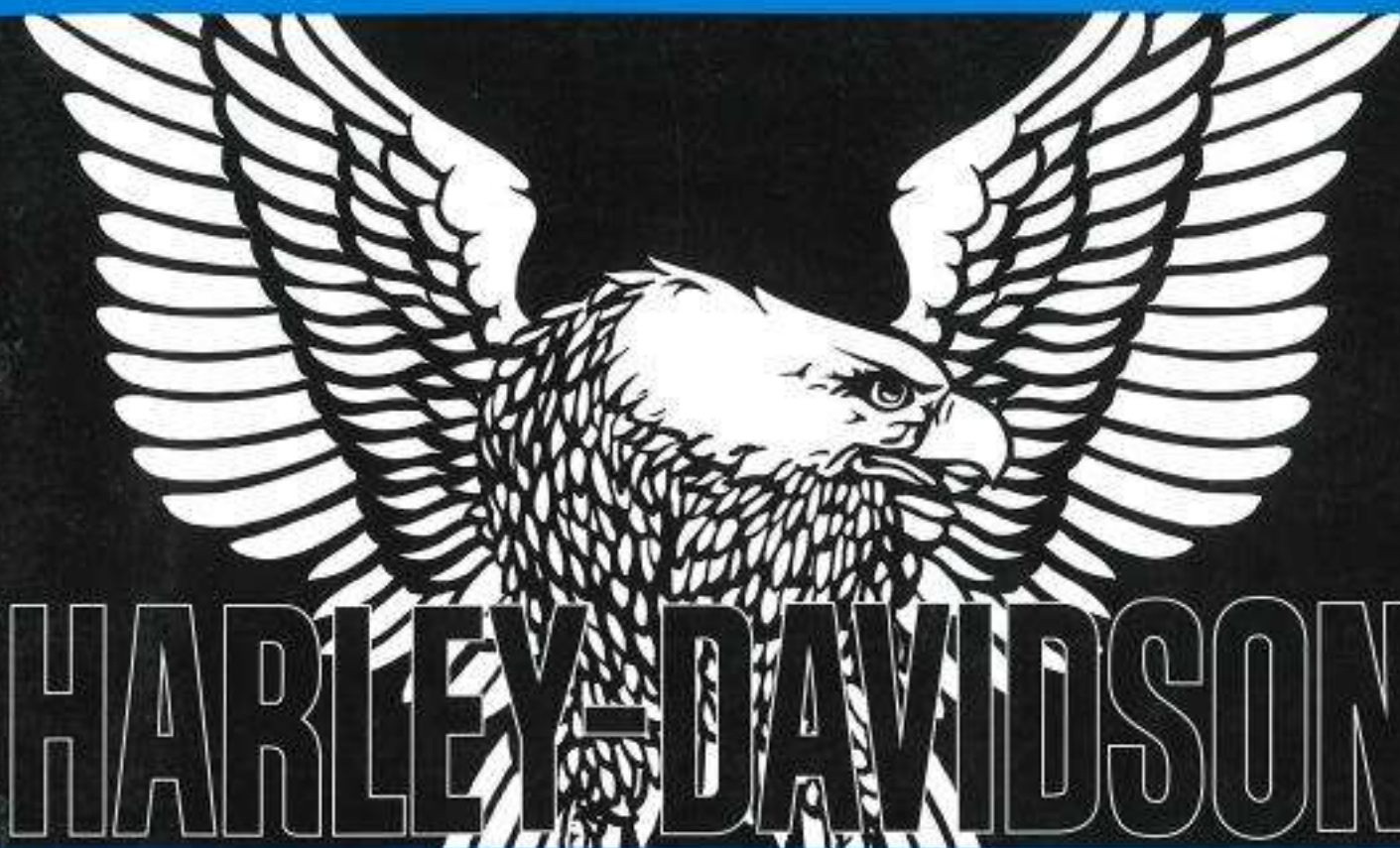




HARLEY-DAVIDSON

SPORTSTER® RH MODELS

2021 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

2021 HARLEY-DAVIDSON® SERVICE MANUAL

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FOREWORD

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
J>	Apply Lubricant: Indicates a part that should be lubricated during installation.
1fiii	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.
'i h	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

A 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.

A 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 dean 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

A 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.

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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	
0	• Content applies to model or feature listed
☐	• Content does not apply to model or feature listed

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NOTES

Customer 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.

A DANGER

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

A WARNING

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

A 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.

A 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

A 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

A 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

A 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

A 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

A 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

A 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
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

A 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

A 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.

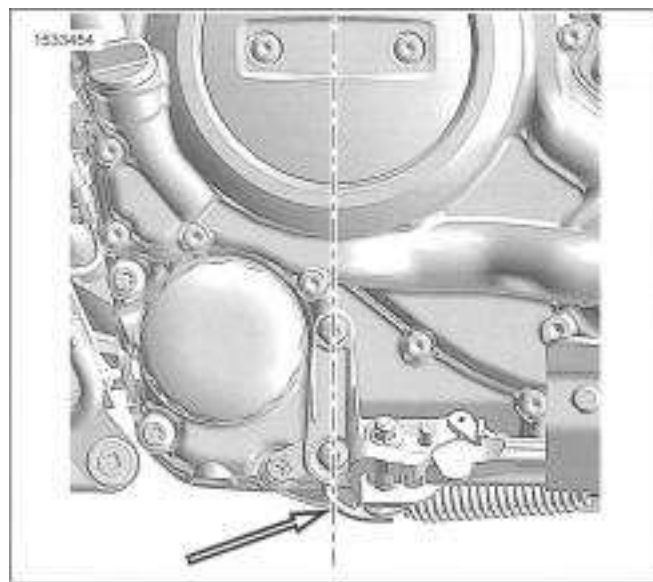


Figure 2-1. Crankshaft Centerline

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 1000 MI	8000 KM 5000 MI	16000 KM 10000 MI	24000 KM 15000 MI	32000 KM 20000 MI	40000 KM 25000 MI	48000 KM 30000 MI	56000 KM 35000 MI	64000 KM 40000 MI	72000 KM 45000 MI	80000 KM 50000 MI	NOTES
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 1000 MI	8000 KM 5000 MI	16000 KM 10000 MI	24000 KM 15000 MI	32000 KM 20000 MI	40000 KM 25000 MI	48000 KM 30000 MI	56000 KM 35000 MI	64000 KM 40000 MI	72000 KM 45000 MI	80000 KM 50000 MI	NOTES
Brake and clutch controls	Lubricate	x	x	x	x	x	x	x	x	x	x	x	2, 3, 8
	Check	x	x			x			x			x	2, 3,4
Rear wheel spoke tightness (if equipped)													
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													
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)													

FUEL

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

A 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)

A 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****A 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)

A 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 Motor-cycle Lubricant	SAE 15W50	Above 30.2 °F (-1 °C)	Excellent
Screamin' Eagle SYN3 Full Synthetic Motor-cycle 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 1,491/4 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.

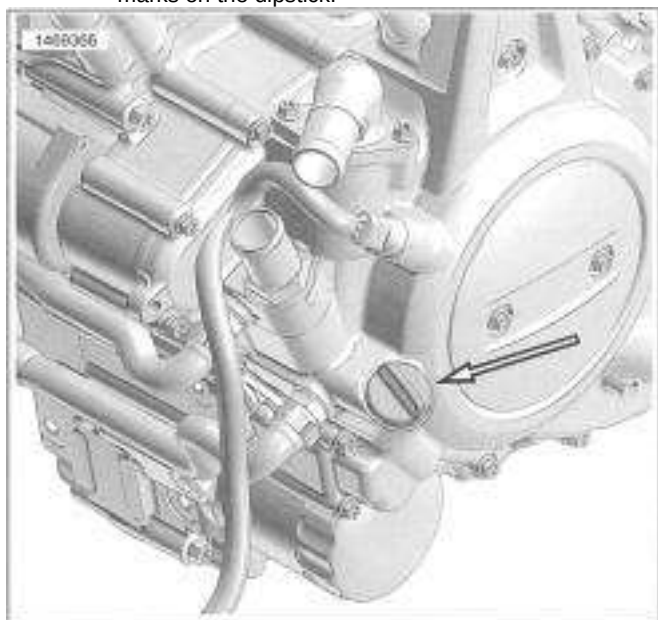


Figure 2-2. Engine Oil Filler Plug/Dipstick

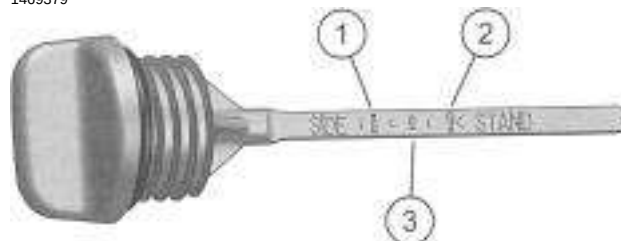
1. Full hot mark
2. Add quart mark
3. Engine oil level range

Figure 2-3. Engine Oil Dipstick (Vehicle Sidestand Gauge)

CHANGE OIL AND OIL FILTER

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

1469379



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)

PART NUMBER	TOOL NAME
HD-52991	OIL FILTER WRENCH

FASTENER	TORQUE VALUE	
Oil drain plug, engine	15 ft-lbs	20 Nm

A WARNING

- 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 4-66).
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.

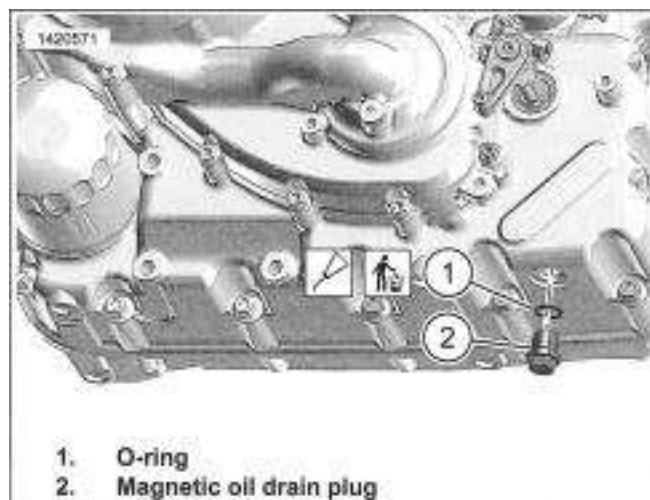


Figure 2-4. Oil Drain Plug

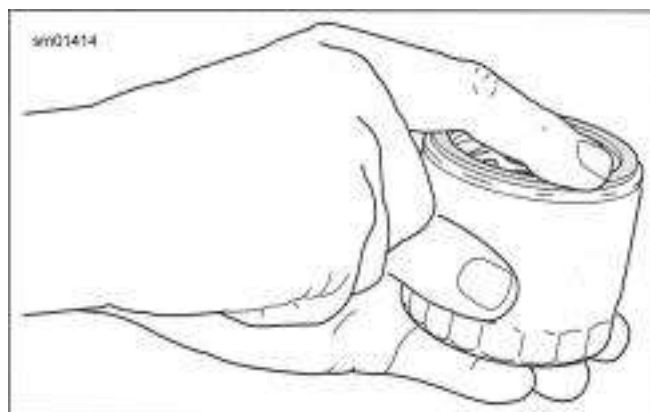


Figure 2-5. Lubricating New Oil Filter Gasket

GENERAL**A 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)

A 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****A 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

A 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

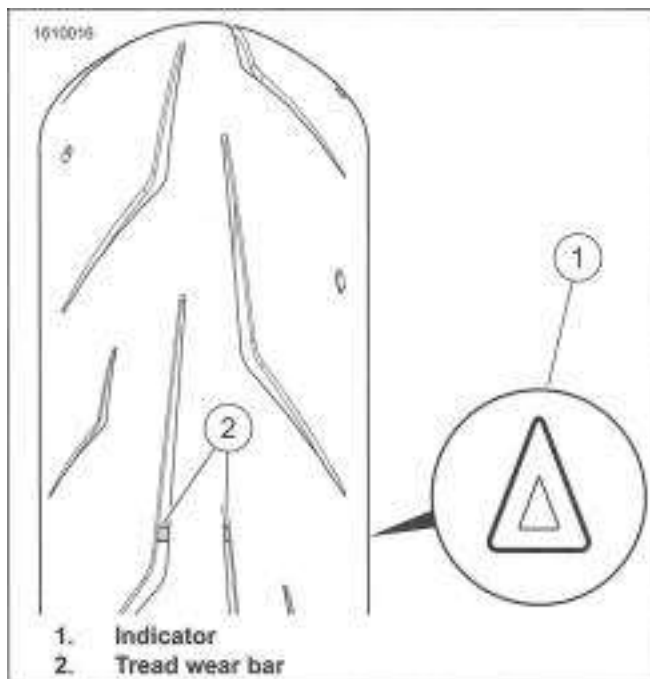


Figure 2-6. Tread Wear Indicator: Dunlop Tires

TIRE REPLACEMENT

appear.

A 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)

A 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)

A 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)

A 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)

A 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)

1610021



1. Front brake hand lever
2. Steering head bearings
3. Clutch cable



4. Clutch hand lever
5. Jiffy stand

Figure 2-7. Lubrication Points

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.

A 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	0.5	0.020
Rear brake pads	0.45	0.018
Front brake discs	5.4	0.213
Rear brake disc	4.5	0.177

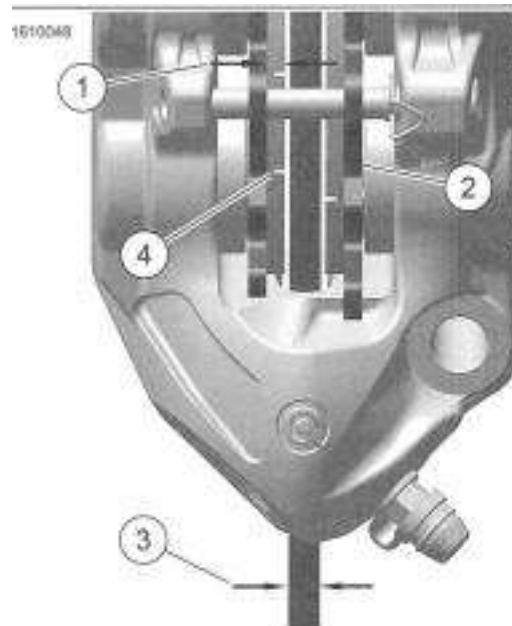
1. Refer to Table 2-7. Check brake disc thickness and

2.8

compare to value indicated in table.

2. Replace if necessary.

REPLACE FRONT BRAKE PADS



1. Brake pad thickness
2. Backplate
3. Brake disc thickness
4. Brake pad wear indicator grooves

Figure 2-8. Brake Thickness

Brake Disc

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

A WARNING

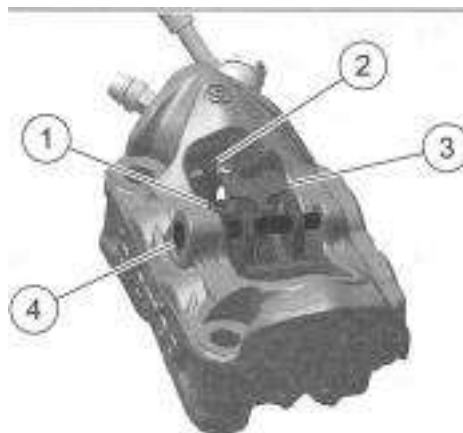
Always replace brake pads in complete sets for correct and safe brake operation. Improper brake operation could result in death or serious injury. (00111a)

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.

A 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 or rear lamps.
 - b. Test ride motorcycle. If brakes feel spongy, bleed brakes. See BLEED BRAKES (Page 3-43).



1. Retainer clip
2. Brake pad (2)
3. Brake pad retaining spring
4. Brake pad hanger pin

Figure 2-9. Front Caliper Assembled

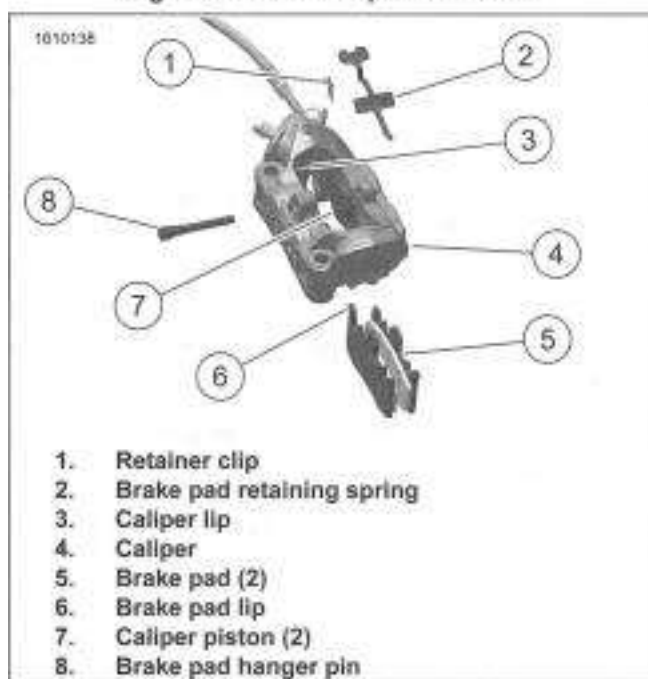


Figure 2-10. Front Brake Pads

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

A 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 Nm) 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.

A 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.

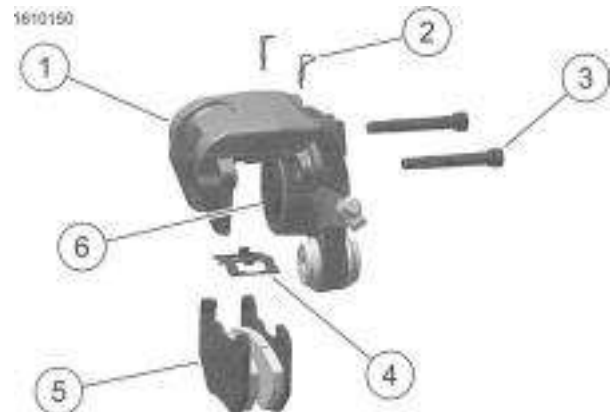
- a. Turn ignition switch ON. Check operation of rear lamps.
- b. Test ride motorcycle. If brakes feel spongy, bleed brakes. See BLEED BRAKES (Page 3-43).



1. Retainer clip
2. Brake pad hanger pin
3. Brake pad (2)

Figure 2-11. Rear Caliper Assembled

Figure 2-12. Rear Brake Pads



1. Caliper
2. Retainer clip
3. Brake pad hanger pin
4. Brake pad retaining spring
5. Brake pad (2)
6. Caliper piston

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

A 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)

A 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)

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

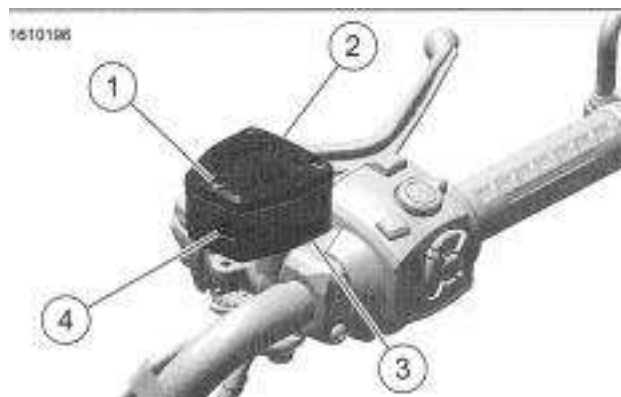
3. **Rear master cylinder reservoir:** See Figure 2-14.

- 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:

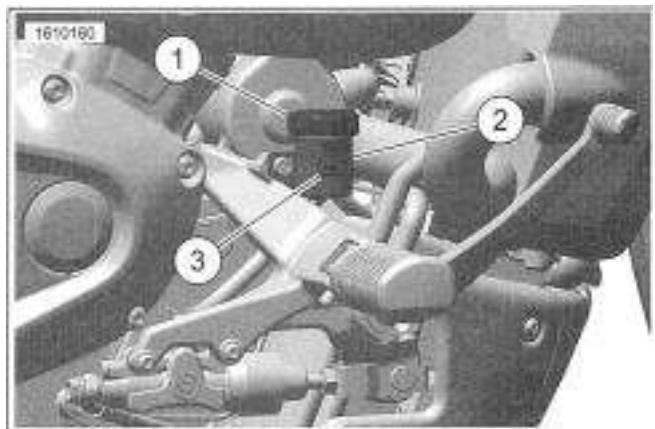
- a. Check for brake system fluid leaks.
- b. Check that brake pads and rotors are properly installed and not worn beyond service wear limits. See INSPECT BRAKES (Page 2-13).

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).



1. Screw (2)
2. Reservoir cover
3. Reservoir
4. Minimum level

Figure 2-13. Front Master Cylinder Reservoir



1. Reservoir cover
2. Reservoir
3. Minimum level

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*	
	Silver colored base material-noticeable feel of wear*	Replace
	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 underload 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).

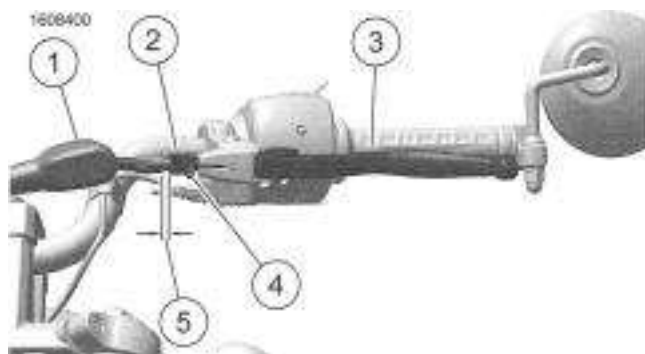
NOTE

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.

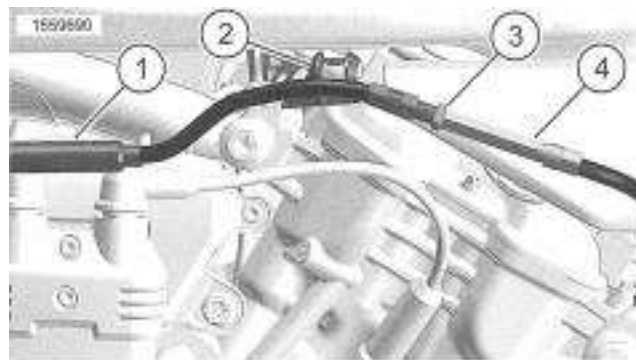
Table 2-9. Clutch Lever Gap

MODEL	MM	IN
All Models	1.0-2.0	0.0394-0.0787



1. Boot
2. Adjuster
3. Clutch lever
4. Adjuster lock
5. Gap

Figure 2-15. Clutch Lever Adjustment



1. Boot
2. Cable holder
3. Adjuster lock
4. Adjuster

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*

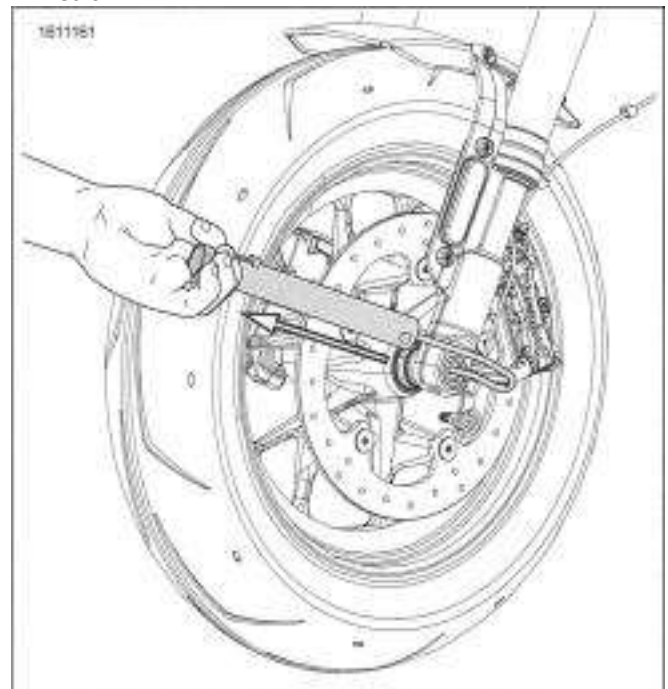
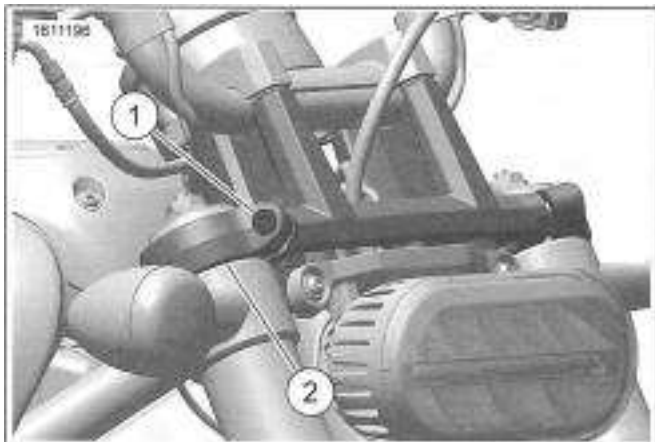
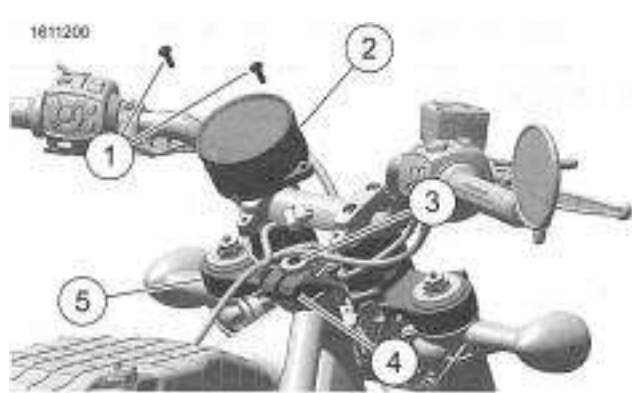


Figure 2-17. Pull Force Orientation



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)

A 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. Remove coolant plug/dipstick. See Figure 2-20.
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. Install coolant reservoir plug/dipstick. See Figure 2-20.

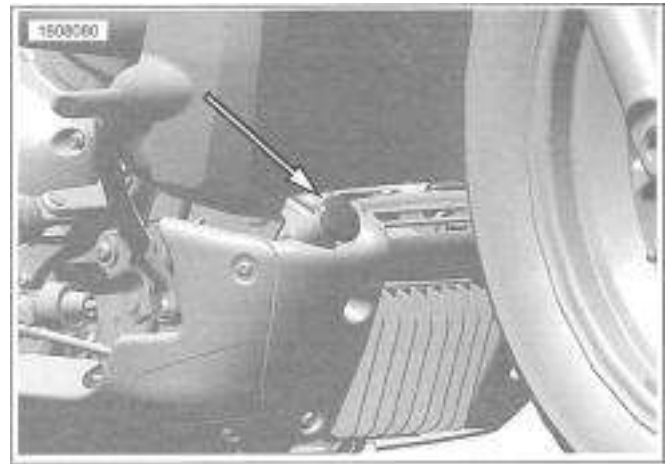


Figure 2-20. Coolant Filler Cap/Dipstick

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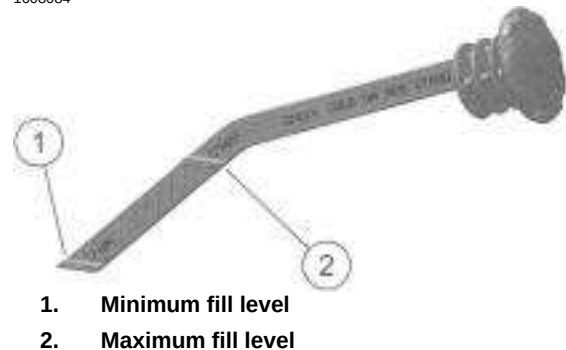


Figure 2-21. Coolant Filler Cap/Dipstick

CLEAN RADIATOR**A 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. Clean debris from radiator fins.

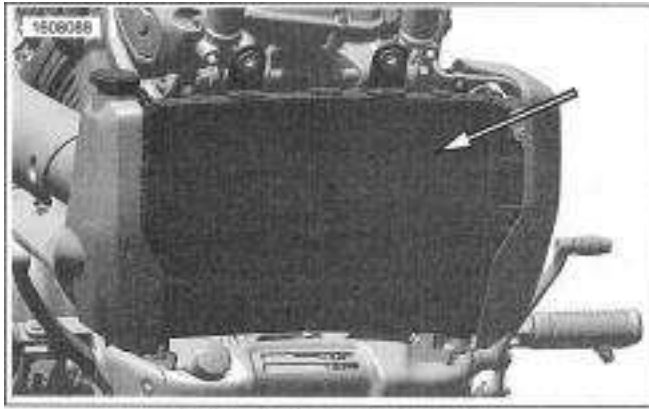


Figure 2-22. Radiator Fins

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)

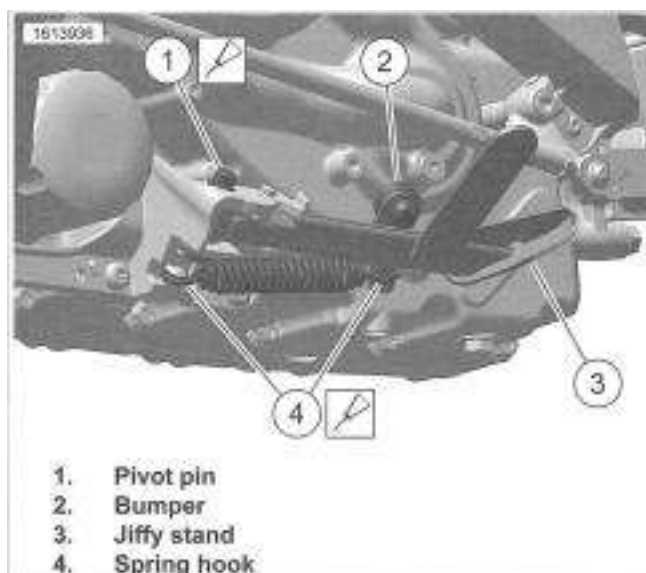


Figure 2-23. Jiffy Stand Lubrication Points

COMPLETE

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

INSPECT**General****A 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.

1611345



1. Too
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- Drive Belt

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

- Cuts or unusual wear patterns
- Outside bevel wear (8).

Figure 2-24. Rear Sprocket

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.

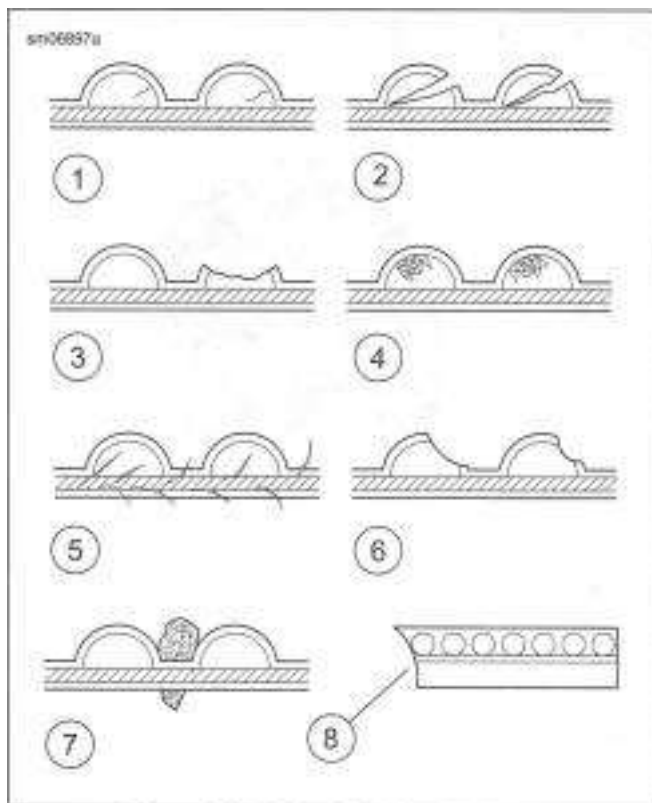


Figure 2-25. Drive Belt Wear Patterns

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

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

A WARNING

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

- Remove main fuse. See POWER DISCONNECT (Page 8-4).
- See Figure 2-26. Remove lower belt guard.
 - Remove screws (1) and lower belt guard (2).
- See Figure 2-27. Measure belt deflection using:
Special Tool: BELT TENSION GAUGE (HD-35381-A)
 - Slide O-ring (4) to zero mark (3).
 - Fit belt cradle (2) against bottom of drive belt halfway between drive pulleys.
 - Press upward on knob (6) until O-ring slides down to 10 lb (4.54 kg) mark (5) and hold steady.
- See Figure 2-28. Measure amount of deflection (4) while holding gauge steady.
- Compare with specifications. Refer to Table 2-12. If not within specification, see ADJUST BELT, which follows.
- See Figure 2-26. Install lower belt guard.
 - Place lower belt guard (2) in position.
 - Install screws (1). Tighten.
Torque: 49-66 **in-lbs** (5.5-7.5 N-m) *Belt guard, lower, screw*
- Install main fuse. See POWER DISCONNECT (Page 8-4).

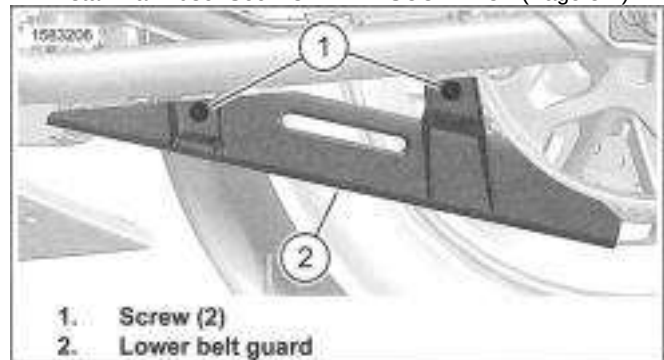


Figure 2-26. Lower Belt Guard

Table 2-12. Drive Belt Deflection

MODEL	DEFLECTION	
Service belt tension™	1/4-5/16	6.4-7.9

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

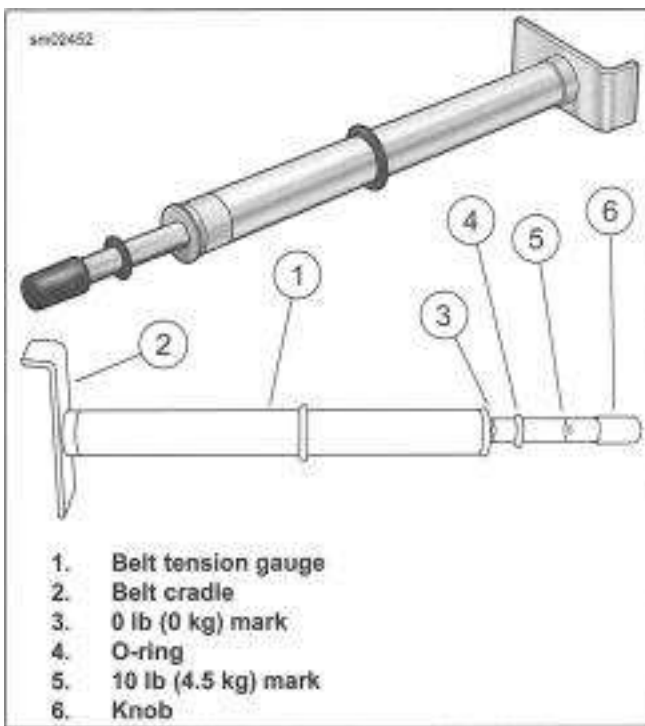


Figure 2-27. Belt Tension Gauge

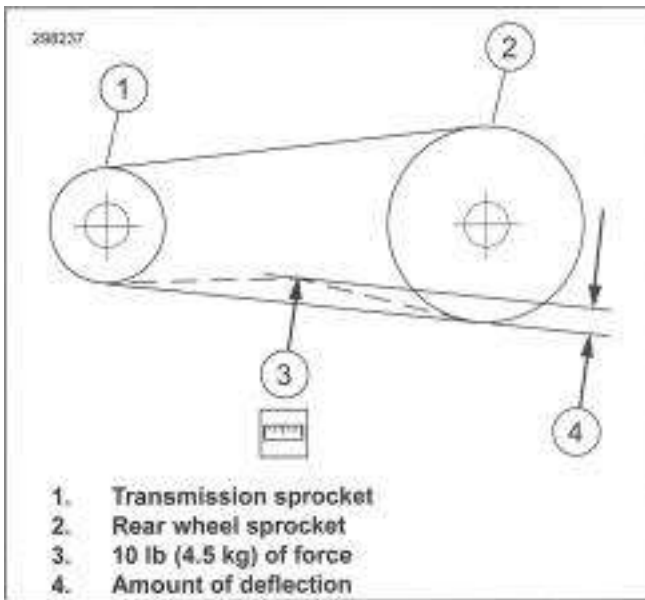


Figure 2-28. Checking Belt Deflection

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.

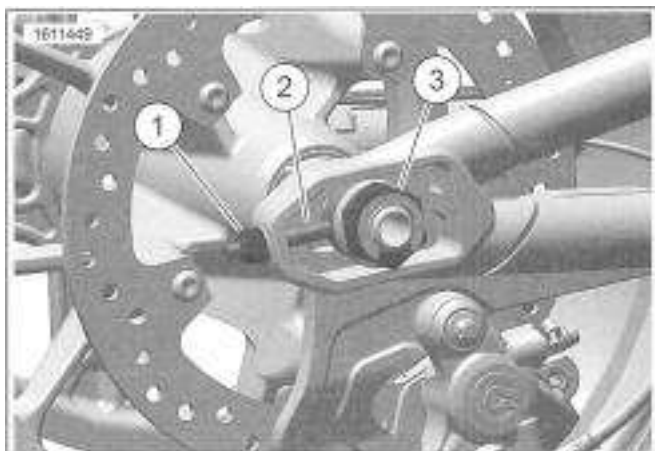
1. See Figure 2-29. Adjust rear axle.
 - a. Loosen axle nut (3).
 - b. Turn adjuster nuts (1) clockwise to decrease belt deflection (increase tension), or counterclockwise to increase belt deflection (decrease tension).
 - c. Check rear wheel alignment. See WHEEL ALIGNMENT (Page 3-22).
 - d. Tighten axle nut (3).
Torque: 95-105 ft-lbs (129-142 N-m) Axle nut, rear

2. Verify drive belt deflection.

A 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)

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



1. Adjuster nut
 2. Axle adjuster
 3. Axle nut
- Figure 2-29. Axle Adjuster

INSPECT REAR SPROCKET ISOLATOR

INSPECT

2.17

1. Support vehicle in an upright position in neutral. Do not lift the wheels off the ground.
2. See Figure 2-30. 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.

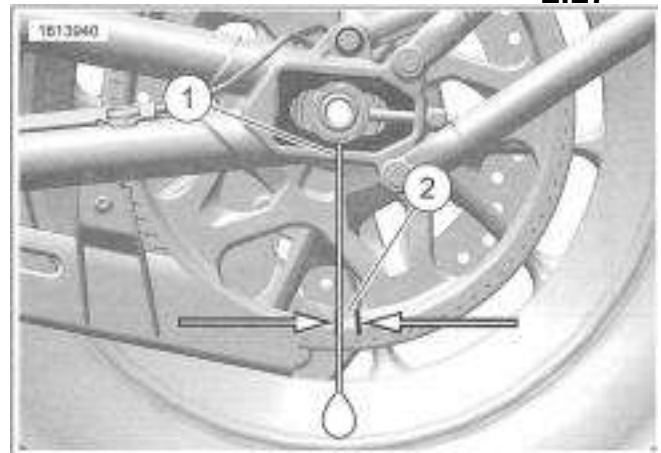
5. While holding sprocket in place, mark masking tape in line with the string.
6. Rotate rear sprocket in opposite direction until it stops.
7. While holding sprocket in place, make second mark in line with the string.
8. Measure distance (2) between marks. If measurement exceeds distance allowed, replace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



1. Weighted string

2. Measured distance

Figure 2-30. 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 2-13. 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 2-13. 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 noticable 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.	
Flarsh 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 2-31. 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 2-16.

Rebound Damping Adjustment

See Figure 2-31. The rebound adjuster (3) screw is located on the top of the left side fork tube.

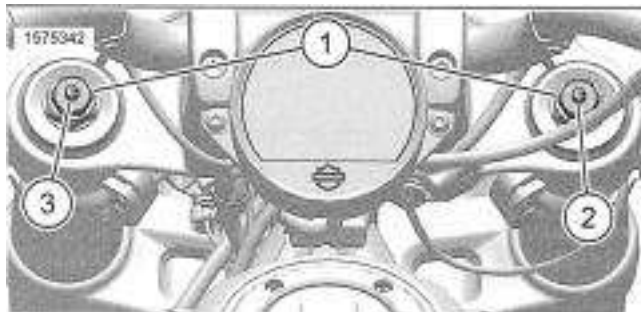
1. Turn rebound adjuster screw clockwise until it stops. This is the maximum rebound damping setting.
2. Turn rebound adjuster screw counter-clockwise the recommended number of turns. Refer to Table 2-16.

Spring Preload

See Figure 2-31. 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.

- Rider:** Refer to Table 2-14 for required rider preload adjustment. Note required adjustment.
 - Passenger or cargo:** Refer to Table 2-15 for required passenger and cargo preload. Note required adjustment.
 - Add rider and passenger/cargo preload amounts together to get final adjustment setting.
- Adjust front preload settings. Turn preload adjuster clockwise the calculated number of turns.



- Preload adjuster (2)
- Compression adjuster
- Rebound adjuster

Figure 2-31. Front Suspension Adjusters

Table 2-14. Front Preload Suspension Settings

RIDER WEIGHT	FRONT FORKS
kg/lb	Turns from Minimum"
<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 2-15. Front Preload with Passenger or Cargo

PASSENGER or CARGO	FRONT FORKS
kg/lb	Additional Turns"
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 2-16. Front Forks Compression and Rebound

RIDE SETTING	FRONT FORKS"	
	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.

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.

- See Figure 2-32. 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.
- Turn rebound adjuster counter-clockwise in the S (soft) direction the recommended number of turns. Refer to Table 2-19.

Compression Damping Adjustment

- See Figure 2-33. Use a flat blade screwdriver to turn compression adjuster clockwise in the high direction until it stops. This is the maximum compression damping setting.
- Turn compression adjuster counter-clockwise in the low direction the recommended number of turns. Refer to Table 2-19.

Preload Adjustment

- See Figure 2-34. 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.
- Calculate rear preload settings.
 - Rider:** Refer to Table 2-17 for preload clicks required for rider. Note clicks required.
 - Passenger or cargo:** Refer to Table 2-18 for additional preload clicks required for passenger or cargo. Note clicks required.
 - Add rider and passenger/cargo preload amounts together to get final adjustment setting.
- Adjust preload adjuster knob to the desired number of clicks.

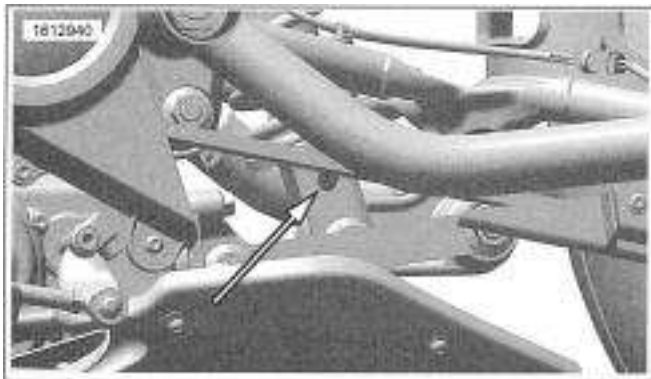


Figure 2-32. Rebound Adjuster

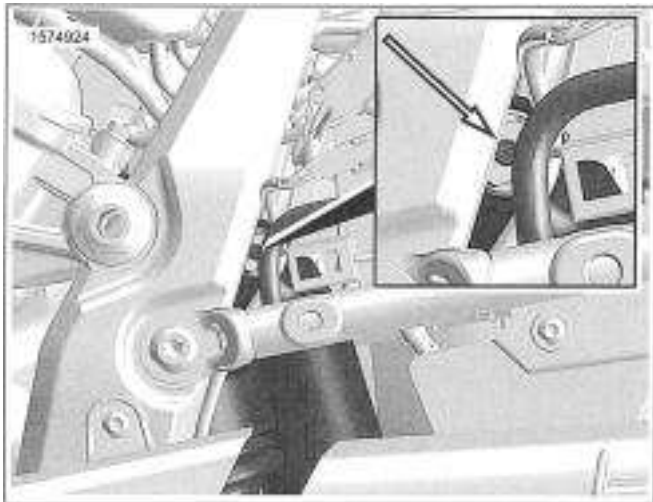


Figure 2-33. Compression Adjuster

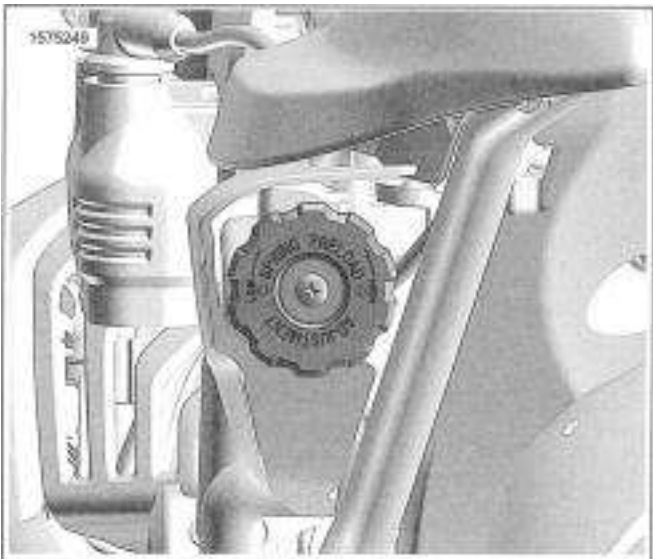


Figure 2-34. Preload Adjuster

Table 2-17. Rear Preload Suspension Settings

RIDER WEIGHT	REAR SHOCK
kg/lb	Clicks from Minimum™
<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 2-18. Rear Preload with Passenger or Cargo

PASSENGER or CARGO	REAR SHOCK
kg/lb	Additional Clicks™
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 2-19. Rear Fork Compression and Rebound

RIDE SETTING	REAR SHOCK™	
	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 counterclockwise 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 2-35. Remove air filter.
 - a. Cover velocity stacks (1) with clean rags.
 - b. Loosen clamp (2).
 - c. Remove air filter (3).

A 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)

A 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 2-35. 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).

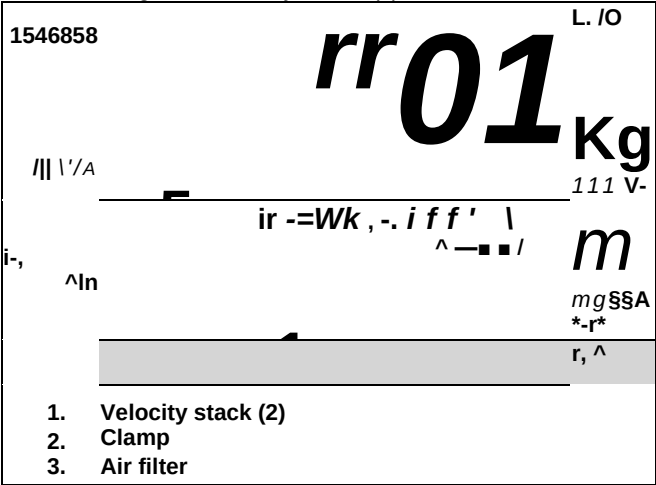


Figure 2-35. Air Filter Maintenance

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).

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

REMOVE

1. Remove battery cables.
 - a. See Figure 2-36. Remove battery negative cable (2) from battery (1).
 - b. Remove battery positive cable (3) from battery.
2. See Figure 2-37. Remove starter cable (1) from starter solenoid (2).
3. Remove voltage regulator bracket.
 - a. See Figure 2-38. Remove voltage regulator bracket screws (2).
 - b. See Figure 2-39. Position voltage regulator bracket (2) out of way.
4. Remove battery.

INSTALL

2. Install voltage regulator bracket.

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.
 - a. See Figure 2-38. 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 2-36. 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*

4. Connect starter cable.

- a. See Figure 2-37. 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 2-40. Route starter cable (2) in bracket (1).

Figure 2-37. Starter Cable

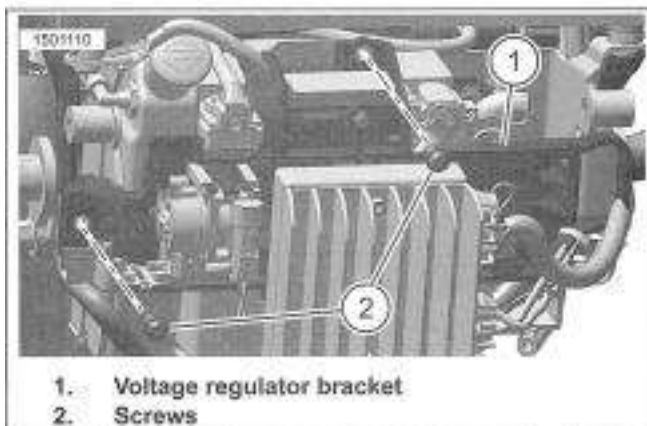


Figure 2-38. Voltage Regulator Bracket Screws

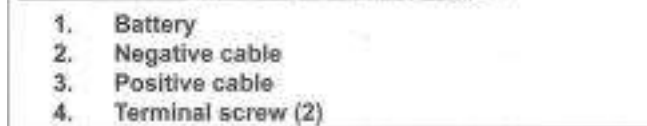
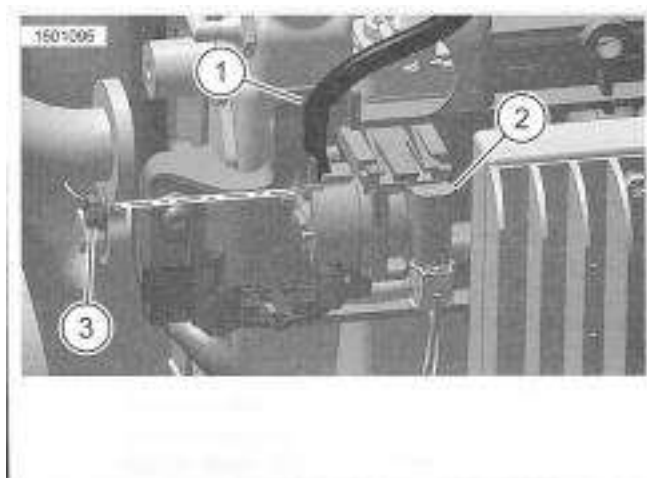


Figure 2-36. Battery Cables



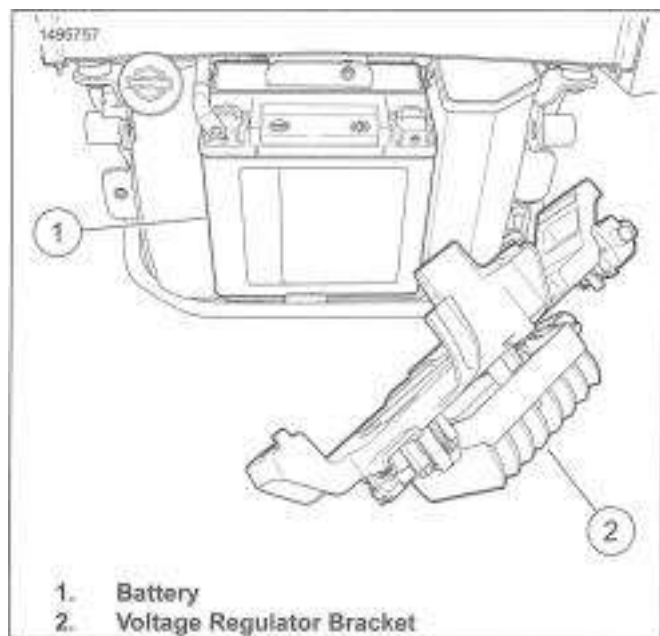


Figure 2-39. Voltage Regulator Bracket

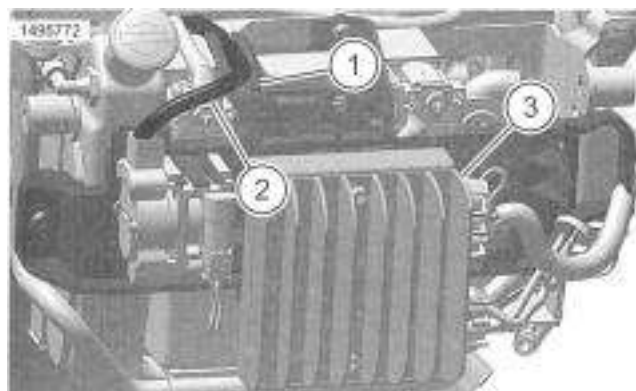


Figure 2-40. Negative Cable Bracket

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 2-20.

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 2-20. 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 2-41. 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.

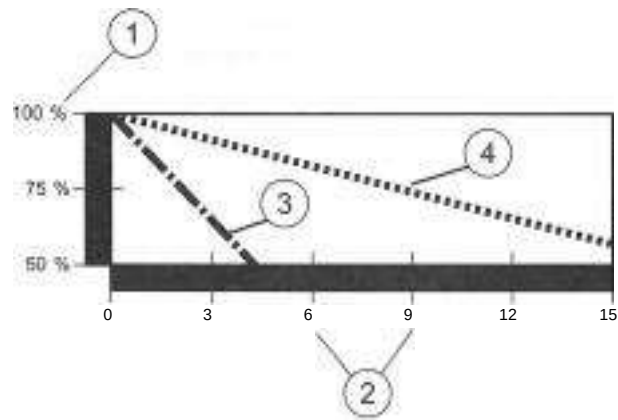
Charge the battery every two weeks if stored in the vehicle. Charge the battery once per month if removed the vehicle.

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.

COMPLETE

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



1. Capacity
2. Months of non-use
3. Measured at 40 °C (105 °F)
4. Measured at 25 °C (77 °F)

Figure 2-41. Effective Rate of Temperature on Battery Self-discharging Rate

PREPARE**A 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**A 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 2-42. 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 2-21.
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 2-21. 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.

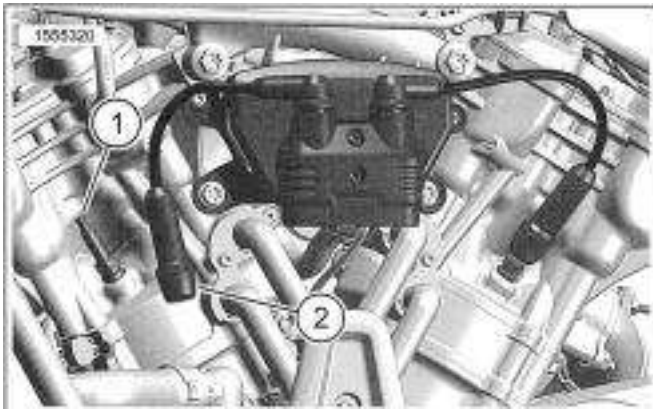
INSTALL

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

NOTE

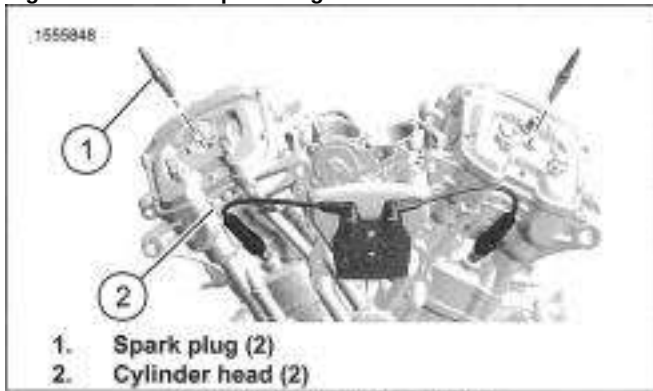
Always install new spark plugs. Do not reuse spark plugs that have been removed.

1. Verify proper gap before installing **new** spark plugs, Refer to Table 2-22.
 - 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 2-42 and Figure 2-43. Install spark plugs (1). Tighten.
Torque: 89-133 in-lbs (10-15 N m) *Spark Plug*
4. Install spark plug cables or coils.



1. Spark plug (2)
2. Spark plug cable (2)

Figure 2-42. Outer Spark Plugs



1. Spark plug (2)
2. Cylinder head (2)

Figure 2-43. Inner Spark Plugs

Table 2-22. 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).

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.

A 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)

A 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)

A 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 2-39).
 - 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 2-39).

4. Prepare battery for storage. See INSPECT BATTERY (Page 2-36).
5. Inspect air filter. See INSPECT AIR FILTER (Page 2-35).
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**A 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 2-36)
2. If spark plugs were removed and not replaced, replace them now. Do **not** reuse. See INSPECT AND REPLACE SPARK PLUGS (Page 2-39).
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.

A 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 ARFI 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
Axle nut, rear	95.1-104.7 ft-lbs	129-142 N-m	3.11 WHEEL ALIGNMENT, Adjust
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, As-semble
Reservoir mount screw	7-11 in-lbs	0.8-1.2 N-m	3.13 FRONT BRAKE MASTER CYLINDER, As-semble
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) TM	
	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
<i>(1) With 180 lb (81.7 kg) rider on seat</i>		

Table 3-3. Weights

ITEM	Sportster S TM (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)**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

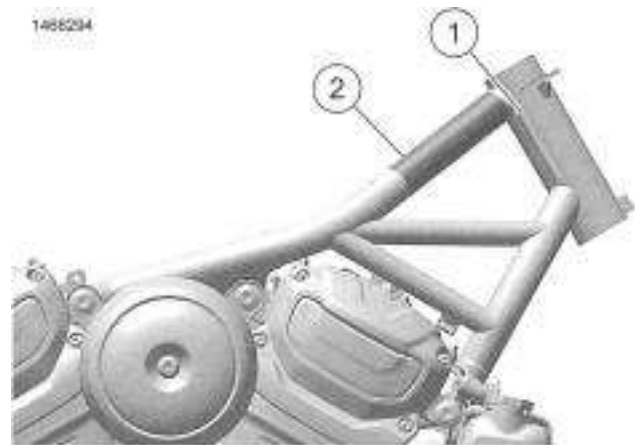
See Figure 3-1. The full 17-digit VIN is stamped on the right side of the frame near the steering head. In some destinations, a printed VIN label is also attached on the front downtube.

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 between the engine cylinders.

NOTE

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



1. Stamped VIN

2. VIN label

Figure 3-1. VIN Locations

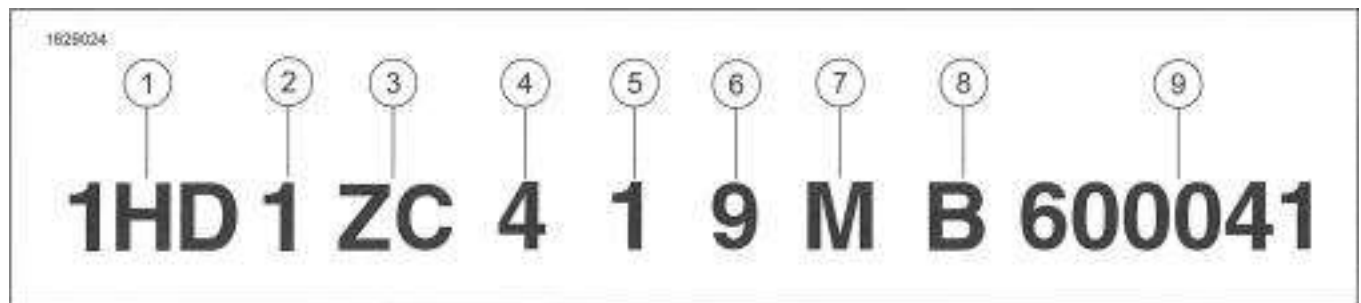


Figure 3-2. Typical Harley-Davidson VIN: 2021 Harley-Davidson Sportster S Model

Table 3-5. Harley-Davidson VIN Breakdown: 2021 Sportster S Model

POSITION	DESCRIPTION	POSSIBLE VALUES
1	World manufacturer identifier	1HD=Originally manufactured in the United States 5HD=Originally manufactured in the United States for sale outside of the United States 932=Originally manufactured in Brazil MEG=Originally manufactured in India 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 T 1252 cc liquid cooled, fuel injected
5	Calibration/configuration, introduction	1=Domestic (DOM) 2=California (CAL) 3=Canada (CAN) 4=ENG/EN2/HDI/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	M=2021
8	Assembly plant	B=York, PA U.S.A. D=H-D Brazil-Manaus, Brazil (CKD) N=Haryana India (Bawal District Rewari) S=Tasit, Pluagdang, Rayong, Thailand
9	Sequential number	Varies

Table 3-6. VIN Model Codes: Sportsters Model

CODE	MODEL
ZC	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**NOTE**

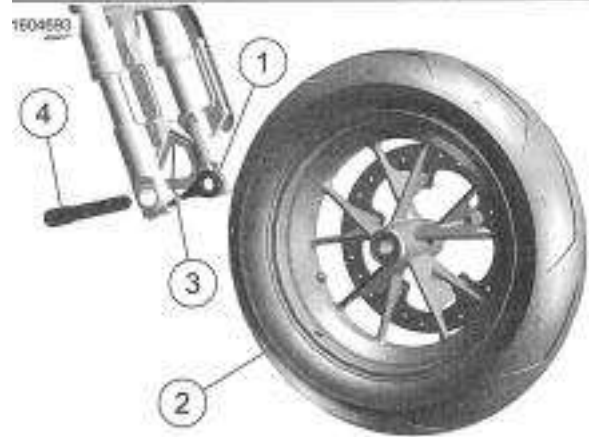
FASTENER	TORQUE VALUE	
Axle, front	74-82 ft-lbs	100-111 N-m
Axle, front, pinch screw	11-15 ft-lbs	15-20 N-m
Brake caliper, front, mounting screws	28-38 ft-lbs	38-52 N-m

CONSUMABLE	PART NUMBER
LOCTITE SILVER GRADE ANTI-SEIZE	11100001

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.



1. WSS
2. Front wheel
3. Pinch screw
4. Front axle

Figure 3-3. Front Wheel Mount

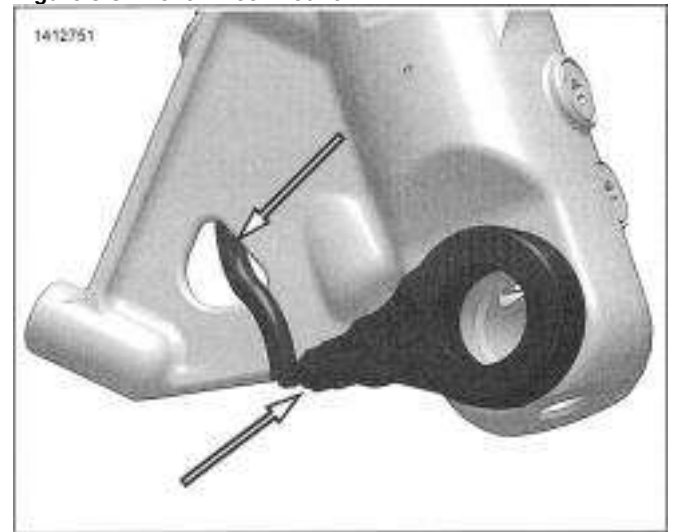


Figure 3-4. Front WSS Routing

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

1. Install wheel bearing spacer (4) and **new** wheel bearings (2,

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

- 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).

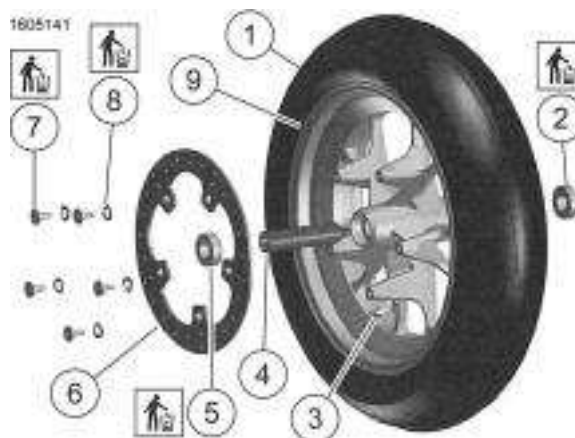
3. Install tire (1). See TIRES (Page 3-18).

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*



1. Tire
2. Left wheel bearing (ABS encoder)
3. Valve stem/TPMS
4. Wheel bearing spacer
5. Right wheel bearing
6. Front brake disc
7. Brake disc screw (5)
8. Spring washer (8)
9. Wheel

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.

A 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.

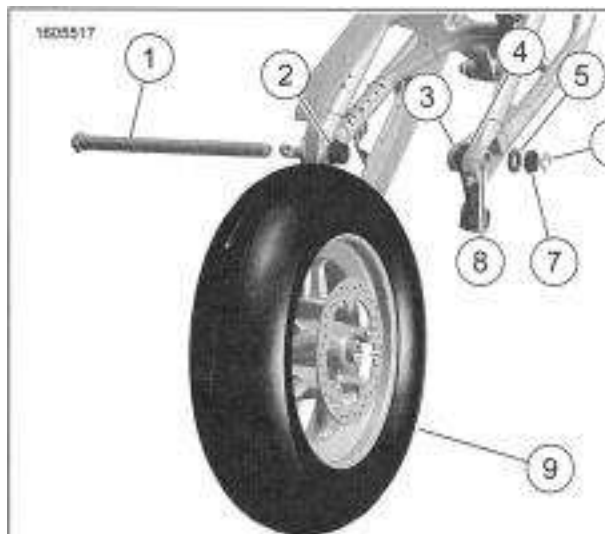
3. Remove wheel (9).

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.

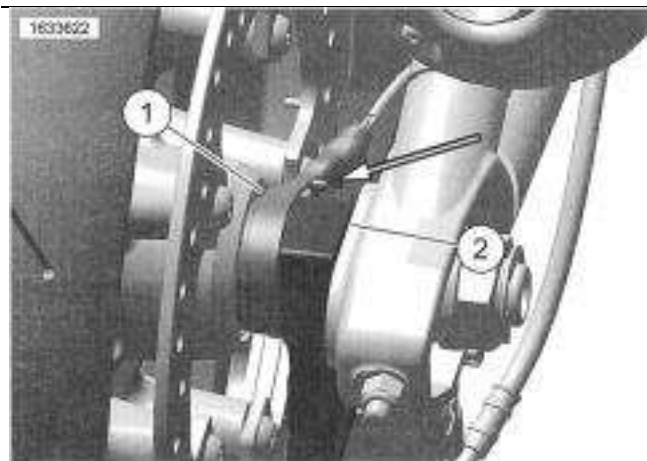


1. Rear axle
2. Spacer
3. Rear WSS
4. Reaction bracket
5. Washer
6. E-clip
7. Nut
8. Axle adjuster (2)
9. Tire and wheel assembly

Figure 3-6. Rear Wheel Mount

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).

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



1. RWSS
2. Reaction bracket

Figure 3-7. Rear WSS Orientation

DISASSEMBLE

REAR WHEEL

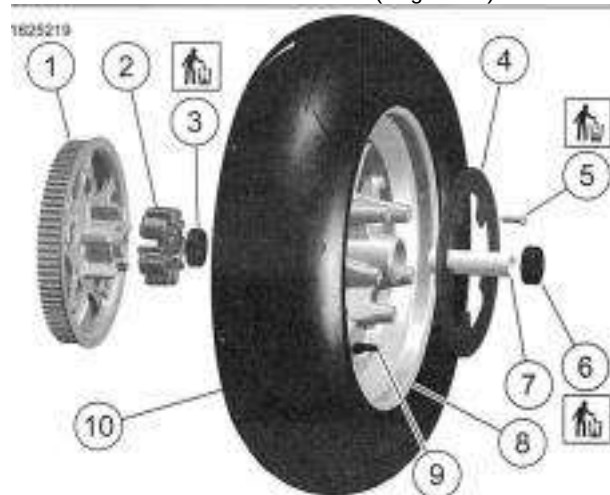
5. Discard bearings (3,6). See SEALED WHEEL BEARINGS (Page 3-15).
6. Remove wheel bearing spacer (7).

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

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).



1. Rear sprocket assembly
2. Isolator
3. Left wheel bearing
4. Brake disc
5. Screw (5)
6. Right wheel bearing
7. Wheel bearing spacer
8. Wheel
9. Tire valve stem
10. Tire

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).

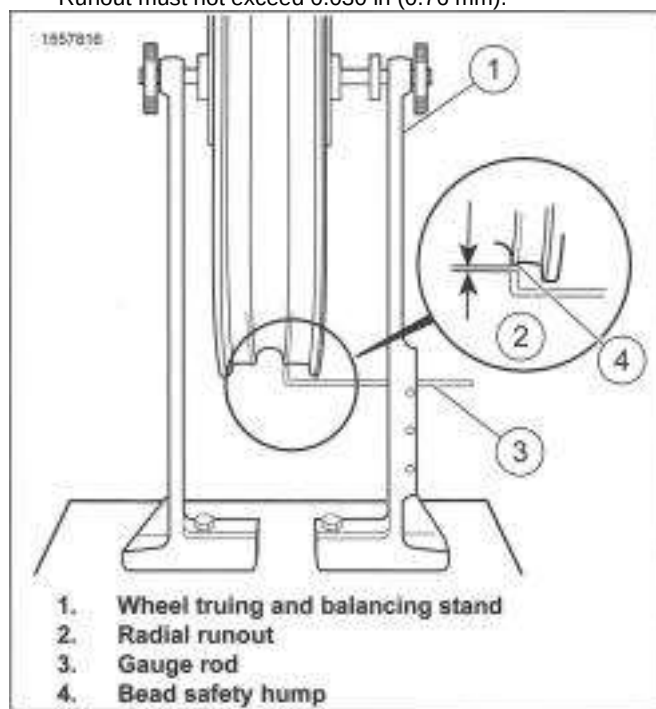


Figure 3-9. Checking Radial Runout

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).

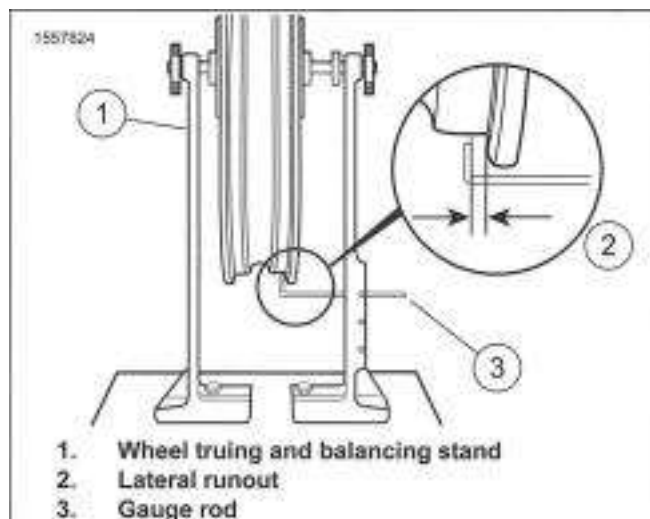


Figure 3-10. Checking Lateral Runout

PREPARE

1. Check compensator sprocket isolator for wear. See INSPECT REAR SPROCKET ISOLATOR (Page 2-30).
2. Remove rear wheel. See REAR WHEEL (Page 3-9).

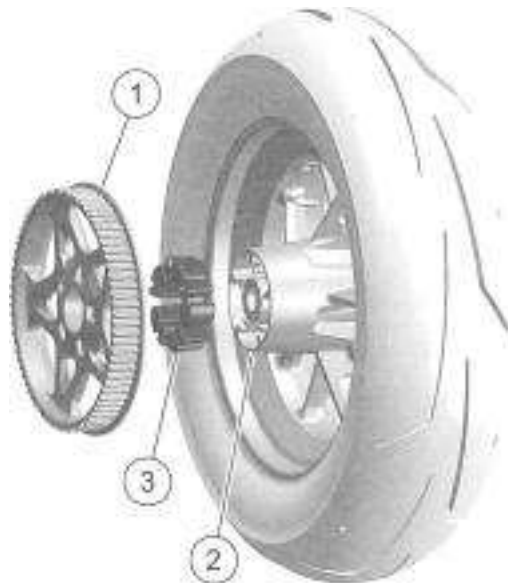
REMOVE

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).

1605855



1. Compensator sprocket assembly
2. Wheel
3. Isolator

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.

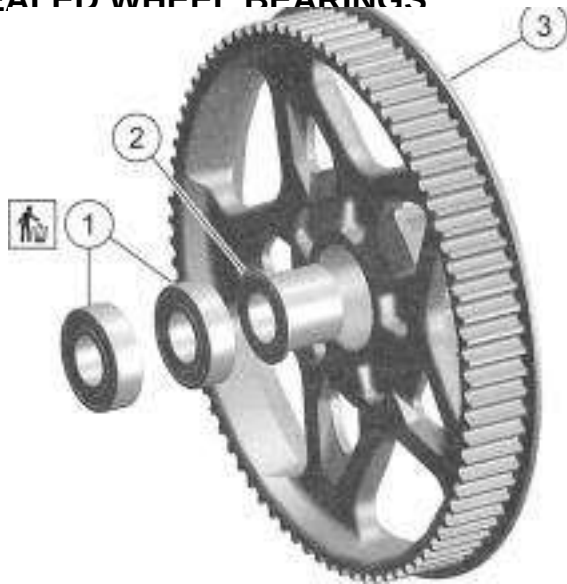
- a. Install spacer (2) in compensator hub (3).
- b. Use remover/installer to press first **new** bearing (1) into compensator hub.

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

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

Figure 3-12. Compensator Sprocket Assembly

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.

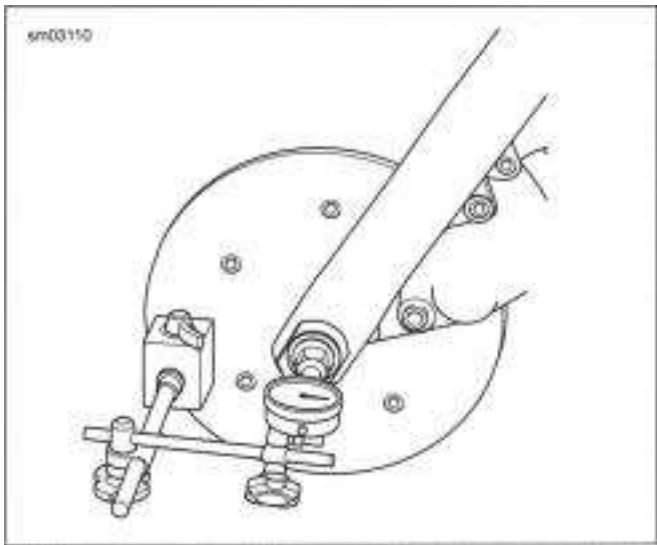


Figure 3-13. Measuring Lateral End Play (Front Wheel) (Typical)

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 - j Lower 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.

COMPLETE

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

- 2. Install wheel. See FRONT WHEEL (Page 3-7) or REAR WHEEL (Page 3-9).

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.

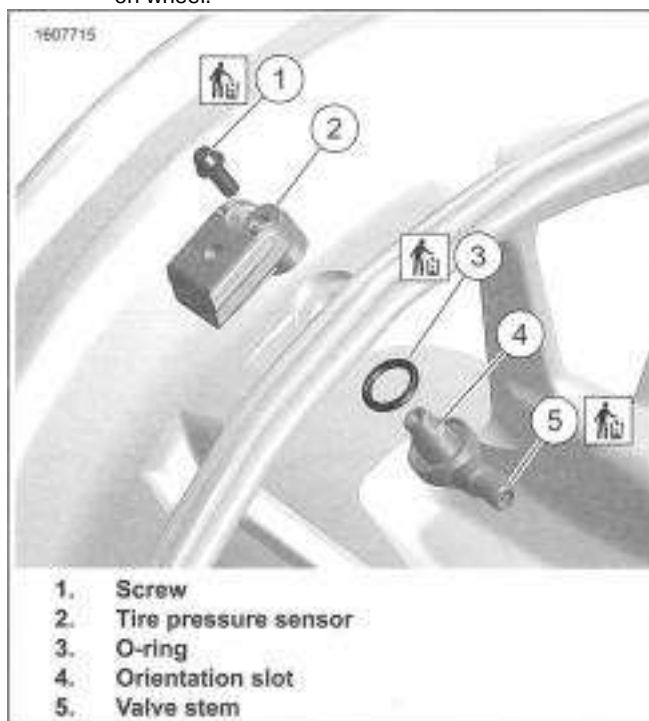


Figure 3-15. Tire Fill Valve/TPMS

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**A 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 % 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.

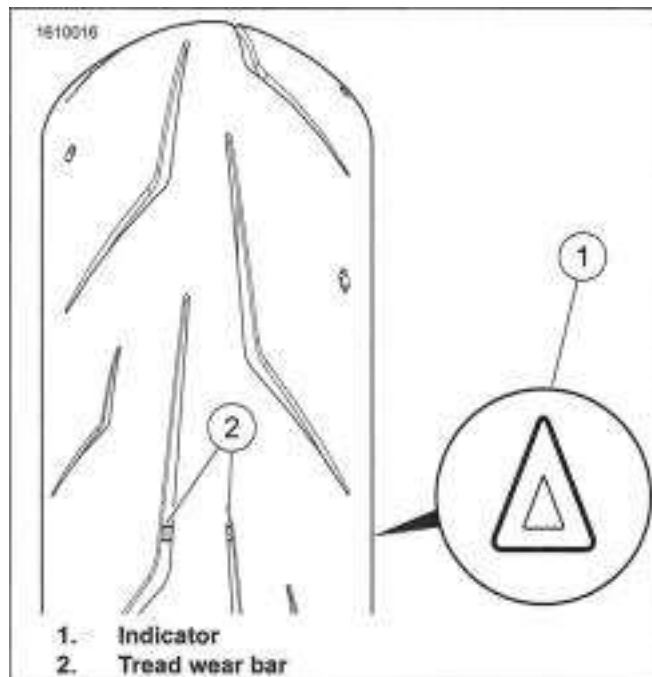


Figure 3-16. Tread Wear Indicator: Dunlop Tires

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.

A 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.

1/4 in (6.4 mm)
 - b. Make repairs from inside the tire.
 - c. Always combine a patch and plug when repairing tire.

INSTALL

A 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)

A 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)

A 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.

NOTE

1.
 - 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).

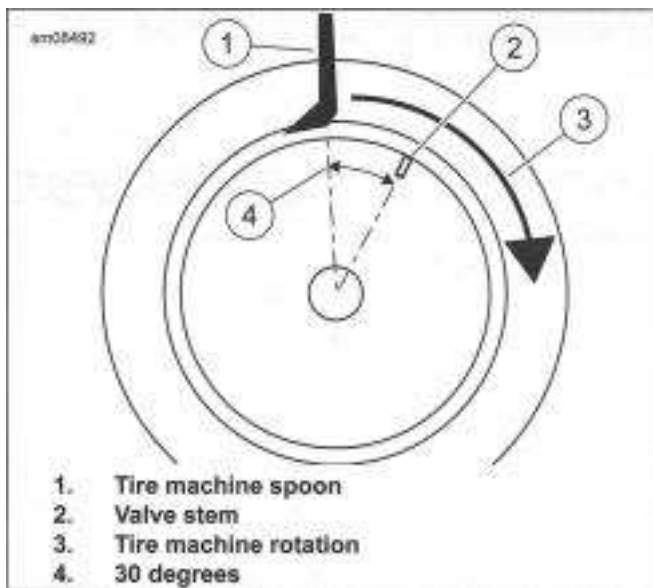


Figure 3-17. Tire Machine Operation
CHECK TIRE RUNOUT

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).

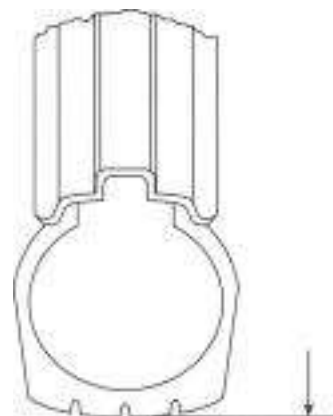


Figure 3-19.
Checking
Tire Radial
Runout

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.

- On cast wheels without a flat area near the bead, place the weights crosswise through the opening.

1. See Figure 3-21. Place weights on a smooth surface of the wheel rim such that centrifugal force will help keep them in place. Make sure the area of application is completely clean, dry, and free of oil and grease.

NOTE

See Figure 3-20. When installing wheel weights, consider cosmetics. Keep snaking (1) within 0.040 in (1.02 mm) (2) of straight. Also keep the angle alignment of individual segments (3) within 3 degrees.

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

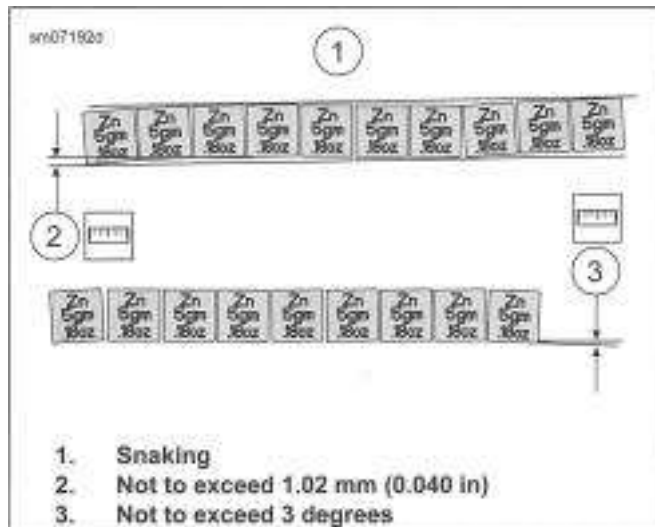


Figure 3-20. Weight Segment Alignment

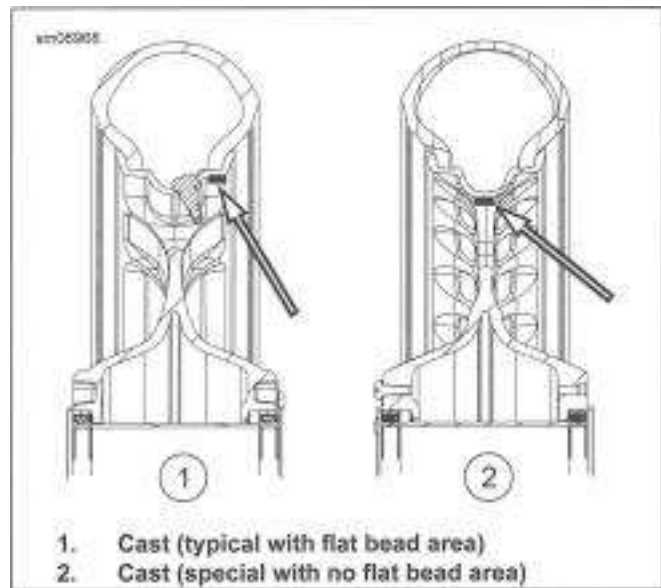


Figure 3-21. Wheel Weight Placement

COMPLETE

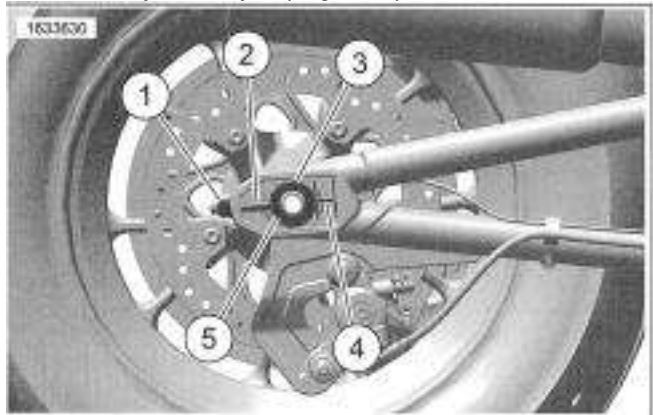
1. Install wheel. See FRONT WHEEL (Page 3-7) or REAR WHEEL (Page 3-9).

2. See Figure 3-22. Loosen rear axle nut (3).

Checking Wheel Alignment

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 3-22. Using a steel rule, measure the distance (4) between adjuster (2) and finished surface on both sides.
- 2. Verify measurements match on both sides of axle. Adjust as necessary. See Adjust (Page 3-22).



- 1. Axle adjuster nut
- 2. Adjuster
- 3. Axle nut
- 4. Distance
- 5. E-clip

Figure 3-22. Axle Adjuster

ADJUST

- 1. Inspect wheel alignment. See Inspect in this section.

FASTENER	TORQUE VALUE	
Axle nut, rear	95.1—104.7ft-lbs	129-142 NTTI

NOTE

Do not remove E-clip (5) when loosening rear axle nut.

3. Adjust rear axle.

- a. Turn axle adjuster nut (1) counterclockwise to shorten distance on the side with the longer distance (4).
- b. Adjust axle until left and right side alignment measurements match.

4. See Figure 3-23. Verify drive belt deflection and belt tracking. 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. See INSPECT AND ADJUST DRIVE BELT AND SPROCKETS (Page 2-27).

5. Tighten rear axle nut.

Torque: 95.1-104.7 ft-lbs (129-142 Nm) Axle nut, rear

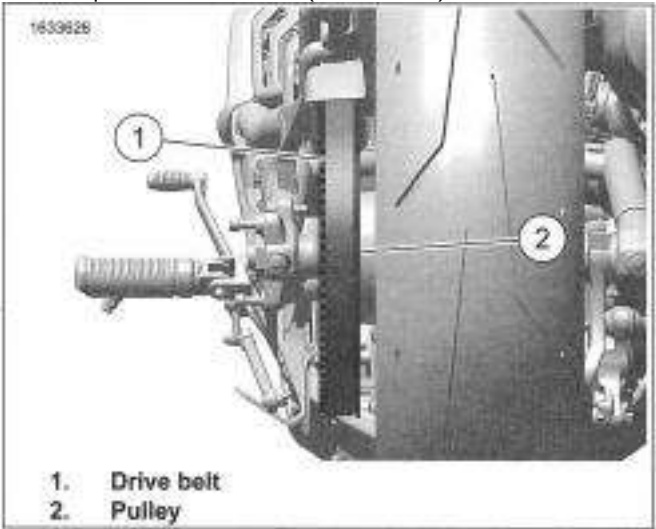


Figure 3-23. Drive Belt Alignment

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 8-30).

REMOVE

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 3-25. Record position of brake line before removing.

1. See Figure 3-24. **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

- a. Position front brake master cylinder (1).

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 3-24. Install front brake master cylinder.

- 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 3-25. 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 3-24. Front Brake Master Cylinder Mount



Figure 3-25. Front Master Cylinder Brake Line Location

DISASSEMBLE

1. ~~Front brake master cylinder~~
2. ~~Gasket washer (2)~~
3. ~~Banjo bolt~~
4. ~~Brake line~~
5. ~~Screw (2)~~
6. ~~Clamp~~

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 push rod assembly is damaged, the master cylinder assembly **must** be replaced.

MASTER CYLINDER RESERVOIR

- 1. See Figure 3-27. 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 3-26. 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

A 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 3-26. 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 Nm) Front brake lever pivot nut

MASTER CYLINDER RESERVOIR

- 1. See Figure 3-27. 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

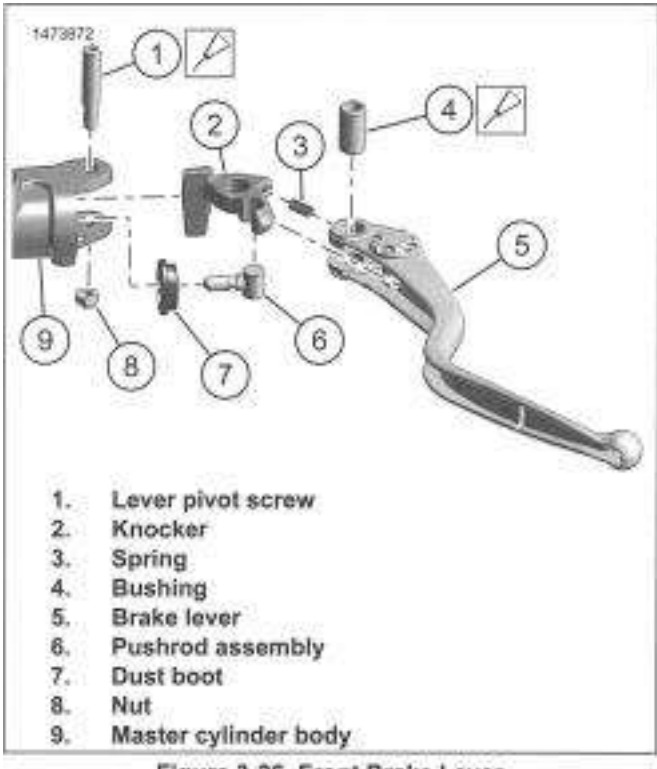
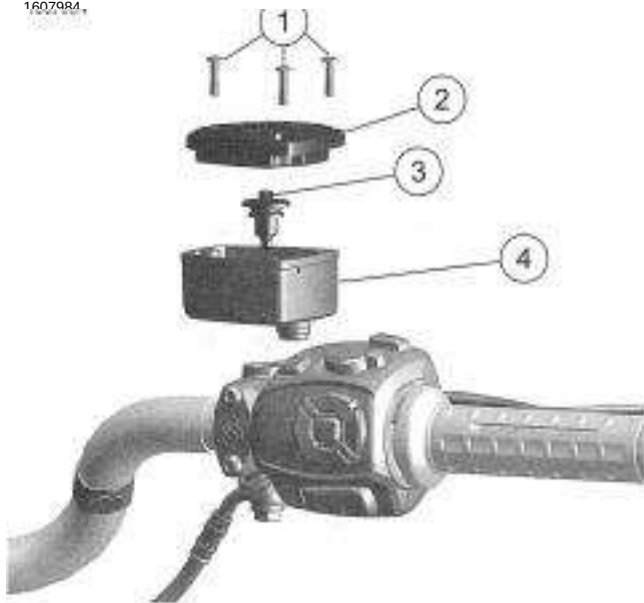


Figure 3-26. Front Brake Lever



1. Screw (3)
 2. Master cylinder reservoir cover
 3. Screw
 4. Master cylinder reservoir
- Figure 3-27. Front Reservoir**

COMPLET
E

1. Install main fuse. See

POWER DISCONNECT (Page 8-4).

2. **If replacing master cylinder:** Install front stoplamp switch. See FRONT STOPLAMP SWITCH (Page 8-30).
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).

2. **If replacing caliper:** Attach brake line.

- Attach brake line (1) with banjo bolt (2) and **new** gasket washers (3).
- See Figure 3-29. Position brake line as shown.
- Tighten banjo bolt.
Torque: 17-19 ft-lbs (23-26 N m) *Brake caliper, front, left, banjo bolt*
- Position wheel speed sensor wire (6), install bleeder screw cap (7).

REMOVE

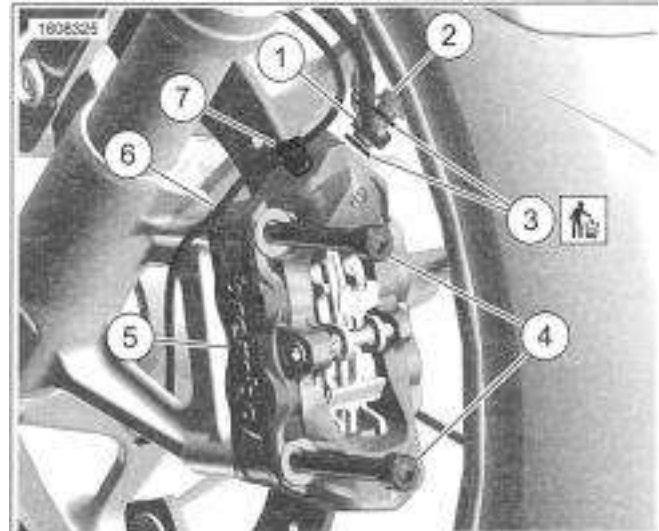
NOTE
See Figure 3-29. Record position of brake line before removing.

- See Figure 3-28. **If replacing caliper:** Detach brake line.
 - Remove banjo bolt (2).
 - Discard gasket washers (3).
- Remove front brake caliper.
 - Remove bleeder screw cap (7) and position wheel speed sensor wire (6) aside.
 - Remove caliper mounting screws (4).
 - 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

- See Figure 3-28. Install front brake caliper.
 - Install front brake caliper (5).
 - Install caliper mounting screws (4), do not tighten.
 - Apply brake pressure.
 - Tighten caliper mounting screws.
Torque: 28-38 ft-lbs (38-52 Nm) *Brake caliper, front, mounting screw*
 - Release brake pressure.



- Banjo bolt
- Gasket washer (2)
- Front brake caliper
- Caliper mounting screw (2)
- ABS module to front brake calipers line
- Crossover brake line

Figure 3-28. Front Brake Caliper

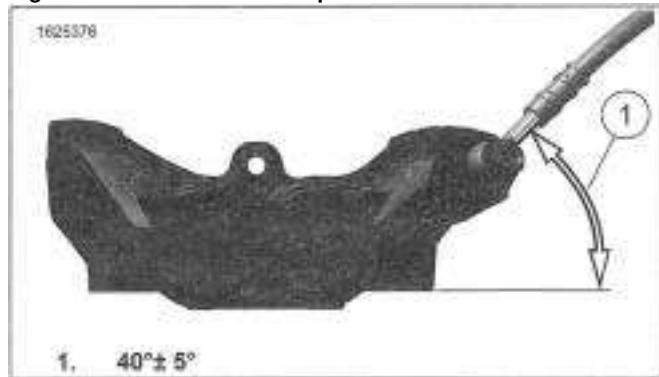


Figure 3-29. Front Caliper Brake Line Location

COMPLETE

- 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 3-31. Record position of brake line before removing.

1. See Figure 3-30. **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).

INSTALL

- 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 Nm) *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 3-31. Position brake line as shown.
- c. Tighten banjo bolt.
Torque: 17—19 ft-lbs (23-26 Nm) *Brake, rear master cylinder banjo bolt*

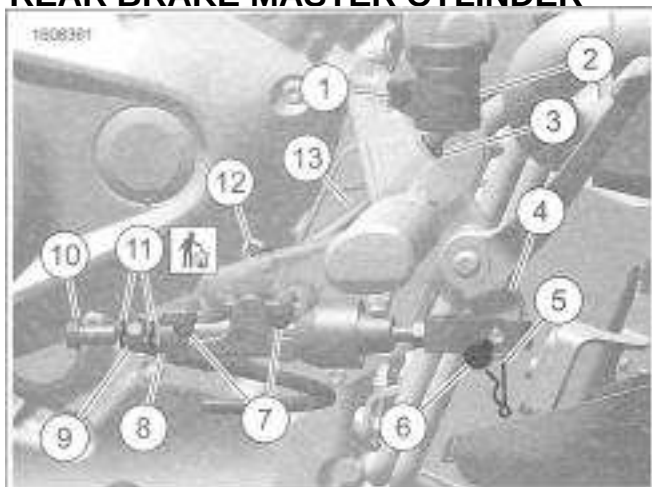
FASTENER	TORQUE VALUE	
Brake, rear master cylinder banjo bolt	17-19 ft-lbs	23-26 N m
Brake, rear master cylinder reservoir screw	62-80 in-lbs	7-9 N-m
Brake, rear master cylinder screws	80-97 in-lbs	9-11 N-m

1. See Figure 3-30. 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).

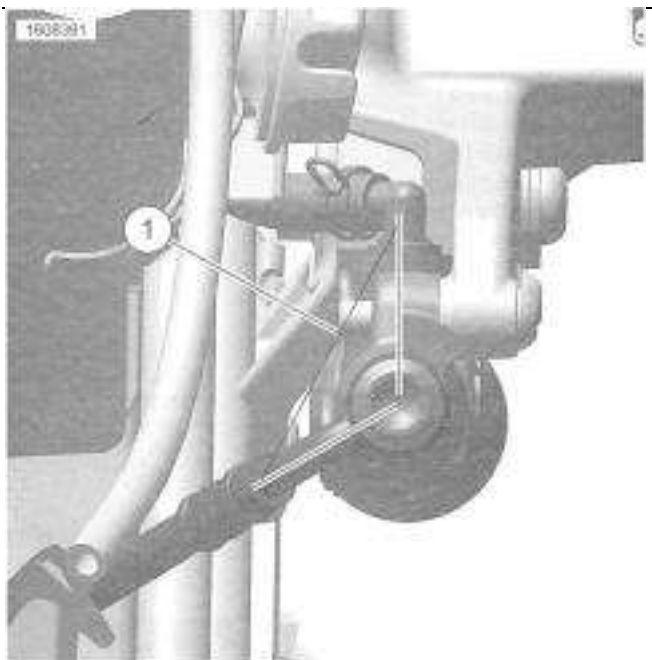
REAR BRAKE MASTER CYLINDER

3.15



1. Reservoir screw
2. Master cylinder reservoir
3. Upper spring clamp
4. Brake pedal
5. Cotter pin
6. Clevis pin
7. Mounting screws
8. Master cylinder
9. ABS module to rear brake master cylinder line
10. Banjo bolt
11. Gasket washer (2)
12. Lower spring clamp
13. Brake reservoir hose

Figure 3-30. Rear Brake Master Cylinder



1. 120⁺⁵

Figure 3-31. Rear Master Cylinder Brake Line Location

DISASSEMBLE

NOTE

Do not scratch or nick banjo sealing surface during handling. 1.

See Figure 3-32. Remove pedal connector, a. Remove E-clip

(13).

3-30b. 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

A 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 Nm

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

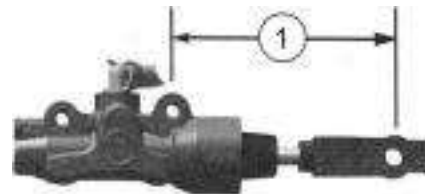
1. Lightly lubricate piston bore and OD of piston seals with brake fluid.

Consumable: Harley-Davidson Platinum Label DOT 4 Brake Fluid (41800xxx)

2. See Figure 3-32. 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 3-33. 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 3-33. Install E-clip (13) in outboard groove of pushrod.

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.
- 13.

1587863



1. Measurement: 3.85-3.97 in (97.9-100.9 mm)

Figure 3-33.

1. If replacing master cylinder: Fill and bleed rear brake system. See CHECK AND REPLACE BRAKE FLUID (Page 2-16).

PREPARE

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

REMOVE

NOTE

See Figure 3-35. Record position of brake line before removing.

1. See Figure 3-34. **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 3-34. Install brake caliper.

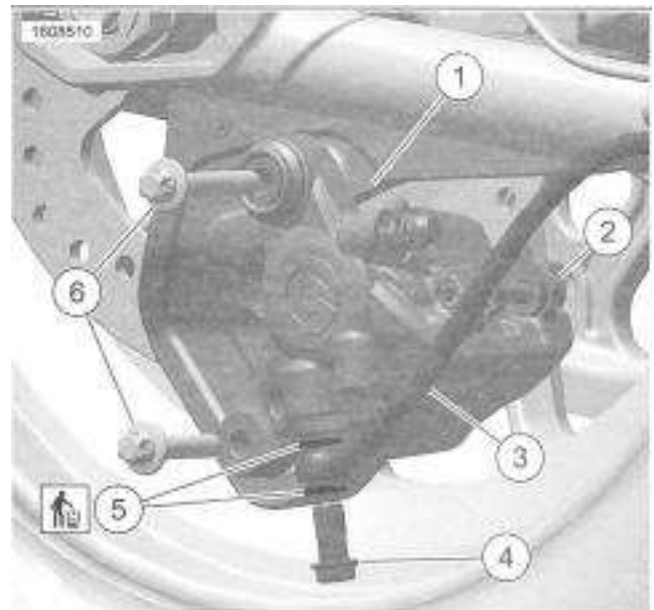
- a. Install brake caliper (2) on caliper bracket (1).
- b. Install mounting screws (6). Tighten.

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 3-35. Position brake line as shown.
- c. Tighten banjo bolt.

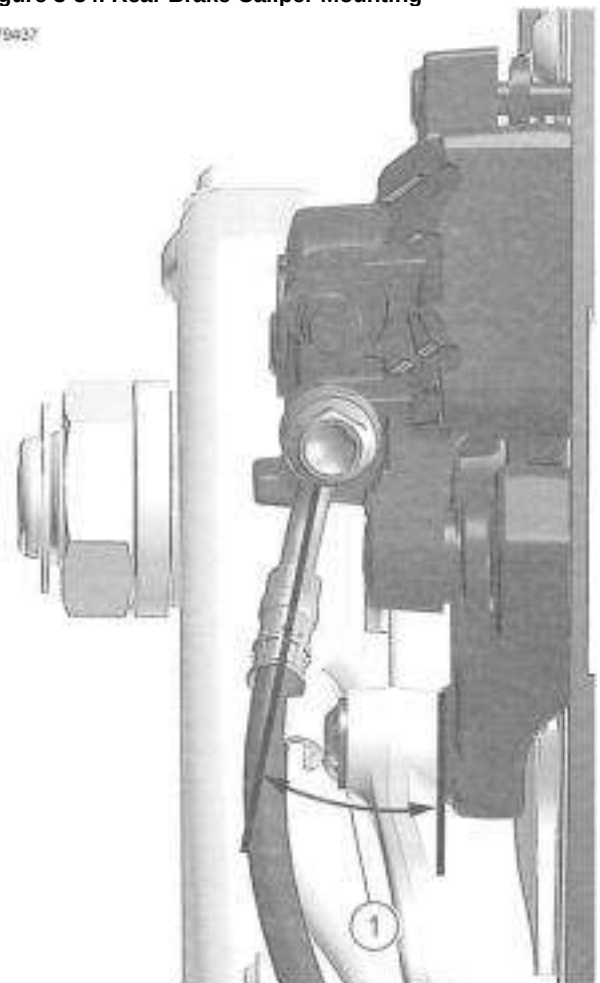
Torque: 17-19 ft-lbs (23-26 N-m) *Brake caliper, rear, banjo bolt*



1. Caliper bracket
2. Brake caliper
3. Brake line
4. Banjo bolt
5. Gasket washer (2)
6. Mounting screw (2)

Figure 3-34. Rear Brake Caliper Mounting

1579437



20.6° ± 5°

Figure 3-35. Rear Caliper Brake Line Location

1. **REAR BRAKE CALIPER** will not bleed rear brake system. See
BLEED BRAKES (Page 3-43).

3.16

**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 8-22).

Remove**NOTE**

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

1. See Figure 3-36. Remove screw (2) and brake line (3) from wire form (1).
2. See Figure 3-37. 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 3-38. 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.

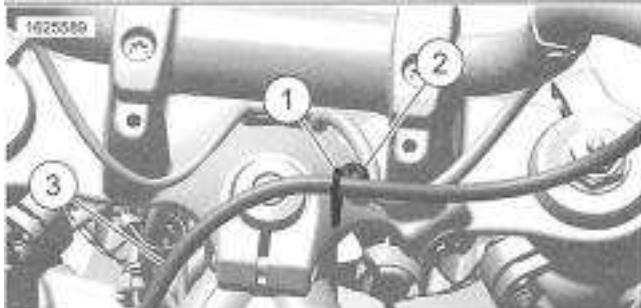
NOTE

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

2. See Figure 3-38. Install rear clamp.
 - a. Install grommet and clamp (3).
 - b. Install screw (2).
3. See Figure 3-37. 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 3-36. 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 3-39. 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*

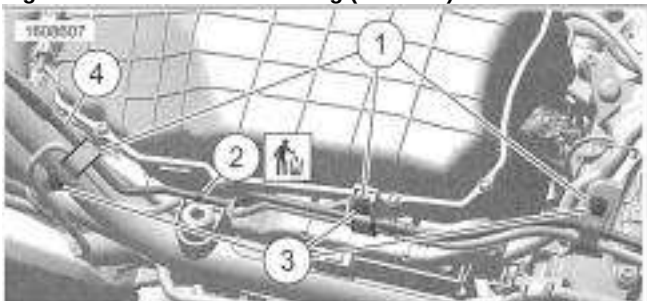
Complete

1. Install instrument module. See INSTRUMENT MODULE (IM) (Page 8-22).
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).



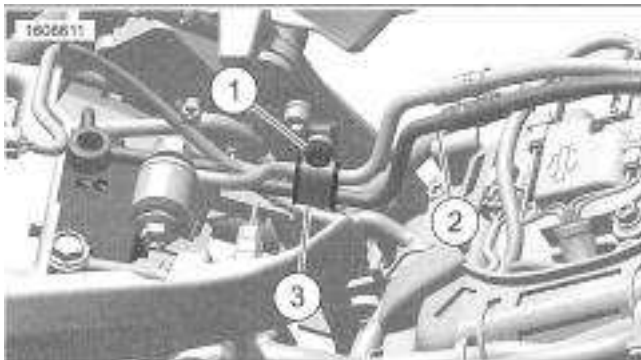
1. Wire form
2. Screw
3. Brake line

Figure 3-36. Brake Line Routing (Forward)



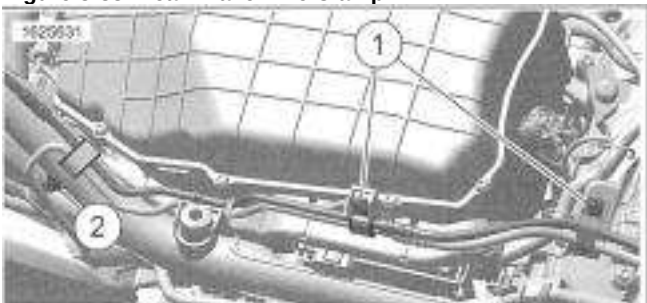
1. Grommets and clamp
2. Double loop cable strap
3. Screw
4. Brake line

Figure 3-37. Left Side Brake Line From Front Master Cylinder



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

Figure 3-38. Rear Brake Line Clamp



1. Rear screws (2)
2. Front screw

Figure 3-39. Tighten Screws

BRAKE LINE: FRONT CALIPER TO ABS

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

MODULE

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 reinstall in their original position.

1. See Figure 3-40. Remove rear clamp.
 - a. Remove screw (1).
 - b. Remove clamp and grommet (3).
2. See Figure 3-41. 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 3-40. 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

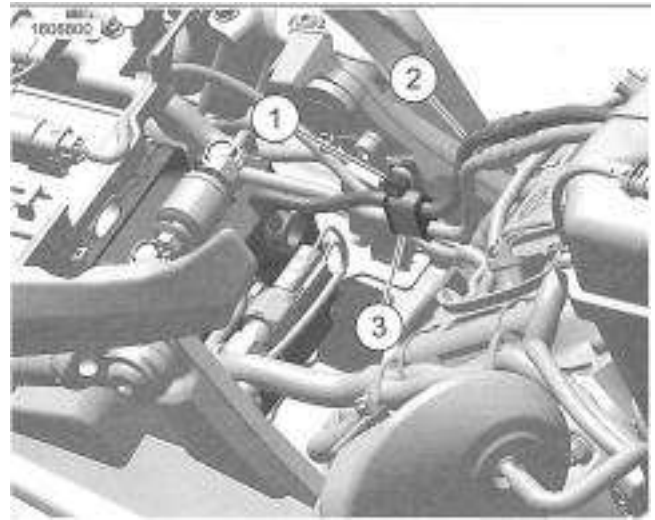
Do not tighten clamp screws until all screws have been installed.

1. See Figure 3-40. Place brake line in position (4).
 - a. Install clips (3).
 - b. Install clamp and grommet (2).
 - c. Install screw (1).
2. See Figure 3-40 Install rear clamp.
 - a. Install grommet and clamp (3).
 - b. Install screw (1).
3. See Figure 3-41. Install double loop cable strap (2).
4. Install brake line left side grommets and clamps (3).
5. Install screws (5).
6. See Figure 3-43. 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*

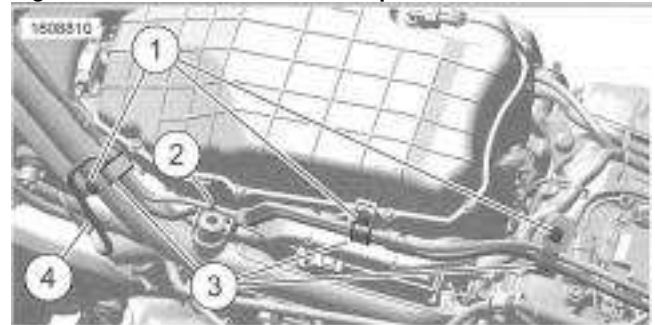
Complete

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).



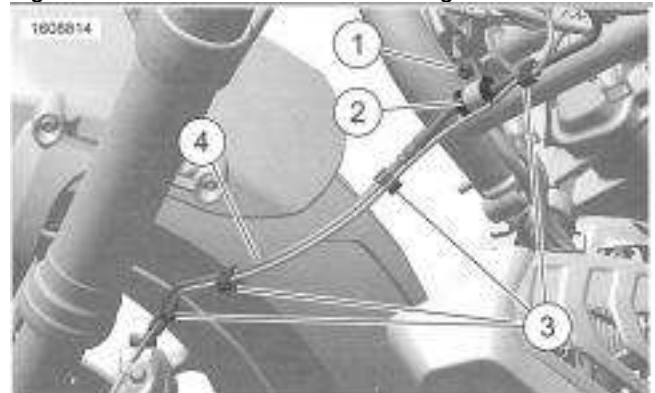
1. Screw
2. Brake line
3. Clamp and grommet

Figure 3-40. Rear Brake Line Clamp



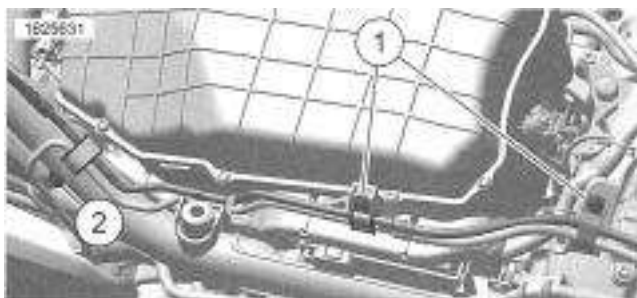
1. Screw
2. Double loop cable strap
3. Clamps and grommets
4. Brake line

Figure 3-41. Left Side Brake Line Routing



1. Screw
2. Clamp and grommet
3. Brake line to WSS wire clips
4. Brake line

Figure 3-42. Front Brake Line Clips



1. Rear screws (2)
2. Front screw

Figure 3-43. 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 3-44. Remove brake line from lower clamps.
 - a. Remove screws (1).
 - b. Remove clamps and grommets (3).
2. See Figure 3-45. Remove brake line from upper clamp.
 - a. Remove screw (2).
 - b. Remove clamp and grommet (3).
3. Remove brake line (1).

Install

NOTE

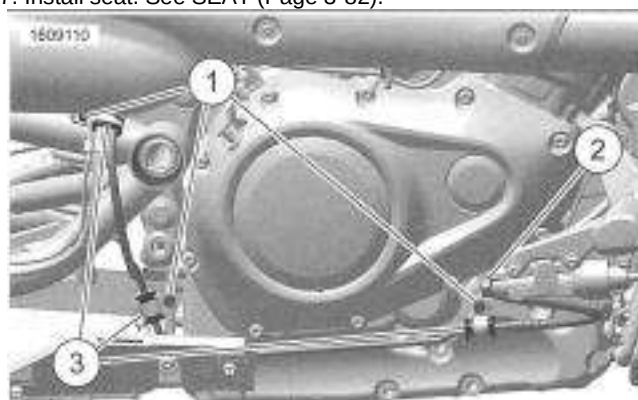
Do not tighten clamp screws until all screws have been installed.

1. See Figure 3-45. Install brake line (1).
 - a. Install grommet and clamp (2).
 - b. Install screw (3).
2. See Figure 3-44. 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*

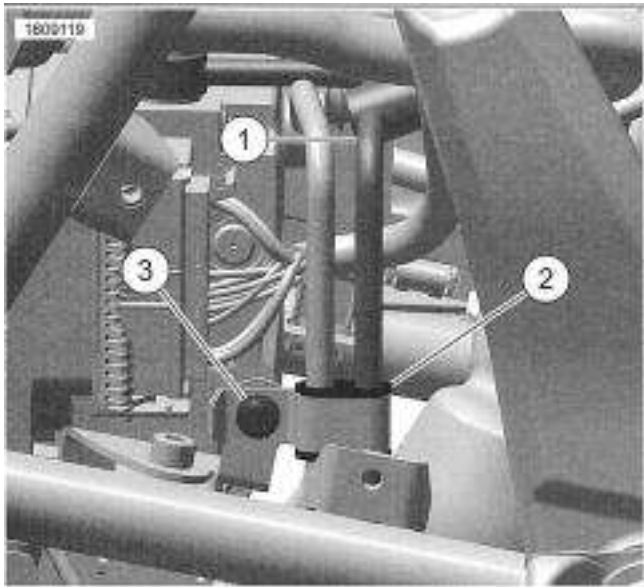
Complete

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).



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

Figure 3-44. ABS Module to Rear Master Cylinder Brake Line Lower Clamps



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

Figure 3-45. 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

Install

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).

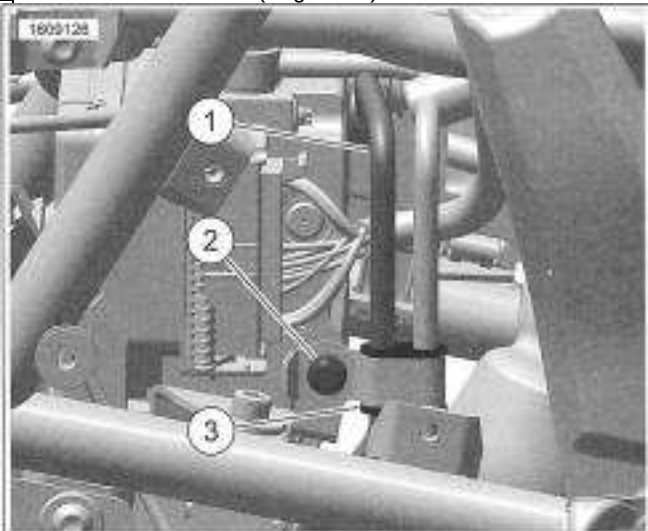
Remove

1. See Figure 3-46. 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 3-47. Remove brake line from clamp.
 - a. Remove clamp screw (2).
 - b. Remove clamp and grommet (3).
4. Remove brake line (1).

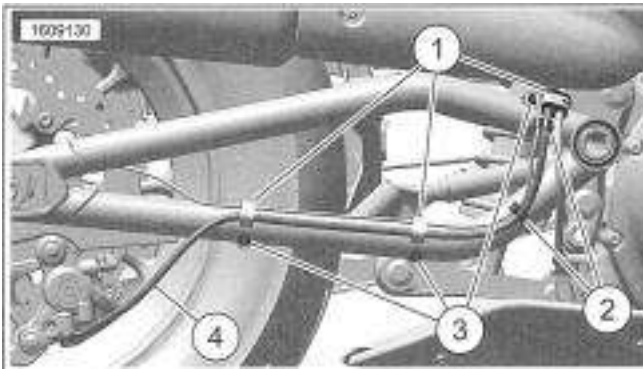
1. See Figure 3-47. Install brake line.
 - a. Install grommet (3).
 - b. Install clamp (4) and screw (2). Tighten.
Torque: 62-80 **in-lbs** (7-9 N-m) *Brake line, rear dual, clamp screw*
2. See Figure 3-46. Install brake line on rear fork.
 - a. Install brake line (5) with WSS wire (3) into P-clamps (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 3-46. Brake Line at ABS Module



1. Clamp and grommets (3)
2. Line clip
3. Screw (3)
4. Brake line

Figure 3-47. 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 3-48. 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 3-49. 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

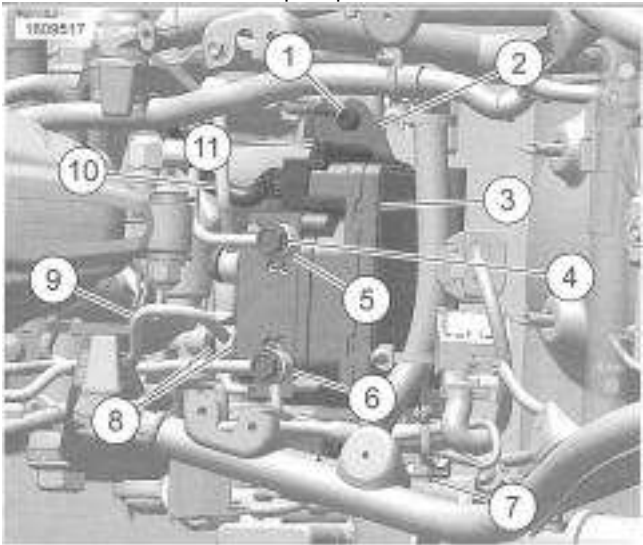
FASTENER	TORQUE VALUE	
ABS module banjo bolts	17-19 ft-lbs	23-26 N-m
ABS module bracket to frame screws	62-80 in-lbs	7-9 N-m
ABS module to mounting bracket screws	40-58 in-lbs	4.5-6.5 N-m

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)

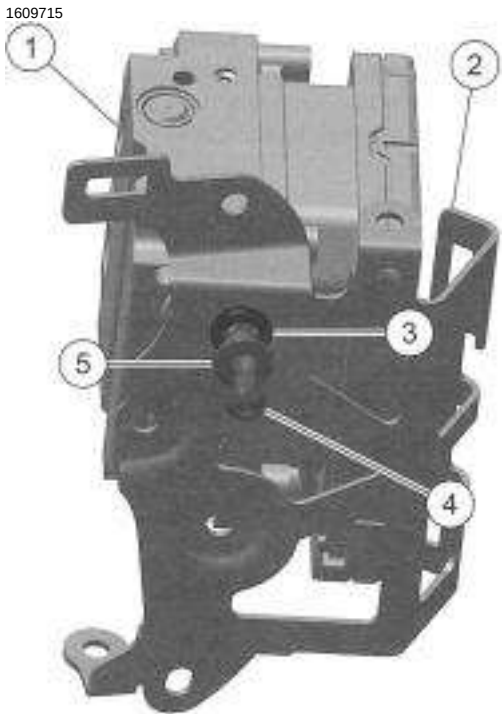
1. See Figure 3-49. Assemble ABS module to bracket.
 - a. If required, install grommets (3) and standoffs (5).
 - b. Install ABS module (3) to bracket (1) with screws (2).
 - c. Tighten screws.
Torque: 40-58 **in-lbs** (4.5-6.5 N-m) *ABS module to mounting bracket screws*
2. See Figure 3-48. Install 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 3-48. 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 3-49. 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.



- 1. Screws (2)
- 2. ABS module bracket
- 3. ABS module
- 4. Banjo bolt (4)
- 5. Rear master cylinder to ABS module
- 6. Front master cylinder to ABS module
- 7. Screw
- 8. Gasket washers (8)
- 9. Front caliper to ABS module
- 10. Rear caliper to ABS module
- 11. ABS connector

Figure 3-48. ABS Module Brake Line Connections



- 1. ABS module
- 2. ABS module bracket
- 3. Grommet (3)
- 4. Screw (3)
- 5. Standoff (3)

Figure 3-49. ABS Module Mounting

COMPLETE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II
A 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).

A 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.

- Remove master cylinder reservoir cap of the affected system.
- See Figure 3-50. Remove cap (1) from bleeder screw (2).

- Using vacuum brake bleeder to drain system.

Special Tool: BASIC VACUUM BRAKE BLEEDER (BB200A)

- Attach vacuum brake bleeder to a caliper bleeder screw. Loosen screw 3/4 turn.
 - Operate vacuum bleeder to evacuate all fluid from master cylinder and line.
 - If needed:** Repeat with remaining caliper.
- Using brake lever or pedal to drain system.
 - Install end of a length of 0.31 in (7.9 mm) of the Inside Diameter (ID) clear plastic tubing over bleeder screw.
 - Place free end of tubing in a suitable container.
 - Open bleeder screw one-half turn.
 - Pump brake lever or pedal repeatedly to drain brake fluid.
 - Close bleeder screw. Tighten. Refer to Table 3-7.
 - Wipe out any remaining fluid inside master cylinder reservoir with a clean, lint-free cloth.

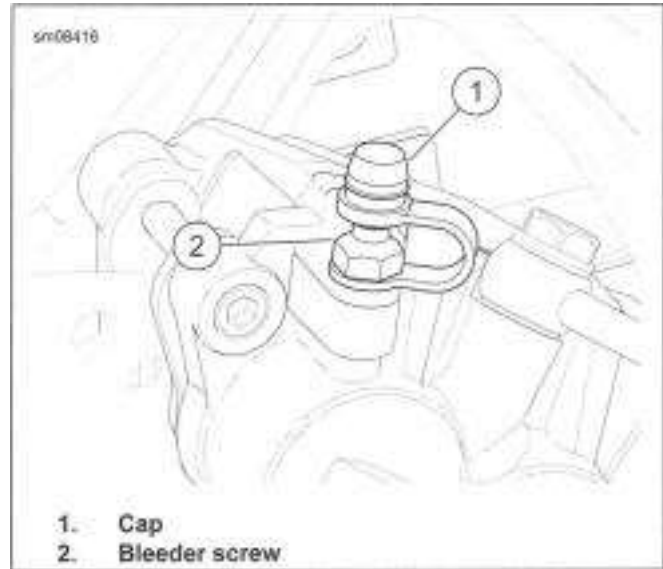


Figure 3-50. Bleeder Screw (Typical)

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

A 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)

A 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)

A 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 Clearwater.

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 3-51. 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 Nm) *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.

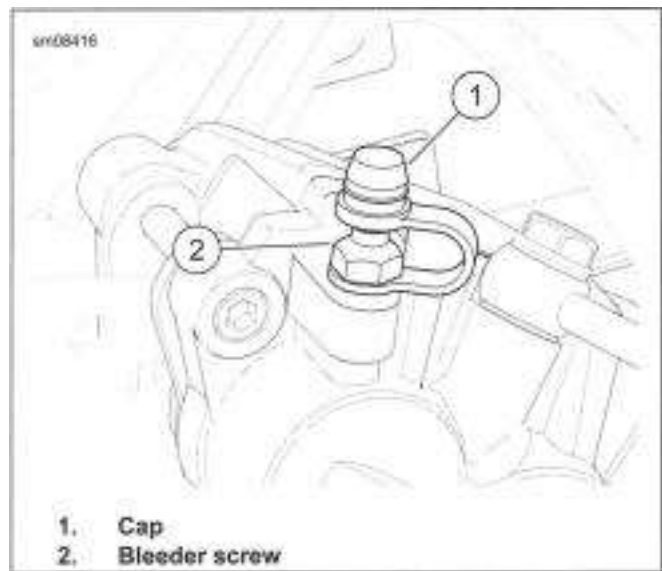


Figure 3-51. Bleeder Screw (Typical)

Table 3-7. Torque Specifications

COMPONENT	TADAI II— UKUJt
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 3-52. 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 3-53. Pull out to remove cover.

Middle Side Cover

1. See Figure 3-54. Remove screws (1).
2. Remove middle side cover (2).

Rear Side Cover

1. See Figure 3-55. Pull out to release from three clips, remove side cover.

Right Side Valley Cover

1. See Figure 3-56. Pull out to release from three clips, remove right side valley cover.

Left Radiator Cover

1. See Figure 3-57. Remove screw (4).
2. Pull out left radiator cover (1) to remove from clip (2).

Right Radiator Cover

1. See Figure 3-58. 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 3-52. 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 3-53. Install cover.

Middle Side Cover

1. See Figure 3-54. 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 3-55. Align three clips, install side cover.

Right Side Valley Cover

1. See Figure 3-56. Align three clips, install right side valley cover.

Left Radiator Cover

1. See Figure 3-57. Align left radiator cover (1) with clip (2). Verify cover is over fan shroud (3).

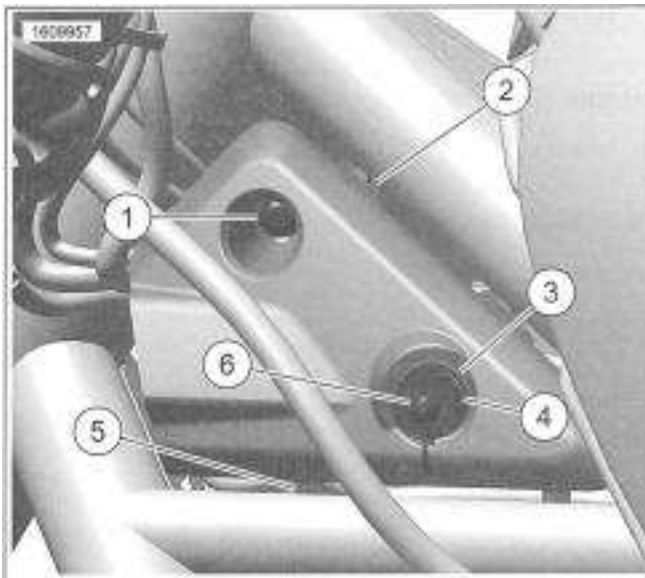
2. Install screw (4). Tighten.

Torque: 71-89 in-lbs (8-10 N-m) *Radiator cover screw*

Right Radiator Cover

1. See Figure 3-58. 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 3-52. Steering Head Cover (left side shown)

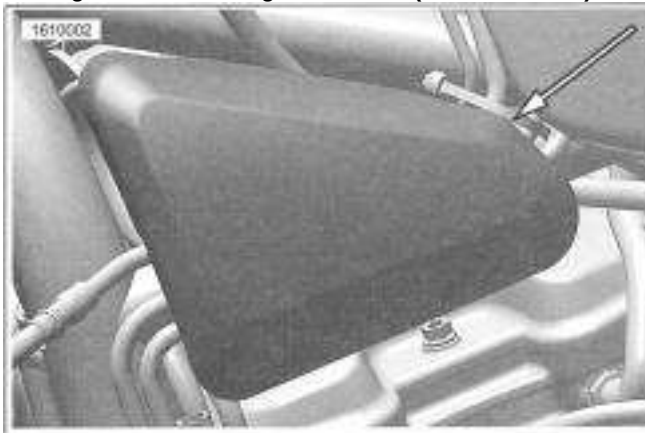


Figure 3-53. Front Cover



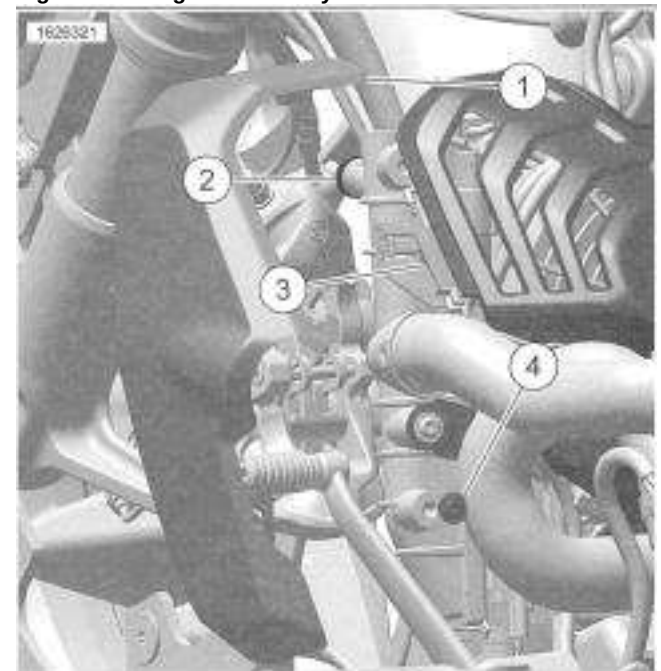
1. Screw (2)
 2. Middle side cover
- Figure 3-54. Middle Side Cover
1. Left radiator cover
 2. Clip



Figure 3-55. Rear Side Cover

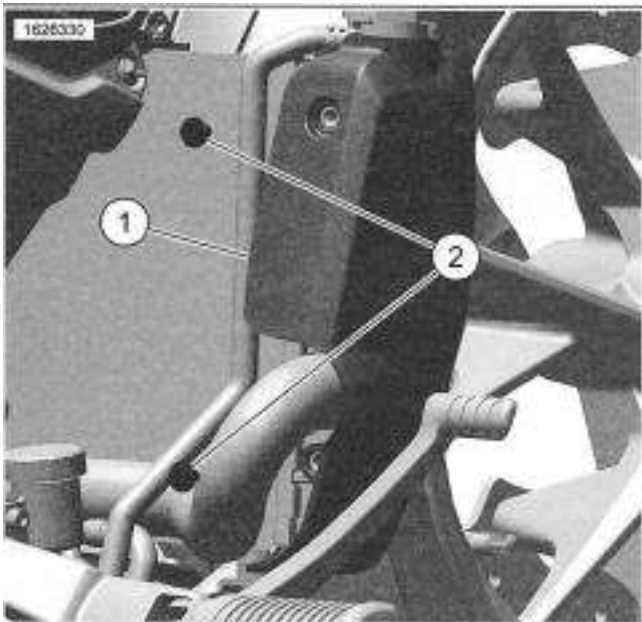


Figure 3-56. Right Side Valley Cover



3. Fan shroud
4. Screw

Figure 3-57. Left Radiator Cover



- 1. Right radiator cover
- 2. Screws (2)

Figure 3-58. 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 3-59. 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.

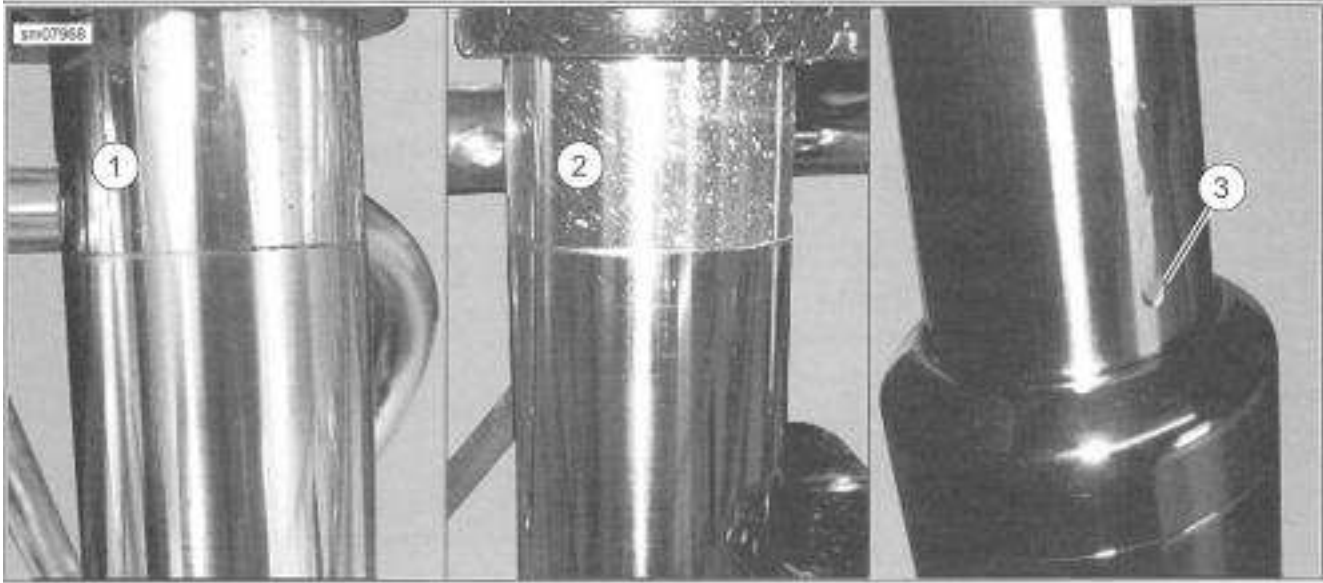


Figure 3-59. Front Forks

PREPARE

INSTALL

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

3. Drip

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 3-60 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).

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 3-60. Install front fork tube assemblies.

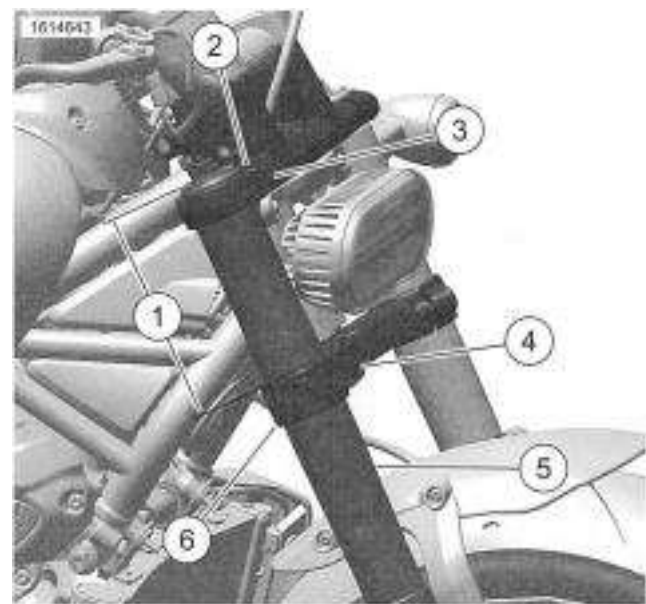
- d. Remove fork tube assemblies (5).

- 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)



Distance
Upper fork bracket Upper fork
bracket pinch screw Lower fork
bracket pinch screw Fork tube
assembly Lower fork bracket
Figure 3-60. Front Fork Mount (typical)

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

DISASSEMBLE

Initial Disassembly

1. See Figure 3-61. 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.

A WARNING

Wear safety glasses or goggles when servicing fork assembly. Do not remove slidertube 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 3-65. Remove fork tube cap.
 - a. Separate fork tube cap (1) from fork tube (11).
 - b. Compress fork assembly.
 - c. See Figure 3-62. 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 3-65. 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).

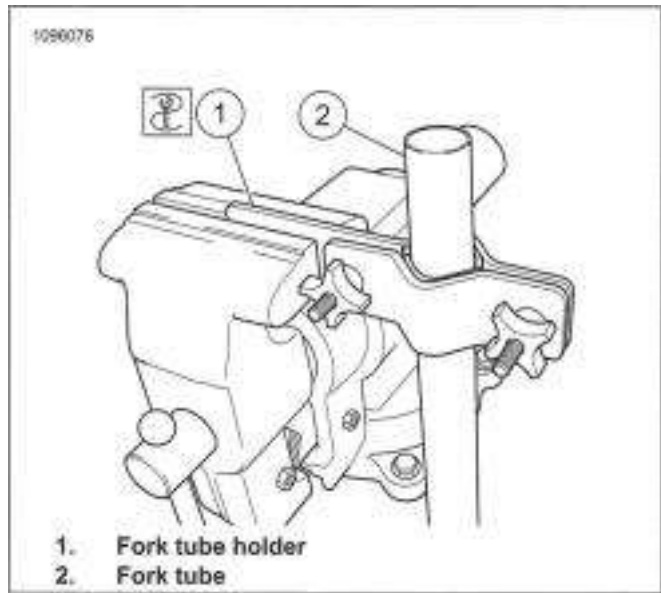
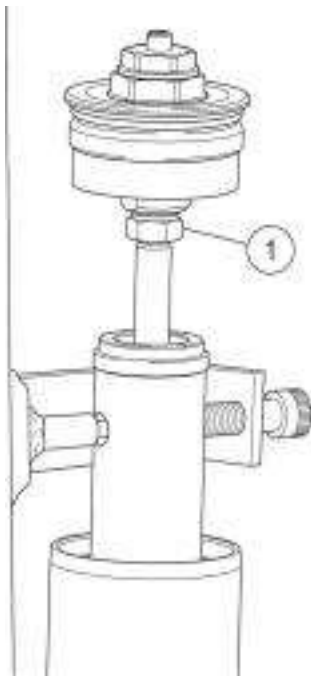


Figure 3-61. Fork Tube Holder



1. Nut

Figure 3-62. 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 3-65. 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 3-63. 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)

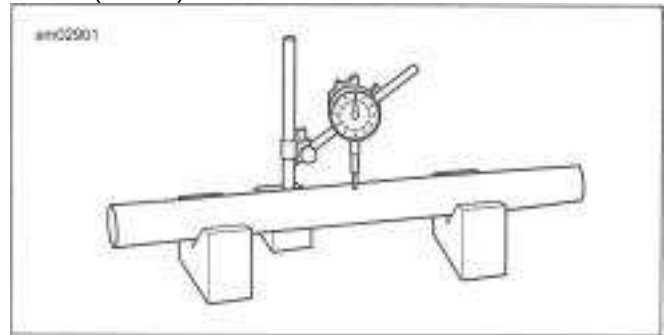


Figure 3-63. Measure Fork Tube Runout

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	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 3-65. 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 3-64. 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 3-65. 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 3-62. 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 3-65. 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.

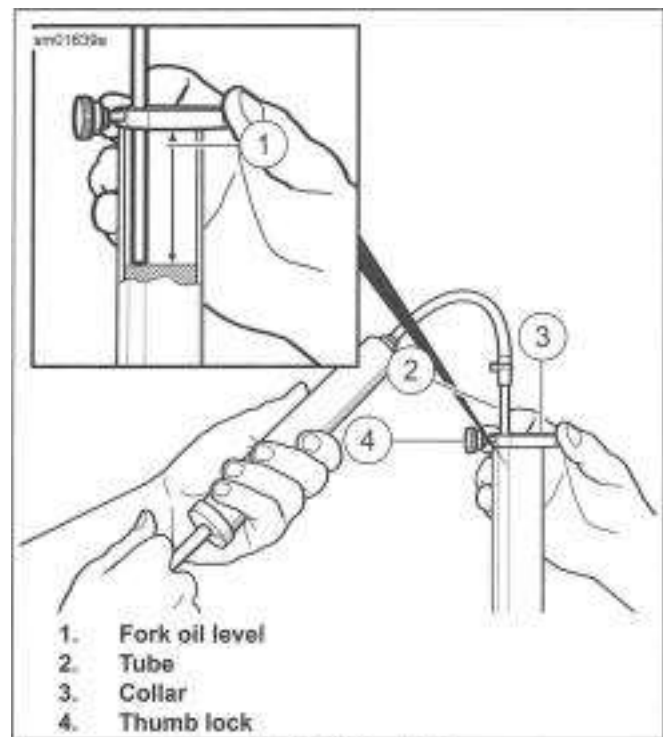
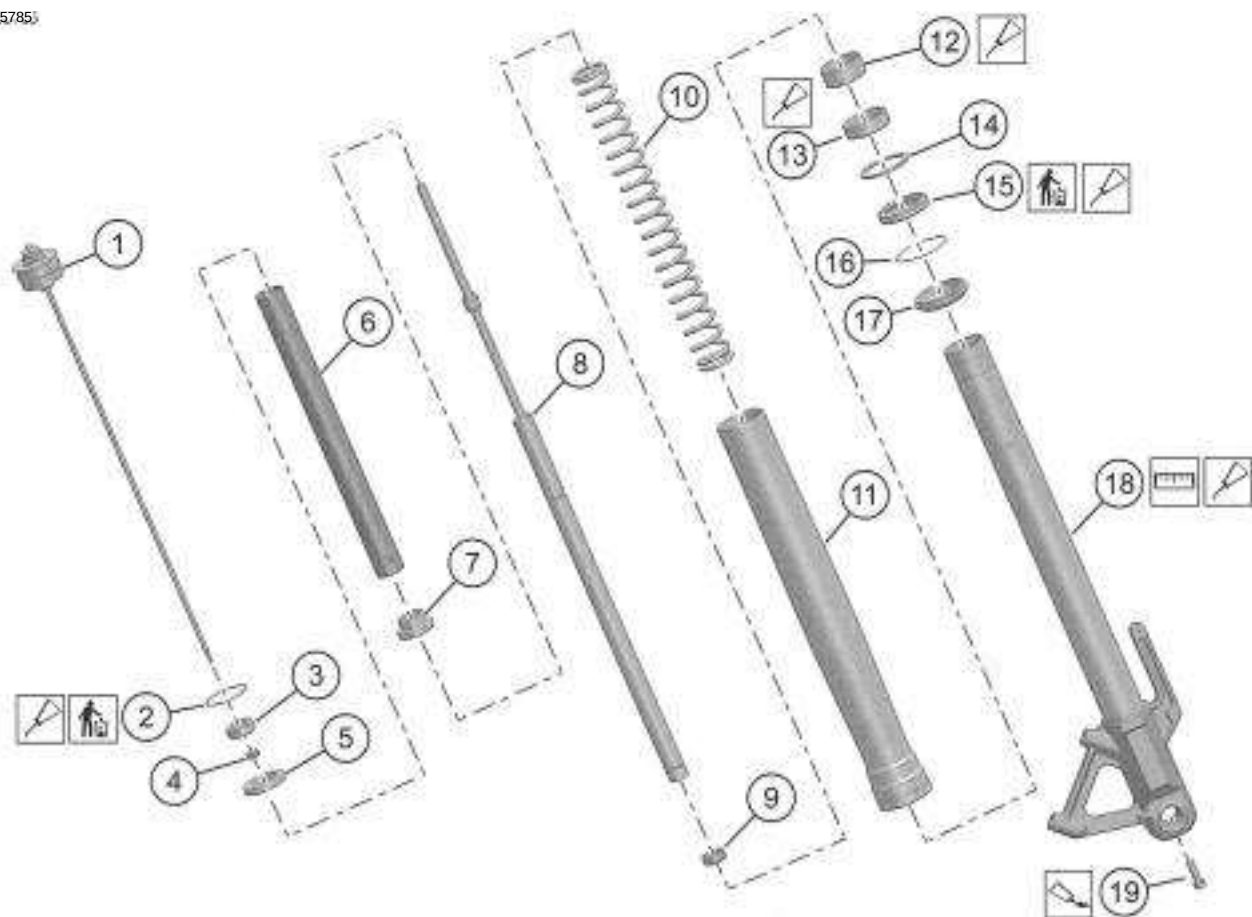


Figure 3-64. Oil Level Gauge



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 3-65. Fork Components, Base Model

COMPLETE

3. Install front fender. See FRONT FENDER (Page 3-75).

1. Install front wheel. See FRONT WHEEL (Page 3-7).
2. Attach front brake calipers. See FRONT BRAKE CALIPER (Page 3-27).

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 8-27).
5. Remove front fork. See FRONT FORK (Page 3-49).

REMOVE**Upper Fork Bracket**

1. See Figure 3-66. 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 3-66. 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 3-66. 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.

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

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

INSTALL

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)

A 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 3-66. **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 3-66. Install front fork stem and lower fork bracket assembly.

- a. Install fork stem through steering head (9).

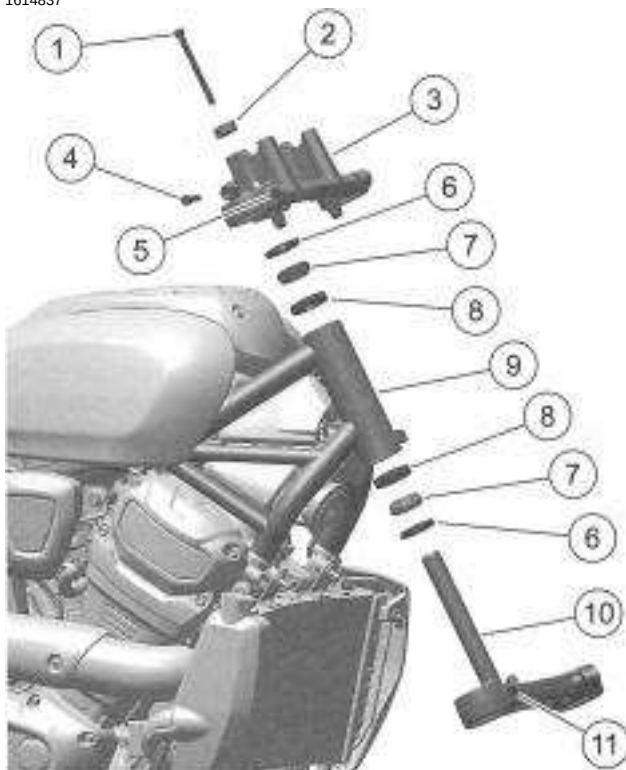
- b. Install **new** upper steering head bearing (7) and **new** dust seal (6).

2. Install upper fork bracket (3).

Upper Fork Bracket

1. See Figure 3-66. **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.

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COMPLETE

1. Install front fork. See FRONT FORK (Page 3-49).
2. Install front turn signal lamps. See FRONT TURN SIGNAL LAMPS (Page 8-27).
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).

1. **Fork stem screw**
 2. **Washer**
 3. **Upper fork bracket**
 4. **Fork stem pinch screw**
 5. **Upper fork bracket pinch screw (2)**
 6. **Dust seal (2)**
 7. **Steering head bearing (2)**
 8. **Bearing cup (2)**
 9. **Steering head**
 10. **Fork stem and lower fork bracket assembly**
 11. **Lower fork bracket pinch screw (2)**
- Figure 3-66. Fork Stem and Bracket Assembly**

REAR FORK
FORK LOCK

3.24
3.23

PREPARE

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

REMOVE

- 1. See Figure 3-67. 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 Nm
Lock reinforcement bracket screw	97-115 in-lbs	11-13 N-m

- 1. See Figure 3-67. 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 Nm) Fork lock screw

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

Torque: 97-115 in-lbs (11-13 Nm) Lock reinforcement bracket screw

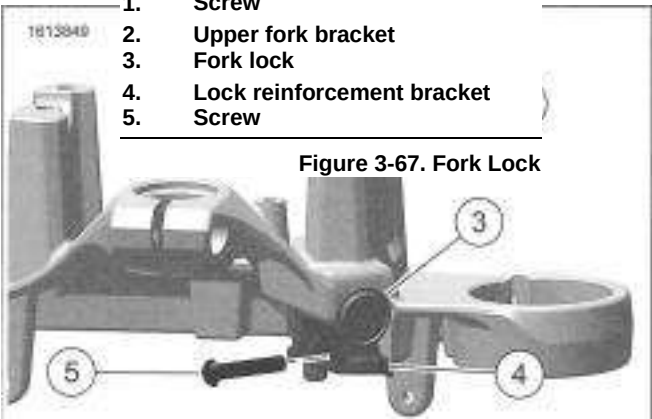


Figure 3-67. Fork Lock

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 3-68. 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 3-68. 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*

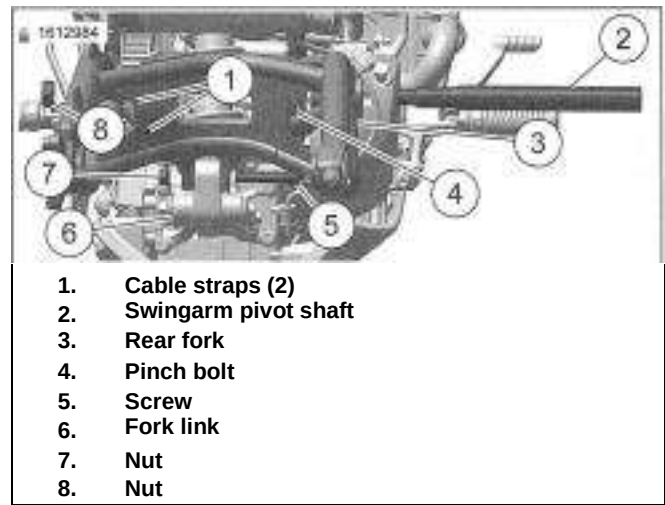


Figure 3-68. Rear Fork Assembly

DISASSEMBLE

1. See Figure 3-69. 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).

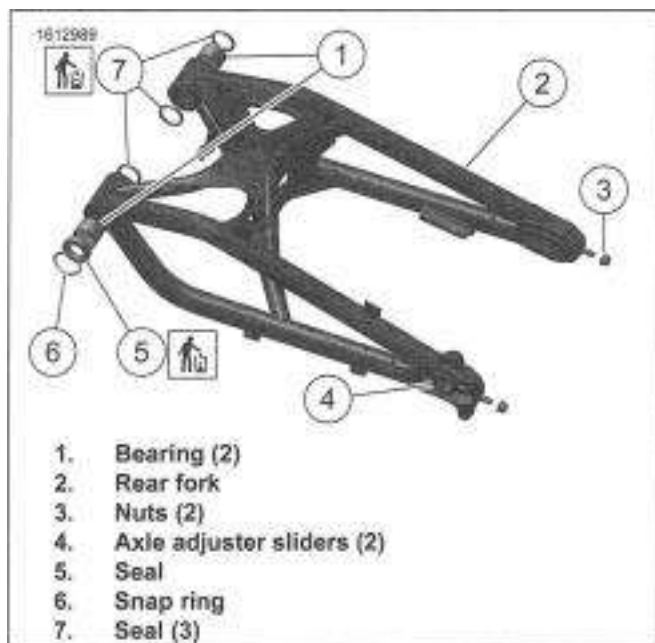


Figure 3-69. Rear Fork Assembly

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 3-69. 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 3-72. Remove screws (1).
- 2. Remove bottom belt guard (2).

Top Belt Guard

- 1. See Figure 3-70. Remove screws (1).
- 2. Remove top belt guard (2).

Sprocket Cover

- 1. See Figure 3-71. 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 3-72. Install sprocket cover (2).
 - b. Install screws (1). Tighten.
Torque: 62-80 **in-lbs** (7-9 N-m) *Sprocket cover screws*

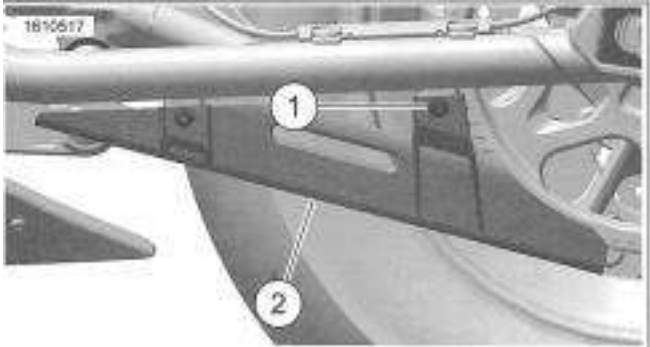
Top Belt Guard

- 1. Install top belt guard.
 - a. See Figure 3-71. 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*

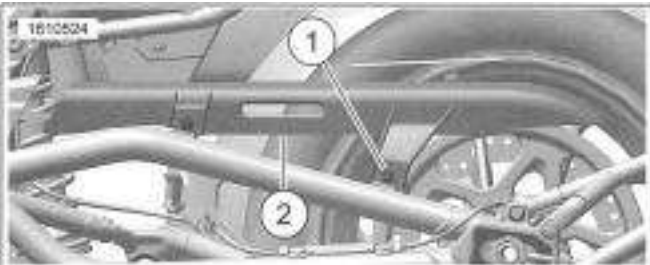
Bottom Belt Guard

- 1. Install bottom belt guard.
 - a. See Figure 3-70. Install bottom belt guard (1).

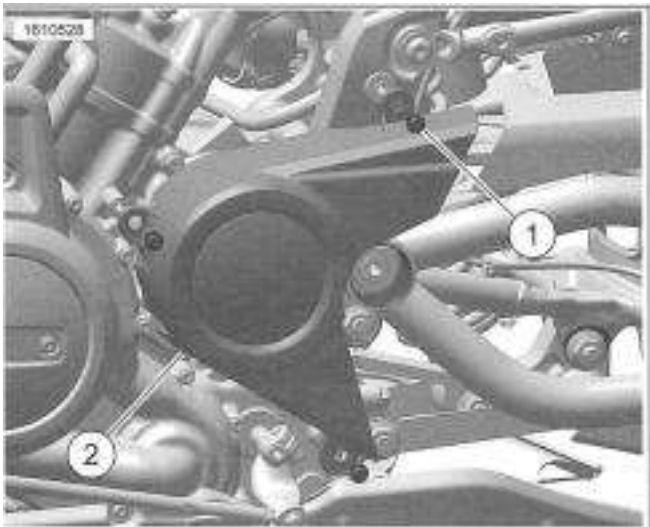
- b. Install screws (2). Tighten.
Torque: 40^19 **in-lbs** (4.5-5.5 N-m) *Belt guard, bottom, screws*



1. Screw (2)
2. Belt guard
Figure 3-70. Bottom Belt Guard



1. Screw (2)
2. Top belt guard
Figure 3-71. Top Belt Guard



1. Inner front chain guard
2. Sprocket cover
3. Screw (3)
Figure 3-72. Sprocket Cover

REAR SHOCK ABSORBER

PREPARE

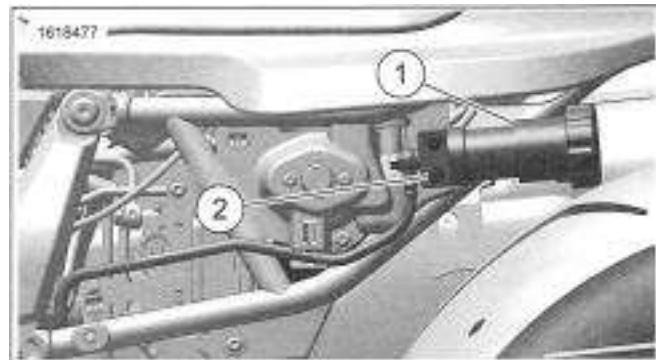
3.26

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

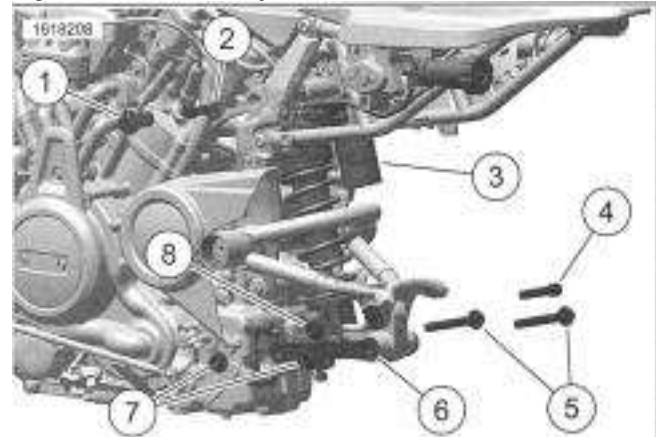
Rear Shock Absorber

1. See Figure 3-73. Remove screws (2) and detach manual shock adjuster (1).
2. See Figure 3-74. 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 3-75. Remove shock.
 - a. Remove nut (4).
 - b. Remove bolt (3).
 - c. Remove shock (1) from rear suspension link (2).



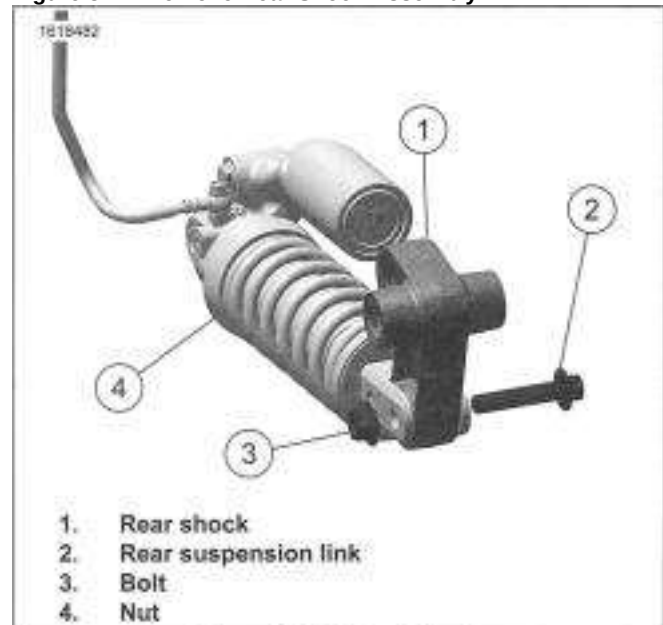
1. Manual shock adjuster
2. Screws (2)

Figure 3-73. Manual Adjuster Knob



1. Screw
2. Screw
3. Rear shock
4. Bolts (2)
5. Nuts (2)
6. Links (2)
7. Nut

Figure 3-74. Remove Rear Shock Assembly



1. Rear shock
2. Rear suspension link
3. Bolt
4. Nut

Figure 3-75. Rear Shock

Swing Arm Mount Block Assembly

1. See Figure 3-76. Remove links.
 - a. Remove nuts (1).
 - b. Remove bolts (4) and links (2).
2. Remove bolts (5) and swing arm mount block assembly (6).

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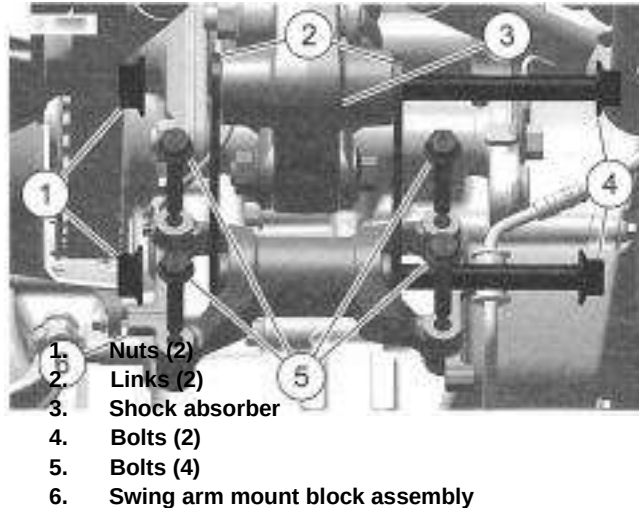


Figure 3-76. Swing Arm Mount Block Assembly

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 3-76. 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 Nm) *Shock absorber link bolt*

Rear Shock Absorber

1. See Figure 3-75. 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 3-74. 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.

Torque: 66-74 ft-lbs (90-100 N-m) *Swing arm assembly mount block nut*

3. See Figure 3-73. Position manual shock adjuster (1) and install screws (2). Tighten.

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

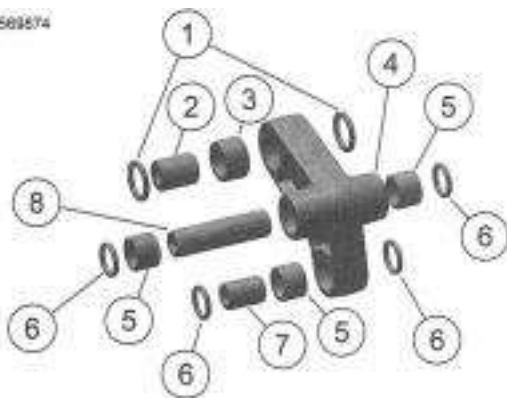
DISASSEMBLE

Rear Suspension Link

NOTE

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

1. See Figure 3-77. Push to remove bushing (2, 7, 8).
2. Remove seals (1, 6).
3. Using suitable tool press bearings out (3, 5).



1. Bearing dust seal
2. Bushing
3. Roll element bearing
4. Rear suspension link
5. Roll element swing arm rocker bearing
6. Bearing linkage seal
7. Bushing
8. Bushing

Figure 3-77. Rear Suspension Link

Swing Arm Assembly Mount Block

1. See Figure 3-78. Push to remove bushing (4).
2. Remove seals (1).
3. Using suitable tool press bearings out (2).

1. Bearing linkage seal (2)

1618457



2. Roll element swing arm rocker bearing (2)
3. Swing arm mount block
4. Bushing

Figure 3-78. Swing Arm Assembly Mount Block

ASSEMBLE

CONSUMABLE	PART NUMBER
SPECIAL PURPOSE GREASE	99857-97A

Rear Suspension Link

3.27

1. Apply lubricant to the inner bores of suspension link prior to installing bearings.
Consumable: SPECIAL PURPOSE GREASE (99857-97A)
2. See Figure 3-77. 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 3-78. 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 3-80. 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 3-82. 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 3-84. 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 3-80. 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 3-79. 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 3-81 and Figure 3-83. 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 3-83. install clutch cable in vehicle.
 - a. Route clutch cable between rear shock and midframe toward clutch cable boss.

Clutch Hand Control

1. See Figure 3-79. 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 Nm) *Clutch hand control bracket screw*
 - d. Install clutch cable upper end.

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

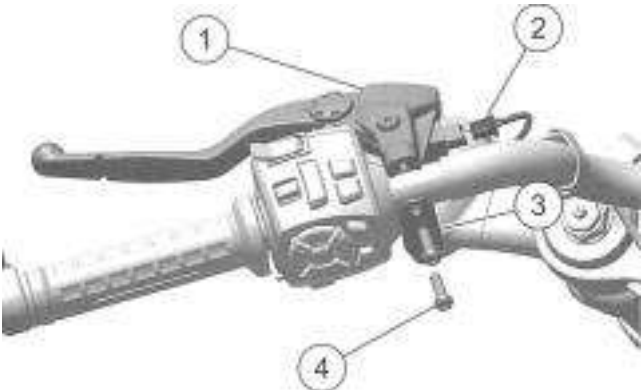
Clutch Cable: Lower End

- 1. See Figure 3-84. 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 3-80. Install clutch cable.
 - a. Verify slots in clutch cable adjuster (3), jamnut (4) and clutch hand lever assembly are aligned.

Install cable end (5) into slot (7).
 - c. Install clutch cable (6) through clutch hand lever assembly, clutch cable adjuster (3) and jamnut (4).
 - 1. **Clutch hand control assembly**
 - d. Install clutch switch cover.



- 2. Clutch switch connector
- 3. Clamp
- 4. Screw (2)

Figure 3-79. Clutch Hand Control

Cable strap
Adjuster
Retainer
Figure 3-82. Mid Clutch Cable Routing



- 1. B
- 2. C
- 3. A
- 4. J
- 5. C
- 6. C
- 7. C
- 8. S

Figure 3-80.



- 1. R
- 2. C
- 3. A
- 4. B
- 5. J

Figure 3-81.



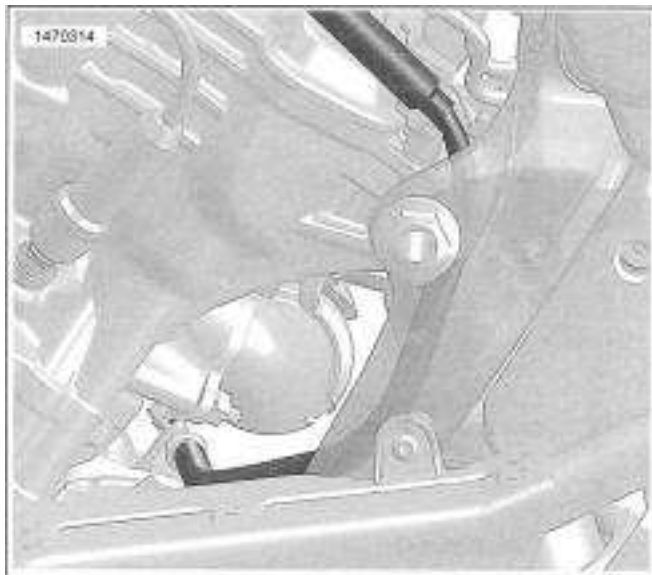
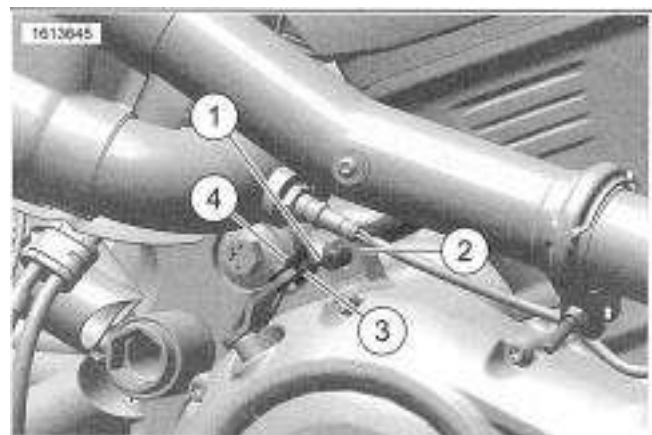


Figure 3-83. Rear Clutch Cable Routing

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



1. Clutch cable
2. Clutch cable boss
3. Cable end
4. Cable joint

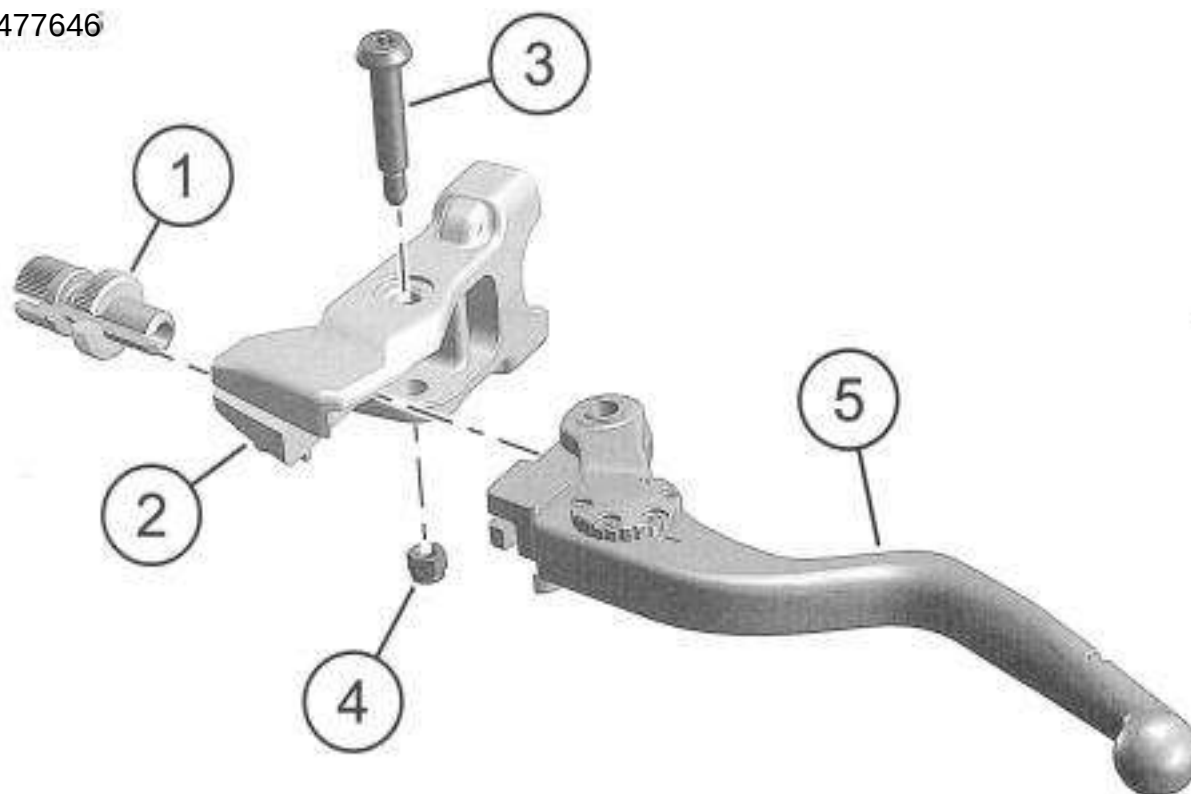
Figure 3-84. Clutch Cable to Clutch Actuator

DISASSEMBLE

1. See Figure 3-85. Remove Cable adjuster (1).
2. Remove clutch lever.
 - a. Remove nut (4).
 - b. Remove lever pivot screw (3).
 - c. Remove clutch lever (5).

ASSEMBLE

1. See Figure 3-85. 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.



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

- 4. Nut
- 5. Clutch lever

Figure 3-85. 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 3-86. Grasp cowl (3) and lift straight up.
- 2. Remove and discard grommet (2) if damaged.

Rear Fenders

- 1. See Figure 3-86. Remove screws (1) and left rear fender (4) .
- 2. Remove screws and right rear fender (6).
- 3. Remove and discard grommets (5) if damaged.

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

INSTALL

Cowl

- 1. See Figure 3-86. Install new grommet (2) if necessary.
- 2. Place cowl (3) in position. Press down until cowl snaps in place.

Rear Fenders

- 1. See Figure 3-86. Install new grommets (5) if necessary.

- 2. Install left rear fender (4). Secure with screws (1). Tighten.
Torque: 35.4^t4.3 **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*

1. Screw (4)

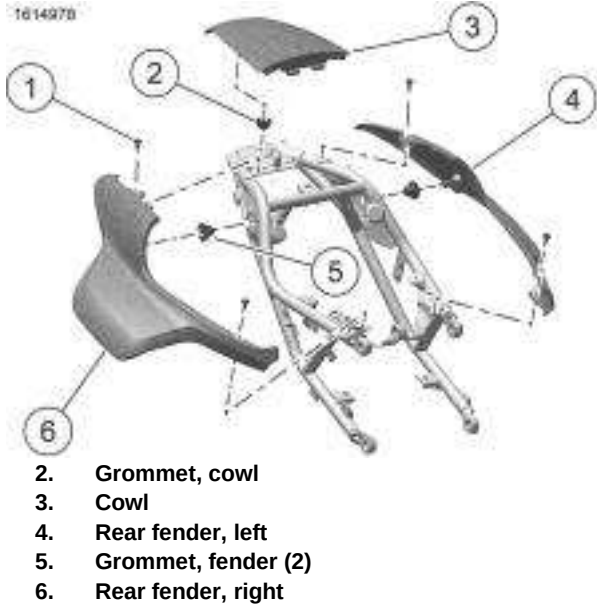


Figure 3-86. Cowl and Rear Fenders

COMPLETE

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

REMOVE _____

Front Chin Spoiler

- 1. See Figure 3-87. Remove screws (1, 3).
- 2. Remove front chin spoiler (2).

Left Side Chin Spoiler

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

Center Rear Chin Spoiler

- 1. See Figure 3-89. Remove screws (1).
- 2. Remove center rear chin spoiler (4).

Right Side Chin Spoiler

- 1. See Figure 3-90. 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 3-87. 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

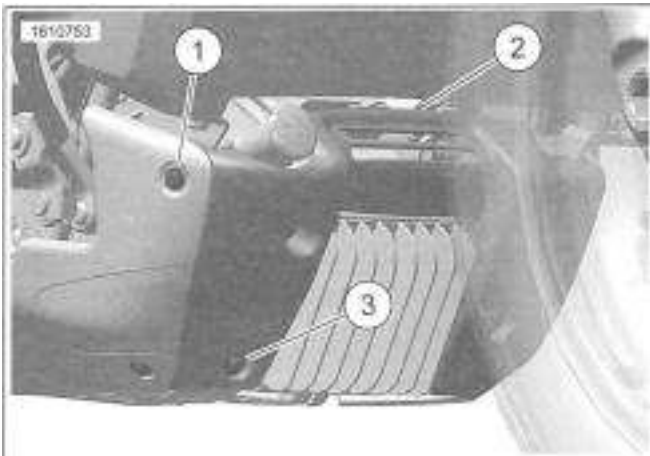
- 1. See Figure 3-88. Position left side chin spoiler (2).
- 2. Install screws (1). Tighten.
Torque: 35-62 in-lbs (4-7 N m) *Chin spoiler screws*

Center Rear Chin Spoiler

- 1. See Figure 3-89. Position center rear chin spoiler (4).
- 2. Install screws (1). Tighten.
Torque: 35-62 in-lbs (4-7 N-m) *Chin spoiler screws*

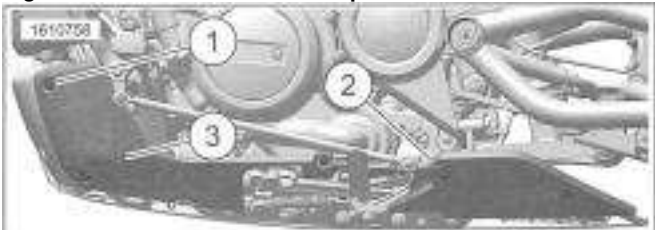
Right Side Chin Spoiler

- 1. See Figure 3-90. Position right side chin spoiler (1).
- 2. Install screws (2). Tighten.
Torque: 35-62 in-lbs (4-7 N-m) *Chin spoiler screws*

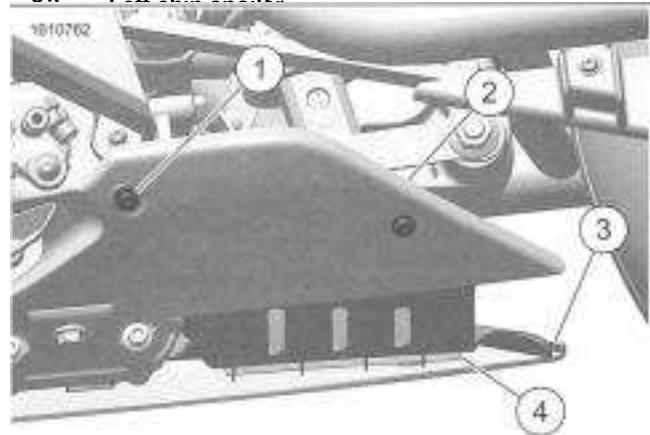


- 1. Right and left chin spoiler screws (4)
- 2. Front chin spoiler
- 3. Front chin spoiler screws (3) _____

Figure 3-87. Front Center Chin Spoiler



1. Screws (5)
Figure 3-88. Left Chin Spoiler



- 1. Screws (4)
 - 2. Left chin spoiler
 - 3. Right chin spoiler
 - 4. Center rear chin spoiler
- Figure 3-89. Rear Center Chin Spoiler

CHIN SPOILER



1. Right side chin spoiler
2. Screws (4)
3. Chin spoiler side access

Figure 3-90. Right Chin Spoiler

PREPARE

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

REMOVE

Left

1. See Figure 3-91 Remove end cap (1).
2. Remove hand grip.
 - a. Loosen clamp screw (3).
 - b. Remove hand grip (2).

Right

1. See Figure 3-92. Remove hand grip.
 - a. Loosen screws (2) and front cover (3).
 - b. Remove end cap (1).
 - c. Remove right hand grip (4).

INSTALL

Left

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

1. See Figure 3-91. Install hand grip.
 - a. Place grip (2) in position.
 - b. Tighten clamp screw (3).
Torque: 22-27 in-lbs (2.5-3.1 Nm) *Handgrip 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 3-93. Install hand grip.
 - a. Align TGS tabs (2) with gaps in grip (1).
 - b. Place grip in position.
2. See Figure 3-92. 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 3-91. Left Hand Grip (typical)

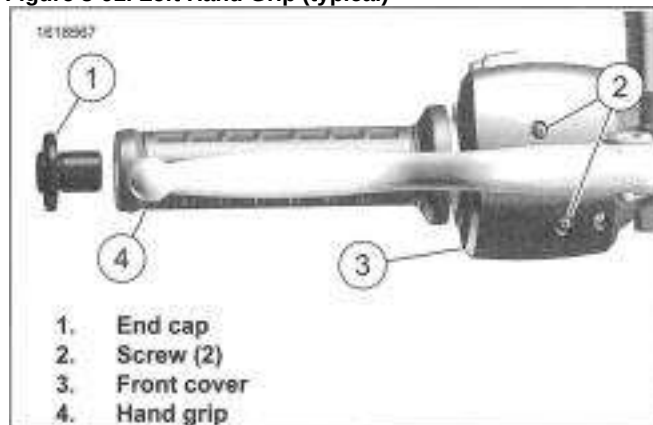


Figure 3-92. Right Hand Grip

1. End cap Hand
2. grip Clamp
3. screw

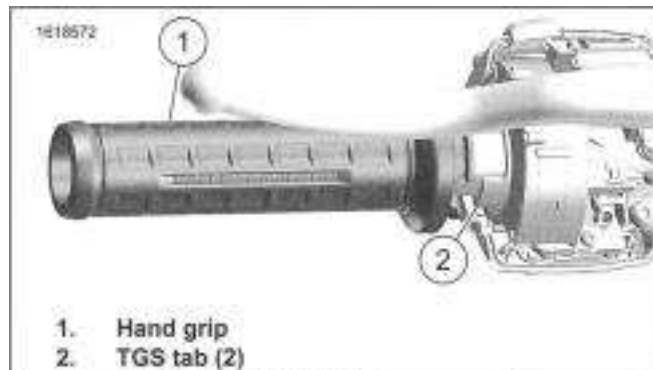


Figure 3-93. TGS Engagement

COMPLETE

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

PREPARE

Replace Handlebar

1. Detach instrument module. See INSTRUMENT MODULE (IM) (Page 8-22).
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 3-94. Remove screws (1) and handlebar clamp (2).
2. Remove handlebar assembly (3).

Remove Handlebar

1. See Figure 3-95. 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 3-94. 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 3-95. 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*

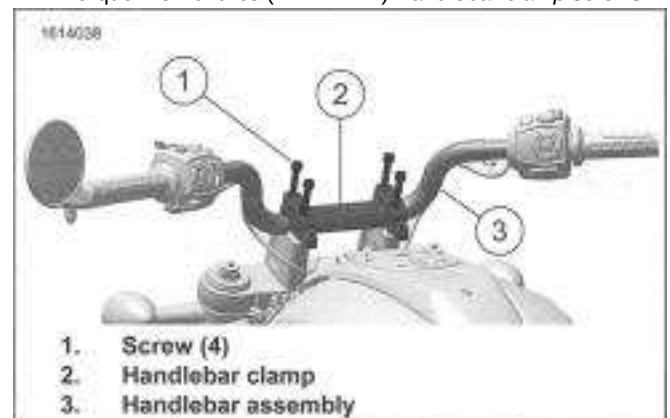


Figure 3-94. Handlebar Assembly

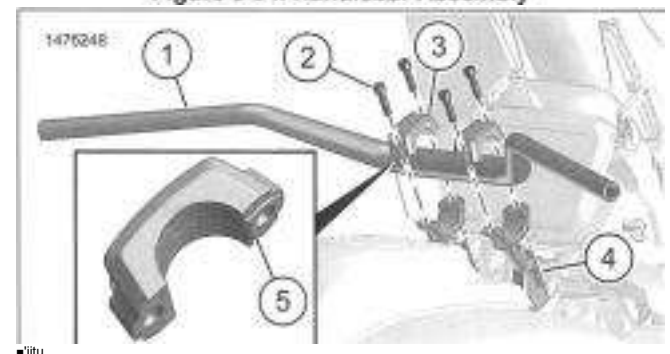


Figure 3-95. Handlebar

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).

HANDLEBAR

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 8-22).

REMOVE _____

- 1. See Figure 3-96. 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 _____

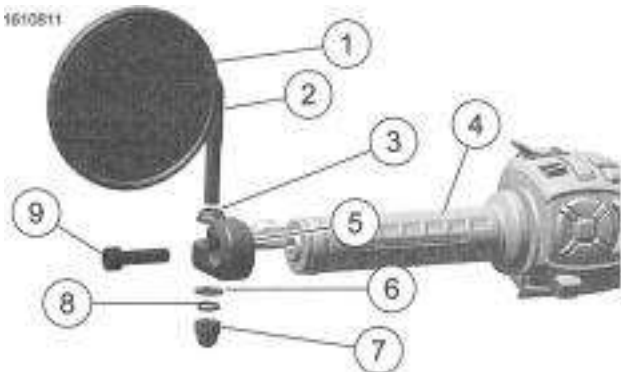
- 1. See Figure 3-96. Install mirror base (5) and screw (9). Tighten.

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

Torque: 124-177 **in-lbs** (14-20 Nm) *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*



- 1. **Mirror**
- 2. **Mirror stem**
- 3. **Stopper**
- 4. **Hand grip**
- 5. **Mirror base**
- 6. **Washer**
- 7. **Nut**
- 8. **Lock washer**
- 9. **Screw**

Figure 3-96. Mirror (left shown)

REMOVE _____

Fender

- 1. See Figure 3-97. Remove screws (1).
- 2. Remove fender (6).

Fender Assembly

- 1. See Figure 3-97. 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

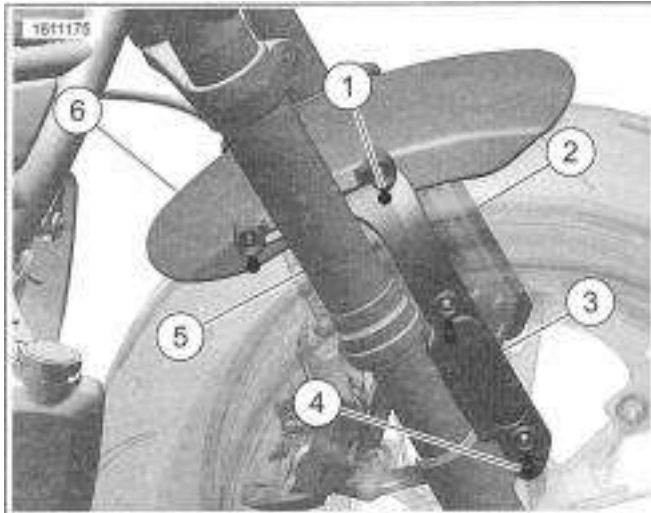
Fender

- 1. See Figure 3-97. 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 3-97. 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 3-97. Front Fender Assembly

PREPARE

- 1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

Remove License Plate Module Swingarm Mount

- 1. See Figure 3-98. 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 8-28).
- 2. Remove license plate lamp. See LICENSE PLATE LAMP (Page 8-32).

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

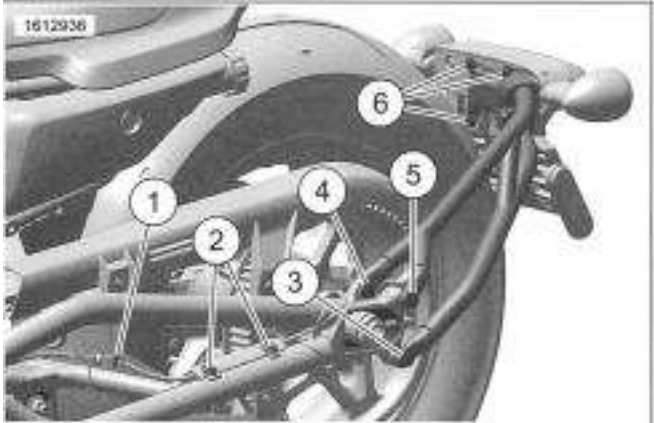
INSTALL

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 8-28)

Install License Plate Module Swingarm Mount

- 1. See Figure 3-98. 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 Nm) *License plate bracket, rear, screw*
- 2. See Figure 3-98. 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).



- 1. Connector
- 2. Scrivet (2)
- 3. Lower screw
- 4. Upper screw
- 5. Rear screw
- 6. License plate bracket screws (4)

Figure 3-98. Rear License Plate Module Swingarm Mount COMPLETE

- 1. Install main fuse. See (Page 8-4). POWER DISCONNECT

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

Remove

1. See Figure 3-99. Depress spring loaded detent and remove

FASTENER	TORQUE VALUE	
Wear peg	31-40 in-lbs	3.5-4.5 N-m

clevis pin (1).

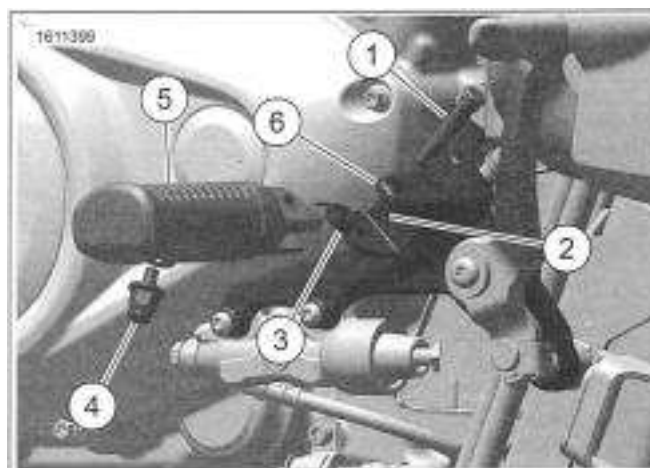
2. Remove rider footpeg (5) and spring (3).
3. If required, remove the wear peg (4).

Install

1. See Figure 3-99. 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*

3. Spring



1. Clevis pin
2. Hole
3. Spring
4. Wear peg
5. Footpeg
6. Bracket

Figure 3-99. Rider Footpeg

REMOVE AND INSTALL: BRACKET

Right Side Footrest 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

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 3-100. Remove screws (2).
2. Remove bracket (1).

Install

1. See Figure 3-100. 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 3-101. Remove screws (2).
2. Remove bracket (1).

Install

1. See Figure 3-101. 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).

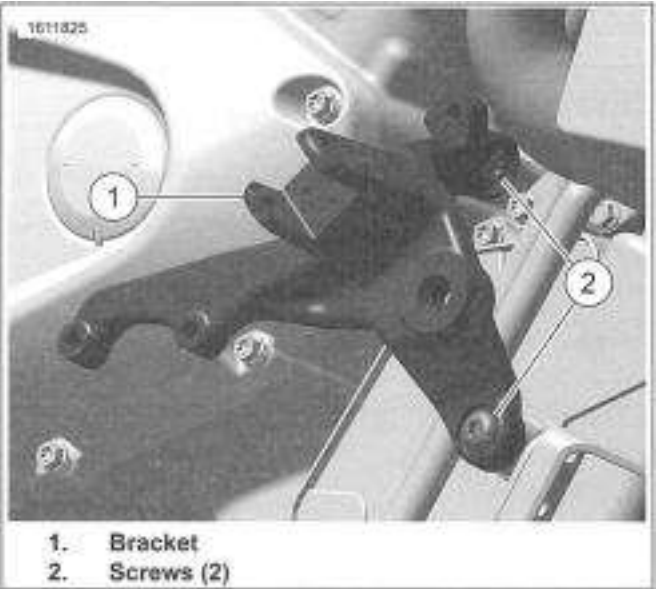
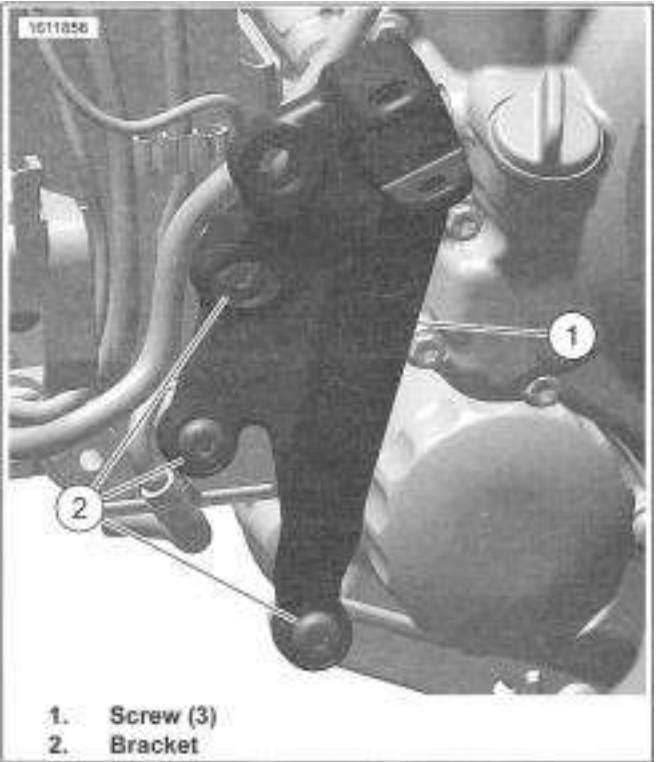


Figure 3-100. Right Footrest Bracket



FASTENER	TORQUE VALUE	
Brake pedal screw	13-15 ft-lbs	17-21 N-m

Remove

1. See Figure 3-102. 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

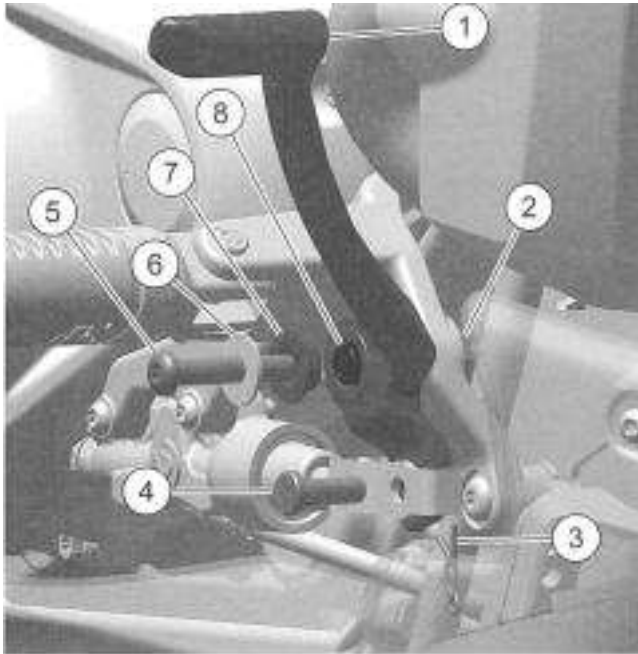
1. See Figure 3-102. Install inner bushing (8), and break pedal (1).

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).

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1. Brake pedal
2. Nut
3. Spring clip
4. Pin
5. Screw
6. Washer
7. Outer bushing
8. inner bushing

Figure 3-102. 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 3-103. 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 3-103. Install jiffy stand (2).
2. Install screws (1). Tighten.
Torque: 15—18 ft-lbs (21-25 N-m) *Jiffy stand screws*

1. Screw (4)

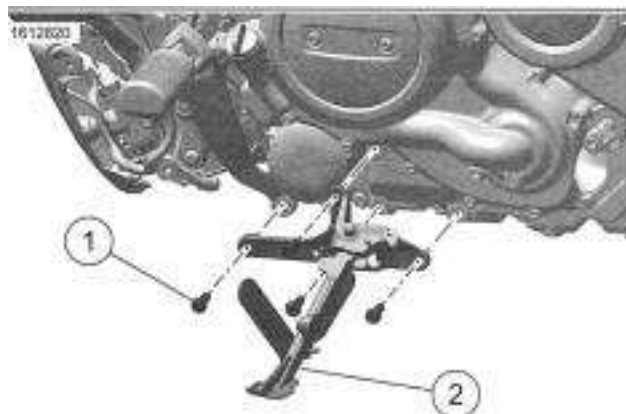


Figure 3-103. Jiffy Stand

DISASSEMBLE

2. Jiffy Stand

1. See Figure 3-104. 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).

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 3-104. Install jiffy stand bumper (4).

ASSEMBLE

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

9. Install spring (6).



1. Jiffy stand bracket
2. Bushing
3. Nut
4. Bumper
5. Jiffy stand
6. Spring
7. Pivot pin
8. Bushing

down position.

Figure 3-104. Jiffy Stand Assembly

1. If equipped, connect jiffy stand sensor. See JIFFY STAND SENSOR (JSS) (Page 8-49).

REMOVE

Seat

1. See Figure 3-105. 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 3-106. Lift up then back on rear of rider seat (1) to remove.

Seat Latch Assembly

If not replacing seat latch assembly:

1. See Figure 3-106. Remove screws (1) and position seat latch assembly (2) aside.

If replacing latch assembly:

1. See Figure 3-106. Remove screws (8) and seat latch (3).
2. Remove screws (5) and lock (6).
3. Remove seat latch assembly.

INSTALL

Seat

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

1. See Figure 3-105. 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 3-106. 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.

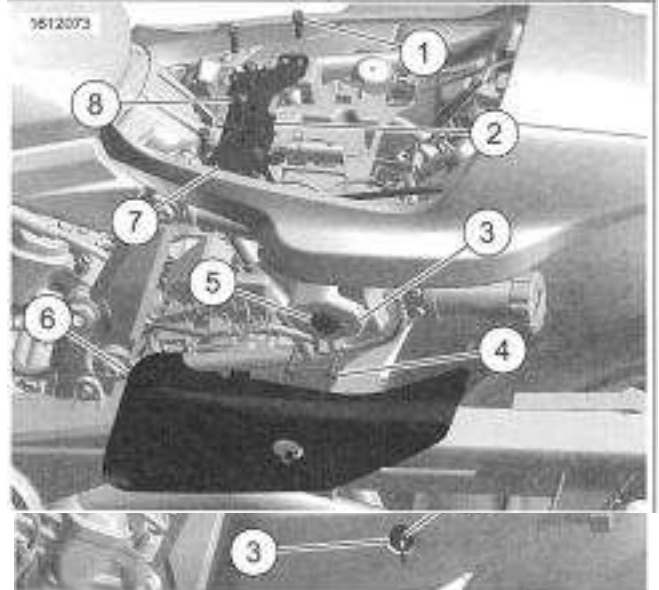
Torque: 44-53 **in-lbs** (5-6 N-m) *Seat latch screws*

If not replacing seat latch assembly:

1. See Figure 3-106. 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 3-105. Seat



1. Tabs
2. Key
3. Seat lock
4. Latch
5. Seat

1. Screw (4)
2. Seat latch bracket
3. Seat latch
4. Seat lock bracket
5. Screws (2)
6. Seat lock
7. Cable
8. Screws (2)

Figure 3-106. 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.

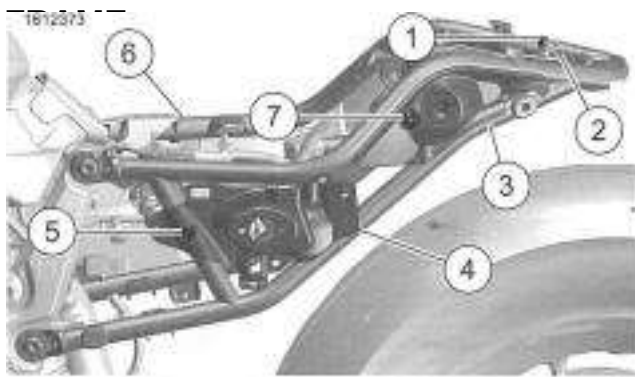
1. See Figure 3-107. If required, remove scrivet (7) and left tail cover (3).
2. If required, remove screw (5) and seat lock bracket (4).
3. Remove ground nut (s) (1) and ground wires (2).
4. See Figure 3-108. Remove scrivet (4) and right tail cover (5).
5. Remove screws (1) and right rear side cover (2).
6. See Figure 3-109. Remove tail section.
 - a. Remove lower screw (4).
 - b. Remove upper screws (2).
 - c. Remove tail section (3).

7. Remove D-Nuts (1).

INSTALL

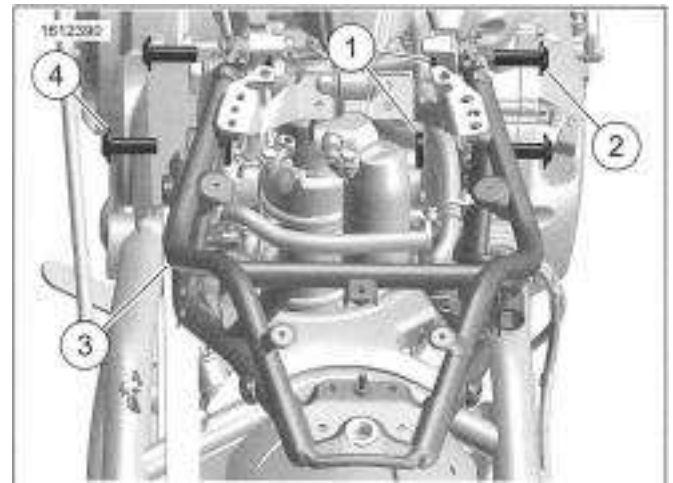
FASTENER	TORQUE VALUE	
GND nut	60-72 in-lbs	6.8-8.1 N-m
Right rear side cover screws	62-75 in-lbs	7-8.5 N-m
Seat lock bracket screw	62-75 in-lbs	7-8.5 N-m
Tail section lower screw	80-88 ft-lbs	108-119 N-m
Tail section upper screws	80-88 ft-lbs	108-119 N-m

1. See Figure 3-109. 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 3-108. 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 3-107. 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*



1. GND nut
2. GND terminals
3. Left tail cover
4. Seat lock bracket
5. Screw
6. Tail section
7. Scrivet

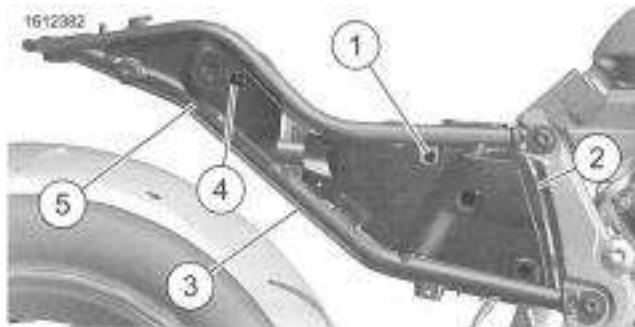
Figure 3-107. Left Tail Section



1. D-Nut (4)
2. Upper screws (2)
3. Tail section
4. Lower screws (2)

Figure 3-109. Tail Section

COMPLETE



1. Right rear side cover
2. Tail section
3. Scrivet
4. Right tail cover
5. Right tail cover

Figure 3-108. Right Tail Section

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 8-22).
11. Remove headlamp and bracket assembly. See HEADLAMP (Page 8-25).
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 8-24).
20. Remove front electrical caddy. See FRONT ELECTRICAL CADDY (Page 8-50).
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 3-110. Cut cable straps (2). Detach right side wire guide (1).
2. See Figure 3-111. 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 3-112. Remove front frame.
 - a. Remove bolts (1) and right side valley cover (2).
 - b. Remove front frame (3).
4. See Figure 3-112. If required, remove screws (1) and horn assembly (3) from frame (2).

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).

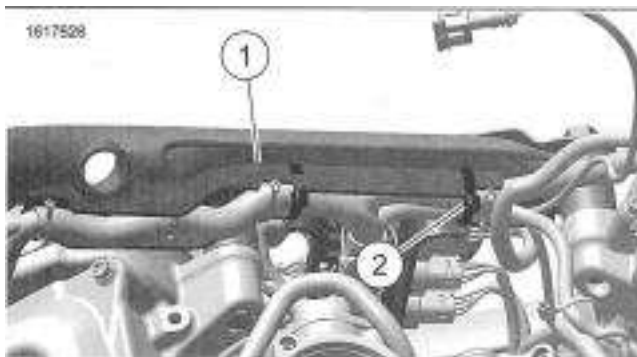


Figure 3-110. Right Side Wire Guide
2. Cable straps (2)



1. Screw (2)
2. Left side wire guide
3. Screw
4. Cable strap

- b. Remove nuts (4).
- c. Remove left midframe (5).

2. See Figure 3-112. Remove right midframe.

- a. Remove right flange screw (1).
- b. Remove nuts (4) and bolt (2).

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

- c. Remove right midframe (3).

INSTALL _____

Front Frame

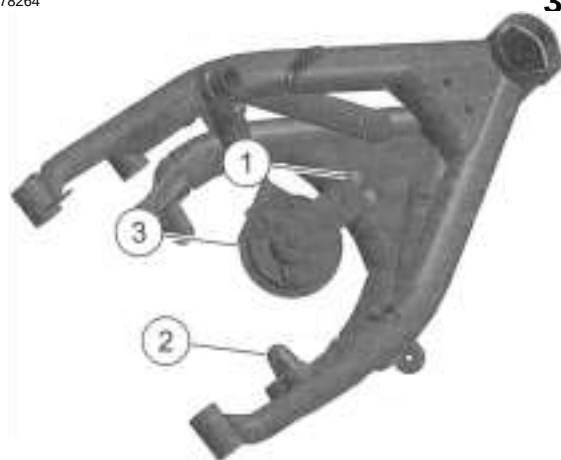
1. See Figure 3-113. Install horn.

- a. Position horn (3).
- b. Install screws (1). Tighten.

Torque: 50-62 **in-lbs** (5.7-7 N-m) *Horn screws*

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3.39



1. Screws (2)
2. Front frame
3. Horn assembly

Figure 3-113. Remove Horn Assembly

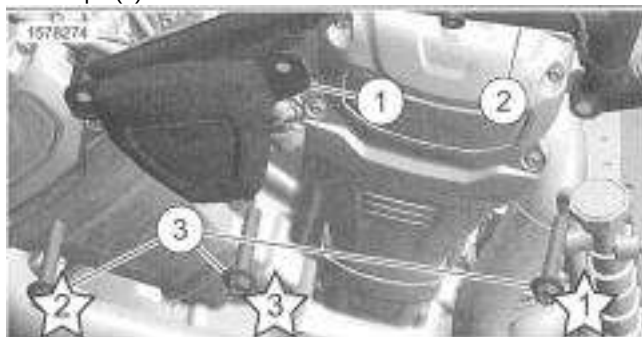
Midframe

1. See Figure 3-112. Remove left midframe.

- a. Remove left flange screw (1).

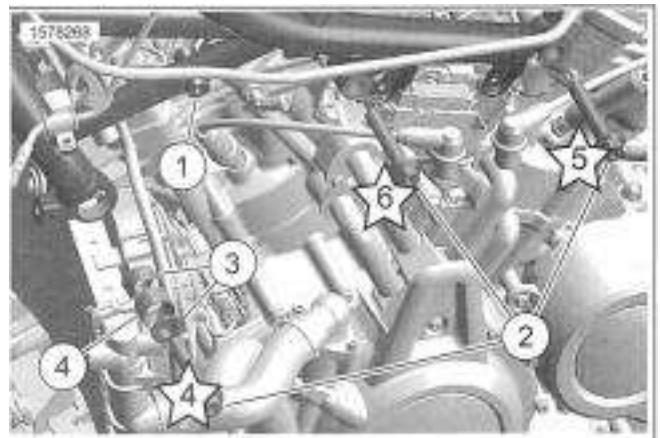
2. See Figure 3-114. Install front frame.
 - a. Position front frame (2), install right front bolt (3).

- b. Install right side valley cover (1).
 - c. Install right side rear bolts (3).
3. See Figure 3-115. 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 3-114 and Figure 3-115.
- Torque: 80-88 ft-lbs (108-119 N-m) *Front frame bolts*
4. See Figure 3-111. 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) *Leftside cable guide screw*
- c. Install screw (1). Tighten.
- Torque: 35-62 **in-lbs** (4-7 N-m) *Leftside brake line clamp screws*
5. Route clutch cable and install cable strap.
6. See Figure 3-110. Install right side cable guide (1) and cable straps (2).



- 1. Right side valley cover
- 2. Front frame
- 3. Right side front frame bolts (3)

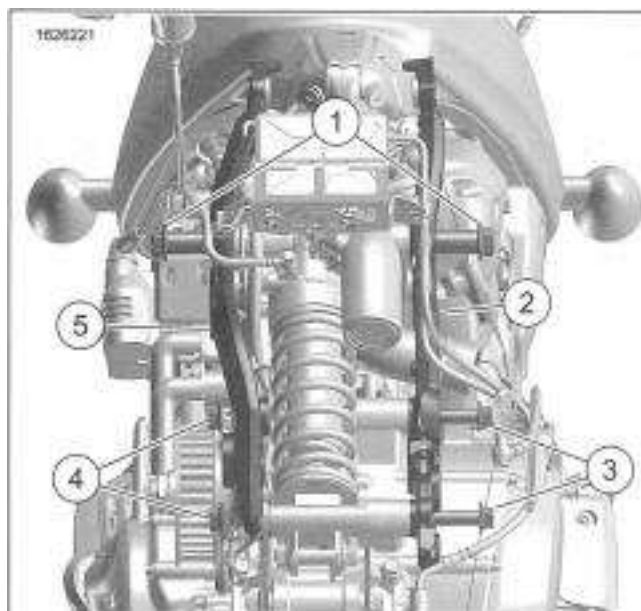
Figure 3-114. Right Side Front Frame Bolts



- 1. Left side valley cover
- 2. Front frame
- 3. Left side front frame bolts (3)

Figure 3-115. Left Side Front Frame Bolts Midframe

- 1. See Figure 3-116. 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*



1. Midframe upper flange screws
2. Midframe lower bolts
3. Right midframe
4. Midframe lower nuts
5. Left midframe

Figure 3-116. Midframe

COMPLETE

Front Frame

1. Install front electrical caddy. See FRONT ELECTRICAL CADDY (Page 8-50).
2. Connect horn connectors. See HORN (Page 8-24).
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 8-25).
12. Install instrument module. See INSTRUMENT MODULE (IM) (Page 8-22).
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).

FRAME CROSSMEMBER PREPARE

3.40

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 3-117. 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).

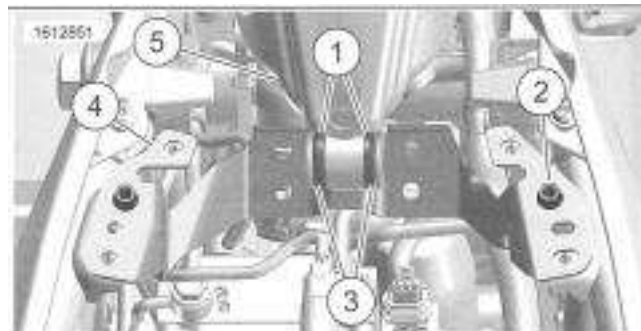
INSTALL

- a. Install fuel tank mount grommets (1) and fuel tank

FASTENER	TORQUE VALUE	
Crossmember screws	71-89 in-lbs	8-10 N-m

1. See Figure 3-117. Install frame crossmember (4). 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*



1. Fuel tank mount grommet
2. Screws (2)
3. Fuel tank mounting bushing
4. Frame crossmember
5. Fuel tank

Figure 3-117. 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 phaser screw torque step 1.	66-81 ft-lbs	90-110 N-m	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install
Cam phaser screw torque step 2.		-360°	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install
Cam phaser screw torque step 3.	13—16 ft-lbs	18-22 N-m	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install
Cam phaser screw torque step 4.		33 ±2°	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, 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 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
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		-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	13-14 ft-lbs	17-19 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
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

FASTENER	TORQUE VALUE		NOTES
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 4-5. 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
Bore		56.0 mm	2.205 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 4-6. 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	
	Max 5.9615	0.2347
	Min 5.9465	0.2341
Valve to guide running clearance	Intake	
	Max 0.0585	0.0023
	Min 0.0285	0.0011
	Exhaust	
	Max 0.0685	0.0027
	Min 0.0385	0.0015
Valve seat 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	216.041 lbf
	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 runout	NA	NA

Table 4-18. Compression

Item	INVESTIGATE IF VALUE IS BE- LOW	
	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 piston. 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 (VT). 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.

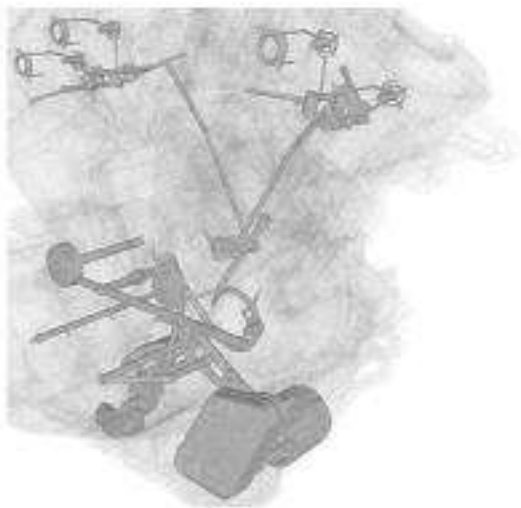


Figure 4-1. Oil Flow
Figure 4-2. Clutch Cavity

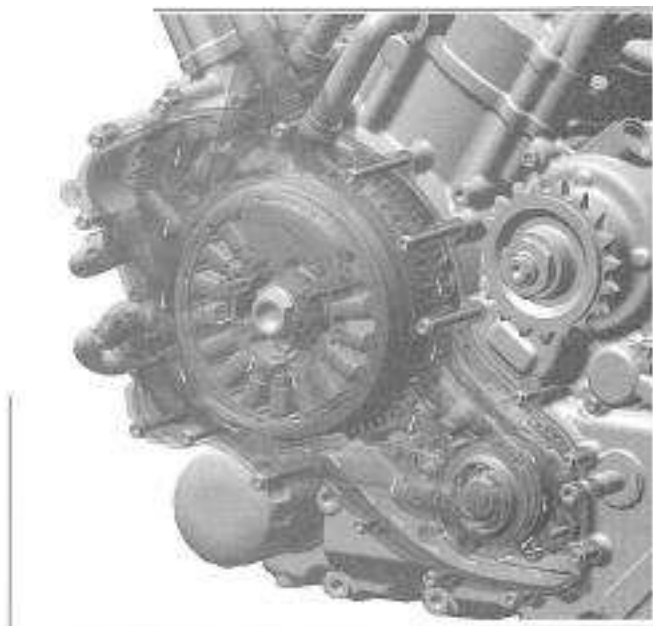


Figure 4-3. Stator Cavity



Figure 4-5. Internal Reservoir

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).

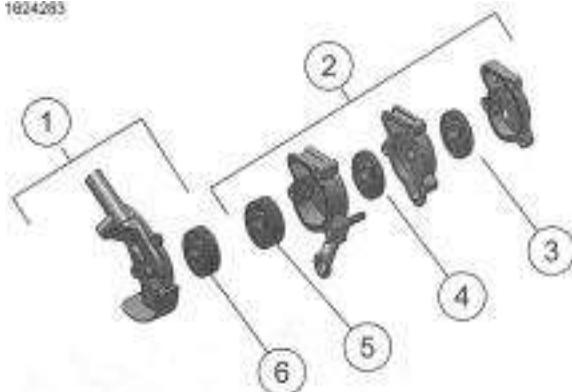
GENERAL

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.

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1. Feed gerotor assembly
2. Scavenge gerotor assembly
3. Clutch cavity scavenge gerotor set
4. Stator cavity scavenge gerotor set
5. Crankshaft cavity scavenge gerotor set
6. Feed gerotor set

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.

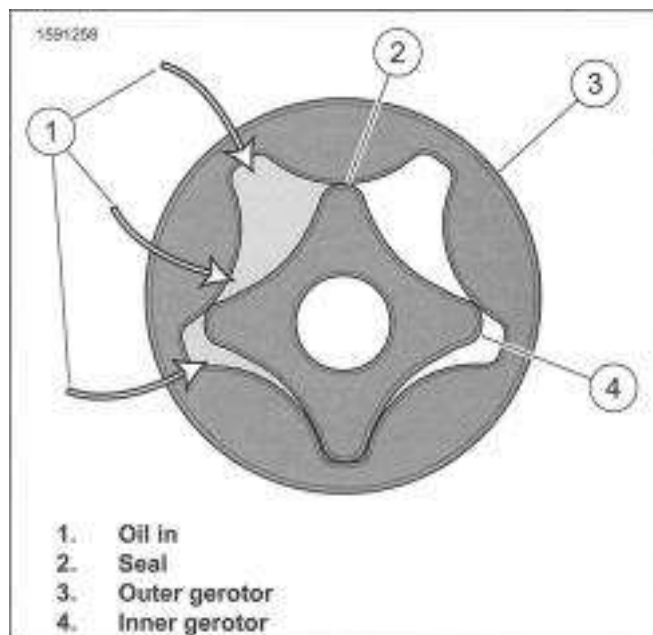
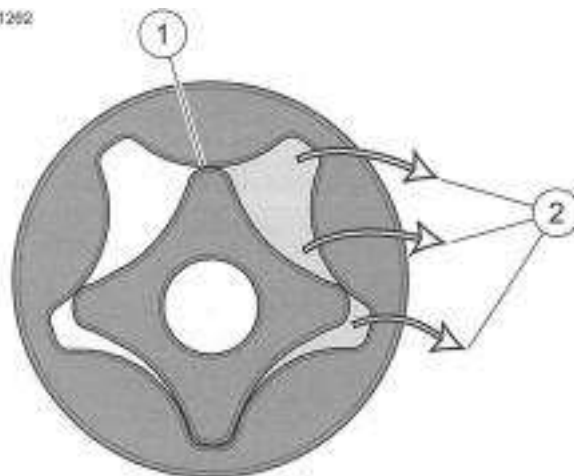


Figure 4-7. Inlet Side Oil Flow

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1. Seal
2. Oil out
3. Continuous 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

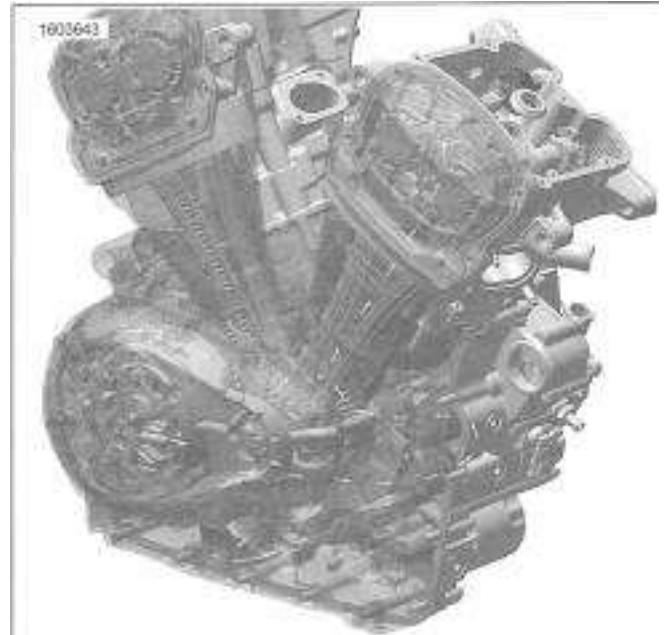


Figure 4-10. Air and Oil Vapor

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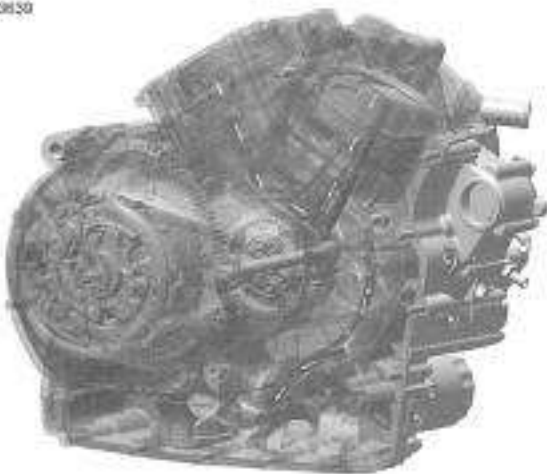
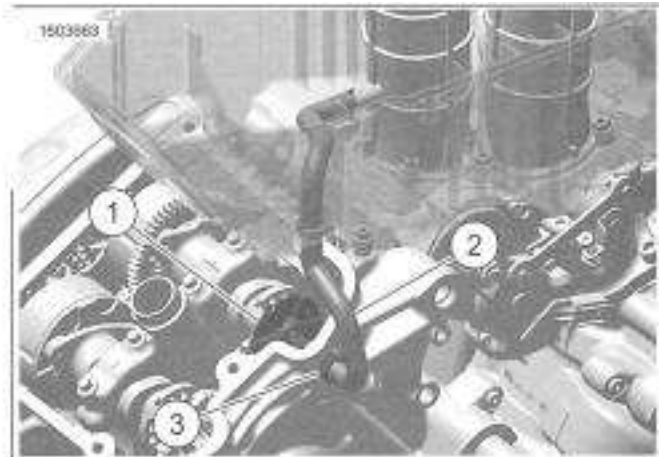


Figure 4-9. Blow-by Gas



the vaporthrough 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.

OPERATION

The engine uses Variable Valve Timing (VT) to reduce compromises between peak power, bottom end torque, fuel economy, emissions and run quality. VT 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 VT 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.

See Figure 4-13. The VT 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 VT 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 VT to advance the exhaust cams and retard the intake cams, reduces compression eliminating the need for ACR solenoids during start-up.

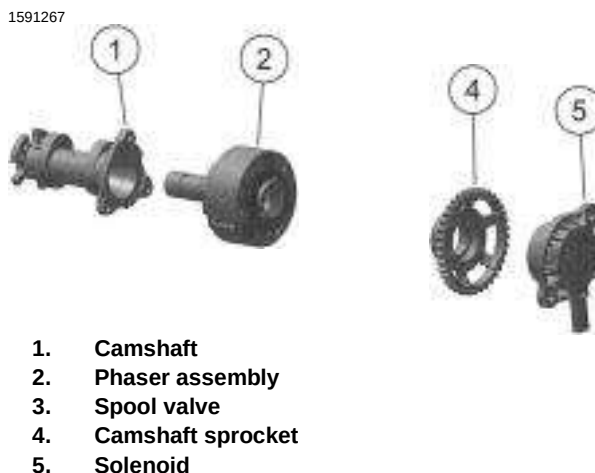
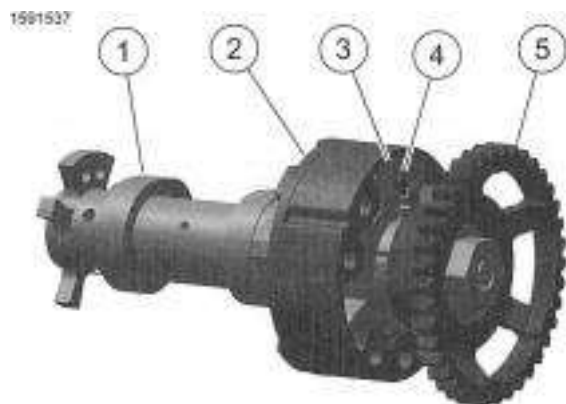


Figure 4-13. Camshaft and Phaser



1. Camshaft
2. Housing
3. Rotor
4. Park pin
5. Camshaft sprocket

Figure 4-12. Rotor and Housing Assembly

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 8-23).

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 8-23).

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)

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

Check for cylinder leakage with a compression test. Use CYLINDER COMPRESSION GAUGE (PART NUMBER: HD-

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 Nm

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
• 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
• 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

1. Verify that the leakdown tester is free from leakage.

Special Tool: CYLINDER LEAKDOWN TESTER (HD-35667-A)

- a. Apply a soap/water solution around all tester fittings.
 - b. Connect cylinder leakdown tester to compressed air source.
 - c. Bubbles indicate leakage.
2. Remove one spark plug per cylinder.
 3. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
Special Tool: CRANKSHAFT LOCKING TOOL (HD-52956)
 4. Follow the manufacturer's instructions to perform the leakdown test.
 - a. Record the percent of leakage.
 - b. Listen for air leaks at throttle body, exhaust pipe, oil fill spout and head gasket.
 5. Results:
 - a. Leakage greater than 25 percent indicates that further diagnosis is warranted.
 - b. Air escaping through the throttle body indicates leaking past intake valves.
 - c. Air escaping through the exhaust pipe indicates leaking past exhaust valves.
 - d. Air sound from the oil fill spout indicates leaking past piston rings.
 - e. inspect cylinder using borescope. See Clean and Inspect (Page 4-43).
Special Tool: BORESCOPE (HD-50549)
 6. 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.

1. Check oil level and condition.
2. With engine and oil at normal operating temperature, check oil pressure at 1500 and 4000 rpm.

3. Check oil pressure. See Oil Pressure Check (Page 4-11).

4. If oil pressure is outside of range, inspect following:

- a. Oil pump wear.
- b. Crankcase passages for blockages.
- c. Oil hoses for blockages.

5. 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).

- a. Clean hydraulic lash adjuster and cam chain tensioner bore of all foreign material.

6. Inspect hydraulic lash adjusters or cam chain tensioners bore for improper fit and unusual wear.

7. Visually inspect camshaft lobes for abnormal wear.

8. Check top end components.

- a. Check for excess roller finger follower wheel or bearing wear.
- b. Inspect valve stems for scuffing. Check stem to guide clearance.
- c. Check for loose valve seats or signs of shifting.

9. 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:

1. Oil level too high.
2. Oil carryover.
3. Restricted breather hose.
4. Restricted oil filter.

Check After Cylinder Head Removal:

1. Clogged oil return passages.
2. Valve guide seals.
3. Valve guide to valve stem clearance.
4. Gasket surfaces of head and cylinder.

5. Cylinder head casting porosity allowing oil to drain into combustion chamber.
 - b. Verify that the piston ring gaps are properly staggered.
 - c. Inspect for excess piston ring wear.
6. If the above checks do not reveal the cause:
 - a. Remove the cylinder.

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.
Excessive noise from piston area	Worn camshaft chain, chain guide or chain tension guide	Replace camshaft chain, chain guide or chain tension guide.
	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.
Engine runs irregularly at higher speed	Valve and/or valve guides worn or imperfect valve seat	Replace valves, rework valve seats or replace cylinder head if necessary.
	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	- 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	Replace oil pump and/or oil pump drive components.
	Damaged or improperly installed oil pump drive	Install oil pump drive gear retaining ring.
	Restricted oil circuit	Clean oil circuit.
	Leaking cylinder head gasket(s)	Replace cylinder head gasket(s).
Engine coolant temperature too low	Intake air leak	Tighten intake flange, replace gasket or replace intake flange if necessary.
	Malfunctioning thermostat	Replace 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.

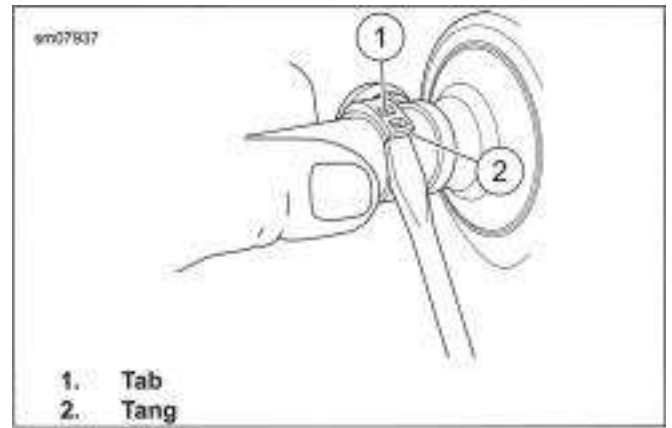


Figure 4-15. Removing Crimp Clamp

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	
Oil cooler screws	80-97 in-lbs	9-11 N-m

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).

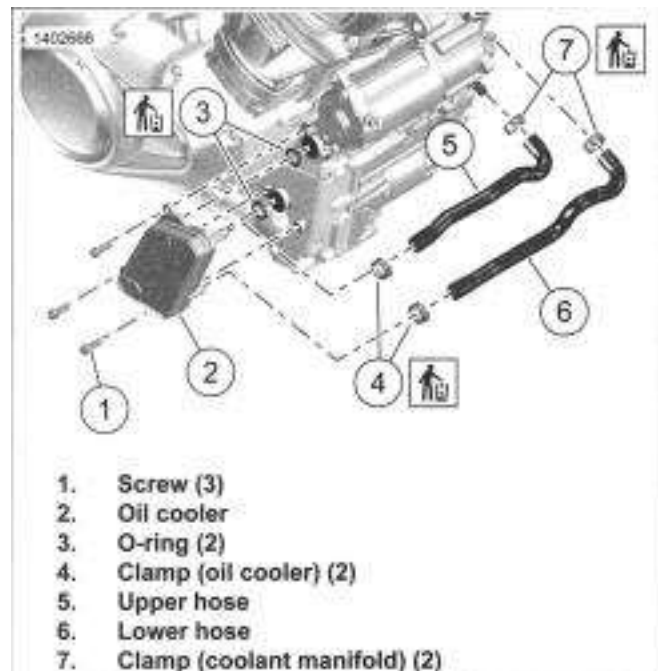


Figure 4-16. Oil Cooler and Hoses

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).

b. Install fuel tank. See FUEL TANK (Page 6-12).

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

c. Install left steering head cover. See SIDE COVERS (Page 3-46).

d. 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).

7. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

4. Install screws (4). Tighten.

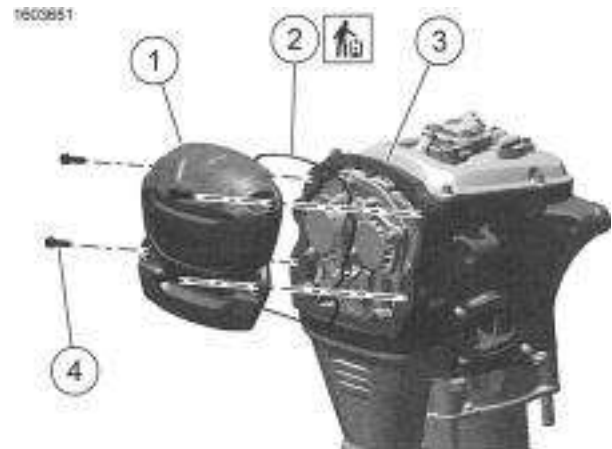
1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove exhaust shield (rear cylinder only). See MUFFLERS (Page 6-33).
3. Remove right rear cosmetic cover (rear cylinder only). See SIDE COVERS (Page 3-46).

REMOVE

1. See Figure 4-19. Remove screws (4).
2. Remove camshaft cover (1).
3. Remove and discard gasket (2).

FASTENER	TORQUE VALUE	
Cylinder head camshaft cover screws	63-77 in-lbs	7.1-8.7 N-m

Torque: 63-77 **in-lbs** (7.1-8.7 N m) *Cylinder head camshaft cover screws*



1. Cam cover
2. Gasket
3. Cylinder head
4. Screw (4)

INSTALL

Figure 4-19. Cylinder Head Cam Cover

1. See Figure 4-19. Clean groove in camshaft cover (3) from all residual oil and debris.

COMPLETE

- 1.
2. Install **new** gasket (2) to camshaft cover (1).
3. Install camshaft cover (1).

Install cosmetic cover (rear cylinder only). See SIDE COVERS (Page 3-46).

Install exhaust shield (rear cylinder only). See MUFFLERS (Page 6-33).

Install main fuse. See POWER DISCONNECT (Page 8-4).

3.

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

- 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).

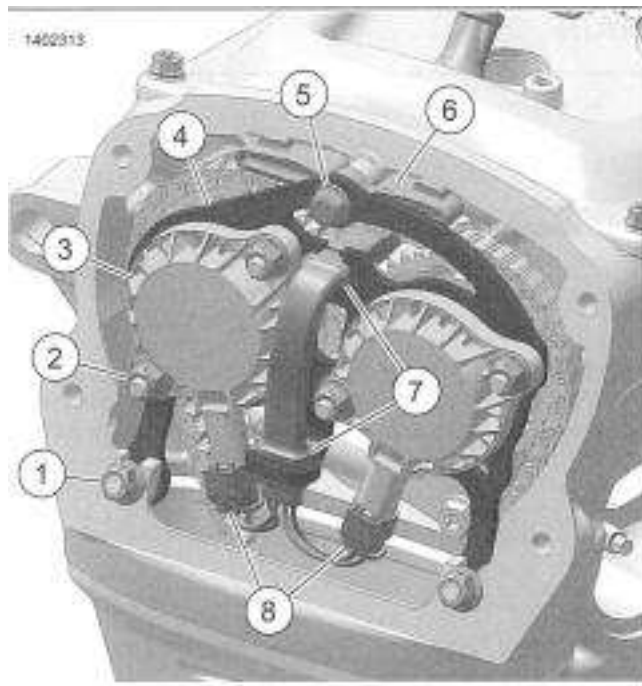
Solenoid

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.

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).



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

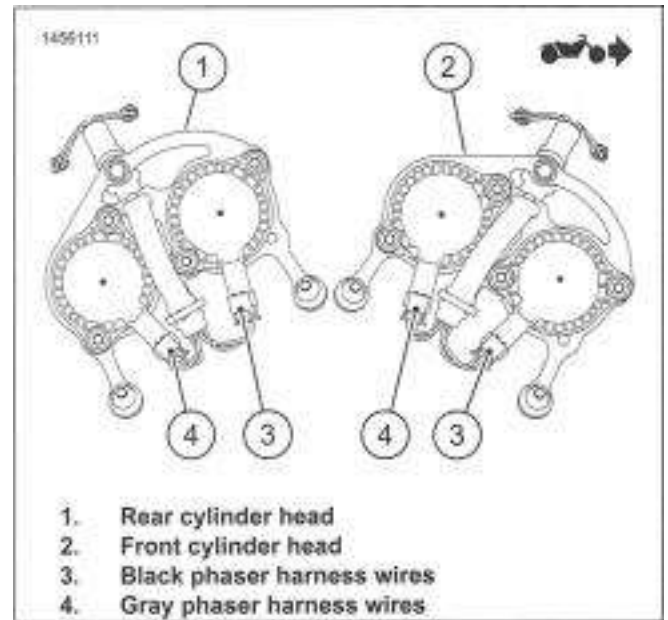


Figure 4-21. VTT Harness Detail

COMPLETE

1. Install camshaft cover. See CAMSHAFT COVERS (Page 4-21).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PART NUMBER	TOOL NAME
HD-52956	CRANKSHAFT LOCKING TOOL

PREPARE

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 4-49).
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).

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.

REMOVE

- 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 (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 timing chain in place.

Special Tool: CAM CHAIN RETENTION TOOL (HD-52951)

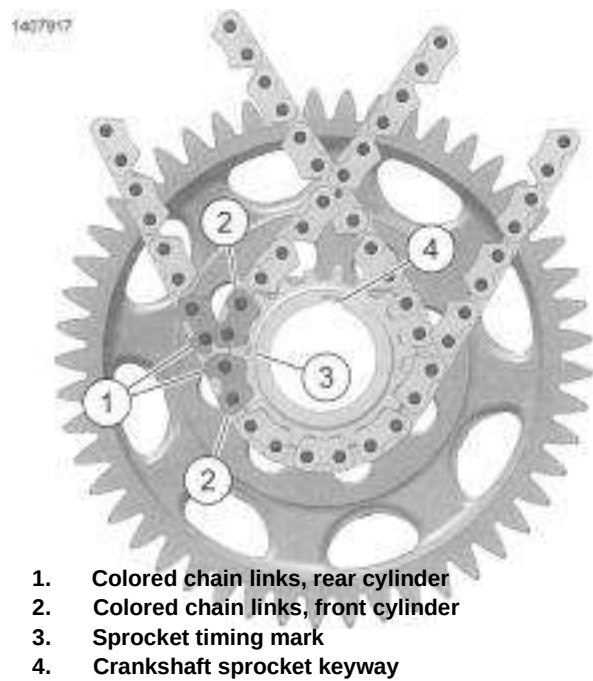


Figure 4-22. Alignment Marks, Crankshaft

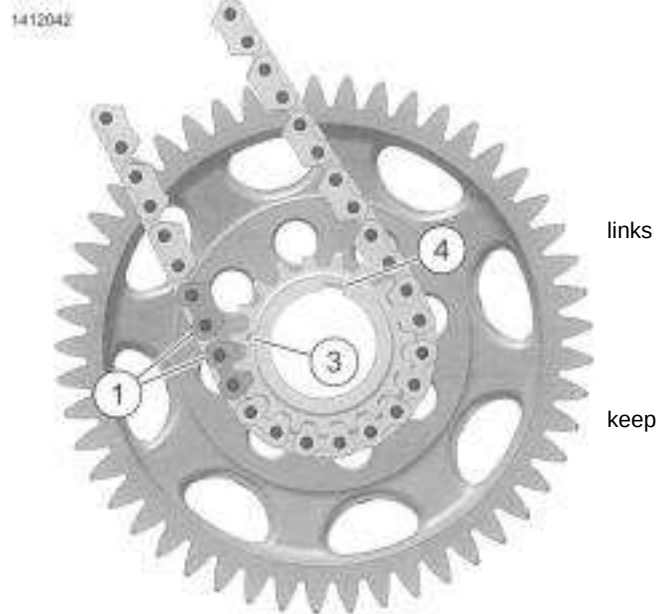


Figure 4-23. Alignment Marks, Rear Cylinder

Camshaft Timing

1. Colored chain link, rear cylinder
3. Sprocket timing mark
4. Crankshaft sprocket keyway

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

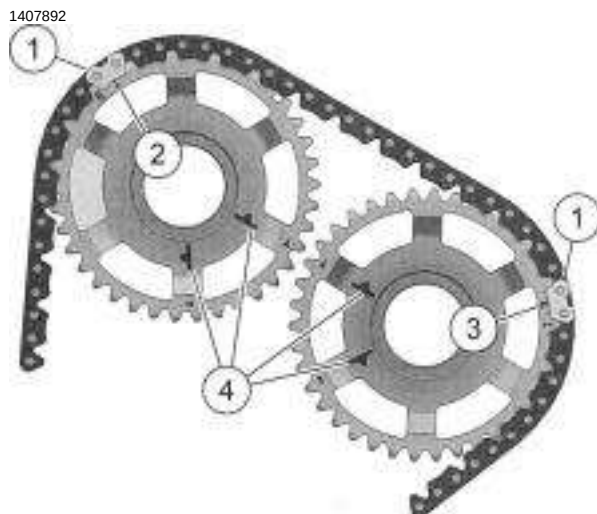
The camshaft may shift when trying to install the sprocket.

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.



1. Colored chain link
2. Intake timing mark
3. Exhaust timing mark
4. Sprocket alignment marks

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

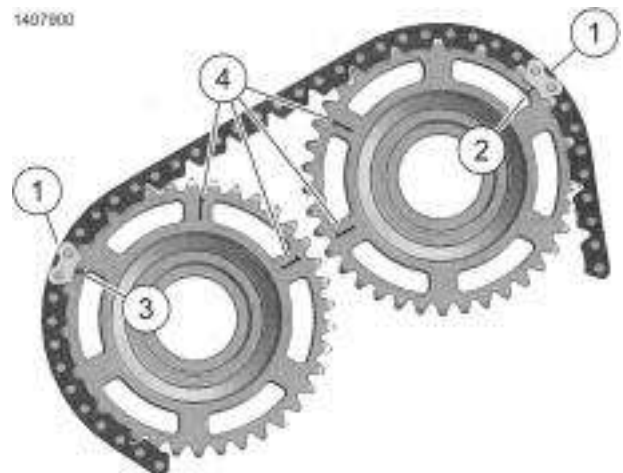
The camshaft may shift when trying to install the sprocket.

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.



1. Colored chain link
2. Intake timing mark
3. Exhaust timing mark
4. Sprocket alignment marks

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.
- a. See Figure 4-30. Leave special tool installed.

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.

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 phaser screw torque step 1.	66-81 ft-lbs	90-110 N-m
Cam phaser screw torque step 2.		-360°
Cam phaser screw torque step 3.	13-16 ft-lbs	18-22 N-m
Cam phaser 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	13-14 ft-lbs	17-19 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

INSTALL

1. Install secondary balancer. See SECONDARY BALANCER (Page 4-31).
2. Install chain tensioner. See SECONDARY BALANCER (Page 4-31).

3. *NOTE*

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: 13-14 ft-lbs (17-19 Nm) *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 washer (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*

6. Remove special tool from chain tensioner.

7. **NOTE**

Cam phaser 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 the 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.

The camshaft may shift when trying to install the cam phaser screw. Make sure components have not become disconnected or catastrophic failure will result.

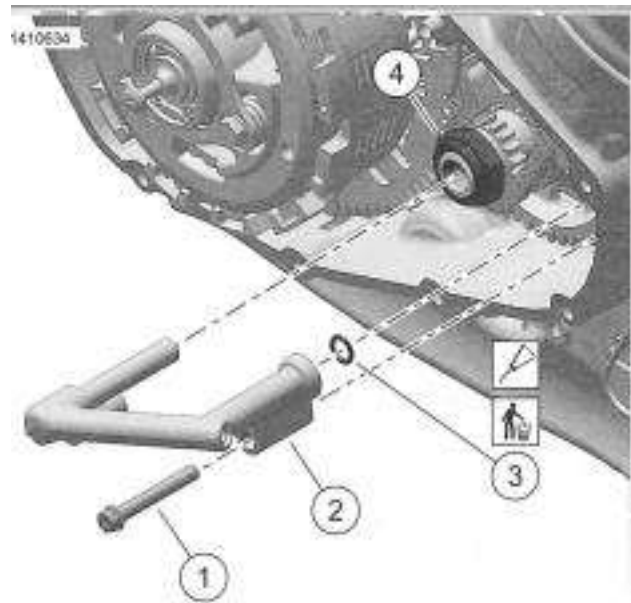
Install cam phaser center screw.

- a. See Figure 4-27. Install camshaft locking tool.
Special Tool: CAMSHAFT LOCKING TOOL (HD-52953)
- b. See Figure 4-28. Install cam phaser center screws (1).
- c. Check that the key has not disengaged from the sprocket.

8. Tighten cam phaser screws (1).

- a. Tighten.
Torque: 66-81 ft-lbs (90-110 N-m) *Cam phaser screw torque step 1.*
- b. Loosen one full turn.
Torque: (-360°) *Cam phaser screw torque step 2.*
- c. Tighten.
Torque: 13—16 ft-lbs (18-22 N-m) *Cam phaser screw torque step 3.*
- d. Tighten.
Torque: (33 ±2°) *Cam phaser screw torque step 4.*

9. See Figure 4-27. Remove camshaft locking tool.



1. Screw
2. Oil feed housing
3. O-ring
4. Crankshaft nut

Figure 4-26. Oil Feed Housing

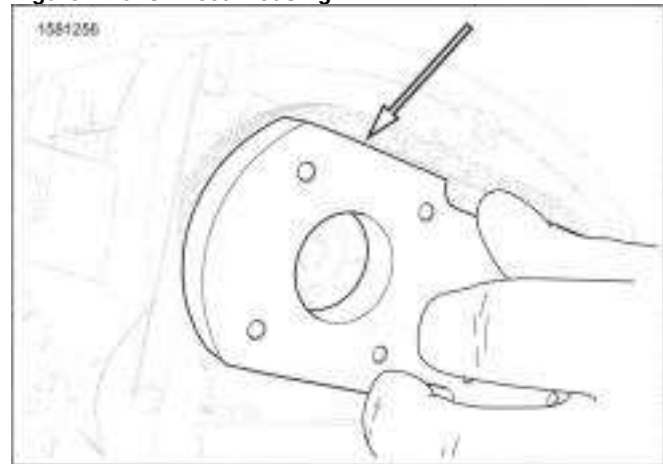


Figure 4-27. Camshaft Locking Tool

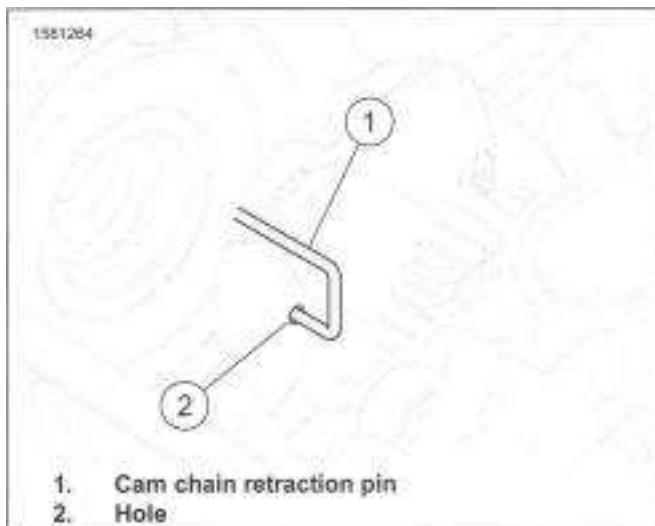


1. Center screw (2)

Figure 4-28. Cam Phaser Center Screw



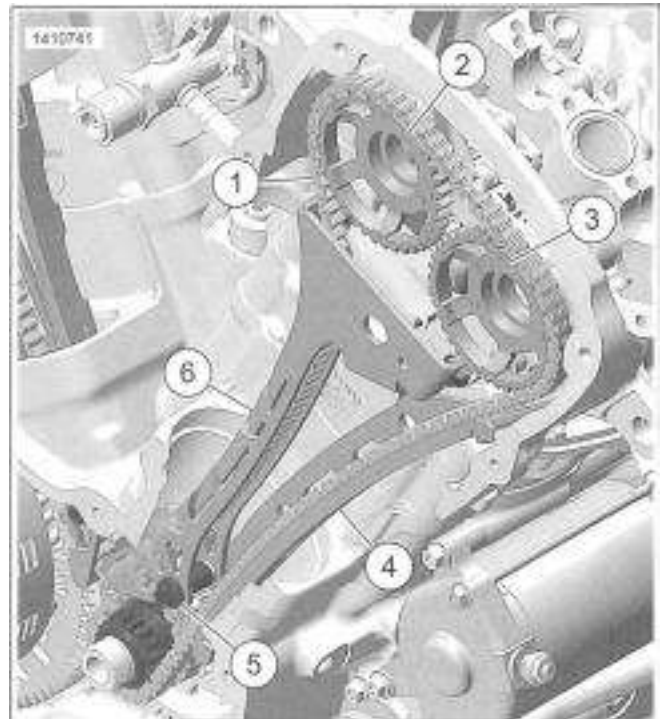
Figure 4-29. Cam Chain Retention Tool



1. Cam chain retraction pin
2. Hole

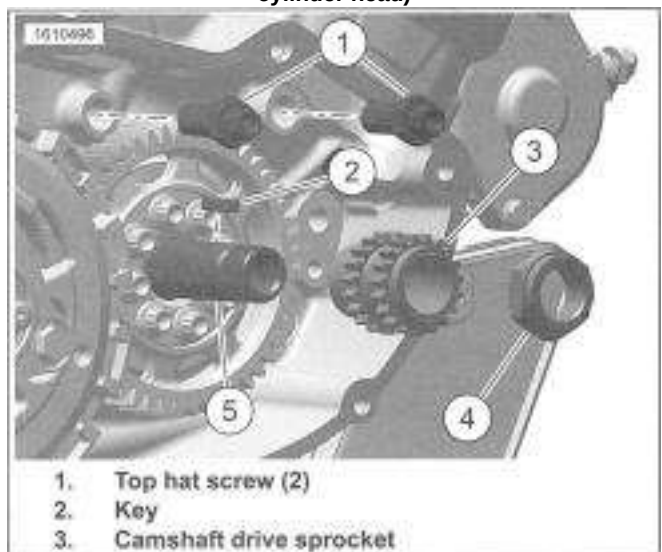
Figure 4-30. Cam Chain Retraction Pin

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

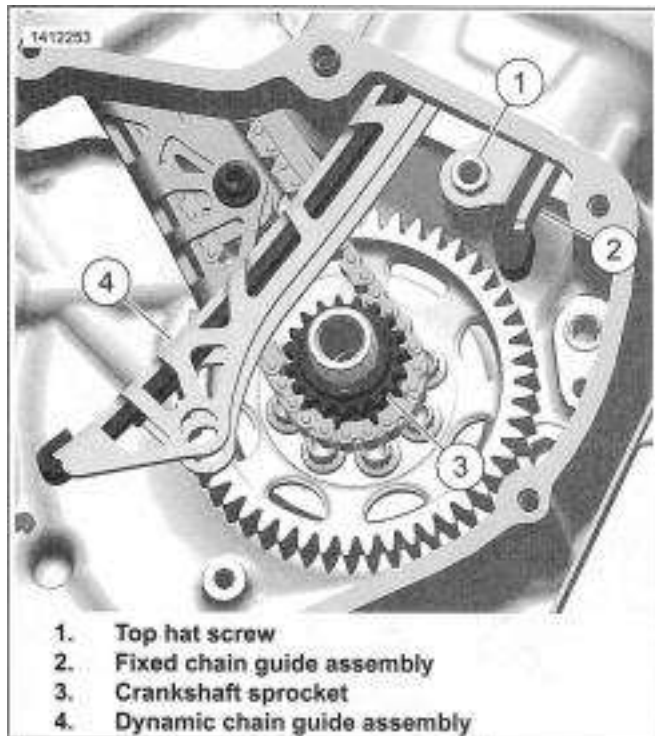


Figure 4-33. Timing Chain Guides

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 4-49).

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 (Page 8-4). POWER DISCONNECT

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. Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-49).
4. Remove seat. See SEAT (Page 3-82).
5. Remove fuel tank. See FUEL TANK (Page 6-12).
6. Remove airbox assembly. See AIR BOX (Page 6-3).
7. Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
8. Remove phaser solenoid with plate assembly. See PHASER SOLENOIDS (Page 4-22).
9. Remove cylinder head cover. See CYLINDER HEAD COVERS (Page 4-19).
10. 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

Balance Gear

1. See Figure 4-37. Remove balancer (5).

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

INSTALL**Balance Gear**

1. Lube balancer bearing and mounting shaft in cylinder head with assembly lube.

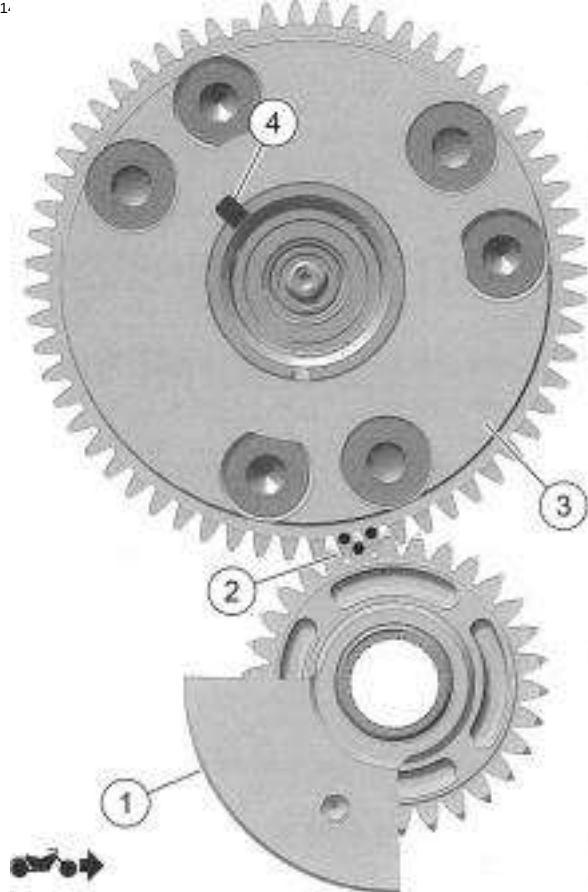
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
2. See Figure 4-37. Install balancer (5).
 - a. See Figure 4-34. If camshaft is installed, use the alignment marks to position the balancer gear.

Tensioner

1. See Figure 4-35 and 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. Remove screws (3, 4).
 3. Remove chain tensioner housing (2).
 4. Discard O-ring (1).



1. Balancer
2. Alignment marks
3. Intake camshaft with gear
4. Key

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 Nm) *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*

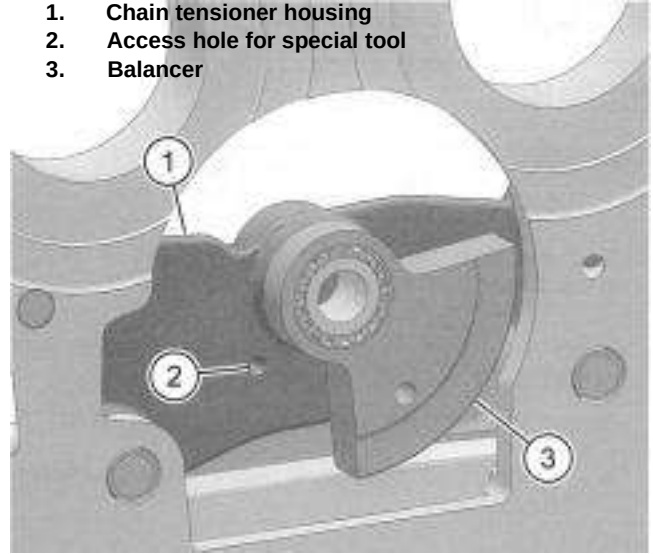


Figure 4-35. Special Tool Access Hole

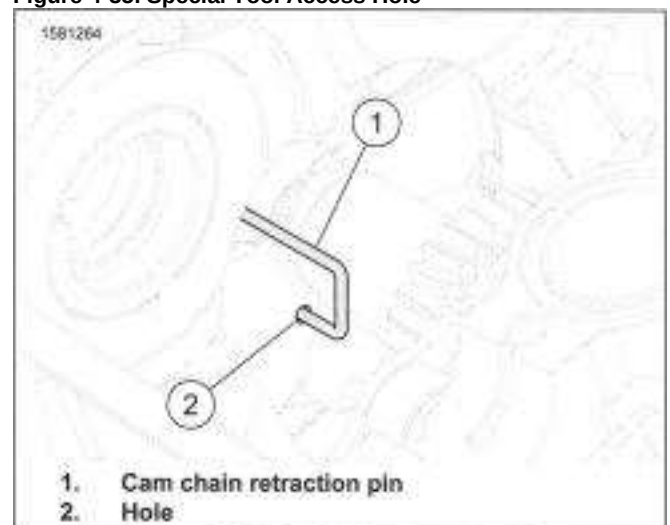
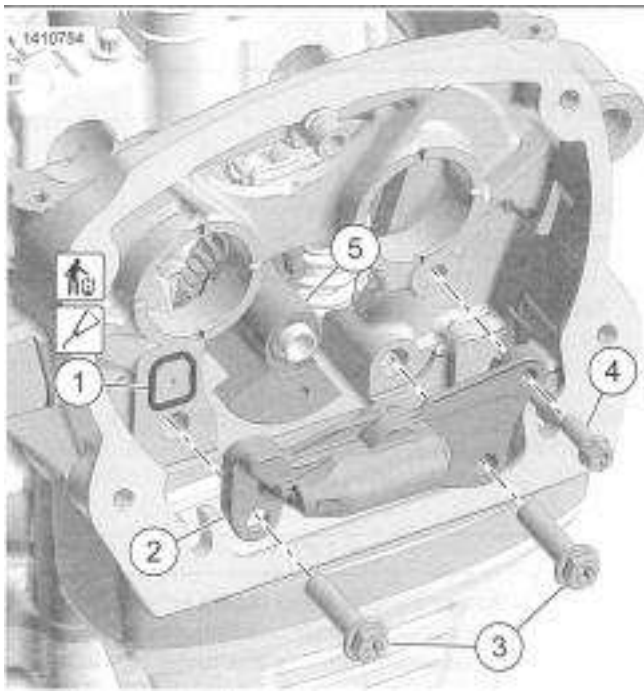


Figure 4-36. Cam Chain Retraction Pin



1. O-ring
2. Chain tensioner housing
3. Screw, long (2)
4. Screw, short
5. Balancer

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 4-49).
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 4-60).
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 4-49).
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.

A 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		-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*

c.

Tighten.
Torque: 15-18 ft-lbs (20-24 N-m) *Cylinder head screws torque step 3*

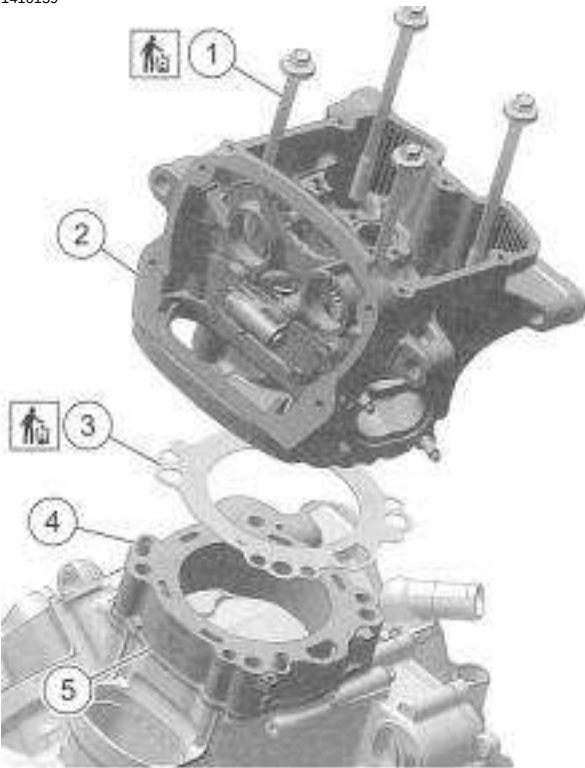
d.

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*

1410159



1. Screw (4)
2. Cylinder head
3. Gasket
4. Dowel pin (2)
5. Cylinder

Figure 4-38. Cylinder Head

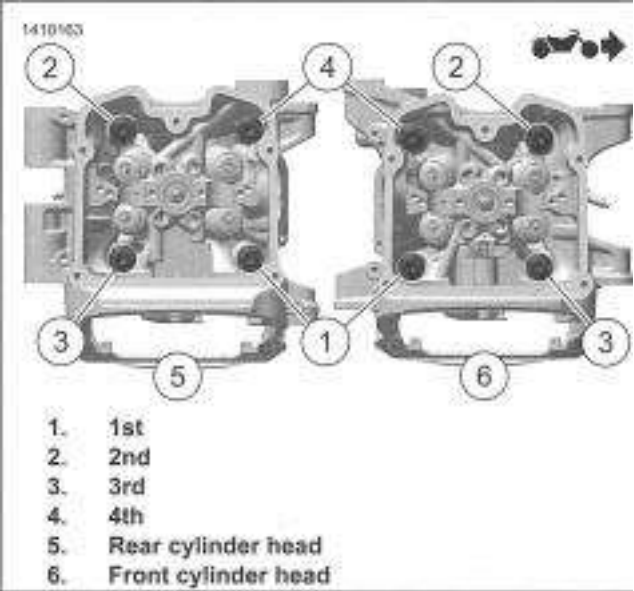


Figure 4-39. Cylinder Head Screw Torque Sequence

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.

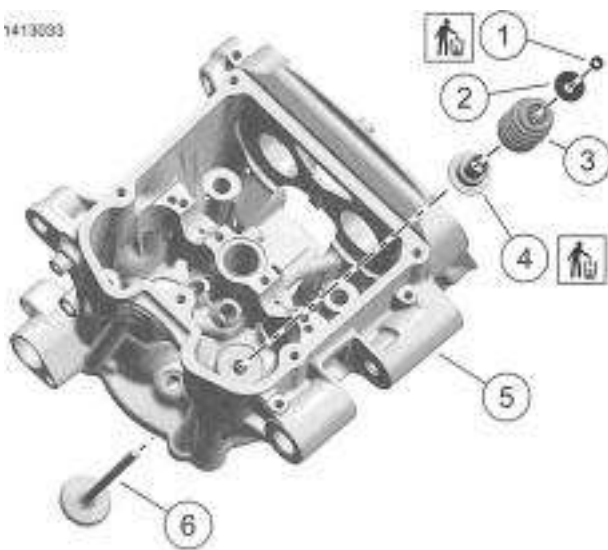
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

- 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.



1. Keeper (2)
2. Retainer
3. Spring
4. Seal
5. Cylinder head
6. Valve

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 4-49).
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 4-60).
12. Install main fuse. See POWER DISCONNECT (Page 8-4).

PART NUMBER	TOOL NAME
HD-52956	CRANKSHAFT LOCKING TOOL

PREPARE

- 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.
- Front Camshaft:**
 - Remove seat. See SEAT (Page 3-82).
 - Remove left steering head cover. See SIDE COVERS (Page 3-46).
 - Remove fuel tank. See FUEL TANK (Page 6-12).
 - Remove airbox assembly. See AIR BOX (Page 6-3).
- Rear Camshaft:**
 - Remove seat. See SEAT (Page 3-82).
 - Remove fuel tank. See FUEL TANK (Page 6-12).
 - Remove cylinder head cover caddy. See CYLINDER HEAD COVER CADDY (Page 8-53).
- Remove camshaft timing sensors. See CAMSHAFT TIMING SENSORS (Page 8-41).
- Remove ignition coil. See IGNITION COIL (Page 8-15).
- Remove camshaft cover. See CAMSHAFT COVERS (Page 4-21).
- Remove cylinder head covers. See CYLINDER HEAD COVERS (Page 4-19).
- Remove camshaft phaser solenoid with plate as an assembly. See PHASER SOLENOIDS (Page 4-22).
- Remove cam phaser center screw. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).

REMOVE

- Remove breather bolt. See BREATHER BOLT (Page 6-5).
- See Figure 4-42. Remove screws (1).
- Remove camshaft cap (2).

- Remove and discard O-ring (3).

NOTE

Shift camshaft sideways to help with removal.

- Remove intake and exhaust camshafts (5, 6).

NOTE

Mark roller finger followers so they can be installed in the same location and orientation.

- See Figure 4-45. Remove roller finger followers (1).

NOTE

Mark lash adjusters so they can be installed in the same location and orientation.

- Remove hydraulic lash adjusters (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

- Inspect lobes for abnormal wear or discoloration.
- Inspect bearing surfaces for scoring or discoloration.
- Measure bearing journals.

NOTE

Remove and replace breather, air/oil separator only if defective.

- See Figure 4-42. Inspect breather, air/oil separator (4).

Roller Finger Followers

- Clean all parts.
- Inspect for wear. Replace or repair as necessary.
 - Inspect roller for excessive wear.
 - Inspect valve contact area for excessive wear.
 - Inspect lash adjuster pocket for excessive wear.
 - Verify that oil holes in roller finger followers are clean and open.

Gears

- Clean parts in a non-volatile cleaning solution. Dry parts with low-pressure, compressed air.
- Replace components with worn or damaged gears.

INSTALL

PART NUMBER	TOOL NAME
HD-42313	CAM CHAIN TENSIONER UNLOADER

FASTENER	TORQUE VALUE	
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 4-45. 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 4-45. Install pre-lubed roller finger followers (0).
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - a. See Figure 4-44. Install roller finger followers with flat side over valve and cupped side (1) over hydraulic lash adjuster (2).

3. See Figure 4-43. 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.

NOTE

Breather is one time use, if not installed properly discard and install a new breather.

4. Install breather on front intake cam.
 - 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.
5. See Figure 4-42. Install intake camshaft.
 - a. Lubricate camshaft journal.
SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - b. See Figure 4-46. Align timing mark (1) on cam phaser (2) with drill spot face in cylinder head.
 - c. See Figure 4-42. Align key (7) in phaser with keyway in camshaft sprocket.
 - d. See Figure 4-47. 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.
6. Install exhaust camshaft.
 - a. Lubricate camshaft journal.
SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
 - b. See Figure 4-46. 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 4-42. Install exhaust camshaft (6).
 - e. Make sure roller finger followers are in proper alignment with camshaft, lash adjusters and valves.
7. 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.

8. Install camshaft cap.

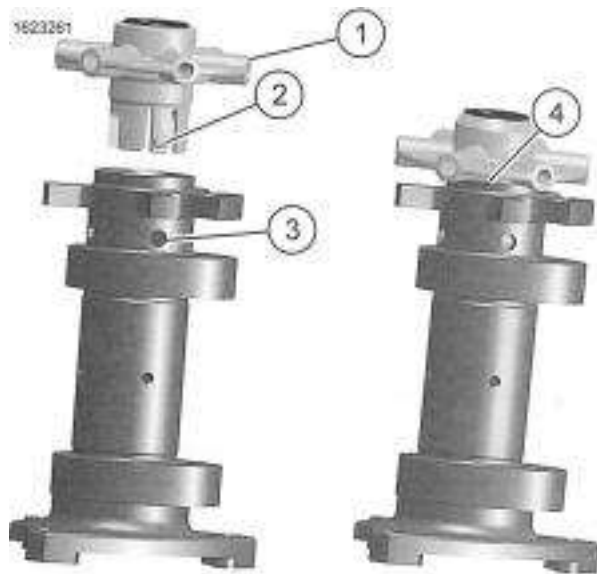
NOTE

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 4-42. Install camshaft cap (2).
- c. Install screws (1).

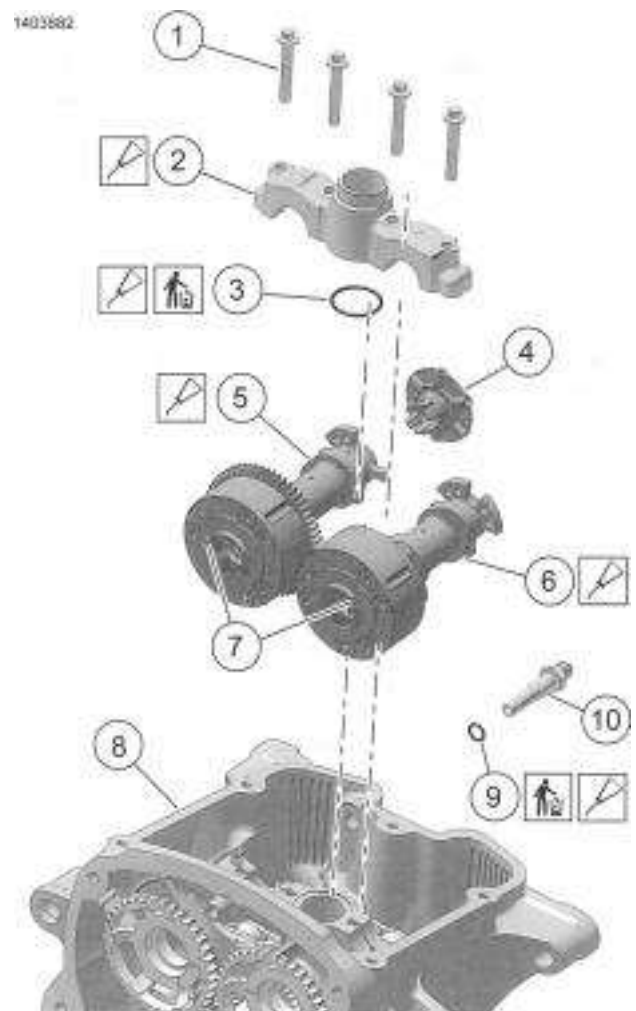
- d. See Figure 4-48. Tighten screws in sequence.
Torque: 44-53 **in-lbs** (5-6 N-m) *Camshaft cap screw (1st torque)*
- e. Tighten screws in sequence.
Torque: 115-133 **in-lbs** (13-15 N-m) *Camshaft cap screw (Final torque)*

9. Install breather bolt. See BREATHER BOLT (Page 6-5)



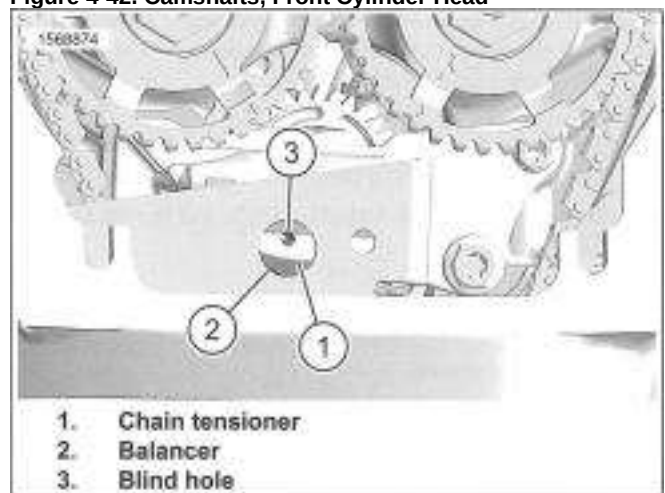
1. Breather, air/oil separator
2. Tab (2)
3. Camshaft hole (2)
4. Mating surface

Figure 4-41. Breather, Air/Oil Separator



1. Screw (4)
2. Camshaft cap
3. O-ring
4. Engine breather air/oil separator
5. Intake camshaft with phaser
6. Exhaust camshaft with phaser
7. Key
8. Front cylinder head
9. O-ring
10. Breather port

Figure 4-42. Camshafts, Front Cylinder Head



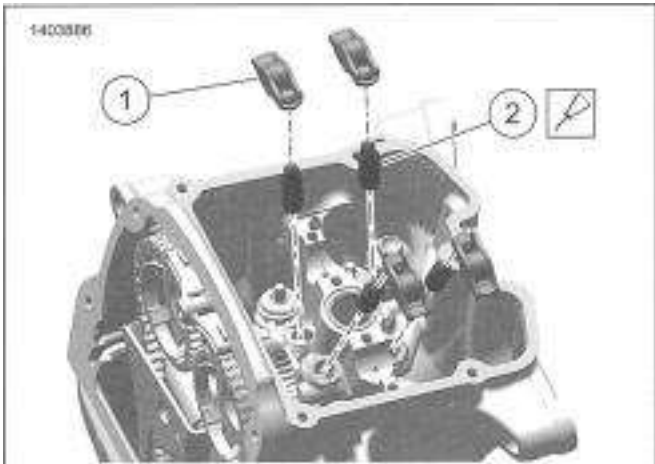
1. Chain tensioner
2. Balancer
3. Blind hole

Figure 4-43. Balancer Lock Holes



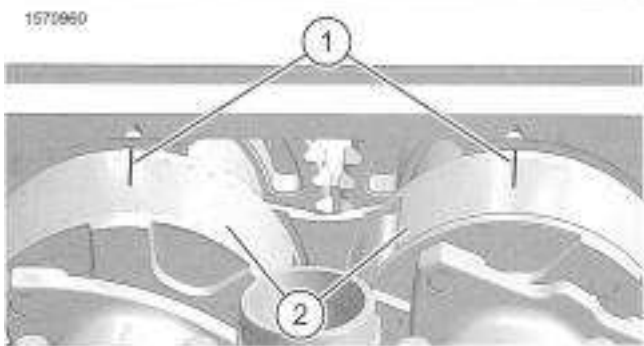
- 1. Roller finger cupped side
- 2. Lash adjuster

Figure 4-44. Lash Adjusters and Roller Finger Position



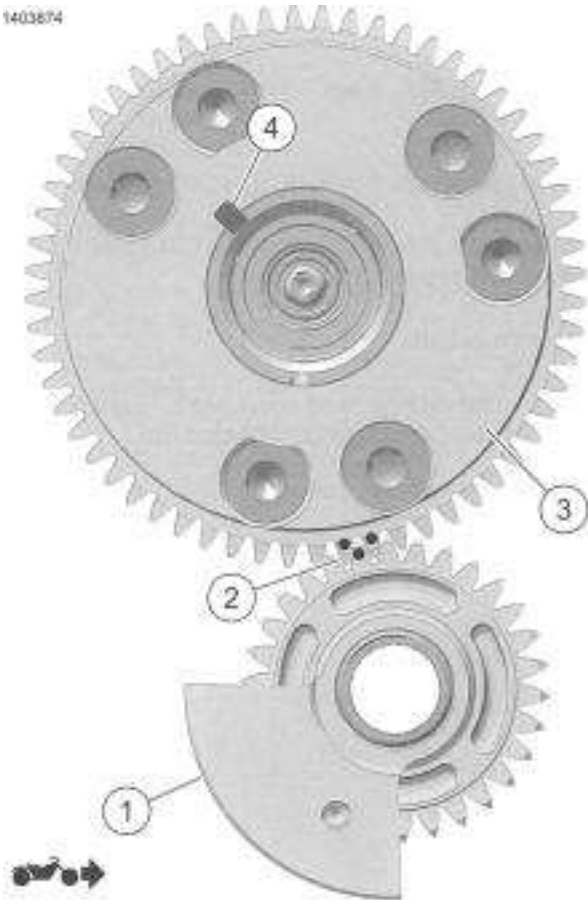
- 1. Roller finger followers (4)
- 2. Hydraulic lash adjuster (4)

Figure 4-45. Lash Adjusters and Roller Finger Followers



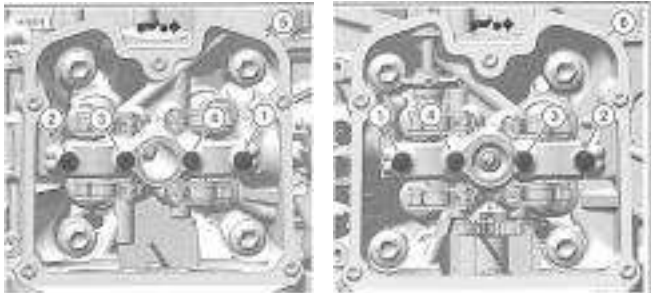
- 1. Timing marks
- 2. Cam phasers

Figure 4-46. Phaser Timing Marks



- 1. Balancer
- 2. Alignment marks
- 3. Intake camshaft with gear
- 4. Key

Figure 4-47. 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 4-48. 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).

dead center. If it is not, remove crankshaft locking tool and

PART NUMBER	TOOL NAME
HD-52956	CRANKSHAFT LOCKING TOOL

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 4-60).
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 4-49).
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 4-49. Remove cylinder (2) from crankcase.
2. Discard gasket (4).

INSTALL

NOTE

Verify that the piston, for the cylinder you are installing, is at top

PISTONS

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.

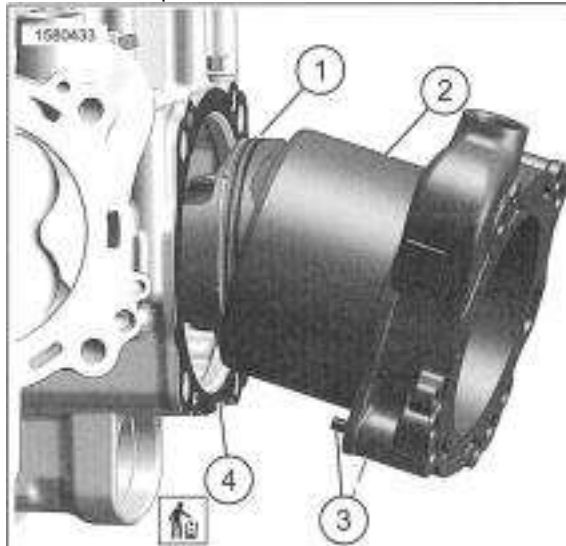
Install cylinder.

- a. See Figure 4-49. 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.



1. Piston rings (3)
2. Cylinder
3. Alignment pin (2)
4. Gasket

Figure 4-49. 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 4-49).
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 4-60).
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 4-60).
4. Install crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
5. Remove primary cover and clutch baffle. See PRIMARY COVER (Page 4-49).
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

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 the connecting rod (4) to prevent piston from striking crankcase. The rod cannot hit the crankcase due to the 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. **NOTE**
Use suitable tool to pry out circlip.

See Figure 4-50. Remove and discard piston pin circlip (2).

3. Remove piston pin (1).
4. Remove piston (3) from connecting rod (4).

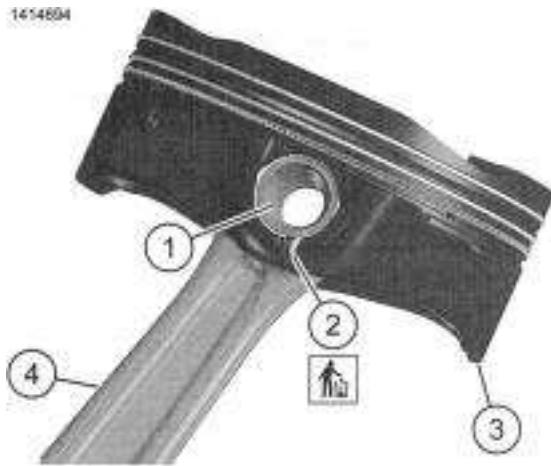
INSTALL

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)

1. See Figure 4-50. Install piston pin circlip (2) on one side of piston (3) with tang of circlip facing towards front of piston as shown.
 - a. Verify piston pin circlip (2) is fully seated in piston pin boss.
2. Apply lubricant to piston pin (1), piston pin bores and connecting rod bore.
Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)
3. Position piston (3) on connecting rod (4) with the Arrow/FRT markings on top of piston pointing toward front of engine.
4. Insert piston pin (1) through piston pin bore and connecting rod (4) until it contacts piston pin circlip (2) in opposite piston pin boss.
5. Cover cylinder opening to prevent piston pin circlip (2) from falling into crankcase.
6. Install second piston pin circlip (2) with tang of circlip facing towards front of piston as shown.
 - a. Verify piston pin circlip (2) is fully seated in piston pin boss.
7. Verify smooth movement of piston (3) and piston pin (1) on connecting rod (4).



1. Piston pin
2. Piston pin circlip
3. Piston
4. Connecting rod

Figure 4-50.

DISASSEMBLE

1. Carefully remove piston rings from piston. Discard.

CLEAN AND INSPECT

Clean

A 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 4-51. 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 guage 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).

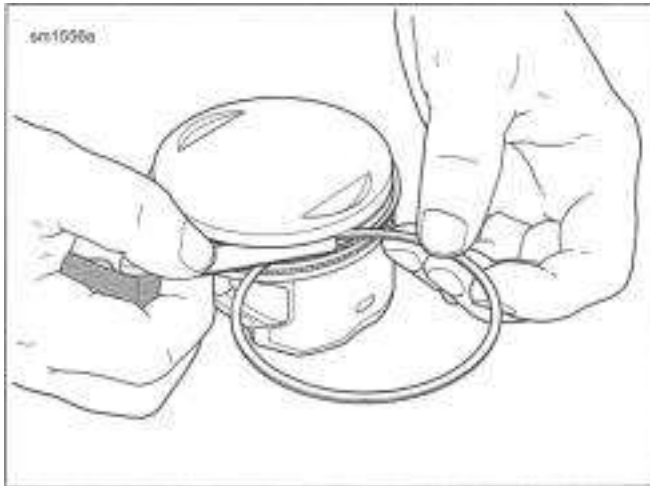


Figure 4-51. Measuring Ring Clearance in Groove



1. Bare aluminum opening
2. Micrometer
3. Spherical anvil adapters

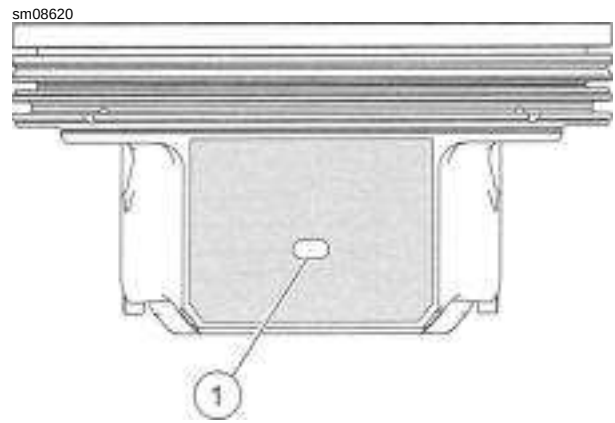


Figure 4-52. Measure Piston Running Clearance
CHECK PISTON RING GAP

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 4-53. 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.

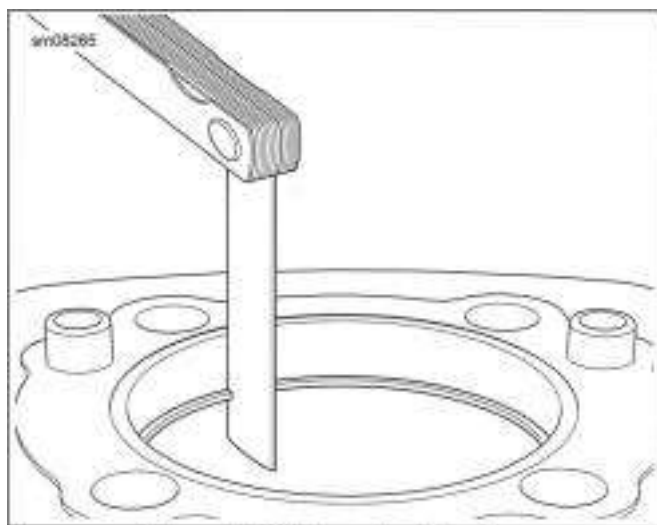


Figure 4-53. Measuring Ring Gap

ASSEMBLE

NOTE

Piston ring position is identical for both pistons.

1. See Figure 4-54. 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.

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.

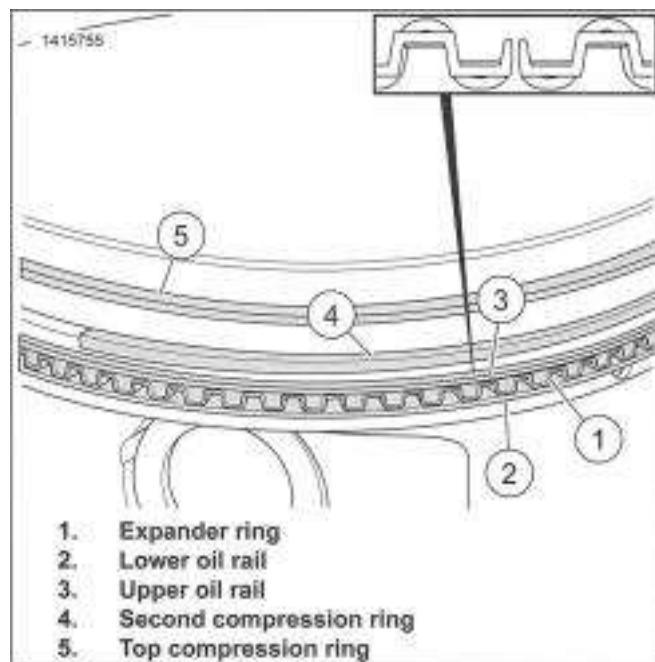


Figure 4-54. Piston Rings

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 4-49).
11. Remove crankshaft locking tool. See CRANKSHAFT LOCKOUT (Page 4-18).
12. Install engine. See REPLACE ENGINE (Page 4-60).
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 4-55. Remove screws (1).
2. Remove primary cover (7).
3. Remove and discard gasket (3).

Oil Baffle

1. See Figure 4-55. Remove screws (4, 6).
2. Remove oil baffle (5).

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

INSTALL**Oil Baffle**

1. See Figure 4-55. Install oil baffle (5).
2. Install screws (4, 6).

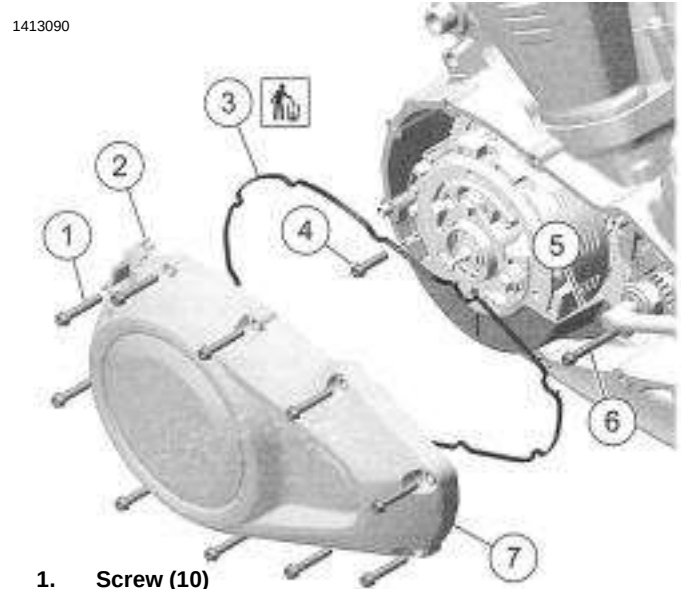
Torque: 80-97 **in-lbs** (9-11 N-m) *Oil baffle screws*

Primary Cover

1. See Figure 4-55. 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 4-56. Tighten screws in sequence.

Torque: 94-115 **in-lbs** (10.6-13 N-m) *Primary cover screws*



1. Screw (10)
2. Clutch actuator
3. Gasket
4. Screw, short
5. Oil baffle
6. Screw, long
7. Primary cover

Figure 4-55. Primary Cover

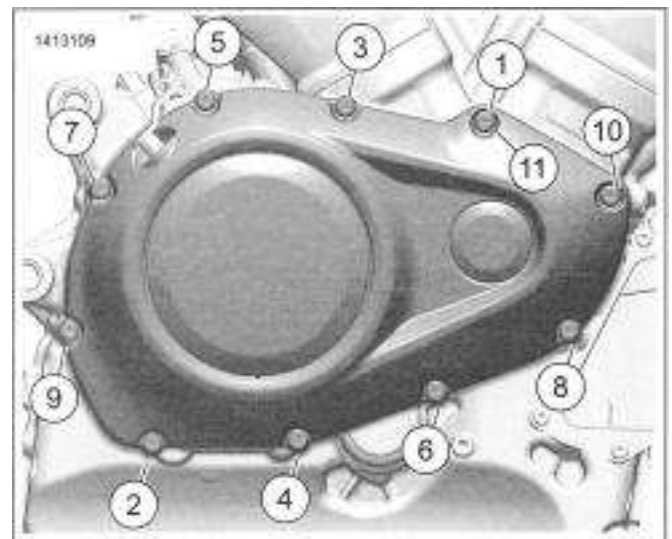


Figure 4-56. Primary Cover Torque Sequence

DISASSEMBLE**NOTE**

Clutch actuator upper and lower bearings are NOT serviceable. Replaced the complete cover if they are worn.

1. See Figure 4-57. Remove spring (5) from clutch actuator's detent (1).

2. Remove clutch actuator (2).

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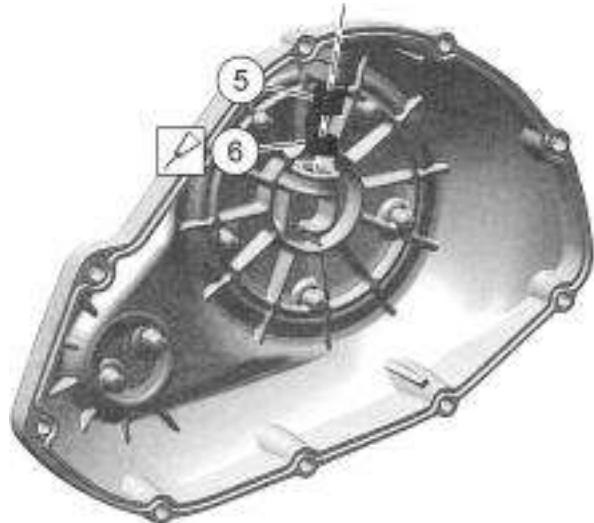
3. Remove and discard seal (3).

ASSEMBLE

1. See Figure 4-57. 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.



1. Detent
2. Clutch actuator
3. Seal
4. Upper bearing
5. Spring
6. Lower bearing

Figure 4-57. Clutch Actuator

COMPLETE

1. Connect clutch cable. See CLUTCFi 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 (EOT) 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**Coolant Manifold**

PART NUMBER	TOOL NAME
HD-45340	GASKET ALIGNMENT DOWELS

1. See Figure 4-58. Remove screws (6 and 7).
2. See Figure 4-59. Install gasket alignment dowels (A) into position marked.
Special Tool: GASKET ALIGNMENT DOWELS (HD-45340)
3. See Figure 4-58. 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 4-58. Remove coolant tubes (5).
2. Discard O-rings (4).

Coolant Pump

1. See Figure 4-60. 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 4-61. Using a small screw drive, gently pry upward between the coolant pump (1) and coolant manifold (2).
 - b. See Figure 4-62. Lift straight upward, remove coolant pump.
3. See Figure 4-63. Remove O-rings.
 - a. Discard the small (1) and large (2) O-rings if coolant pump is being reused.

Stator

1. See Figure 4-64. Disconnect and remove terminals (2) from stator connector (1).
2. See Figure 4-65. Remove stator screws (1).

NOTE

The stators harness grommet has a chance of leaking if used more than one time.

3. See Figure 4-66. 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 4-58. 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 4-59. Remove alignment dowels (A) from positions marked.

Special Tool: GASKET ALIGNMENT DOWELS (HD-45340)

NOTE

See parts catalog for screw location.

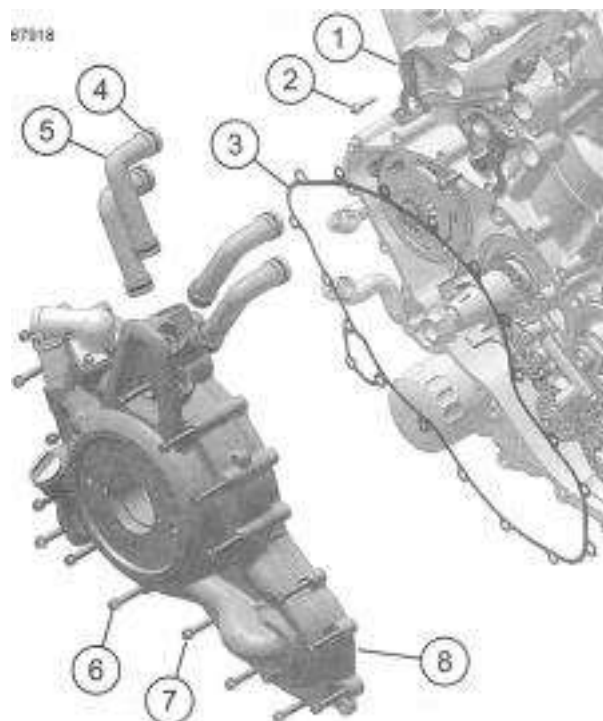
5. See Figure 4-58. Install screws.

a. Install longs (6)

b. Install short screws (7).

6. See Figure 4-59. Tighten screws in sequence.

Torque: 71-89 **in-lbs** (8-10 N-m) *Coolant manifold screws*



1. Clamp (2)
2. Clamp screw (2)
3. Gasket
4. O-ring (8)
5. Coolant tube
6. Long screw (8)
7. Short screw (11)
8. Coolant manifold

Figure 4-58. Coolant Manifold

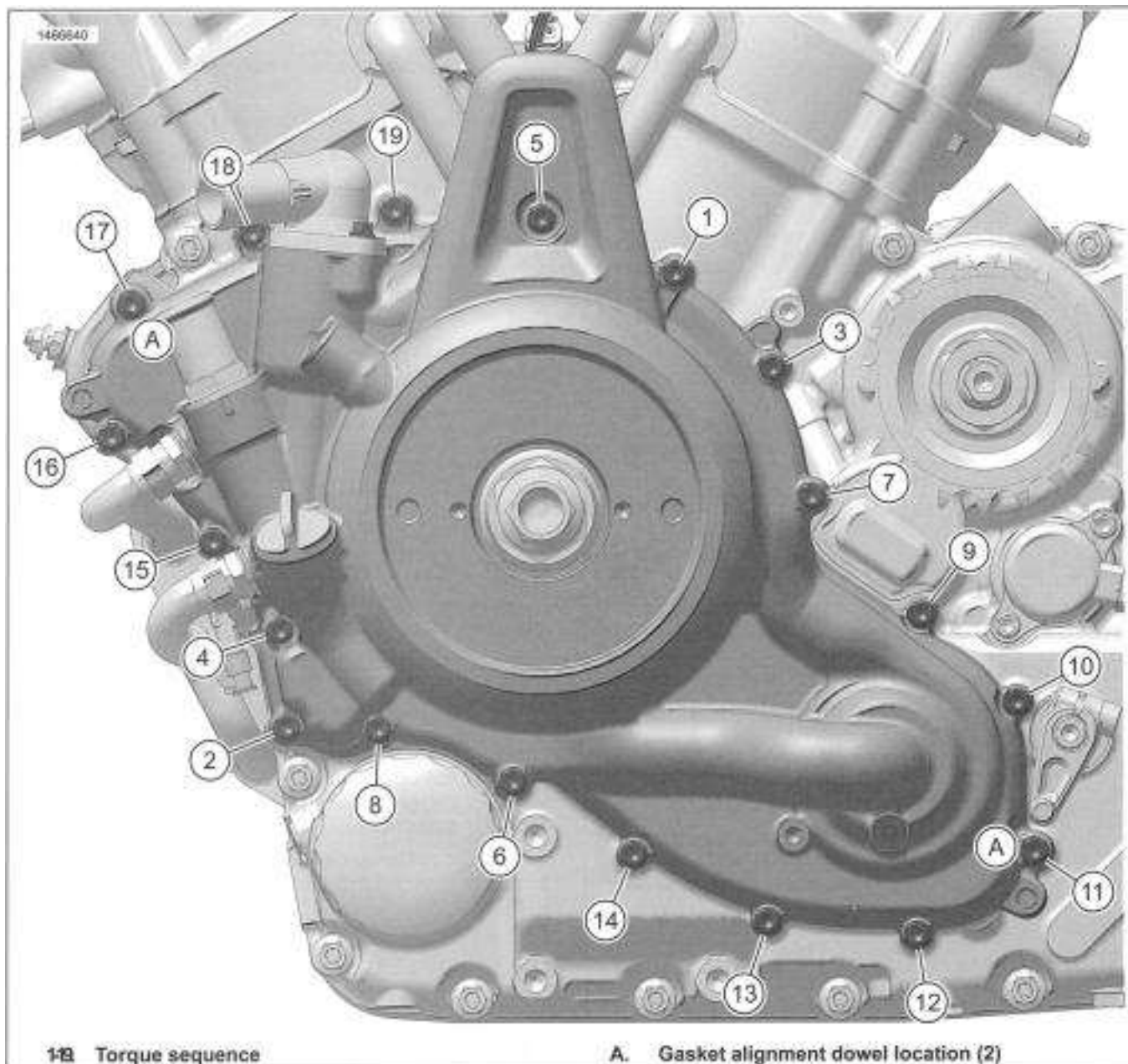


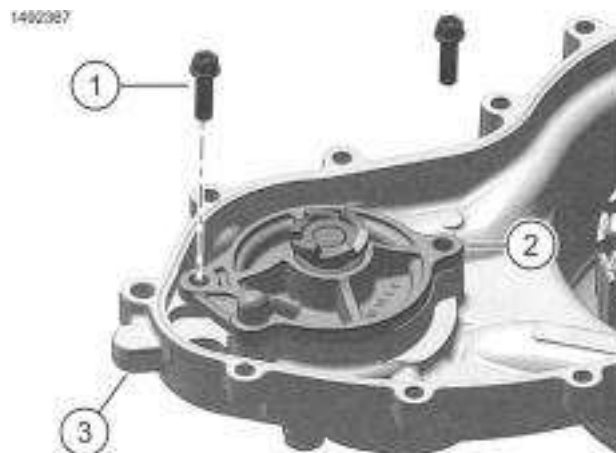
Figure 4-59. Coolant Manifold Torque Sequence

Coolant Tubes

1. See Figure 4-58. 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.

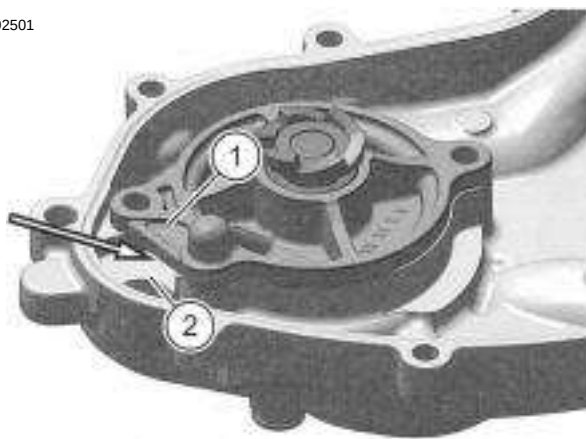
Coolant Pump

1. See Figure 4-63. **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 4-62. Position coolant pump assembly.
4. See Figure 4-60. 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 4-60. Coolant Pump Screws



1. Coolant pump
2. Coolant manifold

Figure 4-61. Pry Point

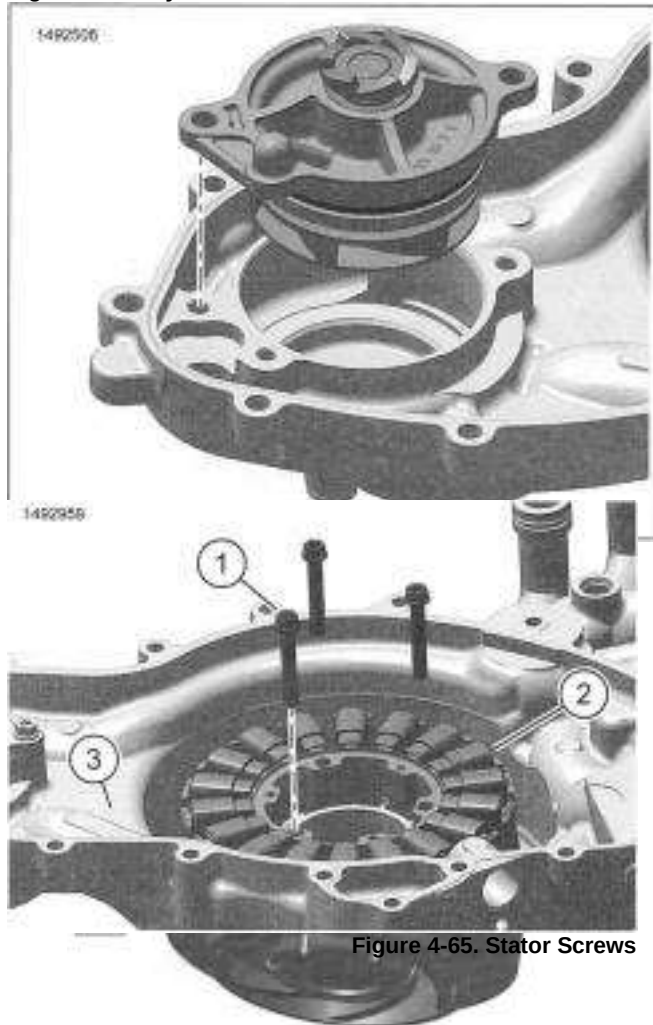


Figure 4-65. Stator Screws

1. Small O-ring
2. Large O-ring

Figure 4-63. Coolant Pump O-Rings

Stator

1. See Figure 4-66. 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 4-65. Install screws (1). Tighten.

Torque: 71-89 **in-lbs** (8-10 N-m) *Stator to coolant manifold screw*

3. See Figure 4-64. Install stator harness (3) terminals (2) into stator connector (1).

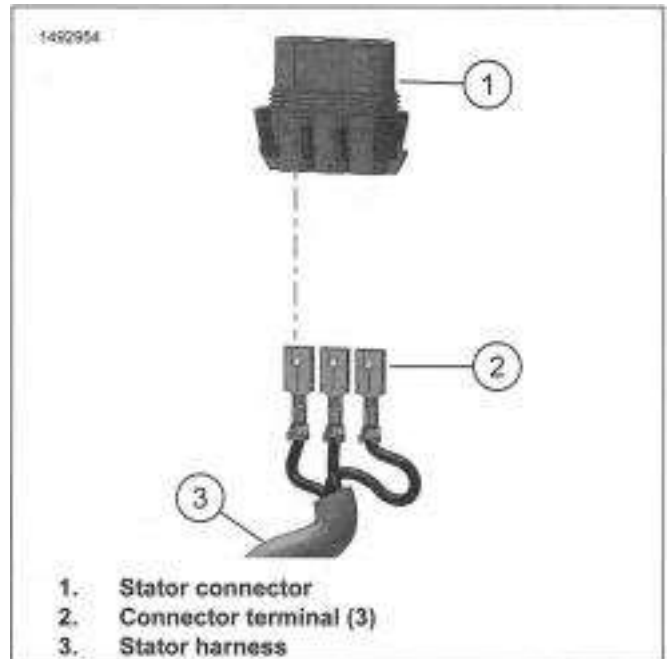


Figure 4-64. Stator Connector

1. Screw (3)
2. Stator
3. Coolant manifold

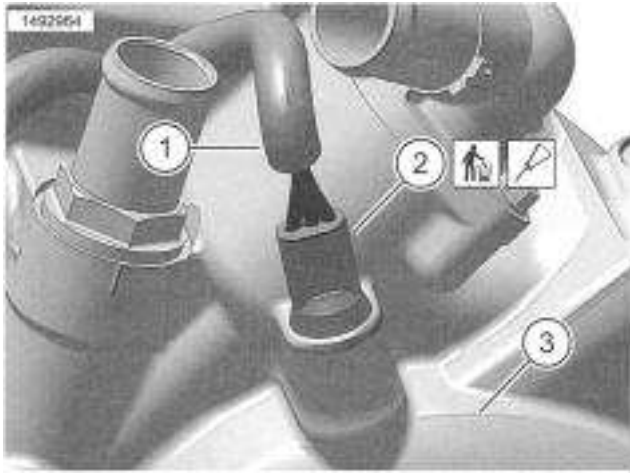


Figure 4-66. Stator Grommet

1. Stator harness
2. Stator grommet
3. Coolant manifold

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 4-51).
3. Remove electrical rotor. See ALTERNATOR (Page 8-7).

REMOVE

1. See Figure 4-67. Remove screw (1).
2. Remove starter gear (2).

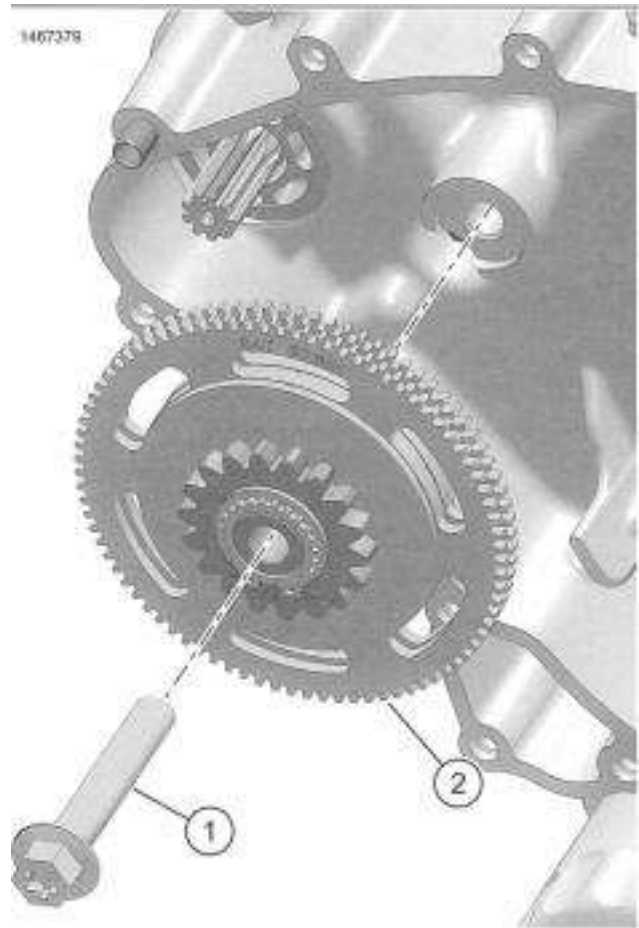
INSTALL

FASTENER	TORQUE VALUE	
Starter gear screw	29-37 ft-lbs	39-50 N m

1. See Figure 4-67. Install starter gear (2).

2. Install screw (1). Tighten.

Torque: 29-37 ft-lbs (39-50 N m) *Starter gear screw*



1. Screw
2. Starter gear

Figure 4-67. Starter Gear

COMPLETE

1. Install electrical rotor. See ALTERNATOR (Page 8-7).
2. Install coolant manifold. See COOLANT MANIFOLD (Page 4-51).
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 4-51).
4. Remove alternator. See ALTERNATOR (Page 8-7).

REMOVE

1. See Figure 4-68. Remove screw (4).
2. Remove chain tensioner.
 - a. Remove screws (2).
 - b. Remove chain tensioner (8).
3. Remove balancer sprocket.
 - a. See Figure 4-69. Install balance sprocket locking tool.
 - b. See Figure 4-68. 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).

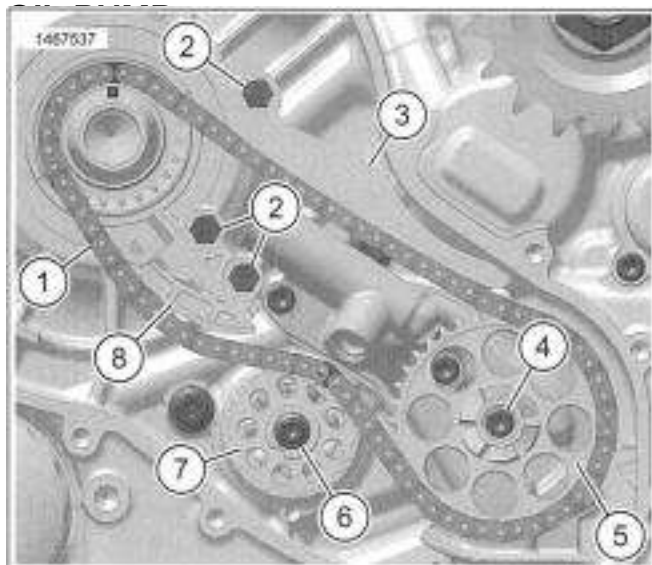
INSTALL

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 4-68. 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 4-70. Rotate balancer sprocket (4) and align diamond hole (5) with marked chain link (6).
8. See Figure 4-68. 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 4-69. Install balancer sprocket locking tool.
Special Tool: BALANCER SPROCKET LOCKING TOOL (HD-52964)
 - b. See Figure 4-68. 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*

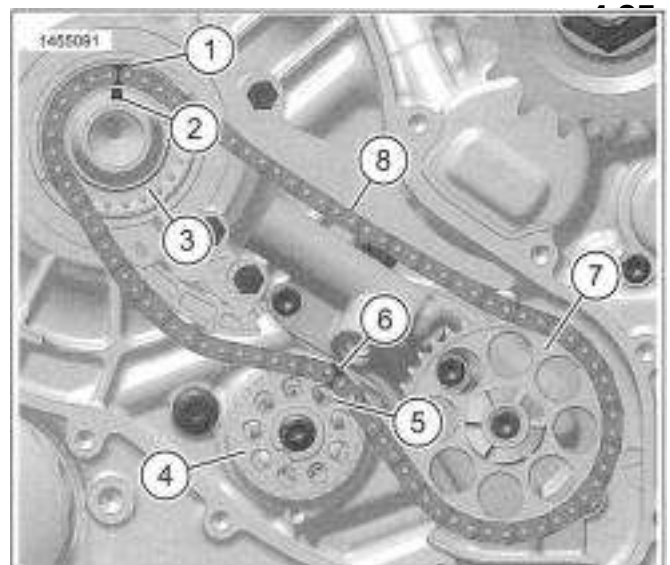
PART NUMBER	TOOL NAME
HD-52964	BALANCER SPROCKET LOCKING TOOL

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 4-68. Install oil pump sprocket (5) and screw (4). Do not tighten screw.
2. See Figure 4-70. Position chain (8) as shown with marked chain links (1,6) facing up.



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



1. Marked chain link
2. Crankshaft key
3. Crankshaft

Figure 4-68. Oil Pump and Balancer Drive

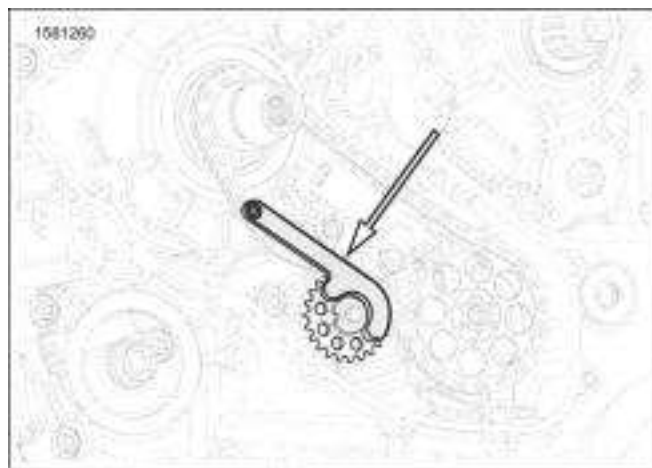


Figure 4-69. Balance Sprocket Locking Tool

4. Balancer sprocket
5. Diamond hole
6. Marked chain link
7. Oil pump sprocket
8. Chain

Figure 4-70. Chain Alignment

COMPLETE

1. Install alternator. See ALTERNATOR (Page 8-7).
2. Install coolant manifold. See COOLANT MANIFOLD (Page 4-51).
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 4-51).
4. Remove alternator. See ALTERNATOR (Page 8-7).
5. Remove oil pump drive. See OIL PUMP DRIVE (Page 4-57).

REMOVE

FASTENER	TORQUE VALUE	
Oil pump (pressure side) screws	80-97 in-lbs	9-11 N-m

1. See Figure 4-71. Remove screws (6).
2. Remove oil pump (5).
3. Discard gasket (4).
4. Remove inner (3) and outer (2) rotors.

INSTALL

1 • *NOTE*

Dimple in rotors should face out ward.

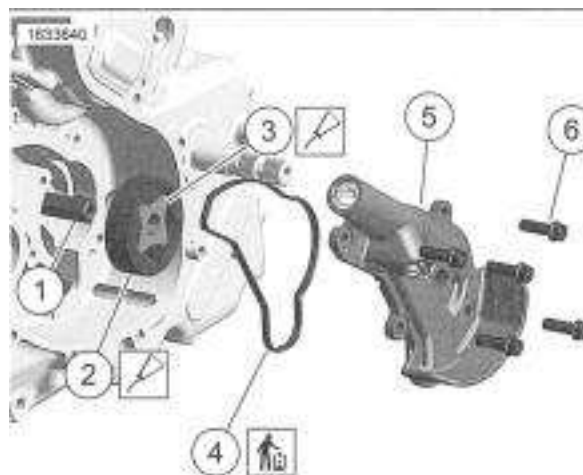
See Figure 4-71. Install gerotor assembly.

- 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 grove 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*



1. Oil pump shaft
2. Outer rotor
3. Inner rotor
4. Gasket
5. Oil pump (pressure side)
6. Screw (5)

Figure 4-71. Oil Pump

COMPLETE

1. Install oil pump drive. See OIL PUMP DRIVE (Page 4-57).
2. Install alternator. See ALTERNATOR (Page 8-7).
3. Install coolant manifold. See COOLANT MANIFOLD (Page 4-51).
4. Remove crankshaft lockout tool. See CRANKSHAFT LOCKOUT (Page 4-18).
5. Install main fuse. See POWER DISCONNECT (Page 8-4).

REPLACE ENGINE REMOVE

4.26

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

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

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 2-36).
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 2-36).
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 4-72. Install support plate to bottom of engine using the correct engine plate spacers.

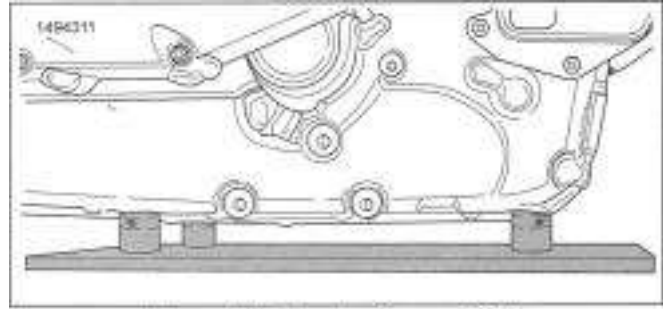


Figure 4-72. Engine Support Plate

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).

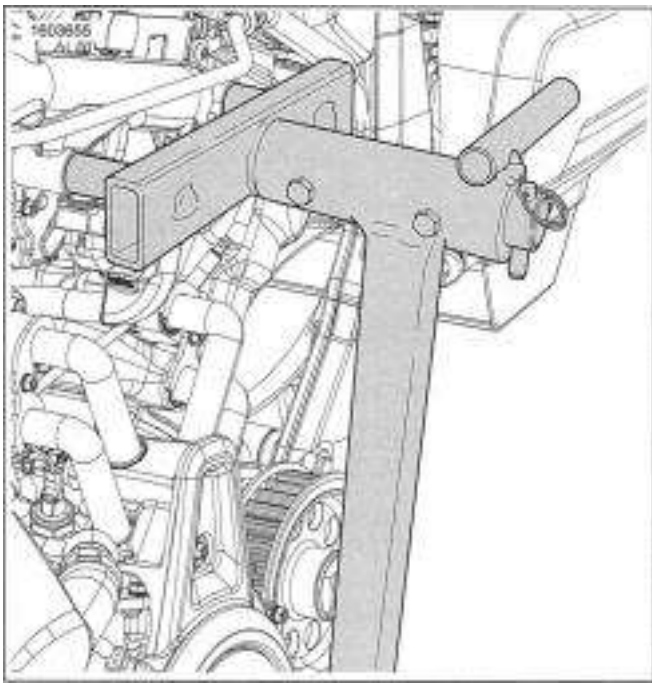


Figure 4-73. Powertrain R&R Fixture Installed (Outboard Side)

- b. See Figure 4-74. Install plate from inboard side of frame.

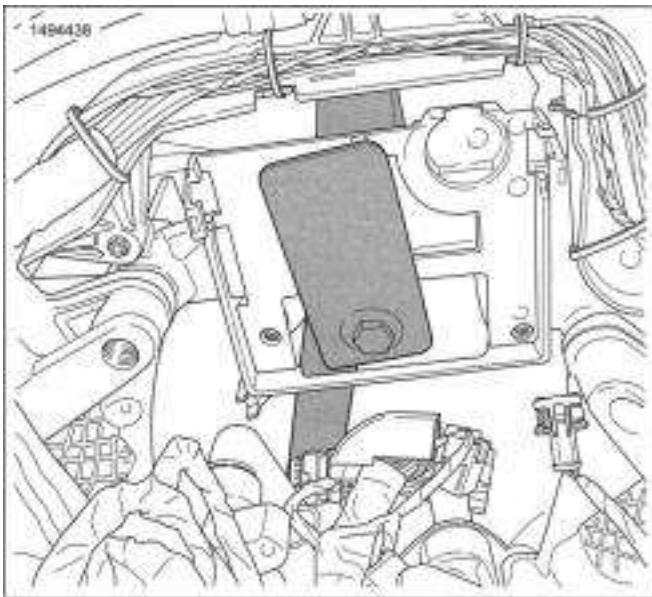


Figure 4-74. Powertrain Fixture Installed (inboard side)

54. Detach tail section. See TAIL SECTION (Page 3-83).

- a. Remove screws.
- b. Swing tail section to the left.
- c. See Figure 4-75. Support tail section on top of Powertrain R&R Fixture.

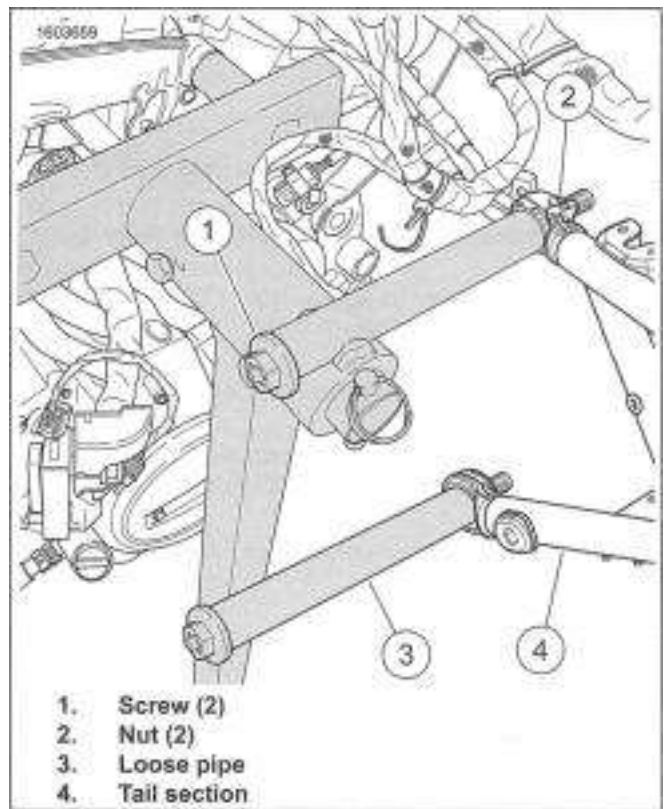


Figure 4-75. Tail Section on Fixture

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 4-76. Lower flat jack. Make sure engine support plate and flat jack do not bind.

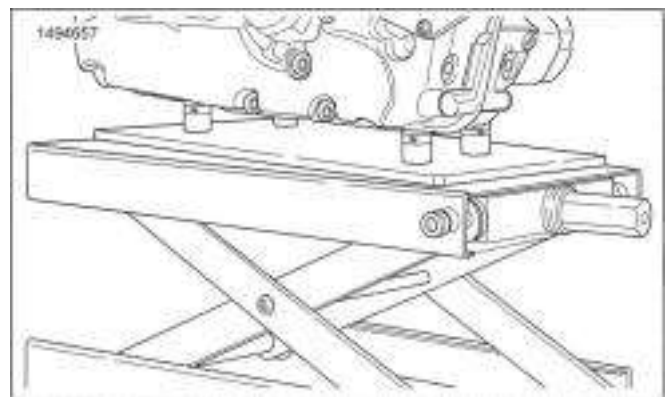


Figure 4-76. Powertrain on Flat Jack

- b. See Figure 4-77. Once flat jack reaches end of travel, place a section of 2 X 4 between flat jack and engine support plate.

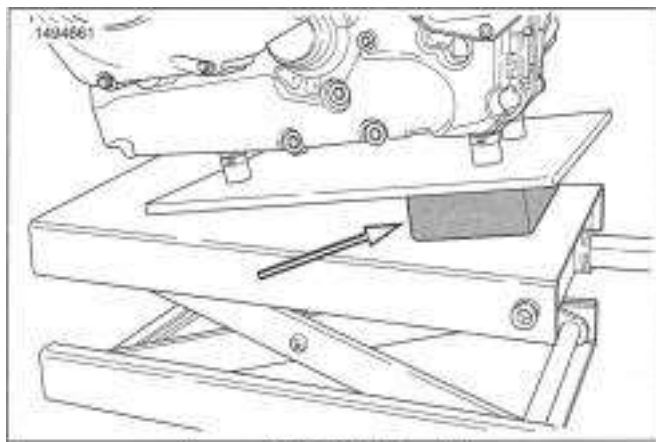


Figure 4-77. 2X4 in Position

c. See Figure 4-78. Secure powertrain to flat jack.

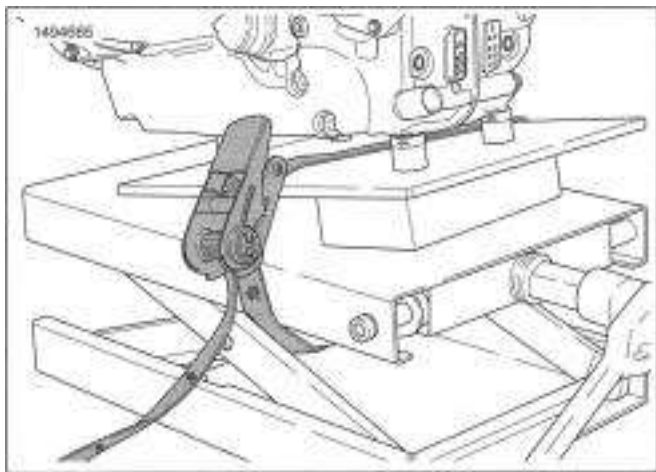


Figure 4-78. Powertrain Secured

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 4-77. Lower powertrain onto flat jack and 2 X 4 .
 - c. See Figure 4-78. 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. 02 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 2-36).
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).
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).

PART NUMBER	TOOL NAME
HD-52956	CRANKSHAFT LOCKING TOOL

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 4-60).
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 4-51).
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 4-57).
 - a. Remove chain guides.
 - b. Remove balancer gear.
23. Remove starter gear. See STARTER GEAR (Page 4-56).
24. Remove oil pump assembly. See OIL PUMP (Page 4-59).

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 4-80. 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 4-77).
3. Remove balancer (6). See BALANCER (Page 4-75).
4. Remove transmission assembly (7). See TRANSMISSION (Page 5-20).
5. Remove scavenge oil pump assembly. See SCAVENGE OIL PUMP (Page 4-80).
6. See Figure 4-79. 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.

A 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 4-77).
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	99650-02
LUBRIPLATE NO. 105	L0034-094

1. See Figure 4-79. 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 4-80. 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 4-75).

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 4-77).

Consumable: LUBRIPLATE NO. 105 (L0034-094)

Consumable: SCREAMIN' EAGLE ASSEMBLY LUBE (11300002)

6. Install scavenge oil pump assembly. See SCAVENGE OIL PUMP (Page 4-80).

7. Connect crankcase halves.

- a. Verify that both dowel pins are installed in split line face of right case half.

- b. See Figure 4-81. 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 splittline parallel as left crankcase is lowered into place.

- e. Wiggle crankcase during installation to help fully seat components in bearings.

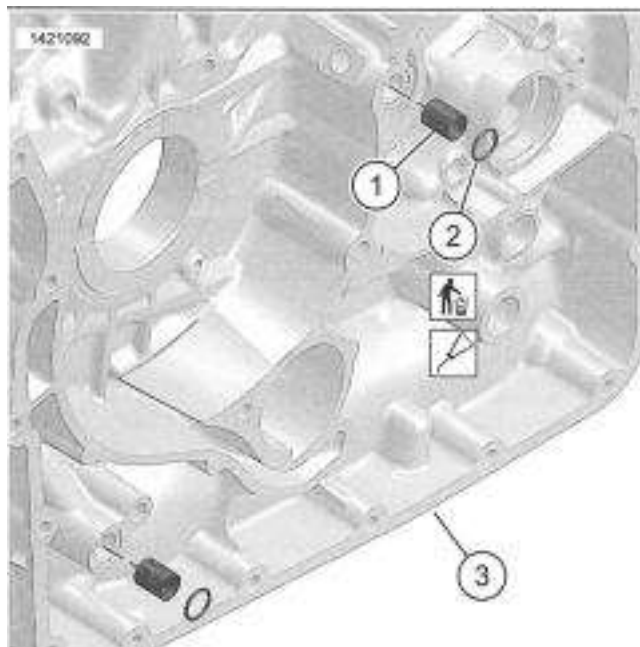
- f. Remove special tool from both ends of crankshaft.

8. install crankcase screws.

- a. Install screws (1,2, 3).
- b. Finger-tighten each screw.

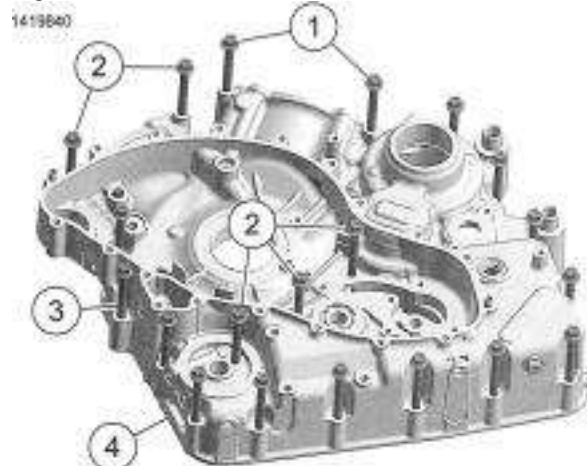
- c. See Figure 4-82. Tighten screws in sequence.

Torque: 16-20 ft-lbs (22-27 N-m) Crankcase screw, left



- 1 Dowel pin (2)
- 2 O-ring (2)
- 3 Right crankcase half

Figure 4-79. Dowel Pins



- 1. Screw, long (2)
 - 2. Screw, medium (5)
 - 3. Screw, short (13)
 - 4. Left crankcase
 - 5. Crankshaft assembly
 - 6. Balancer
 - 7. Transmission assembly
 - 8. Right crankcase
- Figure 4-80. Separate Crankcase Halves

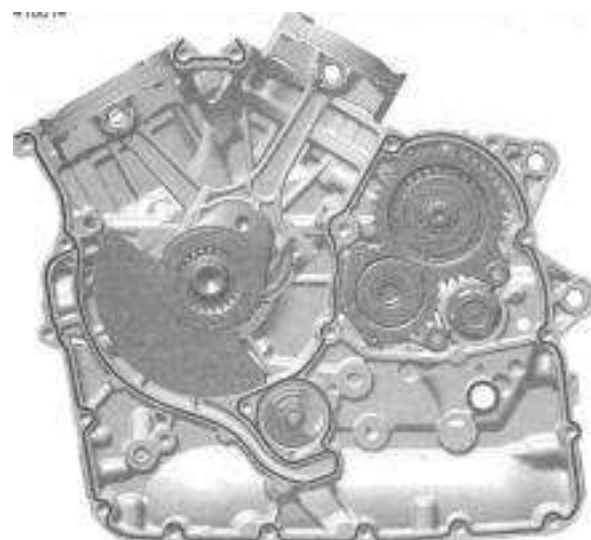


Figure 4-81. Crankcase Sealant Application

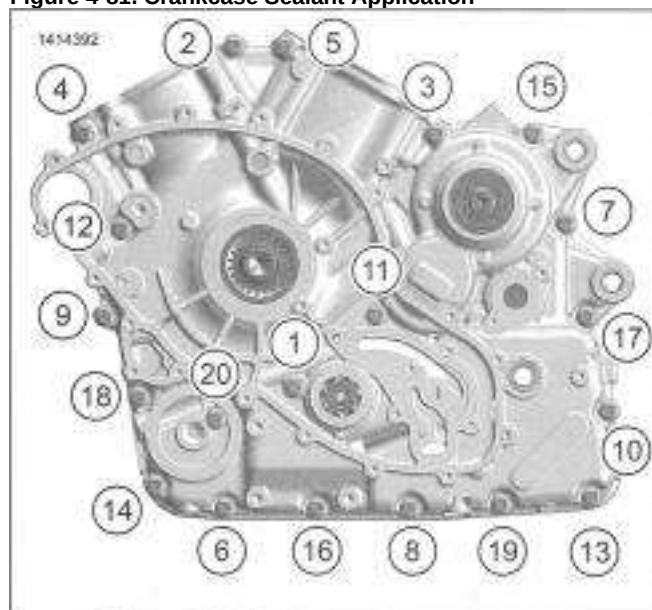


Figure 4-82. Crankcase Torque Sequence

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 4-83. Place main bearing removal/installation tool base (2) wide end (1) up.

Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)
 - b. See Figure 4-84. 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 4-85. Place main bearing removal/installation tool base (2) thin end (1) up.

Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)
 - b. See Figure 4-86. 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 4-87. Place crankcase cover 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 4-88. Verify bearing position.

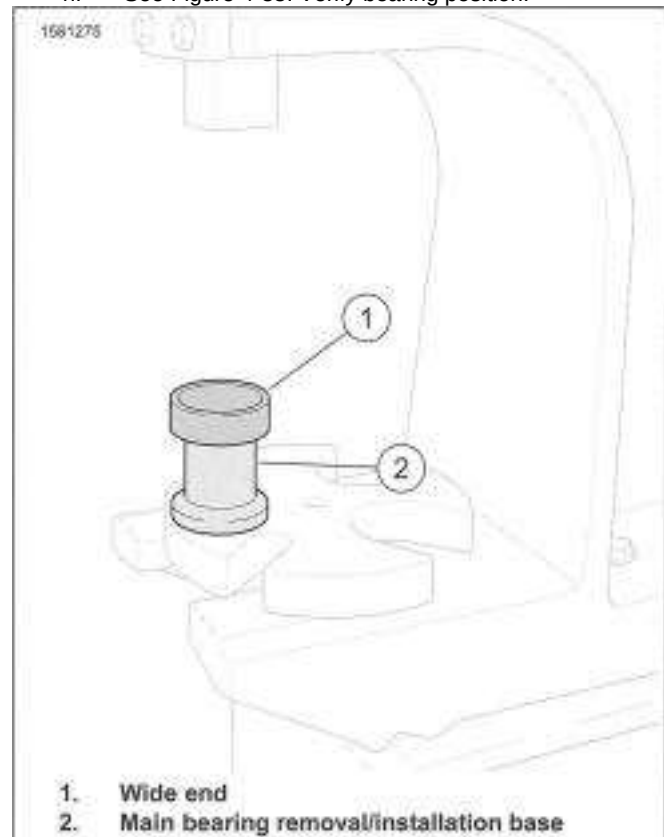


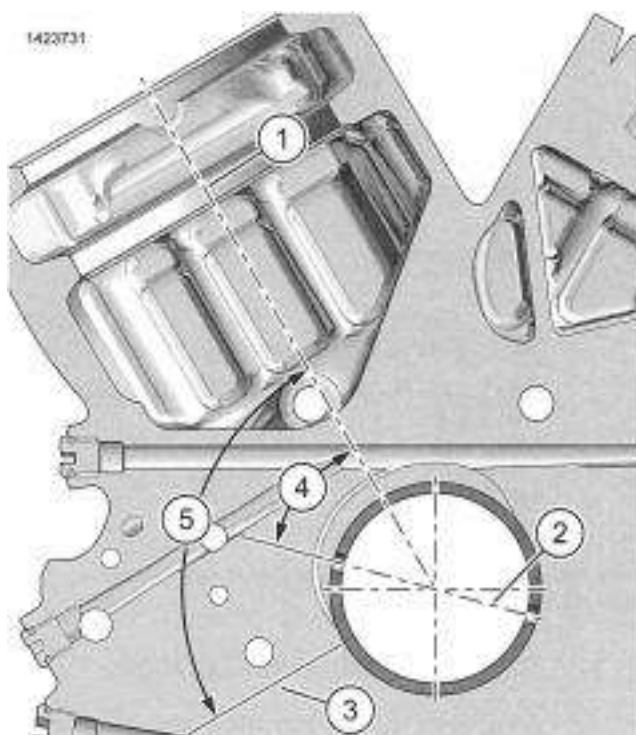
Figure 4-83. Main Bearing Removal/Installation Tool Base



Figure 4-84.



Figure 4-85.



1. Front cylinder axis
2. Oil hole orientation
3. Bearing shell split line
4. 45°
5. 90° +5°

Figure 4-88. Right Main Bearing Orientation

Balancer Bearing Remove

1. See Figure 4-89. Remove balancer bearing (7). a. Use suitable blind hole puller.
2. Discard bearing (7).

Install

1. See Figure 4-89. 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 4-89. Remove transmission mainshaft bearing (1).
 - a. Use suitable blind hole puller.
2. Discard bearing (1).

Install

1. See Figure 4-89. 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 4-89. Remove screws (2).
2. Remove retaining plate (3).
3. Remove transmission countershaft bearing (4).
4. Discard bearing (4).

Install

1. See Figure 4-89. 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

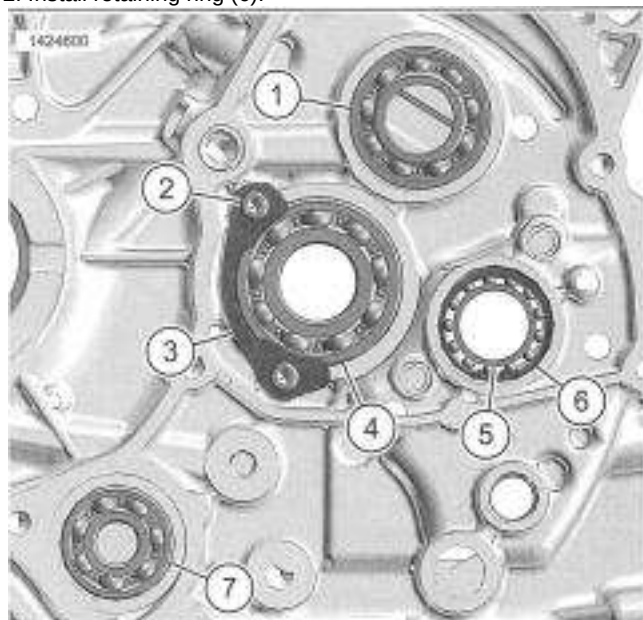
Remove

1. See Figure 4-89. Remove retaining ring (6).
2. Remove shift drum bearing (5).
3. Discard bearing (5).

Install

1. See Figure 4-89. 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 4-89. Right Crankcase Bearing Replacement
REPAIR LEFT CRANKCASE HALF

PART NUMBER	TOOL NAME
HD-52961	MAIN BEARING INSTALLATION TOOL

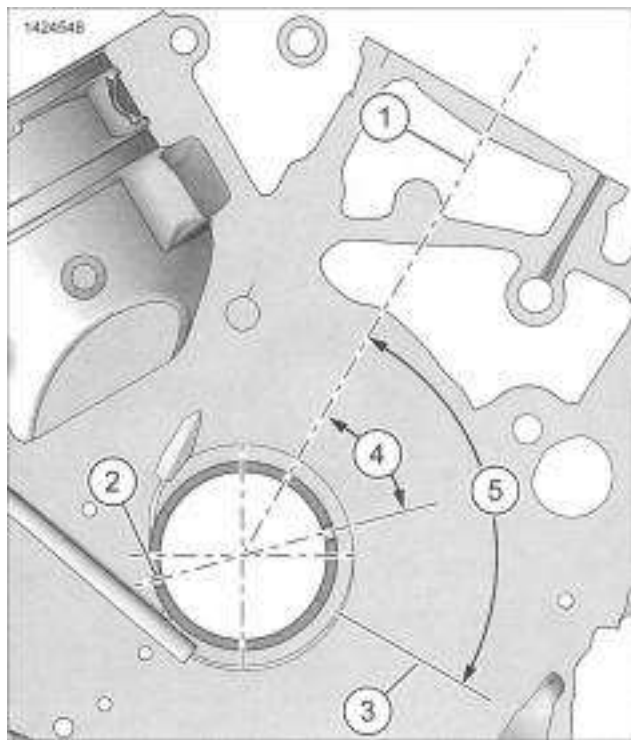
Main Bearing

Remove

1. See Figure 4-90. Remove main bearing using special tool.
Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)
2. Discard bearing halves.

Install

1. See Figure 4-90. Install **new** bearing halves. Use special tool.
Special Tool: MAIN BEARING INSTALLATION TOOL (HD-52961)
 - a. Orient bearing half oil holes (2).
 - b. Orient bearing half split lines (3).



- 1. Front cylinder axis
- 2. Oil hole orientation
- 3. Bearing shell split line
- 4. 45°
- 5. 90° ±5°

Figure 4-90. Left Main Bearing Orientation

Balancer Bearing

Remove

1. See Figure 4-91. Remove balancer bearing (5).
2. Discard bearing (5).

Install

1. See Figure 4-91. 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 4-91. Remove retaining ring (2).
2. Remove transmission mainshaft bearing (1).
3. Discard bearing (1).

Install

1. See Figure 4-91. 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 4-91. Remove transmission countershaft bearing (4).
 - a. Use suitable blind hole puller.
2. Discard bearing (4).

Install

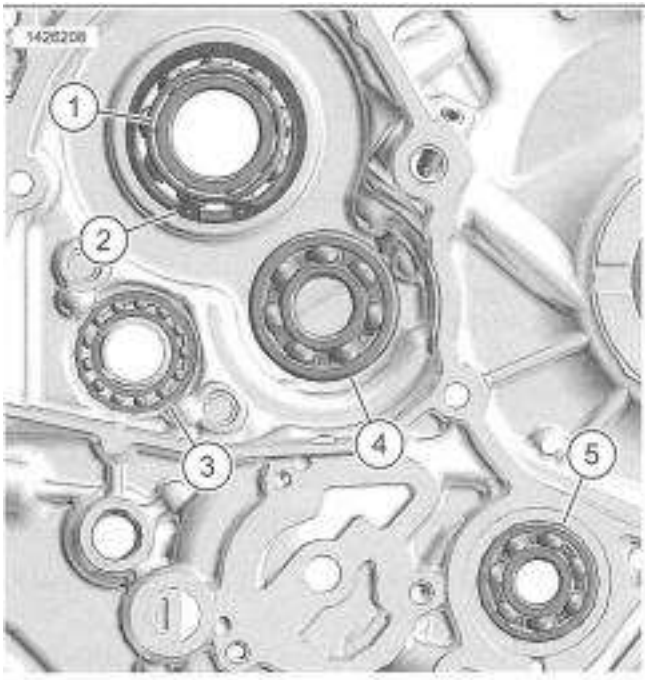
1. See Figure 4-91. Install **new** bearing.
 - a. Place crankcase with split line facing up.
 - b. Spread clean engine oil on outside diameter of **new** bearing (4).
 - c. Install transmission countershaft bearing (4).
 - d. Press **new** bearing until fully seated in bore.

Transmission Shift Drum Bearing Remove

1. See Figure 4-91. Remove shift drum bearing (3).
2. Discard bearing (3).

Install

1. See Figure 4-91. 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.



1. Transmission mainshaft bearing
2. Retaining ring
3. Shift drum bearing
4. Transmission countershaft bearing
5. Balancer bearing

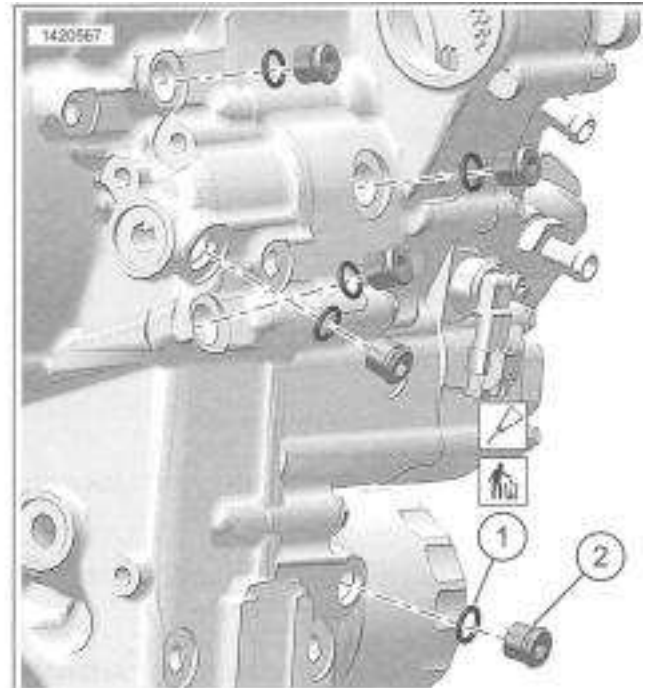
Figure 4-91. Left Crankcase Bearing Replacement

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

PLUGS AND OIL FITTINGS

Engine Body Plug

1. See Figure 4-92. 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*

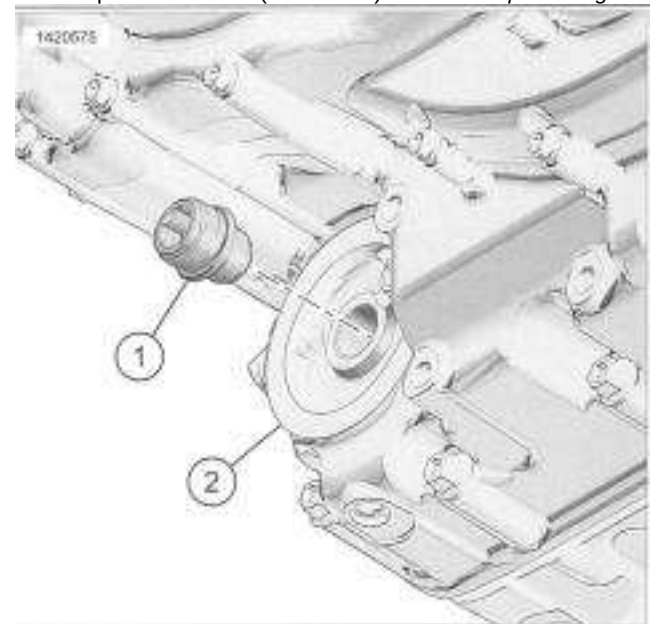


1. O-ring (5)
2. Body plug (5)

Figure 4-92. 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*



1. Oil filter adapter
2. Left crankcase half

Figure 4-93. Oil Filter Adapter Fitting

COMPLETE

PART NUMBER	TOOL NAME
HD-52956	CRANKSHAFT LOCKING TOOL

1. Install oil pump assembly. See OIL PUMP (Page 4-59).

2. Install starter gear. See STARTER GEAR (Page 4-56).

3. Install oil pump drive. See OIL PUMP DRIVE (Page 4-57).
 - 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 4-51).
8. Install clutch primary drive gear. See CRANKSHAFT AND CONNECTING RODS (Page 4-77).
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 4-60).
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 4-60).
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 4-51).
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 4-77).
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 4-57).

- a. Remove chain guides.
- b. Remove balancer gear.

23. Remove starter gear. See STARTER GEAR (Page 4-56).

REMOVE

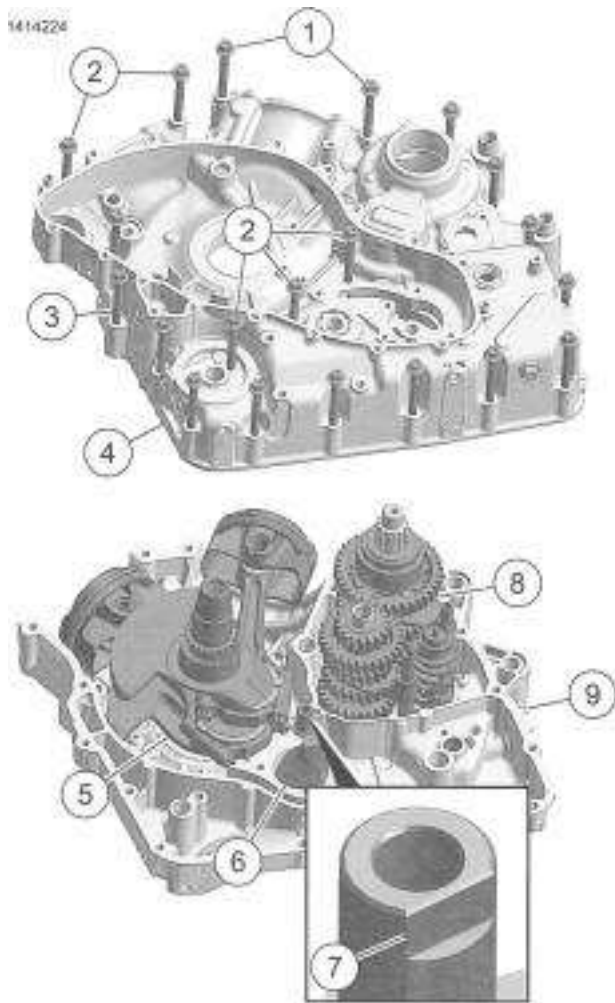
1. See Figure 4-94. Remove screws (1,2, 3).
2. Remove left crankcase (4).
3. Remove balancer (6).
4. Clean both crankcase halves from gasket material. See CRANKCASE (Page 4-66).

INSTALL

- a. Balancer flat (7) should face left crankcase (4) for proper

CONSUMABLE	PART NUMBER
HARLEY-DAVIDSON HIGH PERFORMANCE	99650-02

1. See Figure 4-94. Install balancer (6) in right crankcase (9). assembly and operation.
2. Install left crankcase.
 - a. See Figure 4-81. 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 4-94. Install left crankcase (4).
3. Install screws (1,2, 3).
4. Tighten screws in sequence. See CRANKCASE (Page 4-66)



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 4-94. Crankcase Components

COMPLETE

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 4-51).
 7. Install camshaft. See CAMSHAFTS AND PHASERS (Page 4-38).
 8. Install primary gear. See CRANKSHAFT AND CONNECTING RODS (Page 4-77).
 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 4-60).
 21. Install output pulley. See OUTPUT PULLEY (Page 5-6).
 22. Install main fuse. See POWER DISCONNECT (Page 8-4).
1. Install starter gear. See STARTER GEAR (Page 4-56).
 2. Install oil pump drive. See OIL PUMP DRIVE (Page 4-57).
 - a. Install chain guides.
 - b. Install balancer gear.

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove engine. See REPLACE ENGINE (Page 4-60).
3. Remove camshaft drive sprocket. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
4. Separate crankcase. See CRANKCASE (Page 4-66).

REMOVE

PART NUMBER	TOOL NAME
HD-52957	CRANKSHAFT PROTECTOR

1. See Figure 4-95. 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 4-96. 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

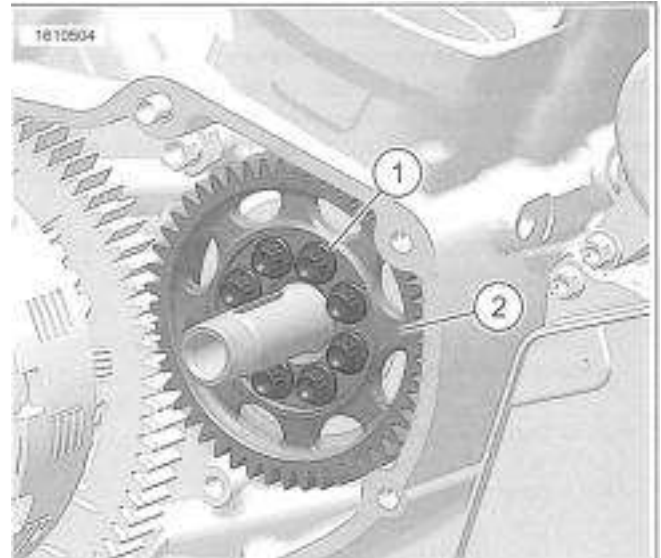
Do not use compressed air to clean threads. This will force debris into the oil passages of the crankshaft.

1. Install crankshaft assembly.
 - a. Place crankshaft protector on end of crankshaft.

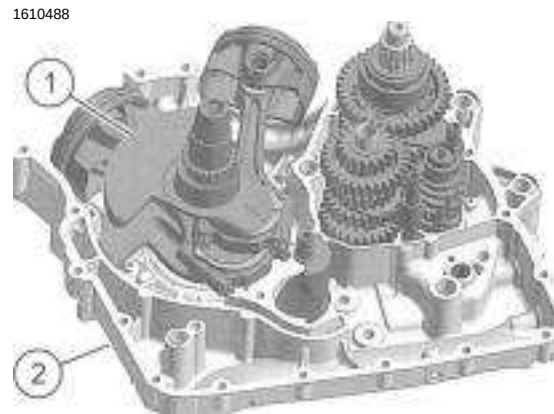
Special Tool: CRANKSHAFT PROTECTOR (HD-52957)
 - b. See Figure 4-96. Install crankshaft assembly (1) into right crankcase (2).
2. See Figure 4-95. Install primary gear.
 - a. Install primary gear (2) with shallow end facing the crankcase.

- b. Install screws (1). Tighten in criss-cross pattern.

Torque: 24-27 ft-lbs (32-36 Nm) *Crankshaft primary gear screws*



1. Screw (8)
2. Primary drive gear
Figure 4-95. Primary Drive Gear



1. Crankshaft assembly
2. Right crankcase
Figure 4-96. Crankshaft

DISASSEMBLE

NOTE

- Mark direction of connecting rod and end cap assemblies before removal.
 - Note dimple location on connecting rod assembly. See Figure 4-99.
 - Each connecting rod and end cap is a machined set. Do not interchange parts.
1. Secure crankshaft assembly.
 2. See Figure 4-97. Remove connecting rods, a. Discard screws (4).

- b. Remove end caps (3).
- c. Discard bearings (2).

CLEAN AND INSPECT

A 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 4-101. 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 4-98 and Figure 4-99. 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 4-97. Install **new** bearings (2).

- a. See Figure 4-100. 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

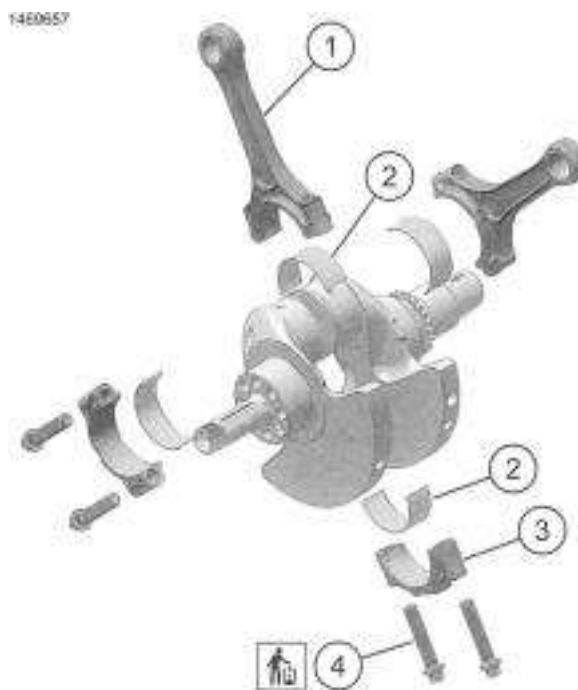
- A new connecting rod and end cap assembly is installed in either direction.
- The existing connecting rod and end cap assembly is installed in the same direction as removed.

Install connecting rods.

- a. See Figure 4-97. Lubricate threads of new screws (4) with fresh engine oil.
- b. See Figure 4-99. Align dimples (4).
- c. See Figure 4-97. 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



1. Connecting rod (2)
2. Bearing (4)
3. End cap (2)
4. Screw (4)

Figure 4-97. Connecting Rods

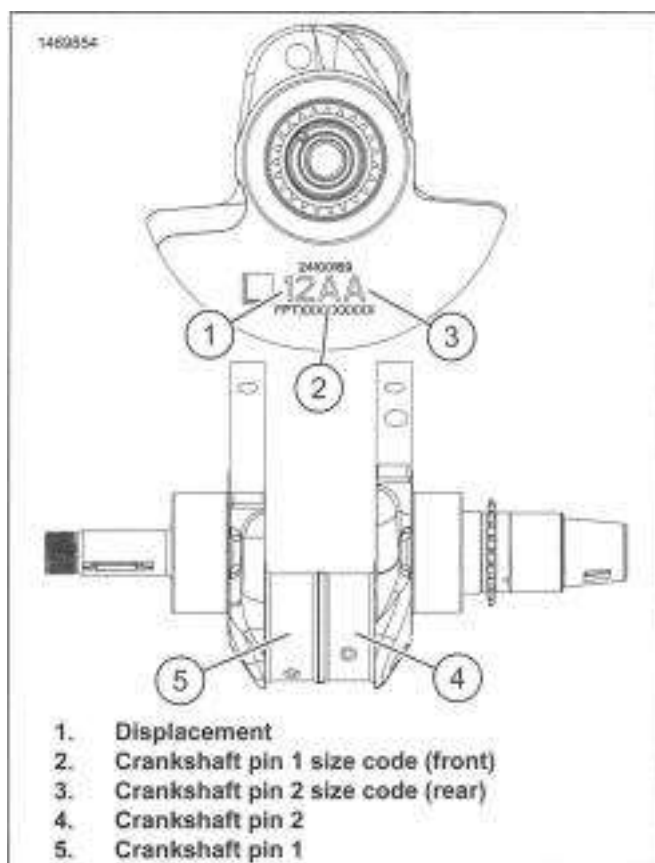


Figure 4-98. Crankshaft Code

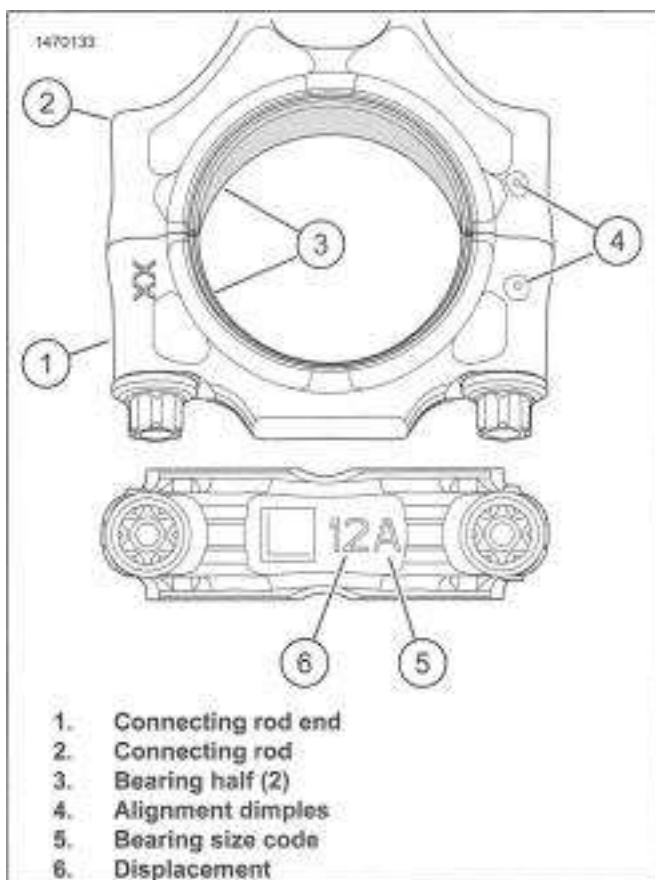
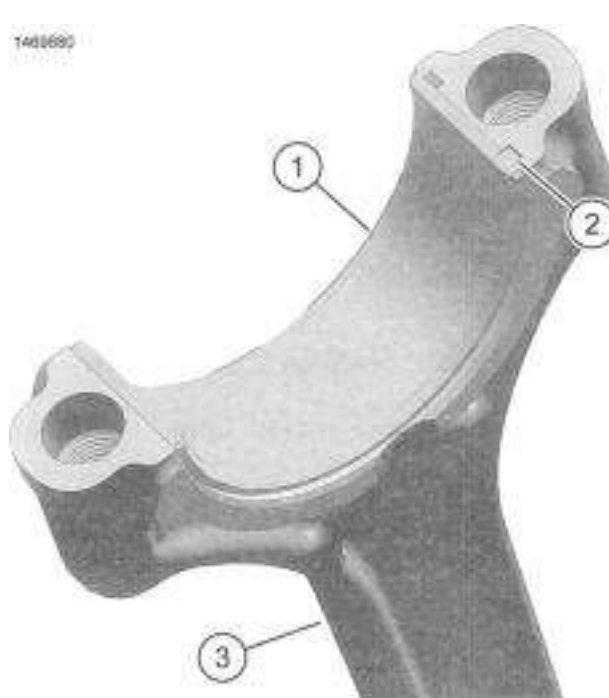
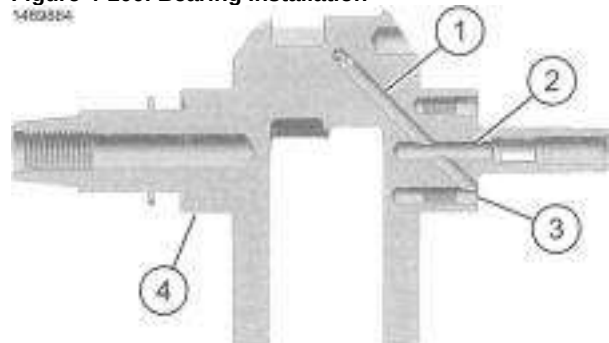


Figure 4-99. Connecting Rod Assembled



1. Bearing half
2. Bearing in groove
3. Connecting rod

Figure 4-100. Bearing Installation



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 4-101. Crankshaft Oil Passage

COMPLETE

1. Assemble crankcase. See CRANKCASE (Page 4-66).
2. Install camshaft drive sprocket. See CAMSHAFT SPROCKET AND TIMING CHAIN (Page 4-24).
3. Install engine. See REPLACE ENGINE (Page 4-60).
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 4-60).
- 4. Separate crankcase halves. See CRANKCASE (Page 4-66).

REMOVE

- 1. See Figure 4-102. 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.

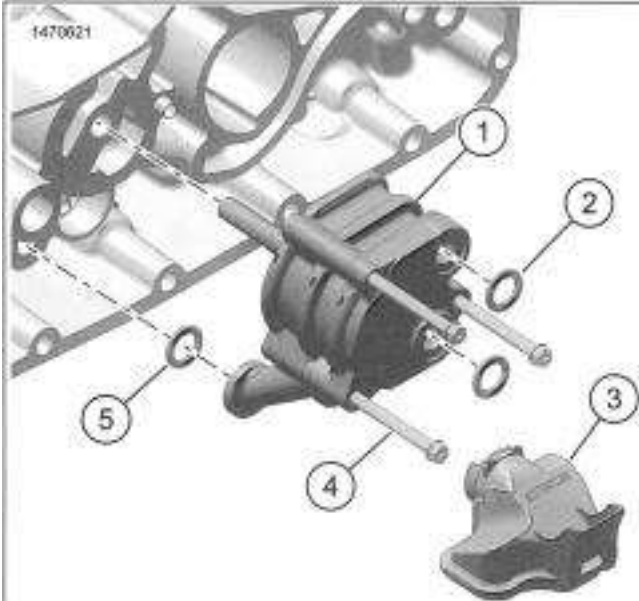
INSTALL

- 1. See Figure 4-102. Lubricate new O-ring (5) with fresh engine

FASTENER	TORQUE VALUE	
Scavenge oil pump screw	80-97 in-lbs	9-11 Nm

- oil.
- 2. Install O-ring (5) and scavenge oil pump (1).
 - 3. Install screws (4). Tighten.
Torque: 80-97 **in-lbs** (9-11 Nm) *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 4-102. Scavenge Oil Pump

COMPLETE

- 1. Assemble crankcase halves. See CRANKCASE (Page 4-66).
- 2. Install engine. See REPLACE ENGINE (Page 4-60).
- 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 4-60).
- 4. Separate crankcase halves. See CRANKCASE (Page 4-66).

REMOVE

- 1. See Figure 4-103 or Figure 4-104. Remove banjo screw (1)-
- 2. Remove oil nozzle (2).

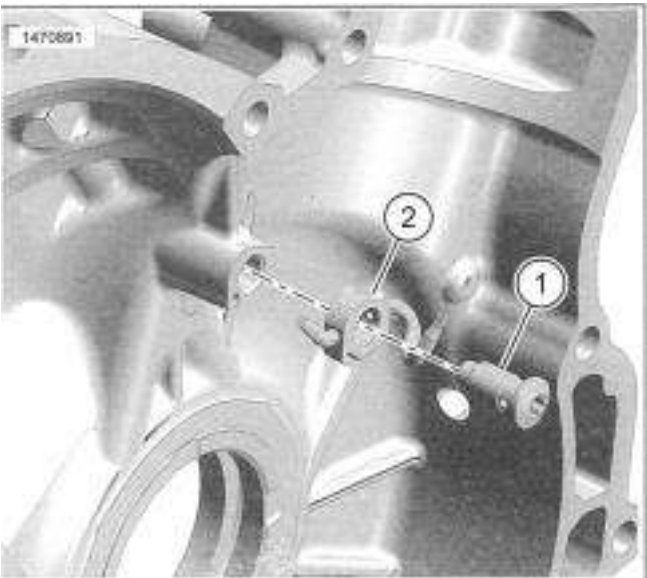
INSTALL

- 2. Install banjo screw (1). Tighten.

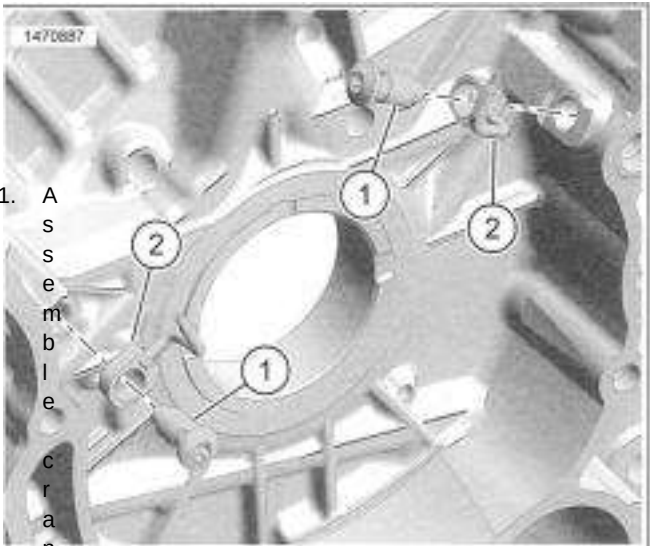
Torque: 142-177 in-lbs (16-20 Nm) *Oil nozzle banjo screw*

FASTENER	TORQUE VALUE	
Oil nozzle banjo screw	142-177 in-lbs	16-20 N-m

- 1. See Figure 4-103 or Figure 4-104. Install oil nozzle (2).



1. Banjo screw
2. Oil nozzle
Figure 4-103. Left Crankcase Oil Nozzle



1. Banjo screw (2)
2. Oil nozzle (2)
Figure 4-104. Right Crankcase Oil Nozzles

COMPLETE

- Reassemble crankcase halves. See CRANKCASE (Page 4-66).
- 2. Install engine. See REPLACE ENGINE (Page 4-60).
- 3. Install main fuse. See POWER DISCONNECT (Page 8-4).

NOTES

SUBJECT	PAGE NO.
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5.2 SPECIFICATIONS.....	5-2
5.3 TRANSMISSION OPERATION.....	5-3
5.4 DRIVE BELT.....	5-5
5.5 OUTPUT PULLEY.....	5-6
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5.8 DRUM AND FORKS.....	5-19
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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.

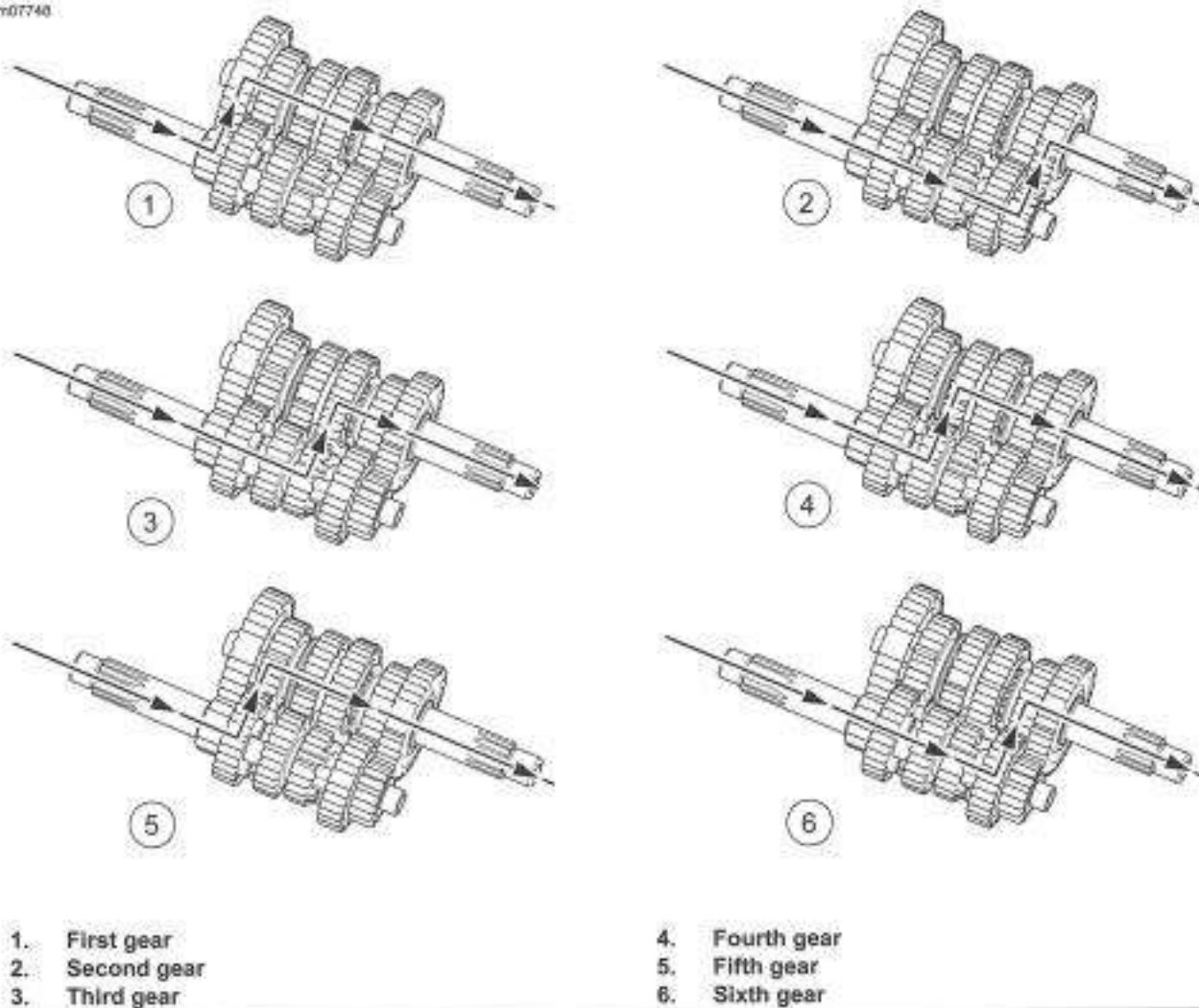


Figure 5-1. Transmission Power Flow

PREPARE

A 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).

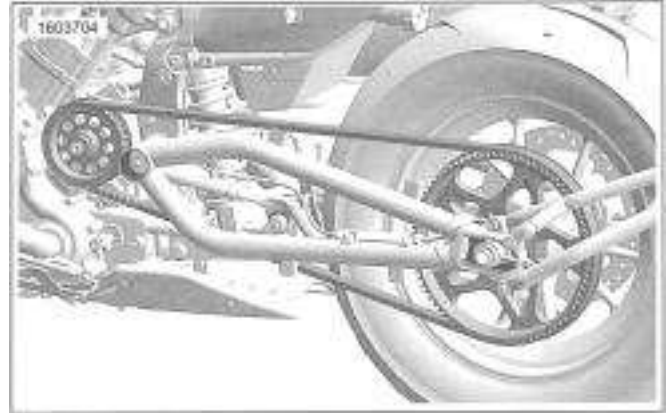


Figure 5-2. Drive Belt

COMPLETE

1. Install belt guards. See BELT GUARDS (Page 3-60).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

PREPARE

A 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).

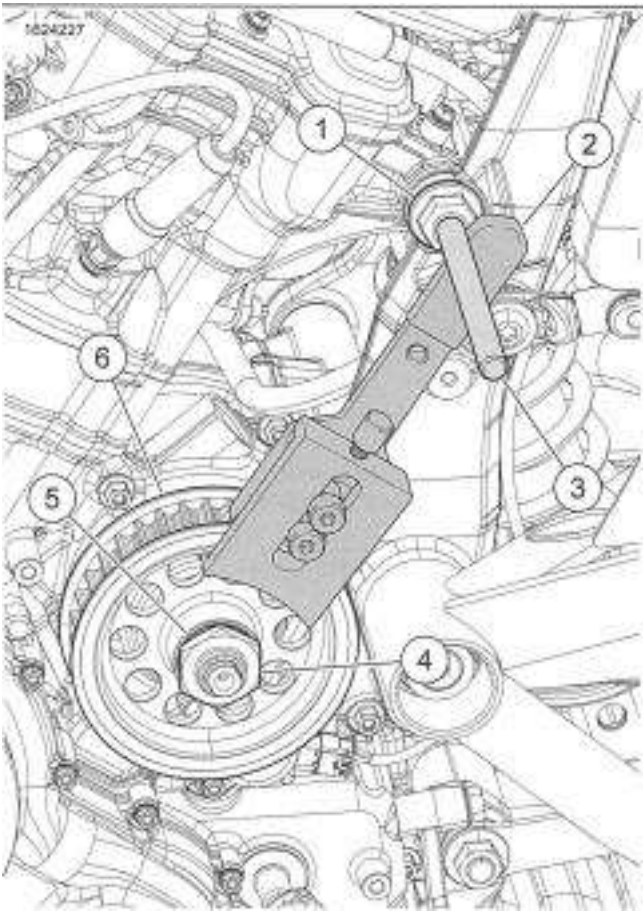
- 2. Remove output pulley (6).

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 Nm) *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

INSTALL

Figure 5-3. Remove Output Pulley

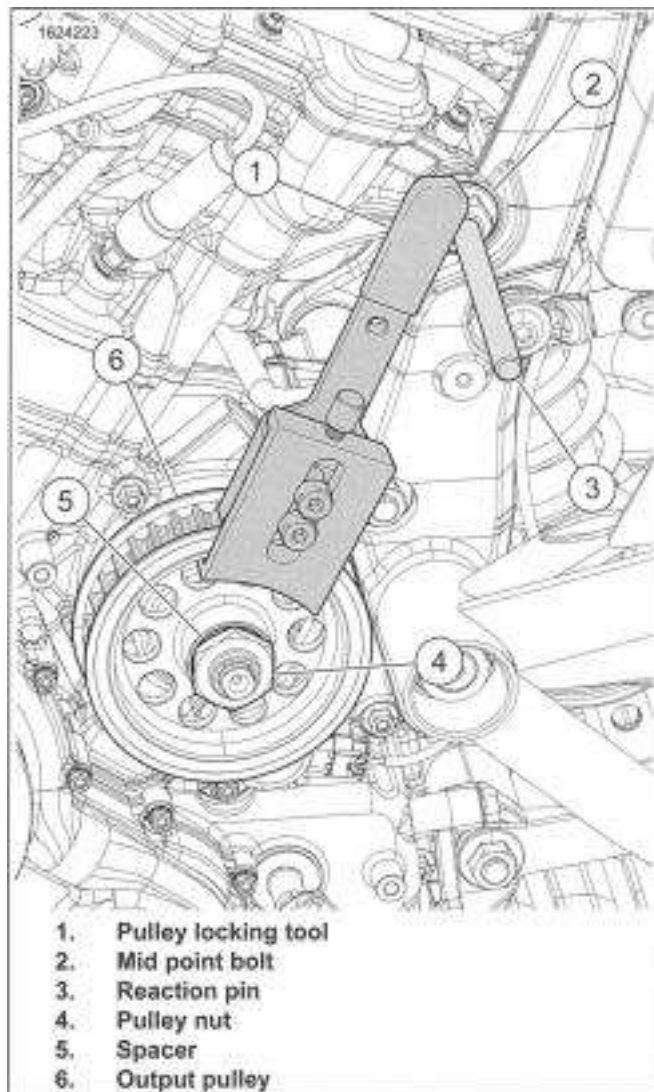


Figure 5-4. Install Output Pulley

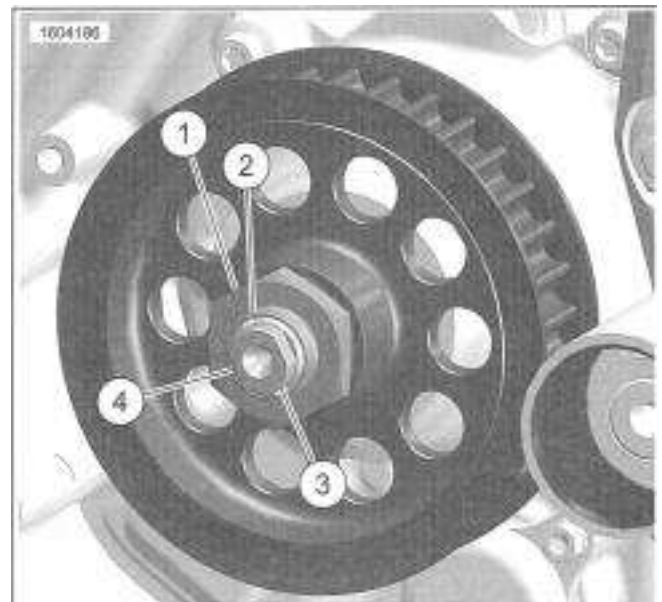


Figure 5-5. Stake Output Pulley Nut

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

A 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 4-49).
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** locking (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*



Figure 5-6. Shifter Link Assembly

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*

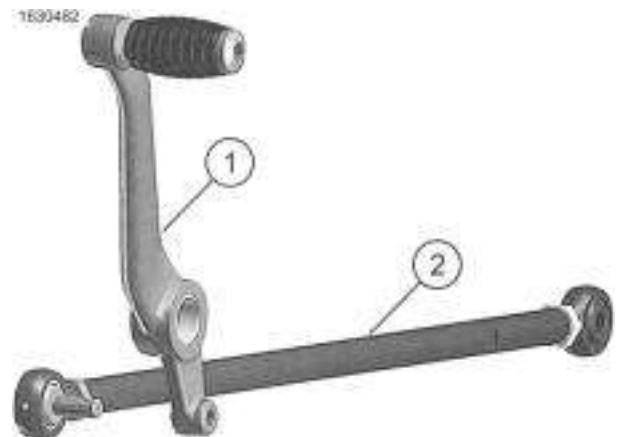
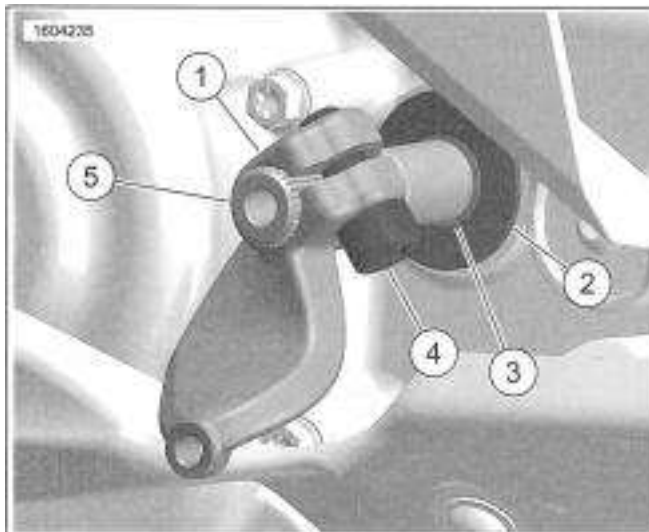


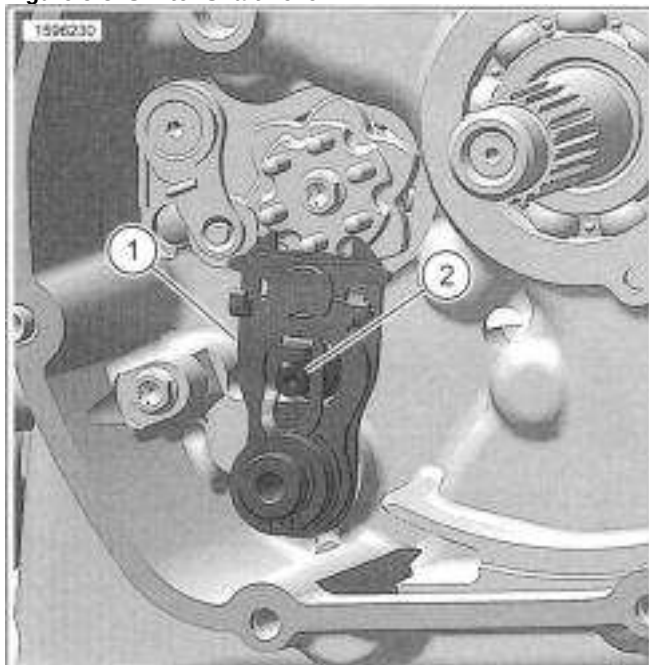
Figure 5-7. Foot Shifter

1. Foot shifter
2. Shifter link



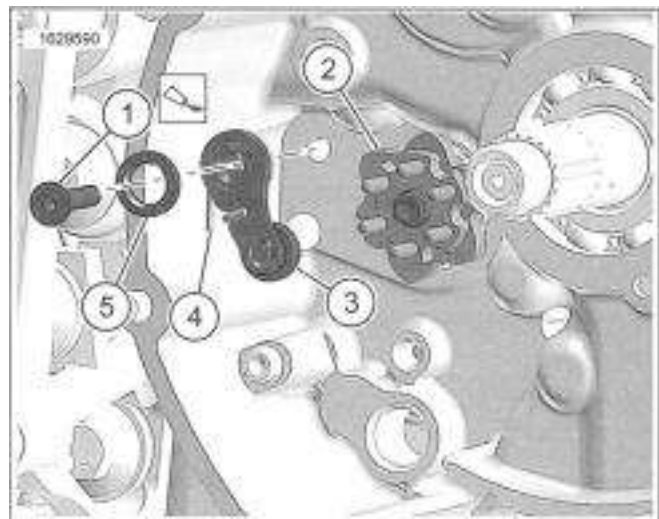
1. Shifter shaft lever
2. Shifter shaft seal washer
3. Lockring
4. Pinch screw
5. Shifter shaft

Figure 5-8. Shifter Shaft Lever



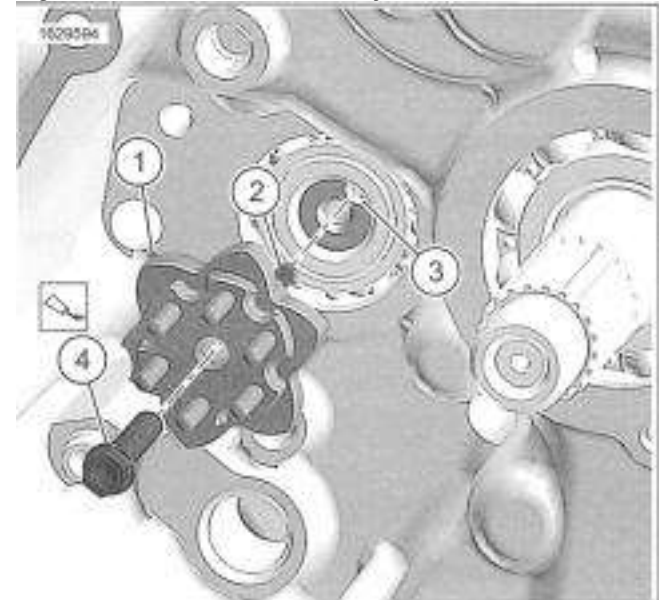
1. Shifter shaft assembly
2. Shift return pin

Figure 5-9. Shifter Shaft Assembly



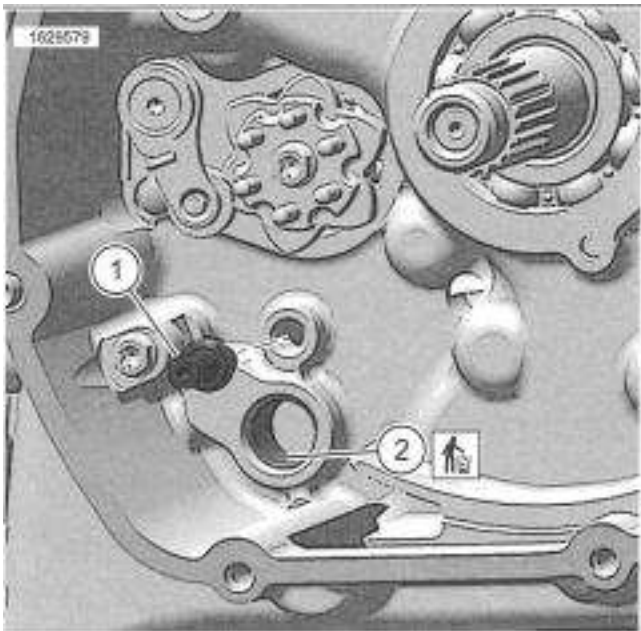
1. Screw
2. Detent collar
3. Detent arm
4. Spring
5. Washer, beveled

Figure 5-10. Detent Arm Assembly



1. Detent collar
2. Alignment pin
3. Alignment hole
4. Screw

Figure 5-11. Detent Collar



1. Shift return pin
2. Shifter shaft bushing
Figure 5-12. Shift Return Pin

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).

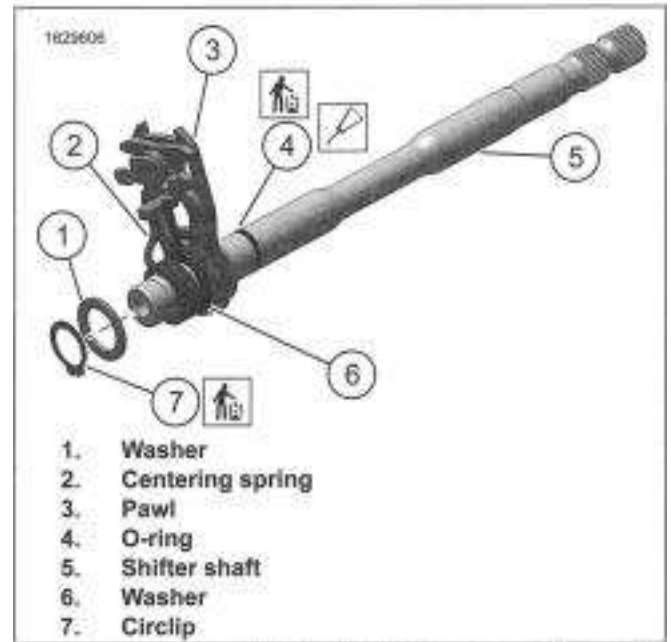


Figure 5-13. Shifter Shaft Assembly

COMPLETE

1. Install clutch. See CLUTCH (Page 5-12).
2. Install primary cover. See PRIMARY COVER (Page 4-49).
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 4-49).
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.

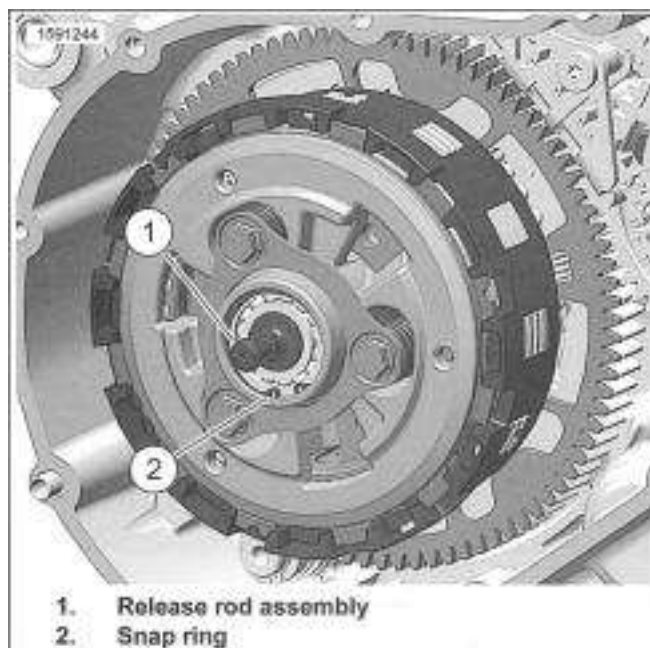


Figure 5-14. Release Rod Assembly

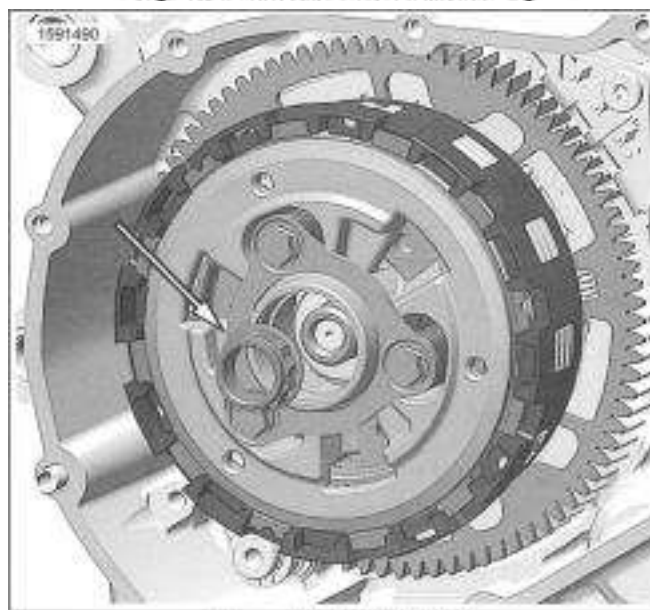


Figure 5-15. Clutch Nut

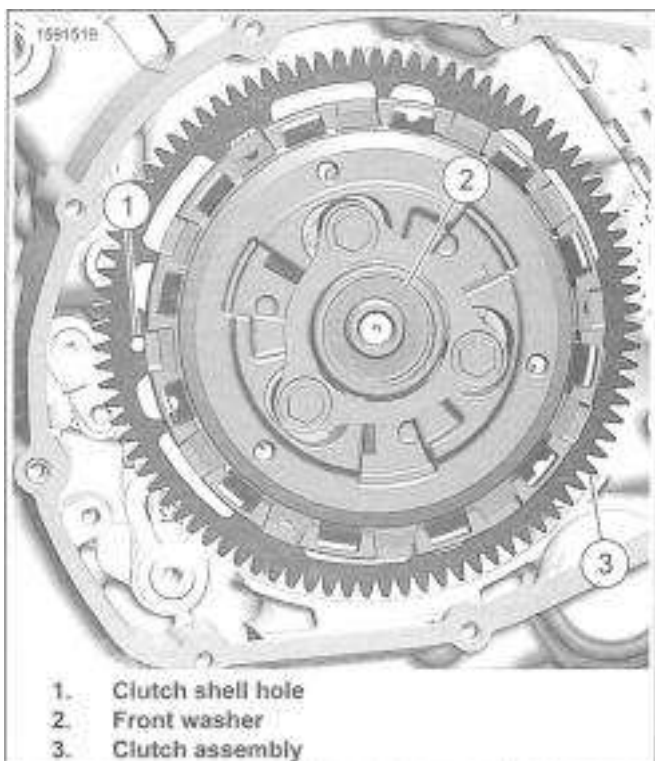


Figure 5-16. Clutch Removal

INSTALL

FASTENER	TORQUE VALUE	
Clutch nut	125-140 ft-lbs	170-190 N-m

1. See Figure 5-17. Install big washer on input shaft.
2. See Figure 5-18. Apply engine oil to needle bearings (1) and inner bushing (2).
3. Install into clutch basket (3).
4. See Figure 5-19. Keep inner bushing and bearing assembly together, install clutch basket and bearings onto input shaft (2).
5. Using suitable awl or screwdriver apply pressure to the spring through clutch shell hole (1) and align teeth (3).
6. Slide assembly onto shaft aligning teeth with crankshaft gear.

NOTE

Verify clutch scissor gear is flush with crankshaft gear.

7. See Figure 5-20. With paint mark facing out, install washer (1).
8. Install new nut (2) using 12 point 24mm socket. Tighten.
Torque: 125-140 ft-lbs (170-190 N-m) *Clutch nut*
9. See Figure 5-21. Install release rod assembly and bearing (1).
10. With paint mark or beveled side out, install snap ring (2).

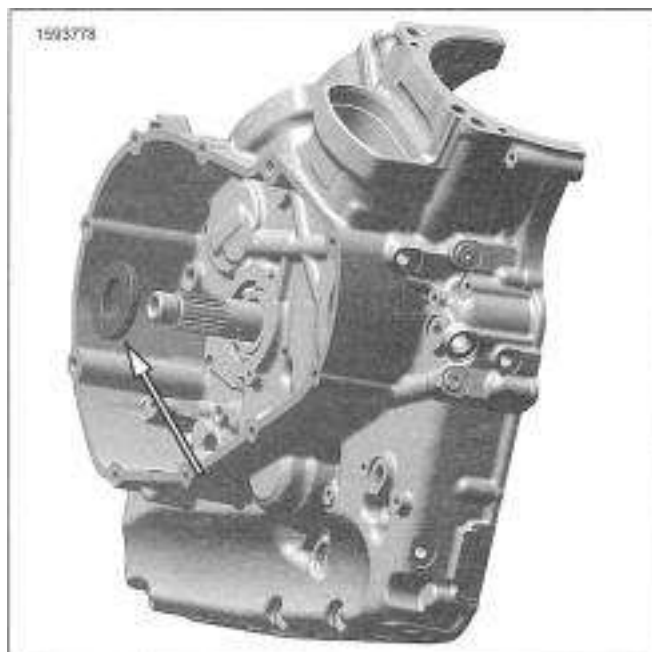
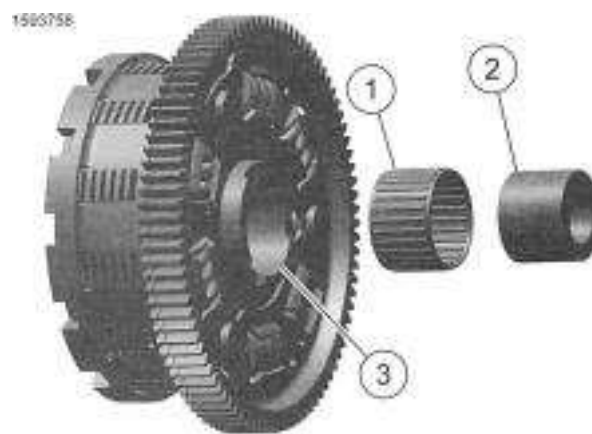
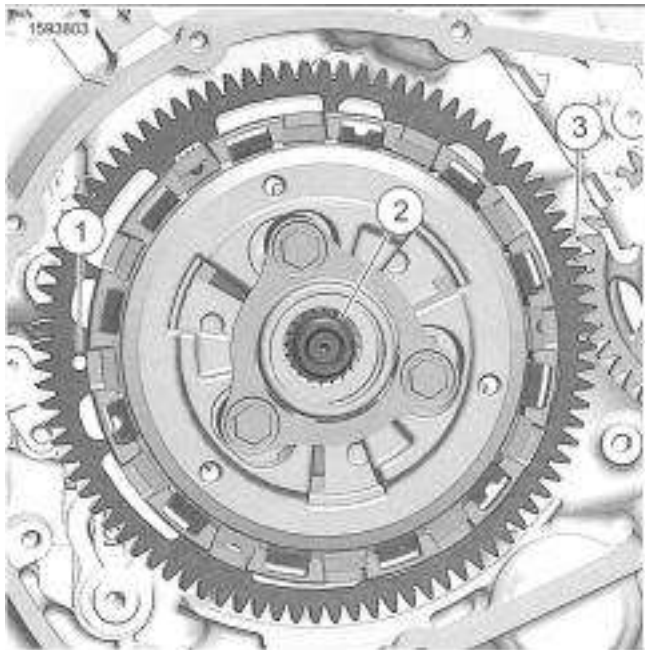


Figure 5-17. Install Washer



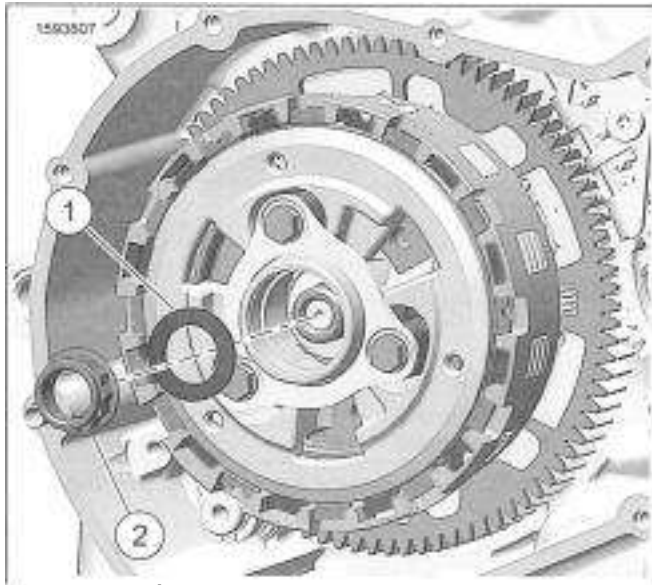
1. Needle bearings
2. Inner bushing
3. Clutch basket

Figure 5-18. Clutch Basket Bushing and Bearings



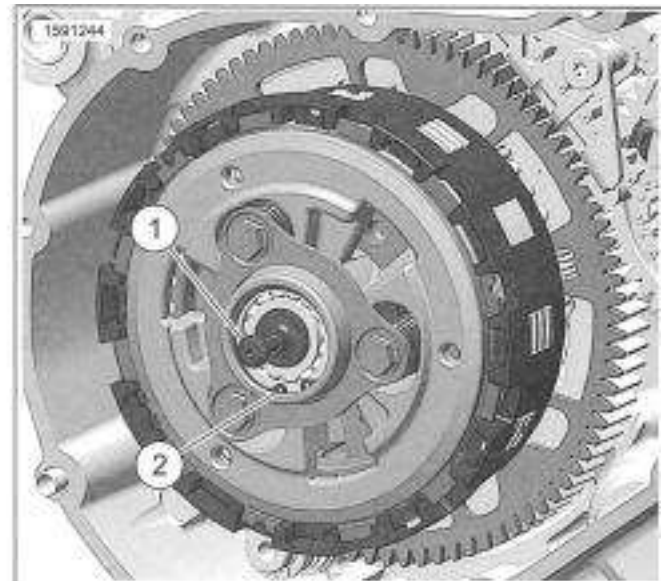
1. Clutch shell hole
2. Input shaft
3. Gear teeth

Figure 5-19. Install Clutch Assembly



1. Washer
2. Nut

Figure 5-20. Clutch Washer and Nut

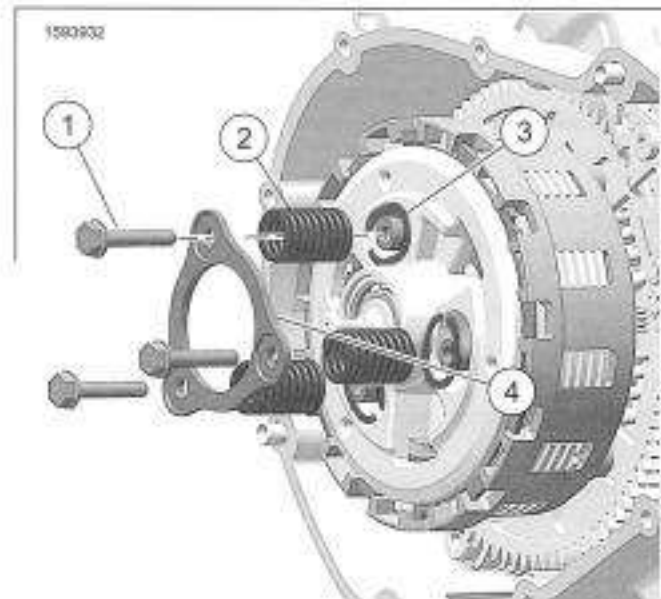


1. Release rod assembly
2. Snap ring

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).



1. Bolt (3)
2. Spring (3)
3. Spring seat (3)
4. Spring plate

Figure 5-22. Spring Plate

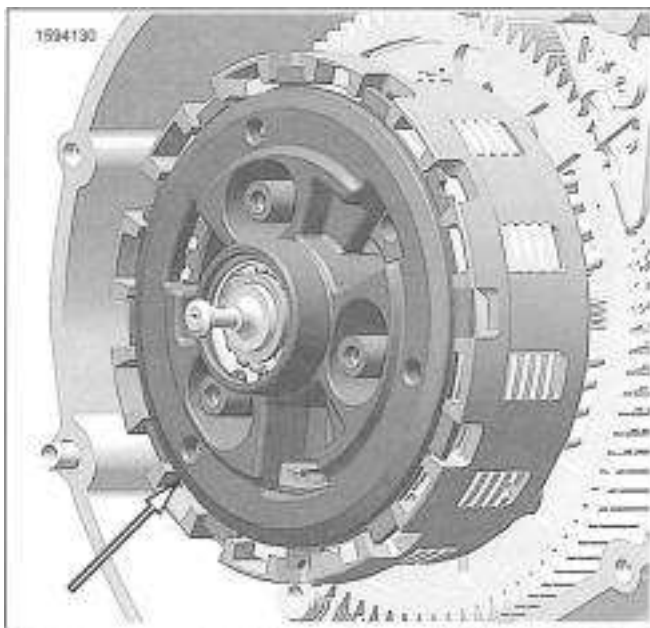


Figure 5-23. Pressure Plate

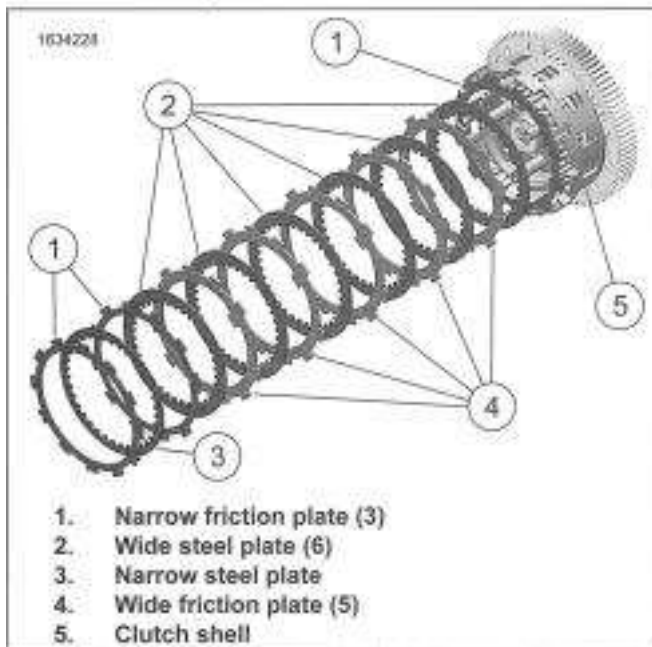


Figure 5-24. Clutch Plates

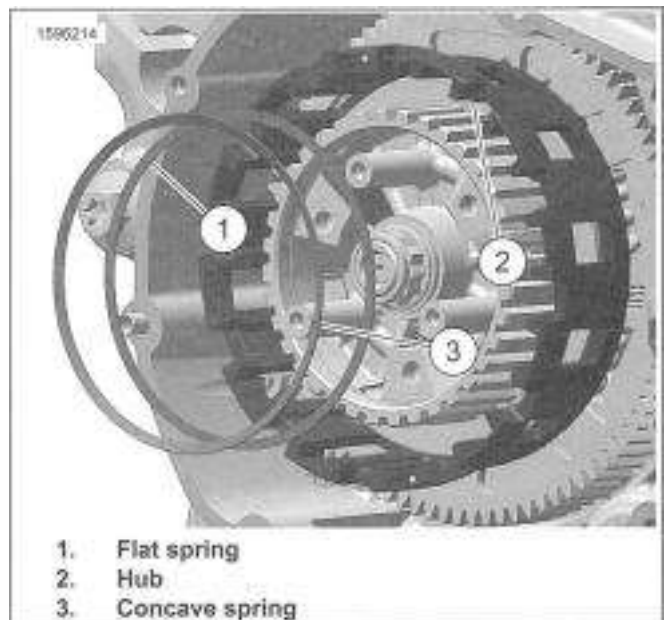


Figure 5-25. Judder Springs
CLEAN AND INSPECT

A 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 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).

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

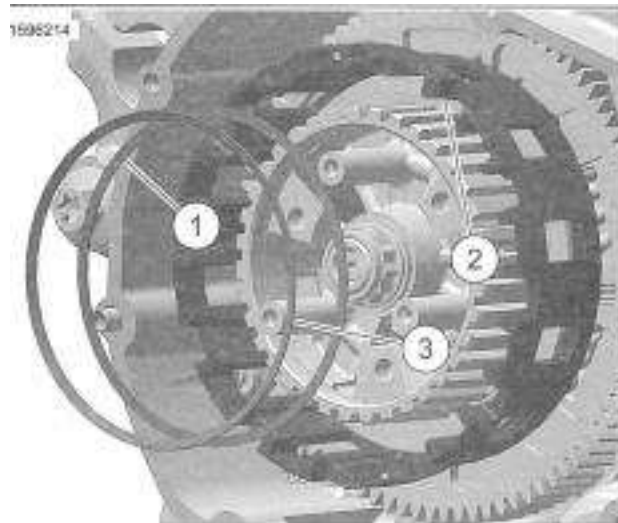
1. Submerge and soak all friction plates in primary chaincase lubricant for at least five minutes.
2. See Figure 5-26. Install judder springs.
 - a. Install flat spring (1).
 - b. Install concave spring (3) (cupped side out).
3. See Figure 5-27 and See Figure 5-28.. Install narrow friction plate.
 - 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*



1. Flat spring
 2. Hub
 3. Concave spring
Figure 5-26. Judder Springs

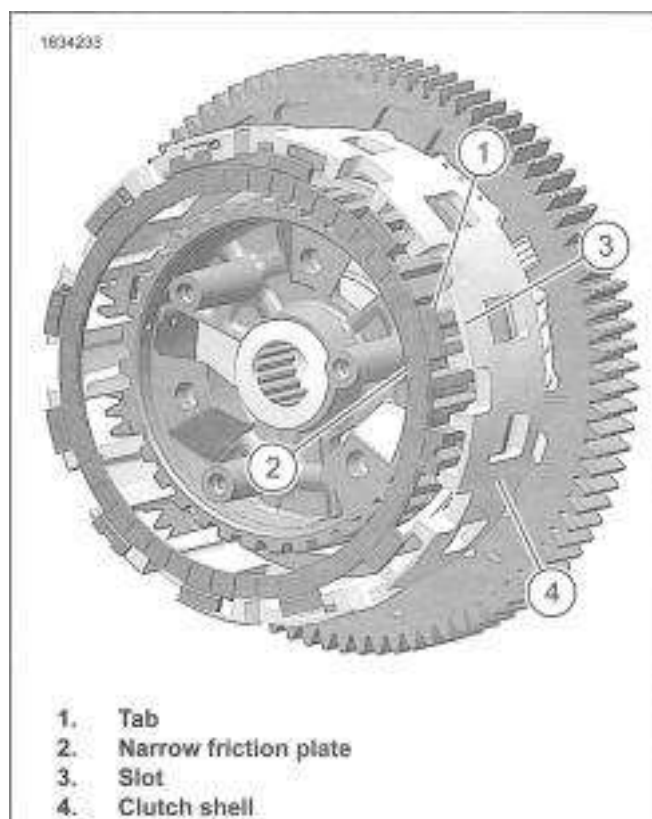
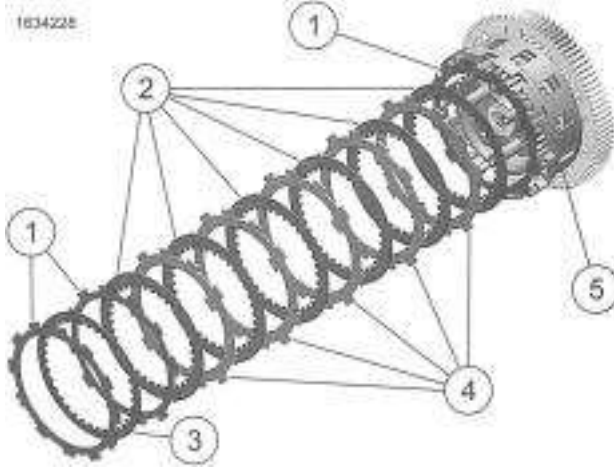


Figure 5-27. Friction Plate and Clutch Shell Alignment



1. Narrow friction plate (3)

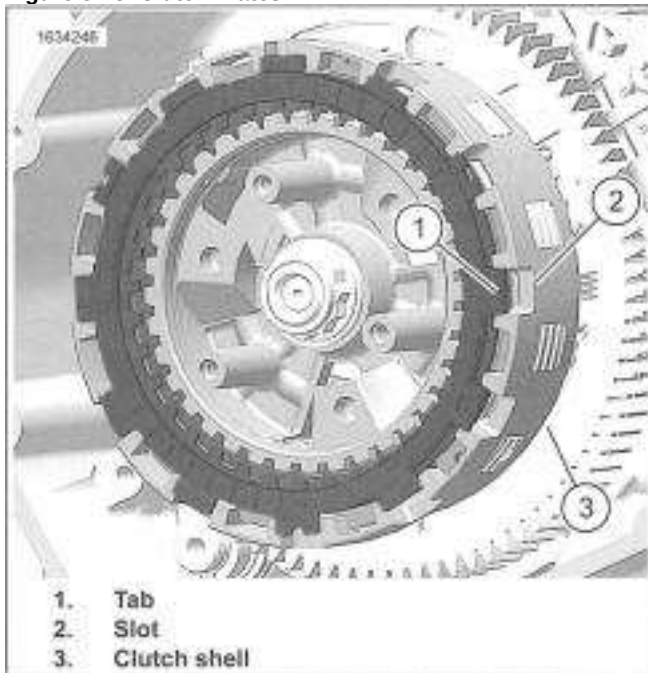
2. Wide steel plate (6)

3. Narrow steel plate

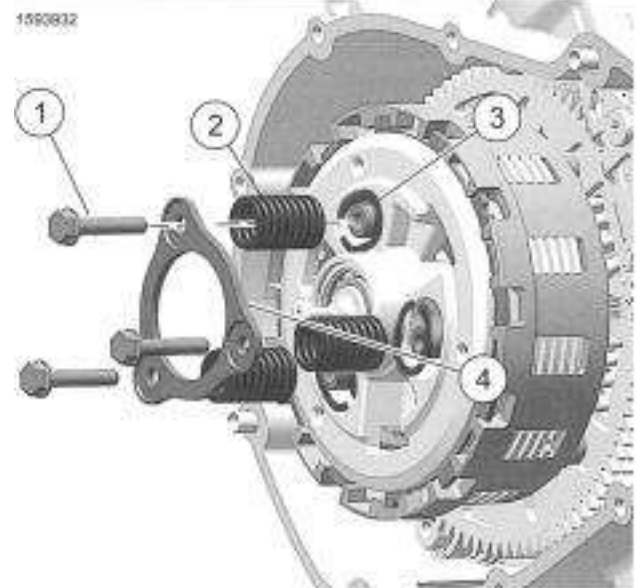
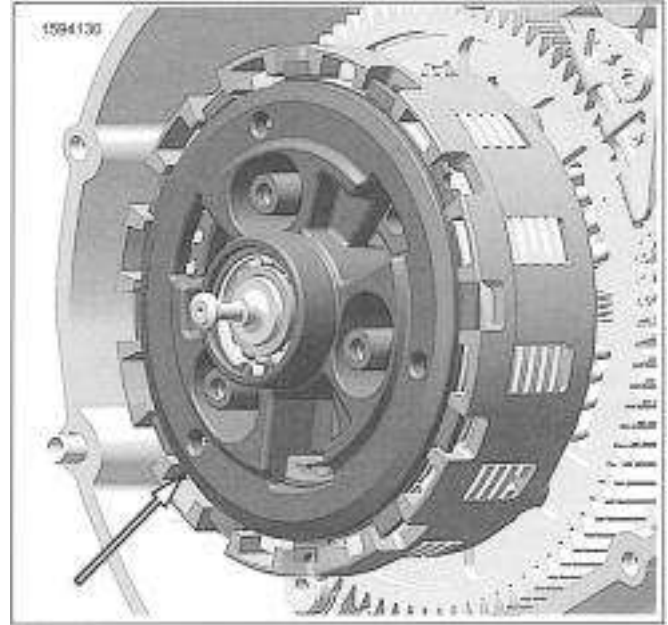
4. Wide friction plate (5)

5. Clutch shell

Figure 5-28. Clutch Plates



1. Tab
2. Slot
3. Clutch shell



1. Bolt (3)
2. Spring (3)
3. Spring seat (3)
4. Spring 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 4-49).
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 4-60).
4. Separate crankcase halves. See CRANKCASE (Page 4-66).

REMOVE

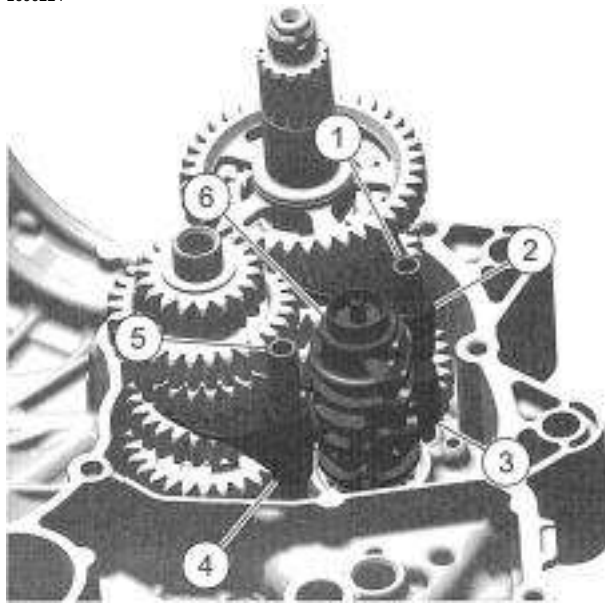
1. See Figure 5-32. Remove shift forks.
 - a. Remove shift fork shaft (5) and 5th/6th gear shift fork (4).
 - b. Remove shift fork shaft (1) and 1st/4th gear shift fork (2).
 - c. Remove 2nd/3rd gear shift fork (3).
 - d. Remove drum shifter cam assembly (6).

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).

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1. Shift fork shaft
2. 1st/4th gear shift fork
3. 2nd/3rd gear shift fork
4. 5th/6th gear shift fork
5. Shift fork shaft
6. Drum shifter cam assembly

Figure 5-32. Shift Forks

COMPLETE

1. Assemble crankcase halves. See CRANKCASE (Page 4-66).
2. Install engine. See REPLACE ENGINE (Page 4-60).
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 4-60).
4. Separate crankcase halves. See CRANKCASE (Page 4-66).
5. Remove drum and forks. See DRUM AND FORKS (Page 5-19).

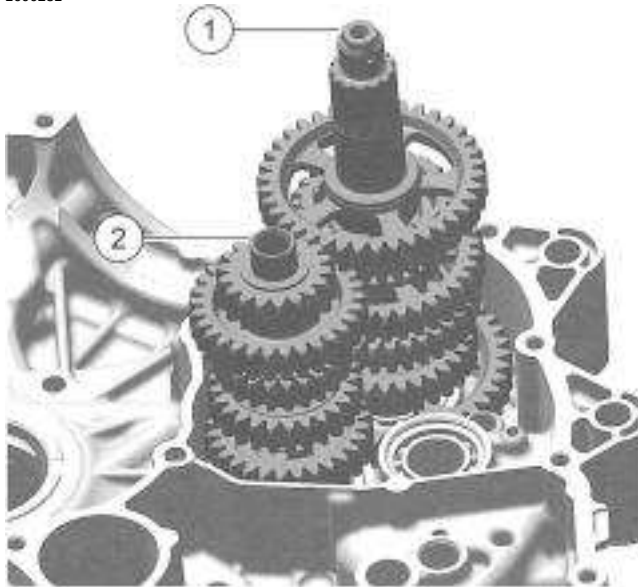
REMOVE

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.

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1. Input shaft assembly
2. Output shaft assembly

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.

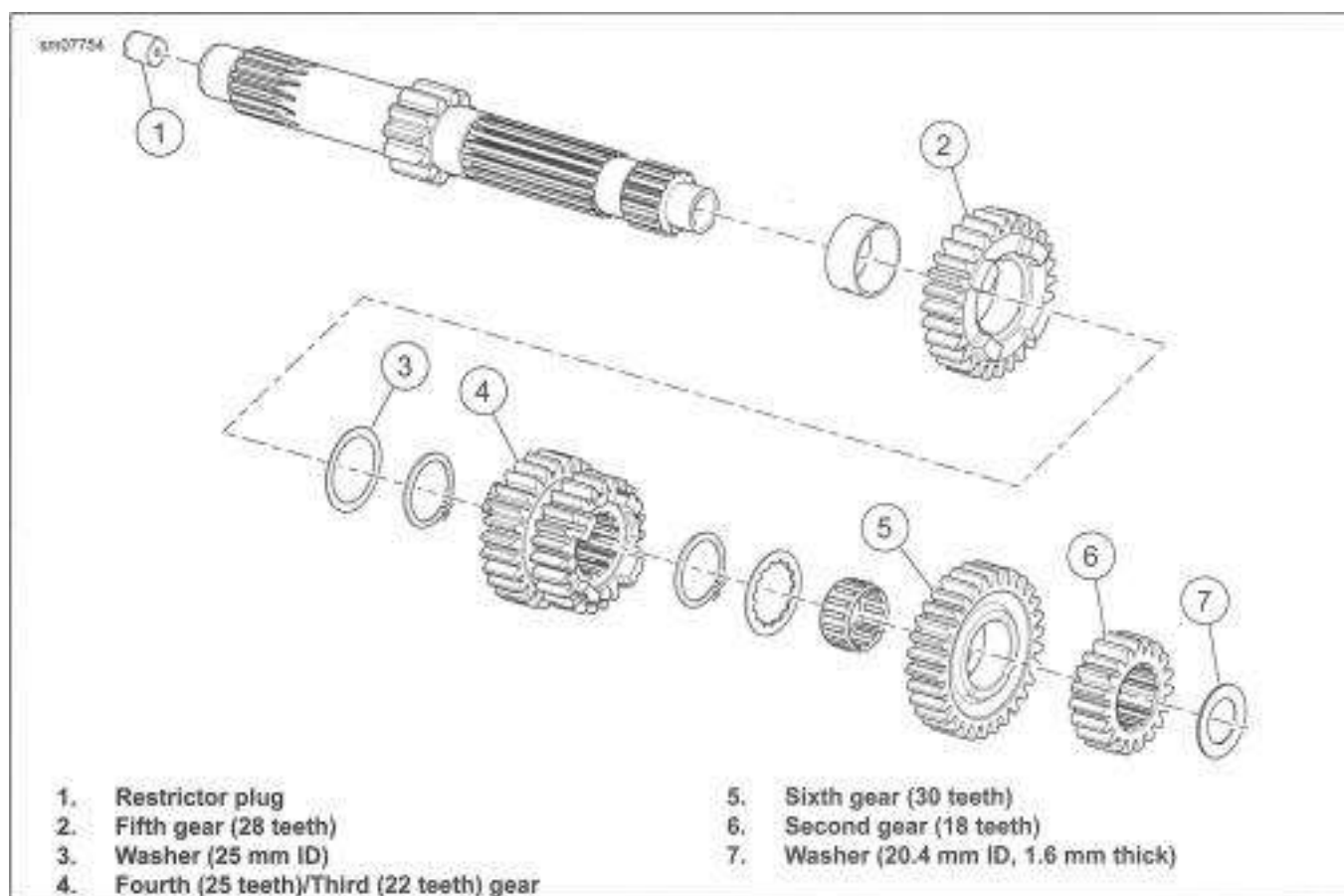
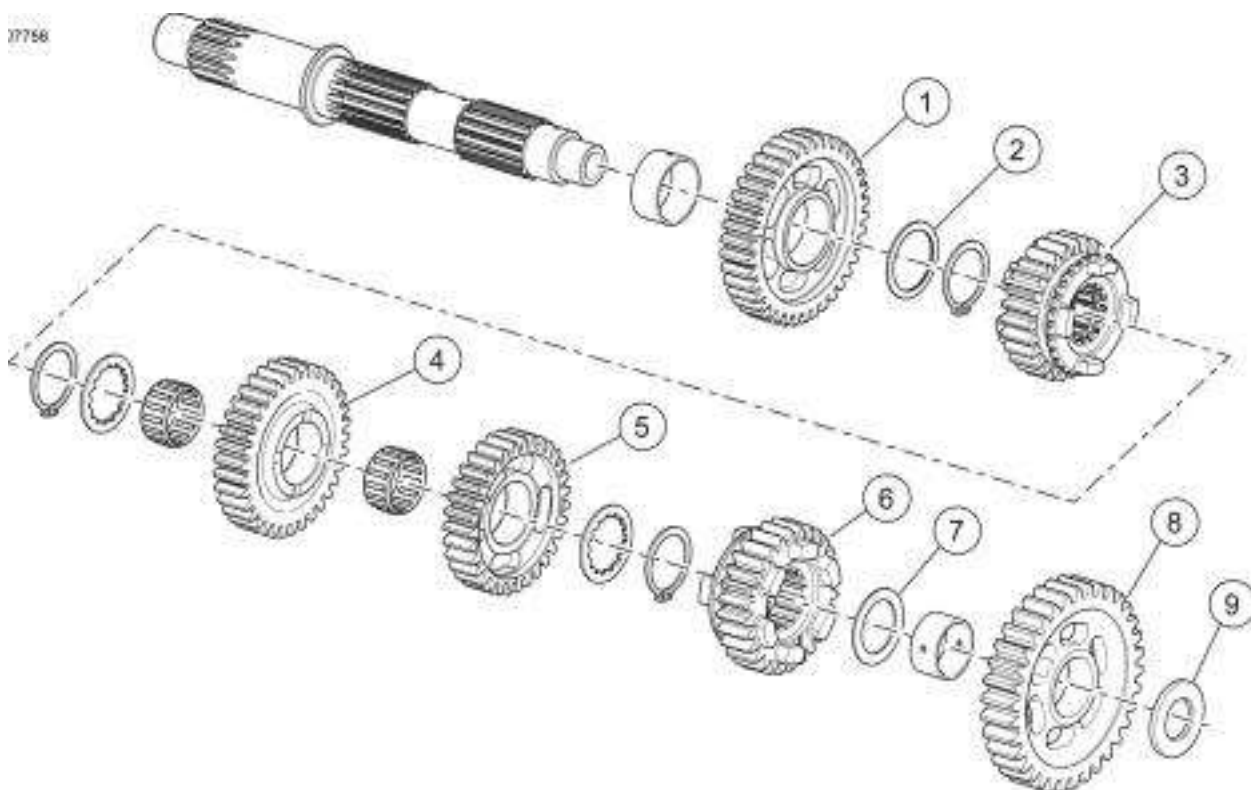


Figure 5-34. Input Shaft



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

2. Assemble crankcase halves. See CRANKCASE (Page 4-66).

COMPLETE

1. Install drum and forks. See DRUM AND FORKS (Page 5-19).
3. Install engine. See REPLACE ENGINE (Page 4-60).
4. Install main fuse. See POWER DISCONNECT (Page 8-4).

GENERAL

See CRANKCASE (Page 4-66) for transmission right crankcase bearing removal and installation.

GENERAL

See CRANKCASE (Page 4-66) for transmission left crankcase bearing removal and installation.

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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	2.5-27 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	13-14 ft-lbs	17.5-19.5 N-m	6.24 HEATED OXYGEN SENSORS (H02S), install
Oxygen sensor, heated	13-14 ft-lbs	17.5-19.5 N-m	6.24 HEATED OXYGEN SENSORS (H02S), Install
TGS screws	4 in-lbs	0.4 N-m	6.18 TWIST GRIP SENSOR (TGS), Install

Table 6-1. Fuel System Specifications

FUEL SYSTEM	TYPE
Recommended fuel	91 Octane

SPECIFICATIONS

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**NOTE**

Clean with a mixture of 50 percent isopropyl alcohol and 50

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

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. Verify inserts (14) are present in the eight mounting holes.

- c. See Figure 6-3. Install air box breather tube (1) to front cylinder head breather bolt.
- d. See Figure 6-4. Pland start screws (1-8) in sequence shown.
- e. 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*
- f. 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*
- g. Install air filter (9) and clamp (10).
- h. Tighten clamp.
Torque: 22-24 **in-lbs** (2.5-2.7 N-m) *Air fitter 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).

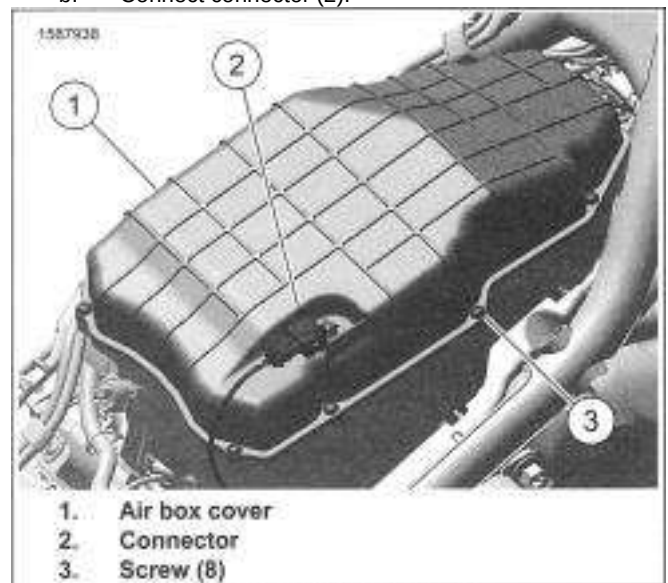
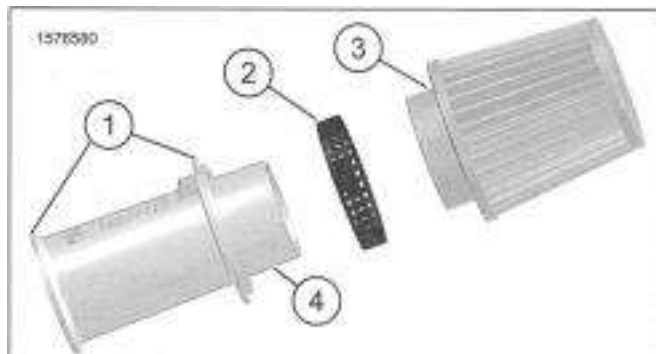
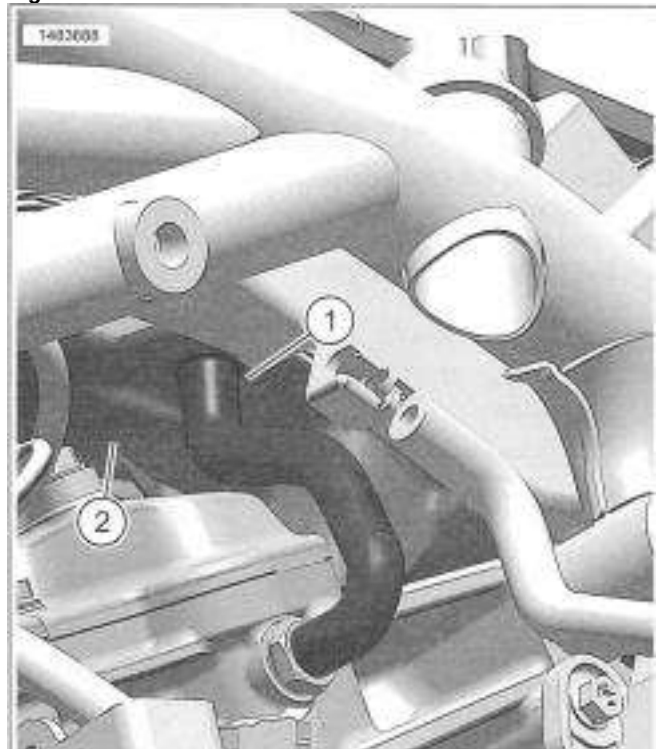


Figure 6-1. Air Box Cover



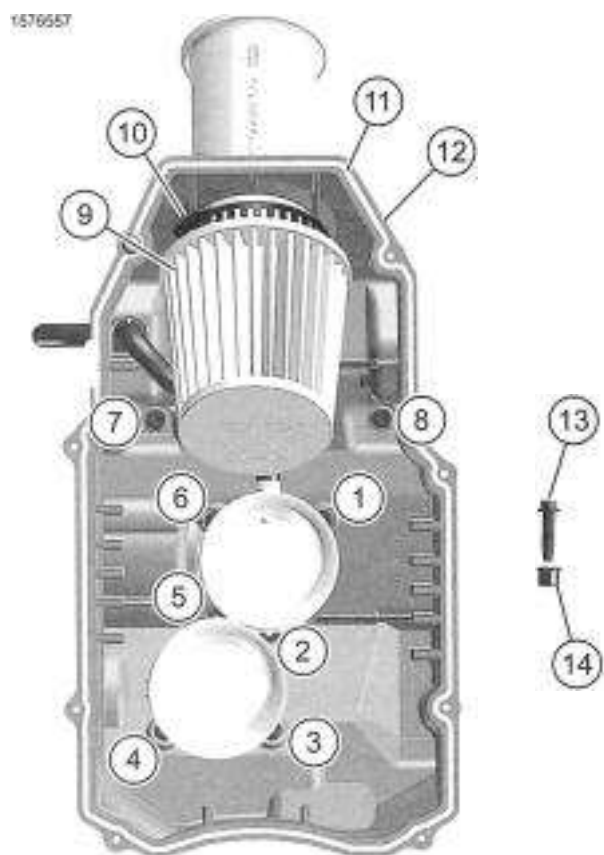
1. Sealing surface
2. Clamp
3. Air filter
4. Snorkel

Figure 6-2. Air Box Snorkel



1. Air box breather tube
2. Air box base

Figure 6-3. Air Box Breather Tube



1. Screw (torque 1st)
2. Screw (torque 2nd)
3. Screw (torque 3rd)
4. Screw (torque 4th)
5. Screw (torque 5th)
6. Screw (torque 6th)
7. Screw (torque 7th)
8. Screw (torque 8th)
9. Air filter
10. Clamp
11. Gasket
12. Air box base
13. Screw (8)
14. Insert (8)

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)

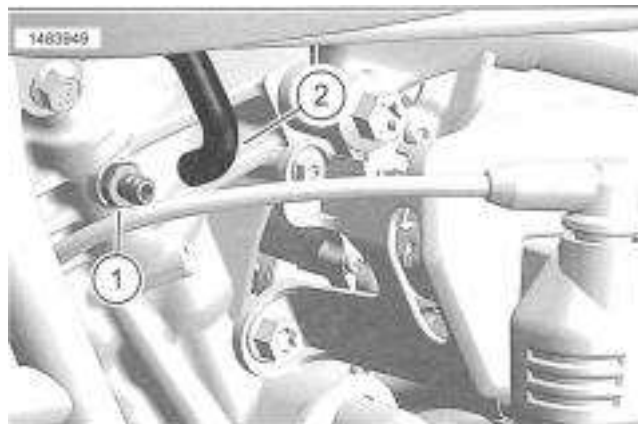
REMOVE

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.

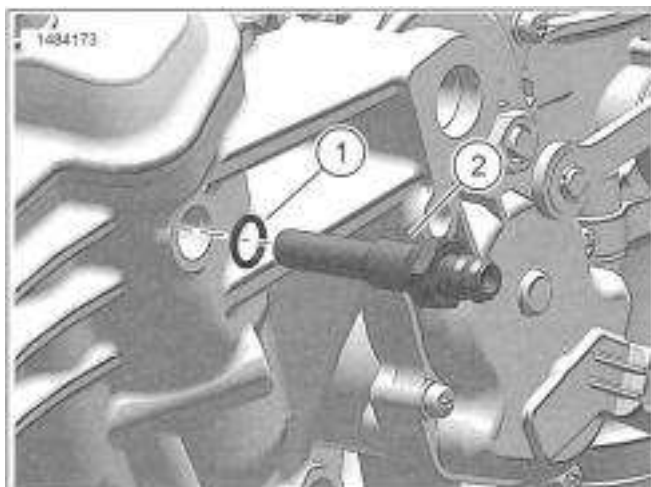
INSTALL

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).



1. Breather bolt
2. Breather tube
Figure 6-5. Breather Tube



1. O-ring
2. Breather bolt
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 2-35).

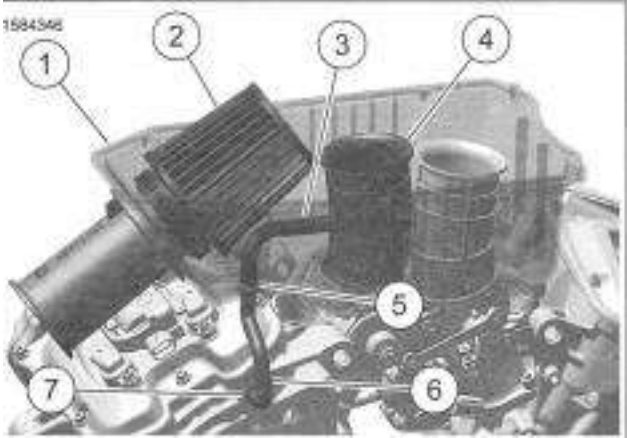
REMOVE

- 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.



- 1. Air box
- 2. Air filter element
- 3. Breather hose upper end
- 4. Front velocity stack
- 5. Press-in breather hose fitting
- 6. Breather hose lower end
- 7. Front cylinder head breather hose fitting

1. In
stall
air
filter
eleme
nt.
See
INSPE
CT
AIR

Figure 6-7. Breather Hose Assembly
COMPLETE

FILTER (Page 2-35).

- 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

INSTALL

- 1. See Figure 6-8. Remove screws (1).
- 2. Lift and remove console (2).

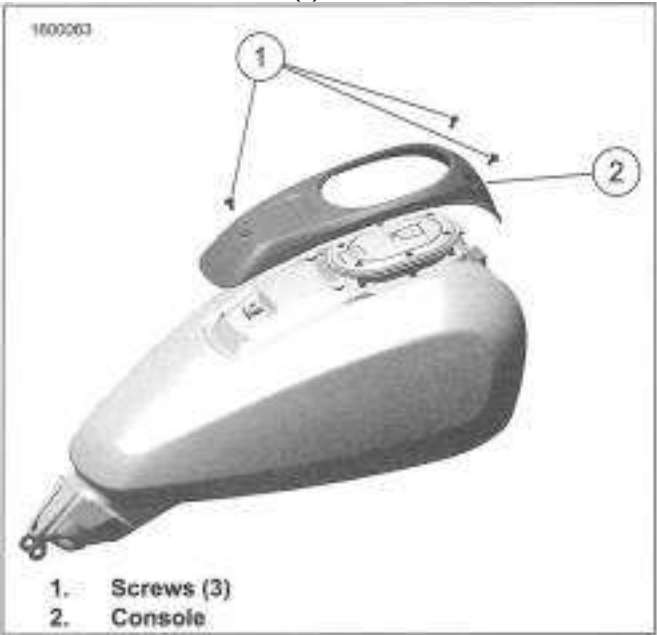


Figure 6-8. Console

FASTENER
Console screws
1. Install console (2).
2. Install screws (1). Tighten.
Torque: 27-35 in-lbs

PREPARE

7.

A 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)

A 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

1. See Figure 6-9. Attach fuel pressure gauge adapter (5) to

PART NUMBER	TOOL NAME
HD-41182	FUEL PRESSURE GAUGE
HD-44061	FUEL PRESSURE GAUGE ADAPTER

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.

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.

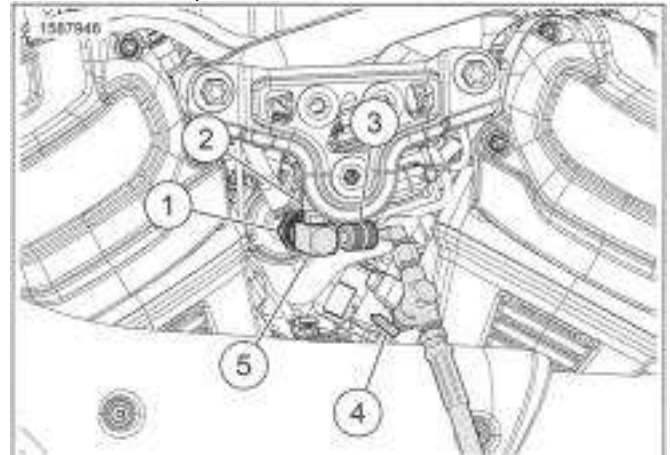


Figure 6-9. Fuel Pressure Test Fittings

COMPLETE

1. Fuel rail quick disconnect fitting
2. Fuel pressure gauge adapter quick to fuel line disconnect fitting
3. Valve union
4. Fuel valve (closed position)
5. Fuel pressure gauge adapter

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

1. Toggle the fuel pump off.

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Special Tool: DIGITAL TECHNICIAN II (HD-48650)

2. Start engine.
3. Run until it stops.
4. Crank engine for 5 seconds.

A 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)

A 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

Remove DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

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**A WARNING****INSTALL**

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)

A 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).

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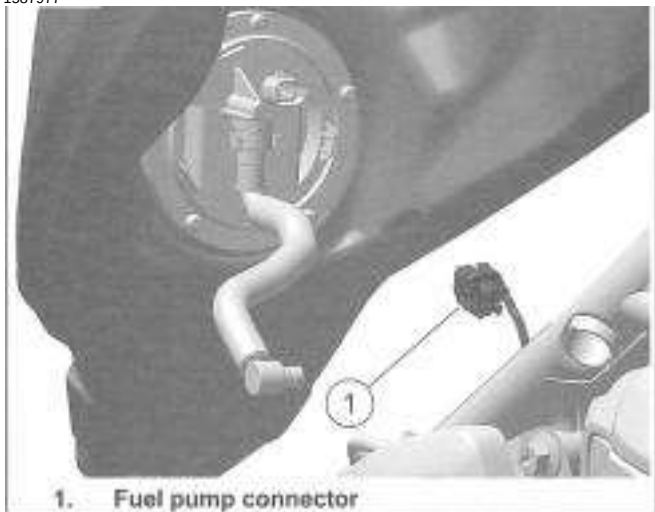
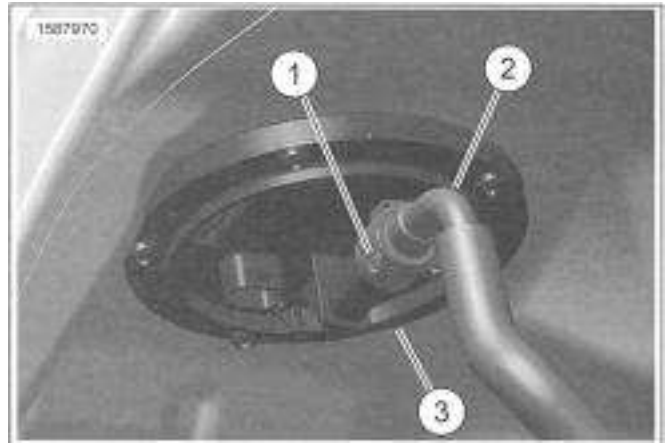


Figure 6-10. Fuel Pump Connector

1. See See Figure 6-11.. Install fuel line,



1. Lock
2. Fuel line
3. Fuel pump

Figure 6-11. Lower 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).

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).

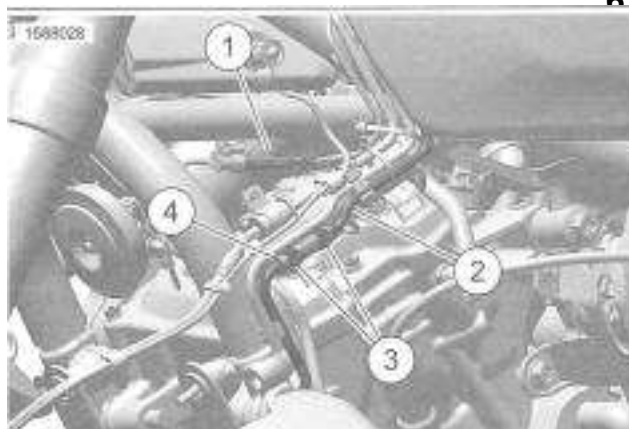
INSTALL

1. See Figure 6-13. Connect fuel level sensor (6) to fuel inlet

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).
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



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

A 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

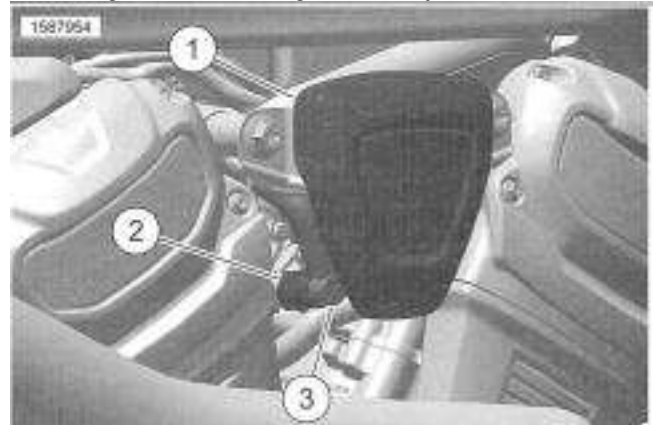
FASTENER	TORQUE VALUE	
Fuel tank mounting bracket bolt	18-21 ft-lbs	25-29 N-m
Fuel tank mounting screws	89-102 in-lbs	10-11.5 N-m

1. Install fuel tank.
2. See Figure 6-14. Connect fuel line at fuel rail.
3. See Figure 6-18. Connect fuel pump connector (1).

4. Route fuel line down to fuel rail.
5. Install bolt (2).

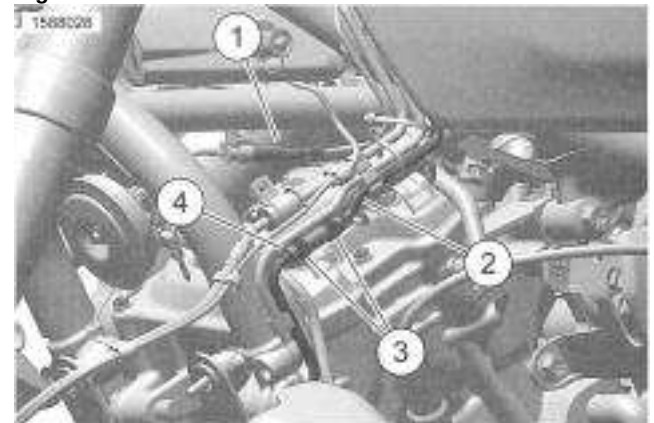
Torque: 18-21 ft-lbs (25-29 N-m) *Fuel tank mounting bracket bolt*
6. See Figure 6-17. Install Screws (1). Tighten.

Torque: 89-102 **in-lbs** (10-11.5 N-m) *Fuel tank mounting screws*
7. See Figure 6-18. Connect fuel level sender connector (1).
8. Install clamp on hose (4).
9. Connect vapor vent tube (2) into hose.
10. Secure hose clamp (3).
11. See Figure 6-14. Install right side valley cover.



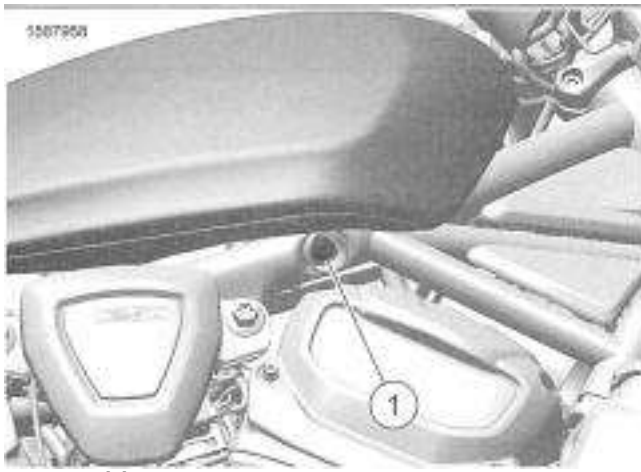
1. Right side valley cover
2. Quick disconnect sleeve
3. Fuel line

Figure 6-14. Fuel Line to Fuel Rail Connection



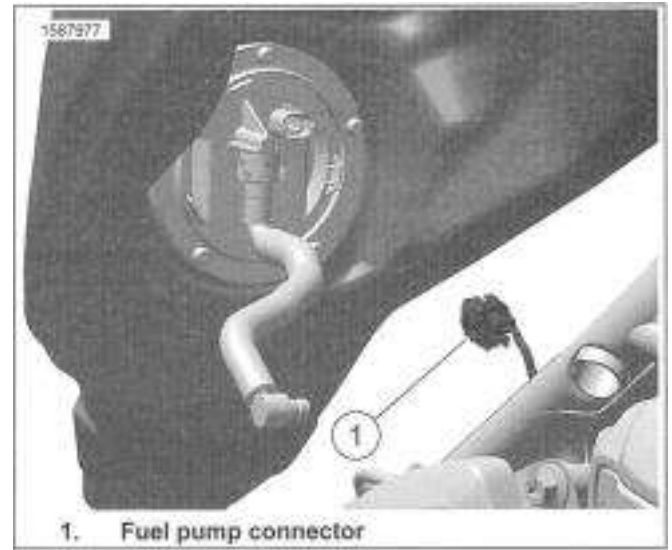
1. Fuel level sender connector
2. Vent tube
3. Clamp (2)
4. Middle connection hose

Figure 6-15. Fuel Level Sender Connector



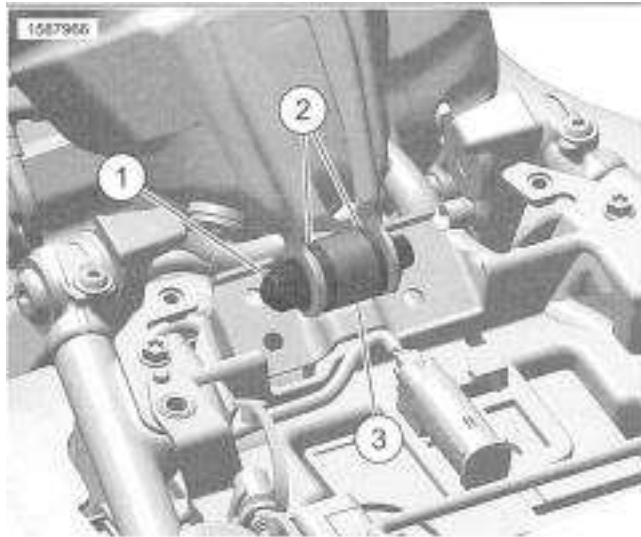
1. Screw (2)

Figure 6-16. Fuel Tank Mount Screws (Right side shown, left side same)



1. Fuel pump connector

Figure 6-18. Fuel Pump Connector



1. Fuel tank mounting bracket bolt
2. Fuel tank mounting bracket bushing assembly
3. Fuel tank mounting bracket

Figure 6-17. Fuel Tank Mounting Bracket

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.

FUEL LEVEL SENDER

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

A 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

1. See Figure 6-20. With the finger on the fuel level sender

FASTENER	TORQUE VALUE	
Fuel cap screws	25-29 in-lbs	2.8-3.3 N-m

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.

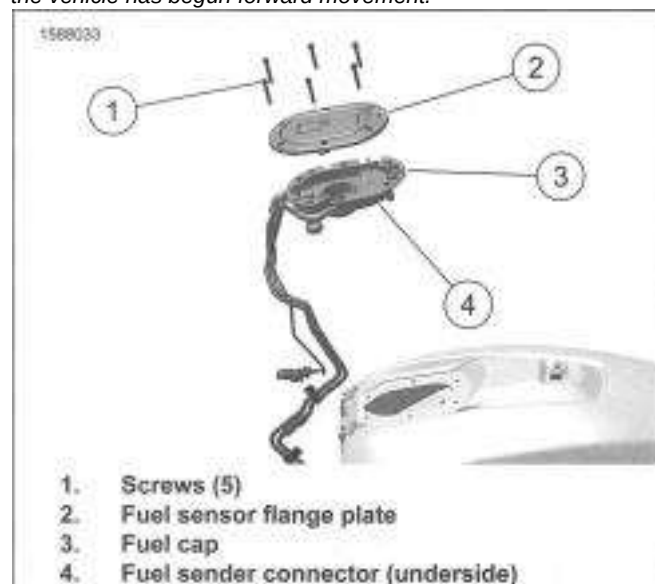


Figure 6-19. Fuel Inlet and Sensor Flange Plate



1. Finger (fuel level sender bracket)
2. Catches (top of tunnel)

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).

A 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)

A 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).

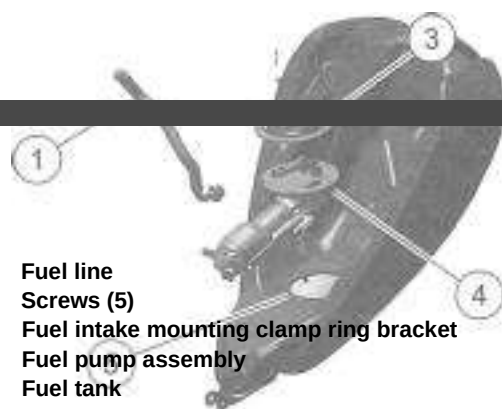
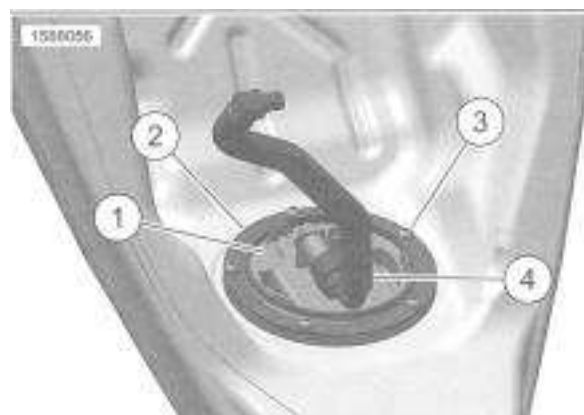


Figure 6-21. Fuel Pump Assembly (Fuel Pump Bracket)

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 Nm) *Fuel pump assembly screw*
 - d. Connect fuel line.



1. Fuel pump assembly
2. Fuel intake mounting clamp ring bracket
3. Screws (5)
4. 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.

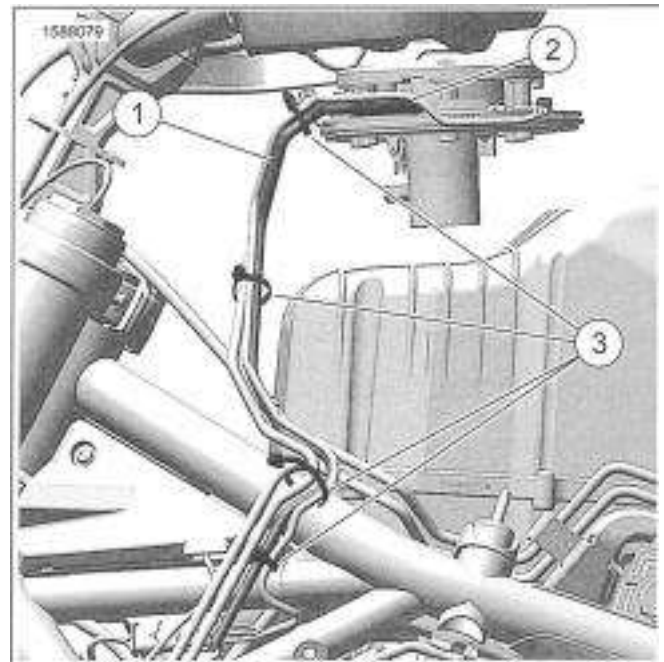


Figure 6-23. Drain Line

COMPLETE

1. Drain line
2. Hose
3. Cable strap (4)

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).

A 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)

A 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).

See Figure 6-24. Install IAT sensor (2) into air box top (1).

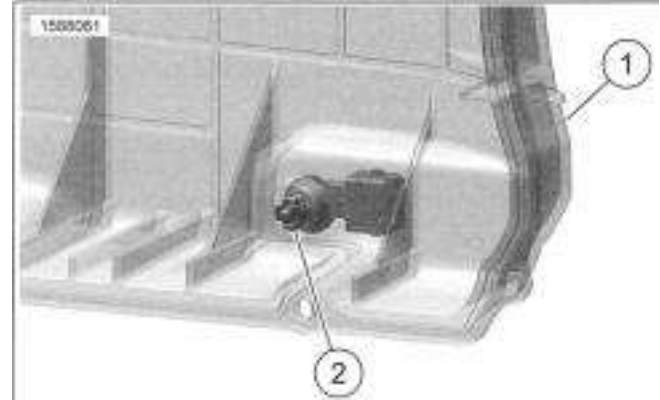


Figure 6-24. IAT Sensor

1. Air box top
2. 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**A 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)

A 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).

- a. Remove screw (2).
- b. Remove MAP sensor (1).

INSTALL**Rear MAP Sensor**

1. See Figure 6-25. Install MAP sensor.
 - a. Install MAP sensor (1).

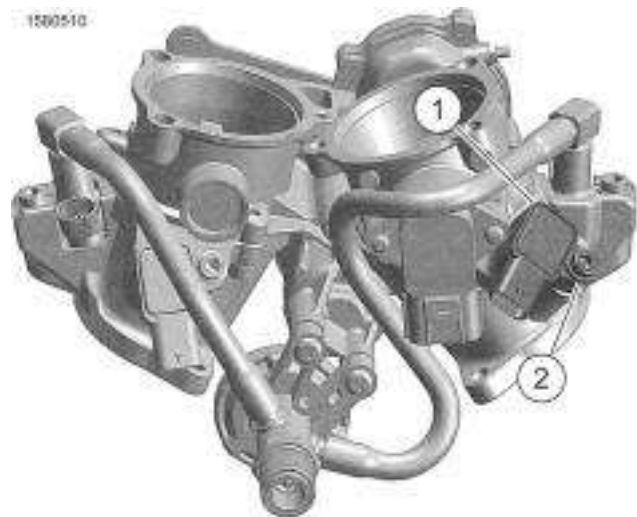


Figure 6-26. Front MAP Sensor

FASTENER	TORQUE VALUE	
MAP sensor screw	80-97 in-lbs	9-11 N-m

2. Remove MAP sensor.
 - a. Remove screw (2).
 - b. Remove MAP sensor (1).

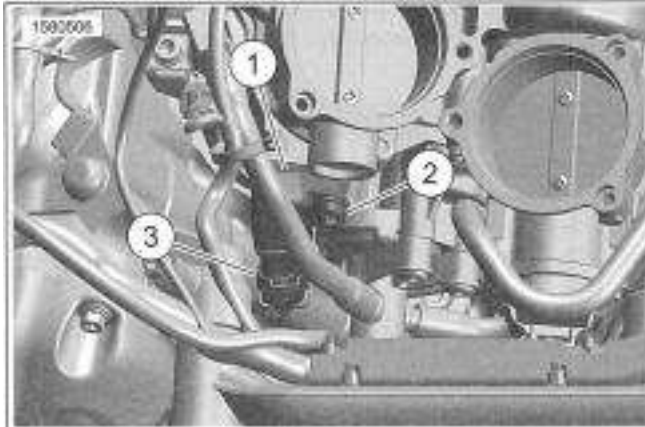
Front MAP Sensor

1. See Figure 6-26. Remove MAP sensor.

- b. Install screw (2). Tighten.

Torque: 80-97 **in-lbs** (9-11 N-m) *MAP sensor screw*

2. Connect MAP sensor connector (3).



1. Rear MAP sensor
2. Screw
3. MAP sensor connector

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*

1. Front MAP sensor
2. Screw

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.

5. Install main fuse. See POWER (Page 8-4). DISCONNECT
Connect fuel line. See FUEL LINE (Page 6-10).

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 Nm) TGS screws



- 1. Screw (2)
- 2. TGS
- 3. RHCM

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

A 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)

A 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.

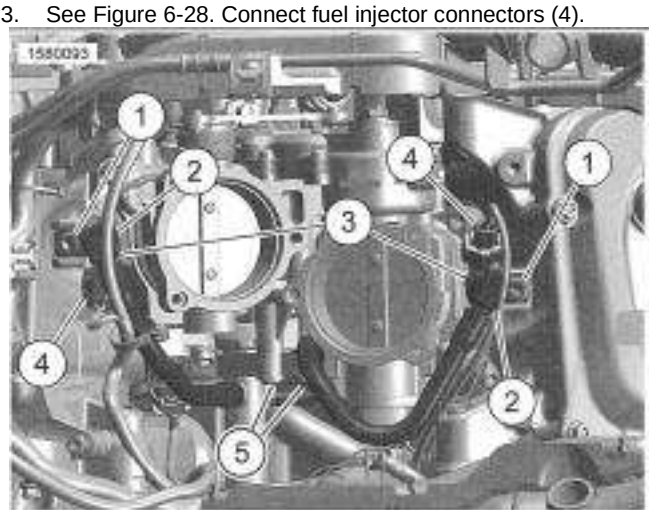
- c. Remove fuel rail (2).
 - d. Remove fuel injectors (3).
- 3. See Figure 6-29. Discard o-rings (2, 4).

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

- 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).

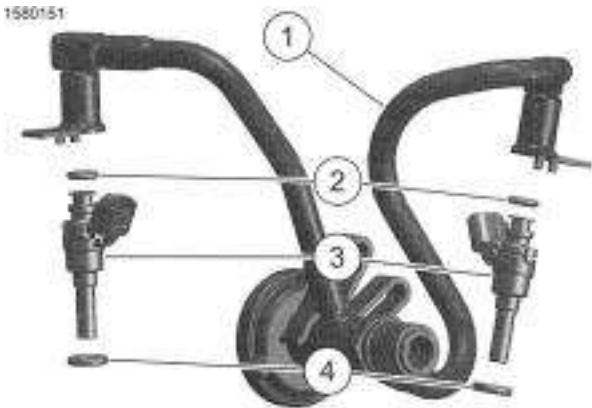
- c. Install screws (1). Tighten.
Torque: 80-97 in-lbs (9-11 N-m) Fuel rail screws
 - d. Install fuel regulator screws (5), Tighten.
Torque: 80-97 in-lbs (9-11 N-m) Fuel regulator screw



- 1. Screw (2)
- 2. Fuel rail (2)
- 3. Fuel injector (2)
- 4. Injector connector (2)
- 5. Fuel regulator screw (2)

Figure 6-28. Fuel Rail and Injector Connectors

- 1. Fuel rail
- 2. Injector to fuel rail o-rings (2)



- 3. Injectors (2)
- 4. Injector to intake manifold o-rings (2)

Figure 6-29. Fuel Injectors

COMPLETE

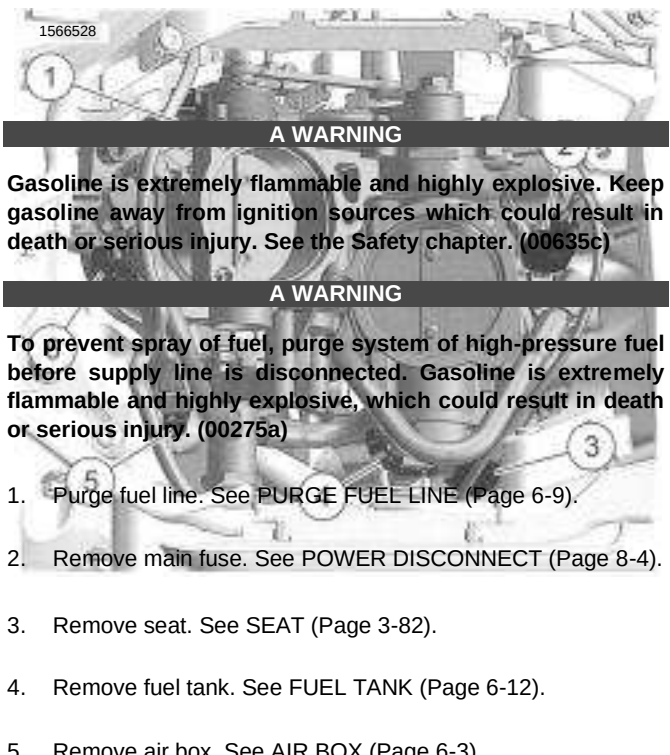
- 1. See Figure 6-28. Install fuel injectors (3).
- 2. Install fuel tank. See FUEL TANK (Page 6-12).
- 3. Install seat. See SEAT (Page 3-82).

4. Connect fuel line. See FUEL LINE (Page 6-10).
5. Connect fuel line. See FUEL LINE (Page 6-10).

INDUCTION MODULE

6.21

PREPARE



A 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)

A 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 6-31. 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).

1.
2.
3.
4.
5.
6.

Figure 6-30



1.
2.



Screws

INDUCTION MODULE

6.21

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

A 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)

A 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).

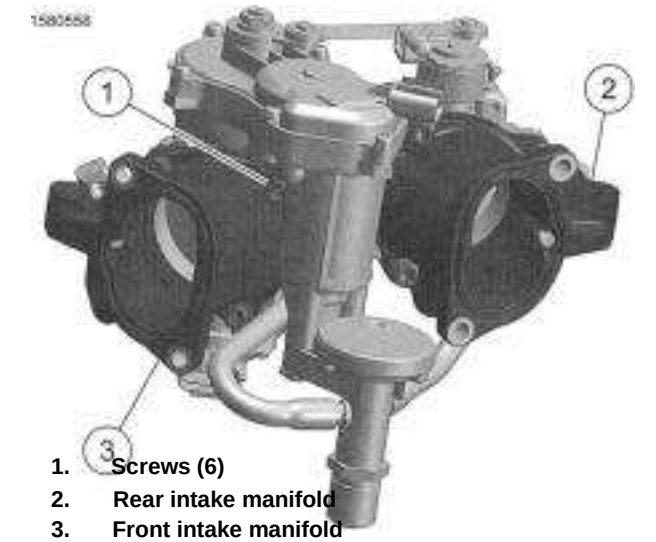
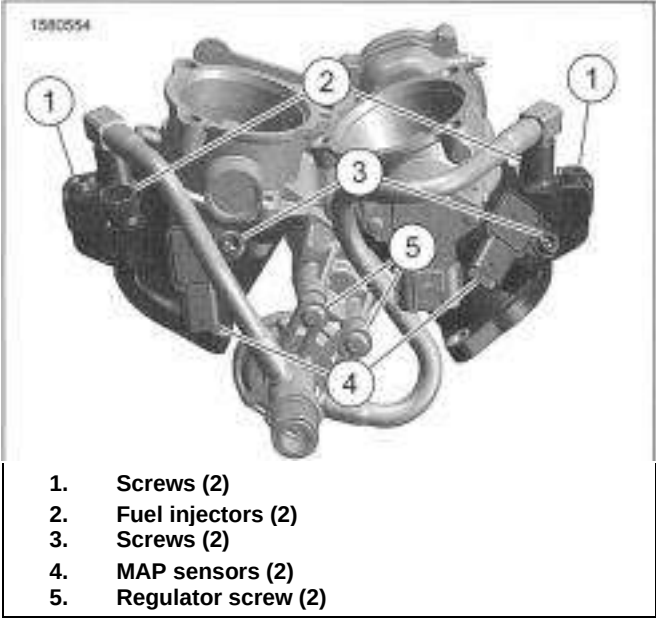
INSTALL

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) 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*



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).

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT
A WARNING	

Do not allow open flame or sparks near propane. Propane is extremely flammable, which could cause death or serious injury. (00521b)

A 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

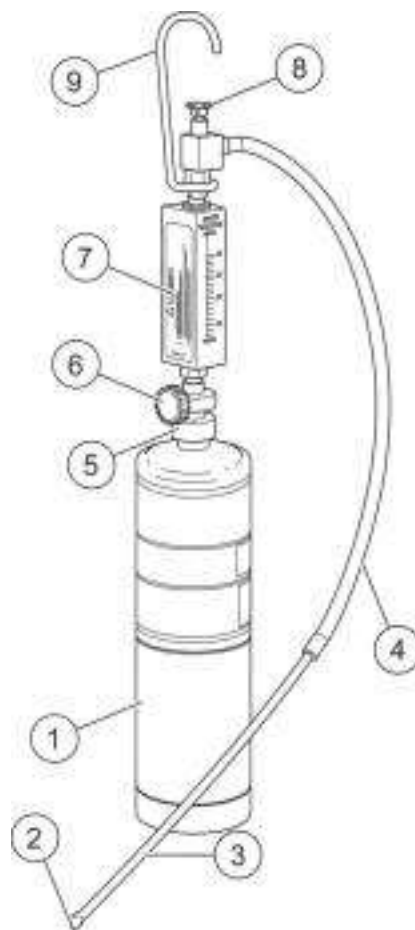
Propane injected into air cleaner causes false readings. Keep air cleaner cover installed.

1. Run motorcycle until engine is at normal operating temperature.
2. Aim nozzle toward possible sources of leak.

NOTE

3. Press and release trigger button to dispense propane
4. Repeat as necessary to detect leak.

5. When test is finished, close valve. The tone of the engine changes when propane enters source of leak.



INTAKE LEAK TEST

6.23

1. Propane bottle
2. Nozzle
3. Copper tube
4. Hose
5. Valve assembly
6. Valve knob
7. Flow gauge
8. Trigger button
9. Hanger

Figure 6-34. Leak Tester

PREPARE

1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove outer exhaust shield and heat shield. See MUFLERS (Page 6-33).
3. **Removing header pipe H02S:**
 - a. Remove right side valley cover. See SIDE COVERS (Page 3-46).
4. **Removing post catalyst H02S:**
 - a. Remove seat. See SEAT (Page 3-82).
 - b. Remove cowl and right rear fender. See COWL AND REAR FENDERS (Page 3-68).
4. Installing post catalyst FI02S (if equipped).
5. Install H02S (1) (if equipped). Tighten.
Torque: 13-14 ft-lbs (17.5-19.5 N-m) *Oxygen sensor, heated*
6. See Figure 6-36. Connect post catalyst H02S connector (1) (if equipped).

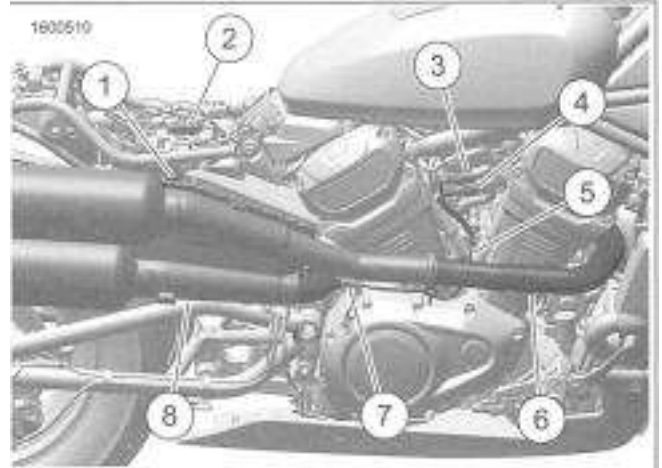


Figure 6-35. Front and Rear H02S Connectors

REMOVE**Header Pipe H02S**

1. See Figure 6-35. Disconnect H02S connectors (3, 4).
2. See Figure 6-35. Remove H02S (5, 7).

Post Catalyst H02S (if equipped)

1. See Figure 6-36. Disconnect post catalyst FI02S connector (2) (if equipped).
2. Remove post catalyst H02S (1) (if equipped).

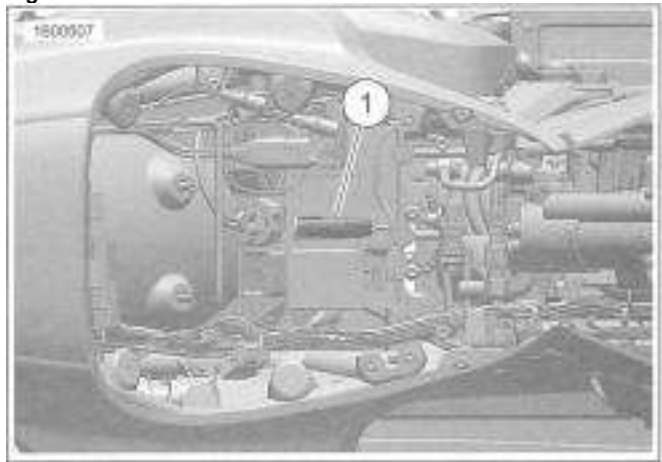


Figure 6-36. Post Catalyst H02S Connector (If Equipped)

INSTALL**NOTE**

FASTENER	TORQUE VALUE	
Oxygen sensor, heated	13-14 ft-lbs	17.5-19.5 N-m

- 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 H02S, 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 H02S, apply a thin coat of ANTI-SEIZE LUBRICANT to each oxygen sensor.

1. Installing front and rear header pipe H02S.
2. See Figure 6-35. Install FI02S (5, 7). Tighten.
Torque: 13-14 ft-lbs (17.5-19.5 N-m) *Oxygen sensor, heated*
3. Connect H02S connectors (3, 4).

COMPLETE

1. **Post catalyst H02S (if equipped):**
 - a. Install cowl and right rear fender. See COWL AND REAR FENDERS (Page 3-68).
 - b. Install seat. See SEAT (Page 3-82).

2. **Header pipe H02S:**

- a. Install right side valley cover. See SIDE COVERS (Page 3-46).
3. Install outer exhaust shield and heat shield. See MUFFLERS (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 rearfender. See COWL AND REAR FENDERS (Page 3-68).
3. Disconnect post H02S (if equipped). See HEATED OXYGEN SENSORS (H02S) (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*

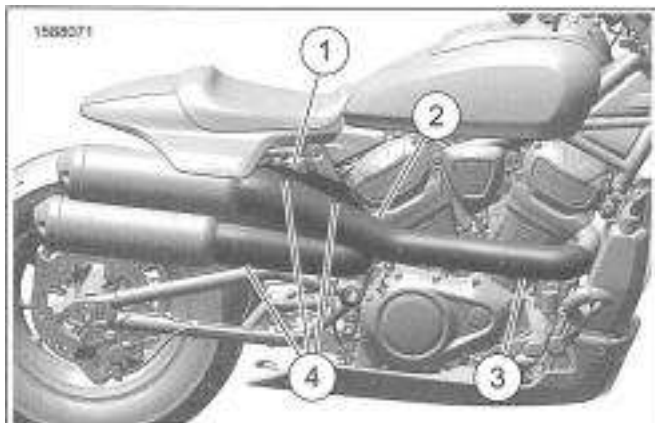
NOTE

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 H02S 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*

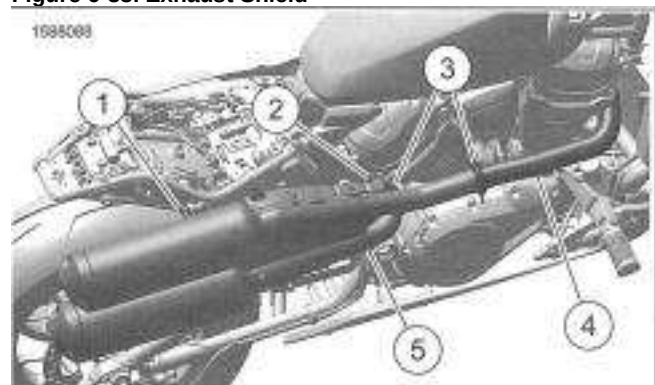


1. Outer exhaust shield
2. Mounting screws (4)
Figure 6-37. Outer Exhaust Shield



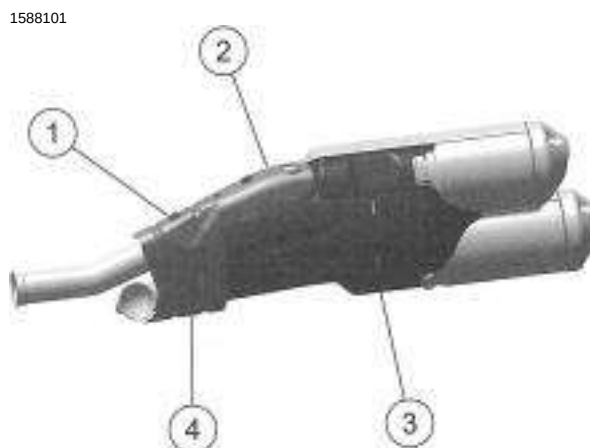
1. Cosmetic cover
2. Exhaust shield
3. Clamp (hidden)
4. Screws (3)

Figure 6-38. Exhaust Shield



1. Screw
2. Rear exhaust header
3. Clamps
4. Front exhaust header
5. Muffler assembly

Figure 6-39. Muffler Assembly



1. Retaining clip
2. Inner exhaust shield
3. Muffler assembly
4. Screws (2)

Figure 6-40. Exhaust Shield (Inner)

COMPLETE

1. Connect post H02S (if equipped). See HEATED OXYGEN SENSORS (H02S) (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 (H02S) connectors. See HEATED OXYGEN SENSORS (H02S) (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

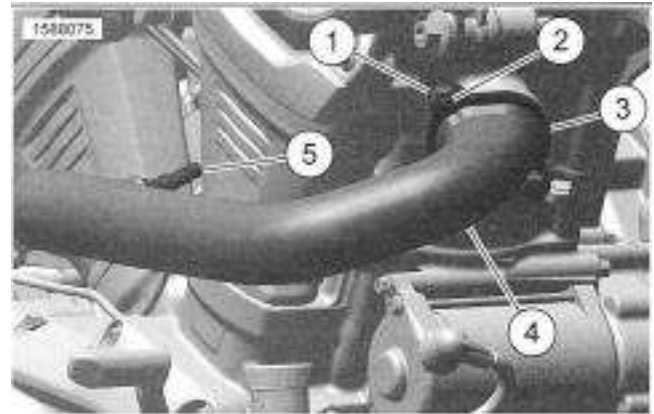
1. See Figure 6-42. install rear header extension.
 - a. Install **new** exhaust port gasket (3) on studs (2).

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

- 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).

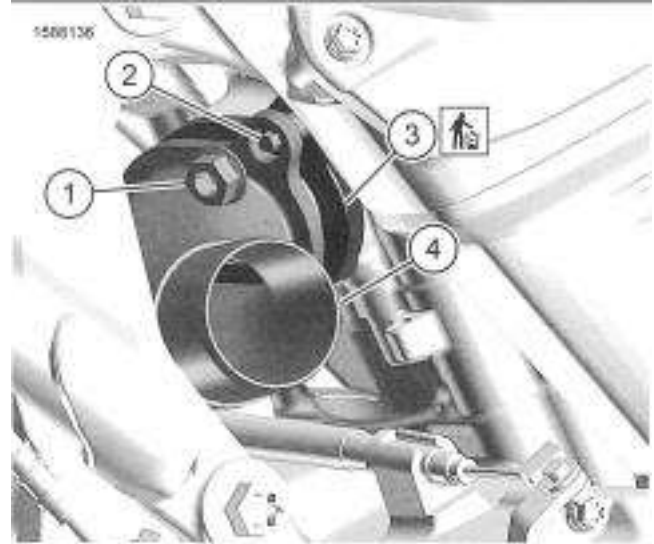
- c. Install nuts (1). Tighten.

Torque: 15-16 ft-lbs (20-22 N-m) *Exhaust header nuts, front*



1. Nut (2)
2. Stud (2)
3. Gasket

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 (H02S) connectors. See HEATED OXYGEN SENSORS (H02S) (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 _____

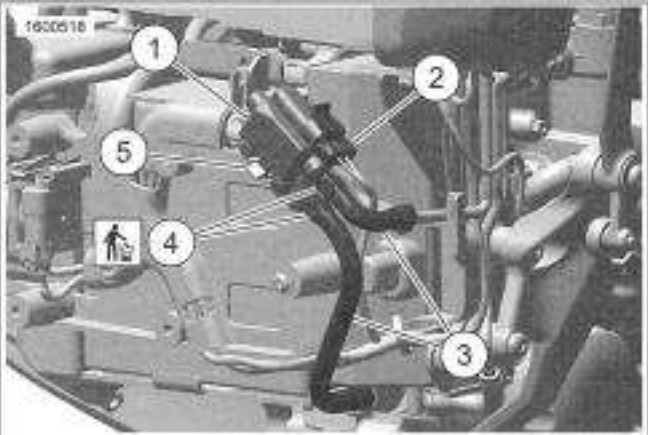
- 1. See Figure 6-43. Disconnect the purge solenoid connector (2).
- 2. Remove Evaporative Emissions Control System (EVAP) hoses (3).
 - a. Using small screwdriver, loosen hose clamps (4).
 - b. Remove EVAP hoses.
 - c. Discard hose clamps.
- 3. Remove purge solenoid (1).
 - a. Position the purge solenoid 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).

- 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 2-36).
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

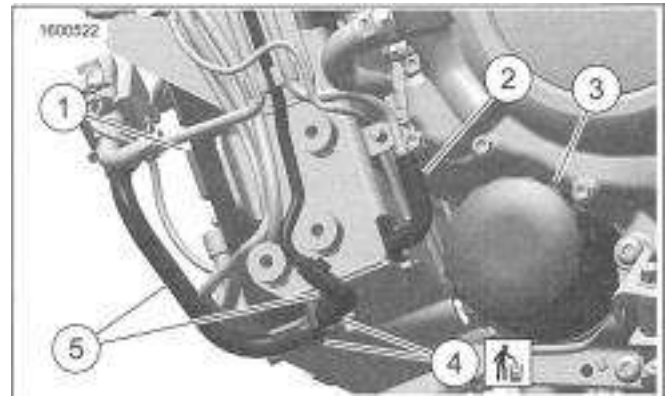
1. See Figure 6-44. Remove back EVAP hose (2).
2. Remove lower EVAP hoses (5).
 - a. Using small screwdriver, loosen hose clamps (4).
 - b. Remove EVAP hoses.
 - c. Discard hose clamps.
3. See Figure 6-45. Remove charcoal canister (2). a.

Slide charcoal canister forward.

INSTALL

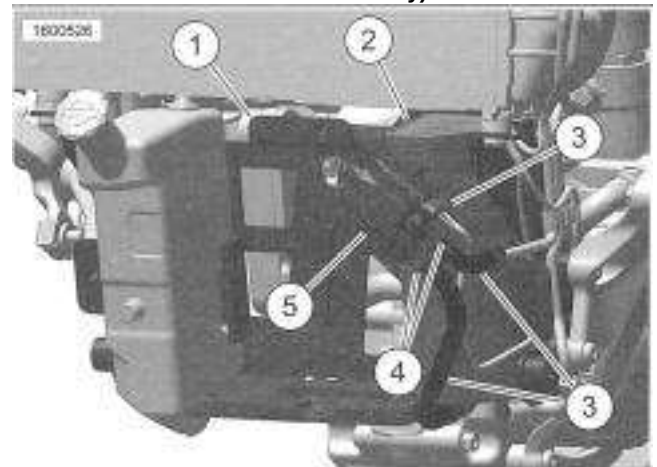
PART NUMBER	TOOL NAME
HD-41137	HOSE CLAMP PLIERS

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).



1. Charcoal canister
2. Back EVAP hose
3. Oil filter
4. Hose clamp (2)
5. Lower EVAP hose (2)

Figure 6-44. EVAP Hoses (Voltage regulator bracket removed for clarity)



1. Battery box
2. Charcoal Canister
3. Purge Solenoid

Figure 6-45. Charcoal Canister

COMPLETE

1. Install battery. See INSPECT BATTERY (Page 2-36).
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).

- 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

PREPARE

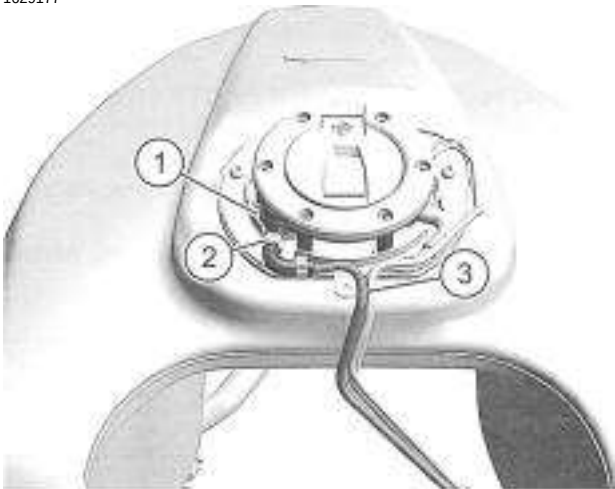
Remove

- 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.

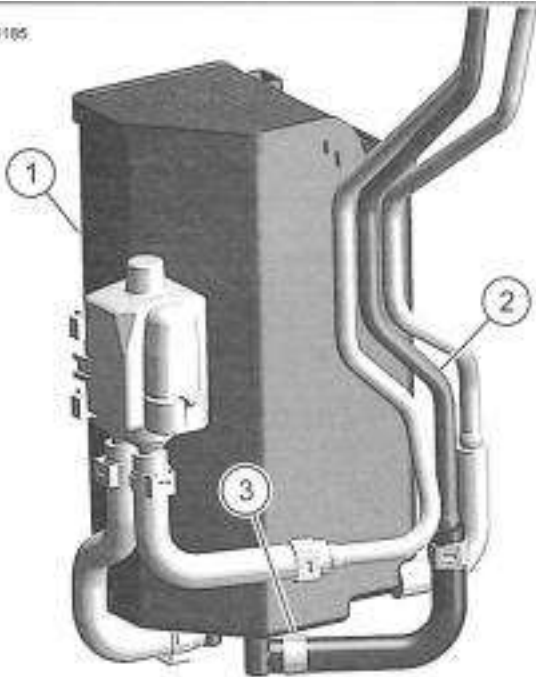
1629177



- 1. Fuel inlet
- 2. Clamp (2)
- 3. Vent line

Figure 6-46. Vent Line to Fuel Inlet

1629185



- 1. Carbon canister
- 2. Vent line
- 3. Clamp (2)

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 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)

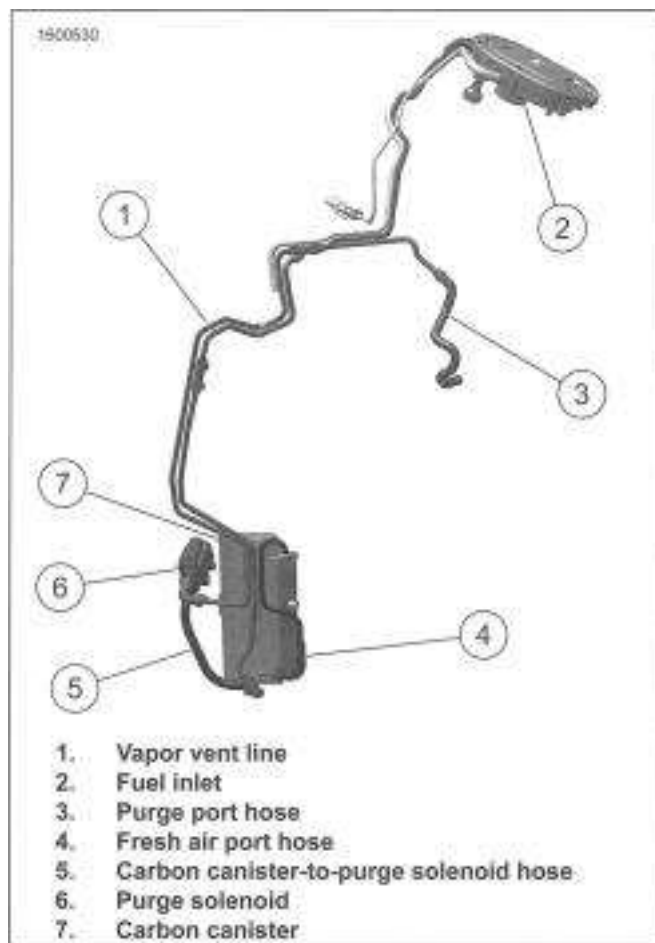


Figure 6-48. Evaporative Emissions System

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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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 Nm	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

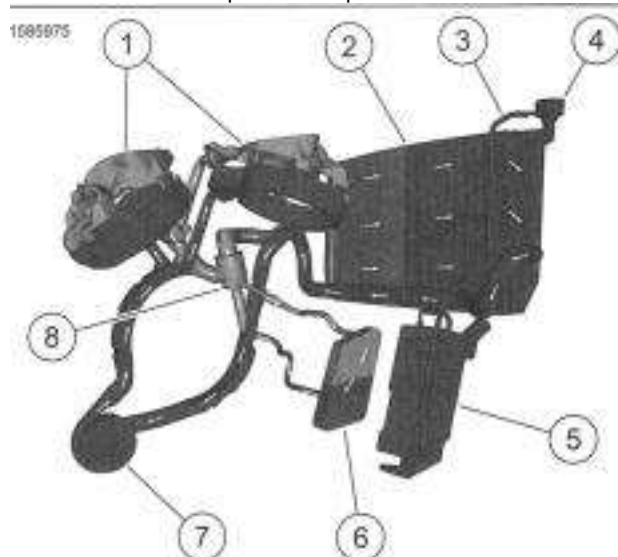
1. Once the coolant temperature reaches 185 °F (85 °C) the thermostat starts to open and is fully open at 212 °F (100 °C) and coolant begins to flow.
 - a. Coolant pump (7) to engine coolant cavities (1).
 - b. Engine coolant cavities (1) to thermostat housing (8).
 - c. Thermostat housing (8) to radiator (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.

1. Coolant cavities
2. Radiator
3. Overflow hose
4. Pressure cap
5. Coolant overflow tank
6. Oil cooler
7. Coolant pump
8. Thermostat housing

Figure 7-1. Coolant Flow



7.4 TROUBLESHOOTING

A 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

PRESSURE CAP TEST

Test pressure cap for the correct operating range every time the

PART NUMBER	TOOL NAME
HD-45335	COOLANT SYSTEM PRESSURE TESTER

coolant is changed or any cooling system maintenance performed.

A 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)

- Remove pressure cap.
- Inspect cap for gasket deterioration and inoperative springs.
- New cap:** Wet the upper sealing gasket before turning onto adapter.
- See Figure 7-2. Connect tester to pressure cap.

Special Tool: COOLANT SYSTEM PRESSURE TESTER (HD-45335)

- Pump handle to pressurize cap. Stop pumping when pressure limiting valve in cap opens.
- Replace pressure cap if:
 - Opens below low limit, 18 psi (124 kPa).
 - Opens above high limit, 22 psi (152 kPa).
 - Pressure falls rapidly when pressurized within range.
- Remove adapter and cap.

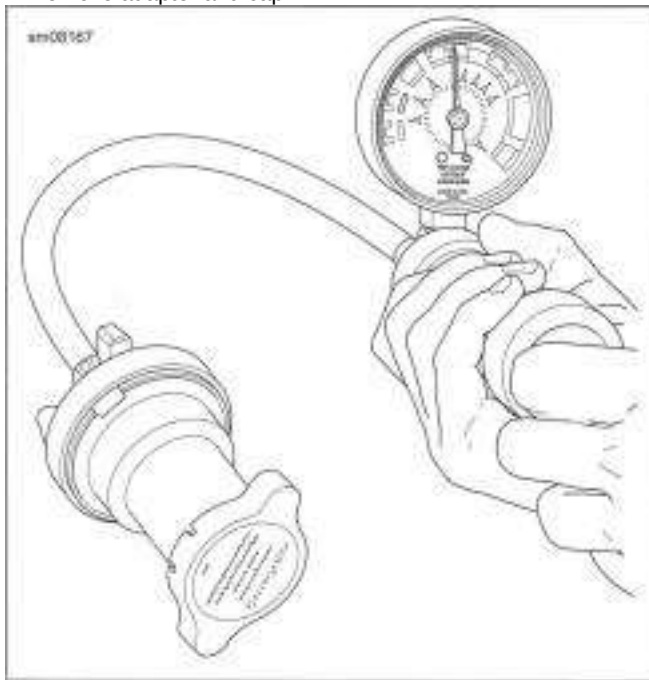


Figure 7-2. Pressure Cap Test

SYSTEM PRESSURE TEST

SYSTEM PRESSURE TEST

A WARNING

PART NUMBER	TOOL NAME
HD-45335	COOLANT SYSTEM PRESSURE TESTER

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)

- 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).
- 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)

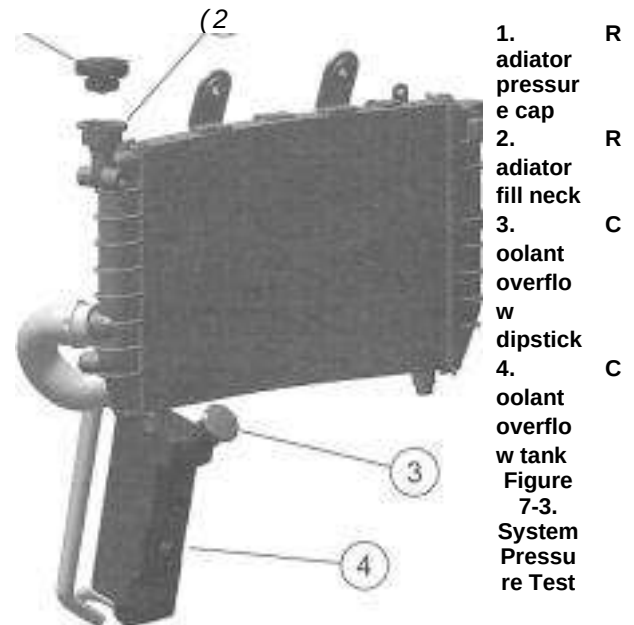
NOTE

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

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



1. radiator pressure cap R
 2. radiator fill neck R
 3. coolant overflow tank C
 4. coolant overflow tank dipstick C
- Figure 7-3. System Pressure Test

FREEZE POINT TEST**FREEZE POINT TEST**

1. Allow engine to cool.

PART NUMBER	TOOL NAME
HD-23688	BATTERY TESTER

CONSUMABLE	PART NUMBER
GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE & COOLANT	99822-02A

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.

(2).

- 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.

PART NUMBER	TOOL NAME
HD-29545-6A	COOLANT FLUORESCENT LEAK DETECTION DYE
HD-35457	BLACK LIGHT LEAK DETECTOR

LEAK DETECTION DYE TEST

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.

A 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)

A 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.

COOLANT

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

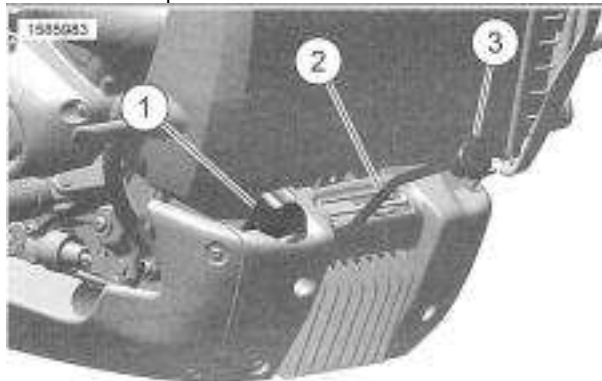
A CAUTION

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
 - a. Add GENUINE HARLEY-DAVIDSON EXTENDED LIFE ANTIFREEZE AND COOLANT until fluid level reaches cold MAX level line.
- b. Install coolant dipstick.



1. Coolant overflow tank
2. Coolant maximum level mark
3. 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

At operating temperature, radiators and oil coolers contain

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

A CAUTION

hot fluids. Contact with a radiator or oil cooler can result in minor or moderate burns. (00141b)

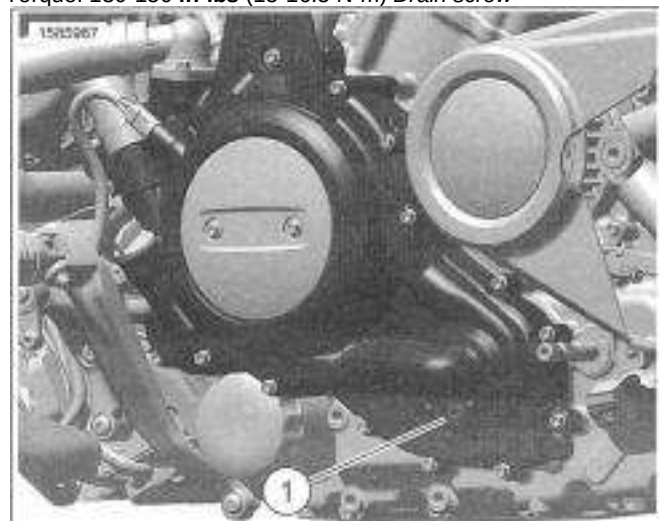
A WARNING

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



1. Coolant 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
10. Check coolant level in overflow bottle.

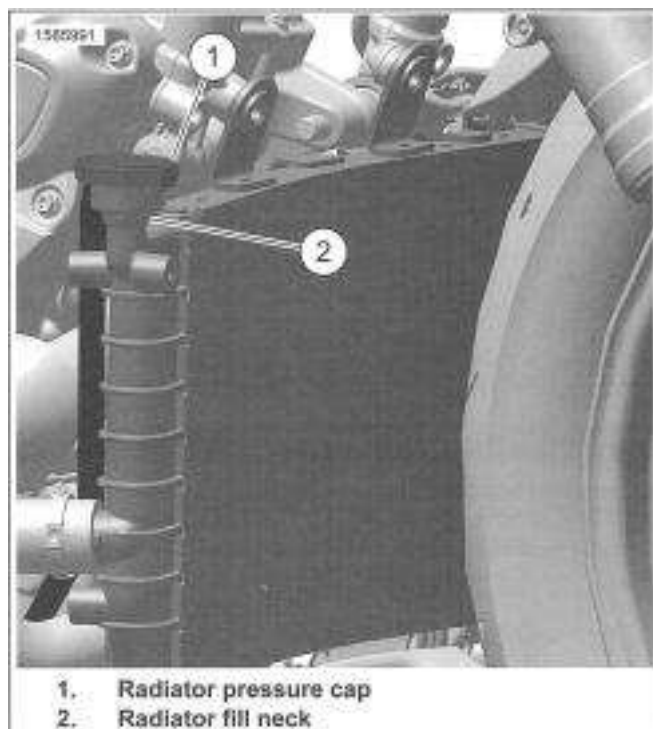


Figure 7-6. Radiator Pressure Cap

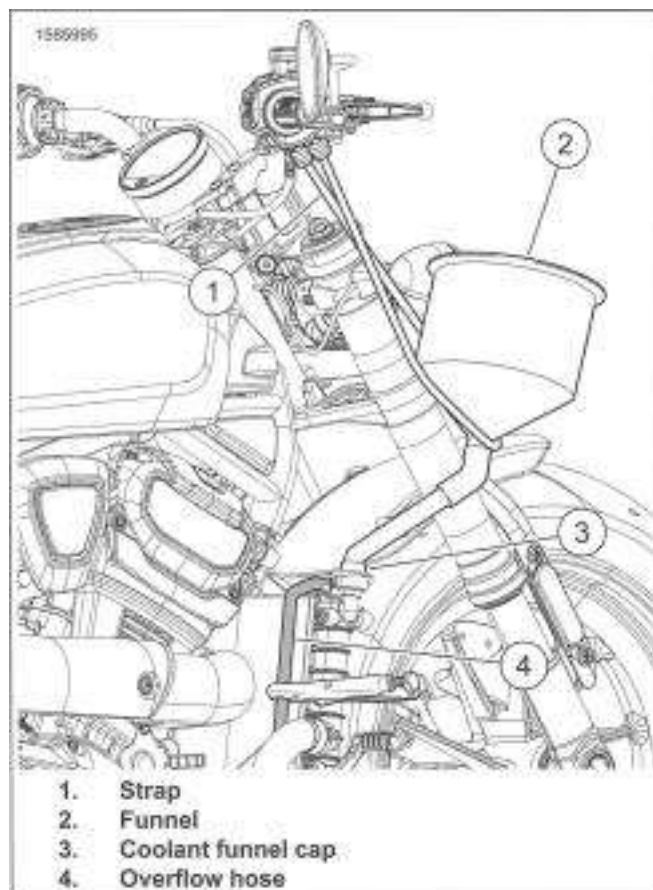


Figure 7-7. Coolant Bleed

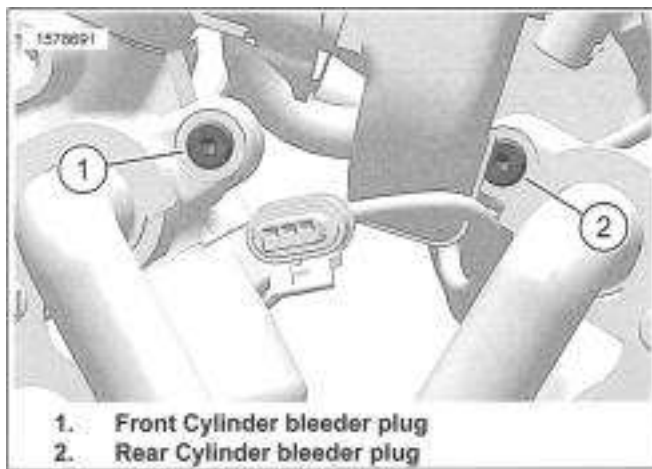


Figure 7-8. Coolant Bleeder Plugs

COMPLETE

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

PREPARE

Drain coolant. See COOLANT (Page 7-7).

PART NUMBER	TOOL NAME
HD-52948	THERMOSTAT REMOVAL TOOL

REMOVE**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.

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

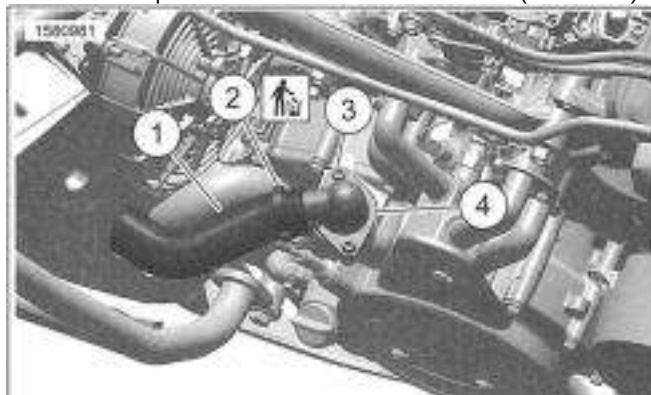
1. See Figure 7-10. Install thermostat.

INSTALL

- 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. Clean inside hose (1) and install.

- d. See Figure 7-11. Install and secure new clamp (1) on positioning mark (3) as shown.

Special Tool: HOSE CLAMP PLIERS (HD-41137)



1. Hose
2. Clamp
3. Screws (2)
4. Thermostat housing assembly
Figure 7-9. Thermostat Housing Assembly

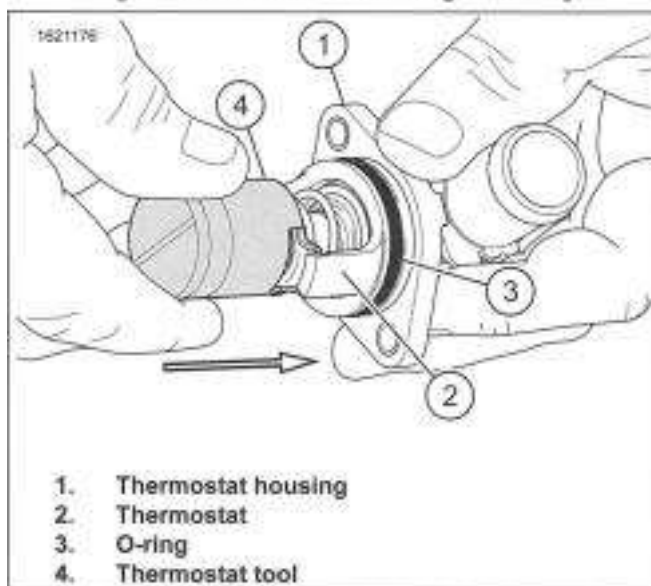
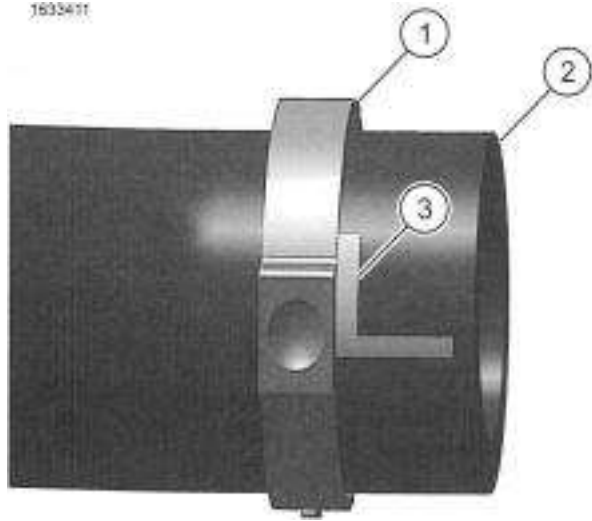


Figure 7-10. Thermostat Tool



Fill system with coolant. See COOLANT (Page 7-7).

1. Clamp
2. Hose
3. Positioning mark

Figure 7-11. Clamp Positioning

GENERAL

See COOLANT MANIFOLD (Page 4-51) 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

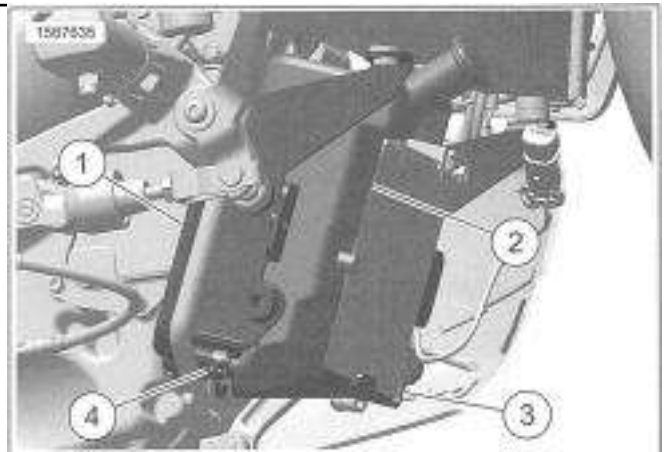
1. Remove coolant overflow tank.
 - a. See Figure 7-13. Disconnect coolant overflow hose (1) and clamp (2) from radiator.
 - b. Remove coolant overflow tank.
 - c. Drain coolant from tank.
 - d. See Figure 7-12. Remove clamp (4).
 - e. Remove coolant overflow hose from coolant overflow tank.

INSTALL

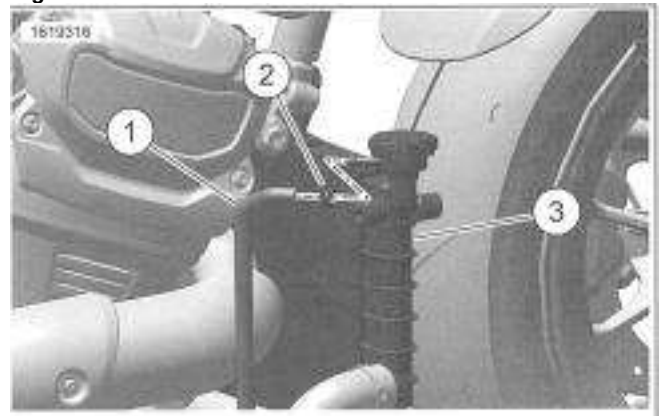
1. Install coolant overflow tank.
 - a. See Figure 7-12. Install coolant overflow hose (1) and clamp (4).
 - b. Press coolant overflow tank in place on battery tray (3).
 - c. See Figure 7-13. Install coolant overflow hose to radiator (1) and clamp (2).
 - d. Fill coolant overflow tank with coolant.

Figure 7-13. 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).



1. Coolant overflow hose
2. Coolant overflow tank
3. Battery tray
4. Clamp

Figure 7-12. Coolant Overflow Tank

1. Overflow hose
2. Clamp
3. Radiator

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 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. Install coolant hose.
3. See Figure 7-15. Align clamp with marking.
4. See Figure 7-14. Secure with **new** clamps (3).
Special Tool: HOSE CLAMP PLIERS (HD-41137)

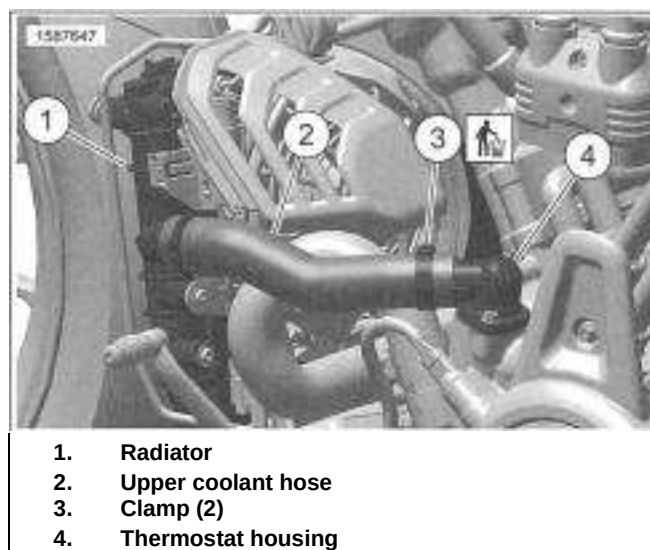
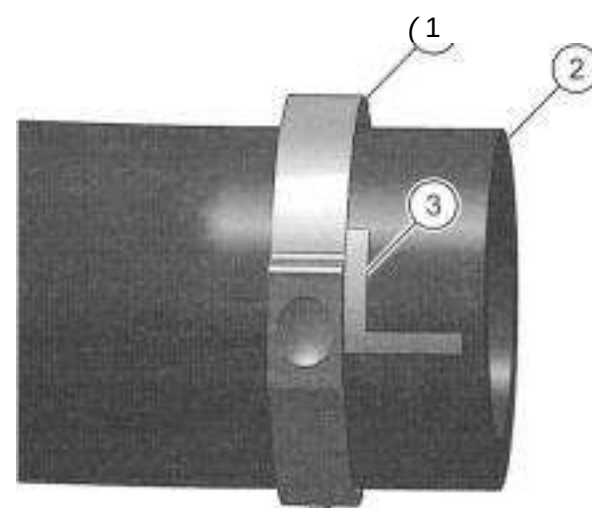


Figure 7-14. Upper Coolant Hose

1633411



1. Clamp
2. Hose
3. Positioning mark

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).

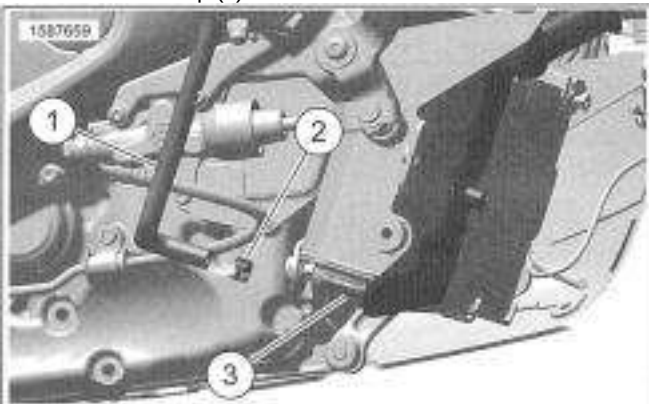
Install

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).

- a. If upper radiator hose was removed, install left side radiator cover.

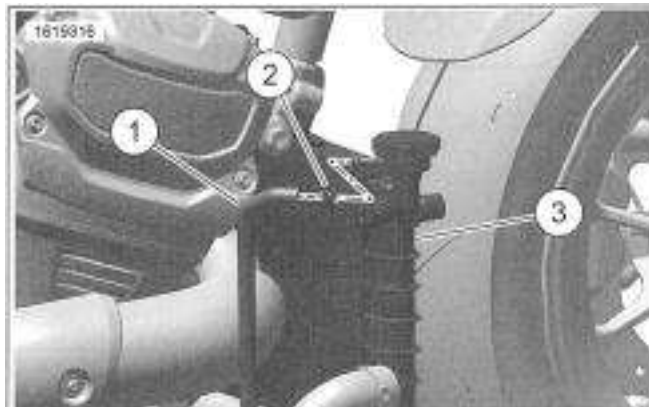
- b. If overflow hose was removed, install right side radiator cover.

3. Install main fuse. See POWER DISCONNECT (Page 8-4).



1. Overflow hose
2. Clamp
3. Hose barb

Figure 7-16. Lower Hose Connection



1. Overflow hose
2. Clamp
3. Radiator

Figure 7-17. Upper Hose Connection

COMPLETE

1. Add coolant. See COOLANT (Page 7-7).
2. Install radiator cover. See SIDE COVERS (Page 3-46).

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

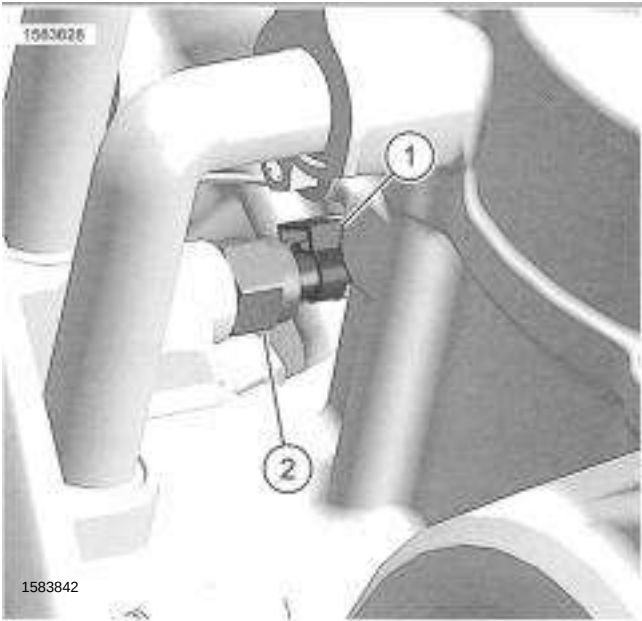
1. See Figure 7-18. Install sensor (2). Tighten

Torque: 26-29 ft-lbs (35-39 Nm) *Coolant temperature*

FASTENER	TORQUE VALUE	
Coolant temperature sensor	26-29 ft-lbs	35-39 N-m

sensor

2. Install connector (1).



1. Connector
2. Sensor

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

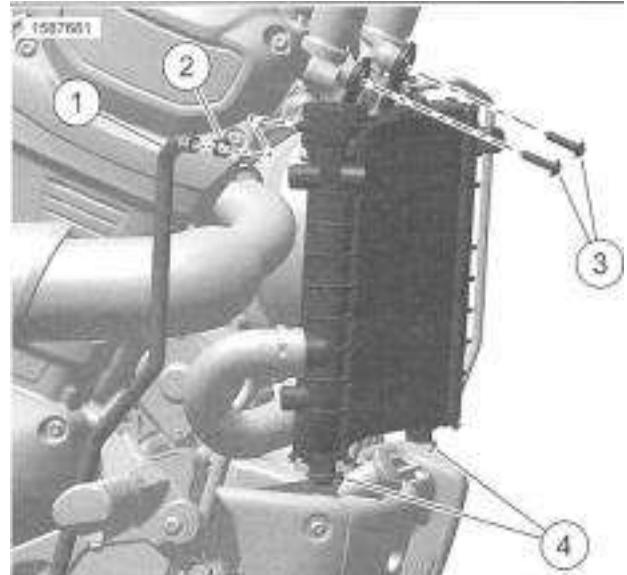
1. Remove main fuse. See POWER DISCONNECT (Page 8-4).
2. Remove radiator cover. See SIDE COVERS (Page 3-46).

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).



- 1. Coolant overflow**
- 2. Clamp**
- 3. Screw (2)**
- 4. Mounting bracket**

Figure 7-20. Radiator Relocating

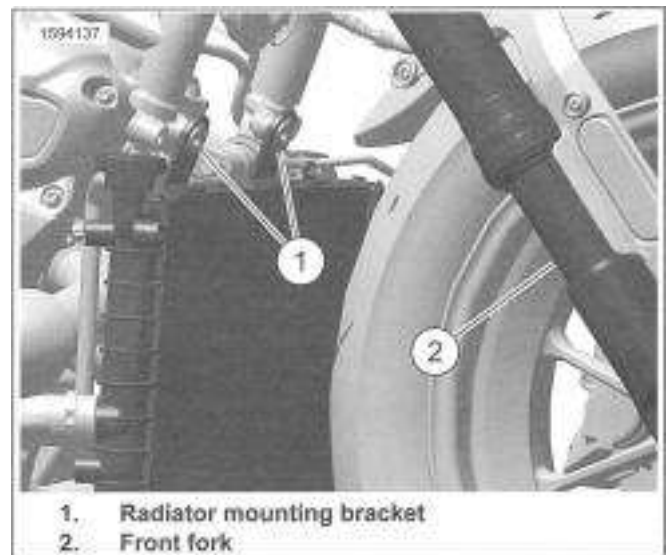


Figure 7-21. Radiator Relocated Complete

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.

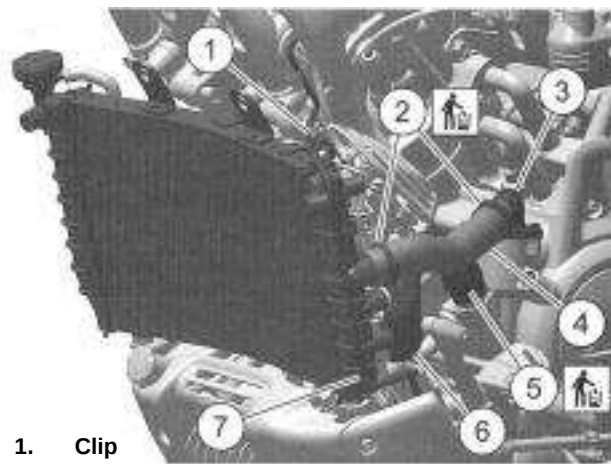
Torque: 71-89 in-lbs (8-10 N-m) *Radiator mounting screw*
2. See Figure 7-23. Attach coolant overflow hose.
 - a. Clean hose barb. Clean inside of overflow hose end.
 - b. Install overflow hose (1).
 - c. Secure with clamp (2).
3. Install coolant hoses.

NOTE

See Figure 7-25. Install clamps (1) on positioning marks (3) as shown for all coolant hoses (2).

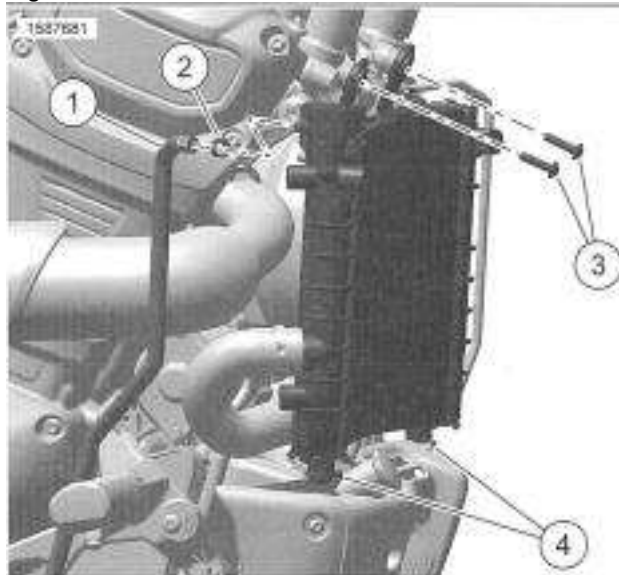
- a. See Figure 7-22. Attach lower coolant hose (6).
 - b. Secure with **new** clamp (5).
 - c. Clean inside of upper coolant hose (4).
 - d. Install upper coolant hose.
 - e. Secure with **new** clamps (2).
4. Snap vent tube (7) into clip (1).
 5. See Figure 7-24. Tighten lower radiator hose clamp (5)

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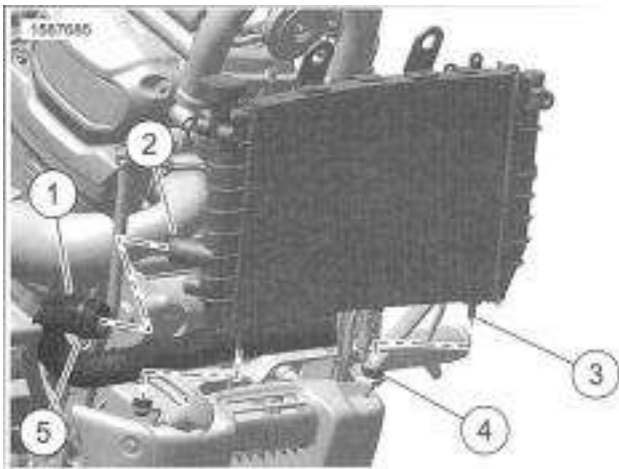
1. Clip
2. Clamp (2)
3. Thermostat housing
4. Upper coolant hose
5. Clamp (2)
6. Lower coolant hose
7. Vent tube

Figure 7-22. Left Side Hoses



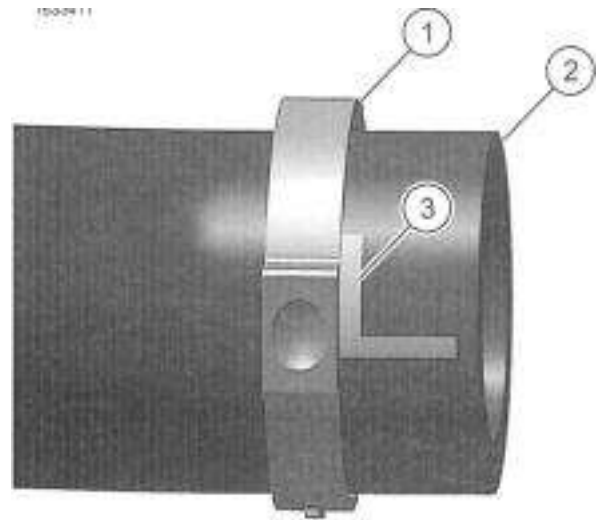
1. Overflow hose
2. Clamp
3. Screws (2)
4. Clamp
5. Lower coolant hose

Figure 7-23. Right Side Hoses



1. Lower coolant hose
2. Outlet
3. Locating pin (2)
4. Isolator grommet (2)
5. Clamp

Figure 7-24. Radiator Locating Pins



1. Clamp
2. Hose
3. Positioning mark

Figure 7-25. Clamp Positioning

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).

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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 (WT) HARNESS, Install
Camshaft solenoid plate screw	62-80 in-lbs	7-9 N-m	8.46 VARIABLE VALVE TIMING (WT) 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 (WT) 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	8.16 HEADLAMP, Install
Headlamp screw	6-7 ft-lbs	8-10 N-m	8.16 HEADLAMP, Adjust
Horn bracket screws	50-62 in-lbs	5.7-7 N-m	8.15 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	8.13 INSTRUMENT MODULE (IM), Install
IM screws	91-101 in-lbs	10.3-11.4 N-m	8.13 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	8.20 FRONT STOPLAMP SWITCH, Install
Switch, Oil Pressure	13-17 ft-lbs	17-23 N-m	8.14 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	8.19 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	8.18 REAR TURN SIGNAL LAMPS, Install
Turn signal screw, front	27-44 in-lbs	3-5 N-m	8.17 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 Ω
Ignition coil secondary resistance at room temperature	1700-2000 Ω
Plug top coil to boot	Less than 5.0 Ω

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).

A 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).

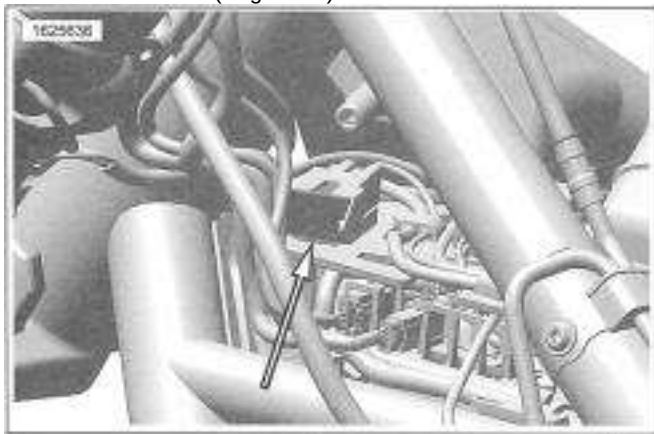


Figure 8-1. Main Fuse

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).

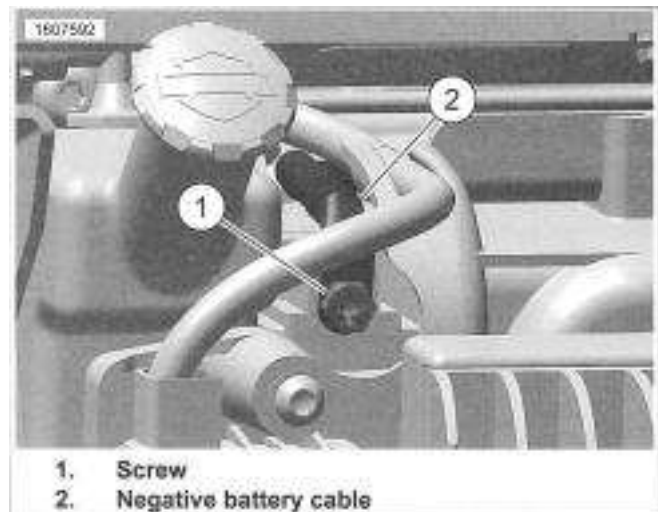


Figure 8-2. Negative Battery Cable

STARTER

8.4

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).

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.

INSTALL

- 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.

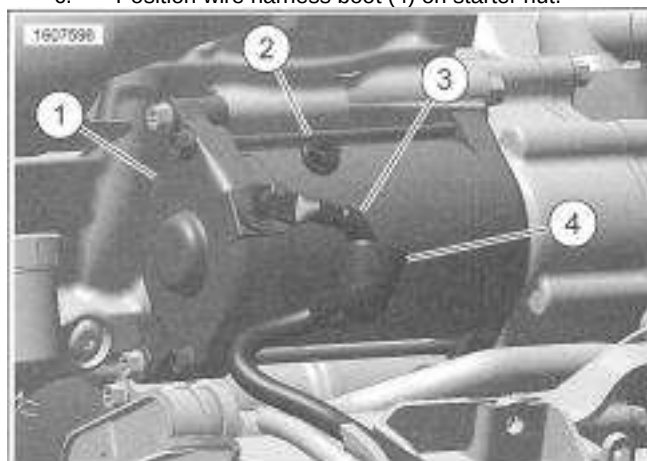
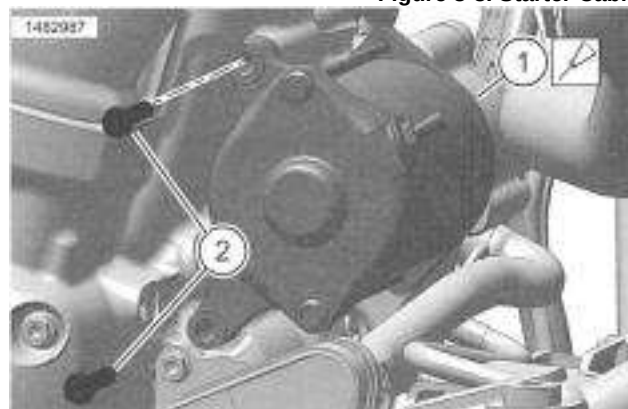


Figure 8-4.
Starter Screws
COMPLETE

1. Starter
2. Nut
3. Starter cable
4. Wire harness boot

Figure 8-3. Starter Cable



1. Starter
2. Starter screws

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 2-36).

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).

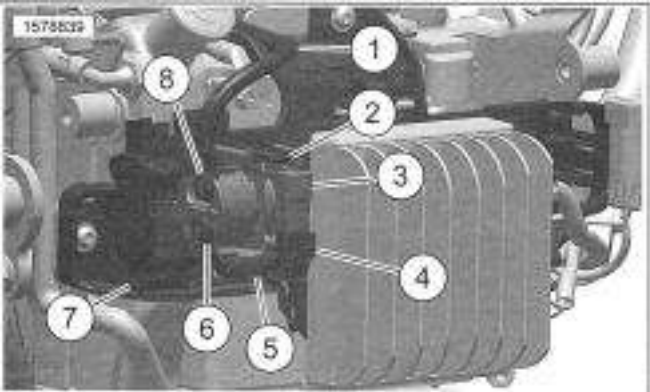
INSTALL

- a. Pull down on rubber boot (7) install starter cable (1) 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).
 - 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).



- 1. Starter cable
- 2. Locking tab
- 3. Starter solenoid
- 4. Solenoid connector
- 5. Positive battery cable
- 6. Nut
- 7. Rubber boot
- 8. Nut

Figure 8-5. Starter Solenoid

COMPLETE

- 1. Connect battery negative cable to battery. See INSPECT BATTERY (Page 2-36).
- 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 4-51).

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 toque on the rotor bolt (3), use an ¹/₄ 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.

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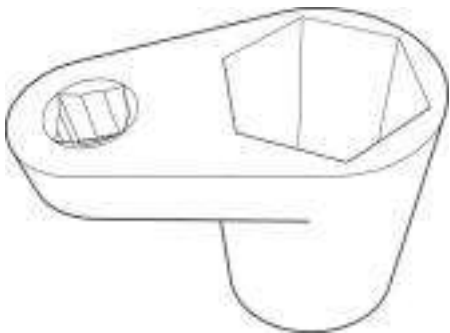


Figure 8-6. Rotor Locking Tool - HD-52968

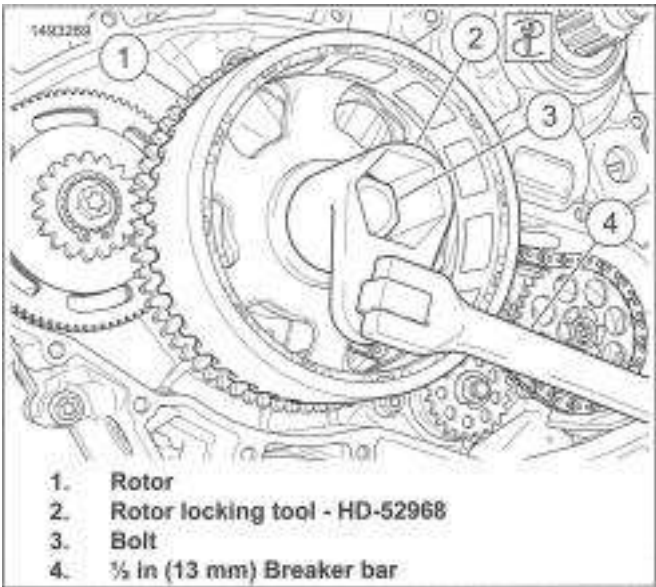


Figure 8-7. Rotor Locking Tool (HD-52968) In Place

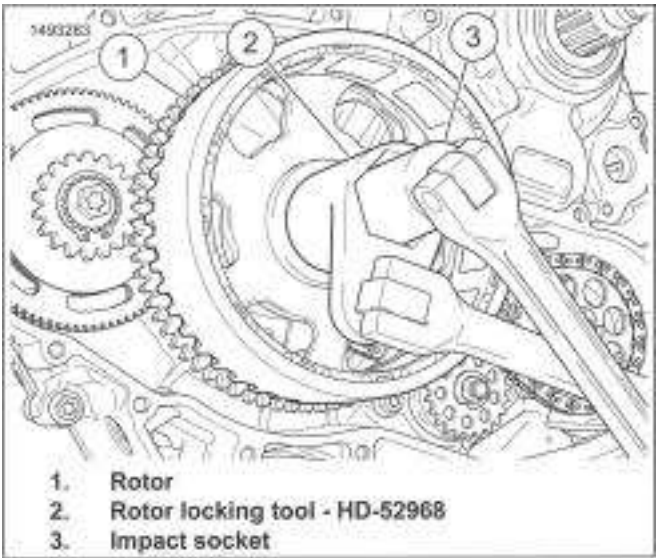


Figure 8-8. Socket in Locking Tool

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 staring 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.

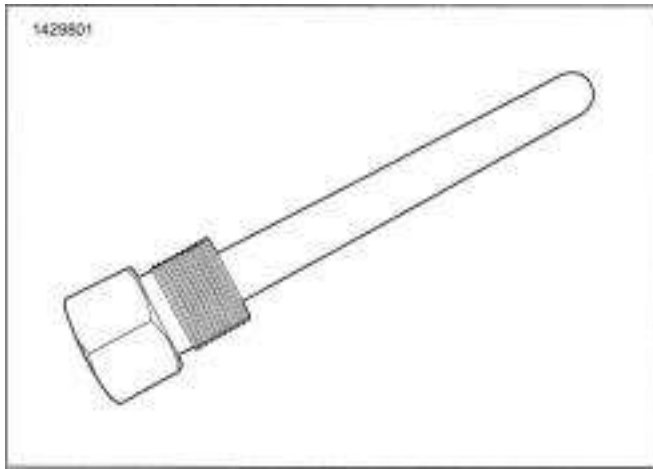


Figure 8-9. Rotor Shell Removal Pin - HD-52969

4. Remove rotor assembly.
5. Remove removal pin.

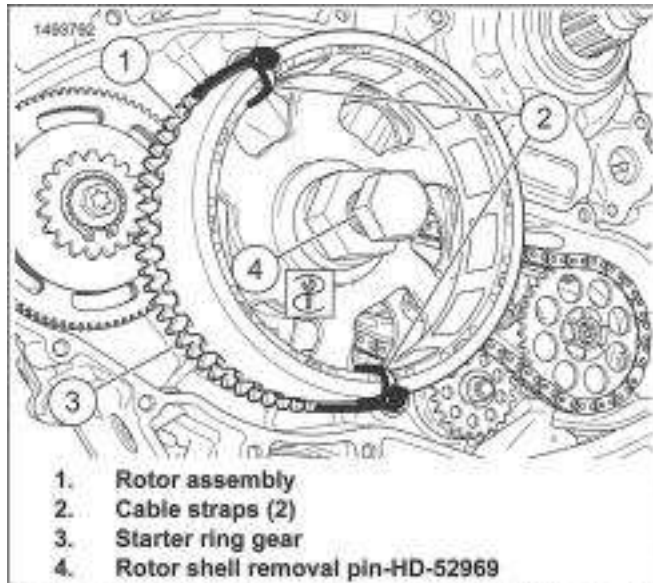


Figure 8-10. Cable Straps Around Rotor Assembly Starter Ring Gear and Needle Bearings

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 4-51).

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 Nm

Stator

1. Install stator. COOLANT MANIFOLD (Page 4-51).

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.

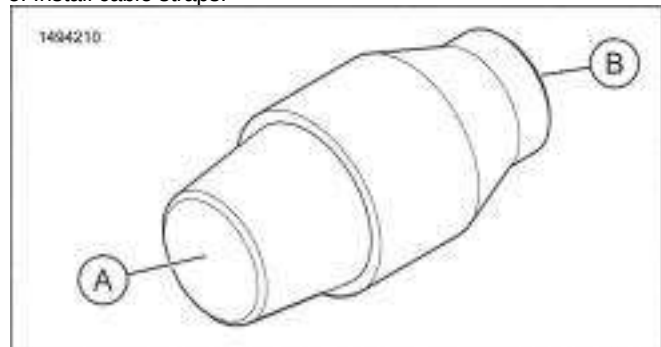
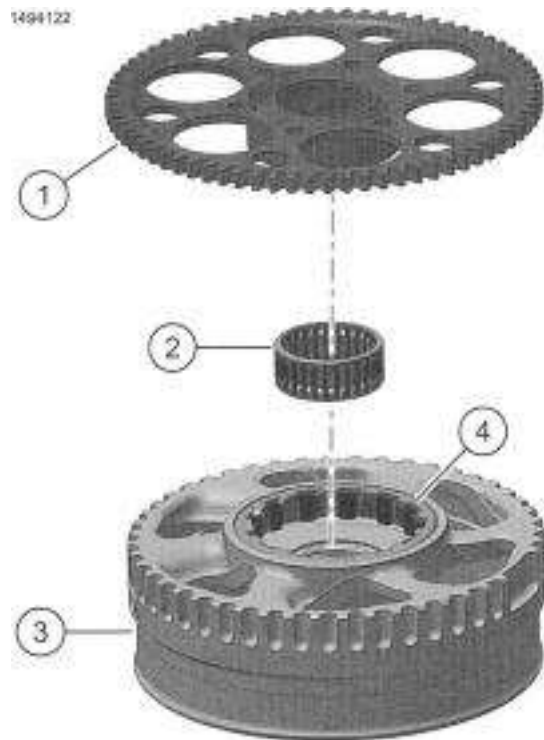


Figure 8-11. Rotor Shell to Starter Drive Assembly Pilot - HD-52970



1. Starter ring gear
2. Needle bearings
3. Rotor shell
4. Sprag clutch

Figure 8-12. Rotor Assembly

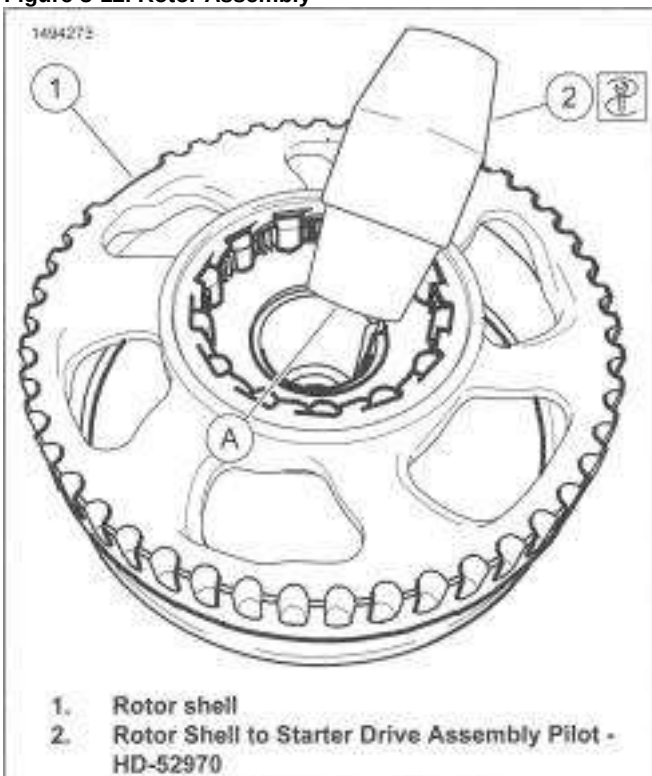
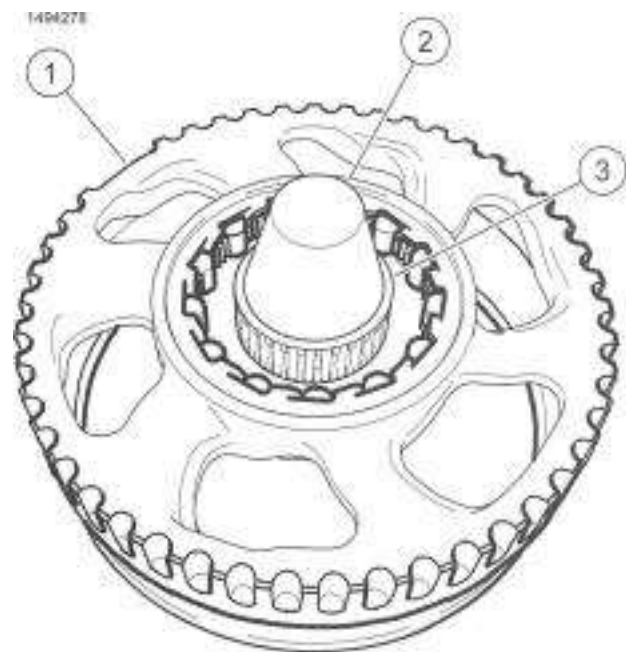


Figure 8-13. Installing HD-52970



1. Rotor shell
2. Rotor Shell to Starter Drive Assembly Pilot - HD-52970
3. Needle bearings

Figure 8-14. Installing Needle Bearings

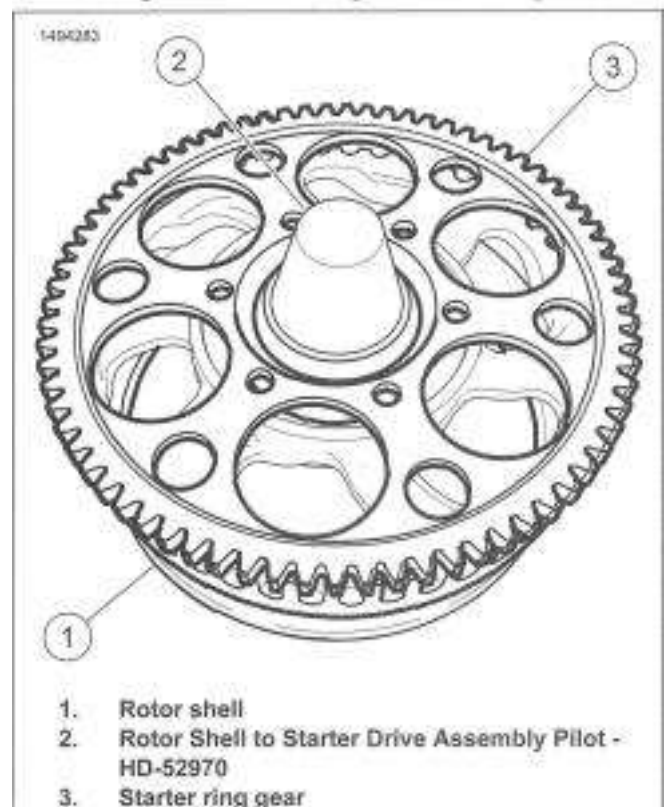


Figure 8-15. Installing Starter Ring Gear

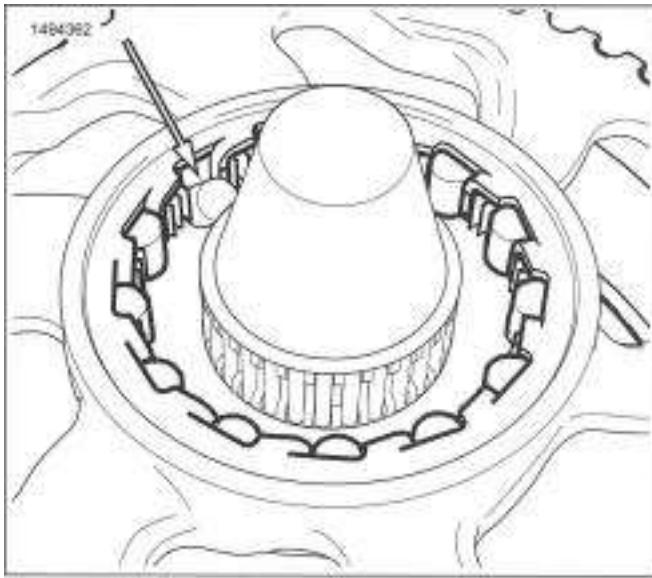


Figure 8-16. Misaligned Rolling Element

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) matting 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.

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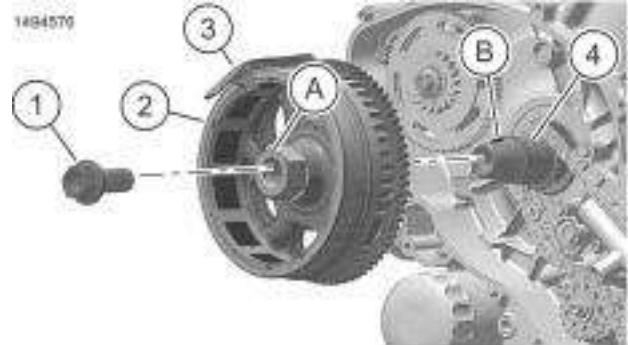


Figure 8-17. New Rotor Assembly - Assembly Clip



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 4-51).

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).

INSTALL

- 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*

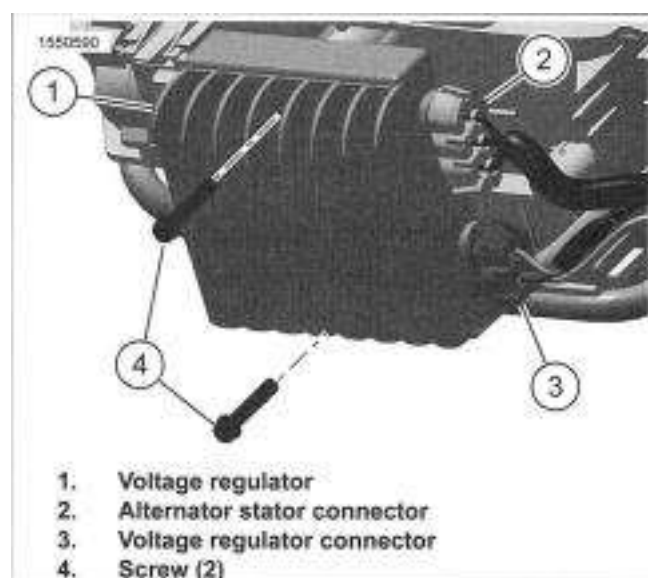
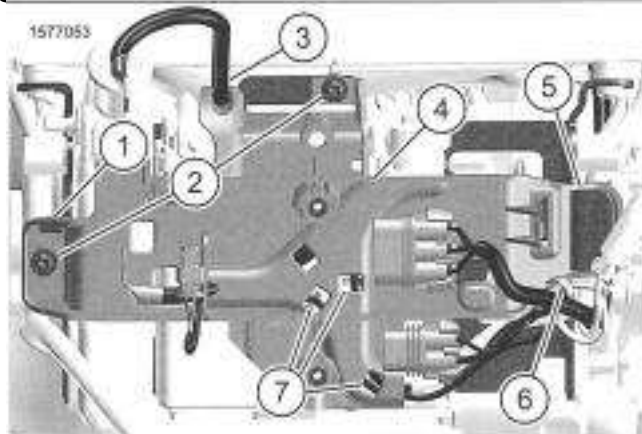


Figure 8-21. Voltage Regulator

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.



- 1. Tab
- 2. Screw (2)
- 3. Starter cable
- 4. Voltage regulator bracket
- 5. Battery tray
- 6. Cable strap
- 7. Clip (3)

Figure 8-22. Voltage Regulator Bracket

COMPLETE

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

A 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

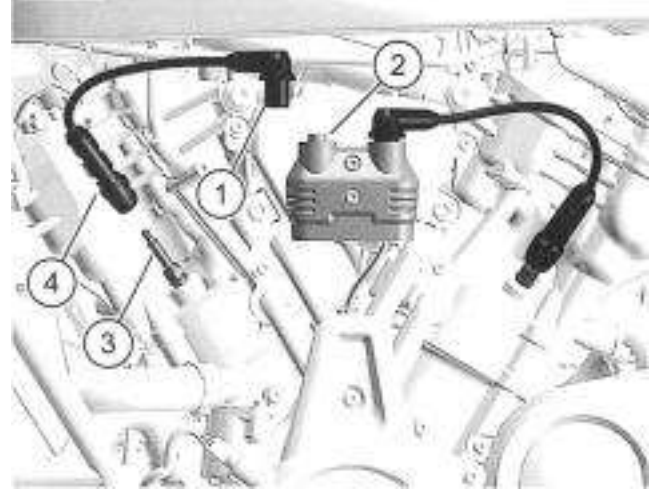
CONSUMABLE	PART NUMBER
ELECTRICAL CONTACT LUBRICANT	11300004

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).

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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**A 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*

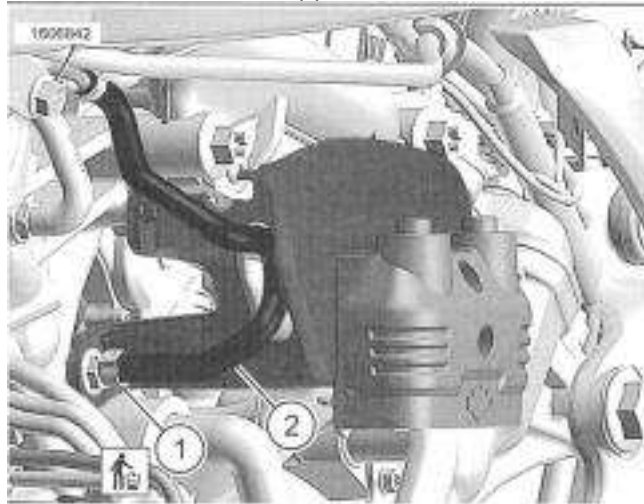
Head mounted ignition coils.

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*

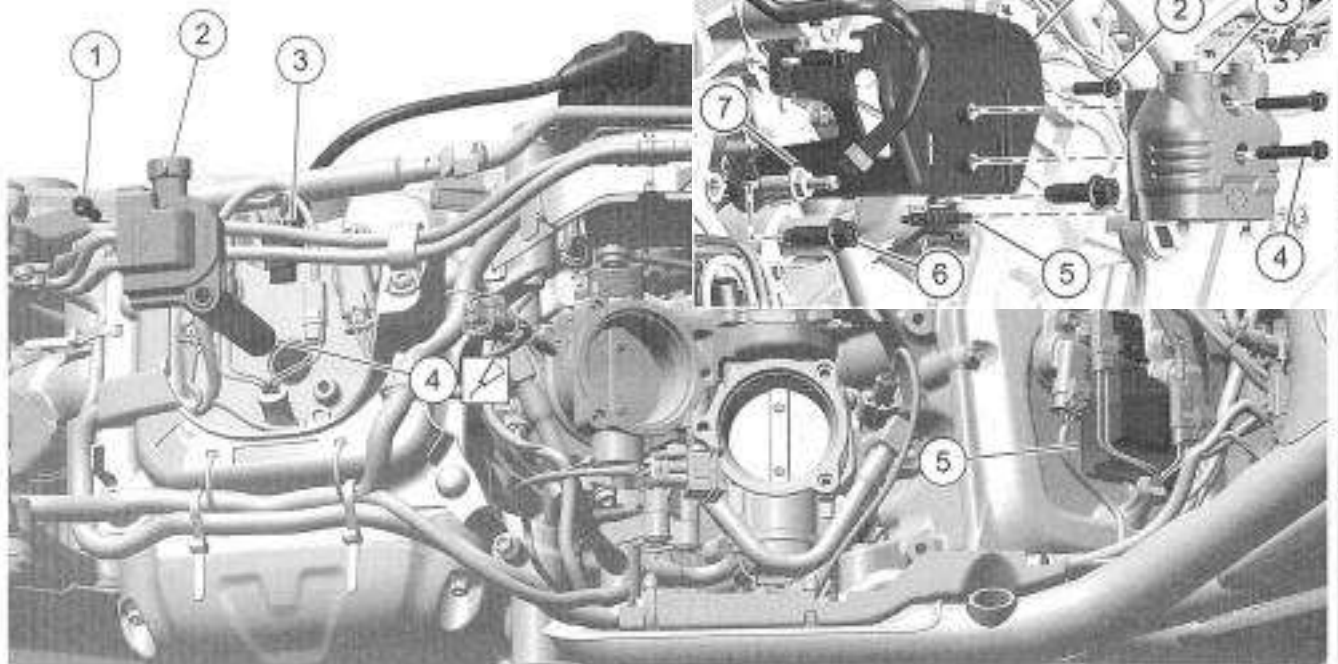
- d. Attach connectors (3).



1. Clamp
2. Hose

Figure 8-24. Side Mount Ignition Coil (With EVAP)

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1. Screw (2)	4. Insulator (2)
2. Rear ignition coil	5. Front ignition coil
3. Connector (2)	

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

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*

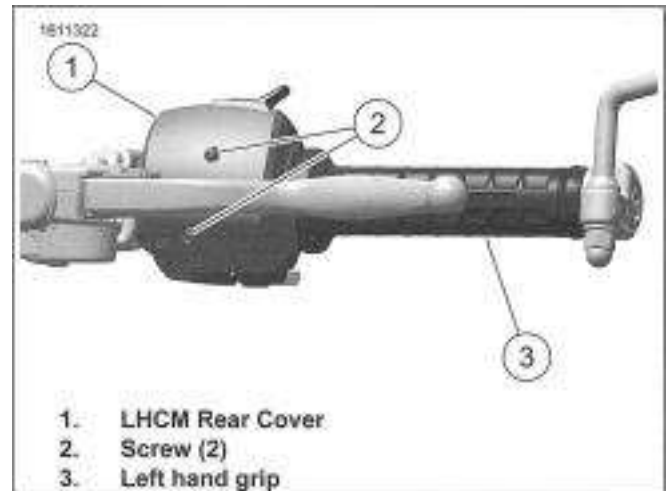


Figure 8-27. LHCM Rear Cover



Figure 8-28. LHCM Connector

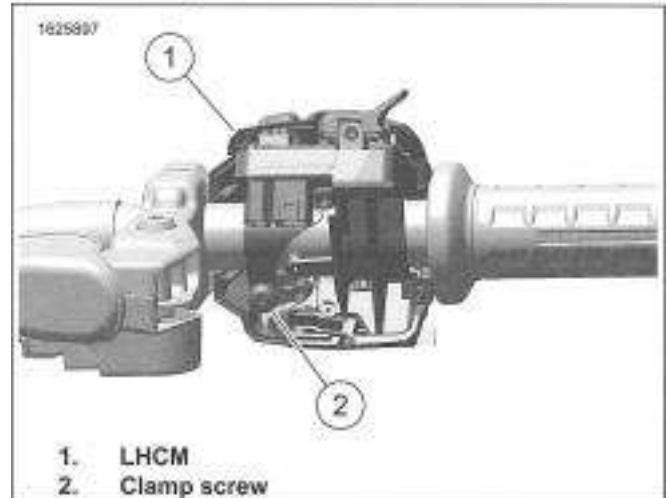


Figure 8-29. Clamping Screw

COMPLETE

1. Install main fuse. See POWER DISCONNECT (Page 8-4)

REMOVE

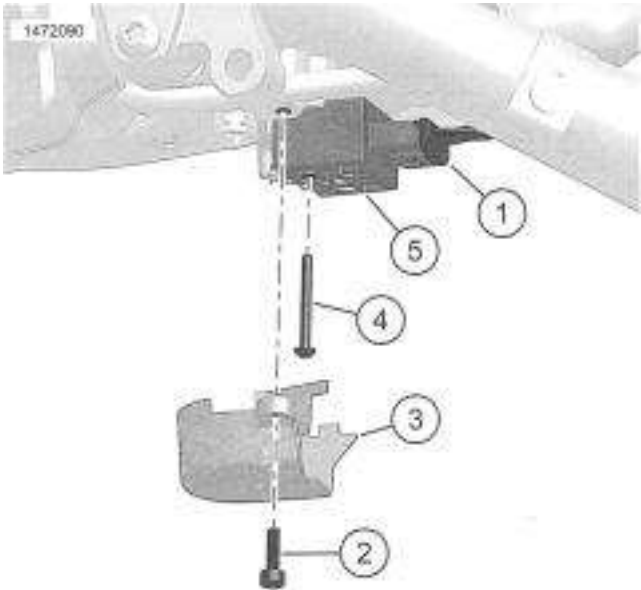
- 1. See Figure 8-30. Remove cover.
 - a. Remove screw (2).
 - b. Remove cover (3).
- 2. Remove switch.
 - a. Disconnect connector (1).
 - b. Remove screw (4).
 - c. Remove switch (5).

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 Nm

- 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 Nm) *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

- 1. Connector
 - 2. Screw
 - 3. Cover
 - 4. Screw
 - 5. Clutch Switch
- 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

1. See Figure 8-32. Position RHCM on handlebar.

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

- 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*

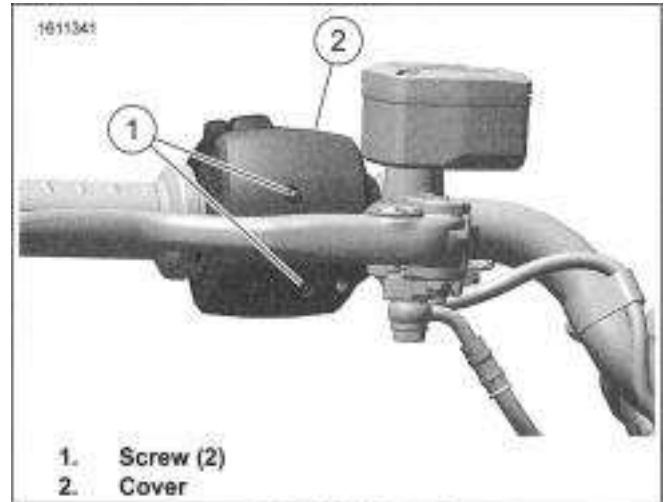


Figure 8-31. RHCM Rear Cover

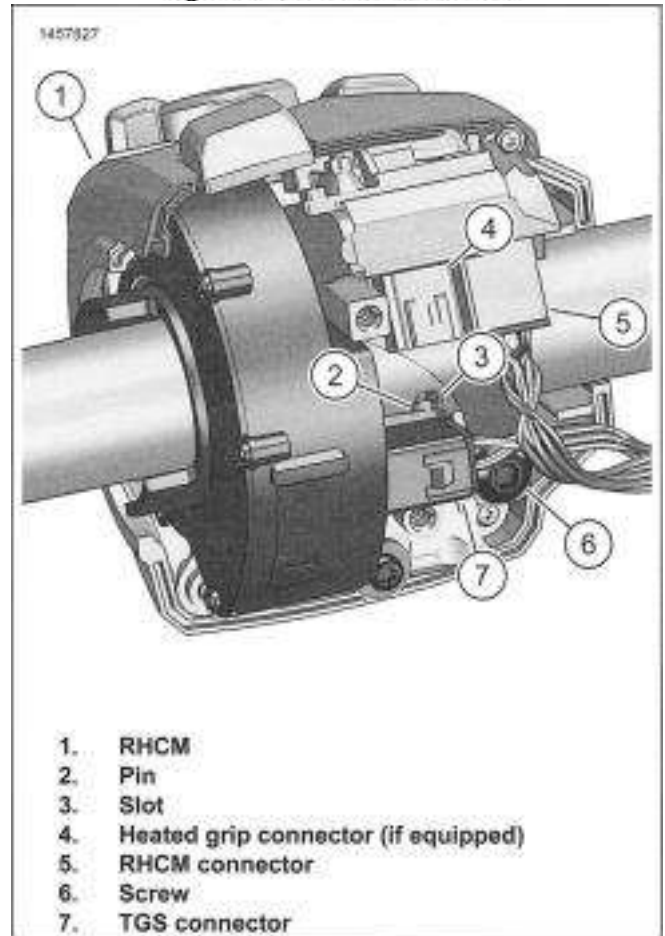


Figure 8-32. RHCM Install (typical)

COMPLETE 1. Install main fuse. See POWER DISCONNECT (Page 8-4)

Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

PREPARE _____

Remove main fuse. See POWER DISCONNECT (Page 8-4).

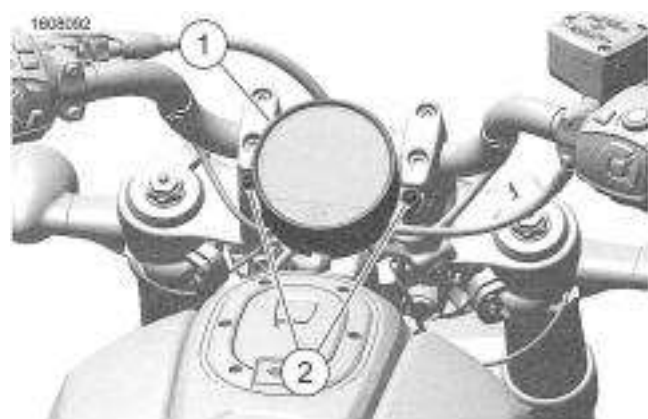
REMOVE _____

1. See Figure 8-33. Remove screws (2).
2. See Figure 8-34. Remove IM assembly (1).
 - a. Disconnect IM connector (2).
 - b. Remove IM assembly.
3. See Figure 8-35. Remove IM from housing (1). a.
Remove screws (4).

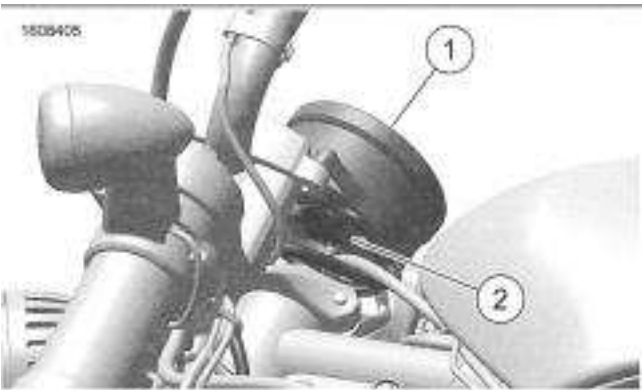
INSTALL _____

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 8-35. 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 8-34. Connect the IM connector (2).
4. See Figure 8-33. Install screws (2). Tighten.
Torque: 91-101 **in-lbs** (10.3-11.4 N-m) */M screws*

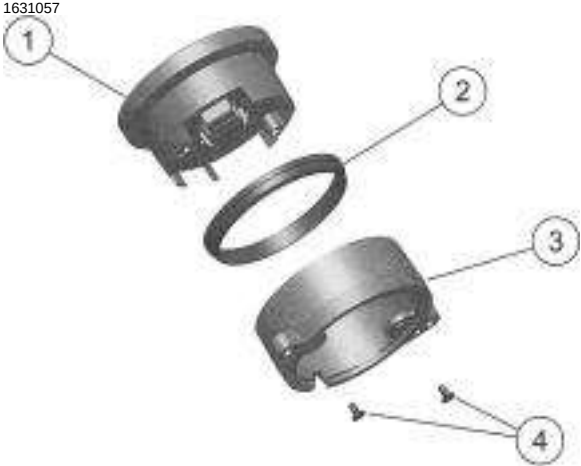


1. Instrument Module (IM)
2. Screws
Figure 8-33. Instrument Module



1. IM
2. IM connector

Figure 8-34. IM Connector



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)

1. IM
2. Gasket
3. Housing
4. Screws

Figure 8-35. IM Connector

COMPLETE _____

PREPARE

- 1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE

- 1. See Figure 8-36. Disconnect oil pressure switch connector (1)-

PART NUMBER	TOOL NAME
HD-52962	OIL PRESSURE SENDING UNIT WRENCH

- 2. Remove switch (2).

Special Tool: OIL PRESSURE SENDING UNIT WRENCH (HD-52962)

INSTALL

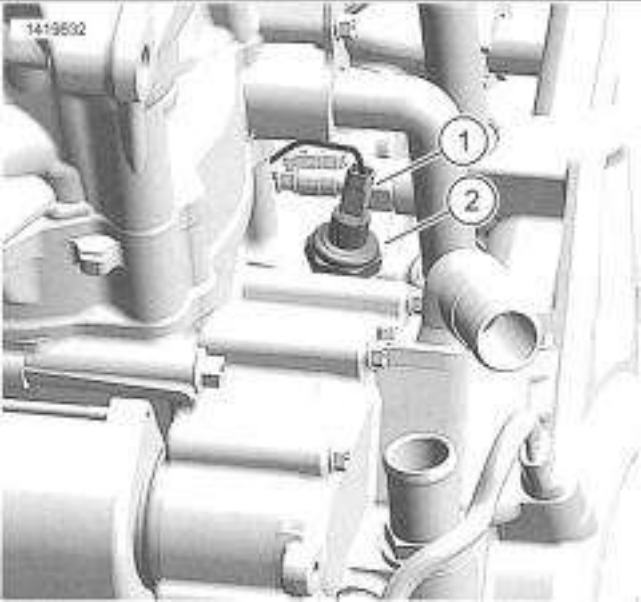
PART NUMBER	TOOL NAME
HD-52962	OIL PRESSURE SENDING UNIT WRENCH

FASTENER	TORQUE VALUE	
Switch, Oil Pressure	13-17 ft-lbs	17-23 N-m

- 1. See Figure 8-36. 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).



1. Connector
2. Switch

Figure 8-36. Oil Pressure Switch

- 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 8-37. Remove horn assembly.
 - a. Disconnect horn connectors (2).
 - b. See Figure 8-38. Remove screws (1).

INSTALL

- a. Install horn assembly (1).

FASTENER	TORQUE VALUE	
Horn bracket screws	50-62 in-lbs	5.7-7 N-m

- 1. See Figure 8-37. Install horn assembly.
 - b. See Figure 8-38. Install screws (1). Tighten.
Torque: 50-62 **in-lbs** (5.7-7 Nm) *Horn bracket screws*
 - c. See Figure 8-37. Connect horn connectors (2).

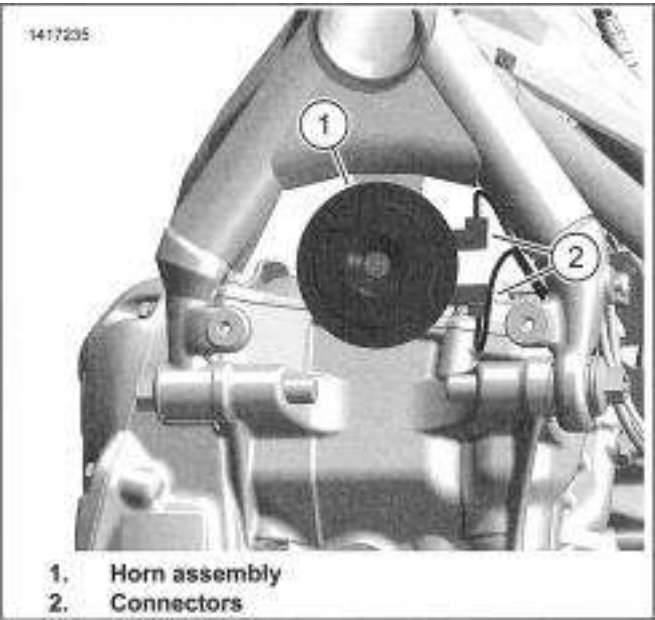


Figure 8-37. Horn

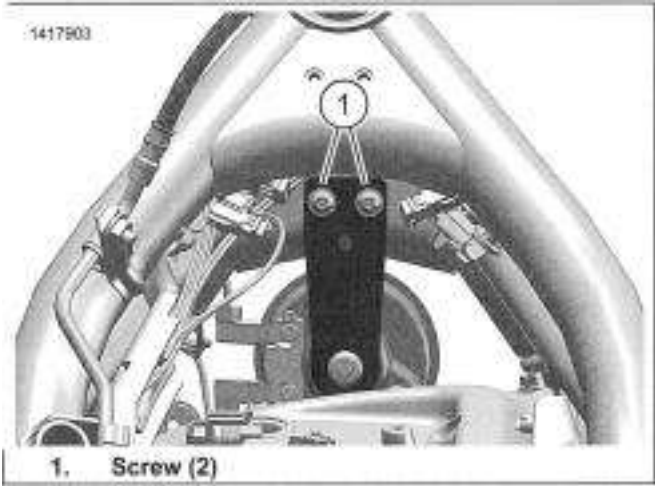


Figure 8-38. Horn Assembly (backside view)

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 8-39. Remove headlamp screws (1).
- 2. Disconnect headlamp connector.
- 3. Remove headlamp (2).

FASTENER	TORQUE VALUE	
Headlamp bracket screw	71-89 in-lbs	8-10 N-m

INSTALL _____

- 1. Connect headlamp connector.
- 2. See Figure 8-39. Position headlamp (2).
- 3. Install screws (1). Tighten.
Torque: 71-89 in-ibs (8-10 N-m) Headlamp bracket screw
- 4. Adjust headlamp. See Adjust in this section.

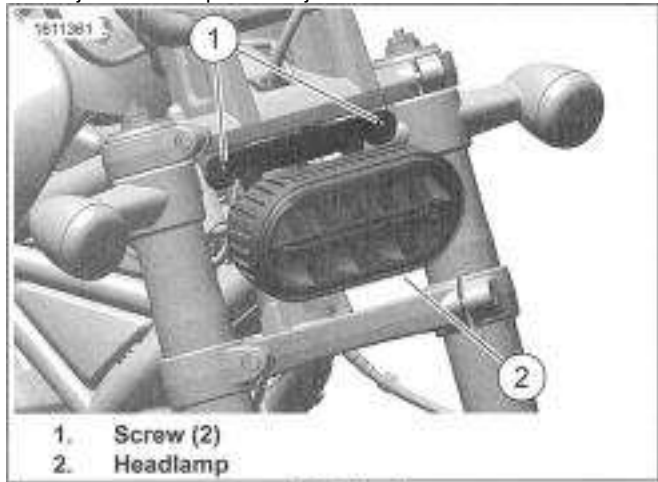


Figure 8-39. Headlamp

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 8-40. 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.

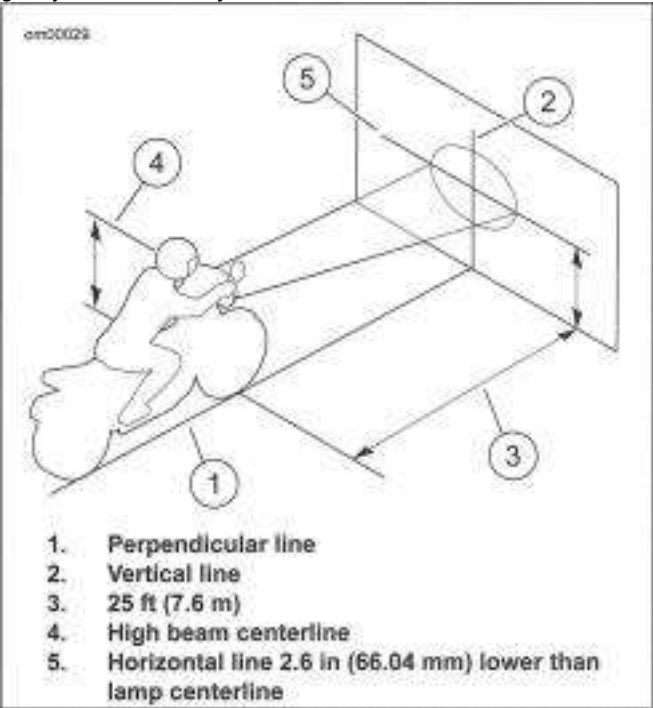


Figure 8-40. Checking Headlamp Alignment

ADJUST

FASTENER	TORQUE VALUE	
Headlamp screw	6-7 ft-lbs	8-10 N-m

- 1. See Figure 8-41. Loosen screws (1).
- 2. Set vertical adjustment.
- 3. Tighten screws.
Torque: 6-7 ft-lbs (8-10 N-m) Headlamp screw

HEADLAMP COMPLETE

2

1. Install main fuse. See POWER DISCONNECT (Page 8-4).

A 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.

1. Screw (2)
2. Headlamp

Figure 8-41. Headlamp Adjustment

PREPARE _____

- 1. Remove main fuse. See POWER DISCONNECT (Page 8-4).

REMOVE _____

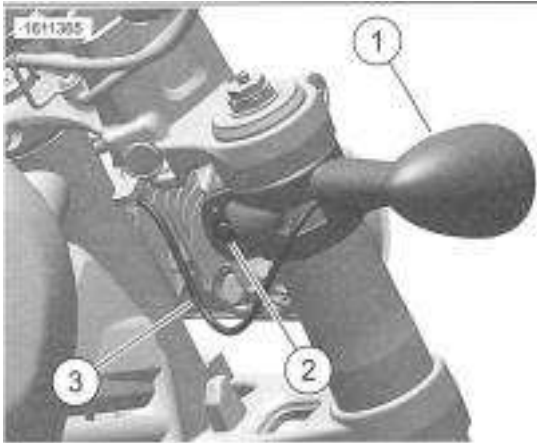
- 1. See Figure 8-42. Remove screw (2).
- 2. Slide front turn signal down fork tube.
- 3. See Figure 8-42. Note wire routing. Remove wire (3).
- 4. Remove front turn signal lamp (1).

INSTALL _____

- 4. Install screw (2). Tighten.
Torque: 27-44 **in-lbs** (3-5 N-m) *Turn signal screw, front*

FASTENER	TORQUE VALUE	
Turn signal screw, front	27-44 in-lbs	3-5 N-m

- 1. See Figure 8-42. 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



- 1. Front turn signal lamp
- 2. Screw
- 3. Wire

Figure 8-42. Front Turn Signal Lamp

COMPLETE _____

- hole in triple clamp.
- 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 8-29).

REMOVE**NOTE**

Turn signal lamp bulbs are not serviceable. Turn signal lamp must be replaced as an assembly.

1. See Figure 8-43. Remove screw (1).
2. Release the wire from the locating track and remove rear turn signal lamp (2).

FASTENER	TORQUE VALUE	
Turn signal lamp screw	71-89 in-lbs	8-10 N-m

1. See Figure 8-43. Install rear turn signal lamp, a.

Install rear turn signal lamp (2).

INSTALL

1. Install tail lamp. See TAIL LAMP (Page 8-29).

- b. Install screw (1). Tighten.

Torque: 71-89 **in-lbs** (8-10 N m) Turn signal lamp screw

- c. Install wire in locating track.

1. Screw

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**2. Rear turn signal lamp**

Figure 8-43. Rear Turn Signal Lamp (right lamp shown)

COMPLETE

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 8-44. Remove screws (1).
2. Remove tail lamp (2).

FASTENER	TORQUE VALUE	
Tail lamp screw	62-80 in-lbs	7-9 N-m

1. See Figure 8-44. Install tail lamp (2).
2. Install screws (1). Tighten.
Torque: 62-80 **in-lbs** (7-9 **Nm**) *Tail lamp screw*

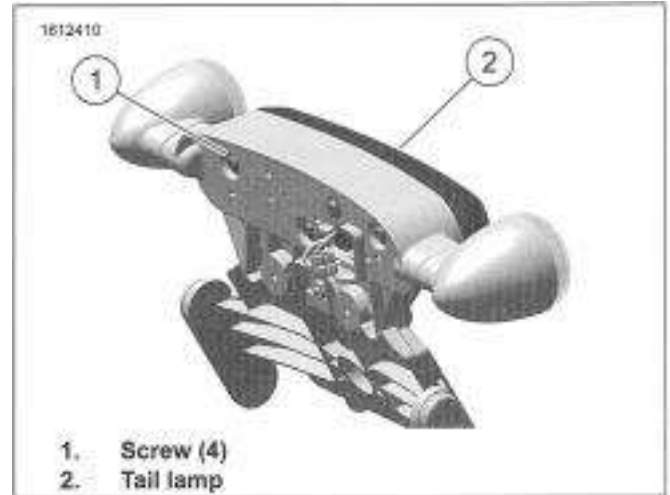


Figure 8-44. Tail Lamp

INSTALL**COMPLETE**

1. install license plate module swingarm mount. See LICENSE PLATE MODULE SWINGARM MOUNT (Page 3-76).
2. Install main fuse. See (Page 8- POWER DISCONNECT 4).

REMOVE _____

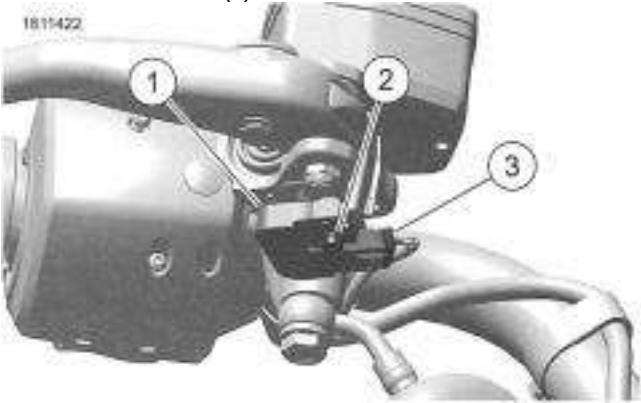
- 1. See Figure 8-45. Disconnect connector (3).
- 2. Remove screw (2).
- 3. Remove stoplamp switch (1).

INSTALL

FASTENER	TORQUE VALUE	
Stoplamp switch screw, front	4-6 in-lbs	0.5-0.7 N-m

- 1. See Figure 8-45. 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).



- 1. Stoplamp switch
- 2. Screw
- 3. Connector

Figure 8-45. Front Stoplamp Switch

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. See Figure 8-46. Install switch (2). Tighten.

2. Remove switch (2).

INSTALL

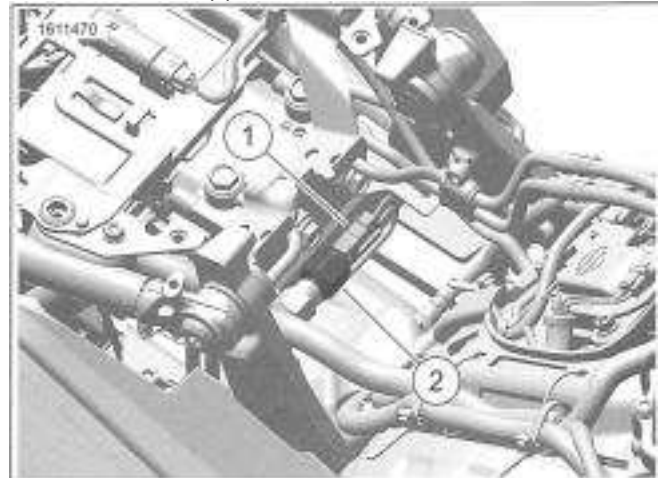
FASTENER	TORQUE VALUE	
Rear stoplamp switch	12-15 ft-lbs	16.3-20.3 N-m

CONSUMABLE	PART NUMBER
LOCTITE 565 THREAD SEALANT	99818-97

1. Apply LOCTITE® 565 to threads of switch.
Consumable: LOCTITE 565 THREAD SEALANT (99818-97)

Torque: 12—15 ft-lbs (16.3-20.3 N-m) *Rearstoplamp switch*

3. Install connector (1).



1. Connector
2. Switch

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).

A 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 8-29) for tail lamp removal and installation.

PREPARE

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

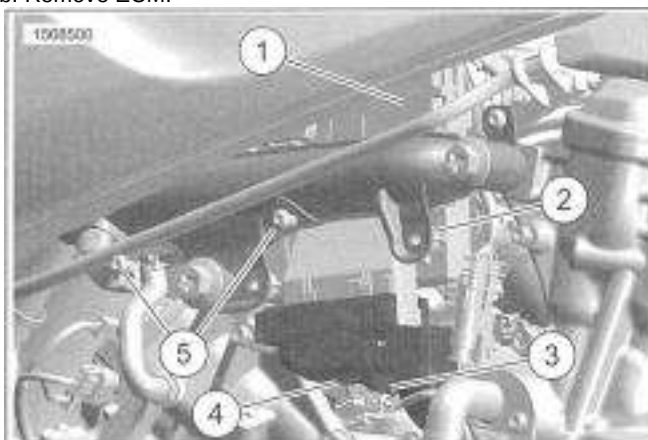
NOTE

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.



1. ECM assembly
2. Frame
 - a. See Figure 8-48.
3. Connector lever
4. Connector lock
5. Screws (2)

Figure 8-47. ECM Removal



1. ECM caddy

2. ECM

Figure 8-48. ECM

INSTALL

FASTENER	TORQUE VALUE	
ECM assembly screws	35-62 in-lbs	4-7 N-m

1. Install ECM.
 - 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 DTI I.

- REMOVE**

-

- Figure 8-49. BCM and Connectors**

NOTE

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

Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

assign the fob to the vehicle.

NOTE

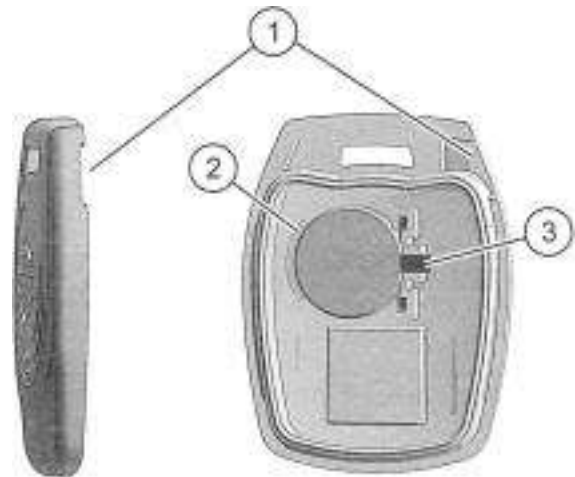
- ' Choose correct fob type. Choosing incorrectly at beginning of the process will result in a failure to assign the fob. This can be mistakenly diagnosed as a bad fob or SCM.
- When assigning a fob, keep the fob within 3 ft (1 m) of vehicle seat.

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.

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1. Thumbnail slot
2. Battery (CR1632)
3. Latch

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.

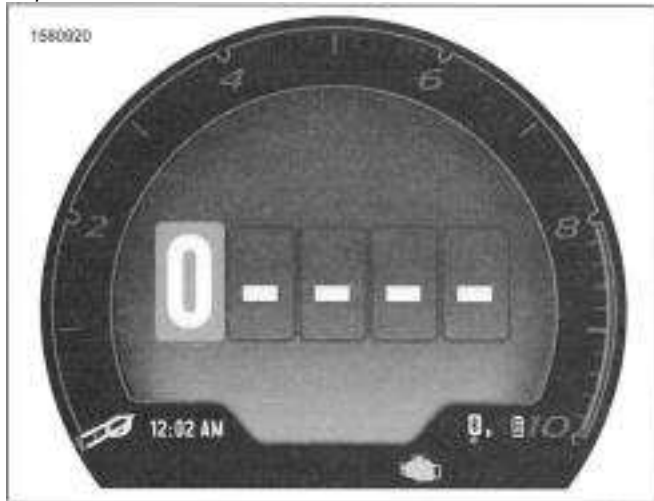


Figure 8-51. PIN Entry Screen

2. See Figure 8-53. Select the next digit.

Hand Control Entry

1. See Figure 8-51. Select the first digit of the PIN.

4. Cycle the ignition to save PIN.

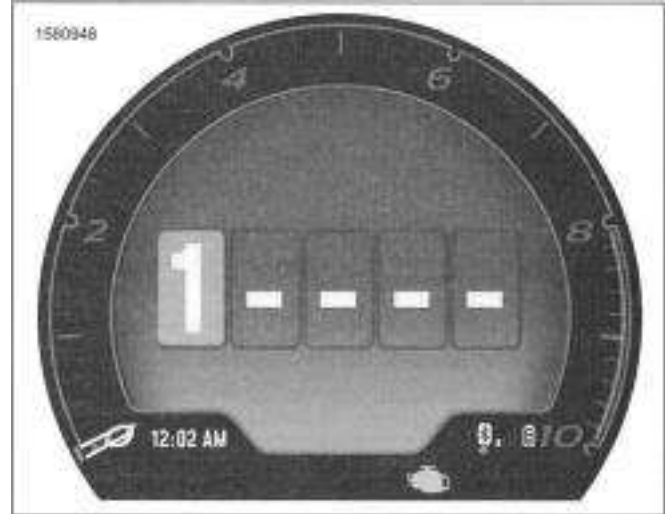


Figure 8-52. First PIN Digit Entry



Figure 8-53. Moving Cursor to Next Digit

- a. Push the left turn signal to scroll through the numbers (1-9) until the desired digit appears.

- 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.

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

It is possible to arm the security system without enabling the motion detector for one ignition cycle. The motorcycle can be moved in an armed state. The motorcycle cannot be turned on or started while in transport mode until the fob is present.

To Enter Transport Mode

1. With security fob present, set the OFF/RUN switch to RUN.
2. Set the OFF/RUN switch to OFF.
3. Simultaneously press both the left and the right turn signal switches within five seconds of turning the OFF/RUN switch to OFF.
4. Following a single flash, the turn signals flash three times to indicate that the system is armed in transport mode.

To Exit Transport Mode

With the fob present, set the OFF/RUN switch to RUN 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.

1495497



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).

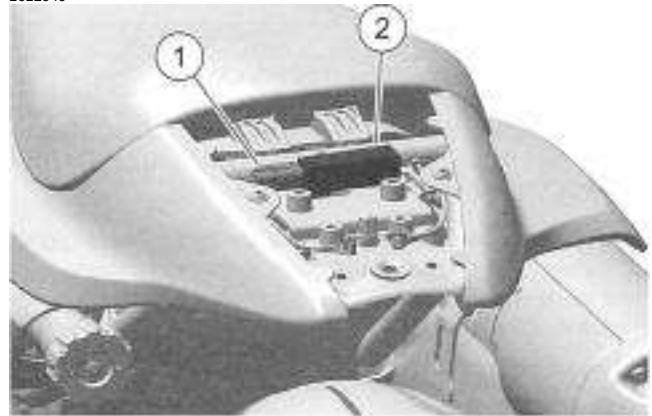
REMOVE

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.

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1. Connector
2. Antenna

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

1. See Figure 8-56. Install cooling fan (1) and cooling fan

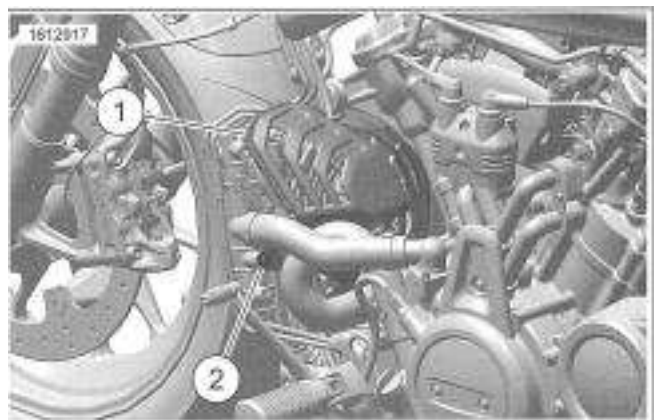
FASTENER	TORQUE VALUE	
Cooling fan mounting nut	35-44 in-lbs	4-5 N-m
Cooling fan shroud screw	71-89 in-lbs	8-10 N-m

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*



1. Cooling fan
2. Nut (3)
3. Connector
Figure 8-56. Cooling Fan



1. Cooling fan shroud
2. Screw
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 2-36).
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).

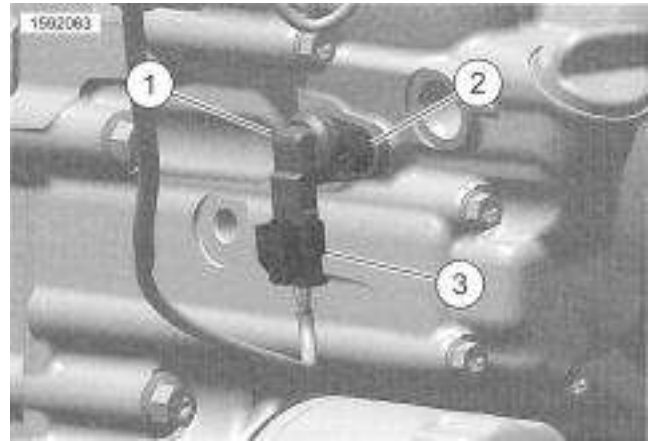
INSTALL

1. See Figure 8-59. Lubricate new o-ring with clean engine

FASTENER	TORQUE VALUE	
CKP sensor screw	53-80 in-lbs	6-9 N-m

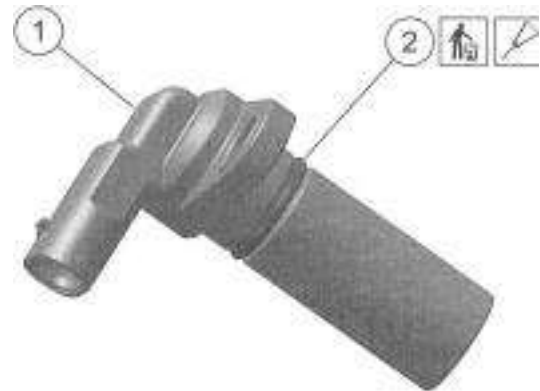
oil.

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 Nm) *CKP sensor screw*
5. Connect CKP connector (3).



1. Crank sensor
2. Screw
3. Connector

Figure 8-58. Crankshaft Position (CKP) Sensor



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1. Crankshaft sensor
2. O-ring

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 2-36).
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).

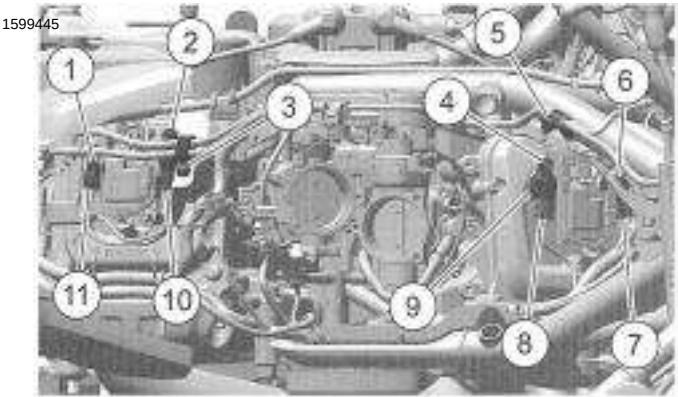
REMOVE

- 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 Nm) *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

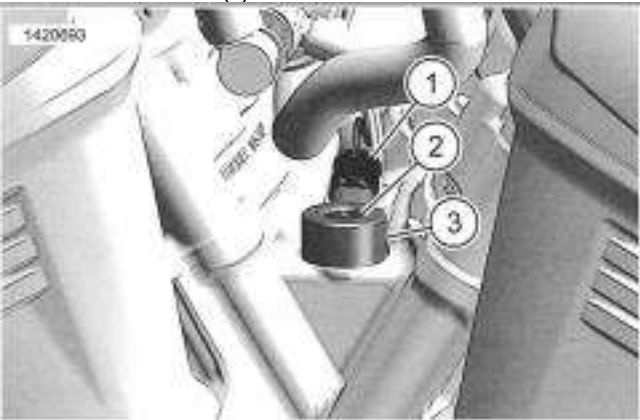
- 1. See Figure 8-62. Disconnect connector (1).
- 2. Remove screw (2).
- 3. Remove knock sensor (3).

INSTALL

FASTENER	TORQUE VALUE	
Knock sensor screw	97-115 in-lbs	11-13 Nm

- 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).



- 1. Connector
- 2. Screw
- 3. Knock sensor

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 Nm) *Gear position sensor screw*
3. Connect the gear position sensor connector (3).



1. Front belt sprocket
2. Gear position sensor
3. Gear position sensor connector
4. Screw (2)

Figure 8-63. Gear Position Sensor Connector (Chain Removed for Clarity)

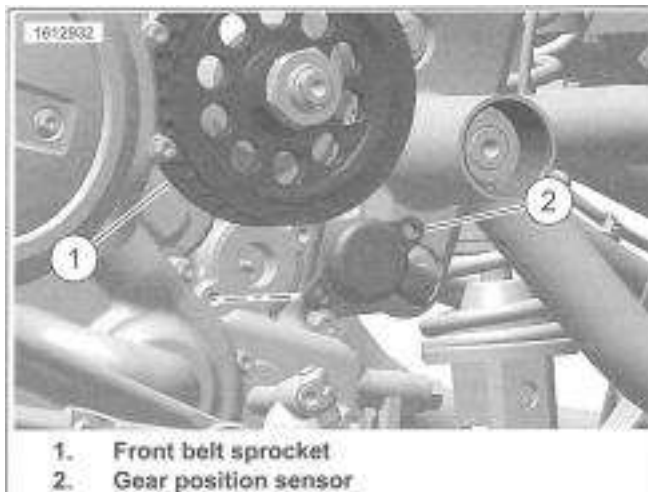


Figure 8-64. Gear Position Sensor

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*

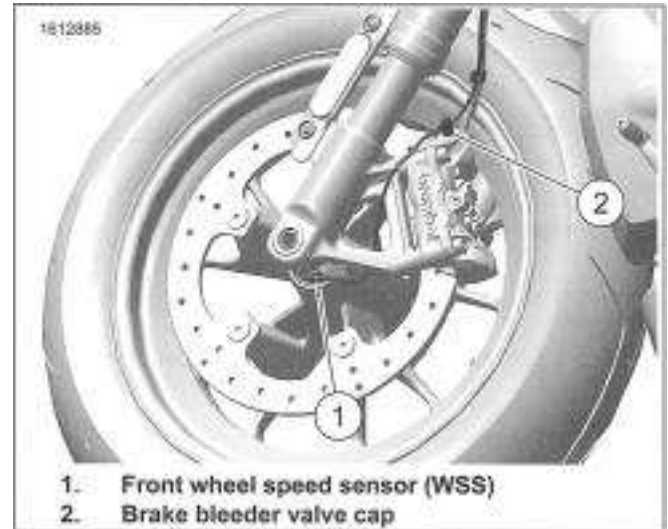
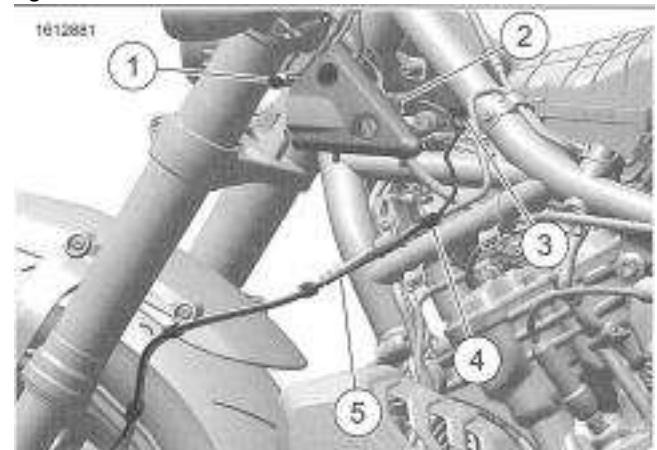


Figure 8-65. Front WSS



1. Screw
2. Left steering head cover
3. Front WSS connector
4. Clip (4)
5. Front WSS cable

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

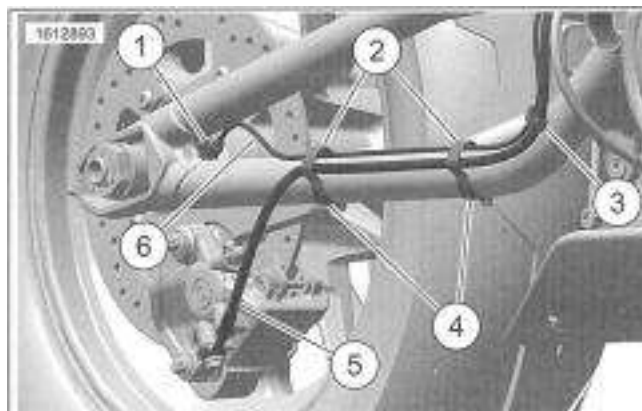
Note rear WSS cable routing and clip locations before removing cable.

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.

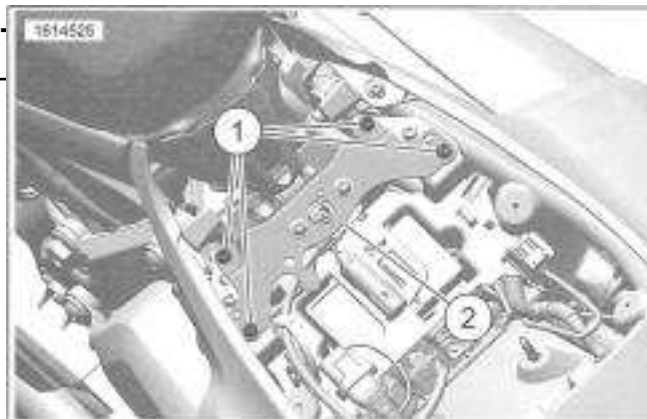
INSTALL

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 Nm) *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*

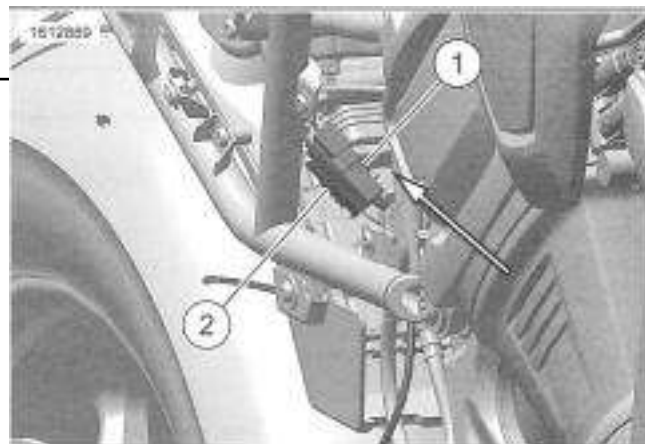


1. Rear wheel speed sensor (WSS)
 2. Clamp (2)
 3. Clip (3)
 4. Screw (2)
 5. Brake hose
 6. Rear WSS cable
- Figure 8-67. Rear WSS Cable



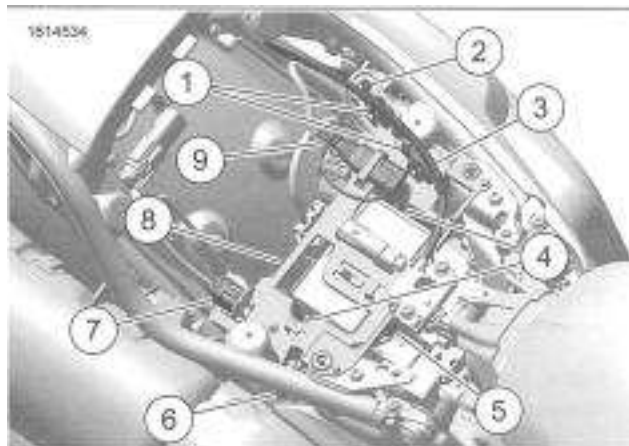
1. Screw (4)
2. Bracket

Figure 8-68. Seat Release Bracket



1. Rear WSS connector
2. Connector retaining bracket

Figure 8-70. Rear WSS Connector Location



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

COMPLETE

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*



- 1. TGS
- 2. RHCM
- 3. 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).

A 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).

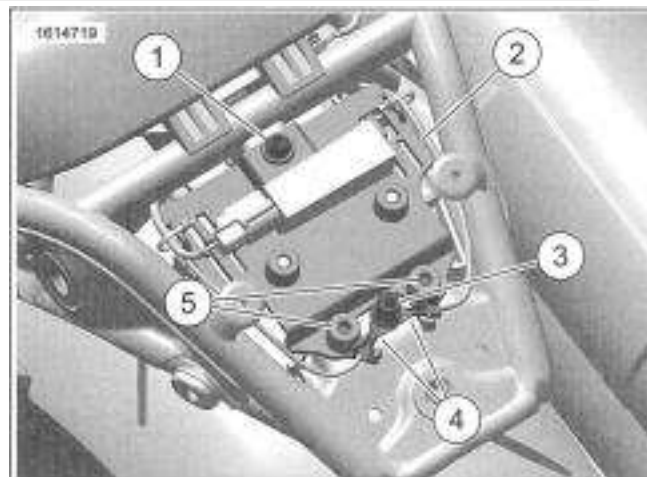
REMOVE

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

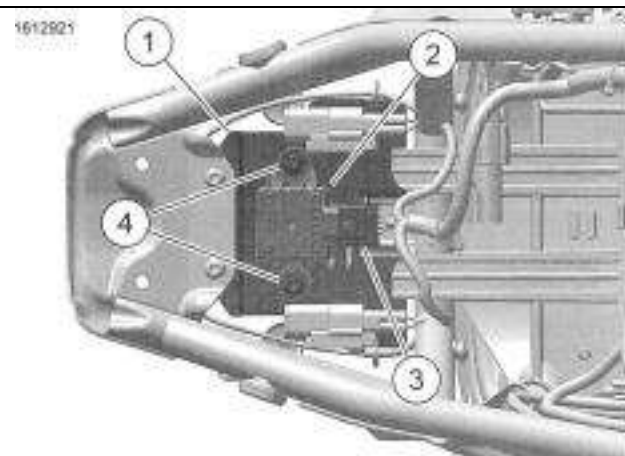
FASTENER	TORQUE VALUE	
Ground wire nut	60-72 in-lbs	6.8-8.1 N-m
IMU mounting screw	89-97 in-lbs	10-11 N-m
Tail caddy bottom screw	35-62 in-lbs	4-7 N-m
Tail caddy front screw	25-29 in-lbs	2.8-3.3 N-m

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*



1. Screw
2. Tail caddy
3. Nut
4. Ground wire connector (2)
5. Screw (2)

Figure 8-72. Tail Caddy



1. Tail section caddy (bottom view)
2. IMU
3. Connector
4. Screw (2)

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

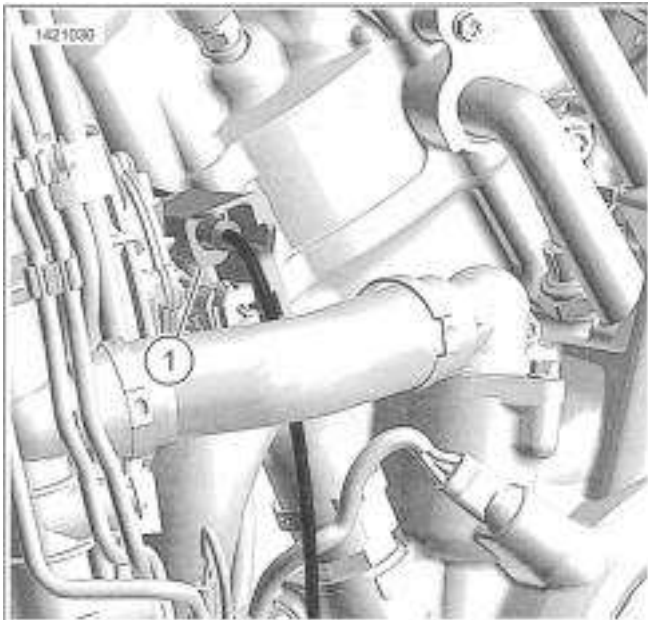
- 1. See Figure 8-74. Disconnect connector (1).
- 2. See Figure 8-75. Remove JSS.
 - a. Remove cable strap (1). Discard.
 - b. Remove screw (2).
 - c. Remove sensor (3).

INSTALL

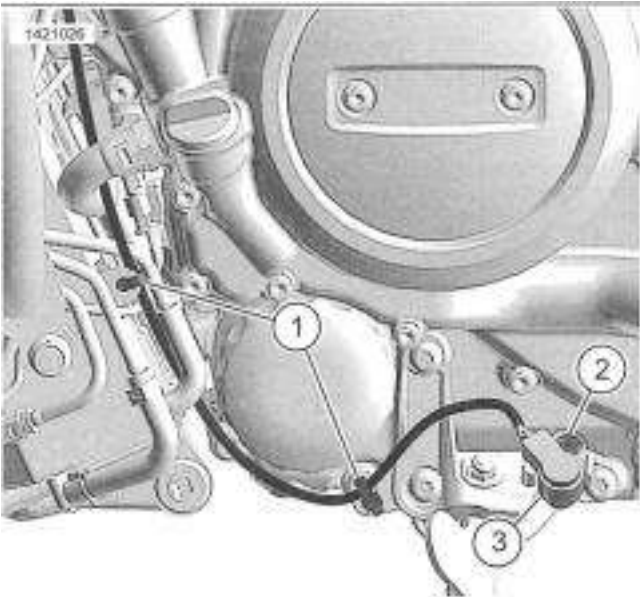
- 1. See Figure 8-75. Install JSS.

FASTENER	TORQUE VALUE	
JSS screw	20-25 in-lbs	2.3-2.8 N m

- a. Install sensor (3).
 - b. Install screw (2). Tighten.
Torque: 20-25 in-lbs (2.3-2.8 Nm) 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.

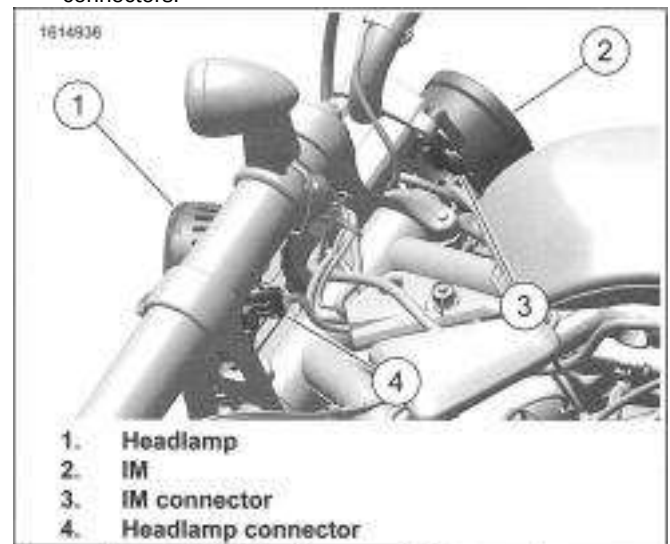
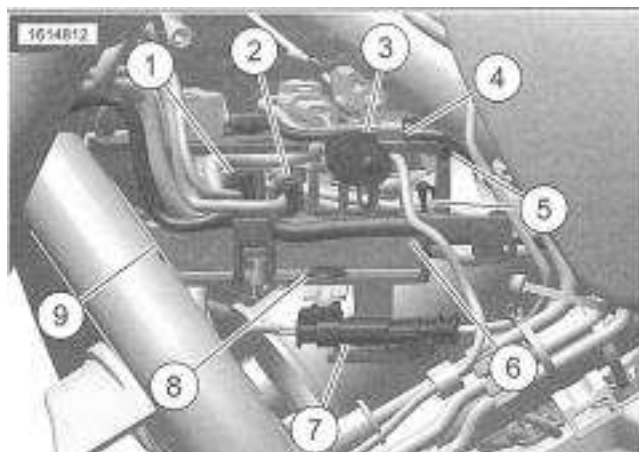
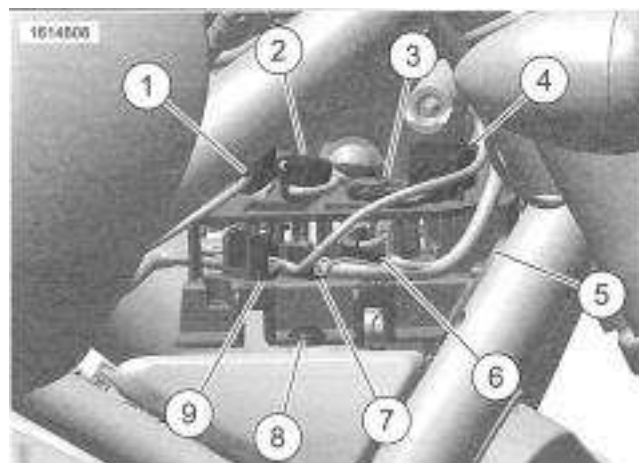


Figure 8-76. Headlamp and IM Connectors



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. Flydraulic 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) .

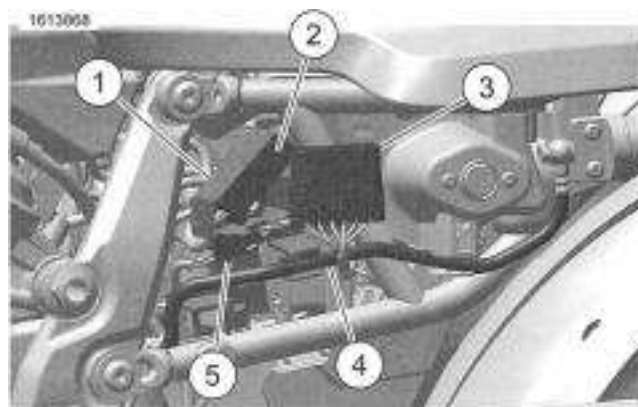
INSTALL

1. See Figure 8-80. Position left side caddy, install screw. Tighten.

FASTENER	TORQUE VALUE	
Caddy, left side screw	25-29 in-lbs	2.8-3.3 N-m

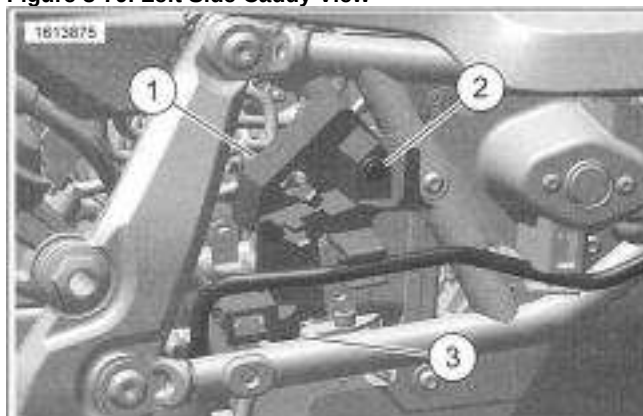
Torque: 25-29 **in-lbs** (2.8-3.3 N-m) *Caddy, left side screw*

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).



1. Left side caddy
2. PAC relay
3. Fuse block
4. Hydraulic hose
5. Rear lighting

Figure 8-79. Left Side Caddy View



1. Left side caddy
2. Screw (1)
3. Locking tab

1. Install left rear side cover. See SIDE COVERS (Page 3-46).
2. Install main fuse. See POWER DISCONNECT (Page 8-4).

Figure 8-80. Left Side Caddy

COMPLETE _____

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

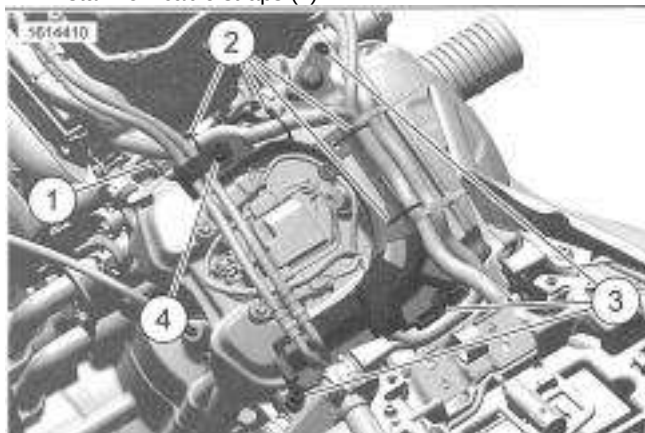
1. See Figure 8-81. Install cylinder head cover caddy (1).

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

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).



1. Engine caddy
2. Cable straps (4)
3. Caddy screws (3)
4. Break-line clamp screw

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

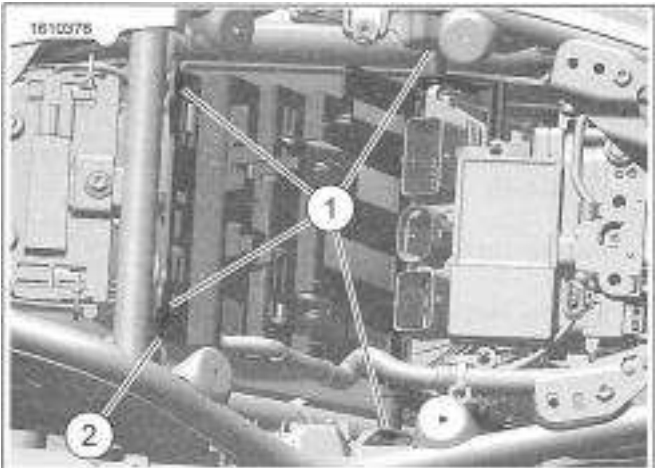
1. See Figure 8-82. Remove screws (1).
2. Remove BCM caddy (2).

FASTENER	TORQUE VALUE	
Under seat caddy screws	35-62 in-lbs	4-7 N-m

1. Install BCM caddy.

INSTALL

2. See Figure 8-82. Position BCM caddy, install screws. Tighten.
Torque: 35-62 in-lbs (4-7 N-m) *Under seat caddy screws*



1. Screws (4)
2. BCM caddy

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 H02S (4) (if equipped).
 - c. DLC (5).
 - d. Battery tender (6).
2. Remove screws (1).
3. Remove under seat caddy (3).

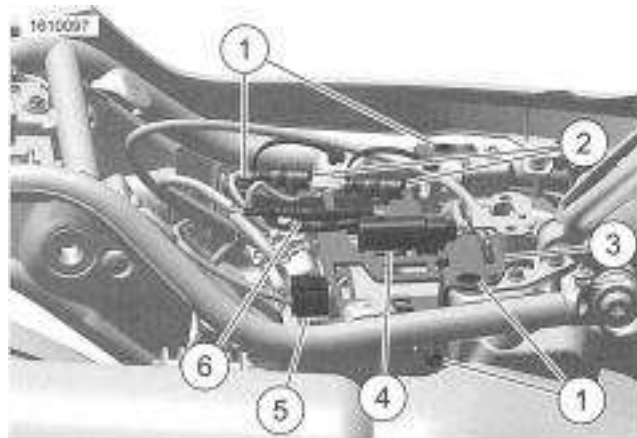
INSTALL

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 H02S (4) (if equipped).
- d. Heated gear (2).



1. Screw (4)
2. Heated gear (2)
3. Under seat caddy
4. Post catalyst H02S
5. DLC
6. Battery tender

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).

TAIL SECTION CADDY 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

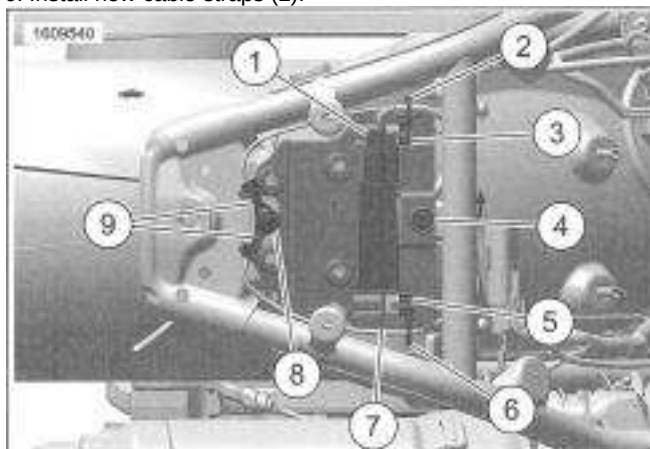
- a. Terminating resistor (3).

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.
 - 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*

8.44

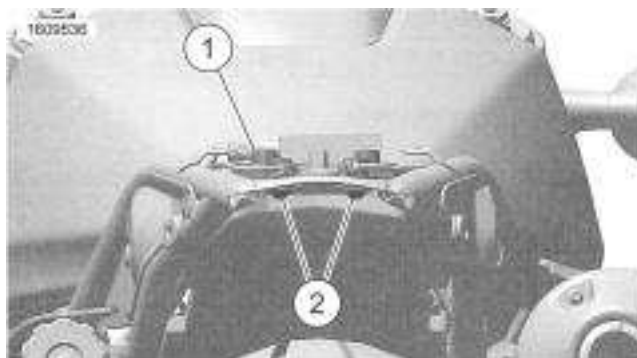
- b. Security antenna (1).
6. Install new cable straps (2).



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. Install rear fender cowl. See COWL AND REAR FENDERS



1. Tail section caddy
2. Screws (2)

Figure 8-85. Tail Section Caddy Screws

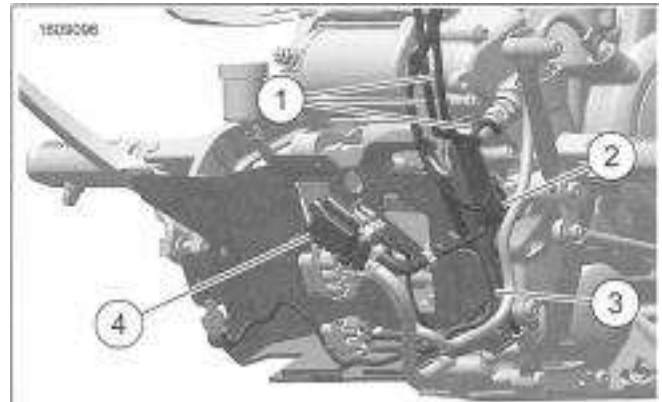
COMPLETE

(Page 3-68).

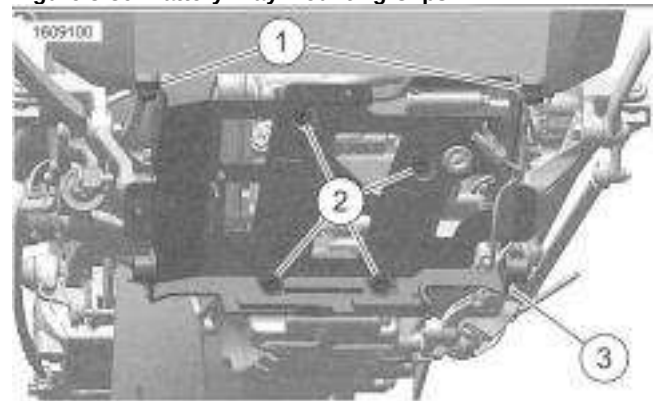
2. Install seat. See SEAT (Page 3-82).
3. Install main fuse. See POWER DISCONNECT (Page 8-4).

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 2-36).
5. Remove coolant overflow tank. See COOLANT OVERFLOW TANK (Page 7-13).
6. Remove charcoal canister (if equipped). See CHARCOAL



1. Purge line
2. Clip
3. Wire retainer
4. Purge solenoid (if equipped)

Figure 8-86. Battery Tray Mounting Clips

1. Support tab (2)
2. Screw (4)
3. Battery tray

b. Install screws (2). Tighten.

Torque: 18-21 ft-lbs
(25-28 Nm) Battery tray screw

2. Install wire harnesses from

retainer (3).

3. See Figure 8-86. Attach EVAP lines (1) to clip (2) (if equipped).

FASTENER	TORQUE VALUE	
Battery tray screw	18-21 ft-lbs	25-28 N m

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

1. Install battery tray.
 - a. See Figure 8-87. Install battery tray (3) on support tabs (1).

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 2-36).
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 WT 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 WT harness (3) up through cylinder head (4).
3. Grasp VVT harness upper grommet and pull to detach it from cylinder head cover.

INSTALL

1. Lubricate grommets on new WT harness with clean engine oil.
2. See Figure 8-88. Route VVT harness (3) up through hole in

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

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 WT 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 WT 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.

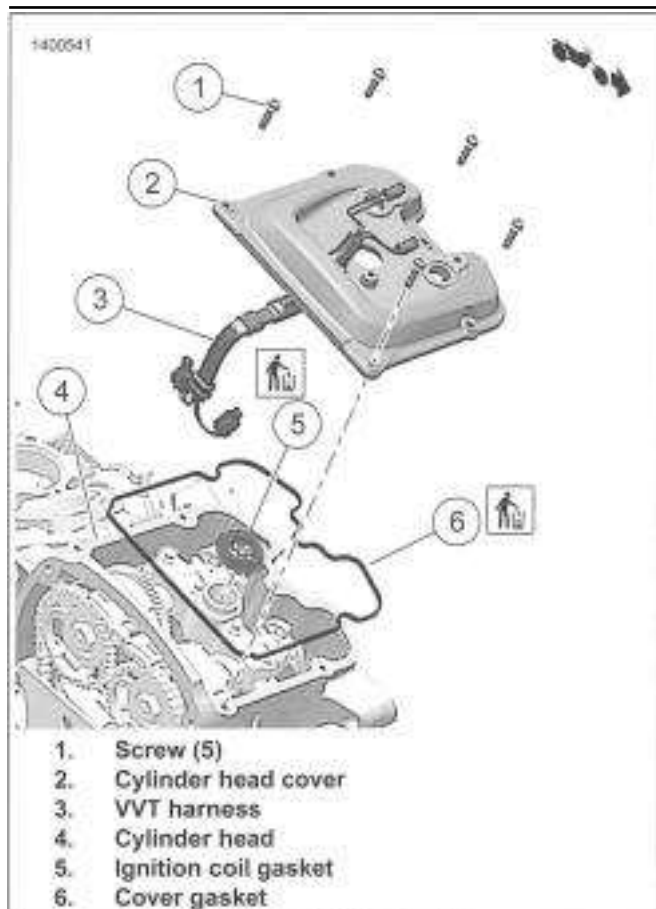


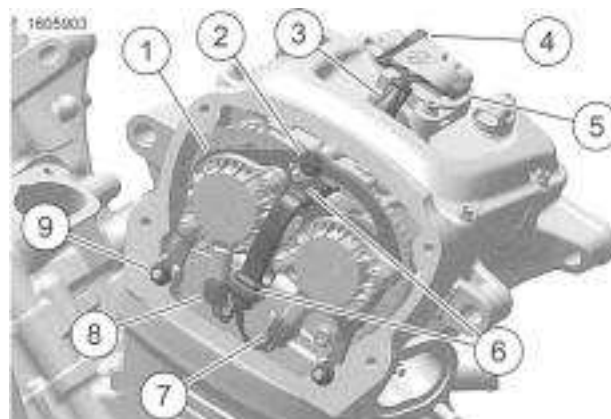
Figure 8-88. Cylinder Head Cover

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1. Grommet
2. Sealing ring
Figure 8-89. Phaser Harness Upper Grommet

1. Camshaft solenoid plate



- 2. Screw
- 3. VVT harness upper grommet
- 4. Engine harness connector (gray wires)
- 5. Engine harness connector (black wires)
- 6. VVT wire harness lower grommet (2)
- 7. Front solenoid connector (black wires)
- 8. Rear solenoid connector (gray wires)
- 9. Nut (2)

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).

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 H02S (International models) (8).
3. See Figure 8-92. Cut and discard cable straps (5).
4. Disconnect connectors:
 - a. Engine harness (1).
 - b. Front H02S (3).
 - c. Rear H02S (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 WT phaser (12).
 - i. Front ignition coil (13).
11. See Figure 8-96. Cut and discard cable straps (3).
12. Remove mid engine caddy bracket (2) with engine harness from motorcycle.

INSTALL

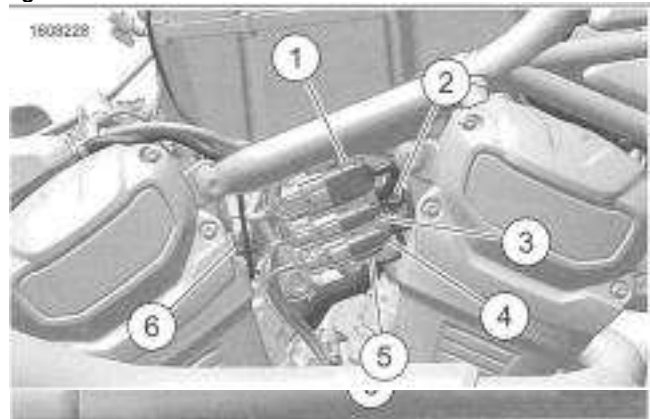
1. See Figure 8-96. Lay mid engine caddy bracket (2) with engine harness on motorcycle. Route harness sections to their proper locations.

2. See Figure 8-95. Connect connectors:
 - a. Fuel level sender (1).
 - b. Front exhaust cam sensor (2).
 - c. Front exhaust WT 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 H02S (3).
 - c. Rear H02S (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 WT phaser (1).
 - d. Rear intake VVT phaser (5).

- e. Rear ignition coil (single) (2).
- f. Post catalyst H02S (International models) (8).

11. See Figure 8-96. Attach mid engine caddy bracket (2) and engine harness to motorcycle with new cable straps (3).

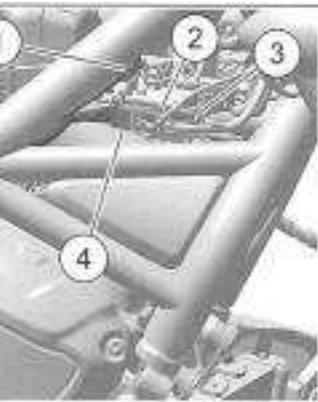
Figure 8-91. Under Seat Connectors



1. Rear exhaust exhaust VVT phaser
2. Rear ignition coil
3. Rear intake cam sensor
4. Inlet air temperature sensor
5. Rear intake VVT phaser
6. Cable straps (3)
7. Rear exhaust cam sensor
8. Post catalyst H02S

Figure 8-92. Right Side Engine Harness Connectors

1. Engine harness
2. Front MAP sensor
3. Front H02S sensor
4. Rear H02S sensor
5. Cable straps (3)
6. Rear MAP sensor



Front Engine Connectors

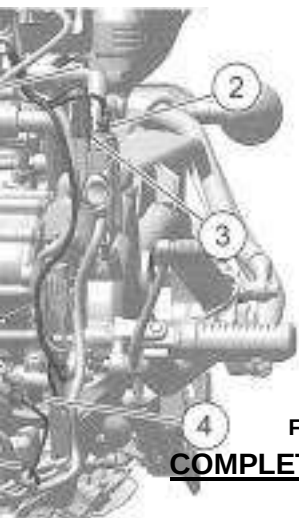
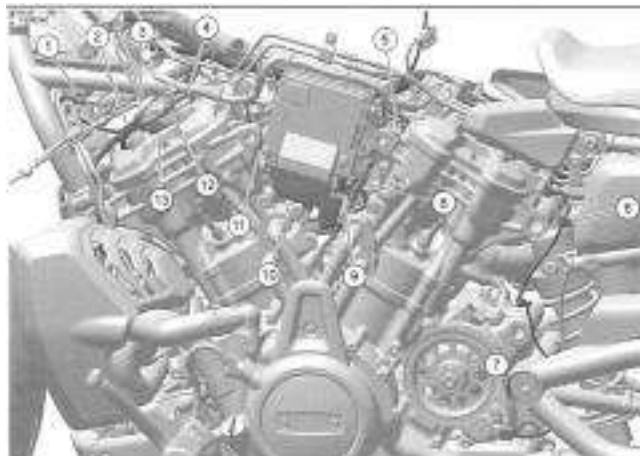


Figure 8-96. Mid Engine Caddy Bracket

COMPLETE



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. Sensorjumper
9. TCA
10. ECM
11. Front fuel injector
12. Front intake VVT phaser
13. Front ignition coil

1. Block coil
2. Cooling fan
3. JSS
4. CKP
5. Cable straps (1)
6. Purge solenoid (if equipped)

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).

Figure 8-94. Front Engine Connectors

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 2-36).
 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).
- 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).

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 H02S (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).

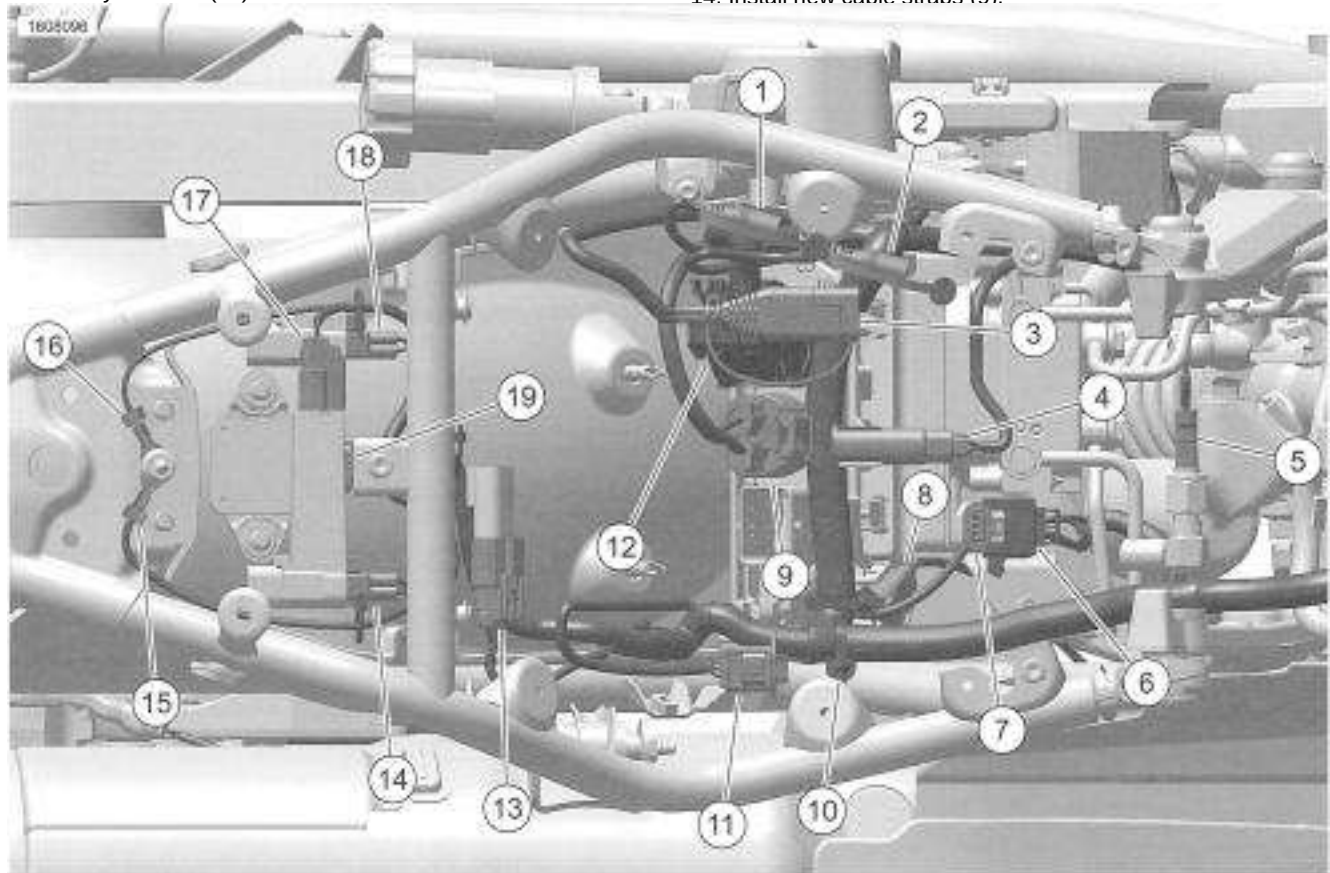
- d. Wire harness from retainer (4).
- e. Wire harness from retainer (6).
- f. Fuel level sender (7).
- g. Scrivet (8).
- 11. See Figure 8-102. Disconnect connectors.
 - a. Engine jumper (1).
 - b. Front H02S (3).
 - c. Rear H02S (4).
- 12. See Figure 8-103. Disconnect connectors.
 - a. PAC relay (2).
 - b. Fuse block (3).
 - c. Rear lighting (5).
- 13. Remove harness caddy fasteners.
- 14. Remove harness.

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 H02S (3).
 - c. Rear H02S (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).
- 6. See Figure 8-100. Connect connectors.
 - a. IM (1).
 - b. Headlamp (7).
 - c. PAC relay (2).

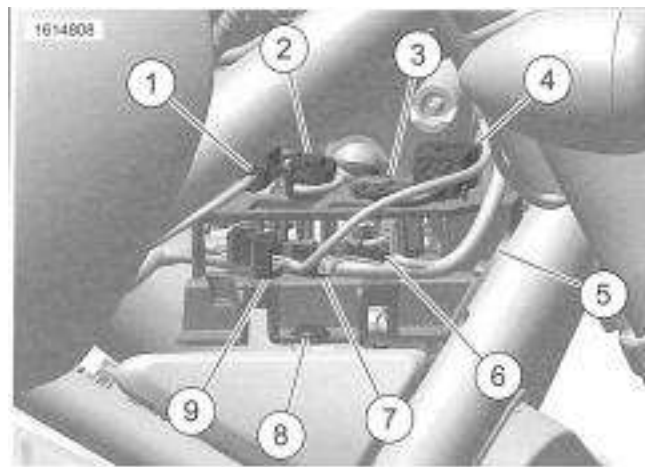
- d. Fuse block (3).
- e. Rear lighting (5).
- 7. Install new cable straps (4).
- 8. See Figure 8-99.
- 9. Install ground screw (7).
- 10. Connect lower front connectors.
 - a. Starter solenoid (6).
 - b. Voltage regulator (5).
 - c. Terminating resistor (3).
 - d. Horn (1) and (2).
- 11. Install new 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).

- Ground 2 (14).
- m. Ground 1 (15).
- n. Security antenna (16).
- o. Terminating resistor (17).
- P- IMU (18).
- 14. Install new cable straps (9).



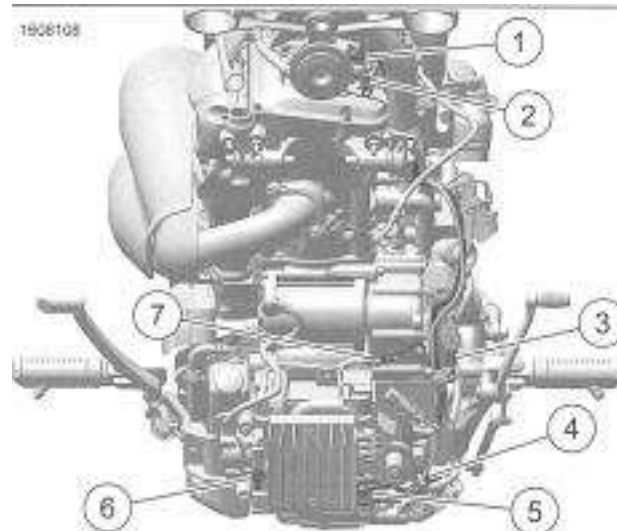
1. Heated gear	11. DLC
2. Heated gear	12. BCM
3. Battery tender	13. PAC
4. Post catalyst H02S	14. Terminating resistor
5. Rear stop lamp switch	15. Ground 2
6. ABS module	16. Ground 1
7. Security siren	17. Security antenna
8. Rear WSS	18. Terminating resistor
9. BCM power	19. IMU
10. Cable strap (6)	

Figure 8-97. Under Seat Main Harness Connectors



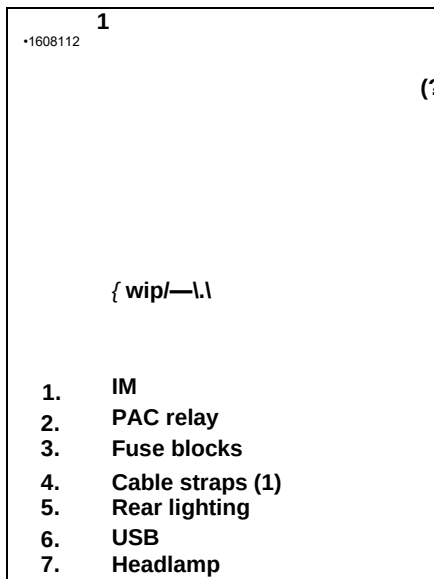
1. Air temperature sensor
2. Front WSS
3. Harness retainer
4. Main fuse
5. Steering head caddy
6. Right hand controls
7. Right hand controls
8. Scrivet

Figure 8-98. RH Front Caddy Connectors



9. Right front turn
1. Horn
2. Horn
3. Terminating resistor
4. Cable straps (2)
5. Voltage regulator
6. Starter solenoid
7. Ground

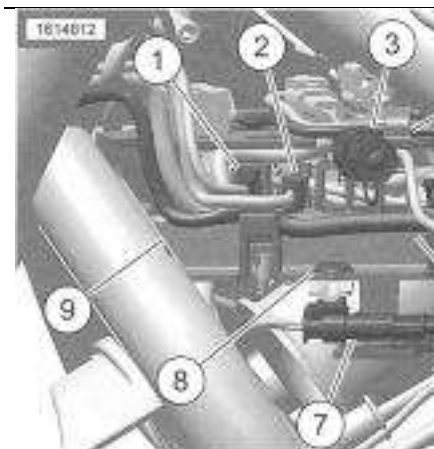
Figure 8-99. Lower Front Connectors



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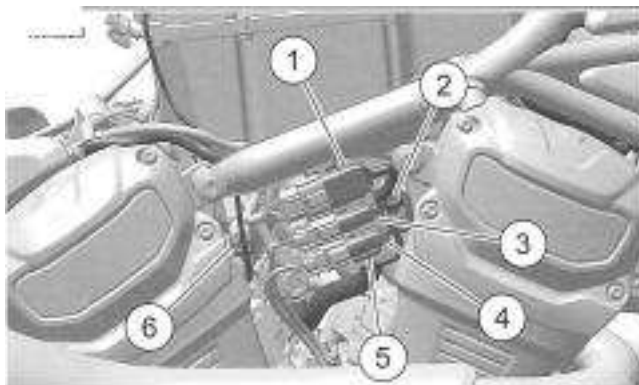
1. IM
2. PAC relay
3. Fuse blocks
4. Cable straps (1)
5. Rear lighting
6. USB
7. Headlamp

Figure 8-100. Left Side Connectors



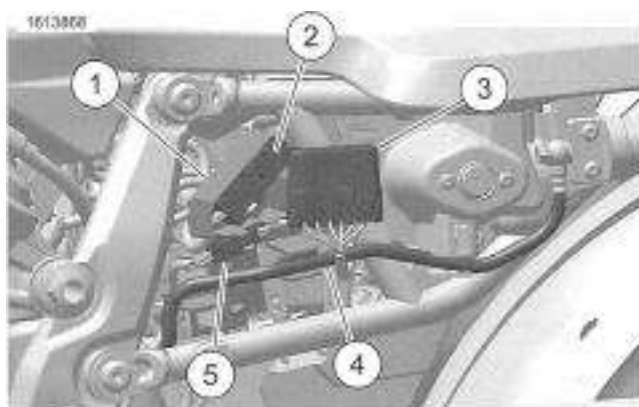
1. Left front turn signal
2. LHCM
3. USB-C
4. Wire harness retainer
5. Cable straps (2)
6. Wire harness
7. Fuel level sender
8. Scrivet
9. Front steering head caddy

Figure 8-101. Left Side Steering Head Connectors



1. Engine harness
2. Front MAP sensor
3. Front H02S sensor
4. Rear H02S sensor
5. Cable straps (3)
6. Rear MAP sensor

Figure 8-102. Right Side Engine Harness Connectors



1. Left side caddy
2. PAC relay
3. Fuse block
4. Hydraulic hose
5. Rear lighting

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 2-36).
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.

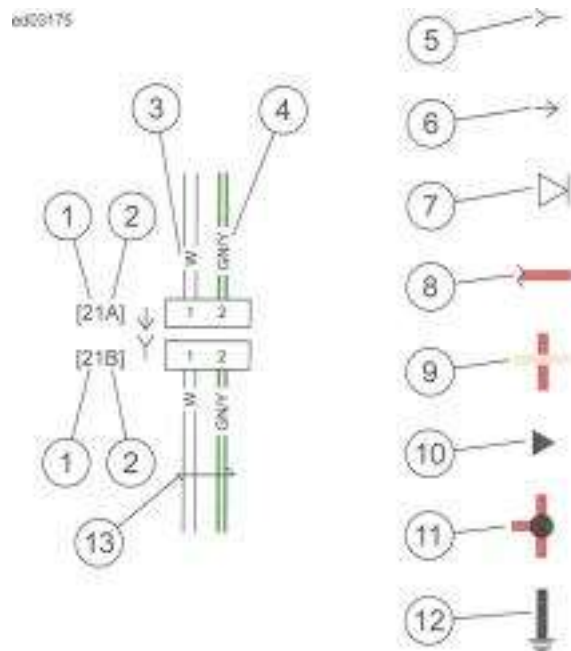
Ground: Grounds can be classified as either clean or dirty grounds. Clean grounds are identified by a (BK/GN) wire and are normally used for sensors or modules.

NOTE

Clean grounds usually do not have electric motors, coils or anything that may cause electrical interference on the ground circuit.

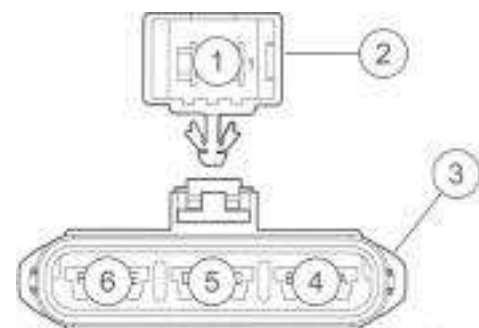
Dirty grounds are identified by a (BK) wire and are used for components that are not as sensitive to electrical interference.

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.



1. Connector number
2. Terminal code (A=pin, B=socket)
3. Solid wire color
4. Striped wire color
5. Socket symbol
6. Pin symbol
7. Diode
8. Wire break
9. No connection
10. Circuit to/from
11. Splice
12. Ground
13. Twisted pair

Figure A-1. Connector/Wiring Diagram Symbols



1. Main fuse
2. Main fuse block [5]
3. Fuse block [64]
4. Infotainment
5. Battery
6. PAC Tender

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: 2021 RH1250S	Figure A-3.
Sensor Grounds: 2021 RH1250S	Figure A-4.
Ground Circuit: 2021 RH1250S	Figure A-5.
Front Lighting and Hand Controls: 2021 RH1250S	Figure A-6.
Main Harness 1 of 4: 2021 RH1250S	Figure A-7.
Engine Harness 2 of 4: 2021 RH1250S	Figure A-8.
Engine Harness 3 of 4: 2021 RH1250S	Figure A-9.
Main Harness 4 of 4: 2021 RH1250S	Figure A-10.
Rear Lighting: 2021 RH1250S	Figure A-11.

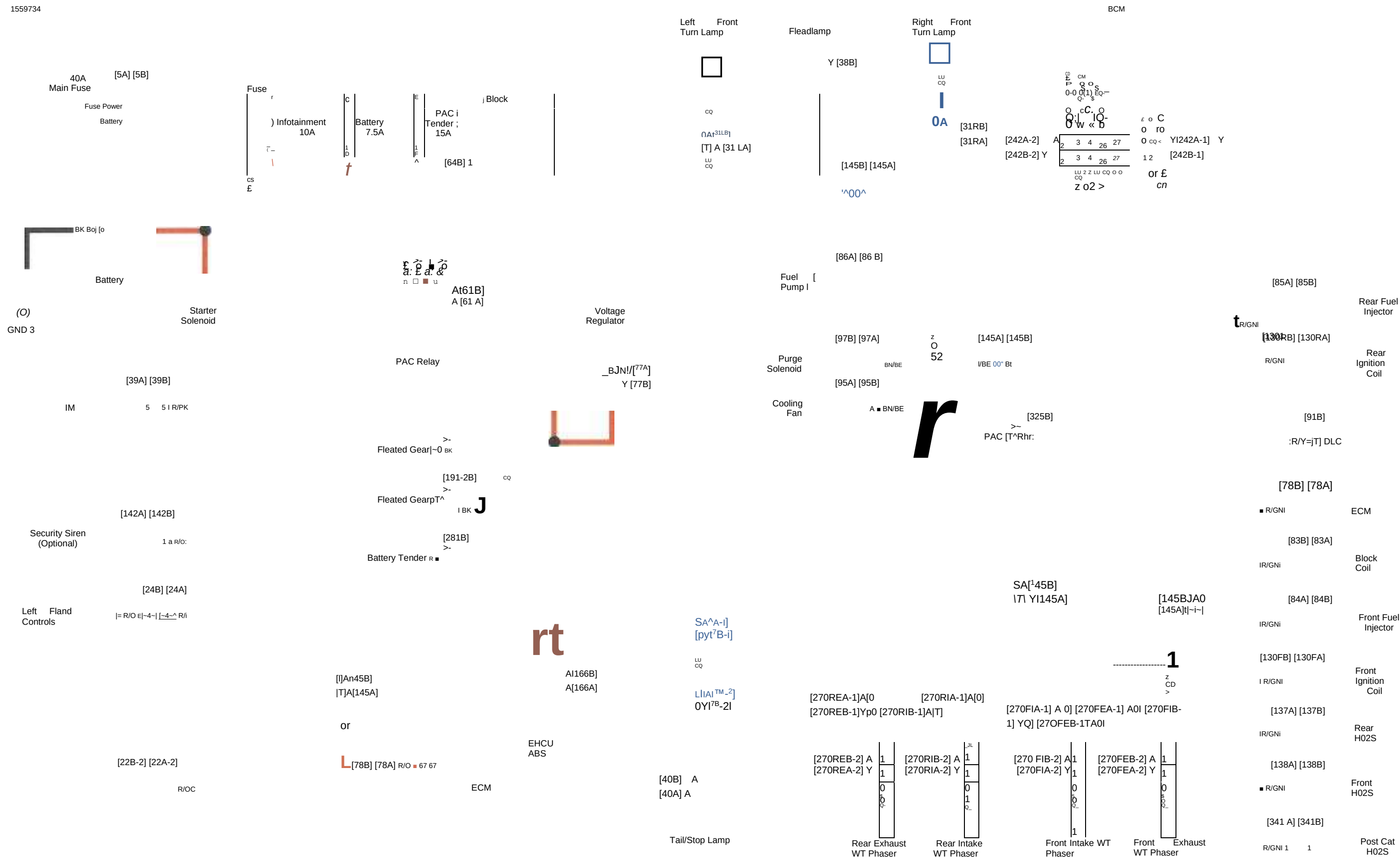


Figure A-3. Power Distribution: 2021 RH1250S

Figure A-3.
Power Distribution: 2021 RH1250S

Figure A-3.
Power Distribution: 2021 RH1250S

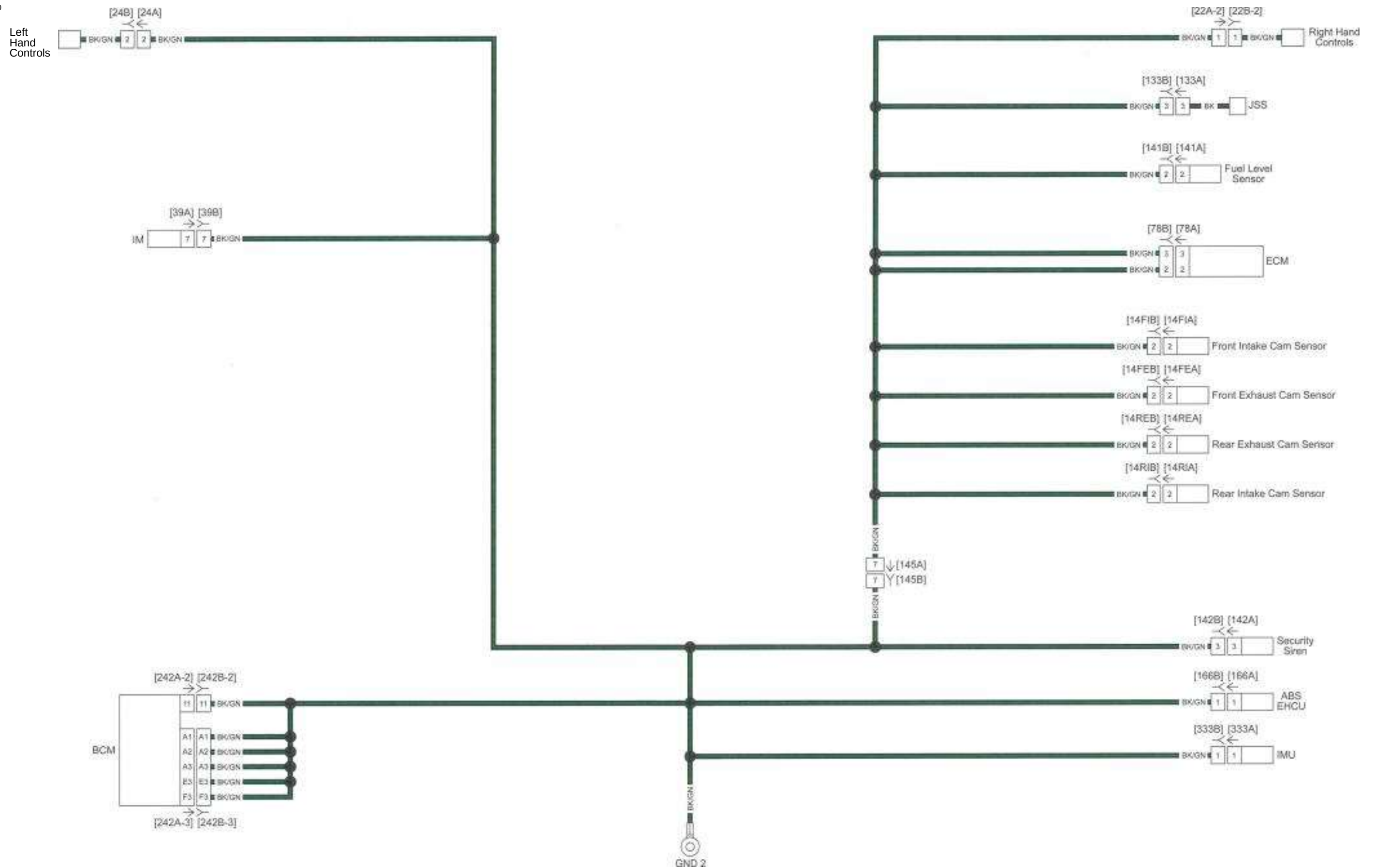


Figure A-4. Sensor Grounds: 2021 RH1250S

Figure A-4.
Sensor Grounds: 2021 RH1250S
Figure A-4.
Sensor Grounds: 2021 RH1250S

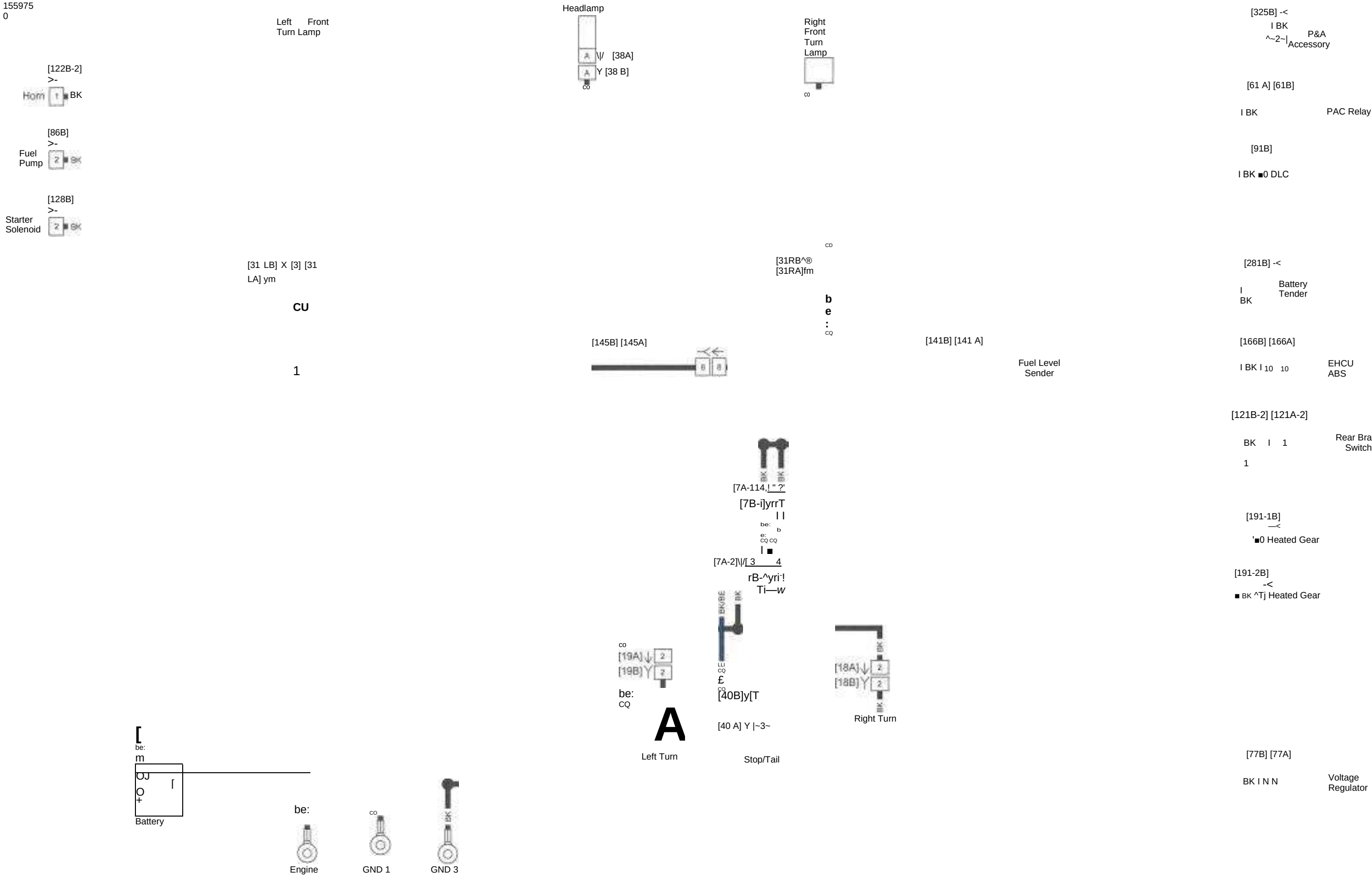


Figure A-5. Ground Circuit: 2021 RH1250S

Figure A-5.
Ground Circuit: 2021 RH1250S
Figure A-5.
Ground Circuit: 2021 RH1250S

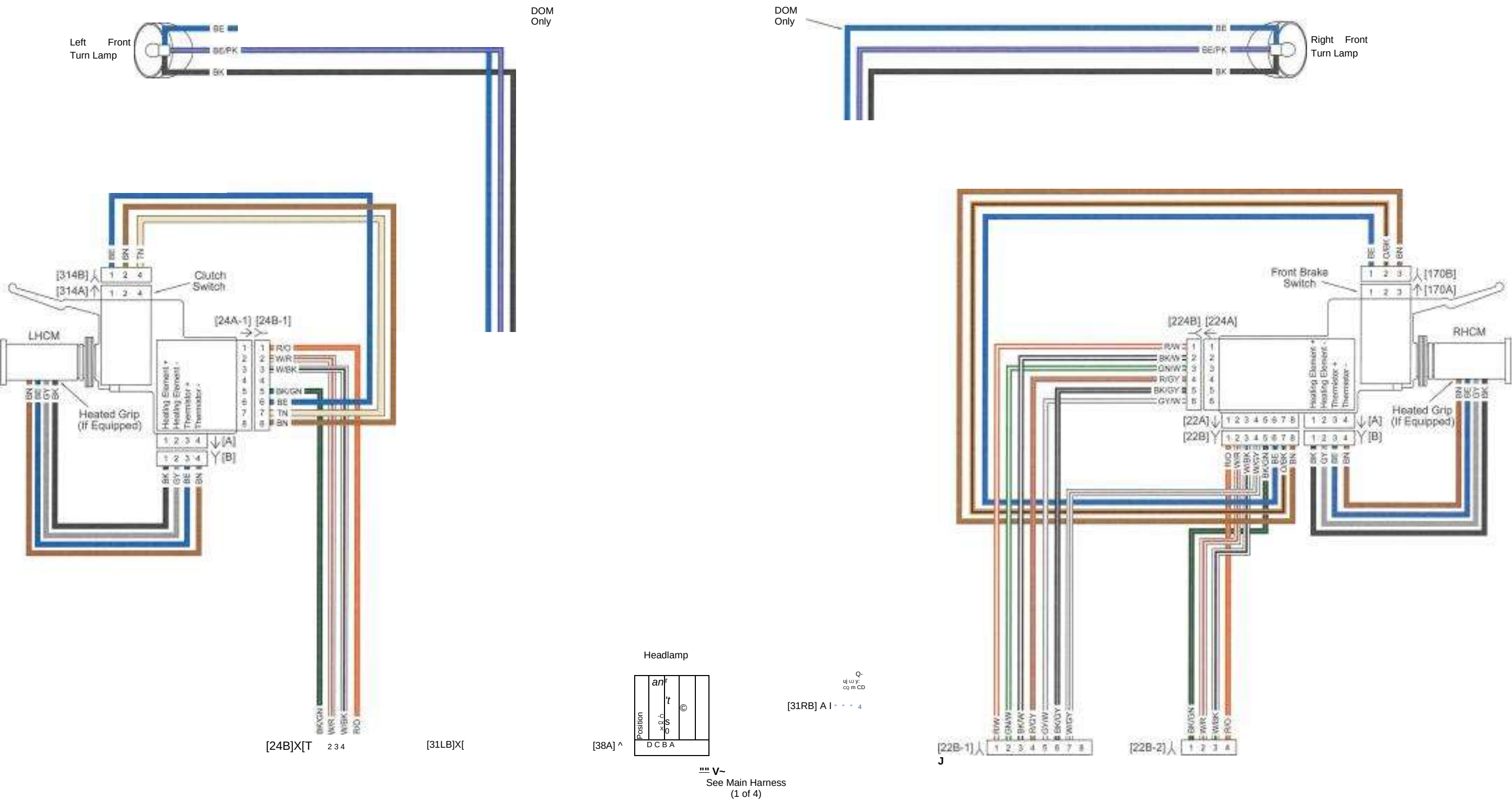


Figure A-6. Front Lighting and Hand Controls: 2021 RH1250S

Figure A-6.
Front Lighting and Hand Controls: 2021 RH1250S

Figure A-6.
Front Lighting and Hand Controls: 2021 RH1250S

See Front
Lighting and
* Hand
Controls

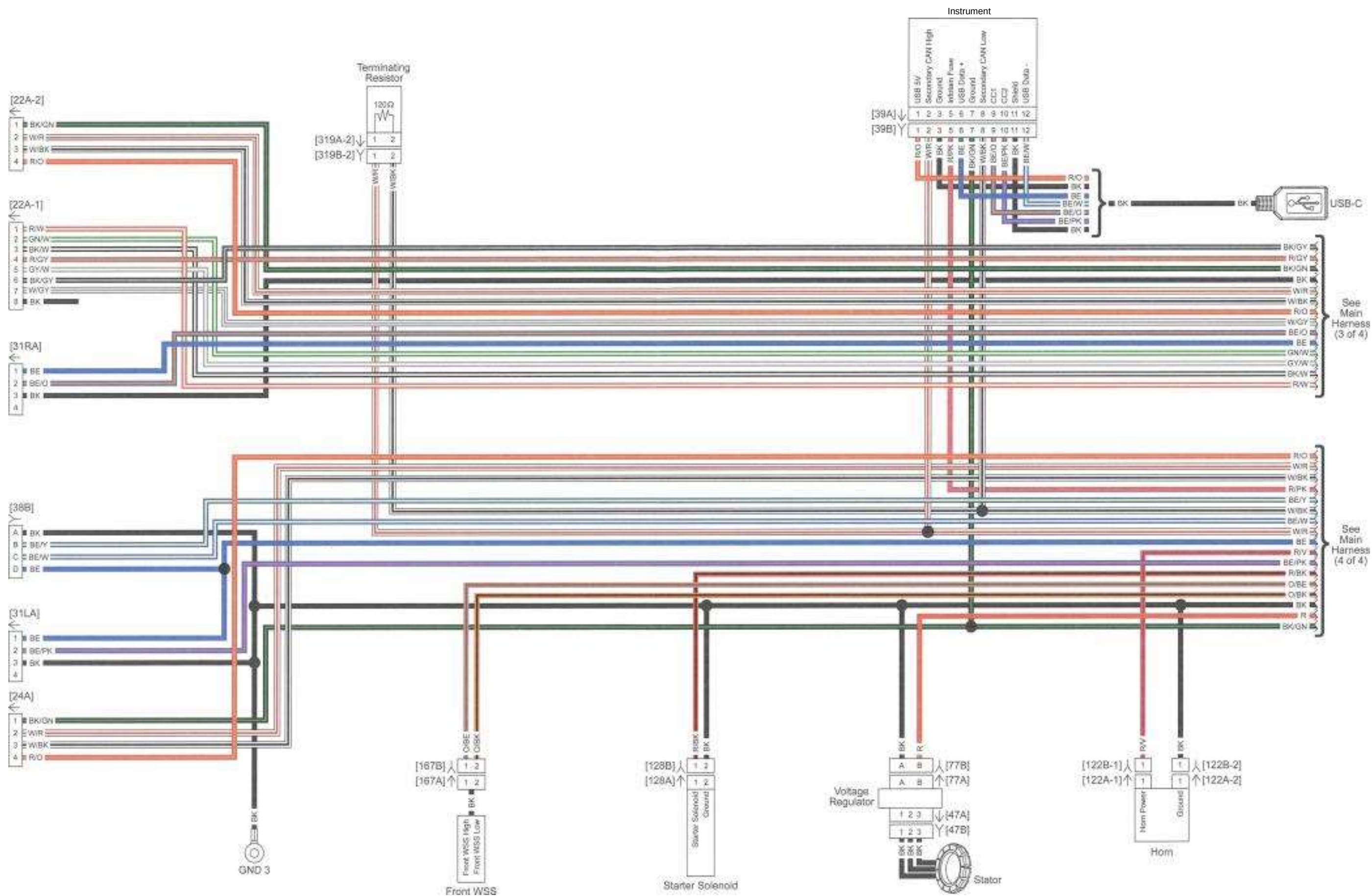


Figure A-7. Main Harness 1 of 4: 2021 RH1250S

Figure A-7.
Main Harness 1 of 4: 2021 RH1250S
Figure A-7.
Main Harness 1 of 4: 2021 RH1250S

Figure A-8. Engine Harness 2 of 4: 2021 RH1250S

Figure A-8.
Engine Harness 2 of 4: 2021 RH1250S
Figure A-8.
Engine Harness 2 of 4: 2021 RH1250S

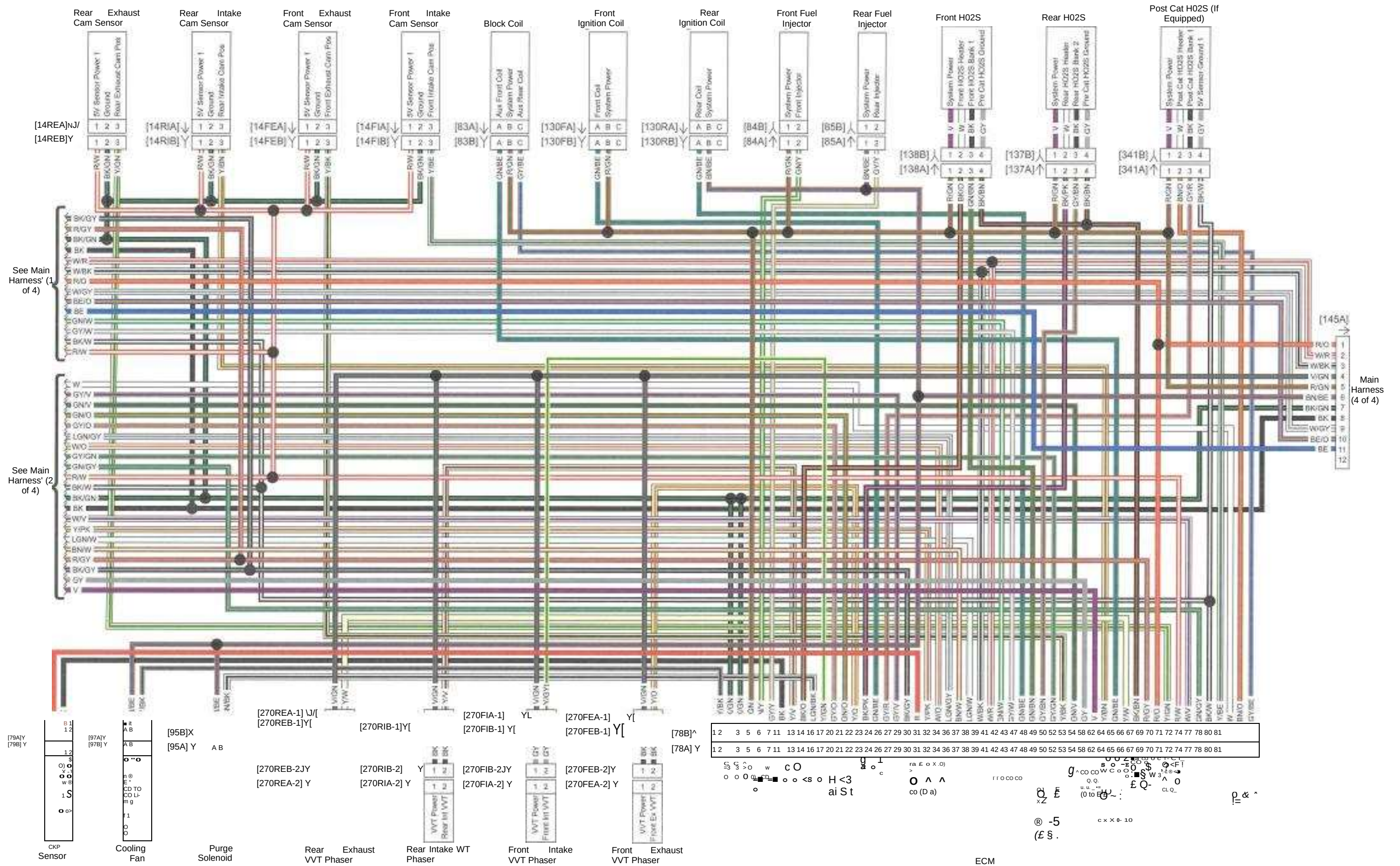


Figure A-9. Engine Harness 3 of 4: 2021 RH1250S

Figure A-9.
Engine Harness 3 of 4: 2021 RH1250S
Figure A-9.
Engine Harness 3 of 4: 2021 RH1250S

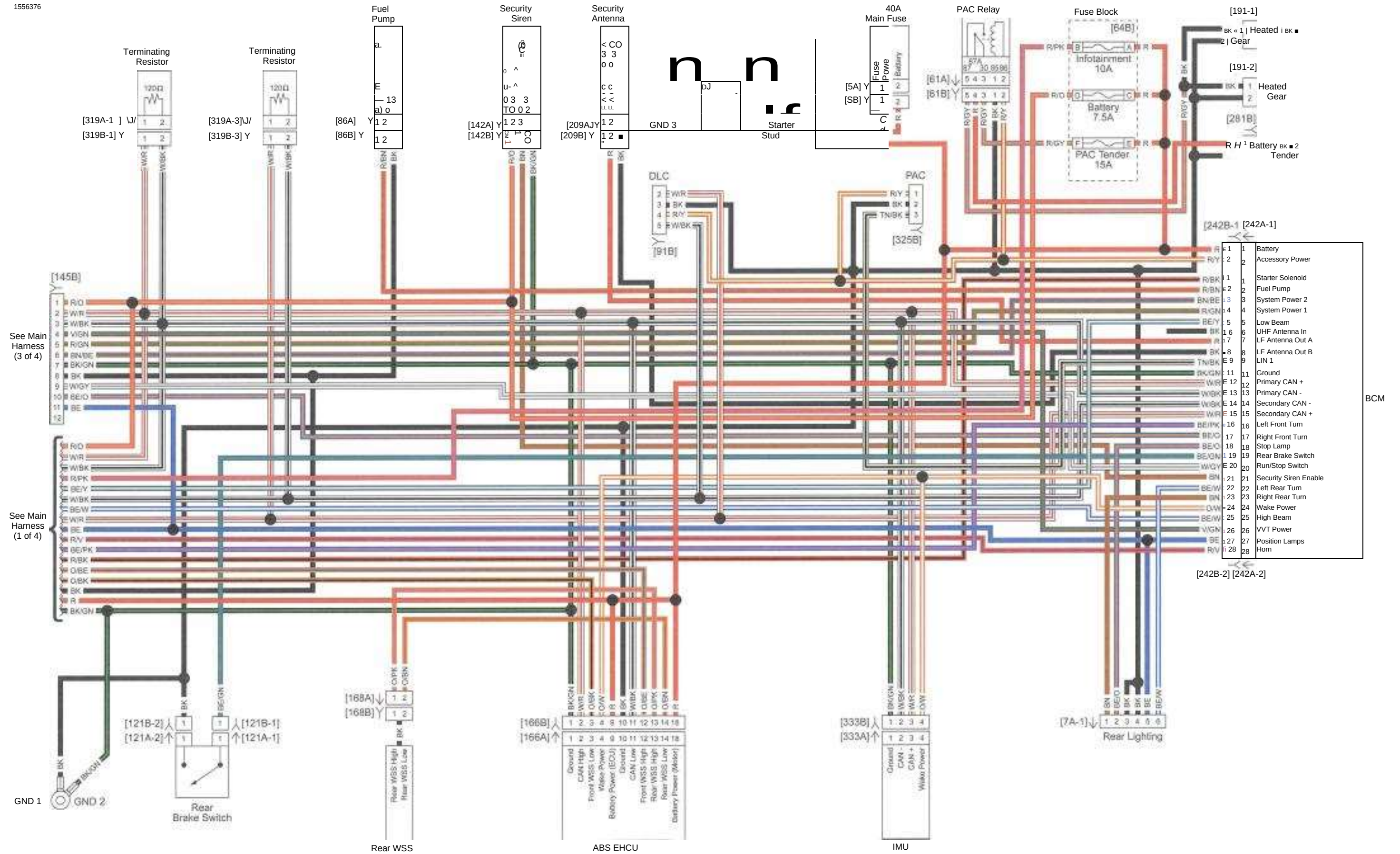


Figure A-10. Main Harness 4 of 4: 2021 RH1250S

Figure A-10.
Main Harness 4 of 4: 2021 RH1250S
Figure A-10.
Main Harness 4 of 4: 2021 RH1250S

Tail/Stop
Lamp

[19B]A
[19A] f

Power	Ground
1	2

1 2

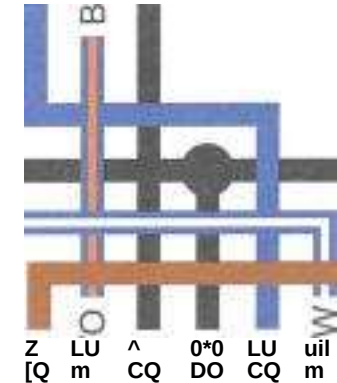
1 2

LU * O ^ " LD tn
a "
DO

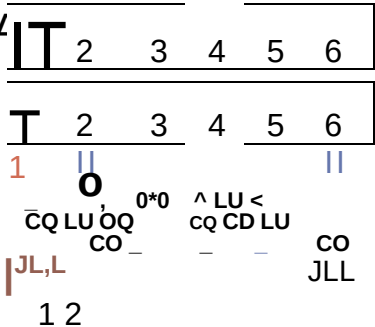
[94 A] ^

12 3 4

[94B] Y | 12 3 4



[7B-2] [7A/
2]^n



S,

See Main Harness (4 of 4)

[18B] X
[18A]Y

Power	Ground
1	2

1 2



Figure A-11. Rear Lighting: 2021 RH1250S

Figure A-11.
Rear Lighting: 2021 RH1250S
Figure A-11.
Rear Lighting: 2021 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 COL- OR	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
[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 un-sealed (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
[8 OF]	MAP sensor	3-way Tyco MCON 1.2 Sealed	Light blue	Top right between cylinders
[8 OR]	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

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COL- OR	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]	H02S rear	4-way Molex MX 150 Sealed (BK)	Gray	Front of engine (behind radiator)
[138]	H02S 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/yel-low	Top of cylinder
[270FE-2]	Front VVT exhaust phaser	2-way Tyco MCON 1.2	Light blue	Under valve cover
[270FI-1]	Front WT intake phaser	2-way Tyco Slimseal (W)	Light blue/yel-low	Top of cylinder
[270FI-2]	Front WT intake phaser	2-way Tyco MCON 1.2	Light blue	Under valve cover
[270RE-1]	Rear WT exhaust phaser	2-way Tyco Slimseal (W)	Light blue/yel-low	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/yel-low	Top of cylinder
[270RI-2]	Rear WT 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. Component Locations

NO.	DESCRIPTION	TYPE	TERMINAL PROBE COL- OR	LOCATION
[325]	PAC	3-way Molex MX150	Gray	Under seat
[333]	IMU	4-way AMP MQS	Yellow	Under seat
[341]	Post cat H02S	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

Table A-3. Main Fuse [5]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	Battery
2	R	Main fuse

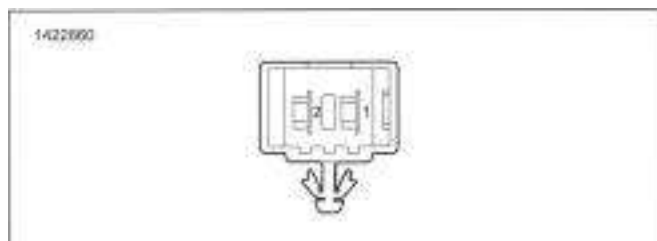


Figure A-12. Main Fuse [5]

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

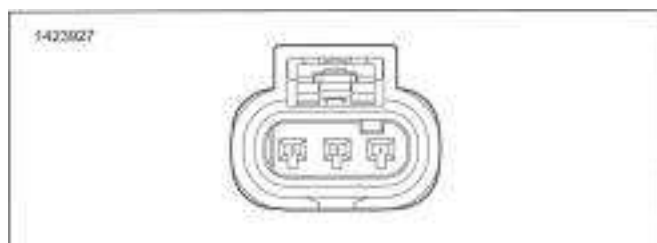


Figure A-13. Front Intake Cam Sensor [14FI]

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

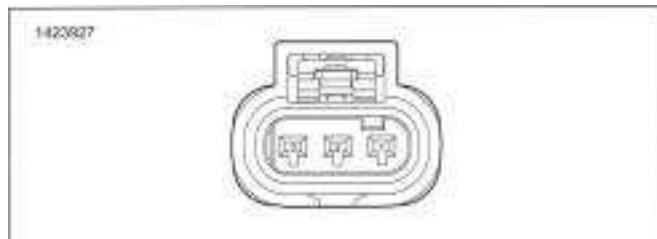


Figure A-14. Front Exhaust Cam Sensor [14FE]

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

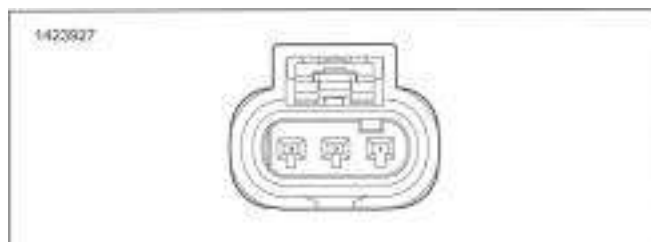


Figure A-15. Rear Intake Cam Sensor [14RI]

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

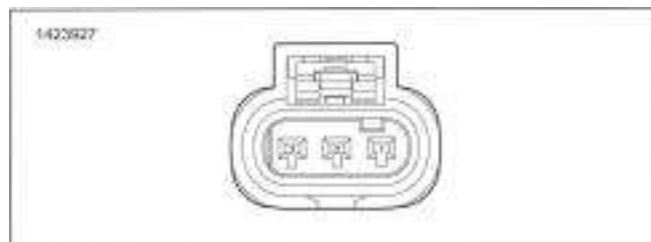


Figure A-16. Rear Exhaust Cam Sensor [14RE]

Table A-8. Right Rear Turn [18]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/BN	Right turn signal
2	BK	GND

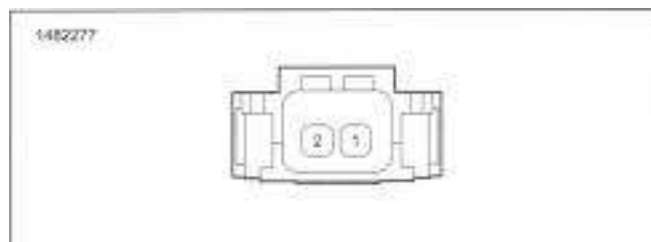


Figure A-17. Right Rear Turn Signal [18]

Table A-9. Left Rear Turn Signal [19]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BEA/	Left turn signal
2	BK	Ground

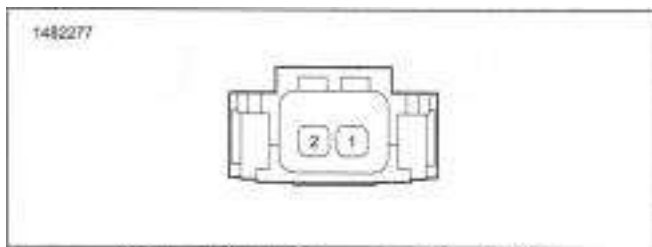


Figure A-18. Left Rear Turn Signal [19]

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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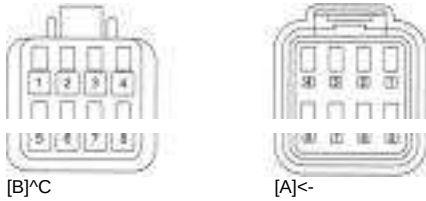


Figure A-19. RHCM [22-1]

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

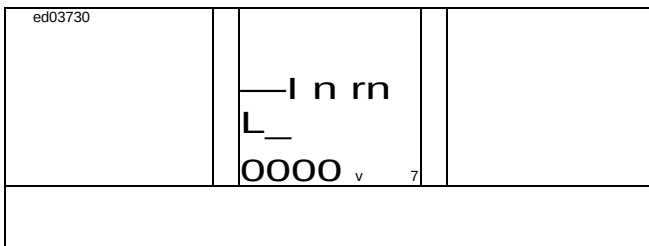


Figure A-20. RHCM [22-2]

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

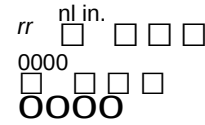


Figure A-21. RHCM [22]

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

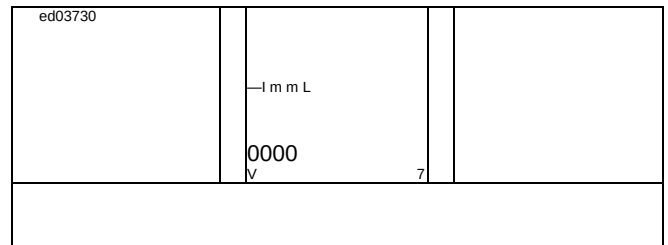


Figure A-22. LHCM [24]

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

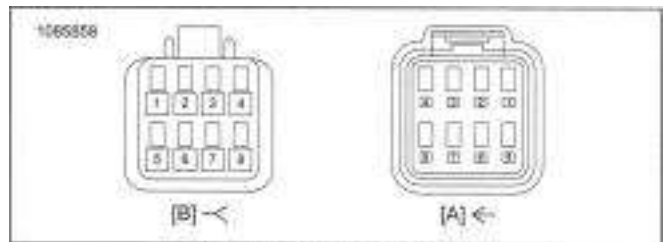


Figure A-23. LHCM [24-1]

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

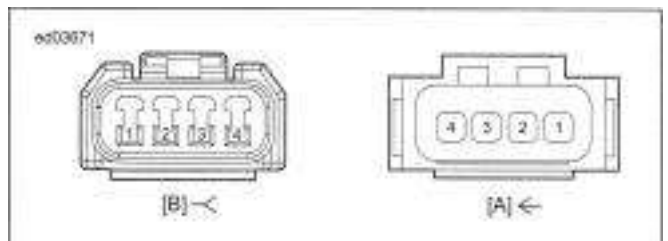


Figure A-24. Front Left Turn Signal [31L]

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

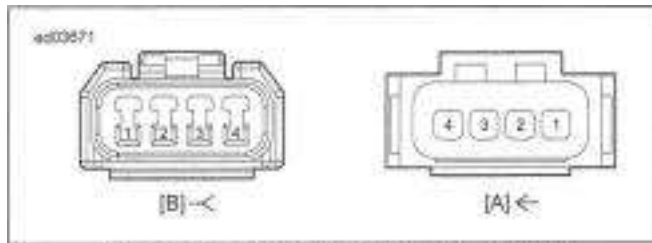


Figure A-25. Front Right Turn Signal [31R]

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

ed03688



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 -

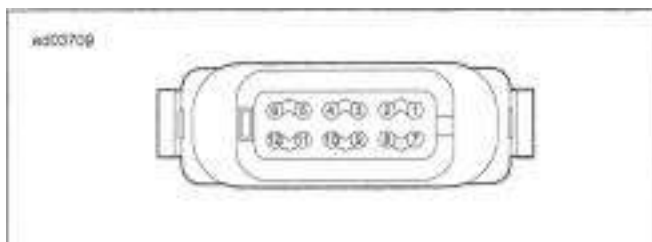


Figure A-27. IM [39]

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

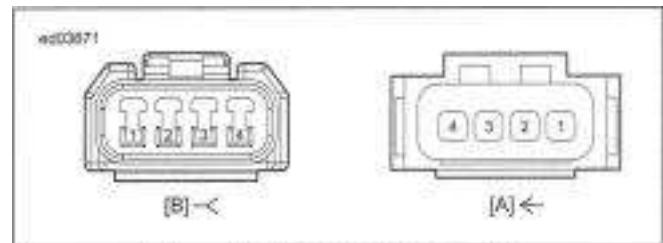


Figure A-28. Center Lighting [40]

Table A-20. LP Lamp [45]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE	Running lamps
2	BK	Ground

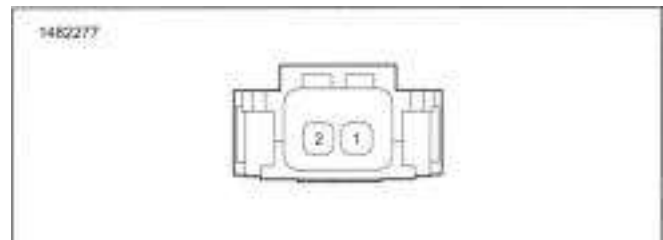


Figure A-29. LP Lamp [45]

Table A-21. Stator [47]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Stator
2	BK	Stator
3	BK	Stator

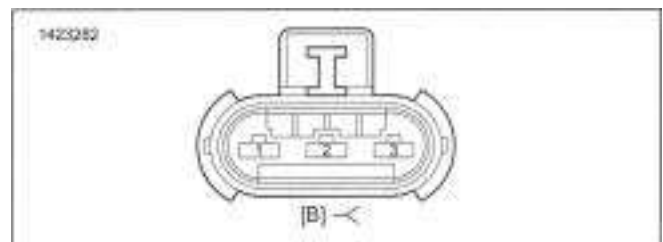


Figure A-30. Stator [47]

Table A-22. PAC Relay [61]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
~T	BK	Ground
2	R/Y	Accessories power
3	R/GY	PAC fuse
4	R	Battery tender
5	R/GY	Heated gear

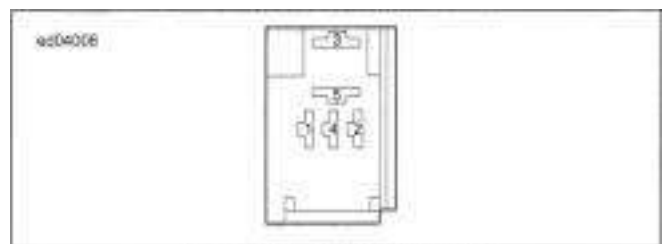


Figure A-31. PAC Relay [61]

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

1423298

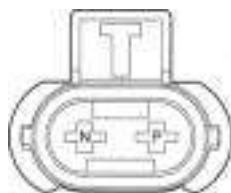


Figure A-33. Voltage Regulator [77]

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	YA/	Rear intake WT control
14	BK/O	Front 02S pre-cat heater ground
15	-	N/C
16	LGN/BK	Purge solenoid
17	Y/GN	Front intake WT control
18	-	N/C
19	-	N/C
20	GY/O	Throttle motor lo
21	GN/O	Throttle motor hi
22	Y/O	Front exhaust WT control
23	BK/PK	Rear 02S pre-cat heater ground
24	GN/BE	Front coil A out
25	-	N/C
26	GY/R	Post-cat 02 sensor
27	GYA/	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 H02S
48	GY/BN	Rear H02S
49	GY/GN	Coolant sensor
50	Y/BK	Front exhaust cam position
51	LGN/Y	Vehicle speed
52	GNA/	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 WT control
65	BK/BN	Pre-cat 02 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	WA/	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	02 Sensor heater post-cat
81	GY/BE	Rear coil B out

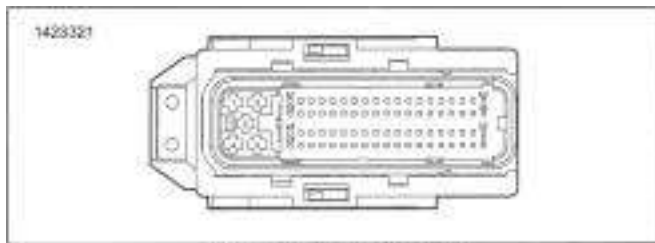


Figure A-34. ECM [78]

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

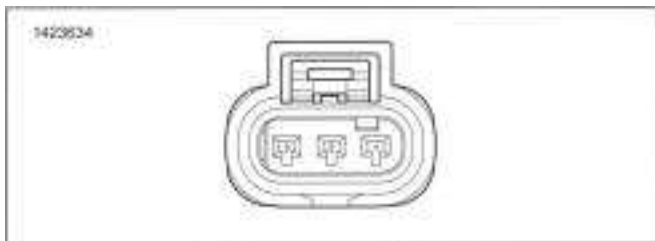


Figure A-36. MAP [80F]

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

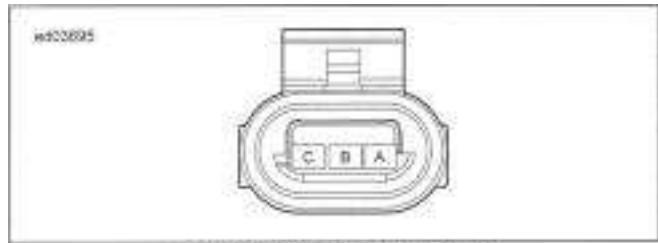


Figure A-38. Block Coil [83]

Table A-30. Front Fuel Injector [84]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	GN/Y	Front fuel injector

1423643



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

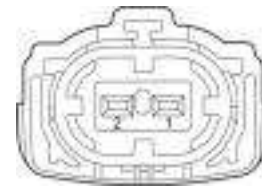


Figure A-40. Rear Fuel Injector [85]

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	GYA/	Throttle position sensor 2
4	BK/W	5V sensor ground 1



Figure A-42. TPS [88]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GN/GY	IAT
2	BK/W	5 Volt sensor ground

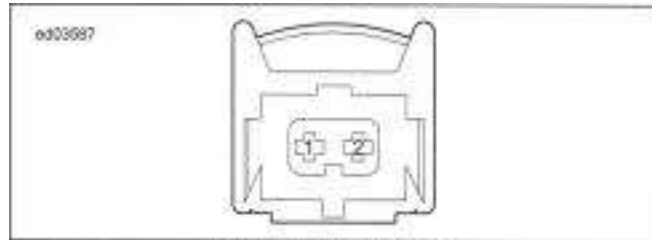


Figure A-43. IAT [89]

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

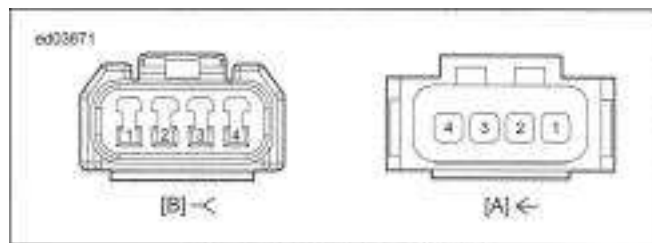


Figure A-45. Tail Lamp [94]

Table A-34. IAT [89]

Table A-37. Purge Solenoid [95]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	BN/BE	Cooling system power
B	LGN/BK	Purge solenoid

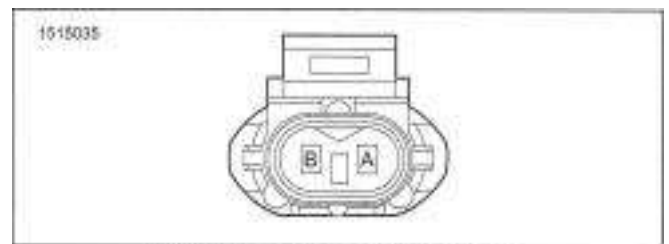


Figure A-46. Purge Solenoid [95]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
A	BN/BE	Cooling system power
B	GY/BK	Cooling fan control

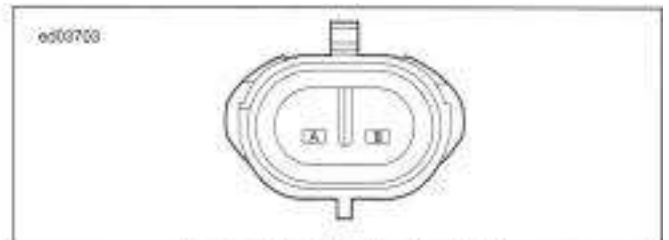


Figure A-47. Cooling Fan [97]

Table A-39. Coolant Temperature Sensor [98]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GY/GN	Coolant temperature
2	BK/W	5V sensor ground 1

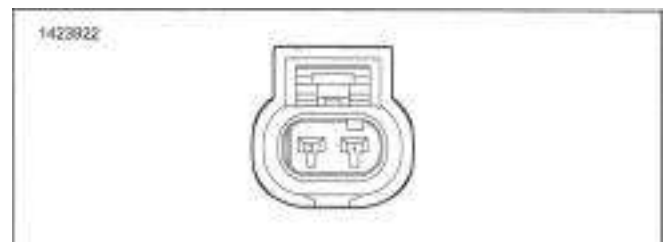


Figure A-48. Coolant Temperature Sensor [98] Table A-40.

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

Table A-38. Cooling Fan [97]

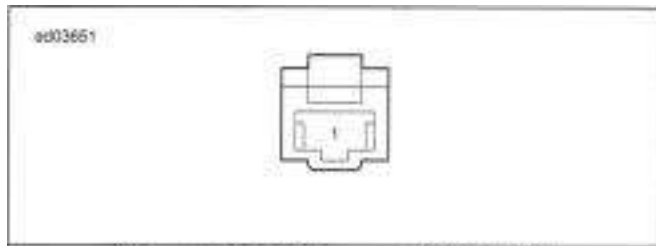


Figure A-50. Oil Pressure Switch [120]

Table A-42. Rear Brake Switch [121-1] [121-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BE/GN	Rear brake switch
1	BK	Ground

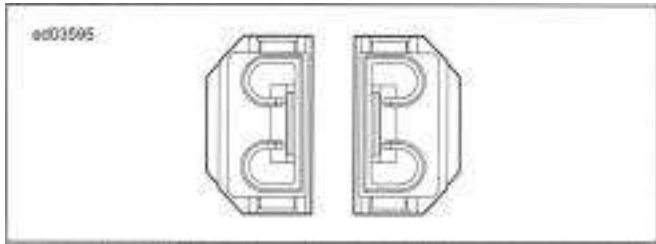


Figure A-51. Rear Brake Switch [121-1] [121-2] Table A-43.

Horn [122-1] [122-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/V	Horn power
1	BK	Ground

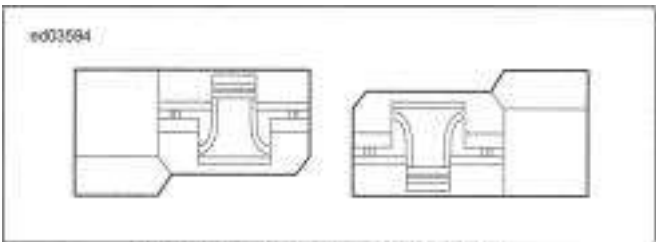


Figure A-52. Horn [122-1] [122-2]

Table A-44. Starter Solenoid [128]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/BK	Power
2	BK	Ground

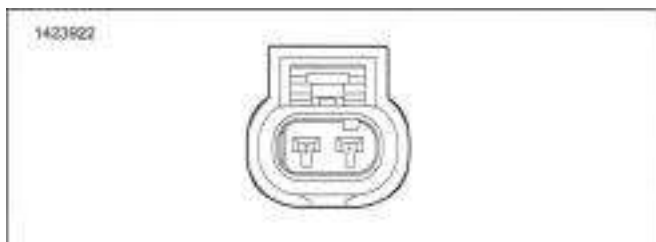


Figure A-53. Starter Solenoid [128]

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

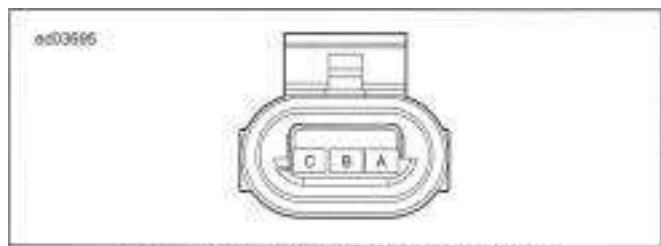


Figure A-54. Front Ignition Coil [130F]

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

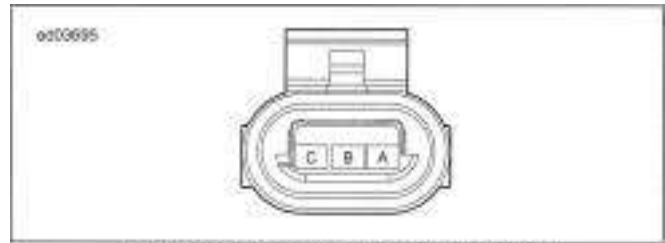


Figure A-55. Rear Ignition Coil [130R]

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

214557



Figure A-56. Jiffy Stand [133]

Table A-48. H02S Rear [137]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	BK/PK	Rear H02S heater
3	GY/BN	Rear H02S
4	BK/BN	Pre cat H02S ground

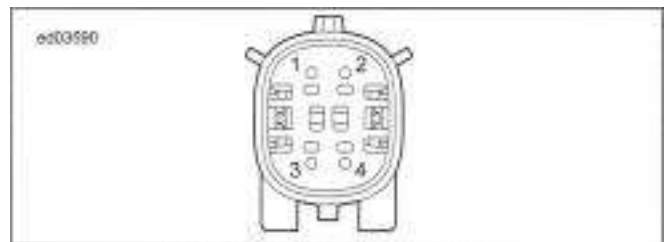


Figure A-57. H02S Rear [137]

Table A-49. H02S Front [138]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	BK/O	Front H02S heater
3	GY/BN	Front H02S
4	BK/BN	Pre cat H02S 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

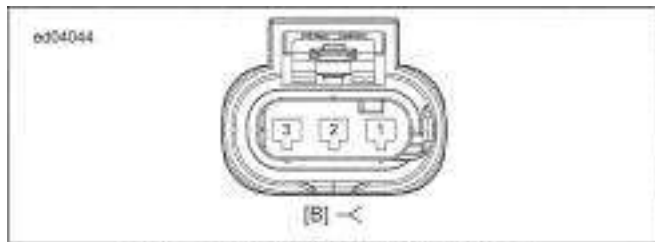


Figure A-59. Fuel Level Sender [141]

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

ed03657

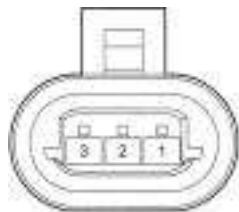


Table A-52. Engine Harness [145]

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

Table A-55. Rear WSS [168]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	O/PK	Rear WSS high
2	O/BN	Rear WSS low

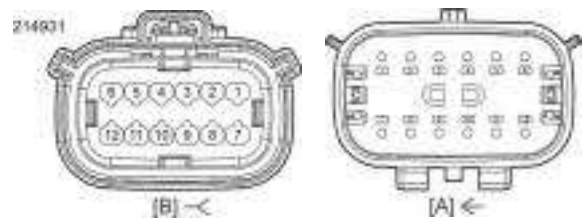


Figure A-61. Engine Harness [145]

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)

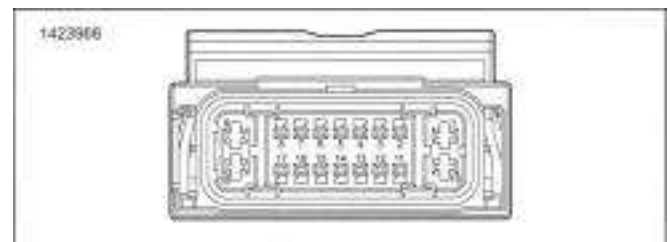


Figure A-62. ABS/EHCU [166]

Figure A-60. Security Siren (Optional) [142]

Table A-54. Front WSS [167]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	O/BE	Front WSS high
2	O/BK	Front WSS low

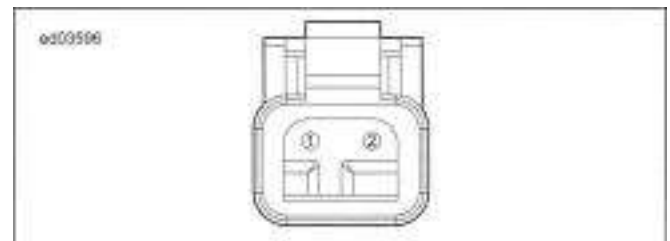


Figure A-63. Front WSS [167]



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

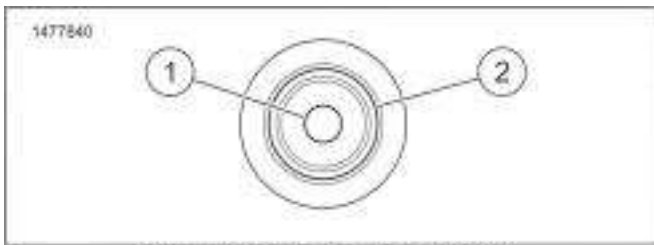


Figure A-66. Heated Gear [191-1]

Table A-58. Heated Gear [191-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	Power
2	BK	Ground

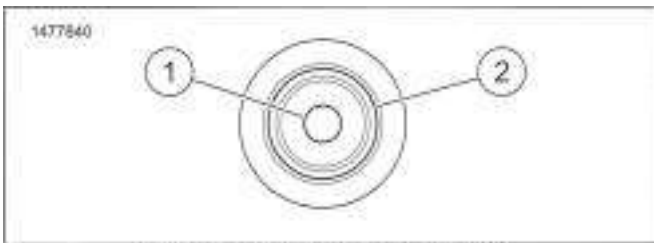


Figure A-67. Heated Gear [191-2]

Table A-59. Security Antenna [209]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R	LF antenna out A
2	BK	LF antenna out B

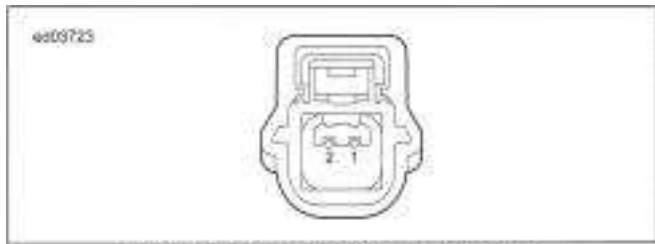


Figure A-68. Security Antenna [209]

Table A-60. TCA [211]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GY/O	Throttle motor LO
2	GN/O	Throttle motor HI

1423971

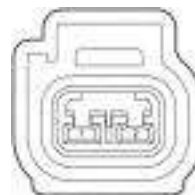


Figure A-69. TCA [211]

Table A-61.TGS [224B]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	RA/V	5V sensor power 1
2	BK/W	Ground 1
3	GNA/V	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

1417852



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	WT power
27	BE	Position lamp
28	R/V	Horn

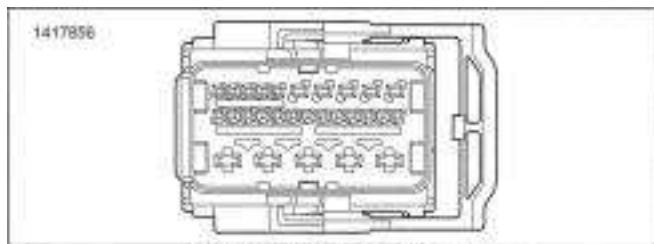


Figure A-72. BCM [242-2]

Table A-64. Gear Position Sensor [269]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	RA/V	5V Sensor power 1
2	W	Gear position
2	BK/W	5V Sensor ground 1

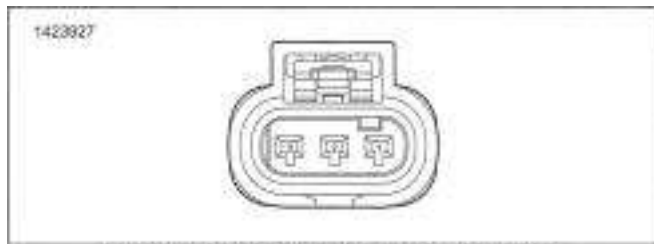


Figure A-73. Gear Position Sensor [269]

Table A-65. Front Exhaust WT Phaser [270FE-1]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	V/GN	WT Power
2	Y/O	Front exhaust VVT control

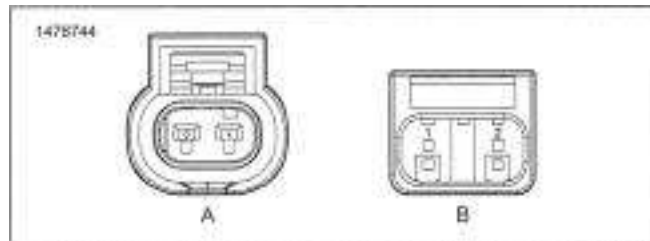


Figure A-74. Front Exhaust VVT Phaser [270FE-1]

Table A-66. Front Exhaust VVT Phaser [270FE-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	WT power
2	BK	Front exhaust WT control



Figure A-75. Front Exhaust WT 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

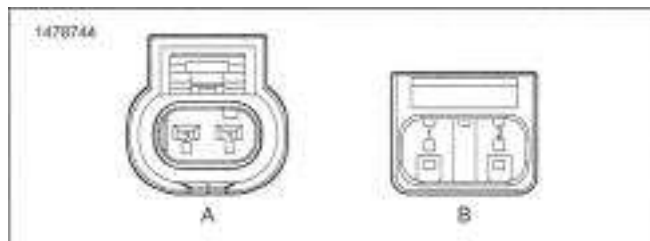


Figure A-76. Front Intake VVT Phaser [270FI-1]

Table A-68. Front Intake VVT Phaser [270FI-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GY	WT power
2	GY	Front intake WT control

1423922



Figure A-77. Front Intake WT Phaser [270FI-2]

Table A-69. Rear Exhaust WT Phaser [270RE-1]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	V/GN	WT Power
2	Y/W	Rear exhaust VVT control

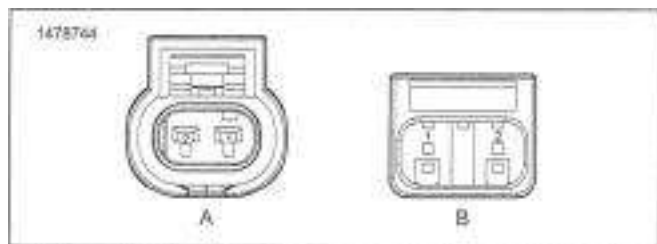


Figure A-78. Rear Exhaust VVT Phaser [270RE-1]

Table A-70. Rear Exhaust WT Phaser [270RE-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	GY	WT power
2	GY	Rear exhaust WT control

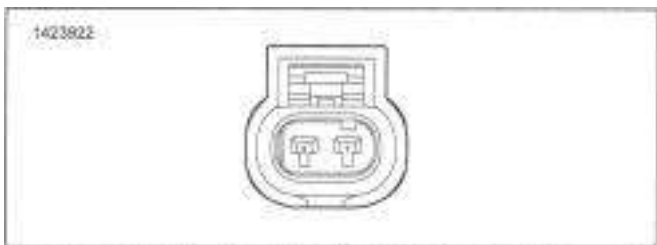


Figure A-79. Rear Exhaust WT Phaser [270RE-2]

Table A-71. Rear Intake WT Phaser [270RI-1]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	Y/GN	WT power
2	Y/V	Rear intake WT control

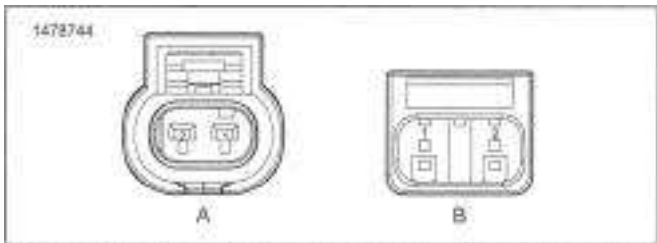


Figure A-80. Rear Intake WT Phaser [270RI-1]

Table A-72. Rear Intake WT Phaser [270RI-2]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	BK	WT power
2	BK	Rear intake WT control

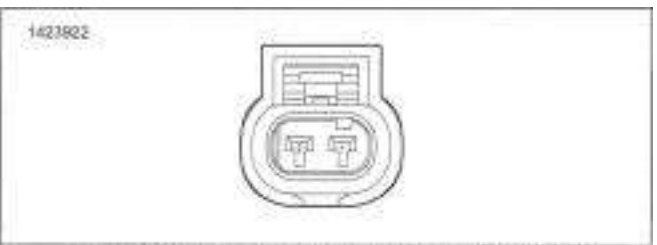


Figure A-81. Rear Intake VVT Phaser [270RI-2]

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

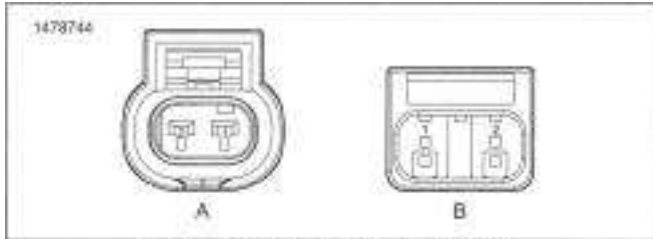


Figure A-84. Knock Sensor [315]

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

1164766



Figure A-86. Termination Resistor [319-2]

1164767

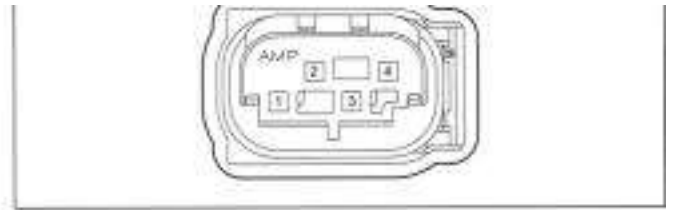


Figure A-89. IMU [333]

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

214557



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

Table A-81. Post Cat H02S [341]

TERMINAL	WIRE COLOR	CIRCUIT DESCRIPTION
1	R/GN	System power
2	BN/O	Rear H02S heater
3	GY/R	Rear H02S
4	BK/BN	Pre cat H02S ground



Figure A-90. Post Cat H02S [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

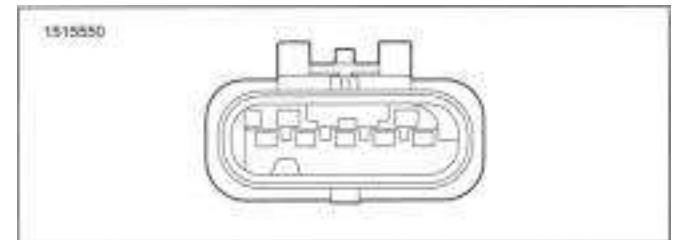


Figure A-91. Engine Jumper Harness [343]

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
CBTx	CB send transmission
CB Rx	CB receive transmission
cc	Cubic centimeters
CCA	Cold cranking amps
CCW	Counterclockwise
CKP	Crankshaft position
cm	Centimeters
^3 cm	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
I AT	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

Table B-2. Metric Conversions

MILLIMETERS to INCHES								INCHES to MILLIMETERS							
(MM x 0.03937 = IN)				(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.) $\times$ 29.574 = milliliters
- pints (U.S.) $\times$ 0.473 = liters
- quarts (U.S.) $\times$ 0.946 = liters
- gallons (U.S.) $\times$ 3.785 = liters
- milliliters $\times$ 0.0338 = fluid ounces (U.S.)
- liters $\times$ 2.114 = pints (U.S.)
- liters $\times$ 1.057 = quarts (U.S.)
- liters $\times$ 0.264 = gallons (U.S.)

Fluid volume measurements in this manual do not include the British Imperial (Imp.) system equivalents. The following

BRITISH IMPERIAL SYSTEM

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.) $\times$ 1.042 = fluid ounces (Imp.)
- pints (U.S.) $\times$ 0.833 = pints (Imp.)
- quarts (U.S.) $\times$ 0.833 = quarts (Imp.)
- gallons (U.S.) $\times$ 0.833 = gallons (Imp.)
- fluid ounces (Imp.) $\times$ 0.960 = fluid ounces (U.S.)
- pints (Imp.) $\times$ 1.201 = pints (U.S.)
- quarts (Imp.) $\times$ 1.201 = quarts (U.S.)
- gallons (Imp.) $\times$ 1.201 = gallons (U.S.)

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this manual. To convert units, use the following equations:

- foot pounds (ft-lbs) $\times 12.00000$ = inch pounds (**in-lbs**)
- inch pounds (**in-lbs**) $\times 0.08333$ = 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) $\times 0.737563$ = foot pounds (ft-lbs)
- Newton meters (Nm) $\times 8.85085$ = inch pounds (**in-lbs**)
- foot pounds (ft-lbs) $\times 1.35582$ = Newton meters (Nm)
- inch pounds (**in-lbs**) $\times 0.112985$ = 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-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
HD-48650	DIGITAL TECHNICIAN II	3.9 TIRE PRESSURE MONITORING SYSTEM (TPMS), Complete

TOOLS

Part Number	TOOL NAME	NOTES
		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 8.13 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 4.29 CRANKSHAFT AND CONNECTING RODS, Install

TOOLS

Part Number	TOOL NAME	NOTES
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 8.14 OIL PRESSURE SWITCH, Remove 8.14 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-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 phaser screw torque step 1.	66-81 ft-lbs	90-110 N-m	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install
Cam phaser screw torque step 2.		-360°	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install
Cam phaser screw torque step 3.	13-16 ft-lbs	18-22 N-m	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, Install
Cam phaser screw torque step 4.		33 ±2°	4.15 CAMSHAFT SPROCKET AND TIMING CHAIN, 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
Cylinder head camshaft cover screws	63-77 in-lbs	7.1-8.7 N-m	4.13 CAMSHAFT COVERS, Install

Torque Values

FASTENER	TORQUE VALUE		NOTES
Cylinder head cover caddy screws	35-62 in-lbs	4-7 Nm	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		-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	13-14 ft-lbs	17-19 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
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

Torque Values

FASTENER	TORQUE VALUE		NOTES
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	8.16 HEADLAMP, Install
Headlamp screw	6-7 ft-lbs	8-10 N-m	8.16 HEADLAMP, Adjust
Horn bracket screws	50-62 in-lbs	5.7-7 N-m	8.15 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	8.13 INSTRUMENT MODULE (IM), Install
IM screws	91-101 in-lbs	10.3-11.4 N-m	8.13 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
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

Torque Values

FASTENER	TORQUE VALUE		NOTES
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	13-14 ft-lbs	17.5-19.5 N-m	6.24 HEATED OXYGEN SENSORS (H02S), 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
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

Torque Values

FASTENER	TORQUE VALUE		NOTES
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 iower 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	8.20 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
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Torque Values

FASTENER	TORQUE VALUE		NOTES
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