRAULIC FORK OIL as specified in table Table 2-14.

Table 2-14. Fork Oil Volume

MODEL	OZ	CC	IN	MM
FXDC, FXDL, FXDB	28.6	845	3.74	95.0
FXDF	26.5	784	4.92	120.0
FXDWG	29.4	869	3.74	95.0
FLD (left)	11.8	350	5.79	147.0
FLD (right)	14.1	417	5.08	129.0

16. Slowly pump slider 8-10 times to exhaust air from assembly. Fully compress slider to determine oil level.

NOTE

Measure fork oil level from top of fork tube with spacer and spring removed and fork fully compressed.

17. Using the PRO-LEVEL OIL GAUGE (Part No. HD-59000A), adjust the oil level to specification.
18. Pull out the slider and install the spring (4) in the fork tube with the tightly wound end at the bottom.
19. Install the washer (5) and spring collar (8).

⚠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)

20. With a **new** O-ring, install and tighten fork tube caps to 22-59 ft-lbs (30-80 Nm).

NOTE

To prevent cross threading fork tube caps, use caution when threading in the caps with the spring compressed.

21. Repeat for opposite side.

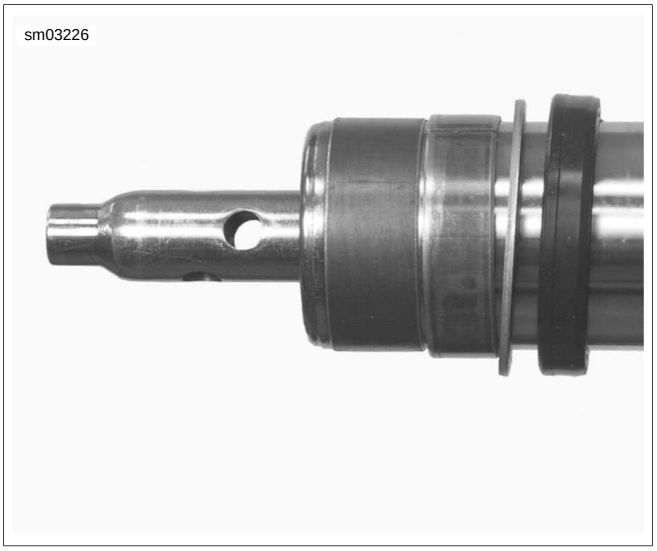
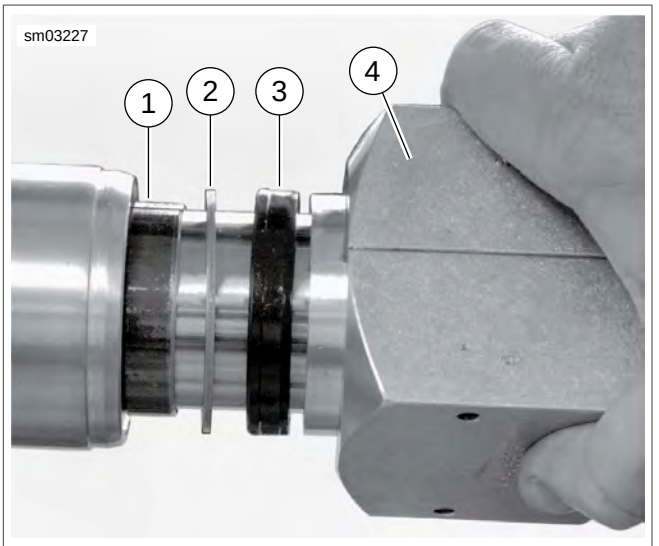


Figure 2-85. Seat Pipe Centered in Fork Tube



1. **Bushing guide**
2. **Spacer**
3. **Oil seal (chamfered lips must face oil)**
4. **Fork seal driver**

Figure 2-86. Assembled Fork Seal Driver

ASSEMBLY: CARTRIDGE FORK (FLD, LEFT SIDE)

PART NUMBER	TOOL NAME
HD-34634	FORK OIL SEAL INSTALLER
HD-41177	FORK TUBE HOLDER
HD-45966	FORK SPRING COMPRESSING TOOL
HD-59000B	FORK OIL LEVEL GAUGE

FASTENER	TORQUE VALUE	
Damper cartridge screw	132-216 **in-lbs**	14.9-24.4 Nm
locknut, fork tube cap	13-16.6 ft-lbs	17.5-22.5 Nm
Fork tube caps	22-59 ft-lbs	30-80 Nm

NOTICE

Exercise caution to avoid scratching or nicking fork tube. Damaging tube can result in fork oil leaks after assembly. (00421b)

1. Coat **new** fork leg bushing ID with TYPE "E" HYDRAULIC FORK OIL. Expand fork leg bushing at split line only as far as required to slip over end and into groove of fork tube.
2. Slide damper cartridge into fork tube so that cartridge end drops through hole at bottom of fork tube.
3. Install lower stop at end of damper cartridge.
4. Install fork tube into fork slider.
5. Install **new** damper cartridge screw with copper crush washer. Insert screw through hole at bottom of fork slider and start into end of damper cartridge.

6. Coat **new** slider bushing ID with TYPE "E" HYDRAULIC FORK OIL. Slide slider bushing down fork tube.
7. Slide slider spacer down fork tube until it contacts slider bushing.
8. Slide FORK OIL SEAL INSTALLER (Part No. HD-34634) down fork tube. Using tool as a slide hammer, drive slider bushing into counterbore of fork slider. Remove tool.

NOTE

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

9. Coat **new** fork oil seal ID with TYPE "E" HYDRAULIC FORK OIL. With lip garter spring side facing toward fork slider, slide seal down fork tube until it contacts slider spacer.
10. Remove masking tape from edge of fork tube.
11. Slide FORK OIL SEAL INSTALLER (Part No. HD-34634) down fork tube until it contacts fork oil seal.
12. See Figure 2-87. Using tool as a slide hammer, drive fork oil seal down fork tube until retaining clip groove is visible in fork slider ID. Remove tool.

NOTE

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

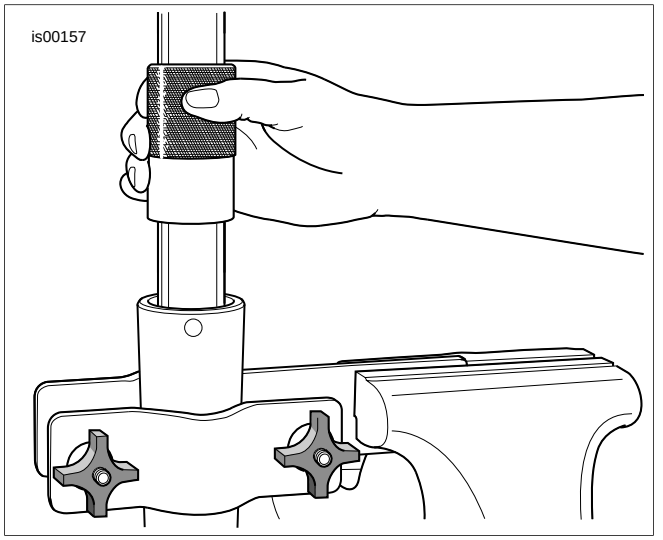


Figure 2-87. Install Fork Oil Seal

13. Slide retaining clip down fork tube until it contacts fork oil seal. Install retaining clip in fork slider groove.
14. Tighten damper cartridge screw to 132-216 **in-lbs** (14.9-24.4 Nm).
15. Clamp fork slider upright in FORK TUBE HOLDER (Part No. HD-41177).
16. Fill fork tube as follows:
    a. Thread damper rod extension tool (part of FORK SPRING COMPRESSING TOOL (Part No. HD-45966)) onto end of damper rod.
    b. Pour 5 oz (147.0 ml) of TYPE "E" HYDRAULIC FORK OIL into fork tube.
    c. See Figure 2-88. Grasping extension tool, slowly pump damper rod until resistance is felt. then pump five more times.
    d. Place damper rod in fully bottomed position. Remove extension tool from end of damper rod.
    e. Pour additional 6 oz (177.5 ml) of TYPE "E" HYDRAULIC FORK OIL into fork tube.
17. Adjust fork oil level to 5.8 in (147 mm) from top of fork tube with fork compressed, as follows:
    a. See Figure 2-89. Obtain FORK OIL LEVEL GAUGE (Part No. HD-59000B).
    b. Loosen thumbscrew on metal ring and move ring up or down rod until bottom of ring is 5.8 in (147 mm) from end of rod. Tighten thumbscrew.
    c. Push plunger on cylinder all the way in.
    d. See Figure 2-90. Insert rod into top of fork tube until metal ring rests flat on top of fork tube.
    e. Pull out plunger to evacuate excess fork oil from fork tube. Observe fork oil through transparent tube as it is drawn into cylinder. If no oil is drawn through transparent tube, add enough oil so tool usage sets fork oil level.
    f. Remove rod from fork tube. Push plunger into cylinder to eject excess fork oil into suitable container.
    g. If necessary, repeat fork oil evacuation procedure. Fork oil level is correct when no more fork oil is observed being drawn through transparent tube.

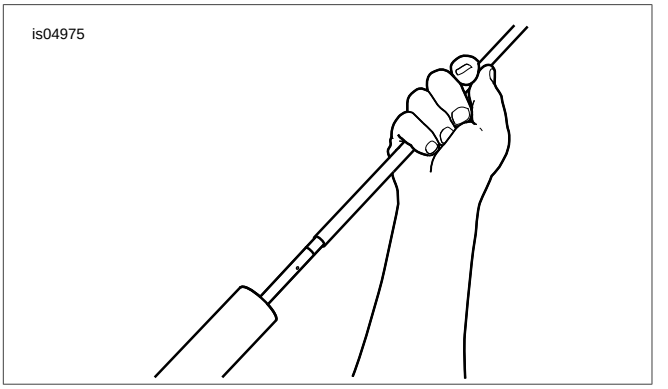


Figure 2-88. Pump Damper Rod Extension Tool

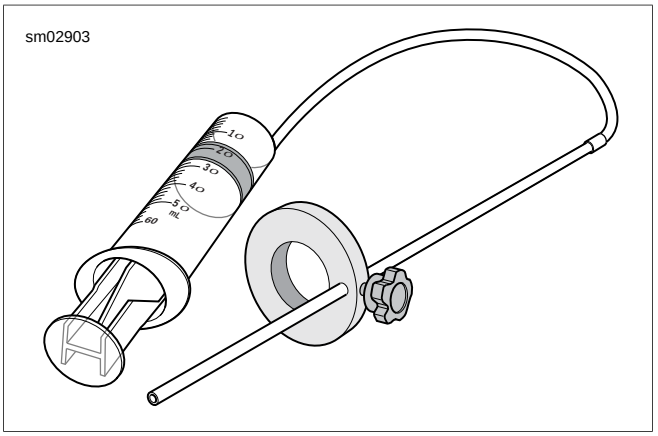


Figure 2-89. Fork Oil level Gauge

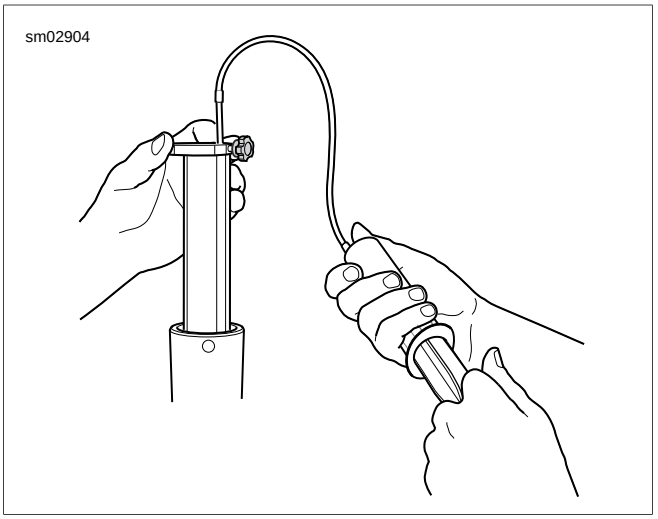


Figure 2-90. Remove Excess Fork Oil

⚠WARNING

Incorrect amount of fork oil can adversely affect handling and lead to loss of vehicle control, which could result in death or serious injury. (00298a)

18. With closer spaced coils toward bottom, slide fork spring into fork tube.
19. Pull up on fork slider to compress fork assembly. This causes damper rod and spring to protrude from top of fork tube.
20. Thread damper rod extension tool onto end of damper rod.
21. Remove fork assembly from FORK TUBE HOLDER (Part No. HD-41177).

⚠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)

22. See Figure 2-81. Clamp FORK SPRING COMPRESSING TOOL (Part No. HD-45966) in vise in a vertical position with length adjuster screw topside.
23. Pull up on fork slider to compress fork assembly.
24. Place hole at bottom of fork slider over post at bottom end of tool.
25. Place flat washer rounded side up over damper rod extension tool and on top of spring. Place spring seat concave side up on top of flat washer. With smaller OD topside, place spring compressor over spring seat and flat washer.

NOTE

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

26. Adjust tool as necessary until three retaining pins engage blind holes in spring compressor. Turn length adjuster screw counterclockwise to lengthen, clockwise to shorten.

⚠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)

27. See Figure 2-82. Turn retaining pins as necessary to lock position of spring compressor.
28. Tighten length adjuster screw to compress spring.
29. After several turns, pull up on extension tool to raise damper rod. If threaded portion of rod cannot be pulled completely out of spring, compress spring further.
30. Repeat previous step until threaded portion of rod can be pulled completely out of spring. Remove extension tool. Do not let go of damper rod.
31. Using a deep socket, thread locknut onto damper rod until it contacts shoulder.
32. Loosen length adjuster screw to release tension on fork spring. Loosen retaining pins and remove spring compressor. Remove fork assembly from tool.
33. Clamp FORK TUBE HOLDER (Part No. HD-41177) in vise. Clamp fork tube into tool.
34. Install **new** O-ring onto fork tube cap. Thread fork tube cap onto threaded end of rod until it bottoms. Now thread locknut in until it contacts fork tube plug. Tighten to 13-16.6 ft-lbs (17.5-22.5 Nm).
35. Tighten fork tube cap to 22-59 ft-lbs (30-80 Nm).
36. Remove fork assembly from fork tube holder.
37. Install fork assembly into vehicle. See 2.17 STEERING HEAD, Installation: FLD.

INSTALLATION

FASTENER	TORQUE VALUE	
Pinch bolts: All models except FLD	30-35 ft-lbs	41-48 Nm

1. See Figure 2-91. Insert fork tube and slider assemblies through lower fork clamp and upper fork clamp.
2. Install fork tubes above upper fork clamp 0.575-0.675 in. (14.6-17.1 mm).

NOTE

Take measurement from midpoint of fork tube between top surface of fork clamp and top of fork cap.

3. Tighten pinch bolts to 30-35 ft-lbs (41-48 Nm).

NOTE

For fork tube protrusion on FLD models see 2.17 STEERING HEAD, Installation: FLD.

4. Install front fender and bracket. See 2.26 FRONT FENDER.
5. Install front brake caliper hydraulic lines and install front brake calipers. See 2.11 FRONT BRAKE CALIPER.
6. See 2.4 FRONT WHEEL. Install front wheel.
7. Adjust steering head. See 1.18 STEERING HEAD BEARINGS.

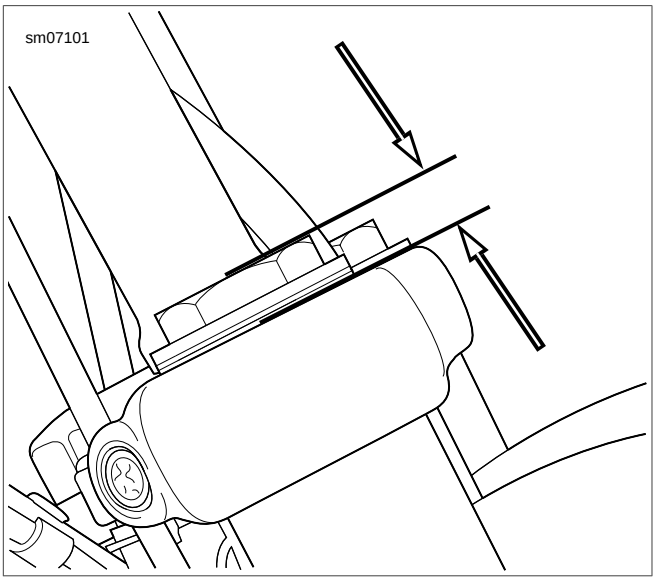
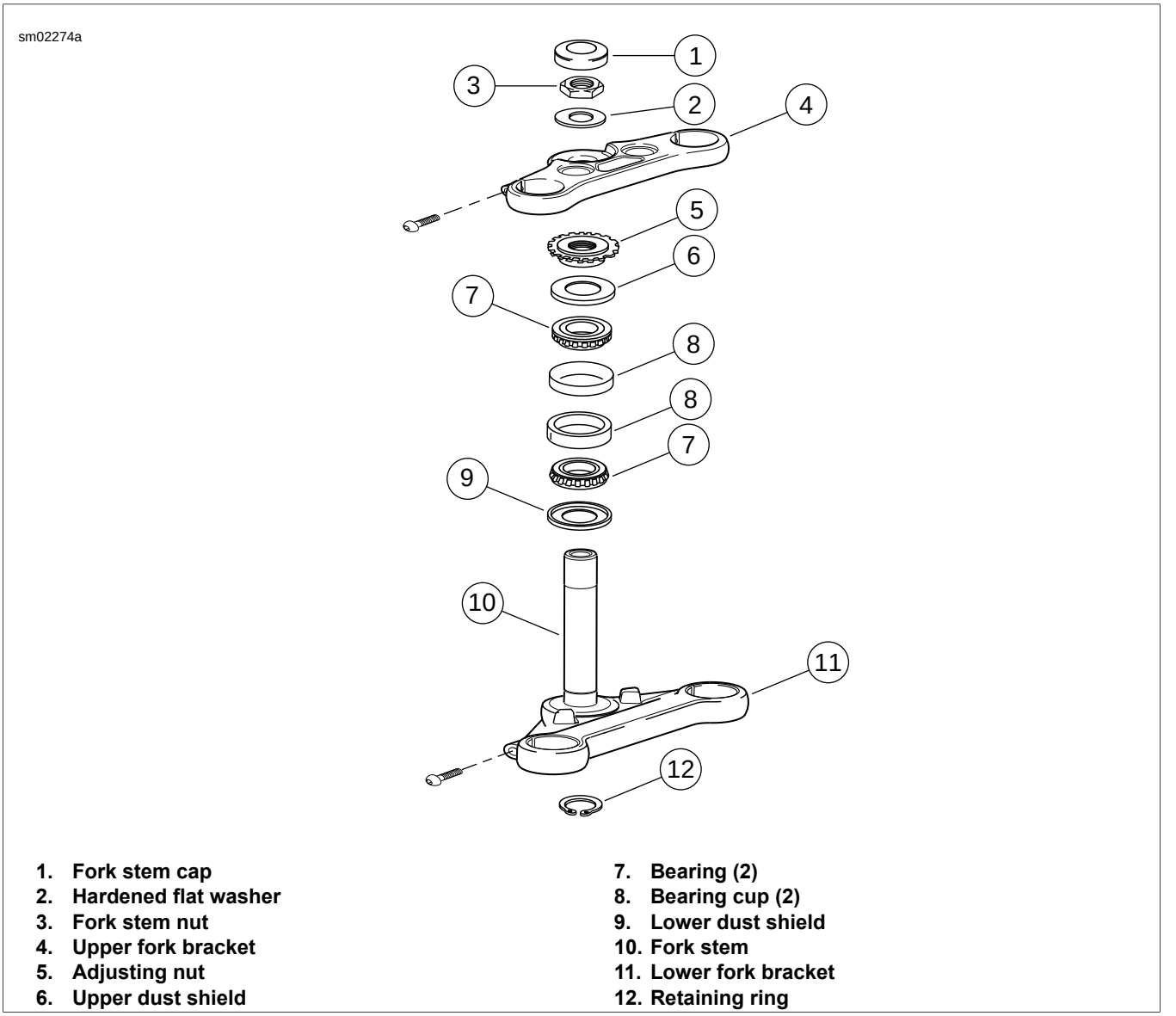


Figure 2-91. Fork Tube Protrusion: All But FLD

STEERING HEAD 2.17

REMOVAL: ALL BUT FLD

1. Cover painted parts using a blanket or protective cover to prevent damage.
2. Remove left and right fork assemblies from upper and lower fork bracket. See 2.16 FRONT FORK.
3. Remove the headlamp from lower fork bracket. See 7.12 HEADLAMP.
4. See Figure 2-92. Remove the fork stem cap (1). Remove the fork stem nut and the handlebar with upper bracket (4). Be careful not to pinch or kink control cables.
5. Remove the adjusting nut (5) and pull the fork stem and bracket (10, 11) out of the steering head. Remove the upper dust shield (6) and bearing (7). Slide fork stem and bracket from frame.



1. **Fork stem cap**
2. **Hardened flat washer**
3. **Fork stem nut**
4. **Upper fork bracket**
5. **Adjusting nut**
6. **Upper dust shield**
7. **Bearing (2)**
8. **Bearing cup (2)**
9. **Lower dust shield**
10. **Fork stem**
11. **Lower fork bracket**
12. **Retaining ring**

Figure 2-92. Steering Head

REMOVAL: FLD

1. Support motorcycle so front wheel is off floor and forks are fully extended. Remove brake caliper and front wheel. See 2.4 FRONT WHEEL.
2. Remove front fender. See 2.26 FRONT FENDER.
3. Remove headlight assembly. See 7.12 HEADLAMP.
4. Loosen handlebar riser bolts, but do not remove.
5. Loosen fork bracket pinch bolts. Do not remove tube caps. Slide left and right fork assemblies downward clear of fork brackets.
6. Remove fuel tank. See 4.4 FUEL TANK.
7. Remove wire harness shield and grommets from backbone of frame. See 7.30 MAIN WIRING HARNESS.

8. Disconnect handlebar control module connectors under fuel tank.
9. **ABS equipped vehicles:**
   a. Disconnect front wheel speed sensor connector
   b. Remove the brake line manifold from the lower fork bracket
10. Remove windshield assembly and docking hardware.

NOTES

- *Slider covers are attached to the lower nacelle.*
- *Only remove slider covers from lower nacelle if replacing them.*

11. Remove lower nacelle along with slider covers.
12. Pull handlebar control module harnesses through upper fork clamp and remove handlebar riser bolts from upper fork clamp.

NOTE

Always remove upper fork clamp first.

13. Remove upper nacelle and upper fork clamp.
14. Remove lower fork clamp.
15. Replace steering head bearings and cups as needed.

INSPECTION

1. Check upper and lower bearing cups in steering head. If they are pitted or grooved, replace the bearings and bearing cups in sets.

NOTICE

Replace both bearing assemblies even if one assembly appeares to be good. Mismatched bearings can lead to excessive wear and premature replacement. (00532b)

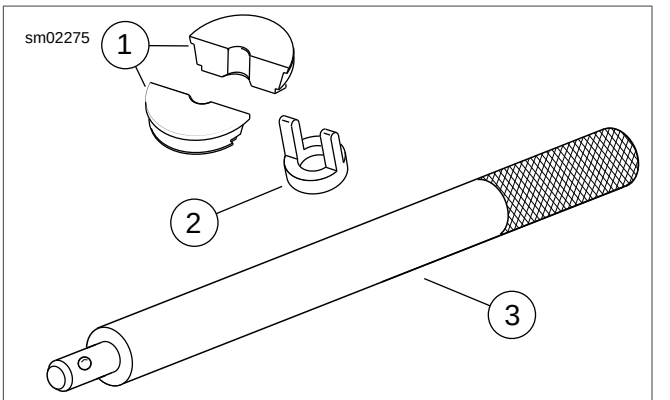
2. Replace bearings that do not turn freely.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-33416	UNIVERSAL DRIVER
HD-39301-A	STEERING HEAD BEARING RACE REMOVER

Steering Head Bearing Race Removal

1. See Figure 2-93. With the tapered side down, seat the two-piece STEERING HEAD BEARING RACE REMOVER (Part No. HD-39301-A) (1) on the upper bearing race leaving a gap in the middle.
2. Install the collet (2) on the UNIVERSAL DRIVER (Part No. HD-33416).
3. Insert the driver at the bottom of the steering head tube (3), and while holding the remover tool on the race, center the collet (2) in the gap. Tap the driver to remove the upper race.
4. Reverse the tool and repeat the procedure (4) to remove the lower bearing race.



1. **Remover (2 pieces)**
2. **Collet**
3. **Driver**

Figure 2-93. Race Remover Tools

NOTE

If bearing cups are removed, the bearings cannot be reused. They must be replaced. The lower bearing cone is not pressed on fork stem and may be slipped off fork stem along with lower dust shield.

ASSEMBLY

PART NUMBER	TOOL NAME
HD-39302	STEERING HEAD BEARING RACE INSTALLER

1. Pack the **new** bearings with SPECIAL PURPOSE GREASE.

NOTE

Press only on inner bearing race or damage to bearing will occur.

2. See Figure 2-92. Install the lower dust shield (9) and **new** bearing (7) on the fork stem (10).

⚠WARNING

Properly seat bearing cups in steering head bore. Improper seating can loosen fork stem bearings adversely affecting stability and handling, which could result in death or serious injury. (00302a)

3. Lubricate the races with engine oil. Install the **new** races using STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).

INSTALLATION: ALL BUT FLD

⚠WARNING

Properly adjust fork stem bearings. Improper adjustments affect stability and handling, which could result in death or serious injury. (00301a)

1. See Figure 2-92. Insert the stem and bracket assembly into the frame steering head and install the upper bearing (7) and dust shield (6).

2. Secure with the adjusting nut (5) and tighten until there is no noticeable shake or freeplay between bearings and races. Fork stem must turn freely from side to side.

NOTE

The washer under the fork stem nut is a special hardened material. Never replace this washer with a common flat washer. Doing so may allow the fork stem nut torque to loosen resulting in loss of steering control.

3. Install upper bracket (4) and hardened flat washer (2).
4. Install stem nut and hand tighten.
5. Install the headlamp assembly. See 7.12 HEADLAMP.
6. Install fork sides. See 2.16 FRONT FORK.
7. Adjust steering head bearings for proper fall-away. See 1.18 STEERING HEAD BEARINGS.

NOTE

After tightening the fork stem nut, verify that the fall-away is correct.

8. Align headlamp. See 1.22 HEADLAMP ALIGNMENT.

INSTALLATION: FLD

PART NUMBER	TOOL NAME
HD-50651	FORK STEM NUT SOCKET

FASTENER	TORQUE VALUE	
Lower nacelle fasteners: FLD models	84-120 **in-lbs**	9.5-13.5 Nm
Upper and lower pinch bolts: FLD models	30-35 ft-lbs	40.6-47.5 Nm
Handlebar riser bolts: FLD models	30-40 ft-lbs	40.6-54.0 Nm
Headlight to nacelle: FLD models	7-10 **in-lbs**	0.8-1.1 Nm
Upper nacelle fasteners: FLD models	84-120 **in-lbs**	9.5-13.5 Nm
Windshield docking hardware: FLD models	84-120 **in-lbs**	9.5-13.5 Nm
Brake manifold to lower fork: FLD models	36-48 **in-lbs**	4.0-5.4 Nm
Fork stem nut: FLD models	70-80 ft-lbs	94.9-108.4 Nm

1. Install lower fork clamp.

NOTE

The washer under the fork stem nut is a special hardened material. Never replace this washer with a common flat washer. Doing so may allow the fork stem nut torque to loosen resulting in loss of steering control.

2. Install upper fork clamp.

NOTE

Always install the lower nacelle cover and cover assemblies prior to installing fork sides into brackets.

3. Install lower nacelle along with cover assemblies. Tighten two lower fasteners to 84-120 **in-lbs** (9.5-13.5 Nm).
4. Slide left and right fork assemblies upward and into upper and lower fork brackets.
5. See Figure 2-94. Make sure the top of fork slider cap extends 0.670-0.770 in (17.0-20.0 mm) above upper fork clamp.
6. Install upper and lower pinch bolts. Tighten to 30-35 ft-lbs (40.6-47.5 Nm).
7. Install upper nacelle with two fasteners in rear of nacelle, but do not tighten.
8. Install handlebar riser bolts through upper fork clamp and upper nacelle. Pull handlebar control module harnesses down through upper fork clamp and upper nacelle.
9. Tighten handlebar riser bolts to 30-40 ft-lbs (40.6-54.0 Nm).
10. Install headlight assembly. Tighten to 7-10 **in-lbs** (0.8-1.1 Nm).
11. Tighten upper nacelle fasteners to 84-120 **in-lbs** (9.5-13.5 Nm).
12. Install docking hardware and windshield assembly. Tighten to 84-120 **in-lbs** (9.5-13.5 Nm).
13. **ABS equipped:** install the brake line manifold to the lower fork bracket and lower nacelle. Tighten to 36-48 **in-lbs** (4.0-5.4 Nm).

NOTE

***ABS equipped:** see C.2 ABS MODULE.*

14. Connect handlebar control modules.
15. **ABS equipped:** connect front WSS.
16. Install harness shield and grommets into backbone of frame. See 7.30 MAIN WIRING HARNESS.
17. Install fuel tank. See 4.4 FUEL TANK.
18. Install front fender. See 2.26 FRONT FENDER.
19. Install front wheel and brake caliper. See 2.4 FRONT WHEEL.
20. Adjust steering head. See 1.18 STEERING HEAD BEARINGS.
21. If proper fall-away has been achieved then use FORK STEM NUT SOCKET (Part No. HD-50651) to tighten fork stem nut. Tighten to 70-80 ft-lbs (94.9-108.4 Nm).

NOTE

After tightening the fork stem nut and before installing the fork stem cap, verify that the fall-away is correct.

22. Install the fork stem cap.
23. Align headlamp. See 1.22 HEADLAMP ALIGNMENT.

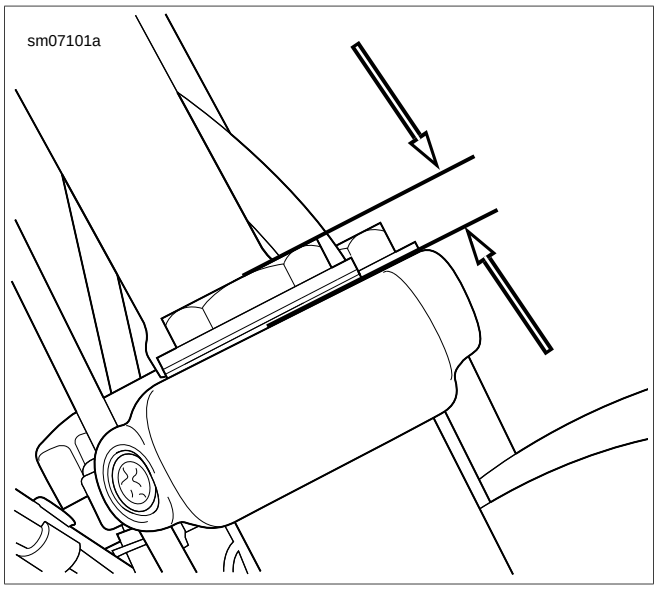


Figure 2-94. Fork Tube Protrusion: FLD

BELT GUARD 2.18

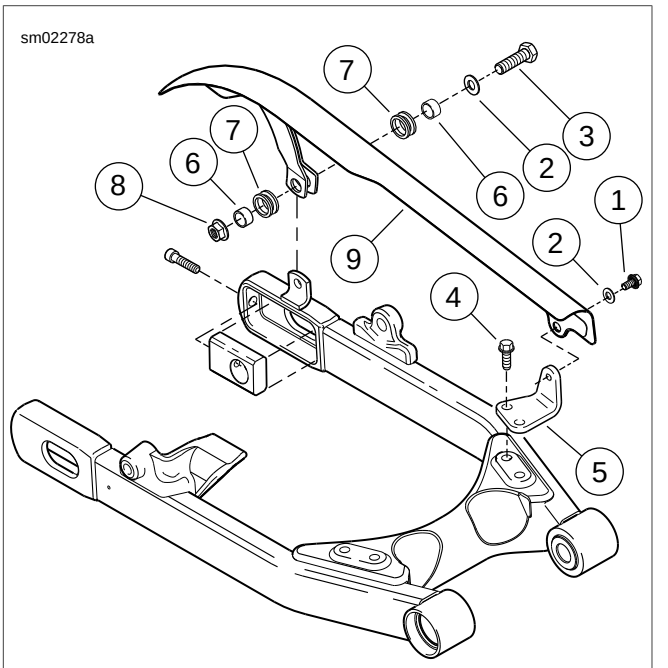
REMOVAL

1. See Figure 2-95. Remove front fastener (1) and washer (2).
2. Remove rear fastener (3) and washer (2) from nut (8).
3. Lift belt guard (9) away from rear fork.
4. Disassemble belt guard by removing grommets (7) and spacers (6).

INSTALLATION

FASTENER	TORQUE VALUE	
Front belt guard fastener	120-180 **in-lbs**	13.6-20.3 Nm
Rear belt guard fastener	120-180 **in-lbs**	13.6-20.3 Nm

1. See Figure 2-95. If removed, install grommets (7) and spacers (6) on belt guard.
2. Place assembled belt guard over front and rear tabs on rear fork.
3. Loosely install front fastener (1) and washer (2).
4. Loosely install rear fastener (3) and washer (2) with nut (8).
5. Tighten front fastener (1) to 120-180 **in-lbs** (13.6-20.3 Nm).
6. Tighten rear fastener (3) and nut (8) to 120-180 **in-lbs** (13.6-20.3 Nm).
7. Verify that belt guard does not contact belt during rear fork travel.



1. **Front fastener**
2. **Washer (2)**
3. **Rear fastener**
4. **Screw, belt guard bracket (2)**
5. **Belt guard bracket (FXDF model only)**
6. **Spacer (2)**
7. **Grommet (2)**
8. **Nut**
9. **Belt guard**

Figure 2-95. Belt Guard

DEBRIS DEFLECTOR 2.19

REMOVAL

See Figure 2-96. Remove three screws to detach debris deflector from rear fork.

INSTALLATION

FASTENER	TORQUE VALUE	
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm

See Figure 2-96. Attach debris deflector to rear fork using three screws. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm).

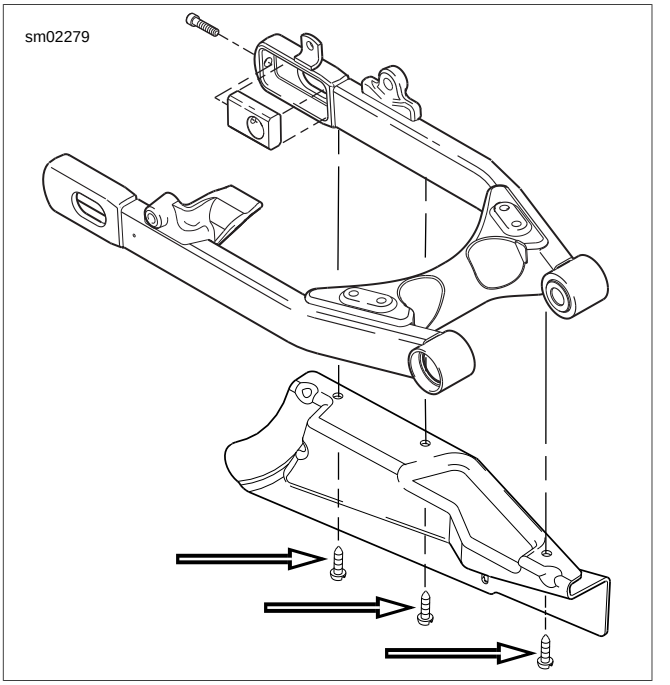
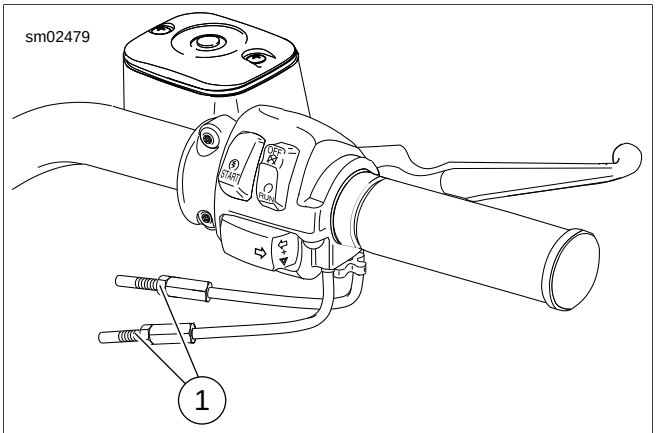


Figure 2-96. Debris Deflector Screws

THROTTLE CONTROL 2.20

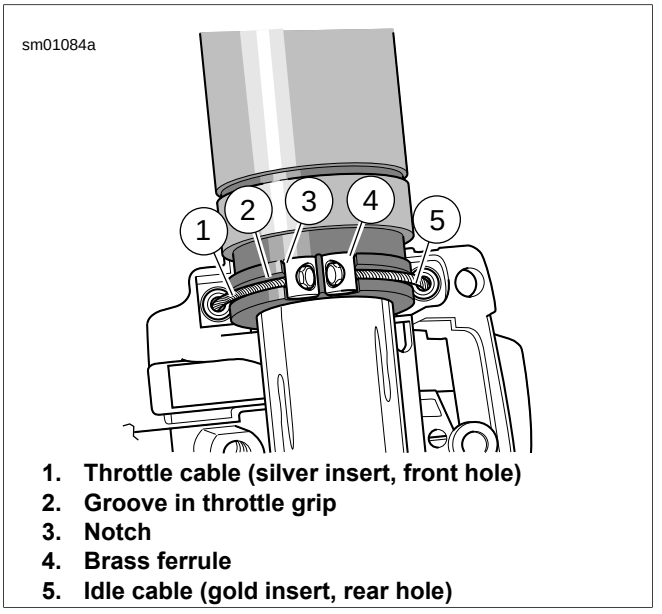
REMOVAL/DISASSEMBLY

1. See Figure 2-97. Loosen cable adjuster jamnuts. Rotate 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, Removal.
4. Disconnect throttle cables from induction module.
5. See Figure 2-98. Apply a drop of oil to the retaining ring holding each cable assembly in the lower housing. Using a rocking motion, firmly pull the bent tubing portion of each cable assembly out of the housing.



1. **Adjuster jamnut (2)**

Figure 2-97. Handlebar Throttle Control



1. **Throttle cable (silver insert, front hole)**
2. **Groove in throttle grip**
3. **Notch**
4. **Brass ferrule**
5. **Idle cable (gold insert, rear hole)**

Figure 2-98. Throttle Cable Attachment

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

FASTENER	TORQUE VALUE	
Hand control module screws	35-45 **in-lbs**	4.0-5.1 Nm

1. Apply a light coating of graphite to the handlebar and inside surface of the housings.
2. See Figure 2-97. Attach the control cable assemblies to the lower housing.
   a. Push the silver insert of the throttle cable housing into the hole in front of the tension adjuster screw.
   b. Push the gold insert of the idle cable 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).
5. Check throttle cable routing.
6. Install throttle cables and adjust.
7. Install air cleaner.

THROTTLE CABLE ROUTING

WARNING

Pinched throttle cables can restrict throttle response, which could result in loss of control and death or serious injury. (00423b)

⚠WARNING

Be sure that steering is smooth and free without interference. Interference with steering could result in loss of vehicle control and death or serious injury. (00371a)

- Be sure throttle/idle control cables do not pull tight when handlebars are turned fully to left or right fork stops.
- Be sure cables are not pinched between the frame and/or forks.

NOTE

Install cable straps securing throttle cables to frame so that tail of cable faces top of vehicle. Using this method will verify proper placement of cables.

See Figure 2-99. Throttle cables are routed behind front fork upper bracket, then under right side of tank to induction module.

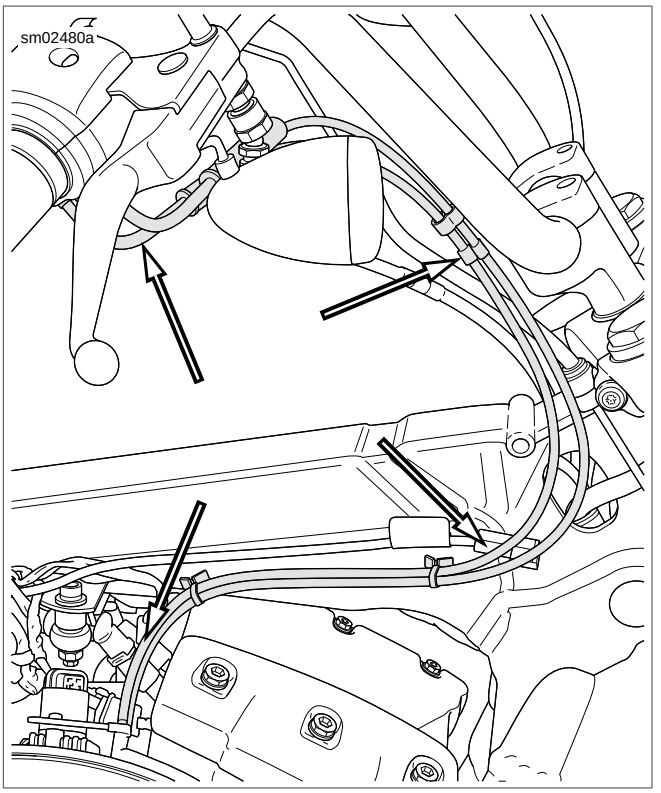


Figure 2-99. Throttle Cable Routing: FXDWG, FXDF (Typical)

REAR SHOCK ABSORBERS 2.21

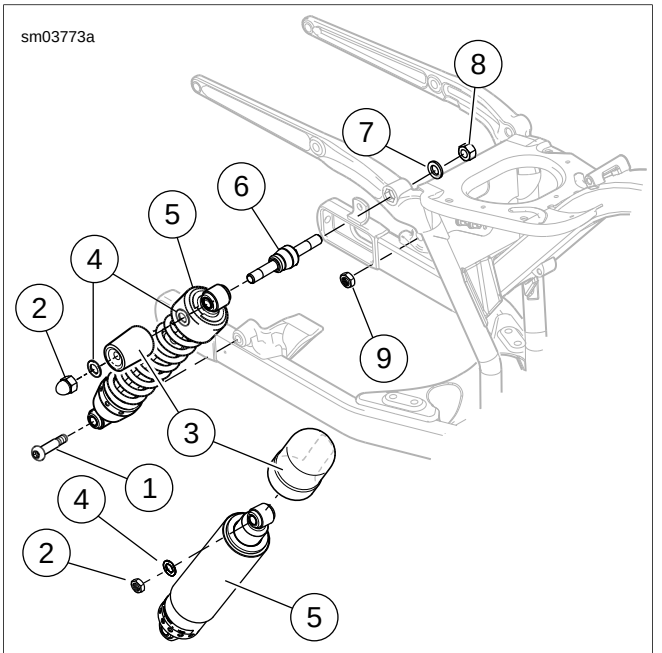
GENERAL

When removing the shocks for repair or replacement, remove and install one shock first, then the other. This will eliminate the need for raising the rear end of the motorcycle. If it is necessary to remove both shocks at once, place the motorcycle on a center stand with the rear wheel raised off the ground.

For information on preload adjustment and suspension settings, see 1.23 SUSPENSION ADJUSTMENTS.

REMOVAL

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
2. See Figure 2-100. Remove lower shock mount screw (1). Nut (9) is only used on left side.
3. Remove upper mounting nut (2), washer (4), shock absorber (5), and cover (3).
4. Repeat for other shock absorber.
5. If stud (6) is to be removed, remove nut (8) and washer (7).



1. **Lower mounting screw (2)**
2. **Upper mounting nut (2)**
3. **Cover, chrome (FXDB, FXDC only, full top cover FLD only) (2)**
4. **Washer (4)**
5. **Shock absorber (2)**
6. **Stud (2)**
7. **Hardened washer (2)**
8. **Nut (2)**
9. **Jamnut (lower-left side only)**

Figure 2-100. Rear Shock Absorber Mounting

INSPECTION

NOTE

Shocks are non-repairable items, except for the rubber mounting bushings. Replace leaking or damaged shocks as an assembly.

1. Inspect the rubber mounting bushings for cracks or wear.
   a. Inspect the shock for leaks.

   NOTE

   The unit should not leak and should compress slightly easier than it extends.

   b. Compare the action of the shock with a **new** one to judge if it is worn.
   c. Replace the shock if necessary.
2. Inspect shock mounting hardware. Replace or clean if necessary.

INSTALLATION

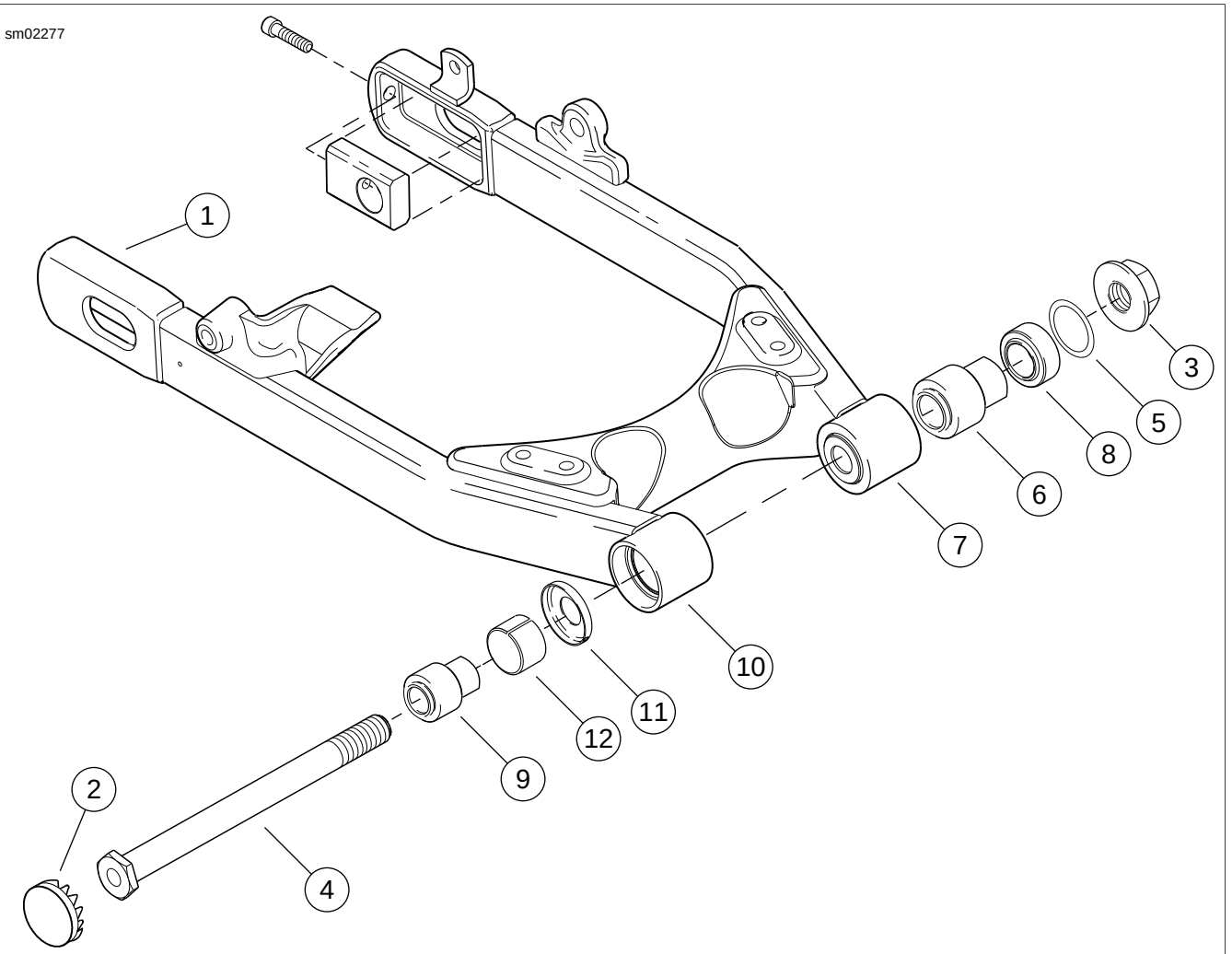
FASTENER	TORQUE VALUE	
Shock mounting stud nut, inner	75-85 ft-lbs	101.7-115.2 Nm
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm

1. See Figure 2-100. If removed, install stud (6), hardened washer (7) and nut (8). Tighten to 75-85 ft-lbs (101.7-115.2 Nm).
2. Fasten each shock to the frame and rear fork using the original hardware.
3. Attach lower shock mount to rear fork.
   a. Apply two to three drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of bottom bolt (1).
   b. Install bolt and hand tighten.
4. Apply two to three drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of upper mounting nut (2).
   a. Install cover (3), shock (5), and washer (4).
   b. Hand tighten upper mounting nut (2).
5. Tighten upper and lower shock mount screws as follows:
   a. Lower mount: 30-40 ft-lbs (40.7-54.2 Nm)
   b. Upper mount: 30-40 ft-lbs (40.7-54.2 Nm)
6. Adjust shocks if needed. See 1.23 SUSPENSION ADJUSTMENTS.

REAR FORK 2.22

REMOVAL

1. Remove exhaust system. See 4.15 EXHAUST SYSTEM.
2. Remove rear brake caliper. See 2.13 REAR BRAKE CALIPER.
3. Remove rear wheel. See 2.5 REAR WHEEL.
4. Remove lower shock absorber fasteners and swing shock absorbers away from rear fork. See 2.21 REAR SHOCK ABSORBERS.
5. Remove the belt guard and debris deflector. See 2.18 BELT GUARD and 2.19 DEBRIS DEFLECTOR.
6. Remove rear brake line clamp from rear fork.
7. See Figure 2-101. Remove plug (2).
8. Remove nut (3).
9. Remove pivot shaft with attached nut (4). Support rear fork (1) and pull assembly from frame.



1. **Rear fork**
2. **Plug**
3. **Nut**
4. **Pivot shaft**
5. **Retaining ring**
6. **Left spacer**
7. **Left boss**
8. **Pivot bearing**
9. **Right spacer**
10. **Right boss**
11. **Dust shield**
12. **Bushing**

Figure 2-101. Rear Fork

DISASSEMBLY

Carefully mark all components as they are removed, so components may be easily returned to their original locations.

NOTE

See Figure 2-101. The pivot bearing (8) is lifetime lubricated and will require no further attention other than cleaning. Only disassemble components from left boss of fork if they are damaged.

1. Remove retaining ring (5), push or with a brass drift tap spacer (6) inboard to remove it from left fork boss (7).
2. From inboard side press or drive pivot bearing (8) from left fork boss.
3. Push or with a brass drift tap spacer (9) outboard to remove it from right fork boss (10).
4. Press pivot bushing (12) and dust shield (11) from fork assembly.

CLEANING AND INSPECTION

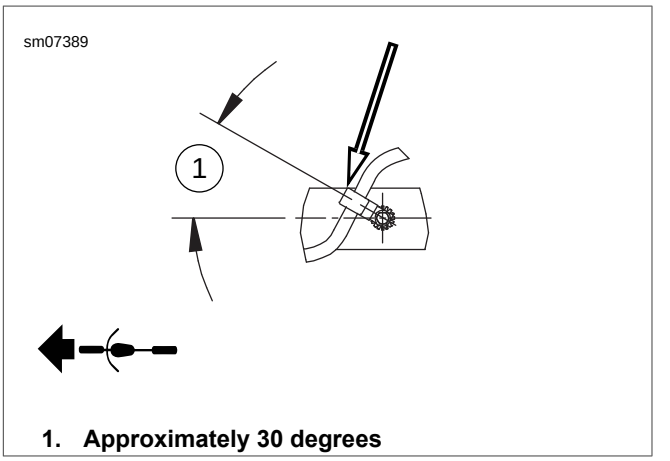
See Figure 2-101. Clean the bearing bore of rear fork with a clean shop towel, removing any dirt or grit adhering to the bearing surface.

1. Inspect bearing components for damage or corrosion. Replace if necessary.
2. Replace bent or twisted rear forks.

ASSEMBLY

FASTENER	TORQUE VALUE	
Rear fork brake hose J-clip	40-60 **in-lbs**	4.5-6.8 Nm

1. See Figure 2-101. If necessary, install **new** pivot bearing (8) and press **new** bearing from outboard side until outer race is seated against shoulder in left fork boss (7).
2. Install retaining ring (5) and spacer (6). The spacer must be inserted from the inboard side.
3. If bushing (12) must be replaced, press the bushing and dust shield (11) into the fork bore so dust shield is flush to 0.060 in. (1.50 mm) above fork bore.
4. Coat right side pivot spacer (9) with WHEEL BEARING GREASE. Insert pivot spacer into pivot bushing (12) with chamfered end facing outward.
5. See Figure 2-102. If removed, orient J-clip as shown and install screw. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). Do not allow clip to pass above top of rear fork.



1. Approximately 30 degrees

Figure 2-102. Brake Line J-Clip at Rear Fork

INSTALLATION

FASTENER	TORQUE VALUE	
Pivot shaft nut	70-77 ft-lbs	95.0-104.5 Nm

1. Coat pivot shaft with ANTI-SEIZE LUBRICANT.
2. Slide rear fork assembly into position on mounting boss of transmission case.
3. See Figure 2-101. Hold fork assembly in position and install the pivot shaft with attached nut (4) from right side. Thread nut (3) on threads of pivot shaft. Tighten nut to 70-77 ft-lbs (95.0-104.5 Nm).
4. Swing shock absorbers into position and install lower shock absorber fasteners. See 2.21 REAR SHOCK ABSORBERS.
5. Install rear brake caliper. See 2.13 REAR BRAKE CALIPER.
6. Install rear brake line in clamp mounted on rear fork.
7. Install rear wheel and adjust drive belt deflection. See 2.5 REAR WHEEL.
8. Install the belt guard and debris deflector. See 2.18 BELT GUARD and 2.19 DEBRIS DEFLECTOR.
9. Install exhaust system. See 4.15 EXHAUST SYSTEM.

CLUTCH CONTROL 2.23

REMOVAL

1. Loosen clutch adjuster so clutch cable is fully slack. See 1.11 CLUTCH, Adjustment.

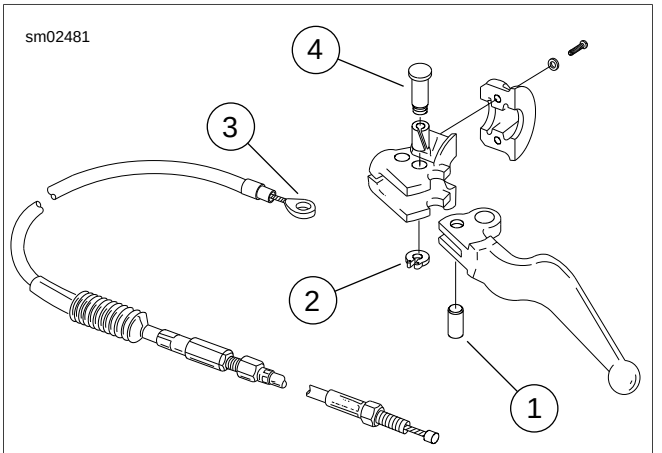
⚠WARNING

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)

NOTE

Use the appropriate size retaining ring pliers and the appropriate tip to remove or install the retaining ring. Verify that the tip is in good condition.

2. See Figure 2-103. Remove the clutch cable anchor pin (1) from the hand lever. To remove anchor pin, remove the retaining ring (2) and pivot pin (4).
3. Drain transmission lubricant and remove fill plug dipstick. Remove transmission side cover. See 6.5 CLUTCH RELEASE COVER.
4. See Figure 2-104. Note position of retaining ring opening. Retaining ring opening must be positioned in approximately the same location during assembly. Remove retaining ring (4).
5. Pull inner ramp 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 (2) from coupling.
7. Back out threaded cable fitting (1) from side cover.



1. **Anchor pin**
2. **Retaining ring**
3. **Clevis**
4. **Pivot pin**

Figure 2-103. Clutch Cable Installation

INSTALLATION

1. See Figure 2-104. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to clutch cable fitting and screw fitting (with O-ring) into clutch release cover. Do not tighten at this time.
2. Connect cable end to ramp coupling (3). Rotate ramps for best access and install coupling on inner ramp. Place ramp assembly in position in side cover.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTE

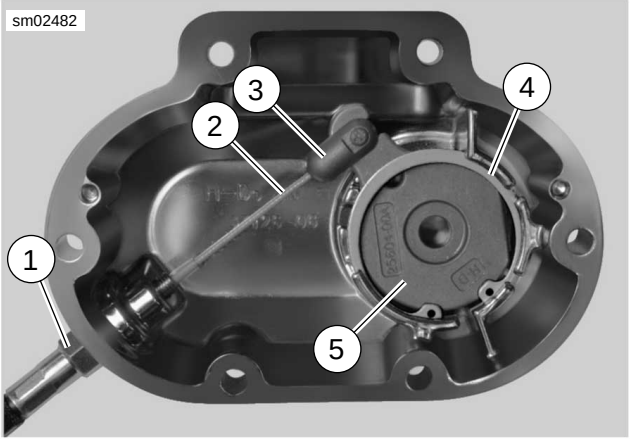
Use the appropriate size retaining ring pliers and the appropriate tip to remove or install the retaining ring. Verify that the tip is in good condition.

3. Install retaining ring (4). Position retaining ring opening to the right of the outer ramp tang (the stop that prevents rotation).
4. Place **new** gasket on side cover and install, fully tightening the clutch cable fitting. See 6.5 CLUTCH RELEASE COVER.
5. Place a few drops of oil inside cable housing.

NOTES

- *Anchor pin does not require lubrication.*
- *When clutch cable is installed, route cable in front of the handlebars for all models except FXDB. FXDB models should have the clutch cable installed so that it is located behind the handlebars.*

6. Check that clutch cable is properly routed along left side of steering head, behind the fork brackets, and through the clips on front frame crossmember.
7. See Figure 2-103. Insert anchor pin (1) through handle and clutch cable clevis end (3).
8. Place handle in bracket and install pivot pin (4) and retaining ring (2).
9. Adjust clutch cable. See 1.11 CLUTCH, Adjustment.



1. Cable fitting
2. Clutch cable end
3. Ramp coupling
4. Retaining ring
5. Inner ramp

Figure 2-104. Clutch Cable Connection

HANDLEBARS: FXDC, FXDL AND FLD 2.24

REMOVAL

All Models

⚠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. Cover painted parts using a blanket or protective cover to prevent damage.
3. Remove front master cylinder assembly. See 2.10 FRONT BRAKE MASTER CYLINDER.
4. Remove clutch control assembly. See 2.23 CLUTCH CONTROL.
5. Remove right and left handlebar switch assemblies and throttle. See 7.33 RIGHT HANDLEBAR CONTROL MODULE and 7.32 LEFT HANDLEBAR CONTROL MODULE.

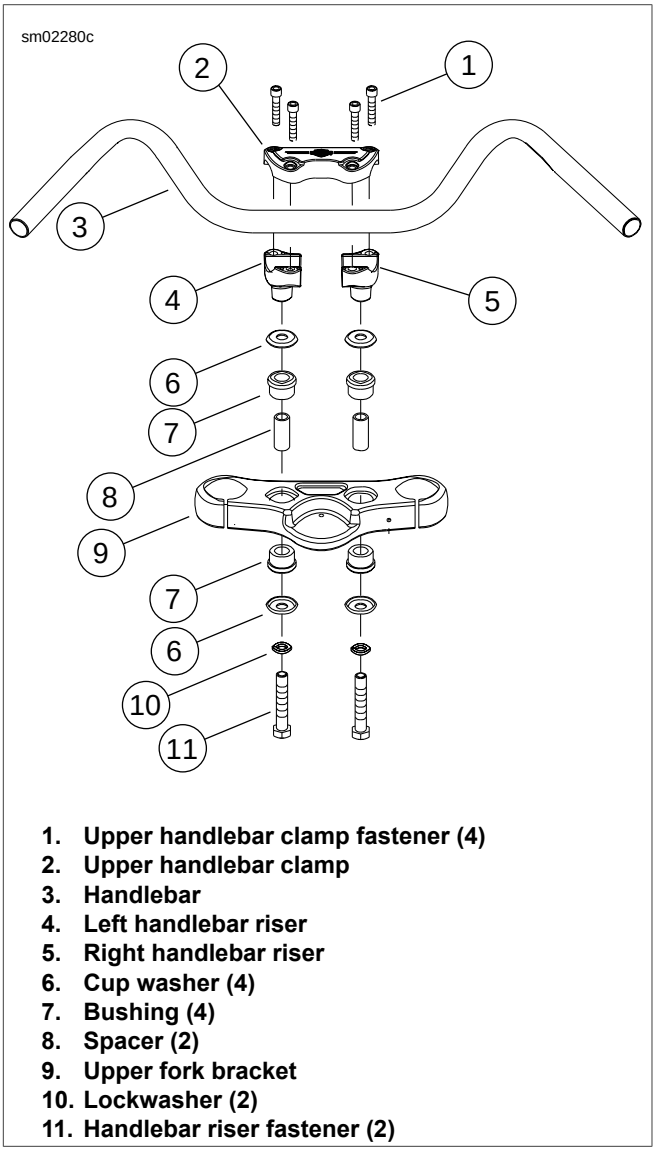
NOTE

Original equipment left grip is glued in place. Remove grip by cutting off only if necessary.

6. If removing left handlebar grip, slice grip open with a sharp knife. Peel grip off handlebar.
7. Now proceed with the steps listed under the appropriate model (below).

FXDC Models

1. Remove speedometer cover fasteners and speedometer cover.
2. See Figure 2-105. Remove upper handlebar clamp fasteners (1) and upper handlebar clamp (2).
3. Remove handlebar (3).
4. If removing handlebar risers (4, 5), remove two handlebar riser fasteners (11), lockwashers (10) and handlebar risers from upper fork bracket (9). Replace bushings (7) if necessary.

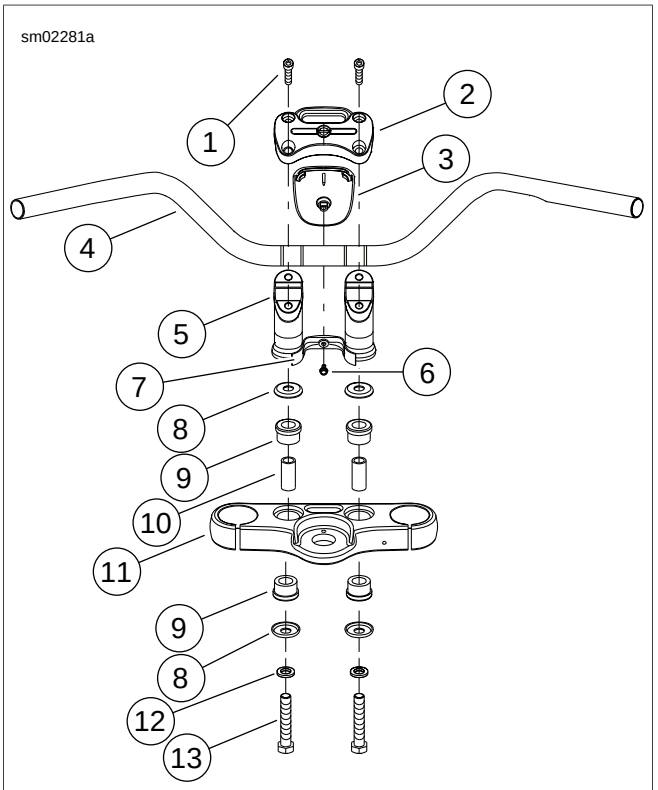


1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp**
3. **Handlebar**
4. **Left handlebar riser**
5. **Right handlebar riser**
6. **Cup washer (4)**
7. **Bushing (4)**
8. **Spacer (2)**
9. **Upper fork bracket**
10. **Lockwasher (2)**
11. **Handlebar riser fastener (2)**

Figure 2-105. Handlebar: FXDC

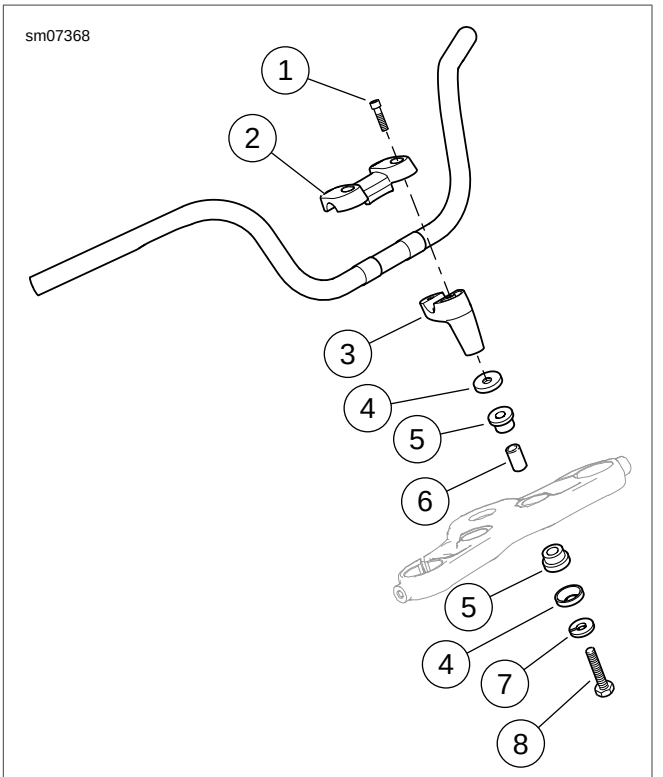
FXDL Models

1. See Figure 2-106. Remove riser cover fastener (6) and riser cover (3).
2. Remove upper handlebar clamp fasteners (1).
3. Remove upper handlebar clamp (2).
4. Remove handlebar (4).
5. If removing risers (5), remove two riser fasteners (13), lockwashers (12) and risers from upper fork bracket (11). Replace bushings (9) if necessary.



1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp**
3. **Riser cover**
4. **Handlebar**
5. **Handlebar riser (2)**
6. **Riser cover fastener**
7. **Riser cover retainer**
8. **Cup washer (4)**
9. **Bushing (4)**
10. **Spacer (2)**
11. **Upper fork bracket**
12. **Lockwasher (2)**
13. **Handlebar riser fastener (2)**

Figure 2-106. Handlebars: FXDL



1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp**
3. **Riser (2)**
4. **Cup washer (4)**
5. **Bushing (4)**
6. **Spacer (2)**
7. **Lockwasher (2)**
8. **Handlebar riser fastener (2)**

Figure 2-107. Handlebars: FLD

FLD Models

1. Remove windshield.
2. Remove headlamp assembly from nacelle. See 7.12 HEADLAMP.

NOTE

See Figure 2-107. If removing risers, loosen fasteners (8) before removing upper handlebar clamp.

3. Remove upper handlebar clamp fasteners (1).
4. Remove upper handlebar clamp (2).
5. Remove handlebar.
6. If removing risers (3), remove two riser fasteners (8), lockwashers (7) and risers from upper fork bracket.
7. Replace bushings (5) if necessary.

INSTALLATION

FASTENER	TORQUE VALUE	
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm
Speedometer cover fastener: FXDC only	50-60 **in-lbs**	5.6-6.8 Nm
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm
Riser cover fastener: FXDC only	50-60 **in-lbs**	5.6-6.8 Nm
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm
Control module housing screw	35-45 **in-lbs**	4.0-5.1 Nm
Control module housing screw	35-45 **in-lbs**	4.0-5.1 Nm
Battery terminal screw: all models	60-70 **in-lbs**	6.8-7.9 Nm

NOTES

- *Always make sure cup washers, bushings and spacers are in position in upper fork bracket before installing handlebars or risers.*
- *On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp. These areas will not be visible at all when handlebar is centered properly.*

FXDC Models

1. See Figure 2-105. If handlebar risers (4, 5) were removed, install lockwashers (10) on handlebar riser fasteners (11).
2. Slide handlebar riser fasteners through upper fork bracket.
3. Loosely install handlebar risers to upper fork bracket using handlebar riser fasteners.
4. Place handlebars (3) on handlebar risers. Install upper handlebar clamp (2). Install but do not tighten clamp fasteners.
5. Using knurled areas of handlebar as a guide, center handlebars between handlebar risers.
6. Raise handlebars to normal riding position and hold in position.
7. Secure handlebars in clamp:
   a. Tighten two rear fasteners (1) until cast-in spacers contact handlebar risers (4, 5).
   b. Tighten front fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Final tighten rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm). Slight gap between upper clamp and handlebar risers should exist at front.
8. Tighten handlebar riser fasteners (11) to 30-40 ft-lbs (40.7-54.2 Nm).
9. Install speedometer cover and speedometer cover fasteners. Tighten fasteners to 50-60 **in-lbs** (5.6-6.8 Nm).

FXDL Models

1. See Figure 2-106. If risers (5) were removed, install lockwashers (12) on riser fasteners (13).
2. Slide riser fasteners through upper fork bracket.
3. Loosely install risers to upper fork bracket using riser fasteners.
4. Place handlebars (4) on risers. Install upper handlebar clamp (2). Install but do not tighten clamp fasteners.
5. Using knurled areas of handlebar as a guide, center handlebars between handlebar risers.
6. Raise handlebars to normal riding position and hold in position.
7. Secure handlebars in clamp:
   a. Tighten two rear fasteners (1) until cast-in spacers contact risers.
   b. Tighten front fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Final tighten rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm). Slight gap between upper clamp and handlebar risers should exist at front.
8. Tighten riser fasteners to 30-40 ft-lbs (40.7-54.2 Nm).
9. Install riser cover (3) and riser cover fastener (6). Tighten fastener to 50-60 **in-lbs** (5.6-6.8 Nm).

FLD Models

1. See Figure 2-107. If risers (3) were removed, install lockwashers (7) on riser fasteners (8).
2. Loosely secure risers to upper fork bracket.
3. Place handlebars on risers. Install upper handlebar clamp (2) but do not tighten clamp fasteners (1).
4. Using knurled areas of handlebar as a guide, center handlebars between handlebar risers.
5. See Figure 2-108. Place a straight edge across the windshield bushings.
6. Measure from the straight edge to the front of the handlebar just below the top bend.
7. Rotate the handlebar in the risers until the gap measures 1.370 in (34.8 mm).

8. Secure handlebars in clamp:
   a. Tighten two rear fasteners (1) until cast-in spacers contact risers.
   b. Tighten front fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Final tighten rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm). Slight gap between upper clamp and handlebar risers should exist at front.
9. Tighten riser fasteners to 30-40 ft-lbs (40.7-54.2 Nm).
10. Install headlamp. See 7.12 HEADLAMP.
11. Install windshield.

All Models

1. Install a **new** left hand grip, if necessary. See 2.24 HANDLEBARS: FXDC, FXDL AND FLD, Left Hand Grip.
2. Install right and left handlebar control module assemblies and throttle. Do not tighten at this time. See 7.33 RIGHT HANDLEBAR CONTROL MODULE and 7.32 LEFT HANDLEBAR CONTROL MODULE.
3. Install clutch control assembly. See 2.23 CLUTCH CONTROL.
4. Install front brake master cylinder. See 2.10 FRONT BRAKE MASTER CYLINDER.
5. Tighten:
   a. Left hand control module clamp screws to 35-45 **in-lbs** (4.0-5.1 Nm).
   b. Right hand control module clamp screws to 35-45 **in-lbs** (4.0-5.1 Nm).
6. Connect battery negative cable. Tighten to 60-70 **in-lbs** (6.8-7.9 Nm).
7. Test front brake lever for pressure and operation.
8. Test throttle for correct operation. Adjust as required. See 1.13 THROTTLE CABLES.
9. Test switches for proper 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)

10. Verify all lamp operation.

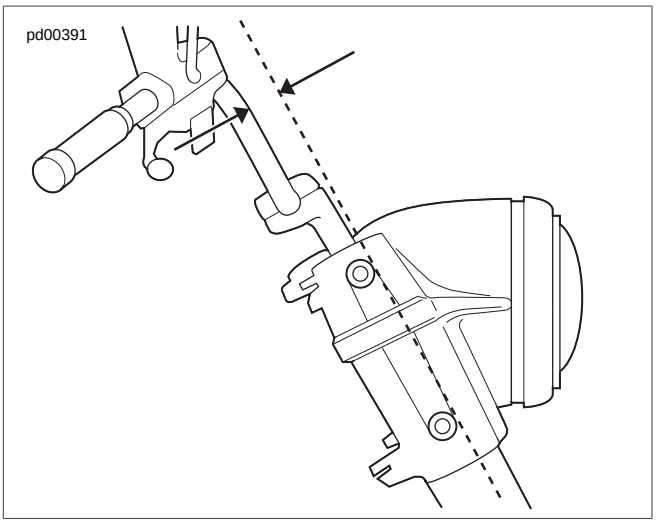


Figure 2-108. Handlebar Adjustment: FLD/103

LEFT HAND GRIP

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.

HANDLEBARS: FXDB/P/A, FXDF AND FXDWG 2.25

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 instrument panel. See 7.21 INSTRUMENTS: FXDC, FXDF AND FLD or 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
3. Unplug fuel gauge connector.
4. Remove fuel tank fasteners, vent, fuel supply fitting and slide fuel tank back. See 4.4 FUEL TANK.
5. Cover painted parts using a blanket or protective cover to prevent damage.
6. Disconnect all left and right side hand control connectors from connectors on main harness.

NOTE

Record wire colors and locations in connector before removal. This will assist with proper wire location in connector during installation.

7. Identify wire leads 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.
8. Remove terminals from turn signal multilock connector. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
9. Remove front master cylinder assembly. See 2.10 FRONT BRAKE MASTER CYLINDER.
10. Remove clutch control assembly from handlebar. See 2.23 CLUTCH CONTROL.
11. Separate right handlebar control module housing and remove throttle. See 7.33 RIGHT HANDLEBAR CONTROL MODULE.

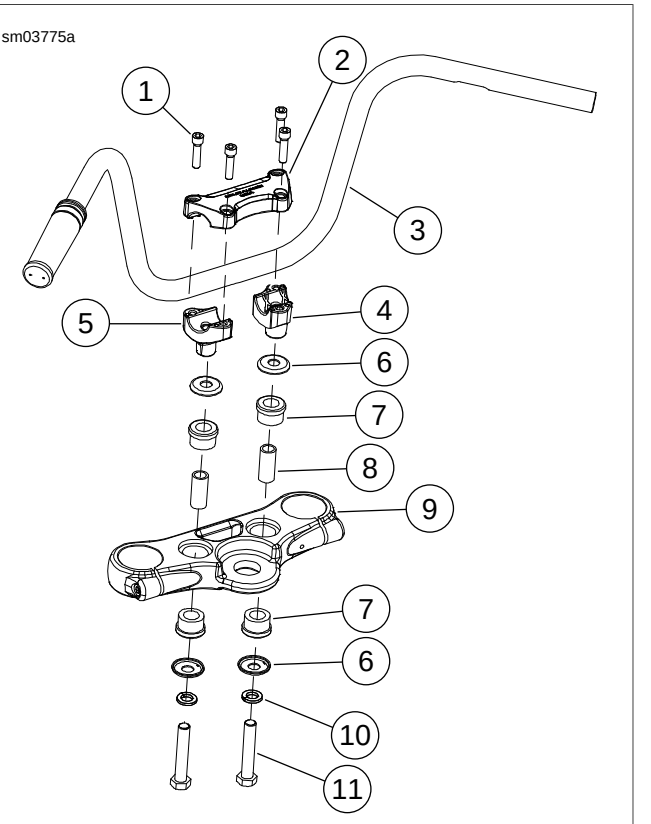
NOTE

Original equipment left handlebar grip is glued in place. Remove grip by cutting off only if necessary.

12. If removing left handlebar grip, slice grip open with a sharp knife. Peel grip off handlebar.
13. Remove control module housings, turn signals and wiring from handlebars.

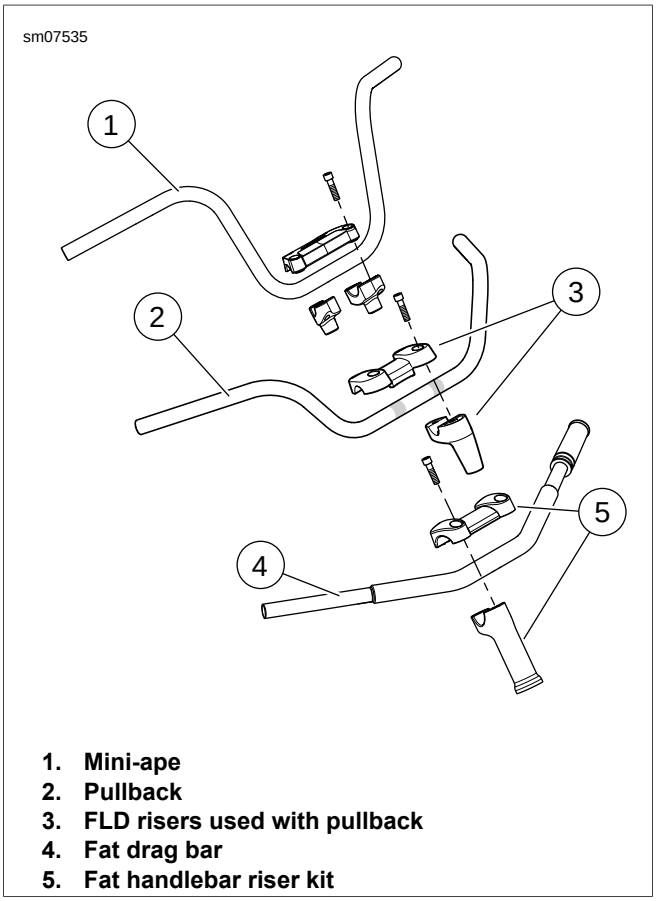
FXDB/P/A

1. See Figure 2-109. If removing handlebar risers (4, 5), loosen, but do not remove two lower handlebar riser fasteners (11).
2. Remove handlebar clamp fasteners (1).
3. Remove upper handlebar clamp (2).
4. Remove handlebar (3).
5. Remove two handlebar riser fasteners (11) and lockwashers (10).
6. Remove handlebar risers (4, 5) from upper fork bracket (9). Replace bushings (7) if necessary.
7. See Figure 2-110 for mini-ape, pullback or fat drag bar.



1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp (2)**
3. **Handlebar**
4. **Right handlebar riser**
5. **Left handlebar riser**
6. **Cup washer (4)**
7. **Bushing (4)**
8. **Spacer (2)**
9. **Upper fork bracket**
10. **Lockwasher (2)**
11. **Handlebar riser fastener (2)**

Figure 2-109. Handlebars: FXDB/P/A

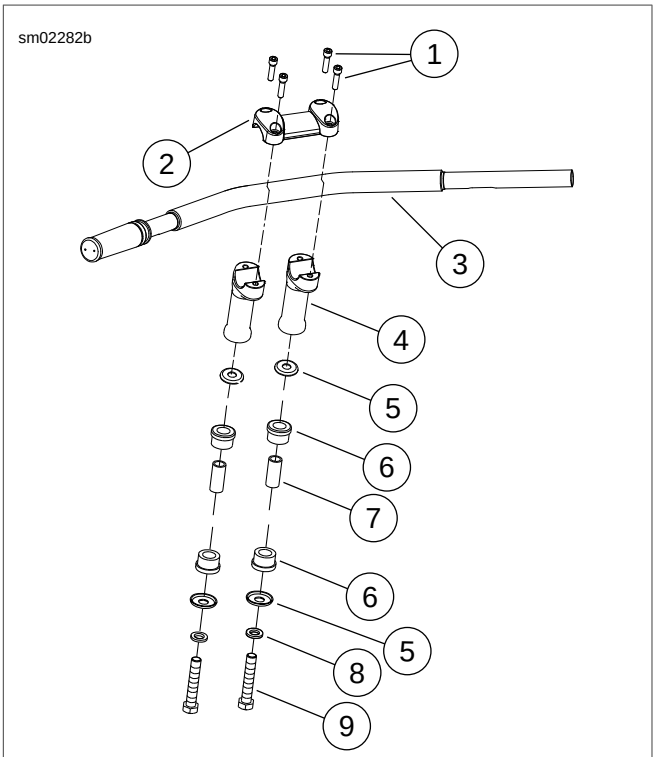


1. **Mini-ape**
2. **Pullback**
3. **FLD risers used with pullback**
4. **Fat drag bar**
5. **Fat handlebar riser kit**

Figure 2-110. Handlebar Options: FXDBP

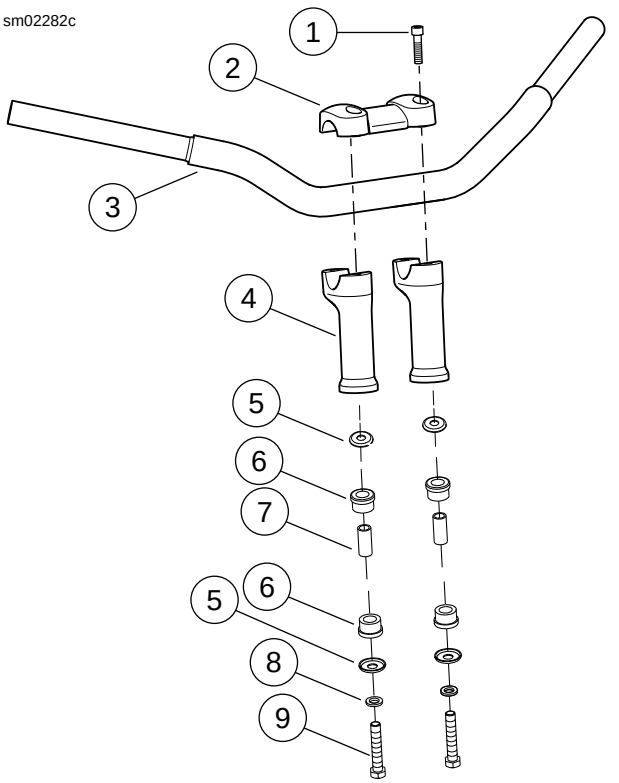
FXDF and FXDWG

1. See Figure 2-111 or Figure 2-112. Remove upper handlebar clamp fasteners (1) and upper handlebar clamp (2). Remove handlebar (3).
2. If removing handlebar risers (4), remove two handlebar riser fasteners (9), lockwashers (8) and handlebar risers from upper fork bracket. Replace bushings (6) if necessary.



1. **Upper handlebar clamp fasteners (4)**
2. **Upper handlebar clamp**
3. **Handlebar**
4. **Handlebar riser (2)**
5. **Cup washers (4)**
6. **Bushings (4)**
7. **Spacer (2)**
8. **Lockwasher (2)**
9. **Handlebar riser fastener (2)**

Figure 2-111. Fat Drag Bars with Risers, FXDF



1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp**
3. **Handlebar**
4. **Handlebar riser (2)**
5. **Cup washer (4)**
6. **Bushing (4)**
7. **Spacer (2)**
8. **Lockwasher (2)**
9. **Riser fastener (2)**

Figure 2-112. Handlebars: FXDWG

INSTALLATION

FASTENER	TORQUE VALUE	
Upper handlebar clamp fastener: FXDB/P/A, FXDF, FXDWG, final tightening	12-16 ft-lbs	16.3-21.7 Nm
Handlebar riser fastener: FXDF, FXDWG, final tightening	30-40 ft-lbs	40.7-54.2 Nm
Upper handlebar clamp fastener: FXDB/P/A, initial tightening	12-16 ft-lbs	16.3-21.7 Nm
Handlebar riser fastener: FXDB/P/A final tightening	30-40 ft-lbs	40.7-54.2 Nm
Upper handlebar clamp fastener: FXDB/P/A final tightening	12-16 ft-lbs	16.3-21.7 Nm
Negative battery fastener: All Models	60-70 **in-lbs**	6.8-7.9 Nm

NOTE

The turn signal wires enter the switch housings through a relief grommet in the housing. Support turn signals throughout this procedure to prevent pulling the grommet or the turn sign 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 7.31 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 leader.
4. Lay mechanics wire along the wire harnesses so a few inches overlap and secure using electrical tape.

⚠WARNING

Grommets in each of the wiring holes in the handlebar must remain in position after routing the wiring through the handlebar. Operation without the grommets in place can damage wires, causing a short circuit which could result in death or serious injury. (00416d)

5. If necessary, replace grommets on handlebars wire openings.
6. Lubricate wire conduits with glass cleaner.
7. See Figure 2-114. Thread the wire leaders through the handlebar grommets and to the center hole.
8. Pull wire bundles through to the handlebar center hole.
9. Loosely install left and right control module housings.
10. Pull slack from wire harnesses and remove the tape and mechanics wire.

11. **FXDF models:** See Figure 2-111. Install handlebars as follows:
    a. If handlebar risers (4) were removed, install lockwashers (8) on handlebar riser fasteners (9).
    b. If removed, install cup washers (5), bushings (6) and spacers (7) in upper fork bracket.
    c. Slide handlebar riser fasteners (9) through upper fork bracket.
    d. Loosely install handlebar risers (4) to upper fork bracket using handlebar riser fasteners.
    e. Place handlebars (3) on handlebar risers. Install upper handlebar clamp (2). Install but do not tighten clamp fasteners (1).
12. **FXDB/P/A models:** See Figure 2-109. Place handlebars (3) on risers. Install upper handlebar clamp (2). Install but do not tighten clamp fasteners (1).
13. Insert wires into proper locations in wire connector housings. See B.2 WIRING DIAGRAMS, 2013 Dyna Wiring Diagrams.
14. Connect left and right hand control connectors [22, 24].
15. Connect turn signal connector [31].

NOTE

When clutch control is installed on handlebars, route cable in front of the handlebars for all models except FXDB/P/A. FXDB/P/A models should have the clutch cable routed behind the handlebars unless different handlebars are being used.

16. Install clutch control and front master cylinder. Align housings and tighten fasteners. See 2.23 CLUTCH CONTROL and 2.10 FRONT BRAKE MASTER CYLINDER.
17. Install fuel tank. Connect vent hose and fuel supply fitting. See 4.4 FUEL TANK.
18. Connect fuel gauge connector [117].
19. Install instrument console. See 7.21 INSTRUMENTS: FXDC, FXDF AND FLD or 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
20. Using knurled areas of handlebar as a guide, center handlebars between handlebar risers.

NOTE

On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp when handlebar is centered properly.

21. See Figure 2-113. Lay a straightedge against the front of the upper and lower fork brackets. Rotate the handlebar to 3.5 in. (89 mm).

NOTE

***FXDF models:** gap between upper clamp and lower risers should be equal front and rear.*

22. **FXDF models:** see Figure 2-111. Tighten upper handlebar clamp as follows:
    a. Tighten front and rear upper handlebar clamp fasteners (1) to 12-16 ft-lbs (16.3-21.7 Nm).
    b. Remove one handlebar riser fastener (9). Apply LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) to fastener threads.
    c. Install fastener. Tighten to 30-40 ft-lbs (40.7-54.2 Nm). Repeat for other fastener.
23. **FXDB/P/A models:** see Figure 2-109. Tighten upper handlebar clamp as follows:
    a. Tighten two front fasteners (1) until cast-in spacers contact risers.
    b. Tighten two rear fasteners (1) to 12-16 ft-lbs (16.3-21.7 Nm).
    c. Remove one handlebar riser fastener (11). Apply LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) to fastener threads.
    d. Install fastener. Tighten to 30-40 ft-lbs (40.7-54.2 Nm). Repeat for other fastener.
    e. Tighten two front fasteners (1) to 12-16 ft-lbs (16.3-21.7 Nm).

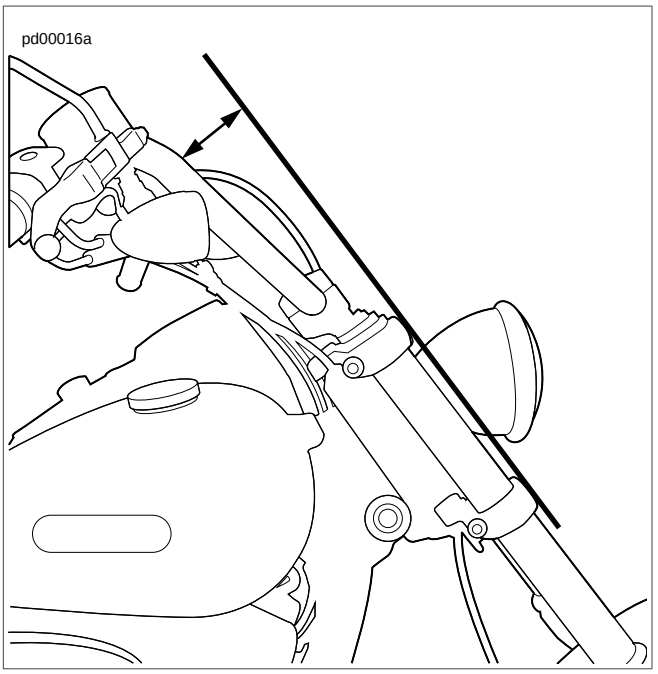


Figure 2-113. Handlebar Adjustment Measurement: FXDB/P/A

24. Connect negative battery cable to battery. Tighten to 60-70 **in-lbs** (6.8-7.9 Nm).
25. Test front brake lever for pressure and operation.
26. 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)

27. Turn the Ignition/Light Key Switch to IGNITION. Test switches for proper operation.
28. Operate brake lever to test stop lamp.

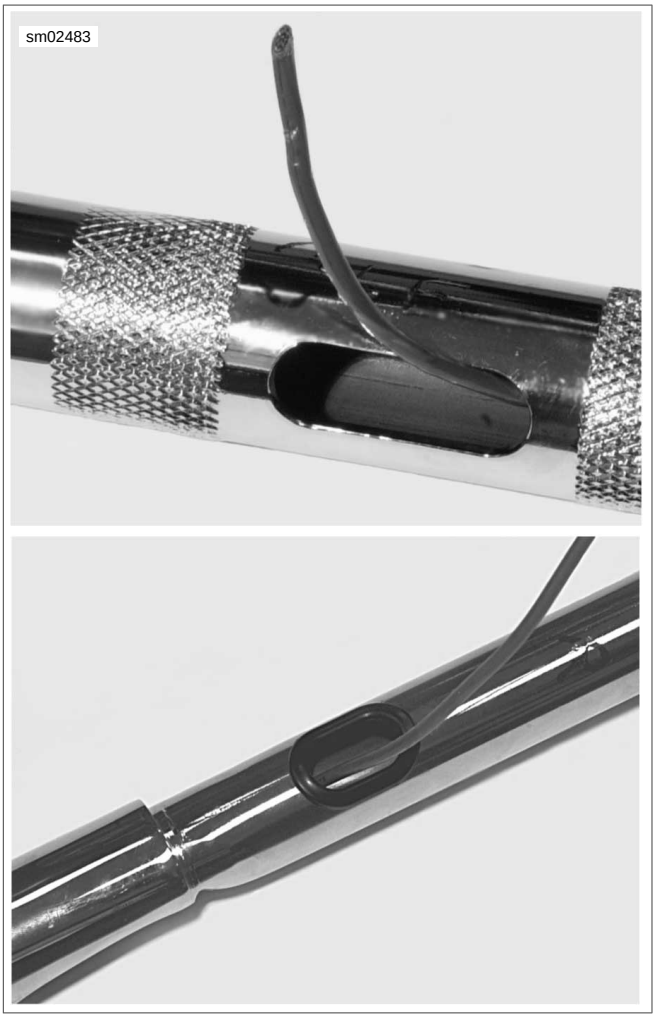


Figure 2-114. Wire Leader in Handlebars (Handlebars Removed from Motorcycle)

FRONT FENDER 2.26

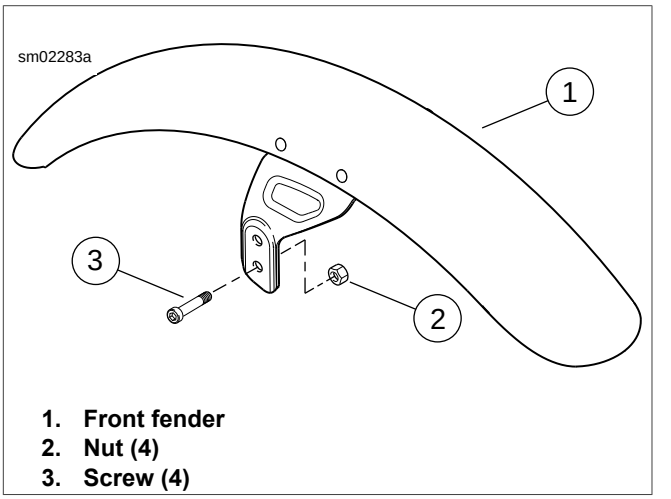
REMOVAL

1. See Figure 2-115 or Figure 2-116. Remove both fender mounting screws (3) and nuts (2) on each side.
2. Carefully remove fender without scratching painted surfaces.

INSTALLATION

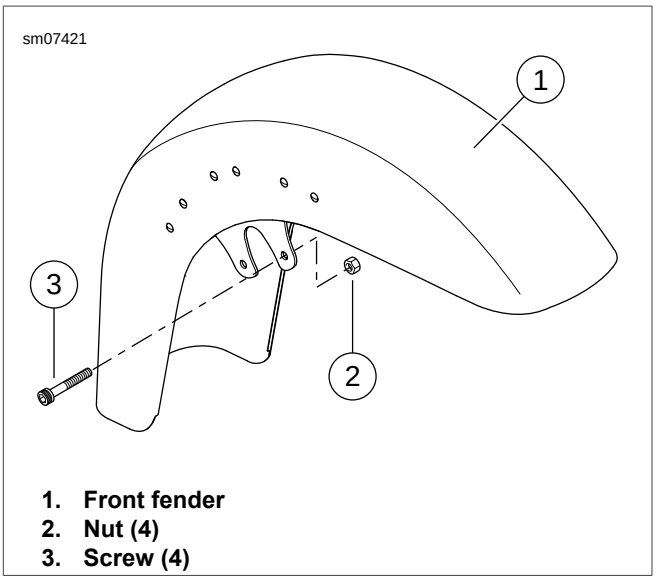
FASTENER	TORQUE VALUE	
Front fender nuts: All models	15-21 ft-lbs	20.3-28.5 Nm

1. See Figure 2-115 or Figure 2-116. Carefully position fender and align mounting holes.
2. Verify the fender mounting brackets are resting against the machined bosses of the forks.
3. Install screws (3) through fender mounting holes in fork legs.
4. Thread nuts (2) onto screws.
5. Tighten fender mounting nuts to 15-21 ft-lbs (20.3-28.5 Nm).



1. **Front fender**
2. **Nut (4)**
3. **Screw (4)**

Figure 2-115. Front Fender: All But FLD



1. **Front fender**
2. **Nut (4)**
3. **Screw (4)**

Figure 2-116. Front Fender: FLD

REAR FENDER 2.27

GENERAL

This topic is split by vehicle type. However, the following steps are common to all models.

Removal

1. Remove seat.

⚠ WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. Detach rear electrical harness.
   a. Follow the tail light and rear turn signal wire harness to the connector under the seat.
   b. Separate the connector.
   c. If necessary, remove the wires and the attached socket terminals from the connector. See the electrical diagnostic manual and B.2 WIRING DIAGRAMS for more information.
4. Cut cable strap securing harness to frame. Pull harness through fender opening.
5. Continue with the steps for your specific vehicle.

Tail Lamp/Turn Signal Harness Routing

NOTES

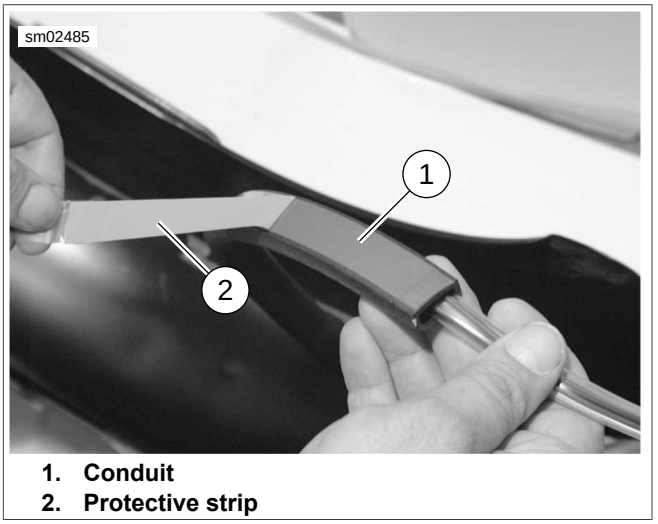
- *Conduit replacement may require adhesive removal.* ***Do NOT use solvents or harsh chemicals to remove adhesive as damage to painted surfaces may occur.***
- *Conduit is not used to route wiring on FXDB/BP models. Wires are run between fender supports and fender through wire channel.*

1. Thoroughly clean inside surface of fender with soap and water until it is free of dirt, oil, or other debris.

NOTE

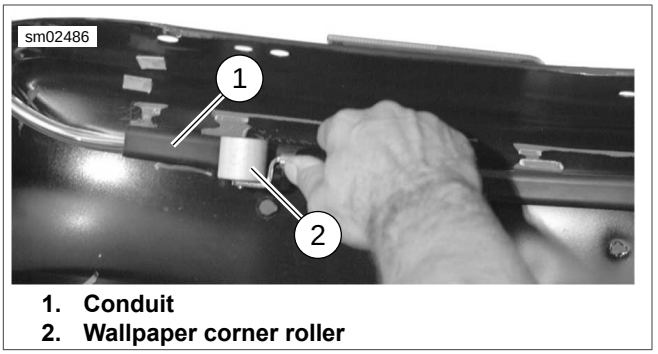
For typical wiring harness/conduit placement, see Figure 2-118.

2. Dry the surface, then wipe the area where conduit will be placed with Isopropyl Alcohol. Allow to dry completely.
3. Slide tail lamp wiring harness through conduit and plug connectors into appropriate sockets. See the electrical diagnostic manual and B.2 WIRING DIAGRAMS for more information.
4. See Figure 2-117. Remove protective strip covering adhesive on conduit and lightly position the conduit in place.



1. **Conduit**
2. **Protective strip**

Figure 2-117. Removing Protective Strip from Conduit



1. **Conduit**
2. **Wallpaper corner roller**

Figure 2-118. Purging Air Between ADHESIVE and Fender

5. See Figure 2-118. 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. Do NOT pull or try to reposition the conduit during this period.*

6. Continue with the installation steps for your specific vehicle.

Installation

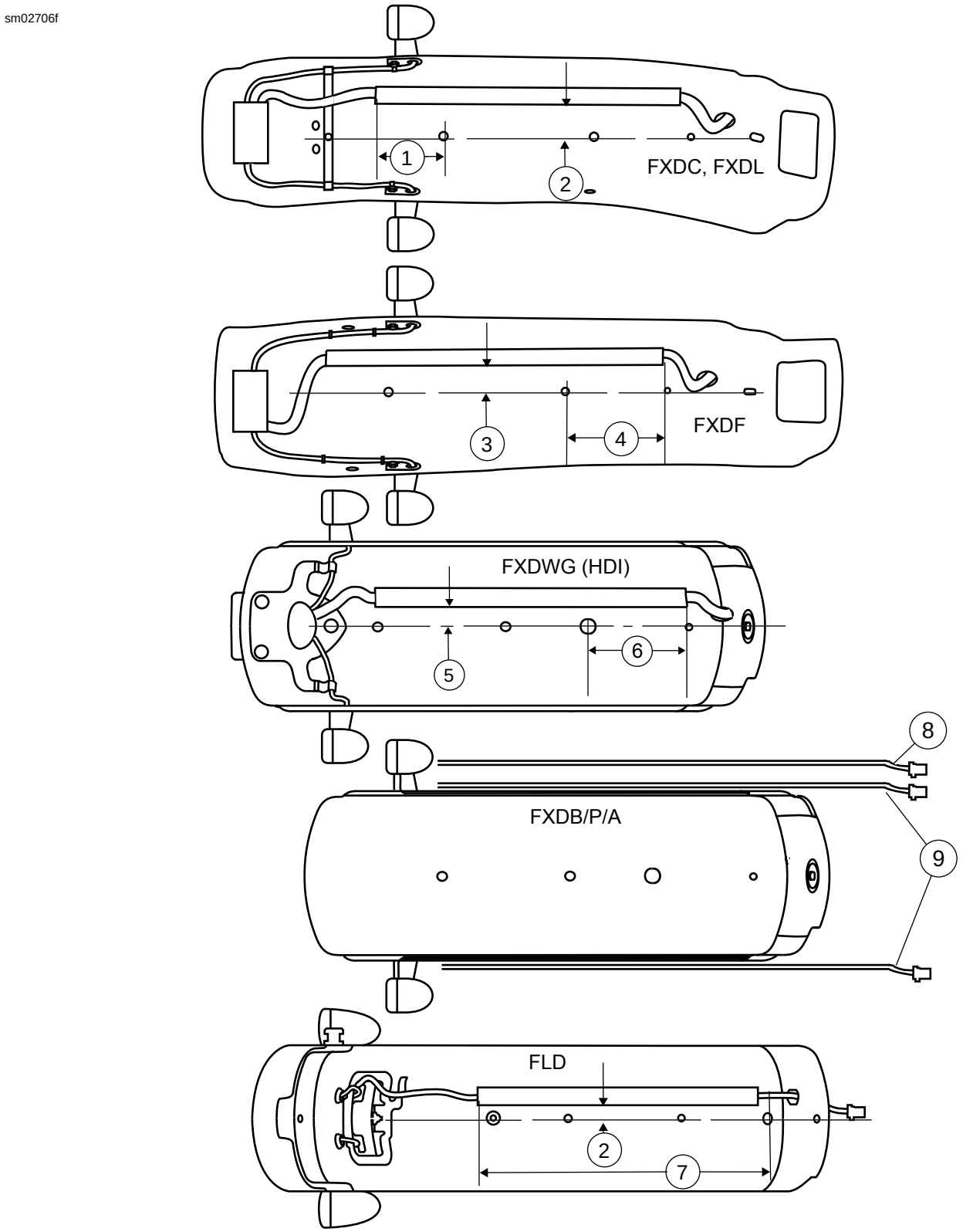
After attaching fender, perform the following steps on all models.

1. Route harness through opening in fender.
2. Install socket terminals back into connector. See the electrical diagnostic manual and B.2 WIRING DIAGRAMS for more information.
3. 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)

4. Install seat.
5. Test lights for proper operation.



1. 4.12 in. (104.6 mm)
2. 0.75 in. (19.1 mm)
3. 0.88 in. (22.4 mm)
4. 4.30 in. (109.2 mm)
5. 0.75 in. (19.1 mm)
6. FXDWG (HDI) 5.12 in. (130.1 mm)
7. FLD 21.12 in. (536.45 mm)
8. FXDB/P/A (license plate wire)
9. FXDB/P/A (stop, tail and turn signal wires)

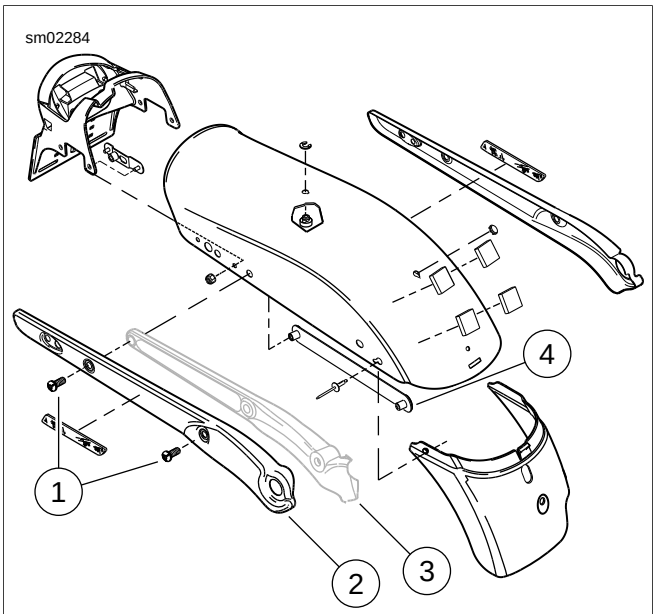
Figure 2-119. Rear Fender Harness Routing-Viewed from Underneath

FXDF

FASTENER	TORQUE VALUE	
Rear fender cover screw: FXDF	12-18 ft-lbs	16.3-24.4 Nm

Removal

1. Remove rear turn signal lamps. See 7.14 TURN SIGNALS.
2. See Figure 2-120. Remove screws (1) from holes in cover (2), fender support (3) and mounting bracket (4).
3. Remove remaining screws (1) from left side of fender and carefully remove fender.



1. **Screw (4)**
2. **Cover, right**
3. **Fender support**
4. **Mounting bracket (inside fender)**

Figure 2-120. Rear Fender (FXDF)

Installation

1. Before installing fender, install tail lamp/turn signal harness and conduit to underside of fender.
2. See Figure 2-120. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the threads of screws (1). Place fender and covers (2) into position. Tighten screws (1) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 7.14 TURN SIGNALS.
4. Finish with installation instructions under 2.27 REAR FENDER, General.

FXDC AND FXDL

FASTENER	TORQUE VALUE	
Rear fender screw: FXDC and FXDL Models	12-18 ft-lbs	16.3-24.4 Nm

Removal

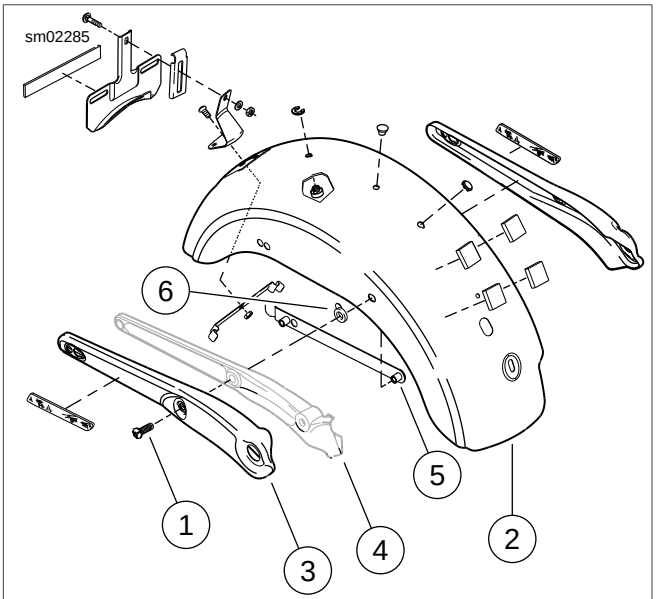
1. Remove rear turn signal lamps. See 7.14 TURN SIGNALS.
2. See Figure 2-121. Remove screws (1) and spacers (6) that hold fender in place and carefully remove fender and covers (3).

Installation

NOTE

Conduit is not used to route wiring on FXDB/BP models. Wire is routed on both sides of fender through channels.

1. Before installing fender, install tail lamp/turn signal harness and conduit to underside of fender. See Tail Lamp/Turn Signal Harness Routing instructions under 2.27 REAR FENDER, General.
2. See Figure 2-121. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the threads of screws (1). Place fender and covers (3) into position. Place spacers (6) into position and tighten screws (1) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 7.14 TURN SIGNALS.
4. Finish with installation instructions under 2.27 REAR FENDER, General.



1. **Screw (2)**
2. **Fender**
3. **Covers (2)**
4. **Fender support**
5. **Mounting bracket (inside fender)**
6. **Spacer (2)**

Figure 2-121. Rear Fender (FXDC and FXDL)

FXDB

FASTENER	TORQUE VALUE	
Rear fender screw: FXDB	12-18 ft-lbs	16.3-24.4 Nm

Removal

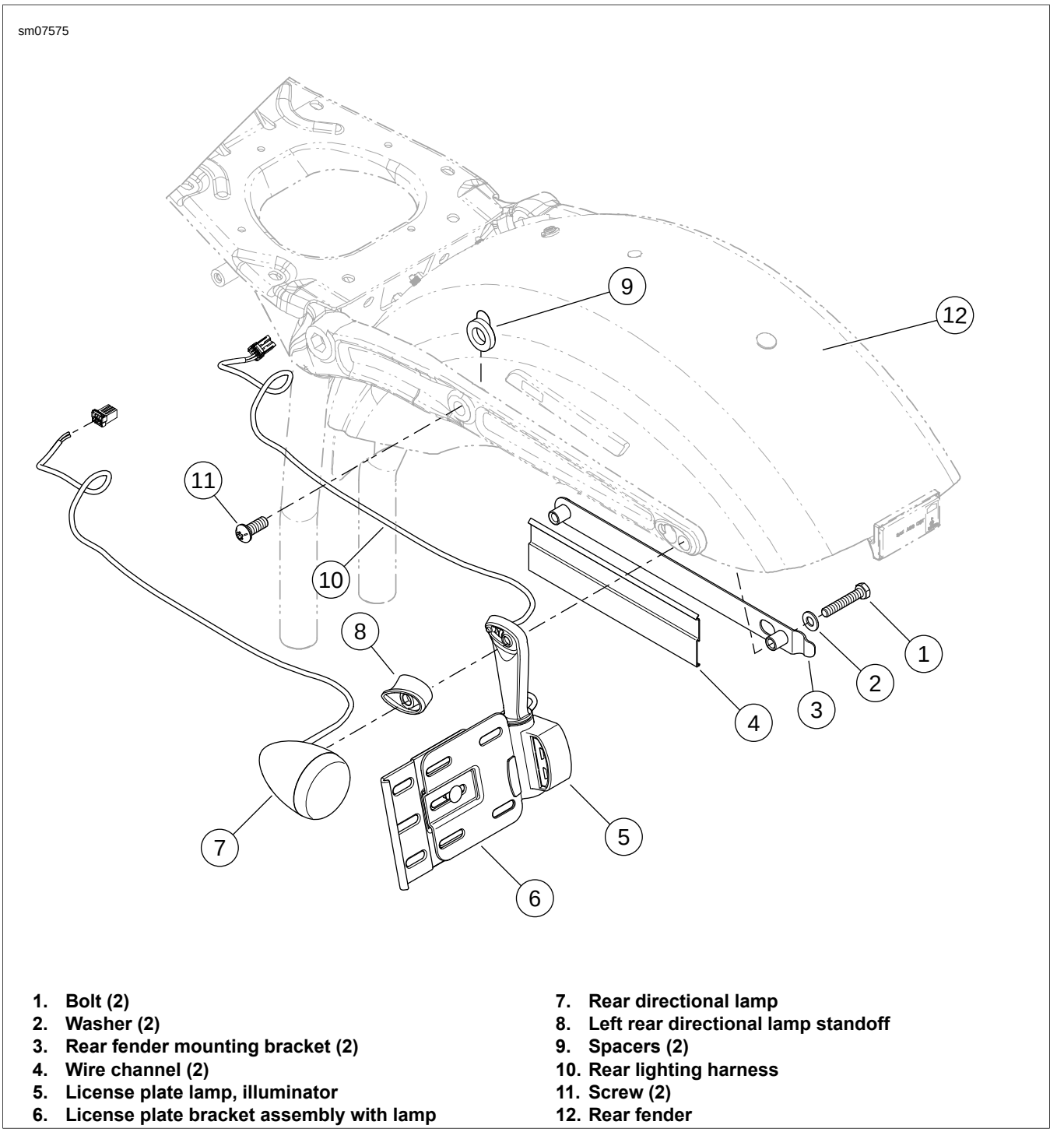
1. Remove rear turn signal lamps. See 7.14 TURN SIGNALS.
2. See Figure 2-122. Remove screws (1, 11) and spacers (9) that hold fender in place and carefully remove fender from supports.

Installation

NOTE

The FXDBP model has chrome frame/fender support covers included with chrome package as one of the customization options.

1. Before installing fender, install tail lamp/turn signal harness and conduit to underside of fender. See Tail Lamp/Turn Signal Harness Routing instructions under 2.27 REAR FENDER, General.
2. See Figure 2-122. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the threads of screws (11, 1). Place fender and mounting bracket (3) into position. Place spacers (9) into position and tighten screws (11, 1) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 7.14 TURN SIGNALS.
4. Finish with installation instructions under 2.27 REAR FENDER, General.



1. Bolt (2)
2. Washer (2)
3. Rear fender mounting bracket (2)
4. Wire channel (2)
5. License plate lamp, illuminator
6. License plate bracket assembly with lamp
7. Rear directional lamp
8. Left rear directional lamp standoff
9. Spacers (2)
10. Rear lighting harness
11. Screw (2)
12. Rear fender

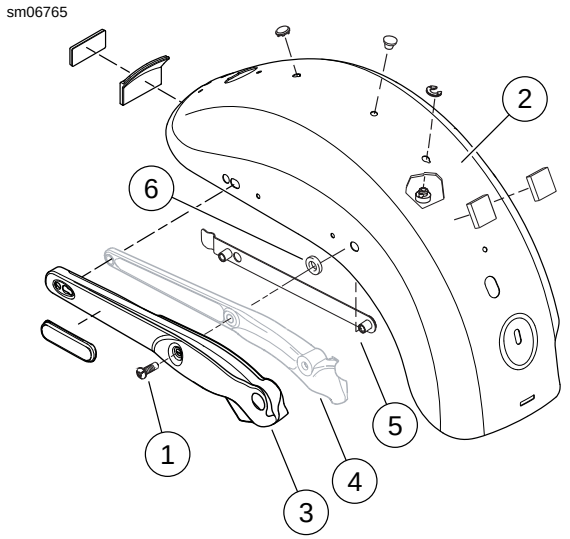
Figure 2-122. FXDB Rear Fender with Side Mount License Bracket and Lamp (Domestic and California)

FXDWG

FASTENER	TORQUE VALUE	
Rear fender screw: FXDWG	12-18 ft-lbs	16.3-24.4 Nm
Side mount license plate bracket screws: FXDWG	84-180 **in-lbs**	9.5-20.3 Nm
Rear mount license plate bracket screws: FXDWG	30-40 **in-lbs**	3.4-4.5 Nm

Removal

1. Remove rear turn signal lamps. See 7.14 TURN SIGNALS.
2. To ease installation, remove rear shock absorber lower bolts. See 2.21 REAR SHOCK ABSORBERS.
3. See Figure 2-123. Remove screws (1) and spacers (6) that hold fender in place and carefully remove fender from supports (4).



1. **Screw (2)**
2. **Fender**
3. **Covers (2)**
4. **Fender support**
5. **Mounting bracket (inside fender)**
6. **Spacer (2)**

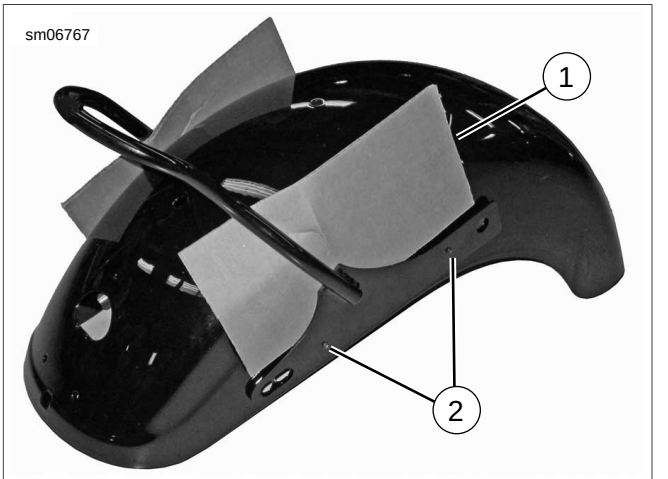
Figure 2-123. Rear Fender (FXDWG)

Sissy Bar

NOTE

Using clean cardboard strips helps prevent scratches to the fender when removing and installing the sissy bar.

1. See Figure 2-124. Install clean cardboard (1) between the fender and sissy bar on each side.
2. Remove push-in fasteners (2) that secure the sissy bar to the fender.
3. Carefully raise the sissy bar up away from the fender, making sure that the cardboard stays between the fender and sissy bar until it's removed.
4. Install sissy bar onto fender using cardboard (1) and secure to fender with **new** push-in fasteners.



1. **Cardboard (2)**
2. **Push-in fastener (4)**

Figure 2-124. Sissy Bar

Installation

1. **FXDWG HDI models:** Install tail lamp/turn signal harness conduit, if removed, to underside of fender. See Tail Lamp/Turn Signal Harness Routing instructions under 2.27 REAR FENDER, General.
2. See Figure 2-123. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the threads of screws (1). Place fender (2), covers (3), mounting bracket (5) and spacers (6) into position. Tighten screws (1) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 7.14 TURN SIGNALS.
4. Make sure wires are properly routed on inner side of fender and that no wires will come in contact with rear wheel.
   a. **FXDWG HDI models:** wires should be routed through wire conduit.
   b. **FXDWG U.S. models:** wires are routed along channels on both sides of fender and through a wire channel on front of fender.
5. If license plate bracket was removed, install bracket and tighten fasteners to:
   a. Side mount license plate bracket screws: 84-180 **in-lbs** (9.5-20.3 Nm).
   b. Rear mount license plate bracket screws: 30-40 **in-lbs** (3.4-4.5 Nm).
6. Install rear shock absorber lower bolts. See 2.21 REAR SHOCK ABSORBERS.
7. Finish with installation instructions under 2.27 REAR FENDER, General.

FLD

FASTENER	TORQUE VALUE	
Seat strap nut: FLD	60-90 **in-lbs**	6.8-10.2 Nm
Saddlebag lower mount spool: FLD	15-20 ft-lbs	20.3-27.1 Nm
Rear fender screw: FLD	30-37 ft-lbs	40.7-50.2 Nm

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.

NOTE

See Figure 2-119. To verify proper installation, make note of fender wire routing and hardware locations before removal.

4. Locate rear lighting wiring harness connector [7] under seat and disconnect.

NOTE

See Figure 2-125. If fender is to be disassembled, loosen screws (4) before removing screws (1).

5. Remove screws (1) along with spools (2, 13). Remove rear fender assembly.

Disassembly

1. Remove rear lighting. See 7.13 TAIL LAMP and 7.14 TURN SIGNALS, Rear Turn Signal Lamps and Bracket: FLD.
2. See Figure 2-125. Remove inner brackets (6).
3. Push push-in fasteners (9) in and remove outer spacers (10).
4. Remove screws (4), spools (5) and doubler bracket (11).
5. Remove retention washer (8) and nut (7).
6. Remove harness and conduit if necessary. See 2.27 REAR FENDER, General.
7. Remove seat strap.

Assembly

1. Install seat strap. Tighten to 60-90 **in-lbs** (6.8-10.2 Nm).
2. Install harness and **new** conduit if removed. See 2.27 REAR FENDER, General.
3. See Figure 2-125. Install nut (7) and retention washer (8).
4. Install doubler bracket (11) and spools (5). Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to screws (4) and tighten to 15-20 ft-lbs (20.3-27.1 Nm).
5. Install outer spacers (10) and engage push-in fasteners (9) to hold spacer in place.
6. Hold inner brackets (6) in place and install rear lighting. See 7.13 TAIL LAMP and 7.14 TURN SIGNALS, Rear Turn Signal Lamps and Bracket: FLD.

Installation

1. See Figure 2-125. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of screws (1).

NOTE

Spacers (12) are adhered to outer spacers (10). Verify they are in place when installing fender.

2. Secure fender with screws (1). Tighten to 30-37 ft-lbs (40.7-50.2 Nm).
3. Mate rear lighting connector [7].

⚠WARNING

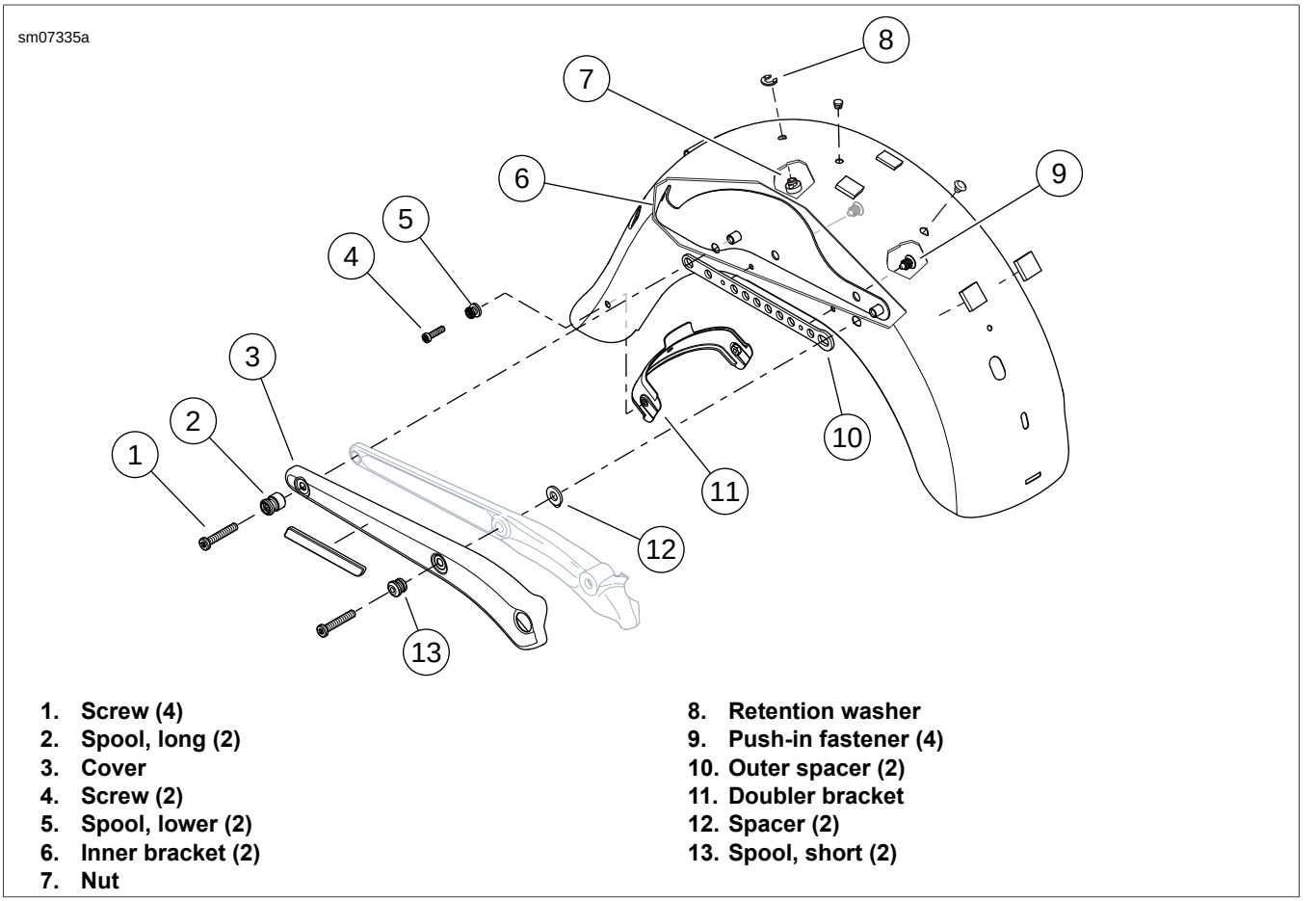
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

4. Install seat.
5. Install main fuse.
6. Install saddlebags.

⚠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. Verify lighting operation.



1. Screw (4)
2. Spool, long (2)
3. Cover
4. Screw (2)
5. Spool, lower (2)
6. Inner bracket (2)
7. Nut
8. Retention washer
9. Push-in fastener (4)
10. Outer spacer (2)
11. Doubler bracket
12. Spacer (2)
13. Spool, short (2)

Figure 2-125. Rear Fender: FLD

SEAT 2.28

REMOVAL

Seat and Seat Strap Removal: All But FXDWG

NOTES

- *See Figure 2-126. There is a nylon retaining clip between the rear seat bracket and the fender. DO NOT lose this clip, substitute a clip of different material or install the seat without this clip. Any of the above actions will result in scratched fender paint. The nylon retaining clip secures the seat screw nut.*
- *There is a bracket at the front of the seat that slips under a U-shaped frame bracket.*
- *There is no need to remove the seat bracket from the seat pan.*

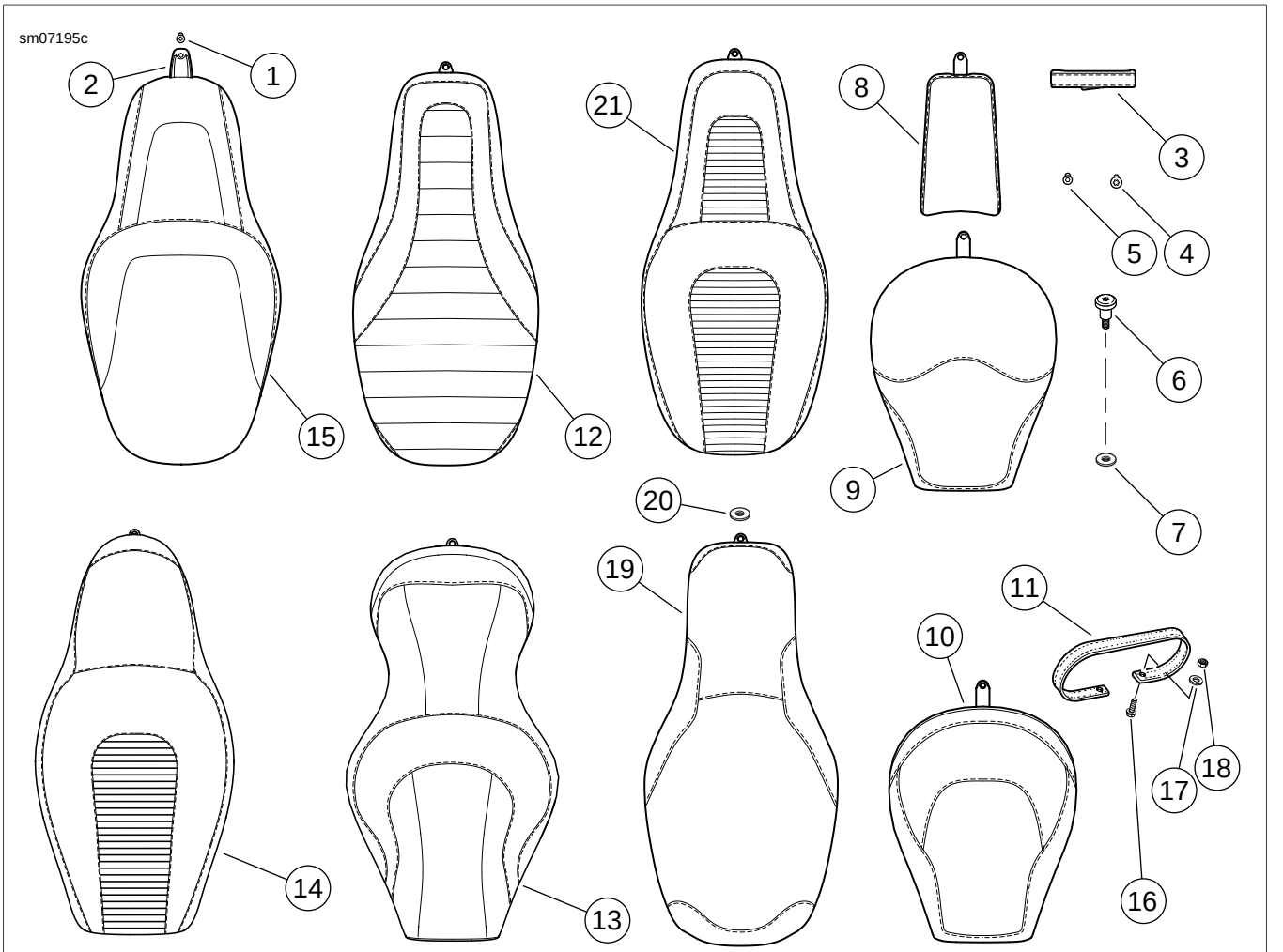
1. See Figure 2-126. Remove screw (1) from rear seat bracket (2). (Nylon clip remains with fender assembly.)
2. Slide seat to the rear of the motorcycle and lift seat.
3. If equipped with seat strap, remove nut (18) and washer (17) and seat strap (11).

Seat and Seat Strap Removal: FXDWG

NOTES

- *The front of the seat pillion is secured to a shoulder bolt located under the pillion.*
- *There is a bracket at the front of the seat that slips under a u-shaped frame bracket.*
- *There is no need to remove the seat bracket from the seat pan.*
- *The strap (3) is secured to the fender by a shoulder bolt (6) and shoulder washer (7).*
- *Note the orientation of the shoulder washer (7) for installation.*

1. See Figure 2-126. Remove screw (1) from pillion (8). (Nylon clip remains with fender assembly.)
2. Slide the pillion forward slightly and lift away from the shoulder bolt.
3. Remove shoulder bolt (6), shoulder washer (7), and seat strap (3).
4. Lift rear of seat and slide seat to the rear.



1. Screw
2. Bracket
3. Seat strap (FXDWG)
4. Nut (FXDWG)
5. Washer, top hat (FXDWG)
6. Shoulder bolt (FXDWG)
7. Shoulder washer (FXDWG)
8. Passenger pillion (FXDWG)
9. Solo seat (FXDWG)
10. Solo seat (FXDB/P/A)
11. Seat strap (all but FXDWG)
12. Seat (FXDC)
13. Seat (FLD)
14. Seat (FXDL)
15. Seat (FXDF)
16. Screw
17. Washer
18. Nut
19. Seat (FXDBP 2-up, Badlander)
20. Seat washer (FXDBP)
21. Seat (FXDC) 110th Anniversary

Figure 2-126. Seat

INSTALLATION

FASTENER	TORQUE VALUE	
Seat rear fastener: All Models except FXDWG	20-40 **in-lbs**	2.3-4.5 Nm
Seat strap nut: FXDWG Only	60-90 **in-lbs**	6.78-10.17 Nm
Seat shoulder bolt: FXDWG	80-90 **in-lbs**	9.0-10.2 Nm
Seat rear fastener: All Models	20-40 **in-lbs**	2.3-4.5 Nm

Seat and Seat Strap: All But FXDWG

1. **FXDBP model:** See Figure 2-126. Place washer (20) between fender and the seat with small diameter facing up.
2. Slide back of seat through seat strap loop.
3. Slide seat bracket, located under front of seat, into the U-shaped frame bracket.

⚠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)

4. Verify nylon retaining clip is in position on fender. Install screw (1) and tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

Seat and Seat Strap: FXDWG

1. See Figure 2-126. Install seat strap, if equipped. Tighten nut (4) to 60-90 **in-lbs** (6.78-10.17 Nm).

NOTE

When the shoulder washer (7) is installed properly, the shoulder will fit into the hole in the seat bracket.

2. Install shoulder bolt (6) through both holes in seat strap and place shoulder washer (7) onto shoulder bolt. Install shoulder bolt through the rear seat bracket and into the fender clip. Tighten shoulder bolt to 80-90 **in-lbs** (9.0-10.2 Nm).
3. Insert the pillion through the seat strap and align the slot under the front of the pillion with the shoulder bolt.
4. Slide pillion backward until firmly secured by the shoulder bolt.

⚠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. Verify nylon retaining clip is in position on fender. Install screw (1) and tighten to 20-40 **in-lbs** (2.3-4.5 Nm).

FOOTBOARDS AND FOOTRESTS 2.29

RIDER FOOTBOARDS

FASTENER	TORQUE VALUE	
Rider footboard pivot bolt nut	60-80 **in-lbs**	6.8-9.0 Nm
Rider footboard bracket screws	32-37 ft-lbs	43.0-50.0 Nm
Shift rod fastener with acorn nut	96-144 **in-lbs**	10.8-16.2 Nm

Removal

NOTE

Both brake pedal and shifter levers will be removed with the footboard brackets.

1. Disconnect brake rod from brake pedal.
2. Remove acorn nut and disconnect shift rod from shift lever.
3. See Figure 2-127. Remove screws (6) from footboard supports.
4. Remove footboards and bracket assemblies from motorcycle.

Disassembly

NOTE

If only replacing the rubber pad, refer to step 1 below and then see steps 3-4 under ASSEMBLY.

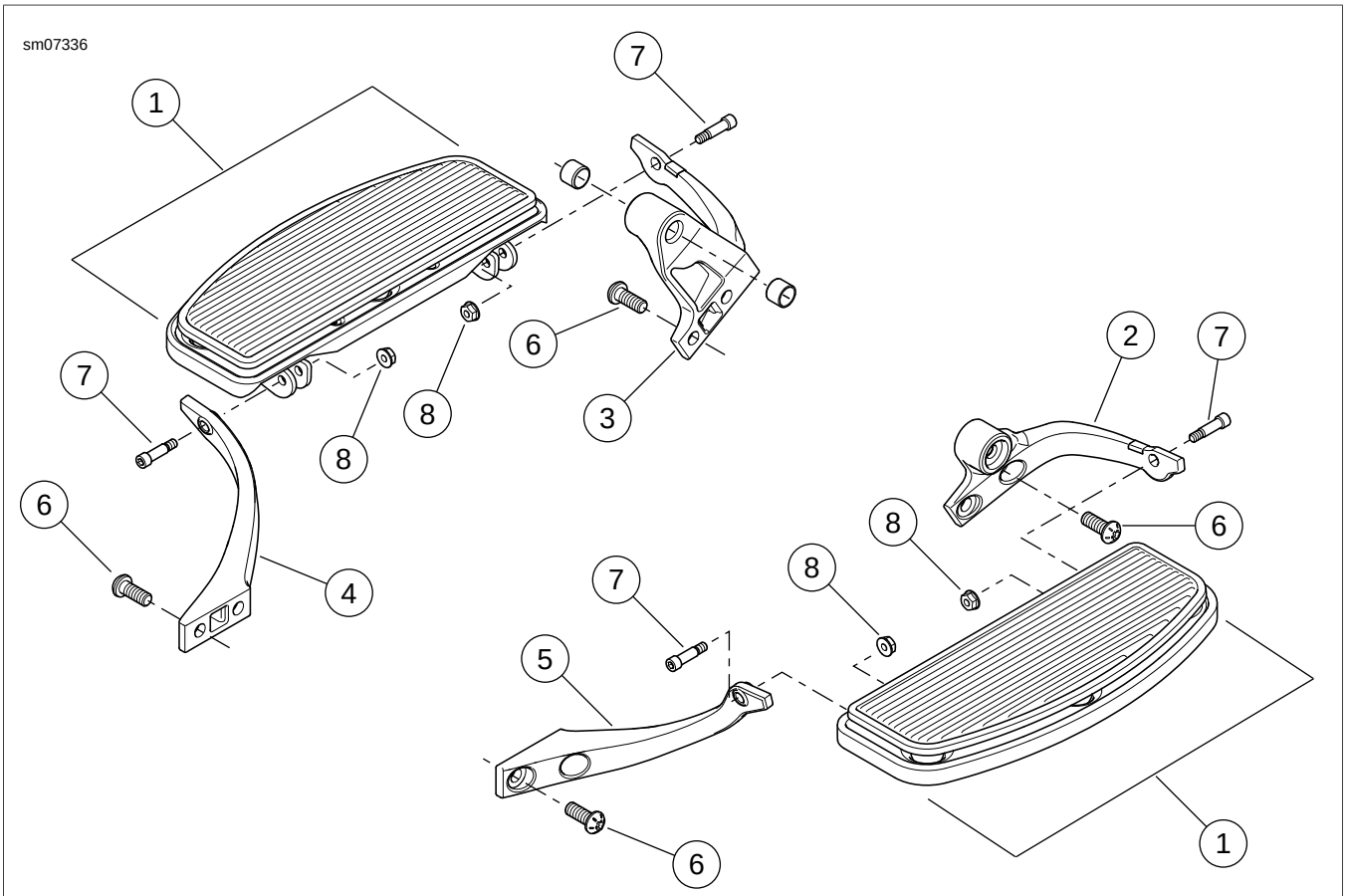
1. Tilt footboard upward. From bottom of footboard, use a large flat blade screwdriver to push four rubber anchors on pad up through holes in footboard.
2. See Figure 2-127. Remove flange locknuts (8) and shoulder bolts (7) from underside of footboard.
3. Remove footboard from brackets.

Assembly

1. Position footboard between brackets and install shoulder bolts (7) so that the flange locknuts (8) will be on the inboard side.
2. Install flange locknuts onto shoulder bolts and tighten to 60-80 **in-lbs** (6.8-9.0 Nm).
3. Moisten four rubber anchors on bottom of **new** pad with soapy water.
4. Position pad on footboard. From bottom of footboard, use pliers to pull rubber anchors through holes in footboard.

Installation

1. See Figure 2-127. Install footboard and bracket assembly and secure with screws (6).
2. Tighten screws to 32-37 ft-lbs (43.0-50.0 Nm).
3. Attach brake rod to brake pedal with a **new** pretzel clip for the cotter pin.
4. Attach shift levers to shift rod using acorn nut. Tighten to 96-144 **in-lbs** (10.8-16.2 Nm)



1. **Footboard**
2. **Right hand front footboard support**
3. **Left hand front footboard support**
4. **Left hand rear footboard support**
5. **Right hand rear footboard support**
6. **Mounting fasteners, footboard supports (4)**
7. **Shoulder bolt (2)**
8. **Flange locknut (2)**

Figure 2-127. Rider Footboards (Quantities shown are for each footboard)

RIDER FOOTRESTS: MID CONTROLS

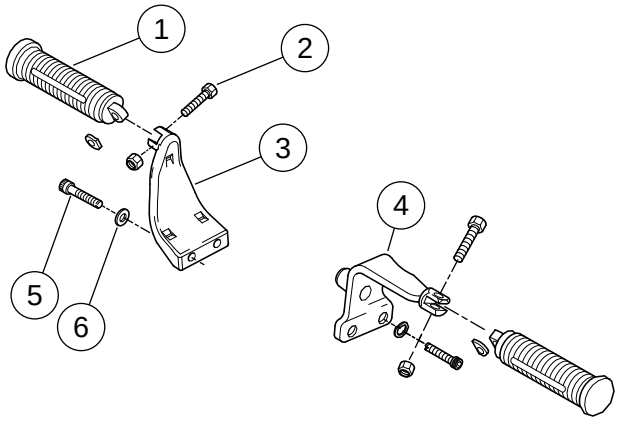
FASTENER	TORQUE VALUE	
Footrest support mounting screws	30-40 ft-lbs	40.7-54.2 Nm
Footrest support mounting screws	30-40 ft-lbs	40.7-54.2 Nm
Footrest mounting screws and nuts	84-108 **in-lbs**	9.5-12.2 Nm

Removal

1. See Figure 2-128. Remove footrest screw, nut and spring washer (2) to remove rider footrests (1).
2. Remove mounting screws (5) and lockwashers (6) to remove left side rider footrest support (3).
3. Remove clevis pin and circle cotter pin and disconnect brake rod from brake pedal.
4. Remove mounting screws (5) and lockwashers (6) to remove right side rider footrest support (4) along with brake pedal.

Installation

1. See Figure 2-128. Install right side rider footrest support (4) and brake pedal with mounting screws (5) and lockwashers (6). Tighten to 30-40 ft-lbs (40.7-54.2 Nm).
2. Install clevis pin and **new** circle cotter pin and connect brake rod to brake pedal.
3. Install left side rider footrest support (3) with mounting screws (5) and lockwashers (6). Tighten to 30-40 ft-lbs (40.7-54.2 Nm).
4. Install each rider footrest (1) with screw (2), nut and spring washer. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).



1. **Rider footrest (2)**
2. **Screw (2)**
3. **Left rider footrest support**
4. **Right rider footrest support**
5. **Mounting screw (4)**
6. **Lockwasher (4)**

Figure 2-128. Rider Footrests: Mid Controls

RIDER FOOTRESTS: FORWARD CONTROLS

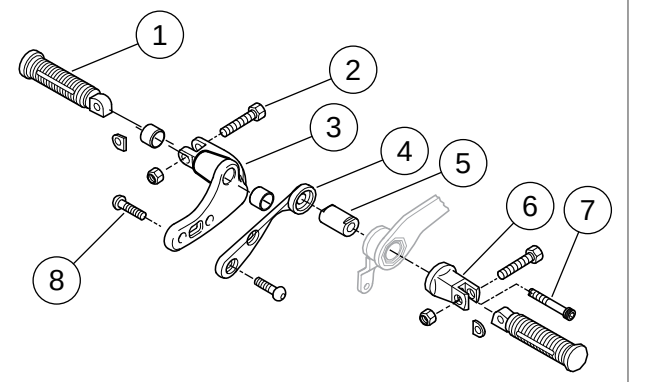
FASTENER	TORQUE VALUE	
Footrest support mounting screws	32-37 ft-lbs	43.4-50.2 Nm
Footrest support mounting screws	32-37 ft-lbs	43.4-50.2 Nm
Footrest mounting screws and nuts	84-108 **in-lbs**	9.5-12.2 Nm

Removal

1. See Figure 2-129. Remove footrest screw (2), nut and spring washer to remove rider footrests (1).
2. Disconnect shift rod from shift lever.
3. Remove mounting screws (8) to remove left side rider footrest support (3).
4. Remove clevis pin, cotter pin and disconnect brake rod from brake pedal and remove screw (7), brake pedal, clevis (6) and pivot shaft (5).
5. Remove mounting screws (8) to remove right side rider footrest support (4).

Installation

1. See Figure 2-129. Install mounting screws (8) to install right side rider footrest support (4). Tighten to 32-37 ft-lbs (43.4-50.2 Nm).
2. Install screw (7), brake pedal, clevis (6) and pivot shaft (5) and connect brake rod to brake pedal using a **new** cotter pin.
3. Install mounting screws (8) to install left side rider footrest support (3). Tighten to 32-37 ft-lbs (43.4-50.2 Nm).
4. Connect shift rod to shift lever.
5. Install footrest screw (2), nut, spring washer and rider footrest (1). Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).



1. **Rider footrest (2)**
2. **Rider footrest screws (2) with nut and spring washer**
3. **Left rider footrest support**
4. **Right rider footrest support**
5. **Pivot shaft**
6. **Footrest mounting clevis**
7. **Footrest mounting clevis screw**
8. **Mounting screw (4)**

Figure 2-129. Rider Footrests: Forward Controls

PASSENGER FOOTRESTS: ALL MODELS EXCEPT FXDF)

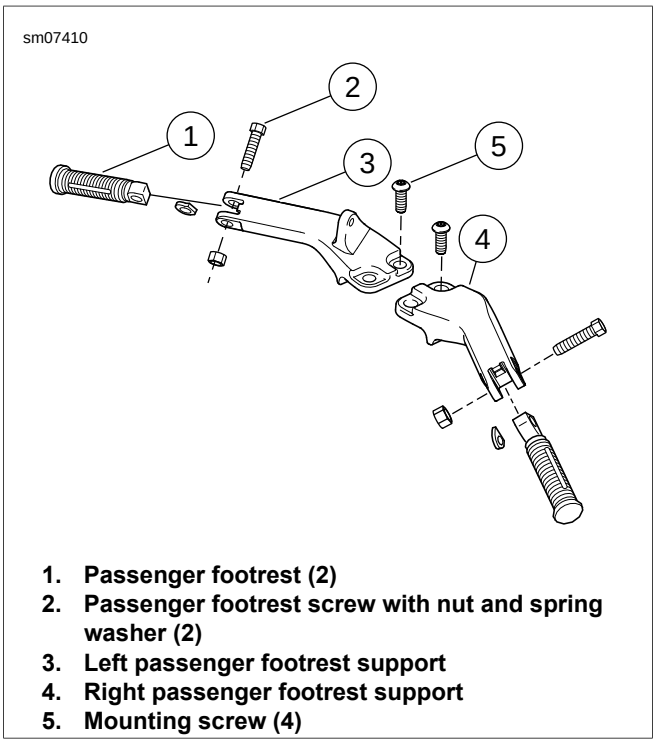
FASTENER	TORQUE VALUE	
Passenger footrest support mounting screw	25-35 ft-lbs	33.9-47.4 Nm
Passenger footrest screw and nut	84-108 **in-lbs**	9.5-12.2 Nm

Removal

1. See Figure 2-130. Remove footrest screw, nut and spring washer (2) to remove passenger footrest (1).
2. Remove mounting screws (5) to remove passenger footrest supports (3, 4).

Installation

1. See Figure 2-130. Install left (3) and right (4) passenger footrest supports using mounting screws (5). Tighten to 25-35 ft-lbs (33.9-47.4 Nm).
2. Install passenger footrest (1) with screw, nut and spring washer (2). Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).



1. **Passenger footrest (2)**
2. **Passenger footrest screw with nut and spring washer (2)**
3. **Left passenger footrest support**
4. **Right passenger footrest support**
5. **Mounting screw (4)**

Figure 2-130. Passenger Footrests (All Models except FXDF)

HEADLAMP NACELLE: FLD 2.30

UPPER AND LOWER NACELLE: FLD

FASTENER	TORQUE VALUE	
Slider cover fasteners: FLD	60-120 **in-lbs**	6.8-13.5 Nm
Handlebar riser bolts: FLD	30-40 ft-lbs	40.6-54.0 Nm
Lower nacelle fasteners: FLD	84-120 **in-lbs**	9.5-13.5 Nm
Upper nacelle fasteners: FLD	84-120 **in-lbs**	9.5-13.5 Nm
Headlight to nacelle: FLD	7-10 **in-lbs**	0.8-1.1 Nm
Windshield docking hardware: FLD	84-120 **in-lbs**	9.5-13.5 Nm

Removal

1. Support motorcycle so front wheel is off floor and forks are fully extended.
2. Remove brake caliper and front wheel. See 2.4 FRONT WHEEL.
3. Remove front fender. See 2.26 FRONT FENDER.

NOTES

- *Take care when removing and installing handlebars to prevent cosmetic damage to upper nacelle.*
- *Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.*

4. Remove headlight assembly.
5. Remove handlebar riser bolts and lay handlebars on protective cover on fuel tank.
6. Loosen the pinch screws at upper and lower fork brackets. Slide left and right fork assemblies downward clear of fork brackets.
7. **If ABS equipped:** Remove the brake line manifold from the lower fork bracket.
8. See Figure 2-131. Remove windshield assembly and docking hardware (1).
9. Remove lower nacelle (4) and slider covers (5).
10. Remove upper nacelle (2).

Installation

NOTE

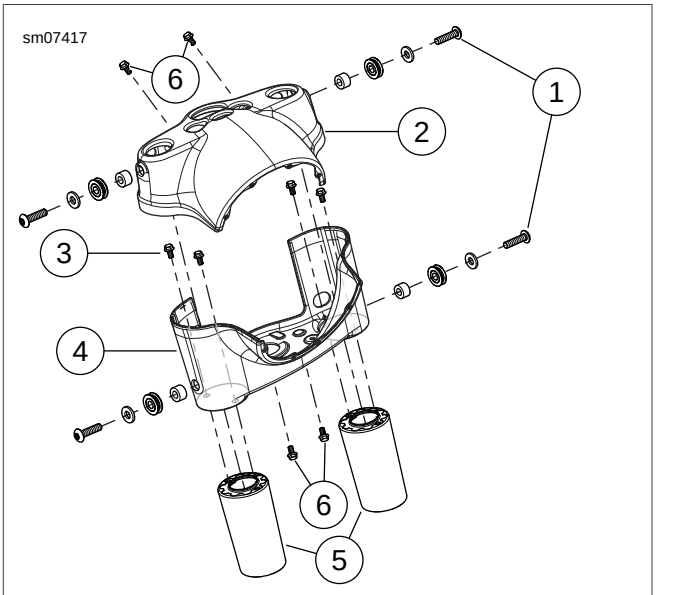
Install lower headlight nacelle and slider covers before fork assemblies are installed into the upper and lower fork brackets.

1. Install slider covers (5) if previously removed. Tighten to 60-120 **in-lbs** (6.8-13.5 Nm).
2. Install lower nacelle (4) along with slider covers (5). Install two lower fasteners (6) to hold lower nacelle in place but do not tighten.
3. Slide left and right fork assemblies upward and into upper and lower fork brackets.
4. Install upper nacelle (2), but do not tighten fasteners.
5. See 2.24 HANDLEBARS: FXDC, FXDL AND FLD. Install handlebar riser bolts through upper fork clamp and upper nacelle. Tighten to 30-40 ft-lbs (40.6-54.0 Nm).
6. Tighten two lower nacelle fasteners to 84-120 **in-lbs** (9.5-13.5 Nm).
7. Tighten two upper nacelle fasteners to 84-120 **in-lbs** (9.5-13.5 Nm).
8. Install headlight assembly. Tighten to 7-10 **in-lbs** (0.8-1.1 Nm).
9. Install docking hardware and windshield assembly. Tighten to 84-120 **in-lbs** (9.5-13.5 Nm).

NOTE

If ABS equipped: *see C.2 ABS MODULE.*

10. **If ABS equipped:** Install the brake line manifold to the lower fork bracket and lower nacelle.
11. Install front fender. See 2.26 FRONT FENDER.
12. Install front wheel and brake caliper. See 2.4 FRONT WHEEL.



1. **Docking hardware for windshield (4)**
2. **Upper nacelle**
3. **Slider cover screws (4)**
4. **Lower nacelle**
5. **Slider covers (2)**
6. **Upper and lower nacelle screws (4)**

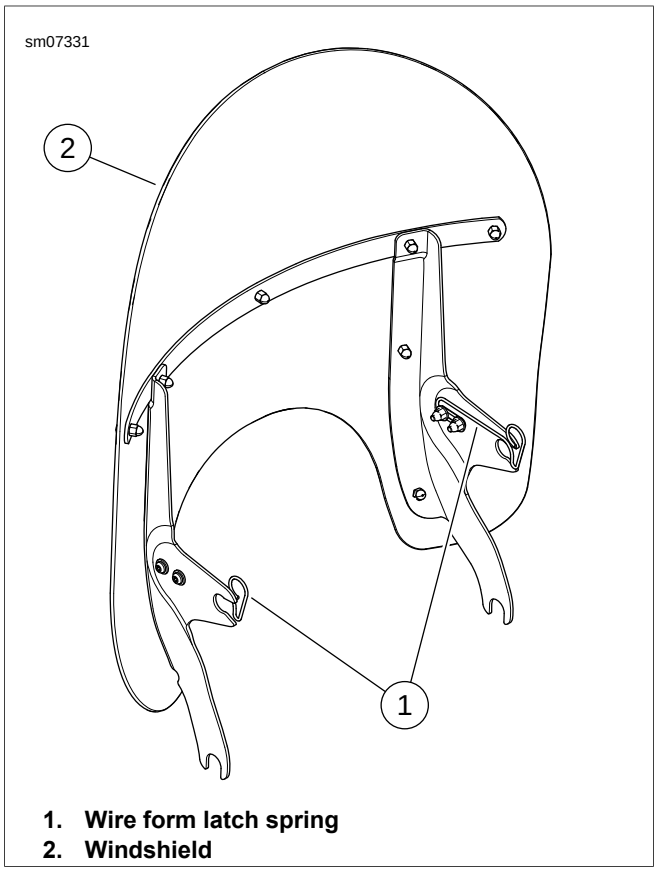
Figure 2-131. Headlamp Nacelles and Slider Covers

WINDSHIELD: FLD 2.31

WINDSHIELD

Removal

1. See Figure 2-132. Raise the wireform latch springs on both sides of the windshield.
2. Gently pull on the top of the windshield until the upper notches on the windshield brackets are free of the upper grommets.
3. Carefully raise the windshield until the lower notches are free of the lower grommets.
4. Remove windshield.



1. **Wire form latch spring**
2. **Windshield**

Figure 2-132. Windshield (FLD)

Installation

NOTE

Firmly seat windshield brackets to prevent scratching headlamp nacelle.

1. Carefully insert the windshield brackets around the headlamp nacelle. Lower the windshield into position until the lower notches on the windshield brackets are seated on the lower grommets.
2. See Figure 2-132. Gently push the top of the windshield toward the rear until the upper notches fully engage the upper grommets.
3. Push down on the wireform latch springs, so that they overhang the rubber grommets. If some adjustment is necessary, loosen the retaining screws and rotate the latch springs into the proper position.

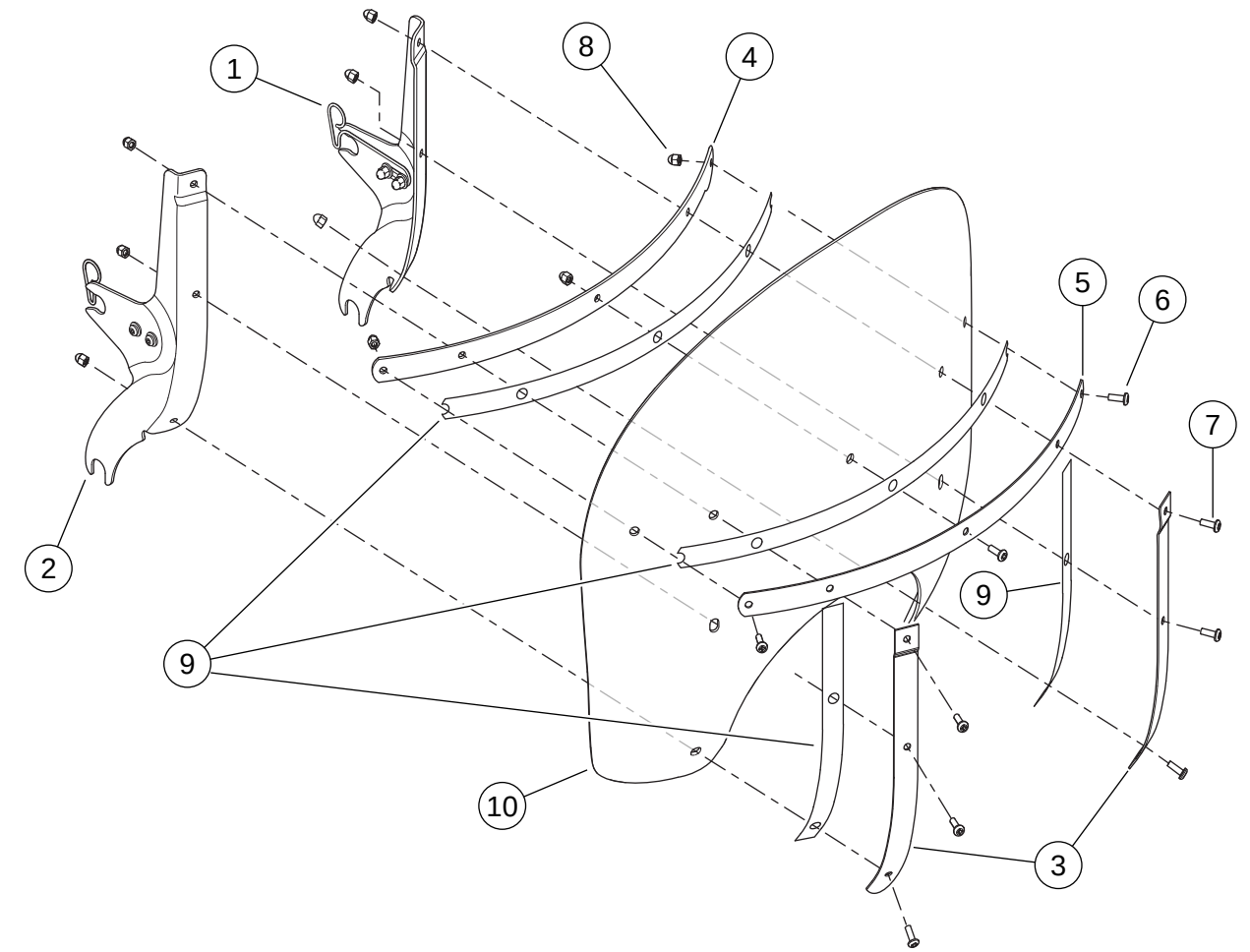
WINDSHIELD WINDOW

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN

FASTENER	TORQUE VALUE	
Windshield window screws: FLD	20-25 **in-lbs**	2.3-2.8 Nm

Removal

1. Remove windshield. See 2.31 WINDSHIELD: FLD.
2. Place windshield front side up on clean padded surface.
3. See Figure 2-133. Remove acorn nuts (8) and screws (6, 7) from each vertical brace (3) to release mounting bracket (2).
4. Remove three remaining screws from horizontal brace.



1. **Wireform latch spring (2)**
2. **Right and left wireform mounting bracket**
3. **Right and left outer vertical windshield brace**
4. **Thicker horizontal windshield brace**
5. **Thinner horizontal windshield brace**
6. **Shorter windshield mounting screw (7)**
7. **Longer windshield mounting screw (2)**
8. **Acorn nut (9)**
9. **Cushioned adhesive tape, windshield brace (4)**
10. **Windshield**

Figure 2-133. Windshield Assembly: FLD

5. Carefully pry braces from windshield (10). Discard windshield.

⚠WARNING

Be sure to follow manufacturer's instructions when using the Robinair Heat Gun or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00379a)

6. Remove cushioned adhesive tape (9) from braces (3, 4, 5):
   a. Liberally apply 3M GENERAL PURPOSE ADHESIVE REMOVER and allow to soak.
   b. Apply heat with ROBINAIR HEAT GUN (Part No. HD-25070).
   c. Peel cushioned adhesive tape (9) from braces.
   d. Remove any remaining adhesive with 3M GENERAL PURPOSE ADHESIVE REMOVER.

Installation

NOTES

- *Carefully align the holes in the new tape with the holes in the braces.*
- *The thicker horizontal brace (4) mounts to the **rear** surface of the windshield.*

1. See Figure 2-133. Remove paper backing from one side of each cushioned adhesive tape (9). Apply to windshield side of each brace (3, 4, 5).
2. Place **new** windshield with front side down on clean padded surface.
3. Remove paper backing from cushioned adhesive tape (9) on thicker horizontal brace. Align holes in brace with holes in windshield and press brace into position.
4. Turn windshield over (front side up).
5. Remove paper backing from cushioned adhesive tape (9) on thinner horizontal brace. Align holes in brace with holes in windshield. Edges of inner and outer braces must be even. Press into position.
6. Install three short screws through the middle and outer holes of the horizontal braces. Loosely install acorn nuts on rear side.
7. See Figure 2-133. Remove paper backing from cushioned adhesive tape (9) on vertical brace. With the stepped end overlapping the horizontal brace and the end with the slight bend angled outward, align holes in brace with holes in windshield. Press into position.
8. Position mounting bracket on rear side of windshield with the wireform facing inboard.
9. Install the longer screw at the stepped end where the vertical brace overlaps the horizontal brace, and short screws in the remaining holes. Loosely install acorn nuts.
10. Install second vertical brace and mounting bracket in a similar manner.
11. See Figure 2-134. Following the sequence shown, tighten all screws to 20-25 **in-lbs** (2.3-2.8 Nm).
12. Install windshield. See 2.31 WINDSHIELD: FLD.

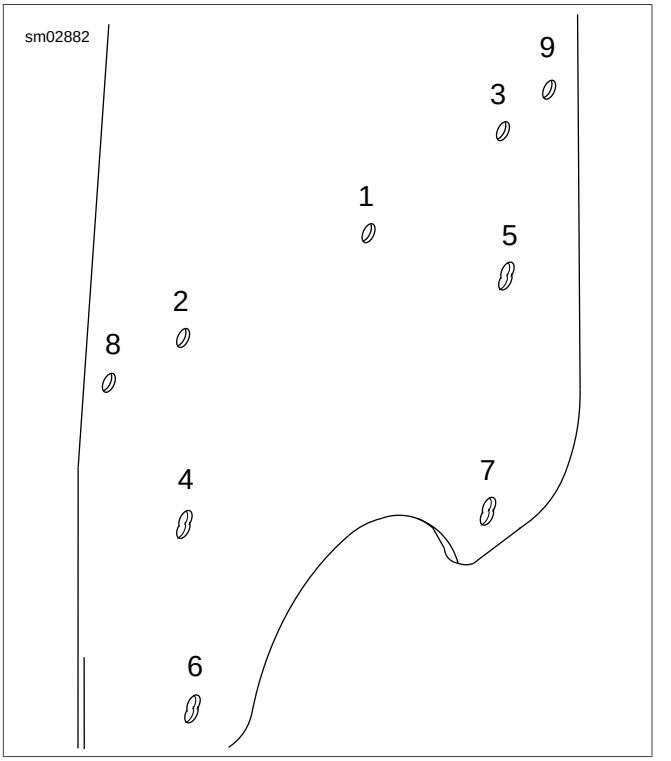


Figure 2-134. Windshield Torque Sequence

SADDLEBAGS: FLD 2.32

SADDLEBAGS: FLD MODEL

Removal

1. Open saddlebag.
2. See Figure 2-135. Inside the saddlebag, pull the knob outward and rotate to the UNLOCK position.
3. See Figure 2-136. Hold the saddlebag and slide it toward the rear of the motorcycle to remove it from the three docking posts.

NOTES

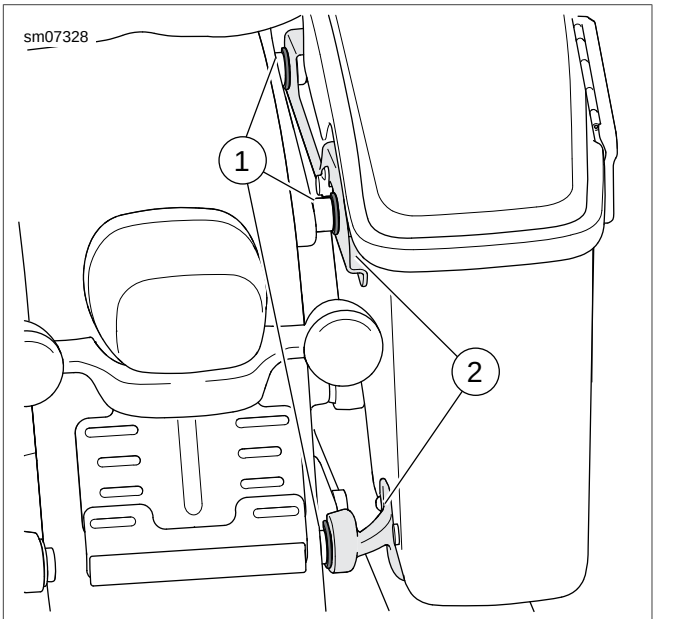
- *The left saddlebag may be easily tipped if not secured in the upright position.*
- *The right saddlebag has a larger cavity along the bottom to accommodate the rear fork and axle.*
- *Place saddlebags on a level surface, preferably supported against a wall or other surface.*
- *Avoid dragging the saddlebags on the ground to prevent scratches.*

Installation

NOTE

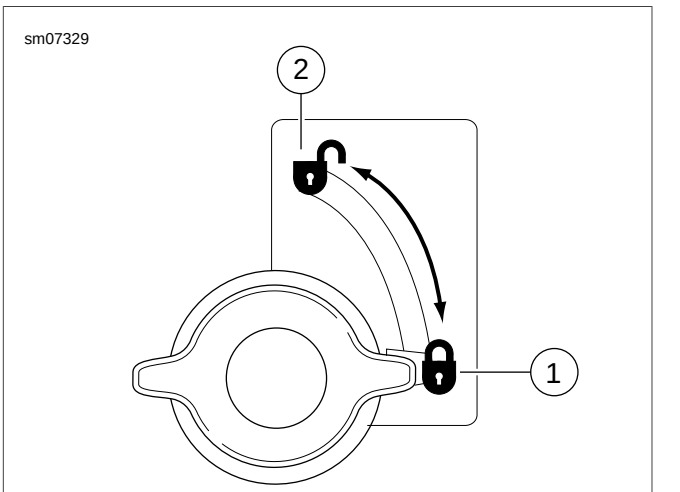
Replace missing or damaged docking bushings before mounting saddlebags.

1. See Figure 2-135. With the knob in the UNLOCK position, slide the saddlebag on to the motorcycle, engaging the saddlebag brackets to the three docking posts on the side of the motorcycle.
2. See Figure 2-136. Pull the knob outward and rotate to the LOCK position until the knob snaps into place.
3. Check that the saddlebag is secure on all three docking posts and the locking latch is secure. Gently pull the saddlebag to the rear to check that it is secure on the motorcycle.
4. Close saddlebag and make sure the lid is shut and latched.



1. Docking posts
2. Saddlebag brackets (with docking bushings)

Figure 2-135. Saddlebag Installation: FLD Model



1. Lock
2. Unlock

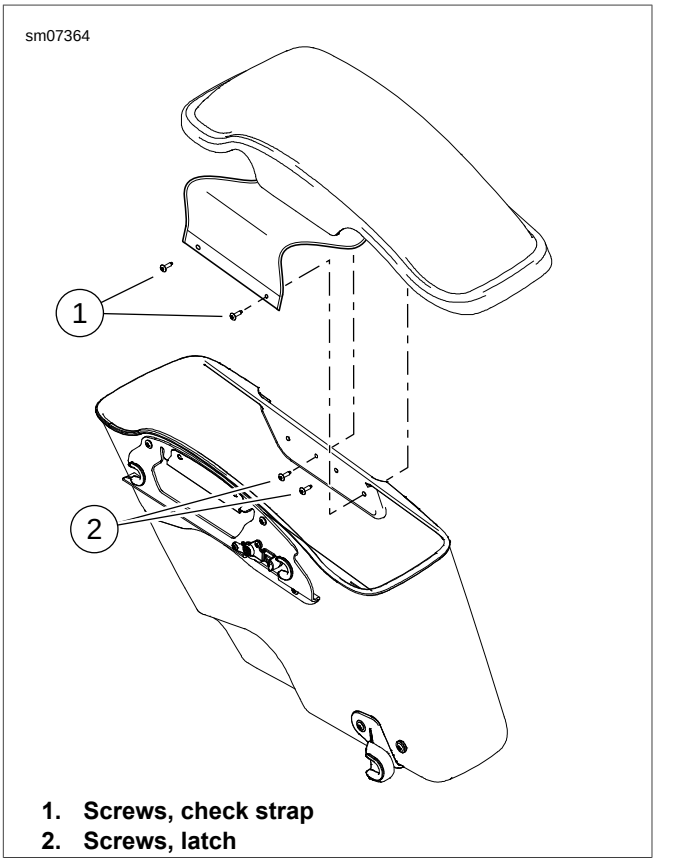
Figure 2-136. Saddlebag Lock Knob: FLD Model

SADDLEBAGS

FASTENER	TORQUE VALUE	
Bracket, saddlebag theft prevention: FLD	24-36 **in-lbs**	2.7-4.1 Nm
Saddlebag latch pivot screw: FLD	96-120 **in-lbs**	10.8-13.6 Nm
Saddlebag inner/outer support screws: FLD	96-120 **in-lbs**	10.8-13.6 Nm
Saddlebag lower mount screws: FLD	96-120 **in-lbs**	10.8-13.6 Nm
Saddlebag latch attaching screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm

Disassembly

1. Remove saddlebags. See 2.32 SADDLEBAGS: FLD.
2. See Figure 2-137. Remove two screws (1) to release tether assembly from saddlebag.
3. Remove two remaining screws (2) to release latch and lid from saddlebag. Set lid assembly aside.
4. See 2.32 SADDLEBAGS: FLD, Saddlebag Lid for service of the cover assembly.
5. See Figure 2-138. Remove screws (17) and remove lower mount (16).
6. Remove screws (15) and outer support (12).
7. Remove cap (11).
8. Hold nut (10) and remove screw (1). Remove latch (2), spring (3), spacer (6) and knob (9).
9. Remove screw (4) and washer (5). Remove inner support (8).
10. Remove screws (14) and bracket (13) if necessary.

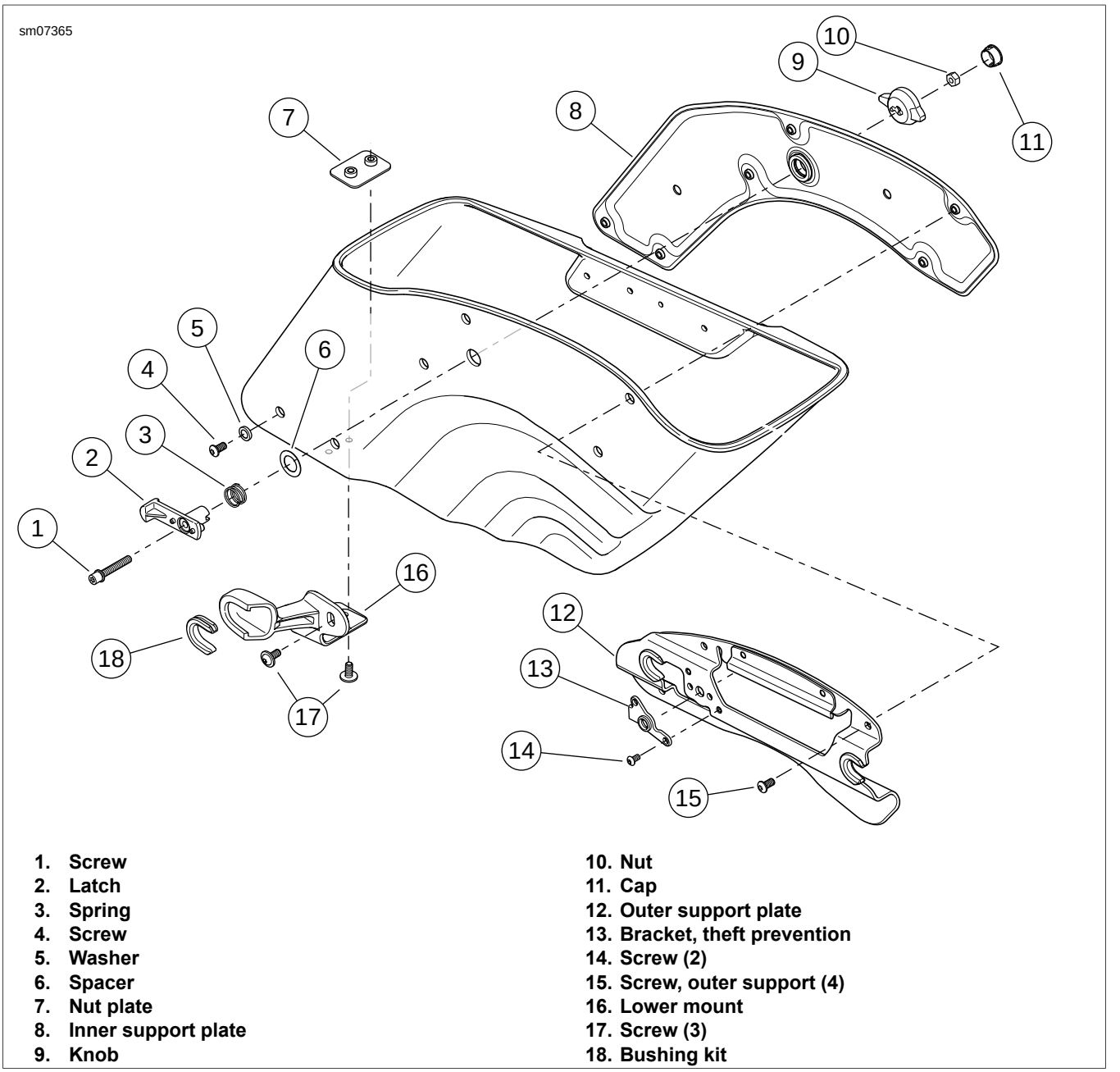


1. **Screws, check strap**
2. **Screws, latch**

Figure 2-137. Saddlebag: FLD

Assembly

1. See Figure 2-138. Install bracket (13). Tighten to 24-36 **in-lbs** (2.7-4.1 Nm).
2. Hold inner support in place and loosely install screw (4) and washer (5). Loosely install a second screw (15) to help support inner support.
3. Install latch components (1, 2, 3, 6, 9, 10). Tighten to 96-120 **in-lbs** (10.8-13.6 Nm). Install cap (11).
4. Install outer support (12). Tighten screws (4, 15) to 96-120 **in-lbs** (10.8-13.6 Nm).
5. Install lower mount (16). Tighten to 96-120 **in-lbs** (10.8-13.6 Nm).
6. Install lid assembly. Tighten screws to 14-20 **in-lbs** (1.6-2.3 Nm).
7. Install saddlebags.



1. **Screw**
2. **Latch**
3. **Spring**
4. **Screw**
5. **Washer**
6. **Spacer**
7. **Nut plate**
8. **Inner support plate**
9. **Knob**
10. **Nut**
11. **Cap**
12. **Outer support plate**
13. **Bracket, theft prevention**
14. **Screw (2)**
15. **Screw, outer support (4)**
16. **Lower mount**
17. **Screw (3)**
18. **Bushing kit**

Figure 2-138. Saddlebag Lower: FLD

SADDLEBAG LID

FASTENER	TORQUE VALUE	
Tether assembly screws: FLD	8-12 **in-lbs**	0.9-1.4 Nm
Saddlebag latch screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm
Saddlebag latch faceplate screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm
Saddlebag latch faceplate nut: FLD	7-17 **in-lbs**	0.8-1.9 Nm
Saddlebag lock screws: FLD	30-40 **in-lbs**	3.4-4.5 Nm

Saddlebag Lid Seal

1. Remove seal from lid.
2. Clean old adhesive using 3M GENERAL PURPOSE ADHESIVE REMOVER.
3. Verify seal insert is in place and located near the end of the seal.

NOTE

See Figure 2-139. The seal adheres to the side of the inner flange surface.

4. Align end with tube inside lid with line on saddlebag lid. Begin installation being sure seal is flush with edge of flange. See Figure 2-140.
5. Use care not to stretch seal during installation and continue until ends meet.

NOTE

Ends must meet with no gap.

6. Trim flush or slightly long and complete installation.
7. Close and latch lid.
8. Inspect to verify seal is in complete contact with saddlebag.

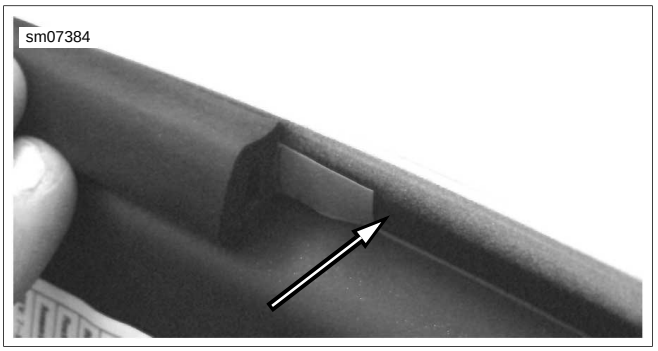


Figure 2-139. Saddlebag Lid Seal

Disassembly

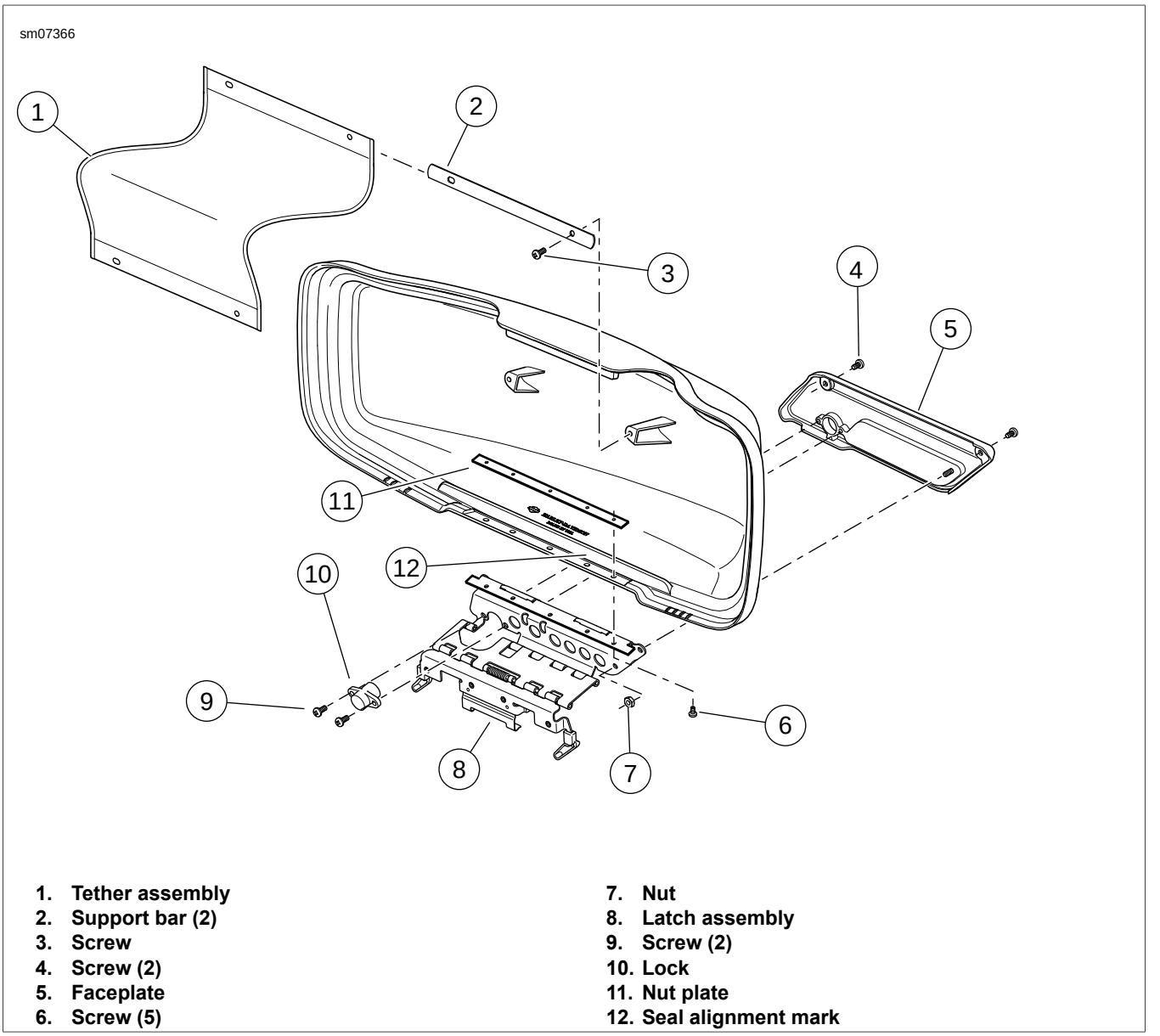
NOTE

Lock assembly, faceplate and tether assembly can be replaced without disassembling saddlebag.

1. Remove lid from saddlebag. See 2.32 SADDLEBAGS: FLD, Saddlebags.
2. See Figure 2-140. Remove screws (9) and lock assembly (10).
3. Remove screws (4), nut plate (11) and nut (7). Remove faceplate (5).
4. Remove screws (6) and latch assembly (8).
5. Remove screws (3) and remove tether assembly (1).

Assembly

1. Secure tether assembly (1) to lid with screws. Tighten to 8-12 **in-lbs** (0.9-1.4 Nm)
2. Install latch assembly. Tighten to 14-20 **in-lbs** (1.6-2.3 Nm).
3. Install faceplate. Tighten screws (4) to 14-20 **in-lbs** (1.6-2.3 Nm). Tighten nut (7) to 7-17 **in-lbs** (0.8-1.9 Nm).
4. Install lock assembly. Tighten screws to 30-40 **in-lbs** (3.4-4.5 Nm).
5. Install lid on saddlebag. See 2.32 SADDLEBAGS: FLD, Saddlebags.



1. Tether assembly
2. Support bar (2)
3. Screw
4. Screw (2)
5. Faceplate
6. Screw (5)
7. Nut
8. Latch assembly
9. Screw (2)
10. Lock
11. Nut plate
12. Seal alignment mark

Figure 2-140. Saddlebag Lid: FLD

JIFFY STAND 2.33

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

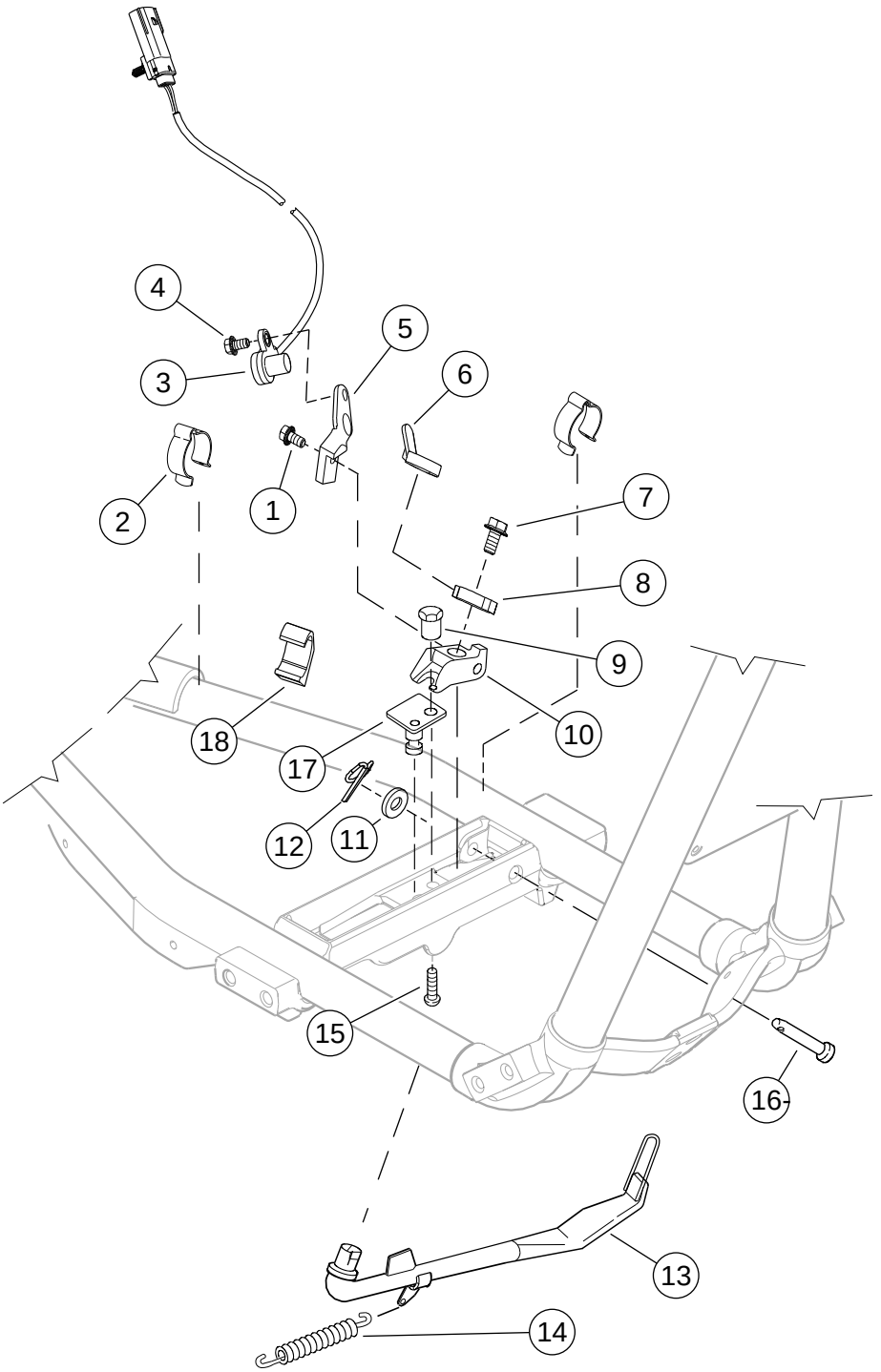
Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)

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 2-141. Inspect top of catch (6 or 8) and pivot block mating surface (10). If covered with dirt, wipe dirt off with a shop towel.
3. Apply ANTI-SEIZE LUBRICANT to mating surface.
4. Move jiffy stand leg (13) forward and back to spread lubricant between mating parts.
5. Apply ANTI-SEIZE LUBRICANT on shaft of jiffy stand leg and pin (16) to lubricate the mating surface between pin and pivot block (10). Move leg back and forth and downward while spraying lubricant.
6. Check that jiffy stand operates correctly before placing in service.

sm03871d



1. Sensor bracket screw (HDI)
2. Harness retainer (2) (HDI)
3. Sensor (HDI)
4. Sensor screw (HDI)
5. Sensor bracket (HDI)
6. Catch (HDI)
7. Bolt
8. Catch (non-HDI)
9. Threaded spacer
10. Pivot block
11. Washer
12. Pretzel clip
13. Jiffy stand leg
14. Spring
15. Screw
16. Pin (secures pivot block)
17. Anchor plate
18. Bumper

Figure 2-141. Jiffy Stand

JIFFY STAND SENSOR: HDI MODELS

FASTENER	TORQUE VALUE	
Jiffy stand sensor screw	96-144 **in-lbs**	10.8-16.3 Nm

1. See Figure 2-142. Record harness routing for ease of assembly. Disconnect sensor connector located under the seat.
2. See Figure 2-141. Remove harness retainers (2).
3. Remove screw (4) and remove sensor (3).
4. If necessary, remove screw (1) and remove sensor bracket (5).
5. Installation is in reverse of removal. Tighten screws (1, 4) to 96-144 **in-lbs** (10.8-16.3 Nm).

NOTES

- *See Figure 2-142. Verify the sensor harness is routed to the inside of the left-lower frame and under the rear engine mount casting.*
- *See Figure 2-143. Route the sensor harness in the same retainer cavity (3) as the vent tube (2).*

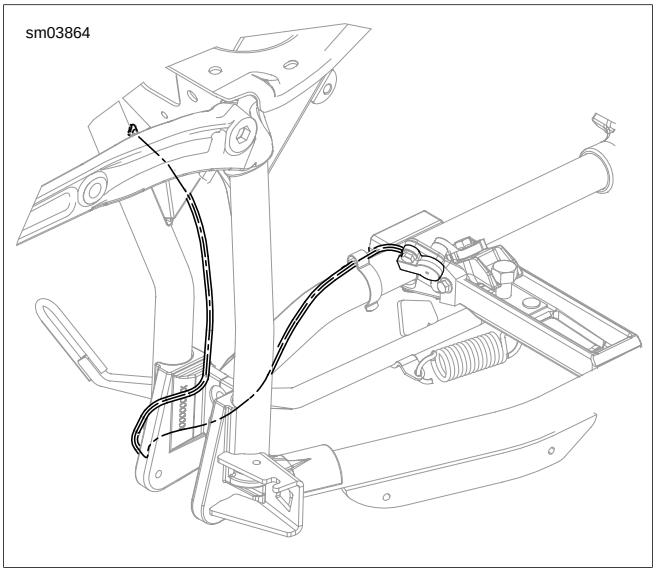
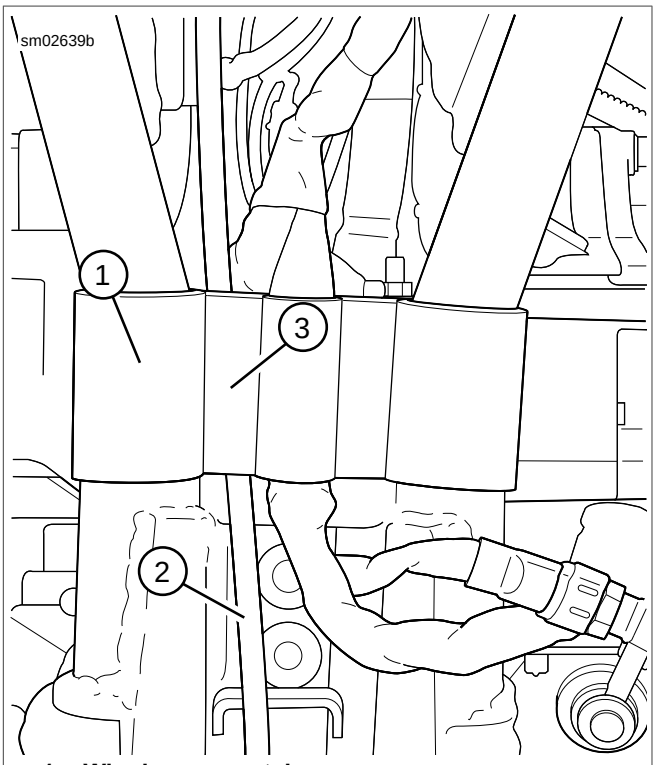


Figure 2-142. Jiffy Stand Sensor Harness Routing



1. **Wire harness retainer**
2. **Vent line**
3. **Retainer cavity**

Figure 2-143. Harness Retainer

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. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-141. Remove pretzel clip (12) and washer (11) from pin (16). Discard pretzel clip.
3. Detach spring (14) from jiffy stand and anchor plate (17).
4. Pull pin (16) from between frame tubes. Jiffy stand and pivot block components will drop as an assembly.

INSTALLATION

⚠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 2-141. Place pivot block (10) and jiffy stand leg (13) assembly between frame tubes.
2. Insert pin (16) from front of vehicle through frame tubes and pivot block. Secure with washer and a **new** pretzel clip (12).

3. Attach spring (14) to anchor plate (17) and jiffy stand leg. When properly installed, hook on spring side connected to jiffy stand leg faces upward.
4. Apply ANTI-SEIZE LUBRICANT on shaft of jiffy stand leg and pin to lubricate the mating surface between pin and pivot block. Move leg back and forth and downward while spraying lubricant.
5. Check that jiffy stand operates correctly before placing in service.

ENGINE MOUNTS 2.34

REMOVAL

NOTE

Motorcycle must be upright and level before performing this procedure.

⚠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)

Front Isolator

1. Support front of engine with jack.
2. See Figure 2-144. Remove bolts, lockwashers and washers securing front isolator (2) to frame.
3. Remove bolts, flange nuts and washers securing the front isolator (2) to the front engine bracket (1). Remove front isolator (2).

Rear Isolator

1. Remove left side footpeg and debris deflector.
2. Use a jack on the oil pan to support rear of transmission.
3. See Figure 2-144. Use a long extension, from right side of motorcycle and a wrench on the left side of rear isolator (3). Remove bolts, flange nuts and washers securing rear isolator to powertrain.

NOTE

Vary the load on the mount to slip the bolts out of the rear isolator (3).

4. Remove bolts, lockwashers and washers securing rear isolator (3) to frame. Remove rear isolator (3).

INSTALLATION

FASTENER	TORQUE VALUE	
Front isolator mounting bolts to front engine bracket	22-27 ft-lbs	29.8-36.6 Nm
Front isolator mounting bolts to frame	22-27 ft-lbs	29.8-36.6 Nm
Front engine bracket bolts to engine	25-32 ft-lbs	34.0-43.3 Nm
Engine mount flange nut	22-27 ft-lbs	29.8-36.6 Nm
Rear isolator to frame bolts	22-27 ft-lbs	29.8-36.6 Nm

Front Isolator

1. Support front of engine with jack.
2. See Figure 2-144. Install front engine bracket (1) to front of engine with bolts and washers. Tighten finger-tight.
3. Place front isolator (2) in position on frame and install bolts lockwashers and washers securing front isolator (2) to frame. Tighten finger-tight.
4. Install bolts, flange nuts and washers securing front isolator (2) to front engine bracket (1). Tighten flange nuts to 22-27 ft-lbs (29.8-36.6 Nm).
5. Tighten isolator to frame bolts to 22-27 ft-lbs (29.8-36.6 Nm).
6. Tighten front engine bracket bolts to 25-32 ft-lbs (34.0-43.3 Nm).

NOTE

For best isolator performance, minimum clearance between engine bracket and top rubber snubber on engine isolator is 0.030 in. (0.76 mm). Measure the vehicle at rest, vertically without jack under engine.

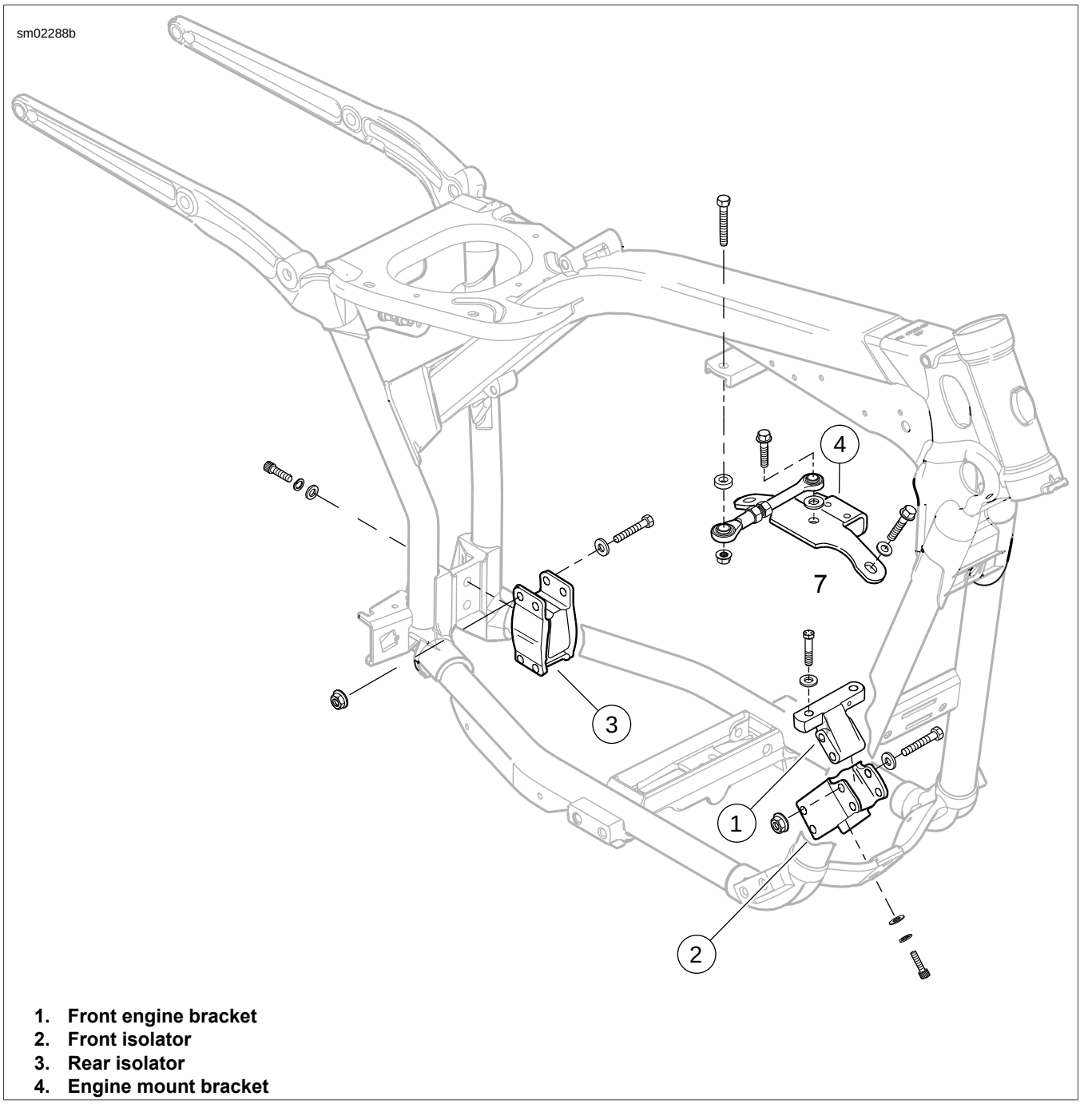
Rear Isolator

1. See Figure 2-144. Use a jack on the oil pan to support rear of transmission.

NOTE

Vary the load on the rear isolator (3) to slip the bolts in.

2. Place rear isolator (3) in position on frame and install bolts, lockwashers and washers. Tighten finger-tight.
3. Use a long extension, from right side of motorcycle and a wrench on the left side of rear isolator (3). Install bolts, flange nuts and washers. Tighten flange nuts to 22-27 ft-lbs (29.8-36.6 Nm).
4. Tighten rear isolator (3) to frame bolts to 22-27 ft-lbs (29.8-36.6 Nm).
5. Install left side footpeg and debris deflector.



1. **Front engine bracket**
2. **Front isolator**
3. **Rear isolator**
4. **Engine mount bracket**

Figure 2-144. Engine Mounts

SAREE GUARD: INDIA MODELS 2.35

REPLACEMENT

FASTENER	TORQUE VALUE	
Rear fender cover rear screw: All models	12-18 ft-lbs	16.3-24.4 Nm
Rear fender cover front screw: All models	12-18 ft-lbs	16.3-24.4 Nm
Rear shock, lower screws: All models	30-40 ft-lbs	40.6-54.2 Nm

Removal

1. Support motorcycle so rear wheel is off floor or lift in order to remove rear fender fasteners.
2. See 2.21 REAR SHOCK ABSORBERS. Remove lower shock screws and lower rear wheel to floor or lift.
3. Remove rear screws from rear fender and turn signals.
4. Remove front screws from rear fender.

Installation

NOTE

See 2.27 REAR FENDER. Install saree guards between fender and frame, using existing fender mounting hardware.

1. See Figure 2-145. Install front mounting screw through saree guard and leave loose at this time.
2. See Figure 2-146. Install rear mounting screw through saree guard into turn signal. Tighten to 12-18 ft-lbs (16.3-24.4 Nm).
3. Tighten front screw to 12-18 ft-lbs (16.3-24.4 Nm).
4. Raise rear wheel and install lower shock screws. Tighten to 30-40 ft-lbs (40.6-54.2 Nm).

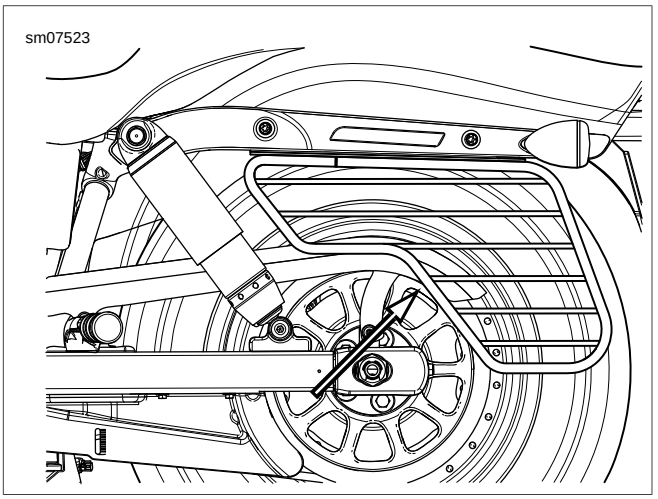


Figure 2-145. Saree Guard, left side, India

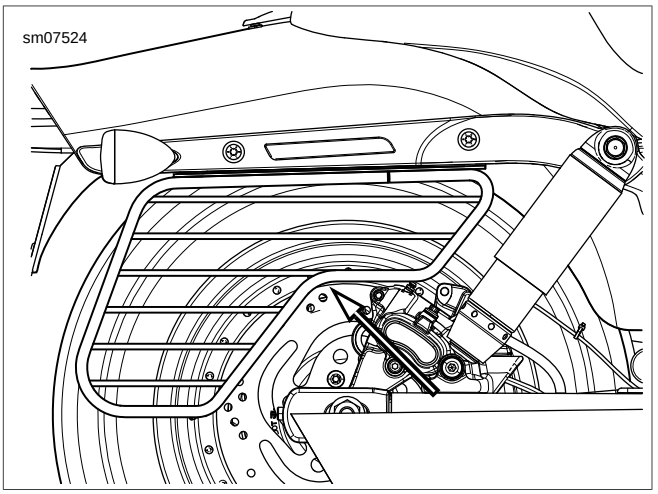


Figure 2-146. Saree Guard, right side, India

MEDALLIONS, SERIALIZED BADGES AND TANK EMBLEMS 2.36

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, the 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 surface to dry.

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 the medallion.*
- *The adhesive bonds in 72 hours at room temperature.*

2. Remove protective film from back of medallion.
3. Apply even pressure across the 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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NOTES

FASTENER TORQUE VALUES 3.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Breather assembly screws	120-156 **in-lbs**	13.6-17.6 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover
Cam chain tensioner fasteners	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam sprocket flange bolt, 1st torque	15 ft-lbs	20.3 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam sprocket flange bolt, final torque	34 ft-lbs	46.1 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Pipe Plug and Oil Fittings
Crankcase screws, 1st torque	120 **in-lbs**	13.6 Nm	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly/Loosen then final tighten
Crankcase screws, final torque	15-19 ft-lbs	20.3-25.8 Nm	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
Crankshaft sprocket bolt, 1st torque	15 ft-lbs	20.3 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Crankshaft sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cylinder head bolts, 1st torque	120-144 **in-lbs**	13.6-16.3 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/ See procedure to tighten
Cylinder head bolts, 2nd torque	15-17 ft-lbs	20.3-23.0 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Cylinder head bolts, final torque	90 degrees	90 degrees	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Cylinder stud	120-240 **in-lbs**	13.6-27.1 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Cylinder Studs
Cylinder torque plate bolts, 1st torque	120-144 **in-lbs**	13.6-16.3 Nm	3.21 CYLINDER, Inspection/ See procedure to tighten
Cylinder torque plate bolts, 2nd torque	15-17 ft-lbs	20.3-23.0 Nm	3.21 CYLINDER, Inspection
Cylinder torque plate bolts, final torque	90 degrees	90 degrees	3.21 CYLINDER, Inspection
Drain plug, engine	14-21 ft-lbs	19.0-28.5 Nm	3.29 OIL PAN, Installation/Clean plug before installation
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure

FASTENER	TORQUE VALUE		NOTES
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Front engine mounting bracket bolts	25-32 ft-lbs	33.9-43.4 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Pushrods, Lifters and Covers
Main bearing, right, retaining screws	40-70 **in-lbs**	4.5-7.9 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
Oil pan screws	132-156 **in-lbs**	14.9-17.6 Nm	3.29 OIL PAN, Installation
Oil pump screws, 1st torque	40-45 **in-lbs**	4.5-5.1 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Oil pump screws, final torque	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Piston jet screws	25-35 **in-lbs**	2.8-3.9 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover screws	15-18 ft-lbs	20.3-24.4 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Secondary cam chain tensioner fastener	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Camshafts
Shifter foot lever pinch bolt	18-22 ft-lbs	24.4-29.8 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	3.8 TROUBLESHOOTING, Compression Test
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure

SPECIFICATIONS 3.2

SPECIFICATIONS

Table 3-1. Engine: Twin Cam 96

ITEM	SPECIFICATION	
Number of cylinders	2	
Type	4-cycle, 45 degree V-Type, air cooled	
Compression ratio	9.2:1	
Bore	3.75 in	95.3 mm
Stroke	4.38 in	111.3 mm
Displacement	96.0 in^3	1585 cm^3
Lubrication system	Pressurized, dry sump	

Table 3-2. Engine: Twin Cam 103

ITEM	SPECIFICATION	
Number of cylinders	2	
Type	4-cycle, 45 degree V-Type, air-cooled	
Compression ratio	9.6:1	
Bore	3.875 in	98.42 mm
Stroke	4.375 in	111.12 mm
Displacement	103.0 in^3	1690 cm^3
Lubrication system	Pressurized, dry sump	

Table 3-3. Oiling System

OIL PUMP	DATA
Type	Twin geroter, dual scavenge, crank mounted and driven, internal oil pump, dry sump
Pressure	30-38 psi (207-262 kN/m^2) at 2000 rpm and normal operating temperature of 230 °F (110 °C)
Filtration	5 micron media, filtered between pump and engine

Table 3-4. Rocker Arms Specifications

ROCKER ARMS	IN	MM
Shaft fit in bushing (loose)	0.0005-0.0020	0.013-0.051
End clearance	0.003-0.013	0.08-0.33
Bushing fit in rocker arm (tight)	0.002-0.004	0.051-0.102

Table 3-5. Rocker Arm Shaft Specifications

ROCKER ARM SHAFTS	IN	MM
Shaft fit in rocker arm support plate (loose)	0.0007-0.0022	0.018-0.056

Table 3-6. Hydraulic Lifter Specifications

HYDRAULIC LIFTERS	IN	MM
Fit in crankcase (loose)	0.0009-0.0026	0.002-0.066

Table 3-7. Cylinder Head Specifications

CYLINDER HEAD	IN	MM
Valve guide in head (tight)	0.0022-0.0033	0.051-0.084
Valve seat in head (tight)	0.003-0.0045	0.076-0.114
Valve stem protrusion (min)	2.022	51.36
Head gasket surface (flatness)	0-0.006	0-0.152

Table 3-8. Valve Specifications

VALVES	IN	MM
Exhaust: fit in guide	0.001-0.003	0.0254-0.0762
Intake: fit in guide	0.001-0.003	0.0254-0.0762
Seat width	0.040-0.062	1.02-1.58
Stem protrusion from cylinder head boss	2.012-2.032	51.10-51.61

Table 3-9. Valve Springs Specifications

VALVE SPRINGS	IN	MM
Closed	135 lbs @ 1.850 in.	61.2 kg @ 47.0 mm
Open	312 lbs @ 1.300 in.	141.5 kg @ 33.0 mm
Free length	2.325 in.	59.1 mm

Table 3-10. Piston: Twin Cam 96

PISTON		IN	MM
Fit in cylinder (loose)		0.0014-0.0025	0.036-0.064
Piston pin fit (loose)		0.0002-0.0005	0.005-0.013
Ring end gap	Top compression	0.010-0.020	0.254-0.508
	2nd compression	0.014-0.024	0.356-0.610
	Oil control ring	0.010-0.050	0.254-1.27
Ring side clearance	Top compression	0.0012-0.0037	0.030-0.094
	2nd compression	0.0012-0.0037	0.030-0.094
	Oil control rails	0.0031-0.0091	0.079-0.231

Table 3-11. Piston: Twin Cam 103

PISTON		IN	MM
Fit in cylinder (loose)		0.0014-0.0025	0.036-0.064
Piston pin fit (loose)		0.0002-0.0005	0.005-0.013
Ring end gap	Top compression	0.012-0.022	0.305-0.559
	2nd compression	0.015-0.025	0.381-0.635
	Oil control ring	0.010-0.050	0.254-1.270
Ring side clearance	Top compression	0.0012-0.0037	0.030-0.094
	2nd compression	0.0012-0.0037	0.030-0.094
	Oil control rails	0.0031-0.0091	0.079-0.231

Table 3-12. Connecting Rod Specifications

CONNECTING ROD	IN	MM
Piston pin fit (loose)	0.0007-0.0012	0.018-0.030
Side play between flywheels	greater than 0.005	greater than 0.13
Connecting rod to crankpin (loose)	0.0004-0.0017	0.0102-0.0432

Table 3-13. Flywheel Specifications

FLYWHEELS	IN	MM
Runout (shaft measured in case)	0.000-0.010	0.0-0.254
Runout (measured in truing stand)	0.000-0.004	0.0-0.102
End play	0.003-0.013	0.076-0.330

Table 3-14. Crankshaft/Sprocket Shaft Bearing Specifications

CRANKSHAFT/SPROCKET SHAFT BEARINGS	IN	MM
Roller bearing fit (loose)	0.0002-0.0015	0.005-0.038
Bearing fit in crankcase (tight)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0004-0.0014	0.010-0.036

SERVICE WEAR LIMITS 3.3

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

ROCKER ARM/ROCKER ARM SHAFT	REPLACE IF WEAR EXCEEDS	
	IN	MM
Shaft fit in bushing (loose)	0.0035	0.089
End clearance	0.025	0.635
Shaft fit in rocker arm support (loose)	0.0035	0.089

Table 3-16. Hydraulic Lifter

HYDRAULIC LIFTER	REPLACE IF WEAR EXCEEDS	
	IN	MM
Fit in crankcase	0.006	0.152
Roller fit	0.0015	0.038
Roller end clearance	0.022	0.559

Table 3-17. Cam Support Plate

ITEM	REPLACE IF WEAR EXCEEDS	
	IN	MM
Cam chain tensioner shoe thickness	0.060 min.	1.52 min.
Crankshaft bore maximum ID	0.8545	21.704
Camshaft bore	1.1023	27.998
Flatness	0.010	0.25

Table 3-18. Oil Pump

OIL PUMP	REPLACE IF WEAR EXCEEDS	
	IN	MM
Rotor tip clearance	0.004	0.10
Rotor thickness variation	0.001	0.025
Rotor protrusion (pump assembled)	0.015-0.025	0.38-0.64

Table 3-19. Cylinder Head

CYLINDER HEAD	REPLACE IF	
	IN	MM
Valve guide press fit in head	Less than 0.002	Less than 0.05
Valve seat press fit in head	Less than 0.002	Less than 0.05
Valve seat width (max)	0.062	1.57
Valve margin (min)	0.031	0.80
Valve stem protrusion (max)	2.069	52.55
Head warpage (max)	0.006	0.15

Table 3-20. Cylinder

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

Table 3-21. Cylinder Bore (Twin Cam 96)

CYLINDER BORE	REPLACE IF WEAR EXCEEDS	
	IN	MM
Standard	3.752	95.301
0.005 in oversize	3.757	95.428
0.010 in oversize	3.762	95.555

Table 3-22. Cylinder Bore (Twin Cam 103)

ITEM	REPLACE IF WEAR EXCEEDS	
	IN	MM
Standard	3.877	98.48
0.005 in oversize	3.882	98.60
0.010 in oversize	3.887	98.73

Table 3-23. Piston

PISTON		REPLACE IF WEAR EXCEEDS	
		IN	MM
Fit in cylinder (loose)		0.003	0.076
Piston pin fit (loose)		0.0008	0.020
Ring end gap	Top compression	0.030	0.762
	2nd compression	0.034	0.864
	Oil control rails	0.050	1.27
Ring side clearance	Top compression	0.0045	0.114
	2nd compression	0.0045	0.114
	Oil control rails	0.010	0.254

Table 3-24. Connecting Rod

CONNECTING ROD	REPLACE IF WEAR EXCEEDS	
	IN	MM
Piston pin fit (loose)	0.002	0.051
Fit on crankpin (loose)	0.002	0.051

Table 3-25. Breather Assembly

BREATHER ASSEMBLY	REPLACE IF WEAR EXCEEDS	
	IN	MM
Breather cover warpage	0.005	0.13
Breather baffle warpage	0.005	0.13

Table 3-26. Valve Stem to Guide

VALVE STEM TO GUIDE	REPLACE IF WEAR EXCEEDS	
	IN	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Table 3-27. Flywheel

FLYWHEEL	REPLACE IF WEAR EXCEEDS	
	IN	MM
Runout (shaft measured in case)	0.012	0.305
Runout (measured in truing stand)	0.005	0.127
End play	0.013	0.330

Table 3-28. Crankshaft Roller Bearing

CRANKSHAFT ROLLER BEARING	REPLACE IF	
	IN	MM
Roller bearing fit (loose)	More than 0.0015	More than 0.038
Bearing fit in crankcase (tight)	Less than 0.0038	Less than 0.097
Inner race on crankshaft (tight)	Less than 0.0004	Less than 0.010

ENGINE OIL FLOW 3.4

OIL FEED

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.

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.

Oil flows from the oil pan through an internal passageway at the front of the transmission housing, and enters the lower passageway (A1) cast into the rear right side of the crankcase.

Oil exits a hole in the crankcase flange (B2). It then enters a hole on the inboard side of the cam support plate. Passing through a channel in the cam support plate (A3), oil enters the feed side of the oil pump. See 3.5 OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate (A4).

A passage in this channel connects to a pressure relief valve mounted in the bypass port of the cam support plate (A5). When the oil pressure exceeds the setting of the relief valve spring 35 psi (241.3 kPa), the orifice opens to bypass excess oil back to the feed side of the pump (A3).

Oil not returned to the oil pump feed side exits a hole on the inboard side of the cam support plate. Oil then flows through a hole in the crankcase flange (B6). Oil flows through a passageway in the crankcase and exits the lower off-center hole in the oil filter mount (D8). The oil pressure sending unit (B7) is also connected to this passage.

After circulating through the oil filter, the flow is directed back into the crankcase through the center hole in the oil filter mount (D9). Exiting a passageway in the crankcase through a hole in the crankcase flange (B10), the flow of oil reenters the cam support plate.

Filtered oil is then routed to the top and bottom ends of the engine as described in 3.4 ENGINE OIL FLOW, Top End and 3.4 ENGINE OIL FLOW, Bottom End which follow.

TOP END

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.

Oil passes through a channel in the cam support plate. 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 (E16), 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 (B25).

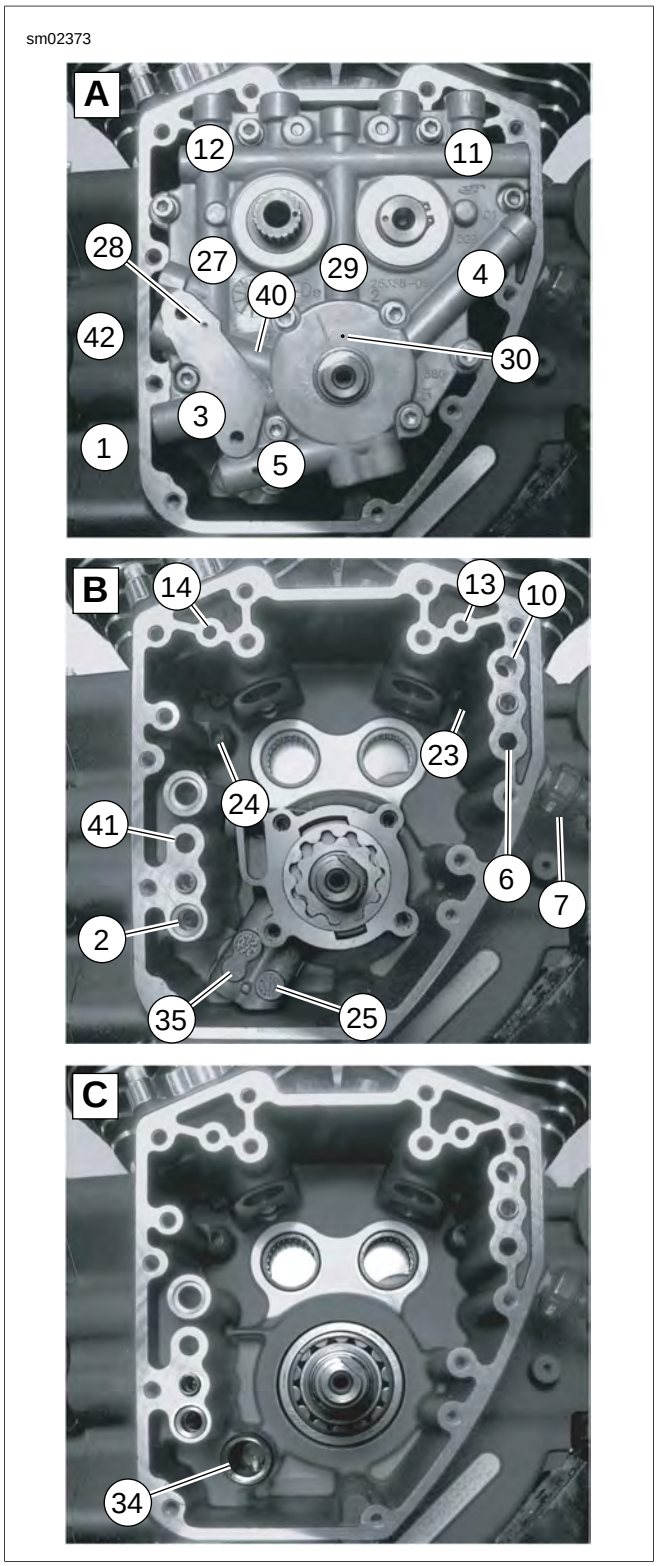


Figure 3-1. Engine Oil Flow: Cam Support Plate/Right Crankcase Half

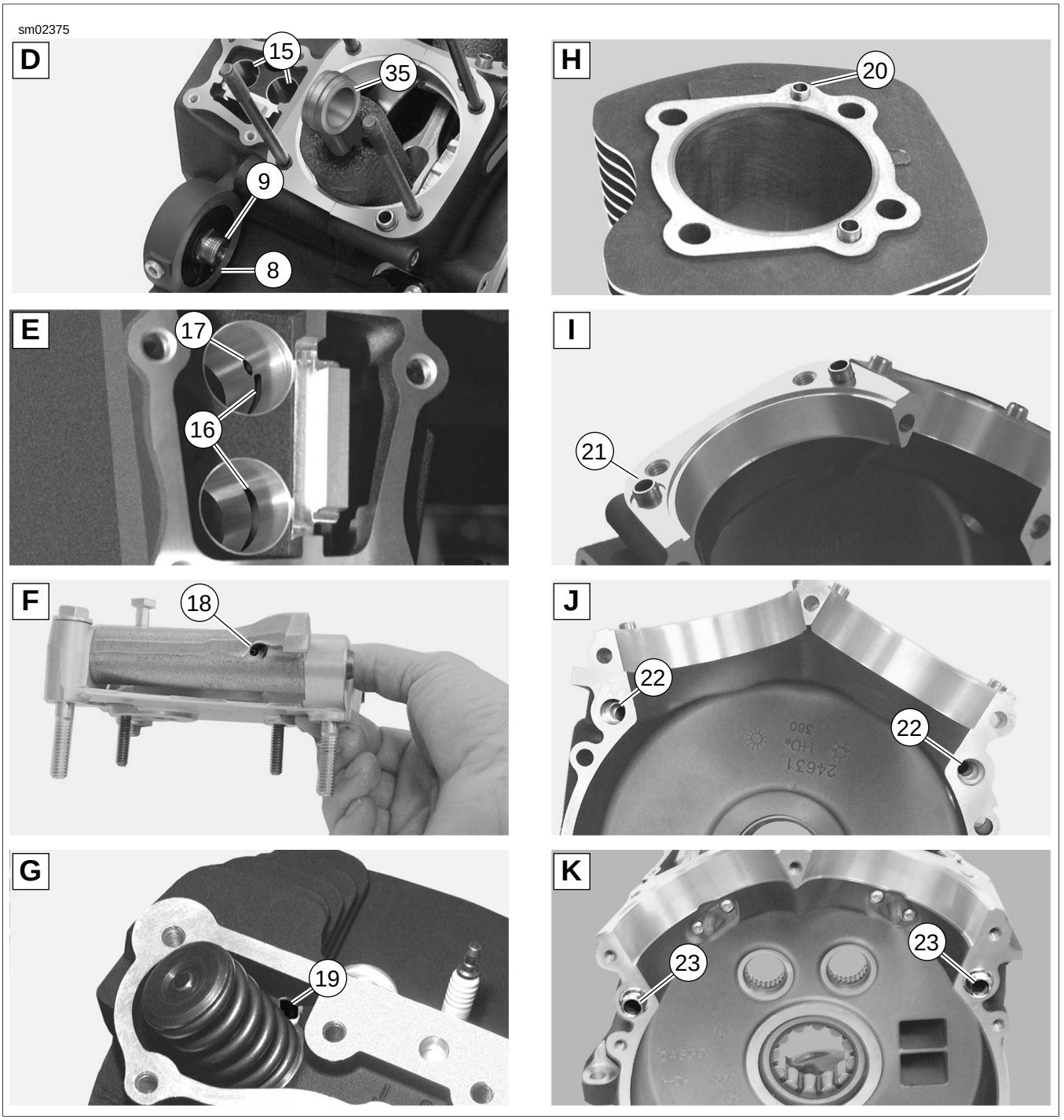


Figure 3-2. Engine Oil Flow: Top End

BOTTOM END

Three illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Top end oil flow is shown in Figure 3-2.
- Bottom end oil flow is shown in Figure 3-3.

Oil traveling through the horizontal passage (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 (A28).

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 (L31).

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 (M32).

Since the oil mist also lubricates the cylinder walls, three holes on each side of the piston (in the area of the third ring land) evacuate excess oil scraped from the walls on the piston downstroke.

The piston jets (N33) 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 kPa). 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 (O34) to lubricate the piston pin. The spray also allows a portion of the oil to reach the upper rod bushing (D35).

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P36). Oil in the sump is drawn to the scavenge side of the oil pump (B35) through an internal channel (P37, C34).

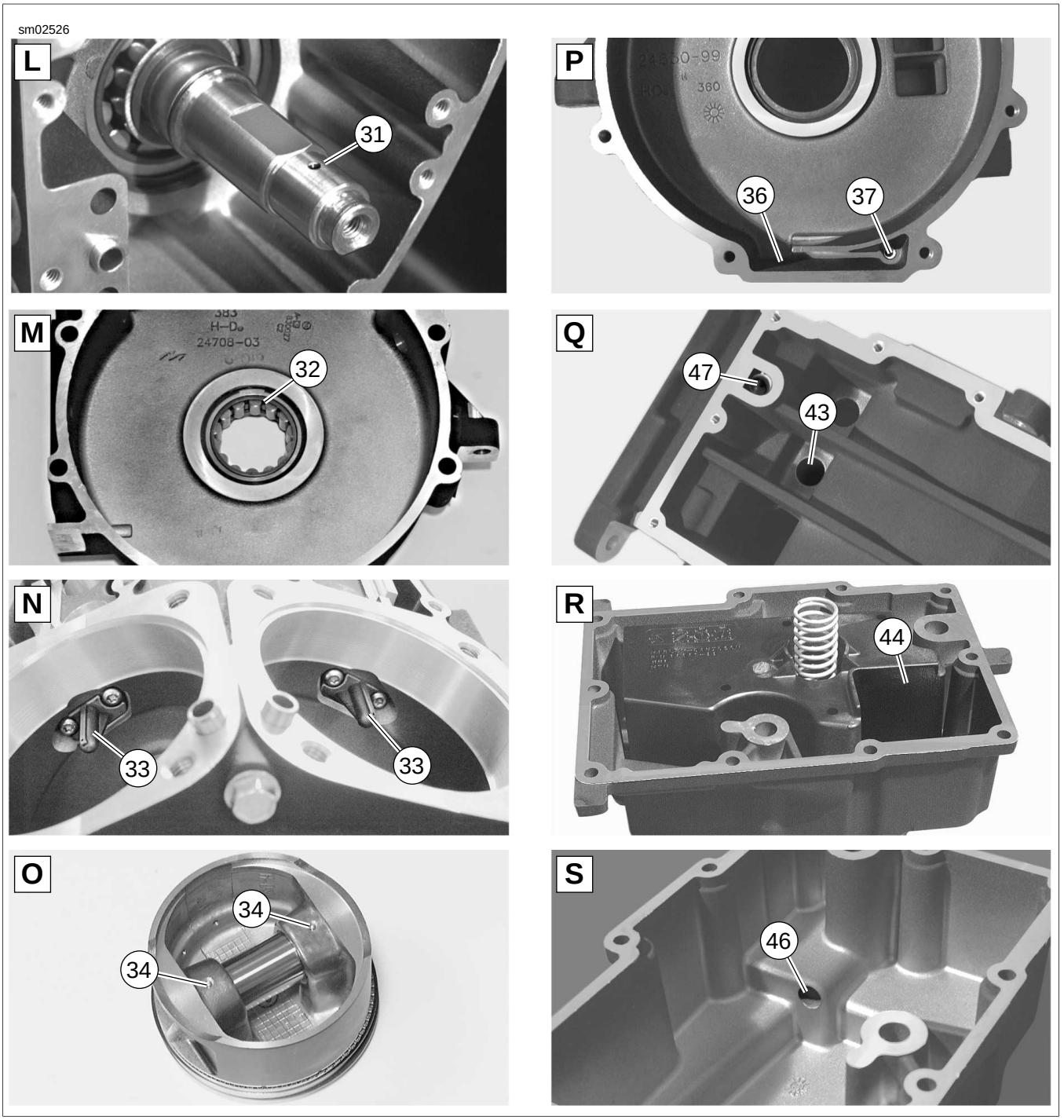


Figure 3-3. Engine Oil Flow-Bottom End

OIL RETURN

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-1.
- Bottom end oil flow is shown in Figure 3-3.

The "dual kidney" designation given to the oil pump refers to its two scavenging functions, whereby it simultaneously draws oil from both the cam and flywheel compartments.

Oil sucked up by the scavenge lobes passes through the scavenge gerotors of the oil pump and is directed through a return channel in the cam support plate (A40). See 3.5 OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate,the oil enters the upper hole in the crankcase flange (B41).

The oil flows through the upper passageway in the crankcase (A42), enters a passageway at the front of the transmission housing and empties into the oil pan at the front of the baffle (Q43, R44).

The oil flows to the rear of the oil pan along each side of the baffle. Spring tension holds the unit tight against the bottom of the pan to prevent oil from entering or escaping around the

perimeter of the baffle. At the back of the oil pan, the oil enters the open side of the baffle where it is redirected for-ward. The baffle plates slow the circulation of the oil through the pan to enhance cooling.

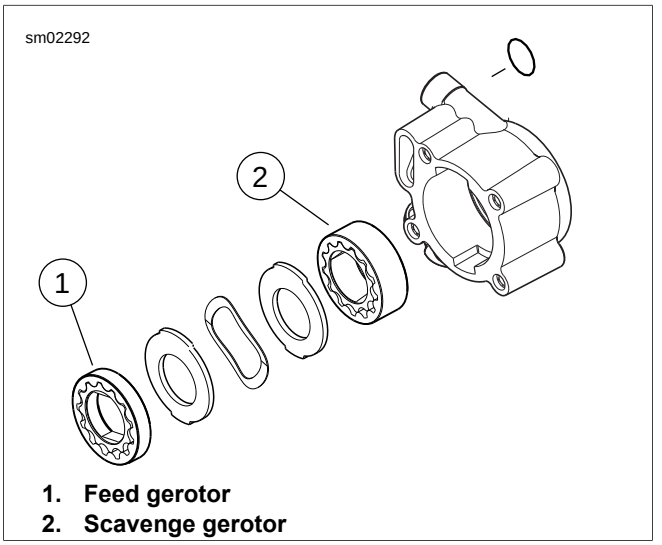
Oil pickup occurs in the front compartment of the baffle where a passageway in the casting (S46) directs the flow upward. Passing through a second passageway in the trans-mission housing (Q47), the flow of oil enters the lower passageway in the crankcase (A1) to repeat the circuit.

OIL PUMP OPERATION 3.5

GENERAL

See Figure 3-4. The oil pump consists of a housing containing two gerotor gear sets driven by the crankshaft. One is feed and the other scavenge. 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.

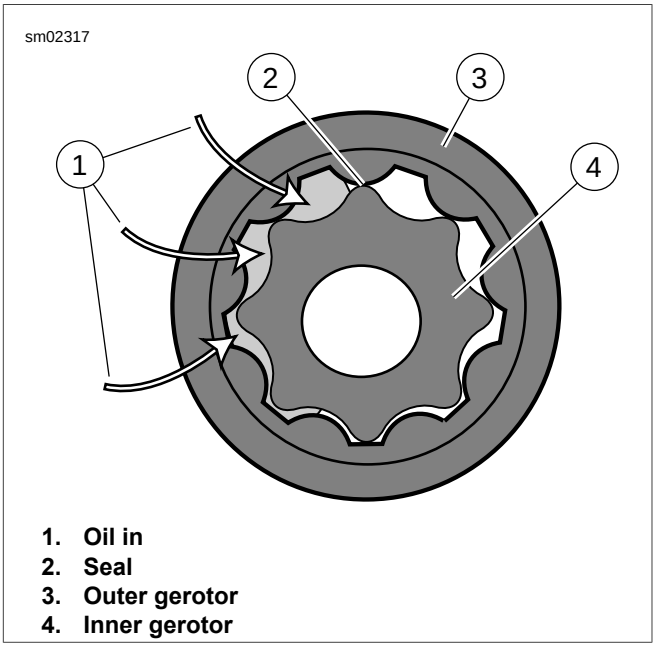


1. **Feed gerotor**
2. **Scavenge gerotor**

Figure 3-4. Oil Pump Gerotors

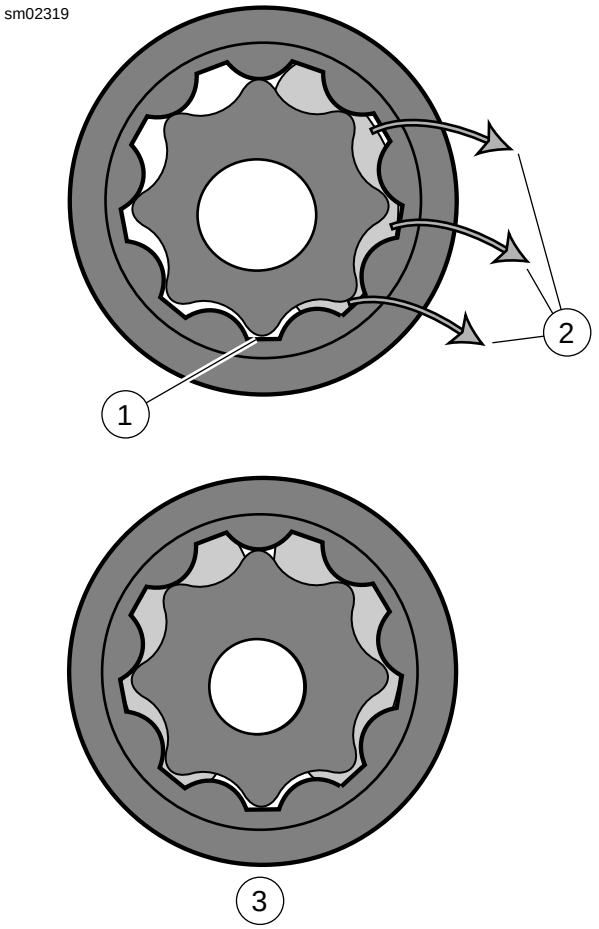
OPERATION

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.



1. **Oil in**
2. **Seal**
3. **Outer gerotor**
4. **Inner gerotor**

Figure 3-5. Inlet Side Oil Flow



1. **Seal**
2. **Oil out**
3. **Continuous flow**

Figure 3-6. Outlet Side Oil Flow

See Figure 3-5. 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 3-6. 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.

BREATHER OPERATION 3.6

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. Burning crankcase vapors eliminates the pollutants normally discharged from the crankcase.

See Figure 3-7. As pistons push downward, displaced air in the crankcase is vented through the crankshaft roller 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 if 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.

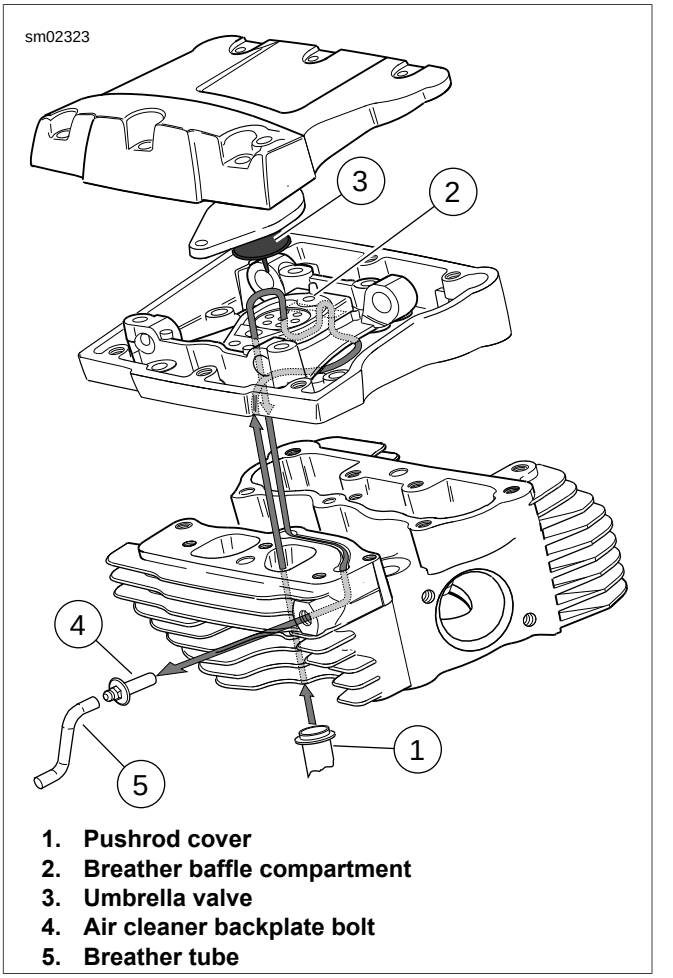
Passing through the oil filter gauze, the vapor passes through the umbrella valve (3) into the breather compartment. The umbrella valve only allows air to be vented one way.

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

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



1. **Pushrod cover**
2. **Breather baffle compartment**
3. **Umbrella valve**
4. **Air cleaner backplate bolt**
5. **Breather tube**

Figure 3-7. Breather Air Flow

OIL PRESSURE 3.7

OIL PRESSURE INDICATOR LAMP

See Figure 3-8. The red OIL PRESSURE indicator lamp illuminates to indicate improper circulation of the engine oil. The lamp illuminates when the ignition is first turned on (before the engine is started), but should be extinguished once the engine is running.

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. In freezing weather, the oil feed and return lines can 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.

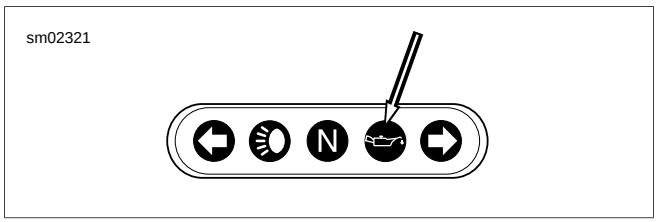


Figure 3-8. Oil Pressure Indicator Lamp

CHECKING OIL PRESSURE

PART NUMBER	TOOL NAME
HD-96921-52D	OIL PRESSURE GAUGE SET

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 3-9. Remove oil pressure switch from crankcase. See 7.26 OIL PRESSURE SWITCH.
3. See Figure 3-10. Install OIL PRESSURE GAUGE SET (Part No. HD-96921-52D).
   a. Install adapter (2) in oil pressure switch mounting hole. Tighten adapter until snug.
   b. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten until snug.
4. Start engine and allow to reach operating temperature.

NOTE

Engine oil should be at normal operating temperature, 230 °F (110 °C), for an accurate reading.

5. Oil pressure should be within specifications. Refer to Table 3-29.
6. See 3.8 TROUBLESHOOTING if readings are questionable.
7. Stop engine. Remove oil pressure gauge assembly.
8. Install oil pressure switch. See 7.26 OIL PRESSURE SWITCH.

Table 3-29. Oil Pressure

CHECK	SPECIFICATION *	
	SAE	METRIC
Oil pressure - min at idle	5 psi	34.5 kPa
Oil pressure - normal at 2000 rpm	30-38 psi	207-262 kPa
Oil pressure - max	50 psi	345 kPa
* With oil at normal operating temperature of 230 °F (110 °C)		

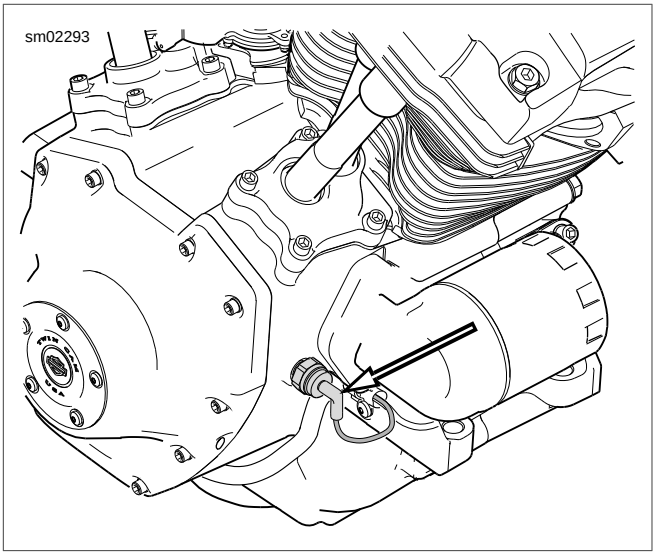
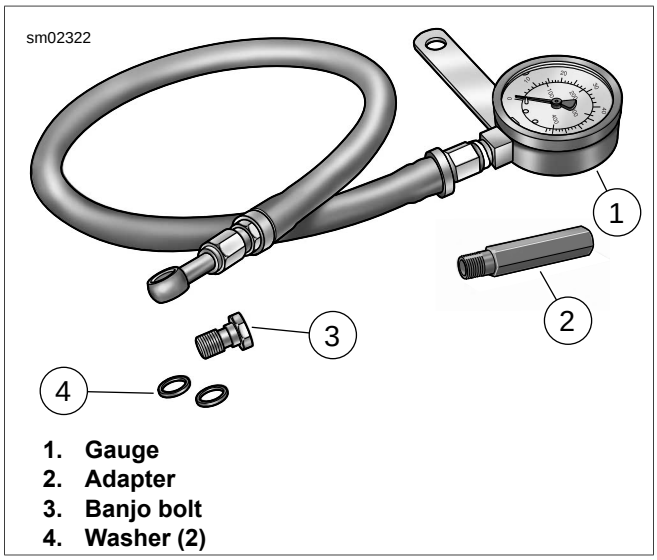


Figure 3-9. Oil Pressure Switch



1. Gauge
2. Adapter
3. Banjo bolt
4. Washer (2)

Figure 3-10. Oil Pressure Gauge Set

DIAGNOSING VALVE TRAIN NOISE

To diagnose and correct noisy hydraulic lifters and valve train components, use the following procedures:

1. With engine and oil at normal operating temperature, check oil pressure at 2000 rpm. If oil pressure is above 50 psi (345 kPa) or below 5 psi (34 kPa), inspect 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.
8. Grind valves and valve seats. See 3.20 CYLINDER HEAD, Valve and Seat Refacing.

COMPRESSION TEST

PART NUMBER	TOOL NAME
HD-33223-1	CYLINDER COMPRESSION GAUGE

FASTENER	TORQUE VALUE	
Spark plug	12-18 ft-lbs	16.3-24.4 Nm

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. Operate engine to normal operating temperature.
2. Disconnect spark plug wires, clean around plug base and remove plugs.
3. Remove air cleaner. See 4.3 AIR CLEANER ASSEMBLY.
4. Connect compression tester to front cylinder per manufacturer's instructions.
5. Make sure transmission is in neutral. Hold throttle at wide open throttle position and crank engine continuously through 5 to 7 full compression strokes and note gauge readings at the end of the first and last compression strokes. Record test results.
6. Repeat test on rear cylinder.

NOTE

Verify throttle is closed before assembling air cleaner.

7. Assemble the air cleaner. See 4.3 AIR CLEANER ASSEMBLY.
8. If the final readings are a minimum of 125 psi (862 kPa) and do not indicate more than a 10% variance between cylinders, compression is considered normal. If compression does not meet specifications, refer to Table 3-30 for possible causes.
9. If readings do not meet specifications, inject approximately 1/2 oz. (15 ml) engine oil into each cylinder and repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.
10. Install the spark plugs and tighten to 12-18 ft-lbs (16.3-24.4 Nm). Connect spark plug wires.

Table 3-30. Compression Test Results

DIAGNOSIS	TEST RESULTS
Ring trouble	Compression low on first stroke, tends to build up on the following strokes, but does not reach normal. Improves considerably when oil is added to cylinder.
Valve trouble	Compression low on first stroke, does not build up much on following strokes. Does not improve considerably with the addition of oil. Check for correct pushrod length.
Head gasket leak	Same reaction as valve trouble.

CYLINDER LEAKDOWN TEST

PART NUMBER	TOOL NAME
HD-35667-A	CYLINDER LEAKDOWN TESTER

NOTE

On vehicles with automatic compression release (ACR), verify the ACRs are closed for this test. Perform the test with the ignition/light 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 leakage 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 engine until it reaches normal operating temperature.

2. Stop engine. Clean dirt from around spark plugs. Remove the spark plugs.
3. Rotate crankshaft until piston in the cylinder being tested is at top dead center of compression stroke (both valves closed) during the test.
4. To keep the engine from turning over when air pressure is applied to the cylinder, engage transmission in highest gear and lock the rear brake.

NOTE

Before performing the cylinder leakdown test, verify the tester itself is free from leakage. Apply a soap solution around all tester fittings. Connect cylinder leakdown tester to compressed air source. Look for any bubbles that indicate leakage from the tester.

5. Following the manufacturer's instructions, perform a cylinder leakdown test on the front cylinder. Make a note of the percent of leakage. Leakage greater than 10% 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 Leakdown Test. If further testing is needed, remove suspect head(s) and inspect for the following:

Check Prior To Cylinder Head Removal

1. Oil level overfull.
2. Oil carryover.
3. Breather hose restricted.
4. Restricted oil filter.

Check After Cylinder Head Removal

1. Oil return passages for clogging.
2. Valve guide seals.
3. Valve guide to valve stem clearance.
4. Gasket surface of both head and cylinder.
5. Cylinder head casting's porosity allowing oil to drain into combustion chamber.
6. O-ring damaged or missing from oil pump/crankcase junction.

HOW TO USE THIS SECTION 3.9

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 seated 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.

TOP END SERVICE 3.10

ENGINE IN CHASSIS

Table 3-31. Engine In Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.17 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE*.
	PUSHRODS, LIFTERS AND COVERS	Inspect and repair. See 3.19 PUSHRODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.20 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.21 CYLINDER*.
	PISTON	Inspect and repair. See 3.22 PISTON*.
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.		

ENGINE REMOVED FROM CHASSIS

Table 3-32. Engine Removed From Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.17 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE*.
	PUSHRODS, LIFTERS AND COVERS	Inspect and repair. See 3.19 PUSHRODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.20 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.21 CYLINDER*.
	PISTON	Inspect and repair. See 3.22 PISTON.
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.		

CAM COMPARTMENT SERVICE 3.11

ENGINE IN CHASSIS

Table 3-33. Engine In Chassis: Cam Compartment Service

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.		
Dissassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.17 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE.
	PUSHRODS, LIFTERS AND COVERS.	Inspect and repair. See 3.19 PUSHRODS, LIFTERS AND COVERS.
Disassemble bottom end. See 3.24 CAM COMPARTMENT AND COMPONENTS.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.24 CAM COMPARTMENT AND COMPONENTS*.
	OIL PUMP	Inspect and repair. See 3.25 OIL PUMP.
Assemble bottom end. See 3.24 CAM COMPARTMENT AND COMPONENTS.		
Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.28 CRANKCASE ASSEMBLY when this step is completed during bottom end service.		

ENGINE REMOVED FROM CHASSIS

Table 3-34. Engine Removed: Flywheel Compartment Service or Complete Engine Overhaul

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.17 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE	Inspect and repair. See 3.18 ROCKER ARM SUPPORT PLATE.
	PUSHRODS, LIFTERS AND COVERS	Inspect and repair. See 3.19 PUSHRODS, LIFTERS AND COVERS.
	CYLINDER HEAD	Inspect and repair. See 3.20 CYLINDER HEAD.
	CYLINDER	Inspect and repair. See 3.21 CYLINDER.
	PISTON	Inspect and repair. See 3.22 PISTON.
Disassemble bottom end.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.24 CAM COMPARTMENT AND COMPONENTS.
	CRANKCASE	Inspect crankcase and repair. See 3.26 CRANKCASE DISASSEMBLY AND REPAIR.
		Inspect and repair flywheel/connecting rod assembly. See 3.27 FLYWHEEL AND CONNECTING RODS.
Assemble bottom end. See 3.28 CRANKCASE ASSEMBLY and 3.24 CAM COMPARTMENT AND COMPONENTS.		
Assemble top end. See 3.23 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.		

STRIPPING MOTORCYCLE FOR SERVICE 3.12

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 though 7.

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 battery cables, negative cable first.
4. Remove heat shields and exhaust. See 4.15 EXHAUST SYSTEM.
5. Remove two screws and rear brake pedal and right footpeg bracket. Disconnect assembly from master cylinder actuator lever.
6. Remove air cleaner cover and backplate. See 4.3 AIR CLEANER ASSEMBLY.

⚠WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

7. Drain and remove the fuel tank. See 4.4 FUEL TANK.
8. Loosen and remove throttle control cables from induction module. See 4.8 INDUCTION MODULE.
9. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
10. Remove right side stabilizer link nut, Allen bolt and spacer from frame tab. Remove two bolts from horn bracket and cylinder heads. Remove stabilizer link and horn bracket as an assembly.
11. Remove induction module connectors and induction module. See 4.8 INDUCTION MODULE.

ASSEMBLING MOTORCYCLE AFTER SERVICE 3.13

PROCEDURE

FASTENER	TORQUE VALUE	
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm

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. Install induction module connectors. See 4.8 INDUCTION MODULE.

NOTE

If the stabilizer link bolt cannot be installed without pushing the engine to the right or left, perform the vehicle alignment procedure. See 2.9 VEHICLE ALIGNMENT.

2. Install horn bracket/stabilizer link assembly to frame tab and cylinder heads. Place spacer between frame tab and stabilizer link. Make sure horn ground wire is installed beneath bracket on front cylinder.
   a. Tighten the stabilizer link bolt to 18-22 ft-lbs (24.4-29.8 Nm).
   b. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 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. See 4.8 INDUCTION MODULE.
5. Install fuel tank, fuel gauge connector, fuel tank crossover tube and vapor valve. See 4.4 FUEL TANK.
6. Connect fuel hose to fuel tank.
7. Install backplate and air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
8. Install master cylinder actuator lever. Install right footpeg bracket and rear brake pedal with two screws. Tighten to 25-35 ft-lbs (33.9-47.5 Nm).
9. Install heat shields and exhaust. See 4.15 EXHAUST SYSTEM.
10. 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)

11. Install seat.
12. Remove motorcycle from lift.

REMOVING ENGINE FROM CHASSIS 3.14

PROCEDURE

NOTE

Removal begins on the RIGHT SIDE of the motorcycle.

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. (00049a)

3. Disconnect battery cables, negative cable first.
4. Remove air cleaner cover and backplate. See 4.3 AIR CLEANER ASSEMBLY.

⚠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)

5. Drain fuel from fuel tank into suitable container. Remove fuel tank. See 4.4 FUEL TANK.
6. Loosen and remove throttle control cables from induction module. See 4.8 INDUCTION MODULE.
7. Remove heat shields and exhaust. See 4.15 EXHAUST SYSTEM.
8. Using a 5/16 in. Allen bit, remove two screws and rear brake pedal and right footpeg bracket. Remove cotter pin and clevis pin and disconnect assembly from master cylinder actuator lever.
9. Disconnect the following connectors.
   a. Crank position sensor connector [79].
   b. Stator/voltage regulator connector [46].
   c. Oil pressure sending unit connector [140].
10. Drain oil from primary chaincase. See 1.9 PRIMARY CHAINCASE LUBRICANT.
11. Loosen pinch bolt and remove shifter foot lever from primary chaincase.
12. Using a 5/16 in. Allen bit, remove two screws and left side footpeg and bracket.
13. Remove primary chaincase cover and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
14. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
15. Remove right side stabilizer link nut, Allen bolt and spacer from frame tab. Remove two bolts from horn bracket and cylinder heads. Remove stabilizer link and horn bracket as an assembly.
16. Remove MAP sensor connector [80] from MAP sensor.
17. 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. See 2.23 CLUTCH CONTROL.
18. Place wire loom or other protective material on both front downtubes to prevent damage.
19. Position jack under transmission. Place a block of wood between jack and oil pan to prevent damage to oil pan and raise jack just enough to support transmission.
20. Using a ratchet and ratchet strap, secure transmission to chassis (vertically) to prevent transmission from shifting position.
21. Remove four bolts and washers that connect engine to transmission.
22. Remove two bolts and washers that secure engine to front engine mount bracket.
23. Remove engine oil dipstick.
24. Using a suitable hoist, remove engine from chassis from the right side.

NOTE

The engine positively aligns to the transmission with two dowels that fit in the lower mounting bolt holes and extend out approximately 0.5 in. (12.7 mm) from the transmission. The engine may have to be rotated counterclockwise slightly to disengage the locating dowels.

INSTALLING ENGINE IN CHASSIS 3.15

PROCEDURE

FASTENER	TORQUE VALUE	
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm
Front engine mounting bracket bolts	25-32 ft-lbs	33.9-43.4 Nm
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm
Shifter foot lever pinch bolt	18-22 ft-lbs	24.4-29.8 Nm
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm

1. Using a suitable hoist, position engine in chassis and align four transmission mounting holes. A pry bar wrapped in a shop rag may be needed to position engine so two lower locating dowel pins engage holes in crankcase.
2. Install **new** engine to transmission case gasket.
3. Install four bolts and washers to mate transmission and engine. Tighten bolts finger tight.
4. Align two front engine mount bracket holes with engine and install bolts and washers. Tighten bolts finger tight.
5. See Figure 3-11. Tighten the four transmission mounting bolts in the sequence shown as follows:
   a. Tighten to 15 ft-lbs (20.3 Nm).
   b. Tighten to 34-39 ft-lbs (46.1-52.9 Nm).
6. Tighten two crankcase to front engine mounting bracket bolts to 25-32 ft-lbs (33.9-43.4 Nm).
7. Remove ratchet strap securing transmission to chassis.
8. Install engine oil dipstick.
9. Remove jack and block of wood from under transmission.
10. Remove wire loom or protective material from front downtubes.
11. See 2.23 CLUTCH CONTROL. Route clutch cable back to left side of motorcycle and install to clutch lever. Secure clutch cable to left downtube with clip.
12. Install MAP sensor connector [80] to MAP sensor.

NOTE

If the stabilizer link bolt cannot be installed without pushing the engine to the right or left, perform the vehicle alignment procedure. See 2.9 VEHICLE ALIGNMENT.

13. Install horn bracket/stabilizer link assembly to frame tab and cylinder heads. Place spacer between frame tab and stabilizer link. Make sure horn ground wire is installed beneath bracket on front cylinder.
    a. Tighten the stabilizer link bolt to 18-22 ft-lbs (24.4-29.8 Nm).
    b. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
14. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.17 SPARK PLUGS.
15. Install **new** gasket between engine and primary chaincase. Install primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.

NOTE

Make sure spring washer is in position on shifter shaft between engine and primary chaincase.

16. Adjust clutch. See 1.11 CLUTCH.



Figure 3-11. Transmission Housing to Crankcase Torque Sequence

17. Adjust primary chain. See 1.9 PRIMARY CHAINCASE LUBRICANT.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

18. Install primary chaincase cover and magnetic drain plug. See 5.5 PRIMARY CHAINCASE HOUSING.
19. Fill primary chaincase with primary chaincase lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT.
20. Install left side footpeg and bracket with two screws. Tighten to 25-35 ft-lbs (33.9-47.5 Nm).

21. Install shifter foot lever to primary chaincase. Tighten pinch bolt to 18-22 ft-lbs (24.4-29.8 Nm). Connect shifter linkage.
22. Move to right side of motorcycle. Connect the following connectors.
    a. Crank position sensor connector [79]
    b. Stator/voltage regulator connector [46]
    c. Oil pressure sending unit connector [140]
23. Install rear brake pedal and right footpeg bracket with two screws. Tighten to 25-35 ft-lbs (33.9-47.5 Nm). Install actuator lever to pedal with clevis pin and **new** cotter pin. See 2.12 REAR BRAKE MASTER CYLINDER.
24. Install exhaust and heat shields. See 4.15 EXHAUST SYSTEM.
25. Install throttle control cables to induction module. See 4.8 INDUCTION MODULE.

⚠WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

26. Install fuel tank and connect crossover tube, fuel gauge connector and clip vapor valve to downtube. See 4.4 FUEL TANK.
27. Install backplate and air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.

⚠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)

28. 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)

29. Install seat.
30. Install **new** oil filter. Fill engine to either wet or dry capacity depending upon service status. See 1.6 ENGINE OIL AND FILTER.

NOTE

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

31. Remove motorcycle from lift.
32. Perform vehicle alignment. See 2.9 VEHICLE ALIGNMENT.
33. Check rear brakes, clutch and throttle for proper operation.
34. Check engine oil level with **both** cold check and hot check procedures. See 1.6 ENGINE OIL AND FILTER.

TOP END OVERHAUL: DISASSEMBLY 3.16

GENERAL

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

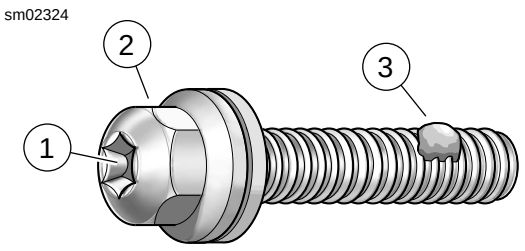
To perform a complete top end overhaul, follow all steps listed in this section including inspection and repair procedures.

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 spray to thoroughly clean exterior surfaces of engine prior to disassembly.
2. See Figure 3-13. Following the sequence shown, alternately loosen the six rocker cover bolts. Remove the rocker cover bolts and their captive washers.
3. Remove the rocker cover and gasket. Discard gasket.



1. **Internal hex**
2. **External hex**
3. **Lock patch**

Figure 3-12. Rocker Cover Bolt (Rocker Housing Bolt Similar)

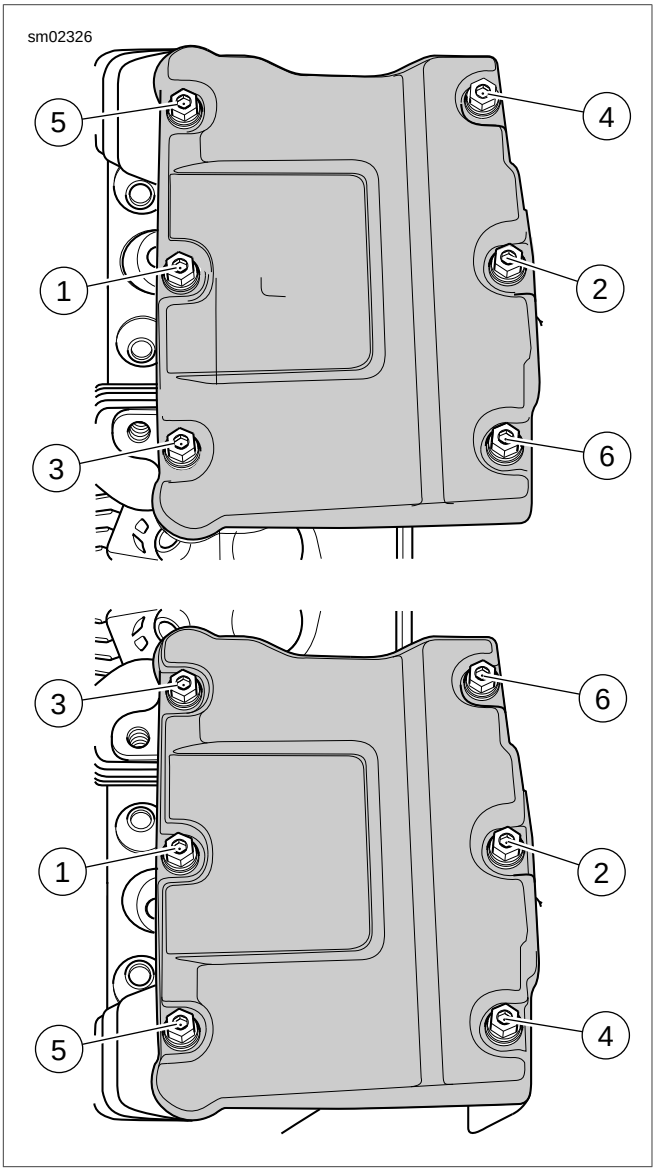
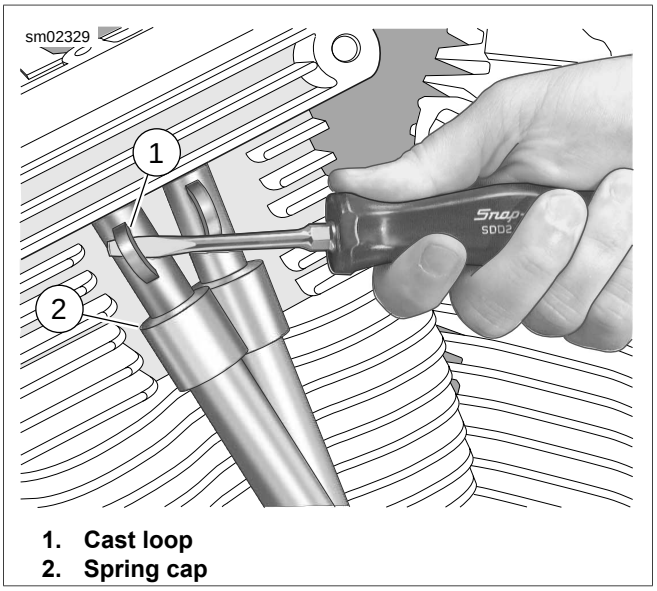


Figure 3-13. Rocker Cover Bolt Removal Sequence

ROCKER ARM SUPPORT PLATE

PART NUMBER	TOOL NAME
HD-48283	CRANKSHAFT ROTATING WRENCH

1. See Figure 3-14. Insert the blade of a small screwdriver into cast loop (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.



1. **Cast loop**
2. **Spring cap**

Figure 3-14. Removing Spring Cap Retainer

2. Collapse upper and lower pushrod covers.

NOTE

Do not attempt to rotate the crankshaft by placing a socket on the crankshaft or primary cam sprocket flange 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 6th 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. Rotate the compensating sprocket shaft nut counterclockwise until the base circle is found.
   c. See Figure 3-15. **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.

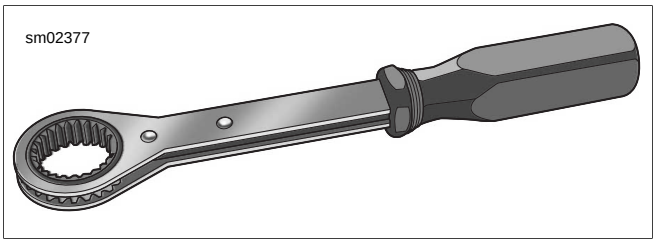


Figure 3-15. Crankshaft Rotating Wrench

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 3-16. Remove two bolts to release breather assembly (arrow) and filter element from the rocker arm support plate. For inspection and repair information, see 3.17 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 3-17. 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.

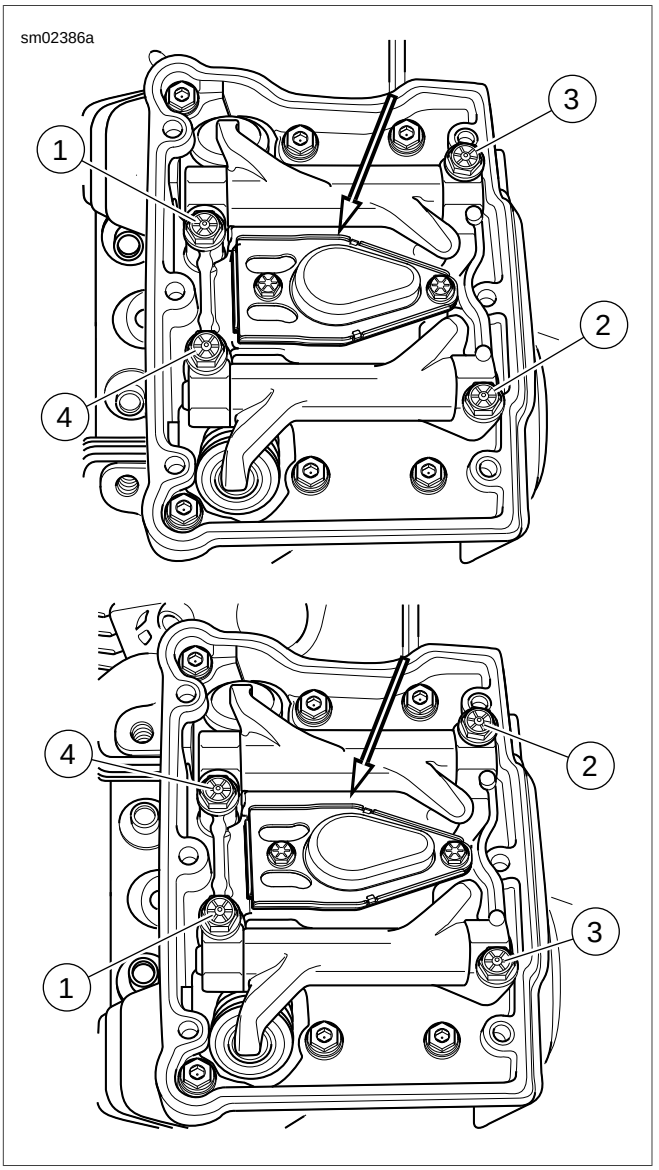


Figure 3-16. Rocker Arm Support Screw Sequence

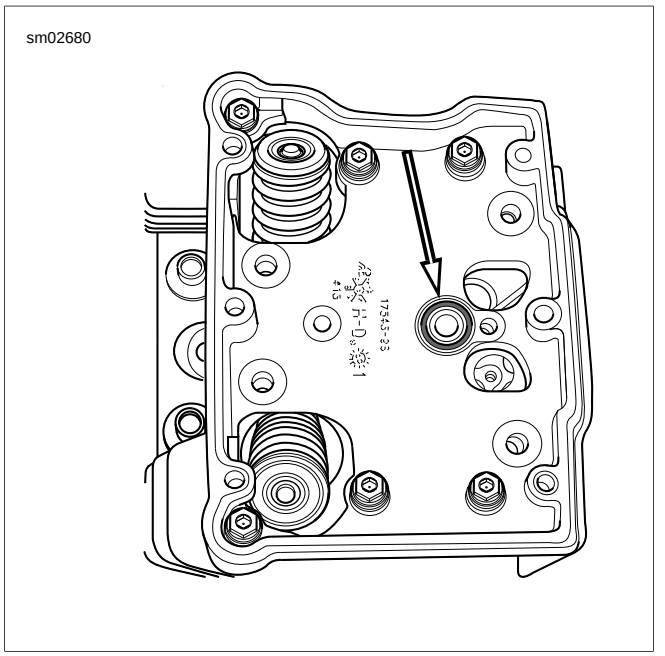


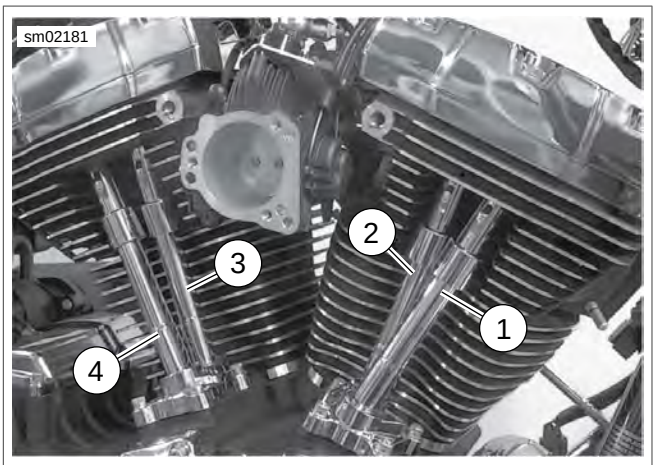
Figure 3-17. Breather Baffle Hole O-Ring

PUSHRODS, LIFTERS AND COVERS

NOTE

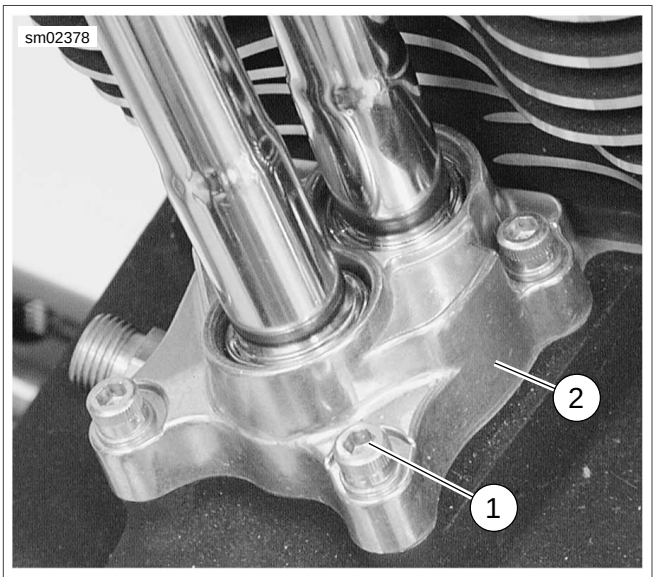
Tag all components for location, function and orientation (top/bottom) as they are removed.

1. See Figure 3-18. 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, be sure to dislodge it from the cylinder head bore.
2. See Figure 3-19. 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.



1. **Front cylinder exhaust pushrod**
2. **Front cylinder intake pushrod**
3. **Rear cylinder intake pushrod**
4. **Rear cylinder exhaust pushrod**

Figure 3-18. Pushrod Locations



1. **Screw with captive washer (4)**
2. **Lifter cover**

Figure 3-19. Lifter Cover

CYLINDER HEAD

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

1. See Figure 3-20. 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 3-21. 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.

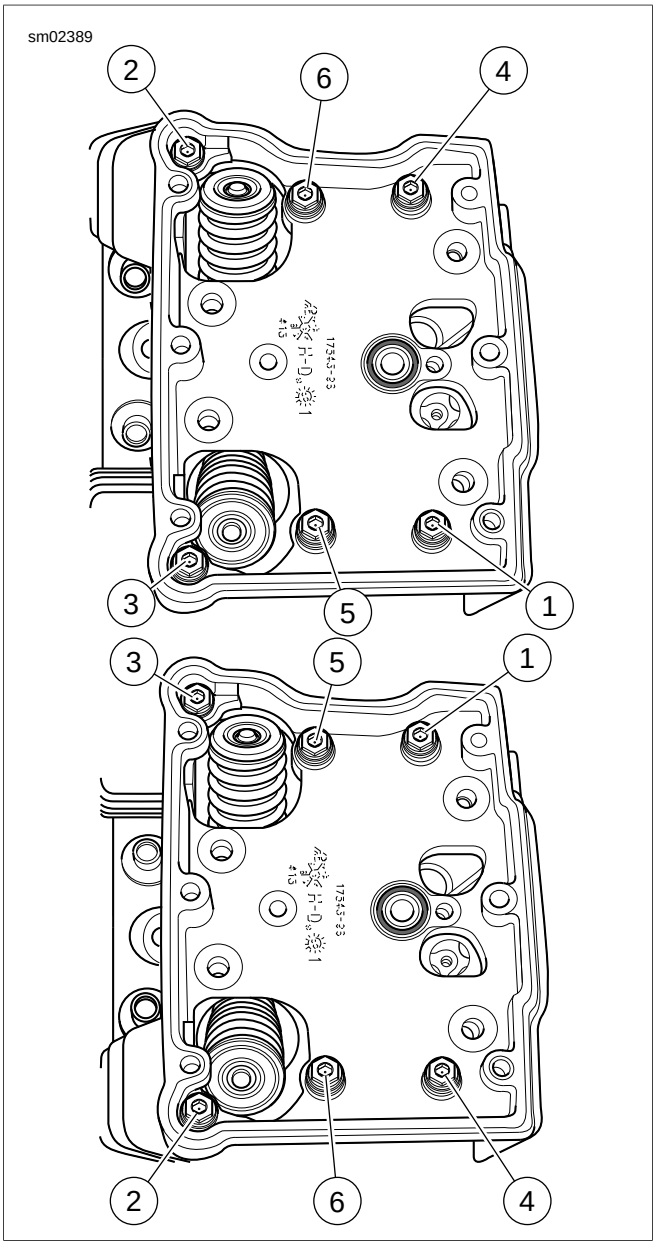


Figure 3-20. Rocker Housing Bolts Removal Sequence

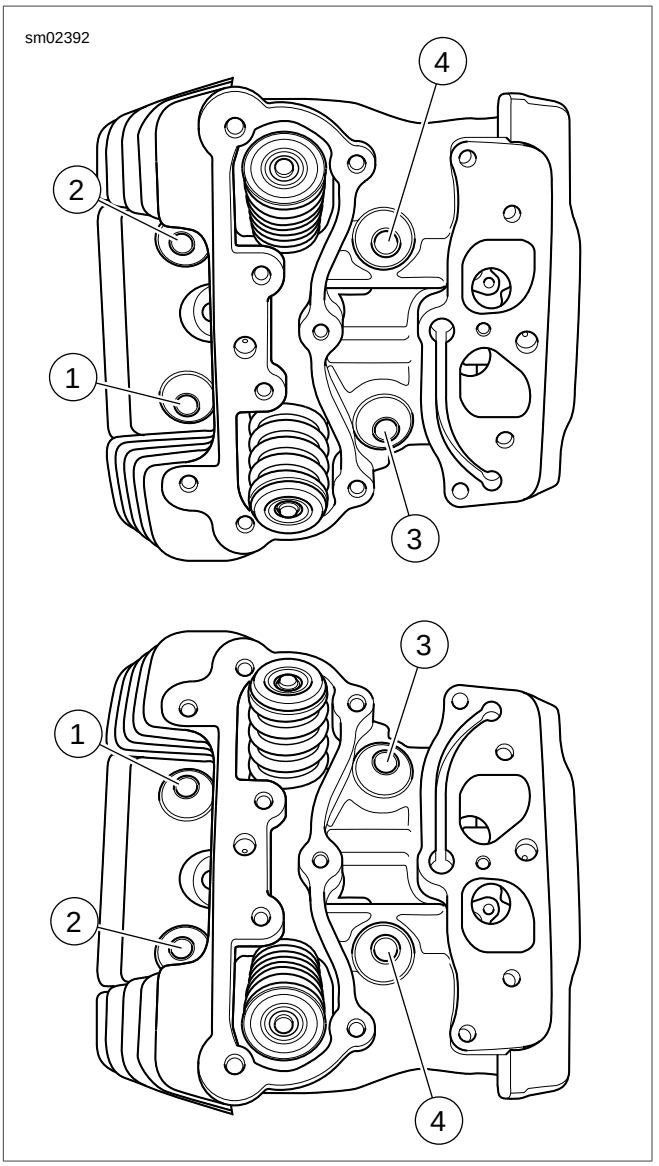


Figure 3-21. 1/4 Turn Head Bolts in Sequence

CYLINDER

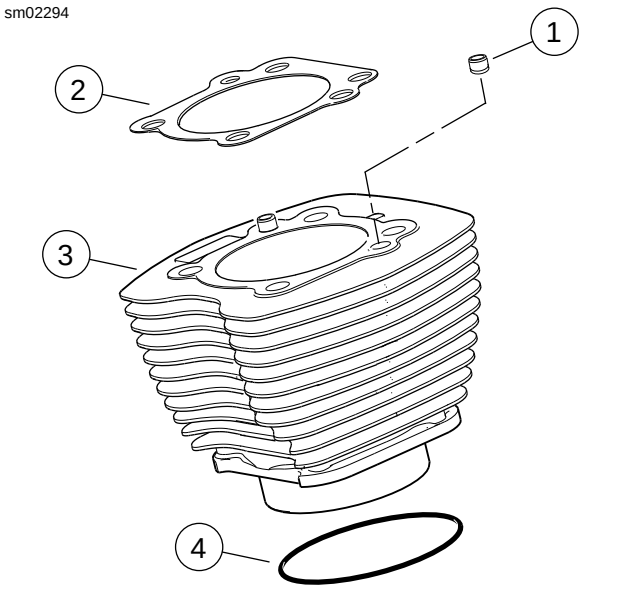
1. Raise the cylinder just enough to place clean shop towels under the piston. This will prevent any dirt or debris, such as broken ring pieces, from falling into the crankcase bore.

NOTE

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 3-22. Remove O-ring seal (4) from the bottom of the cylinder liner. Discard O-ring seal.

6. See Figure 3-23. Remove O-ring from dowel pin (4) on base of cylinder deck. Discard O-ring.
7. For inspection and repair information, see 3.21 CYLINDER.



1. **Dowel pin**
2. **Head gasket**
3. **Cylinder**
4. **O-ring seal**

Figure 3-22. Cylinder Assembly

PISTON

PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN RETAINING RING INSTALLER
HD-42320-B	PISTON PIN REMOVER

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

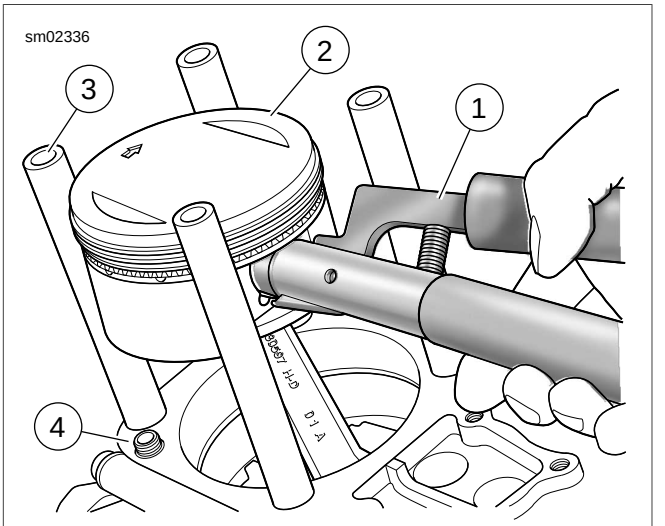
⚠WARNING

Wear safety glasses or goggles when removing or installing piston pin retaining rings. Piston pin retaining rings are compressed in the ring groove and can fly out when removed from the groove, which could result in serious eye injury. (00293a)

NOTE

It is not necessary to remove both piston pin circlips for piston removal.

2. See Figure 3-23. Using PISTON PIN RETAINING RING INSTALLER (Part No. HD-42317-A), remove and discard one piston pin circlip.
   a. Insert tool (1) into the piston pin bore. Position claw on tool in slot of piston (2) (directly under circlip).
   b. Hold shop towel over piston pin bore in case circlip flies out during removal. Squeeze handles of tool together. Pull circlip from bore. Discard circlip.

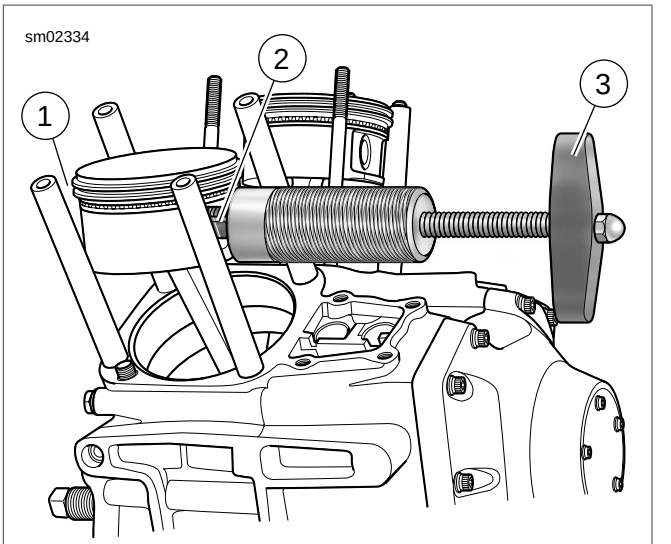


1. **Piston pin circlip remover/installer**
2. **Piston**
3. **Protective material over cylinder studs**
4. **Cylinder deck dowel (O-ring not shown)**

Figure 3-23. Piston Pin Circlip Removal

3. See Figure 3-24. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-B).
   a. Remove acorn nut and spacer from rod end of tool.
   b. Slide rod end through piston pin. Install spacer and acorn nut (1) on end of rod.
   c. Position rubber-coated tips (2) of tool on flat each side of pin bore.
   d. Turn handle (3) clockwise to remove piston pin.
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(ront) or R(ear) to identify location.
7. For inspection and repair 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.



1. **Spacer and acorn nut**
2. **Rubber coated tip**
3. **Handle**

Figure 3-24. Piston Pin Removal

BREATHER ASSEMBLY 3.17

DISASSEMBLY

NOTE

See Figure 3-25. 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

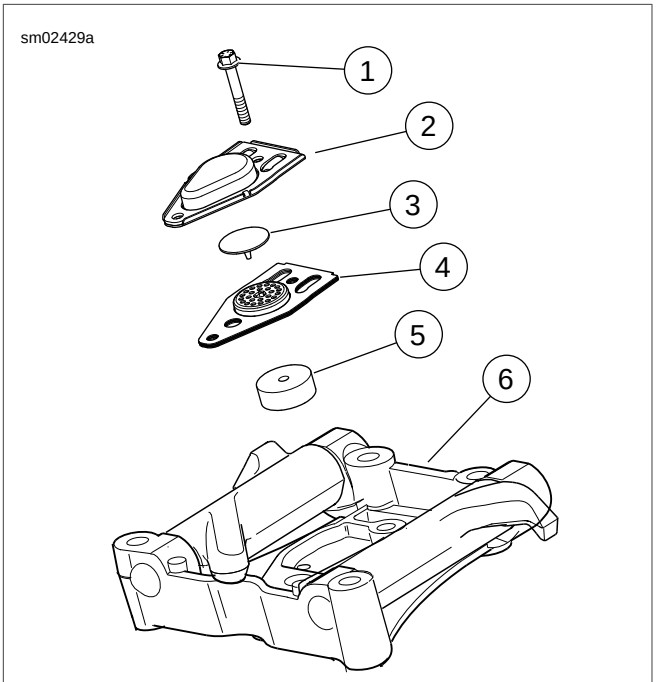
⚠WARNING

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 3-25. Install breather assembly and rocker cover using **new** baffle assembly. See 3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover.



1. **Fasteners (2)**
2. **Breather cover**
3. **Umbrella valve**
4. **Breather baffle**
5. **Filter element**
6. **Rocker arm support plate**

Figure 3-25. Breather Assembly

ROCKER ARM SUPPORT PLATE 3.18

DISASSEMBLY

1. See Figure 3-26. 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.

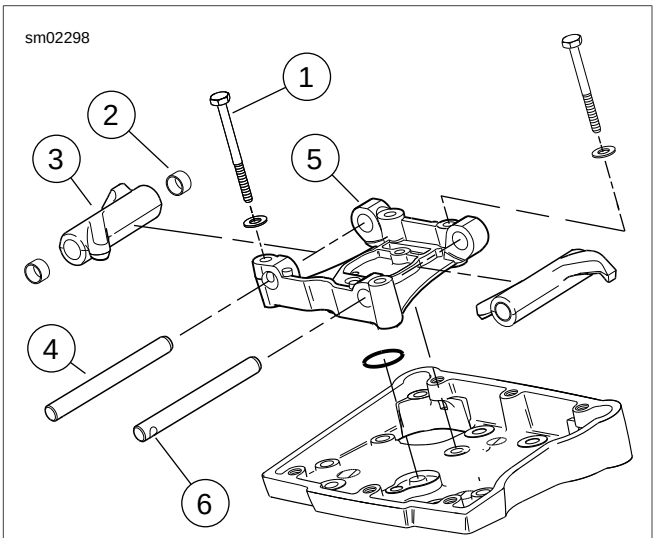
CLEANING AND INSPECTION

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 3-26. 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 3-26. Rocker Arm Assembly

Rocker Shaft Fit

1. See Figure 3-27. Measure the inside diameter of the rocker arm support plate bore.
2. See Figure 3-28. Measure the outside diameter of the rocker arm shaft where it fits in the bore.
3. Repeat the measurement on opposite side of support plate and shaft. Replace shaft or support plate if clearance equals or exceeds 0.0035 in. (0.089 mm).

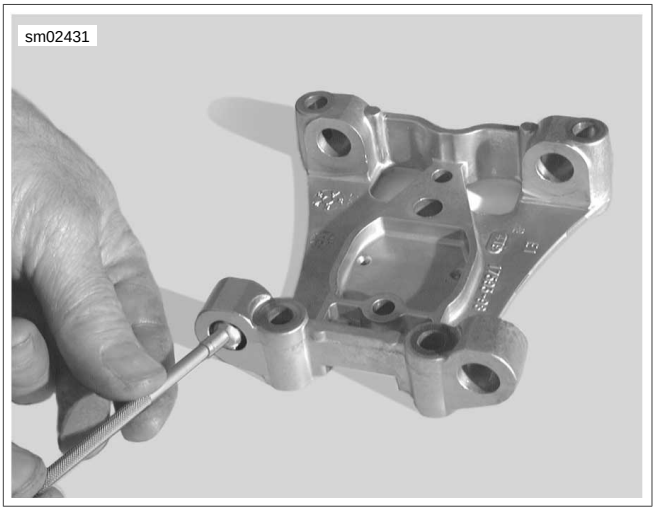


Figure 3-27. Checking Support Plate Bore



Figure 3-28. Checking Shaft to Support Plate Fit

Rocker Arm Shaft to Bushing

1. Check rocker arm shaft to bushing fit.
   a. See Figure 3-29. Measure the inside diameter of the rocker arm bushing.
   b. See Figure 3-30. Measure the outside diameter of the rocker arm shaft where it rides in the bushing.
2. Repeat measurement on opposite side of rocker arm and shaft. Replace shaft or bushings if clearance equals or exceeds service wear limit of 0.0035 in. (0.089 mm).

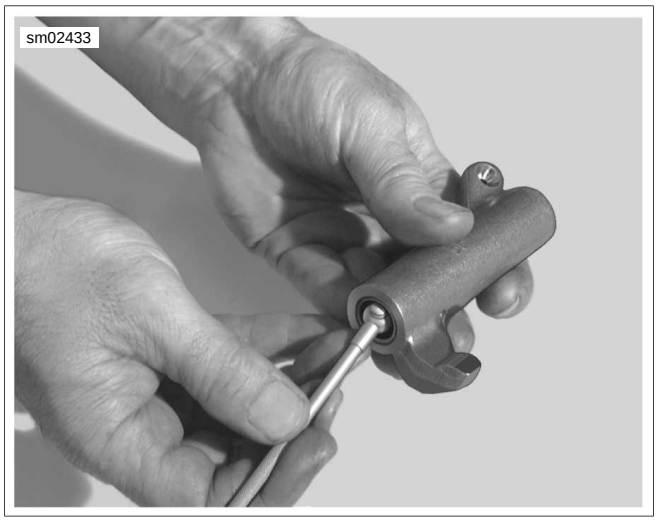


Figure 3-29. Checking Bushings



Figure 3-30. Checking Shaft to Bushing Fit

Replace Rocker Arm Bushings

NOTE

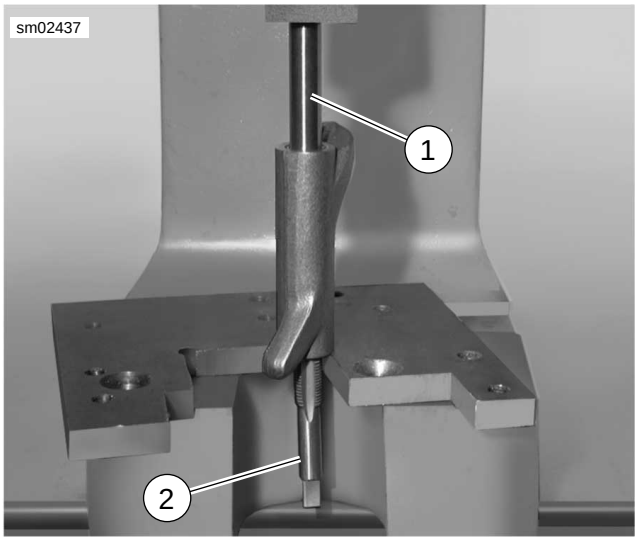
Bushing replacement and reaming must be done one at a time to achieve proper alignment. Follow all steps for one bushing and then repeat for the other bushing.

1. See Figure 3-31. 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 3-32. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. Be sure to orient bushing so that split line faces top of rocker arm.

NOTE

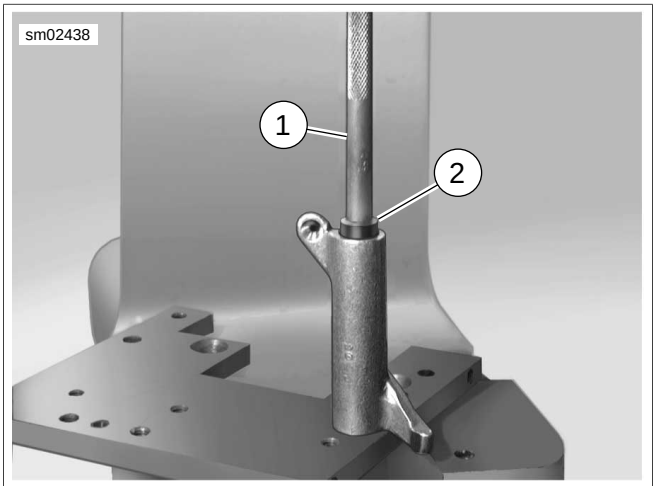
*Never back reamer out of rocker arm or **new** bushing will be damaged.*

3. Ream bushing:
   a. See Figure 3-33. 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.



1. **Discarded shaft used as driver**
2. **Tap**

Figure 3-31. Removing Bushing



1. **Driver**
2. **Bushing**

Figure 3-32. Installing Bushing

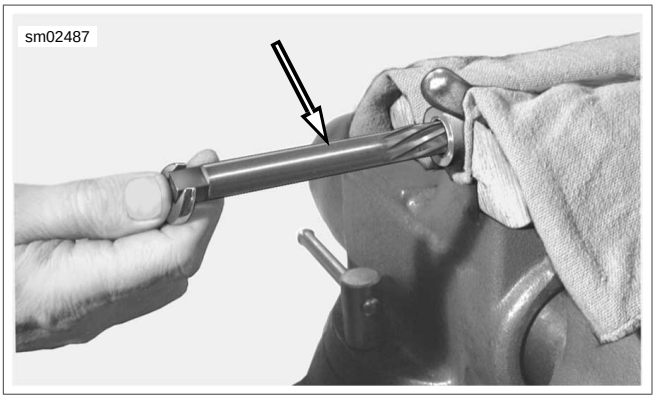


Figure 3-33. Ream Bushing

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 3-34. 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.



Figure 3-34. Check End Play

PUSHRODS, LIFTERS AND COVERS 3.19

DISASSEMBLY

See Figure 3-35. With the exception of the lifter covers, all parts should have been disassembled and marked during the removal procedure.

1. Separate upper (2) and lower (8) pushrod covers.
2. Remove O-ring (9). Discard O-ring.
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.

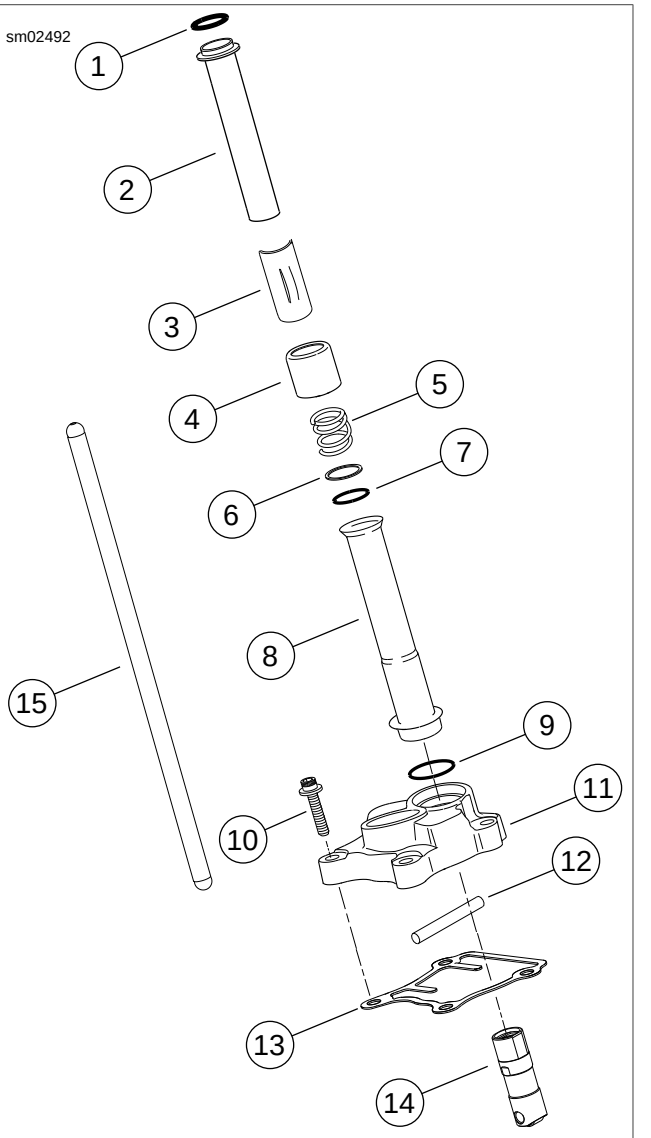
CLEANING AND GENERAL INSPECTION

1. See Figure 3-35. 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. (00061a)

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 C-clip. 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.



1. **Upper O-ring (small)**
2. **Upper pushrod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower pushrod cover**
9. **Lower O-ring (large)**
10. **Lifter cover screw**
11. **Lifter cover**
12. **Anti-rotation pin**
13. **Lifter cover gasket**
14. **Hydraulic lifter**
15. **Pushrod**

Figure 3-35. Pushrods, Lifters and Covers

LIFTER INSPECTION

NOTE

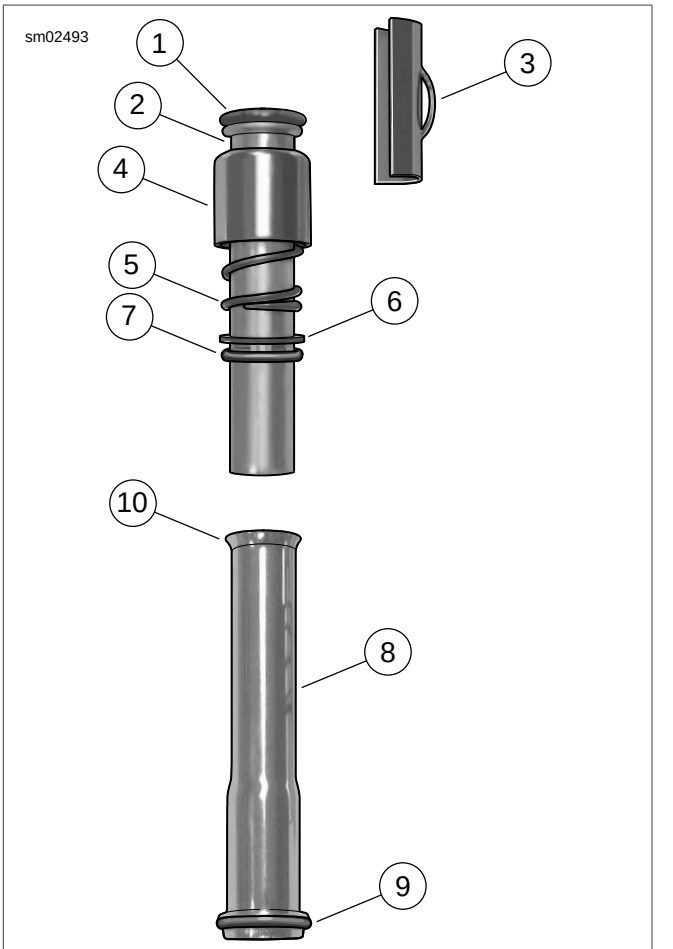
Inside and outside micrometers used for measuring lifters and lifter bores must be calibrated to take accurate readings.

1. Inspect lifters for excessive clearance in bores. Accurately measure the lifter outer diameter and record the measurement.
2. Accurately measure lifter bore inner diameter with a snap gauge. Subtract this measurement from the lifter measurement to determine clearance.
   a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
   b. Install **new** lifters and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in (0.076 mm).
3. Check lifter roller radial play.
   a. Roller radial movement should be within 0.0006-0.0010 in (0.0152-0.0254 mm).
   b. Replace lifters if radial movement exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).
4. Check lifter roller end clearance.
   a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
   b. Replace lifters if end clearance exceeds SERVICE WEAR LIMIT of 0.022 in. (0.559 mm).
5. Soak lifters in clean engine oil. Keep covered until assembly.

ASSEMBLY

With the exception of the pushrod covers, all parts will be assembled during the installation procedure.

1. See Figure 3-36. 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.



1. **Upper O-ring (small)**
2. **Upper pushrod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower pushrod cover**
9. **Lower O-ring (large)**
10. **Flared end of lower pushrod cover**

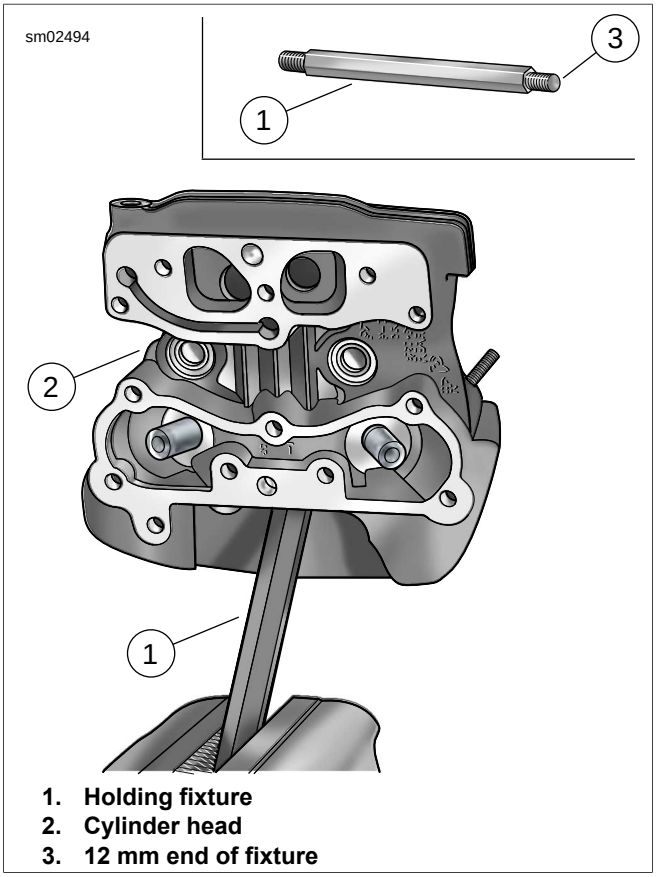
Figure 3-36. Assembled Pushrod Cover

CYLINDER HEAD 3.20

DISASSEMBLY

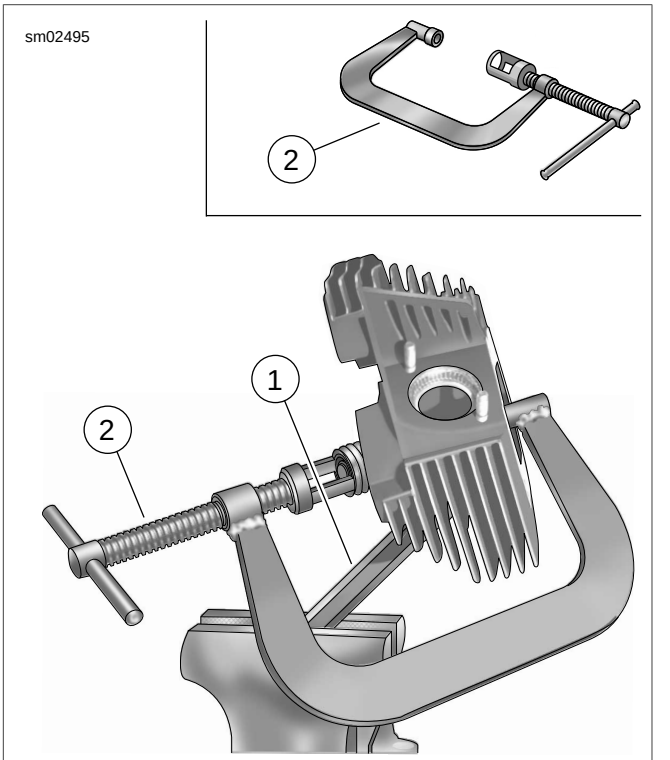
PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Before proceeding with the disassembly procedure, determine if 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 3-37. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) (1) into cylinder head (2) spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.



1. Holding fixture
2. Cylinder head
3. 12 mm end of fixture

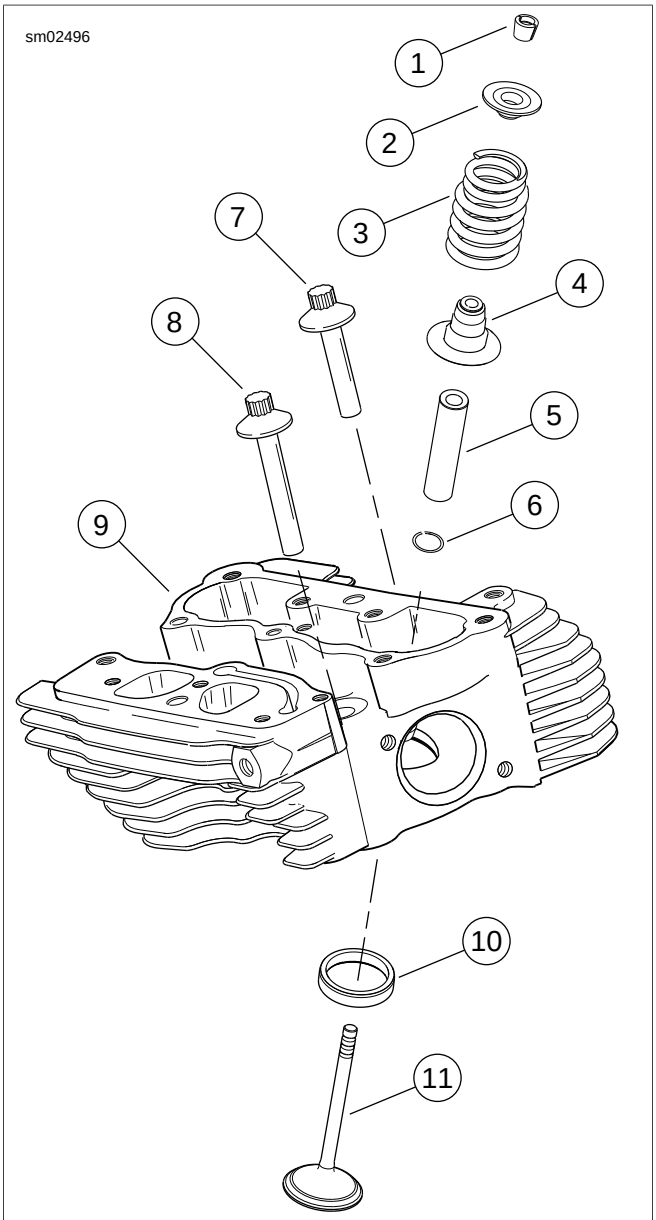
Figure 3-37. Cylinder Head Holding Fixture



1. Holding fixture
2. Compressor

Figure 3-38. Valve Spring Compressor

3. See Figure 3-38. Release valve spring compression.
   a. Place VALVE SPRING COMPRESSOR (Part No. HD-34736-B) (2) over cylinder head. Center blunt end on the valve head. Seat adapter at end of forcing screw on the valve spring retainer.
   b. Rotate forcing screw to compress valve spring.
   c. See Figure 3-39. If spring retainer (2) is not free of tapered keepers (1), give head of tool a sharp tap with a soft mallet. Using magnetic rod or small screwdriver, remove the keepers (1) from the valve stem (11) groove.
   d. Rotate forcing screw to release the valve spring compression.
4. Remove the spring retainer (2) and valve spring (3).
5. Slide the valve (11) from the valve guide (5).
6. Remove valve seal assembly.
7. Mark the valve head F(ront) or R(ear) for identification. Also, separate and tag tapered keepers, valve spring and spring retainer so that they are installed on the same valve at time of assembly.
8. Remove the remaining valve and components.
9. Remove fixture tool from spark plug hole.



1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem seal**
5. **Valve guide**
6. **Lock ring**
7. **Cylinder headbolt, short**
8. **Cylinder headbolt, long**
9. **Cylinder head**
10. **Valve seat**
11. **Valve**

Figure 3-39. Cylinder Head Assembly

CLEANING

1. See Figure 3-39. Remove old gasket material from cylinder head (9). Gasket material left on sealing surfaces will cause leaks. Scraping may result in scratches or nicks.

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. (00534b)

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. (00061a)

5. Dry parts with low pressure compressed air.

INSPECTION

PART NUMBER	TOOL NAME
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-42324-A	CYLINDER TORQUE PLATES
HD-96796-47	VALVE SPRING TESTER

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.

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 oil 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 3-35. If the clearance between stem and guide exceeds the limits shown, the valve stem and/or guide are excessively worn.
   d. Repeat measurements with a **new** valve to determine if the guide must be replaced.

Table 3-35. Valve Stem to Guide Clearance Service Wear Limits

VALVE	IN	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Valves

1. Replace the valve if there is evidence of burning or cracking.
2. Inspect the end of the valve stem for pitting or uneven wear. Replace as necessary.
3. Inspect for burrs around the valve stem keeper groove. Remove burrs with a fine tooth file.
4. To determine if the valve stem is excessively worn, see valve guide inspection.

Valve Springs

1. Inspect springs for cracked or discolored coils. Replace as necessary.
2. Set the valve springs on a level surface and use a straightedge to check for proper squareness and height. Too much height corresponds to a reduction in spring pressure which results in sluggish valve action.
3. Check free length of springs using a dial vernier caliper or load test with the VALVE SPRING TESTER (Part No. HD-96796-47). Replace springs if free length or compression force do not meet specifications. See 3.2 SPECIFICATIONS.

Tapered Keepers

1. Inspect parts for damage or rust pits. Replace as necessary.
2. Inspect inboard side of tapered keepers for excessive wear. Upraised center must be pronounced and fit snugly in valve stem groove. Place keepers into groove and verify that they grip tightly without sliding.

Valve Seats

1. Inspect seats for cracking, chipping or burning. Replace as necessary.
2. Check seats wear by measuring valve stem protrusion. See 3.20 CYLINDER HEAD, Valve and Seat Refacing.

VALVE GUIDE REPLACEMENT

PART NUMBER	TOOL NAME
B-45523	VALVE GUIDE REAMER
B-45524-1	VALVE GUIDE DRIVER
B-45524-2A	VALVE GUIDE INSTALLER SLEEVE
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39782-B	CYLINDER HEAD SUPPORT STAND KIT
HD-39786	CYLINDER HEAD HOLDING FIXTURE
HD-39847	REAMER T-HANDLE
HD-39964	REAMER LUBRICANT

Removal

NOTES

- *If valve guide replacement is necessary, always install **new** guide before refacing valve seat.*
- *CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-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 3-40. Prepare cylinder head for valve guide replacement.
   a. Obtain CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-B).
   b. Insert sleeve of appropriate seat 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

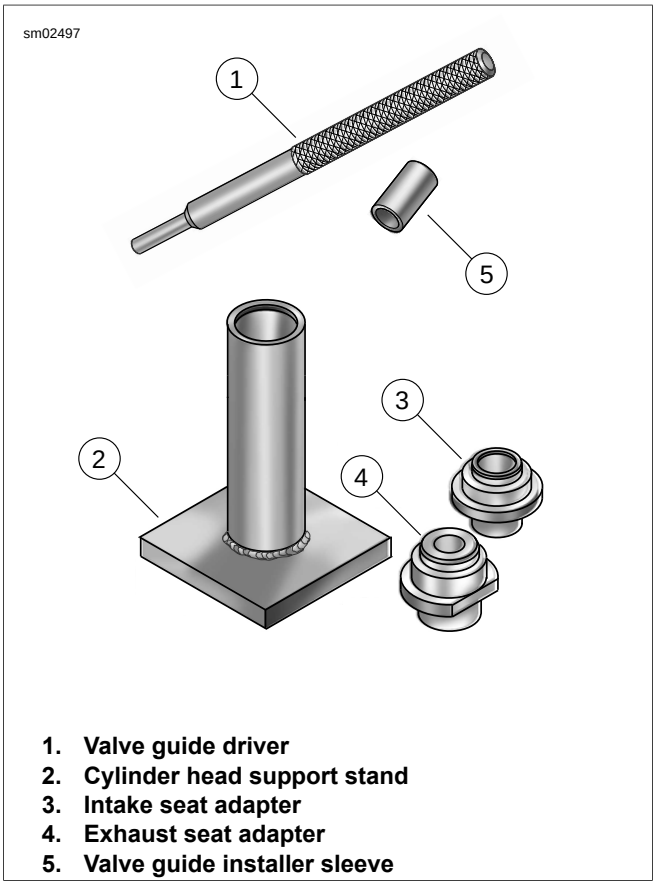
Always press valve guide toward combustion chamber. Carbon buildup on combustion chamber side of guide can damage cylinder head bore. As a result, a proper interference fit may not be possible.

2. Remove and discard lock ring from valve guide groove.

NOTE

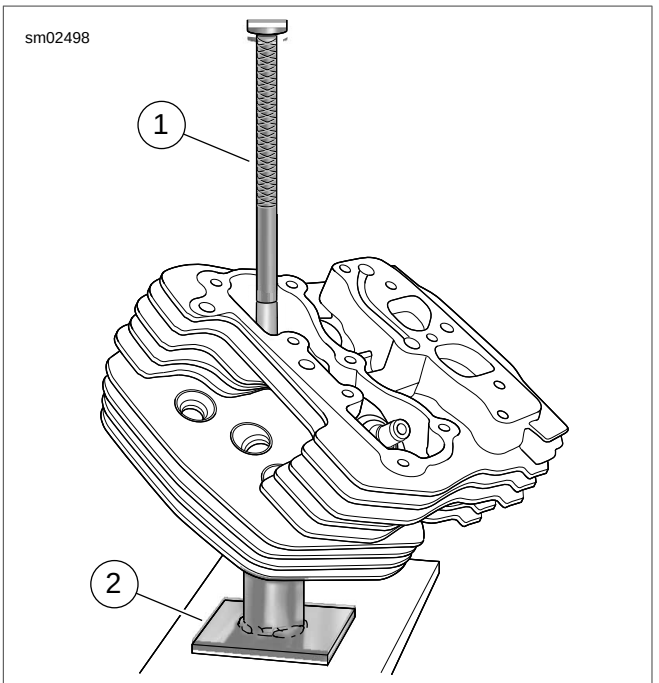
Lock ring is present on OEM intake and exhaust valve guides.

3. Insert VALVE GUIDE DRIVER (Part No. B-45524-1) (1) into valve guide bore.
4. See Figure 3-41. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.



1. **Valve guide driver**
2. **Cylinder head support stand**
3. **Intake seat adapter**
4. **Exhaust seat adapter**
5. **Valve guide installer sleeve**

Figure 3-40. Valve Guide Replacement Tools



1. **Valve guide driver**
2. **Cylinder head stand**

Figure 3-41. 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

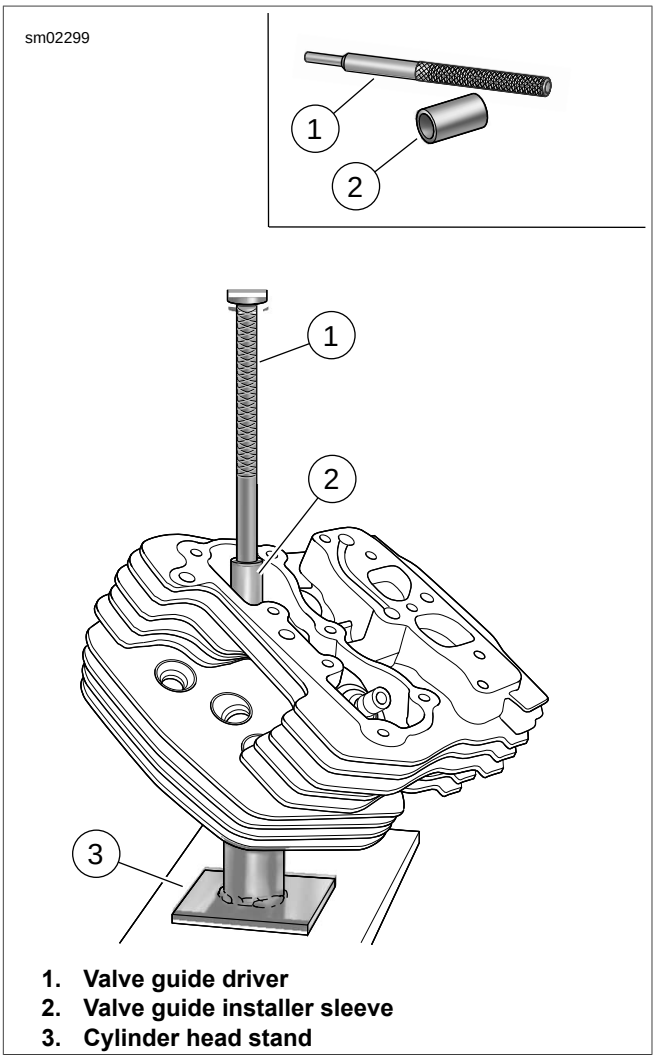
The support stand ensures that valve guide and seat are perpendicular. Not keeping cylinder head valve guide bore perpendicular will result in damage during the press procedure.

3. Prepare cylinder head for valve guide replacement.
   a. See Figure 3-40. 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 3-42. 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.

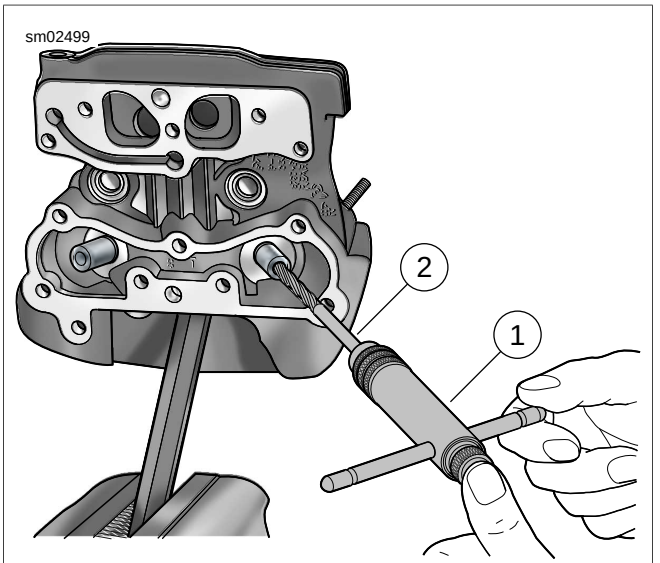
   f. Verify that support stand (3) and driver (1) are square. Center driver under ram and press valve guide further into bore, then back off ram again to allow valve guide to center itself.
   g. Repeat previous step until installer sleeve contacts machined area of cylinder head.
   h. Install **new** lock ring into valve guide groove. Verify that lock ring is square and fully seated in the groove.



1. **Valve guide driver**
2. **Valve guide installer sleeve**
3. **Cylinder head stand**

Figure 3-42. Install Valve Guide

4. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.



1. **T-handle**
2. **Valve guide reamer**

Figure 3-43. Reaming Valve Guide Bore

NOTE

Valve guides will be reamed to within 0.0005-0.0001 in. (0.013-0.0025 mm) under finished size.

5. See Figure 3-43. Ream the guide.
   a. Install REAMER T-HANDLE (Part No. HD-39847) (1) on VALVE GUIDE REAMER (Part No. B-45523) (2).
   b. Apply a liberal amount of REAMER LUBRICANT (Part No. HD-39964) to valve guide bore and reamer bit. Start reamer into bore.

   NOTE

   Never turn reamer backwards.

   c. Apply slight pressure on reamer while rotating clockwise. Squirt additional lubricant onto reamer and into guide as necessary.

   NOTE

   For best results, do not push on reamer or apply pressure to the reamer handle. Excessive pressure results in a rough cut and the bore will be tapered if pressure is not centrally applied.

   d. Continue rotating reamer T-handle until entire bit has passed through valve guide bore.
   e. Remove T-handle from reamer, and carefully draw reamer out through combustion chamber side of valve guide.

⚠WARNING

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

6. Remove metal shavings with low pressure compressed air.
7. See Figure 3-44. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).
8. See Figure 3-45. 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 to 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 3-36. If the clearance is not within specification, repeat the honing process and recheck.

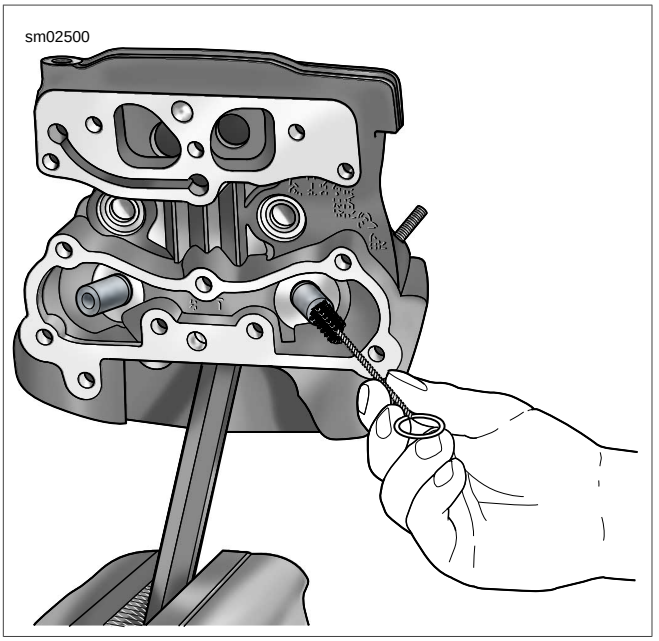


Figure 3-44. Scrubbing Valve Guide Bore

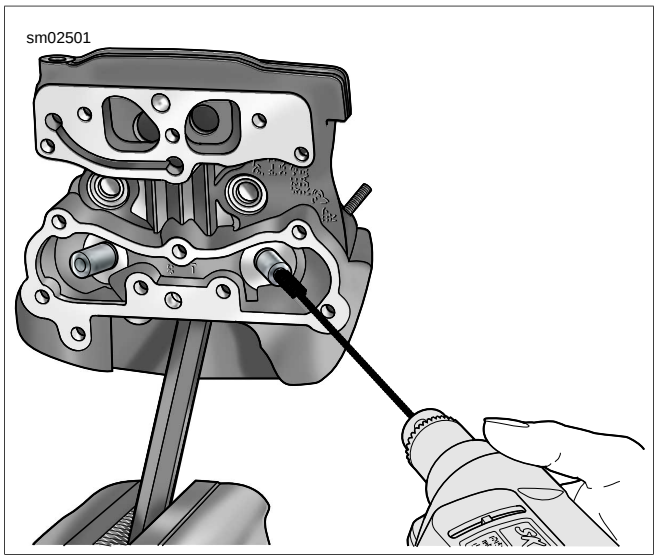


Figure 3-45. Honing Valve Guide Bore

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 3-36. Valve Stem to Guide Clearance

VALVE	IN	MM
Intake	0.001-0.003	0.0254-0.0762
Exhaust	0.001-0.003	0.0254-0.0762

VALVE AND SEAT REFACING

PART NUMBER	TOOL NAME
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-35758-C	NEWAY VALVE SEAT CUTTER SET
HD-39786	CYLINDER HEAD HOLDING FIXTURE

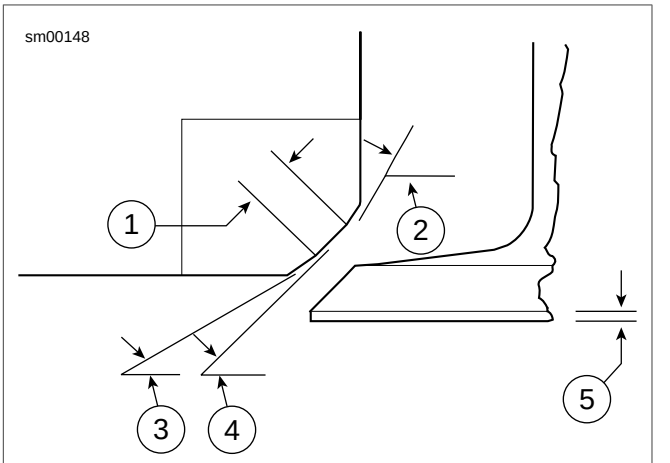
NOTES

- *Verify correct valve stem to valve guide clearance before refacing. If **new** guides must be installed, complete that task before refacing valve seats. Refer to Table 3-36.*
- *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 3-46.*



1. **Minimum: 0.040 in. (1.016 mm) / Maximum: 0.062 in. (1.575 mm)**
2. **60 degrees**
3. **31 degrees**
4. **46 degrees**
5. **Margin**

Figure 3-46. Valve and Seat Dimensions

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 3-47. 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.

6. Secure cylinder head for servicing.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp fixture in vise and further tighten cylinder head onto the fixture to prevent any movement during operation.
   c. Place cylinder head at a 45 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 0.080 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.

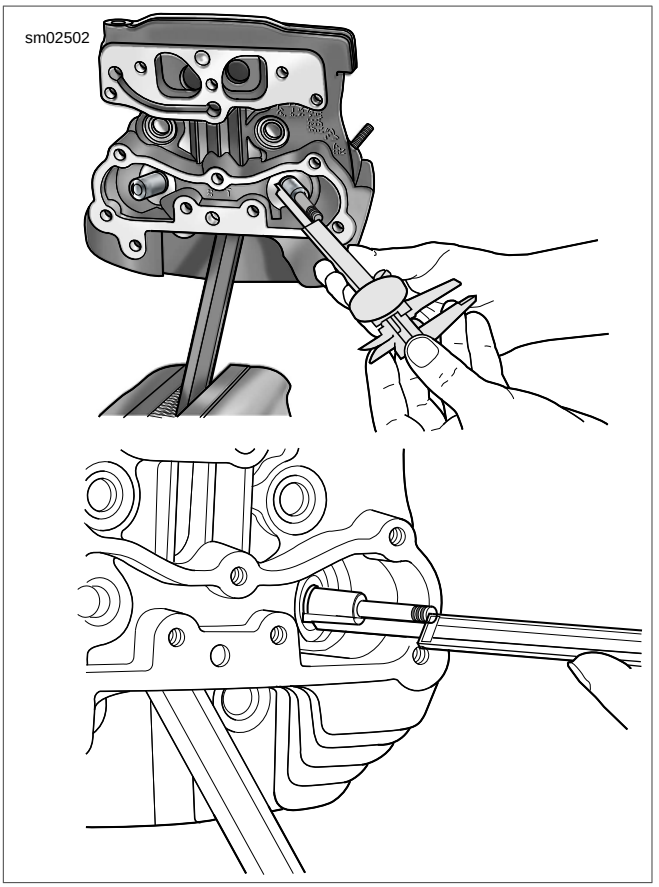


Figure 3-47. Checking Valve Stem Protrusion

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 3-48. 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 46 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.*

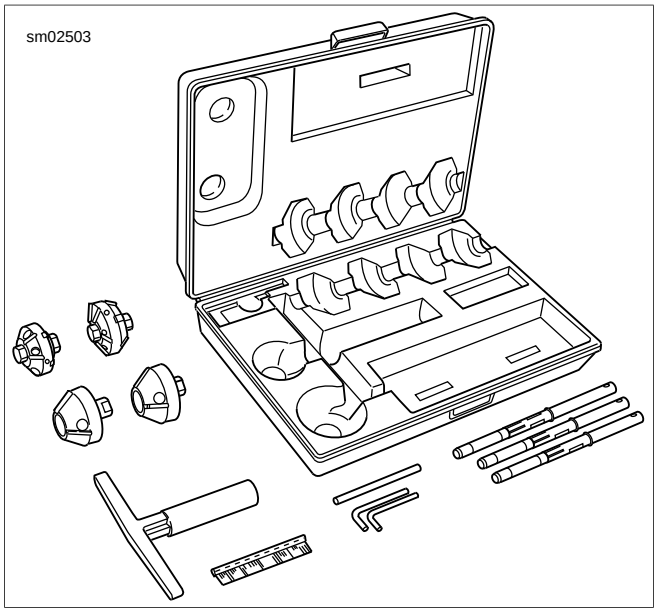


Figure 3-48. Neway Valve Seat Cutter Set

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.

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Secure cylinder head for service.
    a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
    b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

At the time of disassembly, all parts should have been marked or tagged so that they are installed on the same valve (and in the same head).

2. Run the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) through the valve guide bore to verify cleanliness.
3. 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 3-49. 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 3-50. 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.

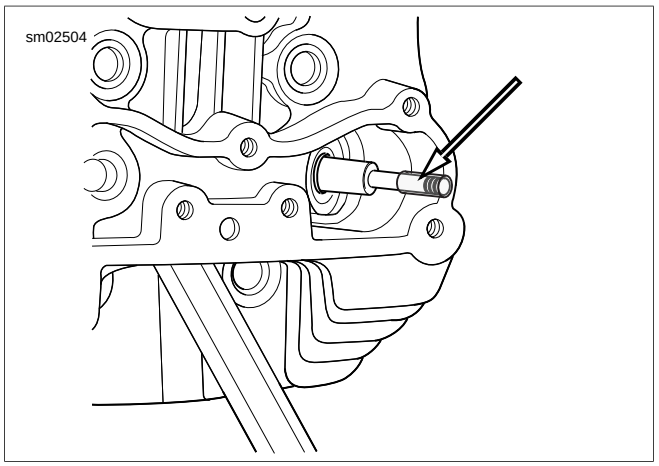
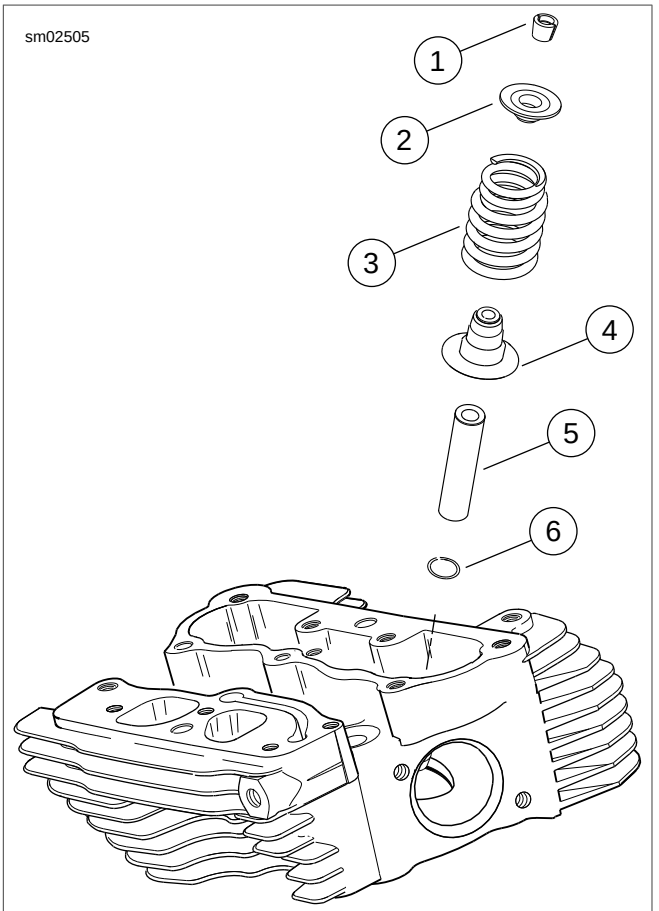


Figure 3-49. Plastic Capsule



Figure 3-50. Valve Stem Seal/Spring Seat Assembly

10. See Figure 3-51. 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.



1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem set seal**
5. **Valve guide**
6. **Lock ring**

Figure 3-51. Valve Assembly

CYLINDER 3.21

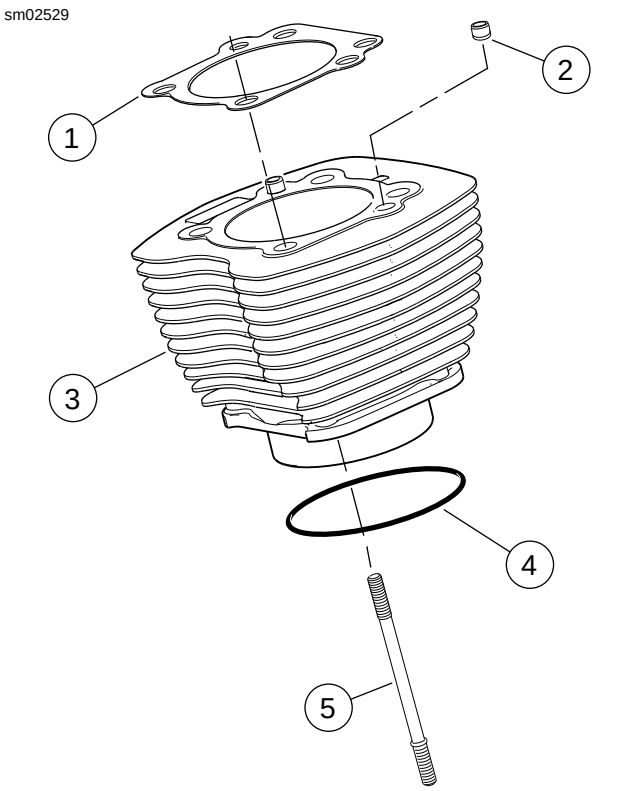
CLEANING

1. See Figure 3-52. 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. Blow parts dry 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.



1. **Cylinder head gasket**
2. **Dowel pin**
3. **Cylinder**
4. **O-ring seal**
5. **Cylinder stud**

Figure 3-52. Cylinder Assembly

INSPECTION

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES
TA360	SNAP-ON TORQUE ANGLE GAUGE

FASTENER	TORQUE VALUE	
Cylinder torque plate bolts, 1st torque	120-144 **in-lbs**	13.6-16.3 Nm
Cylinder torque plate bolts, 2nd torque	15-17 ft-lbs	20.3-23.0 Nm
Cylinder torque plate bolts, final torque	90 degrees	90 degrees

1. Using Magnaflux Dye Penetrant, inspect the cylinder for cracks. If no cracks are found, thoroughly wash cylinder to remove traces of dye.
2. See Figure 3-53. Check the machined surfaces for flatness using a feeler gauge and CYLINDER TORQUE PLATES (Part No. HD-42324-A) as follows:
   a. Lay gasket side of the upper torque plate (3) 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 is not within specification.

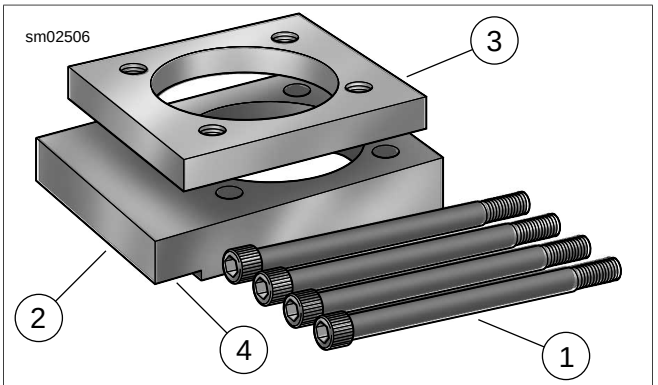
NOTE

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 not suitable for service.

3. Install CYLINDER TORQUE PLATES (Part No. HD-42324-A):
   a. Remove O-ring seal from cylinder sleeve, if installed.
   b. See Figure 3-54. 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 3-55. 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.



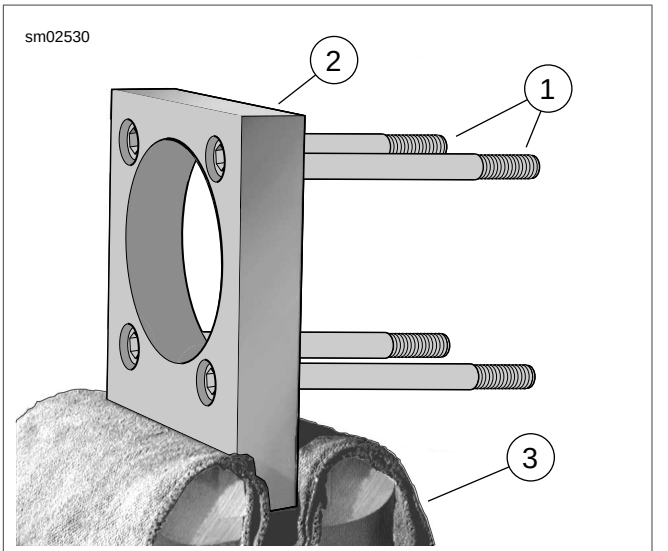
1. **Bolts**
2. **Lower plate**
3. **Upper plate**
4. **Vise grip step**

Figure 3-53. Cylinder Torque Plates

NOTE

Maximum cylinder wear occurs at the top of top ring travel. Minimum wear occurs below ring travel. Failure to measure the cylinder at these points may result in a faulty decision regarding the condition of the cylinder for continued use.

4. See Figure 3-56. 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.



1. **Bolt (4)**
2. **Lower plate**
3. **Vise**

Figure 3-54. Attaching Cylinder Torque Plates

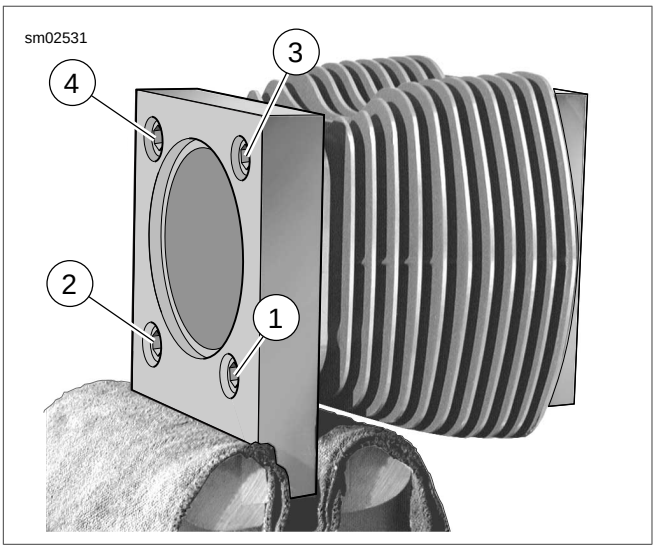


Figure 3-55. Cylinder Torque Plate Bolt Sequence

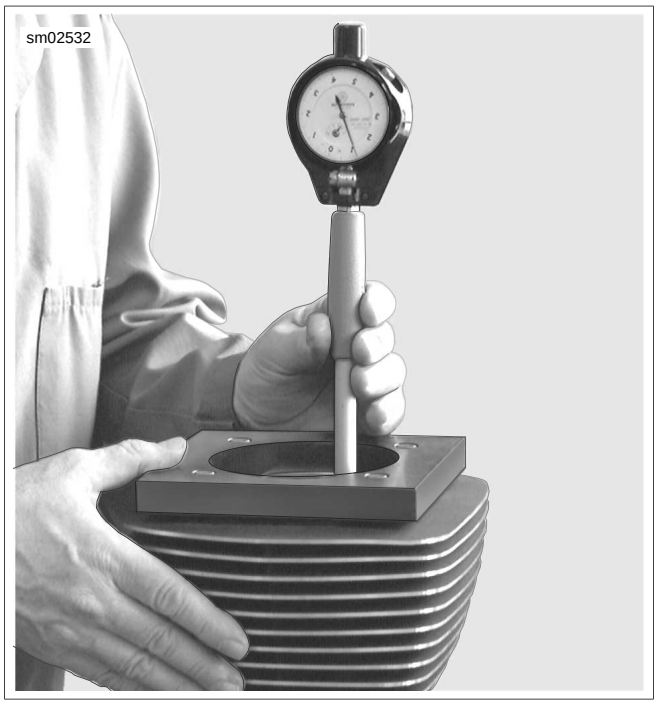


Figure 3-56. Measure for Out-of-Round and Taper

DEGLAZING CYLINDER

NOTE

Deglazing removes wear patterns, minor scuff marks and scratches without enlarging the bore diameter.

1. Lightly swab the cylinder bore with a cloth dipped in clean engine oil.
2. Obtain a 240 grit flexible ball-type deglazing tool with a bristle tip or finishing stone arrangement able to produce a 60 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.

NOTICE

The angular crosshatch pattern ensures an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An incorrect cross hatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00536c)

NOTICE

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 3-37 or Table 3-38.

NOTICE

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

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. (95.377-95.390 mm).

NOTICE

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537c)

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 3-37. Oversize Pistons/Cylinder Bores, Twin Cam 96

PISTON			CYLINDER BORE FINISHED SIZE	
SIZE	IN	MM	IN	MM
Standard	N/A	N/A	3.7500-3.7505	95.250-95.263
Oversize	0.005	0.13	3.7550-3.7555	95.377-95.390
	0.010	0.25	3.7600-3.7605	95.504-95.517

Table 3-38. Oversize Pistons and Cylinder Bores, Twin Cam 103

PISTON		CYLINDER BORE FINISHED SIZE	
TYPE	SIZE	MINIMUM	MAXIMUM
Standard	STD	3.8750 in (98.425 mm)	3.8755 in (98.438 mm)
Oversize	0.010 in (0.25 mm)	3.8850 in (98.679 mm)	3.8855 in (98.692 mm)

PISTON 3.22

DISASSEMBLY

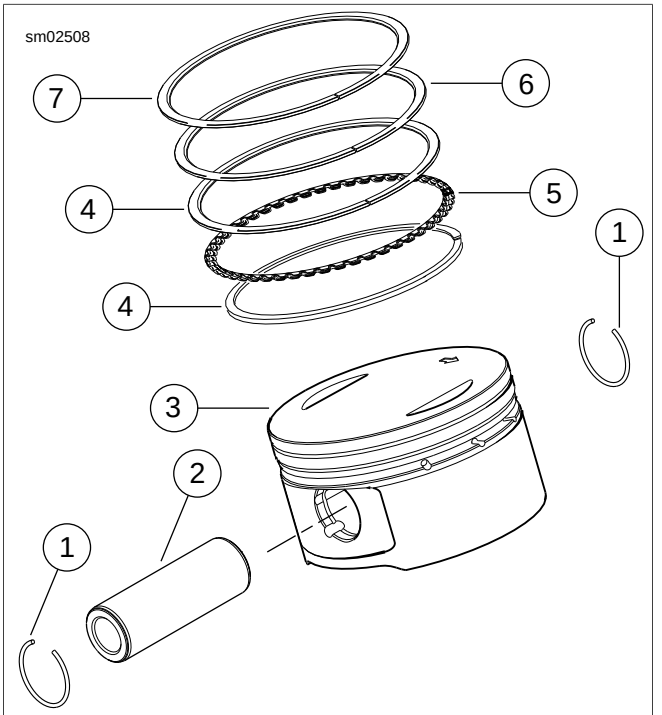
PART NUMBER	TOOL NAME
SNAP-ON PRS8	PISTON RING EXPANDER

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 3-57. 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.



1. **Circlip**
2. **Piston pin**
3. **Piston**
4. **Oil rail**
5. **Expansion ring**
6. **Second compression ring**
7. **Top compression ring**

Figure 3-57. Piston Assembly

CLEANING

1. Remove all carbon and 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.

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.

⚠WARNING

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

2. Thoroughly rinse the pistons. 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 Magnaflux 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 3-58. 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 may continue to be used.

2. Carefully inspect the pistons for damage or excessive wear.
   a. Discard pistons with cracked, worn or bent ring lands.
   b. Check the piston skirt for cracks, gouges, deep scratches or heavy scoring.
   c. Check the piston heads for evidence of burning, etching or melting.
   d. Look for marks or imprints caused by contact with valves.
3. Run your index finger around the edge of the piston crown to feel for dings, nicks or burrs. Lightly file the edge of the crown to remove any defects.

NOTE

Worn ring grooves result in high oil consumption and blow-by of exhaust gases. Blow-by of exhaust gases contaminates the engine oil supply with acids and leaves sludge in the crankcase. It also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.

4. See Figure 3-59. 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 3-60. 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 3-60. 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 3-60. 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. (0.076 mm).



Figure 3-58. Piston Pin Clearance

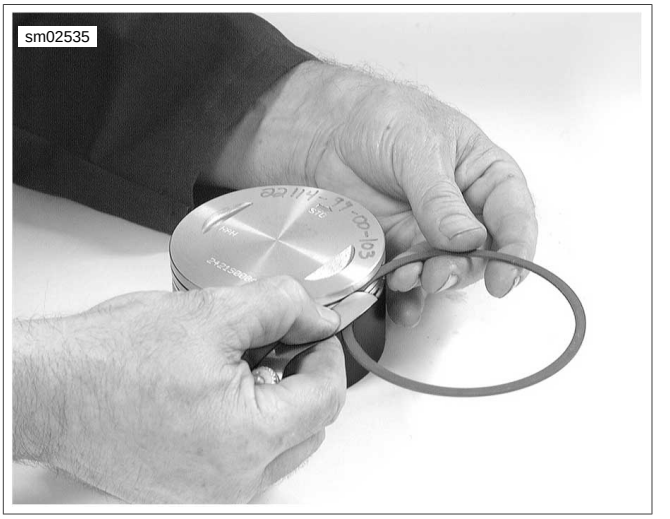
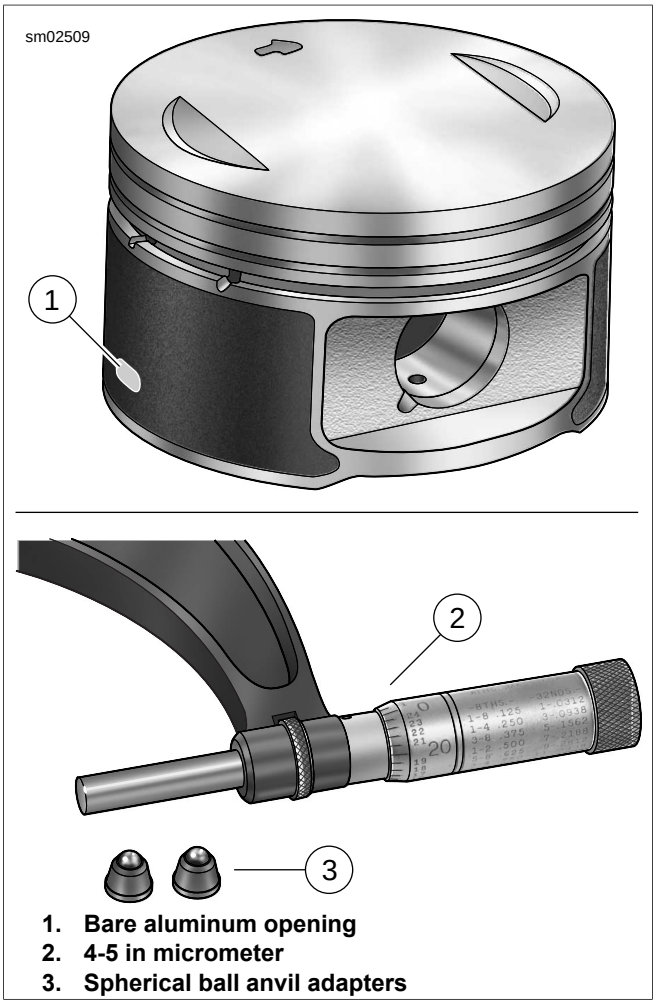


Figure 3-59. Measure Piston Ring Side Clearance



1. **Bare aluminum opening**
2. **4-5 in micrometer**
3. **Spherical ball anvil adapters**

Figure 3-60. Measuring Running Clearance of Piston

ASSEMBLY

PART NUMBER	TOOL NAME
SNAP-ON PRS8	PISTON RING EXPANDER

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 supply and leaves sludge in the crankcase. It also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.*

1. See Figure 3-61. 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 3-39.

NOTE

Ring end gap dimensions also apply to oversize rings. Replace ring if end gap exceeds specification. If end gap is under specification, filing is permissible.

⚠WARNING

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

2. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.

Table 3-39. Piston Ring End Gap

PISTON		IN	MM
Twin Cam 103	Top compression	0.012-0.022	0.305-0.559
	2nd compression	0.015-0.025	0.381-0.635
	Oil control ring	0.010-0.050	0.254-1.270



Figure 3-61. Measuring Ring Gap

Installing Piston Rings

1. See Figure 3-62. Apply clean engine oil to three piston ring grooves.
2. Install expansion ring (4) into third ring groove.
3. Spiral bottom oil rail (5) into space below expansion ring (4). Position gap 90 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.

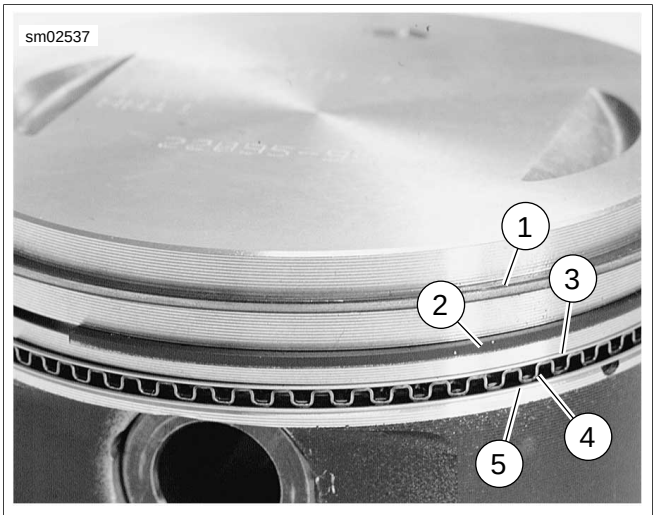
⚠WARNING

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

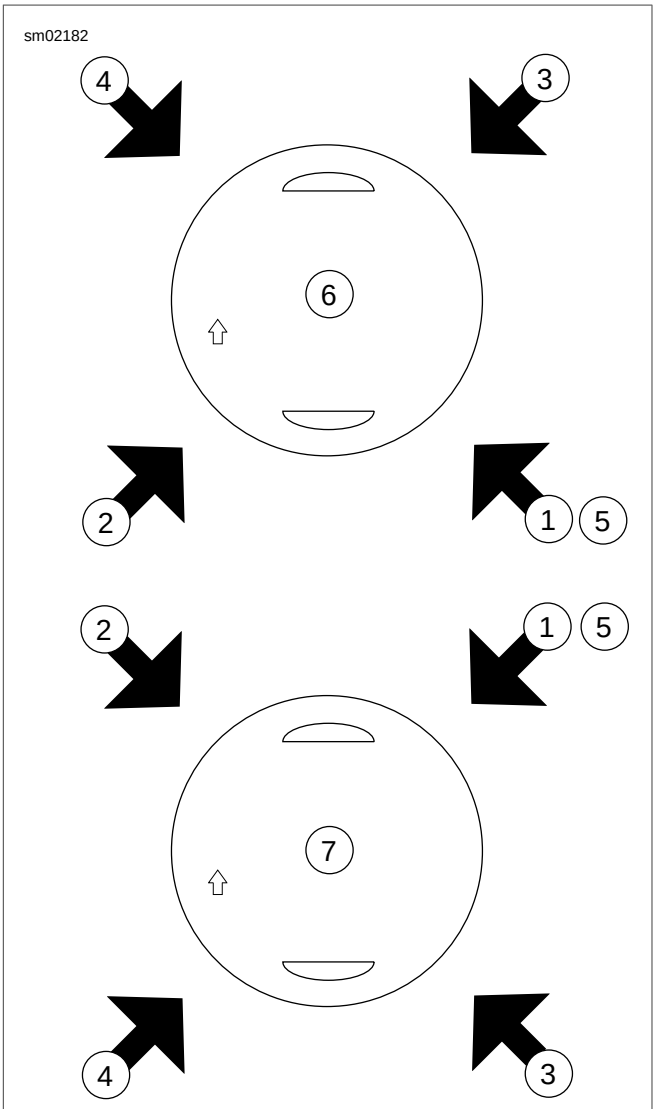
- *Use the proper piston ring spreader to prevent excessive ring twist and expansion. Over expansion may cause the ring to crack. Damaged or distorted rings result in blow-by of exhaust gases. This will result in increased oil consumption and lower service life on valves and other components.*
- *Installing 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 3-63. Verify the ring gaps are still properly staggered.



1. **Top compression ring**
2. **Second compression ring**
3. **Top oil rail**
4. **Expansion ring**
5. **Bottom oil rail**

Figure 3-62. Piston Rings



1. **Expander ring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-63. Piston Ring Gap Alignment

TOP END OVERHAUL: ASSEMBLY 3.23

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.

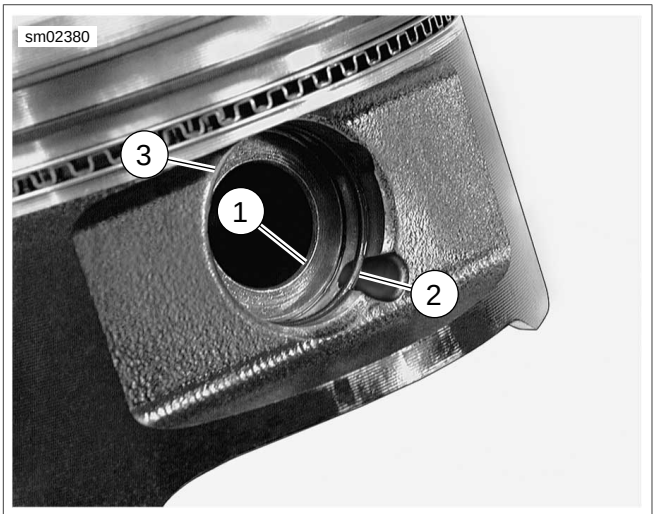
PISTON

PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER

1. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
2. Apply 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 3-64. 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 3-65. Insert piston pin (1) through pin bore and upper connecting rod bore. Push pin until it contacts circlip installed in opposite pin boss. Verify that end gap (3) for circlip is 180 degrees from opening (2).
6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin circlip from falling into the crankcase. Verify that the circlip groove is clean and free of dirt and grime.



Figure 3-64. Piston Installation Arrow



1. **Piston pin**
2. **Circlip opening**
3. **End gap location**

Figure 3-65. Pre-Installed Circlip

NOTE

Do not reuse piston pin circlips. The circlips could weaken during removal causing them to break or dislodge during engine operation, a condition that will result in engine damage.

7. Install **new** piston pin circlip with the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A).
   a. See Figure 3-66. Slide circlip down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture circlip in claw.
   b. Releasing pressure on handles, rotate circlip so that the end gap is centered at top of tool and then recapture in claw.
   c. Tilt the circlip forward until the end gap contacts nose of tool.
   d. See Figure 3-67. Insert the tool (1) into the piston pin bore until claw is aligned with slot (2) in piston.
   e. Firmly push the tool into the piston pin bore until it bottoms. Release handles and remove tool.
   f. Inspect the circlip to verify that it is fully seated in the groove.

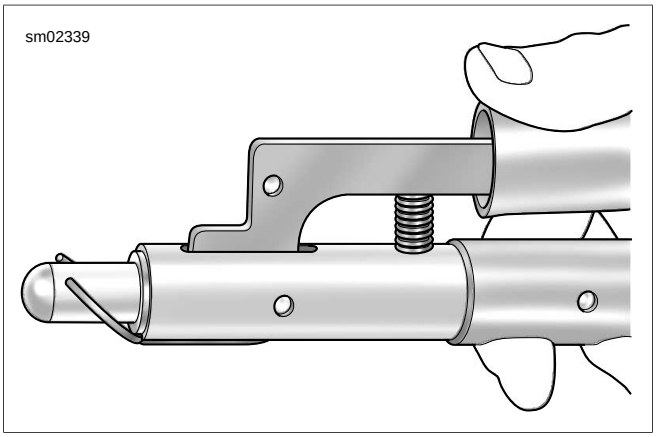
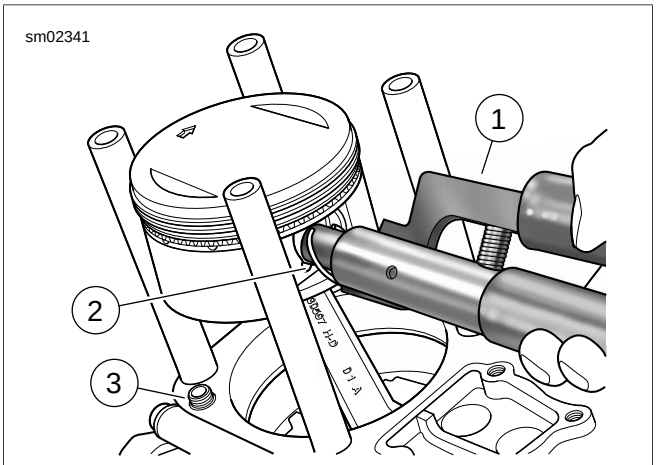


Figure 3-66. Aligning Circlip



1. **Piston pin circlip remover/installer**
2. **Slot**
3. **Cylinder deck dowel (O-ring not shown)**

Figure 3-67. Pin Circlip Installation

CYLINDER

PART NUMBER	TOOL NAME
HD-42322	PISTON SUPPORT PLATE
HD-95952-1	THREADED CYLINDERS
HD-95952-33C	CONNECTING ROD CLAMPING TOOL
HD-96333-51F	PISTON RING COMPRESSOR

1. See Figure 3-67. Apply a very thin film of clean engine oil to **new** O-rings for both lower cylinder deck dowels. Install and verify that O-ring is properly seated in groove.
2. See Figure 3-68. Apply a very thin film of clean engine oil to **new** O-ring seal for the bottom of the cylinder liner. Install **new** O-ring seal.

NOTE

Excessive lubrication of cylinder sleeve O-ring seal will result in oil weepage between cylinder and crankcase as engine is run. This condition may be incorrectly diagnosed as an oil leak.

3. See Figure 3-69. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.
4. Apply clean 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 3-70. 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 3-71. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96333-51F).
   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, so disregard the word "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 3-72. 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.

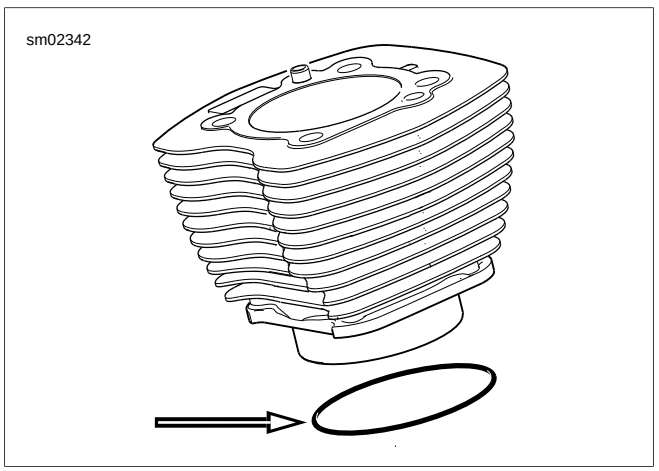
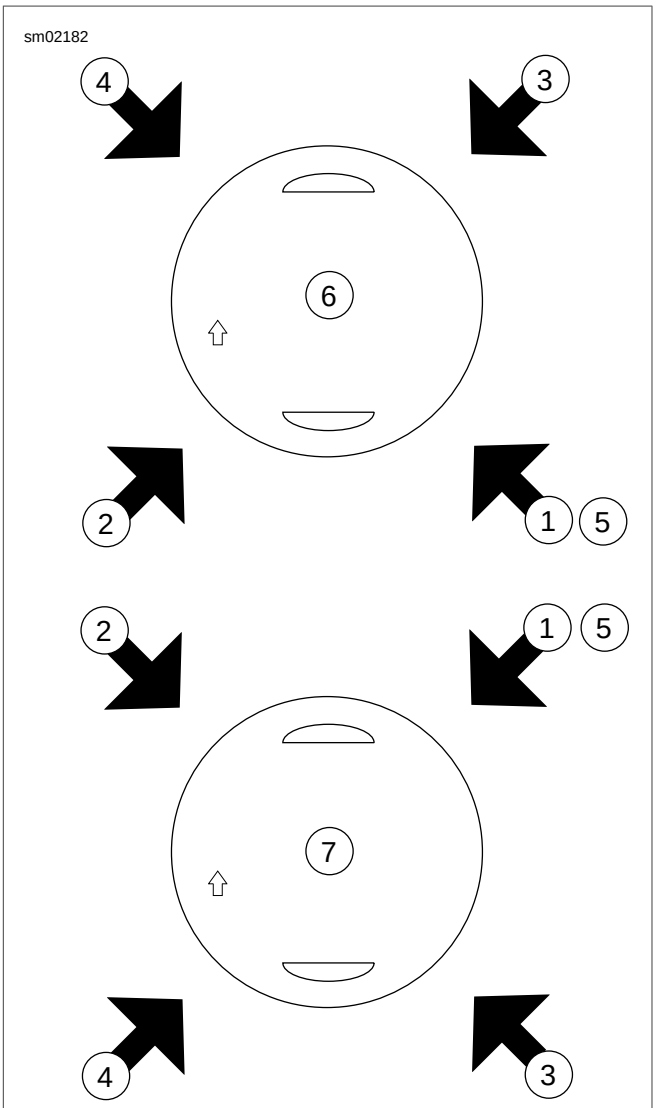
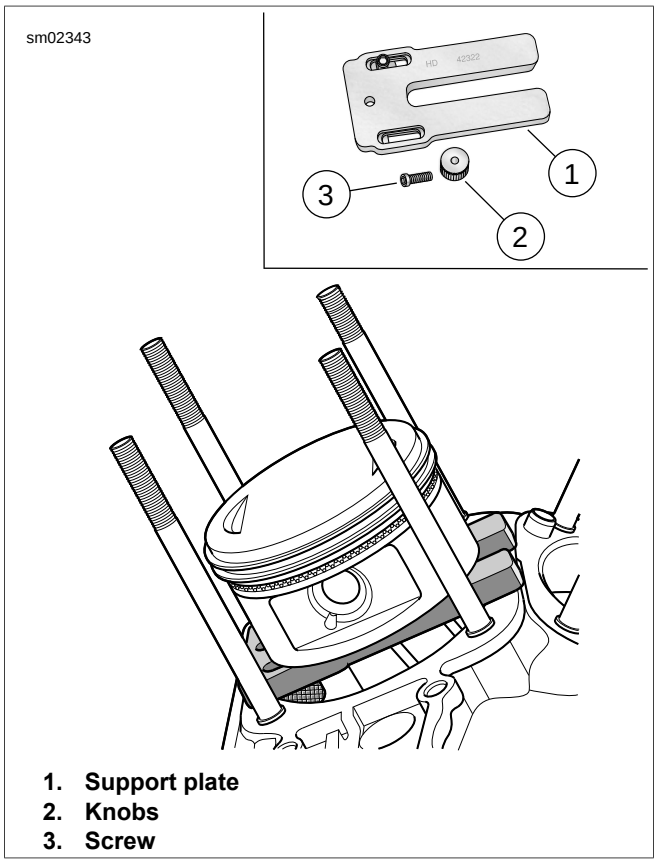


Figure 3-68. O-ring Seal For Cylinder



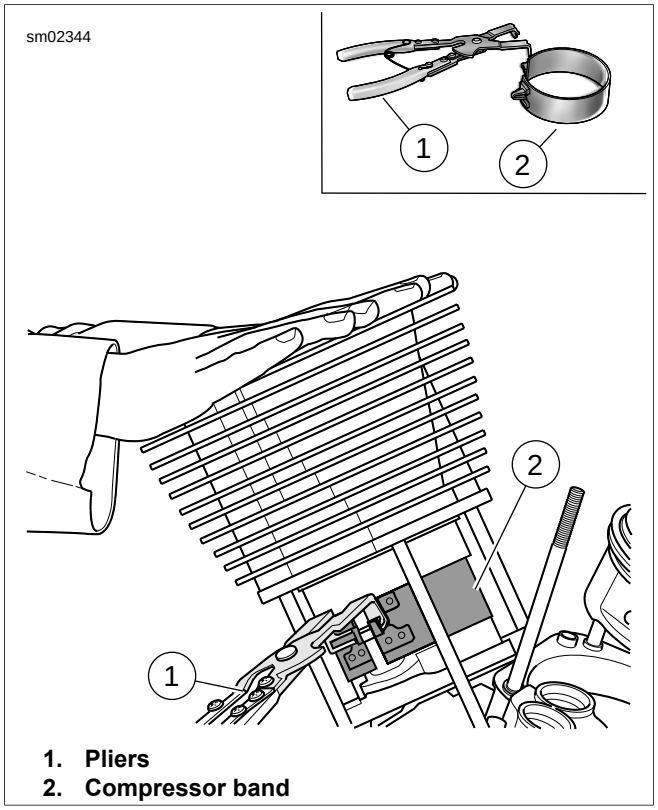
1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-69. Piston Ring Alignment



1. **Support plate**
2. **Knobs**
3. **Screw**

Figure 3-70. Piston Support Plate



1. **Pliers**
2. **Compressor band**

Figure 3-71. Piston Ring Compressor

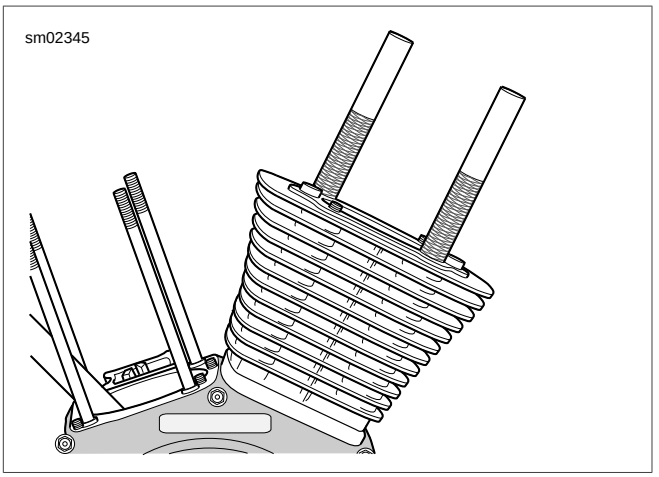


Figure 3-72. Install Threaded Cylinders to Studs

CYLINDER HEAD

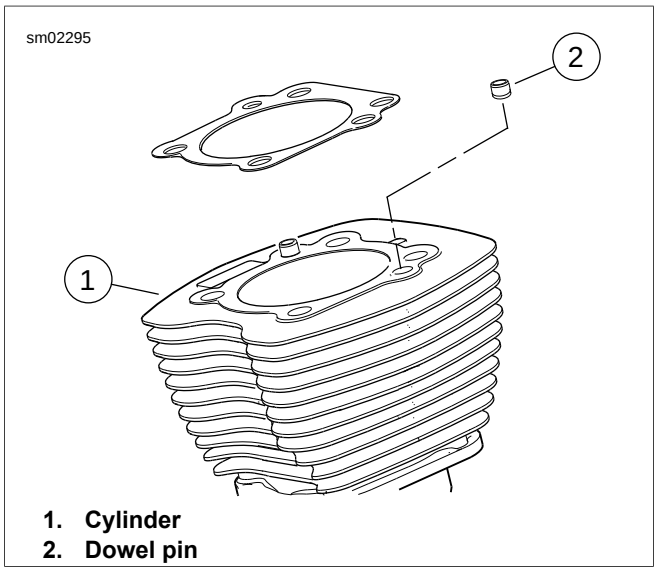
PART NUMBER	TOOL NAME
TA360	SNAP-ON TORQUE ANGLE GAUGE

FASTENER	TORQUE VALUE	
Cylinder head bolts, 1st torque	120-144 **in-lbs**	13.6-16.3 Nm
Cylinder head bolts, 2nd torque	15-17 ft-lbs	20.3-23.0 Nm
Cylinder head bolts, final torque	90 degrees	90 degrees
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm

NOTES

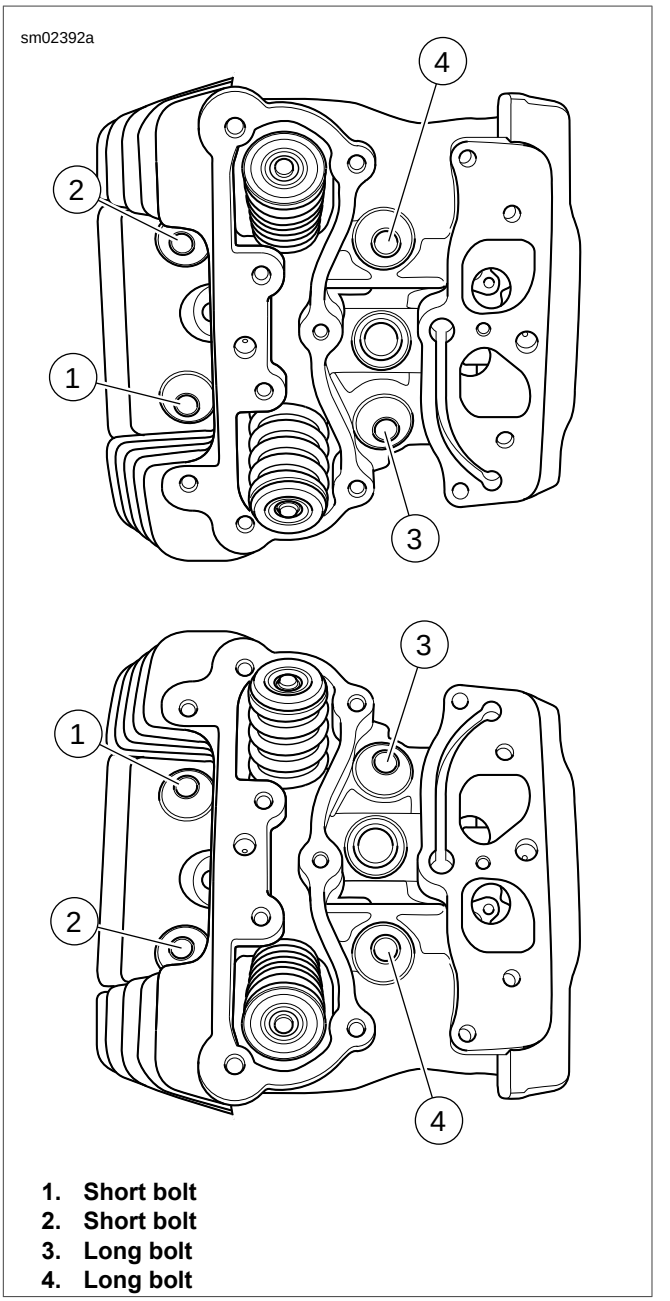
- *"Front" or "Rear" is cast into the top of the cylinder head to verify proper installation. The indent in the cooling fins always faces the right side of the engine.*
- *Lower the cylinder head at an angle that closely approximates the angle of the crankcase to avoid damage to machined surfaces or the dowel pins.*
- *Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.*

1. See Figure 3-73. With the part number facing up, place the head gasket over the two dowel pins in the upper flange of the cylinder.
2. Slide cylinder head squarely over the two cylinder flange dowel pins.
3. Lightly coat the threads and bottom face of the cylinder head bolts in clean engine oil. Wipe off any excess oil.
4. See Figure 3-74. Loosely install the cylinder head bolts. Place two short bolts on the left side of the engine and two long bolts on the right.



1. **Cylinder**
2. **Dowel pin**

Figure 3-73. Cylinder Dowel Pins



1. **Short bolt**
2. **Short bolt**
3. **Long bolt**
4. **Long bolt**

Figure 3-74. Cylinder Head Bolt Torque Sequence (Top: Front Cylinder Head, Bottom: Rear Cylinder Head)

NOTE

Improperly tightened cylinder head bolts may result in gasket leaks, stud failure or distortion of the cylinder and/or cylinder head.

5. Tighten the cylinder head bolts:
   a. See Figure 3-74. 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 3-75. 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.

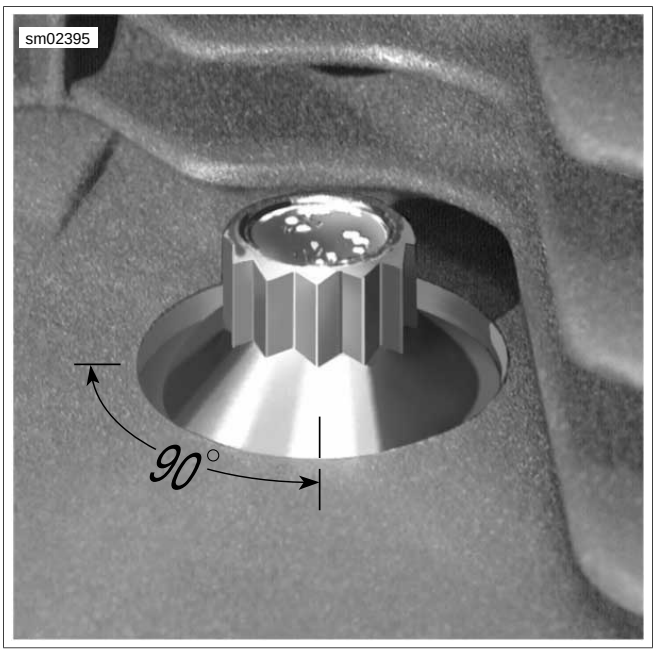
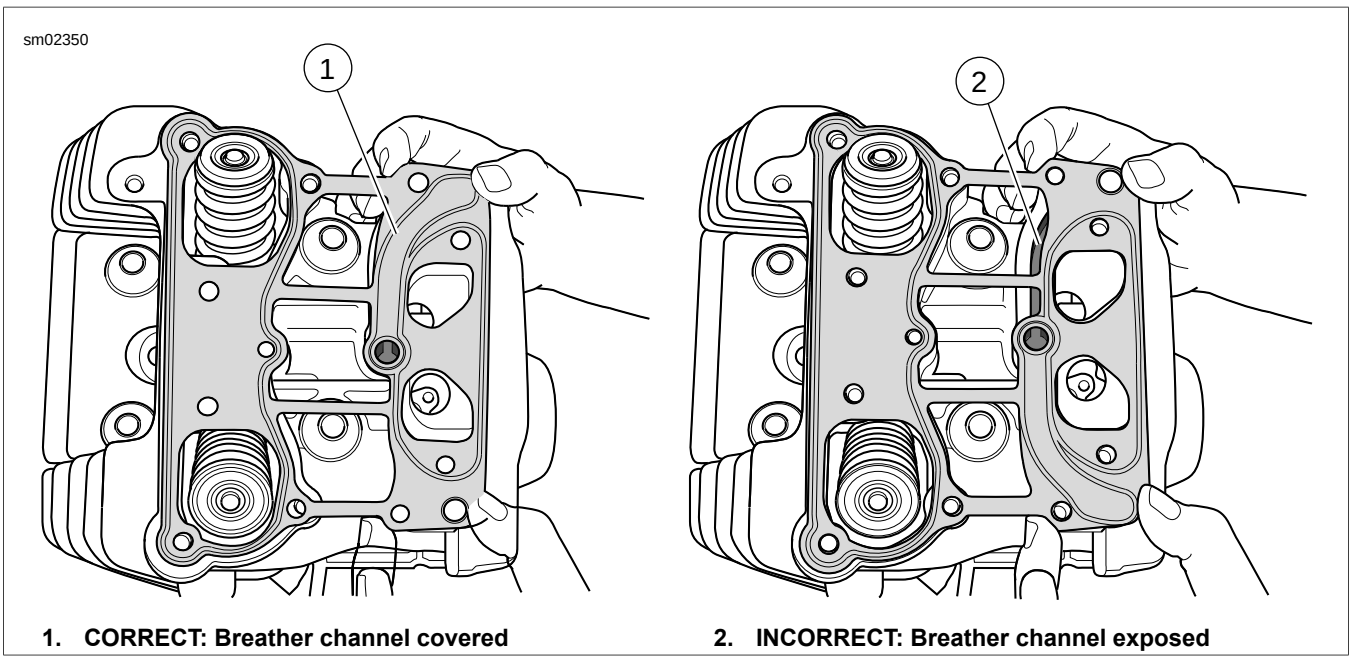


Figure 3-75. Final Tightening for Cylinder Head Bolts

NOTES

- *Although the gasket bolt holes appear to be in alignment, the rocker housing gasket can be installed upside down. An upside down gasket will result in an open breather channel. This will cause 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 3-76. Install a **new** rocker housing gasket on the cylinder head. Verify that the rocker housing gasket covers the breather channel.



1. **CORRECT: Breather channel covered**
2. **INCORRECT: Breather channel exposed**

Figure 3-76. Install Rocker Housing Gasket (Rear Cylinder Shown)

8. See Figure 3-78. 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 3-77. 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).

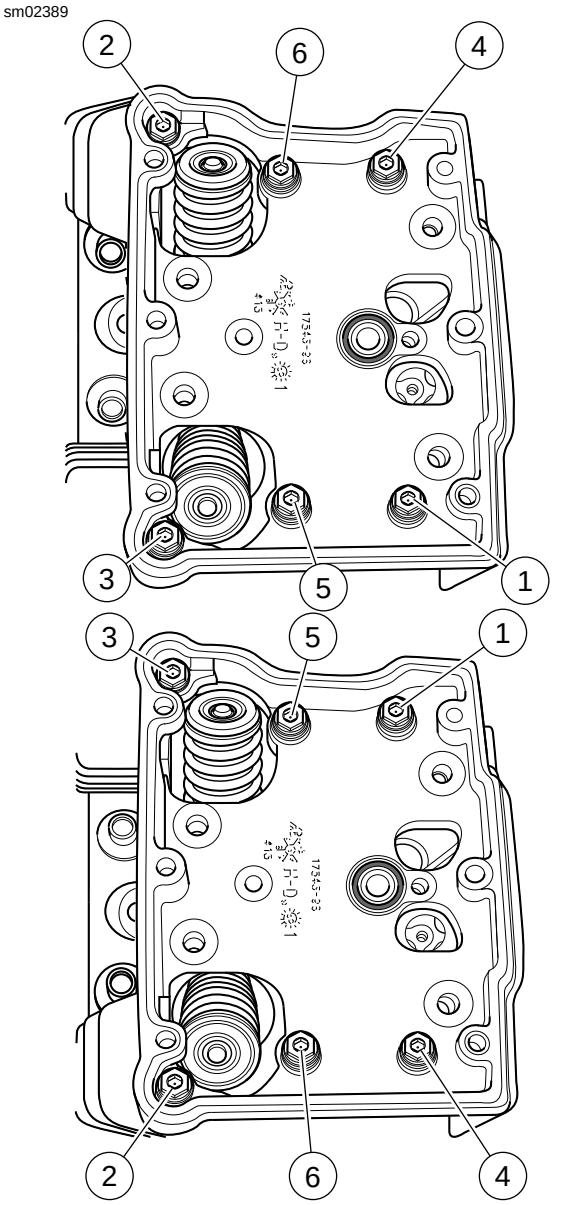
NOTES

- *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. Use of the wrong O-ring will result in either oil leakage or low oil pressure. Keep them packaged until use to avoid confusion.*

9. See Figure 3-78. 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.

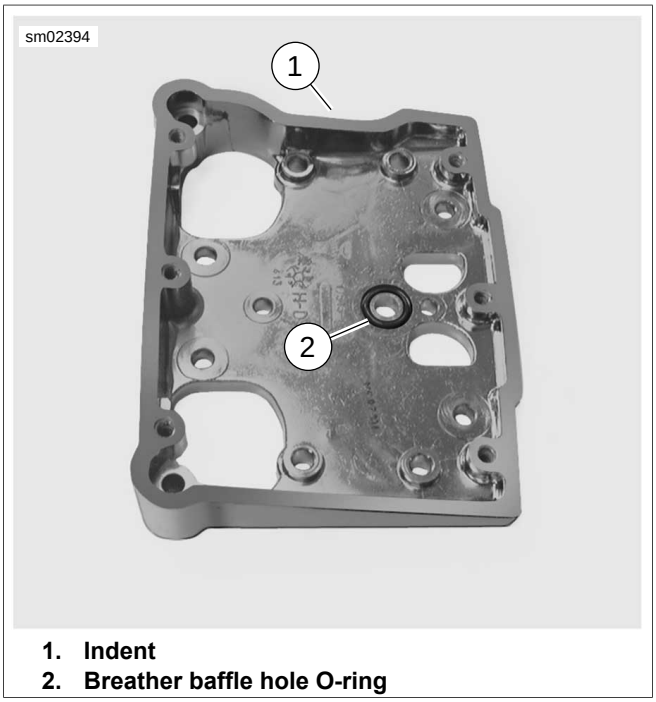
NOTE

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).



1. **Short bolt, 1.25 in. (31.8 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Long bolt, 1.75 in. (44.5 mm)**
4. **Short bolt, 1.25 in. (31.8 mm)**
5. **Short bolt, 1.25 in. (31.8 mm)**
6. **Short bolt, 1.25 in. (31.8 mm)**

Figure 3-77. Rocker Housing Torque Sequence and Bolt Size



1. **Indent**
2. **Breather baffle hole O-ring**

Figure 3-78. Rocker Housing Alignment

PUSHRODS, LIFTERS AND COVERS

FASTENER	TORQUE VALUE	
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm

1. Remove any labels used on the hydraulic lifters. Apply a thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to outer 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 3-79. 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

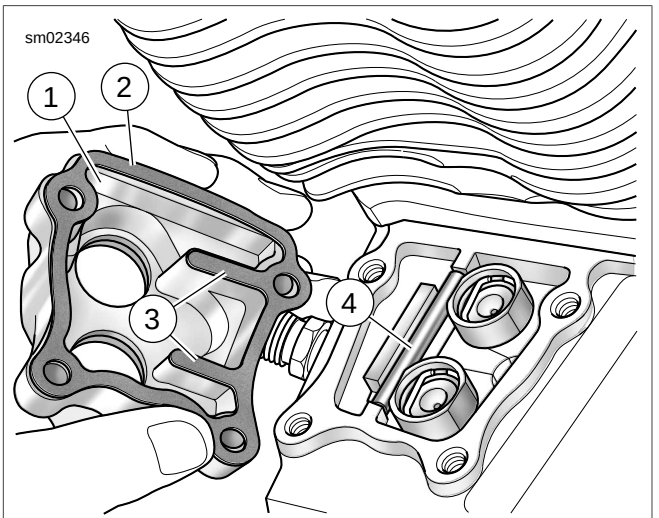
During cover installation, verify that the anti-rotation pin (4) is held in place by the ribs (3) cast into the inboard side of the lifter cover. Movement or loss of the pin can result in lifter rotation causing engine damage.

5. Install the lifter cover (1) and **new** gasket (2). Install four socket head screws. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a crosswise pattern.
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

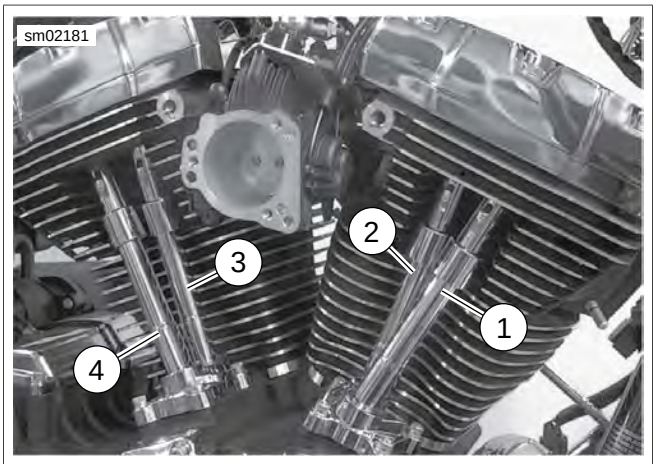
To install spring cap retainers, see 3.23 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.

7. Apply a small amount of SCREAMIN' EAGLE ASSEMBLY LUBE to the ends of each pushrod.
8. See Figure 3-80. Install the pushrods. If installing original parts, install them in their original locations and orientation. Be sure to remove any tags that may have been used for identification.



1. **Cover**
2. **Gasket**
3. **Ribs on cover**
4. **Anti-rotation pin**

Figure 3-79. Installing Lifters



1. **Front cylinder exhaust pushrod**
2. **Front cylinder intake pushrod**
3. **Rear cylinder intake pushrod**
4. **Rear cylinder exhaust pushrod**

Figure 3-80. Pushrod Locations

ROCKER ARM SUPPORT PLATE

PART NUMBER	TOOL NAME
FRDH161	SNAP-ON "DOG BONE" TORQUE ADAPTER

FASTENER	TORQUE VALUE	
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm

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 3-81. Place the rocker arm support plate assembly into the rocker housing and loosely install four rocker arm support plate bolts with flat washers.

NOTE

***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.

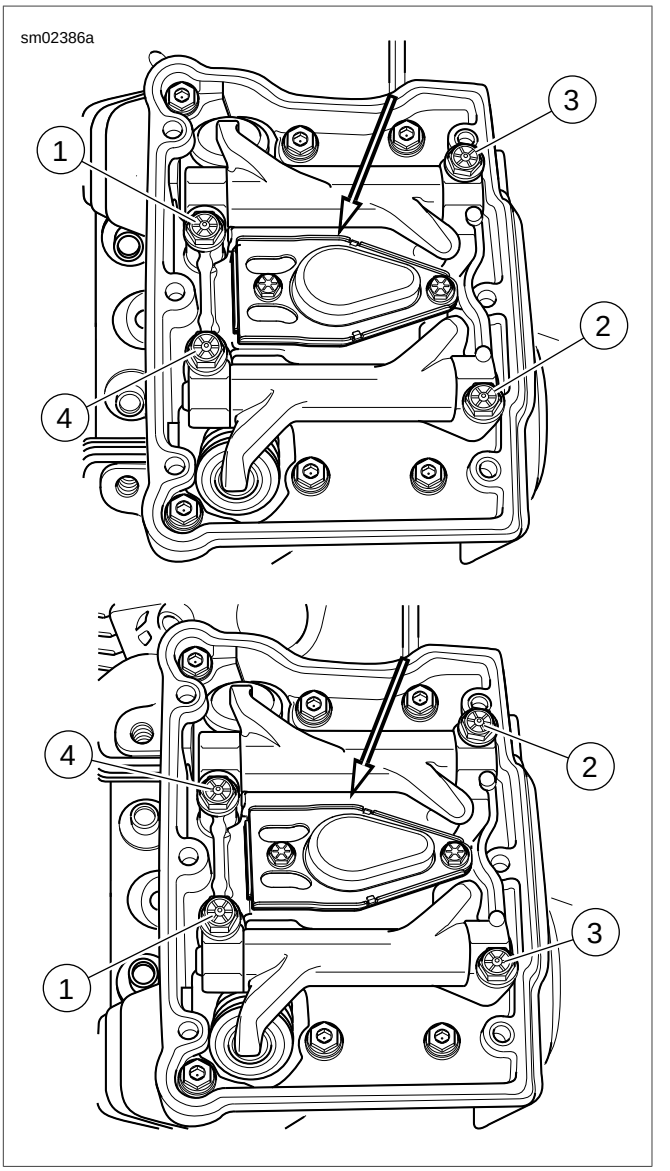


Figure 3-81. Rocker Arm Support Screw Sequence

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 3-82. 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.



Figure 3-82. Install Spring Cap Retainers

BREATHER AND ROCKER COVER

PART NUMBER	TOOL NAME
SNAP-ON FRDH141	"DOG BONE" TORQUE ADAPTER

FASTENER	TORQUE VALUE	
Breather assembly screws	120-156 **in-lbs**	13.6-17.6 Nm
Rocker cover screws	15-18 ft-lbs	20.3-24.4 Nm

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).

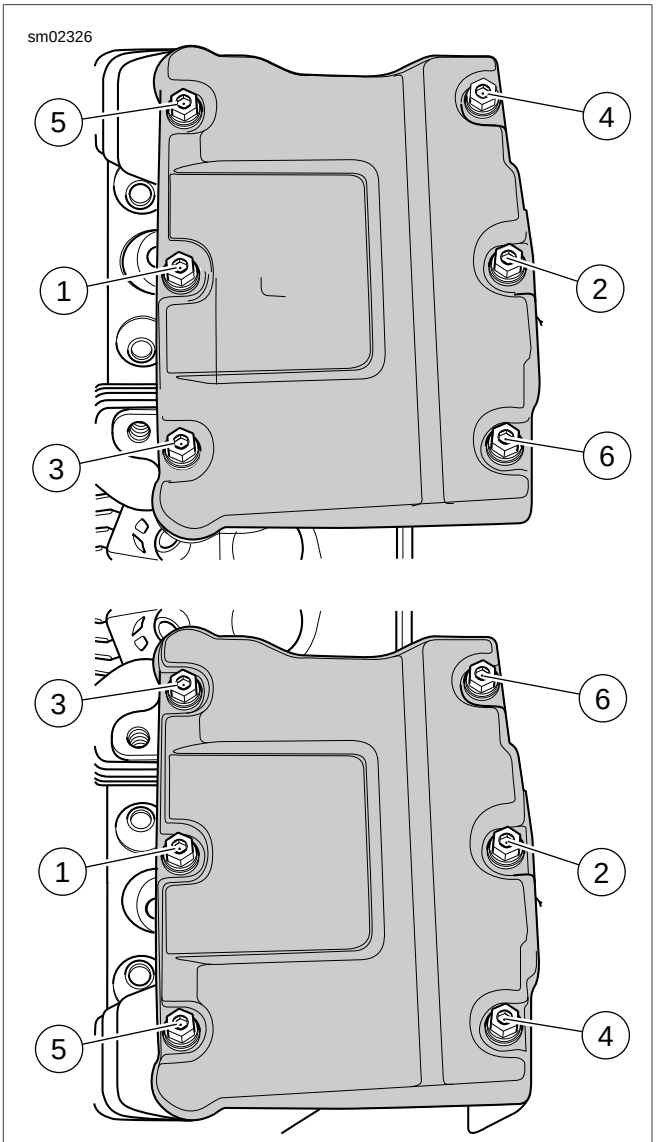
NOTE

If the engine is in the chassis, final tighten the three rocker cover bolts on the left side of the rear cylinder using a 3/8 in. drive torque wrench with a 7/16 in. flank drive "DOG BONE" TORQUE ADAPTER (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 3-83. 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).

4. Complete motorcycle assembly.
   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.



1. **Short bolt, 1.0 in. (25.4 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Short bolt, 1.0 in. (25.4 mm)**
4. **Long bolt, 1.75 in. (44.5 mm)**
5. **Short bolt, 1.0 in. (25.4 mm)**
6. **Long bolt, 1.75 in. (44.5 mm)**

Figure 3-83. Rocker Cover Bolts Torque Sequence

CAM COMPARTMENT AND COMPONENTS 3.24

CAM SUPPORT PLATE AND COVER REMOVAL

PART NUMBER	TOOL NAME
93979-10	SCREAMIN' EAGLE MAGNETIC LIFTER HOLDERS
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

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 3-85. Support lifters using SCREAMIN' EAGLE MAGNETIC LIFTER HOLDERS (Part No. 93979-10).

NOTE

Label cam cover screws to aid during assembly.

3. See Figure 3-84. Remove the socket head screws to release the cam cover. Remove and discard the cam cover gasket.

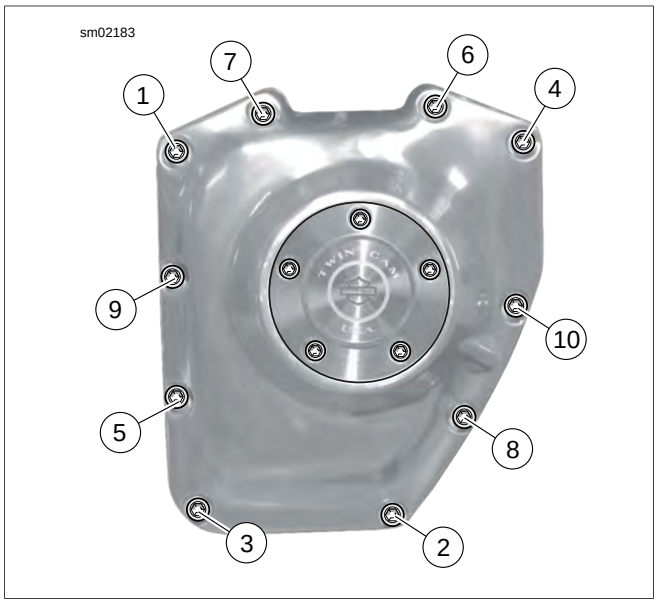


Figure 3-84. Cam Cover Screws

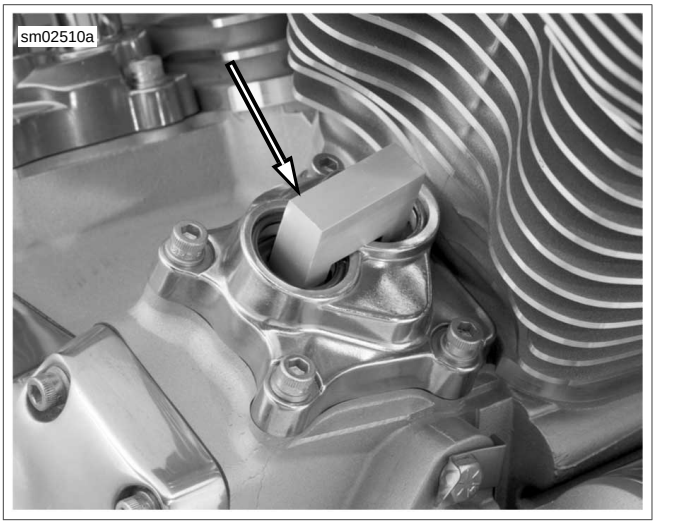


Figure 3-85. SCREAMIN' EAGLE Magnetic Lifter Holder

Cam Chain and Sprockets Removal

1. See Figure 3-86. 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 3-87. 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.**

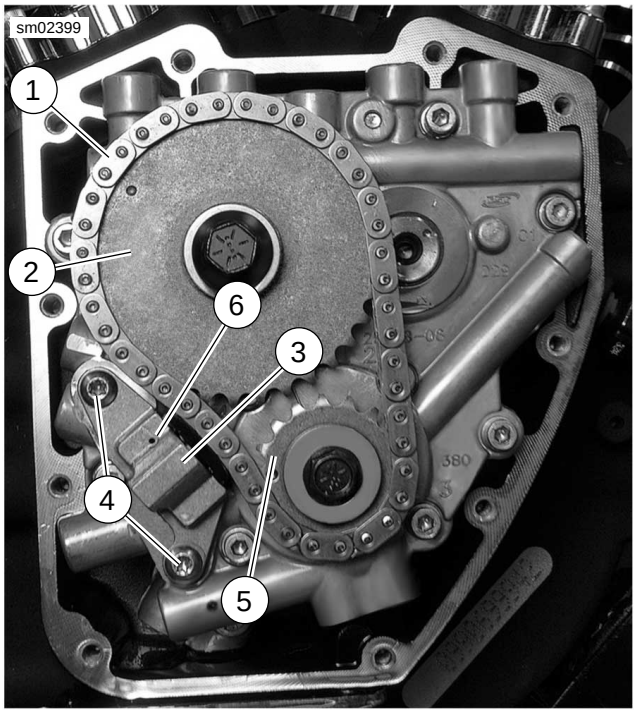
NOTES

- *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.

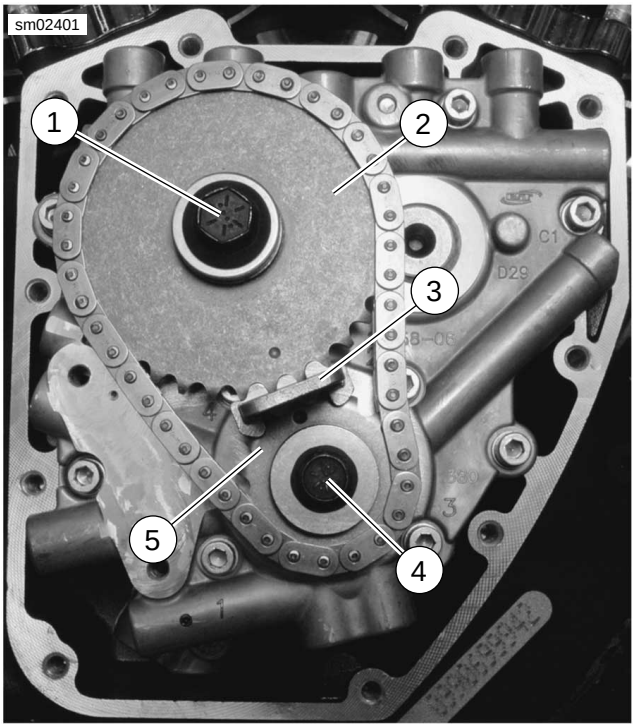
- *If necessary, soften LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but do not allow bolt to turn blue.*

4. Remove the rear cam sprocket bolt and flat washer (1) from the rear cam sprocket (2).
5. Remove the crank sprocket bolt and flat washer (4) from the crank sprocket (5).
6. Remove camshaft locking tool.
7. 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.



1. **Link**
2. **Rear cam sprocket**
3. **Primary cam chain tensioner**
4. **Primary cam chain tensioner fasteners**
5. **Crank sprocket**
6. **Retention hole**

Figure 3-86. Cam Support Plate Assembly



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 3-87. Cam Support Plate Assembly

Cam Support Plate Removal

1. See Figure 3-88. Following the sequence shown, remove four socket head screws.
2. See Figure 3-89. Following the sequence shown, remove six socket head screws to release the cam support plate from the crankcase.
3. See Figure 3-90. Use a small pry bar between the cam support plate and crankcase flange in areas adjacent to the ring dowels (2, 3) to work cam support plate and camshafts from end of crankshaft.

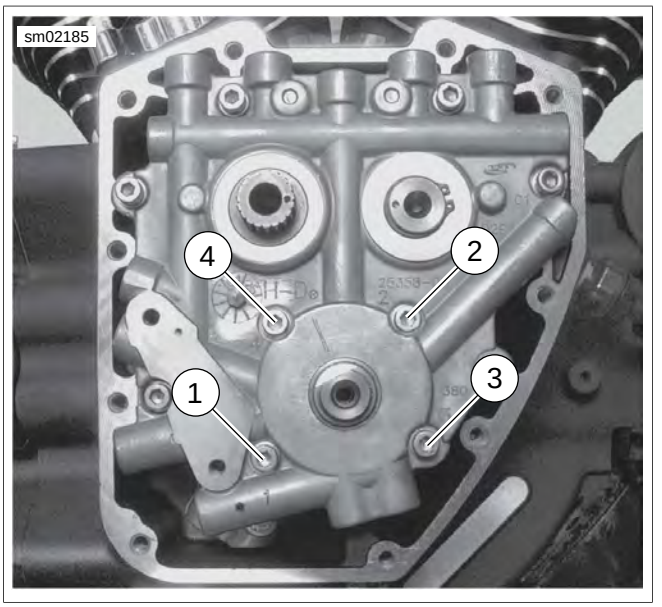


Figure 3-88. Oil Pump Torque Sequence

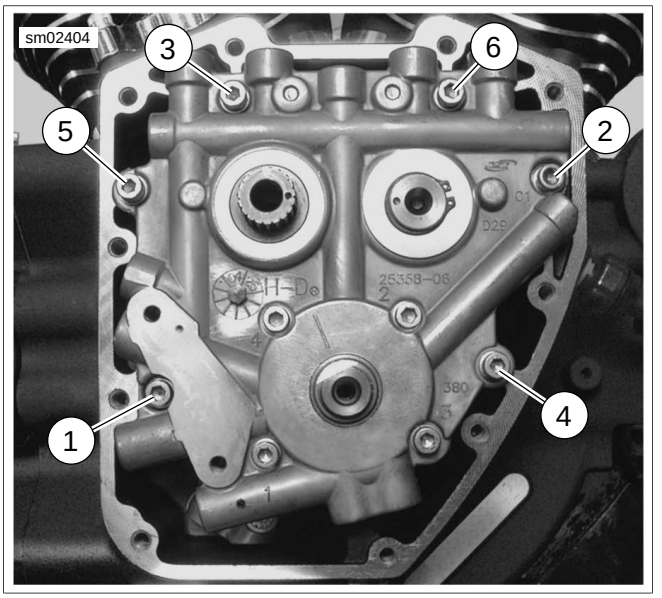
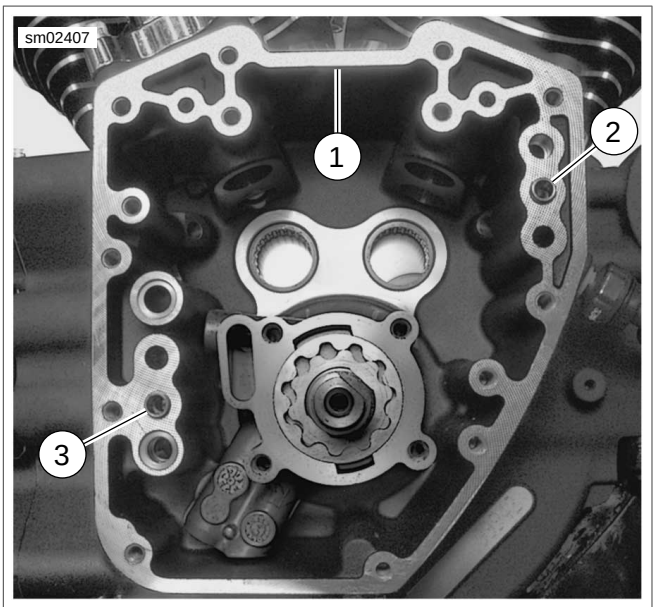


Figure 3-89. Cam Support Plate Torque Sequence



1. **Right crankcase half**
2. **Forward ring dowel**
3. **Rear ring dowel**

Figure 3-90. Ring Dowels

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 gerotor 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

PART NUMBER	TOOL NAME
HD-47956	CAMSHAFT ASSEMBLY TOOL

FASTENER	TORQUE VALUE	
Secondary cam chain tensioner fastener	90-120 **in-lbs**	10.2-13.6 Nm

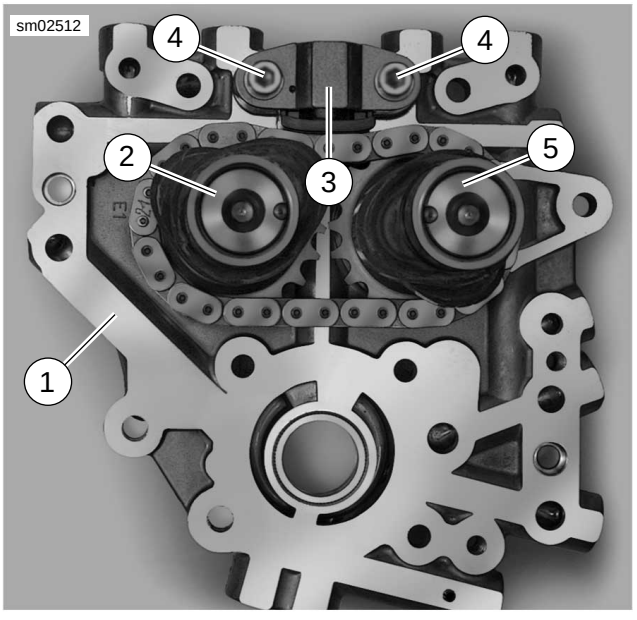
Removal

1. See Figure 3-91. Remove screws (4) and remove secondary cam chain tensioner (3).

WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

2. Remove retaining ring 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.



1. **Cam support plate**
2. **Front cam**
3. **Secondary cam chain tensioner**
4. **Secondary cam chain tensioner fasteners**
5. **Rear cam**

Figure 3-91. Camshafts

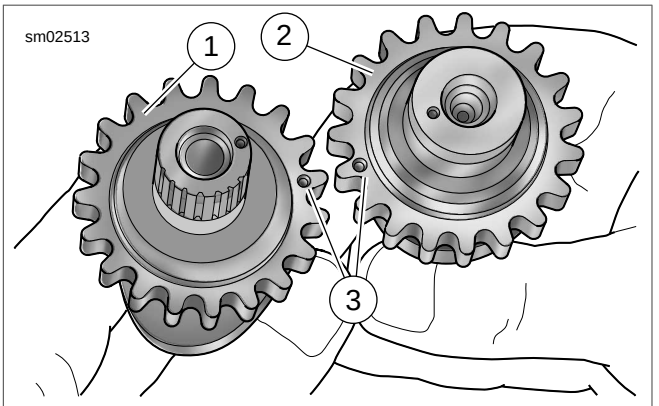
Installation

1. See Figure 3-92. Align timing marks on teeth of secondary cam sprockets.

NOTE

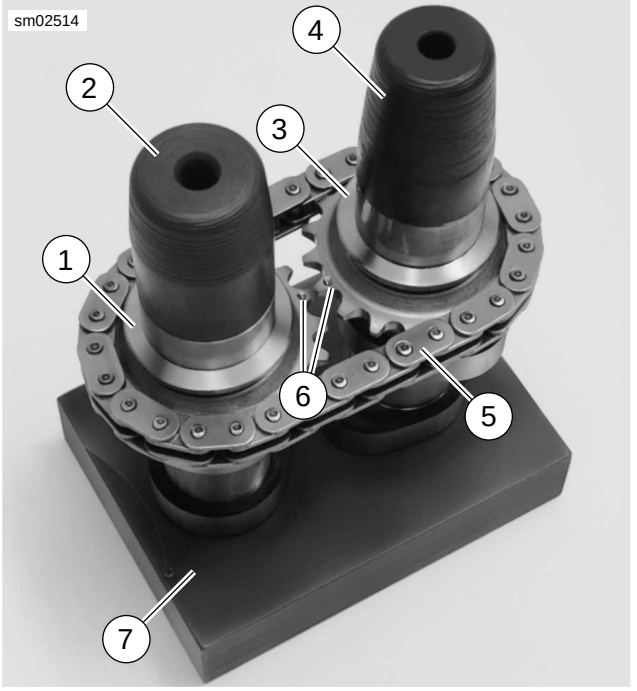
Do not mix camshafts during installation. The rear camshaft, identified by the splined shaft, must go into the hole at the rear of the cam support plate.

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.



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-92. Camshaft Timing Marks



1. **Rear camshaft**
2. **Small guide**
3. **Front camshaft**
4. **Large guide**
5. **Cam chain**
6. **Timing marks**
7. **Assembly tool base**

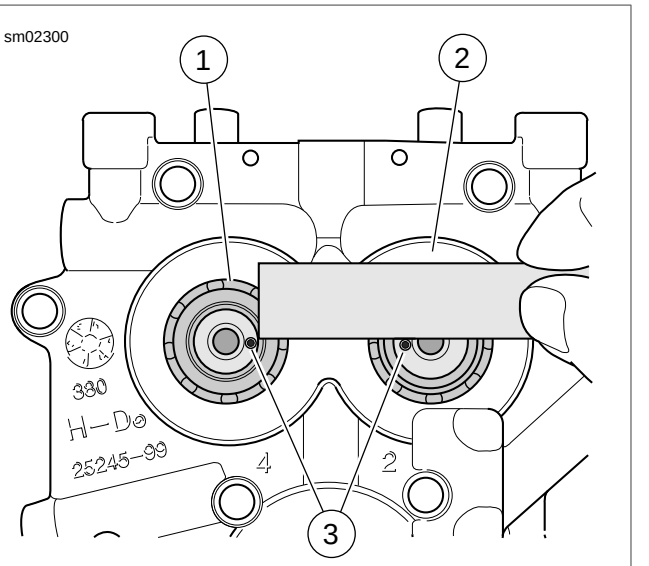
Figure 3-93. Camshaft Assembly Tool

3. See Figure 3-93. 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 3-94. 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

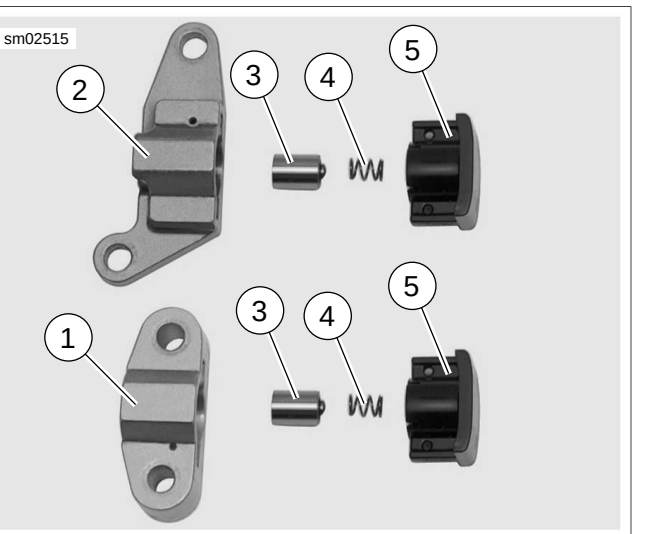
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

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 3-95. 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 fastenters. Tighten to 90-120 **in-lbs** (10.2-13.6 Nm).



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-94. Verify Alignment of Timing Marks



1. **Secondary cam chain tensioner**
2. **Primary cam chain tensioner**
3. **Piston**
4. **Spring**
5. **Shoe**

Figure 3-95. Cam Chain Tensioner Assemblies

OIL PRESSURE RELIEF VALVE

Removal

1. See Figure 3-96. 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

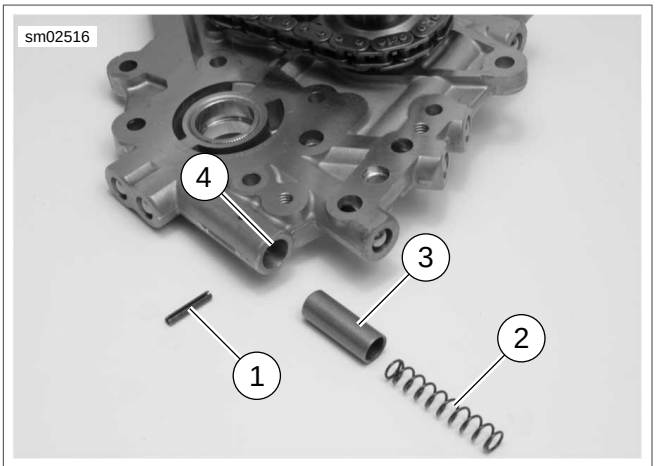
NOTE

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 burrs, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.
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.

Installation

1. Secure the cam support plate in a vise with soft jaws.
2. See Figure 3-96. 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.



1. **Roll pin**
2. **Spring**
3. **Piston**
4. **Bypass port**

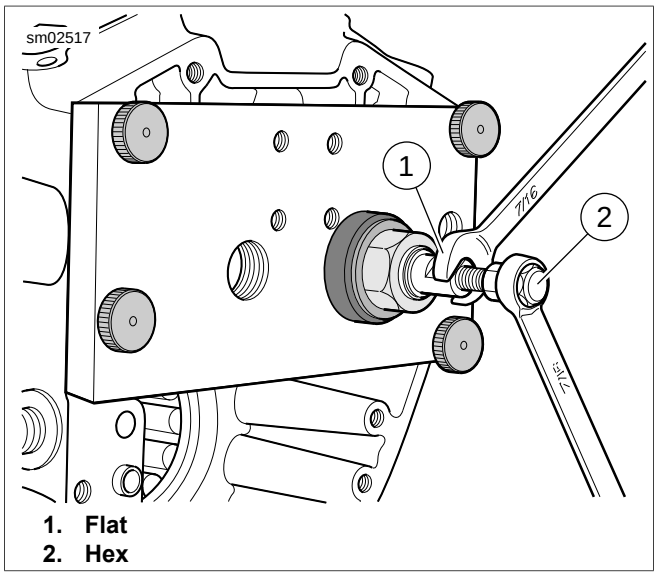
Figure 3-96. Oil Pressure Relief Valve Assembly

CAM NEEDLE BEARINGS

PART NUMBER	TOOL NAME
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER

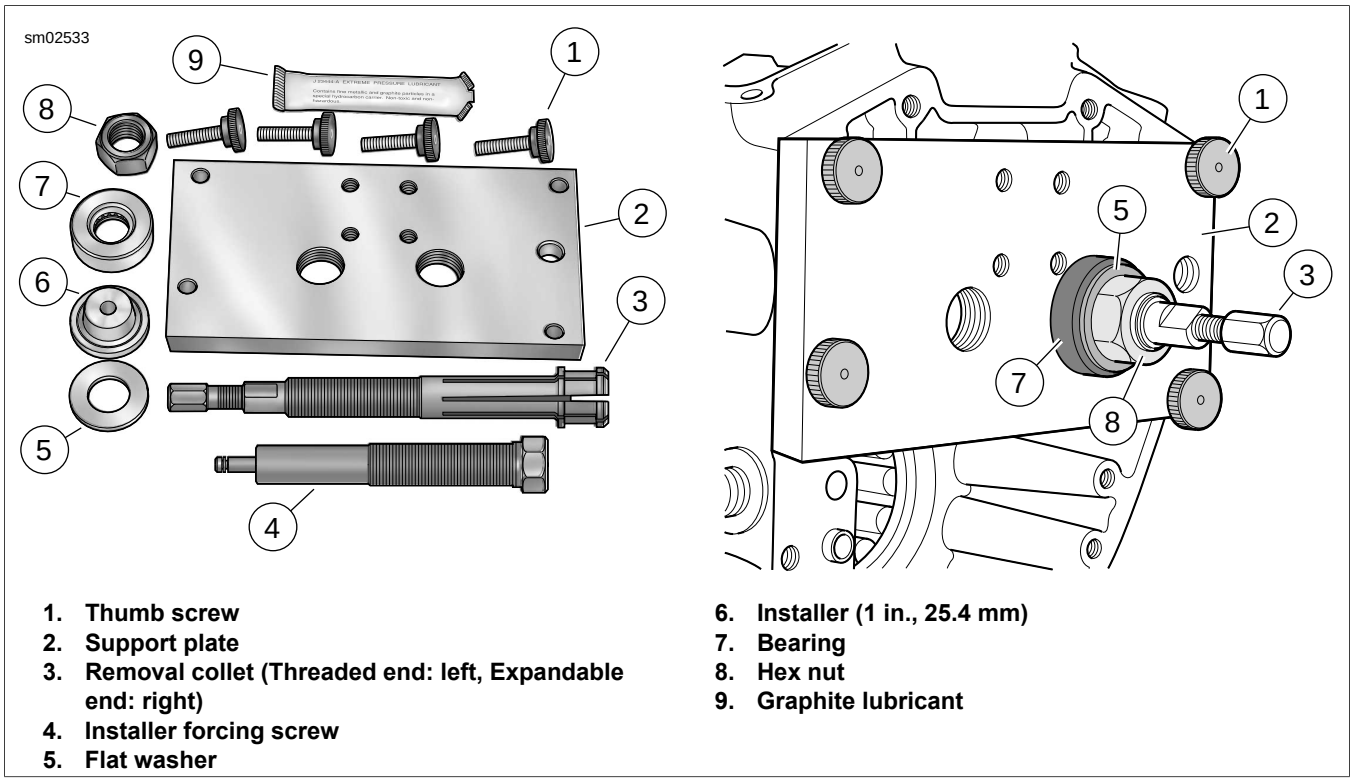
Removal

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).
2. See Figure 3-98. Remove four thumb screws (1) from threaded holes in support plate (2), if installed.
3. Sparingly apply clean engine oil (9) 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.



1. **Flat**
2. **Hex**

Figure 3-97. Expanding Collet by Turning Hex Clockwise



1. **Thumb screw**
2. **Support plate**
3. **Removal collet (Threaded end: left, Expandable end: right)**
4. **Installer forcing screw**
5. **Flat washer**
6. **Installer (1 in., 25.4 mm)**
7. **Bearing**
8. **Hex nut**
9. **Graphite lubricant**

Figure 3-98. Camshaft Needle Bearing Remover/Installer

9. Holding collet to prevent lateral movement, finger tighten hex nut until bearing contacts support plate.
10. See Figure 3-97. 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 3-99. 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.

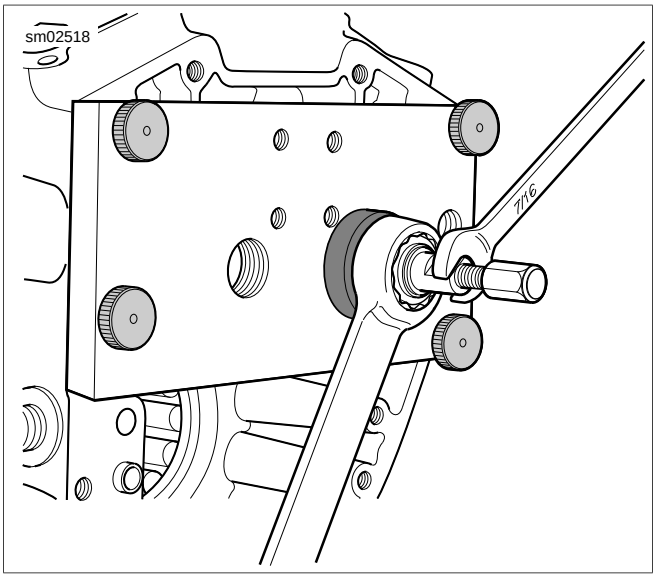


Figure 3-99. Bearing Removal

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 3-100. 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 3-98. Sparingly 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 3-101. 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.

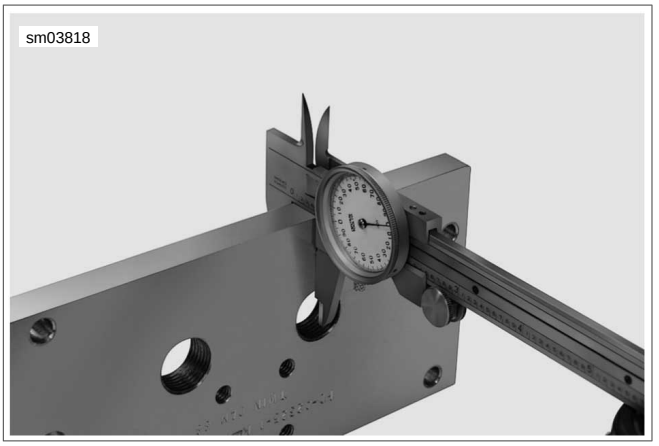


Figure 3-100. Measure Thickness of Support Plate

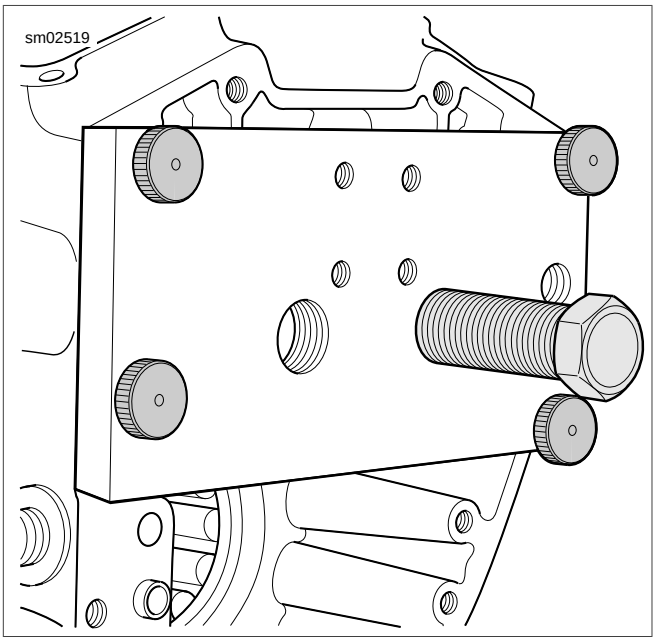


Figure 3-101. Installer Forcing Screw Installation

10. Install first needle bearing as follows:
    a. See Figure 3-102. 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 3-103. 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 3-104. 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.

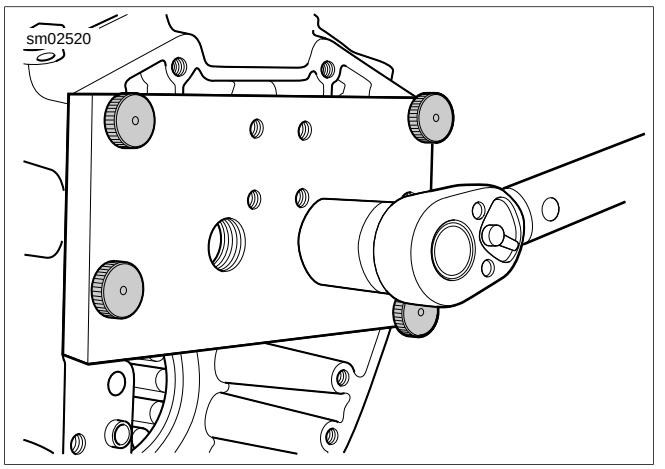


Figure 3-102. Bearing Installation

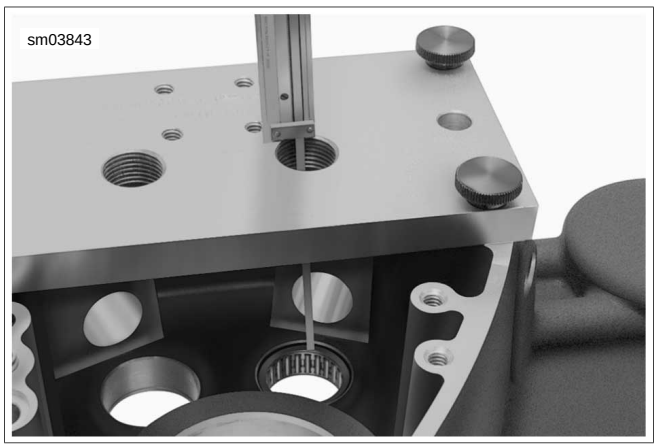


Figure 3-103. Measure from Top of Support Plate to Edge of Needle Bearing

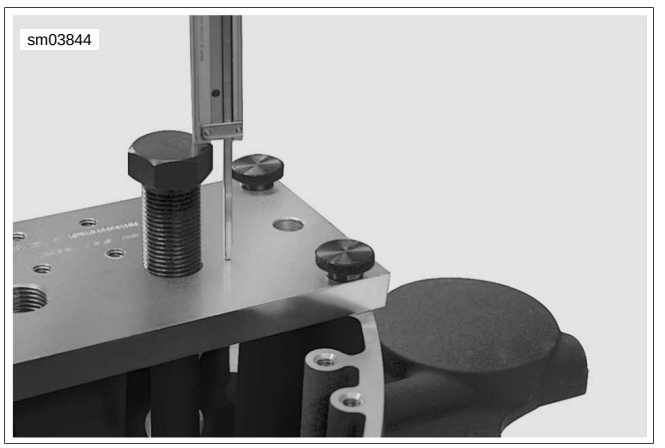


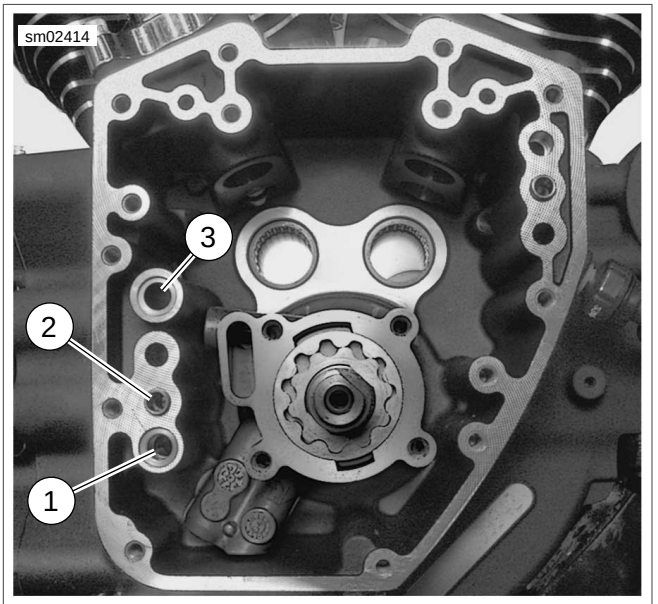
Figure 3-104. Measure from Top of Forcing Screw to Support Plate

CAM SUPPORT PLATE AND COVER INSTALLATION

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

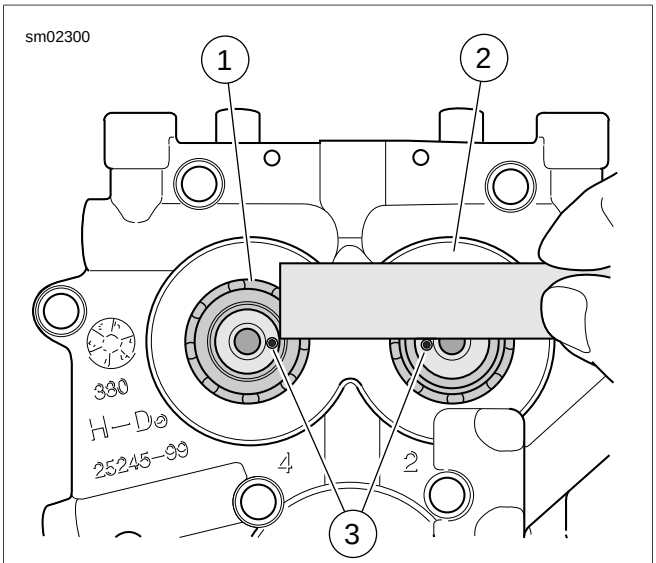
FASTENER	TORQUE VALUE	
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm
Oil pump screws, 1st torque	40-45 **in-lbs**	4.5-5.1 Nm
Oil pump screws, final torque	90-120 **in-lbs**	10.2-13.6 Nm
Cam sprocket flange bolt, 1st torque	15 ft-lbs	20.3 Nm
Crankshaft sprocket bolt, 1st torque	15 ft-lbs	20.3 Nm
Cam sprocket flange bolt, final torque	34 ft-lbs	46.1 Nm
Crankshaft sprocket bolt, final torque	24 ft-lbs	32.5 Nm
Cam chain tensioner fasteners	90-120 **in-lbs**	10.2-13.6 Nm
Cam cover screws	90-120 **in-lbs**	10.2-13.6 Nm

1. See Figure 3-105. 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 3-106. Verify that the timing marks on the ends of the front and rear camshafts are in alignment.



1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on crankcase post**

Figure 3-105. Oil Feed Hole



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-106. Verify Alignment of Timing Marks

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.

NOTE

The cam cover and support plate use different screw sizes. Verify screws are installed in the proper locations.

5. See Figure 3-107. Install cam support plate screws. Tighten to 90-120 **in-lbs** (10.2-13.6 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 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.*
- *Numbers cast adjacent to the bolt holes indicate the oil pump torque sequence.*

6. See Figure 3-108. 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.

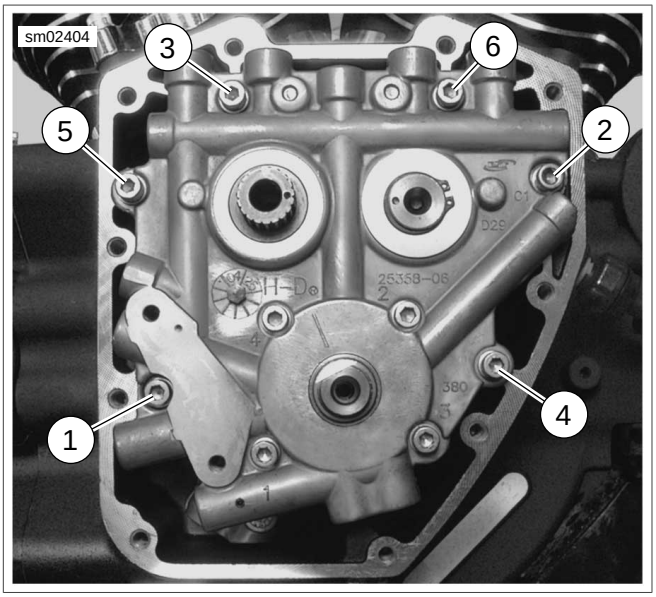


Figure 3-107. Cam Support Plate Torque Sequence

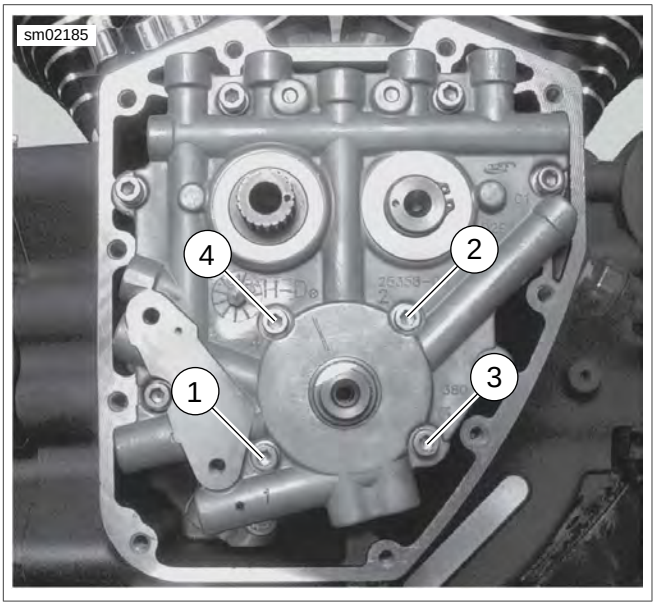


Figure 3-108. Oil Pump Torque Sequence

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 3-109. 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 3-40 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.

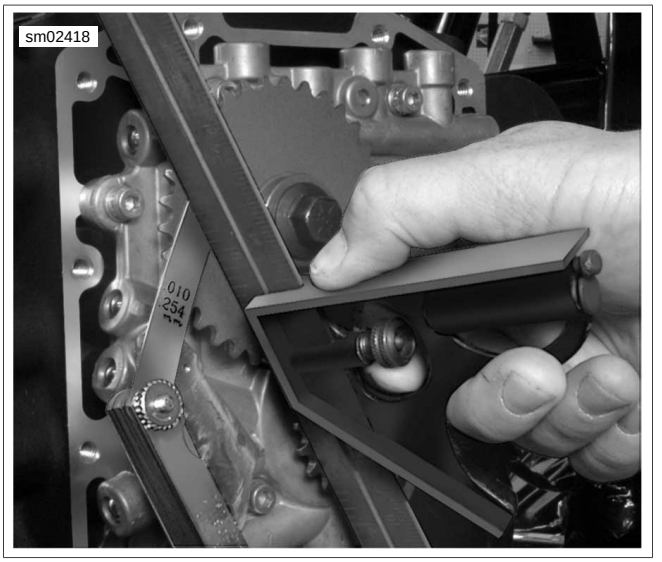


Figure 3-109. Check Alignment of Crank and Rear Cam Sprocket Faces

Table 3-40. Rear Cam Sprocket Spacers

PART NO.	IN	MM
25729-06	0.100	2.54
25731-06	0.110	2.79
25734-06	0.120	3.05
25736-06	0.130	3.30
25737-06	0.140	3.56
25738-06	0.150	3.81

9. See Figure 3-110. 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 crankshaft sprocket on the chain, rotate the rear cam sprocket clockwise until the flat on the crankshaft sprocket is aligned with the flat on the crankshaft. Install the crankshaft sprocket.
10. Rotate the crankshaft 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 install freely by hand.*
- *The crankshaft and rear cam sprocket flange bolts and flat washers are **not** interchangeable.*
- *Refer to Table 3-40.*

11. Apply a film of oil to bottom of both sprocket bolt heads and washers. Loosely install to secure sprockets.
12. Position the CRANKSHAFT/CAMSHAFT 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 90-120 **in-lbs** (10.2-13.6 Nm).

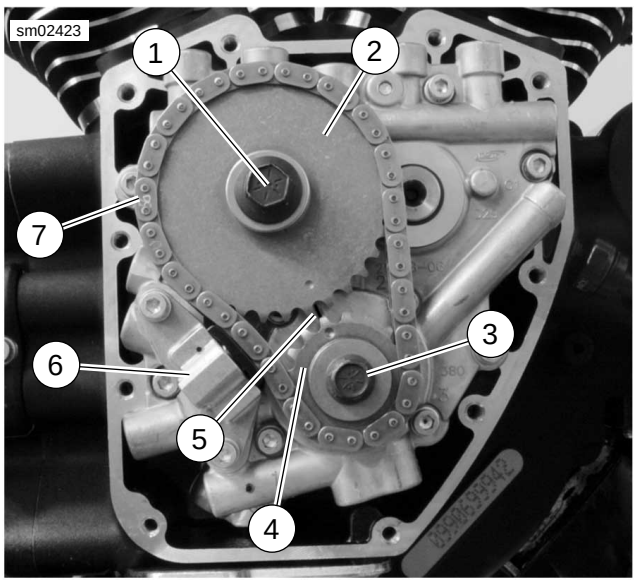
14. Apply SCREAMIN' EAGLE ASSEMBLY LUBE to both sprockets.

NOTE

Inserting a screw into a blind hole with debris can damage the crankcase.

15. Clean all blind holes in crankcase.

16. See Figure 3-111. Install cam cover and **new** cam cover gasket.



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 3-110. Primary Chain and Sprockets

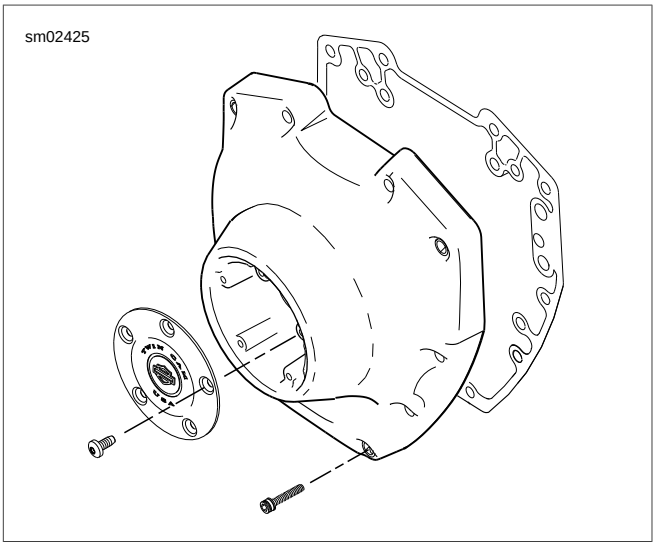


Figure 3-111. Cam Cover Gasket

17. See Figure 3-112. Secure cover with socket head screws. Following the sequence shown, tighten the screws to 90-120 **in-lbs** (10.2-13.6 Nm).

18. Complete motorcycle assembly.

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.

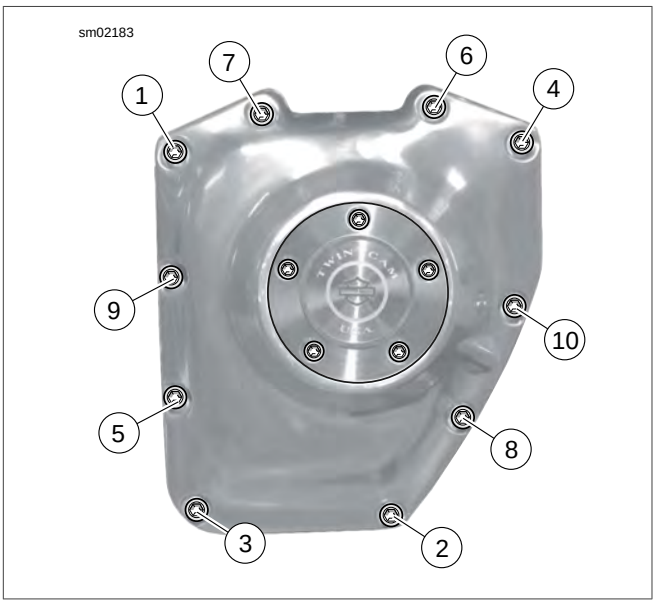
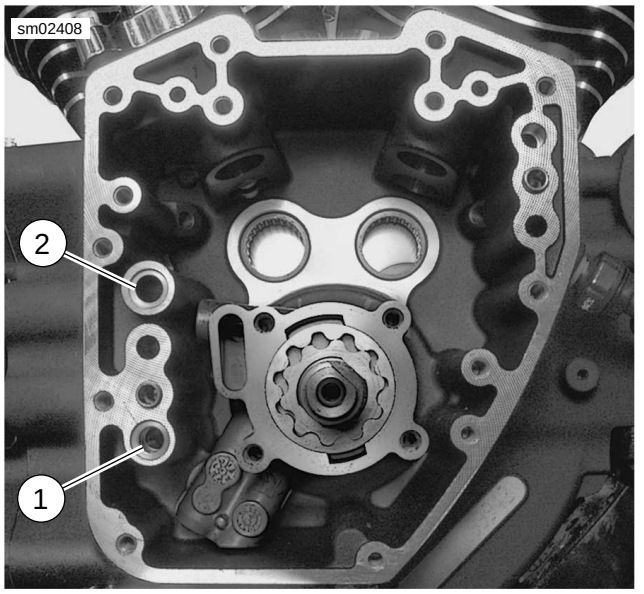


Figure 3-112. Cam Cover Screws

OIL PUMP 3.25

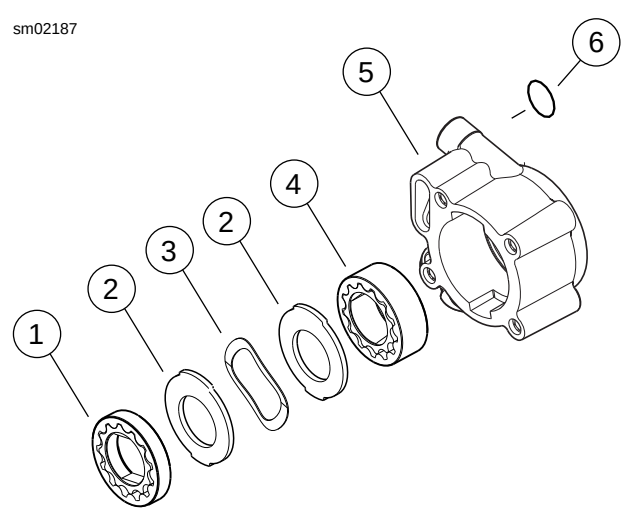
REMOVAL

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 fabricated tool. 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 3-113. Remove and discard O-rings (1, 2).
5. See Figure 3-114. Disassemble and inspect oil pump components.



1. **Oil feed hole O-ring**
2. **O-ring on crankcase post**

Figure 3-113. Oil Pump O-rings



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-114. Assembling Oil Pump

CLEANING AND INSPECTION

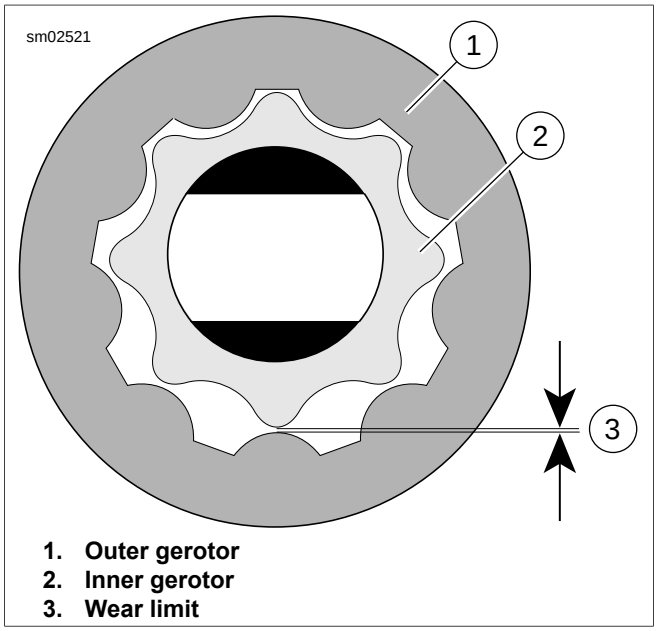
1. Clean all parts in a non-volatile cleaning solution or solvent.

⚠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 3-115. Check gerotor wear.
   a. Mesh pieces of one gerotor set together.
   b. Use a feeler gauge to determine clearance between tips of lobes on inner and outer gerotors.
   c. Replace gerotors as a set if clearance exceeds 0.004 in. (0.10 mm). Inspect second gerotor set in the same manner.
7. Measure 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 3-116. Assemble the oil pump.
9. Verify feed gerotors 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 feed gerotor set and reassemble using **new** wave washer.
11. Repeat measurement and replace oil pump body if not within specification.



1. **Outer gerotor**
2. **Inner gerotor**
3. **Wear limit**

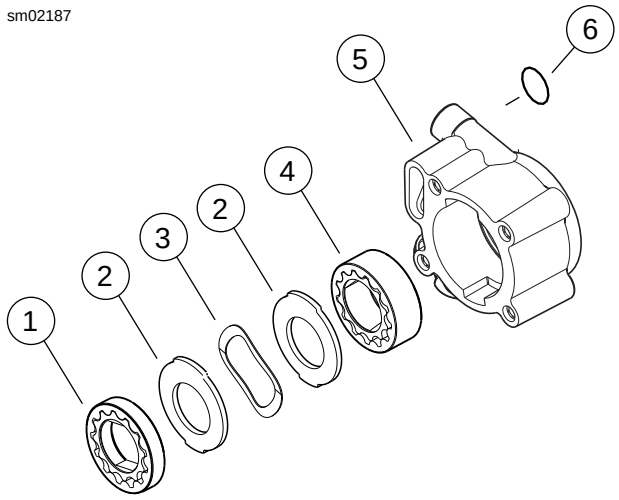
Figure 3-115. Measure Gerotor Sets for Wear

INSTALLATION

NOTE

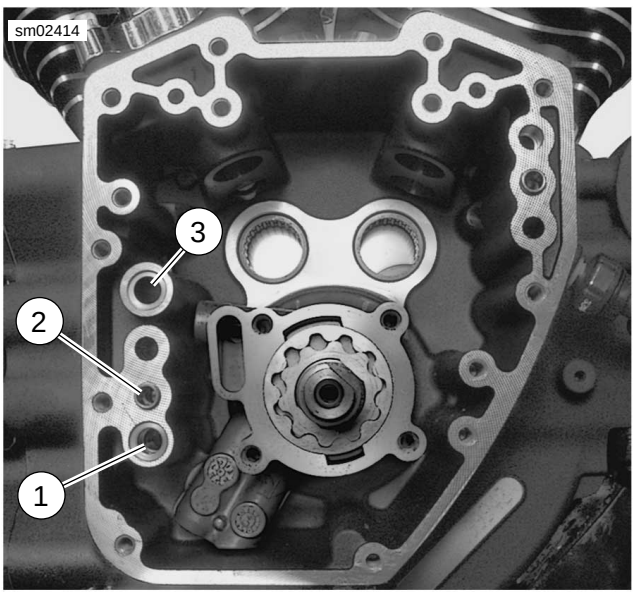
Lubricate parts with SCREAMIN' EAGLE ASSEMBLY LUBE during assembly.

1. See Figure 3-116. 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 gerotor 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 gerotor set (4). Install wave washer (3) and outside separator plate (2).
5. Assemble the narrow gerotor 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. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-116. Assembling Oil Pump



1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on crankcase post**

Figure 3-117. Oil Feed Hole

CRANKCASE DISASSEMBLY AND REPAIR 3.26

CRANKCASE DISASSEMBLY

1. Remove oil pump from crankshaft.

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.

2. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward.
3. See Figure 3-118. Remove the nine crankcase bolts in the sequence shown.

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped.

4. Separate case halves. Lift right crankcase half off end of crankshaft.
5. See Figure 3-119. Remove two dowel pins in split line face of right case half.
6. Remove flywheel assembly from the crankcase. Inspect crankshaft/flywheel assembly. See 3.27 FLYWHEEL AND CONNECTING RODS.

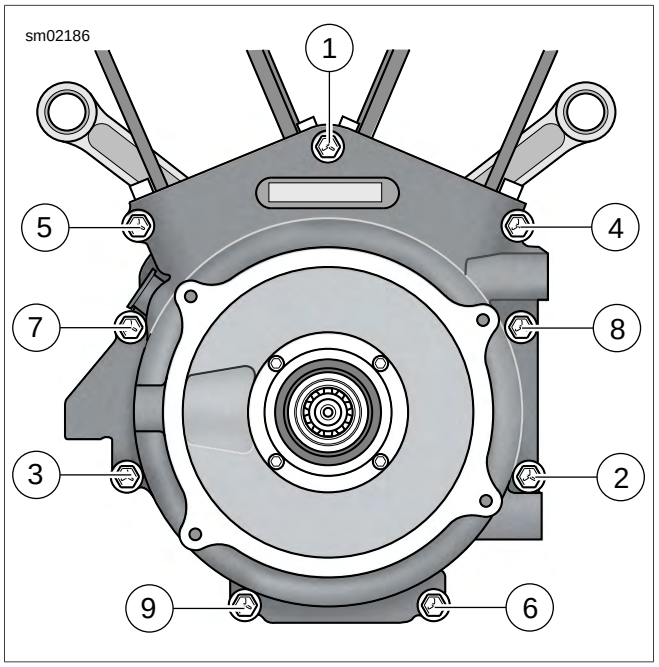


Figure 3-118. Crankcase Bolt Sequence

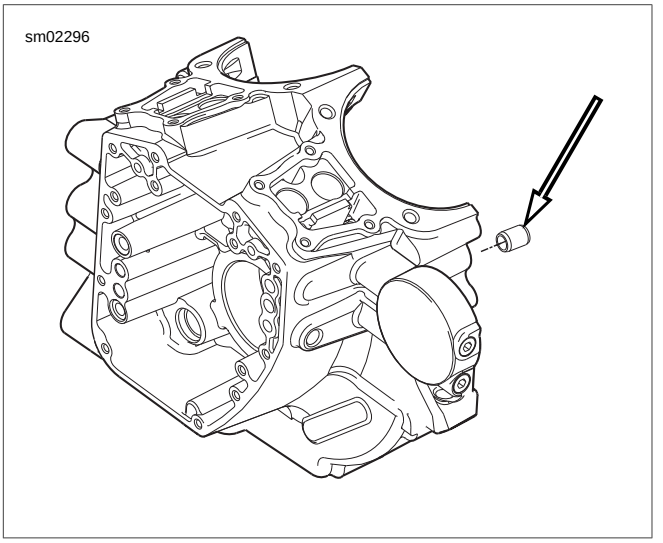


Figure 3-119. Right Crankcase Forward Dowel Pin (Rear Dowel Pin Not Shown)

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

PART NUMBER	TOOL NAME
B-45655	CRANKCASE BEARING REMOVER/INSTALLER
HD-42720-4	CRANKSHAFT BEARING DRIVER SHIM
HD-42720-5	REMOVER/INSTALLER SUPPORT TUBE

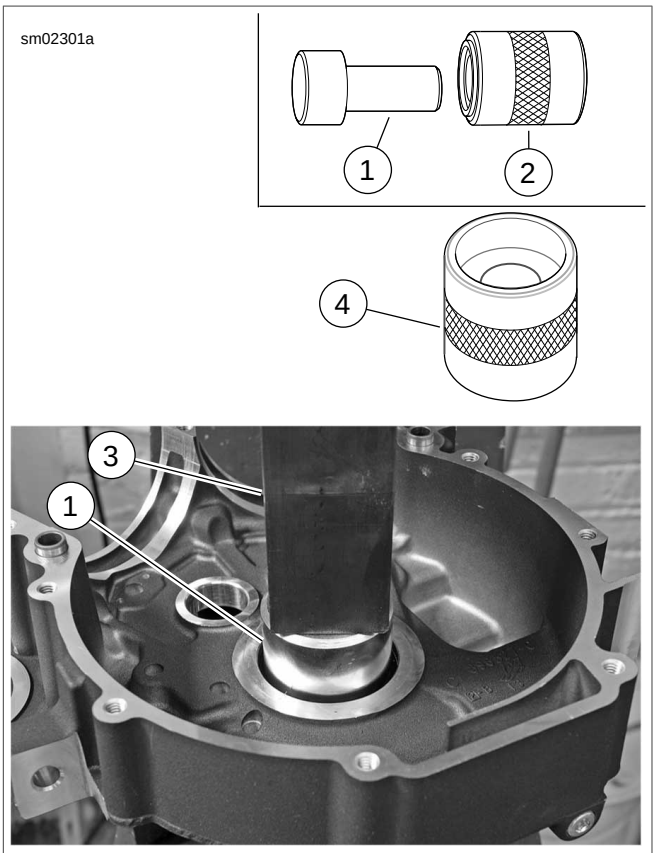
FASTENER	TORQUE VALUE	
Main bearing, right, retaining screws	40-70 **in-lbs**	4.5-7.9 Nm
Piston jet screws	25-35 **in-lbs**	2.8-3.9 Nm

Main Bearing Removal

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped.

1. See Figure 3-122. Remove two main bearing retaining screws (5) from the cam compartment side.
2. See Figure 3-120. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and REMOVER/INSTALLER SUPPORT TUBE (Part No. HD-42720-5).
3. Place support tube (4) on hydraulic press table with the "A" end up. Note that the sides of the support tube are stamped to verify proper orientation.
4. With the cam compartment side facing downward, position main bearing bore over support tube.
5. Slide remover/installer (1) through bearing into support tube.
6. Center remover/installer under ram (3) of press. Apply pressure until bearing is free.
7. Remove crankcase, remover/installer and bearing from support tube. Discard bearing.



1. **Crankcase bearing remover/installer**
2. **Support tube**
3. **Ram**
4. **Support tube "A" end up**

Figure 3-120. Right Main Bearing Removal

Main Bearing Installation

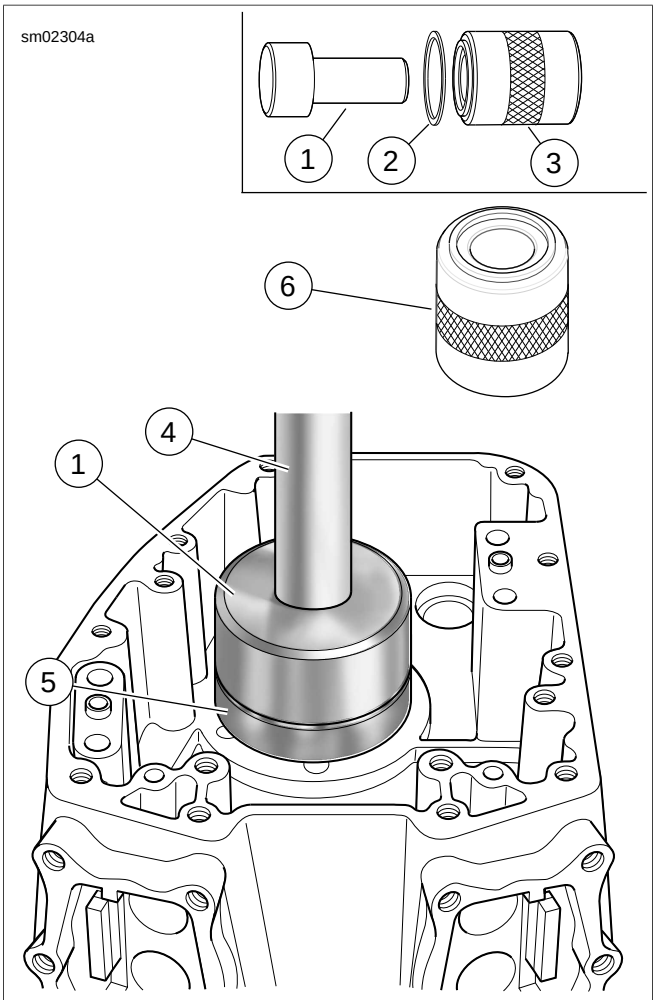
1. See Figure 3-121. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655), CRANKSHAFT BEARING DRIVER SHIM (Part No. HD-42720-4) and REMOVER/INSTALLER SUPPORT TUBE (Part No. HD-42720-5).
2. Spread a thin film of clean engine oil on OD of **new** bearing (5).
3. Place support tube (3) on press table with the "B" end is up. The ends of the support tube are stamped "A" and "B" to verify proper orientation.
4. Place CRANKSHAFT BEARING DRIVER SHIM (Part No. HD-42720-4) (2) on support tube (3).
5. With the cam compartment side facing upward, position main bearing bore over support tube.
6. Start the **new** bearing in bearing bore with the lettering facing into the cam compartment (up).
7. Slide remover/installer (1) through bearing into support tube.
8. Center remover/installer under ram (4) of press. Apply pressure until resistance is felt and bearing is bottomed on the support tube.

9. Remove remover/installer and crankcase half from support tube.

NOTES

- *Verify that the bearing is flush or slightly below the surface of the crankcase. Never "push" the bearing into position using the retaining screws.*
- *If **new** retaining screws are not available, apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of screws before installation.*

10. See Figure 3-122. Install two **new** main bearing retaining screws (5) from the cam compartment side. Tighten screws to 40-70 **in-lbs** (4.5-7.9 Nm).

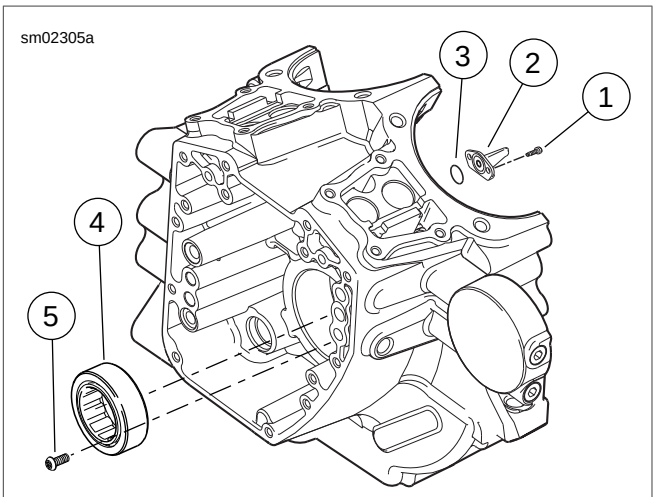


1. **Pilot/driver**
2. **Bearing driver shim**
3. **Support tube**
4. **Ram**
5. **Main bearing**
6. **Support tube (2) "B" end up**

Figure 3-121. Right Main Bearing Installation

Piston Jets Removal

1. See Figure 3-122. 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.



1. **Screw (2 each jet)**
2. **Piston jet (2)**
3. **O-ring (2)**
4. **Main bearing**
5. **Screw (2)**

Figure 3-122. Piston Jets

Piston Jets Installation

NOTE

If piston jet is being reused, apply LOCTITE 222 LOW STRENGTH THREADLOCKER AND SEALANT (purple) to threads of screws before installation.

1. See Figure 3-122. Apply a very thin film of clean engine oil to **new** O-ring (3). Install **new** O-ring in groove of jet mounting flange.
2. With jet pointed upward, secure piston jet (2) with two screws (1). Tighten to 25-35 **in-lbs** (2.8-3.9 Nm).

LEFT CRANKCASE HALF

PART NUMBER	TOOL NAME
B-45655	CRANKCASE BEARING REMOVER/INSTALLER
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE

Main Bearing Removal

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped.

⚠CAUTION

Do not rotate left crankcase half in engine stand such that flywheel sprocket shaft is facing up. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552b)

1. 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 3-123. 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.

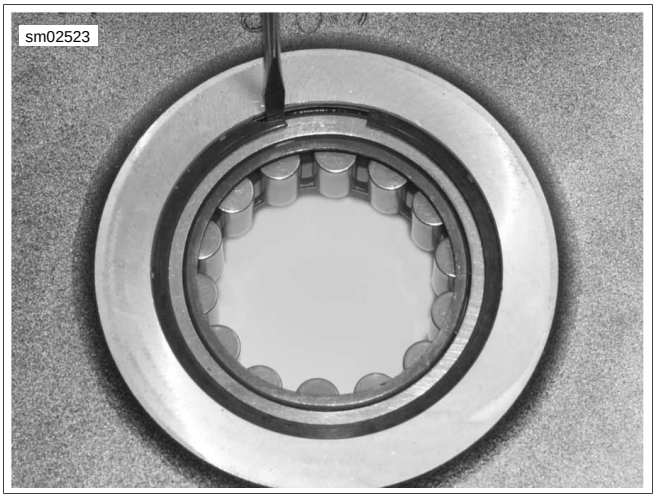
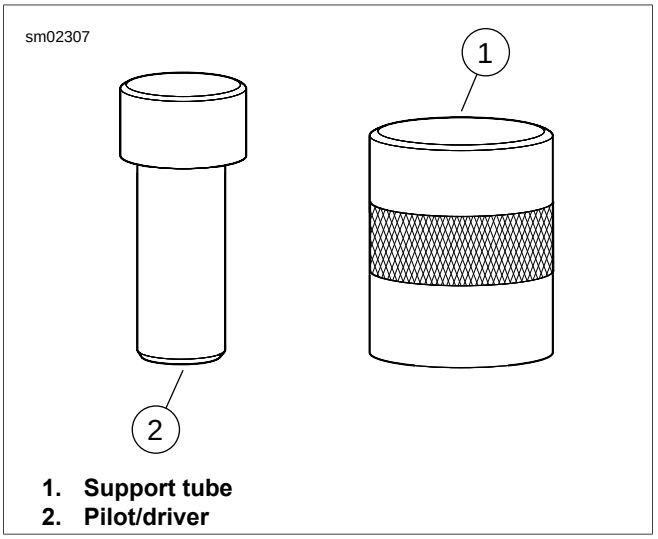
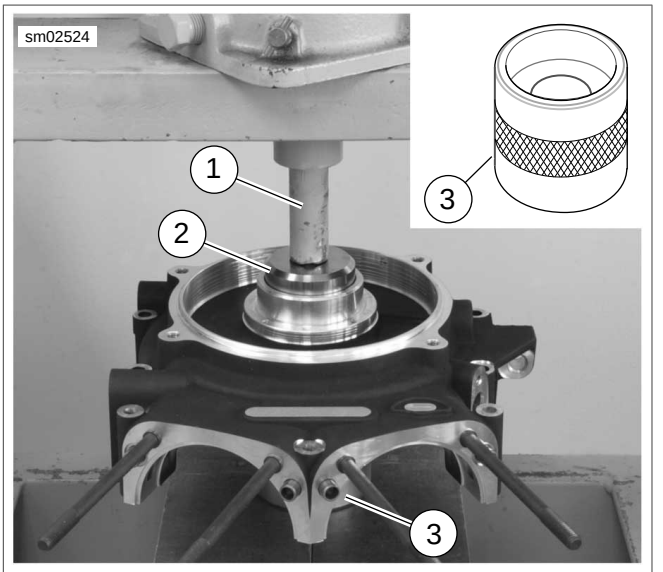


Figure 3-123. Removing Retaining Ring



1. **Support tube**
2. **Pilot/driver**

Figure 3-124. Left Main Bearing Remover and Installer Tools



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**

Figure 3-125. Left Main Bearing Removal

NOTE

See Figure 3-124. 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.

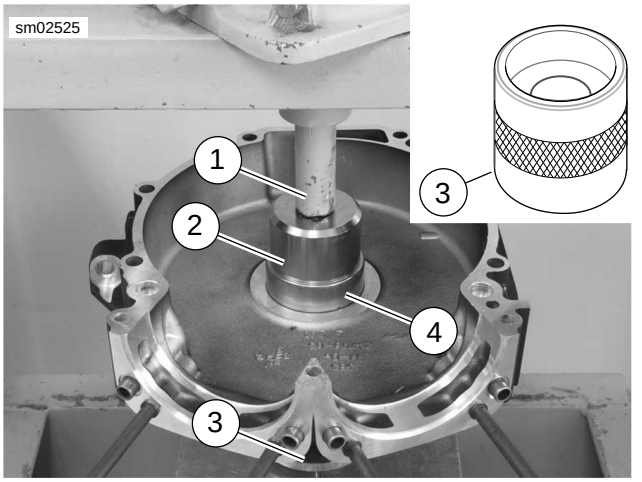
7. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
8. See Figure 3-125. Place support tube (3) on press table with "A" end up. Note that support tube is stamped "A" and "B" to provide proper orientation.
9. With the outboard 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).
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 may 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 3-124. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**
4. **Main bearing**

Figure 3-126. Left Main Bearing Installation

2. See Figure 3-126. Place a thin film of clean engine oil on outer diameter of **new** main bearing (4).
3. Place support tube (3) on hydraulic press table with the "A" end up.
4. With the inboard side of the left crankcase half facing upward, position main bearing bore over support tube.
5. Start **new** main bearing in bearing bore, letter side down.
6. Slide pilot/driver (2) through bearing into support tube.
7. Apply pressure to pilot/driver until bearing is lightly bottomed in main bearing bore.
8. Remove crankcase half and pilot/driver from support tube.
9. Install **new** retaining ring in bearing bore groove, being careful not to damage edges of groove. Make sure retaining ring is fully seated in groove.

NOTE

If retaining ring will not fit into groove, the bearing may not be fully seated in the bore. Inspect bearing and bore. If necessary, remove bearing, clean bore and install bearing. Then install retaining ring.

SPROCKET SHAFT BEARING INNER RACE

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-34902-B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER
HD-44358	FLYWHEEL SUPPORT FIXTURE
HD-95637-46B	WEDGE ATTACHMENT
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER

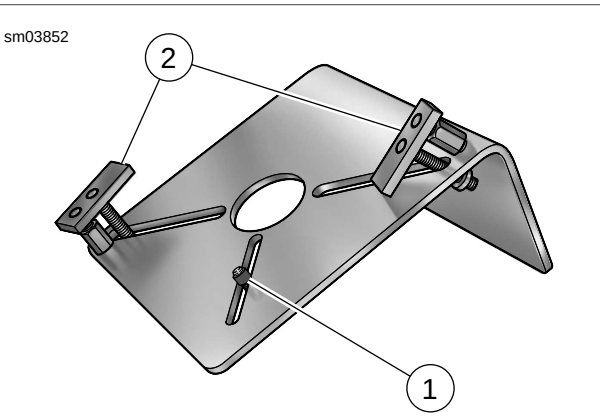
Removal

If reusing flywheel, remove bearing inner race and thrust washer as follows:

1. See Figure 3-127. 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 the round hole topside.
2. Insert crankshaft end through hole resting flywheel assembly on fixture. Slide knurled locating pin down slot in tool to engage crank pin hole. Hand tighten locating pin.
3. Slide hold-down clamp down slot to engage inboard side of right flywheel half, and then hand tighten knurled nut at bottom to secure. Repeat step to secure hold-down clamp on opposite side of flywheel.

NOTE

For proper clamping force, hold-down clamp must not be tilted. Rotate hex on outboard stud until clamp is level.



1. **Locating pin**
2. **Hold-down clamp**

Figure 3-127. Flywheel Holding Fixture

4. Position WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of thrust washer and turn hex nuts an equal number of turns to draw halves of wedge together.

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)

5. Obtain two 3/8-16 inch bolts 7-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge and forcing screw from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (Part No. HD-34902-B). Also obtain a suitable hardened washer to use between the puller screw and the end of the shaft.
6. Slide one bolt into channel on each side of bridge so that flat washer is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns.
7. Sparingly apply graphite lubricant to threads of forcing screw to prolong service life and 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.

⚠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

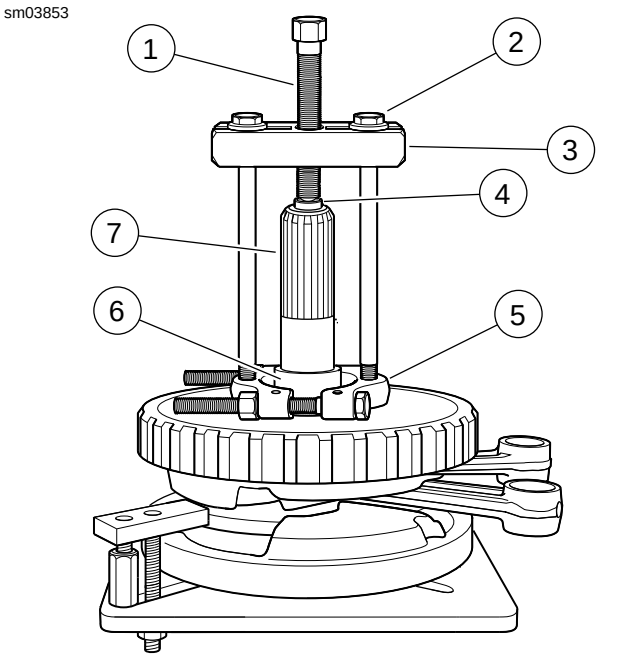
Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

13. See Figure 3-128. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal.
14. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To assist removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

15. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.
16. Remove thrust washer from sprocket shaft.



1. **Forcing screw**
2. **3/8-16 in. bolt with flat washer**
3. **Bridge**
4. **Hardened washer**
5. **Wedge attachment**
6. **Bearing inner race**
7. **Sprocket shaft**

Figure 3-128. Remove Inner Race from Sprocket Shaft

Installation

1. Place **new** thrust washer over sprocket shaft.
2. Place **new** bearing inner race on bench top. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat bearing inner race for about 60 seconds using a circular motion.
3. Wearing suitable gloves to protect hands from burns, place heated bearing inner race over sprocket shaft.

⚠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.

4. See Figure 3-129. Obtain the SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C). Assemble tool as described below.
   a. See Figure 3-130. 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 3-131. Thread handle onto pilot shaft.
5. See Figure 3-132. 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.

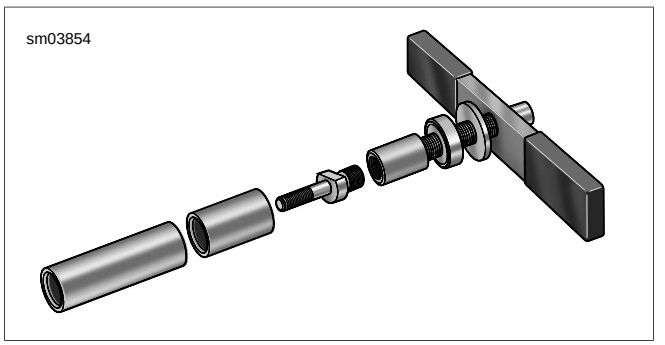


Figure 3-129. Sprocket Shaft Bearing Installer

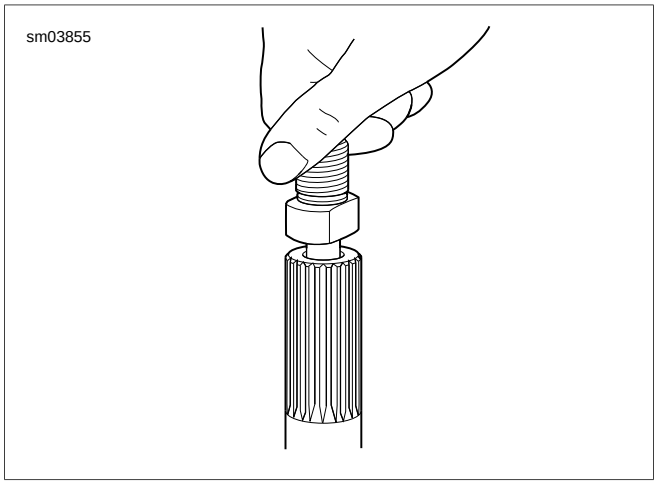
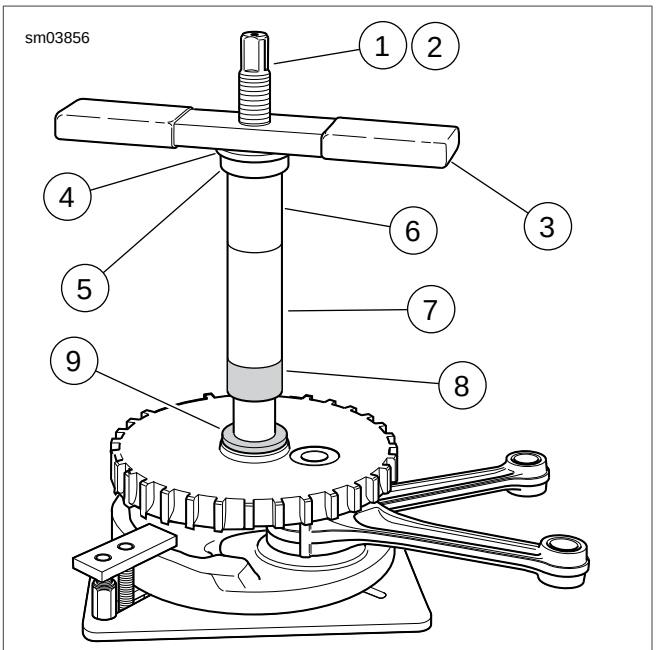


Figure 3-130. Thread Pilot Adapter into Sprocket Shaft



1. **Pilot adapter**
2. **Pilot shaft**
3. **Handle**
4. **Flat washer**
5. **Bearing**
6. **Short collar**
7. **Long collar**
8. **Inner race**
9. **Thrust washer**

Figure 3-131. Press Inner Race onto Sprocket Shaft: Setup

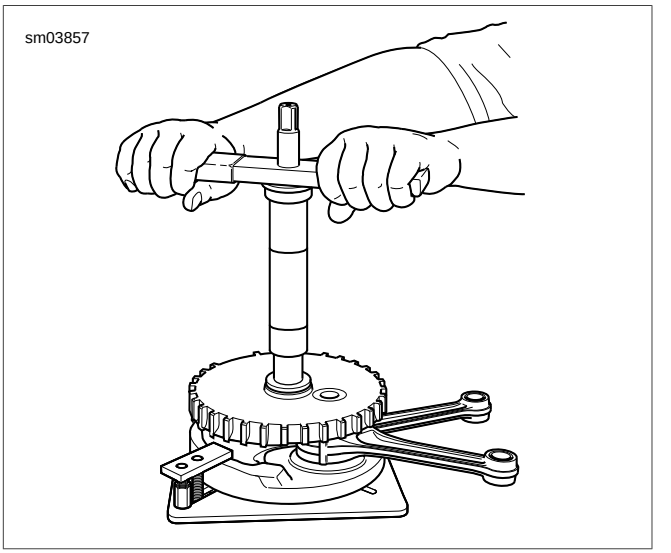


Figure 3-132. Press Inner Race onto Sprocket Shaft: Operation

CYLINDER STUDS

FASTENER	TORQUE VALUE	
Cylinder stud	120-240 **in-lbs**	13.6-27.1 Nm

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 PLUG AND OIL FITTINGS

FASTENER	TORQUE VALUE	
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm

Removal

See Figure 3-133. Turn pipe plug counterclockwise until free.

Installation

1. Apply LOCTITE 565 THREAD SEALANT to threads.
2. Install pipe plug. Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).

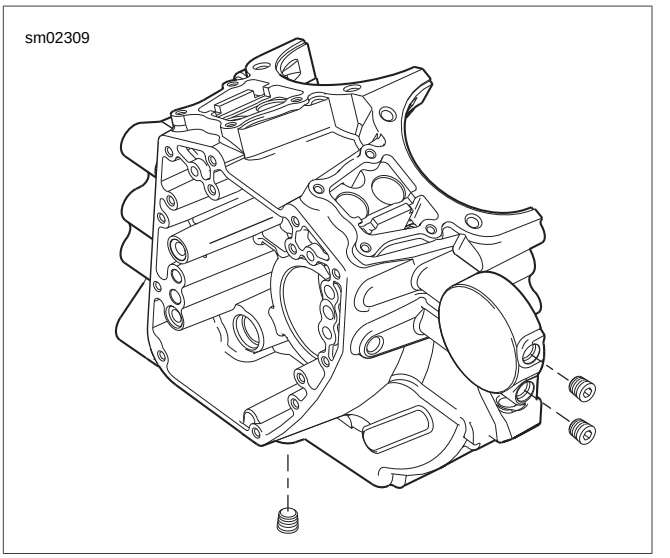


Figure 3-133. Pipe Plug

FLYWHEEL AND CONNECTING RODS 3.27

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 right side crankshaft shifts more than 0.015 in (0.381 mm), it can break the oil pump gerotors, 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 gerotors 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 1.25 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 1.25 TROUBLESHOOTING.

If correct chassis set-up has been verified and other items in 1.25 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 bushing and lower bearing.

1. Replace the flywheel/connecting rod assembly if any of the following conditions are noted:
   a. Connecting rods are bent or twisted.
   b. Connecting rods do not fall under their own weight or are in a bind.
   c. Sprocket teeth are worn in an irregular pattern or chipped.
   d. The crankshaft (roller) bearing inner races are brinelled, burnt, scored, blued or damaged.
   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 3-134.
   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.

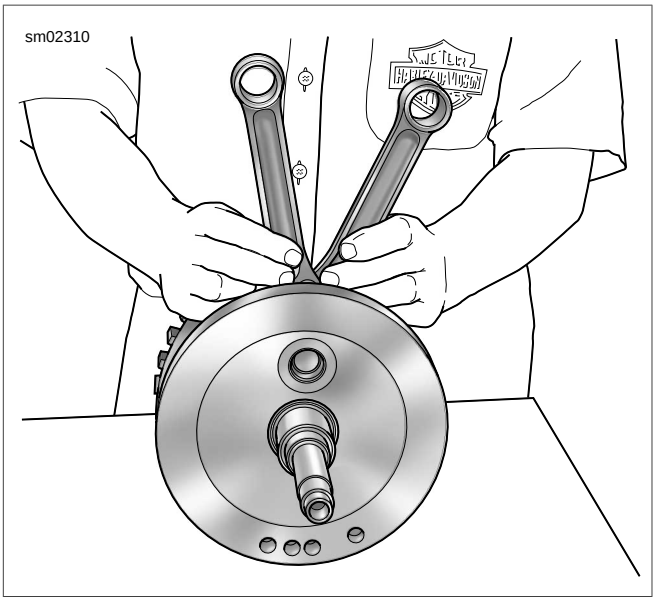


Figure 3-134. Connecting Rod Bearing Clearance

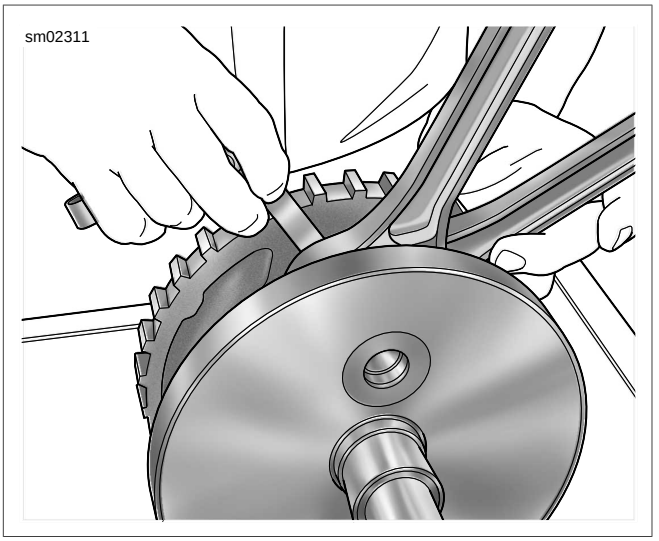


Figure 3-135. Connecting Rod Side Play

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 3-41.

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 3-41. 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-true.*
- *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 3-136. 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

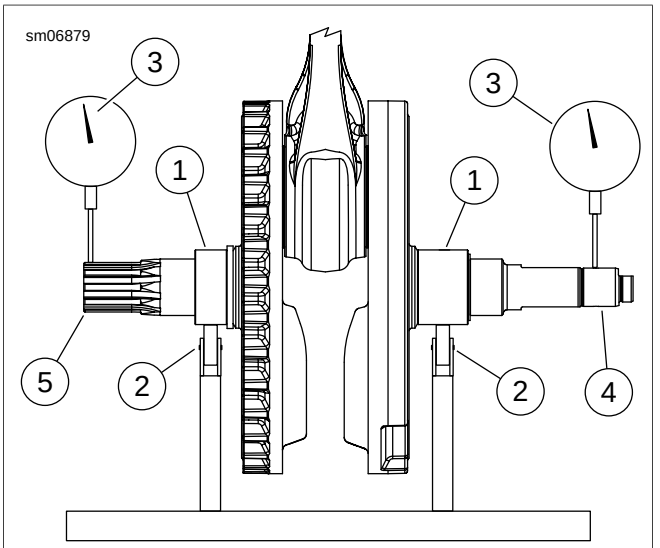
Dial indicators must be perpendicular to the shaft in both directions.

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 3-41.



1. **Bearing race**
2. **Roller support**
3. **Dial indicator**
4. **Machined surface**
5. **Spline**

Figure 3-136. Checking Crankshaft Runout

Table 3-41. Flywheel

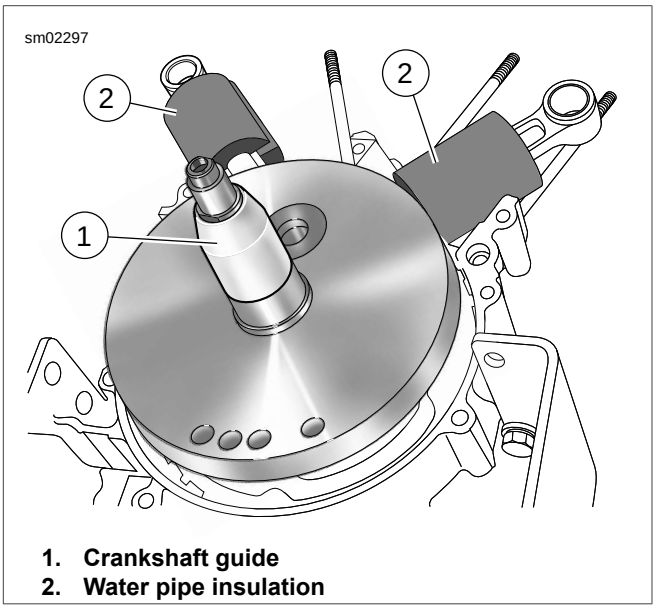
FLYWHEEL	REPLACE IF WEAR EXCEEDS	
	IN	MM
Runout (shaft measured in case)	0.012	0.305
Runout (measured in truing stand)	0.005	0.127
End play	0.013	0.330

CRANKCASE ASSEMBLY

PART NUMBER	TOOL NAME
99650-02	HIGH-PERFORMANCE SEALANT, GRAY
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER
HD-42326-B	CRANKSHAFT GUIDE
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER

FASTENER	TORQUE VALUE	
Crankcase screws, 1st torque	120 **in-lbs**	13.6 Nm
Crankcase screws, final torque	15-19 ft-lbs	20.3-25.8 Nm

1. Secure left crankcase half upright in engine stand.
2. Slide CRANKSHAFT GUIDE (Part No. HD-42326-B) onto flywheel sprocket shaft.
3. Slide flywheel assembly into left crankcase half. Remove crankshaft guide tool.
4. Rotate crankcase assembly so flywheel sprocket shaft is pointing straight up.
5. Verify that both dowel pins are installed in split line face of right case half.
6. Apply a bead of HIGH-PERFORMANCE SEALANT, GRAY (Part No. 99650-02) approximately 0.056 in. (1.42 mm) wide to the split line face and around the two dowel pins of right crankcase half.
7. See Figure 3-137. Place CRANKSHAFT GUIDE (Part No. HD-42326-B) over end of crankshaft until it contacts shoulder on shaft.
8. Mate case halves. Remove crankshaft guide.



1. Crankshaft guide
2. Water pipe insulation

Figure 3-137. Crankshaft Guide

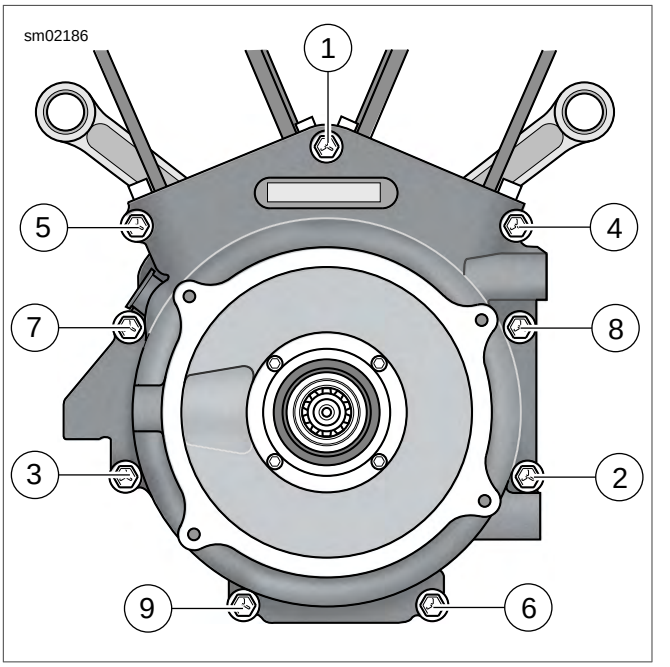


Figure 3-138. Tightening Crankcase Bolts

9. See Figure 3-138. Start the nine crankcase bolts and tighten in the following sequence.
   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).
10. Rotate crankcase assembly so sprocket shaft is pointing straight up.

11. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to the main bearing. Rotate flywheel assembly to distribute lube.
12. Install thrust washer on sprocket shaft with "THIS SIDE OUT" facing out (and the chamfer inboard). If using original part without markings, orient as required to preserve existing wear pattern.
13. See Figure 3-139. 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

    Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and provide smooth operation.

    g. Slide short collar, bearing and large flat washer onto pilot shaft. Thread handle on to complete assembly of tool.
14. Rotate handle clockwise until oil seal installer makes firm contact with crankcase stator mount.
15. Remove tool components from sprocket shaft.
16. Rotate crankcase in engine stand so cam cover flange is facing upward.
17. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to the main bearing. Rotate flywheel assembly to distribute lube.
18. Install oil pump and cam support plate. See 3.24 CAM COMPARTMENT AND COMPONENTS.
19. Complete engine assembly.

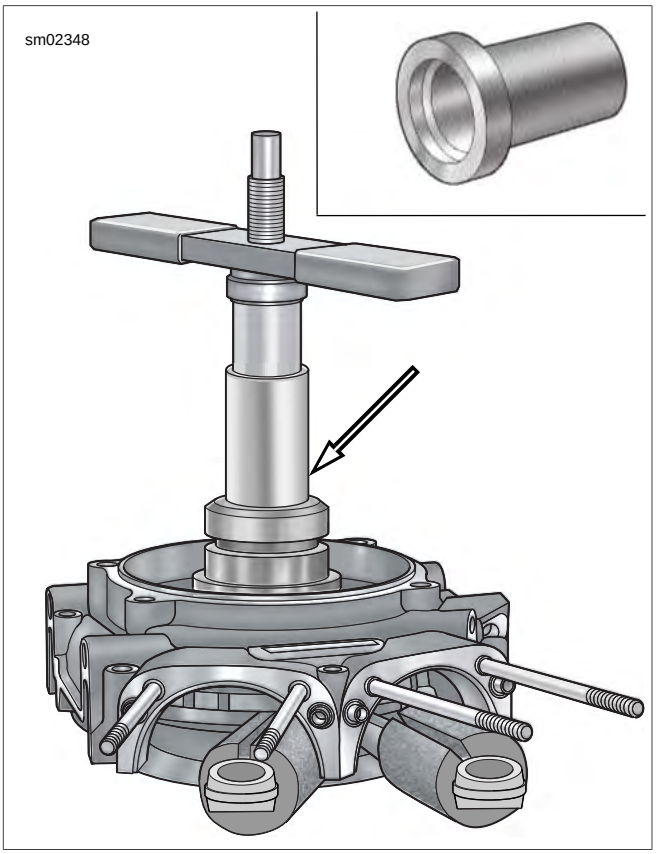


Figure 3-139. Sprocket Shaft Oil Seal Installer

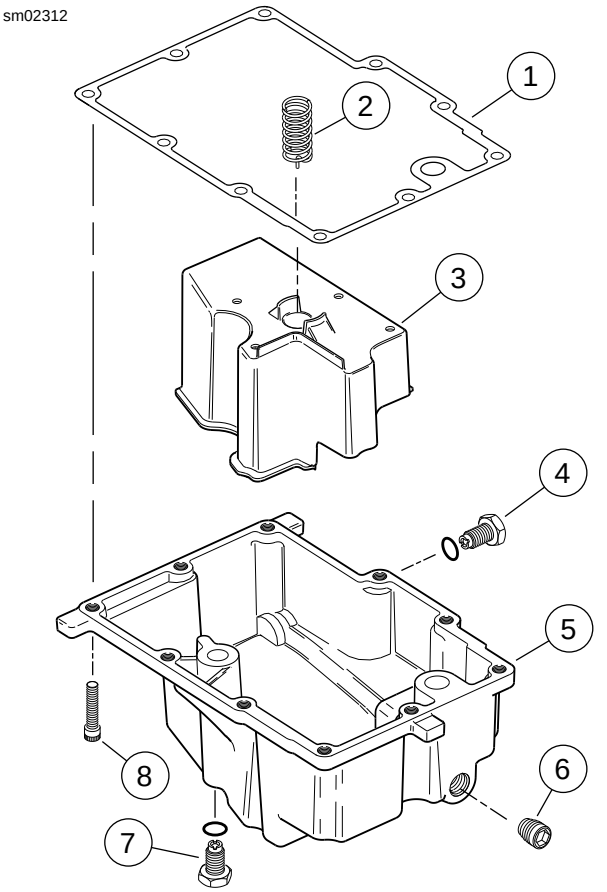
OIL PAN 3.29

REMOVAL

NOTE

When jacking up motorcycle, do not apply pressure directly to the oil pan. Damage can occur unless measures are taken to distribute the pressure (such as a block of wood placed between the jack and the oil pan). A suitable lift which applies pressure at the tires is the only recommended method for raising the motorcycle.

1. Position motorcycle on a suitable lift.
2. See Figure 3-140. Drain fluids from oil pan.
   a. Remove engine oil drain plug (4), fill plug/dipstick and oil filter. Drain oil into suitable container. See 1.6 ENGINE OIL AND FILTER.
   b. Remove transmission drain plug (7). Drain transmission fluid into suitable container. See 1.10 TRANSMISSION LUBRICANT.
3. Remove ten screws (8) that secure the oil pan to the transmission housing.
4. Remove oil pan (5) and gasket (1). Discard gasket.
5. Remove baffle assembly (3) and spring (2) from oil pan.



1. **Gasket**
2. **Spring**
3. **Baffle assembly**
4. **Engine oil drain plug**
5. **Oil pan**
6. **Pipe plug**
7. **Transmission drain plug and O-ring**
8. **Screw (10)**

Figure 3-140. Oil Pan: Dyna Glide

INSTALLATION

FASTENER	TORQUE VALUE	
Oil pan screws	132-156 **in-lbs**	14.9-17.6 Nm
Drain plug, engine	14-21 ft-lbs	19.0-28.5 Nm

1. Clean and examine all flange surfaces. Examine drain plug O-rings for tears or damage. Replace O-rings as required.
2. See Figure 3-140. Insert baffle assembly (3) and spring (2) in oil pan.
3. Place **new** gasket (1) on oil pan.

NOTE

Use a few drops of HYLOMAR GASKET AND THREAD SEALANT to keep gasket in place and simplify installation.

4. Position gasket and oil pan on transmission housing and install with ten screws (8). Tighten to 132-156 **in-lbs** (14.9-17.6 Nm) following sequence shown in Figure 3-141.
5. Wipe any foreign material from engine and transmission drain plugs. Install plugs with O-rings. Tighten plugs to 14-21 ft-lbs (19.0-28.5 Nm).
6. Remove motorcycle from lift.
7. Replace fluids.
   a. Fill transmission with transmission fluid and check level. See 1.10 TRANSMISSION LUBRICANT.
   b. Install engine oil filter and fill oil pan. Check oil level with hot engine after inspecting for leaks. See 1.6 ENGINE OIL AND FILTER.

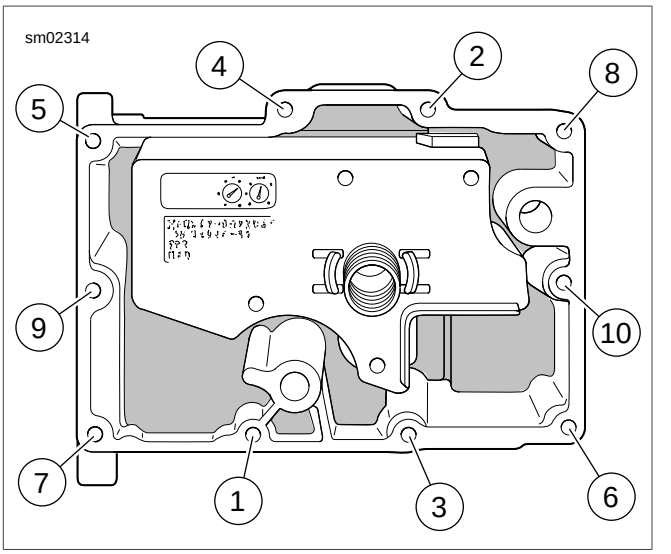


Figure 3-141. Oil Pan Torque Sequence

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NOTES

FASTENER TORQUE VALUES 4.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Breather bolts	22-24 ft-lbs	29.8-32.5 Nm	4.3 AIR CLEANER ASSEMBLY, Installation/metric
Charcoal canister fasteners	15-20 **in-lbs**	1.7-2.3 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Charcoal canister mounting fasteners	15-20 **in-lbs**	1.7-2.3 Nm	4.17 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister
Engine temperature sensor	120-180 **in-lbs**	13.6-20.3 Nm	4.7 ENGINE TEMPERATURE SENSOR (ET), Installation/Hand start 2-3 turns
Exhaust crossover pipe clamp	20-25 ft-lbs	27.1-33.9 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FLD

FASTENER	TORQUE VALUE		NOTES
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Front pipe clamp	25-30 ft-lbs	33.9-40.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Fuel supply tube fastener	90-110 **in-lbs**	10.2-12.4 Nm	4.12 FUEL INJECTORS, Installation
Fuel tank mounting fasteners	15-20 ft-lbs	20.3-27.1 Nm	4.4 FUEL TANK, Installation/Front and rear
Intake air temperature sensor fastener	15-20 **in-lbs**	1.7-2.3 Nm	4.6 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Manifold mounting screws, 1st torque	16-20 **in-lbs**	1.8-2.3 Nm	4.8 INDUCTION MODULE, Installation
Manifold mounting screws, final torque	96-156 **in-lbs**	10.9-17.6 Nm	4.8 INDUCTION MODULE, Installation
Muffler bracket bolt	15-19 ft-lbs	20.3-25.8 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler bracket fastener	17-21 ft-lbs	23-28 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Muffler bracket flange nuts	15-19 ft-lbs	20.3-25.8 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler clamp nut	38-43 ft-lbs	51.6-58.4 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Muffler clamp nuts	38-43 ft-lbs	51.6-58.4 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Muffler clamp nuts	38-43 ft-lbs	51.6-58.4 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler fastener	17-21 ft-lbs	23-28 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Muffler mounting bolt	15-19 ft-lbs	20.3-25.8 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler support bracket nuts	20-30 ft-lbs	27.1-40.7 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Oxygen sensor	12.2-14.2 ft-lbs	16.5-19.3 Nm	4.11 OXYGEN SENSOR, Installation
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.9 IDLE AIR CONTROL (IAC), Installation
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.10 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), Installation/Use new screws
Throttle position sensor fasteners	18 **in-lbs**	2.0 Nm	4.5 THROTTLE POSITION SENSOR (TPS), Installation
Top plate fasteners	27-33 **in-lbs**	3.1-3.7 Nm	4.13 FUEL PUMP, Installation

SPECIFICATIONS: FUEL SYSTEM 4.2

SPECIFICATIONS

Table 4-1. Fuel Capacity

MODEL	GALLONS	LITERS
FXDL FXDB FXDWG	4.56	17.26
FXDC FXDF FLD	4.96	18.77

AIR CLEANER ASSEMBLY 4.3

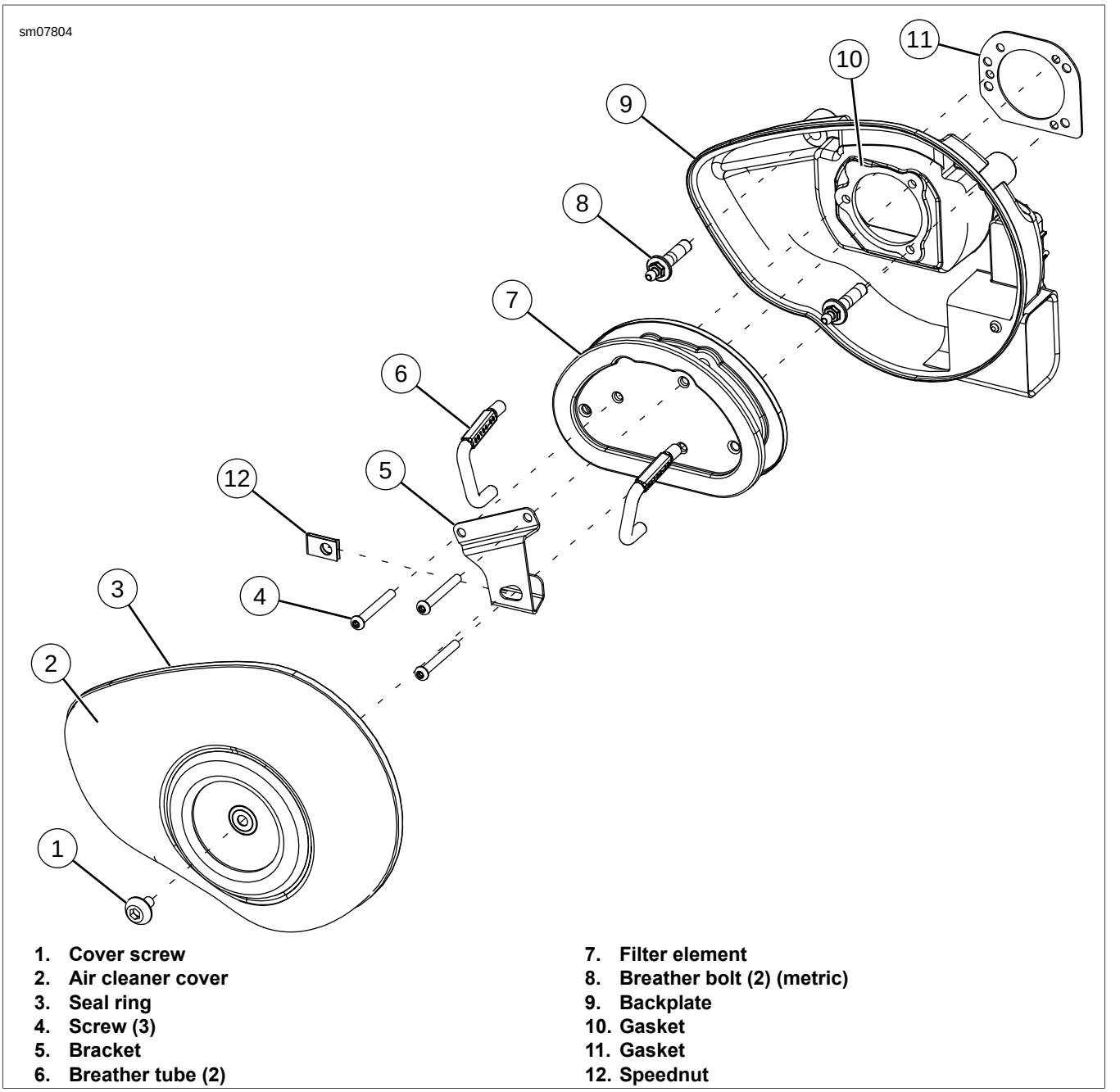
REMOVAL

1. See Figure 4-1 or Figure 4-2. Remove screw (1) and air cleaner cover (2).
2. Gently pull both rubber breather tubes (6) from the element.
3. **All but FXDB:** Slide speednut (12) to the left to access third screw (4).
4. Remove three screws (4), bracket (5) and filter element (7).
5. Gently pull breather tubes from breather bolts (8) on backplate (9).

⚠WARNING

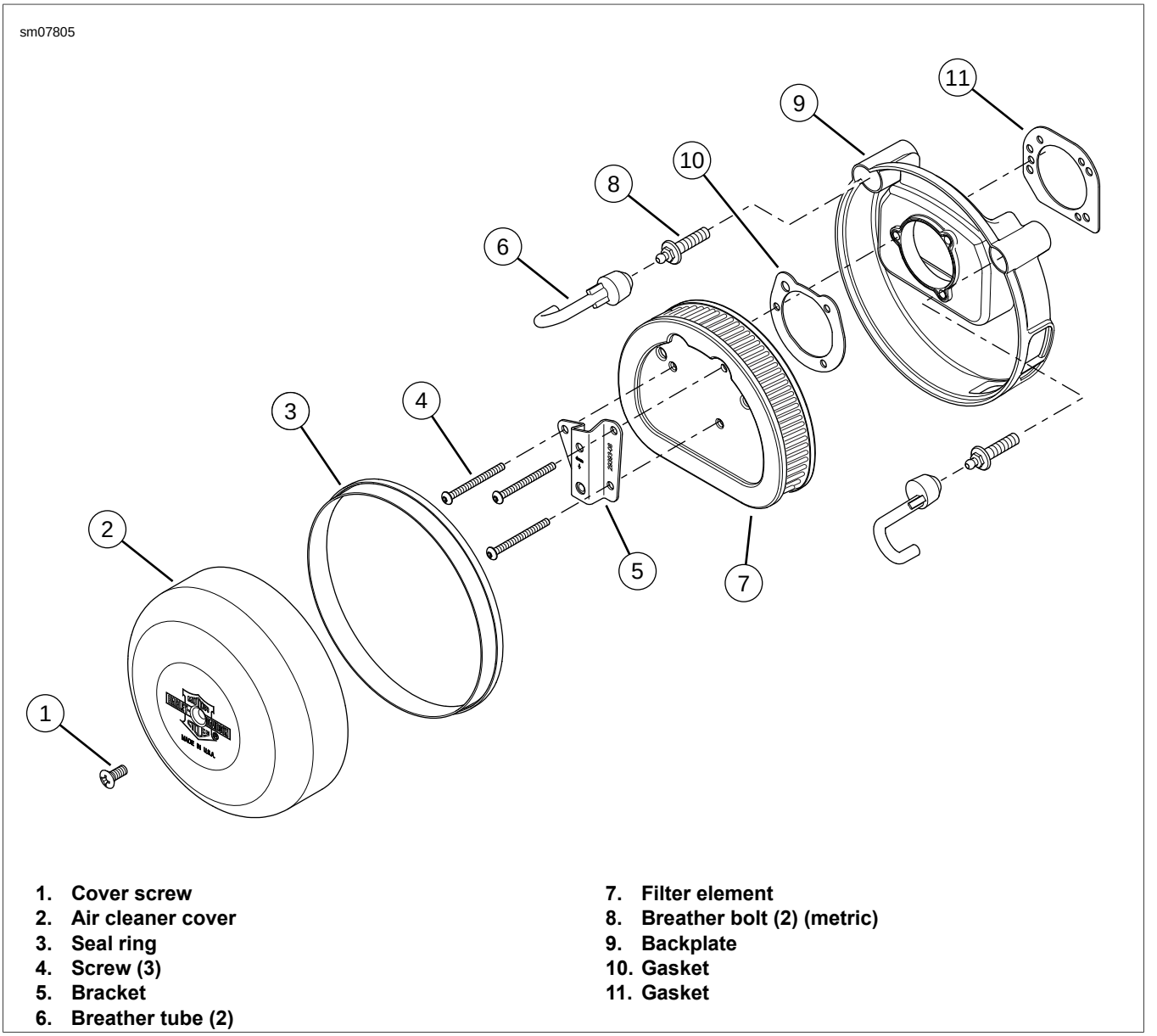
Do not use gasoline or solvents to clean filter element. Flammable cleaning agents can cause an intake system fire, which could result in death or serious injury. (00101a)

6. Inspect filter element. See 1.7 AIR CLEANER AND EXHAUST SYSTEM. Replace filter element if damaged or if filter media cannot be adequately cleaned.
7. Inspect seal ring (3) for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
8. Alternately loosen both breather bolts a few turns at a time while pulling backplate away from induction module. Continue this process until breather bolts are clear.
9. Remove backplate, gasket (10) and gasket (11). Discard gaskets.
10. Clean dust from air cleaner cover and backplate.



1. Cover screw
2. Air cleaner cover
3. Seal ring
4. Screw (3)
5. Bracket
6. Breather tube (2)
7. Filter element
8. Breather bolt (2) (metric)
9. Backplate
10. Gasket
11. Gasket
12. Speednut

Figure 4-1. Air Cleaner Assembly: All but FXDB Models



1. **Cover screw**
2. **Air cleaner cover**
3. **Seal ring**
4. **Screw (3)**
5. **Bracket**
6. **Breather tube (2)**
7. **Filter element**
8. **Breather bolt (2) (metric)**
9. **Backplate**
10. **Gasket**
11. **Gasket**

Figure 4-2. Air Cleaner Assembly: FXDB Models

INSTALLATION

FASTENER	TORQUE VALUE	
Breather bolts	22-24 ft-lbs	29.8-32.5 Nm
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm

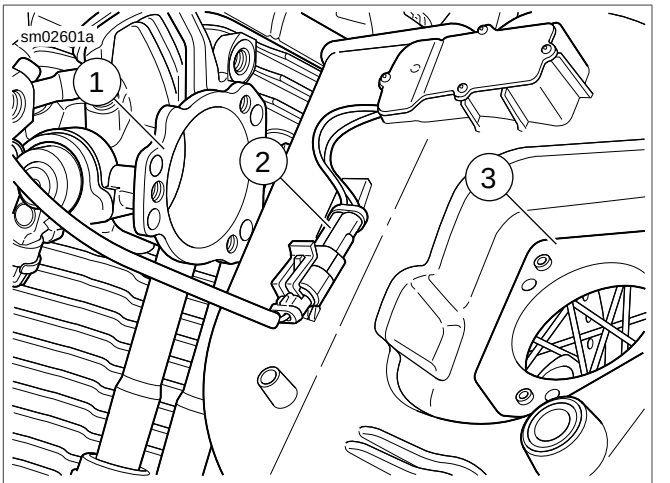
1. See Figure 4-1 or Figure 4-2. Position **new** gasket (11) on backplate (9). Insert two breather bolts (8) (metric) through backplate into each cylinder head. Tighten bolts to 22-24 ft-lbs (29.8-32.5 Nm).
2. Position **new** gasket (10) on filter element (7). Make sure gasket holes are aligned with screw holes.
3. Attach breather tubes (6) to breather screws on backplate.
4. Install air filter element and bracket (5) with three screws (4). Tighten to 40-60 **in-lbs** (4.5-6.8 Nm).
5. **All but FXDB:** Slide speednut (12) to the right and into place.
6. Insert breather tubes (6) into holes in filter element.
7. Install air cleaner cover (2).
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of air cleaner cover screw (1).
   b. Install air cleaner cover. Tighten screw to 36-60 **in-lbs** (4.1-6.8 Nm).

BACKPLATE ASSEMBLY: HDI MODELS

See Figure 4-3. 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.



1. **Intake module**
2. **Intake solenoid connector [178]**
3. **Air cleaner backplate**

Figure 4-3. Backplate: HDI Models

FUEL TANK 4.4

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 1.24 STORAGE.

For information on the tank-mounted fuel gauge, see the electrical diagnostic manual and 7.19 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 the fuel supply line of high pressure gasoline.
   a. See Figure 4-4. Disconnect the fuel pump module connector from the tank plate.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

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)

⚠WARNING

Do not twist fuel line fitting, as fuel line can crack causing a fuel leak. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00274a)

2. See Figure 4-5. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

⚠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. Remove instrument panel.
   a. For FXDC, FXDF and FLD models, see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
   b. For FXDL, FXDB and FXDWG models, see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.

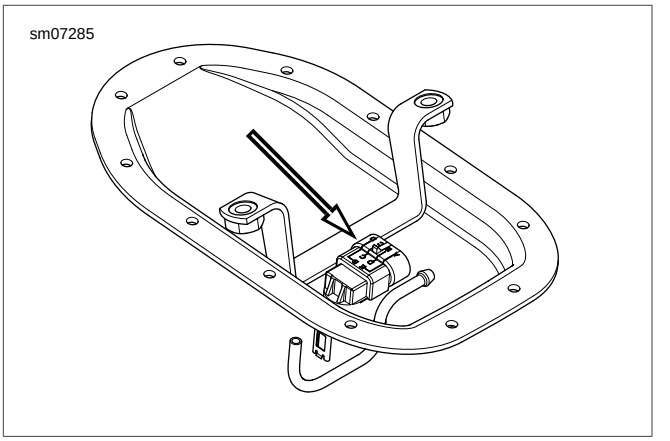
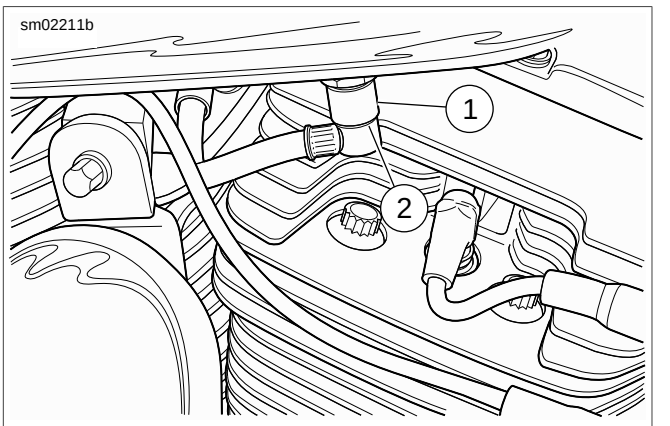


Figure 4-4. Fuel Pump Connector [141] (Typical)



1. **Quick connect fitting**
2. **Fuel supply line**

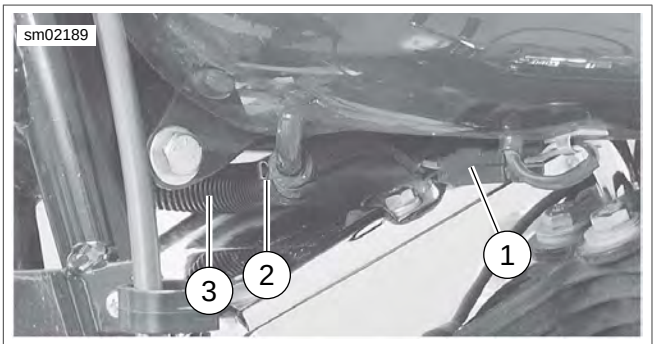
Figure 4-5. Fuel Supply Line Fitting

5. See Figure 4-4. Unplug fuel pump module connector [141].

⚠WARNING

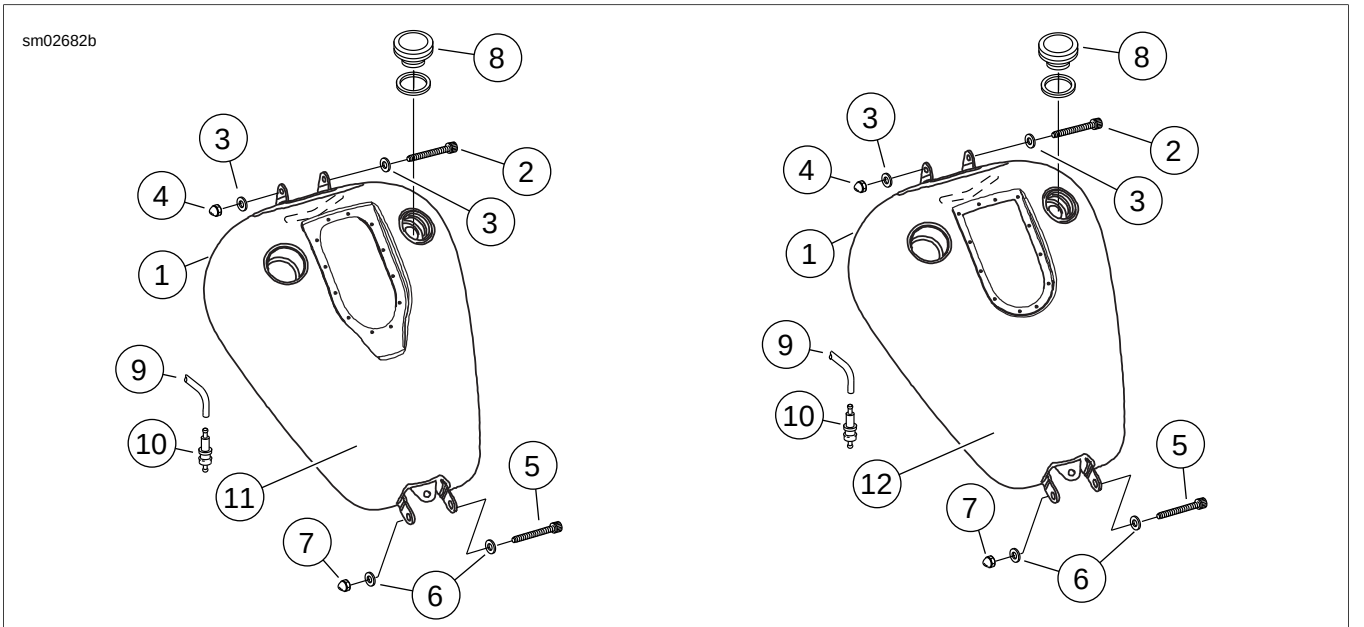
Gasoline can drain from the crossover line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00259a)

6. 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 4-6. Cut clamp (2) from one end of crossover hose (3). 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.
7. See Figure 4-7. Disconnect continuous venting vent line (9).
8. Remove the front mounting bolt (2), flat washers (3), and acorn nut (4).
9. Remove the rear mounting bolt (5), flat washers (6), and acorn nut (7).
10. See Figure 4-6. Disconnect fuel gauge connector [117] (1) located under left side of fuel tank.



1. **Fuel gauge connector [117]**
2. **Clamp**
3. **Crossover hose**

Figure 4-6. Fuel Gauge Connector and Crossover Hose



1. **Crossover line**
2. **Front mounting fastener**
3. **Flat washer (2)**
4. **Acorn nut**
5. **Rear mounting fastener**
6. **Flat washer (2)**
7. **Acorn nut**
8. **Fuel cap**
9. **Continuous venting system vent line**
10. **Vapor valve**
11. **FXDL, FXDB, FXDWG, FLD**
12. **FXDC, FXDF**

Figure 4-7. Fuel Tank

CLEANING AND INSPECTION

1. Remove fuel pump. See 4.13 FUEL PUMP.
2. Remove fuel gauge sending unit. See 7.20 FUEL GAUGE SENDER.
3. Clean the tank interior with commercial cleaning solvent or a soap and water solution. Shake the tank to agitate the cleaning agent.
4. Flush the tank thoroughly after cleaning. Allow it to air dry.
5. Inspect the interconnect lines, continuous venting system vent line (if applicable) and fuel line for cuts, cracks or holes. Replace lines as needed.
6. Inspect the tank for leaks and other damage. If a damaged tank cannot be successfully repaired, replace it.
7. Install fuel gauge sending unit. See 7.20 FUEL GAUGE SENDER.

8. Install fuel pump. See 4.13 FUEL PUMP.

INSTALLATION

PART NUMBER	TOOL NAME
HD-97087-65B	HOSE CLAMP PLIERS

FASTENER	TORQUE VALUE	
Fuel tank mounting fasteners	15-20 ft-lbs	20.3-27.1 Nm

WARNING

Excessive pressure can build in the fuel tank if vapor valve is not mounted vertically with long fitting to top. Leaks due to excessive pressure can cause a fire or explosion, which could result in death or serious injury. (00265a)

1. See Figure 4-7. Install continuous venting system vent line (9) to vapor valve (10).
2. Place a washer (3, 6) over each fastener (2, 5) and insert the fasteners through the tank mounting lugs and frame bracket tubes.
3. Install acorn nuts (4, 7) and tighten to 15-20 ft-lbs (20.3-27.1 Nm).

NOTE

In next step, make sure crimped end of clamp faces toward front of vehicle.

4. See Figure 4-6. Connect the crossover tube (3). Install **new** hose clamp (2) using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
5. Connect the fuel feed line. Install **new** hose clamp using HOSE CLAMP PLIERS.
6. Connect the fuel gauge connector located under left side of fuel tank. See 7.19 FUEL GAUGE.
7. Install instrument panel.
   a. For FXDC, FXDF and FLD models, see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
   b. For FXDL, FXDB/P/A and FXDWG models, see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
8. Check for leaks.

NOTE

The low fuel lamp will not turn off until there is sufficient fuel in the tank. The ignition switch must be turned off and back on. The vehicle must begin forward speed.

Vapor Valve

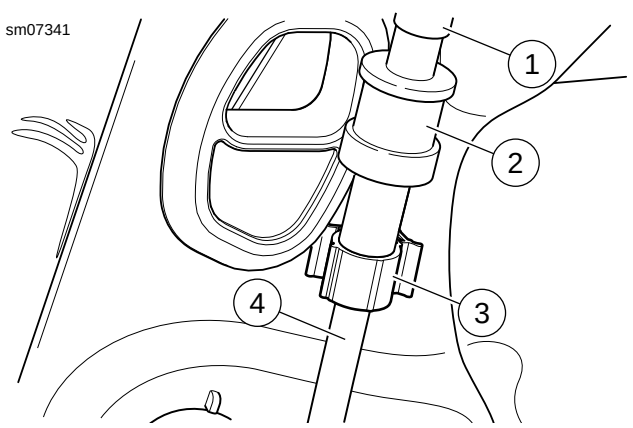
WARNING

Keep vent and vapor valve lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00263a)

See Figure 4-8. The vapor valve (2) is attached to the frame member just ahead of the fuel tank on the left side with reusable clamp with an anchor. Mark the two lines (1, 4) connected to the upper and lower fittings of the vapor valve before removing it from its clamp (3). When installing the vapor valve, place the valve back into the cable strap with the long necked end at the top.

NOTE

On California and APC models, the hose from the vapor valve bottom fitting goes to the charcoal EVAP canister. On non-California models, the bottom fitting hose is vented to the atmosphere.



1. **Upper continuous venting system vent line**
2. **Vapor valve**
3. **Resealable clamp with fin clip**
4. **Lower continuous venting system vent line**

Figure 4-8. Vapor Valve Installation

THROTTLE POSITION SENSOR (TPS) 4.5

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 backplate. See 4.3 AIR CLEANER ASSEMBLY.
4. See Figure 4-9. Unplug TP sensor connector [88].
5. Remove two fasteners to detach TP sensor from throttle body. Discard fasteners.

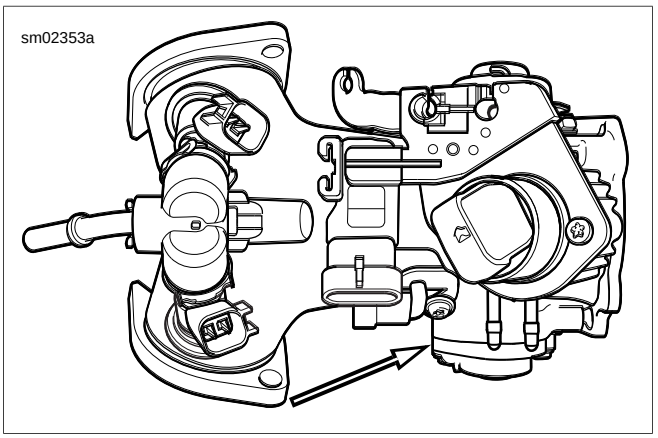


Figure 4-9. Throttle Position Sensor

INSTALLATION

FASTENER	TORQUE VALUE	
Throttle position sensor fasteners	18 **in-lbs**	2.0 Nm

NOTE

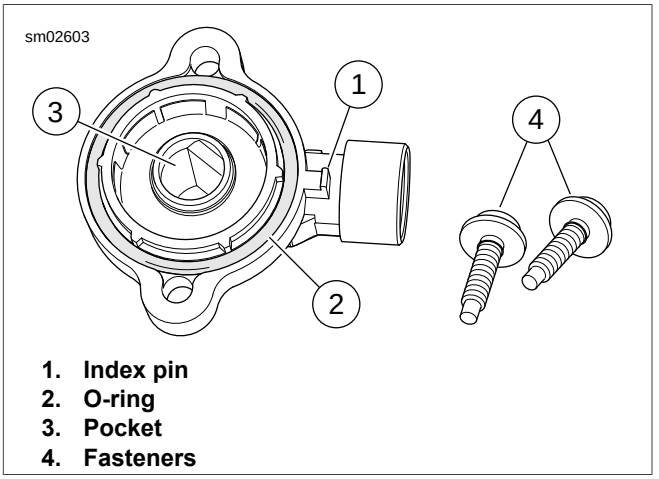
Close throttle for proper installation of throttle position sensor.

1. See Figure 4-10. 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 screws 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.



1. **Index pin**
2. **O-ring**
3. **Pocket**
4. **Fasteners**

Figure 4-10. Throttle Position Sensor Installation

INTAKE AIR TEMPERATURE SENSOR (IAT) 4.6

GENERAL

See the electrical diagnostic manual for information on the function and testing of the intake air temperature sensor (IAT sensor).

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 air cleaner backplate. See 4.3 AIR CLEANER ASSEMBLY.
3. See Figure 4-11. Unplug IAT sensor connector [89].
4. Remove fastener to detach IAT sensor. Discard fastener.

INSTALLATION

FASTENER	TORQUE VALUE	
Intake air temperature sensor fastener	15-20 **in-lbs**	1.7-2.3 Nm

1. See Figure 4-12Install **new** O-ring (1) if necessary.
2. See Figure 4-11. Insert sensor into induction module with electrical connector facing toward the left side of the motorcycle.
3. See Figure 4-12. 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. Connect negative battery cable.

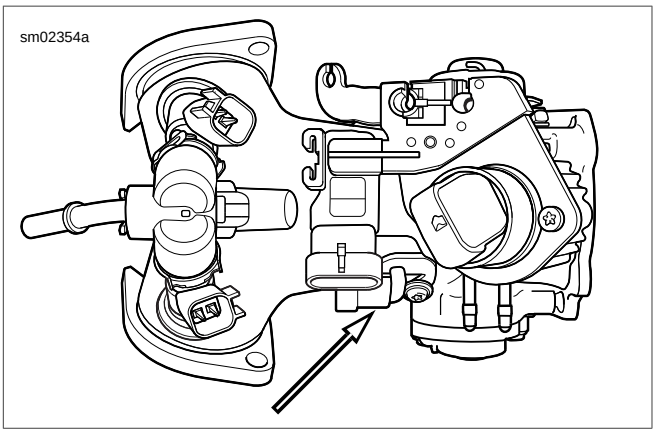
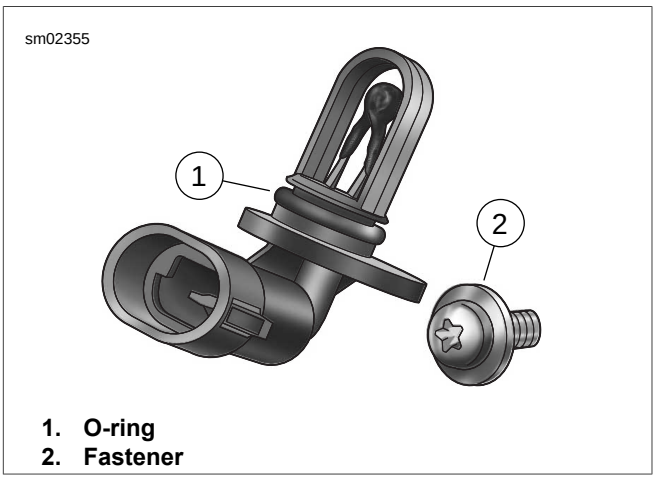


Figure 4-11. Intake Air Temperature Sensor Location



1. **O-ring**
2. **Fastener**

Figure 4-12. Intake Air Temperature Sensor

ENGINE TEMPERATURE SENSOR (ET) 4.7

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

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-13. Disconnect the fuel pump module connector from the tank plate.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

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)

2. See Figure 4-14. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

⚠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. See Figure 4-15. Pull back boot to reveal ET sensor at back of front cylinder.
5. Unplug ET sensor connector [90] by pulling external latch outward and using rocking motion to remove.
6. See Figure 4-16. Loosen ET sensor using socket. When sensor starts to turn easily, finish removing by hand.

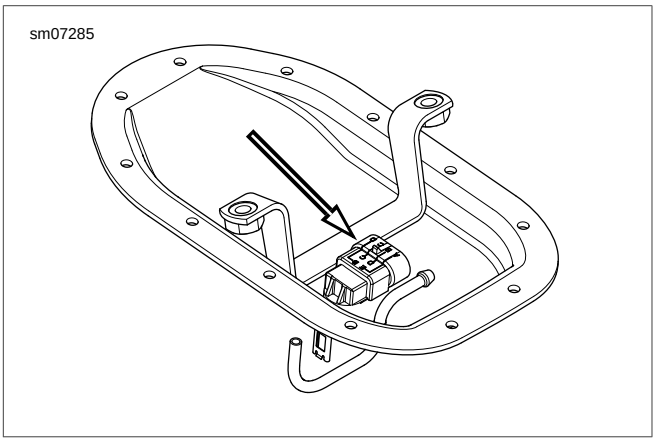
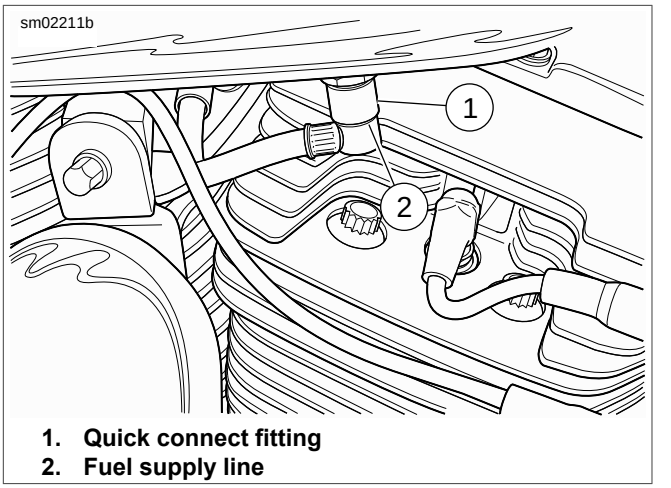


Figure 4-13. Fuel Pump Connector [141] (Typical)



1. Quick connect fitting
2. Fuel supply line

Figure 4-14. Fuel Supply Line Fitting

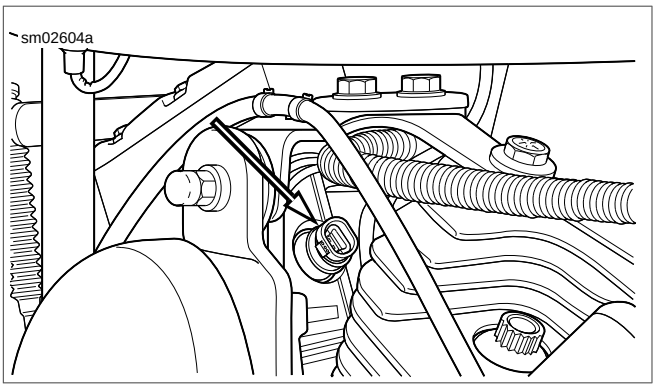


Figure 4-15. Engine Temperature Sensor

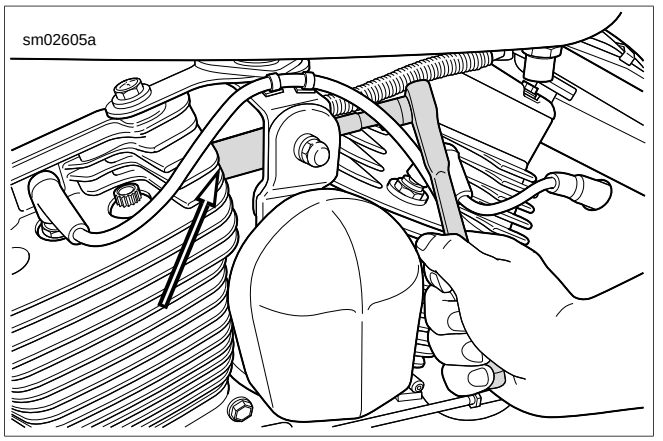


Figure 4-16. Engine Temperature Sensor Removal

INSTALLATION

FASTENER	TORQUE VALUE	
Engine temperature sensor	120-180 **in-lbs**	13.6-20.3 Nm

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. See Figure 4-14. Install fuel line fitting.
6. Connect negative battery cable.

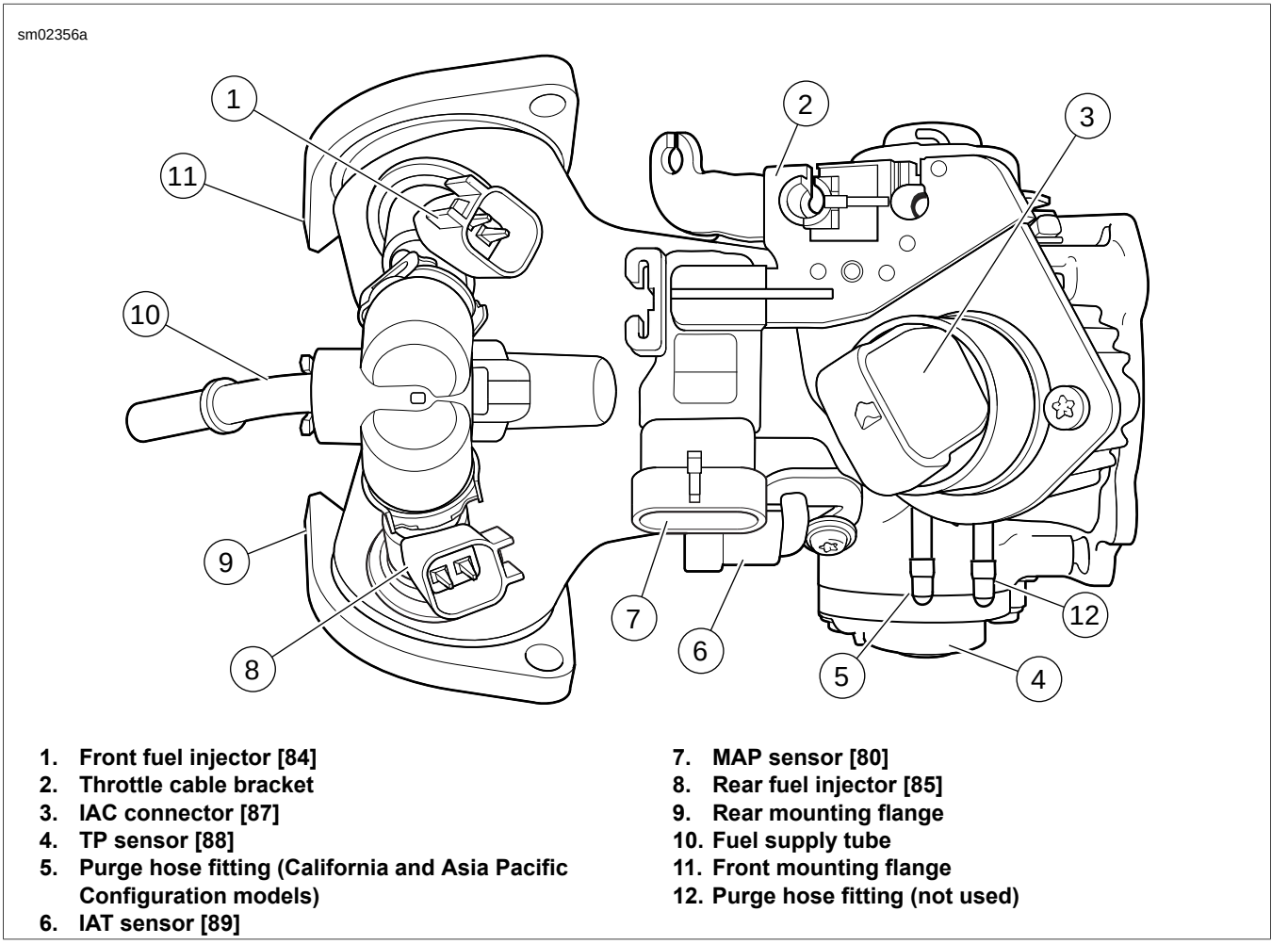
INDUCTION MODULE 4.8

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 4.4 FUEL TANK.
2. Loosen cable adjusters on throttle cables.
3. Remove air cleaner backplate. See 4.3 AIR CLEANER ASSEMBLY.
4. See Figure 4-17. Pull purge hose from fitting (5) at top of induction module (California and select models only).
5. See Figure 4-18. 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 4-17. Remove idle air control connector (3) [87] and manifold absolute pressure sensor connector (7) [80].



1. **Front fuel injector [84]**
2. **Throttle cable bracket**
3. **IAC connector [87]**
4. **TP sensor [88]**
5. **Purge hose fitting (California and Asia Pacific Configuration models)**
6. **IAT sensor [89]**
7. **MAP sensor [80]**
8. **Rear fuel injector [85]**
9. **Rear mounting flange**
10. **Fuel supply tube**
11. **Front mounting flange**
12. **Purge hose fitting (not used)**

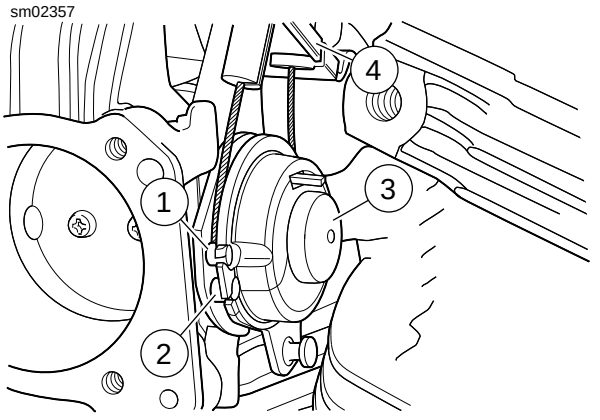
Figure 4-17. Induction Module

7. Remove front fuel injector connector (1) [84] and rear fuel injector connector (8) [85].
8. Remove throttle position sensor connector (4) [88] and intake air temperature sensor connector (6) [89].
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.

⚠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 4-19. 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).
12. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.



1. **Idle cable barrel**
2. **Throttle cable barrel**
3. **Throttle wheel**
4. **Throttle cable bracket**

Figure 4-18. Throttle/Idle Cables

INSTALLATION

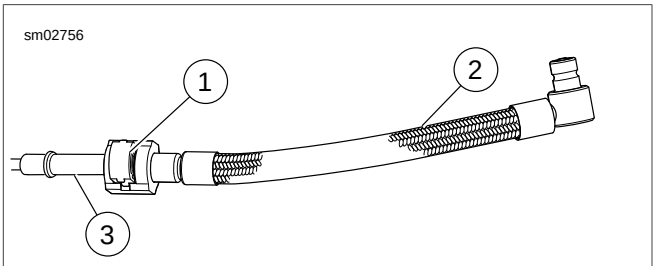
FASTENER	TORQUE VALUE	
Manifold mounting screws, 1st torque	16-20 **in-lbs**	1.8-2.3 Nm
Manifold mounting screws, final torque	96-156 **in-lbs**	10.9-17.6 Nm

1. See Figure 4-17. Place a **new** seal in each mounting flange (9, 11) with the beveled side in against the counter-bore.

NOTE

When induction module is positioned on manifold mounting screws, verify the mounting flanges are correctly installed on the manifold. Verify the rubber seals are in place.

2. Place intake manifold seal, flanges and induction module in position. Install the manifold mounting screws finger-tight.
3. See Figure 4-19. 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 it is locked into place.
4. See Figure 4-18. 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 4-17. 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.
14. Install air cleaner filter and cover.
15. Secure fuel tank. See 4.4 FUEL TANK.



1. **Tab**
2. **Fuel supply line**
3. **Fuel supply tube**

Figure 4-19. Fuel Supply Line

IDLE AIR CONTROL (IAC) 4.9

GENERAL

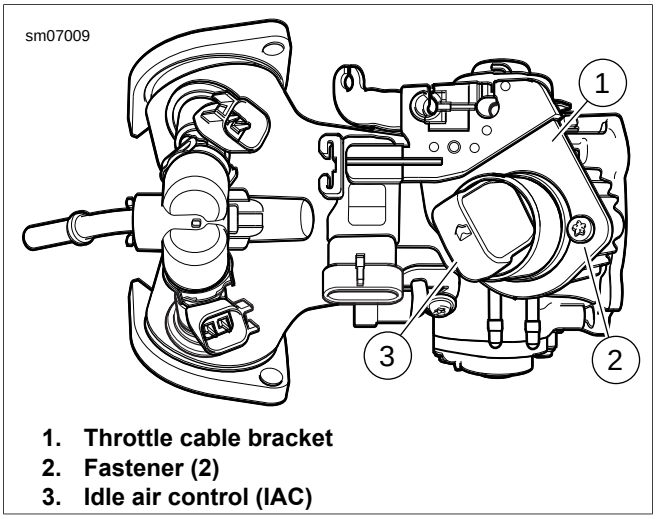
⚠WARNING

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).

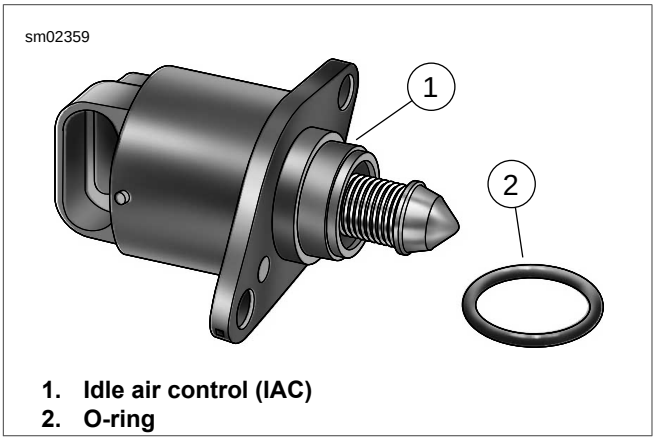
REMOVAL

1. Remove induction module. See 4.8 INDUCTION MODULE.
2. See Figure 4-20. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. See Figure 4-21. Pull IAC (1) and O-ring (2) from throttle body.



1. **Throttle cable bracket**
2. **Fastener (2)**
3. **Idle air control (IAC)**

Figure 4-20. Idle Air Control (IAC) Location



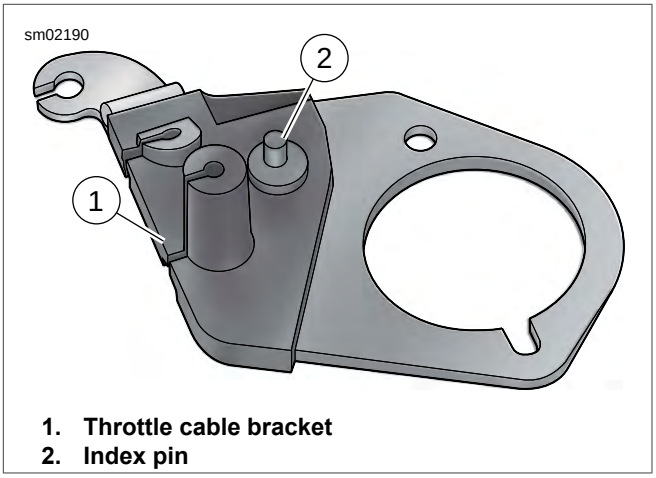
1. **Idle air control (IAC)**
2. **O-ring**

Figure 4-21. Idle Air Control (IAC)

INSTALLATION

FASTENER	TORQUE VALUE	
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm

1. See Figure 4-21. 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 4-22. Insert index pin (2) at bottom of throttle cable bracket (1) into hole in boss at top of induction module.
5. See Figure 4-20. Install **new** throttle cable bracket fasteners (2). Tighten to 20-35 **in-lbs** (2.3-4.0 Nm).
6. Install induction module. See 4.8 INDUCTION MODULE.



1. **Throttle cable bracket**
2. **Index pin**

Figure 4-22. Throttle Cable Bracket

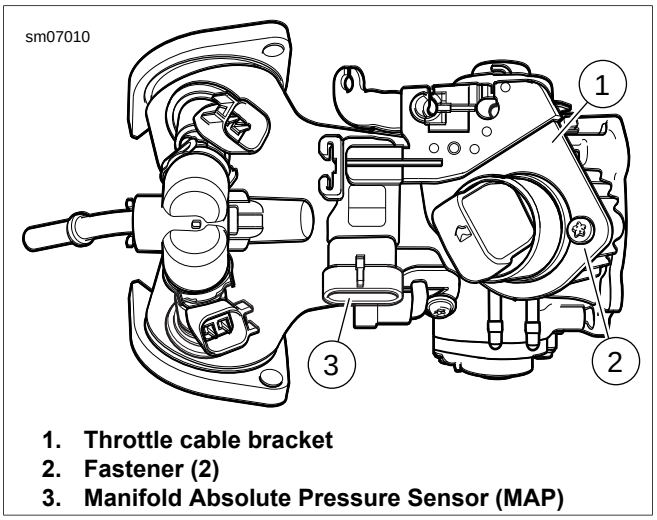
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP) 4.10

GENERAL

See the electrical diagnostic manual for information on the function and testing of the manifold absolute pressure (MAP) sensor.

REMOVAL

1. Remove induction module. See 4.8 INDUCTION MODULE.
2. See Figure 4-23. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. Using appropriate tool, gently push up on MAP sensor and attached seal to remove from intake manifold.



1. **Throttle cable bracket**
2. **Fastener (2)**
3. **Manifold Absolute Pressure Sensor (MAP)**

Figure 4-23. Throttle Cable Bracket Location

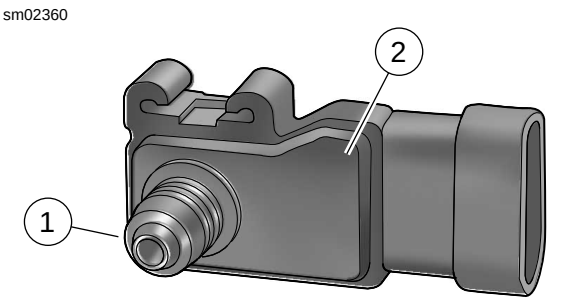
INSTALLATION

FASTENER	TORQUE VALUE	
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm

NOTE

*See Figure 4-24. Prior to installing the original sensor, inspect the seal (1). Seals not in good condition 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 4-22. Insert index pin (2) at bottom of throttle cable bracket into hole in boss at top of induction module.
4. See Figure 4-23. Install **new** throttle cable bracket fasteners (2). Tighten to 20-35 **in-lbs** (2.3-4.0 Nm).
5. Install induction module. See 4.8 INDUCTION MODULE.



1. **Seal**
2. **MAP sensor**

Figure 4-24. MAP Sensor

OXYGEN SENSOR 4.11

GENERAL

See the electrical diagnostic manual for information on the function and testing of the heated oxygen sensor (HO2).

REMOVAL

1. See Figure 4-25. The O2 sensors are installed in threaded bosses on the inboard side of front and rear exhaust pipes.

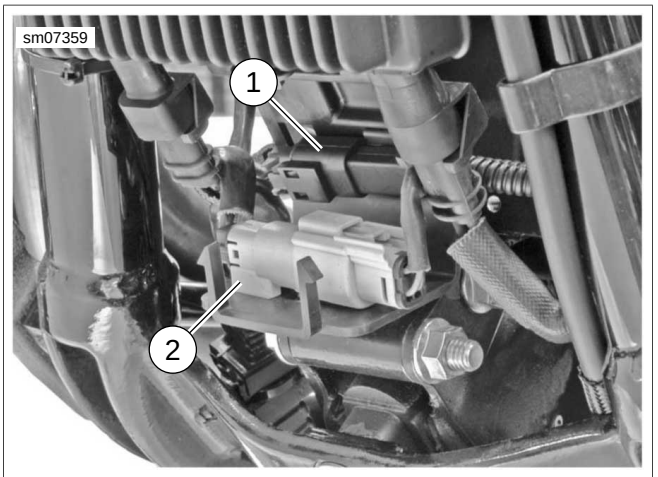
NOTE

See Figure 4-26. Front oxygen sensor connector is located in front electrical caddy. See 7.3 ELECTRICAL CADDY.

2. Open front electrical caddy and disconnect O2 sensor connector (2). Remove any cable straps securing harness before loosening and removing front O2 sensor.
3. See Figure 4-27. Remove seat. Disconnect sensor connector and remove any cable straps securing harness before loosening and removing rear O2 sensor.

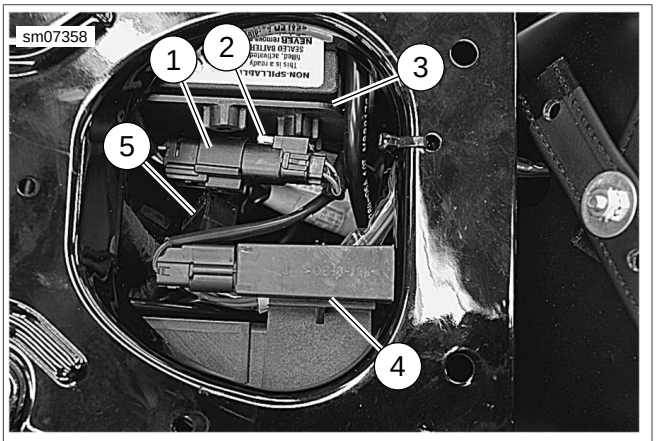


Figure 4-25. Oxygen Sensors (Inboard Side of Exhaust Pipes)



1. **CKP connector**
2. **Front O2 sensor connector**

Figure 4-26. Front Electrical Caddy



1. **Rear O2 sensor connector [137]**
2. **Connector anchor**
3. **Battery tray**
4. **Security antenna**
5. **Tail lamp connector [7]**

Figure 4-27. Rear O2 Sensor Connector Location

INSTALLATION

FASTENER	TORQUE VALUE	
Oxygen sensor	12.2-14.2 ft-lbs	16.5-19.3 Nm

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 LOCTITE ANTI-SEIZE and **new** seal rings.*
- *If O2 sensor will be reused, replace the gasket. Use a high-quality professional grade sidecutters for gasket removal. Make sure larger side of new gasket faces exhaust pipe.*
- *If O2 sensor will be reused, apply a thin coat of LOCTITE ANTI-SEIZE 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.*

1. Thread sensor into threaded boss on exhaust pipe. Tighten to 12.2-14.2 ft-lbs (16.5-19.3 Nm).

NOTE

Verify both connector halves are clean and free of any dielectric grease. Never use dielectric grease on sealed connectors.

2. Route sensor harness to mating connector and connect. Install cable straps that were removed during removal.
3. Repeat previous steps for other sensor.

FUEL INJECTORS 4.12

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.

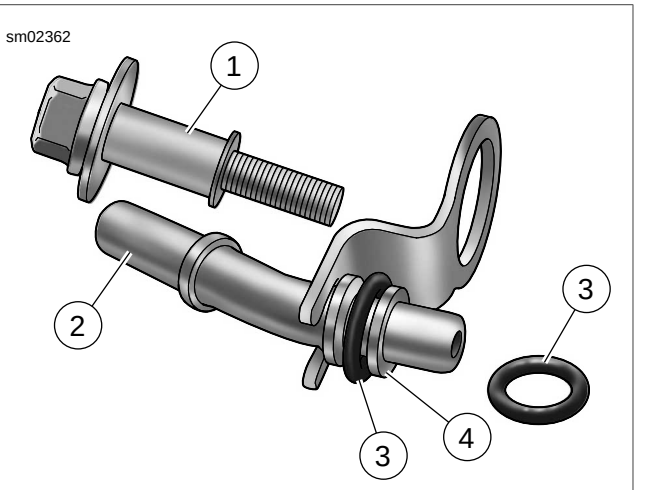
REMOVAL

1. Remove induction module. See 4.8 INDUCTION MODULE.

NOTE

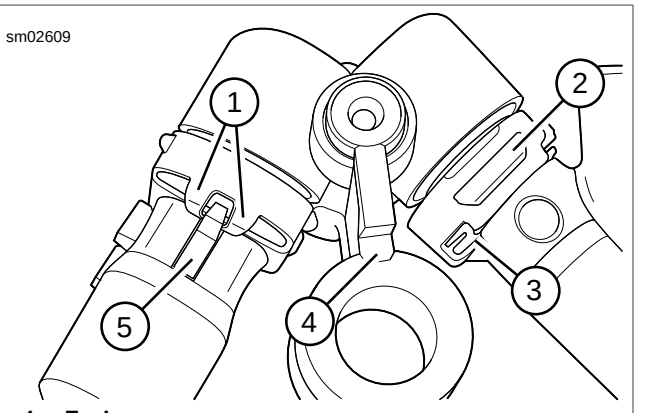
If not replacing fuel supply tube or O-rings, do not remove.

2. See Figure 4-28. Remove fastener (1) retaining fuel supply tube (2).
3. Pull fuel supply tube from fuel rail. Remove sealing washer (4) and O-ring (3) from fuel supply tube. Remove second O-ring from fuel rail bore. Discard sealing washer and O-rings.
4. See Figure 4-29. With a rocking motion, pull fuel injectors with attached fuel rail from the induction module.
5. See Figure 4-30. 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.
6. Remove O-rings (1) from fuel injectors. Discard O-rings.



1. **Fastener**
2. **Fuel supply tube**
3. **O-ring (2)**
4. **Sealing washer**

Figure 4-28. Fuel Supply Tube



1. **Fork**
2. **Lip**
3. **Opening**
4. **Rail tab**
5. **Injector tab**

Figure 4-29. Fuel Rail

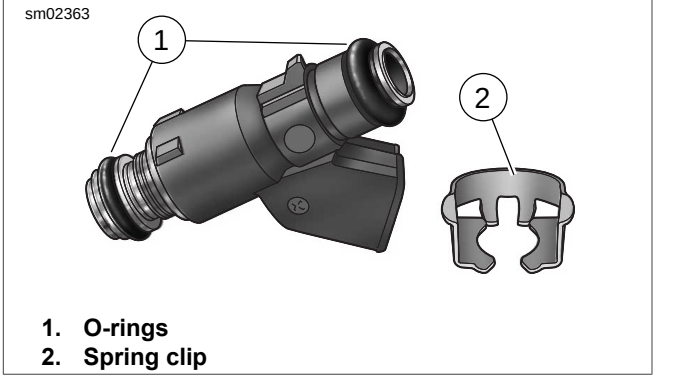
INSTALLATION

FASTENER	TORQUE VALUE	
Fuel supply tube fastener	90-110 **in-lbs**	10.2-12.4 Nm

1. See Figure 4-30. Apply a thin coat of clean engine oil to **new** fuel injector O-rings (1). Install on fuel injectors.
2. See Figure 4-29. 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 4-28. 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. 4.8 INDUCTION MODULE.



1. O-rings
2. Spring clip

Figure 4-30. Fuel Injector

FUEL PUMP 4.13

GENERAL

WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

Carefully inspect hose for cuts, tears, holes or other damage. Replace hose if any damage is found. Even a small hole can cause a reduction in fuel pressure.

See the electrical diagnostic manual for information on the function and testing of the fuel pump.

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 the fuel supply line of high pressure gasoline.
   a. See Figure 4-31. Disconnect the fuel pump module connector from the tank plate.
   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.

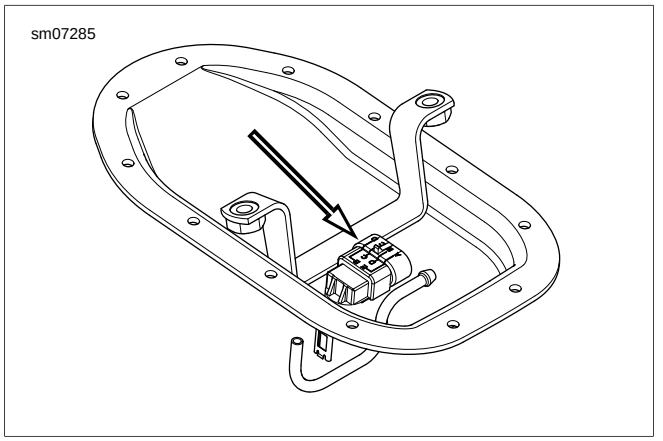


Figure 4-31. Fuel Pump Connector [141] (Typical)

WARNING

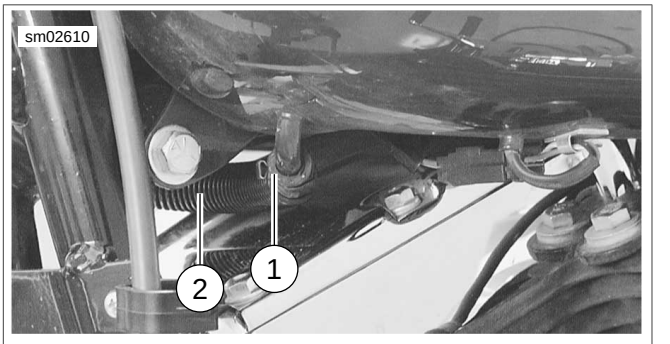
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. Remove instrument console.
   a. For FXDC, FXDF and FLD models, see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
   b. For FXDL, FXDB and FXDWG models, see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
4. Disconnect console wiring.

WARNING

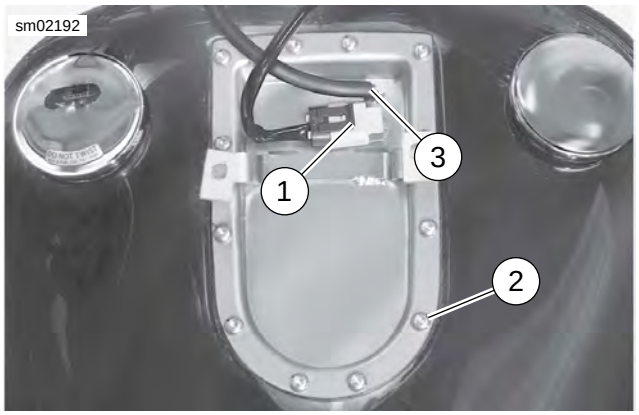
Gasoline can drain from the crossover line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00259a)

5. 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 4-32. 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.
6. See Figure 4-33. Unplug fuel pump and sender connector (1) [141].
7. Remove vent hose (3).
8. Remove top plate screws (2) and discard.
9. See Figure 4-34. On all models, rotate top plate (3) until vent tube (1) clears fuel tank.



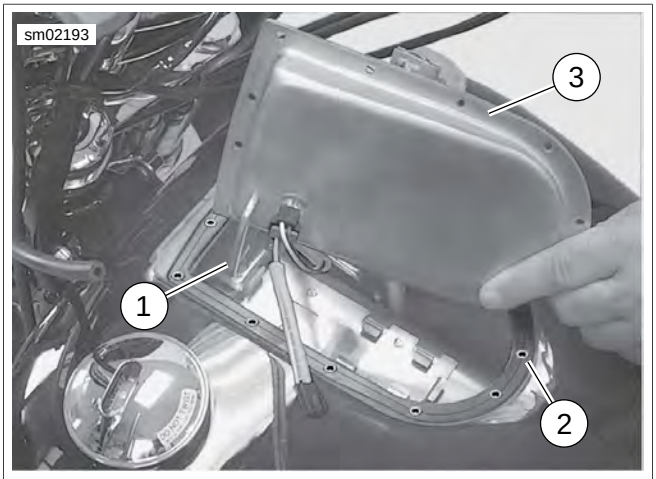
1. Clamp
2. Crossover hose

Figure 4-32. Fuel Crossover Hose



1. **Fuel pump and sender connector [141]**
2. **Screws (12)**
3. **Vent hose**

Figure 4-33. Top Plate Screws (Typical)



1. **Vent tube**
2. **Gasket**
3. **Top plate**

Figure 4-34. Top Plate

10. See Figure 4-35. Press tab and remove fuel pump/sender wiring from top plate. Remove top plate.
11. See Figure 4-36. Press tabs (1) and remove fuel line (4) from fuel pump assembly (2).
12. Remove fuel gauge wiring harness (5) from clip (6).
13. Disconnect fuel pump connector (3).
14. See Figure 4-37. Lift fuel pump assembly tab. Push assembly towards front of vehicle to disengage from fuel tank.
15. Rotate fuel pump assembly clockwise and upward to remove fuel pump assembly from fuel tank.

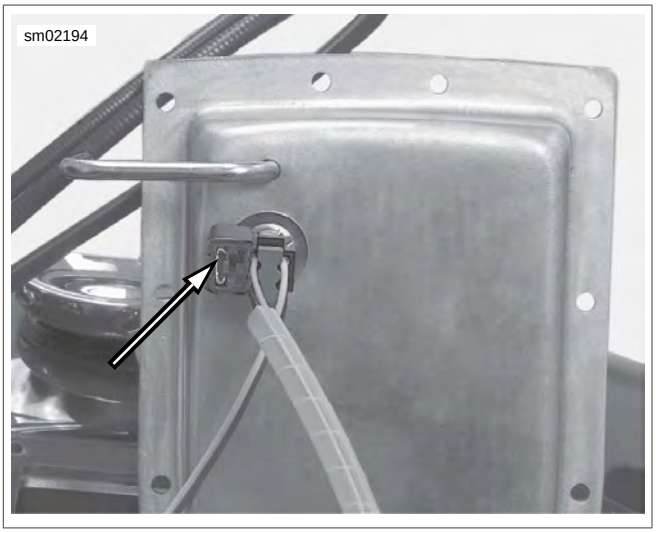
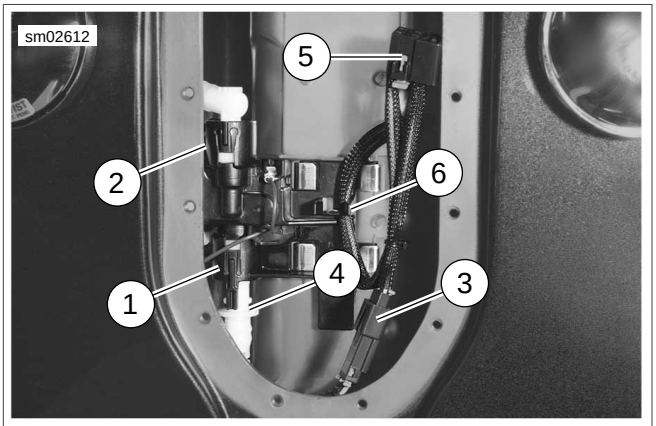


Figure 4-35. Connector Tab

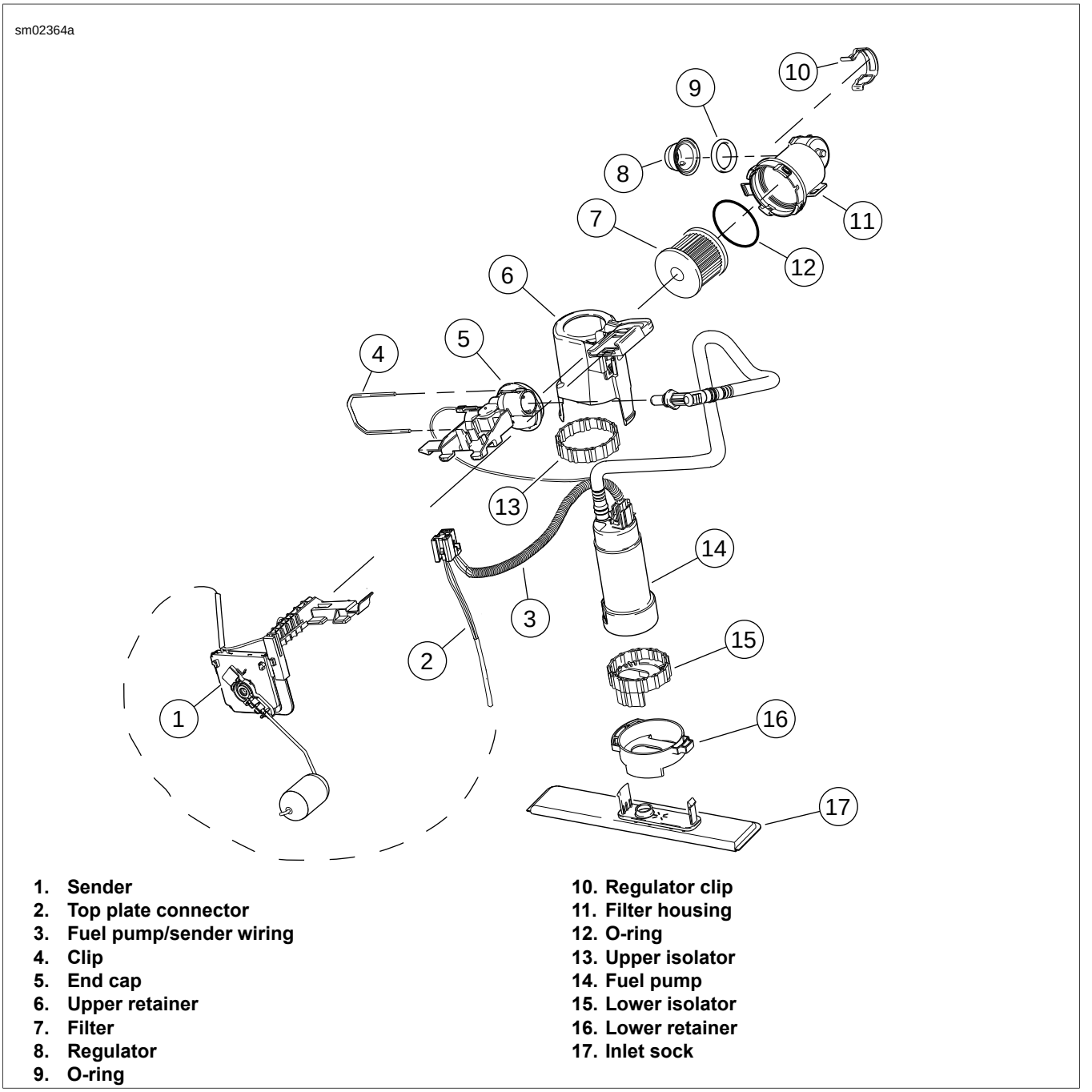


1. **Tabs (2)**
2. **Fuel pump assembly**
3. **Fuel pump connector**
4. **Fuel line**
5. **Fuel gauge wiring harness**
6. **Clip**

Figure 4-36. Fuel Pump



Figure 4-37. Fuel Pump Removal



1. **Sender**
2. **Top plate connector**
3. **Fuel pump/sender wiring**
4. **Clip**
5. **End cap**
6. **Upper retainer**
7. **Filter**
8. **Regulator**
9. **O-ring**
10. **Regulator clip**
11. **Filter housing**
12. **O-ring**
13. **Upper isolator**
14. **Fuel pump**
15. **Lower isolator**
16. **Lower retainer**
17. **Inlet sock**

Figure 4-38. Fuel Pump/Fuel Gauge Sending Unit

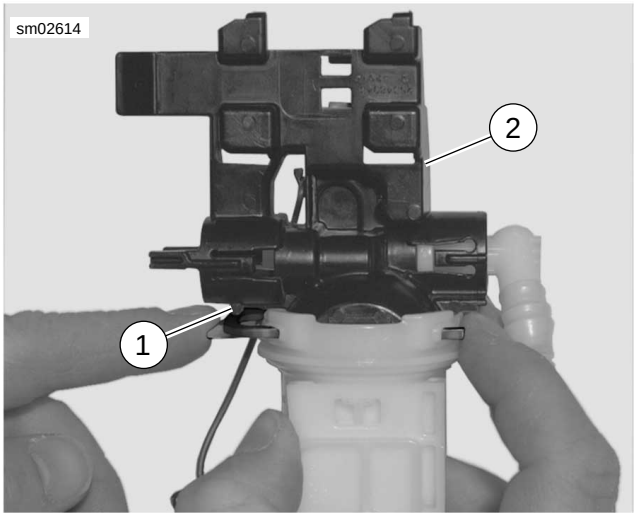
DISASSEMBLY AND ASSEMBLY

Fuel Filter

1. See Figure 4-39. Press tab and remove filter retainer clip (1).
2. Separate fuel pump body from end cap (2).
3. See Figure 4-40. Remove O-ring (2).
4. Remove fuel filter (1).
5. Install **new** fuel filter.
6. Install **new** O-ring.
7. See Figure 4-39. Place end cap (2) on fuel pump body.
8. Install fuel filter retainer clip (1).

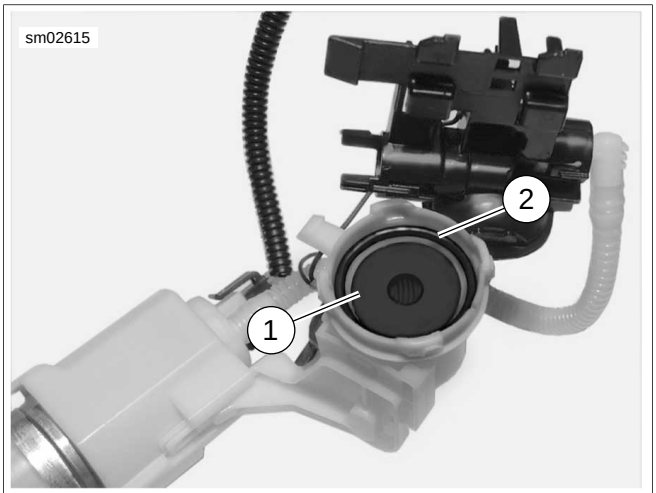
Regulator

1. See Figure 4-41. Remove wire terminal (3).
2. Disengage clip (2) from regulator.
3. Remove regulator from pump assembly.
4. Install **new** O-ring on **new** regulator.
5. Install regulator into pump assembly.
6. Install clip over regulator.
7. Replace wire terminal.



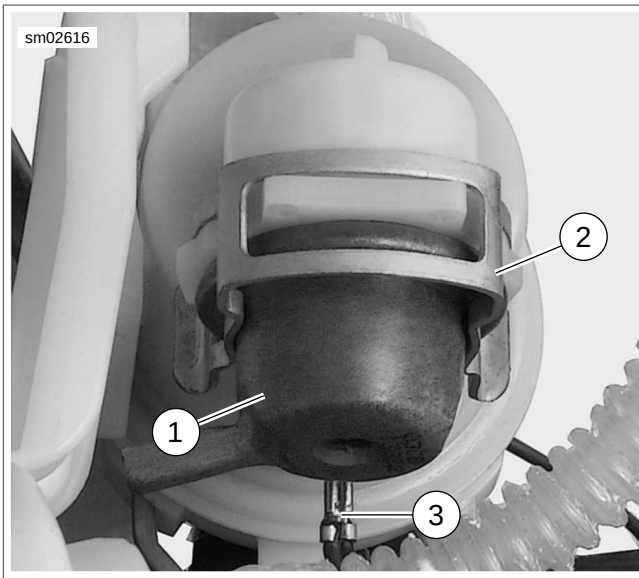
1. **Fuel filter retainer clip**
2. **End cap**

Figure 4-39. Filter Retainer Clip



1. **Fuel pump filter**
2. **O-ring**

Figure 4-40. Bail Bracket



1. **Regulator**
2. **Clip**
3. **Wire terminal**

Figure 4-41. Regulator

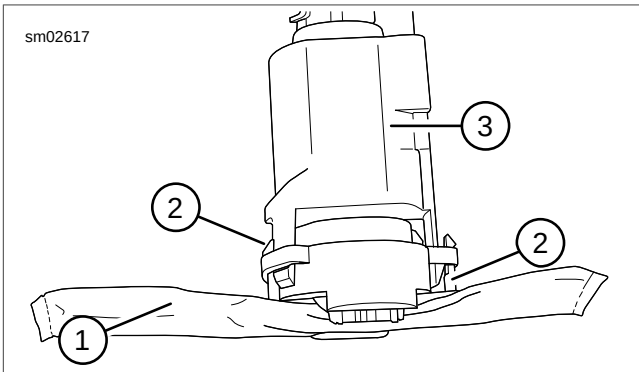
Inlet Sock

1. See Figure 4-42. Press tabs (2) securing inlet sock (1) to upper retainer (3).
2. Remove inlet sock from upper retainer.

NOTE

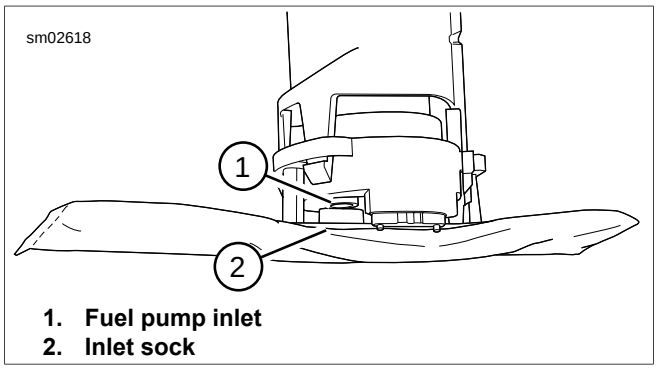
See Figure 4-43. In next step, verify inlet sock engages fuel pump inlet.

3. See Figure 4-42. Install inlet sock (1) on upper retainer (3). Be sure tabs (2) engage slots in body.



1. **Inlet sock**
2. **Tab (2)**
3. **Upper retainer**

Figure 4-42. Fuel Sock



1. **Fuel pump inlet**
2. **Inlet sock**

Figure 4-43. Fuel Sock Installation

Fuel Pump

1. See Figure 4-44. Using screwdriver, break tabs securing fuel pump hose to end cap.
2. Remove inlet sock. See 4.13 FUEL PUMP, Disassembly and Assembly.
3. See Figure 4-45. Disconnect fuel pump connector (1).
4. See Figure 4-46. Press tabs (1) and remove lower retainer (2) from upper retainer.
5. Remove fuel pump from fuel pump body.
6. See Figure 4-38. Install lower isolator in lower retainer.
7. Install upper isolator into upper retainer.
8. Install fuel pump into upper retainer.
9. See Figure 4-46. Install lower retainer.
10. See Figure 4-44. Install fuel pump hose into **new** end cap.
11. See Figure 4-45. Install fuel pump connector (1). Inspect fuel pump wiring, (2) replace if damaged.
12. Install inlet sock. See 4.13 FUEL PUMP, Disassembly and Assembly.

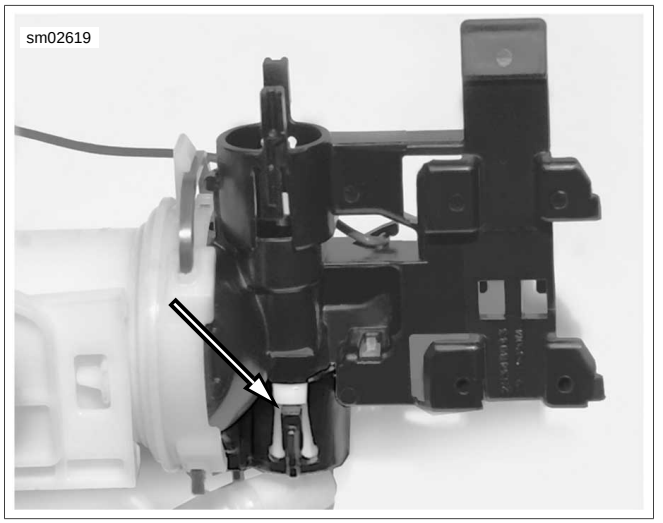
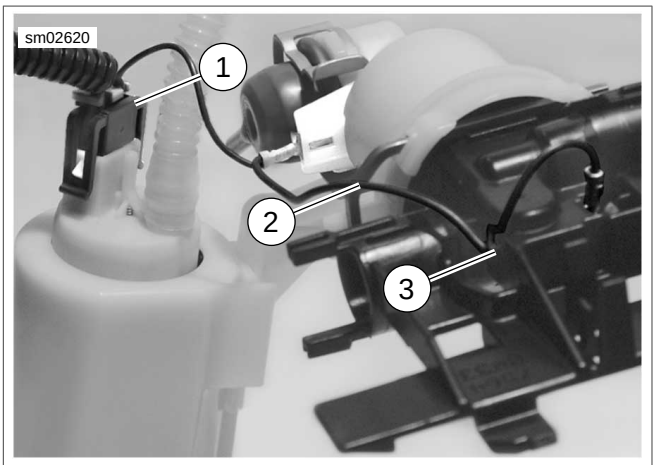
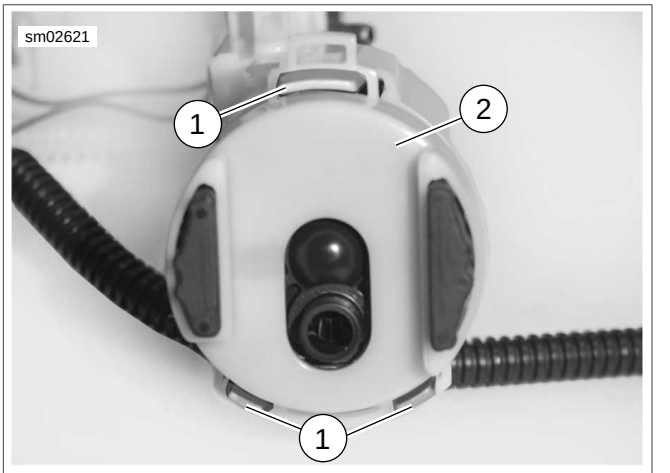


Figure 4-44. Fuel Pump Hose Retaining Clip (2)



1. **Fuel pump connector**
2. **Wire harness**
3. **Wire clip**

Figure 4-45. Fuel Pump Connector



1. **Tab (3)**
2. **Fuel pump lower retainer**

Figure 4-46. Filter Retainer Clip

INSTALLATION

FASTENER	TORQUE VALUE	
Top plate fasteners	27-33 **in-lbs**	3.1-3.7 Nm

1. See Figure 4-47. Install fuel pump into left side of fuel tank as shown.
2. Rotate pump counterclockwise and downward into position.
3. See Figure 4-48. Install fuel pump so end cap (8) engages mounting tabs (4).
4. Connect fuel pump connector (7).
5. Place fuel gauge wiring harness (5) into clip (6).
6. Install **new** O-ring on fuel line (1). Install fuel line.
7. Install **new** top plate gasket on fuel tank. Do not apply any type of sealant to gasket.

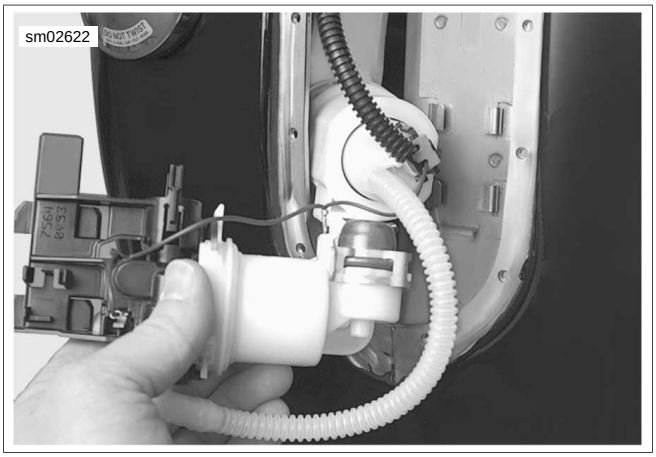
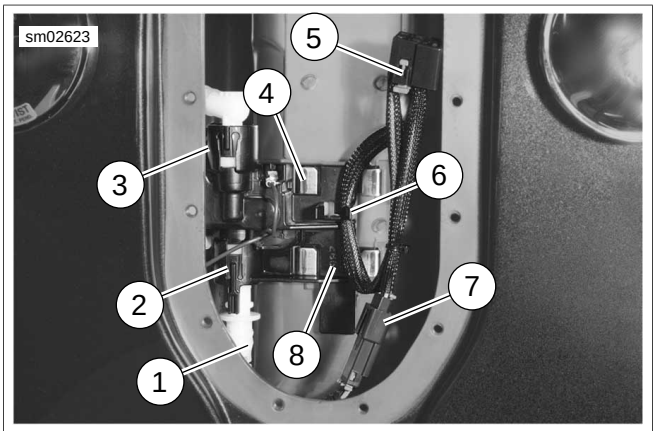


Figure 4-47. Fuel Pump Installation



1. **Fuel line**
2. **Tabs (2)**
3. **Fuel pump assembly**
4. **Mounting tabs (4)**
5. **Fuel gauge wiring harness**
6. **Clip**
7. **Fuel pump connector**
8. **End cap**

Figure 4-48. Fuel Pump

8. See Figure 4-49. Install fuel pump/sender wire connector (4) on top plate (3).
9. Install top plate.
   a. On FXDL and FXDF models, hold top plate at 90 degree angle.
   b. See Figure 4-48. On all models, install sender wiring into clip (6).
   c. On all models, make sure that vent tube is installed inside of tank, rotate top plate into position.
10. Loosely install **new** sealing screws in top plate.
11. See Figure 4-52. Tighten sealing fasteners using pattern shown to 27-33 **in-lbs** (3.1-3.7 Nm).
12. Connect fuel pump/sending unit connector [141].
13. Install instrument console.
    a. For FXDC and FXDF models, see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
    b. For FXDB/P/A, FXDL, FLD and FXDWG models, see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.

NOTE

Be sure crimped end of clamp faces toward front of vehicle.

14. Connect crossover hose with **new** clamps.
15. Connect negative battery cable.

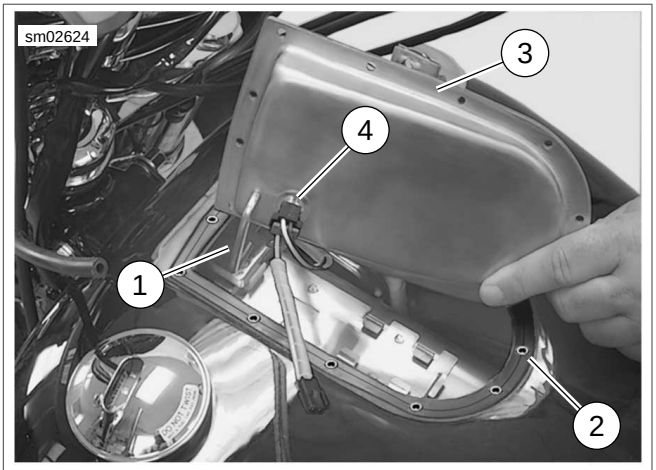
⚠WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

16. Fill tank with gasoline and check for leaks.
17. Check fuel system pressure. See 4.14 FUEL PRESSURE TEST.

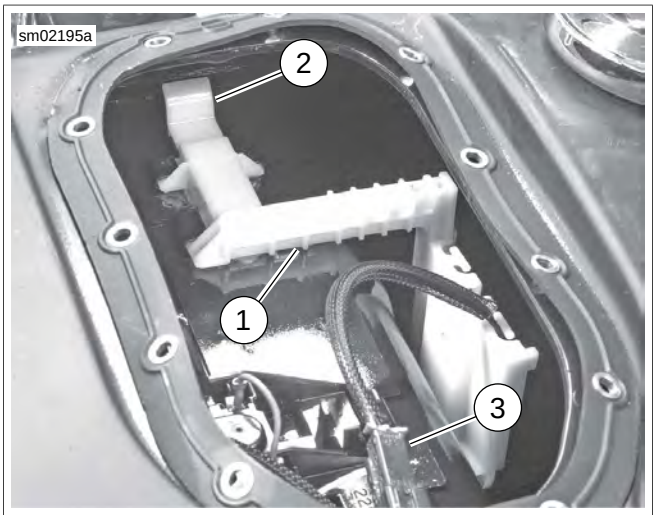
NOTE

The low fuel lamp will not turn off until there is sufficient fuel in the tank, the ignition switch is turned off and back on, and the vehicle has begun forward motion.



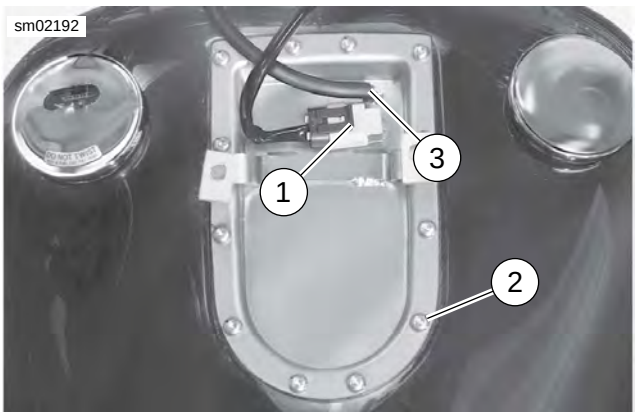
1. **Vent tube**
2. **Gasket**
3. **Top plate**
4. **Fuel pump/sender wire connector**

Figure 4-49. Top Plate: FXDC and FXDF



1. Fuel gauge sender
2. Removal tab
3. Connector

Figure 4-50. Fuel Gauge Sender



1. Fuel pump and sender connector [141]
2. Screws (12)
3. Vent hose

Figure 4-51. Top Plate: FXDC and FXDF Models

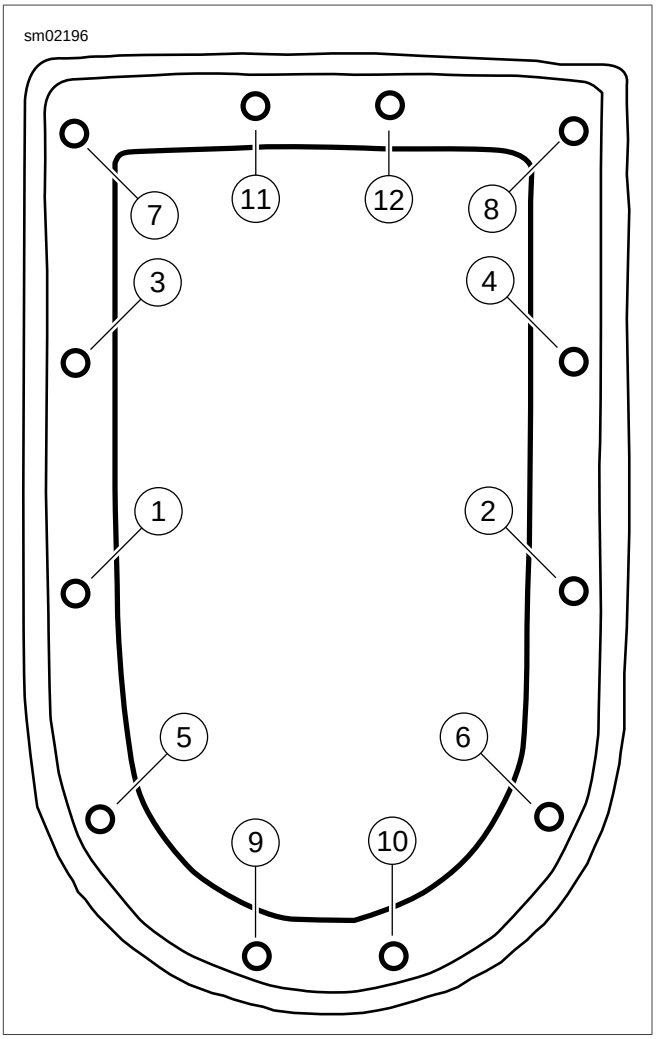


Figure 4-52. Top Plate Torque Sequence: All Models

FUEL PRESSURE TEST 4.14

GENERAL

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but won't run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

See the electrical diagnostic manual for further information on the function and testing of the fuel system.

TESTING

PART NUMBER	TOOL NAME
HD-41182	FUEL PRESSURE GAUGE
HD-44061	FUEL PRESSURE GAUGE ADAPTER

The fuel pressure gauge (0-100 PSI) allows for fuel injector and fuel system pressure diagnosis. A special adapter allows the gauge to be attached to the external fuel supply line.

Avoid kinking the fuel line when installing/removing fuel pressure gauge and adapter.

1. Remove instrument console. See 7.21 INSTRUMENTS: FXDC, FXDF AND FLD or 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.

⚠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. Purge the fuel supply line of high pressure gas.
   a. Disconnect the fuel pump module connector from the tank plate.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

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)

3. Pull up on chrome sleeve of quick-connect fitting (fitting on left side of fuel tank) and pull down on fuel supply line to disconnect.

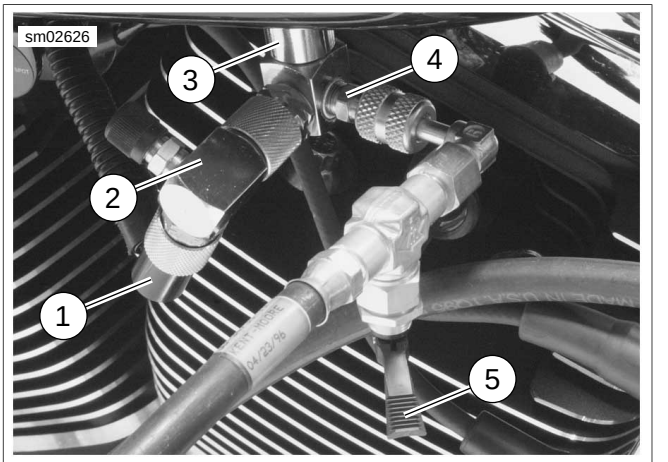
NOTE

Use two fuel pressure gauge adapters to prevent twisting fuel line. Failure to do this may result in a damaged fuel line or fuel line fitting.

4. Attach fuel line to gauge assembly.
   a. See Figure 4-53. Install a second adapter in series with the first.
   b. See Figure 4-54. Pull up on chrome sleeve of quick-connect fitting and insert neck of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061) into fuel supply line.
   c. While pushing up on bottom of adapter, pull down on chrome sleeve until it clicks into the locked position. Pull on adapter to be sure that it will not come free.
   d. In the same manner, install neck of second fuel supply line fitting into quick-connect fitting on fuel tank. Pull on fuel supply line to be sure that it will not come free.



Figure 4-53. Fuel Pressure Gauge Adapters



1. **Fuel supply line**
2. **Adapter to fuel line**
3. **Adapter to fuel tank**
4. **Pressure adapter Schroeder valve union**
5. **Fuel valve (closed position)**

Figure 4-54. Fuel Line

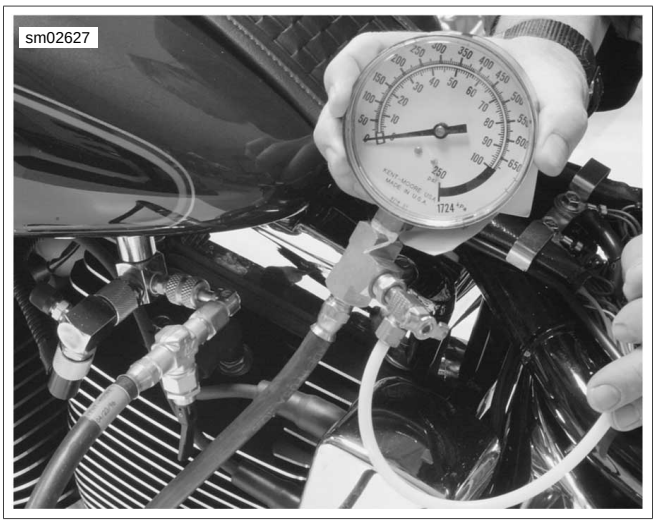


Figure 4-55. Fuel Pressure Gauge Installed (Typical)

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

5. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
6. See Figure 4-53. Remove protective cap from free end of fuel pressure gauge adapter. Connect fuel pressure gauge to Schroeder valve.
7. Start and idle engine to pressurize the fuel system. Open the fuel valve to allow the flow of fuel down the hose of the pressure gauge.
8. Position the clear air bleed tube in a suitable container and open and close the air bleed petcock to purge the gauge and hose of air. Repeat this step several times until only a solid stream of 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.

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.

⚠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)

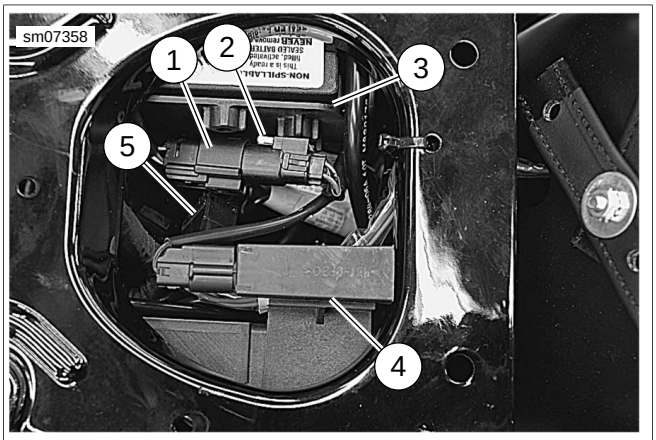
13. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it clicks into the locked position. Pull on fuel supply line to be sure that it will not come free.
14. Install instrument console. See 7.21 INSTRUMENTS: FXDC, FXDF AND FLD or 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.

REMOVAL: FXDB, FXDC AND FXDL

NOTE

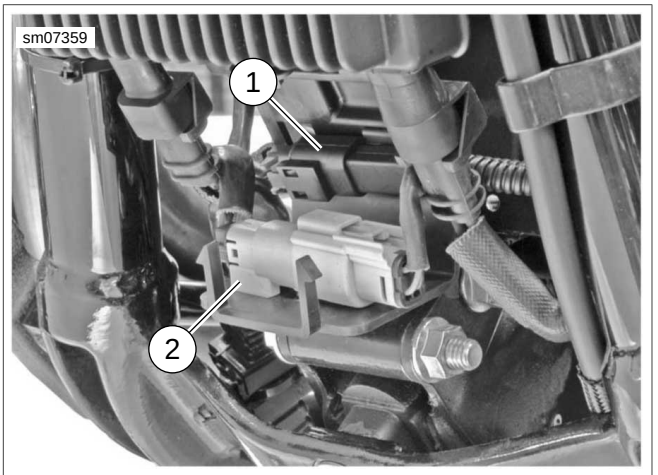
If removing exhaust as an assembly and not removing mufflers or heat shields, skip muffler and heat shield removal steps.

1. Remove seat.
2. See Figure 4-56. Disconnect rear O2 sensor connector [137]. Note wire routing for proper installation.
3. See Figure 4-57. Open front electrical caddy cover and disconnect front O2 sensor connector [138] (1). Remove connector housing from caddy.
4. See Figure 4-58. On models with an active exhaust module, remove active exhaust cable (1):
   a. Remove cable (1) and retainer (2) from exhaust pipe.
   b. Remove ferrule (3) from bellcrank (4).
5. See Figure 4-59. Remove muffler support bracket nuts (29) from bolts (30). Remove muffler support bracket (28).
6. Loosen nuts (17) on muffler clamps (19) to exhaust pipes. Remove mufflers (16, 27).
7. Loosen or remove heat shields (1, 8) by opening worm drive clamps (2).
8. Remove flange nuts (35) from front and rear cylinder head exhaust studs.
9. Remove locknut (3) and bolt (41) attaching front exhaust pipe clamp (4) to front exhaust bracket (40).
10. Remove bolt (13) and washer (14) attaching rear exhaust bracket (15).
11. Remove exhaust system as an assembly.



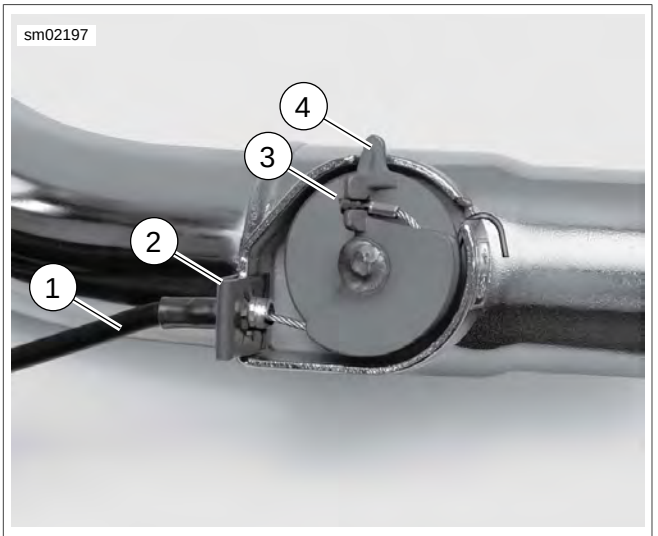
1. **Rear O2 sensor connector [137]**
2. **Connector anchor**
3. **Battery tray**
4. **Security antenna**
5. **Tail lamp connector [7]**

Figure 4-56. Rear O2 Sensor Connector Location



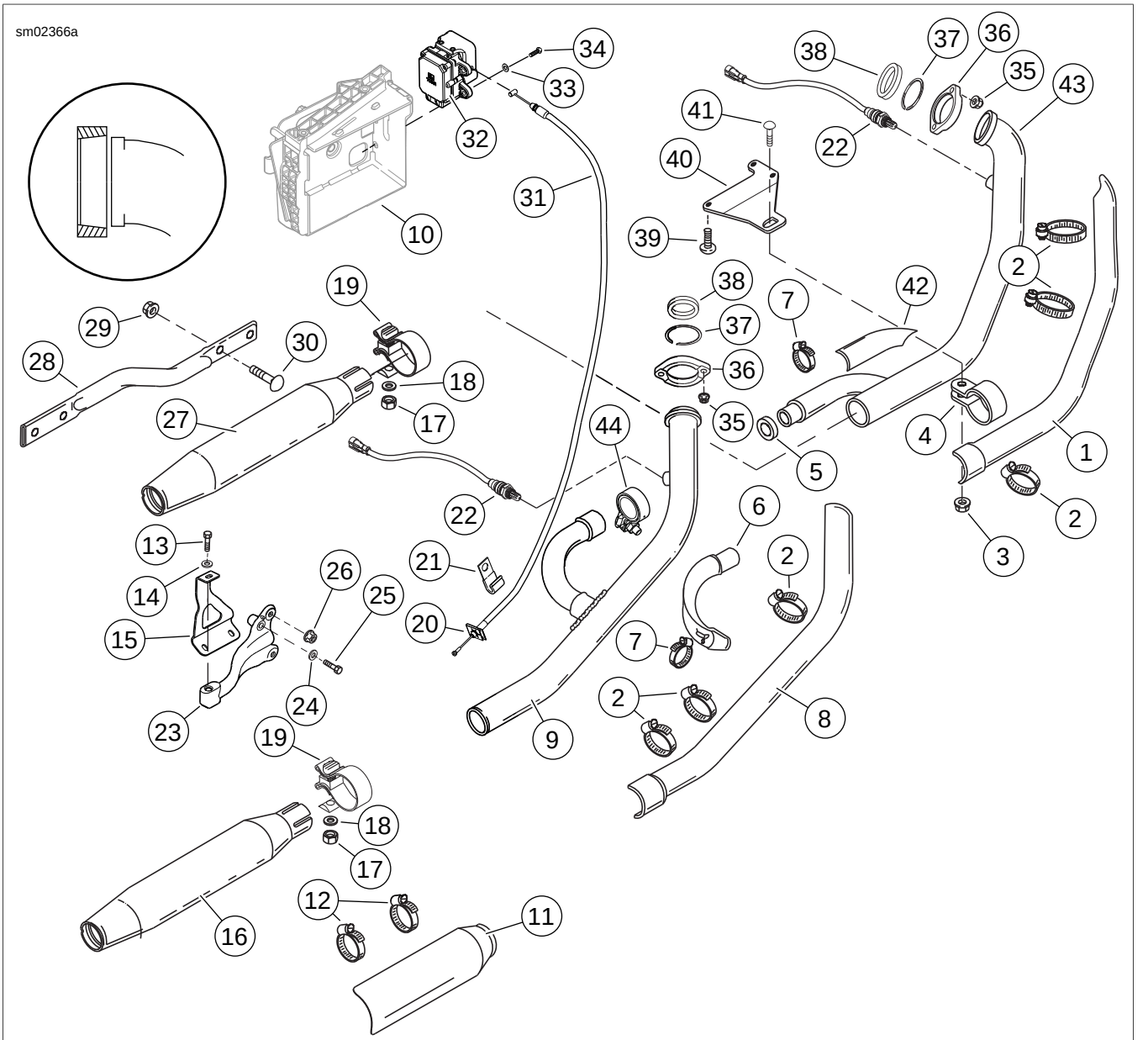
1. **CKP connector**
2. **Front O2 sensor connector**

Figure 4-57. Front Electrical Caddy



1. **Active exhaust cable**
2. **Cable retainer**
3. **Ferrule**
4. **Bellcrank**

Figure 4-58. Bellcrank



1. Front heat shield
2. Worm drive clamp (6)
3. Locknut
4. Exhaust pipe front clamp
5. Interconnect gasket
6. Rear crossover pipe heat shield
7. Worm drive clamp (4)
8. Rear heat shield
9. Rear exhaust pipe
10. Battery cover
11. Muffler heat shield (2)
12. Worm drive clamp (4)
13. Bolt
14. Washer
15. Bracket (active exhaust equipped models only)
16. Rear muffler
17. Locknut (2)
18. Washer
19. Muffler clamp (2)
20. Cable retainer
21. Active exhaust cable clip
22. Oxygen sensor (2, DOM only)
23. Rear exhaust bracket
24. Washer
25. Rear exhaust bracket fastener
26. Nut (2)
27. Front muffler
28. Muffler support bracket
29. Nut
30. Bolt
31. Active exhaust cable
32. Active exhaust module
33. Washer
34. Active exhaust module fastener
35. Flange nut (4)
36. Exhaust manifold flange (2)
37. Retaining ring (2)
38. Exhaust gasket (2)
39. Screw (3)
40. Front exhaust bracket
41. Bolt
42. Front crossover pipe heat shield
43. Front exhaust pipe
44. Muffler clamp

Figure 4-59. Exhaust System: All But FLD, FXDF and FXDWG

DISASSEMBLY: FXDB/P/A, FXDC AND FXDL

1. See Figure 4-59. Remove exhaust clamp (44).
2. Free front exhaust pipe (43) from rear exhaust pipe (9) by twisting and separating at crossover pipe.
3. Examine exhaust gaskets (38) and retaining rings (37) in cylinder head exhaust ports. Replace if necessary.
4. Replace the front (42) and rear (6) crossover pipe heat shields, if necessary.
5. Remove interconnect gasket (5) from crossover pipe bell on rear exhaust pipe.

ASSEMBLY: FXDB/P/A, FXDC AND FXDL

1. See Figure 4-59. If front (42) and rear (6) crossover pipes heat shield were removed, install now.
2. Insert **new** interconnect gasket (5) into crossover pipe bell on rear exhaust pipe (9). Connect rear exhaust pipe to front exhaust pipe (43) at crossover pipe with **new** exhaust clamp (44) but do not tighten clamp at this time.

INSTALLATION: FXDB/P/A, FXDC AND FXDL

FASTENER	TORQUE VALUE	
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm
Muffler support bracket nuts	20-30 ft-lbs	27.1-40.7 Nm
Muffler clamp nuts	38-43 ft-lbs	51.6-58.4 Nm
Exhaust crossover pipe clamp	20-25 ft-lbs	27.1-33.9 Nm

NOTES

- *See inset in Figure 4-59. Replacement exhaust gaskets (38) are tapered internally. Be sure the thin end goes over the exhaust pipe. Also check condition of retaining ring (37) before installation.*
- *If mufflers and heat shields were not removed, skip muffler and heat shield installation steps.*

1. Position ends of exhaust pipes into front and rear cylinder head exhaust ports with holes in exhaust manifold flanges (36) over cylinder head exhaust studs. Loosely thread on flange nuts (35).
2. Position front exhaust pipe clamp (4) on front exhaust bracket (40). Install bolt (41) and locknut (3). Do not tighten nut and bolt at this time.
3. Position rear exhaust bracket (15) on rear exhaust bracket (23). Install bolt (13) and washer (14). Do not tighten bolt at this time.

NOTE

*TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. Discard clamps upon removal. Always use **new** clamps for installation.*

4. Install front and rear mufflers (27, 16) on front and rear exhaust pipes. Install muffler clamps (19) using nuts (17). Do not tighten nuts at this time.
5. Install muffler support bracket (28) and bracket (15) (if equipped) using nuts (29) and bolts (30). Do not tighten nuts at this time. Install exhaust system.
6. Align exhaust system beginning at cylinder head exhaust ports and working backwards tightening all nuts and bolts.
7. Tighten flange nuts (35), at front cylinder studs as follows:
   a. Install lower nut and tighten finger tight.
   b. Install upper nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).

NOTE

Make sure position on rear exhaust heat shield on ABS models is oriented so that a minimum of.500 in (12.7 mm) of clearance is maintained between clamp and ABS module or module cover.

8. Tighten flange nuts at rear cylinder studs as follows:
   a. Install upper nut and tighten finger tight.
   b. Install lower nut and tighten to 9-18 **in-lbs** (1-2 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).
9. Open the worm drive clamps (2) and install heat shields (1, 8). Tighten worm drive clamps (2) to 20-40 **in-lbs** (2.3-4.5 Nm).
10. Tighten nuts (29) to 20-30 ft-lbs (27.1-40.7 Nm).
11. Align mufflers. Tighten muffler clamp nuts (17) to 38-43 ft-lbs (51.6-58.4 Nm).
12. Tighten crossover exhaust clamp (44) to 20-25 ft-lbs (27.1-33.9 Nm).
13. See Figure 4-58. On models with an active exhaust module, install active exhaust cable (1) to bellcrank (4):
   a. Install ferrule (3) in bellcrank.
   b. Wrap cable around bellcrank.
   c. Install cable retainer (2) on exhaust pipe.
   d. See Figure 4-60. Verify cable is properly routed and secured.
14. See Figure 4-56. Connect rear O2 sensor connector [137].

NOTE

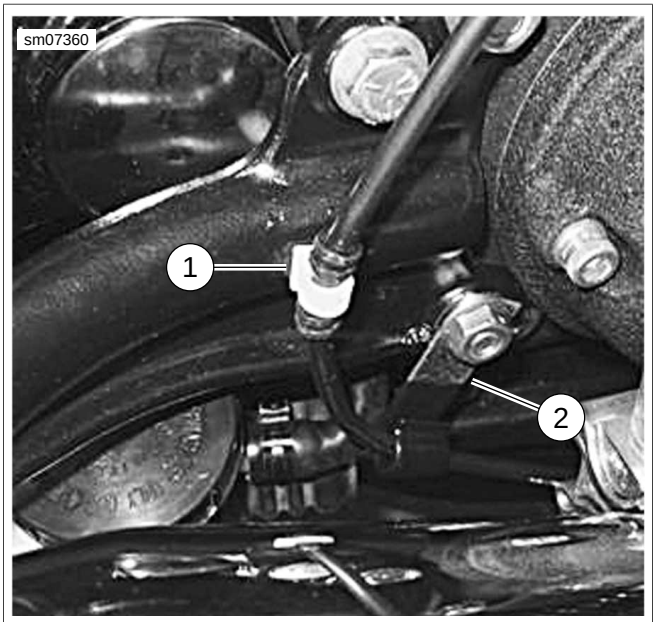
Connector halves must be clean and dry. Do not apply dielectric grease to sealed connectors or terminals.

15. See Figure 4-57. Connect front O2 sensor connector [138]. Close front electrical caddy cover.

⚠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)

16. Install seat.



1. **Clip with anchor mounted to muffler bracket**
2. **Clamp mounted to transmission**

Figure 4-60. Active Exhaust Cable Retention

REMOVAL: FXDF AND FXDWG

NOTE

If removing exhaust as an assembly and not removing mufflers, skip muffler removal steps.

1. Remove seat.
2. See Figure 4-61. Disconnect rear O2 sensor connector [137]. Note wire routing for proper installation.
3. See Figure 4-62. Open front electrical caddy cover and disconnect front O2 sensor connector [138] (2). Remove connector housing from caddy.
4. See Figure 4-63. On models with an active exhaust module, remove active exhaust cable (1):
   a. Remove cable and retainer (2) from exhaust pipe.
   b. Remove ferrule (3) from bellcrank (4).
5. See Figure 4-64. Remove screw (1) attaching mufflers together.
6. Remove muffler support bracket bolt (4) and washer (3) attaching mufflers (22, 23) to rear exhaust bracket (5).
7. Loosen nuts on muffler clamps (21). Remove mufflers.
8. Loosen or remove heat shields (16, 17, 18) by opening worm drive clamps (15, 19).
9. Remove flange nuts (12) from front and rear cylinder head exhaust studs.
10. Remove head pipe assembly (14).
11. If necessary, remove flange locknuts (7) and bolt (8) to remove muffler bracket (5).

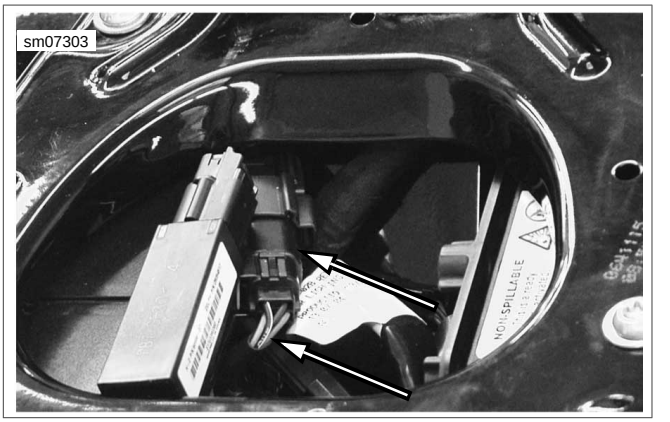
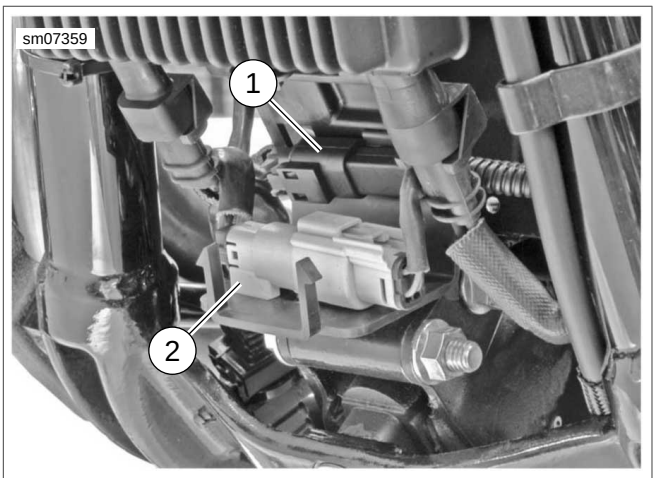
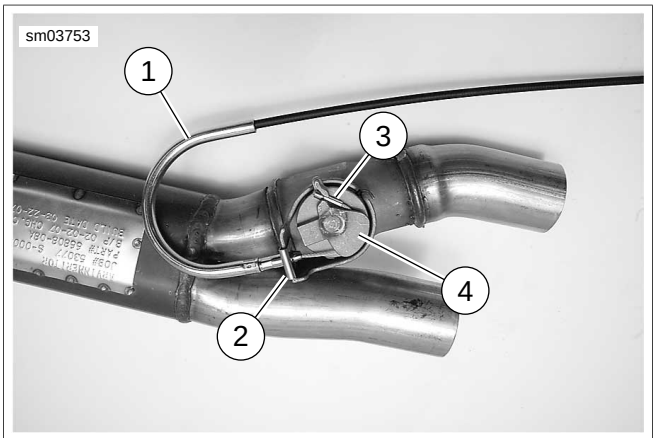


Figure 4-61. Rear O2 Connector and Harness



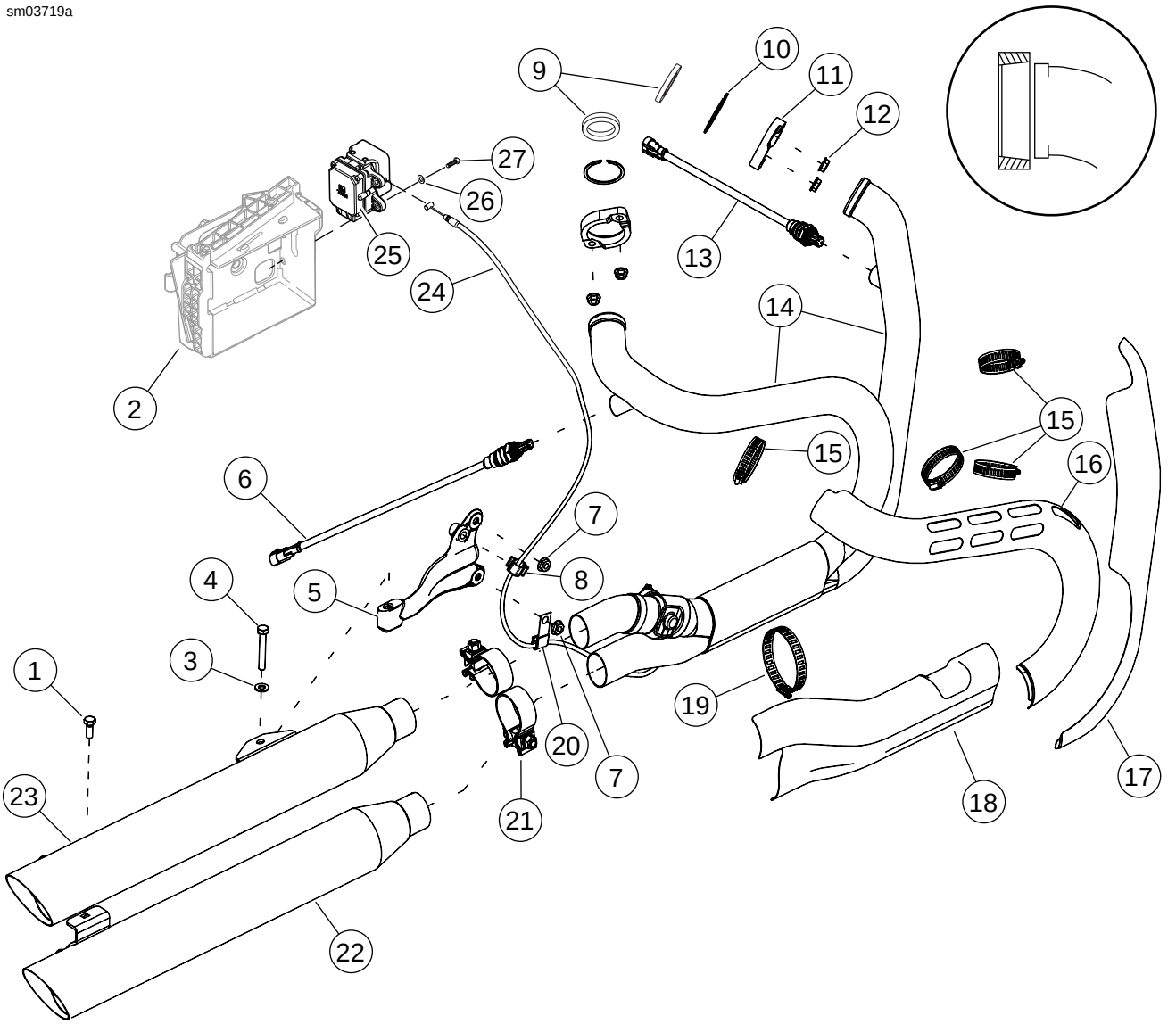
1. **CKP connector**
2. **Front O2 sensor connector**

Figure 4-62. Front Electrical Caddy



1. **Active exhaust cable**
2. **Cable retainer**
3. **Ferrule**
4. **Bellcrank**

Figure 4-63. Bellcrank: FXDF/FXDWG



1. Screw, muffler-to-muffler
2. Battery tray
3. Washer
4. Bolt, muffler mounting
5. Muffler bracket
6. Rear O2 sensor
7. Flange locknut (2)
8. Clamp with anchor
9. Exhaust gasket (2)
10. Retaining ring (2)
11. Exhaust pipe flange
12. Flange nut (4)
13. Front O2 sensor
14. Head pipe assembly
15. Worm drive clamp, small (4)
16. Rear heat shield
17. Front heat shield
18. Collector heat shield
19. Worm drive clamp, large (3)
20. Cable clamp (2)
21. Muffler clamp (2)
22. Front (lower) muffler
23. Rear (upper) muffler
24. Active exhaust cable assembly
25. Active exhaust module
26. Washer
27. Active exhaust module fastener

Figure 4-64. Exhaust System: FXDF and FXDWG

INSTALLATION: FXDF AND FXDWG

FASTENER	TORQUE VALUE	
Muffler bracket flange nuts	15-19 ft-lbs	20.3-25.8 Nm
Muffler bracket bolt	15-19 ft-lbs	20.3-25.8 Nm
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm
Muffler mounting bolt	15-19 ft-lbs	20.3-25.8 Nm
Muffler clamp nuts	38-43 ft-lbs	51.6-58.4 Nm

NOTES

- *See inset in Figure 4-64. Replacement exhaust gaskets (9) are tapered internally. Be sure the thin end goes over the exhaust pipe. Also check condition of retaining ring (10) before installation.*
- *If mufflers and heat shields were not removed, skip muffler and heat shield installation steps.*

1. See Figure 4-64. If removed, install muffler bracket. Tighten flange locknuts (7) to 15-19 ft-lbs (20.3-25.8 Nm). Tighten bolt (8) to 15-19 ft-lbs (20.3-25.8 Nm).
2. Position ends of head pipe assembly (14) into front and rear cylinder head exhaust ports with holes in exhaust manifold flanges (11) over cylinder head exhaust studs. Loosely install flange nuts (12).
3. Slide muffler clamps (21) onto exhaust pipes.

NOTE

*TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. Discard clamps upon removal. Always use **new** clamps for installation.*

4. Install front and rear mufflers (22, 23) on exhaust pipes. Install muffler clamps (21). Do not tighten nuts at this time.
5. Install muffler to muffler screw (1). Do not tighten at this time.
6. Install muffler mounting bolt (4) and washer (3). Do not tighten at this time.

NOTE

Align exhaust system and tighten all nuts and bolts, beginning at cylinder head exhaust ports and working backwards.

7. Tighten flange nuts (12), at front cylinder studs as follows:
   a. Install lower nut and tighten finger tight.
   b. Install upper nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
8. Tighten flange nuts at rear cylinder studs as follows:
   a. Install upper nut and tighten finger tight.
   b. Install lower nut and tighten to 9-18 **in-lbs** (1-2 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).
9. Open the worm drive clamps (15, 19) and install heat shields (16, 17, 18). Tighten worm drive clamps (15, 19) to 20-40 **in-lbs** (2.3-4.5 Nm).
10. Tighten muffler mounting bolt (4) to 15-19 ft-lbs (20.3-25.8 Nm). Tighten muffler attaching bolt (1) securely.
11. Align mufflers. Tighten muffler clamp nuts to 38-43 ft-lbs (51.6-58.4 Nm).
12. See Figure 4-63. On models with an active exhaust module, install active exhaust cable (1):
    a. Install ferrule (3) in bellcrank (4).
    b. Wrap cable around bellcrank.
    c. Install cable and retainer (2) on exhaust pipe.
    d. See Figure 4-65. Make sure cable routing is correct and secure with two clamps (3).

NOTE

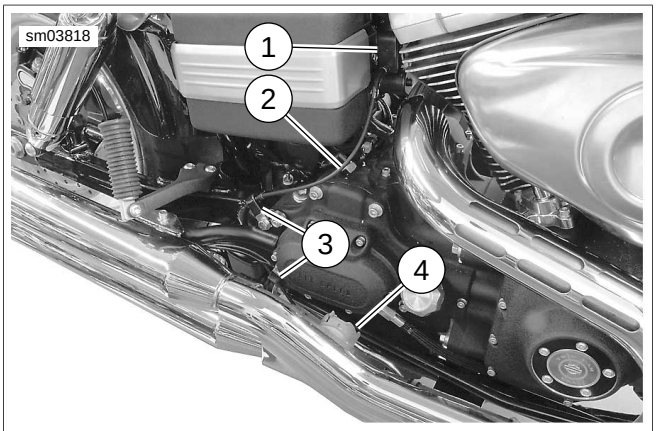
Connector halves must be clean and dry. Do not apply dielectric grease to sealed connectors or terminals.

13. See Figure 4-61. Connect rear O2 sensor connector [137].
14. See Figure 4-57. Connect front O2 sensor connector [138]. Close front electrical caddy cover.

⚠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. Install seat.

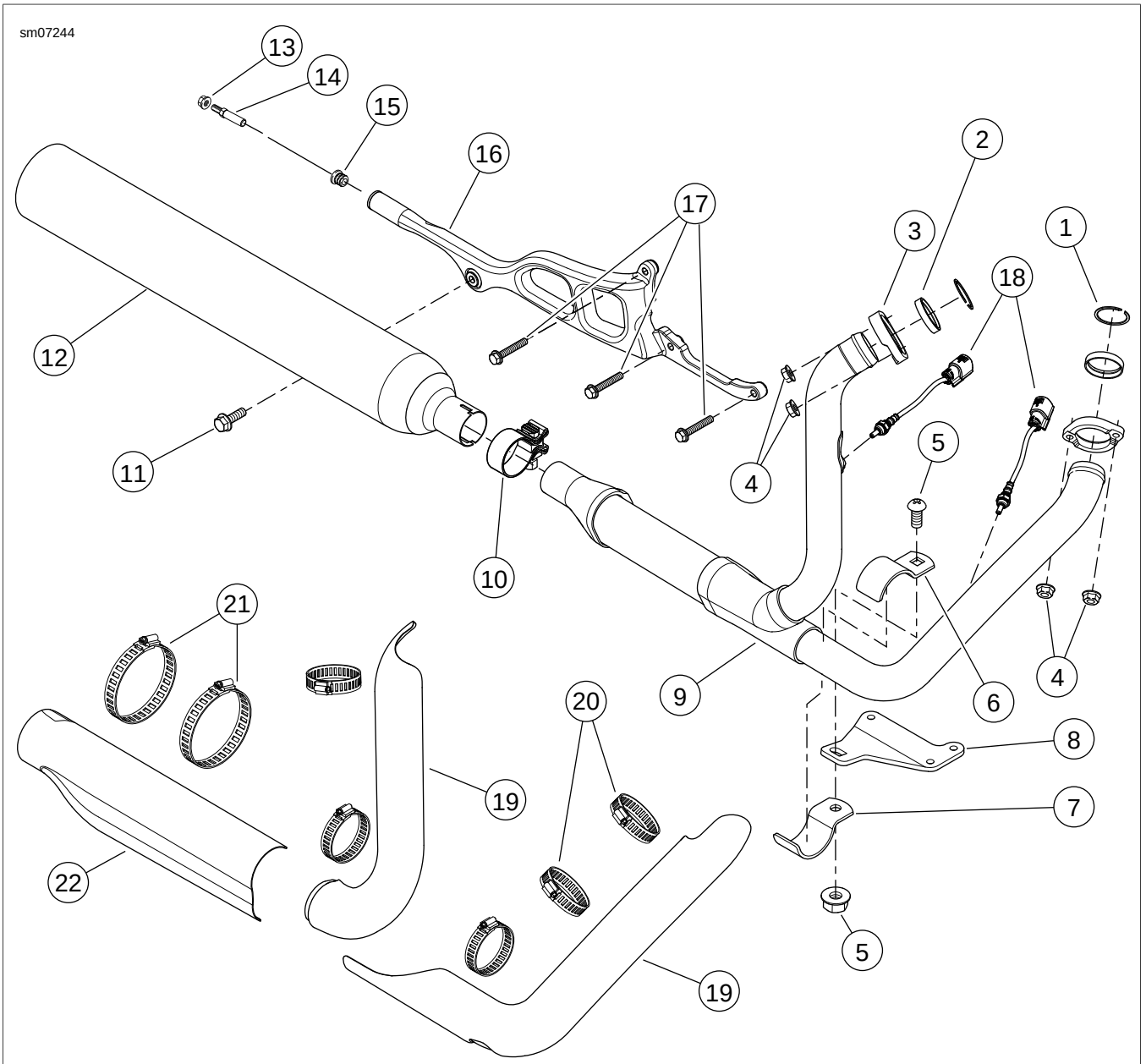


1. **Active exhaust module**
2. **Active exhaust cable**
3. **Clamp (2)**
4. **Bellcrank**

Figure 4-65. Active Exhaust Cable: FXDF and FXDWG

REMOVAL: FLD

1. Remove seat.
2. Remove right saddlebag. See 2.32 SADDLEBAGS: FLD.
3. Remove right side front footboard and rear bracket from frame as an assembly. See 2.29 FOOTBOARDS AND FOOTRESTS.
4. See Figure 4-66. Loosen muffler clamp (10).
5. Remove muffler fastener (11) and muffler (12).
6. Remove muffler clamp (10).
7. If equipped, loosen charcoal canister mounting bracket fasteners. See 4.17 EVAPORATIVE EMISSIONS CONTROL (CA MODELS). Slide canister to the left of vehicle to access the front O2 sensor connector. Do not remove canister.
8. Disconnect front and rear O2 sensor connectors.
9. Remove heat shields (19, 22) from pipes.
10. Remove four flange nuts (4) to release exhaust pipe assembly (9) from studs of front and rear cylinder heads. Slide exhaust flanges down exhaust pipe to gain clearance around exhaust port.
11. Remove carriage bolt and locknut (5) and top and bottom exhaust pipe clamp (6, 7).
12. Remove exhaust pipe assembly from motorcycle.
13. Remove and discard gaskets (2) from front and rear exhaust ports.



1. Retaining ring (2)
2. Exhaust port gasket (2)
3. Exhaust pipe flange (2)
4. Flange nut (4)
5. Carriage bolt with locknut
6. Top exhaust clamp
7. Bottom exhaust clamp
8. Mounting bracket
9. Exhaust pipe assembly
10. Muffler clamp
11. Muffler to exhaust bracket fastener
12. Muffler
13. Flange nut
14. Pin
15. Isolator
16. Muffler support bar
17. Muffler support bar fasteners (3)
18. Oxygen sensor (2)
19. Front and rear exhaust shields
20. Small worm drive clamp (5)
21. Large worm drive clamp (2)
22. Collector exhaust shield

Figure 4-66. Exhaust System: FLD

INSTALLATION: FLD

FASTENER	TORQUE VALUE	
Muffler bracket fastener	17-21 ft-lbs	23-28 Nm
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm
Front pipe clamp	25-30 ft-lbs	33.9-40.6 Nm
Muffler clamp nut	38-43 ft-lbs	51.6-58.4 Nm
Muffler fastener	17-21 ft-lbs	23-28 Nm
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm
Charcoal canister fasteners	15-20 **in-lbs**	1.7-2.3 Nm

NOTES

- *See Figure 4-66. Replacement exhaust port gaskets (2) are tapered internally. Be sure the thin end goes over the exhaust pipe. Also check condition of retaining ring (1) before installation.*
- *If muffler and heat shields were not removed, skip muffler and heat shield installation steps.*

1. See Figure 4-66. Install **new** exhaust port gaskets (2).
2. Inspect retaining rings (1) and flanges (3). Replace as necessary.
3. Position ends of exhaust pipes into front and rear cylinder head exhaust ports. Install exhaust manifold flanges (3) over cylinder head exhaust studs. Install flange nuts (4). Do not tighten at this time.
4. Position header assembly clamp (6, 7) on front exhaust mounting bracket (8). Install carriage bolt and locknut (5). Do not tighten at this time.

NOTE

*TORCA muffler clamps (10) have eliminated the need for silicone or graphite tape during assembly. Always use **new** clamps for installation.*

5. Install **new** muffler clamp (10) onto muffler (12) inlet. Do not tighten nut and bolt at this time.
6. If muffler bracket was removed, install and tighten fasteners to 17-21 ft-lbs (23-28 Nm).
7. Install muffler (12) onto header assembly (9). Do not tighten nuts at this time.
8. Tighten flange nuts (4), at front cylinder studs as follows:
   a. Install lower nut and tighten finger tight.
   b. Install upper nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
9. Tighten flange nuts at rear cylinder studs as follows:
   a. Install lower nut and tighten finger tight.
   b. Install upper nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
10. Tighten the front exhaust clamp carriage bolt and locknut (5) to 25-30 ft-lbs (33.9-40.6 Nm).
11. Align muffler. Tighten muffler clamp (8) nut to 38-43 ft-lbs (51.6-58.4 Nm).
12. Verify muffler alignment. Tighten muffler fastener (11) to 17-21 ft-lbs (23-28 Nm).

NOTE

O2 sensor connector halves must be clean and dry. Do not apply dielectric grease to sealed connectors or terminals.

13. See Figure 4-61. Connect rear O2 sensor connector [137].
14. See Figure 4-62. Connect front O2 sensor connector [138]. Close front electrical caddy cover.
15. See Figure 4-66. Open the worm drive clamps (20, 21) and install heat shields (19, 22). Tighten worm drive clamps to 20-40 **in-lbs** (2.3-4.5 Nm).
16. Install right saddlebag. See 2.32 SADDLEBAGS: FLD.
17. Install right side front footboard and brackets onto frame and attach brake rod. See 2.29 FOOTBOARDS AND FOOTRESTS.
18. Install charcoal canister if equipped. Tighten fasteners to 15-20 **in-lbs** (1.7-2.3 Nm). See 4.17 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).

INTAKE LEAK TEST 4.16

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

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

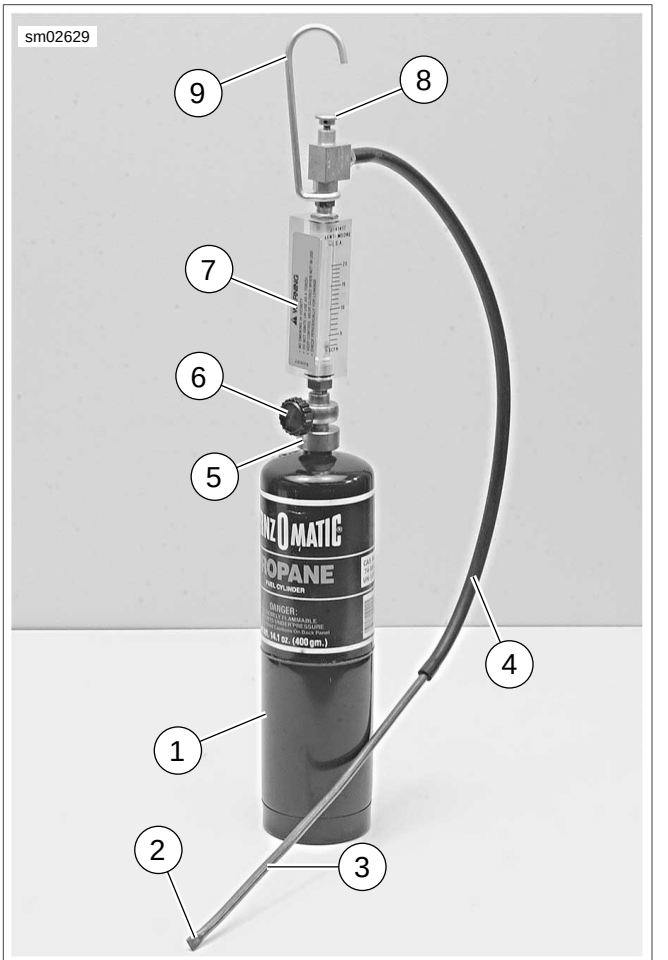
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

Tester Assembly

1. See Figure 4-67. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 4-67. 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.



1. **Propane bottle**
2. **Nozzle**
3. **Copper tube**
4. **Hose**
5. **Valve assembly**
6. **Valve knob**
7. **Flow gauge**
8. **Trigger button**
9. **Hanger**

Figure 4-67. Leak Tester

PROCEDURE

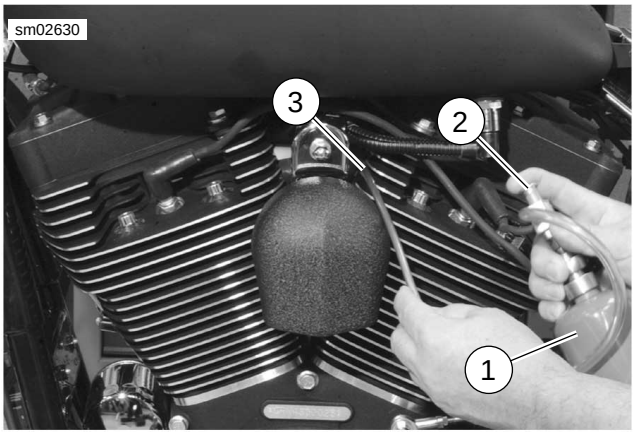
1. Start engine.
2. Warm up engine to operating temperature.

NOTE

Do not direct propane stream toward air cleaner. If propane enters air cleaner, a false reading will be obtained.

3. See Figure 4-68. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.
4. Press and release trigger button (2) to dispense propane. Tone of engine will change when propane enters source of leak. Repeat as necessary to detect leak.

5. When test is finished, close valve knob (turn knob fully clockwise).



1. **Propane bottle**
2. **Trigger button**
3. **Nozzle**

Figure 4-68. Checking for Leaks

EVAPORATIVE EMISSIONS CONTROL (CA MODELS) 4.17

GENERAL

Motorcycles sold in some markets are equipped with an evaporative (EVAP) emissions control system. See Figure 4-69. The EVAP system functions as follows:

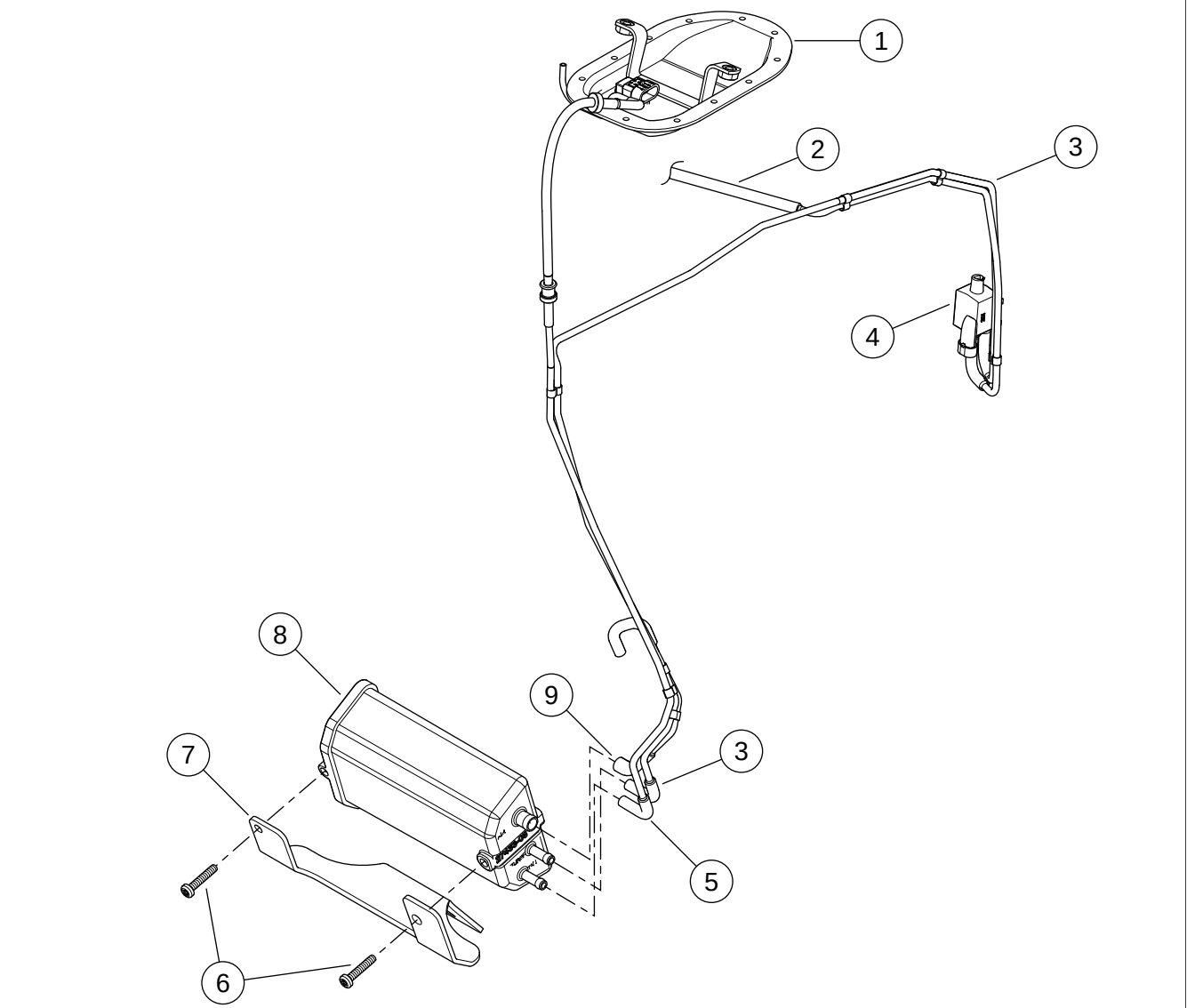
- The fuel vapor vent tube is connected to the vent tube on the fuel tank top plate. It allows fuel vapors in the fuel tank to be vented to the charcoal canister.
- Under certain engine conditions, the ECM (working in conjunction with the EFI system relay) opens the purge solenoid. Negative pressure (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. Tank plate
2. Hose to throttle body
3. Hose from solenoid to canister
4. Purge solenoid
5. Hose to fuel tank plate
6. Fasteners, mounting bracket to canister (2)
7. Canister mounting bracket
8. Charcoal canister
9. Hose from canister to fresh air vent

Figure 4-69. Schematic-CA/APC Evaporative Emissions Control System

CHARCOAL CANISTER

FASTENER	TORQUE VALUE	
Charcoal canister mounting fasteners	15-20 **in-lbs**	1.7-2.3 Nm

Removal

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

NOTE

See Figure 4-70. The EVAP charcoal canister is mounted between the forward frame downtubes.

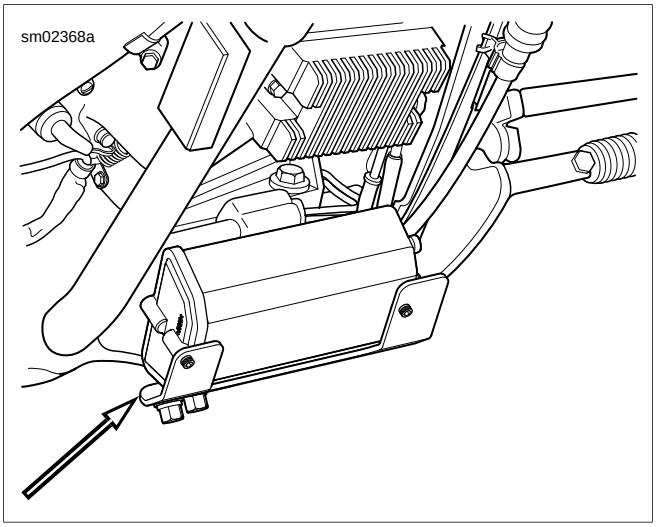


Figure 4-70. Charcoal Canister Location

1. Remove maxi-fuse. See 7.8 FUSES.
2. Pull clean air hose, coming from the throttle body, off of large nipple on charcoal canister.

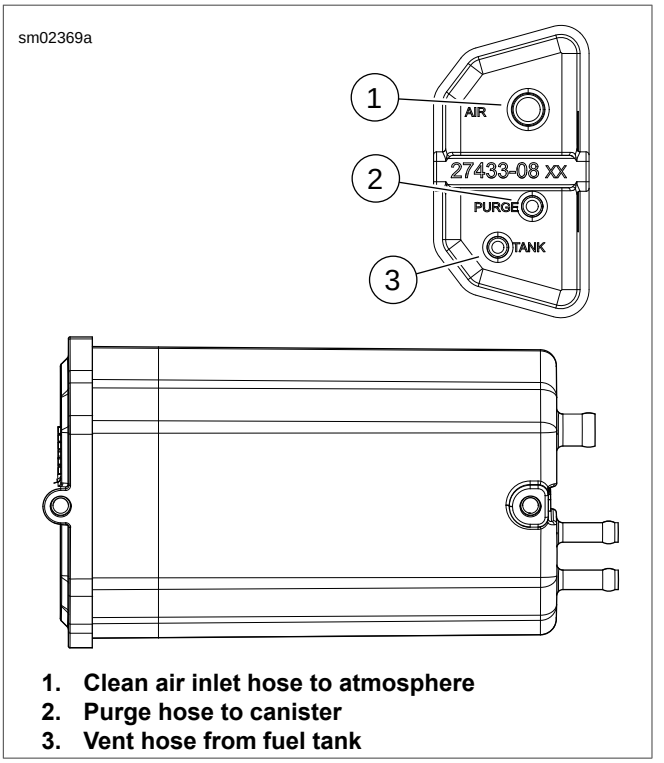
NOTE

See Figure 4-71. Note the two hose connections on the lower left side of the charcoal canister.

3. To verify correct assembly, label each hose to match the stamps on the charcoal canister before disconnecting.
4. Remove two fasteners retaining charcoal canister.
5. Remove charcoal canister.

Installation

1. See Figure 4-70. Slide charcoal canister into mounting bracket and install two fasteners retaining charcoal canister. Tighten to 15-20 **in-lbs** (1.7-2.3 Nm).
2. Attach all hoses to throttle body. See 4.8 INDUCTION MODULE.
3. See Figure 4-71. Attach hoses to charcoal canister nipples as marked.



1. **Clean air inlet hose to atmosphere**
2. **Purge hose to canister**
3. **Vent hose from fuel tank**

Figure 4-71. Charcoal Canister Connections

NOTES

TABLE OF CONTENTS

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5.8 DRIVE BELT	5-23

NOTES

FASTENER TORQUE VALUES 5.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Clutch diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm	5.6 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt, final torque	140 ft-lbs	190 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt, initial torque	100 ft-lbs	135.6 Nm	5.4 DRIVE COMPONENTS, Installation
Primary chaincase sealing fasteners	26-28 ft-lbs	35.3-38.0 Nm	5.5 PRIMARY CHAINCASE HOUSING, Installation
Primary chain tensioner fasteners	21-24 ft-lbs	28.5-32.6 Nm	5.4 DRIVE COMPONENTS, Installation
Primary cover fasteners	12-13 ft-lbs	16.0-17.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Primary cover mass, Japan only	15-19 ft-lbs	20.3-25.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Shift lever bolt	18-22 ft-lbs	24.4-29.8 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Transmission lockplate screws	90-120 **in-lbs**	10.2-13.6 Nm	5.7 TRANSMISSION SPROCKET, Installation/LOC-TITE patch, use 3-5 times
Transmission sprocket nut, final torque	35 ft-lbs	47.5 Nm	5.7 TRANSMISSION SPROCKET, Installation/plus 35-40 degrees
Transmission sprocket nut, initial torque	100 ft-lbs	135.6 Nm	5.7 TRANSMISSION SPROCKET, Installation/Right hand threads, initial torque only, apply several drops of LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) to last few threads.

SPECIFICATIONS: DRIVE 5.2

SPECIFICATIONS

Table 5-1. Sprocket Specifications

SPROCKETS	NO. OF TEETH
	DOM/HDI
Compensating	34
Clutch	46
Transmission	32
Rear wheel	66

Table 5-2. Clutch Specifications

CLUTCH	DESCRIPTION
Type	Wet-multiple disc
Clutch lever free play (after internal adjustment)	1/16-1/8 in (1.6-3.2 mm)

Table 5-3. Gear Specifications

GEAR	OVERALL GEAR RATIO	
	DOM/HDI	Japan
First (low)	9.311	9.029
Second	6.454	6.259
Third	4.793	4.648
Fourth	3.882	3.764
Fifth	3.307	3.207
Sixth (high)	2.790	2.706

NOTE

Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

PRIMARY CHAINCASE COVER 5.3

GENERAL

The primary chaincase is a sealed housing containing the primary chain, chain tensioner, clutch, engine compensating sprocket and alternator.

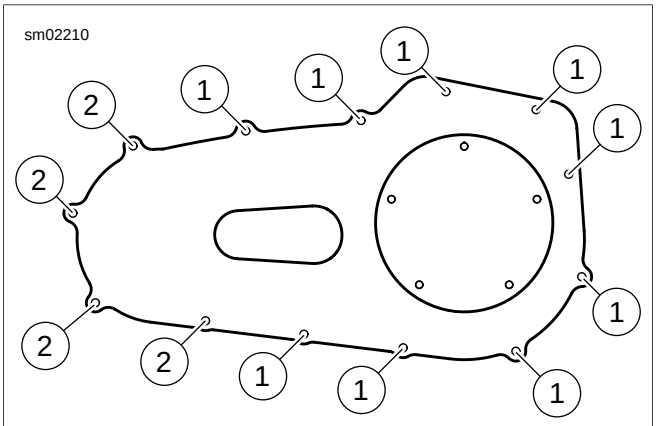
For information on primary chain lubrication, see 1.9 PRIMARY CHAINCASE LUBRICANT.

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.



1. **Fastener, short (9)**
2. **Fastener, long (4)**

Figure 5-1. Primary Chaincase Cover and Fasteners

INSTALLATION

FASTENER	TORQUE VALUE	
Primary cover mass, Japan only	15-19 ft-lbs	20.3-25.6 Nm
Primary cover fasteners	12-13 ft-lbs	16.0-17.6 Nm
Shift lever bolt	18-22 ft-lbs	24.4-29.8 Nm

1. See Figure 5-2. **Japanese Models with Forward Controls:** If primary cover mass (3) was removed from primary chaincase cover (2), apply two drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to mass threads. Install cover mass and tighten to 15-19 ft-lbs (20.3-25.6 Nm).
2. **All models without forward controls:** Replace tower gasket (4).

NOTE

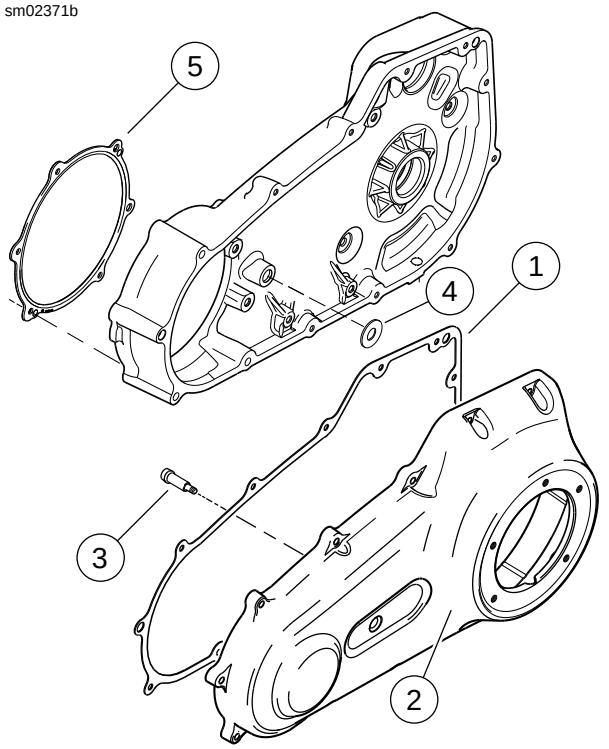
Never reuse gasket between primary chaincase cover and chaincase after cover removal. Failure to replace this gasket may cause primary chaincase leaks.

3. Install **new** cover gasket (1).
4. See Figure 5-1. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to each primary cover fastener. Install short (1) and long (2) fasteners in positions shown and tighten finger-tight.
5. See Figure 5-3. Tighten primary cover fasteners (1-13) to 12-13 ft-lbs (16.0-17.6 Nm) in the sequence shown.
6. See Figure 5-4. Install shift lever (3) with bolt (1) and lockwasher (2). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).

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)

7. Fill primary chaincase. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.
8. Connect negative battery cable.



1. Cover gasket
2. Primary chaincase cover
3. Primary cover mass (models with forward controls, Japan only)
4. Gasket (Japan only)
5. Crankcase gasket

Figure 5-2. Primary Chaincase Cover Gasket

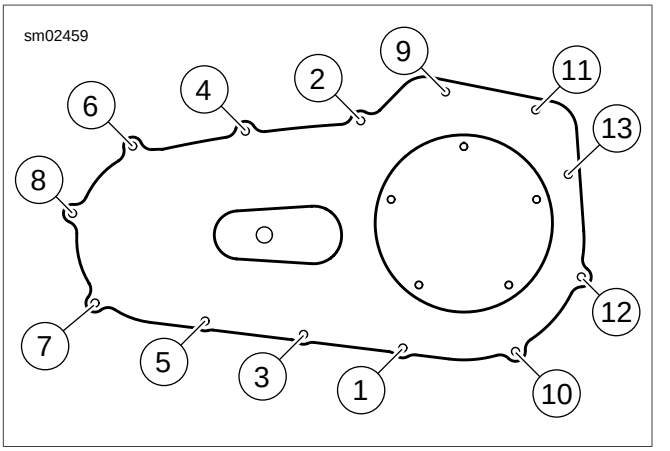
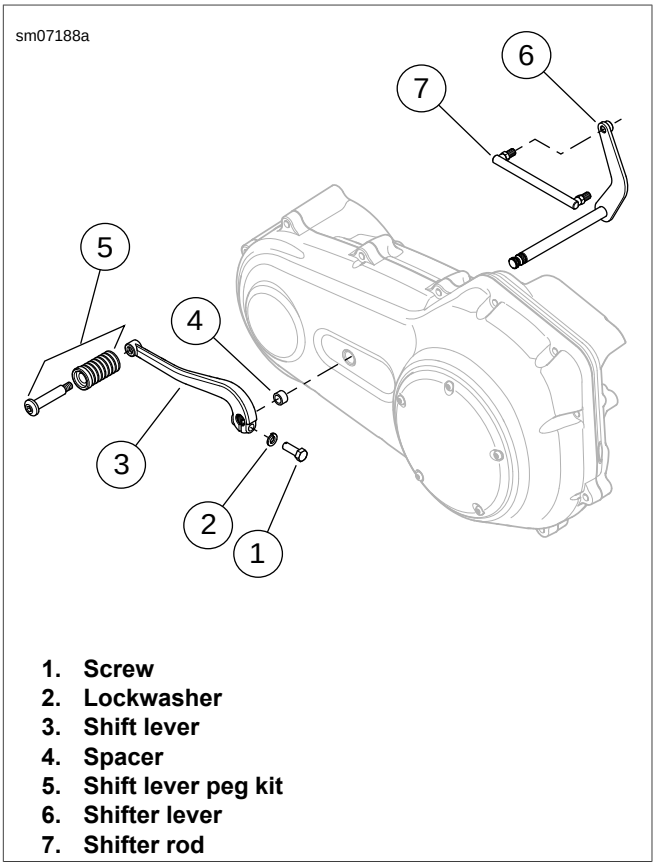


Figure 5-3. Primary Chaincase Cover Torque Sequence



1. Screw
2. Lockwasher
3. Shift lever
4. Spacer
5. Shift lever peg kit
6. Shifter lever
7. Shifter rod

Figure 5-4. Mid Control Shifter Linkage

DRIVE COMPONENTS 5.4

REMOVAL

PART NUMBER	TOOL NAME
HD-47977	PRIMARY DRIVE LOCKING TOOL

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. Disconnect negative battery cable.
2. Remove shift lever if required.
3. Drain the primary chaincase lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT.
4. Remove primary chaincase cover. See 5.5 PRIMARY CHAINCASE HOUSING.
5. See Figure 5-5. Install cable strap (2) as shown. Exposed portion below cover will indicate need for removal before cover installation.
6. See Figure 5-6. Remove chain tensioner fasteners (2) and chain tensioner (1).
7. 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.
8. See Figure 5-7. 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. (00312a)

9. Remove retaining ring (1) and release plate (2).

⚠WARNING

Do not apply heat to remove the clutch hub nut. Fuel vapor and possible fuel mixture in crankcase oil is extremely flammable and highly explosive, which could result in death or serious injury. (00440b)

NOTE

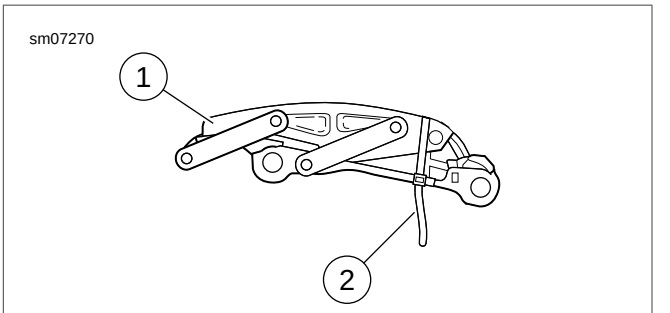
Do not use PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) to remove or install components. Damage to components can occur if this tool is used. Use only recommended primary drive locking tool to remove and install components.

10. 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.

NOTE

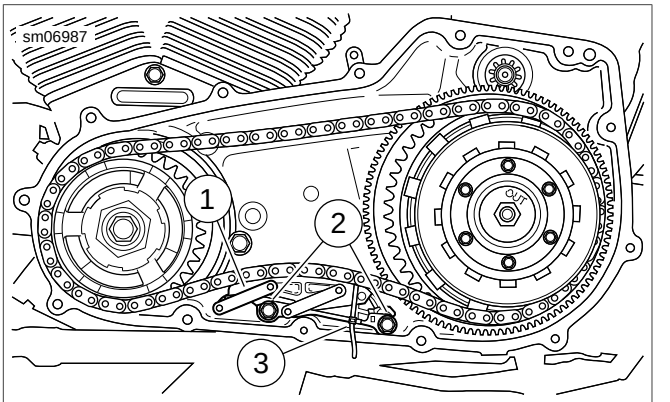
The clutch hub mainshaft nut has left-hand threads. Turn clockwise to remove.

11. Using a breaker bar, rotate clutch hub mainshaft nut in direction shown to remove.
12. See Figure 5-9. Place the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) between the teeth of the engine and clutch sprockets as shown.
13. Using a breaker bar, rotate compensating sprocket bolt in direction shown to remove.
14. See Figure 5-10. Remove bolt (9) and washer (7).
15. See Figure 5-11. Remove clutch assembly, primary chain and compensating sprocket assembly as a single assembly.



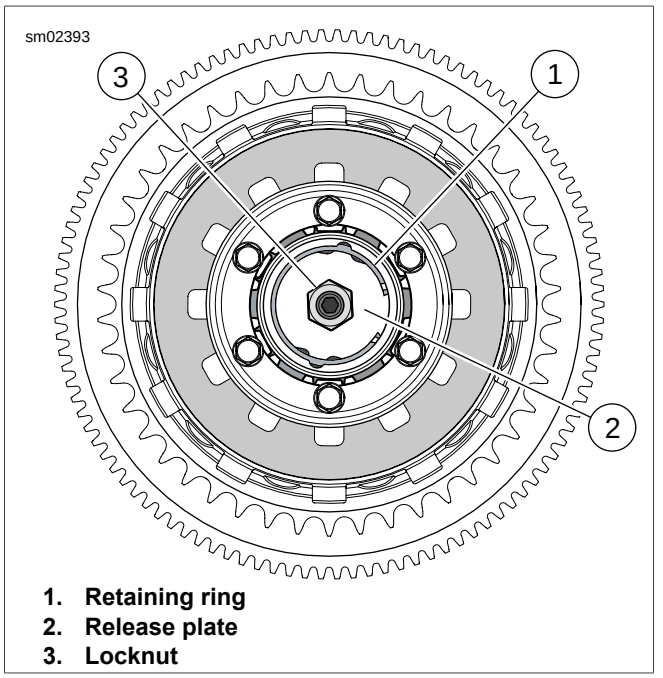
1. **Chain tensioner shoe**
2. **Cable strap**

Figure 5-5. Securing Chain Tensioner



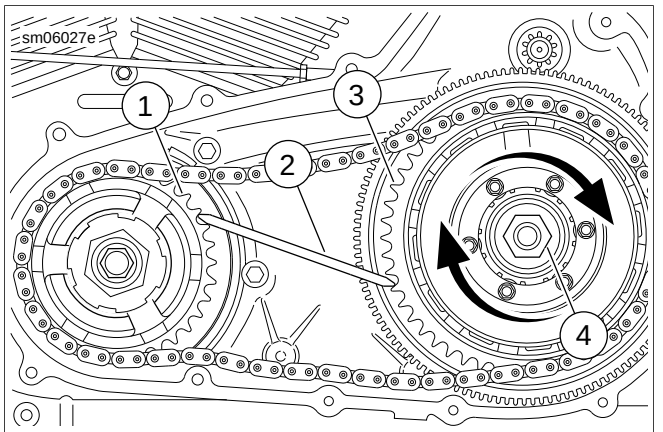
1. **Chain tensioner**
2. **Chain tensioner fasteners**
3. **Cable strap**

Figure 5-6. Chain Tensioner



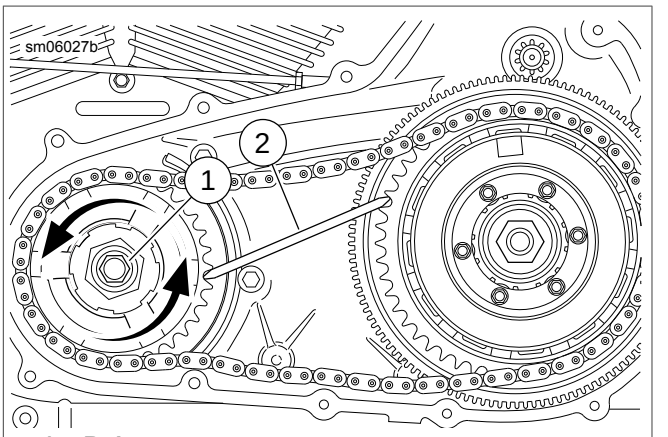
1. Retaining ring
2. Release plate
3. Locknut

Figure 5-7. Clutch



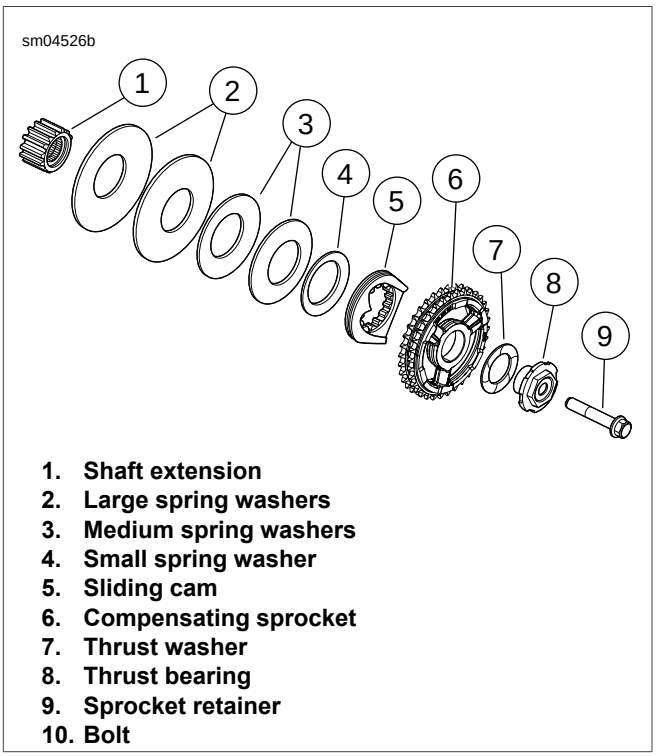
1. Engine compensating sprocket
2. Primary drive locking tool
3. Clutch sprocket
4. Clutch hub mainshaft nut

Figure 5-8. Removing Clutch Hub Mainshaft Nut



1. Bolt
2. Primary drive locking tool

Figure 5-9. 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

Figure 5-10. Engine Compensating Sprocket Assembly

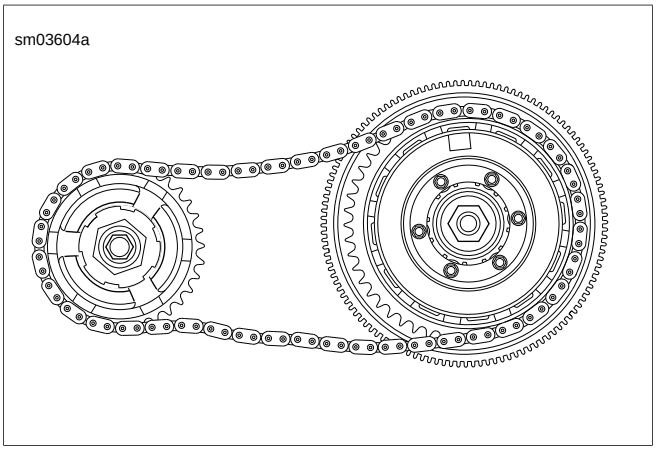


Figure 5-11. Remove Drive Components

INSTALLATION

PART NUMBER	TOOL NAME
HD-47977	PRIMARY DRIVE LOCKING TOOL

FASTENER	TORQUE VALUE	
Compensating sprocket bolt, initial torque	100 ft-lbs	135.6 Nm
Compensating sprocket bolt, final torque	140 ft-lbs	190 Nm
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm
Primary chain tensioner fasteners	21-24 ft-lbs	28.5-32.6 Nm

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 5-12. 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

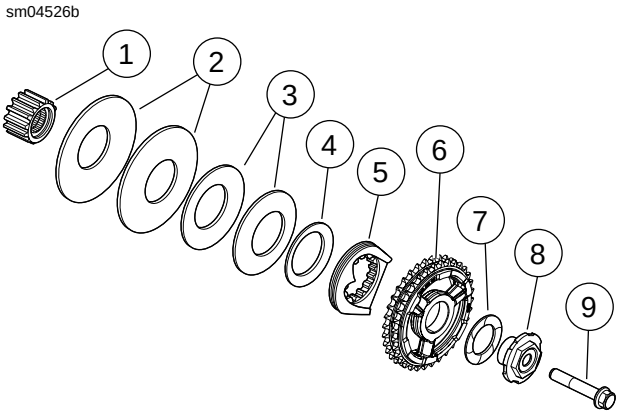
Outer diameter of spring washers will contact each other.

2. Install small spring washer (4) with outer diameter contacting sliding cam (5). Place primary chain over compensating sprocket assembly.
3. Place drive components (primary chain, compensating sprocket assembly, and clutch assembly) into position. Since the clutch hub and shaft extension are splined, rotate the chain drive to align parts.
4. Install **new** bolt (9) and thrust washer (7) finger tight.

NOTE

Clutch hub mainshaft nut has left-hand threads.

5. Clean and prime threads of clutch hub mainshaft nut. Apply two drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to the threads of the nut. Start nut onto mainshaft and tighten finger tight.



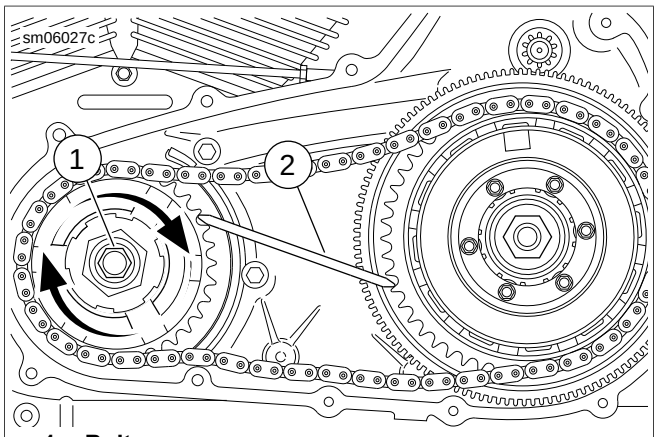
1. **Shaft extension**
2. **Large spring washers**
3. **Medium spring washers**
4. **Small spring washer**
5. **Sliding cam**
6. **Compensating sprocket**
7. **Thrust washer**
8. **Thrust bearing**
9. **Sprocket retainer**
10. **Bolt**

Figure 5-12. Engine Compensating Sprocket Assembly

NOTE

See Figure 5-13. 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).

6. Tighten compensating sprocket nut to 100 ft-lbs (135.6 Nm).
7. Loosen compensating sprocket nut one full turn (360 degrees).
8. Tighten compensating sprocket nut to 140 ft-lbs (190 Nm).



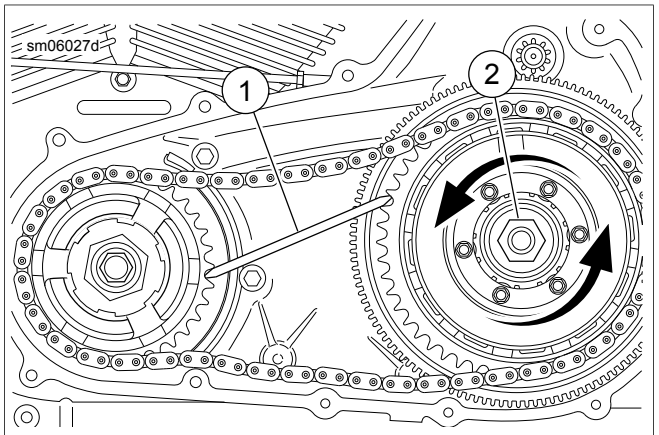
1. **Bolt**
2. **Primary drive locking tool**

Figure 5-13. Installing Engine Compensating Sprocket Bolt

NOTE

See Figure 5-14. 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.

9. Install primary drive locking tool.
10. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-108.5 Nm).



1. **Primary drive locking tool**
2. **Clutch hub mainshaft nut**

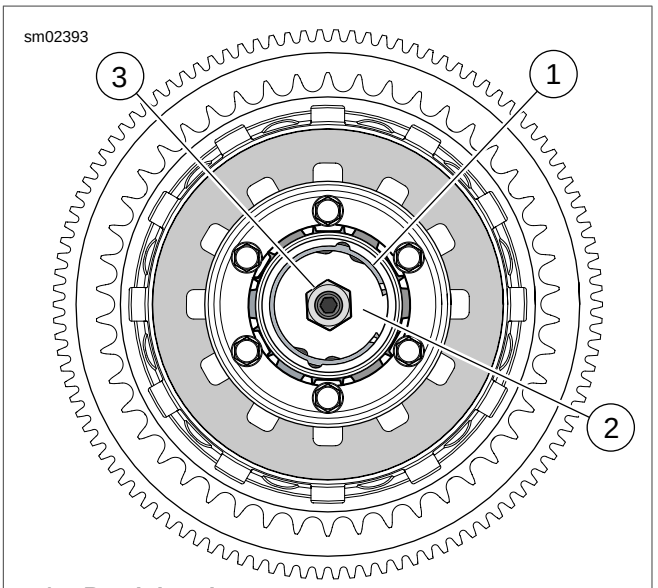
Figure 5-14. Installing Clutch Hub Mainshaft Nut

11. See Figure 5-15. 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 pliers and could be propelled with enough force to cause serious eye injury. (00312a)

12. 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.
13. Adjust clutch. See 1.11 CLUTCH, Adjustment.



1. **Retaining ring**
2. **Release plate**
3. **Locknut**

Figure 5-15. Clutch

NOTES

- *Primary chain tensioner is non-repairable. Replace as an assembly.*
- *See Figure 5-16. Although primary chain tensioner is sold as an assembly, tensioner parts can be disassembled. If primary chain tensioner becomes disassembled, assemble in order shown.*

14. Locate end of spring rod (2) on roll pin (3).
15. See Figure 5-17. Slide wedge of primary chain tensioner in direction of arrow until all travel is removed.
16. See Figure 5-18. Push shoe (1) down until it contacts wedge. Keep tension on shoe so wedge stays in place.
17. Install cable strap (2) as shown. Exposed portion below cover will flag need for removal before cover installation.

NOTE

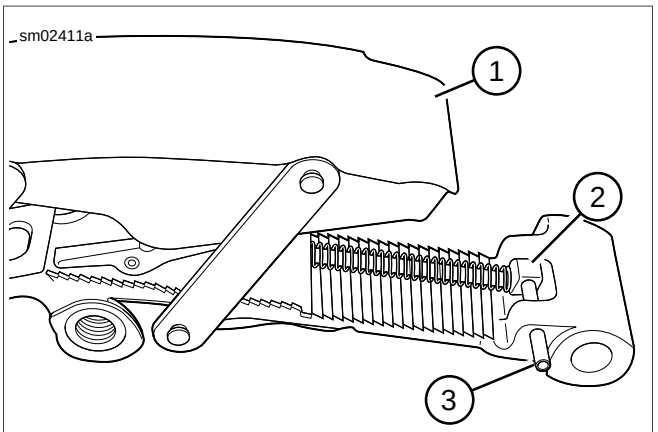
Primary chain tensioner will not complete chain adjustment until vehicle is ridden. After tensioner removal/installation procedure, test ride vehicle to verify adjustment.

18. See Figure 5-19. 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

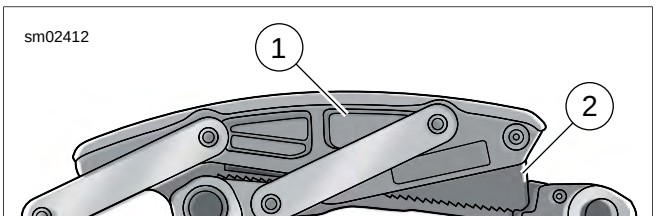
Replace the gasket between the primary chaincase cover and chaincase each time the cover is removed.

19. Install primary chaincase cover with **new** gasket and fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.



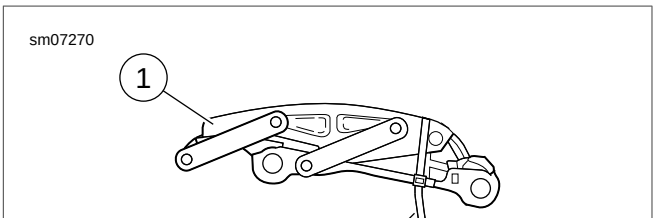
1. Shoe
2. Spring rod
3. Roll pin

Figure 5-16. Spring Rod Location



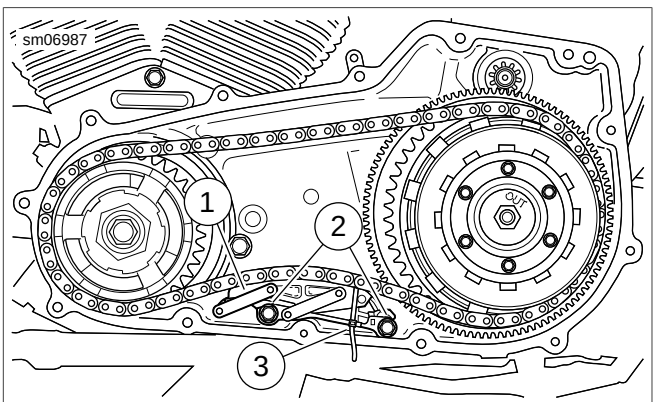
1. Shoe
2. Wedge

Figure 5-17. Primary Chain Tensioner



1. Chain tensioner shoe
2. Cable strap

Figure 5-18. Securing Chain Tensioner



1. Chain tensioner
2. Chain tensioner fasteners
3. Cable strap

Figure 5-19. Chain Tensioner

PRIMARY CHAINCASE HOUSING 5.5

REMOVAL

NOTICE

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

⚠WARNING

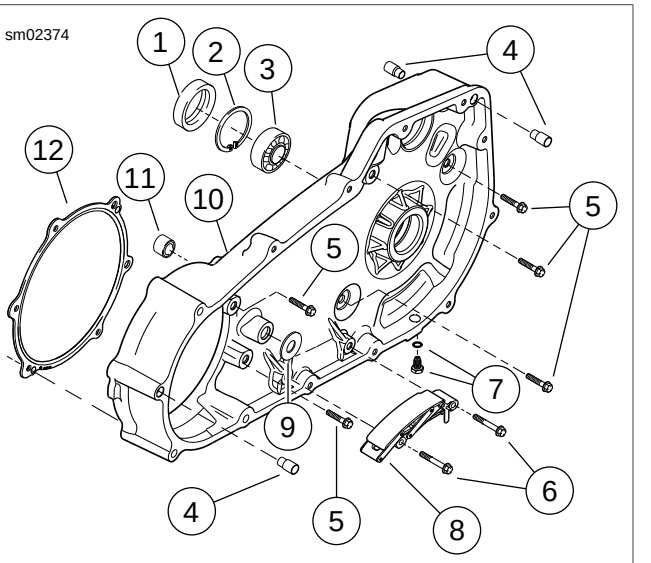
Be sure that no lubricants or fluids get on tires, wheels or brakes when changing fluid. Traction can be adversely affected, which could result in loss of control of the motorcycle and death or serious injury. (00047d)

1. Run motorcycle until engine is warmed up to normal operating temperature.

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. See Figure 5-20. Remove magnetic drain plug at bottom of primary chaincase.
   a. Drain lubricant into suitable container.
   b. Discard drain plug O-ring.
   c. Remove primary chaincase cover. See 5.5 PRIMARY CHAINCASE HOUSING.
4. Remove starter. See 7.11 STARTER, Removal.
5. Remove primary chain, clutch, and compensating sprocket. See 5.4 DRIVE COMPONENTS, Removal.
6. See Figure 5-20. Remove five sealing fasteners (5) and remove primary chaincase housing (10). Discard the crankcase gasket (12) and sealing fasteners.
7. Connect negative battery cable.



1. **Seal**
2. **Retaining ring**
3. **Bearing**
4. **Dowel pin**
5. **Sealing fastener**
6. **Chain tensioner fasteners**
7. **Drain plug and O-ring**
8. **Chain tensioner**
9. **Tower gasket**
10. **Primary chaincase housing**
11. **Shifter shaft bushing**
12. **Crankcase gasket**

Figure 5-20. Primary Chaincase Housing

INSPECTION

1. Inspect primary chaincase for cracks or damaged gasket surface.
2. Check the mainshaft bearing. Replace if bearing does not rotate freely. Replace the lip seal. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing and Seal.
3. On all but models with forward controls, inspect shifter shaft bushing. Replace if worn or damaged. See 5.5 PRIMARY CHAINCASE HOUSING, Shifter Shaft Bushing.

MAINSHAFT BEARING AND SEAL

Removal

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

1. See Figure 5-20. 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

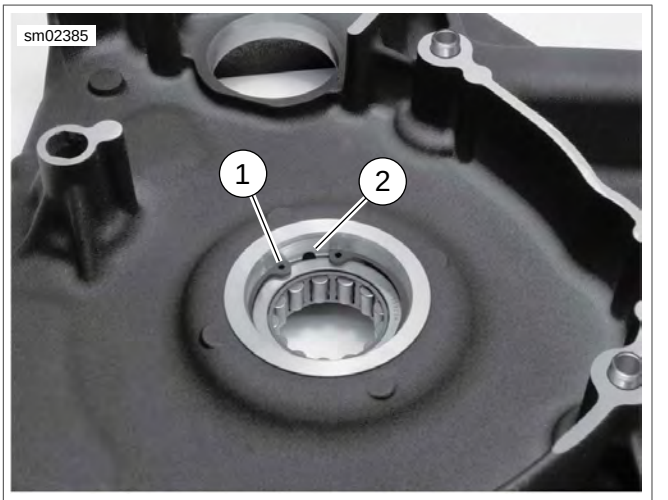
Support the bearing support area on the clutch side of the primary chaincase while pressing bearing in.

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 5-21. 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 5-22. 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.



1. **Retaining ring**
2. **Oil passage**

Figure 5-21. Retaining Ring Orientation

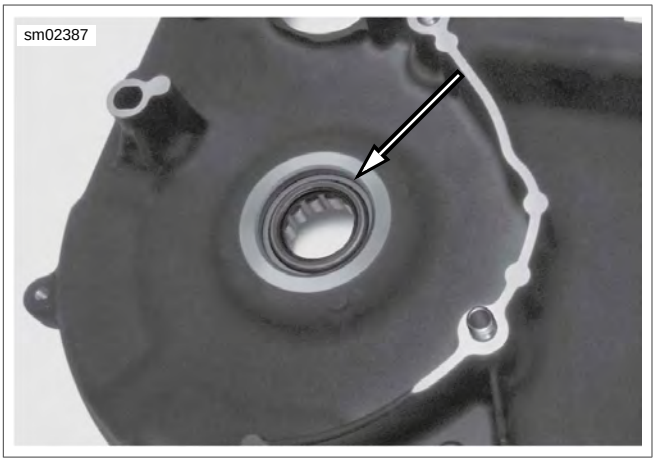


Figure 5-22. Oil Seal

MAINSHAFT BEARING INNER RACE

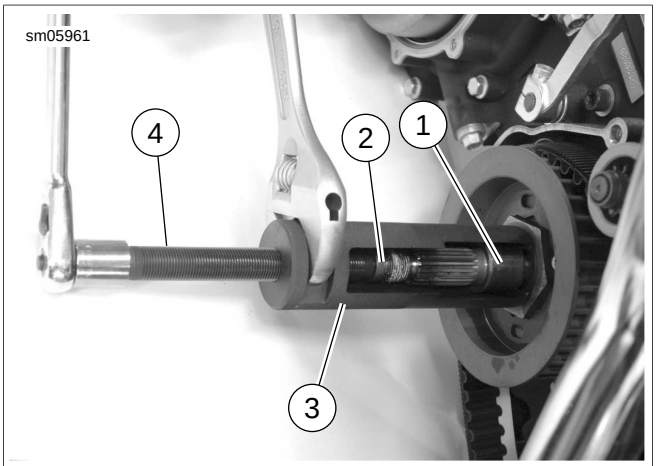
PART NUMBER	TOOL NAME
HD-34902-C	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER

Removal

NOTE

Bearing outer race installation requires properly aligned bearing inner race. Use the recommended tool MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER (Part No. HD-34902-C).

1. See Figure 5-23. 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.



1. **Bearing inner race**
2. **End cap**
3. **Puller**
4. **Forcing screw**

Figure 5-23. Pulling Mainshaft Inner Bearing Race

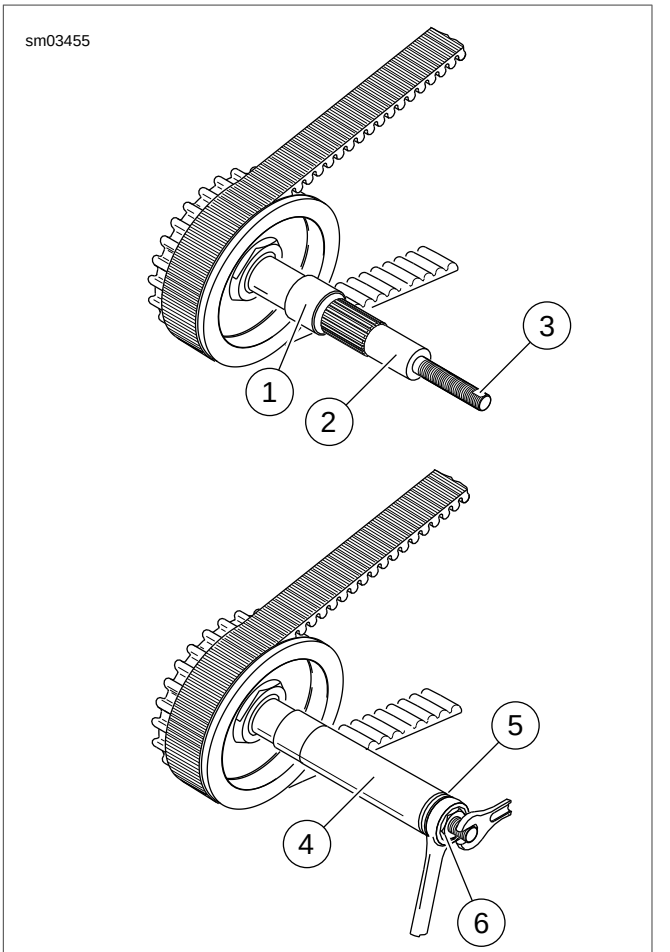
Installation

1. See Figure 5-24. Slide bearing inner race (1) onto mainshaft.

NOTE

Extension shaft has left-hand threads.

2. Thread extension shaft (2) onto end of mainshaft.
3. Position installer sleeve (4) over extension shaft and against bearing inner race. Apply graphite lubricant to threads of extension shaft.
4. Place two washers (5) over threaded portion of extension shaft and install nut.
5. Tighten nut (6) while holding extension shaft stationary with wrench on flats (3) at end of screw threads. Press race onto shaft until edge of race contacts step on shaft.
6. Lubricate race with SCREAMIN' EAGLE ASSEMBLY LUBE.



1. **Bearing inner race**
2. **Extension shaft**
3. **Wrench flat**
4. **Installer sleeve**
5. **Washers**
6. **Nut**

Figure 5-24. Installing Bearing Race

SHIFTER SHAFT BUSHING

1. See Figure 5-25. Press out old bushing from clutch side of housing. Inspect the bushing bore to verify that it is clean and smooth.
2. Press **new** bushing into bore from transmission side of housing. Installed bushing must be flush to 0.020 in. (0.51 mm) below edge of bore.

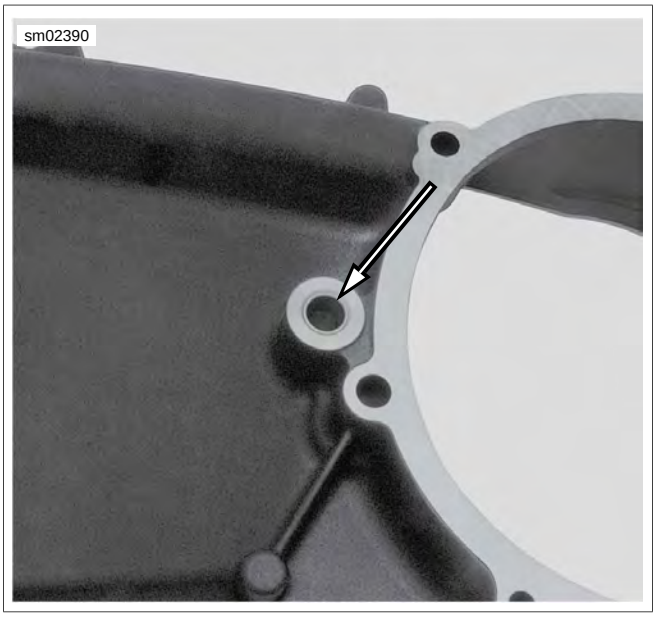


Figure 5-25. Shifter Shaft Bushing

INSTALLATION

FASTENER	TORQUE VALUE	
Primary chaincase sealing fasteners	26-28 ft-lbs	35.3-38.0 Nm

NOTE

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.

1. Verify pivot shaft torque. See 2.22 REAR FORK, Installation.

NOTE

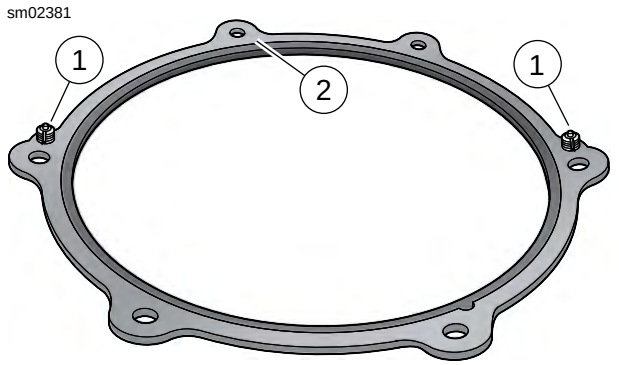
See Figure 5-26. Dowels (1) in crankcase gasket (2) must engage holes in crankcase.

2. See Figure 5-27. Position gasket on gasket surface (2). Verify dowels in gasket engage dowel holes (3).
3. Spread a thin film of oil on mainshaft oil seal lip and rubber portion of crankcase gasket.
4. Install chaincase. Avoid damaging mainshaft seal during installation.
5. See Figure 5-28. Insert **new** sealing fasteners.
6. See Figure 5-29. Tighten fasteners in sequence shown to 26-28 ft-lbs (35.3-38.0 Nm).
7. Install the primary chain, clutch, and compensating sprocket as an assembly. See 5.4 DRIVE COMPONENTS, Installation.
8. Install chain tensioner assembly.
9. Install starter. See 7.11 STARTER, Installation.

NOTE

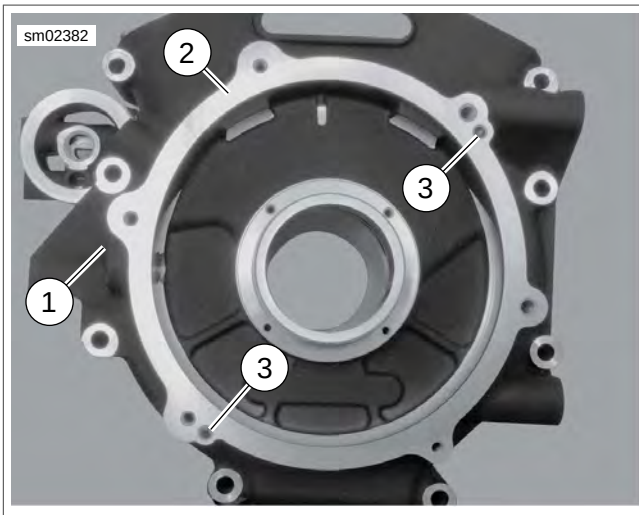
*Always install a **new** gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.*

10. Install primary chaincase cover. Fill primary chaincase with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.
11. Adjust rear belt tension.
12. Connect negative battery cable.



1. **Dowel**
2. **Crankcase gasket**

Figure 5-26. Crankcase Gasket



1. **Crankcase**
2. **Gasket surface**
3. **Dowel holes**

Figure 5-27. Crankcase

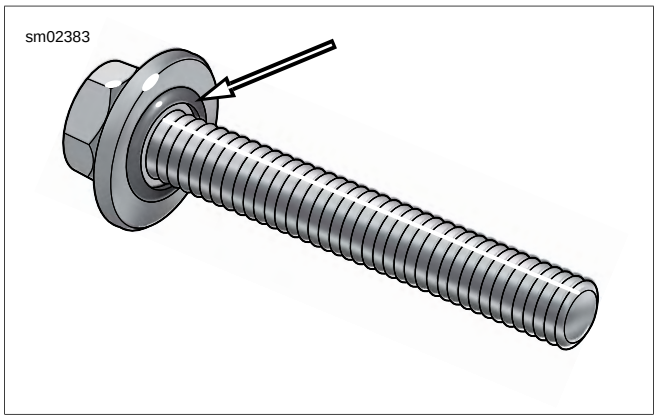


Figure 5-28. Primary Chaincase Sealing Fastener

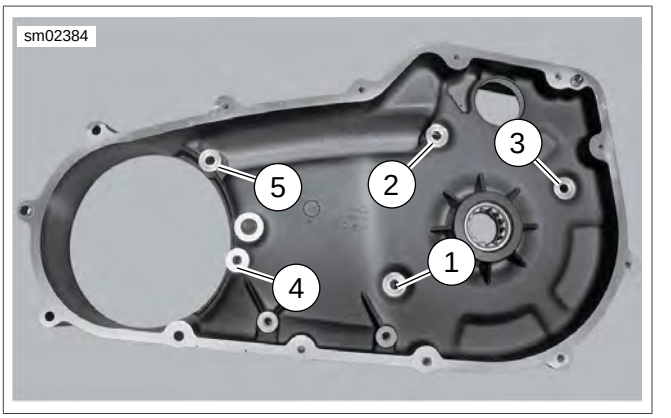


Figure 5-29. Primary Chaincase Sealing Fastener Torque Sequence

CLUTCH 5.6

REMOVAL AND INSTALLATION

To remove the clutch without disassembly or for installation instructions, see 5.4 DRIVE COMPONENTS, Removal.

CLUTCH PACK ONLY

FASTENER	TORQUE VALUE	
Clutch diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm

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 5-30. Remove six bolts (1) (metric) to release diaphragm spring retainer (2) from clutch hub. Loosen each bolt gradually and in a star sequence around the hub.
3. Remove diaphragm spring retainer, diaphragm spring (3) and pressure plate (4) from clutch hub.
4. Remove friction plates (5, 7), steel plates (6), damper spring (8) and damper spring seat (9) from clutch hub (11).

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

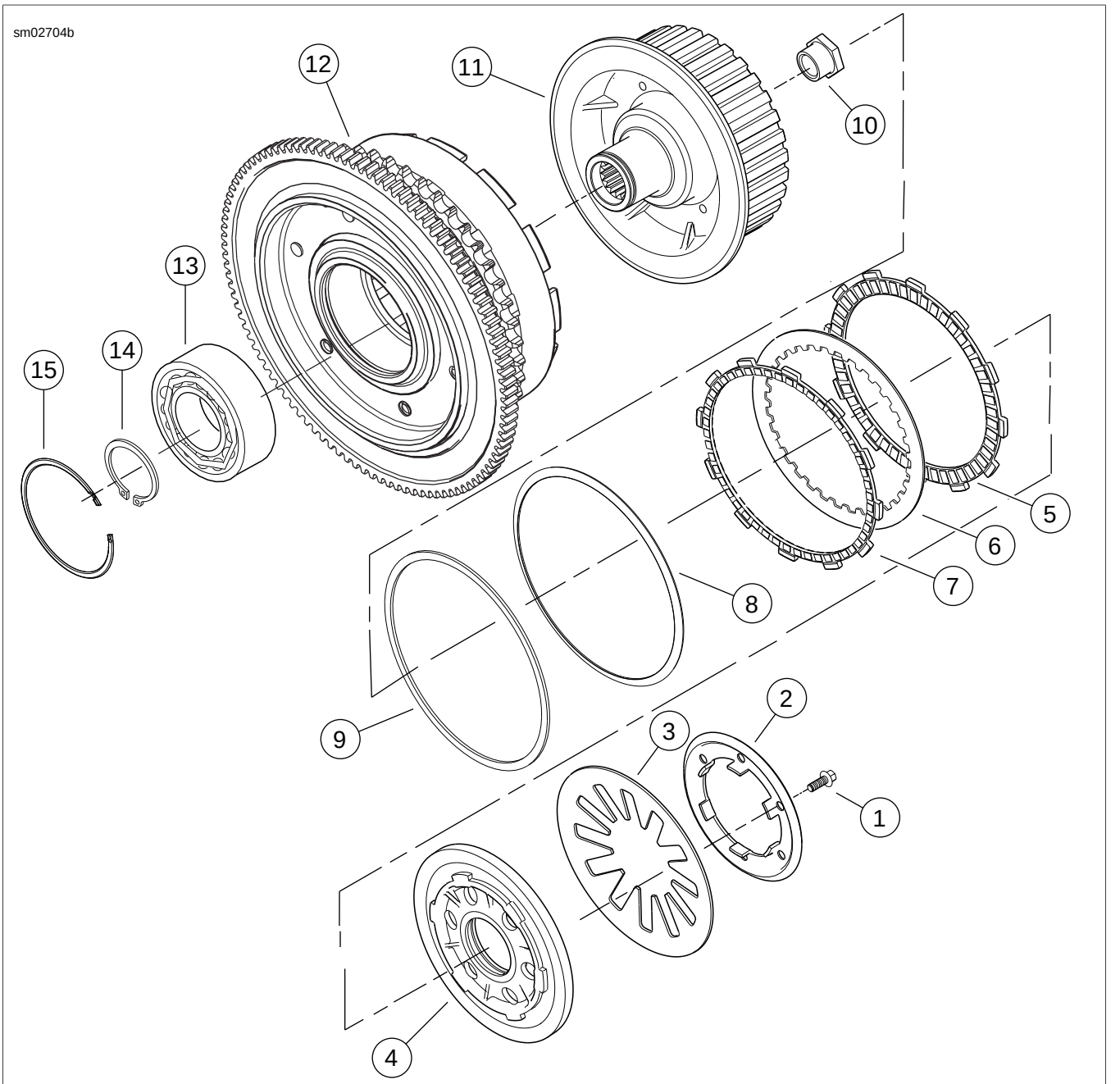
*Replace all nine friction plates with an entirely **new** set if any individual plate shows evidence of wear or damage.*

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.



1. **Bolt (6) (metric)**
2. **Diaphragm spring retainer**
3. **Diaphragm spring**
4. **Pressure plate**
5. **Friction plate (9)**
6. **Steel plate (8)**
7. **Narrow friction plate**
8. **Damper spring**
9. **Damper spring seat**
10. **Mainshaft nut (metric)**
11. **Clutch hub**
12. **Clutch shell**
13. **Bearing**
14. **Retaining ring**
15. **Retaining ring**

Figure 5-30. Clutch Shell Assembly

Assembly

NOTE

Submerge and soak all friction plates in primary chaincase lubricant for at least five minutes.

1. See Figure 5-31. Install the narrow friction plate on the clutch hub.
2. See Figure 5-30. Install damper spring seat (9) on clutch hub (11). It must sit inboard of narrow friction plate (7).

NOTE

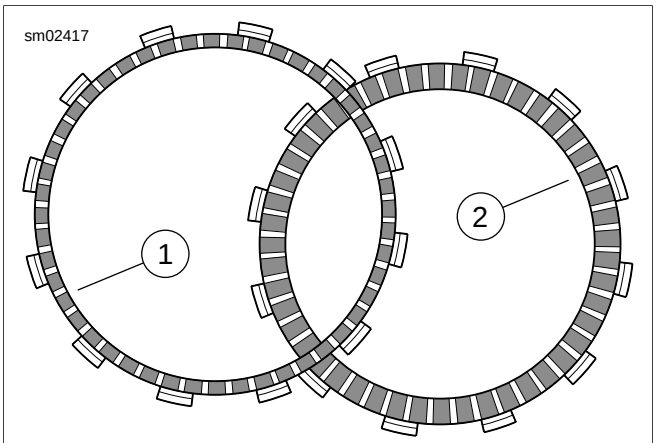
See Figure 5-36. Notice damper spring (4) orientation with respect to damper spring seat (3).

3. See Figure 5-30. 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.



1. **Narrow plate**
2. **Regular plate**

Figure 5-31. Friction Plates

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.

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 5-32. Remove retaining ring.
5. See Figure 5-33. 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 5-34. Remove retaining ring from groove in clutch shell bore.
7. See Figure 5-35. 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.



Figure 5-32. Clutch Hub Retaining Ring



Figure 5-33. Pressing Clutch Hub From Bearing

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. (00312a)

3. See Figure 5-34. 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 5-32. 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. Install Clutch Shell Retaining Ring with Flat Side Against Bearing

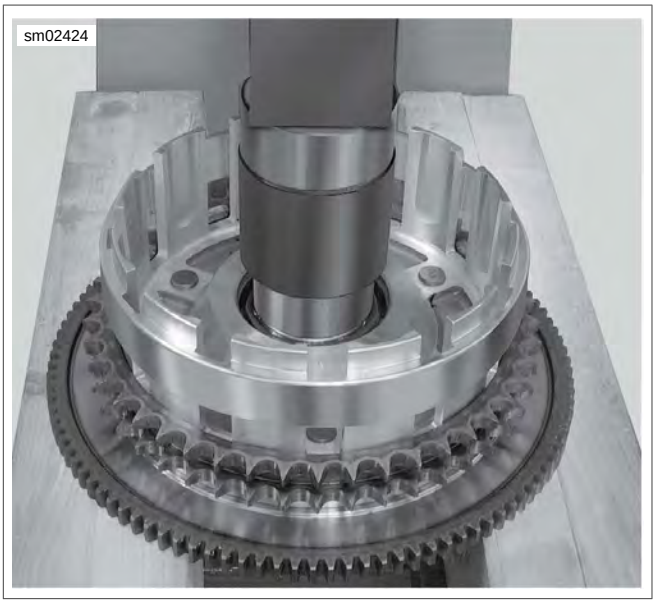
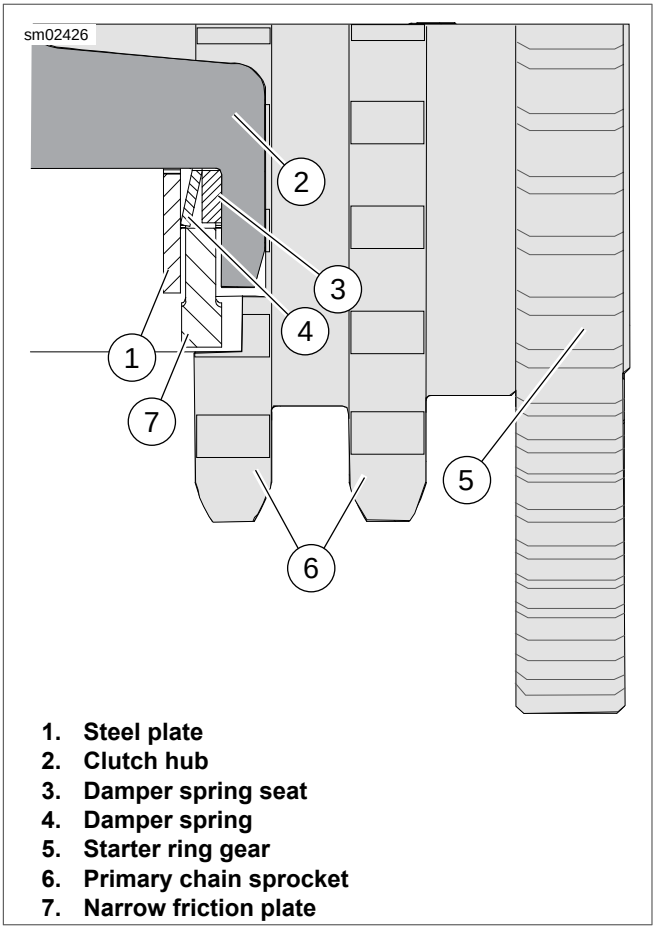
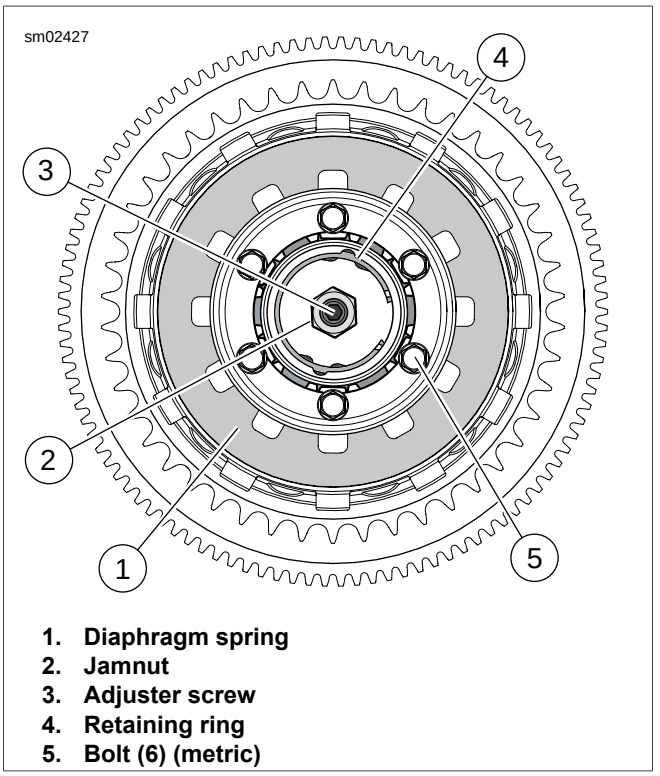


Figure 5-35. Pressing Bearing From Clutch Shell



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 5-36. Clutch Stackup



1. **Diaphragm spring**
2. **Jamnut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Bolt (6) (metric)**

Figure 5-37. Assembled Clutch

TRANSMISSION SPROCKET 5.7

REMOVAL

PART NUMBER	TOOL NAME
HD-46282-A	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

1. Remove primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
2. Remove debris deflector and belt guard. See 2.18 BELT GUARD and 2.19 DEBRIS DEFLECTOR.

NOTE

Loosen both axle adjusters an equal number of turns to maintain wheel alignment.

3. See Figure 5-38. Remove rear axle retaining ring (3). Loosen rear axle nut (2). Loosen both axle adjusters (1) to release tension on the drive belt.

NOTE

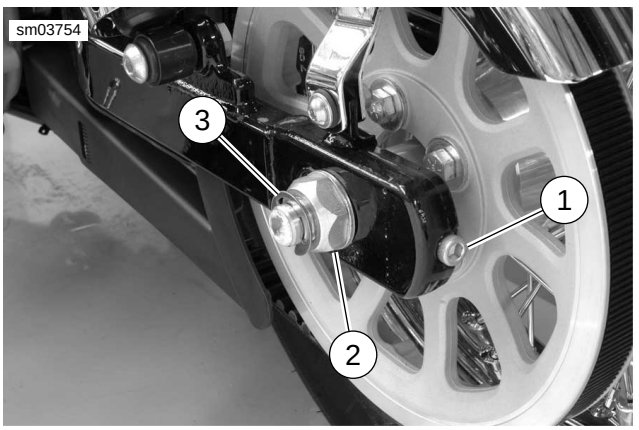
Only remove sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.

4. Remove transmission sprocket.
   a. See Figure 5-39. Remove two screws (1) and lockplate (2).
   b. See Figure 5-40. 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

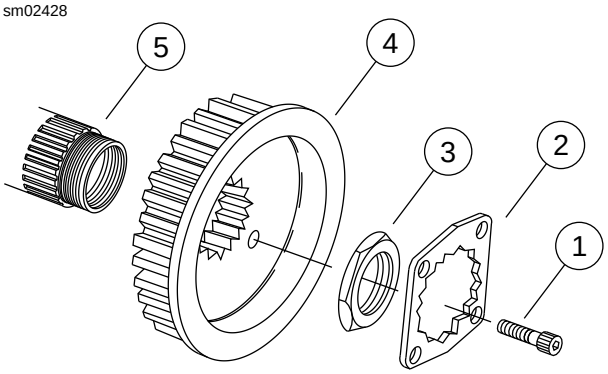
*Sprocket nut has a **right-hand** thread.*

   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.



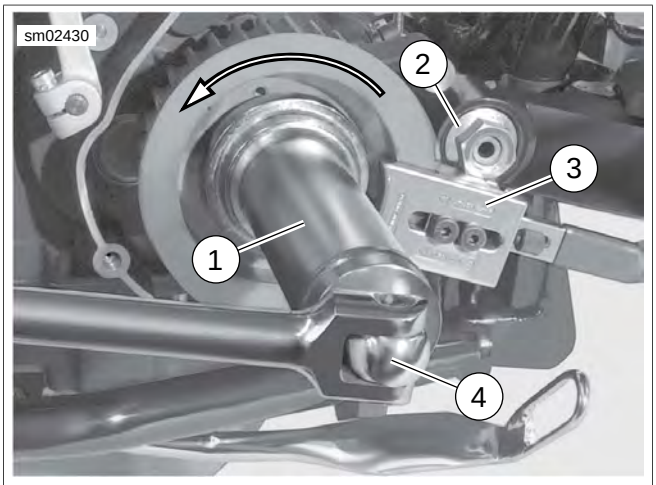
1. **Axle adjuster**
2. **Axle nut**
3. **Retaining ring**

Figure 5-38. Axle Adjusters (Left Side Shown)



1. **Screw (2)**
2. **Lockplate**
3. **Sprocket nut**
4. **Sprocket**
5. **Main drive gear**

Figure 5-39. Transmission Sprocket



1. **Mainshaft locknut wrench**
2. **Rear fork pivot nut**
3. **Final drive sprocket locking tool**
4. **3/4 in. breaker bar**

Figure 5-40. Sprocket Nut Removal (Typical)

CLEANING AND INSPECTION

1. Using a non-volatile cleaning solvent, clean sprocket of all grease and dirt.
2. Inspect belt and sprocket. See 1.12 DRIVE BELT AND SPROCKETS, Inspection.
3. Inspect both main drive gear and mainshaft seals. Replace if damaged.

INSTALLATION

PART NUMBER	TOOL NAME
HD-46282A	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT
SNAP-ON TA360	TORQUE ANGLE GAUGE

FASTENER	TORQUE VALUE	
Transmission sprocket nut, initial torque	100 ft-lbs	135.6 Nm
Transmission sprocket nut, final torque	35 ft-lbs	47.5 Nm
Transmission lockplate screws	90-120 **in-lbs**	10.2-13.6 Nm

NOTE

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.

NOTES

- *Never get oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.*
- *The transmission sprocket nut has **right-hand** threads. Turn the nut **clockwise** to install.*

3. See Figure 5-39. 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 5-41. 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 5-42. 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.

NOTES

- ***New** screws have LOCTITE patches.*
- *Screws can be re-used up to three times if LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) is applied before installation.*
- *To confirm the lockplate security, install BOTH screws.*

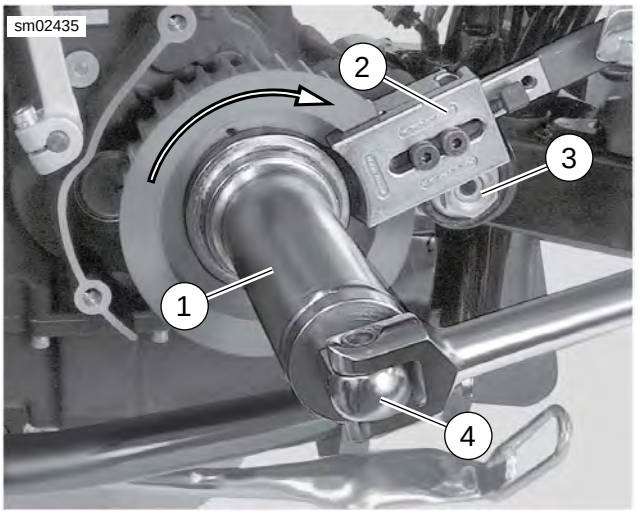
11. See Figure 5-39. Install two screws (1) to secure lockplate (2) to sprocket (4). Tighten to 90-120 **in-lbs** (10.2-13.6 Nm).
12. Install primary chain assembly. See 5.4 DRIVE COMPONENTS.

NOTE

Never reuse gasket between primary chaincase cover and chaincase after cover removal. Failure to replace this gasket may cause primary chaincase leaks.

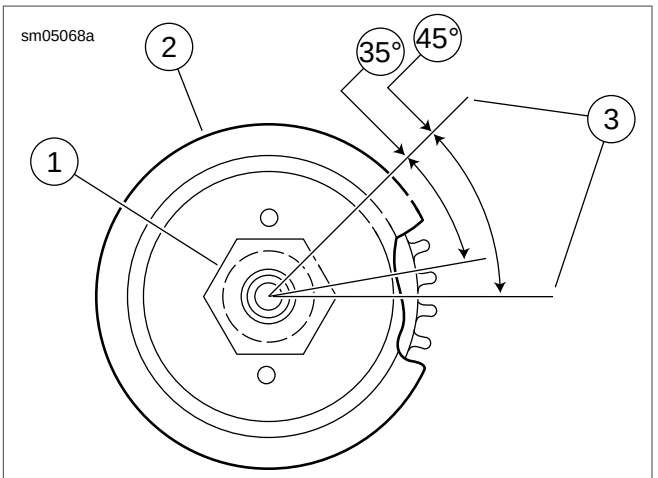
13. Install primary chaincase cover. Fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER.
14. Verify pivot shaft torque. See 2.22 REAR FORK.

15. Adjust belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
16. Verify vehicle alignment and tighten rear axle. See 2.9 VEHICLE ALIGNMENT.
17. Install debris deflector. See 2.19 DEBRIS DEFLECTOR.



1. **Mainshaft locknut wrench**
2. **Final drive sprocket locking tool**
3. **Rear fork pivot nut**
4. **1/2 in. breaker bar**

Figure 5-41. Sprocket Nut Installation (Typical)



1. **Transmission sprocket nut**
2. **Transmission sprocket**
3. **Scribed lines**

Figure 5-42. Transmission Sprocket Nut Final Tightening

DRIVE BELT 5.8

REMOVAL

1. Remove rear wheel. See 2.5 REAR WHEEL, Removal.
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. Remove lower shock absorber fasteners, allow rear fork to rotate down. See 2.21 REAR SHOCK ABSORBERS.
5. Slip drive belt from transmission sprocket and rear fork.
6. Inspect belt and sprockets. See 1.12 DRIVE BELT AND SPROCKETS, General.

INSTALLATION

⚠WARNING

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

1. Install belt over transmission sprocket and rear fork.

NOTE

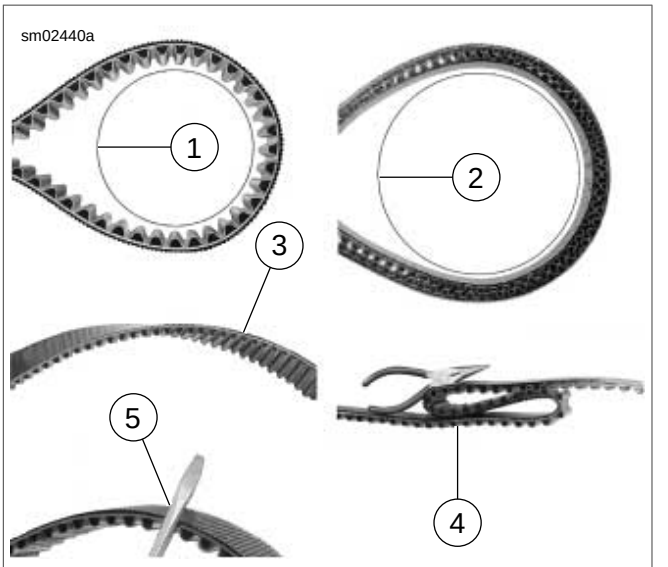
See Figure 5-43. Handling of belt during installation can effect belt durability.

2. Rotate rear fork up and install lower shock absorber mounting fasteners. See 2.21 REAR SHOCK ABSORBERS, Installation.
3. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Installation.

NOTE

Never reuse gasket between primary chaincase cover and chaincase after cover removal. 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. See 5.3 PRIMARY CHAINCASE COVER.
6. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT.
7. Install rear wheel. See 2.5 REAR WHEEL, Installation.
8. Align vehicle. See 2.9 VEHICLE ALIGNMENT.
9. Adjust belt tension. See 1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection.



1. **Forward bend: 5 in (127 mm) minimum diameter**
2. **Reverse bend: 10 in (254 mm) minimum diameter**
3. **Do not twist**
4. **Do not crimp, pinch or kink**
5. **Do not pry**

Figure 5-43. Proper Drive Belt Handling

NOTES

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NOTES

FASTENER TORQUE VALUES 6.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Clutch release cover screws	132-156 **in-lbs**	14.9-17.6 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Mainshaft/countershaft nuts	85-95 ft-lbs	115.3-128.8 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	6.8 TRANSMISSION CASE, Installation
Oil spout fastener	84-132 **in-lbs**	9.5-14.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shifter linkage locknut	96-144 **in-lbs**	10.8-16.3 Nm	6.4 SHIFTER LINKAGE, Adjustment
Shifter pawl centering screw	18-23 ft-lbs	24.4-31.2 Nm	6.8 TRANSMISSION CASE, Assembly
Shifter rod lever pinch screw, transmission lever	18-22 ft-lbs	24.4-29.8 Nm	6.8 TRANSMISSION CASE, Assembly
Shift lever screw	18-22 ft-lbs	24.4-29.8 Nm	6.4 SHIFTER LINKAGE, Adjustment
Shift rod jamnut	80-120 **in-lbs**	9.0-13.6 Nm	6.4 SHIFTER LINKAGE, Adjustment
Transmission bearing housing fasteners	23-25 ft-lbs	31.2-33.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	6.8 TRANSMISSION CASE, Installation
Transmission top cover	90-120 **in-lbs**	10.2-13.6 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
VSS fastener	84-132 **in-lbs**	9.5-14.9 Nm	6.8 TRANSMISSION CASE, Installation

SPECIFICATIONS: TRANSMISSION 6.2

SPECIFICATIONS

Table 6-1. Transmission Specifications

TRANSMISSION	DATA
Type	6-speed forward constant mesh
FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT	Part No. 99851-05 (qt)
SYN3 20W50 Oil	Part No. 99824-03/00QT (qt)
Capacity (dry)	32 oz. (946.4 ml)

Table 6-2. Transmission Gear Ratios

GEAR	GEAR RATIO
First (low)	3.34
Second	2.31
Third	1.72
Fourth	1.39
Fifth	1.19
Sixth (high)	1.00

NOTE

Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.

SERVICE WEAR LIMITS

Table 6-3. Main Drive Gear Specifications

MAIN DRIVE GEAR (6th)	IN	MM
Bearing fit in transmission case (loose)	0.0003-0.0017	0.0076-0.043
Fit in bearing (press-fit)	0.001-0.003	0.025-0.076
End play	none	none

Table 6-4. Mainshaft Tolerance Specifications

MAINSHAFT TOLERANCE	IN.	MM
Mainshaft runout	0.000-0.003	0.00-0.08
Mainshaft end play	none	none
5th gear end play (axial)	0.002-0.026	0.05-0.66
5th gear clearance (radial)	0.0004-0.0020	0.009-0.052
Main drive gear (6th) fit	0.0009-0.0022	0.023-0.056

Table 6-5. Countershaft Tolerance Specifications

COUNTERSHAFT TOLERANCE	IN	MM
Countershaft runout	0.000-0.003	0.00-0.08
Countershaft end play	0.001-0.003	0.025-0.08
1st gear end play (axial)	0.001-0.023	0.03-0.58
1st gear clearance (radial)	0.0004-0.0020	0.010-0.052
2nd gear end play (axial)	0.001-0.40	0.03-1.02
2nd gear clearance (radial)	0.0004-0.0020	0.010-0.052
3rd gear end play (axial)	0.001-0.042	0.03-1.07
3rd gear clearance (radial)	0.0004-0.0020	0.010-0.052
4th gear end play (axial)	0.001-0.028	0.03-0.71
4th gear clearance (radial)	0.0004-0.0020	0.010-0.052

Table 6-6. Shifter Dog Clearance Specifications

SHIFTER DOG	IN	MM
1st	0.013-0.121	0.33-3.07
2nd	0.016-0.138	0.41-3.51
3rd	0.010-0.125	0.25-3.17
4th	0.018-0.129	0.46-3.28
5th	0.007-0.117	0.18-2.97
6th	0.022-0.131	0.56-3.33

Table 6-7. Bearing Housing Bearing Specifications

BEARING HOUSING BEARING	IN	MM
Fit in bearing housing (tight)	0.0001-0.0014	0.0025-0.0356
Fit on countershaft (tight)	-0.0004	-0.010
Fit on countershaft (loose)	+0.0012	+0.030
Fit on mainshaft (tight)	-0.0004	-0.010
Fit on mainshaft (loose)	+0.0012	+0.030

Table 6-8. Shifter Fork Specifications

SHIFTER FORKS	IN	MM
Shifter fork to cam groove end play	0.004-0.012	0.102-0.305
Shifter fork to dog ring end play	0.004-0.016	0.102-0.4060
First and second gear shift fork pad thickness wear limit	0.258	6.55
Third and fourth gear shift fork pad thickness wear limit	0.198	5.03
Fifth and sixth gear shift fork pad thickness wear limit	0.258	6.55

TRANSMISSION 6.3

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).

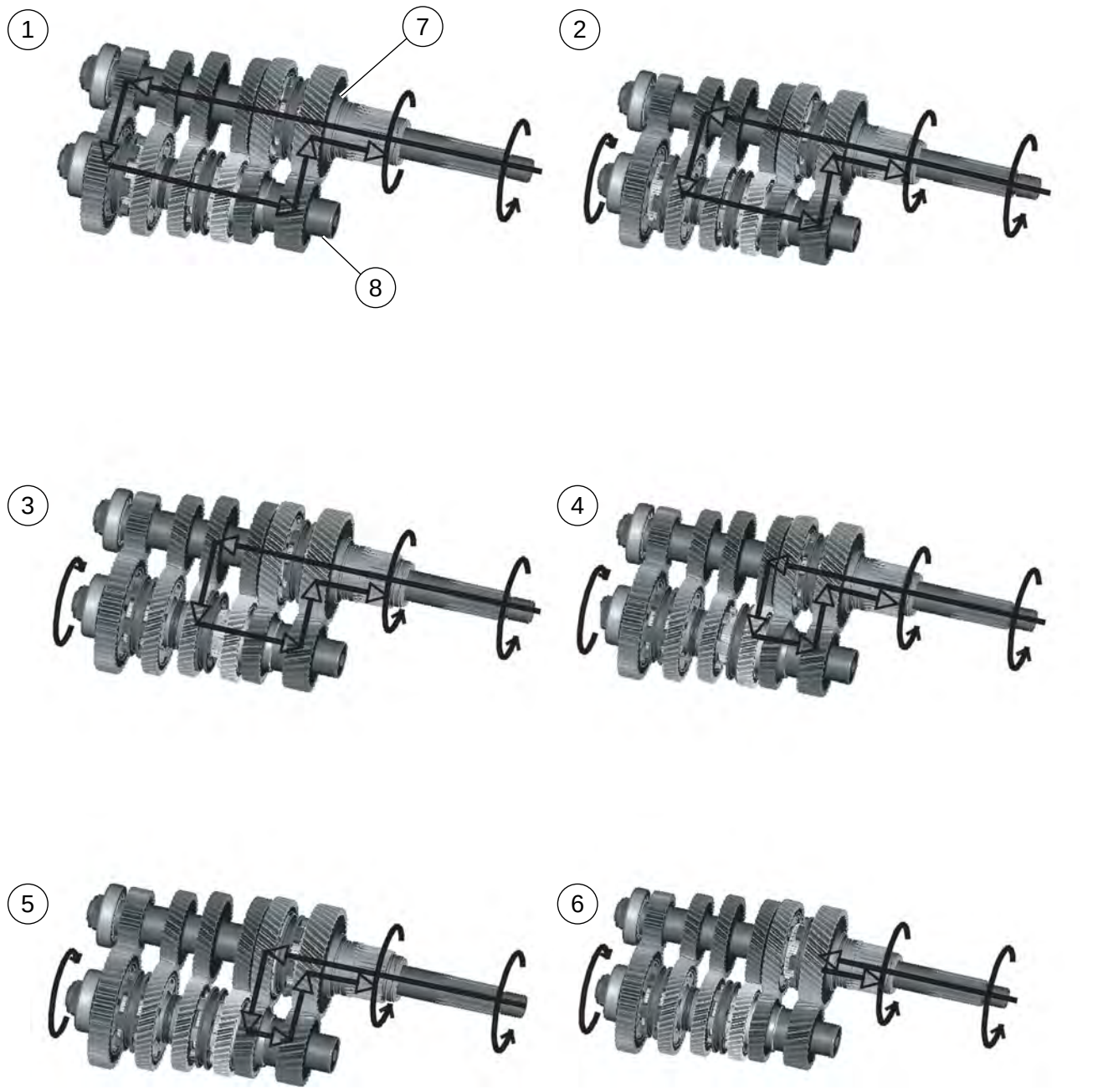
Fifth Gear

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).

sm00068a



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 LINKAGE 6.4

ADJUSTMENT

FASTENER	TORQUE VALUE	
Shifter linkage locknut	96-144 **in-lbs**	10.8-16.3 Nm
Shift rod jamnut	80-120 **in-lbs**	9.0-13.6 Nm
Shift lever screw	18-22 ft-lbs	24.4-29.8 Nm

NOTE

See Figure 6-3. Not all models are equipped with adjustable linkage.

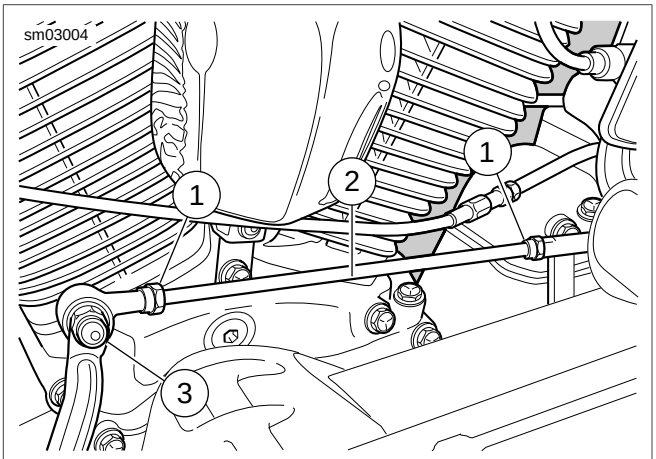
Forward Control Shifter Adjustment

The shift rod is set at the factory and should not need adjustment under normal circumstances. However, if full engagement or full lever travel is not achieved, adjust the shift rod.

1. See Figure 6-2. Remove locknut (3), lockwasher and flat washer to free front end of shift rod from inner shift arm.
2. Loosen jamnuts (1) and adjust rod (2) as necessary.
3. Install flat washer, lockwasher and locknut (3) to fasten front end of shift rod to inner shift arm.
4. Tighten locknut (3) to 96-144 **in-lbs** (10.8-16.3 Nm).
5. Tighten jamnuts (1) to 80-120 **in-lbs** (9.0-13.6 Nm).

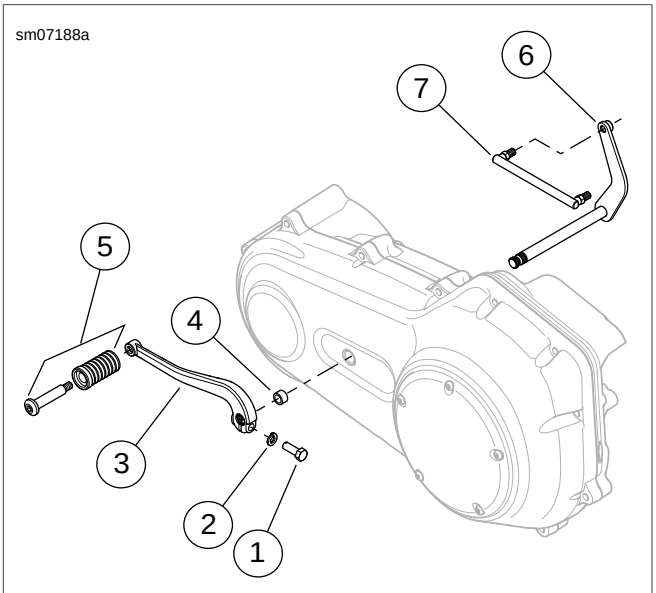
Mid Control Shifter Adjustment

1. See Figure 6-3. Remove screw (1) and lockwasher (2).
2. Slide shift lever (3) off shifter lever (6). Raise or lower shift peg end of shift lever to adjust for rider comfort.
3. Slide shift lever on to shifter lever.
4. Install screw and lockwasher. Tighten to 18-22 ft-lbs (24.4-29.8 Nm).



1. **Jamnut (2)**
2. **Rod**
3. **Locknut**

Figure 6-2. Forward Control Shifter Linkage



1. **Screw**
2. **Lockwasher**
3. **Shift lever**
4. **Spacer**
5. **Shift lever peg kit**
6. **Shifter lever**
7. **Shifter rod**

Figure 6-3. Mid Control Shifter Linkage

CLUTCH RELEASE COVER 6.5

REMOVAL AND DISASSEMBLY

1. Remove main fuse.
2. Remove exhaust system if needed. See 4.15 EXHAUST SYSTEM.
3. Drain transmission. See 1.10 TRANSMISSION LUBRICANT.

NOTE

Actuating the clutch hand lever after removing the six screws will help break the cover free.

4. See Figure 6-4. Remove six screws securing the clutch release cover. Remove the clutch release cover. Discard the gasket.
5. Add freeplay to clutch cable. See 1.11 CLUTCH.

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 ramp coupling (3).
7. Remove coupling (3) from inner ramp.
8. See Figure 6-6. Remove balls (4) and outer ramp (2).
9. Remove clutch cable fitting from clutch release cover.

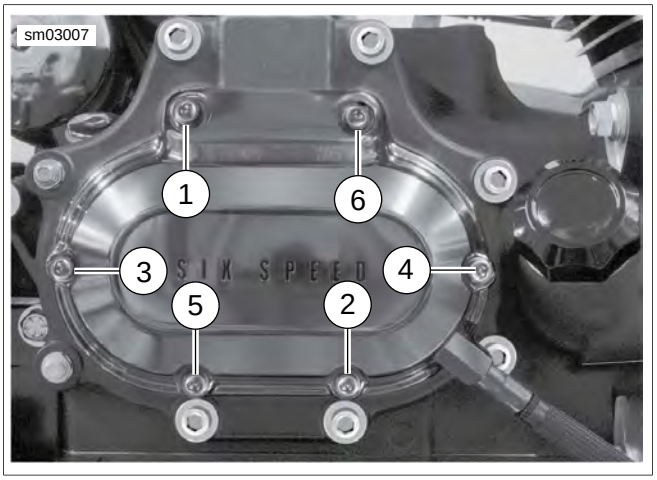
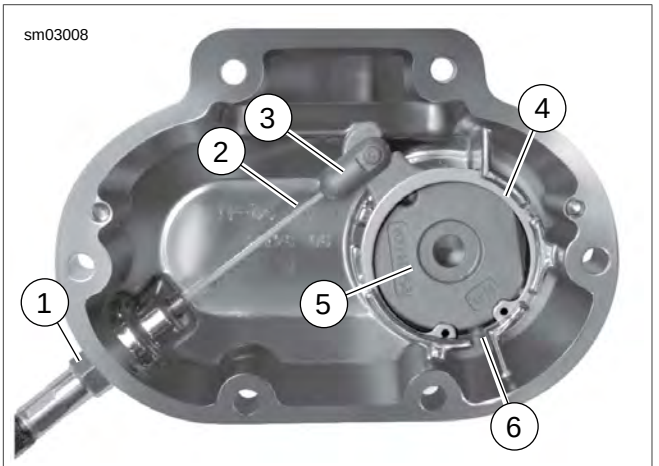


Figure 6-4. Cover Screws



1. **Cable fitting**
2. **Clutch cable end**
3. **Ramp coupling**
4. **Retaining ring**
5. **Inner ramp**
6. **Retaining ring opening**

Figure 6-5. Clutch Cable Connection



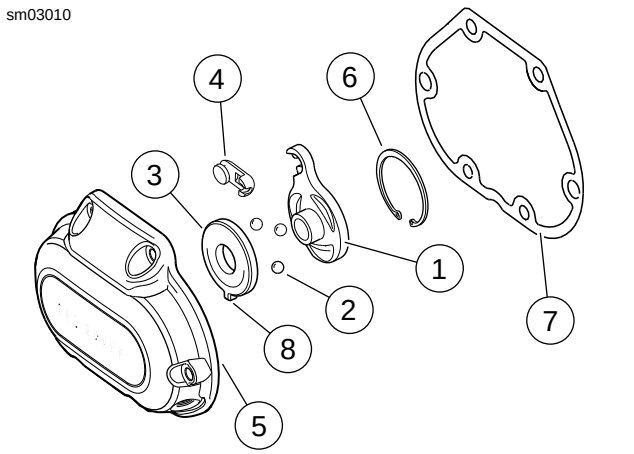
1. **Inner ramp**
2. **Outer ramp**
3. **Outer ramp tab**
4. **Balls (3)**
5. **Ramp coupling**

Figure 6-6. Coupling and Ramp Assembly

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. **Inner ramp**
2. **Balls (3)**
3. **Outer ramp**
4. **Ramp coupling**
5. **Clutch release cover**
6. **Retaining ring**
7. **Gasket**
8. **Tab**

Figure 6-7. Release Mechanism Assembly

ASSEMBLY AND INSTALLATION

FASTENER	TORQUE VALUE	
Clutch release cover screws	132-156 **in-lbs**	14.9-17.6 Nm
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm

NOTE

Replace cable fitting O-ring if damaged.

1. See Figure 6-5. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the clutch cable fitting (1). Install in 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. Confirm tab (8) is in clutch release cover slot.
3. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of the outer ramp sockets.
4. See Figure 6-5. Connect cable end to ramp coupling (3). Install coupling on inner ramp (5). Place inner ramp and coupling in position in clutch release cover.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTE

Center the opening of the retaining ring above the break in the ribbing at bottom of the clutch release cover.

5. Install retaining ring (4).
6. Verify that two dowel pins are in place on transmission bearing housing flange. Place a **new** gasket 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 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, Changing Transmission Lubricant.
10. Adjust clutch cable. See 1.11 CLUTCH.
11. Install exhaust system if removed. See 4.15 EXHAUST SYSTEM.
12. Install main fuse.

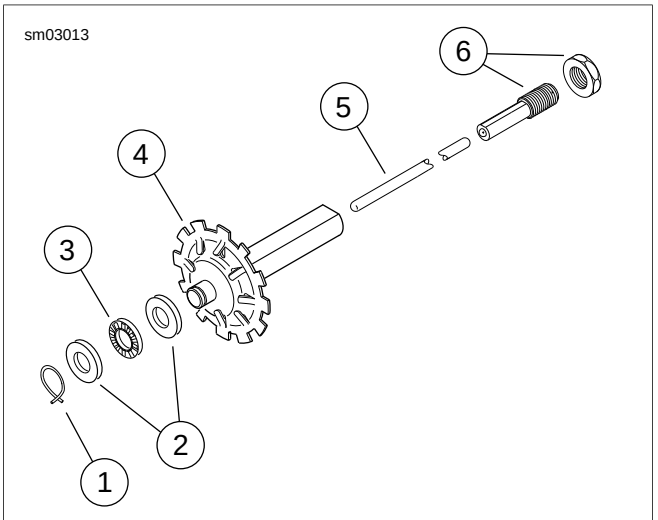
TRANSMISSION ASSEMBLY 6.6

REMOVAL

NOTE

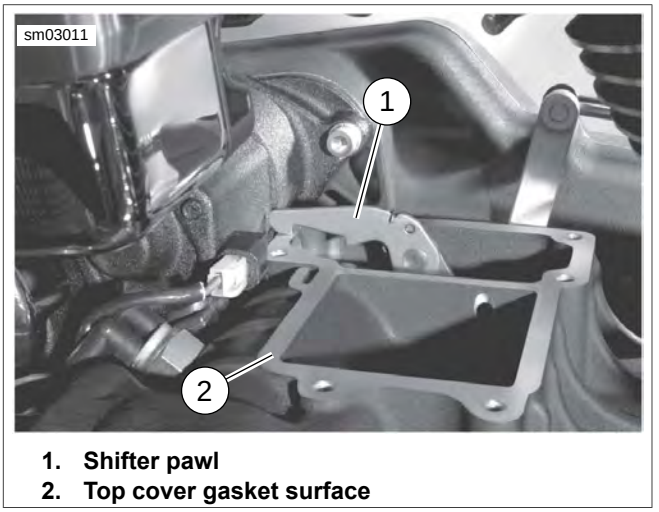
Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed. For information on case removal see 6.8 TRANSMISSION CASE.

1. Remove exhaust system. See 4.15 EXHAUST SYSTEM.
2. Relieve drive belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
3. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket assembly and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
4. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
5. Remove the clutch release cover from the transmission bearing housing. See 6.5 CLUTCH RELEASE COVER, Removal and Disassembly.
6. See Figure 6-8. Remove oil slinger assembly from mainshaft. Insert long rod through mainshaft bore and remove pushrod.
7. Remove transmission top cover, leaving the cover gasket in place.
8. See Figure 6-9. Rotate the shifter pawl forward enough to raise the free end and place shifter cam pawl on top cover gasket.



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Pushrod**
6. **Pushrod end, left side**

Figure 6-8. Pushrod Assembly: Cable Clutch



1. **Shifter pawl**
2. **Top cover gasket surface**

Figure 6-9. Set Shifter Pawl on Gasket

NOTES

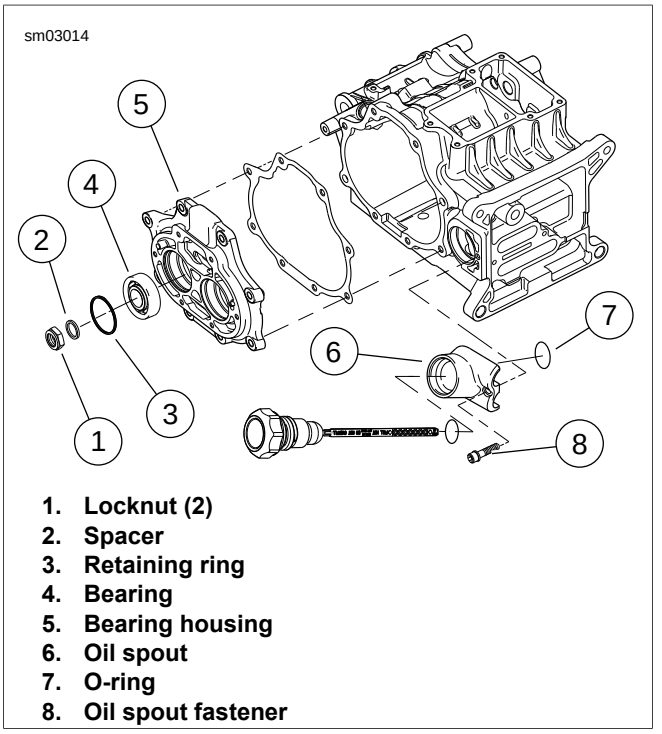
- *Only remove and install sprocket nut while transmission is in vehicle frame. Trying to remove and install sprocket nut with transmission in transmission stand may cause damage to transmission or stand.*
- *The main drive gear bearing and retainer must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*

9. If main drive gear is to be removed, see 6.7 MAIN DRIVE GEAR AND BEARING, Removal.
10. See Figure 6-10. Remove oil spout fastener (8), oil spout (6) and O-ring (7). Discard O-ring.

NOTE

See Figure 6-11. Do not 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 open using indents at each side of bearing housing.

11. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear bearings.
12. See Figure 6-12. Remove the transmission bearing housing mounting hardware. Remove exhaust bracket, if equipped.
13. Pry the bearing housing loose and remove bearing housing, mainshaft, countershaft and shifter cam from transmission case as an assembly. Discard gasket.



1. **Locknut (2)**
2. **Spacer**
3. **Retaining ring**
4. **Bearing**
5. **Bearing housing**
6. **Oil spout**
7. **O-ring**
8. **Oil spout fastener**

Figure 6-10. Bearing Housing Bearings

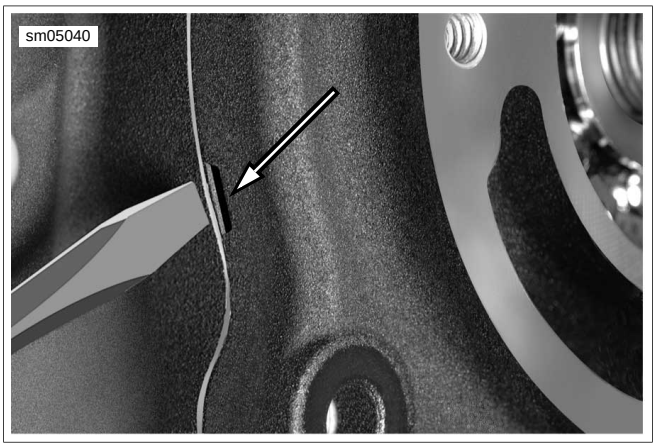


Figure 6-11. Bearing Housing Pry Point

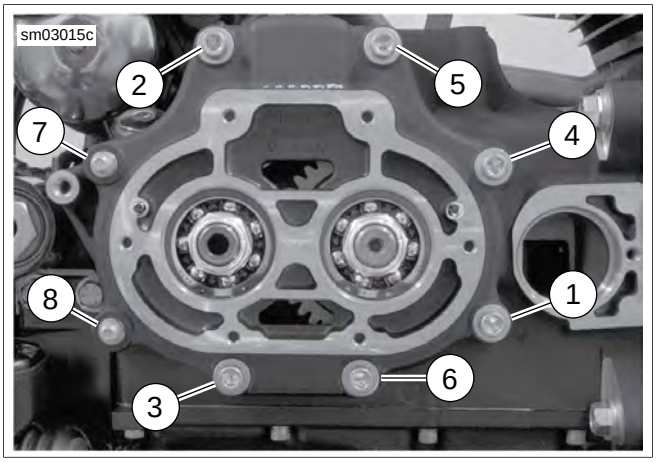


Figure 6-12. Torque Sequence

DISASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

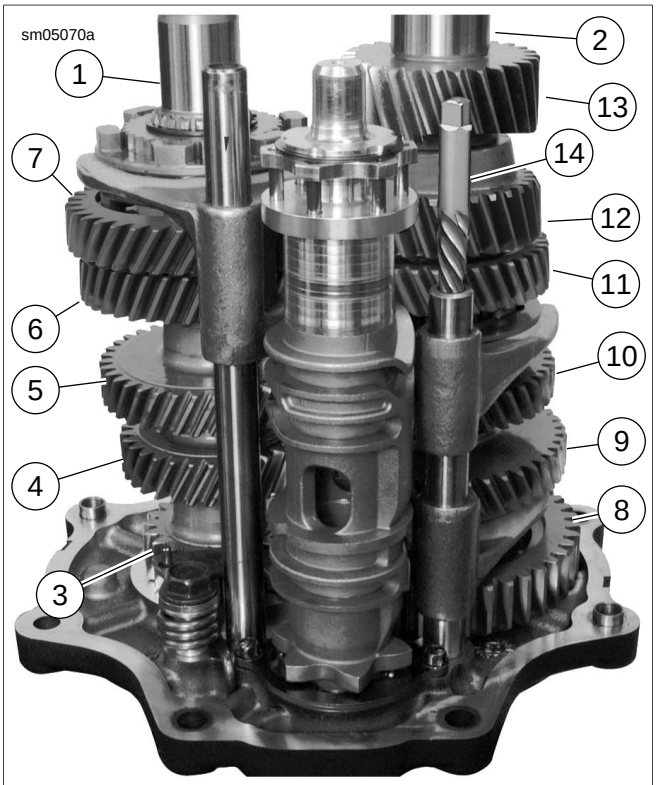
Shifter Cam/Shifter Forks

1. See Figure 6-13. 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 6-14. Remove lock plate fasteners (3) from lock plate (2). Discard fasteners.
4. See Figure 6-15. 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

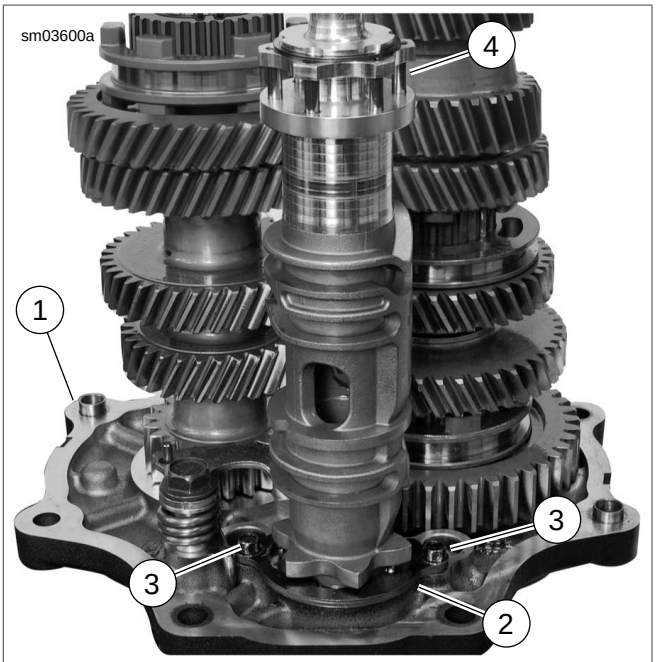
Many transmission parts can be installed in either direction. To prolong usable life, install used parts in same direction as when removed.

6. See Figure 6-16. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
7. Remove mainshaft and countershaft locknuts.
8. Remove transmission assembly from transmission case.



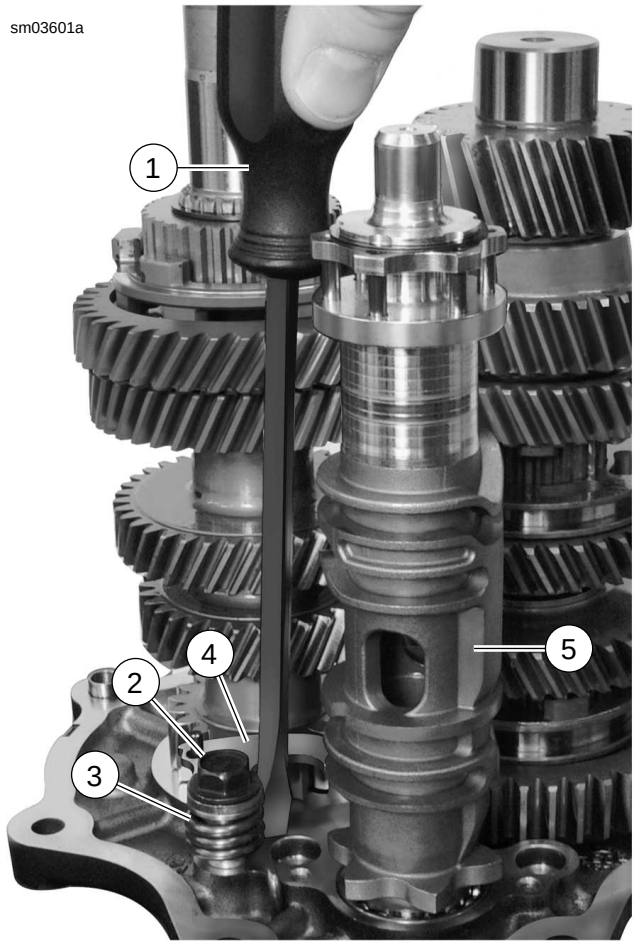
1. Mainshaft
2. Countershaft
3. Mainshaft 1st gear
4. Mainshaft 2nd gear
5. Mainshaft 3rd gear
6. Mainshaft 4th gear
7. Mainshaft 5th gear
8. Countershaft 1st gear
9. Countershaft 2nd gear
10. Countershaft 3rd gear
11. Countershaft 4th gear
12. Countershaft 5th gear
13. Countershaft 6th gear
14. Screw extractor

Figure 6-13. Gear Set



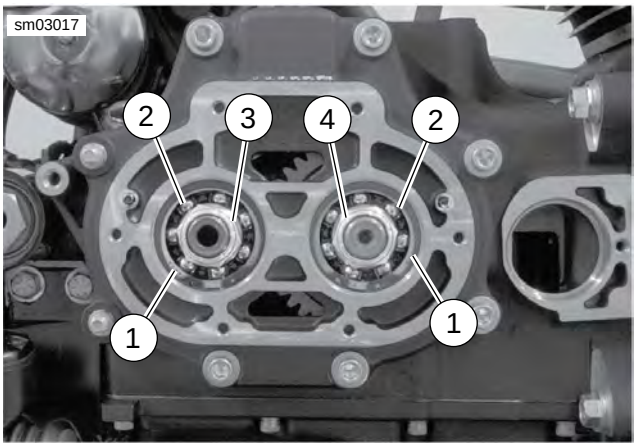
1. Bearing housing
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

Figure 6-14. Shift Drum



1. **Screwdriver**
2. **Detent fastener**
3. **Detent spring**
4. **Detent arm**
5. **Shift cam**

Figure 6-15. Detent Assembly



1. **Retaining ring (2)**
2. **Bearing (2)**
3. **Mainshaft locknut**
4. **Countershaft locknut**

Figure 6-16. Bearing Housing Locknuts

Mainshaft

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTE

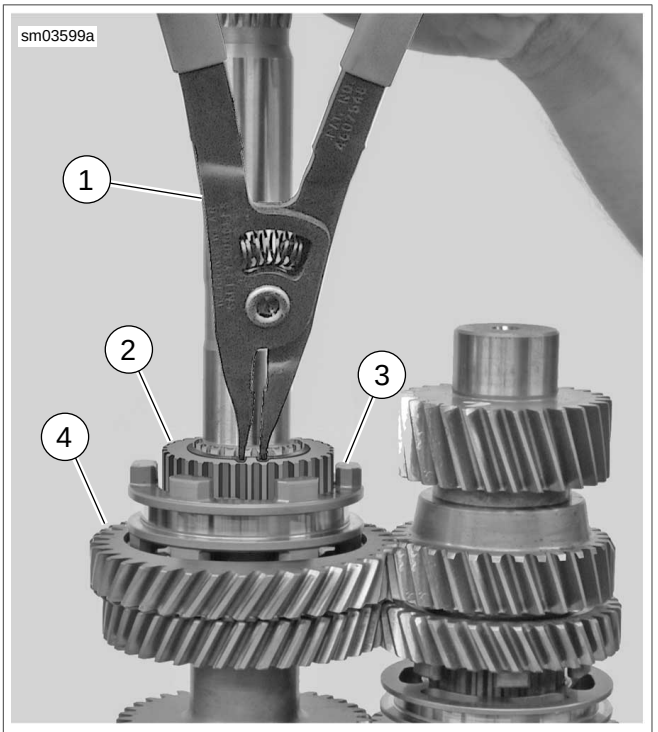
The mainshaft 4th gear, 3rd gear, 2nd gear and 1st gear are integral parts of the shaft. Damage to any gear requires mainshaft replacement.

1. See Figure 6-17. 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

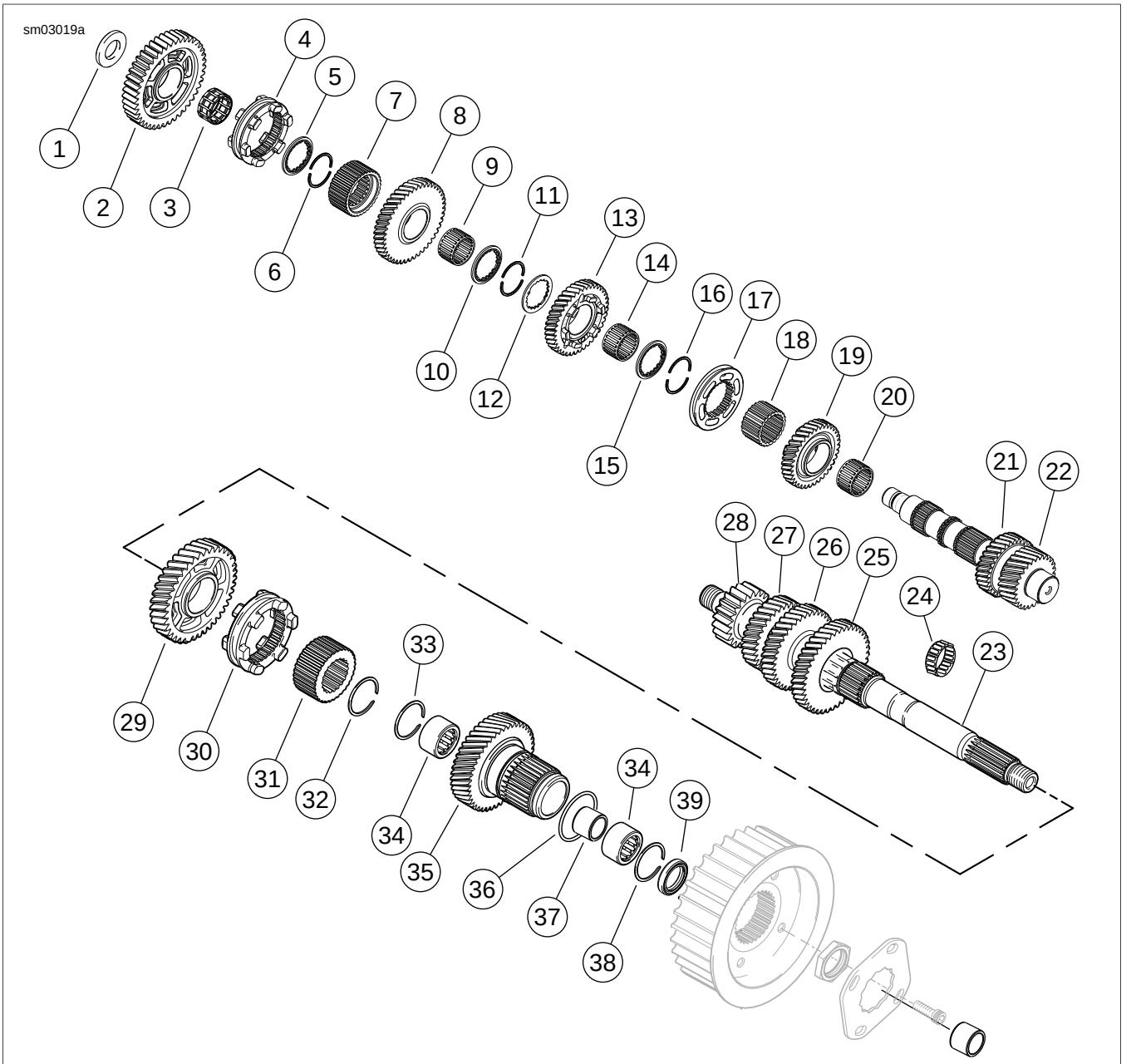
Do not press directly on the end of the mainshaft. Place a spacer such as a washer between the end of the mainshaft and the press ram.

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 6-17. 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 6-18. 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 6.6 TRANSMISSION ASSEMBLY for bearing housing bearing replacement.
3. See Figure 6-19. Remove washer (1), countershaft 1st gear (2) and bearing.

NOTE

See Figure 6-20. Note the direction that the 2nd gear locking ring is installed.

4. Remove countershaft 2nd gear lock ring.
5. See Figure 6-21. Remove securing segments (1). Remove dog ring (3), guiding hub (2), countershaft 2nd gear (4) and bearing.



1. **Washer**
2. **Countershaft 1st gear**

Figure 6-19. Countershaft 1st Gear

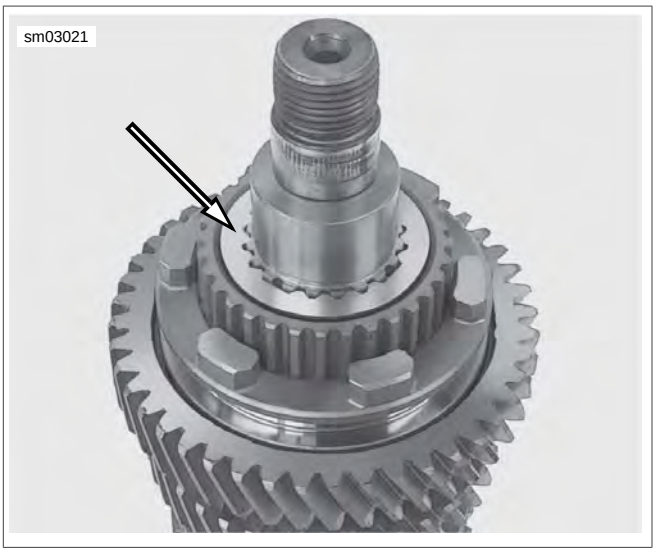
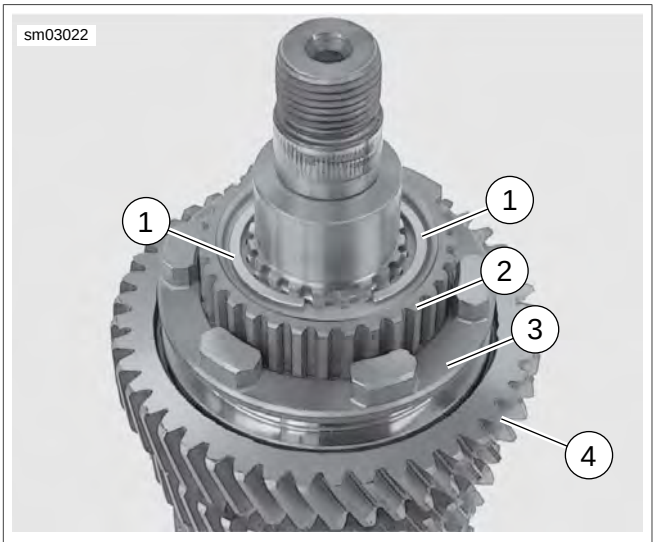


Figure 6-20. Lock Ring



1. **Securing segment**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 2nd gear**

Figure 6-21. Securing Segment

NOTE

See Figure 6-22. Note the direction that the 3rd gear locking ring is installed.

6. Remove countershaft 3rd gear lock ring.
7. See Figure 6-23. Remove securing segments (1), internal spline washer (2), countershaft 3rd gear (3) and bearing.

NOTE

See Figure 6-24. 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.

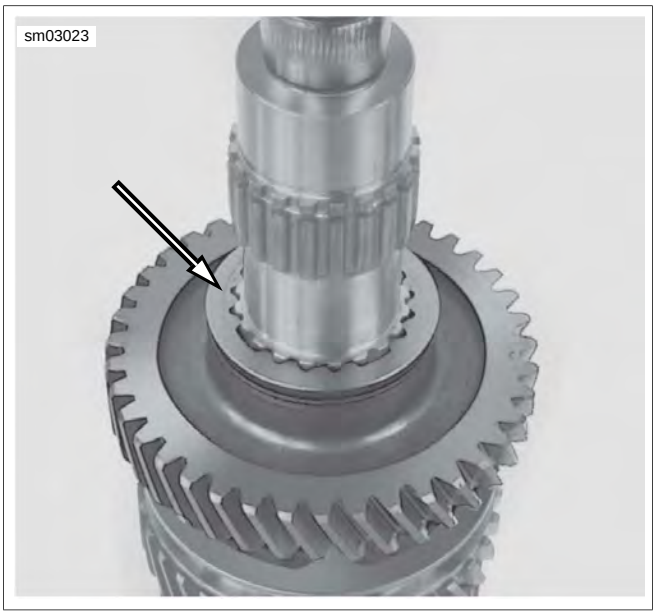
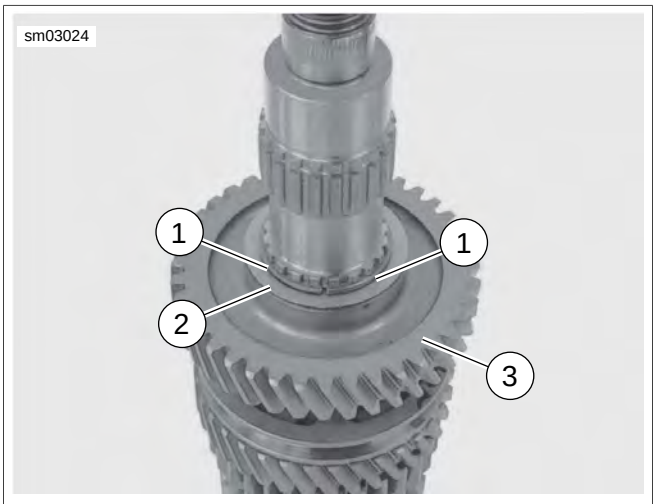
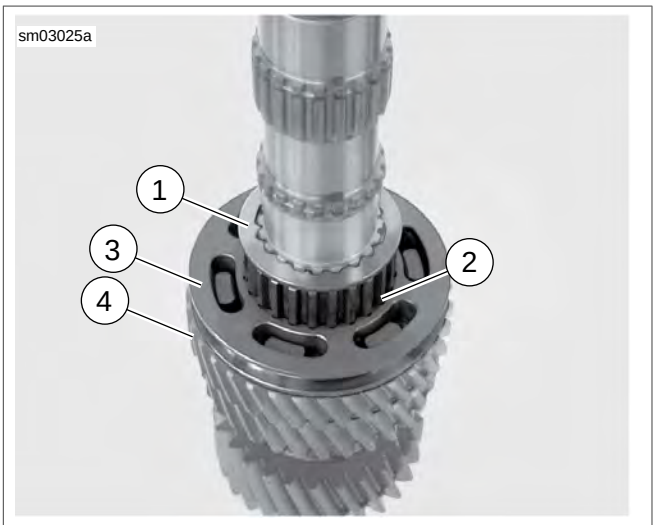


Figure 6-22. Third Gear Lock Ring



1. **Securing segment**
2. **Internal spline washer**
3. **Countershaft 3rd gear**

Figure 6-23. Countershaft Third Gear



1. **4th gear lock ring**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 4th gear**

Figure 6-24. Countershaft Assembly

Removing Bearing Housing Bearings

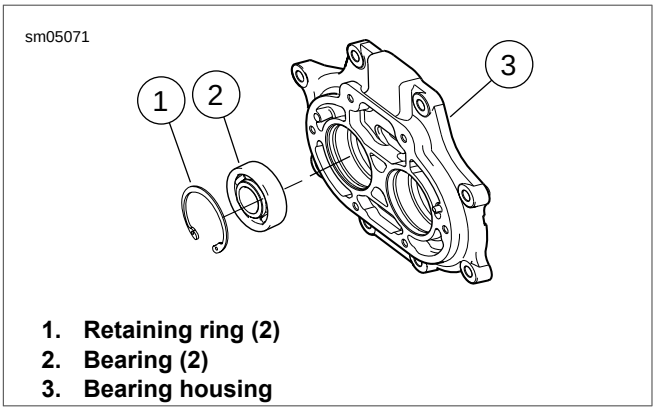
NOTE

Always replace bearing housing bearing if the shaft is pressed out.

⚠WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

1. See Figure 6-25. Remove the retaining rings (1).
2. Press the bearings out of the bearing housing.



1. **Retaining ring (2)**
2. **Bearing (2)**
3. **Bearing housing**

Figure 6-25. Bearing Housing Bearings

CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all parts with solvent. 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, battered or chipped.
4. Inspect guiding hubs. Replace guiding hubs if splines are rounded, battered or chipped.
5. Inspect shift fork shafts. Replace if bent or damaged.
6. Inspect shift forks for wear or signs of overheating. Replace a shift fork if it is excessively worn or shows signs of overheating.
7. See Figure 6-26. 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.

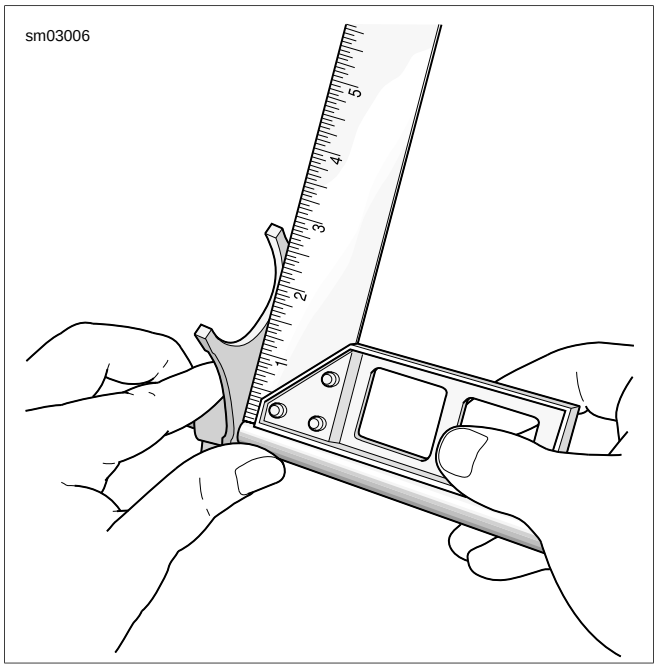


Figure 6-26. Checking Fork

ASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

FASTENER	TORQUE VALUE	
Mainshaft/countershaft nuts	85-95 ft-lbs	115.3-128.8 Nm
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm

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.

⚠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 6-25. Install beveled retaining ring (1) with the flat side against the bearing.

Countershaft

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 countershaft.*
- *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 6-24. 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 6-23. Install **new** needle bearing, countershaft 3rd gear (3), internal spline washer (2) and securing segments (1).
3. See Figure 6-22. Place countershaft 3rd gear lock ring over securing segments.

NOTES

- *In next step, the side of the guiding hub with the deeper counterbore faces countershaft 2nd gear.*
- *Countershaft 2nd gear bearing is wider than other bearings on the countershaft.*

4. See Figure 6-21. Install **new** needle bearing, countershaft 2nd gear (4), guiding hub (2), dog ring (3) and securing segments (1) on countershaft.
5. See Figure 6-20. Place lock ring over securing segments with the stepped face of the lock ring against the securing segments.
6. See Figure 6-19. Install **new** needle bearing, countershaft 1st gear (2) and washer (1).

NOTES

- *If installing countershaft only, hold countershaft 3rd and 4th gear shift dog up while pressing bearing housing bearing on to countershaft.*
- *Failure to press on inner bearing races while pressing bearings on the shafts will damage the bearings.*

7. See Figure 6-27. 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.



Figure 6-27. Installing Countershaft

Mainshaft

NOTES

- *Failure to press on inner bearing race while pressing bearing on the shaft will damage the bearing.*
- *See Figure 6-28. 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 6-17. 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-5586A) (1).

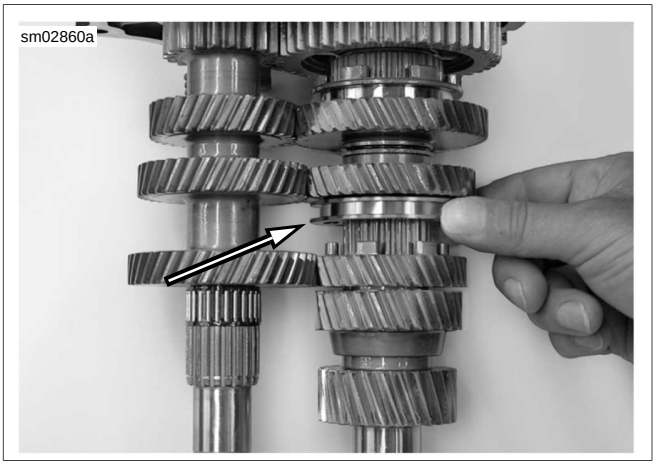


Figure 6-28. Raise and Hold Dog Ring

Shifter Cam/Shifter Forks

1. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
2. Install **new** nuts on mainshaft and countershaft. Tighten 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 6-29. 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 6-30. Using screwdriver (1), pull detent arm back to allow installation of shift cam assembly.
7. Install shift cam assembly (5).
8. See Figure 6-31. Install lock plate (2) and **new** lock plate fasteners (3). Tighten to 57-63 **in-lbs** (6.4-7.1 Nm).

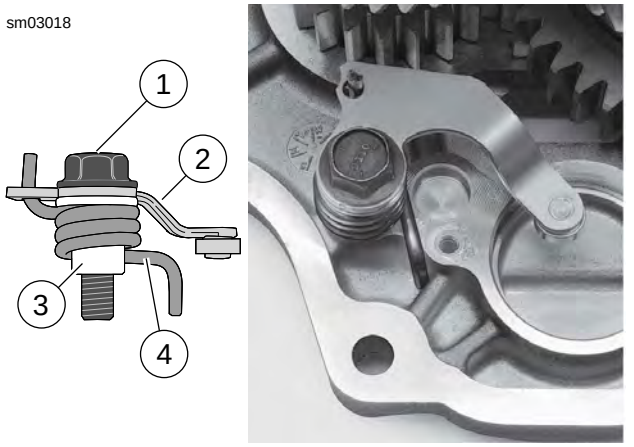
NOTE

See Figure 6-32. The forks are different from each other and are identified as shown.

9. See Figure 6-33. 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.

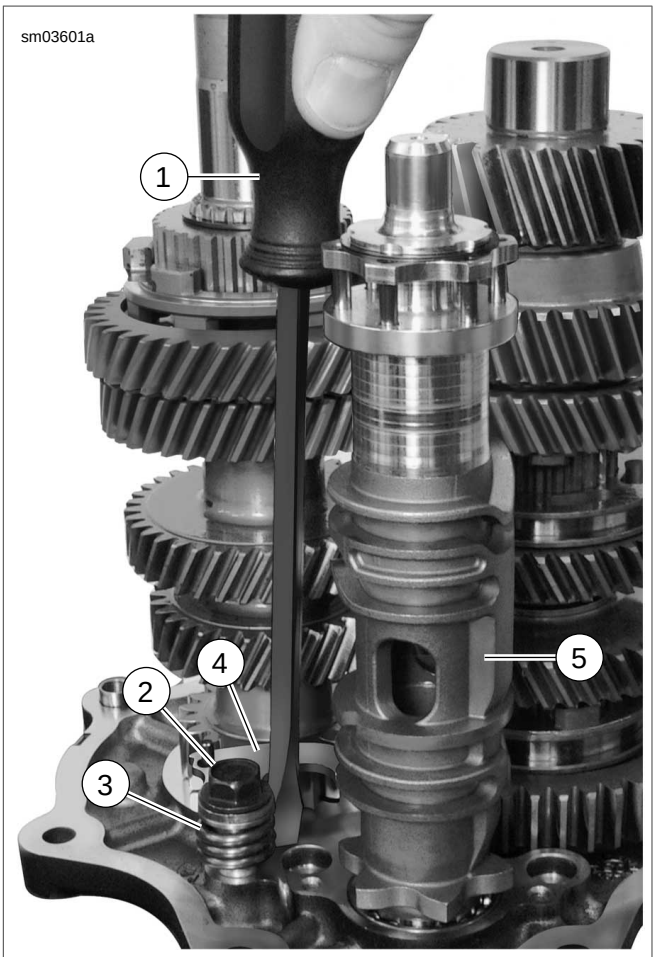
NOTE

If main drive gear was removed, install it now. See 6.7 MAIN DRIVE GEAR AND BEARING.



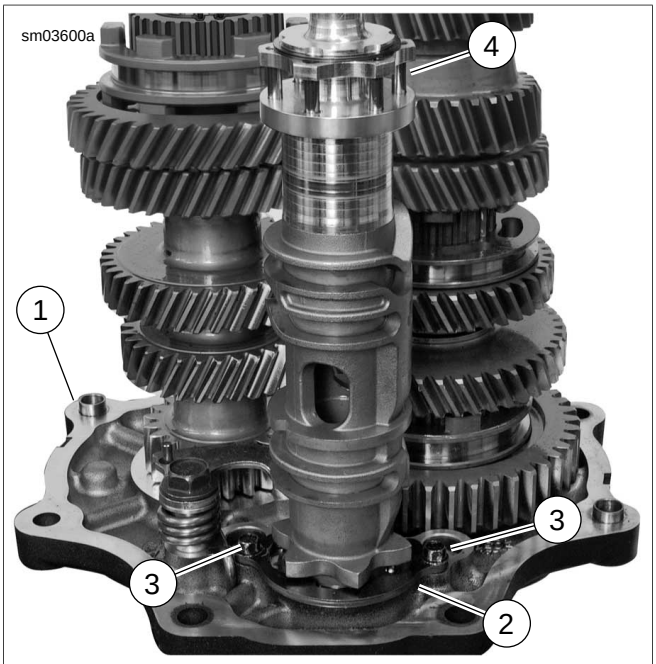
1. **Detent screw**
2. **Detent arm**
3. **Sleeve**
4. **Detent spring**

Figure 6-29. Detent Assembly



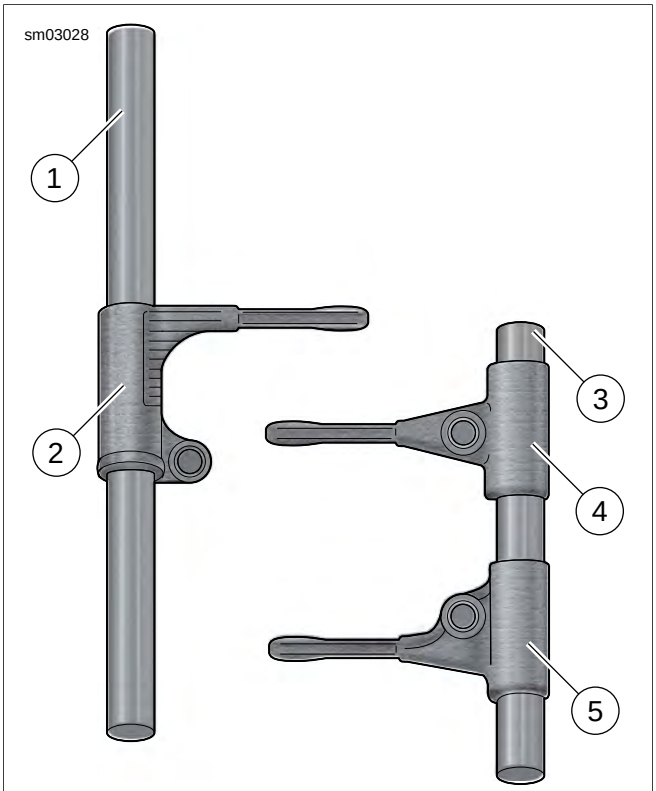
1. **Screwdriver**
2. **Detent fastener**
3. **Detent spring**
4. **Detent arm**
5. **Shift cam**

Figure 6-30. Detent Assembly



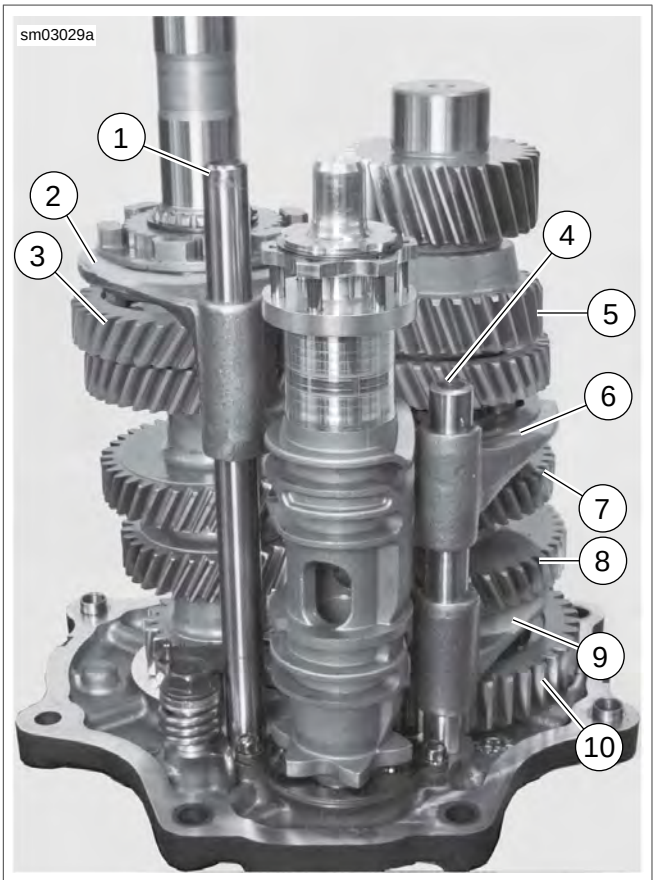
1. **Bearing housing**
2. **Lock plate**
3. **Lock plate fastener (2)**
4. **Shift cam**

Figure 6-31. Shift Drum



1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **Short shift shaft**
4. **3rd and 4th gear shifter fork**
5. **1st and 2nd gear shifter fork**

Figure 6-32. Shifter Forks and Shafts



1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **5th gear**
4. **Short shift shaft**
5. **5th gear**
6. **3rd and 4th gear shifter fork**
7. **3rd gear**
8. **2nd gear**
9. **1st and 2nd gear shifter fork**
10. **1st gear**

Figure 6-33. Transmission Gears and Shifter Forks

INSTALLATION

FASTENER	TORQUE VALUE	
Transmission bearing housing fasteners	23-25 ft-lbs	31.2-33.9 Nm
Transmission top cover	90-120 **in-lbs**	10.2-13.6 Nm
Oil spout fastener	84-132 **in-lbs**	9.5-14.9 Nm
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm

1. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.
2. Verify that two ring dowels are in place on bearing housing flange. place a **new** gasket on the ring dowels.
3. Apply clean transmission lubricant to the main drive gear bearings.

NOTE

Verify the transmission filler plug/dipstick is removed before installing transmission assembly. Contact with the filler plug/dipstick will prevent installation of transmission assembly.

4. Install the transmission assembly in the transmission case.
5. If equipped, place exhaust bracket into position. Install bearing housing fasteners.
6. See Figure 6-34. Tighten all bearing housing hardware in the sequence shown to 23-25 ft-lbs (31.2-33.9 Nm).

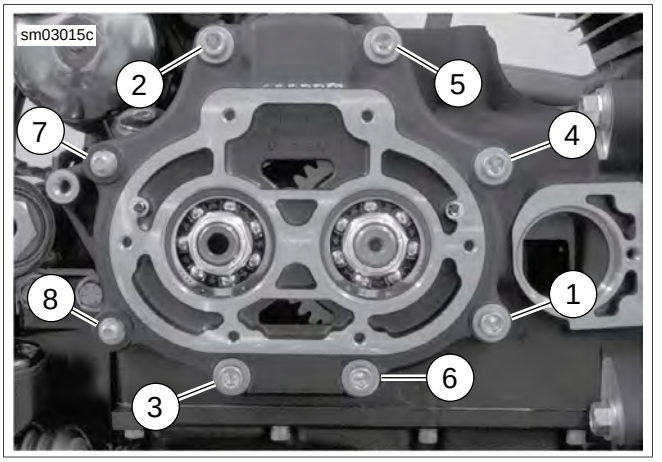
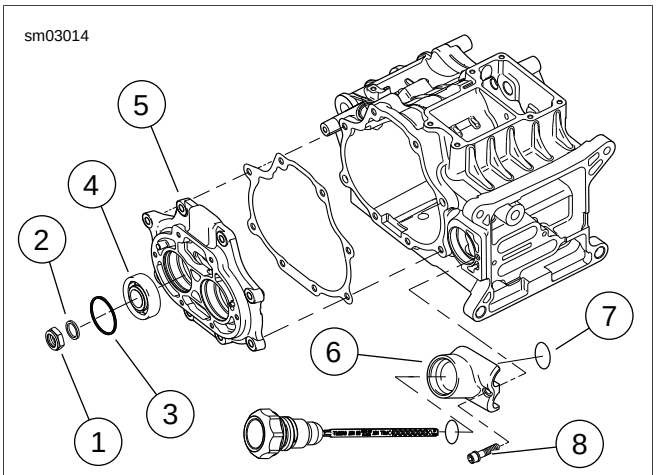
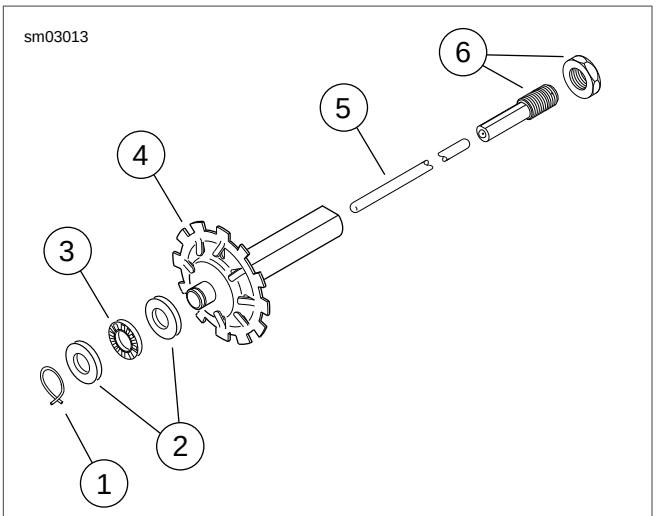


Figure 6-34. Torque Sequence



1. **Locknut (2)**
2. **Spacer**
3. **Retaining ring**
4. **Bearing**
5. **Bearing housing**
6. **Oil spout**
7. **O-ring**
8. **Oil spout fastener**

Figure 6-35. Bearing Housing Bearings



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Pushrod**
6. **Pushrod end, left side**

Figure 6-36. Pushrod Assembly: Cable Clutch

7. Install mainshaft bearing inner race. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
8. See Figure 6-36. 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 in length than the others.

9. Install 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. See Figure 6-35. Install **new** O-ring (7) on oil spout (6). Apply clean engine oil to O-ring. Push oil spout into transmission case. Install oil spout fastener (8). Tighten fastener to 84-132 **in-lbs** (9.5-14.9 Nm).
13. Install transmission sprocket nut. See 5.7 TRANSMISSION SPROCKET.
14. Install primary chaincase, clutch assembly and primary cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
15. Replace O-ring on plug. Clean and install transmission drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
16. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.
17. Install exhaust system. See 4.15 EXHAUST SYSTEM.

MAIN DRIVE GEAR AND BEARING 6.7

REMOVAL

PART NUMBER	TOOL NAME
HD-35316-10	PILOT
HD-35316-11	RECEIVER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-9	BEARING DRIVER
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER
HD-95637-10	LONG BOLTS
HD-95637-46B	WEDGE ATTACHMENT
RS-25100-200	BEARING

NOTE

Leave transmission case in the frame unless the case itself must be replaced. For illustration purposes, some photographs may show the case removed.

1. Remove exhaust system. See 4.15 EXHAUST SYSTEM.
2. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket, and primary chaincase and remove bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING.
3. Remove 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. Use MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER (Part No. HD-35316-C).

4. Remove retaining ring.

NOTES

- *The main drive gear bearing and retaining ring must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *The CROSS PLATE (Part No. HD-35316-3A) is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up.*

5. See Figure 6-37. 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).
6. 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.
7. 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.

NOTES

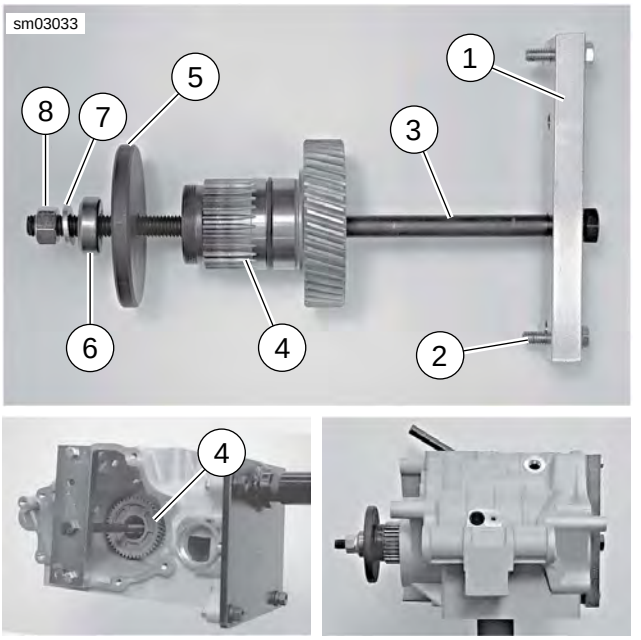
- *When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing must also be replaced.*
- *See Figure 6-38. When the main 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 reused, this inner race must be removed first.*

8. Remove tool and remove gear from gearcase.
9. See Figure 6-38. Use WEDGE ATTACHMENT (Part No. HD-95637-46B) and LONG BOLTS (Part No. HD-95637-10) to remove inner race from main drive gear.
10. Remove large main drive gear oil seal.
11. Remove retaining ring from bearing bore.
12. See Figure 6-39. Slide PILOT (Part No. HD-35316-10) (3) over small end of BEARING DRIVER (Part No. HD-35316-9) (2).
13. 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.
14. 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.
15. 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

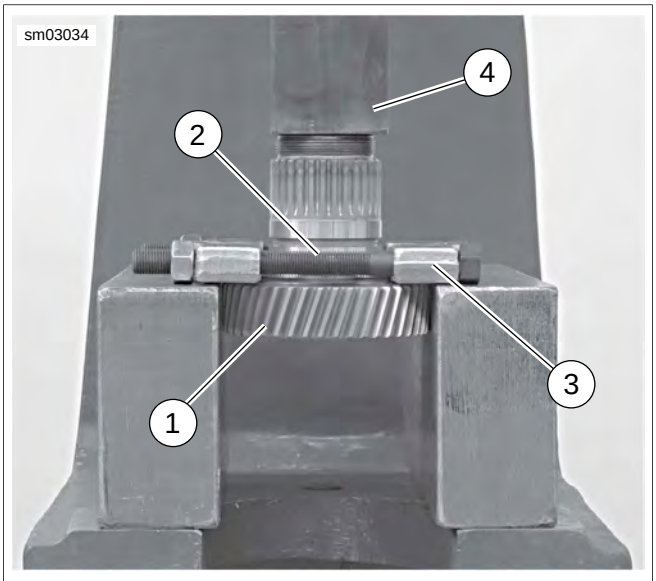
Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of transmission case when bearing comes free.

16. Tighten nut until main drive gear bearing is free.
17. Discard main drive gear bearing.



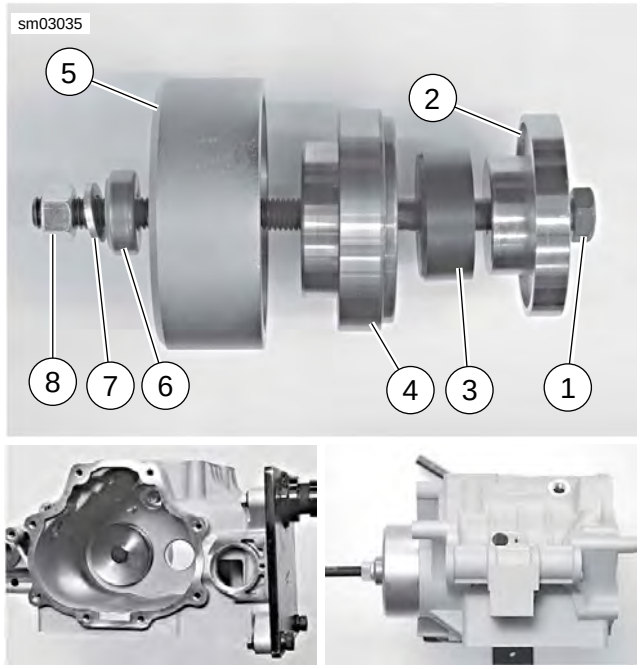
1. Cross plate
2. Screw (2)
3. 12 in. bolt
4. Main drive gear
5. Washer
6. Bearing
7. Flat washer
8. Nut

Figure 6-37. Removing Main Drive Gear



1. Main drive gear
2. Long bolt (2)
3. Wedge attachment
4. Press ram

Figure 6-38. Removing Inner Bearing Race From Main Drive Gear



1. 8 in. Bolt
2. Bearing driver
3. Pilot
4. Main drive gear bearing
5. Receiver cup
6. Bearing
7. Flat washer
8. Nut

Figure 6-39. Removing Main Drive Gear Bearing

CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL

⚠WARNING

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

1. Clean all parts in solvent except the transmission case and needle bearings. 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.

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

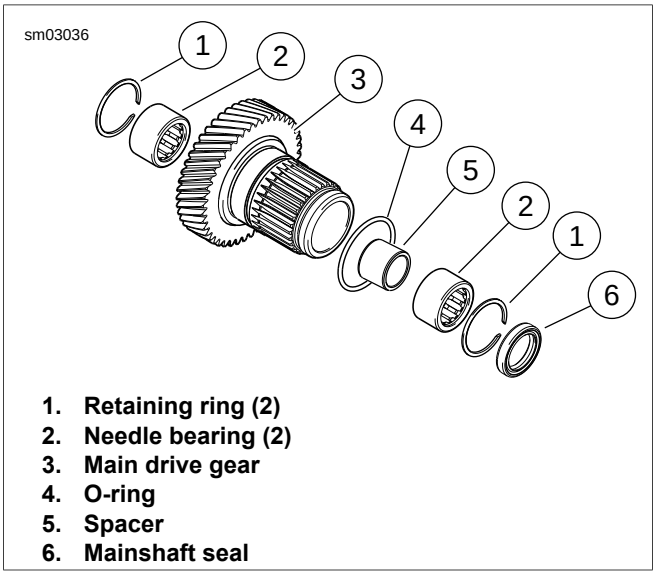
WARNING

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

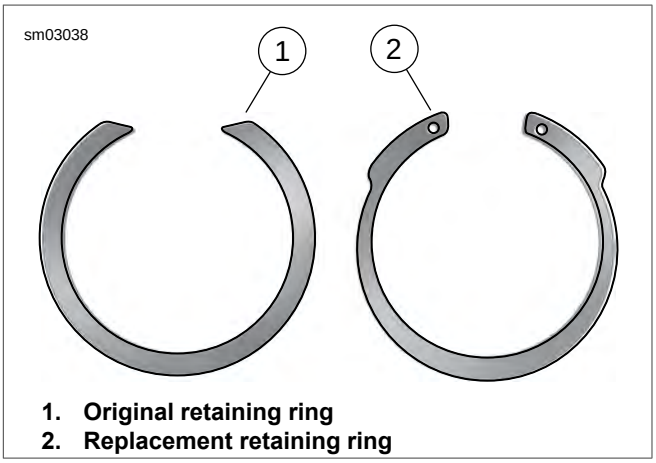
- *See Figure 6-41. When replacing needle bearings, discard original retaining rings (1) and install replacement retaining rings (2).*
- *To install the inner main drive gear needle bearings and mainshaft seal, use MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL (Part No. HD-47932).*

1. See Figure 6-40. Remove mainshaft seal (6). Remove retaining rings (1), needle bearings (2) and spacer (5) from main drive gear (3). Discard retaining rings.
2. Remove and discard O-ring (4).



1. **Retaining ring (2)**
2. **Needle bearing (2)**
3. **Main drive gear**
4. **O-ring**
5. **Spacer**
6. **Mainshaft seal**

Figure 6-40. Main Drive Gear Assembly



1. **Original retaining ring**
2. **Replacement retaining ring**

Figure 6-41. Main Drive Gear Retaining Rings

3. See Figure 6-42. 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.

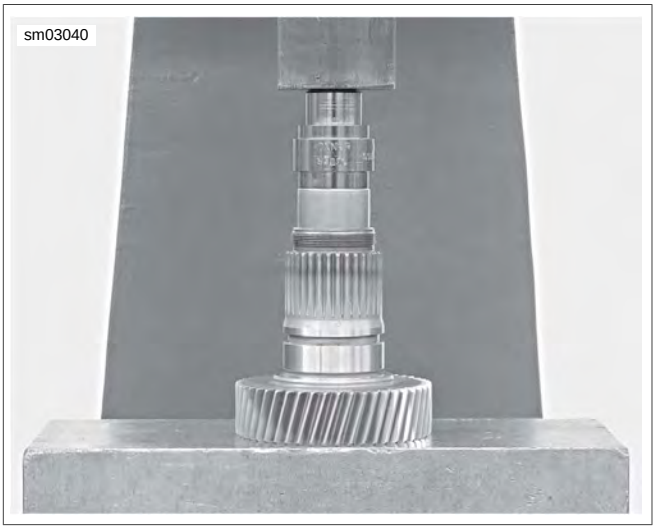


Figure 6-42. Installing Clutch Side Needle Bearing in Main Drive Gear

NOTE

An alternative method is provided which allows the mainshaft seal to be pressed into place after installation of the main drive gear. See 6.7 MAIN DRIVE GEAR AND BEARING, Removal.

4. See Figure 6-43. 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 6-40. 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 6-40. Install **new** retaining rings (1).
8. Install **new** O-ring (4) into groove in main drive gear.

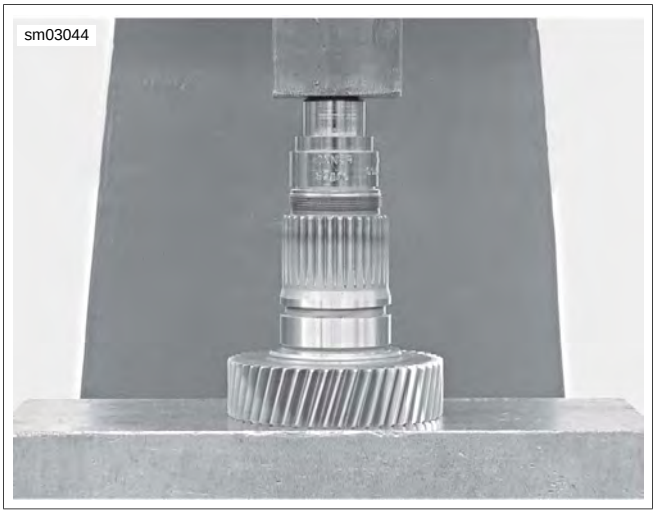


Figure 6-43. Pressing in Seal

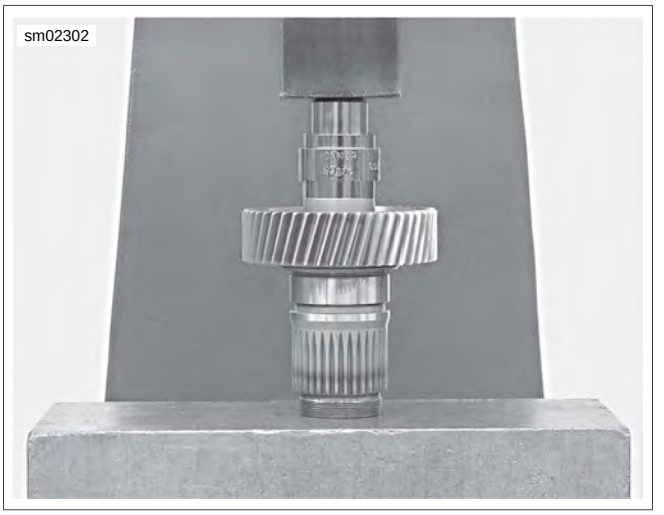


Figure 6-44. Installing Transmission Side Needle Bearing in Main Driver Gear

INSTALLATION

PART NUMBER	TOOL NAME
HD-35316-12	INSTALLER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-8	BEARING DRIVER
HD-47856-1	INSTALLER
HD-47856-2	PILOT
HD-47856-3	ADAPTER
HD-47856-6	NUT
HD-47856-7	CROW'S FOOT WRENCH

NOTICE

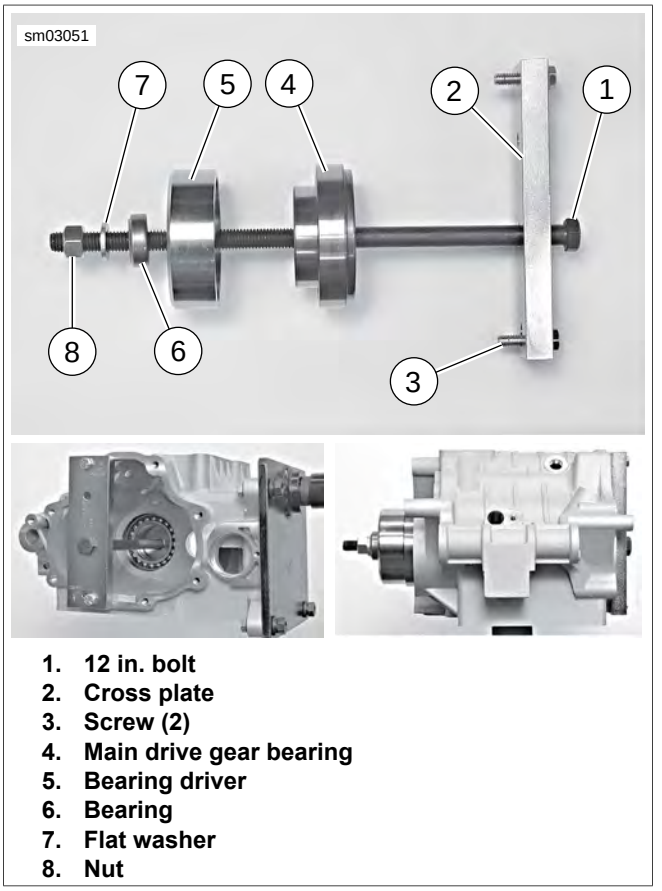
Improper tightening of sprocket nut can cause drive component damage. (00541b)

Installing Main Drive Gear Bearing

NOTE

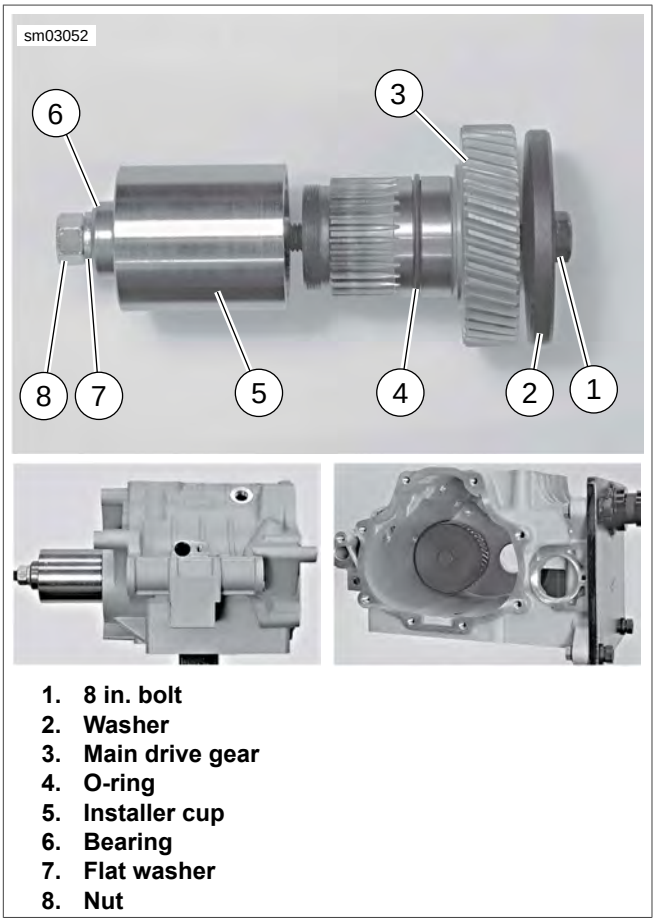
CROSS PLATE (Part No. HD-35316-3A) will retrofit to earlier transmissions. Note that one end of cross plate is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up for 6 speed transmissions.

1. See Figure 6-45. Secure CROSS PLATE (Part No. HD-35316-3A) (2) on right side of transmission case with two screws (3). Position cross plate with large bolt hole aligned with center of 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. 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 lip cast into transmission case bearing bore.



1. **12 in. bolt**
2. **Cross plate**
3. **Screw (2)**
4. **Main drive gear bearing**
5. **Bearing driver**
6. **Bearing**
7. **Flat washer**
8. **Nut**

Figure 6-45. Installing Main Drive Gear Bearing (Typical)



1. **8 in. bolt**
2. **Washer**
3. **Main drive gear**
4. **O-ring**
5. **Installer cup**
6. **Bearing**
7. **Flat washer**
8. **Nut**

Figure 6-46. Installing Main Drive Gear (Typical)

Installing Main Drive Gear

NOTE

*See Figure 6-46. Make sure **new** O-ring (4) is installed onto main drive gear (3). Lubricate O-ring with clean engine oil.*

1. See Figure 6-46. 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. 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.

⚠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

See Figure 6-47. Retaining ring must be installed with the flat side facing the bearing and the opening within the ninety degree range shown.

4. See Figure 6-48. Install **new** retaining ring (2).

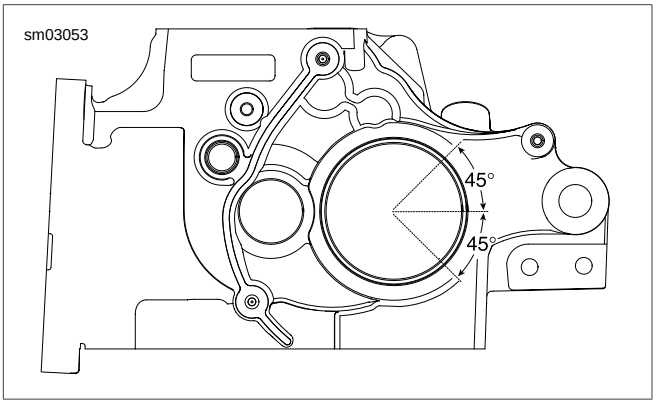


Figure 6-47. Retaining Ring Opening

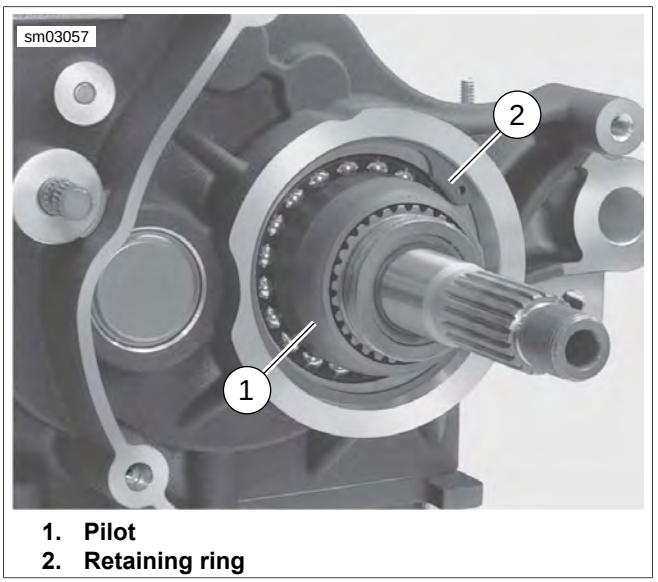
Installing Main Drive Gear Large Seal

1. See Figure 6-48. Install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.
2. Coat lips of **new** main drive gear seal with transmission lubricant.
3. See Figure 6-49. 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 6-50. Thread ADAPTER (Part No. HD-47856-3) onto end of main drive gear until it contacts main drive gear.



1. **Pilot**
2. **Retaining ring**

Figure 6-48. Install Pilot

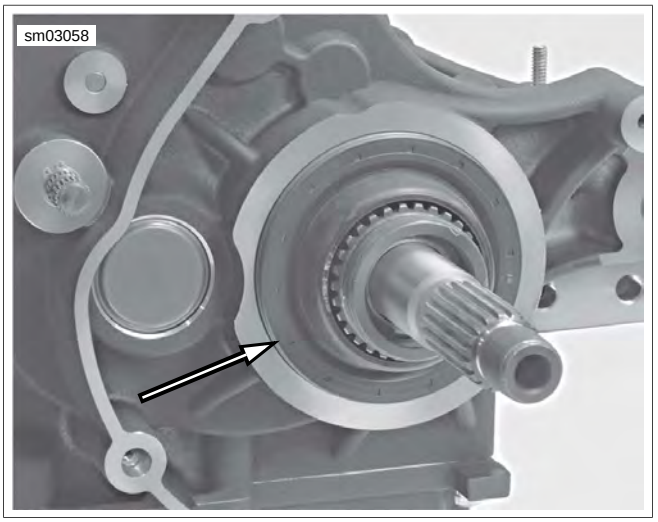


Figure 6-49. Place Main Drive Gear Seal Over Pilot

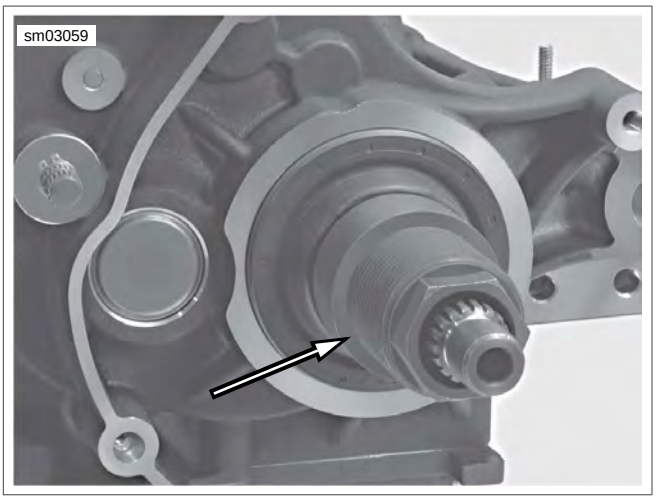


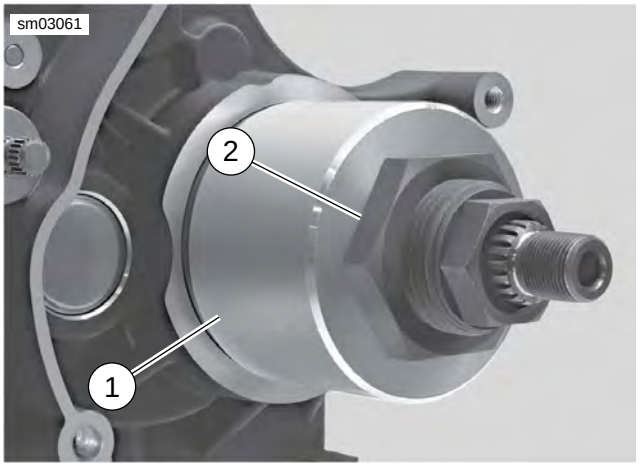
Figure 6-50. Install Adapter

5. See Figure 6-51. 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 against installer.
7. See Figure 6-52. Hold adapter from rotating and tighten large nut with CROW'S FOOT WRENCH (Part No. HD-47856-7) (1) attached to a 1/2 in breaker bar (2) until outer face of seal is flush with outer edge of transmission bore.

NOTE

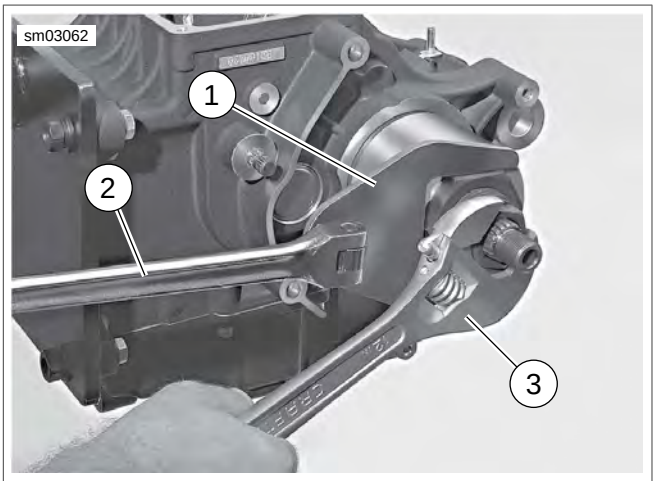
Seal depth will be controlled by tool. Seal can be recessed as much as 0.030 in. (0.762 mm) below outer edge of bore.

8. Remove nut, installer, adapter and pilot.
9. Install bearing housing and transmission components. See 6.6 TRANSMISSION ASSEMBLY, Installation.
10. Install sprocket and drive belt. See 5.7 TRANSMISSION SPROCKET. Do not adjust belt at this time.
11. Install the bearing inner race on the transmission mainshaft. See 6.6 TRANSMISSION ASSEMBLY, Assembly.
12. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Installation.
13. Install the clutch assembly, primary chain, chain tensioner assembly and compensating sprocket components. See 5.4 DRIVE COMPONENTS, Installation.
14. Install the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
15. Adjust the drive belt. See 1.12 DRIVE BELT AND SPROCKETS, Checking Belt Deflection.
16. Install exhaust system. See 4.15 EXHAUST SYSTEM.



1. Installer
2. Nut

Figure 6-51. Installer and Nut



1. Crow's foot wrench
2. 1/2 in breaker bar
3. Adjustable wrench

Figure 6-52. Press Seal Into Crankcase

TRANSMISSION CASE 6.8

REMOVAL

⚠WARNING

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

1. Disconnect battery.
2. Drain engine oil. See 1.6 ENGINE OIL AND FILTER.
3. Drain transmission lubricant. See 1.10 TRANSMISSION LUBRICANT.
4. Remove starter. See 7.11 STARTER.
5. Remove transmission assembly. See 6.3 TRANSMISSION.
6. Remove oil pan. See 3.29 OIL PAN, Removal.

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 crossmembers, oil pan, mounting brackets, components or housings. Failure to comply can cause serious damage resulting in the need to perform major repair work. (00586d)

7. Position jack across lower frame to support rear of motorcycle. Slide wooden blocks beneath the crankcase to support the weight of the engine and transmission assembly.
8. Remove rear fork. See 2.22 REAR FORK.
9. Disconnect vehicle speed sensor (VSS). See 7.23 VEHICLE SPEED SENSOR (VSS).
10. Disconnect neutral switch. See 7.25 NEUTRAL SWITCH, Removal.
11. Remove fastener from ground post at top of transmission case and remove battery negative ring terminal.
12. Move aside the harness that terminates at the O2 sensor, starter solenoid, neutral switch and VSS.
13. Mark splines on shift arm and shift shaft to assist in assembly. Remove shift arm from shift shaft.
14. In a crosswise pattern, remove four fasteners that connect transmission to engine.

NOTE

See Figure 6-53. Do not use a hammer to remove transmission. If the transmission sticks or binds on the ring dowels, gently pry away from crankcase using the indent.

15. Move transmission rearward until two ring dowels in lower flange are free of crankcase. Remove transmission case from left side of the motorcycle.

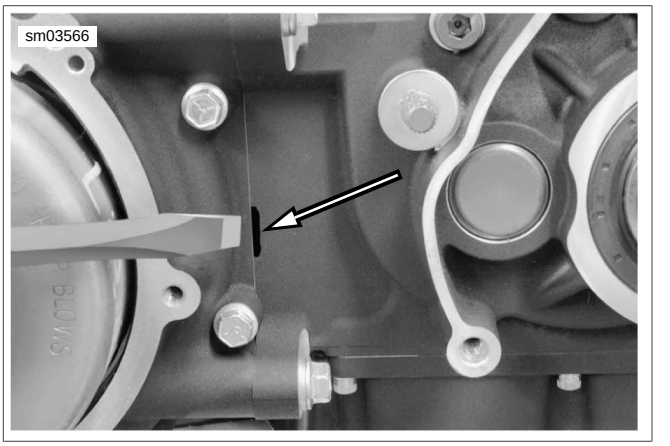


Figure 6-53. Transmission Case Pry Point

INSTALLATION

FASTENER	TORQUE VALUE	
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm
VSS fastener	84-132 **in-lbs**	9.5-14.9 Nm
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm

1. Install **new** ground post at top of transmission case. Tighten ground post until snug.

NOTE

*A **new** transmission case comes with the shifter shaft sleeve and seal, centering screw, countershaft needle bearing and main drive gear bearing and seal installed.*

2. Thoroughly wipe all engine oil from pockets in crankcase flange.
3. Install **new** engine-to-transmission gasket engaging two index pins in holes of transmission flange.
4. Verify that transmission dowels are seated. Place transmission case into position behind crankcase. Mate engine and transmission flanges.
5. Install and tighten fasteners.
   a. Install shorter fasteners at the top, longer fasteners at the bottom. **Hand tighten** fasteners in a crosswise pattern.
   b. See Figure 6-54. Tighten bolts in the sequence shown 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).
6. Install oil pan. See 3.29 OIL PAN.
7. Install rear fork. See 2.22 REAR FORK, Installation.

8. Install shift arm on shift shaft. Align marks made during disassembly.
9. Install transmission and bearing housing assembly. See 6.6 TRANSMISSION ASSEMBLY, Installation.
10. Connect battery ground cable to ground post at top of transmission case. Tighten securely.
11. Adjust drive belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
12. Install primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
13. Install drive components. See 5.4 DRIVE COMPONENTS.

NOTE

*Always install a **new** gasket between primary chaincase cover and chaincase. Failure to replace this gasket may cause primary chaincase leaks.*

14. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER.
15. Install neutral switch. Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
16. Install VSS with screw. Tighten to 84-132 **in-lbs** (9.5-14.9 Nm).
17. Mate VSS, O2 sensors, starter solenoid and neutral switch connectors to main harness.
18. Install starter. See 7.11 STARTER, Installation.
19. Install exhaust system. See 4.15 EXHAUST SYSTEM.
20. Install drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Fill transmission. 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)

21. Fill primary chaincase. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.
22. Fill engine oil. See 1.6 ENGINE OIL AND FILTER, Changing 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)

23. Connect battery cables.

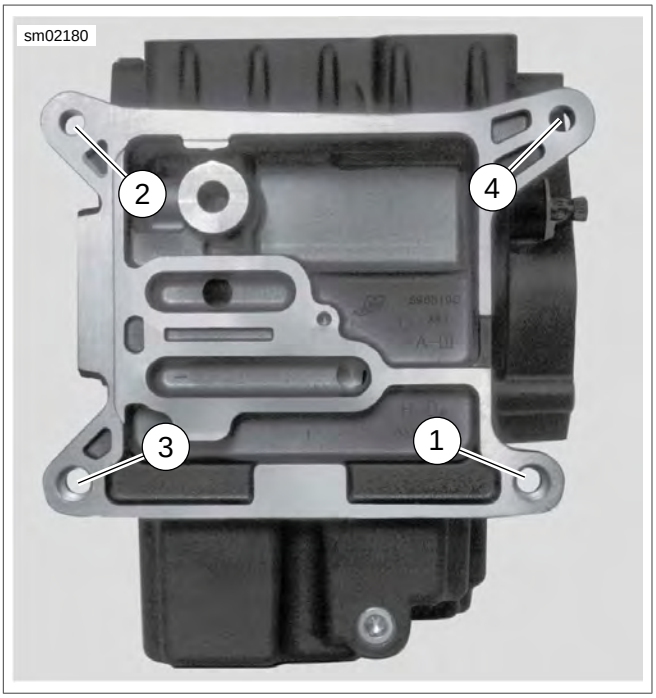


Figure 6-54. Transmission Housing to Crankcase Torque Sequence

DISASSEMBLY

Shifter Arm Assembly

1. See Figure 6-55. 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)

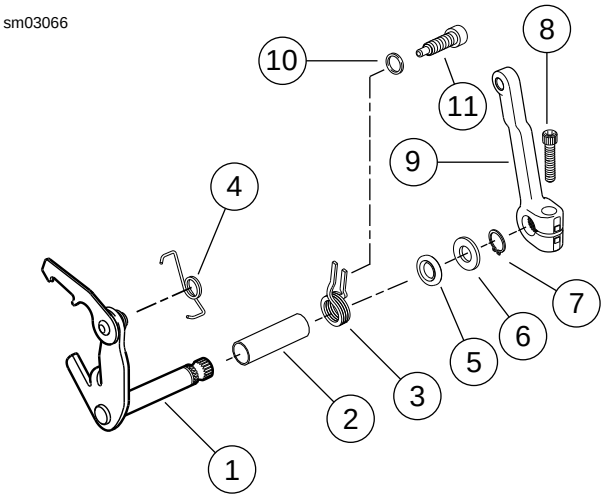
1. Clean all parts in solvent except the case and main drive gear needle bearings. Blow parts dry with low pressure compressed air.

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 6-55. 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.



1. **Shifter pawl lever assembly**
2. **Sleeve (inside transmission case)**
3. **Shift lever centering spring**
4. **Shifter shaft lever spring**
5. **Seal**
6. **Washer**
7. **Retaining ring**
8. **Screw**
9. **Shifter rod lever**
10. **Washer**
11. **Screw**

Figure 6-55. Shifter Arm Assembly

ASSEMBLY

FASTENER	TORQUE VALUE	
Shifter pawl centering screw	18-23 ft-lbs	24.4-31.2 Nm
Shifter rod lever pinch screw, transmission lever	18-22 ft-lbs	24.4-29.8 Nm

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).
3. Lubricate the bearing with SCREAMIN' EAGLE ASSEMBLY LUBE.

Shifter Pawl Lever Assembly

1. See Figure 6-55. 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 6-56. 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

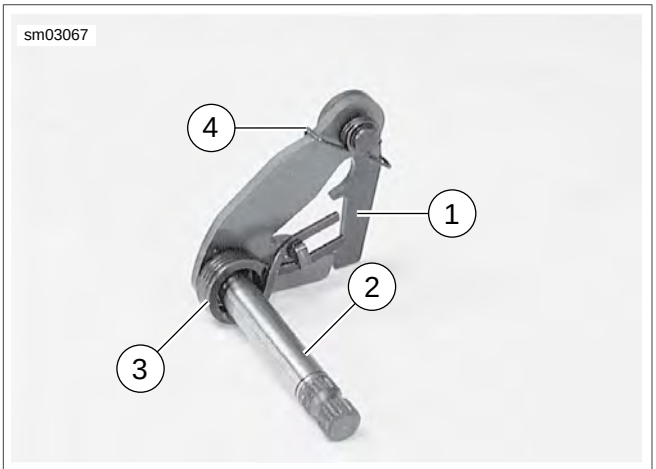
Do not bend shifter shaft lever spring more than necessary for assembly.

5. See Figure 6-57. Insert the assembly into the transmission case.
6. See Figure 6-58. Verify that pin sits inside shifter shaft lever spring.
7. See Figure 6-57. Install a **new** seal. Install washer (1) and a **new** retaining ring (2).

NOTE

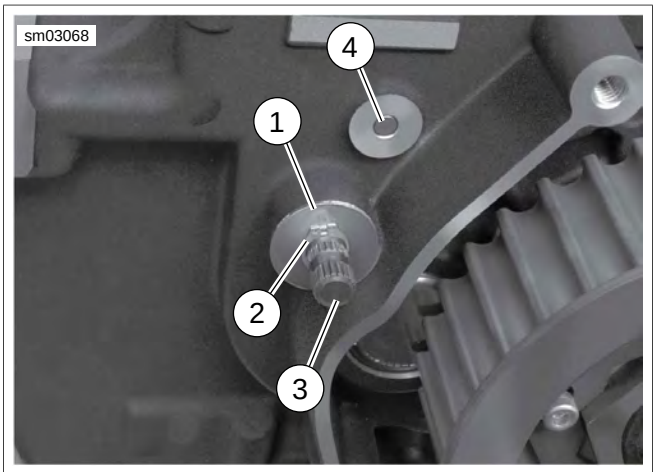
In next step, shifter rod lever must be installed so angle of lever is toward front of vehicle, one spline from vertical.

8. See Figure 6-55. Install shifter rod lever (9) on the shifter pawl lever assembly shaft end using screw (8). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).



1. **Pawl (part of shifter pawl lever assembly)**
2. **Shifter pawl lever assembly**
3. **Shifter lever centering spring**
4. **Shifter shaft lever spring**

Figure 6-56. Shifter Pawl Lever Assembly



1. Washer (with seal behind)
2. Retaining ring
3. Shifter shaft lever
4. Pin

Figure 6-57. Shifter Shaft Lever, Exterior View

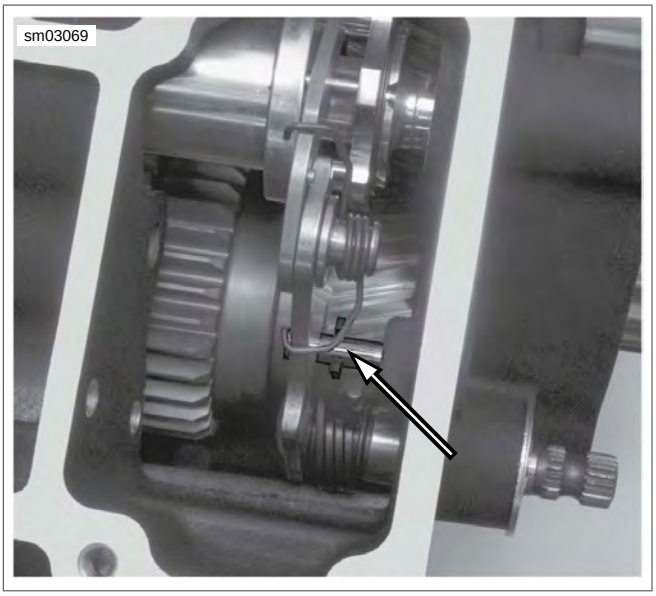


Figure 6-58. Shifter Shaft Lever Spring

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NOTES

FASTENER TORQUE VALUES 7.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
ABS bracket fastener	90-114 **in-lbs**	10.2-12.8 Nm	7.30 MAIN WIRING HARNESS, Installation
ABS module bracket	90-114 **in-lbs**	10.2-12.8 Nm	7.11 STARTER, Installation
ACR	132-180 **in-lbs**	14.9-20.3 Nm	7.16 AUTOMATIC COMPRESSION RELEASE (ACR), Installation/Apply three equally spaced dots of LOCTITE 246 MEDIUM STRENGTH/HIGH TEMPERATURE THREADLOCKER (blue) around lower third of threads
Active exhaust module fasteners	36-60 **in-lbs**	4.0-6.8 Nm	7.29 ACTIVE EXHAUST, Installation
Battery tray screws	96-120 **in-lbs**	10.8-13.6 Nm	7.10 BATTERY TRAY AND BATTERY CABLES, Battery Tray
CKP sensor screw	90-120 **in-lbs**	10.1-13.6 Nm	7.15 CRANK POSITION SENSOR (CKP), Installation
Console mounting screws: FXDB/P/A and FXDWG	41-49 **in-lbs**	4.6-5.5 Nm	7.24 INDICATOR LAMPS, Installation
Console mounting screws: FXDC, FLD and FXDF	41-49 **in-lbs**	4.6-5.5 Nm	7.24 INDICATOR LAMPS, Installation
Console mounting screws: FXDC, FXDF, FLD	41-49 **in-lbs**	4.6-5.5 Nm	7.21 INSTRUMENTS: FXDC, FXDF AND FLD, Speedometer
Console mounting screws: FXDC, FXDF, FXDWG, FLD, FXDB/P/A	41-49 **in-lbs**	4.6-5.5 Nm	7.9 IGNITION SWITCH/FORK LOCK, FXDC, FXDF, FXDWG, FLD, FXDB/P/A Models: Ignition Switch Only
Console mounting screws: FXDL	41-49 **in-lbs**	4.6-5.5 Nm	7.24 INDICATOR LAMPS, Installation
Console to fuel tank fasteners: FXDB/P/A and FXDWG	41-49 **in-lbs**	4.6-5.5 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Console to fuel tank fasteners: FXDL	41-49 **in-lbs**	4.6-5.5 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Electrical caddy fastener, front	40-60 **in-lbs**	4.5-6.8 Nm	7.3 ELECTRICAL CADDY, Installation
Electrical caddy fasteners, top	90-110 **in-lbs**	10.1-12.4 Nm	7.3 ELECTRICAL CADDY, Installation
Fuel tank trim screw: FXDC, FXDF, FLD	18-24 **in-lbs**	2.03-2.71 Nm	7.21 INSTRUMENTS: FXDC, FXDF AND FLD, Speedometer
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Installation
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation
Handlebar clutch lever clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Installation
Handlebar master cylinder clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation
Handlebar module assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Installation
Handlebar module assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation
Handlebar switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Clutch Switch Replacement

FASTENER	TORQUE VALUE		NOTES
Handlebar switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Front Brake Switch Replacement
Headlamp door screw: FLD	9-18 **in-lbs**	1.0-2.0 Nm	7.12 HEADLAMP, Headlamp: FLD Models
Headlamp screws: FLD	7-10 **in-lbs**	0.8-1.1 Nm	7.12 HEADLAMP, Headlamp: FLD Models
Headlight horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	7.12 HEADLAMP, Headlamp Assembly Installation: Except FLD
Horn mounting nut	120-180 **in-lbs**	13.6-20.3 Nm	7.28 HORN, Replacement
License bracket screws: FLD	60-80 **in-lbs**	6.8-9.0 Nm	7.14 TURN SIGNALS, Rear Turn Signal Lamps and Bracket: FLD
Mirror acorn nut: FLD	84-156 **in-lb**	9.5-17.6 Nm	7.14 TURN SIGNALS, Front Turn Signal Lamps: FLD
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	7.25 NEUTRAL SWITCH, Installation
Oil pressure switch	96-144 **in-lbs**	10.8-16.3 Nm	7.26 OIL PRESSURE SWITCH, Installation
Rear light bar housing screws: FLD	84-144 **in-lbs**	9.5-16.3 Nm	7.14 TURN SIGNALS, Rear Turn Signal Lamps and Bracket: FLD/Use LOCTITE 271 HIGH STRENGTH THREADLOCKER (red)
Rear stop lamp switch	12-15 ft-lbs	16.3-20.3 Nm	7.27 REAR STOPLAMP SWITCH, Installation
Rear turn signal lamp fastener	12-16 ft-lbs	16.3-21.7 Nm	7.14 TURN SIGNALS, Rear Lamp Housing Replacement: All Except FLD
Solenoid contact post jamnut	65-80 **in-lbs**	7.3-9.0 Nm	7.11 STARTER, Solenoid
Solenoid terminal post nut	70-90 **in-lbs**	7.9-10.1 Nm	7.11 STARTER, Drive Assembly
Speedometer, tachometer screw: FXDB/P/A and FXDWG	10-20 **in-lbs**	1.1-2.3 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Speedometer/tachometer back clamp screw: FXDL	10-20 **in-lbs**	1.1-2.3 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Speedometer VSS mounting bolt	84-108 **in-lbs**	9.5-12.2 Nm	7.23 VEHICLE SPEED SENSOR (VSS), Installation
Starter end cover screw	90-110 **in-lbs**	10.1-12.4 Nm	7.11 STARTER, Drive Assembly
Starter mounting fasteners	25-27 ft-lbs	33.9-36.6 Nm	7.11 STARTER, Installation
Starter positive terminal nut	60-80 **in-lbs**	6.8-9.0 Nm	7.10 BATTERY TRAY AND BATTERY CABLES, Battery Cables/metric
Starter positive terminal nut	60-80 **in-lbs**	6.8-9.0 Nm	7.11 STARTER, Installation
Starter ring terminal hex nut	60-80 **in-lbs**	6.8-9.0 Nm	7.11 STARTER, Solenoid
Starter through bolts	39-65 **in-lbs**	4.4-7.3 Nm	7.11 STARTER, Drive Assembly
Stator screws	55-75 **in-lbs**	6.2-8.4 Nm	7.18 ALTERNATOR, Installation/TORX screws, use only once
Tail lamp base screws: all but FXDB/P/A, FXDWG	40-48 **in-lbs**	4.5-5.4 Nm	7.13 TAIL LAMP, Base Replacement: All But FXDB/P/A and FXDWG
Tail lamp base screws: FXDWG (HDI and Canada)	66-90 **in-lbs**	7.5-10.1 Nm	7.13 TAIL LAMP, Base Replacement: FXDWG/HDI and Canada
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm	7.13 TAIL LAMP, Tail Lamp Bulb Replacement: Standard Style
Tail lamp lens screws: all but FXDB/P/A, FXDWG	20-24 **in-lbs**	2.3-2.7 Nm	7.13 TAIL LAMP, Base Replacement: All But FXDB/P/A and FXDWG
Top plate fasteners	27-33 **in-lbs**	3.1-3.7 Nm	7.20 FUEL GAUGE SENDER, Installation
Transmission ground stud nut	96-144 **in-lbs**	10.8-16.3 Nm	7.10 BATTERY TRAY AND BATTERY CABLES, Battery Cables
Voltage regulator fasteners	100-120 **in-lbs**	11.2-13.6 Nm	7.17 VOLTAGE REGULATOR, Installation

SPECIFICATIONS: ELECTRICAL 7.2

SPECIFICATIONS

Table 7-1. Ignition

IGNITION	DATA
Idle speed	1000 ± 50 rpm
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in
	0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance	0.5-0.7 ohms
Ignition coil secondary resistance	5500-7500 ohms

Table 7-2. Fuses

FUSE	AMPS
Main fuse	40
Battery	15
Accessories	15

Table 7-3. Charging System

CHARGING SYSTEM	DATA
Battery	19 A hour/315 CCA
Alternator AC voltage output	16-23 VAC per 1000 rpm
Alternator stator coil resistance	0.1-0.2 ohms
Regulator voltage output @ 3600 rpm	14.3-14.7 VDC @ 75 °F (24 °C)
Regulator amperes @ 3000 rpm	35-50 A

Table 7-4. Starter Specifications

STARTER DATA	
Free speed	3000 rpm (min) @ 11.5 V
Free current	90 A (max) @ 11.5 V
Cranking current	200 A (max) @ 68 °F
Stall torque	8.0 ft-lbs (10.8 Nm) @ 2.4 V

ELECTRICAL CADDY 7.3

REMOVAL

NOTE

Security siren connector [142] is located under seat in the rear of the electrical caddy.

1. Remove seat.

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Remove battery cover.
3. Disconnect negative battery cable.
4. See Figure 7-1. Remove electrical caddy cover:
   a. Push up on the lower tab securing the electrical caddy cover.
   b. Pull outward on bottom until retainer on cover clears tab.
   c. Lift cover up and off of two upper tabs on electrical caddy and remove.
5. See Figure 7-2. Slide data link connector (2) [91] up to disengage from electrical caddy.

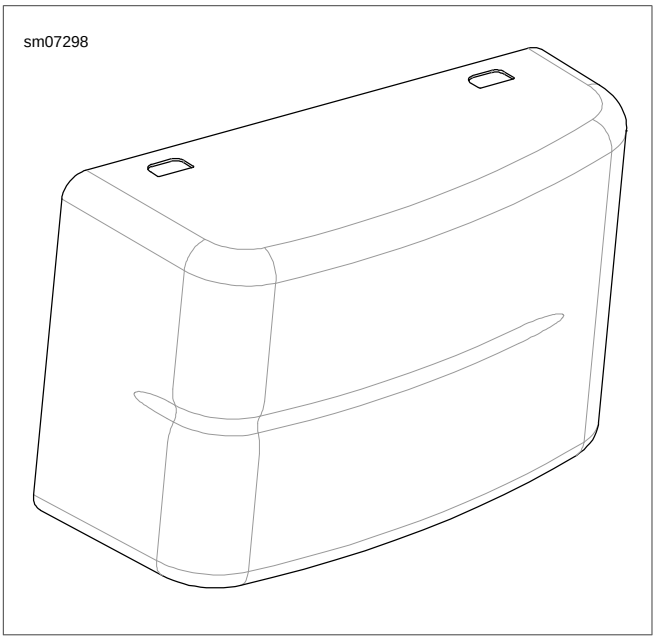
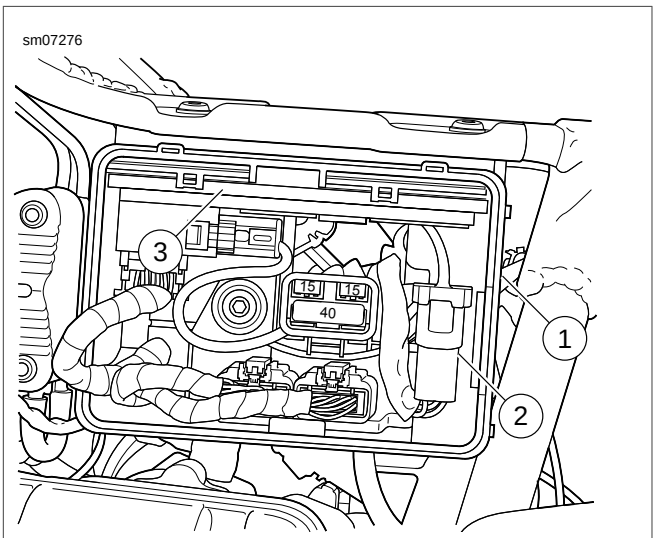
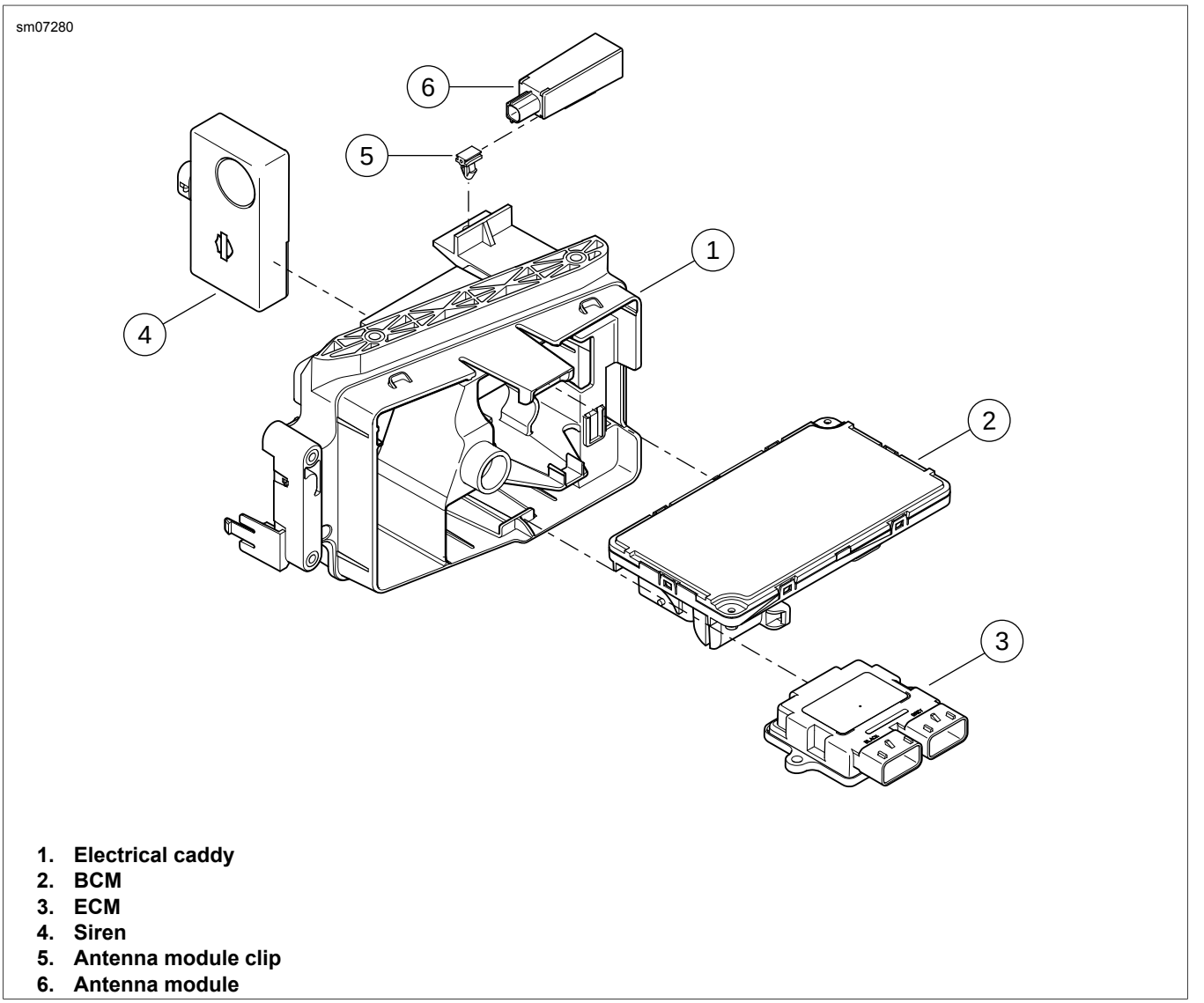


Figure 7-1. Electrical Caddy Cover



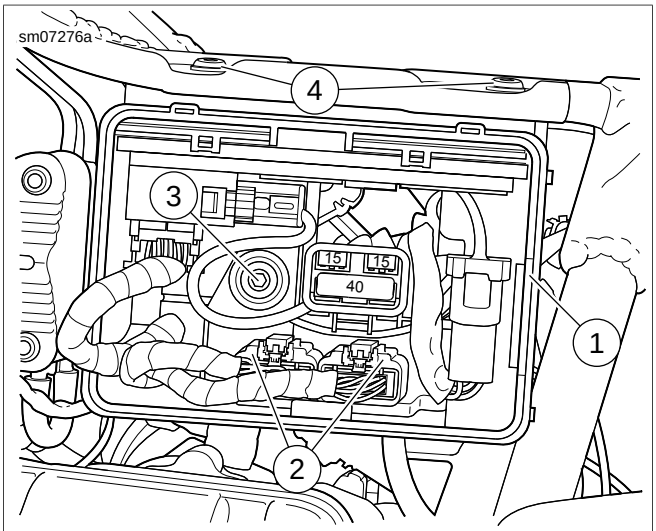
1. **Electrical caddy**
2. **Data link connector**
3. **BCM**

Figure 7-2. Electrical Caddy



1. **Electrical caddy**
2. **BCM**
3. **ECM**
4. **Siren**
5. **Antenna module clip**
6. **Antenna module**

Figure 7-3. Electrical Caddy Components



1. **Electrical caddy**
2. **ECM connectors [78]**
3. **Front electrical caddy fastener**
4. **Electrical caddy fasteners (2)**

Figure 7-4. Electrical Caddy Fasteners

NOTE

No components are held in with fasteners.

6. See Figure 7-3. Disconnect ECM connectors [78-1], [78-2] and remove the ECM.
7. Disconnect BCM connectors [259], [242] and remove the BCM.
8. Disconnect antenna module for security siren [209] and remove.
9. Disconnect ignition coil connector [83].
10. Disconnect spark plug cables from coil.
11. See Figure 7-4. Remove front electrical caddy fastener (3).
12. Remove top electrical caddy fasteners (4).
13. Pull the electrical caddy away from vehicle and remove wiring from back of electrical caddy.
14. With electrical caddy pulled away from the vehicle, disconnect security siren [142] and remove.
15. See Figure 7-4. Remove the electrical caddy.

INSTALLATION

FASTENER	TORQUE VALUE	
Electrical caddy fasteners, top	90-110 **in-lbs**	10.1-12.4 Nm
Electrical caddy fastener, front	40-60 **in-lbs**	4.5-6.8 Nm

NOTE

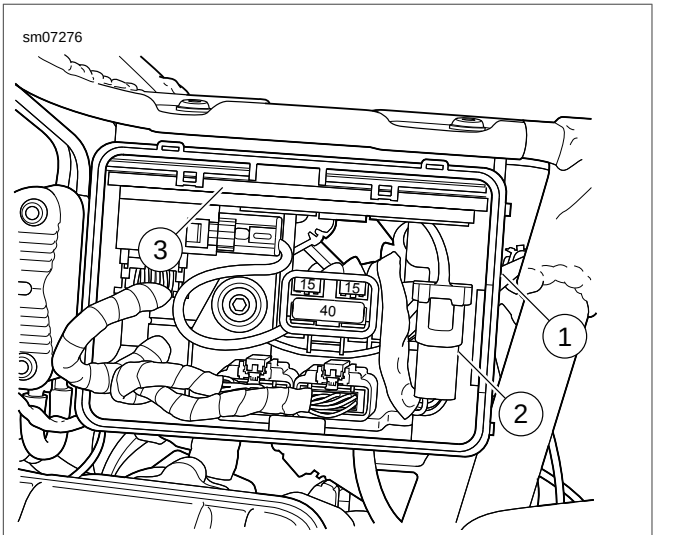
No fasteners are used to attach the BCM or ECM to the electrical caddy.

1. See Figure 7-3. Attach ECM to electrical caddy.
2. Route all wiring and fuse block through back of electrical caddy along with ECM and data link connectors before installing the electrical caddy.
3. Connect BCM connectors to BCM, and install.
4. Connect siren connector and insert siren into back of electrical caddy. If not equipped with security system, attach siren connector to back of electrical caddy.
5. See Figure 7-4. Install but do not tighten electrical caddy front fastener (3).
6. Install electrical caddy top fasteners (4). Tighten to 90-110 **in-lbs** (10.1-12.4 Nm).
7. Tighten electrical caddy front fastener to 40-60 **in-lbs** (4.5-6.8 Nm).
8. Connect electronic control module (ECM) connectors [78-1] [78-2].
9. See Figure 7-5. Install data link connector (2) to electrical caddy as shown.
10. Install main fuse.
11. Attach coil connector [83].
12. Attach spark plug cables. Install rear cable on upper coil tower.
13. Install electrical caddy cover.
14. Connect negative battery cable and install battery cover.

⚠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. Install seat.



1. **Electrical caddy**
2. **Data link connector**
3. **BCM**

Figure 7-5. Electrical Caddy

ELECTRONIC CONTROL MODULE (ECM) 7.4

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The ECM is mounted in the bottom of the electrical caddy.

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.*
- *Always calibrate replaced ECMs with DIGITAL TECHNICIAN II (Part No. HD-48650).*

REPLACEMENT

Removal

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove electrical caddy cover.
2. Remove main fuse.
3. See Figure 7-3. Remove ECM from mounting bracket.
   a. A lip on the electrical caddy holds the ECM in place. Press latches on connectors [78-1] ECM (Bk), [78-2] ECM (Gy) and disconnect from ECM.
   b. Lift the ECM up and slide it out of the electrical caddy after it has been disconnected.

Installation

1. Install ECM into bottom of electrical caddy and snap in place to secure.
2. Plug connectors [78-1] 18-place Tyco (Bk), [78-2] 18-place Tyco (Gy) into ECM.
3. Install main fuse.
4. Install electrical caddy cover.

BODY CONTROL MODULE (BCM) 7.5

GENERAL

See Figure 7-3. The BCM is located on the left side of the vehicle in the top of the electrical caddy. The BCM supplies ignition and accessory power to the vehicle. The fuses are the main fuse (40 amp), the battery fuse (15 amp) and the accessories fuse (15 amp). See the electrical diagnostic manual for more information.

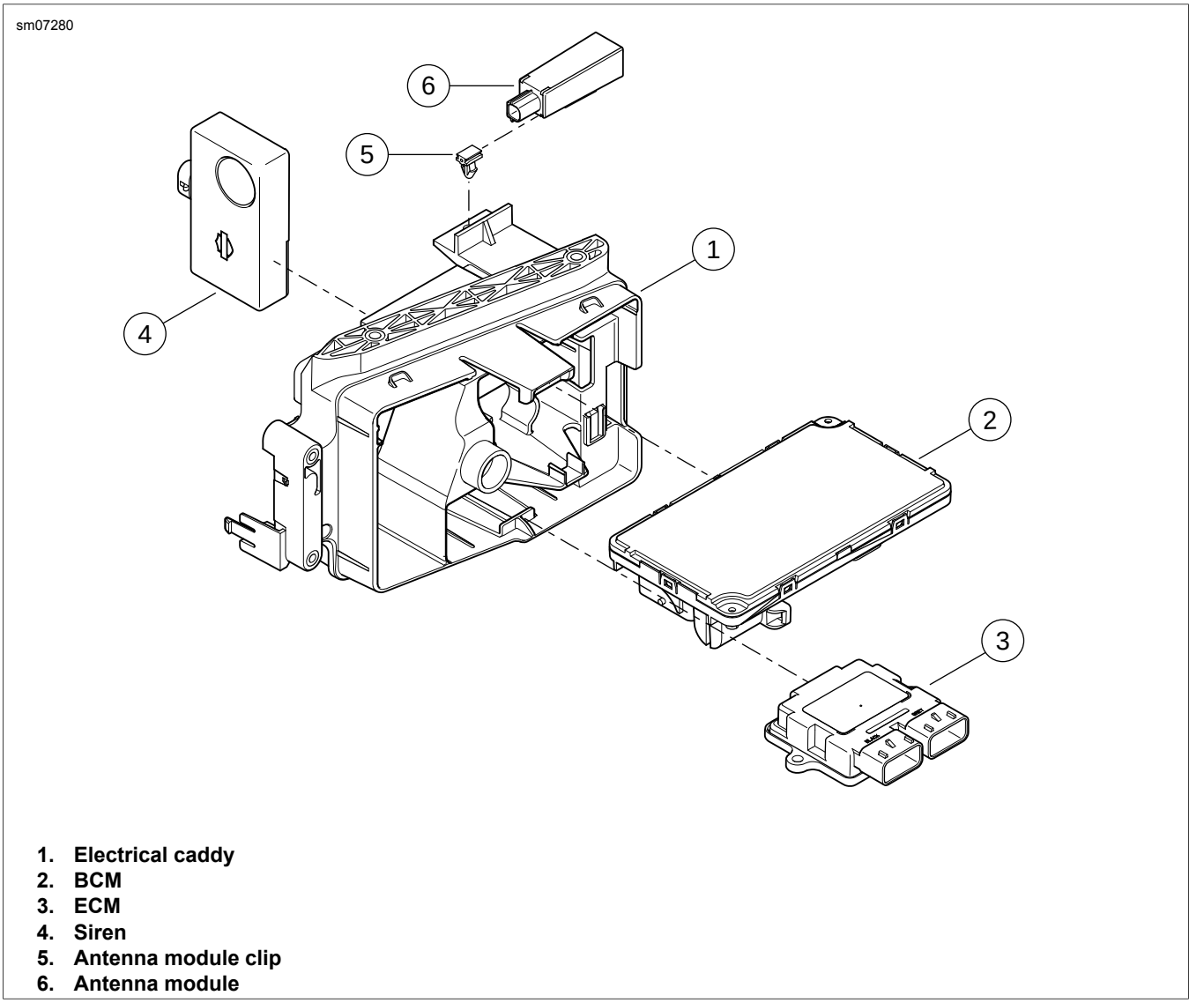
REMOVAL

1. Remove electrical caddy cover from left side of vehicle.

⚠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 7.8 FUSES.
3. See Figure 7-6. Slide BCM (2) out of electrical caddy (1).
4. Disconnect electrical connectors [259] BCM battery power (Bk), [242] BCM (Bk) on the Body Control Module.



1. **Electrical caddy**
2. **BCM**
3. **ECM**
4. **Siren**
5. **Antenna module clip**
6. **Antenna module**

Figure 7-6. Electrical Caddy Components

INSTALLATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

NOTES

- *All replacement BCMs are configured for keyless ignition. If the RUN/STOP switch is in the RUN position when the BCM is replaced and the battery is reconnected, 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.*
- *If ignition is cycled ON when BCM is not secured in electrical caddy, the lights may cycle ON for 2 seconds and the word "tip" will be displayed on the odometer.*

1. Verify ignition and RUN/STOP switches are in the OFF position.
2. See Figure 7-3. Connect both BCM connectors [259], [242] and install BCM (2) into electrical caddy.
3. Install main fuse.
4. Turn ignition switch to ON to configure BCM for keyed ignition operation.

NOTE

Use DIGITAL TECHNICIAN II (Part No. HD-48650) for configuration and password learning after replacing BCM.

5. Configure BCM.

⚠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 of all components, both ignition and lights.

SECURITY SIREN 7.6

REMOVAL

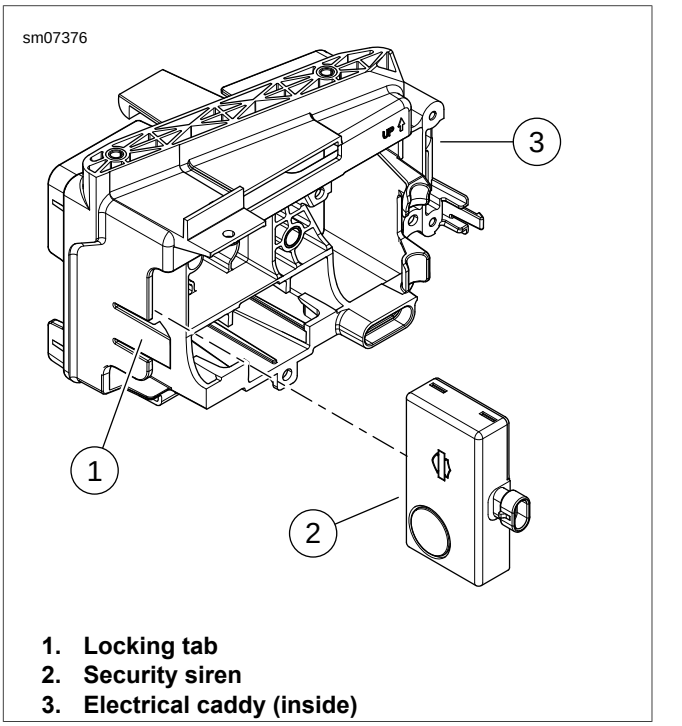
NOTE

For information on the anti-theft module and antenna for vehicles sold in the Brazilian market, see the electrical diagnostic manual.

1. Disarm security system if equipped.
2. Remove electrical caddy. See 7.3 ELECTRICAL CADDY.
3. See Figure 7-7. Remove security siren (2) from electrical caddy.

INSTALLATION

1. See Figure 7-7. Install security siren (2) into back of electrical caddy.
2. Install electrical caddy. See 7.3 ELECTRICAL CADDY.
3. Test security system if equipped.



1. **Locking tab**
2. **Security siren**
3. **Electrical caddy (inside)**

Figure 7-7. Security Siren

SPARK PLUG CABLES 7.7

REMOVAL

⚠WARNING

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

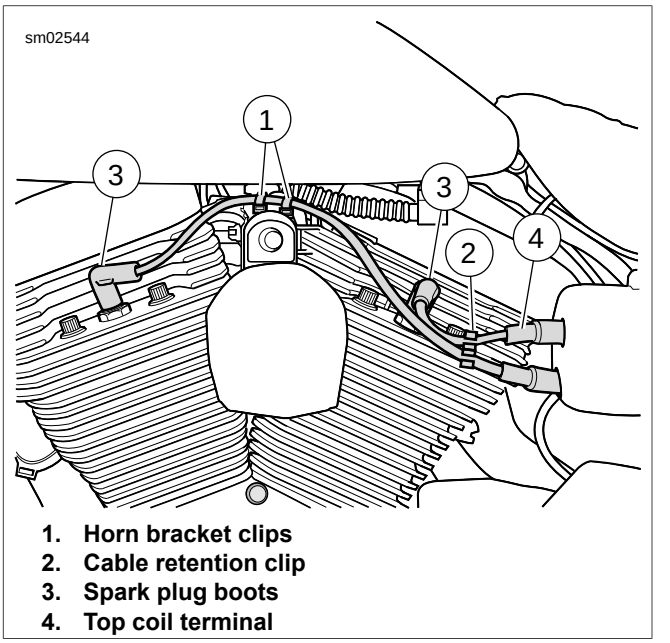
NOTE

When disconnecting spark plug cable, grasp and pull on the rubber boot at the end of the cable assembly. Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

1. Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.
2. See Figure 7-8. Remove clips (1) on horn bracket for front spark plug cable.

INSTALLATION

1. See Figure 7-8. Connect spark plug cables to ignition coil and spark plugs. Rear cylinder plug cable attaches to top coil terminal (4). Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.
2. Secure front spark plug cable to horn bracket with clips (1).
3. Install cable retention clip (2) over spark plug cables. Be sure clip is 1.5-2.0 in. (38.1-50.8 mm) from spark plug boots (3).



1. **Horn bracket clips**
2. **Cable retention clip**
3. **Spark plug boots**
4. **Top coil terminal**

Figure 7-8. Spark Plug Cable Routing

FUSES 7.8

GENERAL

See Figure 7-10. The fuse block is under the electrical caddy cover. The block contains a 40 ampere main fuse and two 15 ampere fuses.

REPLACEMENT

1. Disarm security system if equipped.
2. Make sure ignition switch is turned OFF.
3. See Figure 7-9. Remove the electrical caddy cover.
4. See Figure 7-10. Remove main fuse.
5. Remove suspect fuse.
6. Plug in **new** fuse.
7. Install main fuse.
8. Install the electrical caddy cover.

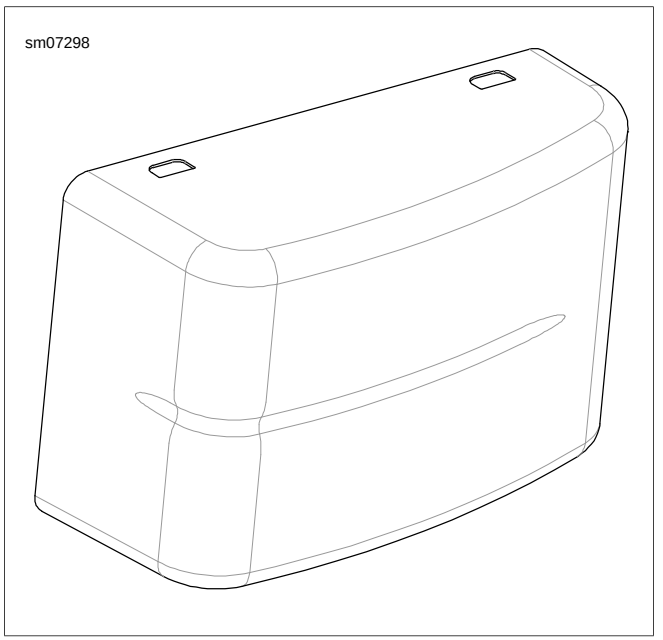
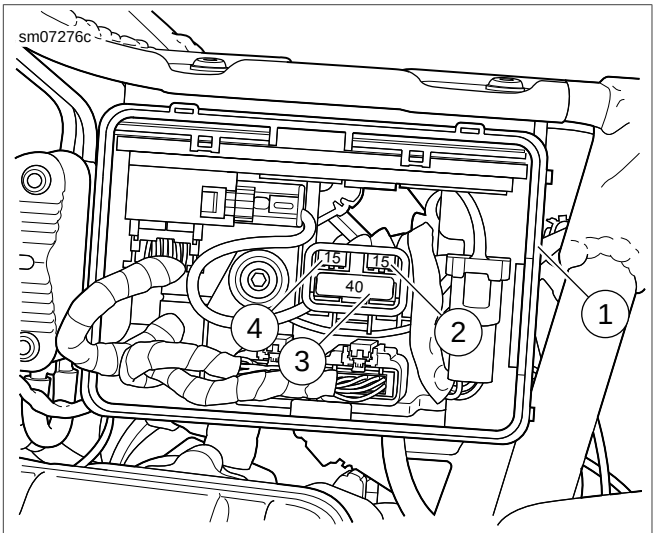


Figure 7-9. Electrical Caddy Cover



1. **Electrical caddy**
2. **P&A fuse, 15 ampere**
3. **Main fuse, 40 ampere**
4. **Battery fuse, 15 ampere**

Figure 7-10. Fuses/Electrical Caddy

IGNITION SWITCH/FORK LOCK 7.9

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)

Dyna 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.

NOTES

- *FXDL models have a combination ignition switch/fork lock. To replace the ignition switch/fork lock, see 7.9 IGNITION SWITCH/FORK LOCK, FXDL Models.*
- *The fork lock on FXDF, FXDC, FXDWG, FXDB and FLD models is similar to the ignition switch/fork lock on FXDL models. To replace the fork lock only on FXDF, FXDC, FXDWG, FXDB and FLD models, see 7.9 IGNITION SWITCH/FORK LOCK, FXDL Models.*
- *To replace the ignition switch only on FXDC, FXDF, FXDWG, FXDB and FLD models, see 7.9 IGNITION SWITCH/FORK LOCK, FXDC, FXDF, FXDWG, FLD, FXDB/P/A Models: Ignition Switch Only.*

Table 7-5. Key Switch Functions and Positions: 2013 Dyna Models

MODEL	LOCATION AND OPERATION	SWITCH POSITION	FUNCTION
FXDL	On the right front of the motorcycle on the steering head. To unlock the switch and the front fork, push the key in and turn it counterclockwise. HDI: Press the lever/key (international) in and turn it clockwise to OFF. Verify by moving key to either position. **Fork Lock:** To lock the fork, move the fork to the full left position. Push down on key and turn it to the right, clockwise, to the closed lock icon. Remove the key.	OFF	Ignition, lamps and accessories are off.
		ACC*	Accessories and hazard warning flasher can be turned on. Instrument lamps are on. Brake lamp and horn can be activated. Key may be removed except on international models.
		IGNITION*	Ignition, lamps and accessories are on.
FXDC, FXDF, FXDWG, FLD, FXDB/P/A	Switch is on fuel tank instrument panel. Switch is locked or unlocked by lifting switch cover, inserting key and turning key counter-clockwise to lock or clockwise to unlock. Key may be removed in any position. **Fork Lock:** The fork lock is on the right front on the steering head. Insert the ignition and fork lock key. Press the key to turn the lock to the closed lock icon. Remove the key. To unlock the fork lock, insert key and press to turn the lock to the open lock icon. Remove the key.	OFF	Ignition, lamps and accessories are off.
		ACC*	Accessories are on. Hazard warning flashers can be operated. Instrument lamps are on. Brake lamp and horn can be activated.
		IGNITION*	Ignition, lamps and accessories are on.
*International models have an additional function-position lamp and tail lamp are also on.			

FXDL MODELS

PART NUMBER	TOOL NAME
HD-47853	IGNITION SWITCH/FORK LOCK WRENCH

⚠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)

Removal

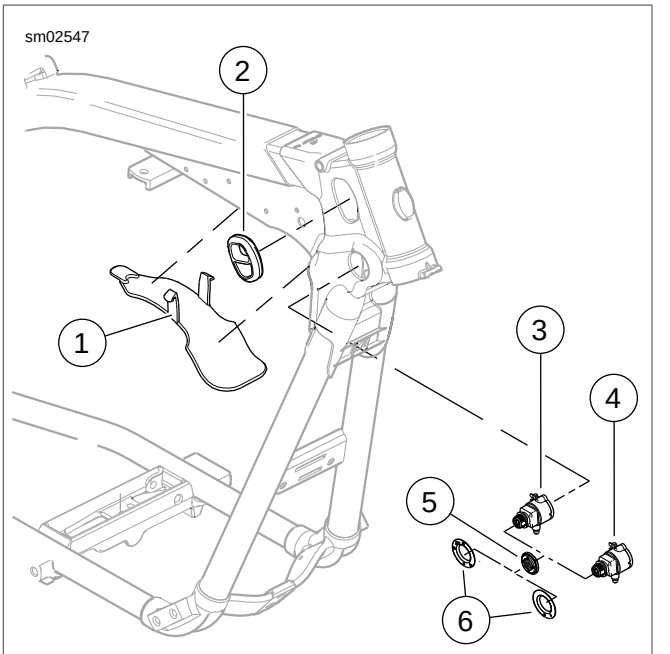
1. Remove seat.

2. Purge the fuel supply line of high pressure gasoline.
   a. Remove instrument console. See 7.21 INSTRUMENTS: FXDC, FXDF AND FLD or 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
   b. Unplug fuel pump connector.
   c. Start the engine and allow the vehicle to run.
   d. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

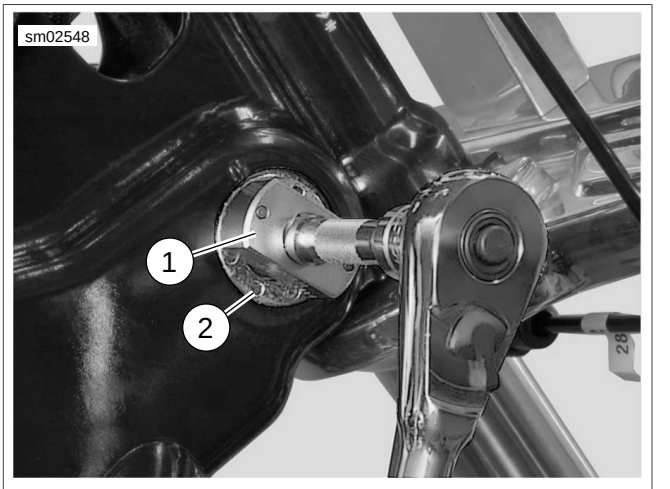
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

3. Disconnect negative battery cable.
4. Disconnect console wiring.
5. Gain access to the ignition switch fork/lock wiring by removing fuel tank hardware and fuel line. Carefully pivot tank upward and prop in position. See 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
6. See Figure 7-11. Remove harness shield (1) by pushing both tabs of shield in at the same time.
7. While leaving harness connectors engaged, pull harness connectors from inside frame.
8. Remove decal (6).
9. See Figure 7-12. Place IGNITION SWITCH/FORK LOCK WRENCH (Part No. HD-47853) (1) on face nut (2). Turn ignition switch/fork lock wrench clockwise to loosen face nut. Turn face nut clockwise until it bottoms on ignition switch/fork lock.
10. See Figure 7-13. Remove plug from fork lock boss cavity (4).
11. Rotate ignition switch/fork lock (2) clockwise to allow fork lock boss (3) to clear fork lock cavity (4). Remove ignition switch/fork lock from frame.
12. On FXDL models, remove connector from ignition switch/fork lock.



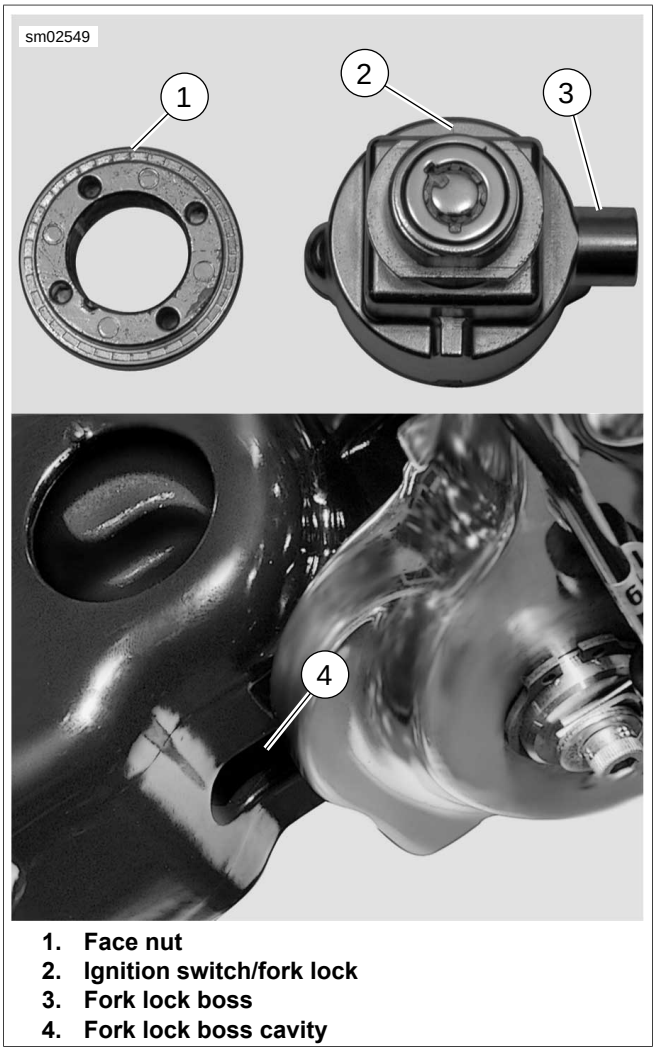
1. **Harness shield**
2. **Grommet (2)**
3. **Fork lock (FXDC, FXDF, FXDWG, FLD and FXDB models)**
4. **Ignition switch/fork lock (FXDL models)**
5. **Face nut**
6. **Decal**

Figure 7-11. Harness Shield



1. **Ignition switch/fork lock wrench**
2. **Face nut**

Figure 7-12. Ignition Switch/Fork Lock Wrench



1. **Face nut**
2. **Ignition switch/fork lock**
3. **Fork lock boss**
4. **Fork lock boss cavity**

Figure 7-13. Fork Lock/Ignition Switch

Installation

1. See Figure 7-13. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of face nut (1).
2. Install face nut on ignition switch/fork lock (2). Turn face nut clockwise until it bottoms on ignition switch/fork lock.
3. Install connector on ignition switch/fork lock.
4. With fork lock boss (3) facing front of vehicle, install ignition switch/fork lock into frame.
5. Install plug into fork lock boss cavity (4).
6. See Figure 7-14. Align flats on ignition switch/fork lock with slots (2) in fork lock cavity (1).

NOTE

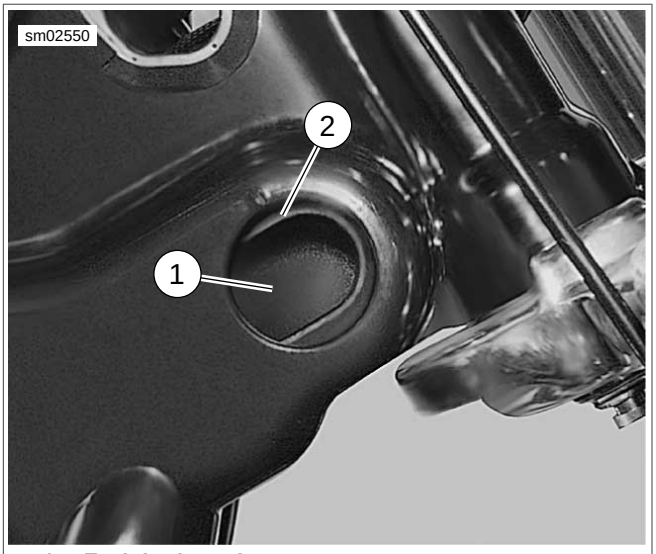
In next step, setting fork lock in the "locked" position may ease installation.

7. See Figure 7-13. Rotate ignition switch/fork lock until fork lock boss (3) engages fork lock boss cavity (4).
8. To verify proper fork lock positioning, hold ignition switch/fork lock as far forward as possible in frame while tightening.
9. See Figure 7-12. Using IGNITION SWITCH/FORK LOCK WRENCH (Part No. HD-47853), turn face nut counter-clockwise until tight.
10. See Figure 7-11. Install decal (6).
11. Remove and save key code tag (on key ring with two keys). Key code is not marked on keys.
12. Push wiring harness into frame. Install harness shield by installing tab of shield into frame first then engaging tabs in holes in frame.
13. Place fuel tank into position and tighten hardware. Connect fuel line. See 4.4 FUEL TANK.
14. Install console wiring.
15. Install instrument console.
    a. For FXDC, FXDF and FLD models, see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
    b. For FXDL, FXDB/P/A and FXDWG models, see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
16. 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)

17. Install seat.
18. Test vehicle and fork lock operation. Refer to Table 7-6.



1. **Fork lock cavity**
2. **Slot**

Figure 7-14. Fork Lock/Ignition Switch Cavity

Table 7-6. Key Switch Functions and Positions: 2013 Dyna Models

MODEL	LOCATION AND OPERATION	SWITCH POSITION	FUNCTION
FXDL	On the right front of the motorcycle on the steering head. To unlock the switch and the front fork, push the key in and turn it counterclockwise. HDI: Press the lever/key (international) in and turn it clockwise to OFF. Verify by moving key to either position. **Fork Lock:** To lock the fork, move the fork to the full left position. Push down on key and turn it to the right, clockwise, to the closed lock icon. Remove the key.	OFF	Ignition, lamps and accessories are off.
		ACC*	Accessories and hazard warning flasher can be turned on. Instrument lamps are on. Brake lamp and horn can be activated. Key may be removed except on international models.
		IGNITION*	Ignition, lamps and accessories are on.
FXDC, FXDF, FXDWG, FLD, FXDB/P/A	Switch is on fuel tank instrument panel. Switch is locked or unlocked by lifting switch cover, inserting key and turning key counter-clockwise to lock or clockwise to unlock. Key may be removed in any position. **Fork Lock:** The fork lock is on the right front on the steering head. Insert the ignition and fork lock key. Press the key to turn the lock to the closed lock icon. Remove the key. To unlock the fork lock, insert key and press to turn the lock to the open lock icon. Remove the key.	OFF	Ignition, lamps and accessories are off.
		ACC*	Accessories are on. Hazard warning flashers can be operated. Instrument lamps are on. Brake lamp and horn can be activated.
		IGNITION*	Ignition, lamps and accessories are on.
*International models have an additional function-position lamp and tail lamp are also on.			

FXDC, FXDF, FXDWG, FLD, FXDB/P/A MODELS: IGNITION SWITCH ONLY

FASTENER	TORQUE VALUE	
Console mounting screws: FXDC, FXDF, FXDWG, FLD, FXDB/P/A	41-49 **in-lbs**	4.6-5.5 Nm

1. Remove seat.

⚠WARNING

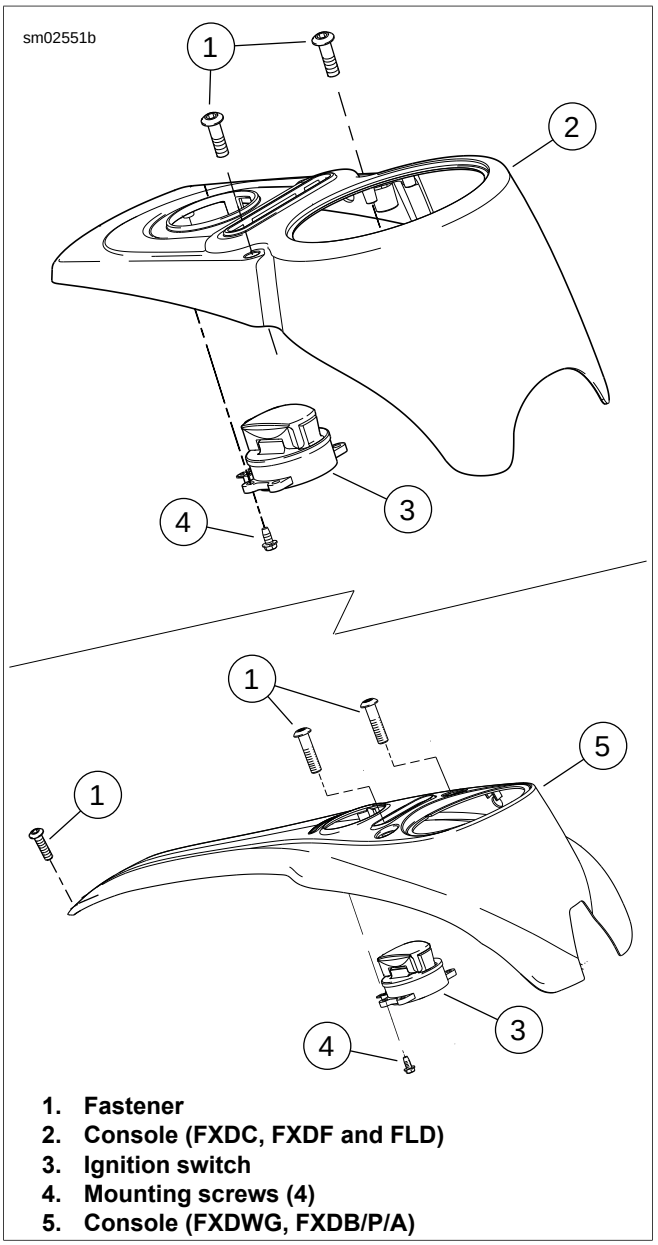
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. See Figure 7-15. Remove fasteners (1) from console (2 or 5) and remove console. Note position and color of the switch wire connectors. Disconnect wires.
4. Remove mounting screws (4). Replace switch (3).
5. Reconnect switch wire connectors in their original positions.
6. Install instrument panel with fasteners. Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).
7. 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)

8. Install seat.
9. Test vehicle operation. Refer to Table 7-6.



1. Fastener
2. Console (FXDC, FXDF and FLD)
3. Ignition switch
4. Mounting screws (4)
5. Console (FXDWG, FXDB/P/A)

Figure 7-15. Ignition Switch: FXDC, FXDF, FXDWG, FLD, FXDB/P/A

BATTERY TRAY AND BATTERY CABLES 7.10

BATTERY TRAY

FASTENER	TORQUE VALUE	
Battery tray screws	96-120 **in-lbs**	10.8-13.6 Nm

NOTES

- *Record routing and retention points before removing battery cables.*
- ***ABS models:** the ABS module is located below the battery tray. Install tray by tipping top of tray inward first, then swing bottom of tray inward.*

Removal

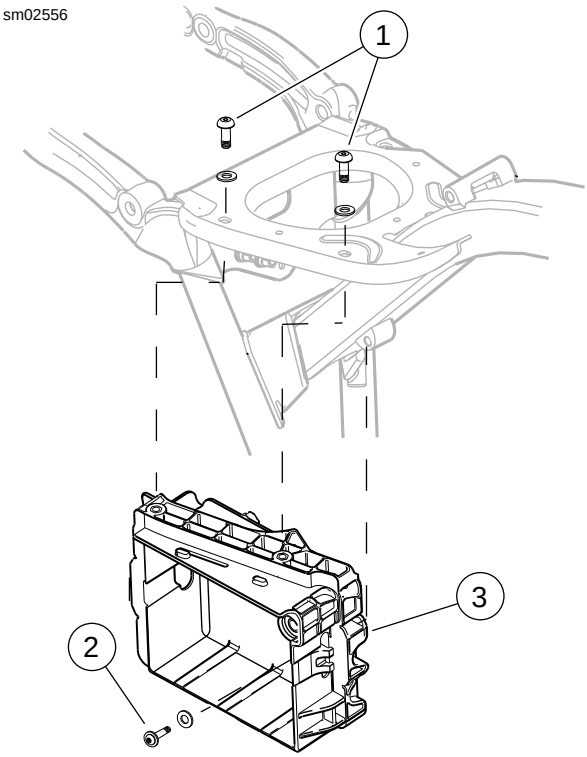
1. **ABS models:** remove ABS heat shield.
2. Remove battery. See 1.20 BATTERY MAINTENANCE, Disconnection and Removal.
3. See Figure 7-16. Remove two top screws and washers (1).
4. Remove screw and washer (2).
5. Guide battery cables out through holes in rear of battery tray (3) and remove tray.

Installation

NOTE

***ABS models:** make sure that rear wheel speed sensor wires are routed so that they are not pinched during installation. Also, make sure that rear brake line is routed so that it is not pinched during installation.*

1. Guide battery cables through holes in rear of battery tray (3) and place tray in position.
2. See Figure 7-17. Place battery cables in recesses at upper corners of battery tray.
3. See Figure 7-16. Install screws and washers (1, 2). Tighten to 96-120 **in-lbs** (10.8-13.6 Nm).
4. **ABS models:** install ABS heat shield.



1. **Screws and washers (2)**
2. **Screw and washer**
3. **Battery tray**

Figure 7-16. Battery Tray

BATTERY CABLES

FASTENER	TORQUE VALUE	
Starter positive terminal nut	60-80 **in-lbs**	6.8-9.0 Nm
Transmission ground stud nut	96-144 **in-lbs**	10.8-16.3 Nm

Routing

1. See Figure 7-17. Route positive cable from battery positive terminal through upper front hole in battery tray. Continue to route positive battery cable to starter post on right side of chassis.

NOTICE

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

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)

NOTICE

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

WARNING

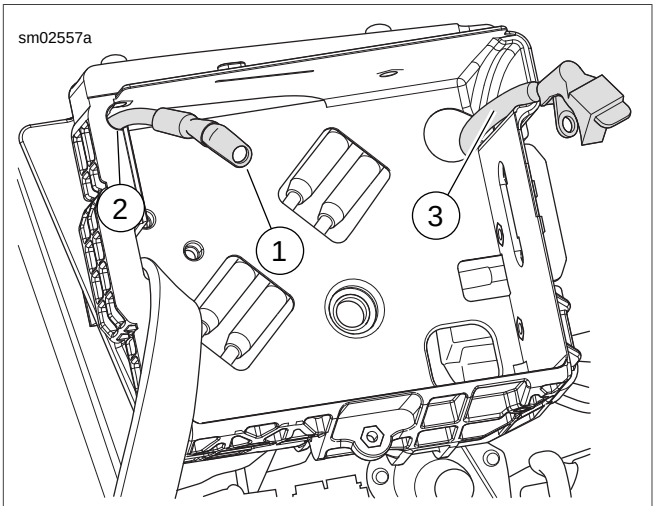
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

2. See Figure 7-18 and Figure 7-19. Install positive battery cable to starter post with nut. Orient terminal so cable faces away (towards left side of motorcycle).
   a. Tighten nut to 60-80 **in-lbs** (6.8-9.0 Nm).
   b. Cover nut with protective rubber boot.
3. See Figure 7-19 and Figure 7-21. Route negative battery cable toward left side of motorcycle and then down to transmission ground stud.

NOTE

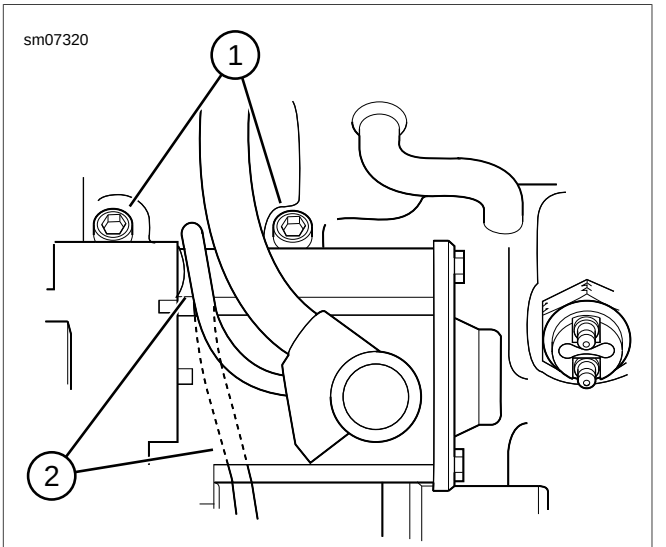
With ground stud nut loosely installed, pull gently on battery ground cable to position it correctly.

4. With negative battery cable installed on transmission ground stud tighten to 96-144 **in-lbs** (10.8-16.3 Nm).
5. See Figure 7-18 and Figure 7-19. Route harness under starter and attach with positive cable.
6. See Figure 7-20. Install battery. Verify that all battery cables are routed correctly.
7. Attach positive cable to battery.
8. Attach negative cable.
9. Secure battery with battery strap and install battery cover.
10. **ABS models:** Install module cover.



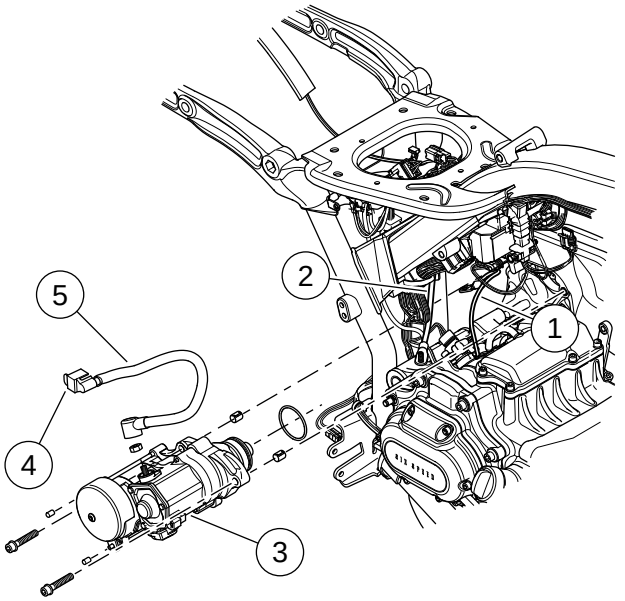
1. **Negative battery cable**
2. **Groove**
3. **Positive battery cable**

Figure 7-17. Battery Cables



1. **Transmission cover screws (2)**
2. **Ring terminal harness (routed under starter)**

Figure 7-18. Starter Cable Connections



1. **Wire from main fuse routed under starter**
2. **Starter motor**
3. **Positive terminal cover**
4. **Positive battery cable**
5. **Negative battery cable**

Figure 7-19. Battery Cables and Starter Motor

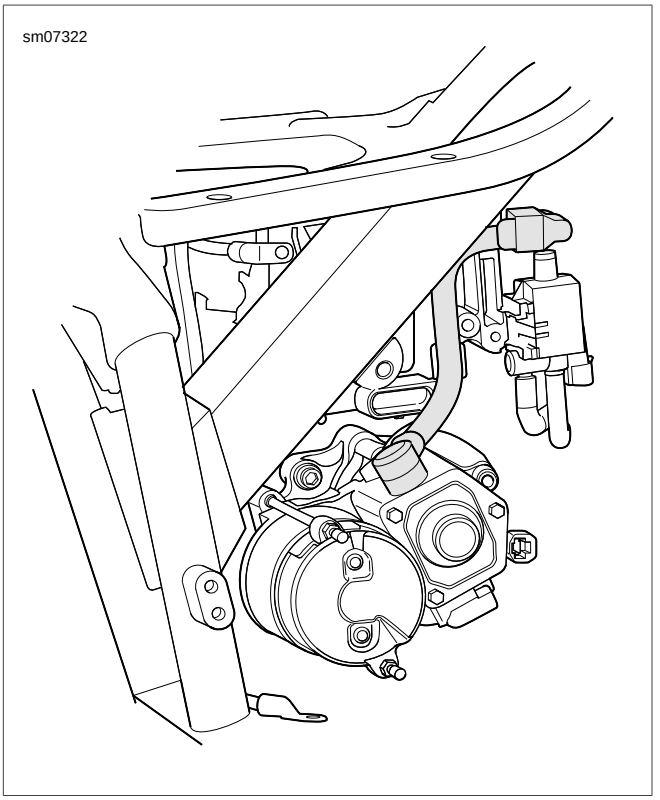


Figure 7-20. Starter Cable Correct Routing From Starter to Battery Area

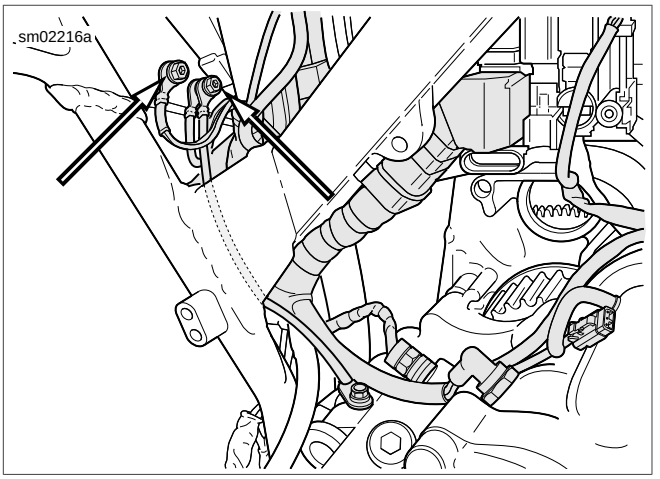


Figure 7-21. Vehicle Ground Studs and Routing

STARTER 7.11

GENERAL

The starter assembly includes a field coil, solenoid and drive assembly.

NOTES

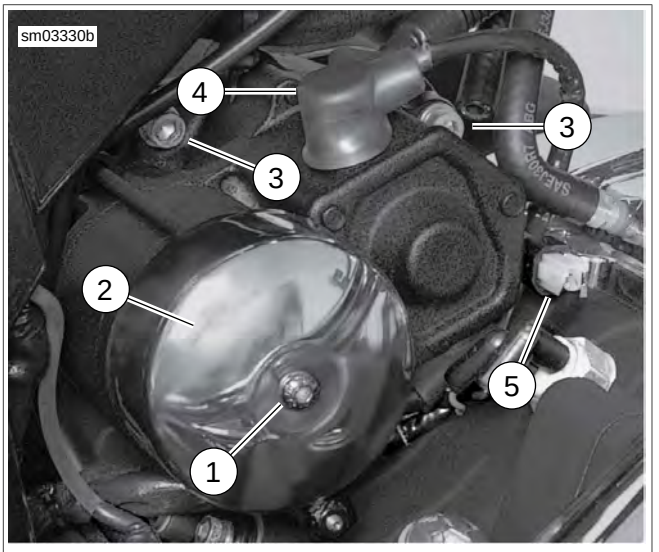
- *For troubleshooting and diagnostic information see the electrical diagnostic manual.*
- *Use touch-up paint as necessary prior to installation. Paint flaking does not require starter replacement.*

REMOVAL

⚠WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. **ABS models:** Remove module cover.
2. Remove battery and battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
3. **ABS models:** Loosen, but do not remove, the fasteners securing the ABS module to the frame.
4. See Figure 7-22. Remove starter cover fastener (1) and starter cover (2) from starter, if applicable.
5. Perform diagnostics if necessary before disassembly.
6. Disconnect starter wiring:
   a. Remove protective boot (4).
   b. Remove nut with washer (metric).
   c. Remove positive battery cable ring terminal.
   d. Detach solenoid wire (5).
7. Remove both starter mounting bolts and washers (3).
8. Remove starter from right side.
9. Discard starter housing O-ring.



1. **Starter cover fastener***
2. **Starter cover***
3. **Starter mounting fasteners**
4. **Protective boot**
5. **Solenoid wire**

Figure 7-22. Starter (Items marked with an asterisk, not used on all models)

DRIVE ASSEMBLY

FASTENER	TORQUE VALUE	
Starter through bolts	39-65 **in-lbs**	4.4-7.3 Nm
Solenoid terminal post nut	70-90 **in-lbs**	7.9-10.1 Nm
Starter end cover screw	90-110 **in-lbs**	10.1-12.4 Nm

Disassembly

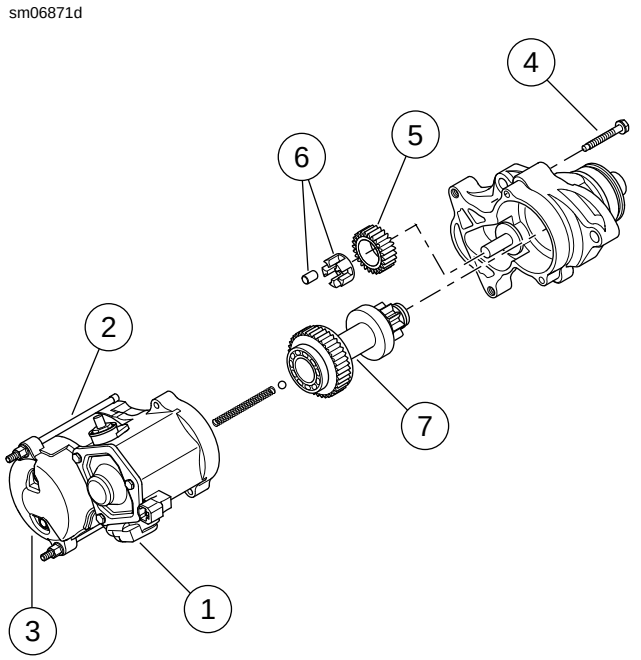
1. Remove end cover if equipped.
2. Remove two nuts to release end cover bracket from through bolts, if equipped.
3. See Figure 7-23. Pull up rubber boot (1) and remove hex nut with captive lockwasher to release field wire from terminal post on solenoid housing.
4. Loosen two through bolts (2) to release 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.



1. **Rubber boot**
2. **Field coil housing through bolts**
3. **Armature housing**
4. **Screws (2)**
5. **Idler gear**
6. **Bearing cage with roller bearings (5)**
7. **Clutch starter sub-assembly**

Figure 7-23. Clutch Starter Sub-Assembly and Housing

Inspection

1. Inspect two O-rings on drive housing for damage. Replace if necessary.
2. See Figure 7-23. 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 7-23.

   Assemble starter.

   a. Lubricate parts with high temperature grease such as LUBRIPLATE 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 LUBRIPLATE 110 before installation. Install **new** clutch starter sub assembly (7) in drive housing seating the larger bearing in the counterbore.
3. Apply a light film of LUBRIPLATE 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.

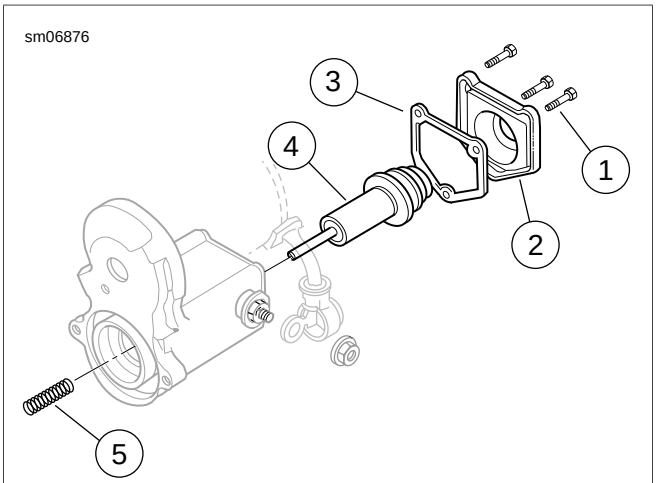
4. Mate the solenoid and drive housings with two screws. Alternately tighten until snug.
5. Install through bolts to fasten field coil to solenoid housing. Tighten to 39-65 **in-lbs** (4.4-7.3 Nm).
6. Secure field wire ring terminal to short post on solenoid housing with hex nut with captive lockwasher. Tighten to 70-90 **in-lbs** (7.9-10.1 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** (10.1-12.4 Nm).

SOLENOID

FASTENER	TORQUE VALUE	
Solenoid contact post jamnut	65-80 **in-lbs**	7.3-9.0 Nm
Starter ring terminal hex nut	60-80 **in-lbs**	6.8-9.0 Nm

Cover and Plunger Removal

1. See Figure 7-24. Remove fasteners (1), cover (2) and gasket (3).
2. Remove the plunger (4) with spring (5).

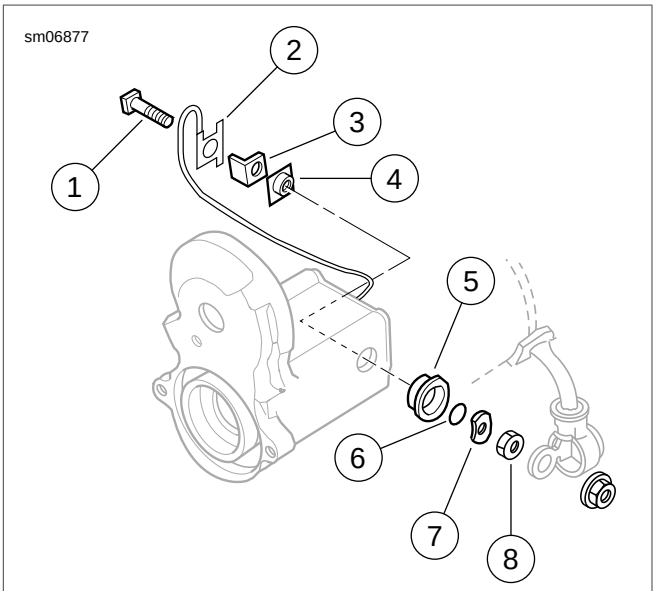


1. **Fasteners**
2. **Cover**
3. **Gasket**
4. **Plunger**
5. **Spring**

Figure 7-24. Soleniod 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 7-25. 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.



1. **Post bolt**
2. **Hold-in terminal**
3. **Contact plate**
4. **Square bushing**
5. **Round bushing**
6. **O-ring**
7. **Wave washer**
8. **Jamnut**

Figure 7-25. Short Post Contact (starter)

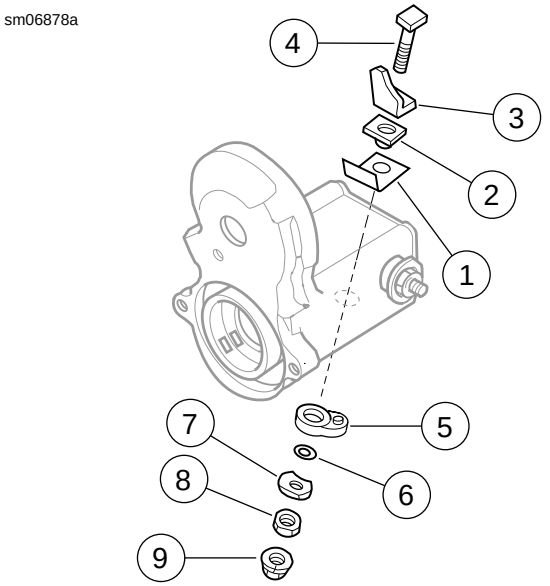
Long Post Contact: Battery Positive

1. See Figure 7-26. Remove the long post contact:
   a. Remove hex nut (9).
   b. Remove jamnut (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 jamnut.



1. **Paper insulator**
2. **Square bushing**
3. **Contact plate**
4. **Post bolt**
5. **Round bushing**
6. **O-ring**
7. **Wave washer**
8. **Jamnut**
9. **Hex nut**

Figure 7-26. Long Post Contact (battery)

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 jamnuts 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 ring terminal.
7. Install the hex nut. Tighten to 60-80 **in-lbs** (6.8-9.0 Nm).

INSTALLATION

FASTENER	TORQUE VALUE	
Starter mounting fasteners	25-27 ft-lbs	33.9-36.6 Nm
Starter positive terminal nut	60-80 **in-lbs**	6.8-9.0 Nm
ABS module bracket	90-114 **in-lbs**	10.2-12.8 Nm

1. Examine two split ring dowel bushings in inner primary housing where starter motor assembly mounts. If dowel bushings are loose, remove bushings and pry open slightly to provide an interference fit in primary housing. Install bushings into primary housing.
2. Install **new** starter housing O-ring.
3. Install starter from right side.
4. See Figure 7-22. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of starter mounting fasteners (3).
5. Install the two starter mounting fasteners (3) and washers. Tighten to 25-27 ft-lbs (33.9-36.6 Nm).

⚠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)

6. See Figure 7-22. Attach positive battery cable, and solenoid wire (5). Tighten nut (metric) to 60-80 **in-lbs** (6.8-9.0 Nm). Place protective boot (4) securely over terminal.
7. Attach starter cover (2) using fastener (1) if present of this model.
8. Install battery tray and battery. See 7.10 BATTERY TRAY AND BATTERY CABLES and 1.20 BATTERY MAINTENANCE.
9. **ABS models:** Install module.
   a. Tighten mounting fasteners securing ABS module bracket to frame.
   b. Tighten to 90-114 **in-lbs** (10.2-12.8 Nm).
   c. Attach ABS module cover.

HEADLAMP 7.12

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, discard bulb and replace. Use only direct replacement bulbs as specified in the Parts Catalogs and 1.4 BULB REQUIREMENTS.

BULB REMOVAL: EXCEPT FOR FLD

NOTICE

Never touch the quartz bulb. Fingerprints 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)

Single Bulb Headlamp

1. See Figure 7-28. Loosen trim ring clamp screw (19) and nut (18). Remove trim ring (17).
2. Remove rubber boot (4) from back of headlamp lens (16).
3. Disconnect headlamp connector (2) from bulb (6) prongs.
4. See Figure 7-27. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

5. Pivot wire retaining clip away from bulb. Remove bulb from headlamp assembly.

NOTE

*Verify connector contacts on **new** bulb are clean before installation.*

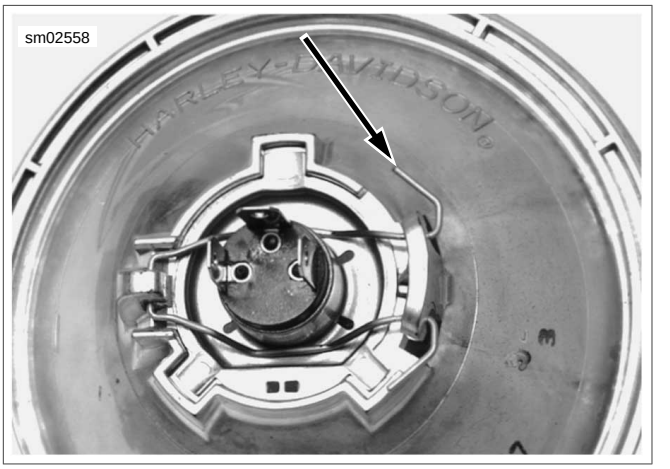
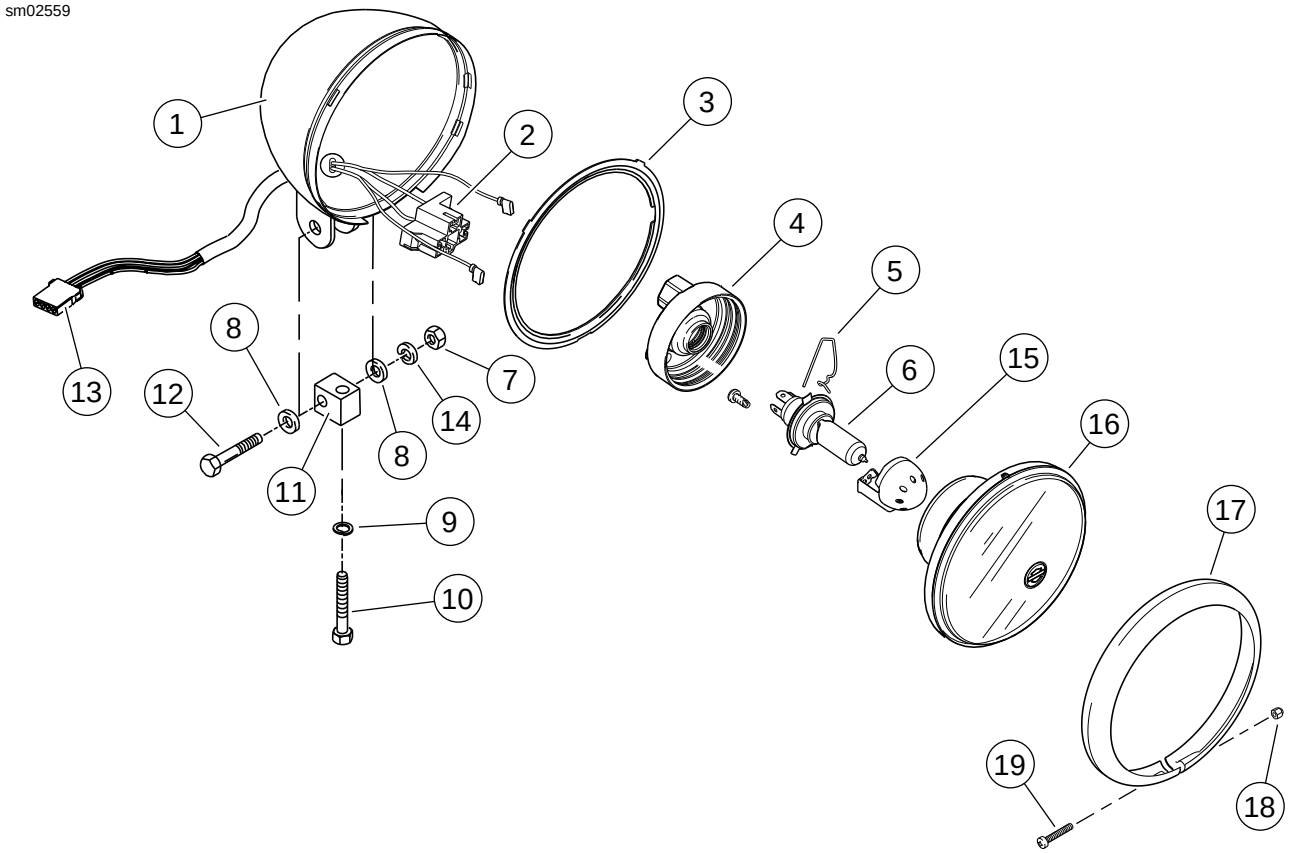


Figure 7-27. Wire Retaining Clip



1. **Headlamp housing**
2. **Headlamp connector**
3. **Adapter ring**
4. **Boot**
5. **Clip**
6. **Bulb**
7. **Vertical adjusting nut**
8. **Washer (2)**
9. **Lockwasher**
10. **Horizontal adjusting bolt**
11. **Mounting block**
12. **Vertical adjusting bolt**
13. **Headlamp housing connector**
14. **Lockwasher**
15. **Bulb shield**
16. **Headlamp lens**
17. **Trim ring**
18. **Nut**
19. **Screw**

Figure 7-28. Single Bulb Headlamp

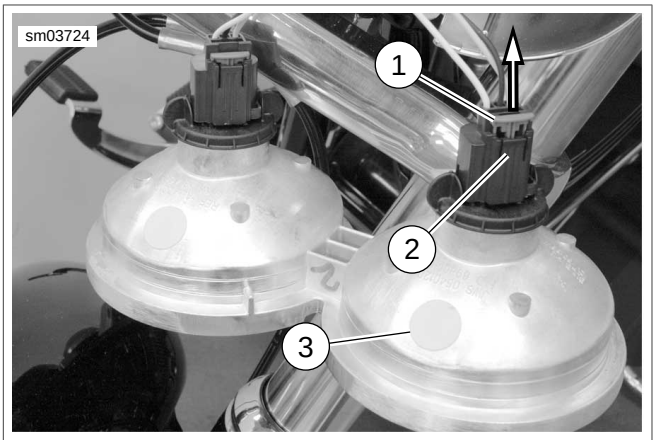
Dual Bulb Headlamp

1. See Figure 7-30. Remove two screws (1) and trim ring (6).
2. Pull reflector assembly (5) away from the headlight housing (2).
3. See Figure 7-29. Raise latch lock (1). Press latch (2) and disconnect connector.

⚠WARNING

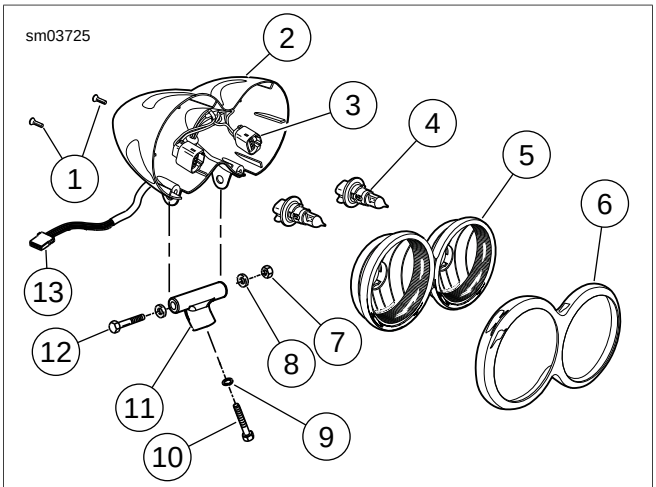
Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

4. Rotate bulb assembly counterclockwise to remove from housing.



1. **Connector lock**
2. **Connector latch**
3. **Vent (yellow dot)**

Figure 7-29. Dual Headlamp Connector



1. **Screw (2)**
2. **Headlamp housing**
3. **Headlamp connector (2)**
4. **Bulb (2)**
5. **Reflector and lens assembly**
6. **Trim ring**
7. **Vertical adjusting nut**
8. **Washer (2)**
9. **Lockwasher**
10. **Horizontal adjusting bolt**
11. **Mounting block**
12. **Vertical adjusting bolt**
13. **Headlamp housing connector**

Figure 7-30. Dual Bulb Headlamp

BULB INSTALLATION: EXCEPT FLD

Install **new** bulb and assemble headlamp components. To adjust light beam, see 1.22 HEADLAMP ALIGNMENT.

NOTES

- ***Single bulb headlamp:*** *When reassembling headlamp, make sure slots and tabs in headlamp, adapter ring and trim ring are aligned.*
- ***Dual bulb headlamp:*** *See Figure 7-29. Verify vents (3) (yellow dots) are UP when installing reflector assembly in housing.*

HEADLAMP ASSEMBLY REMOVAL: EXCEPT FLD

1. Loosen fuel tank to gain access to the headlamp harness connector (13). See 4.4 FUEL TANK.
2. See Figure 7-28 or Figure 7-30. Separate connector (13) [38].
3. Remove bolt (12), nut (7) and washers (8, 14).
4. Remove headlamp assembly.
5. Disassemble and repair headlamp as necessary.

HEADLAMP ASSEMBLY INSTALLATION: EXCEPT FLD

FASTENER	TORQUE VALUE	
Headlight horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm

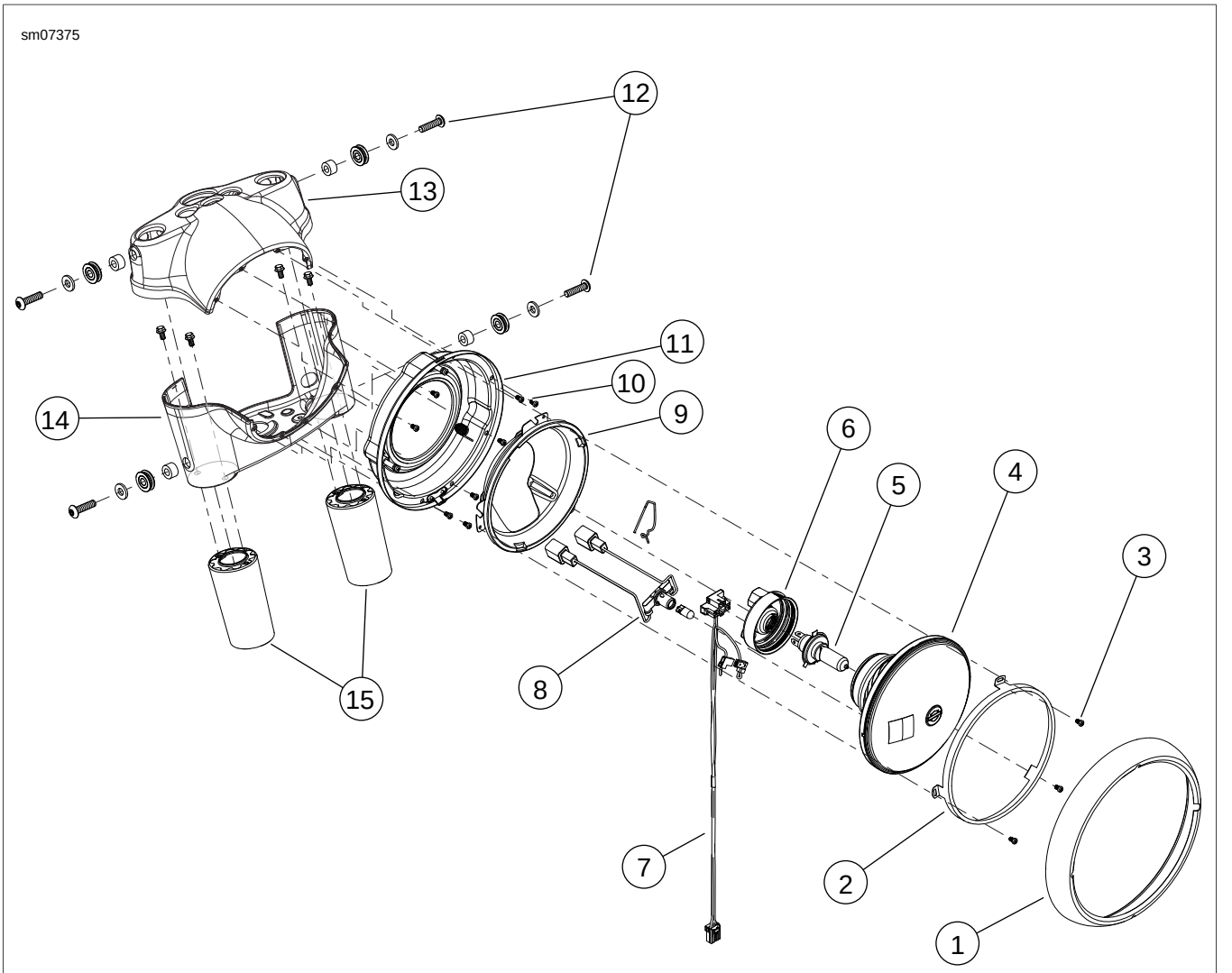
1. See Figure 7-28 or Figure 7-30. Attach headlamp assembly to mount (11) using bolt (12) nut (7) and washers (8, 14).
2. Tighten bolt (10) to 25-30 ft-lbs (33.9-40.7 Nm).
3. Connect electrical harness connector. Attach fuel tank. See 4.4 FUEL TANK.
4. Adjust headlamp alignment. See 1.22 HEADLAMP ALIGNMENT.

HEADLAMP: FLD MODELS

FASTENER	TORQUE VALUE	
Headlamp screws: FLD	7-10 **in-lbs**	0.8-1.1 Nm
Headlamp door screw: FLD	9-18 **in-lbs**	1.0-2.0 Nm

Removal

1. Remove screw at bottom of headlamp door (chrome ring). Remove headlamp door.
2. See Figure 7-31. Remove screws (3) securing headlamp assembly.
3. Remove rubber boot (6) from back of reflector assembly (4).
4. Remove headlamp connector from headlamp bulb (5).



1. **Headlamp door**
2. **Ring assembly**
3. **Screw (3)**
4. **Reflector assembly**
5. **Bulb**
6. **Boot**
7. **Jumper harness**
8. **Terminal flag, HDI**
9. **Mounting ring**
10. **Screw (8)**
11. **Bucket assembly**
12. **Screws, docking hardware for windshield**
13. **Upper nacelle**
14. **Lower nacelle**
15. **Slider cover assembly**

Figure 7-31. Headlamp Assembly: FLD Models

Bulb Replacement

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)

NOTE

The headlamp uses a replaceable quartz halogen bulb. Handle this fragile part with care.

1. See Figure 7-31. Remove reflector assembly (4).
2. Remove rubber boot at back of housing (6).
3. See Figure 7-32. Release wire retaining clip (1) from retainer (2). Swing wire retaining clip out of the way.

NOTE

Loosening retainer screw 1/2-1 turn may assist in releasing clip.

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

4. Remove and discard bulb.

NOTICE

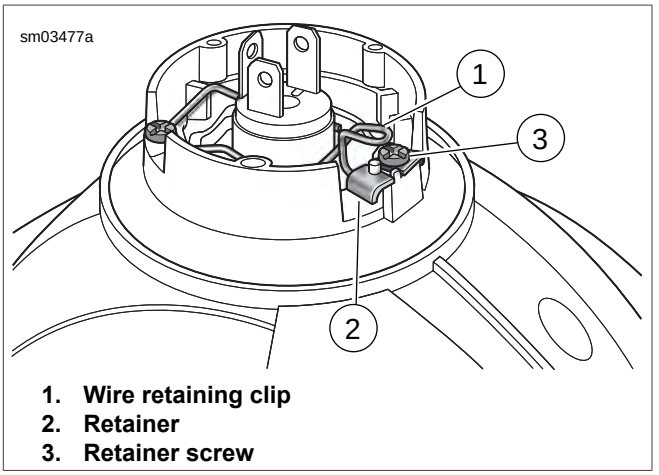
Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Handle the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210b)

5. Install **new** bulb. Align the tab on the bulb with the notch in the headlamp housing.
6. See Figure 7-32. Rotate wire retaining clip (1) into place and latch under lip of retainer (2).

NOTE

If retainer screw was loosened to release wire retaining clip, hold retainer in place and tighten screw until snug. Verify that reflector cone is still centered under decorative logo. If it is not, loosen retainer screw and repeat step until centered.

7. Install rubber boot at back of housing.
8. **HDI models:** Rotate position lamp bulb retainer 1/4 turn counterclockwise to remove. Replace bulb and install bulb retainer in lamp housing.



1. **Wire retaining clip**
2. **Retainer**
3. **Retainer screw**

Figure 7-32. Headlamp Bulb Assembly

Installation

1. Install headlamp connector on headlamp bulb.
2. Install headlamp assembly screws. Tighten to 7-10 **in-lbs** (0.8-1.1 Nm).
3. Fit the headlamp door spring into slot at top of headlamp housing. Secure the headlamp door (chrome ring) with screw. Tighten to 9-18 **in-lbs** (1.0-2.0 Nm).

TAIL LAMP 7.13

GENERAL

FXDC, FLD and FXDL models are equipped with a tail lamp that uses a mini harness and circuit board to simplify replacement.

FXDF uses a similar type assembly, but the lens and base is oriented 180 degrees different from the other models. There is no chrome tail lamp bezel. FXDF also uses a different mini-harness than the other models.

FXDWG (HDI) models use an LED assembly with no replaceable bulb. The cover on the tail lamp is not removable.

FXDWG and FXDB/P domestic models incorporate the stop lamp with the turn signals. See 7.14 TURN SIGNALS.

FXDB Canada models use a center mount license plate lamp with a built in stop lamp.

TAIL LAMP BULB REPLACEMENT: STANDARD STYLE

FASTENER	TORQUE VALUE	
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm

1. See Figure 7-33. Turn ignition switch off.
2. Remove two screws and lens from base.

NOTE

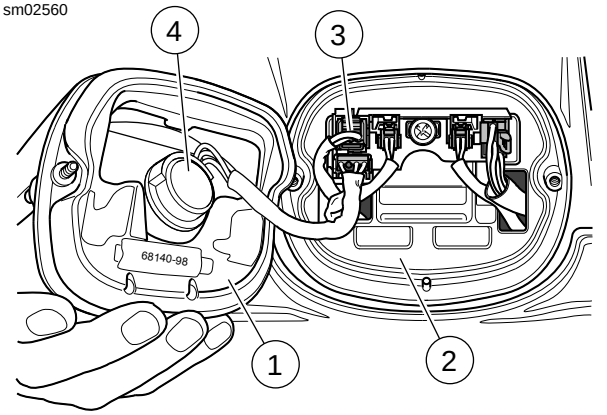
Disconnect 4-Pin multilock connector from circuit board to simplify bulb removal.

3. Remove bulb assembly from lens. Remove bulb from socket.
4. Coat base of **new** bulb with ELECTRICAL CONTACT LUBRICANT. Install **new** bulb in socket.
5. Install bulb assembly to lens.
6. If removed, 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).

⚠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 and test for proper tail lamp operation.



1. **Lens**
2. **Base**
3. **4-Pin multilock connector**
4. **Bulb assembly**

Figure 7-33. Tail Lamp: FXDC, FLD and FXDL Models

BASE REPLACEMENT: ALL BUT FXDB/P/A AND FXDWG

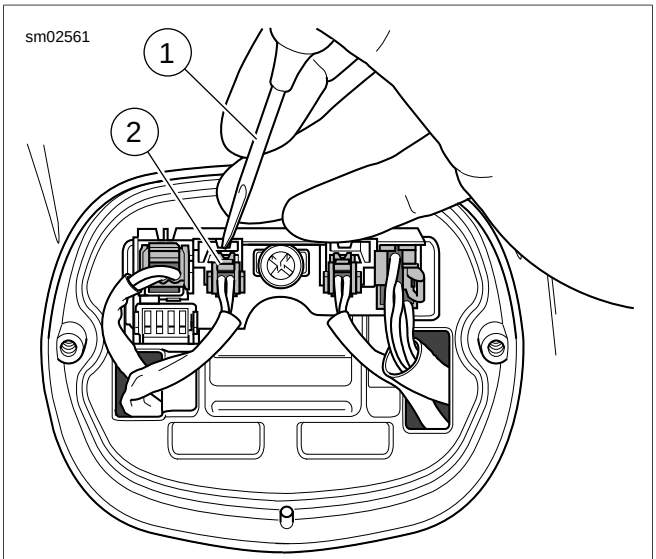
FASTENER	TORQUE VALUE	
Tail lamp base screws: all but FXDB/P/A, FXDWG	40-48 **in-lbs**	4.5-5.4 Nm
Tail lamp lens screws: all but FXDB/P/A, FXDWG	20-24 **in-lbs**	2.3-2.7 Nm

1. See Figure 7-33. Remove two screws and lens from base.
2. Press locking tab and remove 4-Pin multilock connector from pin housing.
3. See Figure 7-34. Using a terminal pick or small screwdriver, press locking tabs and remove two 2-Pin turn signal connectors and 6-Pin Power In connector from pin housing.
4. See Figure 7-35. Remove screw, pin housing and circuit board from base.

NOTE

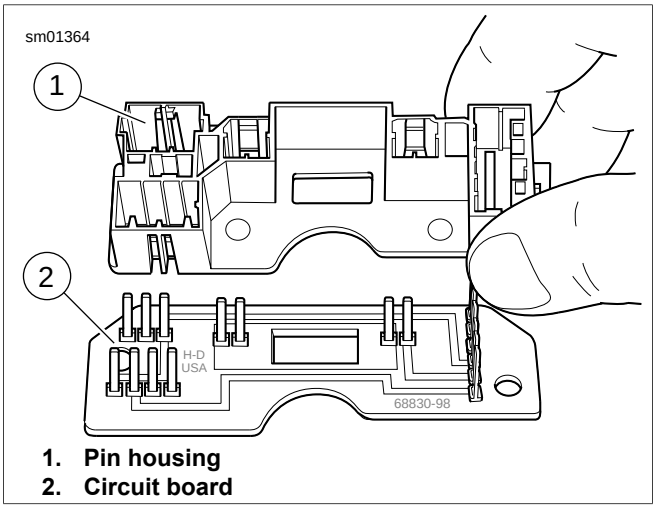
The circuit board is a press fit in the tail lamp housing. FXDF models require no screw to hold it in place.

5. Remove two nuts, screws and base from rear fender.
6. Install **new** base to rear fender with two screws and nuts. Tighten to 40-48 **in-lbs** (4.5-5.4 Nm).
7. Install circuit board/pin housing to base with screw. Circuit board snaps in on bottom.



1. **Terminal pick**
2. **2-Pin connector**

Figure 7-34. Removing 2-Pin Connectors



1. **Pin housing**
2. **Circuit board**

Figure 7-35. Pin Housing and Circuit Board

8. See Figure 7-36. Install connectors to pin housing.
9. Install lens to base with two screws. Tighten to 20-24 **in-lbs** (2.3-2.7 Nm).

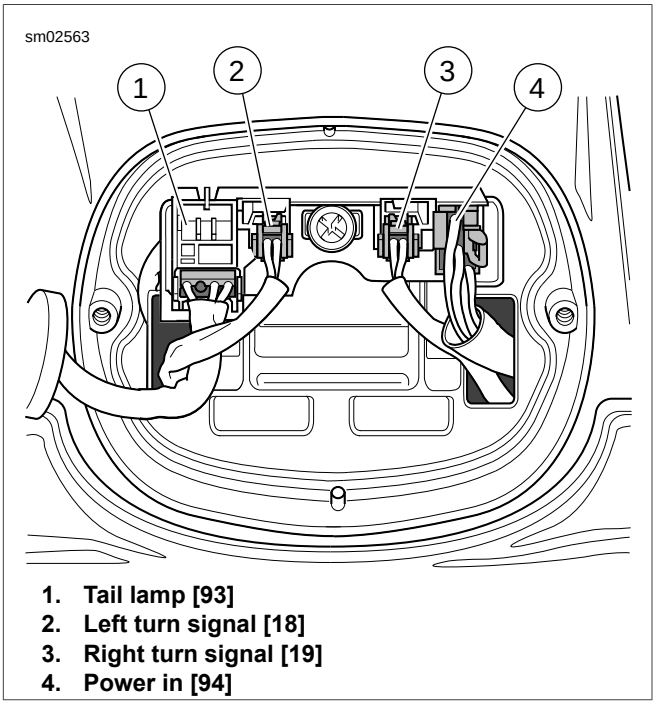
⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

10. Turn ignition on. Test for proper tail lamp and turn signal operation.

NOTE

Refer to Table 7-7. Cavity numbers are on back side of secondary locks. All FXDF components are oriented 180 degrees from above and the turn signal connectors are reversed.



1. **Tail lamp [93]**
2. **Left turn signal [18]**
3. **Right turn signal [19]**
4. **Power in [94]**

Figure 7-36. Wire Location at Connectors

Table 7-7. Tail Lamp Wires: All but FXDB/FXDWG

FUNCTION	NO.	TYPE	WIRE COLOR	CAVITY
Right turn signal	[19]	2-pin Multilock	V/BN	1
			BK	2
Left turn signal	[18]	2-pin Multilock	V/BN	1
			BK	2
Tail lamp	[93]	4-pin Multilock	BE	1
			HDI only-O/W or open on domestic models	2
			R/Y	3
			BK	4

Table 7-7. Tail Lamp Wires: All but FXDB/FXDWG

FUNCTION	NO.	TYPE	WIRE COLOR	CAVITY
Power in	[94]	6-pin Multilock	O/W	1
			BN (V on FXDF)	2
			BE	3
			R/Y	4
			V (BN on FXDF)	5
			BK	6

BASE REPLACEMENT: FXDWG/HDI AND CANADA

FASTENER	TORQUE VALUE	
Tail lamp base screws: FXDWG (HDI and Canada)	66-90 **in-lbs**	7.5-10.1 Nm

NOTE

U.S. only, FXDB/P/A and FXDWG models incorporate the tail lamp in with the turn signals.

1. See Figure 7-37. Remove plastic plug (2) from under rear fender (1).
2. Remove three screws (4).
3. Lift up slightly on tail lamp (3) and disconnect connector (5).

NOTE

While installing tail lamp onto fender, make sure turn signal connectors (6) fit properly into tail lamp housing. Verify that wires do not get pinched between tail lamp and rear fender.

4. Install connector (5) to tail lamp and place tail lamp into position on fender.
5. Install screws (4). Tighten to 66-90 **in-lbs** (7.5-10.1 Nm).
6. Install plastic plug (2).

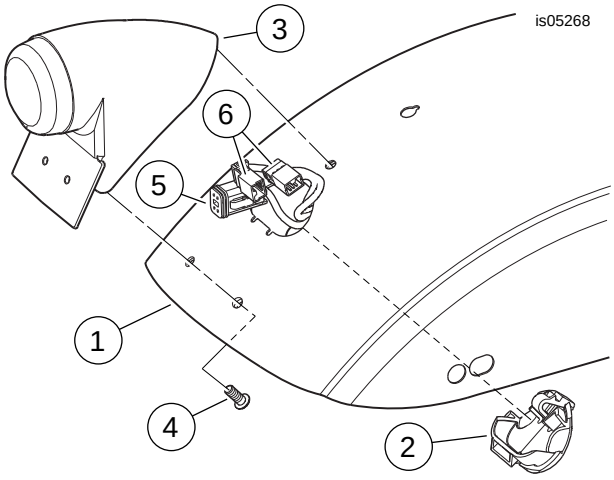
⚠WARNING

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. Turn ignition on. Test for proper tail lamp and turn signal operation.

NOTE

Refer to Table 7-8 for proper wire routing of tail lamp and turn signal connectors.



1. **Rear fender**
2. **Plastic plug**
3. **Tail lamp**
4. **Tail lamp screws (3)**
5. **Gray four-way tail lamp connector**
6. **Four-way turn signal socket housing (2)**

Figure 7-37. Rear Lighting Connections (FXDWG: HDI and Canada Models)

Table 7-8. Tail Lamp Wires: FXDWG

FUNCTION	NO.	TYPE	WIRE COLOR	CAVITY
Right turn signal	[19]	4-pin Multilock	BK	1
			BN	2
			BE	3
			Not used	4

Table 7-8. Tail Lamp Wires: FXDWG

FUNCTION	NO.	TYPE	WIRE COLOR	CAVITY
Left turn signal	[18]	4-pin Multilock	BK	1
			V	2
			BE	3
			Not used	4
Tail lamp	[93]	4-pin Deutsch	Not used	1
			R/Y	2
			O/W	3
			BK	4

TURN SIGNAL BULB REPLACEMENT: BULLET STYLE

1. See Figure 7-38. Insert a coin or the blade of a small screwdriver into the notch at the bottom of the lens cap. Carefully twist until the lens cap pops out of the lamp housing.
2. Push bulb in and rotate counterclockwise. Pull bulb from socket.
3. Inspect condition of electrical contacts in socket. If necessary, clean with a small wire brush and electrical contact cleaner.
4. Apply ELECTRICAL CONTACT LUBRICANT to contacts in socket and at bottom of **new** bulb.
5. Align pins on **new** bulb with pin guides in bulb socket. Push bulb in and turn clockwise to lock in place.
6. Snap lens cap onto the lamp housing with notch at bottom.

⚠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. Test lamp operation.

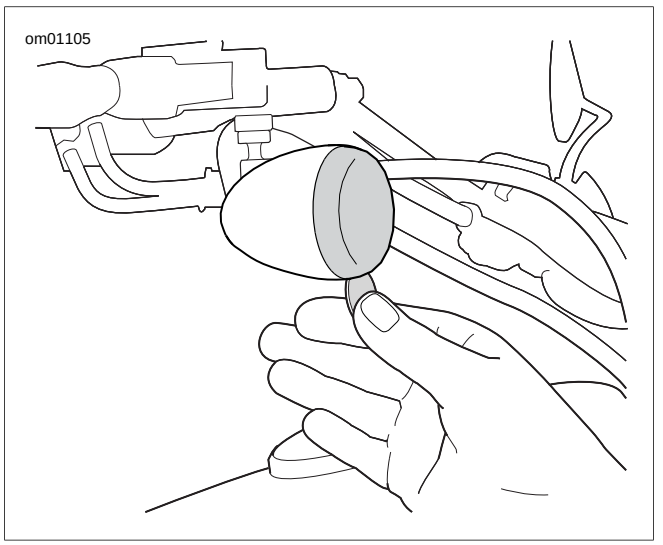


Figure 7-38. Turn Signal Lens Removal: Bullet Style

FRONT LAMP HOUSING REPLACEMENT: ALL EXCEPT FLD

NOTE

On FXDF and FXDB models, the turn signal wiring is routed through the lower switch housings, and the handlebar control modules are replaced with the turn signal lamps as an assembly.

⚠WARNING

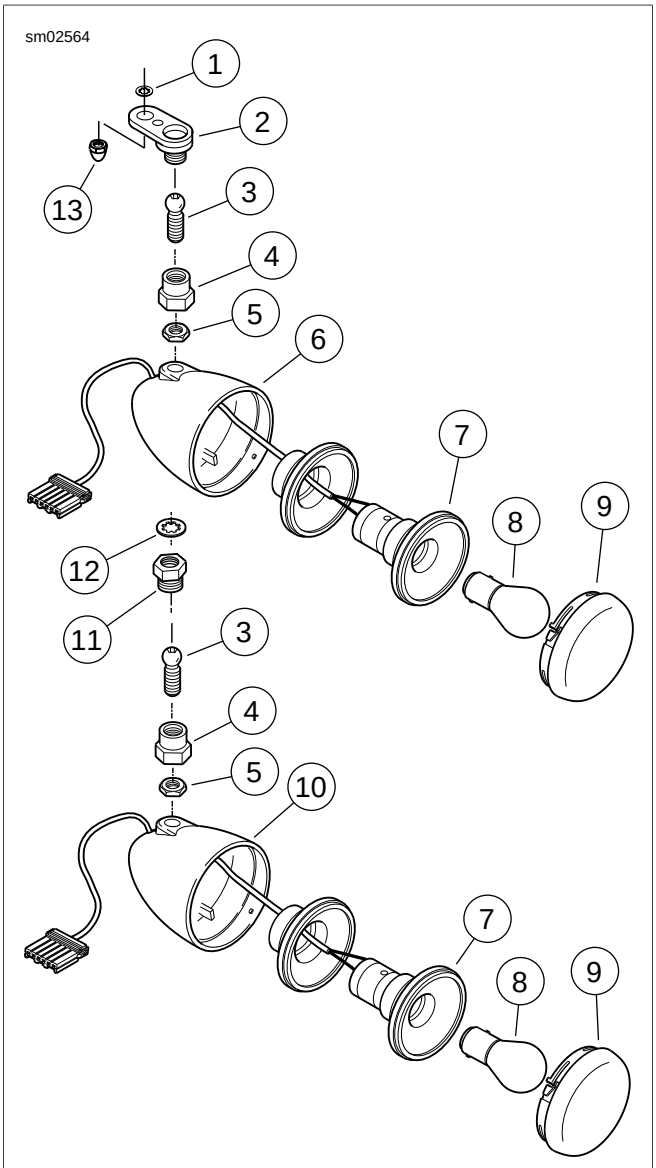
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.

NOTE

Before removing turn signal wires, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

2. Remove fuel tank fasteners, vent, fuel supply fitting and slide fuel tank back. See 4.4 FUEL TANK.
3. Unplug fuel gauge connector [117].
4. Disconnect turn signal connector and cut cable straps around turn signal wire conduit.
5. Remove turn signal lamp wires from multilock connector. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.



1. **Lockwasher**
2. **Ball receptacle**
3. **Ball stud**
4. **Ball stud clamp**
5. **Jamnut**
6. **Left lamp housing**
7. **Socket assembly**
8. **Bulb**
9. **Lens**
10. **Right lamp housing**
11. **Retainer**
12. **Lockwasher**
13. **Acorn nut**

Figure 7-39. Front Turn Signals

6. See Figure 7-39. Remove lamp housing:
   a. For left side housing, loosen ball stud clamp (4) until turn signal assembly is free from ball receptacle (2). Loosen jamnut (5) and remove ball stud (3) and ball stud clamp from lamp housing.
   b. For right side housing, loosen ball stud clamp (4) until turn signal assembly is free from retainer (11). Loosen jamnut (5) and remove ball stud (3) and ball stud clamp from lamp housing.
7. Pull turn signal wires from conduit and remove turn signal lamp housing.
8. Lay old turn signal lamp housing next to **new** one and cut **new** wires to length. Crimp **new** terminals onto wires. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
9. Install ball stud, ball stud clamp and jamnut in **new** lamp housing.
10. Install lamp housing:
    a. For left side housing, loosely install ball stud clamp to ball receptacle. Tighten jamnut.
    b. For right side housing, loosely install ball stud clamp to ball retainer. Tighten jamnut.
11. Using attached wire, pull turn signal wiring through conduit. Route wiring to connector location under fuel tank.
12. Install turn signal lamp wires in proper locations in multilock connector.
13. Connect turn signal connector [31]. install connector inside frame backbone.
14. Connect fuel gauge connector.
15. Install fuel tank.
16. Connect negative battery cable.
17. Adjust turn signals:
    a. For left side lamp, adjust position of directional lamp as necessary. While holding lamp in position, tighten ball stud clamp.
    b. For right side lamp, adjust position of directional lamp as necessary. Hold retainer with a wrench then use another wrench to tighten ball stud clamp on right directional lamp.
18. Lay a protective blanket over fuel tank. Adjust lamps to prevent fuel tank contact. Always keep lens aimed forward.

⚠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)

19. Turn ignition ON. Test for proper turn signal operation.

REAR LAMP HOUSING REPLACEMENT: ALL EXCEPT FLD

FASTENER	TORQUE VALUE	
Rear turn signal lamp fastener	12-16 ft-lbs	16.3-21.7 Nm

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.

NOTE

Before removing turn signal wires, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

2. Remove seat.
3. Disconnect turn signal wiring. See 7.14 TURN SIGNALS.
4. Cut cable straps around turn signal wires.
5. Remove turn signal lamp wires from multilock connector. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
6. See Figure 7-40. Remove the lamp support (5) by removing the fastener (7) and washer (6) inside the rear fender, then the lamp housing (4) can be removed from the lamp support (5).
7. Pull lamp housing wiring from conduit.
8. Lay old turn signal lamp housing next to **new** one and cut **new** wires to length. Crimp **new** terminals onto wires. See Appendix A for more information.
9. See Figure 7-41. Install **new** lamp housing and wires as shown. Install **new** cable straps, if removed. Insert terminals into connector and mate connector.
10. Rotate lamp assembly so lens points directly rearward.
11. While holding lamp assembly, tighten fastener to 12-16 ft-lbs (16.3-21.7 Nm).
12. Connect negative battery cable.

WARNING

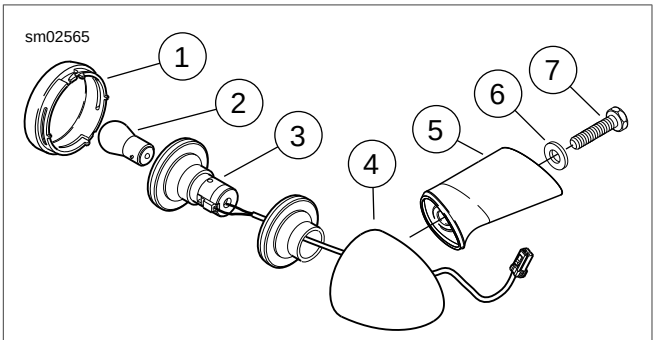
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

13. Install seat.

WARNING

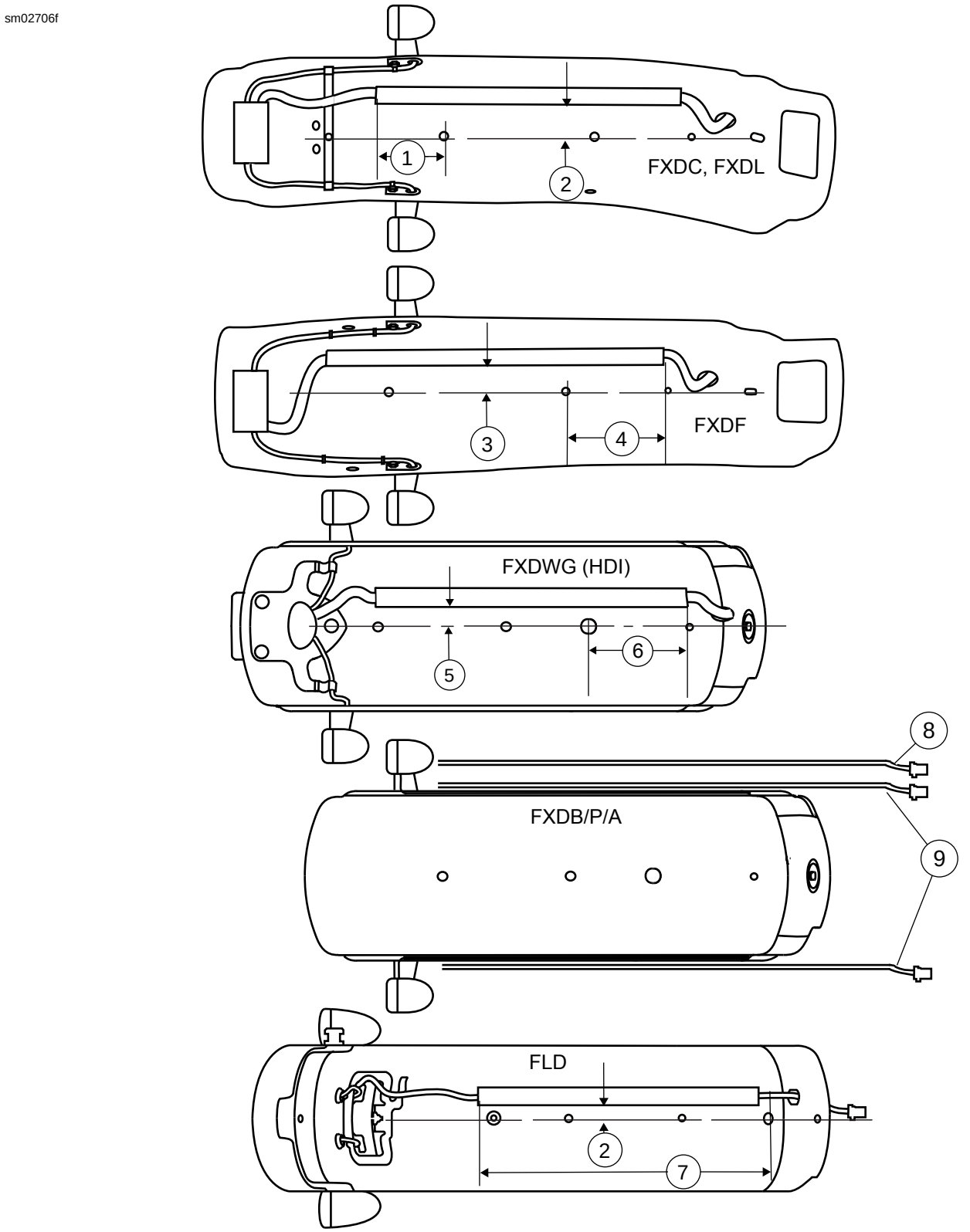
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

14. Turn ignition ON. Test for proper turn signal operation.



1. **Lens**
2. **Bulb**
3. **Socket assembly**
4. **Lamp housing**
5. **Lamp support**
6. **Washer**
7. **Fastener**

Figure 7-40. Rear Turn Signals



1. 4.12 in. (104.6 mm)
2. 0.75 in. (19.1 mm)
3. 0.88 in. (22.4 mm)
4. 4.30 in. (109.2 mm)
5. 0.75 in. (19.1 mm)
6. FXDWG (HDI) 5.12 in. (130.1 mm)
7. FLD 21.12 in. (536.45 mm)
8. FXDB/P/A (license plate wire)
9. FXDB/P/A (stop, tail and turn signal wires)

Figure 7-41. Rear Fender Harness Routing-Viewed from Underneath

FRONT TURN SIGNAL LAMPS: FLD

FASTENER	TORQUE VALUE	
Mirror acorn nut: FLD	84-156 **in-lb**	9.5-17.6 Nm

Removal

1. See Figure 7-42. Remove grommet from frame.
2. Disconnect the turn signal lamp connector [31L/R], (4-place Multilock).
3. Remove terminals from connector housing. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
4. Attach a chase wire to the harness and pull the harness up through the headlamp nacelle.
5. Remove harness from retainers on handlebar.
6. See Figure 7-43. Loosen jamnut (3) and remove lamp housing from ball stud (6).
7. If mounting bracket (2) requires removal, remove acorn nut (4).

NOTES

- *Reflector and harness are not serviced separately.*
- *Replace turn signal lamp assembly if damaged.*

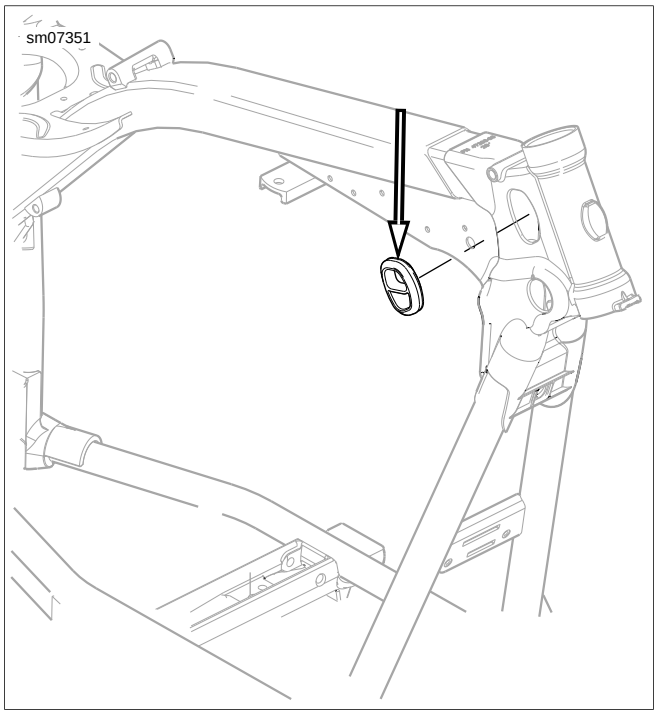
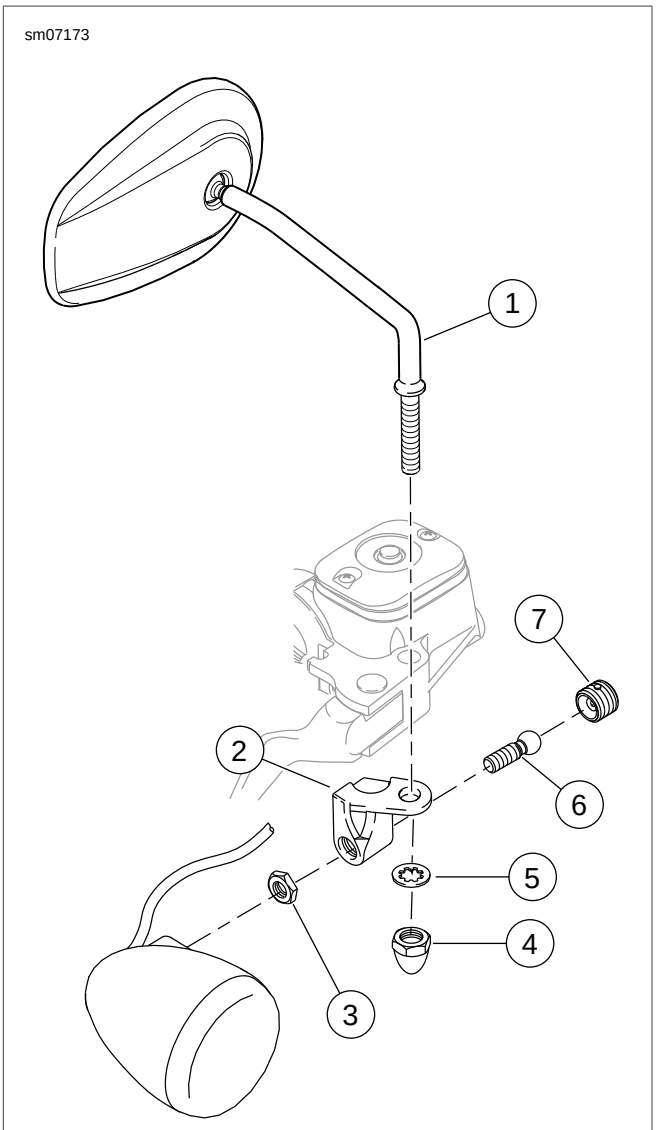


Figure 7-42. Frame Grommet



1. **Mirror**
2. **Turn signal bracket**
3. **Jamnut**
4. **Acorn nut**
5. **Lockwasher**
6. **Ball stud**
7. **Lock screw**

Figure 7-43. Front Turn Signals: FLD

Installation

1. See Figure 7-43. If removed, install mounting bracket (2) and acorn nut (4). Tighten to 84-156 **in-lb** (9.5-17.6 Nm).
2. Install lamp housing to ball stud (6). Tighten jamnut (3) securely.
3. Adjust turn signal as required and tighten lock screw (7).
4. Route wiring harness along handlebars and secure with **new** anchors.
5. Route harness through hole in nacelle.
6. Install terminals into connector housing as shown in Table 7-9. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.

7. See Figure 7-42. Connect to vehicle harness. Push connector into frame and install grommet.

⚠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 and test for proper turn signal operation.

Table 7-9. Turn Signal Lamp Connectors: FLD

CAVITY	COLOR
1	Violet
2	Black

REAR TURN SIGNAL LAMPS AND BRACKET: FLD

FASTENER	TORQUE VALUE	
License bracket screws: FLD	60-80 **in-lbs**	6.8-9.0 Nm
Rear light bar housing screws: FLD	84-144 **in-lbs**	9.5-16.3 Nm

Removal

1. Remove circuit board and chrome base. See 7.13 TAIL LAMP.
2. Release harnesses from cable clips inside fender.
3. See Figure 7-44. Remove two screws (3) to release light bar assembly. Remove bracket and harnesses from fender.
4. Remove screws (6) to release license bracket.
5. Remove two screws (8) to release license lamp.
6. See 7.14 TURN SIGNALS, Rear Turn Signal Reflector/Isolator Repair: FLD if socket assembly (2) requires replacement.

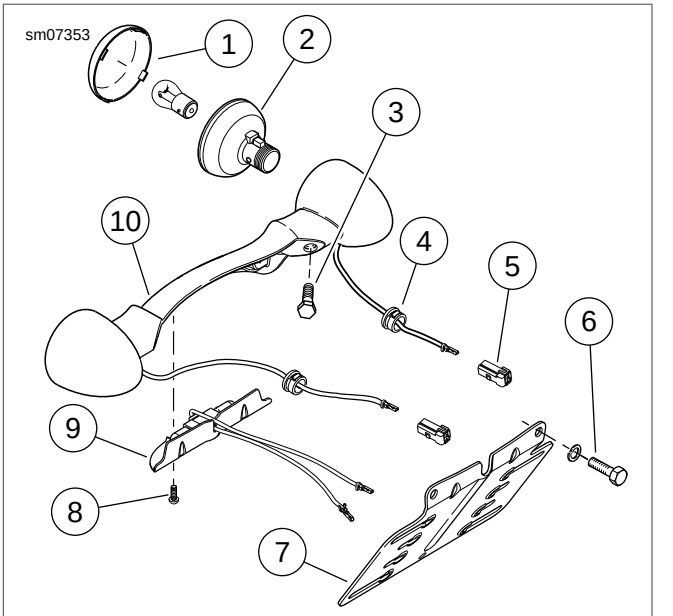
Installation

1. See Figure 7-44. Install license lamp.
2. Install license bracket (7) and screws (6). Tighten to 60-80 **in-lbs** (6.8-9.0 Nm).
3. Verify grommets (4) are in place and feed harnesses through respective holes to inboard side of fender.
4. Apply one drop of LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) to screws (3).
5. Install rear turn signal lamps bracket and screws. Tighten to 84-144 **in-lbs** (9.5-16.3 Nm).
6. Install chrome base and circuit board assembly. See 7.13 TAIL LAMP.
7. Connect turn signal and license lamp connectors.
8. Secure harnesses under clips inside fender.

⚠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 and test for proper lamp operation.



1. **Lens**
2. **Socket assembly**
3. **Screw, light bar (2)**
4. **Grommet (2)**
5. **Connector housing**
6. **Screw, license bracket (2)**
7. **License bracket**
8. **Screw, license lamp (2)**
9. **License lamp housing**
10. **Light bar housing**

Figure 7-44. Rear Turn Signals: FLD

REAR TURN SIGNAL REFLECTOR/ISOLATOR REPAIR: FLD

Removal

NOTE

This procedure covers replacement of the rear turn signal lamp reflector/ isolator assembly only.

1. Remove chrome base and circuit board assembly. See 7.13 TAIL LAMP.
2. Remove terminals from turn signal lamp connector housing. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
3. Release harness from cable clip inside fender.
4. Draw harness and terminals through hole to outboard side of fender.
5. Remove lens and bulb.
6. See Figure 7-45. Insert a right angle pick or a 7/64 in. hex key through hole (4) and pull reflector from lamp.

7. Remove isolator (3) from lamp if still installed.

Installation

1. Place **new** reflector/isolator assembly next to discarded unit and cut wires to proper length.
2. Install reflector/isolator assembly:
   a. Seat reflector assembly in rubber isolator, aligning tab on reflector with slot in isolator.
   b. Feed wires through lens opening and out through hole in lamp housing.
   c. Install grommet in lamp housing. Lightly lubricate grommet with glass cleaner, if necessary.
   d. Aligning tab on reflector with slot inside lamp, use thumbs of both hands and apply even pressure around outer edge of reflector assembly until fully seated.
   e. Liberally apply dielectric grease to contacts in socket and at bottom of bulb. Install bulb and lens with slot at bottom of lamp.
3. Install **new** terminals onto wires. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
4. Feed terminals through hole to inboard side of fender.
5. Install terminals into connector housing. Refer to Table 7-10. See A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR.
6. Capture harness in cable clip inside fender.
7. Install chrome base and circuit board assembly. See 7.13 TAIL LAMP.

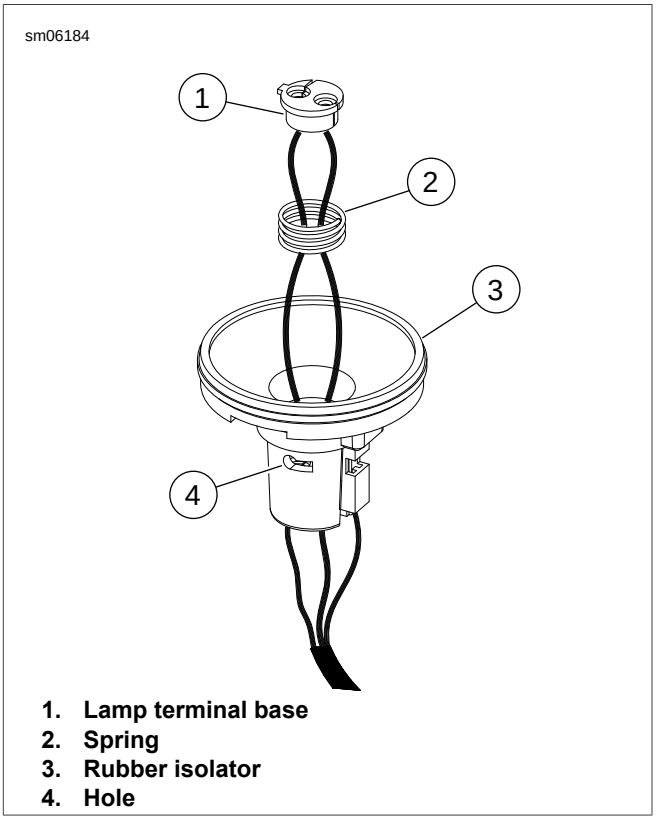
⚠WARNING

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. Test lamp operation.

Table 7-10. Turn Signal Lamp Connectors: FLD

CAVITY	COLOR
1	Violet
2	Black



1. **Lamp terminal base**
2. **Spring**
3. **Rubber isolator**
4. **Hole**

Figure 7-45. Reflector Assembly

CRANK POSITION SENSOR (CKP) 7.15

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

WARNING

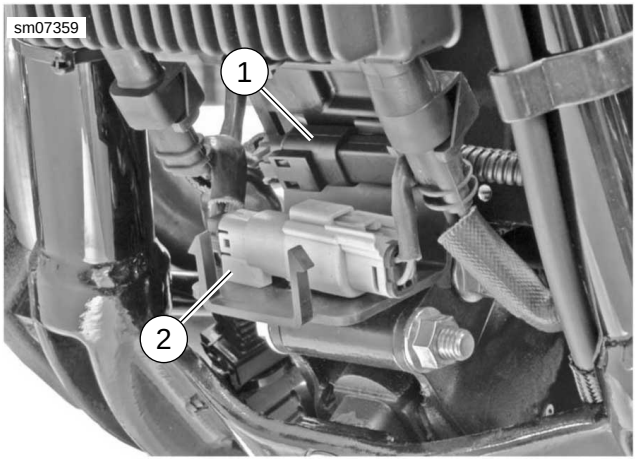
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.

NOTE

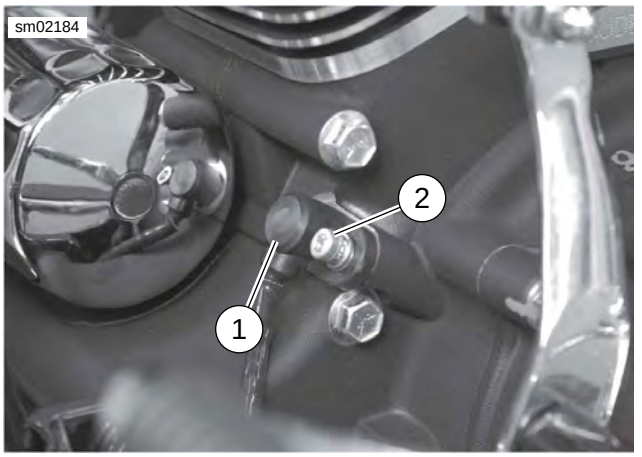
Before removing wiring, carefully note wire routing.

2. Press upper front electrical caddy cover tabs to open cover.
3. See Figure 7-46. Remove CKP sensor connector (1) from front electrical caddy.
4. Disconnect CKP sensor connector.
5. See Figure 7-47. Remove screw and captive washer (2) to detach CKP sensor (1) and O-ring from crankcase. Carefully remove crank position sensor.



1. **CKP connector**
2. **Front O2 sensor connector**

Figure 7-46. Front Electrical Caddy



1. **CKP sensor**
2. **Screw and captive washer**

Figure 7-47. Crank Position Sensor

INSTALLATION

FASTENER	TORQUE VALUE	
CKP sensor screw	90-120 **in-lbs**	10.1-13.6 Nm

1. See Figure 7-48. Lubricate CKP sensor O-ring with clean engine oil.
2. Install **new** CKP sensor with screw and captive washer. Tighten to 90-120 **in-lbs** (10.1-13.6 Nm).
3. Connect CKP sensor connector.
   a. Mate connector halves.
   b. Install connector on front electrical caddy.
4. Close and latch front electrical caddy cover.
5. Connect negative battery cable.

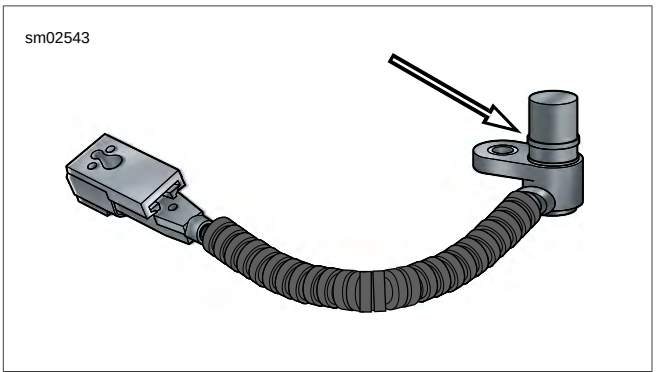


Figure 7-48. CKP Sensor O-Ring

AUTOMATIC COMPRESSION RELEASE (ACR) 7.16

GENERAL

NOTE

ACR is used only on 103 cu. in. and larger engines.

See Figure 7-49. The ACR is opened and closed by the ECM to assist starting.

See Figure 7-50. When open, compressed gases are released through the exhaust port.

REMOVAL

PART NUMBER	TOOL NAME
HD-48498-A	ACR SOLENOID SOCKET

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 7-54. Use ACR SOLENOID SOCKET (Part No. HD-48498-A) to remove the ACR from the cylinder head.

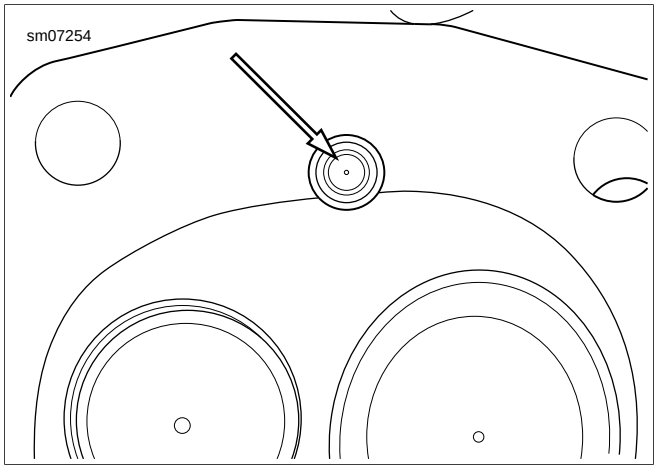


Figure 7-49. ACR Valve in Combustion Chamber

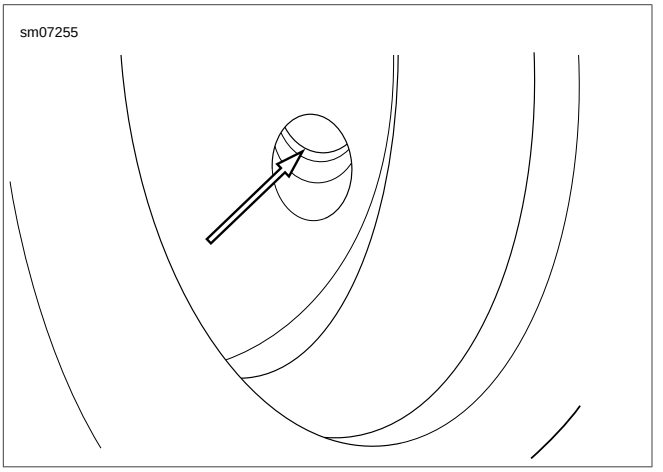


Figure 7-50. ACR Exhaust Port Release

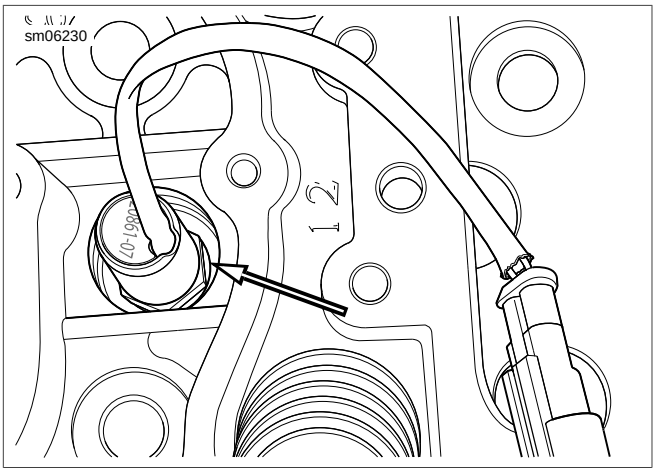


Figure 7-51. ACR in Head

INSTALLATION

PART NUMBER	TOOL NAME
HD-48498-A	ACR SOLENOID SOCKET

FASTENER	TORQUE VALUE	
ACR	132-180 **in-lbs**	14.9-20.3 Nm

1. Verify that the copper seal washer is in place on the ACR.
2. See Figure 7-52. Identify a location around the threads of the ACR approximately 1/3 of the way up from the end.
3. See Figure 7-53. 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 7-54. Using ACR SOLENOID SOCKET (Part No. HD-48498-A), tighten to 132-180 **in-lbs** (14.9-20.3 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.

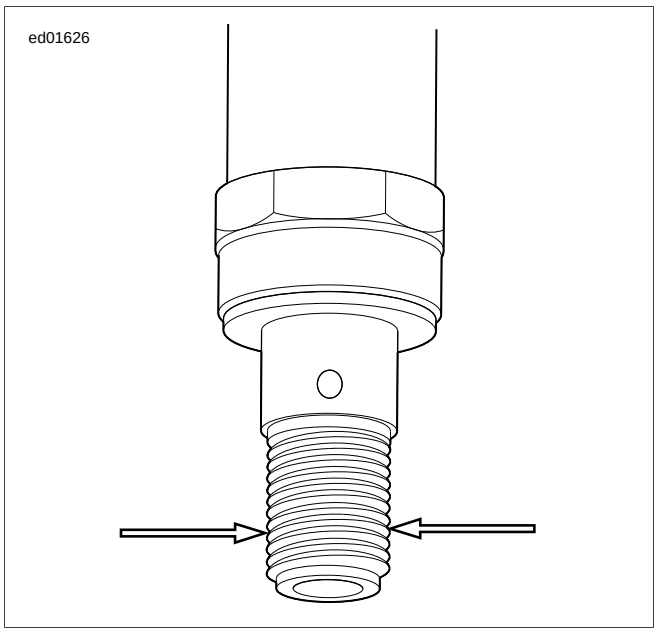


Figure 7-52. Bottom Third

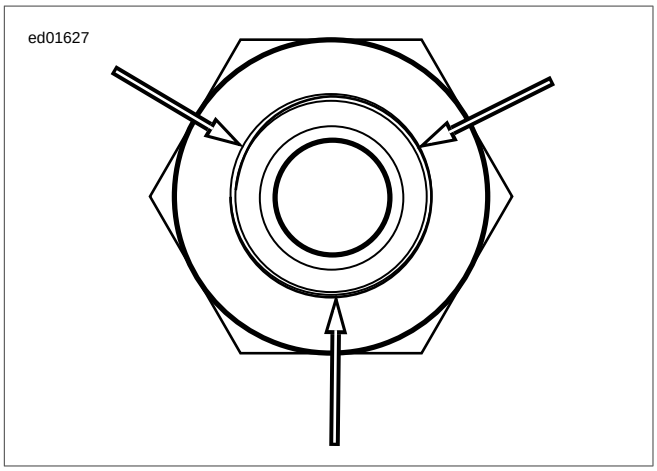


Figure 7-53. Three Dots of LOCTITE 246 MEDIUM STRENGTH/HIGH TEMPERATURE THREADLOCKER (blue)

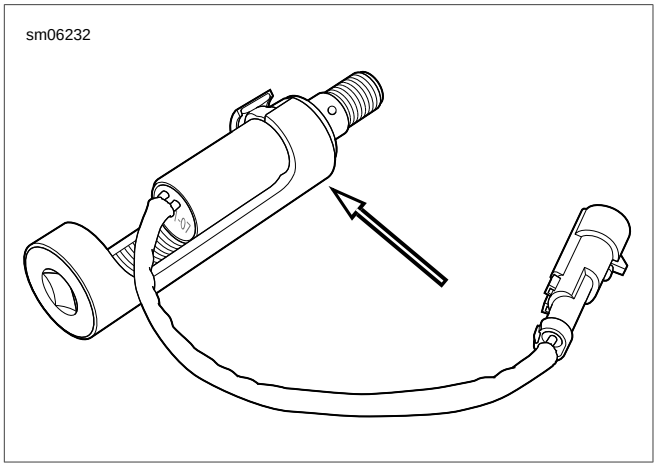


Figure 7-54. ACR Solenoid Socket and ACR

VOLTAGE REGULATOR 7.17

REMOVAL

NOTE

The voltage regulator cannot be repaired. Replace the unit if it fails.

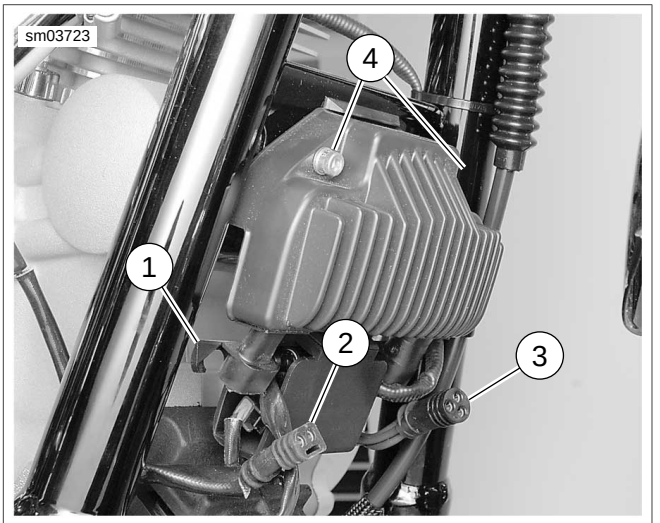
⚠WARNING

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. See Figure 7-55. Release latches (1) from each connector.
3. Disconnect stator connector (3) and regulator output connector (2).
4. Remove voltage regulator fasteners (4).

NOTE

When removing wiring, carefully note routing.



1. **Connector latch**
2. **Regulator output connector**
3. **Stator connector**
4. **Regulator fastener (2)**

Figure 7-55. Voltage Regulator

INSTALLATION

FASTENER	TORQUE VALUE	
Voltage regulator fasteners	100-120 **in-lbs**	11.2-13.6 Nm

1. See Figure 7-55. Install voltage regulator with fasteners (4). Tighten fasteners to 100-120 **in-lbs** (11.2-13.6 Nm).
2. Connect voltage regulator output connector (2).
3. Connect stator connector (3).
4. Secure latches (1) on both connectors.
5. Connect negative battery cable.

ALTERNATOR 7.18

REMOVAL

⚠WARNING

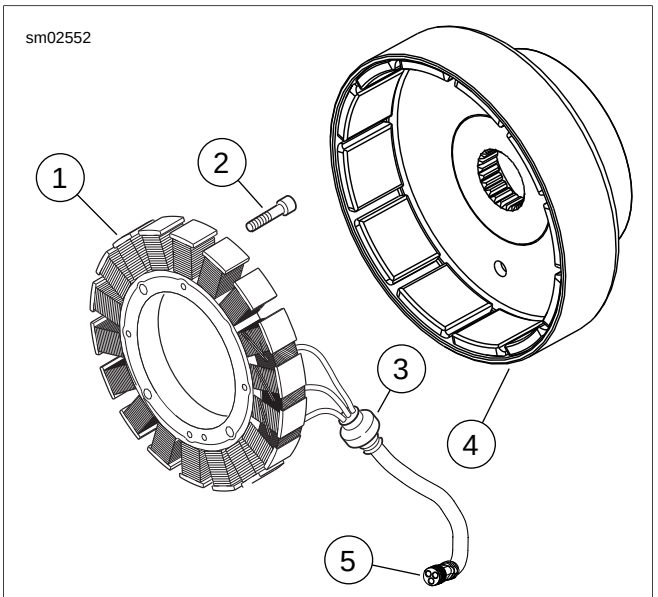
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.
3. Disconnect stator connector from voltage regulator. See 7.17 VOLTAGE REGULATOR.
4. See Figure 7-56. Remove alternator rotor (4). Two bolts can be inserted through the holes in the rotor face to aid during removal.

NOTE

See Figure 7-56. 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.



1. **Stator**
2. **TORX screw (4)**
3. **Grommet**
4. **Rotor**
5. **Connector [47B]**

Figure 7-56. Rotor and Stator (Typical)

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.

NOTE

Replace parts as necessary.

INSTALLATION

FASTENER	TORQUE VALUE	
Stator screws	55-75 **in-lbs**	6.2-8.4 Nm

NOTE

Discard and replace stator Torx screws after each removal.

1. Insert wires through crankcase hole.
2. See Figure 7-56. 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 7.17 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.

FUEL GAUGE 7.19

GENERAL

The fuel gauge is mounted in a simulated left fuel tank cap. Remove by gently pulling upward. Do not twist.

If replacing gauge, remove wires from back of gauge.

The fuel gauge sending unit is in the fuel tank under a console and top plate.

REMOVAL

NOTE

The gauge wires are routed through a tube in the tank. Wires are secured by a cable strap located in the top frame tube underneath the fuel 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)

⚠WARNING

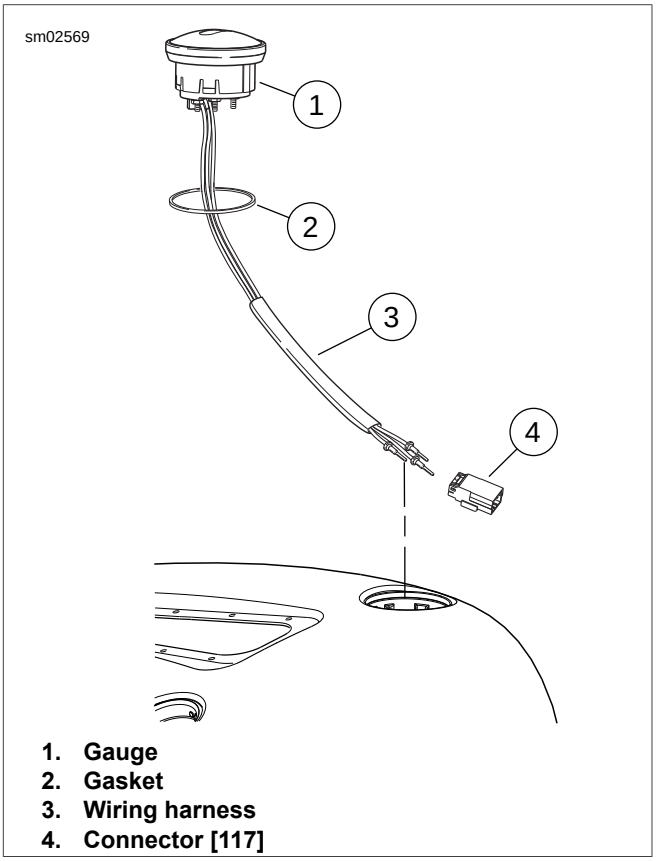
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Loosen fuel tank to gain access to the fuel gauge connector. See 4.4 FUEL TANK.
3. Disconnect fuel gauge connector [117] located under left side of fuel tank.
4. See Figure 7-57. Detach terminals from connector (4).

NOTE

Do not twist gauge and wiring during removal.

5. Pull up on gauge (1). Remove gauge, gasket (2) and wiring from fuel tank. Discard gasket.



1. **Gauge**
2. **Gasket**
3. **Wiring harness**
4. **Connector [117]**

Figure 7-57. Fuel Gauge

FUEL GAUGE SENDER 7.20

REMOVAL

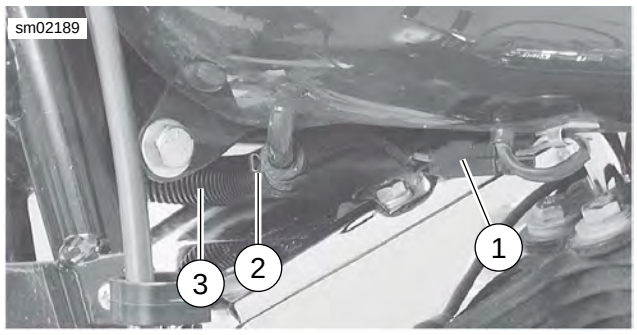
⚠WARNING

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)

⚠WARNING

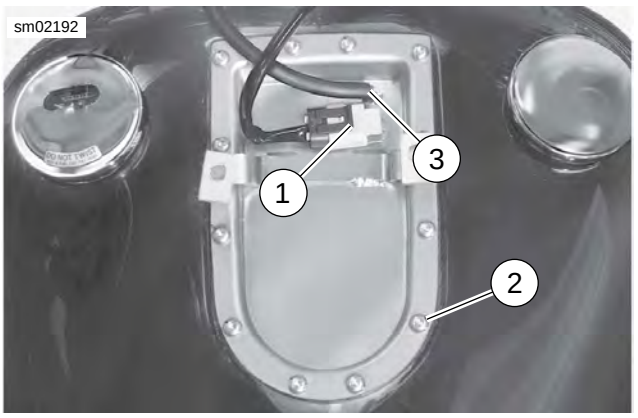
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Drain fuel into adequately sized, approved gasoline container.
3. Remove instrument console.
   a. **For FXDC, FXDF and FLD models:** see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
   b. **For FXDL, FXDB/P/A and FXDWG models:** see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
4. Disconnect console wiring.
5. See Figure 7-59. Unplug fuel pump and sender connector (1) [141].
6. Remove vent hose (3).
7. Remove top plate screws (2) and discard.



1. **Fuel gauge connector [117]**
2. **Clamp**
3. **Crossover hose**

Figure 7-58. Fuel Gauge Connector and Crossover Hose



1. **Fuel pump and sender connector [141]**
2. **Screws (12)**
3. **Vent hose**

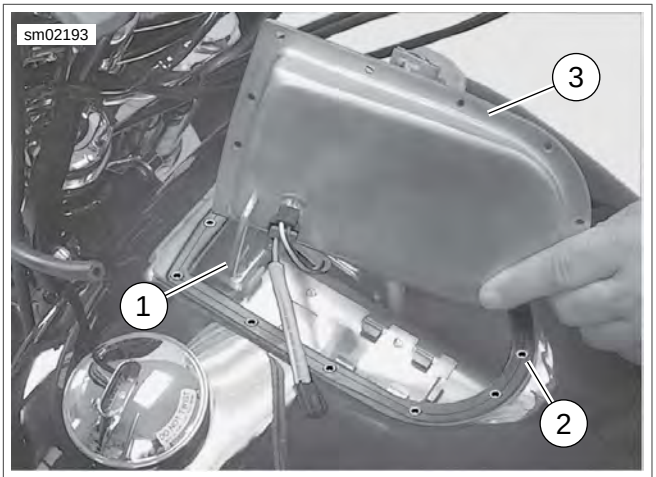
Figure 7-59. Top Plate Screws (Typical)

8. See Figure 7-60. Rotate top plate (3) until vent tube (1) clears fuel tank.
9. See Figure 7-61. Press tab and remove fuel pump/sender wiring from top plate. Remove top plate.
10. Disconnect wire harness from fuel pump.
11. See Figure 7-62. Pull removal tab (2) towards rear of vehicle to disengage sender (1) from mounting tabs.

NOTE

Do not to bend float arm while removing. A bent float arm will give inaccurate readings.

12. Remove fuel gauge sender from fuel tank.

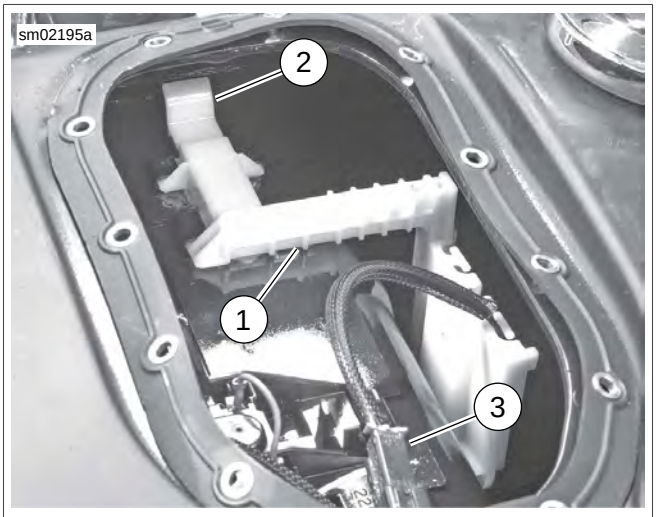


1. **Vent tube**
2. **Gasket**
3. **Top plate**

Figure 7-60. Top Plate



Figure 7-61. Connector Tab



1. **Fuel gauge sender**
2. **Removal tab**
3. **Connector**

Figure 7-62. Fuel Gauge Sender

INSTALLATION

FASTENER	TORQUE VALUE	
Top plate fasteners	27-33 **in-lbs**	3.1-3.7 Nm

1. See Figure 7-62. Install fuel gauge sender (1), making sure that removal tab (2) is locked in place.
2. Attach connector (3) to wiring harness.

NOTE

Do not apply any type of sealant to gasket.

3. See Figure 7-63. Place **new** gasket (2) under top plate. Align gasket with screw holes.
4. Install fuel pump/sender wire connector (4) on top plate (3).
5. Hold top plate at 90 degree angle. Making sure that vent tube is installed inside of tank, rotate top plate into position.
6. Loosely install **new** sealing screws in top plate.

NOTE

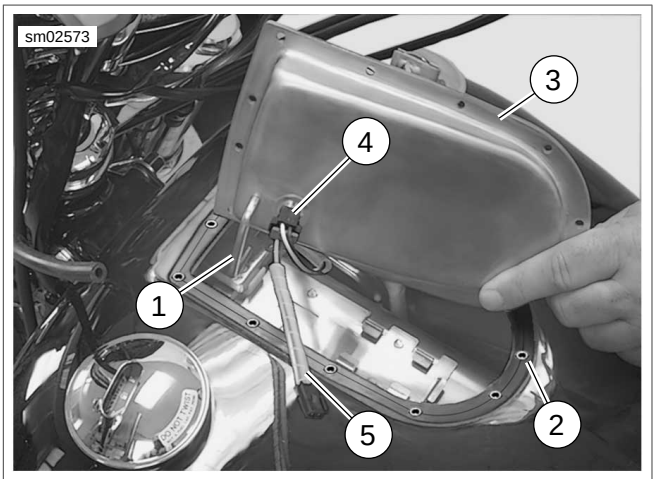
All models use the same torque sequence despite shape differences in top plate.

7. See Figure 7-65. Tighten sealing fasteners using pattern shown to 27-33 **in-lbs** (3.1-3.7 Nm).
8. See Figure 7-64. Connect fuel pump/sending unit connector [141].
9. Install instrument console.
   a. **For FXDC, FXDF and FLD models:** see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
   b. **For FXDL, FXDB/P/A and FXDWG models:** see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.

NOTE

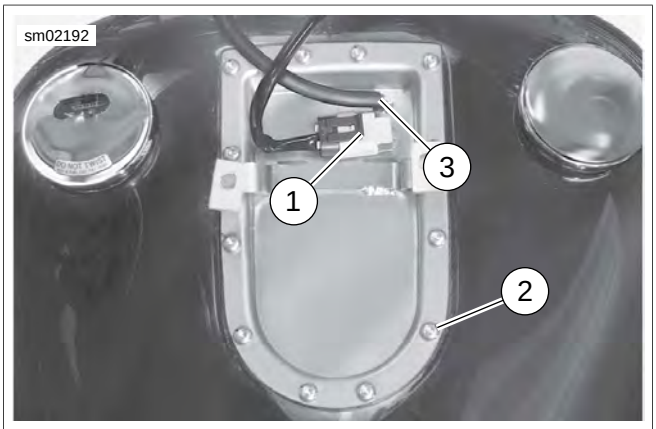
In next step, be sure crimped end of clamp faces toward front of vehicle.

10. Connect fuel tank crossover hose with **new** clamps.
11. Connect negative battery cable.
12. Fill tank with gasoline.
13. Check fuel tank for leaks.



1. **Vent tube**
2. **Gasket**
3. **Top plate**
4. **Fuel pump/sender wire connector**
5. **Fuel pump harness**

Figure 7-63. Top Plate



1. **Fuel pump and sender connector [141]**
2. **Screws (12)**
3. **Vent hose**

Figure 7-64. Top Plate Screws (Typical)

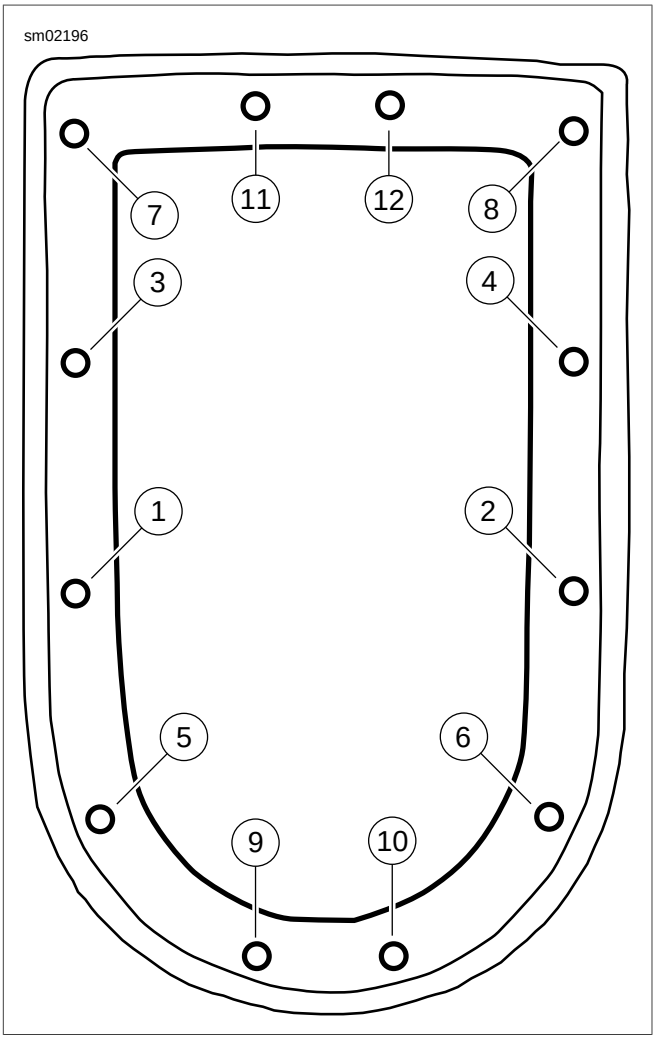


Figure 7-65. Top Plate Torque Sequence: All Models

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.

INSTRUMENTS: FXDC, FXDF AND FLD 7.21

SPEEDOMETER

FASTENER	TORQUE VALUE	
Console mounting screws: FXDC, FXDF, FLD	41-49 **in-lbs**	4.6-5.5 Nm
Fuel tank trim screw: FXDC, FXDF, FLD	18-24 **in-lbs**	2.03-2.71 Nm

Removal

NOTES

- *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 count down 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 count down reaches zero, it will reset the mileage count down 31.1 mi (50 km). This mileage count down allows for a road test to verify that speedometer replacement was the proper repair.*
- *Use glass cleaner to lubricate speedometer during removal and installation.*

1. See Figure 7-66. Remove screw (2) securing trim to fuel tank. Remove screws (3) securing console to top plate.

NOTE

Two push nuts secure trim to console.

2. Position clean towel on fuel tank and flip console over to expose underside.
3. Press connector tab and disconnect 12-place harness connector [39] from speedometer (5) under console.
4. Pry between three tabs and speedometer with a screwdriver to raise and release back clamp (7) from speedometer. Remove back clamp from speedometer.
5. Remove speedometer from console (6).
6. Remove gasket (4) from speedometer.

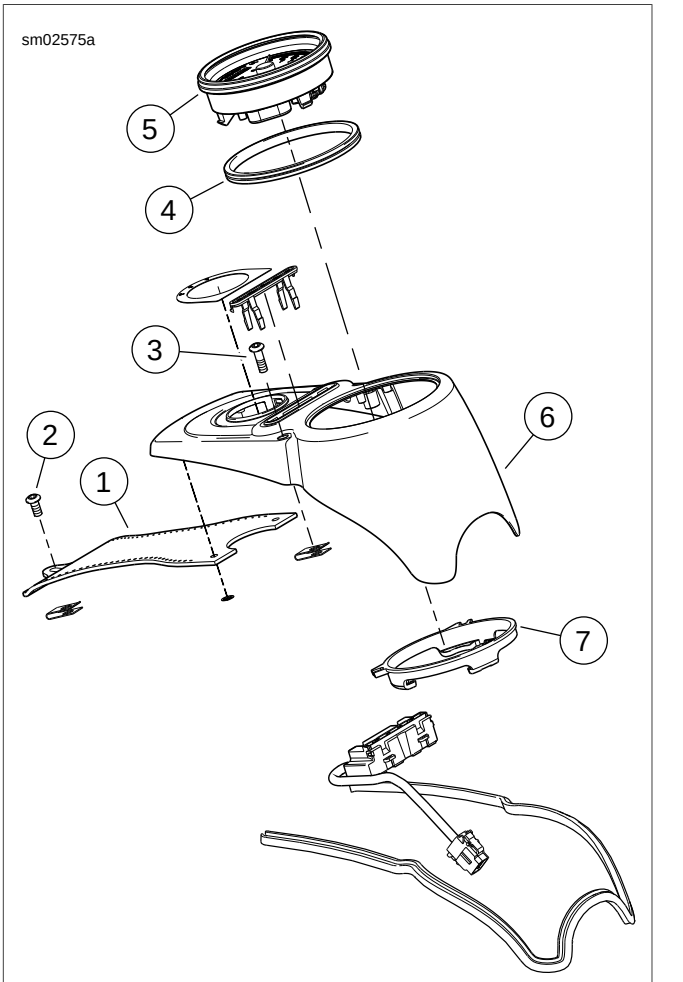
Installation

1. See Figure 7-66. Install gasket (4) to speedometer (5).
2. Position speedometer in console (6).
3. Press on back clamp (7) until three tabs engage on back of speedometer.
4. Connect 12-place connector [39] to speedometer under console.

NOTE

Two push nuts secure trim to console.

5. Install console to fuel tank with screws (3). Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).
6. Install screw (2) securing fuel tank trim (1) to fuel tank. Tighten to 18-24 **in-lbs** (2.03-2.71 Nm).
7. Test speedometer for proper operation.



1. **Trim**
2. **Screw**
3. **Screw (2)**
4. **Gasket**
5. **Speedometer**
6. **Console**
7. **Back clamp**

Figure 7-66. Speedometer: FXDC, FXDF, FLD

INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG 7.22

REMOVAL

General

Do not cut any of the wiring harness cable straps to replace the speedometer and tachometer. Lubricate speedometer gasket with alcohol or glass cleaner for removal and installation.

Speedometer

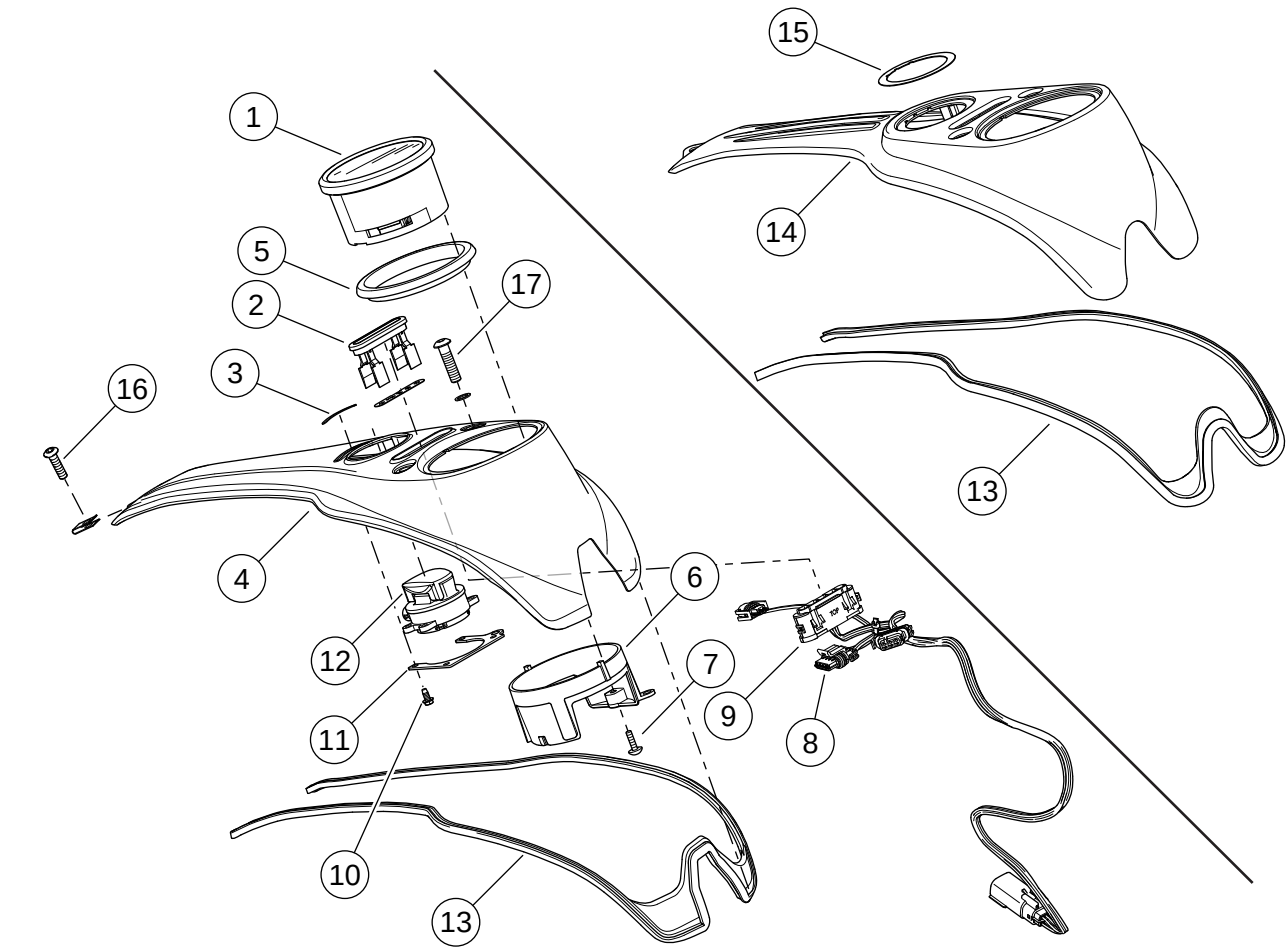
NOTES

- *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 count down 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 count down reaches zero, it will reset the mileage count down to 31.1 mi (50 km). This mileage count down allows for a road test to verify that speedometer replacement was the proper repair.*

1. See Figure 7-68. Remove screws (5, 6) and lift console from fuel tank.
2. Position clean towel on fuel tank and flip console over to expose underside.
3. Remove screws (1) and back clamp (2 or 15).
4. Press connector tab and remove speedometer connector [39] (11) from back of speedometer (10).
5. Remove speedometer from console. Remove gasket (7) from speedometer/console.

Tachometer: FXDL Only

1. Complete steps 1-3 of speedometer removal.
2. Press connector tab and remove tachometer connector [108] (8) from back of tachometer.
3. Remove tachometer from console. Remove gasket (7) from tachometer/console.



1. Speedometer
2. Indicator lamp bezel
3. Ignition switch nameplate (FXDWG)
4. Console assembly (FXDWG)
5. Speedometer shock gasket
6. Speedometer retaining backclamp
7. Button head screw (2)
8. Speedometer connector
9. Indicator lamp
10. Self tapping screw (4)
11. Ignition switch bracket
12. Ignition switch
13. Console assembly trim
14. Console assembly (FXDB/P/A)
15. Ignition switch nameplate (FXDB/P/A)
16. Short console fastener
17. Long console fastener (2)

Figure 7-67. Instrumentation: FXDWG and FXDB/P/A

INSTALLATION

FASTENER	TORQUE VALUE	
Speedometer, tachometer screw: FXDB/P/A and FXDWG	10-20 **in-lbs**	1.1-2.3 Nm
Console to fuel tank fasteners: FXDB/P/A and FXDWG	41-49 **in-lbs**	4.6-5.5 Nm
Speedometer/tachometer back clamp screw: FXDL	10-20 **in-lbs**	1.1-2.3 Nm
Console to fuel tank fasteners: FXDL	41-49 **in-lbs**	4.6-5.5 Nm

General

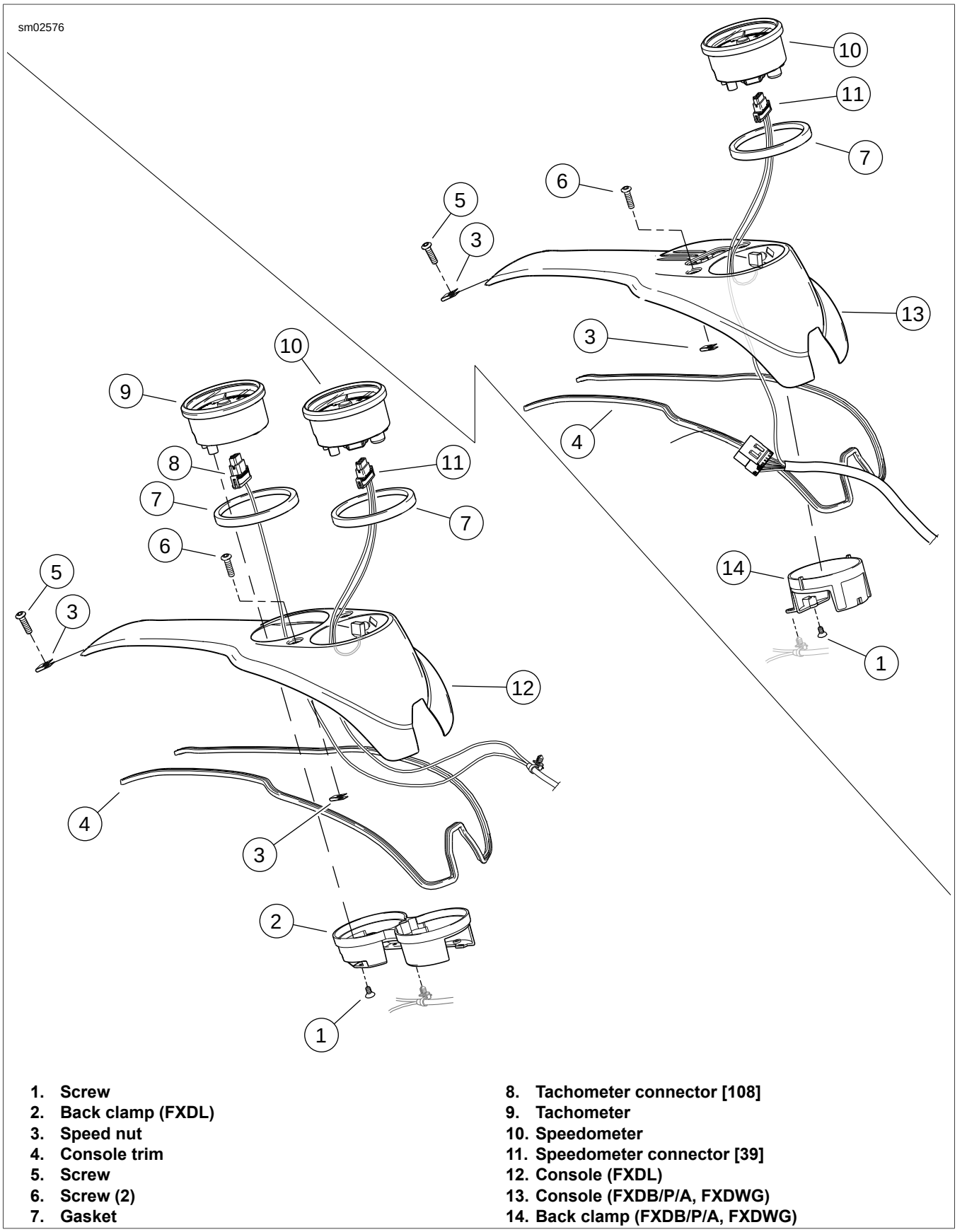
Lubricate gasket with alcohol or glass cleaner.

Speedometer

1. See Figure 7-67. Install console trim (13) to console (4 or 14).
2. Install speedometer (1) in console. Tighten to 10-20 **in-lbs** (1.1-2.3 Nm).
3. Install speedometer connector [39] to back of speedometer.
4. Install back clamp (6) to speedometer with screws (7). Make sure there is no binding with the wiring harnesses and the bracket.
5. Install console to fuel tank with fasteners (16, 17). Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).
6. Test speedometer for proper operation.

Tachometer: FXDL Only

1. See Figure 7-68. Install console trim (4) to console (12).
2. Install tachometer (9) and speedometer (10) in console with gaskets (7) and install back clamp (2) to speedometer/tachometer with screws (1). Make sure there is no binding with the wiring harnesses and the bracket. Tighten to 10-20 **in-lbs** (1.1-2.3 Nm).
3. Install tachometer connector [108] to tachometer under console.
4. Install speedometer connector [39] to speedometer under console.
5. Install console to fuel tank with screws (5, 6). Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).
6. Test tachometer and speedometer for proper operation.



1. Screw
2. Back clamp (FXDL)
3. Speed nut
4. Console trim
5. Screw
6. Screw (2)
7. Gasket
8. Tachometer connector [108]
9. Tachometer
10. Speedometer
11. Speedometer connector [39]
12. Console (FXDL)
13. Console (FXDB/P/A, FXDWG)
14. Back clamp (FXDB/P/A, FXDWG)

Figure 7-68. Instrumentation: FXDB/P/A, FXDL, FXDWG

VEHICLE SPEED SENSOR (VSS) 7.23

GENERAL

The VSS is a Hall Effect sensor that takes readings off 4th gear in the transmission.

The VSS is located on the transmission just behind the transmission top cover.

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. See Figure 7-69. Disconnect the VSS connector [65].
3. Remove VSS mounting bolt.
4. Remove sensor from transmission case.

NOTE

*Before removing VSS wire, carefully note wire routing. Lay the **new** VSS wire next to the old wire and remove and replace the wires together, one cable strap at a time, to verify proper routing.*

INSTALLATION

FASTENER	TORQUE VALUE	
Speedometer VSS mounting bolt	84-108 **in-lbs**	9.5-12.2 Nm

1. See Figure 7-69. Install VSS into transmission case using mounting bolt. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).
2. Install connector [65] to VSS.
3. Connect battery cables.



Figure 7-69. VSS Connector [65]

INDICATOR LAMPS 7.24

GENERAL

Dyna models are equipped with Light Emitting Diode (LED) indicators. The indicator LED assembly is not serviceable. Replace assembly upon failure of any one LED.

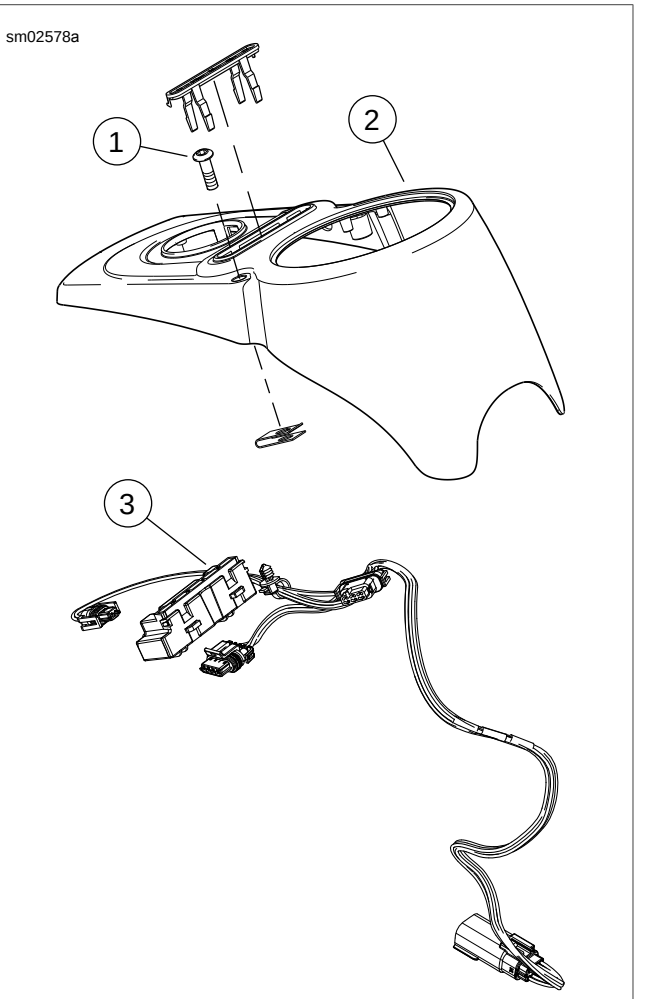
REMOVAL

FXDC, FXDF and FLD Models

1. See Figure 7-70. Remove screws (1) and raise console (2) from fuel tank. Place shop rags on tank and turn console over to expose underside.
2. Squeeze clips on indicator lamp together and gently pry LED assembly (3) from the side with a screwdriver.
3. See Figure 7-70. Disconnect harness from speedometer, fuel tank, ignition switch, and main harness. Remove harness and indicator lamp assembly. Squeeze clips together and gently pry LED assembly (3) out of console from the side with a screwdriver.

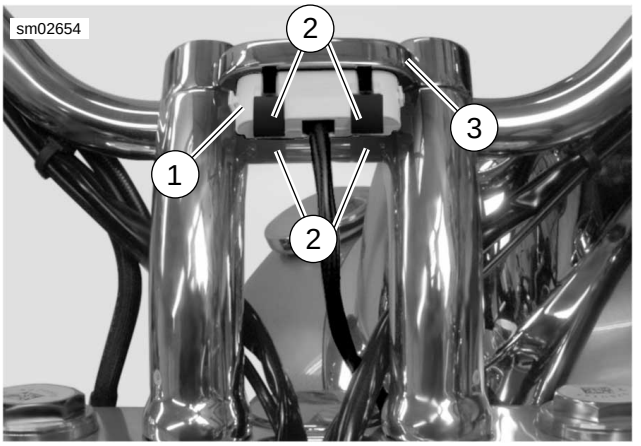
FXDB/P/A and FXDWG Models

1. Remove long console fasteners and short console fastener.
2. Raise console from fuel tank. Place shop rags on tank and turn console over to expose underside.
3. Release clips to free LED housing from console.
4. See Figure 7-72. Disconnect harness from speedometer, fuel tank, ignition switch, and main harness. Remove harness and indicator lamp assembly.



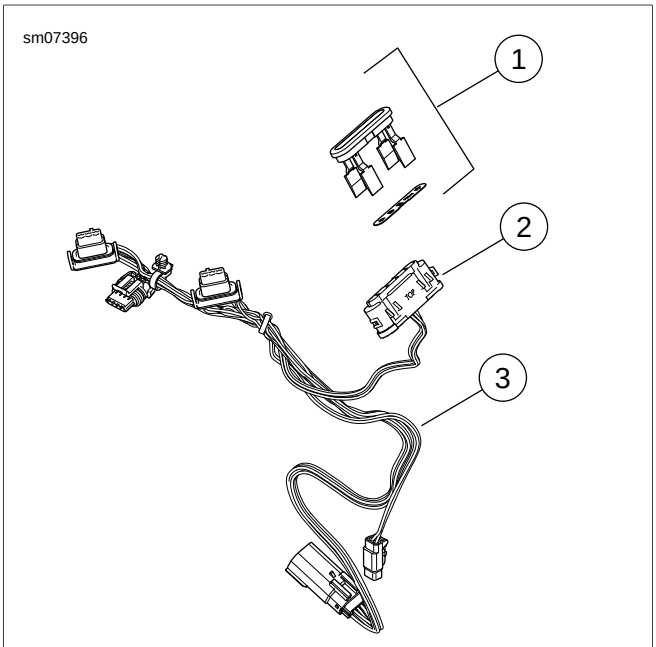
1. **Screw (2)**
2. **Console**
3. **LED assembly with harness**

Figure 7-70. Indicator Lamp Assembly: FXDC, FXDF and FLD



1. **LED assembly**
2. **Clips (2 pair)**
3. **Handlebar cover**

Figure 7-71. FXDL LED Assembly



1. **Bezel, indicator lamp**
2. **LED assembly**
3. **Under console wiring harness**

Figure 7-72. Indicator Lamp and Under Console Wiring Harness: Typical

FXDL Models

1. Pull riser cover from between handlebar risers.
2. See Figure 7-71. Squeeze clips (2) together and gently pull LED assembly (1) from handlebar cover (3).
3. Remove long console fasteners and short console fastener.
4. Raise console from fuel tank. Place shop rags on tank and turn console over to expose underside.
5. See Figure 7-72. Remove harness from speedometer, fuel tank, ignition switch, and main harness.
6. Remove harness and indicator lamp assembly.

Table 7-11. LED Assembly Wiring

INDICATOR LAMP	CONNECTION
Oil pressure	Ground through switch
Neutral	Ground through switch
High beam	12V when active
Right/left turn	12V when active

INSTALLATION

FASTENER	TORQUE VALUE	
Console mounting screws: FXDC, FLD and FXDF	41-49 **in-lbs**	4.6-5.5 Nm
Console mounting screws: FXDB/P/A and FXDWG	41-49 **in-lbs**	4.6-5.5 Nm
Console mounting screws: FXDL	41-49 **in-lbs**	4.6-5.5 Nm

FXDC, FXDF and FLD Models

1. See Figure 7-70. Install LED assembly into console. Make sure clips engage to secure assembly in place.
2. Connect [20] to main wiring harness.
3. Install speedometer, fuel tank, and ignition switch harness.
4. Secure console (2) in position with screws (1). Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).

FXDB/P/A and FXDWG

1. See Figure 7-72. Install LED assembly (2) into console.
2. Engage bezel clips into tabs on LED assembly.
3. Install speedometer, fuel tank, and ignition switch harness.
4. Connect [20] to main wiring harness.
5. See Figure 7-67 Secure console (14) in position with long console fasteners (17) and short console fastener (16). Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).

FXDL Models

1. See Figure 7-71. Install LED assembly (1) into handlebar cover.
2. Engage clips (2) into tabs on LED assembly (1).
3. Install speedometer, fuel tank, and ignition switch harness.
4. Install handlebar riser cover.
5. Connect [20] to main wiring harness.
6. See Figure 7-68 Secure console (12) in position with long console fasteners (6) and short console fastener (5). Tighten to 41-49 **in-lbs** (4.6-5.5 Nm).

NEUTRAL SWITCH 7.25

GENERAL

The neutral switch is located on the transmission case. The two terminal switch is normally closed. When the transmission shifter is in neutral and the ignition switch is in the IGNITION position, the switch causes the NEUTRAL indicator light to illuminate.

REMOVAL

1. Place transmission in NEUTRAL.
2. See Figure 7-73. Remove two elbow connectors from neutral switch posts.
3. Remove neutral switch from transmission case.

INSTALLATION

FASTENER	TORQUE VALUE	
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm

1. See Figure 7-74. Inspect O-ring for damage. Replace as necessary. Lightly lubricate **new** O-ring with clean transmission oil before installation.
2. Verify that transmission is in NEUTRAL.
3. Install neutral switch in transmission case. Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).

NOTE

The neutral switch is not polarity sensitive. Install connectors on either post.

4. Install both connectors onto neutral switch posts.
5. Verify proper operation of neutral switch.
   a. Turn ignition/light key switch to IGNITION.
   b. Verify that neutral indicator light illuminates.

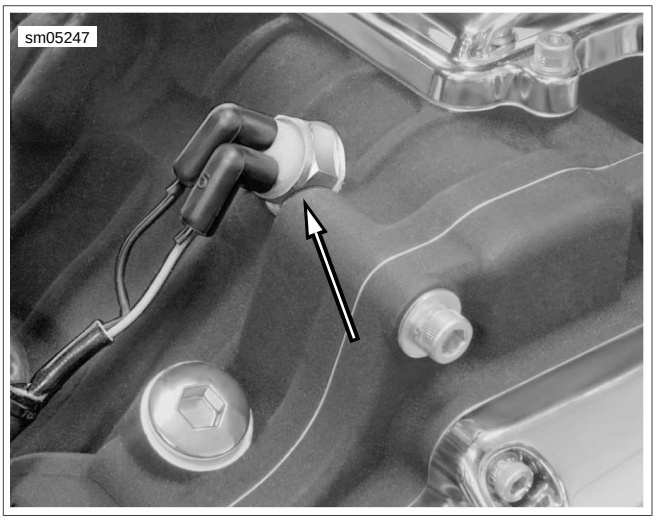


Figure 7-73. Neutral Switch

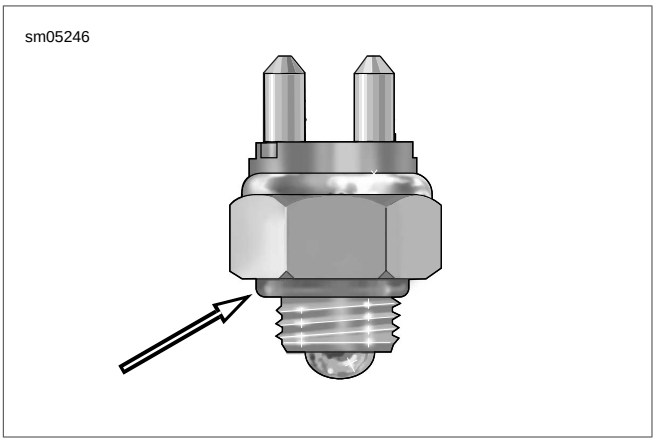


Figure 7-74. Neutral Switch O-Ring

OIL PRESSURE SWITCH 7.26

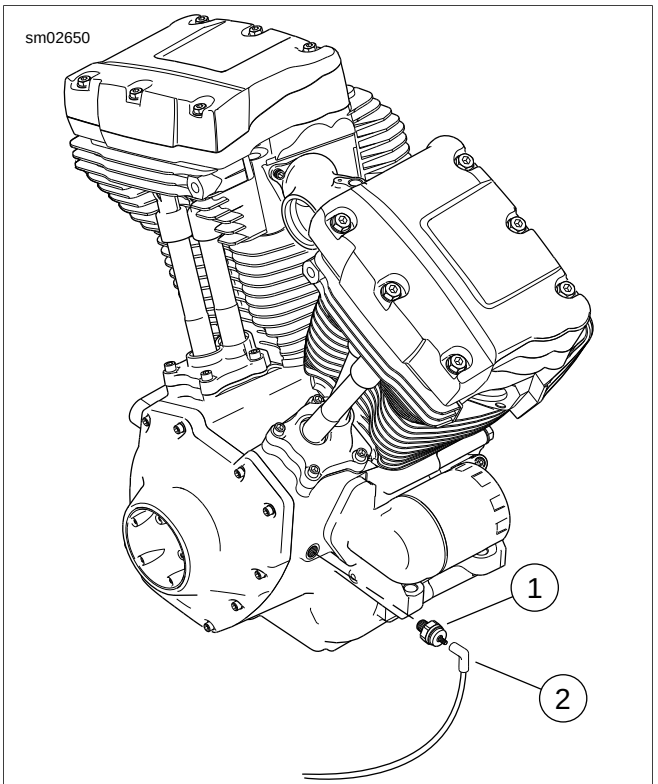
GENERAL

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.

See Figure 7-75. The oil pressure switch is located on the right side of the crankcase.

REMOVAL

1. See Figure 7-75. Remove connector (2) from oil pressure switch (1).
2. Remove oil pressure switch from crankcase.



1. **Oil pressure switch**
2. **Connector**

Figure 7-75. Oil Pressure Switch

INSTALLATION

FASTENER	TORQUE VALUE	
Oil pressure switch	96-144 **in-lbs**	10.8-16.3 Nm

1. Coat threads of oil pressure switch with LOCTITE 565 THREAD SEALANT.
2. See Figure 7-75. 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.23 SEALED SPLICE CONNECTORS.

REAR STOPLAMP SWITCH 7.27

GENERAL

See Figure 7-76. 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 7-76. 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

FASTENER	TORQUE VALUE	
Rear stop lamp switch	12-15 ft-lbs	16.3-20.3 Nm

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 7-76. Install rear stop lamp switch (1). Tighten to 12-15 ft-lbs (16.3-20.3 Nm).
3. Install both switch connectors (2).

⚠WARNING

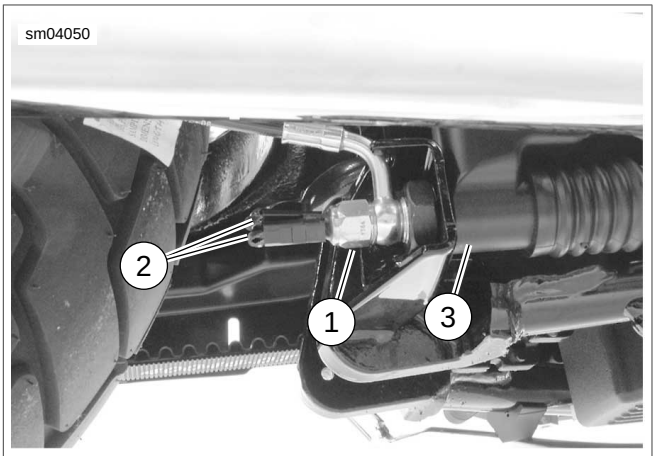
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

4. Bleed brake system. See 2.14 BLEEDING BRAKES.

⚠WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

5. Check stop lamp for proper operation.



1. **Stoplamp switch**
2. **Connectors**
3. **Master cylinder**

Figure 7-76. Rear Stoplamp Switch

HORN 7.28

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.

REPLACEMENT

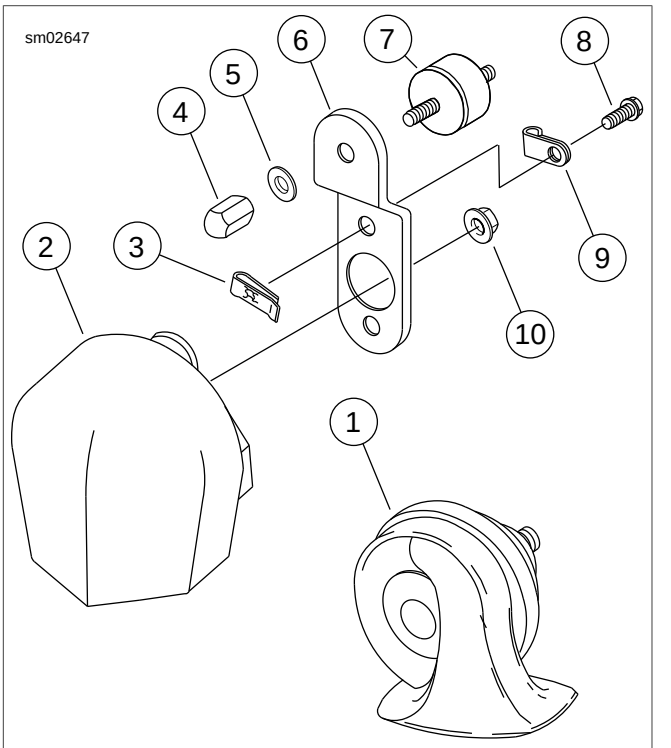
FASTENER	TORQUE VALUE	
Horn mounting nut	120-180 **in-lbs**	13.6-20.3 Nm

1. See Figure 7-77. Remove nut (4) and washer (5) to detach horn bracket (6).
2. See Figure 7-78. Disconnect wires from posts (1, 2) on back side of horn.
3. See Figure 7-77. Remove screws (8) and nut (10) to detach horn from bracket. Free wires from clamp (9).
4. Install **new** horn on bracket. Secure with screws (8), push nuts (3) and nut (10). Fold wires under clamp (9).
5. See Figure 7-78. Attach wiring.
   a. Connect Y/BK wire to gold post (1).
   b. Connect BK wire to silver post (2).

NOTE

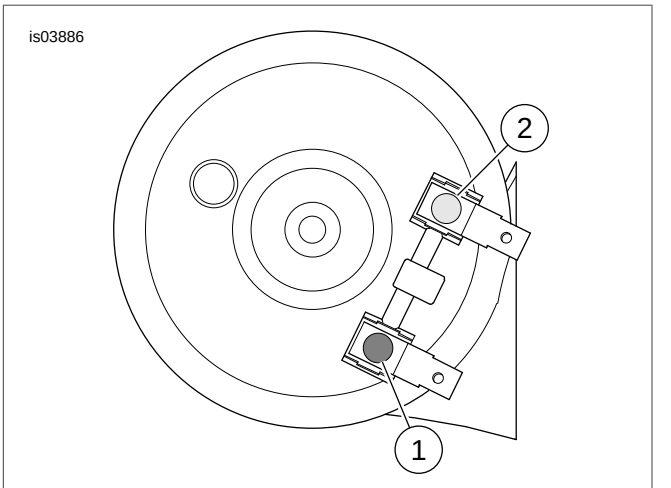
When tightening fasteners, be sure the horn does not contact the horn cover or other parts.

6. See Figure 7-77. Attach horn to vehicle using washer (5) and nut (4). Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).



1. **Horn**
2. **Cover**
3. **Push nut (2)**
4. **Acorn nut**
5. **Washer**
6. **Bracket**
7. **Rubber mount**
8. **Screw (2)**
9. **Clamp**
10. **Nut**

Figure 7-77. Horn: All But FXS/B



1. **Gold post and Y/BK wire**
2. **Silver post and BK wire**

Figure 7-78. Horn Wiring

ACTIVE EXHAUST 7.29

GENERAL

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe. The valve connects to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

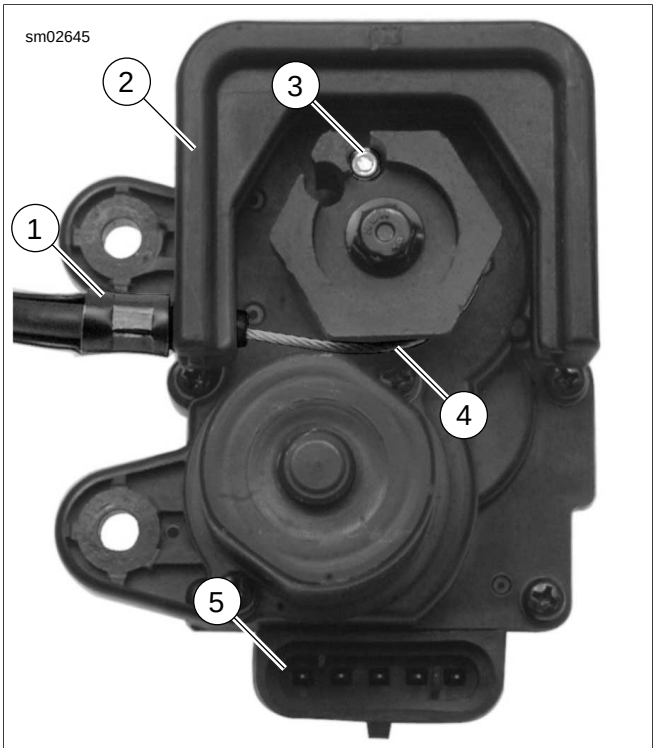
The active exhaust module is located in front of the battery box. The attached cable is routed to a bellcrank located on the rear exhaust pipe.

NOTE

***ABS Models:** The active exhaust cable is routed on the outside of the ABS heat shield.*

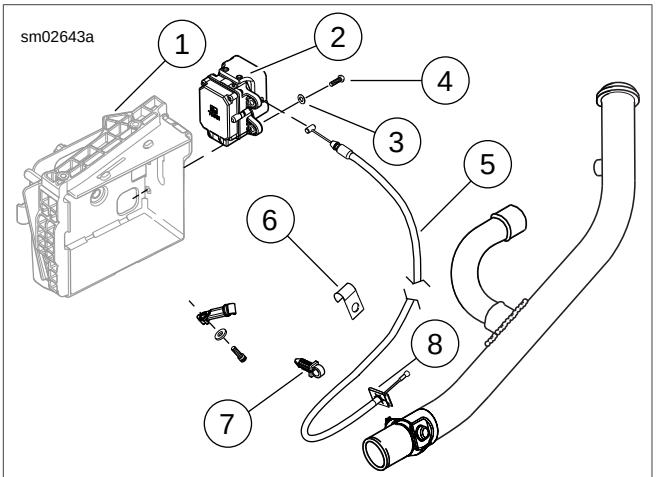
REMOVAL

1. See Figure 7-79. Remove active exhaust cable housing (1) from notch in shroud (2). Remove ferrule (3) from active exhaust module to free cable (4).
2. See Figure 7-80. Remove module fasteners (4) and washers (3) from battery box (1).
3. Remove active exhaust cable (5) from clip (7), cable clamp (6) and exhaust valve cable clip (8).
4. Detach cable from exhaust head pipe to free cable.



1. **Active exhaust cable housing**
2. **Shroud, HDI, Australia and England only**
3. **Ferrule**
4. **Active exhaust cable**
5. **Active exhaust module connector [179]**

Figure 7-79. Active Exhaust Module



1. **Battery box**
2. **Active exhaust module**
3. **Washer (2)**
4. **Module fastener (2)**
5. **Cable**
6. **Cable clamp**
7. **Cable clip**
8. **Exhaust valve cable clip**

Figure 7-80. Active Exhaust

REPAIR

NOTE

See Figure 7-79. 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

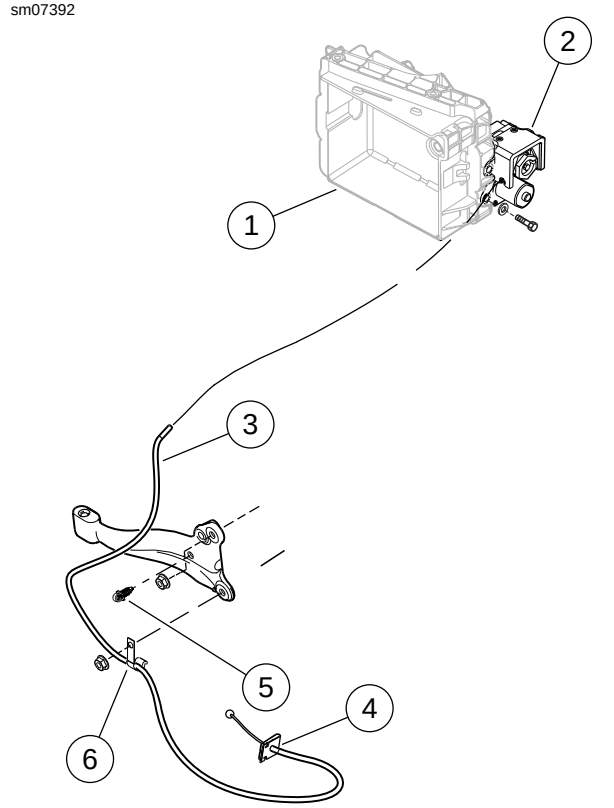
FASTENER	TORQUE VALUE	
Active exhaust module fasteners	36-60 **in-lbs**	4.0-6.8 Nm

NOTE

Verify that active exhaust cable to does not contact rear exhaust pipe or any other part of the vehicle after installation.

1. See Figure 7-79. Install ferrule (3) into slot shown. Wrap cable counterclockwise around active exhaust module shroud as shown.
2. Clip cable housing into active exhaust module housing shroud (2).
3. Place active exhaust module into position in front of battery box.
4. See Figure 7-80. Install fasteners (4) and washers (3). Tighten to 36-60 **in-lbs** (4.0-6.8 Nm).

5. See Figure 7-81. After installation, be sure active exhaust cable is routed correctly. Cable must not contact the exhaust pipe, battery cover or transmission case.



1. **Battery tray**
2. **Exhaust actuator**
3. **Active exhaust cable**
4. **Exhaust valve cable retainer**
5. **Clamp, mounted to muffler bracket**
6. **Clamp, active exhaust cable**

Figure 7-81. Active Exhaust Cable Retention: All HDI Models with Dual Exhaust Only

MAIN WIRING HARNESS 7.30

GENERAL

The main wiring harness is routed through the frame backbone. It has enough slack designed into it so that it can be pulled out of the front end of the backbone to access the connectors located inside the frame.

NOTE

See B.1 CONNECTORS, Connector Locations for a description of all connector locations.

REMOVAL

1. Remove seat.
2. **FLD model:** Remove saddlebags. See 2.32 SADDLEBAGS: FLD.

NOTES

- *To verify proper installation, make note of all wire routing and connector locations before removal. In particular, pay close attention to the locations of cable straps and anchors which must be replaced.*
- *Main wire harness is removed from rear of vehicle through rear section of frame.*

3. **Security System:** Disarm system before removal of BCM and main harness.
4. **ABS Models:** Loosen but do not remove fasteners attaching ABS module bracket to frame.

⚠WARNING

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

5. Disconnect battery cables, negative cable first.
6. Remove battery.
7. Remove battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
8. Remove instrument console.
   a. **FXDC, FXDF and FLD models:** see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD. On some models this includes the trim strip.
   b. **FXDL, FXDB and FXDWG models:** see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
   c. Disconnect [20] when removing instrument console.
9. See Figure 7-82. Disconnect fuel pump/sender connector [141].
10. Remove fuel tank and detach fuel gauge connector [117]. See 4.4 FUEL TANK.
11. Remove muffler. See 4.15 EXHAUST SYSTEM.
12. Remove rear brake master cylinder. See 2.12 REAR BRAKE MASTER CYLINDER.
13. On HDI vehicles with dual exhaust, remove active exhaust module connector [179] located on front of electrical caddy.

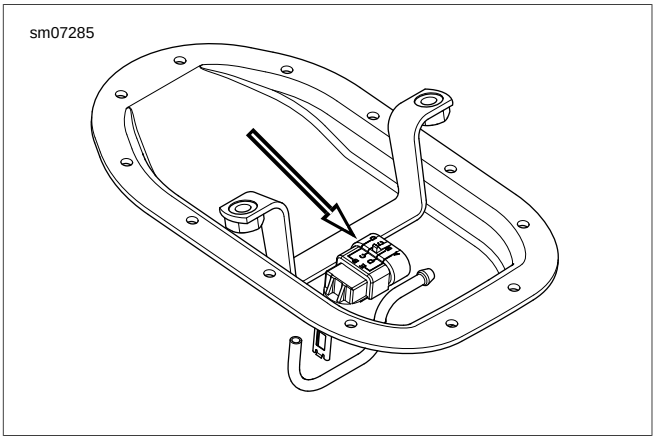


Figure 7-82. Fuel Pump Connector [141] (Typical)

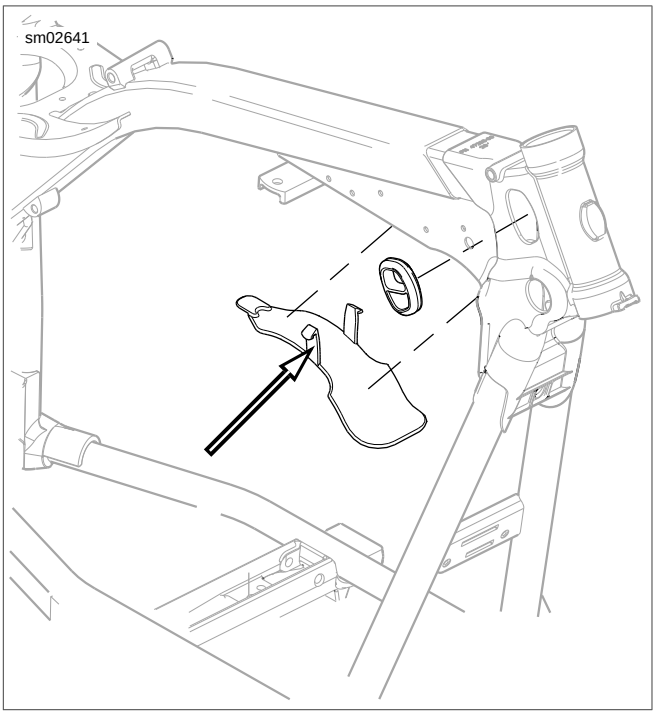


Figure 7-83. Harness Shield

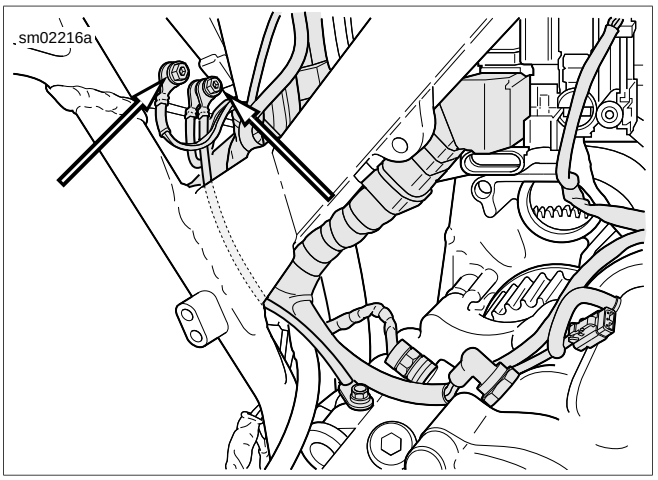
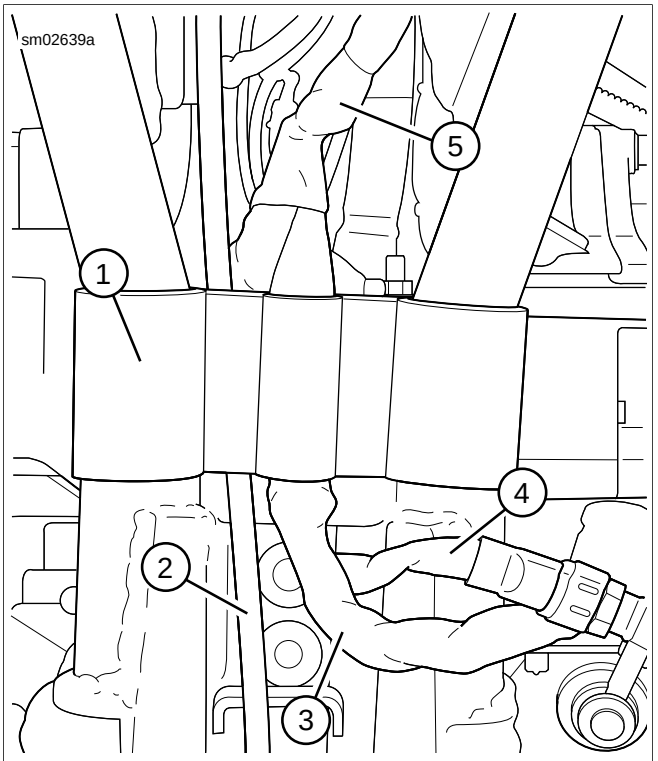


Figure 7-84. Vehicle Ground Studs



1. **Wire harness retainer**
2. **Vent line**
3. **To front of vehicle**
4. **Rear stoplight switch harness**
5. **Front engine harness**

Figure 7-85. Main Wire Harness Retainer

14. See Figure 7-83. Remove harness shield by pushing both tabs of shield in at the same time.
15. Pull harness connectors from inside frame.
16. Disconnect the following connectors:
    a. Right handlebar controls [22-1, 22-2],
    b. Left handlebar controls [24],
    c. Turn signals [31],
    d. Headlamp [38],
    e. Ignition switch/fork lock [33]
    f. **ABS Models:** Front wheel speed sensor [167].

NOTE

In next step, note location of ground wires before removal to verify proper installation.

17. See Figure 7-84. Remove ground wires from studs on frame.
18. Disconnect connectors located under seat:
    a. Accessory connector [4].
    b. Tail lamp harness connector [7].
    c. Rear oxygen sensor [137].
    d. **If Security System Equipped:** security siren connector [142].
    e. B+ connector [160].
    f. Jiffy stand sensor [133].
    g. **ABS Models:** Rear wheel speed sensor [168].
    h. **ABS Models:** ABS EHCU [166], electro hydraulic control unit.
19. Disconnect starter solenoid [128].
20. Disconnect two neutral switch post terminals [131] located on top of transmission.
21. Remove rear stoplamp switch terminals [121]. See 7.27 REAR STOPLAMP SWITCH.
22. Remove starter post nut, main wiring harness ring terminal and positive battery cable from starter post.
23. Disconnect and remove rear fender. See 2.27 REAR FENDER.

NOTE

In order to access wire harness retainer, remove the lower shock bolts and lower rear fork.

24. See Figure 7-85. Slide wire harness retainer up frame tubes. Remove harness retainer from frame and harness.

25. Remove the following connectors located in fuel tank area:
    a. MAP sensor connector [80].
    b. Horn wires [122].
    c. IAT sensor connector [89].
    d. ET sensor connector [90].
    e. IAC connector [87].
    f. TP sensor connector [88].
    g. Front [84] and rear [85] fuel injector connectors.
    h. ACR [203F & R], if equipped.
    i. Intake solenoid connector [178] from air cleaner backing plate.

NOTES

- *Remove harness anchors from harness trough and frame.*
- *Do not reuse harness anchors.*

26. Disconnect:
    a. Voltage regulator [77],
    b. Crank position sensor [79],
    c. Front oxygen sensor [138],
    d. Oil pressure switch [120].
27. Remove electrical caddy and ignition coil. See 7.3 ELECTRICAL CADDY.
28. Remove starter. See 7.11 STARTER

NOTE

The upper portion of the wiring harness is now free. Be careful to note routing before pulling harness out of position.

29. Attach a long thin wire to the top end of the wiring harness before pulling harness through frame backbone. This guide wire will aid in pulling the **new** harness back through the backbone.
30. Gently pull wiring harness out of rear of frame tube.

INSTALLATION

FASTENER	TORQUE VALUE	
ABS bracket fastener	90-114 **in-lbs**	10.2-12.8 Nm

NOTES

- *Be sure to replace all cable straps and anchors.*
- *Do not remove factory installed wire harness tape securing connectors to harness unless necessary.*
- *Before installing starter route all necessary cables and harnesses along top of crankcase.*

1. Guide wiring harness back into frame backbone. Pull the front of the harness through using the guide wire while pushing the harness through the frame tube opening.
2. Connect the following connectors:
    a. Right handlebar controls [22-1, 22-2],
    b. Left handlebar controls [24],
    c. Turn signals [31],
    d. Headlamp [38],
    e. Instruments [20],
    f. Ignition switch/fork lock [33],
    g. **ABS Models:** Front wheel speed sensor [167].

NOTE

Be sure to leave enough slack in harness at front of vehicle so when front wheel is turned, harness does not bind.

3. See Figure 7-86. Install connectors into frame. Install harness shield.
4. **ABS Models:** Connect ABS components.
    a. ABS EHCU, electro hydraulic control module [166],
    b. Rear wheel speed sensor [168].
5. To ease installation, wrap voltage regulator terminals with electrical tape.
6. See Figure 7-85. Route engine harness (which contains voltage regulator connector [77], crank position sensor connector [79], stator connector [46] and front oxygen sensor [138] wiring to front of vehicle as shown. Install the oxygen sensor and crank position sensor connectors in front electrical caddy, see 7.15 CRANK POSITION SENSOR (CKP). Connect the engine harness and stator connectors to the voltage regulator.
7. Install starter motor. See 7.11 STARTER.
8. Install starter post nut, positive battery cable and main wiring harness ring terminal to starter post.
9. Route rear brake switch wiring and connect to rear brake switch [121].
10. Route neutral switch wiring and connect to neutral switch [131].
11. Route starter solenoid wiring and connect to starter solenoid [128].
12. Install rear brake master cylinder and rear brake control. See 2.12 REAR BRAKE MASTER CYLINDER.
13. Secure front engine harness with harness clamps.
14. See Figure 7-87. Install wire harness retainer (1).

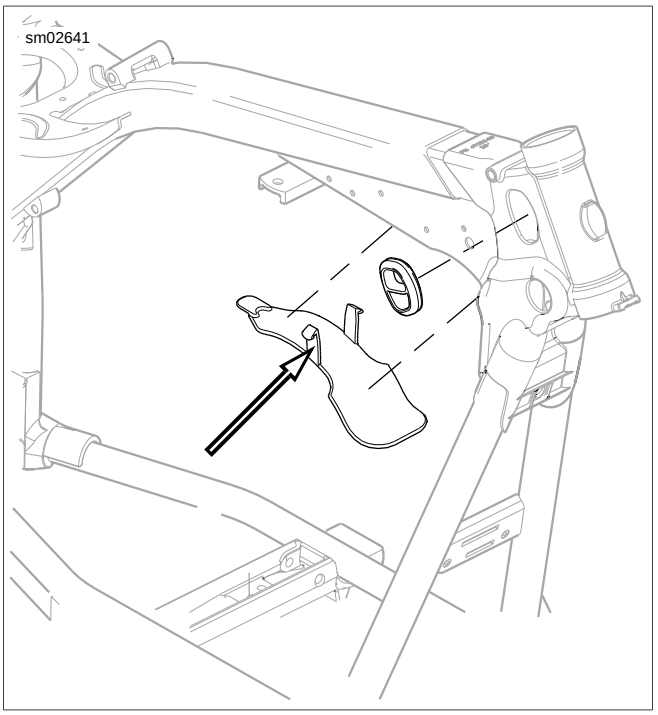
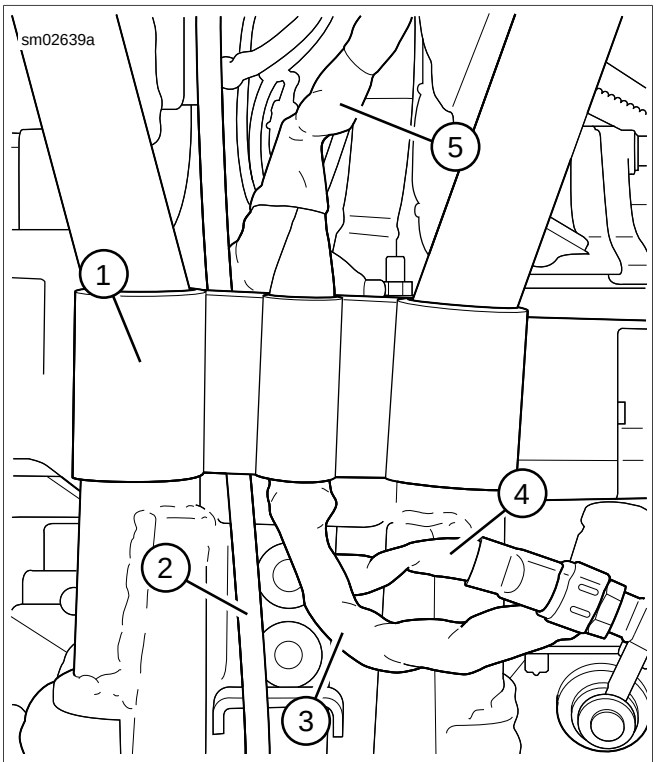


Figure 7-86. Harness Shield



1. **Wire harness retainer**
2. **Vent line**
3. **To front of vehicle**
4. **Rear stoplight switch harness**
5. **Front engine harness**

Figure 7-87. Main Wire Harness Retainer

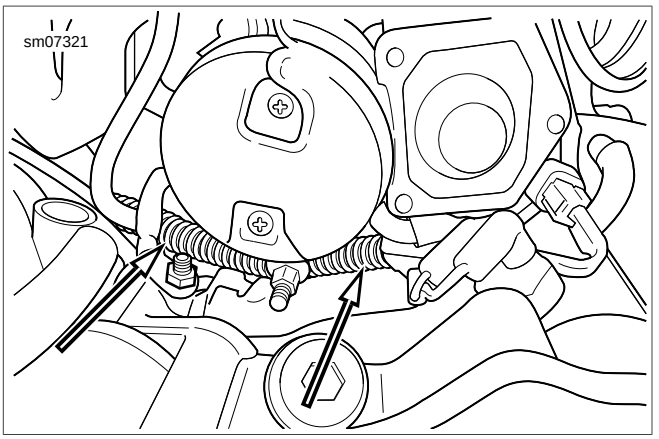


Figure 7-88. Wire Harness Routed Under Starter

NOTES

- *See Figure 7-85. To prevent contact with rear fork, front engine harness (5) and rear brake switch wiring must be secured in wire harness retainer (1).*
- *If equipped with jiffy stand sensor (HDI models only), route the sensor harness up along the vent line (2) and secure in the same retainer cavity as the vent line.*

15. Install rear stoplamp switch terminals. See 7.27 REAR STOPLAMP SWITCH.
16. Connect oil pressure switch [120].
17. See Figure 7-89. Connect vehicle speed sensor connector [65].
18. See Figure 7-90. Secure harness grounds to studs.
19. Route top engine harness to fuel tank area.
20. Connect:
    a. MAP sensor connector [80],
    b. Horn wires [122],
    c. IAT sensor connector [89],
    d. ET sensor connector [90],
    e. IAC connector [87],
    f. TP sensor connector [88],
    g. Front [84] and rear [85] fuel injector connectors,
    h. ACR [203F&R], if equipped,
    i. Intake solenoid connector [178] from air cleaner backing plate.
21. See Figure 7-91. Install wire harness retainer on frame tubes. Install harness retainer onto harness.
22. Install and connect rear fender. See 2.27 REAR FENDER.
23. Install lower shock bolts through shocks and into rear fork.
24. Install electrical caddy, wiring and coil. See 7.3 ELECTRICAL CADDY.

25. See Figure 7-92. Mate connectors located under seat:
    a. Accessory connector [4], if used.
    b. Tail lamp harness connector [7].
    c. Rear oxygen sensor [137].
    d. Security siren connector [142] if security siren installed.
    e. B+ connector [160].
26. HDI Models: Install active exhaust module connector [179] located in front of electrical caddy.
27. Install fuel tank. See 4.4 FUEL TANK. Connect fuel gauge connector [117].
28. See Figure 7-85. Connect fuel pump/sender connector [141].
29. For all models when installing instrument console connect [20].
30. Install instrument console.
    a. **FXDC, FXDF and FLD models:** see 7.21 INSTRUMENTS: FXDC, FXDF AND FLD.
    b. **FLD model:** Install trim strip and instrument console and disconnect [20].
    c. **FXDL, FXDB/P/A and FXDWG models:** see 7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG.
31. Install muffler. See 4.15 EXHAUST SYSTEM.

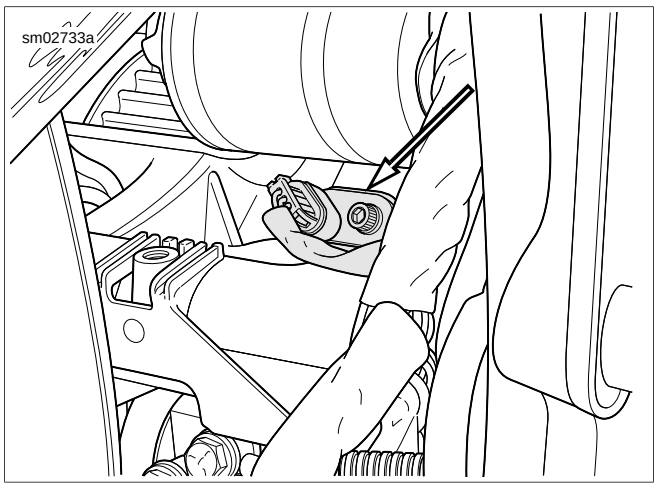


Figure 7-89. Vehicle Speed Sensor

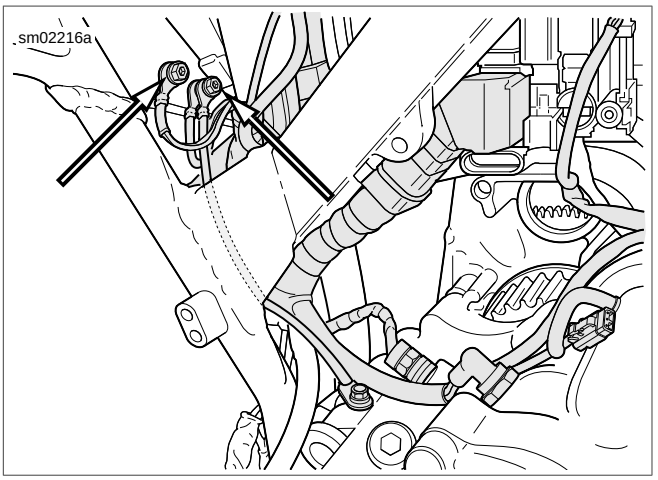
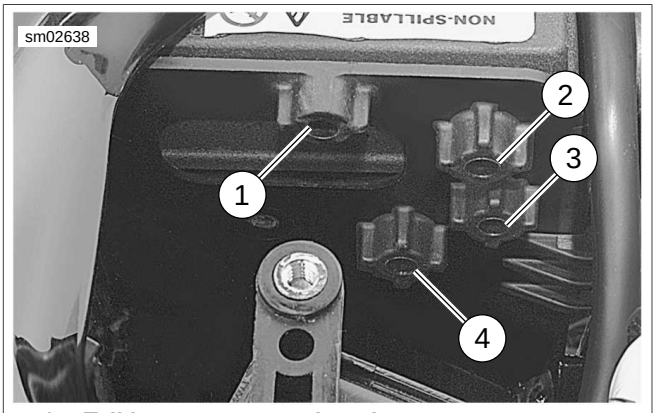
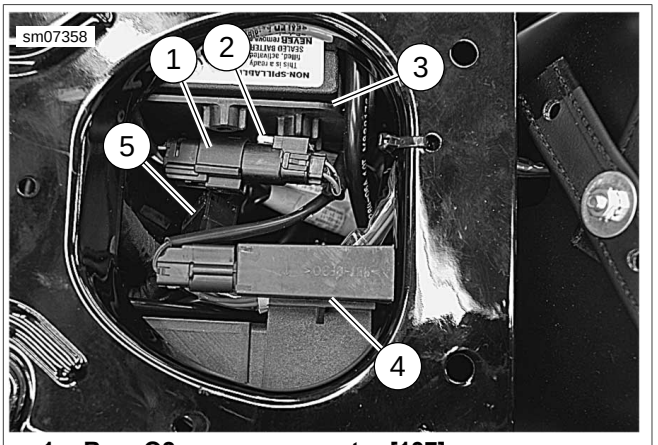


Figure 7-90. Vehicle Ground Studs



1. **Tail lamp connector location**
2. **B+ connector location**
3. **Accessory connector location**
4. **Unused**

Figure 7-91. Under Seat Connector Mounting Locations



1. **Rear O2 sensor connector [137]**
2. **Connector anchor**
3. **Battery tray**
4. **Security antenna**
5. **Tail lamp connector [7]**

Figure 7-92. Rear O2 Sensor Connector Location

⚠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)

32. **ABS Models:** Install the ABS heat shield.
33. Install BCM and connect to main harness.
34. Install cable straps and anchors in correct locations after installing main wire harness.
35. Pull harness connectors inside of frame backbone and install shield.

⚠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)

36. **ABS Models:** Tighten fasteners attaching ABS module bracket to frame. Tighten to 90-114 **in-lbs** (10.2-12.8 Nm)
37. Install battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
38. Install battery.
39. Connect battery cables, positive cable first.
40. Arm security, if equipped.
41. **FLD model:** Install saddlebags. See 2.32 SADDLEBAGS: FLD.

⚠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)

42. 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)

43. Turn ignition ON. Test all electrical components for correct operation.

HANDLEBAR CONTROL MODULES 7.31

GENERAL

The handlebar switches are now modular and are of rugged construction and feature a superior seal to protect electrical contacts and components from dirt and moisture in harsh environments.

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 7.33 RIGHT HANDLEBAR CONTROL MODULE or 7.32 LEFT HANDLEBAR CONTROL MODULE.*

REPAIR PROCEDURES

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

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.

⚠WARNING

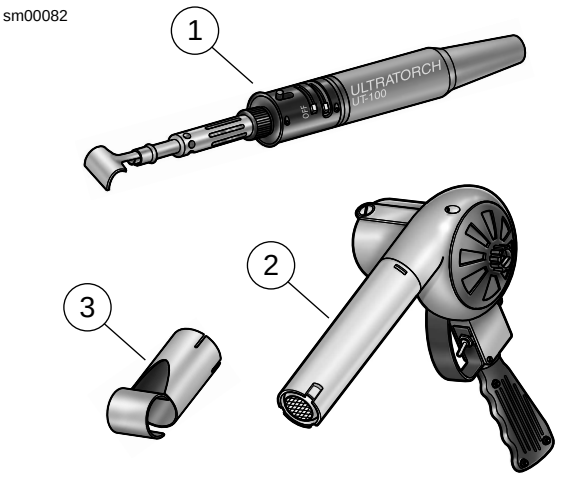
Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

6. See Figure 7-93. Use ULTRA TORCH UT-100 (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 meltable sealant exudes 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 7-93. Radiant Heating Devices

LEFT HANDLEBAR CONTROL MODULE 7.32

REMOVAL

WARNING

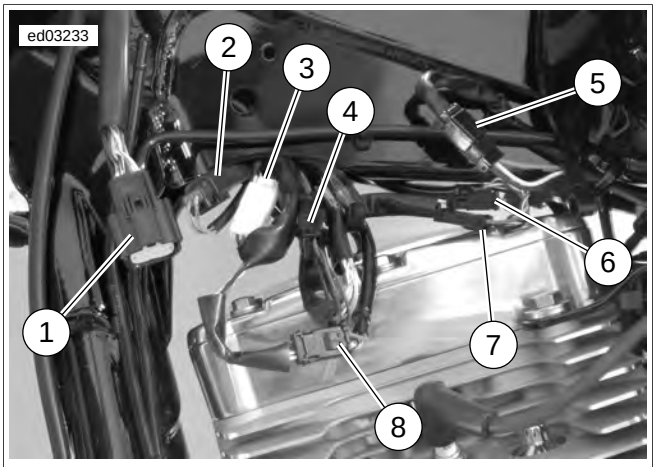
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.
2. Remove fuel tank. See 4.4 FUEL TANK.
3. Remove shield at bottom of frame backbone and remove rubber grommets on each side of the frame.
4. See Figure 7-94. Disconnect left hand control connector (8).
5. Loosen the upper handlebar clamp-to-clutch lever screws.
6. Remove the upper and lower module housing screws. Remove upper switch housing.
7. See Figure 7-95. Remove screws (3) and retainer (1).
8. Carefully remove clutch switch (2) and left hand control module from lower housing.

NOTE

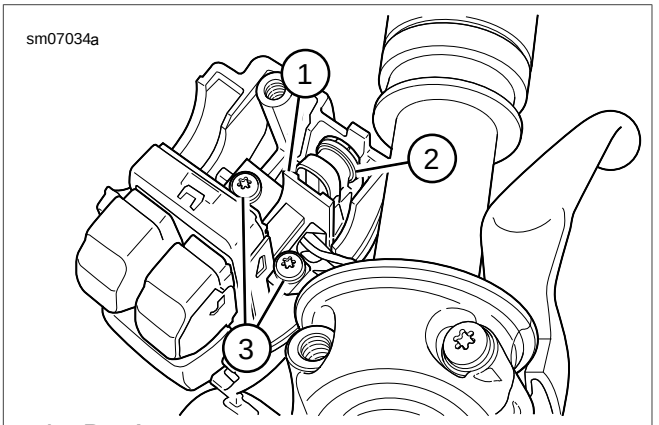
Record wire routing along with clamp and cable strap locations before removal.

9. Remove left hand control module from motorcycle.



1. **Console gauges/instrument lamps [20]**
2. **Front WSS (ABS only) [167]**
3. **Left front turn signal [31LA]**
4. **Right front turn signal [31RA]**
5. **Fuel gauge [117]**
6. **Right hand control [22-2]**
7. **Right hand control [22-1]**
8. **Left hand control [24]**

Figure 7-94. Under Fuel Tank: FXDB/FXDL



1. **Retainer**
2. **Clutch switch**
3. **Screw (2)**

Figure 7-95. Left Handlebar Control Module and Clutch Switch Retainer

CLUTCH SWITCH REPLACEMENT

FASTENER	TORQUE VALUE	
Handlebar switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm

1. Remove upper switch housing cover. See 7.32 LEFT HANDLEBAR CONTROL MODULE, Removal.
2. See Figure 7-96. 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 7.31 HANDLEBAR CONTROL MODULES, Repair Procedures.
8. See Figure 7-96. 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 7.32 LEFT HANDLEBAR CONTROL MODULE, Installation.

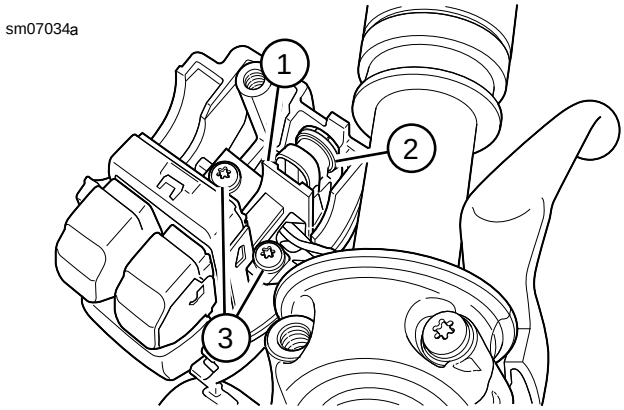
INSTALLATION

FASTENER	TORQUE VALUE	
Handlebar module assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm
Handlebar clutch lever clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm

NOTE

When installing the left hand control module and retainer, do not pinch wires. Verify that the rubber grommet on the wire harness is properly placed on the housing.

1. See Figure 7-96. Place hand control module into position on lower housing and carefully install clutch switch (2).



1. **Retainer**
2. **Clutch switch**
3. **Screw (2)**

Figure 7-96. Left Handlebar Control Module and Clutch Switch Retainer

NOTE

See Figure 7-98. When installing left hand control module 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 screws to 8-10 **in-lbs** (0.9-1.1 Nm).
3. Position the upper module housing over the handlebar and lower module housing.
4. Start the upper and lower module housing screws, but do not tighten.
5. See Figure 7-97. Position the clutch hand lever assembly inboard of the module housing assembly, engaging the tab (3) on the lower module housing in the groove (2) at the bottom of the clutch lever bracket.
6. Align the holes in the handlebar clutch lever clamp with those in the clutch lever bracket and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten to 60-80 **in-lbs** (6.8-9.0 Nm).

NOTE

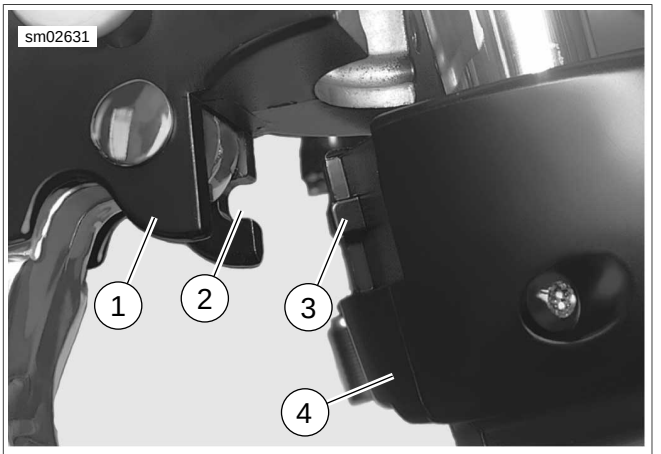
Always tighten the lower module housing screw first so that any gap between the upper and lower housings is at the front of the housing.

7. Tighten module housing screws to 35-45 **in-lbs** (4.0-5.1 Nm).
8. See Figure 7-94. Connect left hand control connector.
9. Secure harness with clamps and cable strap as noted during removal.
10. Install fuel tank. See 4.4 FUEL TANK.
11. Install main fuse. See 7.8 FUSES.

⚠WARNING

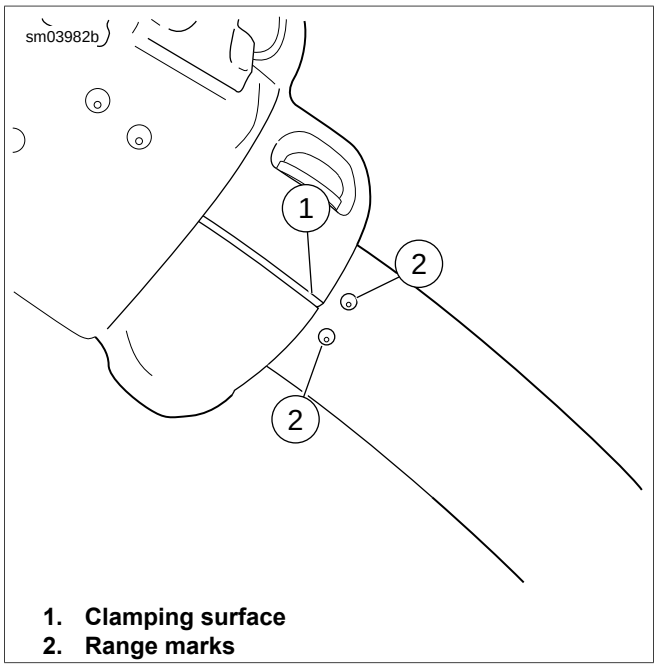
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

12. Test the switches for proper operation.



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

Figure 7-97. Clutch Lever Bracket



1. Clamping surface
2. Range marks

Figure 7-98. Left Hand Control Assembly to Handlebar Alignment

RIGHT HANDLEBAR CONTROL MODULE 7.33

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. Remove fuel tank. See 4.4 FUEL TANK.
3. See 7.30 MAIN WIRING HARNESS. Remove shield at bottom of frame backbone and remove rubber grommets on each side of the frame and disconnect right hand control connectors.
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.

NOTE

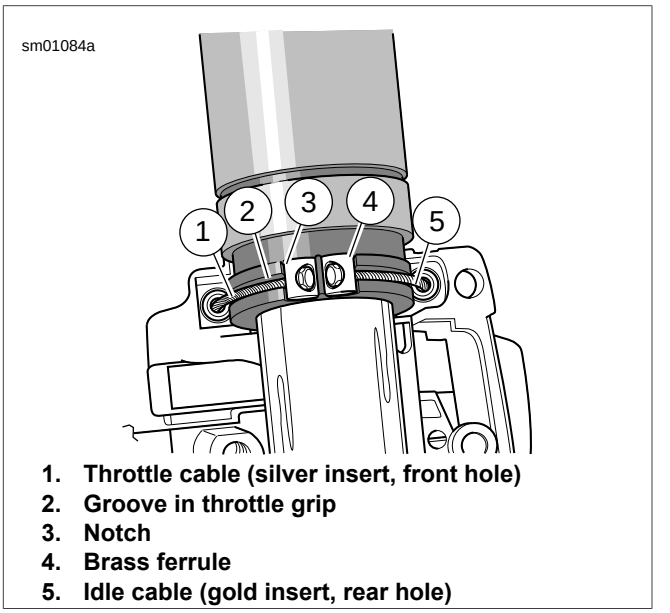
The friction shoe is a loose fit. It may fall out or become dislodged if the lower switch housing is turned upside down or shaken.

6. Remove the friction shoe from the end of the tension adjuster screw.
7. Loosen cable adjusters. See 1.13 THROTTLE CABLES.
8. See Figure 7-99. 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 7-100. If replacing lower switch housing,
    a. Pull the crimped inserts at the end of the throttle and idle control cable housings from the lower switch housing.
    b. For best results, use a rocking motion while pulling.
    c. Place a drop of light oil on the retaining rings, if necessary.
    d. Remove the cables from the switch housing.
11. See Figure 7-101. Remove screws (3) and retainer (1).

NOTE

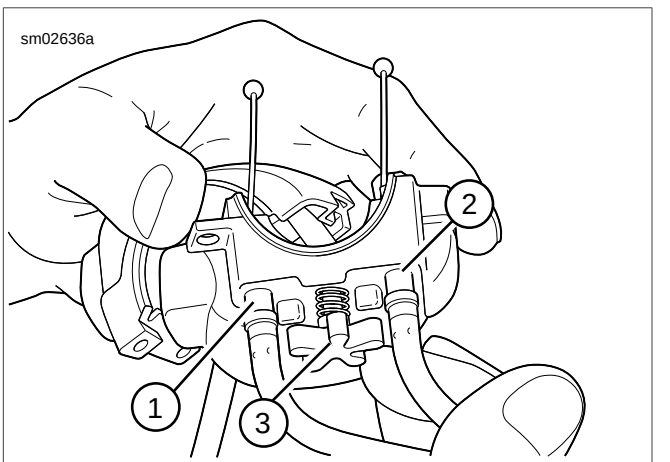
Record wire routing before removal.

12. Carefully remove brake switch (2) and right hand control module from lower housing. Remove right hand control module.



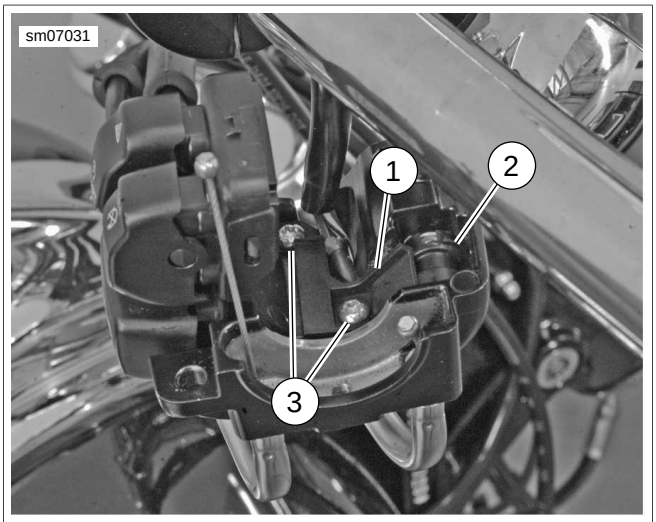
1. **Throttle cable (silver insert, front hole)**
2. **Groove in throttle grip**
3. **Notch**
4. **Brass ferrule**
5. **Idle cable (gold insert, rear hole)**

Figure 7-99. Throttle Cable Attachment



1. **Idle cable insert (gold insert, rear hole)**
2. **Throttle cable insert (silver insert, front hole)**
3. **Tension adjuster screw**

Figure 7-100. Right Lower Module Housing



1. **Retainer**
2. **Brake switch**
3. **Screw (2)**

Figure 7-101. Right Control Module and Brake Switch Retainer

FRONT BRAKE SWITCH REPLACEMENT

FASTENER	TORQUE VALUE	
Handlebar switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm

1. Remove upper switch housing cover. See 7.33 RIGHT HANDLEBAR CONTROL MODULE, Removal.
2. See Figure 7-101. 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 7.31 HANDLEBAR CONTROL MODULES, Repair Procedures.
8. See Figure 7-101. Install brake switch (2) into housing. Install retainer (1) and screws (3). Tighten screws to 8-10 **in-lbs** (0.9-1.1 Nm).
9. Assemble right handlebar switch housing. See 7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation.

INSTALLATION

FASTENER	TORQUE VALUE	
Handlebar module assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm
Handlebar master cylinder clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm

NOTE

When installing the left hand control module and retainer, do not pinch wires. Verify that the rubber grommet on the wire harness is properly placed on the housing.

1. See Figure 7-101. Place control module into position on module housing and carefully install brake switch (2).
2. Install retainer (1) with screws (3). Tighten screws to 8-10 **in-lbs** (0.9-1.1 Nm).
3. See Figure 7-100. If previously removed from lower module housing, push the throttle and idle control cables into the lower module 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

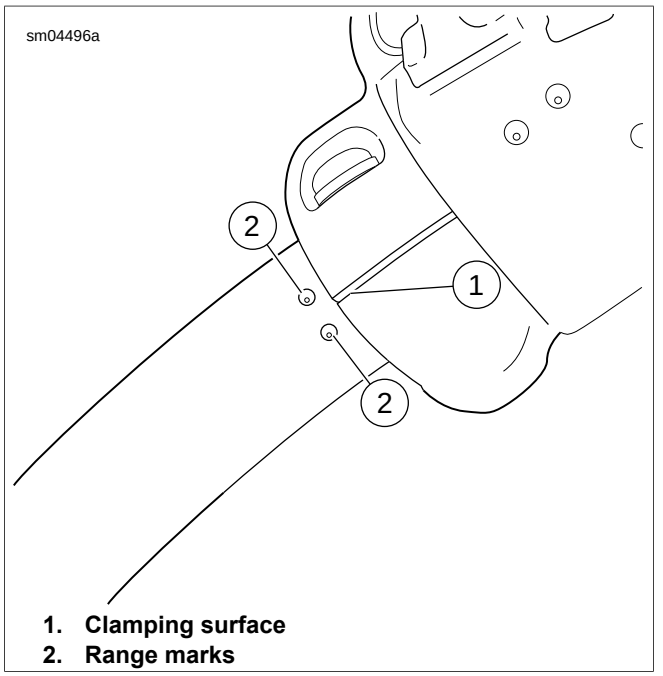
To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.

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

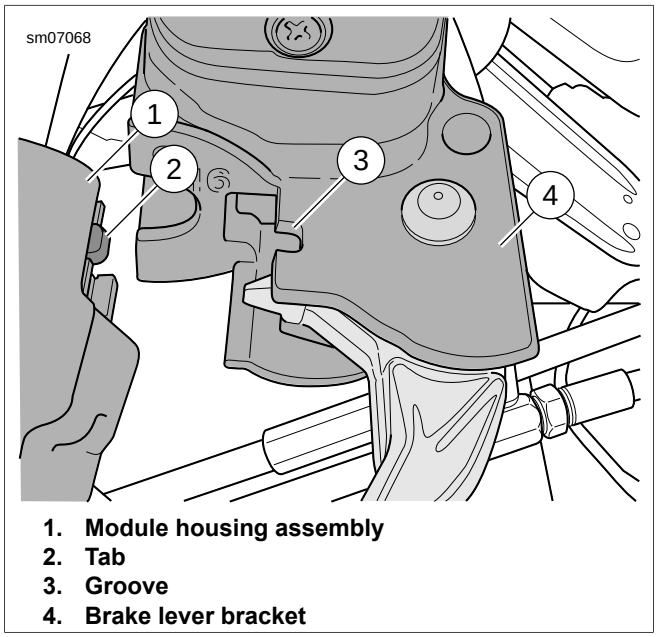
The friction shoe is a loose fit. It may fall out or become dislodged if the lower module housing is turned upside down or shaken.

6. See Figure 7-99. Position lower module 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.



1. **Clamping surface**
2. **Range marks**

Figure 7-102. Right Hand Control Assembly to Handlebar Alignment



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

Figure 7-103. Module Housing Alignment

NOTE

See Figure 7-102. When installing right handlebar module 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 module housing over the handlebar and lower module housing.
8. Start the upper and lower module housing screws, but do not tighten.
9. See Figure 7-103. Position the brake lever/master cylinder assembly inboard of the module housing assembly, engaging the tab (2) on the lower module 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 module housing screws to 35-45 **in-lbs** (4.0-5.1 Nm).

NOTE

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

12. Adjust throttle cables. See 2.20 THROTTLE CONTROL.
13. Connect right hand control connectors.
14. Secure harness with clamps and cable strap as noted during removal.
15. Install fuel tank. See 4.4 FUEL TANK.
16. Install main fuse. See 7.8 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)

17. Test the switches for proper operation.

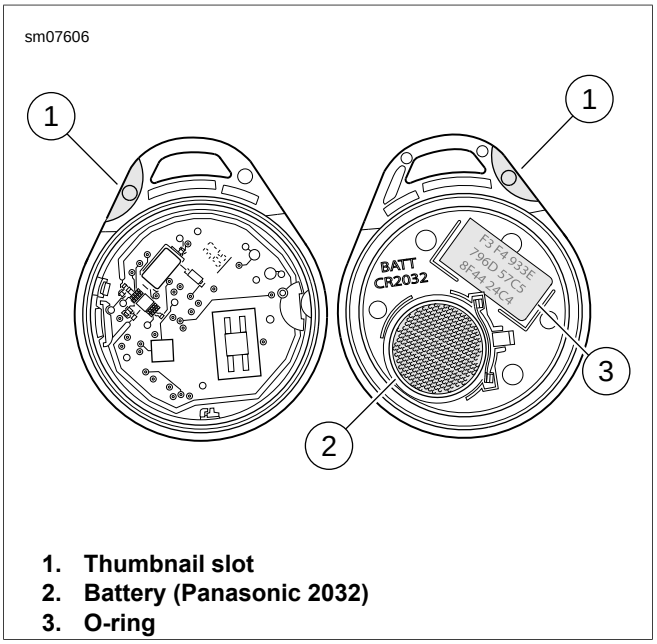
FOB BATTERY

Battery Replacement Schedule

Replace the fob battery every year.

Battery Replacement

1. Open the fob case.
   a. See Figure 7-104. Place a thin blade in the thumbnail slot (1) between the two halves of the case.
   b. Slowly twist the blade.
2. Replace the battery.
   a. Remove the original battery.
   b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. Close the case.
   a. See Figure 7-104. With O-ring (3) in place, align case halves.
   b. Snap case halves together.



1. **Thumbnail slot**
2. **Battery (Panasonic 2032)**
3. **O-ring**

Figure 7-104. Open Fob: HFSM

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.

NOTE

The internal siren battery may not charge if the motorcycle's battery is less than 12.5V.

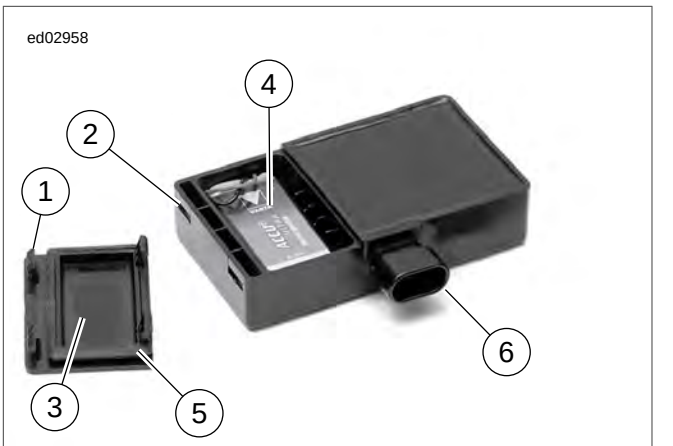
Battery Replacement

1. Disarm system and remove siren.
2. See Figure 7-105. 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.



1. **Catch (2)**
2. **Slot (2)**
3. **Cover**
4. **9 Volt battery**
5. **Rubber seal**
6. **Connector [142A]**

Figure 7-105. Battery Compartment

PERSONAL IDENTIFICATION NUMBER (PIN) 7.35

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 fob becomes unavailable.

CHANGING THE PIN

The rider can change the PIN at any time. Refer to Table 7-12.

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 7-12. Changing the PIN

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Select a 5-digit (1 thru 9) PIN and record on the wallet card from Owner's Manual.		
2	With an assigned fob present, turn the OFF/RUN switch to **OFF**.		
3	Turn the ignition switch to **IGN**.		
4	Cycle the OFF/RUN switch twice: **RUN - OFF - RUN - OFF - RUN**.		
5	Press **left** turn signal switch **2 times**.	ENTER PIN will scroll through the odometer window.	
6	Press **right** turn signal switch **1 time** and release.	Turn signals will flash 3 times. Current PIN will appear in odometer. The first digit will be flashing.	
7	Enter first digit of new PIN by pressing and releasing the **left** turn signal switch until the selected digit appears.		
8	Press **right** turn signal switch **1 time** and release.	The new digit will replace the current in odometer window.	
9	Enter second digit of selected PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
10	Press **right** turn signal switch **1 time** and release.	The new digit will replace the current in odometer window.	
11	Enter third digit of the selected PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
12	Press **right** turn switch **1 time** and release.	The new digit will replace the current in odometer window.	
13	Enter fourth digit of new PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
14	Press **right** turn switch **1 time** and release.	The new digit will replace the current in odometer window.	
15	Enter fifth digit of the new PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		

Table 7-12. Changing the PIN

STEP NO.	ACTION	WAIT FOR CONFIRMATION	NOTES
16	Press **right** turn switch **1 time** and release.	The new digit will replace the current in odometer window.	
17	Turn the OFF/RUN switch **OFF**, then turn the ignition switch to **OFF**.		Pushing the OFF/RUN switch to **OFF** stores the new PIN in the module.

H-DSSS ACTUATION 7.36

SIDECAR CONFIGURATION

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

ACTUATION

Actuation consists of assigning two fobs to the system, and entering an initial PIN. The PIN can be changed by the rider at any time.

1. Configure vehicles by assigning **both** fobs to the vehicle.
2. Configure vehicles by entering a PIN picked by the owner. The personal code 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 7.35 PERSONAL IDENTIFICATION NUMBER (PIN).

Once the system has been activated, it will always "arm" within 5 seconds of turning the ignition switch to **OFF** or **ACC** and no motorcycle motion.

FOB ASSIGNMENT

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

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.

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NOTES

AUTOFUSE UNSEALED ELECTRICAL CONNECTORS A.1

AUTOFUSE UNSEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
GA500A	SNAP-ON TERMINAL PICK

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.

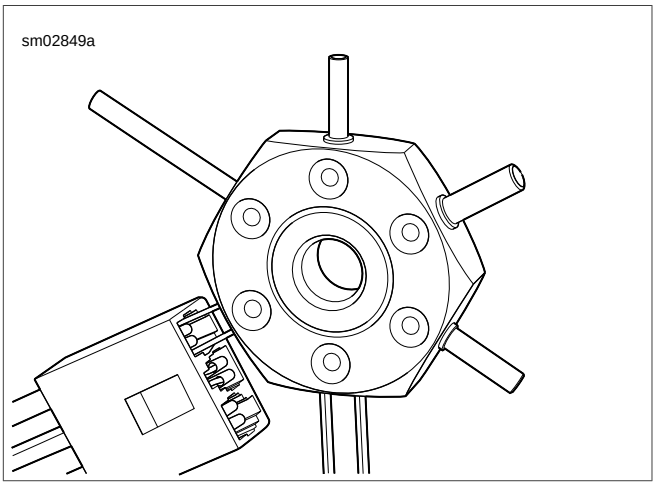


Figure A-1. Removing Autofuse Unsealed Terminal from Ignition Switch

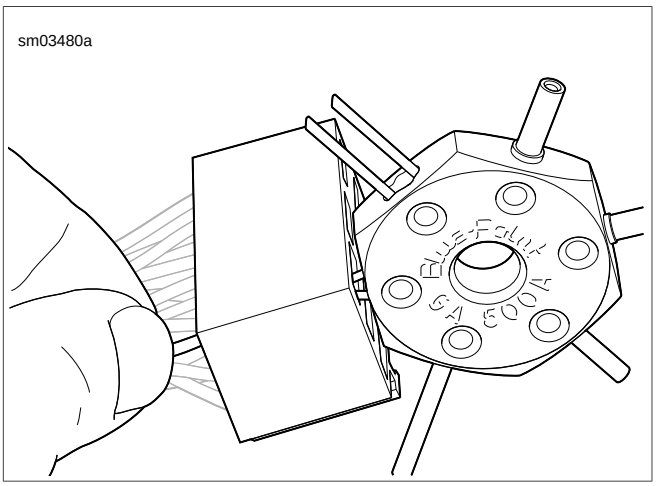


Figure A-2. Removing Autofuse Unsealed Terminal from Fuse Block

BOSCH COMPACT 1.1M CONNECTOR A.2

BOSCH COMPACT 1.1M CONNECTOR

PART NUMBER	TOOL NAME
GA500A	SNAP-ON TERMINAL PICK

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.

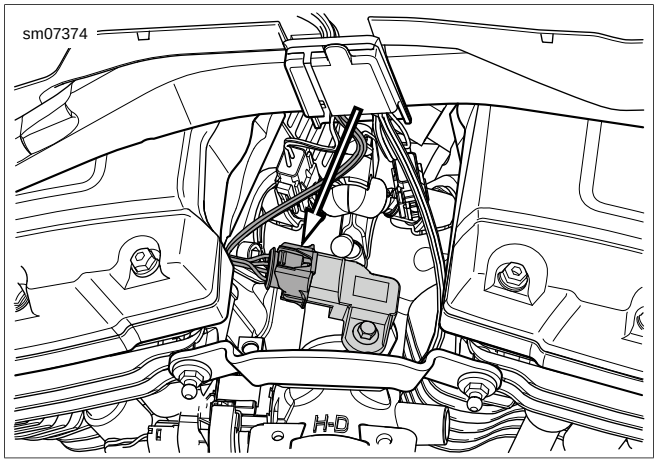


Figure A-3. Bosch Compact 1.1M Connector

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 tangs on each side of the terminal.
3. Gently pull on the wire to remove the terminal.

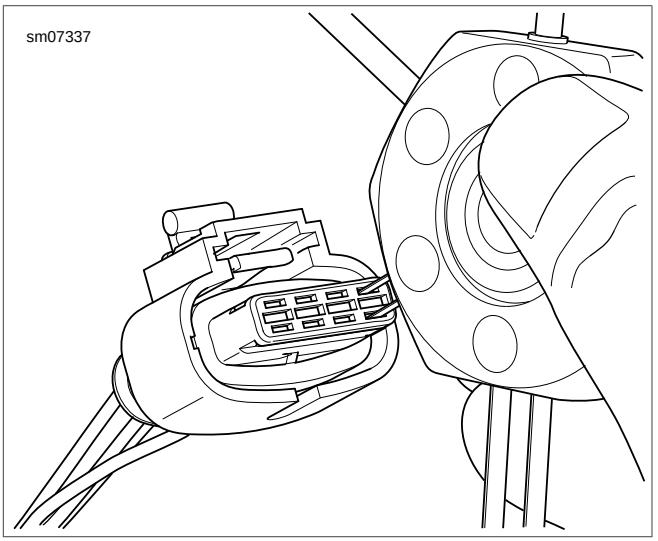


Figure A-4. Terminal Removal: Bosch Compact 1.1M Connector

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.

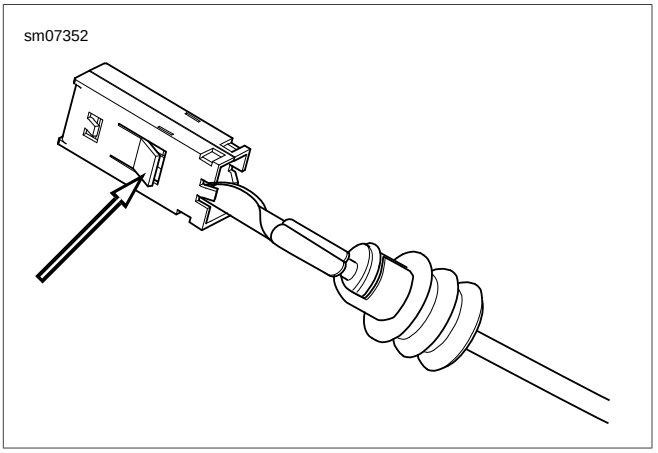


Figure A-5. Tangs: Bosch Compact 1.1M Socket Terminal

DELPHI 100W MICRO-PACK SEALED CONNECTOR A.3

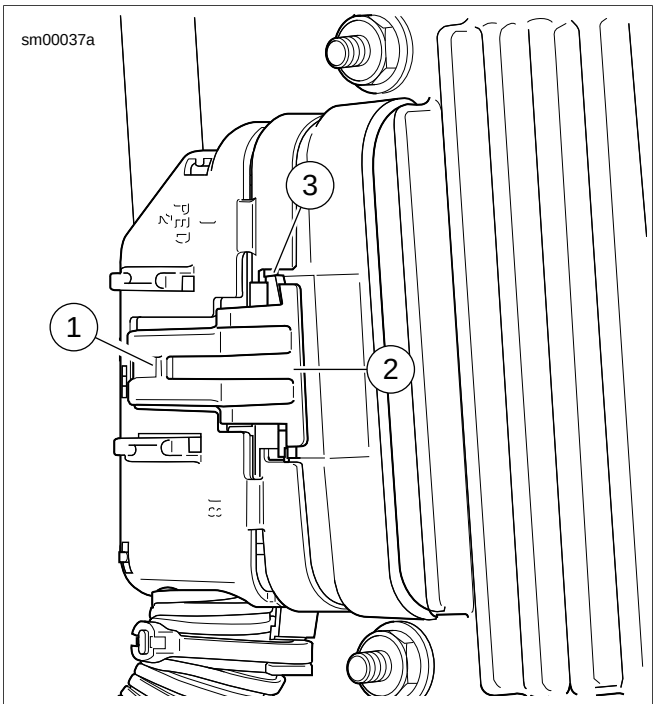
DELPHI 100W MICRO-PACK SEALED CONNECTOR REPAIR

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-6. 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.

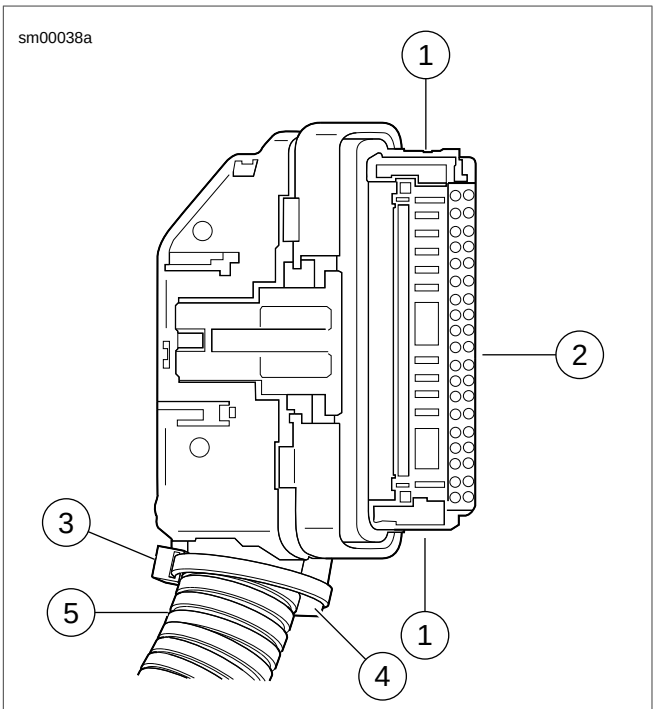


1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

Figure A-6. Delphi 100W Micro-Pack Sealed Connector to ECM

Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.



1. **Latch**
2. **Secondary lock**
3. **Cable strap**
4. **Strain relief collar**
5. **Conduit**

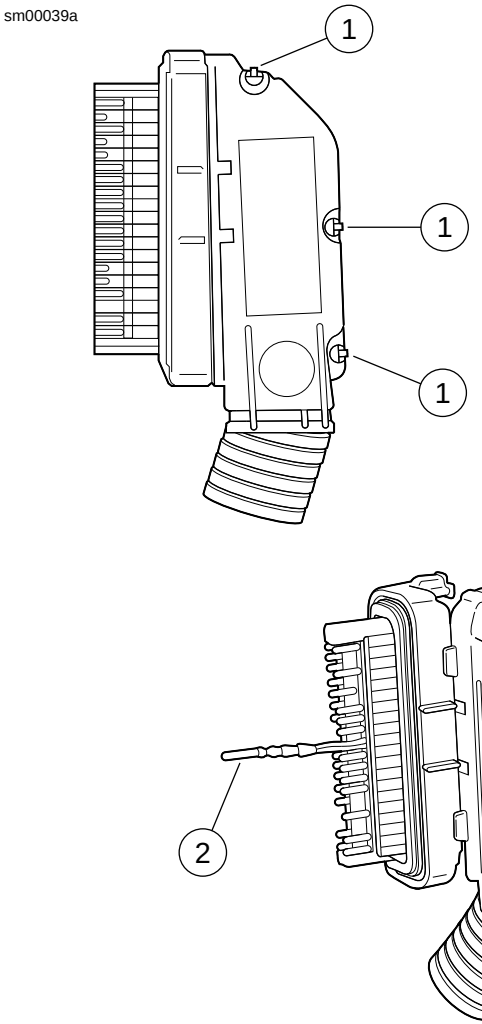
Figure A-7. Delphi 100W Micro-Pack Sealed Connector

Removing Socket Terminal

1. See Figure A-7. 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-8. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins (1) from slots in housing. Separate and spread halves of socket housing.
4. Push on wire lead to free terminal from chamber.

Installing Socket Terminal

1. From inside socket housing, gently pull on wire to draw terminal into chamber.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit.
4. With the two ribs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.



1. **Pins**
2. **Socket terminal**

Figure A-8. Delphi 100W Micro-Pack Sealed Connector: Separate Halves of Socket Housing

CRIMPING TERMINALS

PART NUMBER	TOOL NAME
HD-50120	UNIVERSAL CRIMPER SET
HD-50120-2	HAND CRIMP FRAME
HD-50120-7	DELPHI 100W MICRO-PACK SEALED DIE

1. Strip the wire insulation to specification. Refer to Table A-1.
2. Install the DELPHI 100W MICRO-PACK SEALED 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)

TERMINAL	PART NO.	STRIP LENGTH		NEST
		in	mm	
Socket: 18 AWG	72076-00	0.200	5.1	B
Socket: 20-22 AWG	72568-08	0.200	5.1	C

DELPHI 150 METRI-PACK SEALED CONNECTORS A.4

DELPHI 150 METRI-PACK SEALED CONNECTOR REPAIR

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-9 for pull-to-seat connector or Figure A-10 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

NOTE

For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

NOTE

The tangs are always positioned in the middle of the chamber. 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).
   a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper. 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.
   a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
   b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

Inserting Socket Terminal

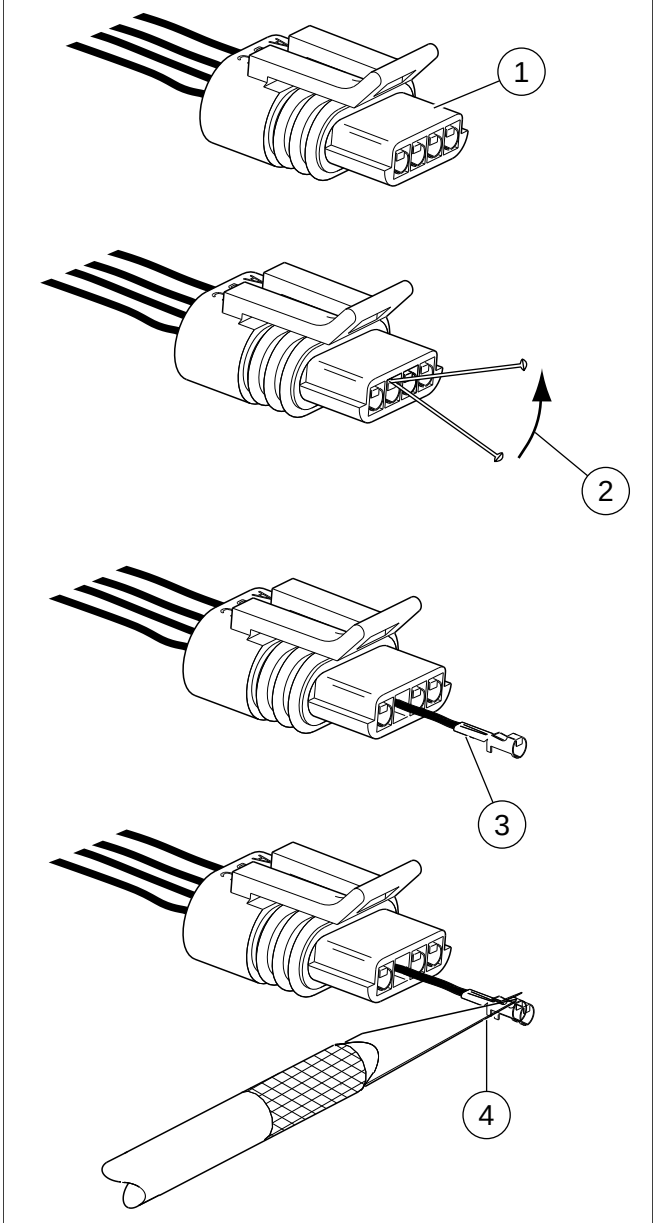
NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. See Figure A-9 for pull-to-seat connector or Figure A-10 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.

   For push-to-seat: See Figure A-10. 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.

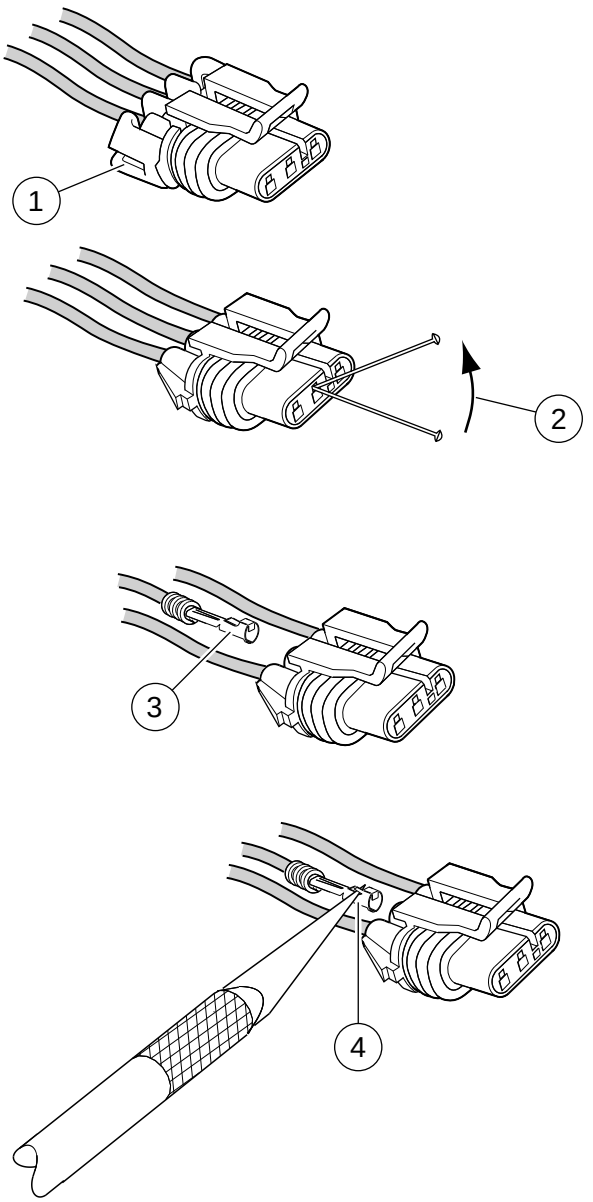
sm00027a



1. Locate tang in chamber
2. Pivot pin to release tang
3. Push to remove
4. Raise tang to install

Figure A-9. Delphi 150 Metri-Pack Sealed Connector: Pull-to-Seat

sm00028a



1. Remove wire lock
2. Pivot pin to release tang
3. Pull to remove
4. Raise tang to install

Figure A-10. Delphi 150 Metri-Pack Sealed Connector: Push-to-Seat

DELPHI 280 METRI-PACK UNSEALED CONNECTORS A.5

FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-11. 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-12. 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 the wire to verify that the terminal is locked in place.
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.

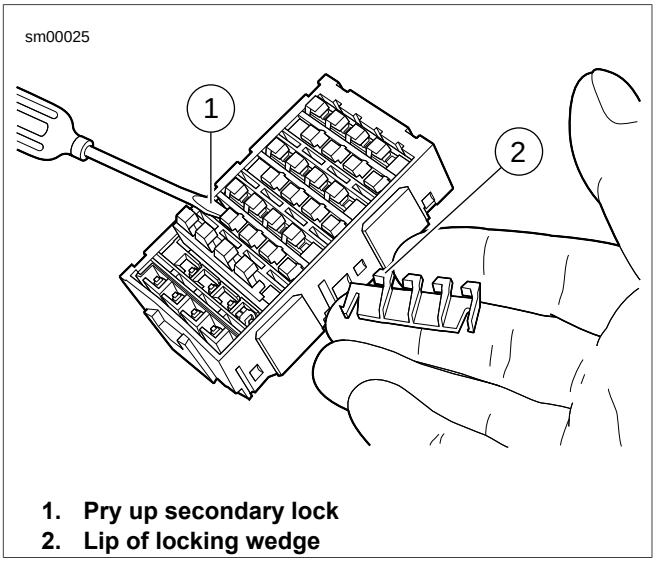
Crimping Terminals

Terminals are crimped twice: once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

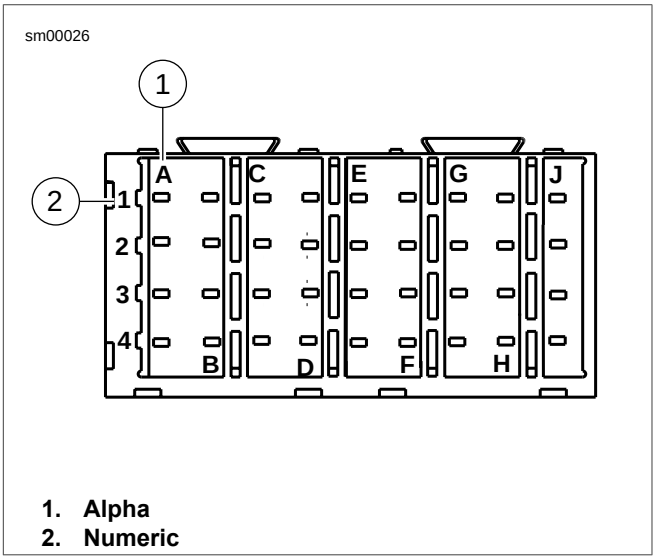
NOTE

The wiring diagram indicates when one socket terminal is be crimped to two wire leads.



1. **Pry up secondary lock**
2. **Lip of locking wedge**

Figure A-11. Fuse Block: Remove Secondary Locks



1. **Alpha**
2. **Numeric**

Figure A-12. Fuse Block: Coordinates (typical)

DELPHI 480 METRI-PACK UNSEALED CONNECTORS A.6

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-13. An AFL housing (5) is used on many ignition/light 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-13. 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

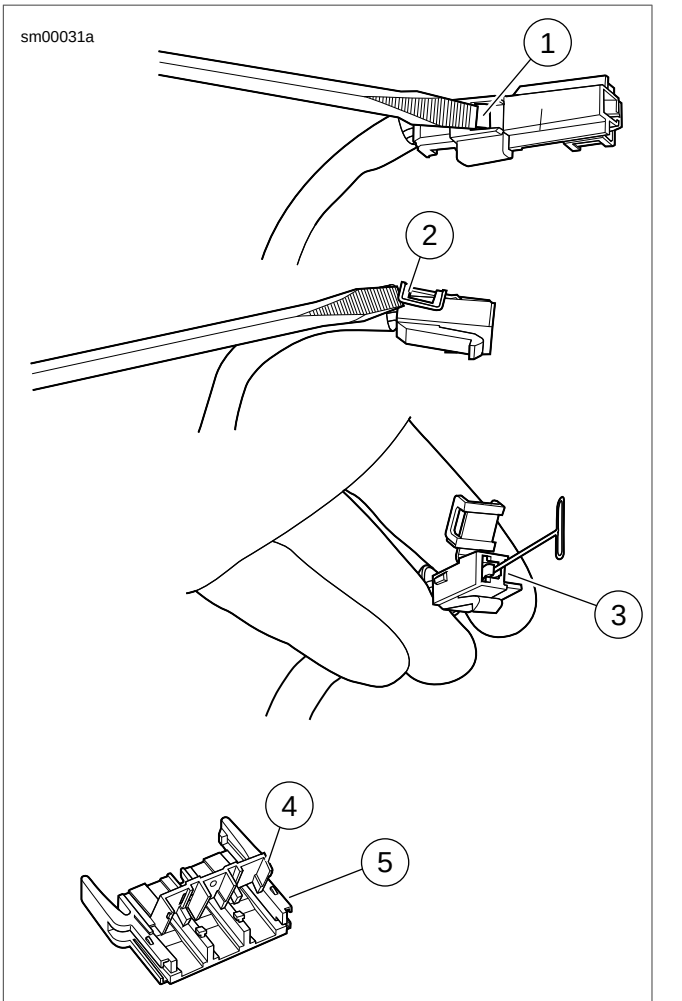
1. See Figure A-13. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to 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.9 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.*



1. **Button on pin housing**
2. **Secondary lock latch**
3. **Opening between tang and chamber wall**
4. **Secondary lock (shown open)**
5. **AFL housing**

Figure A-13. Delphi 480 Metri-Pack Unsealed Connector: Remove Socket Terminal

DELPHI 630 METRI-PACK UNSEALED CONNECTORS A.7

DELPHI 630 METRI-PACK UNSEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
SNAP-ON TT600-3	SNAP-ON PICK

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 and 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. SNAP-ON 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. Refer to A.9 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 the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

DELPHI 800 METRI-PACK SEALED MAIN FUSE HOUSING A.8

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. (00049a)

1. Disconnect battery.
2. See Figure A-14. 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.

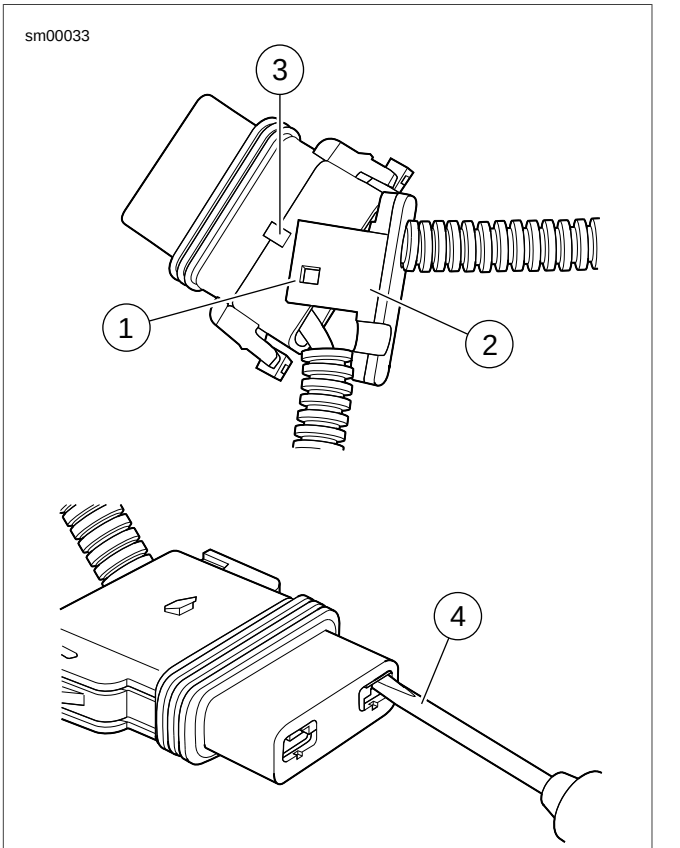
Installing Socket Terminals

1. See Figure A-15. 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.



1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

Figure A-14. Delphi 800 Metri-Pack Sealed Main Fuse Housing: Remove Socket Terminals

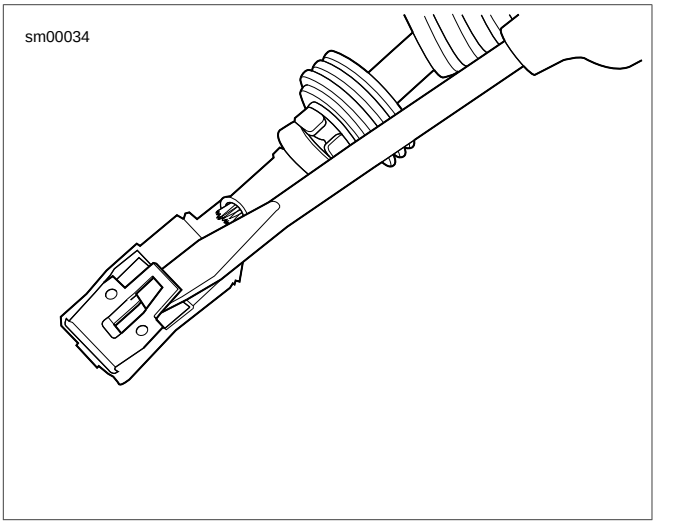


Figure A-15. Delphi 800 Metri-Pack Sealed Main Fuse Housing: Bend Tang

DELPHI METRI-PACK TERMINAL REPAIR A.9

METRI-PACK TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-6	PACKARD TERMINAL CRIMP TOOL
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-38125-8	PACKARD CRIMPING TOOL

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-16. A crimp can require two crimping dies. The dies are found on the PACKARD TERMINAL CRIMP TOOL (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 insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

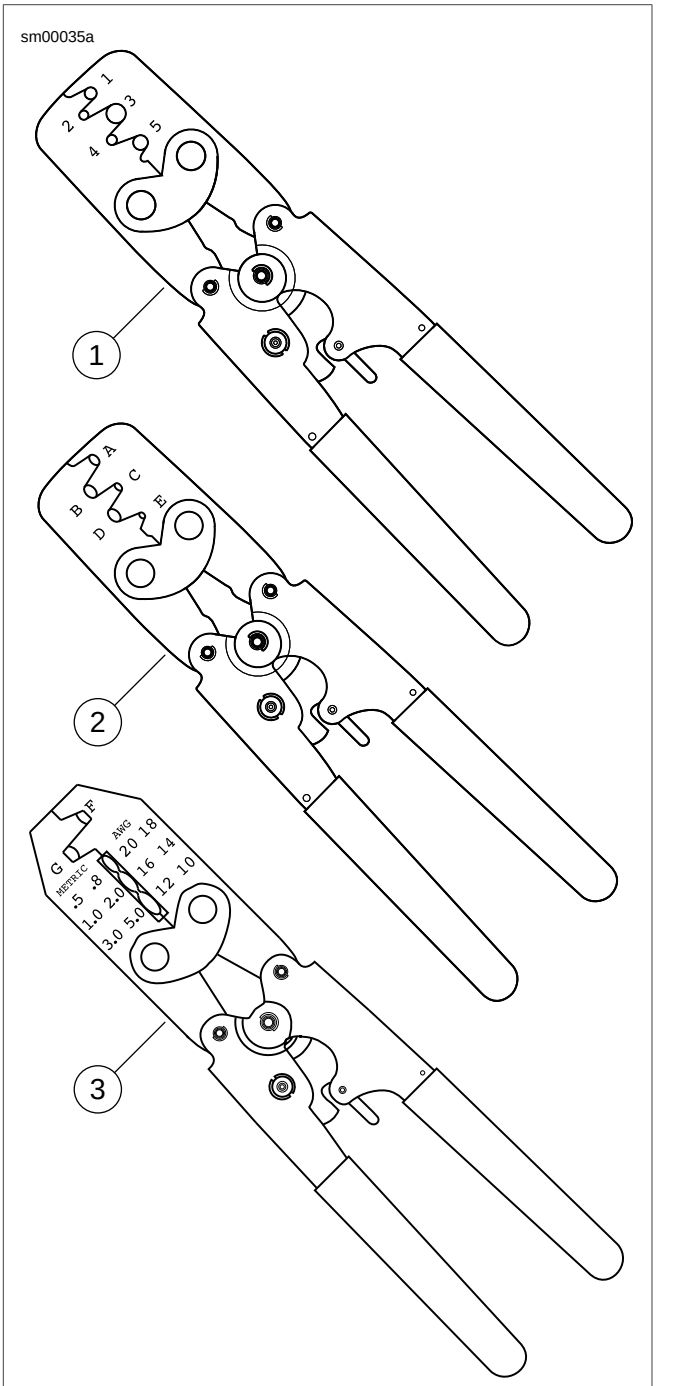
Strip 5/32 in (4.0 mm) of insulation from the wire lead.

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. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.



1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

Figure A-16. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

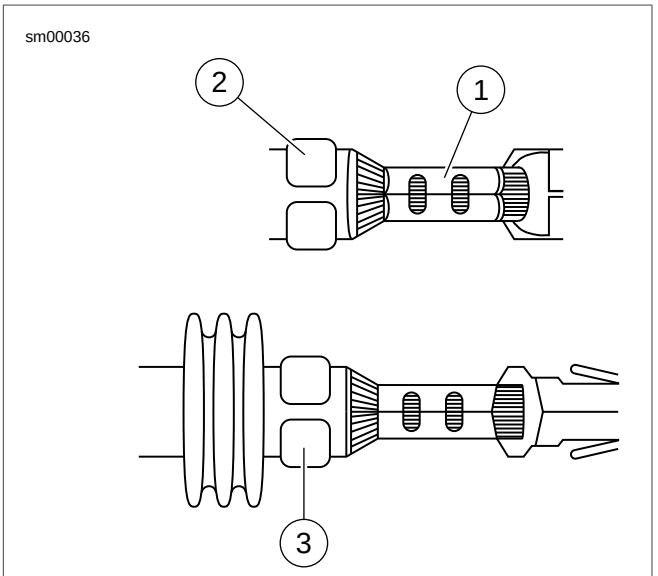
NOTE

*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-17. Identify the correct die for the insulation/seal crimp (2).
2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

Inspecting Crimps

1. See Figure A-17. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.



1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

Figure A-17. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

DELPHI MICRO-64 SEALED CONNECTORS A.10

DELPHI MICRO 64 SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	TERMINAL REMOVER
HD-45929	TERMINAL CRIMPER

General

Delphi Micro 64 Sealed connectors are frequently found on speedometers, tachometers and the ECM of Touring Models.

Separating Pin and Socket Housings

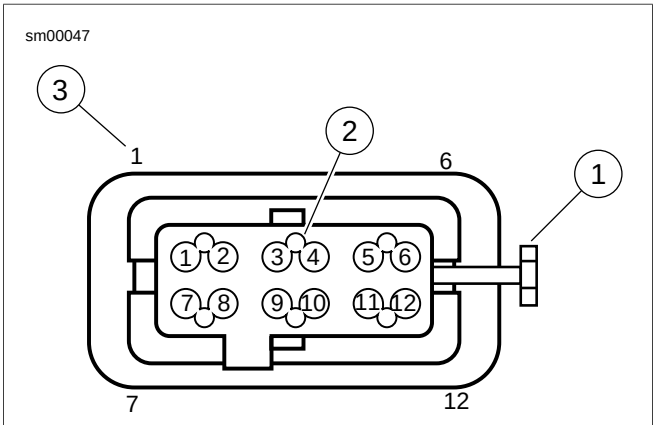
Bend back the external latches slightly and separate the pin and socket housings.

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-18. 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.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-18. Delphi Micro-64 Sealed Connector: Housing

4. See Figure A-19. Obtain the TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-20. 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-19. Terminal Remover (HD-45928)

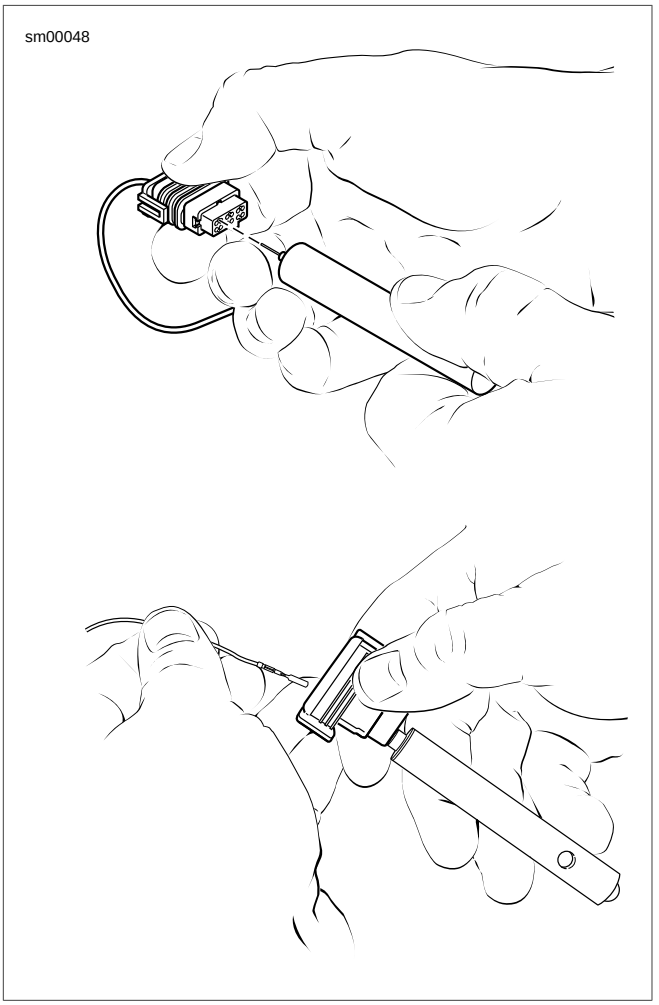


Figure A-20. Delphi Micro-64 Sealed Connector: Insert Tool and Remove Terminal

Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

NOTE

See Figure A-18. 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 wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

Strip 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-22. 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.

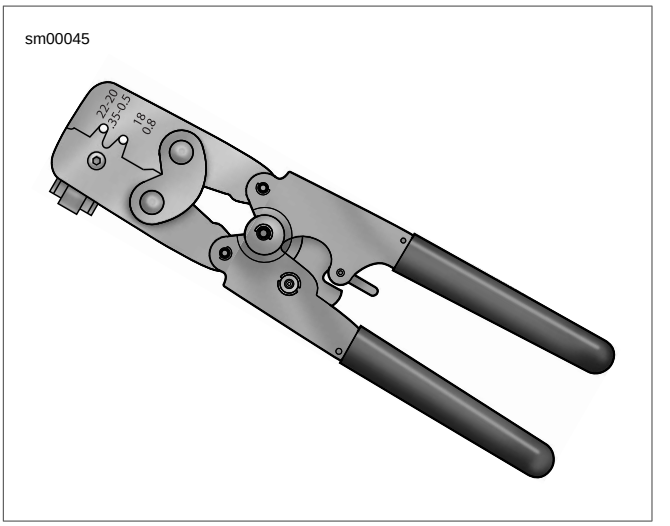
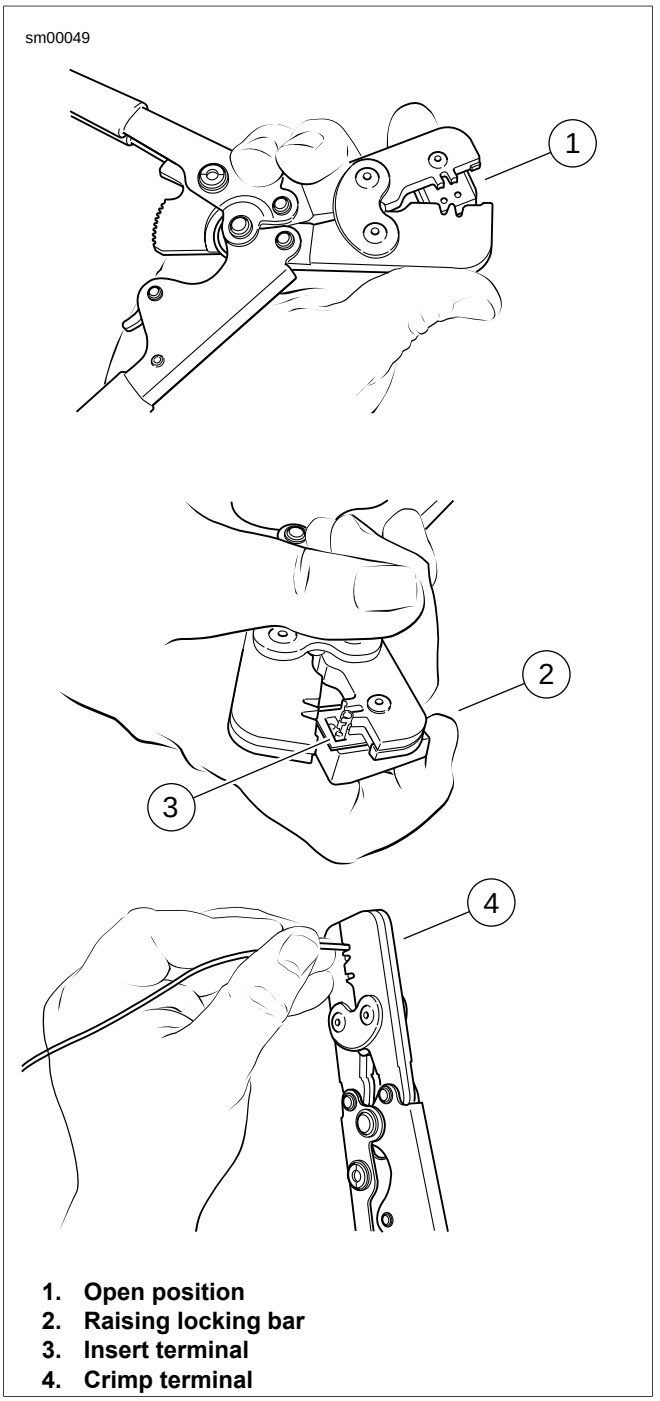


Figure A-21. Terminal Crimper (HD-45929)



1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

Figure A-22. Delphi Micro-64 Sealed Connector: Terminal in Crimper

DELPHI GT 150 SEALED CONNECTORS A.11

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-23. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE

Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all.

1. See Figure A-24. 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 from socket 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.

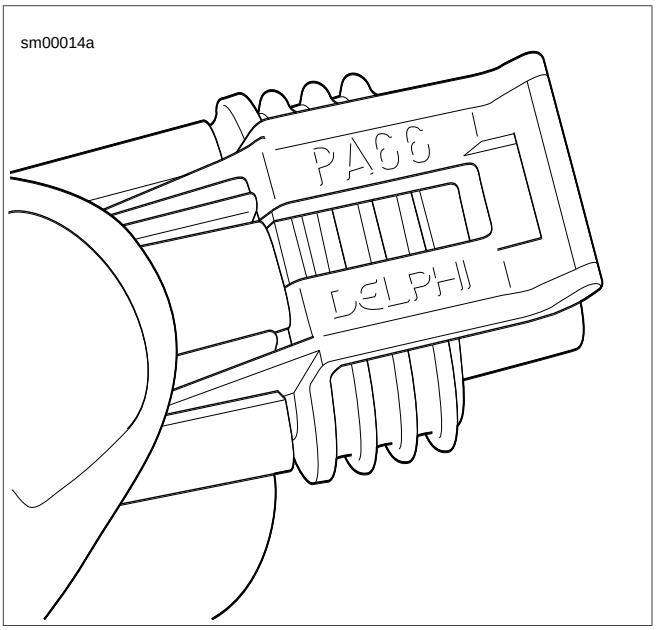
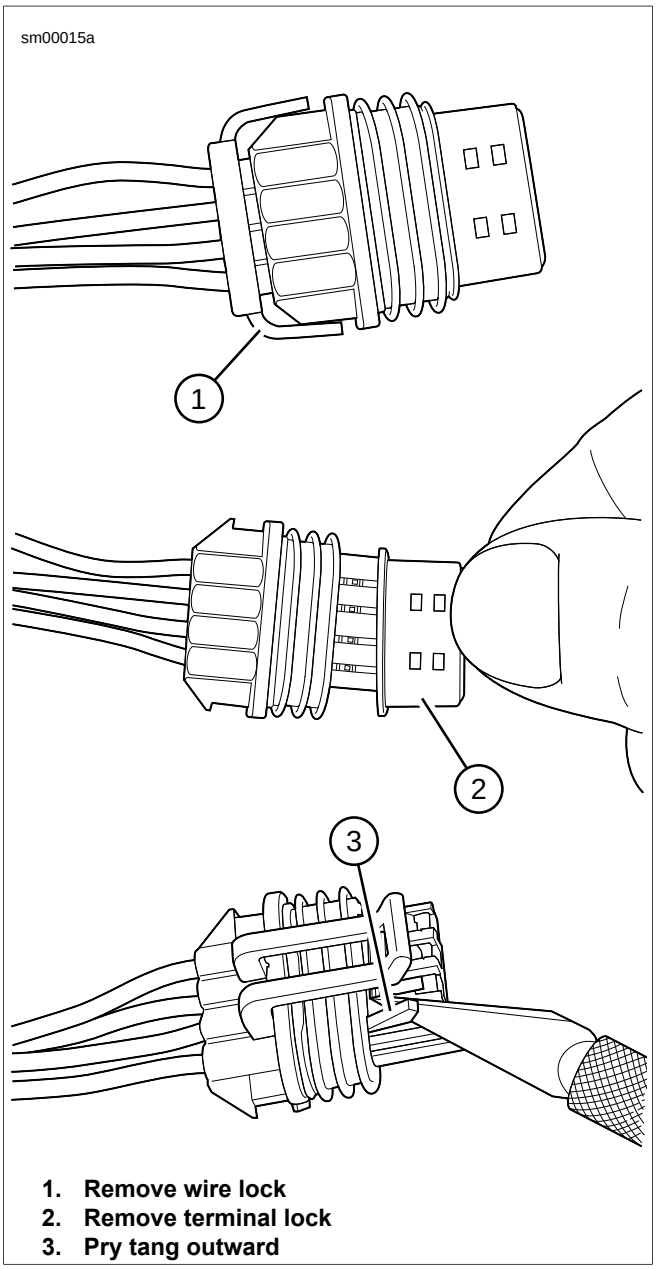


Figure A-23. Delphi GT 150 Sealed Connector: Socket Housing Latch



1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

Figure A-24. Delphi GT 150 Sealed Connector: Removing Socket Terminals

DELPHI GT 280 SEALED 73-TERMINAL ECM CONNECTOR A.12

DELPHI GT 280 SEALED 73-TERMINAL ECM CONNECTOR

NOTE

Do not operate latch lever when connector is not mated to ECU. Damage will occur.

Separating Socket Housing From ECM

See Figure A-25. Remove strap (1). Press the latch (2). Rotate lock lever to the released position (3).

Mating Socket Housing To ECM

Push the connector into the ECM. Rotate the lock lever to the locked position.

Socket Terminal

1. Cut cable strap to release harness from strain relief collar of connector housing.
2. See Figure A-26. Release latches (4) that retain cover (3) to housing (2) and remove cover.
3. Remove and service the Micro-64 terminals. See A.10 DELPHI MICRO-64 SEALED CONNECTORS.
4. Install connector housing cover. Verify all wires are within the confines of the cover and that the cover latches are engaged.
5. Install **new** cable strap cable to the strain relief of the connector.

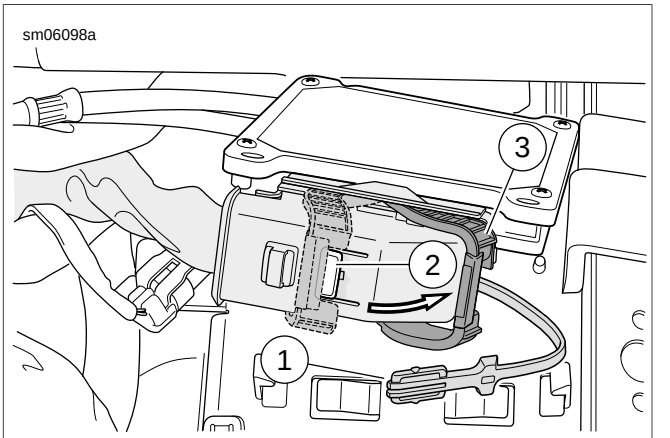
ECM Ground Terminal

1. See Figure A-26. Remove secondary lock (1).
2. See Figure A-27. Using a thin blade screwdriver, gently pry ground terminal retainer from connector housing.
3. See Figure A-28. Using a thin blade screwdriver, release latch and pull ground wire, wire seal and terminal from cover side of housing.
4. Follow instructions in A.9 DELPHI METRI-PACK TERMINAL REPAIR to replace the terminal or wire seal.
5. Push the terminal into place from the cover side of the connector housing until the latch engages. Pull on wire to verify terminal is secure.

NOTE

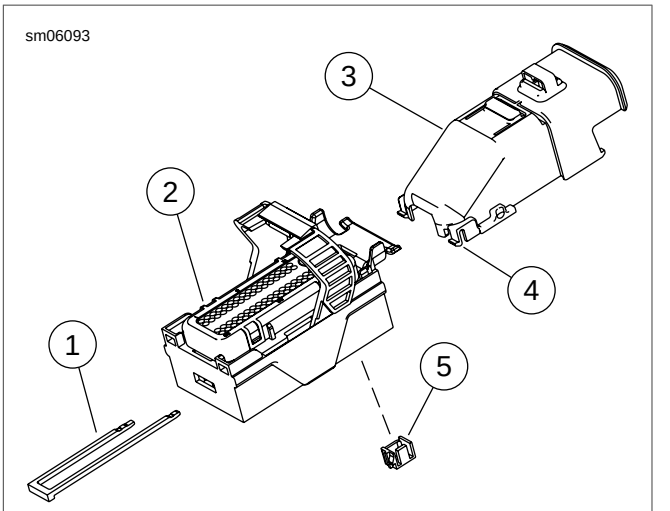
See Figure A-26. Secondary lock has one short leg and one long leg. Install as shown.

6. See Figure A-26. Install ground secondary lock (5) and install secondary lock (1) as shown.



1. **Strap**
2. **Latch**
3. **Lock lever released**

Figure A-25. Unlatch ECM Connector



1. **Secondary lock**
2. **Terminal housing**
3. **Cover**
4. **Cover latch**
5. **Ground secondary lock**

Figure A-26. Delphi 73-Terminal ECM Connector

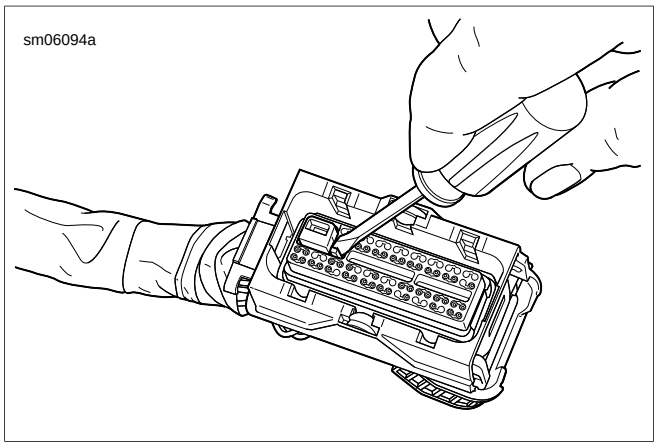


Figure A-27. Remove Ground Secondary Lock

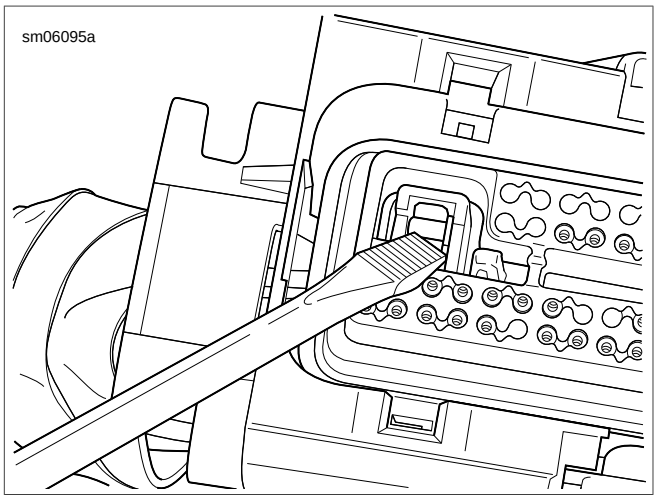


Figure A-28. Remove ECM Ground Terminal

DEUTSCH DT SEALED CONNECTORS A.13

DEUTSCH DT SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41475	DEUTSCH TERMINAL REPAIR KIT
HD-41475-100	FLAT BLADE L-HOOK

General

Deutsch DT sealed connectors are colored 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-29. 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.*

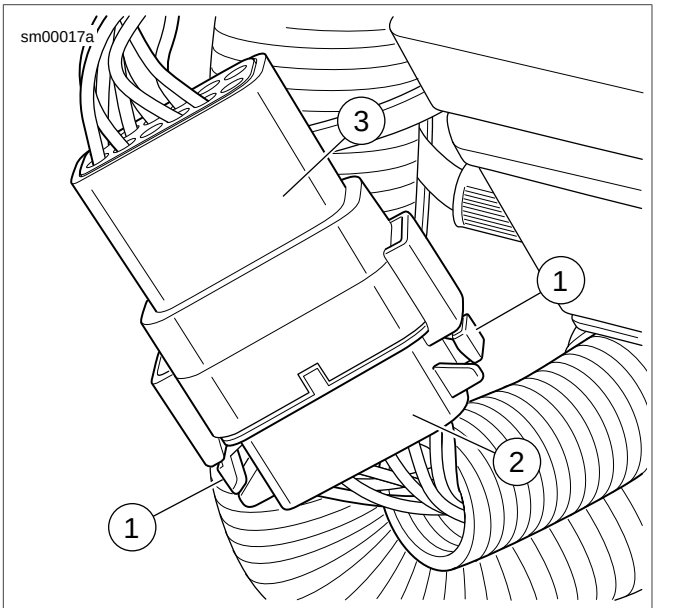
Mating Pin and Socket Housings

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.



1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure A-29. Deutsch DT Sealed Connector

Removing Socket Terminals

1. See Figure A-30. 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-33. 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-32. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it clicks in place.
4. A tug on the wire will confirm that it is properly locked in place.

NOTE

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-31. 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.*

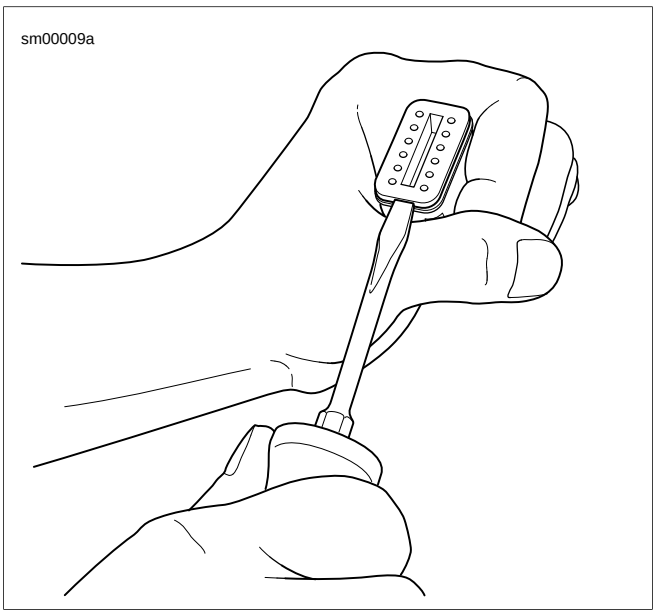
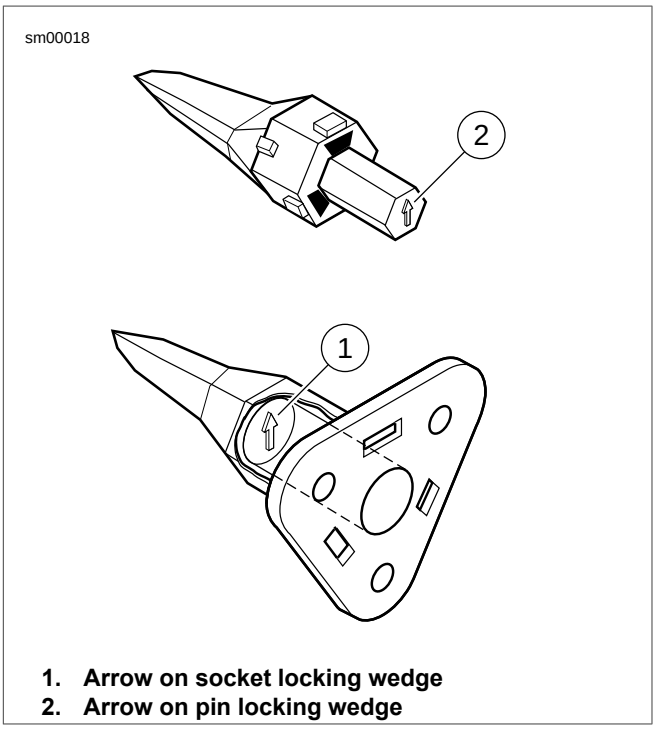
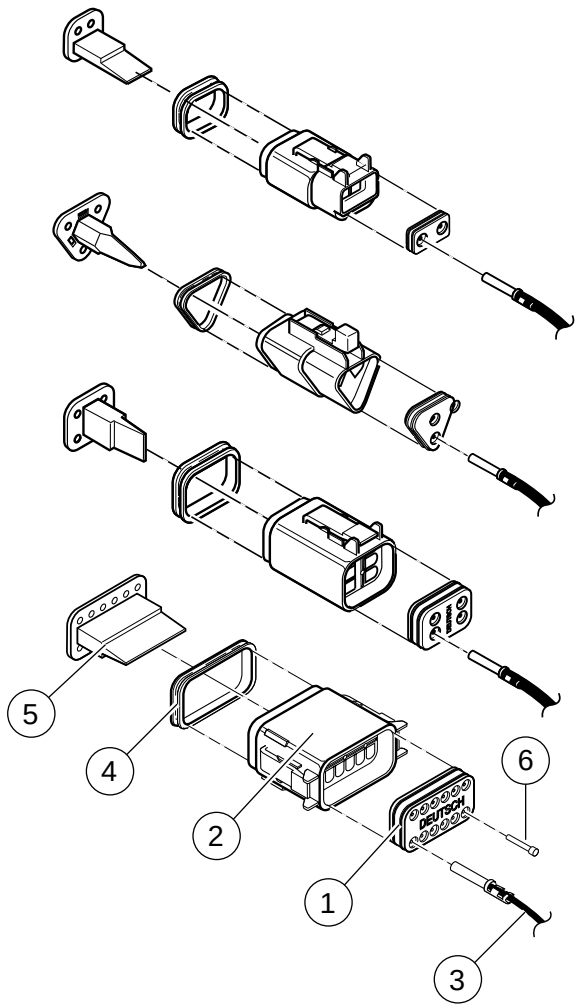


Figure A-30. Deutsch DT Sealed Connector: Remove Secondary Locking Wedge



1. **Arrow on socket locking wedge**
2. **Arrow on pin locking wedge**

Figure A-31. Deutsch DT Sealed Connector: 3-Place Locking Wedges



1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-32. 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.*

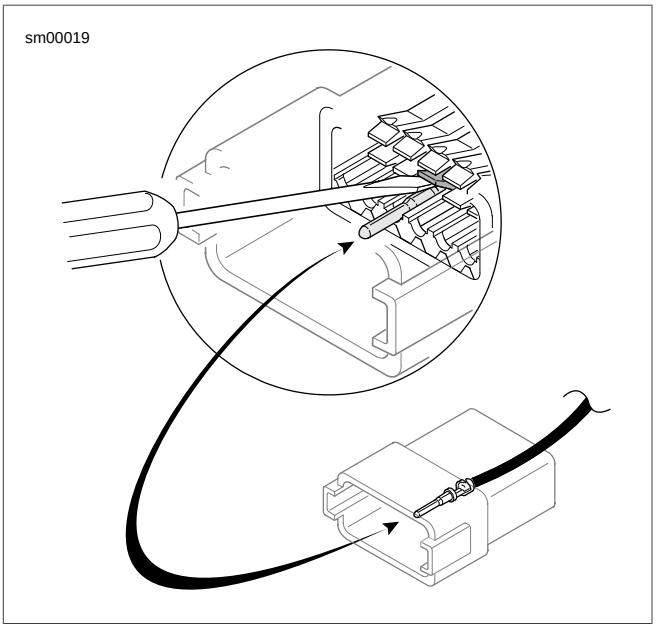


Figure A-33. Deutsch DT Sealed Connector: Press Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-34. 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.

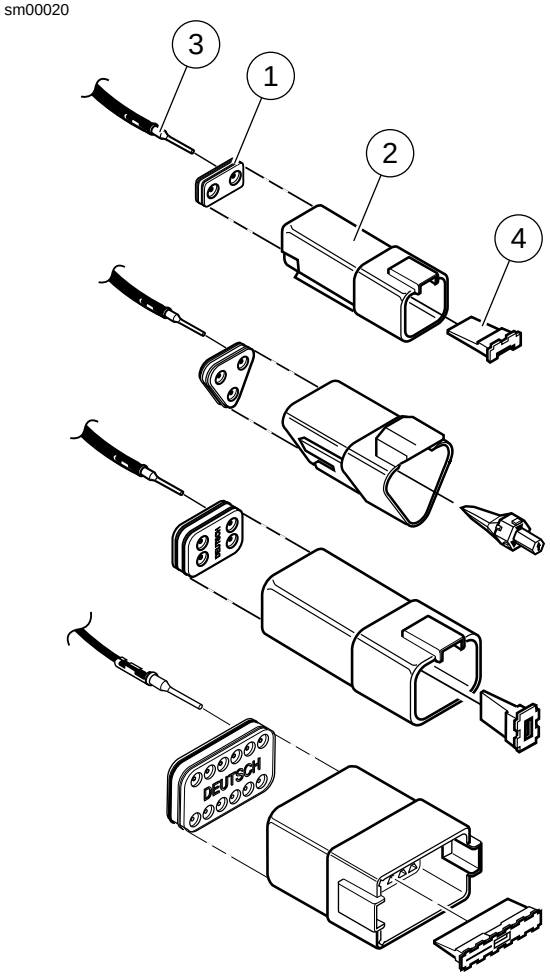
NOTE

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-31. 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.*



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-34. 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 A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
DT Sealed (with crimp tails)	A.14 DEUTSCH DT SEALED TERMINAL REPAIR
DTM Mini Sealed Terminal (solid barrel)	A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR
DTM Mini Sealed Terminal (with crimp tails)	A.15 DEUTSCH DTM SEALED MINI TERMINAL REPAIR

DEUTSCH DT SEALED TERMINAL REPAIR A.14

DEUTSCH DT SEALED TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip 5/32 in (4.0 mm) of insulation from the wire lead.

Crimping Terminal to Lead

1. See Figure A-35. 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.

NOTE

If the crimp tails are slightly out of alignment, the crimp tool rotates the terminal to face the tails upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

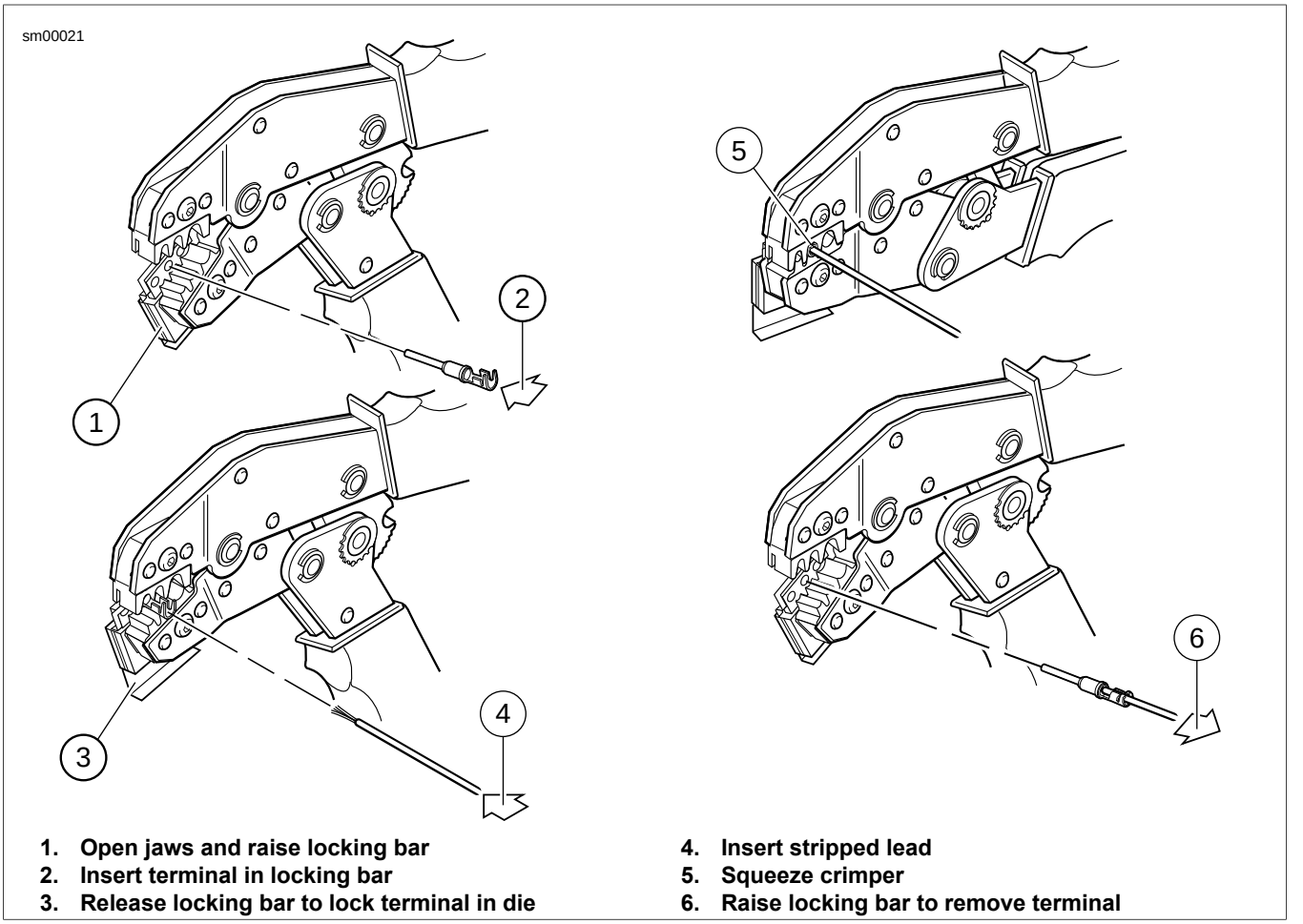
5. Insert stripped wire core between crimp tails until ends make contact with locking bar. Position wire that the wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
6. Squeeze handle of crimp tool until tightly closed. Tool automatically opens 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

WIRE GAUGE (AWG)	CRIMP TOOL DIE
20	Front
16-18	Middle



1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar to remove terminal**

Figure A-35. Crimping a Deutsch DT Sealed Terminal

DEUTSCH DTM SEALED MINI TERMINAL REPAIR A.15

DEUTSCH DTM SEALED MINI TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER

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-36. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

Always perform core crimp before insulation crimp.

2. Position the core crimp on die E (1) of the crimper. 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 that the short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

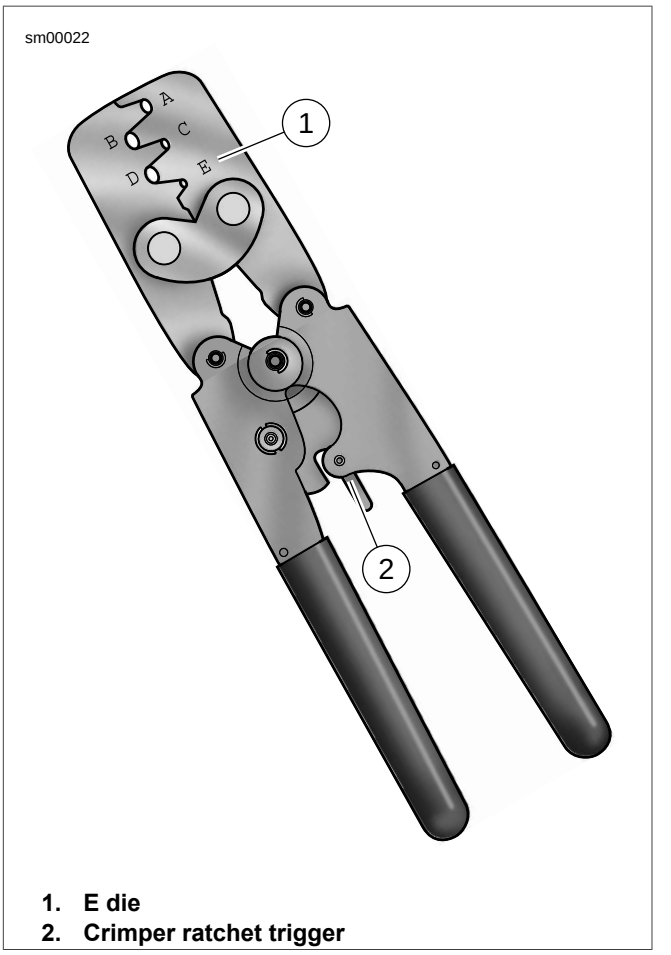
NOTE

If the crimper does not open, squeeze the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimper. Verify the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.



1. E die
2. Crimper ratchet trigger

Figure A-36. Packard Terminal Crimper (HD-38125-7)

DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR A.16

DEUTSCH DTM SEALED SOLID BARREL TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-42879	ELECTRICAL CRIMPER TOOL

Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip 1/4 in (6.4 mm) of insulation from the wire lead.

Adjusting Crimper Tool

1. See Figure A-37. 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. Roate 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-38. 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.

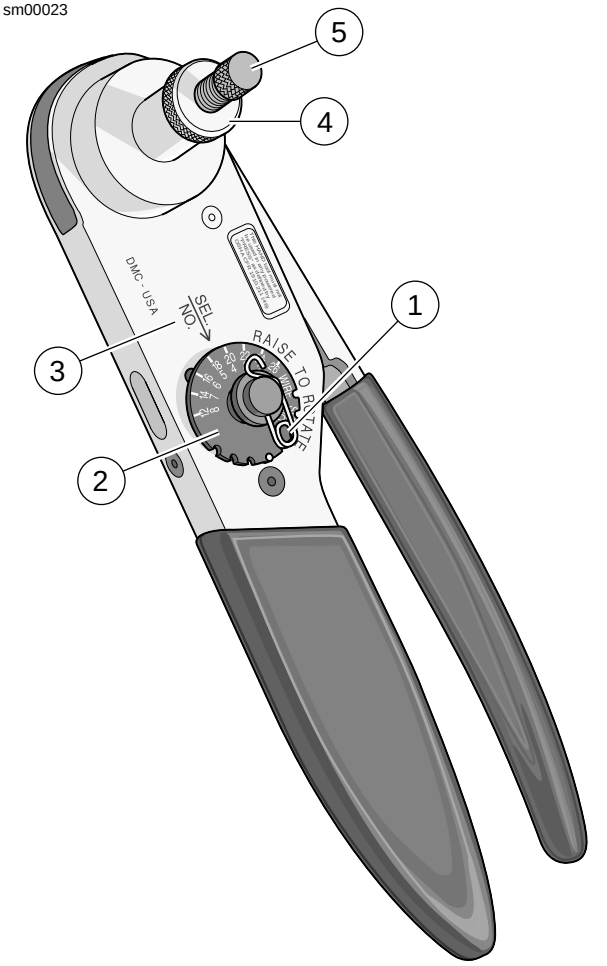
NOTE

Adjust the crimper tool for each contact/wire size.

6. Install pin to lock selector knob.

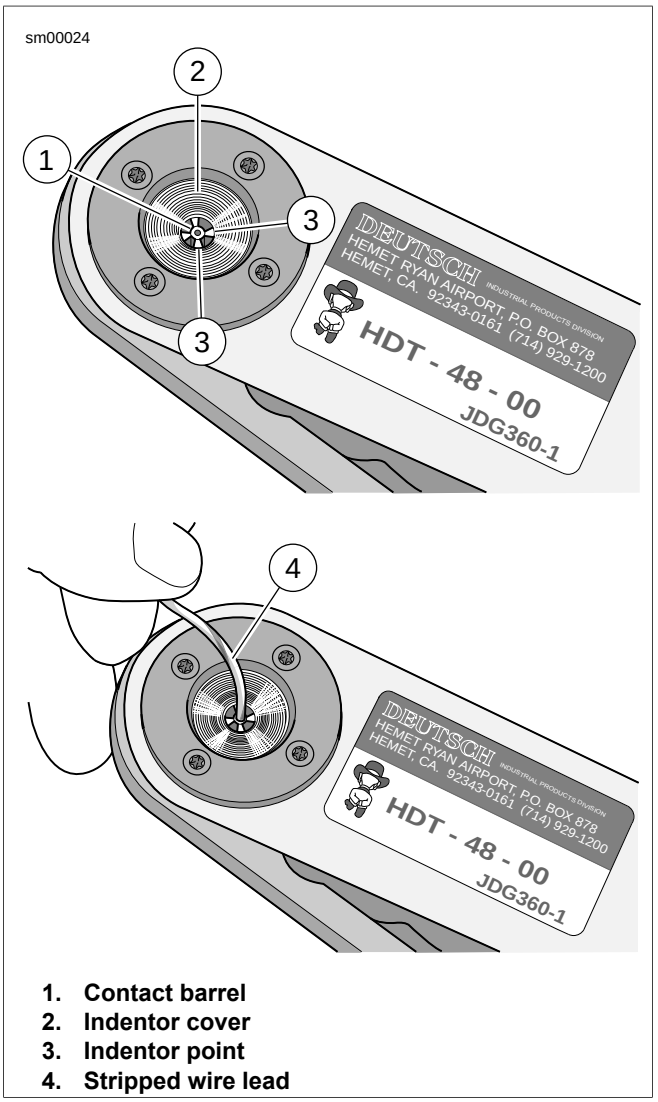
Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.



1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

Figure A-37. Electrical Crimper Tool (HD-42879)



1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

Figure A-38. Deutsch Solid Barrel

JAE MX19 SEALED CONNECTORS A.17

JAE MX19 SEALED CONNECTORS

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR

Connector Housings

Separate Housings: See Figure A-39. 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.

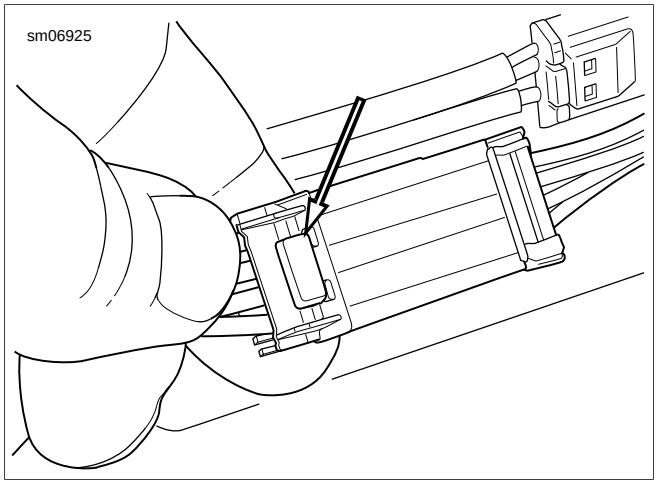


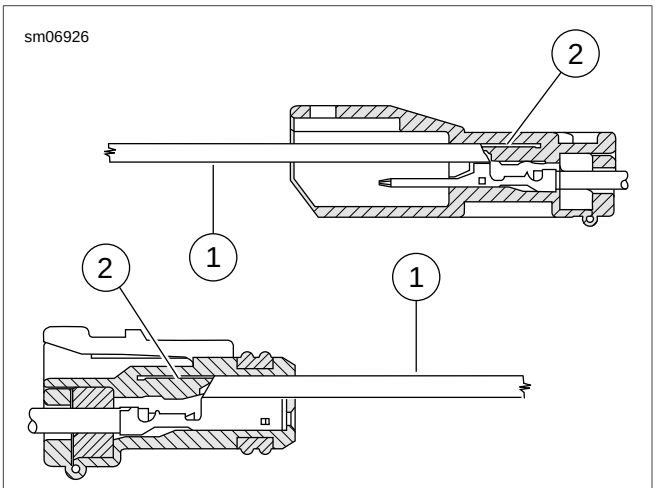
Figure A-39. Release Buttons: JAE MX19 Sealed Connector

Removing Terminals

1. Modify a TERMINAL EXTRACTOR (Part No. B-50085) by filing the front edge to 45 degrees.
2. See Figure A-40. 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.



1. **Extractor**
2. **Plastic molding**

Figure A-40. JAE MX19 Terminal Removal

CRIMPING TERMINALS

PART NUMBER	TOOL NAME
HD-50120	UNIVERSAL CRIMPER SET
HD-50120-2	HAND CRIMP FRAME
HD-50120-6	JAE DIE

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)

TERMINAL	PART NO.	STRIP LENGTH		NEST
		in	mm	
Socket	72910-11	0.051-0.098	2.0-2.5	B
Pin	72909-11	0.051-0.098	2.0-2.5	A

MOLEX CMC SEALED CONNECTORS A.18

MOLEX CMC SEALED CONNECTORS

PART NUMBER	TOOL NAME
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL

Separating the Connector

Release: See Figure A-41. 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.

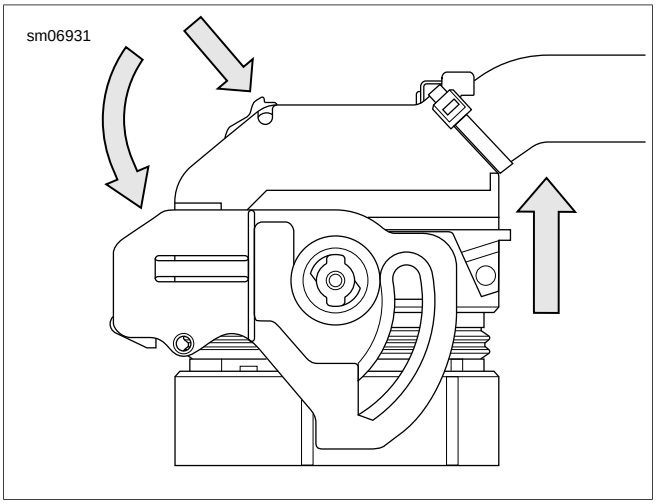


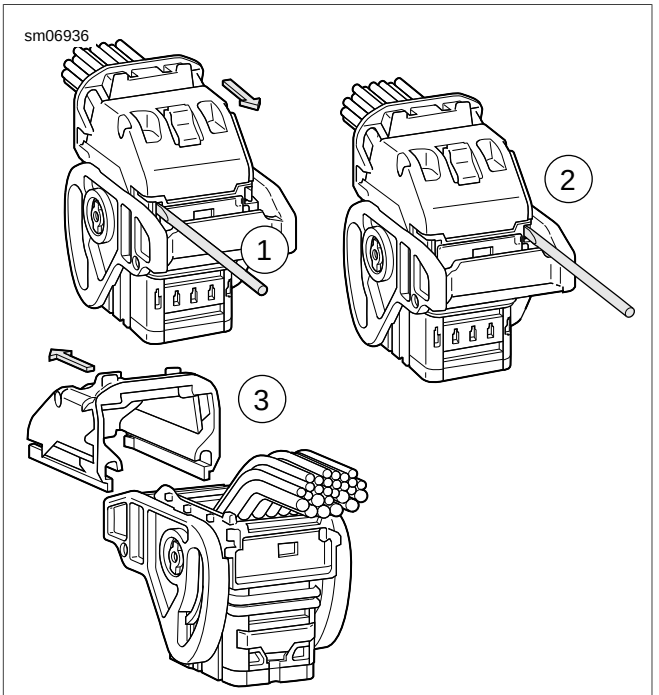
Figure A-41. Release

Removing Terminals

1. With the lever arm open, cut the cable strap around the wire bundle.
2. See Figure A-42. 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-43. Use the screwdriver to open the secondary lock. Pull the locking bar all the way out.
6. See Figure A-44. Locate the wire lead cavity by the alpha-numeric 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-45. Insert the pins of the CMC extractor tool (1) into the access slots (2) of the terminal cavity and retract the lead and terminal.

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.



1. **Press latch**
2. **Press cap and latch**
3. **Remove cap**

Figure A-42. Remove the Wire Lead Cap

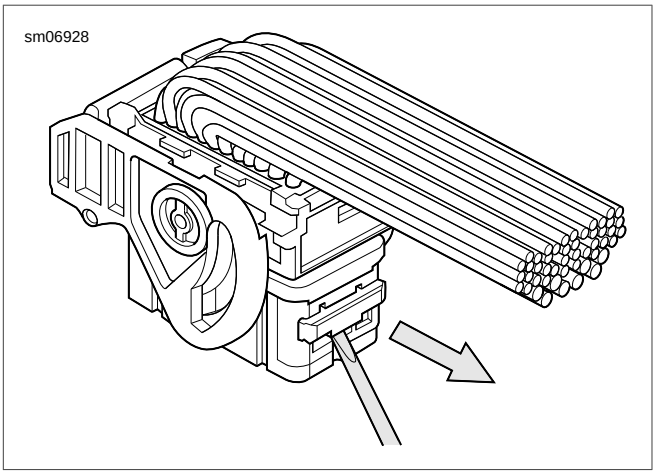
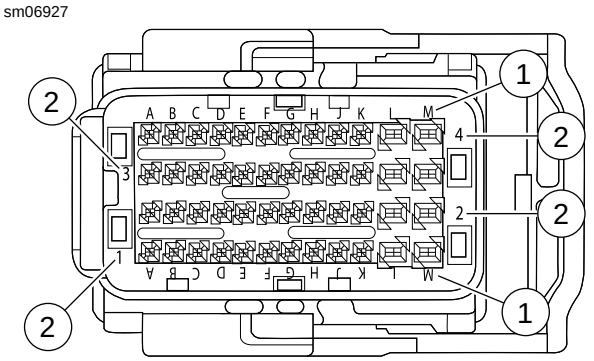
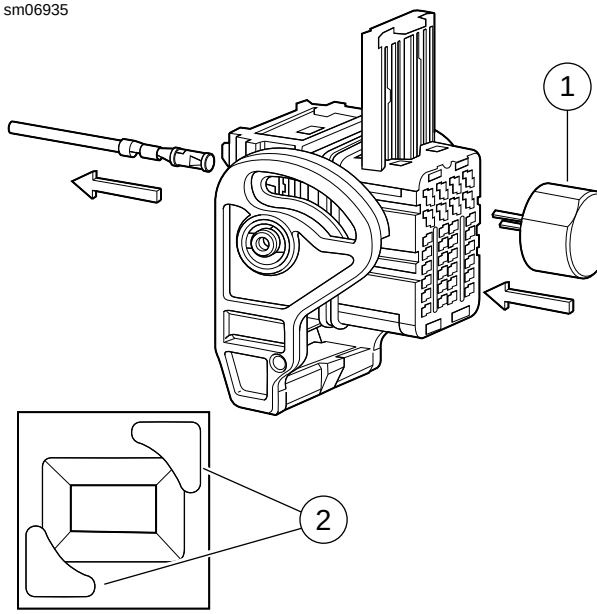


Figure A-43. Molex CMC Sealed Connector Secondary Lock



1. **Alpha**
2. **Numeric**

Figure A-44. Alpha-Numeric Coordinates



1. **Extractor tool**
2. **Access slots**

Figure A-45. Terminal Removal

CRIMPING TERMINALS

PART NUMBER	TOOL NAME
HD-50120	UNIVERSAL CRIMPER SET
HD-50120-2	HAND CRIMP FRAME
HD-50120-3	JAE DIE
HD-50120-4	JAE DIE

1. Select the crimper 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 Crimper Die (Part No. HD-50120-3)

PART NO.	TERMINAL: WIRE GAUGE	STRIP LENGTH		NEST
		in	mm	
72226-11	Socket: 16 AWG	0.177	4.5	B
72227-11	Socket: 18 AWG	0.177	4.5	A

Table A-6. Molex CMC Sealed Crimper Die (Part No. HD-50120-4)

PART NO.	TERMINAL: WIRE GAUGE	STRIP LENGTH		NEST
		in	mm	
72222-11	Socket: 18 AWG	0.138	3.5	B
72222-11	Socket: 20 AWG	0.138	3.5	A

MOLEX MX 150 SEALED CONNECTORS A.19

MOLEX MX 150 SEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-46. 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-47. 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-48. 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-49. 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-50. 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.

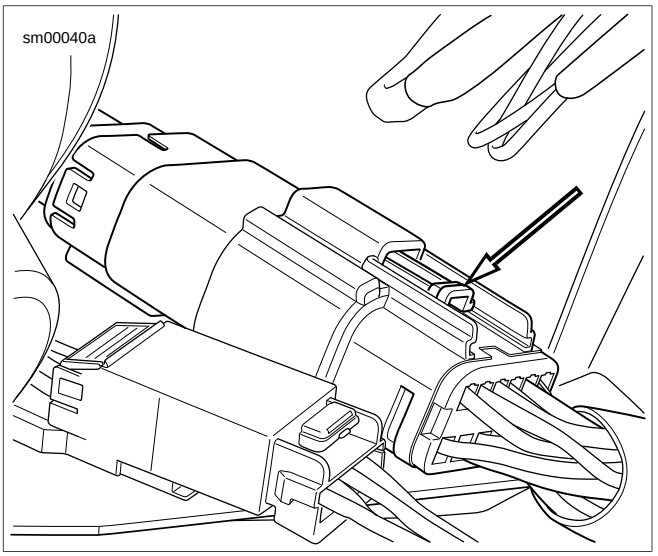


Figure A-46. Molex MX 150 Sealed Connector: Latch

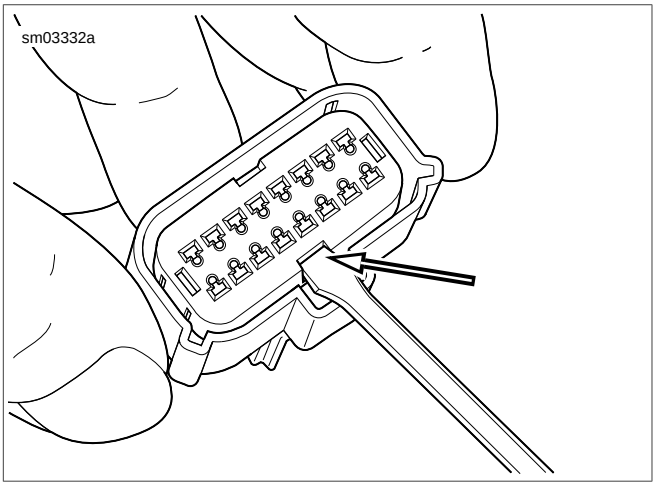


Figure A-47. Secondary Lock Pry Slot (Socket Housing)

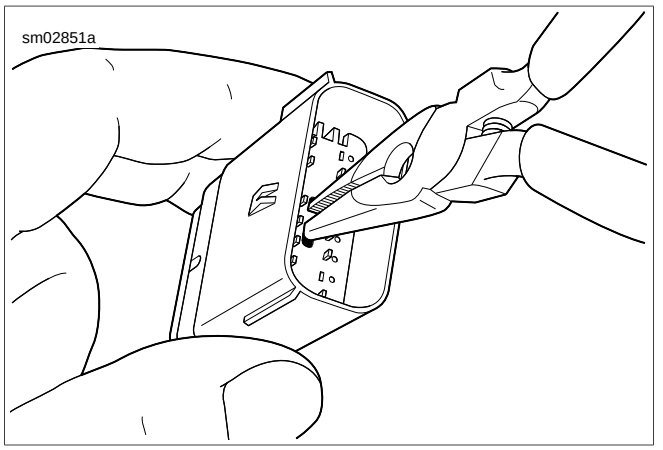


Figure A-48. Pull Up Secondary Lock

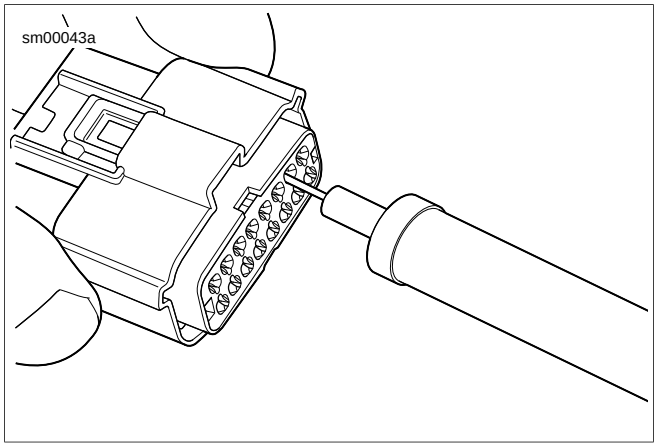
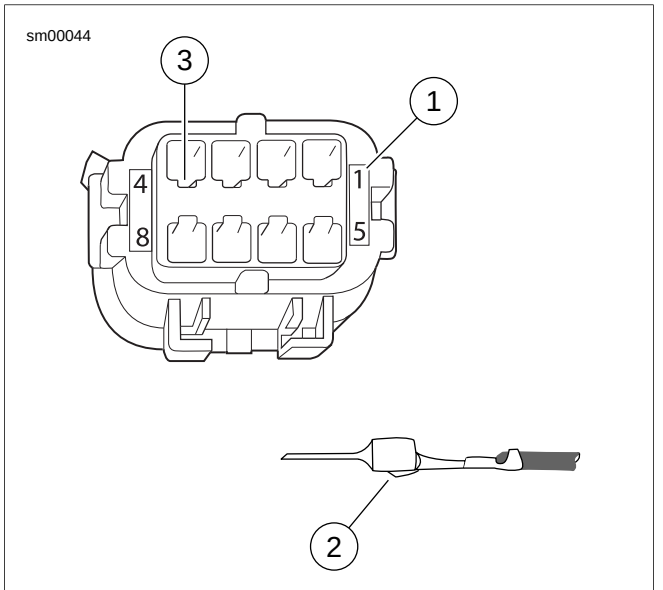


Figure A-49. Molex MX 150 Sealed Connector: Terminal Remover (HD-48114)



1. **Cavity number**
2. **Tang**
3. **Cavity slot**

Figure A-50. Molex MX 150 Sealed Connector: Pin Cavities and Wire Terminal

CRIMP TERMINAL TO LEAD

PART NUMBER	TOOL NAME
HD-48119	TERMINAL CRIMPER

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.

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-51. Hold fully open tool at approximately 45 degrees.

NOTE

Do NOT tighten the locknut holding the locator bars. The bars must float to accommodate the different terminal gauges.

Table A-7. Crimp Tool Wire Gauge Punch/Die

AWG (WIRE GAUGE)	PUNCH/DIE
22	Left
18-20	Middle
14-16*	Right
* Crimp 16 AWG **pin** terminals in the 18-20 middle die.	

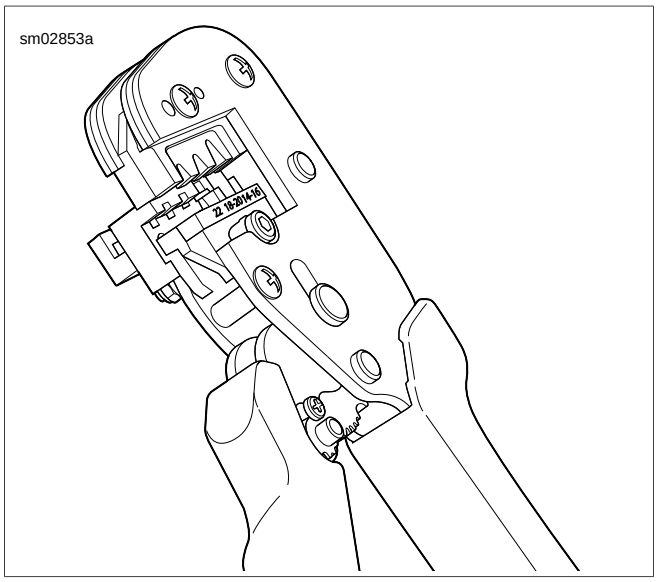
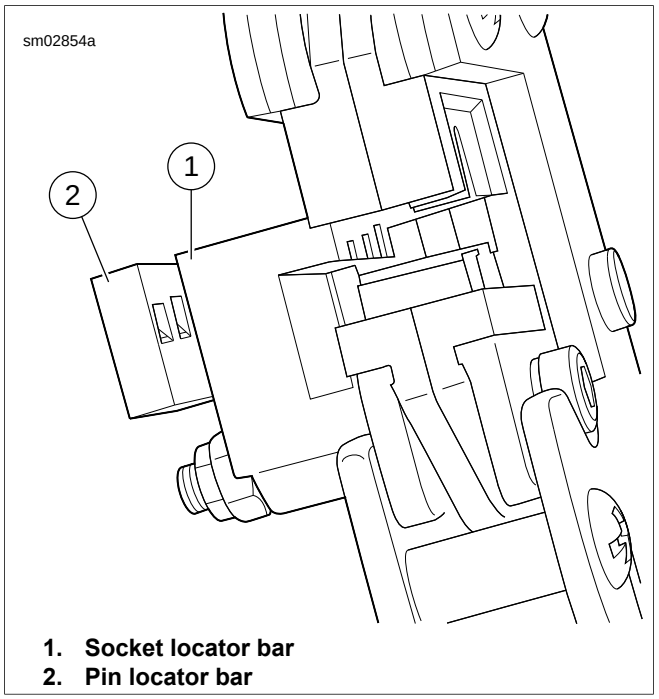


Figure A-51. Open Terminal Crimper (HD-48119) at 45 Degrees



1. **Socket locator bar**
2. **Pin locator bar**

Figure A-52. Terminal Locator Bars

Position Terminal in the Punch/Die

1. See Figure A-53. 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-52. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-54. 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-55. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

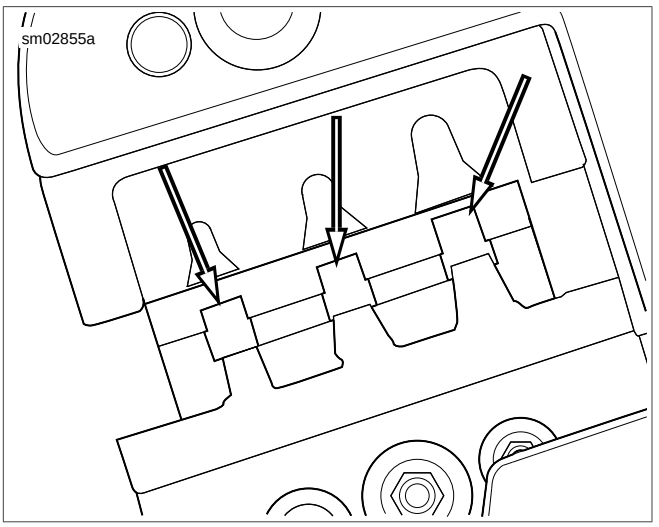


Figure A-53. Square Openings in Socket Locator Bar

Insert Stripped Lead

See Figure A-56. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

NOTES

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

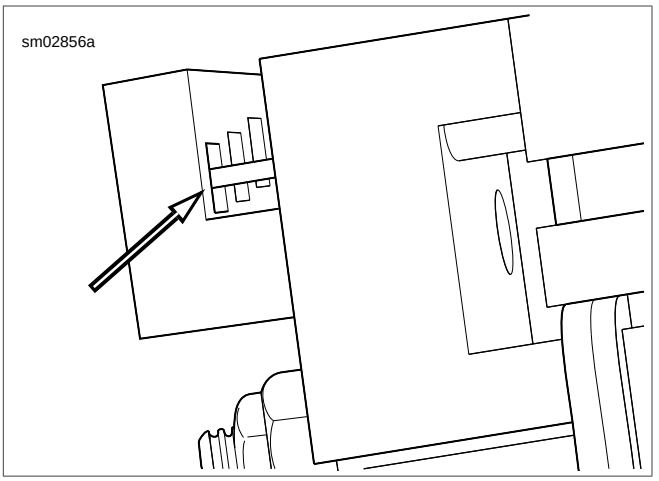


Figure A-54. Pin Terminal against Pin Locator Bar

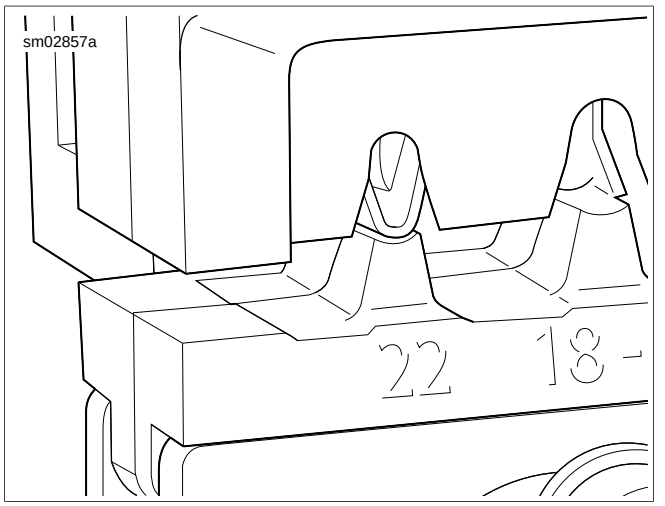


Figure A-55. Crimp Tails in Vertical Alignment between Punch and Die

Crimp Terminal to Lead

1. Holding the wire lead in position touching the locator face at an angle, quickly and smoothly squeeze the crimp tool closed.
2. Final squeeze the handles to open the tool and release the terminal.

NOTE

*Open a stuck or jammed tool by pressing the ratchet release lever found between the handles. Do **not** force the handles open or closed.*

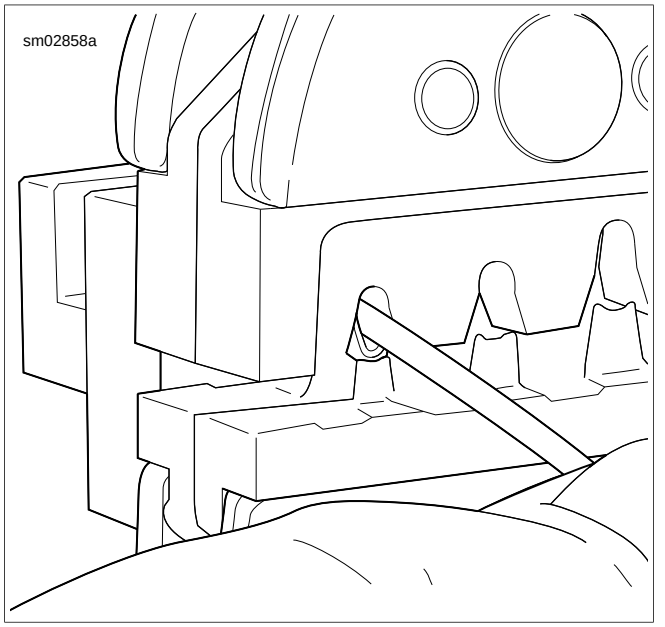
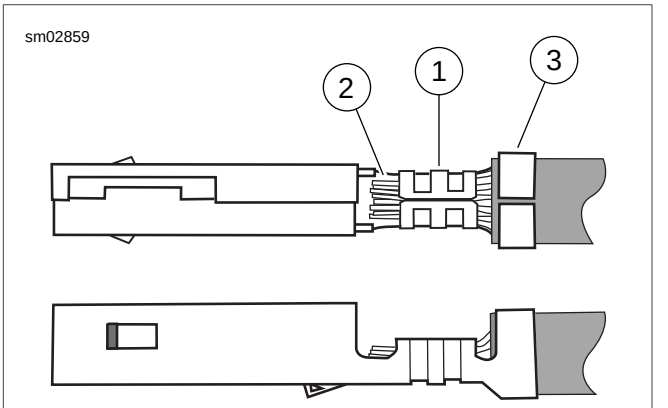


Figure A-56. Stripped Lead at Up Angle

Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
   a. See Figure A-57. 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.



1. **Core crimp**
2. **Wire strands**
3. **Insulation crimp**

Figure A-57. Terminal Crimp

TYCO 070 MULTILOCK UNSEALED CONNECTOR A.20

TYCO 070 MULTILOCK UNSEALED CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTI-LOCK CRIMPER
SNAP-ON TT600-3	SNAP-ON PICK

General

Tyco 070 Multilock Unsealed connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-58. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

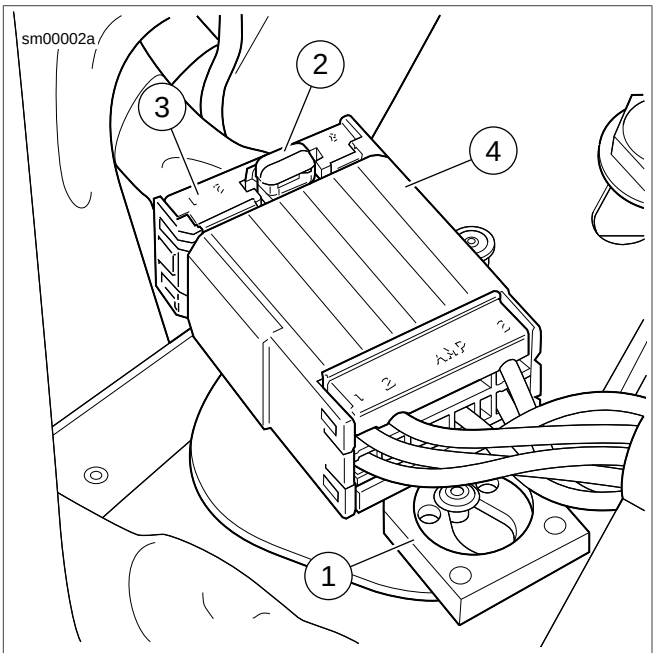
For terminal crimping use the AMP MULTI-LOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-58. Press the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it clicks in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.



1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

Figure A-58. Tyco 070 Multilock Unsealed Connector

Removing Terminals from Housing

1. See Figure A-59. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

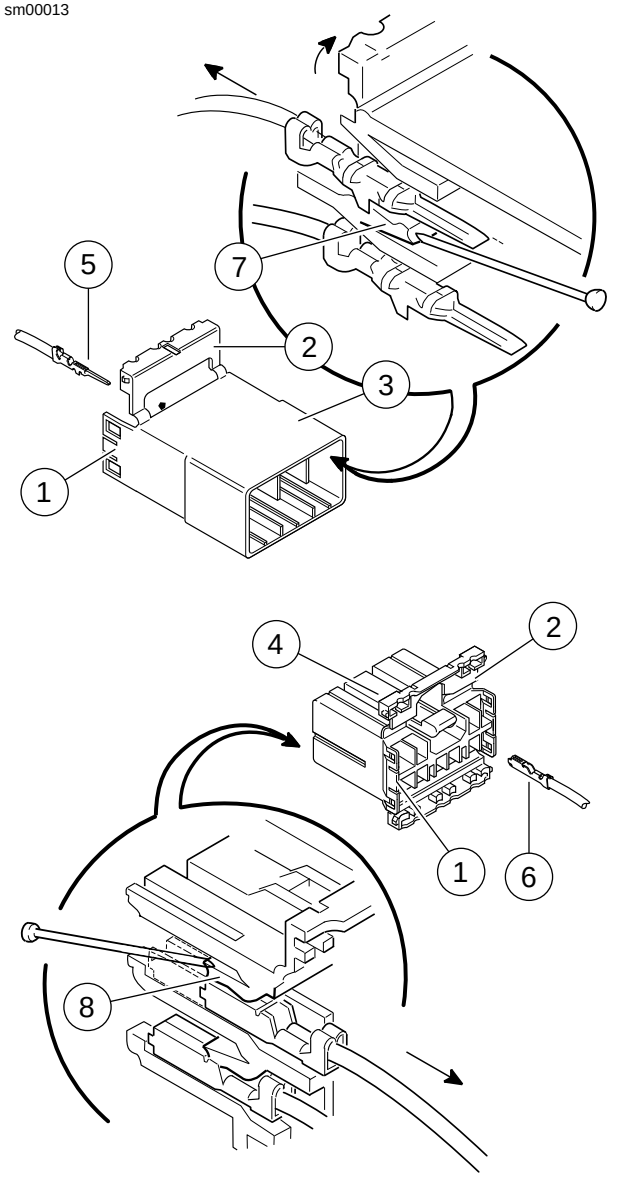
If socket/pin terminal tool is not available, use a push pin/safety pin or a SNAP-ON PICK (Part No. SNAP-ON TT600-3).

4. Press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang (8) up.
   b. **Pin:** Press the pin tang (7) down.

NOTE

A click is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.



1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-59. Tyco 070 Multilock Unsealed Connector: Socket and Pin Housings

Inserting Terminals into Housing

NOTE

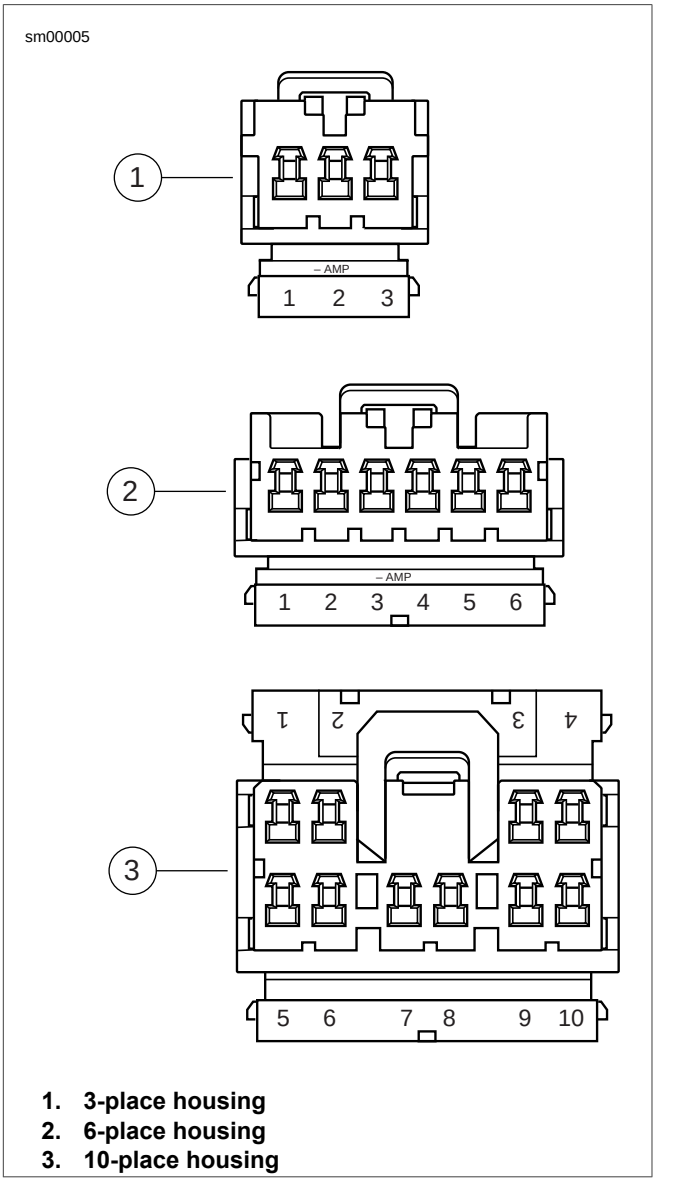
See Figure A-60. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

NOTES

- *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, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.



1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

Figure A-60. Tyco 070 Multilock Unsealed Connector: Cavity Numbers on Secondary Locks (socket housings shown)

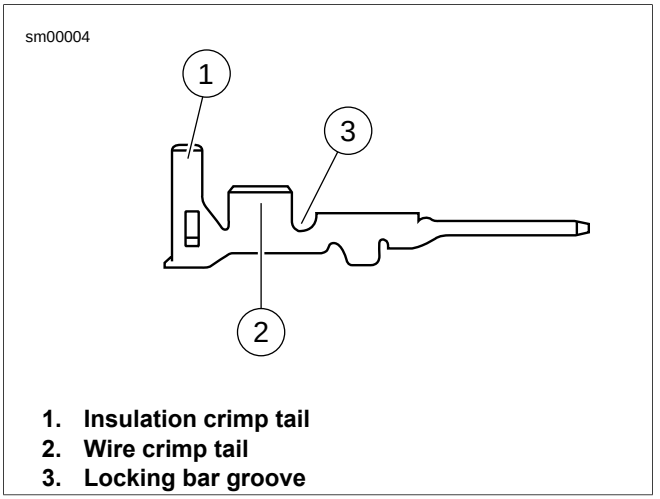
Preparing Wire Leads for Crimping

1. Strip wire lead removing 5/32 in (4.0 mm) of insulation.

2. See Figure A-61 and Figure A-62. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).
3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-8.

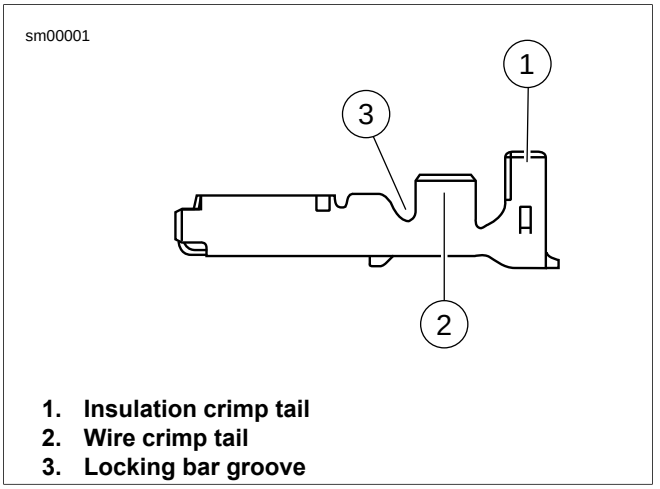
Table A-8. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

WIRE GAUGE	NEST
20	Front
16	Middle
18	Rear



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-61. Tyco 070 Multilock Unsealed Connector: Pin Terminal



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-62. Tyco 070 Multilock Unsealed Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

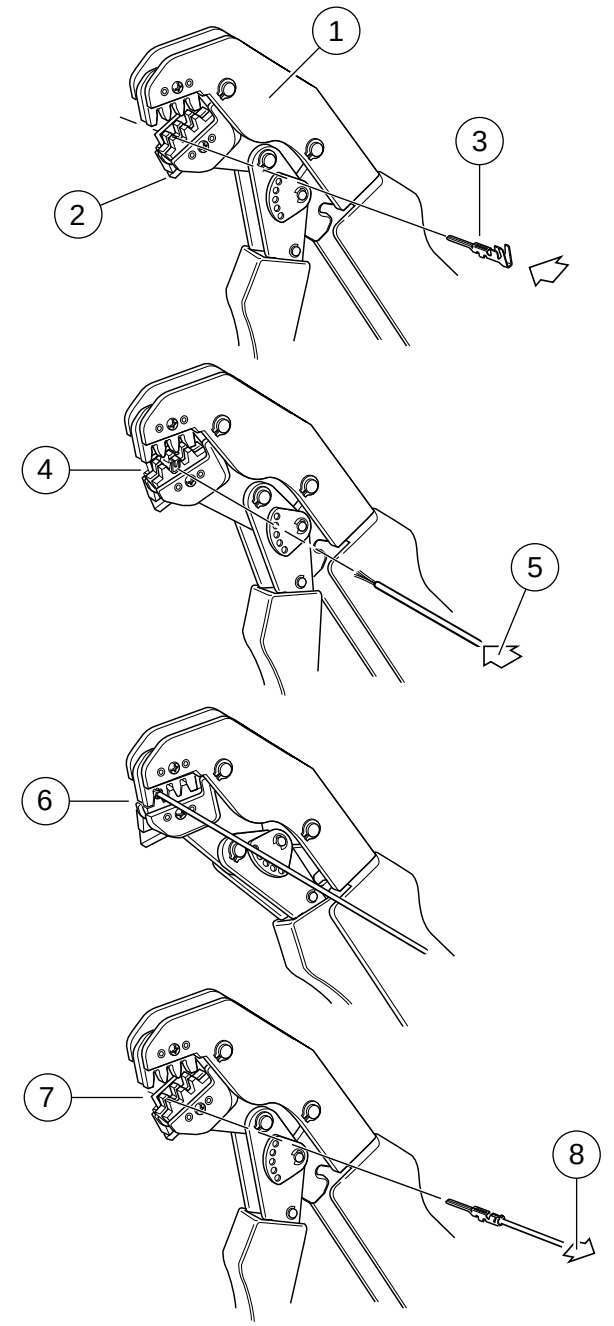
Crimping with the AMP Multi-lock Crimper is a one step operation. One squeeze crimps both the wire core and the insulation tails.

1. See Figure A-63. Squeeze the handles to cycle the AMP MULTI-LOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

NOTE

See Figure A-61 and Figure A-62. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and simultaneously crimp around the stripped lead and the insulation.

3. See Figure A-63. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. 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. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (7) to remove crimped terminal.

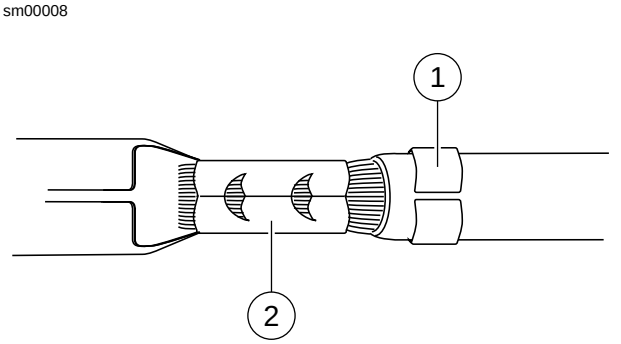


1. **Open position**
2. **Locking bar flange**
3. **Insert contact**
4. **Release locking bar**
5. **Insert lead**
6. **Squeeze**
7. **Raise locking bar**
8. **Remove crimped terminal**

Figure A-63. Tyco 070 Multilock Unsealed Connector: Terminal Crimping Procedure

Inspecting Crimped Terminals

See Figure A-64. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.



1. **Insulation crimp**
2. **Wire core crimp**

Figure A-64. Tydo 070 Multilock Unsealed Connector: Terminal Crimp

TYCO GET 64 SEALED CONNECTOR A.21

TYCO GET 64 SEALED CONNECTOR

PART NUMBER	TOOL NAME
B-50085	TERMINAL EXTRACTOR

General

See Figure A-65. The Tyco GET 64 Sealed connector is found on the ECM of Dyna and Softail Models.

Housings

Separate: Press on the latch. Pull the socket housings off of the ECM.

Join: Align the socket housing latch with the catch on the ECM. Press housing onto ECM.

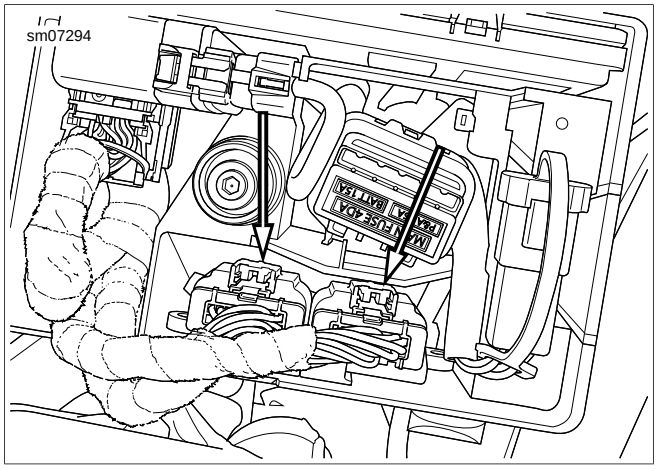


Figure A-65. Tyco GET 64 Sealed Connector Latch

Removing Socket Terminals

1. Remove the black wrap to access the back of the connector.
2. See Figure A-66. Use needle nose pliers to pull the secondary lock out of the housing.
3. See Figure A-67. 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 adjacent to the terminal.
4. Rotate the extractor to release the retention beam and simultaneously pull on the wire lead to remove the terminal.

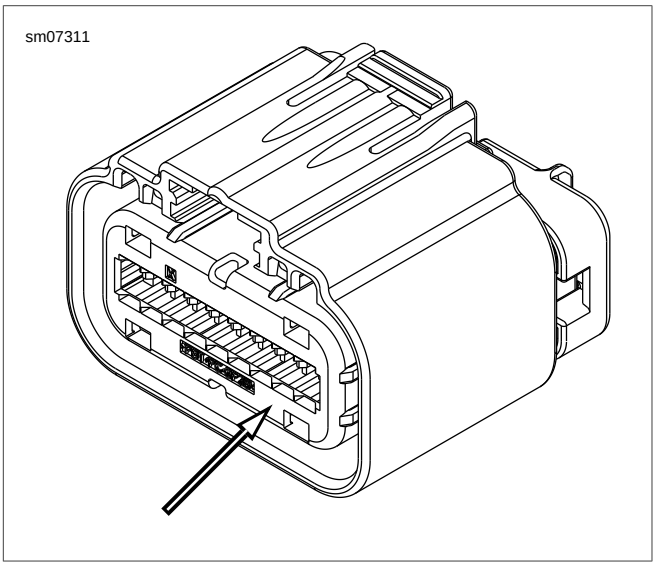
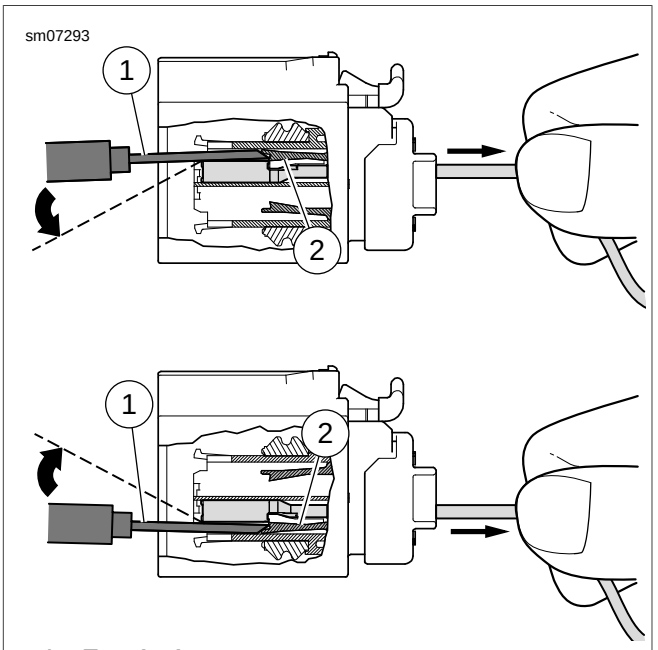


Figure A-66. Tyco GET 64 Secondary Lock



1. **Terminal extractor**
2. **Retention beam**

Figure A-67. Removing Terminals: Tyco GET 64 Sealed Connector

Installing Socket Terminals

1. See Figure A-68. Locate the wire lead cavity by number.
2. See Figure A-69. 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.

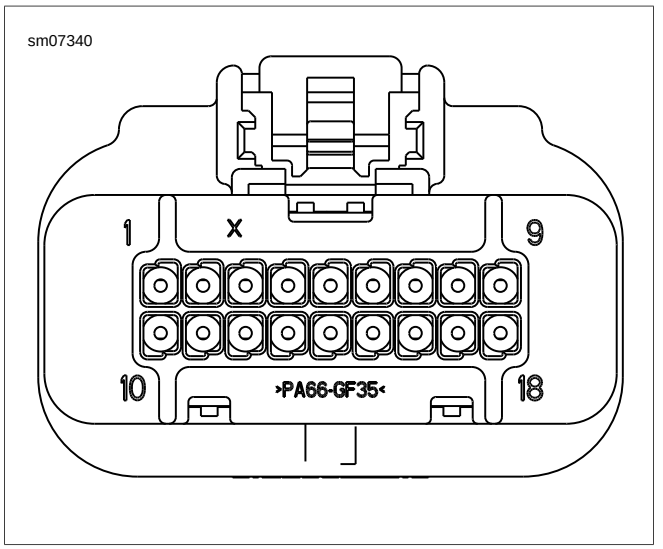


Figure A-68. Cavity Numbers

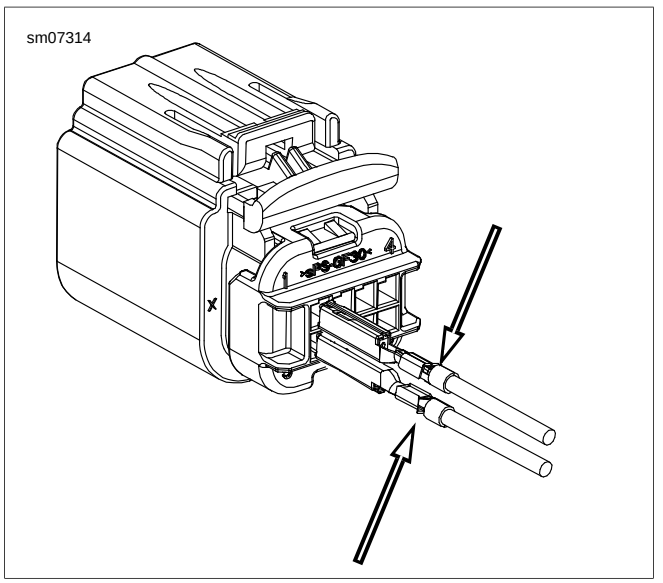


Figure A-69. Socket Terminal Orientation: Crimp Open Side

CRIMPING TERMINALS

PART NUMBER	TOOL NAME
HD-50120	UNIVERSAL CRIMPER SET
HD-50120-2	HAND CRIMP FRAME
HD-50120-7	TYCO GET 64 DIE

1. Strip the wire insulation. Refer to Table A-9.
2. Install the TYCO GET 64 DIE (Part No. HD-50120-7) in 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. Refer to Table A-9.
4. Insert the wire to the wire stop. Crimp the terminal.
5. Inspect the crimped terminal and wire lead.

Table A-9. Tyco GET 64 Sealed Crimper Die (Part No. HD-50120-7)

TERMINAL	PART NO.	STRIP LENGTH		NEST
		in	mm	
Socket: 18-20 AWG	72666-12	0.170	4.4	A

TYCO MCP SEALED CONNECTOR A.22

TYCO MCP SEALED CONNECTOR

PART NUMBER	TOOL NAME
B-0085	TERMINAL EXTRACTOR
GA500A	SNAP-ON TERMINAL PICK

General

The Tyco MCP sealed connector is used on certain ABS modules.

Housing

Separate: See Figure A-70. 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.

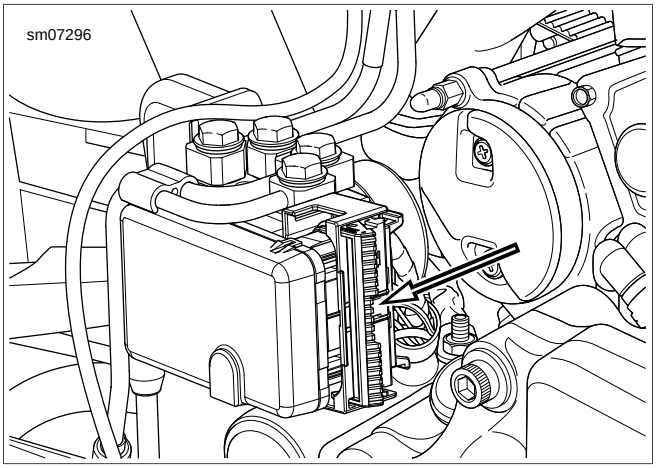


Figure A-70. Tyco MCP Connector Release Bar

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-71. Gently slide the secondary lock out of the connector with a screw driver.
3. See Figure A-72. 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.

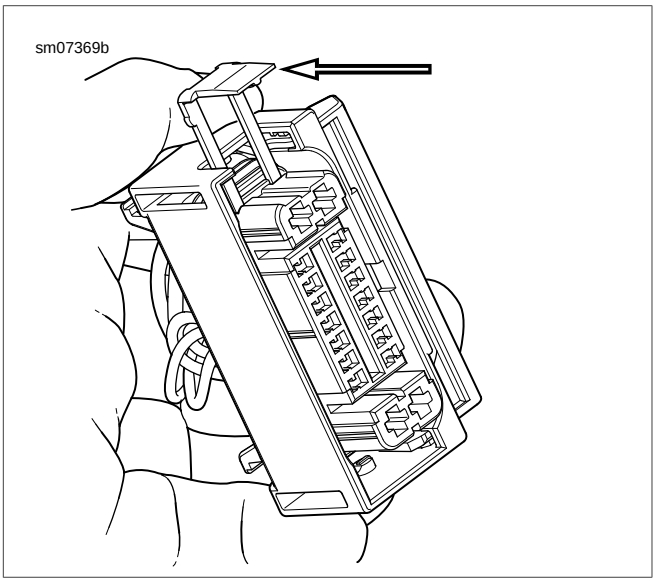


Figure A-71. Tyco MCP Connector Secondary Lock

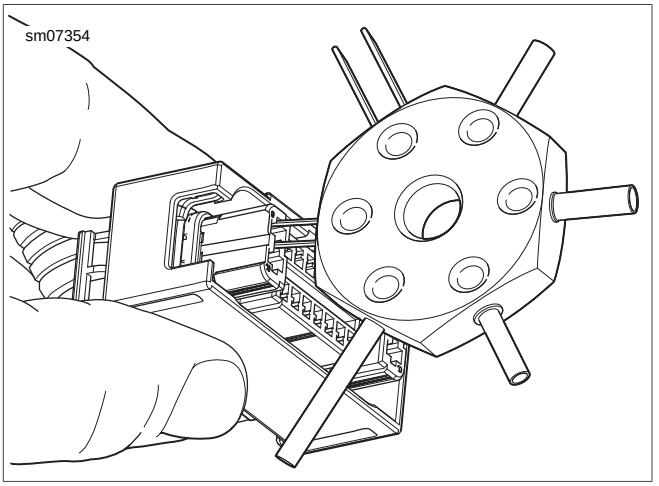


Figure A-72. Removing Large Socket Terminals: Tyco MCP Connector

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-71. Gently slide the secondary lock out of the connector with a screw driver.
3. See Figure A-73. Insert the TERMINAL EXTRACTOR (Part No. B-0085) 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.

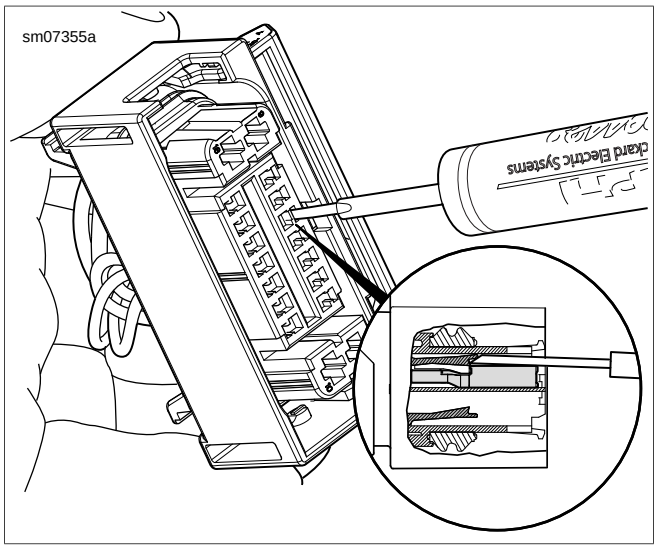


Figure A-73. Removing Small Socket Terminal: Tyco MCP Connector

Installing Terminals

1. See Figure A-74. 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.

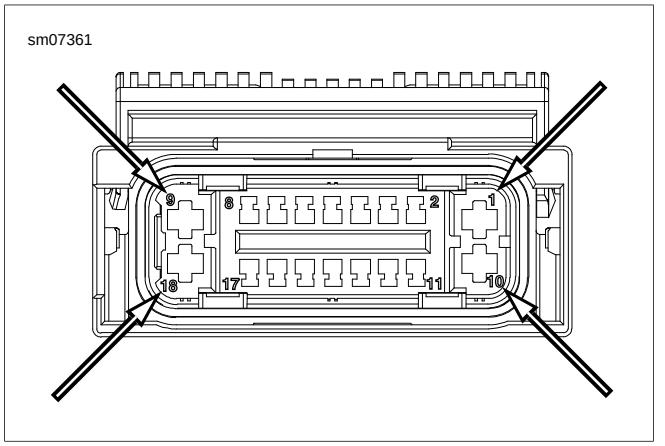


Figure A-74. Tyco MCP Sealed Connector Cavity Numbers

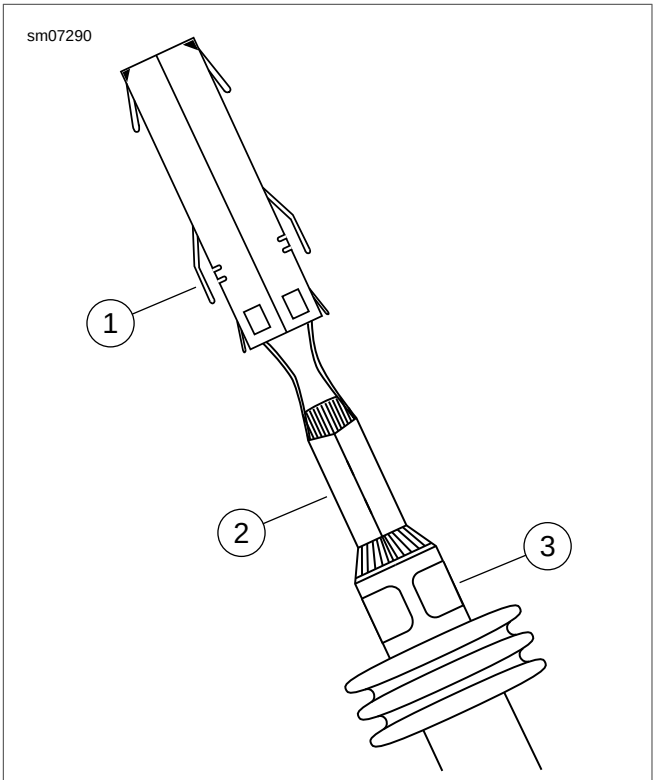
CRIMPING TERMINALS

PART NUMBER	TOOL NAME
HD-50120	UNIVERSAL CRIMPER SET
HD-50120-8	TYCO MCP DIE

1. Strip the wire insulation to specification. Refer to Table A-10.
2. Install the TYCO MCP DIE (Part No. HD-50120-8) in the handle 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.
5. Crimp the terminal.
6. Inspect the crimped terminal.

Table A-10. Tyco MCP Crimper Die (Part No. HD-50120-8)

TERMINAL	PART NO.	STRIP LENGTH		NEST
		in	mm	
Large socket: 14 AWG	72579-12	0.165-0.189	4.2-4.8	A
Large socket: 16 AWG	72579-12	0.165-0.189	4.2-4.8	B
Small socket: 20 AWG	72580-12	0.130-0.153	3.3-3.9	C



1. **Locking tang**
2. **Lead crimp**
3. **Seal crimp**

Figure A-75. Tyco MCP Socket Terminal Crimp

SEALED SPLICE CONNECTORS A.23

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA TORCH
HD-41183	HEAT SHIELD ATTACHMENT

General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

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-11.
3. Strip insulation off the the wire lead. Refer to Table A-11.

Table A-11. Sealed Splice Connectors

WIRE GAUGE	COLOR	PART NO.	STRIP LENGTH	
			in	mm
18-20 (0.5-0.8 mm)	Red	70585-93	3/8	9.5
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8	9.5
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8	9.5

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-77. The connector is crimped on one side and then the other.

1. See Figure A-76. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws. Insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-77. 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.

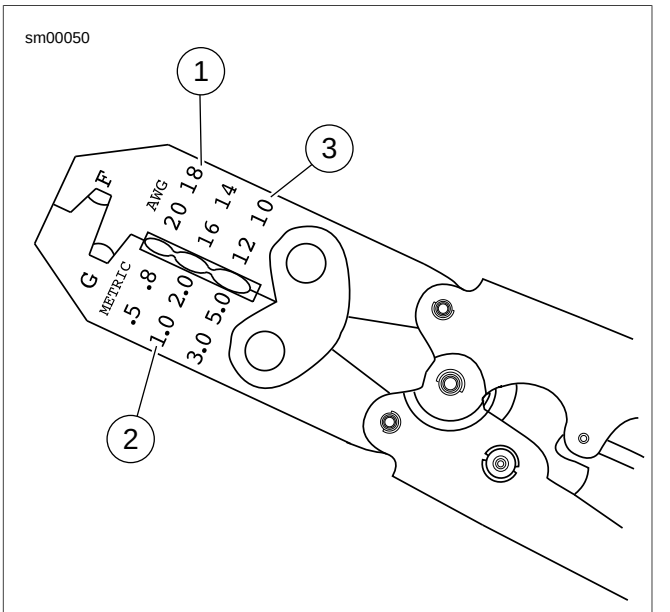
7. Use an ULTRA TORCH (Part No. HD-39969), or a HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

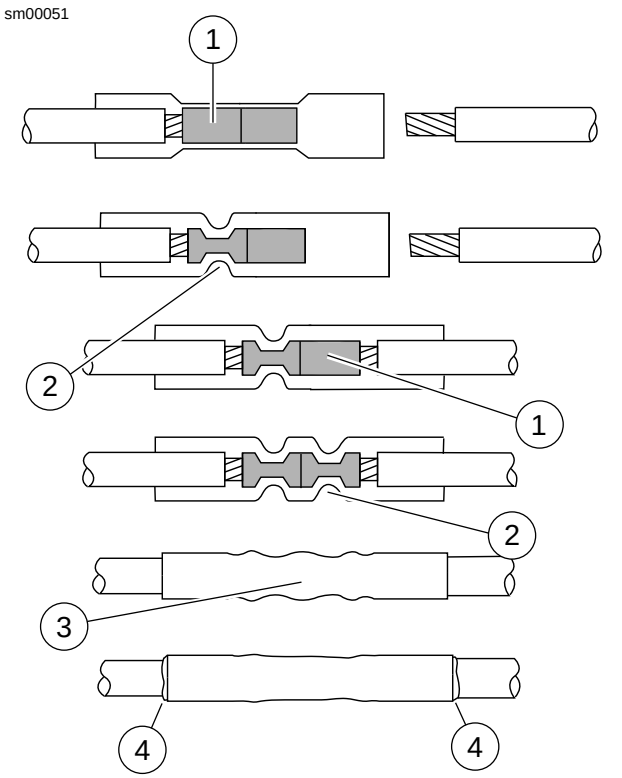
Inspecting Seals

See Figure A-77. 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-76. 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-77. Sealed Splice Connector

TABLE OF CONTENTS

SUBJECT **PAGE NO.**
B.1 CONNECTORS.....B-1
B.2 WIRING DIAGRAMS.....B-4

NOTES

CONNECTORS B.1

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.

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.

Table B-1. Dyna Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[7]	Tail lamp harness to main harness	8-place Tyco 070 Multilock Unsealed (BK)	Gray	Under seat
[18]	Right rear turn signal	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens
[19]	Left rear turn signal	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens
[20]	Console gauges/instrument lamps	8-place Molex MX 150 Sealed (BK)	Gray	Under console (except FXD/B/L) Inside top frame tube (FXD/B/L)
[22-1]	Right hand controls	4-place JAE MX19 Sealed (BK)	Yellow	Inside top frame tube
[22-2]	Right hand controls	2-place JAE MX19 Sealed (BK)	Yellow	Inside top frame tube
[24]	Left hand controls	4-place JAE MX19 Sealed (BK)	Yellow	Inside top frame tube
[29]	Position lamp (HDI)	Spade terminals	Red	Behind headlamp
[31L]	Left directional and DOM running lamps	3-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside top frame tube
[31R]	Right directional and DOM running lamps	3-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside top frame tube
[33]	Ignition switch	2-place Delphi GT 150 Sealed (GY)	Gray	Under fuel tank console (except FXD/B/L) Inside top frame tube (FXD/B/L)
[38]	Headlamp	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside top frame tube (FXD/B/L) Behind headlamp (except FXD/B/L)
[39]	Speedometer	12-place Delphi Micro 64 Sealed (GY)	Breakout Box	Back of speedometer
[40]	LP, stop, and tail lamp	4-place Deutsch DT Sealed (FXD/B/WG) (GY)	Brown	Inside tail lamp lens
[45]	Rear fender tip lamp	3-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens
[47]	Voltage regulator to stator	3-place Dekko (BK)		Back of voltage regulator
[64]	Fuse block	Spade terminals	Gray	Under left side cover
[65]	VSS	3-place Delphi GT 150 Sealed (BK)	Gray	Top of transmission case
[77]	Voltage regulator	2-place Dekko (BK)		Back of voltage regulator
[78-1]	ECM	18-place Tyco (BK)	Breakout Box	Under left side cover
[78-2]	ECM	18-place Tyco (GY)	Breakout Box	Under left side cover
[79]	CKP sensor	2-place Deutsch DTM Sealed (BK)	Brown	Back of voltage regulator bracket

Table B-1. Dyna Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[80]	MAP sensor	3-place Delphi 150 Metripack Sealed (GY)	Gray	Top of induction module
[83]	Ignition coil	4-place Delphi GT 150 Sealed (BK)	Gray	Back of coil
[84]	Front fuel injector	2-place Delphi GT 150 Sealed (GY)	Gray	Beneath fuel tank
[85]	Rear fuel injector	2-place Delphi GT 150 Sealed (GY)	Gray	Beneath fuel tank
[87]	IAC	4-place Delphi GT 150 Sealed (BK)	Gray	Top of induction module
[88]	TPS	3-place Delphi GT 150 Sealed (BK)	Gray	Behind air cleaner backing plate
[89]	IAT sensor	2-place Delphi GT 150 Sealed (GY)	Gray	Behind air cleaner backing plate
[90]	ET sensor	2-place Delphi GT 150 Sealed (BK)	Gray	Back of front cylinder, left side
[91]	DLC	6-place Deutsch DT Sealed (GY)	Black	Under left side cover
[93]	Tail lamp	4-place Tyco 070 Multilock Unsealed (BK)	Gray	Inside tail lamp lens (except FXD/B/L)
[94]	Rear fender lights harness in circuit board	6-place Tyco 070 Multilock Unsealed (BK)	Gray	Circuit board under tail lamp assembly (except FXD/B/L)
[95]	Purge solenoid	2-place Delphi 150 Metripack Sealed (BK)	Purple	Behind coil left side
[108]	Tachometer	12-place Packard (GY)	Breakout Box	Back of tachometer
[117]	Fuel gauge	4-place Tyco 040 Unsealed (BK)	Gray	Under fuel tank
[120]	Oil pressure switch	Spade terminals (BK)		Front of right crankcase
[121]	Rear stop lamp switch	Tyco Insulated Spade terminal (BK)	Red	Right side of transmission
[122]	Horn	Spade terminals (BK)	Red	Between cylinders, left side
[128]	Starter solenoid	Spade terminal (W)	Red	Top of starter
[131]	Neutral switch	Spade terminals (BK)		Top of transmission
[133]	JSS	3-place Molex MX 150 Sealed (BK)	Gray	Under seat
[137]	Rear HO2S	4-place Molex MX 150 Sealed (BK)	Gray	Under seat
[138]	Front HO2S	4-place Molex MX 150 Sealed (BK)	Gray	Behind voltage regulator
[141]	Fuel pump and sender	4-place Delphi GT 150 Sealed (BK)	Gray	Top of fuel tank
[142]	Security siren (optional)	3-place Delphi GT 150 Sealed (BK)	Gray	Under seat
[166]	ABS ECU	18-place Tyco (BK)	Breakout Box	Under battery
[167]	Front WSS	2-place Deutsch (BK)	Brown	Inside top frame tube
[168]	Rear WSS	2-place Delphi 150 Metripack Sealed (BK)	Gray	Under seat

Table B-1. Dyna Connector Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COLOR	LOCATION
[178]	Active intake solenoid	2-place Tyco Superseal 1.5 Sealed (BK)	Gray	Air cleaner backing plate
[179]	Active exhaust	5-place Tyco Superseal 1.5 Sealed (BK)	Gray	Above starter
[203F]	ACR (front)	2-place Tyco Superseal 1.5 Sealed	Gray	Bracket attached to the throttle body
[203R]	ACR (rear)	2-place Tyco Superseal 1.5 Sealed	Gray	Bracket attached to the throttle body
[209]	Security antenna	2-place Molex MX 64 Unsealed (BK)	Light Blue	Under seat
[222]	Ignition switch harness	2-place Delphi GT 150 Sealed Gray (GY)	Gray	Inside top frame tube (FXD/B/L)
[233]	License plate lamp	4-place (BK)	Gray	Inside tail lamp housing
[242]	BCM	48-place Molex CMC Sealed (BK)	Breakout Box	Under left side cover
[259]	BCM battery power	1-place Delphi 800 Metripack Sealed (BK)		Under left side cover
[GND1] [GND2]	Harness grounds	Ring terminals		Under seat

WIRING DIAGRAMS B.2

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.

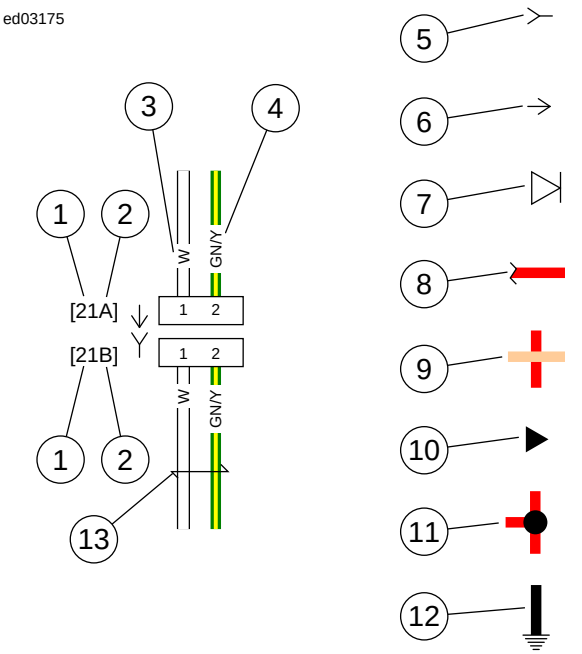
Ground: Grounds can be classified as either clean or dirty grounds. Clean grounds are identified by a (BK/GN) wire and are normally used for sensors or modules.

NOTE

Clean grounds usually do not have electric motors, coils or anything that may cause electrical interference on the ground circuit.

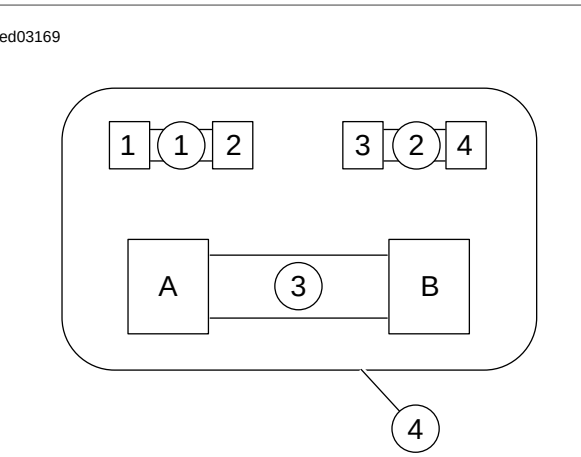
Dirty grounds are identified by a (BK) wire and are used for components that are not as sensitive to electrical interference.

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



1. **Battery**
2. **P&A**
3. **Main**
4. **Fuse block [64]**

Figure B-2. Fuse Block and Socket Terminals

Table B-2. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Gray
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

2013 DYNA WIRING DIAGRAMS

Refer to the table below for wiring diagram information.

Wiring Diagram List

DIAGRAM	LOCATION
Battery Power Distribution	Figure B-3
Ignition and Accessory Power Distribution: 1 of 2	Figure B-4
Ignition and Accessory Power Distribution: 2 of 2	Figure B-5
Sensor Grounds	Figure B-6
Ground Circuit: 1 of 2	Figure B-7
Ground Circuit: 2 of 2	Figure B-8
Front Lighting and Hand Controls: 2013 Dyna	Figure B-9
Main Harness 1 of 2: 2013 Dyna	Figure B-10
Main Harness 2 of 2: 2013 Dyna	Figure B-11
Rear Lighting: 2013 Dyna	Figure B-12

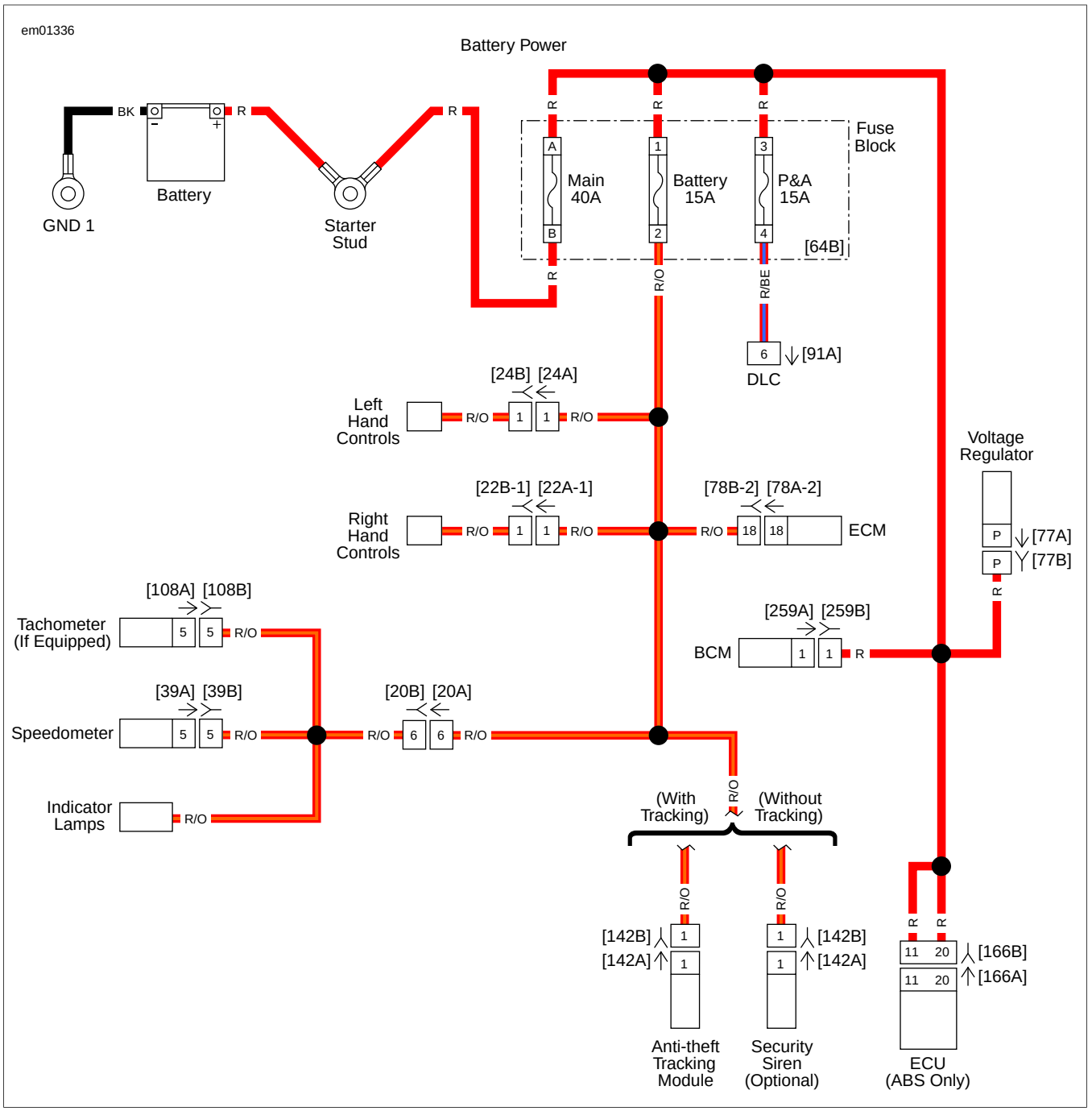


Figure B-3. Battery Power Distribution

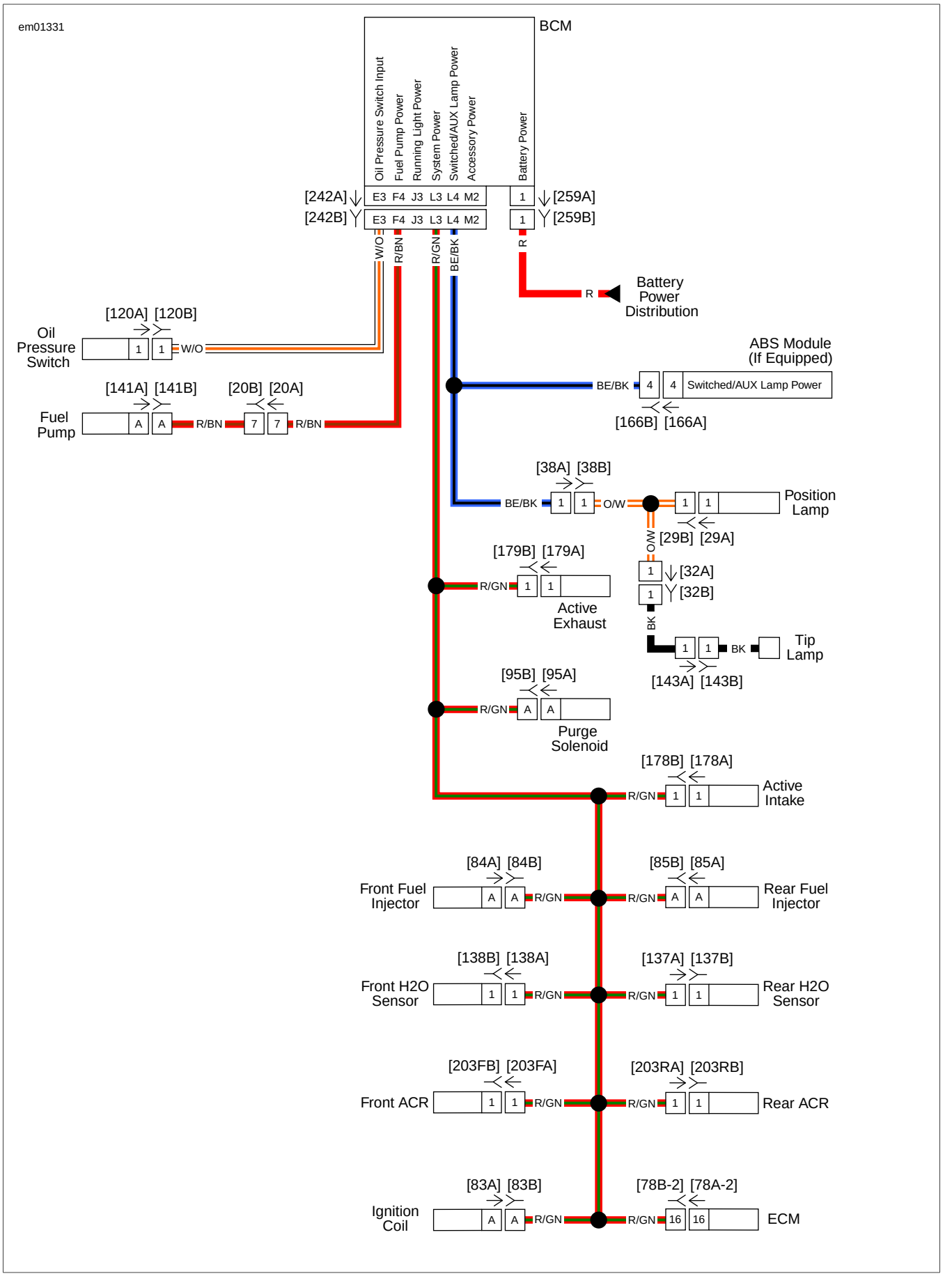


Figure B-4. Ignition and Accessory Power Distribution: 1 of 2

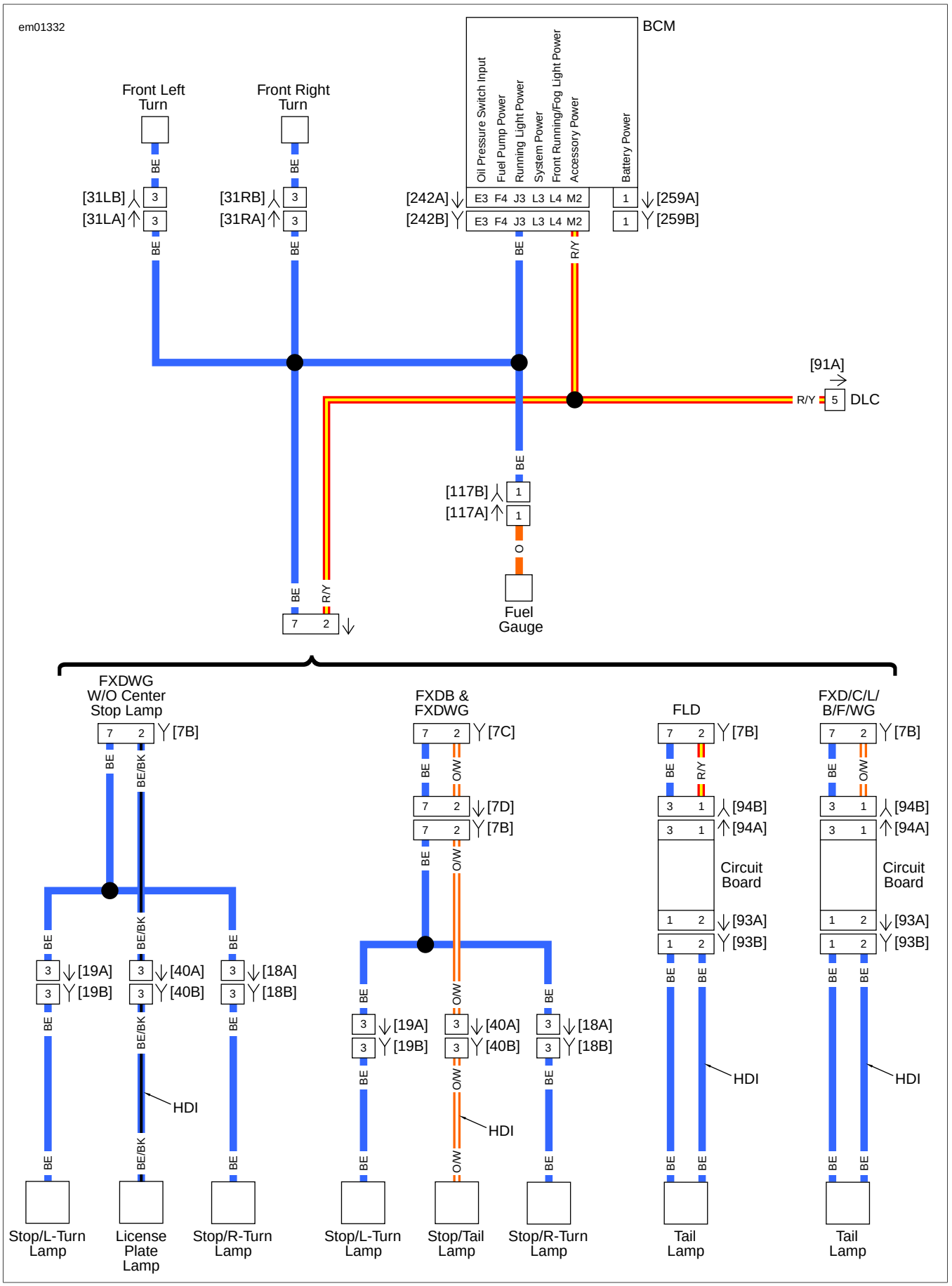


Figure B-5. Ignition and Accessory Power Distribution: 2 of 2

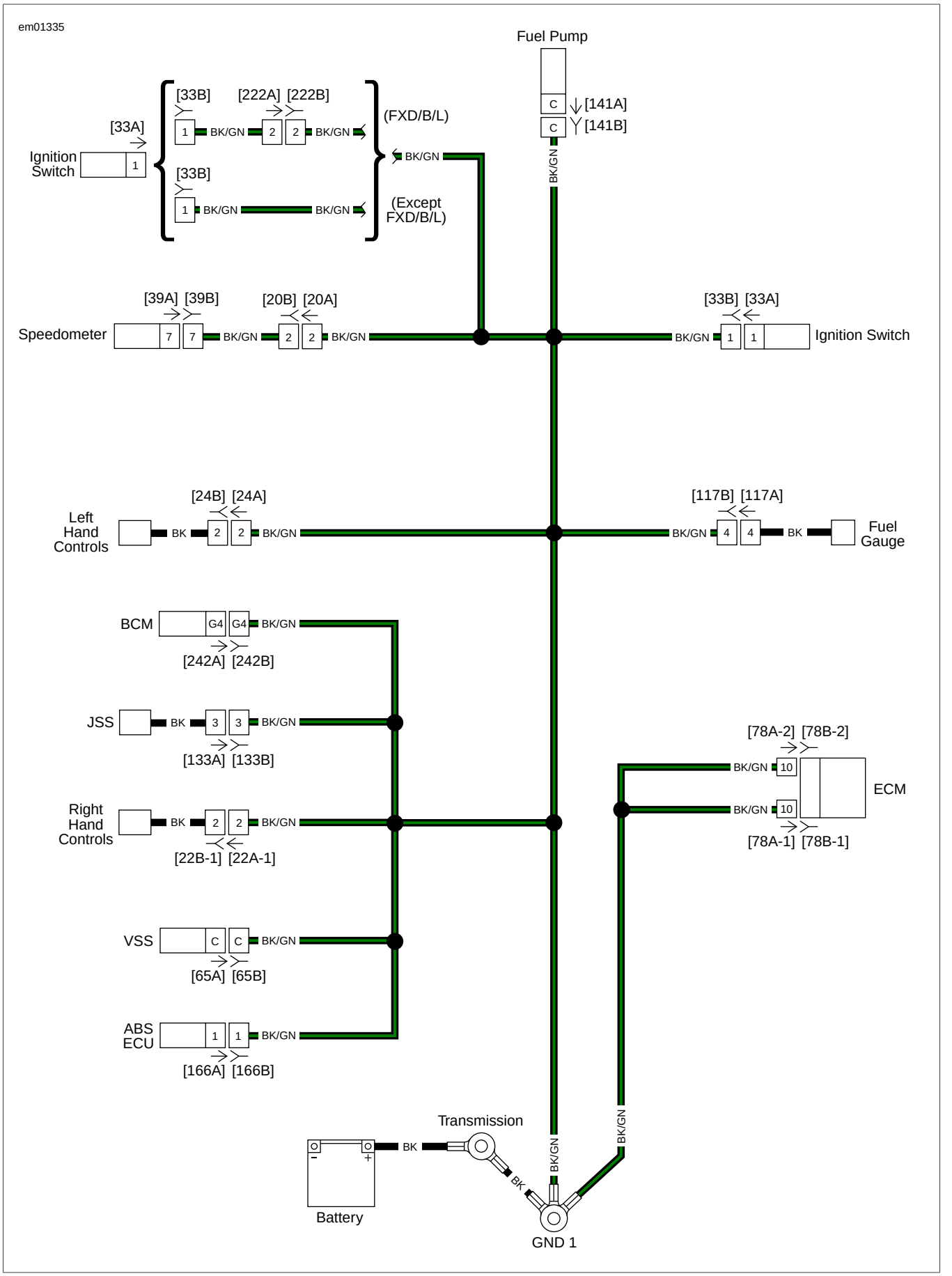


Figure B-6. Sensor Grounds

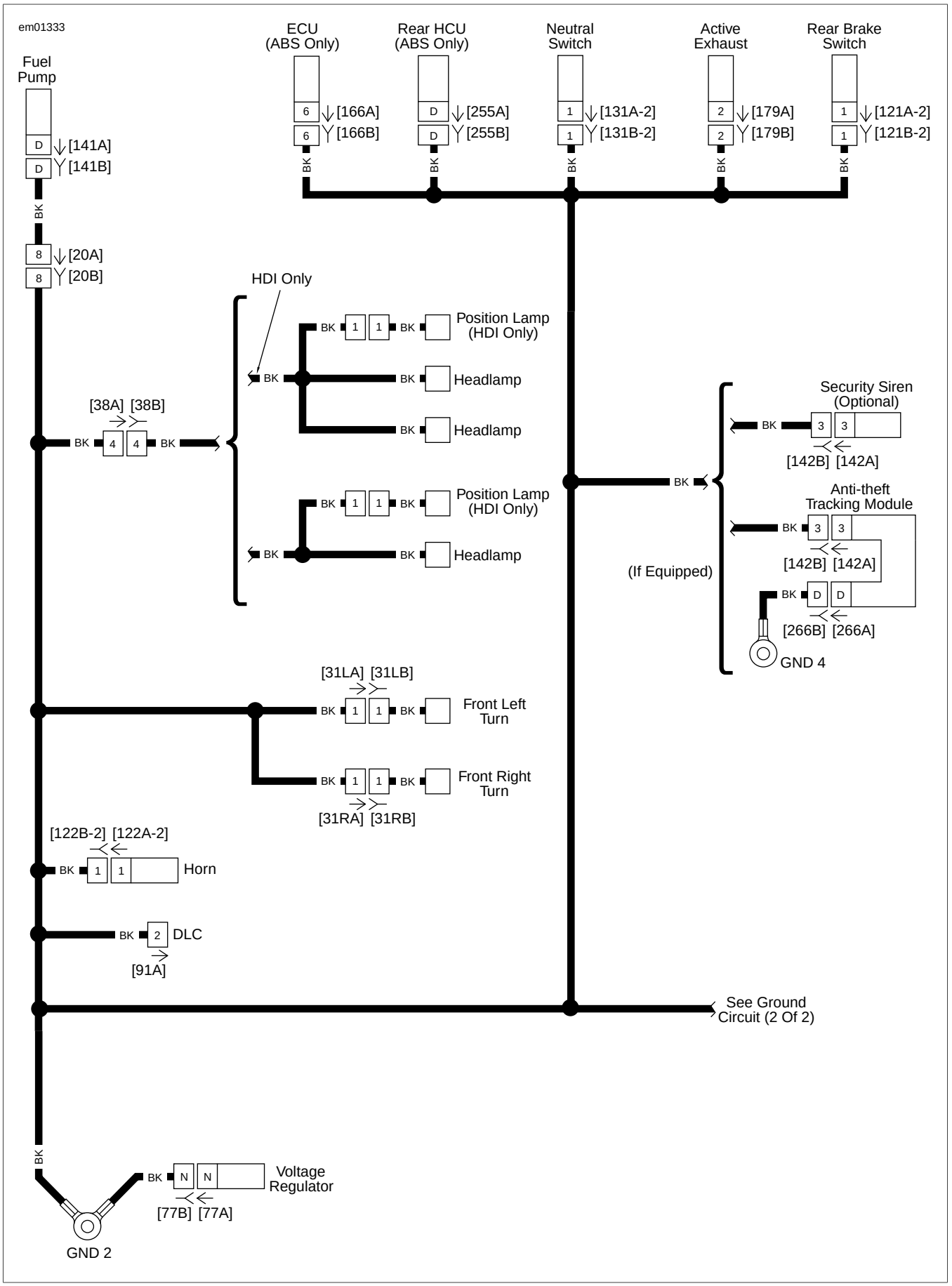


Figure B-7. Ground Circuit: 1 of 2

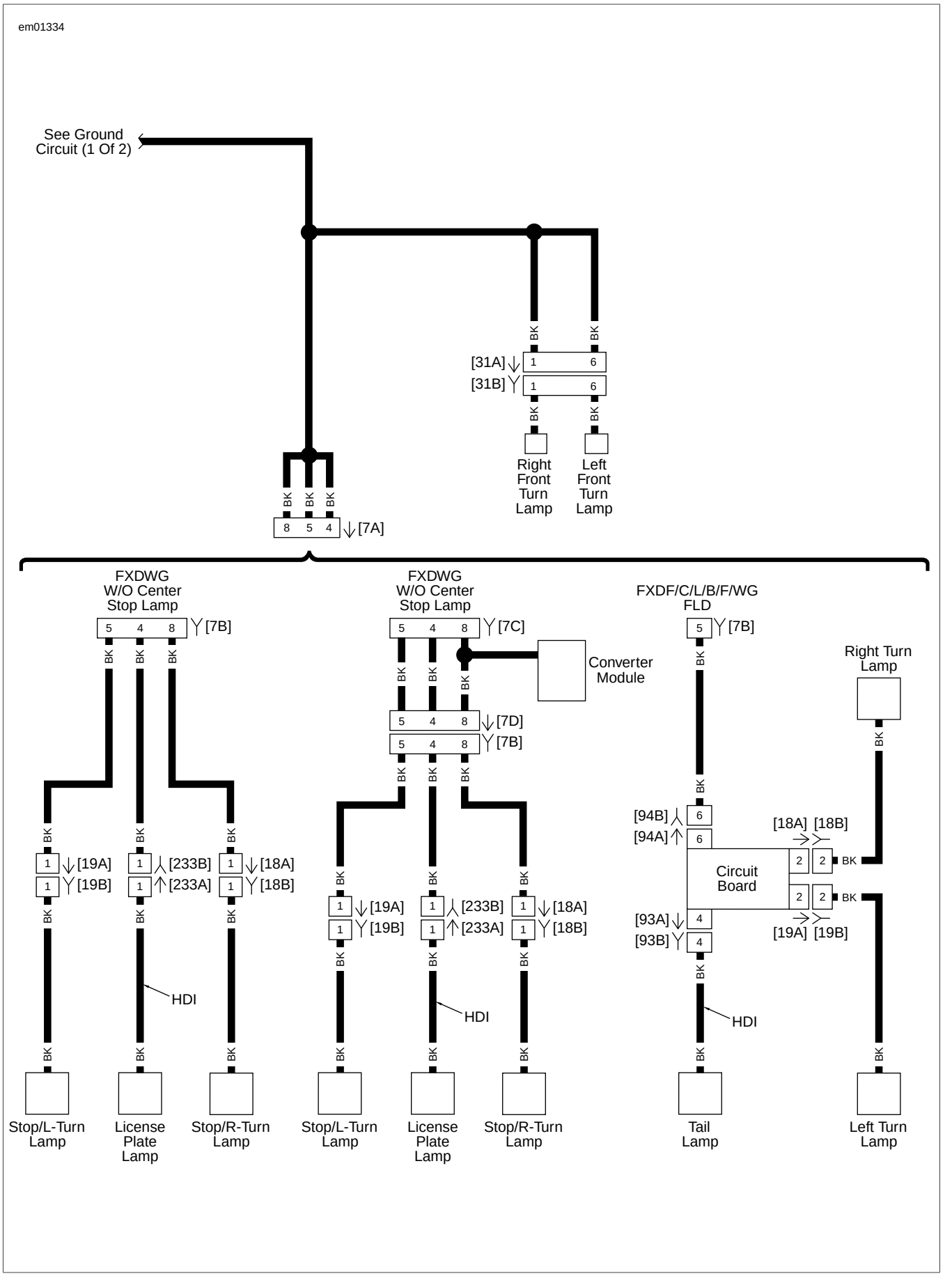


Figure B-8. Ground Circuit: 2 of 2

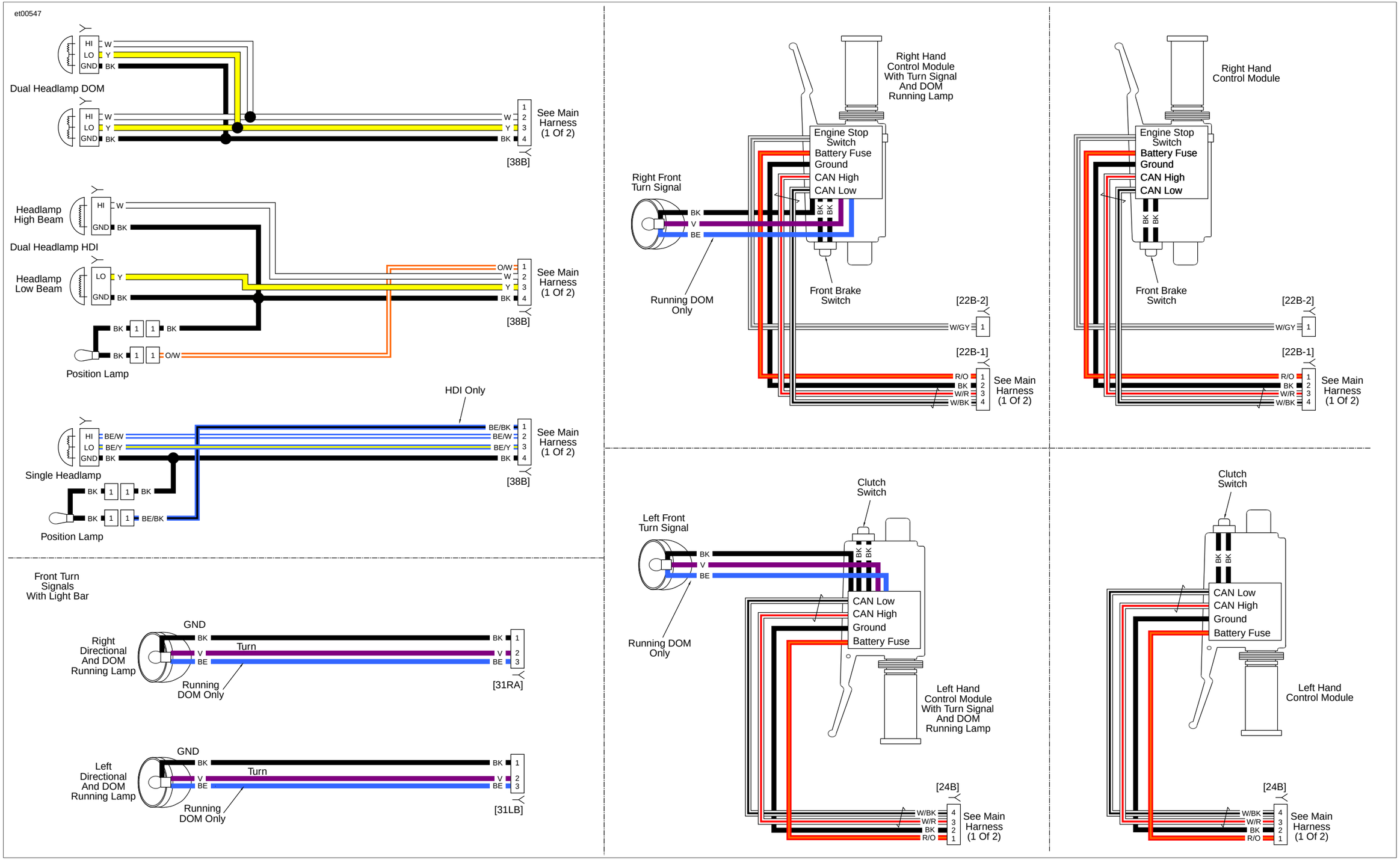


Figure B-9. Front Lighting and Hand Controls: 2013 Dyna

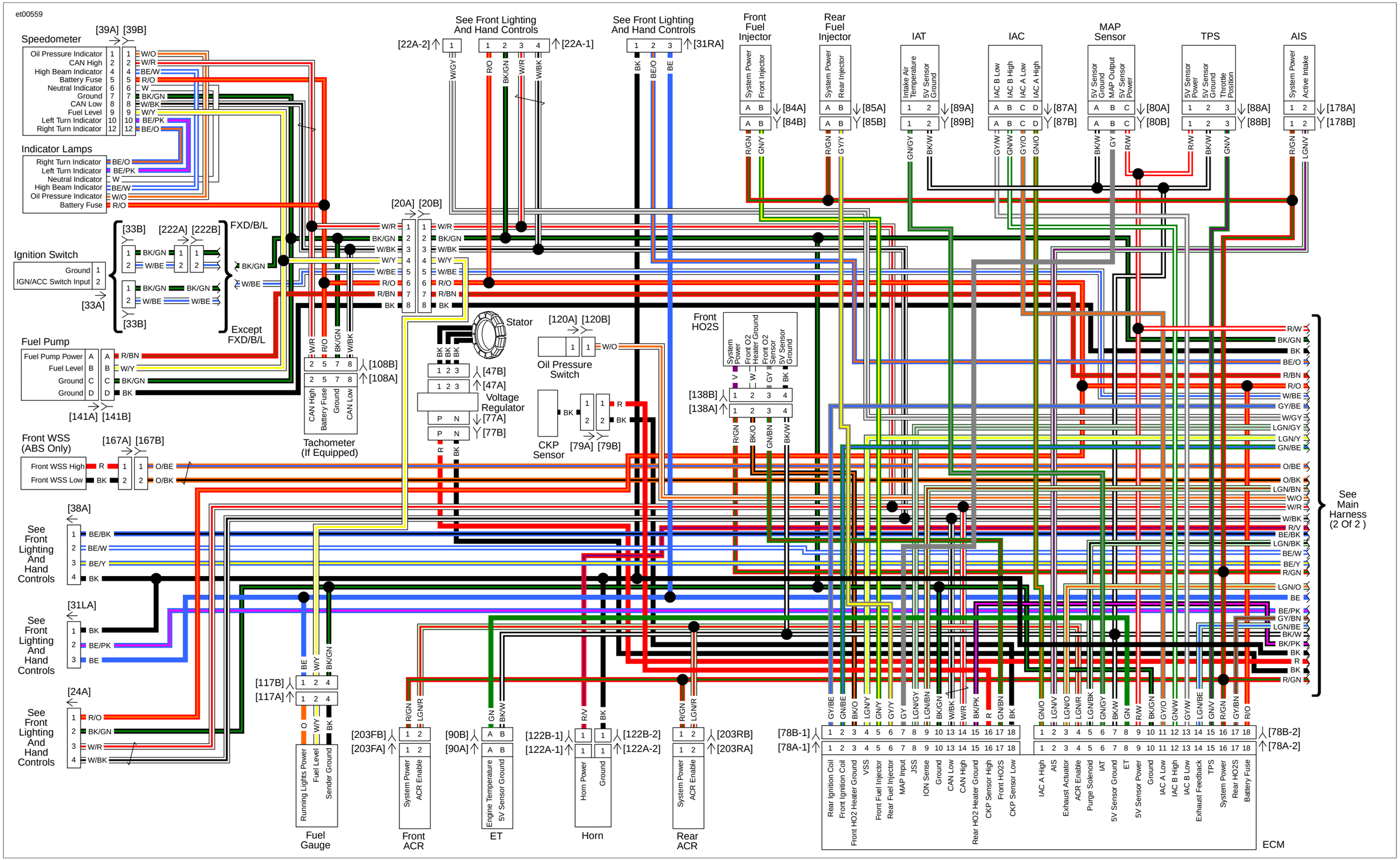


Figure B-10. Main Harness 1 of 2: 2013 Dyna

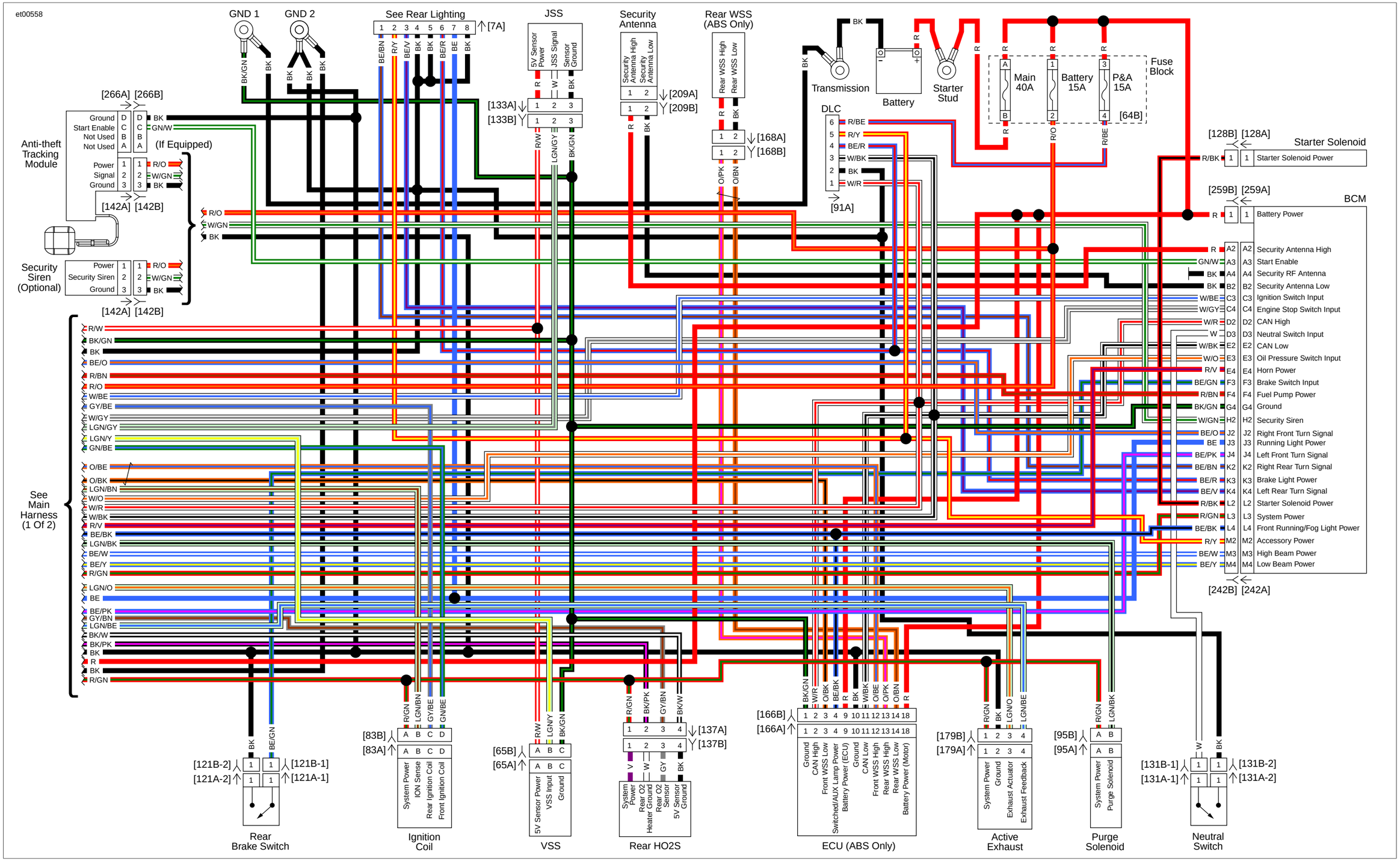
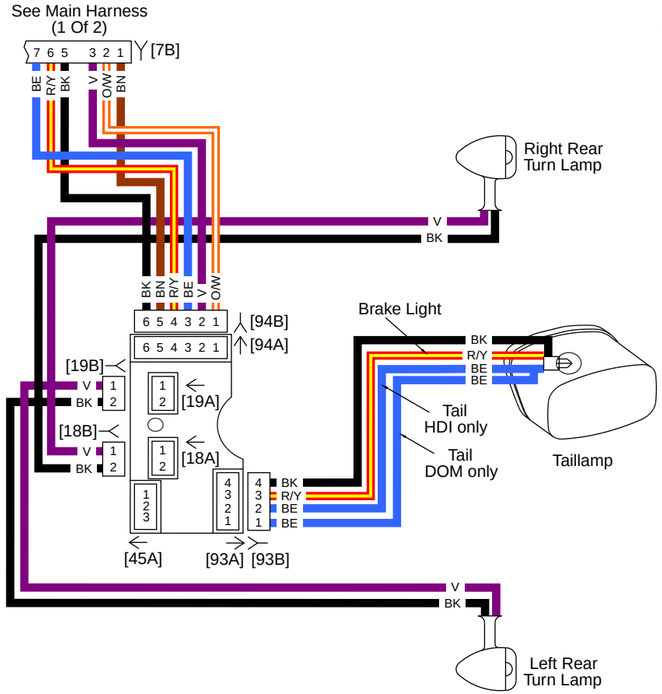
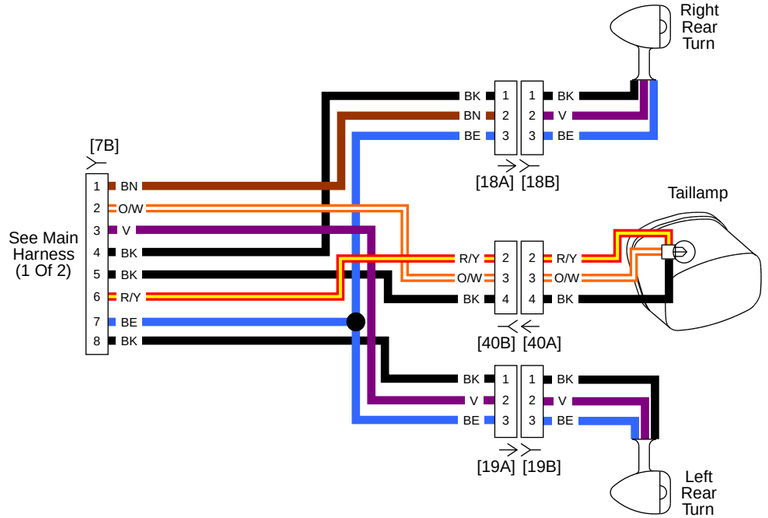


Figure B-11. Main Harness 2 of 2: 2013 Dyna

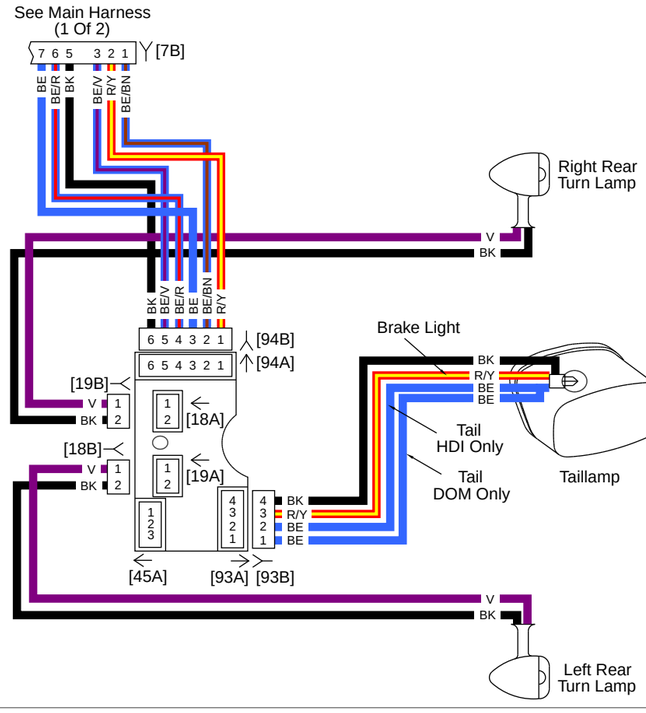
et00453



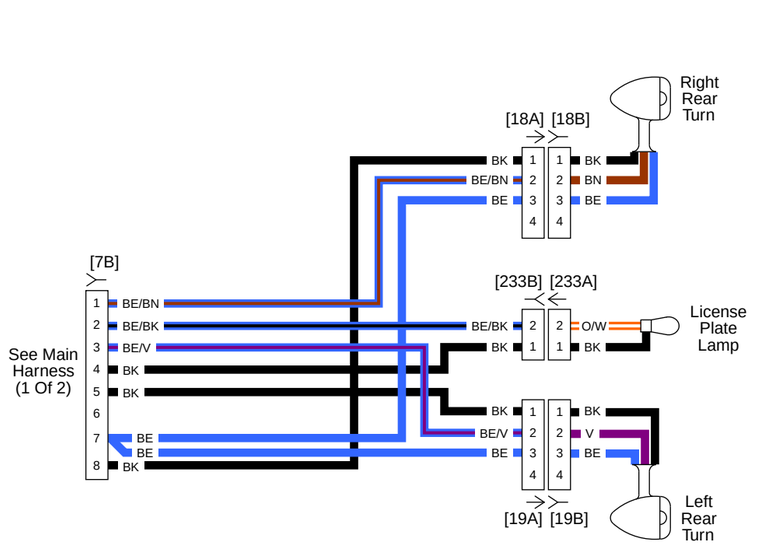
Rear Lighting Harness FXDF



Rear Lighting FXD/B/WG W/Center Stop Lamp



Rear Lighting FLD/FXD/C/L



Rear Lighting FXDWG Without Center Stop Lamp

Figure B-12. Rear Lighting: 2013 Dyna

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NOTES

FASTENER TORQUE VALUES C.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
ABS brake line flare nuts	120-144 **in-lbs**	13.6-16.3 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
ABS brake line flare nuts	120-144 **in-lbs**	13.6-16.3 Nm	C.4 ABS BRAKE LINES, Front ABS Lines
ABS module to bracket fastener	50-70 **in-lbs**	5.6-7.9 Nm	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
ABS module to frame fastener	90-114 **in-lbs**	10.2-12.8 Nm	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.4 ABS BRAKE LINES, Front ABS Lines
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.4 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Banjo bolt to front caliper	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
Banjo bolt to front master cylinder	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
Banjo bolt to rear caliper	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Brake switch/banjo bolt to rear master cylinder	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Front brake line manifold fastener	36-48 **in-lbs**	4.1-5.4 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
Rear fork brake hose J-clip	40-60 **in-lb**	4.5-6.8 Nm	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper

ABS MODULE C.2

GENERAL

NOTE

All Dyna models equipped with ABS brakes (except FLD) use a remote brake fluid reservoir on the rear.

⚠WARNING

Do not use parts from single caliper repair kits (9/16 inch bore) on dual caliper models. Likewise, do not use parts from dual caliper repair kits (11/16 inch bore) on single caliper models. Using incorrect parts can cause brake failure, which could result in death or serious injury. (00278a)

⚠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)

ELECTRO HYDRAULIC CONTROL UNIT (EHCU)

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

FASTENER	TORQUE VALUE	
ABS module to bracket fastener	50-70 **in-lbs**	5.6-7.9 Nm
ABS module to frame fastener	90-114 **in-lbs**	10.2-12.8 Nm
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm

NOTE

The ABS module consists of ECU (electrical control unit) and HCU (hydraulic control unit) and are not serviceable separately. If any component of the ABS module fails, replace the entire unit.

Removal

1. Remove seat.
2. Remove right side saddlebag, if equipped. See 2.32 SADDLEBAGS: FLD.
3. Remove battery and battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
4. Remove active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.

NOTE

For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

5. Drain brake systems.
6. See Figure C-1. Disconnect ABS module electrical connector (5).

NOTE

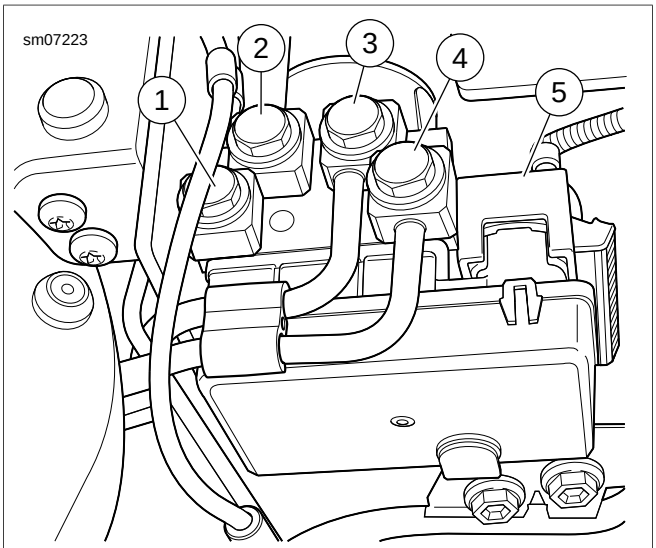
Wrap banjo fittings with pieces of lint-free shop towel to absorb any loss of brake fluid.

7. Remove cable strap securing the rear WSS to the rear brake line.
8. See Figure C-3. Remove brake line clip at ABS module.
9. See Figure C-1. Remove four banjo bolts to release brake lines from ABS module. Discard sealing washers.

NOTICE

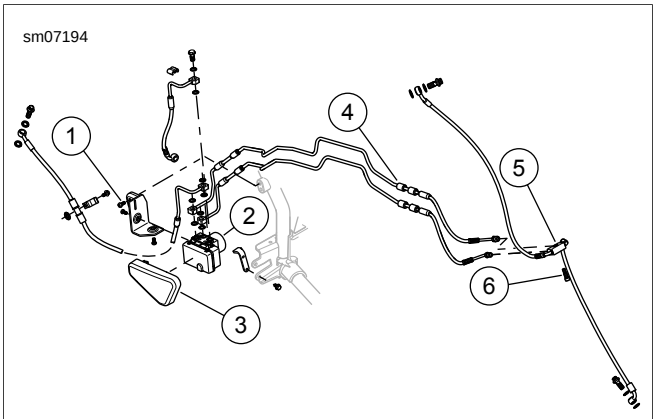
This device is sensitive to electrostatic discharge (ESD). To prevent damage to the device, always touch the motorcycle frame or a grounded surface before handling. (00588c)

10. See Figure C-2. Remove two fasteners (1) to release ABS module (2) bracket from frame.
11. Remove ABS module.
12. Remove two fasteners to release ABS module from mounting bracket.



1. **ABS module-to-front manifold (F)**
2. **Front master cylinder-to-ABS module (MC 1)**
3. **Rear master cylinder-to-ABS module (MC 2)**
4. **ABS module-to-rear caliper (R)**
5. **Electrical connector**

Figure C-1. ABS Module Connections



1. **Screws, ABS module mounting (2)**
2. **ABS module**
3. **ABS heat shield**
4. **Brake lines, ABS module to front manifold**
5. **Manifold**
6. **Fastener, front manifold to lower fork bracket**

Figure C-2. ABS Brake System (typical)

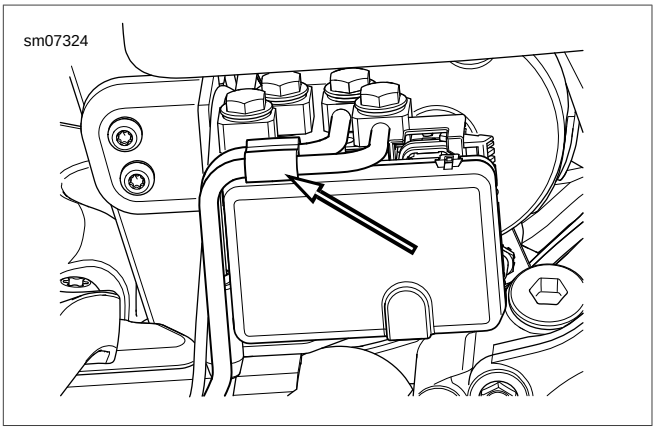


Figure C-3. Brake Line Clip at ABS Module

Installation

1. Install two fasteners attaching ABS module to mounting bracket. Tighten to 50-70 **in-lbs** (5.6-7.9 Nm).
2. Position ABS module (2) on frame.
3. See Figure C-2. Install two fasteners (1) attaching bracket to frame. Tighten to 90-114 **in-lbs** (10.2-12.8 Nm).

NOTE

Markings on ABS module designate brake line connections.

4. See Figure C-1. Loosely install banjo fittings to their respective ports on the ABS module using **new** sealing washers.

NOTE

See Figure C-3. Failure to install clip on rear brake lines at ABS module may result in the brake lines rubbing against the rear fork during vehicle operation.

5. See Figure C-3. Install brake line clip at ABS module.
6. Tighten banjo bolts to 14-18 ft-lbs (18.9-24.4 Nm).
7. Install cable strap securing the rear WSS to the rear brake line.
8. Connect ABS module electrical connector.
9. Install battery tray and battery. See 7.10 BATTERY TRAY AND BATTERY CABLES and 1.20 BATTERY MAINTENANCE.
10. Install active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.
11. If a **new** ABS module assembly was installed, program the ABS module using DIGITAL TECHNICIAN II (Part No. HD-48650).
12. Fill and bleed brake systems. See 2.14 BLEEDING BRAKES.

⚠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)

13. 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.
14. Install ABS heat shield.
15. Install right side saddlebag, if removed. See 2.32 SADDLEBAGS: FLD.

⚠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)

16. Install seat.

⚠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)

17. Test brake system.
    a. Turn ignition switch ON and verify operation of the brake lamp.
    b. Test ride the motorcycle. Repeat the bleeding procedure if the brakes feel spongy.

WHEEL SPEED SENSORS C.3

FRONT WHEEL SPEED SENSOR (WSS)

Removal

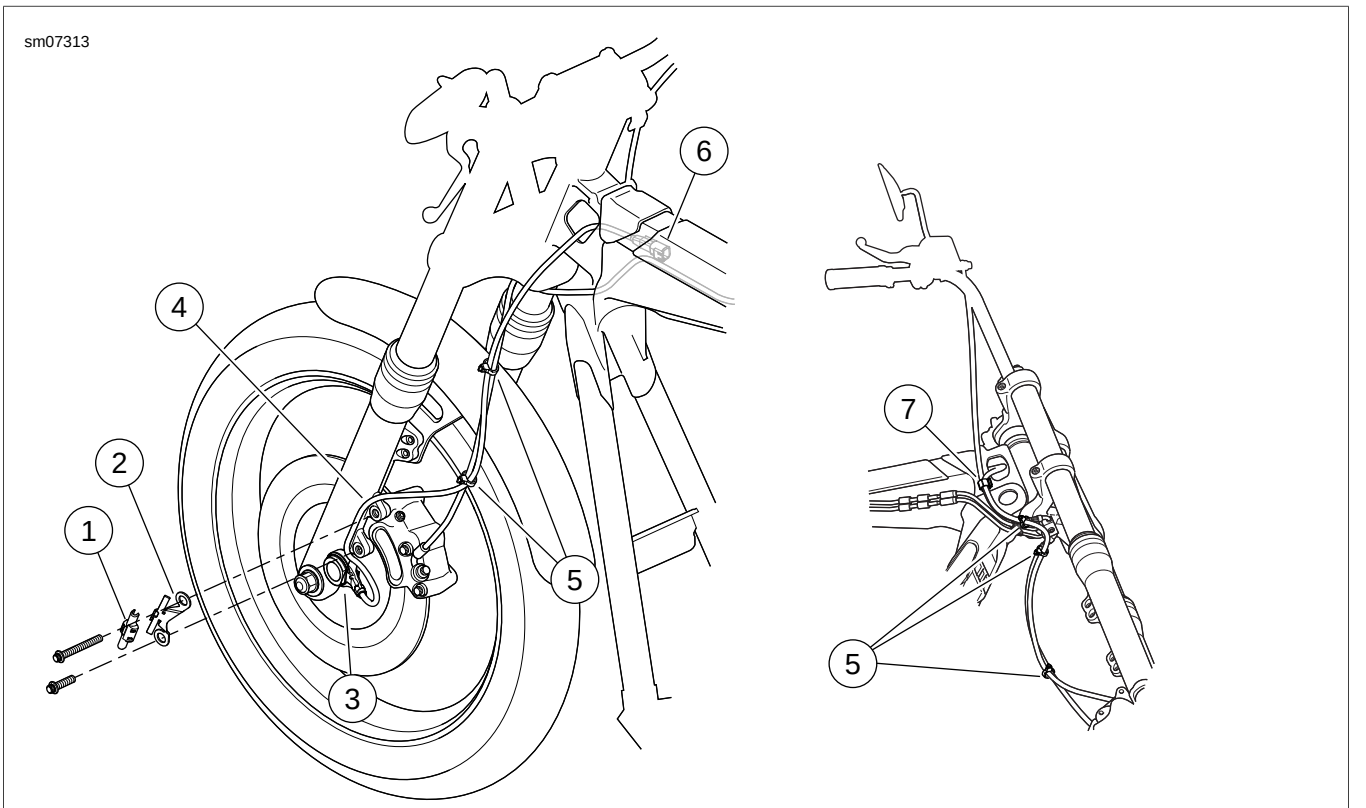
NOTE

WSS harness and connector are routed through the plastic clip in the steering head and then the hole on right hand side of steering head.

1. Remove fuel tank. See 4.4 FUEL TANK.
2. See Figure C-4. Disconnect front WSS connector (6).
3. Cut cable straps (5) to release front WSS cable from brake hose.
4. Remove front WSS clip (1).
5. Retract axle until front WSS (3) is free. See 2.4 FRONT WHEEL.

NOTE

The WSS 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.



1. **Clip, wheel speed sensor (WSS)**
2. **Bracket, WSS clip mounting**
3. **Sensor, wheel speed**
4. **Harness, WSS**
5. **Cable strap (3)**
6. **WSS connector (routed through frame backbone)**
7. **WSS harness and brake line clip, push in**

Figure C-4. Front Wheel Speed Sensor and Connector

Installation

NOTES

- *Always keep the WSS away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur.*
- *Never pull WSS cable taut or use to retain wheel, axle or other components.*
- *See Figure C-5. Install WSS with index pin on the outboard side and rotate until index pin contacts shoulder on fork slider.*

1. Push axle through **new** front WSS and left fork slider and secure. See 2.4 FRONT WHEEL.
2. See Figure C-4. Route WSS wire and brake line through clip with anchor (7).
3. Connect front WSS connector (6).

NOTE

See Figure C-4. Cable straps (5) must be located at white stripe on brake line and approximately 1 in (25 mm) below connection at manifold.

4. Install three **new** cable straps (5) to secure front wheel speed sensor cable to brake hose.
5. Install front WSS clip (1).
6. Install fuel tank. See 4.4 FUEL TANK.

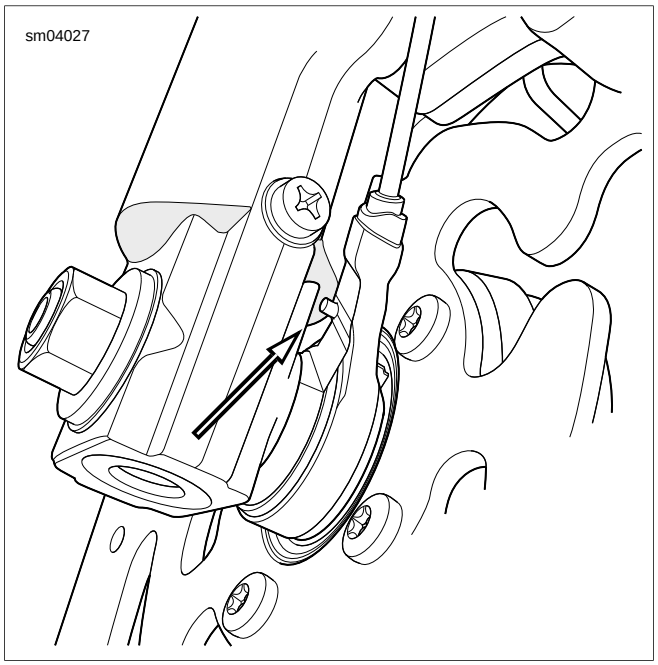


Figure C-5. Front Wheel Speed Sensor Index Pin (ABS Models)

REAR WHEEL SPEED SENSOR (WSS)

Removal

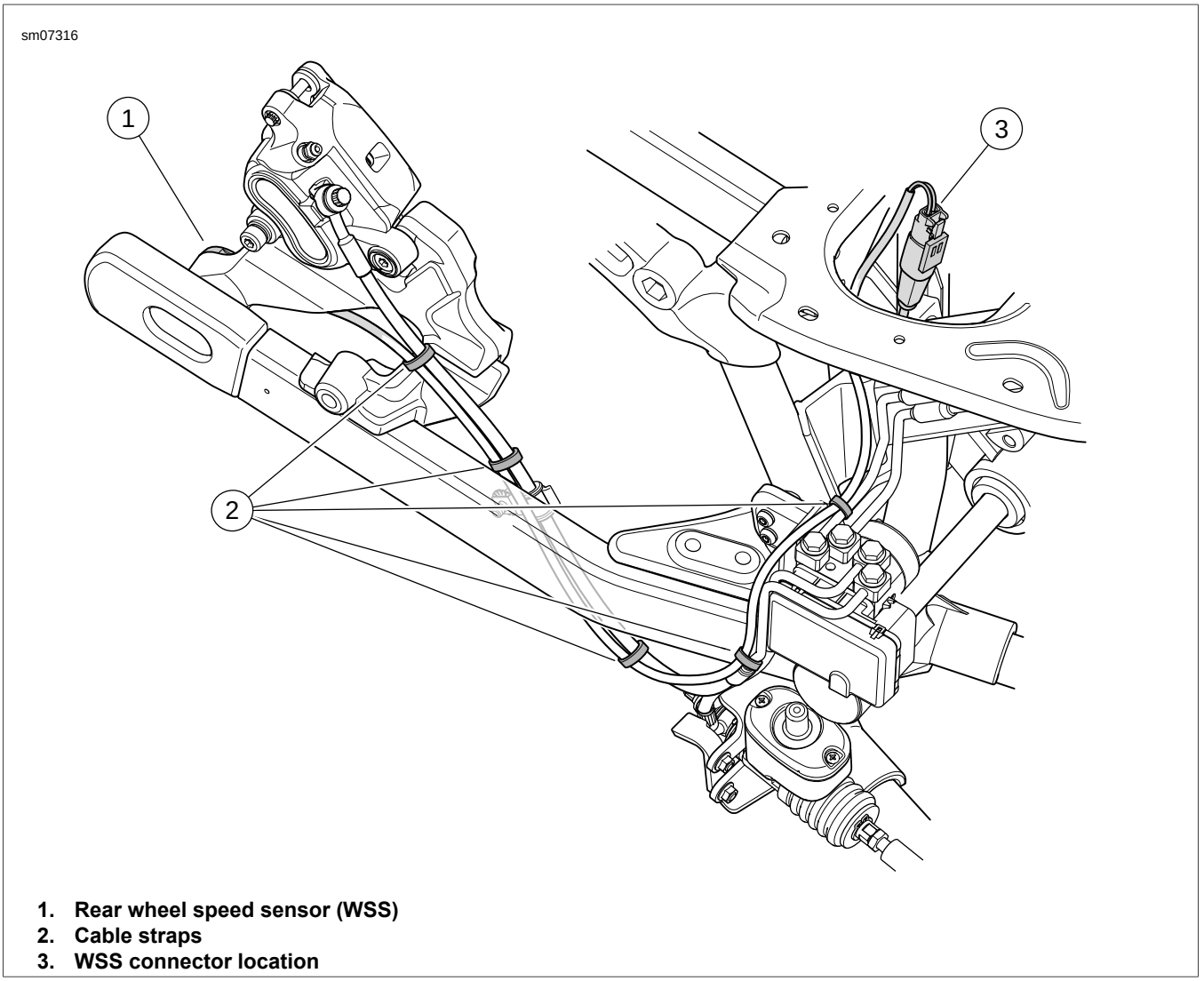
NOTE

The wheel speed sensor (WSS) is installed between the rear wheel hub and brake caliper bracket assembly.

1. Remove right saddlebag, if equipped. See 2.32 SADDLEBAGS: FLD.
2. Remove seat.
3. Remove battery and battery tray. See 1.20 BATTERY MAINTENANCE and 7.10 BATTERY TRAY AND BATTERY CABLES.
4. Remove active exhaust cable if equipped. See 7.29 ACTIVE EXHAUST.
5. See Figure C-6. Disconnect rear WSS connector (3).
6. Remove cable straps (2).
7. Remove cable strap securing WSS harness to brake line under the battery tray.
8. Remove axle to free WSS. See 2.5 REAR WHEEL.

NOTE

The WSS 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.



1. **Rear wheel speed sensor (WSS)**
2. **Cable straps**
3. **WSS connector location**

Figure C-6. Rear Wheel Speed Sensor and Cable Routing

Installation

NOTES

- *Always keep the WSS away from magnetic fields (such as magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.) or damage will occur. Never pull WSS cable taut or use to retain wheel, axle or other components.*
- *Install WSS with index pin on the outboard side to prevent sensor damage during installation.*

1. See 2.5 REAR WHEEL and Figure C-7. Install axle with **new** rear WSS in place. Make sure index pin is pointed outboard toward rear fork. Rotate WSS so that the index pin is against the lower edge of the rear caliper mounting bracket.
2. See Figure C-6. Secure WSS cable to brake line at locations shown using cable straps (2).
3. Connect rear WSS connector (3).
4. Install a cable strap to secure the WSS harness to the brake line under the battery tray.
5. Install active exhaust cable if equipped. See 7.29 ACTIVE EXHAUST.
6. Install battery tray and battery. See 7.10 BATTERY TRAY AND BATTERY CABLES and 1.20 BATTERY MAINTENANCE.

⚠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.
8. Install right saddlebag, if equipped. See 2.32 SADDLEBAGS: FLD.

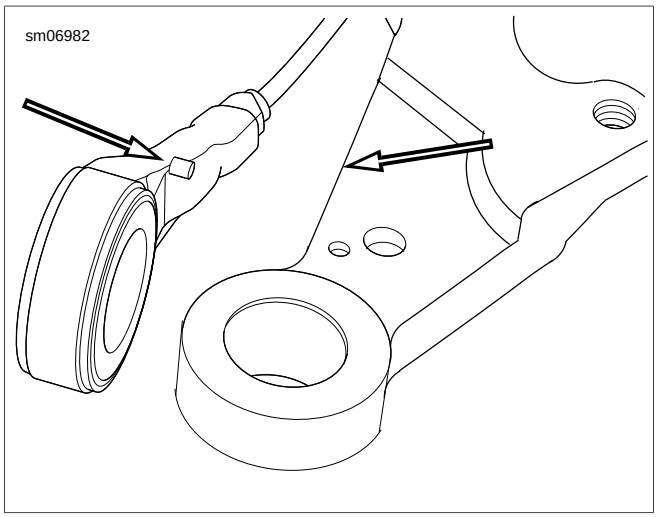


Figure C-7. Rear Wheel Speed Sensor Index Pin (ABS Equipped)

ABS BRAKE LINES C.4

FRONT MASTER CYLINDER TO FRONT CALIPER LINE ASSEMBLY

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

FASTENER	TORQUE VALUE	
Banjo bolt to front master cylinder	17-22 ft-lbs	23.0-29.8 Nm
Front brake line manifold fastener	36-48 **in-lbs**	4.1-5.4 Nm
Banjo bolt to front caliper	17-22 ft-lbs	23.0-29.8 Nm
ABS brake line flare nuts	120-144 **in-lbs**	13.6-16.3 Nm

Removal

NOTE

See Figure C-8. The front master cylinder to manifold brake line, manifold, and manifold to front caliper brake line must be replaced as an assembly.

1. Remove cable straps securing WSS harness to front brake line, if equipped.

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

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

3. Remove banjo bolt to release brake line from master cylinder reservoir. Discard sealing washers.
4. Remove banjo bolt securing brake line to caliper. Discard sealing washers.
5. See Figure C-8. Disconnect ABS lines from manifold (5).
6. Remove fastener (6) securing manifold to lower fork bracket and remove front brake line.
7. Remove brake line assembly from motorcycle.

Installation

1. Secure brake line with **new** sealing washers to master cylinder. Tighten banjo bolt to 17-22 ft-lbs (23.0-29.8 Nm).
2. See Figure C-8. Secure front brake line manifold (5) and tighten fastener (6) to 36-48 **in-lbs** (4.1-5.4 Nm).
3. Install brake line to front caliper with banjo bolt and **new** sealing washers. Tighten to 17-22 ft-lbs (23.0-29.8 Nm). Repeat for models with dual front calipers.
4. Install ABS brake lines (4) to manifold (5) and tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
5. Secure WSS cable to brake line with cable straps at correct locations. See C.3 WHEEL SPEED SENSORS.

⚠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)

6. Fill and bleed brake system. See 2.14 BLEEDING BRAKES.
7. To confirm that brake system is properly connected and all air is purged, install master cylinder reservoir cover. Connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.

⚠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)

8. Test brake system.
   a. Turn ignition switch ON and verify operation of the brake lamp.
   b. Test ride the motorcycle. Bleed the system again if the brakes feel spongy.

FRONT ABS LINES

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

FASTENER	TORQUE VALUE	
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm
ABS brake line flare nuts	120-144 **in-lbs**	13.6-16.3 Nm

Removal

1. Remove fuel tank. See 4.4 FUEL TANK.
2. Remove battery and battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
3. Remove active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.

NOTE

For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

4. Drain front brake system.

5. See Figure C-8.
6. See Figure C-9. Cut cable strap (1) and remove anchor from frame.
7. Remove cable strap securing WSS harness to brake lines.

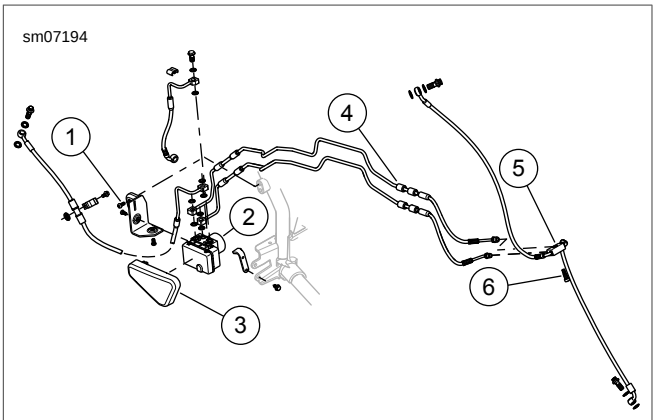
NOTICE

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

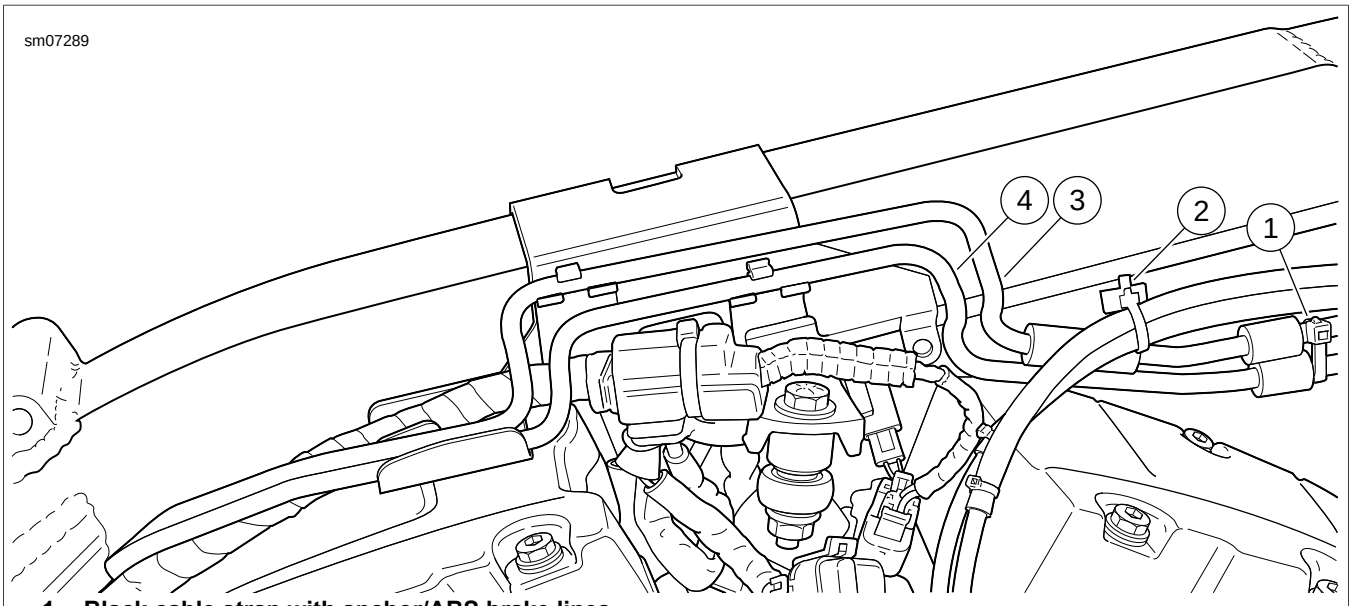
Wrap banjo fittings with pieces of lint-free shop towel to absorb any loss of brake fluid.

8. See Figure C-10. Remove banjo bolts from ABS module at module locations (1) and (2). Discard sealing washers.
9. See Figure C-8. Disconnect brake lines from front manifold (5) under the lower fork bracket. Hold suitable container under manifold to allow reservoir to drain.
10. Remove ABS brake lines from frame.



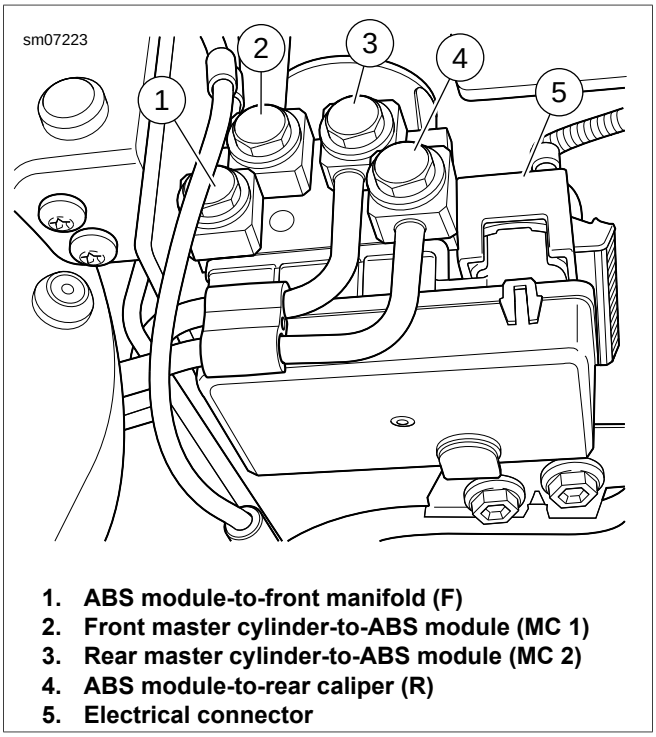
1. **Screws, ABS module mounting (2)**
2. **ABS module**
3. **ABS heat shield**
4. **Brake lines, ABS module to front manifold**
5. **Manifold**
6. **Fastener, front manifold to lower fork bracket**

Figure C-8. ABS Brake System (typical)



1. **Black cable strap with anchor/ABS brake lines**
2. **White cable strap with anchor/throttle cables**
3. **ABS brake line from module to front manifold to caliper**
4. **ABS brake lines from module to front manifold to master cylinder**

Figure C-9. ABS Brake Lines with Anchors



1. **ABS module-to-front manifold (F)**
2. **Front master cylinder-to-ABS module (MC 1)**
3. **Rear master cylinder-to-ABS module (MC 2)**
4. **ABS module-to-rear caliper (R)**
5. **Electrical connector**

Figure C-10. ABS Module Connections

Installation

1. Route brake lines from ABS module through caddy on frame backbone.

NOTE

See Figure C-9. Install anchor into frame and cable strap (1) before tightening brake lines at manifold to prevent brake lines from moving when tightening.

2. See Figure C-9. Install anchor into main frame and secure lines with cable strap (1).
3. See Figure C-10. Secure brake lines to ABS module with **new** sealing washers. Tighten to 14-18 ft-lbs (18.9-24.4 Nm).
4. Install brake lines to manifold. Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
5. Secure rear WSS to brake lines with cable straps.
6. Fill and bleed brake system. See 2.14 BLEEDING BRAKES.
7. Install battery tray and battery. See 7.10 BATTERY TRAY AND BATTERY CABLES and 1.20 BATTERY MAINTENANCE.
8. Install active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.
9. Install fuel tank. See 4.4 FUEL TANK.

⚠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)

10. 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.

⚠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.

⚠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 brake system.
    a. Turn ignition switch ON and verify operation of the brake lamp.
    b. Test ride the motorcycle. Repeat the bleeding procedure if the brakes feel spongy.

REAR MASTER CYLINDER TO ABS MODULE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake switch/banjo bolt to rear master cylinder	17-22 ft-lbs	23.0-29.8 Nm
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm

Removal

1. Remove seat.
2. Remove right side saddlebag, if equipped. See 2.32 SADDLEBAGS: FLD.
3. Drain rear brake fluid.
4. Remove battery and battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
5. Remove active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.

6. See Figure C-11. Remove clip from ABS module brake lines.

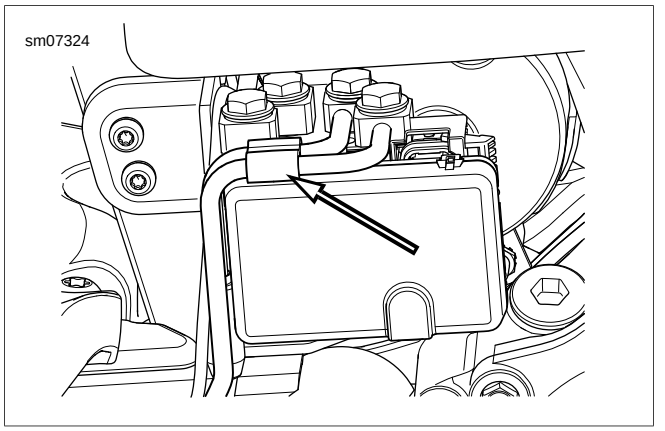


Figure C-11. Brake Line Clip at ABS Module

7. Remove terminals from rear brake light switch.
8. Remove brake switch/banjo bolt from master cylinder reservoir. Hold suitable container under banjo bolt bore to allow reservoir to drain. Discard sealing washers.

NOTE

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

9. See Figure C-10. Remove banjo bolt at module location (3) to release brake line from ABS module. Discard sealing washers.
10. Remove brake line.

Installation

1. Place rear brake line in approximate installed position.
2. Loosely attach line to ABS module with banjo bolt and **new** sealing washers.
3. Secure rear brake line to master cylinder with rear brake switch/banjo bolt and **new** sealing washers. Using flats on rear brake switch/banjo bolt, tighten to 17-22 ft-lbs (23.0-29.8 Nm).
4. Connect terminals onto rear brake light switch (4). If removed, install **new** cable strap to secure rear brake light switch wires.

NOTE

See Figure C-11. Failure to install clip on rear brake lines at ABS module may result in the brake lines rubbing against the rear fork during vehicle operation.

5. See Figure C-11. Install brake line clip at ABS module.
6. Tighten banjo bolt securing brake line to ABS module to 14-18 ft-lbs (18.9-24.4 Nm).
7. See Figure C-6. Secure WSS cable to rear brake line with cable straps (2).
8. Fill and bleed brake system. See 2.14 BLEEDING BRAKES.

⚠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)

9. To confirm that brake system is properly connected and all air is purged, install master cylinder reservoir cover. Connect motorcycle to DIGITAL TECHNICIAN II (Part No. HD-48650) and perform "ABS Service" procedure.
10. Install battery tray and battery. See 7.10 BATTERY TRAY AND BATTERY CABLES and 1.20 BATTERY MAINTENANCE.
11. Install active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.
12. Install right side saddlebag, if removed. See 2.32 SADDLEBAGS: FLD.

⚠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

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 and verify operation of the brake lamp.
    b. Test ride the motorcycle. Repeat the bleeding procedure if the brakes feel spongy.

ABS MODULE TO REAR BRAKE CALIPER

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

FASTENER	TORQUE VALUE	
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm
Banjo bolt to rear caliper	17-22 ft-lbs	23.0-29.8 Nm
Rear fork brake hose J-clip	40-60 **in-lb**	4.5-6.8 Nm

Removal

1. Remove seat.

2. Remove right side saddlebag, if equipped. See 2.32 SADDLEBAGS: FLD.
3. Remove four cable straps securing rear WSS to rear brake line.
4. Remove rear brake line from clamp on inside of rear fork.
5. Remove battery. See 1.20 BATTERY MAINTENANCE.
6. Remove battery tray. See 7.10 BATTERY TRAY AND BATTERY CABLES.
7. Remove active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.

NOTE

For best results, use the BASIC VACUUM BRAKE BLEEDER (Part No. Snap-On BB200A) or equivalent tool to drain the brake systems.

8. Drain rear brake fluid.
9. See Figure C-12. Remove brake line clip.

NOTE

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

10. See Figure C-10. Remove banjo bolt to release rear brake line (4) from ABS module. Discard sealing washers.
11. Remove banjo bolt from rear brake caliper. Discard sealing washers.
12. Remove brake line.

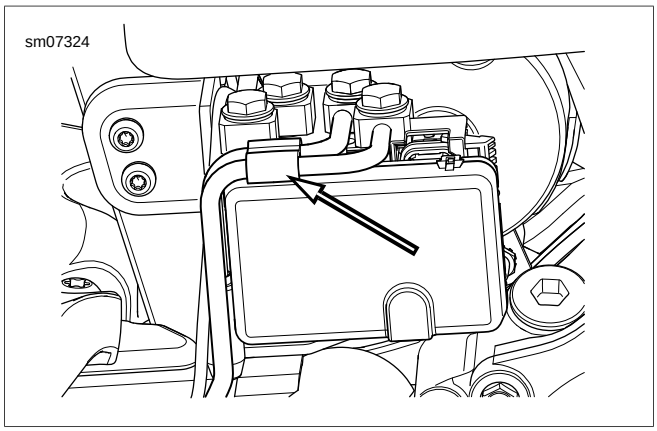


Figure C-12. Brake Line Clip at ABS Module

Installation

1. Place rear brake line into approximate installed position.

NOTE

See Figure C-12. Failure to install clip on rear brake lines at ABS module may result in the brake lines rubbing against the rear fork during vehicle operation.

2. See Figure C-12. Install brake line clip at ABS module.
3. See Figure C-10. Secure brake line to ABS module with banjo bolt and **new** sealing washers. Tighten to 14-18 ft-lbs (18.9-24.4 Nm).
4. Secure brake line to rear caliper with banjo bolt and **new** sealing washers. Tighten to 17-22 ft-lbs (23.0-29.8 Nm).
5. See Figure C-13. If removed, orient J-clip as shown and install screw. Tighten to 40-60 **in-lb** (4.5-6.8 Nm). Do not allow clip to pass above top of rear fork.
6. Capture rear brake hose in J-clip mounted on rear fork.
7. Capture rear speed sensor cable along brake line using four cable straps. See C.3 WHEEL SPEED SENSORS, Rear Wheel Speed Sensor (WSS).
8. Install battery tray and battery. See 7.10 BATTERY TRAY AND BATTERY CABLES and 1.20 BATTERY MAINTENANCE.
9. Install active exhaust cable, if equipped. See 7.29 ACTIVE EXHAUST.
10. Fill and bleed brake system. See 2.14 BLEEDING BRAKES.

⚠WARNING

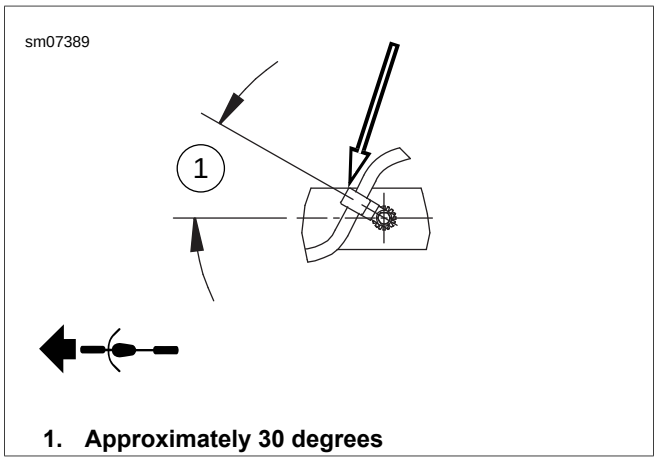
When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could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

11. 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.
12. Install right side saddlebag, if equipped. See 2.32 SADDLEBAGS: FLD.

⚠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 brake system.
    a. Turn ignition switch ON and verify operation of the brake lamp.
    b. Test ride the motorcycle. Repeat the bleeding procedure if the brakes feel spongy.



1. **Approximately 30 degrees**

Figure C-13. Brake Line J-Clip at Rear Fork

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LENGTH CONVERSION D.1

CONVERSION TABLE

Table D-1. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN)								INCHES to MILLIMETERS (IN x 25.40 = MM)							
mm	in	mm	in	mm	in	mm	in	in	mm	in	mm	in	mm	in	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

FLUID CONVERSION D.2

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this service manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this service manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). 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 service manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. 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.)

TORQUE CONVERSION D.3

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

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GLOSSARY E.1

ACRONYMS AND ABBREVIATIONS

Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AAT	Ambient air temperature
ABS	Anti-lock braking system
AC	Alternating current
ACC	Accessory position on ignition switch
ACR	Automatic compression release
AGM	Absorbed glass mat (battery)
Ah	Ampere-hour
AIS	Active Intake Solenoid
AWG	American wire gauge
B+	Battery voltage
bar	Bar
BAS	Bank angle sensor
BCM	Body control module
BOB	Breakout box
BTDC	Before top dead center
°C	Celsius (Centigrade)
CA	California
CAL	Calibration
CAN	Controller area network
cc	Cubic centimeters
CCA	Cold cranking amps
CCW	Counterclockwise
CKP	Crankshaft position
cm	Centimeters
cm^3	Cubic centimeters
CW	Clockwise
DC	Direct current
DLC	Data link connector
DOM	Domestic
DOT	Department of Transportation
DTC	Diagnostic trouble code
DVOM	Digital volt ohm meter
ECM	Electronic control module
ECT	Engine coolant temperature
ECU	Electronic Control Unit
EEPROM	Electrically erasable programmable read only memory
EFI	Electronic fuel injection
EHCU	Electro Hydraulic Control Unit
ET	Engine temperature

Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
EVAP	Evaporative emissions control system
°F	Fahrenheit
FPS	Fuel pressure sensor
ft	Feet
ft-lbs	Foot pounds
fl oz	Fluid ounce
g	Gram
gal	Gallon
GAWR	Gross axle weight rating
GND	Ground (electrical)
GPS	Global positioning system
GVWR	Gross vehicle weight rating
HCU	Hydraulic control unit
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson smart security system
HFSM	Hands-free security module
Hg	Mercury
H02S	Heated oxygen sensor
hp	Horsepower
hr	Hour
IAC	Idle air control
IAT	Intake air temperature
IC	Instrument cluster
ID	Inside diameter
IGN	Ignition light/key switch position
in	inch
in^3	Cubic inch
INJ PW	Injector pulse width
in-lbs	Inch pounds
JSS	Jiffy stand sensor
kg	Kilogram
km	Kilometer
km/h	Kilometers per hour
kPa	Kilopascal
kW	Kilowatt
L	Liter
lb	Pounds
LCD	Liquid crystal display
LED	Light emitting diode
LH	Left hand
LHCM	Left hand control module
LP	License plate
LT	Left

Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
mA	Milliampere
MAP	Manifold absolute pressure
max	Maximum
mi	Mile
min	Minimum
mL	Milliliter
mm	Millimeter
mph	Miles per hour
ms	Millisecond
Nm	Newton-meter
NIM	Navigation interface module
NiMH	Nickel metal hydride
N/A	Not applicable
O2	Oxygen
OD	Outside diameter
OEM	Original equipment manufacturer
oz	Ounce
P&A	Parts and Accessories
Part No.	Part number
PIN	Personal identification number
psi	Pounds per square inch
PWM signal	Pulse width modulated signal
qt	Quart
RCM	Reverse control module
RES	Reserve mark on fuel supply valve
RH	Right hand
RHCM	Right hand control module
rpm	Revolutions per minute
RT	Right
s	Seconds
SCFH	Cubic feet per hour at standard conditions
SDARS	Satellite digital audio radio service
SPDO	Speedometer
SPKR	Speaker
STT	Stop/tail/turn
TCA	Throttle control actuator
TDC	Top dead center
TGS	Twist grip sensor
TPS	Throttle position sensor
TSM	Turn signal module
TSSM	Turn signal/security module
V	Volt
VAC	Volts of alternating current

Table E-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
VDC	Volts of direct current
VIN	Vehicle identification number
VR	Voice recognition
VSS	Vehicle speed sensor
W	Watt
WSS	Wheel speed sensor

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
93979-10	SCREAMIN' EAGLE MAGNETIC LIFTER HOLDERS	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Removal
94448-82B	SHOCK ADJUSTMENT SPANNER	1.23 SUSPENSION ADJUSTMENTS, Shock Absorber Preload Adjustment
99650-02	HIGH-PERFORMANCE SEALANT, GRAY	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
99863-01A	GLOBAL BATTERY CHARGER	1.20 BATTERY MAINTENANCE, Storage
B-0085	TERMINAL EXTRACTOR	A.22 TYCO MCP SEALED CONNECTOR, Tyco MCP Sealed Connector
B-45523	VALVE GUIDE REAMER	3.20 CYLINDER HEAD, Valve Guide Replacement
B-45524-1	VALVE GUIDE DRIVER	3.20 CYLINDER HEAD, Valve Guide Replacement
B-45524-2A	VALVE GUIDE INSTALLER SLEEVE	3.20 CYLINDER HEAD, Valve Guide Replacement
B-45525	VALVE GUIDE HONE	3.20 CYLINDER HEAD, Inspection
B-45525	VALVE GUIDE HONE	3.20 CYLINDER HEAD, Valve Guide Replacement
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Left Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Left Crankcase Half
B-50085	TERMINAL EXTRACTOR	A.17 JAE MX19 SEALED CONNECTORS, JAE MX19 Sealed Connectors
B-50085	TERMINAL EXTRACTOR	A.21 TYCO GET 64 SEALED CONNECTOR, Tyco GET 64 Sealed Connector
FRDH161	SNAP-ON "DOG BONE" TORQUE ADAPTER	3.23 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
GA500A	SNAP-ON TERMINAL PICK	A.1 AUTOFUSE UNSEALED ELECTRICAL CONNECTORS, Autofuse Unsealed Connector Repair
GA500A	SNAP-ON TERMINAL PICK	A.22 TYCO MCP SEALED CONNECTOR, Tyco MCP Sealed Connector
HD-25070	ROBINAIR HEAT GUN	2.31 WINDSHIELD: FLD, Windshield Window
HD-25070	ROBINAIR HEAT GUN	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	7.31 HANDLEBAR CONTROL MODULES, Repair Procedures
HD-25070	HEAT GUN	A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-33223-1	CYLINDER COMPRESSION GAUGE	3.8 TROUBLESHOOTING, Compression Test
HD-33416	UNIVERSAL DRIVER	2.17 STEERING HEAD, Disassembly
HD-34634	FORK OIL SEAL INSTALLER	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-34736-B	VALVE SPRING COMPRESSOR	3.20 CYLINDER HEAD, Disassembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.20 CYLINDER HEAD, Assembly
HD-34751	VALVE GUIDE CLEANING BRUSH	3.20 CYLINDER HEAD, Inspection
HD-34751	VALVE GUIDE CLEANING BRUSH	3.20 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.20 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.20 CYLINDER HEAD, Valve and Seat Refacing

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-34751	VALVE GUIDE CLEANING BRUSH	3.20 CYLINDER HEAD, Assembly
HD-34902-B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race
HD-34902-C	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER	5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race
HD-35316-10	PILOT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-11	RECEIVER CUP	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-12	INSTALLER CUP	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-3A	CROSS PLATE	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-3A	CROSS PLATE	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-4A	8 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-5	12 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-5	12 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-7	WASHER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-7	WASHER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-8	BEARING DRIVER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-9	BEARING DRIVER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35381-B	H-D BELT TENSION GAUGE	1.12 DRIVE BELT AND SPROCKETS, Checking Belt Deflection
HD-35667-A	CYLINDER LEAKDOWN TESTER	3.8 TROUBLESHOOTING, Cylinder Leakdown Test
HD-35758-C	NEWAY VALVE SEAT CUTTER SET	3.20 CYLINDER HEAD, Valve and Seat Refacing
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.9 DELPHI METRI-PACK TERMINAL REPAIR, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.9 DELPHI METRI-PACK TERMINAL REPAIR, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.15 DEUTSCH DTM SEALED MINI TERMINAL REPAIR, Deutsch DTM Sealed Mini Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.9 DELPHI METRI-PACK TERMINAL REPAIR, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39301-A	STEERING HEAD BEARING RACE REMOVER	2.17 STEERING HEAD, Disassembly
HD-39302	STEERING HEAD BEARING RACE INSTALLER	2.17 STEERING HEAD, Assembly
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
HD-39782-B	CYLINDER HEAD SUPPORT STAND KIT	3.20 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.20 CYLINDER HEAD, Disassembly
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.20 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.20 CYLINDER HEAD, Valve and Seat Refacing
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.20 CYLINDER HEAD, Assembly
HD-39847	REAMER T-HANDLE	3.20 CYLINDER HEAD, Valve Guide Replacement

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PART NUMBER	TOOL NAME	NOTES
HD-39964	REAMER LUBRICANT	3.20 CYLINDER HEAD, Valve Guide Replacement
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.14 DEUTSCH DT SEALED TERMINAL REPAIR, Deutsch DT Sealed Terminal Crimps
HD-39969	ULTRA TORCH UT-100	7.31 HANDLEBAR CONTROL MODULES, Repair Procedures
HD-39969	ULTRA TORCH	A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41177	FORK HOLDING TOOL	2.16 FRONT FORK, Disassembly
HD-41177	FORK HOLDING TOOL	2.16 FRONT FORK, Assembly
HD-41177	FORK TUBE HOLDER	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-41177	FORK TUBE HOLDER	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-41177	FORK TUBE HOLDER	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-41182	FUEL PRESSURE GAUGE	4.14 FUEL PRESSURE TEST, Testing
HD-41183	HEAT SHIELD ATTACHMENT	7.31 HANDLEBAR CONTROL MODULES, Repair Procedures
HD-41183	HEAT SHIELD ATTACHMENT	A.23 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41417	PROPANE ENRICHMENT KIT	4.16 INTAKE LEAK TEST, Leak Tester
HD-41475	DEUTSCH TERMINAL REPAIR KIT	A.13 DEUTSCH DT SEALED CONNECTORS, Deutsch DT Sealed Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	A.13 DEUTSCH DT SEALED CONNECTORS, Deutsch DT Sealed Connector Repair
HD-41494	HUBCAP REMOVER AND INSTALLER	1.18 STEERING HEAD BEARINGS, Adjustment
HD-41609	AMP MULTI-LOCK CRIMPER	A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR, Tyco 070 Multilock Unsealed Connector Repair
HD-41609	AMP MULTI-LOCK CRIMPER	A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR, Tyco 070 Multilock Unsealed Connector Repair
HD-42311	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-42317-A	PISTON PIN RETAINING RING INSTALLER	3.16 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.23 TOP END OVERHAUL: ASSEMBLY, Piston
HD-42320-B	PISTON PIN REMOVER	3.16 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42322	PISTON SUPPORT PLATE	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-42324-A	CYLINDER TORQUE PLATES	3.16 TOP END OVERHAUL: DISASSEMBLY, Cylinder Head
HD-42324-A	CYLINDER TORQUE PLATES	3.20 CYLINDER HEAD, Inspection
HD-42324-A	CYLINDER TORQUE PLATES	3.21 CYLINDER, Inspection
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Needle Bearings
HD-42326-B	CRANKSHAFT GUIDE	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
HD-42326-B	CRANKSHAFT GUIDE	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
HD-42720-4	CRANKSHAFT BEARING DRIVER SHIM	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half

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PART NUMBER	TOOL NAME	NOTES
HD-42720-4	CRANKSHAFT BEARING DRIVER SHIM	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
HD-42720-5	REMOVER/INSTALLER SUPPORT TUBE	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
HD-42720-5	REMOVER/INSTALLER SUPPORT TUBE	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Left Crankcase Half
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Left Crankcase Half
HD-42879	ELECTRICAL CRIMPER TOOL	A.16 DEUTSCH DTM SEALED SOLID BARREL MINI TERMINAL REPAIR, Deutsch DTM Sealed Solid Barrel Terminal Crimps
HD-44060-10	25 MM COLLET	2.6 SEALED WHEEL BEARINGS, Removal
HD-44060C	WHEEL BEARING INSTALLER/REMOVER	2.6 SEALED WHEEL BEARINGS, Removal
HD-44060C	WHEEL BEARING INSTALLER/REMOVER	2.6 SEALED WHEEL BEARINGS, Installation
HD-44061	FUEL PRESSURE GAUGE ADAPTER	4.14 FUEL PRESSURE TEST, Testing
HD-44067	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-44358	FLYWHEEL SUPPORT FIXTURE	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race
HD-45305	FORK SEAL DRIVER	2.16 FRONT FORK, Assembly
HD-45928	TERMINAL REMOVER	A.10 DELPHI MICRO-64 SEALED CONNECTORS, Delphi Micro 64 Sealed Connector Repair
HD-45929	TERMINAL CRIMPER	A.10 DELPHI MICRO-64 SEALED CONNECTORS, Delphi Micro 64 Sealed Connector Repair
HD-45966	FORK SPRING COMPRESSING TOOL	2.16 FRONT FORK, Disassembly: Cartridge Fork (FLD, Left Side)
HD-45966	FORK SPRING COMPRESSING TOOL	2.16 FRONT FORK, Disassembly: Cartridge Fork (FLD, Left Side)
HD-45966	FORK SPRING COMPRESSING TOOL	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-45966	FORK SPRING COMPRESSING TOOL	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-45966-2	FORK SPRING COMPRESSING TOOL COLLAR	2.16 FRONT FORK, Disassembly: Cartridge Fork (FLD, Left Side)
HD-46282A	FINAL DRIVE SPROCKET LOCKING TOOL	5.7 TRANSMISSION SPROCKET, Installation
HD-46282-A	FINAL DRIVE SPROCKET LOCKING TOOL	5.7 TRANSMISSION SPROCKET, Removal
HD-47853	IGNITION SWITCH/FORK LOCK WRENCH	7.9 IGNITION SWITCH/FORK LOCK, FXDL Models
HD-47856-1	INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-2	PILOT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-3	ADAPTER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-6	NUT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-7	CROW'S FOOT WRENCH	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47910	MAINSHAFT LOCKNUT WRENCH	5.7 TRANSMISSION SPROCKET, Removal
HD-47910	MAINSHAFT LOCKNUT WRENCH	5.7 TRANSMISSION SPROCKET, Installation
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL	6.7 MAIN DRIVE GEAR AND BEARING, Cleaning and Inspection

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PART NUMBER	TOOL NAME	NOTES
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Removal
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
HD-47956	CAMSHAFT ASSEMBLY TOOL	3.24 CAM COMPARTMENT AND COMPONENTS, Camshafts
HD-47977	PRIMARY DRIVE LOCKING TOOL	5.4 DRIVE COMPONENTS, Removal
HD-48114	TERMINAL REMOVER	A.19 MOLEX MX 150 SEALED CONNECTORS, Molex MX 150 Sealed Connector Repair
HD-48119	TERMINAL CRIMPER	A.19 MOLEX MX 150 SEALED CONNECTORS, Crimp Terminal to Lead
HD-48283	CRANKSHAFT ROTATING WRENCH	3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate
HD-48498-A	ACR SOLENOID SOCKET	7.16 AUTOMATIC COMPRESSION RELEASE (ACR), Removal
HD-48648	BRAKE CALIPER PISTON REMOVER	2.13 REAR BRAKE CALIPER, Disassembly
HD-48649	FRONT BRAKE CALIPER PISTON REMOVER	2.11 FRONT BRAKE CALIPER, Disassembly
HD-48650	DIGITAL TECHNICIAN II	2.14 BLEEDING BRAKES, Procedure
HD-48650	DIGITAL TECHNICIAN II	7.4 ELECTRONIC CONTROL MODULE (ECM), General
HD-48650	DIGITAL TECHNICIAN II	7.36 H-DSSS ACTUATION, Fob Assignment
HD-48650	DIGITAL TECHNICIAN II	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
HD-48650	DIGITAL TECHNICIAN II	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
HD-48650	DIGITAL TECHNICIAN II	C.4 ABS BRAKE LINES, Front ABS Lines
HD-48650	DIGITAL TECHNICIAN II	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
HD-48856-A	AXLE ALIGNMENT PLUG SET	2.9 VEHICLE ALIGNMENT, Inspection
HD-48985	SPOKE TORQUE WRENCH	1.8 TIRES AND WHEELS, Wheel Spokes
HD-48985	SPOKE TORQUE WRENCH	2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels
HD-50120	UNIVERSAL CRIMPER SET	A.3 DELPHI 100W MICRO-PACK SEALED CONNECTOR, Crimping Terminals
HD-50120	UNIVERSAL CRIMPER SET	A.17 JAE MX19 SEALED CONNECTORS, Crimping Terminals
HD-50120	UNIVERSAL CRIMPER SET	A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120	UNIVERSAL CRIMPER SET	A.21 TYCO GET 64 SEALED CONNECTOR, Crimping Terminals
HD-50120	UNIVERSAL CRIMPER SET	A.22 TYCO MCP SEALED CONNECTOR, Crimping Terminals
HD-50120-2	HAND CRIMP FRAME	A.3 DELPHI 100W MICRO-PACK SEALED CONNECTOR, Crimping Terminals
HD-50120-2	HAND CRIMP FRAME	A.17 JAE MX19 SEALED CONNECTORS, Crimping Terminals
HD-50120-2	HAND CRIMP FRAME	A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals

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PART NUMBER	TOOL NAME	NOTES
HD-50120-2	HAND CRIMP FRAME	A.21 TYCO GET 64 SEALED CONNECTOR, Crimping Terminals
HD-50120-3	JAE DIE	A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120-4	JAE DIE	A.18 MOLEX CMC SEALED CONNECTORS, Crimping Terminals
HD-50120-6	JAE DIE	A.17 JAE MX19 SEALED CONNECTORS, Crimping Terminals
HD-50120-7	DELPHI 100W MICRO-PACK SEALED DIE	A.3 DELPHI 100W MICRO-PACK SEALED CONNECTOR, Crimping Terminals
HD-50120-7	TYCO GET 64 DIE	A.21 TYCO GET 64 SEALED CONNECTOR, Crimping Terminals
HD-50120-8	TYCO MCP DIE	A.22 TYCO MCP SEALED CONNECTOR, Crimping Terminals
HD-50423	0.6 MM TERMINAL EXTRACTOR TOOL	A.18 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-50424	1.5 MM TERMINAL EXTRACTOR TOOL	A.18 MOLEX CMC SEALED CONNECTORS, Molex CMC Sealed Connectors
HD-50651	FORK NUT SOCKET	1.18 STEERING HEAD BEARINGS, Adjustment
HD-50651	FORK STEM NUT SOCKET	2.17 STEERING HEAD, Installation: FLD
HD-59000A	PRO-LEVEL OIL GAUGE	2.16 FRONT FORK, Assembly
HD-59000B	FORK OIL LEVEL GAUGE	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
HD-94660-2	PILOT	5.7 TRANSMISSION SPROCKET, Removal
HD-94660-2	PILOT	5.7 TRANSMISSION SPROCKET, Installation
HD-94681-80	SPOKE NIPPLE WRENCH	1.8 TIRES AND WHEELS, Wheel Spokes
HD-94681-80	SPOKE NIPPLE WRENCH	1.8 TIRES AND WHEELS, Wheel Spokes
HD-94681-80	SPOKE NIPPLE WRENCH	2.8 CHECKING AND TRUING WHEELS, Laced Wheel Rim Offset
HD-94681-80	SPOKE NIPPLE WRENCH	2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels
HD-94700-52C	SHOCK ADJUSTMENT SPANNER	1.23 SUSPENSION ADJUSTMENTS, Shock Absorber Preload Adjustment
HD-95637-10	LONG BOLTS	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-95637-46B	WEDGE ATTACHMENT	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-95952-1	THREADED CYLINDERS	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-95952-33C	CONNECTING ROD CLAMPING TOOL	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96333-51F	PISTON RING COMPRESSOR	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96796-47	VALVE SPRING TESTER	3.20 CYLINDER HEAD, Inspection
HD-96921-52D	OIL PRESSURE GAUGE SET	3.7 OIL PRESSURE, Checking Oil Pressure
HD-97087-65B	HOSE CLAMP PLIERS	4.4 FUEL TANK, Installation
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Sprocket Shaft Bearing Inner Race

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PART NUMBER	TOOL NAME	NOTES
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
HD-99500-80	WHEEL TRUING AND BALANCING STAND	2.8 CHECKING AND TRUING WHEELS, Checking Wheel Runout
HD-99500-80	WHEEL TRUING STAND	2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels
HD-99500-80	WHEEL TRUING STAND	2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS	6.6 TRANSMISSION ASSEMBLY, Disassembly
RS-25100-200	BEARING	6.7 MAIN DRIVE GEAR AND BEARING, Removal
RS-25100-200	BEARING	6.7 MAIN DRIVE GEAR AND BEARING, Removal
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	2.14 BLEEDING BRAKES, Procedure
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	C.4 ABS BRAKE LINES, Front ABS Lines
SNAP-ON BB200A	BASIC VACUUM BRAKE BLEEDER	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
SNAP-ON FRDH141	"DOG BONE" TORQUE ADAPTER	3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover
SNAP-ON PRS8	PISTON RING EXPANDER	3.22 PISTON, Disassembly
SNAP-ON TA360	TORQUE ANGLE GAUGE	5.7 TRANSMISSION SPROCKET, Installation
SNAP-ON TT600-3	SNAP-ON PICK	A.7 DELPHI 630 METRI-PACK UNSEALED CONNECTORS, Delphi 630 Metri-Pack Unsealed Connector Repair
SNAP-ON TT600-3	SNAP-ON PICK	A.20 TYCO 070 MULTILOCK UNSEALED CONNECTOR, Tyco 070 Multilock Unsealed Connector Repair
TA360	SNAP-ON TORQUE ANGLE GAUGE	3.21 CYLINDER, Inspection
TA360	SNAP-ON TORQUE ANGLE GAUGE	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head

NOTES

FASTENER	TORQUE VALUE		NOTES
ABS bracket fastener	90-114 **in-lbs**	10.2-12.8 Nm	7.30 MAIN WIRING HARNESS, Installation
ABS brake line flare nuts	120-144 **in-lbs**	13.6-16.3 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
ABS brake line flare nuts	120-144 **in-lbs**	13.6-16.3 Nm	C.4 ABS BRAKE LINES, Front ABS Lines
ABS module bracket	90-114 **in-lbs**	10.2-12.8 Nm	7.11 STARTER, Installation
ABS module to bracket fastener	50-70 **in-lbs**	5.6-7.9 Nm	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
ABS module to frame fastener	90-114 **in-lbs**	10.2-12.8 Nm	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
ACR	132-180 **in-lbs**	14.9-20.3 Nm	7.16 AUTOMATIC COMPRESSION RELEASE (ACR), Installation/Apply three equally spaced dots of LOCTITE 246 MEDIUM STRENGTH/HIGH TEMPERATURE THREADLOCKER (blue) around lower third of threads
Active exhaust module fasteners	36-60 **in-lbs**	4.0-6.8 Nm	7.29 ACTIVE EXHAUST, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Axle adjuster	120-144 **in-lbs**	13.6-16.3 Nm	1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection/Tighten after axle is tightened.
Axle cap fastener: Rear, All but FLD	132-180 **in-lbs**	14.9-20.3 Nm	2.4 FRONT WHEEL, Installation
Axle nut, rear	95-105 ft-lbs	128.8-142.4 Nm	1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection
Axle nut: Front	62-67 ft-lbs	84.1-90.9 Nm	2.4 FRONT WHEEL, Installation
Axle pinch bolt: Front FLD only	18-22 ft-lbs	24.4-29.9 Nm	2.4 FRONT WHEEL, Installation
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.2 ABS MODULE, Electro Hydraulic Control Unit (EHCU)
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.4 ABS BRAKE LINES, Front ABS Lines
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.4 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Banjo bolt to ABS module	14-18 ft-lbs	18.9-24.4 Nm	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Banjo bolt to front caliper	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
Banjo bolt to front master cylinder	17-22 ft-lbs	23.1-29.9 Nm	2.10 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Banjo bolt to front master cylinder	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
Banjo bolt to rear caliper	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Banjo bolt to rear master cylinder	17-22 ft-lbs	23.1-29.9 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation
Battery terminal fastener	60-72 **in-lbs**	6.8-8.1 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm	1.5 MAINTENANCE SCHEDULE, General

FASTENER	TORQUE VALUE		NOTES
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm	1.20 BATTERY MAINTENANCE, Installation and Connection
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 Nm	1.20 BATTERY MAINTENANCE, Installation and Connection
Battery terminal screw: all models	60-70 **in-lbs**	6.8-7.9 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Battery tray screws	96-120 **in-lbs**	10.8-13.6 Nm	7.10 BATTERY TRAY AND BATTERY CABLES, Battery Tray
Bottom brake caliper mounting bolt: Front	28-38 ft-lbs	38.0-51.5 Nm	2.4 FRONT WHEEL, Installation
Bracket, saddlebag theft prevention: FLD	24-36 **in-lbs**	2.7-4.1 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	2.11 FRONT BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.11 FRONT BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.13 REAR BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.14 BLEEDING BRAKES, Procedure
Brake caliper bridge bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.11 FRONT BRAKE CALIPER, Assembly
Brake caliper mounting bolt, rear	120-168 **in-lbs**	13.6-18.9 Nm	2.13 REAR BRAKE CALIPER, Installation
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm	2.5 REAR WHEEL, Assembly
Brake disc screws: front cast wheel	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL, Assembly
Brake disc screws: front laced wheel	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL, Assembly
Brake manifold fastener	36-60 **in-lbs**	4.0-6.8 Nm	1.18 STEERING HEAD BEARINGS, Adjustment
Brake manifold to lower fork: FLD models	36-48 **in-lbs**	4.0-5.4 Nm	2.17 STEERING HEAD, Installation: FLD
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	2.13 REAR BRAKE CALIPER, Assembly
Brake pad pin/bridge bolt, front caliper	15-16 ft-lbs	20.3-22.6 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Brake switch/banjo bolt to rear master cylinder	17-22 ft-lbs	23.0-29.8 Nm	C.4 ABS BRAKE LINES, Rear Master Cylinder to ABS Module
Breather assembly screws	120-156 **in-lbs**	13.6-17.6 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover
Breather bolts	22-24 ft-lbs	29.8-32.5 Nm	4.3 AIR CLEANER ASSEMBLY, Installation/metric
Caliper, front, mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Cam chain tensioner fasteners	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam sprocket flange bolt, 1st torque	15 ft-lbs	20.3 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam sprocket flange bolt, final torque	34 ft-lbs	46.1 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Charcoal canister fasteners	15-20 **in-lbs**	1.7-2.3 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Charcoal canister mounting fasteners	15-20 **in-lbs**	1.7-2.3 Nm	4.17 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister

FASTENER	TORQUE VALUE		NOTES
CKP sensor screw	90-120 **in-lbs**	10.1-13.6 Nm	7.15 CRANK POSITION SENSOR (CKP), Installation
Clutch adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch cable adjustment jamnut	120 **in-lbs**	13.6 Nm	1.11 CLUTCH, Adjustment
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Clutch diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm	5.6 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.4 DRIVE COMPONENTS, Installation
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant/Torque sequence
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.11 CLUTCH, Adjustment
Clutch jamnut	72-120 **in-lbs**	8.1-13.6 Nm	1.11 CLUTCH, Adjustment
Clutch release cover screws	132-156 **in-lbs**	14.9-17.6 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Compensating sprocket bolt, final torque	140 ft-lbs	190 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt, initial torque	100 ft-lbs	135.6 Nm	5.4 DRIVE COMPONENTS, Installation
Console mounting screws: FXDB/P/A and FXDWG	41-49 **in-lbs**	4.6-5.5 Nm	7.24 INDICATOR LAMPS, Installation
Console mounting screws: FXDC, FLD and FXDF	41-49 **in-lbs**	4.6-5.5 Nm	7.24 INDICATOR LAMPS, Installation
Console mounting screws: FXDC, FXDF, FLD	41-49 **in-lbs**	4.6-5.5 Nm	7.21 INSTRUMENTS: FXDC, FXDF AND FLD, Speedometer
Console mounting screws: FXDC, FXDF, FXDWG, FLD, FXDB/P/A	41-49 **in-lbs**	4.6-5.5 Nm	7.9 IGNITION SWITCH/FORK LOCK, FXDC, FXDF, FXDWG, FLD, FXDB/P/A Models: Ignition Switch Only
Console mounting screws: FXDL	41-49 **in-lbs**	4.6-5.5 Nm	7.24 INDICATOR LAMPS, Installation
Console to fuel tank fasteners: FXDB/P/A and FXDWG	41-49 **in-lbs**	4.6-5.5 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Console to fuel tank fasteners: FXDL	41-49 **in-lbs**	4.6-5.5 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Control module housing screw	35-45 **in-lbs**	4.0-5.1 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Control module housing screw	35-45 **in-lbs**	4.0-5.1 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Pipe Plug and Oil Fittings
Crankcase screws, 1st torque	120 **in-lbs**	13.6 Nm	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly/Loosen then final tighten
Crankcase screws, final torque	15-19 ft-lbs	20.3-25.8 Nm	3.28 CRANKCASE ASSEMBLY, Crankcase Assembly
Crankshaft sprocket bolt, 1st torque	15 ft-lbs	20.3 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Crankshaft sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation

FASTENER	TORQUE VALUE		NOTES
Cylinder head bolts, 1st torque	120-144 **in-lbs**	13.6-16.3 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/ See procedure to tighten
Cylinder head bolts, 2nd torque	15-17 ft-lbs	20.3-23.0 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Cylinder head bolts, final torque	90 degrees	90 degrees	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Cylinder stud	120-240 **in-lbs**	13.6-27.1 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Cylinder Studs
Cylinder torque plate bolts, 1st torque	120-144 **in-lbs**	13.6-16.3 Nm	3.21 CYLINDER, Inspection/ See procedure to tighten
Cylinder torque plate bolts, 2nd torque	15-17 ft-lbs	20.3-23.0 Nm	3.21 CYLINDER, Inspection
Cylinder torque plate bolts, final torque	90 degrees	90 degrees	3.21 CYLINDER, Inspection
Damper cartridge screw	132-216 **in-lbs**	14.9-24.4 Nm	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm	2.5 REAR WHEEL, Installation
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm	2.19 DEBRIS DEFLECTOR, Installation
Drain plug, engine	14-21 ft-lbs	19.0-28.5 Nm	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
Drain plug, engine	14-21 ft-lbs	19.0-28.5 Nm	3.29 OIL PAN, Installation/Clean plug before installation
Dual disc brake disc screws: front cast wheel (FXDF)	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL, Assembly
Electrical caddy fastener, front	40-60 **in-lbs**	4.5-6.8 Nm	7.3 ELECTRICAL CADDY, Installation
Electrical caddy fasteners, top	90-110 **in-lbs**	10.1-12.4 Nm	7.3 ELECTRICAL CADDY, Installation
Engine mount flange nut	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Engine temperature sensor	120-180 **in-lbs**	13.6-20.3 Nm	4.7 ENGINE TEMPERATURE SENSOR (ET), Installation/Hand start 2-3 turns
Exhaust crossover pipe clamp	20-25 ft-lbs	27.1-33.9 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG

FASTENER	TORQUE VALUE		NOTES
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Exhaust heat shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Footrest mounting screws and nuts	84-108 **in-lbs**	9.5-12.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Mid Controls
Footrest mounting screws and nuts	84-108 **in-lbs**	9.5-12.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Forward Controls
Footrest support mounting screws	30-40 ft-lbs	40.7-54.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Mid Controls
Footrest support mounting screws	30-40 ft-lbs	40.7-54.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Mid Controls
Footrest support mounting screws	32-37 ft-lbs	43.4-50.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Forward Controls
Footrest support mounting screws	32-37 ft-lbs	43.4-50.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footrests: Forward Controls
Fork clamp pinch bolts: lower	30-35 ft-lbs	40.7-47.5 Nm	1.18 STEERING HEAD BEARINGS, Adjustment
Fork clamp stem nut	70-80 ft-lbs	95-108.5 Nm	1.18 STEERING HEAD BEARINGS, Adjustment
Fork stem nut: FLD models	70-80 ft-lbs	94.9-108.4 Nm	2.17 STEERING HEAD, Installation: FLD
Fork tube caps	22-59 ft-lbs	30-80 Nm	2.16 FRONT FORK, Assembly

FASTENER	TORQUE VALUE		NOTES
Fork tube caps	22-59 ft-lbs	30-80 Nm	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
Front and rear isolator mounting bolts to frame	22-27 ft-lbs	29.9-36.6 Nm	2.9 VEHICLE ALIGNMENT, Inspection
Front axle cap fastener: All but FLD	132-180 **in-lbs**	14.9-20.3 Nm	2.4 FRONT WHEEL, Installation
Front belt guard fastener	120-180 **in-lbs**	13.6-20.3 Nm	2.18 BELT GUARD, Installation
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.11 FRONT BRAKE CALIPER, Installation
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.11 FRONT BRAKE CALIPER, Installation
Front brake line manifold fastener	36-48 **in-lbs**	4.1-5.4 Nm	C.4 ABS BRAKE LINES, Front Master Cylinder to Front Caliper Line Assembly
Front caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.11 FRONT BRAKE CALIPER, Installation
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Front engine bracket bolts to engine	25-32 ft-lbs	34.0-43.3 Nm	2.34 ENGINE MOUNTS, Installation
Front engine mounting bracket bolts	25-32 ft-lbs	33.9-43.4 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Front fender nuts: All models	15-21 ft-lbs	20.3-28.5 Nm	2.26 FRONT FENDER, Installation
Front fork seat pipe screw	132-216 **in-lbs**	14.9-24.4 Nm	2.16 FRONT FORK, Assembly
Front isolator mounting bolts to frame	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Front isolator mounting bolts to front engine bracket	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Front isolator mounting bolts to front engine bracket	18-22 ft-lbs	24.4-29.9 Nm	2.9 VEHICLE ALIGNMENT, Inspection
Front master cylinder reservoir cover screws	12-15 **in-lbs**	1.4-1.7 Nm	2.14 BLEEDING BRAKES, Procedure
Front pipe clamp	25-30 ft-lbs	33.9-40.6 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Fuel supply tube fastener	90-110 **in-lbs**	10.2-12.4 Nm	4.12 FUEL INJECTORS, Installation
Fuel tank mounting fasteners	15-20 ft-lbs	20.3-27.1 Nm	4.4 FUEL TANK, Installation/Front and rear
Fuel tank trim screw: FXDC, FXDF, FLD	18-24 **in-lbs**	2.03-2.71 Nm	7.21 INSTRUMENTS: FXDC, FXDF AND FLD, Speedometer
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	1.5 MAINTENANCE SCHEDULE, General
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	2.10 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Installation
Hand control module housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation
Hand control module screws	35-45 **in-lbs**	4.0-5.1 Nm	2.20 THROTTLE CONTROL, Assembly/Installation
Handlebar clutch lever clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Installation
Handlebar master cylinder clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	2.10 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Handlebar master cylinder clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation
Handlebar module assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Installation

FASTENER	TORQUE VALUE		NOTES
Handlebar module assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Installation
Handlebar riser bolts: FLD	30-40 ft-lbs	40.6-54.0 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Handlebar riser bolts: FLD models	30-40 ft-lbs	40.6-54.0 Nm	2.17 STEERING HEAD, Installation: FLD
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Handlebar riser fastener: all models	30-40 ft-lbs	40.7-54.2 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Handlebar riser fastener: FXDB/P/A final tightening	30-40 ft-lbs	40.7-54.2 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Handlebar riser fastener: FXDF, FXDWG, final tightening	30-40 ft-lbs	40.7-54.2 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Handlebar switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.32 LEFT HANDLEBAR CONTROL MODULE, Clutch Switch Replacement
Handlebar switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 Nm	7.33 RIGHT HANDLEBAR CONTROL MODULE, Front Brake Switch Replacement
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	1.13 THROTTLE CABLES, Cable Inspection, Lubrication and Adjustment
Headlamp door screw: FLD	9-18 **in-lbs**	1.0-2.0 Nm	7.12 HEADLAMP, Headlamp: FLD Models
Headlamp horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	1.22 HEADLAMP ALIGNMENT, Adjustment: All Models Except FLD
Headlamp screws: FLD	7-10 **in-lbs**	0.8-1.1 Nm	7.12 HEADLAMP, Headlamp: FLD Models
Headlamp vertical adjusting nut	25-30 ft-lbs	33.9-40.7 Nm	1.22 HEADLAMP ALIGNMENT, Adjustment: All Models Except FLD
Headlight horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	7.12 HEADLAMP, Headlamp Assembly Installation: Except FLD
Headlight to nacelle: FLD	7-10 **in-lbs**	0.8-1.1 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Headlight to nacelle: FLD models	7-10 **in-lbs**	0.8-1.1 Nm	2.17 STEERING HEAD, Installation: FLD
Horn mounting nut	120-180 **in-lbs**	13.6-20.3 Nm	7.28 HORN, Replacement
Intake air temperature sensor fastener	15-20 **in-lbs**	1.7-2.3 Nm	4.6 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Jiffy stand sensor screw	96-144 **in-lbs**	10.8-16.3 Nm	2.33 JIFFY STAND, Jiffy Stand Sensor: HDI Models
License bracket screws: FLD	60-80 **in-lbs**	6.8-9.0 Nm	7.14 TURN SIGNALS, Rear Turn Signal Lamps and Bracket: FLD
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Push-rods, Lifters and Covers
locknut, fork tube cap	13-16.6 ft-lbs	17.5-22.5 Nm	2.16 FRONT FORK, Assembly: Cartridge Fork (FLD, Left Side)
Lower nacelle fasteners: FLD	84-120 **in-lbs**	9.5-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Lower nacelle fasteners: FLD models	84-120 **in-lbs**	9.5-13.5 Nm	2.17 STEERING HEAD, Installation: FLD
Main bearing, right, retaining screws	40-70 **in-lbs**	4.5-7.9 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
Mainshaft/countershaft nuts	85-95 ft-lbs	115.3-128.8 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly

FASTENER	TORQUE VALUE		NOTES
Manifold mounting screws, 1st torque	16-20 **in-lbs**	1.8-2.3 Nm	4.8 INDUCTION MODULE, Installation
Manifold mounting screws, final torque	96-156 **in-lbs**	10.9-17.6 Nm	4.8 INDUCTION MODULE, Installation
Master cylinder cover screw torque: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder cover screw torque: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder mounting nut, rear	30-40 ft-lbs	40.7-54.2 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.10 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.11 FRONT BRAKE CALIPER, Installation
Master cylinder reservoir cover screws: rear cover, including ABS	6-8 **in-lbs**	0.7-0.9 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir rear cover screws: FLD (ABS and non-ABS) and all other non-ABS models	6-8 **in-lbs**	0.68-0.90 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation
Mirror acorn nut: FLD	84-156 **in-lb**	9.5-17.6 Nm	7.14 TURN SIGNALS, Front Turn Signal Lamps: FLD
Muffler bracket bolt	15-19 ft-lbs	20.3-25.8 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler bracket fastener	17-21 ft-lbs	23-28 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Muffler bracket flange nuts	15-19 ft-lbs	20.3-25.8 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler clamp nut	38-43 ft-lbs	51.6-58.4 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Muffler clamp nuts	38-43 ft-lbs	51.6-58.4 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Muffler clamp nuts	38-43 ft-lbs	51.6-58.4 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler fastener	17-21 ft-lbs	23-28 Nm	4.15 EXHAUST SYSTEM, Installation: FLD
Muffler mounting bolt	15-19 ft-lbs	20.3-25.8 Nm	4.15 EXHAUST SYSTEM, Installation: FXDF and FXDWG
Muffler support bracket nuts	20-30 ft-lbs	27.1-40.7 Nm	4.15 EXHAUST SYSTEM, Installation: FXDB/P/A, FXDC and FXDL
Negative battery fastener: All Models	60-70 **in-lbs**	6.8-7.9 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	6.8 TRANSMISSION CASE, Installation
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	7.25 NEUTRAL SWITCH, Installation
Oil pan screws	132-156 **in-lbs**	14.9-17.6 Nm	3.29 OIL PAN, Installation
Oil pressure switch	96-144 **in-lbs**	10.8-16.3 Nm	7.26 OIL PRESSURE SWITCH, Installation
Oil pump screws, 1st torque	40-45 **in-lbs**	4.5-5.1 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Oil pump screws, final torque	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Cam Support Plate and Cover Installation
Oil spout fastener	84-132 **in-lbs**	9.5-14.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation

FASTENER	TORQUE VALUE		NOTES
Oxygen sensor	12.2-14.2 ft-lbs	16.5-19.3 Nm	4.11 OXYGEN SENSOR, Installation
Pad pin, rear caliper	80-120 **in-lbs**	9.0-13.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Passenger footrest screw and nut	84-108 **in-lbs**	9.5-12.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Passenger Footrests: All models except FXDF)
Passenger footrest support mounting screw	25-35 ft-lbs	33.9-47.4 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Passenger Footrests: All models except FXDF)
Pinch bolts: All models except FLD	30-35 ft-lbs	41-48 Nm	2.16 FRONT FORK, Installation
Piston jet screws	25-35 **in-lbs**	2.8-3.9 Nm	3.26 CRANKCASE DISASSEMBLY AND REPAIR, Right Crankcase Half
Pivot shaft nut	70-77 ft-lbs	95.0-104.5 Nm	2.22 REAR FORK, Installation
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.5 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Primary chaincase sealing fasteners	26-28 ft-lbs	35.3-38.0 Nm	5.5 PRIMARY CHAINCASE HOUSING, Installation
Primary chain tensioner fasteners	21-24 ft-lbs	28.5-32.6 Nm	5.4 DRIVE COMPONENTS, Installation
Primary cover fasteners	12-13 ft-lbs	16.0-17.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Primary cover mass, Japan only	15-19 ft-lbs	20.3-25.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm	2.5 REAR WHEEL, Installation
Rear belt guard fastener	120-180 **in-lbs**	13.6-20.3 Nm	2.18 BELT GUARD, Installation
Rear caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.13 REAR BRAKE CALIPER, Installation
Rear caliper fasteners	16-20 ft-lbs	21.7-27.1 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Rear fender cover front screw: All models	12-18 ft-lbs	16.3-24.4 Nm	2.35 SAREE GUARD: INDIA MODELS, Replacement
Rear fender cover rear screw: All models	12-18 ft-lbs	16.3-24.4 Nm	2.35 SAREE GUARD: INDIA MODELS, Replacement
Rear fender cover screw: FXDF	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDF
Rear fender screw: FLD	30-37 ft-lbs	40.7-50.2 Nm	2.27 REAR FENDER, FLD/Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Rear fender screw: FXDB	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDB
Rear fender screw: FXDC and FXDL Models	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDC and FXDL
Rear fender screw: FXDWG	12-18 ft-lbs	16.3-24.4 Nm	2.27 REAR FENDER, FXDWG
Rear fork brake hose J-clip	40-60 **in-lbs**	4.5-6.8 Nm	2.22 REAR FORK, Assembly
Rear fork brake hose J-clip	40-60 **in-lb**	4.5-6.8 Nm	C.4 ABS BRAKE LINES, ABS Module to Rear Brake Caliper
Rear isolator mounting bolts to transmission case	22-27 ft-lbs	29.9-36.6 Nm	2.9 VEHICLE ALIGNMENT, Inspection
Rear isolator to frame bolts	22-27 ft-lbs	29.8-36.6 Nm	2.34 ENGINE MOUNTS, Installation
Rear light bar housing screws: FLD	84-144 **in-lbs**	9.5-16.3 Nm	7.14 TURN SIGNALS, Rear Turn Signal Lamps and Bracket: FLD/Use LOCTITE 271 HIGH STRENGTH THREADLOCKER (red)
Rear master cylinder reservoir cover screws, non-ABS models	6-8 **in-lbs**	0.7-0.9 Nm	2.14 BLEEDING BRAKES, Procedure

FASTENER	TORQUE VALUE		NOTES
Rear mount license plate bracket screws: FXDWG	30-40 **in-lbs**	3.4-4.5 Nm	2.27 REAR FENDER, FXDWG
Rear shock, lower screws: All models	30-40 ft-lbs	40.6-54.2 Nm	2.35 SAREE GUARD: INDIA MODELS, Replacement
Rear sprocket screws-final torque	77-83 ft-lbs	104.5-112.6 Nm	2.5 REAR WHEEL, Assembly
Rear sprocket screws-initial torque	60 ft-lbs	81.4 Nm	2.5 REAR WHEEL, Assembly
Rear stop lamp switch	12-15 ft-lbs	16.3-20.3 Nm	7.27 REAR STOPLAMP SWITCH, Installation
Rear turn signal lamp fastener	12-16 ft-lbs	16.3-21.7 Nm	7.14 TURN SIGNALS, Rear Lamp Housing Replacement: All Except FLD
Rider footboard bracket screws	32-37 ft-lbs	43.0-50.0 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Rider footboard pivot bolt nut	60-80 **in-lbs**	6.8-9.0 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Riser cover fastener: FXDC only	50-60 **in-lbs**	5.6-6.8 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover screws	15-18 ft-lbs	20.3-24.4 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Breather and Rocker Cover
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.23 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Saddlebag inner/outer support screws: FLD	96-120 **in-lbs**	10.8-13.6 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag latch attaching screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag latch faceplate nut: FLD	7-17 **in-lbs**	0.8-1.9 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag latch faceplate screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag latch pivot screw: FLD	96-120 **in-lbs**	10.8-13.6 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag latch screws: FLD	14-20 **in-lbs**	1.6-2.3 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag lock screws: FLD	30-40 **in-lbs**	3.4-4.5 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Saddlebag lower mount screws: FLD	96-120 **in-lbs**	10.8-13.6 Nm	2.32 SADDLEBAGS: FLD, Saddlebags
Saddlebag lower mount spool: FLD	15-20 ft-lbs	20.3-27.1 Nm	2.27 REAR FENDER, FLD/Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Seat rear fastener: All Models	20-40 **in-lbs**	2.3-4.5 Nm	2.28 SEAT, Installation
Seat rear fastener: All Models except FXDWG	20-40 **in-lbs**	2.3-4.5 Nm	2.28 SEAT, Installation
Seat shoulder bolt: FXDWG	80-90 **in-lbs**	9.0-10.2 Nm	2.28 SEAT, Installation
Seat strap nut: FLD	60-90 **in-lbs**	6.8-10.2 Nm	2.27 REAR FENDER, FLD
Seat strap nut: FXDWG Only	60-90 **in-lbs**	6.78-10.17 Nm	2.28 SEAT, Installation
Secondary cam chain tensioner fastener	90-120 **in-lbs**	10.2-13.6 Nm	3.24 CAM COMPARTMENT AND COMPONENTS, Camshafts
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shifter foot lever pinch bolt	18-22 ft-lbs	24.4-29.8 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Shifter linkage locknut	96-144 **in-lbs**	10.8-16.3 Nm	6.4 SHIFTER LINKAGE, Adjustment

FASTENER	TORQUE VALUE		NOTES
Shifter pawl centering screw	18-23 ft-lbs	24.4-31.2 Nm	6.8 TRANSMISSION CASE, Assembly
Shifter rod lever pinch screw, transmission lever	18-22 ft-lbs	24.4-29.8 Nm	6.8 TRANSMISSION CASE, Assembly
Shift lever bolt	18-22 ft-lbs	24.4-29.8 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Shift lever screw	18-22 ft-lbs	24.4-29.8 Nm	6.4 SHIFTER LINKAGE, Adjustment
Shift rod fastener with acorn nut	96-144 **in-lbs**	10.8-16.2 Nm	2.29 FOOTBOARDS AND FOOTRESTS, Rider Footboards
Shift rod jamnut	80-120 **in-lbs**	9.0-13.6 Nm	6.4 SHIFTER LINKAGE, Adjustment
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm	2.5 REAR WHEEL, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm	2.21 REAR SHOCK ABSORBERS, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm	2.5 REAR WHEEL, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm	2.21 REAR SHOCK ABSORBERS, Installation/LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue)
Shock mounting stud nut, inner	75-85 ft-lbs	101.7-115.2 Nm	2.21 REAR SHOCK ABSORBERS, Installation
Side mount license plate bracket screws: FXDWG	84-180 **in-lbs**	9.5-20.3 Nm	2.27 REAR FENDER, FXDWG
Slider cover fasteners: FLD	60-120 **in-lbs**	6.8-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Solenoid contact post jamnut	65-80 **in-lbs**	7.3-9.0 Nm	7.11 STARTER, Solenoid
Solenoid terminal post nut	70-90 **in-lbs**	7.9-10.1 Nm	7.11 STARTER, Drive Assembly
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.5 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.17 SPARK PLUGS, Inspection
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	3.8 TROUBLESHOOTING, Compression Test
Speedometer, tachometer screw: FXDB/P/A and FXDWG	10-20 **in-lbs**	1.1-2.3 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Speedometer/tachometer back clamp screw: FXDL	10-20 **in-lbs**	1.1-2.3 Nm	7.22 INSTRUMENTS: FXDB/P/A, FXDL AND FXDWG, Installation
Speedometer cover fastener: FXDC only	50-60 **in-lbs**	5.6-6.8 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Speedometer VSS mounting bolt	84-108 **in-lbs**	9.5-12.2 Nm	7.23 VEHICLE SPEED SENSOR (VSS), Installation
Spoke nipple	55 **in-lbs**	6.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Spoke nipple	55 **in-lbs**	6.2 Nm	1.8 TIRES AND WHEELS, Wheel Spokes
Spoke nipple	55 **in-lbs**	6.2 Nm	2.8 CHECKING AND TRUING WHEELS, Truing Laced Wheels
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Starter end cover screw	90-110 **in-lbs**	10.1-12.4 Nm	7.11 STARTER, Drive Assembly
Starter mounting fasteners	25-27 ft-lbs	33.9-36.6 Nm	7.11 STARTER, Installation

FASTENER	TORQUE VALUE		NOTES
Starter positive terminal nut	60-80 **in-lbs**	6.8-9.0 Nm	7.10 BATTERY TRAY AND BATTERY CABLES, Battery Cables/metric
Starter positive terminal nut	60-80 **in-lbs**	6.8-9.0 Nm	7.11 STARTER, Installation
Starter ring terminal hex nut	60-80 **in-lbs**	6.8-9.0 Nm	7.11 STARTER, Solenoid
Starter through bolts	39-65 **in-lbs**	4.4-7.3 Nm	7.11 STARTER, Drive Assembly
Stator screws	55-75 **in-lbs**	6.2-8.4 Nm	7.18 ALTERNATOR, Installation/TORX screws, use only once
Tail lamp base screws: all but FXDB/P/A, FXDWG	40-48 **in-lbs**	4.5-5.4 Nm	7.13 TAIL LAMP, Base Replacement: All But FXDB/P/A and FXDWG
Tail lamp base screws: FXDWG (HDI and Canada)	66-90 **in-lbs**	7.5-10.1 Nm	7.13 TAIL LAMP, Base Replacement: FXDWG/HDI and Canada
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm	7.13 TAIL LAMP, Tail Lamp Bulb Replacement: Standard Style
Tail lamp lens screws: all but FXDB/P/A, FXDWG	20-24 **in-lbs**	2.3-2.7 Nm	7.13 TAIL LAMP, Base Replacement: All But FXDB/P/A and FXDWG
Tether assembly screws: FLD	8-12 **in-lbs**	0.9-1.4 Nm	2.32 SADDLEBAGS: FLD, Saddlebag Lid
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.9 IDLE AIR CONTROL (IAC), Installation
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.10 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), Installation/Use new screws
Throttle position sensor fasteners	18 **in-lbs**	2.0 Nm	4.5 THROTTLE POSITION SENSOR (TPS), Installation
Top brake caliper mounting bolt: Front	28-38 ft-lbs	38.0-51.5 Nm	2.4 FRONT WHEEL, Installation
Top plate fasteners	27-33 **in-lbs**	3.1-3.7 Nm	4.13 FUEL PUMP, Installation
Top plate fasteners	27-33 **in-lbs**	3.1-3.7 Nm	7.20 FUEL GAUGE SENDER, Installation
Transmission bearing housing fasteners	23-25 ft-lbs	31.2-33.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Checking Transmission Lubricant
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.8 TRANSMISSION CASE, Installation
Transmission filler plug/dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission ground stud nut	96-144 **in-lbs**	10.8-16.3 Nm	7.10 BATTERY TRAY AND BATTERY CABLES, Battery Cables
Transmission lockplate screws	90-120 **in-lbs**	10.2-13.6 Nm	5.7 TRANSMISSION SPROCKET, Installation/LOC-TITE patch, use 3-5 times
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts, final torque	34-39 ft-lbs	46.1-52.9 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	6.8 TRANSMISSION CASE, Installation

FASTENER	TORQUE VALUE		NOTES
Transmission sprocket nut, final torque	35 ft-lbs	47.5 Nm	5.7 TRANSMISSION SPROCKET, Installation/plus 35-40 degrees
Transmission sprocket nut, initial torque	100 ft-lbs	135.6 Nm	5.7 TRANSMISSION SPROCKET, Installation/Right hand threads, initial torque only, apply several drops of LOCTITE 271 HIGH STRENGTH THREADLOCKER (red) to last few threads.
Transmission top cover	90-120 **in-lbs**	10.2-13.6 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Upper and lower pinch bolts: FLD models	30-35 ft-lbs	40.6-47.5 Nm	2.17 STEERING HEAD, Installation: FLD
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, front: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener, rear: all models	12-16 ft-lbs	16.3-21.7 Nm	2.24 HANDLEBARS: FXDC, FXDL AND FLD, Installation
Upper handlebar clamp fastener: FXDB/P/A, FXDF, FXDWG, final tightening	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Upper handlebar clamp fastener: FXDB/P/A, initial tightening	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Upper handlebar clamp fastener: FXDB/P/A final tightening	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: FXDB/P/A, FXDF AND FXDWG, Installation
Upper nacelle fasteners	84-120 **in-lbs**	9.5-13.5 Nm	1.18 STEERING HEAD BEARINGS, Adjustment
Upper nacelle fasteners: FLD	84-120 **in-lbs**	9.5-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Upper nacelle fasteners: FLD models	84-120 **in-lbs**	9.5-13.5 Nm	2.17 STEERING HEAD, Installation: FLD
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.15 TIRES, Installation
Valve stem nut, tube type	3-7 **in-lbs**	0.3-0.8 Nm	2.15 TIRES, Installation
Voltage regulator fasteners	100-120 **in-lbs**	11.2-13.6 Nm	7.17 VOLTAGE REGULATOR, Installation
VSS fastener	84-132 **in-lbs**	9.5-14.9 Nm	6.8 TRANSMISSION CASE, Installation
Windshield docking hardware: FLD	84-120 **in-lbs**	9.5-13.5 Nm	2.30 HEADLAMP NACELLE: FLD, Upper and lower nacelle: FLD
Windshield docking hardware: FLD models	84-120 **in-lbs**	9.5-13.5 Nm	2.17 STEERING HEAD, Installation: FLD
Windshield window screws: FLD	20-25 **in-lbs**	2.3-2.8 Nm	2.31 WINDSHIELD: FLD, Windshield Window

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