



HARLEY-DAVIDSON



SPORTSTER® RH MODELS

2022 HARLEY-DAVIDSON® SERVICE MANUAL

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



SPORTSTER® RH MODELS

2022 HARLEY-DAVIDSON® SERVICE MANUAL

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2022 HARLEY-DAVIDSON® SERVICE MANUAL - SPORTSTER® RH MODELS

- Return this form to:
Harley-Davidson Motor Company
Department 625 Service Communications
P.O. Box 653
Milwaukee WI 53201 USA

NOTES

GENERAL

This manual has been created to inform Harley-Davidson technicians about the construction of Harley-Davidson products and the latest tested and approved maintenance and repair techniques.

MANUAL LAYOUT

Safety

Refer to the Safety section before performing any procedures on a vehicle.

Sections

This service manual is organized into chapters, sections and topics. Each section is laid out in the following manner:

- Prepare
- Remove
- Install
- Disassemble (if applicable)
- Clean/Inspect (if applicable)
- Assemble (if applicable)
- Complete

Topics

The purpose of the **Prepare** topics is to provide an outline of procedures required before beginning a specific task. Links to the necessary procedures are provided in the topic.

The **Remove** and **Install** topics allow the technician to only remove and install the component - which may be all that is required. If a component can be repaired, **Disassemble**, **Assemble** and **Clean/Inspect** topics are provided as appropriate.

Complete topics provide a list of procedures that need to be performed to return the vehicle to ride-ready condition. If additional removal procedures need to be performed, move to the next section without performing the Complete topics in the current section.

Procedural Steps

Each topic contains steps to complete the procedure. These steps are laid out in numeric and alpha steps.

The purpose of the numeric steps is to provide the experienced technician with high-level information to complete the procedure.

The alpha steps provide a less-experienced technician with step-by-step instructions to perform the procedure.

Symbol Identification

Symbols are used in some graphics to provide information about parts. Refer to Table 1 for symbol definitions.

Table 1. Symbols

| Symbol | Description |
|---|---|
|  | Apply Lubricant: Indicates a part that should be lubricated during installation. |
|  | Discard/Do Not Reuse: Indicates a part that must be replaced with a new part during installation. |
|  | Apply Sealant: Indicates a part that must be installed with a threadlocker or sealant. |
|  | Special Tool: Indicates that a special tool is recommended. |
|  | Measure: Indicates a part that should be measured or gauged to verify that it is within specification. |

HOW TO USE THIS SERVICE MANUAL

Cross-References and Page Numbers

A cross-reference shown as **2.2 SPECIFICATIONS** refers to chapter 2 CHASSIS, heading 2.2 SPECIFICATIONS.

All pages contain a chapter number followed by a page number. For example, **page 3-5** refers to page 5 in Chapter 3.

Item References and Quantities

In figure legends and tables, the number in parentheses that follows the part name indicates the quantity of that part necessary for one complete assembly.

Example:

2. Screw (4)

In a procedure step or paragraph, the number in parentheses that follows a part name indicates the legend item of the part in the figure referenced by the text.

Example:

1. Remove screws (2).

Acronyms and Abbreviations

Acronyms and abbreviations are used in this document. See the Acronyms and Abbreviations (Page B-1) for a list of acronyms, abbreviations and definitions.

PREPARATION FOR SERVICE

- Start each job with a clean work area.
- Clean the motorcycle before work begins.
- Gather any tools, instruments and parts needed for the job before work begins.
- Carefully read all related service information, including service bulletins, before service work begins.

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.

SHOP PRACTICES

| CONSUMABLE | PART NUMBER |
|--|-------------|
| LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) | 99642-97 |

Removing Parts

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.

Always tag hoses, wiring or tubes to verify proper installation.

Cleaning

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. See Cleaning (Page II).

Checking Torques on Fasteners and Threadlocking Agents

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. See Cleaning Threads and Threaded Holes later in this section. Replace the fastener with a **new** one or clean the original fastener threads. Use the threadlocker stated in the appropriate procedure. If no threadlocker is indicated, use LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) (99642-97) or equivalent. Install and tighten the fastener to specification.

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

CLEANING

General

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.

Always clean around lines or covers before they are removed. When cleaning parts:

- Plug, tape or cap holes and openings to keep out dirt, dust and debris.
- Clean and inspect all parts as they are removed.
- Cover all clean parts with clean lint-free cloth, paper or other material.
- Verify that the part is clean when installed.

Cleaning Threads and Threaded Holes

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.

To attain proper clamp load, always clean fastener threads and threaded holes prior to assembly.

NOTE

Never use a thread-cutting tap or die to clean threads.

- Clean all threadlocking material from fastener threads and threaded holes.
- Use a wire brush or thread-chasing die to clean fastener threads.
- Use a thread chaser to clean threaded holes.
- Use a mixture of 50 percent isopropyl alcohol and 50 percent distilled water or equivalent to remove all traces of oil and contaminants from threads.
- Clear all threaded holes with low-pressure compressed air.

Cleaning Plastic and Rubber Parts

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

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.

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. Allow bearings 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.

DISPOSAL AND RECYCLING

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.

TOOLS AND MATERIALS

▲ WARNING

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

Some service procedures require the use of tools designed for a specific purpose. These tools should be used when and as recommended.

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

Special Tools

Special tools mentioned in this manual with a part number that begins with an "HD", "J" or "B" must be purchased, serviced or warranted through a Harley-Davidson dealer.

Specific use of special tools is not discussed in this manual. Refer to the tool instruction sheet for instructions. If the tool instructions are misplaced, a copy can be obtained online at H-Dnet.com > My Toolbox > Edit > Bosch Tool Site.

LOCTITE Sealing and Threadlocking Products

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

PRODUCT REGISTERED MARKS

Apple, Alcantara S.p.A., Allen, Amp Multilock, Android Auto, Bluetooth, Brembo, CarPlay, City Navigator, Delphi, Deutsch, Dunlop, Dynojet, Fluke, G.E. Versilube, Garmin, Google LLC,

Gunk, Heli-Coil, Hydroseal, Hylomar, iPhone, iPod, Kevlar, Lexan, Loctite, Lubriplate, Keps, K&N, Magnaflux, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, Michelin, MPZ, Multilock, nano, NGK, Novus, Packard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Road Tech, Robinair, S100, Sems, Siri, SiriusXM, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufoil, Tyco, Ultratorch, Velcro, X-Acto and XM Satellite Radio are among the trademarks of their respective owners.

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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.

Content Applicability

Certain areas within this manual may have tables designating model or feature applicability. Refer to Table 2.

Table 2. Sample Applicability Table

| APPLICABILITY | |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | • Content applies to model or feature listed |
| <input type="checkbox"/> | • Content does not apply to model or feature listed |

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1.1 SAFETY.....1-1

NOTES

SAFETY

Harley-Davidson service manuals are intended for use by professional, qualified and experienced technicians. Attempting the procedures found within this manual without the proper training, tools and equipment could result in death or injury to you or others. This could also damage the vehicle, or cause the vehicle to operate improperly.

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

- Always have a complete understanding of the task.
- Use common sense.
- Use proper tools for the task.
- Protect yourself and bystanders with approved eye protection.

Harley-Davidson does not evaluate or advise the technicians of every way in which service might be performed, or all possible hazardous consequences of every method, or undertaken such a broad evaluation. Before using a tool not recommended by Harley-Davidson, make sure that technician or rider safety will not be jeopardized as a result.

Warnings against the use of specific service methods which could damage the motorcycle or render it unsafe are stated in this manual. **These warnings are not all-inclusive.** Inadequate safety precautions could result in death or serious injury.

Safety Messages

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

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury. (08704a)

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

NOTE

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

Customer Safety

⚠ WARNING

The rider's safety depends upon proper motorcycle service and maintenance. If a procedure in this manual is not within your capabilities or you do not have the correct tools, have a Harley-Davidson dealer perform the procedure. Improper service or maintenance could result in death or serious injury. (00627b)

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 and are essential to your customer's safety and the reliable and safe operation of your customer's vehicle.

Personal Protection

⚠ WARNING

- **Always wear safety glasses or goggles when performing service or maintenance procedures. Flying objects or materials can cause serious eye injury or death.**
- **Wear protective gear that is appropriate to the situation. Helmets, gloves, boots and other protective clothing can prevent serious injury or death.**
- **Wear ear protection when loud noises are present. Loud noises can damage ears and cause hearing loss.**

(00628b)

Tool Safety

Some of these service operations require the use of tools specially designed for the purpose. Follow the manufacturer's suggested usage and safety instructions. If using a tool other than that recommended by Harley-Davidson, be sure that the tool is appropriate for the service or maintenance procedure and is being used in accordance with the tool's safety instructions.

Product Safety

⚠ 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 to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be substituted.
- Some referenced or recommended products contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm as indicated on the product label or at the point of purchase.

Hazardous Materials

⚠ WARNING

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

- Keep hazardous products out of the reach of children.
- Many products (oils, lubricants, solvents, sealants and cleaners, etc.) can cause death or serious injury if inhaled, absorbed, injected, ingested or improperly contacted. If hazardous contact is made with a product, follow the instructions on the product label and, if necessary, contact poison control or a medical facility.
- Some products are flammable and/or explosive as indicated on the product label or at the point of purchase. Keep these products away from flame and intense heat.
- Some products are corrosive as indicated on the product label. Wear appropriate protective gear to prevent skin contact. Use service covers to prevent damage to cosmetic surfaces on the motorcycle.
- Some products contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm as indicated on the product label or at the point of purchase.

Fuel

⚠ WARNING

Keep gasoline away from ignition sources. Gasoline is extremely flammable and highly explosive and, if ignited, could result in death or serious injury. (00634b)

- Stop the engine when refueling or servicing the fuel system.
- Do not allow open flame, sparks, radiant heat or other ignition sources near gasoline.
- Do not store motorcycle with gasoline in tank within the home or garage where ignition sources, such as open flames, pilot lights, sparks or electric motors are present.
- Do not overfill fuel tank. Allow for fuel expansion .
- Do not use gasoline as a cleaner or solvent.
- Gasoline can leak or drain from loosened or improperly tightened fuel fittings or from removed fuel components.
- Clean spilled gasoline immediately. Dispose of waste materials properly.

Battery

⚠ WARNING

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

- 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 out of the reach of children.
- Do not remove warning label attached to top of battery.

- 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.

Coolant

- Coolant contains toxic chemicals which could cause death or serious injuries if ingested. Do not induce vomiting. Call a physician immediately.
- Irritation to skin or eyes can occur from vapors or direct contact. Flush thoroughly with water if contact is made.
- Use in a well ventilated area.

Hydraulic (Brake) Fluid

- Direct contact with brake fluid to the eyes can cause irritation. Flush thoroughly with water if contact is made.
- Do not swallow brake fluid. Swallowing brake fluid can cause digestive discomfort. Call a physician immediately.
- Brake fluid will cause cosmetic damage to painted surfaces. Always use caution and protect surfaces from spills whenever brake work is performed.

Engine Oil

- 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.
- Do not swallow oil. If swallowed, do not induce vomiting. Contact a physician immediately.
- Direct contact with eyes can cause irritation. Flush thoroughly with water if contact is made. Contact a physician if irritation persists.

Electrical Systems

⚠ WARNING

Improper service or maintenance of the electrical system can cause damage to the electrical system. This may result in component failure. In certain situations, a component failure during operation could lead to a loss of control, which could result in death or serious injury. (00637b)

- Always use replacement fuses that are of the specified type and amperage rating.
- Do NOT pull on electrical wires. Pulling on electrical wires may damage wire conductivity.
- Route wires and harnesses properly to prevent chafing, stripping, pinching, crimping or cutting wires. Damaged wires can cause short circuits and component damage or failure.
- Do NOT overload the vehicle's charging system. If the electrical accessories consume more electrical current than the charging system can produce, the battery may be discharged and cause damage to the motorcycle's electrical system.
- Do NOT exceed the maximum amperage rating of the fuse or circuit breaker protecting a modified circuit.
- Avoid directly heating electrical system components other than the connectors on which heat shrink work is being performed.

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|--|----------------------|---------------|---|
| Air filter clamp | 22–24 in-lbs | 2.5–2.7 N·m | 2.20 INSPECT AIR FILTER, Remove and Install |
| Axle nut, rear | 95–105 ft-lbs | 129–142 N·m | 2.16 INSPECT AND ADJUST DRIVE BELT AND SPROCKETS, Adjust Belt |
| Axle nut, rear | 95–105 ft-lbs | 129–142 N·m | 2.16 INSPECT AND ADJUST DRIVE BELT AND SPROCKETS, Adjust Belt |
| Battery cable screw, negative | 60–70 in-lbs | 6.8–7.9 N·m | 2.21 INSPECT BATTERY, Install |
| Battery cable screw, positive | 60–70 in-lbs | 6.8–7.9 N·m | 2.21 INSPECT BATTERY, Install |
| Belt guard, lower, screw | 49–66 in-lbs | 5.5–7.5 N·m | 2.16 INSPECT AND ADJUST DRIVE BELT AND SPROCKETS, Measure Drive Belt Deflection |
| Brake caliper, front, brake pad hanger pin | 44–62 in-lbs | 5–7 N·m | 2.8 INSPECT BRAKES, Replace Front Brake Pads |
| Brake master cylinder, front, reservoir cover screws | 7–11 in-lbs | 0.8–1.2 N·m | 2.9 CHECK AND REPLACE BRAKE FLUID, Check Brake Fluid Level |
| Brake pad hanger pin | 75–102 in-lbs | 8.5–11.5 N·m | 2.8 INSPECT BRAKES, Replace Rear Brake Pads |
| Fork bracket, upper pinch screws | 15–18 ft-lbs | 20.4–25 N·m | 2.12 ADJUST AND LUBRICATE STEERING HEAD BEARINGS, Check and Adjust |
| Fork stem pinch screw | 15–18 ft-lbs | 20.4–25 N·m | 2.12 ADJUST AND LUBRICATE STEERING HEAD BEARINGS, Check and Adjust |
| Instrument cluster screw | 91–101 in-lbs | 10.3–11.4 N·m | 2.12 ADJUST AND LUBRICATE STEERING HEAD BEARINGS, Check and Adjust |
| Oil drain plug, engine | 15 ft-lbs | 20 N·m | 2.5 REPLACE ENGINE OIL AND FILTER, Change Oil and Oil Filter |
| Spark Plug | 89–133 in-lbs | 10–15 N·m | 2.22 INSPECT AND REPLACE SPARK PLUGS, Install |
| Starter cable nut | 27–41 in-lbs | 3–4.6 N·m | 2.21 INSPECT BATTERY, Install |
| Voltage regulator bracket screw | 35–62 in-lbs | 4–7 N·m | 2.21 INSPECT BATTERY, Install |

SERVICING A 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 General (Page 2-3).

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

Perform all of the checks in the PRE-RIDING CHECKLIST in the owner's manual following any service procedure. Operate the motorcycle to perform any final check or adjustments. If all is correct, the vehicle is ready to return to the customer.

Caution must be taken when pushing vehicle onto a lift for servicing or a trailer that there is the potential that the oil drain plug will come in contact with the ramp causing damage to the drain plug or crankcases. Use a long ramp or block the ramp with a 2x4. DO NOT RIDE VEHICLE UP RAMP.

SECURE THE MOTORCYCLE FOR SERVICE

| PART NUMBER | TOOL NAME |
|-------------|-----------|
| HD-45968 | FAT JACK |

⚠ 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 motorcycle.

Set Motorcycle Upright

1. Place motorcycle upright on a level surface or suitable lift if available.
2. Verify that motorcycle is level.
3. Secure with tie-downs.

Lifting Motorcycle

NOTE

- See Figure 2-1. When lifting motorcycle from underneath, always lift directly below crankshaft centerline with wood between motorcycle and lift.
- Always support a motorcycle that is being serviced with blocks or stands.

1. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
2. Place a fat jack with block of wood below crankshaft centerline.
Special Tool: FAT JACK (HD-45968)
3. Raise motorcycle to allow servicing.

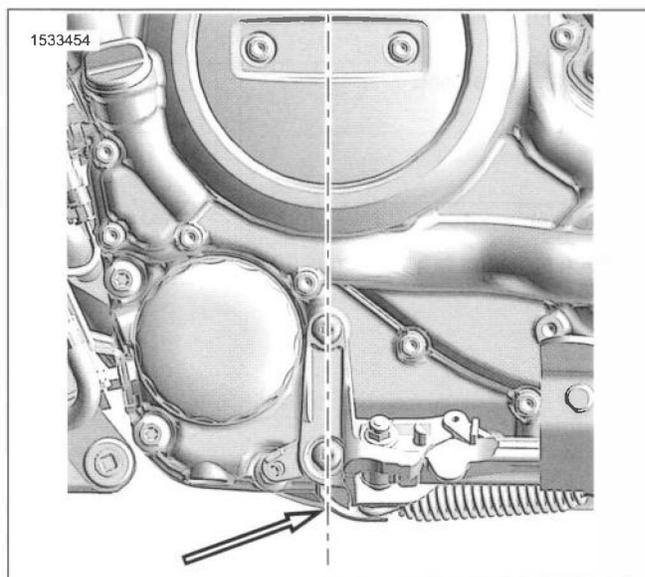


Figure 2-1. Crankshaft Centerline

GENERAL

Regular Service Intervals

Service must be performed at specified intervals to keep your Harley-Davidson motorcycle operating at peak performance. See the Regular Service Intervals table below.

NOTE

- The use of parts and service procedures other than Harley-Davidson approved parts and service procedures may void the limited warranty. Any alterations to the emission system components, such as the intake and exhaust system, may be in violation of motor vehicle laws.

- Some countries, such as Brazil, may require all regular maintenance to be performed by an authorized Harley-Davidson dealer for your limited warranty to remain in effect. Check with your authorized Harley-Davidson dealer.
- Some countries, such as Brazil, may require additional annual (or semi-annual) regular maintenance steps to be performed to keep your limited warranty in effect and/or comply with vehicle regulations. Check with your authorized Harley-Davidson dealer as well as the motorcycle regulations in your country.
- After completing the final service interval, repeat the service schedule starting at the 8000 km (5000 mi) interval.
- Whenever a vehicle is in for maintenance, always check for and complete recalls and open product programs.
- Whenever a vehicle is in for maintenance, always verify that the latest calibration is installed.

Table 2-1. Regular Service Intervals: Harley-Davidson Sportster RH Models

| COMPONENT | ACTION | 1600 KM | 8000 KM | 16000 KM | 24000 KM | 32000 KM | 40000 KM | 48000 KM | 56000 KM | 64000 KM | 72000 KM | 80000 KM | NOTES |
|--|-----------|--|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|
| | | 1000 MI | 5000 MI | 10000 MI | 15000 MI | 20000 MI | 25000 MI | 30000 MI | 35000 MI | 40000 MI | 45000 MI | 50000 MI | |
| Service Intervals | | | | | | | | | | | | | |
| Electrical equipment and switches | Inspect | x | x | x | x | x | x | x | x | x | x | x | |
| Front tire pressure and tread | Check | x | x | x | x | x | x | x | x | x | x | x | 1 |
| Front wheel spoke tightness (if equipped) | Check | x | x | | | x | | | x | | | x | 2, 4, 3 |
| Front brake fluid level | Inspect | x | x | x | x | x | x | x | x | x | x | x | 7 |
| DOT4 front brake fluid moisture content | Check | x | x | x | x | x | x | x | x | x | x | x | 1, 2 |
| Steering head bearings | Adjust | x | | x | | x | | x | | x | | x | 2 |
| Steering head bearings | Lubricate | | | | | | x | | | | | x | 2 |
| Clutch lever handlebar clamp screw torque | Tighten | x | | x | | x | | x | | x | | x | 1, 2, 5 |
| Master cylinder handlebar clamp screw torque | Tighten | x | | x | | x | | x | | x | | x | 1, 2, 5 |
| Air cleaner filter | Inspect | x | x | x | x | x | x | x | x | x | x | x | 3 |
| Engine oil and filter | Replace | x | x | x | x | x | x | x | x | x | x | x | 1, 3 |
| Coolant | Replace | Replace coolant every 30000 mi (48000 km) | | | | | | | | | | | 2 |
| Clean radiators and oil cooler | Clean | x | x | x | x | x | x | x | x | x | x | x | |
| Brake system | Inspect | x | x | x | x | x | x | x | x | x | x | x | 1, 2 |
| Fuel lines and fittings | Inspect | x | x | x | x | x | x | x | x | x | x | x | 1, 2 |
| Rear brake fluid level | Inspect | x | x | x | x | x | x | x | x | x | x | x | 7 |
| DOT4 rear brake fluid moisture content | Check | x | x | x | x | x | x | x | x | x | x | x | 1, 2 |
| Brake systems | Replace | Flush brake systems and replace DOT 4 hydraulic brake fluid every two years or sooner if moisture content is 3 percent or greater. | | | | | | | | | | | 2 |
| Brake pads and discs | Inspect | x | x | x | x | x | x | x | x | x | x | x | |
| Jiffy stand | Lubricate | x | x | x | x | x | x | x | x | x | x | x | 2, 3 |
| Centerstand (if equipped) | Lubricate | x | x | x | x | x | x | x | x | x | x | x | 2, 3 |
| Clutch system | Adjust | x | x | x | x | x | x | x | x | x | x | x | 2, 3 |

NOTES

1. Perform annually or at specified intervals, whichever comes first.
2. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified.
3. Perform maintenance more frequently in severe riding conditions. This includes extreme temperatures, dusty environments, mountainous or rough roads, long storage conditions, short runs, heavy stop/go traffic or poor fuel quality.
4. Perform spoke tension check at 1,000 mi (2,000 km), 5,000 mi (8,000 km), 20,000 mi (32,000 km) services and every 15,000 mi (24,000 km) interval thereafter. Not all vehicles have spoked wheels. Consult appropriate topic in the service manual.
5. For torque instructions, see Shop Practices in the service manual.
6. Check for leaks, contact or abrasion.
7. Brake fluid level drops as brake pads wear.
8. Use HARLEY LUBE.
9. Disassemble, lubricate and inspect every 25000 mi (40000 km)

Table 2-1. Regular Service Intervals: Harley-Davidson Sportster RH Models

| COMPONENT | ACTION | 1600 KM | 8000 KM | 16000 KM | 24000 KM | 32000 KM | 40000 KM | 48000 KM | 56000 KM | 64000 KM | 72000 KM | 80000 KM | NOTES |
|--|-----------|--|---------|----------|----------|----------|----------|----------|----------|----------|----------|----------|---------|
| | | 1000 MI | 5000 MI | 10000 MI | 15000 MI | 20000 MI | 25000 MI | 30000 MI | 35000 MI | 40000 MI | 45000 MI | 50000 MI | |
| Brake and clutch controls | Lubricate | x | x | x | x | x | x | x | x | x | x | x | 2, 3, 8 |
| Rear wheel spoke tightness (if equipped) | Check | x | x | | | x | | | x | | | x | 2, 3, 4 |
| Rear tire pressure and tread | Check | x | x | x | x | x | x | x | x | x | x | x | 1 |
| Drive belt and sprockets | Inspect | x | x | x | x | x | x | x | x | x | x | x | 2, 3 |
| Drive Belt | Adjust | x | x | x | x | x | x | x | x | x | x | x | 2, 3 |
| Exhaust system, fasteners and shields | Inspect | x | x | x | x | x | x | x | x | x | x | x | 1, 3 |
| 12 volt battery | Check | Check battery, terminal torque and clean connections annually. Lubricate terminals with ELECTRICAL CONTACT LUBRICANT. | | | | | | | | | | | 1 |
| Spark plugs | Replace | Replace spark plugs every two years or every 10,000 mi (16,000 km), whichever comes first. | | | | | | | | | | | 2 |
| Front forks | Rebuild | Disassemble, inspect, rebuild front forks and replace fork oil every 50000 mi (80000 km) | | | | | | | | | | | 2 |
| Rear sprocket compensator | Inspect | Inspect rear sprocket isolators for wear at each rear tire change. | | | | | | | | | | | 2, 3 |
| Component and system functions | Road Test | x | x | x | x | x | x | x | x | x | x | x | |
| NOTES | | | | | | | | | | | | | |
| <p>1. Perform annually or at specified intervals, whichever comes first.</p> <p>2. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified.</p> <p>3. Perform maintenance more frequently in severe riding conditions. This includes extreme temperatures, dusty environments, mountainous or rough roads, long storage conditions, short runs, heavy stop/go traffic or poor fuel quality.</p> <p>4. Perform spoke tension check at 1,000 mi (2,000 km), 5,000 mi (8,000 km), 20,000 mi (32,000 km) services and every 15,000 mi (24,000 km) interval thereafter. Not all vehicles have spoked wheels. Consult appropriate topic in the service manual.</p> <p>5. For torque instructions, see Shop Practices in the service manual.</p> <p>6. Check for leaks, contact or abrasion.</p> <p>7. Brake fluid level drops as brake pads wear.</p> <p>8. Use HARLEY LUBE.</p> <p>9. Disassemble, lubricate and inspect every 25000 mi (40000 km)</p> | | | | | | | | | | | | | |

FUEL

Always use a good quality unleaded gasoline. Octane ratings are usually found on the pump. Refer to Table 2-2.

⚠ WARNING

Avoid spills. Slowly open fuel 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. (00028b)

⚠ WARNING

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

Modern service station pumps dispense a high flow of gasoline into a motorcycle fuel tank. This can cause air entrapment and pressurization.

Table 2-2. Octane Rating

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

GASOLINE BLENDS

Harley-Davidson motorcycles are designed to get the best performance and efficiency using unleaded gasoline. Most gasoline is blended with alcohol and/or ether to create oxygenated blends. The type and amount of alcohol or ether added to the fuel is important.

NOTICE

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

- Gasoline/METHYL TERTIARY BUTYL ETHER (MTBE) blends are a mixture of gasoline and as much as 15 percent MTBE. Gasoline/MTBE blends use in your motorcycle is approved.
- ETHANOL fuel is a mixture of ethanol (grain alcohol) and unleaded gasoline and can have an impact on fuel mileage. Fuels with an ethanol content of up to 10 percent may be used in your motorcycle without affecting vehicle performance. U.S. EPA regulations currently indicate that fuels with 15 percent ethanol (E15) are restricted from use in motorcycles at the time of this publication. Some motorcycles are calibrated to operate with higher ethanol concentrations to meet the fuel standards in certain countries.

- REFORMULATED OR OXYGENATED GASOLINES (RFG) describes gasoline blends that are specifically designed to burn cleaner than other types of gasoline. This results in fewer tailpipe emissions. They are also formulated to evaporate less when filling the tank. Reformulated gasolines use additives to oxygenate the gas. Your motorcycle will run normally using this type of fuel. Harley-Davidson recommends using it whenever possible as an aid to cleaner air in our environment.
- Do not use racing fuel or fuel containing methanol. Use of these fuels will damage the fuel system.
- Using fuel additives other than those approved for use by Harley-Davidson may damage the engine, fuel system and other components.

Some gasoline blends might adversely affect starting, performance 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

Engine Lubrication

⚠ CAUTION

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

⚠ CAUTION

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

NOTICE

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

Always use the proper grade of oil for the lowest temperature expected before the next scheduled oil change. Refer to Table 2-3.

This motorcycle was originally equipped with GENUINE HARLEY-DAVIDSON SYN-BLEND MOTORCYCLE OIL 15W50. SYN-BLEND is the preferred oil under normal operating conditions. If operation under extreme cold or heat are expected, refer to Table 2-3 for alternative choices.

If necessary and SYN-BLEND, SYN3, or HD 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 2-3. Recommended Engine Oils

| TYPE | VISCOSITY | LOWEST AMBIENT TEMPERATURE | COLD-WEATHER STARTS BELOW 50 °F (10 °C) |
|--|-----------|----------------------------|---|
| Harley-Davidson Genuine SYN-BLEND Motorcycle Lubricant | SAE 15W50 | Above 30.2 °F (-1 °C) | Excellent |
| Screamin' Eagle SYN3 Full Synthetic Motorcycle Lubricant | SAE 20W50 | Above 30.2 °F (-1 °C) | Excellent |
| Genuine Harley-Davidson H-D 360 Motorcycle Oil | SAE 20W50 | Above 39.2 °F (4 °C) | Good |

Low Temperature Lubrication

Change engine oil often in colder climates. If motorcycle is frequently ridden less than 15 mi (24 km), in ambient temperatures below 60.8 °F (16 °C), reduce oil change intervals to 1,491½ mi (2,400 km).

NOTE

Lower ambient temperatures require more frequent oil changes.

Water vapor is a normal by-product of combustion. During cold-weather operation, some water vapor condenses to liquid

form on the cool surfaces inside the engine. In freezing weather, this water becomes slush or ice. If the engine is not warmed to operating temperature, accumulated slush or ice blocks the oil lines and causes engine damage. Over time, water will accumulate, mix with the engine oil and form a sludge that is harmful to the engine.

If the engine is allowed to warm to normal operating temperature, most of the water evaporates and exits through the crankcase breather.

CHECK ENGINE OIL LEVEL

NOTICE

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

NOTE

Perform engine oil level hot check only with engine oil at normal operating temperature.

1. Check engine oil hot.
 - a. Ride vehicle for more than 5 minutes at mid-range engine speeds or idle for 10 minutes on jiffy stand.
2. Rest bike on jiffy stand.
3. Check oil level.
 - a. See Figure 2-2. Remove filler plug/dipstick.
 - b. Wipe off the dipstick.
 - c. Insert the dipstick and tighten.
 - d. Remove filler plug/dipstick.
 - e. See Figure 2-3. Check oil level range (3). Oil level must register between full hot (1) and add quart (2) marks on the dipstick.

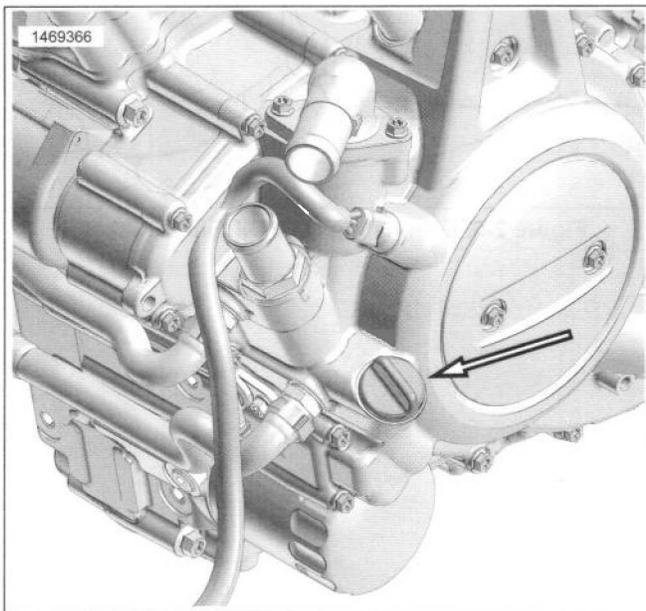


Figure 2-2. Engine Oil Filler Plug/Dipstick

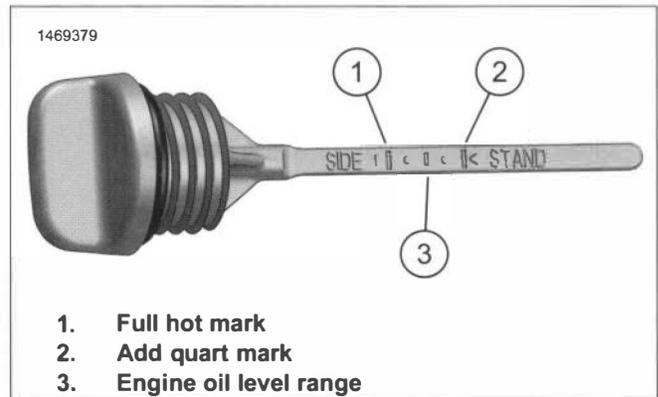


Figure 2-3. Engine Oil Dipstick (Vehicle Sidestand Gauge)
CHANGE OIL AND OIL FILTER

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-52991 | OIL FILTER WRENCH |

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|--------|
| Oil drain plug, engine | 15 ft-lbs | 20 N·m |

⚠ WARNING

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

NOTICE

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

- Change engine oil at the first 1000 mi (1,600 km) for a new engine. After the initial service, change oil at regular intervals in normal service at warm or moderate temperatures. See GENERAL (Page 2-2).
 - Change oil at more frequent intervals in cold weather or severe operating conditions. See FUEL AND OIL (Page 2-5).
1. Run motorcycle until engine is at normal operating temperature. Turn off engine.
 2. Rest bike on jiffy stand.
 3. Remove left side chin spoiler. See CHIN SPOILER (Page 3-69).
 4. Remove filler plug/dipstick.
 5. See Figure 2-4. Remove magnetic oil drain plug (2). Allow oil to drain completely.
 - a. Remove and discard O-ring (1).
 6. Remove oil filter using special tool. Do **NOT** use air tools.

Special Tool: OIL FILTER WRENCH (HD-52991)

- a. Secure oil filter adapter fitting, if needed. See CRANKCASE (Page 4-68).
7. Clean oil filter mount flange.
8. Clean any residual oil on crankcase housing.
9. See Figure 2-5. Install **new** oil filter.
 - a. Lubricate gasket with a thin film of clean engine oil.
 - b. Install new oil filter.
 - c. Hand-tighten oil filter three-quarters of a turn after gasket first contacts filter mounting surface. Do **NOT** use oil filter wrench for installation.
10. See Figure 2-4. Install **new** O-ring (1).
 - a. Lubricate with clean engine oil.
11. Install magnetic oil drain plug (5). Tighten.
Torque: 15 ft-lbs (20 N-m) *Oil drain plug, engine*
12. Install left side chin spoiler. See CHIN SPOILER (Page 3-69).
13. Add an initial volume of engine oil. Refer to Table 2-4.

Table 2-4. Initial Oil Fill

| ITEM | QUANTITY |
|-------------------------|--------------|
| Engine oil initial fill | 3 qt (2.8 L) |

14. Install filler plug/dipstick.
15. Run engine for 10 seconds.
16. Turn off engine and remove filler plug/dipstick.

17. See Figure 2-3. Add only enough oil to bring the level to the add quart mark.
18. Verify proper oil level.
 - a. Start engine and carefully check for oil leaks around drain plug and oil filter.
 - b. Check engine oil level. See Check Engine Oil Level (Page 2-7). in this section.

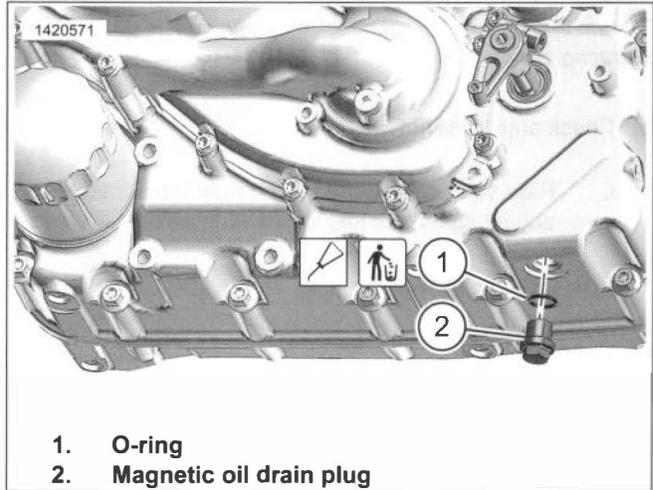


Figure 2-4. Oil Drain Plug

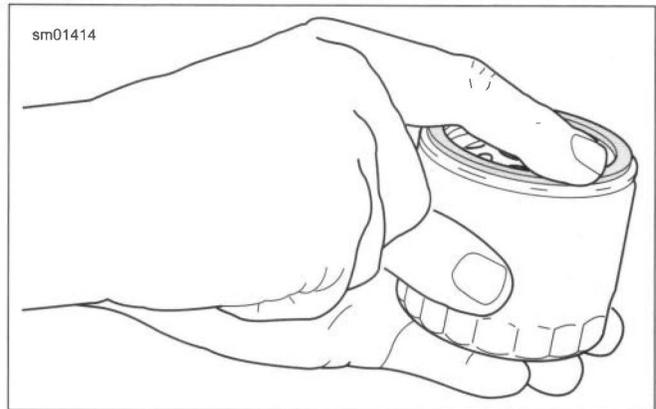


Figure 2-5. Lubricating New Oil Filter Gasket

GENERAL

⚠ 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)

⚠ 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)

NOTE

Tubeless tires are used on all Harley-Davidson cast wheels.

Tire sizes are molded on the tire sidewall. inner tube sizes are printed on the tube.

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 crushes the beads.

TIRES

Tire Pressure

⚠ 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)

Tire pressures should be set using information in Table 2-5 and Table 2-6. Tires are considered Cold Tires if the vehicle has not been recently ridden. The tire pressure increases as the tire warms. Tires can warm due to both riding and high ambient air temperatures. Tires can remain warm for up to 2 hours after riding. For the most accurate reading, check tire pressures with a good gauge before riding while the tires are cold.

Check tire pressure:

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

For Cold Tires with an Ambient Air Temp of 68 °F (20 °C) or less: Refer to Table 2-5.

Table 2-5. Specified Tires

| MODEL | MOUNT | SIZE | SPECIFIED TIRE | PRESSURE COLD | |
|----------------------|-------|-------|--|---------------|---------|
| | | | | psi | kPa |
| RH1250S Sportster® S | Front | 17 in | Dunlop® Harley-Davidson Series GT503 160/70R17 73V | 36 psi | 248 kPa |
| RH1250S Sportster® S | Rear | 16 in | Dunlop® Harley-Davidson Series GT503 180/70R16 77V | 42 psi | 290 kPa |

For Cold Tires with an Ambient Air Temp higher than 68 °F (20 °C): Refer to the first column in Table 2-6 to determine the tire pressure adjustments. For example: If the motorcycle has not been ridden for 2 hours or more and the ambient temperature is 88 °F (31 °C), the recommended front and rear pressures are Table 2-5 pressures plus 2 psi (14 kPa).

Tires warm due to riding which increases the tire pressure. If the vehicle has been recently ridden, refer to the second column in Table 2-6 to determine the tire pressure adjustment. For example: If the motorcycle has been recently ridden and

the ambient temperature is 88 °F (31 °C), the recommended front and rear pressures are the Table 2-5 pressures plus 7 psi (48 kPa).

If a tire pressure adjustment is made when the vehicle has been recently ridden, re-adjust the tire pressure per recommendations when the tires have cooled. Tires can remain warm for up to 2 hours after riding.

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 2-6. Tire Pressure Adjustment

| AMBIENT AIR TEMPERATURE | MOTORCYCLE NOT RIDDEN FOR 2 HOURS OR MORE: ADD TO FRONT AND REAR PRESSURES IN TABLE 1 | MOTORCYCLE RECENTLY RIDDEN: ADD TO FRONT AND REAR PRESSURES IN TABLE 1 |
|--------------------------|---|--|
| 68 °F (20 °C) or less | 0 psi (0 kPa) | 5 psi (34 kPa) |
| 79 °F (26 °C) | 1 psi (7 kPa) | 6 psi (41 kPa) |
| 88 °F (31 °C) | 2 psi (14 kPa) | 7 psi (48 kPa) |
| 99 °F (37 °C) | 3 psi (21 kPa) | 8 psi (55 kPa) |
| 108 °F (42 °C) or higher | 4 psi (28 kPa) | 9 psi (62 kPa) |

Inspecting Tires

⚠ WARNING

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

Check tire tread:

- As part of the pre-ride checklist.
 - At every scheduled service interval.
1. Inspect each tire for punctures, cuts and breaks.

Harley-Davidson tires are equipped with wear bars that run horizontally across the tread.

A tire is considered worn when the wear bars are visible or if only 1/32 in (1 mm) tread depth remains. A worn tire can:

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

See Figure 2-6. Always replace tires before the tread wear bars appear.

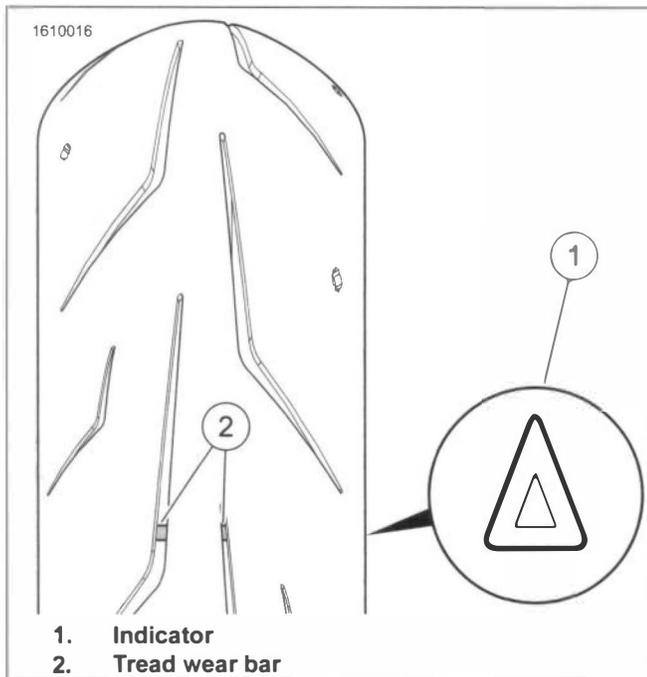


Figure 2-6. Tread Wear Indicator: Dunlop Tires

TIRE REPLACEMENT

⚠ WARNING

Tires are a critical safety component. Contact a Harley-Davidson dealer for tire repair or replacement. Improper tire service can adversely affect stability and handling, which could result in death or serious injury. (00057a)

⚠ WARNING

Harley-Davidson recommends the use of its specified tires. Harley-Davidson vehicles are not designed for operation with non-specified tires, including snow, moped and other special-use tires. Use of non-specified tires can adversely affect stability, handling or braking and lead to loss of vehicle control, which could result in death or serious injury. (00024d)

⚠ 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)

⚠ 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 (129 km/h). Failure to follow this warning could lead to tire failure and result in death or serious injury. (00015b)

⚠ WARNING

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

New tires are needed if any of the following conditions exist (see Tires (Page 2-9) for the specified replacement tires):

- Tread wear bars become visible on the tread surfaces.
- Tire cords or fabric become visible through cracked sidewalls, snags or deep cuts.
- Bumps, bulges or slits in the tire.
- Punctures, cuts, or other damage to the tire that cannot be repaired.

When installing tires on rims, do not rely on tread design to determine direction of rotation. Always be sure the rotational arrows molded into the sidewalls point in the direction of rotation when the vehicle is moving forward.

WHEEL BEARINGS

NOTE

Replace bearings in sets only. See SEALED WHEEL BEARINGS (Page 3-15).

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 hand 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.

GENERAL

Inspect and lubricate the following items according to General (Page 2-3).

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

LUBRICATION POINTS

| CONSUMABLE | PART NUMBER |
|------------------------|-------------|
| HARLEY LUBE | 94968-09 |
| ANTI-SEIZE LUBRICANT | 98960-97 |
| SPECIAL PURPOSE GREASE | 99857-97A |

See Figure 2-7 for general location of lubrication points.

1. **Front brake hand lever:** Use grease on front brake lever pivot screw. See FRONT BRAKE MASTER CYLINDER (Page 3-24).

2. **Steering head bearings:** Lubricate steering head bearings. See ADJUST AND LUBRICATE STEERING HEAD BEARINGS (Page 2-21).

Consumable: SPECIAL PURPOSE GREASE (99857-97A)

NOTE

HARLEY LUBE (94968-09) is formulated to be compatible with the clutch cable lining. Use of other lubricants could damage clutch cable lining.

3. **Clutch cable:** See CLUTCH CONTROL (Page 3-64).

Consumable: HARLEY LUBE (94968-09)

4. **Clutch hand lever:** See CLUTCH CONTROL (Page 3-64).

Consumable: HARLEY LUBE (94968-09)

5. **Jiffy stand:** See INSPECT AND LUBRICATE JIFFY STAND (Page 2-26).

Consumable: ANTI-SEIZE LUBRICANT (98960-97)

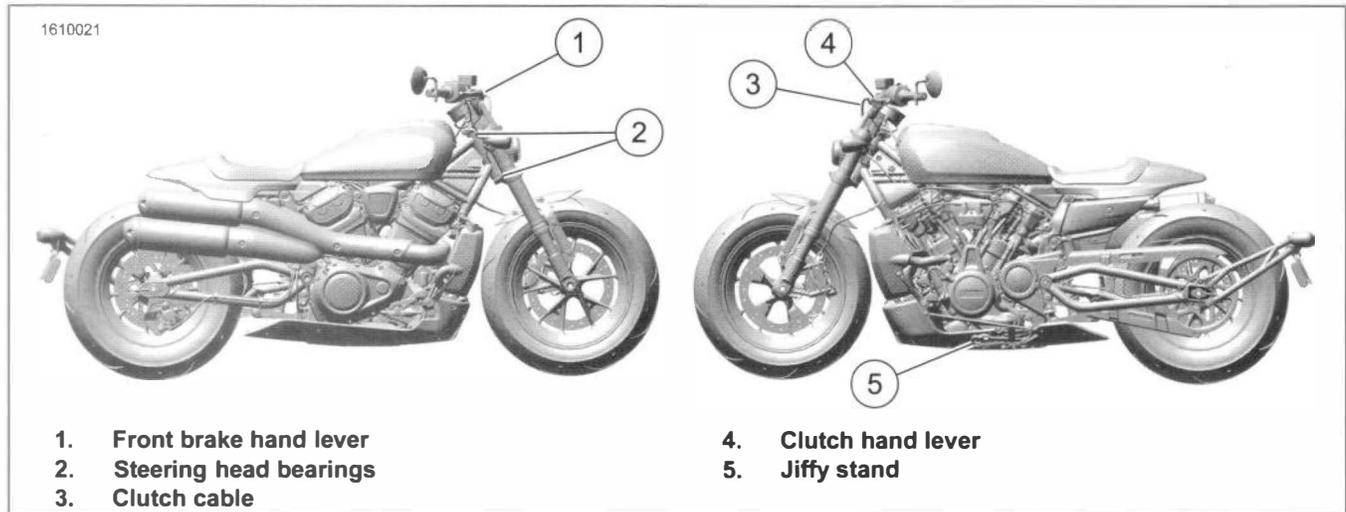


Figure 2-7. Lubrication Points

INSPECT

Brake Pads

Harley-Davidson has provided your new motorcycle with the optimum brake pad friction material available. It is selected to give the best performance possible under dry, wet and high operating temperature conditions. It exceeds all regulatory requirements currently in effect. However, during some braking conditions you may experience noise. This is normal for this friction material.

⚠ WARNING

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

1. Check the brake disc as it spins. The disc should run true in the brake caliper.
2. See Figure 2-8. Measure the thickness of the brake pad friction material.

NOTE

The pads do not necessarily wear evenly. The grooves on the front brake pads are no longer visible when the pads are near the end of service life.

3. Refer to Table 2-7. If the brake pad friction material is at the minimum thickness or less, replace the pads. Always replace brake pads in pairs.

Table 2-7. Brake Specifications

| MINIMUM THICKNESS | mm | in |
|-------------------|------|-------|
| Front brake pads | 0.4 | 0.157 |
| Rear brake pads | 0.45 | 0.018 |
| Front brake discs | 5.4 | 0.213 |
| Rear brake disc | 4.5 | 0.177 |

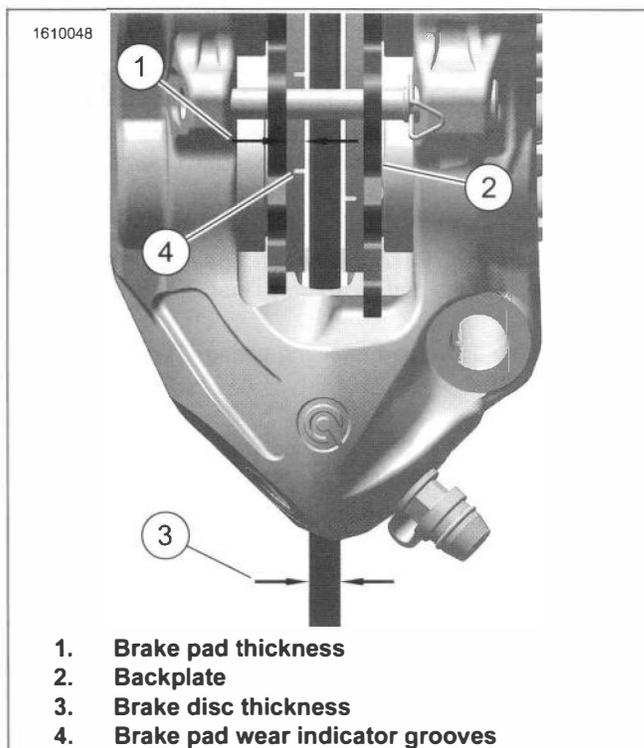


Figure 2-8. Brake Thickness

Brake Disc

1. Refer to Table 2-7. Check brake disc thickness and compare to value indicated in table.
2. Replace if necessary.

REPLACE FRONT BRAKE PADS

| FASTENER | TORQUE VALUE | |
|--|--------------|---------|
| Brake caliper, front, brake pad hanger pin | 44–62 in-lbs | 5–7 N·m |

Remove

1. Remove front caliper. See FRONT BRAKE CALIPER (Page 3-27).
2. See Figure 2-9. Remove retainer clip (1).
3. Remove brake pad hanger pin (4).
4. Remove brake pad spring (3).
5. Remove brake pads (2).
6. Loosen front master cylinder reservoir cap. See CHECK AND REPLACE BRAKE FLUID (Page 2-16).

NOTE

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

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

7. See Figure 2-10. Using the old brake pad and a C-clamp, retract the pistons (7) fully into the caliper (4).

Install

⚠ WARNING

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

1. See Figure 2-10. Position **new** brake pads (5) inside caliper (4) resting brake pad lip (6) on caliper lip (3).
2. Insert **new** brake pad retaining spring (2) on brake pads and caliper.
3. Press down on retaining spring while sliding **new** brake pad hanging pin (8) through caliper holes. Tighten
Torque: 44–62 in-lbs (5–7 N·m) *Brake caliper, front, brake pad hanger pin*
4. Install **new** retainer clip (1).
5. Install caliper. See FRONT BRAKE CALIPER (Page 3-27).
6. Check fluid in the front master cylinder reservoir. Tighten front master cylinder reservoir cap. See CHECK AND REPLACE BRAKE FLUID (Page 2-16).
7. Pump brakes to move pistons out until brake pads contact rotor. Verify piston location against pads. If the front wheel is off the ground, rotate wheel to check for excessive brake pad drag.
8. Recheck front master cylinder reservoir.

⚠ 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)

9. Test brakes. Avoid making hard stops for the first 100 mi (160 km) in order to wear in the brakes properly.
 - a. Turn ignition switch ON. Check operation of rear lamps.
 - b. Test ride motorcycle. If brakes feel spongy, bleed brakes. See BLEED BRAKES (Page 3-43).

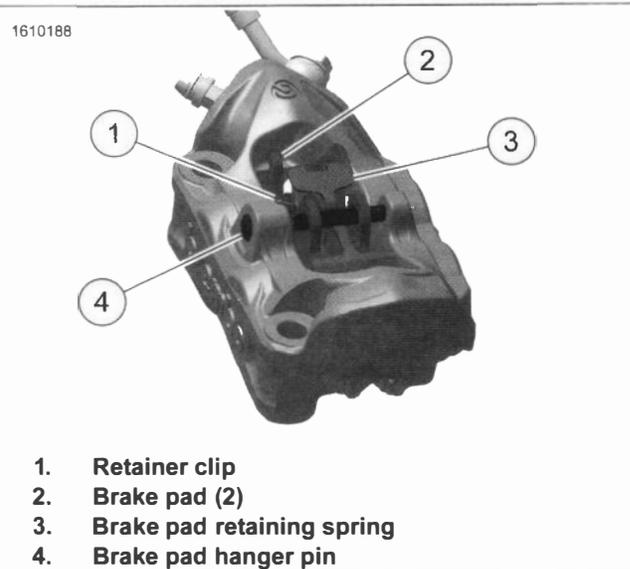


Figure 2-9. Front Caliper Assembled

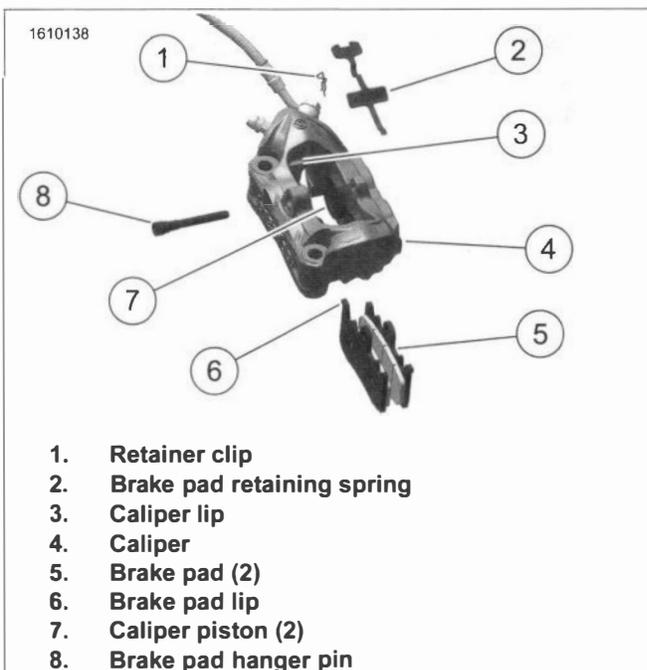


Figure 2-10. Front Brake Pads

REPLACE REAR BRAKE PADS

| FASTENER | TORQUE VALUE | |
|----------------------|---------------|--------------|
| Brake pad hanger pin | 75–102 in-lbs | 8.5–11.5 N·m |

Remove

1. Remove rear caliper. See REAR BRAKE CALIPER (Page 3-32).
2. See Figure 2-11. Remove retainer clips (2).
3. Remove brake pad hanger pin (1).
4. Remove brake pad (3).
5. Loosen rear master cylinder reservoir cap. See CHECK AND REPLACE BRAKE FLUID (Page 2-16).

NOTE

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

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

6. See Figure 2-12. Using the old brake pad and a C-clamp, retract the piston (4) fully into caliper (3).

Install

▲ WARNING

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

1. See Figure 2-12. Position **new** brake pad retaining spring (4) in caliper (1).
2. Slide **new** brake pads (5) into caliper.
3. While holding brake pads, slide **new** brake pad hanger pins (3) through caliper and into brake pads. Tighten.
Torque: 75–102 **in-lbs** (8.5–11.5 N·m) *Brake pad hanger pin*
4. Install **new** retainer clip (2) as shown.
5. Install rear caliper. See REAR BRAKE CALIPER (Page 3-32).
6. Check fluid in the rear master cylinder reservoir. Tighten rear master cylinder reservoir cap. See CHECK AND REPLACE BRAKE FLUID (Page 2-16).
7. Pump brakes to move piston out until brake pads contact rotor. Verify piston location against pads. If the rear wheel is off the ground, rotate wheel to check for excessive brake pad drag.
8. Recheck rear master cylinder reservoir.

▲ 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)

9. Test brakes. Avoid making hard stops for the first 100 mi (160 km) in order to wear in the brakes properly.
 - a. Turn ignition switch ON. Check operation of rear lamps.
 - b. Test ride motorcycle. If brakes feel spongy, bleed brakes. See BLEED BRAKES (Page 3-43).

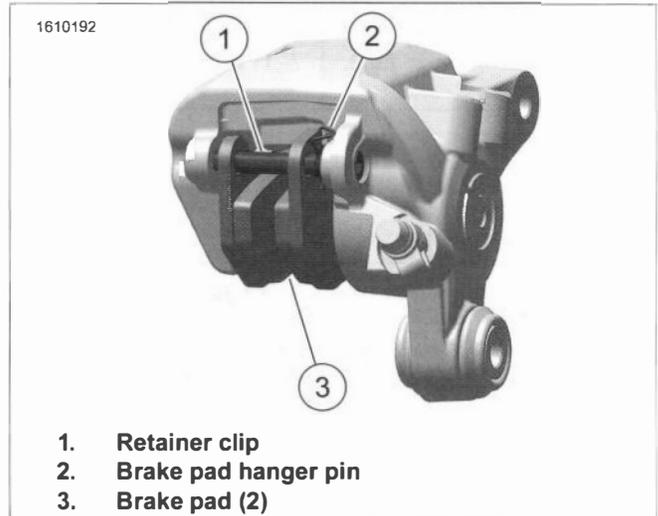


Figure 2-11. Rear Caliper Assembled

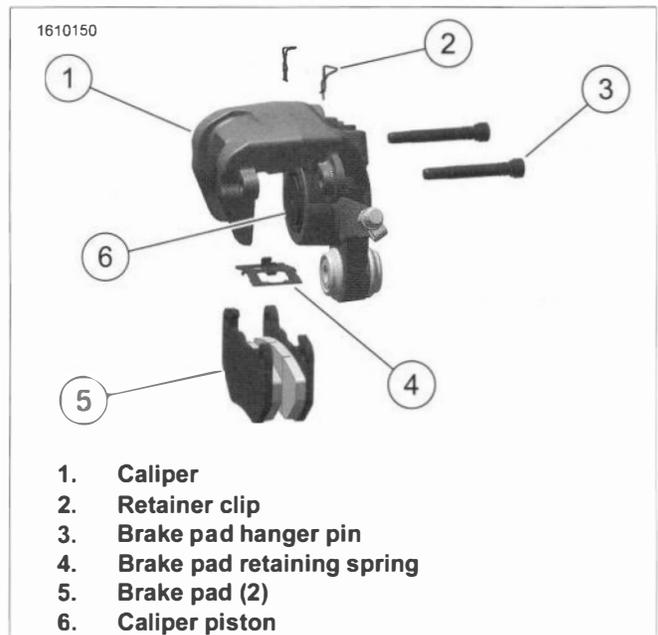


Figure 2-12. Rear Brake Pads

CHECK BRAKE FLUID LEVEL

| PART NUMBER | TOOL NAME |
|-------------|-----------------------------------|
| HD-48497-A | DOT 4 BRAKE FLUID MOISTURE TESTER |

| FASTENER | TORQUE VALUE | |
|--|--------------|-------------|
| Brake master cylinder, front, reservoir cover screws | 7–11 in-lbs | 0.8–1.2 N·m |

| CONSUMABLE | PART NUMBER |
|--|-------------|
| Harley-Davidson Platinum Label DOT 4 Brake Fluid | 41800xxx |

▲ WARNING

Clean reservoir filler cap or cover before removing. Use only DOT 4 brake fluid from a sealed container. Contaminated fluid can adversely affect braking or clutch disengagement, which could result in death or serious injury. (00504d)

▲ WARNING

Contact with DOT 4 brake fluid can have serious health effects. Failure to wear proper skin and eye protection could result in death or serious injury.

- If inhaled: Keep calm, remove to fresh air, seek medical attention.
- If on skin: Remove contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, seek medical attention.
- If in eyes: Wash affected eyes for at least 15 minutes under running water with eye lids held open. If irritation develops, seek medical attention.
- If swallowed: Rinse mouth and then drink plenty of water. Do not induce vomiting. Contact Poison Control. Immediate medical attention required.
- See Safety Data Sheet (SDS) for more details available at sds.harley-davidson.com

(00240e)

NOTICE

DOT 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. (00239c)

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)

NOTE

- At every service, check moisture content of fluid using DOT 4 BRAKE FLUID MOISTURE TESTER (PART NUMBER: HD-48497-A). Follow the instructions included with tool.

- Flush brake system and replace Harley-Davidson Platinum Label DOT 4 Brake Fluid (41800xxx) fluid every two years or sooner if brake fluid test shows moisture content is 3% or greater.
- Fluid should never need to be added or removed from the system during normal wear, except for fluid replacement as specified in the maintenance schedule.
- Fluid level in reservoir will decrease with brake wear. Reservoir volume is adequate to provide fluid to the wear limits of the pads and rotors.

1. Set motorcycle upright. Verify that the fluid in the reservoir is level. See Secure the Motorcycle for Service (Page 2-2).

2. **Front master cylinder reservoir:** See Figure 2-13.

- a. Remove screws (1).
- b. Remove cover (2).
- c. Check fluid level is above minimum mark (4) on side of reservoir (3).
- d. If fluid is low, fill to appropriate level.
- e. Install cover (2).
- f. Install screws (1). Tighten.

Torque: 7–11 **in-lbs** (0.8–1.2 N·m) *Brake master cylinder, front, reservoir cover screws*

3. **Rear master cylinder reservoir:** See Figure 2-14.

- a. Remove cover (1).
- b. Check fluid level is above minimum mark (3) on side of reservoir (2).
- c. If fluid is low, fill to appropriate level.
- d. Install cover. Hand tighten.

4. If fluid level was below minimum mark:

- a. Check for brake system fluid leaks.
- b. Check that brake pads and rotors are properly installed and not worn beyond service wear limits. See INSPECT BRAKES (Page 2-13).

5. Verify front brake hand lever and rear brake foot pedal have a firm feel when applied. If brakes are not firm, the brake system must be bled. See BLEED BRAKES (Page 3-43).

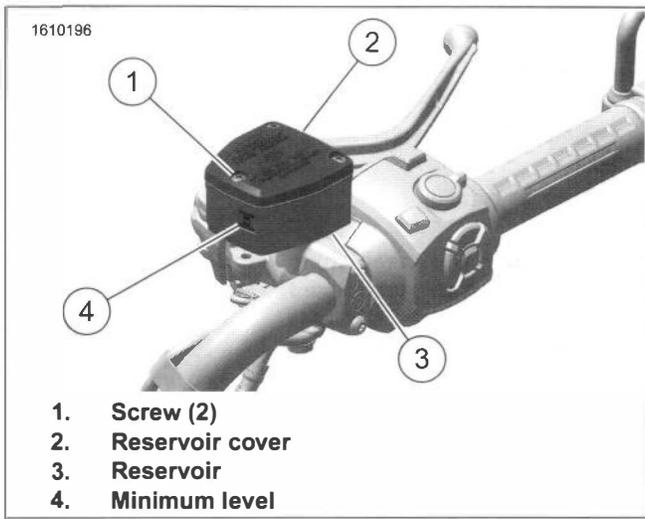


Figure 2-13. Front Master Cylinder Reservoir

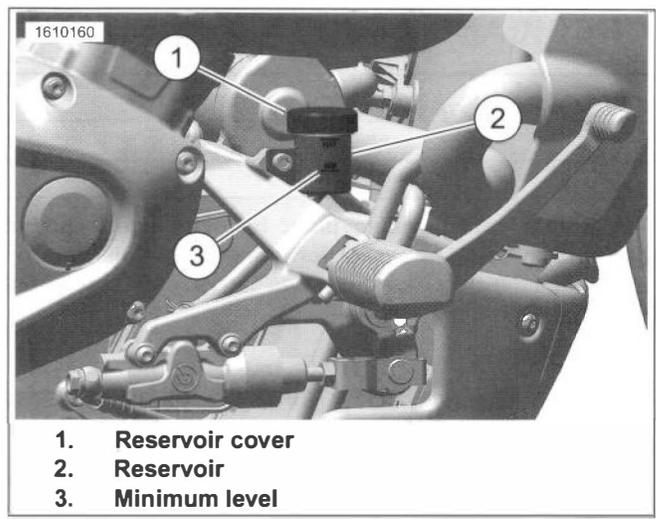


Figure 2-14. Rear Master Cylinder Reservoir

DRAIN AND REPLACE FLUID

For this scheduled maintenance procedure, see BLEED BRAKES (Page 3-43).

INSPECT BRAKE LINES

Inspect brake lines for leaks, contact or abrasion.

Table 2-8. Brake Line Inspection

| LINE TYPE | INSPECTION | REMEDY |
|---|--|--------------|
| Steel lines | No marks | Okay/Monitor |
| | Slight mark in paint or plating* | |
| | Copper colored-paint/plating worn off* | |
| | Silver colored base material-no noticeable feel of wear* | Replace |
| | Silver colored base material-noticeable feel of wear* | |
| Brake fluid leak or other damage | | |
| Flexible lines | No marks | Okay/Monitor |
| | Slight dent in protective cover or flattening of ribs* | Replace |
| | Worn through protective cover or to bottom of ribs | |
| | Brake fluid leak or other damage | |
| Protective cover (steel, rubber, plastic or braided) | No marks | Okay/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.

CHECK AND ADJUST

NOTICE

The clutch control cable must be oiled and adjusted periodically to compensate for lining wear. Failure to oil and adjust the clutch control cable can result in equipment damage. (00203c)

NOTE

Perform maintenance more frequently in severe riding conditions. This includes extreme temperatures, dusty environments, mountainous or rough roads, long storage conditions, short runs or heavy stop/go traffic.

If the clutch slips under load or drags when released, the control cable may need to be adjusted or clutch service may need to be performed. If clutch service is needed see CLUTCH (Page 5-12).

The clutch lever should move smoothly through its full range.

Clutch cable at clutch lever check:

1. Check with engine cold.
2. Rotate front wheel straight ahead.
3. See Figure 2-15. Slide clutch boot (1) back.
4. Operate the clutch lever (3) 3-4 times.
5. Check free play (5) specification. Refer to Table 2-9.
 - a. Pull clutch cable straight out from hand lever.
 - b. Measure gap between adjuster (2) and the shoulder of the metal ferrule on the cable sheathing.
6. If not within specification adjust clutch cable at clutch lever.

Clutch cable adjustment at clutch lever:

1. Engine should be cold.
2. Rotate front wheel straight ahead.
3. See Figure 2-15. Slide clutch boot (1) back.
4. Operate clutch lever (3) 3-4 times assuring cable is properly seated.
5. Loosen adjuster lock (4).

NOTE

Do not turn the adjuster past the point where no gap is achieved, this could pre-lift the clutch.

6. Pull clutch cable straight out from hand lever, turn adjuster (2) counter-clockwise until it just makes contact with the shoulder of the metal ferrule on the cable sheathing.
7. Turn adjuster clockwise 2 full turns.

8. Tighten adjuster lock and recheck clutch specification. Refer to Table 2-9.

9. Reinstall boot.

Clutch cable adjustment when replacing clutch cable or Inline adjuster has been moved:

1. Engine should be cold.
2. Rotate front wheel straight ahead.
3. See Figure 2-15. Slide clutch boot (1) back.
4. Operate clutch lever (3) 3-4 times assuring cable is properly seated.
5. Loosen adjuster lock (4).

NOTE

Do not turn the adjuster past the point where no gap is achieved, this could pre-lift the clutch.

6. Turn adjuster (2) clockwise until adjuster bottoms out.
7. Turn adjuster counterclockwise 3 full turns.
8. Tighten adjuster lock.
9. See Figure 2-16. Remove inline adjuster (4) from cable holder (2).
10. Slide boot (1) back.
11. Loosen adjuster lock (3).
12. Adjust inline adjuster until there is no gap in the clutch lever.
13. Tighten inline adjuster lock.
14. Slide boot (1), covering clutch adjuster.
15. Place in cable holder.
16. Perform **Clutch cable adjustment at clutch lever** in this procedure.

Table 2-9. Clutch Lever Gap

| MODEL | MM | IN |
|------------|---------|---------------|
| All Models | 1.0-2.0 | 0.0394-0.0787 |

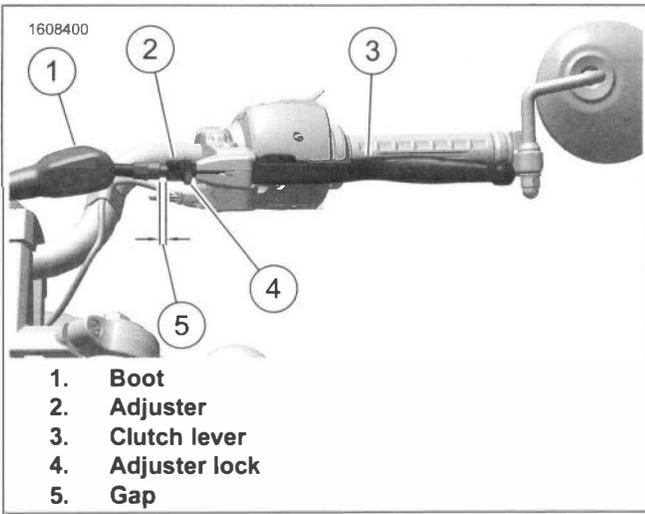


Figure 2-15. Clutch Lever Adjustment

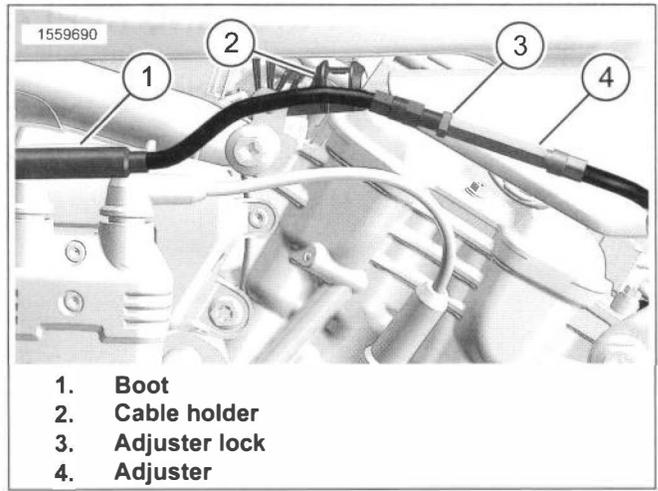


Figure 2-16. Inline Clutch Adjuster

REBUILD AND REPLACE FORK OIL

For this scheduled maintenance procedure, see FRONT FORK
(Page 3-49)

PREPARE

1. Move forks from stop to stop to check for smooth operation. Rough operation indicates damaged bearings. See STEERING HEAD (Page 3-55)

CHECK AND ADJUST

| FASTENER | TORQUE VALUE | |
|----------------------------------|---------------|---------------|
| Fork bracket, upper pinch screws | 15–18 ft-lbs | 20.4–25 N·m |
| Fork stem pinch screw | 15–18 ft-lbs | 20.4–25 N·m |
| Instrument cluster screw | 91–101 in-lbs | 10.3–11.4 N·m |

Measure:

1. Have a helper position motorcycle vertical with steering straight.
2. Measure fork angle.
 - a. Measure fork angle on a vertical bike (steering straight).
 - b. Raise motorcycle. See Secure the Motorcycle for Service (Page 2-2)
 - c. Make sure the fork angle is the same lifted as it was on the ground.
 - d. Use a suitable cell phone app or angle finder accurate within a degree or two.
3. Perform test.
 - a. Move handlebars from left to right steering stops three times, ending at full left steering stop.
 - b. Using a 0-25 lbs pull force scale with a peak hold feature, pull from the inside diameter of the front axle until the front end is straight.

NOTE

See Figure 2-17. While pulling, keep scale parallel to front tire and perpendicular to fork leg.

Be sure to pull slowly without tugging the scale.

- c. Repeat steps a and b until the peak force value becomes consistent.
4. If peak force value is not within specification, adjust the fork stem screw. Refer to Table 2-10.

Adjust:

1. See Figure 2-18. Loosen upper fork bracket pinch screws (1).
2. See Figure 2-19. Remove screws (1) and instrument cluster (2).

3. Loosen fork stem pinch screw (4).
4. Adjust fork stem screw (3).
 - a. If pull force dimension is more than the maximum, loosen the fork stem screw.
 - b. If pull force dimension is less than the minimum, tighten the fork stem screw.
5. Tighten fork stem pinch screw.
Torque: 15–18 ft-lbs (20.4–25 N·m) *Fork stem pinch screw*
6. See Figure 2-18. Tighten upper fork bracket pinch screws (1).
Torque: 15–18 ft-lbs (20.4–25 N·m) *Fork bracket, upper pinch screws*
7. Repeat measure and adjust as needed.
8. See Figure 2-19. Install instrument cluster (2). Secure with screws (1). Tighten.
Torque: 91–101 in-lbs (10.3–11.4 N·m) *Instrument cluster screw*

Table 2-10. Pull Force Specifications

| MODEL | MINIMUM | MAXIMUM |
|-------|---------|---------|
| ALL | 7 | 10 |

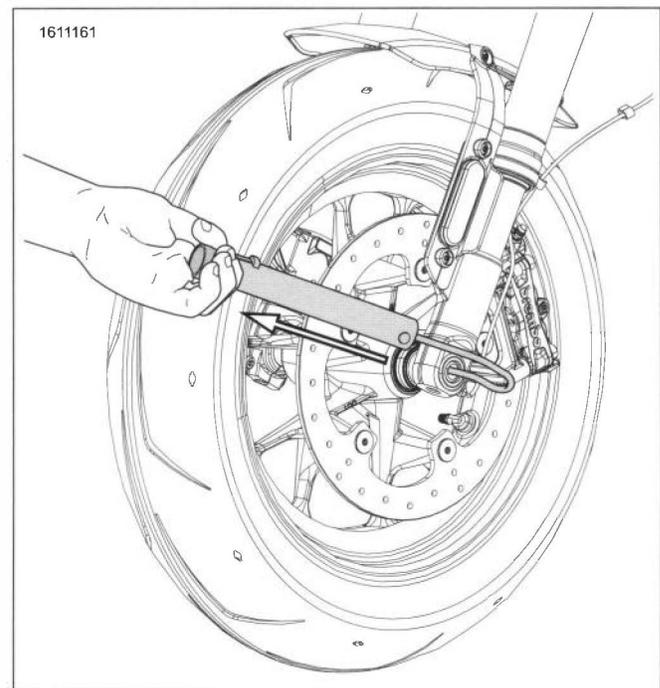
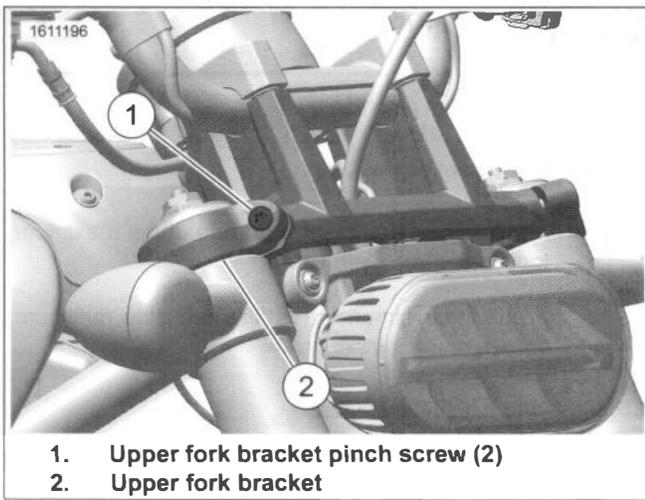
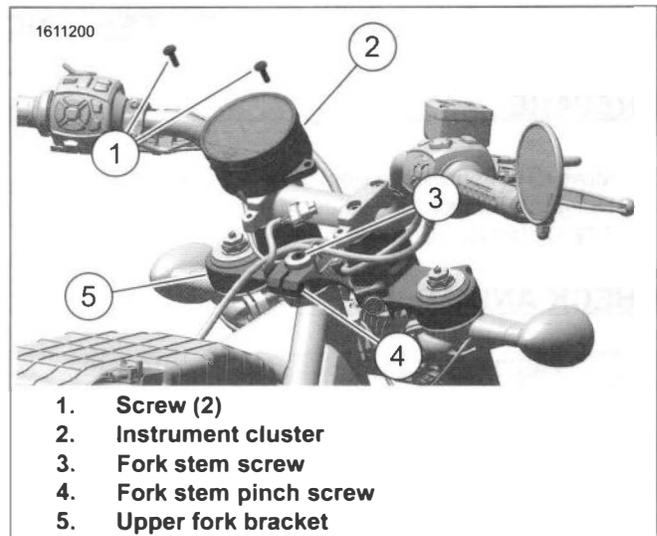


Figure 2-17. Pull Force Orientation



1. Upper fork bracket pinch screw (2)
2. Upper fork bracket

Figure 2-18. Upper Fork Bracket



1. Screw (2)
2. Instrument cluster
3. Fork stem screw
4. Fork stem pinch screw
5. Upper fork bracket

Figure 2-19. Fork Stem Screw

LUBRICATE

| CONSUMABLE | PART NUMBER |
|------------------------|-------------|
| SPECIAL PURPOSE GREASE | 99857-97A |

Disassemble the steering head assembly and lubricate the tapered roller bearings with SPECIAL PURPOSE GREASE (99857-97A). See STEERING HEAD (Page 3-55).

COMPLETE

Lower motorcycle.

GENERAL**General****NOTICE**

Use only Genuine Harley-Davidson Extended Life Antifreeze and Coolant. Use of other coolants/mixtures may lead to motorcycle damage. (00179c)

GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE AND COOLANT is pre-diluted and ready to use full strength. It provides temperature protection to -34.0 °F (-36.7 °C). DO NOT add water.

NOTICE

De-ionized water must be used with the antifreeze in the cooling system. Hard water can cause scale accumulation in water passages which reduces cooling system efficiency, leading to overheating and motorcycle damage. (00195b)

⚠ WARNING

Do not loosen or remove pressure cap when cooling system is hot. The cooling system is under pressure and hot coolant and steam can escape from pressure cap, which could cause severe burns. Allow motorcycle to cool before servicing the cooling system. (00091c)

If GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE AND COOLANT is unavailable, a mixture of de-ionized water and ethylene glycol-based antifreeze may be used. At the first opportunity, change back to GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE AND COOLANT.

Checking Coolant Level

1. Position vehicle on level ground resting on the jiffy stand.
2. Allow motorcycle to cool.
3. See Figure 2-20. Remove coolant plug/dipstick.
4. See Figure 2-21. Check that coolant level is at the "MAX" line (2).

NOTE

If the coolant reservoir is low when the motorcycle is cold, inspect the system for leaks. Repair as needed. Fill system with coolant and purge any trapped air. See COOLANT (Page 7-7).

5. If level is below "MIN" line (1), add GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE AND COOLANT until fluid level reaches the "MAX" line (2).
6. See Figure 2-20. Install coolant reservoir plug/dipstick.

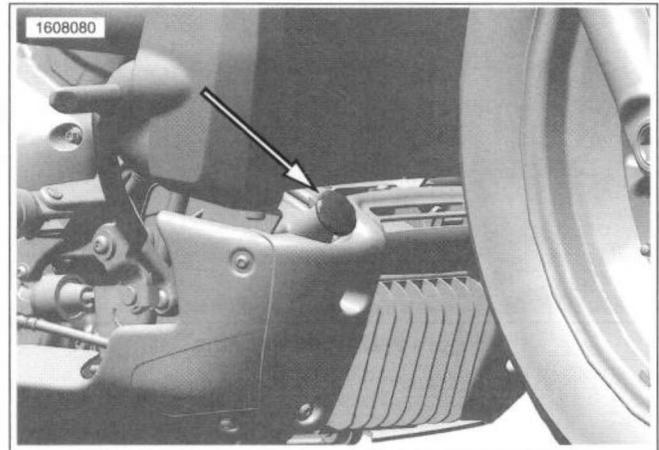
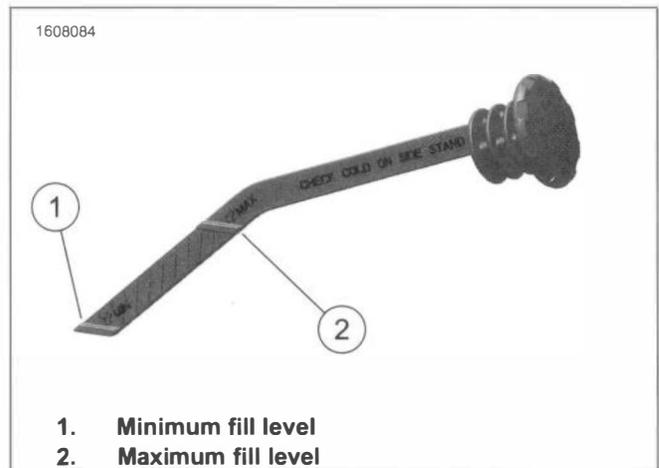


Figure 2-20. Coolant Filler Cap/Dipstick



1. Minimum fill level
2. Maximum fill level

Figure 2-21. Coolant Filler Cap/Dipstick

CLEAN RADIATOR**⚠ CAUTION**

At operating temperature, radiators and oil coolers contain hot fluids. Contact with a radiator or oil cooler can result in minor or moderate burns. (00141b)

NOTICE

Using a pressure washer to clean radiators or oil coolers can damage cooling fins and reduce airflow. Reduced airflow can lead to overheating, resulting in motorcycle damage. (00056c)

NOTICE

Clean the inlet surface of the radiator regularly. Leaves and other debris can collect on the radiator surface and degrade radiator performance which could lead to overheating and motorcycle damage. (00197d)

1. See Figure 2-22. Clean debris from radiator fins.

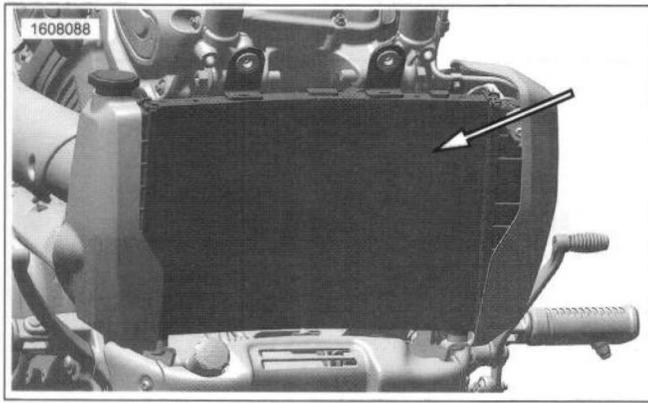


Figure 2-22. Radiator Fins

INSPECT

Check Freeze Point

For this scheduled maintenance procedure, see DIAGNOSE AND TEST (Page 7-4).

Check for leaks

For this scheduled maintenance procedure, see DIAGNOSE AND TEST (Page 7-4).

DRAIN AND FILL COOLING SYSTEM

For this scheduled maintenance procedure, see COOLANT (Page 7-7).

INSPECT

FUEL LINE (Page 6-10)

For this scheduled maintenance procedure, see

PREPARE

1. Set motorcycle upright. See Secure the Motorcycle for Service (Page 2-2).

INSPECT AND LUBRICATE

| CONSUMABLE | PART NUMBER |
|----------------------|-------------|
| ANTI-SEIZE LUBRICANT | 98960-97 |

1. See Figure 2-23. Verify that jiffy stand (3) swings freely to fully extended and retracted positions.
2. Inspect parts for wear or damage. Replace as necessary. See JIFFY STAND (Page 3-80).
3. Inspect bumper (2) for looseness. Replace as necessary.
4. Lubricate pivot pin (1) and spring hooks (4).
Consumable: ANTI-SEIZE LUBRICANT (98960-97)

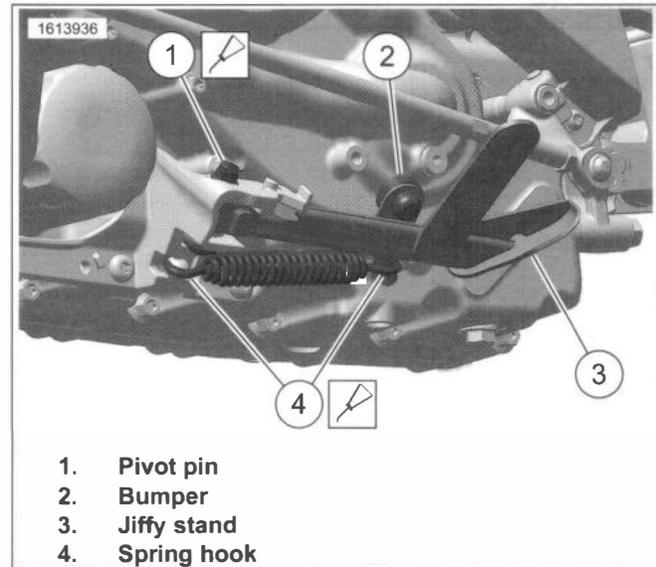


Figure 2-23. Jiffy Stand Lubrication Points

COMPLETE

1. Remove motorcycle from upright. See Secure the Motorcycle for Service (Page 2-2).

INSPECT

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.

Sprockets

1. See Figure 2-24. Inspect each tooth (1) of rear sprocket for:
 - a. Major tooth damage
 - b. Large chrome chips with sharp edges
 - c. Gouges caused by hard objects
 - d. Excessive loss of chrome plating (see next step)
2. Check for worn chrome plating. Drag a sharp object across the bottom of a groove (2) using medium pressure.
 - a. If sharp object slides across groove without digging in or leaving a visible mark, chrome plating is still good.
 - b. If sharp object digs in and leaves a visible mark, it is cutting the bare aluminum. The chrome plating is worn.
3. Replace rear sprocket if major tooth damage or loss of chrome exists.

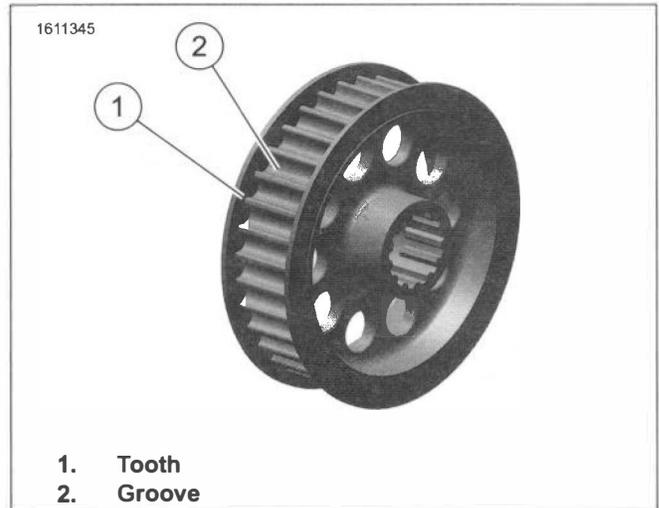


Figure 2-24. Rear Sprocket

Drive Belt

See Figure 2-25 and Table 2-11 Inspect drive belt for:

- Cuts or unusual wear patterns
- Outside bevel wear (8). Some beveling is common, but it indicates that sprockets are misaligned
- Outside ribbed surface for signs of stone damage (7). If cracks or other damage exists near edge of belt, replace belt immediately. Damage to center of belt eventually requires belt replacement. 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). 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.

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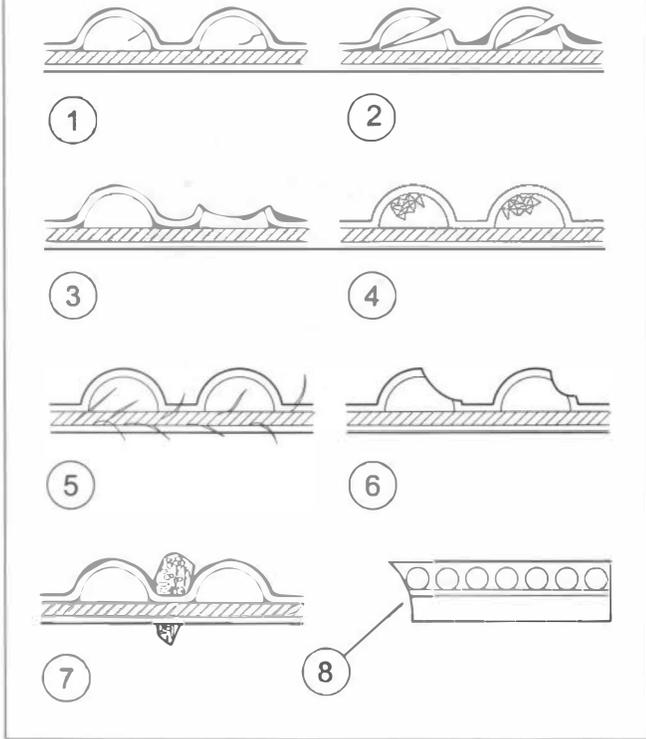


Figure 2-25. Drive Belt Wear Patterns

Table 2-11. Drive Belt Wear Analysis

| NO. * | 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. |

* See Figure 2-25

MEASURE DRIVE BELT DEFLECTION

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

| FASTENER | TORQUE VALUE | |
|--------------------------|--------------|-------------|
| Belt guard, lower, screw | 49–66 in-lbs | 5.5–7.5 N·m |

NOTE

Always use the required special tool to measure belt deflection. Failure to use tension gauge may cause under-tensioned belts. Loose belts can fail due to "ratcheting" (jumping a tooth) which causes tensile cord crimping and breakage.

Check belt deflection:

- With transmission in neutral.
- With motorcycle at ambient temperature.

- With motorcycle upright or on jiffy stand with rear wheel on the ground.
- With the vehicle unladen, no rider and no luggage.

▲ WARNING

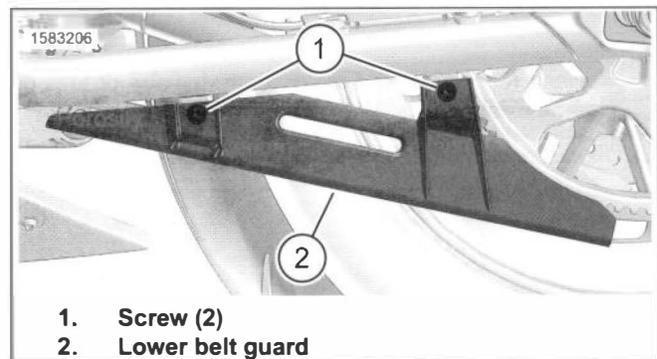
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. See Figure 2-26. Remove lower belt guard.
 - a. Remove screws (1) and lower belt guard (2).
3. See Figure 2-27. Measure belt deflection using:

Special Tool: BELT TENSION GAUGE (HD-35381-A)

 - a. Slide O-ring (4) to zero mark (3).
 - b. Fit belt cradle (2) against bottom of drive belt halfway between drive pulleys.
 - c. Press upward on knob (6) until O-ring slides down to 10 lb (4.54 kg) mark (5) and hold steady.
4. See Figure 2-28. Measure amount of deflection (4) while holding gauge steady.
5. Compare with specifications. Refer to Table 2-12. If not within specification, see ADJUST BELT, which follows.
6. See Figure 2-26. Install lower belt guard.
 - a. Place lower belt guard (2) in position.
 - b. Install screws (1). Tighten.

Torque: 49–66 in-lbs (5.5–7.5 N·m) *Belt guard, lower, screw*
7. Install main fuse. See POWER DISCONNECT (Page 8-4).



1. Screw (2)
2. Lower belt guard

Figure 2-26. Lower Belt Guard

Table 2-12. Drive Belt Deflection

| MODEL | DEFLECTION | |
|-------------------------------------|------------|---------|
| Service belt tension ⁽¹⁾ | 1/4-5/16 | 6.4-7.9 |

(1) Deflection measured at 10 lb (4.5 kg) tension.

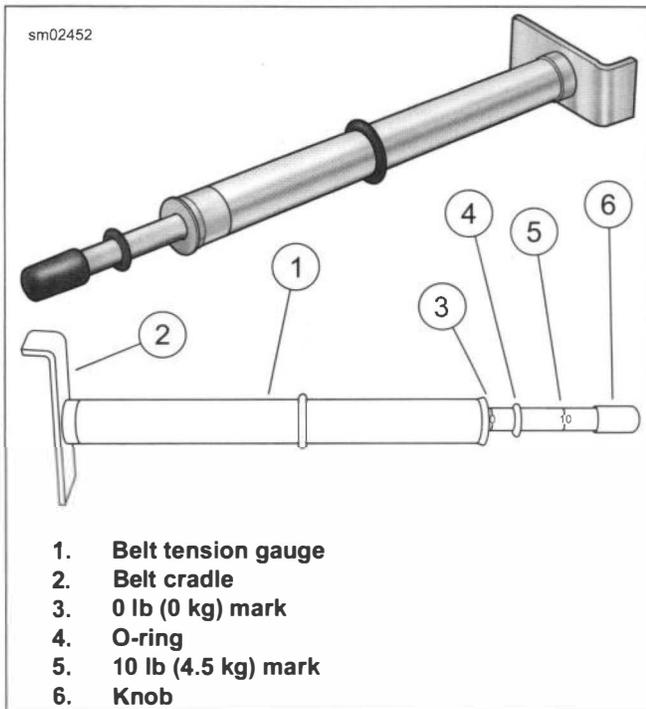


Figure 2-27. Belt Tension Gauge

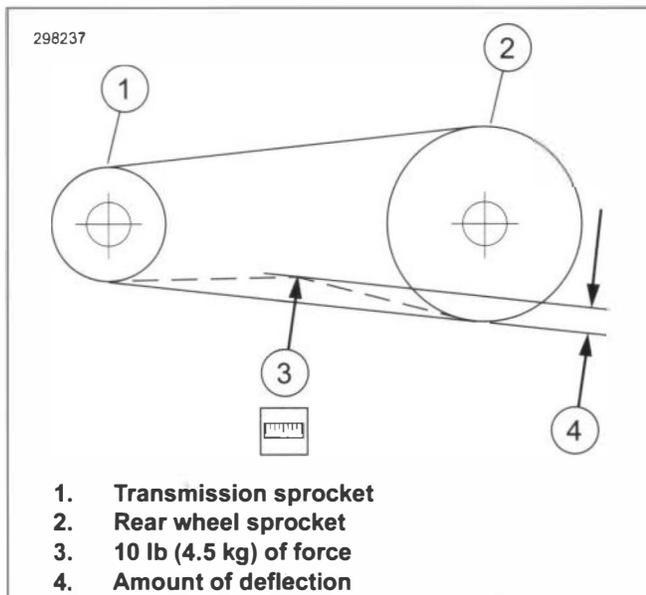


Figure 2-28. Checking Belt Deflection

ADJUST BELT

| FASTENER | TORQUE VALUE | |
|----------------|---------------|-------------|
| Axle nut, rear | 95–105 ft-lbs | 129–142 N·m |

NOTE

Turn both adjuster nuts same number of turns in order to maintain approximate alignment of rear wheel. Proper belt tracking must place the outside of the belt even with the outside of the pulley to center of pulley. The axle may need to be adjusted so the wheel alignment measurements are not exact from left to right side.

1. See Figure 2-29. Adjust belt deflection.
 - a. Loosen axle nut (3).

NOTE

Do not remove E-clip when loosening axle nut.

- b. Turn adjuster nuts (1) on either side clockwise to decrease belt deflection (increase tension), or counterclockwise to increase belt deflection (decrease tension).
 - c. Measure belt deflection until specification is achieved. Refer to Table 2-13.
 - d. Tighten axle nut (3).
Torque: 95–105 ft-lbs (129–142 N·m) *Axle nut, rear*
2. Check rear wheel alignment.
 - a. Lift motorcycle. See Secure the Motorcycle for Service (Page 2-2).
 - b. See Figure 2-30. Spin rear wheel in normal direction of rotation while observing drive belt (1) alignment.
 - c. If belt is tracking outside of pulley (2) or tracking on inside lip of pulley, adjust wheel.
3. Adjust wheel alignment.
 - a. See Figure 2-29. Loosen axle nut (3).

NOTE

Do not remove E-clip when loosening axle nut.

- b. Turn right side adjuster nut (1) slightly verifying axle moves when turning nut.
 - c. See Figure 2-30. Observe drive belt (1) alignment while spinning wheel in normal direction of rotation.
 - d. Verifying belt is moving in the correct alignment direction on pulley (2), if not move nut other way.
 - e. Continue until belt is centered in pulley.
 - f. Tighten axle nut (3).
Torque: 95–105 ft-lbs (129–142 N·m) *Axle nut, rear*
4. Verify drive belt deflection.

⚠ 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)

5. Check wheel bearing end play. See SEALED WHEEL BEARINGS (Page 3-15).

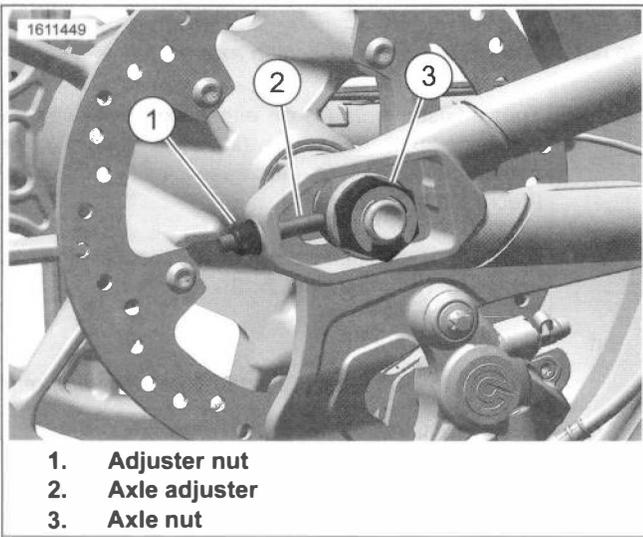


Figure 2-29. Axle Adjuster

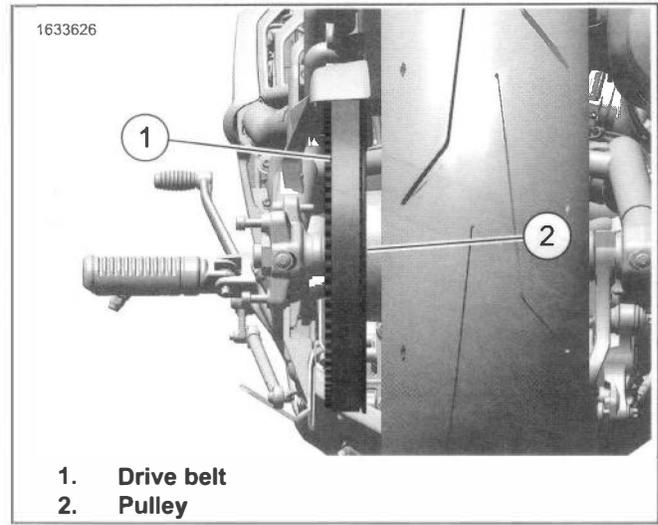


Figure 2-30. Drive Belt Alignment

Table 2-13. Drive Belt Deflection

| MODEL | DEFLECTION | |
|---|------------|---------|
| Service belt tension ⁽¹⁾ | 1/4-5/16 | 6.4-7.9 |
| <i>(1) Deflection measured at 10 lb (4.5 kg) tension.</i> | | |

INSPECT

1. Support vehicle in an upright position in neutral. Do not lift the wheels off the ground.
2. See Figure 2-31. Hang a weighted string (1) on left axle spacer without touching the drive belt.
3. Place masking tape on lower part of sprocket where marks will be drawn.

4. **NOTE**

Do not allow rear wheel to rotate when rotating sprocket. A false measurement will occur.

Rotate rear sprocket by hand in one direction until it stops.

5. While holding sprocket in place, mark masking tape in line with the string.
6. Rotate rear sprocket in opposite direction until it stops.
7. While holding sprocket in place, make second mark in line with the string.
8. Measure distance (2) between marks. If measurement exceeds distance allowed, replace rubber isolator.

0.24 in (6 mm)

NOTE

Visually inspect components when disassembled. See REAR WHEEL COMPENSATOR (Page 3-13) to replace rear wheel compensator.

- *Excessive play in compensator components is caused by deteriorated rubber segments.*
- *Wear on the raised "nubs" or small amounts of rubber debris are normal. This type of wear does not indicate a worn out isolator.*

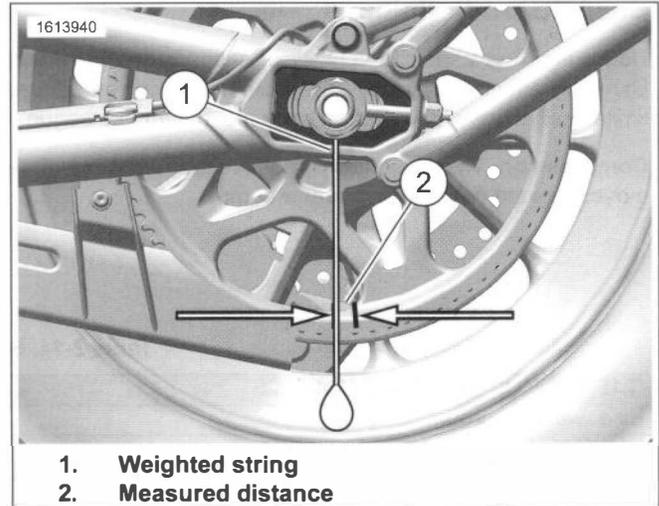


Figure 2-31. Check Compensator Wear

SUSPENSION ADJUSTMENTS

Damping is set at the factory for the average solo rider under normal riding conditions. The rider may make adjustments to compensate for individual riding styles and varying road conditions.

Evaluating and changing the rebound and compression damping is a very subjective process with many variables and should be approached carefully.

Suspension Definitions

Damping: Resistance to velocity of suspension movement. Damping affects how easily the suspension can move and limits oscillations of the system once movement has begun.

Compression: The suspension is compressed when the wheel moves upward (when riding over a bump).

Rebound: The suspension is rebounding when it is moving back from being compressed (rebounding to the road surface after a bump).

Preload: An adjustment made to the rear shock and front fork springs to limit vehicle and rider sag to a standard percentage of total suspension travel.

Suspension Tuning

Make all suspension adjustments in small increments. Radical setting changes may cause you to skip the best adjustment.

Refer to Table 2-14. Possible suspension and operating characteristics and their probable causes are listed. This table is helpful in keeping your motorcycle in good operating condition.

To achieve the proper settings you will need the preload properly adjusted, the tires properly inflated and a familiar bumpy road. It is useful if the road contains a variety of different kinds of bumps from small sharp bumps such as potholes or frost heaves to large cracks.

Table 2-14. Suspension Tuning

| SUSPENSION CHARACTERISTICS | SOLUTION |
|---|-------------------------------|
| Bike wallows through turns. | Increase rebound damping. |
| Bike feels loose or vague after bumps. | |
| Wheel tends to "pogo" or suffer continuous bouncing after passing a bump. This is often noticeable by watching the bike as it travels over bumps. | |
| Wheel responds to bump but doesn't return to ground quickly after bumps. This is more pronounced over a series of bumps and is often referred to as "packing down." | Reduce rebound damping. |
| Bike bottoms in dips or while cornering. | Increase compression damping. |
| Bike has excessive brake dive. | |
| Harsh ride, particularly over washboard surfaces. | Reduce compression damping. |
| Bumps transfer through handlebars or seat. | |
| Suspension seems not to respond to bumps. Tires chatter through corners or rider is jolted over rough roads. | |

Changes in Load

The front and rear preload setting will need to be adjusted for the rider's weight and cargo. This adjustment should be made before the motorcycle is ridden any distance and after changing the overall vehicle weight (adding saddlebags, etc.).

Changes in the load carried requires changes in the preload settings. Carrying less weight than was used for setting up the suspension requires decreasing the amount of preload. Increasing the load carried requires adding more preload.

FRONT FORK

NOTICE

Compression and rebound adjusting valves may be damaged if too much force is used at either end of the adjustment range. (00237a)

NOTE

Do not force adjusters beyond mechanical stops.

Compression Damping Adjustment

See Figure 2-32. The compression adjuster (2) screw is located on the top of the right side fork tube.

1. Turn compression adjuster screw clockwise until it stops. This is the maximum compression damping setting.
2. Turn compression adjuster screw counter-clockwise the recommended number of turns. Refer to Table 2-17.

Rebound Damping Adjustment

See Figure 2-32. The rebound adjuster (3) screw is located on the top of the left side fork tube.

1. Turn rebound adjuster screw clockwise until it stops. This is the maximum rebound damping setting.
2. Turn rebound adjuster screw counter-clockwise the recommended number of turns. Refer to Table 2-17.

Spring Preload

See Figure 2-32. The preload adjuster (1) is located on the top of each fork tube.

1. Turn preload adjuster counter-clockwise until it stops. This is the minimum preload setting.

2. Calculate front preload settings.
 - a. **Rider:** Refer to Table 2-15 for required rider preload adjustment. Note required adjustment.
 - b. **Passenger or cargo:** Refer to Table 2-16 for required passenger and cargo preload. Note required adjustment.
 - c. Add rider and passenger/cargo preload amounts together to get final adjustment setting.
3. Adjust front preload settings. Turn preload adjuster clockwise the calculated number of turns.

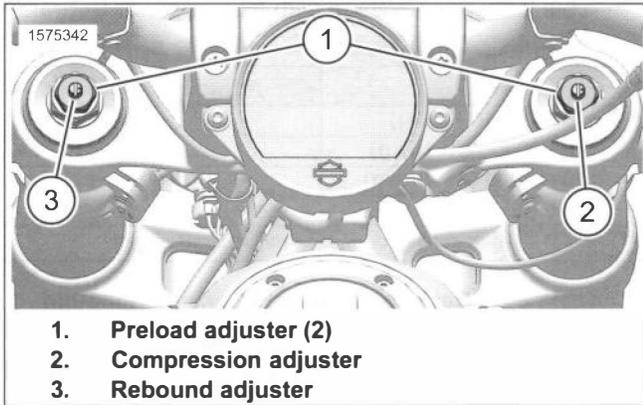


Figure 2-32. Front Suspension Adjusters

Table 2-15. Front Preload Suspension Settings

| RIDER WEIGHT kg/lb | FRONT FORKS Turns from Minimum ⁽¹⁾ |
|-------------------------|--|
| < 150 lb (68 kg) | 0 |
| 150–170 lb (68–77 kg) | 2 |
| 170–190 lb (77–86 kg) | 5 |
| 190–210 lb (86–95 kg) | 9 |
| 210–230 lb (95–104 kg) | 12 |
| 230–250 lb (104–113 kg) | 15 |
| 250–270 lb (113–122 kg) | 15 |
| 270–290 lb (122–132 kg) | 15 |
| 290 lb (132 kg) to GVWR | 15 |

(1) Number of clockwise turns from minimum preload setting.

Table 2-16. Front Preload with Passenger or Cargo

| PASSENGER or CARGO kg/lb | FRONT FORKS Additional Turns ⁽¹⁾ |
|-----------------------------|--|
| 0–50 lb (0–23 kg) | +0 |
| 50–100 lb (23–45 kg) | +0 |
| 100–150 lb (45–68 kg) | +0 |
| 150 lb (68 kg) to GVWR | +0 |

(1) Add to the turns required for rider weight.

Table 2-17. Front Forks Compression and Rebound

| RIDE SETTING | FRONT FORKS ⁽¹⁾ | |
|--------------|----------------------------|---------------------|
| | Compression (right fork) | Rebound (left fork) |
| Standard | 2 | 2 |
| Comfort | 3 | 3 |
| Sport | 1 | 1 |

(1) Damping adjuster settings are done by turning adjuster clockwise until it stops at the maximum setting, then counting the turns counter-clockwise to the desired setting.

REAR SHOCK

NOTICE

Compression and rebound adjusting valves may be damaged if too much force is used at either end of the adjustment range. (00237a)

NOTE

Do not force adjusters beyond mechanical stops.

Rebound Damping Adjustment

NOTE

Rebound adjuster is marked as **TEN** on the absorber.

1. See Figure 2-33. Use a flat blade screwdriver to turn rebound adjuster clockwise in the H (hard) direction until it stops. This is the maximum rebound damping setting.
2. Turn rebound adjuster counter-clockwise in the S (soft) direction the recommended number of turns. Refer to Table 2-20.

Compression Damping Adjustment

1. See Figure 2-34. Use a flat blade screwdriver to turn compression adjuster clockwise in the high direction until it stops. This is the maximum compression damping setting.
2. Turn compression adjuster counter-clockwise in the low direction the recommended number of turns. Refer to Table 2-20.

Preload Adjustment

1. See Figure 2-35. Rotate the preload adjuster knob clockwise in the HIGH direction to increase preload setting, or counterclockwise to decrease preload setting until desired setting is reached.
2. Calculate rear preload settings.
 - a. **Rider:** Refer to Table 2-18 for preload clicks required for rider. Note clicks required.
 - b. **Passenger or cargo:** Refer to Table 2-19 for additional preload clicks required for passenger or cargo. Note clicks required.
 - c. Add rider and passenger/cargo preload amounts together to get final adjustment setting.
3. Adjust preload adjuster knob to the desired number of clicks.

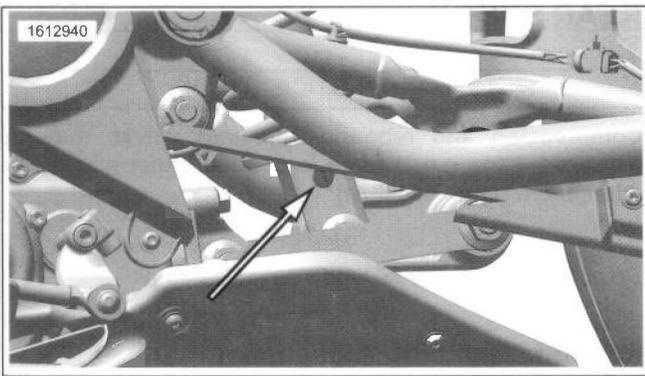


Figure 2-33. Rebound Adjuster

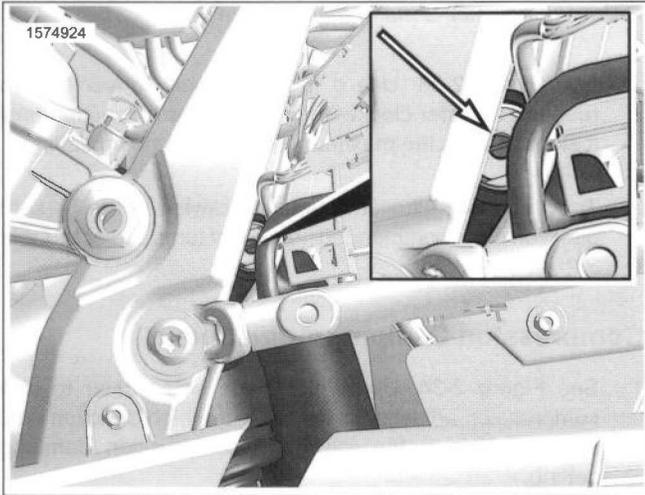


Figure 2-34. Compression Adjuster

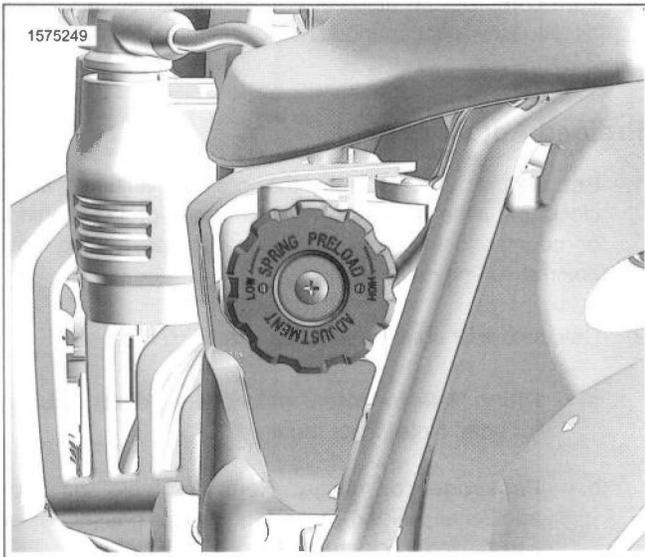


Figure 2-35. Preload Adjuster

Table 2-18. Rear Preload Suspension Settings

| RIDER WEIGHT | REAR SHOCK |
|-------------------------|------------------------------------|
| kg/lb | Clicks from Minimum ⁽¹⁾ |
| < 150 lb (68 kg) | 0 |
| 150–170 lb (68–77 kg) | 0 |
| 170–190 lb (77–86 kg) | 0 |
| 190–210 lb (86–95 kg) | 11 |
| 210–230 lb (95–104 kg) | 22 |
| 230–250 lb (104–113 kg) | 33 |
| 250–270 lb (113–122 kg) | 40 |
| 270–290 lb (122–132 kg) | 40 |
| 290 lb (132 kg) to GVWR | 40 |

(1) Minimum is defined as fully turned out counter-clockwise.

Table 2-19. Rear Preload with Passenger or Cargo

| PASSENGER or CARGO | REAR SHOCK |
|------------------------|----------------------------------|
| kg/lb | Additional Clicks ⁽¹⁾ |
| 0–50 lb (0–23 kg) | +22 |
| 50–100 lb (23–45 kg) | +40 |
| 100–150 lb (45–68 kg) | +40 |
| 150 lb (68 kg) to GVWR | +40 |

(1) Add to preload setting for passenger or cargo weight.

Table 2-20. Rear Fork Compression and Rebound

| RIDE SETTING | REAR SHOCK ⁽¹⁾ | |
|--------------|---------------------------|---------|
| | Compression | Rebound |
| Standard | 2.75 | 1.75 |
| Comfort | 2.75 | 3 |
| Sport | 1.5 | 1.5 |

(1) Damping adjuster settings are done by turning adjuster clockwise until it stops at the maximum setting, then counting the turns counter-clockwise to the desired setting.

LEAK CHECK

1. Check exhaust system for obvious signs of leakage such as carbon tracks and marks at pipe joints.
 - a. Check for loose or missing fasteners.
 - b. Check for cracked pipe clamps or brackets.
 - c. Check for loose or cracked exhaust shields.
2. Check exhaust system for audible signs of leakage.
 - a. Start engine.
 - b. Cover end of muffler with clean, dry shop towel.
 - c. Listen for signs of exhaust leakage.
3. Correct any detected leaks.
 - a. See EXHAUST SYSTEM (Page 6-35). Disassemble exhaust system.
 - b. Clean all mating surfaces.
 - c. Repair or replace damaged components.
 - d. Assemble exhaust system.

NOTE

If leak continues, disassemble and apply PERMATEX ULTRA COPPER or LOCTITE 5920 FLANGE SEALANT or equivalent oxygen sensor/catalyst-safe alternative to mating surfaces.

PREPARE

1. Remove seat. See SEAT (Page 3-82).
2. Purge fuel system. See PURGE FUEL LINE (Page 6-9).
3. Remove main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove air box cover. See AIR BOX (Page 6-3).

REMOVE AND INSTALL

| FASTENER | TORQUE VALUE | |
|------------------|--------------|-------------|
| Air filter clamp | 22–24 in-lbs | 2.5–2.7 N·m |

1. See Figure 2-36. Remove air filter.
 - a. Cover velocity stacks (1) with clean rags.
 - b. Loosen clamp (2).
 - c. Remove air filter (3).

⚠ 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)

2. Clean air filter.
 - a. Wash filter element in lukewarm water with a mild detergent.
 - b. Allow filter element to air dry or use low-pressure compressed air from the Outside to inside of air filter.

- c. Hold filter element up to a strong light source. The element is sufficiently clean when light is uniformly visible through the media.
 - d. Replace filter element if damaged or if filter media cannot be adequately cleaned.
3. See Figure 2-36. Install air filter.

- a. Install air filter (3).

NOTE

Do not over tighten air filter clamp.

- b. Tighten clamp (2). Tighten.
Torque: 22–24 in-lbs (2.5–2.7 N·m) Air filter clamp
 - c. Vacuum or wipe out any debris in the air filter box.
 - d. Remove rags from velocity stacks (1).

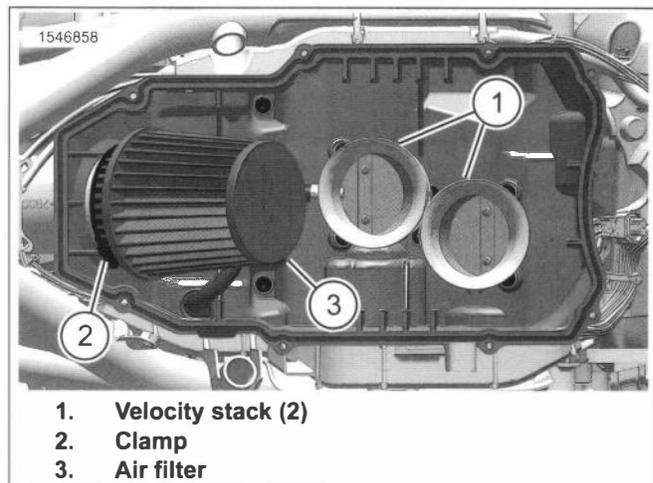


Figure 2-36. Air Filter Maintenance

COMPLETE

1. Install air box cover. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install seat. See SEAT (Page 3-82).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove chin spoiler. See CHIN SPOILER (Page 3-69).

REMOVE

1. Remove battery cables.
 - a. See Figure 2-37. Remove battery negative cable (2) from battery (1).
 - b. Remove battery positive cable (3) from battery.
2. See Figure 2-38. Remove starter cable (1) from starter solenoid (2).
3. Remove voltage regulator bracket.
 - a. See Figure 2-39. Remove voltage regulator bracket screws (2).
 - b. See Figure 2-40. Position voltage regulator bracket (2) out of way.
4. Remove battery.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------------|---------------------|-------------|
| Battery cable screw, negative | 60–70 in-lbs | 6.8–7.9 N·m |
| Battery cable screw, positive | 60–70 in-lbs | 6.8–7.9 N·m |
| Starter cable nut | 27–41 in-lbs | 3–4.6 N·m |
| Voltage regulator bracket screw | 35–62 in-lbs | 4–7 N·m |

1. Install battery.
2. Install voltage regulator bracket.
 - a. See Figure 2-39. Position voltage regulator bracket (1).
 - b. Install voltage regulator bracket screws (2). Tighten.
Torque: 35–62 **in-lbs** (4–7 N·m) *Voltage regulator bracket screw*
3. Connect battery cables.
 - a. See Figure 2-37. Connect battery positive cable (3) to battery. Tighten.
Torque: 60–70 **in-lbs** (6.8–7.9 N·m) *Battery cable screw, positive*
 - b. Connect battery negative cable (2) to battery. Tighten.
Torque: 60–70 **in-lbs** (6.8–7.9 N·m) *Battery cable screw, negative*

- a. See Figure 2-38. Connect starter cable (1) to starter solenoid (2). Tighten.
Torque: 27–41 **in-lbs** (3–4.6 N·m) *Starter cable nut*
- b. See Figure 2-41. Route starter cable (2) in bracket (1).

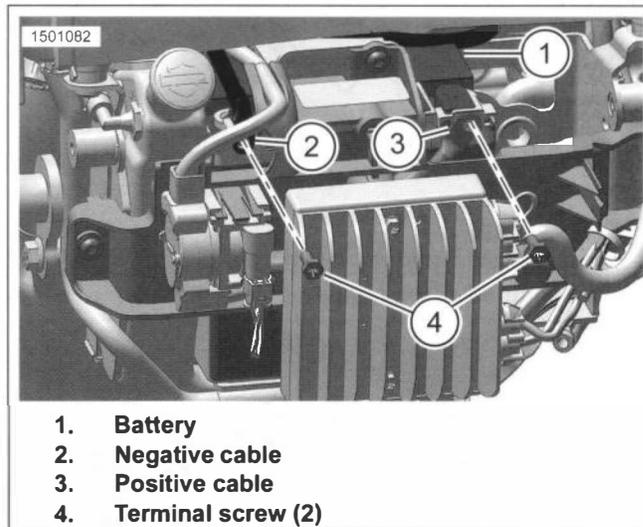


Figure 2-37. Battery Cables

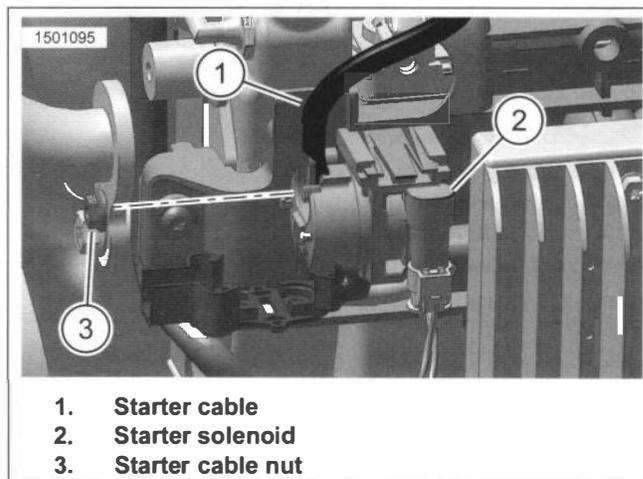


Figure 2-38. Starter Cable

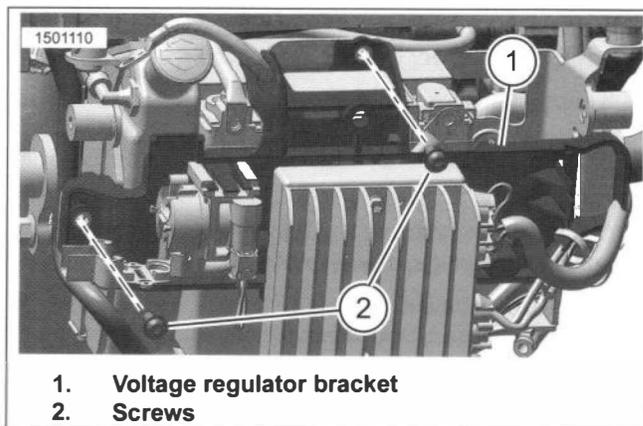
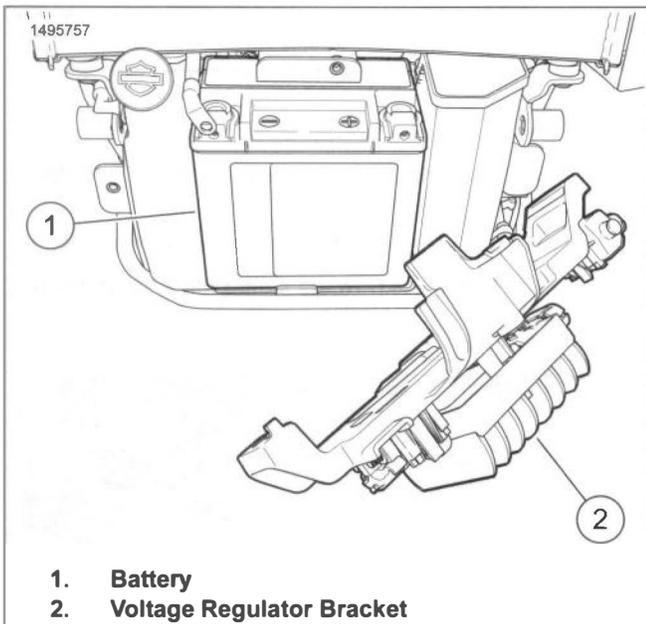
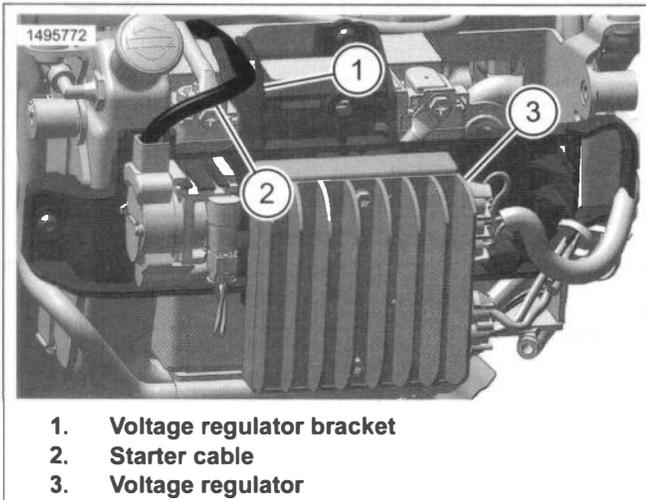


Figure 2-39. Voltage Regulator Bracket Screws



1. Battery
2. Voltage Regulator Bracket

Figure 2-40. Voltage Regulator Bracket



1. Voltage regulator bracket
2. Starter cable
3. Voltage regulator

Figure 2-41. Negative Cable Bracket

CLEAN AND INSPECT

NOTE

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

1. Clean battery top.
 - a. Mix a solution of five teaspoons of baking soda (sodium bicarbonate) per liter or quart of water.
 - b. Apply to battery top.
2. When the solution stops bubbling, rinse off battery with clean water.
3. Clean cable connectors and battery terminals with a wire brush or sandpaper. Remove any oxidation.
4. Inspect the battery terminal screws and cables for breakage, loose connections and corrosion.
5. Check the battery terminals for melting or damage.
6. Inspect the battery for discoloration, raised top or a warped or distorted case. Replace as necessary.
7. Inspect the battery case for cracks or leaks.

VOLTAGE TEST

The voltage test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is fully charged. Refer to Table 2-21.

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.

Table 2-21. Voltage 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% |

STORAGE

See Figure 2-42. A battery is affected by self-discharge whether stored in or out of the vehicle. A battery that is stored in the vehicle is also affected 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. Store battery in a cool, dry place to reduce the self-discharge rate.

Charge the battery every two weeks if stored in the vehicle. Charge the battery once per month if removed the vehicle.

NOTE

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

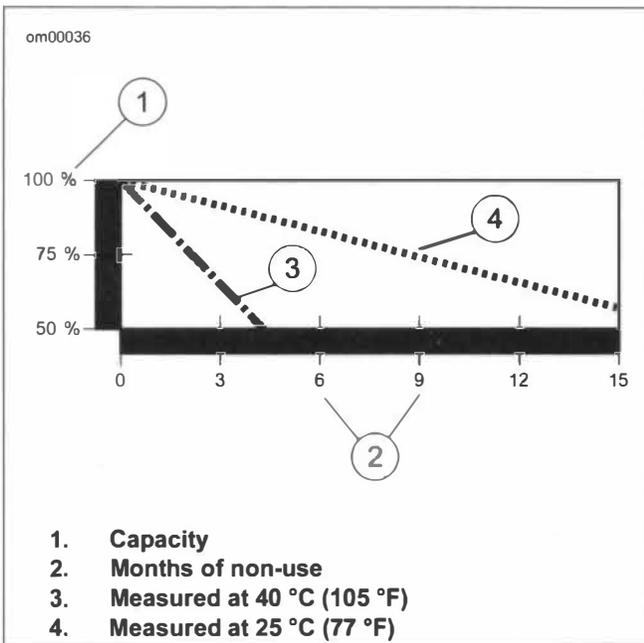


Figure 2-42. Effective Rate of Temperature on Battery Self-discharging Rate

1. Install chin spoiler. See CHIN SPOILER (Page 3-69).

PREPARE**⚠ WARNING**

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. **Removing inner spark plugs:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove fuel tank. See FUEL TANK (Page 6-12).
 - c. Remove air box. See AIR BOX (Page 6-3).
 - d. Remove inner ignition coils. See IGNITION COIL (Page 8-15).

REMOVE**⚠ WARNING**

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

NOTE

- If spark plugs are removed, they must be replaced with new ones.
 - Never remove spark plug wires until heads have cooled.
 - Clear area around spark plug of all debris before removing spark plug.
1. See Figure 2-43. Remove spark plug cables (2) from outer spark plugs (1).
 2. Thoroughly clean around spark plug base.
 3. Remove spark plugs.

INSPECT

When removing spark plugs always install new spark plugs.

1. Inspect spark plug. Compare spark plug deposits, Refer to Table 2-22.
2. Inspect spark plug cables. Replace as necessary.
 - a. Check for cracks or loose terminals.
 - b. Check for loose fit on ignition coil and spark plugs.
3. Check cable boots/caps for cracks or tears. Replace as necessary.

Table 2-22. Spark Plug Deposit Analysis

| DEPOSITS | POSSIBLE CAUSE |
|---|---|
| Wet, black and shiny | Worn pistons Worn piston rings Worn valves Worn valve guides Worn valve seals Weak battery Faulty ignition system |
| Dry, fluffy or sooty and black | Air-fuel mixture too rich |
| Light brown and glassy* (May be accompanied by cracks in the insulator or by electrode erosion.) | Air-fuel mixture too lean Hot running engine Valves not seating Improper ignition timing |
| White, gray or tan and powdery | Balanced combustion |
| * The glassy deposit on a spark plug may cause high speed misfiring. | |

INSTALL

| FASTENER | TORQUE VALUE | |
|------------|---------------|-----------|
| Spark Plug | 89–133 in-lbs | 10–15 N·m |

NOTE

Always install new spark plugs. Do not reuse spark plugs that have been removed.

1. Verify proper gap before installing new spark plugs, Refer to Table 2-23.
 - a. Use a wire-type feeler gauge within specification.
 - b. Pass the wire gauge between the center and the outer electrodes.
 - c. Adjust gap to within specification.
2. Verify that spark plug threads are clean and dry.
3. See Figure 2-43 and Figure 2-44. Install spark plugs (1). Tighten.
Torque: 89–133 in-lbs (10–15 N·m) Spark Plug
4. Install spark plug cables or coils.

Table 2-23. Spark Plug Gap

| MODEL | MM | IN |
|------------|---------|-------------|
| All Models | 0.7-0.8 | 0.027-0.032 |

COMPLETE

1. Install inner ignition coils. See IGNITION COIL (Page 8-15).
2. Install air box. See AIR BOX (Page 6-3).
3. Install fuel tank. See FUEL TANK (Page 6-12).
4. Install seat. See SEAT (Page 3-82).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).

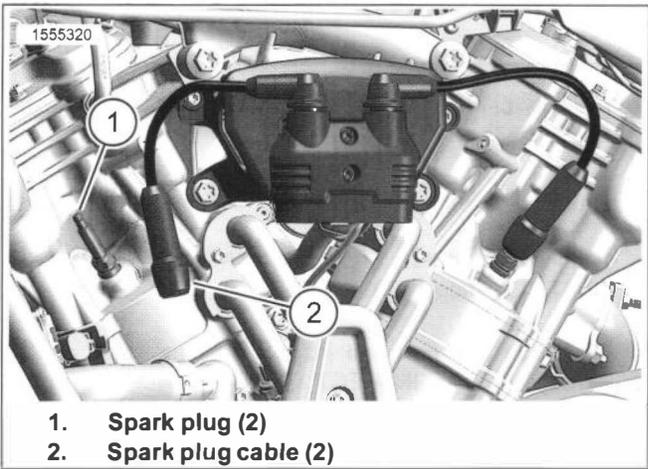


Figure 2-43. Outer Spark Plugs

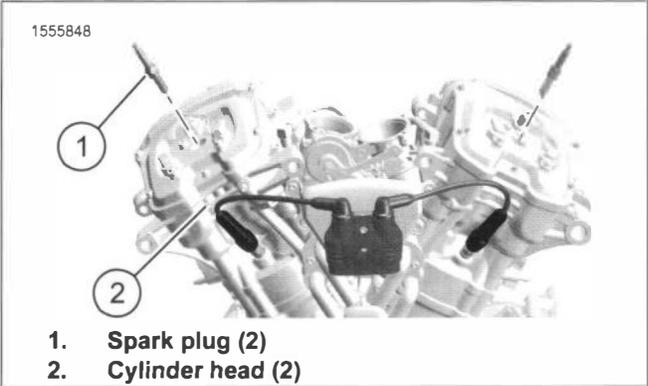


Figure 2-44. Inner Spark Plugs

PLACE IN STORAGE

Make a list of everything you do and fasten it to a handlebar grip. When you take the motorcycle out of storage, this list is your reference/checklist to get your motorcycle in operating condition.

If the motorcycle will not be operated for several months, take steps to protect the motorcycle. Always protect parts against corrosion, preserve the battery and prevent the build-up of gum and varnish in the fuel before 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 open fuel 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. (00028b)

⚠ 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 fuel tank.
 - a. Fill fuel tank.
 - b. Add a fuel stabilizer.
2. Change engine oil and filter. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
3. Lubricate cylinders.
 - a. Remove spark plugs. See INSPECT AND REPLACE SPARK PLUGS (Page 2-40).
 - b. Inject a few squirts of engine oil into each cylinder.
 - c. Crank engine for 5-6 revolutions.
 - d. Install spark plugs. See INSPECT AND REPLACE SPARK PLUGS (Page 2-40).

4. Prepare battery for storage. See INSPECT BATTERY (Page 2-37).
5. Inspect air filter. See INSPECT AIR FILTER (Page 2-36).
6. Lubricate controls. See LUBRICATE CABLES AND CHASSIS (Page 2-12).
7. Check tire inflation and inspect tires for wear and/or damage. See INSPECT TIRES AND WHEELS (Page 2-9).
8. If the motorcycle will be stored for an extended period of time, securely support the motorcycle so that all weight is off the tires. See GENERAL (Page 2-2).
9. Inspect operation of all electrical equipment and switches.
10. To protect the body panels, engine, chassis and wheels from corrosion, follow the cosmetic care procedures before storage. See Owner's Manual.
11. Cover the motorcycle with a material such as light canvas that breathes. Plastic materials that do not breathe promote condensation and corrosion.

REMOVE 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. Install battery if removed. See INSPECT BATTERY (Page 2-37)
2. If spark plugs were removed and not replaced, replace them now. Do **not** reuse. See INSPECT AND REPLACE SPARK PLUGS (Page 2-40).
3. Fill fuel tank, if empty.
4. Start engine. Run until it reaches normal operating temperature.
5. Check engine oil level. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
6. Perform all of the checks in the PRE-RIDING CHECKLIST in the owner's manual.

GENERAL**▲ WARNING**

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

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

NOTE

See the electrical diagnostic manual for additional information.

ENGINE**Starter Motor Does Not Operate or Does Not Turn Engine Over**

1. Engine run switch in OFF position.
2. Discharged battery, loose or corroded connections (solenoid chatters).
3. Starter control circuit faulty.
4. Overrunning clutch slipping.
5. Inertial Measurement Unit (IMU) tripped and ignition not cycled OFF then back to RUN.
6. Security system activated.
7. Motorcycle in gear and clutch not pulled in.
8. Jiffy stand down and transmission in gear (HDI and ARH models only).
9. Main fuse not in place.

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fouled spark plugs.
3. Discharged battery, loose or damaged battery terminal connections.
4. The engine lubricant too heavy (winter operation).
5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Damaged wire or loose wire connection at ignition coil, battery or ECM connector.
7. Follow any current DTC's in order of priority.
8. Ignition timing incorrect due to faulty ignition coil, ECM or sensors.
9. Inertial Measurement Unit (IMU) tripped and ignition not cycled OFF then back to RUN.
10. Manually check fuel pressure to verify it is in specification.
11. Manually check compression and leak down to verify they are in specification.

12. Fuel filter clogged.
13. Sticking or damaged valve(s).
14. Plugged fuel injectors.

Starts Hard

1. Spark plugs in bad condition or have improper gap or are partially fouled.
2. Spark plug cables in poor condition.
3. Battery nearly discharged.
4. Damaged wire or loose wire connection at ignition coil, battery or ECM connector.
5. Water or dirt in fuel system.
6. Intake air leak.
7. Fuel tank vent hose, filler cap vent or vapor valve plugged, or fuel line closed off, restricting fuel flow.
8. Engine lubricant too heavy (winter operation).
9. Ignition not functioning properly (possible sensor failure).
10. Faulty ignition coil.
11. Valves sticking.
12. Partially plugged fuel injector(s).

Starts But Runs Irregularly or Misses

1. Spark plugs in poor condition or partially fouled.
2. Spark plug cables in poor condition and shorting or leaking.
3. Spark plug gap too close or too wide.
4. Follow any current DTC's in order of priority.
5. Faulty ignition coil, ECM or sensor.
6. Battery nearly discharged.
7. Damaged wire or loose wire connection at ignition coil, battery or ECM connector.
8. Intermittent short circuit due to damaged wire insulation.
9. Water or dirt in fuel system.
10. Fuel tank vent system plugged.
11. Air leak at intake manifold or air cleaner.
12. Loose or dirty ECM connector.
13. Incorrect valve timing.
14. Weak or damaged valve springs.
15. Manually check compression and leak down to verify they are in specification.
16. Damaged intake or exhaust valve.
17. Partially plugged fuel injector(s).

A Spark Plug Fouls Repeatedly

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

Pre-Ignition or Detonation (Knocks or Pings)

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

Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow through radiator during extended periods of idling (cooling fan inoperative).
3. Heavy carbon deposits.
4. Ignition timing retarded due to defective ECM or faulty sensor(s) (TMAP and/or CKP).
5. Leaking valve(s).
6. Low coolant level.
7. Restricted radiator air flow.
8. Coolant pump or fans inoperative.
9. Vent hose crimped.
10. Air in coolant.

Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Valve sticking in guide.
3. Chain tensioning shoe worn.
4. Cam(s) or cam gear(s) worn.
5. Cam timing incorrect.
6. Valve seat loose in cylinder.

Excessive Vibration

1. Wheels bent or damaged and/or tires worn or damaged.
2. Engine/Transmission/Rear Wheel not aligned properly.
3. Ignition timing advanced due to faulty sensor inputs (MAP and/or CKP)/poorly tuned engine.
4. Internal engine problem.
5. Damaged frame.
6. Rear fork pivot shaft fasteners loose.
7. Exhaust system binding and causing unnecessary side loads.

Check Engine Light Illuminates During Operation

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

LUBRICATION SYSTEM

Engine Oil Not Circulating (Oil Pressure Indicator Lit)

1. Insufficient or diluted oil supply.
2. Grounded oil signal switch wire or faulty signal switch.
3. Oil pump problem.

Oil Does Not Return To Crankcase Oil Reservoir

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

Engine Uses Too Much Oil Or Smokes Excessively

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

Engine Leaks Oil From Cases, Etc.

1. Loose parts.
2. Imperfect seal at gaskets, washers, etc.
3. Restricted breather passages or hose to air cleaner.
4. Restricted oil filter.
5. Oil reservoir overfilled.
6. Restricted oil return line to oil reservoir.
7. Porosity.

Low Oil Pressure

1. Oil reservoir underfilled.
2. Faulty low oil pressure switch.
3. Oil pump cover seal damaged or missing.
4. Bypass valve stuck in open position.
5. Ball(s) and/or plug(s) missing in drillings.
6. Worn oil pump gerotor(s).
7. Oil diluted with gasoline.

High Oil Pressure

1. Oil reservoir overfilled.

2. Bypass valve stuck in closed position.

ELECTRICAL SYSTEM

Alternator Does Not Charge

1. Regulator not grounded.
2. Engine ground wire loose or damaged.
3. Loose or damaged wires in charging circuit.

Alternator Charge Rate is Below Normal

1. Weak battery.
2. Excessive use of add-on accessories.
3. Loose or corroded connections.
4. Extensive periods of idling or low speed riding.

TRANSMISSION

Transmission Shifts Hard

1. Clutch controls or clutch cable improperly adjusted.
2. Damaged shift lever linkage.

Transmission Jumps Out of Gear

1. Worn shifter dogs in transmission.

Clutch Slips

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

Clutch Drags or Does Not Release

1. Clutch controls or clutch cable improperly adjusted.
2. Clutch discs warped.

Clutch Chatters

1. 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. See Tires (Page 2-9)
5. Shock absorber not functioning normally.
6. Loose wheel axle nuts. Tighten to recommended torque specification.
7. Rear wheel out of alignment with frame and front wheel.
8. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
9. Tire and wheel unbalanced.
10. Rims and tires out-of-round or eccentric with hub.
11. Rims and tires out-of-true sideways.
12. Rear fork pivot-improper torque.
13. Incorrect, non-specified tire(s) mounted on front or rear wheel.

BRAKES

Brakes Do Not Hold Normally

1. Master cylinder low on fluid, system leaking or pads worn.
2. Brake line contains air bubbles.
3. Master cylinder piston 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 fades due to heat build up-Excessive braking or brake pads dragging.
8. Brake drags-insufficient brake pedal or hand lever free play, caliper piston worn or damaged, or excessive brake fluid in reservoir.

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|--|---------------------|---------------|--|
| | | | |
| ABS module banjo bolts | 17–19 ft-lbs | 23–26 N·m | 3.18 ABS MODULE, Install |
| ABS module bracket to frame screws | 62–80 in-lbs | 7–9 N·m | 3.18 ABS MODULE, Install |
| ABS module to mounting bracket screws | 40–58 in-lbs | 4.5–6.5 N·m | 3.18 ABS MODULE, Install |
| Axle, front | 74–82 ft-lbs | 100–111 N·m | 3.4 FRONT WHEEL, Install |
| Axle, front, pinch screw | 11–15 ft-lbs | 15–20 N·m | 3.4 FRONT WHEEL, Install |
| Belt guard, bottom, screws | 40–49 in-lbs | 4.5–5.5 N·m | 3.25 BELT GUARDS, Install |
| Belt guard, top, screws | 40–49 in-lbs | 4.5–5.5 N·m | 3.25 BELT GUARDS, Install |
| Brake, front master cylinder banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Install |
| Brake, front master cylinder mounting screw | 62–80 in-lbs | 7–9 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Install |
| Brake, rear master cylinder banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Install |
| Brake, rear master cylinder reservoir screw | 62–80 in-lbs | 7–9 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Install |
| Brake, rear master cylinder screws | 80–97 in-lbs | 9–11 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Install |
| Brake caliper, front, left, banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.14 FRONT BRAKE CALIPER, Install |
| Brake caliper, front, mounting screw | 28–38 ft-lbs | 38–52 N·m | 3.14 FRONT BRAKE CALIPER, Install |
| Brake caliper, front, mounting screw | 28–38 ft-lbs | 38–52 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Brake caliper, front, mounting screws | 28–38 ft-lbs | 38–52 N·m | 3.4 FRONT WHEEL, Install |
| Brake caliper, rear, banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.16 REAR BRAKE CALIPER, Install |
| Brake caliper, rear, mounting screw | 18–21 ft-lbs | 24–28 N·m | 3.16 REAR BRAKE CALIPER, Install |
| Brake caliper, rear, mounting screw | 15–18 ft-lbs | 20–24 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Brake disc, front, screw | 20–22 ft-lbs | 27–30 N·m | 3.4 FRONT WHEEL, Assemble |
| Brake line, rear dual, clamp screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Rear Master Cylinder to ABS Module |
| Brake line, rear dual, clamp screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Rear Caliper to ABS Module |
| Brake line, rear fork, clamp screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Rear Caliper to ABS Module |
| Brake master cylinder, reservoir cover screw | 5–7 in-lbs | 0.6–0.8 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Brake pedal screw | 13–15 ft-lbs | 17–21 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Brake Pedal |
| Chin spoiler screws | 35–62 in-lbs | 4–7 N·m | 3.29 CHIN SPOILER, Install |
| Chin spoiler screws | 35–62 in-lbs | 4–7 N·m | 3.29 CHIN SPOILER, Install |
| Chin spoiler screws | 35–62 in-lbs | 4–7 N·m | 3.29 CHIN SPOILER, Install |
| Chin spoiler screws | 35–62 in-lbs | 4–7 N·m | 3.29 CHIN SPOILER, Install |
| Clutch hand control bracket screw | 60–80 in-lbs | 6.8–9 N·m | 3.27 CLUTCH CONTROL, Install |
| Clutch lever pivot nut | 44–62 in-lbs | 5–7 N·m | 3.27 CLUTCH CONTROL, Assemble |
| Crossmember screws | 71–89 in-lbs | 8–10 N·m | 3.40 FRAME CROSSMEMBER, Install |
| Fender, front, screw | 62–71 in-lbs | 7–8 N·m | 3.33 FRONT FENDER, Install |
| Fender, front, screw | 62–71 in-lbs | 7–8 N·m | 3.33 FRONT FENDER, Install |
| Fender assembly, front, screw | 62–71 in-lbs | 7–8 N·m | 3.33 FRONT FENDER, Install |
| Footrest bracket, rider, left side | 21–23 ft-lbs | 28.5–31.5 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Bracket |

| FASTENER | TORQUE VALUE | | NOTES |
|--|----------------|---------------|---|
| Footrest bracket screw | 21–23 ft-lbs | 28.5–31.5 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Bracket |
| Fork bracket, lower, pinch screw | 15–18 ft-lbs | 20.4–25 N·m | 3.21 FRONT FORK, Install |
| Fork bracket, upper, pinch screw | 15–18 ft-lbs | 20.4–25 N·m | 3.21 FRONT FORK, Install |
| Fork damper nut | 13–17 ft-lbs | 17.5–22.5 N·m | 3.21 FRONT FORK, Assemble |
| Fork link screw | 66–74 ft-lbs | 90–100 N·m | 3.24 REAR FORK, Install |
| Fork lock screw | 97–124 in-lbs | 11–14 N·m | 3.23 FORK LOCK, Install |
| Fork tube cap | 22–30 ft-lbs | 30–40 N·m | 3.21 FRONT FORK, Assemble |
| Fork tube damper screw, standard | 133–221 in-lbs | 15–25 N·m | 3.21 FRONT FORK, Assemble |
| Front bleeder screw | 80–97 in-lbs | 9–11 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Front brake lever pivot nut | 44–62 in-lbs | 5–7 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Assemble |
| Front brake line, front clamp screw | 49–66 in-lbs | 5.5–7.5 N·m | 3.17 BRAKE LINES, Brake Line: Front Master Cylinder to ABS Module |
| Front brake line, front clamp screw | 49–66 in-lbs | 5.5–7.5 N·m | 3.17 BRAKE LINES, Brake Line: Front Caliper to ABS Module |
| Front brake line, rear clamp screws | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Front Master Cylinder to ABS Module |
| Front brake line, rear clamp screws | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Front Caliper to ABS Module |
| Front frame bolts | 80–88 ft-lbs | 108–119 N·m | 3.39 FRAME, Install |
| Front turn signal pinch screw | 27–44 in-lbs | 3–5 N·m | 3.21 FRONT FORK, Install |
| GND nut | 60–72 in-lbs | 6.8–8.1 N·m | 3.38 TAIL SECTION, Install |
| Hand grip clamp, left | 22–27 in-lbs | 2.5–3.1 N·m | 3.30 HAND GRIPS, Install |
| Handlebar clamp screws | 18–20 ft-lbs | 24–27 N·m | 3.31 HANDLEBAR, Install |
| Handlebar clamp screws | 18–20 ft-lbs | 24–27 N·m | 3.31 HANDLEBAR, Install Tighten front screws first |
| Handlebar end cap, left | 124–177 in-lbs | 14–20 N·m | 3.30 HAND GRIPS, Install |
| Handlebar end cap, right | 124–177 in-lbs | 14–20 N·m | 3.30 HAND GRIPS, Install |
| Horn screws | 50–62 in-lbs | 5.7–7 N·m | 3.39 FRAME, Install |
| Jiffy stand pivot pin nut | 91–101 in-lbs | 10.3–11.4 N·m | 3.36 JIFFY STAND, Assemble |
| Jiffy stand screws | 15–18 ft-lbs | 21–25 N·m | 3.36 JIFFY STAND, Install |
| Left side brake line clamp screws | 35–62 in-lbs | 4–7 N·m | 3.39 FRAME, Install |
| Left side cable guide screw | 35–62 in-lbs | 4–7 N·m | 3.39 FRAME, Install |
| License plate bracket, rear, screw | 89–106 in-lbs | 10–12 N·m | 3.34 LICENSE PLATE MODULE SWINGARM MOUNT, Install |
| License plate module swingarm mount, screw | 24–27 ft-lbs | 32–36 N·m | 3.34 LICENSE PLATE MODULE SWINGARM MOUNT, Install |
| Lock reinforcement bracket screw | 97–115 in-lbs | 11–13 N·m | 3.23 FORK LOCK, Install |
| Manual adjuster screws | 77–93 in-lbs | 8.7–10.5 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Middle side cover screw | 71–89 in-lbs | 8–10 N·m | 3.20 SIDE COVERS, Install |
| Midframe lower bolt and nut | 80–88 ft-lbs | 108–119 N·m | 3.39 FRAME, Install |
| Midframe upper flange screws | 125–137 ft-lbs | 169–186 N·m | 3.39 FRAME, Install |
| Mirror base screw | 124–177 in-lbs | 14–20 N·m | 3.32 MIRRORS, Install |
| Mirror mounting nut | 96–144 in-lbs | 10.8–16.3 N·m | 3.32 MIRRORS, Install |
| Pedal connector nut | 93–111 in-lbs | 10.5–12.5 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Assemble |
| Pivot shaft pinch bolt | 16–18 ft-lbs | 22–25 N·m | 3.24 REAR FORK, Install |
| Radiator cover screw | 71–89 in-lbs | 8–10 N·m | 3.20 SIDE COVERS, Install |
| Radiator cover screws | 71–89 in-lbs | 8–10 N·m | 3.20 SIDE COVERS, Install |

| FASTENER | TORQUE VALUE | | NOTES |
|------------------------------------|-------------------------|---------------|---|
| Rear bleeder screw | 106–142 in-lbs | 12–16 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Rear disc screw | 16–24 ft-lbs | 21.7–32.5 N·m | 3.5 REAR WHEEL, Assemble |
| Rear fender mounting screw | 35.4–44.3 in-lbs | 4–5 N·m | 3.28 COWL AND REAR FENDERS, Install |
| Rear fender mounting screw | 35.4–44.3 in-lbs | 4–5 N·m | 3.28 COWL AND REAR FENDERS, Install |
| Reservoir mount screw | 142–159 in-lbs | 16–18 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Assemble |
| Reservoir mount screw | 7–11 in-lbs | 0.8–1.2 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Assemble |
| RHCM cover screws, front | 5–8 in-lbs | 0.6–0.9 N·m | 3.30 HAND GRIPS, Install |
| Right rear side cover screws | 62–75 in-lbs | 7–8.5 N·m | 3.38 TAIL SECTION, Install |
| Seat latch bracket screws | 73–89 in-lbs | 8.2–10 N·m | 3.37 SEAT, Install |
| Seat latch screws | 44–53 in-lbs | 5–6 N·m | 3.37 SEAT, Install |
| Seat lock bracket screw | 62–75 in-lbs | 7–8.5 N·m | 3.38 TAIL SECTION, Install |
| Seat lock screws | 12–15 in-lbs | 1.3–1.7 N·m | 3.37 SEAT, Install |
| Shock absorber link bolt | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber link bolt | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber lower bolt | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber lower screw | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber upper screw | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Sprocket cover screws | 62–80 in-lbs | 7–9 N·m | 3.25 BELT GUARDS, Install |
| Steering head cover screw | 7–11 in-lbs | 0.8–1.2 N·m | 3.20 SIDE COVERS, Install |
| Swing arm assembly mount block nut | 18–21 ft-lbs | 25–28 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Swing arm assembly mount block nut | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Swing arm pivot nut | 60–74 ft-lbs | 81–100 N·m | 3.24 REAR FORK, Install |
| Tail section lower screw | 80–88 ft-lbs | 108–119 N·m | 3.38 TAIL SECTION, Install |
| Tail section upper screws | 80–88 ft-lbs | 108–119 N·m | 3.38 TAIL SECTION, Install |
| Upper frame screw | 125–139 ft-lbs | 169–188 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Valve stem screw | 23–27 in-lbs | 2.6–3 N·m | 3.9 TIRE PRESSURE MONITORING SYSTEM (TPMS), Install |
| Wear peg | 31–40 in-lbs | 3.5–4.5 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Footpegs |
| Wire form screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Front Master Cylinder to ABS Module |

CHASSIS

Chassis Specifications

Table 3-1. Capacities

| ITEM | U.S. | METRIC |
|---|---------|--------|
| Fuel tank (total) | 3.1 gal | 11.8 L |
| Low fuel warning light on (approximate) | 0.8 gal | 3.0 L |
| Engine oil capacity | 4.75 qt | 4.5 L |
| Service oil change capacity | 4.0 qt | 3.8 L |
| Coolant (approximate) | 2.32 qt | 2.2 L |

Table 3-2. Dimensions

| ITEM | Sportster S™ (RH1250S) | |
|----------------------------|------------------------|------|
| | in | mm |
| Length | 89.2 | 2265 |
| Overall Width | 33.2 | 843 |
| Overall height | 42.9 | 1089 |
| Wheel base | 59.8 | 1518 |
| Road clearance | 3.66 | 93 |
| Seat height ⁽¹⁾ | 28.9 | 753 |

(1) With 180 lb (81.7 kg) rider on seat

Table 3-3. Weights

| ITEM | Sportster S™ (RH1250S) | |
|---|------------------------|-----|
| | lb | kg |
| Running weight ⁽¹⁾ | 502 | 228 |
| Maximum added weight allowed ⁽²⁾ | 420 | 191 |
| GVWR | 922 | 418 |
| GAWR front | 359 | 163 |
| GAWR rear | 595 | 270 |

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

Table 3-4. Specified Tires

| MODEL | MOUNT | SIZE | SPECIFIED TIRE | PRESSURE COLD | |
|----------------------|-------|-------|--|---------------|---------|
| | | | | psi | kPa |
| RH1250S Sportster® S | Front | 17 in | Dunlop® Harley-Davidson Series GT503 160/70R17 73V | 36 psi | 248 kPa |
| RH1250S Sportster® S | Rear | 16 in | Dunlop® Harley-Davidson Series GT503 180/70R16 77V | 42 psi | 290 kPa |

VEHICLE IDENTIFICATION NUMBER (VIN)

NOTE

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

General

See Figure 3-2. A unique 17-digit serial or Vehicle Identification Number (VIN) is assigned to each motorcycle. Refer to Table 3-5.

Location

See Figure 3-1. The full 17-digit VIN is stamped on the right side of the frame near the steering head. In some destinations, a printed VIN label is also attached on the front downtube.

Abbreviated VIN

An abbreviated VIN showing the vehicle model, engine type, model year, and sequential number is stamped on the left side of the crankcase below the gear shifter.

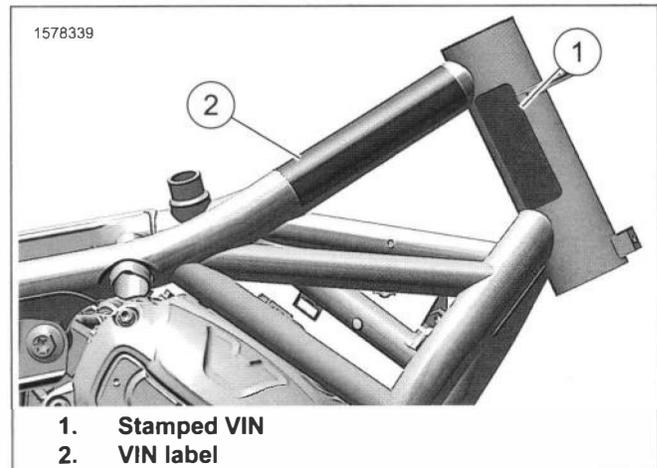


Figure 3-1. VIN Locations

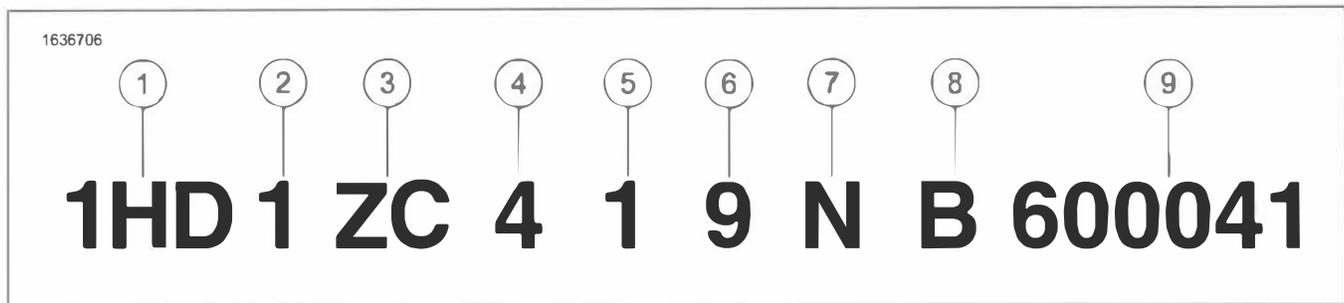


Figure 3-2. Typical Harley-Davidson VIN: 2022 Harley-Davidson Sportster RH

Table 3-5. Harley-Davidson VIN Breakdown: 2022 Sportster S

| POSITION | DESCRIPTION | POSSIBLE VALUES |
|----------|---|--|
| 1 | World manufacturer identifier | 1HD=Originally manufactured in the United States 5HD=Originally manufactured in the United States or Thailand for sale outside of the United States 932=Originally manufactured in Brazil MLY=Originally manufactured in Thailand |
| 2 | Motorcycle type | 1=Heavyweight motorcycle (901 cm ³ or larger) |
| 3 | Model | See VIN model table |
| 4 | Engine type | 4=Revolution Max™ 1250T 1252 cm ³ liquid-cooled, fuel-injected |
| 5 | Calibration/configuration, introduction | 1=Domestic (DOM) 2=California (CAL) 3=Canada (CAN) 4=ENG/EN2/HD1/HD2/HD4 5=Japan (JPN) 6=Australia (AUS) 7=Brazil (BRZ) 8=Asia Pacific (APC) 9=IND/IN2 0=ASEAN (AZN) A=China (CHN) G=HD3 |
| 6 | VIN check digit | Can be 0-9 or X |
| 7 | Model year | N=2022 |
| 8 | Assembly plant | B=York, PA U.S.A. D=H-D Brazil-Manaus, Brazil (CKD) S=Tasit, Pluagdang, Rayong, Thailand |
| 9 | Sequential number | Varies |

Table 3-6. VIN Model Codes: Sportster S Models

| CODE | MODEL |
|------|----------------------|
| ZC | RH1250S Sportster® S |

PREPARE

1. Raise front wheel. See Secure the Motorcycle for Service in GENERAL (Page 2-2).
2. Detach front brake caliper from fork. See FRONT BRAKE CALIPER (Page 3-27).

REMOVE

NOTE

Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.

Keep wheel speed sensor and ABS encoder bearing away from magnetic fields.

1. See Figure 3-3. Remove front wheel.
 - a. Loosen pinch screw (3).
 - b. Remove front axle (4).
 - c. Remove front wheel (2).
2. Clean and inspect axle pinch bore.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------------------|--------------|-------------|
| Axle, front | 74–82 ft-lbs | 100–111 N·m |
| Axle, front, pinch screw | 11–15 ft-lbs | 15–20 N·m |
| Brake caliper, front, mounting screws | 28–38 ft-lbs | 38–52 N·m |

| CONSUMABLE | PART NUMBER |
|---------------------------------|-------------|
| LOCTITE SILVER GRADE ANTI-SEIZE | 11100001 |

NOTE

Keep ANTI-SEIZE LUBRICANT off axle threads and axle pinch bore.

1. See Figure 3-3. Install front wheel.
 - a. Apply a light coat of ANTI-SEIZE LUBRICANT to right wheel bearing bore only.
LOCTITE SILVER GRADE ANTI-SEIZE (11100001)
 - b. Position front wheel (2) between front forks.
 - c. See Figure 3-4. Position wheel speed sensor as shown.
 - d. See Figure 3-3. Install front axle (4) through right fork, front wheel and wheel speed sensor (1).
 - e. Thread axle into left fork. Tighten.
Torque: 74–82 ft-lbs (100–111 N·m) Axle, front

2. Install brake caliper.
3. Apply brake pressure.
4. Tighten caliper.
Torque: 28–38 ft-lbs (38–52 N·m) Brake caliper, front, mounting screws
5. Tighten front axle pinch screw.
Torque: 11–15 ft-lbs (15–20 N·m) Axle, front, pinch screw
6. Release brake pressure.

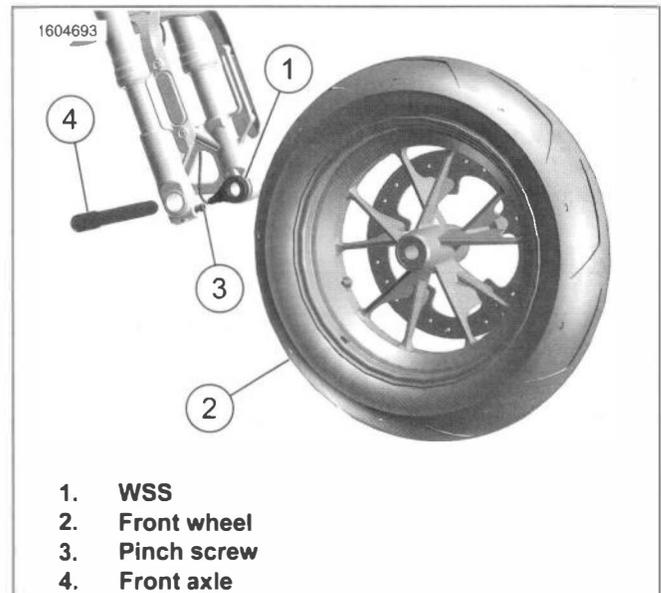


Figure 3-3. Front Wheel Mount

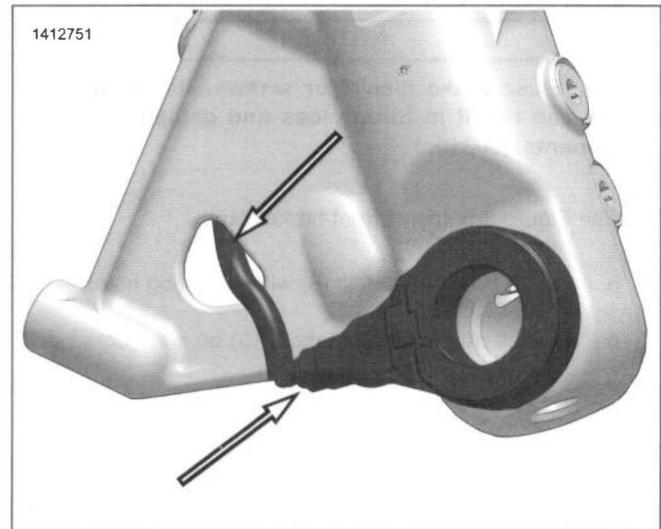


Figure 3-4. Front WSS Routing

DISASSEMBLE

1. See Figure 3-5. Remove front brake disc.
 - a. Remove and discard screws (7).
 - b. Remove spring washers (8).

- c. Remove front brake disc (6).
2. Remove front tire (1). See TIRES (Page 3-18).
 3. See Figure 3-5. Remove tire valve stem (3). See TIRE PRESSURE MONITORING SYSTEM (TPMS) (Page 3-16).
 4. Discard wheel bearings (2, 5). See SEALED WHEEL BEARINGS (Page 3-15).
 5. See Figure 3-5. Remove wheel bearing spacer (4).

CLEAN AND INSPECT

1. Clean all parts thoroughly.
2. Inspect front wheel for damage. Replace or repair as necessary.
3. Check wheel lateral and radial runout before installing a new tire. See CHECKING AND TRUING WHEELS (Page 3-12).

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|--------------------------|--------------|-----------|
| Brake disc, front, screw | 20–22 ft-lbs | 27–30 N·m |

1. Install wheel bearing spacer (4) and **new** wheel bearings (2, 5). See SEALED WHEEL BEARINGS (Page 3-15).
2. See Figure 3-5. Install **new** tire valve stem (3). See TIRE PRESSURE MONITORING SYSTEM (TPMS) (Page 3-16).
3. Install tire (1). See TIRES (Page 3-18).

NOTICE

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

4. See Figure 3-5. Install front brake disc.
 - a. Align front brake disc (6) with mounting holes.
 - b. Install **new** spring washers (8) on **new** brake disc screws (7).

- c. Install **new** brake disc screws (7).
- d. Tighten screws in crosswise pattern.
Torque: 20–22 ft-lbs (27–30 N·m) *Brake disc, front, screw*

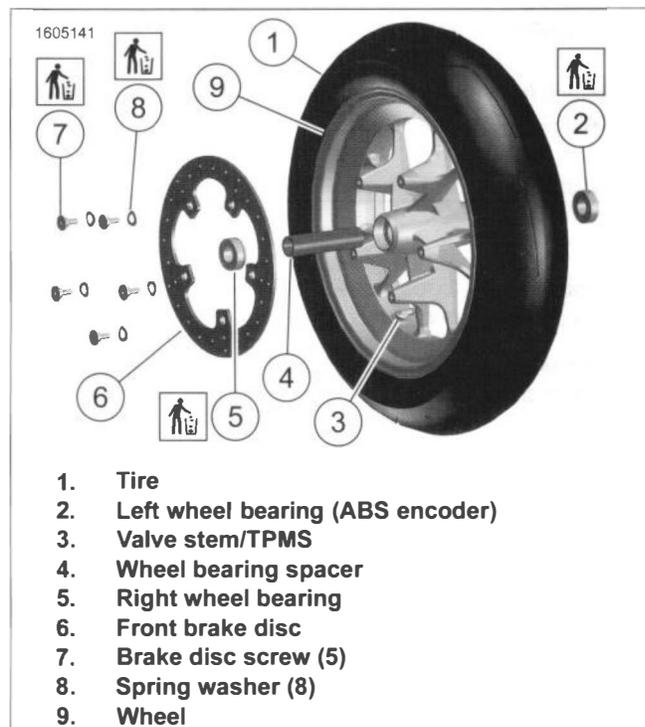


Figure 3-5. Front Wheel Components (Cast Wheel)

COMPLETE

1. Attach front brake calipers. See FRONT BRAKE CALIPER (Page 3-27).
2. Lower front of vehicle.

▲ 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)

3. Test brake operation.

PREPARE

1. Raise rear of motorcycle. See Secure the Motorcycle for Service in GENERAL (Page 2-2).
2. Inspect wheel bearings. See SEALED WHEEL BEARINGS (Page 3-15).
3. Measure brake disc runout. See INSPECT BRAKES (Page 2-13).
4. Measure rear wheel compensator wear. See REAR WHEEL COMPENSATOR (Page 3-13).
5. Remove license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).

NOTE

Do not operate brakes with caliper removed or caliper pistons may be forced out. The caliper contains no serviceable components and would require replacement.

6. Detach rear brake caliper from reaction bracket. See REAR BRAKE CALIPER (Page 3-32).

REMOVE

NOTE

- Never pull wheel speed sensor cable taut or use to retain wheel, axle or other components.
- Keep wheel speed sensor and ABS encoder bearing away from magnetic fields.

1. See Figure 3-6. Remove rear axle.
 - a. Discard E-clip (6).
 - b. Remove nut (7).
 - c. Remove washer (5).
 - d. Release rear WSS wire from brake line.
 - e. Support wheel (9).
 - f. Remove rear axle. Catch rear WSS (3) and spacer (2).

2. Remove belt from sprocket assembly.

NOTE

Hold sprocket to prevent it from dropping.

3. Remove wheel (9).

INSTALL

| CONSUMABLE | PART NUMBER |
|---------------------------------|-------------|
| LOCTITE SILVER GRADE ANTI-SEIZE | 11100001 |

1. See Figure 3-6. Install rear wheel.
 - a. Apply a light coat of anti-seize lubricant to rear axle (1), wheel bearing bores, and bore of wheel bearing spacer.
LOCTITE SILVER GRADE ANTI-SEIZE (11100001)
 - b. Position rear wheel (9) between rear fork.
 - c. Install rear axle through axle adjuster (8), left leg of rear fork, and spacer (2).
 - d. Install rear axle through rear wheel.
 - e. See Figure 3-7. Rotate WSS to position shown. Verify wire harness is routed correctly.
 - f. See Figure 3-6. Install rear axle through rear wss (3), reaction bracket (4), right leg of rear fork and axle adjuster (8).
 - g. Install washer (5).
 - h. Install nut (7). Hand-tighten.
 - i. Install **new** E-clip (6).
 - j. Slide rear axle forward. Install drive belt on front and rear sprockets.

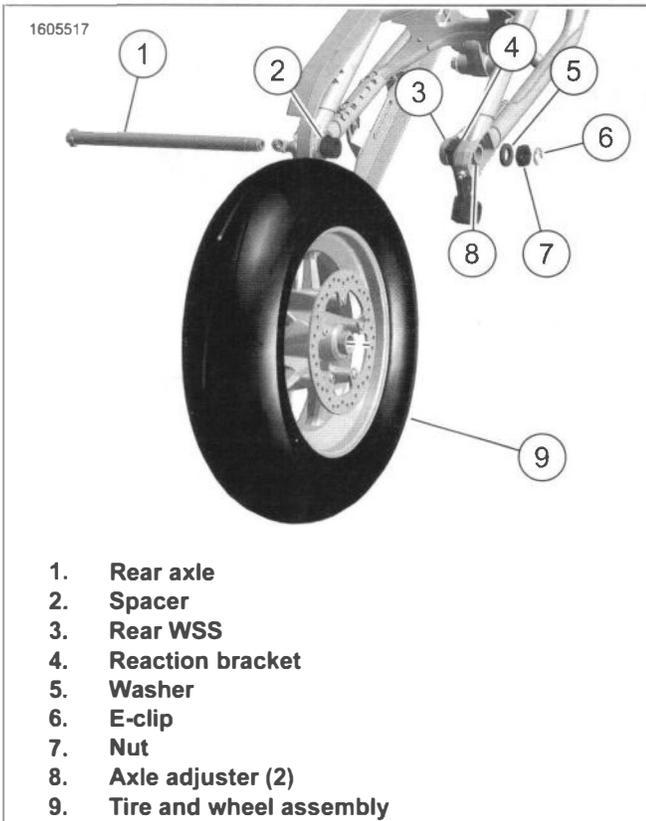


Figure 3-6. Rear Wheel Mount

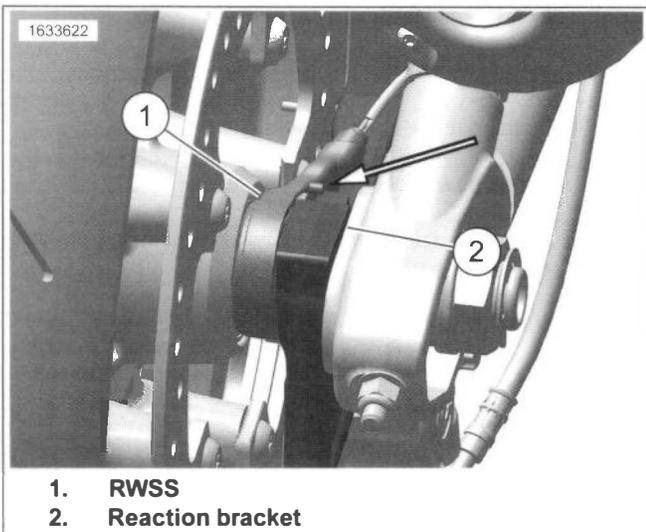


Figure 3-7. Rear WSS Orientation

DISASSEMBLE

1. See Figure 3-8. Remove rear sprocket assembly (1) and isolator (2). See REAR WHEEL COMPENSATOR (Page 3-13).
2. Remove tire (10). See TIRES (Page 3-18).
3. Remove tire valve stem (9). See TIRE PRESSURE MONITORING SYSTEM (TPMS) (Page 3-16).
4. Remove brake disc.
 - a. Remove and discard screws (5).
 - b. Remove brake disc (4).

5. Discard bearings (3, 6). See SEALED WHEEL BEARINGS (Page 3-15).
6. Remove wheel bearing spacer (7).

CLEAN AND INSPECT

1. Clean all parts thoroughly.
2. Inspect rear wheel for damage. Replace or repair as necessary.
3. Check wheel runout. See CHECKING AND TRUING WHEELS (Page 3-12).

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|-----------------|--------------|---------------|
| Rear disc screw | 16–24 ft-lbs | 21.7–32.5 N·m |

1. See Figure 3-8. Install bearing spacer (7) and **new** wheel bearings (3, 6). See SEALED WHEEL BEARINGS (Page 3-15).
2. See Figure 3-8. Install brake disc (4) and **new** screws (5).
 - a. Tighten screws in a cross-wise pattern.
Torque: 16–24 ft-lbs (21.7–32.5 N·m) *Rear disc screw*
3. Install new tire valve stem (9). See TIRE PRESSURE MONITORING SYSTEM (TPMS) (Page 3-16).
4. Install tire (10). See TIRES (Page 3-18).
5. Install isolator (2) and rear sprocket assembly (1). See REAR WHEEL COMPENSATOR (Page 3-13).

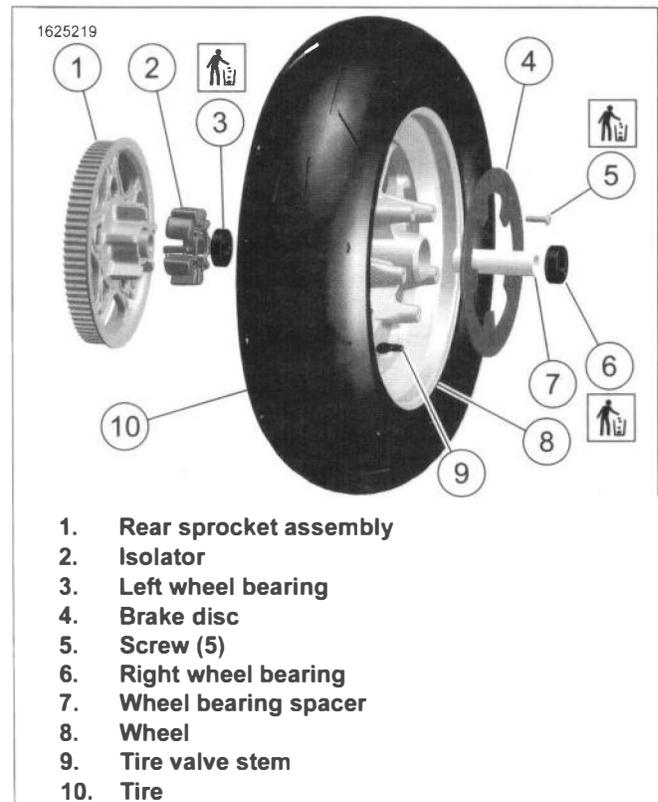


Figure 3-8. Rear Wheel (typical)

COMPLETE

1. Install brake caliper. See REAR BRAKE CALIPER (Page 3-32).
2. Install license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
3. Align rear wheel. See WHEEL ALIGNMENT (Page 3-22).
4. Adjust drive belt deflection. See INSPECT AND ADJUST DRIVE BELT AND SPROCKETS (Page 2-27).

GENERAL

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

Never attempt to straighten cast wheels.

Always check condition of the wheel bearings before checking wheel runout. See SEALED WHEEL BEARINGS (Page 3-15).

CHECKING WHEEL RUNOUT

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

Check wheels for both radial runout and lateral runout. If either measurement is not within specification, replace the wheel.

Checking Radial Runout

1. See Figure 3-9. Mount wheel in WHEEL TRUING STAND (PART NUMBER: 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).

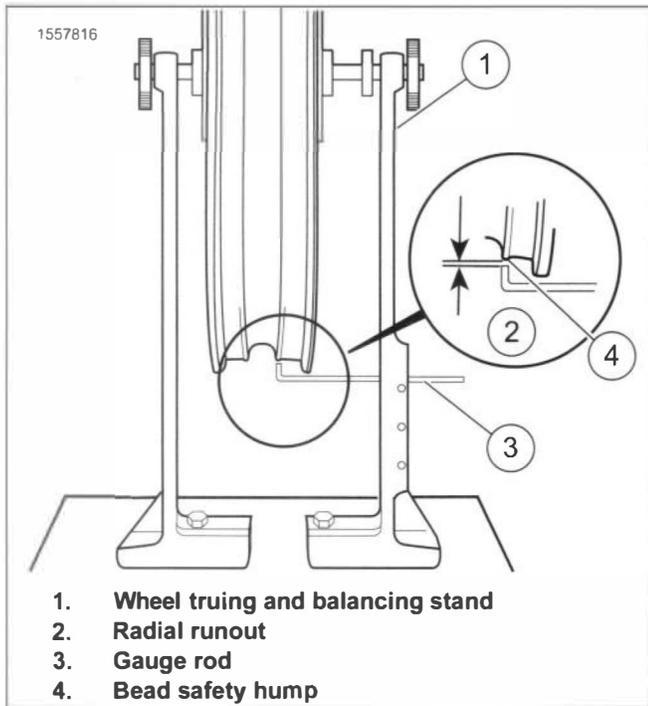


Figure 3-9. Checking Radial Runout

Checking Lateral Runout

1. See Figure 3-10. Mount wheel in WHEEL TRUING STAND (PART NUMBER: 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).

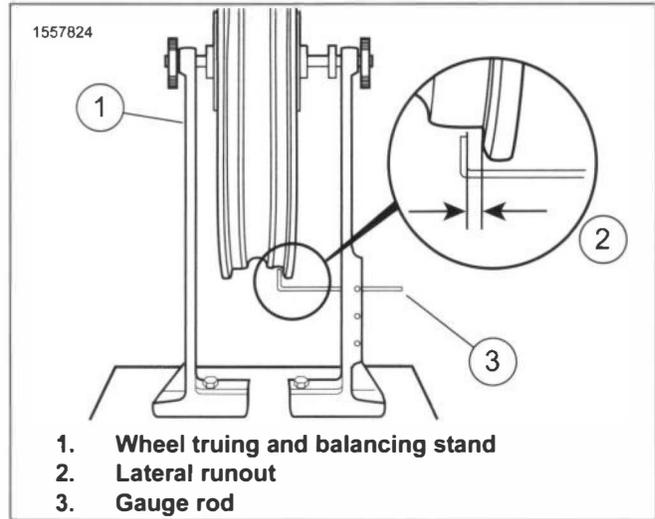


Figure 3-10. Checking Lateral Runout

PREPARE

1. Check compensator sprocket isolator for wear. See INSPECT REAR SPROCKET ISOLATOR (Page 2-31).
2. Remove rear wheel. See REAR WHEEL (Page 3-9).

REMOVE

1. See Figure 3-11. Remove rear wheel compensator.
 - a. Pull compensator sprocket assembly (1) from rear wheel (2).
 - b. Discard isolator (3).

INSTALL

1. See Figure 3-11. Install **new** rear wheel compensator.
 - a. Lubricate each segment of **new** isolator (3) with equal mix of isopropyl alcohol and water.
 - b. Push **new** isolator into wheel. Verify that each segment is completely installed.
 - c. Push compensator sprocket assembly (1) into wheel (2).

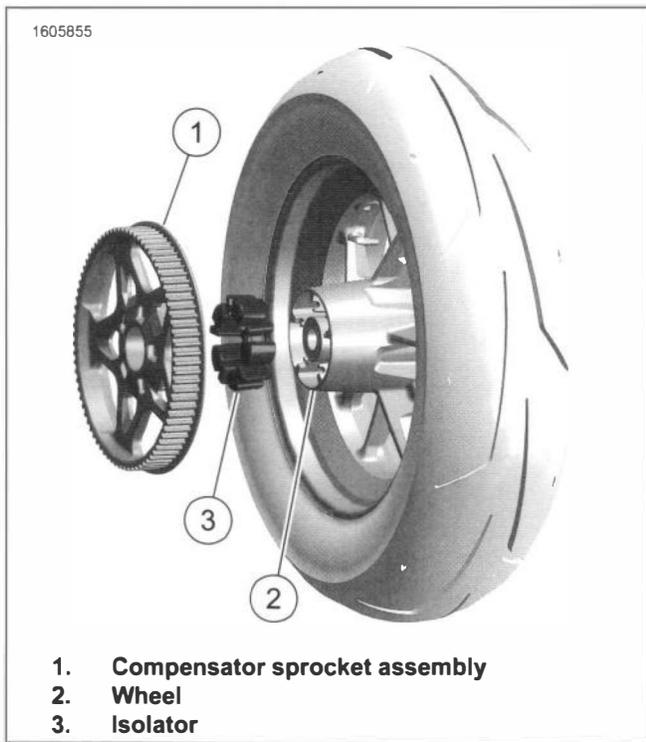


Figure 3-11. Sprocket and Wheel Isolator

DISASSEMBLE

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

1. See Figure 3-12. Use remover/installer to disassemble compensator.

Special Tool: REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER (HD-48921)

- a. Press bearings (1) and spacer (2) out inboard side of compensator hub (3).
- b. Discard bearings.

CLEAN AND INSPECT

1. Clean all parts thoroughly.
2. Verify compensator hub bearing bore is clean and dry.
3. Inspect each tooth of the rear wheel sprocket for wear or damage. Replace as necessary.

ASSEMBLE

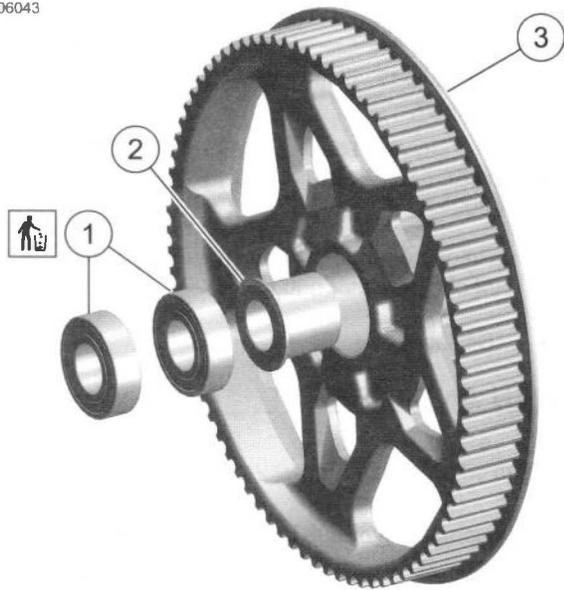
| PART NUMBER | TOOL NAME |
|-------------|---|
| HD-48921 | REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER |

1. See Figure 3-12. Assemble compensator hub.
 - a. Install spacer (2) in compensator hub (3).
 - b. Use remover/installer to press first **new** bearing (1) into compensator hub.

Special Tool: REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER (HD-48921)
 - c. Use remover/installer to press second **new** bearing into compensator hub.

NOTE

Verify spacer rotates freely.



1. Bearing (2)
2. Spacer
3. Compensator hub

Figure 3-12. Compensator Sprocket Assembly

COMPLETE

1. Install rear wheel. See REAR WHEEL (Page 3-9).

PREPARE

1. Raise front or rear wheel. See Secure the Motorcycle for Service (Page 2-2).

INSPECT

1. Turn the wheel through several rotations.

NOTE

- When checking end play, pull or push on the wheel not the brake disc. Pulling or pushing brake disc can distort disc causing a false end play reading.

2. Check end play:
 - a. See Figure 3-13. Mount a magnetic base dial indicator to the brake disc. Set the indicator contact point on the end of the axle.
 - b. Firmly push the wheel to one side. Zero the dial indicator gauge.
 - c. Firmly pull the wheel back. Note the reading of the dial indicator.
 - d. Repeat the procedure to verify the reading.
 - e. Replace the bearings if end play exceeds Dimension: 0.002 in (0.051 mm) or if there is drag, rough rotation or abnormal noise.

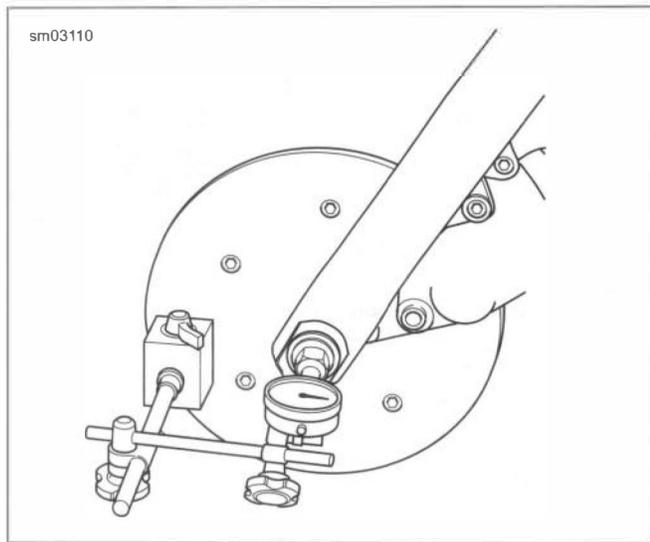


Figure 3-13. Measuring Lateral End Play (Front Wheel) (Typical)

REMOVE

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

1. Remove wheel. See FRONT WHEEL (Page 3-7) or REAR WHEEL (Page 3-9).
2. Use wheel bearing installer/remover to remove wheel bearings.

Special Tool: WHEEL BEARING INSTALLER/REMOVER (HD-44060D)

INSTALL

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

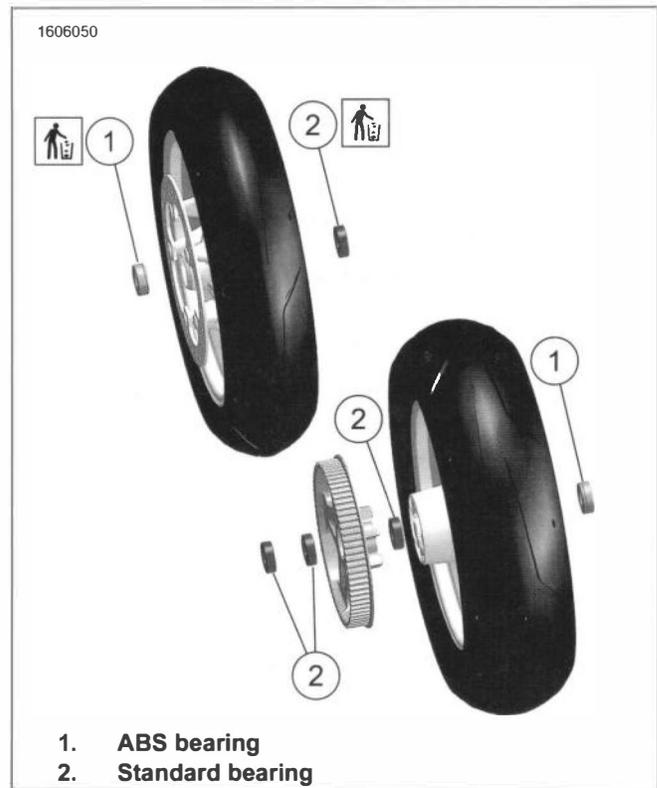
NOTICE

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

NOTE

- See Figure 3-14. Install ABS bearing first.
- **Standard bearing:** Lettered side away from wheel.
- **ABS bearing:** Red side against wheel.

1. Use wheel bearing installer/remover to install wheel bearings.
Special Tool: WHEEL BEARING INSTALLER/REMOVER (HD-44060D)
2. Install wheel. See FRONT WHEEL (Page 3-7) or REAR WHEEL (Page 3-9).



1. ABS bearing
2. Standard bearing

Figure 3-14. Wheel Bearing Locations

COMPLETE

1. Lower wheel.

GENERAL

Sensors mounted in each tire measure and report tire pressure data to the BCM. The BCM monitors the data and displays each tire pressure on the instrument module. See the electrical diagnostic manual for more information and diagnostics.

NOTE

- Do not use the TPMS as a pressure gauge when adding or removing air from a tire. Sensor transmissions vary with conditions and may not react immediately when adding or removing air from the tire. Over-inflation or under-inflation can result.
- The TPMS sensor will not communicate pressures above 345–414 kPa (50–60 psi) depending on altitude.
- TPMS has been calibrated to use air in the tire. Use of 100% nitrogen may affect the accuracy of the system.

PREPARE

1. Remove wheel. See FRONT WHEEL (Page 3-7) or REAR WHEEL (Page 3-9).
2. Check wheels for lateral and radial runout. See CHECKING AND TRUING WHEELS (Page 3-12).
3. Remove tire. See TIRES (Page 3-18).

REMOVE

1. See Figure 3-15. Remove sensor.
 - a. Remove and discard screw (1).
 - b. Remove and discard valve stem (5) and o-ring (3).
 - c. Remove tire pressure sensor (2) from wheel.

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------|--------------|-----------|
| Valve stem screw | 23–27 in-lbs | 2.6–3 N·m |

Install Sensor

1. Clean valve stem mounting location.

NOTE

- Tire pressure sensors are designed for use with the wheels specified for the motorcycle. Attempting to use sensors on other wheels can result in lack of proper fitment, TPMS malfunction and air leakage.
- Sensors with good batteries can be reused.
- Never install a used valve stem, O-ring or screw.
- See Figure 3-15. **New** screw (1) has pre-applied threadlocker.
- Orientation slot (4) engages orientation rail inside tire pressure sensor.

- Install tire pressure sensor so valve stem aims toward right side of wheel when complete.

2. Install **new** valve stem and sensor in wheel.
 - a. Install tire pressure sensor (2).
 - b. Install **new** O-ring (3) on **new** valve stem (5).
 - c. Install **new** valve stem.
 - d. Install **new** screw (1).
 - e. While holding valve stem aligned with wheel, tighten. Torque: 23–27 in-lbs (2.6–3 N·m) Valve stem screw
 - f. Do not attempt to rotate valve stem once it is installed on wheel.

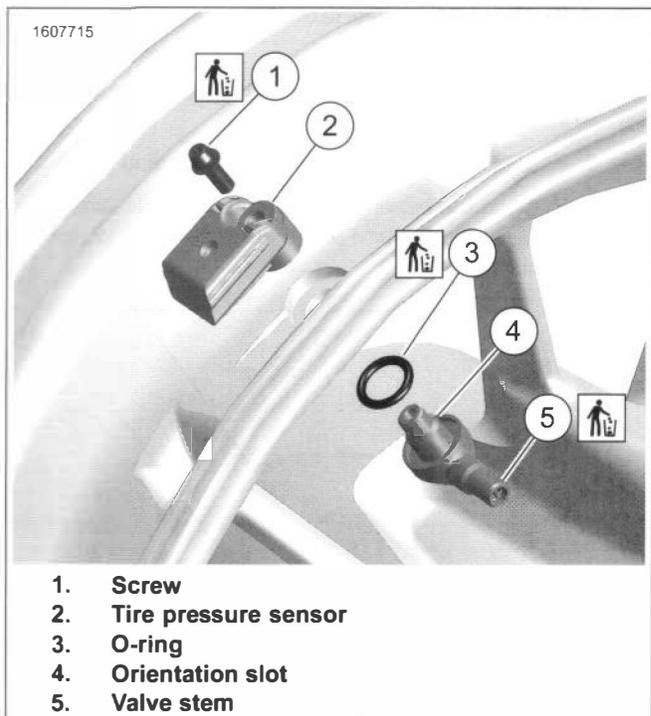


Figure 3-15. Tire Fill Valve/TPMS

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |
| HD-51794 | TPMS ACTIVATION TOOL |

1. Install tire. See TIRES (Page 3-18).

- 2.

NOTE

The sensor must be in PARK mode (have been at rest for approximately 7 minutes) to assign to the vehicle. This includes spin balancing or riding the motorcycle.

New sensor: Before riding motorcycle, assign using TPMS activation tool with Digital Technician II (DT II).

Special Tool: TPMS ACTIVATION TOOL (HD-51794)

Special Tool: DIGITAL TECHNICIAN II (HD-48650)

a. Connect Digital Technician II to vehicle.

b. Go to Toolbox > Vehicle Setup > TPMS > Configure.
Select sensor assignment.

c. Follow the online instructions to configure system to recognize sensors.

GENERAL

⚠ WARNING

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

Always maintain proper tire pressure. See INSPECT TIRES AND WHEELS (Page 2-9). Do not load tires beyond GAWR. Refer to tables in SPECIFICATIONS (Page 3-4). Underinflated, over-inflated or overloaded tires can fail.

NOTE

- Check runout on wheel before installing a **new** tire. See CHECKING AND TRUING WHEELS (Page 3-12).
- Store **new** tires on a horizontal tire rack. Storing in a vertical stack compresses the tires and closes the beads.
- Inspect tires for punctures, cuts, breaks and wear at least weekly.
- See Figure 3-16. The tread wear indicators appear when $\frac{1}{32}$ in (0.8 mm) or less tread remains. Always replace tires before tread is worn to the indicators.

Replace tire if:

- Tread is worn to the tire wear indicators.
- Tire cords or fabric are visible.
- Tire has a bump, bulge or split.
- Puncture that cannot be repaired.

Refer to INSPECT TIRES AND WHEELS (Page 2-9) for recommended tires.

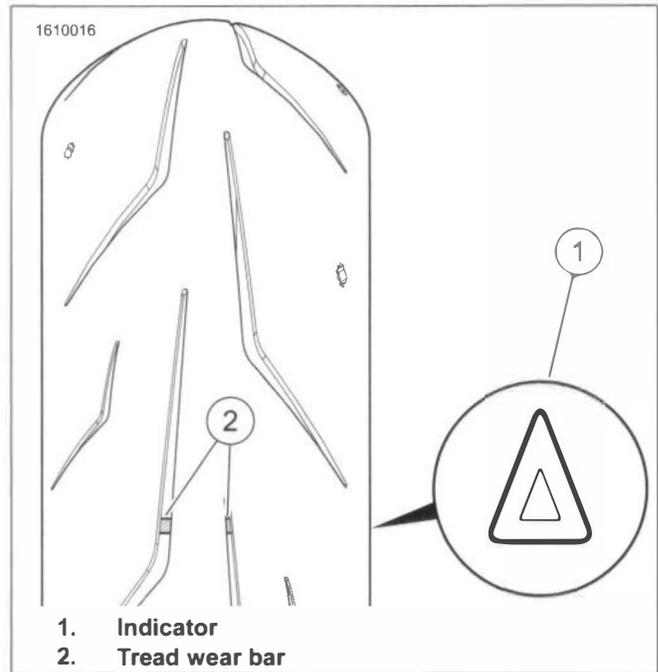


Figure 3-16. Tread Wear Indicator: Dunlop Tires

NOTE

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

Different diameter wheels or tires can:

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

Operating with over- or under-inflated tires can reduce ABS performance.

PREPARE

1. Remove wheel. See FRONT WHEEL (Page 3-7) or REAR WHEEL (Page 3-9).
2. Check wheels for lateral and radial runout. See Checking Wheel Runout (Page 3-12).

REMOVE**NOTE**

- Wheels equipped with tire pressure sensors require special tire mounting and dismounting procedures. Failure to follow these procedures results in damaged sensors.
- Never allow tire machine spoon, tire iron or tire bead to contact sensor. Sensor damage will occur.

NOTE

Take care when replacing tire to prevent cosmetic damage to wheel.

1. Deflate tire.

NOTE

Break the bead being careful to not damage tire pressure sensor.

2. See Figure 3-17. Engage tire machine spoon (1) 30 degrees (4) from the valve stem (2) in the direction of tire machine rotation (3).
3. While rotating wheel away from valve stem, remove the first bead.
4. Repeat with remaining bead. Remove tire.

CLEAN, INSPECT AND REPAIR

1. Inspect.
 - a. Verify wheel is true. See CHECKING AND TRUING WHEELS (Page 3-12).
 - b. Check tire tread depth.
 - c. Inspect tire for punctures or tears. Small punctures can be repaired.
2. Clean.
 - a. Clean the inside of tire.
 - b. Clean rim bead area with a stiff wire brush.

⚠ 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 (129 km/h). Failure to follow this warning could lead to tire failure and result in death or serious injury. (00015b)

1. Repair.
 - a. Repair tread on tubeless tires if puncture is at dimension or smaller.
 $\frac{1}{4}$ in (6.4 mm)
 - b. Make repairs from inside the tire.
 - c. Always combine a patch and plug when repairing tire.

INSTALL

⚠ WARNING

Harley-Davidson recommends the use of its specified tires. Harley-Davidson vehicles are not designed for operation with non-specified tires, including snow, moped and other special-use tires. Use of non-specified tires can adversely affect stability, handling or braking and lead to loss of vehicle control, which could result in death or serious injury. (00024d)

⚠ 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)

For tire pressures, refer to INSPECT TIRES AND WHEELS (Page 2-9).

NOTE

- Mount tires with arrows molded into the tire sidewall pointing in the direction of forward rotation.
- If tire has a balance dot on the sidewall, align the balance dot with the valve stem.

1.

NOTE

- Wheels equipped with tire pressure sensors require special tire mounting and dismounting procedures. Failure to follow these procedures results in damaged sensors.
- Never allow tire machine spoon, tire iron or tire bead to contact sensor. Sensor damage will occur.

See Figure 3-17. Install tire on wheel.

2. Start the first bead opposite from the valve stem.
3. Install first bead.
4. Engage the second bead 30 degrees from the valve stem in the direction of machine rotation.
5. While rotating away from the valve stem, install the second bead.
6. Inflate to the correct pressure. Refer to INSPECT TIRES AND WHEELS (Page 2-9).

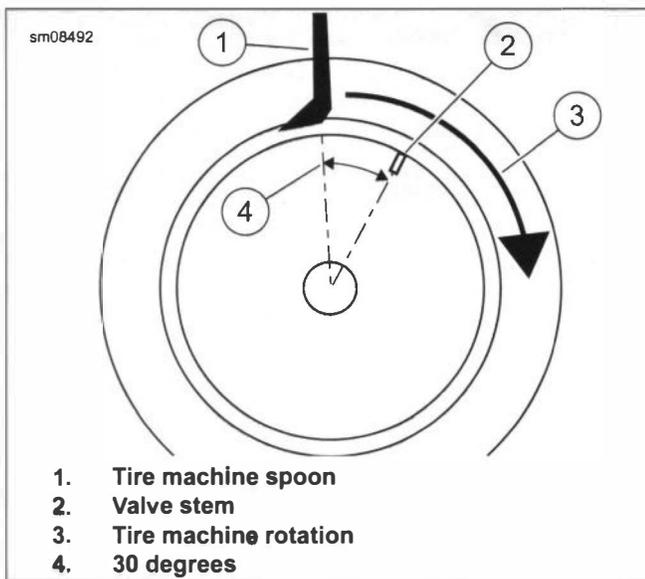


Figure 3-17. Tire Machine Operation

CHECK TIRE RUNOUT

Lateral Runout

NOTE

- Measure runout with wheel installed on motorcycle or using a wheel stand.
- Avoid measuring on raised letters or vents.

1. Check tire pressure.
2. See Figure 3-18. Spin the wheel and measure lateral runout from a fixed point to a smooth area on the tire sidewall.
3. If lateral runout exceeds dimension shown, remove tire from rim and check rim lateral runout. See CHECKING AND TRUING WHEELS (Page 3-12).

0.090 in (2.29 mm)

- a. If rim runout is within specification, replace faulty tire.
- b. If rim runout is not within specification, replace wheel. See CHECKING AND TRUING WHEELS (Page 3-12).

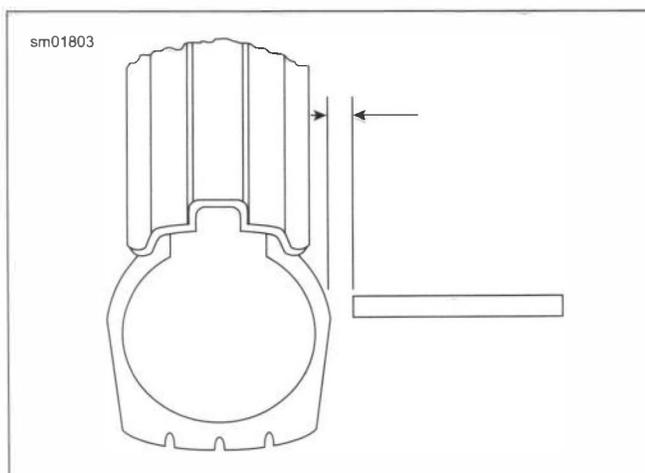


Figure 3-18. Checking Tire Lateral Runout

Radial Runout

1. Check tire pressure.
2. See Figure 3-19. Spin the wheel on the axle and measure radial runout at the tread centerline.
3. If tire runout exceeds dimension, remove tire from rim and check rim radial runout. See CHECKING AND TRUING WHEELS (Page 3-12).

0.090 in (2.29 mm)

- a. If rim runout is within specification, replace faulty tire.
- b. If rim runout is not within specification, replace wheel. See CHECKING AND TRUING WHEELS (Page 3-12).

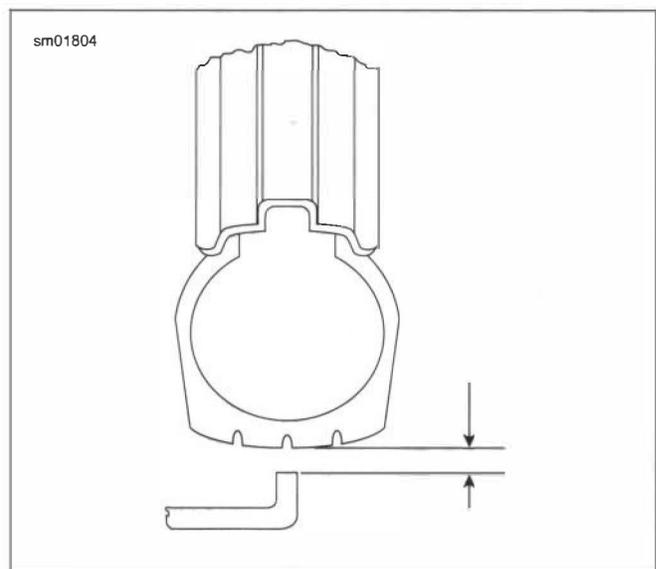


Figure 3-19. Checking Tire Radial Runout

BALANCE

Static versus 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.

NOTE

- 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.

GENERAL

See INSPECT AND ADJUST DRIVE BELT AND SPROCKETS (Page 2-27) for wheel alignment procedure.

RIDER ENHANCEMENTS

For information about the ABS system, see ABS MODULE (Page 3-40).

System Components

The braking system includes the following:

Wheel Speed Sensor (WSS) (front and rear): Reports wheel speed data directly to the ABS module.

Inertial Measurement Unit (IMU): Reports lateral, longitudinal, and vertical acceleration, as well as roll, yaw, and pitch to ABS module, ECM and BCM.

ABS Module: The ABS Module collects data from IMU and each WSS. Communicates with ECM and BCM to manage brake application under extreme stopping and cornering conditions. Controls Linking function described below.

When ABS is activated, the solenoid valves decrease, hold or increase hydraulic fluid pressure to control the individual calipers of each wheel to prevent wheel slipping.

Traction Control System (TCS)

Traction control is selectable and can be turned off.

The cornering traction control system stored in the ABS module constantly monitors the IMU and WSSs to observe the vehicles lean angle during turns, and will adjust torque to the drive wheel by sending a signal to the ECM to reduce throttle input when it senses excessive rear wheel slip, or when necessary to improve vehicle control while cornering.

During start up, the traction-control and ABS lamps flash simultaneously indicating that both systems are waiting for the vehicle to complete a wheel speed sensor check. The traction control system is operational after startup even during the wheel speed sensor check. The traction control lamp should turn off when the sensor check is complete.

Propulsive Torque Management (PTM)

PTM functionality follows traction control status.

PTM limits the rate of torque increase available as a function of the vehicle position, such as under a cornering condition (lean angle). PTM works off of inputs from the IMU and WSSs and is a function of TCS. When system detects that excessive throttle is being applied for conditions, the ABS module will request a reduction in engine torque.

Drag-Torque Slip Control System (DSCS)

The ABS module monitors rear wheel slip via the WSSs during a downshift or with throttle closed. When the ABS module detects this condition, a torque command signal is sent to the ECM until the rear wheel is no longer slipping. DSCS functions at speeds over approximately 10 mph (16 km/h) and works with the ABS system to balance vehicle deceleration and rider control. DSCS is not selectable and cannot be disabled.

If the DSCS senses rear wheel slip because of powertrain deceleration it may decrease drag torque, by increasing engine rpm (Revolutions per minute), to limit slip and maintain control.

DSCS function is not adjusted for lean angle, performance of this feature was developed for straight-line use.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. **If replacing master cylinder:** Drain brake fluid from front brake system. See BLEED BRAKES (Page 3-43).
3. **If replacing master cylinder:** Remove front stop lamp switch. See FRONT STOPLAMP SWITCH (Page 8-22).

REMOVE

NOTICE

DOT 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. (00239c)

- If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.

NOTE

See Figure 3-23. Record position of brake line before removing.

1. See Figure 3-22. **If replacing master cylinder:** Detach brake line.
 - a. Remove banjo bolt (3).
 - b. Detach brake line (4) and discard gasket washers (2).
2. **If necessary:** Disconnect front stop lamp switch.
3. Detach front brake master cylinder.
 - a. Remove screws (5).
 - b. Remove clamp (6) and front brake master cylinder (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|---|--------------|-----------|
| Brake, front master cylinder banjo bolt | 17–19 ft-lbs | 23–26 N·m |
| Brake, front master cylinder mounting screw | 62–80 in-lbs | 7–9 N·m |

1. See Figure 3-22. Install front brake master cylinder.
 - a. Position front brake master cylinder (1).
 - b. Position clamp (6).
 - c. Install screws (5). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) *Brake, front master cylinder mounting screw*

2. **If disconnected:** Connect front stoplamp switch.

NOTICE

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

3. **If replacing master cylinder:** Attach brake line.
 - a. Attach brake line (4) with banjo bolt (3), and new gasket washers (2).
 - b. See Figure 3-23. Position brake line as shown.
 - c. Tighten banjo bolt.
Torque: 17–19 ft-lbs (23–26 N·m) *Brake, front master cylinder banjo bolt*

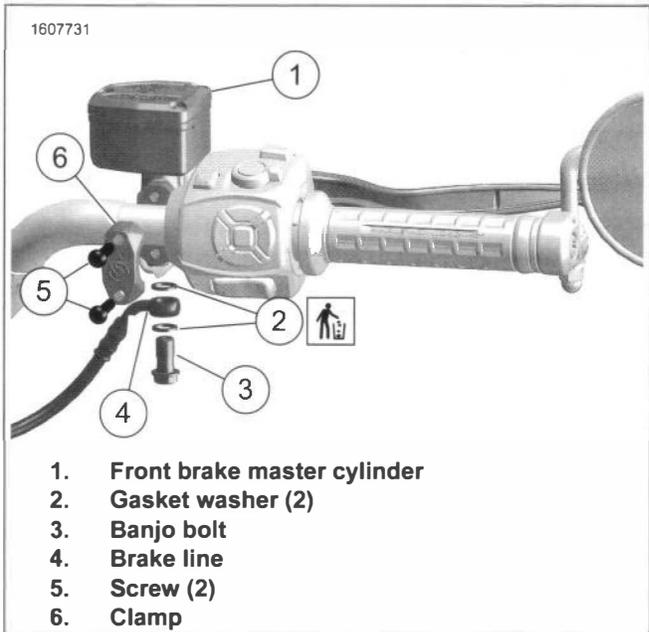


Figure 3-22. Front Brake Master Cylinder Mount



Figure 3-23. Front Master Cylinder Brake Line Location
DISASSEMBLE

NOTE

*Front master cylinder knocker and pushrod assembly **must** stay with master cylinder. The dead stroke of the master cylinder is set at the factory and should not be tampered with.*

If the lever is being replaced, the knocker **must** be transferred to the new lever. If the knocker or pushrod assembly is damaged, the master cylinder assembly **must** be replaced.

MASTER CYLINDER RESERVOIR

1. See Figure 3-25. Remove master cylinder reservoir.
 - a. Remove screws (1).
 - b. Remove master cylinder reservoir cover (2).
 - c. Remove screw (3).
 - d. Remove master cylinder reservoir (4).

BRAKE LEVER

1. See Figure 3-24. Remove brake lever.
 - a. Remove nut (8).
 - b. Remove lever pivot screw (1).
 - c. Remove brake lever (5).
2. Remove knocker.
 - a. Remove bushing (4).
 - b. Remove knocker (2).
 - c. Remove spring (3).
 - d. Remove pushrod assembly (6).
 - e. Remove dust boot (7).

CLEAN AND INSPECT

⚠ WARNING

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

1. Clean all parts thoroughly.
2. Inspect parts for wear or damage. Replace as necessary.
 - a. Inspect front brake master cylinder for leaks.
 - b. Inspect rubber boot for wear or damage.

ASSEMBLE

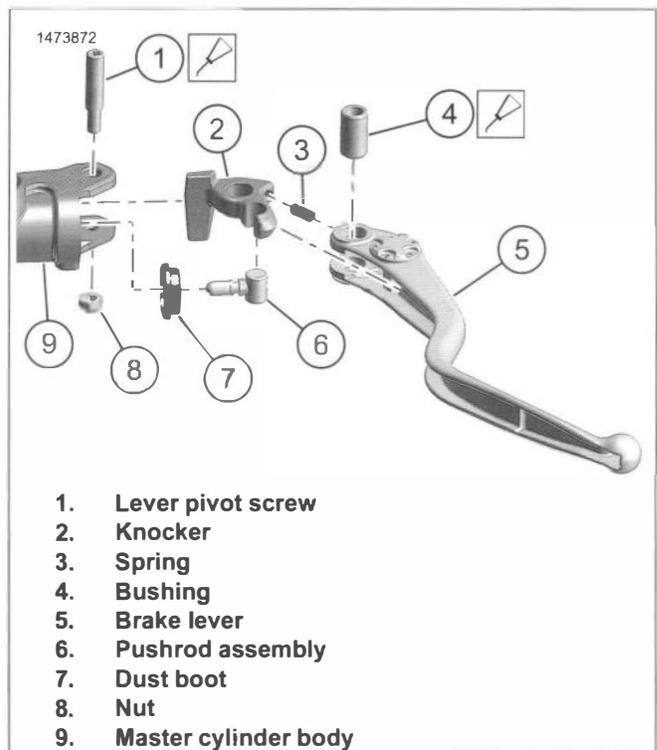
| FASTENER | TORQUE VALUE | |
|-----------------------------|----------------|-----------|
| Front brake lever pivot nut | 44–62 in-lbs | 5–7 N·m |
| Reservoir mount screw | 142–159 in-lbs | 16–18 N·m |

BRAKE LEVER

1. See Figure 3-24. Install knocker.
 - a. Install dust boot (7) on pushrod assembly (6).
 - b. Install pushrod assembly in knocker (2).
 - c. Lubricate bushing (4) using grease supplied
 - d. Install spring (3) in brake lever (5).
 - e. Place knocker (2) in position in brake lever.
 - f. Install bushing.
2. Install brake lever.
 - a. Lubricate lever pivot screw (1).
 - b. Place brake lever (5) in position.
 - c. Install lever pivot screw.
 - d. Install nut (8). Tighten.
Torque: 44–62 in-lbs (5–7 N·m) *Front brake lever pivot nut*

MASTER CYLINDER RESERVOIR

1. See Figure 3-25. Install master cylinder reservoir (4).
2. Install screw (3). Tighten.
Torque: 142–159 in-lbs (16–18 N·m) *Reservoir mount screw*
3. Install master cylinder cover (2) and screws (1). Tighten.
Torque: 7–11 in-lbs (0.8–1.2 N·m) *Reservoir mount screw*



1. Lever pivot screw
2. Knocker
3. Spring
4. Bushing
5. Brake lever
6. Pushrod assembly
7. Dust boot
8. Nut
9. Master cylinder body

Figure 3-24. Front Brake Lever

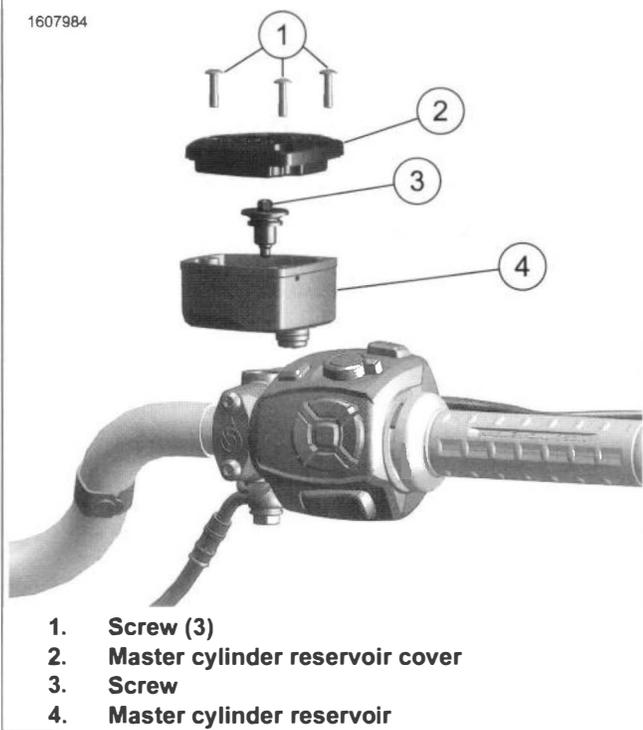


Figure 3-25. Front Reservoir

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).
2. **If replacing master cylinder:** Install front stoplamp switch. See FRONT STOPLAMP SWITCH (Page 8-22).
3. **If replacing master cylinder:** Fill and bleed front brake system. See BLEED BRAKES (Page 3-43).

PREPARE

1. **NOTE**
If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.

If only replacing brake pads, see INSPECT BRAKES (Page 2-13).

If replacing caliper: Drain brake fluid from front brake system. See BLEED BRAKES (Page 3-43).

REMOVE

NOTE

See Figure 3-27. Record position of brake line before removing.

1. See Figure 3-26. **If replacing caliper:** Detach brake line.
 - a. Remove banjo bolt (2).
 - b. Discard gasket washers (3).
2. Remove front brake caliper.
 - a. Remove bleeder screw cap (7) and position wheel speed sensor wire (6) aside.
 - b. Remove caliper mounting screws (4).
 - c. Remove front brake caliper (5).

INSTALL

| FASTENER | TORQUE VALUE | |
|--|--------------|-----------|
| Brake caliper, front, left, banjo bolt | 17–19 ft-lbs | 23–26 N·m |
| Brake caliper, front, mounting screw | 28–38 ft-lbs | 38–52 N·m |

1. See Figure 3-26. Install front brake caliper.
 - a. Install front brake caliper (5).
 - b. Install caliper mounting screws (4), do not tighten.
 - c. Apply brake pressure.
 - d. Tighten caliper mounting screws.
Torque: 28–38 ft-lbs (38–52 N·m) *Brake caliper, front, mounting screw*
 - e. Release brake pressure.

2. **If replacing caliper:** Attach brake line.
 - a. Attach brake line (1) with banjo bolt (2) and new gasket washers (3).
 - b. See Figure 3-27. Position brake line as shown.
 - c. Tighten banjo bolt.
Torque: 17–19 ft-lbs (23–26 N·m) *Brake caliper, front, left, banjo bolt*
 - d. Position wheel speed sensor wire (6), install bleeder screw cap (7).

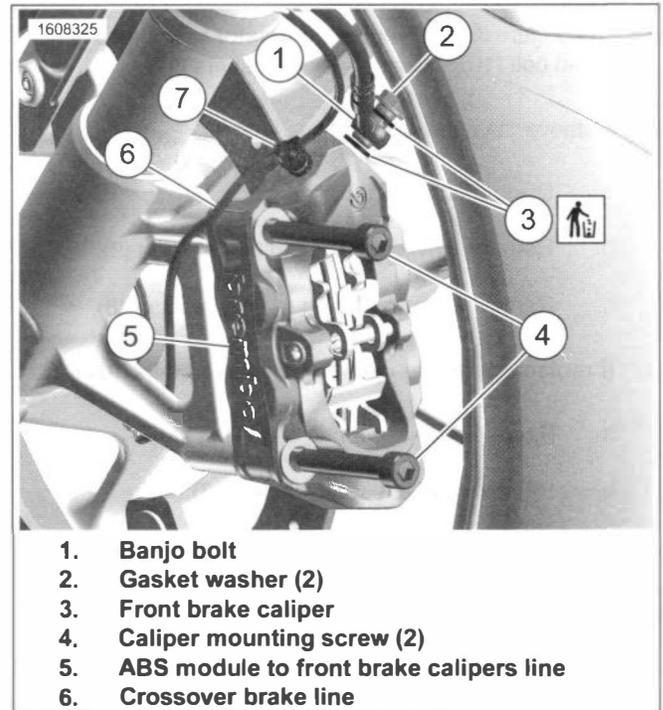
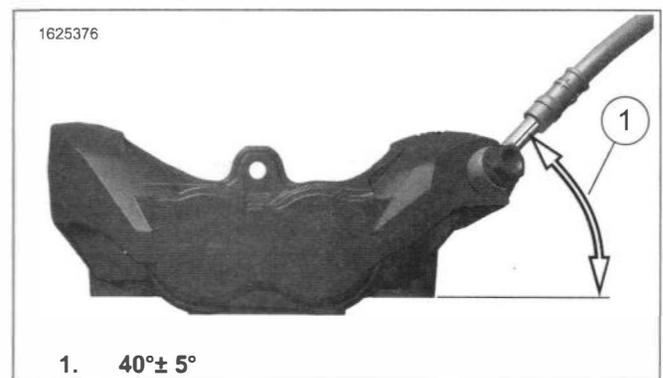


Figure 3-26. Front Brake Caliper



1. 40°± 5°
Figure 3-27. Front Caliper Brake Line Location COMPLETE

1. **If replacing caliper:** Fill and bleed front brake system. See BLEED BRAKES (Page 3-43).

PREPARE

1. Remove right side chin spoiler. See CHIN SPOILER (Page 3-69).
2. **If replacing master cylinder:** Drain brake fluid from rear brake system. See BLEED BRAKES (Page 3-43).

REMOVE

NOTE

See Figure 3-29. Record position of brake line before removing.

1. See Figure 3-28. **If replacing master cylinder:** Remove banjo bolt (10). Discard gasket washers (11).
2. Remove master cylinder.
 - a. Discard cotter pin (5).
 - b. Remove clevis pin (6) from brake pedal (9).
 - c. Remove screws (7) and master cylinder (8).
3. **If replacing master cylinder:** Remove brake hose.
 - a. Reposition lower spring clamp (12).
 - b. Remove brake reservoir hose (13).
4. **If replacing master cylinder reservoir:** Remove master cylinder reservoir.
 - a. Reposition upper spring clamp (3).
 - b. Remove brake reservoir hose (13).
 - c. Remove reservoir screw (1) and master cylinder reservoir (2).

- d. Move upper spring clamp (3) into position.
2. **If replacing master cylinder:** Install brake hose.
 - a. Install brake reservoir hose (13).
 - b. Move lower spring clamp (12) into position.
3. Install master cylinder.
 - a. Align master cylinder (8) with brake pedal (4).
 - b. Install clevis pin (6) through brake pedal and pushrod.
 - c. Install **new** cotter pin (5).
 - d. Install master cylinder (8) in position.
 - e. Install mounting screws (7). Tighten.
Torque: 80–97 **in-lbs** (9–11 N·m) *Brake, rear master cylinder screws*
4. **If replacing master cylinder:** Attach brake line.
 - a. Attach ABS module to rear brake master cylinder line (9) to master cylinder (8) with banjo bolt (10) and **new** gasket washers (11).
 - b. See Figure 3-29. Position brake line as shown.
 - c. Tighten banjo bolt.
Torque: 17–19 ft-lbs (23–26 N·m) *Brake, rear master cylinder banjo bolt*

INSTALL

| FASTENER | TORQUE VALUE | |
|---|---------------------|-----------|
| Brake, rear master cylinder banjo bolt | 17–19 ft-lbs | 23–26 N·m |
| Brake, rear master cylinder reservoir screw | 62–80 in-lbs | 7–9 N·m |
| Brake, rear master cylinder screws | 80–97 in-lbs | 9–11 N·m |

1. See Figure 3-28. **If replacing master cylinder reservoir:** Install master cylinder reservoir.
 - a. Install master cylinder reservoir (2).
 - b. Install reservoir screw (1). Tighten.
Torque: 62–80 **in-lbs** (7–9 N·m) *Brake, rear master cylinder reservoir screw*
 - c. Install brake reservoir hose (13).

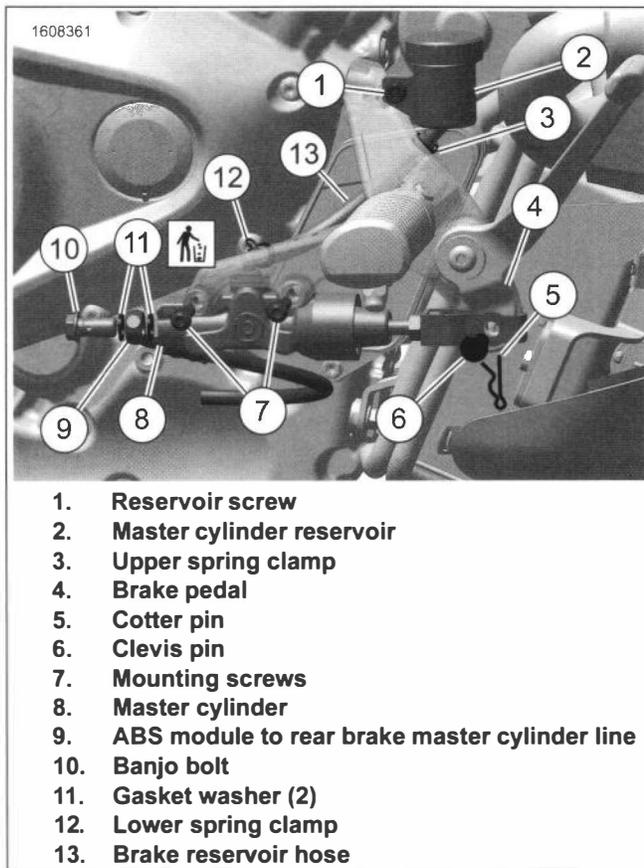


Figure 3-28. Rear Brake Master Cylinder

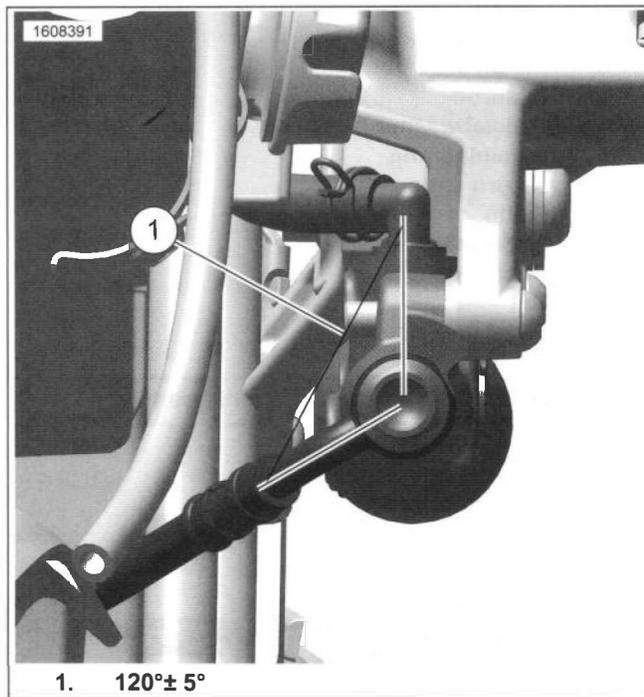


Figure 3-29. Rear Master Cylinder Brake Line Location

DISASSEMBLE

NOTE

Do not scratch or nick banjo sealing surface during handling.

1. See Figure 3-30. Remove pedal connector.
 - a. Remove E-clip (13).

- b. Remove pedal connector (12).
 - c. Remove nut (11).
2. Remove dust boot (10).
3. Remove return spring.
 - a. Remove flat washer (9).
 - b. Push and hold return spring (7).
 - c. Remove E-clip (8).
 - d. Release return spring tension and remove return spring.
4. Remove pushrod.
 - a. Push and hold end of pushrod (4).
 - b. Discard retaining ring (6).
 - c. Remove pushrod with special washer (5).
5. Pull piston assembly from piston bore.
6. Discard spigot (1).

CLEAN AND INSPECT

⚠ WARNING

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

1. Clean all parts with denatured alcohol.
2. Inspect parts for wear or damage. Replace or repair as necessary.
 - a. Inspect rear brake master cylinder for leaks.
 - b. Inspect rubber boot for wear or damage.

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|---------------------|---------------|---------------|
| Pedal connector nut | 93–111 in-lbs | 10.5–12.5 N·m |

| CONSUMABLE | PART NUMBER |
|--|-------------|
| Harley-Davidson Platinum Label DOT 4 Brake Fluid | 41800xxx |

1. Lightly lubricate piston bore and OD of piston seals with brake fluid.
Consumable: Harley-Davidson Platinum Label DOT 4 Brake Fluid (41800xxx)

2. See Figure 3-30. Press **new** spigot (1) assembly into master cylinder body (2).
3. Insert piston assembly (3) into piston bore.
4. Slide special washer (5), with collar facing outer end of pushrod (4), and **new** retaining ring (6) over pushrod.
5. Install retaining ring.
 - a. Hold piston assembly in with pushrod.
 - b. Install retaining ring in groove.
 - c. Verify retaining ring is seated.
6. Install pedal return spring.
 - a. Seat return spring (7) on retaining ring.
 - b. Compress return spring and install E-clip (8) in inboard groove of pushrod.
 - c. Slide flat washer (9) over pushrod.
7. Install dust boot (10).
8. Install nut (11) on pushrod.
9. Install pedal connector.
 - a. See Figure 3-31. Install pedal connector (12) on pushrod to measurement.

Length/Dimension/Distance: 3.83–3.94 in (97.2–100.2 mm)
 - b. Tighten nut against pedal connector.

Torque: 93–111 **in-lbs** (10.5–12.5 N·m) *Pedal connector nut*
 - c. See Figure 3-31. Install E-clip (13) in outboard groove of pushrod.

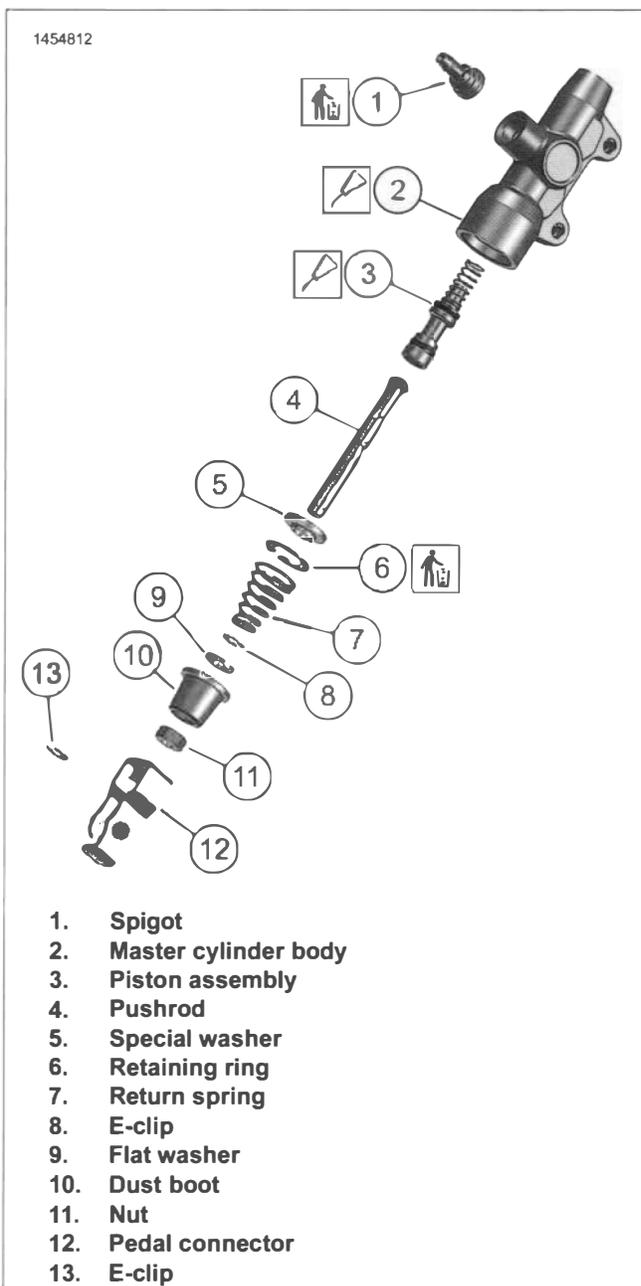


Figure 3-30. Master Cylinder Assembly

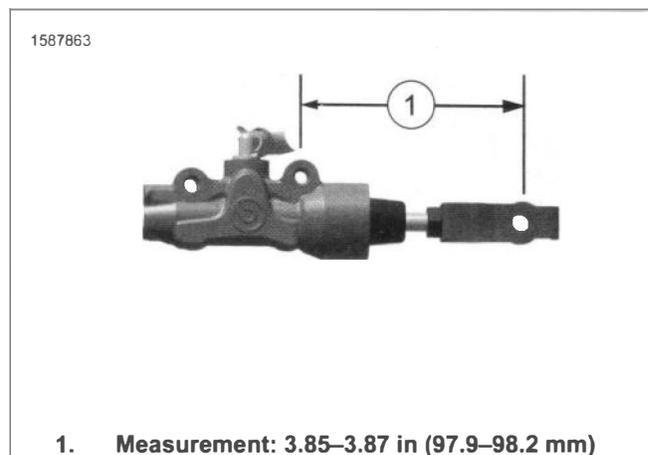


Figure 3-31.

COMPLETE

1. **If replacing master cylinder:** Fill and bleed rear brake system. See CHECK AND REPLACE BRAKE FLUID (Page 2-16).
2. Install right side chin spoiler. See CHIN SPOILER (Page 3-69).

PREPARE

1. **If replacing caliper:** Drain brake fluid. See BLEED BRAKES (Page 3-43).

REMOVE

NOTE

See Figure 3-33. Record position of brake line before removing.

1. See Figure 3-32. **If replacing caliper:** Detach brake line.
 - a. Remove banjo bolt (4).
 - b. Discard gasket washers (5).
2. Remove rear brake caliper.
 - a. Remove mounting screws (6).
 - b. Remove caliper (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------------------|--------------|-----------|
| Brake caliper, rear, banjo bolt | 17–19 ft-lbs | 23–26 N·m |
| Brake caliper, rear, mounting screw | 18–21 ft-lbs | 24–28 N·m |

1. See Figure 3-32. Install brake caliper.
 - a. Install brake caliper (2) on caliper bracket (1).
 - b. Install mounting screws (6). Tighten.
Torque: 18–21 ft-lbs (24–28 N·m) *Brake caliper, rear, mounting screw*
2. **If replacing caliper:** Attach brake line.
 - a. Attach brake line (3) with banjo bolt (4) and **new** gasket washers (5).
 - b. See Figure 3-33. Position brake line as shown.
 - c. Tighten banjo bolt.
Torque: 17–19 ft-lbs (23–26 N·m) *Brake caliper, rear, banjo bolt*

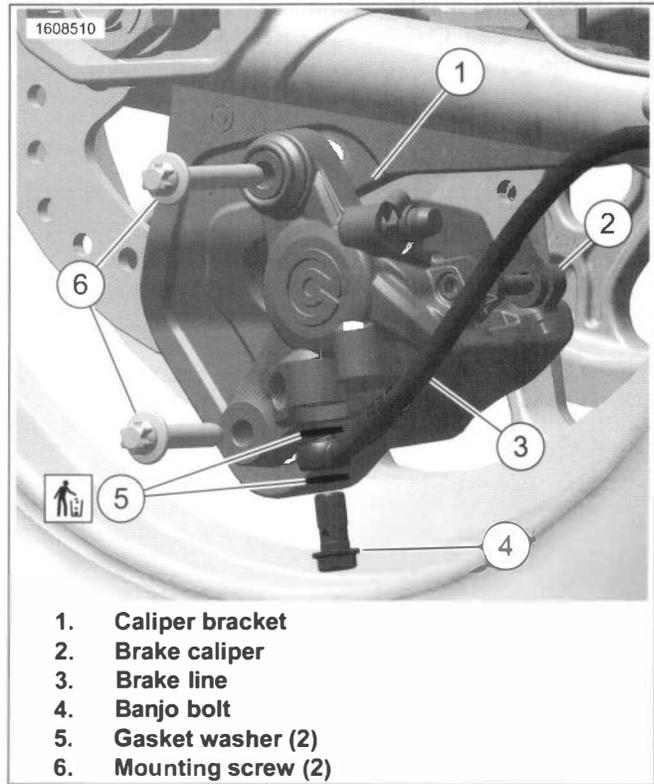


Figure 3-32. Rear Brake Caliper Mounting

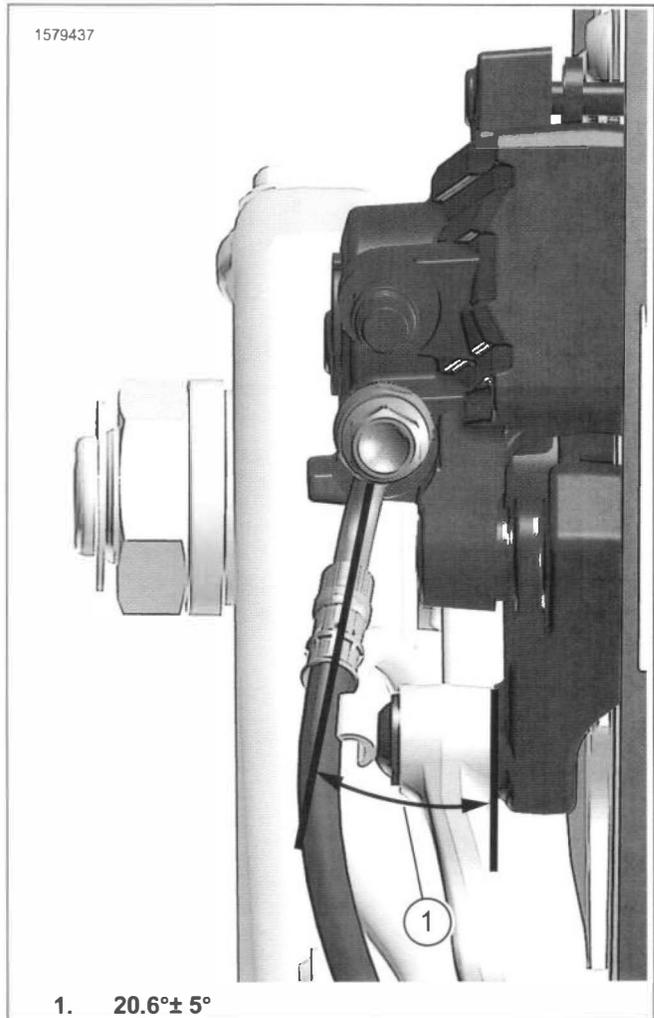


Figure 3-33. Rear Caliper Brake Line Location

COMPLETE

1. **If replacing caliper:** Fill and bleed rear brake system. See BLEED BRAKES (Page 3-43).

BRAKE LINE: FRONT MASTER CYLINDER TO ABS MODULE

| FASTENER | TORQUE VALUE | |
|-------------------------------------|--------------|-------------|
| Front brake line, front clamp screw | 49–66 in-lbs | 5.5–7.5 N·m |
| Front brake line, rear clamp screws | 62–80 in-lbs | 7–9 N·m |
| Wire form screw | 62–80 in-lbs | 7–9 N·m |

Prepare

1. Remove seat. See SEAT (Page 3-82).
2. Remove fuel tank. See FUEL TANK (Page 6-12).
3. Remove frame crossmember. See FRAME CROSSMEMBER (Page 3-89).
4. Drain front brake lines. See BLEED BRAKES (Page 3-43).
5. Remove brake line from front brake master cylinder. See FRONT BRAKE MASTER CYLINDER (Page 3-24).
6. Remove brake line from ABS module. See ABS MODULE (Page 3-40).
7. Remove instrument module. See INSTRUMENT MODULE (IM) (Page 8-23).

Remove

NOTE

All brake line retaining clamps must be reinstalled in their original position.

1. See Figure 3-34. Remove screw (2) and brake line (3) from wire form (1).
2. See Figure 3-35. Remove brake line left side clamps.
 - a. Remove screws (3).
 - b. Remove clamps and grommets (1).
3. Remove double loop cable strap (2), discard.
4. See Figure 3-36. Remove rear clamp.
 - a. Remove screw (1).
 - b. Remove clamp and grommet (3).
 - c. Remove brake line (2).

Install

1. Place brake line in position.

NOTE

Do not tighten clamp screws until all screws have been installed.

2. See Figure 3-36. Install rear clamp.
 - a. Install grommet and clamp (3).
 - b. Install screw (2).
3. See Figure 3-35. Install **new** line double loop cable strap (2).
4. Install brake line left side clamps.
 - a. Install grommet and clamps (1).
 - b. Install screws (3).
5. See Figure 3-34. Install brake line (3) in wire form (1). Install screw (2). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) *Wire form screw*
6. See Figure 3-37. Tighten clamp screws.
Torque: 62–80 in-lbs (7–9 N·m) *Front brake line, rear clamp screws*
Torque: 49–66 in-lbs (5.5–7.5 N·m) *Front brake line, front clamp screw*

Complete

1. Install instrument module. See INSTRUMENT MODULE (IM) (Page 8-23).
2. Install brake line at ABS module. See ABS MODULE (Page 3-40).
3. Install brake line at front master cylinder. See FRONT BRAKE MASTER CYLINDER (Page 3-24).
4. Fill and bleed brake system. See BLEED BRAKES (Page 3-43).
5. Install frame crossmember. See FRAME CROSSMEMBER (Page 3-89).
6. Install fuel tank. See FUEL TANK (Page 6-12).
7. Install seat. See SEAT (Page 3-82).

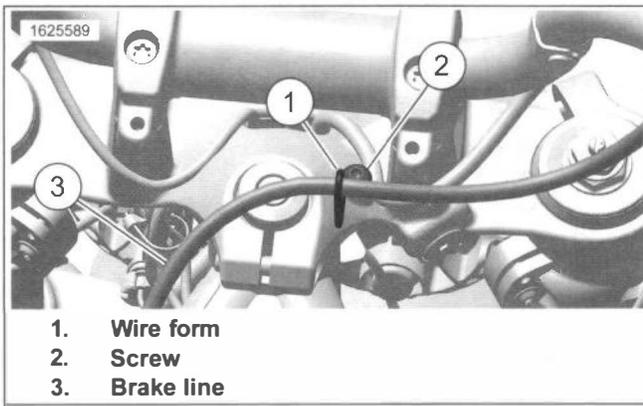


Figure 3-34. Brake Line Routing (Forward)

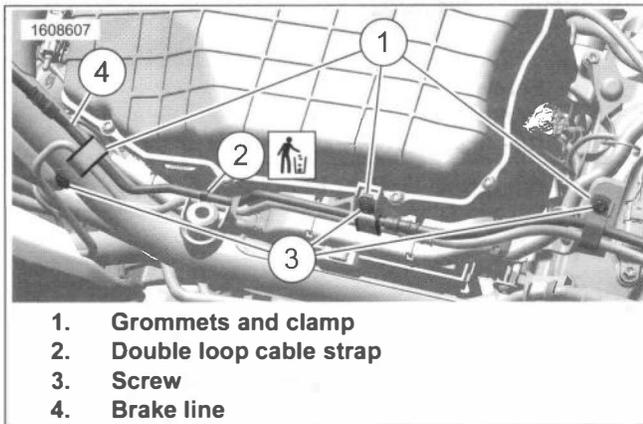


Figure 3-35. Left Side Brake Line From Front Master Cylinder

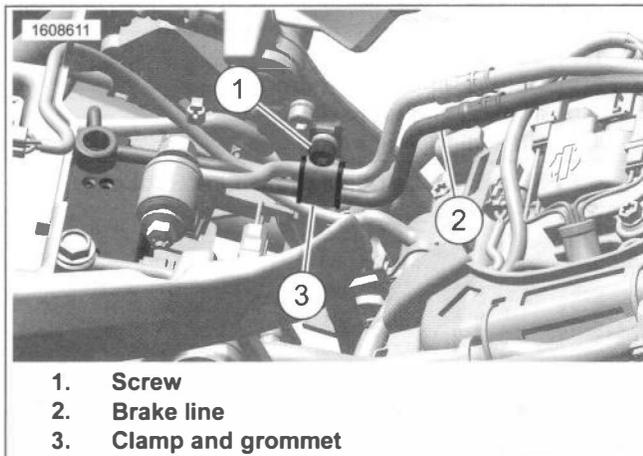


Figure 3-36. Rear Brake Line Clamp

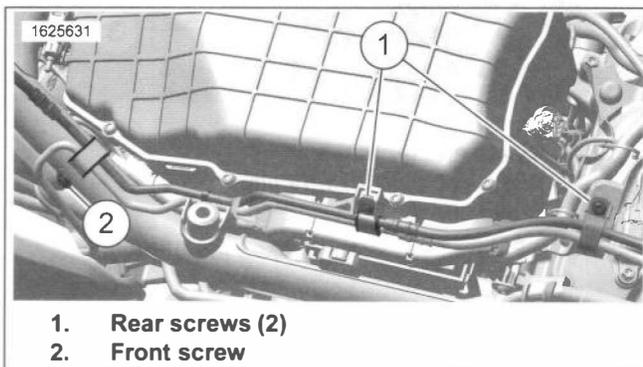


Figure 3-37. Tighten Screws

BRAKE LINE: FRONT CALIPER TO ABS MODULE

| FASTENER | TORQUE VALUE | |
|-------------------------------------|--------------|-------------|
| Front brake line, front clamp screw | 49–66 in-lbs | 5.5–7.5 N·m |
| Front brake line, rear clamp screws | 62–80 in-lbs | 7–9 N·m |

Prepare

1. Remove seat. See SEAT (Page 3-82).
2. Remove fuel tank. See FUEL TANK (Page 6-12).
3. Remove left steering head cover. See SIDE COVERS (Page 3-46).
4. Remove frame crossmember. See FRAME CROSSMEMBER (Page 3-89).
5. Drain front brake lines. See BLEED BRAKES (Page 3-43).
6. Remove brake line from ABS module. See ABS MODULE (Page 3-40).
7. Remove brake line from front brake caliper. See FRONT BRAKE CALIPER (Page 3-27).

Remove

NOTE

All brake line retaining clamps must be reinstalled in their original position.

1. See Figure 3-38. Remove rear clamp.
 - a. Remove screw (1).
 - b. Remove clamp and grommet (3).
2. See Figure 3-39. Remove clamps.
 - a. Remove screws (1).
 - b. Remove clamps and grommets (3).
 - c. Remove double loop cable strap.
3. Remove brake lines line clip (2).
4. See Figure 3-38. Remove front caliper to ABS module brake line.
 - a. Remove screw (1).
 - b. Remove clamp and grommet (2).
 - c. Remove clips (3).
5. Remove brake line (4).

Install

NOTE

Do not tighten clamp screws until all screws have been installed.

1. See Figure 3-38. Place brake line in position (4).
 - a. Install clips (3).
 - b. Install clamp and grommet (2).
 - c. Install screw (1).
2. See Figure 3-38 Install rear clamp.
 - a. Install grommet and clamp (3).
 - b. Install screw (1).
3. See Figure 3-39. Install double loop cable strap (2).
4. Install brake line left side grommets and clamps (3).
5. Install screws (5).
6. See Figure 3-41. Tighten clamp screws.

Torque: 62–80 **in-lbs** (7–9 N·m) *Front brake line, rear clamp screws*
Torque: 49–66 **in-lbs** (5.5–7.5 N·m) *Front brake line, front clamp screw*

Complete

1. Install brake line at ABS module. See ABS MODULE (Page 3-40).
2. Install brake line at front caliper. See Front Crossover Brake Line in this section.
3. Fill and bleed brake system. See BLEED BRAKES (Page 3-43).
4. Install frame crossmember. See FRAME CROSSMEMBER (Page 3-89).
5. Install fuel tank. See FUEL TANK (Page 6-12).
6. Install seat. See SEAT (Page 3-82).

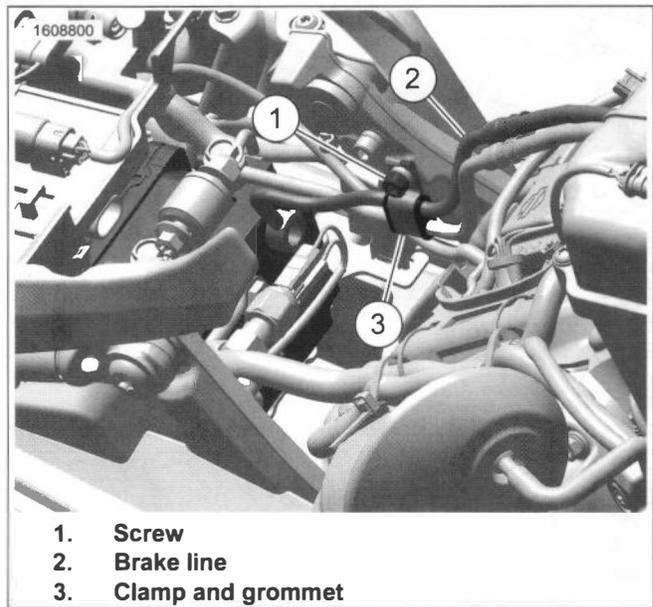


Figure 3-38. Rear Brake Line Clamp

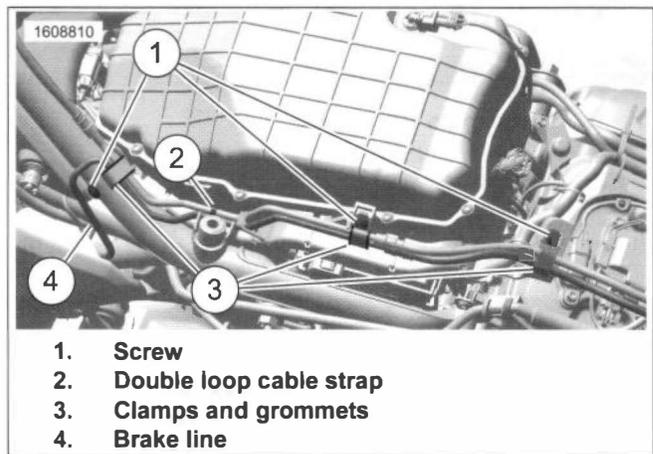


Figure 3-39. Left Side Brake Line Routing

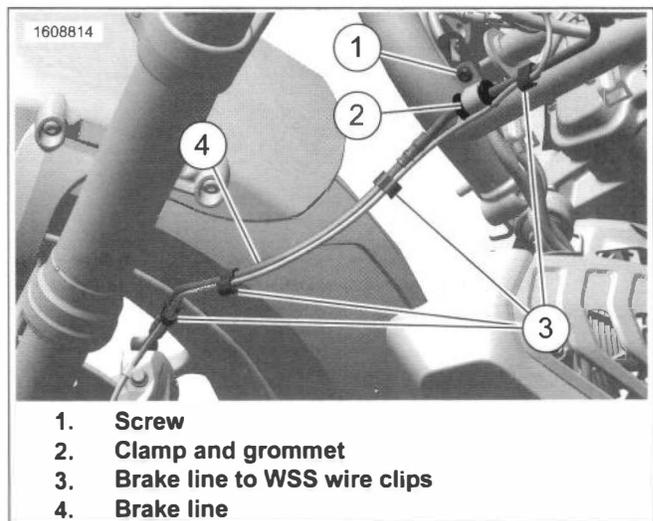
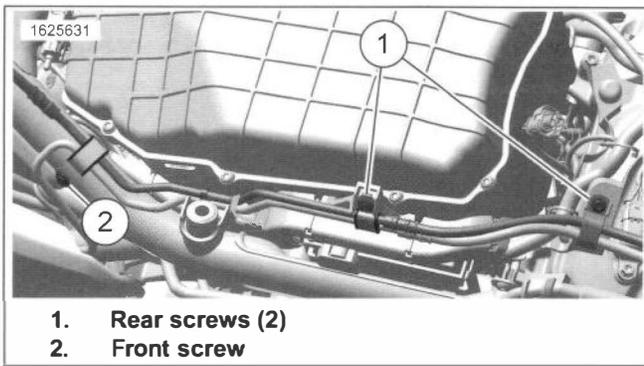


Figure 3-40. Front Brake Line Clips



1. Rear screws (2)
2. Front screw

Figure 3-41. Tighten Screws

BRAKE LINE: REAR MASTER CYLINDER TO ABS MODULE

| FASTENER | TORQUE VALUE | |
|------------------------------------|--------------|---------|
| Brake line, rear dual, clamp screw | 62–80 in-lbs | 7–9 N·m |

Prepare

1. Remove seat. See SEAT (Page 3-82).
2. Drain rear brake lines. See BLEED BRAKES (Page 3-43).
3. Remove mufflers. See MUFFLERS (Page 6-33).
4. Remove tail section cover. See TAIL SECTION (Page 3-83).
5. Disconnect rear stoplamp switch. See REAR STOPLAMP SWITCH (Page 8-31).
6. Remove brake line from rear brake master cylinder. See REAR BRAKE MASTER CYLINDER (Page 3-28).
7. Remove brake line from ABS module. See ABS MODULE (Page 3-40).

Remove

1. See Figure 3-42. Remove brake line from lower clamps.
 - a. Remove screws (1).
 - b. Remove clamps and grommets (3).
2. See Figure 3-43. Remove brake line from upper clamp.
 - a. Remove screw (2).
 - b. Remove clamp and grommet (3).
3. Remove brake line (1).

Install

NOTE

Do not tighten clamp screws until all screws have been installed.

1. See Figure 3-43. Install brake line (1).
 - a. Install grommet and clamp (2).
 - b. Install screw (3).
2. See Figure 3-42. Install lower clamps and grommets (3).
3. Install screws (1). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) Brake line, rear dual, clamp screw

Complete

1. Install brake line to ABS module. See ABS MODULE (Page 3-40).
2. Install brake line to rear brake master cylinder. See REAR BRAKE MASTER CYLINDER (Page 3-28).
3. Connect rear stoplamp switch. See REAR STOPLAMP SWITCH (Page 8-31).
4. Fill and bleed brake system. See BLEED BRAKES (Page 3-43).
5. Install mufflers. See MUFFLERS (Page 6-33).
6. Install tail section cover. See TAIL SECTION (Page 3-83).
7. Install seat. See SEAT (Page 3-82).

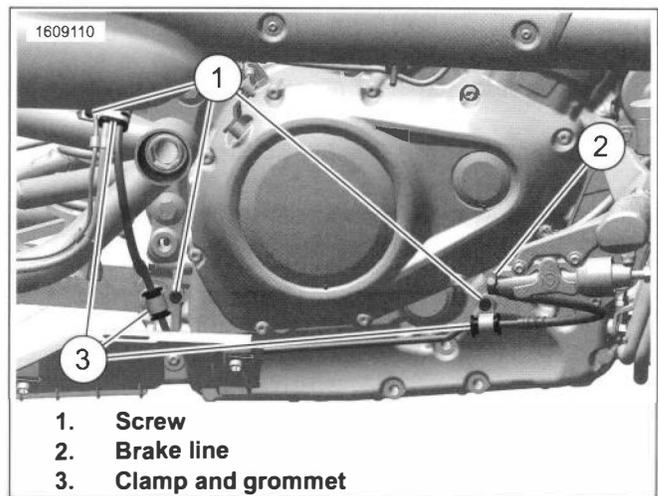
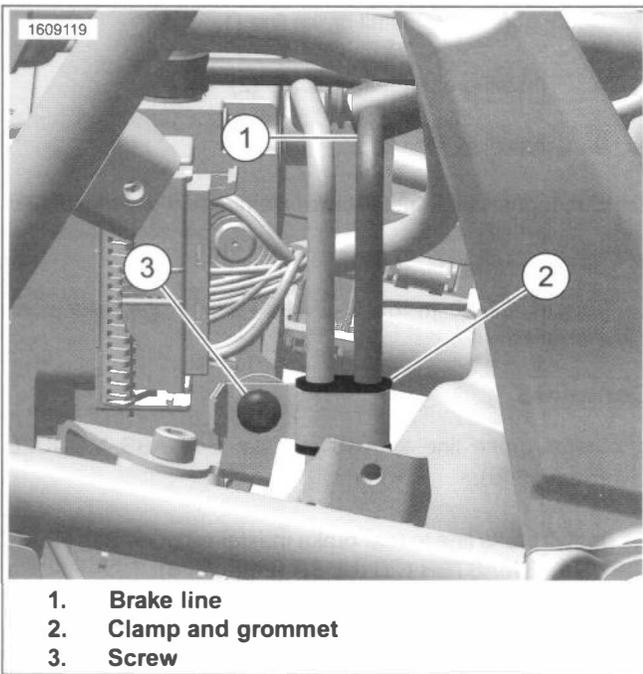


Figure 3-42. ABS Module to Rear Master Cylinder Brake Line Lower Clamps



1. Brake line
2. Clamp and grommet
3. Screw

**Figure 3-43. Rear Brake Line Upper Clamp
BRAKE LINE: REAR CALIPER TO ABS
MODULE**

| FASTENER | TORQUE VALUE | |
|------------------------------------|--------------|---------|
| Brake line, rear dual, clamp screw | 62–80 in-lbs | 7–9 N·m |
| Brake line, rear fork, clamp screw | 62–80 in-lbs | 7–9 N·m |

Prepare

1. Remove seat. See SEAT (Page 3-82).
2. Drain rear brake line. See BLEED BRAKES (Page 3-43).
3. Remove brake line from rear caliper. See REAR BRAKE CALIPER (Page 3-32).
4. Remove brake line from ABS module. See ABS MODULE (Page 3-40).

Remove

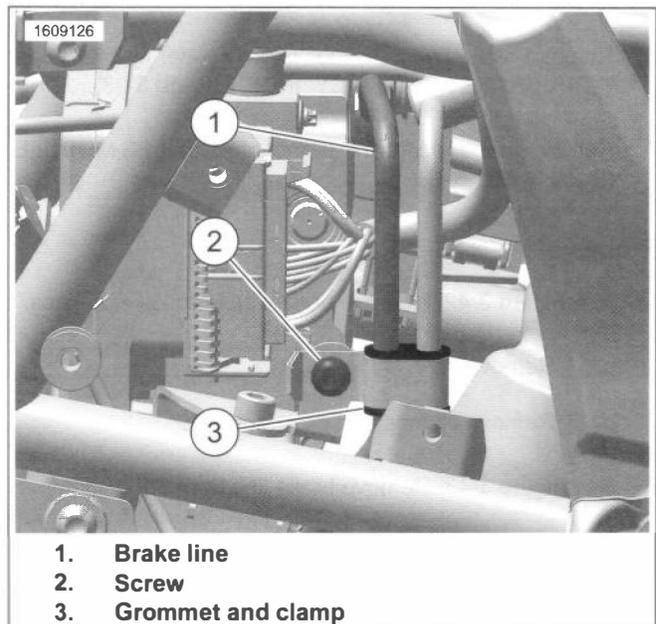
1. See Figure 3-44. Remove line clips (2).
2. Remove brake line from rear fork.
 - a. Remove screws (3).
 - b. Remove P-clamps (1) from brake line (4).
3. See Figure 3-45. Remove brake line from clamp.
 - a. Remove clamp screw (2).
 - b. Remove clamp and grommet (3).
4. Remove brake line (1).

Install

1. See Figure 3-45. Install brake line.
 - a. Install grommet (3).
 - b. Install clamp (4) and screw (2). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) Brake line, rear dual, clamp screw
2. See Figure 3-44. Install brake line on rear fork.
 - a. Install brake line (5) with WSS wire (3) into P-clamps (2).
 - b. Install screws (1). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) Brake line, rear fork, clamp screw
3. Install line clip (4).

Complete

1. Install brake line to rear brake caliper. See REAR BRAKE CALIPER (Page 3-32).
2. Install brake line to ABS module. See ABS MODULE (Page 3-40).
3. Fill and bleed brake system. See BLEED BRAKES (Page 3-43).
4. Install seat. See SEAT (Page 3-82).



1. Brake line
2. Screw
3. Grommet and clamp

Figure 3-44. Brake Line at ABS Module

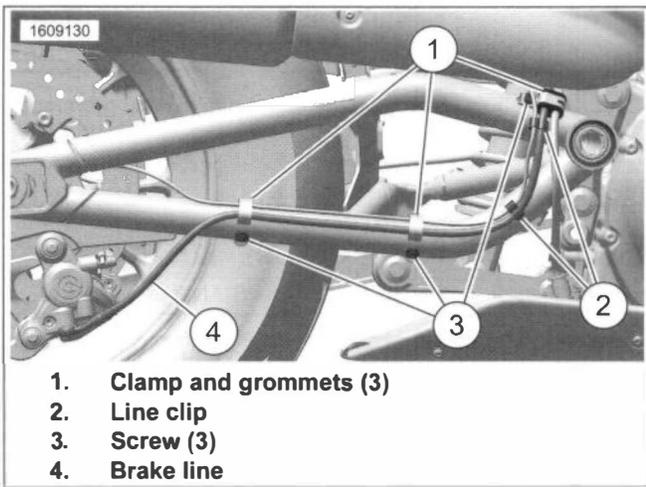


Figure 3-45. Rear Brake Line and WSS Routing

GENERAL

NOTE

The ABS module consists of the Hydraulic Control Unit (HCU) and the Electronic Control Unit (ECU). The two are not serviced separately.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove under seat caddy. See UNDER SEAT CADDY (Page 8-55).
4. Remove left side caddy. See LEFT SIDE CADDY (Page 8-52).
5. Remove BCM caddy. See BCM CADDY (Page 8-54).
6. Drain brake lines. See BLEED BRAKES (Page 3-43).
7. Remove screw from clamp securing both rear brake lines to the ABS module mounting bracket. See BRAKE LINES (Page 3-34).

REMOVE

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)

1. See Figure 3-46. Remove screw (7).
2. Disconnect brake lines.
 - a. Remove banjo bolts (4).
 - b. Discard gasket washers (8).
 - c. Move brake lines (5, 6, 9, 10) out of the way.
 - d. Disconnect ABS connector (11).
3. Remove ABS module and bracket assembly.
 - a. Remove screws (1).
 - b. Remove ABS module with ABS module bracket (2, 3).
4. See Figure 3-47. Remove ABS module from bracket.
 - a. Remove screws (4).
 - b. Remove ABS module (1) from mounting bracket (2).

- c. If required, remove the stand offs (5) and grommets (3).

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

| FASTENER | TORQUE VALUE | |
|---------------------------------------|--------------|-------------|
| ABS module banjo bolts | 17–19 ft-lbs | 23–26 N·m |
| ABS module bracket to frame screws | 62–80 in-lbs | 7–9 N·m |
| ABS module to mounting bracket screws | 40–58 in-lbs | 4.5–6.5 N·m |

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)

1. See Figure 3-47. Assemble ABS module to bracket.
 - a. If required, install grommets (3) and standoffs (5).
 - b. Install ABS module (3) to bracket (1) with screws (2).
 - c. Tighten screws.
Torque: 40–58 in-lbs (4.5–6.5 N·m) ABS module to mounting bracket screws
2. See Figure 3-46. Install ABS module and bracket assembly.
 - a. Install ABS module bracket (2).
 - b. Install screws (1). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) ABS module bracket to frame screws
3. See Figure 3-46. Install brake lines.
 - a. Place brake lines (5, 6, 10, 11) in correct position.
 - b. Install each brake line with a banjo bolt (4) and new gasket washers (8).
 - c. Tighten banjo bolts.
Torque: 17–19 ft-lbs (23–26 N·m) ABS module banjo bolts
4. Connect ABS connector (11).
5. See Figure 3-47. Install ABS module frame cover.
 - a. Place frame cover (2) in position.
6. If installing a new ABS module, use DTII for set-up procedure:

- a. Choose REFLASH icon.
- b. Follow on-screen prompts.

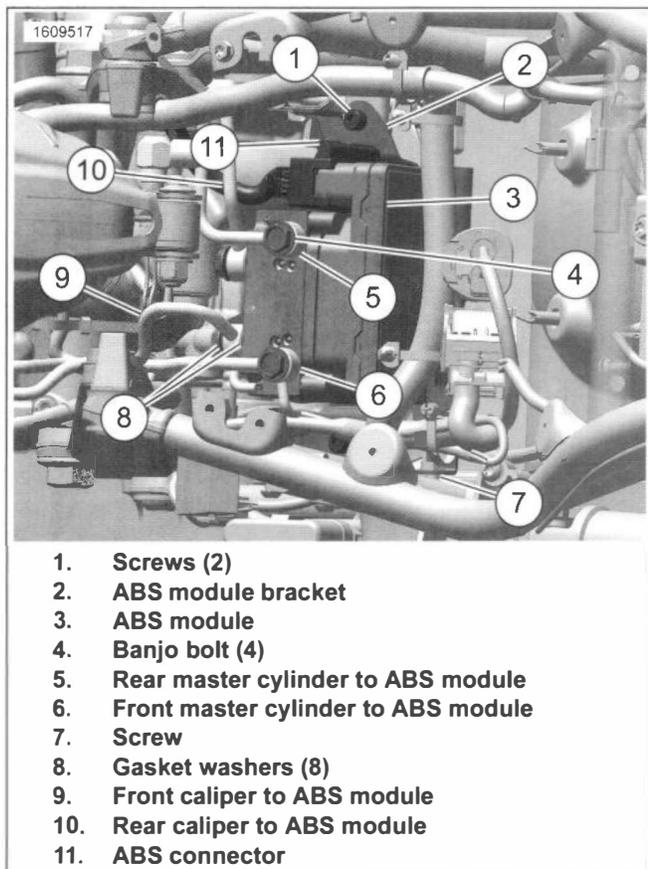


Figure 3-46. ABS Module Brake Line Connections

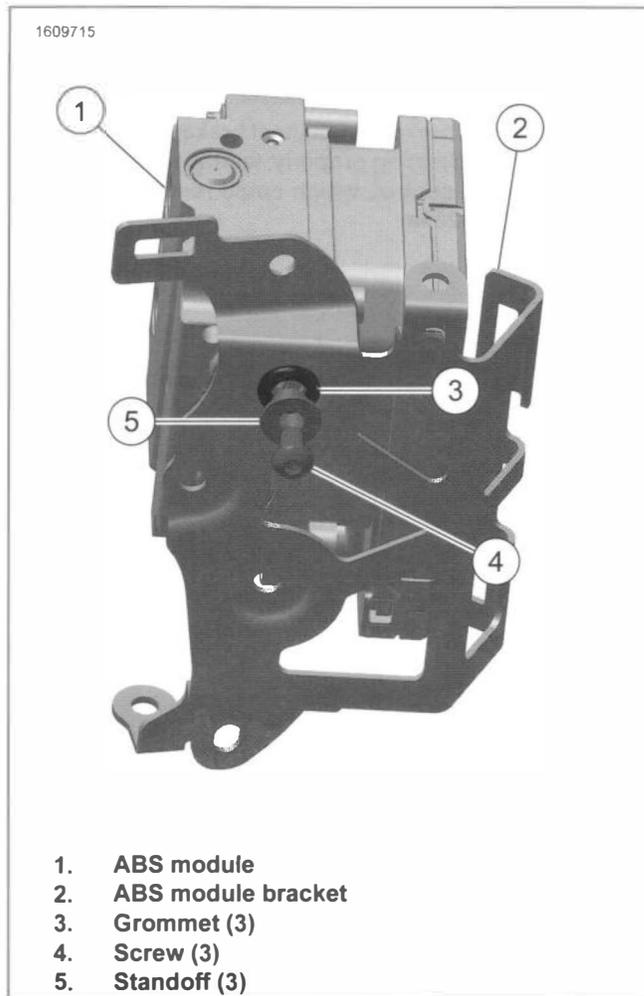


Figure 3-47. ABS Module Mounting

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

⚠ 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)

1. Attach rear brake lines to ABS bracket. See BRAKE LINES (Page 3-34).
2. Remove under seat caddy. See UNDER SEAT CADDY (Page 8-55).
3. Remove left side caddy. See LEFT SIDE CADDY (Page 8-52).
4. Remove BCM caddy. See BCM CADDY (Page 8-54).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).
6. Fill and bleed brakes. See BLEED BRAKES (Page 3-43).

7. Install seat. See SEAT (Page 3-82).

⚠ 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. Operate motorcycle at low speeds to verify braking systems operate properly.

9. Reset service lamp interval.

Special Tool: DIGITAL TECHNICIAN II (HD-48650)

DRAIN

| PART NUMBER | TOOL NAME |
|-------------|----------------------------|
| BB200A | BASIC VACUUM BRAKE BLEEDER |

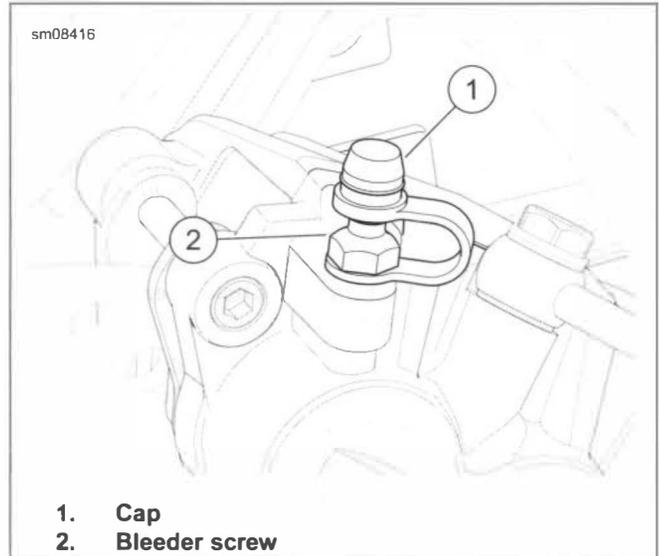
NOTICE

DOT 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. (00239c)

NOTE

- For best results, use BASIC VACUUM BRAKE BLEEDER (PART NUMBER: BB200A) to drain the brake systems.
- Both front and rear brake systems are affected when removing Anti-lock Braking System (ABS) module.

1. Remove master cylinder reservoir cap of the affected system.
2. See Figure 3-48. Remove cap (1) from bleeder screw (2).
3. Using vacuum brake bleeder to drain system.
Special Tool: BASIC VACUUM BRAKE BLEEDER (BB200A)
 - a. Attach vacuum brake bleeder to a caliper bleeder screw. Loosen screw 3/4 turn.
 - b. Operate vacuum bleeder to evacuate all fluid from master cylinder and line.
 - c. **If needed:** Repeat with remaining caliper.
4. Using brake lever or pedal to drain system.
 - a. Install end of a length of 0.31 in (7.9 mm) of the Inside Diameter (ID) clear plastic tubing over bleeder screw.
 - b. Place free end of tubing in a suitable container.
 - c. Open bleeder screw one-half turn.
 - d. Pump brake lever or pedal repeatedly to drain brake fluid.
5. Close bleeder screw. Tighten. Refer to Table 3-7.
6. Wipe out any remaining fluid inside master cylinder reservoir with a clean, lint-free cloth.



1. Cap
2. Bleeder screw

Figure 3-48. Bleeder Screw (Typical)

FILL AND BLEED

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

| FASTENER | TORQUE VALUE | |
|--|----------------|-------------|
| Brake caliper, front, mounting screw | 28–38 ft-lbs | 38–52 N·m |
| Brake caliper, rear, mounting screw | 15–18 ft-lbs | 20–24 N·m |
| Brake master cylinder, reservoir cover screw | 5–7 in-lbs | 0.6–0.8 N·m |
| Front bleeder screw | 80–97 in-lbs | 9–11 N·m |
| Rear bleeder screw | 106–142 in-lbs | 12–16 N·m |

⚠ 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)

▲ WARNING

Contact with DOT 4 brake fluid can have serious health effects. Failure to wear proper skin and eye protection could result in death or serious injury.

- If inhaled: Keep calm, remove to fresh air, seek medical attention.
- If on skin: Remove contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, seek medical attention.
- If in eyes: Wash affected eyes for at least 15 minutes under running water with eye lids held open. If irritation develops, seek medical attention.
- If swallowed: Rinse mouth and then drink plenty of water. Do not induce vomiting. Contact Poison Control. Immediate medical attention required.
- See Safety Data Sheet (SDS) for more details available at sds.harley-davidson.com

(00240e)

NOTICE

DOT 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. (00239c)

- If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.

NOTICE

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

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

Bleed procedure

1. Verify fluid in front and rear master cylinders are up to specification.
2. Vacuum bleed calipers to remove air from brake lines. Cycle EHCUs during this step using DTII.
Special Tool: BASIC VACUUM BRAKE BLEEDER (BB200A)
Special Tool: DIGITAL TECHNICIAN II (HD-48650)

NOTE

For dual front brake systems, first bleed from caliper that is furthest from master cylinder.

- a. See Figure 3-49. Remove cap (1) from bleeder screw (2).
- b. Attach vacuum brake bleeder to a caliper bleeder screw. Loosen screw 3/4 turn.
- c. Operate vacuum bleeder to evacuate just the air from master cylinder and line.
- d. Close bleeder screw. Tighten. Refer to Table 3-7.

- e. Repeat with remaining caliper.

3. Again verify fluid in front and rear master cylinders are up to specification.
4. Have a helper compress brake lever or press on rear brake foot pedal, hold in compressed position.

NOTE

Brake lever and foot pedal pressure must be maintained through steps 5-9.

5. Loosen a bleeder screw on one of the calipers to relieve pressure in system. Re-tighten bleeder screw.
6. Remove brake caliper.
 - a. Remove caliper mounting screws.
 - b. Remove caliper.
 - c. With bleeder screw facing up, open caliper bleed screw.
 - d. Push pads apart until caliper pistons are fully extended.
 - e. Close bleeder screw.
 - f. Repeat steps with remaining calipers.
7. **Front brake caliper:** Install caliper to axle holder. Do not tighten.
8. **Rear brake caliper:** Install brake caliper on caliper bracket with screws. Tighten.
Torque: 15–18 ft-lbs (20–24 N·m) *Brake caliper, rear, mounting screw*
9. Release pressure on lever or rear brake foot pedal.

NOTE

For dual front brake systems, first bleed from caliper that is furthest from master cylinder.

10. Vacuum bleed calipers to remove air from brake lines.
 - a. Attach vacuum brake bleeder to a caliper bleeder screw. Loosen screw 3/4 turn.
 - b. Operate vacuum bleeder to evacuate any remaining air from master cylinder and line.
 - c. Close bleeder screw. Tighten. Refer to Table 3-7.
11. Vacuum bleed from master cylinder bleeder screw if master cylinder was replaced or master cylinder was ran dry during bleed procedure.
12. Tighten procedure for front caliper mounting screws.
 - a. Pump brake lever until firm.
 - b. Have a helper compress brake lever, hold in compressed position.

- c. Tighten front caliper mounting screws.
Torque: 28–38 ft-lbs (38–52 N·m) *Brake caliper, front, mounting screw*
- d. Release pressure on brake lever.

- 13. Verify brake lever and rear brake foot pedal is firm.
- 14. Test ride motorcycle. Repeat bleeding procedure if brakes feel spongy.

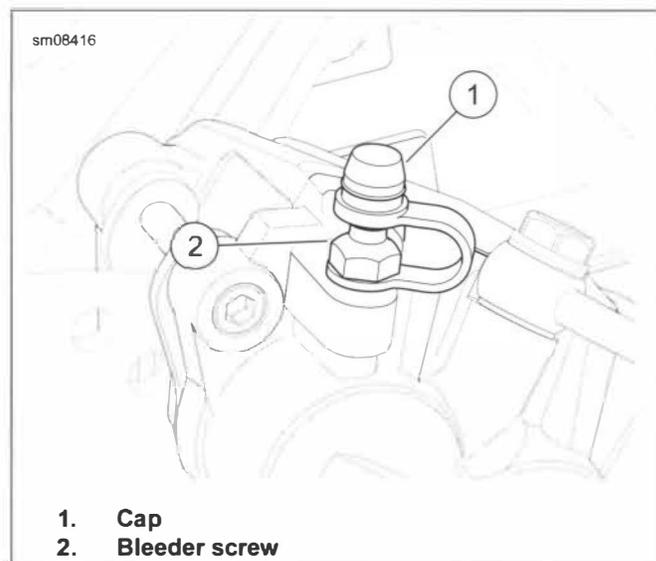


Figure 3-49. Bleeder Screw (Typical)

Table 3-7. Torque Specifications

| COMPONENT | TORQUE |
|--|-----------------------------------|
| Front bleeder screw | 80–97 in-lbs (9–11 N·m) |
| Rear bleeder screw | 106–142 in-lbs (12–16 N·m) |
| Brake master cylinder, reservoir cover screw | 5–7 in-lbs (0.6–0.8 N·m) |

PREPARE**Middle Side Cover**

1. Remove seat. See SEAT (Page 3-82).

Rear Side Cover

1. Remove seat. See SEAT (Page 3-82).

REMOVE**Steering Head Cover**

1. See Figure 3-50. Remove screw (1).
2. Remove steering head covers (2).
3. If replacing left steering head cover, remove the USB connector.
 - a. Remove USB cover (6).
 - b. Remove the locking ring (3) and the USB connector (4).

Front Side Cover

1. See Figure 3-51. Pull out to remove cover.

Middle Side Cover

1. See Figure 3-52. Remove screws (1).
2. Remove middle side cover (2).

Rear Side Cover

1. See Figure 3-53. Pull out to release from three clips, remove side cover.

Right Side Valley Cover

1. See Figure 3-54. Pull out to release from three clips, remove right side valley cover.

Left Radiator Cover

1. See Figure 3-55. Remove screw (4).
2. Pull out left radiator cover (1) to remove from clip (2).

Right Radiator Cover

1. See Figure 3-56. Remove screws (2) and right radiator cover (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------|--------------|-------------|
| Middle side cover screw | 71–89 in-lbs | 8–10 N·m |
| Radiator cover screw | 71–89 in-lbs | 8–10 N·m |
| Radiator cover screws | 71–89 in-lbs | 8–10 N·m |
| Steering head cover screw | 7–11 in-lbs | 0.8–1.2 N·m |

Steering Head Cover

1. See Figure 3-50. Position USB connector (4), install USB locking ring (3) and USB cover (6).
2. Insert locating tabs and install steering head covers.
3. Install screw. Tighten.
Torque: 7–11 in-lbs (0.8–1.2 N·m) *Steering head cover screw*

Front Side Cover

See Figure 3-51. Install cover.

Middle Side Cover

1. See Figure 3-52. Install middle side cover (2).
2. Install screws (1). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Middle side cover screw*

Rear Side Cover

1. See Figure 3-53. Align three clips, install side cover.

Right Side Valley Cover

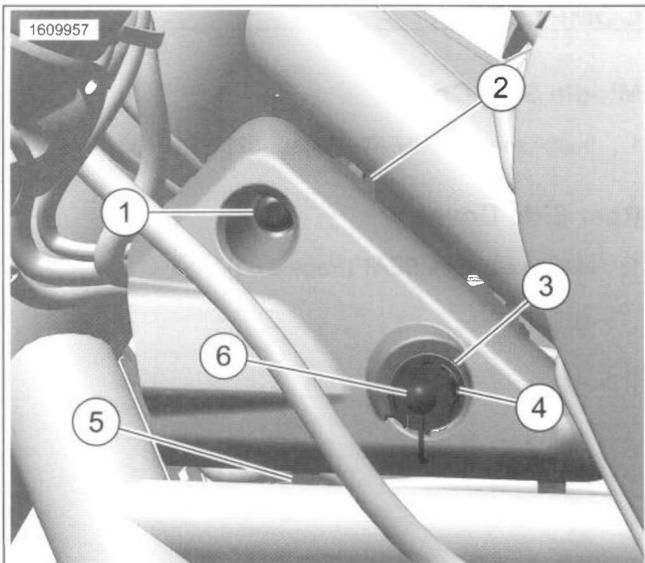
1. See Figure 3-54. Align three clips, install right side valley cover.

Left Radiator Cover

1. See Figure 3-55. Align left radiator cover (1) with clip (2). Verify cover is over fan shroud (3).
2. Install screw (4). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Radiator cover screw*

Right Radiator Cover

1. See Figure 3-56. Position right radiator cover (1) and screws (2).
Torque: 71–89 in-lbs (8–10 N·m) *Radiator cover screws*



1. Screw
2. Steering head cover
3. USB locking ring
4. USB connector
5. Locating tabs
6. USB cover

Figure 3-50. Steering Head Cover (left side shown)

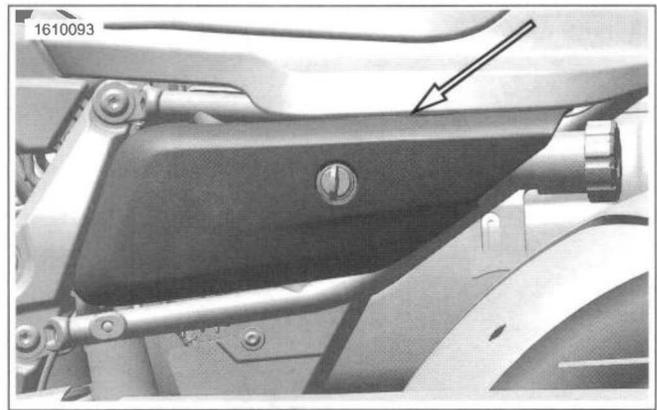


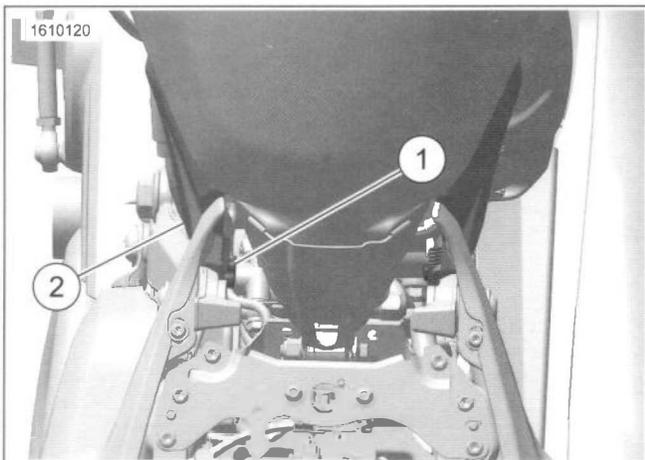
Figure 3-53. Rear Side Cover



Figure 3-54. Right Side Valley Cover

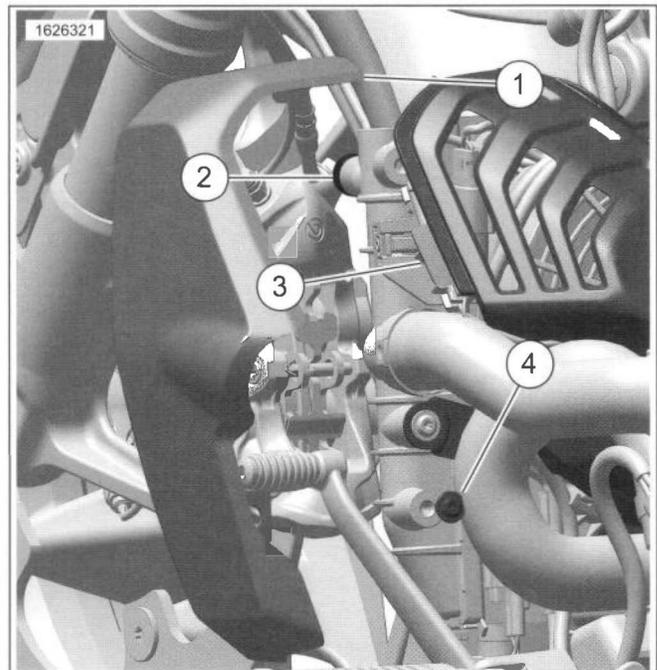


Figure 3-51. Front Cover



1. Screw (2)
2. Middle side cover

Figure 3-52. Middle Side Cover



1. Left radiator cover
2. Clip
3. Fan shroud
4. Screw

Figure 3-55. Left Radiator Cover

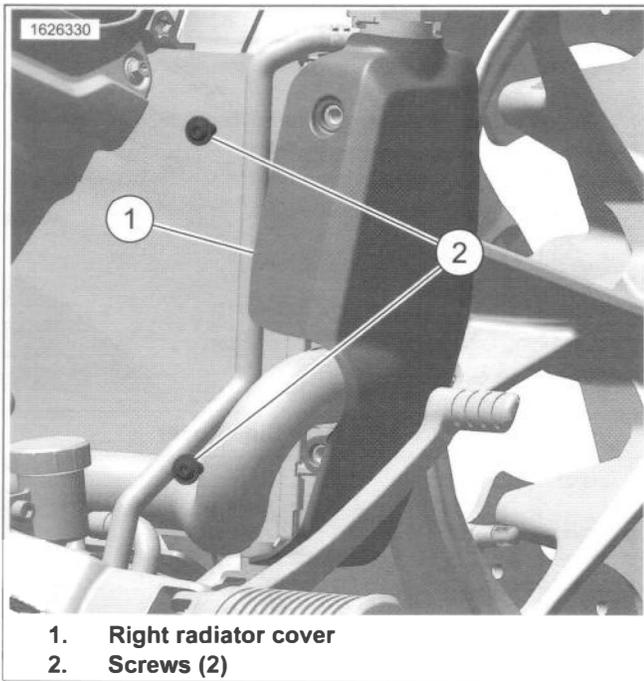


Figure 3-56. Right Radiator Cover

COMPLETE

Middle Side Cover

1. Install seat. See SEAT (Page 3-82).

Rear Side Cover

1. Install seat. See SEAT (Page 3-82).

CHECK FOR OIL LEAK

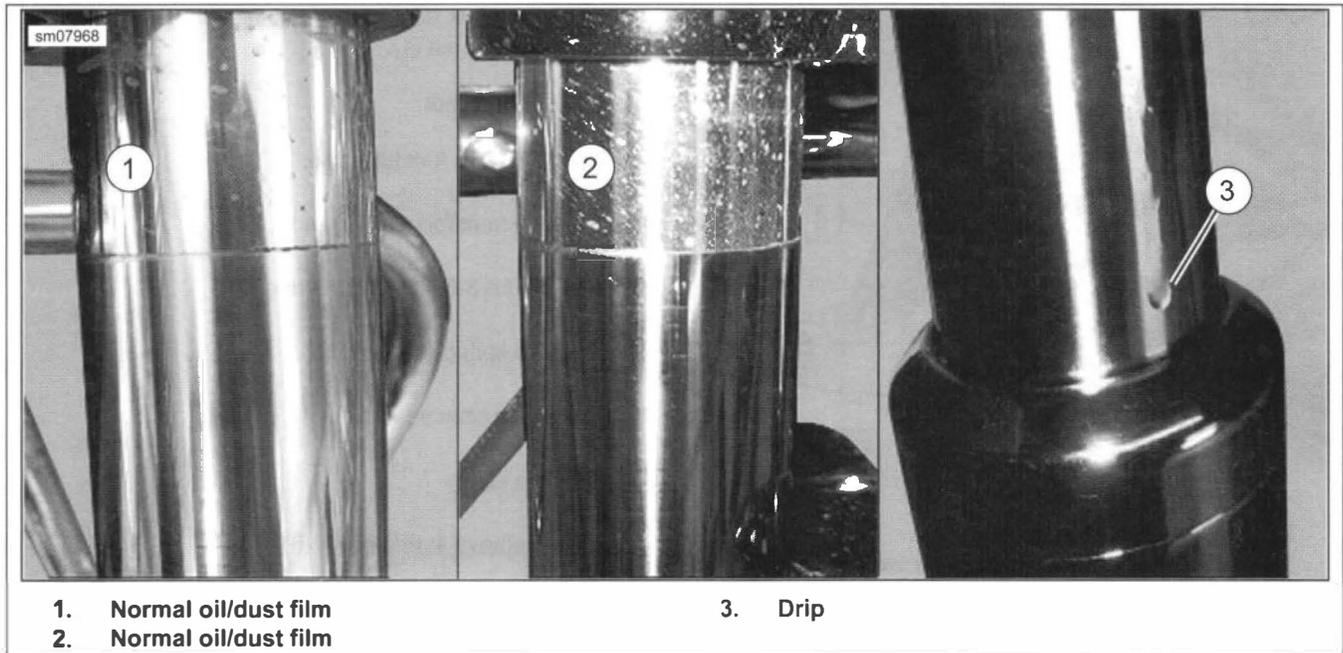
Fork Oil Seals

The fork oil seal allows a fine film of oil to lubricate the fork sliding surface.

- The oil film is more visible after continuous high-speed compression and rebound movement.
- Due to greater lubrication needs, larger forks have a greater amount of oil film than smaller forks.

Check Oil Leak

1. Observe oil ring.
2. Wipe fork clean.
3. Ride motorcycle over bumpy road or complete six braking events.
4. See Figure 3-57. Check fork slider tube for oil.
 - a. If a normal oil/dust film (1, 2) is present, there is no leak.
 - b. If an oil run or drip (3) is present, perform procedure two or three more times to confirm oil leak.



1. Normal oil/dust film
2. Normal oil/dust film

3. Drip

Figure 3-57. Front Forks

PREPARE

1. Raise front wheel. See Secure the Motorcycle for Service (Page 2-2).
2. Remove front fender. See FRONT FENDER (Page 3-75).
3. Detach front brake caliper. See FRONT BRAKE CALIPER (Page 3-27).
4. Remove front wheel. See FRONT WHEEL (Page 3-7).

REMOVE

1. See Figure 3-58 Remove front fork tube assemblies.
 - a. Remove pinch screw from front turn signal.
 - b. Loosen lower pinch screws (4).
 - c. Loosen upper pinch screws (3).
 - d. Remove fork tube assemblies (5).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------------|--------------|-------------|
| Fork bracket, lower, pinch screw | 15–18 ft-lbs | 20.4–25 N·m |
| Fork bracket, upper, pinch screw | 15–18 ft-lbs | 20.4–25 N·m |
| Front turn signal pinch screw | 27–44 in-lbs | 3–5 N·m |

1. See Figure 3-58. Install front fork tube assemblies.
 - a. Insert each fork tube assembly (5) through lower fork bracket (6), front turn signal lamp and upper fork bracket (2).
 - b. Measure distance (1) from top of fork tube to top of lower fork bracket (6) to set fork height. Refer to Table 3-8.
 - c. Tighten lower fork bracket pinch screws (4). Tighten. Torque: 15–18 ft-lbs (20.4–25 N·m) *Fork bracket, lower, pinch screw*
 - d. Tighten upper fork bracket pinch screws (3). Tighten. Torque: 15–18 ft-lbs (20.4–25 N·m) *Fork bracket, upper, pinch screw*

- e. Slide front turn signal lamps up, engaging alignment pin into hole in upper fork bracket.
- f. Install front turn signal lamp pinch screws. Tighten.
Torque: 27–44 in-lbs (3–5 N·m) *Front turn signal pinch screw*

Table 3-8. Fork Installation Distance

| Model | Distance |
|----------------|-----------------|
| RH1250S (Both) | 7 in (175.7 mm) |

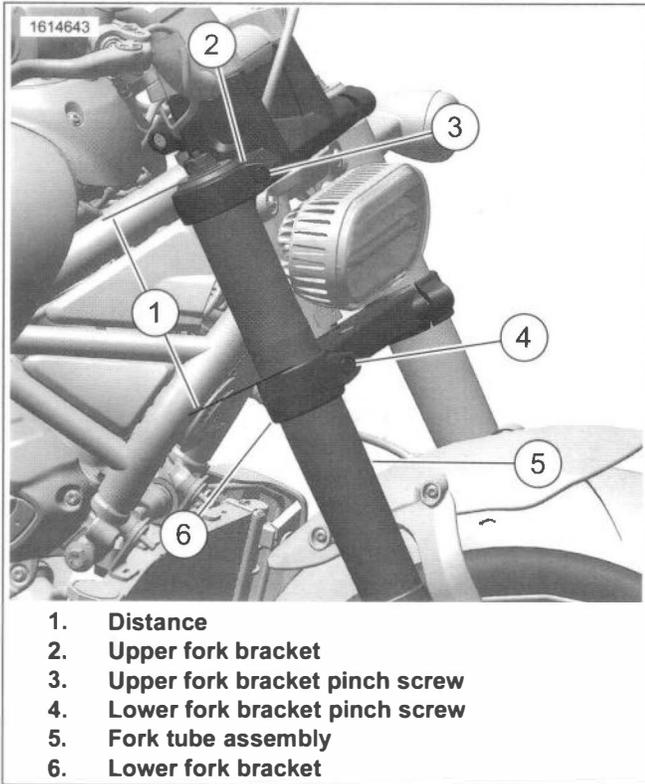


Figure 3-58. Front Fork Mount (typical)

DISASSEMBLE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-41177 | FORK TUBE HOLDER |
| HD-45966 | FRONT FORK COMPRESSOR |

Initial Disassembly

1. See Figure 3-59. Clamp fork tube in fork tube holder. Mount in vise with fork vertical.

Special Tool: FORK TUBE HOLDER (HD-41177)

NOTE

Record preload, compression and rebound settings.

2. Turn preload adjuster fully counterclockwise. See the owner's manual.

▲ 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)

NOTE

Have a suitable container ready to place components into after removal from tube.

3. See Figure 3-63. Remove fork tube cap.
 - a. Separate fork tube cap (1) from fork tube (11).
 - b. Compress fork assembly.
 - c. See Figure 3-60. Clamp front fork compressor vertically in vise with length adjuster screw topside.
Special Tool: FRONT FORK COMPRESSOR (HD-45966)
 - d. Hold fork tube cap and compress spring enough to access nut (1).
 - e. Loosen nut.
 - f. Remove fork tube cap.
4. Remove front fork compressor.
5. See Figure 3-63. Discard O-ring (2).
6. Remove spring seat stop (3).
7. Remove rubber seat (5).
8. Remove spring.
 - a. Remove spring collar (6).
 - b. Remove spring joint (7).
 - c. Remove spring (10).

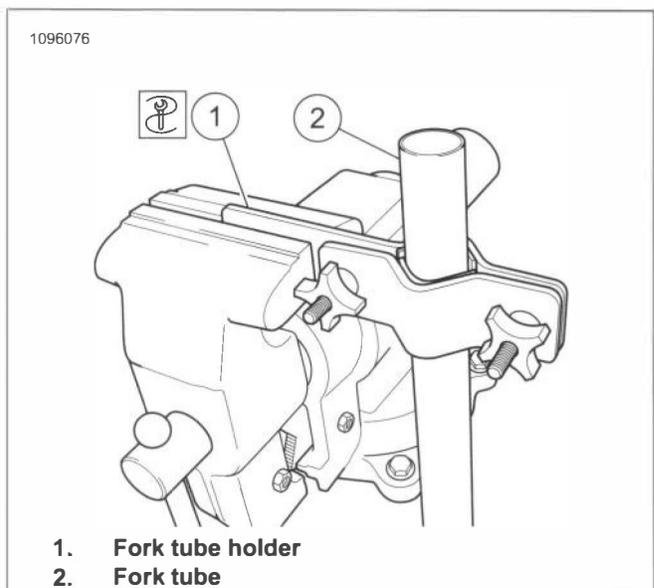


Figure 3-59. Fork Tube Holder

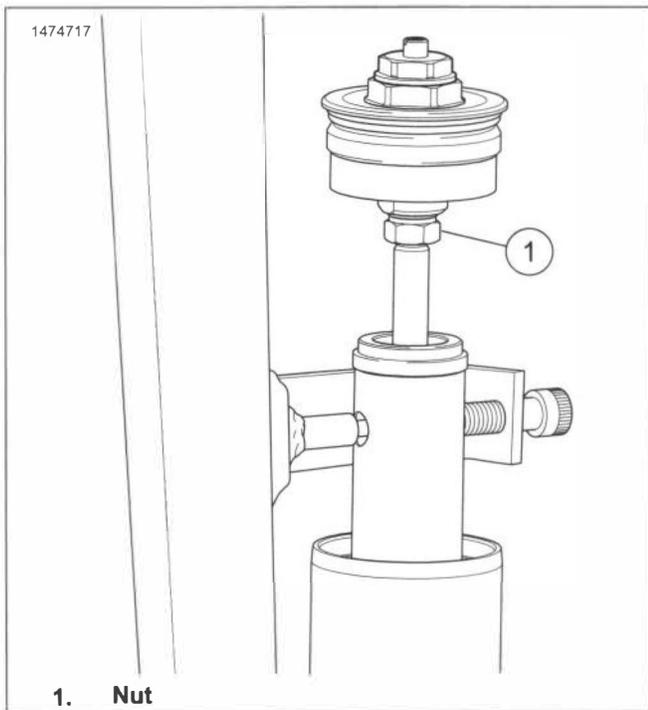


Figure 3-60. Compress Fork Spring

Drain Fork Oil

NOTE

Drain fork oil into a suitable container.

1. Drain fork oil.
 - a. Thread rod extension tool (part of front fork compressor) onto end of damper rod.
Special Tool: FRONT FORK COMPRESSOR (HD-45966)
 - b. Turn fork assembly upside down over drain pan and slowly pump damper rod at least 20 times until rod moves freely.
2. Remove extension tool from damper.

Complete Disassembly

1. See Figure 3-63. Remove damper.
 - a. Remove screw (19). Use an air impact wrench for best results.
 - b. Remove damper (8).
 - c. Remove centering plate (9).
2. Separate fork tube from fork slider.
 - a. Remove dust seal (17).
 - b. Remove stopper ring (16) from groove inside fork tube (11).
 - c. Expand fork slider (18) and fork tube against each other repeatedly (in a slide-hammer effect) to remove fork tube.

3. Disassemble fork slider.
 - a. Remove slider bushing (12).
 - b. Remove guide bushing (13).
 - c. Remove seal spacer (14).
 - d. Discard oil seal (15).
 - e. Remove stopper ring (16).
 - f. Remove dust seal (17).

Clean and Inspect

1. Clean all parts.
2. Inspect parts for wear or damage. Replace parts as necessary.
3. Inspect OD of slider bushing and ID of fork tube bushing.
 - a. If coating is worn through (metallic substrate showing), replace bushing.
 - b. Inspect for distortion.
 - c. If deep scratches or scoring are found, replace bushing. Also inspect mating components for similar wear. Replace or repair as necessary.
4. Check fork tube and fork slider for scoring, scratches and abnormal wear.
5. Inspect slider tube for nicks from stones and road debris, especially in area where seal contacts it. Replace if necessary.
6. See Figure 3-61. Check runout with a dial indicator.
 - a. Set fork slider on V-blocks.
 - b. Replace fork if runout exceeds:
0.008 in (0.2 mm)

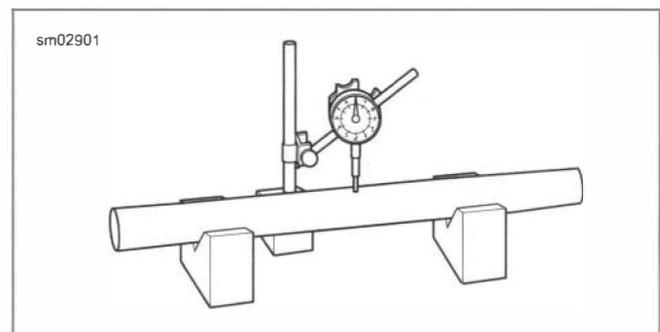


Figure 3-61. Measure Fork Tube Runout

ASSEMBLE

| PART NUMBER | TOOL NAME |
|-------------|---|
| B-42571 | FORK SEAL DRIVER AND DUST BOOT INSTALLER (43MM) |
| HD-41177 | FORK TUBE HOLDER |

| PART NUMBER | TOOL NAME |
|-------------|-------------------------------------|
| HD-45966 | FRONT FORK COMPRESSOR |
| HD-59000-B | HARLEY-DAVIDSON PRO-LEVEL OIL GAUGE |

| FASTENER | TORQUE VALUE | |
|----------------------------------|-----------------------|---------------|
| Fork damper nut | 13–17 ft-lbs | 17.5–22.5 N·m |
| Fork tube cap | 22–30 ft-lbs | 30–40 N·m |
| Fork tube damper screw, standard | 133–221 in-lbs | 15–25 N·m |

| CONSUMABLE | PART NUMBER |
|-----------------------------|-------------|
| HARLEY-DAVIDSON SEAL GREASE | 11300005 |
| TYPE "D" HYDRAULIC FORK OIL | 62600098 |

Initial Assembly

NOTE

Lubricate all seal lips and O-rings with seal grease during assembly.

HARLEY-DAVIDSON SEAL GREASE (11300005)

1. See Figure 3-63. Assemble fork slider.
 - a. Install dust seal (17).
 - b. Install stopper ring (16).
 - c. Install **new** oil seal (15) with lettering facing down.
 - d. Install seal spacer (14).
 - e. Install guide bushing (13).
 - f. Install slider bushing (12). Expand bushing only enough to fit fork slider (18).
 - g. Install **new** screw (19).
 - h. Install centering plate (9) with damper (8).
 - i. Install screw. Tighten.
Torque: 133–221 **in-lbs** (15–25 N·m) *Fork tube damper screw, standard*

2. Assemble fork slider to fork tube.

- a. Slide fork slider into fork tube.
- b. Seat oil seal with installer.
Special Tool: FORK SEAL DRIVER AND DUST BOOT INSTALLER (43MM) (B-42571)
- c. Install stopper ring (16) into groove in fork tube.
- d. Seat dust seal with installer.

Fork Fill

1. Mount fork assembly in fork tube holder and fully compress assembly.

Special Tool: FORK TUBE HOLDER (HD-41177)

2. Install damper rod extension from front fork compressor tool on damper rod.
3. Bleed fork assembly.

NOTE

Set fork oil level with assembly fully compressed.

- a. Fill fork with fork oil.
TYPE "D" HYDRAULIC FORK OIL (62600098)
- b. Pump fork slider (18) 8-10 times to expel air from assembly.

NOTE

It is important that the pumping procedure is performed.

- c. Fully compress assembly.
 - d. Fill fork with fork oil until oil is above specified depth from top of fully compressed fork.
3.78 in (96 mm)
 - e. Pump assembly 8-10 times to expel any additional air.
4. See Figure 3-62. Use fork oil level gauge to set oil level to specified depth.
3.78 in (96 mm)
Special Tool: HARLEY-DAVIDSON PRO-LEVEL OIL GAUGE (HD-59000-B)

Complete Assembly

NOTE

Install spring tapered end up.

1. See Figure 3-63. Install spring (10).
 2. Install spring joint (7).
 3. Install spring collar (6).
 4. Install spring seat stop (3).
 5. Install rubber seat (5).
 6. Install **new** O-ring (2).
 7. See Figure 3-60. Compress fork using front fork compressor.
Special Tool: FRONT FORK COMPRESSOR (HD-45966)
- NOTE**
- Lubricate all seal lips and O-rings with HARLEY-DAVIDSON SEAL GREASE during assembly.
 - Insert needle rod slowly into damper.

- a. Compress spring enough to allow damper to be raised above spring seat stop.

- b. Remove extension tool while holding damper.
 - c. Fully install nut (1) on damper.
8. Install fork tube cap.
- a. Fully install fork tube cap on damper.
 - b. Tighten nut (1) against fork tube cap.
Torque: 13–17 ft-lbs (17.5–22.5 N·m) *Fork damper nut*
 - c. See Figure 3-63. Install fork tube cap (1). Tighten.
Torque: 22–30 ft-lbs (30–40 N·m) *Fork tube cap*
9. Adjust preload. See the owner's manual.

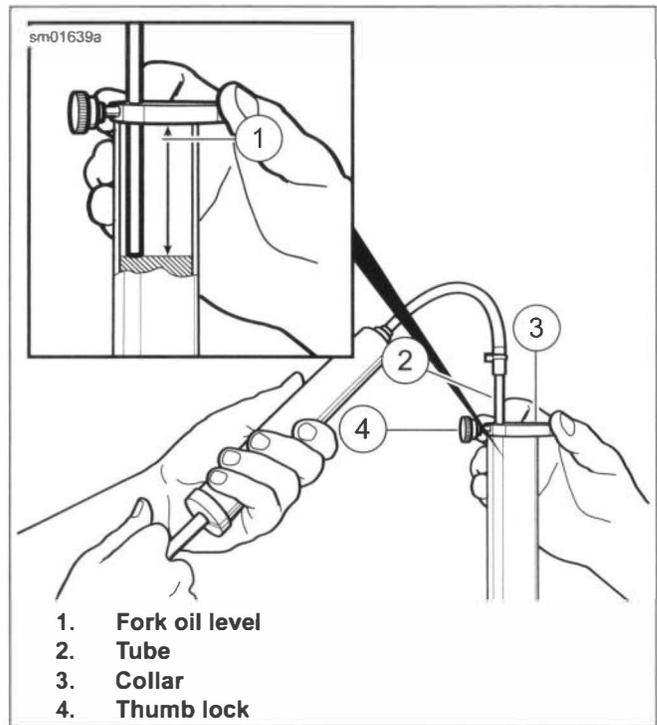
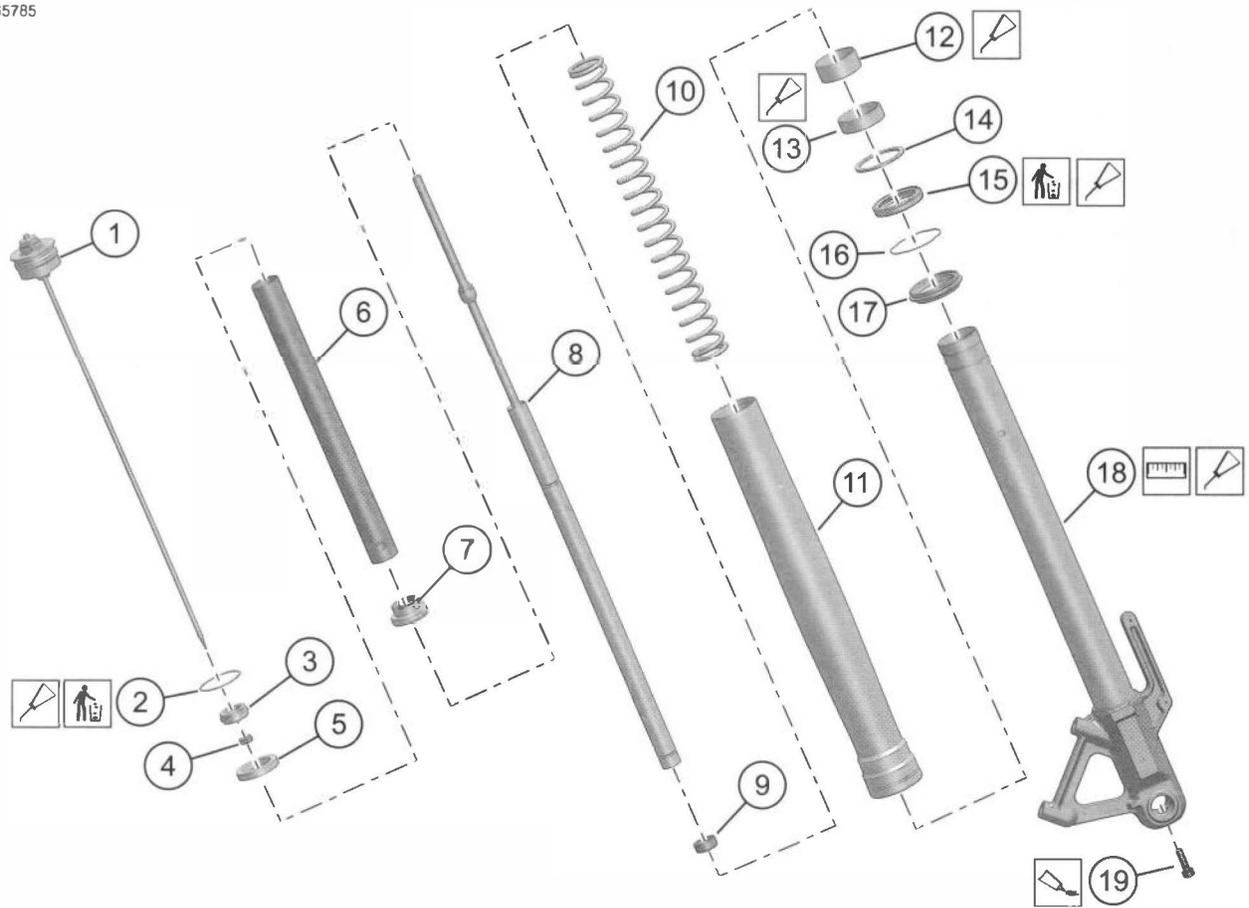


Figure 3-62. Oil Level Gauge



1. Fork tube cap
2. O-ring
3. Spring seat stop
4. Nut
5. Rubber seat
6. Spring collar
7. Spring joint
8. Damper
9. Centering plate
10. Spring

11. Fork tube
12. Slider bushing
13. Guide bushing
14. Seal spacer
15. Oil seal
16. Stopper ring
17. Dust seal
18. Fork slider
19. Screw

Figure 3-63. Fork Components, Base Model

COMPLETE

1. Install front wheel. See FRONT WHEEL (Page 3-7).
2. Attach front brake calipers. See FRONT BRAKE CALIPER (Page 3-27).
3. Install front fender. See FRONT FENDER (Page 3-75).
4. Lower front wheel. See Secure the Motorcycle for Service (Page 2-2).

PREPARE

1. Remove right steering head cover. See SIDE COVERS (Page 3-46).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove handlebar. See HANDLEBAR (Page 3-72).
4. Remove front turn signal lamps. See FRONT TURN SIGNAL LAMPS (Page 8-28).
5. Remove front fork. See FRONT FORK (Page 3-49).

REMOVE

Upper Fork Bracket

1. See Figure 3-64. Remove upper fork bracket assembly.
 - a. Remove fork stem screw (1).
 - b. Remove washer (2).
 - c. Loosen fork stem pinch screw (4).
 - d. Remove upper fork bracket (3).
2. Inspect fork stem and lower fork bracket assembly (10). Replace as necessary.
3. **If replacing upper fork bracket:**
 - a. Remove fork lock. See FORK LOCK (Page 3-57).

Lower Fork Bracket

1. See Figure 3-64. Remove upper fork bracket assembly.
2. Remove fork stem and lower fork bracket assembly (10) from steering head (9).

Steering Head Bearings

1. See Figure 3-64. Inspect steering head bearings (7) and bearing cups (8) for:
 - a. Pitting
 - b. Wear
 - c. Scoring

NOTE

Removing bearings destroys them. Always install new bearings upon assembly.

2. Replace bearings as necessary.

NOTE

Internal reliefs in steering head allow punch access to bearing cups.

3. **If necessary:** Remove bearing cups (8) from steering head (9).
4. Inspect bores in steering head.
 - a. Remove any paint, rust or burrs.

INSTALL

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

| CONSUMABLE | PART NUMBER |
|------------------------|-------------|
| SPECIAL PURPOSE GREASE | 99857-97A |

⚠ 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)

⚠ WARNING

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

Steering Head Bearings

NOTICE

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

1. See Figure 3-64. **If removed:** Install **new** bearing cups (8) using bearing installer.
Special Tool: STEERING HEAD BEARING RACE INSTALLER (HD-39302)
2. Grease steering head bearings (7).
Consumable: SPECIAL PURPOSE GREASE (99857-97A)
3. **If removed:** Install **new** dust shield (6) and **new** steering head bearing (7) on fork stem and lower fork bracket assembly (10).

Lower Fork Bracket

1. See Figure 3-64. Install front fork stem and lower fork bracket assembly.
 - a. Install fork stem through steering head (9).

- b. Install **new** upper steering head bearing (7) and **new** dust seal (6).

2. Install upper fork bracket (3).

Upper Fork Bracket

1. See Figure 3-64. **If replacing upper fork bracket:**
 - a. Install fork lock. See FORK LOCK (Page 3-57).
2. Install upper fork bracket assembly.
 - a. Install washer (2) and fork stem screw (1). Tighten.

COMPLETE

1. Install front fork. See FRONT FORK (Page 3-49).
2. Install front turn signal lamps. See FRONT TURN SIGNAL LAMPS (Page 8-28).
3. Install handlebar. See HANDLEBAR (Page 3-72).
4. Adjust steering head bearings. See ADJUST AND LUBRICATE STEERING HEAD BEARINGS (Page 2-21).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).
6. Install steering head cover. See SIDE COVERS (Page 3-46).

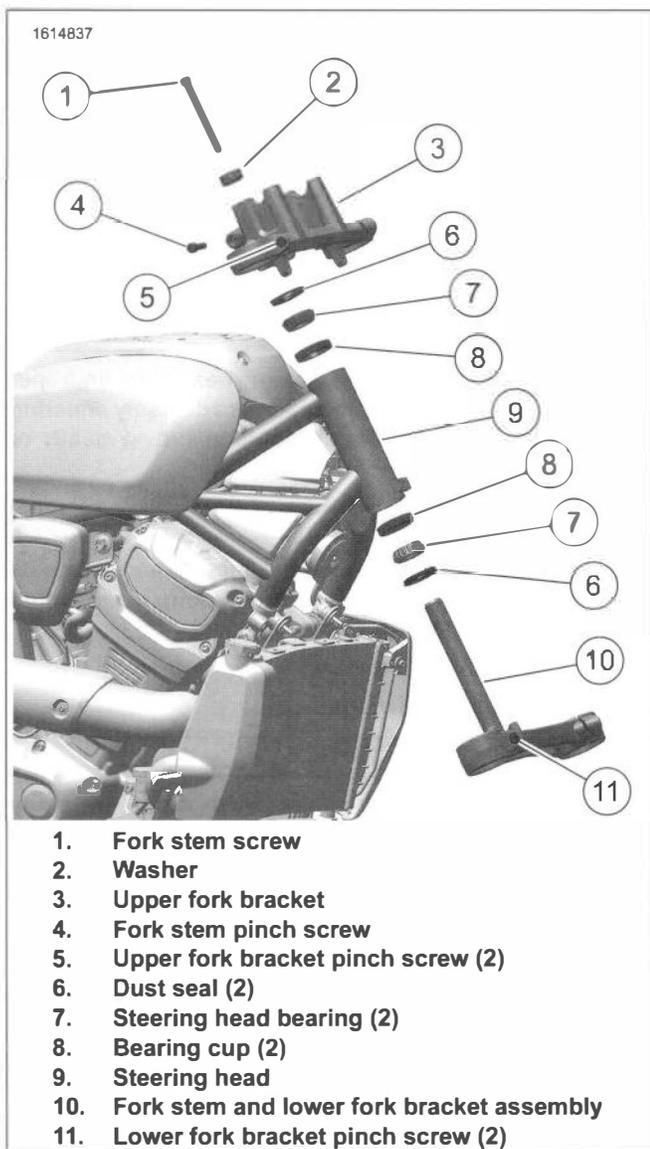


Figure 3-64. Fork Stem and Bracket Assembly

PREPARE

1. Remove upper fork clamp. See STEERING HEAD (Page 3-55).

REMOVE

1. See Figure 3-65. Remove screws (1, 5).
2. Remove lock reinforcement bracket (4).
3. Remove fork lock (3).

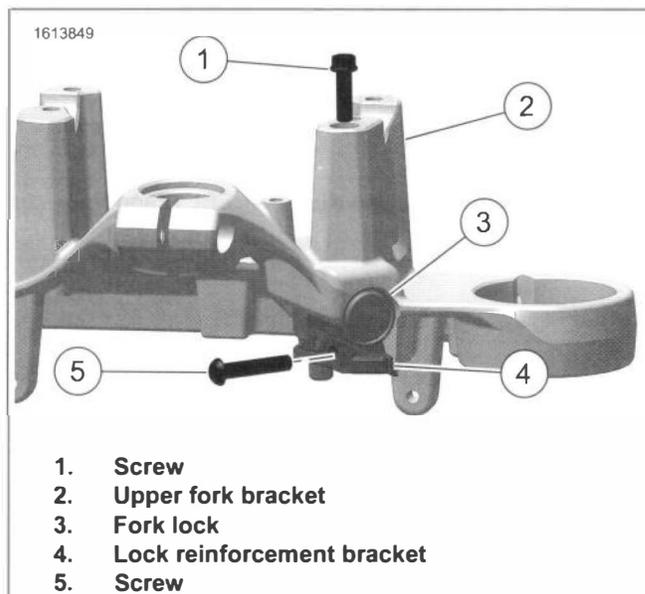
INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------------|----------------------|-----------|
| Fork lock screw | 97–124 in-lbs | 11–14 N·m |
| Lock reinforcement bracket screw | 97–115 in-lbs | 11–13 N·m |

1. See Figure 3-65. Install fork lock.
 - a. Install fork lock (3) in upper fork bracket (2).
 - b. Install screw (1). Tighten.
Torque: 97–124 **in-lbs** (11–14 N·m) *Fork lock screw*

- c. Position lock reinforcement bracket (4). Install screw (5). Tighten.

Torque: 97–115 **in-lbs** (11–13 N·m) *Lock reinforcement bracket screw*



1. Screw
2. Upper fork bracket
3. Fork lock
4. Lock reinforcement bracket
5. Screw

Figure 3-65. Fork Lock

COMPLETE

1. Install upper fork bracket. See STEERING HEAD (Page 3-55).
2. Verify proper lock operation. See Owner's Manual.

PREPARE

1. Remove mufflers. See MUFFLERS (Page 6-33).
2. Remove belt guards. See BELT GUARDS (Page 3-60).
3. Remove rear brake line p-clamp from rear fork. See BRAKE LINES (Page 3-34).
4. Remove the license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
5. Remove rear wheel. See REAR WHEEL (Page 3-9).

REMOVE

1. See Figure 3-66. Support rear fork (3).
2. Remove fork link (5) screw and nut (7).
3. Remove rear fork.
 - a. Remove nut (8).
 - b. Remove and discard cable straps (1).
 - c. Loosen pivot shaft pinch bolt (4).
 - d. Remove swing arm shaft (2) and rear fork assembly (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|------------|
| Fork link screw | 66–74 ft-lbs | 90–100 N·m |
| Pivot shaft pinch bolt | 16–18 ft-lbs | 22–25 N·m |
| Swing arm pivot nut | 60–74 ft-lbs | 81–100 N·m |

1. See Figure 3-66. Align rear fork (3) with frame.
2. Install rear fork.
 - a. Install pivot shaft (2) through right side of rear fork (3) and frame.
 - b. Install nut (7). Tighten.
Torque: 60–74 ft-lbs (81–100 N·m) *Swing arm pivot nut*
 - c. Tighten bolt (4).
Torque: 16–18 ft-lbs (22–25 N·m) *Pivot shaft pinch bolt*
 - d. Install new cable straps (1).
3. Position rear suspension link (5).
 - a. Install fork link screw (4) and nut (6). Tighten.
Torque: 66–74 ft-lbs (90–100 N·m) *Fork link screw*

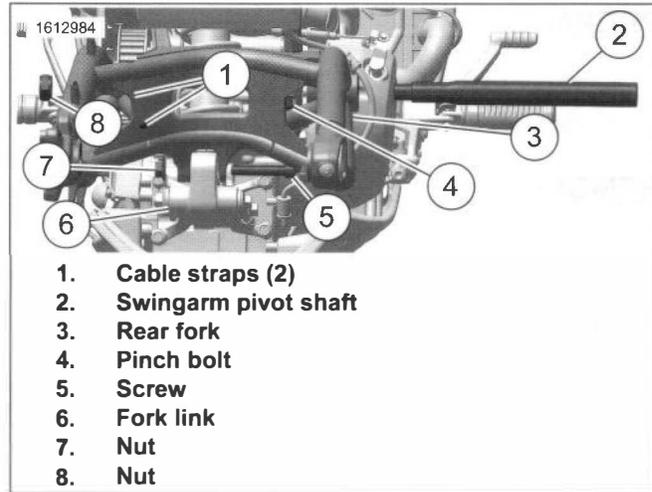


Figure 3-66. Rear Fork Assembly

DISASSEMBLE

1. See Figure 3-67. Remove right side components.
 - a. Discard seals (7).
 - b. Measure and record bearing location in swingarm bore prior to removal.
 - c. If necessary, remove bearing (1) using a suitable press.
2. Remove left side components.
 - a. Discard seal (7).
 - b. Remove snap ring (6) and seal (5).
 - c. If necessary, remove bearing (1) using a suitable press.
 - d. If necessary, remove the nuts (3) and axle adjuster sliders (4).

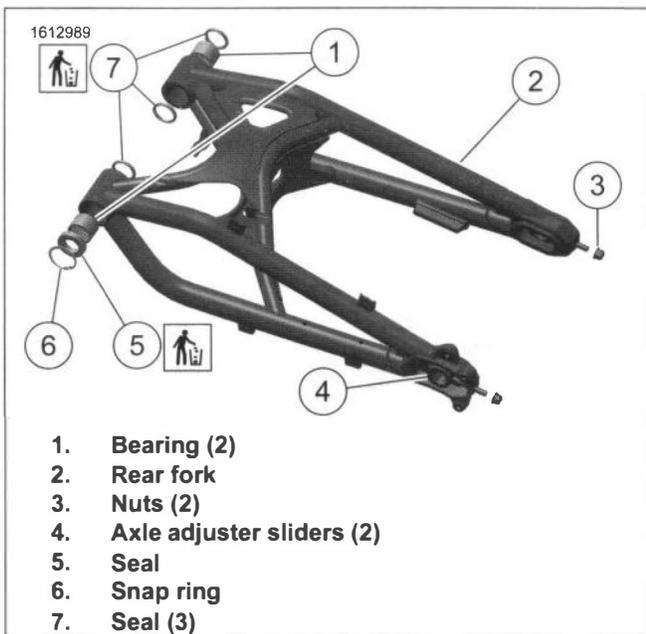


Figure 3-67. Rear Fork Assembly

CLEAN AND INSPECT

1. Clean all components.
2. Carefully inspect bearings for wear and/or corrosion. Replace as necessary.
3. Check that rear fork is not bent, twisted or cracked. Replace as necessary.

ASSEMBLE

| CONSUMABLE | PART NUMBER |
|------------------------|-------------|
| SPECIAL PURPOSE GREASE | 99857-97A |

1. Apply lubricant to the inner bores of the swingarm prior to installing bearings.

Consumable: SPECIAL PURPOSE GREASE (99857-97A)

2. See Figure 3-67. Install right side components.
 - a. Install bearings (1) to previously recorded depth using a suitable press.
 - b. Install **new** seals (7).
3. Install left side components.
 - a. Install bearing (1) to previously recorded depth using a suitable press.
 - b. Install seal (5) until lightly contacts bearing (1).
 - c. Install snap ring (6).
 - d. Install **new** seal (7).

4. If necessary, axle adjuster sliders (4) and nuts (3).

COMPLETE

1. Install rear wheel. See REAR WHEEL (Page 3-9).
2. Install rear brake line p-clamp from rear fork. See BRAKE LINES (Page 3-34).
3. Install license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
4. Install belt guards. See BELT GUARDS (Page 3-60).
5. Install mufflers. See MUFFLERS (Page 6-33).

REMOVE

Bottom Belt Guard

1. See Figure 3-68. Remove screws (1).
2. Remove bottom belt guard (2).

Top Belt Guard

1. See Figure 3-69. Remove screws (2).
2. Remove top belt guard (1).

Sprocket Cover

1. See Figure 3-70. Remove screws (1).
2. Remove sprocket cover (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|---------------------|-------------|
| Belt guard, bottom, screws | 40–49 in-lbs | 4.5–5.5 N·m |
| Belt guard, top, screws | 40–49 in-lbs | 4.5–5.5 N·m |
| Sprocket cover screws | 62–80 in-lbs | 7–9 N·m |

Sprocket Cover

1. Install sprocket cover.
 - a. See Figure 3-70. Install sprocket cover (2).
 - b. Install screws (1). Tighten.
Torque: 62–80 **in-lbs** (7–9 N·m) *Sprocket cover screws*

Top Belt Guard

1. Install top belt guard.
 - a. See Figure 3-69. Install top belt guard (1).
 - b. Install screws (2). Tighten.
Torque: 40–49 **in-lbs** (4.5–5.5 N·m) *Belt guard, top, screws*

Bottom Belt Guard

1. Install bottom belt guard.
 - a. See Figure 3-68. Install bottom belt guard (2).

- b. Install screws (1). Tighten.
Torque: 40–49 **in-lbs** (4.5–5.5 N·m) *Belt guard, bottom, screws*

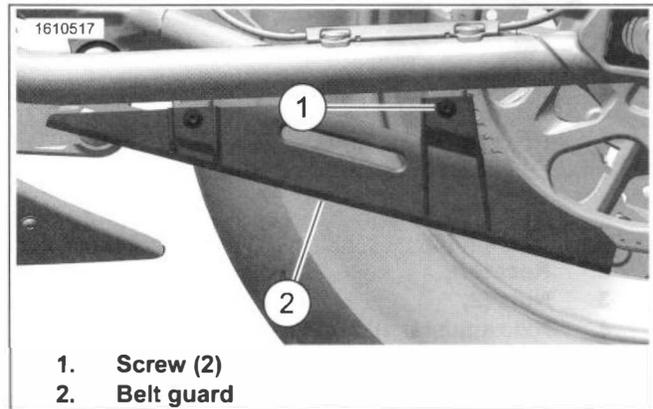


Figure 3-68. Bottom Belt Guard

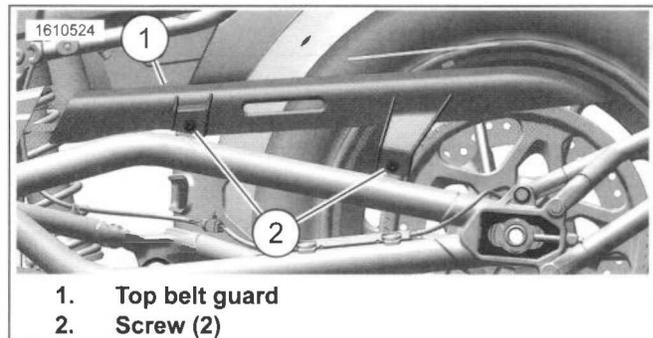


Figure 3-69. Top Belt Guard

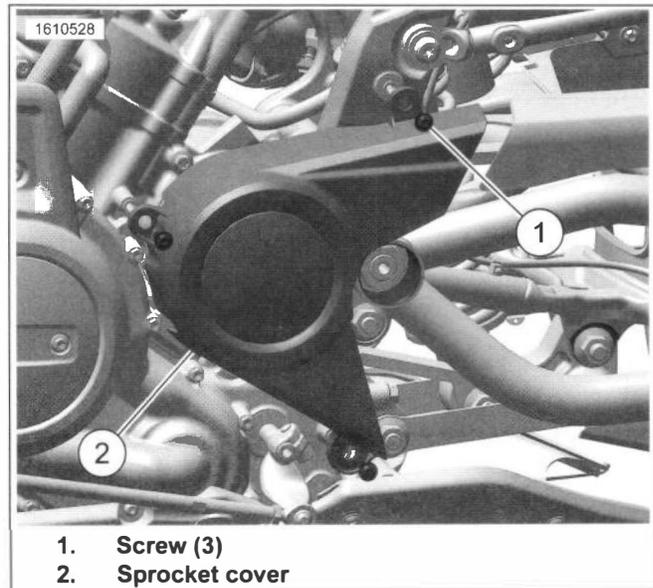


Figure 3-70. Sprocket Cover

PREPARE

1. Secure motorcycle for service. See Secure the Motorcycle for Service (Page 2-2).
2. Raise rear of motorcycle.
3. Remove the main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove right, left and rear chin spoilers. See CHIN SPOILER (Page 3-69).
5. Remove left rear side cover. See SIDE COVERS (Page 3-46).
6. Detach left side caddy. See LEFT SIDE CADDY (Page 8-52).
7. Remove mufflers. See MUFFLERS (Page 6-33).
8. Remove the rear fork. See REAR FORK (Page 3-58).

REMOVE

Rear Shock Absorber

1. See Figure 3-71. Remove screws (2) and detach manual shock adjuster (1).
2. See Figure 3-72. Remove shock assembly.
 - a. Remove screw (1).
 - b. Remove upper shock screw (2).
 - c. Loosen mount block nut (7).
 - d. Remove nuts (5) and bolts (4).
 - e. Lower links (6).
 - f. Remove shock assembly (3).
3. See Figure 3-73. Remove shock.
 - a. Remove nut (4).
 - b. Remove bolt (3).
 - c. Remove shock (1) from rear suspension link (2).

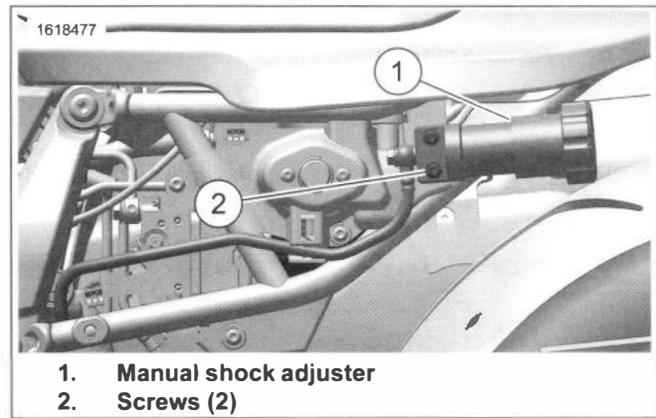


Figure 3-71. Manual Adjuster Knob

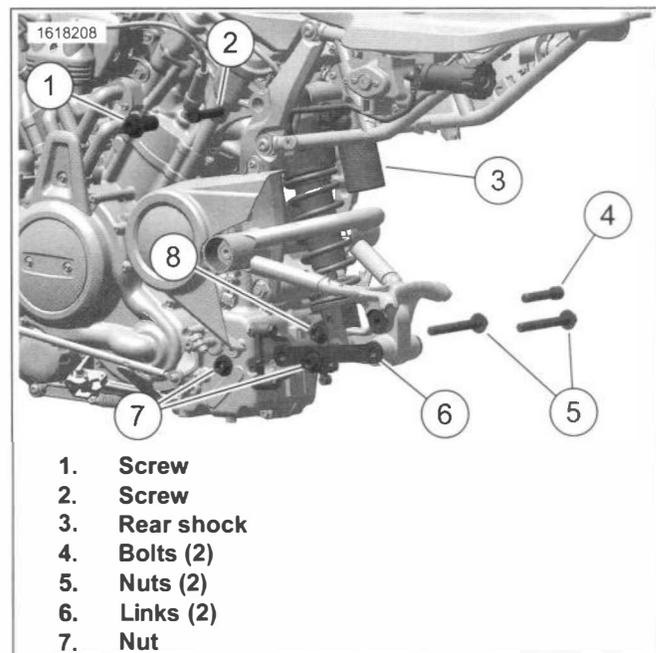


Figure 3-72. Remove Rear Shock Assembly

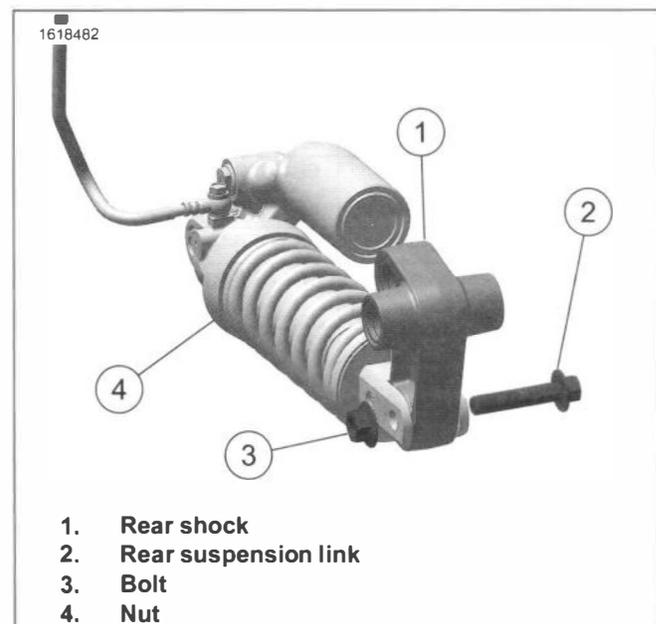


Figure 3-73. Rear Shock

Swing Arm Mount Block Assembly

1. See Figure 3-74. Remove links.
 - a. Remove nuts (1).
 - b. Remove bolts (4) and links (2).
2. Remove bolts (5) and swing arm mount block assembly (6).

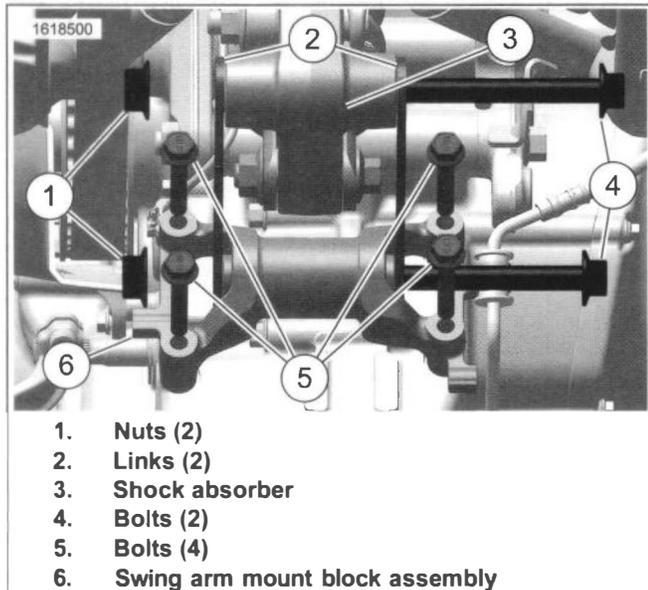


Figure 3-74. Swing Arm Mount Block Assembly

CLEAN AND INSPECT

1. Inspect shock absorber for signs of leakage. Replace if leak is found.
2. Inspect rear suspension link and swing arm mount block bearings and bushings for cracks and wear. Replace as necessary.

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------------------|----------------|--------------|
| Manual adjuster screws | 77–93 in-lbs | 8.7–10.5 N·m |
| Shock absorber link bolt | 66–74 ft-lbs | 90–100 N·m |
| Shock absorber lower bolt | 66–74 ft-lbs | 90–100 N·m |
| Shock absorber lower screw | 66–74 ft-lbs | 90–100 N·m |
| Shock absorber upper screw | 66–74 ft-lbs | 90–100 N·m |
| Swing arm assembly mount block nut | 18–21 ft-lbs | 25–28 N·m |
| Upper frame screw | 125–139 ft-lbs | 169–188 N·m |

Swing Arm Mount Block Assembly

1. See Figure 3-74. Position swing arm mount block assembly (6) and install screws (5). Tighten.

Torque: 18–21 ft-lbs (25–28 N·m) *Swing arm assembly mount block nut*
2. Install links.
 - a. Install links (2) and bolts (4).

- b. Install nuts (1). Tighten.

Torque: 66–74 ft-lbs (90–100 N·m) *Shock absorber link bolt*

Rear Shock Absorber

1. See Figure 3-73. Install rear suspension link.
 - a. Position rear suspension link (2).
 - b. Install bolt (3) and nut (4). Tighten.

Torque: 66–74 ft-lbs (90–100 N·m) *Shock absorber lower bolt*
2. See Figure 3-72. Install rear shock assembly.
 - a. Position rear shock assembly (3).
 - b. Install upper shock screw (2). Tighten.

Torque: 66–74 ft-lbs (90–100 N·m) *Shock absorber upper screw*
 - c. Install upper frame screw (1). Tighten.

Torque: 125–139 ft-lbs (169–188 N·m) *Upper frame screw*
 - d. Install lower shock screw (4) and nut (5). Tighten.

Torque: 66–74 ft-lbs (90–100 N·m) *Shock absorber lower screw*
 - e. Position link, install bolt (4) and nut (5). Tighten.

Torque: 66–74 ft-lbs (90–100 N·m) *Shock absorber link bolt*
 - f. Tighten link to swing arm assembly mount block nut. Tighten.

Torque: 66–74 ft-lbs (90–100 N·m) *Swing arm assembly mount block nut*
3. See Figure 3-71. Position manual shock adjuster (1) and install screws (2). Tighten.

Torque: 77–93 in-lbs (8.7–10.5 N·m) *Manual adjuster screws*

DISASSEMBLE

Rear Suspension Link

NOTE

All three bushings, bearings and seals are serviced in similar manner.

1. See Figure 3-75. Push to remove bushing (2, 7, 8).
2. Remove seals (1, 6).
3. Using suitable tool press bearings out (3, 5).

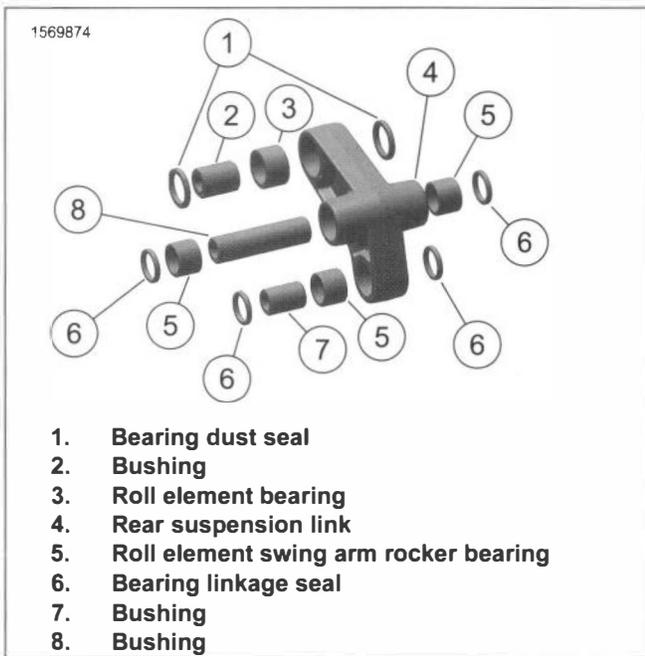


Figure 3-75. Rear Suspension Link

Swing Arm Assembly Mount Block

1. See Figure 3-76. Push to remove bushing (4).
2. Remove seals (1).
3. Using suitable tool press bearings out (2).

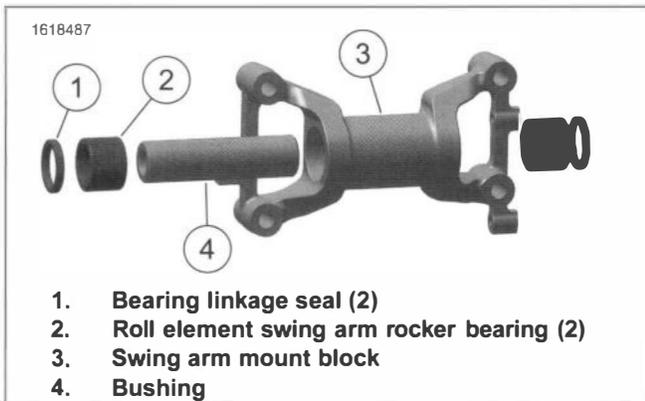


Figure 3-76. Swing Arm Assembly Mount Block

ASSEMBLE

| CONSUMABLE | PART NUMBER |
|------------------------|-------------|
| SPECIAL PURPOSE GREASE | 99857-97A |

Rear Suspension Link

1. Apply lubricant to the inner bores of suspension link prior to installing bearings.
 Consumable: SPECIAL PURPOSE GREASE (99857-97A)
2. See Figure 3-75. Using suitable tool, press bearings in (3, 5) until each bearing is centered in link.
3. Using suitable tool, install seals (1, 6).
4. Install bushings (2, 7, 8).

Swing Arm Assembly Mount Block

1. Apply lubricant to the inner bores of suspension link prior to installing bearings.
 Consumable: SPECIAL PURPOSE GREASE (99857-97A)
2. See Figure 3-76. Using suitable tool, press bearings in (2).
 - a. Press bearing 0 in (5.5 mm) below outer surface to allow installation of seal.
3. Using suitable tool, install seals (1).
4. Install bushing (4).

ADJUST PRELOAD

Adjust preload, rebound and compression settings to customer's previous settings.

COMPLETE

1. Install the rear fork. See REAR FORK (Page 3-58).
2. Install muffler. See MUFFLERS (Page 6-33).
3. Attach left side caddy. See LEFT SIDE CADDY (Page 8-52).
4. Install left rear side cover. See SIDE COVERS (Page 3-46).
5. Install right, left and rear chin spoilers. See CHIN SPOILER (Page 3-69).
6. Install main fuse. See POWER DISCONNECT (Page 8-4).
7. Lower rear wheel.

PREPARE

1. Remove steering head covers. See SIDE COVERS (Page 3-46).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE**Clutch Cable: Lower End**

1. See Figure 3-78. Loosen clutch cable.
 - a. Slide boot (1) away from cable housing end (2).
 - b. Loosen jamnut (4).
 - c. Turn adjuster (3) to loosen cable housing.
2. See Figure 3-80. Loosen mid cable adjuster.
 - a. Remove cable from retainer (1).
 - b. Slide boot (4) away from adjuster (3).
 - c. Loosen jamnut (5).
 - d. Loosen mid-cable adjuster to maximum free play.
3. See Figure 3-82. Disconnect from clutch actuator.
 - a. Remove clutch cable end (3) from cable joint (4).
 - b. Remove clutch cable (1) from clutch cable boss (2).

Clutch Cable: Upper End

1. See Figure 3-78. Remove clutch cable.
 - a. Slide boot (1) away from cable housing end (2).
 - b. Remove clutch switch cover.
 - c. Loosen jamnut (4).
 - d. Turn adjuster (3) to loosen cable housing.
 - e. Align adjuster (3) and adjuster lock (4) to allow cable (6) removal.
 - f. Remove cable end (5) from slot (7).

Clutch Hand Control

1. See Figure 3-77. Disconnect clutch switch connector.
2. Remove clutch hand control assembly.
 - a. Disconnect clutch cable upper end.
 - b. Note position of clutch hand control assembly (1).

- c. Remove screws (4).
- d. Remove clamp (3).

Clutch Switch

1. Remove clutch switch. See CLUTCH SWITCH (Page 8-19).

Complete Cable

1. See Figure 3-79 and Figure 3-81. Remove clutch cable from vehicle.

CLEAN AND INSPECT

1. Inspect clutch lever and cable for wear or damage. Replace or repair as necessary.
2. Inspect clutch cable. Replace as necessary.

NOTICE

The clutch control cable must be oiled and adjusted periodically to compensate for lining wear. Failure to oil and adjust the clutch control cable can result in equipment damage. (00203c)

3. Lubricate clutch cable and hand lever pivot pin hole with HARLEY LUBE.

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------------------------|--------------|-----------|
| Clutch hand control bracket screw | 60–80 in-lbs | 6.8–9 N·m |

Clutch Switch

1. Install clutch switch. See CLUTCH SWITCH (Page 8-19).

Complete Cable

1. See Figure 3-81. Install clutch cable in vehicle.
 - a. Route clutch cable between rear shock and midframe toward clutch cable boss.

Clutch Hand Control

1. See Figure 3-77. Install clutch hand control assembly.
 - a. Install clutch hand control assembly (1) on handlebar.
 - b. Install clamp (3).
 - c. Install screws (4).
Torque: 60–80 in-lbs (6.8–9 N·m) *Clutch hand control bracket screw*
 - d. Install clutch cable upper end.

- e. Connect clutch switch connector (2) and cover.

Clutch Cable: Lower End

1. See Figure 3-82. Install clutch cable.
 - a. Install clutch cable (1) into clutch cable boss (2).
 - b. Install clutch cable end (3) into cable joint (4).

Clutch Cable: Upper End

1. See Figure 3-78. Install clutch cable.
 - a. Verify slots in clutch cable adjuster (3), jamnut (4) and clutch hand lever assembly are aligned.
 - b. Install cable end (5) into slot (7).
 - c. Install clutch cable (6) through clutch hand lever assembly, clutch cable adjuster (3) and jamnut (4).
 - d. Install clutch switch cover.

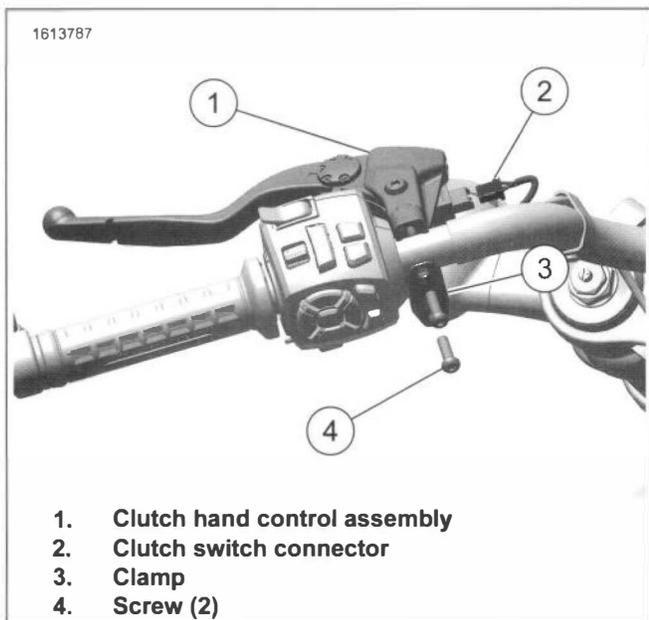


Figure 3-77. Clutch Hand Control

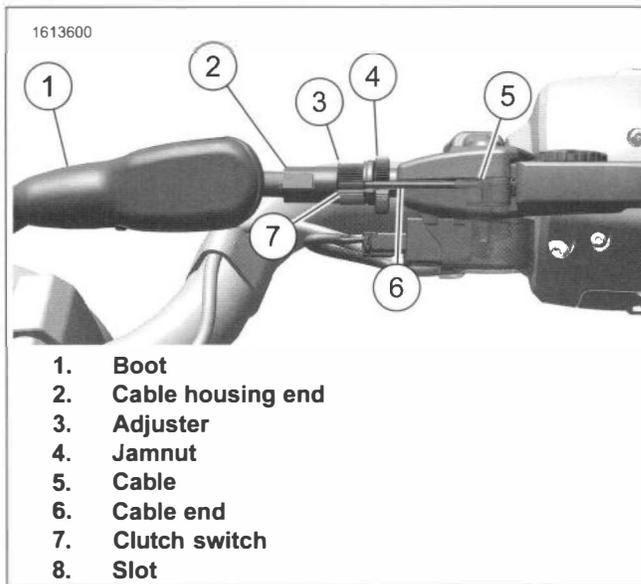


Figure 3-78. Clutch Cable at Hand Lever

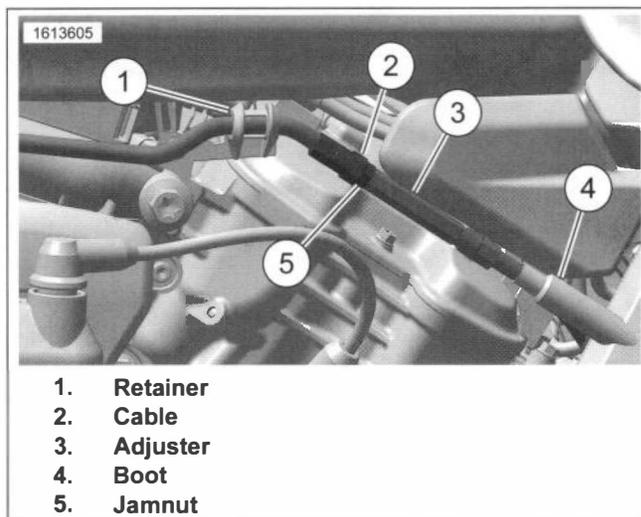


Figure 3-79. Mid Cable Adjuster

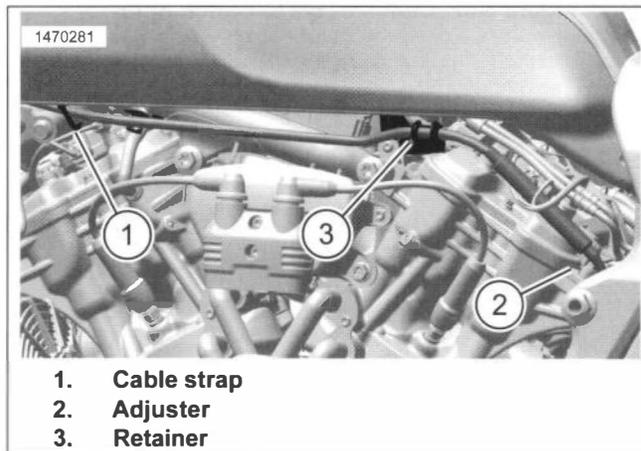


Figure 3-80. Mid Clutch Cable Routing



Figure 3-81. Rear Clutch Cable Routing

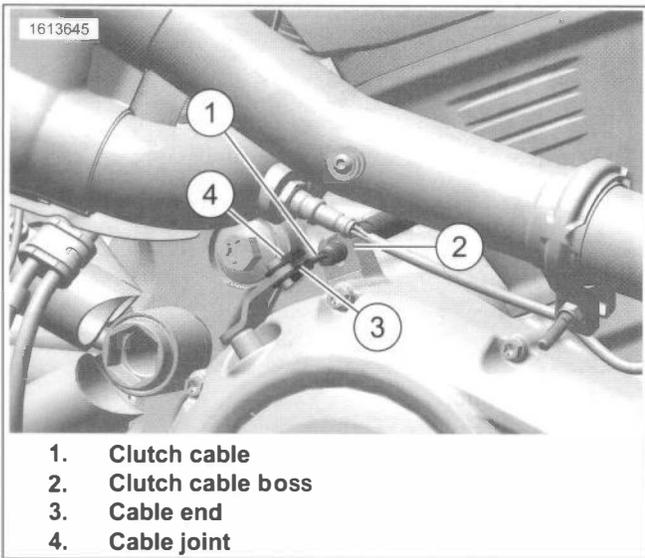


Figure 3-82. Clutch Cable to Clutch Actuator

DISASSEMBLE

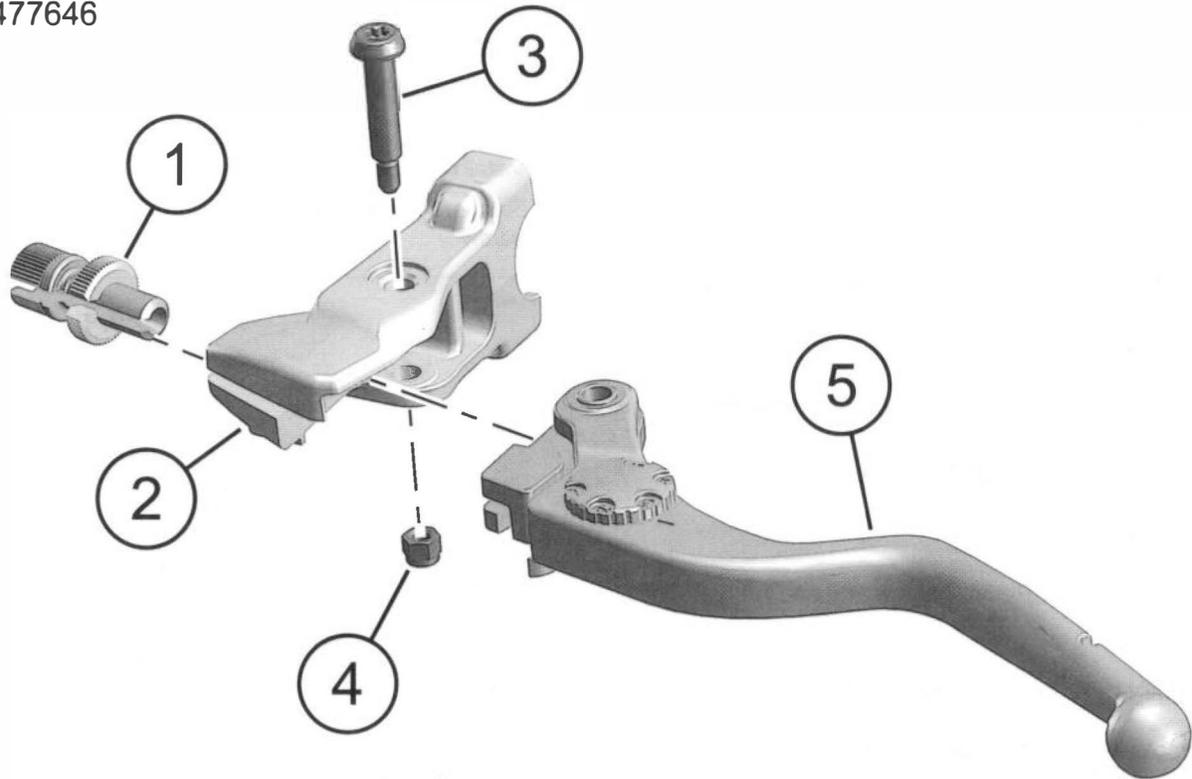
1. See Figure 3-83. Remove Cable adjuster (1).
2. Remove clutch lever.
 - a. Remove nut (4).
 - b. Remove lever pivot screw (3).
 - c. Remove clutch lever (5).

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|---------|
| Clutch lever pivot nut | 44–62 in-lbs | 5–7 N·m |

1. See Figure 3-83. Install clutch lever.
 - a. Install clutch lever (5) in lever mount (2).
 - b. Install lever pivot screw (3).
 - c. Install nut (4). Tighten.
Torque: 44–62 in-lbs (5–7 N·m) *Clutch lever pivot nut*
2. Install cable adjuster (1) in lever mount.

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- 1. Cable adjuster
- 2. Lever mount
- 3. Lever pivot screw

- 4. Nut
- 5. Clutch lever

Figure 3-83. Clutch Lever Assembly

COMPLETE

- 1. Adjust clutch cable. See CHECK AND ADJUST CLUTCH (Page 2-18).
- 2. Install main fuse. See POWER DISCONNECT (Page 8-4).
- 3. Install steering head covers. See SIDE COVERS (Page 3-46).

PREPARE

1. Support motorcycle upright. See Secure the Motorcycle for Service (Page 2-2).
2. Remove seat. See SEAT (Page 3-82).

REMOVE

Cowl

1. See Figure 3-84. Grasp cowl (3) and lift straight up.
2. Remove and discard grommet (2) if damaged.

Rear Fenders

1. See Figure 3-84. Remove screws (1) and left rear fender (4).
2. Remove screws and right rear fender (6).
3. Remove and discard grommets (5) if damaged.

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|------------------|---------|
| Rear fender mounting screw | 35.4–44.3 in-lbs | 4–5 N·m |

Cowl

1. See Figure 3-84. Install new grommet (2) if necessary.
2. Place cowl (3) in position. Press down until cowl snaps in place.

Rear Fenders

1. See Figure 3-84. Install new grommets (5) if necessary.

2. Install left rear fender (4). Secure with screws (1). Tighten. Torque: 35.4–44.3 in-lbs (4–5 N·m) *Rear fender mounting screw*
3. Install right rear fender (6). Secure with screws (1). Tighten. Torque: 35.4–44.3 in-lbs (4–5 N·m) *Rear fender mounting screw*

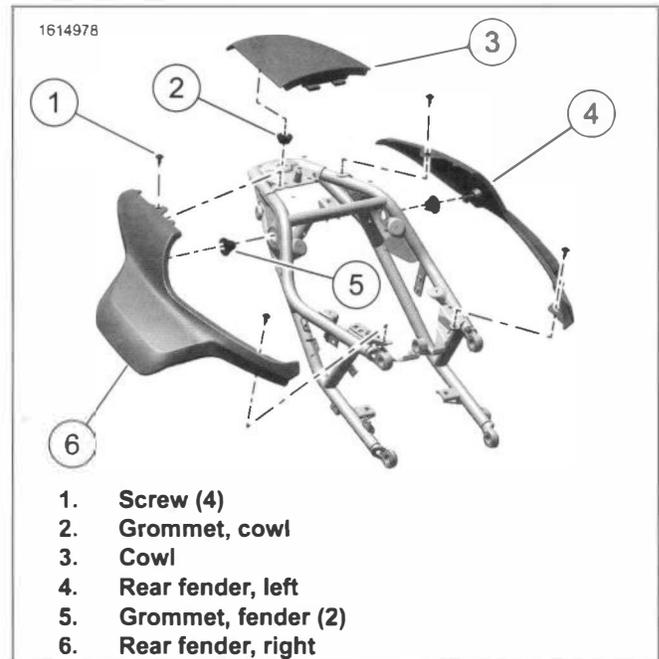


Figure 3-84. Cowl and Rear Fenders

COMPLETE

1. Install seat. See SEAT (Page 3-82).
2. Remove motorcycle from lift.

REMOVE

Front Chin Spoiler

1. See Figure 3-85. Remove screws (1, 3).
2. Remove front chin spoiler (2).

Left Side Chin Spoiler

1. See Figure 3-86. Remove screws (1).
2. Remove left side chin spoiler (2).

Center Rear Chin Spoiler

1. See Figure 3-87. Remove screws (1).
2. Remove center rear chin spoiler (4).

Right Side Chin Spoiler

1. See Figure 3-88. Remove screws (2).
2. Remove right side chin spoiler (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------|--------------|---------|
| Chin spoiler screws | 35-62 in-lbs | 4-7 N·m |

Front Chin Spoiler

1. See Figure 3-85. Position front chin spoiler (2).
2. Install screws (1, 3). Tighten.
Torque: 35-62 in-lbs (4-7 N·m) *Chin spoiler screws*

Left Side Chin Spoiler

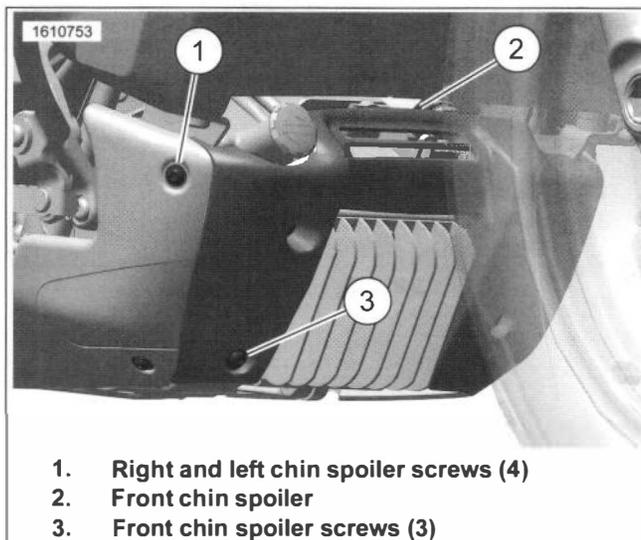
1. See Figure 3-86. Position left side chin spoiler (2).
2. Install screws (1). Tighten.
Torque: 35-62 in-lbs (4-7 N·m) *Chin spoiler screws*

Center Rear Chin Spoiler

1. See Figure 3-87. Position center rear chin spoiler (4).
2. Install screws (1). Tighten.
Torque: 35-62 in-lbs (4-7 N·m) *Chin spoiler screws*

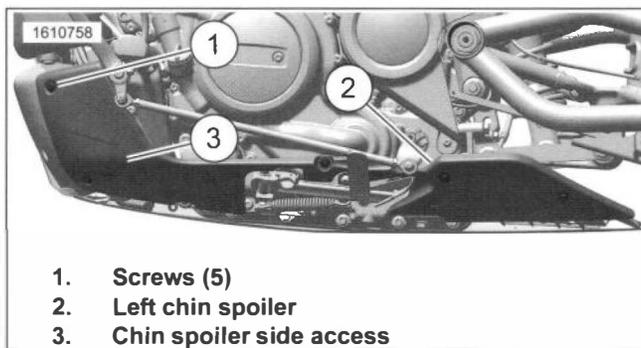
Right Side Chin Spoiler

1. See Figure 3-88. Position right side chin spoiler (1).
2. Install screws (2). Tighten.
Torque: 35-62 in-lbs (4-7 N·m) *Chin spoiler screws*



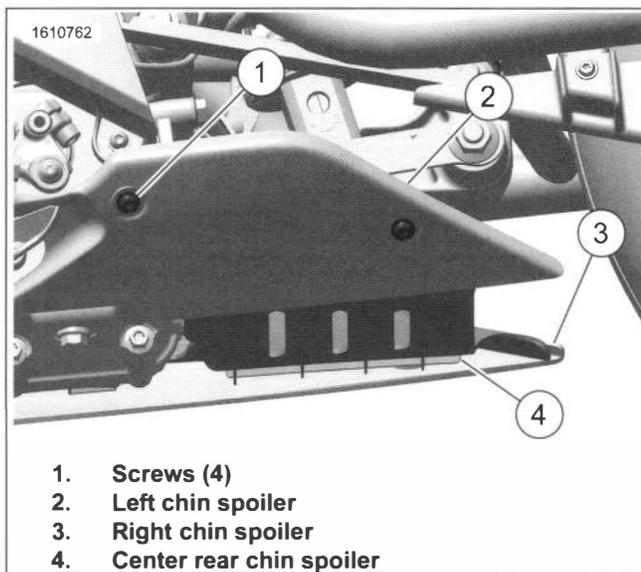
1. Right and left chin spoiler screws (4)
2. Front chin spoiler
3. Front chin spoiler screws (3)

Figure 3-85. Front Center Chin Spoiler



1. Screws (5)
2. Left chin spoiler
3. Chin spoiler side access

Figure 3-86. Left Chin Spoiler



1. Screws (4)
2. Left chin spoiler
3. Right chin spoiler
4. Center rear chin spoiler

Figure 3-87. Rear Center Chin Spoiler

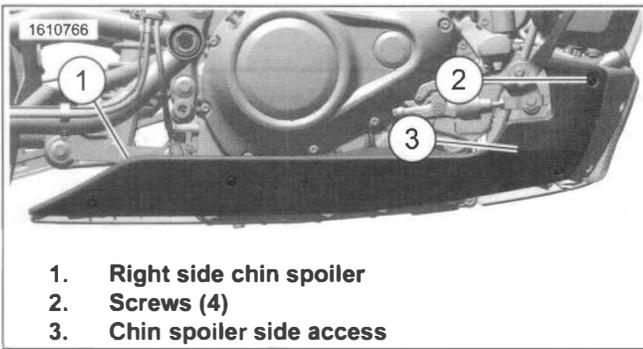


Figure 3-88. Right Chin Spoiler

PREPARE

1. Remove mirror base. See MIRRORS (Page 3-74).

REMOVE

Left

1. See Figure 3-89 Remove end cap (1).
2. Remove hand grip.
 - a. Loosen clamp screw (3).
 - b. Remove hand grip (2).

Right

1. See Figure 3-90. Remove hand grip.
 - a. Loosen screws (2) and front cover (3).
 - b. Remove end cap (1).
 - c. Remove right hand grip (4).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------------|----------------|-------------|
| Hand grip clamp, left | 22–27 in-lbs | 2.5–3.1 N·m |
| Handlebar end cap, left | 124–177 in-lbs | 14–20 N·m |
| Handlebar end cap, right | 124–177 in-lbs | 14–20 N·m |
| RHCM cover screws, front | 5–8 in-lbs | 0.6–0.9 N·m |

Left

1. See Figure 3-89. Install hand grip.
 - a. Place grip (2) in position.
 - b. Tighten clamp screw (3).
Torque: 22–27 in-lbs (2.5–3.1 N·m) *Hand grip clamp, left*
2. Install end cap (1). Tighten.
Torque: 124–177 in-lbs (14–20 N·m) *Handlebar end cap, left*

Right

1. See Figure 3-91. Install hand grip.
 - a. Align TGS tabs (2) with gaps in grip (1).
 - b. Place grip in position.
2. See Figure 3-90. Install end cap (1). Tighten.
Torque: 124–177 in-lbs (14–20 N·m) *Handlebar end cap, right*

3. Place front cover (3) in position.
4. Tighten screws (2).
Torque: 5–8 in-lbs (0.6–0.9 N·m) *RHCM cover screws, front*

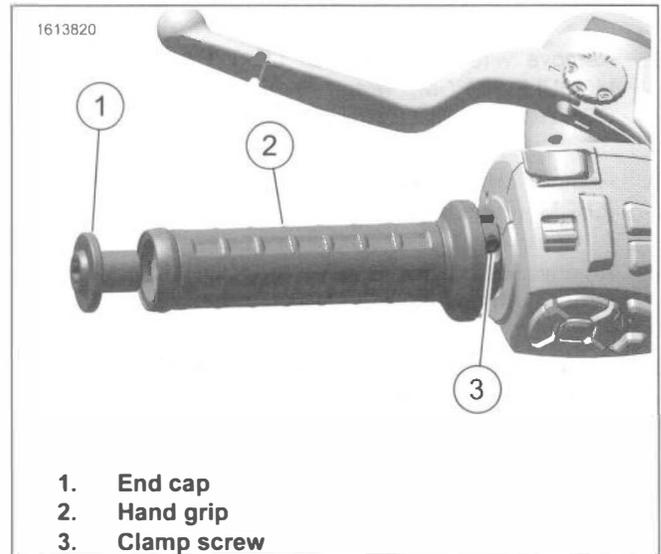


Figure 3-89. Left Hand Grip (typical)

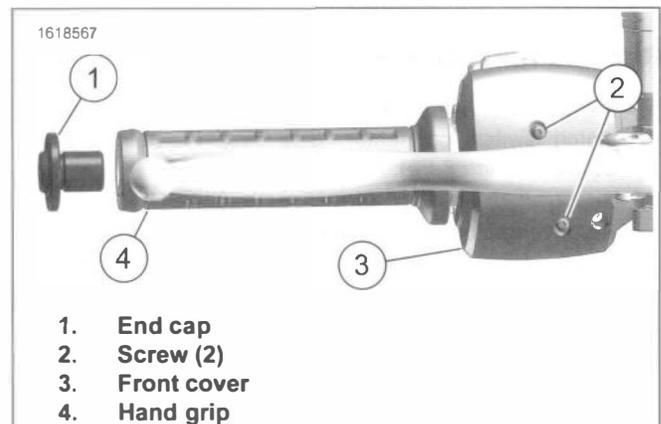


Figure 3-90. Right Hand Grip

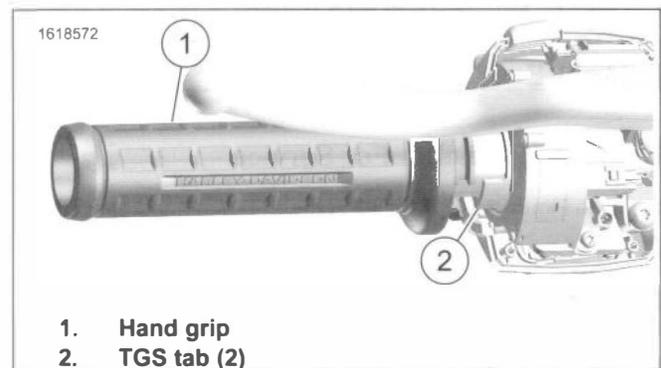


Figure 3-91. TGS Engagement

COMPLETE

1. Install mirror base. See MIRRORS (Page 3-74).

PREPARE**Replace Handlebar**

1. Detach instrument module. See INSTRUMENT MODULE (IM) (Page 8-23).
2. Remove wire retainers. See LEFT HAND CONTROL MODULE (LHCM) (Page 8-18) and RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).
3. Remove LHCM. See LEFT HAND CONTROL MODULE (LHCM) (Page 8-18).
4. Remove RHCM. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).
5. Detach front brake master cylinder assembly and remove front brake line retainer from riser. See FRONT BRAKE MASTER CYLINDER (Page 3-24).
6. Detach clutch hand control assembly. See CLUTCH CONTROL (Page 3-64).
7. Remove hand grips. See HAND GRIPS (Page 3-71).

Remove Handlebar For Service

1. Remove rear cover from LHCM and disconnect wiring and clutch switch connector. See FRONT ELECTRICAL CADDY (Page 8-50).
2. Remove rear cover from RHCM and disconnect wiring and brake switch connector. See FRONT ELECTRICAL CADDY (Page 8-50).
3. Detach clutch lever assembly. See CLUTCH CONTROL (Page 3-64).
4. Detach front brake master cylinder assembly. See FRONT BRAKE MASTER CYLINDER (Page 3-24).

REMOVE**Remove Handlebar For Service**

1. See Figure 3-92. Remove screws (1) and handlebar clamp (2).
2. Remove handlebar assembly (3).

Remove Handlebar

1. See Figure 3-93. Remove screws (1).
2. Remove handlebar clamp (2).
3. Remove handlebar (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|-----------|
| Handlebar clamp screws | 18–20 ft-lbs | 24–27 N·m |

Install Handlebar After Service

1. See Figure 3-92. Install handlebar assembly (3).
2. Install handlebar clamp (2) and screws (1). Tighten.
Torque: 18–20 ft-lbs (24–27 N·m) *Handlebar clamp screws*

Install New Handlebar

1. See Figure 3-93. Install handlebar (3) centered on riser.
2. Install handlebar clamp (2).
3. Install screws (1). Tighten front screws then rear screws.
Torque: 18–20 ft-lbs (24–27 N·m) *Handlebar clamp screws*

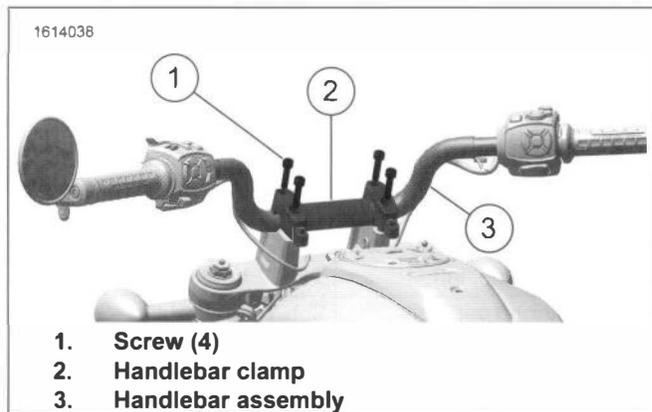


Figure 3-92. Handlebar Assembly

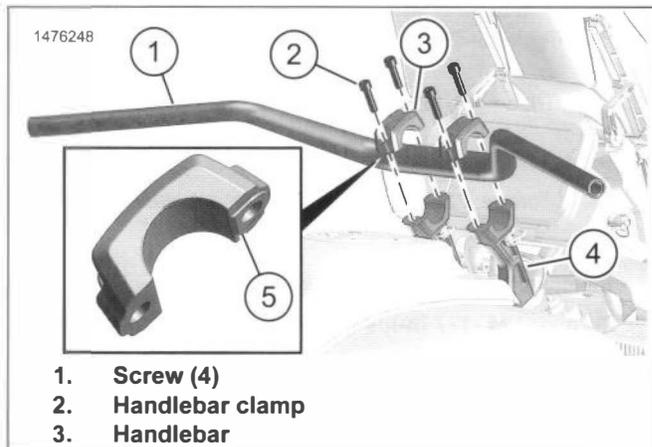


Figure 3-93. Handlebar

COMPLETE**Install Handlebar After Service**

1. Attach front brake master cylinder assembly. See FRONT BRAKE MASTER CYLINDER (Page 3-24).
2. Attach clutch lever assembly. See CLUTCH CONTROL (Page 3-64).

3. Connect RHCM wiring, brake switch connector and rear cover. See FRONT ELECTRICAL CADDY (Page 8-50).
4. Connect LHCM wiring, clutch switch connector and rear cover. See FRONT ELECTRICAL CADDY (Page 8-50).

Replace Handlebar

1. Install LHCM. See LEFT HAND CONTROL MODULE (LHCM) (Page 8-18).
2. Install RHCM. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).

3. Install hand grips. See HAND GRIPS (Page 3-71).
4. Attach clutch hand control assembly. See CLUTCH CONTROL (Page 3-64).
5. Attach front brake master cylinder assembly. See FRONT BRAKE MASTER CYLINDER (Page 3-24).
6. Install wire retainers. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20) and LEFT HAND CONTROL MODULE (LHCM) (Page 8-18).
7. Install instrument module. See INSTRUMENT MODULE (IM) (Page 8-23).

REMOVE

1. See Figure 3-94. Remove mirror.
 - a. Remove nut (7).
 - b. Remove lock washer (8) and washer (6).
 - c. Remove mirror (1), stem (2) and stopper (3).
2. Remove screw (9) and mirror base (5).

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------|----------------|---------------|
| Mirror base screw | 124–177 in-lbs | 14–20 N·m |
| Mirror mounting nut | 96–144 in-lbs | 10.8–16.3 N·m |

1. See Figure 3-94. Install mirror base (5) and screw (9). Tighten.
Torque: 124–177 in-lbs (14–20 N·m) *Mirror base screw*
2. Install mirror.
 - a. Install stopper (3).
 - b. Install mirror (1) and stem (2).

- c. Install washer (6), lock washer (8).
- d. Install nut (7). Tighten.
Torque: 96–144 in-lbs (10.8–16.3 N·m) *Mirror mounting nut*

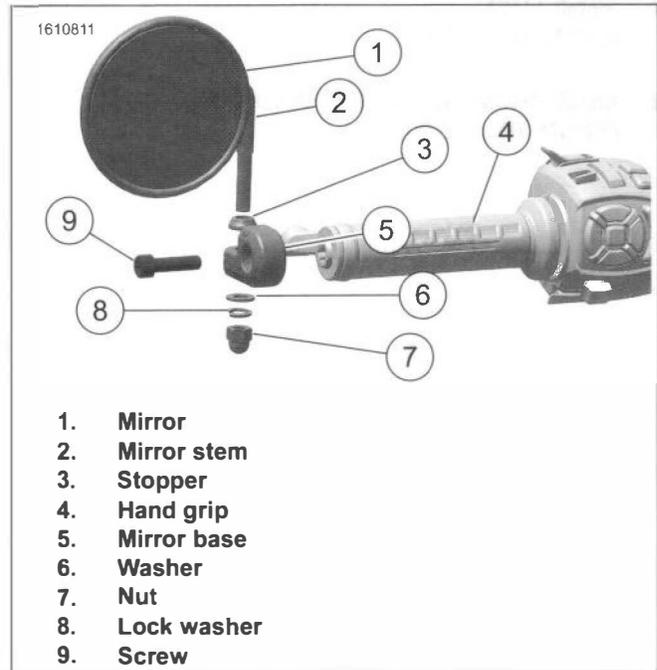


Figure 3-94. Mirror (left shown)

REMOVE**Fender**

1. See Figure 3-95. Remove screws (1).
2. Remove fender (6).

Fender Assembly

1. See Figure 3-95. Remove screws (4).
2. Remove fender assembly.
3. Remove screws (1), left fender side (2), right fender side (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------------|---------------------|---------|
| Fender assembly, front, screw | 62–71 in-lbs | 7–8 N·m |
| Fender, front, screw | 62–71 in-lbs | 7–8 N·m |

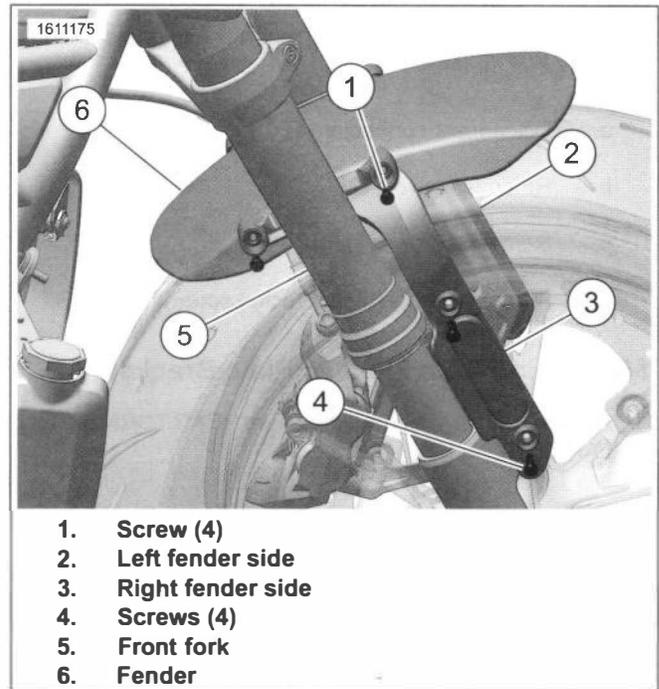
Fender

1. See Figure 3-95. Install fender (6).
2. Install screws (1). Tighten.
Torque: 62–71 **in-lbs** (7–8 N·m) *Fender, front, screw*

Fender Assembly

1. See Figure 3-95. Install right fender side (3) and left fender side to fender (6).

2. Install screws (4). Tighten.
Torque: 62–71 **in-lbs** (7–8 N·m) *Fender, front, screw*
3. Install fender assembly.
4. Install screws (4). Tighten.
Torque: 62–71 **in-lbs** (7–8 N·m) *Fender assembly, front, screw*



1. **Screw (4)**
2. **Left fender side**
3. **Right fender side**
4. **Screws (4)**
5. **Front fork**
6. **Fender**

Figure 3-95. Front Fender Assembly

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

Remove License Plate Module Swingarm Mount

1. See Figure 3-96. Remove rear license plate module swingarm mount.
 - a. Disconnect connector (1).
 - b. Remove scrivets (2).
 - c. Remove screws (3).
 - d. Remove license plate bracket screws (4).

If Replacing Rear License Plate Bracket

1. Remove rear turn signal lamps. See REAR TURN SIGNAL LAMPS (Page 8-29).
2. Remove license plate lamp. See LICENSE PLATE LAMP (Page 8-32).

INSTALL

| FASTENER | TORQUE VALUE | |
|--|---------------|-----------|
| License plate bracket, rear, screw | 89–106 in-lbs | 10–12 N·m |
| License plate module swingarm mount, screw | 24–27 ft-lbs | 32–36 N·m |

If Rear License Plate Bracket Was Replaced

1. Install license plate lamp. See LICENSE PLATE LAMP (Page 8-32)
2. Install rear turn signal lamps. See REAR TURN SIGNAL LAMPS (Page 8-29)

Install License Plate Module Swingarm Mount

1. See Figure 3-96. Install rear license plate bracket.
 - a. Position rear license plate bracket.
 - b. Install license plate bracket screws (2). Tighten.
Torque: 89–106 in-lbs (10–12 N·m) *License plate bracket, rear, screw*
2. See Figure 3-96. Install license plate module swingarm mount.
 - a. Position license plate swingarm mount.
 - b. Install swingarm screws and tighten in sequence (3, 4, 5). Tighten.
Torque: 24–27 ft-lbs (32–36 N·m) *License plate module swingarm mount, screw*
 - c. Install scrivets (2).
 - d. Connect connector (1).

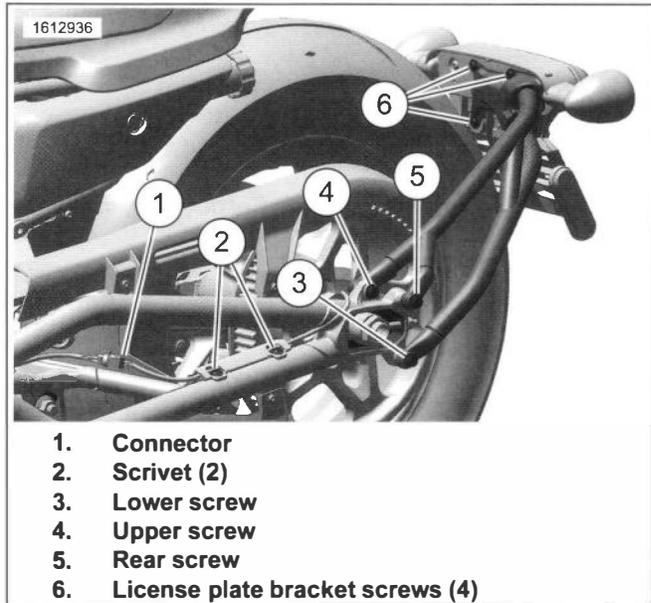


Figure 3-96. Rear License Plate Module Swingarm Mount COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

If removing right side footrest bracket or brake pedal.

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Detach rear brake master cylinder from bracket. See REAR BRAKE MASTER CYLINDER (Page 3-28).

If removing left side footrest bracket or shift lever.

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove shift lever. See SHIFTER SHAFT (Page 5-8).

REMOVE AND INSTALL: FOOTPEGS

| FASTENER | TORQUE VALUE | |
|----------|--------------|-------------|
| Wear peg | 31–40 in-lbs | 3.5–4.5 N·m |

Remove

1. See Figure 3-97. Depress spring loaded detent and remove clevis pin (1).
2. Remove rider footpeg (5) and spring (3).
3. If required, remove the wear peg (4).

Install

1. See Figure 3-97. Insert short leg of spring (3) into hole in footpeg (5).
2. Install long leg of spring with footpeg into hole (2) in bracket (6).
3. Install clevis pin (1).
4. If required, install wear peg. Tighten.
Torque: 31–40 in-lbs (3.5–4.5 N·m) *Wear peg*

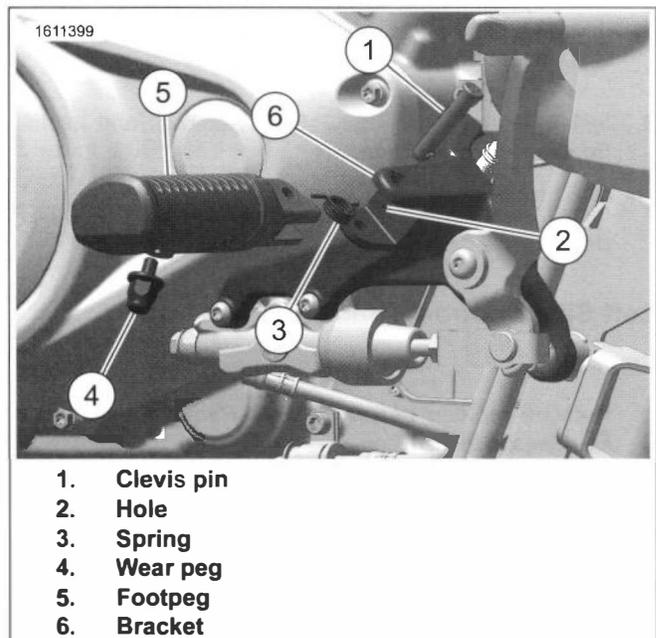


Figure 3-97. Rider Footpeg

REMOVE AND INSTALL: BRACKET

| FASTENER | TORQUE VALUE | |
|------------------------------------|--------------|---------------|
| Footrest bracket screw | 21–23 ft-lbs | 28.5–31.5 N·m |
| Footrest bracket, rider, left side | 21–23 ft-lbs | 28.5–31.5 N·m |

Right Side Footrest Bracket

Prepare

1. Remove footpeg assembly. See Remove and Install: Footpegs in this section.
2. Remove brake pedal. See REAR BRAKE MASTER CYLINDER (Page 3-28).
3. Remove rear master cylinder mounting screws. See REAR BRAKE MASTER CYLINDER (Page 3-28).
4. Remove right side chin spoiler. See CHIN SPOILER (Page 3-69).

Remove

1. See Figure 3-98. Remove screws (2).
2. Remove bracket (1).

Install

1. See Figure 3-98. Install bracket (1).
2. Install screws (2). Tighten both screws.
Torque: 21–23 ft-lbs (28.5–31.5 N·m) *Footrest bracket screw*

Complete

1. Install rear master cylinder mounting screws. See REAR BRAKE MASTER CYLINDER (Page 3-28).
2. Install brake pedal. See REAR BRAKE MASTER CYLINDER (Page 3-28).
3. Install footpeg assembly. See Remove and Install: Footpegs in this section.
4. Install right side chin spoiler. See CHIN SPOILER (Page 3-69).

Left Side Footrest Bracket

Prepare

1. Remove footpeg assembly. See Remove and Install: Footpegs in this section.
2. Remove shifter assembly. See SHIFTER SHAFT (Page 5-8).
3. Remove left side chin spoiler. See CHIN SPOILER (Page 3-69).

Remove

1. See Figure 3-99. Remove screws (2).
2. Remove bracket (1).

Install

1. See Figure 3-99. Install bracket (1).
2. Install screws (2). Tighten.
Torque: 21–23 ft-lbs (28.5–31.5 N·m) *Footrest bracket, rider, left side*

Complete

1. Install shifter assembly. See SHIFTER SHAFT (Page 5-8).
2. Install footpeg assembly. See Remove and Install: Footpegs in this section.
3. Install left side chin spoiler. See CHIN SPOILER (Page 3-69).

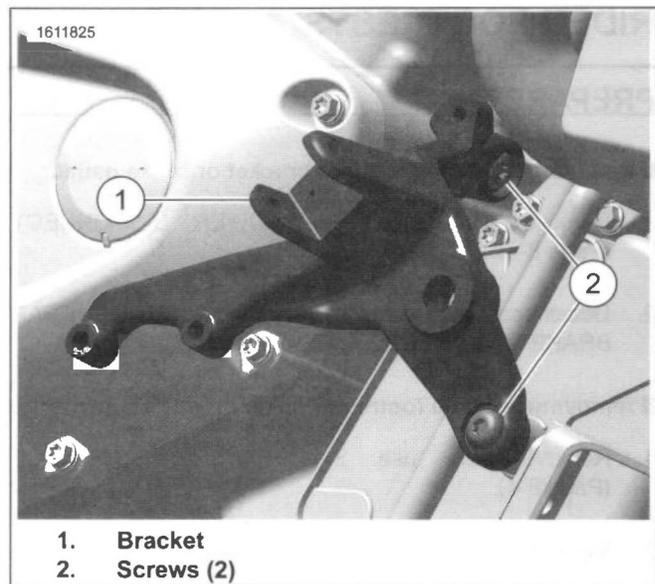


Figure 3-98. Right Footrest Bracket

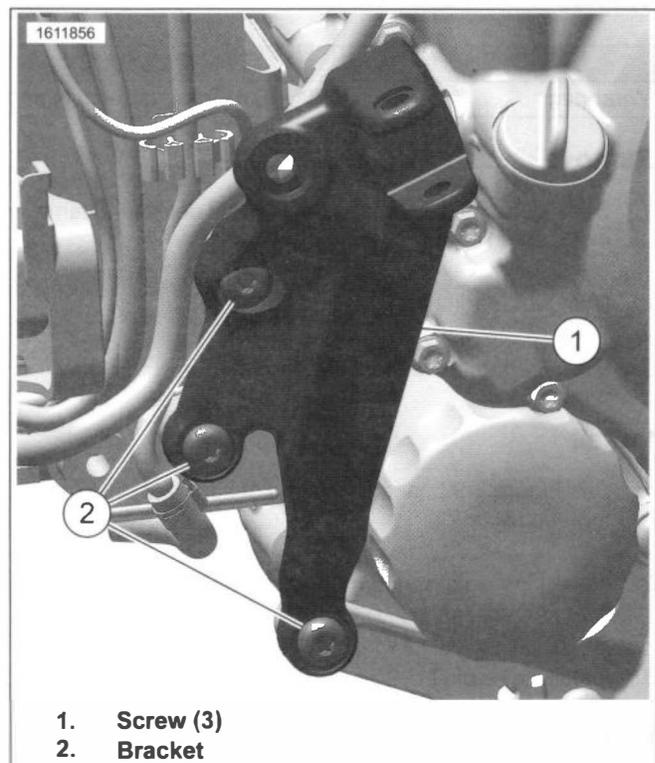


Figure 3-99. Left Side Footrest Bracket

REMOVE AND INSTALL: BRAKE PEDAL

| FASTENER | TORQUE VALUE | |
|-------------------|--------------|-----------|
| Brake pedal screw | 13–15 ft-lbs | 17–21 N·m |

Remove

1. See Figure 3-100. Remove spring clip (3) and pin (4).
2. Remove screw (5), nut (2), washer (6) outer bushing (7).
3. Remove brake pedal (1) and inner bushing (8).

Install

1. See Figure 3-100. Install inner bushing (8), and break pedal (1).

2. Install outer bushing (7), washer (6), screw (5) and nut (2). Tighten screw.

Torque: 13–15 ft-lbs (17–21 N·m) *Brake pedal screw*

3. Install pin (4) and spring clip (3).

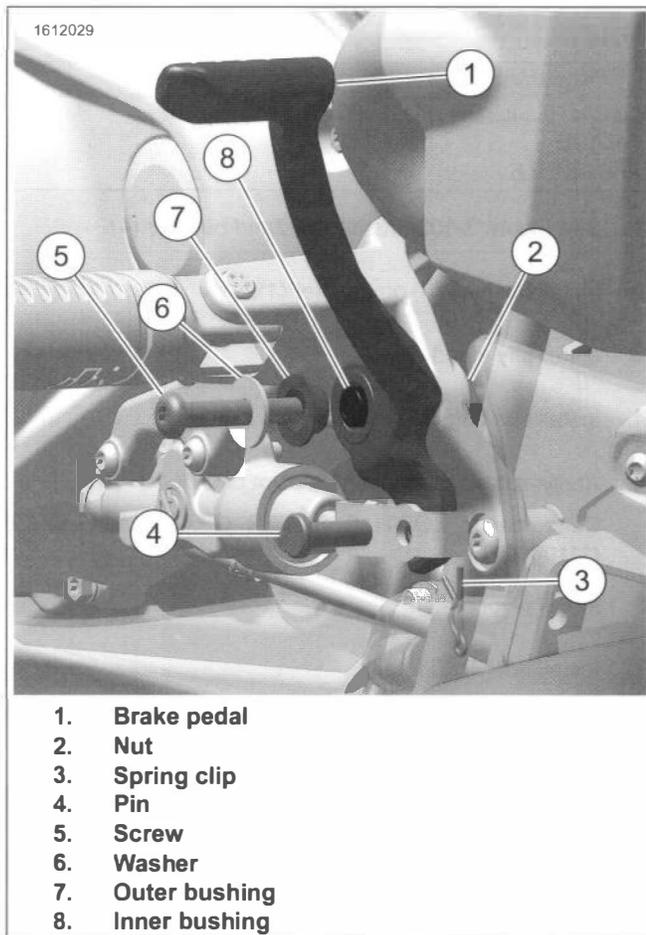


Figure 3-100. Rear Brake Pedal

COMPLETE

If right side footrest bracket or brake pedal was removed.

1. **Right Footrest Bracket:** Attach rear brake master cylinder to bracket. See REAR BRAKE MASTER CYLINDER (Page 3-28).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

If left side footrest bracket or pedal was removed.

1. Install shift lever. See SHIFTER SHAFT (Page 5-8).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Set motorcycle upright. See Secure the Motorcycle for Service (Page 2-2).
2. Disconnect jiffy stand sensor, if equipped. See JIFFY STAND SENSOR (JSS) (Page 8-49).

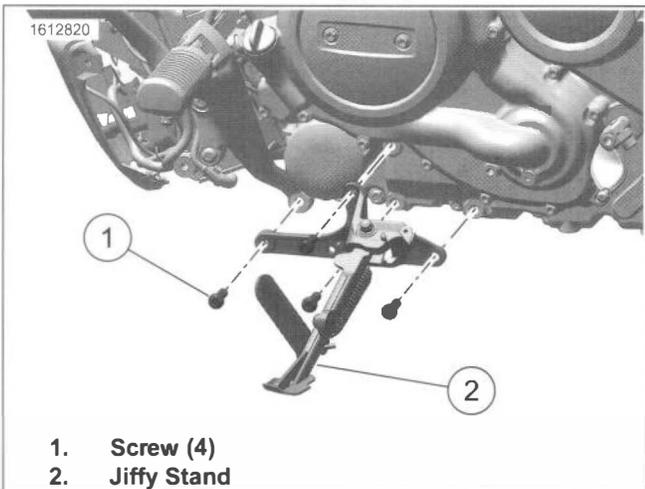
REMOVE

1. See Figure 3-101. Lower jiffy stand (2).
2. Remove screws (1).
3. Remove jiffy stand.

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------|--------------|-----------|
| Jiffy stand screws | 15–18 ft-lbs | 21–25 N·m |

1. See Figure 3-101. Install jiffy stand (2).
2. Install screws (1). Tighten.
Torque: 15–18 ft-lbs (21–25 N·m) *Jiffy stand screws*



1. Screw (4)
2. Jiffy Stand

Figure 3-101. Jiffy Stand

DISASSEMBLE

1. See Figure 3-102. Remove spring (6).
2. Remove nut (3).
3. Remove pivot pin (7).
4. Remove jiffy stand (5).
5. Remove bushings (2 and 8).
6. Inspect bushings for wear or damage, replace if necessary.
7. Remove jiffy stand bumper (4).

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|---------------------------|---------------|---------------|
| Jiffy stand pivot pin nut | 91–101 in-lbs | 10.3–11.4 N·m |

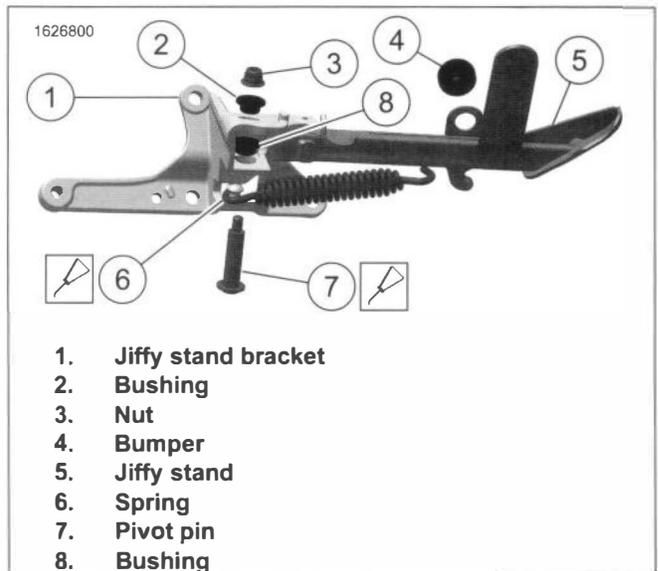
| CONSUMABLE | PART NUMBER |
|---------------------------------|-------------|
| LOCTITE SILVER GRADE ANTI-SEIZE | 11100001 |

1. See Figure 3-102. Install jiffy stand bumper (4).
2. Install bushing (8) on bracket (1).
3. Install jiffy stand (5).
4. Install bushing (2).
5. Apply anti-sieze lubricant to pivot pin (7).
Consumable: LOCTITE SILVER GRADE ANTI-SEIZE (11100001)
6. Install pivot pin.
7. Install nut (3). Tighten.
Torque: 91–101 in-lbs (10.3–11.4 N·m) *Jiffy stand pivot pin nut*
8. Apply anti-sieze lubricant to spring hook groove on jiffy stand bracket.
Consumable: LOCTITE SILVER GRADE ANTI-SEIZE (11100001)

NOTE

Spring hooks must face rear of motorcycle when jiffy stand is in down position.

9. Install spring (6).



1. Jiffy stand bracket
2. Bushing
3. Nut
4. Bumper
5. Jiffy stand
6. Spring
7. Pivot pin
8. Bushing

Figure 3-102. Jiffy Stand Assembly

COMPLETE

1. If equipped, connect jiffy stand sensor. See JIFFY STAND SENSOR (JSS) (Page 8-49).
2. Remove motorcycle from upright. See Secure the Motorcycle for Service (Page 2-2).

REMOVE**Seat**

1. See Figure 3-103. Insert key (2) in seat lock (3).
2. Turn key to release latch (4).
3. Lift the front of the seat (5) to remove.
4. See Figure 3-104. Lift up then back on rear of rider seat (1) to remove.

Seat Latch Assembly**If not replacing seat latch assembly:**

1. See Figure 3-104. Remove screws (1) and position seat latch assembly (2) aside.

If replacing latch assembly:

1. See Figure 3-104. Remove screws (8) and seat latch (3).
2. Remove screws (5) and lock (6).
3. Remove seat latch assembly.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------|--------------|-------------|
| Seat latch bracket screws | 73–89 in-lbs | 8.2–10 N·m |
| Seat latch screws | 44–53 in-lbs | 5–6 N·m |
| Seat lock screws | 12–15 in-lbs | 1.3–1.7 N·m |

Seat

1. See Figure 3-103. Insert tabs (1) of rider seat into position in rear cover.
2. Lower front of rider seat (5) into position.
3. Press front of rider seat down until a click is heard.
4. Pull up on the seat to verify it is secure.

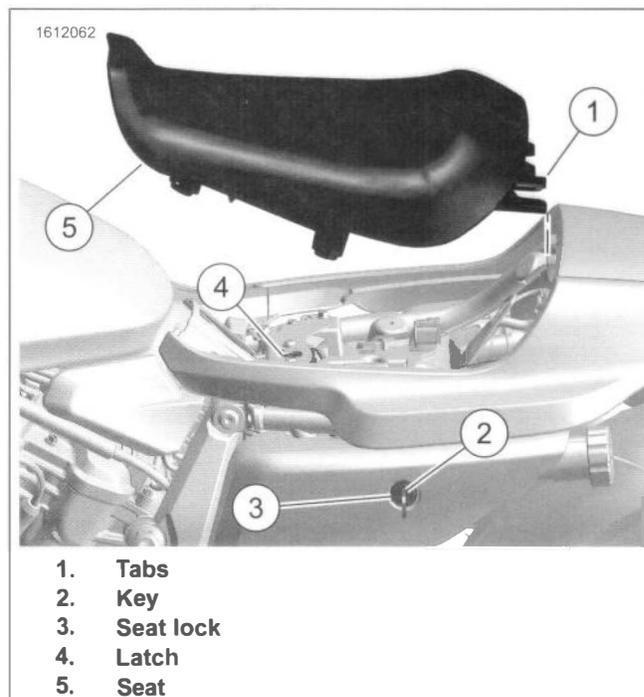
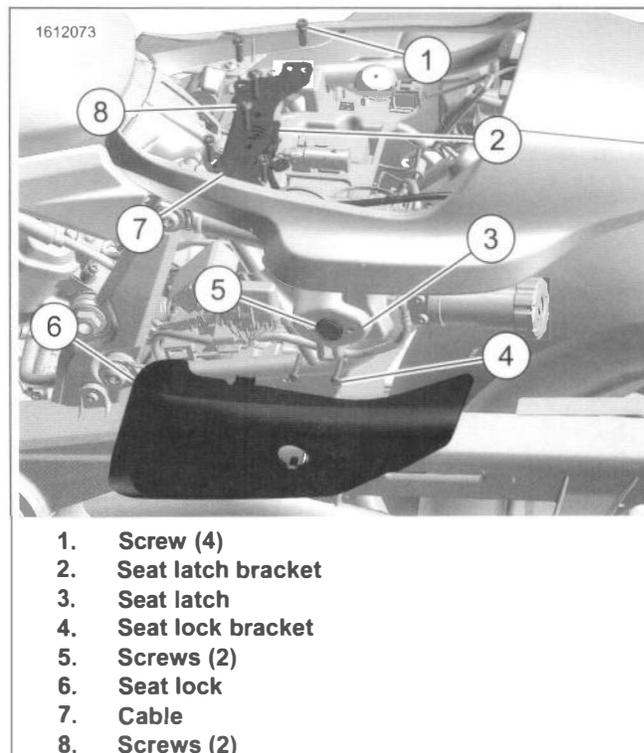
Seat Latch Assembly**If replacing latch assembly:**

1. See Figure 3-104. Install seat lock (6) into the seat lock bracket (4).
2. Install screws (5). Tighten.
Torque: 12–15 in-lbs (1.3–1.7 N·m) *Seat lock screws*
3. Position the seat latch assembly (3) into the seat latch bracket (2).

4. Install screws (8). Tighten.
Torque: 44–53 in-lbs (5–6 N·m) *Seat latch screws*

If not replacing seat latch assembly:

1. See Figure 3-104. Position seat latch assembly (2) aside and screws (1). Tighten.
Torque: 73–89 in-lbs (8.2–10 N·m) *Seat latch bracket screws*

**Figure 3-103. Seat****Figure 3-104. Seat Latch Assembly**

PREPARE

1. Remove right side steering head cover. See **SIDE COVERS** (Page 3-46).
2. Remove main fuse. See **POWER DISCONNECT** (Page 8-4).
3. Remove fuel tank. See **FUEL TANK** (Page 6-12).
4. Remove rear fender. See **COWL AND REAR FENDERS** (Page 3-68).
5. Detach under seat caddy. See **UNDER SEAT CADDY** (Page 8-55).
6. Detach ABS module. See **ABS MODULE** (Page 3-40).
7. Remove mufflers See **MUFFLERS** (Page 6-33).
8. Detach cross member. See **FRAME CROSSMEMBER** (Page 3-89).
9. Detach tail caddy. See **TAIL SECTION CADDY** (Page 8-56).
10. Detach fuse block. See **LEFT SIDE CADDY** (Page 8-52).
11. Detach manual suspension adjuster. See **REAR SHOCK ABSORBER** (Page 3-61).
12. Detach left side caddy. See **LEFT SIDE CADDY** (Page 8-52).

REMOVE

NOTE

Support ABS module to prevent brake line damage.

1. See Figure 3-105. If required, remove scrivet (7) and left tail cover (3).
2. If required, remove screw (5) and seat lock bracket (4).
3. Remove ground nut (s) (1) and ground wires (2).
4. See Figure 3-106. Remove scrivet (4) and right tail cover (5).
5. Remove screws (1) and right rear side cover (2).
6. See Figure 3-107. Remove tail section.
 - a. Remove lower screw (4).
 - b. Remove upper screws (2).
 - c. Remove tail section (3).

7. Remove D-Nuts (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------------|--------------|---------|
| | in-lbs | N·m |
| GND nut | 60–72 | 6.8–8.1 |
| Right rear side cover screws | 62–75 | 7–8.5 |
| Seat lock bracket screw | 62–75 | 7–8.5 |
| Tail section lower screw | 80–88 | 108–119 |
| Tail section upper screws | 80–88 | 108–119 |

1. See Figure 3-107. Install tail section.
 - a. Install D-Nuts (1).
 - b. Install tail section (3).
 - c. Install upper screws (2).
 - d. Install lower screw (4). Tighten.
Torque: 80–88 ft-lbs (108–119 N·m) *Tail section lower screw*
 - e. Tighten upper screws.
Torque: 80–88 ft-lbs (108–119 N·m) *Tail section upper screws*
2. See Figure 3-106. If required, install right rear side cover (2) and screws (1). Tighten.
Torque: 62–75 **in-lbs** (7–8.5 N·m) *Right rear side cover screws*
3. If required, install right side tail cover (5) and scrivet (4).
4. See Figure 3-105. If required, install left rear side cover (3) and scrivet (7). If required, install seat lock bracket (4) and screw (5). Tighten.
Torque: 62–75 **in-lbs** (7–8.5 N·m) *Seat lock bracket screw*
5. Install GND wires (2) and nuts (1). Tighten.
Torque: 60–72 **in-lbs** (6.8–8.1 N·m) *GND nut*

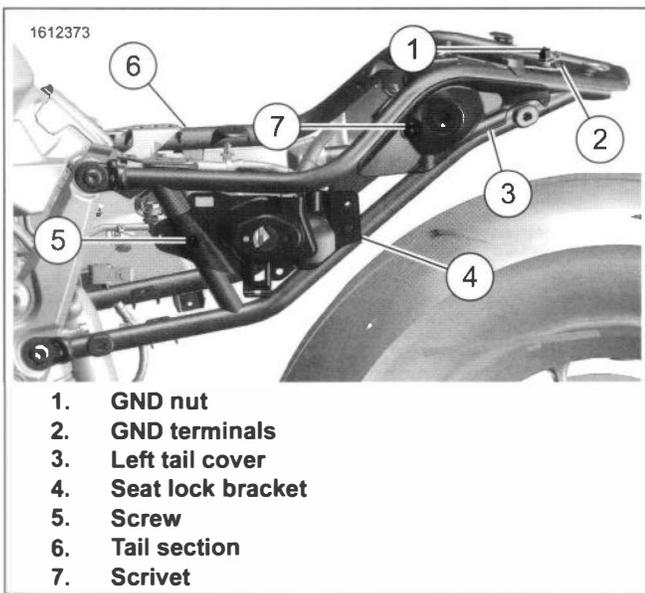


Figure 3-105. Left Tail Section

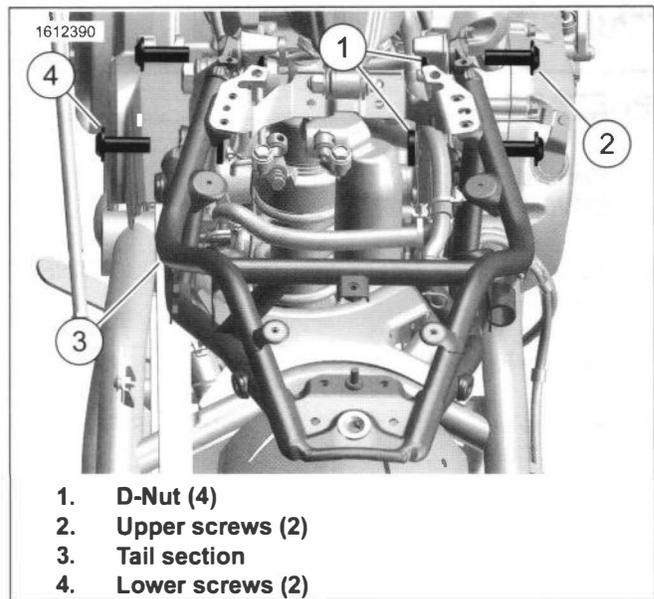


Figure 3-107. Tail Section

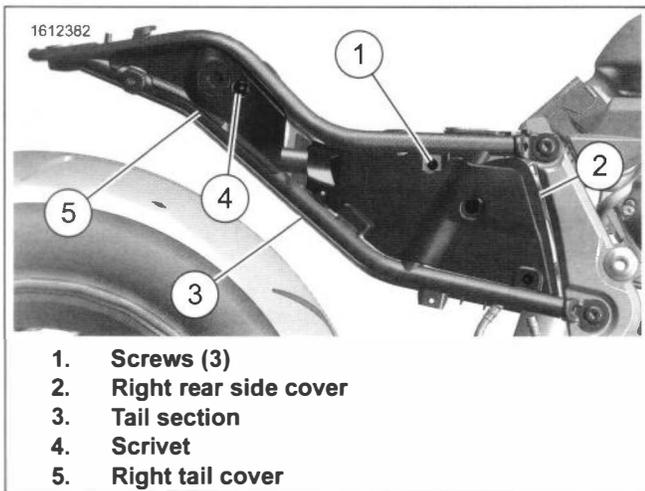


Figure 3-106. Right Tail Section

COMPLETE

1. Attach left side caddy. See LEFT SIDE CADDY (Page 8-52).
2. Attach manual suspension adapter. See REAR SHOCK ABSORBER (Page 3-61).
3. Attach fuse block. See LEFT SIDE CADDY (Page 8-52).
4. Attach tail caddy. See TAIL SECTION CADDY (Page 8-56).
5. Attach crossmember. See FRAME CROSSMEMBER (Page 3-89).
6. Attach muffler. See MUFFLERS (Page 6-33).
7. Attach ABS module See ABS MODULE (Page 3-40).
8. Attach under seat caddy. See UNDER SEAT CADDY (Page 8-55).
9. Install fuel tank. See FUEL TANK (Page 6-12).
10. Install rear fender. See COWL AND REAR FENDERS (Page 3-68).
11. Install seat. See SEAT (Page 3-82).
12. Install main fuse. See POWER DISCONNECT (Page 8-4).
13. Install right side steering head cover. See SIDE COVERS (Page 3-46).

PREPARE**Front Frame**

1. Clamp rear wheel.
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Install jack. See GENERAL (Page 2-2).
4. Remove seat. See SEAT (Page 3-82).
5. Purge fuel line. See PURGE FUEL LINE (Page 6-9).
6. Remove fuel tank. See FUEL TANK (Page 6-12).
7. Remove side covers. See SIDE COVERS (Page 3-46).
8. Remove main fuse. See POWER DISCONNECT (Page 8-4).
9. Remove cross-member. See FRAME CROSSMEMBER (Page 3-89).
10. Remove instrument module. See INSTRUMENT MODULE (IM) (Page 8-23).
11. Remove headlamp and bracket assembly. See HEADLAMP (Page 8-26).
12. Remove handlebar for service. See HANDLEBAR (Page 3-72).
13. Remove air box assembly. See AIR BOX (Page 6-3).
14. Detach front caliper. See FRONT BRAKE CALIPER (Page 3-27).
15. Remove steering head/fork stem and bracket, and front fork assembly. See STEERING HEAD (Page 3-55).
16. Detach ignition coil bracket. See IGNITION COIL (Page 8-15).
17. Detach ECM bracket. See ELECTRONIC CONTROL MODULE (ECM) (Page 8-33).
18. Detach radiator. See RADIATOR (Page 7-17).
19. Disconnect horn connectors. See HORN (Page 8-25).
20. Remove front electrical caddy. See FRONT ELECTRICAL CADDY (Page 8-50).

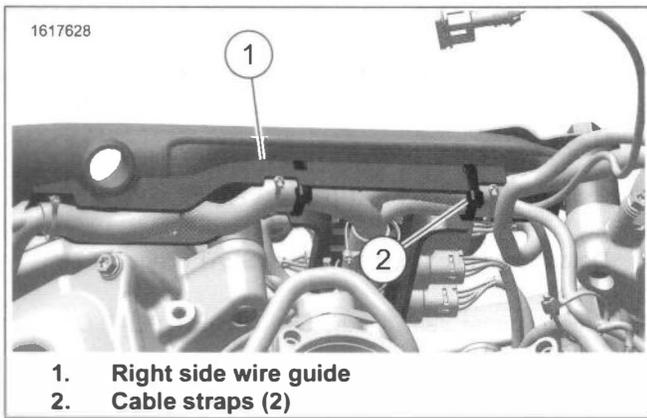
Midframe

1. Remove rear, middle side and steering head covers. See SIDE COVERS (Page 3-46).

2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Detach seat latch assembly. See SEAT (Page 3-82).
5. Detach under seat caddy. See UNDER SEAT CADDY (Page 8-55).
6. Remove crossmember. See FRAME CROSSMEMBER (Page 3-89).
7. Detach ABS module. See ABS MODULE (Page 3-40).
 - a. Remove ABS module frame cover.
 - b. Detach ABS module.
8. Remove front master cylinder to ABS module rear clamp. See BRAKE LINES (Page 3-34).
9. Remove mufflers. See MUFFLERS (Page 6-33).
10. Detach tail section. See TAIL SECTION (Page 3-83).
11. Remove belt guards. See BELT GUARDS (Page 3-60).
12. Remove rear brake line p-clamp from rear fork. See BRAKE LINES (Page 3-34).
13. Remove rear wheel. See REAR WHEEL (Page 3-9).
14. Remove rear fork. See REAR FORK (Page 3-58).

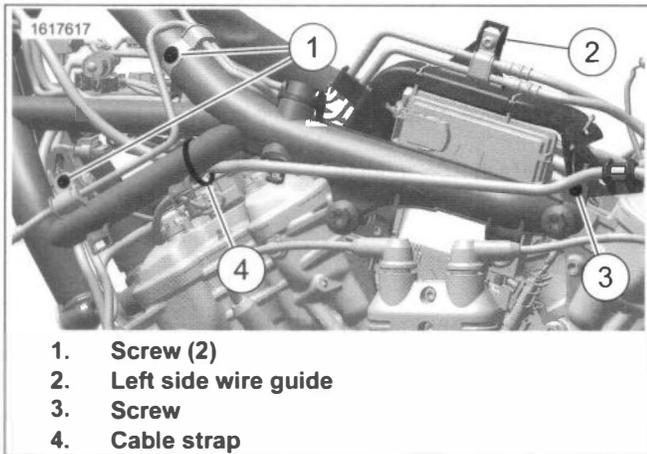
REMOVE**Front Frame**

1. See Figure 3-108. Cut cable straps (2). Detach right side wire guide (1).
2. See Figure 3-109. Detach left side wire guide.
 - a. Remove screw (3).
 - b. Remove screws (1).
 - c. Discard cable strap (4).
 - d. Detach left side wire guide (2).
3. See Figure 3-110. Remove front frame.
 - a. Remove bolts (1) and right side valley cover (2).
 - b. Remove front frame (3).
4. See Figure 3-110. If required, remove screws (1) and horn assembly (3) from frame (2).



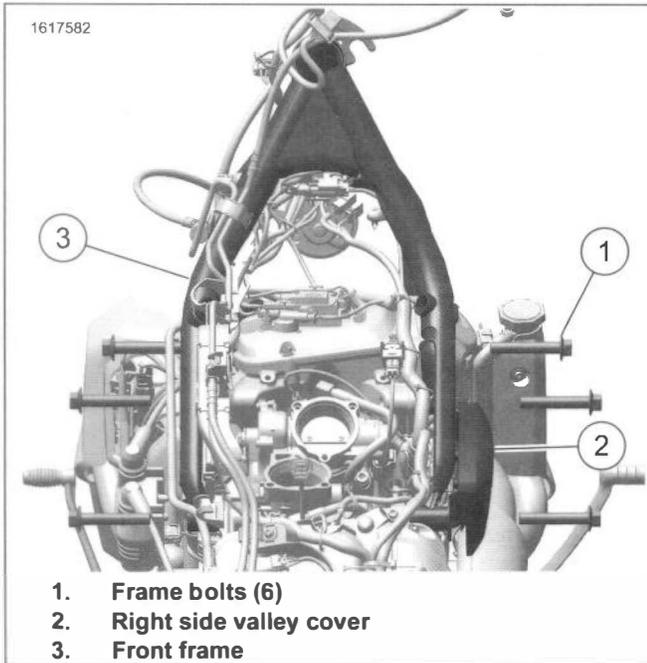
1. Right side wire guide
2. Cable straps (2)

Figure 3-108. Right Side Wire Guide



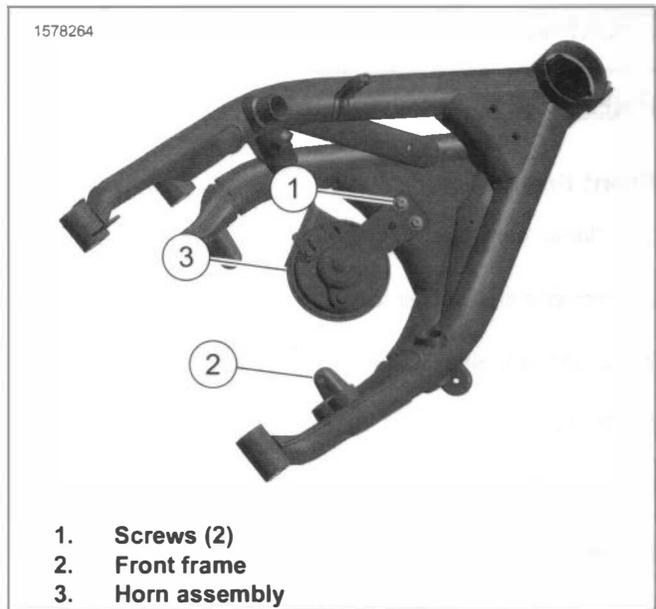
1. Screw (2)
2. Left side wire guide
3. Screw
4. Cable strap

Figure 3-109. Left Side Wire Guide



1. Frame bolts (6)
2. Right side valley cover
3. Front frame

Figure 3-110. Front Frame



1. Screws (2)
2. Front frame
3. Horn assembly

Figure 3-111. Remove Horn Assembly

Midframe

1. See Figure 3-110. Remove left midframe.
 - a. Remove left flange screw (1).
 - b. Remove nuts (4).
 - c. Remove left midframe (5).
2. See Figure 3-110. Remove right midframe.
 - a. Remove right flange screw (1).
 - b. Remove nuts (4) and bolt (2).
 - c. Remove right midframe (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------------------------|----------------|-------------|
| Front frame bolts | 80–88 ft-lbs | 108–119 N·m |
| Horn screws | 50–62 in-lbs | 5.7–7 N·m |
| Left side brake line clamp screws | 35–62 in-lbs | 4–7 N·m |
| Left side cable guide screw | 35–62 in-lbs | 4–7 N·m |
| Midframe lower bolt and nut | 80–88 ft-lbs | 108–119 N·m |
| Midframe upper flange screws | 125–137 ft-lbs | 169–186 N·m |

Front Frame

1. See Figure 3-111. Install horn.
 - a. Position horn (3).
 - b. Install screws (1). Tighten.
Torque: 50–62 in-lbs (5.7–7 N·m) *Horn screws*
2. See Figure 3-112. Install front frame.
 - a. Position front frame (2), install right front bolt (3).

- b. Install right side valley cover (1).
 - c. Install right side rear bolts (3).
3. See Figure 3-113. Install left side front frame bolts.
- a. Assemble tapered washer (3), collet (4), tapered washer (3) onto the front frame lower bolt (2).
 - b. Install front frame bolts (2). Tighten all six front frame bolts in the sequence shown using the star callouts in Figure 3-112 and Figure 3-113.
- Torque: 80–88 ft-lbs (108–119 N·m) *Front frame bolts*
4. See Figure 3-109. Install left side wire guide.
- a. Install left side wire guide (2).
 - b. Install screw (3).
- Torque: 35–62 in-lbs (4–7 N·m) *Left side cable guide screw*
- c. Install screw (1). Tighten.
- Torque: 35–62 in-lbs (4–7 N·m) *Left side brake line clamp screws*
5. Route clutch cable and install cable strap.
6. See Figure 3-108. Install right side cable guide (1) and cable straps (2).

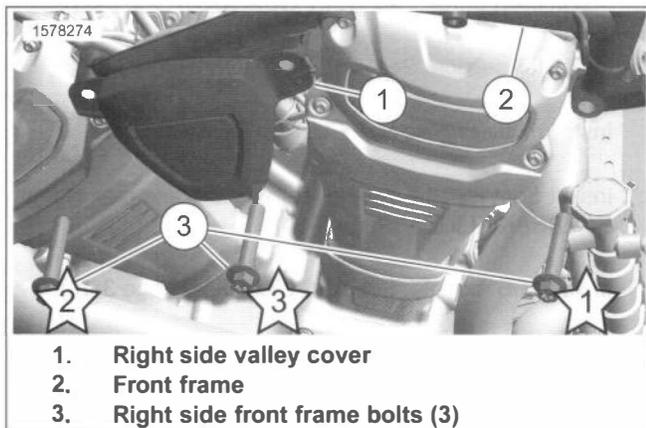


Figure 3-112. Right Side Front Frame Bolts

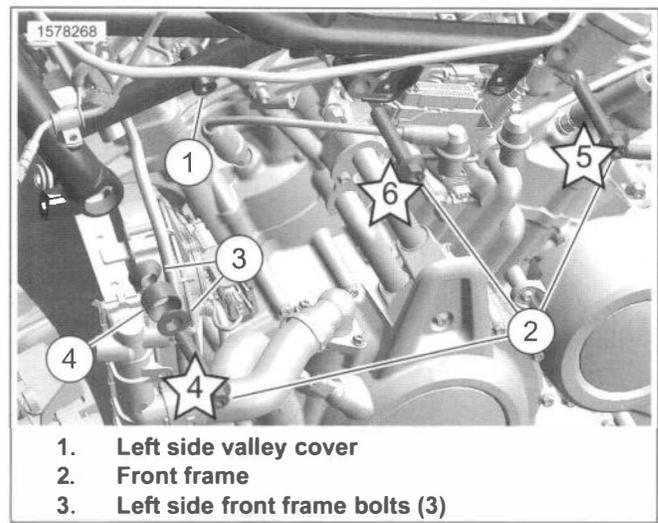


Figure 3-113. Left Side Front Frame Bolts

Midframe

1. See Figure 3-114. Place right and left midframes in position.
 2. Loosely install upper flange screws (1).
 3. Loosely install lower lower bolts and nuts (2, 4).
 4. Follow steps in Complete (Midframe), further in this section, until upper shock bolt and rear fork are in position.
 5. Tighten midframe nut and bolt (2, 4).
- Torque: 80–88 ft-lbs (108–119 N·m) *Midframe lower bolt and nut*
6. Tighten midframe upper flange screws (1).
- Torque: 125–137 ft-lbs (169–186 N·m) *Midframe upper flange screws*

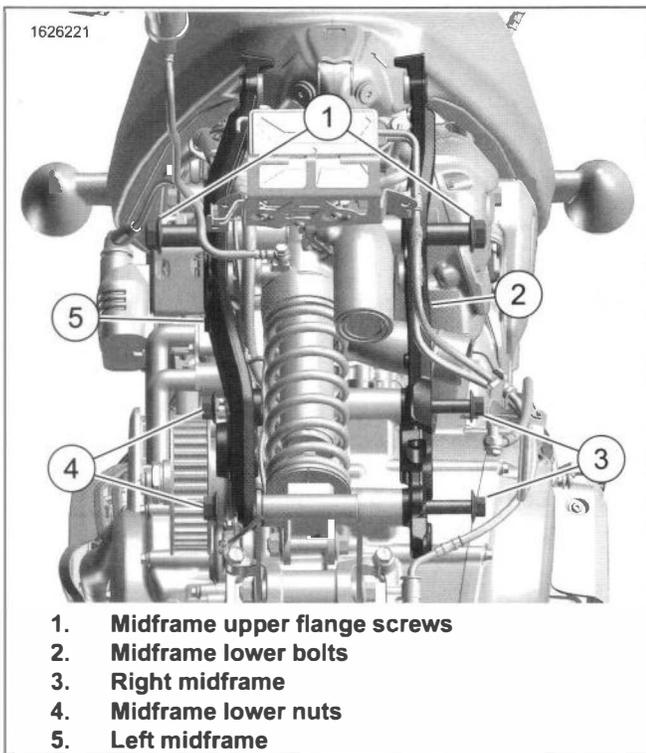


Figure 3-114. Midframe

COMPLETE

Front Frame

1. Install front electrical caddy. See FRONT ELECTRICAL CADDY (Page 8-50).
2. Connect horn connectors. See HORN (Page 8-25).
3. Attach radiator. See RADIATOR (Page 7-17).
4. Attach ECM bracket. See ELECTRONIC CONTROL MODULE (ECM) (Page 8-33).
5. Attach ignition coil bracket. See IGNITION COIL (Page 8-15).
6. Install steering head/fork stem and bracket, and front fork assembly. See STEERING HEAD (Page 3-55).
7. Attach front caliper. See FRONT BRAKE CALIPER (Page 3-27).
8. Attach front brake lines from fender, steering head and front frame. See BRAKE LINES (Page 3-34).
9. Install air box assembly. See AIR BOX (Page 6-3).
10. Install handlebar for service. See HANDLEBAR (Page 3-72).
11. Install headlamp and bracket assembly. See HEADLAMP (Page 8-26).

12. Install instrument module. See INSTRUMENT MODULE (IM) (Page 8-23).
13. Install cross-member. See FRAME CROSSMEMBER (Page 3-89).
14. Install main fuse. See POWER DISCONNECT (Page 8-4).
15. Install side covers. See SIDE COVERS (Page 3-46).
16. Install fuel tank. See FUEL TANK (Page 6-12).
17. Install seat. See SEAT (Page 3-82).
18. Remove jack. See GENERAL (Page 2-2).
19. Install chin spoiler. See CHIN SPOILER (Page 3-69).
20. Release rear wheel.

Midframe

1. Install rear fork. See REAR FORK (Page 3-58).
2. Install rear wheel. See REAR WHEEL (Page 3-9).
3. Install rear brake line p-clamp from rear fork. See BRAKE LINES (Page 3-34).
4. Install belt guards. See BELT GUARDS (Page 3-60).
5. Install tail section. See TAIL SECTION (Page 3-83).
6. Install mufflers. See MUFFLERS (Page 6-33).
7. Install front master cylinder to ABS module rear clamp. See BRAKE LINES (Page 3-34).
8. Install ABS module. See ABS MODULE (Page 3-40).
 - a. Remove ABS module frame cover.
 - b. Detach ABS module.
9. Install crossmember. See FRAME CROSSMEMBER (Page 3-89).
10. Install under seat caddy. See UNDER SEAT CADDY (Page 8-55).
11. Install seat latch assembly. See SEAT (Page 3-82).
12. Install seat. See SEAT (Page 3-82).
13. Install main fuse. See POWER DISCONNECT (Page 8-4).
14. Install rear, middle side and steering head covers. See SIDE COVERS (Page 3-46).

PREPARE

1. Remove seat. See SEAT (Page 3-82).
2. Detach the seat latch assembly. See SEAT (Page 3-82).
3. Remove fuel tank mounting bracket bolt and fuel tank mounting screws. See FUEL TANK (Page 6-12).
4. Remove front under seat caddy. See UNDER SEAT CADDY (Page 8-55).

REMOVE

1. See Figure 3-115. Remove crossmember.
 - a. Remove screws (2).
 - b. Slightly raise fuel tank (5).
 - c. Remove crossmember (4).
 - d. Remove fuel tank mounting bushings (3) and fuel tank mount grommets (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------|--------------|----------|
| Crossmember screws | 71–89 in-lbs | 8–10 N·m |

1. See Figure 3-115. Install frame crossmember (4).
 - a. Install fuel tank mount grommets (1) and fuel tank mounting bushings (3).

- b. Slightly raise fuel tank (5).
- c. Install frame crossmember (4).
- d. Install screws (2). Tighten.

Torque: 71–89 **in-lbs** (8–10 N·m) *Crossmember screws*

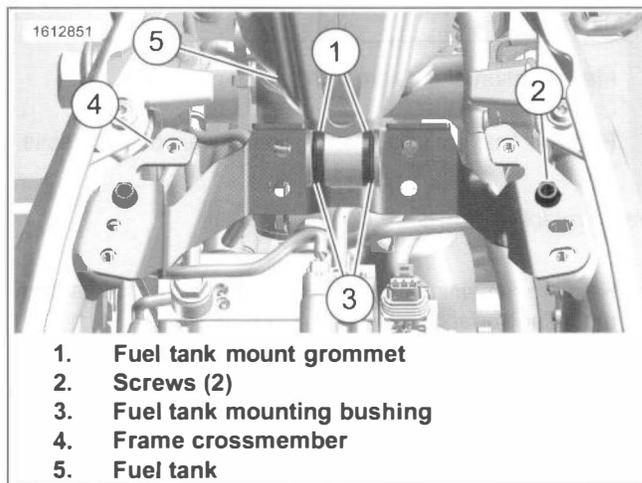


Figure 3-115. Frame Crossmember

COMPLETE

1. Install fuel tank mounting bracket bolt and fuel tank mounting screws. See FUEL TANK (Page 6-12).
2. Install front under seat caddy. See UNDER SEAT CADDY (Page 8-55).
3. Install the seat latch assembly. See SEAT (Page 3-82).
4. Install seat. See SEAT (Page 3-82).

REMOVE

| CONSUMABLE | PART NUMBER |
|-------------------------------------|-------------|
| 3M GENERAL PURPOSE ADHESIVE REMOVER | |

1. Mark location of emblem with masking tape.
2. Remove emblem using fishing line or waxed dental floss.

NOTE

Wear protective gloves.

3. Remove remaining foam backing tape and adhesive from mounting surface.

Consumable: 3M GENERAL PURPOSE ADHESIVE REMOVER ()

NOTE

- Do not clean with denatured alcohol, mineral spirits or other solvents. Damage to components may occur.
 - For maximum bond, surface must be clean and dry.
4. Clean with a mixture of 50 percent isopropyl alcohol and 50 percent distilled water.

INSTALL

NOTE

- Apply in ambient temperatures between 70–100 °F (21–38 °C).

- Parts cannot be repositioned after initial installation. Do not remove protective film from adhesive until ready to apply.
- Do not bend emblem to fit contour of mounting surface.
- Allow at least 24 hours after application before exposing the area to vigorous washing, strong water spray or extreme weather.
- The adhesive bond will increase to maximum strength after about 72 hours at normal room temperature.

1. Test fit medallion.
 - a. Check medallion against curve of mounting surface.
 - b. Match left and right sides of fuel tank or top cover, as applicable.

2. Remove protective film from back of medallion.

NOTE

- Protect adhesive from grease, oil, dust, dirt and fingerprints.
 - Once applied, do not shift medallion.
3. Apply even pressure across entire surface. Hold in place for 15 seconds.
 4. Wait 20 minutes before touching medallion.

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|--|-----------------------|---------------|--|
| Balancer sprocket screw | 310–327 in-lbs | 35–37 N·m | 4.24 OIL PUMP DRIVE, Install |
| Cam and sprocket center screw torque step 1. | 66–81 ft-lbs | 90–110 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam and sprocket center screw torque step 2. | | -360° | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam and sprocket center screw torque step 3. | 13–16 ft-lbs | 18–22 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam and sprocket center screw torque step 4. | | 33 ± 2° | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam phaser screws torque step 1. | 40–49 in-lbs | 4.5–5.5 N·m | 4.18 CAMSHAFTS AND PHASERS, Install |
| Cam phaser screws torque step 2. | | 46 ± 3° | 4.18 CAMSHAFTS AND PHASERS, Install |
| Camshaft cap screw (1st torque) | 44–53 in-lbs | 5–6 N·m | 4.18 CAMSHAFTS AND PHASERS, Install |
| Camshaft cap screw (Final torque) | 115–133 in-lbs | 13–15 N·m | 4.18 CAMSHAFTS AND PHASERS, Install |
| Camshaft drive sprocket locknut | 125–140 ft-lbs | 170–190 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Camshaft solenoid plate nut | 62–80 in-lbs | 7–9 N·m | 4.14 PHASER SOLENOIDS, Install |
| Camshaft solenoid plate screw | 62–80 in-lbs | 7–9 N·m | 4.14 PHASER SOLENOIDS, Install |
| Camshaft solenoid screws | 62–80 in-lbs | 7–9 N·m | 4.14 PHASER SOLENOIDS, Install |
| Chain tensioner, oil pump, screws | 58–75 in-lbs | 6.5–8.5 N·m | 4.24 OIL PUMP DRIVE, Install |
| Chain tensioner housing screw, long | 12–13 ft-lbs | 16–18 N·m | 4.16 SECONDARY BALANCER, Install |
| Chain tensioner housing screw, short | 27–35 in-lbs | 3–4 N·m | 4.16 SECONDARY BALANCER, Install |
| Coolant manifold screws | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Coolant pump screw | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Coolant tube clamp screw | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Crankcase locking tool access plug | 97–115 in-lbs | 11–13 N·m | 4.11 CRANKSHAFT LOCKOUT, Crankshaft Lock-out |
| Crankcase screw, left | 16–20 ft-lbs | 22–27 N·m | 4.27 CRANKCASE, Assemble |
| Crankshaft primary gear screws | 24–27 ft-lbs | 32–36 N·m | 4.29 CRANKSHAFT AND CONNECTING RODS, Install |
| Cylinder head camshaft cover screws | 63–77 in-lbs | 7.1–8.7 N·m | 4.13 CAMSHAFT COVERS, Install |
| Cylinder head cover screws | 63–77 in-lbs | 7.1–8.7 N·m | 4.12 CYLINDER HEAD COVERS, Install |
| Cylinder head screws torque step 1 | 20–23 ft-lbs | 27–31 N·m | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 2: loosen | | -360° | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 3 | 15–18 ft-lbs | 20–24 N·m | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 4 | 35–38 ft-lbs | 47.5–51.5 N·m | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 5 | | 148–155° | 4.17 CYLINDER HEADS, Install |
| Dynamic chain guide assembly top hat screw | 29–32 ft-lbs | 39–43 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| End cap, connecting rod, screw torque step 1 | 20 ft-lbs | 27 ± 2 N·m | 4.29 CRANKSHAFT AND CONNECTING RODS, Assemble |
| End cap, connecting rod, screw torque step 2 | | 80 ± 2° | 4.29 CRANKSHAFT AND CONNECTING RODS, Assemble |
| Oil baffle screws | 80–97 in-lbs | 9–11 N·m | 4.21 PRIMARY COVER, Install |
| Oil cooler screws | 80–97 in-lbs | 9–11 N·m | 4.10 OIL COOLER, Install |

| FASTENER | TORQUE VALUE | | NOTES |
|--|----------------|-------------|--|
| | | | |
| Oil filter adapter fitting | 19–24 ft-lbs | 26–32 N·m | 4.27 CRANKCASE, Plugs and Oil Fittings |
| Oil nozzle banjo screw | 142–177 in-lbs | 16–20 N·m | 4.31 CRANKCASE OIL NOZZLES, Install |
| Oil pump (pressure side) screws | 80–97 in-lbs | 9–11 N·m | 4.25 OIL PUMP, Install |
| Oil pump sprocket screw | 80–97 in-lbs | 9–11 N·m | 4.24 OIL PUMP DRIVE, Install |
| Plug, engine body | 97–115 in-lbs | 11–13 N·m | 4.27 CRANKCASE, Plugs and Oil Fittings |
| Primary cover screws | 94–115 in-lbs | 10.6–13 N·m | 4.21 PRIMARY COVER, Install |
| Scavenge oil pump screw | 80–97 in-lbs | 9–11 N·m | 4.30 SCAVENGE OIL PUMP, Install |
| Screw, retaining plate, transmission mainshaft bearing | 80–97 in-lbs | 9–11 N·m | 4.27 CRANKCASE, Repair Right Crankcase Half |
| Spark plug | 89–133 in-lbs | 10–15 N·m | 4.8 TROUBLESHOOTING, Compression Test |
| Starter gear screw | 29–37 ft-lbs | 39–50 N·m | 4.23 STARTER GEAR, Install |
| Stator to coolant manifold screw | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Timing chain guide screw | 80–97 in-lbs | 9–11 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Upper chain guide, oil pump, screw | 58–75 in-lbs | 6.5–8.5 N·m | 4.24 OIL PUMP DRIVE, Install |

ENGINE

Table 4-1. Engine

| ITEM | SPECIFICATION | |
|---------------------|--|----------------------|
| Number of cylinders | 2 | |
| Type | 4-cycle, 60 degree V-Type, Liquid cooled Dual over head camshafts (DOHC) | |
| Compression ratio | 13.0:1 | |
| Bore | 105 mm | 4.13 in |
| Stroke | 72.3 mm | 2.85 in |
| Displacement | 1252 cm ³ | 76.3 in ³ |
| Fuel requirement | Premium unleaded | |
| Lubrication system | Pressurized, semi-dry sump | |

Table 4-2. Crankshaft/Crankcase

| ITEM | LEFT HAND SIDE | | RIGHT HAND SIDE | |
|------------------------------|----------------|--------|-----------------|--------|
| | MM | IN | MM | IN |
| Main bearing journal | Max 56.000 | 2.2047 | Max 55.992 | 2.2044 |
| | Min 55.984 | 2.2040 | Min 55.976 | 2.2037 |
| Main bearing bore w/shells | Max 56.05 | 2.2067 | Max 56.05 | 2.2067 |
| | Min 56.03 | 2.2059 | Min 56.03 | 2.2059 |
| Main bearing bore w/o shells | Max 63.015 | 2.481 | Max 63.015 | 2.481 |
| | Min 63.00 | 2.480 | Min 63.00 | 2.480 |
| Axial end play | Max 0.36 | 0.014 | Max 0.36 | 0.014 |
| | Min 0.13 | 0.005 | Min 0.13 | 0.005 |

Table 4-3. Connecting Rod Bearing Selection

| CRANKSHAFT PIN SIZE CODE | CONNECTING ROD SIZE CODE | |
|--------------------------|--------------------------|---------------|
| | B | A |
| | 54.000-54.008 | 54.008-54.016 |
| B (49.992-50.000) | Yellow | Black |
| A (49.984-49.992) | Black | Red |

Table 4-4. Connecting Rod/Piston

| ITEM | MM | IN |
|-------------------------|------------|---------|
| Rod small end bore dia. | Max 20.03 | 0.7886 |
| | Min 20.02 | 0.7882 |
| Piston pin diameter | Max 20.00 | 0.78740 |
| | Min 19.995 | 0.78720 |
| Running clearance | Max 0.050 | 0.0020 |
| | Min 0.022 | 0.0009 |

Table 4-5. Piston

| PISTON | | MM | IN |
|----------------------------------|-------------------|-------------|---------------|
| Fit in cylinder | | 0.029-0.057 | 0.001-0.002 |
| Piston pin fit in connecting rod | | 0.022-0.050 | 0.0009-0.0020 |
| Ring side clearance | Top compression | 0.02-0.08 | 0.0008-0.0030 |
| | 2nd compression | 0.02-0.08 | 0.0008-0.0030 |
| | Oil control ring | 0.04-0.11 | 0.0016-0.0043 |
| Ring end gap | Top compression | 0.2-0.43 | 0.0008-0.0169 |
| | 2nd compression | 0.65-0.98 | 0.0256-0.0386 |
| | Oil control rails | 0.2-0.89 | 0.008-0.0350 |

Table 4-6. Valve Diameter

| ITEM | MM | IN |
|---------|------|-------|
| Intake | 40.0 | 1.574 |
| Exhaust | 33.0 | 1.299 |

Table 4-7. Valve Lash

| ITEM | DATA |
|---------|---|
| Intake | DOHC, Roller Finger Follower with Hydraulic Lash Compensation |
| Exhaust | DOHC, Roller Finger Follower with Hydraulic Lash Compensation |

Table 4-8. Cylinder Heads

| ITEM | MM | IN |
|---|------------|--------|
| Valve guide in head (interference fit) | Max 0.057 | 0.002 |
| | Min 0.022 | 0.0009 |
| Intake valve seat in head (interference fit) | Max 0.109 | 0.0043 |
| | Min 0.068 | 0.0027 |
| Exhaust valve seat in head (interference fit) | Max 0.106 | 0.0042 |
| | Min 0.065 | 0.0026 |
| Valve guide I.D. | Max 6.015 | 0.2368 |
| | Min 6.000 | 0.2362 |
| Valve stem diameter | Intake | |
| | Max 5.9715 | 0.2351 |
| | Min 5.9565 | 0.2345 |
| | Exhaust | |
| Valve to guide running clearance | Intake | |
| | Max 0.0585 | 0.0023 |
| | Min 0.0285 | 0.0011 |
| | Exhaust | |
| Valve seat run-out | Max 0.0685 | 0.0027 |
| | Min 0.0385 | 0.0015 |
| Valve seat to guide run-out | Max NA | NA |
| Valve seat to guide run-out | Max 0.052 | 0.0020 |
| Cylinder head flatness | Max 0.100 | 0.0039 |
| Intake valve stem protrusion | Max 53.03 | 2.087 |
| | Min 52.38 | 2.062 |
| Exhaust valve stem protrusion | Max 52.45 | 2.065 |
| | Min 51.80 | 2.039 |

Table 4-9. Valve Springs

| ITEM | METRIC | SAE |
|--|-------------|------------|
| Valve spring free length | Nominal | |
| | 49.1 mm | 1.933in |
| Intake valve spring installed height | Nominal | |
| | Max 41.2 mm | 1.622in |
| Exhaust valve spring installed height | Nominal | |
| | Max 40.5 mm | 1.594 in |
| Intake valve spring force installed | Max 321N | 72.163lbf |
| | Min 291N | 65.419lbf |
| Exhaust valve spring force installed | Max 357N | 80.256lbf |
| | Min 327N | 73.512lbf |
| Intake valve spring force max lift (h=29.2mm) | Max 976N | 219.413lbf |
| | Min 894N | 200.979lbf |
| Exhaust valve spring force max lift (h=29.5mm) | Max 961N | 216.041lbf |
| | Min 879N | 197.607lbf |

Table 4-10. Cam Drive

| ITEM | DATA | |
|---|----------------------|-------------------|
| Intake Lobe Peak Lift Angle (Parked/Full Phased) | 125.0 degrees AT-DC | 85.0 degrees ATDC |
| Exhaust Lobe Peak Lift Angle - (Parked/Full Phased) | 132.5 degrees BT-DC | 92.5 degrees BTDC |
| Total intake lift | 11.5 mm | |
| Duration, intake @ 1 mm | 209.4 degree (Crank) | |
| Total exhaust lift | 11 mm | |
| Duration, exhaust @ 1 mm | 226.5 degree (Crank) | |

Table 4-11. Oiling System

| ITEM | SPECIFICATION |
|----------------------|---|
| Capacity with filter | Service oil change 4 qt (3.8 L) |
| Recommended oil | Harley-Davidson Genuine SYN-BLEND Motorcycle Lubricant 15W50, Genuine Harley-Davidson H-D 360 or Screamin' Eagle SYN3 Full Synthetic Motorcycle Lubricant 20W50 |
| Pump | Gerotor, triple scavenge, chain driven, internal oil pump, semi-dry sump |
| Pressure | 38–45 psi (262–310 kPa) at 4000 RPM 15–20 psi (104–138 kPa) at 1500 RPM and normal operating temperature of 230 °F (110 °C) |
| Filtration | Spin-on Oil Filter with 17 micron media, bypass, and anti-drainback valve |
| Cooling | Oil cooler |

Table 4-12. Water Pump

| ITEM | DATA |
|------|---|
| Type | Impeller type, thermostat controlled bypass |

SERVICE WEAR LIMITS

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed these values.

Table 4-13. Connecting Rod/Piston

| Item | REPLACE IF WEAR EXCEEDS | |
|-------------------------|-------------------------|--------|
| | MM | IN |
| Small end bore diameter | 20.05 | 0.7893 |
| Piston pin diameter | 19.99 | 0.7870 |

Table 4-14. Connecting Rod/Crankshaft

| Item | REPLACE IF WEAR EXCEEDS | |
|---------------------|-------------------------|--------|
| | MM | IN |
| Rod bearing journal | 49.98 | 1.9677 |
| Rod bearing bore | 50.074 | 1.9714 |

Table 4-15. Piston/Cylinder Liner

| Item | REPLACE IF WEAR EXCEEDS | |
|--|-------------------------|--------|
| | MM | IN |
| Cylinder liner i. d. bore (freestate) 10mm from deck | 105.002 | 4.1339 |
| Cylinder liner i. d. bore (freestate) 77mm from deck | 105.016 | 4.1345 |
| Cylinder liner out-of-round (freestate) | 0.012 | 0.0005 |
| Piston major diameter | 104.945 | 4.1317 |
| Running clearance 10mm from deck | 0.057 | 0.0022 |
| Running clearance 77mm from deck | 0.071 | 0.0028 |

Table 4-16. Piston Rings

| Item | REPLACE IF WEAR EXCEEDS | |
|---------------------------------|-------------------------|------|
| | MM | IN |
| Top ring end gap | 0.43 | 0.2 |
| 2nd ring end gap | 0.98 | 0.65 |
| Oil control ring end gap | 0.89 | 0.20 |
| Top ring side clearance | 0.08 | 0.02 |
| 2nd ring side clearance | 0.08 | 0.02 |
| Oil control ring side clearance | 0.11 | 0.04 |

Table 4-17. Cylinder heads

| Item | REPLACE IF WEAR EXCEEDS | |
|---|-------------------------|--------|
| | MM | IN |
| Cylinder head flatness | 0.150 | 0.0059 |
| Cylinder head cam bore diameter (large) | 36.045 | 1.4191 |
| Cylinder head cam bore diameter (small) | 24.039 | 0.9464 |
| Valve guide i.d. diameter (int) | 6.040 | 0.2378 |
| Valve guide i.d. diameter (exh) | 6.040 | 0.2378 |
| Valve seat width - intake | 1.85 | 0.0728 |
| Valve seat width - exhaust | 2.0 | 0.0787 |
| Valve seat-to-guide run-out | NA | NA |

Table 4-18. Compression

| Item | INVESTIGATE IF VALUE IS BELOW | |
|--------------------------|-------------------------------|---------|
| | psi | kpa |
| Compression- Dry, WOT | 125 | 862 |
| Item | INVESTIGATE IF VALUE IS ABOVE | |
| | Percent | Percent |
| Leakage (Dry) (@100 psi) | 25 | 25 |

OPERATION

The lubrication system is a semi-dry sump system. It uses scavenge pumps to return oil to a specific part of the sump. Three scavenge pumps, with separate inlets, remove excess oil from different areas of the engine with rotating parts minimizing components passing through settling oil. This design is optimized to scavenge at extreme lean angles. This system provides optimum lubrication and oil pressure to critical components while minimizing oil aeration.

Oil Distribution

1. See Figure 4-1. The feed pump pulls oil from the internal reservoir through a screen filtered pickup. This protects the feed pump from large debris contaminants and prevents crankcase sealant extrusions from plugging small internal passages.
2. The pressure reducing valve (PRV) regulates oil pressure by circulating oil within the pump cover after the pump outlet reaches a design-specified value.
3. Oil flows into the outer shell of the oil filter and either passes through the filter media or through the internal bypass valve. Oil filter bypass is engineered to occur:
 - In cold ambient starts.
 - When the filter reaches its debris-holding capacity.
 - When no warm-up occurs prior to riding.
4. After the oil filter, the oil flows into the bottom of the layered core oil cooler (LCOC) mounted to the right front of the crankcase. Oil exits the top port of the LCOC, then returned into the crankcase. The LCOC works as a heat exchanger. During warm-up, the oil absorbs heat from the coolant to bring the oil up to temperature faster. Under heavy load or high rpm operation, heat is transferred from the oil into the coolant. Under light load and cruising conditions, the oil temperature is regulated to the coolant temperature for optimal fuel efficiency and oil quality.
5. Oil from the LCOC flows through the right crankcase main feed passage. Some of this oil flows into the crankshaft manifold, where it is fed through the bushing interface into the passages of the rotating crankshaft. From there, oil is pumped by centrifugal force optimizing delivery at high rpm and distributed evenly between the front and rear lower rod bearing (LRB).
6. The rest of the oil from the LCOC flows through passages feeding the main bearings, piston cooling jets (PCJ) and transmission shafts. The main bearings are oiled through feed holes from grooves around the bearing. Oil from the three PCJ sprays the underside of the pistons. Two of the PCJ target the exhaust side of the pistons. The center PCJ targets the intake side of both pistons. The transmission has two metered feeds, one on the input shaft and one on the output shaft. This allows oil to flow through the shafts out to the transmission.

7. At the end of the lower engine feed passages is the oil pressure sensor and the oil passages leading up to each of the cylinder heads. The passages lead up to the left side of the cylinder heads feeding oil to the hydraulic lash adjusters (HLA), chain tensioner and the camshaft bearing feed grooves.
 - HLA use oil pressure to adjust the valve lash.
 - Chain tensioner uses oil pressure to adjust the camshaft timing chains tension.
 - Feed grooves are machined into the cylinder head bearings.
8. Oil flows from the cam bearing feed groove through an internal passage to the camshaft phaser and sprocket. The phaser uses the oil to adjust variable valve timing (VVT). The sprocket contains feed holes that direct the oil to the cam drive sprocket bearing journal.

Oil Scavenge

1. See Figure 4-2. The clutch cavity, located on the right side of the engine, catches return oil from the following areas.
 - Clutch.
 - Right side of front and rear cylinder head.
 - Right main bearing.
 - Camshaft chains.
 - Transmission cavity.

Oil is pushed out from the center of the clutch. The clutch cavity has a passage at the bottom. Oil draining into the clutch cavity is pulled through this passage by the clutch cavity scavenge pump.
2. See Figure 4-3. The stator cavity, located on the left side of the engine, catches return oil from the following areas.
 - Stator.
 - Left side of front and rear cylinder head.
 - Left main bearing.
 - Transmission cavity.

As the rotor spins, oil in the stator cavity cools the stator. The stator cavity has a passage at the bottom. Oil draining into the stator cavity is pulled through this passage by the stator cavity scavenge pump.
3. See Figure 4-4. The crankshaft cavity, located in the center of the engine around the crankshaft, catches excess oil from the following areas.
 - Piston cooling jets.
 - Main bearings.
 - Both LRB.

Oil is pushed out from the crankshaft. The crankshaft cavity has a passage at the bottom. Oil draining into the crankshaft cavity is pulled through this passage by the crankshaft cavity scavenge pump.

4. See Figure 4-5. The scavenge pumps force oil to the front of the crankcase through an outlet passage machined into the crankcase. This oil contains air caused by piston ring blow-by and crankcase pressure. As oil moves from the front of the crankcase to the internal reservoir, trapped air is removed and flows up the front of the crankcase and out the reservoir vent passage into the clutch cavity. See BREATHER OPERATION (Page 4-9).

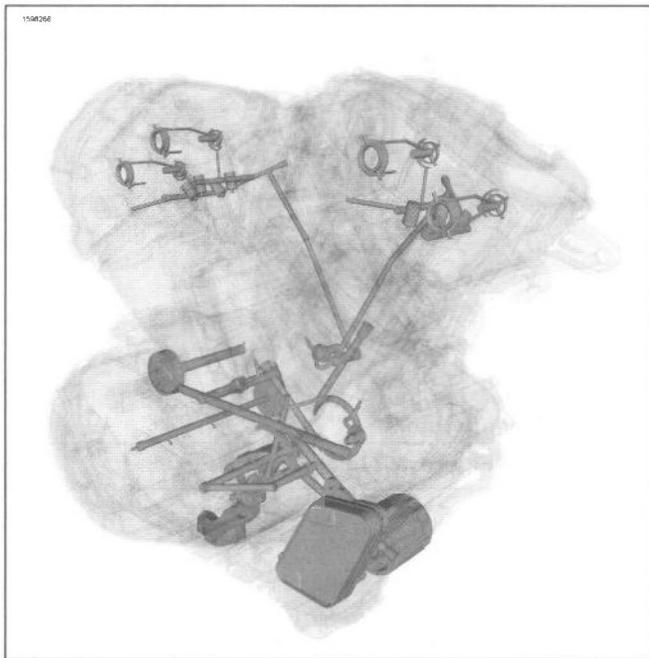


Figure 4-1. Oil Flow

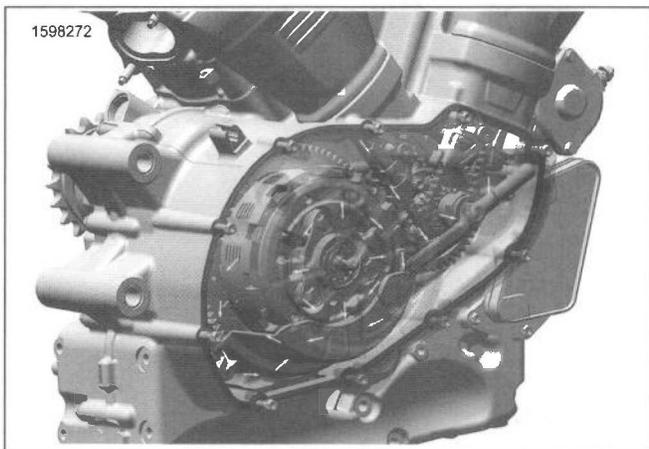


Figure 4-2. Clutch Cavity

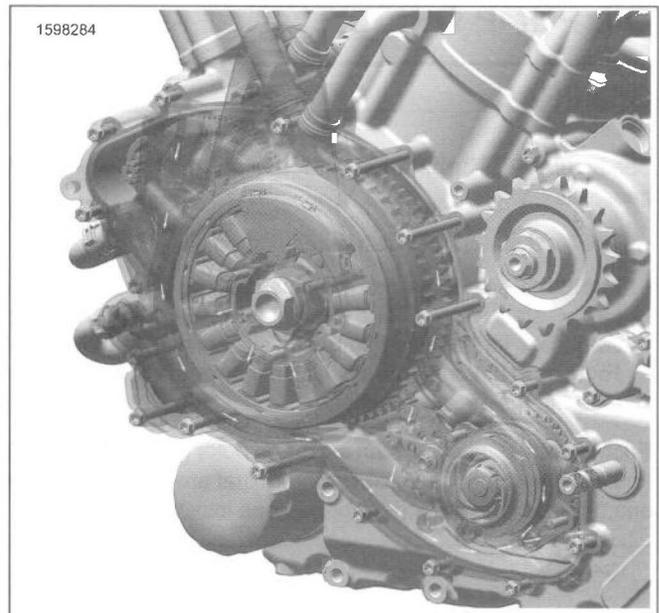


Figure 4-3. Stator Cavity

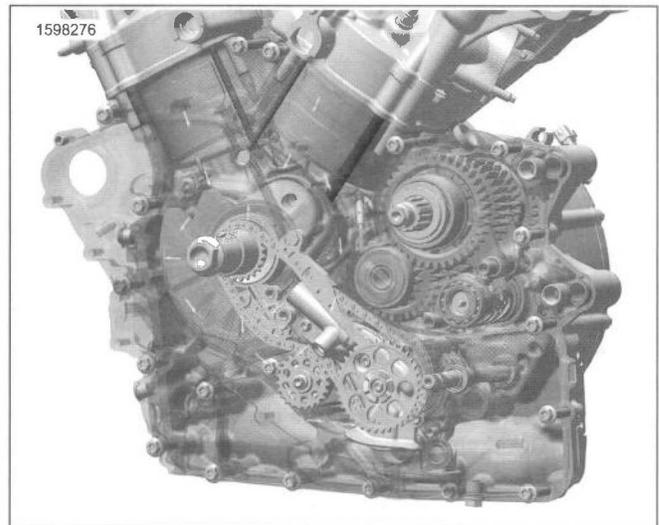


Figure 4-4. Crankshaft Cavity

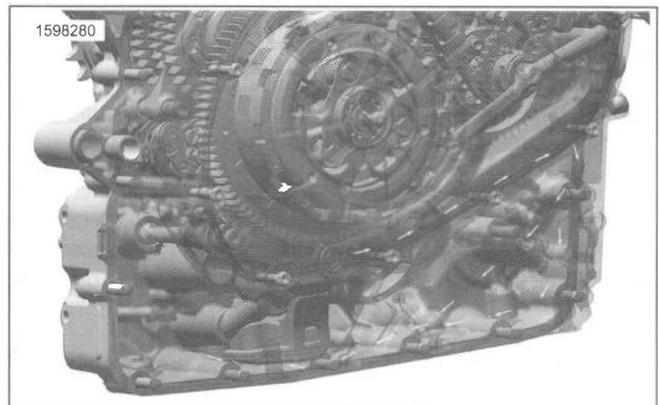


Figure 4-5. Internal Reservoir

GENERAL

See Figure 4-6. The oil pump has four crankshaft driven gerotor gear sets.

- The feed gerotor set distributes engine oil.
- The three scavenge gerotor sets draw oil from the clutch cavity, stator cavity and crankshaft cavity to the lower crankcase for the feed pump. The system directs oil through sections of the crankcase, which minimizes aeration, before entering the storage section.

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. The inner gerotor has one less tooth.

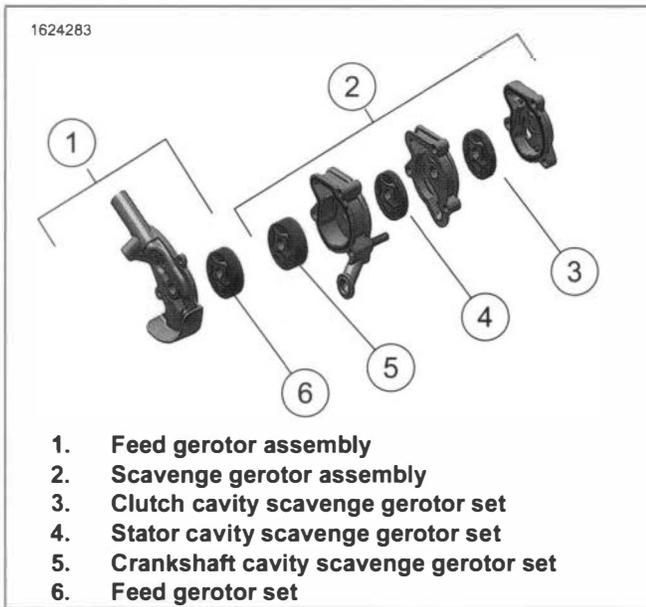


Figure 4-6. Oil Pump

OPERATION

The oil feed and scavenge pumps are driven by a chain from the crankshaft. Pump inlet and outlet sides are sealed by tips and lobes of inner and outer gerotors, preventing outlet side (high pressure) oil from being transferred to the inlet side.

See Figure 4-7. As gerotors rotate, cavity volume increases between inner and outer gerotors on pump inlet side. A vacuum is created causing oil to be drawn in. The cavity increases until the volume is equivalent to that of missing tooth on inner gerotor.

See Figure 4-8. As oil moves to pump outlet side, the cavity decreases in volume. Pressurized oil is forced out the discharge port. In operation, gerotors provide continuous oil flow.

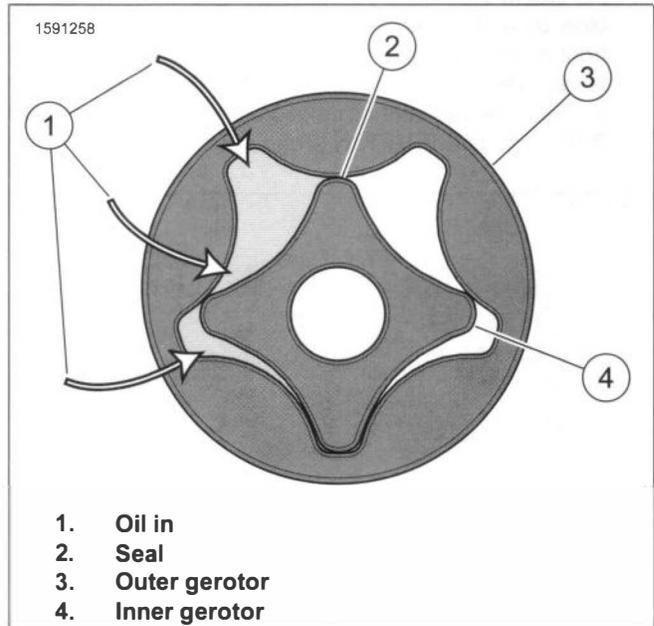


Figure 4-7. Inlet Side Oil Flow

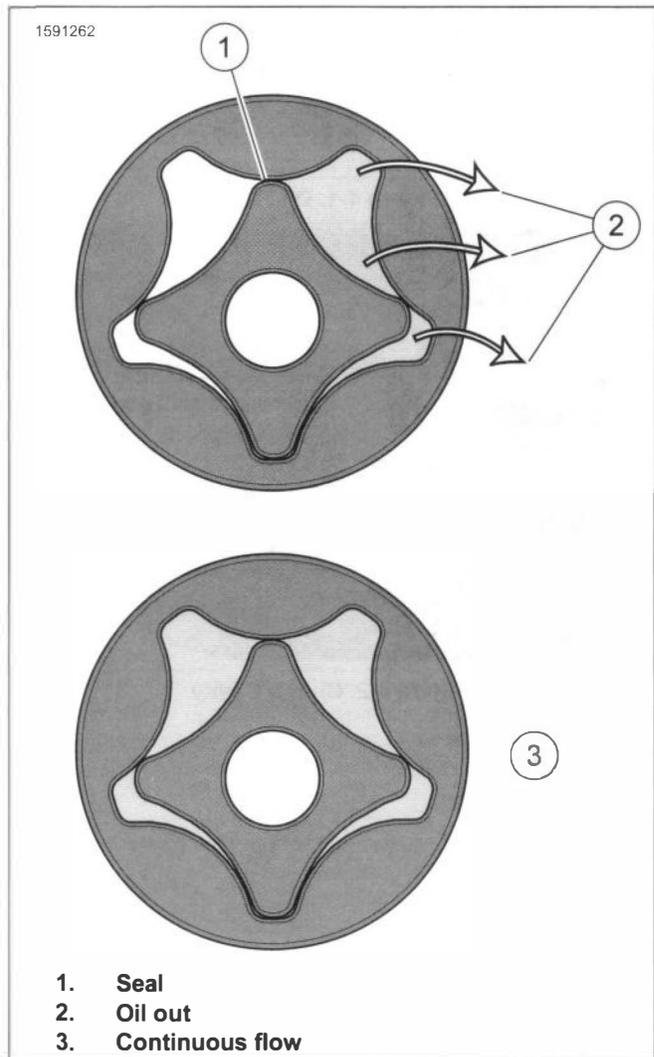


Figure 4-8. Outlet Side Oil Flow

GENERAL

See Figure 4-9. As pistons push downward, displaced air in the crankcase is vented into the crankshaft cavity. The piston ring blow-by and crankcase pressure gasses in the crankshaft cavity travel through the crankshaft cavity scavenge pump into the internal reservoir cavity through the scavenge return passage.

See Figure 4-10. The blow-by gas vents to the clutch cavity through the vent passage at the front of the internal reservoir cavity. From the clutch cavity, the blow-by gas flows up the chain tubes to the heads. A centrifugal separator engine breather assembly is attached to the intake camshaft in the front cylinder head. The breather bolt and centrifugal breather are part of a breather assembly.

Crankcase air absorbs a small amount of oil vapor as it travels through the engine. The centrifugal breather assembly uses centrifugal force to separate the oil from the air.

See Figure 4-11. The breather bolt is installed into a lip seal on the oil slinger part of the centrifugal breather assembly. Oil is slung out of the oil slinger as it spins with the camshaft, passing the vapor through the breather bolt. The vapor passes into a breather tube and into the air box where it combines with the intake air stream and burns during normal combustion. Burning crankcase vapor eliminates the pollutants normally discharged from the crankcase.

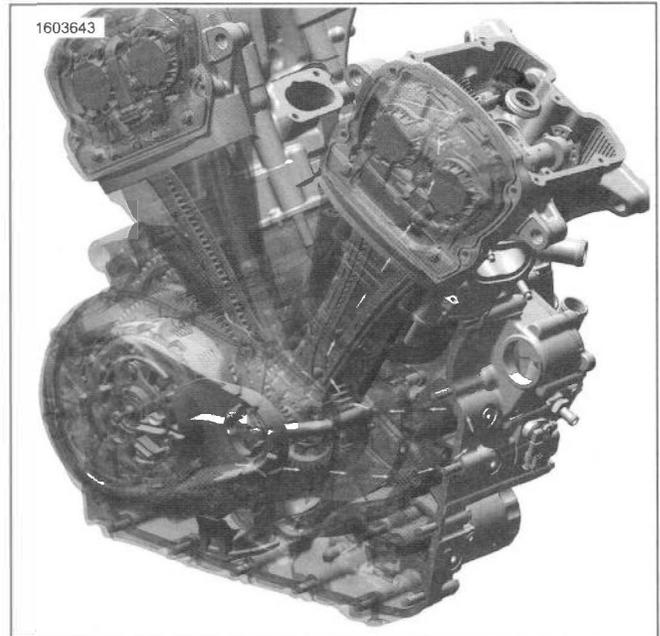


Figure 4-10. Air and Oil Vapor

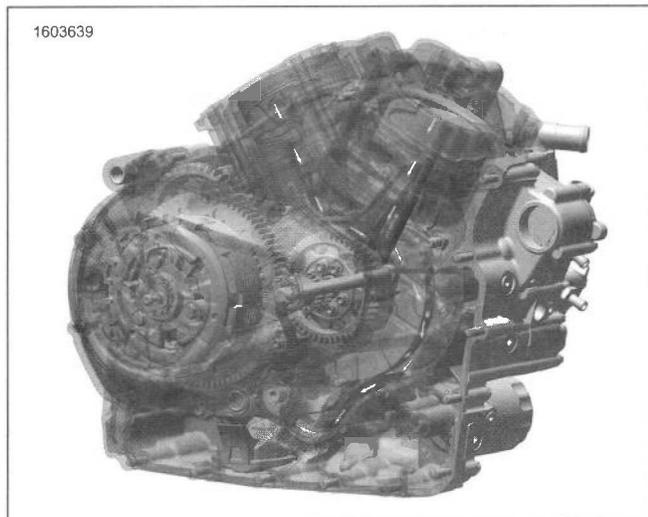


Figure 4-9. Blow-by Gas

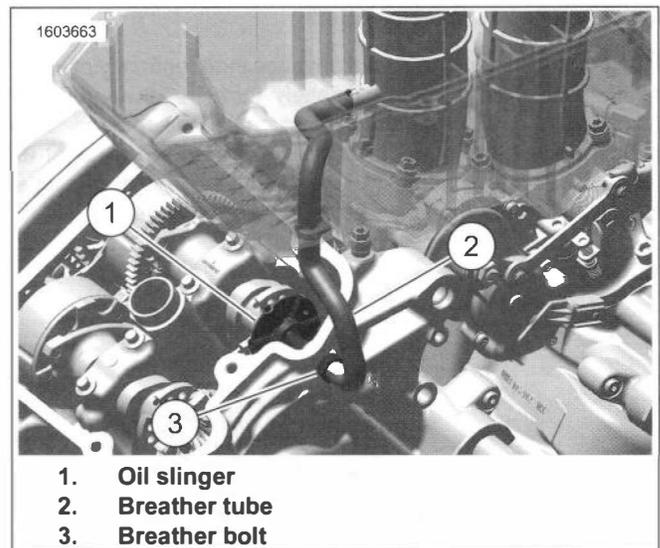


Figure 4-11. Breather Assembly

OPERATION

The engine uses Variable Valve Timing (VVT) to reduce compromises between peak power, bottom end torque, fuel economy, emissions and run quality. VVT controls and varies the timing of the valves opening and closing to accommodate a wide RPM range.

The Electronic Control Module (ECM) monitors a variety of parameters to make valve timing adjustments including:

- Camshaft position
- Throttle position
- Engine temperature
- Engine load
- RPM

See Figure 4-12. In order for VVT to function, the camshaft must be able to move separately from the camshaft sprocket. Camshaft phasers allow the cam timing to change relative to the crankshaft. The phaser includes a rotor and housing assembly. The rotor attaches to the camshaft sprocket. The housing connects to the camshaft.

Intake and exhaust camshafts advance independently of each other. Valve timing adjusts infinitely through 20 degrees of camshaft rotation or 40 degrees of crankshaft rotation. The phasers allow the intake to advance 40° and the exhaust to retard 40° from the parked position. During startup, the phaser's rotor is fully rotated and locked to the parked position.

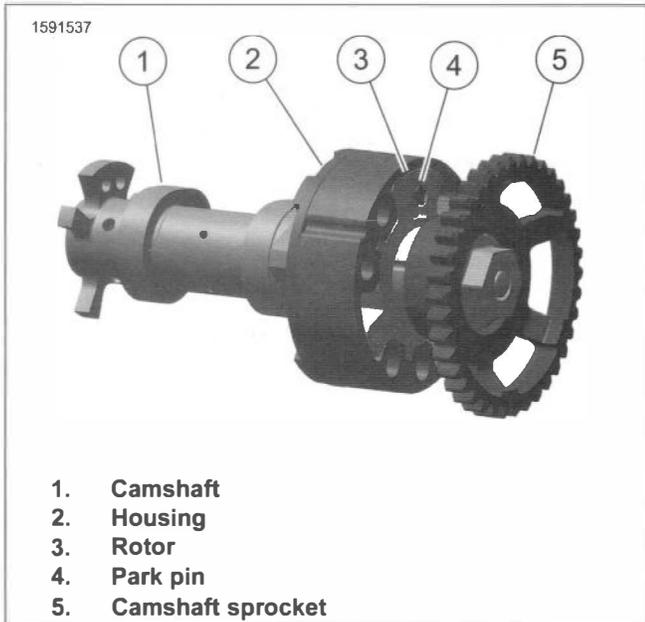


Figure 4-12. Rotor and Housing Assembly

See Figure 4-13. The VVT uses Cam Torque Actuation (CTA) to adjust valve timing. The valve spring force on the cam lobes adjusts the cam's advancement depending on whether it is going up the cam lobe (less advance) or coming down the lobe (more advance). CTA phasers require less oil pressure versus traditional hydraulic phasers.

The VVT system uses oil from the lubrication system to adjust valve timing as needed. The spool valve allows oil to flow into the housing chambers creating a hydraulic lock on cam rotation. Using VVT to advance the exhaust cams and retard the intake cams, reduces compression eliminating the need for ACR solenoids during start-up.

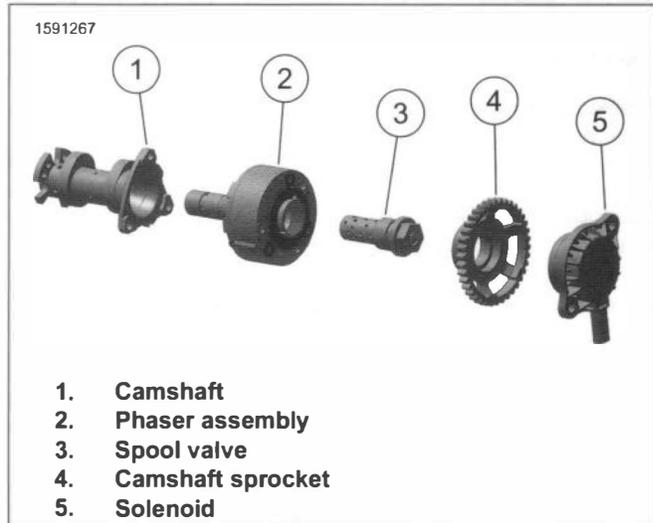


Figure 4-13. Camshaft and Phaser

OPERATION

See Figure 4-14. The red OIL PRESSURE indicator lamp illuminates to indicate improper pressure of the engine oil. The lamp illuminates when the ignition is initially turned on (before the engine is started), but should extinguish once the engine is running.

NOTICE

If the oil pressure indicator lamp remains lit, always check the oil supply first. If the oil supply is normal and the lamp is still lit, stop the engine at once and do not ride further until the trouble is located and the necessary repairs are made. Failure to do so may result in engine damage. (00157a)

If the indicator lamp does not extinguish, it may be caused by low oil level or diluted oil supply. 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.

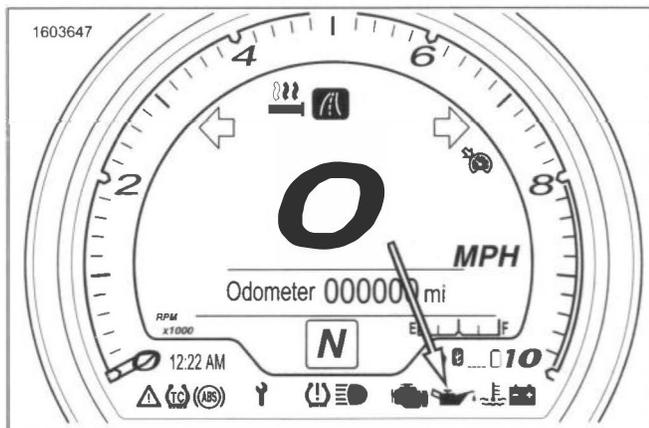


Figure 4-14. Oil Pressure Indicator Lamp

OIL PRESSURE CHECK

| PART NUMBER | TOOL NAME |
|-------------|----------------------------------|
| HD-45308 | OIL PRESSURE GAUGE |
| HD-52962 | OIL PRESSURE SENDING UNIT WRENCH |

| PART NUMBER | TOOL NAME |
|-------------|-----------------------------|
| HD-52963 | OIL PRESSURE TESTER ADAPTER |

1. Verify that engine oil is at the proper level. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
2. Remove oil pressure switch from crankcase. See OIL PRESSURE SWITCH (Page 8-24).
Special Tool: OIL PRESSURE SENDING UNIT WRENCH (HD-52962)
3. Install test kit.
Special Tool: OIL PRESSURE GAUGE (HD-45308)
Special Tool: OIL PRESSURE TESTER ADAPTER (HD-52963)
Special Tool: OIL PRESSURE SENDING UNIT WRENCH (HD-52962)
 - a. Install swivel adapter in oil pressure switch mounting hole and snug with wrench.
 - b. Install straight adapter into swivel adapter. Hold swivel adapter with wrench and tighten straight adapter.
 - c. Install oil pressure gauge on straight adapter. Hold straight adapter with wrench, tighten oil pressure gauge fitting.
4. Run motorcycle until engine oil reaches specification.
Temperature: 230 °F (110 °C)
5. Check oil pressure.
 - a. Operate engine at 1500 and 4000 rpm.
 - b. Record results.
 - c. Stop engine.
6. Verify that oil pressure is within specifications. Refer to Table 4-19.
7. Remove oil pressure gauge assembly.
8. Install oil pressure switch. See OIL PRESSURE SWITCH (Page 8-24).

Table 4-19. Oil Pressure

| CHECK | SPECIFICATION * | |
|----------------------------|-----------------|-------------|
| | SAE | METRIC |
| Oil pressure - 1500 rpm | 15-20 psi | 103-138 kPa |
| Oil pressure - at 4000 rpm | 38-45 psi | 262-310 kPa |

* With oil at normal operating temperature of 219–241 °F (104–116 °C)

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. However 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.

COMPRESSION TEST

| PART NUMBER | TOOL NAME |
|-------------|----------------------------|
| HD-33223-1 | CYLINDER COMPRESSION GAUGE |
| HD-48650 | DIGITAL TECHNICIAN II |
| HD-50549 | BORESCOPE |

| FASTENER | TORQUE VALUE | |
|------------|---------------|-----------|
| Spark plug | 89–133 in-lbs | 10–15 N·m |

Check for cylinder leakage with a compression test. Use CYLINDER COMPRESSION GAUGE (PART NUMBER: HD-33223-1) with a screw-in type adapter.

1. Start engine and let idle for 10 seconds.
2. Use DTII to relieve fuel pressure. See PURGE FUEL LINE (Page 6-9).
Special Tool: DIGITAL TECHNICIAN II (HD-48650)
3. Remove outer spark plug cables.
4. Remove and discard outer spark plug from each cylinder.
5. Remove side mount ignition coil and bracket. See IGNITION COIL (Page 8-15).
6. Disconnect temperature sensor, oil pressure sensor, and knock sensor jumper harness connector from the ECM caddy.
7. Remove ECM assembly from caddy. See ELECTRONIC CONTROL MODULE (ECM) (Page 8-33).
8. Connect ECM connector.
9. Disconnect TCA connector [211] from the induction module.

10. Connect compression tester to front cylinder following manufacturer's instructions.
11. Hold the throttle open by the linkage on the ECM side of the throttle body.
12. Press start button, engine will crank for 10 seconds.
13. Note gauge readings at the end of the first and last compression strokes. Record test results.
14. Repeat on rear cylinder.
15. Compare with specifications.
 - a. If readings do not meet specifications, inject 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.
Volume: 0.5 fl oz (15 ml)
 - b. Refer to Table 4-21 for possible causes of low compression.
 - c. Inspect cylinder using borescope. Refer to Clean and Inspect (Page 4-43) for more detail.
Special Tool: BORESCOPE (HD-50549)

16. Connect TCA connector.

NOTE

When removing spark plugs, always install new spark plugs.

17. Install new spark plugs. Connect spark plug wires.
Torque: 89–133 in-lbs (10–15 N·m) Spark plug

Table 4-20. Compression Specifications

| Compression Range | PSI | kPa |
|-------------------|-----|------|
| Minimum | 125 | 862 |
| Normal | 160 | 1103 |

Table 4-21. Compression Test Results

| TEST RESULTS | DIAGNOSIS |
|---|---|
| <ul style="list-style-type: none"> • Compression low on first stroke. • Compression builds on the following strokes, but does not reach normal. • Improves considerably when oil is added to cylinder. | - Ring trouble |
| <ul style="list-style-type: none"> • Compression low on first stroke. • Compression does not build much on following strokes. • Does not improve considerably with the addition of oil. | - Head gasket leak - Incorrect valve lash - Valve trouble |

CYLINDER LEAKDOWN TEST

| PART NUMBER | TOOL NAME |
|-------------|--------------------------|
| HD-35667-A | CYLINDER LEAKDOWN TESTER |
| HD-50549 | BORESCOPE |
| HD-52956 | CRANKSHAFT LOCKING TOOL |

- Verify that the leakdown tester is free from leakage.
Special Tool: CYLINDER LEAKDOWN TESTER (HD-35667-A)
 - Apply a soap/water solution around all tester fittings.
 - Connect cylinder leakdown tester to compressed air source.
 - Bubbles indicate leakage.
- Remove one spark plug per cylinder.
- Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
- Follow the manufacturer's instructions to perform the leakdown test.
 - Record the percent of leakage.
 - Listen for air leaks at throttle body, exhaust pipe, oil fill spout and head gasket.
- Results:
 - Leakage greater than 25 percent indicates that further diagnosis is warranted.
 - Air escaping through the throttle body indicates leaking past intake valves.
 - Air escaping through the exhaust pipe indicates leaking past exhaust valves.
 - Air sound from the oil fill spout indicates leaking past piston rings.
 - Inspect cylinder using borescope. See Clean and Inspect (Page 4-43).
Special Tool: BORESCOPE (HD-50549)
- Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).

DIAGNOSE VALVE TRAIN NOISE

NOTE

Some valve train noise at start-up is normal until hydraulic lash adjusters and cam chain tensioners fill with oil. Continuous abnormal noise requires diagnosis.

- Check oil level and condition.
- With engine and oil at normal operating temperature, check oil pressure at 1500 and 4000 rpm.

- Check oil pressure. See Oil Pressure Check (Page 4-11).
- If oil pressure is outside of range, inspect following:
 - Oil pump wear.
 - Crankcase passages for blockages.
 - Oil hoses for blockages.
- If oil-starved hydraulic lash adjusters or cam chain tensioners are suspected, remove hydraulic lash adjusters or cam chain tensioners and inspect. See CAMSHAFTS AND PHASERS (Page 4-38) and CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
 - Clean hydraulic lash adjuster and cam chain tensioner bore of all foreign material.
- Inspect hydraulic lash adjusters or cam chain tensioners bore for improper fit and unusual wear.
- Visually inspect camshaft lobes for abnormal wear.
- Check top end components.
 - Check for excess roller finger follower wheel or bearing wear.
 - Inspect valve stems for scuffing. Check stem to guide clearance.
 - Check for loose valve seats or signs of shifting.
- Grind valves and valve seats. See CYLINDER HEADS (Page 4-34).

DIAGNOSE SMOKING ENGINE OR HIGH OIL CONSUMPTION

Perform both a compression test and a cylinder leakage test. See Compression Test (Page 4-12) and Cylinder Leakdown Test (Page 4-13). If further testing is needed, inspect for the following:

Check Before Cylinder Head Removal:

- Oil level too high.
- Oil carryover.
- Restricted breather hose.
- Restricted oil filter.

Check After Cylinder Head Removal:

- Clogged oil return passages.
- Valve guide seals.
- Valve guide to valve stem clearance.
- Gasket surfaces of head and cylinder.

5. Cylinder head casting porosity allowing oil to drain into combustion chamber.
6. If the above checks do not reveal the cause:
 - a. Remove the cylinder.
 - b. Verify that the piston ring gaps are properly staggered.
 - c. Inspect for excess piston ring wear.

TROUBLESHOOTING TABLES

Table 4-22. Troubleshooting: Engine Noise or Vibration

| CONDITION | CHECK | REMEDY |
|---------------------------------------|--|--|
| Engine vibrates | Loose engine mounts | Secure engine mounts. |
| | Worn bearing or bearing seat | Replace bearing or worn component. |
| | Incorrect balancer shaft timing | Properly set balancer shaft timing. |
| Excessive noise while cranking | Worn starter motor teeth, friction clutch or freewheel gear | Replace starter motor, friction clutch or freewheel gear. |
| | Inoperative or damaged chain tensioner | Noise disappears after engine started when oil pressure is available. |
| Excessive noise from valve train area | Improper valve clearance | Inspect hydraulic lash adjusters & roller finger followers for damage. |
| | Inoperative or damaged chain tensioner | Replace chain tensioner. |
| | Worn camshaft or camshaft journals | Replace camshafts and/or cylinder head. |
| | Worn camshaft drive or camshaft sprockets and camshaft gears loose | Tighten or replace camshaft gears or camshaft sprocket. |
| | Worn camshaft chain, chain guide or chain tension guide | Replace camshaft chain, chain guide or chain tension guide. |
| Excessive noise from piston area | Worn piston or cylinder | Replace piston or cylinder. |
| | Worn piston pin bore or piston pin | Replace piston and/or piston pin. |
| | Worn piston ring grooves or damaged piston rings | Replace piston and/or piston rings. |

Table 4-23. Troubleshooting: Engine Does Not Crank, Cranks But Does Not Start or Starts Hard

| CONDITION | CHECK | REMEDY |
|---|---|--|
| Engine cranks but does not start or starts hard | Incorrect or worn spark plugs | Replace spark plugs. |
| | Fouled or wet spark plugs | Replace spark plugs. |
| | Discharged battery, cranking rpm too low | Check/replace battery, connections and charging system. |
| | Inadequate fuel supply | Check fuel level in tank, add if necessary. Check/replace fuel filter, fuel supply lines, fuel pump, fuel pressure sensor and fuel injectors. |
| | Improper valve clearance | Replace associated broken valve train components. |
| | Incorrect valve timing | Adjust position of camshaft gears and camshaft sprocket. |
| | Inoperative or damaged ignition coil(s) | Replace ignition coil(s). |
| | Inoperative or damaged CKP or ECM | Check/replace CKP and/or ECM. |
| | Leaking cylinder head gasket(s) | Replace cylinder head gasket(s). |
| | Valve and/or valve guides worn or imperfect valve seat | Replace valves, rework valve seats or replace cylinder head if necessary. |
| | Worn piston rings and/or cylinder bore | Replace piston rings and cylinders if necessary. |
| | Improper viscosity oil for ambient temperature conditions | Change engine oil and refill with correct viscosity oil for ambient temperature. |

Table 4-24. Troubleshooting: Engine Performance

| CONDITION | CHECK | REMEDY |
|---|--|--|
| Engine runs irregularly at idle | Excessive spark plug electrode gap | Replace spark plugs. |
| | Valve clearance below specification | Replace associated broken valve train components. |
| | Intake air leak | Tighten intake flange, replace gasket or replace intake flange if necessary. |
| | Malfunctioning ECM or incorrect ignition timing | Check CKP and ECM, replace if necessary. |
| | Valve and/or valve guides worn or imperfect valve seat | Replace valves, rework valve seats or replace cylinder head if necessary. |
| Engine runs irregularly at higher speed | Fuel pressure too low | Check fuel pressure sensor, fuel pump and fuel supply. |
| | Intake air leak | Tighten intake flange, replace gasket or replace intake flange if necessary. |
| | Worn camshafts | Check and replace if necessary. |
| Insufficient engine performance | Intake air leak | Tighten intake flange, replace gasket or replace intake flange if necessary. |
| | Incorrect or worn spark plugs | Replace spark plugs. |
| | Improper valve clearance | Replace associated broken valve train components. |
| | Incorrect valve timing | Adjust position of camshaft gears and camshaft sprocket. |
| | Insufficient ignition voltage | Check/replace ECM. |
| | Inoperative or damaged CKP or ECM | Check/replace CKP and/or ECM. |
| | Valve and/or valve guides worn or imperfect valve seat | Replace valves, rework valve seats or replace cylinder head if necessary. |
| | Inadequate fuel supply | Check fuel level in tank, add if necessary. Check/replace fuel filter, fuel supply lines, fuel pump and fuel injectors. |
| | Restricted air filter | Replace air filter. |
| | Restricted exhaust system | Replace restricted exhaust system components. |
| | Worn piston rings and/or cylinder bore | Replace piston rings and cylinders if necessary. |
| Incorrect or contaminated engine oil | Change engine oil and refill with correct viscosity oil for ambient temperature. | |
| Engine knocks or pings | Fuel has octane rating that is too low | Use correct octane fuel. |
| | Incorrect or worn spark plugs | Replace spark plugs. |
| | Intake air leak | Tighten intake flange, replace gasket or replace intake flange if necessary. |
| | Malfunctioning ECM or incorrect ignition timing | Check CKP and ECM, replace if necessary. |
| Engine overheats | <ul style="list-style-type: none"> • Low coolant level • Cooling system leaking • Air in cooling system | Refill coolant, pressure test cooling system. |
| | Inoperative cooling fan motor | Replace cooling fan motor. |
| | Low engine oil | Fill engine oil to the proper level. |
| | Debris in radiator fins | Remove debris from radiator(s). |
| | Malfunctioning thermostat | Replace thermostat. |
| | Malfunctioning ECM or incorrect ignition timing | Check CKP and ECM, replace if necessary. |
| | Inoperative coolant pump or coolant pump drive | Replace coolant pump and/or coolant water pump drive. |
| | Inoperative oil pump or oil pump drive Damaged or improperly installed oil pump drive Restricted oil circuit | Replace oil pump and/or oil pump drive components. Install oil pump drive gear retaining ring. Clean oil circuit. |
| | Leaking cylinder head gasket(s) | Replace cylinder head gasket(s). |
| | Intake air leak | Tighten intake flange, replace gasket or replace intake flange if necessary. |
| | Engine coolant temperature too low | Malfunctioning thermostat |

REMOVE

Removal

NOTE

Pry overlap to release crimp clamps. If clamps must be cut, use a sharp high-quality wire cutter. To prevent breaking plastic fittings, do not twist clamp while cutting.

1. See Figure 4-15. Push tip of small screwdriver under end of tang (2).

2. **NOTE**

Plastic fittings are fragile. Use care when removing clamp.

Pry until tang is free of tab (1).

3. Remove clamp.

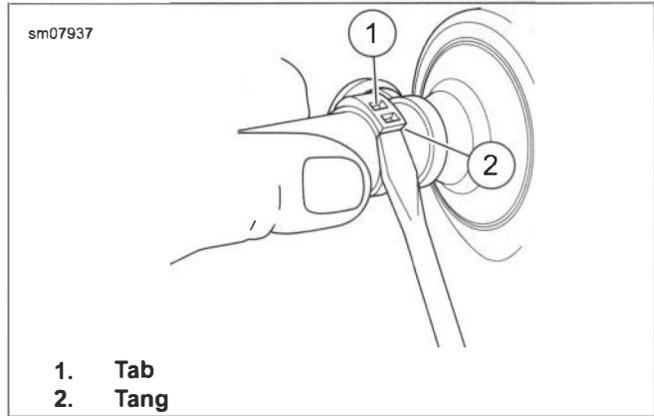


Figure 4-15. Removing Crimp Clamp

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

Installation

1. Install **new** clamp.
2. Tighten clamp using hose clamp pliers.
Special Tool: HOSE CLAMP PLIERS (HD-41137)

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Drain coolant. See COOLANT (Page 7-7).
4. Remove radiator mounting screws and position radiator away from oil cooler. Support as needed. See RADIATOR (Page 7-17).
5. Relocate right side rider footrest and bracket assembly. See RIDER FOOTRESTS (Page 3-77).
6. Remove battery tray. See BATTERY TRAY (Page 8-57).

REMOVE**Hose****NOTE**

Use drain pan for residual coolant.

1. See Figure 4-16. Remove and discard clamps (4, 7).
2. Remove hose (5, 6).

Oil Cooler

1. See Figure 4-16. Remove screws (1).
2. Remove oil cooler (2).
3. Discard O-rings (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------|--------------|----------|
| | 80–97 in-lbs | 9–11 N·m |
| Oil cooler screws | | |

NOTE

Position clamps far enough from the end of the hose to ease the installation of the hose onto the nipple of the adjoining piece.

Make sure the battery ground cable is routed underneath the upper oil hose.

Oil Cooler

1. See Figure 4-16. Install **new** O-rings (3).
 - a. Lubricate O-rings with fresh engine oil.

2. Install oil cooler (2).
3. Install screws (1). Tighten.
Torque: 80–97 **in-lbs** (9–11 N·m) *Oil cooler screws*

Hose

1. See Figure 4-16. Place **new** clamps (4, 7) on hoses (5, 6).
2. Install hoses (5, 6).
3. Secure clamps on hose ink marks using special tool. See CRIMP CLAMPS (Page 4-16).

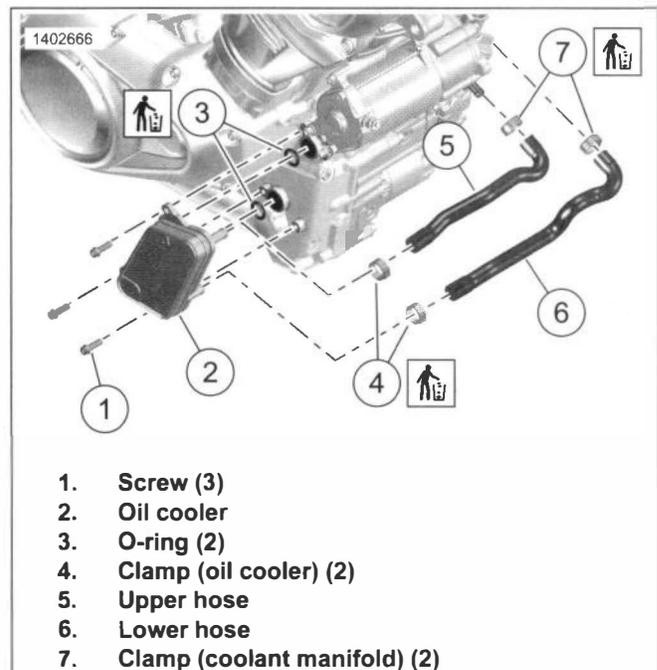


Figure 4-16. Oil Cooler and Hoses

COMPLETE

1. Install battery tray. See BATTERY TRAY (Page 8-57).
2. Install rider footrest and bracket assembly. See RIDER FOOTRESTS (Page 3-77).
3. Install radiator. See RADIATOR (Page 7-17).
4. Bleed coolant system. See COOLANT (Page 7-7).
5. Install chin spoiler. See CHIN SPOILER (Page 3-69).
6. Install main fuse. See POWER DISCONNECT (Page 8-4).

CRANKSHAFT LOCKOUT

| PART NUMBER | TOOL NAME |
|-------------|----------------------------|
| HD-45314 | CRANKSHAFT ROTATING WRENCH |
| HD-52956 | CRANKSHAFT LOCKING TOOL |

| FASTENER | TORQUE VALUE | |
|------------------------------------|---------------|-----------|
| Crankcase locking tool access plug | 97–115 in-lbs | 11–13 N·m |

Prepare

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Remove radiator mounting screws and position radiator away from oil cooler. Support as needed. See RADIATOR (Page 7-17).
4. Remove outboard spark plugs. See INSPECT AND REPLACE SPARK PLUGS (Page 2-40).

Lock

NOTE

Valves should be closed.

1. Use special tool to rotate crankshaft to top dead center (TDC) compression stroke on rear cylinder.
Special Tool: CRANKSHAFT ROTATING WRENCH (HD-45314)

2. See Figure 4-17. Remove crankcase plug (2) to access crankshaft locking feature.

- a. Remove and discard O-ring (1).

3. **NOTE**

Intake and exhaust valves overlap.

Rotate crankshaft 360° from TDC compression stroke to TDC exhaust stroke on rear cylinder.

4. Install special tool (3) and hand tighten.
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)

Unlock

1. Remove special tool (3).
2. Lubricate **new** O-ring (1) with fresh oil.
3. Install plug (2) with O-ring. Tighten.

Torque: 97–115 in-lbs (11–13 N·m) *Crankcase locking tool access plug*

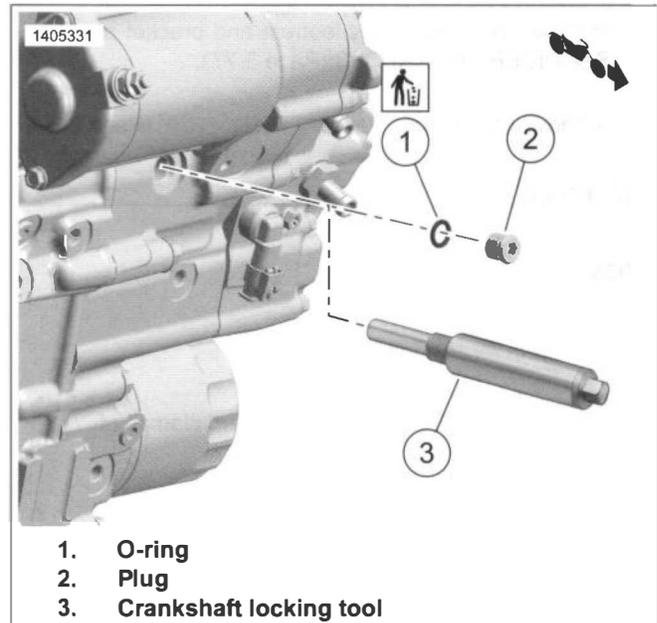


Figure 4-17. Crankshaft Locking Tool

Complete

1. Install outboard spark plugs. See INSPECT AND REPLACE SPARK PLUGS (Page 2-40).
2. Install radiator assembly. See RADIATOR (Page 7-17).
3. Install chin spoiler. See CHIN SPOILER (Page 3-69).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. **Removing front cover:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove left steering head cover. See SIDE COVERS (Page 3-46).
 - c. Remove fuel tank. See FUEL TANK (Page 6-12).
 - d. Remove airbox assembly. See AIR BOX (Page 6-3).
3. **Removing rear cover:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove fuel tank. See FUEL TANK (Page 6-12).
 - c. Remove cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
4. Remove camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
5. Remove ignition coil. See IGNITION COIL (Page 8-15).
6. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
7. Remove camshaft phaser solenoid harness with plate as an assembly. See PHASER SOLENOIDS (Page 4-22).

REMOVE

1. See Figure 4-18. Remove screws (1).
2. Remove cover (2).
 - a. Route camshaft phaser solenoid harness (3) through cylinder head (4).
3. Remove and discard ignition coil gasket (5).
4. Remove and discard cover gasket (6).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|--------------|-------------|
| Cylinder head cover screws | 63–77 in-lbs | 7.1–8.7 N·m |

1. See Figure 4-18. Install **new** ignition coil gasket (5) to cylinder head (4).

2. Install cylinder head cover.
 - a. Clean groove in cover (2) from all residual oil and debris.
 - b. Install **new** cover gasket (6) to cover (2).
 - c. Route camshaft phaser solenoid harness (3) through cylinder head (4).
 - d. Install cover (2) and screws (1). Tighten.
Torque: 63–77 **in-lbs** (7.1–8.7 N·m) *Cylinder head cover screws*

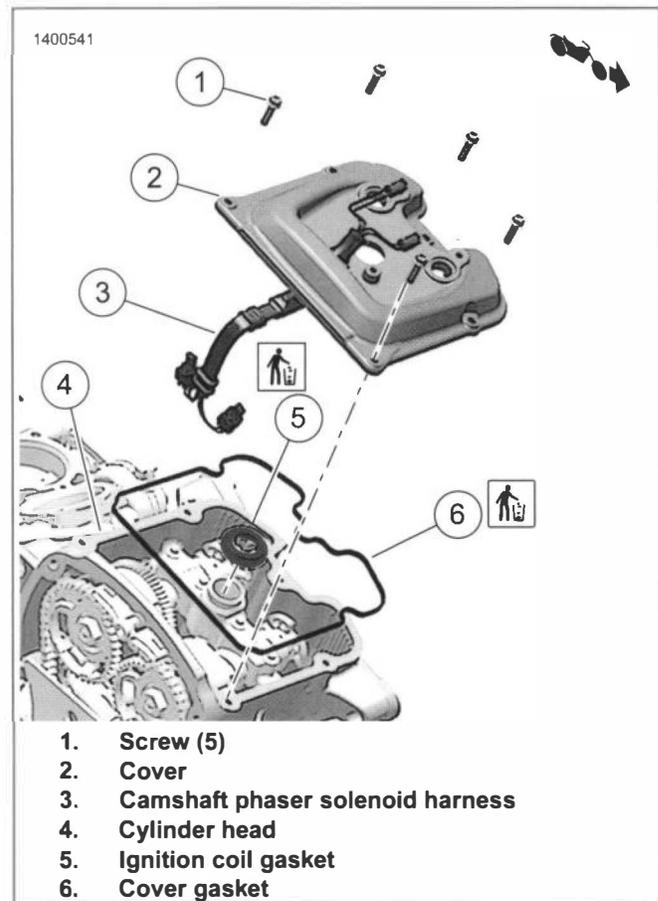


Figure 4-18. Cylinder Head Cover

COMPLETE

1. Install camshaft phaser solenoid harness with plate as an assembly. See PHASER SOLENOIDS (Page 4-22).
2. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
3. Install ignition coil. See IGNITION COIL (Page 8-15).
4. Install camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
5. **Rear cover:**
 - a. Install cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).

- b. Install fuel tank. See FUEL TANK (Page 6-12).
 - c. Install seat. See SEAT (Page 3-82).
6. **Front cover:**
- a. Install airbox assembly. See AIR BOX (Page 6-3).
 - b. Install fuel tank. See FUEL TANK (Page 6-12).
- c. Install left steering head cover. See SIDE COVERS (Page 3-46).
 - d. Install seat. See SEAT (Page 3-82).
7. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove exhaust shield (rear cylinder only). See MUFFLERS (Page 6-33).
3. Remove right rear cosmetic cover (rear cylinder only). See SIDE COVERS (Page 3-46).

REMOVE

1. See Figure 4-19. Remove screws (4).
2. Remove camshaft cover (1).
3. Remove and discard gasket (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------------------|--------------|-------------|
| Cylinder head camshaft cover screws | 63–77 in-lbs | 7.1–8.7 N·m |

1. See Figure 4-19. Clean groove in camshaft cover (3) from all residual oil and debris.
2. Install **new** gasket (2) to camshaft cover (1).
3. Install camshaft cover (1).

4. Install screws (4). Tighten.

Torque: 63–77 **in-lbs** (7.1–8.7 N·m) *Cylinder head camshaft cover screws*

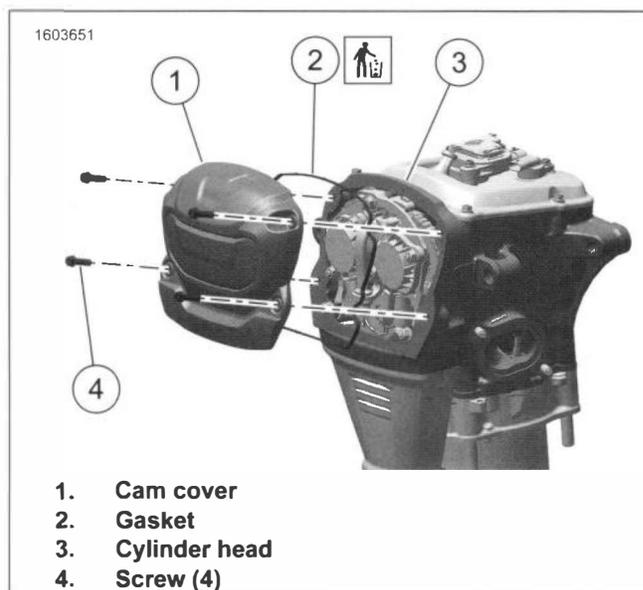


Figure 4-19. Cylinder Head Cam Cover

COMPLETE

1. Install cosmetic cover (rear cylinder only). See SIDE COVERS (Page 3-46).
2. Install exhaust shield (rear cylinder only). See MUFFLERS (Page 6-33).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).

REMOVE

Plate Assembly

1. See Figure 4-20. Disconnect solenoid connectors (8).
2. Detach wire harness grommets (7) from camshaft solenoid plate (4).
3. Remove camshaft solenoid plate assembly.
 - a. Remove nuts (1).
 - b. Remove screw (5).
 - c. Remove camshaft solenoid plate (4).
 - d. Route wire harness through solenoid plate (4).
4. Remove upper chain guide (6).
 - a. Inspect guide and replace if needed.

Solenoid

1. See Figure 4-20. Disconnect solenoid connectors (8).
2. Remove nuts (2).
3. Remove solenoid (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------------|--------------|---------|
| Camshaft solenoid plate nut | 62–80 in-lbs | 7–9 N·m |
| Camshaft solenoid plate screw | 62–80 in-lbs | 7–9 N·m |
| Camshaft solenoid screws | 62–80 in-lbs | 7–9 N·m |

Plate Assembly

1. See Figure 4-20. Install upper chain guide (6).
 - a. Short stem of chain guide (6) points toward front of vehicle.
2. Route wire harness through camshaft solenoid plate (4).
3. Install camshaft solenoid plate (4) into cylinder head.
4. Secure camshaft solenoid plate (4).
 - a. Install screw (5).

- b. Install nuts (1).
- c. Tighten screw (5).
Torque: 62–80 in-lbs (7–9 N·m) *Camshaft solenoid plate screw*
- d. Tighten nuts (1).
Torque: 62–80 in-lbs (7–9 N·m) *Camshaft solenoid plate nut*

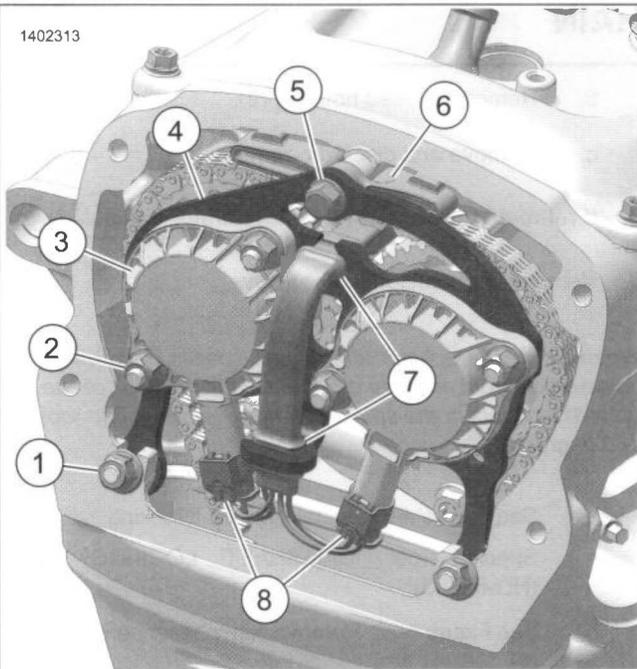
NOTE

- Make sure wires between solenoid connectors (8) and harness lower grommet (7) do not rub on edge of plate or get pinched by cam cover, once installed.
 - Make sure wire harness, routed through cylinder head, does not interfere with moving parts. Do not allow harness to twist.
5. Secure wire harness grommets (7) to camshaft solenoid plate (4).
 6. Connect solenoid connectors (8).

Solenoid

1. See Figure 4-20. Install solenoid (3).
2. Install nuts (2). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) *Camshaft solenoid screws*
3. Connect solenoid connectors (8).
 - a. See Figure 4-21. Connector with black wires to front phaser in cylinder head.
 - b. Connector with gray wires to rear phaser in cylinder head.
 - c. See Figure 4-20. Verify wiring does not rub on other components.

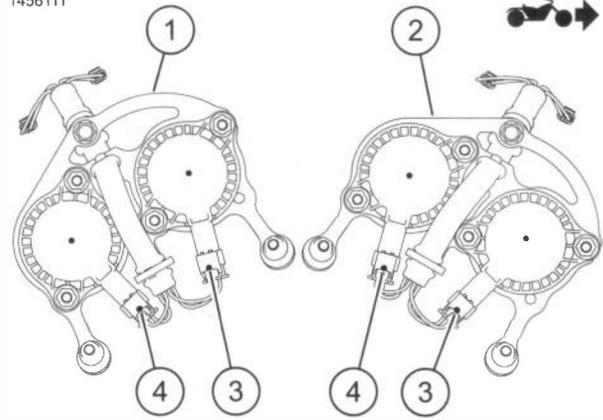
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1. Nut (solenoid plate) (2)
2. Nut (solenoid) (4)
3. Solenoid (2)
4. Camshaft solenoid plate
5. Screw
6. Upper chain guide
7. Wire harness grommet (2)
8. Solenoid connector (2)

Figure 4-20. Camshaft Solenoid Plate Assembly

1456111



1. Rear cylinder head
2. Front cylinder head
3. Black phaser harness wires
4. Gray phaser harness wires

Figure 4-21. VTT Harness Detail

COMPLETE

1. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
 - a. Move radiator assembly to allow access to crankshaft lockout plug.
4. Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
5. **Front Sprockets:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove left cosmetic cover. See SIDE COVERS (Page 3-46).
 - c. Remove fuel tank. See FUEL TANK (Page 6-12).
 - d. Remove airbox assembly. See AIR BOX (Page 6-3).
6. **Rear Sprockets:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove fuel tank. See FUEL TANK (Page 6-12).
 - c. Remove cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
7. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
8. Remove cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
9. Remove phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|--------------------------|
| HD-52951 | CAM CHAIN RETENTION TOOL |
| HD-52953 | CAMSHAFT LOCKING TOOL |
| HD-53023 | CAM CHAIN RETRACTION PIN |

1. See Figure 4-26. Remove oil feed housing.
 - a. Remove screw (1).

- b. Remove oil feed housing (2).
 - c. Remove and discard o-ring (3).
2. **If removing lower gear:** Remove crankshaft nut (4).
3. Remove cam phaser center screw.

NOTE

When using the special tool, it has specific orientation between the front and rear cylinders. If the pins do not line up with the slots in the sprockets, remove and rotate tool 180 degrees.

- a. See Figure 4-27. Install camshaft locking tool.
Special Tool: CAMSHAFT LOCKING TOOL (HD-52953)
 - b. See Figure 4-28. Remove cam phaser center screws (1).
 - c. Remove camshaft locking tool.
4. See Figure 4-29. Install cam chain retention tool to end of crankshaft to keep timing chain in place.
Special Tool: CAM CHAIN RETENTION TOOL (HD-52951)
5. Secure piston in chain tensioner housing. See SECONDARY BALANCER (Page 4-31).
 - a. Push piston into cam tensioner housing.
 - b. See Figure 4-30. Install cam chain retraction pin (1) in hole (2).
Special Tool: CAM CHAIN RETRACTION PIN (HD-53023)
6. See Figure 4-31. Remove sprockets and chain.
 - a. Remove screw (5). Use impact wrench with short bursts.
 - b. Detach dynamic chain guide assembly (6) and lower into engine case.
 - c. Detach fixed chain guide assembly (4) and lower into engine case.
 - d. Remove sprockets (2, 3).
 - e. Remove both chain guide assemblies (4, 6).
 - f. See Figure 4-29. Remove cam chain retention tool from crankshaft.
Special Tool: CAM CHAIN RETENTION TOOL (HD-52951)
 - g. Remove timing chain (1).
7. See Figure 4-32. Remove camshaft drive sprocket.
 - a. Remove locknut (4).

b. Remove camshaft drive sprocket (3).

c. Remove key (2).

8. Remove top hat screw (1).

9. Remove chain tensioner. See SECONDARY BALANCER (Page 4-31).

10. Remove secondary balancer. See SECONDARY BALANCER (Page 4-31).

CAM TIMING

| PART NUMBER | TOOL NAME |
|-------------|--------------------------|
| HD-52951 | CAM CHAIN RETENTION TOOL |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |

Crankshaft

NOTE

The cylinder heads are offset. Make sure the rear timing chain is installed prior to installing the front timing chain.

Improper alignment of the timing marks will damage the engine. It is crucial that the timing mark **Must Not** be off a single tooth.

There are two timing marks on the crankshaft sprocket. Each chain sprocket has its own dedicated timing mark. Both are located in the same position, one in front of the other.

1. See Figure 4-22 and Figure 4-23. Align the two colored chain links (1 or 2) with sprocket timing mark (3).

a. Sprocket timing mark (3) should point between the two colored chain links.

2. See Figure 4-29. Install special tool to end of crankshaft to keep timing chain in place.

Special Tool: CAM CHAIN RETENTION TOOL (HD-52951)

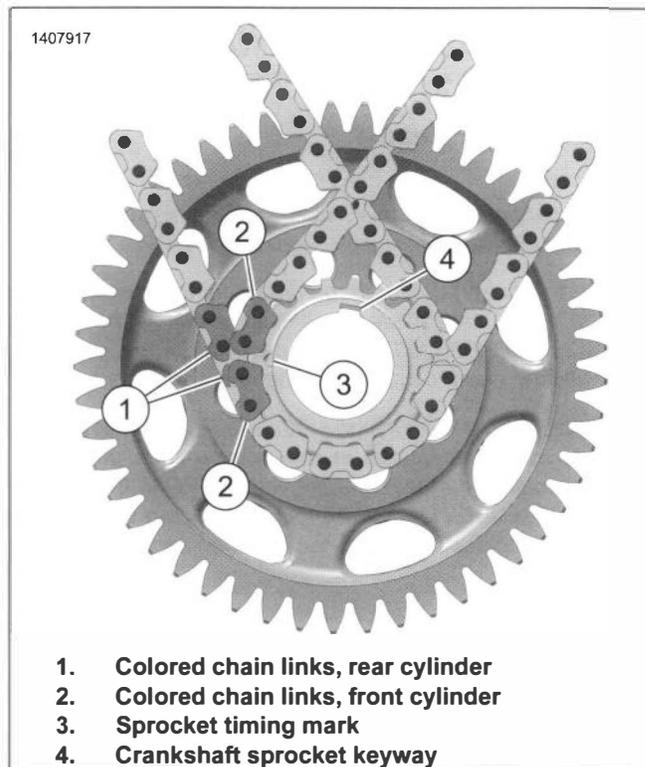


Figure 4-22. Alignment Marks, Crankshaft

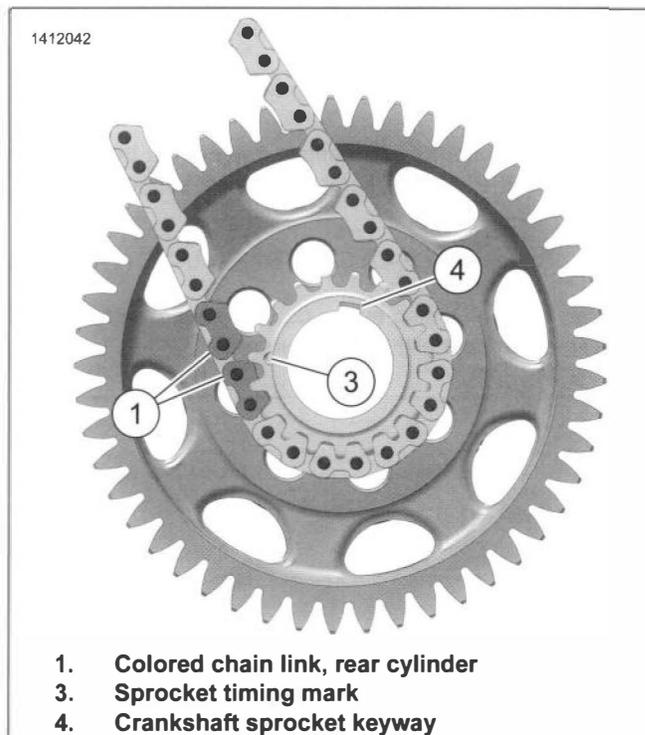


Figure 4-23. Alignment Marks, Rear Cylinder

Camshaft Timing

See Figure 4-24 and Figure 4-25. The colored chain links (1) and sprocket alignment marks (4) are represented when assembling the engine's camshaft sprocket and timing chain components from a complete tear down. When the camshaft cover has been removed after the engine's Crankshaft Lockout procedure, the colored chain links (1) **may not** be in alignment with the intake or exhaust timing marks (2). **Do not** unlock the crankshaft and rotate the assembly. Check the location of the sprocket alignment marks (4) and if they are in aligned as shown, then the camshaft timing is correct. Work may continue.

If the alignment marks (4) are not as shown, then one of two things have happened. The Crankshaft Lockout procedure has been done incorrectly or the timing components have slipped.

Front Cylinder Head

NOTE

The cylinder heads are offset. Make sure the rear timing chain is installed prior to installing the front timing chain.

Camshafts do not have to be installed to complete this procedure. If camshafts are present, sprockets will have to be aligned and installed to the keyed camshaft. Front sprockets are shallow in depth compared to the rear sprockets.

Cam drive sprockets are integral with outside camshaft journal. Lubricate camshaft journal in the cylinder head and drive sprocket mating surface liberally with SCREAMIN' EAGLE ASSEMBLY LUBE (11300002). Failure to do so will result in catastrophic engine damage and oil system contamination.

1. See Figure 4-24. Align intake timing mark (2) to colored chain link and hold sprocket in place.
2. Align exhaust timing mark (3) to colored chain link and hold sprocket in place.

3. NOTE

The camshaft may shift when trying to install the sprocket.

Install both sprockets into cylinder head.

- a. Lubricate the end camshaft journal in the cylinder head and drive sprocket mating surface **liberally** with SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
4. Check that all timing marks (2, 3) and orientation marks (4) are in proper alignment as shown.

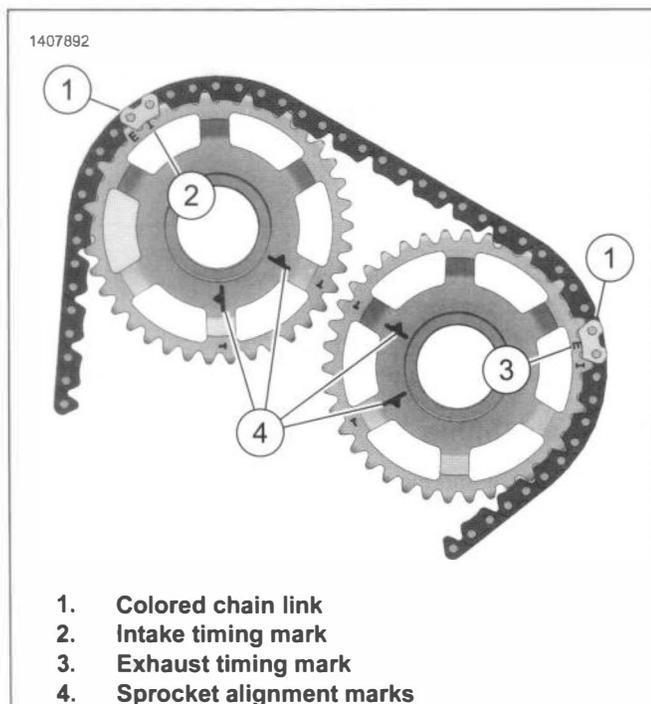


Figure 4-24. Alignment Marks, Front Cylinder Head

Rear Cylinder Head

NOTE

Camshafts do not have to be installed to complete this procedure.

If camshafts are present, sprockets will have to be aligned and installed to the keyed camshaft. Rear sprockets are deep in depth compared to the front sprockets.

Cam drive sprockets are integral with outside camshaft journal. Lubricate camshaft journal in the cylinder head and drive sprocket mating surface liberally with SCREAMIN' EAGLE ASSEMBLY LUBE (11300002). Failure to do so will result in catastrophic engine damage and oil system contamination.

1. See Figure 4-25. Align intake timing mark (2) to colored chain link and hold sprocket in place.
2. Align exhaust timing mark (3) to colored chain link and hold sprocket in place.

3. NOTE

The camshaft may shift when trying to install the sprocket.

Install both sprockets into cylinder head.

- a. Lubricate the end camshaft journal in the cylinder head and drive sprocket mating surface **liberally** with SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
4. Check that all timing marks (2, 3) and orientation marks (4) are in proper alignment as shown.

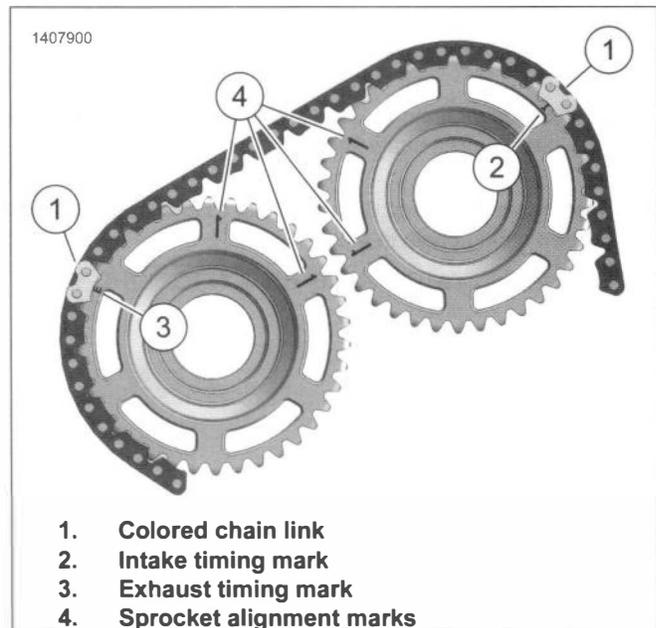


Figure 4-25. Alignment Marks, Rear Cylinder Head
CLEAN AND INSPECT

Sprockets and Timing Chain

1. Clean all parts thoroughly.

2. Inspect for wear. Replace or repair as necessary.

- a. Inspect camshaft drive sprocket teeth.
- b. Inspect timing chain.

Timing Chain Tensioner

NOTE

The timing chain tensioner assembly contains no serviceable parts. Replace as necessary.

- 1. Inspect timing chain tensioner assembly.
 - a. Clean all parts.
 - b. Inspect bore and piston of tensioner assembly for debris and scoring.
 - c. Verify smooth movement of tensioner piston.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|--------------------------|
| HD-52951 | CAM CHAIN RETENTION TOOL |
| HD-52953 | CAMSHAFT LOCKING TOOL |
| HD-53023 | CAM CHAIN RETRACTION PIN |

| FASTENER | TORQUE VALUE | |
|--|----------------|-------------|
| Cam and sprocket center screw torque step 1. | 66–81 ft-lbs | 90–110 N·m |
| Cam and sprocket center screw torque step 2. | | -360° |
| Cam and sprocket center screw torque step 3. | 13–16 ft-lbs | 18–22 N·m |
| Cam and sprocket center screw torque step 4. | | 33 ± 2° |
| Camshaft drive sprocket locknut | 125–140 ft-lbs | 170–190 N·m |
| Dynamic chain guide assembly top hat screw | 29–32 ft-lbs | 39–43 N·m |
| Timing chain guide screw | 80–97 in-lbs | 9–11 N·m |

| CONSUMABLE | PART NUMBER |
|---|-------------|
| LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (RED) | 94759-99 |
| LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) | 99642-97 |

- 1. Install secondary balancer. See SECONDARY BALANCER (Page 4-31).
- 2. Install chain tensioner. See SECONDARY BALANCER (Page 4-31).
 - a. See Figure 4-30. Leave special tool installed.

Special Tool: CAM CHAIN RETRACTION PIN (HD-53023)

3. **NOTE**

Make sure that the tools used to torque the top hat bolt do not come in contact with the crankcases. Contact can reduce the final torque of the bolt. Not doing this procedure can result in a catastrophic failure.

See Figure 4-32. Install top hat screw.

- a. Chase threads in engine block. Remove any residual threadlocker.
- b. Clean threads on top hat screw (1). Remove any residual threadlocker.
- c. Apply threadlocker to top hat screw (1).
LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (RED) (94759-99)
- d. Install top hat screw (1). Tighten.
Torque: 29–32 ft-lbs (39–43 N·m) *Dynamic chain guide assembly top hat screw*

4. Install Camshaft drive sprocket.

- a. Install key (2).
- b. Install camshaft drive sprocket (3).
- c. Install locknut (4). Tighten.
Torque: 125–140 ft-lbs (170–190 N·m) *Camshaft drive sprocket locknut*

5. See Figure 4-31. Install sprockets and chain.

- a. See Figure 4-33. Install fixed chain guide assembly (2). Position guide properly on top hat screw (1).
- b. Position dynamic chain guide assembly (6). Drop chain guide into engine case.
- c. Install timing chain to crankshaft. See Cam Timing in this section.
- d. See Figure 4-29. Install special tool to end of crankshaft to keep timing chain in place.
Special Tool: CAM CHAIN RETENTION TOOL (HD-52951)
- e. See Figure 4-31. Install sprockets (2, 3). See Cam Timing in this section.
- f. Install dynamic chain guide assembly (6).
- g. Clean threads on screw (5). Remove any residual threadlocker.
- h. Apply threadlocker to screw (5).
LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) (99642-97)

- i. Install screw (5). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Timing chain guide screw*

NOTE

After tightening screw allow at least 3 hours for lock patch to cure before engine is started.

- 6. Remove special tool from chain tensioner.

- 7. **NOTE**

Cam and sprocket center screws come in different lengths. The pair in the front cylinder head are short and long for the pair in the rear cylinder head.

When using the Camshaft Locking Tool (HD-52953), it has a specific orientation between front and rear cylinders. If the pins in the tool do not line up with the slots in the cam sprockets, remove and rotate tool 180 degrees.

Camshaft may shift when trying to install Cam and sprocket center screw. Make sure components have not become disconnected or catastrophic failure will result.

Install Cam and sprocket center screw.

- a. See Figure 4-27. Install camshaft locking tool.
Special Tool: CAMSHAFT LOCKING TOOL (HD-52953)
- b. See Figure 4-28. Install cam and sprocket center screws (1).
- c. Check that the key has not disengaged from the sprocket.

- 8. Tighten cam and sprocket center screws (1).

- a. Tighten.
Torque: 66–81 ft-lbs (90–110 N·m) *Cam and sprocket center screw torque step 1.*
- b. Loosen one full turn.
Torque: (-360°) *Cam and sprocket center screw torque step 2.*
- c. Tighten.
Torque: 13–16 ft-lbs (18–22 N·m) *Cam and sprocket center screw torque step 3.*
- d. Tighten.
Torque: (33 ± 2°) *Cam and sprocket center screw torque step 4.*

- 9. See Figure 4-27. Remove camshaft locking tool.

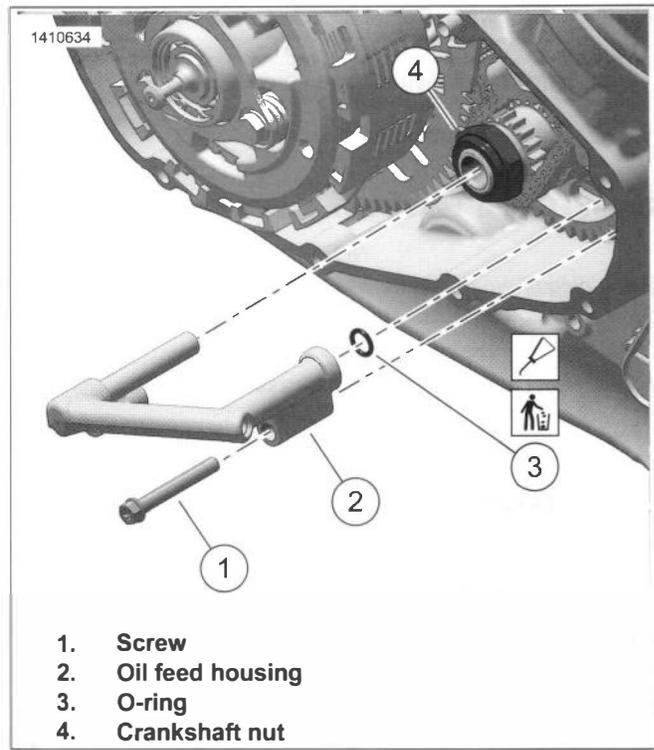


Figure 4-26. Oil Feed Housing

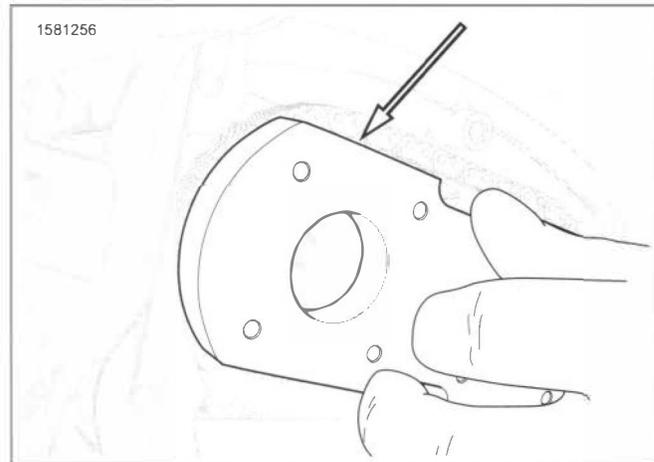
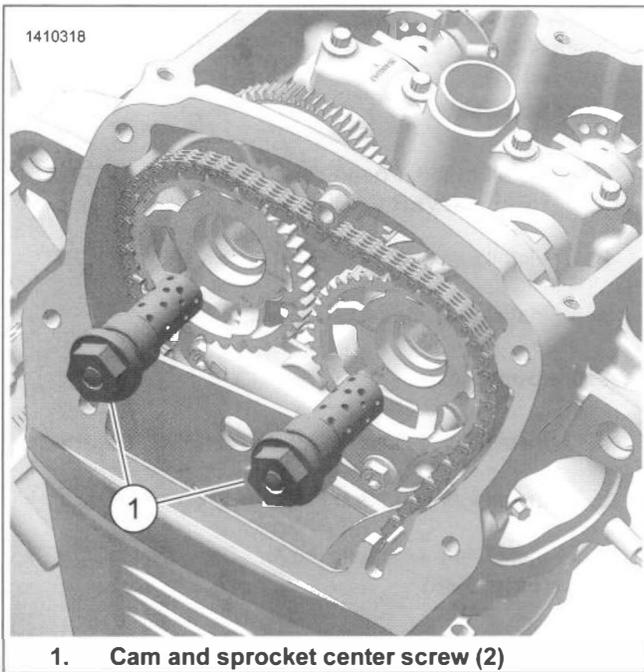


Figure 4-27. Camshaft Locking Tool



1. Cam and sprocket center screw (2)

Figure 4-28. Cam and Sprocket Center Screw

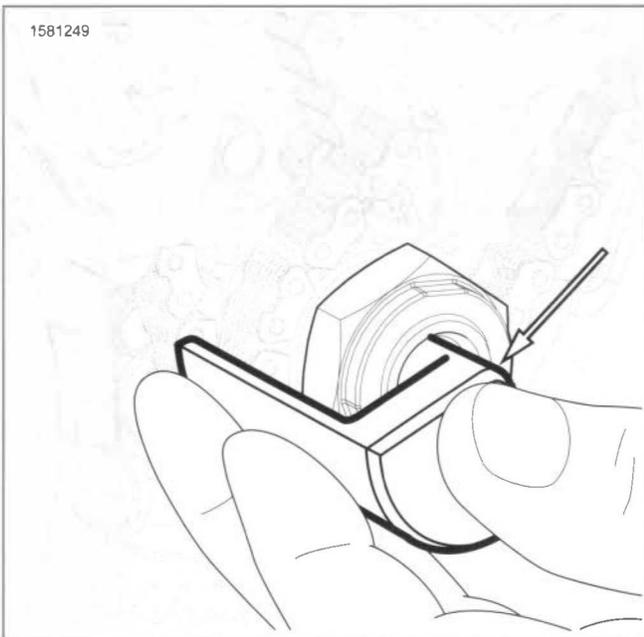
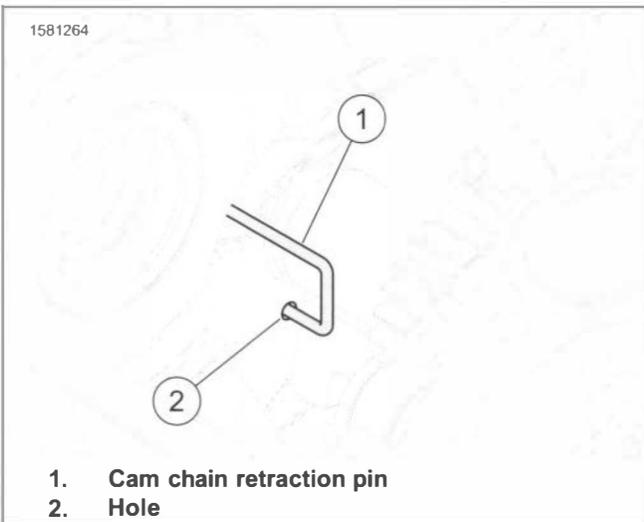
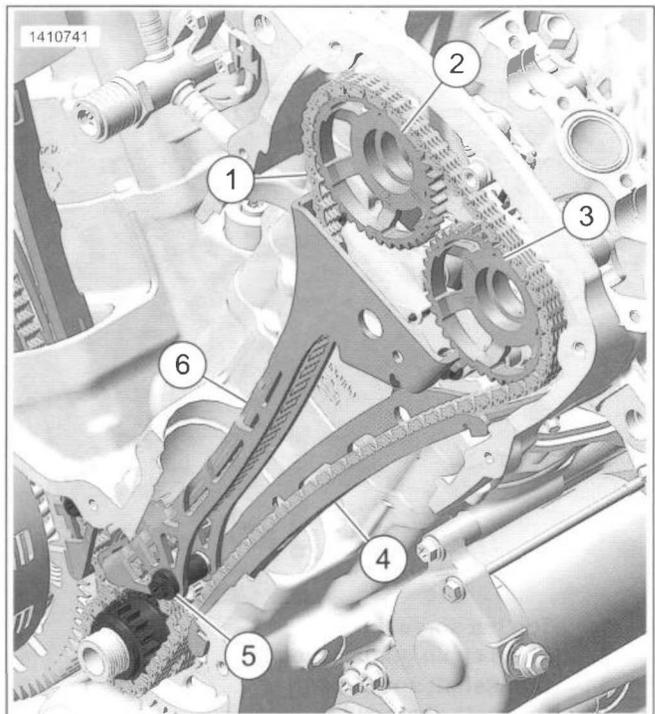


Figure 4-29. Cam Chain Retention Tool



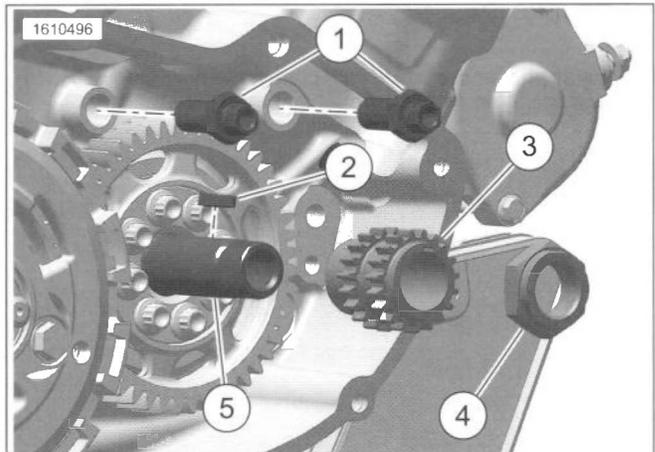
1. Cam chain retraction pin
2. Hole

Figure 4-30. Cam Chain Retraction Pin



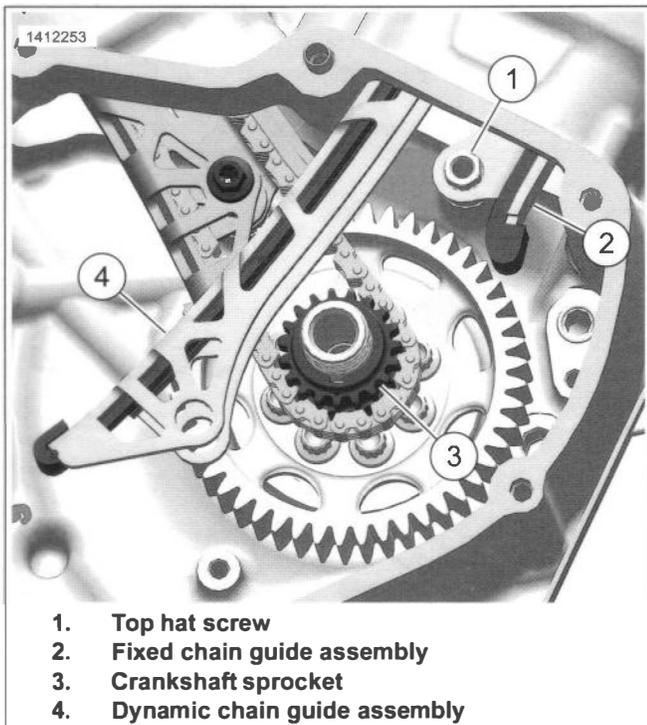
1. Timing chain
2. Intake sprocket
3. Exhaust sprocket
4. Fixed chain guide assembly
5. Screw
6. Dynamic chain guide assembly

Figure 4-31. Sprockets and Chain (Section view of front cylinder head)



1. Top hat screw (2)
2. Key
3. Camshaft drive sprocket

Figure 4-32. Top Hat Screw and Camshaft Drive Sprocket



1. Top hat screw
2. Fixed chain guide assembly
3. Crankshaft sprocket
4. Dynamic chain guide assembly

Figure 4-33. Timing Chain Guides

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
2. Install phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).

3. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).

4. Rear Sprockets:

- a. Install cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
- b. Install fuel tank. See FUEL TANK (Page 6-12).
- c. Install seat. See SEAT (Page 3-82).

5. Front Sprockets:

- a. Install airbox assembly. See AIR BOX (Page 6-3).
- b. Install fuel tank. See FUEL TANK (Page 6-12).
- c. Install left cosmetic cover. See SIDE COVERS (Page 3-46).
- d. Install seat. See SEAT (Page 3-82).

6. Install clutch baffle and primary cover. See PRIMARY COVER (Page 4-51).

7. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).

Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)

8. Install radiator assembly. See RADIATOR (Page 7-17).

9. Install chin spoiler. See CHIN SPOILER (Page 3-69).

10. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

- Remove main fuse. See POWER DISCONNECT (Page 8-4).
- Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
 - Move radiator assembly to allow access to crankshaft lockout plug.
- Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
- Remove seat. See SEAT (Page 3-82).
- Remove fuel tank. See FUEL TANK (Page 6-12).
- Remove airbox assembly. See AIR BOX (Page 6-3).
- Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
- Remove phaser solenoid with plate assembly. See PHASER SOLENOIDS (Page 4-22).
- Remove cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
- Remove front cylinder head camshaft sprockets and chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|--------------------------|
| HD-53023 | CAM CHAIN RETRACTION PIN |

Tensioner

- See Figure 4-35 and Figure 4-36. Install cam chain retraction pin.
Special Tool: CAM CHAIN RETRACTION PIN (HD-53023)
 - Compress piston on chain tensioner.
 - Insert cam chain retraction pin (1) into access hole (2).
- See Figure 4-37. Remove screws (3, 4).
- Remove chain tensioner housing (2).
- Discard O-ring (1).

Balance Gear

- See Figure 4-37. Remove balancer (5).

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|--------------------------|
| HD-53023 | CAM CHAIN RETRACTION PIN |

| FASTENER | TORQUE VALUE | |
|--------------------------------------|--------------|-----------|
| Chain tensioner housing screw, long | 12–13 ft-lbs | 16–18 N·m |
| Chain tensioner housing screw, short | 27–35 in-lbs | 3–4 N·m |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |

Balance Gear

- Lube balancer bearing and mounting shaft in cylinder head with assembly lube.
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
- See Figure 4-37. Install balancer (5).
 - See Figure 4-34. If camshaft is installed, use the alignment marks to position the balancer gear.

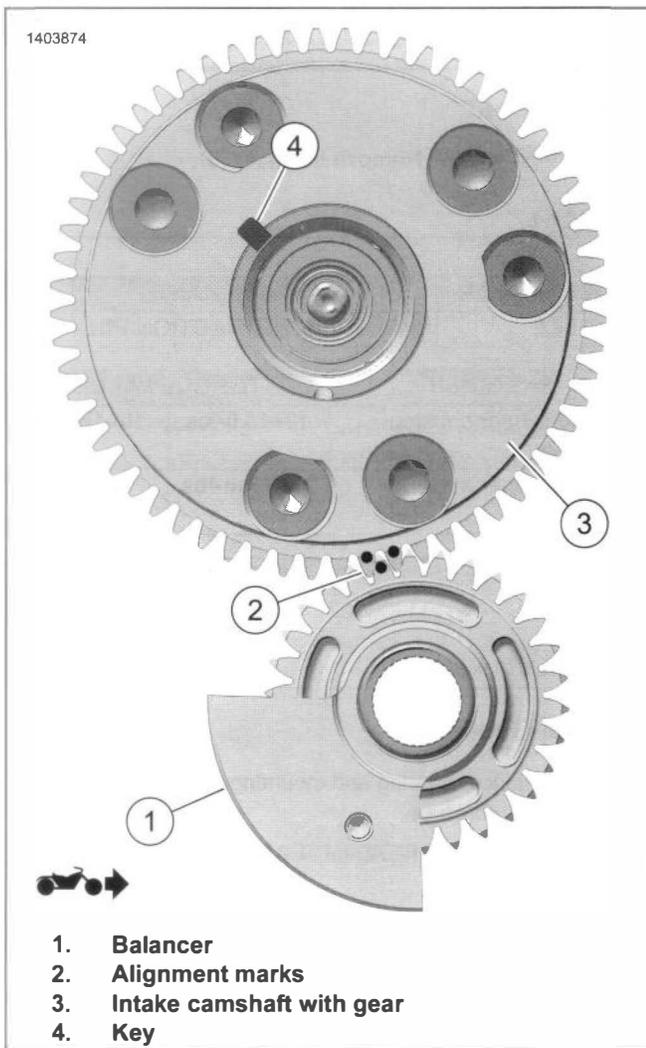


Figure 4-34. Balance Gear Alignments Marks (Front Cylinder Head Only)

Tensioner

1. See Figure 4-36. Install cam chain retraction pin.

Special Tool: CAM CHAIN RETRACTION PIN (HD-53023)

 - a. Compress piston on chain tensioner.
 - b. Insert cam chain retraction pin (1) into access hole (2).
2. See Figure 4-37. Install chain tensioner.
 - a. Lubricate **new** O-ring (1) with fresh engine oil.
 - b. Install O-ring (1) to chain tensioner housing (2).
 - c. Install chain tensioner housing (2).
 - d. Install long screws (3). Tighten.

Torque: 12–13 ft-lbs (16–18 N·m) *Chain tensioner housing screw, long*
 - e. Install short screw (4). Tighten.

Torque: 27–35 in-lbs (3–4 N·m) *Chain tensioner housing screw, short*

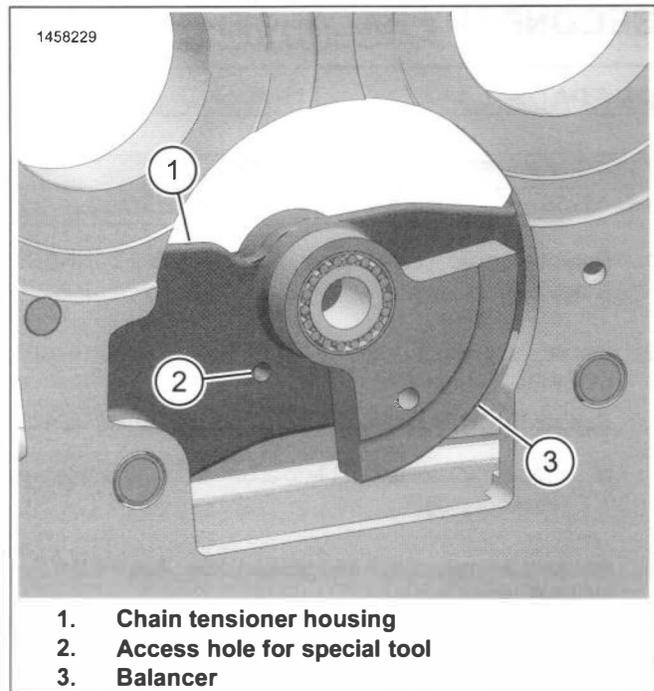


Figure 4-35. Special Tool Access Hole

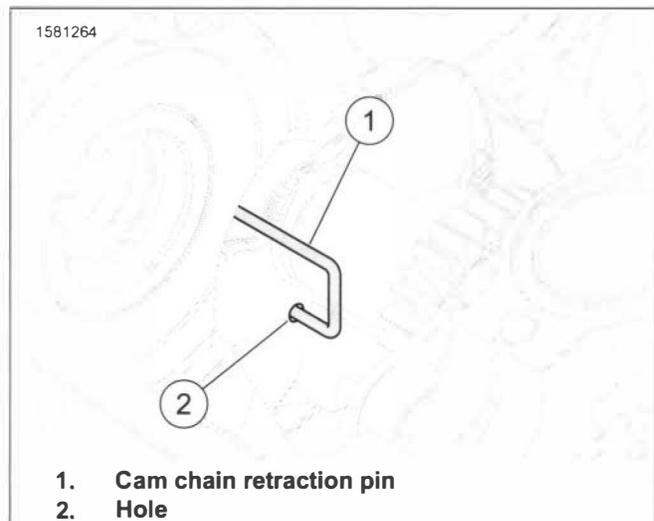


Figure 4-36. Cam Chain Retraction Pin

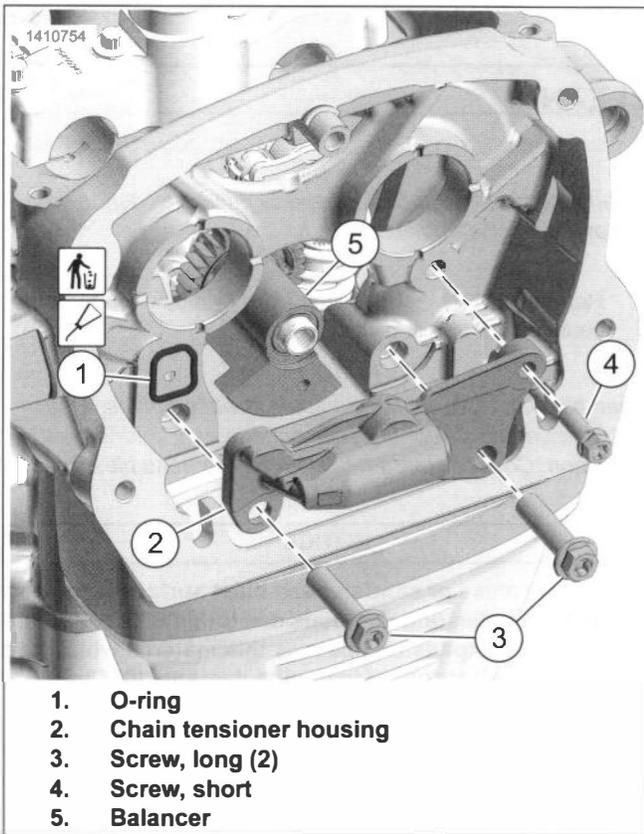


Figure 4-37. Chain Tensioner

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install front cylinder head camshaft sprockets and chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
2. Install cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
3. Install phaser solenoid with plate assembly. See PHASER SOLENOIDS (Page 4-22).
4. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
5. Install airbox assembly. See AIR BOX (Page 6-3).
6. Install fuel tank. See FUEL TANK (Page 6-12).
7. Install primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
8. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
9. Install radiator assembly. See RADIATOR (Page 7-17).
10. Install seat. See SEAT (Page 3-82).
11. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

NOTE

Abrasive particles can damage machined surfaces or plug oil passageways. Clean parts before disassembly to prevent component damage.

1. Use low-pressure compressed air to clean exterior surfaces of engine.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
5. Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
6. Remove camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
7. Remove ignition coil. See IGNITION COIL (Page 8-15).
8. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
9. Remove cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
10. Remove breather bolt. See BREATHER BOLT (Page 6-5).
11. Remove phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
12. Remove camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
13. Remove sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).

REMOVE

1. See Figure 4-38. Remove cylinder head.
 - a. Remove and discard screws (1).
 - b. Remove cylinder head (2).
 - c. Discard gasket (3).

CLEAN

NOTE

Avoid getting debris in coolant and oil passages during gasket removal and cleaning.

1. Remove old gasket material from cylinder head. Do not cause scratches or nicks.

NOTE

Bead blasting materials could enter threaded holes. This would adversely affect fastener engagement and torque indication. Cover all threaded holes before bead blasting.

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)

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.

NOTE

Keep all parts grouped by location so they can be installed in the original location.

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.
5. Thoroughly flush all coolant and oil passages to remove loose debris.

⚠ 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. Dry parts with low-pressure, compressed air.
7. Clean threadlocker from all screws and threaded holes. See **Cleaning Fastener Threads** in Cleaning (Page II).
 - a. Cover exposed internal engine area to prevent contamination from loosened threadlocker.

INSTALL

| FASTENER | TORQUE VALUE | |
|--|--------------|---------------|
| | | |
| Cylinder head screws torque step 1 | 20–23 ft-lbs | 27–31 N·m |
| Cylinder head screws torque step 2: loosen | | -360° |
| Cylinder head screws torque step 3 | 15–18 ft-lbs | 20–24 N·m |
| Cylinder head screws torque step 4 | 35–38 ft-lbs | 47.5–51.5 N·m |
| Cylinder head screws torque step 5 | | 148–155° |

1. Clean all gasket surfaces.
2. Thoroughly flush all coolant and oil passages to remove loose debris.
3. See Figure 4-38. Install cylinder head.

NOTE

Screws (1) to be installed **without** lubricant.

- a. Install **new** gasket (3).
 - b. Install cylinder head (2) on dowel pins (4).
 - c. Install **new** screws (1).
4. See Figure 4-39. Tighten **new** screws in sequence:
 - a. Tighten.
Torque: 20–23 ft-lbs (27–31 N·m) *Cylinder head screws torque step 1*
 - b. Loosen all screws one full turn.
Torque: (-360°) *Cylinder head screws torque step 2: loosen*
 - c. Tighten.
Torque: 15–18 ft-lbs (20–24 N·m) *Cylinder head screws torque step 3*
 - d. Tighten.
Torque: 35–38 ft-lbs (47.5–51.5 N·m) *Cylinder head screws torque step 4*
 - e. Tighten.
Torque: 148–155° *Cylinder head screws torque step 5*

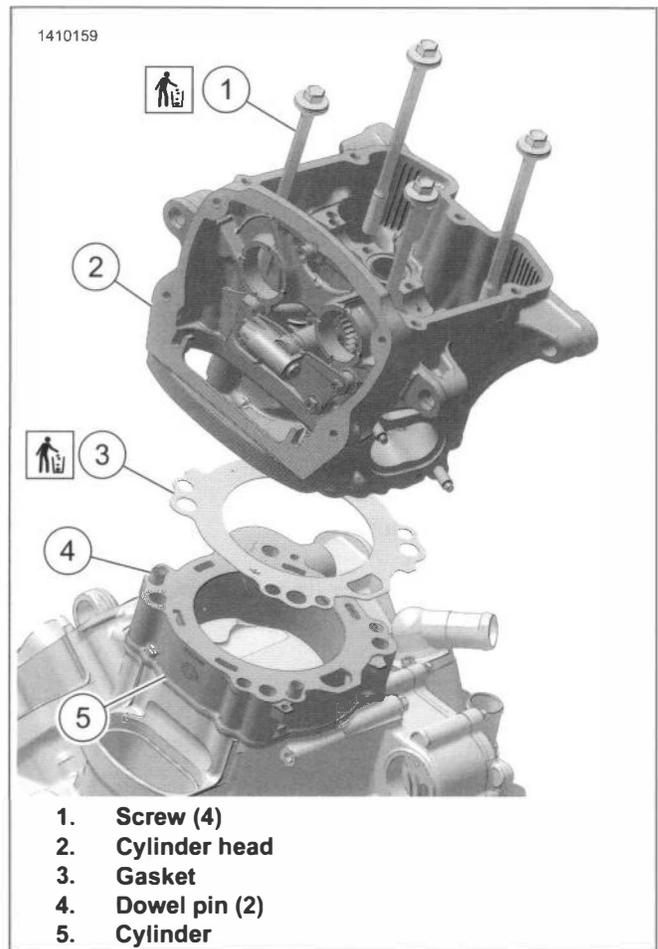


Figure 4-38. Cylinder Head

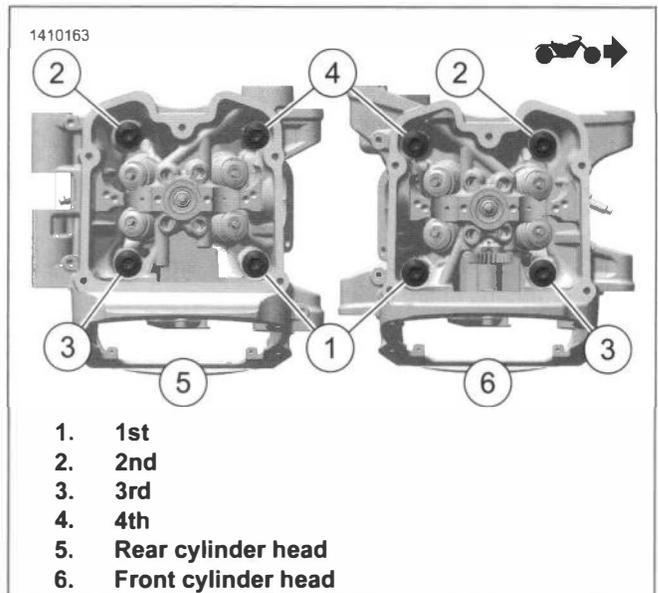


Figure 4-39. Cylinder Head Screw Torque Sequence

DISASSEMBLE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-34736-B | VALVE SPRING COMPRESSOR |

1. Secure cylinder head for service.
2. See Figure 4-40. Remove valves.
 - a. Use special tool to compress valve spring.

Special Tool: VALVE SPRING COMPRESSOR (HD-34736-B)

- b. Remove and discard tapered keepers (1).
 - c. Remove spring retainer (2) and valve spring (3).
 - d. Remove valve (6).
3. Remove and discard valve stem seal (4).
 4. Remove remaining valves.

CLEAN AND INSPECT

Cylinder Head

1. Clean all parts thoroughly.
2. Inspect cylinder head for wear or damage. Replace or repair as necessary.
 - a. Inspect cylinder head.
 - b. Inspect mating surfaces for damage and warping.
3. Verify that all oil and coolant passages are clean and open.

Valve

1. Clean all parts thoroughly.
2. With valves removed, inspect the end of the valve stem for pitting or uneven wear.
 - a. Remove any burrs around the valve stem keeper groove with a fine tooth file.
 - b. Inspect the sealing surface of the valve face and valve seat.
 - c. The sealing surfaces must be smooth and even around entire contact area.
 - d. If the sealing contact area is uneven or shows evidence of burning, pitting, cracking, carbon tracking, or other indications of combustion gas leakage, replace the cylinder head assembly.

ASSEMBLE

| PART NUMBER | TOOL NAME |
|-------------|----------------------------|
| HD-34736-B | VALVE SPRING COMPRESSOR |
| HD-45322 | VALVE GUIDE SEAL INSTALLER |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |

1. Secure cylinder head for service.

2. NOTE

See Figure 4-40. Install all parts in their original location and position.

Install valves using a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to valve stem.

Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- a. Install valve (6) into cylinder head (5).
 - b. Spin valve while installing to distribute lubricant evenly.
 - c. Remove valve and apply a second coat of SCREAMIN' EAGLE ASSEMBLY LUBE to valve stem. Install valve.
3. Install valve stem seal.
 - a. Apply SCREAMIN' EAGLE ASSEMBLY LUBE to valve stem.
 - b. Install seal installer over tip of valve stem.

Special Tool: VALVE GUIDE SEAL INSTALLER (HD-45322)

NOTE

If tool is not available seal can be installed if care is used to prevent damage from keeper grooves.

- c. Slide **new** valve stem seal (4) over valve stem until seated against cylinder head casing.
4. Install valve spring.
 - a. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to valve stem tip and keeper groove.
 - b. Install valve spring (3) with the smaller diameter coils topside.
 - c. Place spring retainer (2) on top of valve spring.
 5. Install **new** keepers.
 - a. Compress valve spring with special tool.
Special Tool: VALVE SPRING COMPRESSOR (HD-34736-B)
 - b. Install the keepers (1).
 - c. Slowly release valve spring compression.
 - d. Tap end of valve stem once or twice with a soft mallet to make sure tapered keepers are tightly seated.
 6. Install remaining valves.

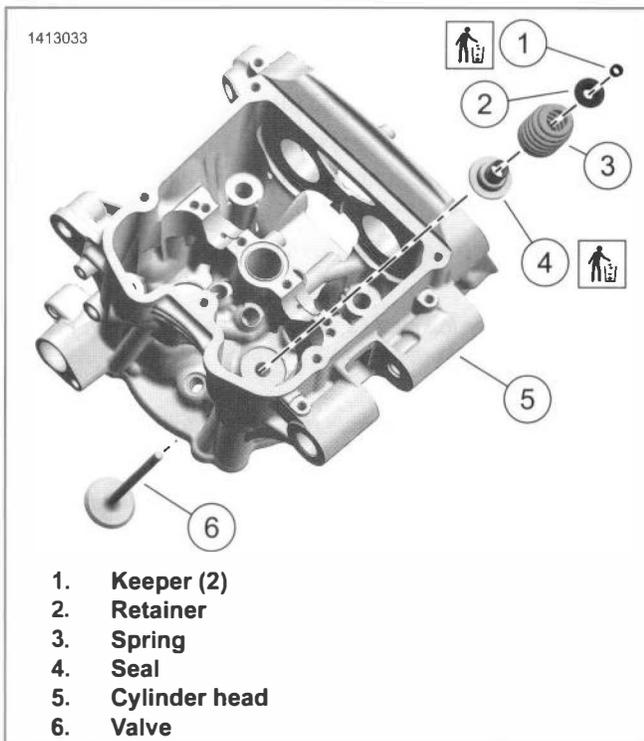


Figure 4-40. Valve Assembly

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).

2. Install camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
3. Install phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
4. Install breather bolt. See BREATHER BOLT (Page 6-5).
5. Install cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
6. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
7. Install ignition coil. See IGNITION COIL (Page 8-15).
8. Install camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
9. Install primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
10. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
11. Install engine. See REPLACE ENGINE (Page 4-62).
12. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
 - a. Move radiator assembly to allow access to crankshaft lockout plug.
3. **Front Camshaft:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove left steering head cover. See SIDE COVERS (Page 3-46).
 - c. Remove fuel tank. See FUEL TANK (Page 6-12).
 - d. Remove airbox assembly. See AIR BOX (Page 6-3).
4. **Rear Camshaft:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove fuel tank. See FUEL TANK (Page 6-12).
 - c. Remove cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
5. Remove camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
6. Remove ignition coil. See IGNITION COIL (Page 8-15).
7. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
8. Remove cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
9. Remove camshaft phaser solenoid with plate as an assembly. See PHASER SOLENOIDS (Page 4-22).
10. Remove cam phaser center screw. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).

REMOVE

1. Remove breather bolt. See BREATHER BOLT (Page 6-5)
2. See Figure 4-43. Remove screws (1).
3. Remove camshaft cap (2).

4. Remove and discard O-ring (3).

NOTE

Shift camshaft sideways to help with removal.

5. Remove intake and exhaust camshafts (5, 6).

NOTE

Mark roller finger followers so they can be installed in the same location and orientation.

6. See Figure 4-46. Remove roller finger followers (1).

NOTE

Mark lash adjusters so they can be installed in the same location and orientation.

7. Remove hydraulic lash adjusters (2).

8. Remove phaser from camshaft if replacing phaser.

- a. See Figure 4-42. Remove cam phaser screws (5).
- b. Remove Phaser (4) from cam (2).

CLEAN AND INSPECT**NOTE**

Do not to remove the three screws to inspect the phaser. There is a special assembly process which can only be done at the manufacturer. If the phaser has been disassembled, it will render the phaser inoperative.

Camshaft

1. Inspect lobes for abnormal wear or discoloration.
2. Inspect bearing surfaces for scoring or discoloration.
3. Measure bearing journals.

NOTE

Remove and replace breather, air/oil separator only if defective.

4. See Figure 4-43. Inspect breather, air/oil separator (4).

Roller Finger Followers

1. Clean all parts.
2. Inspect for wear. Replace or repair as necessary.
 - a. Inspect roller for excessive wear.
 - b. Inspect valve contact area for excessive wear.
 - c. Inspect lash adjuster pocket for excessive wear.
 - d. Verify that oil holes in roller finger followers are clean and open.

Gears

1. Clean parts in a non-volatile cleaning solution. Dry parts with low-pressure, compressed air.
2. Replace components with worn or damaged gears.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|------------------------------|
| HD-42313 | CAM CHAIN TENSIONER UNLOADER |

| FASTENER | TORQUE VALUE | |
|-----------------------------------|----------------|-------------|
| Cam phaser screws torque step 1. | 40–49 in-lbs | 4.5–5.5 N·m |
| Cam phaser screws torque step 2. | | 46 ± 3° |
| Camshaft cap screw (1st torque) | 44–53 in-lbs | 5–6 N·m |
| Camshaft cap screw (Final torque) | 115–133 in-lbs | 13–15 N·m |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |

NOTE

It is critical for initial start up of engine that the camshaft: lobes, journals, and caps along with the hydraulic lash adjuster's and roller finger followers be coated liberally with SCREAMIN' EAGLE ASSEMBLY LUBE (11300002). Failure to do so will result in catastrophic engine failure and contamination of oil system.

NOTE

If reinstalling the same hydraulic lash adjusters, place them in the same bore from which they were removed.

1. See Figure 4-46. Install pre-lubed hydraulic lash adjusters (2).
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

NOTE

Roller finger followers are held in place by their own weight.

Make sure roller finger followers are installed in correct orientation. Failure to do so will result in catastrophic engine failure and contamination of oil system.

2. See Figure 4-46. Install pre-lubed roller finger followers (1).
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - a. See Figure 4-45. Install roller finger followers with flat side over valve and cupped side (1) over hydraulic lash adjuster (2).
3. See Figure 4-44. Install locking pin from unloader through chain tensioner (1) into blind hole (3) to lock balancer (2).
Special Tool: CAM CHAIN TENSIONER UNLOADER (HD-42313)

NOTE

Front cylinder head has an engine balancer assembly. The gear on balancer will have to be aligned with gear on intake camshaft phaser.

Rear cylinder head is the same procedure minus alignment of gears.

4. Assemble phaser and cam if disassembled.
 - a. See Figure 4-42. Slide alignment pin (3) into alignment opening (1).
 - b. Install screws (5). Tighten.
Torque: 40–49 in-lbs (4.5–5.5 N·m) *Cam phaser screws torque step 1.*
 - c. Tighten additional.
Torque: (46 ± 3°) *Cam phaser screws torque step 2.*
5. Install breather on front intake cam.

NOTE

*Breather is one time use, if not installed properly discard and install a **new** breather.*

- a. See Figure 4-41. Align tabs (2) with camshaft holes (3), install breather (1).
 - b. Verify breather tabs engaged camshaft holes.
 - c. Verify mating surfaces (4) are fully seated.
6. See Figure 4-43. Install intake camshaft.
 - a. Lubricate camshaft journal.
SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - b. See Figure 4-47. Align timing mark (1) on cam phaser (2) with drill spot face in cylinder head.
 - c. See Figure 4-43. Align key (7) in phaser with keyway in camshaft sprocket.
 - d. See Figure 4-48. Use alignment marks to position balancer gear.
 - e. Install intake camshaft (5).
 - f. Make sure roller finger followers are in proper alignment with camshaft, lash adjusters and valves.
 7. Install exhaust camshaft.
 - a. Lubricate camshaft journal.
SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - b. See Figure 4-47. Align timing mark (1) on cam phaser (2) with drill spot face in cylinder head.
 - c. Align key (7) in phaser with keyway in camshaft sprocket.
 - d. See Figure 4-43. Install exhaust camshaft (6).

- e. Make sure roller finger followers are in proper alignment with camshaft, lash adjusters and valves.

8. Lubricate **new** O-ring (3) with fresh oil and install.

NOTE

The camshaft may shift when trying to install the camshaft cap. Make sure components have not become disconnected or catastrophic failure will result.

9. Install camshaft cap.

NOTE

It is imperative to tighten the camshaft cap screws using torque sequence shown.

- a. Lubricate cap journal.

SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- b. See Figure 4-43. Install camshaft cap (2).
- c. Install screws (1).
- d. See Figure 4-49. Tighten screws in sequence.
Torque: 44–53 in-lbs (5–6 N-m) *Camshaft cap screw (1st torque)*
- e. Tighten screws in sequence.
Torque: 115–133 in-lbs (13–15 N-m) *Camshaft cap screw (Final torque)*

10. Install breather bolt. See BREATHER BOLT (Page 6-5)

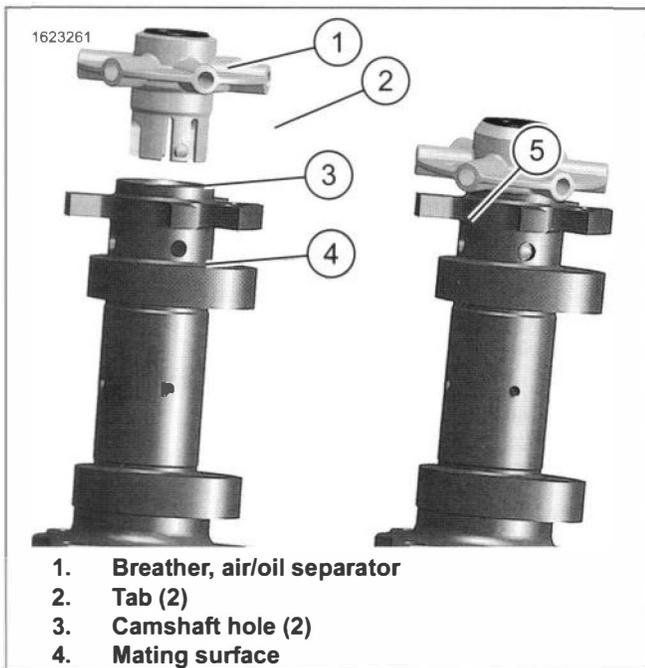


Figure 4-41. Breather, Air/Oil Separator

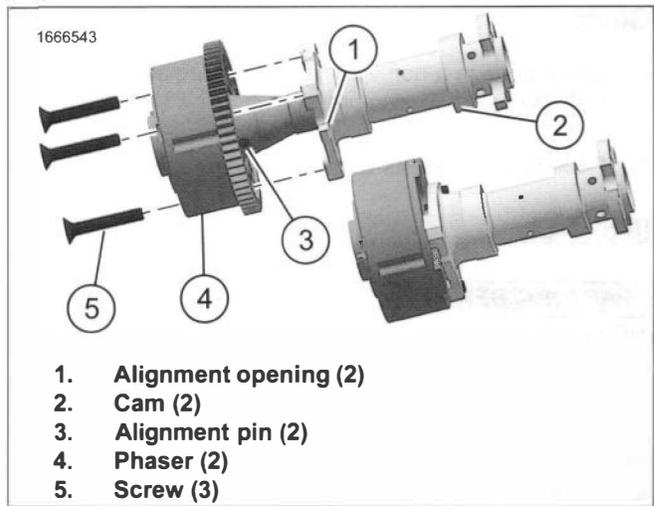


Figure 4-42. Phaser and Camshaft

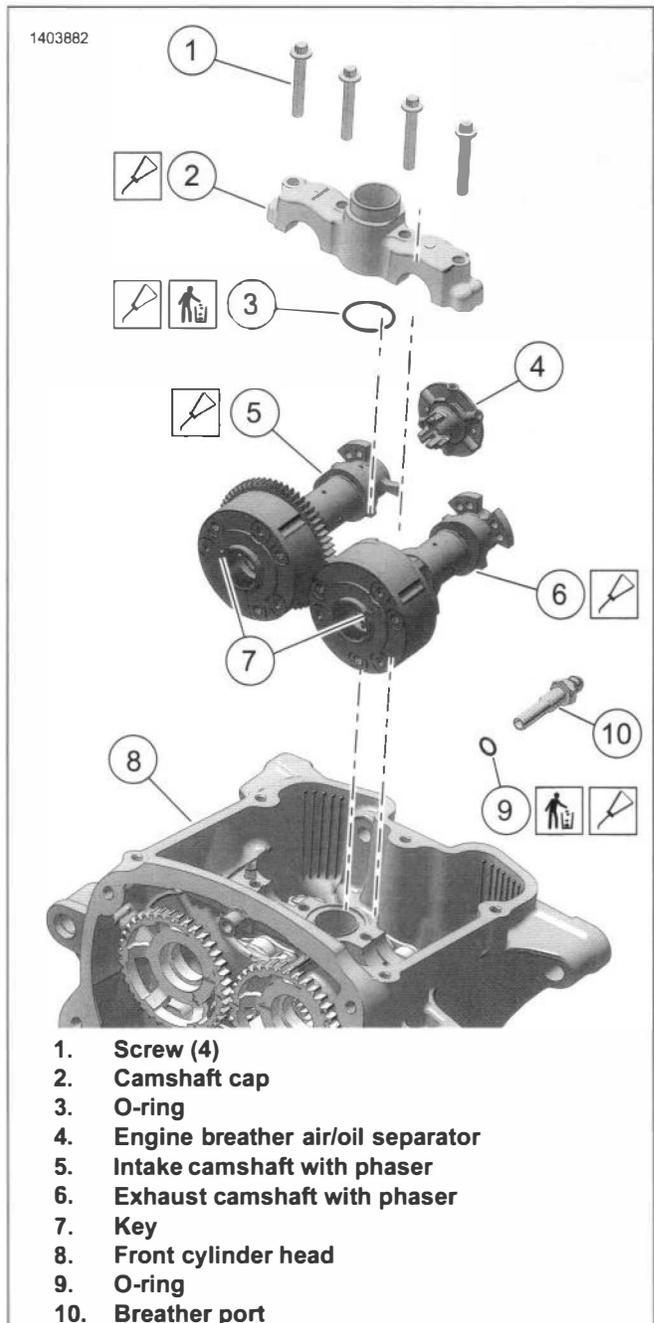


Figure 4-43. Camshafts, Front Cylinder Head

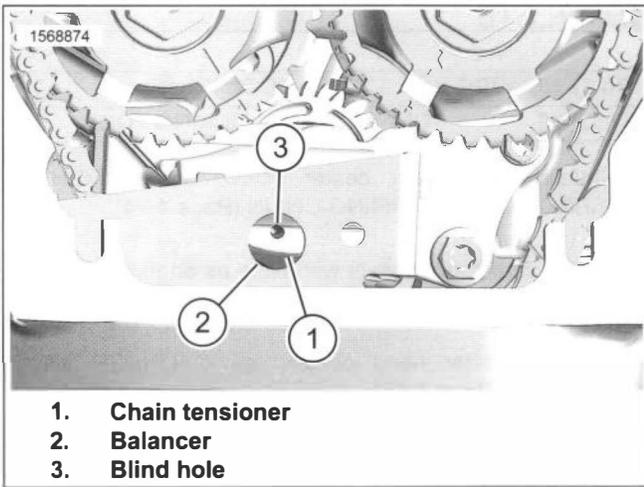


Figure 4-44. Balancer Lock Holes

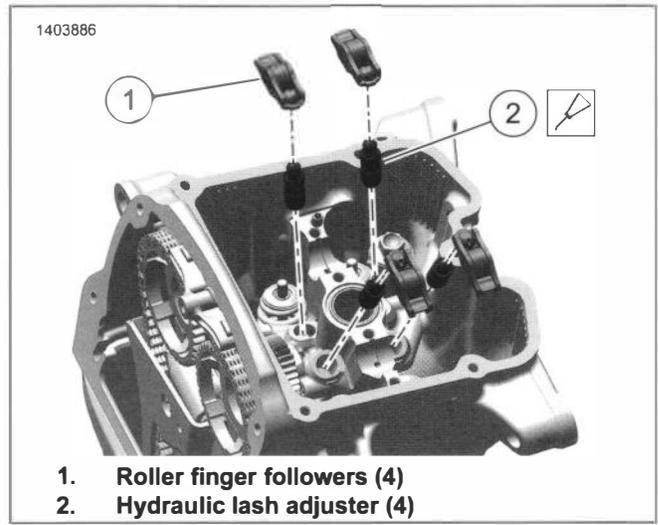


Figure 4-46. Lash Adjusters and Roller Finger Followers



Figure 4-45. Lash Adjusters and Roller Finger Position

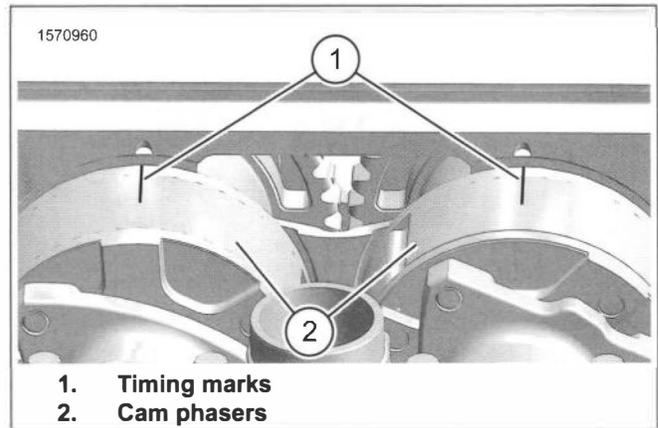


Figure 4-47. Phaser Timing Marks

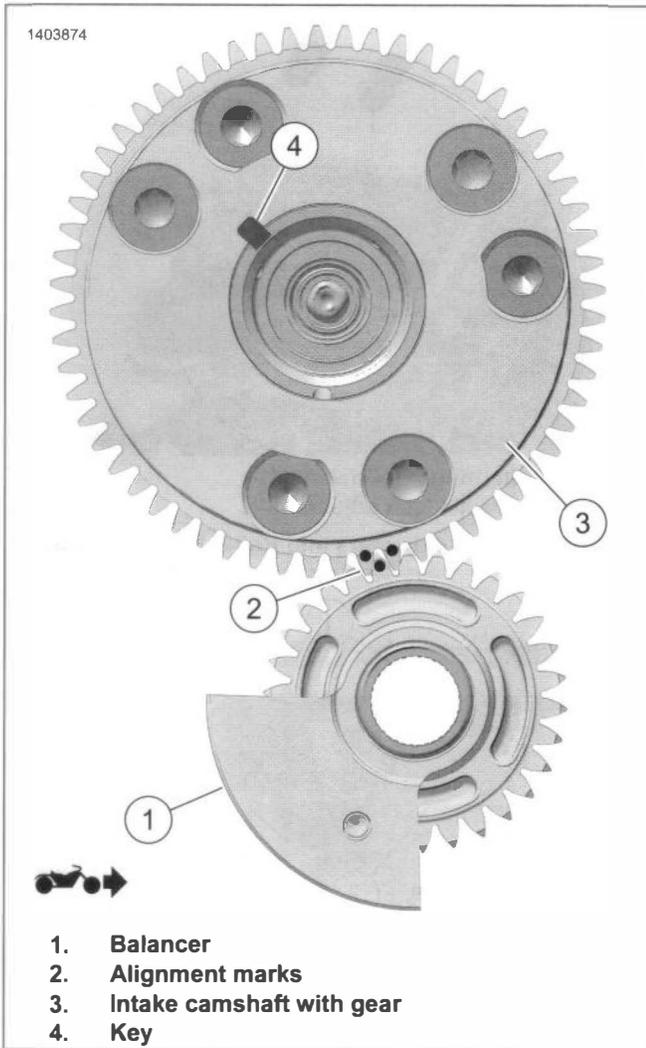
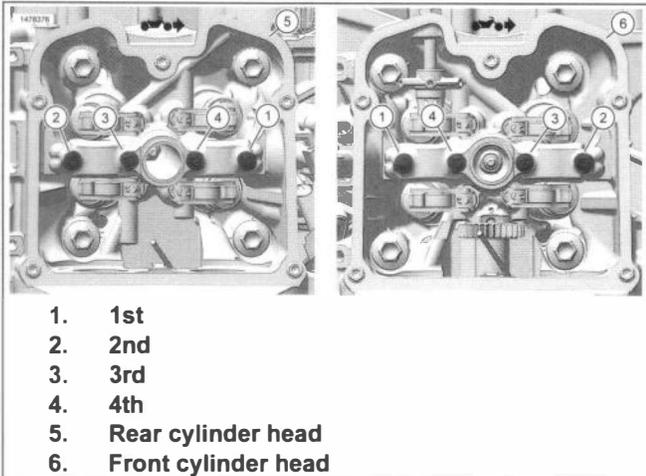


Figure 4-48. Balance Gear Alignments Marks (Front Cylinder Head Only)



1. 1st
2. 2nd
3. 3rd
4. 4th
5. Rear cylinder head
6. Front cylinder head

Figure 4-49. Camshaft Cap Screw Torque Sequence

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install cam phaser center screw. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
2. Install camshaft phasers with plate as an assembly. See PHASER SOLENOIDS (Page 4-22).
3. Install cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
4. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
5. Install ignition coil. See IGNITION COIL (Page 8-15).
6. Install camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
7. **Rear Camshaft:**
 - a. Install cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
 - b. Install fuel tank. See FUEL TANK (Page 6-12).
 - c. Install seat. See SEAT (Page 3-82).
8. **Front Camshaft:**
 - a. Install airbox assembly. See AIR BOX (Page 6-3).
 - b. Install fuel tank. See FUEL TANK (Page 6-12).
 - c. Install left steering head cover. See SIDE COVERS (Page 3-46).
 - d. Install seat. See SEAT (Page 3-82).
9. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
10. Install radiator assembly. See RADIATOR (Page 7-17).
11. Install chin spoiler. See CHIN SPOILER (Page 3-69).
12. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

NOTE

Abrasive particles can damage machined surfaces or plug oil passageways. Clean parts before disassembly to prevent component damage.

1. Use low-pressure compressed air to clean exterior surfaces of engine.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
5. Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
6. Remove cam timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
7. Remove ignition coil. See IGNITION COIL (Page 8-15).
8. Remove camshaft covers. See CAMSHAFT COVERS (Page 4-21).
9. Remove cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
10. Remove phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
11. Remove camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
12. Remove cam sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
13. Remove cylinder heads. See CYLINDER HEADS (Page 4-34).

REMOVE

1. See Figure 4-50. Remove cylinder (2) from crankcase.
2. Discard gasket (4).

INSTALL

NOTE

Verify that the piston, for the cylinder you are installing, is at top dead center. If it is not, remove crankshaft locking tool and

rotate crankshaft to position it at top dead center. The crankshaft locking tool can only be installed with the rear cylinder at top dead center. When working on the front cylinder the locking tool will just have to be removed.

1. **NOTE**

The gasket should remain attached to bottom of cylinder block for ease of installation.

Install cylinder.

- a. See Figure 4-50. Install **new** gasket (4) aligning with dowel pins (3) at bottom of cylinder (2).
2. Verify piston is at top dead center.
 3. Verify piston ring alignment. See PISTONS (Page 4-45).
 - a. Apply clean engine oil to piston, rings, and cylinder block bore.

NOTE

Install cylinder at a slight angle compressing piston rings (1) while rotating cylinder in position.

- b. Align the cylinder dowel pins to crankcase and slide into place.

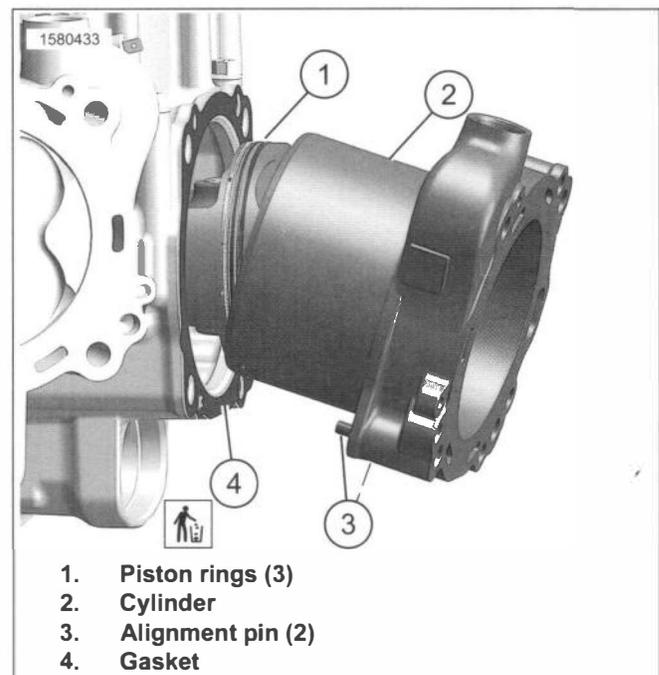


Figure 4-50. Cylinder Remove and Install
CLEAN AND INSPECT

NOTE

The cylinder wall has a special coating and can not be honed. Cylinders must be replaced if worn or damaged beyond use limits.

1. Clean all parts in a non-volatile cleaning solution. Dry parts with low-pressure, compressed air.

2. Inspect the cylinder bore for defects or damage in the piston ring travel area.
 - a. Inspect cylinder block for corrosion or cracking.
 - b. Cylinders with scratches shallower than the crosshatch surface and shorter than the length of piston travel are acceptable for use.
 - c. Run a fingernail across the scratches. If a scratch catches a fingernail, cylinder must be replaced.
 - d. Scoring or broad bands the length of piston travel, or evidence material transferred between piston and cylinder, require cylinder replacement.
3. Carefully remove any nicks or burrs from machined gasket surfaces.
4. Check gasket surfaces for flatness. Measure with a straightedge and feeler gauge.
5. Discard cylinder if either gasket surface flatness is not within wear limits. See SPECIFICATIONS (Page 4-3).

2. Install cam sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
3. Install camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
4. Install phasers solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
5. Install cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
6. Install camshaft covers. See CAMSHAFT COVERS (Page 4-21).
7. Install ignition coil. See IGNITION COIL (Page 8-15).
8. Install camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
9. Install primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
10. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
11. Install engine. See REPLACE ENGINE (Page 4-62).
12. Install main fuse. See POWER DISCONNECT (Page 8-4).

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install cylinder heads. See CYLINDER HEADS (Page 4-34).

PREPARE

NOTE

Abrasive particles can damage machined surfaces or plug oil passageways. Clean parts before disassembly to prevent component damage.

1. Use low-pressure compressed air to clean exterior surfaces of engine.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
5. Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
6. Remove camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
7. Remove ignition coil. See IGNITION COIL (Page 8-15).
8. Remove camshaft covers. See CAMSHAFT COVERS (Page 4-21).
9. Remove cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
10. Remove phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
11. Remove camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
12. Remove sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
13. Remove cylinder heads. See CYLINDER HEADS (Page 4-34).
14. Remove cylinders. See CYLINDERS (Page 4-43).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|---|
| HD-42320-D | PISTON PIN EXTRACTOR |
| HD-52966 | PISTON PIN CIRCLIP INSTALL/REMOVAL TOOL |
| HD-52967 | PISTON PIN REMOVAL TOOL |

NOTICE

Handle piston with extreme care. The alloy used in these pistons is very hard. Any scratches, gouges or other marks in the pistons could score the cylinder during engine operation and cause engine damage. (00546b)

NOTE

Support connecting rod to prevent piston from striking crankcase. The rod cannot hit the crankcase due to deck height of the block. Protect connecting rod to prevent damage while disassembled.

1. Cover cylinder opening to prevent piston pin circlip from falling into crankcase.
2. Remove circlip.
Special Tool: PISTON PIN CIRCLIP INSTALL/REMOVAL TOOL (HD-52966)
 - a. See Figure 4-52. Install circlip tool (1) into piston pin.
 - b. Place circlip tang in hole (2) in pliers as shown.
 - c. See Figure 4-53. Push on circlip tool while wiggling and pulling pliers (2).
 - d. Remove circlip (1) from pliers and discard.
3. Remove piston pin.
 - a. See Figure 4-57. Align adaptor (2) with piston pin removal tool (1).
Special Tool: PISTON PIN REMOVAL TOOL (HD-52967)
Special Tool: PISTON PIN EXTRACTOR (HD-42320-D)
 - b. See Figure 4-58. Insert piston pin removal tool (2) through piston pin.
 - c. Align longer leg (3) of adaptor (1) with front of piston (4).

NOTE

Shorter leg on adaptor will be aligned on back of piston.

- d. Install washer and nut on backside.
 - e. Turn handle clockwise.
 - f. Remove piston.
 - g. Remove piston pin from tool.
4. Remove second circlip if needed.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|---|
| HD-42320-D | PISTON PIN EXTRACTOR |
| HD-52966 | PISTON PIN CIRCLIP INSTALL/REMOVAL TOOL |
| HD-52967 | PISTON PIN REMOVAL TOOL |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |

NOTICE

Handle piston with extreme care. The alloy used in these pistons is very hard. Any scratches, gouges or other marks in the pistons could score the cylinder during engine operation and cause engine damage. (00546b)

NOTE

If both circlips were removed install first circlip on bench, do not use circlip tool.

1. See Figure 4-51. Install piston pin circlip (1) on one side of piston (3) with tang of circlip facing towards front of piston if removed.
 - a. Verify piston pin circlip is fully seated in piston pin groove.
2. Apply lubricant to piston pin (2), piston pin bores (5) and connecting rod bore (4).
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
3. Position piston on connecting rod with Arrow/FRT markings on top of piston pointing toward front of engine.

NOTE

Cover cylinder opening to prevent objects from falling into crankcase.

4. Install piston pin.
 - a. Install piston pin into piston.
 - b. See Figure 4-57. Align adaptor (2) with piston pin removal tool (1).
- Special Tool: PISTON PIN REMOVAL TOOL (HD-52967)
Special Tool: PISTON PIN EXTRACTOR (HD-42320-D)
- c. See Figure 4-58. Insert piston pin removal tool (2) through piston pin.
 - d. Align longer leg (3) of adaptor (1) with front of piston (4).
 - e. Install washer and nut on backside of tool.

NOTE

Wiggling tool handle aids in installation of piston pin.

- f. Turn handle clockwise until piston pin contacts circlip.
 - g. Remove piston pin tool.
5. Install second circlip.

Special Tool: PISTON PIN CIRCLIP INSTALL/REMOVAL TOOL (HD-52966)

- a. See Figure 4-54. Place circlip tang (1) facing towards front of piston and in groove as shown.
 - b. See Figure 4-55. Insert circlip tool with pin (1) on circlip tang.
 - c. See Figure 4-56. While pressing in on circlip tool (2) turn counter clockwise.
 - d. Verify piston pin circlip (1) is fully seated in piston pin groove.
6. See Figure 4-51. Verify smooth movement of piston (3) and piston pin (2) on connecting rod.

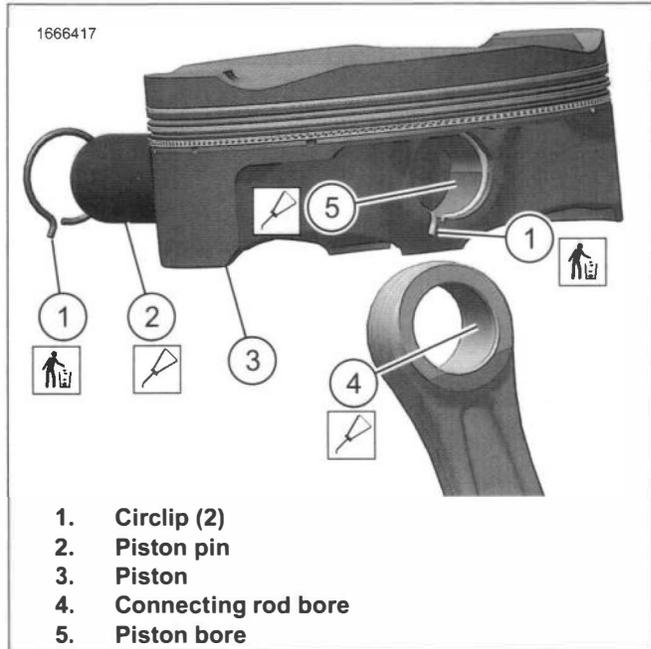


Figure 4-51. Piston Pin Assembly

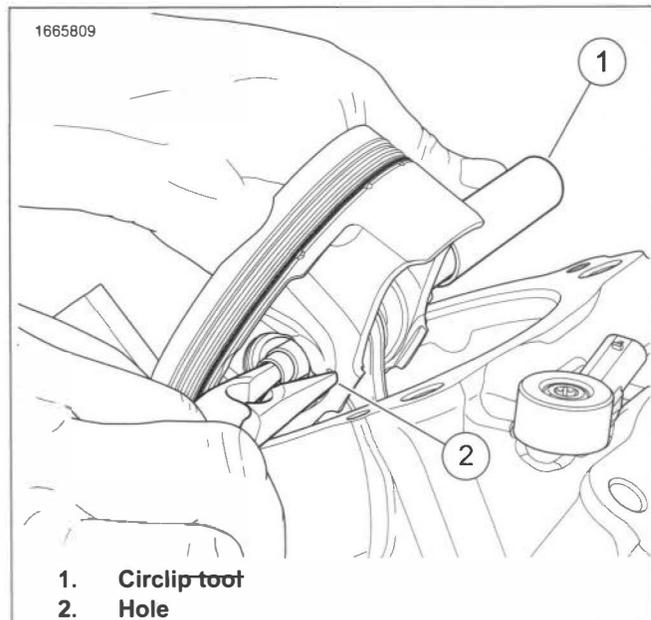


Figure 4-52. Circlip Pliers

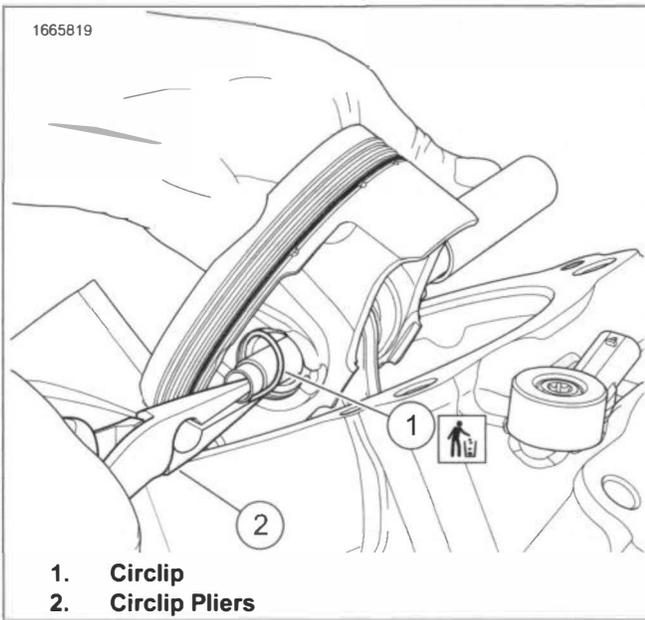


Figure 4-53. Circlip Removed

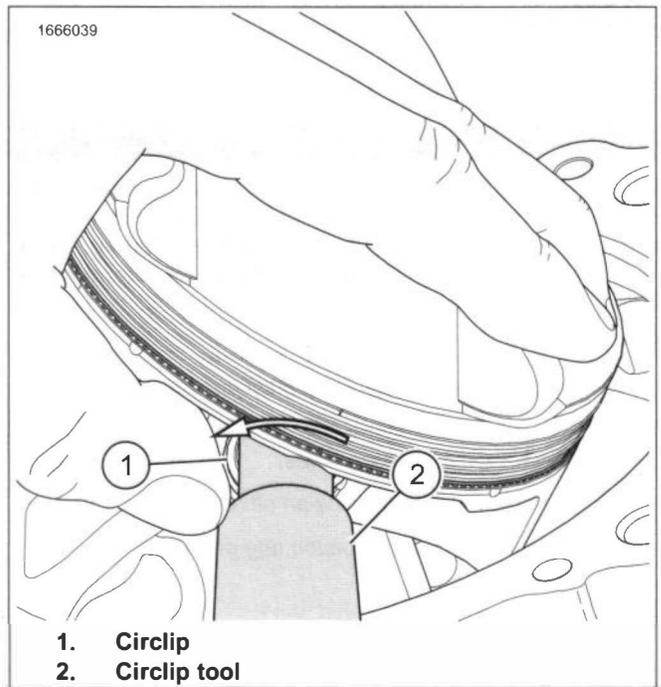


Figure 4-56. Installing Circlip

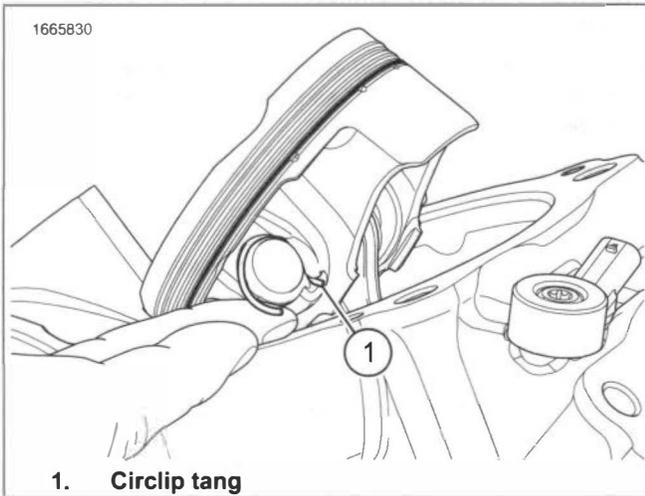


Figure 4-54. Circlip Alignment

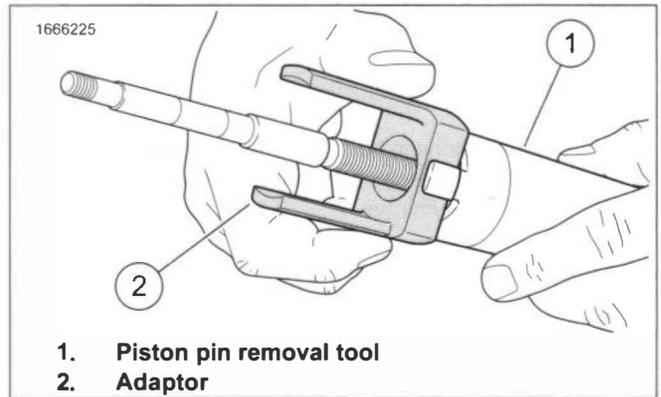


Figure 4-57. Piston Pin Removal Tool

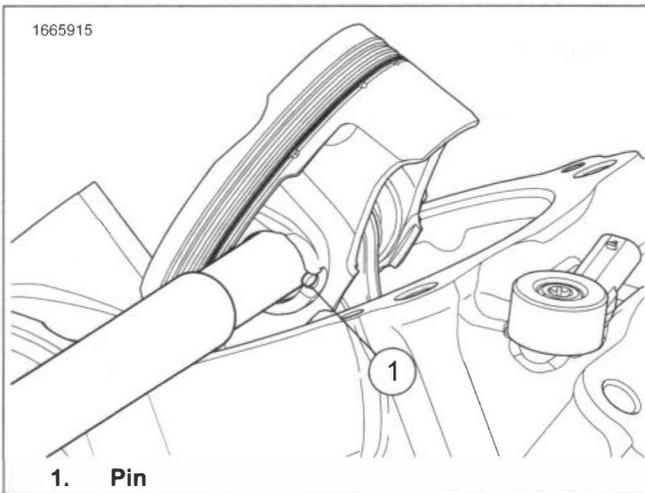


Figure 4-55. Circlip Tool Pin

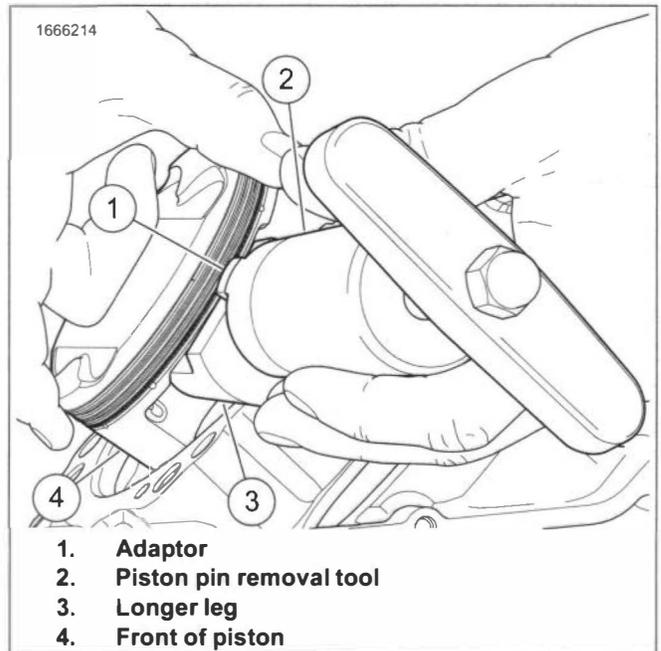


Figure 4-58. Piston Pin Removal Tool Assembled

DISASSEMBLE

1. Carefully remove piston rings from piston. Discard.

CLEAN AND INSPECT

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)

NOTE

- Do not sandblast or glass bead blast pistons. Bead blasting rounds off ring lands.
- Do not damage or enlarge holes.
- Do not use a wire brush to clean oil holes.
- Avoid scratching sides of piston ring grooves

1. Clean piston.

NOTE

A portion of a used compression ring properly ground to a sharp chisel-like edge works well to clean piston ring grooves.

- a. Remove all combustion deposits.
 - b. Soak pistons in hot water with dishwashing liquid or a cleaner designed to remove carbon and does not corrode aluminum.
 - c. Thoroughly rinse pistons.
 - d. Clean oil drain holes in oil control ring groove with a small bristle brush.
 - e. Dry parts with low-pressure compressed air.
 - f. Verify that all oil holes are open and clean.
2. Thoroughly clean the three piston ring grooves of all carbon deposits.

Inspect

1. Check piston running clearance.

NOTE

Pistons with superficial wear marks, minor scratching or mild scoring are acceptable for use.

- a. Insert a lightly oiled good piston pin into piston bore to feel for proper fit. The pin should slide in and out without binding, pivoting, or rocking.
 - b. Measure pin and pin bore diameters to determine running clearance. Replace piston and/or pin if clearance exceeds specified dimension. See SPECIFICATIONS (Page 4-3).
2. Carefully inspect pistons for damage or excessive wear. Discard if any following conditions are found:

NOTE

Thoroughly wash usable pistons to remove traces of dye.

- a. Using dye penetrant, inspect pistons for surface cracks. Particularly examine area around pin bores, ring lands and oil drain holes beneath piston crown.
- b. Cracked, worn or bent ring lands.
- c. Cracks, gouges, deep scratches or heavy scoring.
- d. Evidence of burning, etching or melting.
- e. Marks or imprints caused by contact with valves.

3. Lightly file to remove any dings, nicks or burns around edge of piston crown.

4. See Figure 4-59. Measure piston ring side clearance.

NOTE

Check piston clearance in the cylinder in which that piston will run.

- This inspection is very heat sensitive.
- Both piston and cylinder must be at room temperature before proceeding.
- The piston skirt coating has an oval shaped bare aluminum opening (1) on each side of the piston for proper micrometer placement.
- Use a blade (2) or ball anvil (3) style micrometer to measure piston.
 - a. Insert edge of a **new** ring into piston ring groove.
 - b. Insert a feeler gauge between upper surface of ring and ring land.
 - c. Repeat this check at several locations around piston.
 - d. Discard piston if side clearance of either compression ring or oil control ring exceeds specified dimension. See SPECIFICATIONS (Page 4-3).

5. Measure running clearance of pistons:

- a. Measure piston skirt at bare aluminum openings (1).
- b. Transfer measurement to dial bore gauge.
- c. Measure cylinder bore at top and middle of piston ring travel zone. Measure parallel and perpendicular to crankshaft.
- d. Replace piston and/or cylinder if running clearance exceeds service wear limits. See SPECIFICATIONS (Page 4-3).

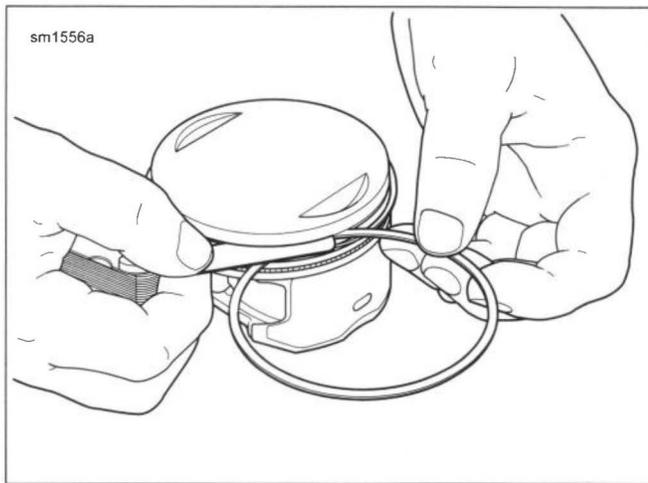


Figure 4-59. Measuring Ring Clearance in Groove

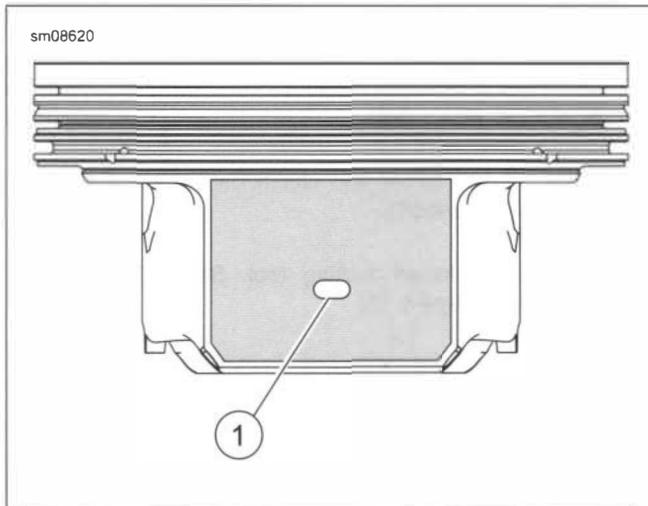


Figure 4-60. Measure Piston Running Clearance
CHECK PISTON RING GAP

NOTE

- Always install **new** piston rings.
- Insufficient piston ring end gap may cause the ends to touch at operating temperatures. This causes ring breakage, cylinder scuffing and/or piston seizure.
- Excessive piston ring end gap causes high oil consumption and blow-by of exhaust gases resulting in contaminated oil and reduced engine efficiency.

1. See Figure 4-61. Check piston ring end gap of each ring before installing on piston.
 - a. Insert piston ring into cylinder. Apply even downward force to align piston ring.
 - b. Measure piston ring end gap with feeler gauge. Refer to Table 4-5.

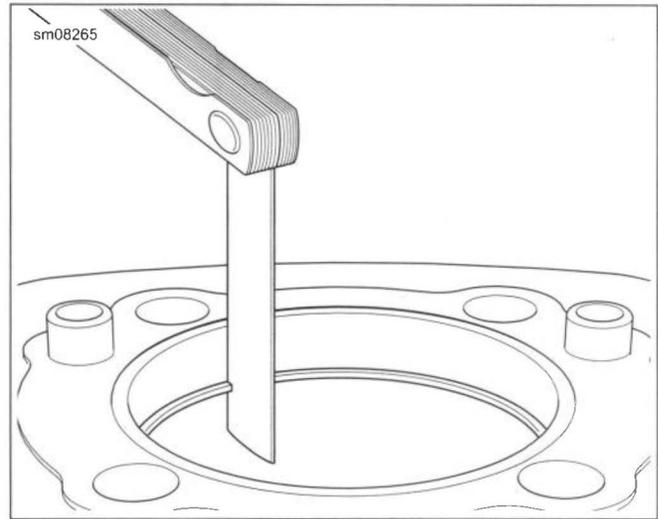


Figure 4-61. Measuring Ring Gap

ASSEMBLE

NOTE

Piston ring position is identical for both pistons.

1. See Figure 4-62. Install three-piece oil control ring.
 - a. Install expander ring (1) with ends facing up on piston (see inset).
 - b. Install lower oil rail (2).
 - c. Install upper oil rail (3).

NOTE

Verify that markings 1R and 2R on compression rings are installed facing up on piston. There will be paint marking the upper surface and can aid in orientating the rings.

2. Install second compression ring marked 2R (4).
3. Install top compression ring marked 1R (5).
4. Verify that all piston rings rotate freely.
5. Verify that all piston ring end gaps are positioned as noted, before installing cylinder over piston.
 - a. Rotate expander ring so that end gap is aligned with piston pin hole.
 - b. Rotate lower oil rail so that end gap is 45 degrees right of piston pin hole.
 - c. Rotate upper oil rail so that end gap is 45 degrees left of piston pin hole.

- d. Rotate second compression ring so that end gap is positioned over the piston pin right side.
- e. Rotate top compression ring so the end gap is positioned over the piston pin left side.

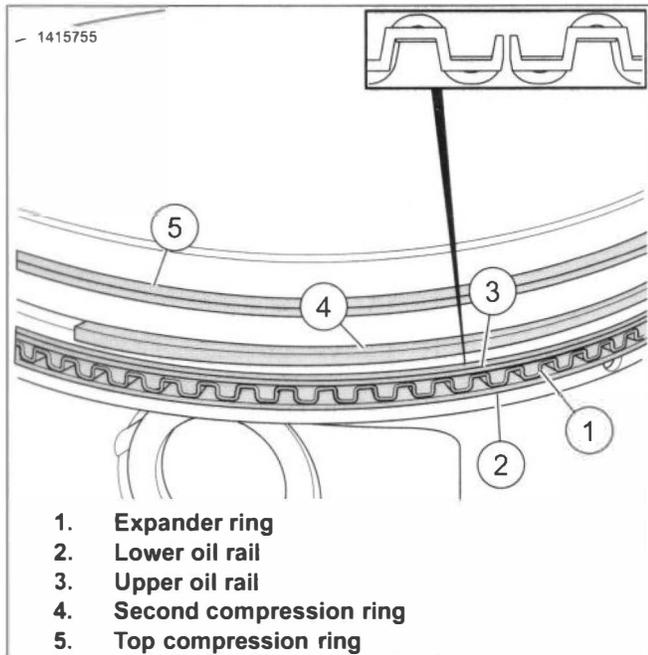


Figure 4-62. Piston Rings

COMPLETE

1. Install cylinders. See CYLINDERS (Page 4-43).
2. Install cylinder head. See CYLINDER HEADS (Page 4-34).
3. Install cam sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
4. Install camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
5. Install phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
6. Install cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
7. Install camshaft covers. See CAMSHAFT COVERS (Page 4-21).
8. Install ignition coil. See IGNITION COIL (Page 8-15).
9. Install camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
10. Install primary cover and clutch baffle. See PRIMARY COVER (Page 4-51).
11. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
12. Install engine. See REPLACE ENGINE (Page 4-62).
13. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Disconnect clutch cable. See CLUTCH CONTROL (Page 3-64)
4. Drain engine oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).

REMOVE

Primary Cover

1. See Figure 4-63. Remove screws (1).
2. Remove primary cover (7).
3. Remove and discard gasket (3).

Oil Baffle

1. See Figure 4-63. Remove screws (4, 6).
2. Remove oil baffle (5).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------|---------------|-------------|
| Oil baffle screws | 80–97 in-lbs | 9–11 N·m |
| Primary cover screws | 94–115 in-lbs | 10.6–13 N·m |

Oil Baffle

1. See Figure 4-63. Install oil baffle (5).
2. Install screws (4, 6).
Torque: 80–97 in-lbs (9–11 N·m) *Oil baffle screws*

Primary Cover

1. See Figure 4-63. Clean groove in primary cover (7) from all residual oil and debris.
2. Install **new** gasket (3) to primary cover (7).
3. Install primary cover.
 - a. Rotate clutch actuator (2) counter-clockwise.
 - b. Align and install primary cover (7) to engine.
 - c. Rotate clutch actuator (2) clockwise to set cover (7) in place and to engage the clutch mechanism.
 - d. Install screws (1).

4. See Figure 4-64. Tighten screws in sequence.
Torque: 94–115 in-lbs (10.6–13 N·m) *Primary cover screws*

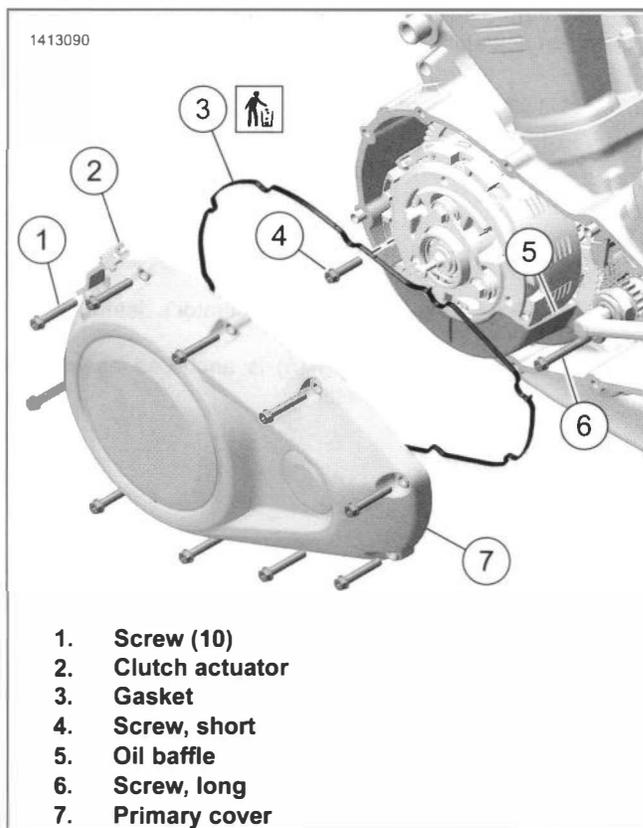


Figure 4-63. Primary Cover

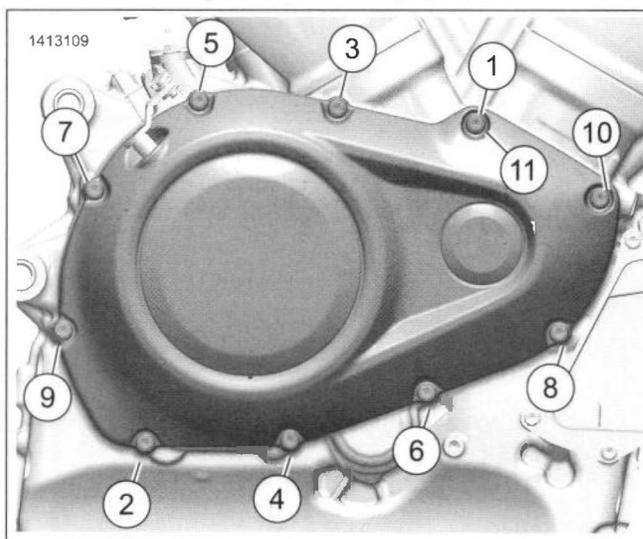


Figure 4-64. Primary Cover Torque Sequence
DISASSEMBLE

NOTE

Clutch actuator upper and lower bearings are NOT serviceable. Replaced the complete cover if they are worn.

1. See Figure 4-65. Remove spring (5) from clutch actuator's detent (1).

2. Remove clutch actuator (2).
3. Remove and discard seal (3).

ASSEMBLE

1. See Figure 4-65. Lubricate and install **new** seal (3) onto clutch actuator (2).
2. Install clutch actuator.
 - a. Position spring (5) into alignment with clutch actuator (2).
 - b. Install clutch actuator (2).
 - c. Lock spring (5) into clutch actuator's detent (1).
 - d. Other end of spring (5) is anchored against the primary cover's casting.

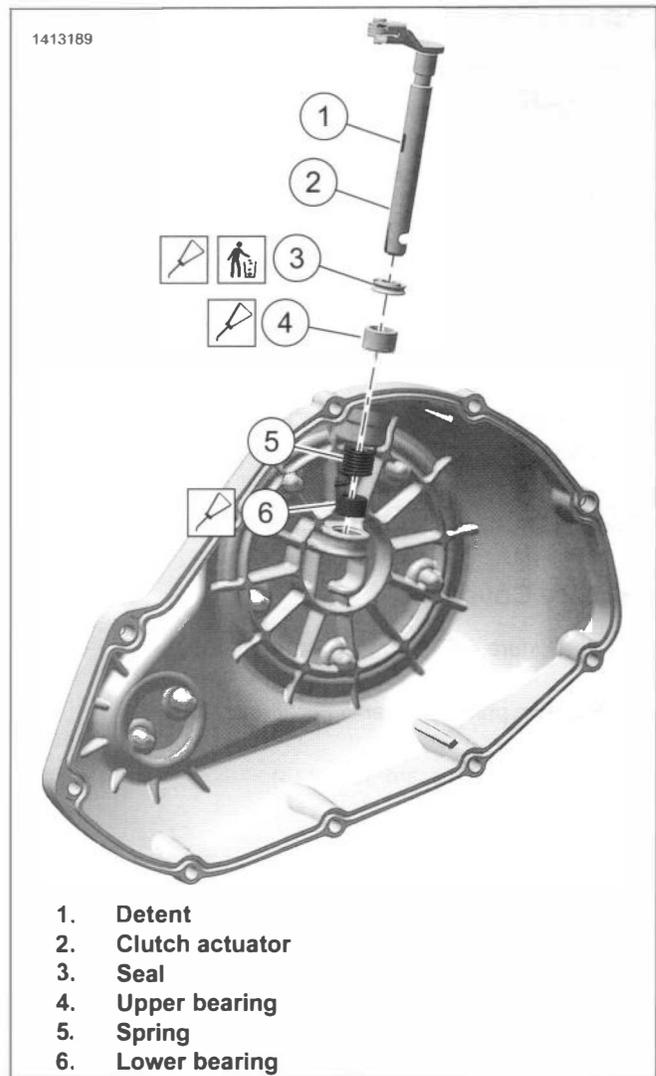


Figure 4-65. Clutch Actuator

COMPLETE

1. Connect clutch cable. See CLUTCH CONTROL (Page 3-64)
2. Service engine oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
3. Install chin spoiler. See CHIN SPOILER (Page 3-69).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Drain engine oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
4. Disconnect alternator harness from voltage regulator. See ALTERNATOR (Page 8-7).
5. Remove radiator. See RADIATOR (Page 7-17).
6. Disconnect oil cooler hoses. See OIL COOLER (Page 4-17).
7. Disconnect coolant temperature sensor connector. See ENGINE COOLANT TEMPERATURE (ECT) SENSOR (Page 7-16).
8. Disconnect crankshaft position sensor connector. See CRANKSHAFT POSITION SENSOR (CKP) (Page 8-40).
9. Remove shift lever. See RIDER FOOTRESTS (Page 3-77).
10. Remove Thermostat housing. See THERMOSTAT HOUSING (Page 7-10).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-45340 | GASKET ALIGNMENT DOWELS |

Coolant Manifold

1. See Figure 4-66. Remove screws (6 and 7).
2. See Figure 4-67. Install gasket alignment dowels (A) into position marked.
Special Tool: GASKET ALIGNMENT DOWELS (HD-45340)
3. See Figure 4-66. Remove clamp screws (2) and tube clamps (1).

NOTE

To prevent damage to the rotor/stator assembly, use the guide pin to lift cover straight off.

4. Remove coolant manifold.
 - a. Pull on coolant tubes (5) to release O-rings (4) from the cylinder heads.
 - b. Pull on coolant manifold tabs.
 - c. Remove coolant manifold (8).
5. Discard gasket (3).

Coolant Tubes

1. See Figure 4-66. Remove coolant tubes (5).
2. Discard O-rings (4).

Coolant Pump

1. See Figure 4-68. Remove coolant pump screws.
2. Remove coolant pump.

NOTE

Place a shop towel on the coolant manifold to protect the manifolds sealing surface.

- a. See Figure 4-69. Using a small screw drive, gently pry upward between the coolant pump (1) and coolant manifold (2).
- b. See Figure 4-70. Lift straight upward, remove coolant pump.
3. See Figure 4-71. Remove O-rings.
 - a. Discard the small (1) and large (2) O-rings if coolant pump is being reused.

Stator

1. See Figure 4-72. Disconnect and remove terminals (2) from stator connector (1).
2. See Figure 4-73. Remove stator screws (1).

NOTE

The stators harness grommet has a chance of leaking if used more than one time.

3. See Figure 4-74. Remove stator and harness, discard.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-45340 | GASKET ALIGNMENT DOWELS |

| FASTENER | TORQUE VALUE | |
|----------------------------------|--------------|----------|
| Coolant manifold screws | 71–89 in-lbs | 8–10 N·m |
| Coolant pump screw | 71–89 in-lbs | 8–10 N·m |
| Coolant tube clamp screw | 71–89 in-lbs | 8–10 N·m |
| Stator to coolant manifold screw | 71–89 in-lbs | 8–10 N·m |

Coolant Manifold

1. See Figure 4-66. Install **new** gasket (3) to crankcase.

NOTE

To prevent damage to the rotor/stator assembly, use the gasket alignment dowels to lower cover.

a. Use gasket alignment dowels as a guide.

2. Install coolant manifold.

a. Install coolant manifold (8).

NOTE

Installing the coolant tubes require alternating pressure on each tube until the coolant tubes O-rings are fully seated.

b. Apply a thin coat of engine oil to O-rings.

c. Simultaneously, install coolant tubes into cylinder head cavities.

3. Install coolant tube clamps (1) and screws (2). Tighten.

Torque: 71–89 **in-lbs** (8–10 N·m) *Coolant tube clamp screw*

4. See Figure 4-67. Remove alignment dowels (A) from positions marked.

Special Tool: GASKET ALIGNMENT DOWELS (HD-45340)

NOTE

See parts catalog for screw location.

5. See Figure 4-66. Install screws.

a. Install longs (6)

b. Install short screws (7).

6. See Figure 4-67. Tighten screws in sequence.

Torque: 71–89 **in-lbs** (8–10 N·m) *Coolant manifold screws*

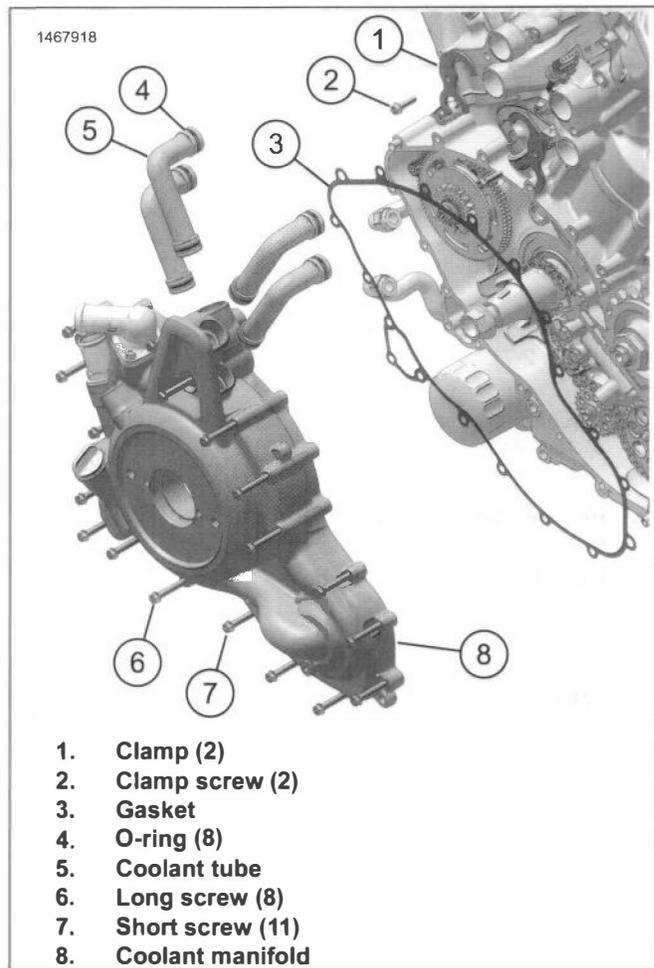
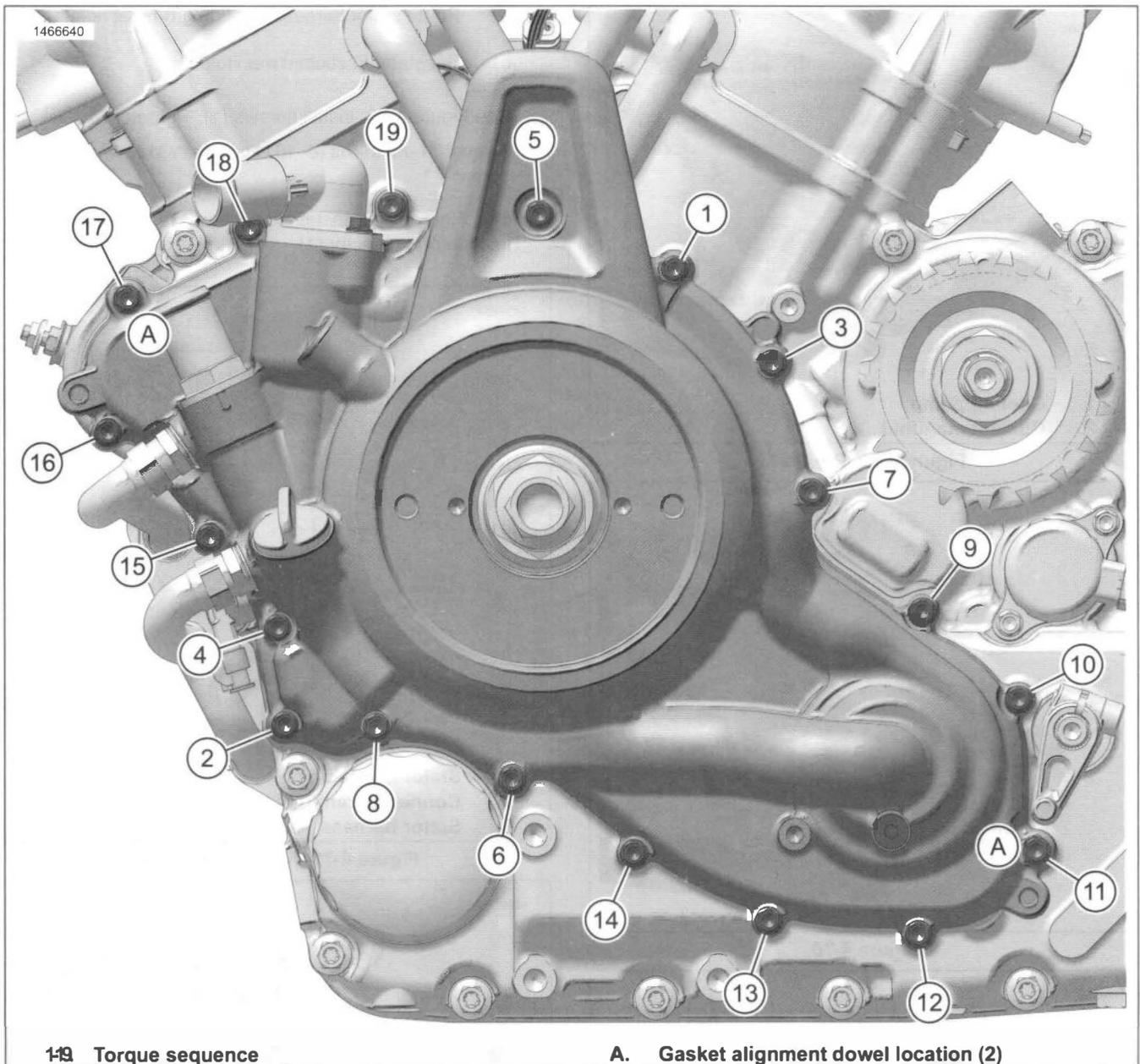


Figure 4-66. Coolant Manifold



1-19 Torque sequence

A. Gasket alignment dowel location (2)

Figure 4-67. Coolant Manifold Torque Sequence

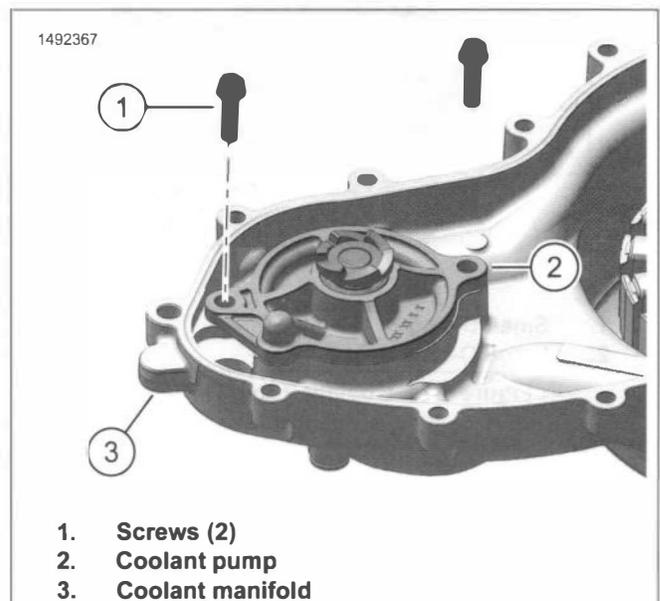
Coolant Tubes

1. See Figure 4-66. Lubricate **new** O-rings (4) with fresh engine oil.
2. Install O-ring's (4) to coolant tube (5).
3. Install long end of coolant tube (5) into coolant manifold (8). Adjust as needed.

Coolant Pump

1. See Figure 4-71. **If needed:** Install large and small O-rings (1 & 2).
2. Apply a light coat of engine oil to both O-rings.
3. See Figure 4-70. Position coolant pump assembly.
4. See Figure 4-68. Install screws (1). Tighten.

Torque: 71–89 in-lbs (8–10 N·m) *Coolant pump screw*



1. Screws (2)
2. Coolant pump
3. Coolant manifold

Figure 4-68. Coolant Pump Screws

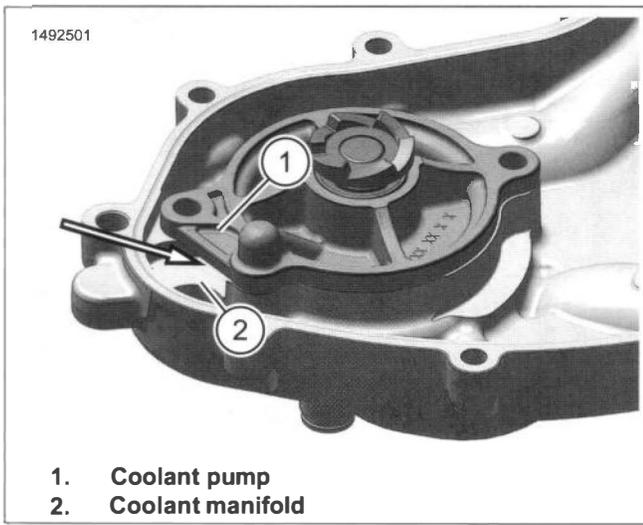


Figure 4-69. Pry Point

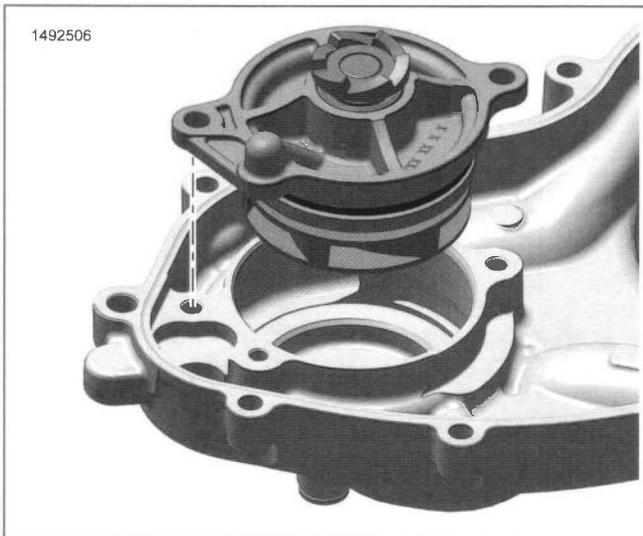


Figure 4-70.



Figure 4-71. Coolant Pump O-Rings

Stator

1. See Figure 4-74. Position stator.
 - a. Apply a light coat of engine oil to the stator grommet (2).

- b. Route stator harness through grommet hole.
 - c. Set stator in coolant manifold.
2. See Figure 4-73. Install screws (1). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Stator to coolant manifold screw*
 3. See Figure 4-72. Install stator harness (3) terminals (2) into stator connector (1).

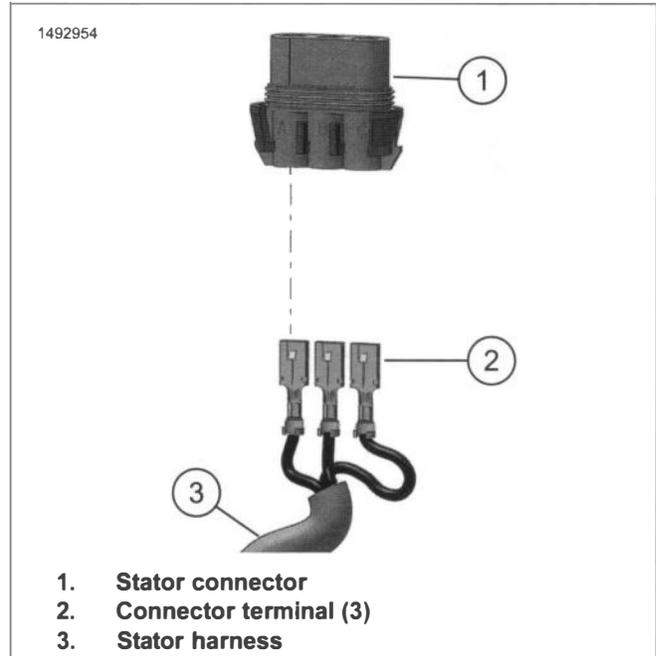


Figure 4-72. Stator Connector

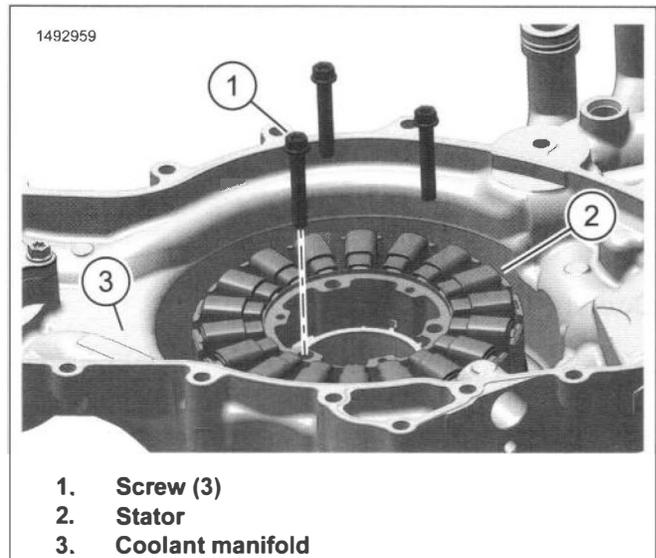
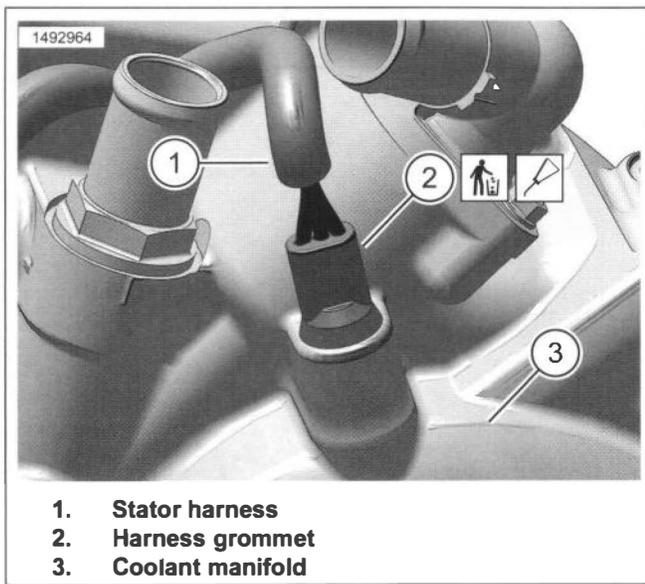


Figure 4-73. Stator Screws



1. Stator harness
2. Harness grommet
3. Coolant manifold

Figure 4-74. Stator Grommet

COMPLETE

1. Install thermostat housing. See THERMOSTAT HOUSING (Page 7-10).
2. Install shift lever. See RIDER FOOTRESTS (Page 3-77).
3. Connect crankshaft position sensor connector. See CRANKSHAFT POSITION SENSOR (CKP) (Page 8-40).
4. Connect coolant temperature sensor connector. See ENGINE COOLANT TEMPERATURE (ECT) SENSOR (Page 7-16).
5. Connect oil cooler hoses. See OIL COOLER (Page 4-17).
6. Install radiator. See RADIATOR (Page 7-17).
7. Bleed coolant system. See COOLANT (Page 7-7).
8. Connect alternator harness from voltage regulator. See ALTERNATOR (Page 8-7).
9. Fill engine oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
10. Install chin spoiler. See CHIN SPOILER (Page 3-69).
11. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove coolant manifold. See COOLANT MANIFOLD (Page 4-53).
3. Remove electrical rotor. See ALTERNATOR (Page 8-7).

REMOVE

1. See Figure 4-75. Remove screw (1).
2. Remove starter gear (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------|--------------|-----------|
| Starter gear screw | 29–37 ft-lbs | 39–50 N·m |

1. See Figure 4-75. Install starter gear (2).
2. Install screw (1). Tighten.
Torque: 29–37 ft-lbs (39–50 N·m) *Starter gear screw*

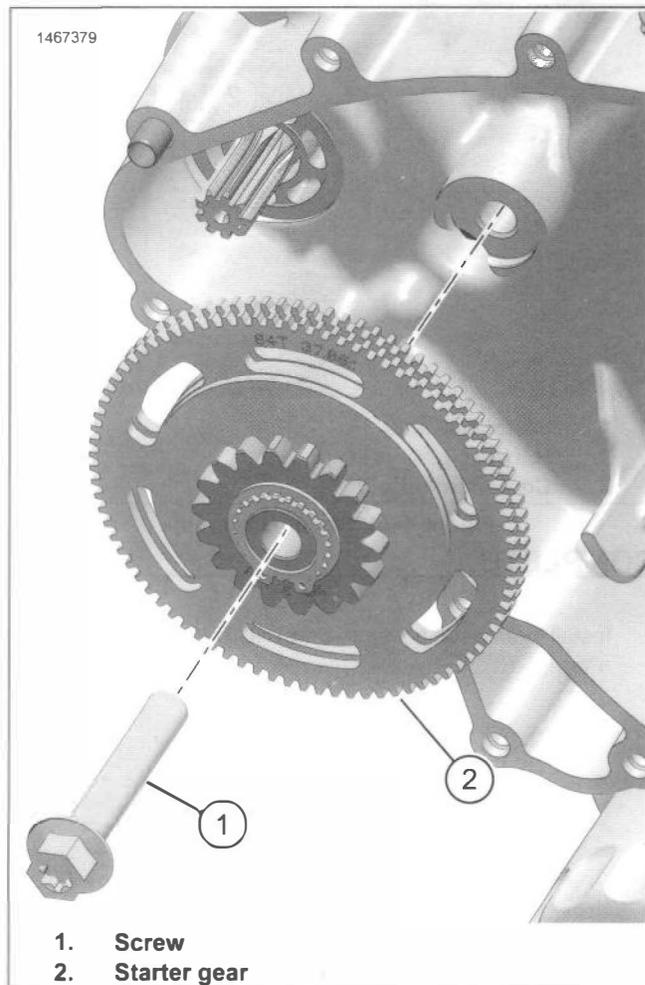


Figure 4-75. Starter Gear

COMPLETE

1. Install electrical rotor. See ALTERNATOR (Page 8-7).
2. Install coolant manifold. See COOLANT MANIFOLD (Page 4-53).
3. Remove main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Install crankshaft lockout tool. See CRANKSHAFT LOCKOUT (Page 4-18).
3. Remove coolant manifold. See COOLANT MANIFOLD (Page 4-53).
4. Remove alternator. See ALTERNATOR (Page 8-7).

REMOVE

1. See Figure 4-76. Remove screw (4).
2. Remove chain tensioner.
 - a. Remove screws (2).
 - b. Remove chain tensioner (8).
 - c. Retract chain tensioner shoe and hold in place using a paper clip or suitable wire.
3. Remove balancer sprocket.
 - a. See Figure 4-77. Install balance sprocket locking tool.
 - b. See Figure 4-76. Remove screw (6).
 - c. Remove balance sprocket (7)
4. Remove oil pump sprocket (5).
5. Remove upper chain guide.
 - a. Remove screw (2).
 - b. Remove upper chain guide (3).

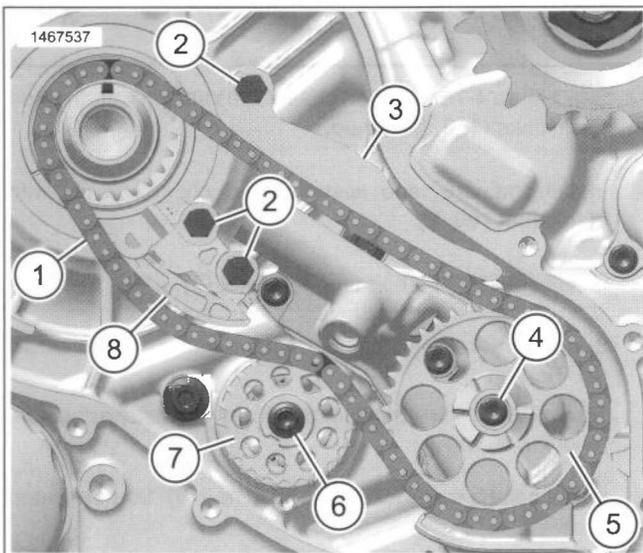
2. See Figure 4-78. Position chain (8) as shown with marked chain links (1, 6) facing up.
3. Install chain (8) and align marked chain link (1) with crankshaft key (2).
4. Install chain (8) on oil pump sprocket (7).
5. See Figure 4-76. Install upper chain guide (3) and screw (2). Tighten.
Torque: 58–75 **in-lbs** (6.5–8.5 N·m) *Upper chain guide, oil pump, screw*
6. Install balancer sprocket (7) and screw (6). Do not tighten screw.
7. See Figure 4-78. Rotate balancer sprocket (4) and align diamond hole (5) with marked chain link (6).
8. See Figure 4-76. Install chain tensioner.
 - a. Reset chain tensioner (8) to lowest setting or tension.
 - b. Install chain tensioner (8).
 - c. Install screws (2). Tighten.
Torque: 58–75 **in-lbs** (6.5–8.5 N·m) *Chain tensioner, oil pump, screws*
9. Install balancer sprocket locking tool.
 - a. See Figure 4-77. Install balancer sprocket locking tool.
Special Tool: BALANCER SPROCKET LOCKING TOOL (HD-52964)
 - b. See Figure 4-76. Tighten screw (6).
Torque: 310–327 **in-lbs** (35–37 N·m) *Balancer sprocket screw*
10. Tighten screw (4).
Torque: 80–97 **in-lbs** (9–11 N·m) *Oil pump sprocket screw*

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|--------------------------------|
| HD-52964 | BALANCER SPROCKET LOCKING TOOL |

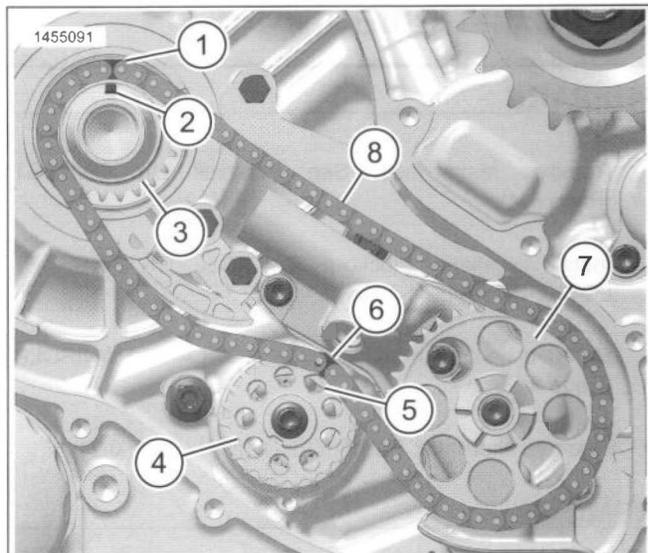
| FASTENER | TORQUE VALUE | |
|------------------------------------|-----------------------|-------------|
| Balancer sprocket screw | 310–327 in-lbs | 35–37 N·m |
| Chain tensioner, oil pump, screws | 58–75 in-lbs | 6.5–8.5 N·m |
| Oil pump sprocket screw | 80–97 in-lbs | 9–11 N·m |
| Upper chain guide, oil pump, screw | 58–75 in-lbs | 6.5–8.5 N·m |

1. See Figure 4-76. Install oil pump sprocket (5) and screw (4). Do not tighten screw.



1. Chain
2. Short screw (3)
3. Upper chain guide
4. Long flange screw
5. Oil pump sprocket
6. Flange screw
7. Balancer sprocket
8. Chain tensioner

Figure 4-76. Oil Pump and Balancer Drive



1. Marked chain link
2. Crankshaft key
3. Crankshaft
4. Balancer sprocket
5. Diamond hole
6. Marked chain link
7. Oil pump sprocket
8. Chain

Figure 4-78. Chain Alignment

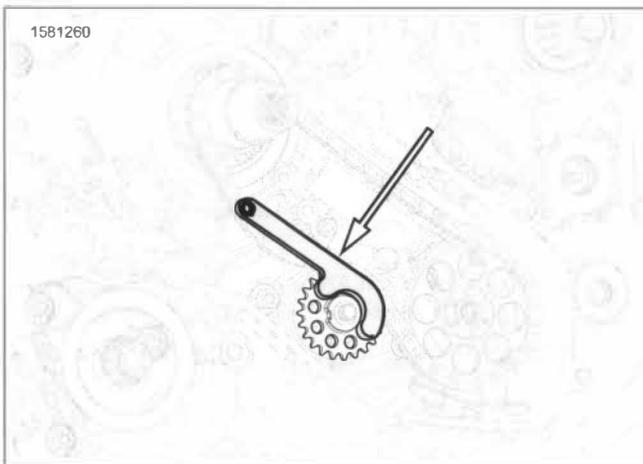


Figure 4-77. Balance Sprocket Locking Tool

COMPLETE

1. Install alternator. See ALTERNATOR (Page 8-7).
2. Install coolant manifold. See COOLANT MANIFOLD (Page 4-53).
3. Remove crankshaft lockout tool. See CRANKSHAFT LOCKOUT (Page 4-18).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Install crankshaft lockout tool. See CRANKSHAFT LOCKOUT (Page 4-18).
3. Remove coolant manifold. See COOLANT MANIFOLD (Page 4-53).
4. Remove alternator. See ALTERNATOR (Page 8-7).
5. Remove oil pump drive. See OIL PUMP DRIVE (Page 4-59).

REMOVE

1. See Figure 4-79. Remove screws (6).
2. Remove oil pump (5).
3. Discard gasket (4).
4. Remove inner (3) and outer (2) rotors.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------------|--------------|----------|
| Oil pump (pressure side) screws | 80–97 in-lbs | 9–11 N·m |

1. **NOTE**
Dimple in rotors should face out ward.

See Figure 4-79. Install gerotor assembly.

- a. Lubricate both rotors with fresh oil.
- b. Install outer rotor (2) in crankcase.
- c. Install inner rotor (3) onto oil pump shaft (1) and into outer rotor (2).
- d. Check inner rotor (3) rotates freely in outer rotor (2).
- e. Check tip clearance of all lobes: 0.006 in (0.15 mm) maximum.

2. Install oil pump assembly.
 - a. Clean groove in oil pump (5) from all residual oil and debris.
 - b. Install **new** gasket (4).
 - c. Install oil pump (5).
 - d. Install screws (6). Tighten center screw first followed by criss-cross pattern.

Torque: 80–97 **in-lbs** (9–11 N·m) *Oil pump (pressure side) screws*

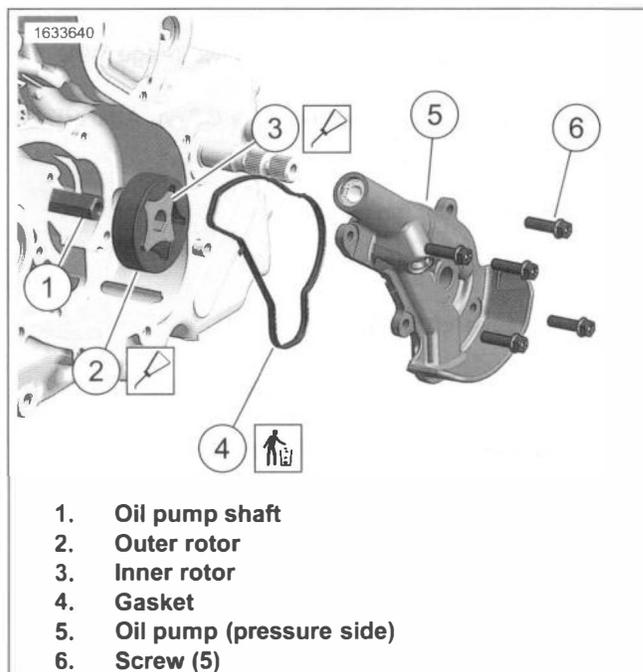


Figure 4-79. Oil Pump

COMPLETE

1. Install oil pump drive. See OIL PUMP DRIVE (Page 4-59).
2. Install alternator. See ALTERNATOR (Page 8-7).
3. Install coolant manifold. See COOLANT MANIFOLD (Page 4-53).
4. Remove crankshaft lockout tool. See CRANKSHAFT LOCKOUT (Page 4-18).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|---------------------------|
| HD-52960 | ENGINE SUPPORT PLATE |
| HD-52960-BK | ENGINE PLATE SPACERS |
| HD-52985 | DRIVE PULLEY LOCKING TOOL |
| HD-53022 | POWERTRAIN R&R FIXTURE |

1. Remove seat. See SEAT (Page 3-82).

NOTE

When mounting hardware is removed, fuel tank may move. Protect fuel tank from damage.

2. Purge fuel line. See PURGE FUEL LINE (Page 6-9).

3. Remove rear fender assembly. See COWL AND REAR FENDERS (Page 3-68).

- a. Remove rear fender cowl.
- b. Remove right fender.
- c. Remove left fender.

4. Remove seat bracket latch. See SEAT (Page 3-82).

5. Remove fuel tank. See FUEL TANK (Page 6-12).

6. Remove steering head covers. See SIDE COVERS (Page 3-46).

- a. Remove right side steering head cover.
- b. Remove left side steering head cover.

7. Remove main fuse. See POWER DISCONNECT (Page 8-4).

8. Remove tail section cross-member. See FRAME CROSSMEMBER (Page 3-89).

9. Remove frame covers. See SIDE COVERS (Page 3-46).

- a. Remove right frame cover.
- b. Remove left frame cover.

10. Detach brake line clamps. See Brake Line: Front Caliper to ABS Module (Page 3-35).

- a. Detach brake line clamp from cylinder head cover caddy.
- b. Detach rear brake line clamp.

11. Remove air box assembly. See AIR BOX (Page 6-3).

12. Remove spark plug cables. See SPARK PLUG CABLES (Page 8-14).

13. Remove side-mount ignition coil. See IGNITION COIL (Page 8-15).

14. **If equipped:** Disconnect EVAP line at front of coil mount.

15. Remove coil mount. See IGNITION COIL (Page 8-15).

16. Remove induction module. See INDUCTION MODULE (Page 6-26).

17. Disconnect electrical connectors.

- a. ECM
- b. Top coils.
- c. Sensor jumper.
- d. Phaser solenoids.
- e. Cam timing sensors.
- f. Knock sensor.
- g. Coolant temperature sensor.
- h. Oil pressure switch.

18. Remove ECM. See ELECTRONIC CONTROL MODULE (ECM) (Page 8-33).

19. Remove cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).

20. Cut right side wire harness guide cable straps.

21. Disconnect connectors at front electrical caddy. See FRONT ELECTRICAL CADDY (Page 8-50).

- a. Disconnect air temp sensor.

22. Remove chin spoiler. See CHIN SPOILER (Page 3-69).

23. Drain engine coolant. See COOLANT (Page 7-7).

24. Drain engine oil and discard oil filter. See REPLACE ENGINE OIL AND FILTER (Page 2-7).

25. **If equipped:** Disconnect purge valve from voltage regulator mounting bracket. See PURGE SOLENOID: EVAPORATIVE EMISSIONS (Page 6-36).

26. Disconnect both battery cables. See INSPECT BATTERY (Page 2-37).

27. Disconnect solenoid to starter cable. See STARTER SOLENOID (Page 8-6).

28. Remove voltage regulator mount. See VOLTAGE REGULATOR (Page 8-12).

- a. Remove voltage regulator.
- b. Remove voltage regulator mounting bracket.

29. Remove battery. See INSPECT BATTERY (Page 2-37).

30. Remove coolant overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).

31. Remove radiator. See RADIATOR (Page 7-17).

32. **If equipped:** Remove charcoal canister. See CHARCOAL CANISTER: EVAPORATIVE EMISSIONS (Page 6-37).

33. Remove left foot control bracket. See RIDER FOOTRESTS (Page 3-77).

34. Detach right foot control bracket. Secure onto tail section. See RIDER FOOTRESTS (Page 3-77).

35. Remove battery tray. See BATTERY TRAY (Page 8-57).

36. Disconnect electrical connectors and ground connections.

- a. Ground cable (dirty ground).
- b. Main harness ground (dirty ground).
- c. Crank position sensor.
- d. Disconnect O2 sensors.
- e. Secure out of way.

37. Remove jiffy stand. See JIFFY STAND (Page 3-80).

38. Remove front belt guard. See BELT GUARDS (Page 3-60).

- a. Remove top belt guard.

NOTE

Use *DRIVE PULLEY LOCKING TOOL (PART NUMBER: HD-52985)* when removing transmission pulley nut.

39. Loosen transmission pulley nut. See OUTPUT PULLEY (Page 5-6).

40. Remove exhaust system. See EXHAUST SYSTEM (Page 6-35).

- a. Leave rear port extension header on engine.

41. Remove top chain guard. See BELT GUARDS (Page 3-60).

42. Disconnect gear position sensor. See GEAR POSITION SENSOR (Page 8-43).

NOTE

Using a flat jack, without the rubber pad on the top surface, will help when removing the powertrain.

43. See Figure 4-80. Install support plate to bottom of engine using the correct engine plate spacers.

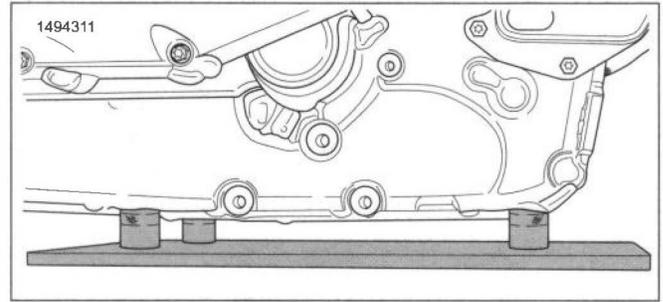


Figure 4-80. Engine Support Plate

Special Tool: ENGINE SUPPORT PLATE (HD-52960)

Special Tool: ENGINE PLATE SPACERS (HD-52960-BK)

44. Detach rear brake caliper. Secure out of the way. See REAR BRAKE CALIPER (Page 3-32).

- a. Remove P-clamps from rear fork.

45. Remove rear wheel. See REAR WHEEL (Page 3-9).

46. Secure ABS sensor onto tail section.

47. Remove drive belt. See DRIVE BELT (Page 5-5).

48. Disconnect rear shock. See REAR SHOCK ABSORBER (Page 3-61).

- a. Disconnect top of rear shock from cylinder head.
- b. Disconnect suspension links from suspension mounting bracket.

49. Loosen midframe fasteners. See FRAME (Page 3-85).

50. Remove rear fork with shock assembly. See REAR FORK (Page 3-58).

NOTE

Retain midframe for the following steps.

51. Reinstall left midframe-to-head top screw. Tighten finger tight.

52. Detach clutch cable from engine and actuator. See CLUTCH CONTROL (Page 3-64).

- a. Relocate clutch cable to front frame and secure.

53. Install powertrain R&R fixture.

Special Tool: POWERTRAIN R&R FIXTURE (HD-53022)

- a. Remove both rear head-to-front frame bolts from the left side. See Front Frame in FRAME (Page 3-85).

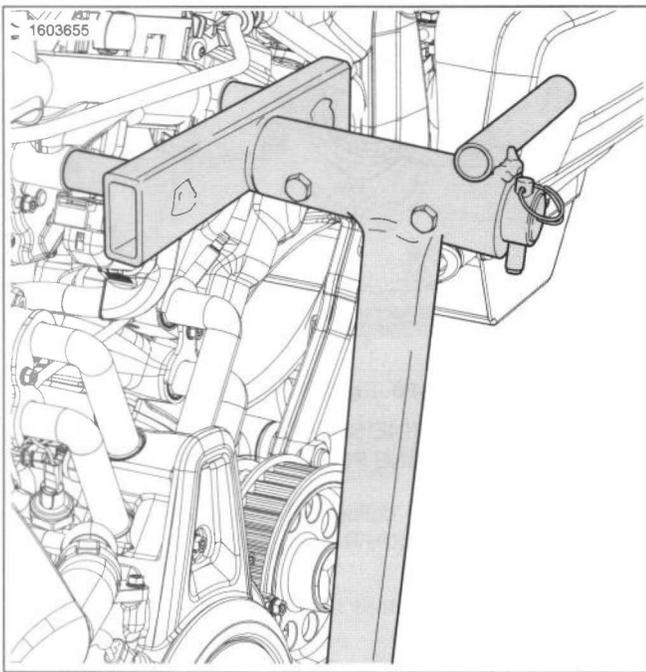


Figure 4-81. Powertrain R&R Fixture Installed (Outboard Side)

- b. See Figure 4-82. Install plate from inboard side of frame.

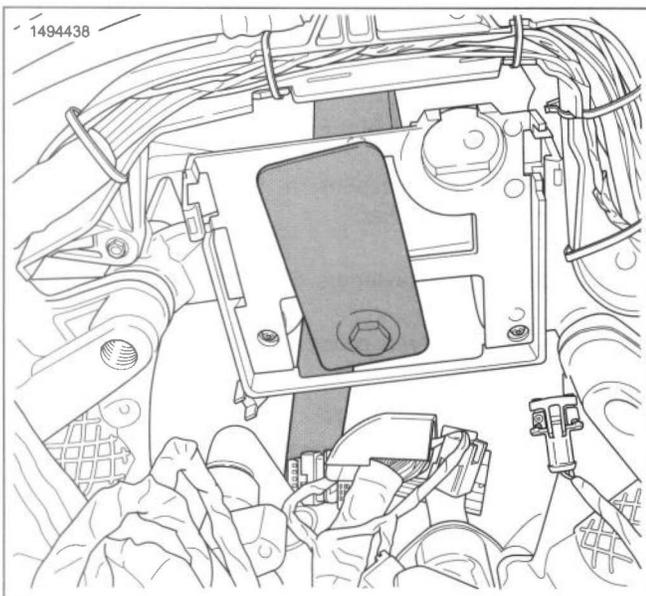


Figure 4-82. Powertrain Fixture Installed (inboard side)

- 54. Detach tail section. See TAIL SECTION (Page 3-83).
 - a. Remove screws.
 - b. Swing tail section to the left.
 - c. See Figure 4-83. Support tail section on top of Powertrain R&R Fixture.

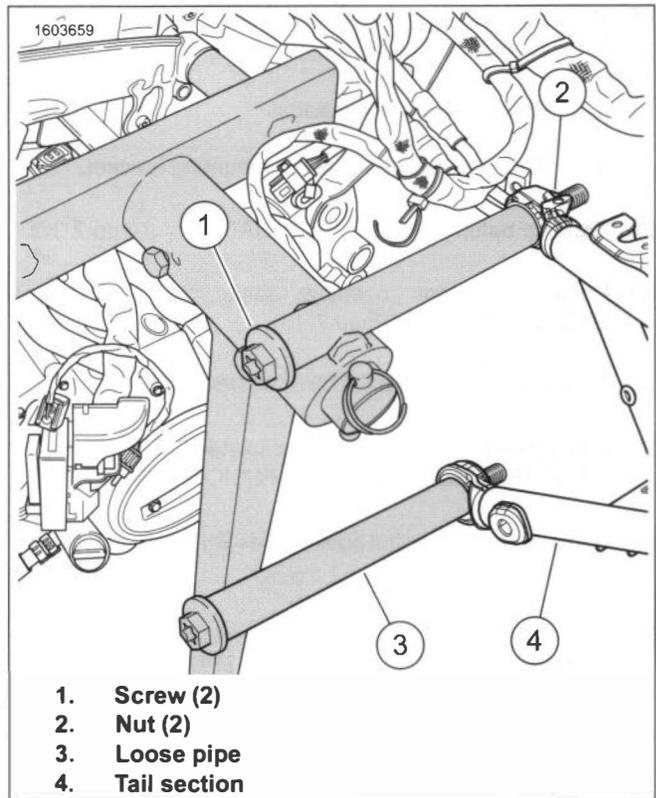


Figure 4-83. Tail Section on Fixture

- 55. Remove mid frame from engine.
- 56. Detach front frame. See front frame in FRAME (Page 3-85).
 - a. Remove both rear head-to-front frame bolts from the right side.
 - b. Loosen, do not remove, both front head-to-front frame bolts.
- 57. Lower flat jack.
 - a. See Figure 4-84. Lower flat jack. Make sure engine support plate and flat jack do not bind.

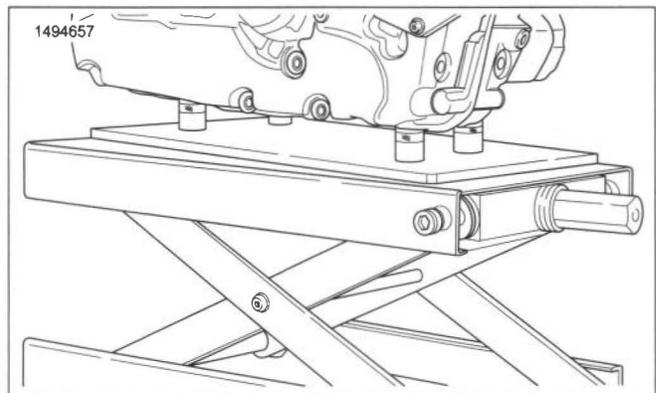


Figure 4-84. Powertrain on Flat Jack

- b. See Figure 4-85. Once flat jack reaches end of travel, place a section of 2 X 4 between flat jack and engine support plate.

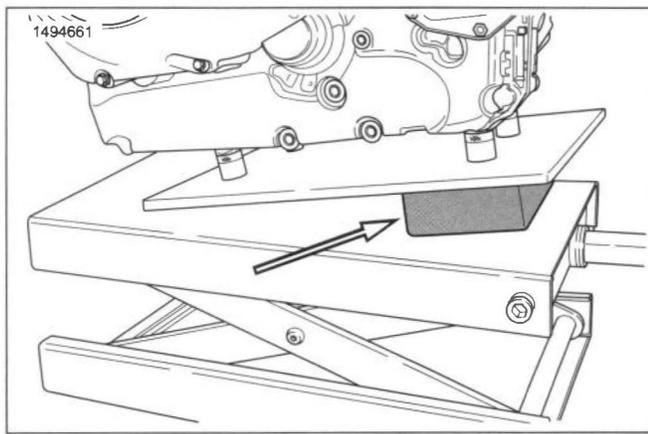


Figure 4-85. 2X4 in Position

- c. See Figure 4-86. Secure powertrain to flat jack.

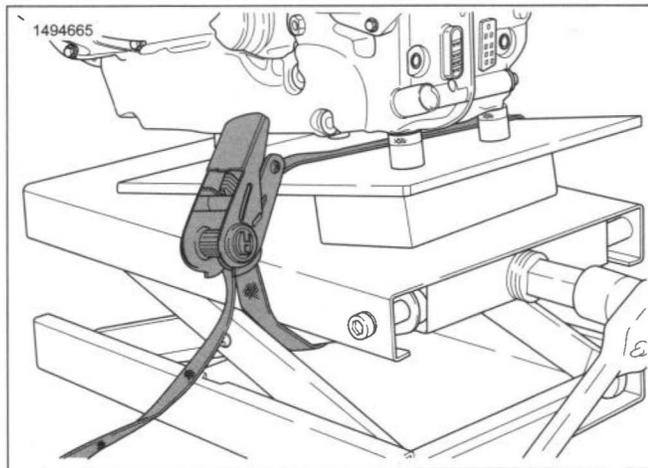


Figure 4-86. Powertrain Secured

58. Remove front head-to-front frame bolts. See FRAME (Page 3-85).

59. Remove engine from front frame.

- a. Check the clearance of harness, cables and other miscellaneous items when removing engine.
- b. Lower engine to clear frame and components.
- c. Remove the powertrain by sliding backwards out of front frame.

60. Transfer engine components.

- a. Sensor harness.
- b. Drive pulley.
- c. Suspension mounting bracket.
- d. Knock sensor.
- e. Gear position sensor.
- f. Rear port extension header.
- g. Starter.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|---------------------------|
| HD-52960 | ENGINE SUPPORT PLATE |
| HD-52960-BK | ENGINE PLATE SPACERS |
| HD-52985 | DRIVE PULLEY LOCKING TOOL |
| HD-53022 | POWERTRAIN R&R FIXTURE |

1. Install engine support plate to bottom of engine using the correct engine plate spacers.

Special Tool: ENGINE SUPPORT PLATE (HD-52960)
Special Tool: ENGINE PLATE SPACERS (HD-52960-BK)

2. Prepare powertrain for installation.

- a. Lift powertrain.
- b. See Figure 4-85. Lower powertrain onto flat jack and 2 X 4.
- c. See Figure 4-86. Secure powertrain to flat jack.

3. Verify components have been transferred to new engine.

- a. Starter.
- b. Rear port extension header.
- c. Knock sensor
- d. Gear position sensor
- e. Suspension mounting bracket.
- f. Transmission pulley.
- g. Sensor harness.

4. Install engine and connect front frame.

- a. Align powertrain and front frame.
- b. Slowly install engine to front frame.
- c. Check clearance of harness wires, cables and other miscellaneous items when installing engine.
- d. Lift flat jack until powertrain and front frame mounting holes are aligned.
- e. Install front head-to-front frame screws. Tighten finger tight.
- f. Remove strap securing powertrain.
- g. Remove 2 X 4.
- h. Using flat jack, align rear head-to-front frame screw holes on right side.
- i. Install rear head-to-front frame screws. Tighten finger tight.

5. Install midframe to powertrain using top head screws.

6. Install tail section.
 - a. Swing tail section into position.
 - b. Install screws.
 - c. Route wire harness and brake components.
 - d. Install lower midframe to powertrain with screws. Tighten finger tight.

NOTE

Midframe screws were used to secure tail section to support fixture.

7. Remove special tool.
Special Tool: POWERTRAIN R&R FIXTURE (HD-53022)
8. Install rear head-to-front frame screws on left side. Tighten finger tight.
9. Tighten all front frame screws in sequence. See FRAME (Page 3-85).
10. Install clutch cable. See CLUTCH CONTROL (Page 3-64).
11. Route and connect electrical connectors.
 - a. Gear position sensor
12. Install rear fork with shock assembly. See REAR FORK (Page 3-58).
 - a. Install rear fork pivot shaft.
 - b. Connect top of rear shock to cylinder head.
 - c. Install suspension links.
13. Tighten screws in the following sequence.
 - a. Top shock screw. See REAR SHOCK ABSORBER (Page 3-61).
 - b. Bottom shock screw to spider bracket.
 - c. Midframe screws.
 - d. Swing arm pivot shaft.
 - e. Pivot shaft pinch screw.
 - f. Top tail section screws.
14. Install rear wheel. See REAR WHEEL (Page 3-9).
15. Install drive belt. See DRIVE BELT (Page 5-5).
16. Attach rear brake caliper. See REAR BRAKE CALIPER (Page 3-32).
 - a. Route brake line along rear fork. Refer to BRAKE LINES (Page 3-34).

- b. Secure brake line and rear wheel speed sensor harness with P-clamps.
 - c. Install rear wheel speed sensor wire retainers to rear brake line. See tape for location reference.
17. Install belt guard. See BELT GUARDS (Page 3-60).

18. Remove engine support plate.
Special Tool: ENGINE SUPPORT PLATE (HD-52960)

NOTE

Rear port extension header should be installed on engine.

19. Install exhaust system. See EXHAUST SYSTEM (Page 6-35).
20. Attach right foot control bracket. See RIDER FOOTRESTS (Page 3-77).
21. Torque front drive pulley nut. See OUTPUT PULLEY (Page 5-6).
Special Tool: DRIVE PULLEY LOCKING TOOL (HD-52985)
22. Install front belt guard. See BELT GUARDS (Page 3-60).
23. Install left foot control bracket. See RIDER FOOTRESTS (Page 3-77).
24. Install jiffy stand. See JIFFY STAND (Page 3-80).
25. Route and connect electrical connectors and connections.
 - a. O2 sensors
 - b. Ground cable (dirty ground)
 - c. Main harness ground (dirty ground)
 - d. Crank position sensor.
26. Install battery tray. See BATTERY TRAY (Page 8-57).
27. Install overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).
28. **If equipped:** Install charcoal canister. See CHARCOAL CANISTER: EVAPORATIVE EMISSIONS (Page 6-37).
29. Install battery. See INSPECT BATTERY (Page 2-37).
30. Install voltage regulator. See VOLTAGE REGULATOR (Page 8-12).
31. **If equipped:** Connect carbon canister purge valve to voltage regulator mounting bracket. See PURGE SOLENOID: EVAPORATIVE EMISSIONS (Page 6-36).
32. Install radiator. See RADIATOR (Page 7-17).
33. Install cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).

34. Install ECM. See ELECTRONIC CONTROL MODULE (ECM) (Page 8-33).
 - a. ECM
 - b. Top coils
 - c. Sensor jumper.
 - d. Phaser solenoids
 - e. Cam timing sensor
 - f. Knock sensor
 - g. Coolant temperature sensor
 - h. Oil pressure switch
35. Route and connect electrical connectors and connections.
 - a. ECM
 - b. Top coils
 - c. Sensor jumper.
 - d. Phaser solenoids
 - e. Cam timing sensor
 - f. Knock sensor
 - g. Coolant temperature sensor
 - h. Oil pressure switch
36. Install frame covers. See SIDE COVERS (Page 3-46).
 - a. Install right frame cover.
 - b. Install left frame cover.
37. Install tail section crossmember. See FRAME (Page 3-85).
 - a. Make sure that the double clamp and brakeline is installed on the top of the inner left mid-frame.
38. Install induction module. See INDUCTION MODULE (Page 6-26).
39. Install airbox assembly. See AIR BOX (Page 6-3).
40. Install fuel tank. See FUEL TANK (Page 6-12).
41. Install seat bracket latch. See SEAT (Page 3-82).
42. Install rear fender. See COWL AND REAR FENDERS (Page 3-68).
 - a. Install rear fender cowl.
- b. Install right fender.
- c. Install left fender.
43. Install seat. See SEAT (Page 3-82).
44. Install main fuse. See POWER DISCONNECT (Page 8-4).
45. Install **new** filter and add **new** engine oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
46. Start bleed procedure, add coolant, and burp cylinder heads. See COOLANT (Page 7-7).
47. Install side-mount ignition coil. See IGNITION COIL (Page 8-15).
48. Install spark plug cables. See SPARK PLUG CABLES (Page 8-14).
49. Finish coolant bleed procedure. See COOLANT (Page 7-7).
50. Check engine oil level. See REPLACE ENGINE OIL AND FILTER (Page 2-7).
51. Install steering head covers. See SIDE COVERS (Page 3-46).
 - a. Install right side steering head cover.
 - b. Install left side steering head cover.
52. Run motorcycle until engine is at normal operating temperature.
 - a. Check clutch operation. Adjust if needed.
 - b. Check instrument lamps.
 - c. Check for leaks.
 - d. Check engine oil level (hot) resting on jiffy stand.
53. Install chin spoiler. See CHIN SPOILER (Page 3-69).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Use low-pressure compressed air to clean exterior surfaces of engine and vehicle.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove output pulley. See OUTPUT PULLEY (Page 5-6).
4. Remove engine. See REPLACE ENGINE (Page 4-62).
5. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
6. Remove starter. See STARTER (Page 8-5).
7. Remove oil cooler hoses. See OIL COOLER (Page 4-17).
8. Remove coil pack. See IGNITION COIL (Page 8-15).
9. Remove cam timing sensor. See CAMSHAFT TIMING SENSORS (Page 8-41).
10. Remove cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
11. Remove camshaft covers. See CAMSHAFT COVERS (Page 4-21).
12. Remove phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
13. Remove cam drive gear. See CAMSHAFTS AND PHASERS (Page 4-38).
14. Remove clutch drive gear. See CLUTCH (Page 5-12).
15. Remove sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
16. Remove coolant manifold. See COOLANT MANIFOLD (Page 4-53).
17. Remove cylinder heads. See CYLINDER HEADS (Page 4-34).
 - a. Remove camshaft drive chain covers.
18. Remove clutch. See CLUTCH (Page 5-12).
19. Remove camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
20. Remove cylinders. See CYLINDERS (Page 4-43).

21. Remove alternator. See ALTERNATOR (Page 8-7).
22. Remove oil pump drive. See OIL PUMP DRIVE (Page 4-59).
 - a. Remove chain guides.
 - b. Remove balancer gear.
23. Remove starter gear. See STARTER GEAR (Page 4-58).
24. Remove oil pump assembly. See OIL PUMP (Page 4-61).

DISASSEMBLE

| PART NUMBER | TOOL NAME |
|-------------|----------------------|
| HD-52957 | CRANKSHAFT PROTECTOR |

NOTE

*When setting down crankcases on a workbench, be **EXTREMELY CAREFUL NOT** to bend the oil nozzles. If they are bent, the stream of oil will be misdirected and could cause the piston to overheat and result in catastrophic engine damage.*

1. See Figure 4-88. Separate crankcase halves.
 - a. Remove screws (1, 2, 3).
 - b. Install Crankshaft protector.
Special Tool: CRANKSHAFT PROTECTOR (HD-52957)
 - c. Separate case halves.
 - d. Lift left crankcase half (4) off end of crankshaft assembly (5), balancer (6) and transmission assembly (7).
2. Remove crankshaft assembly (5). See CRANKSHAFT AND CONNECTING RODS (Page 4-81).
3. Remove balancer (6). See BALANCER (Page 4-79).
4. Remove transmission assembly (7). See TRANSMISSION (Page 5-20).
5. Remove scavenge oil pump assembly. See SCAVENGE OIL PUMP (Page 4-84).
6. See Figure 4-87. Remove and discard O-rings (2) from right crankcase half (3) dowel pins (1).

CLEAN AND INSPECT

1. Remove all gasket material from the crankcase flanges.
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 are clean and open.
5. Check dowel pins for looseness, wear or damage. Replace if 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 balancer for damage.
11. Inspect crankshaft/rotating assembly. See CRANKSHAFT AND CONNECTING RODS (Page 4-81).
12. Inspect transmission assembly. See TRANSMISSION (Page 5-20).

ASSEMBLE

| PART NUMBER | TOOL NAME |
|-------------|----------------------|
| HD-52957 | CRANKSHAFT PROTECTOR |

| FASTENER | TORQUE VALUE | |
|-----------------------|--------------|-----------|
| Crankcase screw, left | 16–20 ft-lbs | 22–27 N·m |

| CONSUMABLE | PART NUMBER |
|---|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |
| HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY | 99650-02 |
| LUBRIPLATE NO. 105 | L0034-094 |

1. See Figure 4-87. Install dowel pins into right case half, if removed.
 - a. Install dowel pins (1).
 - b. Lubricate O-ring (2) with clean engine oil and install.
2. See Figure 4-88. Position right crankcase (8) with clutch compartment facing down.

3. Install transmission assembly (7). See TRANSMISSION (Page 5-20).

4. Install balancer (6). See BALANCER (Page 4-79).

NOTE

Lubriplate 105 or if unavailable use Screamin' Eagle assembly lube liberally on main bearings and connecting rods or bearing failure may occur.

5. Install crankshaft assembly (5). See CRANKSHAFT AND CONNECTING RODS (Page 4-81).

Consumable: LUBRIPLATE NO. 105 (L0034-094)
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

6. Install scavenge oil pump assembly. See SCAVENGE OIL PUMP (Page 4-84).

7. Connect crankcase halves.

- a. Verify that both dowel pins are installed in split line face of right case half.

- b. See Figure 4-89. Apply a bead of sealant to specification to the split line face of right crankcase half.

0.092 in (2.3 mm) HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY (99650-02)

- c. Install crankshaft special tool.

Special Tool: CRANKSHAFT PROTECTOR (HD-52957)

- d. Lower left crankcase half (4) onto end of crankshaft assembly (5), balancer (6) and transmission assembly (7).

NOTE

Keep crankcase splitline parallel as left crankcase is lowered into place.

- e. Wiggle crankcase during installation to help fully seat components in bearings.

- f. Remove special tool from both ends of crankshaft.

8. Install crankcase screws.

- a. Install screws (1, 2, 3).

- b. Finger-tighten each screw.

- c. See Figure 4-90. Tighten screws in sequence.

Torque: 16–20 ft-lbs (22–27 N·m) *Crankcase screw, left*

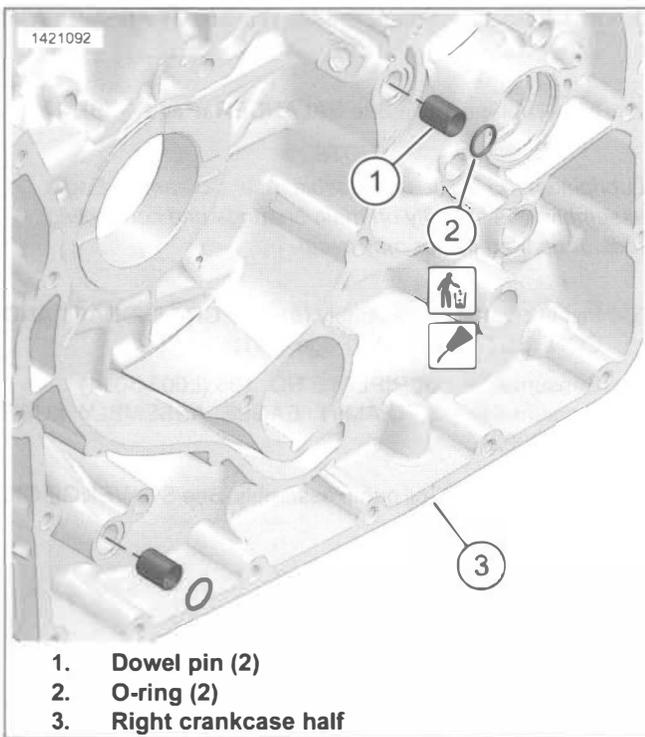


Figure 4-87. Dowel Pins

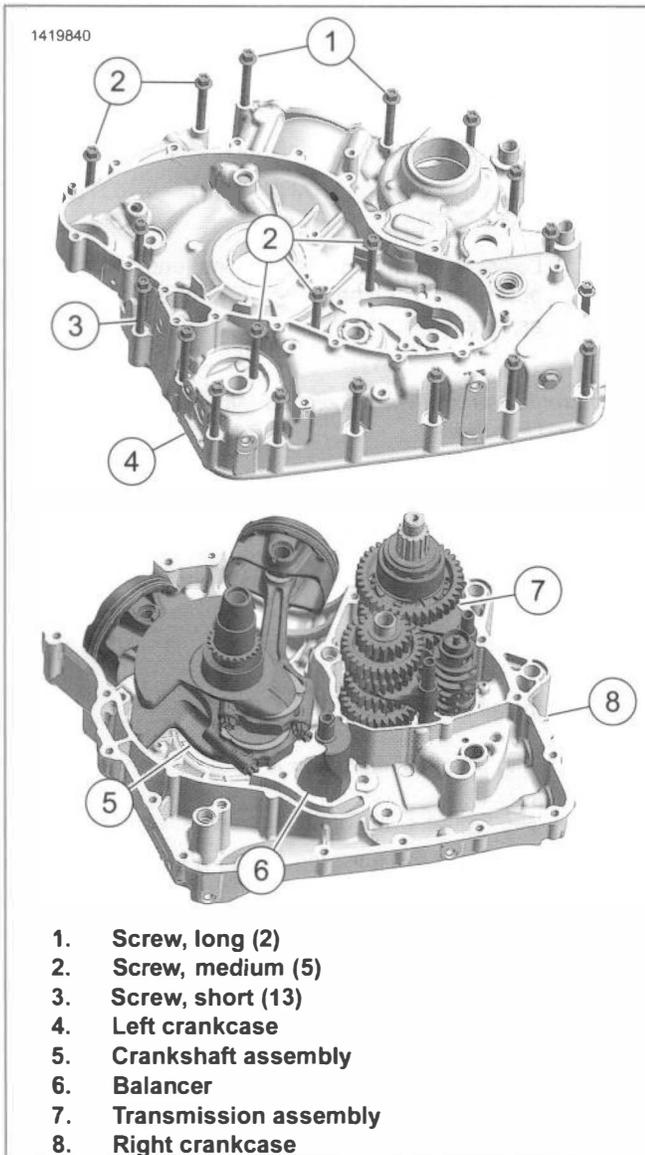


Figure 4-88. Separate Crankcase Halves

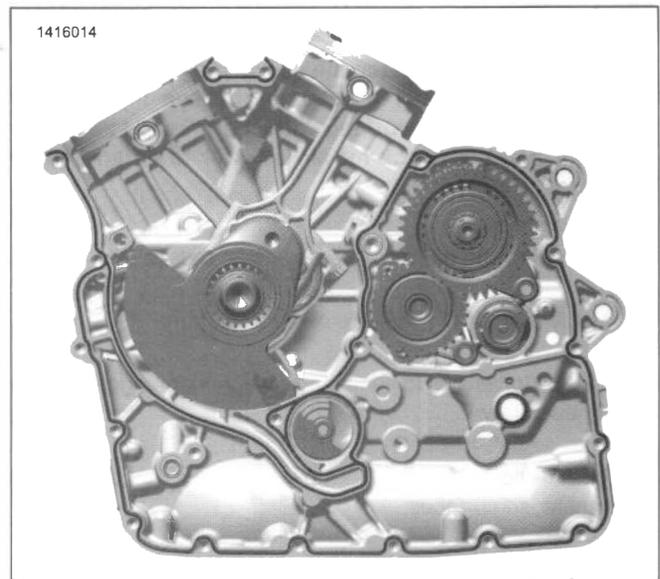


Figure 4-89. Crankcase Sealant Application

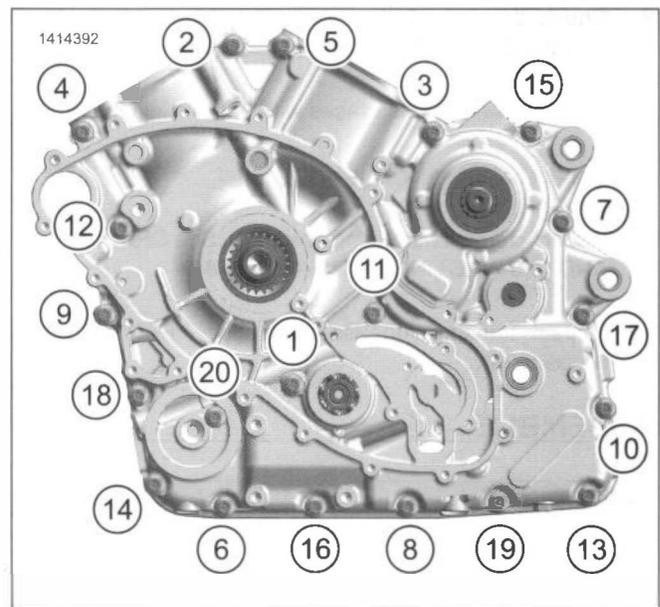


Figure 4-90. Crankcase Torque Sequence

REPAIR RIGHT CRANKCASE HALF

| PART NUMBER | TOOL NAME |
|-------------|--------------------------------|
| HD-52961 | MAIN BEARING INSTALLATION TOOL |

| FASTENER | TORQUE VALUE | |
|--|--------------|----------|
| Screw, retaining plate, transmission mainshaft bearing | 80–97 in-lbs | 9–11 N·m |

Main Bearing

Remove

1. Remove main bearings.
 - a. See Figure 4-91. Place main bearing removal/installation tool base (2) wide end (1) up.
Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)
 - b. See Figure 4-92. Place crankcase main bearing on tool base.

- c. Install main bearing removal tool shaft as shown.
- d. Press out bearings.
- e. Discard bearing halves.

Install

- 1. Install main bearings.
 - a. See Figure 4-93. Place main bearing removal/installation tool base (2) stepped end (1) up.
- Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)

NOTE

Bearing holder has a taper to inner diameter of tool. This is to help lead main bearings into bore of crankcase without causing damage. Make sure smaller I.D. of tool is at the bottom and larger I.D. is on top.

- b. See Figure 4-94. Install **new** bearings (1) in bearing holder (3).

NOTE

Hole not shown on other bearing half is opposite of hole shown.

- c. Orient bearing half oil hole (2) as shown.
- d. See Figure 4-95. Place crankcase on tool base.
- e. Place bearing holder with bearings over main bearing journal on crankcase cover.
- f. Install bearing removal/installation shaft (1) in bearing holder (2).
- g. Press in bearings.
- h. See Figure 4-96. Verify bearing position.

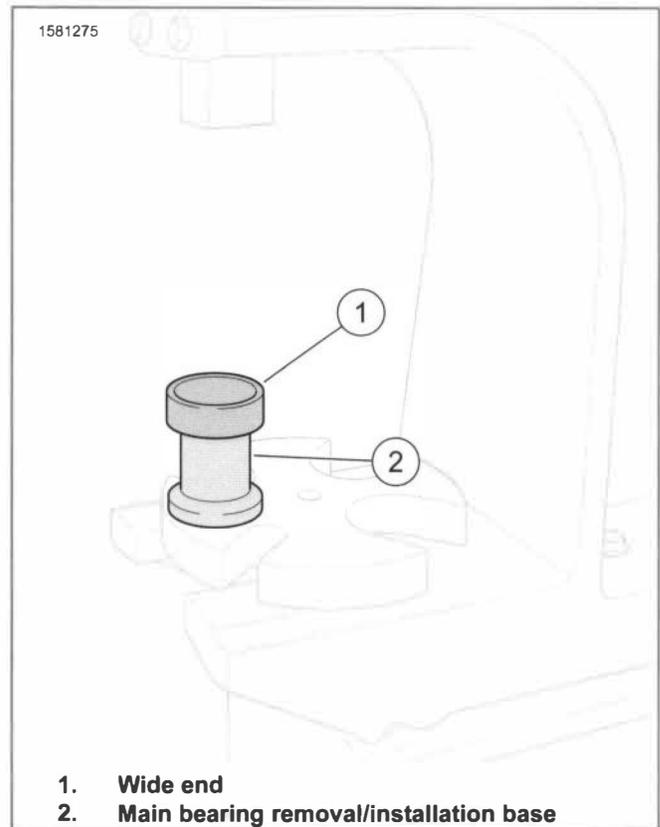


Figure 4-91. Main Bearing Removal/Installation Tool Base

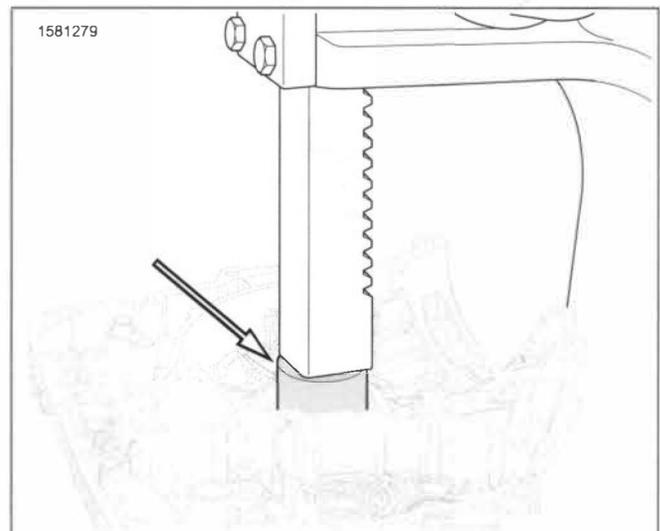
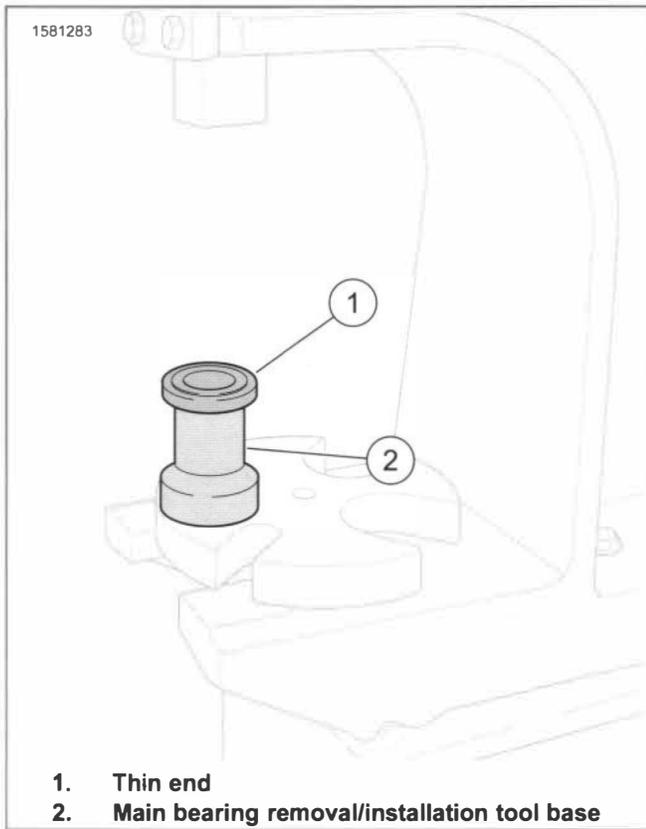
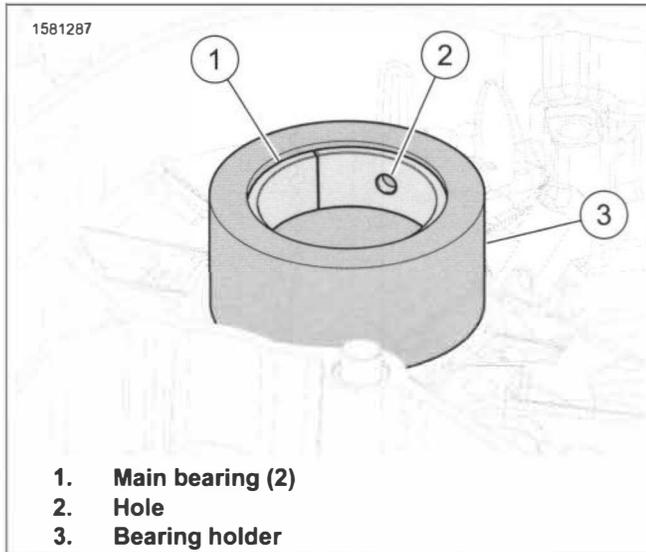


Figure 4-92. Main Bearing Removal, Right Crankcase



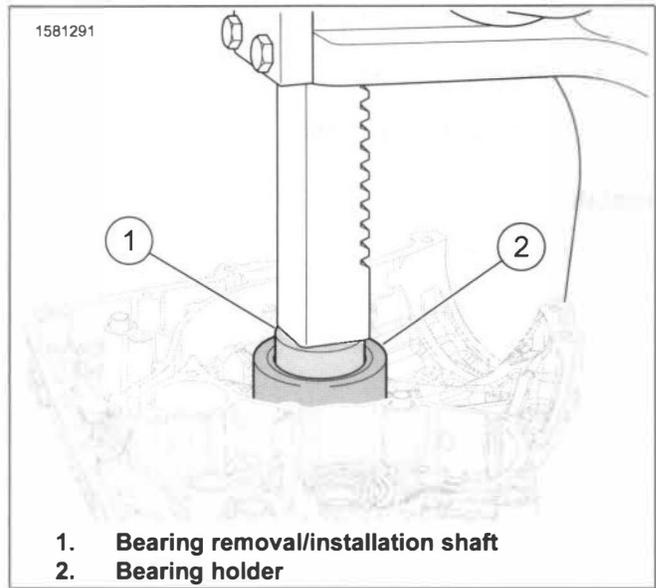
1. Thin end
2. Main bearing removal/installation tool base

Figure 4-93. Main Bearing Removal/Installation Tool Base



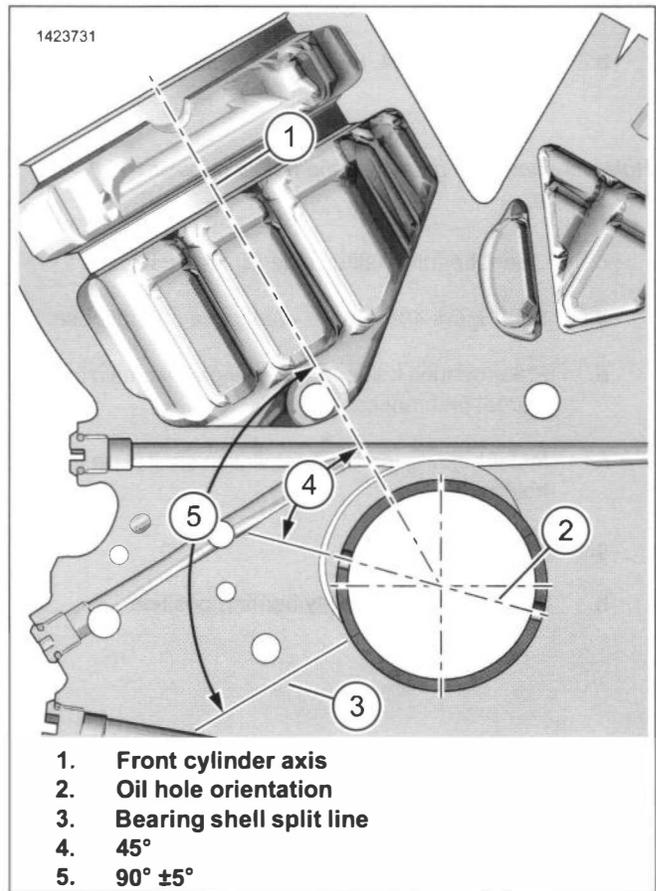
1. Main bearing (2)
2. Hole
3. Bearing holder

Figure 4-94. Main Bearing Position, Right Crankcase



1. Bearing removal/installation shaft
2. Bearing holder

Figure 4-95. Main Bearing Installation, Right Crankcase



1. Front cylinder axis
2. Oil hole orientation
3. Bearing shell split line
4. 45°
5. 90° ±5°

Figure 4-96. Right Main Bearing Orientation

Balancer Bearing

Remove

1. See Figure 4-97. Remove balancer bearing (7).
 - a. Use suitable blind hole puller.
2. Discard bearing (7).

Install

1. See Figure 4-97. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (7).
 - c. Install balancer bearing (7).
 - d. Press **new** bearing until fully seated in bore.

Transmission Mainshaft Bearing

Remove

1. See Figure 4-97. Remove transmission mainshaft bearing (1).
 - a. Use suitable blind hole puller.
2. Discard bearing (1).

Install

1. See Figure 4-97. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (1).
 - c. Install transmission mainshaft bearing (1).
 - d. Press **new** bearing until fully seated in bore.

Transmission Countershaft Bearing

Remove

1. See Figure 4-97. Remove screws (2).
2. Remove retaining plate (3).
3. Remove transmission countershaft bearing (4).
4. Discard bearing (4).

Install

1. See Figure 4-97. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (4).
 - c. Install transmission countershaft bearing (4).
 - d. Press **new** bearing until fully seated in bore.
2. Install retaining plate (3).

3. Install screws (2). Tighten.

Torque: 80–97 **in-lbs** (9–11 N·m) *Screw, retaining plate, transmission mainshaft bearing*

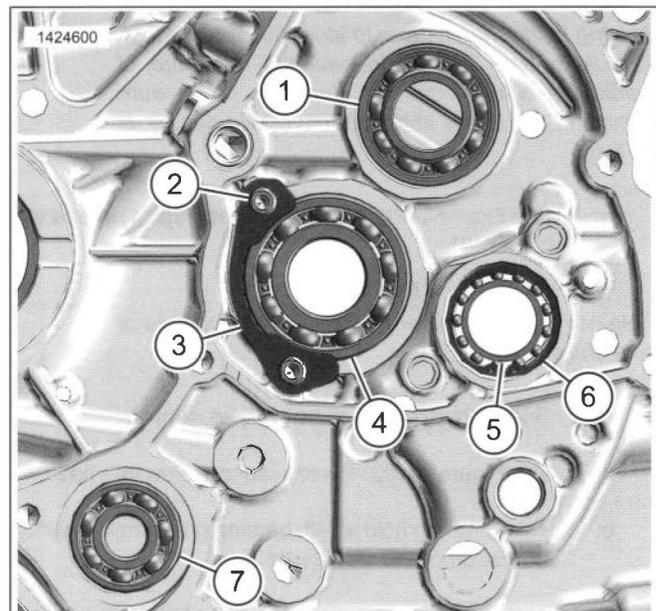
Transmission Shift Drum Bearing

Remove

1. See Figure 4-97. Remove retaining ring (6).
2. Remove shift drum bearing (5).
3. Discard bearing (5).

Install

1. See Figure 4-97. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (5).
 - c. Install shift drum bearing (5).
 - d. Press **new** bearing until fully seated in bore.
2. Install retaining ring (6).



1. Transmission mainshaft bearing
2. Screw (2)
3. Retainer plate
4. Transmission countershaft bearing
5. Shift drum bearing
6. Retaining ring
7. Balancer bearing

Figure 4-97. Right Crankcase Bearing Replacement
REPAIR LEFT CRANKCASE HALF

| PART NUMBER | TOOL NAME |
|-------------|--------------------------------|
| HD-52961 | MAIN BEARING INSTALLATION TOOL |

Main Bearing

Remove

1. Remove main bearings.
 - a. See Figure 4-98. Place main bearing removal/installation tool base (2) wide end (1) up.
Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)
 - b. See Figure 4-99. Place crankcase main bearing on tool base.
 - c. Install main bearing removal tool shaft as shown.
 - d. Press out bearings.
 - e. Discard bearing halves.

Install

1. Install main bearings.
 - a. See Figure 4-100. Place main bearing removal/installation tool base (2) stepped end (1) up.
Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)

NOTE

Bearing holder has a taper to inner diameter of tool. This is to help lead main bearings into bore of crankcase without causing damage. Make sure smaller I.D. of tool is at the bottom and larger I.D. is on top.

- b. See Figure 4-101. Install **new** bearings (1) in bearing holder (3).

NOTE

Hole not shown on other bearing half is opposite of hole shown.

- c. Orient bearing half oil hole (2) as shown.
- d. See Figure 4-102. Place crankcase on tool base.
- e. Place bearing holder with bearings over main bearing journal on crankcase cover.
- f. Install bearing removal/installation shaft (1) in bearing holder (2).
- g. Press in bearings.
- h. See Figure 4-103. Verify bearing position.

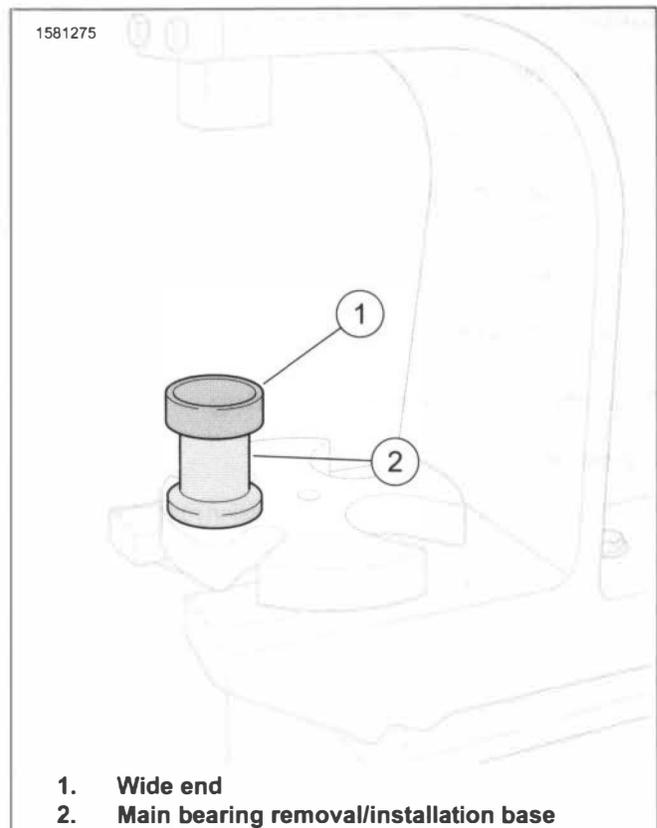


Figure 4-98. Main Bearing Removal/Installation Tool Base

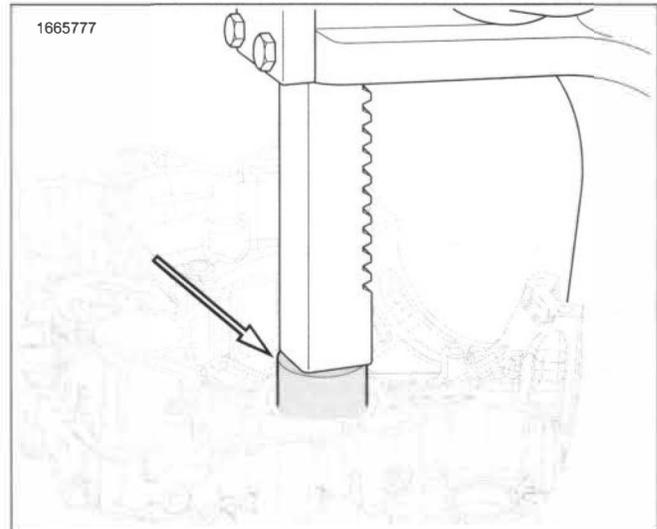
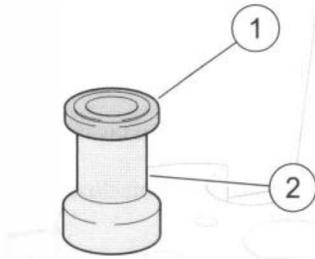
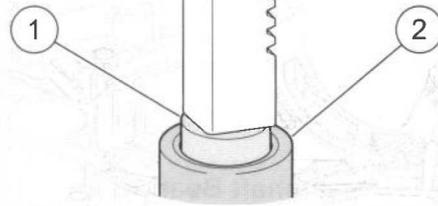


Figure 4-99. Main Bearing Removal, Left Crankcase



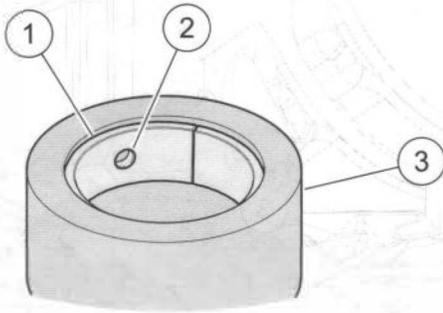
- 1. Thin end
- 2. Main bearing removal/installation tool base

Figure 4-100. Main Bearing Removal/Installation Tool Base



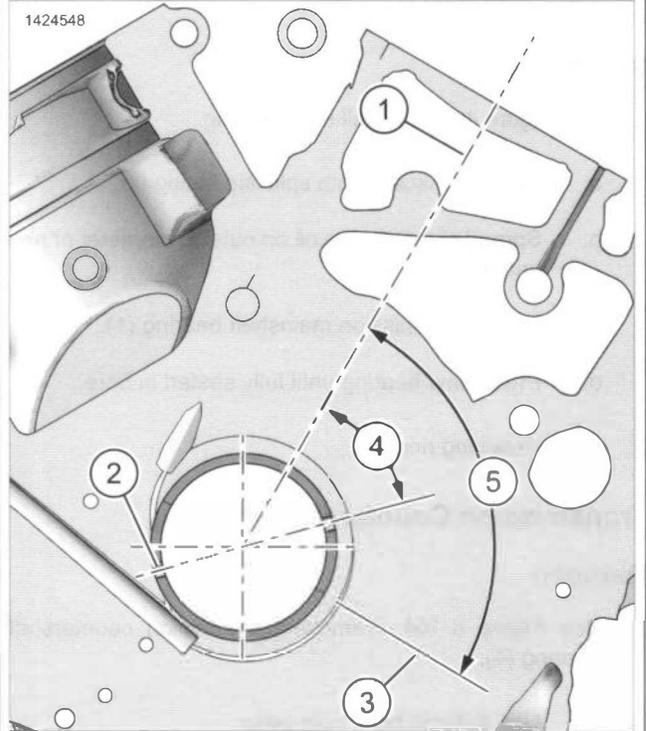
- 1. Bearing removal/installation shaft
- 2. Bearing holder

Figure 4-102. Main Bearing Installation, Left Crankcase



- 1. Main bearing (2)
- 2. Hole
- 3. Bearing holder

Figure 4-101. Main Bearing Position, Left Crankcase



- 1. Front cylinder axis
- 2. Oil hole orientation
- 3. Bearing shell split line
- 4. 45°
- 5. 90° ±5°

Figure 4-103. Left Main Bearing Orientation

Balancer Bearing

Remove

- 1. See Figure 4-104. Remove balancer bearing (5).
- 2. Discard bearing (5).

Install

1. See Figure 4-104. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (5).
 - c. Install balancer bearing (5).
 - d. Press **new** bearing until fully seated in bore.

Transmission Mainshaft Bearing

Remove

1. See Figure 4-104. Remove retaining ring (2).
2. Remove transmission mainshaft bearing (1).
3. Discard bearing (1).

Install

1. See Figure 4-104. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (1).
 - c. Install transmission mainshaft bearing (1).
 - d. Press **new** bearing until fully seated in bore.
2. Install retaining ring (2).

Transmission Countershaft Bearing

Remove

1. See Figure 4-104. Remove transmission countershaft bearing (4).
 - a. Use suitable blind hole puller.
2. Discard bearing (4).

Install

1. See Figure 4-104. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (4).
 - c. Install transmission countershaft bearing (4).
 - d. Press **new** bearing until fully seated in bore.

Transmission Shift Drum Bearing

Remove

1. See Figure 4-104. Remove shift drum bearing (3) using a suitable blind hole puller.
2. Discard bearing (3).

Install

1. See Figure 4-104. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (3).
 - c. Install shift drum bearing (3).
 - d. Press **new** bearing until fully seated in bore.

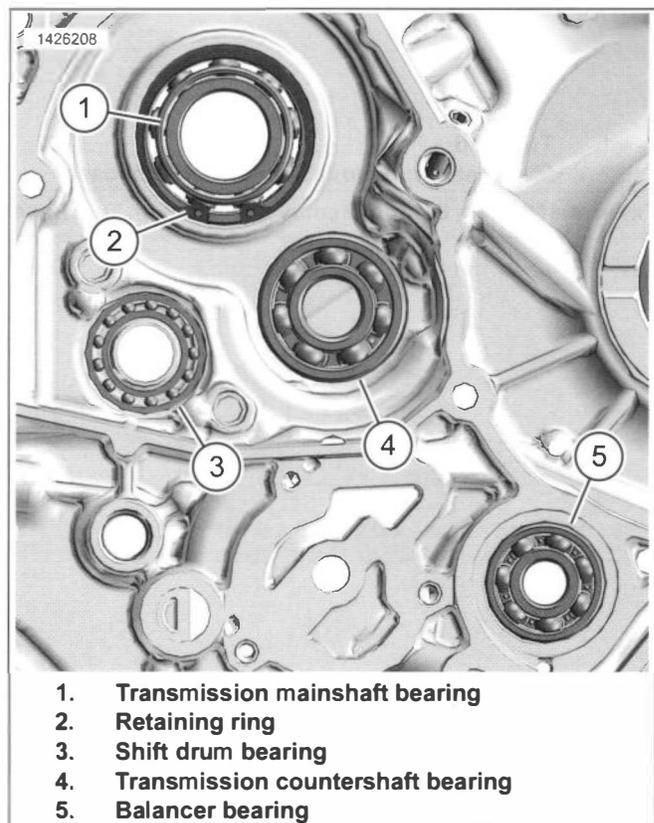


Figure 4-104. Left Crankcase Bearing Replacement
PLUGS AND OIL FITTINGS

| FASTENER | TORQUE VALUE | |
|----------------------------|---------------|-----------|
| Oil filter adapter fitting | 19–24 ft-lbs | 26–32 N·m |
| Plug, engine body | 97–115 in-lbs | 11–13 N·m |

Engine Body Plug

1. See Figure 4-105. Remove body plug (5).
2. Remove and discard O-ring (1).
3. Lubricate **new** O-ring (1) with clean engine oil.

4. Install **new** O-ring (1).

5. Install body plug (5). Tighten.

Torque: 97–115 **in-lbs** (11–13 N·m) *Plug, engine body*

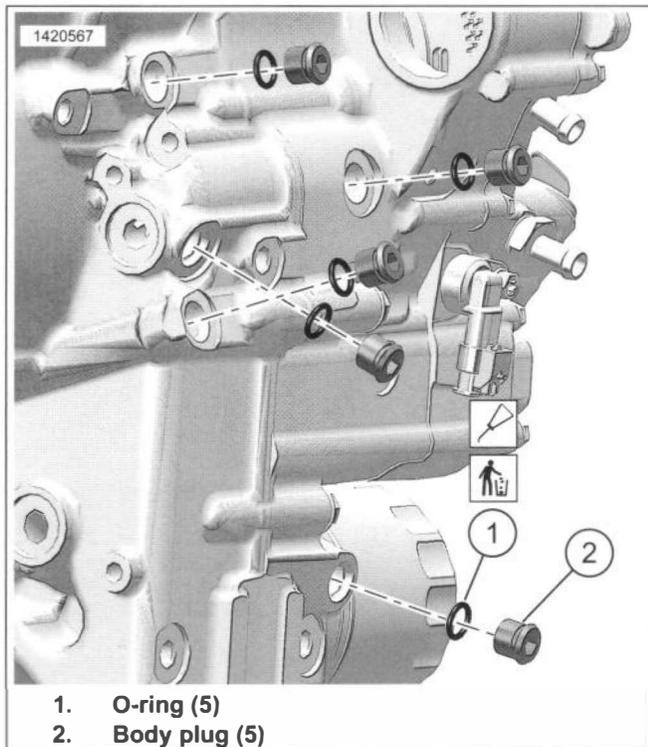


Figure 4-105. Engine Body Plugs

Oil Filter Adapter Fitting

1. Install fitting (1). Tighten.

Torque: 19–24 **ft-lbs** (26–32 N·m) *Oil filter adapter fitting*

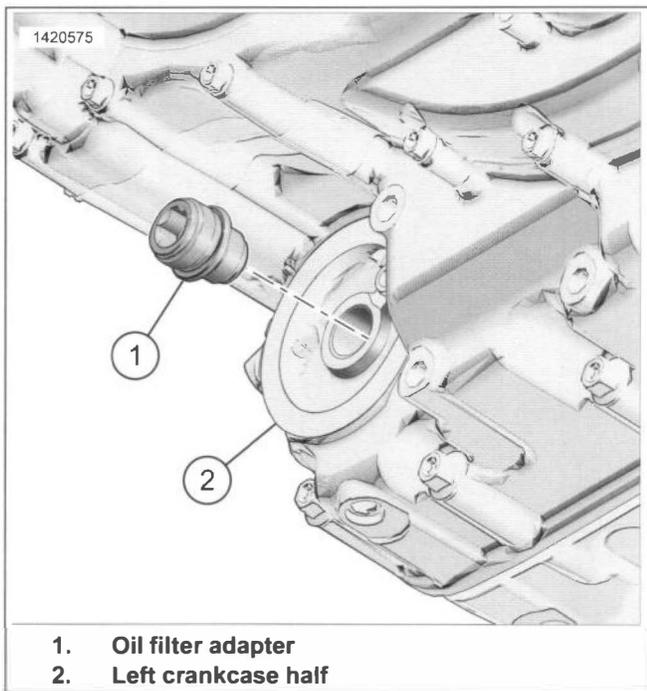


Figure 4-106. Oil Filter Adapter Fitting

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install oil pump assembly. See OIL PUMP (Page 4-61).
2. Install starter gear. See STARTER GEAR (Page 4-58).
3. Install oil pump drive. See OIL PUMP DRIVE (Page 4-59).
 - a. Install chain guides.
 - b. Install balancer gear.
4. Install alternator. See ALTERNATOR (Page 8-7).
5. Install cylinders. See CYLINDERS (Page 4-43).
6. Install cylinder heads. See CYLINDER HEADS (Page 4-34).
 - a. Install camshaft drive chain covers.
7. Install coolant manifold. See COOLANT MANIFOLD (Page 4-53).
8. Install clutch primary drive gear. See CRANKSHAFT AND CONNECTING RODS (Page 4-81).
9. Install sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
10. Install clutch. See CLUTCH (Page 5-12).
11. Install camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
12. Install phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
13. Install camshaft covers. See CAMSHAFT COVERS (Page 4-21).
14. Install cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
15. Remove camshaft timing sensor. See CAMSHAFT TIMING SENSORS (Page 8-41).
16. Remove coil pack. See IGNITION COIL (Page 8-15).
17. Install oil cooler hoses. See OIL COOLER (Page 4-17).
18. Install starter. See STARTER (Page 8-5).
19. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).

Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
20. Install engine. See REPLACE ENGINE (Page 4-62).

21. Install output pulley. See OUTPUT PULLEY (Page 5-6).

22. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Use low-pressure compressed air to clean exterior surfaces of engine and vehicle.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove output pulley. See OUTPUT PULLEY (Page 5-6).
4. Remove engine. See REPLACE ENGINE (Page 4-62).
5. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
6. Remove starter. See STARTER (Page 8-5).
7. Remove oil cooler hoses. See OIL COOLER (Page 4-17).
8. Remove coil pack. See IGNITION COIL (Page 8-15).
9. Remove cam timing sensor. See CAMSHAFT TIMING SENSORS (Page 8-41).
10. Remove cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
11. Remove camshaft covers. See CAMSHAFT COVERS (Page 4-21).
12. Remove phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
13. Remove camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
14. Remove sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
15. Remove coolant manifold. See COOLANT MANIFOLD (Page 4-53).
16. Remove cylinder heads. See CYLINDER HEADS (Page 4-34).
 - a. Remove camshaft drive chain covers.
17. Remove clutch. See CLUTCH (Page 5-12).
18. Remove camshaft. See CAMSHAFTS AND PHASERS (Page 4-38).
19. Remove primary gear. See CRANKSHAFT AND CONNECTING RODS (Page 4-81).
20. Remove cylinders. See CYLINDERS (Page 4-43).
21. Remove alternator. See ALTERNATOR (Page 8-7).
22. Remove oil pump drive. See OIL PUMP DRIVE (Page 4-59).
 - a. Remove chain guides.
 - b. Remove balancer gear.
23. Remove starter gear. See STARTER GEAR (Page 4-58).

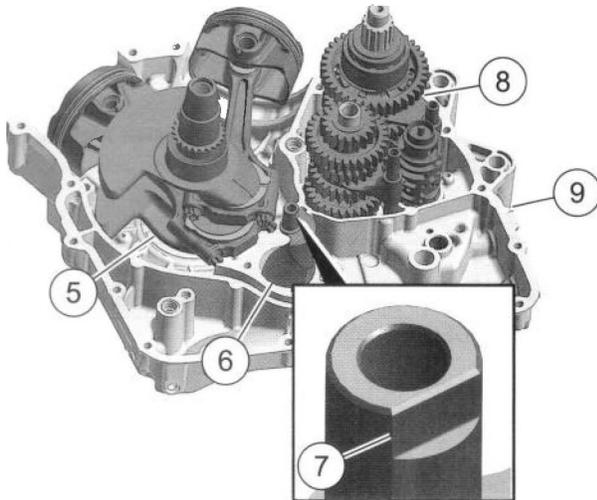
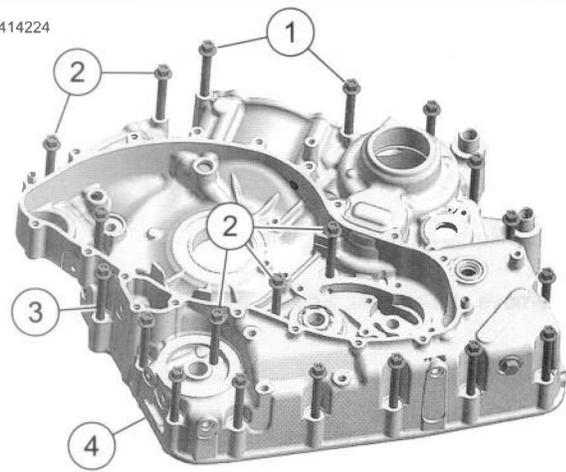
REMOVE

1. See Figure 4-107. Remove screws (1, 2, 3).
2. Remove left crankcase (4).
3. Remove balancer (6).
4. Clean both crankcase halves from gasket material. See CRANKCASE (Page 4-68).

INSTALL

| CONSUMABLE | PART NUMBER |
|--|-------------|
| HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY | 99650-02 |

1. See Figure 4-107. Install balancer (6) in right crankcase (9).
 - a. Balancer flat (7) should face left crankcase (4) for proper assembly and operation.
2. Install left crankcase.
 - a. See Figure 4-89. Apply Diameter: .090 in (2 mm) bead of sealant to right crankcase as shown.
HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY (99650-02)
 - b. See Figure 4-107. Install left crankcase (4).
3. Install screws (1, 2, 3).
4. Tighten screws in sequence. See CRANKCASE (Page 4-68)



1. Screw, long (2)
2. Screw, medium (5)
3. Screw, short (13)
4. Left crankcase
5. Crankshaft assembly
6. Balancer
7. Balancer flat
8. Transmission assembly
9. Right crankcase

Figure 4-107. Crankcase Components

COMPLETE

1. Install starter gear. See STARTER GEAR (Page 4-58).
2. Install oil pump drive. See OIL PUMP DRIVE (Page 4-59).
 - a. Install chain guides.
 - b. Install balancer gear.

3. Install alternator. See ALTERNATOR (Page 8-7).
4. Install cylinders. See CYLINDERS (Page 4-43).
5. Install cylinder heads. See CYLINDER HEADS (Page 4-34).
 - a. Install camshaft drive chain covers.
6. Install coolant manifold. See COOLANT MANIFOLD (Page 4-53).
7. Install camshaft. See CAMSHAFTS AND PHASERS (Page 4-38).
8. Install primary gear. See CRANKSHAFT AND CONNECTING RODS (Page 4-81).
9. Install clutch. See CLUTCH (Page 5-12).
10. Install sprockets and timing chain. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
11. Install camshafts. See CAMSHAFTS AND PHASERS (Page 4-38).
12. Install phaser solenoids with plate assembly. See PHASER SOLENOIDS (Page 4-22).
13. Install camshaft covers. See CAMSHAFT COVERS (Page 4-21).
14. Install cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
15. Remove cam timing sensor. See CAMSHAFT TIMING SENSORS (Page 8-41).
16. Remove coil pack. See IGNITION COIL (Page 8-15).
17. Install oil cooler hoses. See OIL COOLER (Page 4-17).
18. Install starter. See STARTER (Page 8-5).
19. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
20. Install engine. See REPLACE ENGINE (Page 4-62).
21. Install output pulley. See OUTPUT PULLEY (Page 5-6).
22. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove engine. See REPLACE ENGINE (Page 4-62).
3. Remove camshaft drive sprocket. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
4. Separate crankcase. See CRANKCASE (Page 4-68).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|----------------------|
| HD-52957 | CRANKSHAFT PROTECTOR |

1. See Figure 4-108. Remove primary gear.
 - a. Remove screws (1).
 - b. Remove primary gear (2).
2. Remove crankshaft assembly.
 - a. Install crankshaft protector.

Special Tool: CRANKSHAFT PROTECTOR (HD-52957)
 - b. See Figure 4-109. Remove crankshaft assembly (1) from right crankcase (2).

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|----------------------|
| HD-52957 | CRANKSHAFT PROTECTOR |

| FASTENER | TORQUE VALUE | |
|--------------------------------|--------------|-----------|
| Crankshaft primary gear screws | 24–27 ft-lbs | 32–36 N·m |

NOTE

Do not use compressed air to clean threads. This will force debris into the oil passages of the crankshaft.

1. Install crankshaft assembly.
 - a. Place crankshaft protector on end of crankshaft.

Special Tool: CRANKSHAFT PROTECTOR (HD-52957)
 - b. See Figure 4-109. Install crankshaft assembly (1) into right crankcase (2).
2. See Figure 4-108. Install primary gear.
 - a. Install primary gear (2) with shallow end facing the crankcase.

- b. Install screws (1). Tighten in criss-cross pattern.

Torque: 24–27 ft-lbs (32–36 N·m) *Crankshaft primary gear screws*

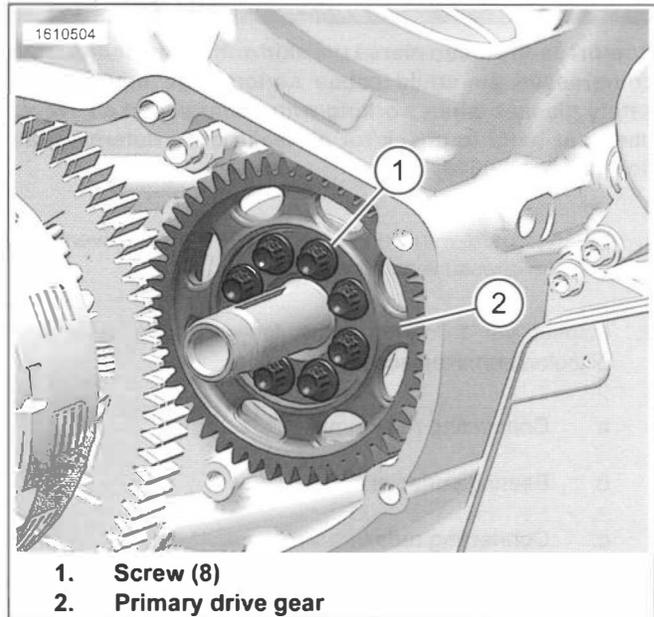


Figure 4-108. Primary Drive Gear

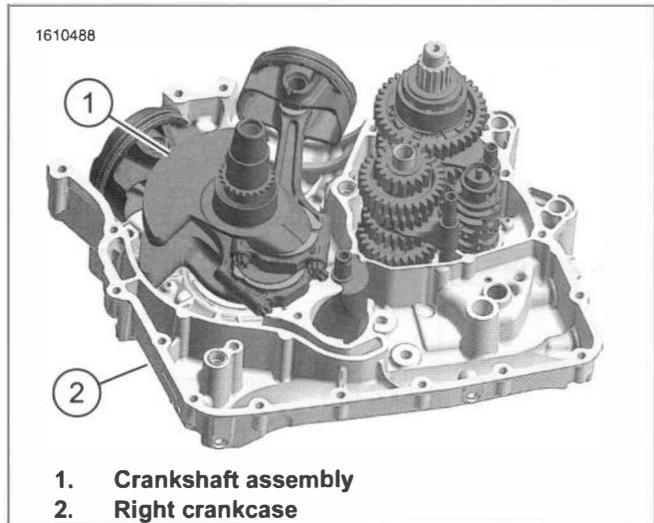


Figure 4-109. Crankshaft

DISASSEMBLE

NOTE

- *Mark direction of connecting rod and end cap assemblies before removal.*
- *Note dimple location on connecting rod assembly. See Figure 4-112.*
- *Each connecting rod and end cap is a machined set. Do not interchange parts.*

1. Secure crankshaft assembly.
2. See Figure 4-110. Remove connecting rods.
 - a. Discard screws (4).

- b. Remove end caps (3).
- c. Discard bearings (2).

CLEAN AND INSPECT

⚠ 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 with a non-flammable cleaning solvent. Dry with low-pressure compressed air.
2. Inspect the following areas for excessive wear and discoloration. Replace as necessary.
 - a. Connecting rod journal.
 - b. Bearing surfaces.
 - c. Connecting rods.
3. See Figure 4-114. Clean oil passages.

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|--|--------------|------------|
| End cap, connecting rod, screw torque step 1 | 20 ft-lbs | 27 ± 2 N·m |
| End cap, connecting rod, screw torque step 2 | | 80 ± 2° |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |
| LUBRIPLATE NO. 105 | L0034-094 |

1. See Figure 4-111 and Figure 4-112. Select proper bearings. Refer to Table 4-25.
 - a. Also check crankshaft pin and connecting rod specifications. SPECIFICATIONS (Page 4-3)

2. **NOTE**
Diligent attention to cleanliness is required. Any debris entering the crankshaft or bearings could cause seizure. Plain bearings have less tolerance to debris.

NOTE
Lubriplate 105 or if unavailable Screamin' Eagle assembly lube must be used liberally or bearing failure may occur.

See Figure 4-110. Install **new** bearings (2).

- a. See Figure 4-113. Apply Lubriplate on the connecting rod and main bearings.

LUBRIPLATE NO. 105 (L0034-094)SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- b. Align groove in bearings (2) with notches in connecting rod and rod end.

3. **NOTE**

- A new connecting rod and end cap assembly is installed in either direction.
- The existing connecting rod and end cap assembly is installed in the same direction as removed.

Install connecting rods.

- a. See Figure 4-110. Lubricate threads of **new** screws (4) with fresh engine oil.
- b. See Figure 4-112. Align dimples (4).
- c. See Figure 4-110. Install end cap (3).
- d. Install **new** screws (4). Tighten.
 Torque: 20 ft-lbs (27 ± 2 N·m) *End cap, connecting rod, screw torque step 1*
- e. Turn fasteners an additional
 Torque: (80 ± 2°) *End cap, connecting rod, screw torque step 2*

Table 4-25. Connecting Rod Bearing Selection

| CRANKSHAFT PIN SIZE CODE | CONNECTING ROD SIZE CODE | |
|--------------------------|--------------------------|-------|
| | B | A |
| B | Yellow | Black |
| A | Black | Red |

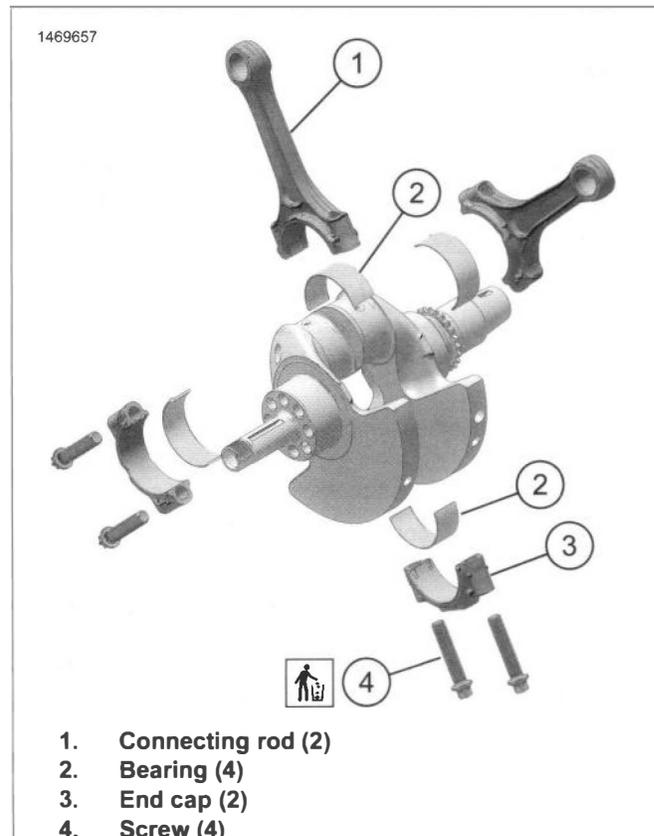
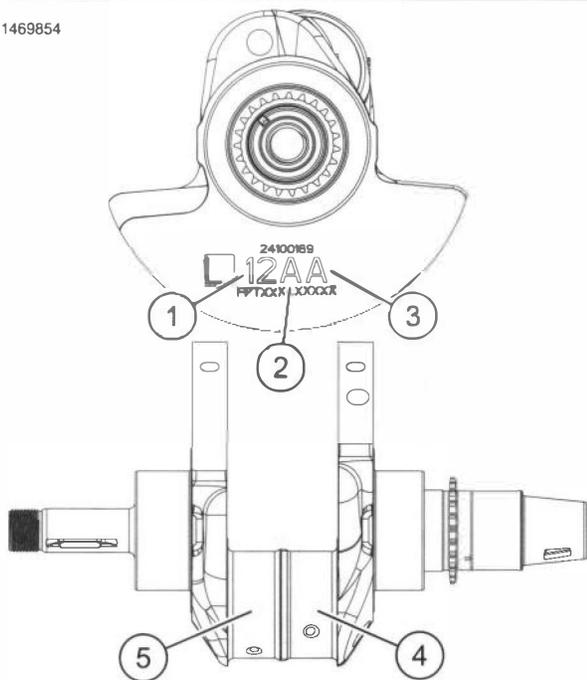


Figure 4-110. Connecting Rods

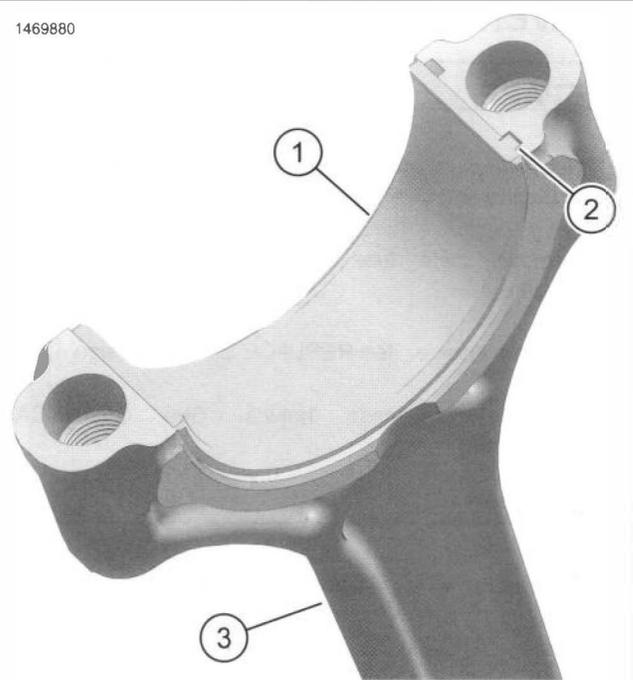
1469854



1. Displacement
2. Crankshaft pin 1 size code (front)
3. Crankshaft pin 2 size code (rear)
4. Crankshaft pin 2
5. Crankshaft pin 1

Figure 4-111. Crankshaft Code

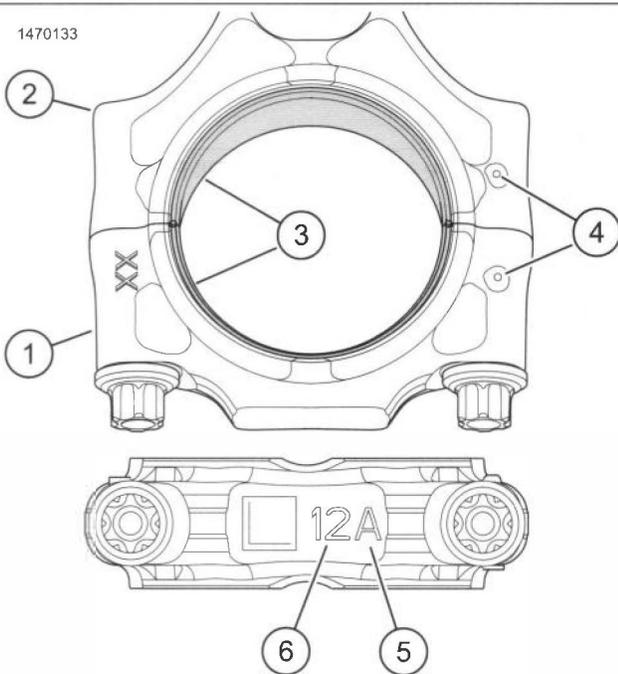
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1. Bearing half
2. Bearing in groove
3. Connecting rod

Figure 4-113. Bearing Installation

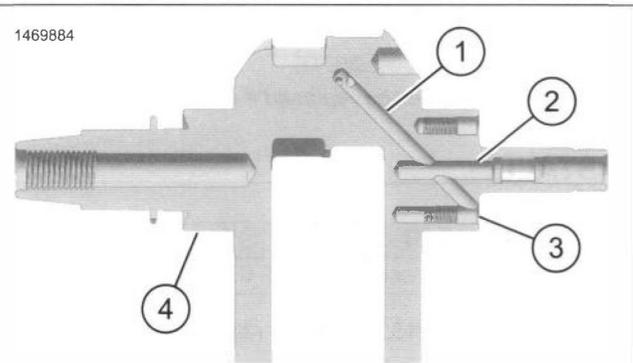
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1. Connecting rod end
2. Connecting rod
3. Bearing half (2)
4. Alignment dimples
5. Bearing size code
6. Displacement

Figure 4-112. Connecting Rod Assembled

1469884



1. Oil feed to front/rear journals
2. Main oil feed with serviceable bushing
3. Passage sealed by screw and gear
4. Crankshaft section view

Figure 4-114. Crankshaft Oil Passage

COMPLETE

1. Assemble crankcase. See CRANKCASE (Page 4-68).
2. Install camshaft drive sprocket. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
3. Install engine. See REPLACE ENGINE (Page 4-62).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Use low-pressure compressed air to clean exterior surfaces of engine and vehicle.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Separate crankcase halves. See CRANKCASE (Page 4-68).

REMOVE

1. See Figure 4-115. Discard O-rings (2).
2. Remove oil baffle (3).
3. Remove screws (4).
4. Remove scavenge oil pump (1)
5. Discard O-ring (5).

NOTE

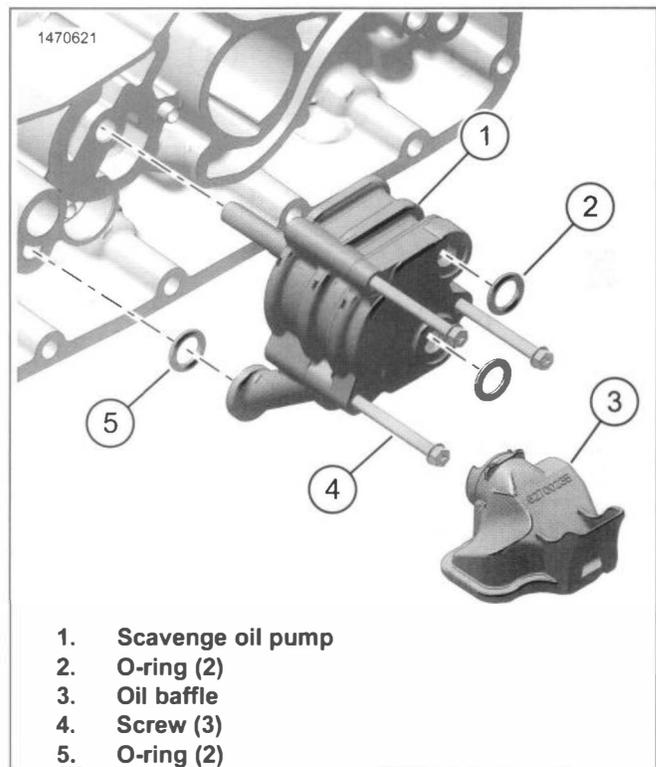
Scavenge pump must be replaced if opened up.

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------|--------------|----------|
| | 80–97 in-lbs | 9–11 N·m |
| Scavenge oil pump screw | 80–97 in-lbs | 9–11 N·m |

1. See Figure 4-115. Lubricate **new** O-ring (5) with fresh engine oil.
2. Install O-ring (5) and scavenge oil pump (1).
3. Install screws (4). Tighten.
Torque: 80–97 **in-lbs** (9–11 N·m) *Scavenge oil pump screw*

4. Install oil baffle (3).
5. Lubricate **new** O-rings (2) with fresh engine oil.
6. Install O-rings (2) to scavenge oil pump (1).



1. Scavenge oil pump
2. O-ring (2)
3. Oil baffle
4. Screw (3)
5. O-ring (2)

Figure 4-115. Scavenge Oil Pump

COMPLETE

1. Assemble crankcase halves. See CRANKCASE (Page 4-68).
2. Install engine. See REPLACE ENGINE (Page 4-62).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Use low-pressure compressed air to clean exterior surfaces of engine and vehicle.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Separate crankcase halves. See CRANKCASE (Page 4-68).

REMOVE

1. See Figure 4-116 or Figure 4-117. Remove banjo screw (1).
2. Remove oil nozzle (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|----------------|-----------|
| Oil nozzle banjo screw | 142–177 in-lbs | 16–20 N·m |

1. See Figure 4-116 or Figure 4-117. Install oil nozzle (2).
2. Install banjo screw (1). Tighten.
Torque: 142–177 in-lbs (16–20 N·m) *Oil nozzle banjo screw*

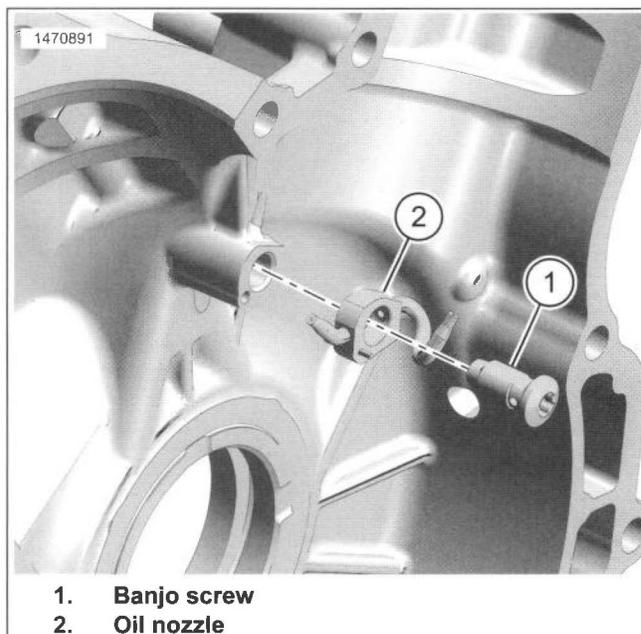


Figure 4-116. Left Crankcase Oil Nozzle

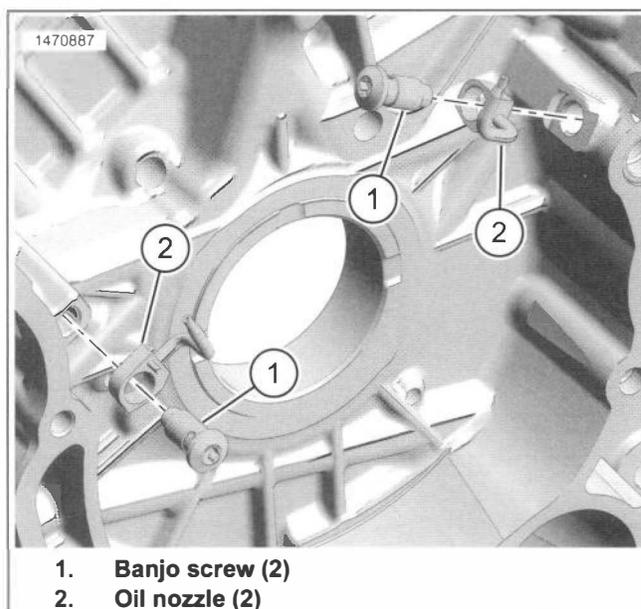


Figure 4-117. Right Crankcase Oil Nozzles

COMPLETE

1. Assemble crankcase halves. See CRANKCASE (Page 4-68).
2. Install engine. See REPLACE ENGINE (Page 4-62).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

NOTES

| SUBJECT | PAGE NO. |
|---|-----------------|
| 5.1 FASTENER TORQUE VALUES..... | 5-1 |
| 5.2 SPECIFICATIONS..... | 5-2 |
| 5.3 TRANSMISSION OPERATION..... | 5-3 |
| 5.4 DRIVE BELT..... | 5-5 |
| 5.5 OUTPUT PULLEY..... | 5-6 |
| 5.6 SHIFTER SHAFT..... | 5-8 |
| 5.7 CLUTCH..... | 5-12 |
| 5.8 DRUM AND FORKS..... | 5-19 |
| 5.9 TRANSMISSION..... | 5-20 |
| 5.10 TRANSMISSION RIGHT CRANKCASE BEARINGS..... | 5-23 |
| 5.11 TRANSMISSION LEFT CRANKCASE BEARINGS..... | 5-24 |

NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|----------------------------|-----------------------|---------------|----------------------------|
| Clutch nut | 125–140 ft-lbs | 170–190 N·m | 5.7 CLUTCH, Install |
| Detent arm screw | 89–106 in-lbs | 10–12 N·m | 5.6 SHIFTER SHAFT, Install |
| Detent collar screw | 73–95 in-lbs | 8.2–10.7 N·m | 5.6 SHIFTER SHAFT, Install |
| Output pulley nut | 85–92 ft-lbs | 115–125 N·m | 5.5 OUTPUT PULLEY, Install |
| Pinch screw | 14–16 ft-lbs | 19.5–21.5 N·m | 5.6 SHIFTER SHAFT, Install |
| Shifter, foot, screw | 18–22 ft-lbs | 24.5–30 N·m | 5.6 SHIFTER SHAFT, Install |
| Shifter link screw | 93–106 in-lbs | 10.5–12 N·m | 5.6 SHIFTER SHAFT, Install |
| Shift link to foot shifter | 89–110 in-lbs | 10.1–12.4 N·m | 5.6 SHIFTER SHAFT, Install |
| Shift return pin | 106–133 in-lbs | 12–15 N·m | 5.6 SHIFTER SHAFT, Install |
| Spring plate bolts | 71–106 in-lbs | 8–12 N·m | 5.7 CLUTCH, Assemble |

DRIVE SPECIFICATIONS

Table 5-1. Sprocket Teeth

| DRIVE | ITEM | NUMBER OF TEETH |
|---------|--------------|-----------------|
| Primary | Engine | 49 |
| | Clutch | 89 |
| Final | Transmission | 34 |
| | Rear wheel | 80 |

Table 5-2. Transmission Gear Ratios

| GEAR | GEAR RATIO |
|--------------|------------|
| First (low) | 2.857 |
| Second | 2.11 |
| Third | 1.636 |
| Fourth | 1.32 |
| Fifth | 1.11 |
| Sixth (high) | 0.97 |

TRANSMISSION SPECIFICATIONS

Table 5-3. Transmission

| TRANSMISSION | SPECIFICATION |
|--------------|---------------------------|
| Type | Constant mesh, foot shift |
| Speeds | 6 forward |

Table 5-4. Balance Shaft and Crankcase Specifications

| CASE BEARING BORE | MM | IN |
|--------------------------|--------|-------|
| Right Side Balance Shaft | 41.965 | 1.652 |
| Left Side Balance Shaft | 41.965 | 1.652 |

Table 5-4. Balance Shaft and Crankcase Specifications

| CASE BEARING BORE | MM | IN |
|--------------------------------|--------|-------|
| Right Side Transmission Input | 61.955 | 2.439 |
| Left Side Transmission Input | 51.963 | 2.046 |
| Right Side Transmission Output | 51.963 | 2.046 |
| Left Side Transmission Output | 61.955 | 2.439 |

TRANSMISSION AND CLUTCH

Table 5-5. Clutch Specifications

| TRANSMISSION | DATA |
|--|---|
| Type | Wet 8-plate |
| Clutch lever free play (after internal adjustment) | 1-2mm (Back off 2 full turns from finger tight) |

Table 5-6. Clutch Pack Plate Specifications

| ITEM | | NEW COMPONENTS | | SERVICE WEAR LIMITS | |
|---------------------------|------------------------|----------------|----------------|---------------------|-------|
| | | MM | IN | MM | IN |
| CLUTCH PLATE THICKNESS | Friction plate (fiber) | 2.80+/- 0.080 | 0.110+/- 0.003 | 2.62 | 0.103 |
| | Steel plate | 2.00+/- 0.120 | 0.079+/- 0.005 | N/A | N/A |
| MAXIMUM ALLOWABLE WARPAGE | Friction plate (fiber) | N/A | N/A | 0.15 | 0.006 |
| | Steel plate | N/A | N/A | 0.15 | 0.006 |

POWER FLOW

See Figure 5-1. The 6-speed transmission consists of two parallel shafts supporting six gears each:

- Input shaft which supports the clutch
- Output shaft which supports the transmission sprocket

Each gear on the input shaft is in constant mesh with a corresponding gear on the output shaft. 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.

Three forks are used to shift gears. A drum-shaped shifter, next to the input and output shafts, controls the position of the shifter forks.

Neutral

Power is introduced to the transmission through the clutch. In neutral with the clutch engaged, the input shaft first, second, third and fourth gears are rotating. No power is transferred to the output shaft since output shaft first, second, third and fourth gears are freewheeling gears.

First Gear

When the transmission is shifted into first gear (1), the first/fourth shift fork engages first gear to the output shaft.

Second Gear

When the transmission is shifted into second gear (2), the second/third shift fork engages second gear to the output shaft.

Third Gear

When the transmission is shifted into third gear (3), the second/third shift fork engages third gear to the output shaft.

Fourth Gear

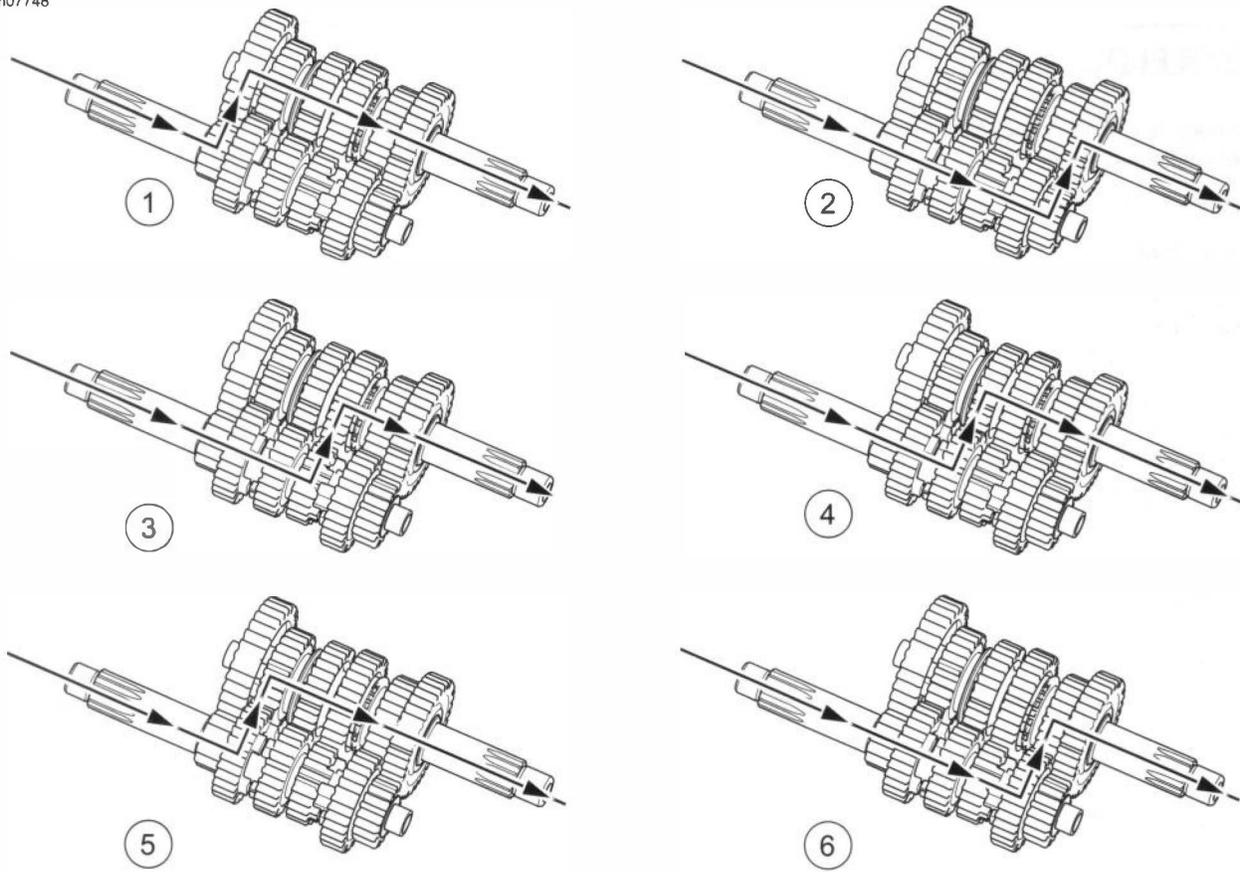
When the transmission is shifted into fourth gear (4), the first/fourth shift fork engages fourth gear to the output shaft.

Fifth Gear

When the transmission is shifted into fifth gear (5), the fifth/sixth shift fork engages fifth gear to the output shaft.

Sixth Gear

When the transmission is shifted into sixth gear (6), the fifth/sixth shift fork engages sixth gear to the output shaft.



- 1. First gear
- 2. Second gear
- 3. Third gear

- 4. Fourth gear
- 5. Fifth gear
- 6. Sixth gear

Figure 5-1. Transmission Power Flow

PREPARE**▲ WARNING**

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Position motorcycle upright on motorcycle lift. See Secure the Motorcycle for Service (Page 2-2).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove belt guards. See BELT GUARDS (Page 3-60).

REMOVE

1. Remove all tension from drive belt. See INSPECT AND ADJUST DRIVE BELT AND SPROCKETS (Page 2-27).
2. See Figure 5-2. Remove drive belt from sprockets.

INSTALL

1. See Figure 5-2. Place drive belt in position on sprockets.

2. Adjust drive belt tension. See INSPECT AND ADJUST DRIVE BELT AND SPROCKETS (Page 2-27).

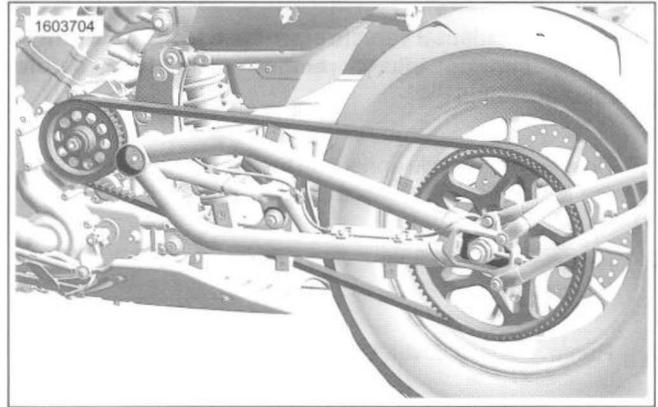


Figure 5-2. Drive Belt

COMPLETE

1. Install belt guards. See BELT GUARDS (Page 3-60).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

⚠ WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Position motorcycle upright on motorcycle lift. See Secure the Motorcycle for Service (Page 2-2).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove pulley cover. See BELT GUARDS (Page 3-60).
4. Remove drive belt from output pulley. See DRIVE BELT (Page 5-5).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|---------------------------|
| HD-52985 | DRIVE PULLEY LOCKING TOOL |

1. See Figure 5-3. Remove output pulley.
 - a. Install pulley locking tool over output pulley (6).
Special Tool: DRIVE PULLEY LOCKING TOOL (HD-52985)
 - b. Align the pulley locking tool (2) to the rear and install reaction pin (3) in the mid frame bolt (1).
 - c. Remove nut (4) and spacer (5).
2. Remove output pulley (6).

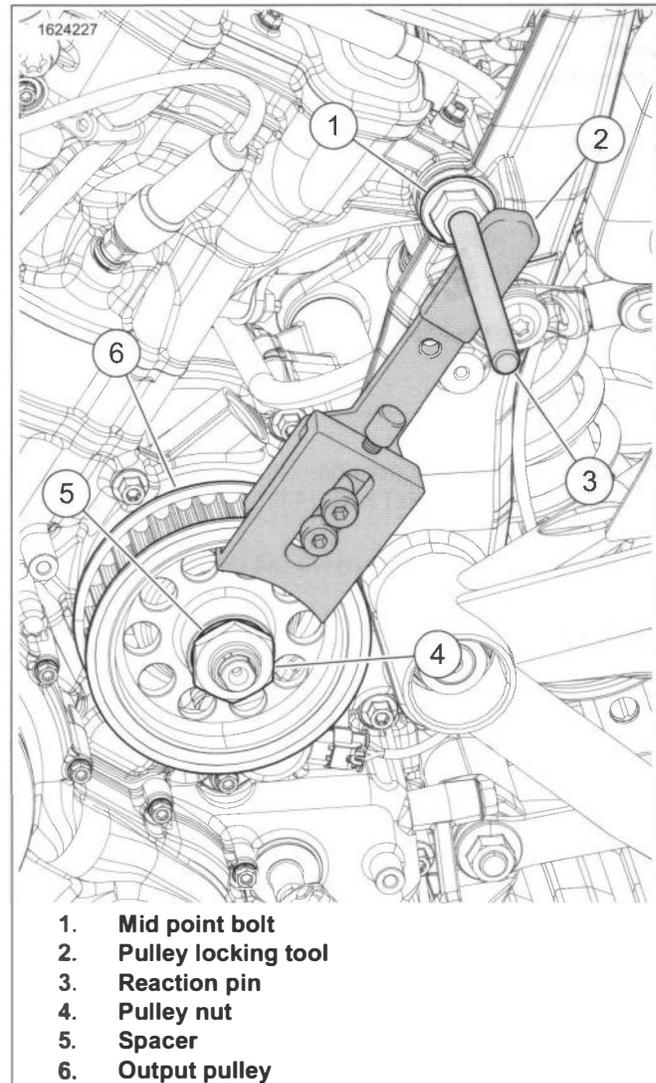
INSTALL

| PART NUMBER | TOOL NAME |
|-------------|---------------------------|
| HD-52985 | DRIVE PULLEY LOCKING TOOL |

| FASTENER | TORQUE VALUE | |
|-------------------|--------------|-------------|
| Output pulley nut | 85–92 ft-lbs | 115–125 N·m |

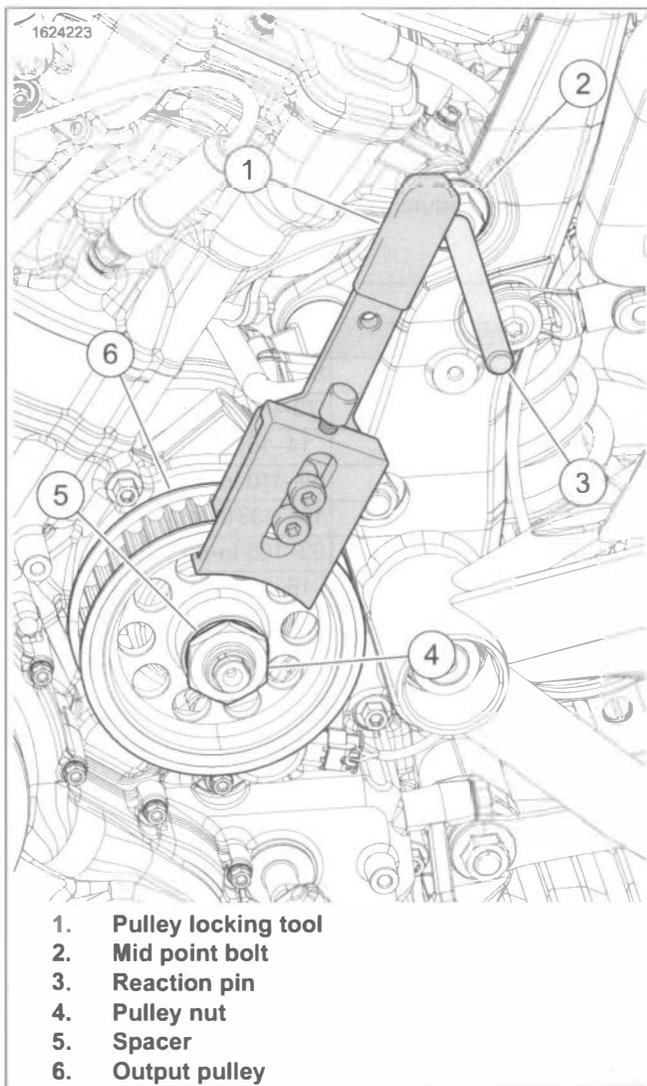
1. See Figure 5-4. Install output pulley (6) and spacer (5).
2. Install new pulley nut (4) finger-tight.
3. Install pulley locking tool over output pulley (6).
Special Tool: DRIVE PULLEY LOCKING TOOL (HD-52985)
4. Align the pulley locking tool (1) to the front.
5. Install reaction pin (3) in the mid frame bolt (2).
6. Tighten output pulley nut.
Torque: 85–92 ft-lbs (115–125 N·m) *Output pulley nut*

7. See Figure 5-5. Using a 1/8 in round flat punch, stake (2) output pulley nut (1) to groove (3) in output shaft (4) in two places, 180 degrees apart.



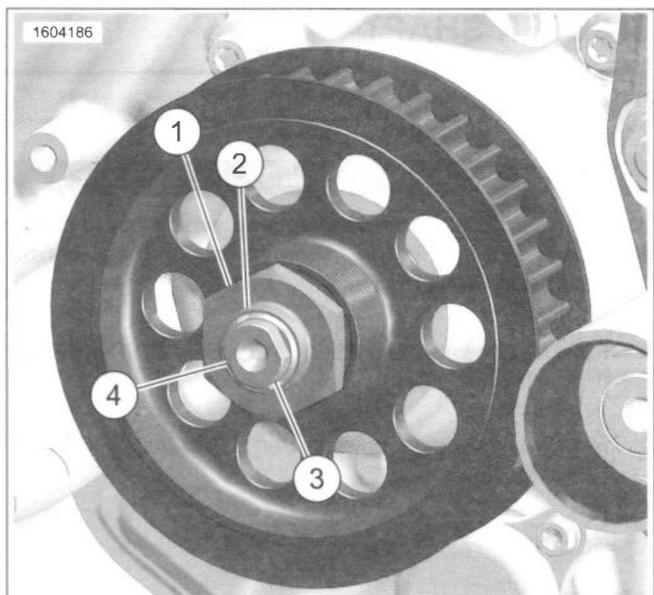
1. Mid point bolt
2. Pulley locking tool
3. Reaction pin
4. Pulley nut
5. Spacer
6. Output pulley

Figure 5-3. Remove Output Pulley



1. Pulley locking tool
2. Mid point bolt
3. Reaction pin
4. Pulley nut
5. Spacer
6. Output pulley

Figure 5-4. Install Output Pulley



1. Output pulley nut
2. Stake (2 locations)
3. Groove
4. Output shaft

Figure 5-5. Stake Output Pulley Nut

COMPLETE

1. Install drive belt. See DRIVE BELT (Page 5-5).
2. Install pulley cover. See BELT GUARDS (Page 3-60).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove motorcycle from lift. See Secure the Motorcycle for Service (Page 2-2).

PREPARE

▲ WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove primary cover. See PRIMARY COVER (Page 4-51).
3. Remove clutch. See CLUTCH (Page 5-12).

REMOVE

Shifter Linkage

1. Remove shifter linkage.
 - a. See Figure 5-6. Remove screw (4).
 - b. Remove screw (5), washer (2) and nut (1).
 - c. Remove shifter link assembly (3).
2. See Figure 5-7. Remove shift link (2) from foot shifter (1).

Shifter Shaft Assembly

1. Remove shift shaft lever.
 - a. See Figure 5-8. Remove pinch screw (4).
 - b. Remove shifter shaft lever (1).
2. Remove shift shaft assembly.
 - a. Remove lockring (3).
 - b. Remove shifter shaft seal washer (2).
 - c. See Figure 5-9. Remove shifter shaft assembly (1).

Detent Assembly

1. Remove detent arm.
 - a. See Figure 5-10. Remove screw (1) and washer (5).
 - b. Remove detent arm (3).
2. Remove detent collar.
 - a. See Figure 5-11. Remove screw (4).
 - b. Remove detent collar (1).

3. See Figure 5-12. Remove shifter shaft bushing (2) if damaged.
4. Remove shift return pin (1) if replacing.

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|----------------|---------------|
| Detent arm screw | 89–106 in-lbs | 10–12 N·m |
| Detent collar screw | 73–95 in-lbs | 8.2–10.7 N·m |
| Pinch screw | 14–16 ft-lbs | 19.5–21.5 N·m |
| Shift link to foot shifter | 89–110 in-lbs | 10.1–12.4 N·m |
| Shift return pin | 106–133 in-lbs | 12–15 N·m |
| Shifter link screw | 93–106 in-lbs | 10.5–12 N·m |
| Shifter, foot, screw | 18–22 ft-lbs | 24.5–30 N·m |

| CONSUMABLE | PART NUMBER |
|---|-------------|
| LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) | 99642-97 |

1. See Figure 5-12. Install **new** shifter shaft bushing (2) if removed.
2. Install shift return pin (1) if removed. Tighten
Torque: 106–133 in-lbs (12–15 N·m) *Shift return pin*

Detent Assembly

1. See Figure 5-10. Install detent arm.
 - a. Assemble detent arm (3), spring (4), washer (5) and screw (1).
 - b. Apply threadlocker to screw (1).
LOCTITE 243 MEDIUM STRENGTH
THREADLOCKER AND SEALANT (BLUE)
(99642-97)
 - c. Install detent arm assembly.
 - d. Tighten screw.
Torque: 89–106 in-lbs (10–12 N·m) *Detent arm screw*
2. See Figure 5-11. Install detent collar.
 - a. Apply threadlocker to screw (4).
LOCTITE 243 MEDIUM STRENGTH
THREADLOCKER AND SEALANT (BLUE)
(99642-97)
 - b. Align alignment pin (2) with alignment hole (3).
 - c. Pry detent arm back and install detent collar (1).

- d. Install screw (4).
- e. Turn input and output shaft back and forth allowing transmission to shift gears. Rotate detent collar clockwise until it stops.
- f. Tighten detent collar screw.
Torque: 73–95 **in-lbs** (8.2–10.7 N·m) *Detent collar screw*

Shifter Shaft Assembly

NOTE

The shifter link should not require adjustment under normal circumstances.

Apply one wrap of tape to shifter shaft to protect shifter shaft seal when reassembling.

- 1. See Figure 5-9. Install shifter shaft assembly.
 - a. Install shifter shaft assembly (1).
 - b. See Figure 5-8. Install **new** shifter shaft seal washer (2) and **new** lockring (3).
- 2. Install shift shaft lever.
 - a. Install shift shaft lever (1).
 - b. Install pinch screw (4). Tighten.
Torque: 14–16 ft-lbs (19.5–21.5 N·m) *Pinch screw*

Shifter Linkage

- 1. See Figure 5-12. Install shifter link (2) to foot shifter (1). Tighten.
Torque: 89–110 **in-lbs** (10.1–12.4 N·m) *Shift link to foot shifter*
- 2. See Figure 5-6. Install shifter linkage.
 - a. Install shifter linkage (3).
 - b. Install screw (4). Tighten.
Torque: 93–106 **in-lbs** (10.5–12 N·m) *Shifter link screw*
 - c. Install washer (2), screw (5) and nut (1). Tighten.
Torque: 18–22 ft-lbs (24.5–30 N·m) *Shifter, foot, screw*

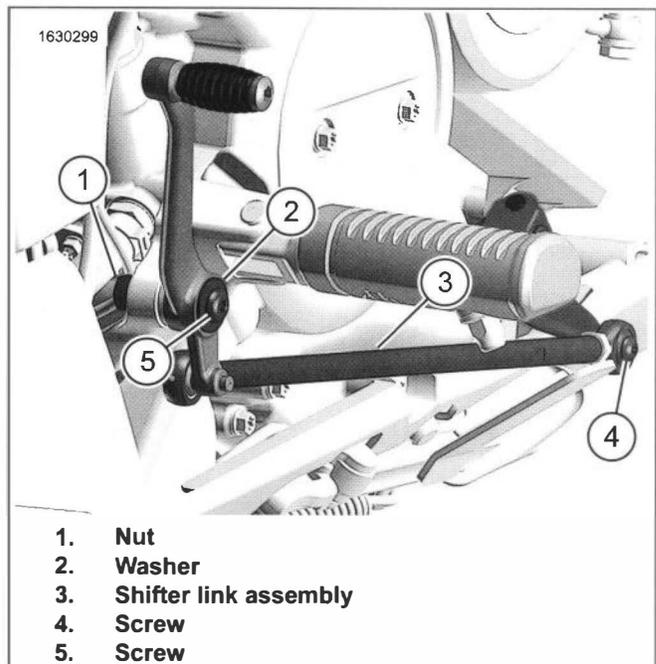


Figure 5-6. Shifter Link Assembly

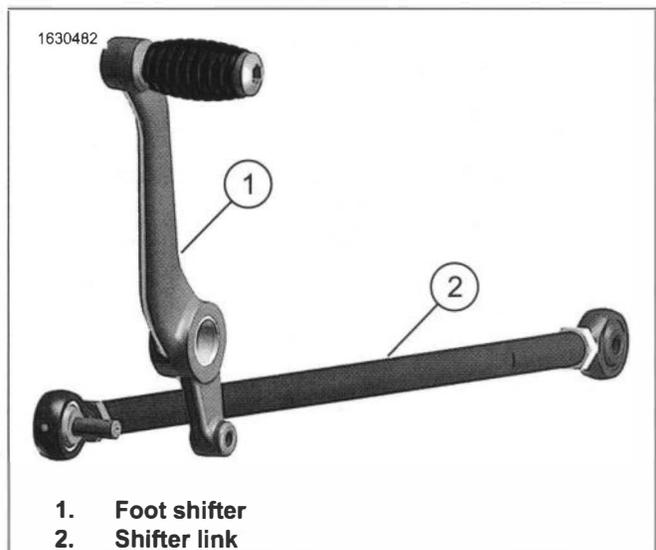
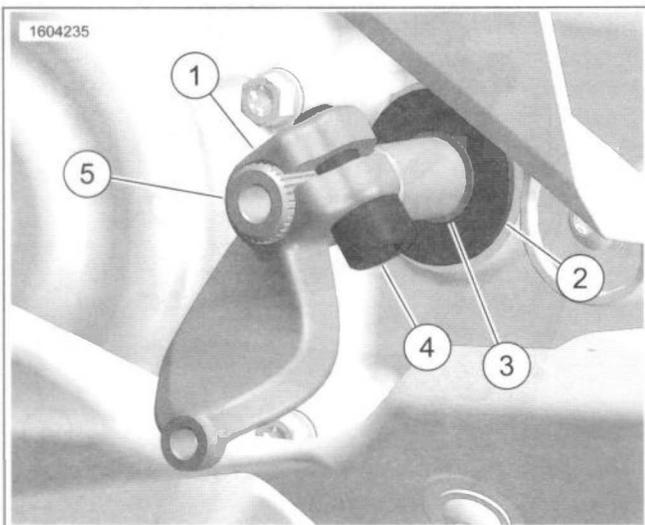
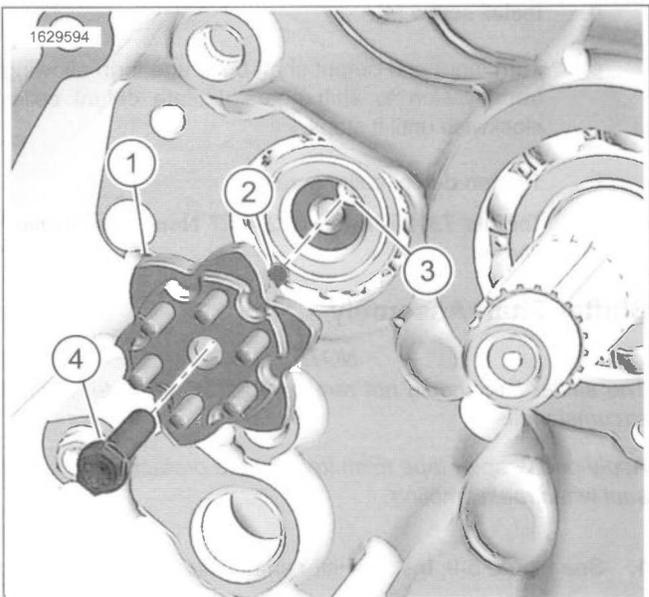


Figure 5-7. Foot Shifter



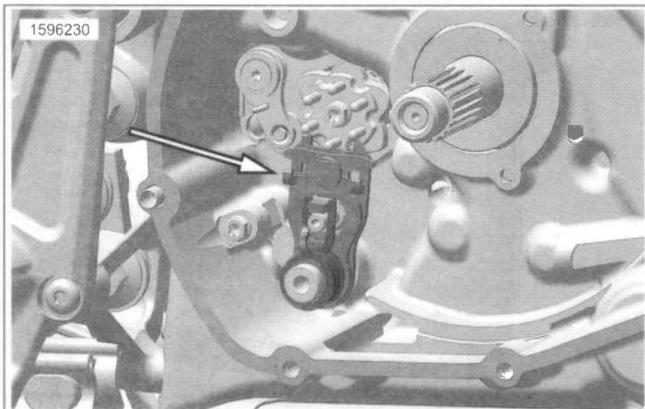
1. Shifter shaft lever
2. Shifter shaft seal washer
3. Lockring
4. Pinch screw
5. Shifter shaft

Figure 5-8. Shifter Shaft Lever



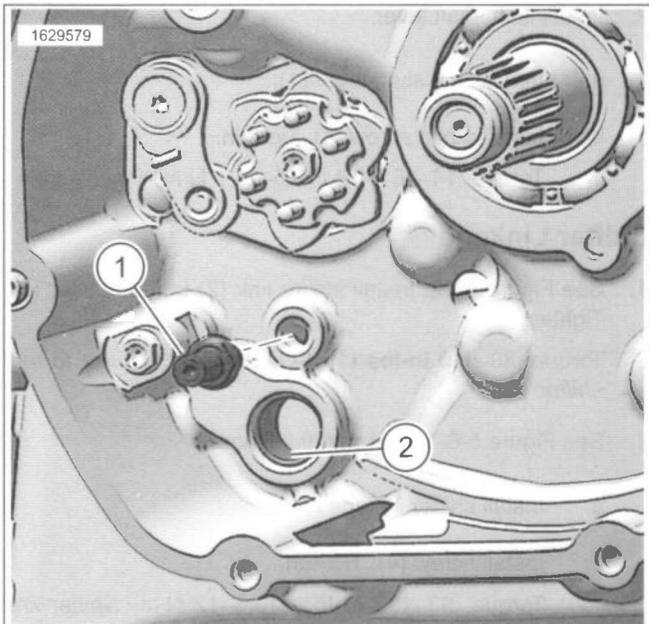
1. Detent collar
2. Alignment pin
3. Alignment hole
4. Screw

Figure 5-11. Detent Collar



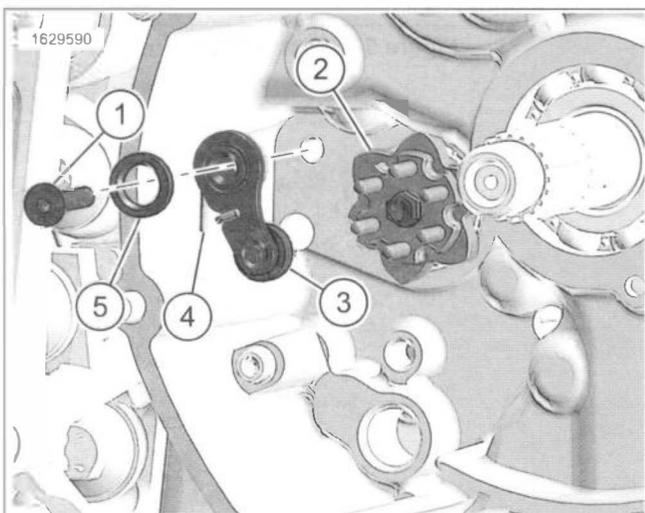
1. Shifter shaft assembly
2. Shift return pin

Figure 5-9. Shifter Shaft Assembly



1. Shift return pin
2. Shifter shaft bushing

Figure 5-12. Shift Return Pin



1. Screw
2. Detent collar
3. Detent arm
4. Spring
5. Washer, beveled

Figure 5-10. Detent Arm Assembly

DISASSEMBLE

Disassemble

1. Disassemble shifter shaft.
 - a. See Figure 5-13. Remove circlip (7). Discard.
 - b. Remove washer (1).
 - c. Remove centering spring (2).
 - d. Remove washer (6).
 - e. Remove O-ring (4). Discard.

ASSEMBLE

Assemble

1. Assemble shifter shaft.
 - a. See Figure 5-13. Lubricate and install **new** O-ring (4).
 - b. Install washer (6).
 - c. Install centering spring (2) as shown.
 - d. Install washer (1).
 - e. Install **new** circlip (7).

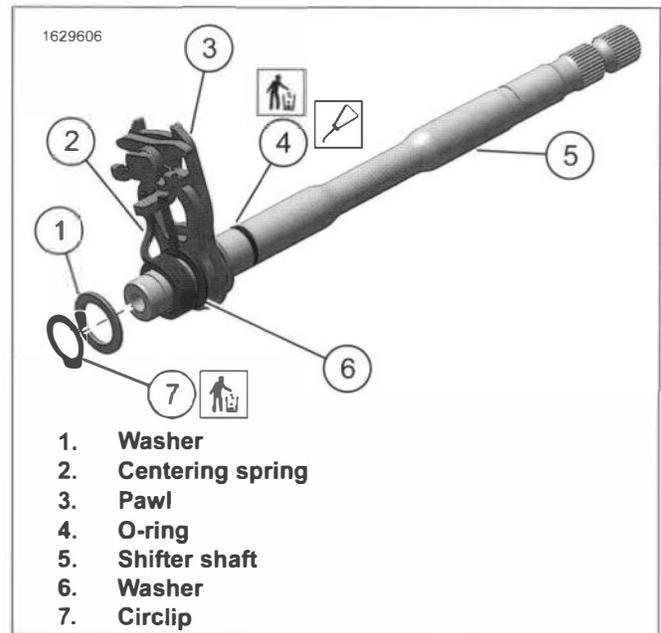


Figure 5-13. Shifter Shaft Assembly

COMPLETE

1. Install clutch. See CLUTCH (Page 5-12).
2. Install primary cover. See PRIMARY COVER (Page 4-51).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Disconnect clutch cable. See CLUTCH CONTROL (Page 3-64).
3. Drain engine oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).

NOTE

Do not disconnect coolant hoses.

4. Remove radiator mounting screws and position radiator away from oil cooler. Support as needed. See RADIATOR (Page 7-17).
5. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
6. Remove primary cover and oil baffle. See PRIMARY COVER (Page 4-51).
7. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).

REMOVE

1. See Figure 5-14. Remove the snap ring (2).
2. Remove the release rod assembly (1).
3. See Figure 5-15. Using a 12 point 24mm socket, remove and discard nut.
4. See Figure 5-16. Insert a suitable awl or screwdriver into the clutch shell hole (1).
5. Pry up on the tool to release spring tension.
6. Capture the front washer (2).
7. Pull the clutch assembly (3) outward, as you pull slide your hands behind the shell.
8. Capture the clutch bearing and spacer.
9. Remove clutch assembly.

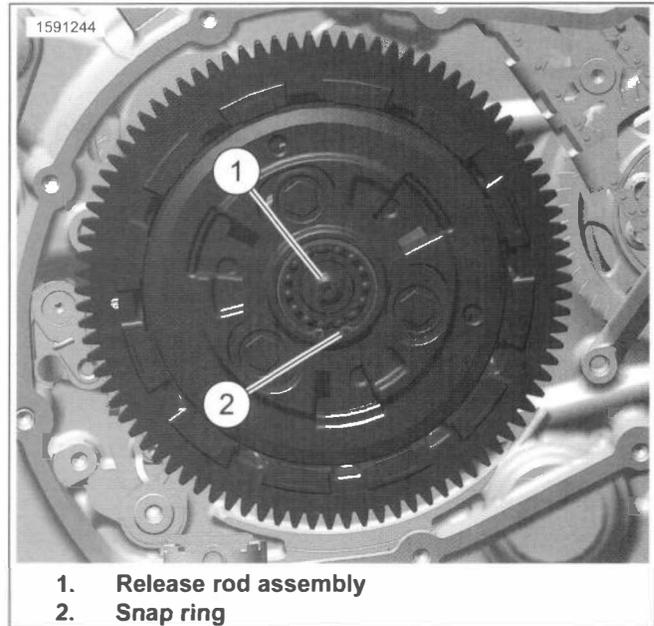


Figure 5-14. Release Rod Assembly

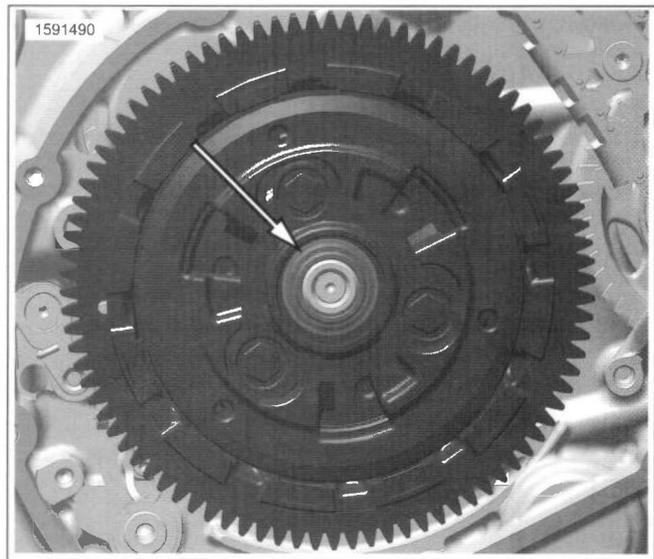


Figure 5-15. Clutch Nut

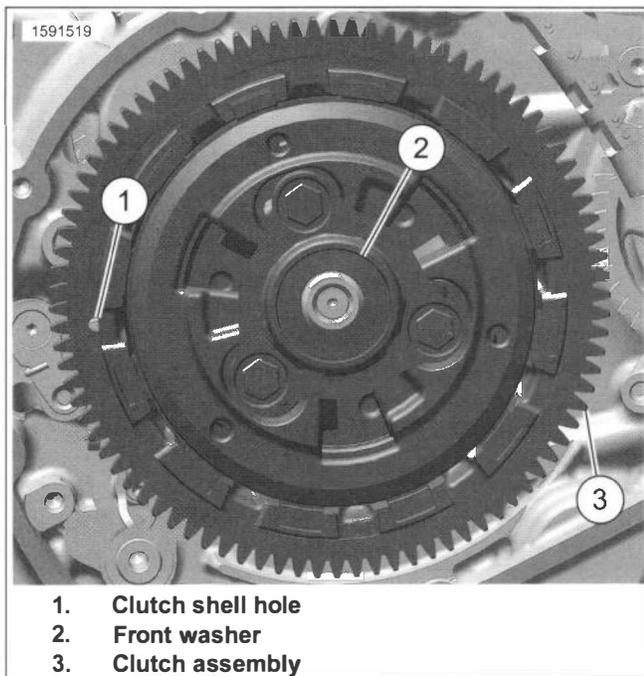


Figure 5-16. Clutch Removal

INSTALL

| FASTENER | TORQUE VALUE | |
|------------|----------------|-------------|
| Clutch nut | 125–140 ft-lbs | 170–190 N·m |

- See Figure 5-17. Install big washer on input shaft.
- See Figure 5-18. Apply engine oil to needle bearings (1) and inner bushing (2).
- Install into clutch basket (3).
- See Figure 5-19. Keep inner bushing and bearing assembly together, install clutch basket and bearings onto input shaft (2).
- Using suitable awl or screwdriver apply pressure to the spring through clutch shell hole (1) and align teeth (3).
- Slide assembly onto shaft aligning teeth with crankshaft gear.

NOTE

Verify clutch scissor gear is flush with crankshaft gear.

- See Figure 5-20. With paint mark facing out, install washer (1).
- Install new nut (2) using 12 point 24m socket. Tighten.
Torque: 125–140 ft-lbs (170–190 N·m) *Clutch nut*
- See Figure 5-21. Install release rod assembly and bearing (1).
- With paint mark or beveled side out, install snap ring (2).

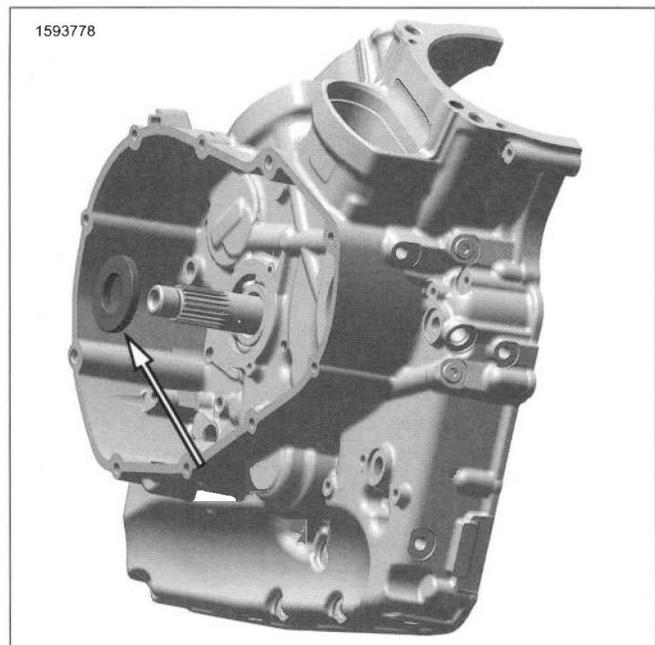


Figure 5-17. Install Washer

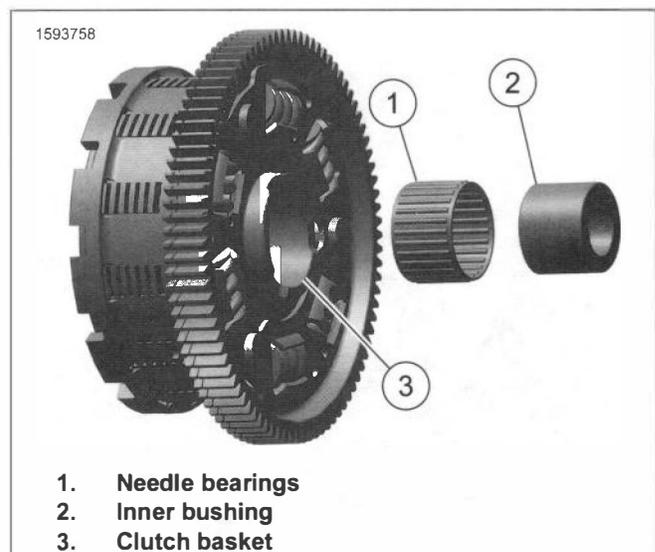


Figure 5-18. Clutch Basket Bushing and Bearings

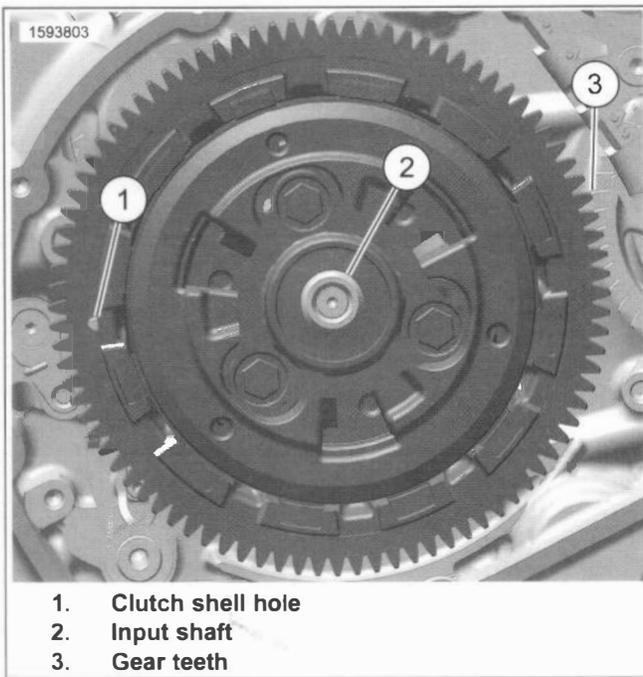


Figure 5-19. Install Clutch Assembly

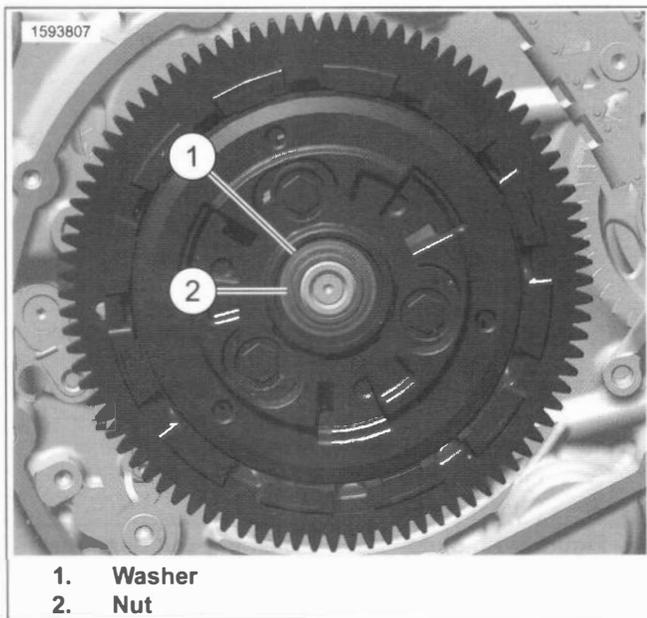


Figure 5-20. Clutch Washer and Nut

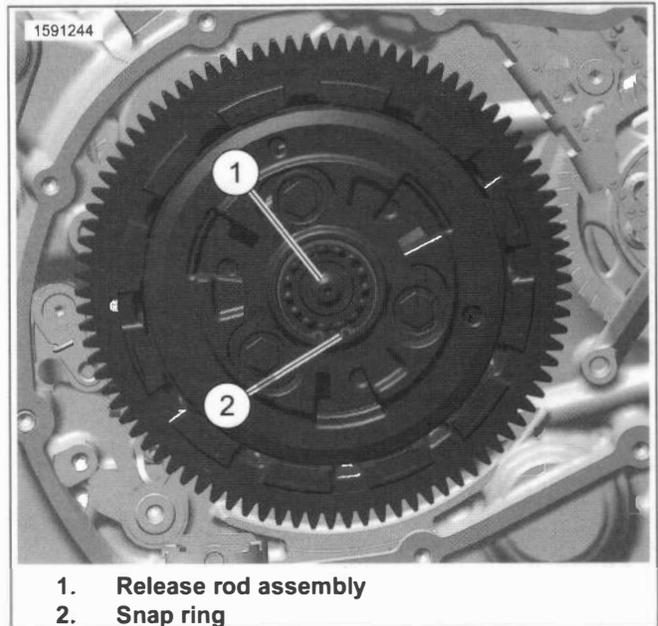


Figure 5-21. Release Rod Assembly

DISASSEMBLE

1. See Figure 5-22. Alternately loosen three bolts (1).
2. Remove bolts, spring plate (4), springs (2) and spring seats (3).
3. See Figure 5-23. Remove pressure plate assembly.
4. See Figure 5-24. Remove friction and steel plates (1-4).
5. See Figure 5-25. Remove the judder springs (1, 3).

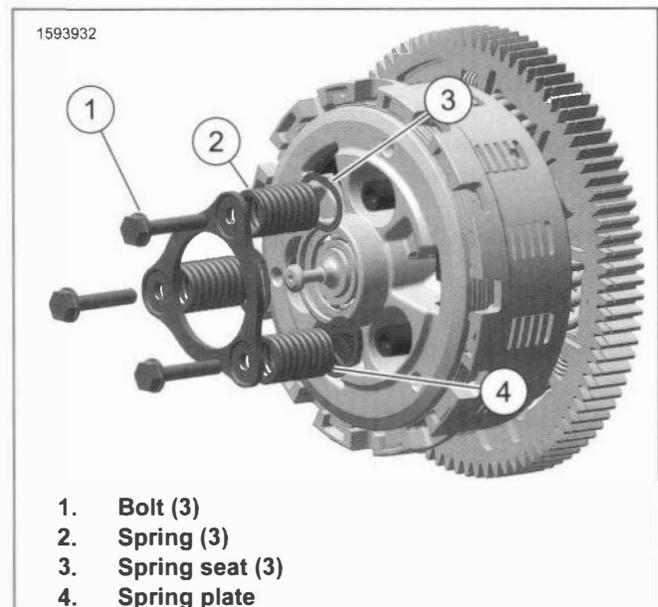


Figure 5-22. Spring Plate

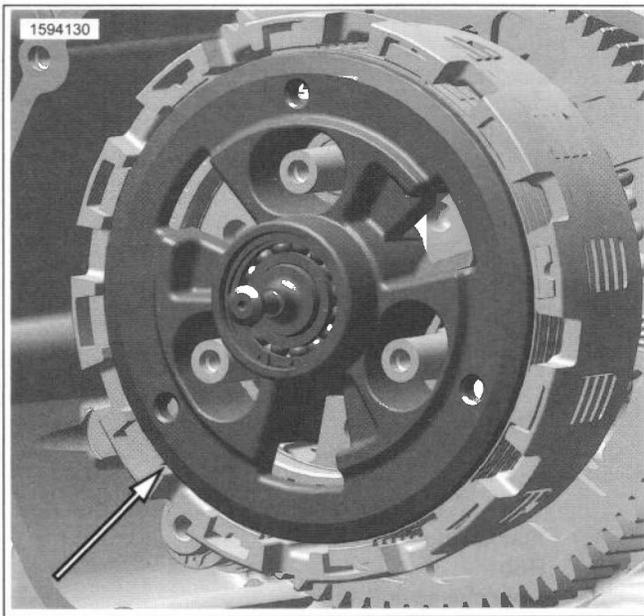


Figure 5-23. Pressure Plate

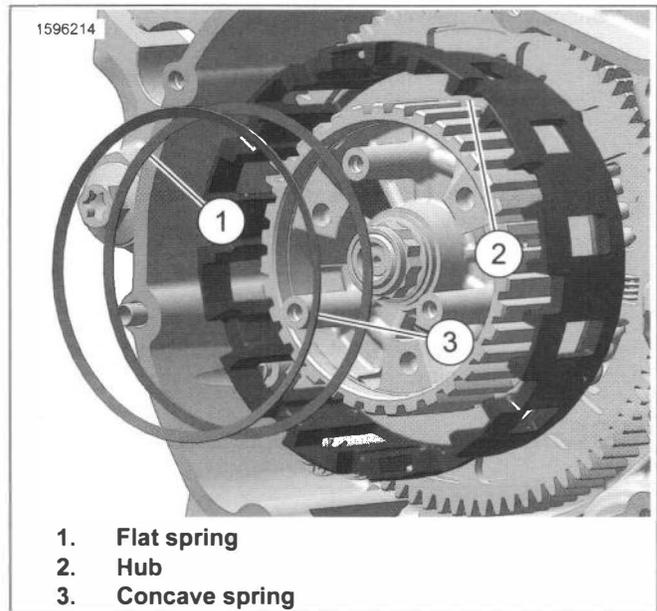


Figure 5-25. Judder Springs

CLEAN AND INSPECT

⚠ 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. (00061 a)

1. Wash parts, except friction plates and bearing, in cleaning solvent. Dry parts with low-pressure, compressed air.

NOTE

If any individual plate shows evidence of wear or damage, replace all friction plates.

2. Check friction plates:

NOTE

Discard any steel plate that is grooved or bluish in color. Blue plates are likely warped or distorted.

- a. Use low-pressure, compressed air to remove all lubricant. Do not dry with cloth.
 - b. Look for worn or damaged fiber surface material on both sides.
 - c. Measure thickness of each plate at friction material with a dial caliper or micrometer.
 - d. Discard all friction plates if any one plate is less than 0.103 in (2.62 mm) thick.
3. Check steel plates:
 - a. Lay each plate on a precision flat surface.
 - b. Insert feeler gauge between plate and flat surface in several places.
 - c. Replace any steel plate that is warped more than 0.15 mm (0.006 in).

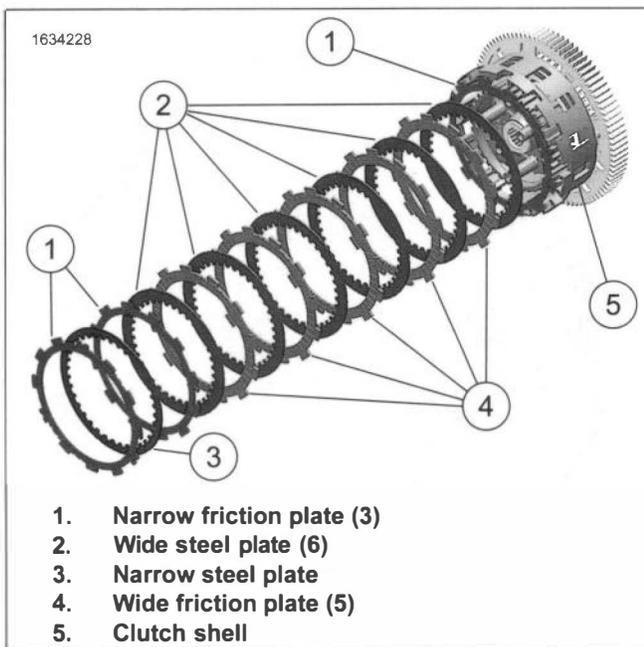


Figure 5-24. Clutch Plates

4. Check clutch basket and hub.
 - a. Check for smooth movement of friction and steel plates in clutch hub and basket. Replace as necessary.
 - b. Check for excessive wear or damage. Replace as necessary.
5. Check bearings.
 - a. Replace bearing if it rotates roughly, binds or has any end play.

ASSEMBLE

| FASTENER | TORQUE VALUE | |
|--------------------|---------------|----------|
| Spring plate bolts | 71–106 in-lbs | 8–12 N·m |

1. Submerge and soak all friction plates in primary chaincase lubricant for at least five minutes.
2. See Figure 5-26. Install judder springs.
 - a. Install flat spring (1).
 - b. Install concave spring (3) (cupped side out).
3. See Figure 5-27 and See Figure 5-28.. Install narrow friction plate.
 - a. Align narrow friction plate (2) tab (1) with slot (3) as shown.
 - b. Slide friction plate completely in clutch shell (4).

4. **NOTE**

Plate tabs need to be in the same slot as first friction plate tabs.

See Figure 5-28. Alternating plates, install wide steel (2) and wide friction (4) plates into clutch shell (5).

5. Install narrow friction plate (1) and narrow steel plate (3) in same slot on clutch shell as other plates.

NOTE

Last friction plate tab is adjacent from other friction plate tabs.

6. See Figure 5-29. Align and install last narrow friction plate tab (1) with slot (2) on clutch shell (3) as shown.
7. See Figure 5-30. Install pressure plate.
8. See Figure 5-31. Install spring seats (3), springs (2), spring plate (4) and bolts (1). Alternately tighten.

Torque: 71–106 in-lbs (8–12 N·m) *Spring plate bolts*

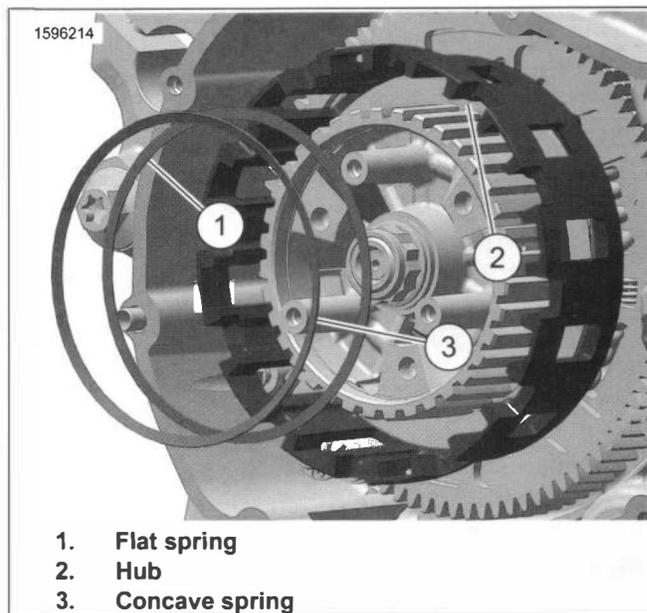


Figure 5-26. Judder Springs

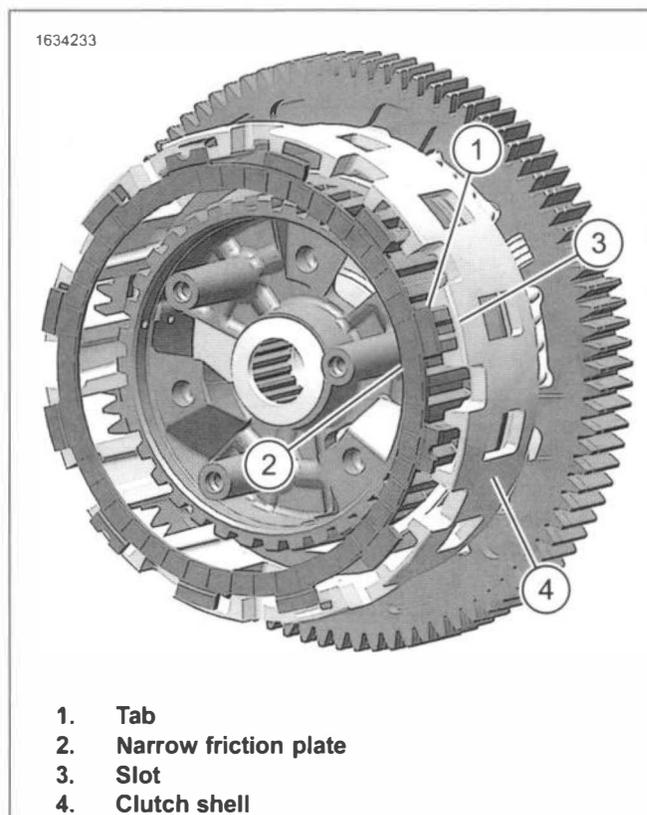


Figure 5-27. Friction Plate and Clutch Shell Alignment

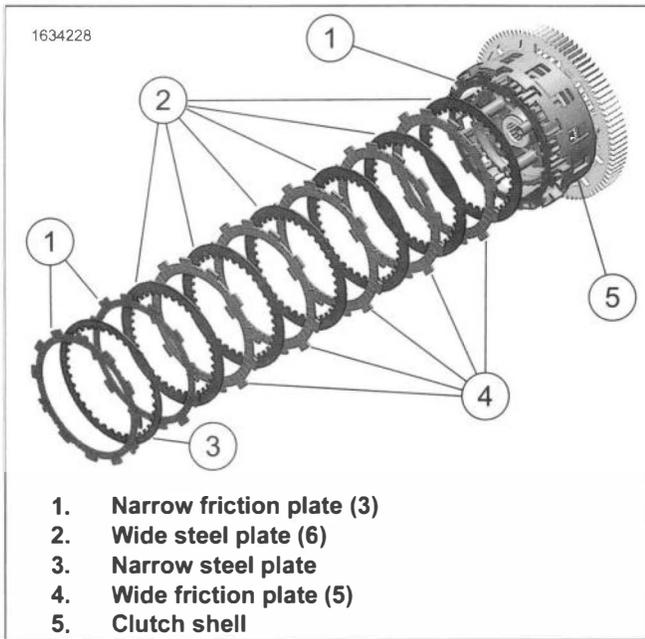


Figure 5-28. Clutch Plates

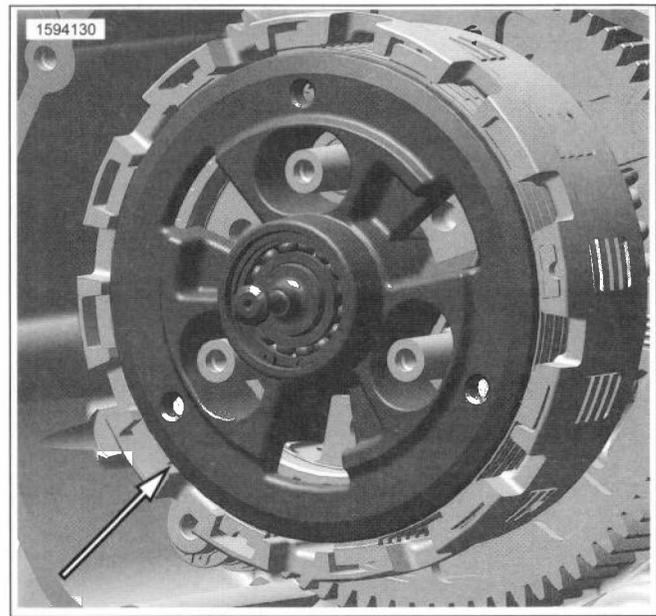


Figure 5-30. Pressure Plate

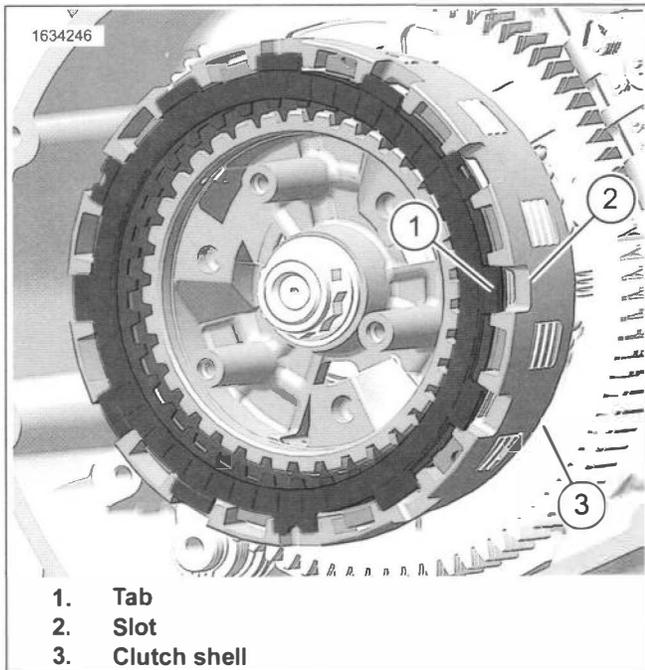


Figure 5-29. Last Friction Plate Alignment

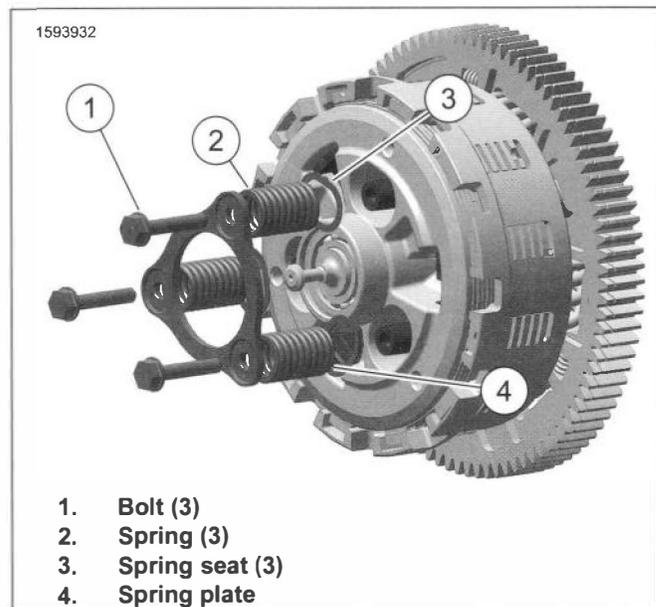


Figure 5-31. Spring Plate

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52956 | CRANKSHAFT LOCKING TOOL |

1. Install clutch baffle and primary cover. See PRIMARY COVER (Page 4-51).
2. Connect and adjust clutch cable. See CLUTCH CONTROL (Page 3-64).
3. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
4. Install radiator assembly. See RADIATOR (Page 7-17).
5. Install chin spoiler. See CHIN SPOILER (Page 3-69).
6. Fill with oil. See REPLACE ENGINE OIL AND FILTER (Page 2-7).

7. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Use low-pressure compressed air to clean exterior surfaces of engine and vehicle.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Separate crankcase halves. See CRANKCASE (Page 4-68).

REMOVE

1. See Figure 5-32. Remove shift forks.
 - a. Remove shift fork shaft (5) and 5th/6th gear shift fork (4).
 - b. Remove shift fork shaft (1) and 1st/4th gear shift fork (2).
 - c. Remove 2nd/3rd gear shift fork (3).
 - d. Remove drum shifter cam assembly (6).

INSTALL

1. See Figure 5-32. Install shift forks.
 - a. Install drum shifter cam assembly (6).
 - b. Install center (5th/6th) shift fork (4), identified by the letter "C" facing up.
 - c. Rotate the drum shifter cam assembly to align the finger on the shift fork.
 - d. Install shift fork shaft (5).
 - e. Install "R" side (2nd/3rd) gear shift fork (3) on the bottom "R" facing down.

- f. Align with the drum shifter cam assembly.
- g. Install "L" side (1st/4th) gear shift fork (2) on the top "L" facing up.
- h. Install shift fork shaft (1).

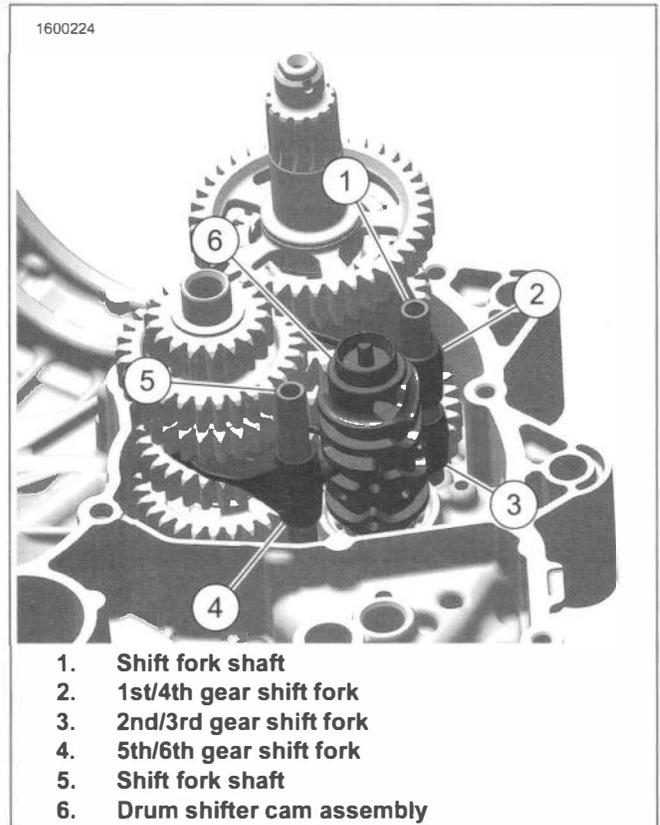


Figure 5-32. Shift Forks

COMPLETE

1. Assemble crankcase halves. See CRANKCASE (Page 4-68).
2. Install engine. See REPLACE ENGINE (Page 4-62).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Use low-pressure compressed air to clean exterior surfaces of engine and vehicle.
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove engine. See REPLACE ENGINE (Page 4-62).
4. Separate crankcase halves. See CRANKCASE (Page 4-68).
5. Remove drum and forks. See DRUM AND FORKS (Page 5-19).

REMOVE

1. See Figure 5-33. Remove gear pack assembly.
 - a. Lift input shaft assembly (1) far enough to support the bottom gear.
 - b. Lift output shaft assembly (2). Remove gear pack assembly.

INSTALL

1. See Figure 5-33. Install gear pack.
 - a. Align input shaft assembly (1) up to the output shaft assembly (2) mesh gears.
 - b. Install gear pack.

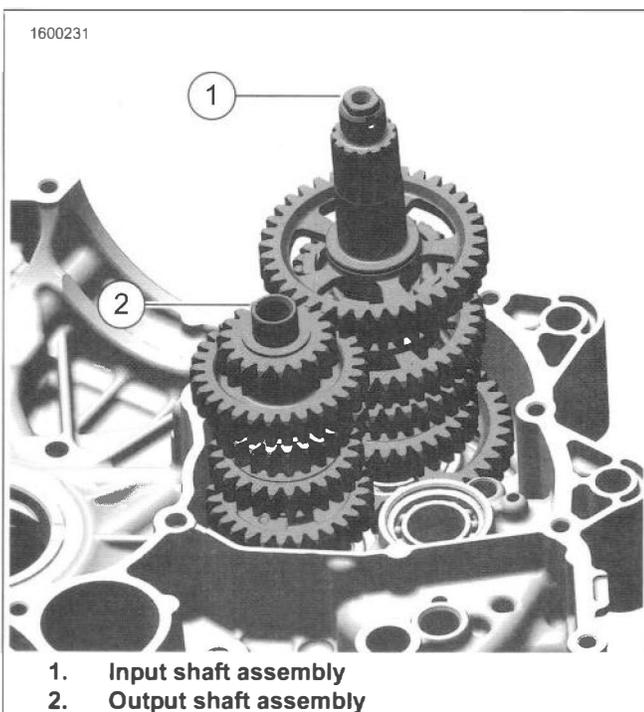


Figure 5-33. Gear Pack Assembly

DISASSEMBLE**Input Shaft**

See Figure 5-34. Remove gears (2 through 6) from input shaft.

Output Shaft

See Figure 5-35. Remove gears (1 through 8) from output shaft.

ASSEMBLE

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| SCREAMIN' EAGLE ASSEMBLY LUBE | 11300002 |

Input Shaft**NOTE**

Do not over stretch circlips.

First gear is part of the shaft.

1. See Figure 5-34. Install fifth gear (2).
 - a. Apply lube to bushing and bore of gear.
SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - b. Slide bushing into gear and install on shaft.
 - c. Install fifth gear washer (3).
 - d. Install circlip. Verify circlip is seated properly in groove.
2. Install fourth and third gear (4).
3. Install sixth gear (5).
 - a. Install circlip. Verify circlip is seated properly in groove.
 - b. Install sixth gear washer.
 - c. Apply lube to sixth gear needle bearing.
SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - d. Slide needle bearing on shaft.
 - e. Install sixth gear.
4. Install second gear (6).
5. Install securing washer (7).

Output Shaft

1. See Figure 5-35. Install second gear (1).
 - a. Apply lube to bushing and bore of gear.

SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- b. Slide bushing into gear.
- c. Identify chamfer on gear.
- d. Install gear and bushing with chamfer facing the next gear being installed.
- e. Install washer (2).
- f. Install circlip with sharp side facing out.
- g. Verify circlip is in groove.

2. Install sixth gear (3).

3. Install third gear (4).

- a. Install circlip with sharp edge facing away from gear being installed.
- b. Verify circlip is in groove.
- c. Install washer
- d. Apply lube to third gear needle bearing.

SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- e. Slide needle bearing on shaft.
- f. Install third gear on shaft.

4. Install fourth gear (5).

- a. Apply lube to fourth gear needle bearing.

SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- b. Slide needle bearing on shaft.
- c. Install fourth gear on shaft.
- d. Install washer.
- e. Install circlip with sharp edge facing away from gear being installed. Verify circlip is seated properly in groove.

5. Install fifth gear (6).

6. Install first gear (8).

- a. Install washer.
- b. Apply lube to bushing and bore of gear.

SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- c. Identify chamfer on gear.
- d. Install gear and bushing with chamfer facing away from other gears.

7. Install keeper washer.

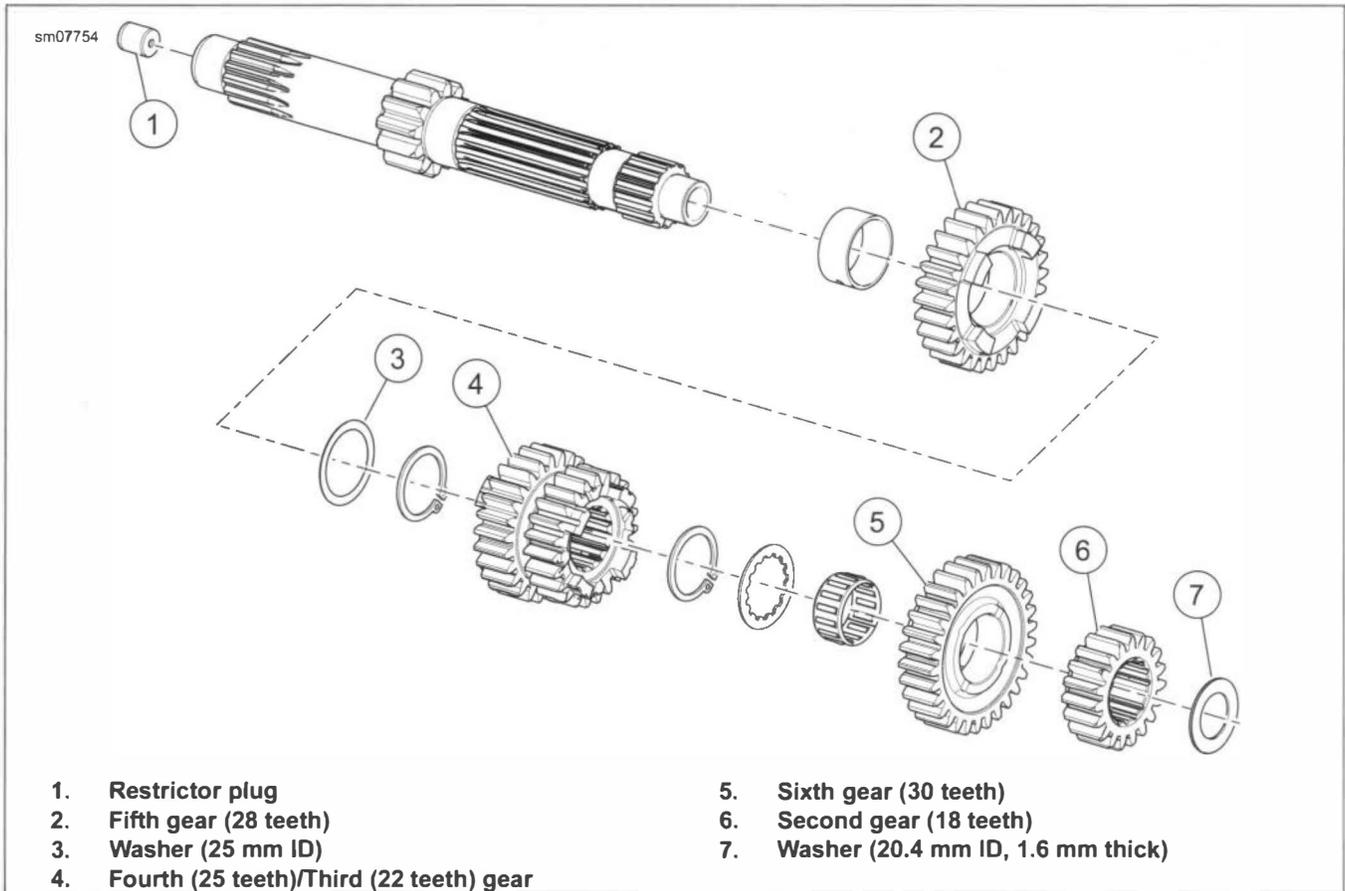
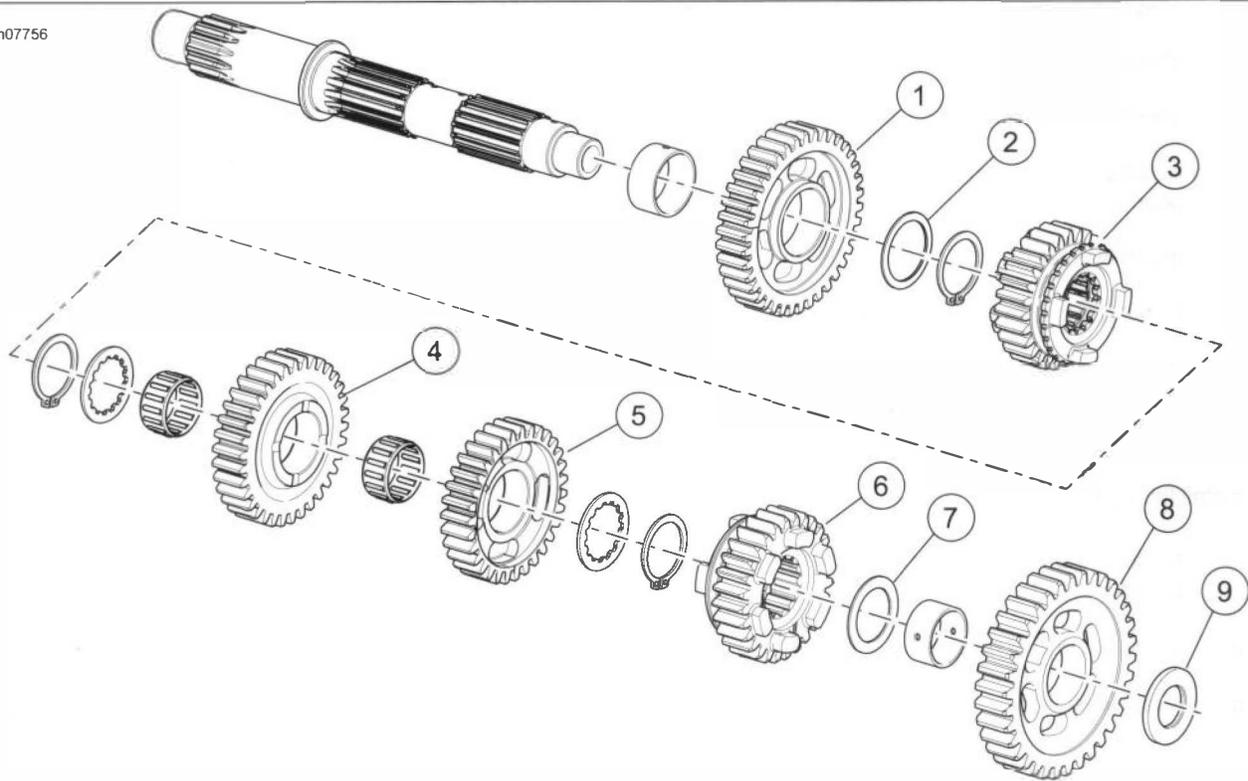


Figure 5-34. Input Shaft



1. Second gear (38 teeth)
2. Washer (25 mm ID)
3. Sixth gear (29 teeth)
4. Third gear (36 teeth)
5. Fourth gear (33 teeth)

6. Fifth gear (31 teeth)
7. Washer (27 mm ID)
8. First gear (40 teeth)
9. Washer (25.4 mm ID, 1.6 mm thick)

Figure 5-35. Output Shaft

COMPLETE

1. Install drum and forks. See DRUM AND FORKS (Page 5-19).

2. Assemble crankcase halves. See CRANKCASE (Page 4-68).

3. Install engine. See REPLACE ENGINE (Page 4-62).

4. Install main fuse. See POWER DISCONNECT (Page 8-4).

GENERAL

See CRANKCASE (Page 4-68) for transmission right crankcase bearing removal and installation.

GENERAL

See CRANKCASE (Page 4-68) for transmission left crankcase bearing removal and installation.

| SUBJECT | PAGE NO. |
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| 6.3 AIR BOX..... | 6-3 |
| 6.4 BREATHER BOLT..... | 6-5 |
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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|---------------------------------|-----------------------|---------------|---|
| | | | |
| Air box base screw final torque | 44–62 in-lbs | 5–7 N·m | 6.3 AIR BOX, Install |
| Air box base screw first torque | 35–44 in-lbs | 4–5 N·m | 6.3 AIR BOX, Install |
| Air box cover screw | 22–27 in-lbs | 2.5–3.1 N·m | 6.3 AIR BOX, Install |
| Air filter clamp | 22–24 in-lbs | 2.5–2.7 N·m | 6.3 AIR BOX, Install |
| Breather bolt | 80–97 in-lbs | 9–11 N·m | 6.4 BREATHER BOLT, Install |
| Console screws | 27–35 in-lbs | 3–4 N·m | 6.6 CONSOLE, Install |
| Exhaust, rear header nuts | 15–16 ft-lbs | 20–22 N·m | 6.26 EXHAUST SYSTEM, Install |
| Exhaust clamp | 71–89 in-lbs | 8–10 N·m | 6.25 MUFFLERS, Install |
| Exhaust header nuts, front | 15–16 ft-lbs | 20–22 N·m | 6.26 EXHAUST SYSTEM, Install |
| Exhaust shield, inner, screw | 44–62 in-lbs | 5–7 N·m | 6.25 MUFFLERS, Install |
| Exhaust shield screw | 44–62 in-lbs | 5–7 N·m | 6.25 MUFFLERS, Install |
| Exhaust shield screws, outer | 44–62 in-lbs | 5–7 N·m | 6.25 MUFFLERS, Install |
| Fuel cap screws | 25–29 in-lbs | 2.8–3.3 N·m | 6.12 FUEL LEVEL SENDER, Install |
| Fuel inlet screws | 40–49 in-lbs | 4.5–5.5 N·m | 6.10 FUEL INLET, Install |
| Fuel pump assembly screw | 40–49 in-lbs | 4.5–5.5 N·m | 6.13 FUEL PUMP, Install |
| Fuel rail screws | 80–97 in-lbs | 9–11 N·m | 6.20 FUEL INJECTORS, Install |
| Fuel rail screws | 80–97 in-lbs | 9–11 N·m | 6.22 INTAKE MANIFOLD, Install |
| Fuel regulator screw | 80–97 in-lbs | 9–11 N·m | 6.20 FUEL INJECTORS, Install |
| Fuel regulator screw | 80–97 in-lbs | 9–11 N·m | 6.22 INTAKE MANIFOLD, Install |
| Fuel tank mounting bracket bolt | 18–21 ft-lbs | 25–29 N·m | 6.11 FUEL TANK, Install |
| Fuel tank mounting screws | 89–102 in-lbs | 10–11.5 N·m | 6.11 FUEL TANK, Install |
| Induction module screw | 124–142 in-lbs | 14–16 N·m | 6.21 INDUCTION MODULE, Install |
| Intake manifold screws | 80–97 in-lbs | 9–11 N·m | 6.22 INTAKE MANIFOLD, Install |
| MAP sensor screw | 80–97 in-lbs | 9–11 N·m | 6.17 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR, Install |
| MAP sensor screw | 80–97 in-lbs | 9–11 N·m | 6.17 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR, Install |
| MAP sensor screws | 80–97 in-lbs | 9–11 N·m | 6.22 INTAKE MANIFOLD, Install |
| Muffler mounting screw | 89–106 in-lbs | 10–12 N·m | 6.25 MUFFLERS, Install |
| Oxygen sensor, heated | 12–14 ft-lbs | 16.5–19.5 N·m | 6.24 HEATED OXYGEN SENSORS (HO2S), Install |
| Oxygen sensor, heated | 12–14 ft-lbs | 16.5–19.5 N·m | 6.24 HEATED OXYGEN SENSORS (HO2S), Install |
| TGS screws | 4 in-lbs | 0.4 N·m | 6.18 TWIST GRIP SENSOR (TGS), Install |

SPECIFICATIONS

Table 6-1. Fuel System Specifications

| FUEL SYSTEM | TYPE |
|--------------------|-------------|
| Recommended fuel | 91 Octane |

Table 6-2. Fuel System Capacities

| ITEM | U.S. | METRIC |
|---|-------------|---------------|
| Fuel tank (total) | 3.1 gal | 11.8 L |
| Low fuel warning light on (approximate) | 0.8 gal | 3.0 L |

Table 6-3. Fuel Pump Pressure Specifications

| RANGE | VALUE |
|--------------|-------------------------|
| Normal | 54–62 psi (376–425 kPa) |

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4)
2. Remove seat. See SEAT (Page 3-82).
3. Remove fuel tank. See FUEL TANK (Page 6-12)

REMOVE

1. See Figure 6-1. Remove air box cover.
 - a. Disconnect connector (2).
 - b. Remove screws (3).
 - c. Remove air box cover (1).
2. See Figure 6-3. Remove air box breather tube (1) from front cylinder head breather bolt.
3. See Figure 6-4. Remove air box base.
 - a. Loosen clamp (10).
 - b. Remove air filter (9).
 - c. Remove screws (1-8).
 - d. Grasp air box base (12) from the rear side, lift 30 degrees. Remove.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------------|---------------------|-------------|
| Air box base screw final torque | 44–62 in-lbs | 5–7 N·m |
| Air box base screw first torque | 35–44 in-lbs | 4–5 N·m |
| Air box cover screw | 22–27 in-lbs | 2.5–3.1 N·m |
| Air filter clamp | 22–24 in-lbs | 2.5–2.7 N·m |

NOTE

Clean with a mixture of 50 percent isopropyl alcohol and 50 percent distilled water.

1. See Figure 6-2. Thoroughly clean snorkel (4) sealing surfaces (1).
2. Thoroughly clean sealing surface inside of air cleaner (3) to ensure a proper seal.
3. See Figure 6-4. Install air box base.
 - a. Install air box base (12). Verify the velocity stacks are properly seated.
 - b. See Figure 6-3. Install air box breather tube (1) to front cylinder head breather bolt.

- c. See Figure 6-4. Hand start screws (1-8) in sequence shown.
- d. Using hand tools, tighten screws in sequence shown to first torque specification.
Torque: 35–44 **in-lbs** (4–5 N·m) *Air box base screw first torque*
- e. Using hand tools, tighten screws in sequence shown to final torque specification.
Torque: 44–62 **in-lbs** (5–7 N·m) *Air box base screw final torque*
- f. Install air filter (9) and clamp (10).
- g. Tighten clamp.
Torque: 22–24 **in-lbs** (2.5–2.7 N·m) *Air filter clamp*
4. See Figure 6-4. Check gasket (11) for damage and replace as necessary.
5. See Figure 6-1. Install air box cover (1).
 - a. Install screws (3). Tighten.
Torque: 22–27 **in-lbs** (2.5–3.1 N·m) *Air box cover screw*
 - b. Connect connector (2).

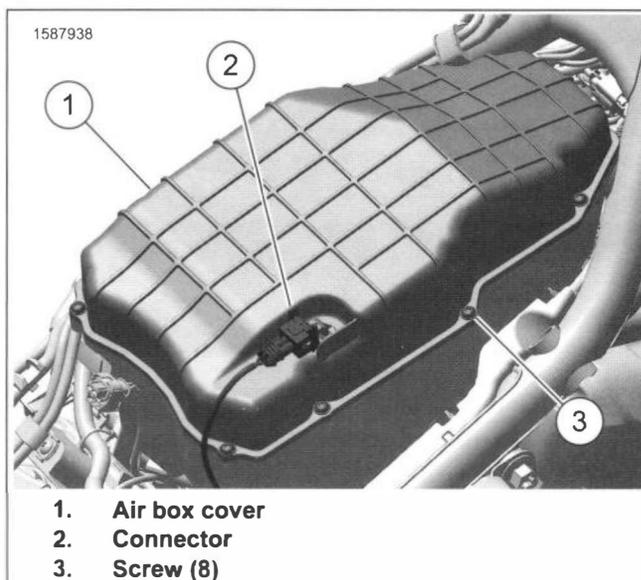


Figure 6-1. Air Box Cover

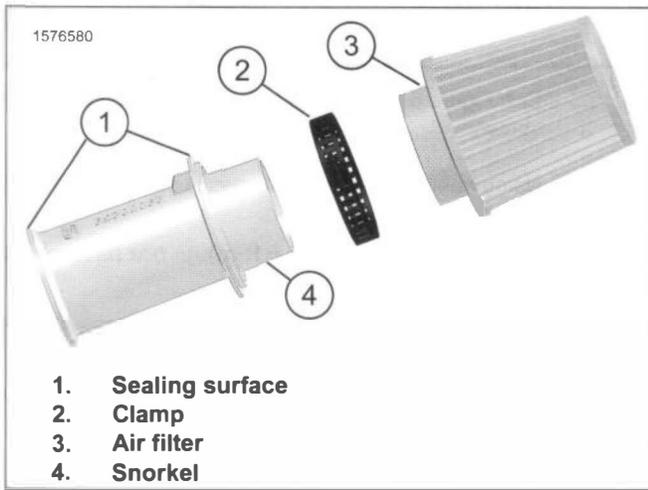


Figure 6-2. Air Box Snorkel

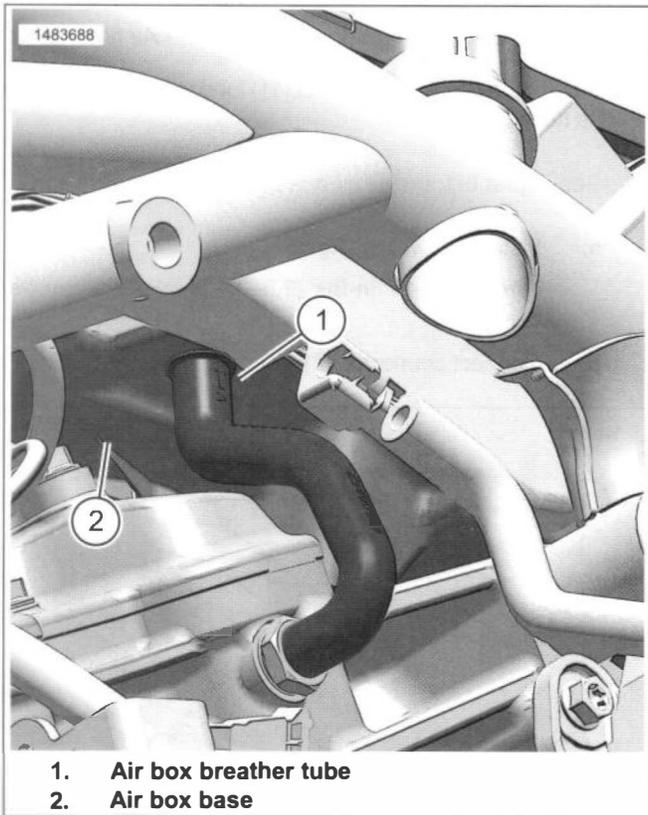


Figure 6-3. Air Box Breather Tube

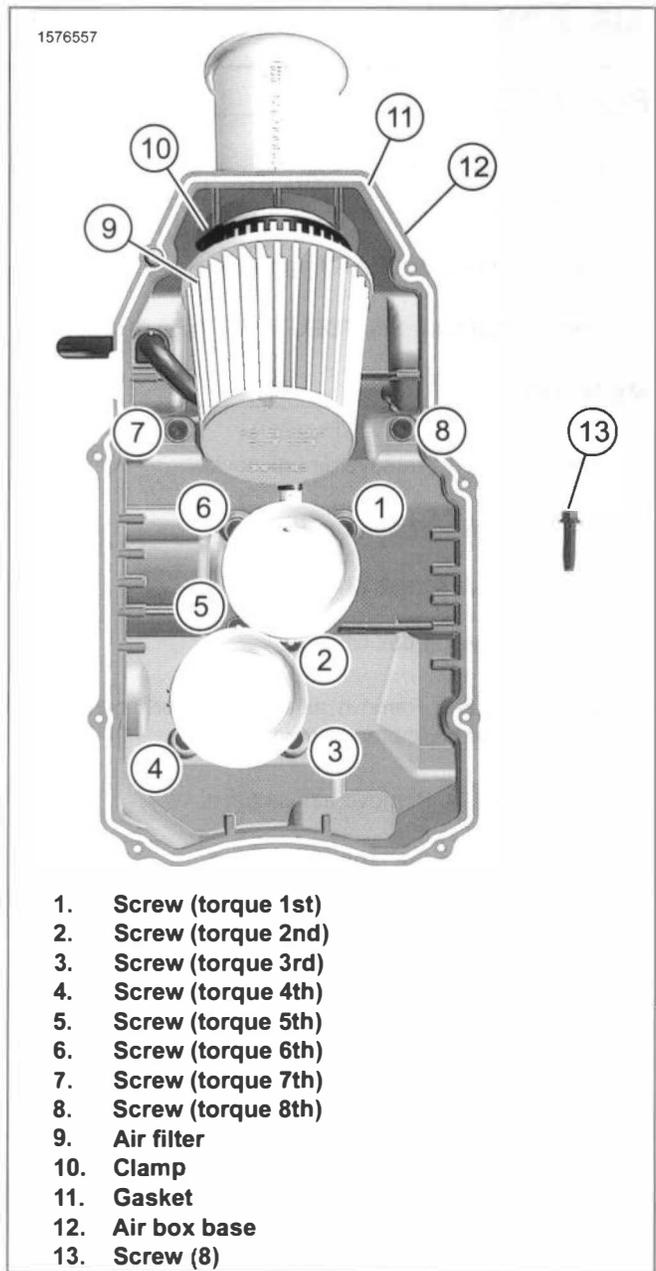


Figure 6-4. Air Box Base Torque Sequence

COMPLETE

1. Install fuel tank. See FUEL TANK (Page 6-12)
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4)

REMOVE

1. Remove breather tube.
 - a. See Figure 6-5. Remove breather tube (2) from front cylinder head breather bolt (1).
2. Remove breather bolt.
 - a. See Figure 6-6. Remove breather bolt (2).
 - b. Remove O-ring (1). Discard.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------|--------------|----------|
| Breather bolt | 80–97 in-lbs | 9–11 N·m |

1. Install breather bolt.
 - a. See Figure 6-6. Lubricate **new** O-ring (1) with fresh oil.
 - b. Install O-ring on breather bolt (2).
 - c. Install breather bolt. Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Breather bolt*
2. Install breather tube.
 - a. See Figure 6-5. Install breather tube (2).

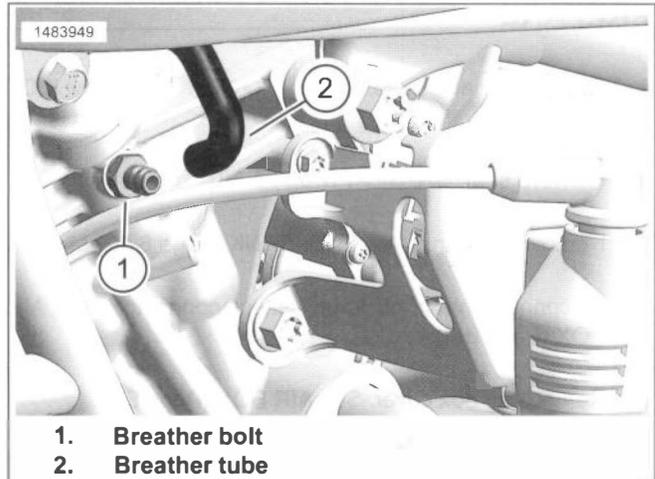


Figure 6-5. Breather Tube

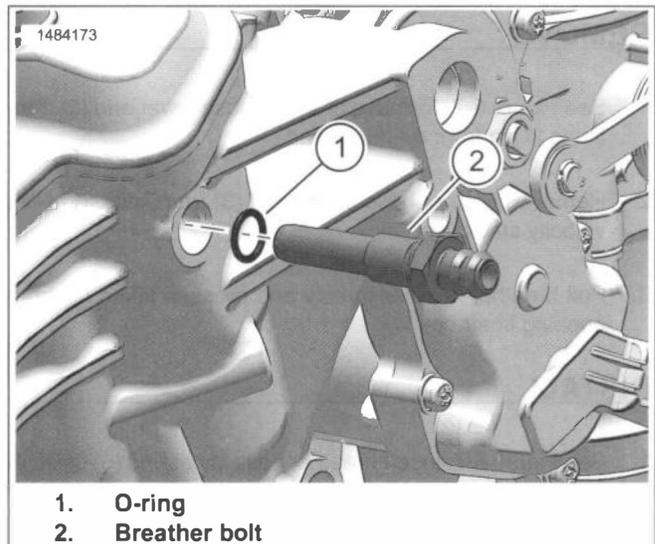


Figure 6-6. Breather Bolt

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove fuel tank. See FUEL TANK (Page 6-12).
4. Disconnect intake air temp sensor connector. See AIR BOX (Page 6-3).
5. Remove air box cover. See AIR BOX (Page 6-3).
6. Remove air filter element. See INSPECT AIR FILTER (Page 2-36).

REMOVE

1. See Figure 6-7. Remove breather hose lower end (6) from fitting (7) in front cylinder head.
2. Remove breather hose upper end (3) from fitting on front velocity stack (4).
3. Pull breather hose assembly and press-in fitting (5) from opening in air box (1).

INSTALL

1. See Figure 6-7. Insert breather hose lower end (6) through opening in air box (1).
2. Lubricate press-in breather hose fitting (5) with equal mix of isopropyl alcohol and water.
3. Insert press-in fitting into air box opening and press down until it snaps in place.
4. Insert breather hose upper end (3) onto fitting on front velocity stack (4).

5. Insert breather hose lower end (6) onto fitting (7) in front cylinder head.

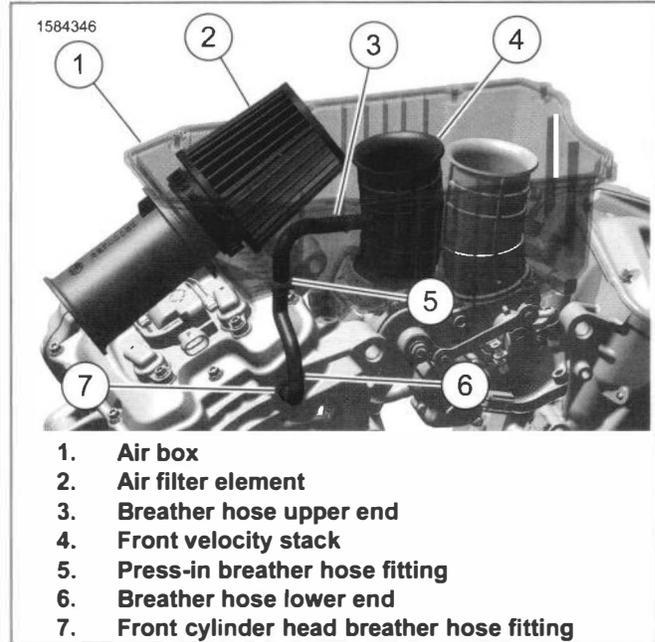


Figure 6-7. Breather Hose Assembly

COMPLETE

1. Install air filter element. See INSPECT AIR FILTER (Page 2-36).
2. Install air box cover. See AIR BOX (Page 6-3).
3. Install intake air temp sensor connector. See AIR BOX (Page 6-3).
4. Install fuel tank. See FUEL TANK (Page 6-12).
5. Install seat. See SEAT (Page 3-82).
6. Install main fuse. See POWER DISCONNECT (Page 8-4).
7. Turn ignition ON and check for fuel leaks.

REMOVE

1. See Figure 6-8. Remove screws (1).
2. Lift and remove console (2).

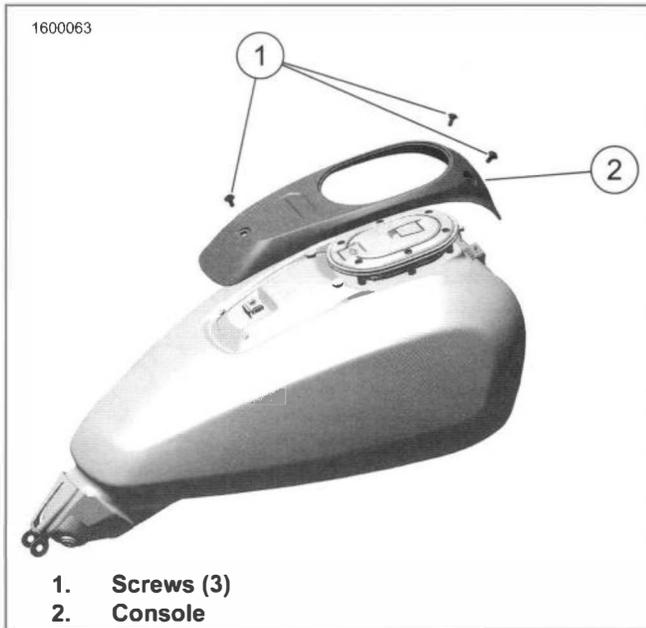


Figure 6-8. Console

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------|--------------|---------|
| Console screws | 27–35 in-lbs | 3–4 N·m |

1. Install console (2).
2. Install screws (1). Tighten.
Torque: 27–35 in-lbs (3–4 N·m) *Console screws*

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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 fuel line. See PURGE FUEL LINE (Page 6-9).
2. Disconnect fuel supply line at quick fuel rail disconnect fitting. See PURGE FUEL LINE (Page 6-9).

TEST

| PART NUMBER | TOOL NAME |
|-------------|-----------------------------|
| HD-41182 | FUEL PRESSURE GAUGE |
| HD-44061 | FUEL PRESSURE GAUGE ADAPTER |

1. See Figure 6-9. Attach fuel pressure gauge adapter (5) to fuel rail quick disconnect fitting (1) and fuel line (2).
Special Tool: FUEL PRESSURE GAUGE (HD-41182)
Special Tool: FUEL PRESSURE GAUGE ADAPTER (HD-44061)
2. Close fuel valve (4).
3. Insert clear tube of fuel pressure gauge into a suitable container.
4. Turn ignition switch to run position.
5. Open fuel valve (4).
6. Open clear tube bleeder valve to remove air from fuel pressure tester.

7. Close clear tube bleeder valve.
8. Start engine. Operate engine at various speeds. Note pressure gauge reading. Compare readings to specifications. Refer to Table 6-4.
9. Turn off engine.
10. Open clear tube bleeder to remove pressure from fuel pressure gauge.
11. Remove fuel pressure tester.

Table 6-4. Fuel Pressure Range

| SPECIFICATION | KPA | PSI |
|---------------|---------|-------|
| Fuel pressure | 359-441 | 52-64 |

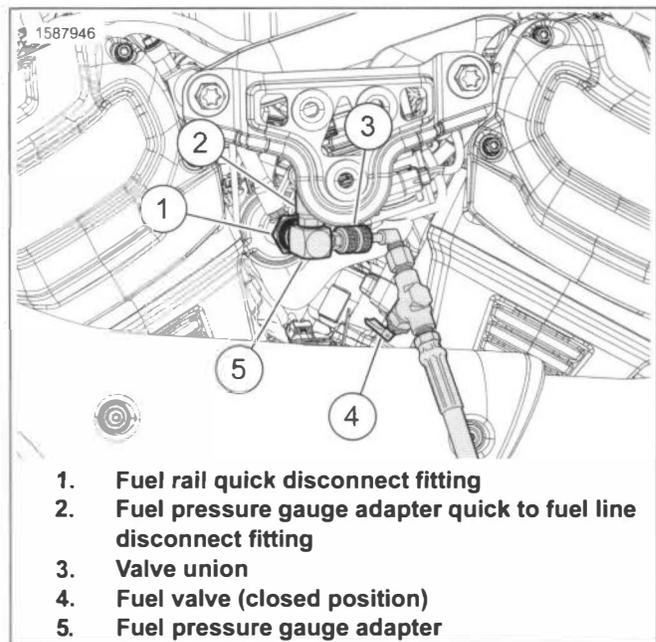


Figure 6-9. Fuel Pressure Test Fittings

COMPLETE

Connect fuel supply line at quick disconnect fitting. See FUEL LINE (Page 6-10).

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

Connect DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

PURGE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

1. Toggle the fuel pump off.
Special Tool: DIGITAL TECHNICIAN II (HD-48650)
2. Start engine.
3. Run until it stops.
4. Crank engine for 5 seconds.

▲ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

▲ 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)

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

Remove DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

PREPARE

1. Remove seat. See SEAT (Page 3-82).
2. Remove seat lock bracket. See SEAT (Page 3-82).
3. Remove right side valley cover. See SIDE COVERS (Page 3-46).
4. Purge fuel line. See PURGE FUEL LINE (Page 6-9).
5. Remove fuel tank. See FUEL TANK (Page 6-12).
6. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

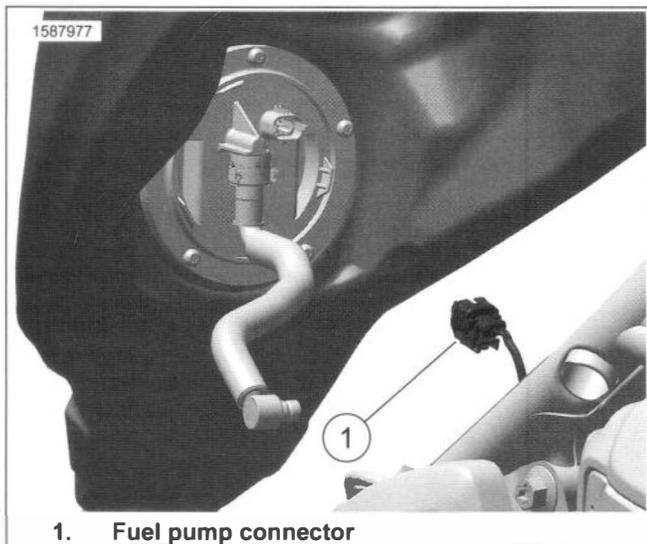
⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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. See Figure 6-10. Disconnect fuel pump connector.
2. See Figure 6-11. Remove fuel line.
 - a. Pry up on tabs to release lock (1).
 - b. Remove fuel line (2) from fuel pump (3).



1. Fuel pump connector
Figure 6-10. Fuel Pump Connector

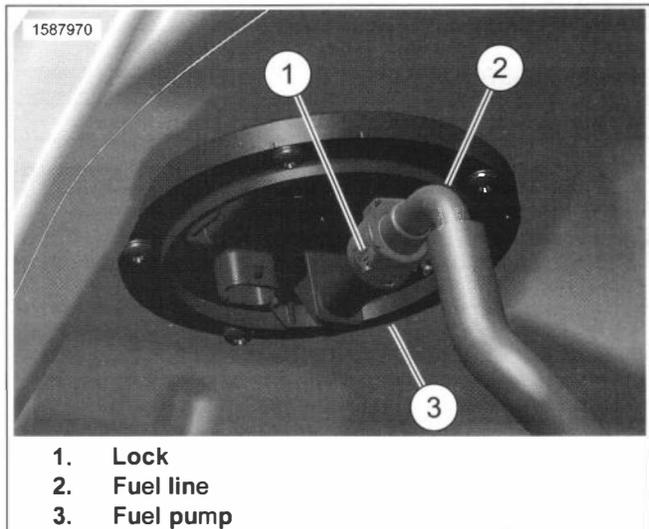


Figure 6-11. Lower Fuel Line

INSTALL

1. See See Figure 6-11.. Install fuel line.
 - a. Position fuel line (2).
 - b. Install clip (1).

COMPLETE

1. Install fuel tank. See FUEL TANK (Page 6-12).
2. Install seat lock bracket. See SEAT (Page 3-82).
3. Install seat. See SEAT (Page 3-82).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).
5. Turn ignition on and check for leaks.
6. Install right side valley cover. See SIDE COVERS (Page 3-46).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove console. See CONSOLE (Page 6-7).

REMOVE

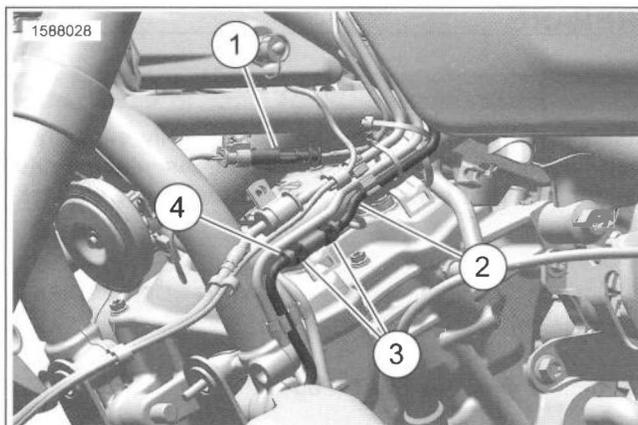
1. See Figure 6-12. Disconnect fuel level sensor connector (1) at main harness.
2. See Figure 6-13. Remove clamp (5) and tip over hose (4) from tip over valve fitting in fuel inlet assembly (1).
3. Remove vapor vent hose (3).
4. Remove screws (2).
5. Pull fuel inlet assembly straight up out of fuel tank.
6. Disconnect fuel level sensor (6) from fuel inlet (1).

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

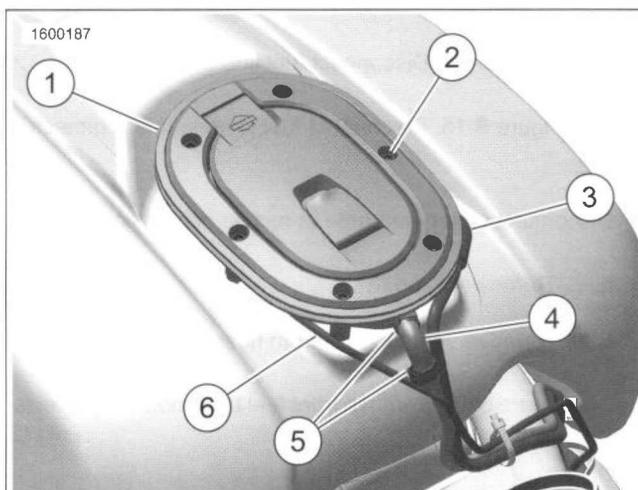
| FASTENER | TORQUE VALUE | |
|-------------------|--------------|-------------|
| Fuel inlet screws | 40–49 in-lbs | 4.5–5.5 N·m |

1. See Figure 6-13. Connect fuel level sensor (6) to fuel inlet (1).
2. Install new fuel inlet assembly (1) with new gasket into fuel tank.
3. Install screws (2). Tighten in star pattern.
Torque: 40–49 in-lbs (4.5–5.5 N·m) *Fuel inlet screws*
4. Install vapor vent hose (3).
5. Install tip over hose (4) with clamp (5) onto tip over valve fitting in fuel inlet assembly.
6. Install clamp.
Special Tool: HOSE CLAMP PLIERS (HD-41137)
7. See Figure 6-12. Connect fuel level sensor connector (1) at main harness.



1. Fuel level sender connector
2. Vent tube
3. Clamp (2)
4. Middle connection hose

Figure 6-12. Fuel Level Sender Connector



1. Fuel inlet assembly
2. Screw (6)
3. Vapor vent hose
4. Tip over hose
5. Clamp
6. Fuel level sending unit harness

Figure 6-13. Fuel Inlet/Tip Over Valve Assembly

COMPLETE

1. Install console. See CONSOLE (Page 6-7).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove seat lock bracket. See SEAT (Page 3-82).
4. Purge fuel line. See PURGE FUEL LINE (Page 6-9).

REMOVE

1. See Figure 6-14. Disconnect fuel line at fuel rail.
2. See Figure 6-15. Disconnect fuel level sender connector (1).
3. Disconnect vapor vent tube at middle connection.
 - a. Remove clamp (3).
 - b. Remove vent tube (2) from hose (4).
4. See Figure 6-16. Remove front fuel tank mounting screws (1).
5. See Figure 6-17. Remove nut (4).
6. Remove bolt (2).
7. See Figure 6-18. Lift rear of fuel tank up.
8. Disconnect fuel pump connector (1).

NOTE

Carefully pull fuel line up while lifting rear of tank, fuel line could catch damaging wiring.

9. Remove fuel tank.

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------------|---------------|-------------|
| Fuel tank mounting bracket bolt | 18–21 ft-lbs | 25–29 N·m |
| Fuel tank mounting screws | 89–102 in-lbs | 10–11.5 N·m |

1. Install fuel tank.
 - a. See Figure 6-18. Connect fuel pump connector (1).
 - b. Route fuel line down to fuel rail.

- c. See Figure 6-15. Route vent tube (2) into position while installing fuel tank.
- d. See Figure 6-17. Position fuel tank on mounting bracket (3).
- e. Install bracket bolt (1). Tighten.
Torque: 18–21 ft-lbs (25–29 N·m) *Fuel tank mounting bracket bolt*
- f. See Figure 6-16. Install Screws (1). Tighten.
Torque: 89–102 in-lbs (10–11.5 N·m) *Fuel tank mounting screws*

2. See Figure 6-15. Connect fuel level sender connector (1).
3. Connect vapor vent tube.
 - a. Connect vapor vent tube (2) into hose (4).
 - b. Install clamp (3).
4. See Figure 6-14. Connect fuel line.
 - a. Push in on sleeve of quick-disconnect (2) fitting. Insert neck of fuel supply line fitting (3).
 - b. While pushing on fuel supply line fitting, pull out on sleeve until it clicks into locked position.
 - c. Pull on fuel line to verify it is secure.
5. Install right side valley cover (1).

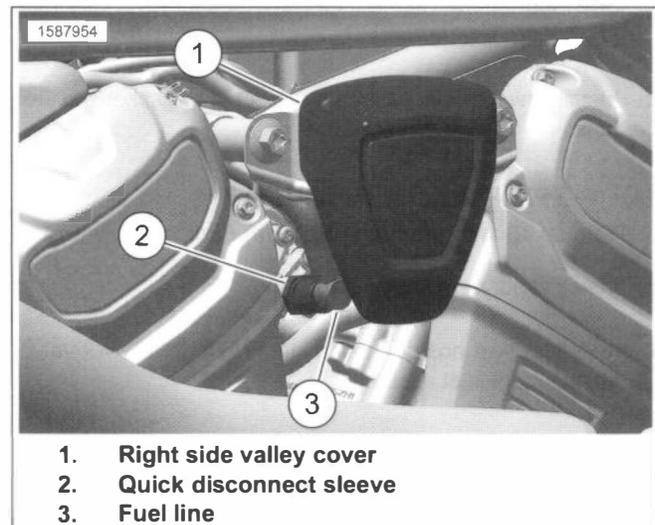


Figure 6-14. Fuel Line to Fuel Rail Connection

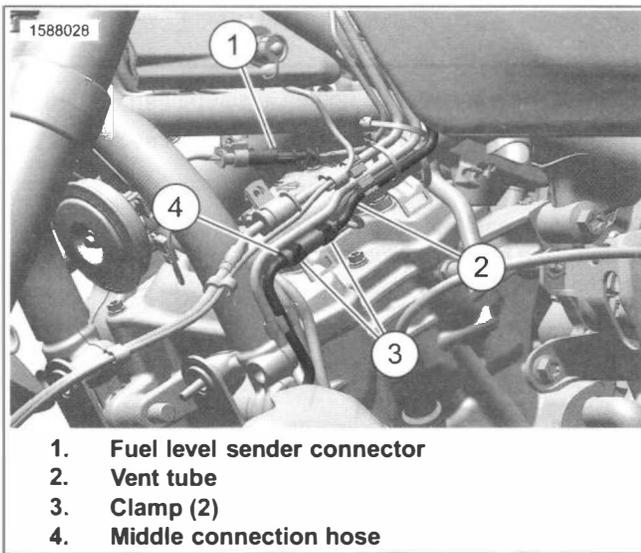


Figure 6-15. Fuel Level Sender Connector

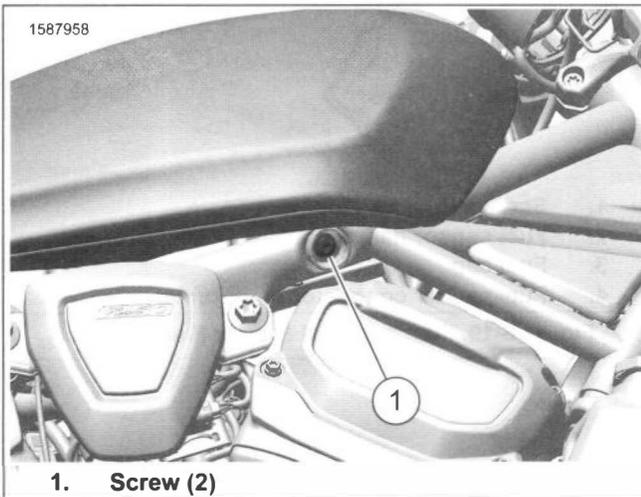


Figure 6-16. Fuel Tank Mount Screws (Right side shown, left side same)

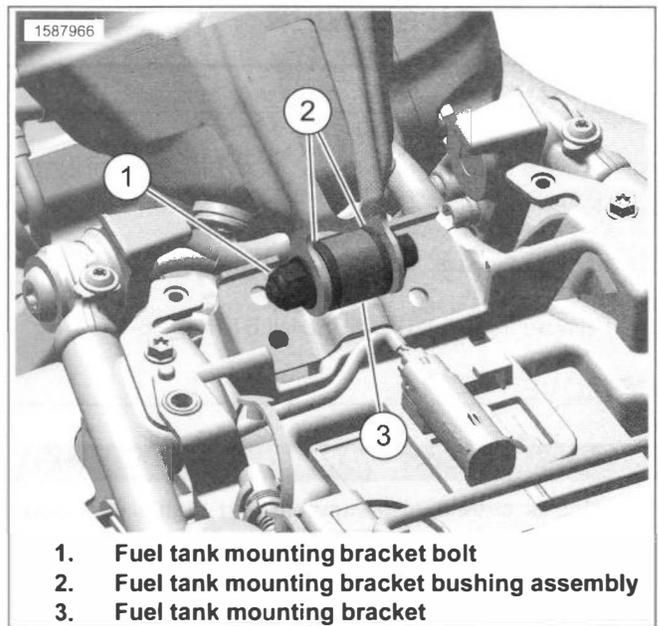


Figure 6-17. Fuel Tank Mounting Bracket

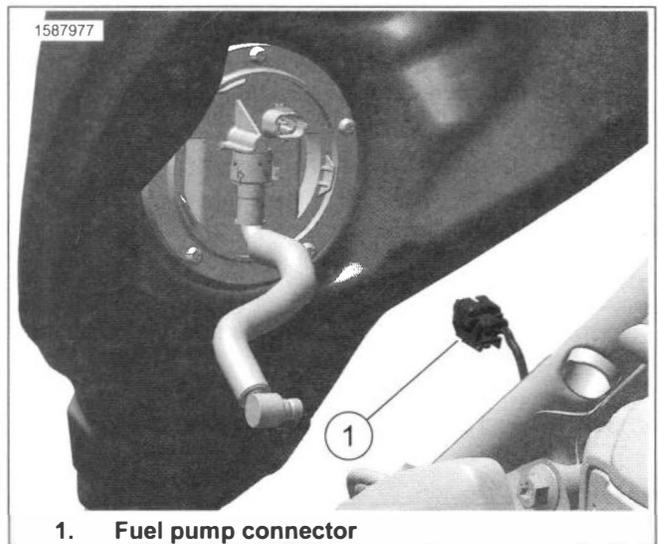


Figure 6-18. Fuel Pump Connector

COMPLETE

1. Install seat lock bracket. See SEAT (Page 3-82).
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).
4. Turn ignition on and check for leaks.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove console. See CONSOLE (Page 6-7).
3. Remove fuel inlet. See FUEL INLET (Page 6-11).

REMOVE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

1. See Figure 6-19. Remove and discard screws (1).
2. Remove fuel cap (2) and fuel tank sensor flange (3) far enough to disconnect the fuel sender connector (4) from under side.

NOTE

Look into fuel tank at bracketry. Note that finger (1) on front bracket points forward.

3. See Figure 6-20. Pull up on finger (1) and slide fuel level sender bracket rearward until four ears on bracket are free of catches at top of tunnel (2).
4. Remove fuel level sender from left side of fuel tank.

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------|--------------|-------------|
| Fuel cap screws | 25–29 in-lbs | 2.8–3.3 N·m |

1. See Figure 6-20. With the finger on the fuel level sender bracket (1) pointing forward, install fuel level sender into left side of fuel tank.
2. Engage four ears on fuel level sender bracket so front set of catches at top of tunnel (2). Push fuel level sender bracket forward until ears/tabs are fully engaged.
3. See Figure 6-19. Connect fuel level sender connector (4) to fuel sensor flange plate (3).
4. Install fuel sensor flange plate (3) and fuel cap (2).

5. Install **new** screws (1). Tighten in star pattern.
Torque: 25–29 in-lbs (2.8–3.3 N·m) Fuel cap screws

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 movement.

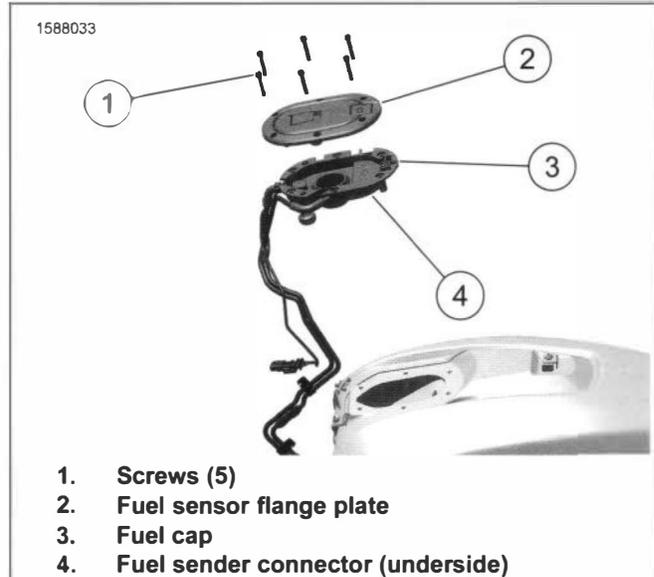


Figure 6-19. Fuel Inlet and Sensor Flange Plate

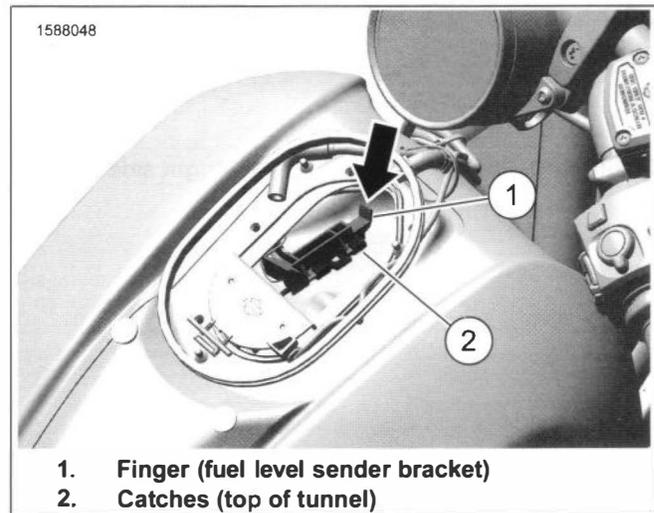


Figure 6-20. Finger (Fuel Level Sender Bracket)

COMPLETE

1. Install console. See CONSOLE (Page 6-7).
2. Install fuel inlet. See FUEL INLET (Page 6-11).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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. (00621b)

NOTE

Carefully inspect tubes for damage. Even a small hole can cause a reduction in fuel pressure. Replace fuel pump as necessary.

NOTE

See the electrical diagnostic manual for information on the function and testing of fuel pump.

1. Purge fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove seat lock bracket. See SEAT (Page 3-82).
5. Remove fuel tank. See FUEL TANK (Page 6-12).

REMOVE

1. See Figure 6-21. Release locks and slide clip outward. Disconnect fuel line (1).
2. Remove fuel pump assembly.
 - a. Remove and discard screws (2).
 - b. Remove fuel pump clamp ring (3).
 - c. Remove fuel pump assembly (4) from fuel tank (5).

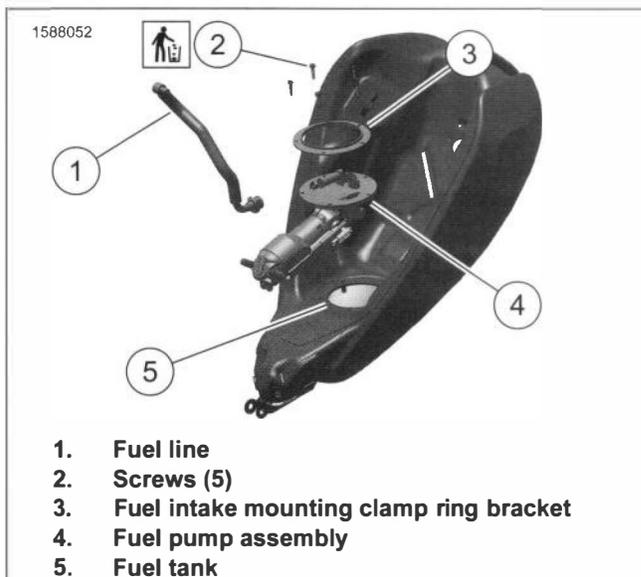


Figure 6-21. Fuel Pump Assembly (Fuel Pump Bracket)
INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------------|--------------|-------------|
| Fuel pump assembly screw | 40–49 in-lbs | 4.5–5.5 N·m |

1. See Figure 6-22. Install fuel pump.
 - a. Hold pump assembly (1) pointing rearward and insert into tank.
 - b. Install fuel pump clamp ring (2).
 - c. Install **new** screws (3). Tighten using a star pattern.
Torque: 40–49 in-lbs (4.5–5.5 N·m) *Fuel pump assembly screw*
 - d. Connect fuel line.

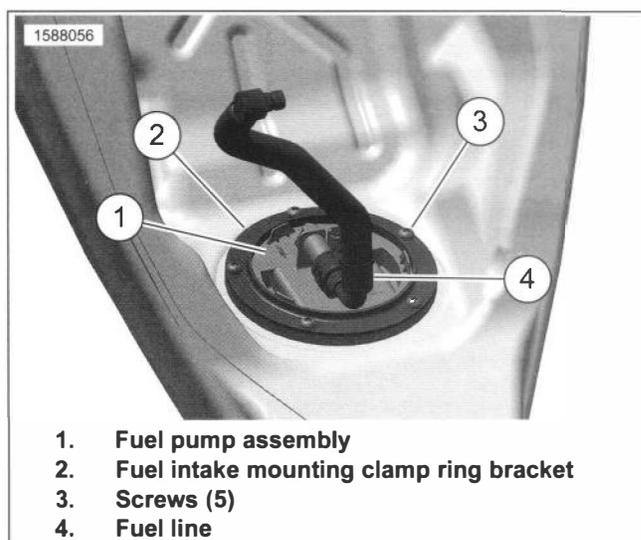


Figure 6-22. Fuel Pump Install

COMPLETE

1. Install fuel tank. See FUEL TANK (Page 6-12).

2. Connect fuel line to fuel rail. See FUEL LINE (Page 6-10).
3. Connect vent tube. See VENT LINE (Page 6-17).
4. Install seat lock bracket. See SEAT (Page 3-82).
5. Install seat. See SEAT (Page 3-82).
6. Install main fuse. See POWER DISCONNECT (Page 8-4).
7. Turn ignition on and check for leaks.

PREPARE

1. Remove console. See CONSOLE (Page 6-7).

REMOVE

1. See Figure 6-23. Make note of location of cable straps (3) and drain line (1) routing.
2. Remove cable straps.
3. Remove hose (2) from fuel inlet.
4. Remove vent line.
5. Remove hose from drain line.

INSTALL

1. See Figure 6-23. Install hose (2) on fuel inlet fitting.
2. Route vent line (1) in location previously noted.
3. Install vent line into hose.
4. Install **new** cable straps (3) in locations previously noted.

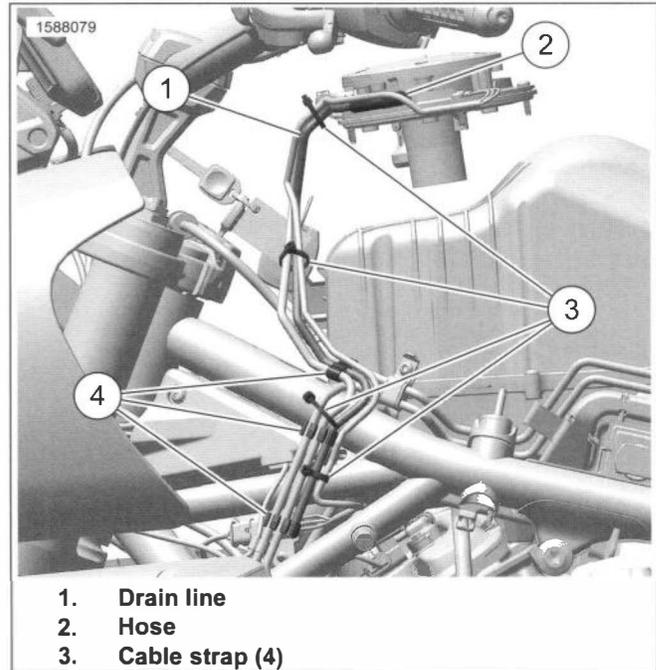


Figure 6-23. Drain Line

COMPLETE

1. Install console. See CONSOLE (Page 6-7).

GENERAL

Throttle Position Sensor (TPS) is not serviceable. Replace induction module. See INDUCTION MODULE (Page 6-26).

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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 fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove top of air box. See AIR BOX (Page 6-3).

REMOVE

See Figure 6-24. From inside the air box top (1), compress the four tabs, remove IAT sensor (2).

INSTALL

See Figure 6-24. Install IAT sensor (2) into air box top (1).

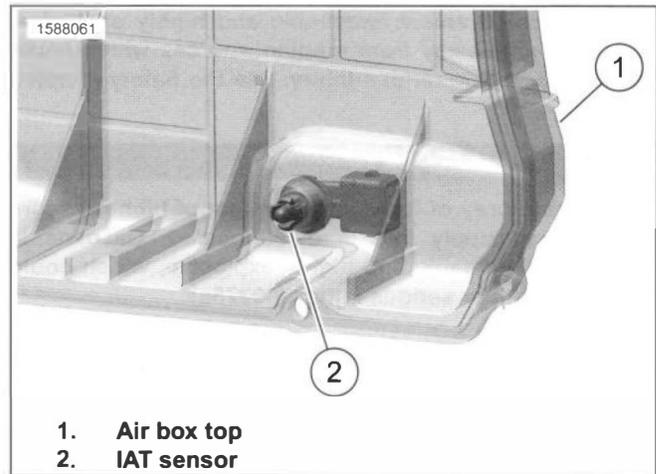


Figure 6-24. IAT Sensor

COMPLETE

1. Install air box. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install seat. See SEAT (Page 3-82).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).
5. Connect fuel line. See FUEL LINE (Page 6-10).

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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 fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove air box. See AIR BOX (Page 6-3).
6. For front MAP sensor, remove induction module. See INDUCTION MODULE (Page 6-26).

REMOVE

Rear MAP Sensor

1. See Figure 6-25. Disconnect MAP sensor connector (3).
2. Remove MAP sensor.
 - a. Remove screw (2).
 - b. Remove MAP sensor (1).

Front MAP Sensor

1. See Figure 6-26. Remove MAP sensor.
 - a. Remove screw (2).
 - b. Remove MAP sensor (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------|--------------|----------|
| MAP sensor screw | 80–97 in-lbs | 9–11 N·m |

Rear MAP Sensor

1. See Figure 6-25. Install MAP sensor.
 - a. Install MAP sensor (1).

- b. Install screw (2). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *MAP sensor screw*

2. Connect MAP sensor connector (3).

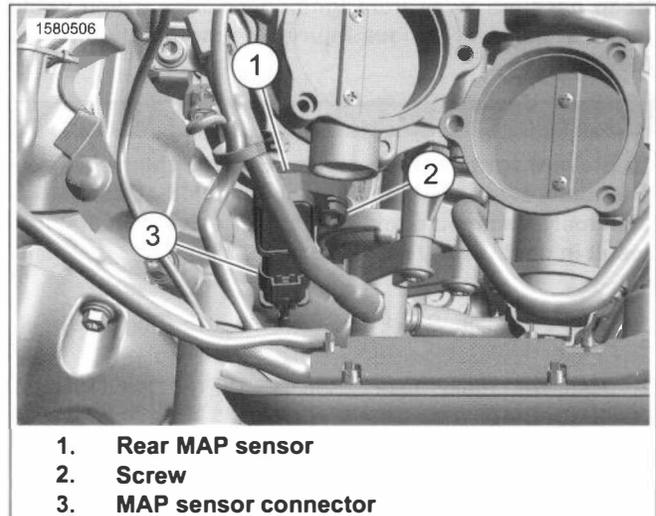


Figure 6-25. Rear MAP Sensor

Front MAP Sensor

1. See Figure 6-26. Install front MAP sensor (1).
2. Install screw (2). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *MAP sensor screw*

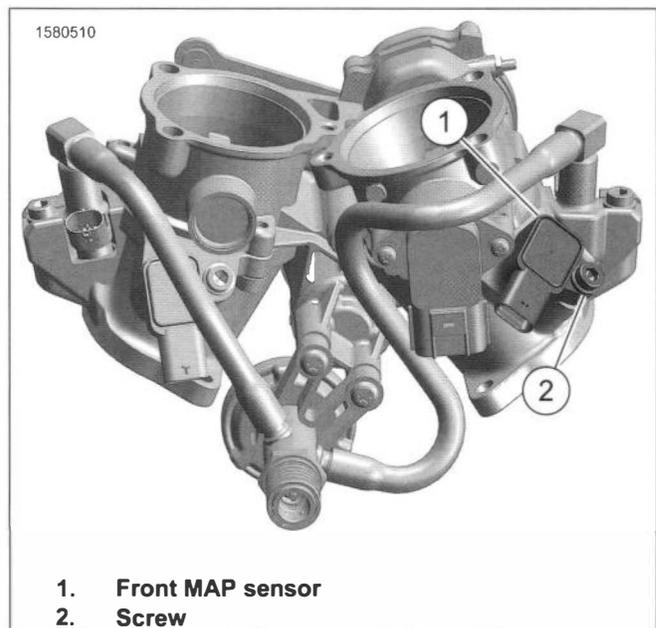


Figure 6-26. Front MAP Sensor

COMPLETE

1. For front MAP sensor, install induction module. See INDUCTION MODULE (Page 6-26).
2. Install air box. See AIR BOX (Page 6-3).
3. Install fuel tank. See FUEL TANK (Page 6-12).

4. Install seat. See SEAT (Page 3-82).

6. Connect fuel line. See FUEL LINE (Page 6-10).

5. Install main fuse. See POWER DISCONNECT
(Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove right hand grip. See HAND GRIPS (Page 3-71).
3. Remove RHCM. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).

REMOVE

1. See Figure 6-27. Remove TGS.
 - a. Remove screws (1).
 - b. Remove TGS (2) from RHCM (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------|--------------|---------|
| TGS screws | 4 in-lbs | 0.4 N·m |

1. See Figure 6-27. Install TGS.
 - a. Position TGS (2) in RHCM (3).
 - b. Install screws (1). Tighten.
Torque: 4 in-lbs (0.4 N·m) *TGS screws*

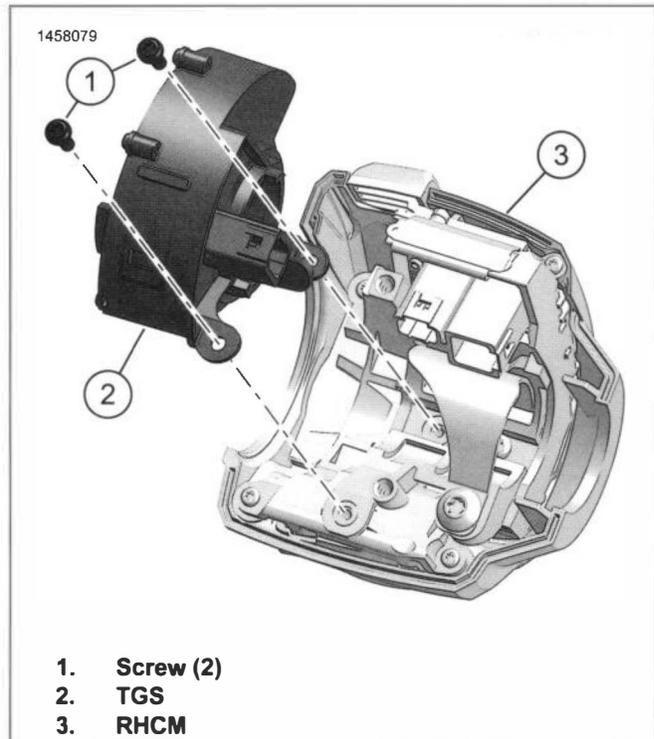


Figure 6-27. TGS (Typical)

COMPLETE

1. Install RHCM. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).
2. Install right hand grip. See HAND GRIPS (Page 3-71).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

GENERAL

Throttle control actuator (TCA) is not serviceable. Replace induction module. See INDUCTION MODULE (Page 6-26).

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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 fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove air box. See AIR BOX (Page 6-3).

REMOVE

1. See Figure 6-28. Disconnect fuel injector connectors (4).
2. Remove fuel rail and fuel injectors.
 - a. Remove screws (1).
 - b. Remove fuel regulator screws (5).

NOTE

The fuel lines are not flexible, remove the fuel rail with the regulator.

- c. Remove fuel rail (2).
 - d. Remove fuel injectors (3).
3. See Figure 6-29. Discard o-rings (2, 4).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------|--------------|----------|
| Fuel rail screws | 80–97 in-lbs | 9–11 N·m |
| Fuel regulator screw | 80–97 in-lbs | 9–11 N·m |

1. See Figure 6-29. If required, install new o-rings (2, 4).
2. Install fuel rail and fuel injectors.
 - a. See Figure 6-28. Install fuel injectors (3).
 - b. Install fuel rail (2).

- c. Install screws (1). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Fuel rail screws*
 - d. Install fuel regulator screws (5). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Fuel regulator screw*

3. See Figure 6-28. Connect fuel injector connectors (4).

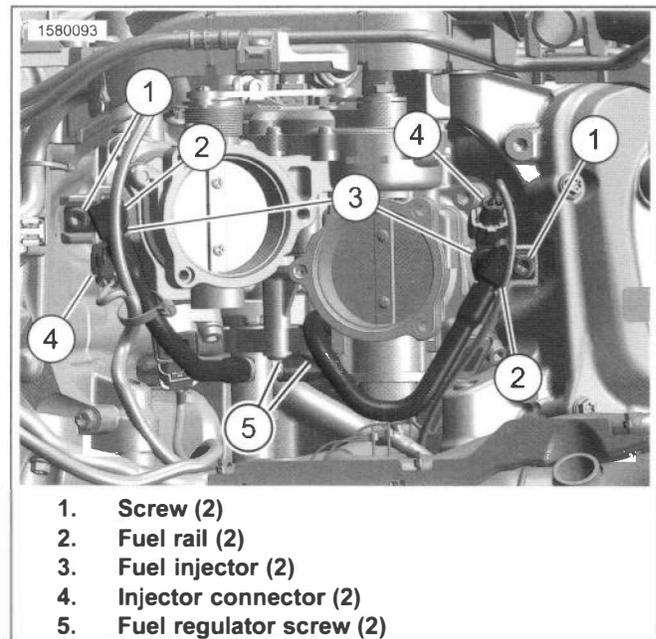


Figure 6-28. Fuel Rail and Injector Connectors

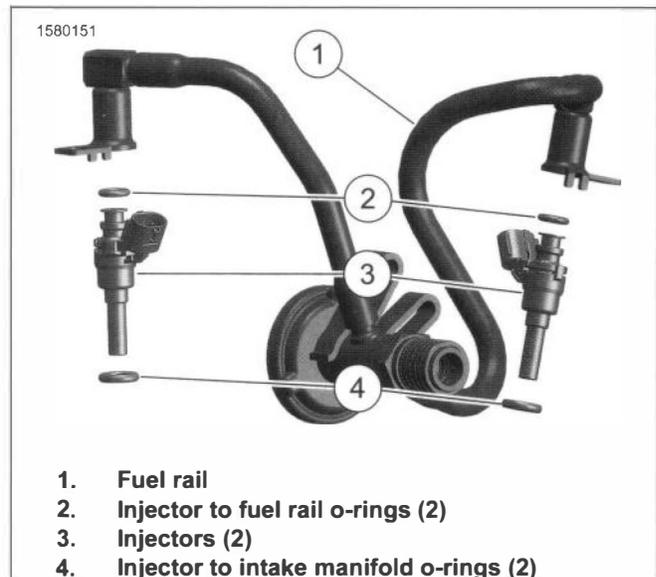


Figure 6-29. Fuel Injectors

COMPLETE

1. Install air box. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install seat. See SEAT (Page 3-82).

4. Install main fuse. See POWER DISCONNECT (Page 8-4).
5. Connect fuel line. See FUEL LINE (Page 6-10).

PREPARE

▲ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

▲ 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 fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove air box. See AIR BOX (Page 6-3).

REMOVE

NOTE

Throttle position sensor (TPS) is not serviceable. Replace induction module if necessary.

1. See Figure 6-30. Disconnect induction module connectors.
2. See Figure 6-31. Remove induction module.
 - a. Remove screws (1).
 - b. Remove induction module (2).

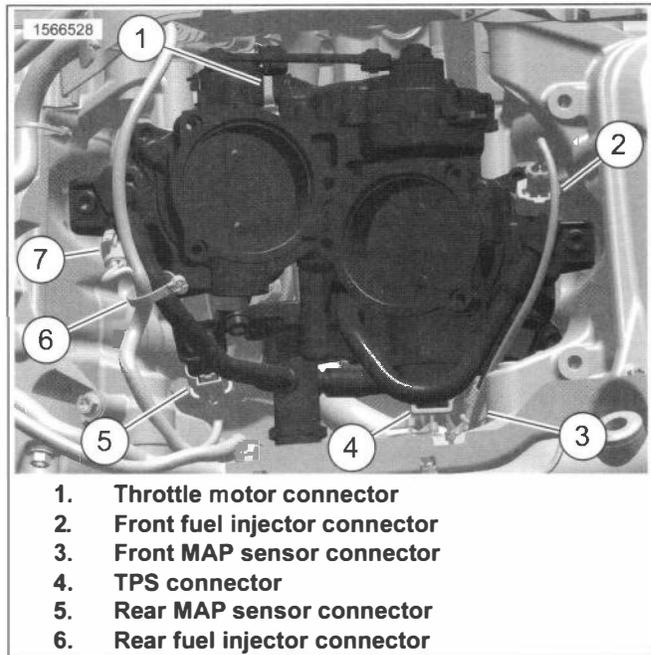


Figure 6-30. Induction Module Connectors

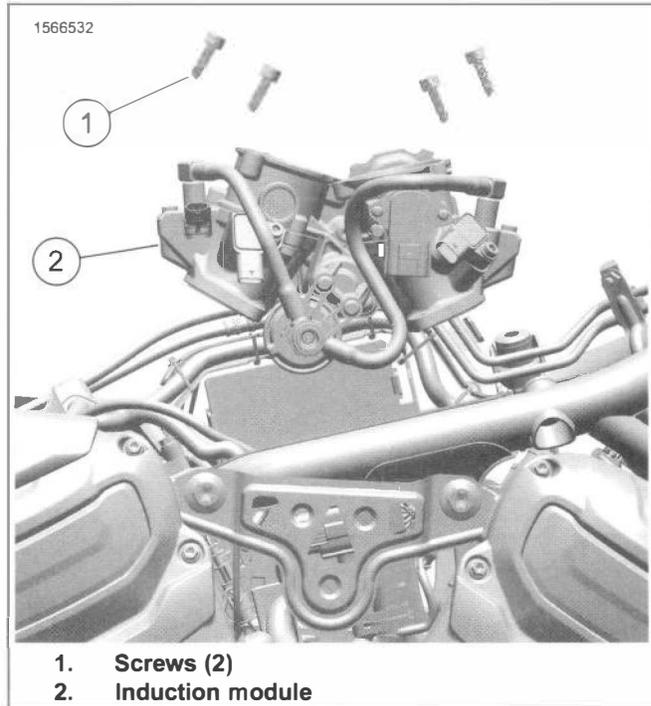


Figure 6-31. Induction Module

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|----------------|-----------|
| Induction module screw | 124–142 in-lbs | 14–16 N·m |

1. See Figure 6-31. Install induction module.
 - a. Install induction module (2).
 - b. Install screws (1). Tighten.
Torque: 124–142 in-lbs (14–16 N·m) *Induction module screw*
2. See Figure 6-30. Install connectors.

COMPLETE

1. Install air box. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install seat. See SEAT (Page 3-82).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).
5. Connect fuel line. See FUEL LINE (Page 6-10).

PREPARE

⚠ WARNING

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

⚠ 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 fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove air box. See AIR BOX (Page 6-3).
6. Remove induction module. See INDUCTION MODULE (Page 6-26).

REMOVE

1. See Figure 6-32. Remove regulator screws (5).
2. Remove screws (1) and fuel injectors (2).
3. Remove screws (3) and MAP sensors (4).
4. See Figure 6-33. Remove screws (1) and intake manifolds (2, 3).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|----------|
| Fuel rail screws | 80–97 in-lbs | 9–11 N·m |
| Fuel regulator screw | 80–97 in-lbs | 9–11 N·m |
| Intake manifold screws | 80–97 in-lbs | 9–11 N·m |
| MAP sensor screws | 80–97 in-lbs | 9–11 N·m |

1. See Figure 6-33. Install intake manifolds (2, 3) and screws (1). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Intake manifold screws*
2. See Figure 6-32. Install MAP sensors (4) and screws (3). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *MAP sensor screws*
3. Install fuel injectors (2) and screws (1). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Fuel rail screws*

4. Install regulator screws (5). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Fuel regulator screw*

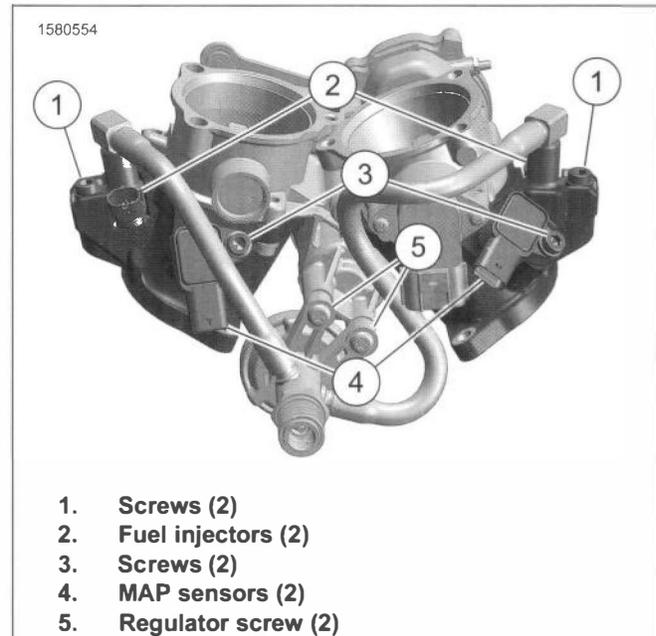


Figure 6-32. Intake Manifold Assembly

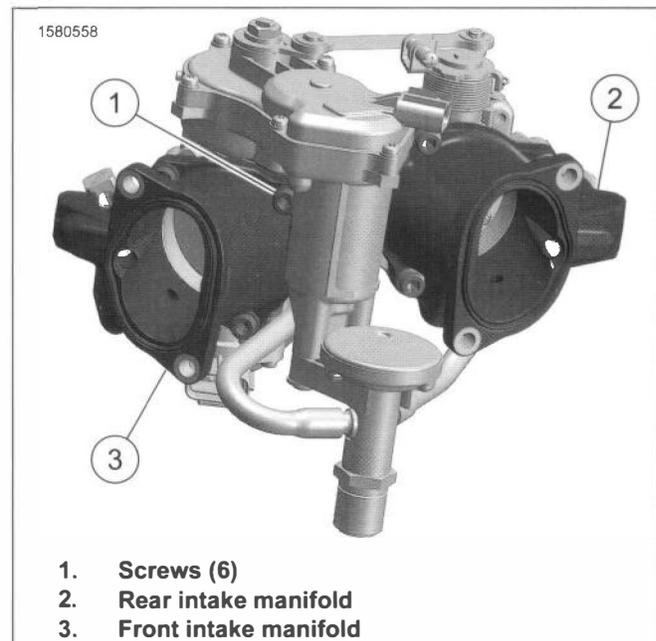


Figure 6-33. Intake Manifolds

COMPLETE

1. Install induction module. See INDUCTION MODULE (Page 6-26).
2. Install air box. See AIR BOX (Page 6-3).
3. Install fuel tank. See FUEL TANK (Page 6-12).
4. Install seat. See SEAT (Page 3-82).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).

6. Connect fuel line. See FUEL LINE (Page 6-10).

LEAK TESTER

| PART NUMBER | TOOL NAME |
|-------------|------------------------|
| HD-41417 | PROPANE ENRICHMENT KIT |

⚠ 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)

Parts List

- Small propane cylinder.
- PROPANE ENRICHMENT KIT (PART NUMBER: HD-41417).

Tester Assembly

1. See Figure 6-34. Make sure valve knob (6) is closed (fully clockwise).
2. Install valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 6-34. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises 5-10 SCFH on gauge.
3. Release trigger button.

PROCEDURE

NOTE

Propane injected into air cleaner causes false readings. Keep air cleaner cover installed.

1. Run motorcycle until engine is at normal operating temperature.
2. Aim nozzle toward possible sources of leak.

NOTE

The tone of the engine changes when propane enters source of leak.

3. Press and release trigger button to dispense propane.
4. Repeat as necessary to detect leak.
5. When test is finished, close valve.

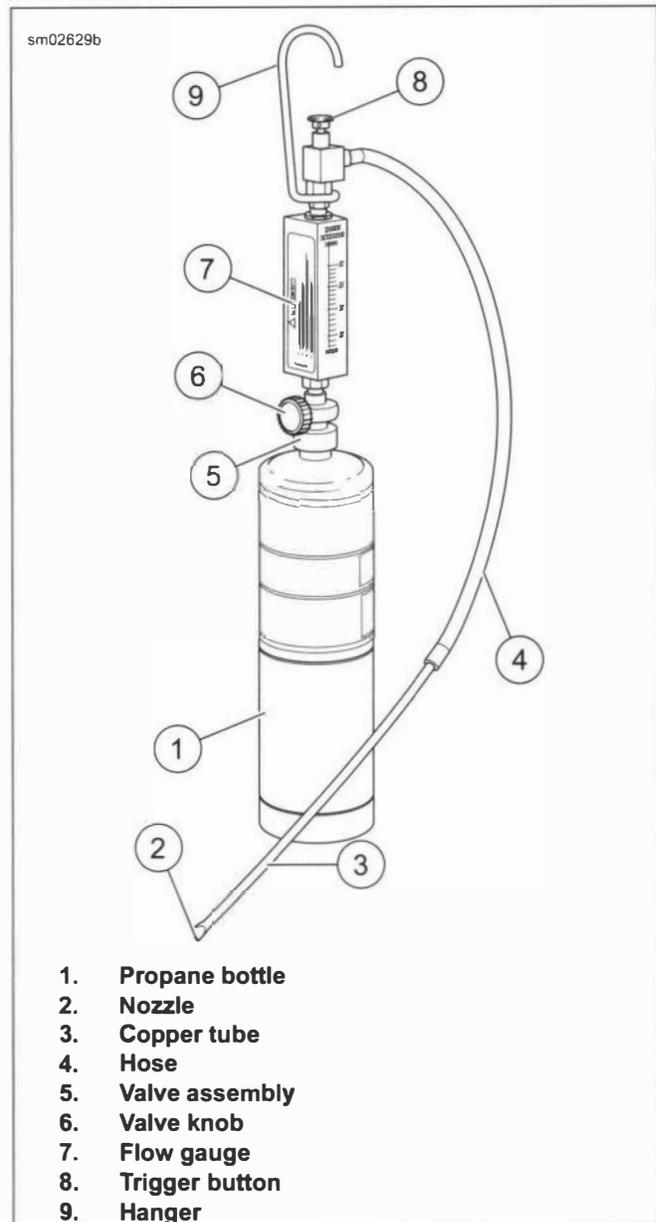
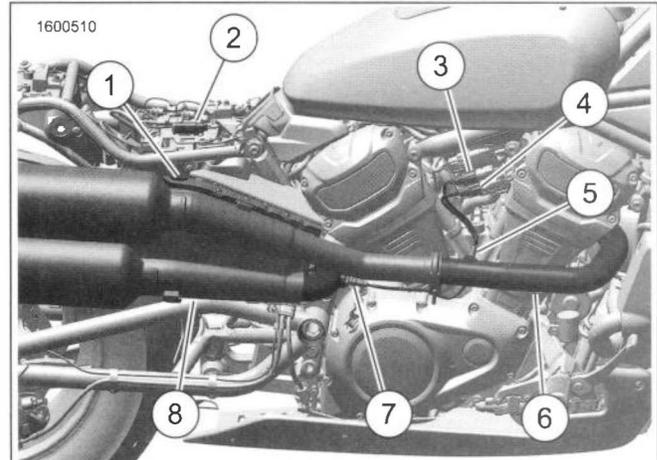


Figure 6-34. Leak Tester

PREPARE

- Remove main fuse. See POWER DISCONNECT (Page 8-4).
- Remove outer exhaust shield and heat shield. See MUFFLERS (Page 6-33).
- Removing header pipe HO2S:**
 - Remove right side valley cover. See SIDE COVERS (Page 3-46).
- Removing post catalyst HO2S:**
 - Remove seat. See SEAT (Page 3-82).
 - Remove cowl and right rear fender. See COWL AND REAR FENDERS (Page 3-68).
- Installing post catalyst HO2S (if equipped).
- Install HO2S (1) (if equipped). Tighten.
Torque: 12–14 ft-lbs (16.5–19.5 N·m) *Oxygen sensor, heated*
- See Figure 6-36. Connect post catalyst HO2S connector (1) (if equipped).



- Post catalyst HO2S (if equipped)
- Post catalyst HO2S connector
- Front HO2S connector
- Rear HO2S connector
- Front HO2S
- Front exhaust header pipe
- Rear HO2S
- Muffler assembly

Figure 6-35. Front and Rear HO2S Connectors

REMOVE**Header Pipe HO2S**

- See Figure 6-35. Disconnect HO2S connectors (3, 4).
- See Figure 6-35. Remove HO2S (5, 7).

Post Catalyst HO2S (if equipped)

- See Figure 6-36. Disconnect post catalyst HO2S connector (2) (if equipped).
- Remove post catalyst HO2S (1) (if equipped).

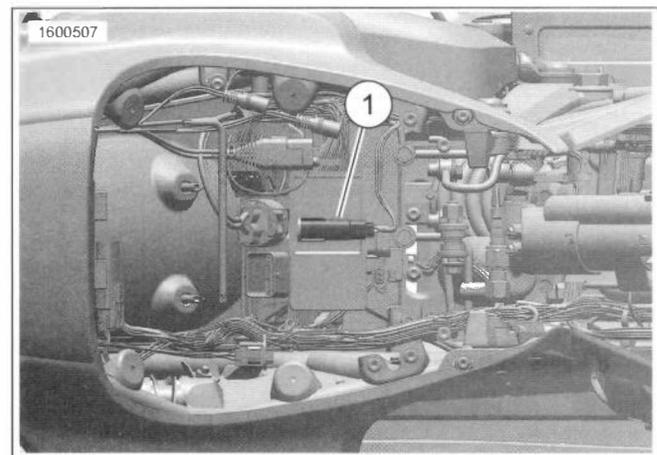
INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------------|--------------|---------------|
| Oxygen sensor, heated | 12–14 ft-lbs | 16.5–19.5 N·m |

NOTE

- Do not install sensors that have dropped or impacted by other components. Damage to the sensing element can occur.
- Replacement sensor assemblies have threads coated with ANTI-SEIZE LUBRICANT and new gaskets.
- If reusing HO2S, replace the gasket. Use a high-quality professional grade side cutter for gasket removal. Make sure larger side of new gasket faces exhaust.
- If reusing HO2S, apply a thin coat of ANTI-SEIZE LUBRICANT to each oxygen sensor.

- Installing front and rear header pipe HO2S.
- See Figure 6-35. Install HO2S (5, 7). Tighten.
Torque: 12–14 ft-lbs (16.5–19.5 N·m) *Oxygen sensor, heated*
- Connect HO2S connectors (3, 4).

Figure 6-36. Post Catalyst HO2S Connector (If Equipped)
COMPLETE

- Post catalyst HO2S (if equipped):**
 - Install cowl and right rear fender. See COWL AND REAR FENDERS (Page 3-68).
 - Install seat. See SEAT (Page 3-82).

2. **Header pipe HO2S:**
 - a. Install right side valley cover. See SIDE COVERS (Page 3-46).
3. Install outer exhaust shield and heat shield. See MUFLERS (Page 6-33).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove seat. See SEAT (Page 3-82).
2. Remove cowl and right rear fender. See COWL AND REAR FENDERS (Page 3-68).
3. Disconnect post HO2S (if equipped). See HEATED OXYGEN SENSORS (HO2S) (Page 6-31).

REMOVE

1. Remove outer exhaust shield.
 - a. See Figure 6-37. Remove screws (2).
 - b. Remove outer exhaust shield (1).
2. Remove exhaust shield.
 - a. See Figure 6-38. Remove screw (4).
 - b. Remove exhaust shield (2).
3. See Figure 6-39. Remove muffler assembly.
 - a. Remove exhaust pipe clamps (3) and discard.
 - b. Remove screw (1).
 - c. Remove muffler assembly (5).
4. See Figure 6-40. Remove inner exhaust shield.
 - a. Remove screws (4).
 - b. Remove exhaust shield (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------------|---------------|-----------|
| Exhaust clamp | 71–89 in-lbs | 8–10 N·m |
| Exhaust shield screw | 44–62 in-lbs | 5–7 N·m |
| Exhaust shield screws, outer | 44–62 in-lbs | 5–7 N·m |
| Exhaust shield, inner, screw | 44–62 in-lbs | 5–7 N·m |
| Muffler mounting screw | 89–106 in-lbs | 10–12 N·m |

1. Install inner exhaust shield.
 - a. See Figure 6-40. Install inner exhaust shield (2).
 - b. Install mounting screw (4). Tighten.
Torque: 44–62 in-lbs (5–7 N·m) *Exhaust shield, inner, screw*

2. Install muffler.
 - a. Install muffler mounting screw (1). Tighten.
Torque: 89–106 in-lbs (10–12 N·m) *Muffler mounting screw*

NOTE

Rotate rear cylinder exhaust clamp to position bolt facing up. Rotate front exhaust clamp to position the bolt facing out.

- b. See Figure 6-39. Install muffler (5) with new clamps (3), keep clamp loose.
- c. Center and right tail sections. Disconnect post cat HO2S if equipped.
- d. Position exhaust clamps (3). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Exhaust clamp*
- e. See Figure 6-38. Install exhaust outer heat shield (2).
- f. Install exhaust shield screw (4). Tighten.
Torque: 44–62 in-lbs (5–7 N·m) *Exhaust shield screw*
- g. See Figure 6-37. Install outer exhaust shield (1).
- h. Install outer exhaust shield screws (2). Tighten.
Torque: 44–62 in-lbs (5–7 N·m) *Exhaust shield screws, outer*

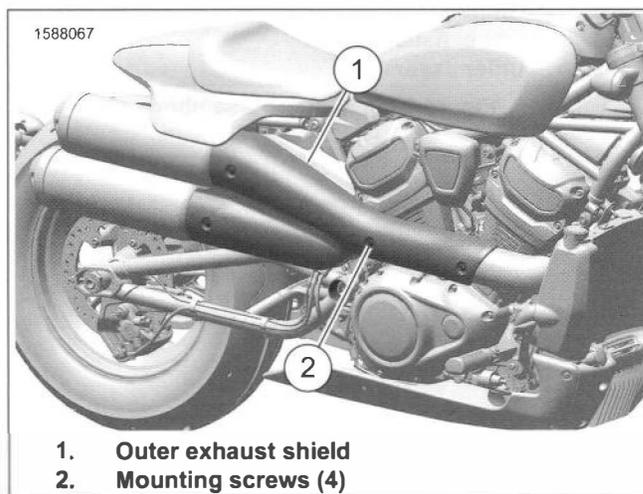


Figure 6-37. Outer Exhaust Shield

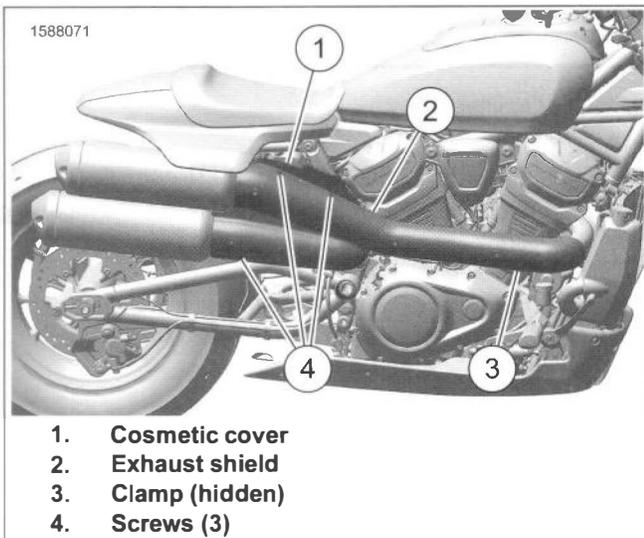


Figure 6-38. Exhaust Shield

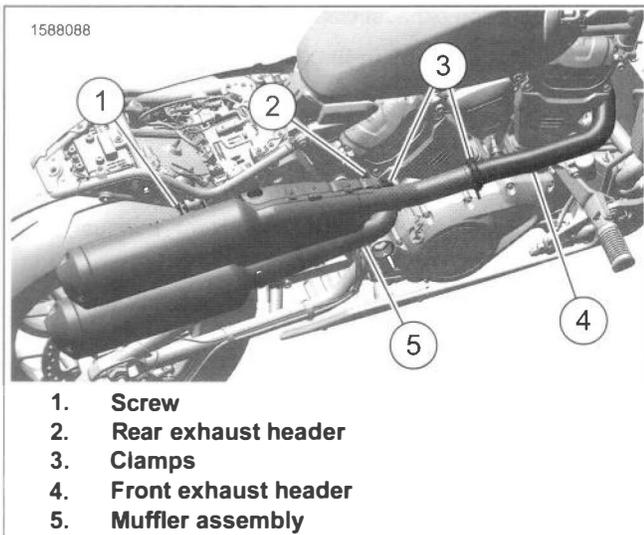


Figure 6-39. Muffler Assembly

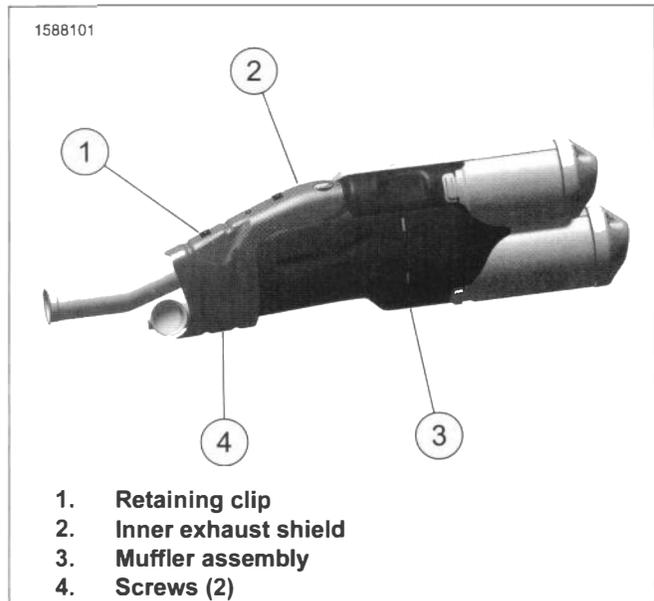


Figure 6-40. Exhaust Shield (Inner)

COMPLETE

1. Connect post HO2S (if equipped). See HEATED OXYGEN SENSORS (HO2S) (Page 6-31).
2. Install cowl and right rear fender. See COWL AND REAR FENDERS (Page 3-68).
3. Install seat. See SEAT (Page 3-82).

GENERAL

The exhaust system consists of a muffler assembly connected to the front and rear header extensions.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove upper radiator screws and position out of way for access to front cylinder head pipe fasteners. See RADIATOR (Page 7-17).
3. Disconnect front and rear heated oxygen sensors (HO2S) connectors. See HEATED OXYGEN SENSORS (HO2S) (Page 6-31).
4. Remove muffler. See MUFFLERS (Page 6-33).

REMOVE

1. See Figure 6-41. Remove front header extension.
 - a. Remove nuts (1).
 - b. Remove header pipe extension (4).
 - c. Remove gasket (3) and discard.
2. See Figure 6-42. Remove rear header extension.
 - a. Remove nuts (1).
 - b. Remove rear header extension (4).
 - c. Remove gasket (3) and discard.

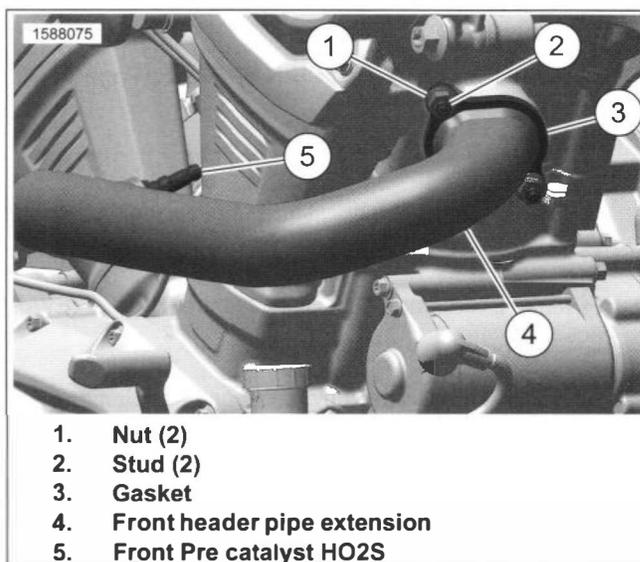
INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|--------------|-----------|
| Exhaust header nuts, front | 15–16 ft-lbs | 20–22 N·m |
| Exhaust, rear header nuts | 15–16 ft-lbs | 20–22 N·m |

1. See Figure 6-42. Install rear header extension.
 - a. Install **new** exhaust port gasket (3) on studs (2).
 - b. Install rear header extension (4).
 - c. Install nuts (1). Tighten.
Torque: 15–16 ft-lbs (20–22 N·m) *Exhaust, rear header nuts*
2. See Figure 6-41. Install front header extension.
 - a. Install **new** exhaust port gasket (3).
 - b. Install exhaust pipe assembly (4).

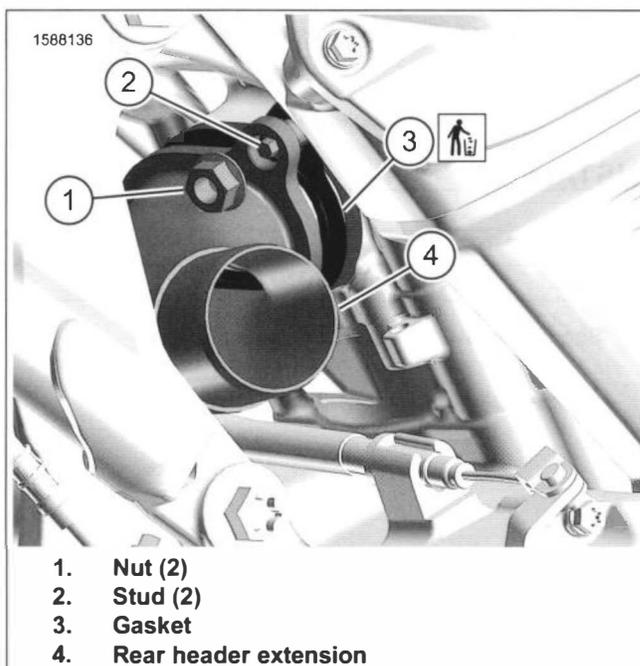
- c. Install nuts (1). Tighten.

Torque: 15–16 ft-lbs (20–22 N·m) *Exhaust header nuts, front*



1. Nut (2)
2. Stud (2)
3. Gasket
4. Front header pipe extension
5. Front Pre catalyst HO2S

Figure 6-41. Front Exhaust Header Pipe Extension



1. Nut (2)
2. Stud (2)
3. Gasket
4. Rear header extension

Figure 6-42. Rear Header Extension

COMPLETE

1. Install mufflers. See MUFFLERS (Page 6-33)
2. Connect front and rear heated oxygen sensors (HO2S) connectors. See HEATED OXYGEN SENSORS (HO2S) (Page 6-31)
3. Install radiator back in position. See RADIATOR (Page 7-17)
4. Install main fuse. See POWER DISCONNECT (Page 8-4)

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).

REMOVE

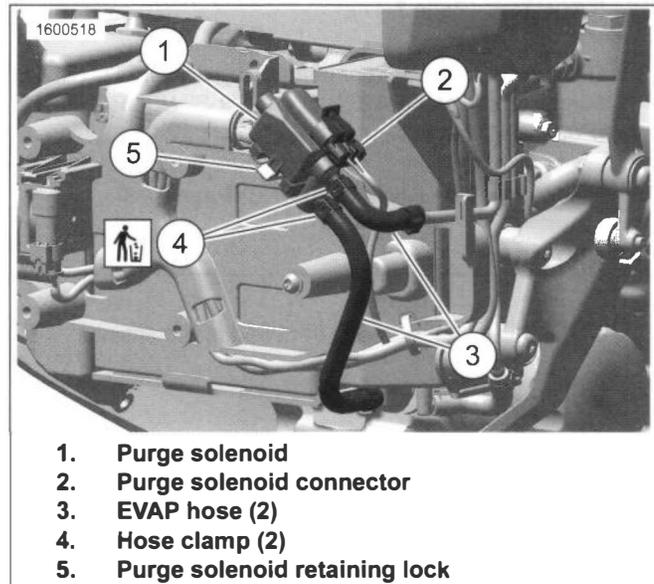
1. See Figure 6-43. Disconnect the purge solenoid connector (2).
2. Remove Evaporative Emissions Control System (EVAP) hoses (3).
 - a. Using small screwdriver, loosen hose clamps (4).
 - b. Remove EVAP hoses.
 - c. Discard hose clamps.
3. Remove purge solenoid (1).
 - a. Position the purge solenoid retaining lock (5) out-of-way.
 - b. Remove purge solenoid.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

1. See Figure 6-43. Install purge solenoid (1).
 - a. Install purge solenoid on bracket.

- b. Verify that the purge solenoid retaining lock (5) is fully setted.
2. Install **new** hose clamps (4).
3. Install EVAP hoses (3).
4. Using crimp tool tighten hose clamps.
Special Tool: HOSE CLAMP PLIERS (HD-41137)
5. Connect purge solenoid connector (2).



1. Purge solenoid
2. Purge solenoid connector
3. EVAP hose (2)
4. Hose clamp (2)
5. Purge solenoid retaining lock

Figure 6-43. Purge Solenoid

COMPLETE

1. Install chin spoiler. See CHIN SPOILER (Page 3-69).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
2. Remove battery. See INSPECT BATTERY (Page 2-37).
3. Remove purge solenoid from bracket. See PURGE SOLENOID: EVAPORATIVE EMISSIONS (Page 6-36).
 - a. Remove purge solenoid from bracket only, position out-of-way.
4. Remove voltage regulator and bracket. See VOLTAGE REGULATOR (Page 8-12).

REMOVE

1. See Figure 6-44. Remove back EVAP hose (2).
2. Remove lower EVAP hoses (5).
 - a. Using small screwdriver, loosen hose clamps (4).
 - b. Remove EVAP hoses.
 - c. Discard hose clamps.
3. See Figure 6-45. Remove charcoal canister (2).
 - a. Slide charcoal canister forward.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

1. See Figure 6-45. Install charcoal canister.
 - a. Slide charcoal canister into place.
 - b. Verify that charcoal canister is fully setted.
2. See Figure 6-44. Install **new** hose clamps (4).
3. Install EVAP hoses (5).
4. Using crimp tool tighten hose clamps.
Special Tool: HOSE CLAMP PLIERS (HD-41137)
5. Install back EVAP hose (2).

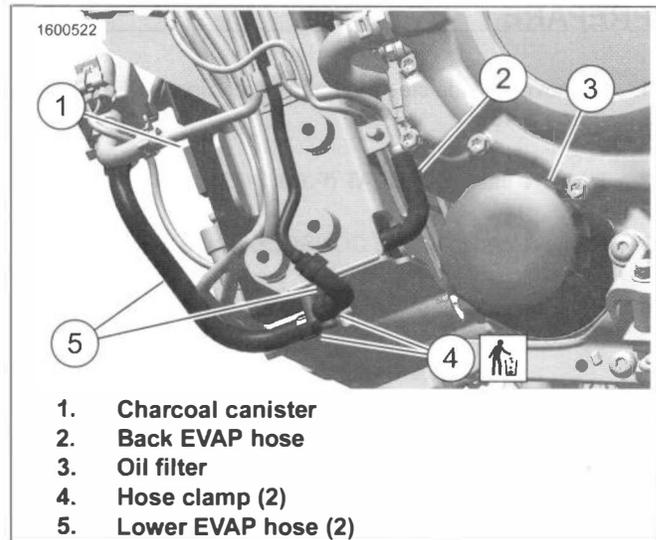


Figure 6-44. EVAP Hoses (Voltage regulator bracket removed for clarity)

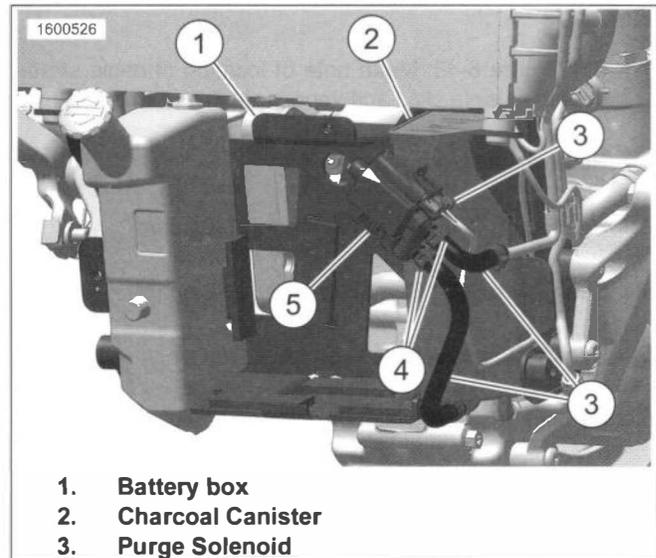


Figure 6-45. Charcoal Canister

COMPLETE

1. Install battery. See INSPECT BATTERY (Page 2-37).
2. Install voltage regulator and bracket. See VOLTAGE REGULATOR (Page 8-12).
3. Install purge solenoid. See PURGE SOLENOID: EVAPORATIVE EMISSIONS (Page 6-36).
4. Install chin spoiler. See CHIN SPOILER (Page 3-69).

PREPARE

1. Remove left side steering head cover. See SIDE COVERS (Page 3-46).
2. Remove seat. See SEAT (Page 3-82).
3. Remove console. See CONSOLE (Page 6-7).
4. Remove left side radiator cover. See SIDE COVERS (Page 3-46).
5. Remove chin spoiler. See CHIN SPOILER (Page 3-69).

REMOVE AND INSTALL: VAPOR VENT LINE

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

Remove

1. See Figure 6-48. Make note of location of cable straps, double or triple clips and vapor vent line (1) routing.
2. Remove cable straps and clips.
3. See Figure 6-46. Remove clamp (2). Discard.
4. See Figure 6-47. Remove clamp (3). Discard.
5. Remove vapor vent line (2).
6. Remove remaining clamps. Discard.

Install

1. See Figure 6-48. Route new vapor vent line (1) as previously noted.
2. See Figure 6-46. Install hose on vent line (3).
3. Install hose on fuel inlet (1).
4. Install **new** clamps (2).
Special Tool: HOSE CLAMP PLIERS (HD-41137)
5. See Figure 6-47. Install hose on vent line (2).
6. Install hose on carbon canister (1).
7. Install **new** clamps (3).
8. Install clips and **new** cable straps in locations previously noted.

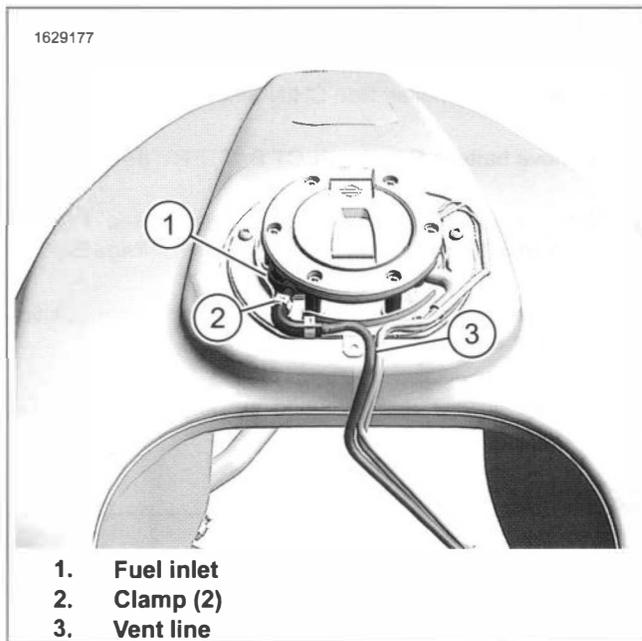


Figure 6-46. Vent Line to Fuel Inlet

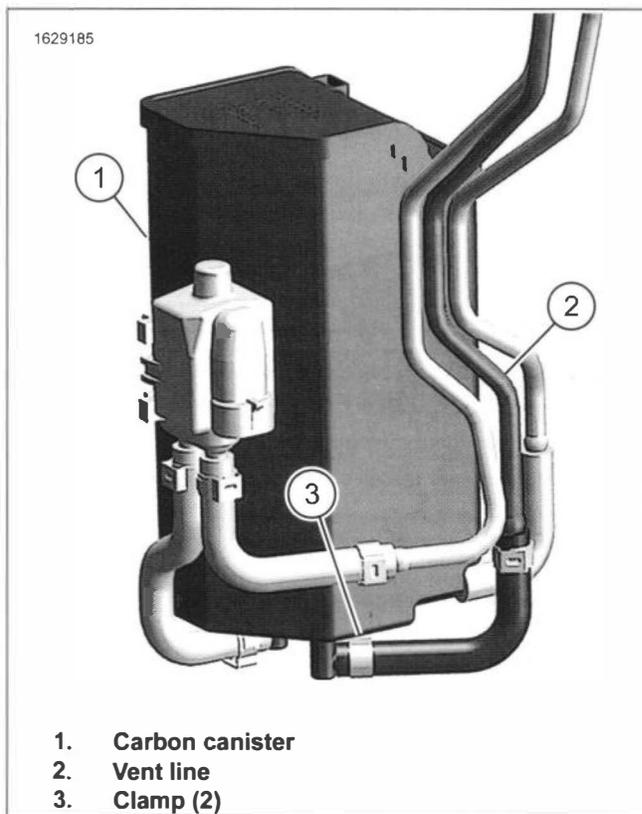


Figure 6-47. Carbon Canister

REMOVE AND INSTALL: PURGE PORT HOSE

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

Remove

1. See Figure 6-48. Make note of the location of any cable straps and double- or triple-clips securing purge port hose (3). Make note of hose routing.

2. Remove cable straps and clips to separate purge port hose from vapor vent line (1) and fresh air port hose (4).
3. Remove clamps from both ends of purge port hose.
4. Remove purge port hose.

Install

1. See Figure 6-48. Position new purge port hose (3) according to routing previously noted.
2. Install clips and **new** cable straps in locations previously noted.
3. Install ends of purge port hose onto fittings on purge solenoid (6) and purge port on front cylinder head with **new** clamps.
4. Install clamps.

Special Tool: HOSE CLAMP PLIERS (HD-41137)

REMOVE AND INSTALL: FRESH AIR PORT HOSE

Remove

1. See Figure 6-48. Make note of the location of any cable straps and double- or triple-clips securing fresh air port hose (4). Make note of hose routing.
2. Remove cable straps and clips securing fresh air port hose.
3. Remove end of fresh air port hose from fitting on carbon canister (7).
4. Remove fresh air air port hose.

Install

1. See Figure 6-48. Position new fresh air port hose (4) according to routing previously noted.
2. Install clips and new cable straps in locations previously noted.
3. Install end of fresh air port hose onto carbon canister (7) fitting.

REMOVE AND INSTALL: CARBON CANISTER-TO-PURGE SOLENOID HOSE

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

Remove

1. See Figure 6-48. Remove clamps from both ends of carbon canister-to-purge solenoid hose (5).

2. Remove carbon canister-to-purge solenoid hose from fittings on purge solenoid (6) and carbon canister (7).

Install

1. See Figure 6-48. Install **new** carbon canister-to-purge solenoid hose (5) onto fittings on purge solenoid (6) and carbon canister (7) with **new** clamps.
2. Install clamps.
Special Tool: HOSE CLAMP PLIERS (HD-41137)

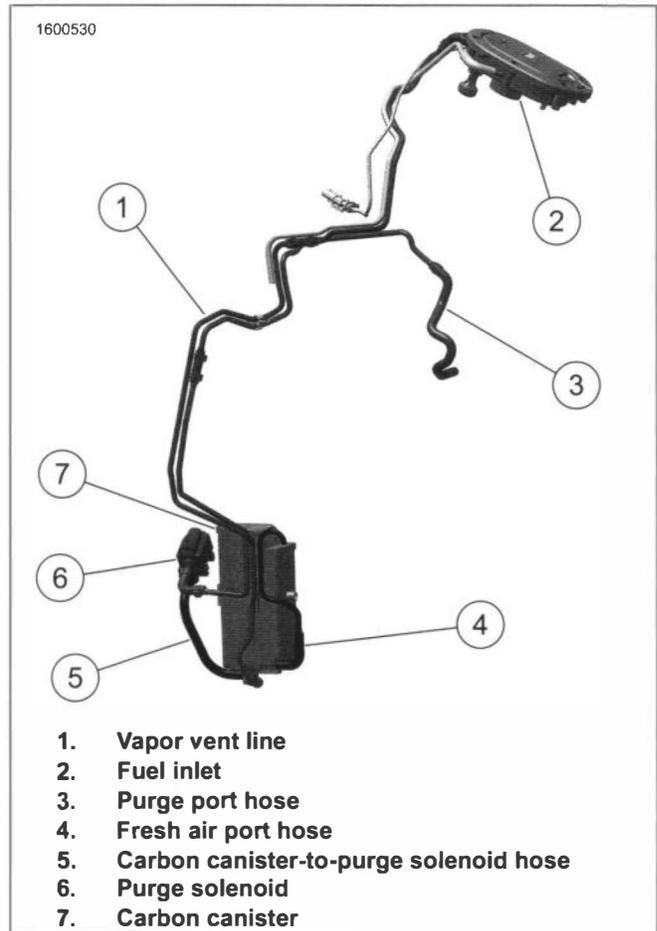


Figure 6-48. Evaporative Emissions System

COMPLETE

1. Install chin spoiler. See CHIN SPOILER (Page 3-69).
2. Install left side radiator cover. See SIDE COVERS (Page 3-46).
3. Install console. See CONSOLE (Page 6-7).
4. Install seat. See SEAT (Page 3-82).
5. Install left side steering head cover. See SIDE COVERS (Page 3-46).

NOTES

| SUBJECT | PAGE NO. |
|---|-----------------|
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| 7.2 SPECIFICATIONS..... | 7-2 |
| 7.3 COOLANT FLOW..... | 7-3 |
| 7.4 DIAGNOSE AND TEST..... | 7-4 |
| 7.5 COOLANT..... | 7-7 |
| 7.6 THERMOSTAT HOUSING..... | 7-10 |
| 7.7 COOLANT PUMP..... | 7-12 |
| 7.8 COOLANT OVERFLOW TANK..... | 7-13 |
| 7.9 COOLANT HOSES..... | 7-14 |
| 7.10 ENGINE COOLANT TEMPERATURE (ECT) SENSOR..... | 7-16 |
| 7.11 RADIATOR..... | 7-17 |

NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|------------------------------|-----------------------|-------------|---|
| Coolant bleed plug, cylinder | 44 in-lbs | 5 N·m | 7.5 COOLANT, Drain and Fill Cooling System |
| Coolant bleed plug, cylinder | 44 in-lbs | 5 N·m | 7.5 COOLANT, Drain and Fill Cooling System |
| Coolant temperature sensor | 26–29 ft-lbs | 35–39 N·m | 7.10 ENGINE COOLANT TEMPERATURE (ECT) SENSOR, Install |
| Drain screw | 130–150 in-lbs | 15–16.5 N·m | 7.5 COOLANT, Drain and Fill Cooling System |
| Radiator mounting screw | 71–89 in-lbs | 8–10 N·m | 7.11 RADIATOR, Remove and Install: Radiator |
| Radiator mounting screws | 71–89 in-lbs | 8–10 N·m | 7.11 RADIATOR, Relocate Radiator for Service |
| Thermostat housing screws | 71–89 in-lbs | 8–10 N·m | 7.6 THERMOSTAT HOUSING, Install |

GENERAL

Table 7-1. Coolant Capacities

| ITEM | LITERS | QUARTS |
|----------------|--------|--------|
| Engine coolant | 2.2 | 2.32 |
| Overflow tank | 0.25 | 0.26 |

Table 7-2. Coolant Pressure

| ITEM | KPA | PSI |
|--------------------|-----|-----|
| Cap lower limit | 124 | 18 |
| Rated cap pressure | 138 | 20 |
| Cap upper limit | 152 | 22 |
| System pressure | 138 | 20 |

Table 7-3. Coolant Temperatures

| ITEM | °C | °F |
|----------------------------|-------|-----|
| Thermostat initially opens | 85 | 185 |
| Thermostat fully open | 100 | 212 |
| Engine temperature lamp | 130 | 266 |
| Antifreeze protection | -36.7 | -34 |

Table 7-4. Fan Operation

| STATUS | °C | °F |
|--------|-----|-----|
| On | 105 | 221 |
| Off | 95 | 203 |

OPERATION

Engine Below Operating Temperature

See Figure 7-1. The thermostat is closed when the engine is below operating temperature. Coolant circulates from the coolant pump to the cylinders, heads, and layered core oil cooler (LCOC).

Coolant Flow with Engine at Operating Temperature

1. Once the coolant temperature reaches 185 °F (85 °C) the thermostat starts to open and is fully open at 212 °F (100 °C) and coolant begins to flow.
 - a. Coolant pump (7) to engine coolant cavities (1).
 - b. Engine coolant cavities (1) to thermostat housing (8).
 - c. Thermostat housing (8) to radiator (2).
 - d. Radiator (2) to coolant pump (7).

Coolant Overflow Tank

1. As temperature increases in the cooling system, so does pressure. To control pressure, the pressure cap (2) allows coolant to flow through the overflow hose (3) to the coolant overflow tank (7) as needed.
 - a. Once coolant pressure reaches a preset value, a valve in the pressure cap opens allowing coolant to escape to the coolant overflow tank.
 - b. Once coolant pressure decreases below the preset value, the valve in the pressure cap closes.

2. As temperature decreases in the cooling system, so does pressure. Once temperature decreases enough, a vacuum is created in the cooling system. To control vacuum, the pressure cap allows coolant to flow back into the cooling system as needed.
 - a. Once coolant vacuum reaches a preset value, a secondary valve in the pressure cap opens. Coolant is then drawn back into the cooling system.
 - b. Once coolant vacuum decreases below the preset value, the valve in the pressure cap closes.

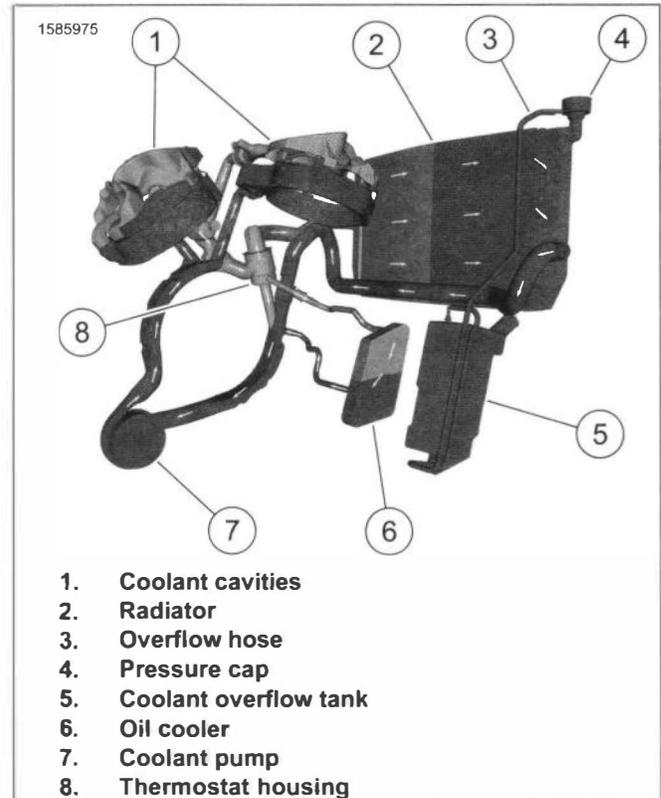


Figure 7-1. Coolant Flow

TROUBLESHOOTING

TROUBLESHOOTING

⚠ 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)

High Engine Temperature

- Blocked hoses, pipes or passages
- Restricted air flow through radiator
- Defective cooling fan
- Faulty coolant pump
- Low coolant level
- Air in system
- Defective pressure cap
- Defective engine coolant sensor

Coolant Leaks

- Pressure cap not properly installed
- Damaged pressure cap gasket
- Deteriorated O-rings on coolant pump or manifolds
- Leaking hose or hose connection

PRESSURE CAP TEST

| PART NUMBER | TOOL NAME |
|-------------|--------------------------------|
| HD-45335 | COOLANT SYSTEM PRESSURE TESTER |

PRESSURE CAP TEST

Test pressure cap for the correct operating range every time the coolant is changed or any cooling system maintenance performed.

⚠ WARNING

Do not loosen or remove pressure cap when cooling system is hot. The cooling system is under pressure and hot coolant and steam can escape from pressure cap, which could cause severe burns. Allow motorcycle to cool before servicing the cooling system. (00091c)

1. Remove pressure cap.
2. Inspect cap for gasket deterioration and inoperative springs.
3. **New cap:** Wet the upper sealing gasket before turning onto adapter.
4. See Figure 7-2. Connect tester to pressure cap.

Special Tool: COOLANT SYSTEM PRESSURE TESTER (HD-45335)

5. Pump handle to pressurize cap. Stop pumping when pressure limiting valve in cap opens.
6. Replace pressure cap if:
 - a. Opens below low limit, 18 psi (124 kPa).
 - b. Opens above high limit, 22 psi (152 kPa).
 - c. Pressure falls rapidly when pressurized within range.
7. Remove adapter and cap.

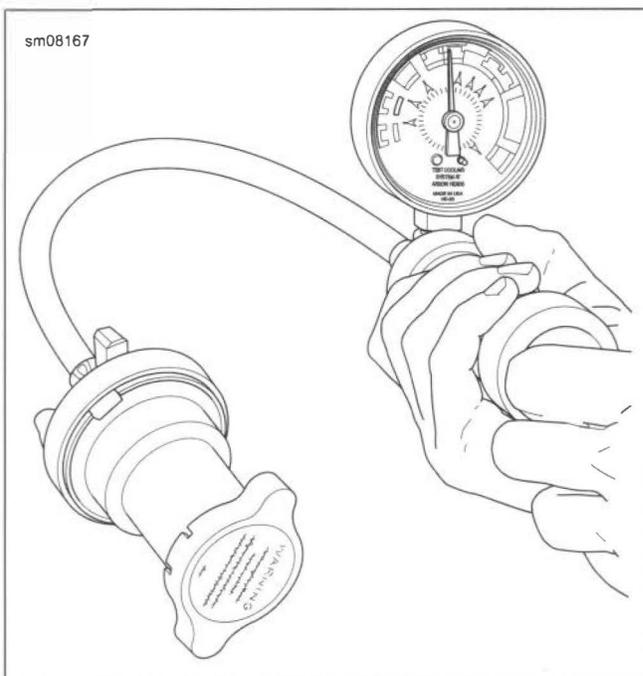


Figure 7-2. Pressure Cap Test

SYSTEM PRESSURE TEST

| PART NUMBER | TOOL NAME |
|-------------|--------------------------------|
| HD-45335 | COOLANT SYSTEM PRESSURE TESTER |

SYSTEM PRESSURE TEST

⚠ WARNING

Do not loosen or remove pressure cap when cooling system is hot. The cooling system is under pressure and hot coolant and steam can escape from pressure cap, which could cause severe burns. Allow motorcycle to cool before servicing the cooling system. (00091c)

1. See Figure 7-3. Before troubleshooting cooling system, make sure that engine coolant level is at or slightly above COLD full mark on coolant overflow dip stick (3).
2. Inspect coolant overflow dipstick for damage. Replace as needed. Install if no damage.

NOTE

Damaged filler neck cams, safety stops and sealing surfaces can cause cap to leak or affect the pressure limiting valve. Replace radiator if damaged. Damaged cap stop can also cause a coolant leak. Replace cap if damaged.

3. Remove radiator cap (1).
4. Inspect radiator cap for damage. Replace as needed.
5. Clean and inspect filler neck (2), upper and lower sealing seats, overflow tube and coolant overflow tank (3).

NOTE

Wet upper sealing surfaces before turning coolant system pressure tester adapter onto tester head.

- a. Filler neck (2).
- b. Sealing seats, upper.
- c. Sealing seats, lower.
- d. Overflow tube.
- e. Coolant overflow tank (3).

6. Connect tester to filler neck.

Special Tool: COOLANT SYSTEM PRESSURE TESTER (HD-45335)

NOTE

When performing the coolant system pressure test, never exceed the upper limit rating of the pressure cap. Excessive pressure can rupture cooling pipes and radiator.

7. Pump tester until pressure reaches 20 psi (138 kPa).
8. Observe pressure gauge and proceed as indicated in Table 7-5.
9. Release system pressure. Remove tester from filler neck (2).

Table 7-5. System Pressure Test

| NEEDLE MOVEMENT | LEAK | ACTION |
|----------------------------|-------|---------------------------|
| Holds steady for 2 minutes | None | None |
| Drops slowly | Small | Perform dye test |
| Drops quickly | Major | Perform visual inspection |

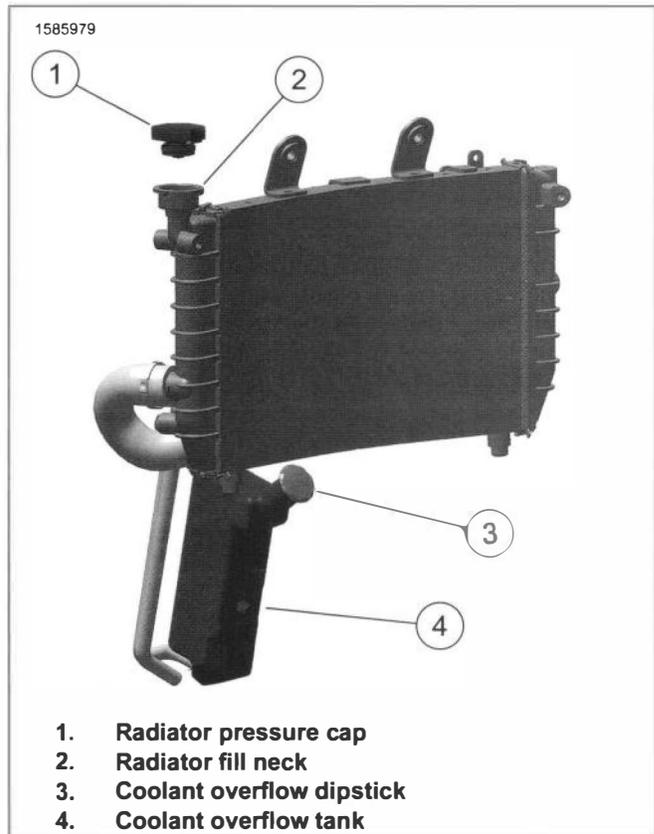


Figure 7-3. System Pressure Test

FREEZE POINT TEST

| PART NUMBER | TOOL NAME |
|-------------|----------------|
| HD-23688 | BATTERY TESTER |

| CONSUMABLE | PART NUMBER |
|--|-------------|
| GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE & COOLANT | 99822-02A |

FREEZE POINT TEST

1. Allow engine to cool.
2. Remove pressure cap.
3. Place a few drops of coolant from filler neck onto prism of the following tester.
Special Tool: BATTERY TESTER (HD-23688)
4. Hold prism up to a light.
5. Coolant freeze point is the mark where the dark area begins on the ETHYLENE GLYCOL temperature scale.
6. Compare freeze point of coolant to anticipated operating or storage temperatures. Replace as required. See COOLANT (Page 7-7).
 - a. If indicated freeze point is less than specified on the container, replace with antifreeze.

GENUINE HARLEY-DAVIDSON EXTENDED LIFE
ANTIFREEZE & COOLANT (99822-02A)

- b. If anticipated cold temperatures exceed that of Harley-Davidson premixed antifreeze, replace with a mixture of de-ionized water and ethylene glycol antifreeze. Follow directions on the container to create a mixture with a freeze point that will exceed the expected cold temperature.

7. Install pressure cap.

LEAK DETECTION DYE TEST

| PART NUMBER | TOOL NAME |
|-------------|--|
| HD-29545-6A | COOLANT FLUORESCENT LEAK DETECTION DYE |
| HD-35457 | BLACK LIGHT LEAK DETECTOR |

LEAK DETECTION DYE TEST

1. See Figure 7-3. Before troubleshooting cooling system, make sure that engine coolant level is at COLD FULL mark on coolant overflow dipstick (3).

NOTE

If coolant overflow tank is empty when engine is cold, air has possibly been drawn into coolant system. Fill system with coolant and purge any trapped air.

⚠ WARNING

Do not loosen or remove pressure cap when cooling system is hot. The cooling system is under pressure and hot coolant and steam can escape from pressure cap, which could cause severe burns. Allow motorcycle to cool before servicing the cooling system. (00091c)

2. Remove radiator pressure cap (1).
3. If filler neck is full of coolant, remove an amount of coolant equal to the amount of dye.
4. Pour dye into filler neck (2).
Special Tool: COOLANT FLUORESCENT LEAK DETECTION DYE (HD-29545-6A)
5. Install radiator cap. Run engine for 10 minutes.
6. Use detector to illuminate entire cooling system. A yellow fluorescence indicates a leak.
Special Tool: BLACK LIGHT LEAK DETECTOR (HD-35457)
7. Inspect engine oil for yellow dye.

NOTE

Dye in the oil may indicate a damaged engine head gasket. Draining and replacing coolant contaminated oil is necessary as part of engine service.

GASKET LEAK TEST

| PART NUMBER | TOOL NAME |
|-------------|--------------------------------|
| HD-45335 | COOLANT SYSTEM PRESSURE TESTER |

GASKET LEAK TEST

Perform the following tests if a leak exists but no external evidence of a leak is found.

1. Start and run cold engine.
 - a. White smoke from exhaust system indicates a leaking gasket.
2. Run engine. Turn off engine.
 - a. Remove oil level dipstick. Light-colored foam on dipstick indicates a leaking gasket.
 - b. Open oil drain plug. Drain a small amount of oil. Water or coolant drains out first if gasket is leaking.

NOTE

- Do not allow pressure to build up past maximum for system. If pressure rises past maximum, turn off engine and turn butterfly pressure valve perpendicular to tester head to release pressure.
 - Do not continue to run engine unattended with COOLANT SYSTEM PRESSURE TESTER (PART NUMBER: HD-45335) installed. There is no safety valve with the pressure cap removed and the COOLANT SYSTEM PRESSURE TESTER (PART NUMBER: HD-45335) installed.
3. Install tester.
Special Tool: COOLANT SYSTEM PRESSURE TESTER (HD-45335)

⚠ WARNING

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

4. Start cold engine and idle engine to normal operating temperature.
 - a. If gauge indicates fast pressure buildup, a gasket is leaking.
 - b. If pressure does not build up immediately, pump the tester to 20 psi (138 kPa).
 - c. A vibrating needle indicates a leaking cylinder head gasket.
 - d. Turn off engine. Disable one spark plug at the coil. Start engine. Repeat for other cylinder. The needle stops vibrating when spark is removed from leaking cylinder.

NOTE

Always replace engine oil after replacing cylinder head gasket.

PREPARE

1. Remove left side chin spoiler. See CHIN SPOILER (Page 3-69).
2. If bleeding system remove side mount ignition coil and bracket. See IGNITION COIL (Page 8-15).

CHECK COOLANT LEVEL

⚠ CAUTION

At operating temperature, radiators and oil coolers contain hot fluids. Contact with a radiator or oil cooler can result in minor or moderate burns. (00141b)

NOTE

- Check coolant level with engine cold and motorcycle on side stand.
- If the coolant bottle is empty when the engine is cold, inspect the system for leaks. Repair as needed. Fill system with coolant and purge any trapped air.

1. See Figure 7-4. Check coolant level.
 - a. Remove coolant dipstick (1).
 - b. Check that coolant level is at or slightly above the cold MAX level line (2).
2. If level is below cold MAX level line, add coolant to coolant overflow tank (3).
 - a. Add GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE AND COOLANT until fluid level reaches cold MAX level line.
 - b. Install coolant dipstick.

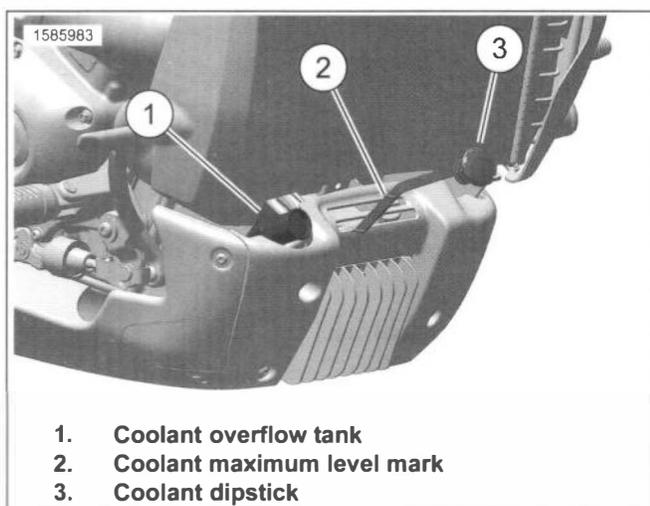


Figure 7-4. Coolant Level

DRAIN AND FILL COOLING SYSTEM

| FASTENER | TORQUE VALUE | |
|------------------------------|--------------|-------|
| Coolant bleed plug, cylinder | 44 in-lbs | 5 N·m |

| FASTENER | TORQUE VALUE | |
|-------------|----------------|-------------|
| Drain screw | 130–150 in-lbs | 15–16.5 N·m |

| CONSUMABLE | PART NUMBER |
|--|-------------|
| GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE & COOLANT | 99822-02A |

⚠ CAUTION

At operating temperature, radiators and oil coolers contain hot fluids. Contact with a radiator or oil cooler can result in minor or moderate burns. (00141b)

⚠ WARNING

Do not loosen or remove pressure cap when cooling system is hot. The cooling system is under pressure and hot coolant and steam can escape from pressure cap, which could cause severe burns. Allow motorcycle to cool before servicing the cooling system. (00091c)

Drain

1. Allow engine to cool.
2. See Figure 7-5. Drain cooling system.
3. Remove coolant drain screw (1).
 - a. Drain and discard used coolant.
 - b. Install coolant drain screw (1).

Torque: 130–150 in-lbs (15–16.5 N·m) *Drain screw*

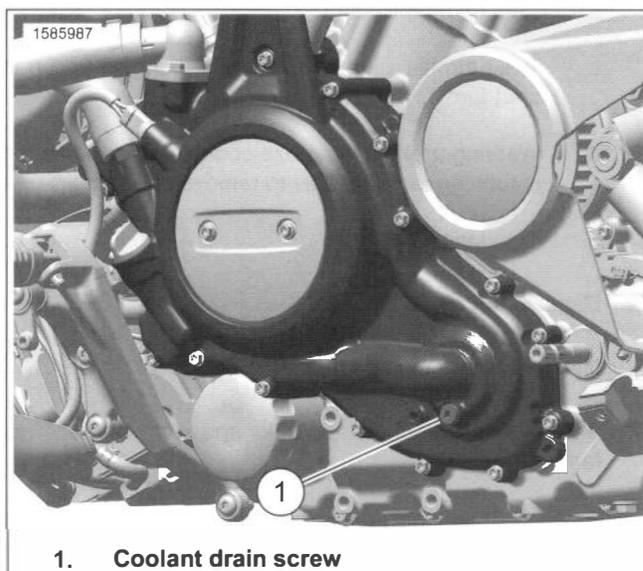


Figure 7-5. Coolant Drain Plug

Fill

1. See Figure 7-6. Remove radiator pressure cap (1).
2. See Figure 7-7. Secure coolant funnel cap (3) to filler neck.

3. Secure funnel (2) with appropriate strap (1).
4. Clamp overflow hose (4).
5. Bleed air from coolant system, **cold**.

- a. Fill funnel half full with coolant.

GENUINE HARLEY-DAVIDSON EXTENDED LIFE
ANTIFREEZE & COOLANT (99822-02A)

NOTE

Do not let funnel go empty or air will get in coolant system.

- b. See Figure 7-8. Remove front cylinder bleeder plug (1) allowing air to escape. Repeat until only coolant emerges. Reinstall bleeder plug as coolant starts to escape and tighten.

Torque: 44 **in-lbs** (5 N·m) *Coolant bleed plug, cylinder*

- c. Remove rear cylinder bleeder plug (1) allowing air to escape. Repeat until only coolant emerges. Reinstall bleeder plug as coolant starts to escape and tighten.

Torque: 44 **in-lbs** (5 N·m) *Coolant bleed plug, cylinder*

- d. Squeeze coolant hoses to release any trapped air.

- e. Install side mount ignition coil bracket and coil. See IGNITION COIL (Page 8-15).

6. Bleed air from coolant system, **hot**.

- a. Start motorcycle and run until coolant temperature reaches 203°. Rev engine occasionally to 3000 rpm to help speed up and slow down water pump.

- b. Shut off motorcycle.

- c. Twist throttle wide open and turn ignition to run to start fan.

- d. Wearing a glove, squeeze coolant hoses while fan is running for 5 minutes to remove trapped air.

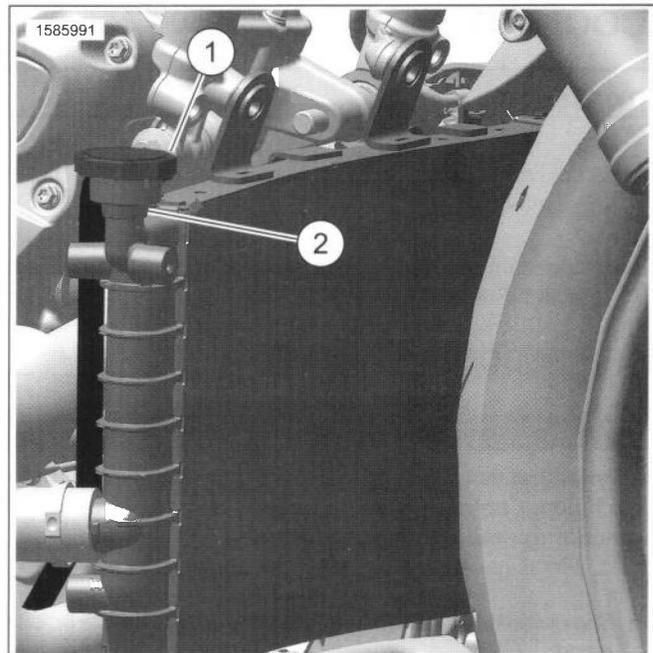
- e. Turn ignition off.

7. Remove funnel.

8. Install radiator pressure cap (1).

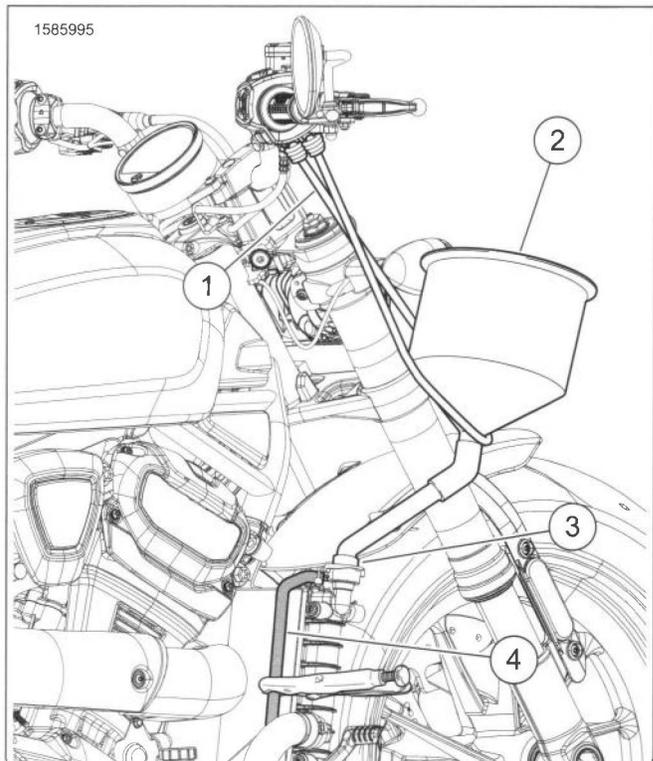
9. Start motorcycle, check for leaks and verify operation of fan.

10. Check coolant level in overflow bottle.



1. Radiator pressure cap
2. Radiator fill neck

Figure 7-6. Radiator Pressure Cap



1. Strap
2. Funnel
3. Coolant funnel cap
4. Overflow hose

Figure 7-7. Coolant Bleed

COMPLETE

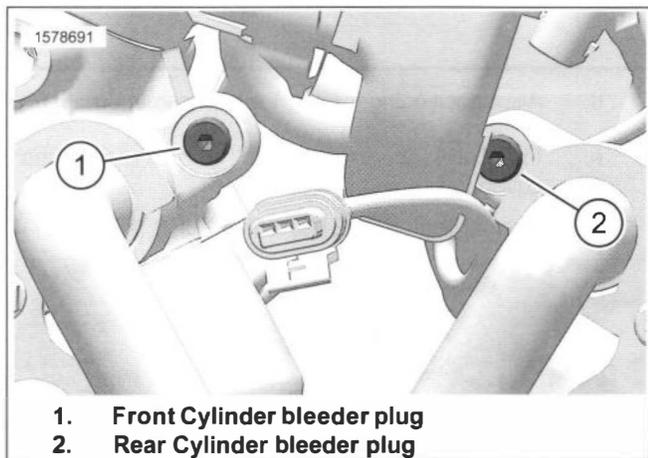


Figure 7-8. Coolant Bleeder Plugs

1. Install left side chin spoiler. See CHIN SPOILER (Page 3-69).

PREPARE

Drain coolant. See COOLANT (Page 7-7).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52948 | THERMOSTAT REMOVAL TOOL |

NOTE

Remove hose only if replacing thermostat housing.

Pry overlap of clamps to remove. If clamps must be cut, use a sharp high-quality wire cutter.

1. See Figure 7-9. Remove thermostat housing.
 - a. Remove and discard clamp (2). Remove hose (1) from thermostat housing (4).
 - b. Remove screws (3).
2. See Figure 7-10. Remove thermostat from housing assembly.
 - a. Push thermostat tool (4) up slightly and rotate thermostat (2), remove from thermostat housing (1).
Special Tool: THERMOSTAT REMOVAL TOOL (HD-52948)
 - b. Inspect o-ring (3), replace as required.

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-41137 | HOSE CLAMP PLIERS |
| HD-52948 | THERMOSTAT REMOVAL TOOL |

| FASTENER | TORQUE VALUE |
|---------------------------|-------------------------|
| Thermostat housing screws | 71–89 in-lbs 8–10 N·m |

1. See Figure 7-10. Install thermostat.
 - a. Push thermostat tool (4) up slightly and rotate thermostat (2) to install in thermostat housing (1).
Special Tool: THERMOSTAT REMOVAL TOOL (HD-52948)
 - b. Inspect o-ring (3), replace as required.
 - c. Use coolant, lube o-ring.
2. See Figure 7-9. Install thermostat housing.
 - a. Position thermostat housing (4).
 - b. Install screws (3). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Thermostat housing screws*
 - c. See Figure 7-11. Clean inside hose (2) and install.

- d. Align positioning mark (3) with alignment mark (4).
- e. Install and secure **new** clamp (1) on positioning mark covering line on hose as shown.
Special Tool: HOSE CLAMP PLIERS (HD-41137)

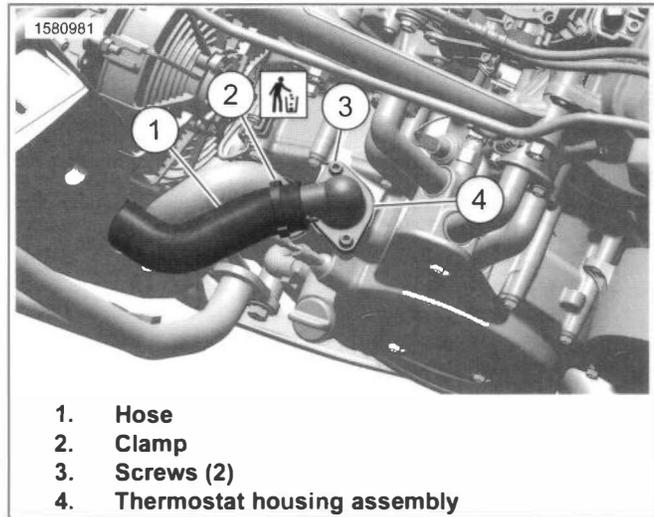


Figure 7-9. Thermostat Housing Assembly

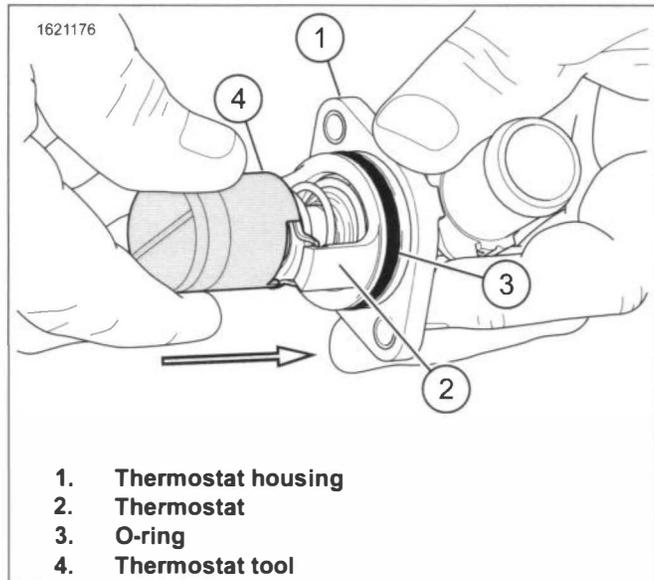


Figure 7-10. Thermostat Tool

COMPLETE

Fill system with coolant. See COOLANT (Page 7-7).

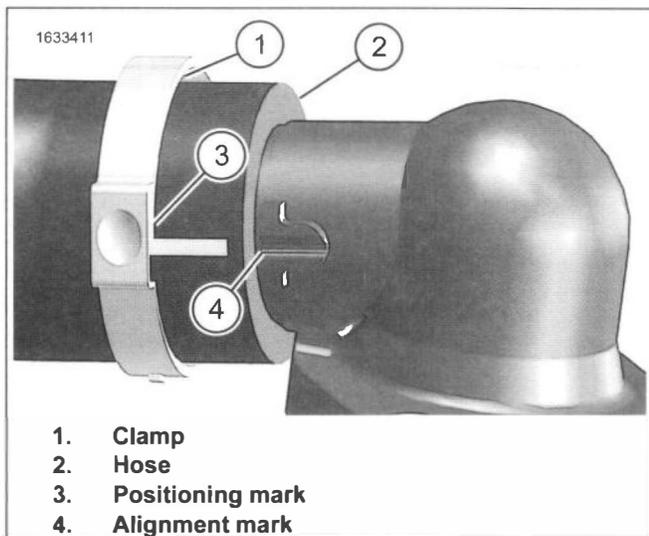


Figure 7-11. Clamp Positioning

GENERAL

See COOLANT MANIFOLD (Page 4-53) for coolant pump removal and installation.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove center chin spoiler. See CHIN SPOILER (Page 3-69).
3. Remove right radiator cover. See SIDE COVERS (Page 3-46).
4. Remove voltage regulator and bracket. See VOLTAGE REGULATOR (Page 8-12).

REMOVE

1. Remove coolant overflow tank.
 - a. See Figure 7-13. Disconnect coolant overflow hose (1) and clamp (2) from radiator.
 - b. Remove coolant overflow tank.
 - c. Drain coolant from tank.
 - d. See Figure 7-12. Remove clamp (4).
 - e. Remove coolant overflow hose from coolant overflow tank.

INSTALL

1. Install coolant overflow tank.
 - a. See Figure 7-12. Install coolant overflow hose (1) and clamp (2).
 - b. Press coolant overflow tank in place on battery tray (3).
 - c. See Figure 7-13. Install coolant overflow hose to radiator (1) and clamp (2).
 - d. Fill coolant overflow tank with coolant.

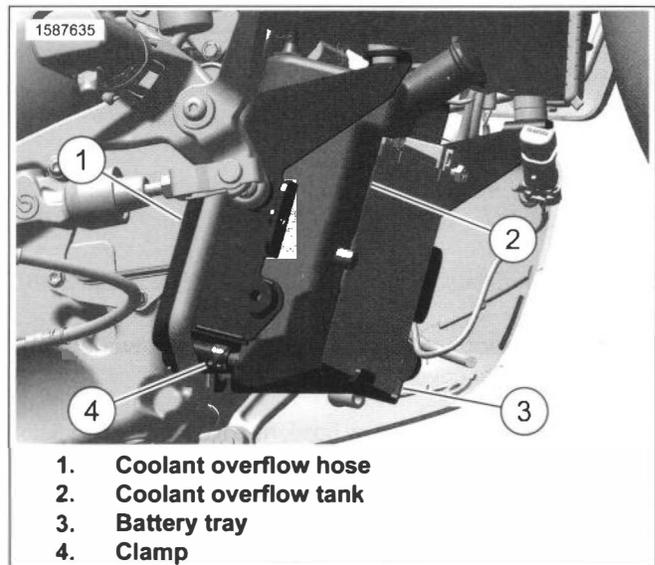


Figure 7-12. Coolant Overflow Tank

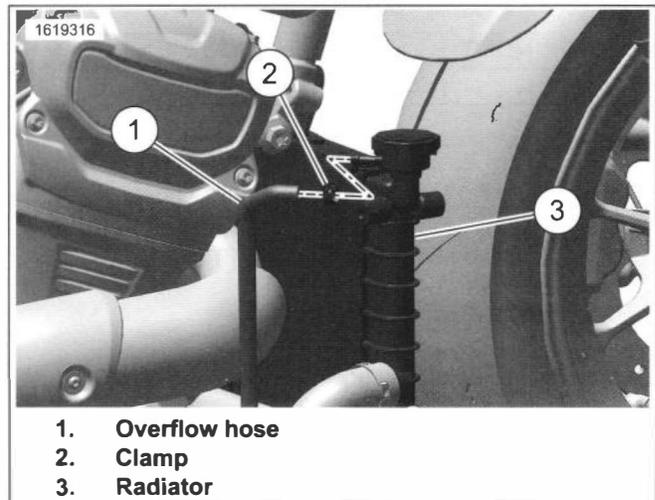


Figure 7-13. Upper Hose Connection

COMPLETE

1. Install voltage regulator bracket and voltage regulator. See VOLTAGE REGULATOR (Page 8-12).
2. Install center chin spoiler. See CHIN SPOILER (Page 3-69).
3. Install right radiator cover. See SIDE COVERS (Page 3-46).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

NOTE

If replacing lower coolant hose, remove radiator.

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove radiator cover. See SIDE COVERS (Page 3-46).
 - a. If replacing upper radiator hose, remove left side radiator cover.
 - b. If replacing overflow hose, remove right side radiator cover.
3. Drain coolant. See COOLANT (Page 7-7).

REMOVE AND INSTALL: COOLANT HOSES

| PART NUMBER | TOOL NAME |
|-------------|-------------------|
| HD-41137 | HOSE CLAMP PLIERS |

Remove

1. See Figure 7-14. Remove upper coolant hose.
 - a. Remove and discard clamps (3).
 - b. Remove upper coolant hose (2).
2. Remove lower coolant hose.
 - a. Remove radiator. See RADIATOR (Page 7-17).

Install

NOTE

See Figure 7-15 Align positioning marks (3) with alignment marks (4). Install clamps (1) on positioning marks (3) as shown for all coolant hoses (2).

1. Install lower coolant hose.
 - a. Install radiator. See RADIATOR (Page 7-17).
2. See Figure 7-14. Upper coolant hose install.
 - a. Clean thermostat hosing outlet (4) and radiator (1) outlet.
 - b. Clean inside ends of coolant hose (2).
 - c. Figure 7-15 Install coolant hose, position mark (3) with alignment mark (4).
3. Align clamp with positioning mark (3) covering line as shown.
4. See Figure 7-14. Secure with new clamps (3).

Special Tool: HOSE CLAMP PLIERS (HD-41137)

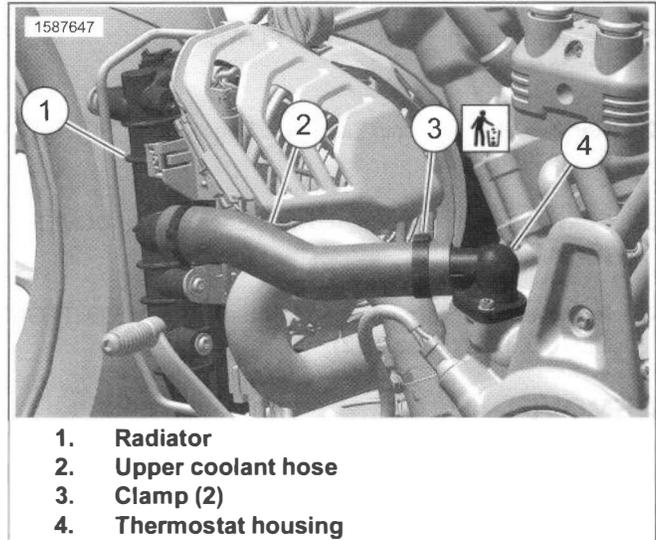


Figure 7-14. Upper Coolant Hose

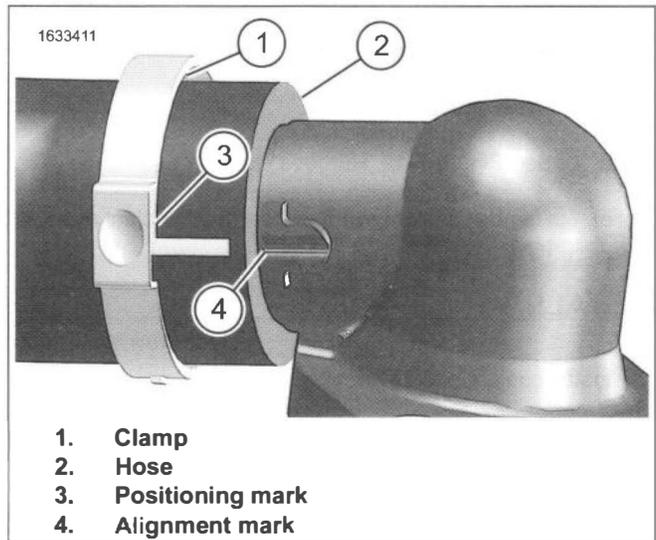


Figure 7-15. Clamp Positioning

REMOVE AND INSTALL: OVERFLOW HOSE

Remove

1. See Figure 7-17. Disconnect coolant overflow hose, upper connection.
 - a. Detach clamp (2).
 - b. Detach overflow hose (1).
2. See Figure 7-16. Disconnect coolant overflow hose, lower connection.

NOTE

Use drain pan for residual coolant.

- a. Detach clamp (2).
- b. Detach overflow hose (1).

Install

1. See Figure 7-16. Attach coolant overflow hose, lower connection.
 - a. Clean hose barb (3). Clean inside of overflow hose end.
 - b. Install overflow hose (1).
 - c. Secure with clamp (2).
2. See Figure 7-17. Attach coolant overflow hose, upper connection.
 - a. Clean hose barb (3). Clean inside of overflow hose end.
 - b. Install overflow hose (1).
 - c. Secure with clamp (2).

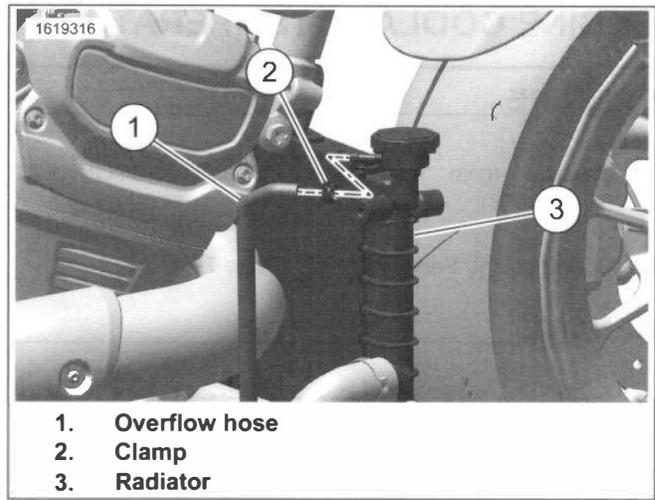


Figure 7-17. Upper Hose Connection

COMPLETE

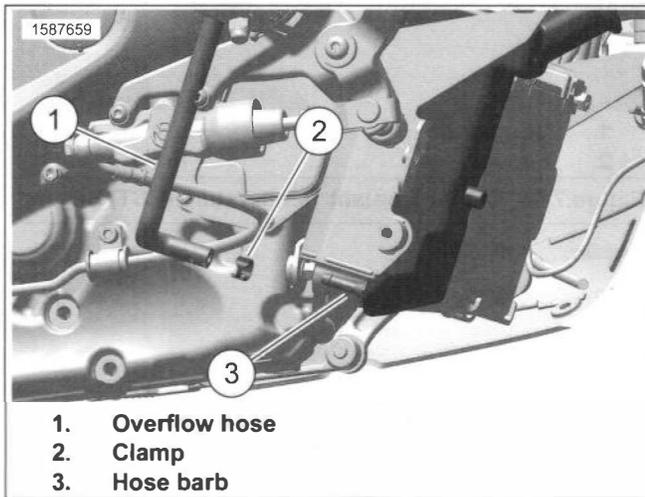


Figure 7-16. Lower Hose Connection

1. Add coolant. See COOLANT (Page 7-7).
2. Install radiator cover. See SIDE COVERS (Page 3-46).
 - a. If upper radiator hose was removed, install left side radiator cover.
 - b. If overflow hose was removed, install right side radiator cover.
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Drain coolant. See COOLANT (Page 7-7).

REMOVE

1. See Figure 7-18. Disconnect connector (1).
2. Remove sensor (2).
3. See Figure 7-19. Inspect O-ring for damage and replace as necessary.

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|--------------|-----------|
| Coolant temperature sensor | 26–29 ft-lbs | 35–39 N·m |

1. See Figure 7-18. Install sensor (2). Tighten
Torque: 26–29 ft-lbs (35–39 N·m) *Coolant temperature sensor*
2. Install connector (1).

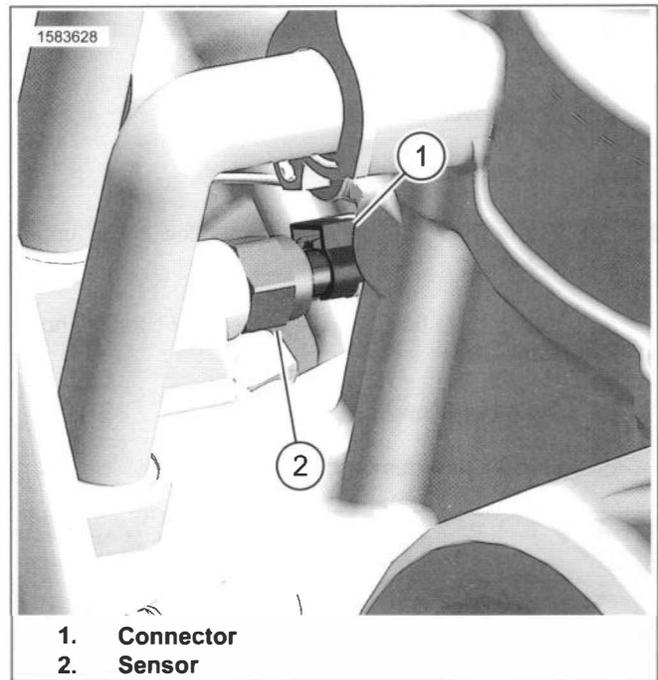


Figure 7-18. Engine Coolant Temperature (ECT) Sensor



Figure 7-19. Coolant Temperature O-ring

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).
2. Fill and bleed coolant system. See COOLANT (Page 7-7).

RELOCATE RADIATOR FOR SERVICE

| FASTENER | TORQUE VALUE | |
|--------------------------|--------------|----------|
| Radiator mounting screws | 71–89 in-lbs | 8–10 N·m |

Prepare

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove radiator cover. See SIDE COVERS (Page 3-46).

Remove

1. Relocate radiator.
 - a. Protect front fender.
 - b. See Figure 7-20. Remove screws (3).
 - c. Remove clamp (2).
 - d. Remove coolant overflow hose (1) from top hose barb.
 - e. Move coolant overflow hose to opposite side of lower coolant hose.
 - f. Lift radiator off mounting brackets (4).
 - g. Pivot radiator away from engine.
 - h. See Figure 7-21. Attach appropriate strap from radiator mounting bracket (1) around both front forks (2) securing radiator.

Install

1. Relocate radiator.
 - a. Remove strap holding radiator to front fork.
 - b. See Figure 7-20. Install radiator bottom mounts on radiator mounting brackets (4).
 - c. Tilt radiator towards engine.
 - d. Install screws (3). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Radiator mounting screws*
 - e. Install coolant overflow hose (1) and clamp (2).

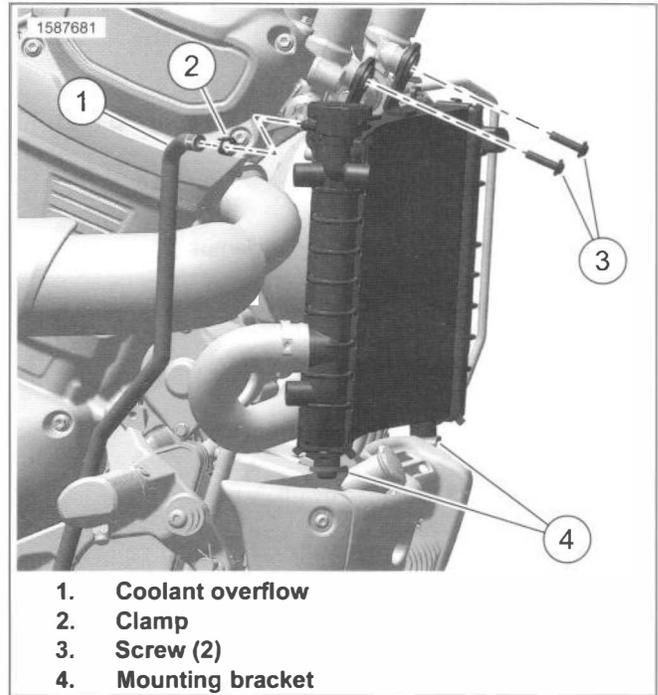


Figure 7-20. Radiator Relocating

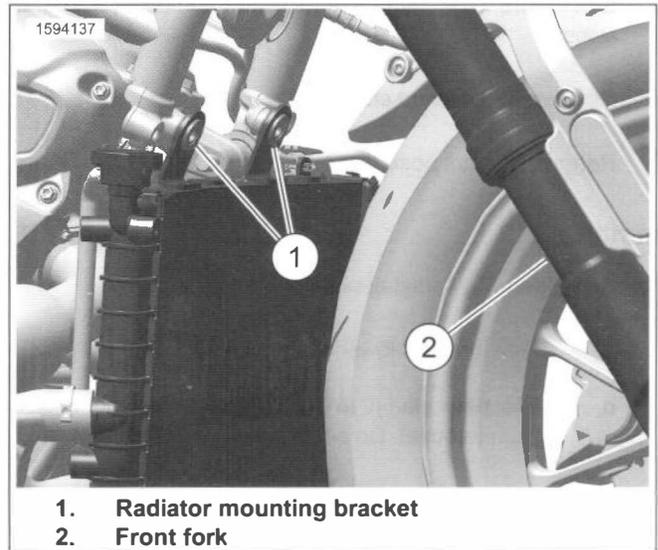


Figure 7-21. Radiator Relocated

Complete

1. Install radiator cover. See SIDE COVERS (Page 3-46).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE AND INSTALL: RADIATOR

| FASTENER | TORQUE VALUE | |
|-------------------------|--------------|----------|
| Radiator mounting screw | 71–89 in-lbs | 8–10 N·m |

Prepare

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

2. Drain coolant. See COOLANT (Page 7-7).
3. Remove radiator cover. See SIDE COVERS (Page 3-46).

Remove

1. See Figure 7-22. Release vent tube (7) from clip (1).
2. Remove upper coolant hose.
 - a. Remove and discard upper clamps (2).
 - b. Remove upper coolant hose (4).
3. Remove and discard lower clamp (5).
4. Detach lower coolant hose (6) from fitting.
5. See Figure 7-23. Remove overflow hose.
 - a. Remove clamp (2).
 - b. Remove overflow hose (1) from hose barb.
6. Remove screws (3).
7. See Figure 7-24. Tilt radiator to drain additional fluid and remove.
8. Remove and discard clamp (5).
9. Remove coolant hose (1).

Install

1. See Figure 7-24. Install radiator.
 - a. Clean inside of lower coolant hose (1) and outlet (2).
 - b. Slide **new** clamp (5) on lower coolant hose and attach to outlet. Do not tighten.
 - c. Align radiator locating pins (3) in isolator grommets (4).
 - d. See Figure 7-23. Pivot radiator up.
 - e. Install screws (3). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Radiator mounting screw*
2. See Figure 7-23. Attach coolant overflow hose.
 - a. Clean hose barb. Clean inside of overflow hose end.
 - b. Install overflow hose (1).
 - c. Secure with clamp (2).
3. Install coolant hoses. See COOLANT HOSES (Page 7-14).
4. See See Figure 7-22.. Snap vent tube (7) into clip (1).

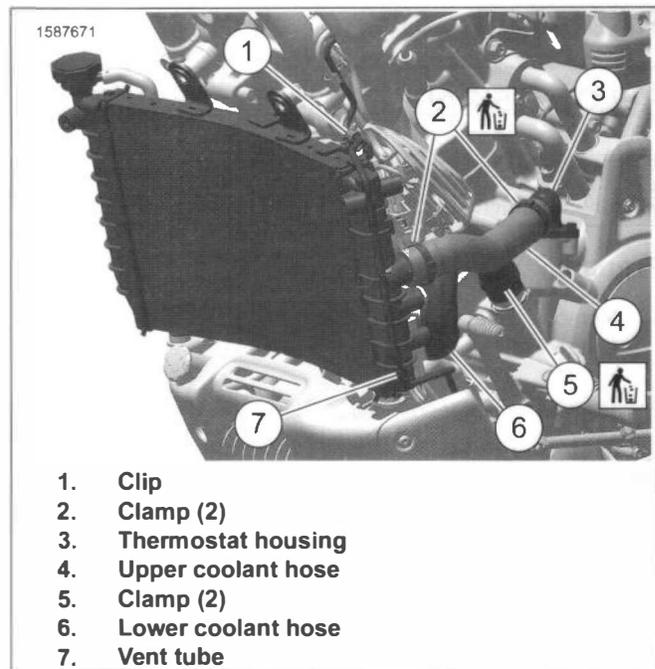


Figure 7-22. Left Side Hoses

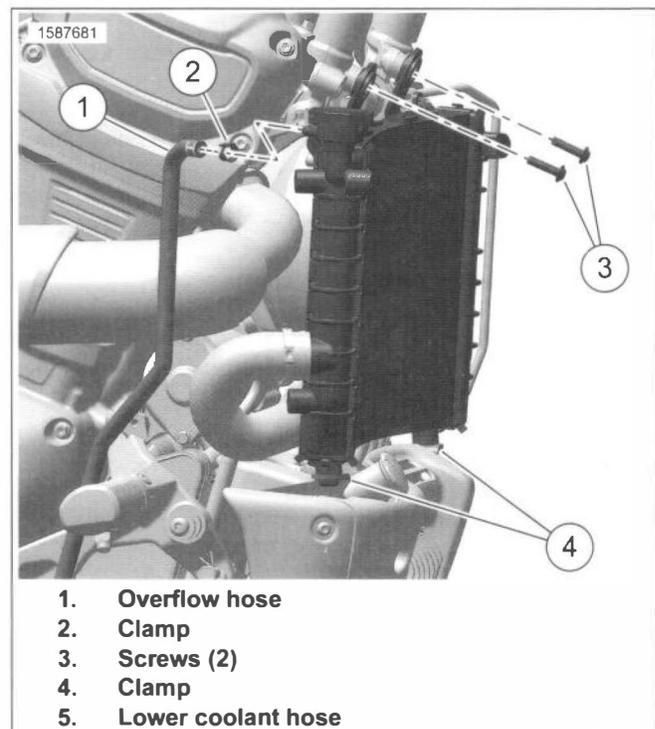


Figure 7-23. Right Side Hoses

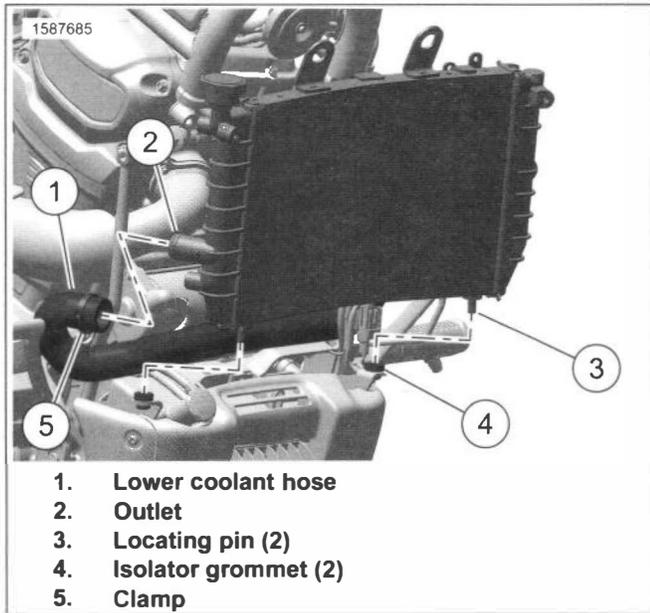


Figure 7-24. Radiator Locating Pins

Complete

1. Install radiator cover. See SIDE COVERS (Page 3-46).
2. Add coolant. See COOLANT (Page 7-7).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

NOTES

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

| FASTENER | TORQUE VALUE | | NOTES |
|--------------------------------------|----------------|---------------|---|
| Battery cable, negative, screw | 60–70 in-lbs | 6.8–7.9 N·m | 8.3 POWER DISCONNECT, Negative Battery Cable |
| Battery tray screw | 18–21 ft-lbs | 25–28 N·m | 8.45 BATTERY TRAY, Install |
| Brake clamp screw | 62–80 in-lbs | 7–9 N·m | 8.31 CAMSHAFT TIMING SENSORS, Install |
| Brake hose clamp screw | 49–66 in-lbs | 5.5–7.5 N·m | 8.35 REAR WHEEL SPEED SENSOR (WSS), Install |
| Brake line clamp screws | 62–80 in-lbs | 7–9 N·m | 8.41 CYLINDER HEAD COVER CADDY, Install |
| Caddy, left side screw | 25–29 in-lbs | 2.8–3.3 N·m | 8.40 LEFT SIDE CADDY, Install |
| Camshaft solenoid plate nut | 62–80 in-lbs | 7–9 N·m | 8.46 VARIABLE VALVE TIMING (VVT) HARNESS, Install |
| Camshaft solenoid plate screw | 62–80 in-lbs | 7–9 N·m | 8.46 VARIABLE VALVE TIMING (VVT) HARNESS, Install |
| Camshaft timing sensor screw | 47–66 in-lbs | 5.3–7.5 N·m | 8.31 CAMSHAFT TIMING SENSORS, Install |
| CKP sensor screw | 53–80 in-lbs | 6–9 N·m | 8.30 CRANKSHAFT POSITION SENSOR (CKP), Install |
| Clutch switch cover screw | 5–8 in-lbs | 0.6–0.9 N·m | 8.11 CLUTCH SWITCH, Install |
| Clutch switch screw | 4–5 in-lbs | 0.5–0.6 N·m | 8.11 CLUTCH SWITCH, Install |
| Cooling fan mounting nut | 35–44 in-lbs | 4–5 N·m | 8.29 COOLING FAN, Install |
| Cooling fan shroud screw | 71–89 in-lbs | 8–10 N·m | 8.29 COOLING FAN, Install |
| Cylinder head cover caddy screws | 35–62 in-lbs | 4–7 N·m | 8.41 CYLINDER HEAD COVER CADDY, Install |
| Cylinder head cover screws | 63–77 in-lbs | 7.1–8.7 N·m | 8.46 VARIABLE VALVE TIMING (VVT) HARNESS, Install |
| ECM assembly screws | 35–62 in-lbs | 4–7 N·m | 8.23 ELECTRONIC CONTROL MODULE (ECM), Install |
| Gear position sensor screw | 71–89 in-lbs | 8–10 N·m | 8.33 GEAR POSITION SENSOR, Install |
| Ground wire nut | 60–72 in-lbs | 6.8–8.1 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Handlebar end cap | 124–177 in-lbs | 14–20 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| Harness ground fastener | 60–72 in-lbs | 6.8–8.1 N·m | 8.44 TAIL SECTION CADDY, Install |
| Headlamp bracket screw | 71–89 in-lbs | 8–10 N·m | 8.17 HEADLAMP, Install |
| Headlamp screw | 18–22 ft-lbs | 24–30 N·m | 8.17 HEADLAMP, Adjust |
| Horn bracket screws | 50–62 in-lbs | 5.7–7 N·m | 8.16 HORN, Install |
| Ignition coil, head mounted screw | 47–66 in-lbs | 5.3–7.5 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil, side mount screw | 81–99 in-lbs | 9.1–11.2 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil bracket, breather bolt | 24–30 ft-lbs | 33.1–40.5 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil bracket, lower screws | 24–30 ft-lbs | 33.1–40.5 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil bracket, upper screws | 71–89 in-lbs | 8–10 N·m | 8.9 IGNITION COIL, Install |
| IM housing screws | 13–17 in-lbs | 1.5–1.9 N·m | 8.14 INSTRUMENT MODULE (IM), Install |
| IM screws | 91–101 in-lbs | 10.3–11.4 N·m | 8.14 INSTRUMENT MODULE (IM), Install |
| IMU mounting screw | 89–97 in-lbs | 10–11 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| JSS screw | 20–25 in-lbs | 2.3–2.8 N·m | 8.38 JIFFY STAND SENSOR (JSS), Install |
| Knock sensor screw | 97–115 in-lbs | 11–13 N·m | 8.32 KNOCK SENSOR (KS), Install |

| FASTENER | TORQUE VALUE | | NOTES |
|--------------------------------|---------------------|---------------|--|
| Left steering head cover screw | 7–11 in-lbs | 0.8–1.2 N·m | 8.34 FRONT WHEEL SPEED SENSOR (WSS), Install |
| LHCM clamp screw | 56–68 in-lbs | 6.3–7.7 N·m | 8.10 LEFT HAND CONTROL MODULE (LHCM), Install |
| LHCM rear cover screw | 5–8 in-lbs | 0.6–0.9 N·m | 8.10 LEFT HAND CONTROL MODULE (LHCM), Install |
| Mirror screw | 124–177 in-lbs | 14–20 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| Rear stoplamp switch | 12–15 ft-lbs | 16.3–20.3 N·m | 8.21 REAR STOPLAMP SWITCH, Install |
| RHCM clamp screw | 56–68 in-lbs | 6.3–7.7 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| RHCM rear cover screw | 6–8 in-lbs | 0.65–0.9 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| Rotor to crankshaft bolt | 214–229 ft-lbs | 290–310 N·m | 8.6 ALTERNATOR, Install |
| Seat release bracket screw | 73–89 in-lbs | 8.2–10 N·m | 8.35 REAR WHEEL SPEED SENSOR (WSS), Install |
| Starter screw to case | 80–97 in-lbs | 9–11 N·m | 8.4 STARTER, Install |
| Starter solenoid nut | 27–41 in-lbs | 3–4.6 N·m | 8.5 STARTER SOLENOID, Install |
| Starter solenoid nut | 27–41 in-lbs | 3–4.6 N·m | 8.5 STARTER SOLENOID, Install |
| Starter terminal nut | 53–71 in-lbs | 6–8 N·m | 8.4 STARTER, Install |
| Stoplamp switch screw, front | 4–6 in-lbs | 0.5–0.7 N·m | 8.13 FRONT STOPLAMP SWITCH, Install |
| Switch, Oil Pressure | 13–17 ft-lbs | 17–23 N·m | 8.15 OIL PRESSURE SWITCH, Install |
| Tail caddy bottom screw | 35–62 in-lbs | 4–7 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Tail caddy front screw | 25–29 in-lbs | 2.8–3.3 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Tail lamp screw | 62–80 in-lbs | 7–9 N·m | 8.20 TAIL LAMP, Install |
| Tail section caddy screws | 35–62 in-lbs | 4–7 N·m | 8.44 TAIL SECTION CADDY, Install |
| TGS mounting screw | 3–4 in-lbs | 0.36–0.44 N·m | 8.36 TWIST GRIP SENSOR (TGS), Install |
| Turn signal lamp screw | 71–89 in-lbs | 8–10 N·m | 8.19 REAR TURN SIGNAL LAMPS, Install |
| Turn signal screw, front | 27–44 in-lbs | 3–5 N·m | 8.18 FRONT TURN SIGNAL LAMPS, Install |
| Under seat caddy screw | 25–29 in-lbs | 2.8–3.3 N·m | 8.35 REAR WHEEL SPEED SENSOR (WSS), Install |
| Under seat caddy screws | 35–62 in-lbs | 4–7 N·m | 8.42 BCM CADDY, Install |
| Under seat caddy screws | 35–62 in-lbs | 4–7 N·m | 8.43 UNDER SEAT CADDY, Install |
| Voltage regulator bracket | 35–62 in-lbs | 4–7 N·m | 8.7 VOLTAGE REGULATOR, Install |
| Voltage regulator screw | 91–101 in-lbs | 10.3–11.4 N·m | 8.7 VOLTAGE REGULATOR, Install |

SPECIFICATIONS

Table 8-1. Battery Specifications

| BATTERY | SPECIFICATIONS |
|---------|--|
| Size | 12 V/ 12 Ah/225 CCA |
| Type | Sealed, Absorbed Glass Mat (AGM) battery |

Table 8-2. Starter Specifications

| STARTER | SPECIFICATIONS |
|------------------|----------------|
| Cranking current | 165 A maximum |
| Free current | 42 A maximum |

Table 8-3. Alternator Specifications

| ALTERNATOR | VALUE |
|------------------------|-------------------------|
| Three phase | 42 A system |
| AC voltage output | 16-28 VAC per 1,000 rpm |
| Stator coil resistance | 75-115 Ω |

Table 8-4. Spark Plug Cables

| LOCATION | LENGTH | RESISTANCE |
|----------------|-----------------------------|---------------|
| Front and rear | 10.47-10.98 in (266-279 mm) | 1,926-7,336 Ω |

Table 8-5. Regulator Specifications

| REGULATOR | VALUE |
|---------------------|-------------------------------|
| Amperes @ 3,600 rpm | 40-44 A |
| Voltage @ 3,600 rpm | 14.1-14.5 V @ 75.2 °F (24 °C) |

Table 8-6. Fuse Specifications

| ITEM | RATING |
|----------------|--------|
| Main | 40 A |
| Battery | 7.5 A |
| Battery tender | 15 A |
| Infotainment | 10 A |

Table 8-7. Dual Ignition Coil Specifications

| WINDING | RESISTANCE |
|----------------------|---------------|
| Primary resistance | 0.2-0.5 Ω |
| Secondary resistance | 5,500-8,000 Ω |

Table 8-8. Single Ignition Coil Specifications

| WINDING | RESISTANCE |
|--|--------------------|
| Ignition coil primary resistance at room temperature | 0.3-0.5 Ohm |
| Ignition coil secondary resistance at room temperature | 1700-2000 Ohms |
| Plug top coil to boot | Less than 5.0 Ohms |

MAIN FUSE

Remove main fuse when there is a possibility of injury caused by accidental vehicle start-up or electrical equipment damage.

Remove

1. Disable security system.
 - a. Verify that fob is present.
 - b. Turn OFF/RUN switch to RUN.
2. Remove steering head covers. See steering head cover in SIDE COVERS (Page 3-46).

▲ WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

3. See Figure 8-1. Remove main fuse.
4. Turn OFF/RUN switch to OFF.

Install

1. See Figure 8-1. Install main fuse.
2. Install right steering head cover. See Steering head cover in SIDE COVERS (Page 3-46).

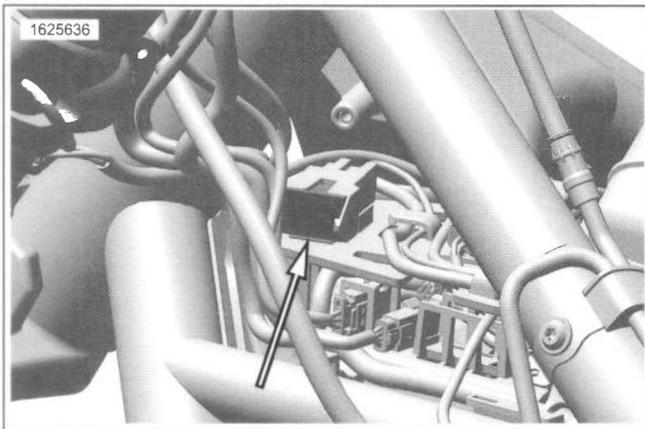


Figure 8-1. Main Fuse

NEGATIVE BATTERY CABLE

| FASTENER | TORQUE VALUE |
|--------------------------------|----------------------------|
| Battery cable, negative, screw | 60–70 in-lbs 6.8–7.9 N·m |

Disconnect negative battery cable from battery when there is a possibility of injury caused by starter engagement (engine rotation).

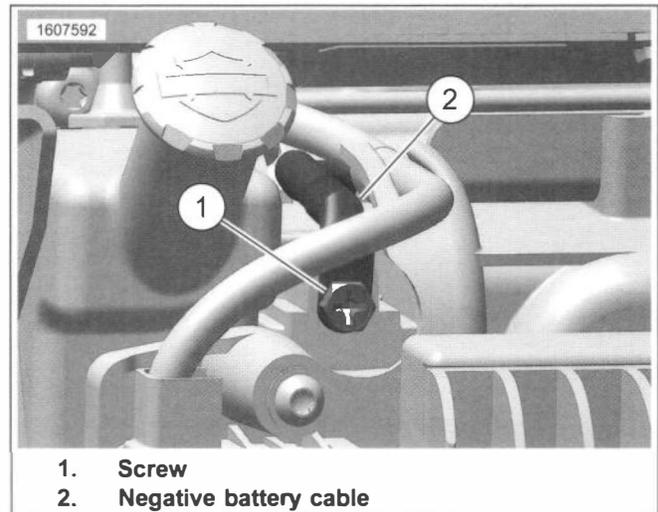
Disconnect Negative Battery Cable

1. **Models with security:** Disable security system.
 - a. Verify that fob is present.
 - b. Turn OFF/RUN switch to RUN.
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. See Figure 8-2. Remove screw (1).
 - a. Position negative battery cable (2) out of way.
4. Turn OFF/RUN switch to OFF.

Connect Negative Battery Cable

1. See Figure 8-2. Connect negative battery cable (2).
 - a. Install screw (1). Tighten.

Torque: 60–70 in-lbs (6.8–7.9 N·m) *Battery cable, negative, screw*
2. Install chin spoiler. See CHIN SPOILER (Page 3-69).



1. Screw
2. Negative battery cable

Figure 8-2. Negative Battery Cable

PREPARE

1. Disconnect negative battery cable. See POWER DISCONNECT (Page 8-4).
2. Remove right side rider footrest bracket. See RIDER FOOTRESTS (Page 3-77).
3. Position radiator out-of-the-way. See RADIATOR (Page 7-17).

REMOVE

1. See Figure 8-3. Remove starter cable.
 - a. Position wire harness boot (4) out-of-the-way.
 - b. Remove starter nut (2).
 - c. Remove starter cable (3) from terminal, position out-of-the-way.
2. See Figure 8-4. Remove starter screws (2).
3. Remove starter (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------------|--------------|----------|
| Starter screw to case | 80–97 in-lbs | 9–11 N·m |
| Starter terminal nut | 53–71 in-lbs | 6–8 N·m |

1. Position starter.
 - a. Apply a light coat of engine oil to the starter O-ring.
 - b. Position starter.

2. See Figure 8-4. Install starter screws (2). Tighten.
Torque: 80–97 in-lbs (9–11 N·m) *Starter screw to case*

NOTE

Starter cable lug to be between 3 o'clock and 6 o'clock positions.

3. See Figure 8-3. Install starter cable.
 - a. Install starter cable (3).

- b. Install starter nut (2). Tighten.
Torque: 53–71 in-lbs (6–8 N·m) *Starter terminal nut*
- c. Position wire harness boot (4) on starter nut.

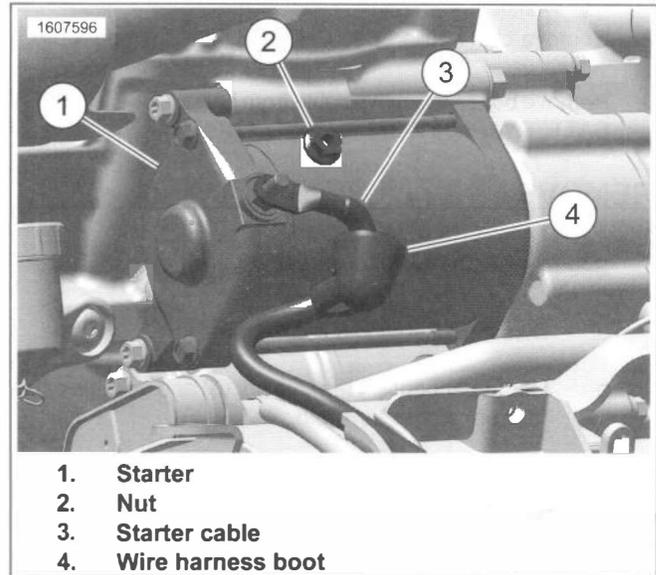


Figure 8-3. Starter Cable

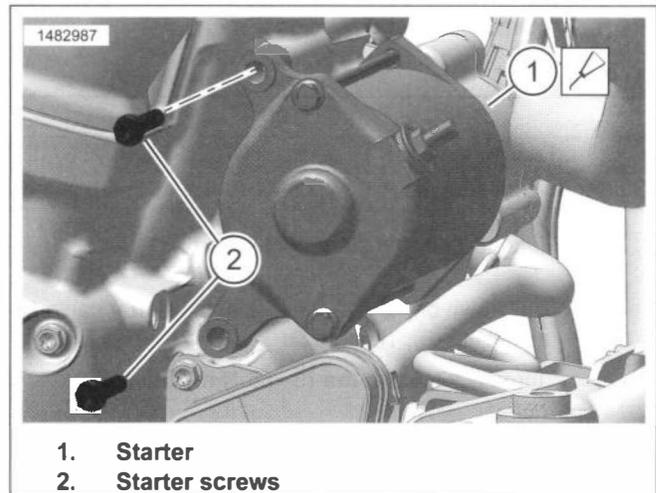


Figure 8-4. Starter Screws

COMPLETE

1. Install radiator. See RADIATOR (Page 7-17).
2. Install right side rider footrest bracket. See RIDER FOOTRESTS (Page 3-77).
3. Connect negative battery cable. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Remove battery negative cable from battery. See INSPECT BATTERY (Page 2-37).

REMOVE

1. See Figure 8-5. Remove starter solenoid (3).
 - a. Disconnect solenoid connector (4).
 - b. Lift rubber boot (7) remove nut (6) and positive cable (5) from starter solenoid.
 - c. Release locking tab (2) and slide starter solenoid forward.
 - d. Pull down on rubber boot (7) remove nut (8) and starter cable (1) from starter solenoid.
 - e. Remove starter solenoid (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------|--------------|-----------|
| Starter solenoid nut | 27-41 in-lbs | 3-4.6 N·m |

1. See Figure 8-5. Install starter solenoid (3).
 - a. Pull down on rubber boot (7) install starter cable (1) install nut (8). Tighten.
Torque: 27-41 **in-lbs** (3-4.6 N·m) *Starter solenoid nut*
 - b. Install starter solenoid (3).

- c. Slide starter solenoid rearward into locking tab (2).
- d. Lift rubber boot (7) install positive cable (5) install nut (6). Tighten.
Torque: 27-41 **in-lbs** (3-4.6 N·m) *Starter solenoid nut*
- e. Connect solenoid connector (4).

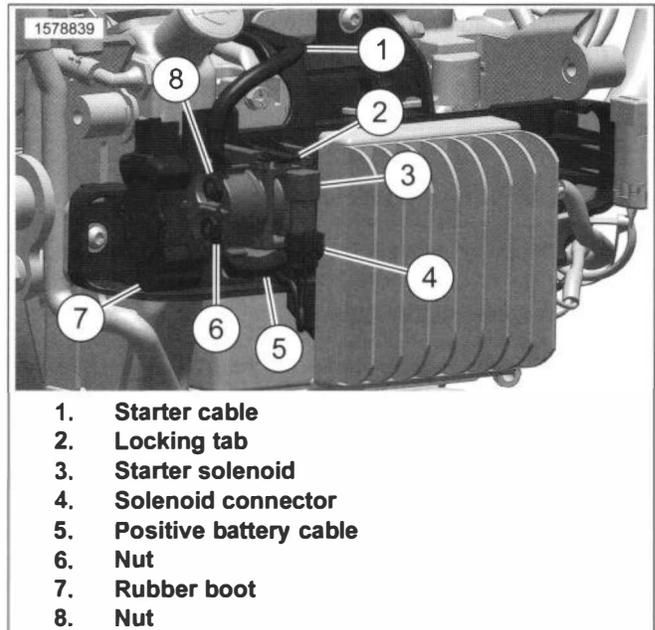


Figure 8-5. Starter Solenoid

COMPLETE

1. Connect battery negative cable to battery. See INSPECT BATTERY (Page 2-37).
2. Install chin spoiler. See CHIN SPOILER (Page 3-69).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. POWER DISCONNECT (Page 8-4).
2. Remove coolant manifold. COOLANT MANIFOLD (Page 4-53).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|-------------------------|
| HD-52968 | ROTOR LOCKING TOOL |
| HD-52969 | ROTOR SHELL REMOVAL PIN |

Rotor

1. See Figure 8-6. Using locking tool, remove rotor bolt. ROTOR LOCKING TOOL (PART NUMBER: HD-52968)
 - a. See Figure 8-7. Position locking tool (2) onto rotor (1) over bolt (3).
 - b. Install breaker bar (4) into locking tool.

NOTE

Due to the high torque on the rotor bolt (3), use an ½ in (13 mm) impact driver and impact socket to loosen the rotor bolt. Use the impact driver in small bursts until rotor nut is loose.

- c. See Figure 8-8. Place socket (3) into locking tool (2).
- d. Verify that socket is fully seated on the rotor bolt.
- e. Loosen then remove rotor bolt.

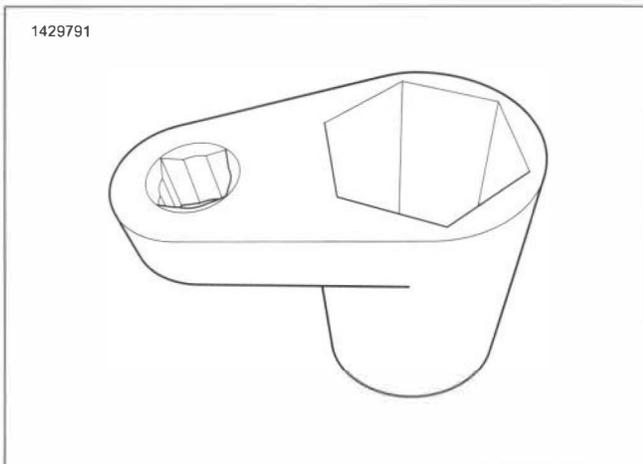
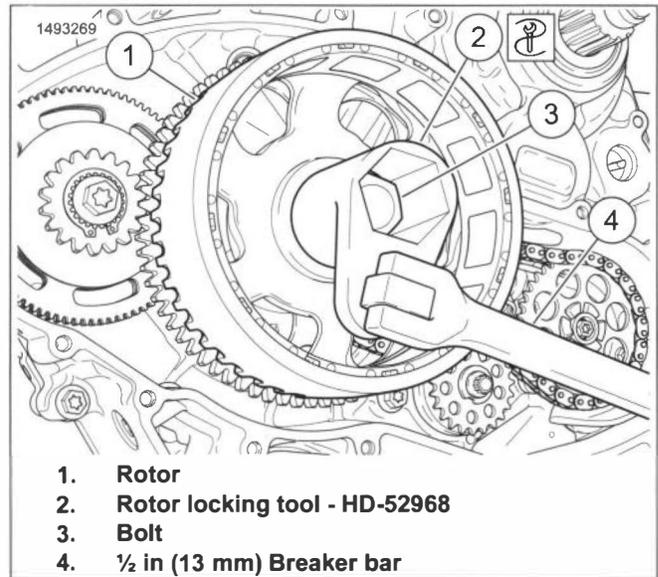
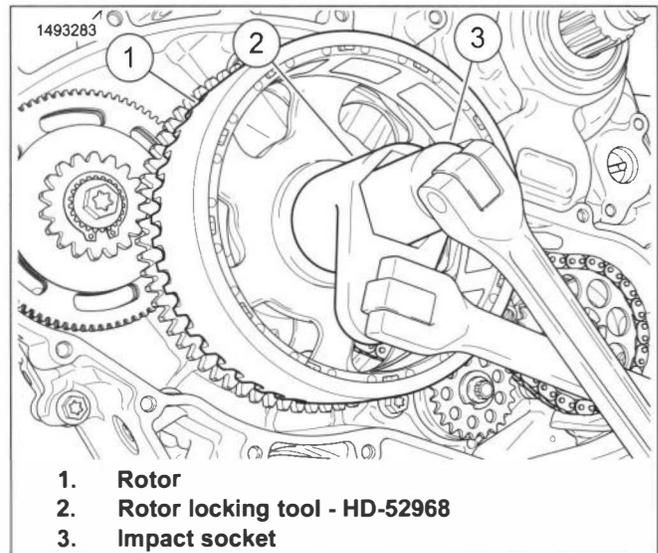


Figure 8-6. Rotor Locking Tool - HD-52968



1. Rotor
2. Rotor locking tool - HD-52968
3. Bolt
4. ½ in (13 mm) Breaker bar

Figure 8-7. Rotor Locking Tool (HD-52968) In Place



1. Rotor
2. Rotor locking tool - HD-52968
3. Impact socket

Figure 8-8. Socket in Locking Tool

NOTE

Cable straps are used to eliminate the possibility of the rotor assembly separating and parts entering the engine compartment.

2. See Figure 8-10. Install cable straps
 - a. Place straps (2) around both rotor shell (1) and stator ring gear (3).
3. See Figure 8-9. Using removal pin, loosen the rotor assembly from crankshaft. ROTOR SHELL REMOVAL PIN (PART NUMBER: HD-52969)
 - a. Apply a light coat of oil on the removal pins threads.
 - b. See Figure 8-10. Install removal pin (4) into rotor (1).
 - c. Turn removal pin clockwise.

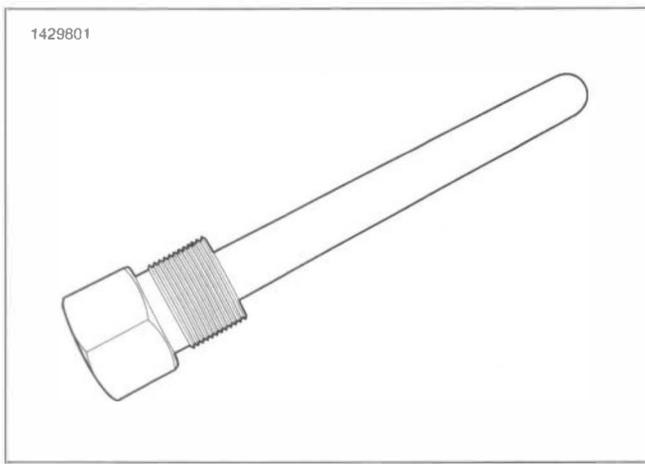
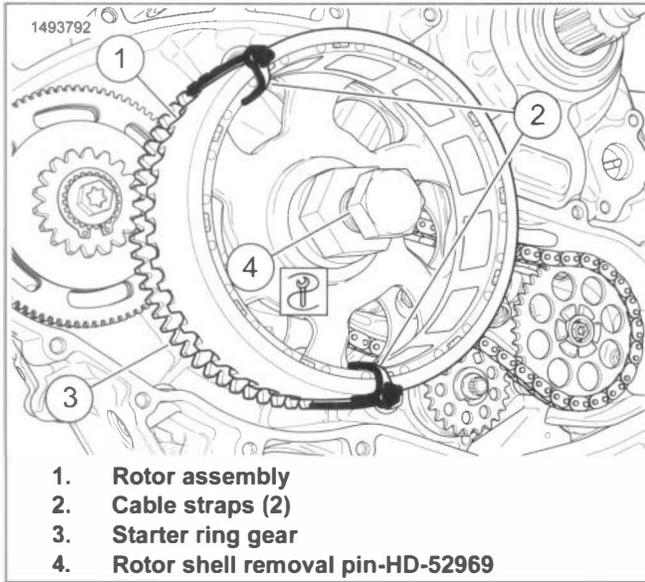


Figure 8-9. Rotor Shell Removal Pin - HD-52969

4. Remove rotor assembly.
5. Remove removal pin.



1. Rotor assembly
2. Cable straps (2)
3. Starter ring gear
4. Rotor shell removal pin-HD-52969

Figure 8-10. Cable Straps Around Rotor Assembly

Starter Ring Gear and Needle Bearings

1. See Figure 8-12. Separate rotor assembly.
 - a. Place rotor assembly on a flat working area with the starter ring gear (1) facing upward.
 - b. Remove cable straps.
 - c. With a slight counterclockwise turn, lifting straight upward removing starter ring gear.
 - d. Remove the needle bearings assembly (2).

Stator

1. Remove stator. See COOLANT MANIFOLD (Page 4-53).

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|--------------------|
| HD-52968 | ROTOR LOCKING TOOL |

| PART NUMBER | TOOL NAME |
|-------------|---|
| HD-52970 | ROTOR SHELL TO STARTER DRIVE ASSEMBLY PILOT |

| FASTENER | TORQUE VALUE | |
|--------------------------|----------------|-------------|
| Rotor to crankshaft bolt | 214–229 ft-lbs | 290–310 N·m |

Stator

1. Install stator. COOLANT MANIFOLD (Page 4-53).

Starter Ring Gear and Needle Bearings

1. See Figure 8-11. Using assembly pilot, install needle bearings and starter ring gear. ROTOR SHELL TO STARTER DRIVE ASSEMBLY PILOT (PART NUMBER: HD-52970)
 - a. See Figure 8-13. Install assembly pilot (2) with the side marked **A** into rotor shell (1).
 - b. See Figure 8-14. Install needle bearings (3) over assembly pilot (2).
 - c. See Figure 8-15. Install starter ring gear (3) over assembly pilot (2).
 - d. With slight downward pressure, turn starter ring gear counterclockwise until fully seated.

NOTE

See Figure 8-16. If starter ring gear does not seat, remove ring gear, check rolling elements or springs for misalignment. Repeat steps C & D.

- e. Install cable straps.

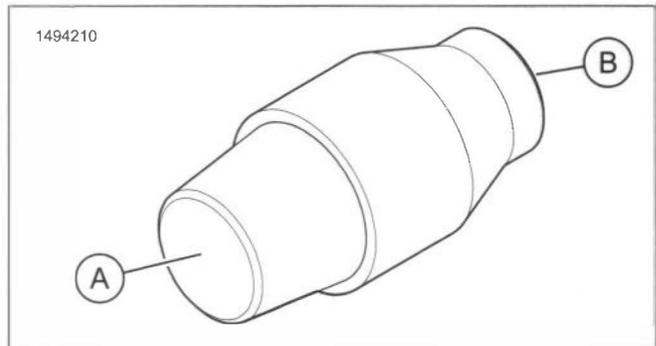


Figure 8-11. Rotor Shell to Starter Drive Assembly Pilot - HD-52970

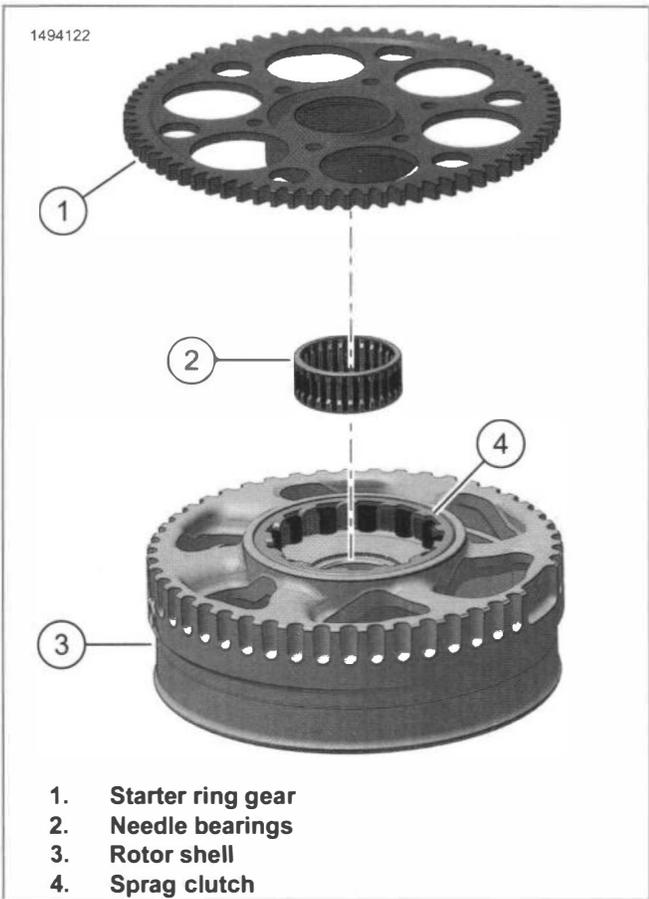


Figure 8-12. Rotor Assembly

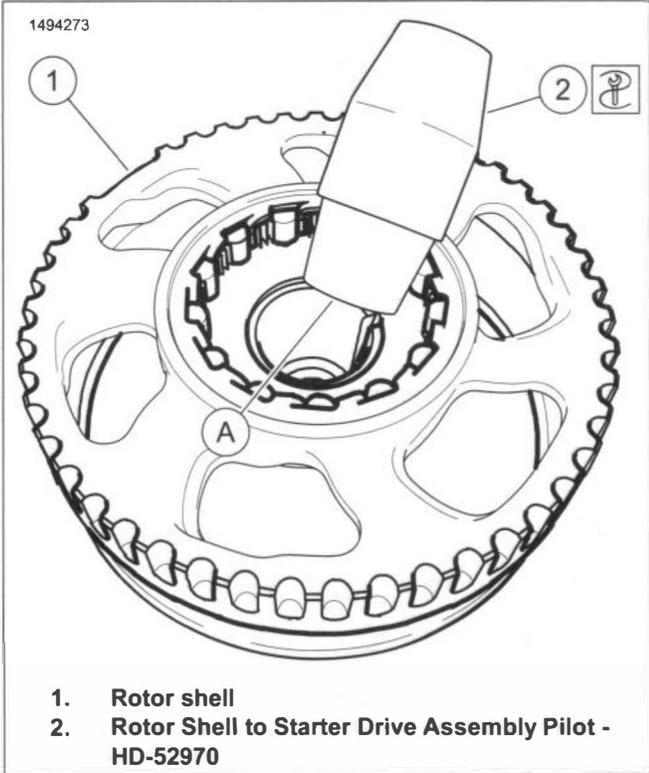


Figure 8-13. Installing HD-52970

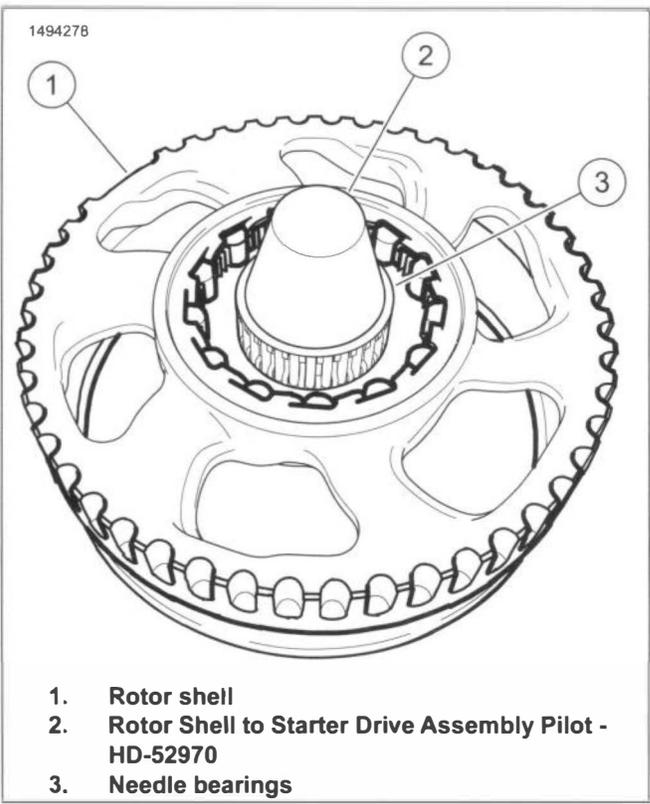


Figure 8-14. Installing Needle Bearings

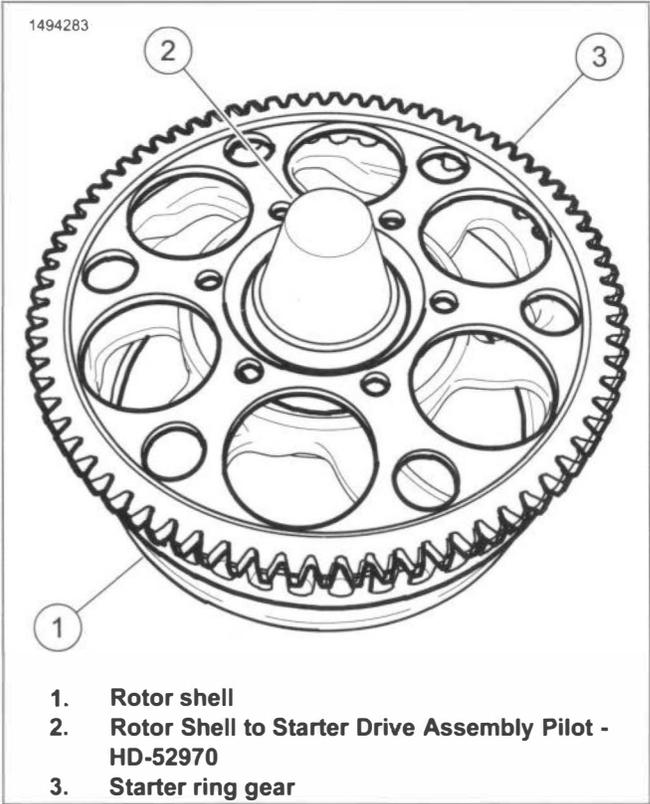


Figure 8-15. Installing Starter Ring Gear

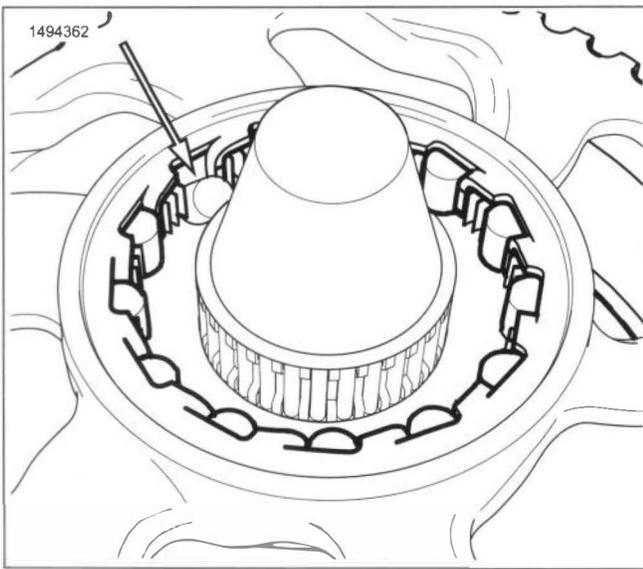


Figure 8-16. Misaligned Rolling Element

Rotor

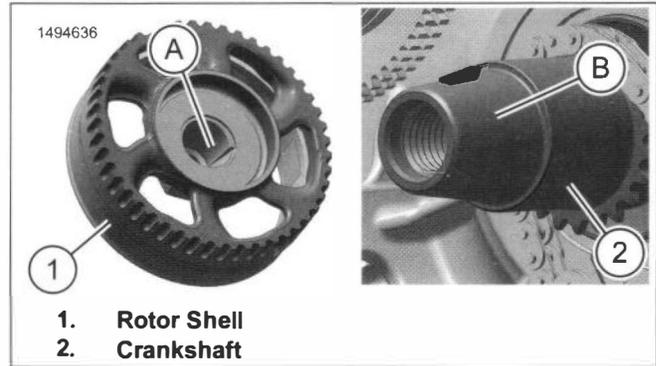
NOTE

See Figure 8-17. If a **new** rotor assembly is being installed, the unit comes with an assembly clip attached. Cable straps are not needed when assembly clip is in place. If using original rotor use cable straps to keep assembly together.

1. See Figure 8-18. Clean crankshaft (2) and rotor (1).
 - a. Using isopropyl alcohol clean any residual oil from crankshaft key taper (B) and rotor inner taper (A) mating surface.
2. See Figure 8-19. Position rotor assembly.
 - a. Align dot (A) on rotor with crankshaft key (B).
 - b. See Figure 8-20. Align starter ring gear (2) with starter gear (1).
3. See Figure 8-19. Install rotor bolt (1). Tighten.
 - a. Using rotor locking tool, to hold rotor from turning.
Special Tool: ROTOR LOCKING TOOL (HD-52968)
 - b. Tighten.
Torque: 214–229 ft-lbs (290–310 N·m) Rotor to crankshaft bolt
4. Remove cable straps or assembly clip.

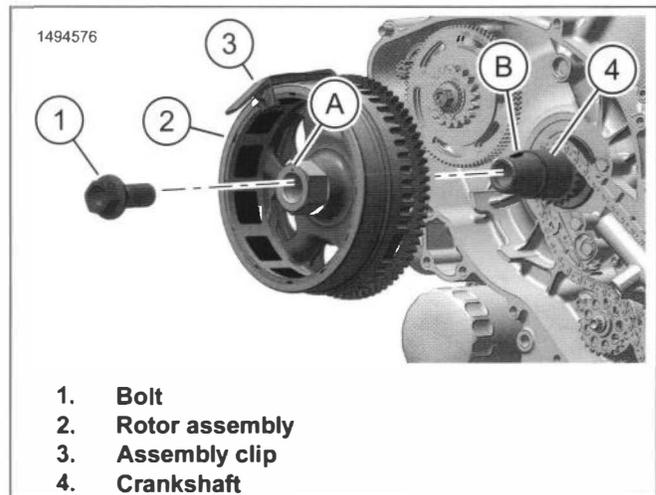


Figure 8-17. New Rotor Assembly - Assembly Clip



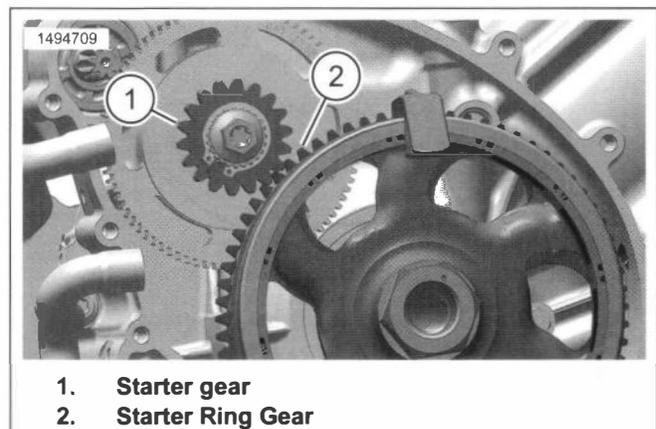
1. Rotor Shell
2. Crankshaft

Figure 8-18. Cleaning Surfaces



1. Bolt
2. Rotor assembly
3. Assembly clip
4. Crankshaft

Figure 8-19. Rotor Assembly and Crankshaft with Key



1. Starter gear
2. Starter Ring Gear

Figure 8-20. Starter Gear to Starter Ring Gear

COMPLETE

1. Install coolant manifold. COOLANT MANIFOLD (Page 4-53).

2. Install main fuse. POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. If removing voltage regulator bracket, remove starter solenoid. See STARTER SOLENOID (Page 8-6).

REMOVE

Remove voltage regulator

1. See Figure 8-21. Remove voltage regulator.
 - a. Remove screws (4).
 - b. Disconnect alternator stator connector (2).
 - c. Disconnect voltage regulator connector (3).
 - d. Remove voltage regulator (1).

Remove voltage regulator bracket

1. See Figure 8-22. Remove voltage regulator bracket.
 - a. Lift starter cable (3) from voltage regulator bracket (4).
 - b. Remove cable strap (6).
 - c. Remove screws (2).
 - d. Slightly lift voltage regulator bracket at tab (1) and slightly swing out.
 - e. Mark wires and lift from clips (7).
 - f. Remove voltage regulator bracket from battery tray (5).

- e. Install screws (2). Tighten.
Torque: 35–62 **in-lbs** (4–7 N·m) *Voltage regulator bracket*
- f. Clip starter cable (3) to voltage regulator bracket.
- g. Install cable strap (6).

Install voltage regulator

1. See Figure 8-21. Install voltage regulator.
 - a. Connect voltage regulator connector (3).
 - b. Connect alternator stator connector (2).
 - c. Position voltage regulator (1).
 - d. Install screws (4). Tighten.
Torque: 91–101 **in-lbs** (10.3–11.4 N·m) *Voltage regulator screw*

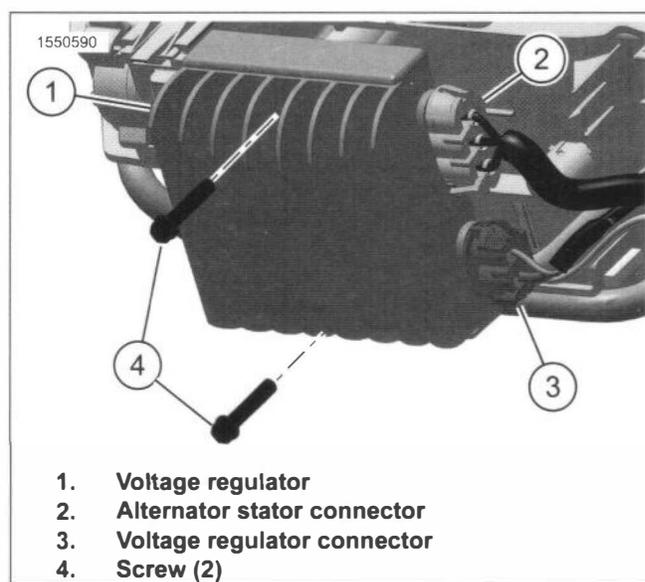


Figure 8-21. Voltage Regulator

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------|----------------------|---------------|
| Voltage regulator bracket | 35–62 in-lbs | 4–7 N·m |
| Voltage regulator screw | 91–101 in-lbs | 10.3–11.4 N·m |

Install voltage regulator bracket

1. See Figure 8-22. Install voltage regulator bracket.
 - a. Slide voltage regulator bracket (4) on battery tray (5).
 - b. Install wires on clips (7).
 - c. Work wires through bracket opening.
 - d. Hook tab (1) on battery tray bracket.

COMPLETE

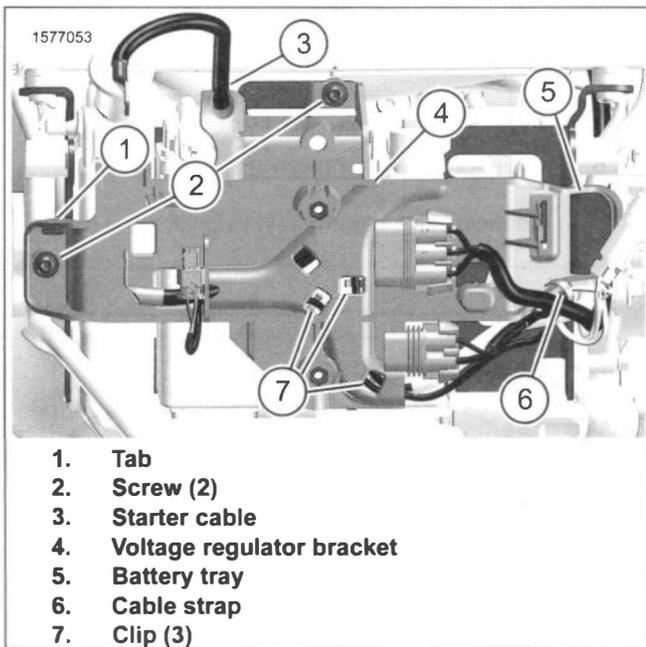


Figure 8-22. Voltage Regulator Bracket

1. Install starter solenoid if removed. See STARTER SOLENOID (Page 8-6).
2. Install chin spoiler. See CHIN SPOILER (Page 3-69).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

⚠ WARNING

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

NOTE

Do not remove spark plug wires while engine is hot.

1. See Figure 8-23. Remove spark plug cables.
 - a. Remove cable coil ends (1) from ignition coil (2).
 - b. Remove terminal boots (4) from spark plugs (3).
 - c. Remove cables.

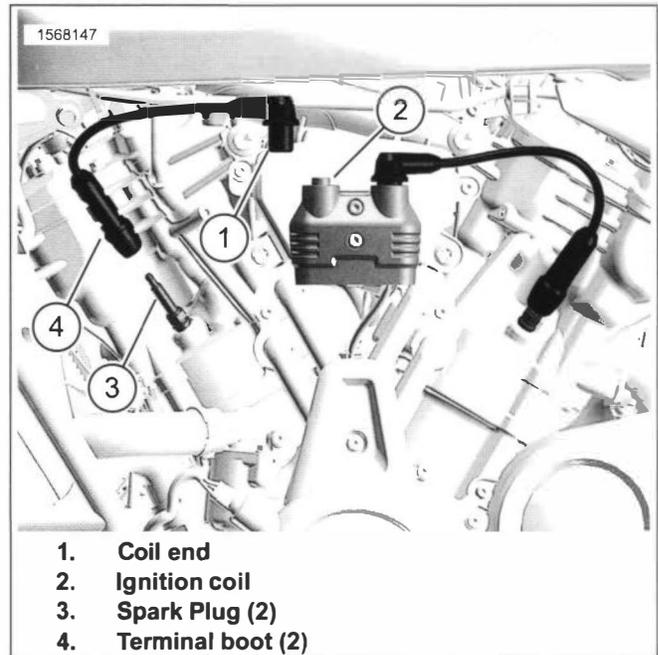
INSTALL

| CONSUMABLE | PART NUMBER |
|------------------------------|-------------|
| ELECTRICAL CONTACT LUBRICANT | 11300004 |

1. See Figure 8-23. Install spark plug cables.
 - a. Apply electrical contact lubricant to inside of terminal boots (4).

ELECTRICAL CONTACT LUBRICANT (11300004)

- b. Connect terminal boots to spark plugs (3).
- c. Connect cable coil ends (1) to ignition coil (2).



1. Coil end
2. Ignition coil
3. Spark Plug (2)
4. Terminal boot (2)

Figure 8-23. Spark Plug Cable

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE**▲ WARNING**

Gasoline is extremely flammable and highly explosive. Keep gasoline away from ignition sources which could result in death or serious injury. See the Safety chapter. (00635c)

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. **Head mounted ignition coils.**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove seat lock bracket. See SEAT (Page 3-82).
 - c. Remove fuel tank. See FUEL TANK (Page 6-12).
 - d. Remove air box. See AIR BOX (Page 6-3).
3. **Side mounted ignition coil.**
 - a. Remove spark plug cables. See SPARK PLUG CABLES (Page 8-14).

REMOVE**Side mount ignition coil.**

1. Remove side mount ignition coil.
 - a. See Figure 8-25. Remove ignition coil screws (4).
 - b. Disconnect connector (5).
 - c. Remove ignition coil (3).

Ignition coil bracket.

1. Remove EVAP hose (if equipped).
 - a. See Figure 8-24. Remove clamp (1), discard.
 - b. Remove hose (2).
 - c. See Figure 8-25. Remove breather bolt (7).
2. Remove Ignition coil bracket.
 - a. See Figure 8-25. Remove side mount ignition coil (3).
 - b. Remove screw or screws (6).
 - c. Remove screws (2).
 - d. Remove ignition coil bracket (1).

Head mounted ignition coils.

1. Remove head mounted ignition coils.
 - a. See Figure 8-26. Disconnect ignition coil connectors (3).
 - b. Remove screws (1).
 - c. Remove ignition coils (2 and 5).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------------------------|--------------|---------------|
| Ignition coil bracket, breather bolt | 24–30 ft-lbs | 33.1–40.5 N·m |
| Ignition coil bracket, lower screws | 24–30 ft-lbs | 33.1–40.5 N·m |
| Ignition coil bracket, upper screws | 71–89 in-lbs | 8–10 N·m |
| Ignition coil, head mounted screw | 47–66 in-lbs | 5.3–7.5 N·m |
| Ignition coil, side mount screw | 81–99 in-lbs | 9.1–11.2 N·m |

Ignition coil bracket.

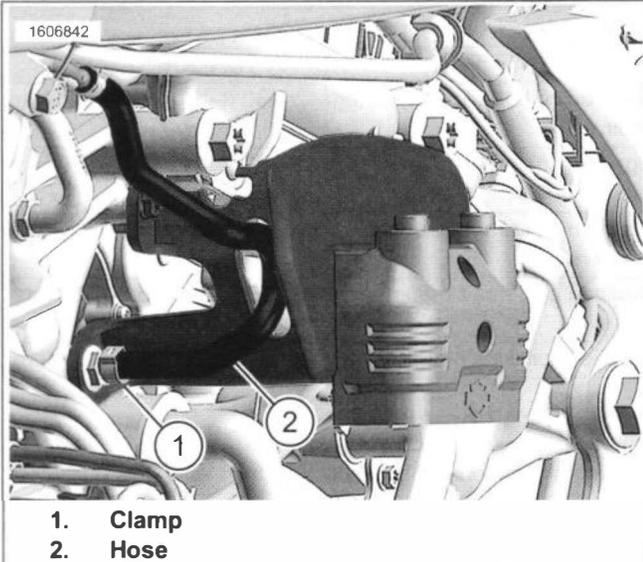
1. Install Ignition coil bracket.
 - a. See Figure 8-25. Install ignition coil bracket (1).
 - b. Install breather bolt (7) (if equipped). Tighten
Torque: 24–30 ft-lbs (33.1–40.5 N·m) *Ignition coil bracket, breather bolt*
 - c. Install screw or screws (6). Tighten.
Torque: 24–30 ft-lbs (33.1–40.5 N·m) *Ignition coil bracket, lower screws*
 - d. Install screws (2). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Ignition coil bracket, upper screws*
 - e. See Figure 8-24. Install hose (2) and clamp (1) (if equipped).

Side mount ignition coil.

1. Install side mount ignition coil.
 - a. See Figure 8-25. Attach connector (5).
 - b. Install side mount ignition coil (3).
 - c. Install ignition coil screws (4). Tighten.
Torque: 81–99 in-lbs (9.1–11.2 N·m) *Ignition coil, side mount screw*

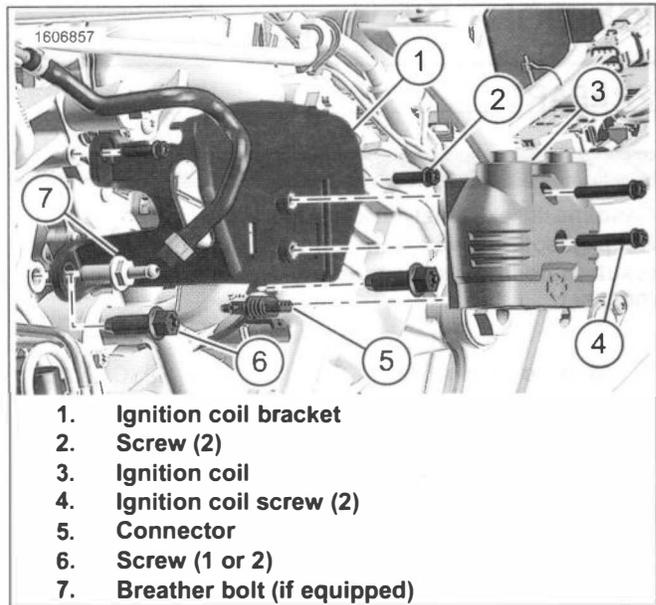
Head mounted ignition coils.

1. Install head mounted ignition coils.
 - a. See Figure 8-26. Apply electrical contact lubricant inside of coil insulators (4).
 - b. Install head mounted coils (2 and 5).
 - c. Install screws (1). Tighten.
Torque: 47–66 in-lbs (5.3–7.5 N·m) *Ignition coil, head mounted screw*
 - d. Attach connectors (3).



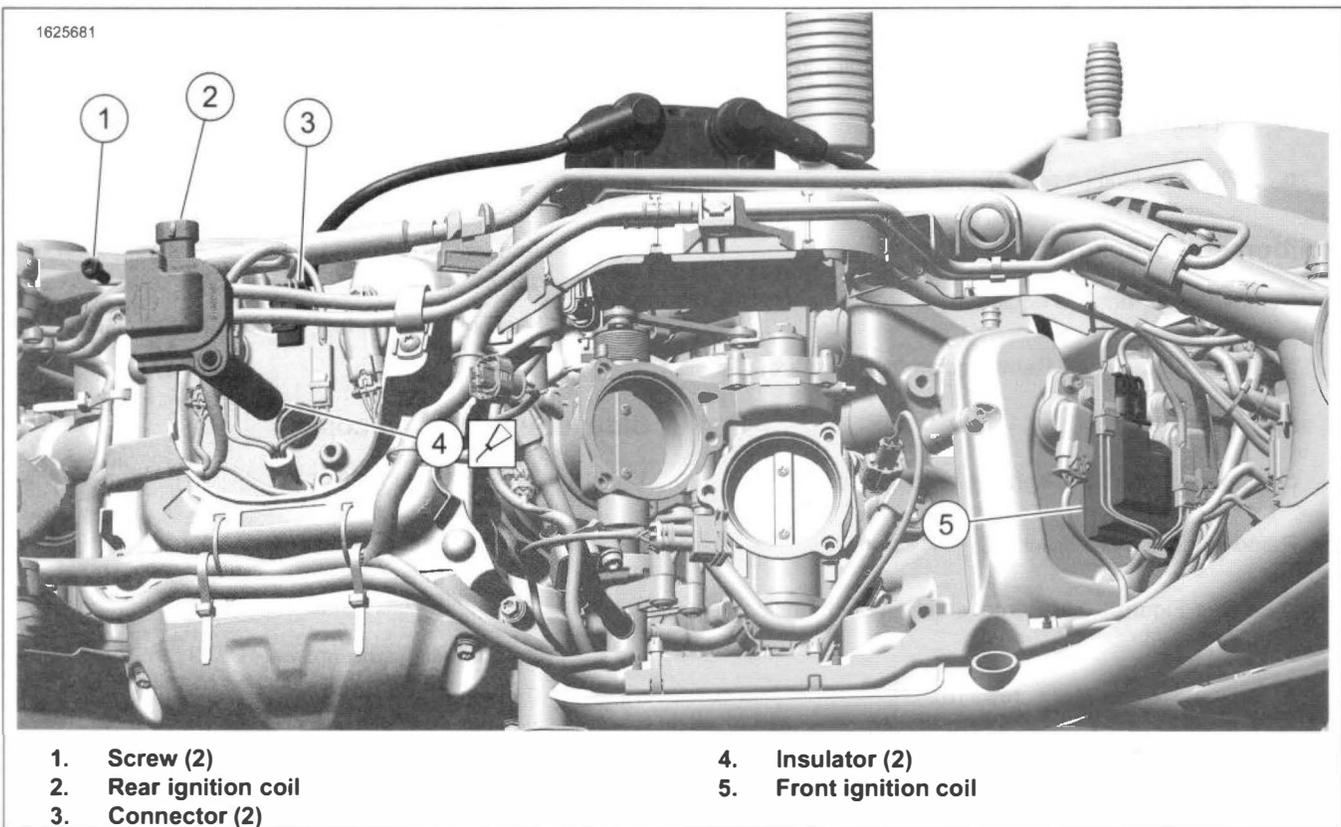
1. Clamp
2. Hose

Figure 8-24. Side Mount Ignition Coil (With EVAP)



1. Ignition coil bracket
2. Screw (2)
3. Ignition coil
4. Ignition coil screw (2)
5. Connector
6. Screw (1 or 2)
7. Breather bolt (if equipped)

Figure 8-25. Side Mount Ignition Coil Assembly



1. Screw (2)
2. Rear ignition coil
3. Connector (2)
4. Insulator (2)
5. Front ignition coil

Figure 8-26. Head Mounted Ignition Coils

COMPLETE

1. **Side mounted coil:**

- a. Install spark plug cables. See SPARK PLUG CABLES (Page 8-14).

2. **Head mounted ignition coils:**

- a. Install air box. See AIR BOX (Page 6-3).

- b. Install fuel tank. See FUEL TANK (Page 6-12).

- c. Install seat lock bracket. See SEAT (Page 3-82).

- d. Install seat. See SEAT (Page 3-82).

3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4)

REMOVE

1. See Figure 8-27. Remove rear cover (1).
 - a. Remove screw (2).
 - b. Remove rear cover.
2. See Figure 8-28. Remove connector.
 - a. Disconnect Left Hand Control Module (LHCM) connector.
 - b. Position connector out-of-way.
3. See Figure 8-29. Remove LHCM.
 - a. Remove clamp screw (2).
 - b. Remove LHCM.

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------------|--------------|-------------|
| LHCM clamp screw | 56–68 in-lbs | 6.3–7.7 N·m |
| LHCM rear cover screw | 5–8 in-lbs | 0.6–0.9 N·m |

1. See Figure 8-29. Install LHCM (1).
 - a. Position LHCM engaging pin in handlebar slot.
 - b. Install clamp screw (2). Tighten.
Torque: 56–68 in-lbs (6.3–7.7 N·m) *LHCM clamp screw*
2. See Figure 8-28. Connect connector.
3. See Figure 8-27. Install rear cover.
 - a. Position rear cover (1).
 - b. Install screws (2). Tighten.
Torque: 5–8 in-lbs (0.6–0.9 N·m) *LHCM rear cover screw*

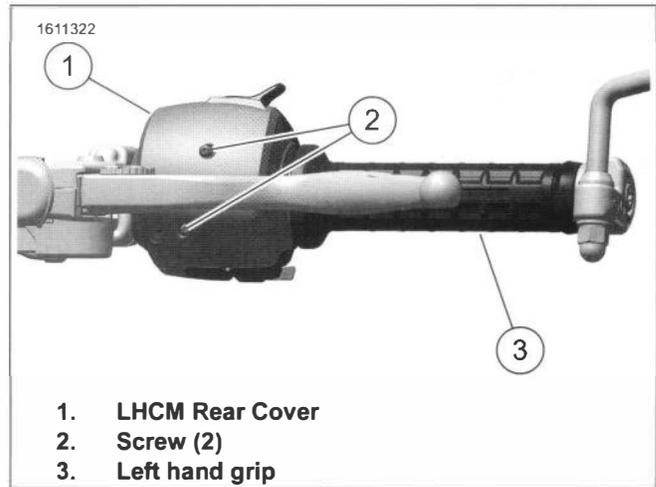


Figure 8-27. LHCM Rear Cover

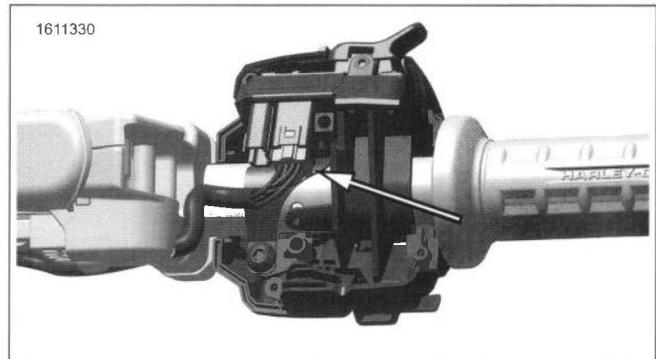


Figure 8-28. LHCM Connector

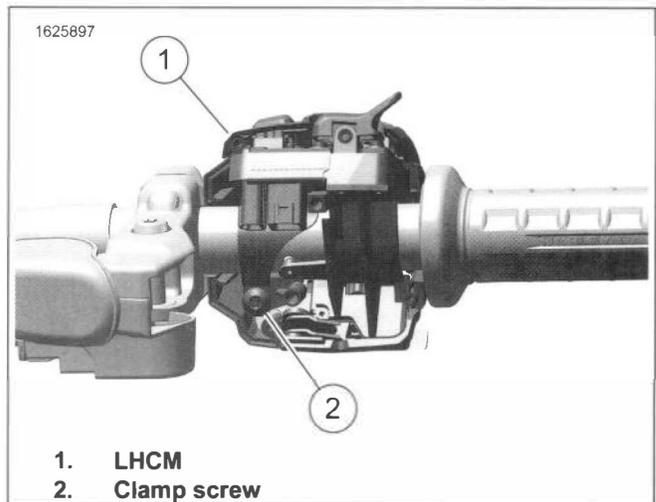


Figure 8-29. Clamping Screw

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4)

REMOVE

1. See Figure 8-30. Remove cover.
 - a. Remove screw (2).
 - b. Remove cover (3).
2. Remove switch.
 - a. Disconnect connector (1).
 - b. Remove screw (4).
 - c. Remove switch (5).

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------|-------------------|-------------|
| Clutch switch cover screw | 5–8 in-lbs | 0.6–0.9 N·m |
| Clutch switch screw | 4–5 in-lbs | 0.5–0.6 N·m |

1. See Figure 8-30. Install clutch hand control switch.
 - a. Install clutch switch (5).
 - b. Install screw (4). Tighten.
Torque: 4–5 **in-lbs** (0.5–0.6 N·m) *Clutch switch screw*
 - c. Connect connector (1).
2. Install cover.
 - a. Install cover (3).

- b. Install screw (2). Tighten.

Torque: 5–8 **in-lbs** (0.6–0.9 N·m) *Clutch switch cover screw*

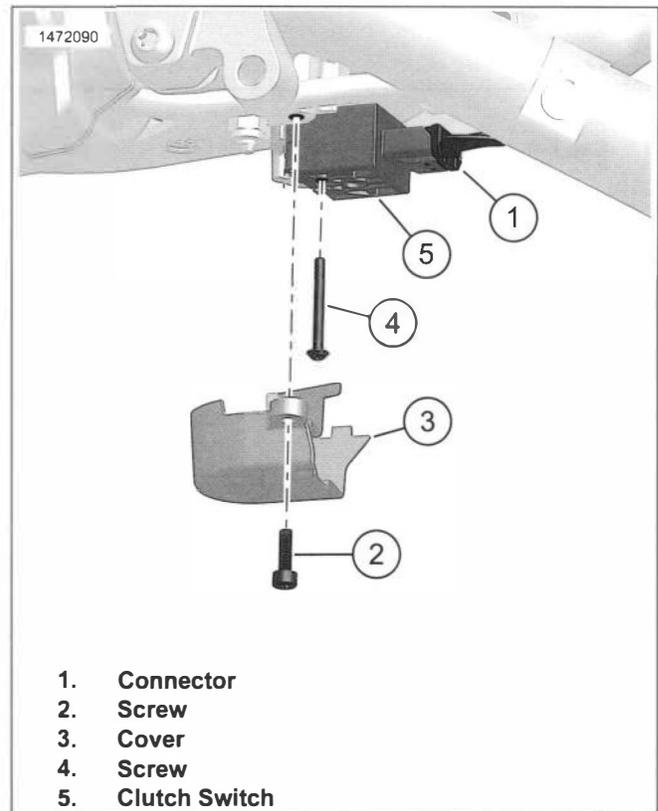


Figure 8-30. Clutch Switch

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

1. See Figure 8-31. Remove rear cover (2).
 - a. Remove screws (1).
 - b. Remove rear cover.
2. See Figure 8-32. Disconnect TGS connector (7).
3. Disconnect RHCM connector (5).
4. Remove RHCM.
 - a. Remove mirror.
 - b. Remove handlebar end cap.
 - c. Loosen screw (6).
 - d. Lift pin (2) from slot (3).
 - e. Remove RHCM (1) from handlebar.

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------------|----------------|--------------|
| Handlebar end cap | 124–177 in-lbs | 14–20 N·m |
| Mirror screw | 124–177 in-lbs | 14–20 N·m |
| RHCM clamp screw | 56–68 in-lbs | 6.3–7.7 N·m |
| RHCM rear cover screw | 6–8 in-lbs | 0.65–0.9 N·m |

1. See Figure 8-32. Position RHCM on handlebar.
 - a. Engage pin (2) on RHCM with slot (3) in handlebar.
 - b. Tighten clamp screw (6).
Torque: 56–68 in-lbs (6.3–7.7 N·m) *RHCM clamp screw*
2. Attach RHCM connector (5).
3. Attach TGS Connector (7).
4. Install mirror. Tighten.
Torque: 124–177 in-lbs (14–20 N·m) *Mirror screw*
5. Install handlebar end cap. Tighten.
Torque: 124–177 in-lbs (14–20 N·m) *Handlebar end cap*
6. See Figure 8-31. Install rear cover (2).
 - a. Position rear cover.

- b. Install screws (1). Tighten.
Torque: 6–8 in-lbs (0.65–0.9 N·m) *RHCM rear cover screw*

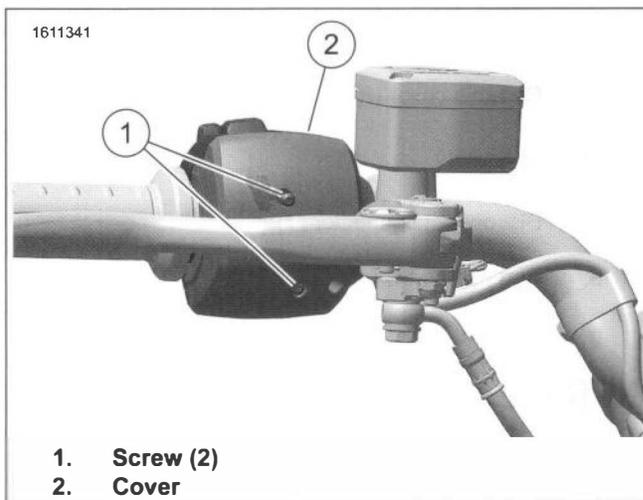


Figure 8-31. RHCM Rear Cover

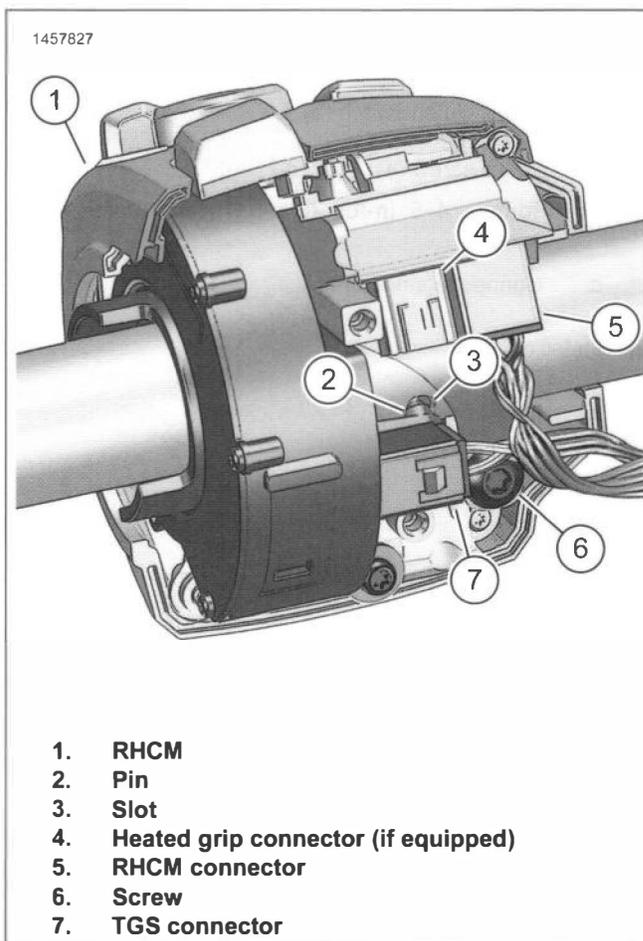


Figure 8-32. RHCM Install (typical)

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4)

⚠ 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)

2. Test switches for proper operation.

REMOVE

1. See Figure 8-33. Disconnect connector (3).
2. Remove screw (2).
3. Remove stoplamp switch (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------------|--------------|-------------|
| Stoplamp switch screw, front | 4–6 in-lbs | 0.5–0.7 N·m |

1. See Figure 8-33. Place stoplamp switch (1) in position.
2. Install screw (2). Tighten.
Torque: 4–6 in-lbs (0.5–0.7 N·m) *Stoplamp switch screw, front*

3. Connect connector (3).

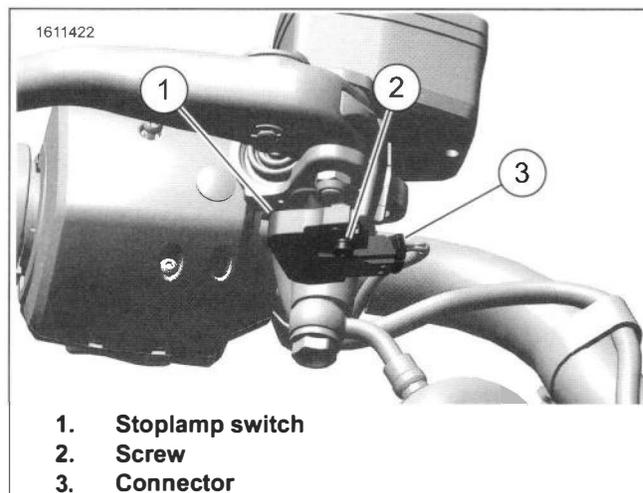


Figure 8-33. Front Stoplamp Switch

PREPARE

Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

1. See Figure 8-34. Remove screws (2).
2. See Figure 8-35. Remove IM assembly (1).
 - a. Disconnect IM connector (2).
 - b. Remove IM assembly.
3. See Figure 8-36. Remove IM from housing (1).
 - a. Remove screws (4).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------|---------------|---------------|
| IM housing screws | 13–17 in-lbs | 1.5–1.9 N·m |
| IM screws | 91–101 in-lbs | 10.3–11.4 N·m |

1. See Figure 8-36. Install IM (1) into housing (3).
2. Install screws (4). Tighten.
Torque: 13–17 in-lbs (1.5–1.9 N·m) *IM housing screws*
3. See Figure 8-35. Connect the IM connector (2).
4. See Figure 8-34. Install screws (2). Tighten.
Torque: 91–101 in-lbs (10.3–11.4 N·m) *IM screws*

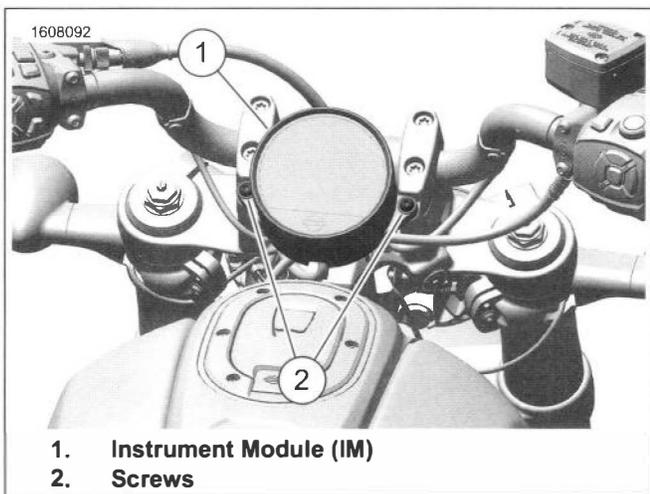


Figure 8-34. Instrument Module

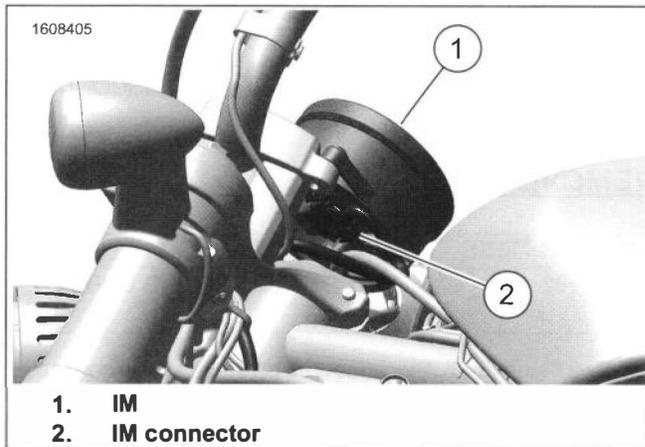


Figure 8-35. IM Connector

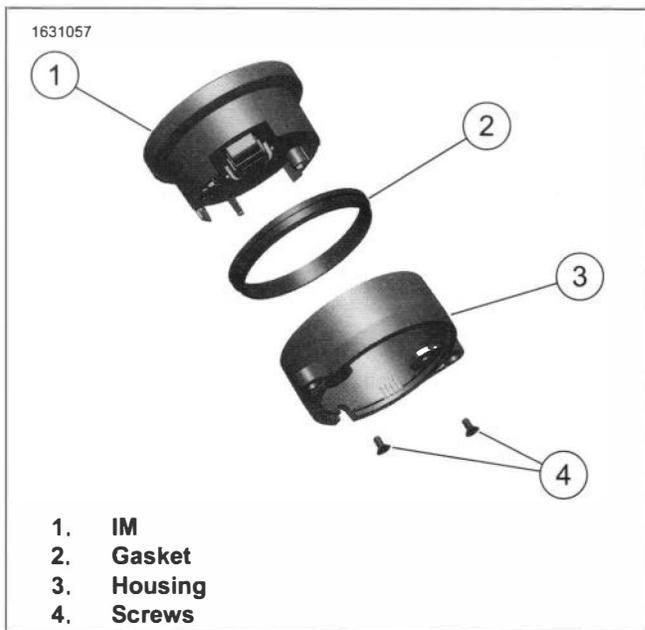


Figure 8-36. IM Connector

COMPLETE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

1. Install main fuse. See POWER DISCONNECT (Page 8-4).
2. **New IM:** Perform module replacement procedure using DT II.
Special Tool: DIGITAL TECHNICIAN II (HD-48650)

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

| PART NUMBER | TOOL NAME |
|-------------|----------------------------------|
| HD-52962 | OIL PRESSURE SENDING UNIT WRENCH |

1. See Figure 8-37. Disconnect oil pressure switch connector (1).
2. Remove switch (2).
Special Tool: OIL PRESSURE SENDING UNIT WRENCH (HD-52962)

INSTALL

| PART NUMBER | TOOL NAME |
|-------------|----------------------------------|
| HD-52962 | OIL PRESSURE SENDING UNIT WRENCH |

| FASTENER | TORQUE VALUE | |
|----------------------|--------------|-----------|
| Switch, Oil Pressure | 13–17 ft-lbs | 17–23 N·m |

1. See Figure 8-37. Install oil pressure switch (2). Tighten.
Torque: 13–17 ft-lbs (17–23 N·m) *Switch, Oil Pressure*
Special Tool: OIL PRESSURE SENDING UNIT WRENCH (HD-52962)

2. Connect oil pressure switch connector (1).

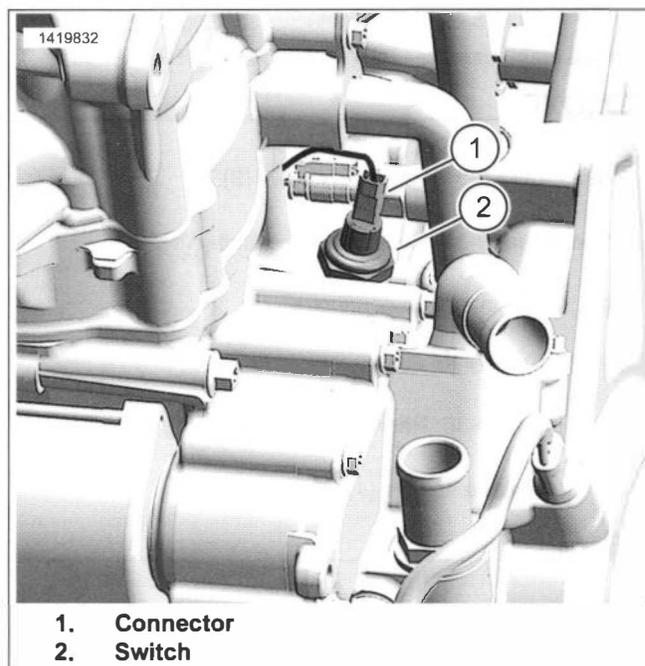


Figure 8-37. Oil Pressure Switch

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4)
2. Remove seat. See SEAT (Page 3-82).
3. Remove fuel tank. See FUEL TANK (Page 6-12).
4. Remove air box. See AIR BOX (Page 6-3).

REMOVE

1. See Figure 8-38. Remove horn assembly.
 - a. Disconnect horn connectors (2).
 - b. See Figure 8-39. Remove screws (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------|--------------|-----------|
| Horn bracket screws | 50–62 in-lbs | 5.7–7 N·m |

1. See Figure 8-38. Install horn assembly.
 - a. Install horn assembly (1).
 - b. See Figure 8-39. Install screws (1). Tighten.
Torque: 50–62 in-lbs (5.7–7 N·m) *Horn bracket screws*
 - c. See Figure 8-38. Connect horn connectors (2).

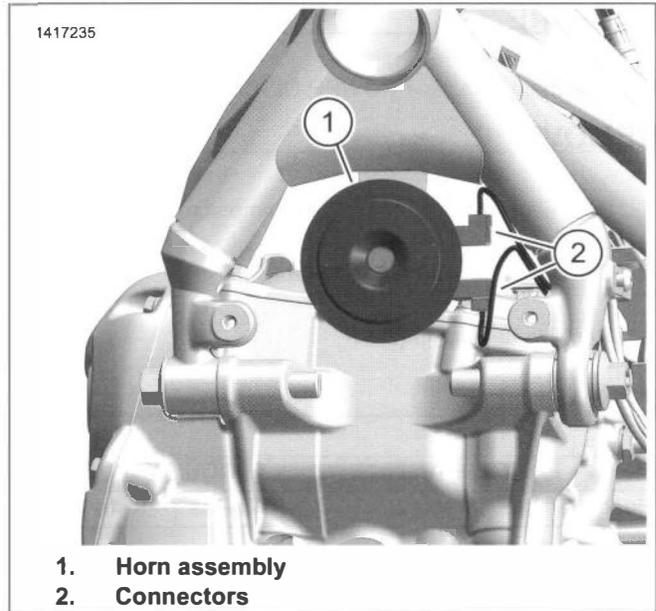


Figure 8-38. Horn

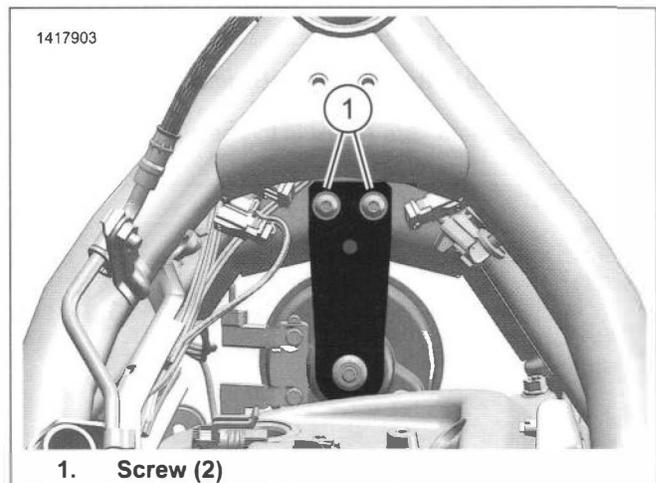


Figure 8-39. Horn Assembly (backside view)

COMPLETE

1. Install air box. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install seat. See SEAT (Page 3-82).
4. Install main fuse. See POWER DISCONNECT (Page 8-4)

PREPARE

Remove main fuse. See POWER DISCONNECT (Page 8-4).

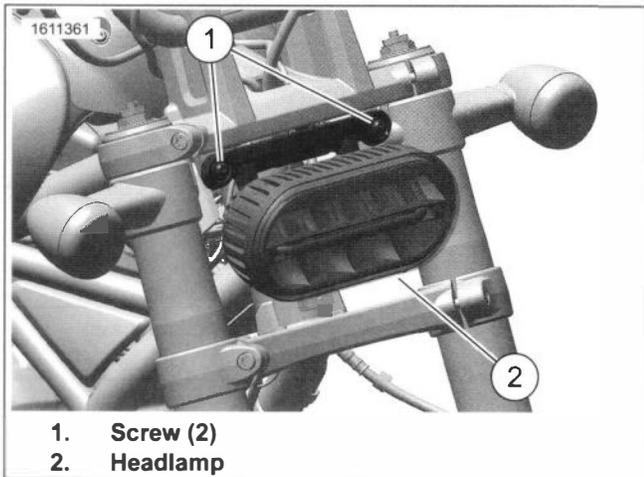
REMOVE

1. See Figure 8-40. Remove headlamp screws (1).
2. Disconnect headlamp connector.
3. Remove headlamp (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|----------|
| Headlamp bracket screw | 71–89 in-lbs | 8–10 N·m |

1. Connect headlamp connector.
2. See Figure 8-40. Position headlamp (2).
3. Install screws (1). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Headlamp bracket screw*
4. Adjust headlamp. See Adjust in this section.



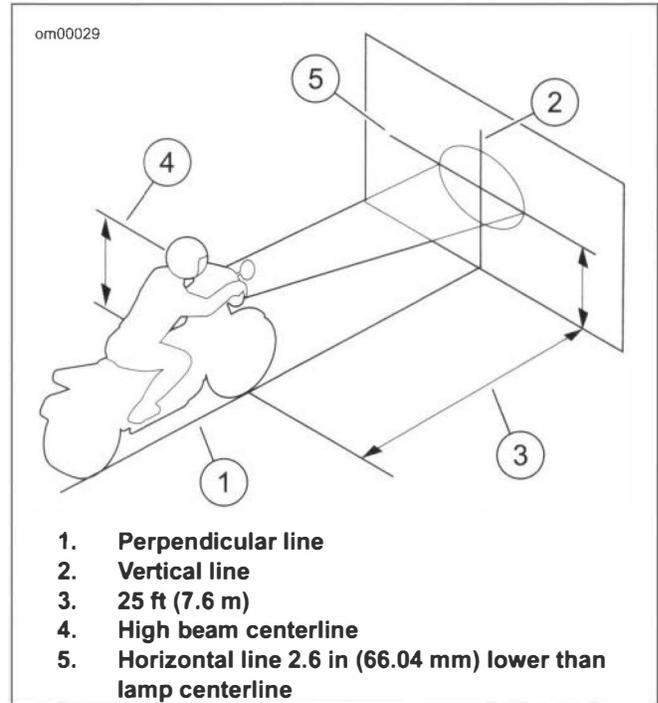
1. Screw (2)
2. Headlamp

Figure 8-40. Headlamp

ALIGN

1. Prepare motorcycle.
 - a. Check tire pressure. See INSPECT TIRES AND WHEELS (Page 2-9).
 - b. Adjust shock preload for rider and intended load. See REAR SHOCK ABSORBER (Page 3-61).
 - c. Fill fuel tank or add an equal amount of ballast.
2. See Figure 8-41. Check alignment.
 - a. Park the motorcycle on a line (1) perpendicular to wall.

- b. Position motorcycle so that front axle is 25 ft (7.6 m) from wall.
- c. Draw a vertical line (2) on wall.
- d. Point the front wheel straight forward at wall.
- e. Measure distance (4) from floor to center of low beam.
- f. With the low beam activated, verify headlamp alignment.
- g. Adjust as necessary.



1. Perpendicular line
2. Vertical line
3. 25 ft (7.6 m)
4. High beam centerline
5. Horizontal line 2.6 in (66.04 mm) lower than lamp centerline

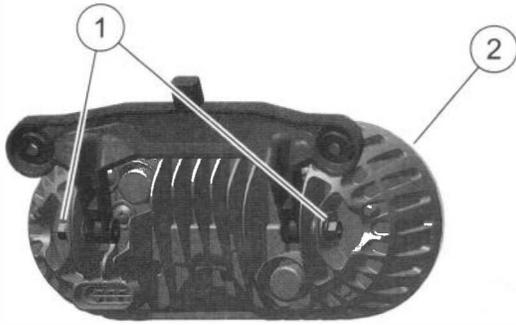
Figure 8-41. Checking Headlamp Alignment

ADJUST

| FASTENER | TORQUE VALUE | |
|----------------|--------------|-----------|
| Headlamp screw | 18–22 ft-lbs | 24–30 N·m |

1. See Figure 8-42. Loosen screws (1).
2. Set vertical adjustment.
3. Tighten screws.
Torque: 18–22 ft-lbs (24–30 N·m) *Headlamp screw*

1611417



1. Screw (2)
2. Headlamp

Figure 8-42. Headlamp Adjustment

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).

▲ 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)

2. Test headlamp for proper operation.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

1. See Figure 8-43. Remove screw (2).
2. Slide front turn signal down fork tube.
3. See Figure 8-43. Note wire routing. Remove wire (3).
4. Remove front turn signal lamp (1).

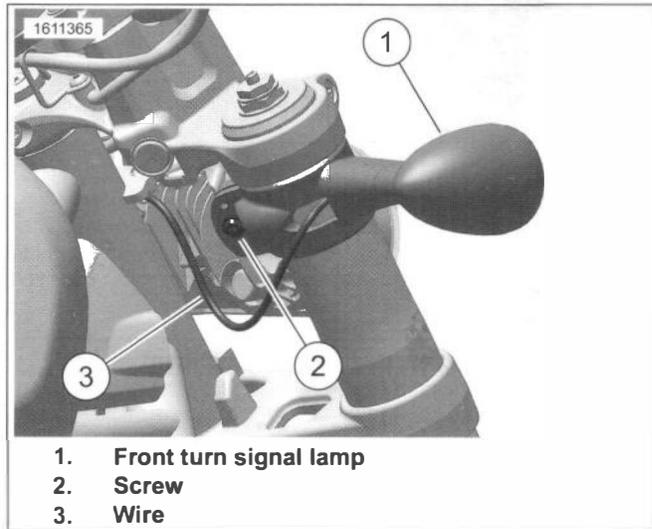
INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------------|--------------|---------|
| Turn signal screw, front | 27-44 in-lbs | 3-5 N·m |

1. See Figure 8-43. Install front turn signal lamp (1) on to fork tube.
2. Install wire (3) following original routing.
3. Slide turn signal up fork tube, inserting alignment pin into hole in triple clamp.

4. Install screw (2). Tighten.

Torque: 27-44 in-lbs (3-5 N·m) *Turn signal screw, front*



1. Front turn signal lamp
2. Screw
3. Wire

Figure 8-43. Front Turn Signal Lamp

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
3. Remove tail lamp. See TAIL LAMP (Page 8-30).

REMOVE

NOTE

Turn signal lamp bulbs are not serviceable. Turn signal lamp must be replaced as an assembly.

1. See Figure 8-44. Remove screw (1).
2. Release the wire from the locating track and remove rear turn signal lamp (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|------|
| | in-lbs | N·m |
| Turn signal lamp screw | 71–89 | 8–10 |

1. See Figure 8-44. Install rear turn signal lamp.
 - a. Install rear turn signal lamp (2).

- b. Install screw (1). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) Turn signal lamp screw
- c. Install wire in locating track.

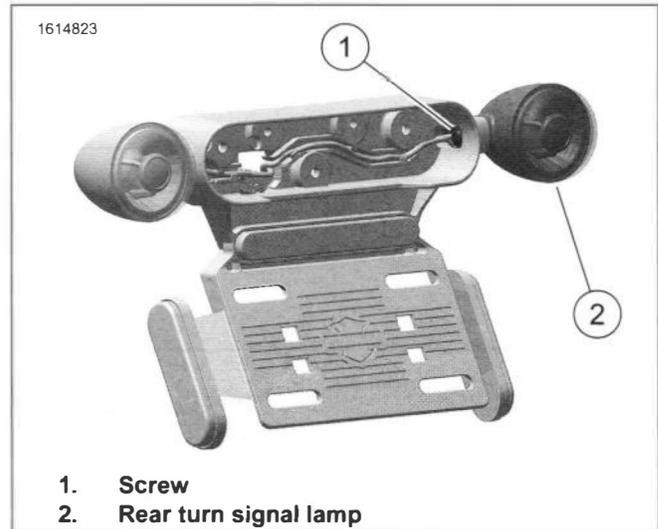


Figure 8-44. Rear Turn Signal Lamp (right lamp shown) COMPLETE

1. Install tail lamp. See TAIL LAMP (Page 8-30).
2. Install license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).

REMOVE

1. See Figure 8-45. Remove screws (1).
2. Remove tail lamp (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|-----------------|--------------|---------|
| Tail lamp screw | 62–80 in-lbs | 7–9 N·m |

1. See Figure 8-45. Install tail lamp (2).
2. Install screws (1). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) *Tail lamp screw*

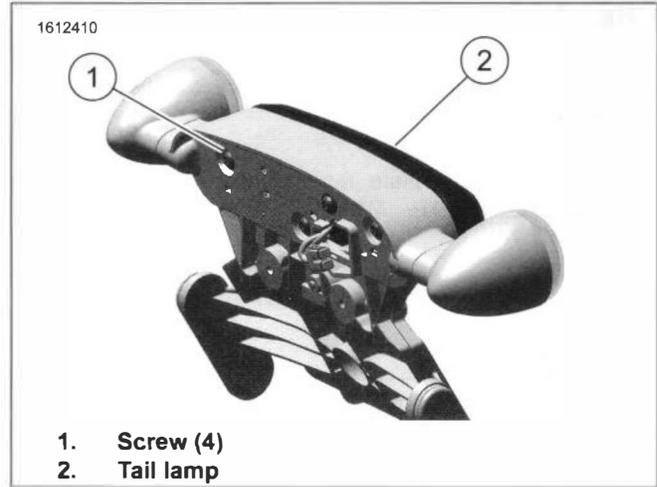


Figure 8-45. Tail Lamp

COMPLETE

1. Install license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Purge fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove seat. See SEAT (Page 3-82).
3. Remove main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove fuel tank. See FUEL TANK (Page 6-12).

REMOVE

NOTICE

DOT 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. (00239c)

1. See Figure 8-46. Remove connector (1).
2. Remove switch (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------|--------------|---------------|
| Rear stoplamp switch | 12–15 ft-lbs | 16.3–20.3 N·m |

| CONSUMABLE | PART NUMBER |
|-------------------------------|-------------|
| LOCTITE 565 THREAD SEALANT | 99818-97 |

1. Apply LOCTITE® 565 to threads of switch.
Consumable: LOCTITE 565 THREAD SEALANT (99818-97)
2. See Figure 8-46. Install switch (2). Tighten.
Torque: 12–15 ft-lbs (16.3–20.3 N·m) *Rear stoplamp switch*

3. Install connector (1).

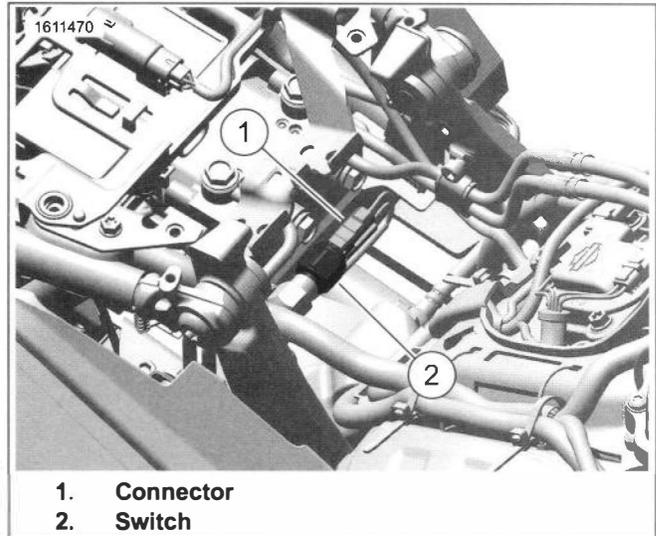


Figure 8-46. Rear Stop Lamp Switch

COMPLETE

1. Install fuel tank. See FUEL TANK (Page 6-12).
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

⚠ 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 BLEED BRAKES (Page 3-43).

GENERAL

See TAIL LAMP (Page 8-30) for tail lamp removal and installation.

PREPARE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

NOTE

Always calibrate replaced ECM with DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove ignition coil bracket. See IGNITION COIL (Page 8-15).

REMOVE

1. Remove ECM assembly.
 - a. See Figure 8-47. Release ECM connector lock (4).
 - b. Rotate the connector lever counter-clockwise (3). Disconnect.
 - c. Remove screws (5).
 - d. Remove ECM assembly (1).
2. Remove Electronic Control Module (ECM).
 - a. See Figure 8-48. Release caddy clips (1).
 - b. Remove ECM.

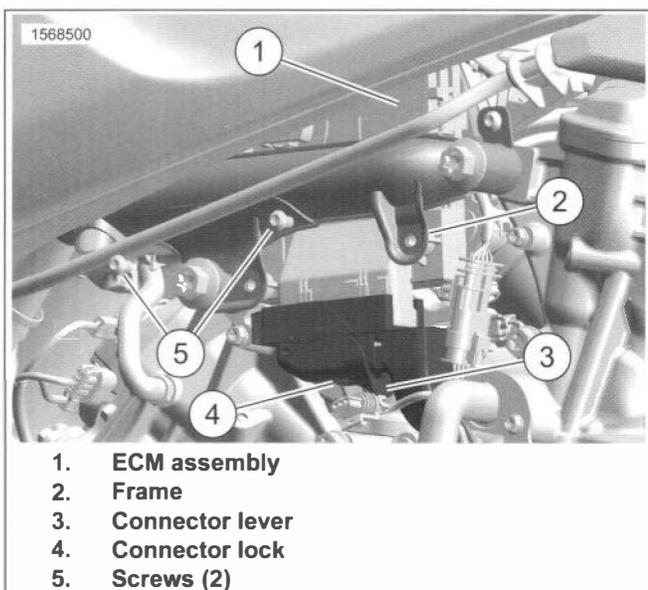


Figure 8-47. ECM Removal

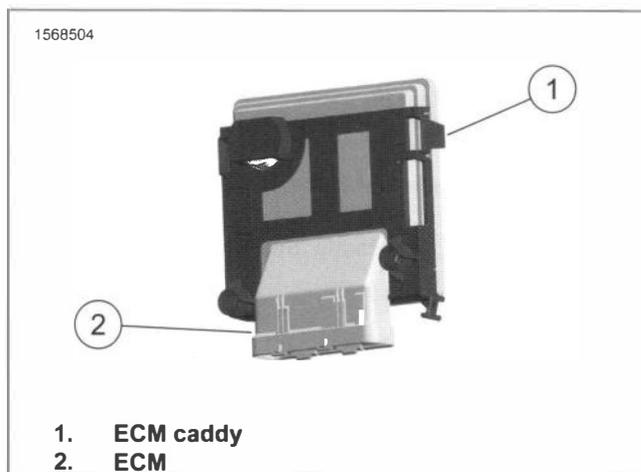


Figure 8-48. ECM

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------|--------------|---------|
| ECM assembly screws | 35–62 in-lbs | 4–7 N·m |

1. Install ECM.
 - a. See Figure 8-48.
 - b. Install ECM (1) into caddy (2).
2. Install ECM assembly.
 - a. See Figure 8-47. Install ECM assembly (1).
 - b. Install screws (3). Tighten
Torque: 35–62 in-lbs (4–7 N·m) ECM assembly screws
 - c. Connect ECM connector. Verify connector lock (4) is engaged.

COMPLETE

1. Install ignition coil bracket. See IGNITION COIL (Page 8-15).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).
3. Program using DTII.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove under seat caddy. See UNDER SEAT CADDY (Page 8-55).

REMOVE

1. See Figure 8-49. Disconnect Body Control Module (BCM).
 - a. Disconnect BCM battery power [242-1] (3).
 - b. Disconnect BCM [242-2] (1).
2. Remove BCM.
 - a. Release BCM lock tabs (2).
 - b. Slide BCM (4) up and out.

INSTALL

NOTE

When installing battery power connector, verify seal does not roll.

1. See Figure 8-49. Install BCM (4). Verify BCM locks in place.

2. Connect BCM.
 - a. Install BCM [242-2] (1).
 - b. Install BCM [242-1] (3).

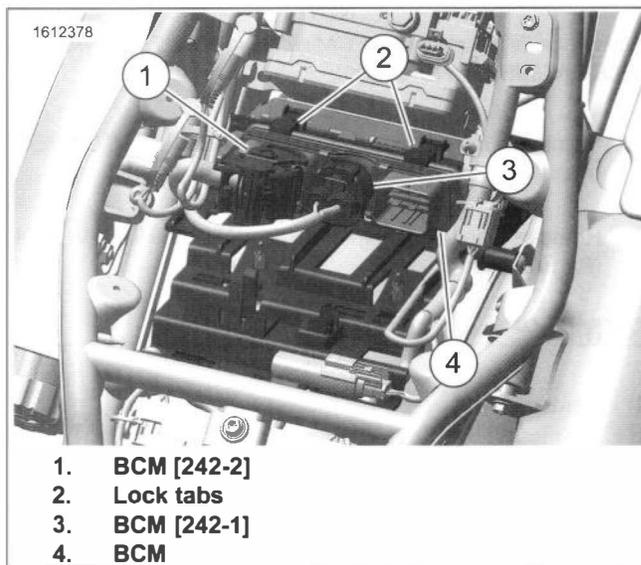


Figure 8-49. BCM and Connectors

COMPLETE

1. Install seat. See SEAT (Page 3-82).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

ACTIVATION

Activation consists of assigning a fob to the system and entering an initial PIN.

NOTE

If the fob is lost or inoperable, the PIN allows the owner to disarm the system. See PERSONAL IDENTIFICATION NUMBER (PIN) (Page 8-36).

1. Configure security system by assigning the fob to the vehicle.
2. Configure security system by entering a PIN picked by the owner.

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 PERSONAL IDENTIFICATION NUMBER (PIN) (Page 8-36).

Once the system has been activated, it "arms" within 5 seconds of switching the IGN switch to OFF and no motorcycle motion.

FOB ASSIGNMENT

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to assign the fob to the vehicle.

NOTE

- Choose correct fob type. Choosing incorrectly at beginning of the process will result in a failure to assign the fob. This can be mistakenly diagnosed as a bad fob or SCM.
- When assigning a fob, keep the fob within 3 ft (1 m) of vehicle seat.

See Figure 8-50. Follow menu prompts to scan the fob serial number with bar code reader. Alternatively, enter the number using the keyboard. Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to assign fob and enter initial PIN.

NOTE

Each fob has a unique serial number. Attach fob label to a blank NOTES page in the owner's manual for reference.

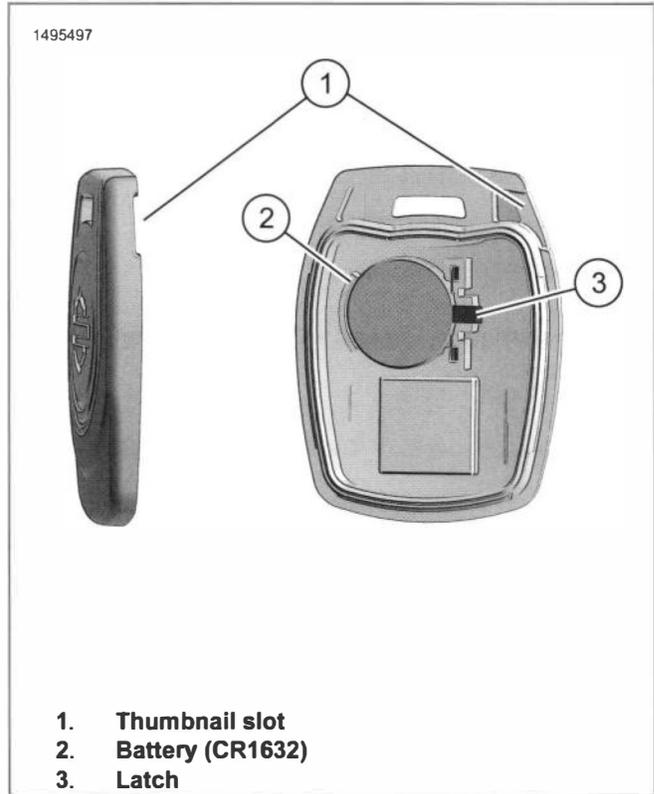


Figure 8-50. Replace Fob Battery

CHANGING THE PIN

The Personal Identification Number (PIN) is a number that can be used to disarm the security system. Use the PIN in case the assigned fob is misplaced, fails or if the fob cannot communicate with the motorcycle because of electromagnetic interference.

A PIN is a five-digit number (1-9).

Changing the PIN

The rider can change the PIN at any time.

- Ignition must be ON
- Fob must be present
- Can select numbers between 1-9

1. Navigate dashboard menu:
 - a. **Settings > General > Change Security PIN**
 - b. Click OK/enter.
 - c. See Figure 8-51. The PIN screen will display.

NOTE

The zero is displayed and is only a default number. Zero cannot be part of the PIN.

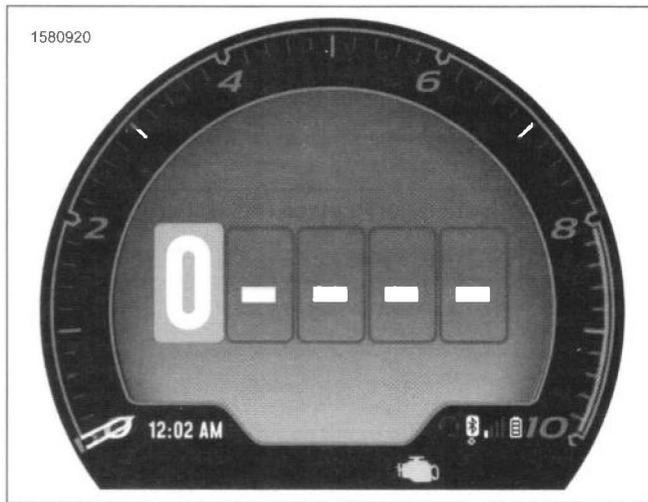


Figure 8-51. PIN Entry Screen

Hand Control Entry

1. See Figure 8-51. Select the first digit of the PIN.
 - a. Push the left turn signal to scroll through the numbers (1-9) until the desired digit appears.

2. See Figure 8-53. Select the next digit.
 - a. Push the right turn signal to move cursor to the right.
 - b. Push the left turn signal to scroll through the numbers (1-9) until the desired digit appears.
3. Repeat step 2 until all five-digits are filled in with the desired PIN.
4. Cycle the ignition to save PIN.

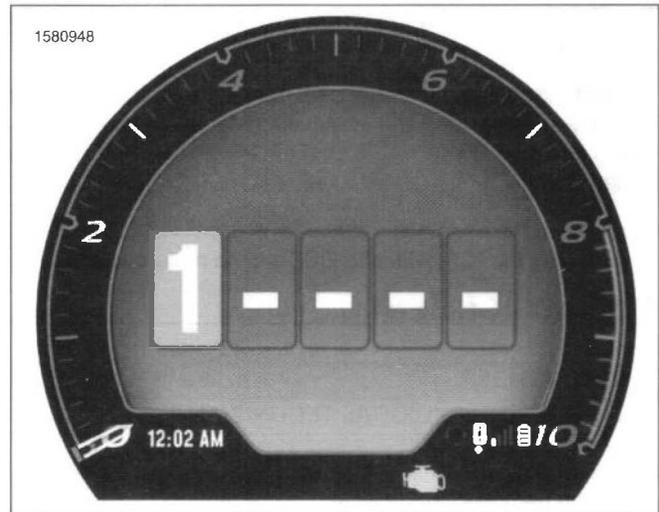


Figure 8-52. First PIN Digit Entry

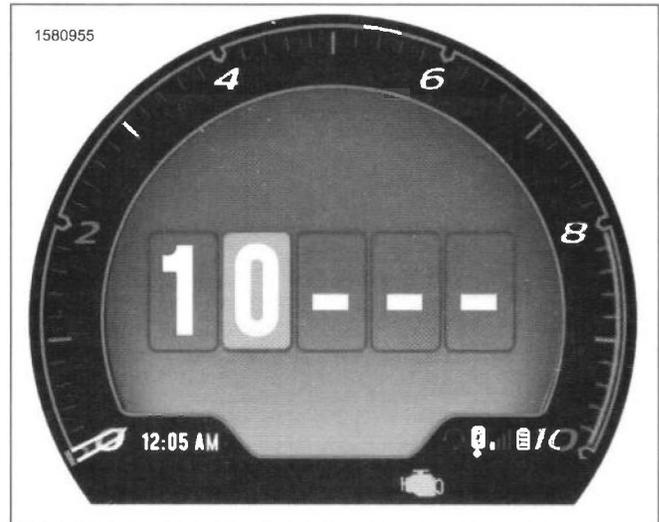


Figure 8-53. Moving Cursor to Next Digit

SERVICE MODE

| PART NUMBER | TOOL NAME |
|-------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |

With fob present, the security system can be configured for service by disabling the security system with DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

Once disabled, the vehicle can be operated without an assigned fob present. To maintain the service mode, the assigned fob must be kept out of range. If the fob appears in range, the service mode is cancelled.

TRANSPORT MODE

Put the system in transport mode to transport the motorcycle. Otherwise, the alarm activated by motion detection can discharge the battery.

In the transport mode, the security system is armed without enabling the motion detector for one ignition cycle. This allows the vehicle to be picked up and moved in an armed state. Any attempt to start the engine when the fob is not within range will trigger the alarm.

To Enter Transport Mode

1. With an assigned fob within range, set the OFF/RUN switch to RUN.
2. Simultaneously press both the left turn signal switch and the flash to pass button for 10 seconds.
3. While holding the switch/button, turn ignition OFF.
4. The IM will display transport mode activated.

To Exit Transport Mode

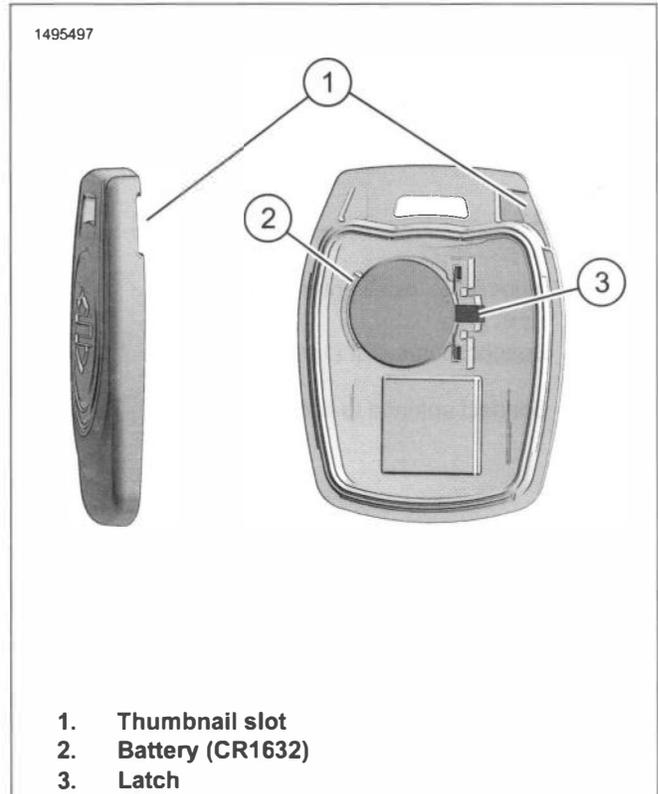
With the fob present, set the OFF/RUN switch to OFF to disarm the system and exit transport mode.

FOB BATTERY

NOTE

Replace the fob battery every year.

1. Replace Fob Battery.
 - a. See Figure 8-54. To open the fob, turn a thin blade in the slot (1).
 - b. Remove the battery (2) and discard in accordance with local regulations.
 - c. Install a **new** battery (Panasonic CR1632 or equivalent) with the positive side up.
 - d. Align the two halves of the fob. Snap the halves together.



1. Thumbnail slot
2. Battery (CR1632)
3. Latch

Figure 8-54. Replace Fob Battery

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove rear fender center section. See COWL AND REAR FENDERS (Page 3-68).

REMOVE

1. See Figure 8-55. Remove antenna (2).
 - a. Remove antenna from caddy.
 - b. Disconnect connector (1).
 - c. Remove antenna.

INSTALL

1. See Figure 8-55. Install antenna (2).
 - a. Connect connector (1).
 - b. Connect antenna to caddy.

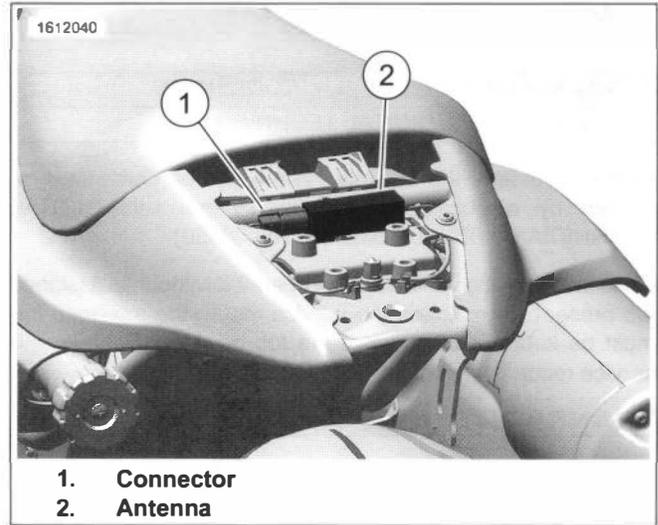


Figure 8-55. Security Antenna

COMPLETE

1. Install rear fender center section. See COWL AND REAR FENDERS (Page 3-68).
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Relocate radiator. See RADIATOR (Page 7-17).

REMOVE

1. See Figure 8-57. Remove screw (2).
2. Move cooling fan shroud (1) to gain access to cooling fan mounting screws.
3. See Figure 8-56. Remove cooling fan and shroud.
 - a. Remove screws (2).
 - b. Disconnect cooling fan connector (3).
 - c. Remove cooling fan (1) and cooling fan shroud together.

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------------|--------------|----------|
| Cooling fan mounting nut | 35–44 in-lbs | 4–5 N·m |
| Cooling fan shroud screw | 71–89 in-lbs | 8–10 N·m |

1. See Figure 8-56. Install cooling fan (1) and cooling fan shroud together.
 - a. Install mounting feet on cooling fan (1) if removed.
 - b. Install cooling fan and cooling fan shroud on radiator.
 - c. Install nuts (2). Tighten.
Torque: 35–44 in-lbs (4–5 N·m) *Cooling fan mounting nut*
2. See Figure 8-57. Install cooling fan shroud.
 - a. Install cooling fan shroud (1).
 - b. Install screw (2). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Cooling fan shroud screw*

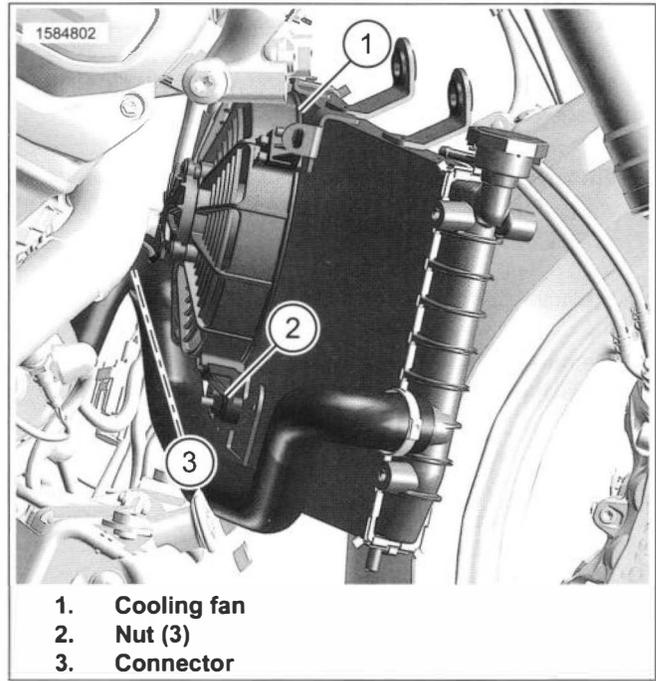


Figure 8-56. Cooling Fan

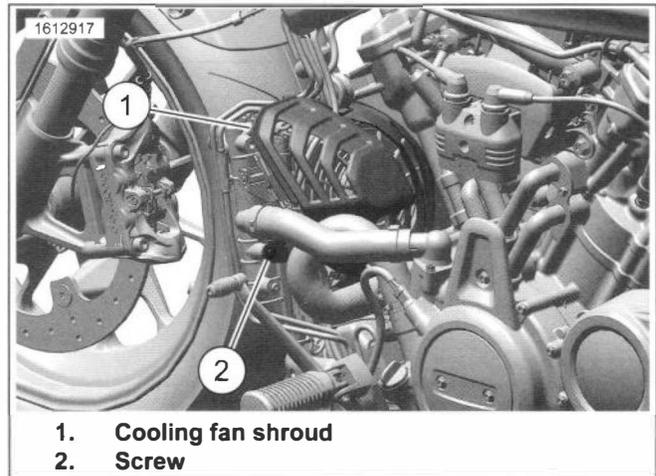


Figure 8-57. Cooling Fan Shroud

COMPLETE

1. Relocate radiator. See RADIATOR (Page 7-17).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove radiator mounting screws and position radiator away from oil cooler. Support as needed. See RADIATOR (Page 7-17).
3. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
4. Remove voltage regulator and bracket. See VOLTAGE REGULATOR (Page 8-12).
5. Remove battery. See INSPECT BATTERY (Page 2-37).
6. Remove coolant overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).
7. Remove charcoal canister (if equipped). See CHARCOAL CANISTER: EVAPORATIVE EMISSIONS (Page 6-37).
8. Remove battery tray. See BATTERY TRAY (Page 8-57).

REMOVE

1. See Figure 8-58. Disconnect CKP connector (3).
 - a. Remove screw (2).
 - b. Remove sensor (1).
2. See Figure 8-59. Discard o-ring (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------|--------------|---------|
| CKP sensor screw | 53–80 in-lbs | 6–9 N·m |

1. See Figure 8-59. Lubricate **new** o-ring with clean engine oil.
2. Install o-ring (2) on CKP (1).
3. See Figure 8-58. Install sensor (1).
4. Install screw (2). Tighten.
Torque: 53–80 in-lbs (6–9 N·m) *CKP sensor screw*
5. Connect CKP connector (3).

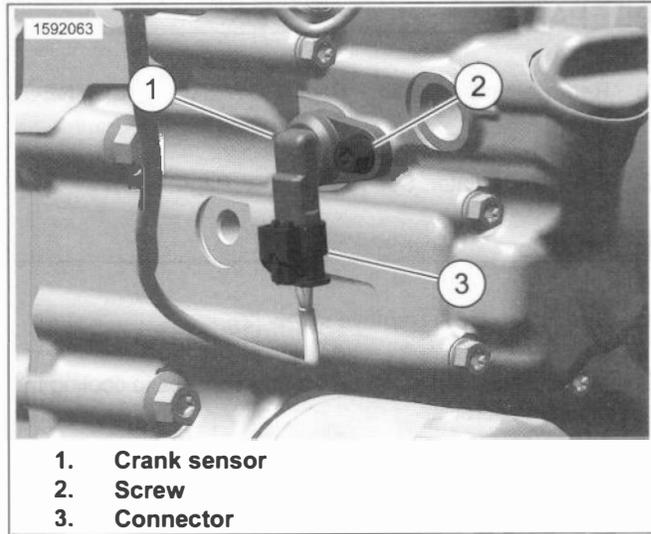


Figure 8-58. Crankshaft Position (CKP) Sensor

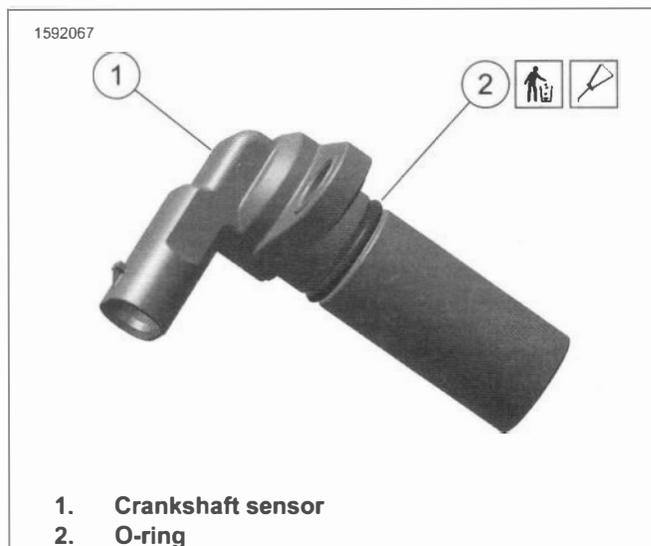


Figure 8-59. CK Sensor Assembly

COMPLETE

1. Install battery tray. See BATTERY TRAY (Page 8-57).
2. Install charcoal canister (if equipped). See CHARCOAL CANISTER: EVAPORATIVE EMISSIONS (Page 6-37).
3. Install coolant overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).
4. Install battery. See INSPECT BATTERY (Page 2-37).
5. Install voltage regulator and bracket. See VOLTAGE REGULATOR (Page 8-12).
6. Install chin spoiler. See CHIN SPOILER (Page 3-69).
7. Install radiator. See RADIATOR (Page 7-17).
8. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Purge fuel line. See PURGE FUEL LINE (Page 6-9).
2. Remove seat. See SEAT (Page 3-82).
3. Remove main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove fuel tank. See FUEL TANK (Page 6-12).
5. Remove air box. See AIR BOX (Page 6-3).

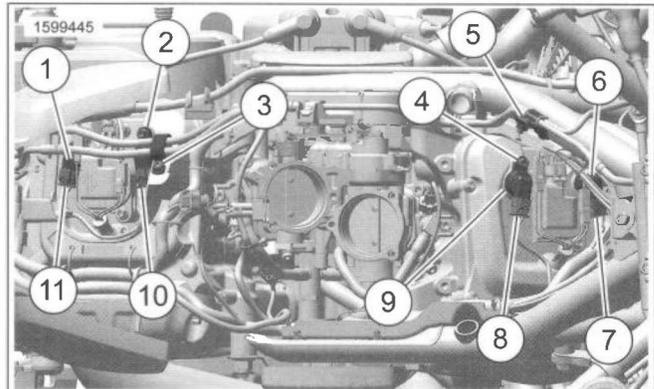
REMOVE

1. See Figure 8-60. Remove rear brake clamp screw (3).
2. Disconnect appropriate camshaft timing sensor connectors (7, 8, 10, 11).
3. Remove appropriate camshaft retaining screw (4).
4. Remove the appropriate camshaft timing sensor (1, 2, 6, 9).
5. See Figure 8-61. Remove o-ring (2) and discard.

INSTALL

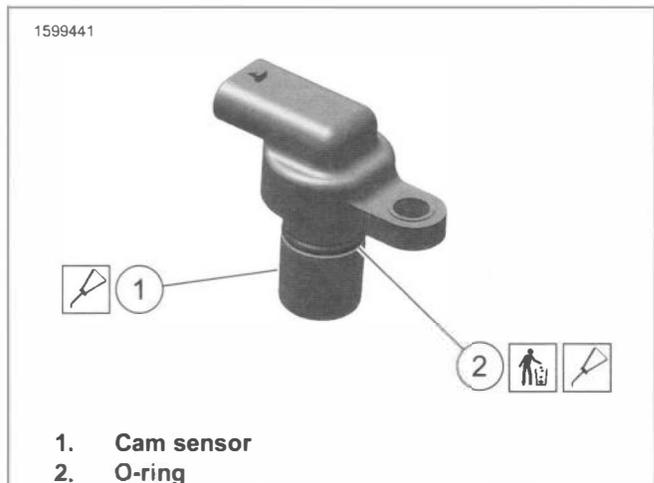
| FASTENER | TORQUE VALUE | |
|------------------------------|--------------|-------------|
| Brake clamp screw | 62–80 in-lbs | 7–9 N·m |
| Camshaft timing sensor screw | 47–66 in-lbs | 5.3–7.5 N·m |

1. See Figure 8-61. Install new o-ring.
2. Lubricate new o-ring (2) with clean engine oil and install.
3. Lubricate cams sensor (1).
4. See Figure 8-60. Install the appropriate camshaft timing sensor (1, 2, 6, 9).
5. Install screw (4). Tighten.
Torque: 47–66 in-lbs (5.3–7.5 N·m) *Camshaft timing sensor screw*
6. Install screw (3) (if removed). Torque.
Torque: 62–80 in-lbs (7–9 N·m) *Brake clamp screw*



1. Rear exhaust camshaft timing sensor
2. Rear intake camshaft timing sensor
3. Rear brake clamp screw
4. Timing sensor screws (4)
5. Front brake clamp screw
6. Front exhaust camshaft timing sensor
7. Front exhaust camshaft timing sensor connector
8. Front Intake camshaft timing sensor connector
9. Front Intake camshaft timing sensor
10. Rear intake camshaft timing sensor connector
11. Rear exhaust camshaft timing sensor connector

Figure 8-60. Camshaft Timing Sensor Connectors



1. Cam sensor
2. O-ring

Figure 8-61. Camshaft Timing Sensor and O-ring

COMPLETE

1. Install air box. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).
4. Install seat. See SEAT (Page 3-82).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

1. See Figure 8-62. Disconnect connector (1).
2. Remove screw (2).
3. Remove knock sensor (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------|---------------|-----------|
| Knock sensor screw | 97–115 in-lbs | 11–13 N·m |

1. See Figure 8-62. Install knock sensor (3).
2. Install screw (2). Tighten.
Torque: 97–115 in-lbs (11–13 N·m) *Knock sensor screw*

3. Connect connector (1).

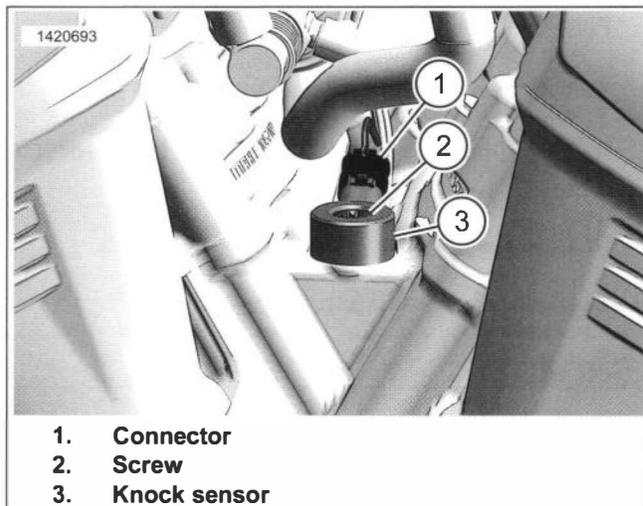


Figure 8-62. Knock Sensor

COMPLETE

1. Install main fuse. POWER DISCONNECT (Page 8-4)

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove front belt guard. See BELT GUARDS (Page 3-60).

REMOVE

1. See Figure 8-63. Disconnect gear position sensor connector (3).
2. Remove screws (4).
3. See Figure 8-64. Remove the gear position sensor (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------|--------------|----------|
| Gear position sensor screw | 71–89 in-lbs | 8–10 N·m |

1. See Figure 8-64. Position gear position sensor.
2. See Figure 8-63. Install screws (4). Tighten.
Torque: 71–89 in-lbs (8–10 N·m) *Gear position sensor screw*
3. Connect the gear position sensor connector (3).

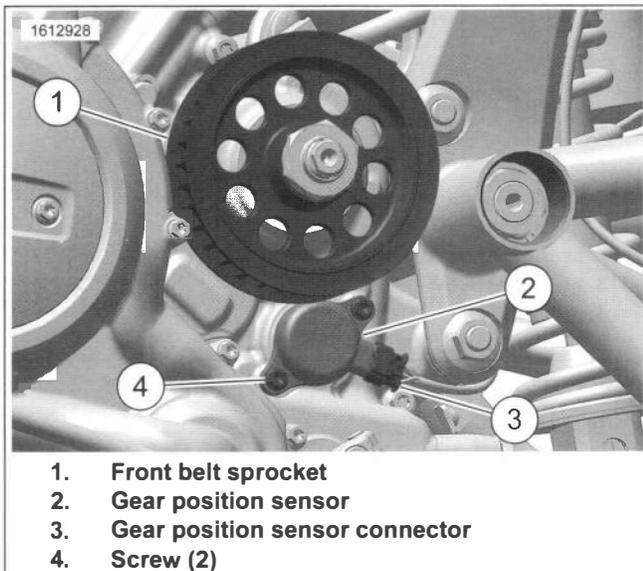


Figure 8-63. Gear Position Sensor Connector (Chain Removed for Clarity)

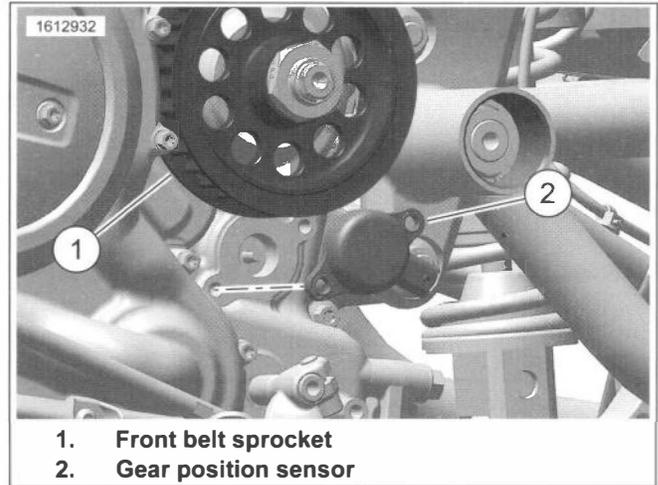


Figure 8-64. Gear Position Sensor

COMPLETE

| PART NUMBER | TOOL NAME |
|--------------|-----------------------|
| HD-48650 | DIGITAL TECHNICIAN II |
| HD-48650-TL3 | TECHLINK 3 |

1. Install front belt guard. See BELT GUARDS (Page 3-60).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).
3. Using DT II and the Techlink 3 (TL-3), perform the Gear Indicator Calibration under the Vehicle Setup tab.
Special Tool: DIGITAL TECHNICIAN II (HD-48650)
Special Tool: TECHLINK 3 (HD-48650-TL3)
 - a. **Import vehicle information > Toolbox > Vehicle Setup**
 - b. Follow directions on screen.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Raise front of motorcycle. See Secure the Motorcycle for Service (Page 2-2).
3. Retract front axle until Wheel Speed Sensor (WSS) is free. See FRONT WHEEL (Page 3-7).

REMOVE

NOTE

Note WSS cable routing and clip locations before removing cable.

1. See Figure 8-65. Remove Wheel Speed Sensor (WSS) (1).
2. Disengage WSS cable from brake bleeder valve cap (2).
3. See Figure 8-66. Remove screw (1) and left steering head cover (2).
4. Disconnect WSS connector (3).
5. Detach WSS cable (5) from clips (4) on front brake hose.
6. Remove WSS and cable assembly from motorcycle.

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------------------|--------------|-------------|
| Left steering head cover screw | 7–11 in-lbs | 0.8–1.2 N·m |

1. See Figure 8-65. Install WSS (1). Position as shown. Slide front axle back in place. Make sure WSS rests against stop tab on front fork.
2. Route WSS cable as previously noted.
3. Capture WSS cable in front brake bleeder valve cap (2).
4. See Figure 8-66. Attach WSS cable (5) to clips (4) on front brake hose in locations previously noted.
5. Connect WSS connector (3).

6. Install cover (2) with screw (1). Tighten.

Torque: 7–11 in-lbs (0.8–1.2 N·m) *Left steering head cover screw*

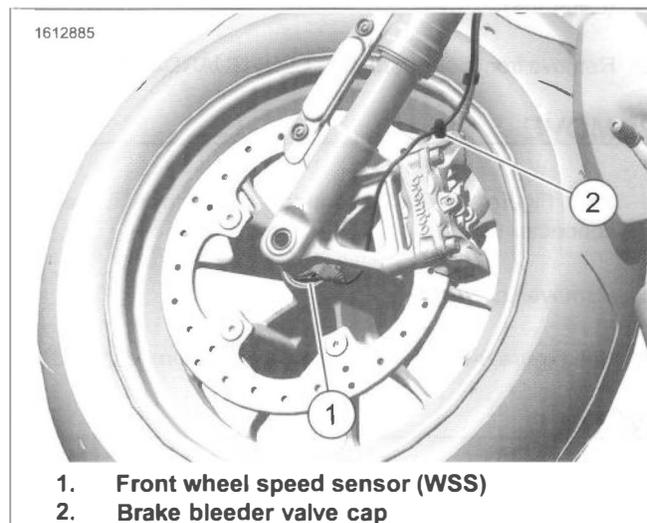


Figure 8-65. Front WSS

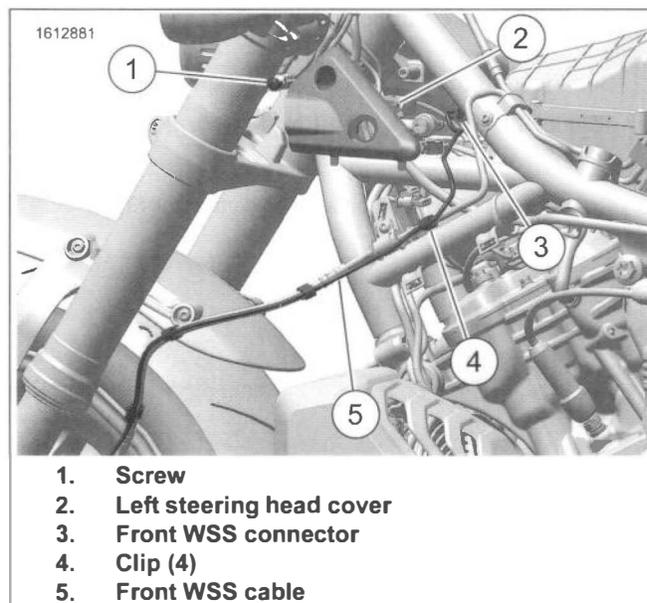


Figure 8-66. Front WSS Cable Assembly

COMPLETE

1. Complete front wheel installation. See FRONT WHEEL (Page 3-7).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove motorcycle from lift. See Secure the Motorcycle for Service (Page 2-2).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Raise rear of motorcycle. See Secure the Motorcycle for Service (Page 2-2).
3. Remove seat. See SEAT (Page 3-82).
4. Remove cowl and rear fenders. See COWL AND REAR FENDERS (Page 3-68).
5. Retract rear axle until WSS is free. See REAR WHEEL (Page 3-9).

REMOVE

NOTE

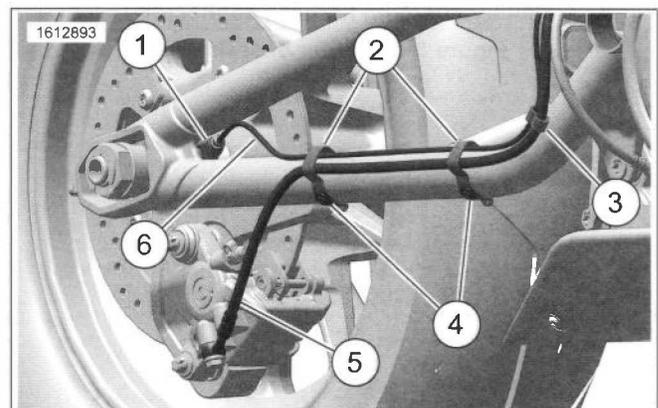
Note rear WSS cable routing and clip locations before removing cable.

1. See Figure 8-67. Remove screws (4) and clamps (2).
2. Remove WSS cable from clips (3).
3. Remove WSS (1).
4. See Figure 8-68. Remove screws (1) and seat release bracket (2). Pull bracket out of the way.
5. See Figure 8-69. Remove heated gear connectors (1), battery charging harness connector (9) and seat release cable (3) from retainers. Pull cable and harnesses out of the way.
6. Remove DLC connector (7) from holder.
7. Disengage main harness tree clips (4) from under seat caddy (8).
8. Remove screws (2, 6). Lift caddy up and remove P&A siren connector (5) from holder in underside of caddy.
9. Pull caddy out of the way to reveal WSS connector.
10. See Figure 8-70. Remove WSS connector (1) from retaining bracket (2). Disconnect connector.
11. Remove WSS and cable assembly from motorcycle.

INSTALL

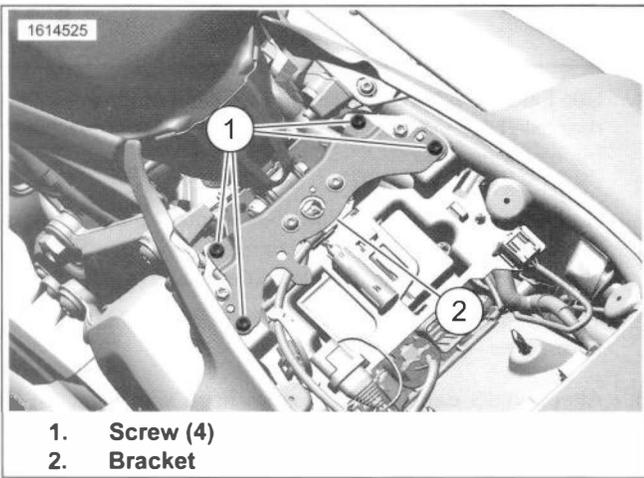
| FASTENER | TORQUE VALUE | |
|----------------------------|--------------|-------------|
| Brake hose clamp screw | 49–66 in-lbs | 5.5–7.5 N·m |
| Seat release bracket screw | 73–89 in-lbs | 8.2–10 N·m |
| Under seat caddy screw | 25–29 in-lbs | 2.8–3.3 N·m |

1. See Figure 8-67. Install WSS (1). Position as shown. Slide rear axle back in place. Make sure WSS rests against stop tab on swingarm.
2. Route WSS cable (6) as previously noted. Install clamps (2). Avoid pinching WSS cable or rear brake hose between clamps and swingarm. Secure with screws (4). Tighten.
Torque: 49–66 in-lbs (5.5–7.5 N·m) Brake hose clamp screw
3. Attach WSS cable to rear brake hose with clips (3) in locations previously noted.
4. See Figure 8-70. Connect rear WSS connector (1). Slide connector into retaining bracket (2).
5. See Figure 8-69. Insert PA connector (5) into holder in underside of under seat caddy (8).
6. Position caddy in frame. Engage main harness tree clips (4) in holes in bottom of caddy.
7. Install screws (2, 6). Tighten.
Torque: 25–29 in-lbs (2.8–3.3 N·m) Under seat caddy screw
8. Install heated gear connectors (1), battery charging harness connector (9) and seat release cable (3) in retainers.
9. Insert DLC connector (7) into holder.
10. See Figure 8-68. Install seat release bracket (2). Secure with screws (1). Tighten.
Torque: 73–89 in-lbs (8.2–10 N·m) Seat release bracket screw



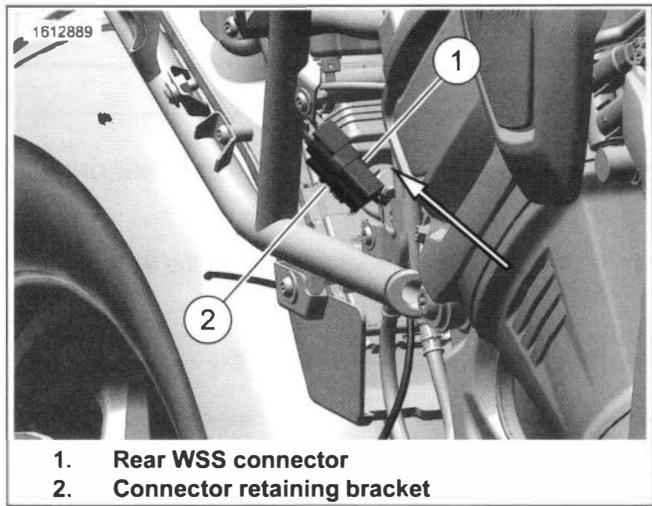
1. Rear wheel speed sensor (WSS)
2. Clamp (2)
3. Clip (3)
4. Screw (2)
5. Brake hose
6. Rear WSS cable

Figure 8-67. Rear WSS Cable



1. Screw (4)
2. Bracket

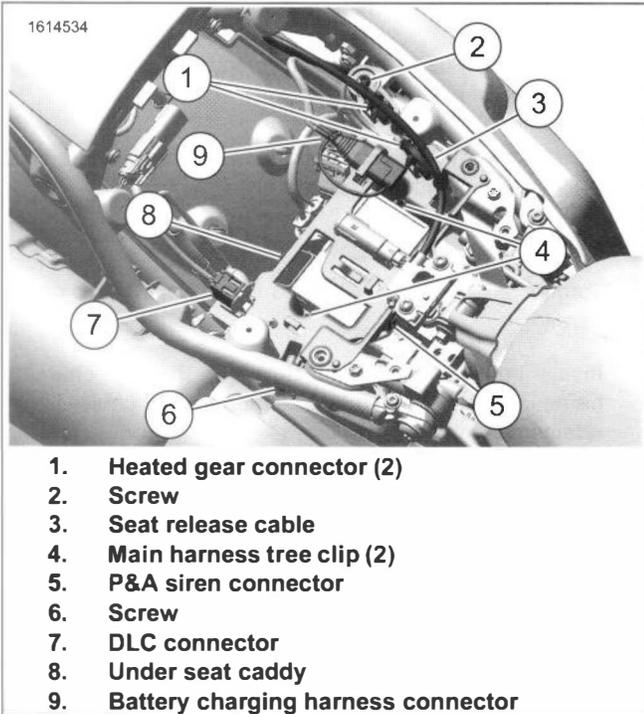
Figure 8-68. Seat Release Bracket



1. Rear WSS connector
2. Connector retaining bracket

Figure 8-70. Rear WSS Connector Location

COMPLETE



1. Heated gear connector (2)
2. Screw
3. Seat release cable
4. Main harness tree clip (2)
5. P&A siren connector
6. Screw
7. DLC connector
8. Under seat caddy
9. Battery charging harness connector

Figure 8-69. Under Seat Caddy

1. Complete rear wheel installation. See REAR WHEEL (Page 3-9).
2. Install rear fenders and cowl. See COWL AND REAR FENDERS (Page 3-68).
3. Install seat. See SEAT (Page 3-82).
4. Remove motorcycle from lift. See Secure the Motorcycle for Service (Page 2-2).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove RHCM. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).

REMOVE

1. See Figure 8-71. Remove screw (3) and TGS (1).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------|--------------|---------------|
| TGS mounting screw | 3–4 in-lbs | 0.36–0.44 N·m |

1. See Figure 8-71. Install TGS (1). Secure with screw (3). Tighten.

Torque: 3–4 **in-lbs** (0.36–0.44 N·m) *TGS mounting screw*

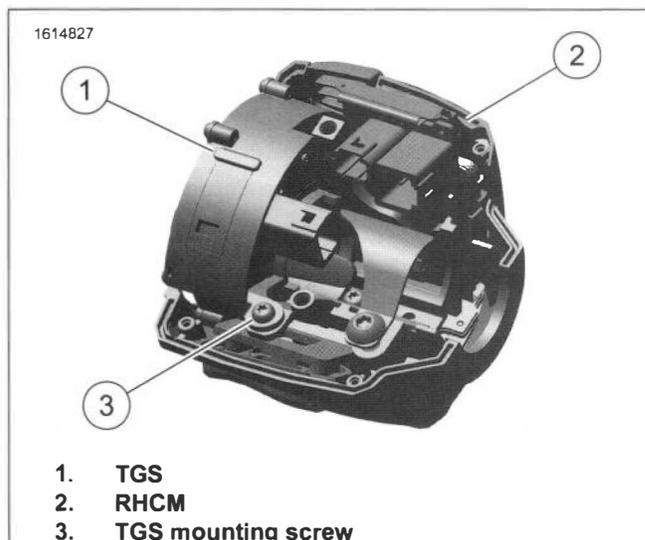


Figure 8-71. TGS

COMPLETE

1. Install RHCM. See RIGHT HAND CONTROL MODULE (RHCM) (Page 8-20).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

⚠ WARNING

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

3. Test switches for proper operation.

PREPARE

1. Remove main fuse. See **POWER DISCONNECT** (Page 8-4).
2. Support motorcycle upright. See **Secure the Motorcycle for Service** (Page 2-2).
3. Remove seat. See **SEAT** (Page 3-82).
4. Remove cowl and rear fenders. See **COWL AND REAR FENDERS** (Page 3-68).

REMOVE

1. See Figure 8-72. Remove nut (3) and ground wire connectors (4).
2. Remove screw (1).
3. Remove screws (5) (accessible from underside of tail section).
4. Lift up tail caddy (2).
5. See Figure 8-73. Disconnect connector (3).
6. Remove screws (4) and IMU (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------|--------------|-------------|
| Ground wire nut | 60–72 in-lbs | 6.8–8.1 N·m |
| IMU mounting screw | 89–97 in-lbs | 10–11 N·m |
| Tail caddy bottom screw | 35–62 in-lbs | 4–7 N·m |
| Tail caddy front screw | 25–29 in-lbs | 2.8–3.3 N·m |

1. See Figure 8-73. Install IMU (2). Secure with screws (4). Tighten.
Torque: 89–97 in-lbs (10–11 N·m) *IMU mounting screw*
2. Connect connector (3).
3. See Figure 8-72. Place tail caddy (2) into position.
4. Install screws (5) from underside of tail section. Tighten.
Torque: 35–62 in-lbs (4–7 N·m) *Tail caddy bottom screw*
5. Install screw (1). Tighten.
Torque: 25–29 in-lbs (2.8–3.3 N·m) *Tail caddy front screw*
6. Install ground wire connectors (4) onto ground stud. Secure with nut (3). Tighten.
Torque: 60–72 in-lbs (6.8–8.1 N·m) *Ground wire nut*

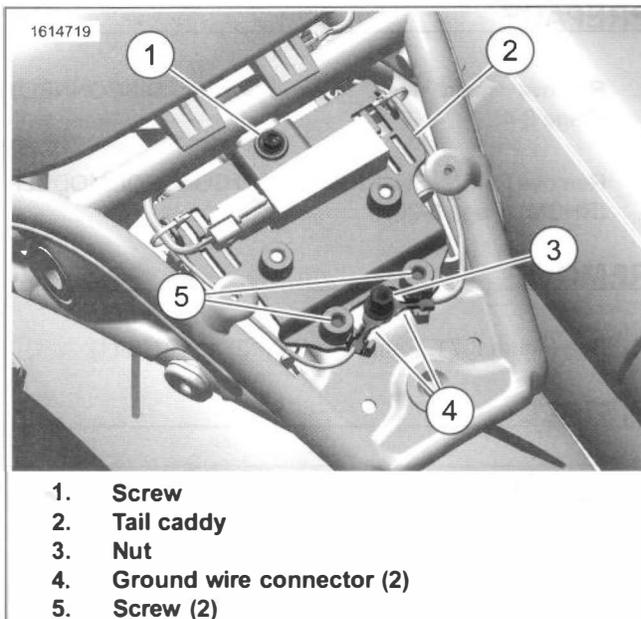


Figure 8-72. Tail Caddy

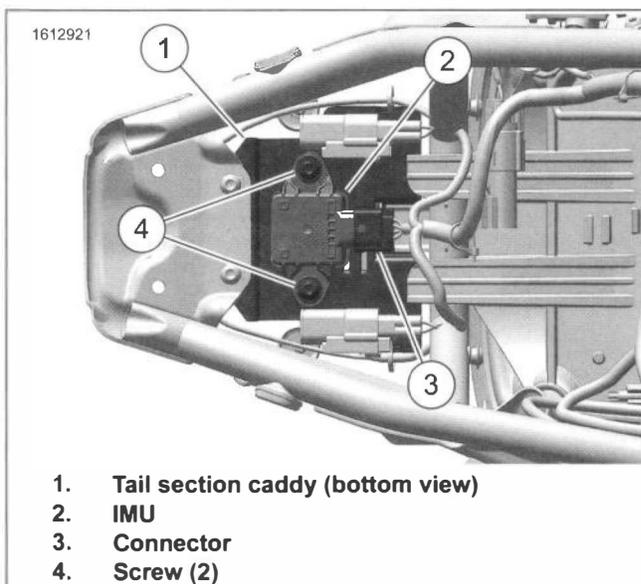


Figure 8-73. IMU (rear cover removed for clarity)

COMPLETE

1. Install rear fenders and cowl. See **COWL AND REAR FENDERS** (Page 3-68).
2. Install seat. See **SEAT** (Page 3-82).
3. Remove motorcycle from lift. See **Secure the Motorcycle for Service** (Page 2-2).
4. Install main fuse. See **POWER DISCONNECT** (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Set motorcycle upright. See Secure the Motorcycle for Service (Page 2-2).
3. Remove left side chin spoiler. See CHIN SPOILER (Page 3-69).
4. Remove left radiator cover. See SIDE COVERS (Page 3-46).

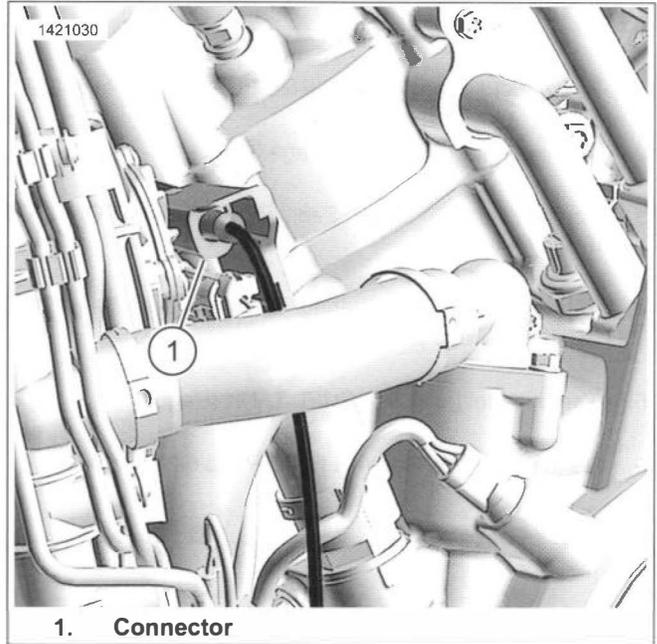
REMOVE

1. See Figure 8-74. Disconnect connector (1).
2. See Figure 8-75. Remove JSS.
 - a. Remove cable strap (1). Discard.
 - b. Remove screw (2).
 - c. Remove sensor (3).

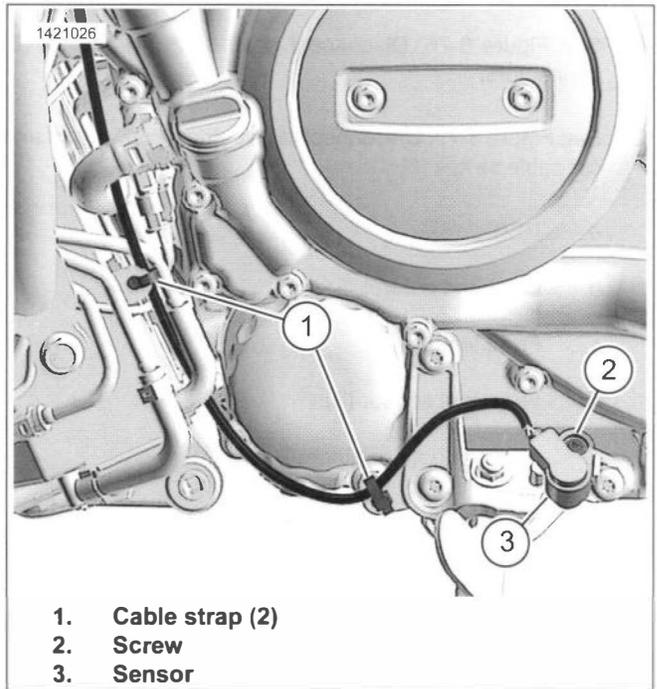
INSTALL

| FASTENER | TORQUE VALUE | |
|-----------|--------------|-------------|
| JSS screw | 20–25 in-lbs | 2.3–2.8 N·m |

1. See Figure 8-75. Install JSS.
 - a. Install sensor (3).
 - b. Install screw (2). Tighten.
Torque: 20–25 in-lbs (2.3–2.8 N·m) *JSS screw*
 - c. Install **new** cable strap (1).
2. See Figure 8-74. Connect connector.
 - a. Install connector (1).



1. Connector
Figure 8-74. Jiffy Stand Sensor Connector



1. Cable strap (2)
2. Screw
3. Sensor
Figure 8-75. Jiffy Stand Sensor

COMPLETE

1. Install left radiator cover. See SIDE COVERS (Page 3-46).
2. Install left side chin spoiler. See CHIN SPOILER (Page 3-69).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove motorcycle from upright. See Secure the Motorcycle for Service (Page 2-2).

PREPARE

1. Purge fuel system. See PURGE FUEL LINE (Page 6-9).
2. Remove seat. See SEAT (Page 3-82).
3. Remove main fuse. See POWER DISCONNECT (Page 8-4).
4. Remove left side steering head covers. See SIDE COVERS (Page 3-46).
5. Remove fuel tank. See FUEL TANK (Page 6-12).
6. Remove air box. See AIR BOX (Page 6-3).

REMOVE**NOTE**

If needed, label each half of the remaining connectors on caddy.

1. See Figure 8-76. Disconnect head lamp (4) and IM (3) connectors.
2. See Figure 8-77. Disconnect LH electrical connectors and cut cable straps (5).
 - a. USB-C (3).
 - b. Left hand control (2).
 - c. Front left turn (1).
 - d. Fuel level sensor (7).
 - e. Harness from retainer (4) and (6).
3. See Figure 8-78. Disconnect RH electrical connectors.
 - a. Right front turn (9).
 - b. Air temperature sensor (1).
 - c. Front WSS (2).
 - d. Right hand controls (6).
 - e. Right hand controls (7).
 - f. Main fuse (4).
 - g. Harness from retainer (3).
4. See Figure 8-77. Remove LH scrivet (8).
5. See Figure 8-78. Remove RH scrivet (8) and front electrical caddy (5).

INSTALL

1. See Figure 8-77. Install front electrical caddy (9) and scrivet (8).
2. See Figure 8-78. Install scrivet (8).
3. See Figure 8-78. Connect RH electrical connectors.
 - a. Harness into guide (3).
 - b. Main fuse (4).
 - c. Right hand controls (7).
 - d. Right hand controls (6).
 - e. Front WSS (2).
 - f. Air temperature sensor (1).
 - g. Right front turn (9).
4. See Figure 8-77. Connect LH electrical connectors.
 - a. Harness into guide (4) and (6).
 - b. Fuel level sensor (7).
 - c. Front left turn (1).
 - d. Left hand control (2).
 - e. USB-C (3).
5. See Figure 8-76. Connect head lamp (4) and IM (3) connectors.

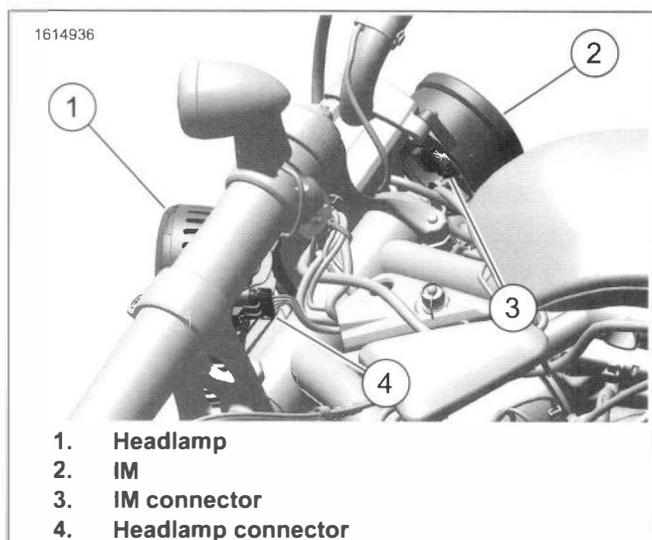
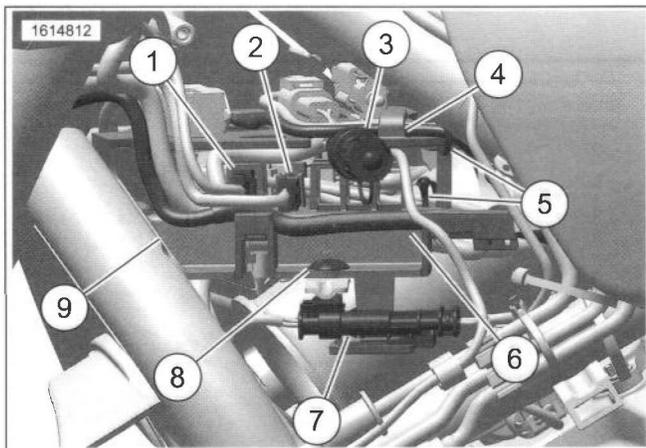
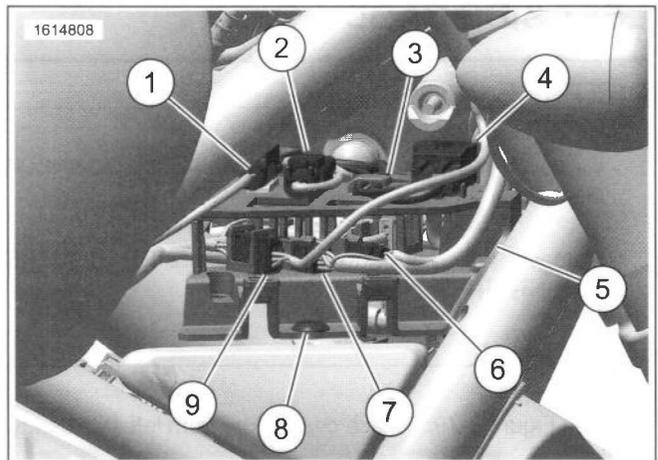


Figure 8-76. Headlamp and IM Connectors



1. Front left turn
2. Left hand control
3. USB-C
4. Harness retainer
5. Cable straps
6. Harness
7. Fuel level sensor
8. Scrivet
9. Steering head caddy

Figure 8-77. LH Caddy Connectors



1. Air temperature sensor
2. Front WSS
3. Harness retainer
4. Main fuse
5. Steering head caddy
6. Right hand controls
7. Right hand controls
8. Scrivet
9. Right front turn

Figure 8-78. RH Front Caddy Connectors

COMPLETE

1. Install air box. See AIR BOX (Page 6-3).
2. Install fuel tank. See FUEL TANK (Page 6-12).
3. Install seat. See SEAT (Page 3-82).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).
5. Install left side steering head cover. See SIDE COVERS (Page 3-46).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove left rear side cover. See SIDE COVERS (Page 3-46).

REMOVE

1. See Figure 8-79. Detach connectors from left side caddy.
 - a. PAC relay (2).
 - b. Fuse block (3).
 - c. Hydraulic hose from retainer (4).
 - d. Rear lighting (5).
2. See Figure 8-80. Remove screw (2).
3. Rotate left side caddy (1) and release caddy locking tab (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|------------------------|--------------|-------------|
| Caddy, left side screw | 25–29 in-lbs | 2.8–3.3 N·m |

1. See Figure 8-80. Position left side caddy, install screw. Tighten.
Torque: 25–29 in-lbs (2.8–3.3 N·m) *Caddy, left side screw*
2. See Figure 8-79. Connect connectors:
 - a. Rear lighting (5).
 - b. Hydraulic hose into retainer (4).
 - c. Fuse block (3).
 - d. PAC relay (2).

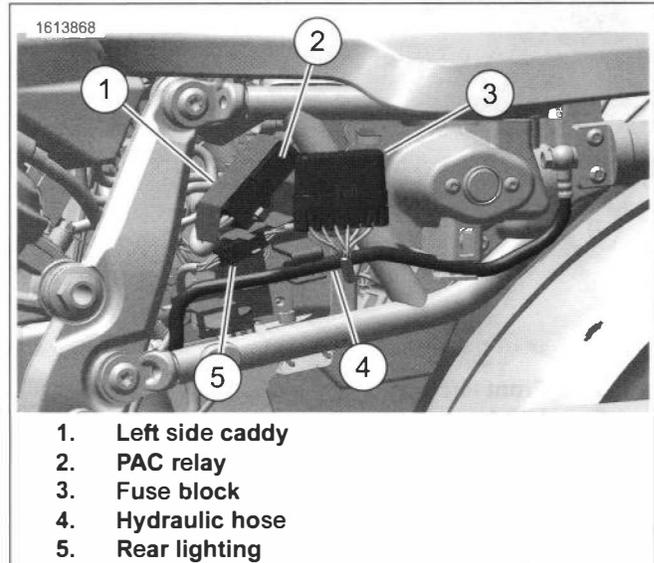


Figure 8-79. Left Side Caddy View

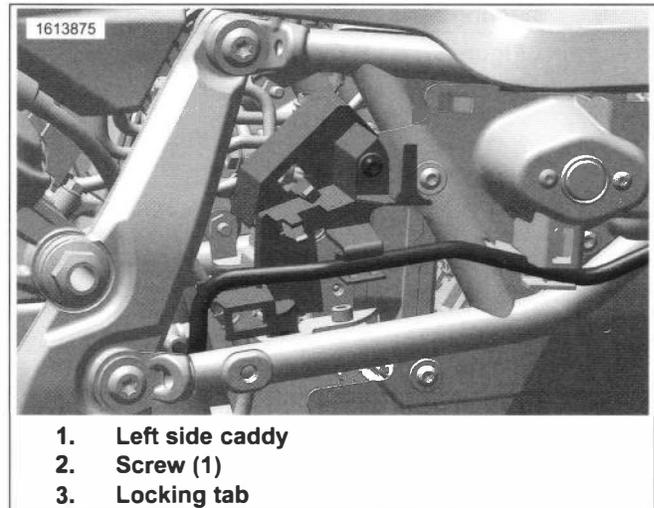


Figure 8-80. Left Side Caddy

COMPLETE

1. Install left rear side cover. See SIDE COVERS (Page 3-46).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Purge fuel system. See PURGE FUEL LINE (Page 6-9).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Remove seat. See SEAT (Page 3-82).
4. Remove seat lock bracket. See SEAT (Page 3-82).
5. Remove middle side covers (2). See SIDE COVERS (Page 3-46).
6. Remove fuel tank. See FUEL TANK (Page 6-12).

REMOVE

1. See Figure 8-81. Remove screw (4).
2. Remove cable straps (2) and discard.
3. Remove screws (3).
4. Remove cylinder head cover caddy.

INSTALL

| FASTENER | TORQUE VALUE | |
|----------------------------------|--------------|---------|
| Brake line clamp screws | 62–80 in-lbs | 7–9 N·m |
| Cylinder head cover caddy screws | 35–62 in-lbs | 4–7 N·m |

1. See Figure 8-81. Install cylinder head cover caddy (1).
2. Install screws (3). Tighten.
Torque: 35–62 in-lbs (4–7 N·m) *Cylinder head cover caddy screws*

3. Install screw (4). Tighten.
Torque: 62–80 in-lbs (7–9 N·m) *Brake line clamp screws*
4. Install new cable straps (2).

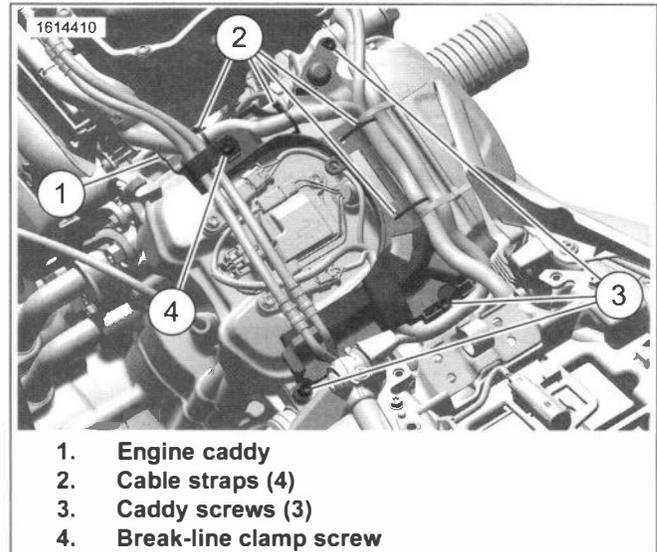


Figure 8-81. Cylinder Head Cover Caddy

COMPLETE

1. Install fuel tank. See FUEL TANK (Page 6-12).
2. Install side covers. See SIDE COVERS (Page 3-46).
3. Install seat lock bracket. See SEAT (Page 3-82).
4. Install seat. See SEAT (Page 3-82).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove cowl and rear fenders. See COWL AND REAR FENDERS (Page 3-68).
4. Remove muffler assembly. See MUFFLERS (Page 6-33).
5. Remove under seat caddy. See UNDER SEAT CADDY (Page 8-55).
6. Remove BCM. See BODY CONTROL MODULE (BCM) (Page 8-34).

REMOVE

1. See Figure 8-82. Remove screws (1).
2. Remove BCM caddy (2).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------|--------------|---------|
| Under seat caddy screws | 35-62 in-lbs | 4-7 N·m |

1. Install BCM caddy.
2. See Figure 8-82. Position BCM caddy, install screws. Tighten.
Torque: 35-62 in-lbs (4-7 N·m) *Under seat caddy screws*

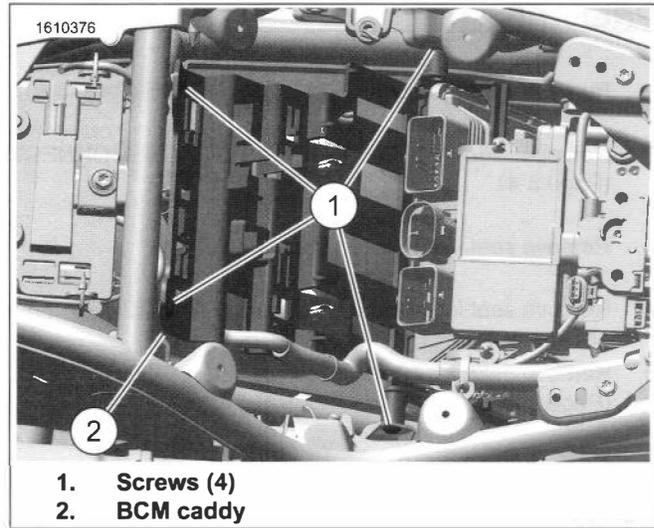


Figure 8-82. BCM Caddy

COMPLETE

1. Install BCM. See BODY CONTROL MODULE (BCM) (Page 8-34).
2. Install under seat caddy. See UNDER SEAT CADDY (Page 8-55).
3. Install muffler assembly. See MUFFLERS (Page 6-33).
4. Install cowl and rear fenders. See COWL AND REAR FENDERS (Page 3-68).
5. Install seat. See SEAT (Page 3-82).
6. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove seat lock bracket. See SEAT (Page 3-82).

REMOVE

1. See Figure 8-83. Detach connectors from under seat caddy.
 - a. Heated gear (2).
 - b. Post HO2S (4) (if equipped).
 - c. DLC (5).
 - d. Battery tender (6).
2. Remove screws (1).
3. Remove under seat caddy (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------|--------------|---------|
| Under seat caddy screws | 35–62 in-lbs | 4–7 N·m |

1. Install under seat caddy.
2. See Figure 8-83. Position under seat caddy, install screws. Tighten.
Torque: 35–62 in-lbs (4–7 N·m) *Under seat caddy screws*

3. Attach connectors to under seat caddy.
 - a. Battery tender (6).
 - b. DLC (5).
 - c. Post HO2S (4) (if equipped).
 - d. Heated gear (2).

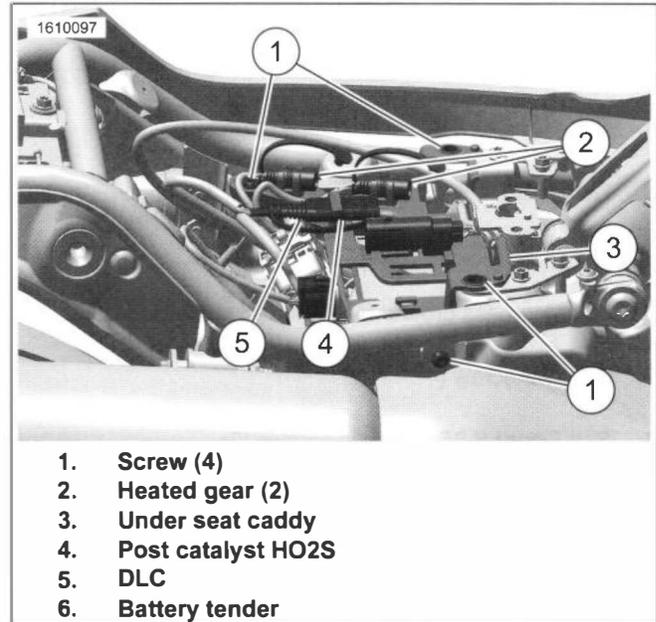


Figure 8-83. Under Seat Caddy

COMPLETE

1. Install seat lock bracket. See SEAT (Page 3-82).
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove seat. See SEAT (Page 3-82).
3. Remove rear fender cowl. See COWL AND REAR FENDERS (Page 3-68).

REMOVE

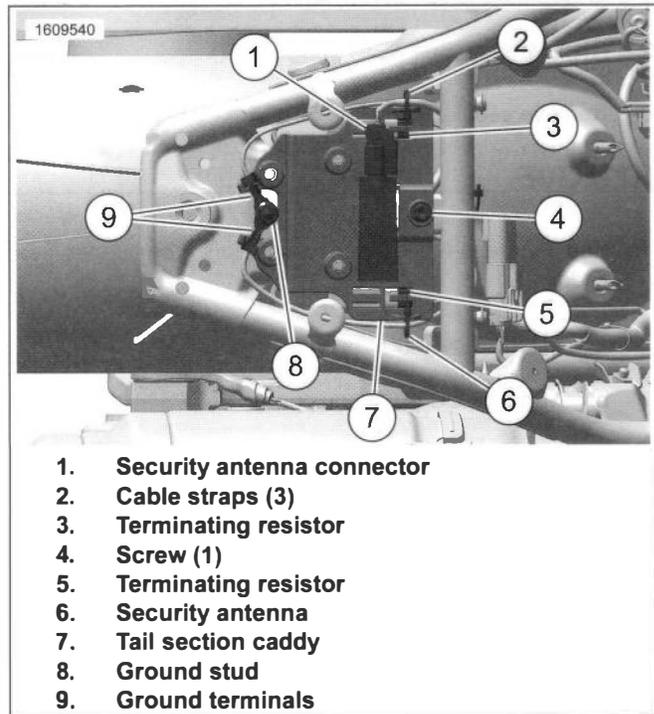
1. See Figure 8-84. Discard cable straps (2).
2. Detach connectors from tail section caddy.
 - a. Security antenna (1).
 - b. Harness ground fastener and terminals (8, 9).
3. Remove screw (4).
4. See Figure 8-85. Remove screws (2).
5. Remove tail section caddy (1).
6. See Figure 8-84. Disconnect connectors:
 - a. Terminating resistor (3).
 - b. Terminating resistor (5).

INSTALL

| FASTENER | TORQUE VALUE | |
|---------------------------|--------------|-------------|
| Harness ground fastener | 60–72 in-lbs | 6.8–8.1 N·m |
| Tail section caddy screws | 35–62 in-lbs | 4–7 N·m |

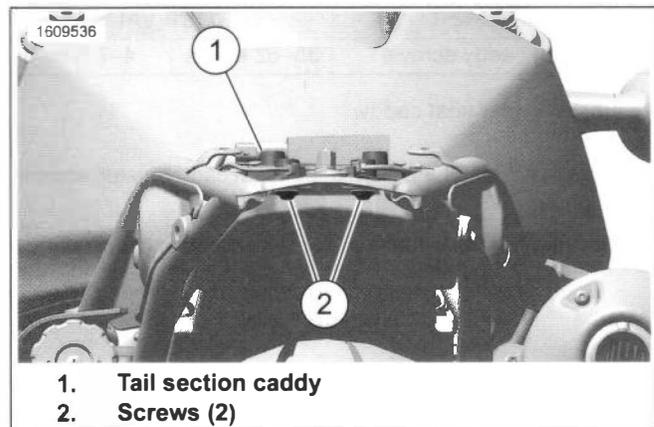
1. See Figure 8-84. Attach connectors to tail section caddy.
 - a. Terminating resistor (3).
 - b. Terminating resistor (5).
2. Install tail section caddy.
3. See Figure 8-85. Position tail section caddy, install screws. Tighten.
Torque: 35–62 in-lbs (4–7 N·m) *Tail section caddy screws*
4. See Figure 8-84. Install screw. Tighten.
5. Attach connectors to tail section caddy.
 - a. Harness ground terminals and fastener (8, 9). Tighten.
Torque: 60–72 in-lbs (6.8–8.1 N·m) *Harness ground fastener*

- b. Security antenna (1).
6. Install new cable straps (2).



1. Security antenna connector
2. Cable straps (3)
3. Terminating resistor
4. Screw (1)
5. Terminating resistor
6. Security antenna
7. Tail section caddy
8. Ground stud
9. Ground terminals

Figure 8-84. Tail Section Caddy



1. Tail section caddy
2. Screws (2)

Figure 8-85. Tail Section Caddy Screws

COMPLETE

1. Install rear fender cowl. See COWL AND REAR FENDERS (Page 3-68).
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
3. Remove voltage regulator and bracket. See VOLTAGE REGULATOR (Page 8-12).
4. Remove battery. See INSPECT BATTERY (Page 2-37).
5. Remove coolant overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).
6. Remove charcoal canister (if equipped). See CHARCOAL CANISTER: EVAPORATIVE EMISSIONS (Page 6-37).
7. Remove purge solenoid (if equipped). See PURGE LINES: EVAPORATIVE EMISSIONS (Page 6-38).
8. Remove left and right side footrest bracket. See RIDER FOOTRESTS (Page 3-77).

REMOVE

1. See Figure 8-86. Remove EVAP lines (1) from clip (2) (if equipped).
2. Remove wire harnesses from retainer (3).
3. Remove battery tray.
 - a. See Figure 8-87. Remove screws (2).
 - b. Remove battery tray (3).

INSTALL

| FASTENER | TORQUE VALUE | |
|--------------------|--------------|-----------|
| Battery tray screw | 18–21 ft-lbs | 25–28 N·m |

1. Install battery tray.
 - a. See Figure 8-87. Install battery tray (3) on support tabs (1).
 - b. Install screws (2). Tighten.
Torque: 18–21 ft-lbs (25–28 N·m) *Battery tray screw*
2. Install wire harnesses from retainer (3).
3. See Figure 8-86. Attach EVAP lines (1) to clip (2) (if equipped).

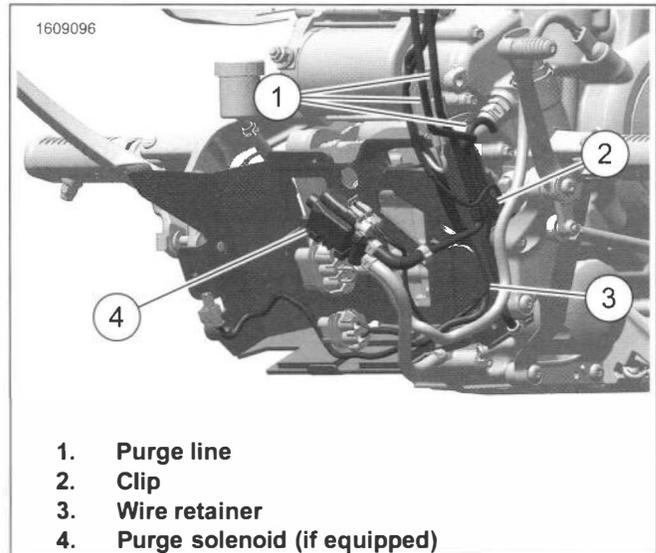


Figure 8-86. Battery Tray Mounting Clips

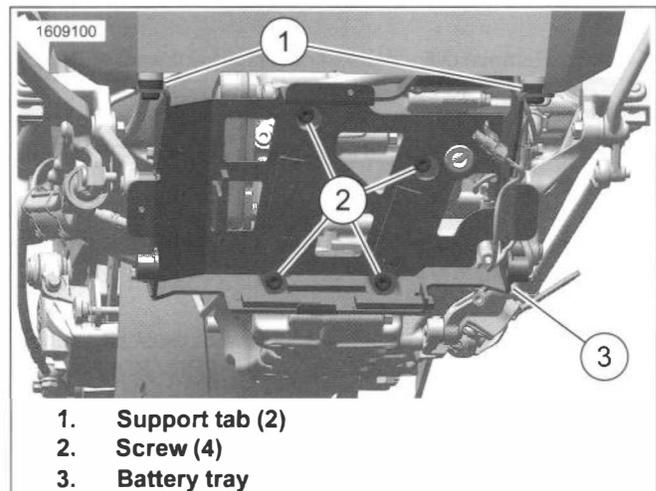


Figure 8-87. Battery Tray

COMPLETE

1. Install left and right side footrest bracket. See RIDER FOOTRESTS (Page 3-77).
2. Install purge solenoid (if equipped). See PURGE SOLENOID: EVAPORATIVE EMISSIONS (Page 6-36).
3. Install charcoal canister (if equipped). See CHARCOAL CANISTER: EVAPORATIVE EMISSIONS (Page 6-37).
4. Install coolant overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).
5. Install battery. See INSPECT BATTERY (Page 2-37).
6. Install voltage regulator bracket and voltage regulator. See VOLTAGE REGULATOR (Page 8-12).
7. Install chin spoiler. See CHIN SPOILER (Page 3-69).
8. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

1. Remove seat. See SEAT (Page 3-82).
2. Remove seat lock bracket. See SEAT (Page 3-82).
3. Purge fuel system. See PURGE FUEL LINE (Page 6-9).
4. Remove main fuse. See POWER DISCONNECT (Page 8-4).
5. Remove fuel tank. See FUEL TANK (Page 6-12).
6. Removing front cylinder VVT harness:
 - a. Remove air box assembly. See AIR BOX (Page 6-3).
7. Removing rear cylinder VVT harness:
 - a. Remove cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
8. Remove head-mounted ignition coil. See IGNITION COIL (Page 8-15).
9. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
10. Remove camshaft phaser solenoids with camshaft solenoid plate as an assembly. See PHASER SOLENOIDS (Page 4-22).

REMOVE

1. See Figure 8-88. Remove screws (1).
2. Remove cylinder head cover (2).
 - a. Route VVT harness (3) up through cylinder head (4).
3. Grasp VVT harness upper grommet and pull to detach it from cylinder head cover.

INSTALL

| FASTENER | TORQUE VALUE | |
|-------------------------------|--------------|-------------|
| Camshaft solenoid plate nut | 62–80 in-lbs | 7–9 N·m |
| Camshaft solenoid plate screw | 62–80 in-lbs | 7–9 N·m |
| Cylinder head cover screws | 63–77 in-lbs | 7.1–8.7 N·m |

1. Lubricate grommets on new VVT harness with clean engine oil.
2. See Figure 8-88. Route VVT harness (3) up through hole in cylinder head cover (2).
3. Grasp upper harness grommet and gently pull until it pops into place in cover.

NOTE

- Do not pull on VVT harness wires or connectors when installing the VVT harness.
 - See Figure 8-89. Make sure grommet's sealing ring (2) is not visible.
4. See Figure 8-88. Install new ignition coil gasket (5) to cylinder head (4).
 5. Install cylinder head cover.
 - a. Clean groove in cover (2) from all residual oil and debris.
 - b. Install new cover gasket (6) to cover.
 - c. Install cover with screws (1). Tighten.
Torque: 63–77 in-lbs (7.1–8.7 N·m) *Cylinder head cover screws*
 6. See Figure 8-90. Route VVT harness through camshaft solenoid plate (1).
 7. Install camshaft solenoid plate into cylinder head.
 8. Secure camshaft solenoid plate.
 - a. Install screw (2).
 - b. Install nuts (9).
 - c. Tighten screw.
Torque: 62–80 in-lbs (7–9 N·m) *Camshaft solenoid plate screw*
 - d. Tighten nuts.
Torque: 62–80 in-lbs (7–9 N·m) *Camshaft solenoid plate nut*

NOTE

- See Figure 8-90. Make sure wires between solenoid connectors (7, 8) and harness lower grommet (6) do not rub on edge of plate or get pinched by cam cover, once installed.
- Make sure VVT harness, routed through cylinder head, does not interfere with moving parts. Do not allow harness to twist.

9. Secure wire harness grommets (6) to camshaft solenoid plate (1).
10. Connect solenoid connectors:
 - a. Connector with black wires (7) to front phaser solenoid.
 - b. Connector with gray wires (8) to rear phaser solenoid.
 - c. Verify wiring will not rub on other components.

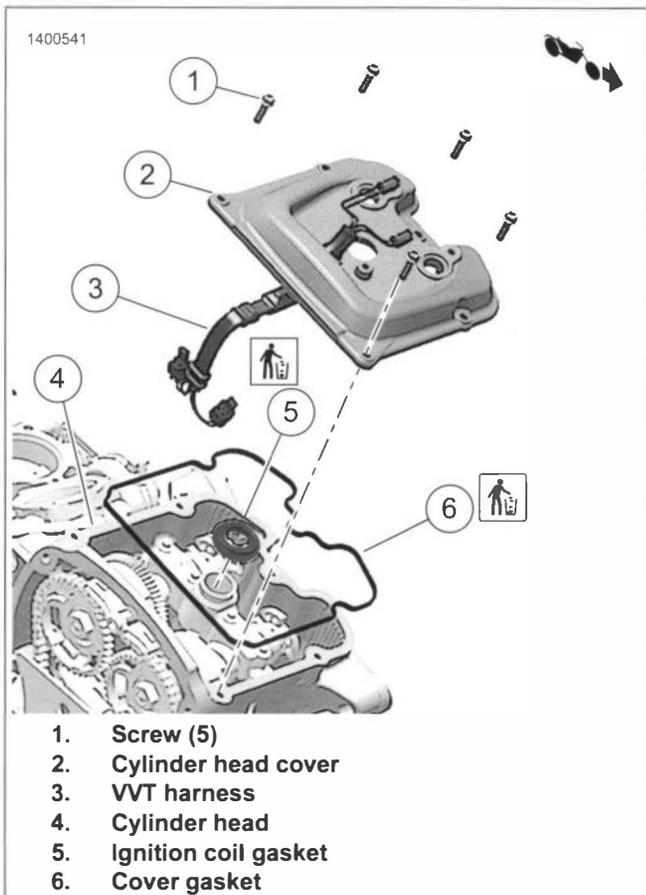


Figure 8-88. Cylinder Head Cover

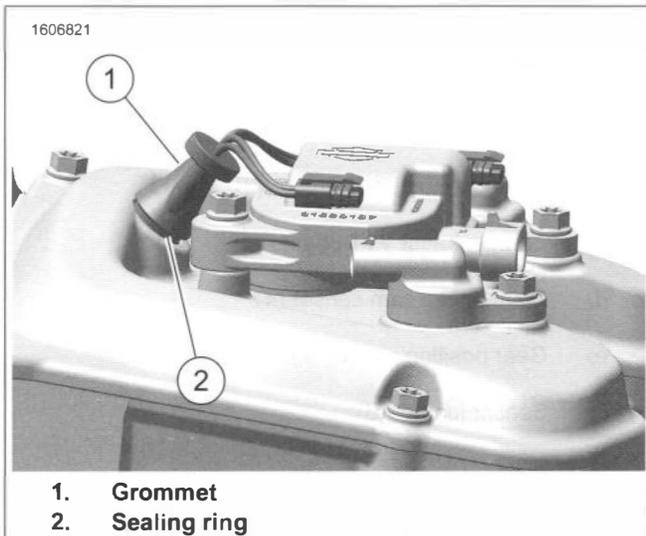


Figure 8-89. Phaser Harness Upper Grommet

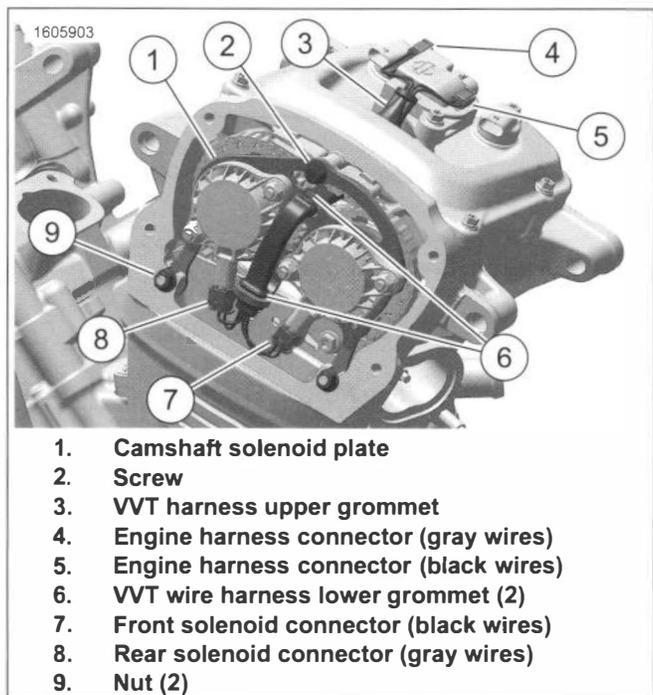


Figure 8-90. Phaser Harness and Camshaft Solenoid Plate
COMPLETE

1. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
2. Install head-mounted ignition coil. See IGNITION COIL (Page 8-15).
3. If rear cylinder VVT harness replaced:
 - a. Install cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
4. If front cylinder VVT harness replaced:
 - a. Install air box assembly. See AIR BOX (Page 6-3).
5. Install fuel tank. See FUEL TANK (Page 6-12).
6. Install main fuse. See POWER DISCONNECT (Page 8-4).
7. Install seat lock bracket. See SEAT (Page 3-82).
8. Install seat. See SEAT (Page 3-82).

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
 2. Remove seat. See SEAT (Page 3-82).
 3. Remove seat lock bracket. See SEAT (Page 3-82).
 4. Purge fuel system. See PURGE FUEL LINE (Page 6-9).
 5. Remove fuel tank. See FUEL TANK (Page 6-12).
 6. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
 7. Remove right side valley cover. See SIDE COVERS (Page 3-46).
 8. Unbolt radiator. Do not disconnect hoses. See RADIATOR (Page 7-17).
 9. Remove output belt cover. See BELT GUARDS (Page 3-60).
 10. Remove air box assembly. See AIR BOX (Page 6-3).
 11. Remove side mount ignition coil and bracket. See IGNITION COIL (Page 8-15).
 12. Remove induction module. See INDUCTION MODULE (Page 6-26).
 13. Cover cylinder head intake ports with shop towels.
 14. Remove rear cylinder head electrical caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
- b. Front HO2S (3).
 - c. Rear HO2S (4).
5. See Figure 8-93. Disconnect connectors:
 - a. AAT sensor (1).
 - b. RHCM (2).
 - c. RHCM (3).
 - d. Right turn signal (4).
 6. Pull radiator forward as far as hoses allow.
 7. See Figure 8-94. Cut and discard cable straps (5).
 8. Disconnect connectors:
 - a. Cooling fan (2).
 - b. JSS (3).
 - c. CKP (4).
 - d. Purge solenoid (6) (if equipped).
 9. See Figure 8-95. Cut and discard cable straps (6).
 10. Disconnect connectors:
 - a. Fuel level sender (1).
 - b. Front exhaust cam sensor (2).
 - c. Front exhaust VVT phaser (3).
 - d. Front intake cam sensor (4).
 - e. Gear position sensor (7).
 - f. Sensor jumper (8).
 - g. ECM (10).
 - h. Front intake VVT phaser (12).
 - i. Front ignition coil (13).

REMOVE

1. See Figure 8-91. Cut and discard cable straps (6).
 2. Disconnect connectors:
 - a. Rear exhaust cam sensor (7).
 - b. Rear intake cam sensor (3).
 - c. Rear exhaust VVT phaser (1).
 - d. Rear intake VVT phaser (5).
 - e. Rear ignition coil (single) (2).
 - f. Post catalyst HO2S (International models) (8).
 3. See Figure 8-92. Cut and discard cable straps (5).
 4. Disconnect connectors:
 - a. Engine harness (1).
11. See Figure 8-96. Cut and discard cable straps (3).
 12. Remove mid engine caddy bracket (2) with engine harness from motorcycle.

INSTALL

1. See Figure 8-96. Lay mid engine caddy bracket (2) with engine harness on motorcycle. Route harness sections to their proper locations.

2. See Figure 8-95. Connect connectors:

- a. Fuel level sender (1).
- b. Front exhaust cam sensor (2).
- c. Front exhaust VVT phaser (3).
- d. Front intake cam sensor (4).
- e. Gear position sensor (7).
- f. Sensor jumper (8).
- g. ECM (10).
- h. Front intake VVT phaser (12).
- i. Front ignition coil (13).

3. Install new cable straps (6).

4. See Figure 8-94. Connect connectors:

- a. Cooling fan (2).
- b. JSS (3).
- c. CKP (4).
- d. Purge solenoid (6) (if equipped).

5. Install new cable straps (5).

6. Install radiator.

7. See Figure 8-93. Connect connectors:

- a. AAT sensor (1).
- b. RHCM (2).
- c. RHCM (3).
- d. Right turn signal (4).

8. See Figure 8-92. Connect connectors:

- a. Engine harness (1).
- b. Front HO2S (3).
- c. Rear HO2S (4).

9. Install new cable straps (5).

10. See Figure 8-91. Connect connectors:

- a. Rear exhaust cam sensor (7).
- b. Rear intake cam sensor (3).
- c. Rear exhaust VVT phaser (1).
- d. Rear intake VVT phaser (5).

e. Rear ignition coil (single) (2).

f. Post catalyst HO2S (International models) (8).

11. See Figure 8-96. Attach mid engine caddy bracket (2) and engine harness to motorcycle with new cable straps (3).

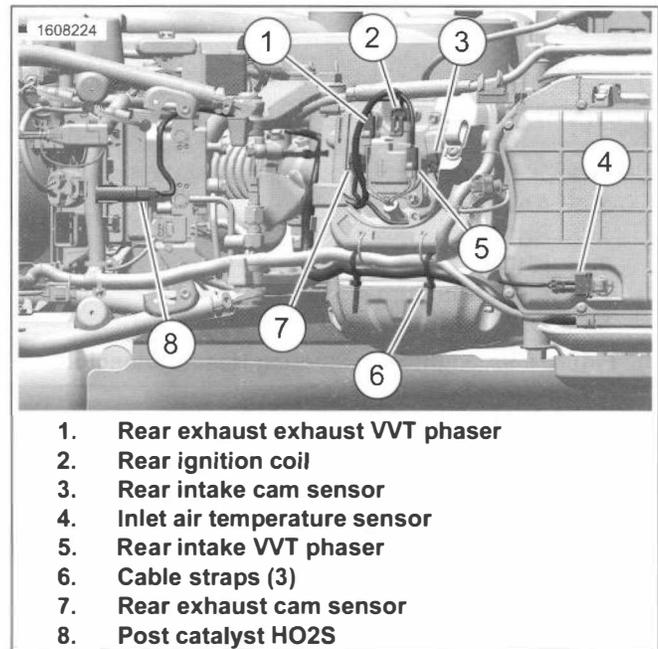


Figure 8-91. Under Seat Connectors

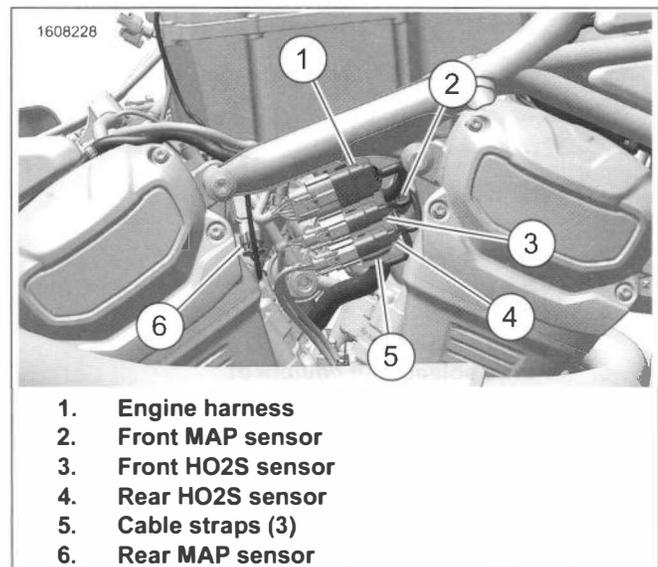
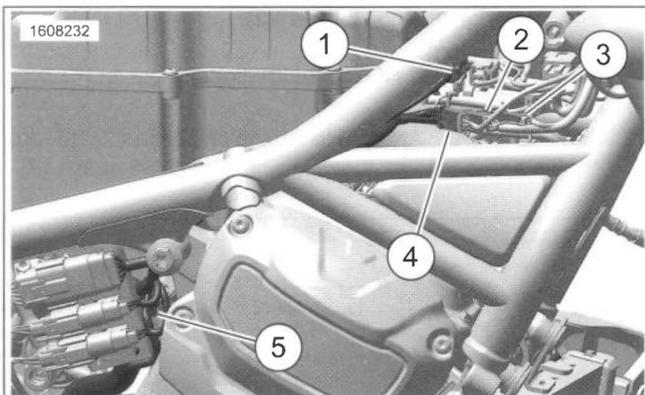
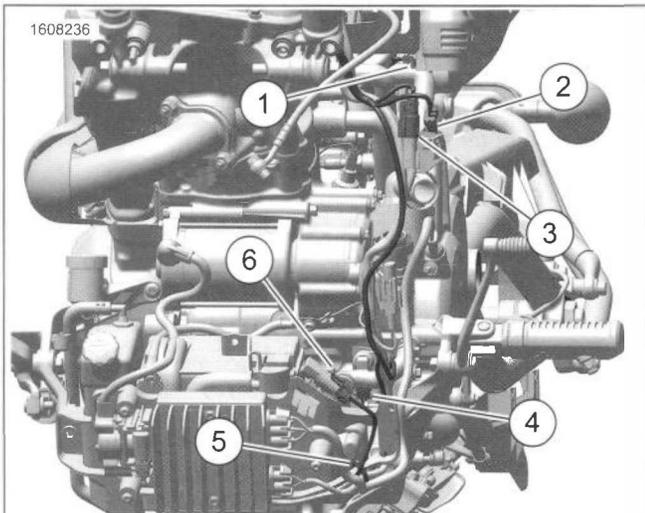


Figure 8-92. Right Side Engine Harness Connectors



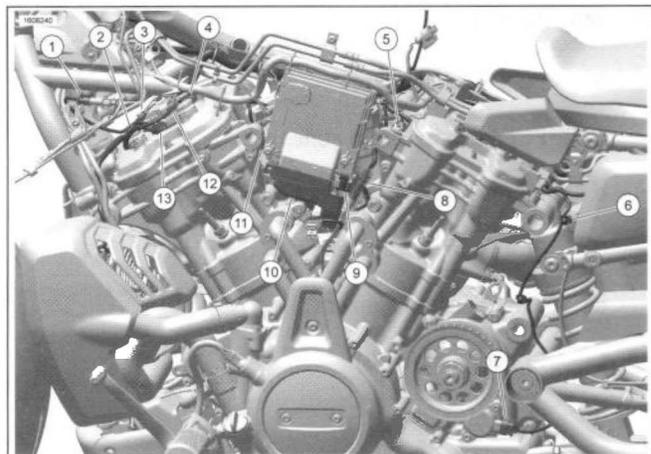
1. AAT sensor
2. RHCM
3. RHCM
4. Right front turn signal
5. TPS

Figure 8-93. Right Side Steering Head Connectors



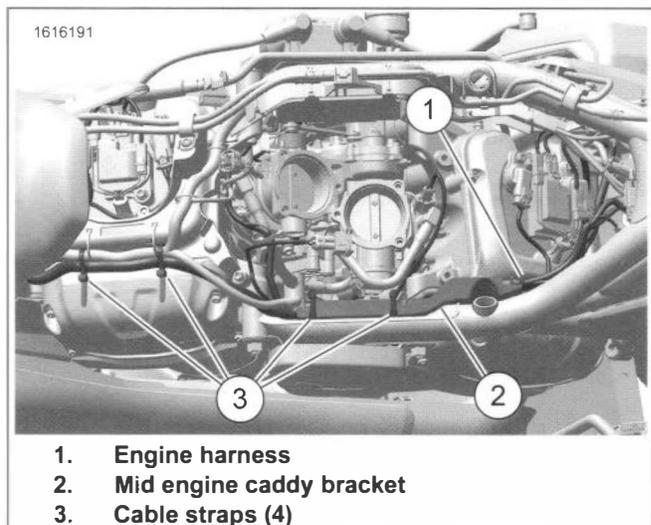
1. Block coil
2. Cooling fan
3. JSS
4. CKP
5. Cable straps (1)
6. Purge solenoid (if equipped)

Figure 8-94. Front Engine Connectors



1. Fuel level sender
2. Front exhaust cam sensor
3. Front exhaust VVT phaser
4. Front intake cam sensor
5. Rear fuel injector
6. Cable straps (2)
7. Gear position sensor
8. Sensor jumper
9. TCA
10. ECM
11. Front fuel injector
12. Front intake VVT phaser
13. Front ignition coil

Figure 8-95. Left Side Engine Connectors



1. Engine harness
2. Mid engine caddy bracket
3. Cable straps (4)

Figure 8-96. Mid Engine Caddy Bracket

COMPLETE

1. Remove shop towels from cylinder head intake ports.
2. Install induction module. See INDUCTION MODULE (Page 6-26).
3. Install rear cylinder head electrical caddy. See CYLINDER HEAD COVER CADDY (Page 8-53)
4. Install side mount ignition coil and bracket. See IGNITION COIL (Page 8-15).
5. Install air box assembly. See AIR BOX (Page 6-3).
6. Install output belt cover. See BELT GUARDS (Page 3-60).

7. Install radiator. See RADIATOR (Page 7-17).
8. Install chin spoiler. See CHIN SPOILER (Page 3-69).
9. Install seat lock bracket. See SEAT (Page 3-82).
10. Install fuel tank. See FUEL TANK (Page 6-12).
11. Install main fuse. See POWER DISCONNECT (Page 8-4).
12. Install right side valley cover. See SIDE COVERS (Page 3-46).
13. Install seat. See SEAT (Page 3-82).

PREPARE

1. Remove left side steering head cover. See SIDE COVERS (Page 3-46).
2. Remove main fuse. See POWER DISCONNECT (Page 8-4).
3. Purge fuel system. See PURGE FUEL LINE (Page 6-9).
4. Remove right side valley cover. See SIDE COVERS (Page 3-46).
5. Remove seat. See SEAT (Page 3-82).
6. Remove seat lock bracket. See SEAT (Page 3-82).
7. Remove fuel tank. See FUEL TANK (Page 6-12).
8. Remove air box. See AIR BOX (Page 6-3).
9. Remove chin spoiler. See CHIN SPOILER (Page 3-69).
10. Remove battery. See INSPECT BATTERY (Page 2-37).
11. Remove radiator covers. See SIDE COVERS (Page 3-46).
12. Remove upper radiator screws. See RADIATOR (Page 7-17).
13. Remove voltage regulator. See VOLTAGE REGULATOR (Page 8-12).

REMOVE

1. See Figure 8-97. Discard cable straps (9).
2. Detach connectors from under seat.
 - a. Heated gear (1, 2).
 - b. Battery tender (3).
 - c. Post catalyst HO2S (if equipped) (4).
 - d. Rear brake switch (5).
 - e. ABS module (6).
 - f. Security siren (7).
 - g. Rear WSS (8).
 - h. BCM power (9).
 - i. DLC (11).
 - j. BCM (12).
 - k. PAC (13).

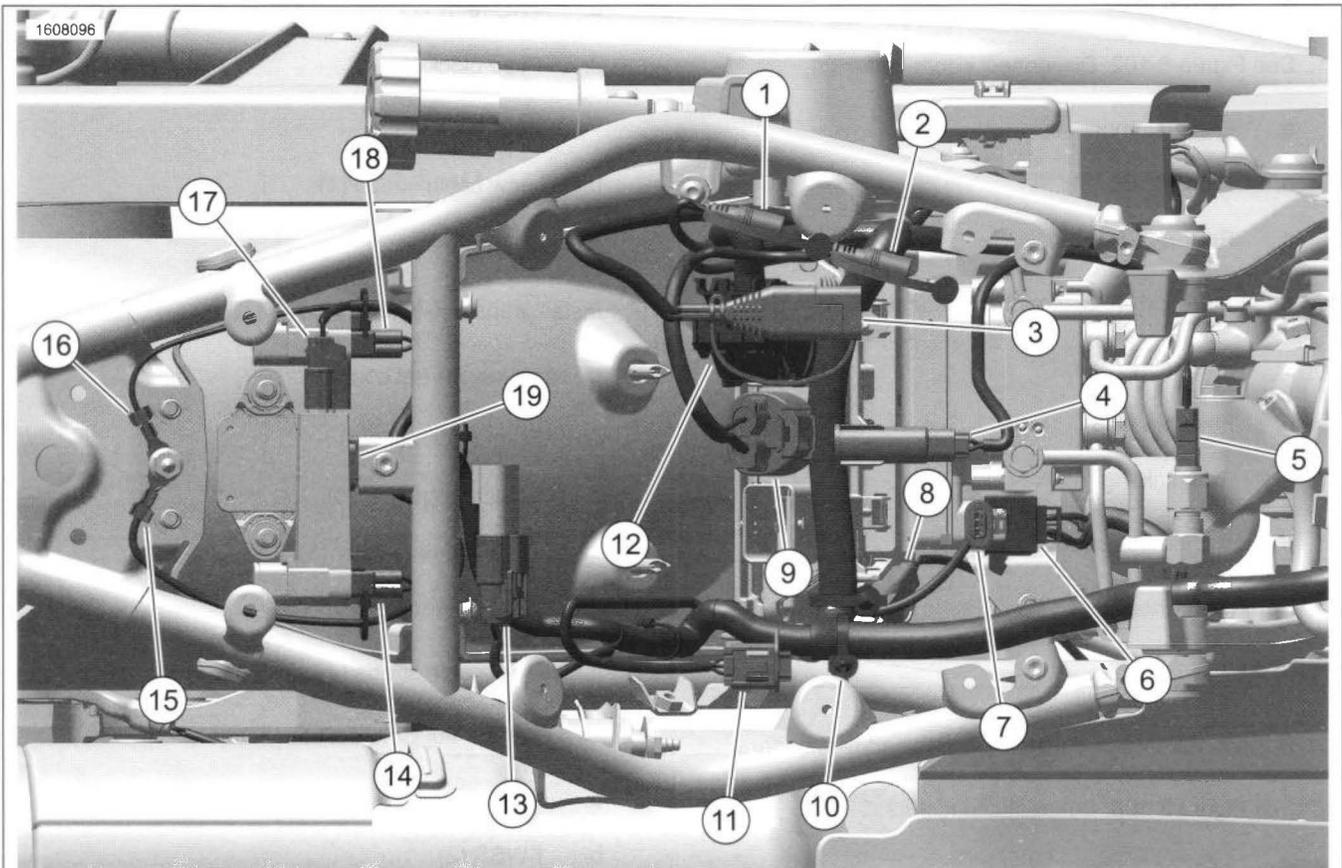
- l. Terminating resistor (14).
 - m. Ground 2 (15).
 - n. Ground 1 (16).
 - o. Security antenna (17).
 - p. Terminating resistor (18).
 - q. IMU (19).
3. See Figure 8-98. Disconnect connectors.
 - a. AAT sensor (1).
 - b. FWSS (2).
 - c. Main fuse (4).
 - d. RHCM (6).
 - e. RHCM (7).
 - f. Right front turn signal (9).
 4. See Figure 8-99. Discard cable straps (4).
 5. Remove ground screw (7).
 6. Disconnect lower front connectors.
 - a. Starter solenoid (6).
 - b. Voltage regulator (5).
 - c. Terminating resistor (3).
 - d. Horn (1) and (2).
 7. See Figure 8-100. Discard cable straps (4).
 8. Disconnect connectors.
 - a. IM (1).
 - b. Headlamp (7).
 - c. PAC relay (2).
 - d. Fuse block (3).
 - e. Rear lighting (5).
 9. See Figure 8-101. Discard cable straps (5).
 10. Disconnect connectors.
 - a. Front turn signal (1).
 - b. LHCM (2).
 - c. USB-C (3).

- d. Wire harness from retainer (4).
 - e. Wire harness from retainer (6).
 - f. Fuel level sender (7).
 - g. Scrivet (8).
11. See Figure 8-102. Disconnect connectors.
 - a. Engine jumper (1).
 - b. Front HO2S (3).
 - c. Rear HO2S (4).
 12. See Figure 8-103. Disconnect connectors.
 - a. PAC relay (2).
 - b. Fuse block (3).
 - c. Rear lighting (5).
 13. Remove harness caddy fasteners.
 14. Remove harness.
6. See Figure 8-100. Connect connectors.
 - a. IM (1).
 - b. Headlamp (7).
 - c. PAC relay (2).
 - d. Fuse block (3).
 - e. Rear lighting (5).
 7. Install new cable straps (4).
 8. See Figure 8-99.
 9. Install ground screw (7).
 10. Connect lower front connectors.
 - a. Starter solenoid (6).
 - b. Voltage regulator (5).
 - c. Terminating resistor (3).
 - d. Horn (1) and (2).

INSTALL

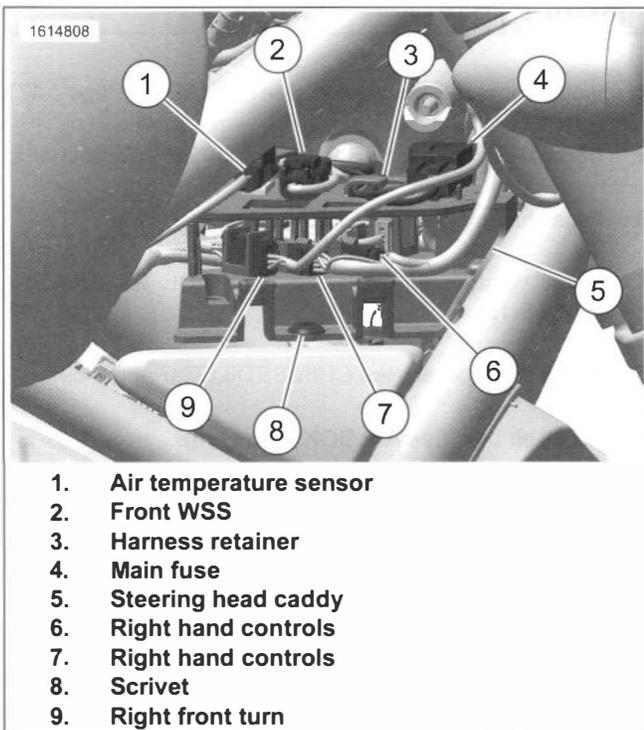
1. Position harness and install harness caddy fasteners.
2. See Figure 8-103. Connect connectors.
 - a. PAC relay (2).
 - b. Fuse block (3).
 - c. Rear lighting (5).
3. See Figure 8-102. Connect connectors.
 - a. Engine jumper (1).
 - b. Front HO2S (3).
 - c. Rear HO2S (4).
4. See Figure 8-101. Connect connectors.
 - a. Front turn signal (1).
 - b. LHCM (2).
 - c. USB-C (3).
 - d. Wire harness from retainer (4).
 - e. Wire harness from retainer (6).
 - f. Fuel level sender (7).
 - g. Scrivet (8).
5. Install new cable straps (5).
11. Install new cable straps (4).
12. See Figure 8-98. Connect connectors.
 - a. AAT sensor (1).
 - b. FWSS (2).
 - c. Main fuse (4).
 - d. RHCM (6).
 - e. RHCM (7).
 - f. Right front turn signal (9).
13. See Figure 8-97. Connectors under seat connectors.
 - a. Heated gear (1, 2).
 - b. Battery tender (3).
 - c. Rear brake switch (4).
 - d. ABS module (5).
 - e. Security siren (6).
 - f. Rear WSS (7).
 - g. BCM power (8).
 - h. DLC (10).
 - i. BCM (11).
 - j. PAC (12).
 - k. Terminating resistor (13).

- l. Ground 2 (14).
 - m. Ground 1 (15).
 - n. Security antenna (16).
 - o. Terminating resistor (17).
 - p. IMU (18).
14. Install new cable straps (9).



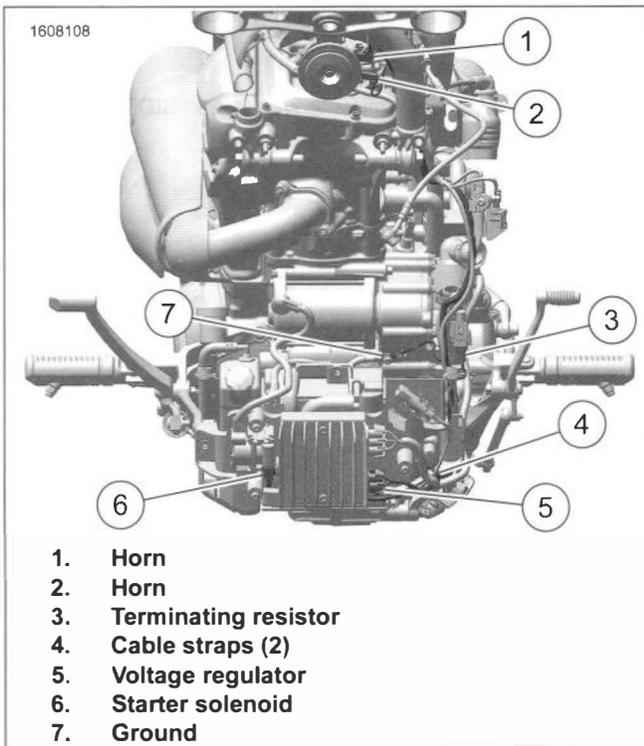
- | | |
|--------------------------|--------------------------|
| 1. Heated gear | 11. DLC |
| 2. Heated gear | 12. BCM |
| 3. Battery tender | 13. PAC |
| 4. Post catalyst HO2S | 14. Terminating resistor |
| 5. Rear stop lamp switch | 15. Ground 2 |
| 6. ABS module | 16. Ground 1 |
| 7. Security siren | 17. Security antenna |
| 8. Rear WSS | 18. Terminating resistor |
| 9. BCM power | 19. IMU |
| 10. Cable strap (6) | |

Figure 8-97. Under Seat Main Harness Connectors



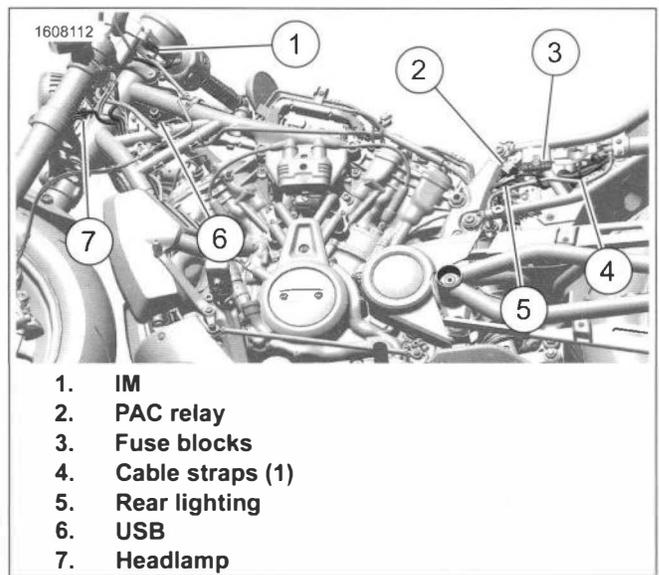
1. Air temperature sensor
2. Front WSS
3. Harness retainer
4. Main fuse
5. Steering head caddy
6. Right hand controls
7. Right hand controls
8. Scrivet
9. Right front turn

Figure 8-98. RH Front Caddy Connectors



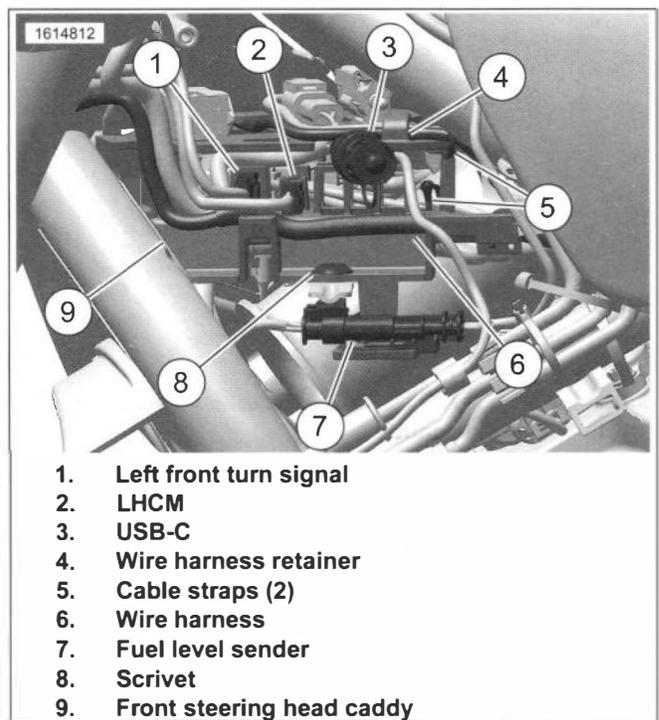
1. Horn
2. Horn
3. Terminating resistor
4. Cable straps (2)
5. Voltage regulator
6. Starter solenoid
7. Ground

Figure 8-99. Lower Front Connectors



1. IM
2. PAC relay
3. Fuse blocks
4. Cable straps (1)
5. Rear lighting
6. USB
7. Headlamp

Figure 8-100. Left Side Connectors



1. Left front turn signal
2. LHCM
3. USB-C
4. Wire harness retainer
5. Cable straps (2)
6. Wire harness
7. Fuel level sender
8. Scrivet
9. Front steering head caddy

Figure 8-101. Left Side Steering Head Connectors

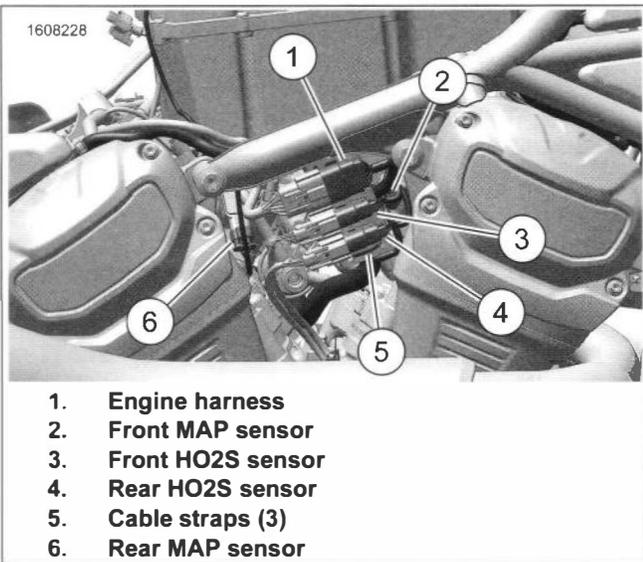


Figure 8-102. Right Side Engine Harness Connectors

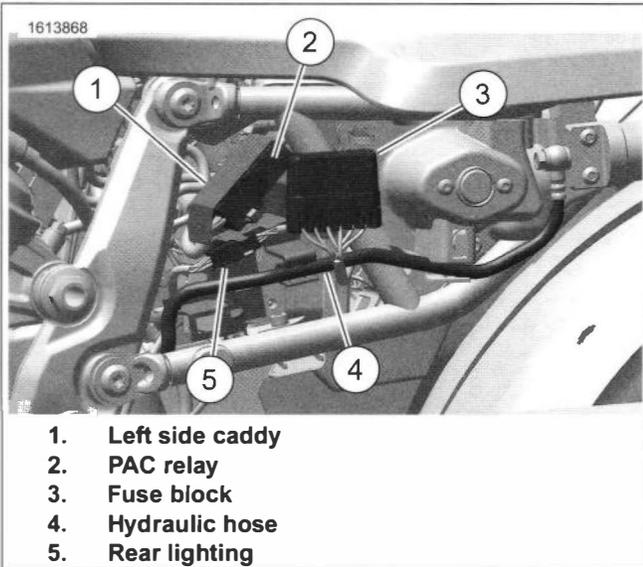


Figure 8-103. Left Side Caddy View

COMPLETE

1. Install upper radiator screws. See RADIATOR (Page 7-17).
2. Install radiator covers. See SIDE COVERS (Page 3-46).
3. Install battery. See INSPECT BATTERY (Page 2-37).
4. Install voltage regulator. See VOLTAGE REGULATOR (Page 8-12).
5. Install chin spoiler. See CHIN SPOILER (Page 3-69).
6. Install air box. See AIR BOX (Page 6-3).
7. Install fuel tank. See FUEL TANK (Page 6-12).
8. Install seat lock bracket. See SEAT (Page 3-82).
9. Install seat. See SEAT (Page 3-82).
10. Install main fuse. See POWER DISCONNECT (Page 8-4).
11. Install left and right side steering head cover. See SIDE COVERS (Page 3-46).
12. Install right side valley cover. See SIDE COVERS (Page 3-46).

| SUBJECT | PAGE NO. |
|----------------------------------|-----------------|
| A.1 WIRING DIAGRAMS..... | A-1 |
| A.2 WIRE HARNESS CONNECTORS..... | A-21 |

NOTES

GENERAL

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table A-1.

For Solid Color Wires: See Figure A-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 A-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.

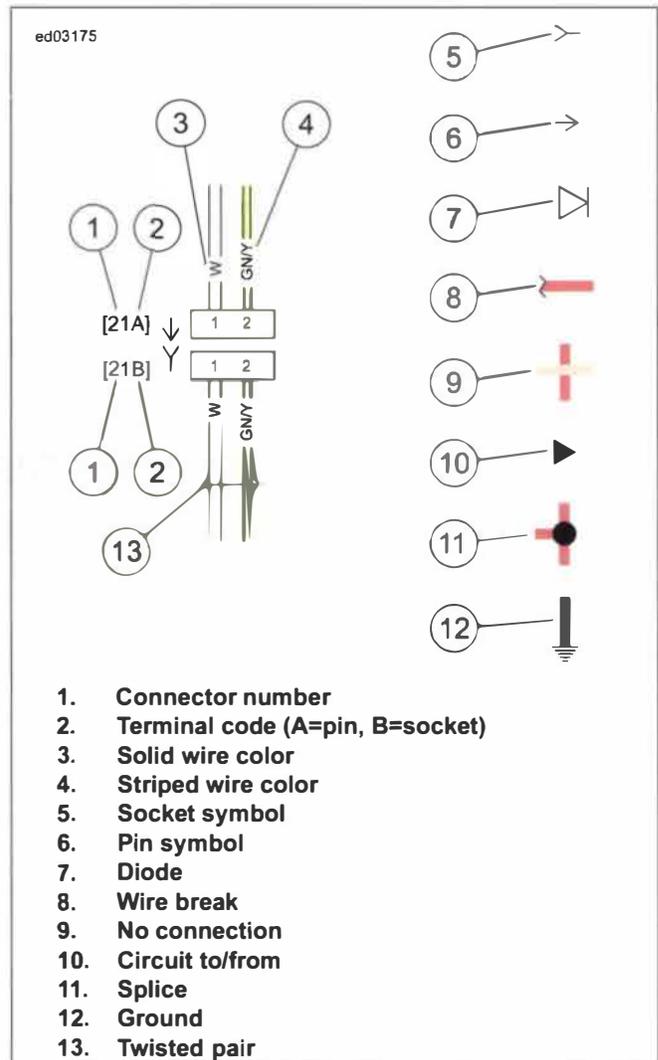


Figure A-1. Connector/Wiring Diagram Symbols

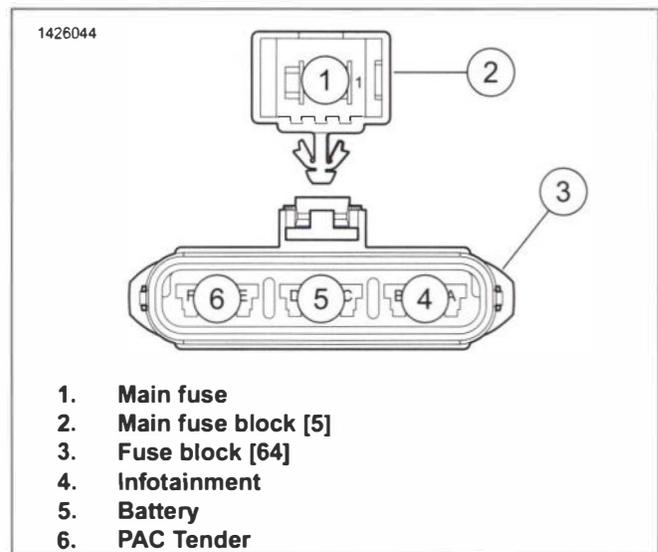


Figure A-2. Fuse Blocks and Socket Terminals

Table A-1. Wire Color Codes

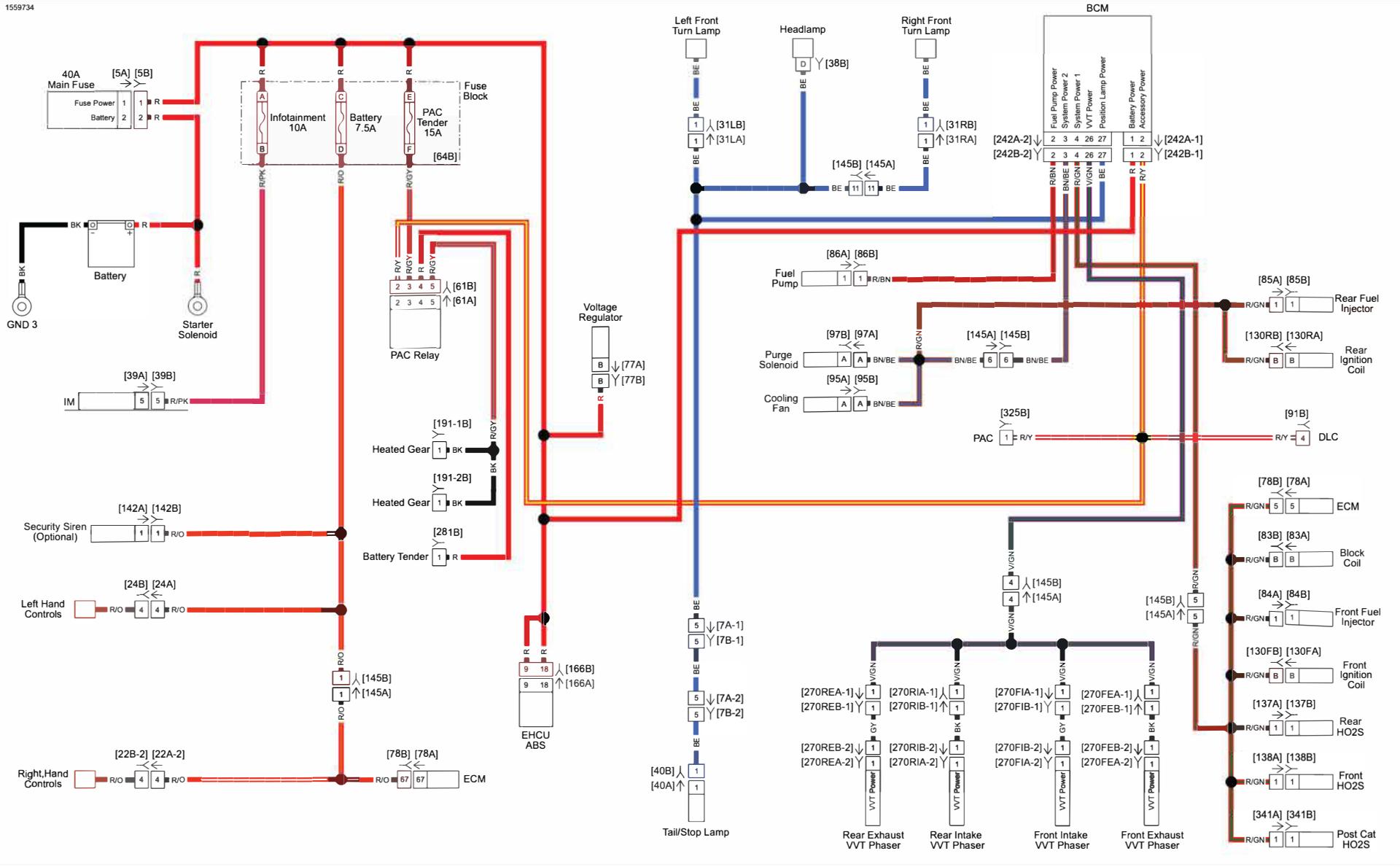
| ALPHA CODE | WIRE COLOR |
|------------|-------------|
| BE | Blue |
| BK | Black |
| BN | Brown |
| GN | Green |
| GY | Gray |
| LBE | Light Blue |
| LGN | Light Green |
| O | Orange |
| PK | Pink |
| R | Red |
| TN | Tan |
| V | Violet |
| W | White |
| Y | Yellow |

WIRING DIAGRAMS

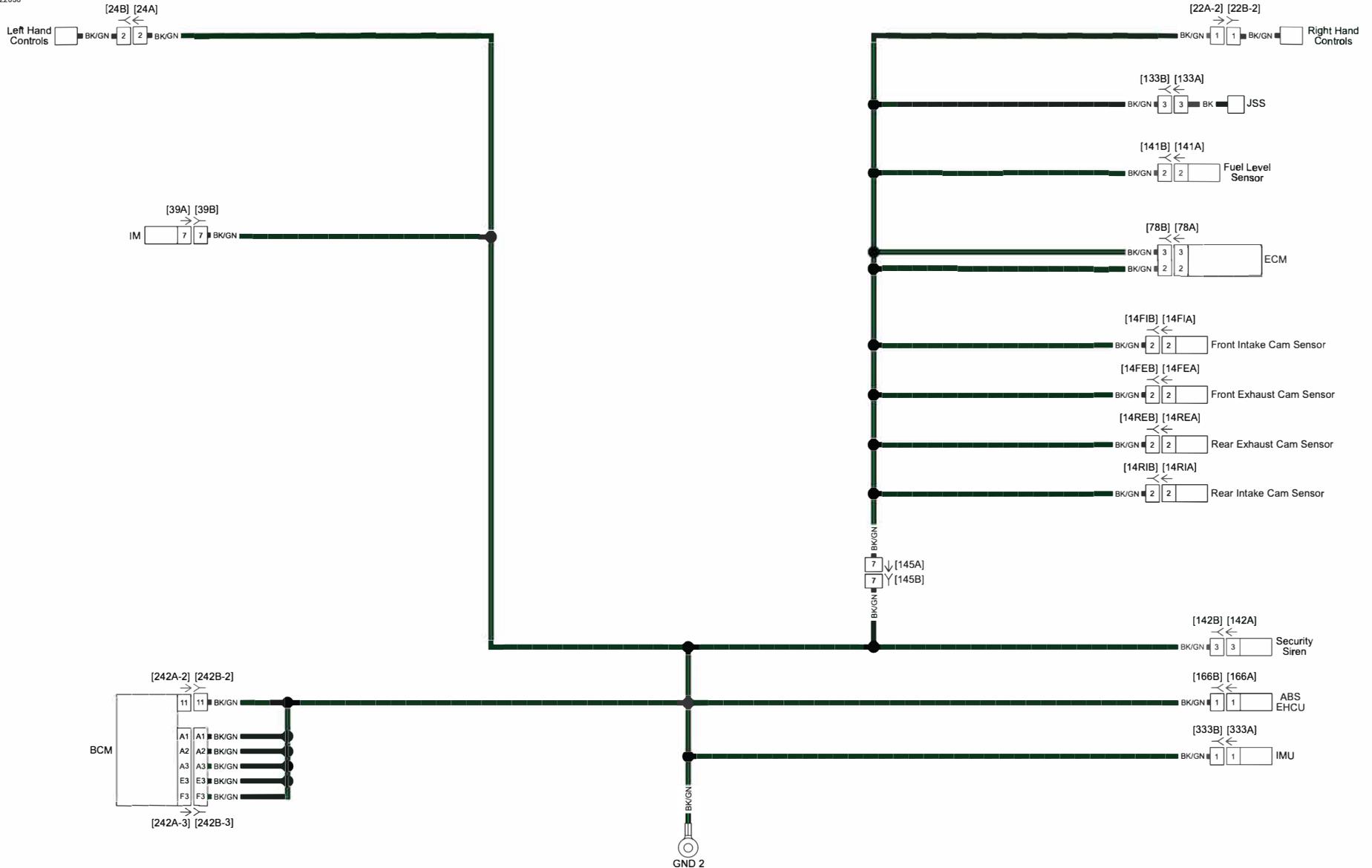
Refer to the table below for wiring diagram information.

WIRING DIAGRAM LIST

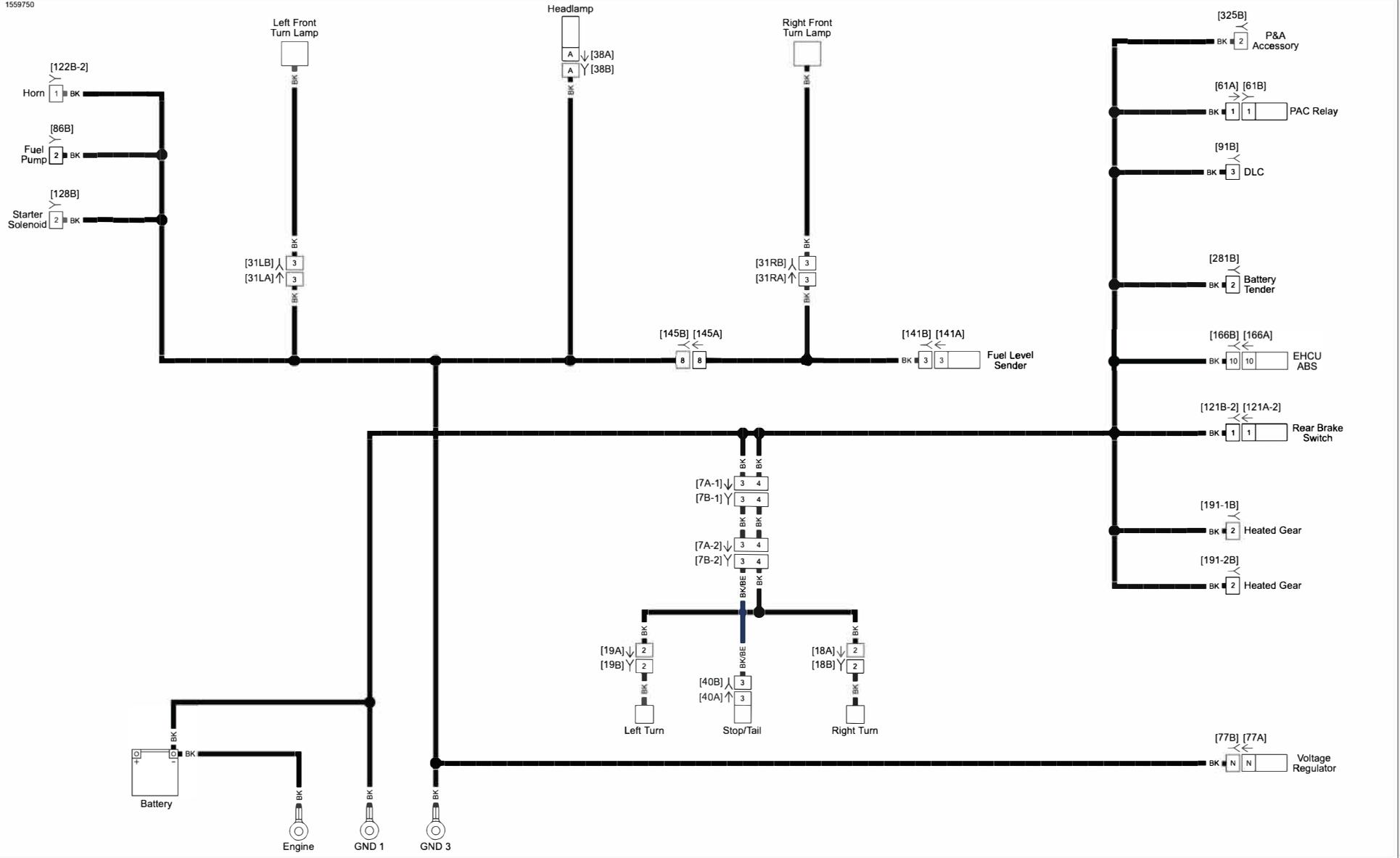
| FIGURE | NUMBER |
|--|--------------|
| Power Distribution: 2022 RH1250S | Figure A-3. |
| Sensor Grounds: 2022 RH1250S | Figure A-4. |
| Ground Circuit: 2022 RH1250S | Figure A-5. |
| Front Lighting and Hand Controls: 2022 RH1250S | Figure A-6. |
| Main Harness 1 of 2: 2022 RH1250S | Figure A-7. |
| Main Harness 2 of 2: 2022 RH1250S | Figure A-8. |
| Engine Harness 1 of 2: 2022 RH1250S | Figure A-9. |
| Engine Harness 2 of 2: 2022 RH1250S | Figure A-10. |
| Rear Lighting: 2022 RH1250S | Figure A-11. |



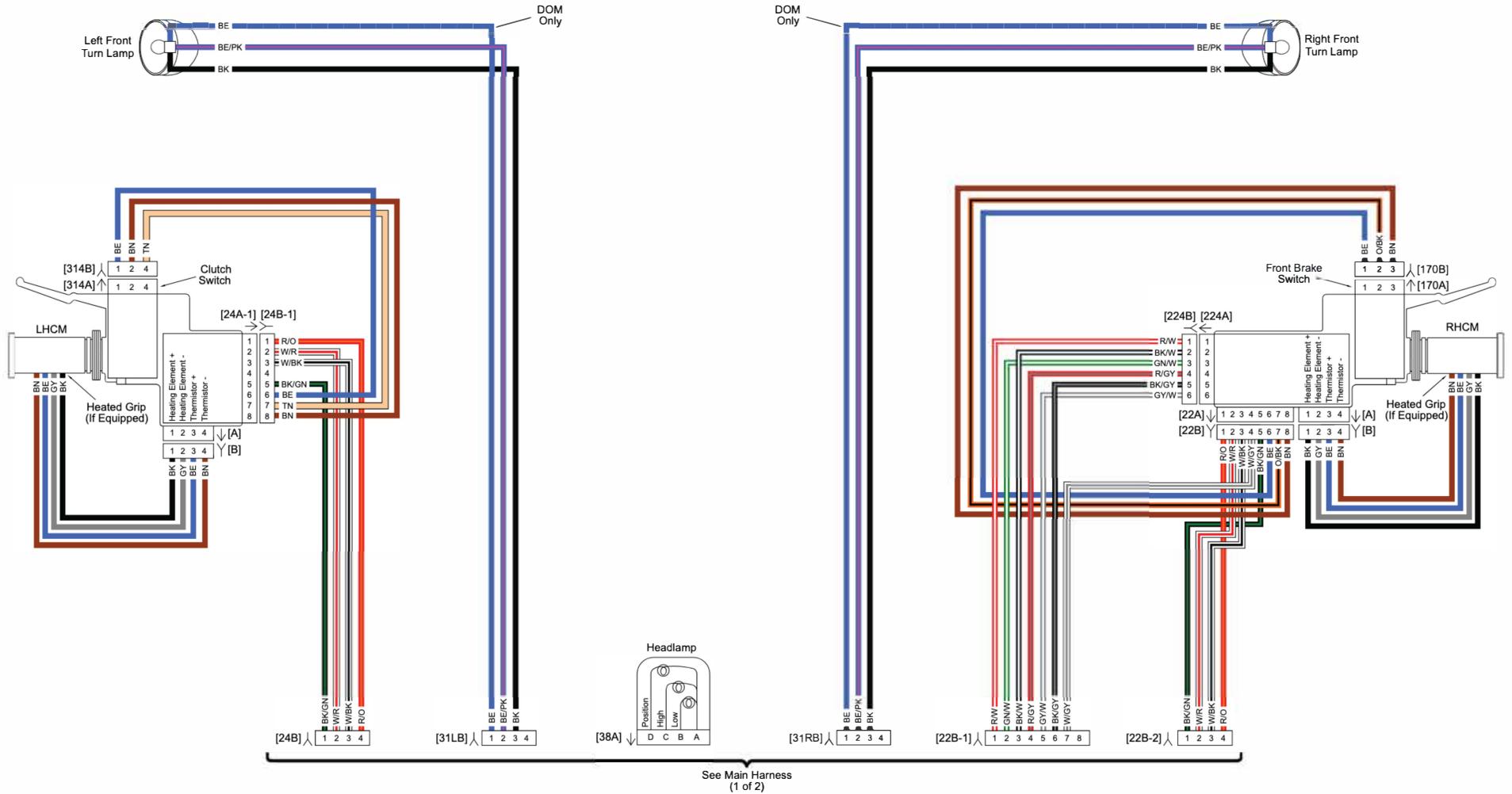
Power Distribution: 2022 RH1250S



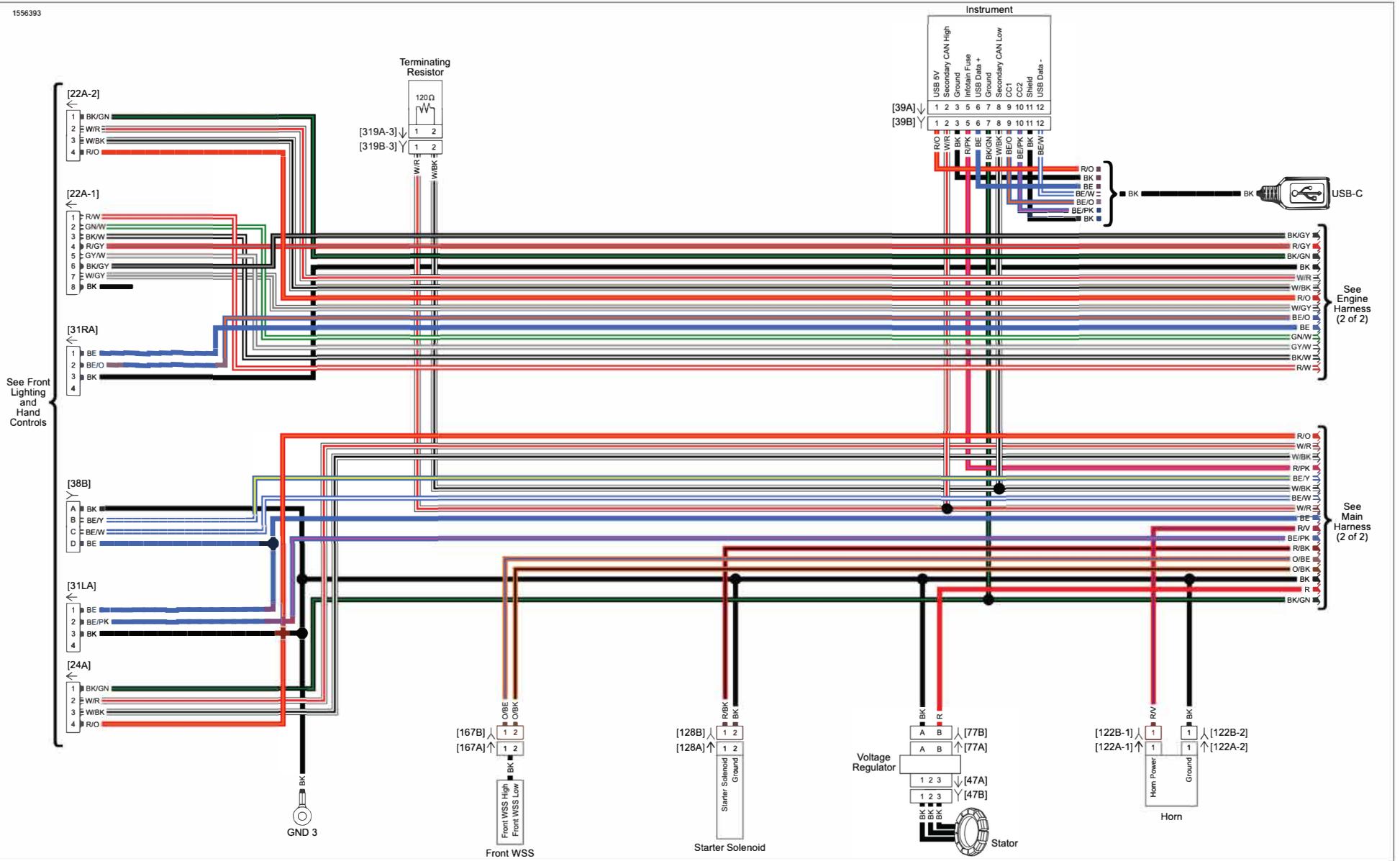
Sensor Grounds: 2022 RH1250S



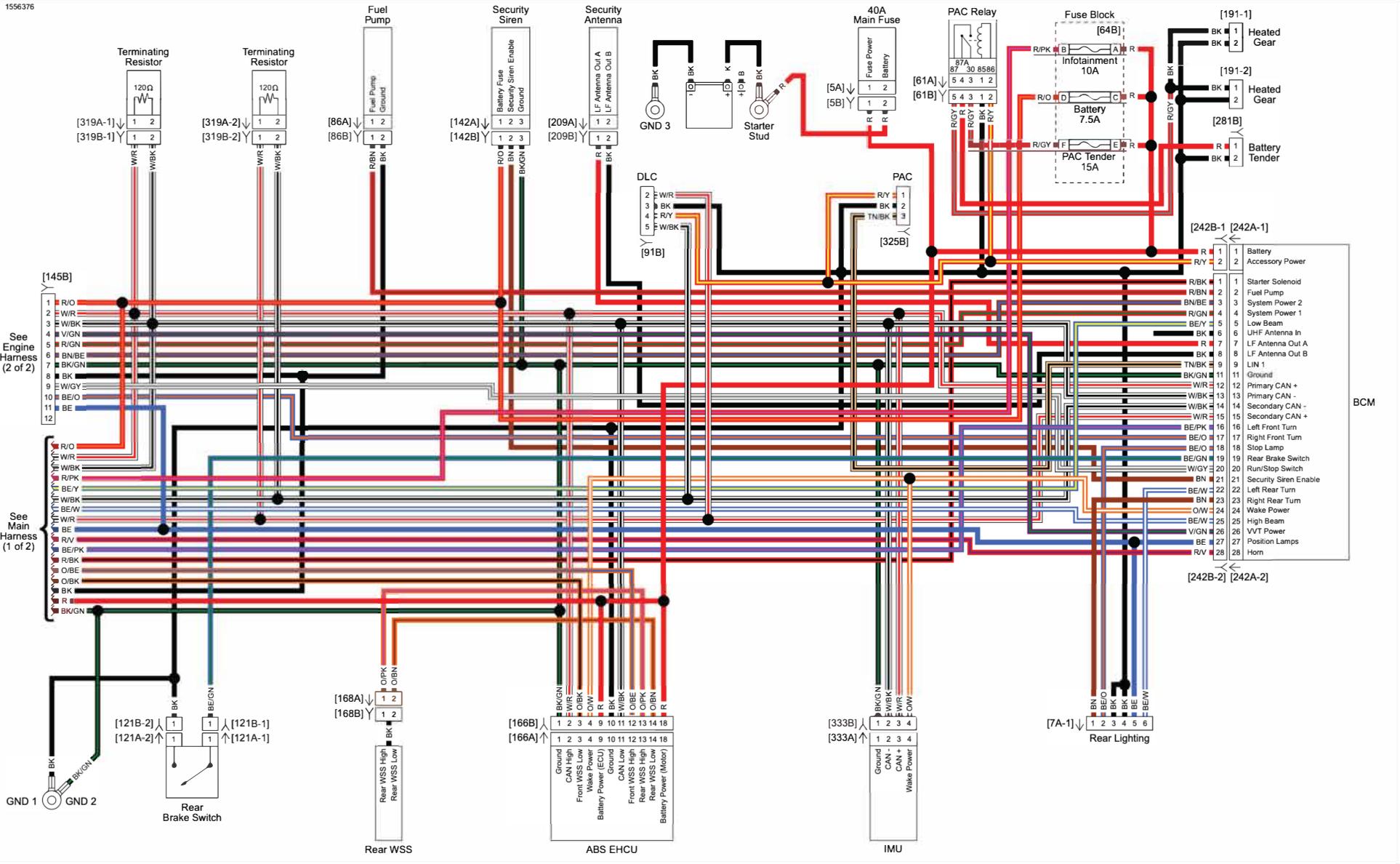
Ground Circuit: 2022 RH1250S



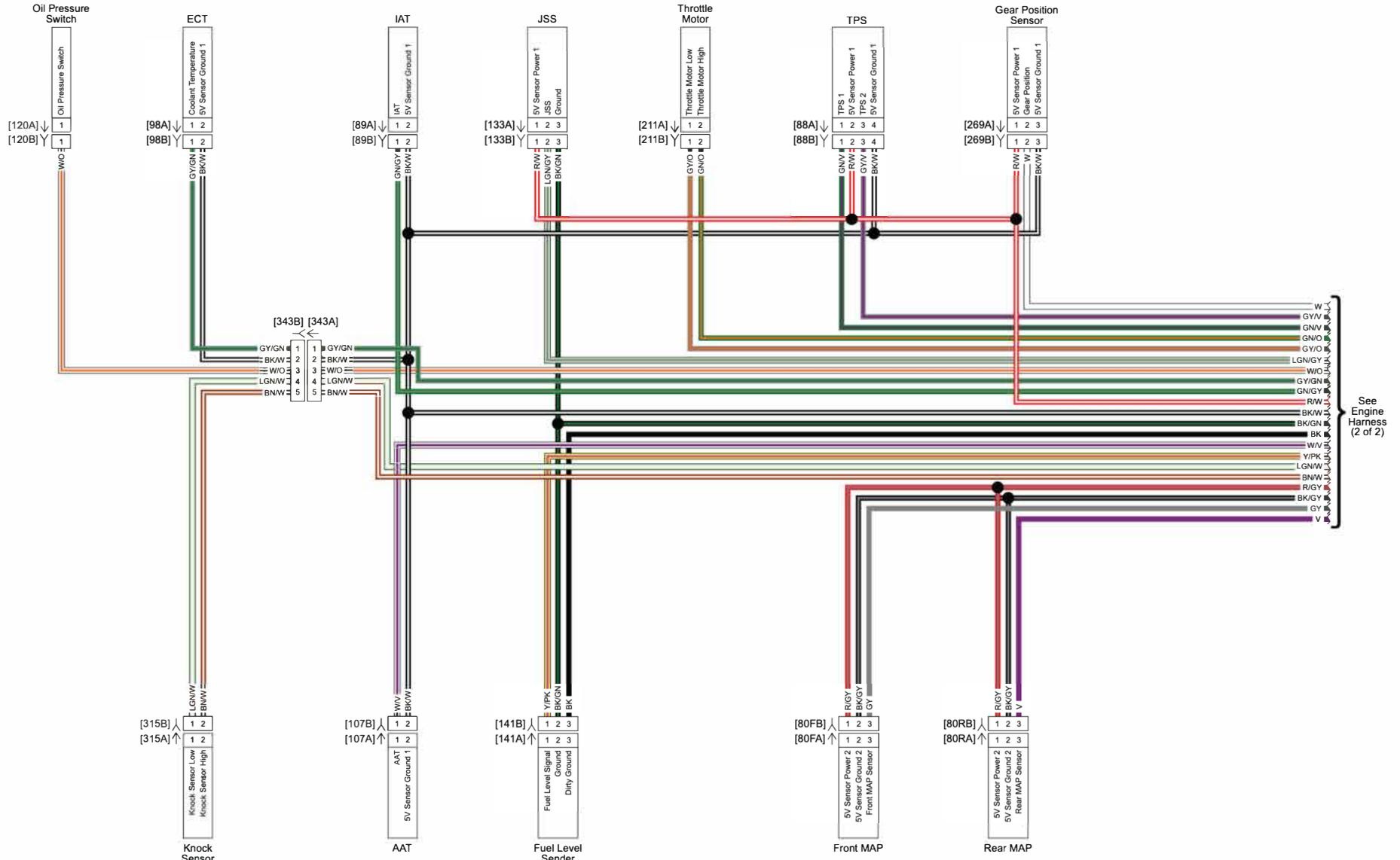
Front Lighting and Hand Controls: 2022 RH1250S



Main Harness 1 of 2: 2022 RH1250S

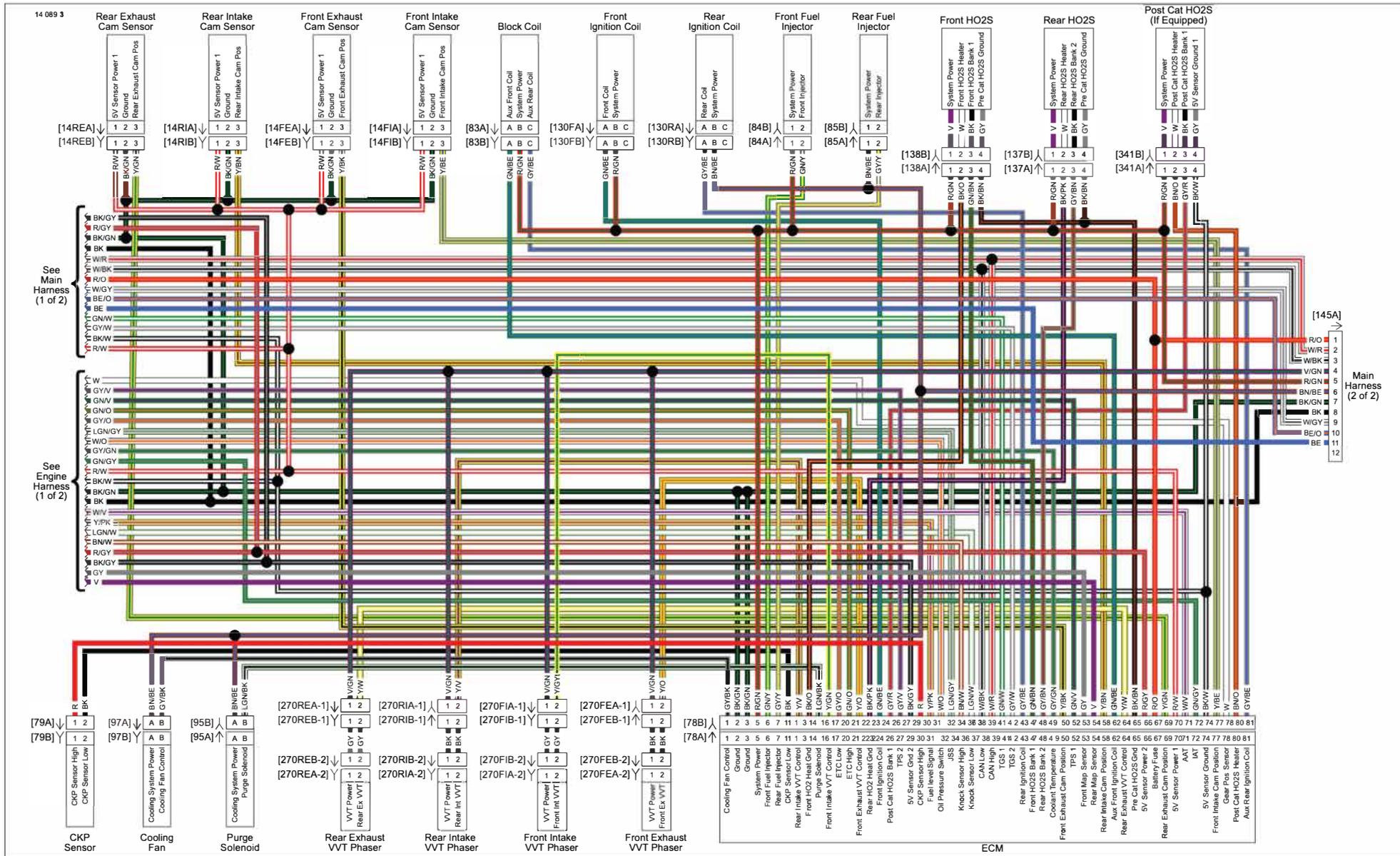


Main Harness 2 of 2: 2022 RH1250S



See Engine Harness (2 of 2)

Engine Harness 1 of 2: 2022 RH1250S

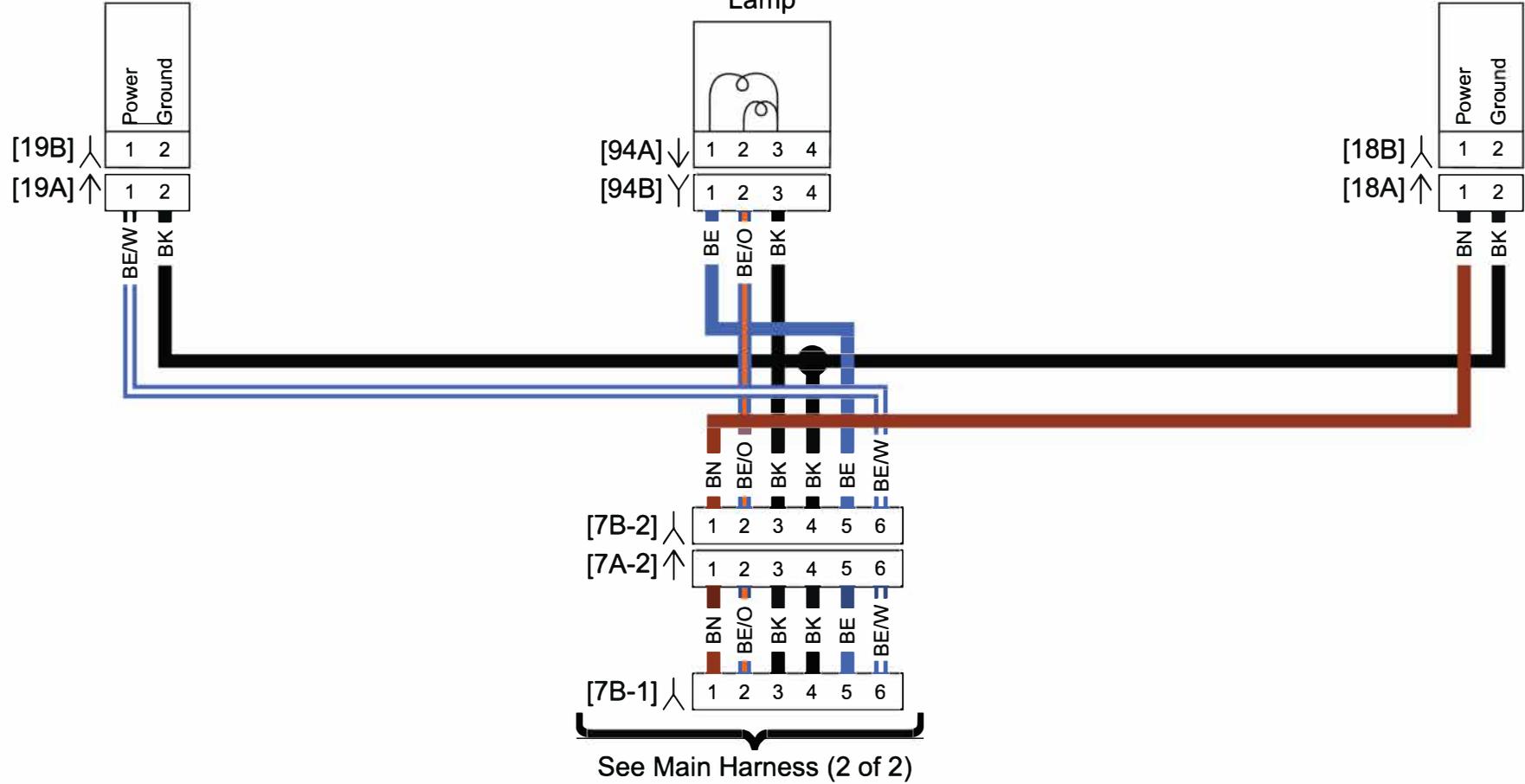


1556419

Left Rear
Turn Lamp

Tail/Stop
Lamp

Right Rear
Turn Lamp



Rear Lighting: 2022 RH1250S

GENERAL

Function/Location

All vehicle connectors are identified by their function and location. Refer to Table A-2.

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 instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in Appendix B of the electrical diagnostic manual (EDM) are by connector type. Refer to Table A-2.

Table A-2. Connector Locations

| NO. | DESCRIPTION | TYPE | TERMINAL PROBE COLOR | LOCATION |
|--------|--------------------------|--|----------------------|---|
| [5] | Main fuse | 2-way SWS J-case (YW) | Red | Right steering head caddy |
| [14RE] | Rear exhaust cam sensor | 3-way Tyco MCON 1.2 Sealed (BK) | Light blue | Top of cylinder head |
| [14RI] | Rear intake cam sensor | 3-way Tyco MCON 1.2 Sealed (BK) | Light blue | Top of cylinder head |
| [14FE] | Front exhaust cam sensor | 3-way Tyco MCON 1.2 Sealed (BK) | Light blue | Top of cylinder head |
| [14FI] | Front intake cam sensor | 3-way Tyco MCON 1.2 Sealed (BK) | Light blue | Top of cylinder head |
| [18] | Right rear turn signal | 2-way JAE MX19 (BK) | Yellow | Behind tail lamp |
| [19] | Left rear turn signal | 2-way JAE MX19 (BK) | Yellow | Behind tail lamp |
| [22] | RHCM | 8-way JST JWPF Sealed (W) | Light blue | RHCM |
| [22-1] | RHCM | 8-way JST JWPF Sealed (W) | Light blue | Right steering head caddy |
| [22-2] | RHCM | 4-way JST JWPF Sealed (W) | Light blue | Right steering head caddy |
| [24] | LHCM | 4-way JST JWPF Sealed (W) | Light blue | Left steering head caddy |
| [24-1] | LHCM | 8-way JST JWPF Sealed (W) | Light blue | LHCM |
| [31L] | Left front turn signal | 4-way JAE MX19 Sealed (BK) | Yellow | Left steering head caddy |
| [31R] | Right front turn signal | 4-way JAE MX19 Sealed (BK) | Yellow | Right steering head caddy |
| [38] | Headlamp | 4-way Delphi 150 Metri-Pack (BK) | Gray | Back of headlamp |
| [39] | IM | 12-way Delphi Micro 64 Sealed (GY) | Breakout Box | Back of IM |
| [40] | Center lighting | 4-way JAE MX19 (BK) | Yellow | Behind tail lamp |
| [47] | Stator | 3-way Aptiv Ducon 6.3 sealed (BK) | Green | Left side of voltage regulator ((lower front) |
| [61] | PAC relay block | Bosch 5-way relay block sealed (BK) | Blue | Behind left side cover |
| [64] | Fuse block | 6-way Delphi fuse block unsealed (BK) | Gray | Under left side cover |
| [77] | Voltage regulator | 2-way Aptiv 6.3 Ducon (BK) | Green | Left side of voltage regulator (lower front) |
| [78] | ECM | 81-way Delphi MTS (BK) | Breakout Box | Under fuel tank (left side) |
| [79] | CKP sensor | 2-way Tyco MCON 1.2 sealed (BK) | Light blue | Lower left side of engine |
| [80F] | MAP sensor | 3-way Tyco MCON 1.2 Sealed | Light blue | Top right between cylinders |
| [80R] | MAP sensor | 3-way Tyco MCON 1.2 Sealed | Light blue | Top right between cylinders |
| [83] | Block coil | 3-way Delphi GT 150 3.5mm | Gray | Left side of engine |
| [84] | Front fuel injector | 2-way Bosch SL Mini (BK) | Purple | Below fuel tank (left side) |
| [85] | Rear fuel injector | 2-way Bosch SL Mini (BK) | Purple | Below fuel tank (left side) |
| [86] | Fuel pump | 2-way Bosch Compact 4 | Orange | Under fuel tank |
| [88] | TPS | 4-way TE Connectivity Econo-seal (BK) | Gray | Between cylinder heads (induction module) |
| [89] | IAT | 2-way Tyco [GY] | Gray | Under fuel tank |
| [91B] | DLC | JST MWT (R) | Light blue | Under seat |
| [94] | Tail lamp | 4-way JAE MX19 Sealed (BK) | Yellow | Behind tail lamp |
| [95] | Purge solenoid | 2-way Delphi 150 Metri-Pack Sealed (R) | Gray | Lower front below radiator |

Table A-2. Connector Locations

| NO. | DESCRIPTION | TYPE | TERMINAL PROBE COLOR | LOCATION |
|--------------------|----------------------------|--|----------------------|---|
| [97] | Cooling fan | 2-way Delphi 150 Metri-Pack Sealed (BK) | Gray | Behind fan |
| [98] | Coolant temperature sensor | 2-way Tyco MCON 1.2 sealed (GY) | Light blue | Left side of engine |
| [107] | AAT sensor | 2-way Molex MX64 Unsealed (BK) | Light blue | Right steering head caddy |
| [120] | Oil pressure switch | Push-on Right Angle Molded terminal (BK) | Black | Left side of engine |
| [121-1] [121-2] | Rear brake switch | Push-on Molded terminals (BK) | Red | Mid-chassis under seat |
| [122-1] [122-2] | Horn | Flag terminals (BK) | Red | Front center of frame |
| [128] | Starter solenoid | 2-way Tyco MCON 1.2 (GY) | Light blue | Top of starter |
| [130F] | Front ignition coil | 3-way Delphi GT 150 (BK) | Gray | Top of cylinder |
| [130R] | Rear ignition coil | 3-way Delphi GT 150 (BK) | Gray | Top of cylinder |
| [133] | JSS | 3-way Molex MX 150 Sealed (BK) | Gray | Lower left side by stand |
| [137] | HO2S rear | 4-way Molex MX 150 Sealed (BK) | Gray | Front of engine (behind radiator) |
| [138] | HO2S front | 4-way Molex MX 150 Sealed (GY) | Gray | Front of engine (behind radiator) |
| [141] | Fuel level sender | 3-way Tyco MCON 1.2 (BK) | Light blue | Under fuel tank |
| [142] | Security siren | 3-way Delphi GT 150 Sealed (BK) | Gray | Under seat |
| [145] | Engine harness | 12-way Molex MX150 Unsealed (BK) | Gray | Between cylinder heads (right side) |
| [166] | ABS/EHCU module | 18-way Tyco MCON 1.2 Sealed | Breakout box | Under seat |
| [167] | Front WSS | 2-way Deutsch DTM (BK) | Brown | Left steering head caddy |
| [168] | Rear WSS | 2-way Deutsch DTM (BK) | Brown | Under seat |
| [170] | Brake switch | 4-way JAE MX19 Sealed (BK) | Yellow | RHCM brake switch |
| [191-1] | Heated gear | 2-way Coliant barrel style | | Under seat |
| [191-2] | Heated gear | 2-way Coliant barrel style | | Under seat |
| [209] | Security antenna | 2-way Molex MX64 Unsealed (BK) | Light blue | Under seat |
| [211] | TCA | 2-way Furukawa FW | Purple | Between cylinder heads (induction module) |
| [224] | TGS | 6-way JST JWPF Sealed | Light blue | RHCM |
| [242-1] | BCM | 2-way TE Connectivity NG1 (BK) | Red | Under seat |
| [242-2] | BCM | 28-way Molex CMC sealed (BK) | Breakout Box | Under seat |
| [265] | USB-C | 7-way | | |
| [269] | Gear position sensor | 3-way Tyco MCON 1.2 sealed | Light blue | Left side of transmission |
| [270FE-1] | Front VVT exhaust phaser | 2-way Tyco Slimseal (BK) | Light blue/yellow | Top of cylinder |
| [270FE-2] | Front VVT exhaust phaser | 2-way Tyco MCON 1.2 | Light blue | Under valve cover |
| [270FI-1] | Front VVT intake phaser | 2-way Tyco Slimseal (W) | Light blue/yellow | Top of cylinder |
| [270FI-2] | Front VVT intake phaser | 2-way Tyco MCON 1.2 | Light blue | Under valve cover |
| [270RE-1] | Rear VVT exhaust phaser | 2-way Tyco Slimseal (W) | Light blue/yellow | Top of cylinder |
| [270RE-2] | Rear VVT exhaust phaser | 2-way Tyco MCON 1.2 | Light blue | Under valve cover |
| [270RI-1] | Rear VVT intake phaser | 2-way Tyco Slimseal (BK) | Light blue/yellow | Top of cylinder |
| [270RI-2] | Rear VVT intake phaser | 2-way Tyco MCON 1.2 | Light blue | Under valve cover |
| [281] | Battery tender | 2-way overmold (BK) | | Under seat |
| [314] | Clutch switch | 4-way JAE MX19 Sealed (BK) | Yellow | LHCM |
| [315] | Knock sensor | 2-way Tyco MCON 1.2 (GY) | Light blue | Between cylinders |
| [319-1] | Terminating resistor | 2-way PKC Sealed | Gray | Under seat |
| [319-2] | Terminating resistor | 2-way PKC Sealed | Gray | Under seat |
| [319-3] | Terminating resistor | 2-way PKC Sealed | Gray | Front left side of engine |

Table A-2. Connector Locations

| NO. | DESCRIPTION | TYPE | TERMINAL PROBE COLOR | LOCATION |
|--------|-----------------------|------------------------|----------------------|----------------------------|
| [325] | PAC | 3-way Molex MX150 | Gray | Under seat |
| [333] | IMU | 4-way AMP MQS | Yellow | Under seat |
| [341] | Post cat HO2S | 4-way Molex MX150 (BK) | Gray | Under seat |
| [343] | Sensor jumper harness | 5-way Tyco MCON 1.2 | Light blue | Left side of engine |
| [GND1] | Ground stud | Ring terminals | | Under seat |
| [GND2] | Ground stud | Ring terminals | | Under seat |
| [GND3] | Engine block ground | Ring terminals | | Front of engine, left side |

CONNECTOR END VIEWS

Table A-3. Main Fuse [5]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R | Battery |
| 2 | R | Main fuse |

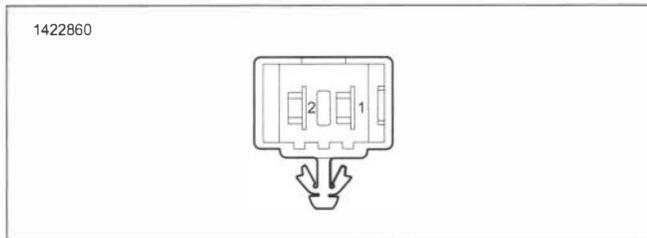


Figure A-12. Main Fuse [5]

Table A-4. Front Intake Cam Sensor [14FI]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------------|
| 1 | R/W | Sensor power 1 |
| 2 | BK/GN | Ground |
| 3 | Y/BE | Front intake cam position |

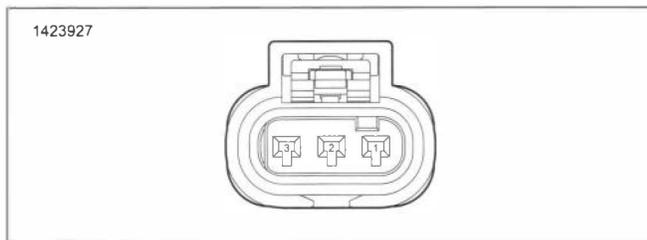


Figure A-13. Front Intake Cam Sensor [14FI]

Table A-5. Front Exhaust Cam Sensor [14FE]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------------|
| 1 | R/W | Sensor power 1 |
| 2 | BK/GN | Ground |
| 3 | Y/BK | Front exhaust cam position |

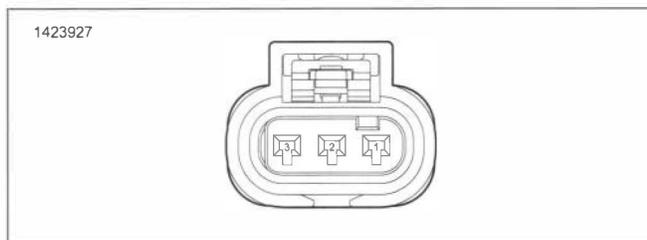


Figure A-14. Front Exhaust Cam Sensor [14FE]

Table A-6. Rear Intake Cam Sensor [14RI]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|--------------------------|
| 1 | R/W | Sensor power 1 |
| 2 | BK/GN | Ground |
| 3 | Y/BN | Rear intake cam position |

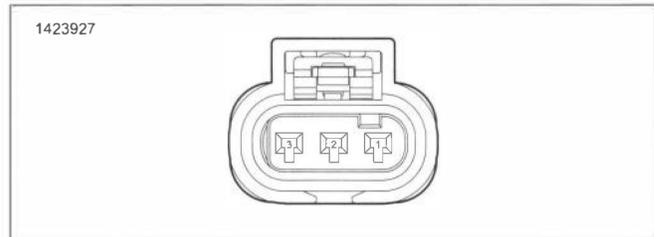


Figure A-15. Rear Intake Cam Sensor [14RI]

Table A-7. Rear Exhaust Cam Sensor [14RE]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------------|
| 1 | R/W | Sensor power 1 |
| 2 | BK/GN | Ground |
| 3 | Y/GN | Rear exhaust cam position |

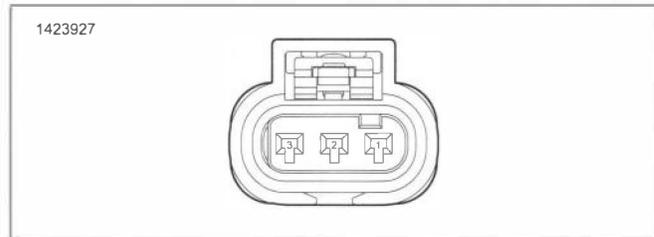


Figure A-16. Rear Exhaust Cam Sensor [14RE]

Table A-8. Right Rear Turn [18]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BE/BN | Right turn signal |
| 2 | BK | GND |

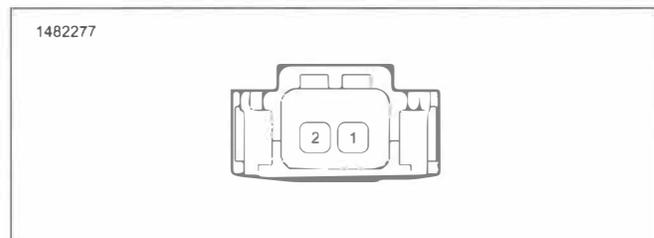


Figure A-17. Right Rear Turn Signal [18]

Table A-9. Left Rear Turn Signal [19]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BE/V | Left turn signal |
| 2 | BK | Ground |

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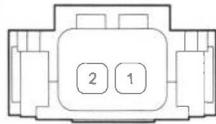


Figure A-18. Left Rear Turn Signal [19]

Table A-10. RHCM [22-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/W | 5V sensor power 1 |
| 2 | GN/W | TGS 1 |
| 3 | BK/W | 5V sensor ground 1 |
| 4 | R/GY | 5V sensor power 2 |
| 5 | GY/W | TGS 2 |
| 6 | BK/GY | 5V sensor ground 2 |
| 7 | W/GY | Run/stop |
| 8 | BK | N/C |

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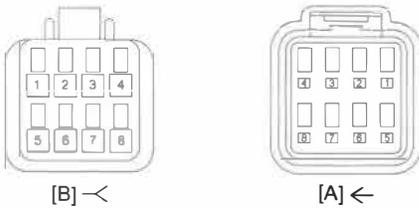


Figure A-19. RHCM [22-1]

Table A-11. RHCM [22-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK/GN | Ground |
| 2 | W/R | CAN high |
| 3 | W/BK | CAN low |
| 4 | R/O | Battery fuse |

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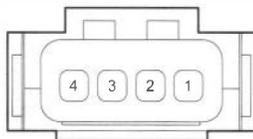


Figure A-20. RHCM [22-2]

Table A-12. RHCM [22-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|------------------------------|
| 1 | R/O | Battery fuse |
| 2 | W/R | CAN high |
| 3 | W/BK | CAN low |
| 4 | W/GY | Redundant engine stop |
| 5 | BK/GN | Ground |
| 6 | BE | Brake lever switch (N.O.) In |
| 7 | O/BK | Brake switch power |
| 8 | BN | Brake lever switch (N.I.) In |

1427631



Figure A-21. RHCM [22]

Table A-13. LHCM [24]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK/GN | Ground |
| 2 | W/R | CAN high |
| 3 | W/BK | CAN low |
| 4 | R/O | Battery fuse |

ed03730

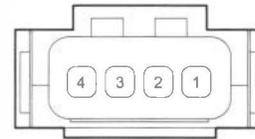


Figure A-22. LHCM [24]

Table A-14. LHCM [24-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/O | Battery |
| 2 | W/R | CAN high |
| 3 | W/BK | CAN low |
| 4 | BK | N/C |
| 5 | BK/GN | Ground |
| 6 | BE | Clutch switch A |
| 7 | TN | Clutch switch power |
| 8 | BN/BE | Clutch switch A |

1085858

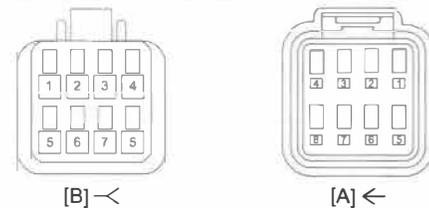


Figure A-23. LHCM [24-1]

Table A-15. Front Left Turn Signal [31L]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|------------------------|
| 1 | BE | Position (DOM only) |
| 2 | BE/PK | Left front turn signal |
| 3 | BK | Ground |
| 4 | - | N/C |

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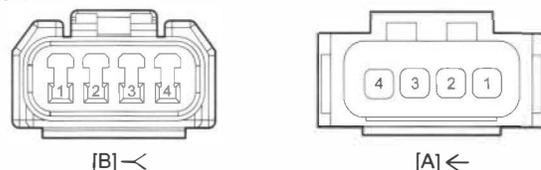


Figure A-24. Front Left Turn Signal [31L]

Table A-16. Front Right Turn Signal [31R]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-------------------------|
| 1 | BE | Position (DOM only) |
| 2 | BE/O | Right front turn signal |
| 3 | BK | Ground |
| 4 | - | N/C |

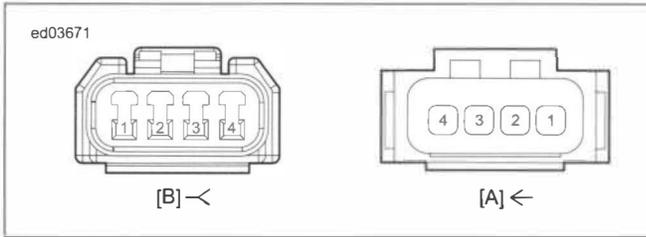


Figure A-25. Front Right Turn Signal [31R]

Table A-17. Headlamp [38]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-----------------------|
| A | BK | Ground |
| B | BE/Y | Low beam |
| C | BE/W | High beam |
| D | BE | Running/position lamp |

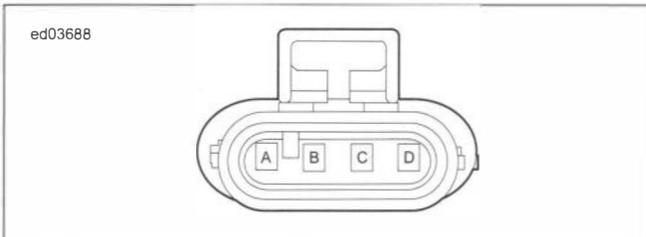


Figure A-26. Headlamp [38]

Table A-18. IM [39]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/O | +5 USB |
| 2 | W/R | CAN high |
| 3 | BK | OV USB |
| 4 | - | N/C |
| 5 | R/PK | Battery |
| 6 | BE | USB Data + |
| 7 | BK/GN | Ground |
| 8 | W/BK | CAN low |
| 9 | BE/O | CC1 |
| 10 | BE/PK | CC2 |
| 11 | BK | Shield |
| 12 | BE/W | USB Data - |

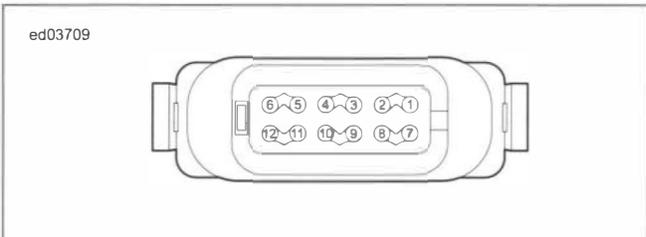


Figure A-27. IM [39]

Table A-19. Center Lighting [40]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|------------------------|
| 1 | BE | Running/position lamps |
| 2 | BE/R | Brake lamp power |
| 3 | BK | Ground |
| 4 | - | N/C |

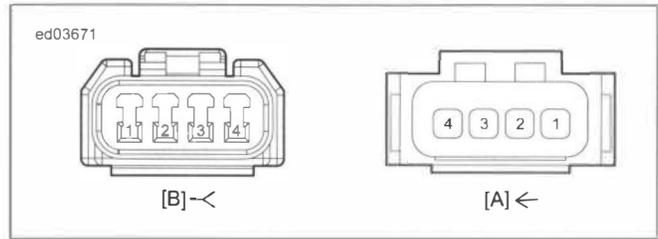


Figure A-28. Center Lighting [40]

Table A-20. LP Lamp [45]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BE | Running lamps |
| 2 | BK | Ground |

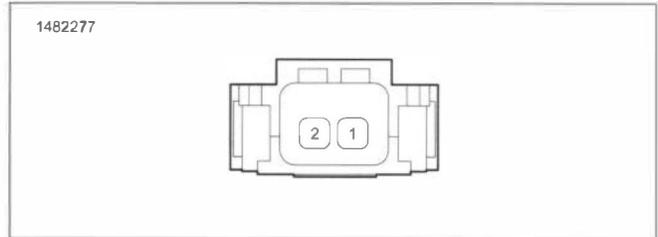


Figure A-29. LP Lamp [45]

Table A-21. Stator [47]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK | Stator |
| 2 | BK | Stator |
| 3 | BK | Stator |

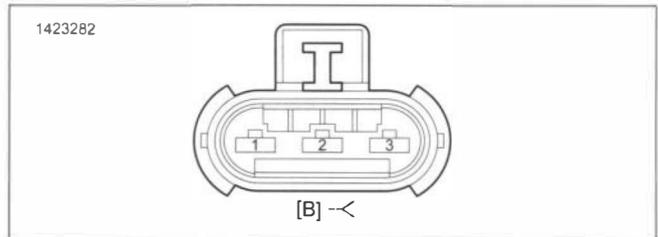


Figure A-30. Stator [47]

Table A-22. PAC Relay [61]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK | Ground |
| 2 | R/Y | Accessories power |
| 3 | R/GY | PAC fuse |
| 4 | R | Battery tender |
| 5 | R/GY | Heated gear |

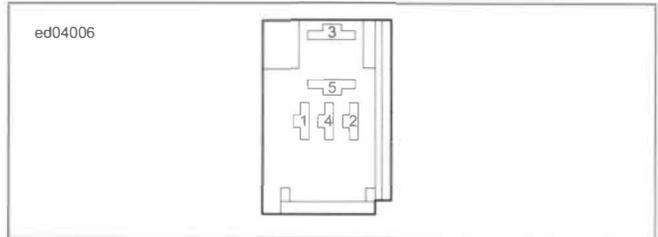


Figure A-31. PAC Relay [61]

Table A-23. Fuse Block [64]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| A | R | Infotainment |
| B | R/PK | Infotainment |
| C | R | Battery |
| D | R/O | Battery tender fuse |
| E | R | PAC tender |
| F | R/GY | PAC tender |

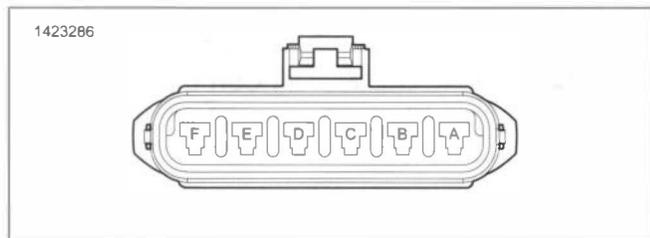


Figure A-32. Fuse Block [64]

Table A-24. Voltage Regulator [77]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| A | BK | Ground |
| B | R | Battery |

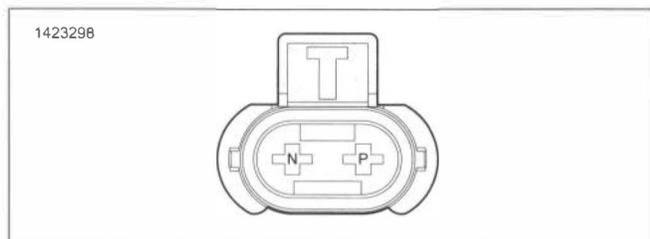


Figure A-33. Voltage Regulator [77]

Table A-25. ECM [78]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------------------|
| 1 | GY/BK | Cooling fan control |
| 2 | BK/GN | Ground |
| 3 | BK/GN | Ground |
| 4 | - | N/C |
| 5 | R/GN | Powertrain system power |
| 6 | GN/Y | Front fuel injector |
| 7 | GY/Y | Rear fuel injector |
| 8 | - | N/C |
| 9 | - | N/C |
| 10 | - | N/C |
| 11 | BK | Crank position sensor |
| 12 | - | N/C |
| 13 | Y/V | Rear intake VVT control |
| 14 | BK/O | Front O2S pre-cat heater ground |
| 15 | - | N/C |
| 16 | LGN/BK | Purge solenoid |
| 17 | Y/GN | Front intake VVT control |
| 18 | - | N/C |
| 19 | - | N/C |
| 20 | GY/O | Throttle motor lo |
| 21 | GN/O | Throttle motor hi |
| 22 | Y/O | Front exhaust VVT control |
| 23 | BK/PK | Rear O2S pre-cat heater ground |
| 24 | GN/BE | Front coil A out |
| 25 | - | N/C |
| 26 | GY/R | Post-cat O2 sensor |
| 27 | GY/V | Throttle position sensor 2 |

Table A-25. ECM [78]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------------|
| 28 | - | N/C |
| 29 | BK/GY | 5V Sensor ground 2 |
| 30 | R | Crank position sensor + |
| 31 | Y/PK | Fuel level |
| 32 | W/O | Oil pressure |
| 33 | - | N/C |
| 34 | LGN/GY | Jiffy stand |
| 35 | - | N/C |
| 36 | BN/W | Knock sensor hi |
| 37 | LGN/W | Knock sensor lo |
| 38 | W/BK | CAN low |
| 39 | W/R | CAN high |
| 40 | - | N/C |
| 41 | GN/W | Twist grip sensor 1 |
| 42 | GY/W | Twist grip sensor 2 |
| 43 | GN/BE | Rear coil A out |
| 44 | - | N/C |
| 45 | - | N/C |
| 46 | - | N/C |
| 47 | GN/BN | Front HO2S |
| 48 | GY/BN | Rear HO2S |
| 49 | GY/GN | Coolant sensor |
| 50 | Y/BK | Front exhaust cam position |
| 51 | LGN/Y | Vehicle speed |
| 52 | GN/V | Throttle position sensor 1 |
| 53 | GY | Front MAP sensor |
| 54 | V | Rear MAP sensor |
| 55 | - | N/C |
| 56 | - | N/C |
| 57 | - | N/C |
| 58 | Y/BN | Rear intake cam position |
| 59 | - | N/C |
| 60 | - | N/C |
| 61 | - | N/C |
| 62 | GN/BE | Front coil B out |
| 63 | - | N/C |
| 64 | Y/W | Rear exhaust VVT control |
| 65 | BK/BN | Pre-cat O2 sensor ground |
| 66 | R/GY | 5V Sensor power 2 |
| 67 | R/O | Battery fuse |
| 68 | - | N/C |
| 69 | Y/GN | Rear exhaust cam position |
| 70 | R/W | 5V Sensor power 1 |
| 71 | W/V | Ambient air temperature |
| 72 | GN/GY | Intake air temperature |
| 73 | - | N/C |
| 74 | BK/W | 5V Sensor Ground 1 |
| 75 | - | N/C |
| 76 | - | N/C |
| 77 | Y/BE | Front intake cam position |
| 78 | W | Gear position |
| 79 | - | N/C |
| 80 | BN/O | O2 Sensor heater post-cat |
| 81 | GY/BE | Rear coil B out |

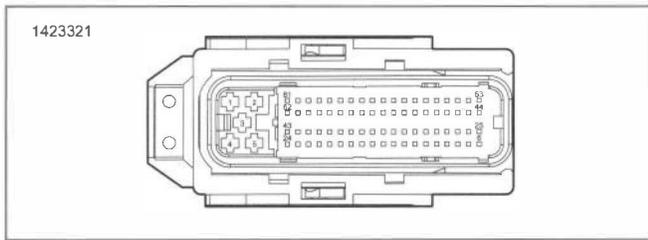


Figure A-34. ECM [78]

Table A-26. CKP Sensor [79]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R | CKP sensor high |
| 2 | BK | CKP sensor low |

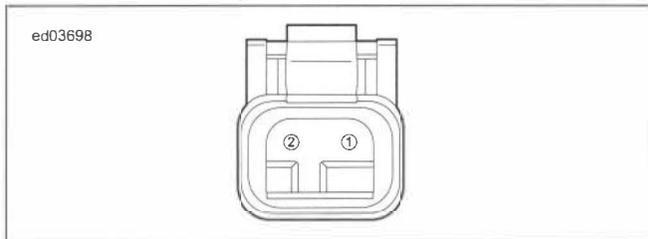


Figure A-35. CKP Sensor [79]

Table A-27. MAP [80F]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/GY | 5V sensor power 2 |
| 2 | BK/GY | 5V sensor ground 2 |
| 3 | GY | Front MAP sensor |

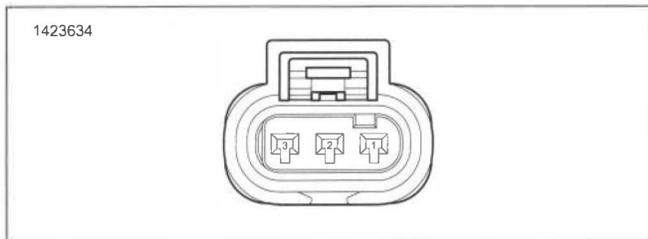


Figure A-36. MAP [80F]

Table A-28. MAP [80R]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/GY | 5V sensor power 2 |
| 2 | BK/GY | 5V sensor ground 2 |
| 3 | V | Rear MAP sensor |

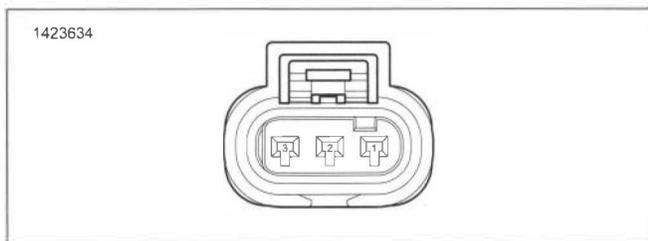


Figure A-37. MAP [80R]

Table A-29. Block Coil [83]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------------|
| A | GN/BE | Front ignition coil B out |
| B | R/GN | System power |
| C | GY/BE | Rear ignition coil B out |

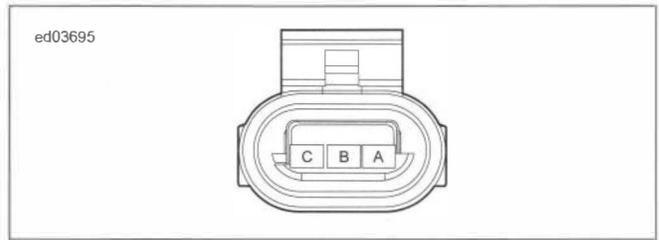


Figure A-38. Block Coil [83]

Table A-30. Front Fuel Injector [84]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/GN | System power |
| 2 | GN/Y | Front fuel injector |

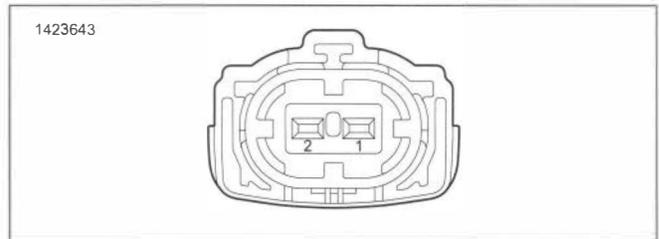


Figure A-39. Front Fuel Injector [84]

Table A-31. Rear Fuel Injector [85]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BN/BE | System power |
| 2 | GY/Y | Rear fuel injector |

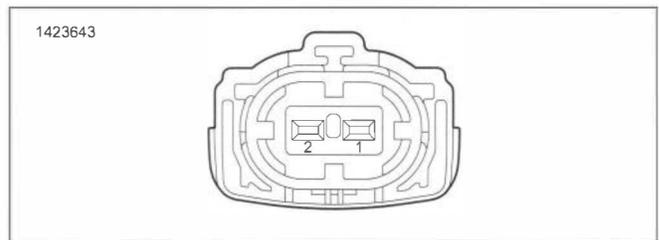


Figure A-40. Rear Fuel Injector [85]

Table A-32. Fuel Pump [86]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/BN | Fuel pump |
| 2 | BK | Ground |

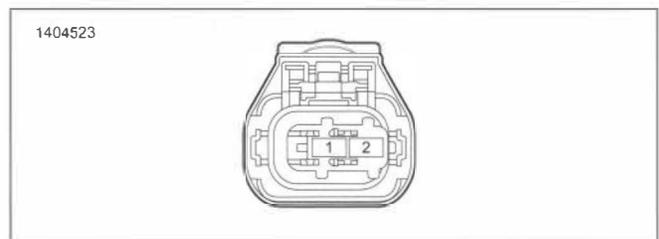


Figure A-41. Fuel Pump [86]

Table A-33. TPS [88]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------------|
| 1 | GN/V | Throttle position sensor 1 |
| 2 | R/W | 5V sensor power 1 |
| 3 | GY/V | Throttle position sensor 2 |
| 4 | BK/W | 5V sensor ground 1 |

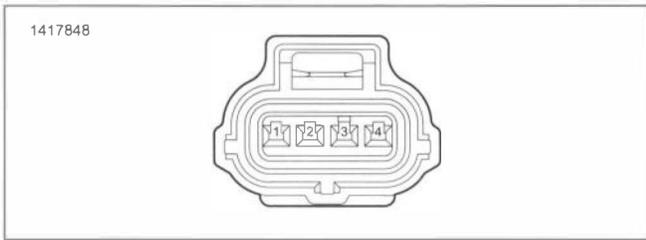


Figure A-42. TPS [88]

Table A-34. IAT [89]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------|
| 1 | GN/GY | IAT |
| 2 | BK/W | 5 Volt sensor ground |

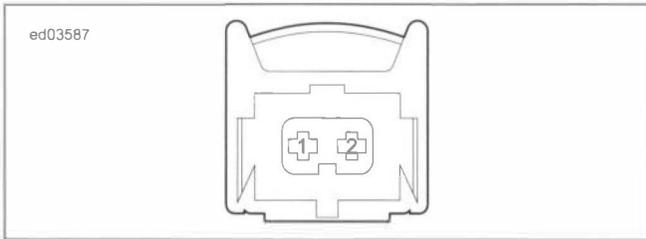


Figure A-43. IAT [89]

Table A-35. DLC [91]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | - | N/C |
| 2 | W/R | CAN high |
| 3 | BK | Ground |
| 4 | R/Y | Accessory power |
| 5 | W/BK | CAN low |
| 6 | - | N/C |

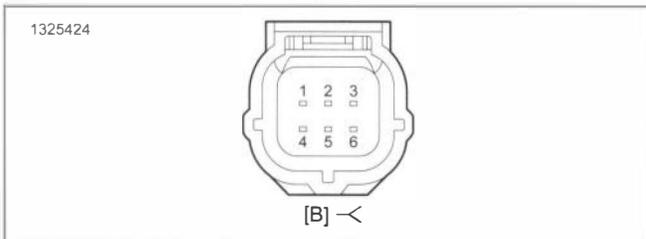


Figure A-44. DLC [91]

Table A-36. Tail Lamp [94]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BE | Position lamp |
| 2 | BE/R | Brake lamp power |
| 3 | BK | Ground |
| 4 | - | N/C |

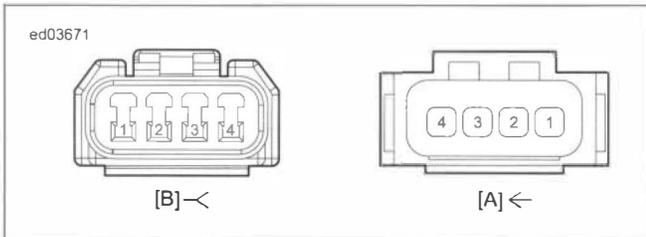


Figure A-45. Tail Lamp [94]

Table A-37. Purge Solenoid [95]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------|
| A | BN/BE | Cooling system power |
| B | LGN/BK | Purge solenoid |

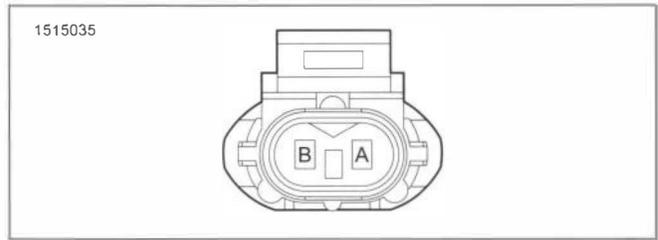


Figure A-46. Purge Solenoid [95]

Table A-38. Cooling Fan [97]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------|
| A | BN/BE | Cooling system power |
| B | GY/BK | Cooling fan control |

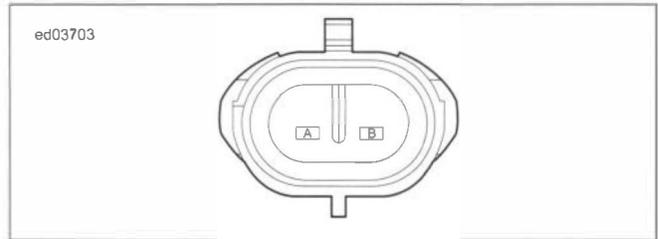


Figure A-47. Cooling Fan [97]

Table A-39. Coolant Temperature Sensor [98]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | GY/GN | Coolant temperature |
| 2 | BK/W | 5V sensor ground 1 |

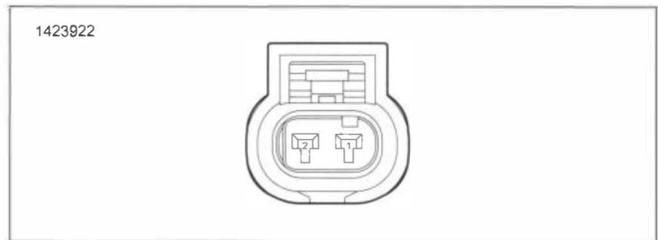


Figure A-48. Coolant Temperature Sensor [98]

Table A-40. AAT [107]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | W/V | Air temperature |
| 2 | BK/W | 5V sensor ground 1 |

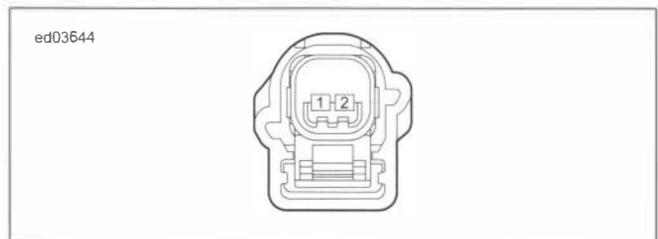


Figure A-49. AAT [107]

Table A-41. Oil Pressure Switch [120]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | W/O | Oil pressure |

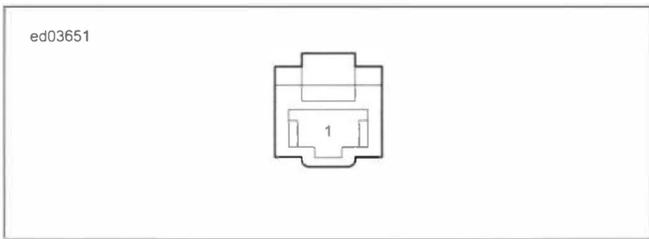


Figure A-50. Oil Pressure Switch [120]

Table A-42. Rear Brake Switch [121-1] [121-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BE/GN | Rear brake switch |
| 1 | BK | Ground |

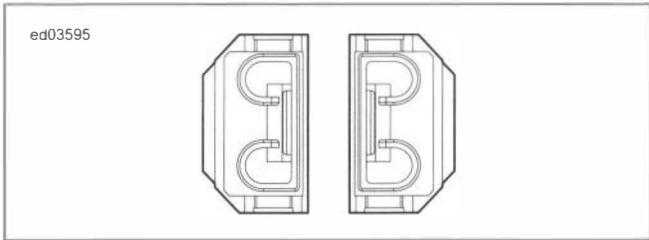


Figure A-51. Rear Brake Switch [121-1] [121-2]

Table A-43. Horn [122-1] [122-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/V | Horn power |
| 1 | BK | Ground |

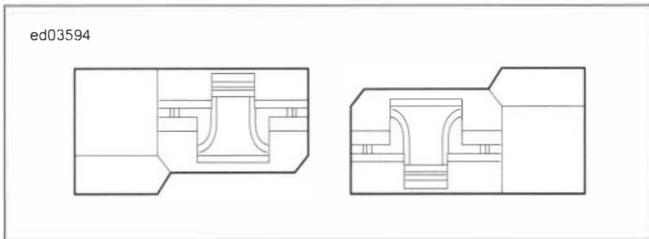


Figure A-52. Horn [122-1] [122-2]

Table A-44. Starter Solenoid [128]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/BK | Power |
| 2 | BK | Ground |

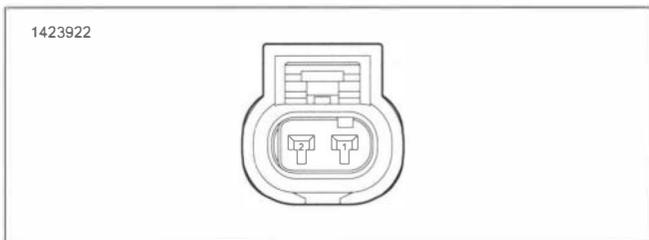


Figure A-53. Starter Solenoid [128]

Table A-45. Front Ignition Coil [130F]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| A | GN/BE | Rear ignition coil |
| B | R/GN | System power |
| C | - | N/C |

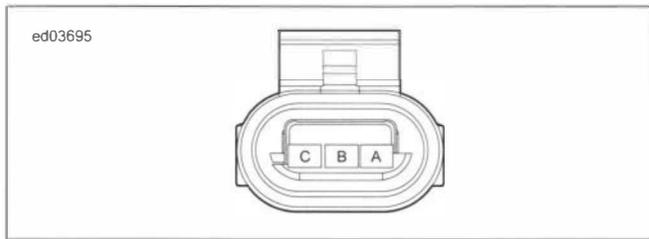


Figure A-54. Front Ignition Coil [130F]

Table A-46. Rear Ignition Coil [130R]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| A | GY/BE | Rear ignition coil |
| B | BN/BE | System power |
| C | - | N/C |

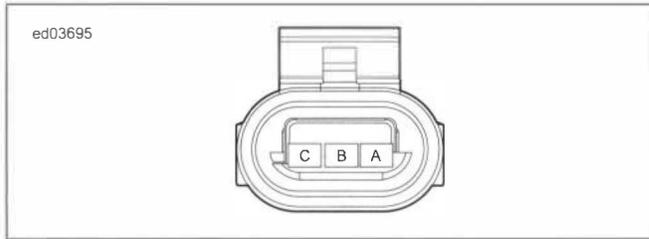


Figure A-55. Rear Ignition Coil [130R]

Table A-47. Jiffy Stand [133]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/W | 5 Volt sensor power |
| 2 | LGN/GY | JSS signal |
| 3 | BK/GN | Sensor ground |

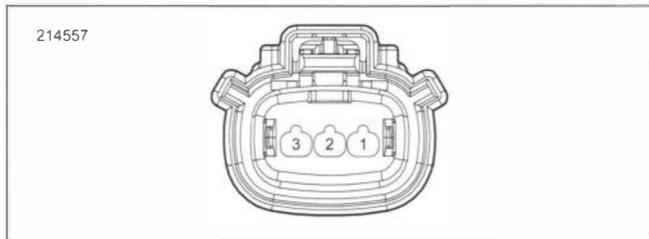


Figure A-56. Jiffy Stand [133]

Table A-48. HO2S Rear [137]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/GN | System power |
| 2 | BK/PK | Rear HO2S heater |
| 3 | GY/BN | Rear HO2S |
| 4 | BK/BN | Pre cat HO2S ground |

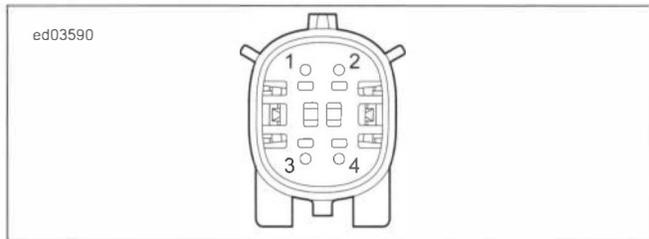


Figure A-57. HO2S Rear [137]

Table A-49. HO2S Front [138]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/GN | System power |
| 2 | BK/O | Front HO2S heater |
| 3 | GY/BN | Front HO2S |
| 4 | BK/BN | Pre cat HO2S ground |

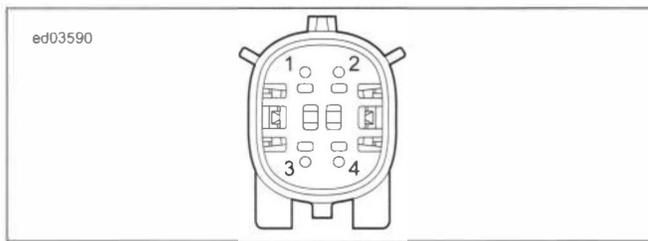


Figure A-58. HO2S Front [138]

Table A-50. Fuel Level Sender [141]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | Y/PK | Fuel level |
| 2 | BK/GN | Fuel level ground |
| 3 | BK | Ground |

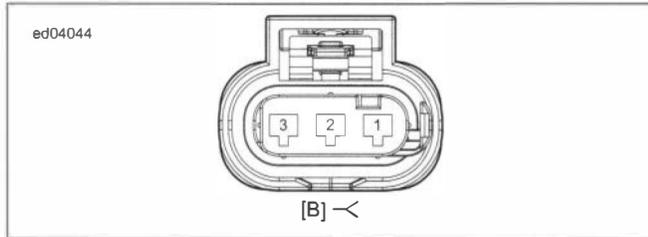


Figure A-59. Fuel Level Sender [141]

Table A-51. Security Siren (Optional) [142]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-----------------------|
| 1 | R/O | Battery fuse |
| 2 | BN | Security siren enable |
| 3 | BK/GN | Ground |

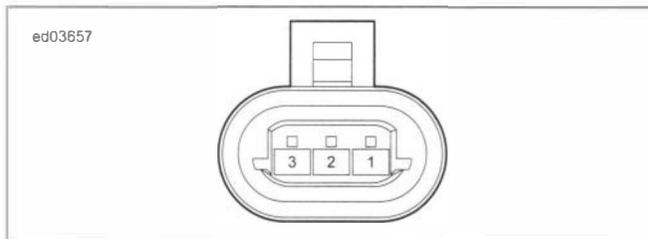


Figure A-60. Security Siren (Optional) [142]

Table A-52. Engine Harness [145]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|----------------------|
| 1 | R/O | Battery power |
| 2 | W/R | CAN + |
| 3 | W/BK | CAN - |
| 4 | V/GN | VVT power |
| 5 | R/GN | System power |
| 6 | BN/BE | Cooling system power |
| 7 | BK/GN | Ground |
| 8 | BK | Ground |
| 9 | W/GY | Run/Stop |
| 10 | BE/O | Right turn |
| 11 | BE | Position |
| 12 | - | N/C |

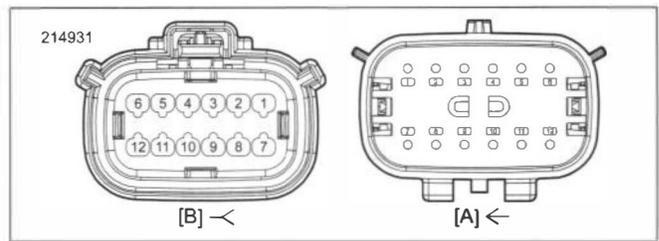


Figure A-61. Engine Harness [145]

Table A-53. ABS/EHCU [166]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-----------------------|
| 1 | BK/GN | Ground |
| 2 | W/R | CAN high |
| 3 | O/BK | Front WSS low |
| 4 | O/W | Wake power |
| 5 | - | N/C |
| 6 | - | N/C |
| 7 | - | N/C |
| 8 | - | N/C |
| 9 | R | Battery power (ECU) |
| 10 | BK | Ground (Motor) |
| 11 | W/BK | CAN low |
| 12 | O/BE | Front WSS high |
| 13 | O/PK | Rear WSS high |
| 14 | O/BN | Rear WSS low |
| 15 | - | N/C |
| 16 | - | N/C |
| 17 | - | N/C |
| 18 | R | Battery power (Motor) |

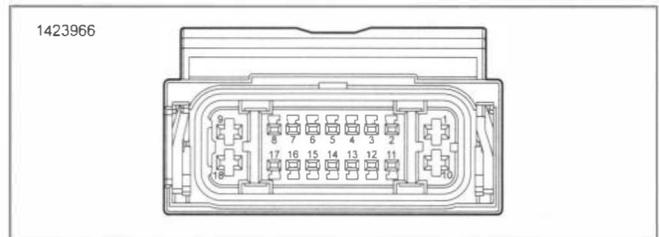


Figure A-62. ABS/EHCU [166]

Table A-54. Front WSS [167]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | O/BE | Front WSS high |
| 2 | O/BK | Front WSS low |

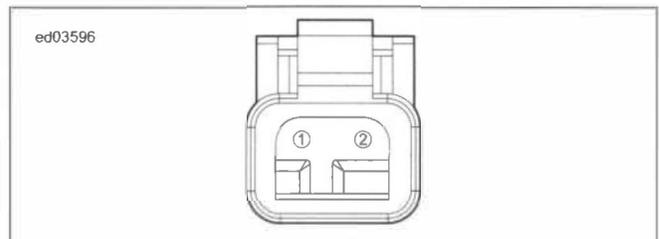


Figure A-63. Front WSS [167]

Table A-55. Rear WSS [168]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | O/PK | Rear WSS high |
| 2 | O/BN | Rear WSS low |

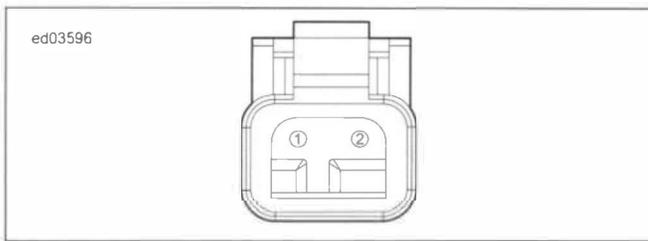


Figure A-64. Rear WSS [168]

Table A-56. Brake Switch [170]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|------------------------------|
| 1 | BE | Brake lever switch (N.O.) IN |
| 2 | O/BK | Brake lever switch |
| 3 | BN | Brake lever switch (N.C.) IN |
| 4 | - | N/C |

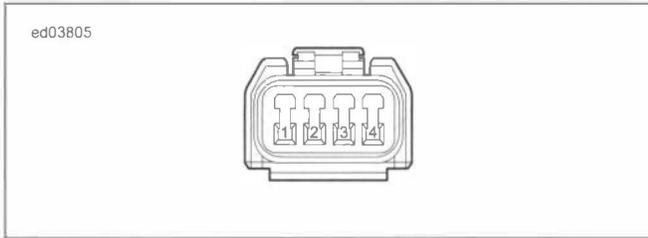


Figure A-65. Brake Switch [170]

Table A-57. Heated Gear [191-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK | Power |
| 2 | BK | Ground |

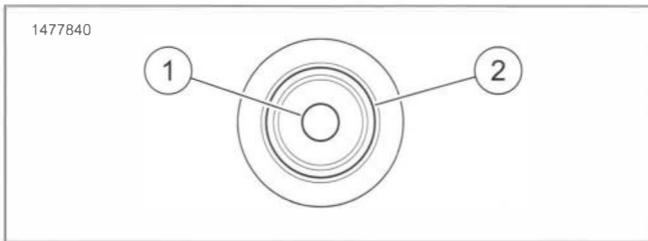


Figure A-66. Heated Gear [191-1]

Table A-58. Heated Gear [191-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK | Power |
| 2 | BK | Ground |

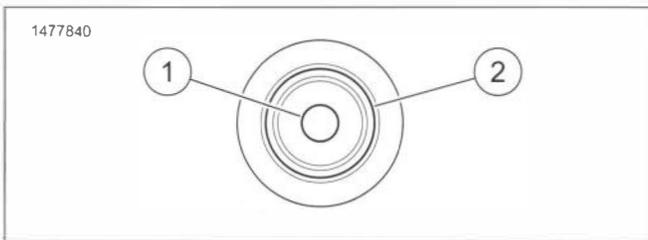


Figure A-67. Heated Gear [191-2]

Table A-59. Security Antenna [209]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R | LF antenna out A |
| 2 | BK | LF antenna out B |

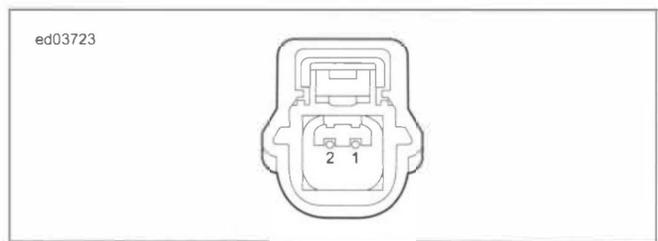


Figure A-68. Security Antenna [209]

Table A-60. TCA [211]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | GY/O | Throttle motor LO |
| 2 | GN/O | Throttle motor HI |

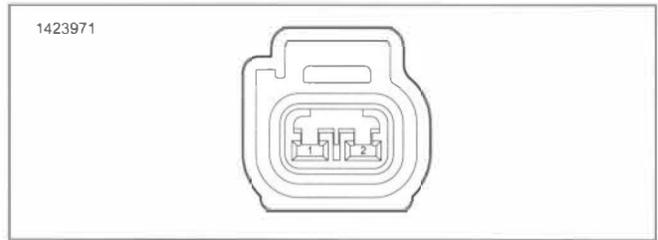


Figure A-69. TCA [211]

Table A-61. TGS [224B]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/W | 5V sensor power 1 |
| 2 | BK/W | Ground 1 |
| 3 | GN/W | TGS sensor 1 |
| 4 | R/GY | 5V sensor power 2 |
| 5 | BK/GY | Ground 2 |
| 6 | GY/W | TGS sensor 2 |

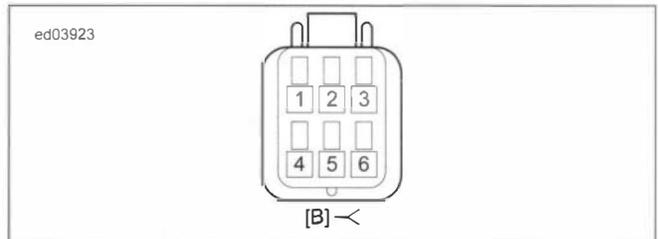


Figure A-70. TGS [224B]

Table A-62. BCM [242-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R | Battery |
| 2 | R/Y | Accessory power |

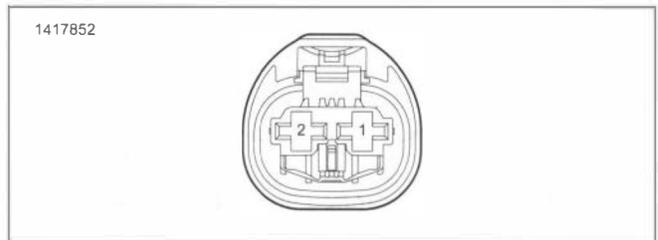


Figure A-71. BCM [242-1]

Table A-63. BCM [242-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-----------------------|
| 1 | R/BK | Starter solenoid |
| 2 | R/BN | Fuel pump |
| 3 | BN/BE | System power 2 |
| 4 | R/GN | System power 1 |
| 5 | BE/Y | Low beam |
| 6 | BK | UHF antenna in |
| 7 | R | LF antenna out A |
| 8 | BK | LF antenna out B |
| 9 | TN/BK | LIN 1 |
| 10 | - | N/C |
| 11 | BK/GN | Ground |
| 12 | W/R | Primary CAN + |
| 13 | W/BK | Primary CAN - |
| 14 | W/BK | Secondary CAN - |
| 15 | W/R | Secondary CAN + |
| 16 | BE/PK | Front left turn |
| 17 | BE/O | Front right turn |
| 18 | BE/R | Stop lamp |
| 19 | BE/GN | Rear brake switch |
| 20 | W/GY | Run/stop switch |
| 21 | BN | Security siren enable |
| 22 | BE/V | Rear left turn |
| 23 | BE/BN | Rear right turn |
| 24 | O/W | Wake power |
| 25 | BE/W | High beam |
| 26 | V/GN | VVT power |
| 27 | BE | Position lamp |
| 28 | R/V | Horn |

1417856

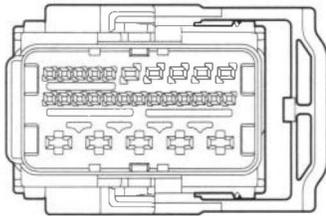


Figure A-72. BCM [242-2]

Table A-64. Gear Position Sensor [269]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/W | 5V Sensor power 1 |
| 2 | W | Gear position |
| 2 | BK/W | 5V Sensor ground 1 |

1423927

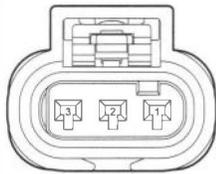


Figure A-73. Gear Position Sensor [269]

Table A-65. Front Exhaust VVT Phaser [270FE-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------------|
| 1 | V/GN | VVT Power |
| 2 | Y/O | Front exhaust VVT control |

1478744

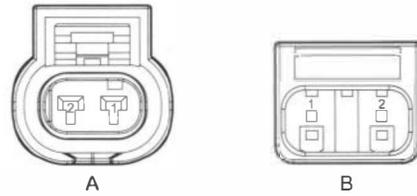


Figure A-74. Front Exhaust VVT Phaser [270FE-1]

Table A-66. Front Exhaust VVT Phaser [270FE-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------------|
| 1 | BK | VVT power |
| 2 | BK | Front exhaust VVT control |

1423922

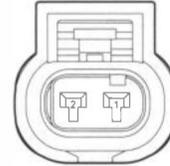


Figure A-75. Front Exhaust VVT Phaser [270FE-2]

Table A-67. Front Intake VVT Phaser [270FI-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|--------------------------|
| 1 | Y/GN | VVT power |
| 2 | Y/GY | Front intake VVT control |

1478744

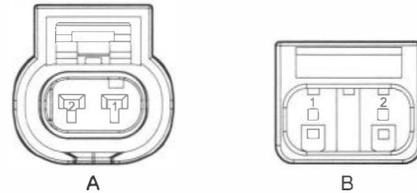


Figure A-76. Front Intake VVT Phaser [270FI-1]

Table A-68. Front Intake VVT Phaser [270FI-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|--------------------------|
| 1 | GY | VVT power |
| 2 | GY | Front intake VVT control |

1423922

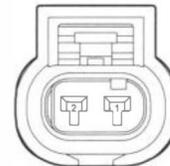


Figure A-77. Front Intake VVT Phaser [270FI-2]

Table A-69. Rear Exhaust VVT Phaser [270RE-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|--------------------------|
| 1 | V/GN | VVT Power |
| 2 | Y/W | Rear exhaust VVT control |

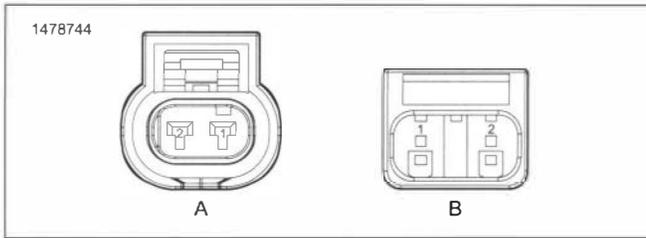


Figure A-78. Rear Exhaust VVT Phaser [270RE-1]

Table A-70. Rear Exhaust VVT Phaser [270RE-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|--------------------------|
| 1 | GY | VVT power |
| 2 | GY | Rear exhaust VVT control |

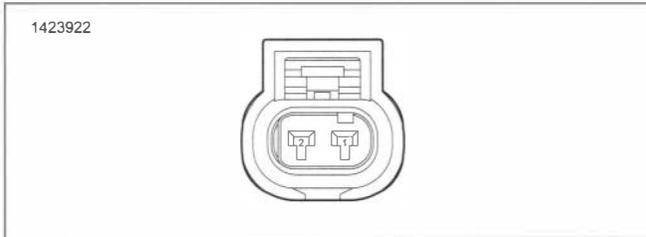


Figure A-79. Rear Exhaust VVT Phaser [270RE-2]

Table A-71. Rear Intake VVT Phaser [270RI-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-------------------------|
| 1 | Y/GN | VVT power |
| 2 | Y/V | Rear intake VVT control |

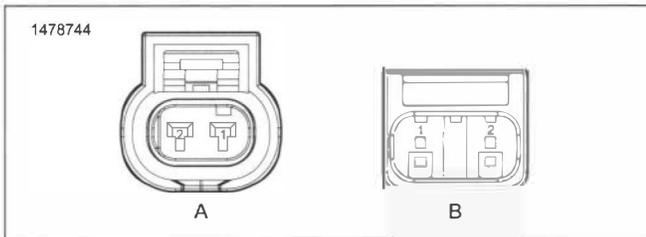


Figure A-80. Rear Intake VVT Phaser [270RI-1]

Table A-72. Rear Intake VVT Phaser [270RI-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-------------------------|
| 1 | BK | VVT power |
| 2 | BK | Rear intake VVT control |

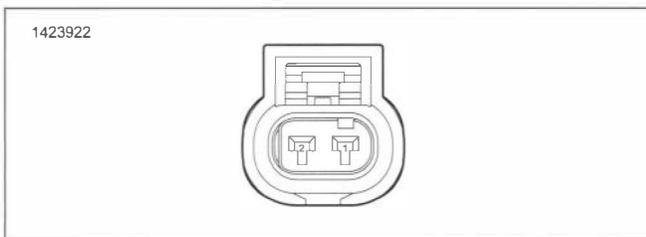


Figure A-81. Rear Intake VVT Phaser [270RI-2]

Table A-73. Battery Tender [281]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R | Battery power |
| 2 | BK | Ground |

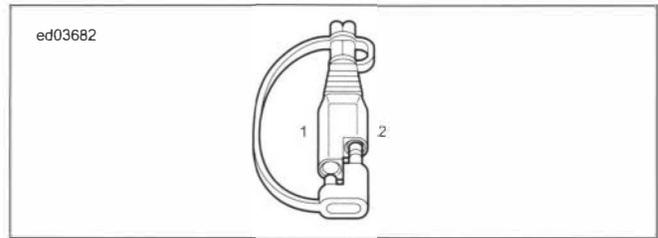


Figure A-82. Battery Tender [281]

Table A-74. Clutch Switch [314]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---|
| 1 | BE | Clutch lever out (Full clutch engagement) |
| 2 | BN | Clutch lever in (Full clutch disengagement) |
| 3 | - | N/C |
| 4 | TN | Clutch lever switch |

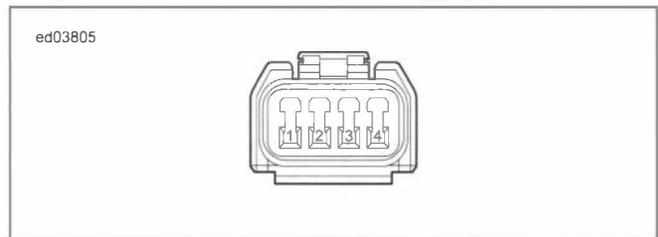


Figure A-83. Clutch Switch [314]

Table A-75. Knock Sensor [315]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|-----------------------|
| 1 | LGN/W | Front knock sensor LO |
| 2 | BN/W | Front knock sensor HI |

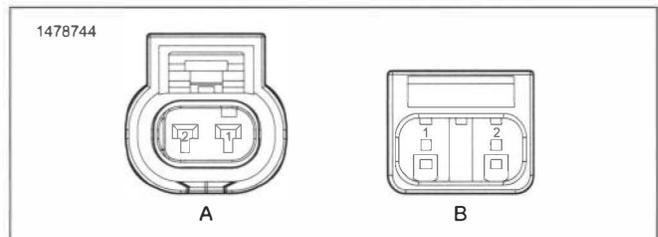


Figure A-84. Knock Sensor [315]

Table A-76. Termination Resistor [319-1]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | W/R | CAN high |
| 2 | W/BK | CAN low |

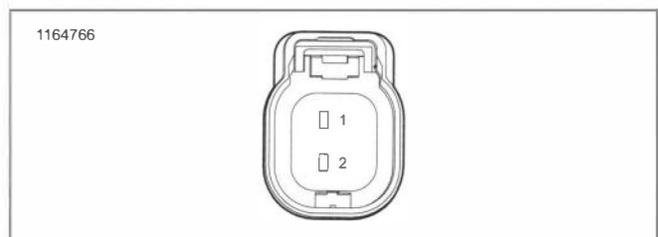


Figure A-85. Termination Resistor [319-1]

Table A-77. Termination Resistor [319-2]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | W/R | CAN High |
| 2 | W/BK | CAN Low |



Figure A-86. Termination Resistor [319-2]

Table A-78. Termination Resistor [319-3]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | W/R | CAN High |
| 2 | W/BK | CAN Low |

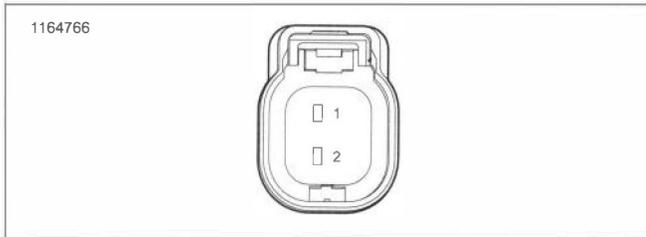


Figure A-87. Termination Resistor [319-3]

Table A-79. PAC [325]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/Y | Accessory power |
| 2 | BK | Ground |
| 3 | TN/BK | LIN 1 |

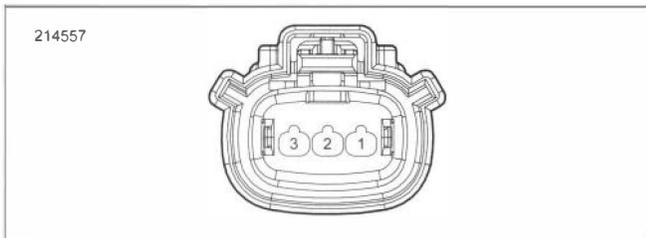


Figure A-88. PAC [325]

Table A-80. IMU [333]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | BK/GN | Ground |
| 2 | W/BK | CAN low |
| 3 | W/R | CAN high |
| 4 | O/W | Wake power |

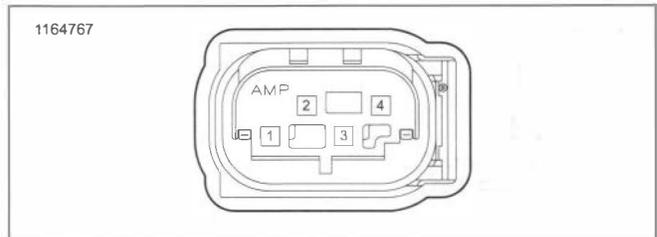


Figure A-89. IMU [333]

Table A-81. Post Cat HO2S [341]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | R/GN | System power |
| 2 | BN/O | Rear HO2S heater |
| 3 | GY/R | Rear HO2S |
| 4 | BK/BN | Pre cat HO2S ground |

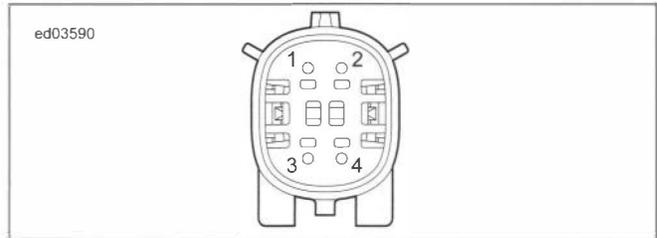


Figure A-90. Post Cat HO2S [341]

Table A-82. Engine Jumper Harness [343]

| TERMINAL | WIRE COLOR | CIRCUIT DESCRIPTION |
|----------|------------|---------------------|
| 1 | GY/GN | Coolant temperature |
| 2 | BK/W | 5V sensor ground |
| 3 | W/O | Oil pressure |
| 4 | LGN/W | Knock sensor low |
| 5 | BN/W | Knock sensor high |

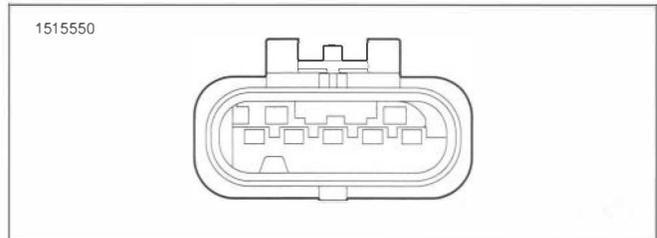


Figure A-91. Engine Jumper Harness [343]

| SUBJECT | PAGE NO. |
|----------------------------|-----------------|
| B.1 GLOSSARY..... | B-1 |
| B.2 METRIC CONVERSION..... | B-4 |
| B.3 FLUID CONVERSION..... | B-5 |
| B.4 TORQUE CONVERSION..... | B-6 |

NOTES

ACRONYMS AND ABBREVIATIONS

Refer to the table below for a list of common acronyms and abbreviations.

Table B-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 |
| ARH | Adaptive Ride Height |
| AWG | American wire gauge |
| B+ | Battery voltage |
| bar | Bar |
| BAS | Bank angle sensor |
| BCM | Body control module |
| BMU | Battery Management Unit |
| BOB | Breakout box |
| BTDC | Before top dead center |
| °C | Celsius (Centigrade) |
| CA | California |
| CAL | Calibration |
| CAN | Controller area network |
| CB Tx | CB send transmission |
| CB Rx | CB receive transmission |
| 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 |
| EPTC | Electronic Powertrain Controller |
| ET | Engine temperature |
| ETC | Electronic throttle control |
| EVAP | Evaporative emissions control system |
| EVPT | Electric Vehicle Powertrain |
| °F | Fahrenheit |
| fl oz | Fluid ounce |
| FPS | Fuel pressure sensor |
| ft | Feet |
| ft-lbs | Foot pounds |
| FTP | Flash to pass |
| g | Gram |

Table B-1. Acronyms and Abbreviations

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|-------------------------|---------------------------------------|
| 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 |
| HD-Link | Networking system |
| H-DSSS | Harley-Davidson smart security system |
| HFM | Hands-free mode |
| 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 |
| IM | Instrument module |
| IMU | Inertial Measurement Unit |
| in | inch |
| in ³ | Cubic inch |
| INJ PW | Injector pulse width |
| INTCM | Intercom |
| in-lbs | Inch pounds |
| JSS | Jiffy stand sensor |
| kg | Kilogram |
| km | Kilometer |
| km/h | Kilometers per hour |
| kPa | Kilopascal |
| kW | Kilowatt |
| KS | Knock sensor |
| 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 |
| mA | Milliampere |
| MAP | Manifold absolute pressure |
| max | Maximum |
| MCM | Motor Control Module |
| 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 |
| O ₂ | Oxygen |
| OBC | Onboard Charger |
| OD | Outside diameter |
| OEM | Original equipment manufacturer |
| oz | Ounce |
| P&A | Parts and Accessories |
| Part No. | Part number |

Table B-1. Acronyms and Abbreviations

| ACRONYM OR ABBREVIATION | DESCRIPTION |
|--------------------------------|--|
| PIN | Personal identification number |
| PND | Personal navigation device |
| psi | Pounds per square inch |
| PWM signal | Pulse width modulated signal |
| qt | Quart |
| RAD | Radio |
| RCM | Reverse control module |
| RDS | Radio data system |
| RES | Reserve mark on fuel supply valve |
| RESS | Rechargeable Energy Storage System |
| RFF | Roller Finger Follower |
| 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 |
| TA | Traffic announcement |
| TCA | Throttle control actuator |
| TCU | Telemetry Control Unit |
| TDC | Top dead center |
| TGS | Twist grip sensor |
| TPMS | Tire pressure monitoring system |
| TPS | Throttle position sensor |
| TSM | Turn signal module |
| TSSM | Turn signal/security module |
| TT | Telltale |
| USB | Universal serial bus |
| V | Volt |
| VAC | Volts of alternating current |
| VDC | Volts of direct current |
| VIN | Vehicle identification number |
| VR | Voice recognition |
| VSC | Vehicle Security Advisory Controller |
| VSS | Vehicle speed sensor |
| W | Watt |
| WA | Weather alert |
| WHIM | Wireless headset interface module |
| WSS | Wheel speed sensor |

CONVERSION TABLE

Table B-2. 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 |

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). To convert between U.S. units-of-measure and metric units-of-measure, refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. To convert between U.S. units and British Imperial units, refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this manual. To convert units, use the following equations:

- foot pounds (ft-lbs) 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)

TOOLS

| Part Number | TOOL NAME | NOTES |
|-------------|---|--|
| B-42571 | FORK SEAL DRIVER AND DUST BOOT INSTALLER (43MM) | 3.21 FRONT FORK, Assemble |
| BB200A | BASIC VACUUM BRAKE BLEEDER | 3.19 BLEED BRAKES, Drain 3.19 BLEED BRAKES, Fill and Bleed |
| HD-23688 | BATTERY TESTER | 7.4 DIAGNOSE AND TEST, Freeze Point Test |
| HD-29545-6A | COOLANT FLUORESCENT LEAK DETECTION DYE | 7.4 DIAGNOSE AND TEST, Leak Detection Dye Test |
| HD-33223-1 | CYLINDER COMPRESSION GAUGE | 4.8 TROUBLESHOOTING, Compression Test |
| HD-34736-B | VALVE SPRING COMPRESSOR | 4.17 CYLINDER HEADS, Disassemble 4.17 CYLINDER HEADS, Assemble |
| HD-35381-A | BELT TENSION GAUGE | 2.16 INSPECT AND ADJUST DRIVE BELT AND SPROCKETS, Measure Drive Belt Deflection |
| HD-35457 | BLACK LIGHT LEAK DETECTOR | 7.4 DIAGNOSE AND TEST, Leak Detection Dye Test |
| HD-35667-A | CYLINDER LEAKDOWN TESTER | 4.8 TROUBLESHOOTING, Cylinder Leakdown Test |
| HD-39302 | STEERING HEAD BEARING RACE INSTALLER | 3.22 STEERING HEAD/FORK STEM AND BRACKET ASSEMBLY, Install |
| HD-41137 | HOSE CLAMP PLIERS | 4.9 CRIMP CLAMPS, Install 6.10 FUEL INLET, Install 6.27 PURGE SOLENOID: EVAPORATIVE EMISSIONS, Install 6.28 CHARCOAL CANISTER: EVAPORATIVE EMISSIONS, Install 6.29 PURGE LINES: EVAPORATIVE EMISSIONS, Remove and Install: Vapor Vent Line 6.29 PURGE LINES: EVAPORATIVE EMISSIONS, Remove and Install: Purge Port Hose 6.29 PURGE LINES: EVAPORATIVE EMISSIONS, Remove and Install: Carbon Canister-to-Purge Solenoid Hose 7.6 THERMOSTAT HOUSING, Install 7.9 COOLANT HOSES, Remove and Install: Coolant Hoses |
| HD-41177 | FORK TUBE HOLDER | 3.21 FRONT FORK, Disassemble 3.21 FRONT FORK, Assemble |
| HD-41182 | FUEL PRESSURE GAUGE | 6.7 FUEL PRESSURE TEST, Test |
| HD-41417 | PROPANE ENRICHMENT KIT | 6.23 INTAKE LEAK TEST, Leak Tester |
| HD-42313 | CAM CHAIN TENSIONER UNLOADER | 4.18 CAMSHAFTS AND PHASERS, Install |
| HD-42320-D | PISTON PIN EXTRACTOR | 4.20 PISTONS, Remove 4.20 PISTONS, Install |
| HD-44060D | WHEEL BEARING INSTALLER/REMOVER | 3.8 SEALED WHEEL BEARINGS, Remove 3.8 SEALED WHEEL BEARINGS, Install |
| HD-44061 | FUEL PRESSURE GAUGE ADAPTER | 6.7 FUEL PRESSURE TEST, Test |
| HD-45308 | OIL PRESSURE GAUGE | 4.7 OIL PRESSURE, Oil Pressure Check |
| HD-45314 | CRANKSHAFT ROTATING WRENCH | 4.11 CRANKSHAFT LOCKOUT, Crankshaft Lockout |
| HD-45322 | VALVE GUIDE SEAL INSTALLER | 4.17 CYLINDER HEADS, Assemble |
| HD-45335 | COOLANT SYSTEM PRESSURE TESTER | 7.4 DIAGNOSE AND TEST, Pressure Cap Test 7.4 DIAGNOSE AND TEST, System Pressure Test 7.4 DIAGNOSE AND TEST, Gasket Leak Test |
| HD-45340 | GASKET ALIGNMENT DOWELS | 4.22 COOLANT MANIFOLD, Remove 4.22 COOLANT MANIFOLD, Install |
| HD-45966 | FRONT FORK COMPRESSOR | 3.21 FRONT FORK, Disassemble 3.21 FRONT FORK, Assemble |
| HD-45968 | FAT JACK | 2.2 GENERAL, Secure the Motorcycle for Service |
| HD-48497-A | DOT 4 BRAKE FLUID MOISTURE TESTER | 2.9 CHECK AND REPLACE BRAKE FLUID, Check Brake Fluid Level |

TOOLS

| Part Number | TOOL NAME | NOTES |
|--------------|---|--|
| HD-48650 | DIGITAL TECHNICIAN II | 3.9 TIRE PRESSURE MONITORING SYSTEM (TPMS), Complete 3.18 ABS MODULE, Install 3.18 ABS MODULE, Complete 3.19 BLEED BRAKES, Fill and Bleed 4.8 TROUBLESHOOTING, Compression Test 6.8 PURGE FUEL LINE, Prepare 6.8 PURGE FUEL LINE, Purge 6.8 PURGE FUEL LINE, Complete 8.14 INSTRUMENT MODULE (IM), Complete 8.23 ELECTRONIC CONTROL MODULE (ECM), Prepare 8.25 SECURITY SYSTEM ACTIVATION, Fob Assignment 8.27 SECURITY SYSTEM MAINTENANCE, Service Mode 8.33 GEAR POSITION SENSOR, Complete |
| HD-48650-TL3 | TECHLINK 3 | 8.33 GEAR POSITION SENSOR, Complete |
| HD-48921 | REAR WHEEL COMPENSATOR SPROCKET BEARING REMOVER/INSTALLER | 3.7 REAR WHEEL COMPENSATOR, Disassemble 3.7 REAR WHEEL COMPENSATOR, Assemble |
| HD-50549 | BORESCOPE | 4.8 TROUBLESHOOTING, Compression Test 4.8 TROUBLESHOOTING, Cylinder Leakdown Test |
| HD-51794 | TPMS ACTIVATION TOOL | 3.9 TIRE PRESSURE MONITORING SYSTEM (TPMS), Complete |
| HD-52948 | THERMOSTAT REMOVAL TOOL | 7.6 THERMOSTAT HOUSING, Remove 7.6 THERMOSTAT HOUSING, Install |
| HD-52951 | CAM CHAIN RETENTION TOOL | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Remove 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Cam Timing 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| HD-52953 | CAMSHAFT LOCKING TOOL | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Remove 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| HD-52956 | CRANKSHAFT LOCKING TOOL | 4.8 TROUBLESHOOTING, Cylinder Leakdown Test 4.11 CRANKSHAFT LOCKOUT, Crankshaft Lockout 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Prepare 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Complete 4.16 SECONDARY BALANCER, Prepare 4.16 SECONDARY BALANCER, Complete 4.17 CYLINDER HEADS, Prepare 4.17 CYLINDER HEADS, Complete 4.18 CAMSHAFTS AND PHASERS, Prepare 4.18 CAMSHAFTS AND PHASERS, Complete 4.19 CYLINDERS, Prepare 4.19 CYLINDERS, Complete 4.27 CRANKCASE, Prepare 4.27 CRANKCASE, Complete 5.7 CLUTCH, Complete |
| HD-52957 | CRANKSHAFT PROTECTOR | 4.27 CRANKCASE, Disassemble 4.27 CRANKCASE, Assemble 4.29 CRANKSHAFT AND CONNECTING RODS, Remove |

TOOLS

| Part Number | TOOL NAME | NOTES |
|-------------|---|--|
| | | 4.29 CRANKSHAFT AND CONNECTING RODS, Install |
| HD-52960 | ENGINE SUPPORT PLATE | 4.26 REPLACE ENGINE, Remove 4.26 REPLACE ENGINE, Install |
| HD-52960-BK | ENGINE PLATE SPACERS | 4.26 REPLACE ENGINE, Remove 4.26 REPLACE ENGINE, Install |
| HD-52961 | MAIN BEARING INSTALLATION TOOL | 4.27 CRANKCASE, Repair Right Crankcase Half 4.27 CRANKCASE, Repair Left Crankcase Half |
| HD-52962 | OIL PRESSURE SENDING UNIT WRENCH | 4.7 OIL PRESSURE, Oil Pressure Check 8.15 OIL PRESSURE SWITCH, Remove 8.15 OIL PRESSURE SWITCH, Install |
| HD-52963 | OIL PRESSURE TESTER ADAPTER | 4.7 OIL PRESSURE, Oil Pressure Check |
| HD-52964 | BALANCER SPROCKET LOCKING TOOL | 4.24 OIL PUMP DRIVE, Install |
| HD-52966 | PISTON PIN CIRCLIP INSTALL/REMOVAL TOOL | 4.20 PISTONS, Remove 4.20 PISTONS, Install |
| HD-52967 | PISTON PIN REMOVAL TOOL | 4.20 PISTONS, Remove 4.20 PISTONS, Install |
| HD-52968 | ROTOR LOCKING TOOL | 8.6 ALTERNATOR, Remove 8.6 ALTERNATOR, Install |
| HD-52969 | ROTOR SHELL REMOVAL PIN | 8.6 ALTERNATOR, Remove |
| HD-52970 | ROTOR SHELL TO STARTER DRIVE ASSEMBLY PILOT | 8.6 ALTERNATOR, Install |
| HD-52985 | DRIVE PULLEY LOCKING TOOL | 4.26 REPLACE ENGINE, Remove 4.26 REPLACE ENGINE, Install 5.5 OUTPUT PULLEY, Remove 5.5 OUTPUT PULLEY, Install |
| HD-52991 | OIL FILTER WRENCH | 2.5 REPLACE ENGINE OIL AND FILTER, Change Oil and Oil Filter |
| HD-53022 | POWERTRAIN R&R FIXTURE | 4.26 REPLACE ENGINE, Remove 4.26 REPLACE ENGINE, Install |
| HD-53023 | CAM CHAIN RETRACTION PIN | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Remove 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install 4.16 SECONDARY BALANCER, Remove 4.16 SECONDARY BALANCER, Install |
| HD-59000-B | HARLEY-DAVIDSON PRO-LEVEL OIL GAUGE | 3.21 FRONT FORK, Assemble |
| HD-99500-80 | WHEEL TRUING STAND | 3.6 CHECKING AND TRUING WHEELS, Checking Wheel Runout |

NOTES

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|--|-----------------------|--------------|---|
| ABS module banjo bolts | 17–19 ft-lbs | 23–26 N·m | 3.18 ABS MODULE, Install |
| ABS module bracket to frame screws | 62–80 in-lbs | 7–9 N·m | 3.18 ABS MODULE, Install |
| ABS module to mounting bracket screws | 40–58 in-lbs | 4.5–6.5 N·m | 3.18 ABS MODULE, Install |
| Air box base screw final torque | 44–62 in-lbs | 5–7 N·m | 6.3 AIR BOX, Install |
| Air box base screw first torque | 35–44 in-lbs | 4–5 N·m | 6.3 AIR BOX, Install |
| Air box cover screw | 22–27 in-lbs | 2.5–3.1 N·m | 6.3 AIR BOX, Install |
| Air filter clamp | 22–24 in-lbs | 2.5–2.7 N·m | 2.20 INSPECT AIR FILTER, Remove and Install |
| Axle nut, rear | 95–105 ft-lbs | 129–142 N·m | 2.16 INSPECT AND ADJUST DRIVE BELT AND SPROCKETS, Adjust Belt |
| Axle, front | 74–82 ft-lbs | 100–111 N·m | 3.4 FRONT WHEEL, Install |
| Axle, front, pinch screw | 11–15 ft-lbs | 15–20 N·m | 3.4 FRONT WHEEL, Install |
| Balancer sprocket screw | 310–327 in-lbs | 35–37 N·m | 4.24 OIL PUMP DRIVE, Install |
| Battery cable screw, negative | 60–70 in-lbs | 6.8–7.9 N·m | 2.21 INSPECT BATTERY, Install |
| Battery cable screw, positive | 60–70 in-lbs | 6.8–7.9 N·m | 2.21 INSPECT BATTERY, Install |
| Battery cable, negative, screw | 60–70 in-lbs | 6.8–7.9 N·m | 8.3 POWER DISCONNECT, Negative Battery Cable |
| Battery tray screw | 18–21 ft-lbs | 25–28 N·m | 8.45 BATTERY TRAY, Install |
| Belt guard, bottom, screws | 40–49 in-lbs | 4.5–5.5 N·m | 3.25 BELT GUARDS, Install |
| Belt guard, lower, screw | 49–66 in-lbs | 5.5–7.5 N·m | 2.16 INSPECT AND ADJUST DRIVE BELT AND SPROCKETS, Measure Drive Belt Deflection |
| Belt guard, top, screws | 40–49 in-lbs | 4.5–5.5 N·m | 3.25 BELT GUARDS, Install |
| Brake caliper, front, brake pad hanger pin | 44–62 in-lbs | 5–7 N·m | 2.8 INSPECT BRAKES, Replace Front Brake Pads |
| Brake caliper, front, left, banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.14 FRONT BRAKE CALIPER, Install |
| Brake caliper, front, mounting screw | 28–38 ft-lbs | 38–52 N·m | 3.14 FRONT BRAKE CALIPER, Install |
| Brake caliper, front, mounting screw | 28–38 ft-lbs | 38–52 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Brake caliper, front, mounting screws | 28–38 ft-lbs | 38–52 N·m | 3.4 FRONT WHEEL, Install |
| Brake caliper, rear, banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.16 REAR BRAKE CALIPER, Install |
| Brake caliper, rear, mounting screw | 18–21 ft-lbs | 24–28 N·m | 3.16 REAR BRAKE CALIPER, Install |
| Brake clamp screw | 62–80 in-lbs | 7–9 N·m | 8.31 CAMSHAFT TIMING SENSORS, Install |
| Brake disc, front, screw | 20–22 ft-lbs | 27–30 N·m | 3.4 FRONT WHEEL, Assemble |
| Brake hose clamp screw | 49–66 in-lbs | 5.5–7.5 N·m | 8.35 REAR WHEEL SPEED SENSOR (WSS), Install |
| Brake line clamp screws | 62–80 in-lbs | 7–9 N·m | 8.41 CYLINDER HEAD COVER CADDY, Install |
| Brake line, rear dual, clamp screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Rear Master Cylinder to ABS Module |
| Brake line, rear fork, clamp screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Rear Caliper to ABS Module |
| Brake master cylinder, front, reservoir cover screws | 7–11 in-lbs | 0.8–1.2 N·m | 2.9 CHECK AND REPLACE BRAKE FLUID, Check Brake Fluid Level |
| Brake master cylinder, reservoir cover screw | 5–7 in-lbs | 0.6–0.8 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Brake pad hanger pin | 75–102 in-lbs | 8.5–11.5 N·m | 2.8 INSPECT BRAKES, Replace Rear Brake Pads |
| Brake pedal screw | 13–15 ft-lbs | 17–21 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Brake Pedal |
| Brake, front master cylinder banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Install |
| Brake, front master cylinder mounting screw | 62–80 in-lbs | 7–9 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Install |

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|--|----------------|-------------|---|
| Brake, rear master cylinder banjo bolt | 17–19 ft-lbs | 23–26 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Install |
| Brake, rear master cylinder reservoir screw | 62–80 in-lbs | 7–9 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Install |
| Brake, rear master cylinder screws | 80–97 in-lbs | 9–11 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Install |
| Breather bolt | 80–97 in-lbs | 9–11 N·m | 6.4 BREATHER BOLT, Install |
| CKP sensor screw | 53–80 in-lbs | 6–9 N·m | 8.30 CRANKSHAFT POSITION SENSOR (CKP), Install |
| Caddy, left side screw | 25–29 in-lbs | 2.8–3.3 N·m | 8.40 LEFT SIDE CADDY, Install |
| Cam and sprocket center screw torque step 1. | 66–81 ft-lbs | 90–110 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam and sprocket center screw torque step 2. | | -360° | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam and sprocket center screw torque step 3. | 13–16 ft-lbs | 18–22 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam and sprocket center screw torque step 4. | | 33 ± 2° | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Cam phaser screws torque step 1. | 40–49 in-lbs | 4.5–5.5 N·m | 4.18 CAMSHAFTS AND PHASERS, Install |
| Cam phaser screws torque step 2. | | 46 ± 3° | 4.18 CAMSHAFTS AND PHASERS, Install |
| Camshaft cap screw (1st torque) | 44–53 in-lbs | 5–6 N·m | 4.18 CAMSHAFTS AND PHASERS, Install |
| Camshaft cap screw (Final torque) | 115–133 in-lbs | 13–15 N·m | 4.18 CAMSHAFTS AND PHASERS, Install |
| Camshaft drive sprocket locknut | 125–140 ft-lbs | 170–190 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Camshaft solenoid plate nut | 62–80 in-lbs | 7–9 N·m | 4.14 PHASER SOLENOIDS, Install |
| Camshaft solenoid plate screw | 62–80 in-lbs | 7–9 N·m | 4.14 PHASER SOLENOIDS, Install |
| Camshaft solenoid screws | 62–80 in-lbs | 7–9 N·m | 4.14 PHASER SOLENOIDS, Install |
| Camshaft timing sensor screw | 47–66 in-lbs | 5.3–7.5 N·m | 8.31 CAMSHAFT TIMING SENSORS, Install |
| Chain tensioner housing screw, long | 12–13 ft-lbs | 16–18 N·m | 4.16 SECONDARY BALANCER, Install |
| Chain tensioner housing screw, short | 27–35 in-lbs | 3–4 N·m | 4.16 SECONDARY BALANCER, Install |
| Chain tensioner, oil pump, screws | 58–75 in-lbs | 6.5–8.5 N·m | 4.24 OIL PUMP DRIVE, Install |
| Chin spoiler screws | 35–62 in-lbs | 4–7 N·m | 3.29 CHIN SPOILER, Install |
| Clutch hand control bracket screw | 60–80 in-lbs | 6.8–9 N·m | 3.27 CLUTCH CONTROL, Install |
| Clutch lever pivot nut | 44–62 in-lbs | 5–7 N·m | 3.27 CLUTCH CONTROL, Assemble |
| Clutch nut | 125–140 ft-lbs | 170–190 N·m | 5.7 CLUTCH, Install |
| Clutch switch cover screw | 5–8 in-lbs | 0.6–0.9 N·m | 8.11 CLUTCH SWITCH, Install |
| Clutch switch screw | 4–5 in-lbs | 0.5–0.6 N·m | 8.11 CLUTCH SWITCH, Install |
| Console screws | 27–35 in-lbs | 3–4 N·m | 6.6 CONSOLE, Install |
| Coolant bleed plug, cylinder | 44 in-lbs | 5 N·m | 7.5 COOLANT, Drain and Fill Cooling System |
| Coolant manifold screws | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Coolant pump screw | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Coolant temperature sensor | 26–29 ft-lbs | 35–39 N·m | 7.10 ENGINE COOLANT TEMPERATURE (ECT) SENSOR, Install |
| Coolant tube clamp screw | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Cooling fan mounting nut | 35–44 in-lbs | 4–5 N·m | 8.29 COOLING FAN, Install |
| Cooling fan shroud screw | 71–89 in-lbs | 8–10 N·m | 8.29 COOLING FAN, Install |
| Crankcase locking tool access plug | 97–115 in-lbs | 11–13 N·m | 4.11 CRANKSHAFT LOCKOUT, Crankshaft Lockout |
| Crankcase screw, left | 16–20 ft-lbs | 22–27 N·m | 4.27 CRANKCASE, Assemble |
| Crankshaft primary gear screws | 24–27 ft-lbs | 32–36 N·m | 4.29 CRANKSHAFT AND CONNECTING RODS, Install |
| Crossmember screws | 71–89 in-lbs | 8–10 N·m | 3.40 FRAME CROSSMEMBER, Install |

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|--|----------------|---------------|--|
| Cylinder head camshaft cover screws | 63–77 in-lbs | 7.1–8.7 N·m | 4.13 CAMSHAFT COVERS, Install |
| Cylinder head cover caddy screws | 35–62 in-lbs | 4–7 N·m | 8.41 CYLINDER HEAD COVER CADDY, Install |
| Cylinder head cover screws | 63–77 in-lbs | 7.1–8.7 N·m | 4.12 CYLINDER HEAD COVERS, Install |
| Cylinder head screws torque step 1 | 20–23 ft-lbs | 27–31 N·m | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 2: loosen | | -360° | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 3 | 15–18 ft-lbs | 20–24 N·m | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 4 | 35–38 ft-lbs | 47.5–51.5 N·m | 4.17 CYLINDER HEADS, Install |
| Cylinder head screws torque step 5 | | 148–155° | 4.17 CYLINDER HEADS, Install |
| Detent arm screw | 89–106 in-lbs | 10–12 N·m | 5.6 SHIFTER SHAFT, Install |
| Detent collar screw | 73–95 in-lbs | 8.2–10.7 N·m | 5.6 SHIFTER SHAFT, Install |
| Drain screw | 130–150 in-lbs | 15–16.5 N·m | 7.5 COOLANT, Drain and Fill Cooling System |
| Dynamic chain guide assembly top hat screw | 29–32 ft-lbs | 39–43 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| ECM assembly screws | 35–62 in-lbs | 4–7 N·m | 8.23 ELECTRONIC CONTROL MODULE (ECM), Install |
| End cap, connecting rod, screw torque step 1 | 20 ft-lbs | 27 ± 2 N·m | 4.29 CRANKSHAFT AND CONNECTING RODS, Assemble |
| End cap, connecting rod, screw torque step 2 | | 80 ± 2° | 4.29 CRANKSHAFT AND CONNECTING RODS, Assemble |
| Exhaust clamp | 71–89 in-lbs | 8–10 N·m | 6.25 MUFFLERS, Install |
| Exhaust header nuts, front | 15–16 ft-lbs | 20–22 N·m | 6.26 EXHAUST SYSTEM, Install |
| Exhaust shield screw | 44–62 in-lbs | 5–7 N·m | 6.25 MUFFLERS, Install |
| Exhaust shield screws, outer | 44–62 in-lbs | 5–7 N·m | 6.25 MUFFLERS, Install |
| Exhaust shield, inner, screw | 44–62 in-lbs | 5–7 N·m | 6.25 MUFFLERS, Install |
| Exhaust, rear header nuts | 15–16 ft-lbs | 20–22 N·m | 6.26 EXHAUST SYSTEM, Install |
| Fender assembly, front, screw | 62–71 in-lbs | 7–8 N·m | 3.33 FRONT FENDER, Install |
| Fender, front, screw | 62–71 in-lbs | 7–8 N·m | 3.33 FRONT FENDER, Install |
| Footrest bracket screw | 21–23 ft-lbs | 28.5–31.5 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Bracket |
| Footrest bracket, rider, left side | 21–23 ft-lbs | 28.5–31.5 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Bracket |
| Fork bracket, lower, pinch screw | 15–18 ft-lbs | 20.4–25 N·m | 3.21 FRONT FORK, Install |
| Fork bracket, upper pinch screws | 15–18 ft-lbs | 20.4–25 N·m | 2.12 ADJUST AND LUBRICATE STEERING HEAD BEARINGS, Check and Adjust |
| Fork bracket, upper, pinch screw | 15–18 ft-lbs | 20.4–25 N·m | 3.21 FRONT FORK, Install |
| Fork damper nut | 13–17 ft-lbs | 17.5–22.5 N·m | 3.21 FRONT FORK, Assemble |
| Fork link screw | 66–74 ft-lbs | 90–100 N·m | 3.24 REAR FORK, Install |
| Fork lock screw | 97–124 in-lbs | 11–14 N·m | 3.23 FORK LOCK, Install |
| Fork stem pinch screw | 15–18 ft-lbs | 20.4–25 N·m | 2.12 ADJUST AND LUBRICATE STEERING HEAD BEARINGS, Check and Adjust |
| Fork tube cap | 22–30 ft-lbs | 30–40 N·m | 3.21 FRONT FORK, Assemble |
| Fork tube damper screw, standard | 133–221 in-lbs | 15–25 N·m | 3.21 FRONT FORK, Assemble |
| Front bleeder screw | 80–97 in-lbs | 9–11 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Front brake lever pivot nut | 44–62 in-lbs | 5–7 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Assemble |
| Front brake line, front clamp screw | 49–66 in-lbs | 5.5–7.5 N·m | 3.17 BRAKE LINES, Brake Line: Front Caliper to ABS Module |
| Front brake line, front clamp screw | 49–66 in-lbs | 5.5–7.5 N·m | 3.17 BRAKE LINES, Brake Line: Front Master Cylinder to ABS Module |
| Front brake line, rear clamp screws | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Front Caliper to ABS Module |

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|--------------------------------------|----------------|---------------|--|
| Front brake line, rear clamp screws | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Front Master Cylinder to ABS Module |
| Front frame bolts | 80–88 ft-lbs | 108–119 N·m | 3.39 FRAME, Install |
| Front turn signal pinch screw | 27–44 in-lbs | 3–5 N·m | 3.21 FRONT FORK, Install |
| Fuel cap screws | 25–29 in-lbs | 2.8–3.3 N·m | 6.12 FUEL LEVEL SENDER, Install |
| Fuel inlet screws | 40–49 in-lbs | 4.5–5.5 N·m | 6.10 FUEL INLET, Install |
| Fuel pump assembly screw | 40–49 in-lbs | 4.5–5.5 N·m | 6.13 FUEL PUMP, Install |
| Fuel rail screws | 80–97 in-lbs | 9–11 N·m | 6.20 FUEL INJECTORS, Install |
| Fuel regulator screw | 80–97 in-lbs | 9–11 N·m | 6.20 FUEL INJECTORS, Install |
| Fuel tank mounting bracket bolt | 18–21 ft-lbs | 25–29 N·m | 6.11 FUEL TANK, Install |
| Fuel tank mounting screws | 89–102 in-lbs | 10–11.5 N·m | 6.11 FUEL TANK, Install |
| GND nut | 60–72 in-lbs | 6.8–8.1 N·m | 3.38 TAIL SECTION, Install |
| Gear position sensor screw | 71–89 in-lbs | 8–10 N·m | 8.33 GEAR POSITION SENSOR, Install |
| Ground wire nut | 60–72 in-lbs | 6.8–8.1 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Hand grip clamp, left | 22–27 in-lbs | 2.5–3.1 N·m | 3.30 HAND GRIPS, Install |
| Handlebar clamp screws | 18–20 ft-lbs | 24–27 N·m | 3.31 HANDLEBAR, Install |
| Handlebar end cap | 124–177 in-lbs | 14–20 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| Handlebar end cap, left | 124–177 in-lbs | 14–20 N·m | 3.30 HAND GRIPS, Install |
| Handlebar end cap, right | 124–177 in-lbs | 14–20 N·m | 3.30 HAND GRIPS, Install |
| Harness ground fastener | 60–72 in-lbs | 6.8–8.1 N·m | 8.44 TAIL SECTION CADDY, Install |
| Headlamp bracket screw | 71–89 in-lbs | 8–10 N·m | 8.17 HEADLAMP, Install |
| Headlamp screw | 18–22 ft-lbs | 24–30 N·m | 8.17 HEADLAMP, Adjust |
| Horn bracket screws | 50–62 in-lbs | 5.7–7 N·m | 8.16 HORN, Install |
| Horn screws | 50–62 in-lbs | 5.7–7 N·m | 3.39 FRAME, Install |
| IM housing screws | 13–17 in-lbs | 1.5–1.9 N·m | 8.14 INSTRUMENT MODULE (IM), Install |
| IM screws | 91–101 in-lbs | 10.3–11.4 N·m | 8.14 INSTRUMENT MODULE (IM), Install |
| IMU mounting screw | 89–97 in-lbs | 10–11 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Ignition coil bracket, breather bolt | 24–30 ft-lbs | 33.1–40.5 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil bracket, lower screws | 24–30 ft-lbs | 33.1–40.5 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil bracket, upper screws | 71–89 in-lbs | 8–10 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil, head mounted screw | 47–66 in-lbs | 5.3–7.5 N·m | 8.9 IGNITION COIL, Install |
| Ignition coil, side mount screw | 81–99 in-lbs | 9.1–11.2 N·m | 8.9 IGNITION COIL, Install |
| Induction module screw | 124–142 in-lbs | 14–16 N·m | 6.21 INDUCTION MODULE, Install |
| Instrument cluster screw | 91–101 in-lbs | 10.3–11.4 N·m | 2.12 ADJUST AND LUBRICATE STEERING HEAD BEARINGS, Check and Adjust |
| Intake manifold screws | 80–97 in-lbs | 9–11 N·m | 6.22 INTAKE MANIFOLD, Install |
| JSS screw | 20–25 in-lbs | 2.3–2.8 N·m | 8.38 JIFFY STAND SENSOR (JSS), Install |
| Jiffy stand pivot pin nut | 91–101 in-lbs | 10.3–11.4 N·m | 3.36 JIFFY STAND, Assemble |
| Jiffy stand screws | 15–18 ft-lbs | 21–25 N·m | 3.36 JIFFY STAND, Install |
| Knock sensor screw | 97–115 in-lbs | 11–13 N·m | 8.32 KNOCK SENSOR (KS), Install |
| LHCM clamp screw | 56–68 in-lbs | 6.3–7.7 N·m | 8.10 LEFT HAND CONTROL MODULE (LHCM), Install |
| LHCM rear cover screw | 5–8 in-lbs | 0.6–0.9 N·m | 8.10 LEFT HAND CONTROL MODULE (LHCM), Install |
| Left side brake line clamp screws | 35–62 in-lbs | 4–7 N·m | 3.39 FRAME, Install |
| Left side cable guide screw | 35–62 in-lbs | 4–7 N·m | 3.39 FRAME, Install |
| Left steering head cover screw | 7–11 in-lbs | 0.8–1.2 N·m | 8.34 FRONT WHEEL SPEED SENSOR (WSS), Install |
| License plate bracket, rear, screw | 89–106 in-lbs | 10–12 N·m | 3.34 LICENSE PLATE MODULE SWINGARM MOUNT, Install |

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|--|------------------|---------------|--|
| License plate module swingarm mount, screw | 24–27 ft-lbs | 32–36 N·m | 3.34 LICENSE PLATE MODULE SWINGARM MOUNT, Install |
| Lock reinforcement bracket screw | 97–115 in-lbs | 11–13 N·m | 3.23 FORK LOCK, Install |
| MAP sensor screw | 80–97 in-lbs | 9–11 N·m | 6.17 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR, Install |
| MAP sensor screws | 80–97 in-lbs | 9–11 N·m | 6.22 INTAKE MANIFOLD, Install |
| Manual adjuster screws | 77–93 in-lbs | 8.7–10.5 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Middle side cover screw | 71–89 in-lbs | 8–10 N·m | 3.20 SIDE COVERS, Install |
| Midframe lower bolt and nut | 80–88 ft-lbs | 108–119 N·m | 3.39 FRAME, Install |
| Midframe upper flange screws | 125–137 ft-lbs | 169–186 N·m | 3.39 FRAME, Install |
| Mirror base screw | 124–177 in-lbs | 14–20 N·m | 3.32 MIRRORS, Install |
| Mirror mounting nut | 96–144 in-lbs | 10.8–16.3 N·m | 3.32 MIRRORS, Install |
| Mirror screw | 124–177 in-lbs | 14–20 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| Muffler mounting screw | 89–106 in-lbs | 10–12 N·m | 6.25 MUFFLERS, Install |
| Oil baffle screws | 80–97 in-lbs | 9–11 N·m | 4.21 PRIMARY COVER, Install |
| Oil cooler screws | 80–97 in-lbs | 9–11 N·m | 4.10 OIL COOLER, Install |
| Oil drain plug, engine | 15 ft-lbs | 20 N·m | 2.5 REPLACE ENGINE OIL AND FILTER, Change Oil and Oil Filter |
| Oil filter adapter fitting | 19–24 ft-lbs | 26–32 N·m | 4.27 CRANKCASE, Plugs and Oil Fittings |
| Oil nozzle banjo screw | 142–177 in-lbs | 16–20 N·m | 4.31 CRANKCASE OIL NOZZLES, Install |
| Oil pump (pressure side) screws | 80–97 in-lbs | 9–11 N·m | 4.25 OIL PUMP, Install |
| Oil pump sprocket screw | 80–97 in-lbs | 9–11 N·m | 4.24 OIL PUMP DRIVE, Install |
| Output pulley nut | 85–92 ft-lbs | 115–125 N·m | 5.5 OUTPUT PULLEY, Install |
| Oxygen sensor, heated | 12–14 ft-lbs | 16.5–19.5 N·m | 6.24 HEATED OXYGEN SENSORS (HO2S), Install |
| Pedal connector nut | 93–111 in-lbs | 10.5–12.5 N·m | 3.15 REAR BRAKE MASTER CYLINDER, Assemble |
| Pinch screw | 14–16 ft-lbs | 19.5–21.5 N·m | 5.6 SHIFTER SHAFT, Install |
| Pivot shaft pinch bolt | 16–18 ft-lbs | 22–25 N·m | 3.24 REAR FORK, Install |
| Plug, engine body | 97–115 in-lbs | 11–13 N·m | 4.27 CRANKCASE, Plugs and Oil Fittings |
| Primary cover screws | 94–115 in-lbs | 10.6–13 N·m | 4.21 PRIMARY COVER, Install |
| RHCM clamp screw | 56–68 in-lbs | 6.3–7.7 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| RHCM cover screws, front | 5–8 in-lbs | 0.6–0.9 N·m | 3.30 HAND GRIPS, Install |
| RHCM rear cover screw | 6–8 in-lbs | 0.65–0.9 N·m | 8.12 RIGHT HAND CONTROL MODULE (RHCM), Install |
| Radiator cover screw | 71–89 in-lbs | 8–10 N·m | 3.20 SIDE COVERS, Install |
| Radiator cover screws | 71–89 in-lbs | 8–10 N·m | 3.20 SIDE COVERS, Install |
| Radiator mounting screw | 71–89 in-lbs | 8–10 N·m | 7.11 RADIATOR, Remove and Install: Radiator |
| Radiator mounting screws | 71–89 in-lbs | 8–10 N·m | 7.11 RADIATOR, Relocate Radiator for Service |
| Rear bleeder screw | 106–142 in-lbs | 12–16 N·m | 3.19 BLEED BRAKES, Fill and Bleed |
| Rear disc screw | 16–24 ft-lbs | 21.7–32.5 N·m | 3.5 REAR WHEEL, Assemble |
| Rear fender mounting screw | 35.4–44.3 in-lbs | 4–5 N·m | 3.28 COWL AND REAR FENDERS, Install |
| Rear stoplamp switch | 12–15 ft-lbs | 16.3–20.3 N·m | 8.21 REAR STOPLAMP SWITCH, Install |
| Reservoir mount screw | 142–159 in-lbs | 16–18 N·m | 3.13 FRONT BRAKE MASTER CYLINDER, Assemble |
| Right rear side cover screws | 62–75 in-lbs | 7–8.5 N·m | 3.38 TAIL SECTION, Install |
| Rotor to crankshaft bolt | 214–229 ft-lbs | 290–310 N·m | 8.6 ALTERNATOR, Install |
| Scavenge oil pump screw | 80–97 in-lbs | 9–11 N·m | 4.30 SCAVENGE OIL PUMP, Install |
| Screw, retaining plate, transmission mainshaft bearing | 80–97 in-lbs | 9–11 N·m | 4.27 CRANKCASE, Repair Right Crankcase Half |

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|------------------------------------|----------------|---------------|--|
| Seat latch bracket screws | 73–89 in-lbs | 8.2–10 N·m | 3.37 SEAT, Install |
| Seat latch screws | 44–53 in-lbs | 5–6 N·m | 3.37 SEAT, Install |
| Seat lock bracket screw | 62–75 in-lbs | 7–8.5 N·m | 3.38 TAIL SECTION, Install |
| Seat lock screws | 12–15 in-lbs | 1.3–1.7 N·m | 3.37 SEAT, Install |
| Seat release bracket screw | 73–89 in-lbs | 8.2–10 N·m | 8.35 REAR WHEEL SPEED SENSOR (WSS), Install |
| Shift link to foot shifter | 89–110 in-lbs | 10.1–12.4 N·m | 5.6 SHIFTER SHAFT, Install |
| Shift return pin | 106–133 in-lbs | 12–15 N·m | 5.6 SHIFTER SHAFT, Install |
| Shifter link screw | 93–106 in-lbs | 10.5–12 N·m | 5.6 SHIFTER SHAFT, Install |
| Shifter, foot, screw | 18–22 ft-lbs | 24.5–30 N·m | 5.6 SHIFTER SHAFT, Install |
| Shock absorber link bolt | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber lower bolt | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber lower screw | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Shock absorber upper screw | 66–74 ft-lbs | 90–100 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Spark Plug | 89–133 in-lbs | 10–15 N·m | 2.22 INSPECT AND REPLACE SPARK PLUGS, Install |
| Spark plug | 89–133 in-lbs | 10–15 N·m | 4.8 TROUBLESHOOTING, Compression Test |
| Spring plate bolts | 71–106 in-lbs | 8–12 N·m | 5.7 CLUTCH, Assemble |
| Sprocket cover screws | 62–80 in-lbs | 7–9 N·m | 3.25 BELT GUARDS, Install |
| Starter cable nut | 27–41 in-lbs | 3–4.6 N·m | 2.21 INSPECT BATTERY, Install |
| Starter gear screw | 29–37 ft-lbs | 39–50 N·m | 4.23 STARTER GEAR, Install |
| Starter screw to case | 80–97 in-lbs | 9–11 N·m | 8.4 STARTER, Install |
| Starter solenoid nut | 27–41 in-lbs | 3–4.6 N·m | 8.5 STARTER SOLENOID, Install |
| Starter terminal nut | 53–71 in-lbs | 6–8 N·m | 8.4 STARTER, Install |
| Stator to coolant manifold screw | 71–89 in-lbs | 8–10 N·m | 4.22 COOLANT MANIFOLD, Install |
| Steering head cover screw | 7–11 in-lbs | 0.8–1.2 N·m | 3.20 SIDE COVERS, Install |
| Stoplamp switch screw, front | 4–6 in-lbs | 0.5–0.7 N·m | 8.13 FRONT STOPLAMP SWITCH, Install |
| Swing arm assembly mount block nut | 18–21 ft-lbs | 25–28 N·m | 3.26 REAR SHOCK ABSORBER, Install |
| Swing arm pivot nut | 60–74 ft-lbs | 81–100 N·m | 3.24 REAR FORK, Install |
| Switch, Oil Pressure | 13–17 ft-lbs | 17–23 N·m | 8.15 OIL PRESSURE SWITCH, Install |
| TGS mounting screw | 3–4 in-lbs | 0.36–0.44 N·m | 8.36 TWIST GRIP SENSOR (TGS), Install |
| TGS screws | 4 in-lbs | 0.4 N·m | 6.18 TWIST GRIP SENSOR (TGS), Install |
| Tail caddy bottom screw | 35–62 in-lbs | 4–7 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Tail caddy front screw | 25–29 in-lbs | 2.8–3.3 N·m | 8.37 INERTIAL MEASUREMENT UNIT (IMU), Install |
| Tail lamp screw | 62–80 in-lbs | 7–9 N·m | 8.20 TAIL LAMP, Install |
| Tail section caddy screws | 35–62 in-lbs | 4–7 N·m | 8.44 TAIL SECTION CADDY, Install |
| Tail section lower screw | 80–88 ft-lbs | 108–119 N·m | 3.38 TAIL SECTION, Install |
| Tail section upper screws | 80–88 ft-lbs | 108–119 N·m | 3.38 TAIL SECTION, Install |
| Thermostat housing screws | 71–89 in-lbs | 8–10 N·m | 7.6 THERMOSTAT HOUSING, Install |
| Timing chain guide screw | 80–97 in-lbs | 9–11 N·m | 4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install |
| Turn signal lamp screw | 71–89 in-lbs | 8–10 N·m | 8.19 REAR TURN SIGNAL LAMPS, Install |
| Turn signal screw, front | 27–44 in-lbs | 3–5 N·m | 8.18 FRONT TURN SIGNAL LAMPS, Install |
| Under seat caddy screw | 25–29 in-lbs | 2.8–3.3 N·m | 8.35 REAR WHEEL SPEED SENSOR (WSS), Install |
| Under seat caddy screws | 35–62 in-lbs | 4–7 N·m | 8.42 BCM CADDY, Install |
| Upper chain guide, oil pump, screw | 58–75 in-lbs | 6.5–8.5 N·m | 4.24 OIL PUMP DRIVE, Install |
| Upper frame screw | 125–139 ft-lbs | 169–188 N·m | 3.26 REAR SHOCK ABSORBER, Install |

Torque Values

| FASTENER | TORQUE VALUE | | NOTES |
|---------------------------------|----------------------|---------------|---|
| Valve stem screw | 23–27 in-lbs | 2.6–3 N·m | 3.9 TIRE PRESSURE MONITORING SYSTEM (TPMS), Install |
| Voltage regulator bracket | 35–62 in-lbs | 4–7 N·m | 8.7 VOLTAGE REGULATOR, Install |
| Voltage regulator bracket screw | 35–62 in-lbs | 4–7 N·m | 2.21 INSPECT BATTERY, Install |
| Voltage regulator screw | 91–101 in-lbs | 10.3–11.4 N·m | 8.7 VOLTAGE REGULATOR, Install |
| Wear peg | 31–40 in-lbs | 3.5–4.5 N·m | 3.35 RIDER FOOTRESTS, Remove and Install: Footpegs |
| Wire form screw | 62–80 in-lbs | 7–9 N·m | 3.17 BRAKE LINES, Brake Line: Front Master Cylinder to ABS Module |

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