2009 Buell XB Models Service Manual

99490-09Y

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IMPORTANT NOTICE

Buell 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.

Buell Motorcycle Company

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2009 Buell XB Models Service Manual (99490-09Y)

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NOTES

ABOUT THIS MANUAL

GENERAL

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

HOW TO USE YOUR SERVICE MANUAL

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

NO.	CHAPTER
1	Maintenance
2	Chassis
3	Engine
4	Fuel System
5	Drive/Transmission
6	Electrical
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C Conversions
D	Appendix D Hose and Wire Routing
E	Appendix E Active Intake (Japanese Models)
F	Appendix F Glossary

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

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

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

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

PREPARATION FOR SERVICE

⚠WARNING

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

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

NOTES

- *To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*

SERVICE BULLETINS

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

USE GENUINE REPLACEMENT PARTS

⚠WARNING

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

To verify satisfactory and lasting repairs, carefully follow the manual instructions and use only genuine Buell replacement parts. This is your assurance that the parts you are using will fit right, operate properly and last longer.

WARNINGS AND CAUTIONS

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

⚠WARNING

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

⚠CAUTION

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

CAUTION

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

NOTE

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

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

⚠WARNING

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

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

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

PRODUCT REFERENCES

⚠WARNING

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

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

Kent-Moore Products

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

Loctite Sealing and Threadlocking Products

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

PRODUCT REGISTERED MARKS

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CONTENTS

All photographs, illustrations and procedures in this manual 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, Buell Motorcycle Company reserves the right to change specifications, equipment or designs at any time without notice and without incurring obligation.

MAINTENANCE

1.1 FASTENER TORQUE VALUES

1.2 GENERAL

1.3 FUEL AND OIL

1.4 MAINTENANCE SCHEDULE

1.5 BATTERY MAINTENANCE

1.6 ENGINE OIL AND FILTER

1.7 BRAKE SYSTEM MAINTENANCE

1.8 TIRES AND WHEELS

1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID

1.10 DRIVE BELT MAINTENANCE

1.11 PRIMARY CHAIN

1.12 STEERING HEAD BEARINGS

1.13 SPARK PLUGS

1.14 AIR CLEANER AND EXHAUST SYSTEM

1.15 THROTTLE CABLE

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TABLE OF CONTENTS

1.16 INTERACTIVE EXHAUST CABLE

1.17 HEADLAMP

1.18 WINDSHIELD MAINTENANCE

1.19 STORAGE

1.20 TROUBLESHOOTING

CHASSIS

2.1 FASTENER TORQUE VALUES

2.2 SPECIFICATIONS

2.3 VEHICLE IDENTIFICATION NUMBER (VIN)

2.4 WHEELS

2.5 FRONT WHEEL

2.6 REAR WHEEL

2.7 TIRES

2.8 CHECKING CAST RIM RUNOUT

2.9 FRONT BRAKE: EIGHT PISTON CALIPER

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TABLE OF CONTENTS

TABLE OF CONTENTS

FUEL SYSTEM

DIGITAL TECHNICIAN HARLEY-DAVIDSON

TABLE OF CONTENTS

DRIVE/TRANSMISSION

ELECTRICAL

TABLE OF CONTENTS

DIGITAL TECHNICIAN II

A.4 DEUTSCH ELECTRICAL CONNECTORS

A.5 DEUTSCH STANDARD TERMINAL REPAIR

A.6 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR

A.7 DEUTSCH MINI TERMINAL REPAIR

A.8 MOLEX CONNECTORS

A.9 PACKARD 150 METRI-PACK CONNECTORS

A.10 PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS

A.11 PACKARD 480 METRI-PACK CONNECTORS

A.12 PACKARD 630 METRI-PACK CONNECTORS

A.13 PACKARD METRI-PACK TERMINALS

A.14 PACKARD ECM CONNECTOR

A.15 PACKARD MICRO-64 CONNECTORS

A.16 SEALED SPLICE CONNECTORS

APPENDIX B WIRING

B.1 CONNECTORS

TABLE OF CONTENTS

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TABLE OF CONTENTS

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

NOTES

FASTENER TORQUE VALUES 1.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	1.5 BATTERY MAINTENANCE, Battery Installation and Connection
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	1.5 BATTERY MAINTENANCE, Battery Installation and Connection
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	1.4 MAINTENANCE SCHEDULE , General
Chain tensioner nut	20-25 ft-lbs	27-34 Nm	1.4 MAINTENANCE SCHEDULE , General
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.4 MAINTENANCE SCHEDULE , General
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Inspection
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Adjustment
Engine oil drain plug	26-29 ft-lbs	35-39 Nm	1.6 ENGINE OIL AND FILTER, Change Engine Oil and Filter/LOCTITE 565 THREAD SEALANT
Front brake caliper fasteners	35-37 ft-lbs	47-50 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement/LOCTITE 271 (red)
Front caliper bleeder valve	36-60 **in-lbs**	4-7 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes
Front caliper pin hanger	11-14 ft-lbs	15-19 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Front master cylinder reservoir cover fasteners	9-13 **in-lbs**	1.0-1.5 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes
Front master cylinder reservoir cover fasteners	9-13 **in-lbs**	1.0-1.5 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Handlebar clamp screw	60-84 **in-lbs**	6.8-9.5 Nm	1.4 MAINTENANCE SCHEDULE , General
Handlebar switch housing screw	25-33 **in-lbs**	3-4 Nm	1.4 MAINTENANCE SCHEDULE , General
Headlamp alignment fasteners (Lightning)	48-72 **in-lbs**	5-8 Nm	1.17 HEADLAMP, Headlamp Adjustment: Lightning
Headlamp horizontal alignment fasteners (Ulysses)	48-72 **in-lbs**	5-8 Nm	1.17 HEADLAMP, Headlamp Adjustment: Ulysses
Headlamp vertical alignment fastener (Ulysses)	36-48 **in-lbs**	4-5 Nm	1.17 HEADLAMP, Headlamp Adjustment: Ulysses
Intake cover assembly fasteners	12-36 **in-lbs**	1.4-4 Nm	1.14 AIR CLEANER AND EXHAUST SYSTEM, Installation
Intake cover screw	12-36 **in-lbs**	1.4-4 Nm	1.4 MAINTENANCE SCHEDULE , General
Lower triple clamp fasteners	20-22 ft-lbs	27-30 Nm	1.12 STEERING HEAD BEARINGS, Determining Proper Resistance
Master cylinder reservoir cover screws	9-13 **in-lbs**	1.0-1.5 Nm	1.4 MAINTENANCE SCHEDULE , General
Oil drain plug	26-29 ft-lbs	35-39 Nm	1.4 MAINTENANCE SCHEDULE , General
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 Nm	1.4 MAINTENANCE SCHEDULE , General
Primary chain inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.11 PRIMARY CHAIN, Inspection
Primary chain tension locknut	20-25 ft-lbs	27-34 Nm	1.11 PRIMARY CHAIN, Adjustment

FASTENER	TORQUE VALUE		NOTES
Primary drain plug	14-30 ft-lbs	19-41 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid
Pushrod adjustment locknut	130-173.5 **in-lbs**	14.7-19.6 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pedal Adjustment
Rear brake caliper mounting fasteners	24-26 ft-lbs	32.5-35 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear brake line assembly fastener	36-60 **in-lbs**	4.1-7 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear caliper bleeder valve	36-60 **in-lbs**	4-7 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes
Rear caliper pin hanger	11-14 ft-lbs	14.9-18.9 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear caliper pin plug	24 **in-lbs**	3 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Screw, primary chain inspection cover	84-108 **in-lbs**	9.5-12 Nm	1.4 MAINTENANCE SCHEDULE , General
Spark plug	12-18 ft-lbs	16-24 Nm	1.4 MAINTENANCE SCHEDULE , General
Spark plug	12-18 ft-lbs	16-24 Nm	1.13 SPARK PLUGS, Inspection
Steering stem capnut	38-42 ft-lbs	52-57 Nm	1.12 STEERING HEAD BEARINGS, Determining Proper Resistance
Steering stem pinch fastener	20-22 ft-lbs	27-30 Nm	1.12 STEERING HEAD BEARINGS, Determining Proper Resistance

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

GENERAL 1.2

SERVICING A NEW MOTORCYCLE

⚠WARNING

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

Service operations to be performed before customer delivery are specified in the applicable model year predelivery and set-up instructions.

The performance of new motorcycle initial service is required to keep warranty in force and to verify proper emissions systems operation. See 1.4 MAINTENANCE SCHEDULE.

SAFE OPERATING MAINTENANCE

NOTES

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

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

Check:

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

SHOP PRACTICES

Repair Notes

General maintenance practices are given in this section.

NOTES

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

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

All required parts or materials can be found in the appropriate parts catalog.

Safety

Safety is always the most important consideration when performing any job. Be sure you have a complete understanding of the task to be performed. Use common sense. Use the proper tools. Protect yourself and bystanders with approved eye protection. Don't just do the job - do the job safely.

Removing Parts

Always consider the weight of a part when lifting. Use a hoist whenever necessary. Do not lift heavy parts by hand. A hoist and adjustable lifting beam or sling are needed to remove some parts. The lengths of chains or cables from the hoist to the part should be equal and parallel and should be positioned directly over the center of the part. Be sure that no obstructions will interfere with the lifting operation. Never leave a part suspended in mid-air.

⚠WARNING

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

Always use blocking or proper stands to support the part that has been hoisted. If a part cannot be removed, verify that all bolts and attaching hardware have been removed. Check to see if any parts are in the way of the part being removed.

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

Cleaning

If you intend to reuse parts, follow good shop practice and thoroughly clean the parts before assembly. Keep all dirt out of parts; the unit will perform better and last longer. Seals, filters and covers are used in this vehicle to keep out environmental dirt and dust. These items must be kept in good condition to verify satisfactory operation.

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

Clean and inspect all parts as they are removed. Be sure all holes and passages are clean and open. After cleaning, cover all parts with clean lint-free cloth, paper or other material. Be sure the part is clean when it is installed.

Always clean around lines or covers before they are removed. Plug, tape or cap holes and openings to keep out dirt, dust and debris.

Always verify cleanliness of blind holes before assembly. Tightening a screw with dirt, water or oil in the hole can cause castings to crack or break.

Disassembly and Assembly

Always assemble or disassemble one part at a time. Do not work on two assemblies simultaneously. Be sure to make all necessary adjustments. Recheck your work when finished. Be sure that everything is done.

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

Checking Torques on Fasteners with Lock Patches

To check the torque on a fastener that has a lock patch:

1. Set the torque wrench for the lowest setting in the specified torque range.
2. Attempt to tighten fastener to set torque. If fastener does not move and lowest setting is satisfied (torque wrench clicks), then the proper torque has been maintained.

Magnetic Parts Trays

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

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

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

REPAIR AND REPLACEMENT PROCEDURES

Hardware and Threaded Parts

Install helical thread inserts when inside threads in castings are stripped, damaged or not capable of withstanding specified torque.

Replace bolts, nuts, studs, washers, spacers and small common hardware if missing or in any way damaged. Clean up or repair minor thread damage with a suitable tap or die.

Replace all damaged or missing lubrication fittings.

Use Teflon pipe sealant or LOCTITE 565 THREAD SEALANT on pipe fitting threads.

Threadlocking Agents

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

Wiring, Hoses and Lines

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

Instruments and Gauges

Replace broken or defective instruments and gauges. Replace dials and glass that are so scratched or discolored that reading is difficult.

Bearings

Anti-friction bearings must be handled in a special way. To keep out dirt and abrasives, cover the bearings as soon as they are removed from the package.

Wash bearings in a non-flammable cleaning solution. Knock out packed lubricant inside by tapping the bearing against a wooden block. Wash bearings again. Cover bearings with clean material after setting them down to dry. Never use compressed air to dry bearings.

Coat bearings with clean oil. Wrap bearings in clean paper.

When bearings are installed against shoulders, be sure that the chamfered side of the bearing always faces the shoulder. Lubricate bearings and all metal contact surfaces before pressing into place. Only apply pressure on the part of the bearing that makes direct contact with the mating part. Install bearings with numbered side facing out.

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

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

Bushings

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

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

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

Gaskets

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

If a gasket must be made, be sure to cut holes that match up with the mating part. Serious damage can occur if any flange holes are blocked by the gasket. Use material that is the right type and thickness.

Lip Type Seals

Lip seals are used to seal oil or grease and are usually installed with the sealing lip facing the contained lubricant. Seal orientation, however, may vary under different applications.

Seals should not be removed unless necessary. Only remove seals if required to gain access to other parts or if seal damage or wear dictates replacement.

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Leaking oil or grease usually means that a seal is damaged. Replace leaking seals to prevent overheated bearings.

Always discard seals after removal. Do not use the same seal twice.

O-Rings (Preformed Packings)

Always discard o-rings after removal. Replace with **new** o-rings. To prevent leaks, lubricate the o-rings before installation. Apply the same type of lubricant as that being sealed. Be sure that all gasket, o-ring and seal mating surfaces are thoroughly clean before installation.

Gears

Always check gears for damaged or worn teeth.

Remove burrs and rough spots with a honing stone or crocus cloth before installation.

Lubricate mating surfaces before pressing gears on shafts.

Shafts

If a shaft does not come out easily, check that all nuts, bolts or retaining rings have been removed. Check to see if other parts are in the way before using force.

Shafts fitted to tapered splines should be very tight. If shafts are not tight, disassemble and inspect tapered splines. Discard parts that are worn. Be sure tapered splines are clean, dry and free of burrs before putting them in place. Press mating parts together tightly.

Clean all rust from the machined surfaces of new parts.

Part Replacement

Always replace worn or damaged parts with **new** parts.

Exhaust System Leakage

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

CLEANING

Part Protection

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

Cleaning Process

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

Rust or Corrosion Removal

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

Bearings

Remove shields and seals from bearings before cleaning. Clean bearings with permanent shields and seals in solution.

⚠WARNING

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

Clean open bearings by soaking them in a petroleum cleaning solution. Never use a solution that contains chlorine.

Let bearings stand and dry. Do not dry with compressed air. Do not spin bearings while they are drying.

TOOL SAFETY

Air Tools

- Always use approved eye protection equipment when performing any task using air-operated tools.
- On all power tools, use only recommended accessories with proper capacity ratings.
- Do not exceed air pressure ratings of any power tools.
- Bits should be placed against work surface before air hammers are operated.
- Disconnect the air supply line to an air hammer before attaching a bit.
- Never point an air tool at yourself or another person.
- Protect bystanders with approved eye protection.

Wrenches

- Never use an extension on a wrench handle.
- If possible, always pull on a wrench handle and adjust your stance to prevent a fall if something lets go.
- Never cock a wrench.
- Never use a hammer on any wrench other than a STRIKING FACE wrench.
- Discard any wrench with broken or battered points.
- Never use a pipe wrench to bend, raise or lift a pipe.

Pliers/Cutters/Pry bars

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

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Hammers

- Never strike a hammer against a hardened object, such as another hammer.
- Always grasp a hammer handle firmly, close to the end.
- Strike the object with the full face of the hammer.
- Never work with a hammer which has a loose head.
- Discard hammer if face is chipped or mushroomed.
- Wear approved eye protection when using striking tools.
- Protect bystanders with approved eye protection.

Punches/Chisels

- Never use a punch or chisel with a chipped or mushroomed end; dress mushroomed chisels and punches with a file.
- Hold a chisel or a punch with a tool holder if possible.
- When using a chisel on a small piece, clamp the piece firmly in a vise and chip toward the stationary jaw.
- Wear approved eye protection when using these tools.
- Protect bystanders with approved eye protection.

Screwdrivers

- Do not use a screwdriver for prying, punching, chiseling, scoring or scraping.
- Use the right type of screwdriver for the job; match the tip to the fastener.
- Do not interchange POZIDRIV, PHILLIPS or REED AND PRINCE screwdrivers.
- Screwdriver handles are not intended to act as insulation. Do not use on live electrical circuits.
- Do not use a screwdriver with rounded edges because it will slip. Redress with a file.

Ratchets and Handles

- Periodically clean and lubricate ratchet mechanisms with a light grade oil. Do not replace parts individually; ratchets should be rebuilt with the entire contents of service kit.
- Never hammer or put a pipe extension on a ratchet or handle for added leverage.
- Always support the ratchet head when using socket extensions, but do not put your hand on the head or you may interfere with the action of its reversing mechanism.
- When breaking loose a fastener, apply a small amount of pressure as a test to be sure the ratchet's gear wheel is engaged with the pawl.

Sockets

- Never use hand sockets on power or impact wrenches.
- Select the right size socket for the job.
- Never cock any wrench or socket.
- Select only impact sockets for use with air or electric impact wrenches.
- Replace sockets showing cracks or wear.
- Keep sockets clean.
- Always use approved eye protection when using power or impact sockets.

Storage Units

- Do not open more than one loaded drawer at a time. Close each drawer before opening up another.
- Close lids and lock drawers and doors before moving storage units.
- Do not pull on a tool cabinet; push it in front of you.
- Set the brakes on the locking casters after the cabinet has been rolled to your workspace.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FUEL AND OIL 1.3

FUEL

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

WARNING

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

WARNING

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

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

Table 1-1. Octane Ratings

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

GASOLINE BLENDS: BUELL MODELS

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

CAUTION

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

- Gasoline containing METHYL TERTIARY BUTYL ETHER (MTBE): Gasoline/MTBE blends are a mixture of gasoline and as much as 15% MTBE. Gasoline/MTBE blends can be used in your motorcycle.
- ETHANOL is a mixture of 10% ethanol (Grain alcohol) and 90% unleaded gasoline. Gasoline/ethanol blends can be used in your motorcycle if the ethanol content does **not** exceed 10%.
- REFORMULATED OR OXYGENATED GASOLINES (RFG): Reformulated gasoline is a term used to describe gasoline blends that are specifically designed to burn cleaner than other types of gasoline, leaving fewer tailpipe emissions. They are also formulated to evaporate less when you are filling your tank. Reformulated gasolines use additives to oxygenate the gas. Your motorcycle will run normally using this type of gas and Harley-Davidson recommends you use it when possible, as an aid to cleaner air in our environment.

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

ENGINE LUBRICATION

CAUTION

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

Engine oil is a major factor in the performance and service life of the engine. Always use the proper grade of oil for the lowest temperature expected before the next scheduled oil change. Refer to Table 1-2. Your authorized dealer has the proper oil to suit your requirements.

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

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

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

Table 1-2. Recommended Engine Oils

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

WINTER LUBRICATION

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

NOTE

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

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

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

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

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

MAINTENANCE SCHEDULE 1.4

GENERAL

Table 1-3. Regular Service Intervals: 2009 XB Models

ITEM SERVICED	PROCEDURE	1000 MI. 1600 KM	5000 MI. 8000 KM	10,000 MI. 16,000 KM	15,000 MI. 24,000 KM	20,000 MI. 32,000 KM	25,000 MI. 40,000 KM	NOTES
Engine oil and filter	Replace	X	X	X	X	X	X	
Air cleaner	Inspect, service as required	X	X	X	X		X	
	Replace filter element					X		
Tires	Check condition and tread	X	X	X	X	X	X	
Transmission lubricant	Replace	X		X		X		
Clutch	Check adjustment	X	X	X	X	X	X	1
Primary chain	Check adjustment	X	X	X	X	X	X	1
Rear belt and idler sprockets	Inspect	X	X	X	X	X	X	1
Throttle, brake, clutch controls, sidestand, active muffler cable and active intake cable adj (if equipped)	Check, adjust, lubricate	X	X	X	X	X	X	1
Brake fluid	Check levels and condition	X	X	X	X	X	X	2
Brake pads and discs	Inspect for wear	X	X	X	X	X	X	
Spark plugs	Replace			X		X		1
Electrical switches and equipment	Check operation	X	X	X	X	X	X	
Front fork oil	Replace			X		X		1
Steering head bearings	Perform resistance test		X	X	X	X	X	1
Oil cooler fins	Clean	X	X	X	X	X	X	
Brake system, oil lines, front forks, rear shock, exhaust system, exhaust system mounting, evaporative emission system (if applicable)	Inspect	X	X	X	X	X	X	1
Critical fasteners	Check tightness			X		X		1
Engine mounts, stabilizer, and links	Inspect			X		X		1
Road test	Verify component and system functions	X	X	X	X	X	X	
NOTES:	1. Should be performed by an authorized Buell dealer, unless you have the proper tools, service data and are mechanically qualified. 2. Change brake fluid every two (2) years.							

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table 1-4. Quick Reference Maintenance Chart: XB Models

ITEM SERVICED	SPECIFICATION	DATA
Engine oil and filter	Drain plug torque	Apply LOCTITE 565 THREAD SEALANT and reinstall plug and tighten to 26-29 ft-lbs (35-39 Nm)
	Oil capacity	2.5 quarts (2.4 liters) and includes the 4.0 ounces (0.12 liter) poured into the filter
	Filter	Hand tighten 1/2-3/4 turn after gasket contact
	Black filter part number	63806-00Y
Primary chain tension	Deflection with hot engine	1/4-3/8 in. (6.4-9.5 mm)
	Deflection with cold engine	3/8-1/2 in. (9.5-12.7 mm)
	Chain tensioner nut torque	20-25 ft-lbs (27-34 Nm)
	Primary chain inspection cover torque	84-108 **in-lbs** (9.5-12 Nm)

Table 1-4. Quick Reference Maintenance Chart: XB Models

ITEM SERVICED	SPECIFICATION	DATA
Primary chain/transmission lubricant	Lubricant level	GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05) as required until fluid level is even with bottom of clutch diaphragm spring
	Primary chaincase drain plug torque	Apply LOCTITE 565 THREAD SEALANT and reinstall plug and tighten to 14-30 ft-lbs (19-40.7 Nm)
Clutch adjustment	Free play at adjuster screw	Clockwise 1/4-1/2 turn
	Free play at hand lever	1/16-1/8 in. (1.6-3.2 mm)
	Clutch inspection cover torque	84-108 **in-lbs** (9.5-12 Nm)
Tire condition and pressure	Pressure for solo rider	Front: 34 psi (234 kPa) Rear:36 psi (248 kPa)
	Pressure for rider and passenger	Same as solo
	Wear	Replace tire if 1/32 in. (0.8 mm) or less of tread pattern remains
Brake fluid reservoir level	D.O.T. 4 hydraulic brake fluid part no.	99953-99A (12 oz.), 99973-05 (gal.)
	Proper fluid level	Front master cylinder, 1/8 in. (3.2 mm) from the top Rear master cylinder, between upper and lower lines.
	Front master cylinder reservoir cover torque	9-13 **in-lbs** (1.0-1.5 Nm)
Brake pad linings and discs	Minimum brake pad thickness	0.040 in. (1.0 mm) or less
	Minimum brake disc thickness	0.18 in. (4.5 mm) or less
Intake cover assembly	Intake cover screw torque	12-36 **in-lbs** (1.4-4 Nm)
Clutch and throttle cables	Lubricant	LUBIT-8 TUFOIL CHAIN AND CABLE LUBE (Part No. HD-94968-85TV)
	Handlebar clamp screw torque	60-84 **in-lbs** (6.8-9.5 Nm)
	Handlebar switch housing screw torque	25-33 **in-lbs** (3-4 Nm)
Spark plugs	Type	10R12X
	Gap	0.035 in (0.9 mm) .
	Torque	12-18 ft-lbs (16-24 Nm)
Engine idle speed	Idle speed	1050-1150 RPM
Front fork oil	Oil Type	HYDRAULIC FORK OIL (TYPE E) Part No. 99884-80
	Oil level: Firebolt and Lightning (except XB12Scg)	4.21 in. (107 mm) from the top of the fork tube
	Oil level: Lightning XB12Scg	4.29 in. (109 mm) from the top of the fork tube
	Oil level: Ulysses Oil level: XB12Ss	4.49 in. (114 mm) from the top of the fork tube 4.65 in. (118 mm) from the top of the fork tube
Battery	Lubricant	ELECTRICAL CONTACT LUBRICANT Part No. 99861-02 (1 oz.)
	Battery terminal torque	72-96 **in-lbs** (8-11 Nm)

BATTERY MAINTENANCE 1.5

GENERAL

⚠WARNING

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

⚠WARNING

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

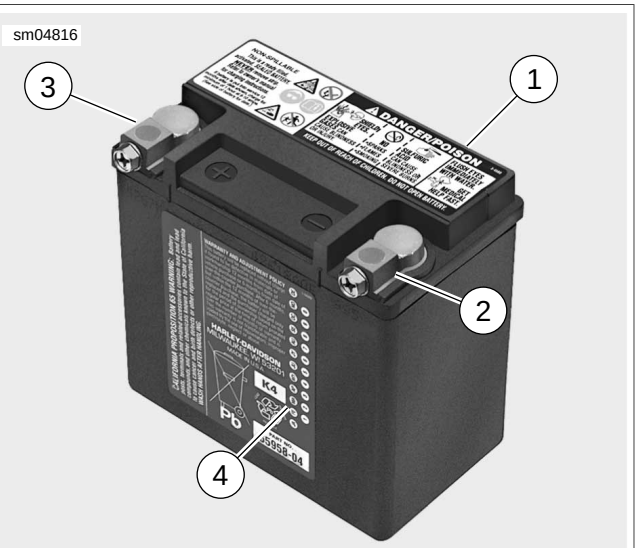
⚠WARNING

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

All AGM batteries are permanently sealed, maintenance-free, valve-regulated, lead/calcium and sulfuric acid batteries. The batteries are shipped pre-charged and ready to be put into service. Do not attempt to open these batteries for any reason.

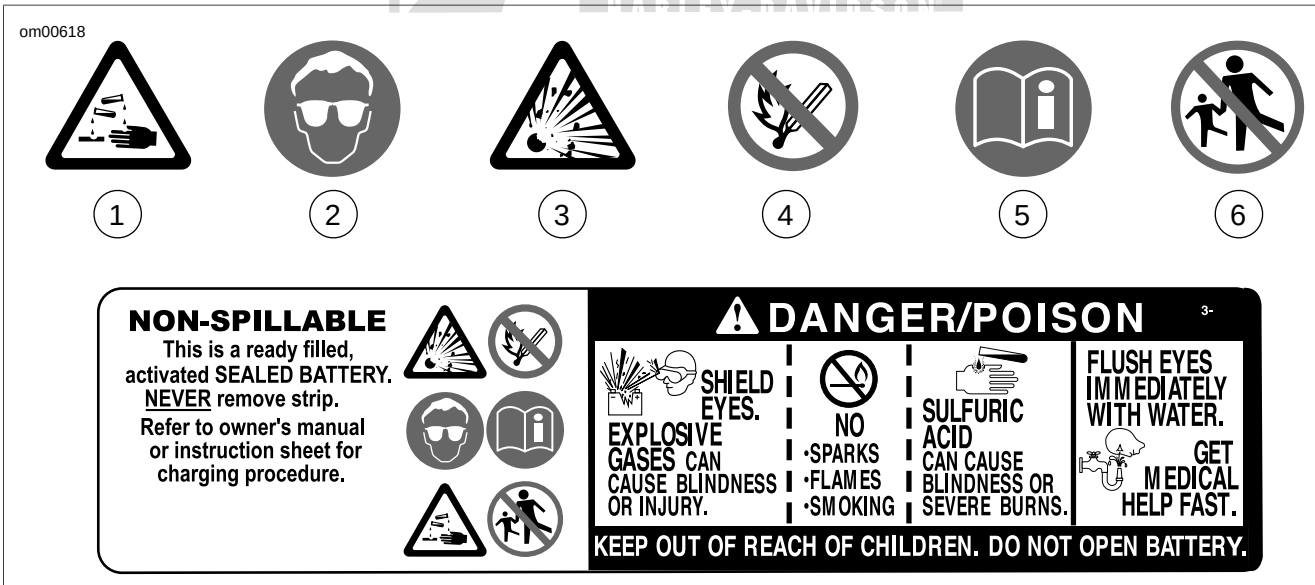
NOTE

For charging information, see 1.5 BATTERY MAINTENANCE, Charging Battery. For testing information, see ELECTRICAL DIAGNOSTIC MANUAL.



1. **Warning label**
2. **Negative (-) terminal**
3. **Positive (+) terminal**
4. **Warranty/date code label**

Figure 1-1. Battery: XB Models



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

Figure 1-2. Battery Warning Label

Table 1-5. Antidotes for Battery Acid

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

BATTERY DISCONNECTION AND REMOVAL

1. Remove seat.

⚠WARNING

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

2. Unthread fastener and remove battery negative cable (black) from battery negative (-) terminal.
3. Pull back terminal cover boot.
4. Unthread fastener and remove battery positive cable (red) from battery positive (+) terminal.
5. Unhook strap and remove battery.

CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When the solution stops bubbling, rinse off the battery with clean water.
2. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
3. Inspect the battery screws, clamps and cables for breakage, loose connections and corrosion. Clean clamps.
4. Check the battery posts for melting or damage caused by overtightening.
5. Inspect the battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
6. Inspect the battery case for cracks or leaks.

CHARGING BATTERY

Safety Precautions

Never charge a battery without first reviewing the instructions for the charger being used. In addition to the manufacturer's instructions, follow these general safety precautions:

- Always wear eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Turn the charger off before connecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery; red positive (+) lead to the positive (+) terminal and black negative (-) lead to the negative (-) terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.
- Make sure that the charger leads to the battery are not separated, frayed or loose.
- If the battery gets hotter than 110° F (43° C) during charging, discontinue charger and allow the battery to cool.
- Always turn the charger off before removing charger leads from the battery to avoid dangerous sparks.

Using a Battery Charger

Charge the battery if any of the following conditions exist:

- Vehicle lights appear dim.
- Electric starter sounds weak.
- Battery has not been used for an extended period of time.

⚠WARNING

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

CAUTION

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

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

NOTE

The figures listed in the table assume that the battery is charging at room temperature. If warmer than room temperature, use a slightly shorter charging time. If colder, use a slightly longer charging time.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table 1-6. 12 Amp-Hour Battery Charging Rates and Times

READING (VOLTS)	PERCENT CHARGE	3 AMP CHARGER	6 AMP CHARGER	10 AMP CHARGER	20 AMP CHARGER
12.7	100	N/A	N/A	N/A	N/A
12.6	75	1 hour 10 minutes	34 minutes	20 minutes	10 minutes
12.3	50	2 hours 20 minutes	1 hour 10 minutes	40 minutes	20 minutes
12.0	25	3 hours 20 minutes	1 hour 40 minutes	1 hour	30 minutes
11.8	0	4 hours 30 minutes	2 hours 14 minutes	1 hour 20 minutes	40 minutes

- The figures listed above assume the battery is charging at room temperature. If warmer than room temperature, use a slightly shorter charging time. If colder, use a slightly longer charging time.
- The use of constant current chargers to charge sealed maintenance-free batteries is not recommended. Any overcharge will cause dry-out and premature battery failure. If a constant current charger is the only type available, do **not** exceed the charge times listed above and do **not** continue charging the battery if it gets hot. When charging, **never** exceed 15 volts for more than 30 minutes.

NOTE

*The use of constant current chargers to charge sealed maintenance-free batteries is not recommended. Any overcharge will cause dry-out and premature battery failure. If a constant current charger is the only type available, do **not** exceed the charge times listed above and do **not** continue charging the battery if it gets hot. When charging, never exceed 15 volts for more than 30 minutes.*

WARNING

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

CAUTION

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

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

NOTE

If the battery is still in the vehicle, connect the negative lead to the chassis ground. Be sure that the ignition and all electrical accessories are turned off.

4. Step away from the battery and turn on the charger. See the charging instructions in Table 1-6.

WARNING

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

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

BATTERY INSTALLATION AND CONNECTION

1. Place the fully charged battery in the mounting position, terminal side to the rear of motorcycle.
2. Hook rubber strap around body of battery.

CAUTION

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

WARNING

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

CAUTION

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

3. Insert fastener through battery positive cable (red) into threaded hole of battery positive (+) terminal and tighten fastener to 72-96 **in-lbs** (8-11 Nm).
4. Install terminal cover boot.
5. Insert fastener through battery negative cable (black) into threaded hole of battery negative (-) terminal and tighten fastener to 72-96 **in-lbs** (8-11 Nm).
6. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.

WARNING

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

7. Install seat.

STORAGE

PART NUMBER	TOOL NAME
94654-98	SUPERSMART BATTERY TENDER

WARNING

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

CAUTION

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

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

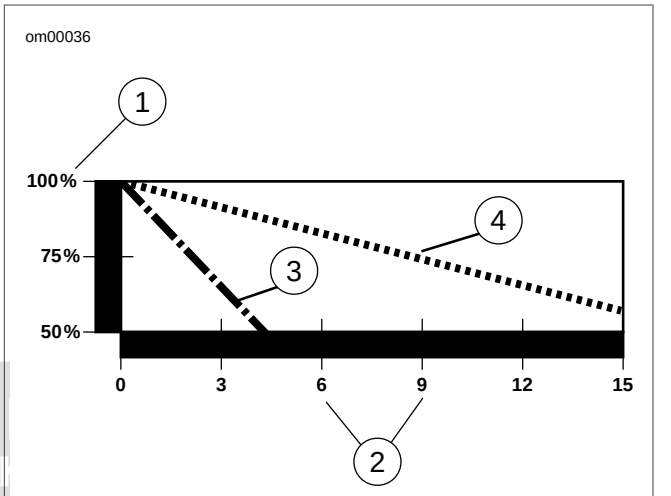
See Figure 1-3. Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place.

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

NOTE

The SUPERSMART BATTERY TENDER (Part No. 94654-98) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.

When returning a battery to service after storage, fully charge the battery.



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

Figure 1-3. Effective Rate of Temperature on Battery Self-discharging Rate

ENGINE OIL AND FILTER 1.6

GENERAL

The engine oil level can be checked with the oil and engine at ambient temperatures (cold check).

However, an accurate reading of the engine oil level can only be taken with the engine at normal operating temperature (hot check). Ride motorcycle for approximately 10 minutes to warm the oil and the engine to normal operating temperature.

NOTE

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

Whether a cold or a hot check, the procedure is the same.

During the pre-ride inspection, at every fueling stop, at scheduled maintenance intervals, and when storing the motorcycle:

- Check for oil leaks from the oil filter and oil lines.
- Check the engine oil level (cold check).
- Check engine oil level (hot check).

NOTES

- *Engine oil and filter should be changed when fluids are hot.*
- *The colder the weather, the shorter the recommended oil change interval. A vehicle used only for short runs in cold weather must have the engine oil drained more frequently.*

ENGINE OIL LEVEL CHECK

CAUTION

Do not operate the engine when the oil level is below the add mark on the dipstick at operating temperature. Engine damage will result. (00187b)

CAUTION

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

CAUTION

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

1. The motorcycle must be on level ground, on the sidestand, with the engine off.
2. See Figure 1-4. Unscrew and remove dipstick from oil tank/swingarm filler hole. Wipe dipstick clean.
3. Insert dipstick into oil tank filler hole, screwing dipstick in completely. DO NOT OVER TIGHTEN.

NOTE

The area between the upper and lower registration marks is the operating range.

4. See Figure 1-5. Unscrew and remove dipstick and read oil level.
5. If the level is below the lower registration mark, add only enough oil to bring oil level between lower and upper registration marks.

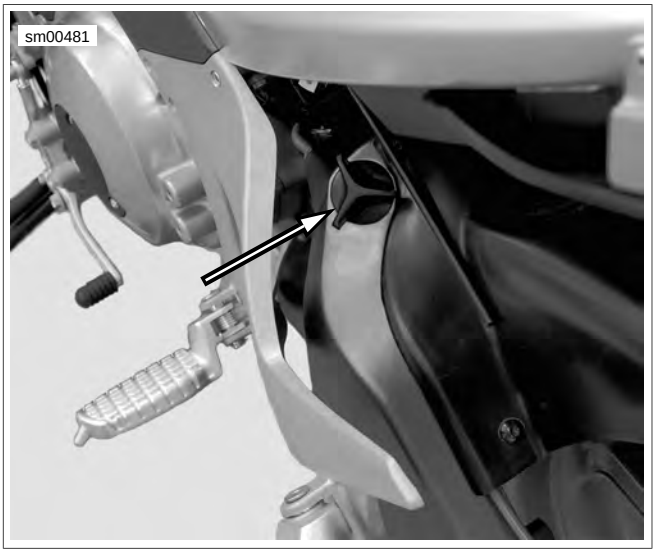


Figure 1-4. Dipstick Location (Ulysses Shown)

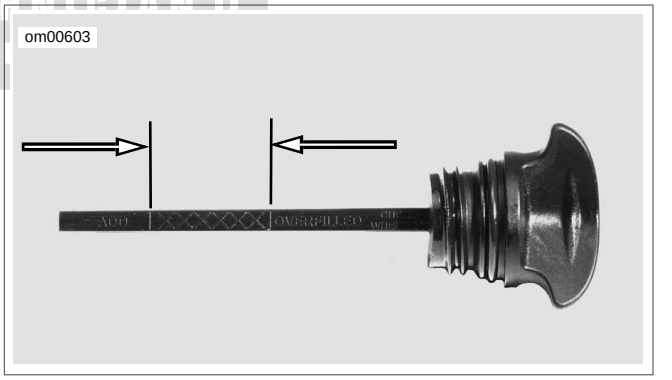


Figure 1-5. Dipstick Oil Level Registration Marks

CHANGE ENGINE OIL AND FILTER

Drain Oil

1. Ride motorcycle for 10 minutes to warm oil to operating temperature. Turn engine off.
2. See Figure 1-6. Place a container under the drain plug on the bottom left side of the oil tank/swingarm.
3. Using a 5/8 in. wrench, remove drain plug from under oil tank/swingarm.
4. Wipe debris from magnetic tip on drain plug.
5. Unscrew and remove dipstick from oil fill hole on top of oil tank/swingarm.

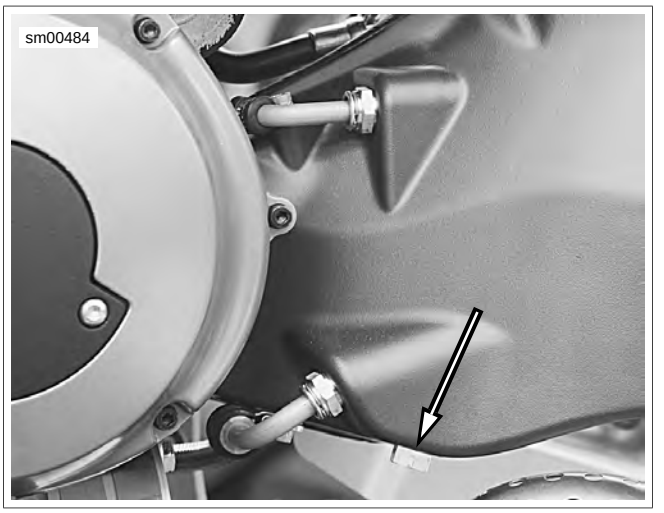


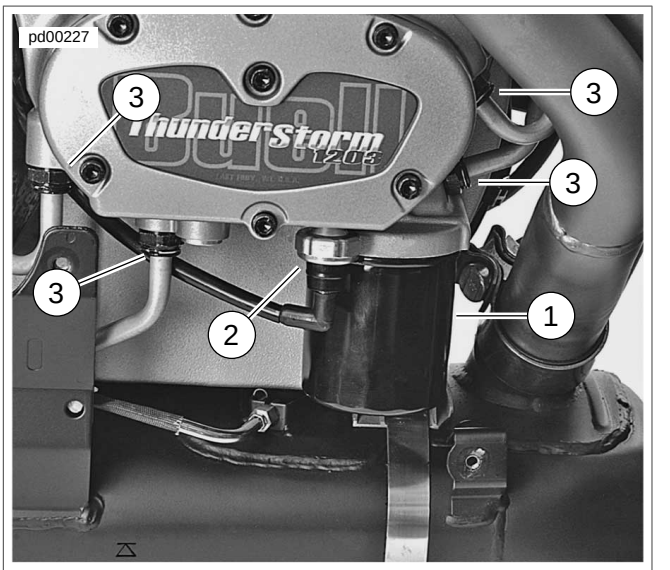
Figure 1-6. Oil Tank Drain Plug (Typical)

Change Filter

1. Remove chin fairing. See 2.50 CHIN FAIRING.
2. See Figure 1-7. Remove oil filter using pliers or belt type oil filter wrench.
3. Clean filter gasket contact surface on crankcase. Surface must be smooth and free of debris or old gasket material.
4. Apply a thin film of clean engine oil to **new** filter gasket.
5. Pour 4.0 ounces (0.12 liter) of clean engine oil into filter (until filter is approximately 1/2 full).
6. Screw filter onto adapter until filter gasket touches crankcase surface.
7. By hand, turn filter an additional 1/2 to 3/4 turn.

⚠WARNING

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



1. **Oil filter**
2. **Oil pressure switch**
3. **Oil line fittings**

Figure 1-7. Oil Filter: Buell Models except Blast

Fill Engine With Oil

1. Inspect drain plug O-ring for tears or damage. Replace if required. Wipe any foreign material from drain plug.
2. Apply LOCTITE 565 THREAD SEALANT, reinstall plug and tighten to 26-29 ft-lbs (35-39 Nm).
3. Fill oil tank through filler (dipstick) hole with fresh oil.

NOTES

- *Use the grade of oil for the lowest temperature expected before the next oil change.*
- *Oil tank capacity with filter change is approximately 2.5 quarts (2.4 liters) and includes the 4.0 ounces (0.12 liter) poured into the filter. Always verify proper hot oil level on dipstick. Do not overfill.*

4. Inspect O-ring on dipstick for rips or tears. Replace as required.

NOTE

For ease of installation, apply a light film of clean engine oil to the dipstick O-ring.

5. Install dipstick into oil tank/swingarm fill hole. Make sure dipstick is installed completely. DO NOT OVER TIGHTEN.

Clear Oil Cooler

1. Remove oil cooler scoop.

⚠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)

BIG TWIN TECHNICIAN II HARLEY-DAVIDSON

2. Blow out any debris from fins with compressed air from the inside of the oil cooler outward. Inspect cooler fins for debris or damage.
3. Install oil cooler scoop. See 2.49 AIR SCOOPS.

Return to Service

1. Wipe up any spilled oil on muffler.
2. Start engine. Verify that oil pressure signal light on instrument cluster turns off after a few seconds when engine speed is 1000 RPM or above.
3. Check for oil leaks at oil filter, drain plug, hoses and oil cooler.
4. Install chin fairing. See 2.50 CHIN FAIRING.
5. Check (hot) oil level. See 1.6 ENGINE OIL AND FILTER, Engine Oil Level Check.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

BRAKE SYSTEM MAINTENANCE 1.7

GENERAL

Check brake fluid level and condition:

- When storing or removing the motorcycle for the season.

Replace **D.O.T. 4 BRAKE FLUID**:

- Every 2 years.

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

Inspect front and rear brake lines and replace as required:

- Every 4 years.

Inspect caliper and master cylinder seals and replace as required:

- Every 2 years.

If determining probable causes of poor brake operation, refer to Table 1-7.

Table 1-7. Brake Troubleshooting

CONDITION	CHECK FOR	REMEDY
Excessive lever/pedal travel or spongy feel	Air in system. Master cylinder fluid low.	Bleed brake(s). Fill master cylinder with approved brake fluid.
Brake fade	Moisture in system.	Bleed brake(s). Replace fluid in master cylinder with approved brake fluid.
Chattering sound when brake is applied	Worn pads. Worn D shape bushings. Loose mounting bolts. Warped rotor.	Replace brake pads. Replace rotor and bushings as a set. Tighten bolts. Replace rotor and bushings as a set.
Ineffective brake, lever/pedal travels to limit	Low fluid level. Piston cup not functioning.	Fill master cylinder with approved brake fluid. Rebuild cylinder.
Ineffective brake, lever/pedal travel normal	Distorted or glazed rotor. Distorted, glazed or contaminated brake pads.	Replace rotor and bushings as a set. Replace brake pads.
Brake pads drag on rotor, will not retract	Cup in master cylinder not uncovering relief port. Rear brake pedal linkage out of adjustment.	Inspect master cylinder. Adjust brake pedal linkage.

BLEEDING BRAKES

⚠CAUTION

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

⚠WARNING

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

⚠WARNING

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)

CAUTION

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

NOTE

*Use only **new** copper crush banjo washers (See Parts Catalog for Part No.) with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time. Failure to comply may adversely affect*

braking ability and lead to brake failure which could result in death or serious injury.

Bleeding Front Brake

NOTE

Hydraulic brake fluid bladder-type pressure equipment can be used to fill the brake master cylinder through the bleeder valve if master cylinder reservoir cover is removed to prevent pressurization.

1. See Figure 1-8. With motorcycle in upright position, remove protective cap and install end of plastic tubing over front caliper bleeder valve; place other end in a clean container.

CAUTION

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

2. Cover body surfaces, right handlebar switches and instrument panel to protect from spillage.
3. See Figure 1-9. Remove two fasteners from front master cylinder cover and remove the reservoir cap, stiffener and diaphragm.
4. Repeat the following steps until all air bubbles are purged and brake fluid flows from the plastic tubing.
   a. See Figure 1-10. Add **D.O.T. 4 BRAKE FLUID** to master cylinder reservoir. Bring fluid level to within 1/8 in. (3.2 mm) of molded boss level indicator inside front master cylinder.

   NOTE

   Do not reuse brake fluid.

   b. Slowly squeeze and release brake lever several times to build up hydraulic pressure, then squeeze or apply pressure to brake lever.
   c. Open bleeder valve about 1/2-turn counterclockwise. Brake fluid will flow from bleeder valve and through tubing into container.
   d. When brake lever has moved 1/2 to 3/4 of its range of travel, close bleeder valve (clockwise).
5. Tighten front caliper bleeder valve (metric) to 36-60 **in-lbs** (4-7 Nm).
6. See Figure 1-10. Verify fluid is within 1/8 in. (3.2 mm) of molded boss level indicator inside front master cylinder.
7. Check that brake lever feels firm. Repeat bleeding procedure as necessary.
8. Attach cover to front master cylinder reservoir and tighten fasteners to 9-13 **in-lbs** (1.0-1.5 Nm).
9. Remove plastic tubing from bleeder and install protective cap.
10. Remove protective cover from molded-in color surfaces, right handlebar switches and instrument panel.

Figure 1-8. Front Caliper Bleeder Valve

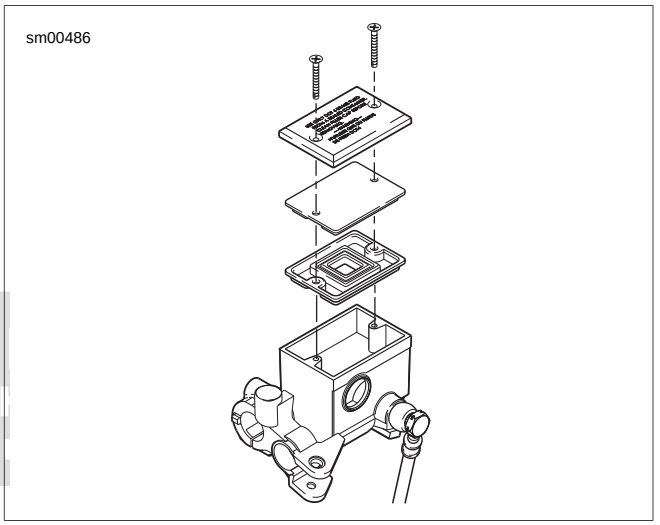


Figure 1-9. Front Master Cylinder (Fasteners, Cap, Stiffener and Diaphragm)

Figure 1-10. Reservoir Fluid Level Indicator

Bleeding Rear Brake

NOTE

Hydraulic brake fluid bladder-type pressure equipment can be used to fill the brake master cylinder through the bleeder valve if master cylinder reservoir cover is removed to prevent pressurization.

1. See Figure 1-11. Remove rubber cap and install end of plastic tubing over rear caliper bleeder valve. Place other end of tubing in a clean container.

CAUTION

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

NOTE

On Ulysses models it will be necessary to remove the right side air flow guide.

2. Remove seat.
3. See Figure 1-12. Unscrew cap from rear master cylinder reservoir.
4. Repeat the following until all air bubbles are purged and only brake fluid flows from the plastic tubing.
   a. Add **D.O.T. 4 BRAKE FLUID** to master cylinder reservoir with motorcycle upright (not on sidestand). Bring fluid level between upper and lower marks on reservoir.

   NOTE

   Do not reuse brake fluid.

   b. Slowly press and release brake pedal several times to build up hydraulic pressure, then hold brake pedal in the pressed position.
   c. While holding brake pedal in the pressed position, open bleeder valve about 1/2-turn counterclockwise. Brake fluid will flow from bleeder valve and through tubing into clean container.
   d. When brake pedal has moved 1/2 to 3/4 of its full range of travel, close bleeder valve (clockwise). Allow brake pedal to return slowly to its released position.
5. Tighten rear caliper bleeder valve (metric) to 36-60 **in-lbs** (4-7 Nm) and replace rubber cap on valve.
6. Verify brake fluid level is between the upper and lower lines on the side of the reservoir.
7. Thread cap on reservoir and tighten securely.
8. Check that the brake pedal feels firm when pressed. Repeat bleeding procedure as necessary.

WARNING

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

9. Install seat, if removed.

Figure 1-11. Rear Caliper Bleeder Valve

Figure 1-12. Rear Master Cylinder Reservoir: Ulysses

BRAKE PEDAL ADJUSTMENT

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)

Check rear brake pedal operation:

- Before every ride.

NOTES

- *See Figure 1-13. On the very end of the threaded brake rod, are two flat sides (2). To verify proper thread engagement with the clevis (3), the flat sides must extend below the extruded nut (1) in the clevis by at least one full thread. This is the rod minimum engagement (4).*
- *Also, there should be a minimum of 0.030 in. (0.8 mm) between brake rod end and brake pedal.*

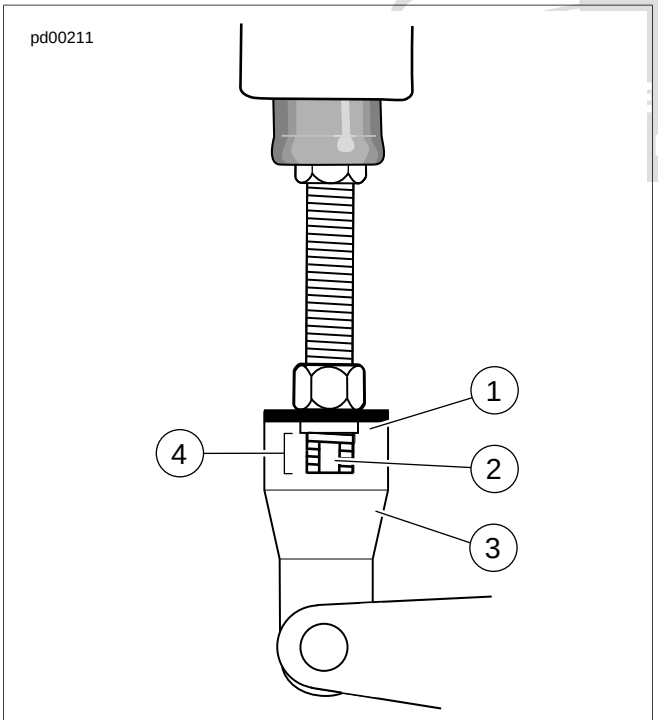
⚠WARNING

Threaded rod should not be adjusted to the point of contacting brake pedal. Improper adjustment could result in death or serious injury. (00559c)

1. See Figure 1-14. Inspect for minimum and maximum brake rod engagement in brake clevis (4). Adjust as required.
2. Adjust brake pedal.
   a. Loosen locknut (3) while holding rod adjuster (2). Move locknut away from top surface of clevis (4).
   b. Turn rod adjuster to set pedal height.
   c. Return locknut (3) to fit flush against top surface of clevis and tighten to 130-173.5 **in-lbs** (14.7-19.6 Nm).

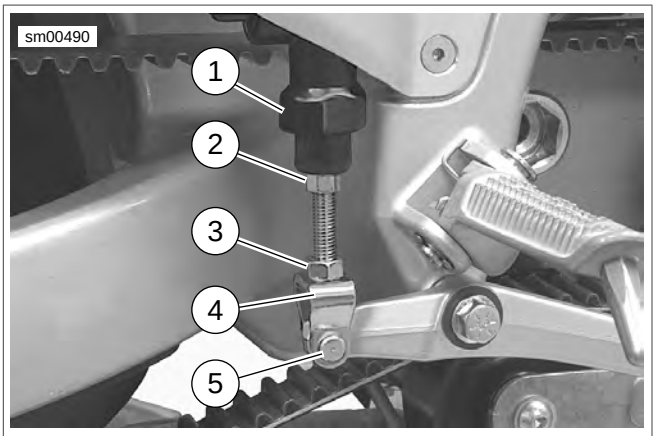
NOTE

Brake pedal has no free play adjustment.



1. **Extruded nut**
2. **Flat sides (on the end of the threaded brake rod)**
3. **Clevis**
4. **Minimum engagement**

Figure 1-13. Critical Measurements with Brake Pedal



1. **Bottom of master cylinder**
2. **Rod adjuster**
3. **Locknut**
4. **Clevis**
5. **Clevis pin**

Figure 1-14. Brake Pedal Pushrod Adjustment (Typical)

BRAKE PAD THICKNESS

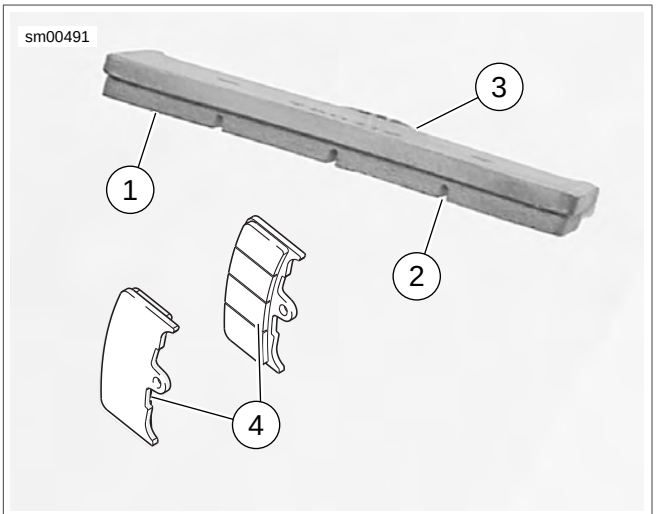
⚠WARNING

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

See Figure 1-15. Inspect both front and rear brake pads for wear and damage. If the friction material (1) of a pad is worn past the wear grooves (2) or if a pad is damaged, replace both pads as a set.

NOTE

Wear grooves (2) disappear if friction material is worn to 0.040 in. (1.0 mm) or less.



1. **Friction material**
2. **Wear groove**
3. **Backing material**
4. **Pad set**

Figure 1-15. Brake Pads

BRAKE ROTOR THICKNESS

⚠WARNING

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

See Figure 1-16 and Figure 1-17. Inspect and measure both front and rear brake rotors for minimum thickness:

- At every scheduled service interval:

1. Inspect rotor. Replace rotor if warped or badly scored.
2. Measure rotor thickness. Replace rotor if minimum thickness is less than 0.18 in. (4.5 mm).

NOTES

- *See 2.5 FRONT WHEEL for rotor replacement.*
- *Whenever rotor is replaced, replace rotor drive bushings, fasteners, washers and springs.*
- *See 2.6 REAR WHEEL for rotor replacement.*

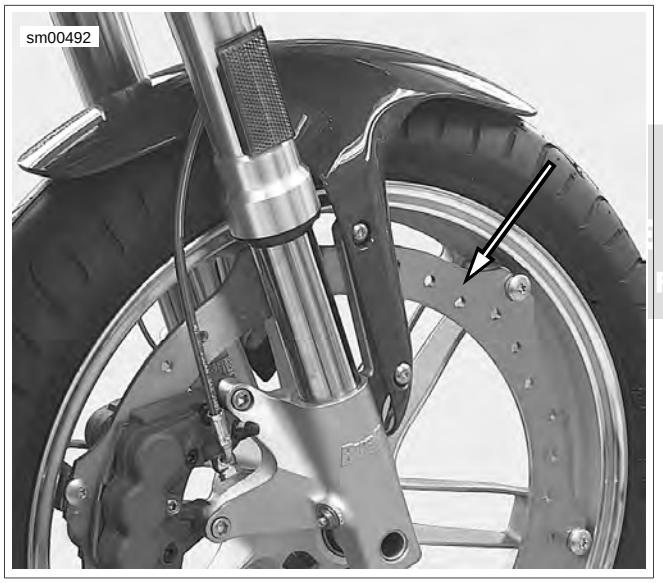


Figure 1-16. Front Brake Rotor (Typical)

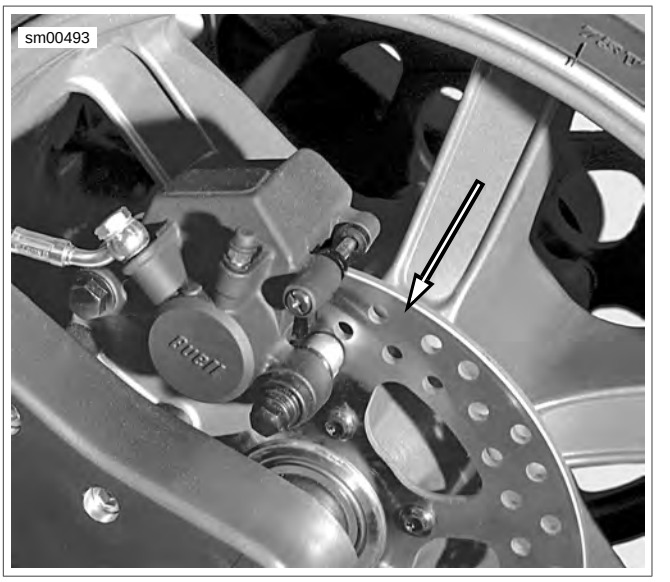


Figure 1-17. Rear Brake Rotor (Typical)

BRAKE PAD REPLACEMENT

Front Pad Removal

NOTE

On XB12X models it will be necessary to remove the right side front fender to access caliper fasteners.

1. See Figure 1-18. Loosen pin hanger (2) but do not remove.
2. Rotate wheel so that caliper is centered between rotor mounting fasteners (1).
3. Remove lower caliper mounting fastener (4) that secures caliper to fork lower.
4. Loosen but do not remove upper caliper mounting fastener (3) that secures caliper to fork lower.
5. Remove pin hanger (2).
6. Rotate caliper counterclockwise to allow access to outer pad.
7. Remove outer pad from right side.
8. Remove inner pad from left side by pulling rearward, rotating pad 90 degrees and pulling through wheel opening.

Front Pad Installation

1. Remove the front master cylinder reservoir cap.

NOTE

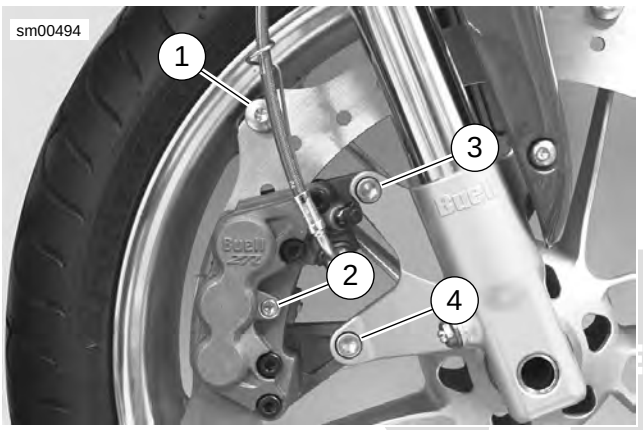
As the pistons are pushed back into the caliper, fluid level may rise more than 1/8 in. (3.2 mm) and overflow the reservoir. Watch the fluid level as the pistons are retracted and remove fluid from the reservoir if necessary.

2. Push pistons in with suitable tool such as a clean paint scraper until fully seated in bores. Be careful not to damage rotor.
3. Install **new** inner pad from left side of motorcycle.
4. Install **new** outer pad from right side of motorcycle.

5. See Figure 1-18. Install pin hanger (2) making sure it engages hole on both pads and spring clip.
6. Rotate caliper clockwise to align mounting fastener hole.
7. Install lower caliper mounting fastener (4).
8. Apply LOCTITE 271 (red) and tighten both caliper mounting fasteners (3, 4) to 35-37 ft-lbs (47-50 Nm).
9. Tighten pin (2) to 11-14 ft-lbs (15-19 Nm).
10. Check brake fluid level and install front master cylinder reservoir cap and tighten screws to 9-13 **in-lbs** (1.0-1.5 Nm).
11. On XB12X models: install right front fender. See 2.15 FENDERS.

NOTE

*Avoid making hard stops for the first 100 miles (160 km) to allow **new** brake pads to "wear in" properly with the rotor.*



1. **Rotor mounting fastener (6)**
2. **Front caliper pin hanger**
3. **Upper caliper mounting fastener (behind fender on Ulysses)**
4. **Lower caliper mounting fastener**

Figure 1-18. Front Brake Caliper (Typical)

Rear Pad Removal

1. See Figure 1-19. Remove rear caliper pin plug (3) and loosen pin (4).
2. On Firebolt and Lightning models (except XB12Ss), remove the fastener securing p-clamp and brake line assembly to swingarm.

NOTE

XB12Ss, XB12X, XB12XT and XB12XP models use the rear fender to secure the brake line and not a p-clamp.

3. On XB12Ss, XB12X, XB12XT and XB12XP models, remove rear fender. See 2.15 FENDERS.
4. Remove two mounting fasteners (1) securing brake caliper and carrier assembly to swingarm.
5. Lift caliper and carrier assembly up and off of rotor.
6. Remove pin hanger (4).
7. See Figure 1-20. Remove inner and outer pads, being careful not to dislodge pad spring.

Rear Pad Installation

1. Remove rear master cylinder reservoir cover.

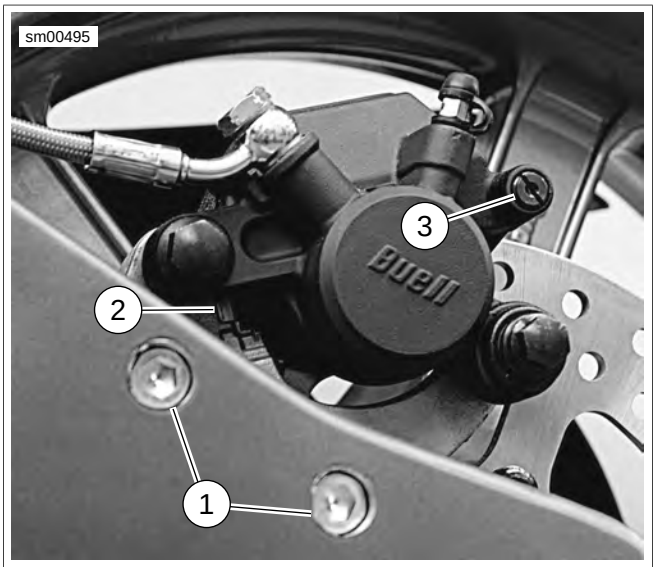
NOTE

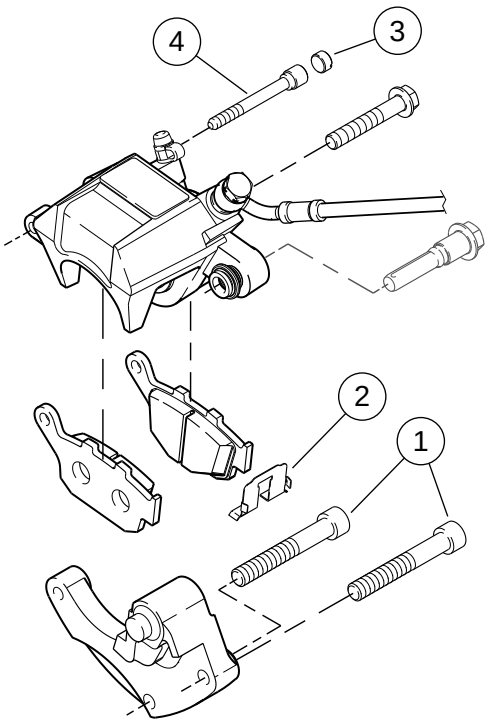
As the pistons are pushed back into the caliper, fluid level may rise more than 1/8 in. (3.2 mm) and overflow the reservoir. Watch the fluid level as the pistons are retracted and remove fluid from the reservoir if necessary.

2. See Figure 1-19. Check that retainer (2) is present.
3. See Figure 1-20. Check that pad spring is present. Should pad spring become dislodged, install with widest area of spring towards piston side of caliper.
4. Push piston in with suitable tool such as a clean paint scraper until fully seated in bore.
5. Install **new** inner and outer brake pads.
6. See Figure 1-19. Install hanger pin (4) making sure pin engages hole on both pads.
7. Install brake caliper and carrier assembly over rotor.
8. Install two mounting fasteners (1) through swingarm into carrier and tighten to 24-26 ft-lbs (32.5-35 Nm).
9. Install hanger pin and tighten to 11-14 ft-lbs (14.9-18.9 Nm).
10. Install pin plug (3) and tighten pin plug to 24 **in-lbs** (3 Nm).
11. On Firebolt and Lightning models (except XB12Ss), install fastener securing p-clamp and brake line assembly to swingarm and tighten to 36-60 **in-lbs** (4.1-7 Nm).
12. On XB12Ss, XB12X, XB12XT and XB12XP models, install rear fender. See 2.15 FENDERS.
13. Check brake fluid level and install master cylinder reservoir cap and tighten cap securely.

NOTE

*Avoid making hard stops for the first 100 miles (160 km) to allow **new** brake pads to "wear in" properly with the rotor.*





1. Rear caliper mounting fasteners
2. Brake pad retainer
3. Rear caliper pin plug
4. Rear caliper pin hanger

Figure 1-19. Rear Brake Caliper

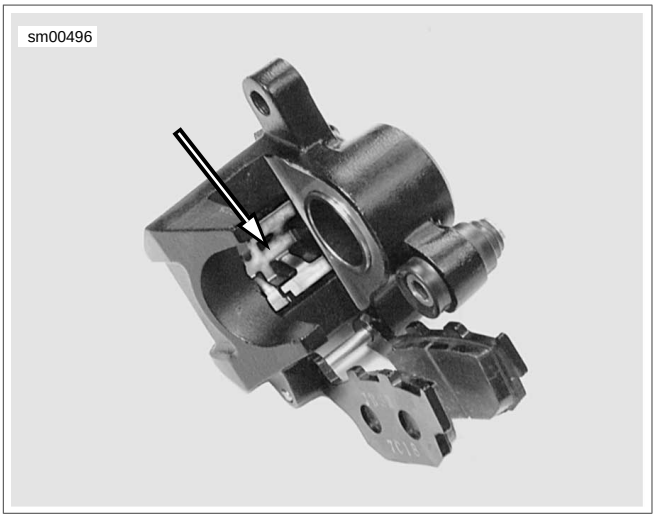


Figure 1-20. Rear Brake Pad Spring Installed

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TIRES AND WHEELS 1.8

TIRE INFLATION

⚠WARNING

Use only Buell approved tires. See a Buell dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00133a)

⚠WARNING

Do not inflate tire beyond maximum pressure as specified on sidewall. Over inflated tires can blow out, which could result in death or serious injury. (00027a)

Check tire pressure and tread:

- Before every ride.

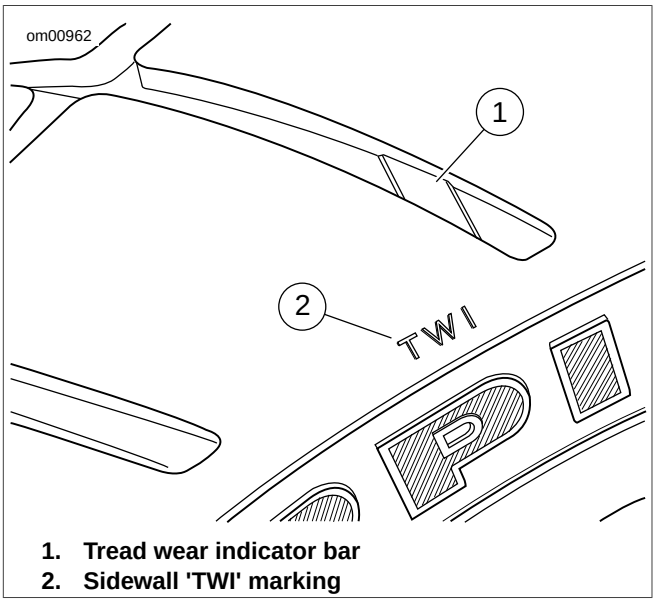
Check for proper front and rear tire pressures when tires are cold. Compare pressure against Table 1-8.

Table 1-8. Tire Pressures: Pirelli Diablo T and Scorpion Sync Tires

TIRE	PRESSURE FOR SOLO RIDING		PRESSURE AT GVWR
	PSI	kPa	
Front	34	234	Same as solo
Rear	36	248	Same as solo

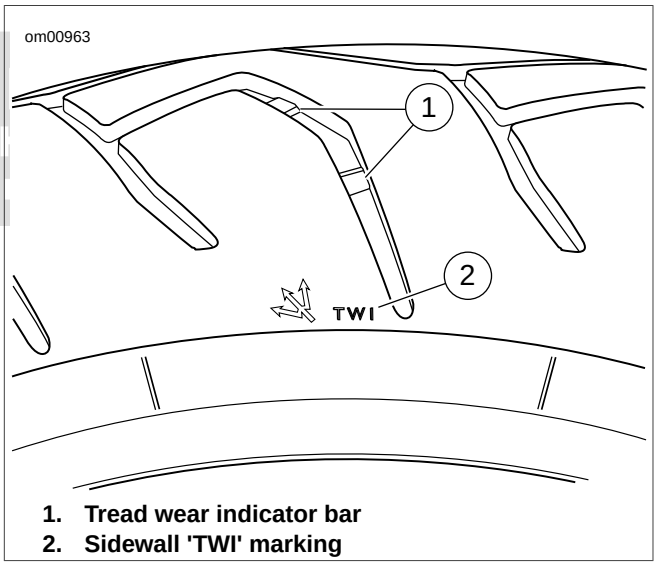
TIRE WEAR

See Figure 1-21 and Figure 1-22. Tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tire tread remains. The letters TWI on tire sidewalls pinpoint location of wear indicators bars. Always remove tires from service before they reach the treadwear indicator bars. Refer to Table 1-9.



1. **Tread wear indicator bar**
2. **Sidewall 'TWI' marking**

Figure 1-21. Tread Wear Indicator: Pirelli Scorpion Sync



1. **Tread wear indicator bar**
2. **Sidewall 'TWI' marking**

Figure 1-22. Tread Wear Indicator: Pirelli Diablo

Table 1-9. Tires: 2009 XB Models

MODEL	TIRE	TYPE	SOLO RIDING		LOADED TO GVWR	
			PSI	kPa	PSI	kPa
XB12R	Front	Pirelli Diablo Corsa III 120/70 ZR 17	34	234	Same as solo riding values.	
	Rear	Pirelli Diablo Corsa III 180/55 ZR 17	36	248		
XB9SX, XB12X, XB12XP	Front	Pirelli Scorpion SYNC 120/70 ZR 17	34	234	Same as solo riding values.	
	Rear	Pirelli Scorpion SYNC 180/55 ZR 17	36	248		
XB12Ss, XB12Scg	Front	Pirelli Diablo T 120/70 ZR 17	34	234	Same as solo riding values.	
	Rear	Pirelli Diablo T 180/55 ZR 17	36	248		
XB12XT	Front	Pirelli Diablo Strada 120/70 ZR 17	34	234	Same as solo riding values.	
	Rear	Pirelli Diablo Strada 180/55 ZR 17	36	248		

WHEEL BEARINGS

WARNING

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

Check front and rear wheel bearings for wear:

- Every time a wheel is removed.
- When storing or removing the motorcycle for the season.

Check wheel bearings for wear and corrosion. Excessive play or roughness indicates worn bearings. Replace bearings in sets only.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

CLUTCH/TRANSMISSION/PRIMARY FLUID 1.9

INSPECTION

1. Remove seat.

⚠WARNING

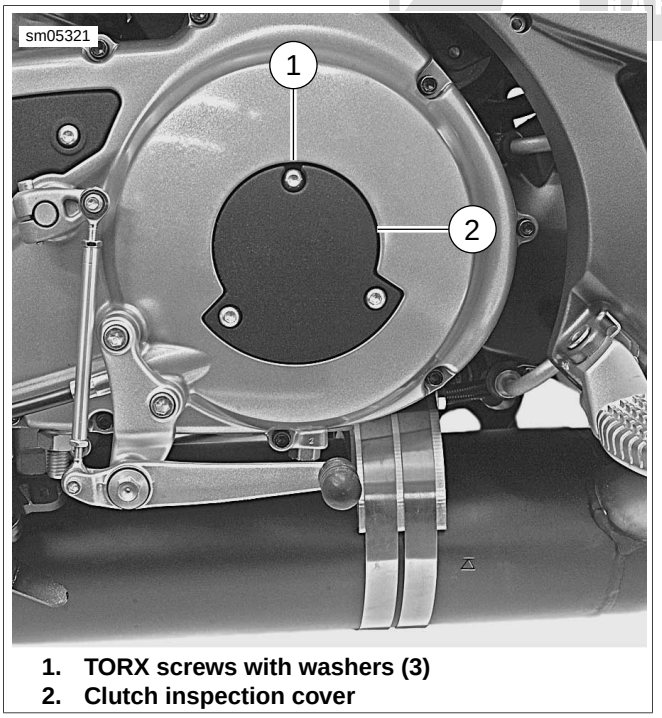
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable from battery.
3. See Figure 1-23. Remove three TORX screws with washers (1) from clutch inspection cover (2). Remove clutch inspection cover from primary cover.
4. See Figure 1-24. Inspect fluid level with motorcycle in upright position.
5. See Figure 1-23. Install **new** gasket and clutch inspection cover using three TORX screws with washers. Tighten in a crosswise pattern to 84-108 **in-lbs** (9.5-12 Nm).
6. Connect negative battery cable to battery.

⚠WARNING

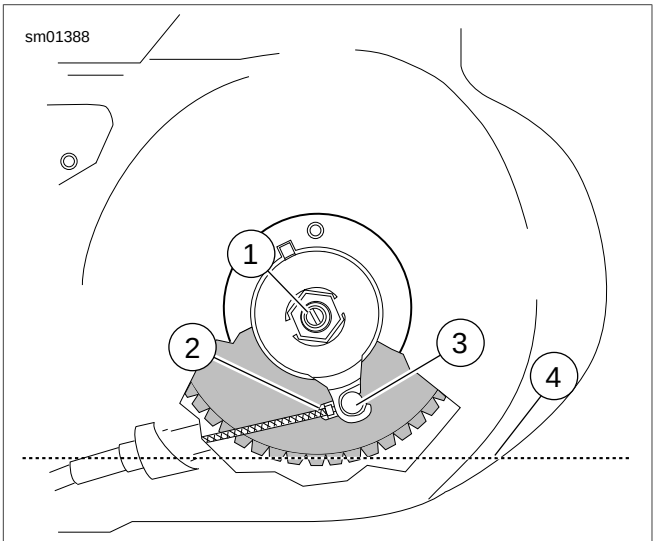
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

7. Install seat.



1. **TORX screws with washers (3)**
2. **Clutch inspection cover**

Figure 1-23. Primary Cover



1. **Adjusting screw**
2. **Cable end**
3. **Coupling**
4. **Correct fluid level**

Figure 1-24. Primary Fluid Level

TRANSMISSION FLUID

Transmission fluid capacity is approximately 1.0 quart (0.95 liter). For best results, drain fluid while hot.

1. When the engine reaches normal operating temperature, turn the engine off and position motorcycle on sidestand. This will allow the chaincase lubricant to drain out of the transmission.

CAUTION

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

2. See Figure 1-26. Position a suitable container under drain plug. Remove plug and drain fluid.
3. Position the motorcycle STRAIGHT UP and LEVEL. This allows additional fluid to be drained from clutch compartment and will prevent chaincase lubricant from draining out of clutch cover opening when refilled.
4. Wipe any foreign material from the magnetic drain plug, inspect/replace o-ring and apply LOCTITE 565 THREAD SEALANT. Reinstall plug and tighten to 14-30 ft-lbs (19-41 Nm).
5. See Figure 1-25. Remove three fasteners and washers from clutch inspection cover. Remove clutch inspection cover with gasket from primary cover.

CAUTION

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

6. Make certain primary chaincase is filled with proper amount of lubricant with motorcycle upright. If under filled, transmission can be damaged during vehicle operation.
7. See Figure 1-24. Add GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, quart size) as required until fluid level is even with bottom of clutch diaphragm spring.

NOTE

Each time the clutch inspection cover is removed, the gasket must be replaced.

8. Install **new** clutch cover gasket.
9. See Figure 1-25. Install clutch inspection cover tightening three fasteners and washers to 84-108 **in-lbs** (9.5-12 Nm).
10. Clean up any fluid that may have spilled on muffler.

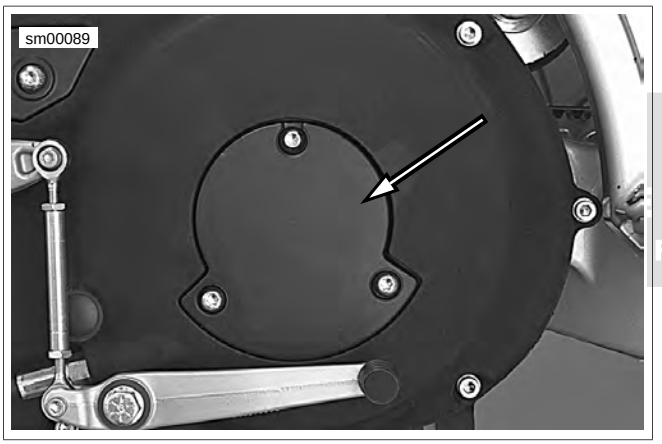


Figure 1-25. Clutch Inspection Cover (Typical)

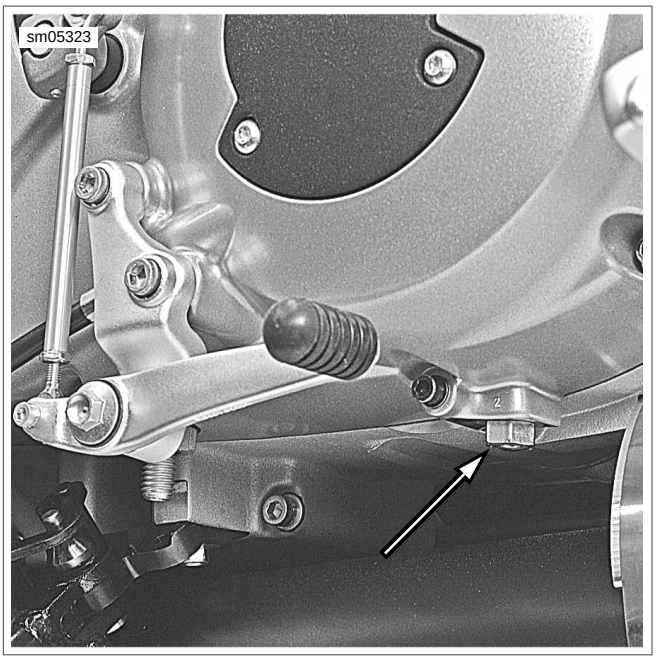


Figure 1-26. Primary Drain Plug: XB Models

ADJUSTMENT

If clutch slips under load or drags when released, first check control cable adjustment. If cable adjustment is within specifications, adjust clutch mechanism as described below.

When necessary, lubricate cable with LUBIT-8 TUFOIL® CHAIN AND CABLE LUBE (Part No. HD-94968-85TV).

1. Position the vehicle upright and level. This will prevent lubricant from draining out when clutch inspection cover is removed.
2. See Figure 1-27. Slide rubber boot (1) upward to expose adjuster mechanism. Loosen jam nut (3) from adjuster (4). Turn adjuster to shorten cable housing until there is a large amount of free play at clutch hand lever.
3. See Figure 1-25. Remove three fasteners and washers from clutch inspection cover. Remove clutch inspection cover and gasket from primary cover.
4. See Figure 1-28. Remove spring (1) and lockplate (2). Using a flat tip screwdriver, turn adjusting screw (3) counterclockwise until it lightly bottoms.
5. Turn adjusting screw clockwise 1/4-1/2 turn. Install lockplate and spring on adjusting screw flats. If hex on lockplate does not align with recess in outer ramp, rotate adjusting screw clockwise until it aligns.

NOTES

- *All Ulysses models now incorporate a hook for the clutch cable into the handlebar assembly. The purpose of this hook is to control the routing of the clutch cable so it will not interfere with the instrument cluster mounted to the front of the upper fork clamp.*
- *All cable adjustments for the Ulysses models are to be performed with the clutch cable free from the handlebar*

hook. Once the measurement has been attained you will need to route the cable through the hook.

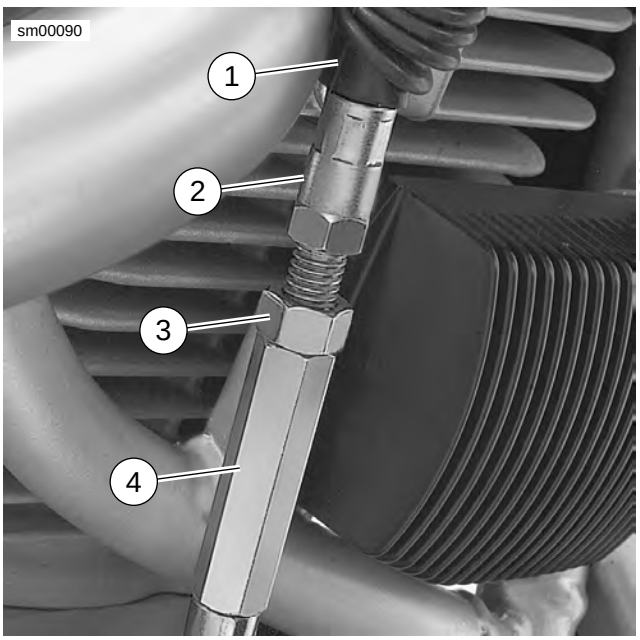
- *Spring installs on outboard side of hex lockplate.*

6. Squeeze clutch hand lever to maximum limit three times. This sets the ball and ramp mechanism. Adjust as follows:
   a. See Figure 1-29. Pull ferrule (end of cable housing) away from bracket. Gap between ferrule and bracket should be 0.0625-0.125 in. (1.6-3.2 mm).
   b. On Ulysses models, gap between ferrule and bracket should be 0.140-0.180 in. (3.6-4.6 mm).
   c. See Figure 1-27. Set free play by turning adjuster (4).
   d. Tighten jam nut (3) against adjuster (4).
   e. Slide boot (1) over cable adjuster mechanism.
7. Change or add transmission fluid if necessary.

NOTE

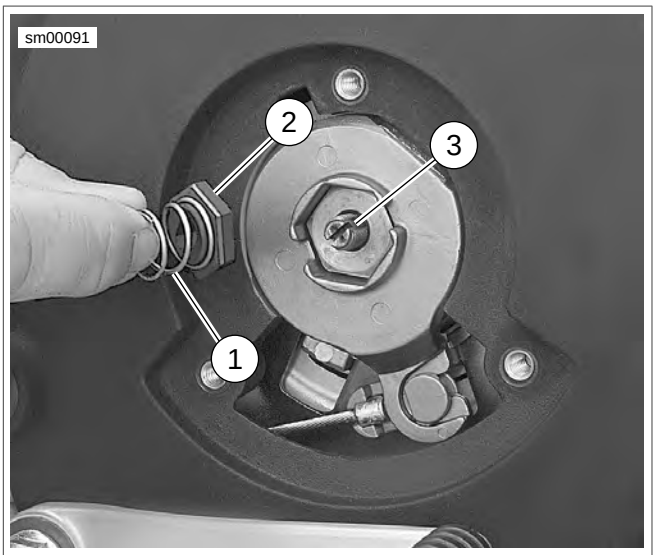
Each time the clutch inspection cover is removed, the gasket must be replaced.

8. See Figure 1-25. Install clutch inspection cover and **new** gasket using three fasteners and washers and tighten to 84-108 **in-lbs** (9.5-12 Nm).



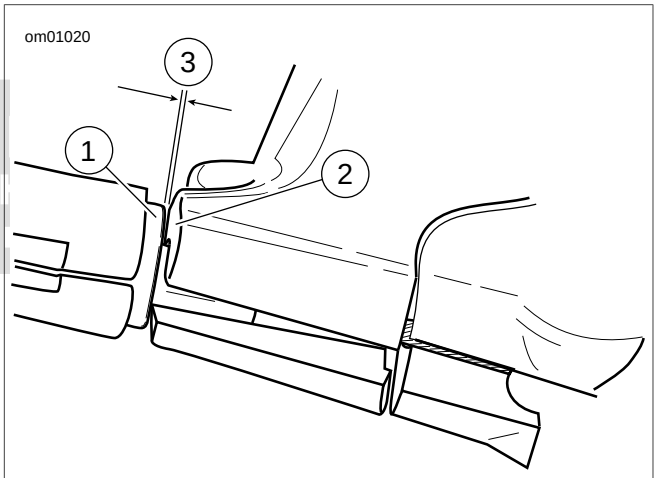
1. **Rubber boot**
2. **Cable end**
3. **Jam nut**
4. **Adjuster**

Figure 1-27. Clutch Cable Adjuster Mechanism



1. **Diaphragm spring**
2. **Lockplate**
3. **Adjusting screw**

Figure 1-28. Clutch Adjustment: XB Models



1. **Ferrule**
2. **Bracket**
3. **Free play**

Figure 1-29. Clutch Cable Free Play

DRIVE BELT MAINTENANCE 1.10

GENERAL

The drive belt tension on a new belt will loosen after approximately 1000 miles (1600 km). The drive belt tension is automatically set by the idler pulley. Axle alignment is not adjustable.

Inspect drive belt and idler pulley assembly after first 1000 miles (1600 km) and at every 5000 mile (8000 km) service interval.

INSPECTION

Rear Sprocket

NOTE

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

1. Inspect each tooth of rear sprocket for:
   a. Major tooth damage.
   b. Coating chips larger than 0.25 in. (6.35 mm) missing/removed.
   c. Gouges caused by hard objects.
2. Replace rear sprocket if major tooth damage or loss of coating in an area 0.25 in. (6.35 mm) or larger occurs.

Drive Belt

Refer to Table 1-10. Inspect drive belt for:

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

Idler Pulley

See Figure 1-30. Inspect idler pulley for signs of uneven wear. Excessive lateral side play of 0.020 in. (0.5 mm) or roughness indicates worn bearings. Replace idler pulley as an assembly. See 5.7 DRIVE BELT AND IDLER PULLEY.

Figure 1-30. Measuring Lateral Side Play on Idler Pulley

CLEANING

Keep dirt, grease, oil, and debris off the belt, idler pulley and sprockets. Clean the drive belt as required by spraying with a solution of mild soap and water. Dry thoroughly. Do not immerse belt in solution. Do not direct pressurized water on belt.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table 1-10. Potential Limits to Belt Drive Service Life

CONDITION	ROOT CAUSE	REQUIRED ACTION
Excessive edge wear (mistracking)	Misalignment or bent drive structure	Check structure (bad bearing, bent members, etc.)
	Bent or rough flange	Repair flange/replace sprocket
	Damage due to handling (pry on, etc.)	Follow proper handling/installation procedure
	Debris damage to edge of belt	Inspect/replace belt
		Inspect for damaged or missing guards
	Belt hitting obstruction	Check structure (bad bearing, bent members, etc.)
		Inspect for loose/missing fasteners
		Inspect for damaged or missing guards
	Bent or loose idler bracket	Replace idler assembly
		Inspect for loose/missing fasteners
	Broken or loose guards	Check structure (bad bearing, bent members, etc.)
		Inspect for loose/missing fasteners
		Inspect for damaged or missing guards
Excessive tooth wear	Rough or damaged sprocket	Inspect/replace sprocket
	Worn sprocket	Inspect/replace sprocket
	Debris in sprocket	Clean and protect drive
		Inspect for damaged or missing guards
	Abrasive environment	Eliminate or control exposure
		Inspect for damaged or missing guards
Apparent belt stretch NOTE: Tension on a new belt will loosen after approximately 1000 mi (1600 km).	Worn sprocket	Inspect/replace sprocket
	Debris in sprocket	Clean and protect drive
		Inspect for damaged or missing guards
	Idler bearing failure	Replace idler assembly
	Aggressive riding/hard use	Riding practice/operator choice
	Exposure to oils, solvents, harsh chemicals	Eliminate or control exposure
		Clean and protect drive
Cracks in back of belt	Idler/bearing binding	Replace idler assembly
	Exposure to oils, solvents, harsh chemicals	Eliminate or control exposure
		Clean and protect drive
	Cut by sharp debris (not at belt edge)	Inspect/replace sprocket
		Continue to run but monitor condition frequently
	Cut by sharp debris at belt edge	Inspect/replace sprocket
		Inspect/replace belt
Tooth shear/cracks	Excessive load/shock load	Inspect/replace belt
		Riding practice/operator choice
	Worn sprocket	Inspect/replace sprocket
	Debris damage	Inspect/replace sprocket
		Clean and protect drive
		Inspect/replace belt
		Continue to run but monitor condition frequently
		Inspect for damaged or missing guards

Table 1-10. Potential Limits to Belt Drive Service Life

CONDITION	ROOT CAUSE	REQUIRED ACTION
Belt breakage	Excessive load/shock load	Inspect/replace belt
		Riding practice/operator choice
	Damage due to handling (pry-on, etc.)	Follow proper handling/installation procedure
	Debris in sprocket or belt	Inspect/replace sprocket
		Clean and protect drive
		Inspect/replace belt
Excessive drive noise	Worn/damaged sprocket	Inspect/replace sprocket
		Missing/damaged belt guards
	Damaged flange	Repair flange/replace sprocket
	Damaged idler	Check structure (bad bearing, bent members, etc.)
		Replace idler assembly
	Damaged belt	Follow proper handling/installation procedure
		Inspect/replace belt
	Debris stuck in belt	Inspect/replace sprocket
		Clean and protect drive
		Inspect/replace belt
		Missing/damaged belt guards
	Debris stuck in sprocket	Inspect/replace sprocket
		Follow proper handling/installation procedure
		Inspect/replace belt
		Missing/damaged belt guards

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®

PRIMARY CHAIN 1.11

INSPECTION

See Figure 1-31. Measure primary chain tension through the inspection cover opening. Adjust primary chains not meeting vertical free play specifications.

1. See Figure 1-31. Remove two fasteners with captive washers and primary chain inspection cover with gasket from primary cover.
2. See Figure 1-32. Check primary chain tension by measuring vertical free play.
   a. Measure vertical free play through chain inspection cover opening.
   b. Rotate engine to move primary chain to a different position on sprockets.
   c. Measure vertical free play several times, each time with primary chain moved so that the measurement is taken with sprockets rotated to the tightest chain position.
3. The tightest measurement taken in the previous step must be within the specifications listed in Table 1-11. If necessary, adjust as described under 1.11 PRIMARY CHAIN, Adjustment.

NOTE

The initial primary chain vertical free play specification used at the assembly plant is 1/4-1/2 in. (6.4-12.7 mm) with a cold engine. The 1/2 in. (6.4 mm) minimum is only allowed at the absolute tightest point in the drive, as measured with specialized factory equipment. If a chain has less than 1/4 in. (6.4 mm) vertical tension (with a cold engine), adjust tension to the "field" specification of 3/8-1/2 in. (9.5-12.7 mm). The looser specification will avoid overtightening, which might otherwise occur during adjustment using "non-factory" equipment and methods.

4. See Figure 1-31. Install primary chain inspection cover and **new** gasket to primary cover using two fasteners with captive washers. Tighten fasteners to 84-108 **in-lbs** (9.5-12 Nm).

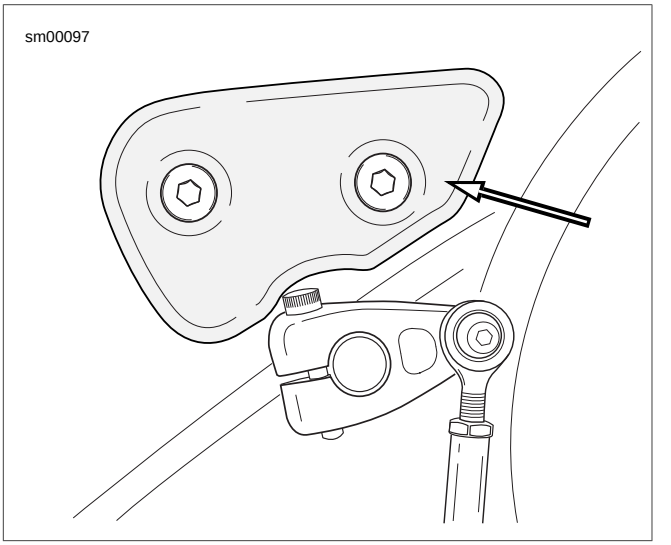


Figure 1-31. Primary Chain Inspection Cover

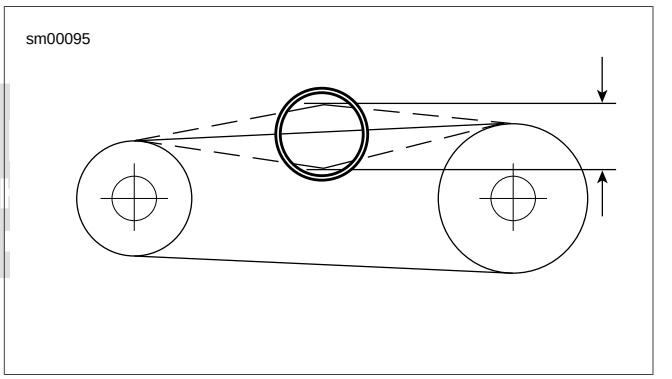


Figure 1-32. Measuring Primary Chain Free Play

Table 1-11. Primary Chain Free Play: XB Models

ENGINE TEMPERATURE	FREE PLAY	
Cold	3/8-1/2 in.	9.5-12.7 mm
Operating temperature	1/4-3/8 in.	6.4-9.5 mm

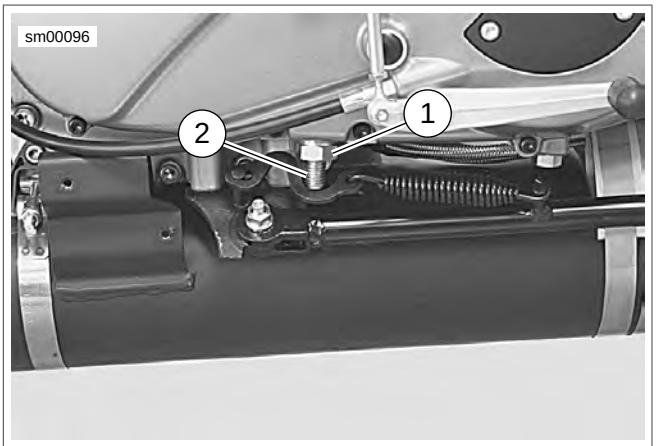
ADJUSTMENT

NOTE

If vertical free play cannot be set within the limits specified, then primary chain and/or chain adjuster are worn beyond adjustment limits. Replace parts as necessary. See 5.6 PRIMARY CHAIN.

1. See Figure 1-33. Loosen locknut (1).
2. Turn adjusting fastener (2):
   a. Clockwise (inward) to increase tension (reduce free play).
   b. Counterclockwise (outward) to reduce tension (increase free play).

3. Tighten locknut (1) to 20-25 ft-lbs (27-34 Nm).



1. **Locknut**
2. **Adjusting fastener**

Figure 1-33. Chain Tension Adjusting Fastener (Typical)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STEERING HEAD BEARINGS 1.12

GENERAL

The steering head bearings are sealed, angular contact bearings and do not require additional lubrication.

Check steering head bearing resistance:

- At every 5000 mile (8000 km) service interval.
- When storing or removing the motorcycle for the season.

INSPECTION

NOTES

- *Check that throttle cables do not bind when measuring bearing resistance.*
- *Steering head bearings are sealed and do not require additional lubrication.*
- *Steering head bearing resistance is not adjustable. Replace bearings that do not meet resistance specifications.*

1. Detach clutch cable at handlebar.
2. Place a scissor jack under jacking point and raise front wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.

⚠WARNING

Do not operate motorcycle with loose, worn or damaged steering or suspension systems. Contact a Buell dealer for repairs. Loose, worn or damaged steering or suspension components can adversely affect stability and handling, which could result in death or serious injury. (00113a)

3. Check steering stem bearings for smooth operation by turning front wheel full right and then left. Repeat if necessary.
4. Next place wheel facing straight ahead and grabbing both fork sides at the bottom move front-end forward and back to check for excessive steering head play.
5. To inspect for correct steering head resistance, turn front wheel all the way to the right.
6. See Figure 1-34. Hook a spring scale into the hole in the front axle. With scale 90 degrees from fork leg, pull front wheel to center position.
   a. The desired resistance to pull front wheel to center is between 1-7 lbs (0.5-3.2 kg).
   b. If steering head resistance measurement is not within specification, see 1.12 STEERING HEAD BEARINGS, Determining Proper Resistance.
7. When adjustment is complete, attach clutch cable and adjust. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.

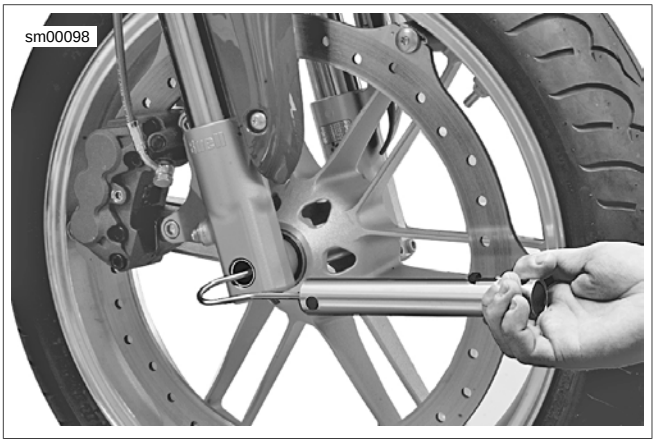


Figure 1-34. Measuring Steering Head Bearing Resistance (Typical)

DETERMINING PROPER RESISTANCE

1. Detach clutch cable at handlebar and verify that throttle cables do not bind before measuring steering head bearing resistance.
2. Remove steering stem pinch fastener at upper triple clamp. See 2.17 FORK CLAMPS: UPPER AND LOWER.
3. Loosen steering stem capnut and back off several turns.
4. Remove lower triple clamp pinch fasteners, two per side.
5. Tighten steering stem capnut to 38-42 ft-lbs (52-57 Nm).
6. Turn front wheel all the way to the right.
7. See Figure 1-34. Hook a spring scale into the hole in the front axle. With scale 90 degrees from fork leg, pull front wheel to center position.
8. The desired resistance is between 1-7 lbs (0.5-3.2 kg).

NOTE

If the correct specification cannot be achieved, the steering head bearings must be replaced. See 2.18 STEERING HEAD BEARINGS.

9. Once correct steering head resistance has been verified, apply LOCTITE 271 to steering stem pinch fastener. Install and tighten to 20-22 ft-lbs (27-30 Nm).
10. Apply LOCTITE 271 to lower triple clamp fasteners, install and tighten to 20-22 ft-lbs (27-30 Nm).
11. Verify torque in previous step.
12. When adjustment is complete, attach clutch cable and adjust. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
13. Remove scissor jack.

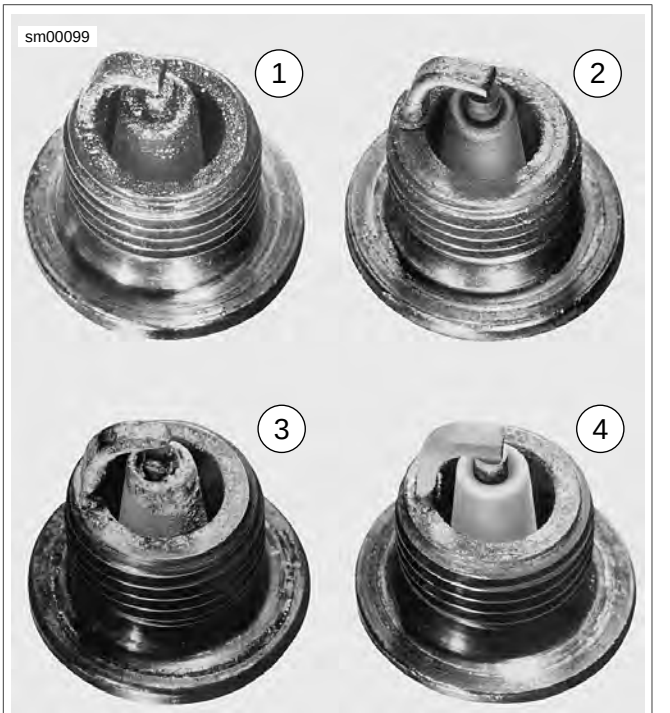
SPARK PLUGS 1.13

INSPECTION

Check spark plugs:

- Replace every 10,000 mile (16,000 km) service interval.
- Use only Harley-Davidson 10R12X spark plugs.

1. Remove left side air scoop to access front cylinder spark plug. See 2.49 AIR SCOOPS.
2. Disconnect cable from front spark plug.
3. Using a 5/8 in. box end wrench and 5/8 in. spark plug socket, remove front spark plug.
4. Remove seat.
5. Remove intake cover and air cleaner assembly. See 2.38 INTAKE COVER and 4.3 AIR CLEANER ASSEMBLY.
6. Disconnect cable from rear spark plug (use automotive spark plug boot remover/installer if required).
7. Using a 5/8 in. wobble socket and 12 in. extension, remove rear spark plug.
8. See Figure 1-35. Compare your observations of the plug deposits with the descriptions provided below.
   a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip (1) indicates an oil fouled plug. The condition may be caused by one or more of the following: worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.
   b. A dry, fluffy or sooty black deposit (2) indicates an air-fuel mixture that is too rich and/or engine idling for excessive periods.
   c. A light brown, glassy deposit (3) indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes and is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.
   d. A plug with a white, yellow, tan or rusty brown powdery deposit (4) indicates balanced combustion. Clean off spark plug deposits at regular intervals.



1. **Oil-fouled**
2. **Sooty black deposits**
3. **Overheated**
4. **Balanced combustion**

Figure 1-35. Typical Spark Plug Deposits

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)

9. If the plugs require cleaning between tune-ups and replacement plugs are not available, proceed as follows:
   a. Degrease firing end of spark plug using ELECTRICAL CONTACT CLEANER. Dry plug with compressed air.
   b. Use a thin file to flatten spark plug electrodes. A spark plug with sharp edges on its electrodes requires 25-40% less firing voltage than one with rounded edges.
10. If the plugs cannot be cleaned, replace with 10R12X spark plugs.
11. Check electrode gap with a wire-type feeler gauge. Gap should be 0.035 in. (0.9 mm).

NOTES

- *Start threading rear spark plug with 3/8 in. fuel hose, being careful not to cross thread spark plug.*
- *Start front spark plug with fingers.*

12. Apply LOCTITE ANTI-SEIZE to threads of spark plugs. Install and tighten spark plugs to 12-18 ft-lbs (16-24 Nm).

NOTE

An extension may be needed to push on rear spark plug boot to verify it is seated properly.

13. Connect spark plug cables. Verify that cables are securely connected to coil and spark plugs. See 6.5 SPARK PLUG CABLES.
14. Install left side air scoop. See 2.49 AIR SCOOPS.
15. Install air cleaner assembly and intake cover. See 2.38 INTAKE COVER and 4.3 AIR CLEANER ASSEMBLY.

WARNING

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

16. Install seat.

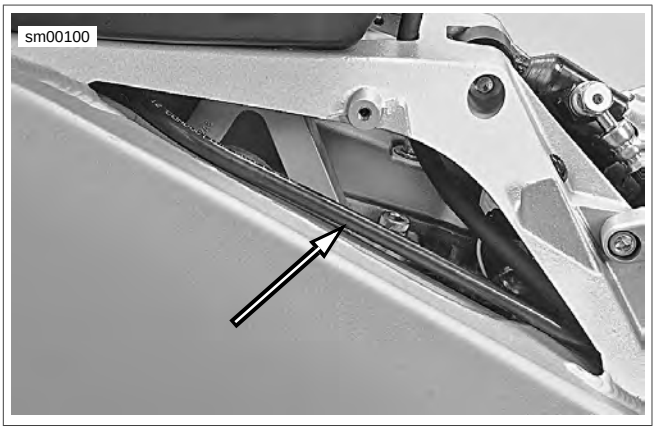


Figure 1-36. Rear Spark Plug Access

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AIR CLEANER AND EXHAUST SYSTEM 1.14

REMOVAL

CAUTION

Install air filter before running engine. Failure to do so can draw debris into the engine and could result in engine damage. (00207a)

Check air filter element:

- Inspect at the 1000 mile (1600 km) service interval and at every 5000 mile (8000 km) service interval thereafter.
- Replace at every 20,000 mile (32,000 km) service interval.

NOTES

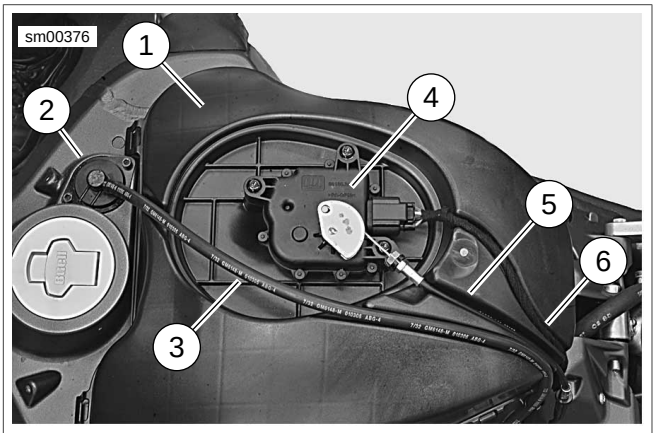
- *Inspect and replace air filter element more often if the motorcycle is run in a dusty environment.*
- *See Figure 1-37. Do not cover or restrict the air intake screen. Certain tank bags or accessories may cover or restrict the air intake screen. This may reduce power and performance.*

Figure 1-37. Air Intake Screen: XB Models

1. Remove seat.
2. Remove intake cover assembly. See 2.38 INTAKE COVER.
3. See Figure 1-38 or Figure 1-39. Remove fuel tank vent tube (3) from fuel tank vent valve (2) at front of air cleaner cover and groove on top of air cleaner cover (1).
4. See Figure 1-40. Unlatch six latching tabs and remove air cleaner cover from baseplate.
5. See Figure 1-41. Remove the filter element (1) from baseplate (2). Inspect and replace if necessary.

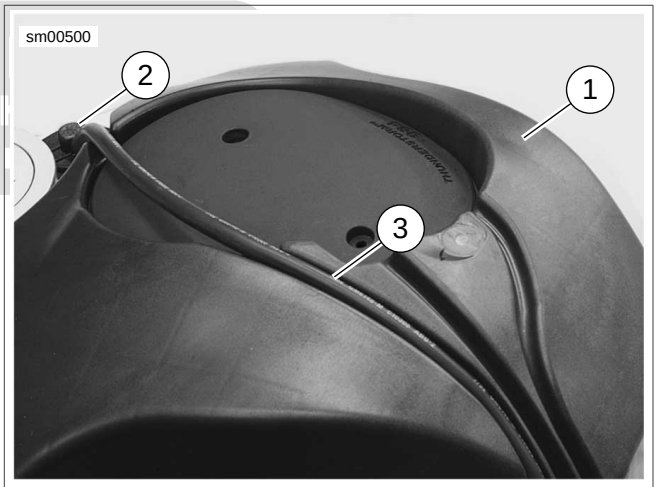
NOTE

Cover the velocity stack so nothing can drop into the motor.



1. **Air cleaner cover**
2. **Fuel tank vent assembly**
3. **Fuel tank vent tube**
4. **Actuator, interactive exhaust**
5. **Cable, interactive exhaust**
6. **Harness, interactive exhaust**

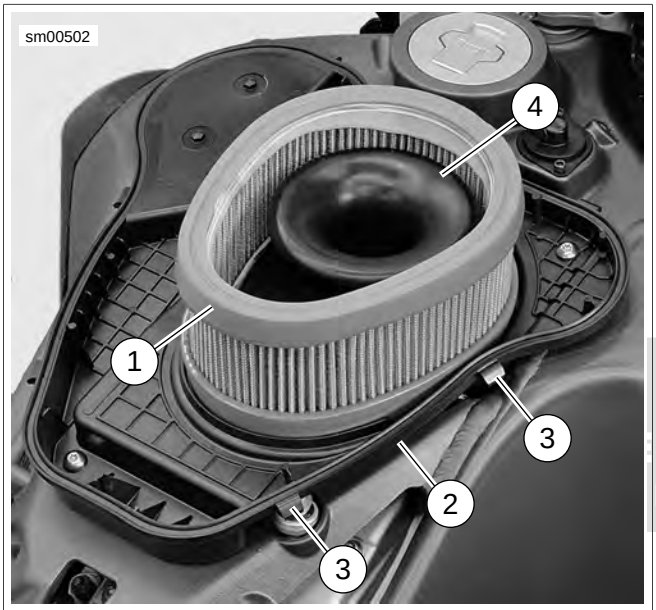
Figure 1-38. Air Cleaner Cover (XB12 Models)



1. **Air cleaner cover**
2. **Fuel tank vent assembly**
3. **Fuel tank vent tube**

Figure 1-39. Air Cleaner Cover, Fuel Tank Vent Tube and Fuel Tank Vent Valve (XB9SX Model)

Figure 1-40. Air Cleaner Cover Latches



1. **Filter element**
2. **Baseplate assembly**
3. **Air cleaner cover latch tabs**
4. **Velocity stack**

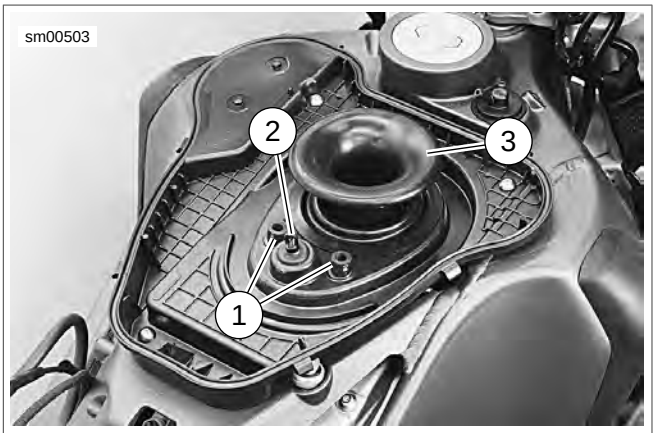
Figure 1-41. Installed Air Cleaner Filter Element

CLEANING AND INSPECTION

⚠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)

1. Check filter element. Hold filter element up to strong light source. The element can be considered sufficiently clean if light is uniformly visible through the element.
2. Thoroughly clean baseplate and inside of air cleaner cover.
3. See Figure 1-42. Make sure two crankcase breather hoses (1) and intake air sensor (2) are captured in baseplate behind velocity stack (3).



1. **Breather hoses (2)**
2. **Intake air sensor**
3. **Velocity stack**

Figure 1-42. Air Cleaner Baseplate Assembly

INSTALLATION

1. See Figure 1-43. Place filter element (1) on baseplate (2).
2. Position air cleaner cover over baseplate. Make sure air filter remains correctly positioned.
3. Install air cleaner cover by latching latch tabs to baseplate.
4. For XB12 models, verify that the actuator cable and harness are located in the grooves in the air cleaner cover.

NOTE

The vent tube is now a larger outer diameter than previous and requires extra effort to install into the functional air cleaner assembly. Failure to properly install vent line will result in cosmetic damage to the inside of the translucent intake cover assembly.

5. Position fuel vent tube in groove on top of air cleaner cover and connect to fuel vent valve. Secure vent tube to vent valve with new cable strap.

NOTE

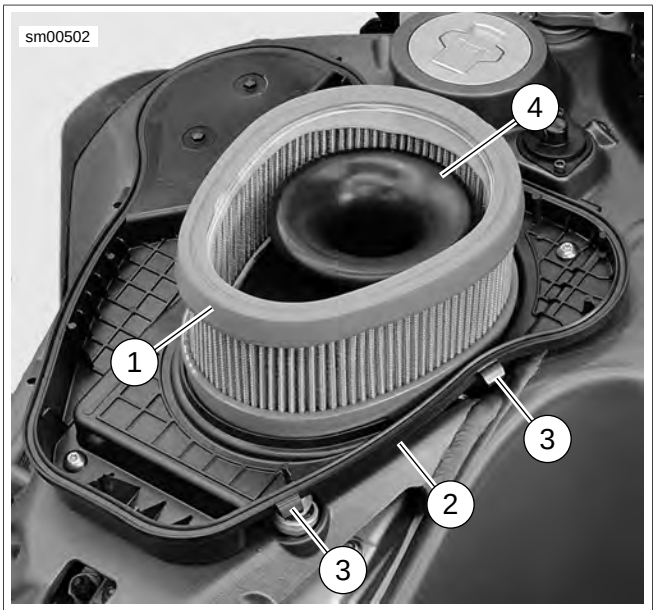
If necessary, adjust interactive exhaust cable. See 1.16 INTERACTIVE EXHAUST CABLE.

6. Install intake cover assembly. Tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

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

7. Install seat.



1. **Filter element**
2. **Baseplate assembly**
3. **Air cleaner cover latch tabs**
4. **Velocity stack**

Figure 1-43. Installed Air Cleaner Filter Element

EXHAUST SYSTEM LEAK CHECK

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

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

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

THROTTLE CABLE 1.15

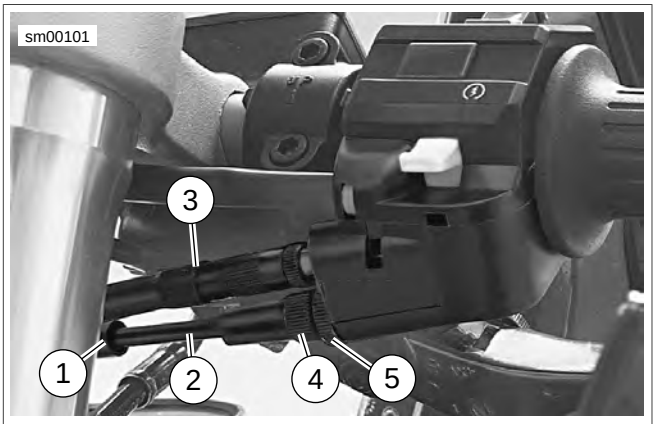
THROTTLE CABLE ADJUSTMENT

⚠WARNING

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

With engine running, turn handlebars through full range of travel. If engine speed changes during this maneuver, turn engine OFF and adjust throttle cables as follows:

1. See Figure 1-44. Loosen cable adjuster lock (5) on each cable.
2. Turn adjusters (4) in direction which will shorten cable housings to minimum length.
3. Point front wheel straight ahead. Twist throttle control grip to fully open position; hold in position.
4. Turn adjuster on throttle control cable (2) until throttle cam stop touches stop plate. Tighten cable adjuster lock (5) on throttle control cable adjuster; release throttle control grip.
5. Turn handlebars fully to right. Turn adjuster on idle control cable (3) until end of cable housing just touches the cable guide.
6. Twist and release throttle control grip a few times. Throttle plate must return to idle position each time throttle grip is released. If this is not the case, turn adjuster on idle control cable (shortening cable housing) until throttle control functions properly.
7. Tighten cable adjuster lock on idle control cable. Recheck operation of throttle control.



1. **Rubber boot**
2. **Throttle control cable**
3. **Idle control cable**
4. **Cable adjuster**
5. **Cable adjuster lock**

Figure 1-44. Throttle Cable Adjuster

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

INTERACTIVE EXHAUST CABLE 1.16

ADJUSTMENT

1. Remove intake cover assembly. See 2.38 INTAKE COVER.

NOTES

- *The actuator cover used on models with Translucid body panels does not need to be removed in order to adjust cable.*
- *When the ignition/light switch is turned off with the interactive exhaust valve in motion, the valve will stop partially open which will cause an inaccurate adjustment. For a description of the inactive exhaust operation, see 6.17 INTERACTIVE EXHAUST SYSTEM.*

2. To close the valve in the muffler, cycle the actuator:
   a. Hold the throttle wide open.
   b. Turn the engine cut-off switch to RUN.
   c. Turn the ignition/light key switch ON.
   d. Watch the actuator cycle close/open/close.
3. See Figure 1-45. Loosen jam nut (3).
4. Remove cable (2) from bracket and cable wheel (4).

NOTE

For the next step in the procedure it will be necessary to obtain a permanent marker.

5. Using a pair of pliers, fully open the exhaust valve in the muffler by pulling the cable core by the ferrule that was disconnected from the cable wheel in the previous step until resistance is felt. Be careful not to damage the cable core.
6. Mark the cable core with the marker all the way around where it comes out of the housing.
7. Release the cable core and reattach the cable to the cable wheel and bracket.
8. Tighten jam nut.

NOTE

Do not overtighten jam nut on interactive exhaust cable.

9. See Figure 1-46. Adjust interactive exhaust cable as follows:
   a. Move cable with your fingers from side to side. There should be no more than 1/8 in. (3.2 mm) side play in cable in either direction with 1/4 in. (6.4 mm) maximum overall side play.
   b. See Figure 1-45. Adjust cable as needed using cable adjuster (1).

NOTES

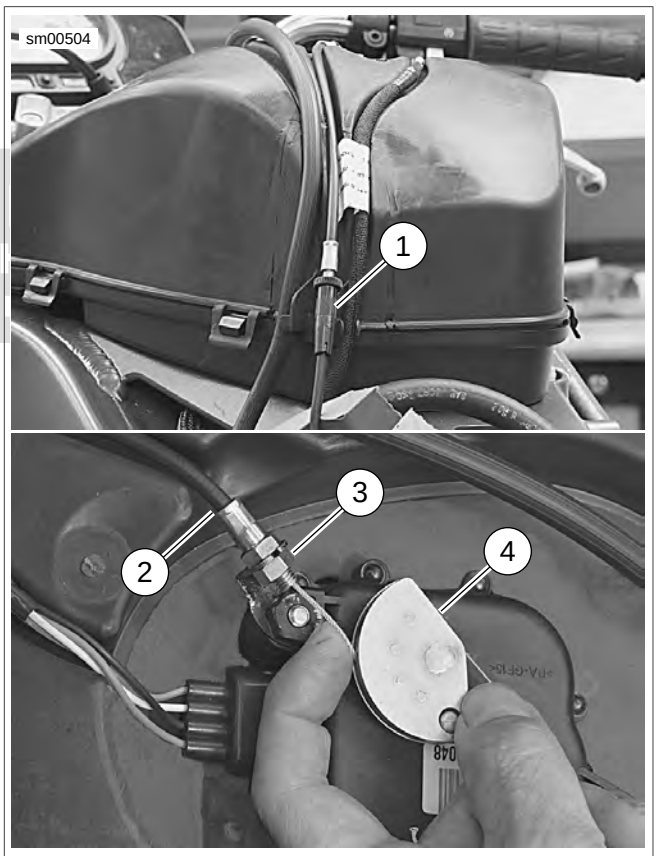
- *In this mode the exhaust valve in the interactive muffler should cycle from the closed position to the wide open position and back to the closed. When the exhaust valve moves to the open position, you should see the mark on the cable core made previously. This verifies the system is working properly. If you do not see the mark, verify previous cable adjustment.*
- *DO NOT start vehicle in this mode.*

10. Cycle the actuator to verify cable and valve operation:
    a. Hold the throttle wide open.
    b. Turn the engine cut-off switch to RUN.
    c. Turn the ignition/light key switch ON.
    d. Watch the actuator cycle close/open/close.
11. See Figure 1-47. Verify that the interactive exhaust cable (1) is routed behind the frame lug (2) before installing air intake cover.

NOTE

If cable is routed in front of the frame lug it will cause the muffler valve to stay open not allowing it to work properly.

12. Install air intake cover. See 2.38 INTAKE COVER.



1. Adjuster
2. Interactive exhaust cable
3. Jam nut
4. Cable wheel

Figure 1-45. Interactive Exhaust Cable

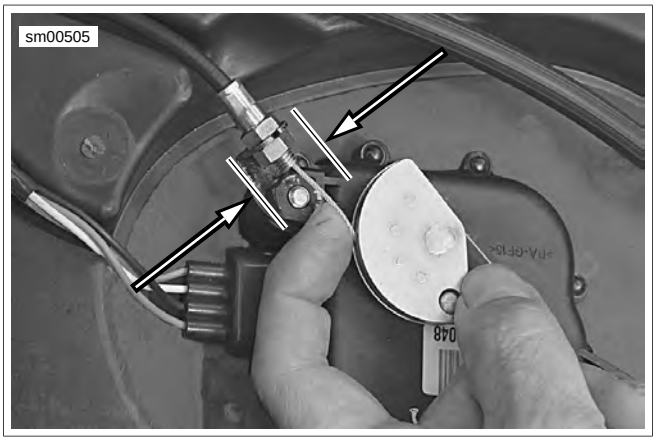
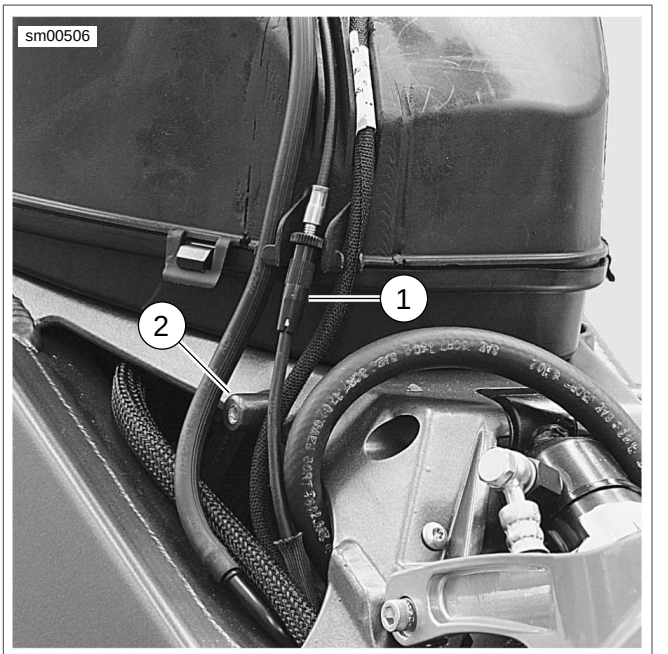


Figure 1-46. Checking For 1/8 in. (3.2 mm) Maximum Free Play In Either Direction For Proper Adjustment



1. **Interactive exhaust cable**
2. **Frame lug**

Figure 1-47. Correct Cable Routing Behind Frame Lug (Typical)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

HEADLAMP 1.17

HEADLAMP ALIGNMENT

⚠WARNING

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

NOTE

Vehicles with multiple beam headlamps that are individually aimed should be adjusted so both lamps converge into one pattern.

1. Verify that front and rear tire inflation pressures are correct and that suspension is adjusted to the weight of the principal rider. See 1.8 TIRES AND WHEELS.
2. Fill fuel tank or add ballast to equal the weight of the fuel needed.

NOTE

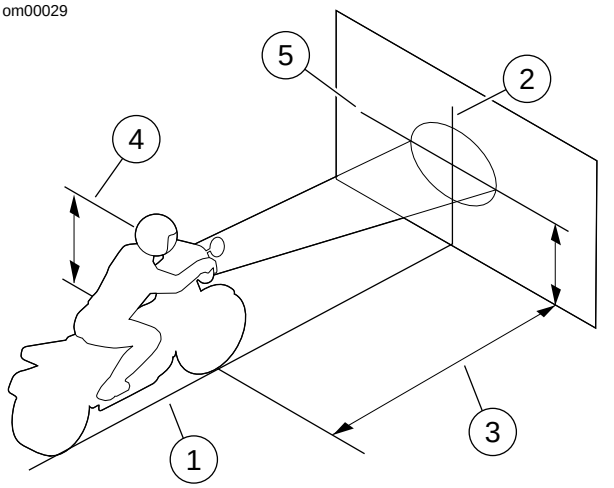
See Figure 1-48. To aid in properly placing the motorcycle, a perpendicular line (1) can be drawn on the floor. For best results, choose an area with minimum light.

3. See Figure 1-48. Draw a vertical line (2) on the wall.
4. Position motorcycle so that front axle is 25 feet (7.6 meters) from wall.

NOTE

As the weight of the rider will compress the suspension slightly, have a person whose weight is approximately the same as that of the principal rider sit on the motorcycle.

5. With the vehicle laden and upright, point the front wheel straight forward at wall and measure the distance (4) from the floor to the center of the HIGH BEAM bulb.
6. Draw a horizontal line (5) through the vertical line on the wall that is 2.1 in. (53.3 mm) lower than the measured bulb centerline.



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

Figure 1-48. Checking Headlamp Alignment

NOTE

As the weight of the rider will compress the suspension slightly, have a person whose weight is approximately the same as that of the principal rider sit on the motorcycle.

7. See Figure 1-48. Verify headlamp alignment. Turn the ignition switch to IGNITION and set the headlamp switch to HIGH beam.
   a. The center of the hot spot (brightest area of light beam) should be centered where the two lines intersect.
   b. Adjust headlamp alignment if necessary.

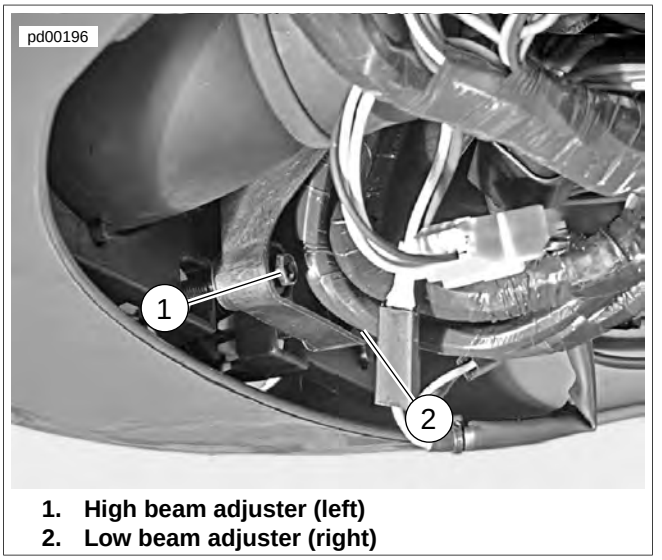
HEADLAMP ADJUSTMENT: FIREBOLT

HIGH beam and LOW beam have independent adjuster screws.

See Figure 1-49. The HIGH Beam adjuster (1) is on the left and the LOW Beam adjuster (2) is on the right beneath the front fairing.

If headlamp requires adjustment, perform the following as required:

- **To lower beam:** Turn adjuster clockwise.
- **To raise beam:** Turn adjuster counterclockwise.



1. **High beam adjuster (left)**
2. **Low beam adjuster (right)**

Figure 1-49. Headlamp Height Adjustment: Firebolt

HEADLAMP ADJUSTMENT: LIGHTNING

Horizontal Alignment

See Figure 1-50 and Figure 1-51. Loosen fasteners on right and left side of headlamp housing to adjust the horizontal alignment.

Vertical Alignment

See Figure 1-52. Loosen fastener on the bottom of headlamp housing to adjust the vertical alignment.

NOTE

Only loosen headlamp alignment fasteners enough to adjust headlamp. Once headlamps are aligned, tighten fasteners to 48-72 ***in-lbs*** *(5-8 Nm).*

Figure 1-50. Horizontal Headlamp Adjustment Fastener Locations: Lightning

Figure 1-51. Horizontal Headlamp Adjustment Fastener: Lightning

Figure 1-52. Vertical Headlamp Adjustment Fastener: Lightning Models

HEADLAMP ADJUSTMENT: ULYSSES

Horizontal Alignment

See Figure 1-53 and Figure 1-54. Loosen fasteners on right and left side of headlamp housing to adjust the horizontal alignment.

NOTE

Only loosen headlamp alignment fasteners enough to adjust headlamp. Once headlamps are aligned, tighten fasteners to 48-72 ***in-lbs*** *(5-8 Nm).*

Vertical Alignment

See Figure 1-55 or Figure 1-56. Loosen fastener on the bottom of headlamp housing to adjust the vertical alignment. The vertical headlamp adjustment screw is located under the front upper fender.

NOTE

Only loosen headlamp alignment fastener enough to adjust headlamp. Once headlamps are aligned, tighten fastener to 36-48 ***in-lbs*** *(4-5 Nm).*

Figure 1-53. Horizontal Headlamp Adjustment Fastener Locations: Ulysses

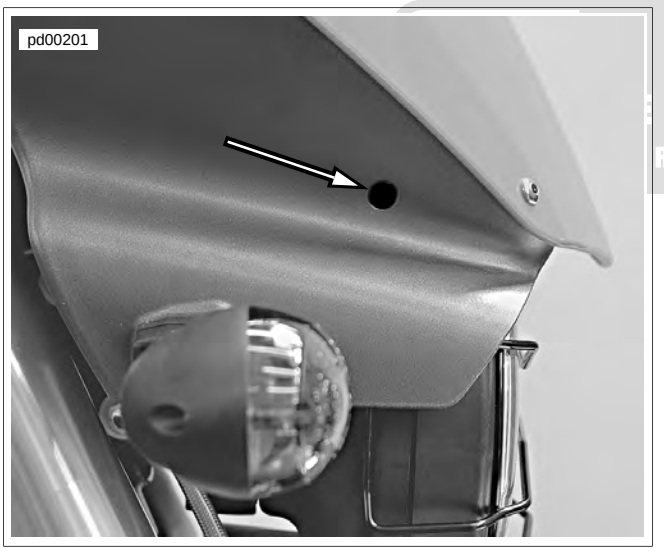


Figure 1-54. Horizontal Headlamp Adjustment Fastener: Ulysses

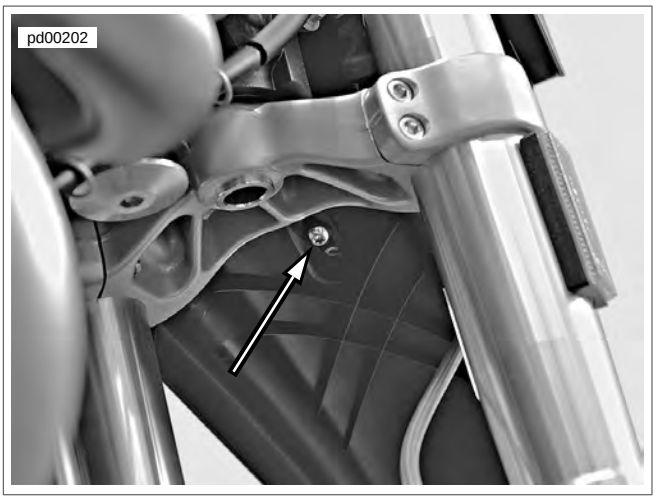


Figure 1-55. Vertical Headlamp Adjustment Fastener: Ulysses XB12X/XB12XP

Figure 1-56. Vertical Headlamp Adjustment Fastener: XB12XT

WINDSHIELD MAINTENANCE 1.18

GENERAL

CAUTION

Polycarbonate windscreens/windshields require proper attention and care to maintain. Failure to maintain polycarbonate properly can result in damage to the windscreen/windshield. (00483d)

Buell recommends using Harley Softcloths with the following products to clean your windscreen. To minimize swirl marks, cleaning should be done when motorcycle is cool and parked in the shade.

- HARLEY-DAVIDSON BUG REMOVER (Part No. 94657-98).
- HARLEY-DAVIDSON SUNWASH (PART No. 94659-98).
- NOVUS 1 CLEANER/PROTECTANT (Part No. 99837-94T).
- NOVUS 2 SCRATCH REMOVER (Part No. 99836-94T).
- HARLEY GLAZE (Part No. 99701-84) to polish and seal after cleaning.

NOTE

Faint swirl marks are normal and may be more visible on tinted than on clear windshields.

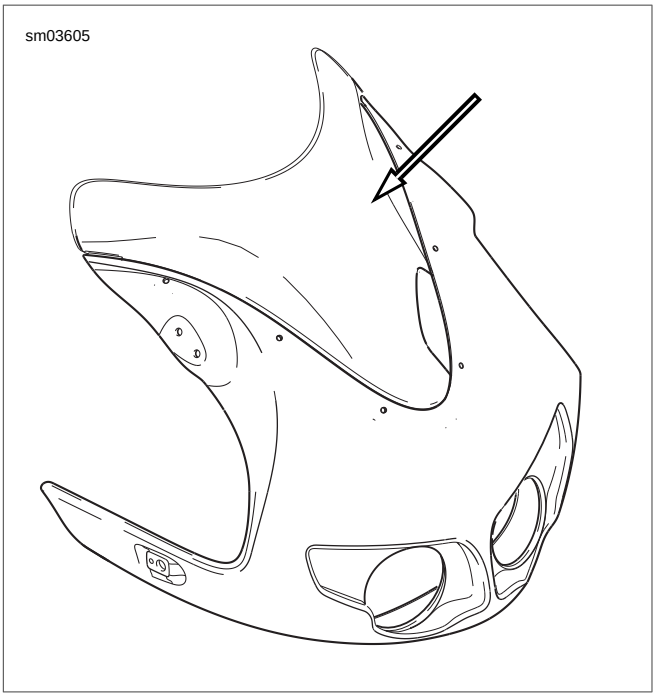


Figure 1-57. Windshield: Firebolt

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STORAGE 1.19

GENERAL

⚠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)

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

1. Warm motorcycle to operating temperature. Perform an oil change.
2. Fill fuel tank and add a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions.
3. Run engine until treated gasoline has had a chance to reach fuel injectors. Stop engine.
4. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Reinstall spark plugs. See 1.13 SPARK PLUGS.
5. Remove battery and charge as needed to maintain the correct voltage. See 1.5 BATTERY MAINTENANCE.
6. Adjust primary chain. See 1.11 PRIMARY CHAIN.
7. Check tire inflation. See 1.8 TIRES AND WHEELS. If the motorcycle will be stored for an extended period of time, securely support the motorcycle so that all weight is off the tires.

⚠WARNING

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

8. Wash and polish molded-in-color, painted and chrome-plated surfaces.
9. If motorcycle is to be covered, use a material that will breathe, such as light canvas. Plastic materials that do not breathe promote the formation of condensation.

REMOVAL FROM STORAGE

⚠WARNING

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

1. Charge and install battery. See 1.5 BATTERY MAINTENANCE.
2. Remove and inspect spark plugs. Replace if necessary. See 1.13 SPARK PLUGS.
3. Inspect air filter element. Replace if necessary. See 1.14 AIR CLEANER AND EXHAUST SYSTEM.
4. If fuel tank was drained, fill fuel tank with fresh gasoline.
5. Start the engine and run until it reaches normal operating temperature. Check fluids and refill to proper levels if required.
   a. Check engine oil level. See 1.6 ENGINE OIL AND FILTER.
   b. Check transmission fluid level. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
6. Perform all of the checks in the PRE-RIDING CHECK LIST in the Owner's Manual.

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TROUBLESHOOTING 1.20

GENERAL

NOTE

The troubleshooting section of this manual is a guide to diagnose problems. Read the appropriate sections of this manual before performing any work.

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

For further troubleshooting information see the Electrical Diagnostic Manual for this motorcycle.

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Ignition switch not in ON position.
2. Engine run switch in OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay, or solenoid faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.
6. Maxi-fuse not in place or blown fuse.
7. Bank Angle Sensor tripped and ignition switch not cycled OFF then ON.
8. Clutch lever not squeezed against handlebar or transmission not in neutral.

Engine Turns Over But Does Not Start

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

NOTE

For cold weather starts, always disengage clutch.

5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Loose wire connection at coil, battery, or ECM connector.
7. Ignition timing incorrect due to faulty coil, ECM or faulty sensors.
8. Bank Angle Sensor tripped and ignition switch not cycled OFF then ON.
9. Fuel filter clogged.
10. Sticking or damaged valve or wrong length push rod.
11. Cam primary gear key sheared or missing the spacer.
12. Fuel pump inoperative.
13. Plugged fuel injectors.
14. Fuse blown.

Starts Hard

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

NOTE

For cold weather starts, always disengage clutch.

9. Ignition not functioning properly (possible sensor failure).
10. Faulty ignition coil.
11. Valves sticking or valves too tight.
12. Rotor key sheared.
13. Partially plugged fuel injectors.

Starts But Runs Irregularly or Misses

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

Spark Plug Fouls Repeatedly

1. Fuel mixture too rich.

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2. Incorrect spark plug for the kind of service.
3. Piston rings badly worn or broken.
4. Valve guides or seals badly worn or damaged.

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.
6. Incorrect heat range spark plug.
7. Intake manifold vacuum leak.

Overheating

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

Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Faulty hydraulic lifters.
3. Bent push rod.
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Cam timing incorrect.
8. Cam, cam gears, or cam bushings worn.

Excessive Vibration

1. Wheels not aligned, rims bent, or tires worn or damaged.
2. Engine/transmission/rear wheel not aligned properly.
3. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
4. Upper engine mounting bracket loose.
5. Ignition timing advanced due to faulty sensor inputs/poorly tuned engine.
6. Internal engine problem.
7. Broken frame.
8. Stabilizer links worn or loose, or stabilizer link brackets loose or broken.

Check Engine Light Illuminates During Operation

1. Fault detected. See the Electrical Diagnostic Manual for this motorcycle.

LUBRICATION SYSTEM

PART NUMBER	TOOL NAME
HD-35457	BLACK LIGHT LEAK DETECTOR

Oil Does Not Return To Oil Tank

1. Oil tank empty.
2. Oil pump not functioning.
3. Restricted oil lines or fittings.
4. Restricted oil filter.
5. Oil pump misaligned or in poor condition.

Engine Uses Too Much Oil Or Smokes Excessively

1. Oil tank overfilled.
2. Restricted oil return line to tank.
3. Restricted breather operation.
4. Restricted oil filter.
5. Piston rings badly worn or broken.
6. Valve guides or seals worn.
7. Plugged crankcase scavenge port.
8. Oil diluted with gas.

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

1. Loose parts.
2. Imperfect seal at gaskets, push rod cover, washers, etc. To aid locating leaks, use BLACK LIGHT LEAK DETECTOR (Part No. HD-35457).
3. Restricted breather hose to air cleaner.
4. Restricted oil filter.
5. Oil tank overfilled.
6. Lower rocker housing gasket installed incorrectly (upside down).
7. Restricted oil return line to tank.
8. Porosity.

Low Oil Pressure

1. Oil tank underfilled.
2. Faulty low oil pressure switch.
3. Bypass valve stuck in open position.
4. Worn oil pump gerotor(s).
5. Restricted feed hose from oil tank.
6. Restricted high-pressure feed hose to oil filter housing.

7. Oil diluted with gas.
8. Open in oiling circuit.

High Oil Pressure

1. Oil tank overfilled.
2. Bypass valve stuck in closed position.
3. Restricted oil tank return hose.

ELECTRICAL SYSTEM

NOTE

For diagnostic information, see the Electrical Diagnostic Manual for this motorcycle.

Alternator Does Not Charge

1. Voltage regulator module not grounded.
2. Engine ground wire loose or broken.
3. Faulty voltage regulator module.
4. Loose or broken wires in charging circuit.
5. Faulty stator and/or rotor.

Alternator Charge Rate Is Below Normal

1. Weak or damaged battery.
2. Loose connections.
3. Faulty voltage regulator module.
4. Faulty stator and/or rotor.

Speedometer Operates Erratically

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

TRANSMISSION

Shifts Hard

1. Primary chaincase overfilled with lubricant.
2. Clutch dragging slightly.
3. Transmission lubrication too heavy (winter operation).
4. Shifter return spring (inside transmission) bent or broken.
5. Bent shifter rod.
6. Shifter forks (inside transmission) sprung.
7. Corners worn off transmission gear dogs (inside transmission).

Jumps Out Of Gear

1. Shifter drum (inside transmission) improperly adjusted or damaged.
2. Shifter engaging parts (inside transmission) badly worn and rounded.
3. Shifter forks bent.
4. Damaged gears.

Clutch Slips

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

Clutch Drags Or Does Not Release

1. Lubricant level too high in primary chaincase.
2. Clutch controls improperly adjusted.
3. Primary chain badly misaligned.
4. Insufficient clutch spring tension.
5. Clutch discs excessively warped.
6. Clutch spacer missing or installed backwards.

Clutch Chatters

1. Friction discs or steel discs worn, warped or dragging.

CLUTCH

Slips

1. Clutch controls improperly adjusted.
2. Worn friction plates.

Drags or Does Not Release

1. Clutch controls improperly adjusted.
2. Clutch plates excessively warped.

Chatters

1. Friction or steel plates worn, warped or dragging.

CHASSIS

Irregular/Inadequate Brake Action

1. Master cylinder low on fluid.
2. Brake line contains air bubbles or moisture.
3. Master or wheel cylinder piston worn.
4. Brake pads covered with grease or oil.
5. Brake pads badly worn to minimum lining thickness.
6. Brake rotor badly worn or warped.
7. Brake pads dragging or excessive braking (brake fades due to heat buildup).
8. Insufficient brake pedal or hand lever free play (brake drags).

Handling Irregularities

1. Tires improperly inflated. See 1.8 TIRES AND WHEELS. Do not overinflate.
2. Loose wheel axle. See 2.5 FRONT WHEEL or see 2.6 REAR WHEEL.
3. Excessive wheel hub bearing play.
4. Rims and tires out-of-true sideways: tire runout should not be more than 0.080 in. (2.03 mm).

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5. Rims and tires out-of-round or eccentric with hub: tire runout should not be more than 0.060 in. (1.5 mm).
6. Irregular or peaked front tire tread wear.
7. Tire and wheel unbalanced or weights on wrong side of wheel (Front wheel weights must be on brake rotor side of wheel.).
8. Steering head bearings improperly tightened or worn. See 1.12 STEERING HEAD BEARINGS. Check for proper torque and replace worn bearings. See 2.17 FORK CLAMPS: UPPER AND LOWER.
9. Shock absorber or front forks not functioning normally due to incorrect adjustment.
10. Heavy front end loading. Non-standard equipment on the front end (such as heavy radio receivers, extra lighting equipment or luggage) tends to cause unstable handling.

SUSPENSION

When making adjustments, remember there are two mediums in setting up a motorcycle, geometry and suspension. Both components work together because suspension is a part of geometry. In order to solve handling problems, it is important to diagnose the problem's true nature.

Chattering, sliding or an uncomfortable feeling are suspension-related. Handling and a swinging fork are geometry-related, but often these unwanted characteristics can be solved by suspension adjustments.

The following tables list possible suspension and operating troubles and their probable causes.

Table 1-12. General Suspension Problems

TROUBLESHOOTING CONDITION	ADJUSTMENT SOLUTION
Motorcycle wallows through turns. Feels loose or vague after bumps. Wheel tends to "pogo" after passing over a bump. This is noticeable by watching the motorcycle continue to bounce as it travels over multiple bumps.	Increase rebound damping.
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.
The motorcycle bottoms out or dips while cornering. Motorcycle has excessive brake dive.	Increase compression damping.
Harsh ride particularly over washboard surfaces. Bumps kick through handlebars or seat. Suspension seems not to respond to bumps. This is evidenced by tire chattering (a movement with short stroke and high frequency) through corners or by jolting the rider over rough roads.	Reduce compression damping.

Table 1-13. Rear Suspension Problems

TROUBLESHOOTING CONDITION	ADJUSTMENT SOLUTION
"Pumping on the Rear" occurs when you are accelerating out of a corner. This problems occurs in two varieties. • The first type has a movement with a long stroke and a high frequency. • The second version has a movement with a short stroke and high frequency.	• For the first case (long stroke and high frequency), the shock is too soft. Increase compression damping. If the adjuster is already set to the maximum, add more preload to the spring (one turn maximum). • For the second case (short stroke and high frequency), the shock is too hard. Decrease compression damping.
Chattering during braking.	Decrease the compression damping. If the problem persists, decrease rebound damping for a faster rebound rate. Less spring preload may also help.
Lack of tire feedback.	The suspension is too soft. Increase compression damping.
Sliding during cornering. Sliding may occur going into the corner or accelerating out of the corner.	The suspension is too hard. Decrease compression damping.

Table 1-14. Front Suspension Problems

TROUBLESHOOTING CONDITION	ADJUSTMENT SOLUTION
Not absorbing bumps.	A good suspension is a balance between damping and track condition. Finding this balance requires exploring all possible compression settings.
Lack of tire feedback.	Increase compression damping.
Tire slides.	Decrease compression damping.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

NOTES

TABLE OF CONTENTS

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

FASTENER TORQUE VALUES 2.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Axle (front)	39-41 ft-lbs	53-56 Nm	2.5 FRONT WHEEL, Installation/ANTI-SEIZE, left handed thread
Axle (rear, final torque)	48-52 ft-lbs	65-70.5 Nm	2.6 REAR WHEEL, Installation/Follow special instructions, ANTI-SEIZE
Axle (rear, initial torque)	23-27 ft-lbs	31.2-36.6 Nm	2.6 REAR WHEEL, Installation/Follow special instructions, ANTI-SEIZE
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	2.37 BELT GUARDS, Installation
Axle pinch fasteners, front	20-22 ft-lbs	27-30 Nm	2.5 FRONT WHEEL, Installation
Axle pinch fasteners, rear	40-45 ft-lbs	54-61 Nm	2.6 REAR WHEEL, Installation
Bank angle sensor fastener	12-36 **in-lbs**	1.4-4 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Bank angle sensor fastener, Firebolt	12-36 **in-lbs**	1.4-4 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Assembly: Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Lightning/Ulysses
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Battery tray and ground wire fasteners, Ulysses	72-96 **in-lbs**	8-11 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Battery tray fasteners	48-72 **in-lbs**	5.4-8 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Battery tray fasteners, Lightning	48-72 **in-lbs**	5.4-8 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly/LOCTITE 271 (red)
Battery tray fasteners, Ulysses	72-96 **in-lbs**	8-11 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Belt guard fasteners	12-36 **in-lbs**	1.4-4 Nm	2.37 BELT GUARDS, Installation
Belt guard fasteners	12-36 **in-lbs**	1.4-4 Nm	2.37 BELT GUARDS, Installation

FASTENER	TORQUE VALUE		NOTES
Brake caliper bleeder valve	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Brake hand lever fastener, Firebolt	80-90 **in-lbs**	9-10 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Brake hand lever housing fasteners	80-90 **in-lbs**	9-10 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Brake lamp switch fastener, front	7-10 **in-lbs**	0.8-1 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Brake lever pivot bolt	4.4-13.2 **in-lbs**	0.5-1.5 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Hand Lever
Brake lever pivot bolt nut	43-61 **in-lbs**	4.9-6.9 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Hand Lever
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Firebolt/Lightning
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Ulysses
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Brake light switch fastener, front	7-10 **in-lbs**	0.8-1 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake line P-clamp, front	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Brake line p-clamp fastener, front	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Brake line p-clamp fastener, rear	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Brake line p-clamp fastener, rear	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Brake line p-clamp fastener, rear	36-60 **in-lbs**	4-7 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Brake line p-clamp fastener on inside of lighting module	36-60 **in-lbs**	4-7 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Brake line P-clamp on inside of front module (Lightning and Ulysses)	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Brake pedal fastener	22-24 ft-lbs	30-33 Nm	2.11 BRAKE PEDAL, Installation
Brake pin hanger set, front	11-15 ft-lbs	15-19.6 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Removal and Installation
Brake pin hanger set, front	11-14 ft-lbs	15-19 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Installation
Brake pin hanger set, rear	11-14 ft-lbs	15-19 Nm	2.14 REAR BRAKE CALIPER, Assembly
Brake pin plug, rear	24 **in-lbs**	2.7 Nm	2.14 REAR BRAKE CALIPER, Assembly
Brake reservoir banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake reservoir banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Brake reservoir clamp fasteners, front	80-90 **in-lbs**	9.0-10.2 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation

FASTENER	TORQUE VALUE		NOTES
Brake reservoir cover fasteners, front	9-18 **in-lbs**	1-2 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake reservoir fastener, rear	48-72 **in-lbs**	5.4-8 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Firebolt/Lightning
Brake reservoir fastener, rear	48-72 **in-lbs**	5.4-8 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Caliper banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Caliper banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Caliper banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Caliper banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Caliper banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.14 REAR BRAKE CALIPER, Installation
Caliper bleeder valve, front	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Removal and Installation
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Reservoir Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Caliper Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.12 REAR BRAKE MASTER CYLINDER, Removal: Firebolt/Lightning
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.12 REAR BRAKE MASTER CYLINDER, Removal: Ulysses
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Removal: Firebolt
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Removal: Lightning
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Removal: Ulysses
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.14 REAR BRAKE CALIPER, Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.14 REAR BRAKE CALIPER, Assembly
Caliper bleeder valves, front	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Removal
Caliper carrier, rear	24-26 ft-lbs	32-35 Nm	2.6 REAR WHEEL, Installation
Caliper fasteners, front	18-22 ft-lbs	24.5-29.4 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Repair
Caliper fasteners, front	15-19 ft-lbs	20-26 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Caliper Assembly
Caliper mounting fasteners, front	35-37 ft-lbs	47-50 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Removal and Installation/LOCTITE 271 (red)
Caliper mounting fasteners, front	35-37 ft-lbs	47-50 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Installation/LOCTITE 271 (red)
Caliper mounting large fastener, rear	18-21 ft-lbs	24-28 Nm	2.14 REAR BRAKE CALIPER, Installation
Caliper mounting small fastener, rear	14-18 ft-lbs	19-24 Nm	2.14 REAR BRAKE CALIPER, Installation
Center cap bolt	20-30 ft-lbs	27-40.6 Nm	2.16 FRONT FORKS: ALL MODELS, Assembly
Chin fairing fasteners	36-48 **in-lbs**	4-5 Nm	2.50 CHIN FAIRING, Installation
Clutch cable bracket	84-92 **in-lbs**	9.5-10.4 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Clutch cable fitting at primary	36-108 **in-lbs**	4-12.2 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Clutch hand lever fastener, Firebolt	60-84 **in-lbs**	7-9.5 Nm	2.31 HANDLEBARS: FIREBOLT, Installation

FASTENER	TORQUE VALUE		NOTES
Clutch hand lever fasteners	60-84 **in-lbs**	7-9.5 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	2.25 CLUTCH CONTROL, Assembly and Installation/Tighten in a crosswise pattern
Damper rod jamnut	22-30 ft-lbs	30-41 Nm	2.16 FRONT FORKS: ALL MODELS, Assembly
Deflector fasteners	24-36 **in-lbs**	2.7-4 Nm	2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP, Assembly and Installation
Deflector jam nuts	39-48 **in-lbs**	4.4-5.4 Nm	2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP, Assembly and Installation
Deflector pivot shaft risers	43-49 **in-lbs**	4.8-5.5 Nm	2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP, Assembly and Installation
ECM fasteners	36-60 **in-lbs**	4-7 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
ECM fasteners, Ulysses	36-60 **in-lbs**	4-7 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Electronic control module fasteners	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Firebolt
Engine shift lever pinch screw	48-60 **in-lbs**	5.4-7 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Engine shroud air scoop fasteners	12-36 **in-lbs**	1.4-4 Nm	2.49 AIR SCOOPS, Engine Shroud Air Scoop
Fairing support bracket fasteners, Firebolt	16-18 ft-lbs	22-26 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Fender fasteners	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Rear Fender: XB12Ss/XB12XT/XB12X
Flasher fastener	36-60 **in-lbs**	4-7 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Assembly: Firebolt
Footpeg mount	132-144 **in-lbs**	15-16 Nm	2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS, Mount Installation
Footpeg mount, Firebolt and Lightning	25-28 ft-lbs	34-38 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Passenger/LOCTITE 271 (red)
Footpeg mount, Firebolt and Lightning	25-28 ft-lbs	34-38 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly/LOCTITE 271 (red)
Footpeg mount fasteners, rider	132-144 **in-lbs**	14.9-16.2 Nm	2.37 BELT GUARDS, Installation
Footpeg mount fasteners, rider, Firebolt and Lightning	132-144 **in-lbs**	14.9-16.2 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Rider
Footpeg support bracket	132-144 **in-lbs**	14.9-16.2 Nm	2.54 LUGGAGE: XB12XT, Installation: Side Case
Footpeg support bracket	132-144 **in-lbs**	14.9-16.2 Nm	2.55 LUGGAGE: XB12XP, SIDE CASE
Fork cap	22-30 ft-lbs	30-41 Nm	2.16 FRONT FORKS: ALL MODELS, Assembly
Fork clamp, lower	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/LOCTITE 271 (red)
Fork clamp, lower	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Fork clamp, upper	23-25 ft-lbs	31-34 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/LOCTITE 271 (red)
Fork clamp, upper	23-25 ft-lbs	31-34 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses/LOCTITE 271 (red)

FASTENER	TORQUE VALUE		NOTES
Fork clamp, upper	23-25 ft-lbs	31.2-33.8 Nm	2.18 STEERING HEAD BEARINGS, Installation/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4-5.4 Nm	2.15 FENDERS, Front Fender: XB12R/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4-5.4 Nm	2.15 FENDERS, Front Fender: XB9SX/XB12Scg/XB12XT/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4.0-5.4 Nm	2.15 FENDERS, Front Fender: XB12X/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4.0-5.4 Nm	2.15 FENDERS, Front Fender: XB12X/LOCTITE 271 (red)
Front fender fasteners and washers	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Front Fender: XB12XP
Front fender fasteners and washers	36-48 **in-lbs**	4.0-5.4 Nm	2.15 FENDERS, Front Fender: XB12XP
Front isolator bolt	49-51 ft-lbs	66-69 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front isolator bracket mounting fastener	49-51 ft-lbs	66-69 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front isolator snubber, upper	12-36 **in-lbs**	1.4-4 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front isolator threaded frame insert	59-61 ft-lbs	80-82.7 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front module fastener, right	12-14 ft-lbs	16.3-19 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Front tie bar to V bracket	25-27 ft-lbs	33.9-36.6 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Front wire guide fasteners	72-84 **in-lbs**	8-9.5 Nm	2.24 THROTTLE CONTROL, Throttle Cable Replacement
Fuse block and relay fasteners	72-96 **in-lbs**	8-11 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Grab rail fasteners	19-20 ft-lbs	26-27 Nm	2.54 LUGGAGE: XB12XT, Installation: Top Case
Handlebar clamp screws, Lightning and Ulysses	10-12 ft-lbs	14-16 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation/LOCTITE 271 (red), Tighten front screws first
Handlebar clamp screws, Lightning and Ulysses	10-12 ft-lbs	14-16 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation/LOCTITE 271 (red), Tighten front screws first
Handlebar clip-on fastener, Firebolt	24-26 ft-lbs	33-35 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Handlebar clip-on fastener, Firebolt	24-26 ft-lbs	33-35 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Hand lever pivot fastener (all models except XB9SX, XB12XT and XB12X)	80-120 **in-lbs**	9-13.5 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder and Hand Lever Assembly
Hand lever pivot fastener (XB9SX, XB12XT, XB12XP and XB12X models)	39-48 **in-lbs**	4.4-5.4 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder and Hand Lever Assembly
Headlight fasteners, Firebolt	20-25 **in-lbs**	2.3-2.8 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Assembly: Firebolt
Headlight support bracket fastener, Ulysses	48-72 **in-lbs**	5.4-8 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Headlight support bracket pivot fasteners, Firebolt	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Firebolt
Heel guard fasteners, passenger, Firebolt and Lightning	72-96 **in-lbs**	8-11 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Passenger
Heel guard fasteners, rider, Firebolt and Lightning	72-96 **in-lbs**	8-11 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Rider

DIGITAL TECHNICIAN HARLEY-DAVIDSON

FASTENER	TORQUE VALUE		NOTES
Horn fastener, Firebolt	72-96 **in-lbs**	8-10 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Horn fastener, Ulysses	36-60 **in-lbs**	4-7 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Lightning/Ulysses
Ignition coil fasteners	120-144 **in-lbs**	13.6-16.3 Nm	2.24 THROTTLE CONTROL, Throttle Cable Replacement
Instrument module fastener	12-36 **in-lbs**	1.4-4 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	2.38 INTAKE COVER, Installation
Left front trunk pan fastener, Lightning	72-96 **in-lbs**	8-11 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly
Left front trunk pan fastener, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
License plate bracket, Firebolt	36-48 **in-lbs**	4-5 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
License plate lamp nuts, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
License plate light fasteners, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.52 SEAT LOCKS, Installation: Ulysses Models
License plate light nuts, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Lower fork clamp fasteners	20-22 ft-lbs	27-30 Nm	2.16 FRONT FORKS: ALL MODELS, Installation
Main battery ground fastener	48-72 **in-lbs**	5.4-8 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Master cylinder banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Master cylinder banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Master cylinder cover fasteners, front	9-13 **in-lbs**	1.0-1.5 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Master cylinder mounting fasteners, rear	72-96 **in-lbs**	8-11 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Firebolt/Lightning
Master cylinder mounting fasteners, rear	72-96 **in-lbs**	8-11 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Ulysses
Mirror adjuster nut	115-130 **in-lbs**	13-14.7 Nm	2.33 MIRRORS, Installation
Mirror fasteners, Firebolt	72-96 **in-lbs**	8-11 Nm	2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT, Installation
Mirror mount onto bracket	20-22 ft-lbs	27-30 Nm	2.33 MIRRORS, Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Oil cooler air scoop fasteners	48-72 **in-lbs**	5.4-8 Nm	2.49 AIR SCOOPS, Oil Cooler Air Scoop
Oil drain plug	26-29 ft-lbs	35-39 Nm	2.19 SWINGARM AND BRACE, Assembly
Oil line fittings on swingarm	108-156 **in-lbs**	12-17.6 Nm	2.19 SWINGARM AND BRACE, Assembly
Oil line p-clamps at swingarm	48-72 **in-lbs**	5.4-8 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Passenger grab handle, front fasteners	108-120 **in-lbs**	12-13.5 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
Passenger grab handle, rear fasteners	23-25 ft-lbs	31-34 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation/LOCTITE 271 (red)
Passenger seat latch, Firebolt	60-96 **in-lbs**	7-11 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly

FASTENER	TORQUE VALUE		NOTES
P clamp, front tie bar and clutch cable	25-27 ft-lbs	33.9-36.6 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Preload adjuster knob fastener	25-43 **in-lbs**	2.8-4.9 Nm	2.23 REAR SHOCK ABSORBER, Removal: Ulysses
Preload adjuster mounting	48-72 **in-lbs**	5.4-8 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Preload adjuster to trunk pan	36-60 **in-lbs**	4-7 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Ram air scoop fasteners	12-36 **in-lbs**	1.4-4 Nm	2.49 AIR SCOOPS, Ram Air Scoop
Rear axle (final torque)	48-52 ft-lbs	65-70.5 Nm	2.19 SWINGARM AND BRACE, Brace
Rear axle (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	2.19 SWINGARM AND BRACE, Brace/After initial torque, back off two turns and tighten to final torque.
Rear axle pinch bolt	40-45 ft-lbs	54-61 Nm	2.19 SWINGARM AND BRACE, Brace
Rear brake line bracket fasteners	48-72 **in-lbs**	5.4-8 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Rear brake line bracket fasteners	48-72 **in-lbs**	5.4-8 Nm	2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS, Mount Installation
Rear brake reservoir fastener	48-72 **in-lbs**	5.4-8 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Ulysses
Rear fender fasteners	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Rear Fender: XB12R
Rear fender fasteners	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Rear Fender: XB9SX/XB12Scg
Rear fender fasteners	12-36 **in-lbs**	1.4-4.0 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Rear shock reservoir clamp, Firebolt	120-144 **in-lbs**	13.6-16.3 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Rear shock reservoir fastener	80-88 **in-lbs**	9.0-9.9 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Rear shock reservoir fastener, Ulysses	80-88 **in-lbs**	9.0-9.9 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Rear shock reservoir fastener, Ulysses	80-88 **in-lbs**	9.0-9.9 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Rear tail sides to center tail section, Lightning	102-114 **in-lbs**	11.5-12.8 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly/LOCTITE 271 (red)
Rear tail sides to center tail section, Lightning	102-114 **in-lbs**	11.5-12.8 Nm	2.41 CENTER TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Rear tail sides to center tail section, Lightning	102-114 **in-lbs**	11.5-12.8 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Reservoir clamp fastener	120-144 **in-lbs**	13.5-16.2 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Retaining clip jamnuts	36-40 in-lbs	4-4.5 Nm	2.24 THROTTLE CONTROL, Throttle Cable Replacement
Rider seat screws	12-36 **in-lbs**	1.4-4 Nm	2.51 SEAT, Firebolt
Right front trunk pan fastener, Lightning	12-36 **in-lbs**	1.4-4 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly
Right front trunk pan fastener, Lightning	12-36 **in-lbs**	1.4-4 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly
Right front trunk pan fastener, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Right tail section to trunk pan, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly

FASTENER	TORQUE VALUE		NOTES
Rotor mounting fasteners, front	25-27 ft-lbs	34-37 Nm	2.5 FRONT WHEEL, Assembly/Metric, replace with new
Rotor mounting fasteners, rear	25-27 ft-lbs	34-37 Nm	2.6 REAR WHEEL, Assembly/Replace with new
Seat latch fastener	60-96 **in-lbs**	7-11 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Seat lock bracket fasteners, Ulysses	60-96 **in-lbs**	7-11 Nm	2.52 SEAT LOCKS, Installation: Ulysses Models
Seat lock latch fasteners, Lightning	60-72 **in-lbs**	7-8 Nm	2.52 SEAT LOCKS, LIGHTNING
Shift linkage fasteners	36-60 **in-lbs**	4-7 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Shift pedal flange head bolt	22-24 ft-lbs	30-32.5 Nm	2.25 CLUTCH CONTROL, Assembly and Installation/LOCTITE 271 (red)
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Shock mounting fastener, upper	48-52 ft-lbs	65-70.5 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Shock mounting fastener, upper	48-52 ft-lbs	65-70.5 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Shock mounting fastener, upper	48-52 ft-lbs	65-70.5 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Shock reservoir clamp, rear (Lightning except XB12Ss)	36-60 **in-lbs**	4-7 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Shock reservoir clamp, rear (XB12Ss)	80-88 **in-lbs**	9-10 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Side case brackets	108-120 **in-lbs**	12-13 Nm	2.54 LUGGAGE: XB12XT, Installation: Side Case
Side case brackets	108-120 **in-lbs**	12-13 Nm	2.55 LUGGAGE: XB12XP, SIDE CASE
Sidestand bracket fasteners	25-27 ft-lbs	34-37 Nm	2.46 SIDESTAND, Installation
Sidestand bracket fasteners	25-27 ft-lbs	34-37 Nm	2.46 SIDESTAND, Installation
Sprocket cover fastener	12-36 **in-lbs**	1.4-4 Nm	2.36 SPROCKET COVER, Installation
Sprocket fasteners	35-37 ft-lbs	47-50 Nm	2.6 REAR WHEEL, Assembly/Replace with new
Steering stem capnut	38-42 ft-lbs	52-57 Nm	2.18 STEERING HEAD BEARINGS, Installation
Steering stem cap nut	38-42 ft-lbs	52-57 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses
Steering stem cap nut (final torque)	38-42 ft-lbs	52-57 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/Follow special instructions, ANTI-SEIZE
Steering stem cap nut (initial torque)	38-42 ft-lbs	52-57 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/Installation/Follow special instructions
Steering stem pinch bolt	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/LOCTITE 271 (red)
Steering stem pinch bolt	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Steering stem pinch bolt	20-22 ft-lbs	27-30 Nm	2.18 STEERING HEAD BEARINGS, Installation/LOCTITE 271 (red)

FASTENER	TORQUE VALUE		NOTES
Stone guard fasteners	12-36 **in-lbs**	1.4-4 Nm	2.37 BELT GUARDS, Installation
Swingarm brace mounting fasteners	25-27 ft-lbs	34-37 Nm	2.19 SWINGARM AND BRACE, Brace
Swingarm pivot shaft	44-46 ft-lbs	59-62 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm/ANTI-SEIZE
Swingarm pivot shaft pinch fastener	17-19 ft-lbs	23-26 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm/LOCTITE 271 (red)
Switch housing fasteners, right	25-33 **in-lbs**	3-4 Nm	2.24 THROTTLE CONTROL, Assembly and Installation
Tail body work, lower, Firebolt	12-36 **in-lbs**	1.4-4 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Tail body work, upper, Firebolt	12-36 **in-lbs**	1.4-4 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Tail frame to frame, Firebolt	21-23 ft-lbs	28.5-31.2 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly/LOCTITE 271 (red)
Tail sections to main frame/fuel tank assembly, Ulysses	21-23 ft-lbs	28.5-31.2 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly/LOCTITE 271 (red)
Tail sections to main frame/fuel tank assembly, Ulysses	21-23 ft-lbs	28.5-31.2 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly/LOCTITE 271 (red)
Tail sections to tail loop, Ulysses	20-22 ft-lbs	27-30 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Tail sections to tail loop, Ulysses	20-22 ft-lbs	27-30 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Tail section to main frame/fuel tank assembly, Lightning	21-23 ft-lbs	28.5-31.2 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly/LOCTITE 271 (red)
Tail section to main frame/fuel tank assembly, Lightning	21-23 ft-lbs	28.5-31.2 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Top case fasteners	96-120 **in-lbs**	11-13 Nm	2.54 LUGGAGE: XB12XT, Installation: Top Case
Triple tail plastic collar screw	36-48 **in-lbs**	4.0-5.4 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
Trunk pan to center tail section, Lightning	48-72 **in-lbs**	5.4-8 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly
Trunk pan to center tail section, Lightning	48-72 **in-lbs**	5.4-8 Nm	2.41 CENTER TAIL SECTION: LIGHTNING, Assembly
Turn signal fasteners, rear	25-28 **in-lbs**	2-3 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Upper fork clamp fasteners	23-25 ft-lbs	31.2-33.8 Nm	2.16 FRONT FORKS: ALL MODELS, Installation
Upper front fender fasteners/XB12X	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Front Fender: XB12X/LOCTITE 271 (red)
Upper module fasteners, Ulysses	36-60 **in-lbs**	4-7 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Valve stem nut	40-44 **in-lbs**	4.5-4.9 Nm	2.7 TIRES, Installation
Wear peg, rider, Firebolt and Lightning	36-48 **in-lbs**	4-5 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Rider/LOCTITE 271 (red)
Windscreen fasteners, Firebolt	10-12 **in-lbs**	1-1.4 Nm	2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT, Installation
Windscreen fasteners, Lightning	10-12 **in-lbs**	1.1-1.4 Nm	2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES, LIGHTNING
Windscreen fasteners, Ulysses	10-12 **in-lbs**	1.1-1.4 Nm	2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES, ULYSSES XB12X
Wire cover screws, Ulysses	36-48 **in-lbs**	4-5.4 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly

FASTENER	TORQUE VALUE		NOTES
Wire cover screws, Ulysses	36-48 **in-lbs**	4-5.4 Nm	2.52 SEAT LOCKS, Installation: Ulysses Models
Wire cover screws, Ulysses	36-48 **in-lbs**	4.0-5.4 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SPECIFICATIONS 2.2

FIREBOLT

NOTE

Gross Vehicle Weight (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR) are given on an information decal located on the steering head.

Table 2-1. Weights: 2009 Firebolt and Lightning Models

ITEM	XB9SX		XB12R		XB12Scg		XB12Ss	
	LB.	KG	LB.	KG	LB.	KG	LB.	KG
Weight	454	206	471	214	459	208	478	217
GVWR	850	386	850	386	850	386	850	386
GAWR front	315	143	325	147	315	143	315	143
GAWR rear	535	243	525	238	535	243	535	243
Load capacity	396	180	379	172	391	177	373	169
All measurements include a full tank of gasoline.								

Table 2-2. Dimensions: 2009 Firebolt

ITEM	IN.	MM
Wheel base (without rider)	52.0	1320
Seat height (with rider)	30.5	775
Ground clearance (without rider)	4.35	110
Trail	3.3	83
Rake	21 degree	

Table 2-3. Capacities: 2009 Firebolt

ITEM	U.S.	LITERS
Fuel tank total (including reserve)	3.82 gallons	14.5
Reserve/low fuel lamp illuminates at	0.75 gallons	2.8
Oil tank	2.5 U.S. quarts	2.4
Transmission	1.0 U.S. quart	0.9

LIGHTNING

Table 2-4. Dimensions: 2009 Firebolt and Lightning Models

ITEM	XB9SX		XB12R		XB12Scg		XB12Ss	
	IN.	MM	IN.	MM	IN.	MM	IN.	MM
Overall length	76.2	1935	76.2	1935	75.7	1923	81.9	2080
Overall width (without mirrors)	29.7	755	28.1	715	29.7	755	29.7	755
Overall height (without mirrors)	42.3	1075	43.3	1100	41.3	1050	43.3	1100
Wheel base (without rider)	52.0	1321	52.0	1320	51.8	1315	53.7	1364
Seat height (with rider)	31.1	765	30.5	775	28.6	726	30.6	776
Ground clearance (without rider)	4.35	110	4.35	110	3.55	90	5.50	140
Trail	3.3	83	3.3	83	3.3	83	4.7	119
Rake	21.0 degree		21.0 degree		21.0 degree		23.1 degree	

Table 2-5. Capacities: 2009 XB9SX and XB12Scg Models

ITEM	U.S.	LITERS
Fuel tank total (including reserve)	3.82 gallons	14.46
Reserve/low fuel lamp illuminates at	0.75 gallons	2.84
Oil tank	2.50 quarts	2.37
Transmission	1.00 quart	0.95

NOTE

Gross Vehicle Weight (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR) are given on an information decal located on the steering head.

Table 2-6. Weights: 2009 Firebolt and Lightning Models

ITEM	XB9SX		XB12R		XB12Scg		XB12Ss	
	LB.	KG	LB.	KG	LB.	KG	LB.	KG
Weight	454	206	471	214	459	208	478	217
GVWR	850	386	850	386	850	386	850	386
GAWR front	315	143	325	147	315	143	315	143
GAWR rear	535	243	525	238	535	243	535	243
Load capacity	396	180	379	172	391	177	373	169
All measurements include a full tank of gasoline.								

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ULYSSES

Table 2-7. Capacities: 2009 XB12Ss

ITEM	U.S.	LITERS
Fuel tank total (including reserve)	4.40 gallons	16.7
Reserve/low fuel lamp illuminates at	0.83 gallons	3.1
Engine oil (with filter)	2.5 quarts	2.4
Transmission	1.0 quart	0.9

Table 2-8. Dimensions: 2009 Ulysses Models

ITEM	XB12X		XB12XT*		XB12XT**		XB12XP*	
	IN.	MM	IN.	MM	IN.	MM	IN.	MM
Overall length	85.0	2158	91.3	2320	85.8	2180	86.1	2188
Overall width	35.1	892	39.6	1005	35.1	892	33.1	840
Overall height	52.4	1331	52.4	1331	52.4	1331	53.1	1349
Wheel base (without rider)	54.1	1374	53.9	1370	53.9	1370	54.1	1374
Seat height (with rider)	31.8	808	30.7	780	30.7	780	31.8	808
Ground clearance (without rider)	6.8	171	5.9	151	5.9	151	7.0	177
Trail	4.8	122	4.9	123	4.9	123	4.8	122
Rake (steering angle)	23.5 degrees		23.8 degrees		23.8 degrees		23.5 degrees	
Rake (fork angle)	22.0 degrees		22.3 degrees		22.3 degrees		22.0 degrees	

*Specifications for vehicle with luggage.
**Specifications for vehicle without luggage and brackets.

Table 2-9. Weights: 2009 Ulysses Models

ITEM	XB12X		XB12XT*		XB12XT**		XB12XP	
	LB.	KG	LB.	KG	LB.	KG	LB.	KG
Weight	495	225	536	243	498	226	533	242
GVWR	950	431	950	431	950	431	950	431
GAWR front	345	156	345	156	345	156	345	156
GAWR rear	685	311	685	311	685	311	685	311
Load capacity***	455	206	414	188	452	205	396	180

All measurements include a full tank of gasoline.
*Specifications for vehicle with luggage.
**Specifications for vehicle without luggage and brackets.
***For XB12XP, load capacity assumes dealer emergency equipment kit installed.

NOTE

Gross Vehicle Weight (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR) are given on an information decal located on the steering head.

Table 2-10. Capacities: 2009 Ulysses Models

ITEM	U.S.	LITERS
Fuel tank total (including reserve)	4.40 gallons	16.7
Reserve/low fuel lamp illuminates at	0.83 gallons	3.1
Engine oil (with filter)	2.5 quarts	2.4
Transmission	1.0 quart	0.9

⚠WARNING

Do not inflate tire beyond maximum pressure as specified on sidewall. Over inflated tires can blow out, which could result in death or serious injury. (00027a)

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

SUSPENSION SETTINGS

WARNING

Be sure tires are properly inflated, balanced and have adequate tread. Inspect your tires regularly and see a Buell dealer for replacements. Riding with excessively worn, unbalanced or under-inflated tires can adversely affect stability and handling, which could result in death or serious injury. (00114a)

WARNING

Do not operate motorcycle with loose, worn or damaged steering or suspension systems. Contact a Buell dealer for repairs. Loose, worn or damaged steering or suspension components can adversely affect stability and handling, which could result in death or serious injury. (00113a)

WARNING

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

WARNING

Both forks should be adjusted equally. Forks that are not properly adjusted can lead to loss of control, which could result in death or serious injury. (00124b)

Table 2-11. Recommended Suspension Settings: 2009 Firebolt XB12R

LOAD***		FRONT FORK			REAR SHOCK		
LB.	KG	*PRELOAD: TURNS IN FROM MINIMUM	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM	PRELOAD POSITION	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM
Less than 140	Less than 63	3	2	1-5/8	1	2-1/2	1-3/4
140-160	63-73	5	1-3/4	1-5/8	2	1-3/4	1-1/2
160-180	73-82	6	1-1/2	1-1/2	3	1-1/2	1-1/4
180-200	82-91	7	1-1/2	1-1/2	4	1-1/4	1-1/4
200-220	91-100	8	1-1/4	1-1/4	5	1-1/4	1
220-240	100-109	9	1-1/4	1-1/4	6	1	3/4
240 to GVWR	109 to GVWR	10	1	1	7	1	3/4

*Front preload is set by loosening adjuster counterclockwise until it stops at minimum and then counting the number of turns in to get to the desired setting.
**All damping adjuster settings are done by tightening adjuster clockwise until it stops at maximum setting, then counting the turns counterclockwise to the desired setting.
***Load includes rider, passenger, cargo, accessories and riding gear.

Table 2-12. Recommended Suspension Settings: 2009 Lightning XB9SX

LOAD***		FRONT FORK			REAR SHOCK		
LB.	KG	*PRELOAD: TURNS IN FROM MINIMUM	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM	PRELOAD POSITION	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM
Less than 130	Less than 59	3	2	1-3/4	1	2-1/2	2
130-150	59-68	4	1-3/4	1-3/4	2	2-1/4	1-3/4
150-170	68-77	5	1-1/2	1-5/8	3	2	1-1/2
170-190	77-86	6	1-1/2	1-1/2	4	1-3/4	1-1/2
190-210	86-95	7	1-1/4	1-1/2	5	1-1/2	1-1/4
210-230	95-104	8	1-1/4	1-1/2	6	1-1/4	1

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Table 2-12. Recommended Suspension Settings: 2009 Lightning XB9SX

LOAD***		FRONT FORK			REAR SHOCK		
LB.	KG	*PRELOAD: TURNS IN FROM MIN-IMUM	**COMPRES-SION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAX-IMUM	PRELOAD POSITION	**COMPRES-SION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAX-IMUM
230 to GVWR	104 to GVWR	9	1	1-1/4	7	1-1/4	1

*Front preload is set by loosening adjuster counterclockwise until it stops at minimum and then counting the number of turns in to get to the desired setting.
**All damping adjuster settings are done by tightening adjuster clockwise until adjuster stops at maximum settings and then counting the turns counterclockwise to get to the desired setting.
***Load includes rider, passenger, cargo, accessories and riding gear.

Table 2-13. Recommended Suspension Settings: 2009 Lightning XB12Scg

LOAD***		FRONT FORK			REAR SHOCK		
LB.	KG	*PRELOAD: TURNS IN FROM MIN-IMUM	**COMPRES-SION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAX-IMUM	PRELOAD POSITION	**COMPRES-SION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAX-IMUM
Less than 150	Less than 68	5	1-3/4	1-3/4	1	3	1-1/2
150-170	68-77	6	1-3/4	1-1/2	2	2-1/2	1-1/4
170-190	77-86	7	1-1/2	1-1/2	3	2-1/4	1-1/4
190-210	86-95	8	1-1/2	1-1/4	4	2	1
210-230	95-104	9	1-1/4	1-1/4	5	1-3/4	1
230-250	104-113	10	1-1/4	1	6	1-1/2	3/4
250-GVWR	113-GVWR	11	1	1	7	1-1/4	3/4

**Front preload is set by loosening adjuster counterclockwise until it stops at minimum and then counting the number of turns in to get to the desired setting.
**All damping adjuster settings are done by tightening adjuster clockwise until adjuster stops at maximum setting and then counter the turns counterclockwise to get to the desired setting.
***Load includes rider, passenger, cargo, accessories and riding gear.

Table 2-14. Recommended Suspension Settings: 2009 Lightning XB12Ss

LOAD**		FRONT FORK			REAR SHOCK		
LB.	KG	PRELOAD: NO. OF LINES SHOWING	*COMPRES-SION: TURNS OUT FROM MAXIMUM	*REBOUND: TURNS OUT FROM MAX-IMUM	PRELOAD POSITION	*COMPRES-SION: TURNS OUT FROM MAXIMUM	*REBOUND: TURNS OUT FROM MAX-IMUM
Less than 140	Less than 63	7	2	1.75	1	2.50	2
140-170	63-77	7	1.75	1.75	2	2.25	1.75
170-200	77-91	7	1.75	1.75	2	2	1.50
200-230	91-104	7	1.75	1.625	4	1.75	1.50
230-260	104-118	6.50	1.50	1.50	5	1.50	1.25
260-290	118-132	6.50	1.50	1.50	6	1.25	1

Table 2-14. Recommended Suspension Settings: 2009 Lightning XB12Ss

LOAD**		FRONT FORK			REAR SHOCK		
LB.	KG	PRELOAD: NO. OF LINES SHOWING	*COMPRESSION: TURNS OUT FROM MAXIMUM	*REBOUND: TURNS OUT FROM MAXIMUM	PRELOAD POSITION	*COMPRESSION: TURNS OUT FROM MAXIMUM	*REBOUND: TURNS OUT FROM MAXIMUM
290 to GVWR	132 to GVWR	6	1.25	1.50	7	1.125	1

*All damping adjuster settings are done by tightening adjuster clockwise until adjuster stops at maximum setting and then counting the turns counterclockwise to get to the desired setting.
**Load includes rider, passenger, cargo, accessories and riding gear.

Table 2-15. Recommended Suspension Settings: 2009 XB12X/XB12XP

LOAD***		FRONT FORKS			REAR SHOCK		
LB	KG	*PRELOAD: TURNS IN FROM MINIMUM	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM	*PRELOAD: TURNS IN FROM MINIMUM	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM
Under 170	Less than 77	1-1/2	2-1/2	1-1/2	3	2-1/2	2
170-200	77-91	2	2-1/4	1-1/4	6	2	1-7/8
200-230	91-104	3	2	1-1/4	9	1-3/4	1-1/2
230-260	104-118	3-1/2	2	1-1/8	13	1-1/2	1-1/4
260-290	118-132	3-1/2	1-7/8	1	16	1-1/8	1
290-320	132-145	4	1-7/8	1	18	7/8	3/4
320-GVWR	145-GVWR	4	1-3/4	7/8	max	1/2	5/8

*Both front and rear spring preload is set by loosening adjuster counterclockwise until it stops at minimum and then counting the number of turns in to get to the desired setting. The rear preload knob clicks every 1/2 turn.
**All damping adjuster settings are done by tightening adjuster clockwise until it stops at maximum setting and then counting the turns counterclockwise to get to the desired setting.
***XB12X (only) load includes rider, passenger, cargo, accessories and riding gear.
***XB12XP (only) add 60 lbs for empty bags, brackets and pursuit equipment.

Table 2-16. Recommended Suspension Settings: 2009 Ulysses XB12XT

LOAD***		FRONT FORKS			REAR SHOCK		
LB	KG	*PRELOAD: TURNS IN FROM MINIMUM	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM	*PRELOAD: TURNS IN FROM MINIMUM**	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM
Under 170	Less than 77	8	2	1-3/4	0	2-1/4	2
170-200	77-91	9	1-7/8	1-3/4	0	1-3/4	1-1/2
200-230	91-104	9	1-7/8	1-3/4	6	1-3/4	1-1/4
230-260	104-118	9	1-7/8	1-3/4	9	1-1/4	1
260-290	118-132	12	1-7/8	1-5/8	14	1	3/4
290-320	132-145	12	1-7/8	1-1/2	max	1	5/8

Table 2-16. Recommended Suspension Settings: 2009 Ulysses XB12XT

LOAD***		FRONT FORKS			REAR SHOCK		
LB	KG	*PRELOAD: TURNS IN FROM MINIMUM	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM	*PRELOAD: TURNS IN FROM MINIMUM**	**COMPRESSION: TURNS OUT FROM MAXIMUM	**REBOUND: TURNS OUT FROM MAXIMUM
320-GVWR	145-GVWR	14	1-7/8	1-1/2	max	1	1/2

Settings are for XB12XT vehicles with sidecase and topcase installed.If operating without sidecase and topcase attached, refer to settings in ONE LOWER weight category.

*Both Front and Rear Spring Preload is set by loosening adjuster counterclockwise until it stops at minimum and then counting the number of turns in to get to the desired setting. The rear preload knob clicks every 1/2 turn.

**All damping adjuster settings are done by tightening adjuster clockwise until it stops at maximum setting and then counting the turns counterclockwise to get to the desired setting.

***Load includes rider, passenger, cargo, accessories and riding gear. **If more than 50% of the load is cargo and passenger, reduce front preload 3-4 turns from the chart.**

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

VEHICLE IDENTIFICATION NUMBER (VIN) 2.3

VEHICLE IDENTIFICATION NUMBER (V.I.N.)

See Figure 2-1. The full 17 digit serial, or Vehicle Identification Number (V.I.N.) is stamped and printed on a label on the right side of the steering head.

A Motor Identification Number is labeled on the left side crankcase near the rear cylinder of the engine.

NOTE

Always give the full Vehicle Identification Number located on steering head when ordering parts or making any inquiry about your motorcycle.

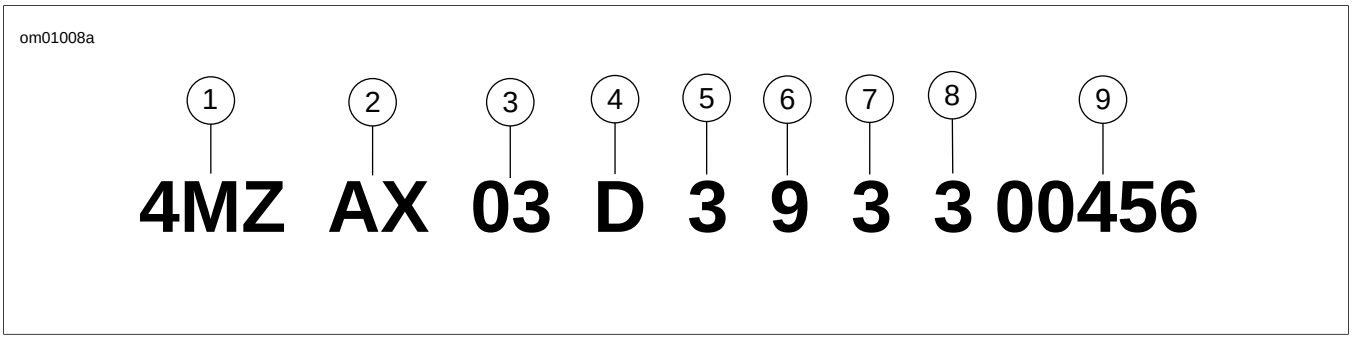

Figure 2-1. Typical Buell V.I.N: 2009 Firebolt Models

Table 2-17. Buell V.I.N. Breakdown: 2009 Models

POSITION	DESCRIPTION	POSSIBLE VALUES
1	Market designation (WMI code)	4MZ = Buell vehicles originally manufactured for sale **within** the United States 5MZ = Buell vehicles originally manufactured for sale **outside** the United States 95Z = Buell vehicles originally manufactured for sale in Brazil at Manaus CKD plant
2	Motorcycle type code	KP=Blast® AX=Firebolt® JX=Lightning® Long KX=Lightning® CityX WX=Lightning® Scg DB=Ulysses™ Police XB12XP DX=Ulysses™ XB12X FX=Ulysses™ XB12XT HL=1125R YL=1125CR
3	Engine type	01=492 cc 02=984 cc Thunderstorm® 03=1203 cc Thunderstorm® 04=1125 cc Helicon™ 06=1125 cc Helicon™ (105 HP, France)
4	Market configuration	A=Australia B=Brazil Z=Brazil CKD L=California N=Canada D=Domestic E=England R=Europe J=Japan
5	V.I.N. check digit	Can be 0-9 or X
6	Model year	9=2009
7	Assembly plant	3=East Troy, WI U.S.A. M=H-D Brazil-Manaus, Brazil (CKD)

Table 2-17. Buell V.I.N. Breakdown: 2009 Models

POSITION	DESCRIPTION	POSSIBLE VALUES
8	Model	0=Blast 2=XB9SX 3=XB12R 5=XB12Scg 6=XB12Ss 7=XB12X 9=XB12XP A=XB12XT B=1125R C=1125CR D=1125R, 105 HP France E=1125CR, 105 HP France
9	Sequential number (last five digits)	Varies

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

WHEELS 2.4

GENERAL

Good handling and maximum tire mileage are directly related to the care of wheels and tires. Regularly inspect wheels and tires for damage and wear. If handling problems occur, see 1.20 TROUBLESHOOTING or Table 2-18.

See 1.8 TIRES AND WHEELS for tire pressures. Keep tires inflated to the recommended air pressure. Always balance the wheel after replacing a tire.

⚠WARNING

Do not inflate tire beyond maximum pressure as specified on sidewall. Over inflated tires can blow out, which could result in death or serious injury. (00027a)

TROUBLESHOOTING

See Figure 2-2. Check tire inflation pressure at least once each week. At the same time, inspect tire tread for punctures, cuts, breaks and other damage. Repeat the inspection before long trips.

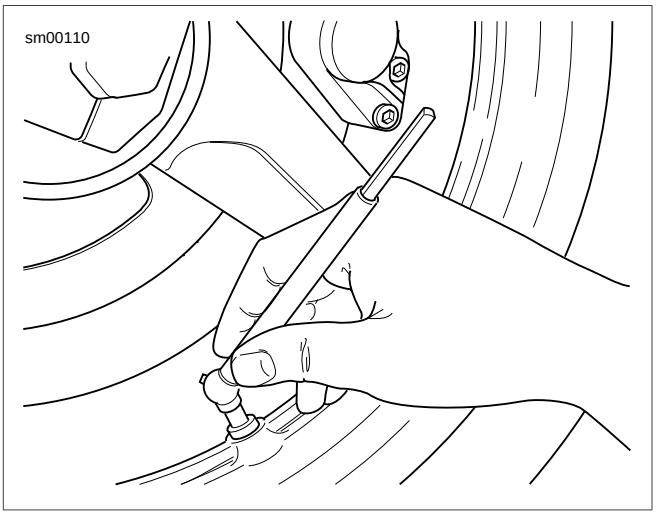

Figure 2-2. Checking Tire Inflation Pressure

Table 2-18. Wheel Service: XB Models

CHECK FOR	REMEDY
Loose axles.	Tighten front axle. See 2.5 FRONT WHEEL. Tighten rear axle. See 2.6 REAR WHEEL
Excessive side-play or radial (up-and-down) play in wheel hubs.	Replace wheel hub bearings.
Alignment of rear wheel in frame or with front wheel.	Repair swingarm. See 2.19 SWINGARM AND BRACE.
Rims and tires out-of-true sideways; should not be more than 0.080 in. (2.03 mm).	Replace rims. See 2.7 TIRES and 2.8 CHECKING CAST RIM RUNOUT.
Rims and tires out-of-round or eccentric with hub; should not be more than 0.090 in. (2.29 mm).	Replace rims. See 2.7 TIRES and 2.8 CHECKING CAST RIM RUNOUT.
Irregular or peaked front tire wear.	Replace. See 2.7 TIRES.
Correct tire inflation.	Inflate tires to correct pressure. See 1.8 TIRES AND WHEELS.
Correct tire and wheel balance.	Static balance may be satisfactory if dynamic balancing facilities are not available. However, dynamic balancing is strongly recommended.
Steering head bearings.	Correct adjustment and replace pitted or worn bearings. See 1.12 STEERING HEAD BEARINGS.
Damper tubes.	Check for leaks. See 2.16 FRONT FORKS: ALL MODELS (Firebolt/Lightning) or 2.16 FRONT FORKS: ALL MODELS (Super TT/Ulysses).
Shock absorbers.	Check damping action and mounts. See 2.23 REAR SHOCK ABSORBER.
Swingarm bearings.	Check for looseness. See 2.19 SWINGARM AND BRACE.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

To prevent death or serious injury, use the following guidelines when installing a new tire or repairing a flat:

- *Always locate and eliminate the cause of the original tire failure.*
- *The use of tires other than those specified can adversely affect handling which could result in death or serious injury.*
- *Tires and wheels are critical items. Since the servicing of these components requires special tools and skills, Buell recommends that you see your dealer for these services.*

⚠WARNING

Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the demounted tire by a Buell dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (130 km/h). Failure to follow this warning could result in death or serious injury. (00118a)

⚠WARNING

Use only Buell approved tires. See a Buell dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00133a)

⚠WARNING

Tires are a critical safety component. Contact a Buell dealer for tire repair or replacement. Improper tire service can adversely affect stability and handling, which could result in death or serious injury. (00134a)

⚠WARNING

Buell tires are equipped with wear bars that run horizontally across the tread. When wear bars become visible and only 1/32 in. (0.8 mm) tread depth remains, replace tire immediately. Using a worn tire can adversely affect stability and handling, which could result in death or serious injury. Use only Buell approved replacement tires. (00497d)

At regular intervals of 5000 miles (8000 km) or whenever handling irregularities are noted, perform the recommended service checks. Refer to Table 2-18.

If tires must be replaced, same as original equipment tires must be used. Other tires may not fit correctly and may be hazardous to use.

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FRONT WHEEL 2.5

REMOVAL

1. Place a scissor jack under jacking point and raise front wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.

NOTE

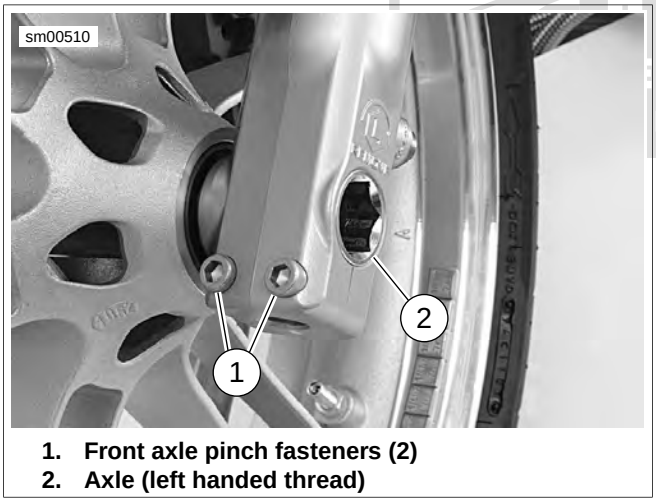
Do not operate front brake lever with front wheel removed or caliper pistons may be forced out. Reseating pistons requires caliper disassembly.

2. Remove the right side lower fender fasteners. See 2.15 FENDERS.
3. See Figure 2-3. Loosen front axle pinch fasteners (1) on front fork.
4. Remove axle (2).

NOTES

- *The front axle is left handed thread.*
- *To prevent cosmetic damage to the wheel, center the caliper between spokes before removal.*

5. See Figure 2-4. Raise the wheel up until the rotor clears the caliper and rotate the fork leg counterclockwise allowing wheel clearance for removal.
6. Remove wheel.



1. Front axle pinch fasteners (2)
2. Axle (left handed thread)

Figure 2-3. Front Wheel Mounting

Figure 2-4. Front Wheel Removal/Installation

DISASSEMBLY

PART NUMBER	TOOL NAME
B-43993-50A	WHEEL BEARING REMOVER/INSTALLER KIT
B-43993-7, FROM KIT PART NO. B-43993-50A	FRONT WHEEL BEARING REMOVER COLLET
HD-44060A	WHEEL BEARING REMOVER/INSTALLER
J-23444-A	EXTREME PRESSURE LUBRICANT

Bearing Removal

NOTE

On single disc wheels, always remove the brake disc side first.

1. See Figure 2-5. Remove wheel bearings using WHEEL BEARING REMOVER/INSTALLER KIT (Part No. B-43993-

50A) and WHEEL BEARING REMOVER/INSTALLER (Part No. HD-44060A).

a. Sparingly apply EXTREME PRESSURE LUBRICANT (Part No. J-23444-A) to the threads of the short forcing screw (1) to prolong service life and verify smooth operation.

b. Assemble the short forcing screw (1), nut (2), Nice bearing (3), washer (4) and bridge (5).

c. See Figure 2-6. Insert the FRONT WHEEL BEARING REMOVER COLLET (Part No. B-43993-7, from kit Part No. B-43993-50A) into the wheel bearing until it fully seats against the bearing.

d. Insert the ball bearing (2) into the collet (1).

e. See Figure 2-7. Thread the puller assembly (1) into the collet (2).

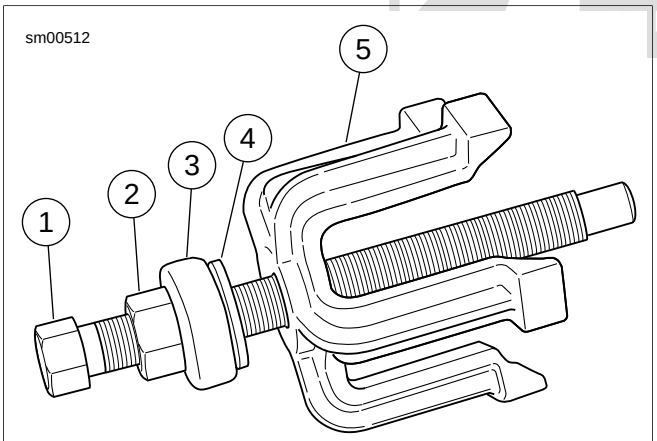
f. Hold the collet (2), and turn the forcing screw (3) to expand the collet.

g. See Figure 2-8. Place the bridge (1) against the wheel hub.

h. Hold the forcing screw (3), and turn the nut (2) clockwise until the bearing is free of the hub.

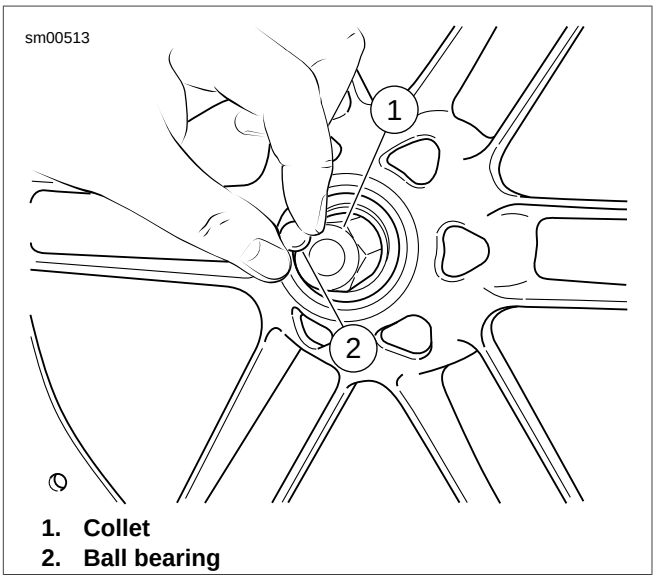
i. See Figure 2-9. Loosen the nut (1), and back off the bridge (2). Hold the forcing screw (3) while holding the collet (4) to remove the forcing screw from the collet.

j. Remove the ball bearing (5) and wheel bearing (6) from the collet (4).



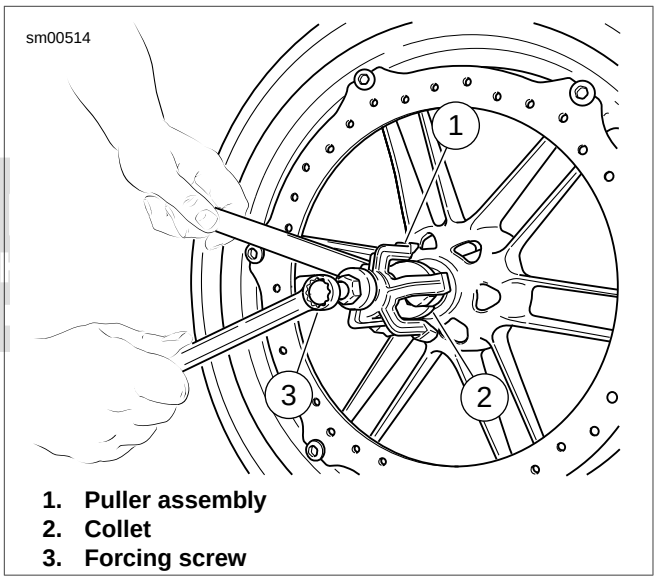
1. **Short forcing screw**
2. **Nut**
3. **Nice bearing**
4. **Washer**
5. **Bridge**

Figure 2-5. Assemble Puller



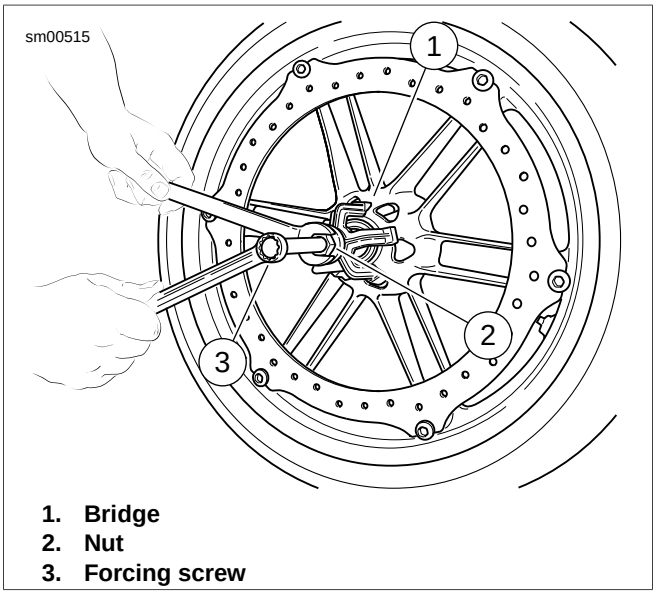
1. **Collet**
2. **Ball bearing**

Figure 2-6. Install Collet and Ball Bearing



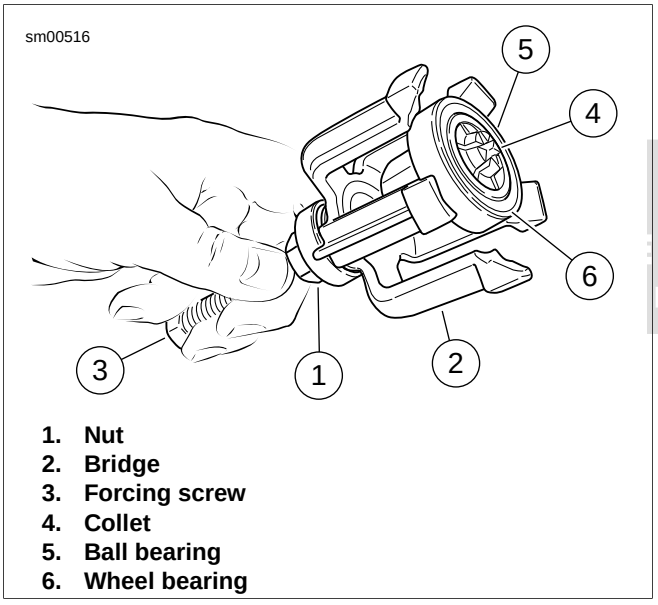
1. **Puller assembly**
2. **Collet**
3. **Forcing screw**

Figure 2-7. Expand the Collet



1. **Bridge**
2. **Nut**
3. **Forcing screw**

Figure 2-8. Remove the Bearing



1. **Nut**
2. **Bridge**
3. **Forcing screw**
4. **Collet**
5. **Ball bearing**
6. **Wheel bearing**

Figure 2-9. Removing Bearing from Puller

2. See Figure 2-10. Remove the spacer.
3. Repeat previous steps for the bearing on the other side of the wheel.

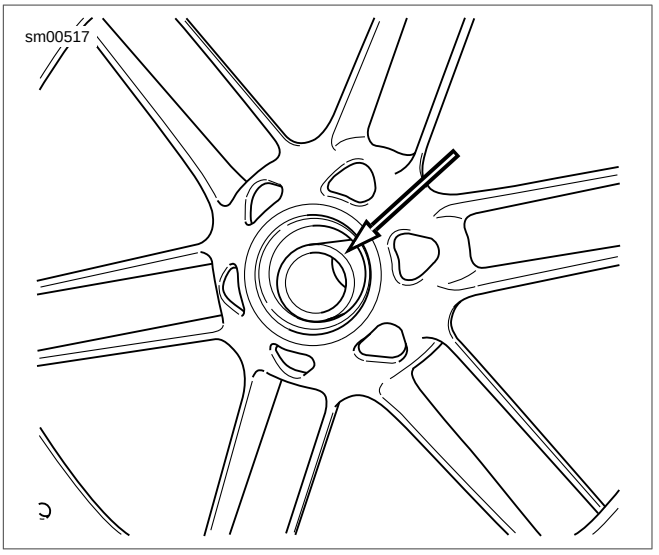


Figure 2-10. Remove the Spacer

Front Rotor Removal

1. See Figure 2-16. Remove and discard rotor mounting fasteners (7).
2. Remove and inspect brake rotor (6) for wear and warping. See 2.10 FRONT BRAKE: SIX PISTON CALIPER, Cleaning and Inspection.
3. Remove drive bushings (8) and discard.
4. Remove washers (9) and discard.
5. Remove front brake springs (4) and discard.

CLEANING AND INSPECTION

⚠WARNING

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

1. Inspect all parts for damage or excessive wear.

NOTE

The wheel bearings are designed as sealed bearings which are not intended to be disassembled, serviced or cleaned with solvents.

⚠WARNING

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

2. Inspect brake rotor and pads. See 1.7 BRAKE SYSTEM MAINTENANCE.

ASSEMBLY

PART NUMBER	TOOL NAME
B-43993-10	FRONT WHEEL BEARING INSTALLER
B-43993-11 FRONT WHEEL	BACKING PLATE
B-43993-50A	WHEEL BEARING REMOVER/INSTALLER KIT
B-43993-7	FRONT WHEEL BEARING REMOVER COLLET
B-43993-9	FRONT BEARING INSTALLER
B-43993-9, FROM KIT PART NO. B-43993-50A	FRONT BEARING INSTALLER
HD-44060A	WHEEL BEARING INSTALLER/REMOVER
J-23444-A	EXTREME PRESSURE LUBRICANT

1. See Figure 2-16. Install **new** wheel bearings (2) into hub using suitable driver. Press on outer race only.

NOTES

- *Press the rotor side bearing in first ensuring it is seated on the shoulder of the wheel. Followed by pressing the alternate side until it contacts the spacer.*
- *The WHEEL BEARING REMOVER/INSTALLER KIT (Part No. B-43993-50A) consists of the FRONT WHEEL BEARING REMOVER COLLET (Part No. B-43993-7), FRONT WHEEL BEARING INSTALLER (Part No. B-43993-10) and BACKING PLATE (Part No. B-43993-11 front wheel).*

⚠WARNING

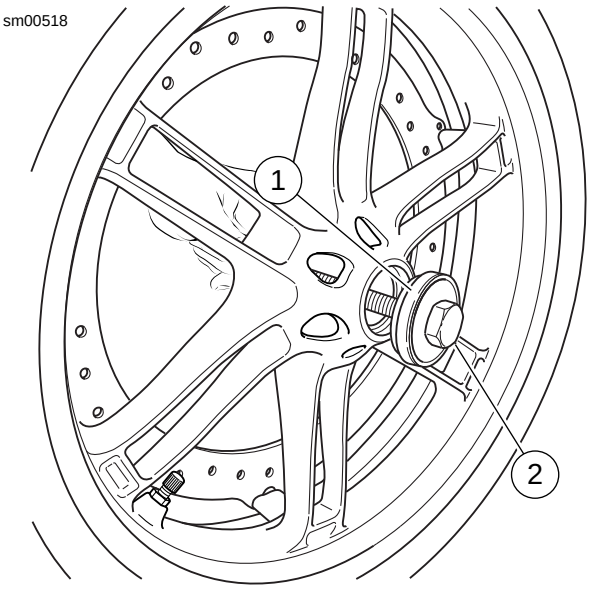
Be sure that brake fluid or other lubricants do not contact brake pads or discs. Such contact can adversely affect braking ability, which could cause loss of control, resulting in death or serious injury. (00290a)

Bearing Installation

NOTE

Always install the brake side bearing first with the lettering facing out from the hub.

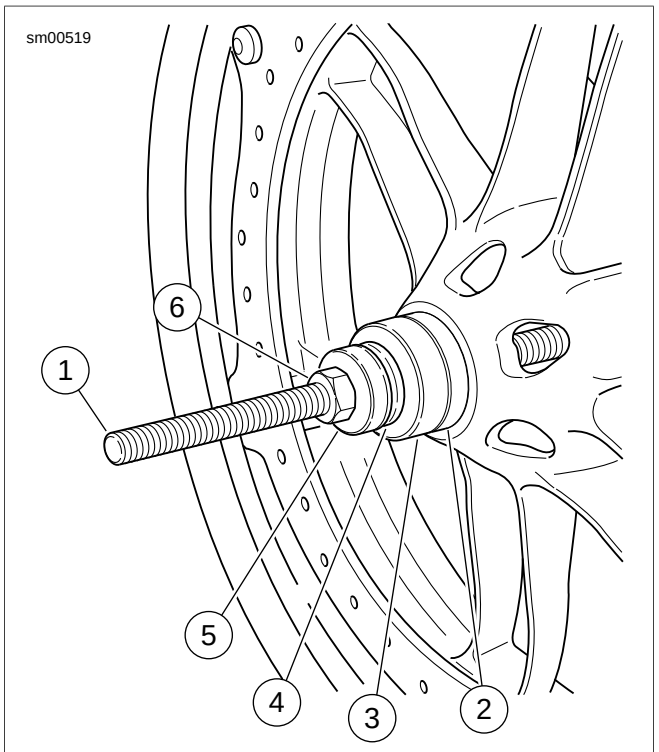
The following procedure describes the bearing installation for the front wheel; the procedure for the rear wheel is the same.



1. Backing plate
2. Forcing screw

Figure 2-11. Install the Backing Plate (B-43993-12) and Forcing Screw

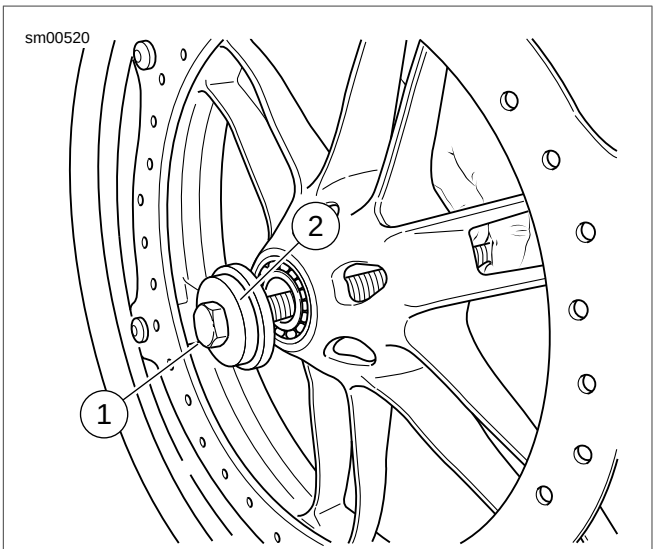
1. See Figure 2-11. Install the BACKING PLATE (Part No. B-43993-11 front wheel)(1) onto the long forcing screw (2) from the WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060A), with the smaller diameter toward the wheel hub. Insert the forcing screw and backing plate into the wheel hub.
2. See Figure 2-12. Sparingly apply EXTREME PRESSURE LUBRICANT (Part No. J-23444-A) to the threads of the long forcing screw (1) to prolong service life and verify smooth operation.



1. **Long forcing screw**
2. **Wheel bearing**
3. **Front wheel bearing installer**
4. **Washer**
5. **Nice bearing**
6. **Nut**

Figure 2-12. Installing Wheel Bearings

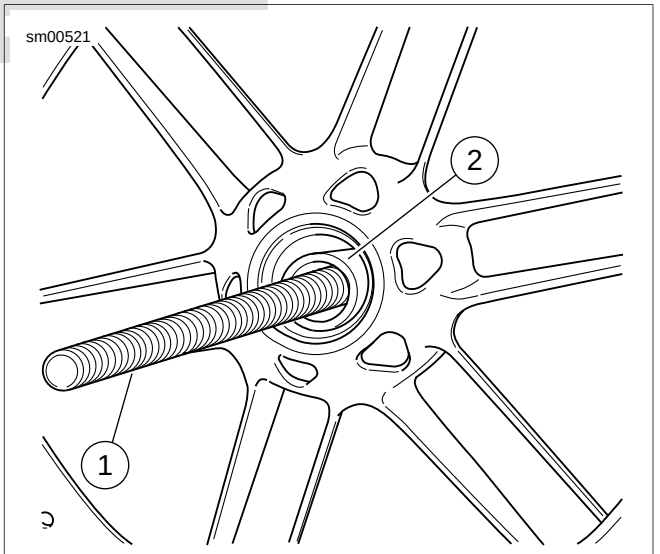
3. Insert a **new** wheel bearing (2) squarely into the hub, with the lettered side facing out (away from the wheel).
4. Slide the FRONT BEARING INSTALLER (Part No. B-43993-9, from kit Part No. B-43993-50A) (3) onto the forcing screw (1), with the smaller diameter toward the bearing bore.
5. Install a washer (4), Nice bearing (5) and nut (6) onto the forcing screw (1).
6. While holding the forcing screw (1), tighten the nut (6) until the bearing is seated firmly against the shoulder inside the bearing bore in the wheel hub.
7. Remove the nut, bearing, washer, front bearing installer, and forcing screw.



1. **Forcing screw**
2. **Backing plate**

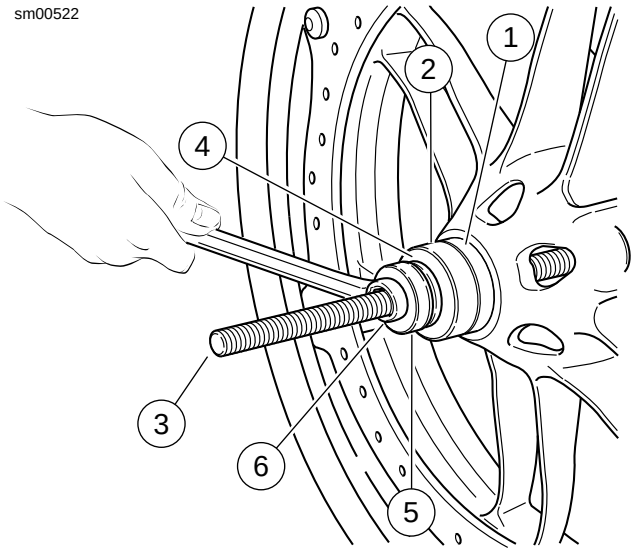
Figure 2-13. Insert Forcing Screw and Backing Plate

8. See Figure 2-13. Remove the backing plate (2) from the long forcing screw (1). Reinstall the Backing Plate onto the forcing screw, with the smaller diameter toward the hex-head.
9. Insert the forcing screw through the wheel hub on the opposite side of the wheel.
10. See Figure 2-14. Install the spacer.



1. **Forcing screw**
2. **Spacer**

Figure 2-14. Install the Spacer



1. **Wheel bearing**
2. **Front wheel bearing installer**
3. **Forcing screw**
4. **Washer**
5. **Nice bearing**
6. **Nut**

Figure 2-15. Install the Bearing

NOTE

See Figure 2-14. Center the spacer (2) while installing the wheel bearing. Failure to center the spacer could cause the bearing not to pull in straight.

11. See Figure 2-15. Insert a **new** wheel bearing (1) squarely into the hub, with the lettered side facing out (away from the wheel).
12. Slide the FRONT BEARING INSTALLER (Part No. B-43993-9) (2) onto the forcing screw (3), with the smaller diameter toward the bearing bore.
13. Install a washer (4), Nice bearing (5) and nut (6) onto the forcing screw (3).
14. See Figure 2-15. While holding the forcing screw (3), tighten the nut (6) until the bearing contacts the spacer.
15. Remove the nut, bearing, washer, front bearing installer, and forcing screw.
16. Install the wheel. See 2.5 FRONT WHEEL, Installation.

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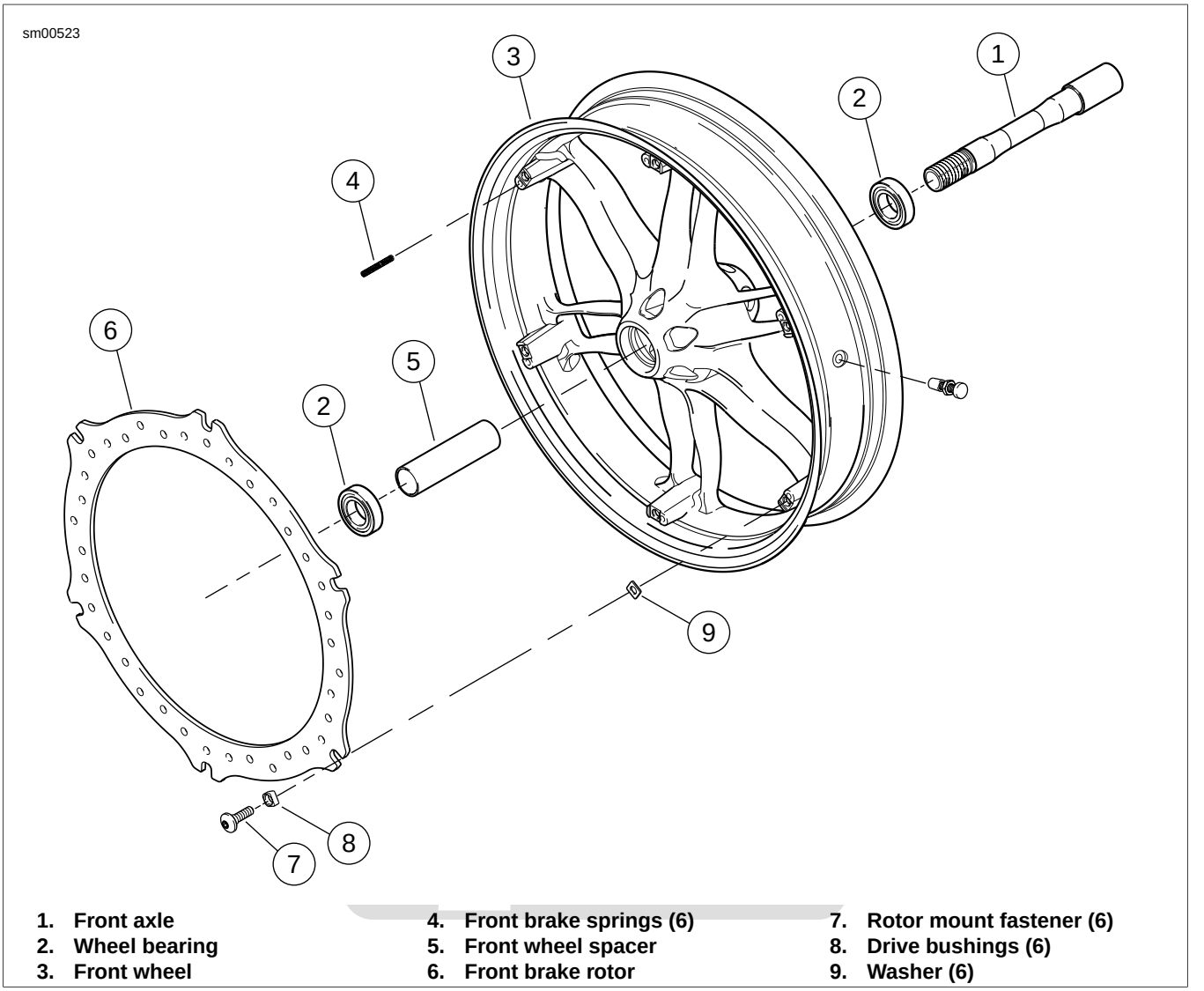


1. **Front axle**
2. **Wheel bearing**
3. **Front wheel**
4. **Front brake springs (6)**
5. **Front wheel spacer**
6. **Front brake rotor**
7. **Rotor mount fastener (6)**
8. **Drive bushings (6)**
9. **Washer (6)**

Figure 2-16. Front Wheel Assembly

Front Rotor Installation

1. See Figure 2-16. Install **new** springs (4).
2. Install **new** washers (9).
3. Install **new** drive bushings (8) into rotor.

NOTE

Note the identifying mark of rotor is up and radius end of drive bushing (8) toward center of wheel.

4. Align reference dot on front rotor with the valve stem.

CAUTION

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

5. Install **new** rotor mounting fasteners (7) in a crisscross pattern around the wheel to verify proper fitting between rotor, fastener and bushing. Tighten to 25-27 ft-lbs (34-37 Nm).

WARNING

Rotor mounting fasteners must be seated into drive bushings and drive bushings must be fitted into rotor properly. Failure to comply can affect braking ability and lead to brake failure which could result in death or serious injury. (00499b)

INSTALLATION

1. Raise front wheel to allow clearance for the caliper to swing under and inside the front rotor.

NOTE

To prevent cosmetic damage to the wheel, center caliper between spokes before installation.

2. See Figure 2-17. Install caliper.
   a. Align wheel so that rotor mounting fasteners straddle caliper.
   b. Rotate right front fork counterclockwise to align caliper with rotor.
   c. Lower front wheel into caliper assembly.

NOTE

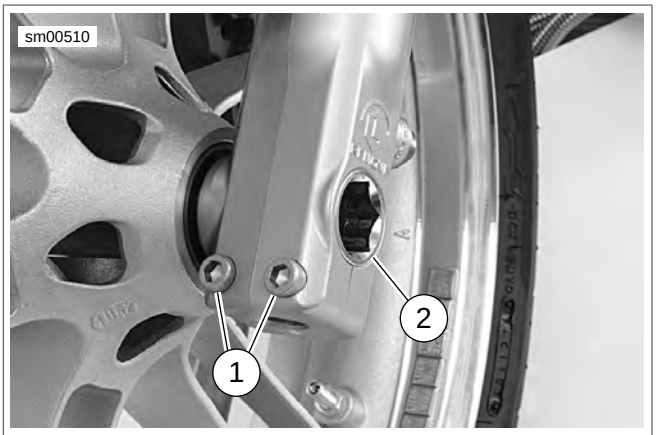
The front axle is left handed thread.

3. Install front axle.
   a. Apply LOCTITE ANTI-SEIZE LUBRICANT to axle.
   b. See Figure 2-18. With pinch fasteners loose, insert threaded end of axle (2) through left side fork, wheel hub and thread into right fork.
   c. Compress the front suspension to make sure it is free and not binding.
   d. Tighten axle (2) (metric) to 39-41 ft-lbs (53-56 Nm).
4. See Figure 2-18. Tighten the front axle pinch fasteners (1) to 20-22 ft-lbs (27-30 Nm).
5. Install right side fender fasteners. See 2.15 FENDERS.

NOTE

For Ulysses, locate and secure the front brake line grommet between the right side and the lower fender.

Figure 2-17. Front Wheel Removal/Installation



1. **Front axle pinch fasteners (2)**
2. **Axle (left handed thread)**

Figure 2-18. Front Wheel Mounting

REAR WHEEL 2.6

REMOVAL

1. Place a scissor jack under jacking point and raise rear wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.

NOTE

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

2. See Figure 2-19. Remove caliper carrier from swingarm by removing caliper carrier fasteners. See 2.14 REAR BRAKE CALIPER.
3. See Figure 2-23. Loosen rear axle pinch fastener (2).
4. Loosen rear axle (1) approximately 15 rotations to allow partial tension to be removed from rear drive system.
5. Remove idler pulley assembly. See 5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Removal.
6. Remove lower belt guard. See 2.37 BELT GUARDS.
7. On XB12Ss, XB12XT and XB12X models, it will be necessary to remove the rear fender. See 2.15 FENDERS.
8. Remove rear axle.
9. Slide drive belt out of the way and remove rear wheel. See 5.7 DRIVE BELT AND IDLER PULLEY for proper handling of drive belt.

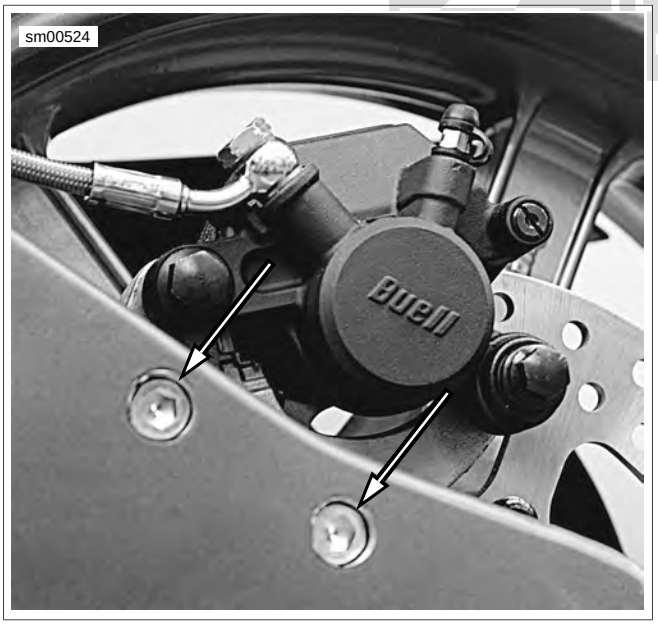


Figure 2-19. Rear Brake Caliper Carrier Fasteners

CLEANING AND INSPECTION

⚠WARNING

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

1. Inspect all parts for damage or excessive wear.
2. Inspect brake rotor. See 1.7 BRAKE SYSTEM MAINTENANCE and 2.14 REAR BRAKE CALIPER.

DISASSEMBLY

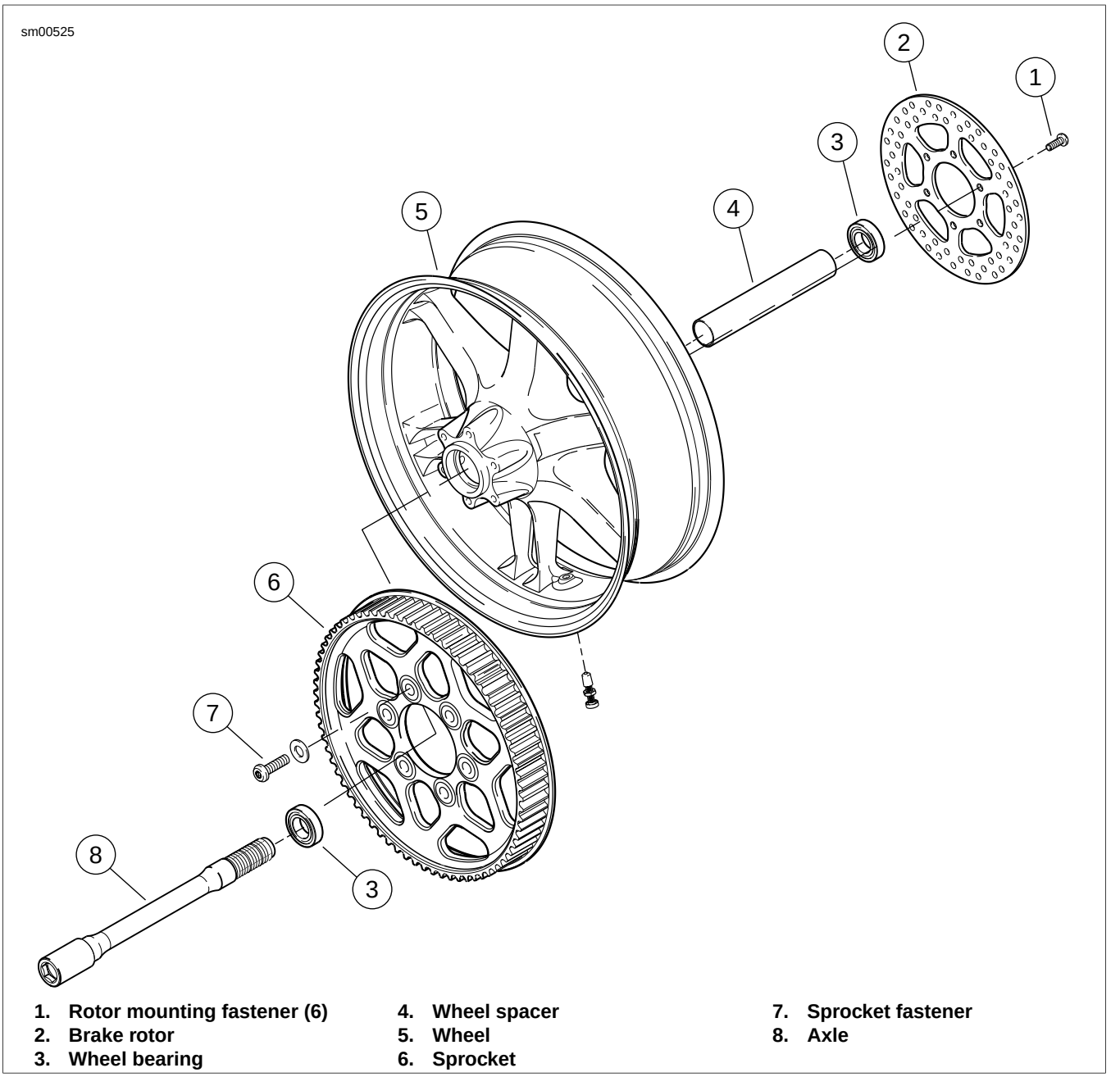
PART NUMBER	TOOL NAME
B43993-8	BUSHING AND BEARING PULLER
HD-44060A	WHEEL BEARING REMOVER AND INSTALLER

1. See Figure 2-20. Remove sprocket.
   a. Remove sprocket fasteners (7) and washers. Discard fasteners.
   b. Remove sprocket (6) from wheel.
2. Remove rear rotor.
   a. Remove and discard rotor mounting fasteners (1).
   b. Remove and inspect brake rotor (2) for wear and warping. See 1.7 BRAKE SYSTEM MAINTENANCE, Brake Rotor Thickness and 2.14 REAR BRAKE CALIPER.
3. Remove rear wheel bearings using BUSHING AND BEARING PULLER (Part No. B43993-8) and WHEEL BEARING REMOVER AND INSTALLER (Part No. HD-44060A).

NOTE

The procedure for the rear wheel bearing removal is the same as front wheel bearing removal. See 2.5 FRONT WHEEL, Disassembly.

4. Remove rear wheel spacer (4).



1. **Rotor mounting fastener (6)**
2. **Brake rotor**
3. **Wheel bearing**
4. **Wheel spacer**
5. **Wheel**
6. **Sprocket**
7. **Sprocket fastener**
8. **Axle**

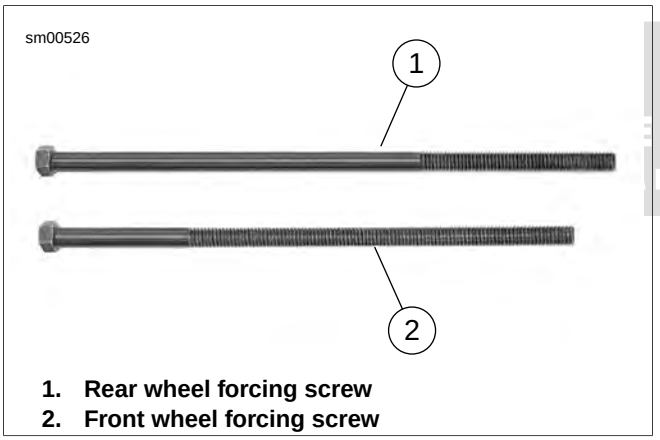
Figure 2-20. Rear Wheel Assembly

ASSEMBLY

PART NUMBER	TOOL NAME
B-43993-10	FRONT WHEEL BEARING INSTALLER
B-43993-11 FRONT WHEEL AND B-43993-12 REAR WHEEL	BACKING PLATES
B-43993-50A	WHEEL BEARING REMOVER/INSTALLER KIT
B-43993-7	FRONT WHEEL BEARING REMOVER COLLET
B-43993-8	REAR WHEEL BEARING REMOVER COLLET
B-43993-9	REAR WHEEL BEARING INSTALLER
HD-39302	STEERING HEAD BEARING RACE INSTALLER

⚠WARNING

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



1. **Rear wheel forcing screw**
2. **Front wheel forcing screw**

Figure 2-21. Forcing Screws Used for Front and Rear Wheel Bearing Installation

NOTES

- *Press the rotor side bearing in first ensuring it is seated on the shoulder of the wheel. Followed by pressing the alternate side bearing until it contacts the spacer.*
- *See Figure 2-21. When installing rear wheel bearings it is necessary to use the FORCING SCREW (1) from the STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).*
- *The WHEEL BEARING REMOVER/INSTALLER KIT (Part No. B-43993-50A) consists of the FRONT WHEEL BEARING REMOVER COLLET (Part No. B-43993-7), REAR WHEEL BEARING REMOVER COLLET (Part No. B-43993-8), REAR WHEEL BEARING INSTALLER (Part No. B-43993-9), FRONT WHEEL BEARING INSTALLER (Part No. B-43993-10) and BACKING PLATES (Part No. B-43993-11 front wheel and B-43993-12 rear wheel).*
- *The procedure for the rear wheel bearing installation is the same as front wheel bearing installation. See 2.5 FRONT WHEEL, Assembly.*

1. See Figure 2-20. Install wheel bearing (3) on rotor side of motorcycle.
2. Install rear wheel spacer (4).
3. Install wheel bearing (3) on sprocket side of motorcycle.

CAUTION

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

4. Install sprocket.
   a. Position sprocket (6) on wheel (5) keeping lip of sprocket facing the inside.
   b. Install **new** sprocket fasteners (7) and washers tightening to 35-37 ft-lbs (47-50 Nm).

CAUTION

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

5. Install rear rotor (2).
   a. Position rear brake rotor (2) on wheel (5).
   b. Install brake rotor (2) with **new** rotor mounting fasteners (1) and tighten to 25-27 ft-lbs (34-37 Nm).

INSTALLATION

1. Center rear wheel in the swingarm at the same time sliding the drive belt onto the rear sprocket.
2. With wheel centered in swingarm, lower motorcycle to align swingarm and wheel hub.
3. Apply ANTI-SEIZE LUBRICANT to hole in right side of swingarm where rear axle slides through.

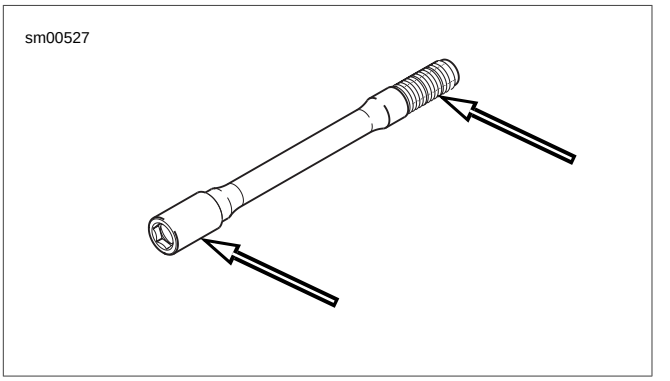


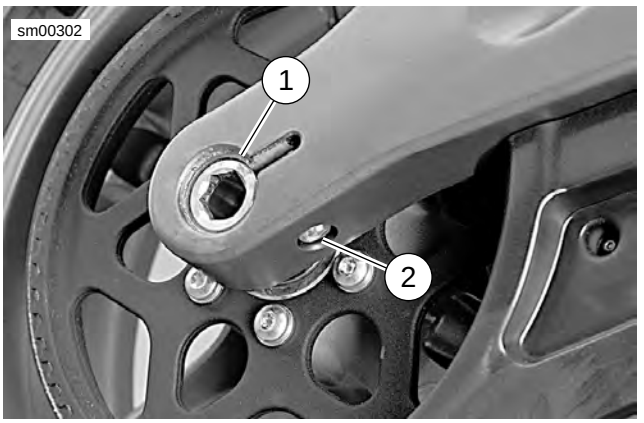
Figure 2-22. Anti-Seize Lubricant Location

4. See Figure 2-22. Coat the axle with ANTI-SEIZE LUBRICANT.

5. Slide axle through right side of swingarm and wheel hub and thread partially into swingarm on left side.
6. Install idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation.

NOTE

Never tighten rear axle with swingarm brace removed.



1. Axle
2. Pinch bolt

Figure 2-23. Rear Axle

7. See Figure 2-23. Tighten rear axle (1) to 23-27 ft-lbs (31.2-36.6 Nm), back off two full turns and then retighten to 48-52 ft-lbs (65-70.5 Nm).
8. Tighten pinch fastener (2) on right side of swingarm to 40-45 ft-lbs (54-61 Nm).
9. Install lower belt guard. See 2.37 BELT GUARDS.

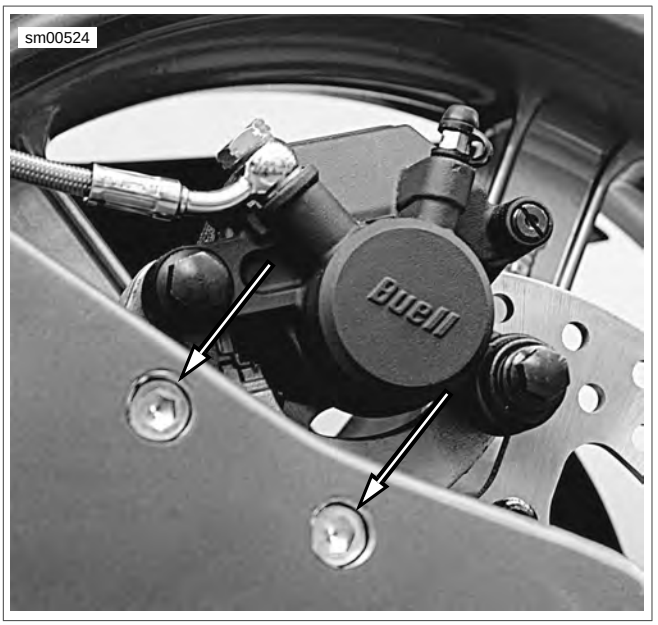


Figure 2-24. Rear Brake Caliper Carrier Fasteners

10. See Figure 2-24. Install caliper carrier and tighten fastener to 24-26 ft-lbs (32-35 Nm). See 2.14 REAR BRAKE CALIPER.
11. On XB12Ss, XB12XT and XB12X models, install the rear fender. See 2.15 FENDERS.

NOTE

The brake pads may become misaligned and will not allow the rotor to slide into the caliper. Press on the brake pad from the outside of the caliper to straighten out the pad.

⚠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)

DIGITAL TECHNICIAN HARLEY-DAVIDSON

TIRES 2.7

GENERAL

Tires should be inspected for punctures, cuts, breaks and wear before every ride.

New tires should be stored in a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.

WARNING

Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the demounted tire by a Buell dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (130 km/h). Failure to follow this warning could result in death or serious injury. (00118a)

WARNING

Buell 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. (00512b)

WARNING

Be sure tires are properly inflated, balanced and have adequate tread. Inspect your tires regularly and see a Buell dealer for replacements. Riding with excessively worn, unbalanced or under-inflated tires can adversely affect stability and handling, which could result in death or serious injury. (00114a)

WARNING

Use only Buell approved tires. See a Buell dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00133a)

WARNING

Tires are a critical safety component. Contact a Buell dealer for tire repair or replacement. Improper tire service can adversely affect stability and handling, which could result in death or serious injury. (00134a)

WARNING

Buell tires are equipped with wear bars that run horizontally across the tread. When wear bars become visible and only 1/32 in. (0.8 mm) tread depth remains, replace tire immediately. Using a worn tire can adversely affect stability and handling, which could result in death or serious injury. Use only Buell approved replacement tires. (00497d)

SPECIFICATIONS

WARNING

Use only Buell approved tires. See a Buell dealer. Using non-approved tires can adversely affect stability, which could result in death or serious injury. (00133a)

See Figure 2-25. Tire sizes are molded on the sidewall. Rim size and contour are marked on the rim's exterior surface.

Example: **J17 X 3.50 MT DOT**

- **J** designates the tire and rim standard.
- **17** is the normal diameter of the rim in inches, measured at the bead seat diameter.
- **3.50** is the width of the bead seat measured in inches.
- **MT** designates the rim type.
- **DOT** means that the rim meets Department of Transportation Federal Motor Vehicle Safety Standards.

Refer to Table 2-19.

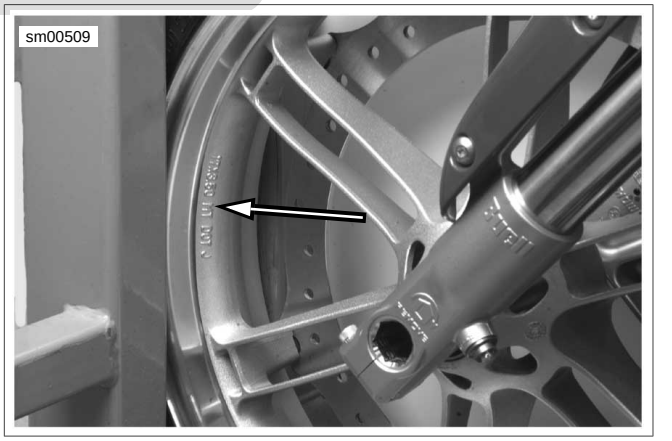


Figure 2-25. Rim Markings

Table 2-19. Tire Fitment-Tubeless Cast Wheels: Firebolt

MODEL	WHEEL SIZE	CONTOUR & RIM SIZE	RIM VALVE HOLE DIAMETER	TIRE SIZE
Firebolt	17 in. - Front	J17 x 3.50 MT DOT	0.33 in.	Pirelli Diablo Corsa III 120/70 ZR17
	17 in. - Rear	J17 x 5.50 MT DOT	0.33 in.	Pirelli Diablo Corsa III 180/55 ZR17

REMOVAL

1. Remove wheel from motorcycle. See 2.5 FRONT WHEEL or 2.6 REAR WHEEL.
2. Deflate tire.
3. See Figure 2-26. Loosen both tire beads from rim flange.

⚠WARNING

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

⚠WARNING

When mounting tires, do not exceed 35 psi to seat tire bead. Exceeding 35 psi can damage tire bead and lead to tire failure, resulting in death or serious injury. (00437b)

4. If a tire machine is not available, use tire tools (not sharp instruments), and start upper bead over edge of rim at valve. Repeat all around rim until first bead is over rim.
5. See Figure 2-27. Push lower bead into rim well on one side and insert tire tool underneath bead from opposite side. Pry bead over rim edge. Remove tire from rim.
6. Remove valve stem if it is damaged or leaks.

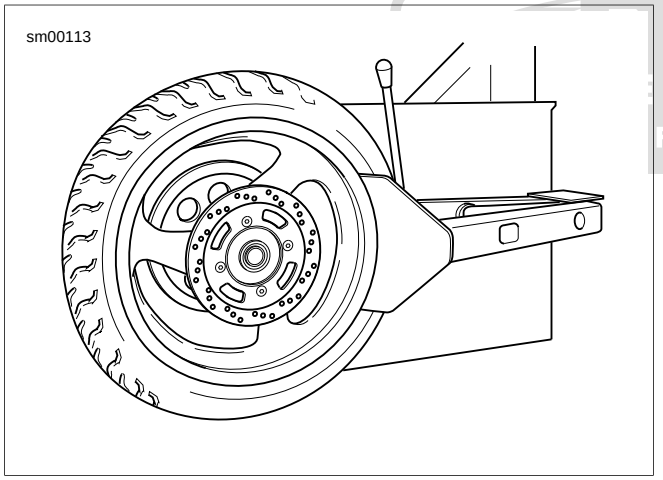


Figure 2-26. Loosening Beads from Rim Flange

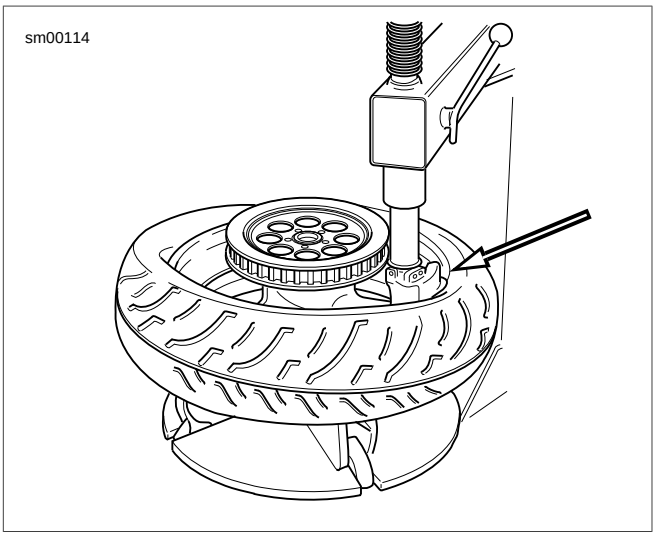


Figure 2-27. Pry Bead Over Rim Edge

CLEANING AND INSPECTION

1. Clean inside of tire with dry rag.
2. If rim is dirty or corroded, clean with a stiff wire brush.
3. Inspect tire for wear and damage. Replace worn or damaged tires. See 1.8 TIRES AND WHEELS.

INSTALLATION

⚠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)

NOTE

Always check both tire sidewalls for arrows indicating forward rotation. Some tires require different tire rotation depending on whether tire is used on front or rear wheel.

⚠WARNING

Buell 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. (00512b)

1. Damaged or leaking valve stems must be replaced.
2. Install valve stem and tighten valve stem nut to 40-44 **in-lbs** (4.5-4.9 Nm).
3. Thoroughly lubricate rim flanges and both beads of tire with tire lubricant.
4. See Figure 2-28. Starting at the valve stem, start first bead into the rim well using a bead breaker machine. If no machine is available, work bead on as far as possible by hand. Use a tire tool to pry the remaining bead over rim flange.

5. Start 180 degrees from valve stem hole and place second bead on rim. Work bead onto rim with tire tools, working toward valve in both directions.

⚠WARNING

Do not inflate tire beyond maximum pressure as specified on sidewall. Over inflated tires can blow out, which could result in death or serious injury. (00027a)

6. Apply air to stem to seat beads on rim.

⚠WARNING

When mounting tires, do not exceed 35 psi to seat tire bead. Exceeding 35 psi can damage tire bead and lead to tire failure, resulting in death or serious injury. (00437b)

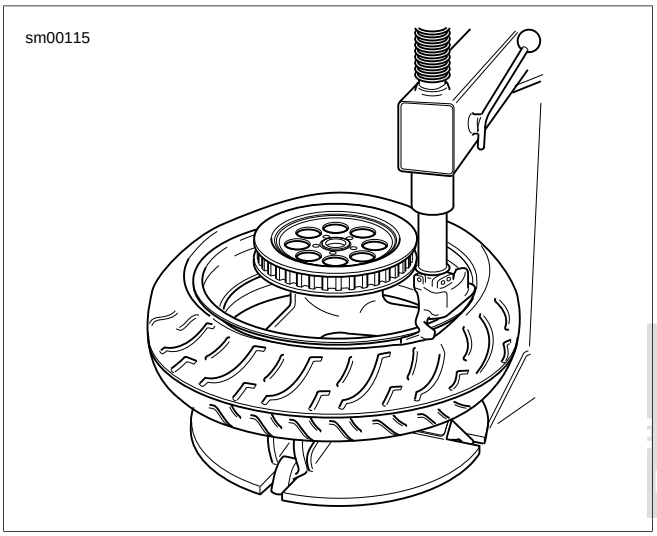


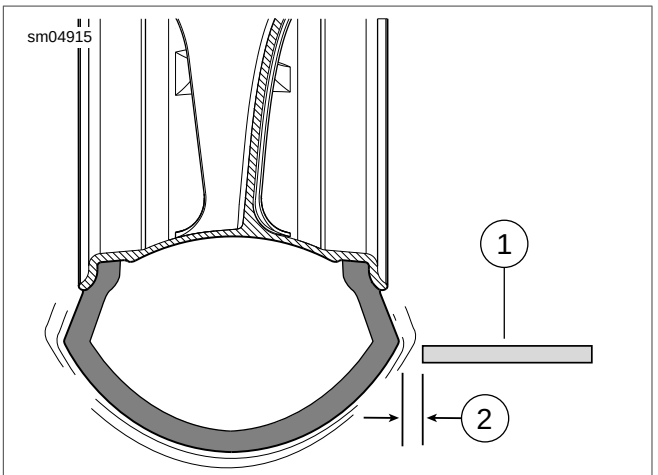
Figure 2-28. Starting Bead on Rim

Checking Tire Lateral Runout

1. See Figure 2-29. Turn wheel on axle and measure amount of displacement from a fixed point to tire sidewall.
2. Refer to Table 2-20. Check tire tread for appropriate lateral runout specification. If tire lateral runout is greater than specification, perform the following:
   a. Remove tire from rim.
   b. Check rim bead side runout. See 2.8 CHECKING CAST RIM RUNOUT. Replace rims not meeting specifications.
   c. Install tire and check again for tire tread lateral runout.

Table 2-20. Tire Runout

TIRE RUNOUT	IN.	MM
Radial	0.060	1.52
Lateral	0.080	2.03

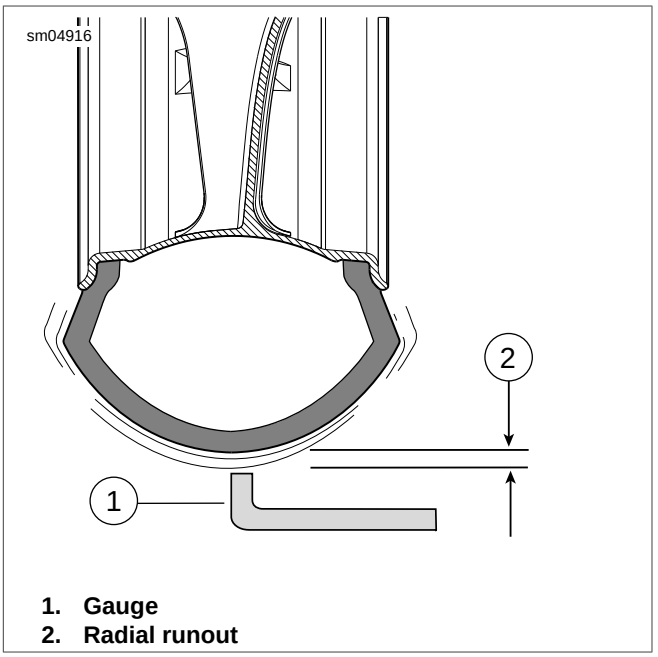


1. Gauge
2. Lateral runout

Figure 2-29. Lateral Runout

Checking Tire Radial Runout

1. See Figure 2-30. Turn wheel on axle and measure tread radial runout.
2. Refer to Table 2-20. Check tire tread for appropriate radial runout specification. If radial runout is greater than specification, perform the following:
   a. Remove tire from rim.
   b. Check rim bead runout. See 2.8 CHECKING CAST RIM RUNOUT. Replace rims not meeting specifications.
   c. Install tire and check tire tread radial runout again.



1. Gauge
2. Radial runout

Figure 2-30. Radial Runout

ADJUSTMENT

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

Wheel Balancing

Wheel balancing is recommended to improve handling and reduce vibration, especially at high road speeds.

In most cases, static balancing using WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80) will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, can be used to produce finer tolerances for better high-speed handling characteristics. Follow the instructions supplied with the balance machine you are using.

Wheels should be balanced to within 1/4 oz. (7 g) at 60 MPH (97 KM/H).

See Figure 2-31. Use only WHEEL WEIGHTS (Part No. 43692-94Y) which have special self-adhesive backings. Apply WHEEL WEIGHTS to the flat surface of the wheel rim.

Refer to Table 2-21 for maximum weight permissible to accomplish balance.

1. Make sure that area of application is completely clean, dry and free of oil and grease.
2. Remove paper backing from weight. For additional adhesive strength, apply three drops of LOCTITE SUPERBONDER 420 to adhesive side of weight.
3. On the front wheel, locate a flat surface on the **right side** of the wheel rim. On the rear wheel locate a flat surface. Press weight firmly in place, holding for ten seconds.
4. Allow eight hours for adhesive to cure completely before using wheel.

NOTE

If wheel assembly is out of specification (1 oz. front, 2 oz. rear) rotate tire on rim and rebalance until wheel is within specification.

Table 2-21. Maximum Weight Applied To Cast Wheels

WHEEL	MAXIMUM WEIGHT
Front	1.0 oz. (28 g)
Rear	2.0 oz. (56 g)

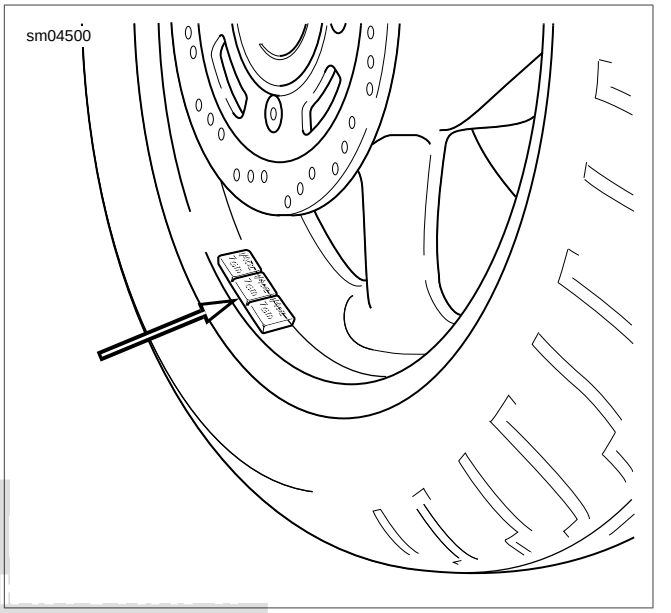


Figure 2-31. Wheel Weights

CHECKING CAST RIM RUNOUT 2.8

GENERAL

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

Before installing a **new** tire, check wheels for lateral and radial runout.

Rim Lateral Runout

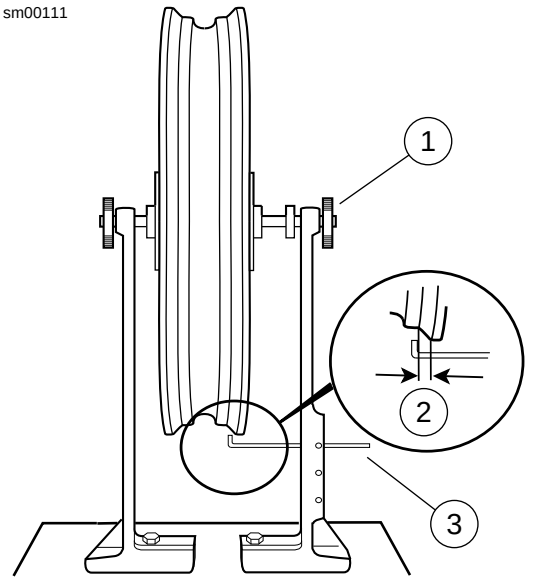
1. See Figure 2-32. Install truing arbor in wheel hub and place wheel in the WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).
2. Tighten arbor nuts so hub will turn on its bearings.
3. Check rim lateral runout by placing a gauge rod or dial indicator near the rim bead. Replace wheel if lateral runout exceeds specification. Refer to Table 2-22.

Rim Radial Runout

1. See Figure 2-33. Install truing arbor in wheel hub and place wheel in the WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).
2. Tighten arbor nuts so hub will turn on its bearings.
3. Check radial runout as shown. Replace wheel if runout exceeds specification. Refer to Table 2-22.

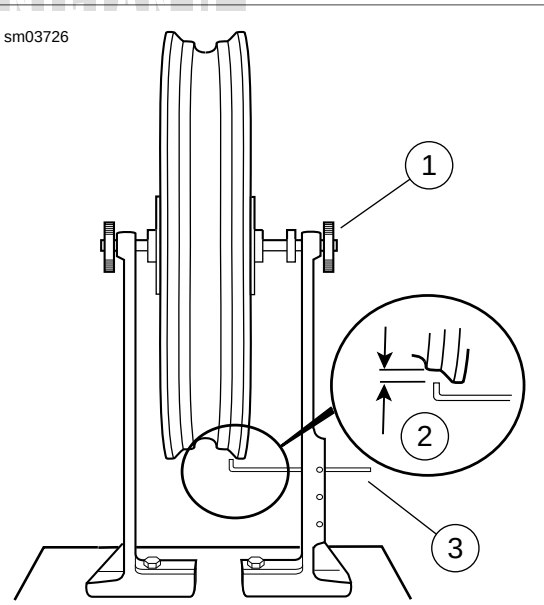
Table 2-22. Wheel Rim Runout

MAXIMUM RUNOUT	IN.	MM
Lateral	0.030	0.76
Radial	0.030	0.76



1. **Wheel truing and balancing stand (HD-99500-80)**
2. **Lateral runout**
3. **Gauge rod**

Figure 2-32. Checking Cast Rim Lateral Runout



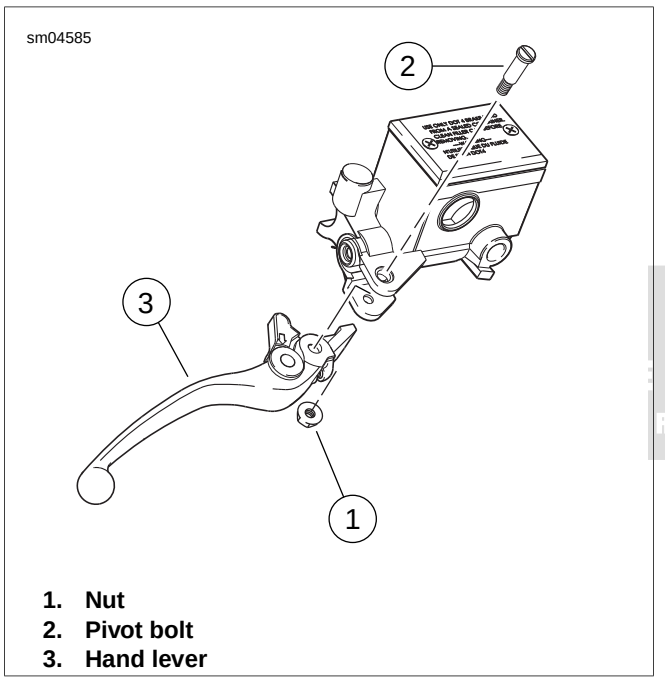
1. **Wheel truing and balancing stand**
2. **Radial runout**
3. **Gauge rod**

Figure 2-33. Checking Cast Wheel Radial Runout

FRONT BRAKE: EIGHT PISTON CALIPER 2.9

FRONT BRAKE HAND LEVER

1. See Figure 2-34. Remove pivot bolt nut (1) and pivot bolt (2) to detach the brake hand lever (3).
2. To install, lubricate pivot bolt with LOCTITE ANTI-SEIZE.
3. Align hole in hand lever with pivot hole in master cylinder/reservoir bracket.
4. Install pivot bolt (2) through bracket and hand lever and thread into bracket.
5. Tighten pivot bolt to 4.4-13.2 **in-lbs** (0.5-1.5 Nm).
6. Thread nut (1) onto pivot bolt and tighten nut to 43-61 **in-lbs** (4.9-6.9 Nm).
7.



1. **Nut**
2. **Pivot bolt**
3. **Hand lever**

Figure 2-34. Front Brake Lever

MASTER CYLINDER/RESERVOIR: REMOVAL

NOTE

It is not necessary to drain the brake fluid to remove the master cylinder assembly from the handlebars. Do not disassemble the master cylinder unless problems are experienced.

⚠CAUTION

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

CAUTION

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

1. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of clear plastic tubing over caliper bleeder valve. Place free end in the container.
   b. Open bleeder valve approximately 1/2-turn.
   c. Pump brake hand lever to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
2. See Figure 2-35. Disconnect the brake light switch spade connectors from the brake light switch.

NOTE

Damaged banjo bolt seating surfaces will leak when assembled. Prevent damage to seating surfaces by carefully removing brake line components.

3. See Figure 2-36. Remove the banjo bolt and two copper washers to disconnect brake line from master cylinder. Discard copper washers.
4. See Figure 2-37. Remove mounting clamp fasteners to detach master cylinder/reservoir from handlebar.

Figure 2-35. Brake Light Switch Spade Connectors

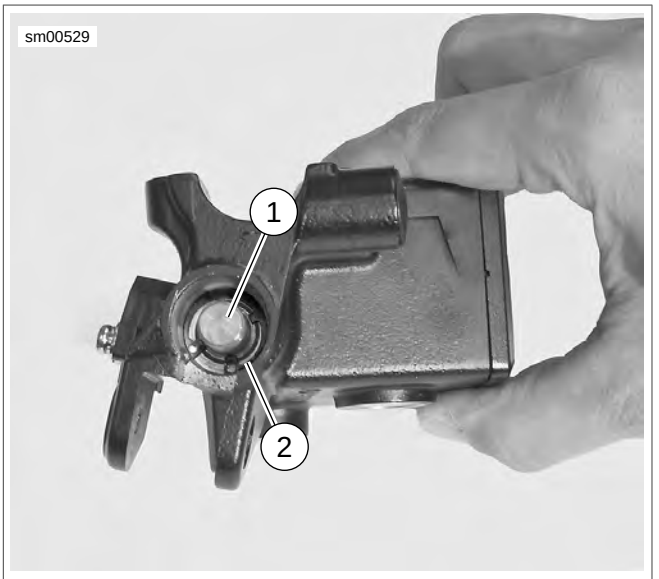
Figure 2-36. Master Cylinder/Reservoir Banjo Bolt

Figure 2-37. Handlebar Clamps

MASTER CYLINDER/RESERVOIR: REPAIR

Disassembly

1. Remove reservoir cover by removing cover fasteners.
2. Drain and discard remaining brake fluid according to local laws.
3. Remove rubber boot and discard.
4. See Figure 2-38. Depress piston assembly (1) and remove internal circlip (2) and discard.
5. Remove piston and spring from master cylinder and discard.



1. **Piston assembly**
2. **Circlip**

Figure 2-38. Piston Assembly in Master Cylinder

Cleaning and Inspection

WARNING

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

WARNING

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

1. Clean all parts with denatured alcohol or **D.O.T. 4 brake fluid**.

NOTE

Do not contaminate with mineral oil or other solvents.

2. Wipe dry with a clean, lint free cloth.
3. See Figure 2-39. Blow out the fluid passages and piston bore with compressed air.

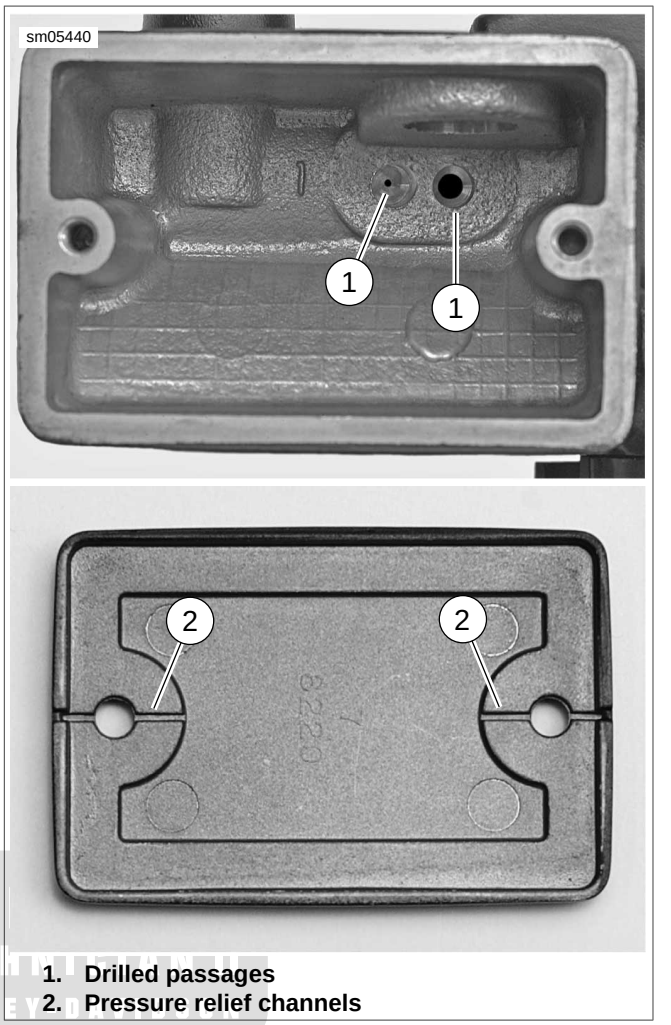
NOTE

See Figure 2-40. Do not use a wire or similar instrument to clean the drilled passages (1) in the bottom of the reservoir.

4. Inspect the piston bore in master cylinder housing. Replace the housing if any scoring, pitting or corrosion is present.

5. Inspect the outlet port that mates with the fluid line banjo fitting. Replace the housing if any scratches, dents or other damage is present.
6. Clean the reservoir diaphragm, stiffener and cover.
7. Clean the pressure relief channels (2) in the cover.

Figure 2-39. Piston Bore and Fluid Passages



1. **Drilled passages**
2. **Pressure relief channels**

Figure 2-40. Fluid Passages and Relief Channels

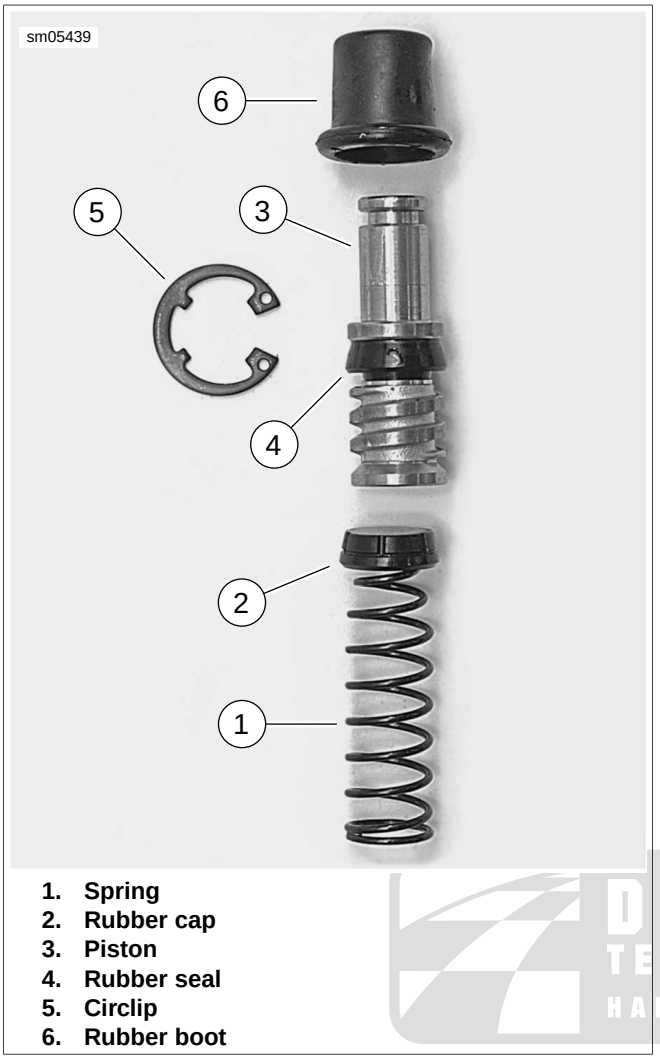
Assembly

1. Lubricate master cylinder bore, piston and piston seals with D.O.T. 4 brake fluid.
2. Push the rubber seal onto the piston of a master cylinder piston set.
3. Fit the rubber cap to the small end of the spring.

⚠WARNING

Be sure circlip snaps in place. An unsecured circlip can cause brake failure, which could result in death or serious injury. (00513b)

4. See Figure 2-41. Insert the spring (1) with cap (2) into master cylinder bore.
5. Insert the piston (3) with seal (4).
6. Secure the piston with circlip (5).
7. Fit rubber boot (6) over the piston and work the top ridge on the rubber boot into the groove in the piston.



1. **Spring**
2. **Rubber cap**
3. **Piston**
4. **Rubber seal**
5. **Circlip**
6. **Rubber boot**

Figure 2-41. Piston Set

MASTER CYLINDER/RESERVOIR: INSTALLATION

1. See Figure 2-42. Install master cylinder/reservoir to handlebar with clamp (1) and fasteners (2).
2. Position for rider posture and tighten to 80-90 **in-lbs** (9.0-10.2 Nm).
3. If removed, install the front brake light switch (3).
   a. Install brake light switch fastener (4) and washer (5).
   b. Tighten to 7-10 **in-lbs** (0.8-1 Nm).
   c. Push brake light socket connectors into brake light switch spade terminals.
   d. Test switch action. Tang on switch must release when hand lever is moved.

CAUTION

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

4. Connect the brake fluid line (6) to the master cylinder/reservoir using two **new** copper washers (7) and banjo bolt (8) and tighten to 16-20 ft-lbs (22-27 Nm).

NOTE

*Use only **new** copper crush banjo washers with D.O.T. 4 brake fluid. Earlier silver banjo washers are not compatible with D.O.T. 4 fluid and will not seal properly over time.*

CAUTION

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

5. Protect the body work from the brake fluid.
6. With the master cylinder in a level position, add D.O.T. 4 brake fluid until the level is above the LOWER line on the sight gauge.

⚠WARNING

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

7. To verify operation of the relief port, actuate the brake lever with the reservoir cover removed. A slight spurt of fluid will break the surface if the relief port is open.
8. Bleed the front brake fluid lines. See 1.7 BRAKE SYSTEM MAINTENANCE.
9. Attach reservoir cover (9), gasket (10) and diaphragm (11). Tighten cover fasteners (12) to 9-18 **in-lbs** (1-2 Nm).

⚠WARNING

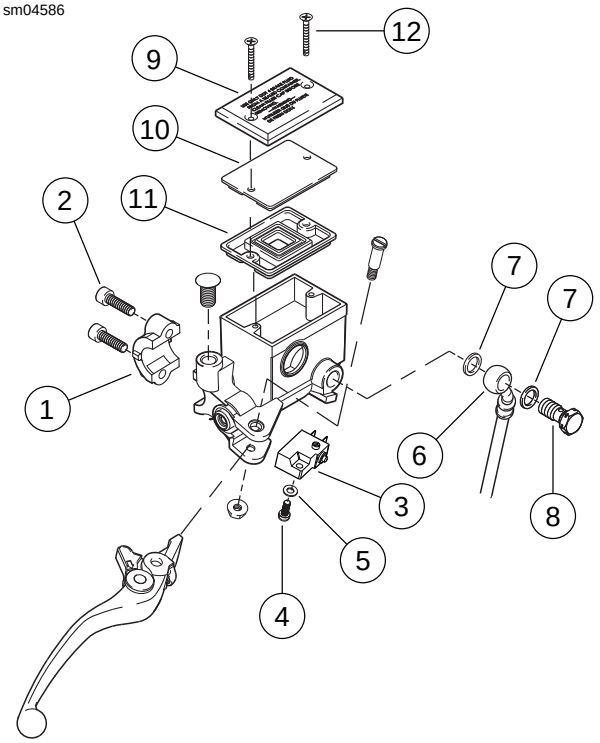
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

⚠WARNING

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

10. Test the brake light.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Clamp**
2. **Fasteners**
3. **Brake light switch**
4. **Fastener**
5. **Washer**
6. **Brake line**
7. **Copper washers**
8. **Banjo bolt**
9. **Reservoir cover**
10. **Gasket**
11. **Diaphragm**
12. **Fasteners**

Figure 2-42. Master Cylinder/Reservoir Brake Lever Assembly

FRONT BRAKE FLUID LINE

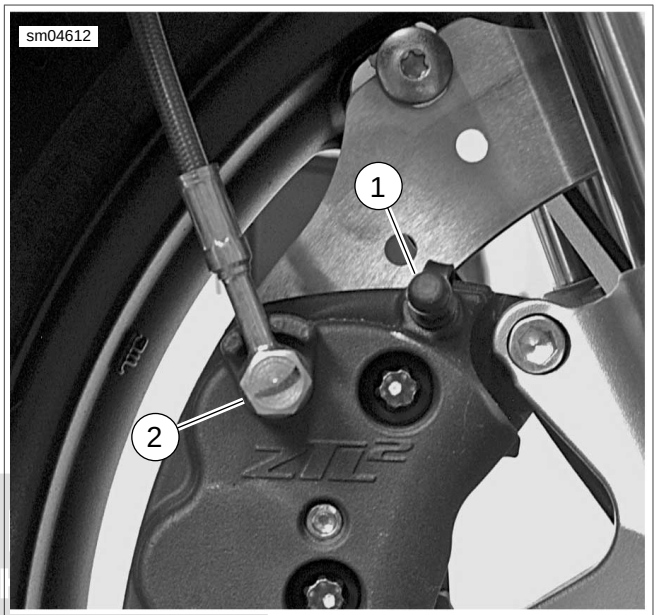
Removal

1. Drain brake fluid. Discard used fluid according to local laws.
   a. See Figure 2-43. Remove the bleeder valve cap and install a length of plastic tubing over valve (1). Place the free end in the collection pan.
   b. Open the bleeder valve about 1/2-turn.
   c. Pump the hand lever to drain the brake fluid.
   d. Tighten the bleeder valve to 36-60 **in-lbs** (4-7 Nm).

NOTE

Damaged banjo bolt seating surfaces will leak when reassembled. Carefully remove banjo bolts to prevent damage to seating surfaces.

2. Remove caliper banjo bolt (2) and two copper washers to disconnect brake line from caliper. Discard copper washers.
3. Remove master cylinder banjo bolt and two copper washers to disconnect brake line from master cylinder/reservoir. Discard copper washers.
4. See Figure 2-46. Remove P-clamp attaching brake line to right side of lower fork clamp.
5. Carefully inspect the brake fluid line for dents, cuts, chaffing or other defects. Replace damaged brake lines.



1. **Bleeder valve**
2. **Banjo bolt**

Figure 2-43. Bleeder Valve and Banjo Bolt

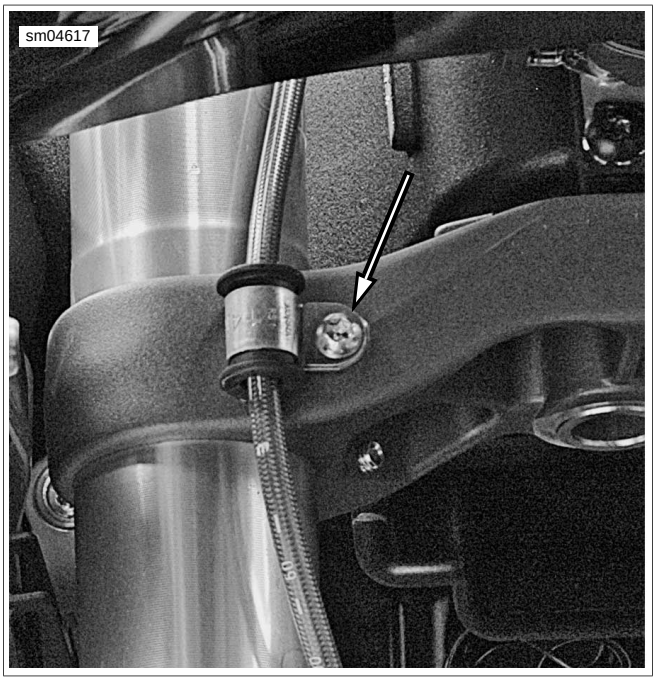


Figure 2-44. Front Brake Fluid Line P-Clamp

Installation

1. See Figure 2-45. Connect the brake fluid line to master cylinder/reservoir using two **new** copper washers (1) and a banjo bolt (2).
2. Finger tighten the banjo bolt into master cylinder/reservoir.
3. Route the fluid line from the master cylinder to the caliper in front of the lower fork clamp and between the forks.

NOTE

*Use only **new** copper crush washers with D.O.T. 4 brake fluid.*

CAUTION

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

4. Connect the brake fluid line to caliper using two **new** copper washers and a banjo bolt.
5. Finger tighten the banjo bolt into the front caliper.
6. Tighten the master cylinder/reservoir banjo bolt to 16-20 ft-lbs (22-27 Nm).
7. Tighten the caliper banjo bolt to 16-20 ft-lbs (22-27 Nm).

WARNING

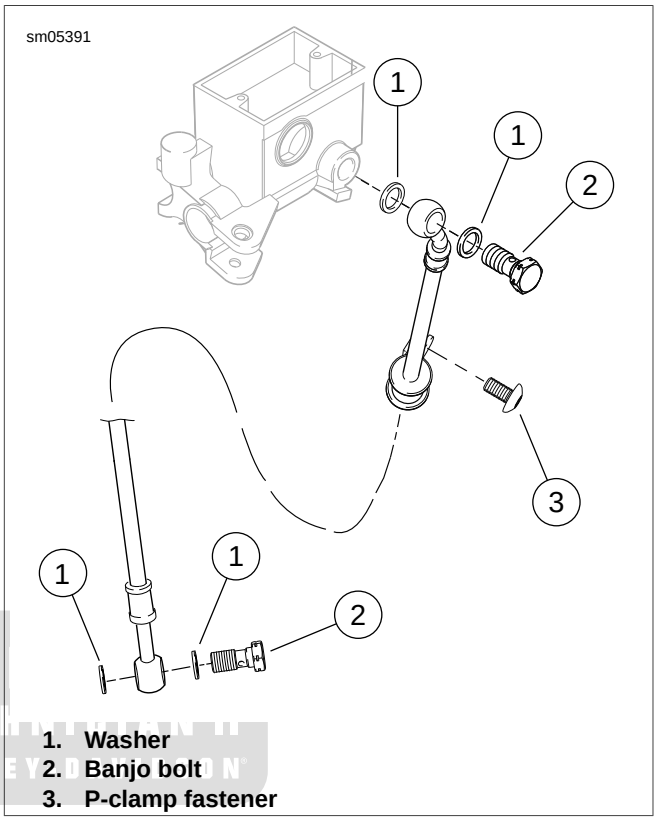
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

8. Fill the master cylinder/reservoir and bleed the brakes. See 1.7 BRAKE SYSTEM MAINTENANCE.
9. Install and tighten the P-clamp (3) on the front fork clamp. Tighten to 36-60 **in-lbs** (4-7 Nm).

WARNING

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

10. Test the brake lamp.



1. **Washer**
2. **Banjo bolt**
3. **P-clamp fastener**

Figure 2-45. Brake Fluid Line

CALIPER: REMOVAL AND INSTALLATION

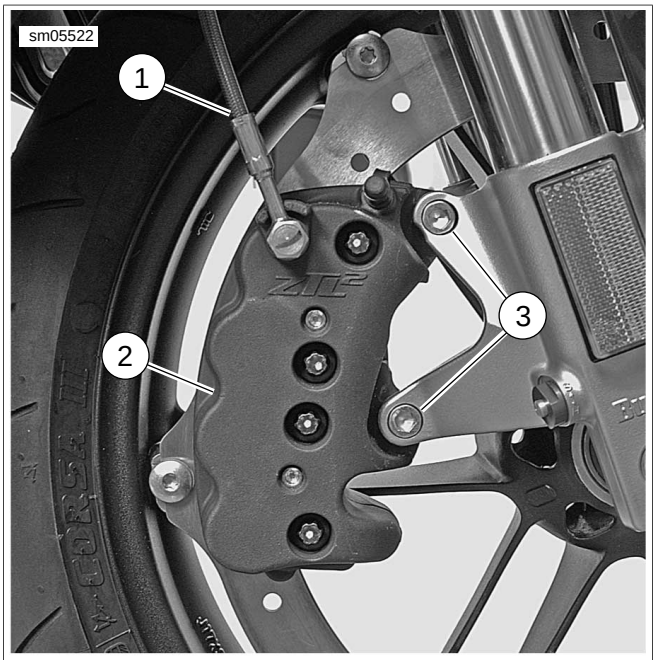
Removal

1. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake hand lever to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

2. See Figure 2-46. Disconnect brake line (1) at caliper (2).
3. Remove caliper mounting fasteners (3).
4. Slide caliper down the rotor to clear fork lower and then remove off rotor.



1. **Brake line**
2. **Front brake caliper**
3. **Caliper mounting fastener (2)**

Figure 2-46. Front Brake Caliper Mounts

Installation

1. If removed, install pad spring and brake pads.
2. Tighten pin hanger set to 11-15 ft-lbs (15-19.6 Nm).
3. Fit pads to rotor and slide the caliper over the rotor up to the mount.
4. Apply LOCTITE 271 (red) to fasteners and install caliper.
5. Tighten caliper mounting fasteners to 35-37 ft-lbs (47-50 Nm).

CAUTION

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

6. Install the brake fluid line to the caliper. See 2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line.
7. Bleed the fluid line. See 1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes.

WARNING

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

WARNING

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

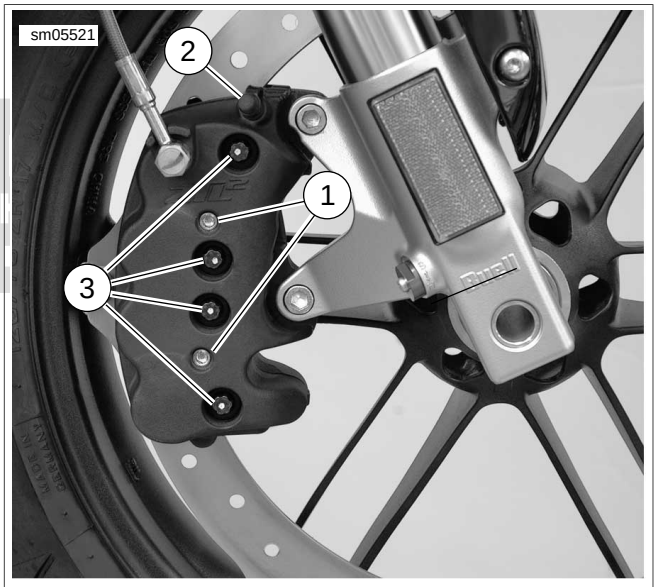
8. Test the brake light.

CALIPER: REPAIR

PART NUMBER	TOOL NAME
B-42887	BRAKE CALIPER PISTON REMOVER

Disassembly

1. See Figure 2-47. Remove pin hanger set (1), brake pads and caliper pad spring.
2. Split caliper by removing caliper fasteners (3).
3. See Figure 2-49. Remove and discard two small stopper o-rings (11) on the pin hangers.
4. See Figure 2-48. Remove pistons using a BRAKE CALIPER PISTON REMOVER (Part No. B-42887).
5. See Figure 2-49. Remove and discard piston o-rings (6).



1. **Front caliper pin hanger (2)**
2. **Bleeder valve**
3. **Caliper fasteners (4)**

Figure 2-47. Brake Pad Pin Hangers

Figure 2-48. Removing Pistons

Clean and Inspect

⚠CAUTION

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

CAUTION

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

NOTE

Do not contaminate with mineral oil or other solvents.

1. Clean all parts with denatured alcohol or **D.O.T. 4 brake fluid**.

⚠WARNING

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

2. Blow out drilled passages and bore with a clean air supply.
3. Wipe dry with a clean, lint free cloth.
4. Carefully inspect all components. Replace any parts that appear damaged or worn. Do not hone caliper piston bore.

⚠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)

5. Measure and inspect brake pads and rotor. Replace as required. See 1.7 BRAKE SYSTEM MAINTENANCE.

Assembly

1. See Figure 2-49. Lubricate **new** o-rings (6), pistons (7) and caliper piston bores with **D.O.T. 4 BRAKE FLUID**.
2. Install two **new** o-rings in grooves of each piston bore.
3. Install pistons in each piston bore.
4. Install **new** o-rings (10) between caliper halves.
5. Clamp caliper together with caliper fasteners (2) and tighten to 18-22 ft-lbs (24.5-29.4 Nm).
6. Install two **new** stopper o-rings on the pin hangers.

Figure 2-49. Intake Flange Gasket

FRONT BRAKE: SIX PISTON CALIPER 2.10

MASTER CYLINDER RESERVOIR REMOVAL

1. On XB9SX, XB12X, XB12XT and XB12XP models, remove the right deflector. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.

⚠CAUTION

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

CAUTION

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

NOTE

Step 2 is not required for removing the master cylinder assembly from the handlebars. Do not disassemble master cylinder unless problems are experienced.

2. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake hand lever to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).

NOTE

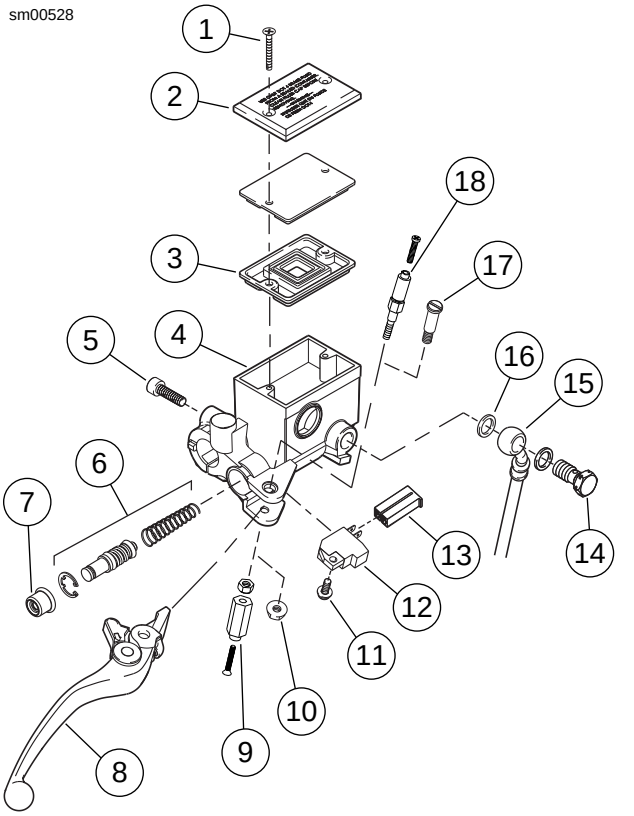
Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

3. See Figure 2-50. Remove the banjo bolt (14) (metric) and two copper washers (16) to disconnect brake line (15) from master cylinder (4). Discard copper washers.
4. Unplug terminal (13) to detach brake lamp switch (12).

NOTE

The individual parts of the brake lamp switch are not serviceable. Replace switch upon failure.

5. Remove mounting clamp fasteners (5) (metric) to detach master cylinder reservoir (4) from handlebar.



1. **Reservoir cover fasteners (2)**
2. **Reservoir cover**
3. **Reservoir cover gasket**
4. **Master cylinder reservoir**
5. **Master cylinder housing fasteners (metric)**
6. **Piston assembly**
7. **Rubber boot**
8. **Brake hand lever**
9. **Pivot shaft riser, nut, and screw (XB9SX and Ulysses models only)**
10. **Pivot bolt nut (metric) (models except XB9SX and Ulysses models)**
11. **Brake switch fastener**
12. **Brake switch**
13. **Brake switch terminal**
14. **Banjo bolt (metric)**
15. **Brake line**
16. **Copper washers**
17. **Pivot bolt (all models except XB9SX and Ulysses models)**
18. **Brake pivot shaft (XB9SX and Ulysses models only)**

Figure 2-50. Front Brake Hand Lever Assembly

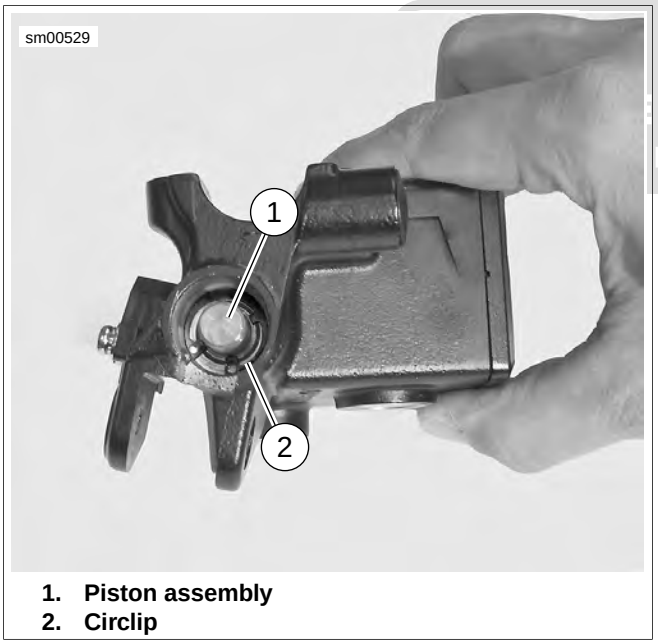
MASTER CYLINDER AND HAND LEVER DISASSEMBLY

Brake Hand Lever

1. See Figure 2-50. On XB9SX, XB12XT, XB12XP and XB12X models, remove the pivot shaft riser and nut (9) from the brake pivot shaft (18) to detach the brake hand lever (8).
2. On all other models, remove pivot bolt nut (10) (metric) and pivot bolt (17) to detach the brake hand lever.
3. Detach front brake hand lever (8).
4. Detach front brake switch (12) by removing the brake switch fastener (11).

Front Master Cylinder

1. See Figure 2-50. Remove reservoir cover (2) by removing cover fasteners (1).
2. Drain and discard used brake fluid according to local laws.
3. Remove rubber boot (7) and discard.
4. See Figure 2-51. Depress piston assembly (1) and remove internal circlip (2) and discard.
5. See Figure 2-50. Remove piston assembly (6) from master cylinder reservoir (4) and discard.



1. **Piston assembly**
2. **Circlip**

Figure 2-51. Piston Assembly in Master Cylinder

CLEANING AND INSPECTION

WARNING

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

1. Clean all parts with denatured alcohol or **D.O.T. 4 BRAKE FLUID**. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages in bottom of reservoir.
2. Inspect piston bore in master cylinder housing for scoring, pitting or corrosion. Replace housing if any of these conditions are found.
3. Inspect outlet port that mates with brake line fitting. As a critical sealing surface, replace housing if any scratches, dents or other damage is noted.

MASTER CYLINDER AND HAND LEVER ASSEMBLY

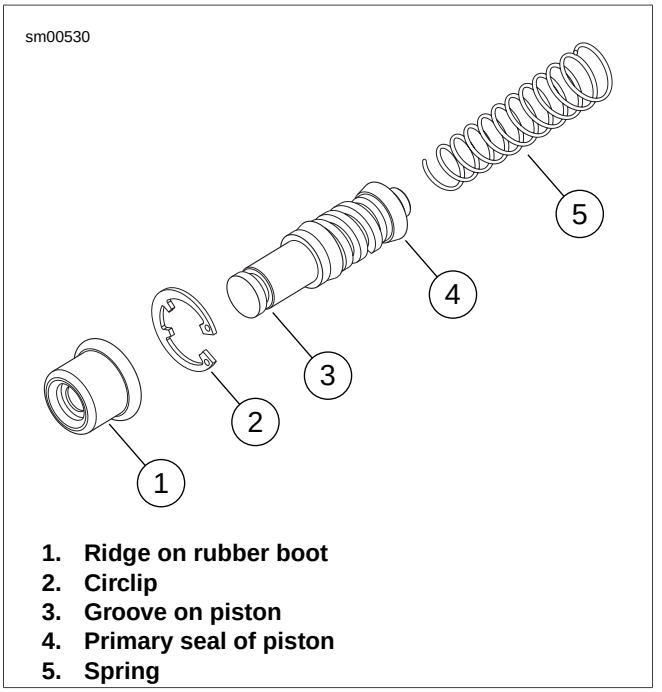
Front Master Cylinder

1. Obtain PISTON ASSEMBLY KIT.
2. See Figure 2-52. Assemble **new** piston components, placing small end of spring (5) behind primary seal of piston (4).
3. Lubricate master cylinder body and piston seals with DOT 4 brake fluid.

WARNING

Be sure circlip snaps in place. An unsecured circlip can cause brake failure, which could result in death or serious injury. (00513b)

4. See Figure 2-50. Insert piston assembly (6), spring first, into master cylinder reservoir (4).
5. See Figure 2-51. Secure piston assembly (1) with a **new** circlip (2).
6. See Figure 2-52. Install ridge on rubber boot (1) into groove on piston (3).



1. **Ridge on rubber boot**
2. **Circlip**
3. **Groove on piston**
4. **Primary seal of piston**
5. **Spring**

Figure 2-52. Front Master Cylinder Piston Assembly

Brake Hand Lever

1. See Figure 2-50. Lubricate pivot bolt (17) with LOCTITE ANTI-SEIZE.
2. Align hole in brake hand lever (8) with hole in hand lever pivot. Install pivot bolt (17) through top of hand lever pivot and thread nut on pivot bolt. On XB9SX, XB12XT and XB12X models, tighten nut to 39-48 **in-lbs** (4.4-5.4 Nm). On all other models, tighten nut to 80-120 **in-lbs** (9-13.5 Nm).

MASTER CYLINDER INSTALLATION

1. See Figure 2-50. Install front brake switch (12).
   a. Install brake switch (12) with switch fastener (10) and tighten to 7-10 **in-lbs** (0.8-1 Nm).
   b. Connect brake switch terminal (13) to brake switch (12).
   c. Test switch action. Tang on switch must release when hand lever is moved.
2. Install master cylinder to handlebar by fastening clamp with fasteners. Position for rider posture and tighten to 80-90 **in-lbs** (9-10 Nm).

CAUTION

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

3. See Figure 2-50. Connect brake line to master cylinder using two **new** copper washers (16) and banjo bolt (14) (metric) and tighten to 16-20 ft-lbs (22-27 Nm).
4. See Figure 2-53. Verify brake switch wires are tight.
5. See Figure 2-54. Remove two master cylinder cover screws, cover and cover gasket.

CAUTION

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

6. Protect body work from brake fluid.
7. With the master cylinder in a level position, add D.O.T. 4 BRAKE FLUID. Bring fluid level to within 1/8 in. (3.2 mm) of molded boss inside front master cylinder reservoir.

⚠WARNING

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

8. Verify proper operation of the master cylinder relief port. Actuate the brake lever with the reservoir cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
9. Bleed brake system. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.
10. See Figure 2-50. Attach master cylinder cover (2) and cover gasket (3). Tighten two cover fasteners (1) to 9-13 **in-lbs** (1.0-1.5 Nm).

⚠WARNING

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

⚠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)

11. Turn ignition key switch to ON. Apply brake hand lever to test brake lamp operation. Turn ignition key switch to OFF.
12. On XB9SX, XB12XT and XB12X models, install right deflector. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.

Figure 2-53. Front Brake Light Switch Connector (Typical)

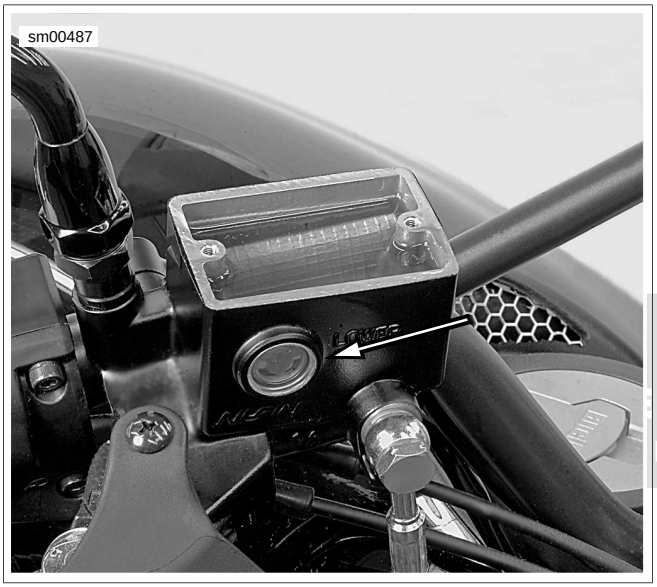


Figure 2-54. Reservoir Fluid Level Indicator

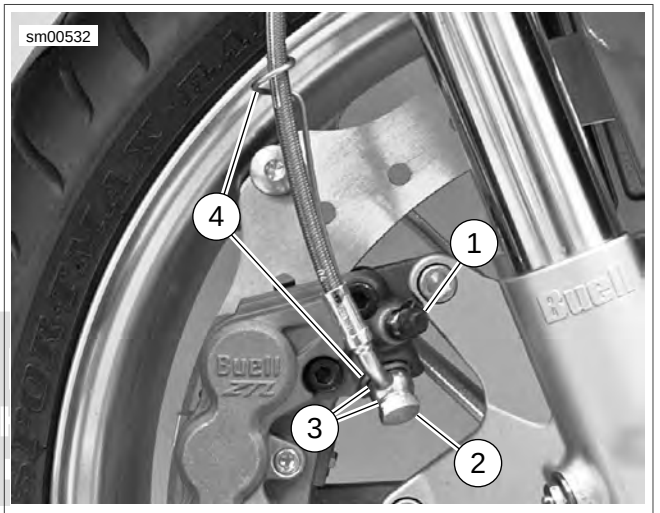
BRAKE LINE REMOVAL

1. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. See Figure 2-55. Remove front caliper bleeder valve cap and install a length of plastic tubing over valve (1). Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake hand lever to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
2. See Figure 2-56. On Lightning and Ulysses models, remove the p-clamp (1) attaching brake line to rear of right front module. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES and 2.30 FRONT MODULES: LIGHTNING/ULYSSES.
3. Remove p-clamp (2) attaching brake line (3) to right side of lower fork clamp.
4. On Ulysses models, remove fasteners (4) on right lower fender.

NOTE

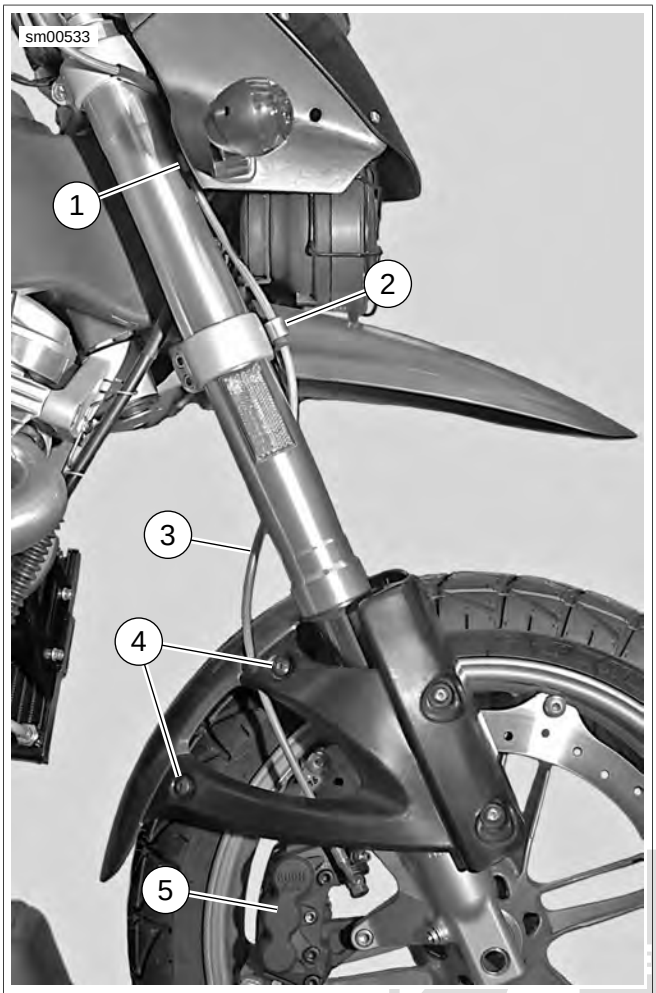
Damaged banjo bolt seating surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

5. See Figure 2-50. Remove master cylinder banjo bolt (metric) (14) and two copper washers (16) to disconnect brake line from master cylinder. Discard copper washers.
6. See Figure 2-55. Remove caliper banjo bolt (metric) (2), two copper washers (3) and wire form (4) (if equipped) to disconnect brake line from caliper. Discard copper washers.
7. Carefully inspect the brake line for dents, cuts, chaffing or other defects. Replace damaged brake lines.



1. **Bleeder valve**
2. **Banjo bolt**
3. **Copper washers**
4. **Wire form (Firebolt and Lightning models only)**

Figure 2-55. Bleeder Valve and Banjo Bolt (Caliper)



1. **P-clamp behind front module (Lightning and Ulysses only)**
2. **P-clamp on fork tube**
3. **Brake line**
4. **Right lower fender fasteners (Ulysses only)**
5. **Front brake caliper**

Figure 2-56. Front Brake Line (Ulysses Shown)

BRAKE LINE INSTALLATION

1. See Figure 2-50. Connect brake line (15) to master cylinder reservoir (4) using two **new** copper washers (16) and a banjo bolt (14) (metric). Loosely install bolt into master cylinder.
2. Route the brake line from the master cylinder to the caliper. See D.1 APPENDIX D: HOSE AND WIRE ROUTING for front brake line routing.
3. On Lightning and Ulysses models, install and tighten P-clamp on inside of front module. Tighten to 36-60 **in-lbs** (4-7 Nm). See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES and 2.30 FRONT MODULES: LIGHTNING/ULYSSES.

CAUTION

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

4. On Firebolt and Lightning models, use the following steps to install the brake line to caliper.
   a. See Figure 2-55. Install **new** copper washer (3), brake line, **new** copper washer (3) and wire form (4) onto banjo bolt (2).
   b. Finger tighten banjo bolt (2) onto front caliper, being careful not to pinch wire form (4) while tightening. Wire form should rotate around banjo bolt freely.
   c. Twist brake line into wire form spiral and cock wire form against bleeder valve (1).
5. On Ulysses models, use the following steps to install the brake line to caliper.
   a. See Figure 2-55. Install **new** copper washer (3), brake line and **new** copper washer (3) onto banjo bolt (2).
   b. See Figure 2-56. Finger tighten banjo bolt onto front caliper and position brake line as shown in the figure.
6. See Figure 2-56. Install and tighten p-clamp (1) with fastener on lower triple clamp to 36-60 **in-lbs** (4-7 Nm).
7. See Figure 2-50. Tighten master cylinder banjo bolt (14) (metric) to 16-20 ft-lbs (22-27 Nm).
8. See Figure 2-55. Tighten brake caliper banjo bolt (2) (metric) to 16-20 ft-lbs (22-27 Nm).

WARNING

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

9. Install bleeder valve, if removed. Refill master cylinder and bleed brakes. See 1.7 BRAKE SYSTEM MAINTENANCE.
10. On Ulysses models, install lower right fender. See 2.15 FENDERS.

NOTE

Verify that the brake line grommet is captured between the center front fender and the lower right front fender.

WARNING

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

11. Turn ignition key switch to ON. Apply brake hand lever to test brake lamp operation. Turn ignition key switch to OFF.

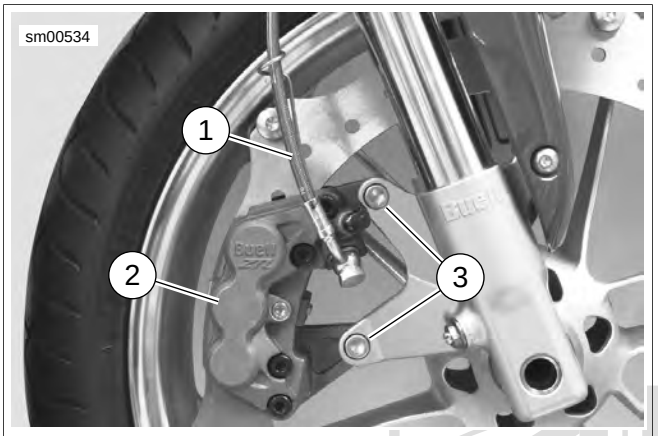
BRAKE CALIPER REMOVAL

1. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake hand lever to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

2. Only Ulysses models, remove fasteners on lower right fender. See 2.15 FENDERS.
3. See Figure 2-57. Disconnect brake line (1) at caliper (2). See 2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Removal.
4. Remove caliper mounting fasteners (3).
5. Slide caliper down the rotor to clear fork lower and then remove off rotor.



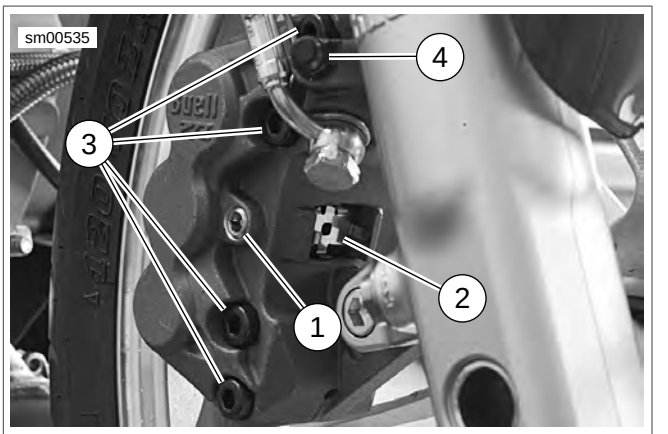
1. **Brake line**
2. **Front brake caliper**
3. **Caliper mounting fasteners (2)**

Figure 2-57. Front Brake Caliper Mounts (Typical)

BRAKE CALIPER DISASSEMBLY

PART NUMBER	TOOL NAME
B-42887	BRAKE CALIPER PISTON REMOVER

1. See Figure 2-58. Remove pin hanger set (1), brake pads and caliper pad spring (2).
2. Split caliper by removing caliper fasteners (3).
3. See Figure 2-60. Remove and discard o-rings (8).
4. See Figure 2-59. Remove pistons using a BRAKE CALIPER PISTON REMOVER (Part No. B-42887).
5. See Figure 2-60. Remove and discard piston o-rings (6).



1. **Pin hanger set**
2. **Caliper pad spring**
3. **Caliper fasteners (4)**
4. **Bleeder valve**

Figure 2-58. Pad Spring (Typical)

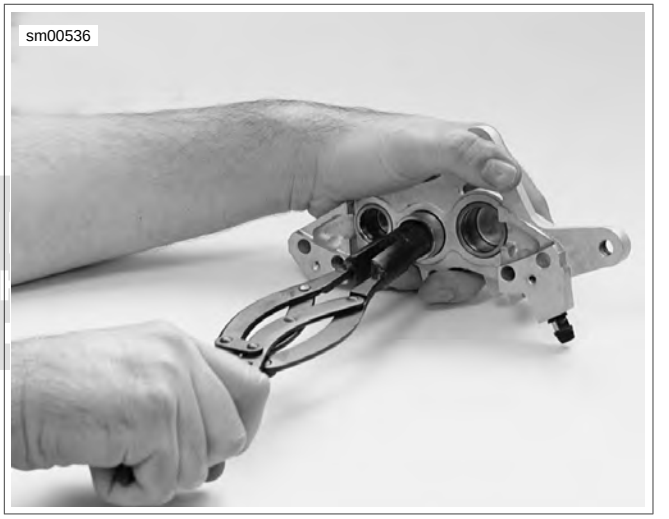


Figure 2-59. Removing Pistons (B-42887)

CLEANING AND INSPECTION

WARNING

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

1. Clean all parts with denatured alcohol or **D.O.T. 4 BRAKE FLUID**. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.
2. Carefully inspect all components. Replace any parts that appear damaged or worn. Do not hone caliper piston bore.

⚠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)

3. Inspect brake rotor and pads. See 1.7 BRAKE SYSTEM MAINTENANCE.
4. Check rotor surface. Replace if warped or badly scored. Refer to Table 2-23.

Table 2-23. Front Rotor Runout

RUNOUT	MM	IN.
Radial	0.45	0.0177
Lateral	0.63	0.0248

BRAKE CALIPER ASSEMBLY

1. See Figure 2-60. Install pistons and o-rings.
   a. Lubricate **new** o-rings (6), pistons (5), and caliper piston bores with **D.O.T. 4 BRAKE FLUID**.
   b. Install two **new** o-rings (6) in grooves of each piston bore.
   c. Install pistons (5) in each piston bore.
2. Install **new** o-rings (8) between caliper halves.
3. Clamp caliper together with caliper fasteners (11) and tighten to 15-19 ft-lbs (20-26 Nm).

INSTALLATION

1. See Figure 2-60. Install pad spring (7) and brake pads (10).
2. Install pin hanger set (1) and tighten to 11-14 ft-lbs (15-19 Nm).
3. Slide the caliper over the rotor up to the mount and install caliper on caliper mount. Using LOCTITE 271 (red). Tighten caliper mounting fasteners (9) to 35-37 ft-lbs (47-50 Nm).

CAUTION

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

4. Install brake line to caliper. See 1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes.
5. Bleed front brakes. See 1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes.
6. On Ulysses models, install lower right fender. See 2.15 FENDERS.

⚠WARNING

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

7. Turn ignition key switch to ON. Apply brake hand lever to test brake lamp operation.

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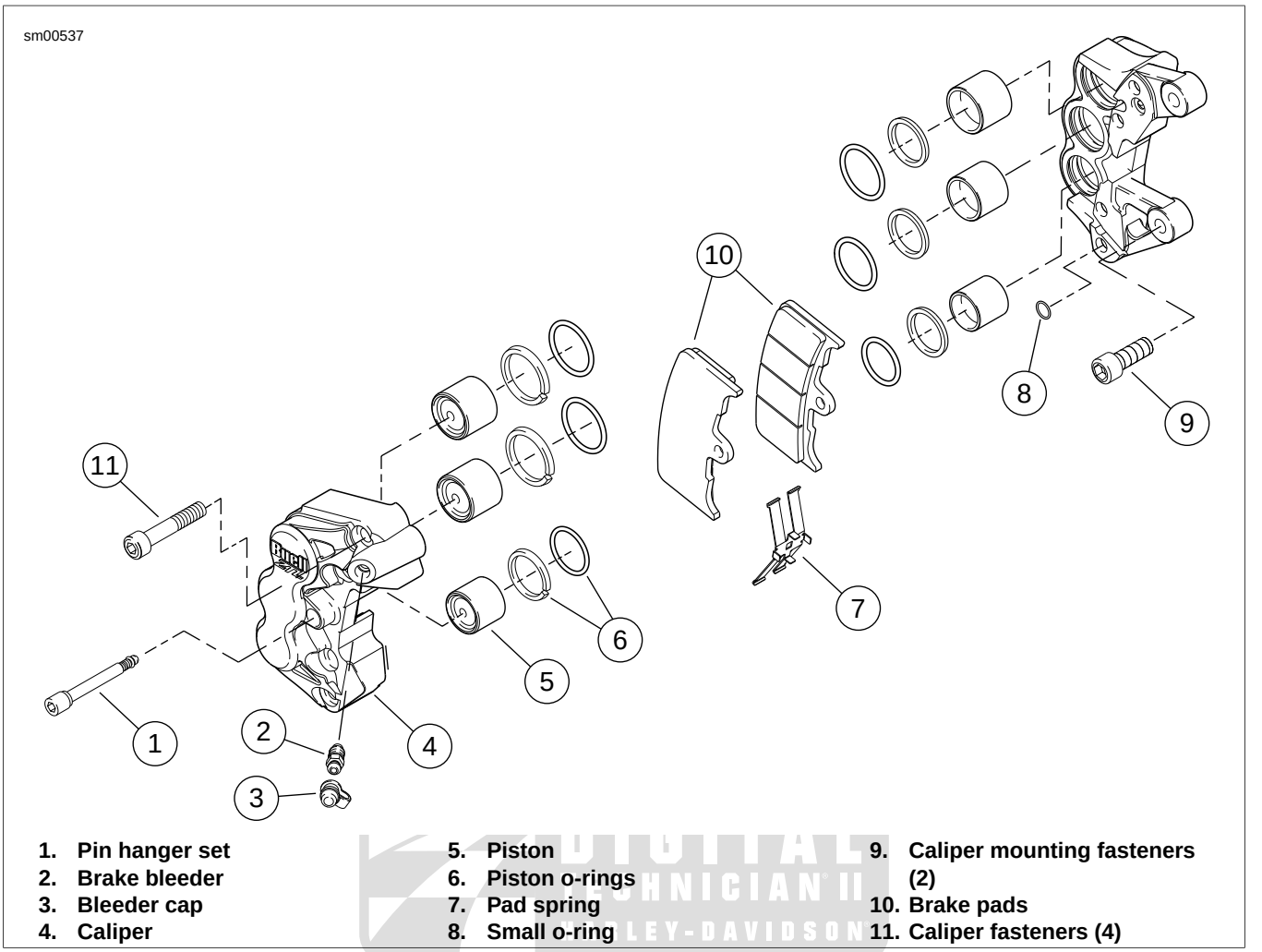


1. Pin hanger set
2. Brake bleeder
3. Bleeder cap
4. Caliper
5. Piston
6. Piston o-rings
7. Pad spring
8. Small o-ring
9. Caliper mounting fasteners (2)
10. Brake pads
11. Caliper fasteners (4)

Figure 2-60. Front Caliper Assembly

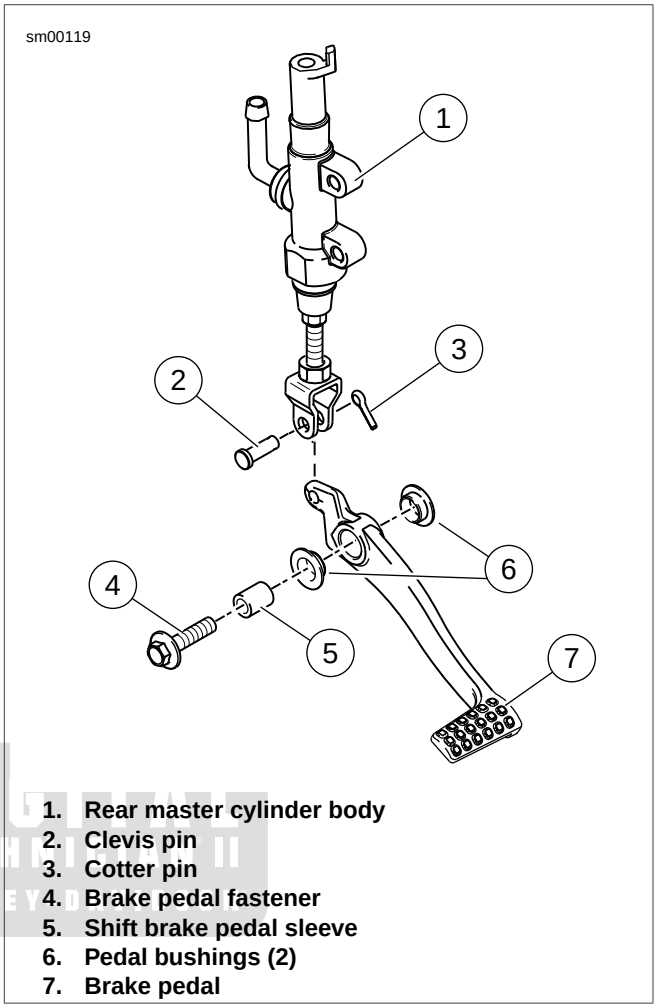
BRAKE PEDAL 2.11

REMOVAL

1. See Figure 2-61. Remove cotter pin (3) and discard.
2. Remove clevis pin (2).
3. Remove pedal fastener (4).
4. Remove shift brake pedal sleeve (5).
5. Remove pedal bushings (6).
6. Remove brake pedal (7).

INSTALLATION

1. See Figure 2-61. Install pedal bushings (6).
2. Install shift brake pedal sleeve (5).
3. Install brake pedal (7) using LOCTITE 271 (Red) and tighten fastener (4) to 22-24 ft-lbs (30-33 Nm).
4. Install clevis pin (2).
5. Install **new** cotter pin (3).



1. **Rear master cylinder body**
2. **Clevis pin**
3. **Cotter pin**
4. **Brake pedal fastener**
5. **Shift brake pedal sleeve**
6. **Pedal bushings (2)**
7. **Brake pedal**

Figure 2-61. Brake Pedal Assembly

REAR BRAKE MASTER CYLINDER 2.12

REMOVAL: FIREBOLT/LIGHTNING

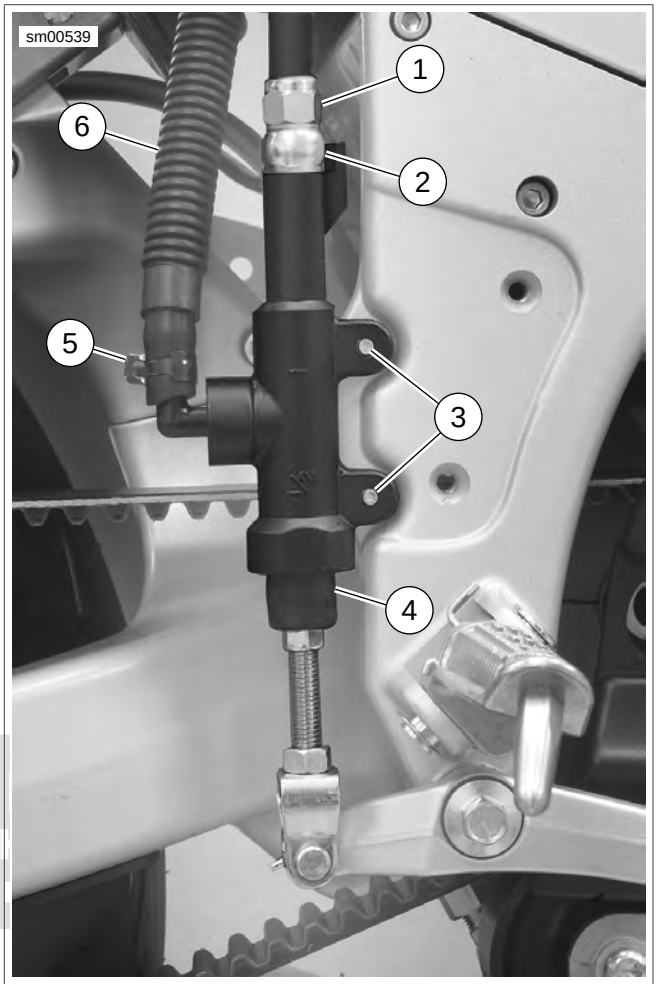
1. See Figure 2-62. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake foot pedal to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
2. Remove brake pedal. See 2.11 BRAKE PEDAL.
3. Remove heel guard. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

4. See Figure 2-63. Remove brake reservoir hose (6) at master cylinder.
5. Remove seat.

Figure 2-62. Rear Caliper Bleeder Valve



1. **Banjo bolt (metric) and rear brake light switch**
2. **Brake line**
3. **Fasteners (2) (metric)**
4. **Master cylinder body**
5. **Clamp**
6. **Remote reservoir hose**

Figure 2-63. Rear Master Cylinder: Firebolt

6. See Figure 2-64 or Figure 2-65. Disconnect brake light connector located under the seat.
7. See Figure 2-63. Remove rear brake light switch (1) (metric) and two copper crush washers (3) to detach brake line (2) from master cylinder (4). Discard copper crush washers.
8. Remove the right side rider footpeg mount. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
9. See Figure 2-63. Remove fasteners (3) (metric) to detach master cylinder (4) from rider footpeg mount.

10. See Figure 2-66 or Figure 2-67. Detach remote reservoir.
    a. Remove top clamp (4) on hose connected to master cylinder. Disconnect hose.
    b. Remove fastener (2) to detach reservoir (1) from frame if necessary.

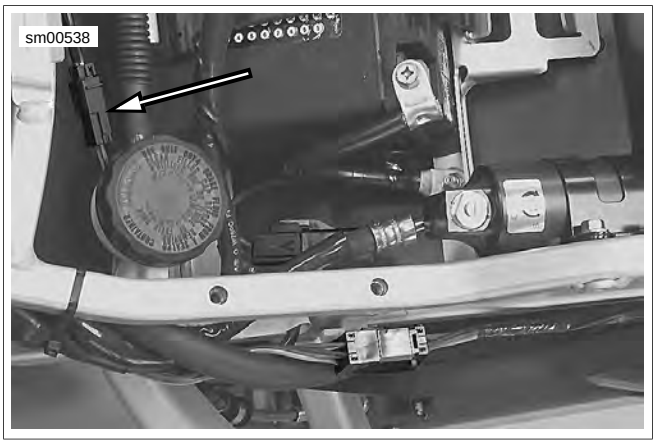


Figure 2-64. Brake Line Switch Connector: Firebolt

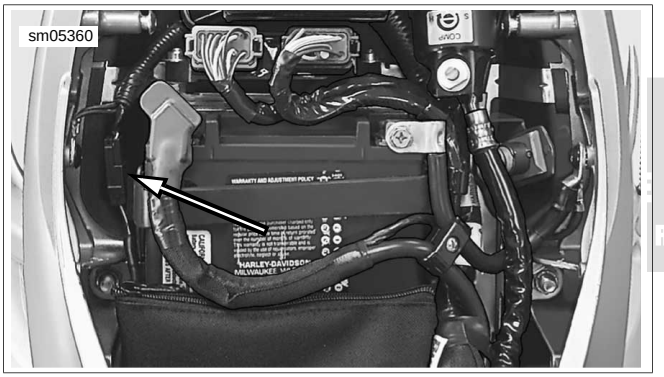
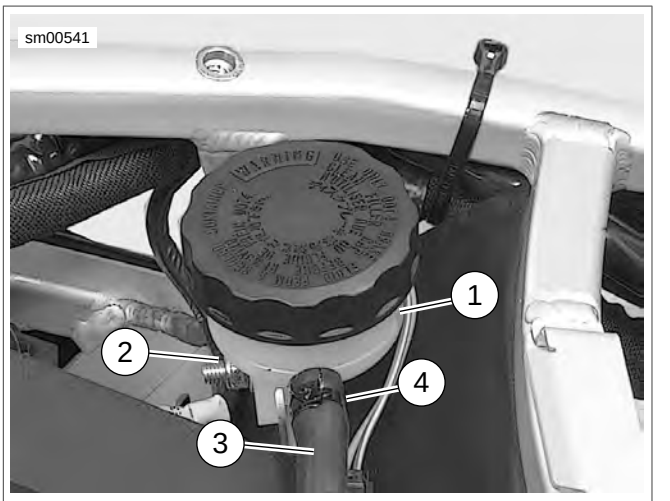


Figure 2-65. Brake Line Switch Connector: Lightning



1. **Reservoir**
2. **Fastener and washer**
3. **Remote reservoir hose**
4. **Clamp**

Figure 2-66. Remote Reservoir: Firebolt

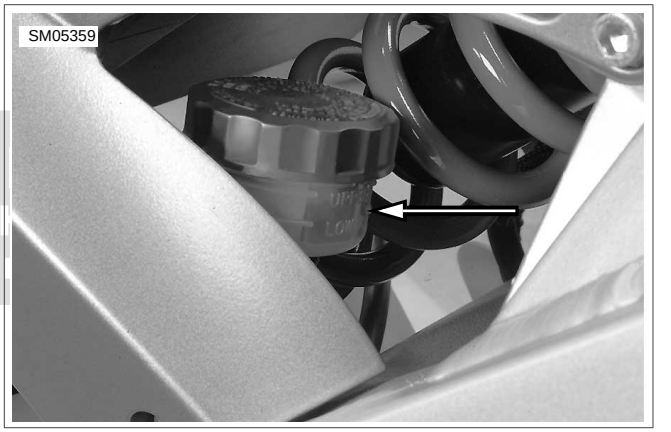


Figure 2-67. Remote Reservoir: Lightning

REMOVAL: ULYSSES

1. See Figure 2-68. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
    a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
    b. Open bleeder valve (metric) about 1/2-turn.
    c. Pump brake foot pedal to drain brake fluid.
    d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
2. Remove right side footpeg mount. See 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.

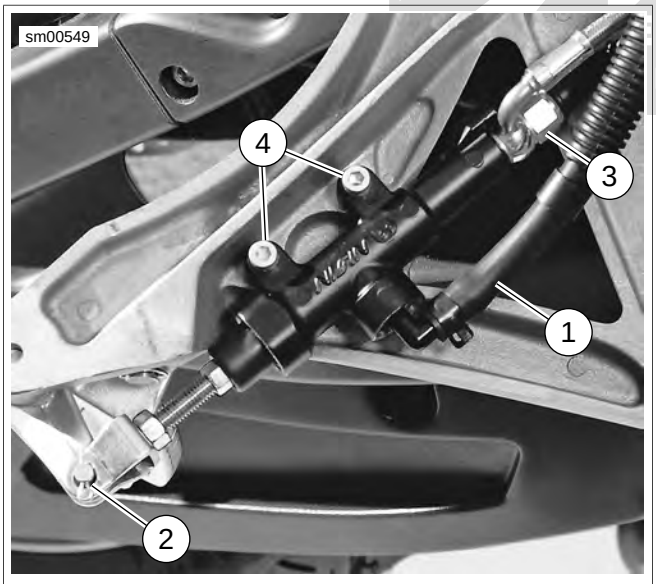
CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

3. See Figure 2-69. Remove brake reservoir hose (1) at master cylinder.

4. Remove cotter pin from brake pedal. See 2.11 BRAKE PEDAL.
5. Remove seat.
6. See Figure 2-70. Disconnect brake light connector located under the seat.

Figure 2-68. Rear Caliper Bleeder Valve



1. **Reservoir hose**
2. **Cotter pin**
3. **Banjo bolt (metric)**
4. **Fasteners (2)**

Figure 2-69. Rear Master Cylinder: Ulysses

7. See Figure 2-72. Remove rear brake light switch (1) (metric) and two copper crush washers (3) to detach brake line (2) from master cylinder (4). Discard copper crush washers.
8. Remove fasteners (11) to detach master cylinder (4) from rider footpeg mount.
9. See Figure 2-71. Detach remote reservoir.
   a. On Ulysses models, remove air flow guide.
   b. Remove top clamp (2) on hose connected to master cylinder.
   c. Remove fastener and washer (3) to detach reservoir (1) from frame if necessary.

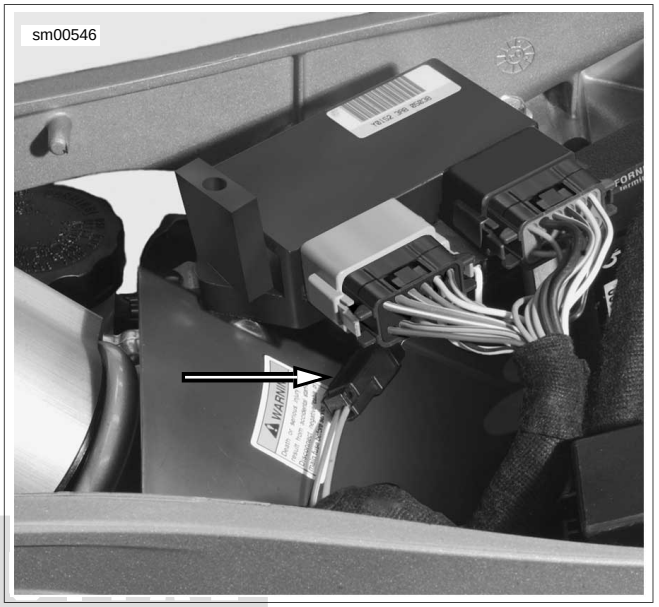
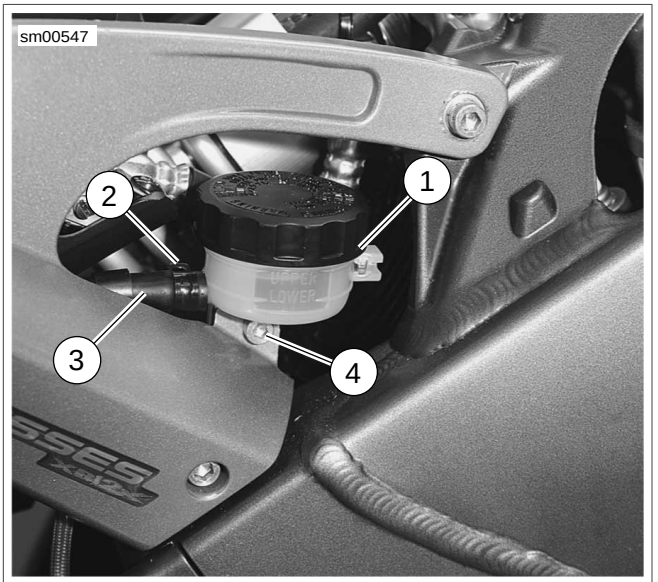
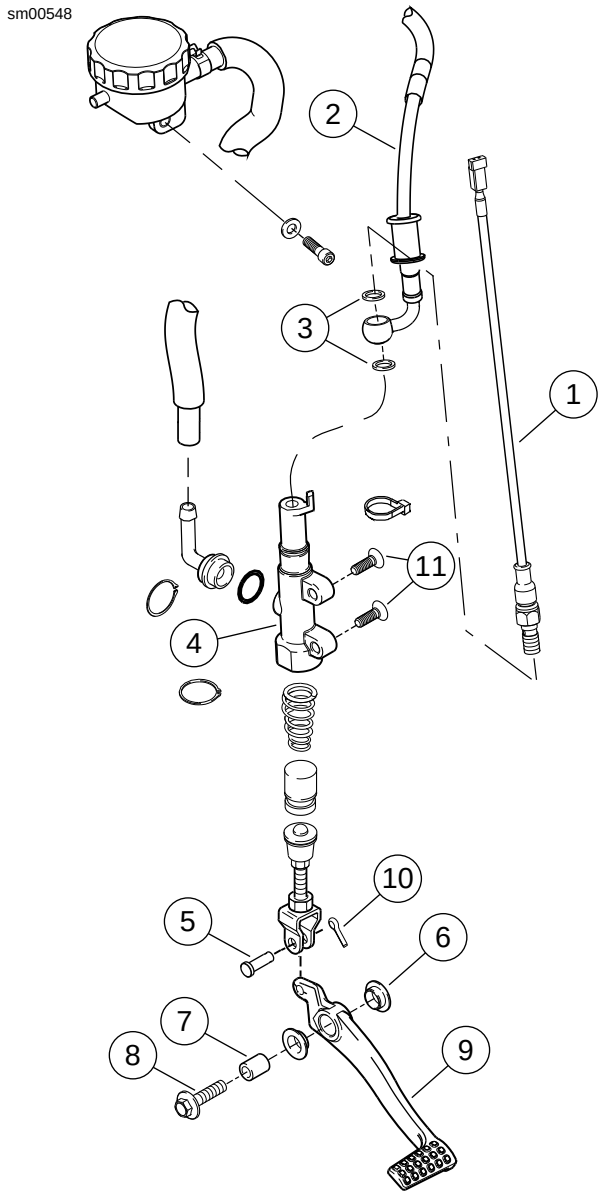


Figure 2-70. Brake Line Switch Connector (Ulysses)



1. **Reservoir**
2. **Clamp**
3. **Fastener and washer**
4. **Remote reservoir hose**

Figure 2-71. Remote Reservoir: Ulysses



1. **Rear brake light switch assembly**
2. **Brake line**
3. **Copper washer (2)**
4. **Rear master cylinder body**
5. **Clevis pin**
6. **Pedal bearing**
7. **Sleeve**
8. **Brake pedal fastener**
9. **Brake pedal**
10. **Cotter pin**
11. **Rear master cylinder mount screw (2)**

Figure 2-72. Rear Master Cylinder Assembly: Ulysses

DISASSEMBLY

1. See Figure 2-73. Slide rubber boot on rod assembly (3) away from master cylinder body (1).
2. Depress rod assembly (3) and remove internal snap ring (2). Discard snap ring.
3. Remove piston assembly (4) from master cylinder body (1).
4. Loosen adjuster locknut on the rod assembly (3).
5. Remove the clevis from the rod assembly (3).

NOTE

Do not disassemble master cylinder unless problems are experienced. Discard all seals during the disassembly procedure. Install a complete rebuild kit upon assembly.

CLEANING AND INSPECTION

⚠WARNING

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

1. Thoroughly clean master cylinder and all brake system components. Stand master cylinder on wooden block or towel to protect seating surfaces.
   a. Examine walls of master cylinder reservoir for scratches and grooves. Replace if damaged.
   b. Verify that vent holes on master cylinder are completely open and free of dirt or debris.
2. Inspect boot on front of master cylinder for cuts, tears or general deterioration. Replace if necessary.

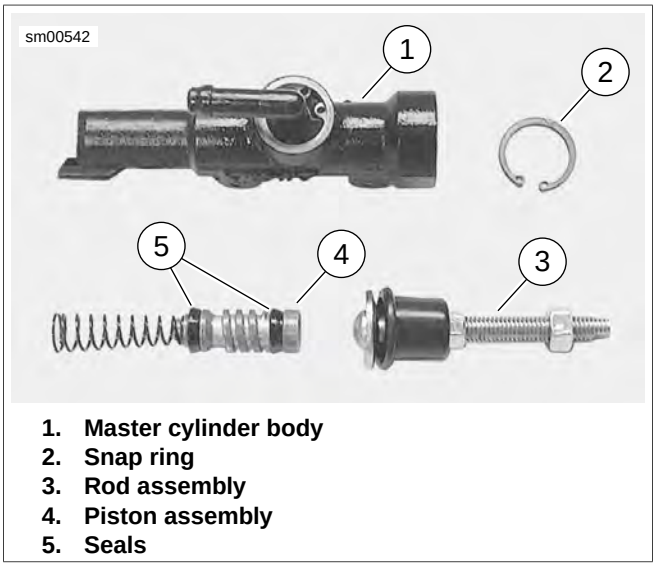
ASSEMBLY

1. Obtain PISTON ASSEMBLY KIT.
2. See Figure 2-73. Assemble **new** piston components placing small end of spring behind primary seal of piston (4).
3. Lubricate master cylinder body (1) and piston seals (5) with **D.O.T. 4 BRAKE FLUID**.

⚠WARNING

Be sure circlip snaps in place. An unsecured circlip can cause brake failure, which could result in death or serious injury. (00513b)

4. Place round side of rod assembly (3) over piston. Depress piston (4) into master cylinder body (1) and secure with a **new** snap ring (2).
5. Tuck rubber boot on rod assembly (3) into master cylinder body (1).



1. **Master cylinder body**
2. **Snap ring**
3. **Rod assembly**
4. **Piston assembly**
5. **Seals**

Figure 2-73. Master Cylinder Internal

INSTALLATION: FIREBOLT/LIGHTNING

1. See Figure 2-72. Install master cylinder (4) onto footpeg mount with fasteners (11). Tighten to 72-96 **in-lbs** (8-11 Nm).
2. Install rear brake switch (1), brake line (2) and **new** copper crush washers (3). Tighten to 16-20 ft-lbs (22-27 Nm).
3. Install footpeg mount to frame. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.

CAUTION

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

4. See Figure 2-66. Connect remote reservoir.
   a. If removed, attach remote reservoir (1) to frame using clamp fastener (2). Tighten to 48-72 **in-lbs** (5.4-8 Nm).
   b. Attach hose (3) to rear brake reservoir using clamp.
5. See Figure 2-64. Connect brake line switch connector under seat.
6. Install heel guard. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
7. Install rear brake pedal. See 2.11 BRAKE PEDAL.
8. Adjust rear brake pedal. See 1.7 BRAKE SYSTEM MAINTENANCE, Brake Pedal Adjustment.

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. Add brake fluid and bleed brake system. See 1.7 BRAKE SYSTEM MAINTENANCE.

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)

WARNING

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

WARNING

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

10. Install seat.

INSTALLATION: ULYSSES

1. See Figure 2-72. Install master cylinder (4) onto footpeg mount with fasteners (11). Tighten to 72-96 **in-lbs** (8-11 Nm).
2. Install rear brake switch (1), brake line (2) and new copper crush washers (3). Tighten to 16-20 ft-lbs (22-27 Nm).
3. Install footpeg mount to frame. See 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.

CAUTION

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

4. See Figure 2-71. Connect remote reservoir.
   a. If removed, attach remote reservoir (1) to frame using fastener and washer (3). Tighten to 48-72 **in-lbs** (5.4-8 Nm).
   b. Attach hose (3) to rear brake reservoir using clamp.
   c. On Ulysses models, install air flow guide.
5. See Figure 2-70. Connect brake line switch connector under seat.
6. Install master cylinder to brake pedal. See 2.11 BRAKE PEDAL.

WARNING

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

7. Add brake fluid and bleed brake system. See 1.7 BRAKE SYSTEM MAINTENANCE.

⚠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)

⚠WARNING

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

⚠WARNING

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

8. Install seat.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

REAR BRAKE LINE 2.13

REMOVAL: FIREBOLT

1. Remove seat.

WARNING

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

2. Disconnect battery by unthreading fastener removing negative cable (black) from battery first. See 1.5 BATTERY MAINTENANCE.
3. See Figure 2-74. Disconnect brake light connector from under seat in the front of the battery.
4. Remove right side heel guard. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
5. Remove rear inner fender. See 2.15 FENDERS.
6. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake foot pedal to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
7. See Figure 2-75. Remove p-clamp (2) securing brake line (1) to the left side of swingarm.

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

8. Remove banjo bolt (3) from rear caliper. Discard copper washers.
9. See Figure 2-76. Remove brake light switch/banjo bolt from rear master cylinder. Discard copper washer.
10. Remove brake line from motorcycle.

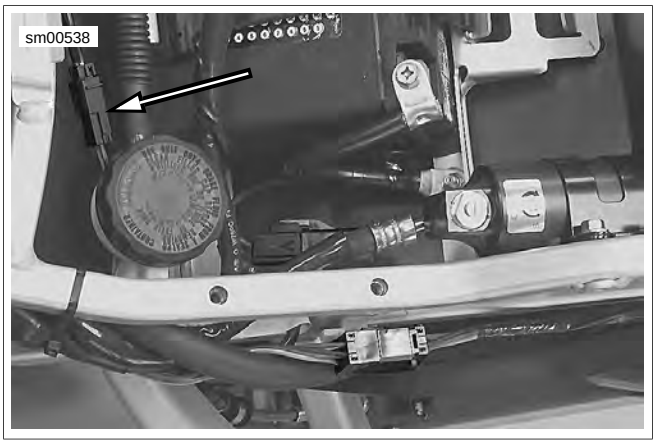
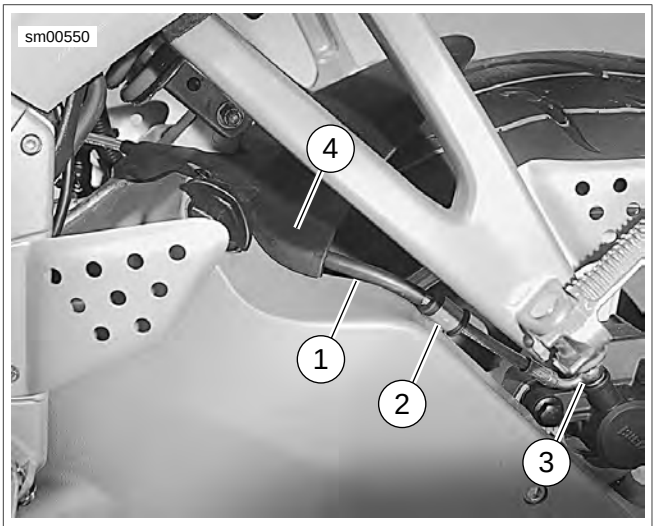


Figure 2-74. Brake Line Switch Connector: Firebolt



1. **Brake line**
2. **P-clamp**
3. **Banjo bolt**
4. **Rear fender**

Figure 2-75. Rear Brake Line

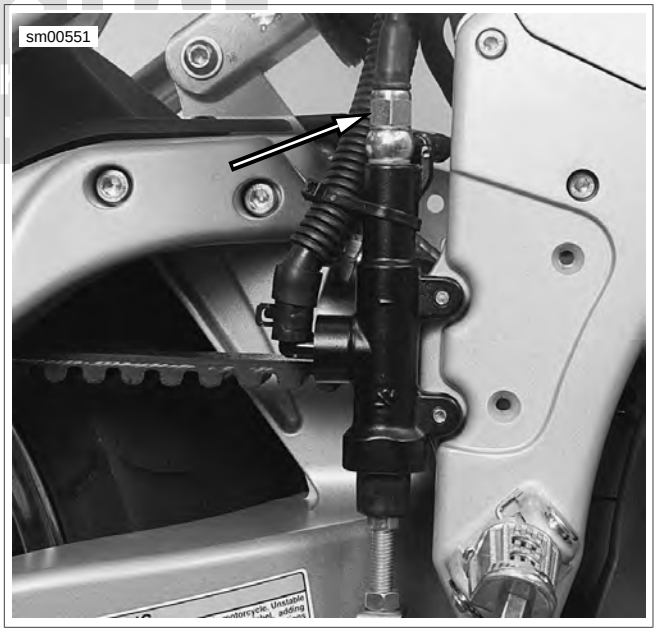


Figure 2-76. Rear Brake Light Switch/Banjo Bolt

INSTALLATION: FIREBOLT

PART NUMBER	TOOL NAME
SNAP-ON FRXM14	FLARE NUT SOCKET

1. See Figure 2-76. Install brake light switch/banjo bolt with **new** copper washers to the master cylinder. Tighten to 16-20 ft-lbs (22-27 Nm).

NOTE

Tighten the right side banjo bolt with FLARE NUT SOCKET (Part No. SNAP-ON FRXM14) or a crowsfoot.

2. Install brake line, banjo bolt and **new** copper washers to rear caliper. Tighten to 16-20 ft-lbs (22-27 Nm).
3. See Figure 2-75. Secure brake line (1) to left side of swingarm with p-clamp (2), and tighten to 36-60 **in-lbs** (4-7 Nm). See D.1 APPENDIX D: HOSE AND WIRE ROUTING for brake line routing.
4. See Figure 2-74. Connect brake light switch connector beneath seat.
5. Install rear inner fender. Verify that brake line is correctly captured by rear fender. See 2.15 FENDERS.
6. Install right heel guard. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
7. Bleed brakes. See 1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes.
8. Install negative battery cable and tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

WARNING

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

9. Install seat.

WARNING

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

10. Turn ignition key ON, press rear brake pedal and check for proper brake light operation.

WARNING

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

WARNING

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

11. Test ride motorcycle and check for proper brake operation.

REMOVAL: LIGHTNING

1. Remove seat.

WARNING

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

2. Disconnect battery by unthreading fastener removing negative cable (black) from battery first. See 1.5 BATTERY MAINTENANCE.
3. See Figure 2-77. Disconnect brake light connector from under seat in the front of the battery.
4. Remove right side heel guard. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
5. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake foot pedal to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
6. Remove rear fender. See 2.15 FENDERS.
7. See Figure 2-76. Remove p-clamp (2) securing brake line (1) to the left side of swingarm.

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

8. Remove banjo bolt (3) from rear caliper. Discard copper washers.
9. See Figure 2-76. Remove brake line switch/banjo bolt from rear master cylinder. Discard copper washer.
10. Remove brake line from motorcycle.

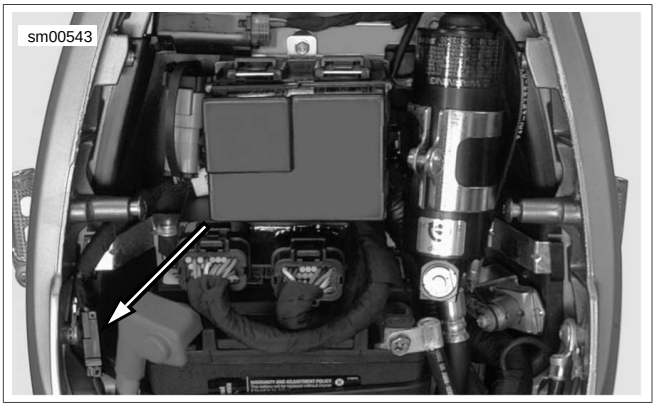


Figure 2-77. Brake Line Switch Connector (XB12S Shown)

INSTALLATION: LIGHTNING

PART NUMBER	TOOL NAME
SNAP-ON FRXB14	FLARE NUT SOCKET

1. See Figure 2-76. Install brake light switch/banjo bolt with **new** copper washers to the master cylinder. Tighten to 16-20 ft-lbs (22-27 Nm).

NOTE

Tighten the right side banjo bolt with FLARE NUT SOCKET (Part No. SNAP-ON FRXB14) or a crowsfoot.

2. Install brake line banjo bolt and **new** copper washers to rear caliper. Tighten to 16-20 ft-lbs (22-27 Nm).
3. See Figure 2-75. Secure brake line (1) to left side of swingarm with p-clamp (2) and tighten to 36-60 **in-lbs** (4-7 Nm). See D.1 APPENDIX D: HOSE AND WIRE ROUTING for brake line routing.
4. See Figure 2-76. Connect brake line switch connector underneath seat.
5. Install right heel guard. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
6. Verify that the brake line fits the fender guide and install rear fender. See 2.15 FENDERS.
7. Bleed brakes. See 1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes.
8. Install negative battery cable and tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

9. Install seat.

⚠WARNING

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

10. Turn ignition key ON, depress rear brake pedal and check for proper brake light operation.

⚠WARNING

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

⚠WARNING

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

11. Test ride motorcycle and check for proper brake operation.

REMOVAL: ULYSSES

1. Remove seat.

⚠WARNING

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

2. Disconnect battery by unthreading fastener removing negative cable (black) from battery first. See 1.5 BATTERY MAINTENANCE.
3. See Figure 2-78. Disconnect brake light connector from under seat in the front of the battery.
4. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake foot pedal to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
5. See Figure 2-79. Remove the rear wheel fender. See 2.15 FENDERS.

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

6. Remove banjo bolt (3) from rear caliper. Discard copper washers.
7. Remove right side rider/passenger peg mount. See 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.
8. See Figure 2-80. Remove brake line switch/banjo bolt from rear master cylinder. Discard copper washers.
9. Remove brake line bracket fasteners.
10. Remove brake line from motorcycle.

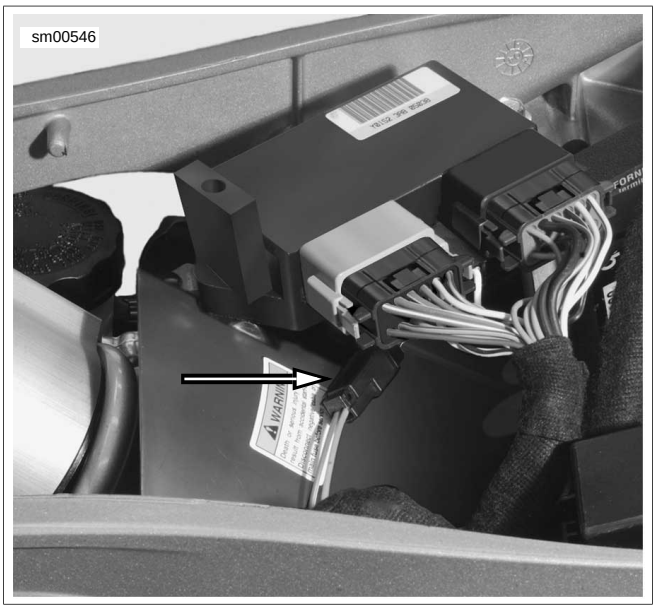
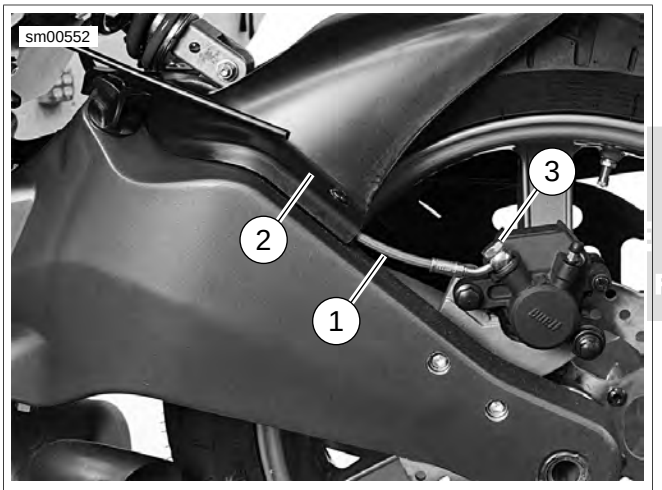


Figure 2-78. Brake Line Switch Connector (Ulysses)



1. **Brake line**
2. **Rear fender**
3. **Banjo bolt**

Figure 2-79. Rear Brake Line: Ulysses

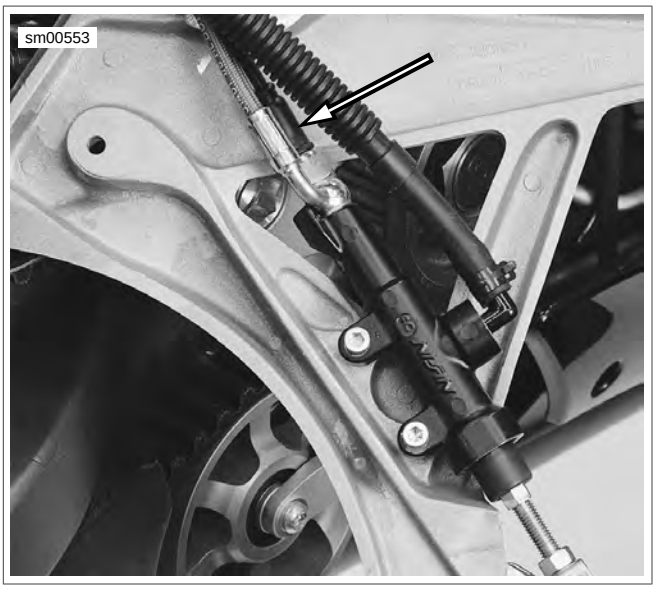


Figure 2-80. Rear Brake Light Switch/Banjo Bolt: Ulysses

INSTALLATION: ULYSSES

1. Route the brake line. See D.1 APPENDIX D: HOSE AND WIRE ROUTING for brake line routing.
2. See Figure 2-80. Install brake light switch/banjo bolt with **new** copper washers to the master cylinder. Tighten to 16-20 ft-lbs (22-27 Nm).
3. Install brake line bracket and tighten fasteners to 48-72 **in-lbs** (5.4-8 Nm).
4. Install the rider/passenger peg mount to the motorcycle. See 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.
5. See Figure 2-78. Connect brake line switch connector beneath seat.
6. Install brake light switch/banjo bolt and **new** copper washers to rear caliper. Tighten to 16-20 ft-lbs (22-27 Nm).
7. Bleed brakes. See 1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes.
8. Install negative battery cable and tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

9. Install seat.

⚠WARNING

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

10. Turn ignition key ON, press rear brake pedal and check for proper brake light operation.

⚠WARNING

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

⚠WARNING

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

11. Test ride motorcycle and check for proper brake operation.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

REAR BRAKE CALIPER 2.14

REMOVAL

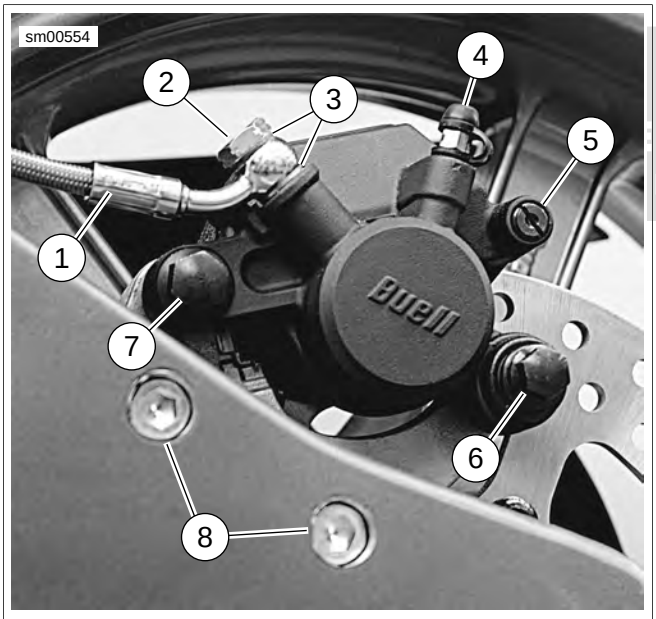
NOTE

Steps 1 and 2 are not required for detaching caliper from rotor. Drain fluid only when disassembling caliper.

CAUTION

Remove brake line components carefully. Damage to seating surfaces can cause leakage. (00320a)

1. Drain brake fluid into a suitable container. Discard used fluid according to local laws.
   a. Install a length of plastic tubing over caliper bleeder valve. Place free end in a suitable container.
   b. Open bleeder valve (metric) about 1/2-turn.
   c. Pump brake foot pedal to drain brake fluid.
   d. Tighten bleeder valve to 36-60 **in-lbs** (4-7 Nm).
2. See Figure 2-81. Remove banjo bolt (2) connecting brake line to rear caliper.
3. Remove caliper mounting fasteners (6 and 7).



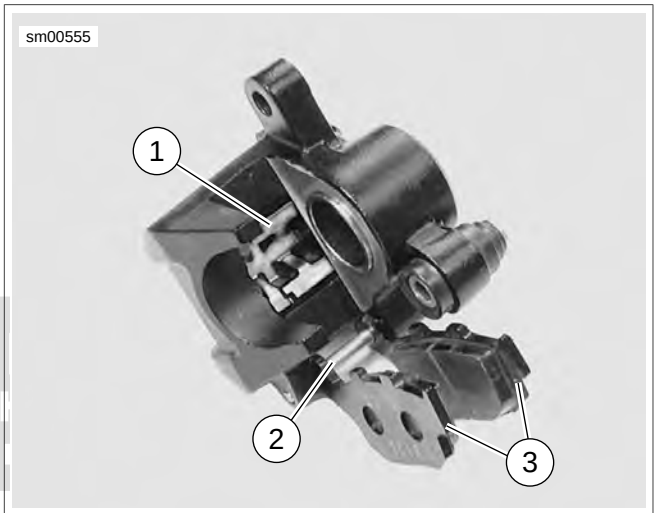
1. **Brake line**
2. **Banjo bolt (metric)**
3. **Copper washers (2)**
4. **Bleeder valve (metric)**
5. **Pin plug**
6. **Small caliper fastener**
7. **Large caliper fastener**
8. **Caliper mounting fasteners (2)**

Figure 2-81. Rear Brake Caliper

DISASSEMBLY

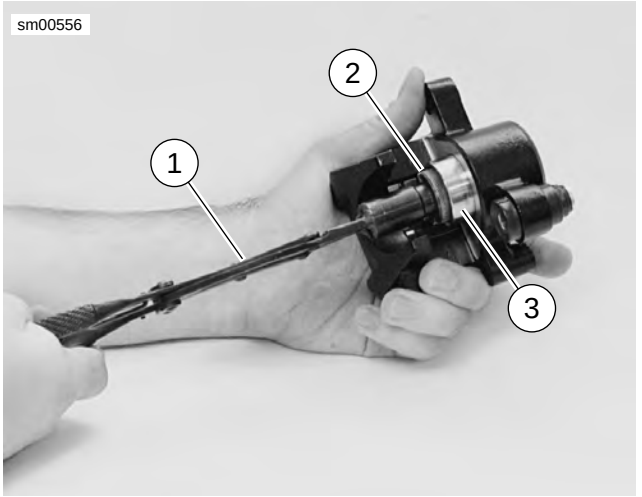
PART NUMBER	TOOL NAME
B-42887	BRAKE CALIPER PISTON REMOVER

1. See Figure 2-81. Remove pin plug (5) and pad hanger (metric) to free brake pads.
2. See Figure 2-82. Remove spring clip (1).
3. See Figure 2-83. Remove piston (3) using BRAKE CALIPER PISTON REMOVER (Part No. B-42887) with adaptor (2).
4. Remove two o-rings from groove in caliper bore and discard.



1. **Clip**
2. **Pin plug and pad hanger (metric)**
3. **Brake pads (2)**

Figure 2-82. Brake Pads



1. **Brake caliper piston remover**
2. **Adaptor**
3. **Piston**

Figure 2-83. Removing Rear Brake Caliper Piston

CLEANING AND INSPECTION

WARNING

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

1. Clean all parts with denatured alcohol or **D.O.T. 4 BRAKE FLUID**. Do not contaminate with mineral oil or other solvents. Wipe dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.
2. Carefully inspect all components. Replace any parts that appear damaged or worn. Do not hone caliper piston bore.
3. Inspect brake rotor.
   a. Measure rotor thickness. Replace if minimum thickness is less than 0.18 in. (4.5 mm).
   b. Check rotor surface. Replace if warped or badly scored. Refer to Table 2-24.

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)

4. Inspect brake pads for damage or excessive wear. Replace both pads as a set if the friction material of either pad is worn to 0.04 in. (1.0 mm) or less.

Table 2-24. Rear Rotor Runout

RUNOUT	IN.	MM
Rotor radial	0.0177	0.45
Rotor lateral	0.0154	0.39

ASSEMBLY

1. See Figure 2-82. Place clip (1) inside caliper body as shown.

NOTE

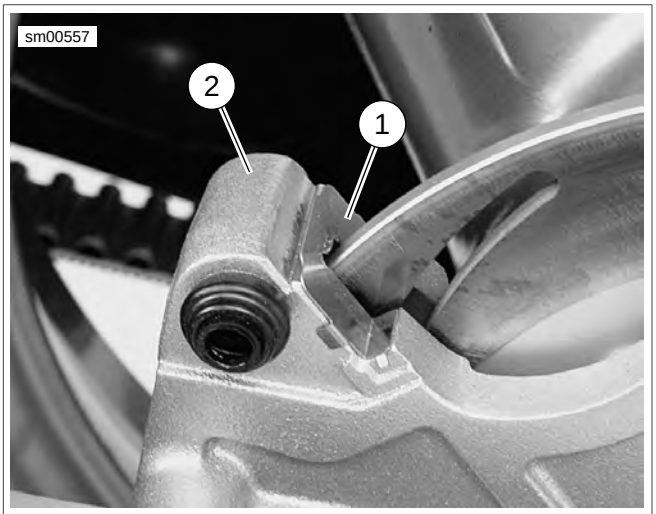
*To verify proper brake pad-to-brake rotor clearance when the caliper is installed, piston must be pressed all the way into the bore whenever **new** brake pads are used.*

2. Install pistons and o-rings.
   a. Apply a light coat of **D.O.T. 4 BRAKE FLUID** to o-rings, piston and caliper piston bore.
   b. Place two **new** o-rings inside grooves of piston bore.
   c. Install piston inside caliper body.

NOTE

See Figure 2-84. Always make sure brake pad retainer is in place on caliper mount before installing pads and caliper.

3. See Figure 2-82. Install brake pads (3) using pin plug and pad hanger (2).
   a. Install pad hanger pin (metric). Tighten to 11-14 ft-lbs (15-19 Nm).
   b. Install pin plug. Tighten to 24 **in-lbs** (2.7 Nm).
4. Install a **new** bleeder valve (metric) if necessary and tighten to 36-60 **in-lbs** (4-7 Nm).



1. **Retainer, brake pads**
2. **Rear caliper mount**

Figure 2-84. Retainer, Brake Pads

INSTALLATION

1. See Figure 2-84. Install brake pad retainer (1) if removed.

2. See Figure 2-81. Install caliper assembly on caliper mount. Brake pad surfaces must face rear brake rotor.
   a. Install large caliper fastener (7) (metric) tightening to 18-21 ft-lbs (24-28 Nm).
   b. Install small caliper fastener (6) (metric) tightening to 14-18 ft-lbs (19-24 Nm).

CAUTION

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

3. See Figure 2-81. Connect brake line (1) to caliper using two **new** copper washers (3) and banjo bolt (2) (metric). Tighten to 16-20 ft-lbs (22-27 Nm).
4. Depress rear brake pedal several times to set brake pads to proper position within caliper. Bleed brake system. See 1.7 BRAKE SYSTEM MAINTENANCE.
5. See Figure 2-85. Verify proper fluid level in reservoir.

WARNING

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

WARNING

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)

6. Turn ignition key switch to ON. Apply brake pedal to test brake lamp operation. Turn ignition key switch to LOCK.

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)

NOTE

Avoid making hard stops for the first 100 miles (160 km) to allow new brake pads to "wear in" properly with the brake rotor.

Figure 2-85. Rear Reservoir (XB12S Shown)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FENDERS 2.15

FRONT FENDER: XB12R

Removal

1. See Figure 2-86. Remove fasteners and washers (2) securing the front fender (1) to front forks.
2. Carefully remove front fender (1).

Installation

1. See Figure 2-86. Align front fender (1) to fender mounts on front forks.
2. Use LOCTITE 271 (red) on all fasteners and install front fender (1) with fasteners and washers (2) and tighten to 36-48 **in-lbs** (4-5.4 Nm).

REAR FENDER: XB12R

Removal

1. See Figure 2-86. Remove fasteners and washers (4) securing the rear fender (3) to swingarm.
2. Remove rear fender (3).

Installation

1. See Figure 2-86. Align rear brake line in rear fender.
2. Install rear fender (3) with fasteners and washers (4) and tighten to 12-36 **in-lbs** (1.4-4 Nm).

FRONT FENDER: XB9SX/XB12SCG/XB12XT

Removal

1. See Figure 2-86. Remove fasteners and washers (2) securing the front fender (1) to front forks.
2. Carefully remove front fender (1).

Installation

1. See Figure 2-86. Align front fender (1) to fender mounts on front forks.
2. Use LOCTITE 271 (red) on all fasteners and install front fender (1) with fasteners and washers (2) and tighten to 36-48 **in-lbs** (4-5.4 Nm).

REAR FENDER: XB9SX/XB12SCG

Removal

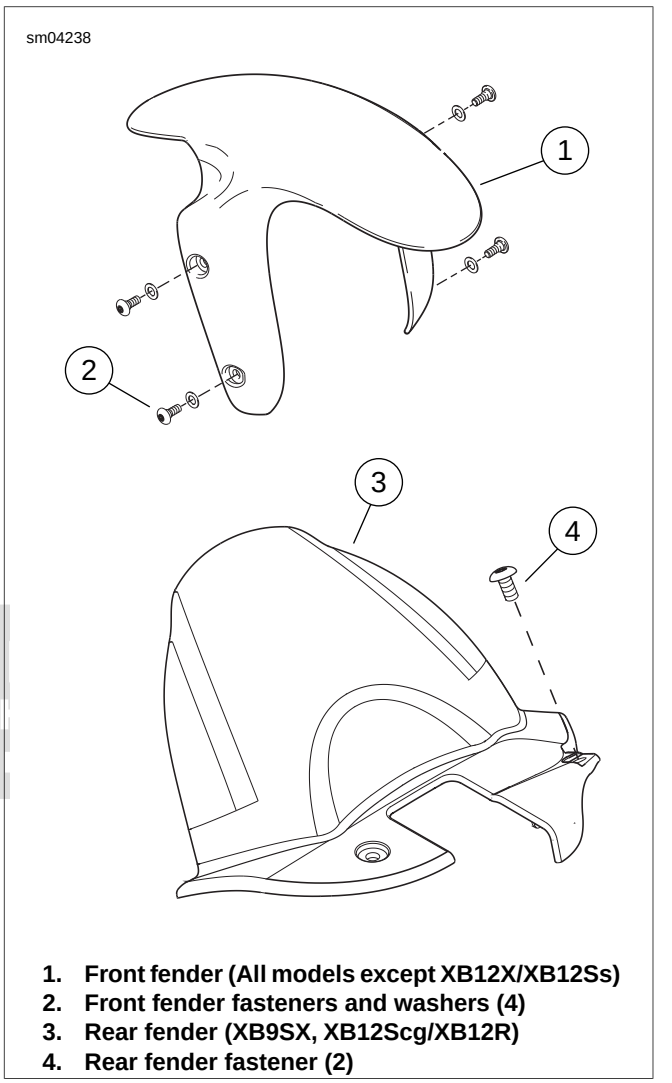
1. See Figure 2-86.
   a. Remove fasteners (4) securing the rear fender (3) to swingarm.
   b. Remove fender fasteners (6).
2. Remove rear fender (3)).

Installation

1. See Figure 2-86. Align rear fender to the swingarm.
2. Install rear fender with fasteners (6) and tighten to 12-36 **in-lbs** (1.4-4 Nm).

NOTE

It is necessary to align the rear brake line with the rear inner fender. The rear fender captures the rear brake line to help maintain the proper alignment and location.



1. **Front fender (All models except XB12X/XB12Ss)**
2. **Front fender fasteners and washers (4)**
3. **Rear fender (XB9SX, XB12Scg/XB12R)**
4. **Rear fender fastener (2)**

Figure 2-86. Front and Rear Fender: All Models except XB12X/XB12Ss

FRONT FENDER: XB12XP

Removal

1. See Figure 2-87. Remove fasteners and washers (1) securing the upper front fender (2) to lower triple clamp.
2. Remove fastener and washer (3) from headlight assembly. Carefully remove front fender (2).

Installation

NOTE

When installing the upper front fender it is important that the front brake line p-clamp be aligned with the slot in the back

right side of the upper front fender before installing and tightening fastener.

1. See Figure 2-87. Align front fender (2) to fender mounts on lower triple clamp, apply LOCTITE 271 (red) and Install front fender fasteners and washers (1) and tighten to 12-36 **in-lbs** (1.4-4 Nm).
2. Install fastener and washer (3) into headlight assembly and tighten to 36-48 **in-lbs** (4.0-5.4 Nm).

REAR FENDER: XB12SS/XB12XT/XB12X

Removal

1. See Figure 2-87. Remove fender fasteners (11).
2. Remove rear fender (10).

Installation

NOTE

When installing the rear fender it is necessary to align rear brake line with trough in the left side of the rear fender.

1. See Figure 2-87. Align rear fender to the swingarm.
2. Install rear fender (10) with fasteners (11).
3. Tighten to 12-36 **in-lbs** (1.4-4 Nm).

FRONT FENDER: XB12X

Removal Upper Front Fender

1. See Figure 2-87. Remove fasteners and washers (1) securing the upper front fender (2) to lower triple clamp.
2. Remove fastener and washer (3) from headlamp assembly. Carefully remove upper front fender (2).

Removal Lower Front Fender

1. Remove fasteners (6, 7) from the right lower front fender (9) and remove.
2. Remove fasteners (6, 7) from left front lower fender (8) and remove lower front fender (8) and lower center fender (4) together.

Installing Upper Front Fender

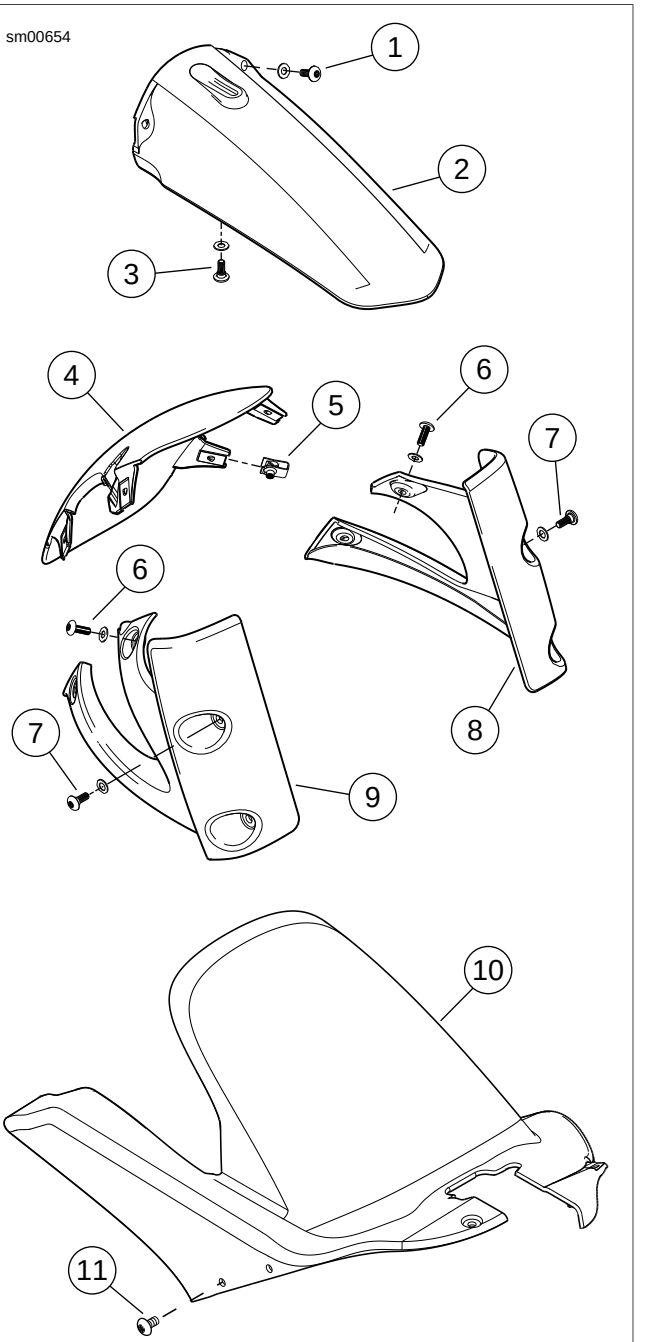
NOTE

When installing the upper front fender it is important that the front brake line p-clamp be aligned with the slot in the back right side of the upper front fender before installing and tightening fastener.

1. See Figure 2-87. Align upper front fender (2) to fender mounts on lower triple clamp and install upper front fender fasteners and washers (1) and tighten to 12-36 **in-lbs** (1.4-4 Nm).
2. Install headlamp fastener and washer (3) and tighten to 36-48 **in-lbs** (4.0-5.4 Nm).

Installing Lower Front Fender

1. Apply LOCTITE 271 (red) and install fasteners (6, 7) in left front lower fender (8). Leave fasteners loose.
2. Verify that the brake line grommet is captured between the lower fender and the right lower front fender.
3. Install the right lower front fender (9) with fasteners (6, 7). Tighten all fender fasteners to 36-48 **in-lbs** (4.0-5.4 Nm).



1. **Upper front fender fasteners and washers (2)**
2. **Fender, front upper (XB12X/XB12XP)**
3. **Front fender fastener and washer**
4. **Fender, front lower center (XB12X)**
5. **Lower front fender nuts (4)**
6. **Lower front fender fasteners and washers (4)**
7. **Lower front fender fasteners and washers (4)**
8. **Fender, front lower left (XB12X)**
9. **Fender, front lower right (XB12X)**
10. **Rear fender (XB12X/XB12XT/XB12XP/XB12Ss)**
11. **Rear fender fastener (5)**

Figure 2-87. Front Fenders: XB12X/XB12XP and Rear Fenders: XB12X/XB12XT/XB12XP/XB12Ss

FRONT FORKS: ALL MODELS 2.16

REMOVAL

1. Remove front fender. See 2.15 FENDERS
2. Remove front wheel. See 2.5 FRONT WHEEL.
3. Remove caliper mounting fasteners. See 2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Caliper Removal.
4. See Figure 2-89. Loosen upper and lower fork clamp pinch fasteners (1, 5).
5. See Figure 2-88. Remove fork from upper fork clamp and slide the stopper ring up and over the top of the fork.
6. See Figure 2-89. Remove fork from lower fork clamp (4).
7. Repeat 4 through 6 on opposite side.

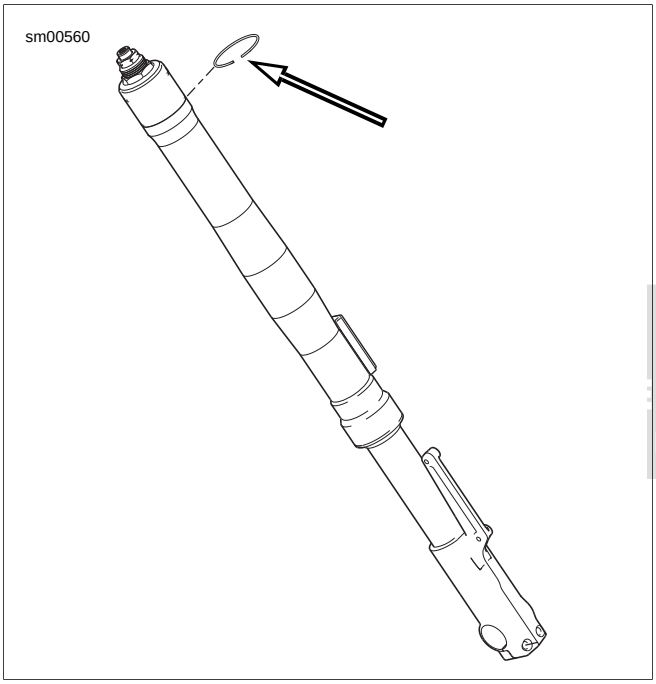
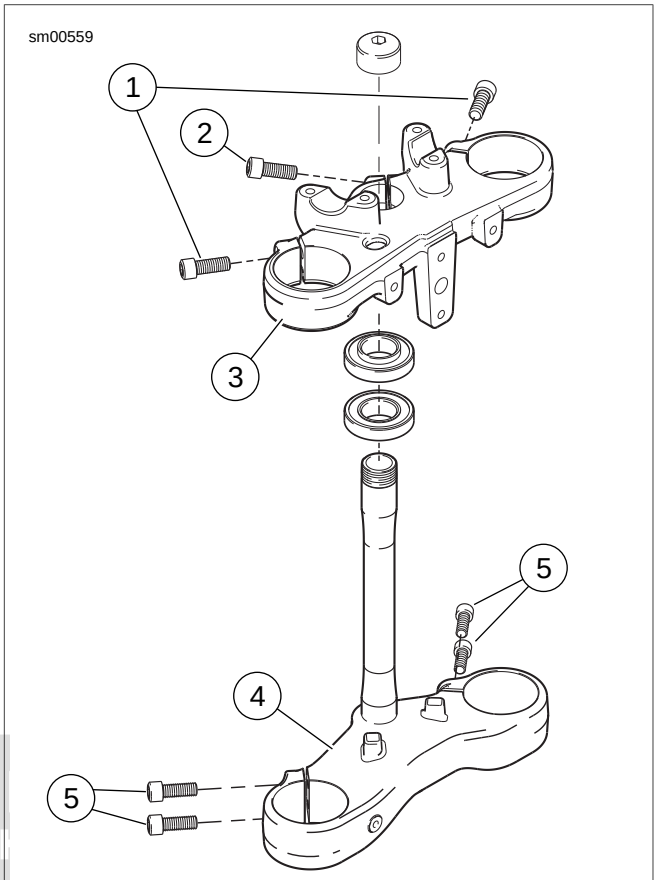


Figure 2-88. Stopper Ring



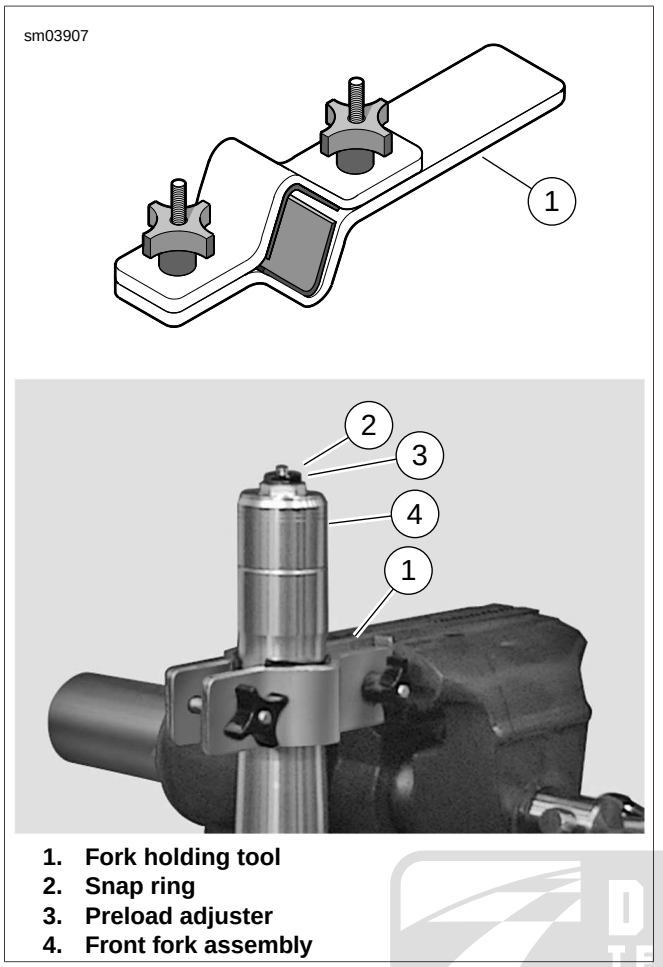
1. **Screw, pinch fastener**
2. **Steering stem pinch fastener**
3. **Triple clamp, upper**
4. **Triple clamp assembly, lower**
5. **Screw, pinch fastener**

Figure 2-89. Upper and Lower Fork Clamp Assembly (Typical)

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-41177	FORK HOLDING TOOL
HD-45966	FRONT FORK COMPRESSOR

1. Remove front fork.



1. **Fork holding tool**
2. **Snap ring**
3. **Preload adjuster**
4. **Front fork assembly**

Figure 2-90. Fork Holding Tool

2. See Figure 2-90. Clamp the FORK HOLDING TOOL (Part No. HD-41177) (1) in a vise and install the upper part of the front fork in the holding tool.

NOTES

- *Record rider suspension settings before disassembly.*
- *Always turn rebound adjuster clockwise until it lightly bottoms out before beginning the disassembly process.*
- *Always turn preload adjuster counterclockwise until it lightly bottoms out before beginning the disassembly process.*

3. See Figure 2-91. Loosen the fork cap and pull up exposing the entire preload and rebound assembly.

4. Remove the fork assembly from the FORK HOLDING TOOL (Part No. HD-41177).

NOTES

- *Holding the fork assembly over a drain pan, pump the fork until there is no resistance felt in order to remove the fork fluid.*
- *FRONT FORK COMPRESSOR (Part No. HD-45966) comes with a cup and screw that are for FLT models only and not to be used with Buell.*
- *When using the FRONT FORK COMPRESSOR (Part No. HD-45966) be sure not to bind the outer fork tube on the tool.*

5. See Figure 2-92. Install the fork assembly in the FRONT FORK COMPRESSOR (Part No. HD-45966).

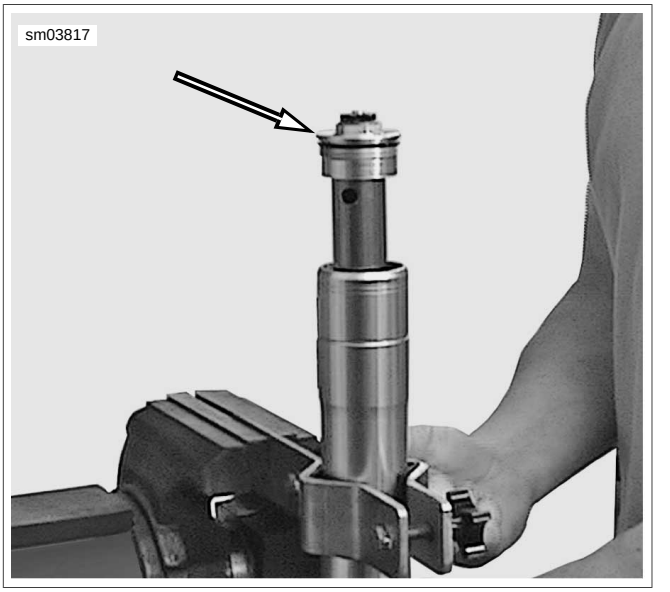


Figure 2-91. Fork Cap: XB All Models

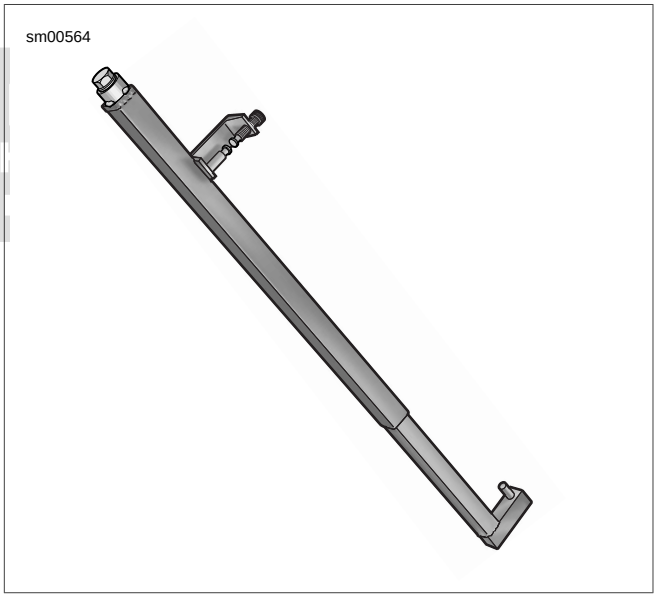


Figure 2-92. Front Fork Compressor

6. See Figure 2-93. Compress the fork spring until the jamnut on the bottom of the fork cap is exposed.

NOTES

- *Attached to the preload assembly is a spacer with two flat sides. This allows a wrench to hold the preload assembly tight while loosening the jamnut for the damper rod assembly.*
- *See Figure 2-93. The bottom of the preload adjuster is round with two flat sides so a wrench (2) can be used to brake to the jamnut (3) loose on the damper rod assembly in order to remove the fork cap from the damper rod.*

7. Loosen the damper rod assembly jamnut (3) and back it off all the way to the bottom.
8. Hold damper rod assembly jamnut (3) and remove fork cap (1).
9. See Figure 2-96. Inside the damper rod assembly (6) is a fork push rod (4) that is tapered on one end to control the movement of fluid in the front fork increasing and decreasing the damping properties. The fork push rod is attached o the fork cap. Remove the fork push rod.
10. Remove fork assembly from spring compressor and remove the spring collar (10), spring joint (11) and fork spring (12).
11. Remove dust seal (21) to access oil seal stopper ring (20).
12. Remove the oil seal stopper ring (20) out from the outer tube with a small pry tool.
13. Using a slide hammer action, remove the slider fork (22) from the outer tube (14).
14. Remove the slide bushing (16) from slider fork by prying the slide bushing at the split.

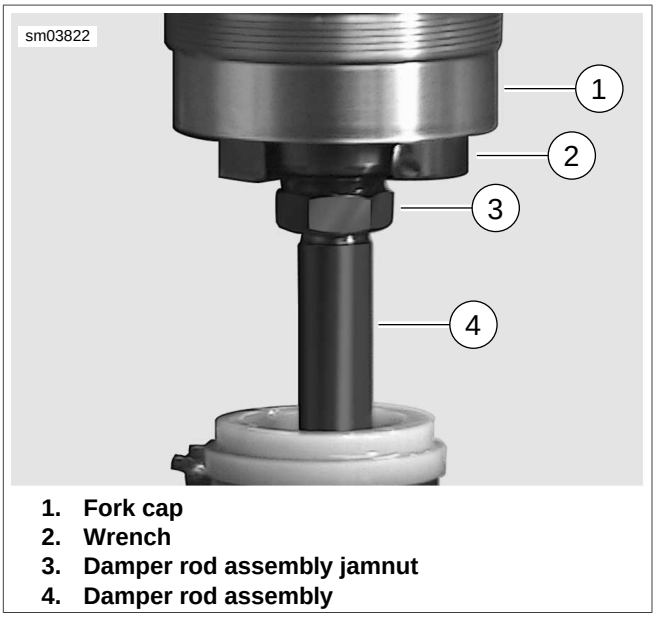
NOTE

Be careful not to over expand slide bushing.

15. Remove guide bushing (17), seal spacer (18), oil seal (19), oil seal stopper ring (20) and dust seal (21).
16. See Figure 2-96. Push the damper rod (6) all the way down in order to seat it and prevent it from spinning in order to remove the center bolt (9) and washer (8).
17. Remove damper rod assembly.

NOTE

See Figure 2-96. The centering plate (7) on the bottom of the damper rod assembly (6) could fall off. Before final assembly make sure the centering plate is on the damper rod assembly.



1. **Fork cap**
2. **Wrench**
3. **Damper rod assembly jamnut**
4. **Damper rod assembly**

Figure 2-93. Holding Damper Rod Assembly: XB All Models

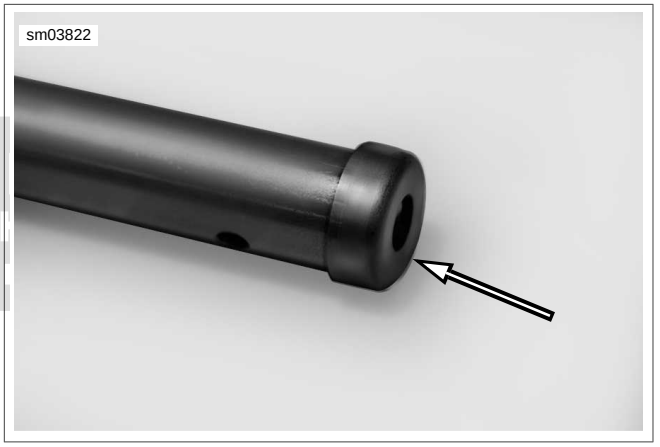
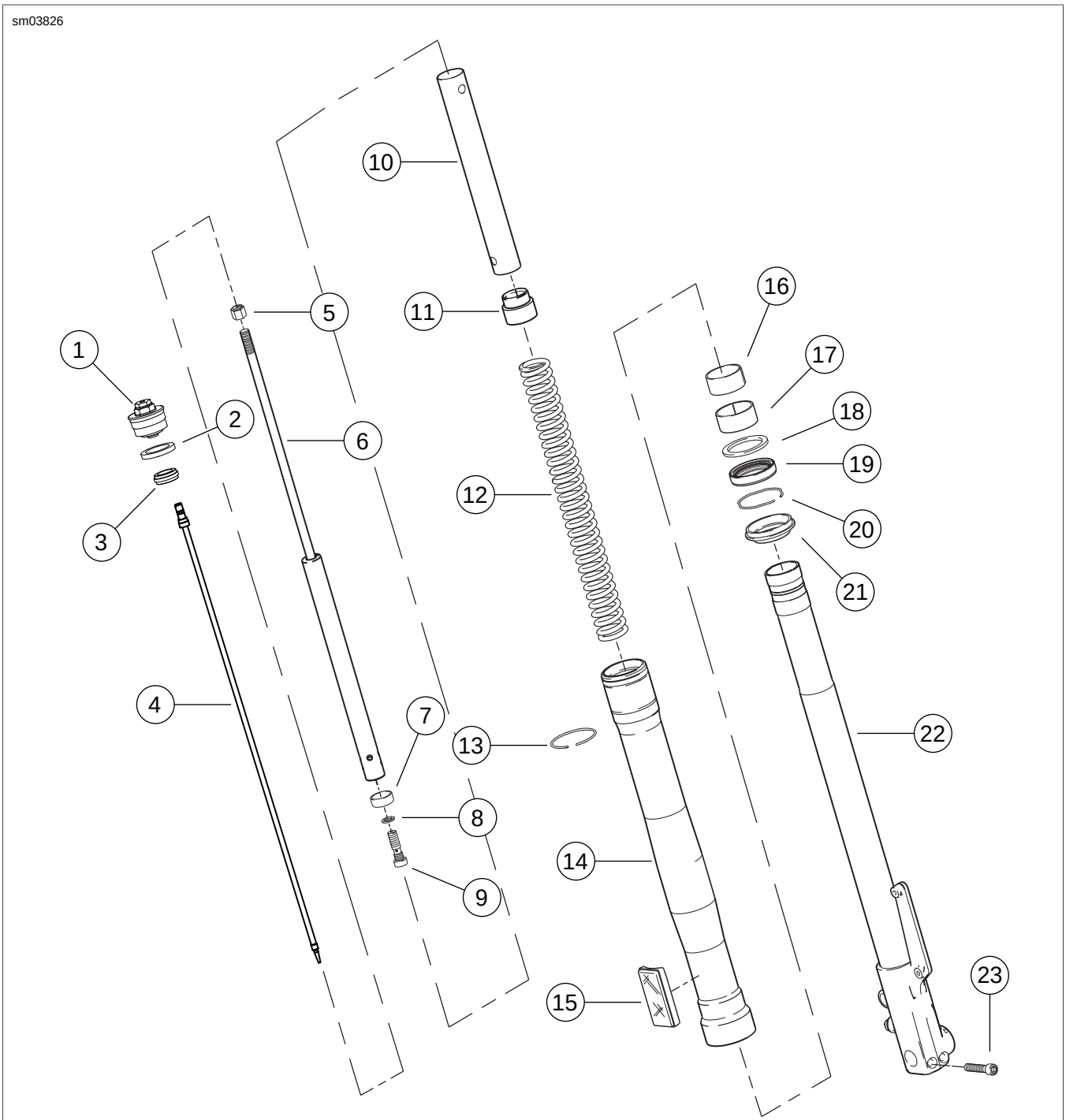


Figure 2-94. Centering Plate on Bottom of Damper Rod

Figure 2-95. Fork Push Rod



1. Fork cap
2. Seat, rubber
3. Slider piston
4. Push rod
5. Damper jamnut
6. Damper rod assembly
7. Centering plate
8. Washer
9. Bolt, center
10. Spring collar
11. Spring joint
12. Spring
13. Stopper ring
14. Outer tube
15. Reflector assembly
16. Slide bushing
17. Guide bushing
18. Seal spacer
19. Oil seal
20. Oil seal stopper ring
21. Dust seal
22. Slider fork
23. Axle clamp bolt

Figure 2-96. Front Fork Assembly: XB All Models

CLEANING AND INSPECTION

1. Thoroughly clean and inspect all parts. Replace any parts that are bent, inoperative or damaged.
2. See Figure 2-96. Check the slider fork (22) and outer tube (14) for score marks, scratches and excessive or abnormal wear. Replace if worn or damaged.
3. Check the slide bushing (16) and the guide bushing (17) for excessive wear or scratches. Replace if damaged or worn.
4. Replace the stopper ring (13) if distorted.
5. Refer to Table 2-25. Measure spring (17) free length. Replace springs shorter than service wear limit.

Table 2-25. Fork Spring Service Wear Limit

MODEL	IN.	MM
XB9R, XB12R	14.31	363.6
XB9SX, XB12Ss	14.31	363.6
XB12Scg	10.92	277.5
XB12X, XB12XP	17.72	450.2
XB12XT	14.99	380.7

6. See Figure 2-97. Measure slider fork runout. Replace pipe if runout exceeds the service wear limit of 0.008 in. (0.2 mm).

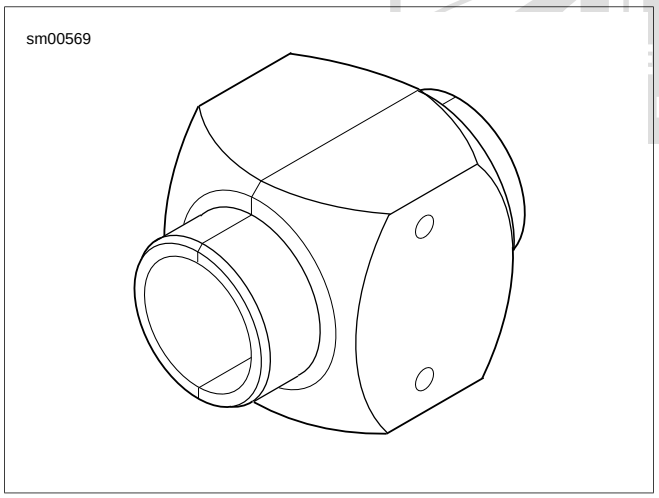


Figure 2-97. Fork Seal Driver

ASSEMBLY

PART NUMBER	TOOL NAME
B-42571-43MM	FORK SEAL DRIVER AND DUST BOOT INSTALLER
B-43721-41MM	FORK SEAL DRIVER AND DUST BOOT INSTALLER
B-48867-47MM	FORK SEAL DRIVER AND DUST BOOT INSTALLER
B-59000A	FRONT FORK OIL LEVEL GAUGE
TBFT 02S	FORK BLEED TOOL SET

1. See Figure 2-96. Install the bottom of the slider fork (22) in the vise using soft jaws.

NOTE

See Figure 2-98. For Buell model motorcycles, there are three different tools that can be used to install the fork seal and dust boot depending on the size of your slider fork. You will either use

- *FORK SEAL DRIVER AND DUST BOOT INSTALLER (Part No. B-43721-41mm) or*
- *FORK SEAL DRIVER AND DUST BOOT INSTALLER (Part No. B-42571-43mm) or*
- *FORK SEAL DRIVER AND DUST BOOT INSTALLER (Part No. B-48867-47mm).*

2. Place the seal driver over the end of the slider fork (22) and the slide bushing channel to avoid damaging the oil seal lip when installing.
3. Coat the sealing lips of the **new** oil seal (19) with fork oil or sealing grease. Install onto the slider fork with its spring side facing the dust seal (21).
4. Remove the seal driver from the slider fork end.
5. Coat the slide bushing (16) and the guide bushing (17) with fork oil. Install the seal spacer (18), the guide bushing (17) and the slide bushing (16) onto the slider fork (22).
6. Install the outer tube (14) over the fork slider and remove assembly from vise.
7. On the workbench drive the guide bushing (17) with the seal spacer (18) and oil seal (19) into position in the outer tube using the front fork seal driver until the oil seal is firmly seated.

NOTE

Be sure to lube the outside of the dust seal with oil and then it can be installed by hand.

8. Install the oil seal stopper ring (20) and a **new** dust seal (21).
9. See Figure 2-96. Make sure the centering plate (7) is on the damper rod assembly (6) and install into the slider tube and push to the bottom of the slider.
10. Install the center cap bolt (9) with a **new** sealing washer (8) and tighten to 20-30 ft-lbs (27-40.6 Nm).

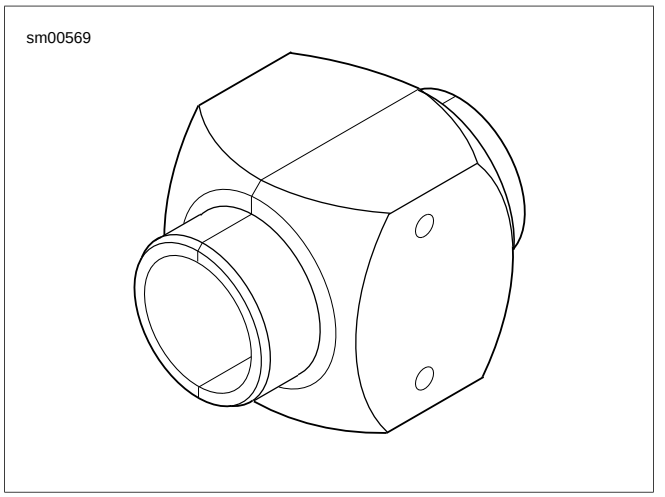


Figure 2-98. Fork Seal Driver

Figure 2-99. Damper Rod Retrieval Tool

11. Once again install the bottom of the slider tube (22) in the vise using soft jaws.

NOTES

- *The recommended fork oil is hydraulic fork oil Type "E" (Part No. HD-99884-80.*
- *The fork spring should not be installed for this part of the procedure.*

12. With the fork fully collapsed, fill the fork with oil until it reaches the threads on the outer tube.

13. See Figure 2-99. Thread damper rod retrieval tool found in the Race Tech Inc. FORK BLEED TOOL SET (Part No. TBFT 02S) onto end of damper rod assembly (6). See Figure 2-96.

NOTE

While pumping the outer tube up and down be sure not to exceed the travel of the fork assembly.

14. Pump the outer tube up and down approximately 6 inches 10 times.

15. See Figure 2-96. Collapse the fork again and once bubbling has stopped, pump the damping rod up and down its full stroke until consistent resistance is felt for the entire stroke.

16. See Figure 2-100.With fork completely collapsed, adjust fork oil level with FRONT FORK OIL LEVEL GAUGE (Part No. B-59000A) to the specified level below the top of the outer tube. Refer to Table 2-26.

NOTE

When installing the fork spring verify that the tighter wound portion of the spring is installed down.

17. See Figure 2-96. Install the fork spring (12), fork spring joint (11) and fork spring collar (10) over the damper rod retrieval tool.

NOTE

Be sure to never over compress the fork assembly.

18. Remove the fork slider from the vise and install the fork assembly in the front fork compressor.

19. See Figure 2-93. Compress the fork spring until you have access to the damper rod assembly with jamnut.

20. Remove the damper rod retrieval tool while holding onto the damper rod with your fingers.

NOTE

Make sure you place the damper rod jamnut at the bottom of the threads.

21. See Figure 2-96. If the fork push rod (4) has been removed from the fork cap assembly (1) install at this time.

22. When installing the fork push rod with fork cap, insert it into the damper rod and allow it to float down until it stops.

23. Thread the fork cap onto the damper rod until it stops. Do not tighten.

NOTE

Before tightening the damper rod jamnut, back the rebound adjuster out 1/4 turn to prevent damage to the tapered end of the fork push rod.

24. Thread the damper rod jamnut until bottoms lightly on the rebound adjuster assembly in the fork cap.

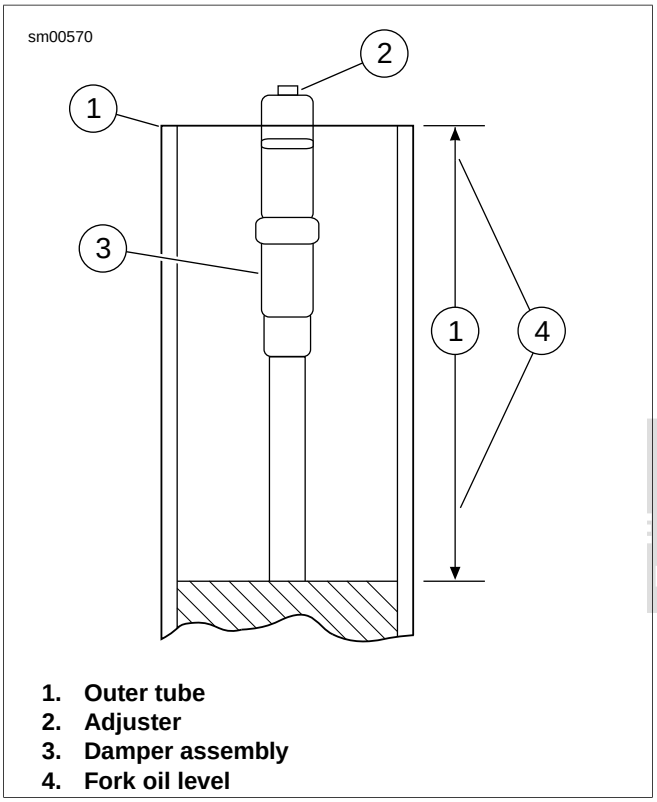
25. Tighten the damper rod jamnut (2) to 22-30 ft-lbs (30-41 Nm).

26. Remove the fork assembly from the front fork compressor and install in the fork holding tool and install in vise.

27. See Figure 2-96. Thread fork cap (3) into fork tube (18) and tighten to 22-30 ft-lbs (30-41 Nm).

Table 2-26. Fork Oil Levels: XB12X/XB12XT

MODEL	IN.	MM
XB12R	4.21	107
XB12Ss	4.65	118
XB9SX	4.21	107
XB12Scg	4.29	109
XB12X	4.49	114
XB12XP	4.49	114
XB12XT	4.69	119



1. **Outer tube**
2. **Adjuster**
3. **Damper assembly**
4. **Fork oil level**

Figure 2-100. Measuring Fork Oil Level

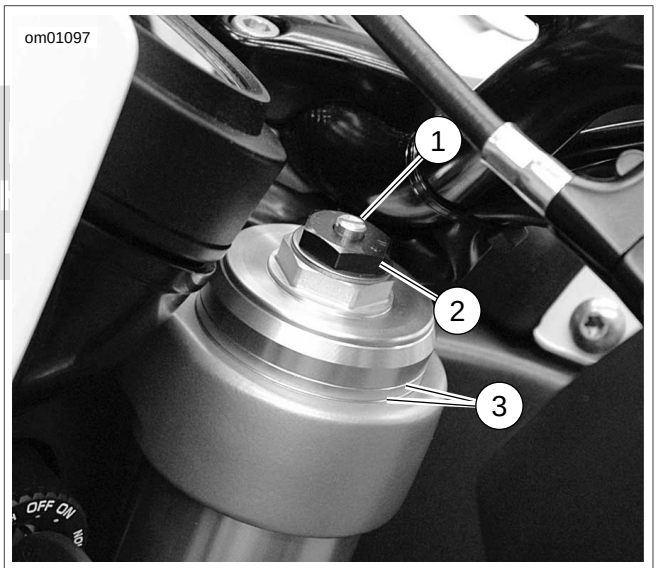
INSTALLATION

1. Install one front fork assembly into lower fork clamp.
2. Slide the stopper ring over top of fork assembly and into groove.
3. Install fork assembly into upper fork clamp.

⚠WARNING

Both forks should be adjusted equally. Forks that are not properly adjusted can lead to loss of control, which could result in death or serious injury. (00124b)

4. Repeat previous steps on second front fork.
5. Temporarily install front axle to the fork assemblies to verify correct alignment.
6. Use LOCTITE 271 (red) on upper fork clamp fasteners. Tighten to 23-25 ft-lbs (31.2-33.8 Nm).
7. Use LOCTITE 271 (red) on lower fork clamp fasteners. Tighten to 20-22 ft-lbs (27-30 Nm).
8. Repeat torque sequence in previous two steps.
9. Install front brake caliper onto caliper mount. See 2.10 FRONT BRAKE: SIX PISTON CALIPER, Installation.
10. Install front wheel. See 2.5 FRONT WHEEL.
11. Install front fender. See 2.15 FENDERS.
12. Check headlamp alignment. See 1.17 HEADLAMP.
13. Adjust front forks suspension to rider preferences.



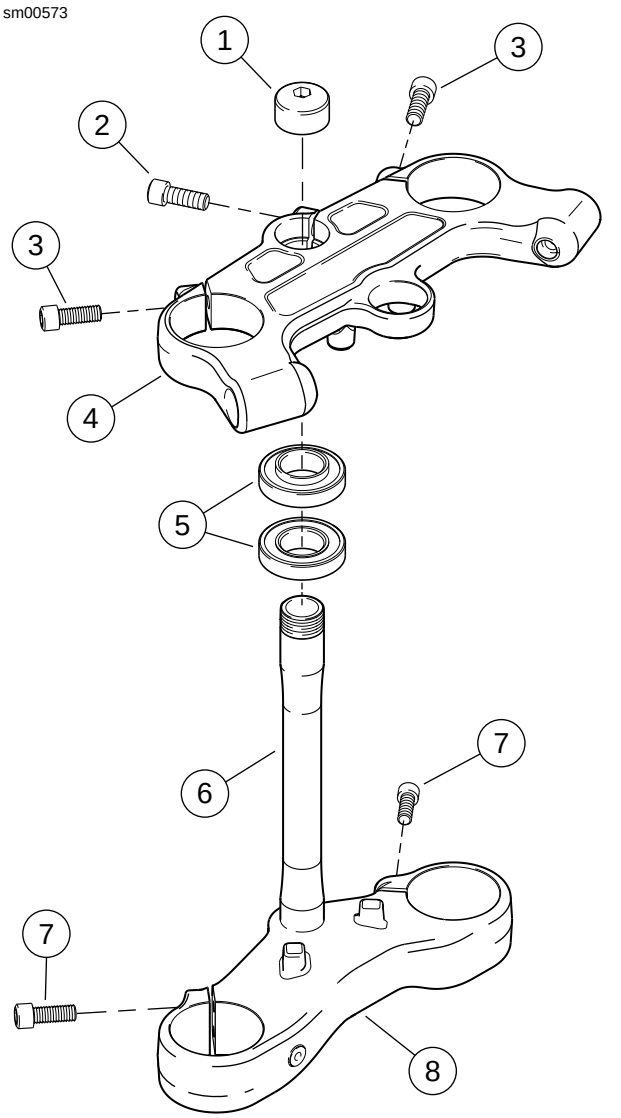
1. **Rebound adjuster screw**
2. **Preload adjuster nut**
3. **Alignment lines**

Figure 2-101. Front Fork Preload and Rebound Adjuster: XB All Models

FORK CLAMPS: UPPER AND LOWER 2.17

REMOVAL FIREBOLT:

1. Place a scissor jack under jacking point and raise front wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.
2. Remove handlebars. See 2.31 HANDLEBARS: FIREBOLT.
3. Remove cable straps securing wiring harnesses to the upper fork clamp.
4. Remove front fork assemblies. See 2.16 FRONT FORKS: ALL MODELS.
5. See Figure 2-102. Remove steering stem pinch fastener (2).
6. Under right side of front fairing, cut cable strap holding ignition switch, fuse block and right handlebar switch wires and unplug the ignition switch. See 6.4 IGNITION/HEADLAMP KEY SWITCH.
7. See Figure 2-102. Hold or brace the lower fork clamp and remove steering stem capnut (1).
8. Remove the upper fork clamp (4).
9. Remove the stem (6) and lower fork clamp (8) as an assembly.
10. Remove ignition switch.
11. If steering head bearings need replacing, see 2.18 STEERING HEAD BEARINGS.



1. **Stem capnut**
2. **Stem pinch fastener**
3. **Upper fork clamp pinch fastener**
4. **Upper fork clamp**
5. **Head bearing**
6. **Stem**
7. **Lower fork clamp pinch fastener**
8. **Lower fork clamp**

Figure 2-102. Steering Stem Assembly: Firebolt

INSTALLATION: FIREBOLT

1. Install ignition switch. See 6.4 IGNITION/HEADLAMP KEY SWITCH.
2. See Figure 2-102. Install the lower fork clamp (8) into the steering stem bore and install the upper fork clamp (4).
3. Install steering stem capnut (1). Thread on by hand but do not torque.

NOTE

Carefully install the fork into the upper fork clamp. Forcing the fork into the upper fork clamp could move the stopper ring out of the groove which will not allow the correct clamp load.

4. Install one front fork assembly into lower fork clamp (8).
5. See Figure 2-96. Slide the stopper ring (19) over top of fork assembly and into groove.
6. Install upper clamp on fork assembly. Tighten but do not torque lower fork clamp pinch fasteners.
7. Repeat previous two steps on second fork assembly.
8. Tighten steering stem cap nut to 38-42 ft-lbs (52-57 Nm), loosen fastener and then retighten to 38-42 ft-lbs (52-57 Nm).
9. Install steering stem pinch bolt applying LOCTITE 271 (red) and tightening to 20-22 ft-lbs (27-30 Nm).

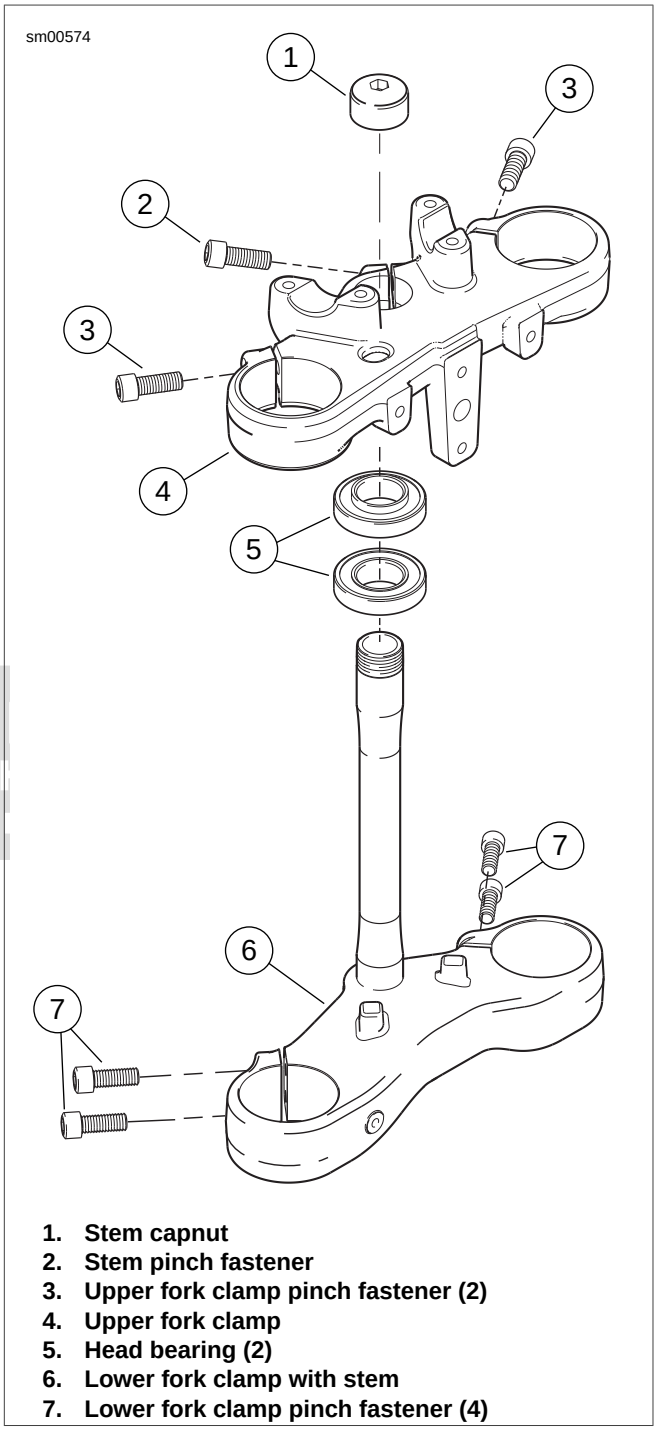
⚠WARNING

Both forks should be adjusted equally. Forks that are not properly adjusted can lead to loss of control, which could result in death or serious injury. (00124b)

10. See Figure 2-101. Position both forks with same number alignment lines (4) visible and reflectors facing to the sides. Do not tighten.
11. Use LOCTITE 271 (red) on upper fork clamp fasteners and tighten to 23-25 ft-lbs (31-34 Nm).
12. Use LOCTITE 271 (red) on lower fork clamp fasteners and tighten to 20-22 ft-lbs (27-30 Nm).
13. Repeat torque sequence previous two steps.
14. Install handlebars. See 2.31 HANDLEBARS: FIREBOLT.
15. Install cable straps.
    a. Install cable strap to the right of ignition switch securing right hand switch and brake line wires to upper fork clamp.
    b. Install cable strap to the left of ignition switch securing left hand switch and clutch cable wires to upper fork clamp.
    c. Connect ignition switch and install cable strap.

REMOVAL: LIGHTNING/ULYSSES

1. Place a scissor jack under jacking point and raise front wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.
2. Remove handlebars. See 2.32 HANDLEBARS: LIGHTNING/ULYSSES.
3. Remove front modules. See 2.30 FRONT MODULES: LIGHTNING/ULYSSES.
4. Remove front fork assemblies. See 2.16 FRONT FORKS: ALL MODELS.
5. See Figure 2-103. Remove steering stem pinch fastener (2).
6. Hold or brace the lower fork clamp and remove steering stem capnut (1).
7. Remove the upper fork clamp (4).
8. Remove the lower fork clamp with stem (6).
9. If steering head bearings need replacing, see 2.18 STEERING HEAD BEARINGS.



1. **Stem capnut**
2. **Stem pinch fastener**
3. **Upper fork clamp pinch fastener (2)**
4. **Upper fork clamp**
5. **Head bearing (2)**
6. **Lower fork clamp with stem**
7. **Lower fork clamp pinch fastener (4)**

Figure 2-103. Steering Stem Assembly: Lightning/Ulysses

INSTALLATION: LIGHTNING/ULYSSES

1. See Figure 2-103. Install the lower fork clamp with stem (6) into the steering stem bore and install the upper fork clamp (4).

2. Install steering stem capnut (1). Tighten but do not torque.
3. Install one front fork assembly into lower fork clamp with stem (6).
4. See Figure 2-96. Slide the stopper ring (19) over top of fork assembly and into groove.
5. Install fork assembly into upper clamp. Tighten but do not torque lower fork clamp pinch fasteners.
6. Repeat previous two steps on second fork assembly.
7. Tighten steering stem cap nut to 38-42 ft-lbs (52-57 Nm).
8. Install steering stem pinch bolt applying LOCTITE 271 (red) and tightening to 20-22 ft-lbs (27-30 Nm).

WARNING

Both forks should be adjusted equally. Forks that are not properly adjusted can lead to loss of control, which could result in death or serious injury. (00124b)

NOTE

For additional information, see 2.16 FRONT FORKS: ALL MODELS.

9. See Figure 2-101. Position both forks with same number alignment lines (4) visible and reflectors facing to the sides. Do not tighten.
10. Use LOCTITE 271 (red) on upper fork clamp fasteners and tighten to 23-25 ft-lbs (31-34 Nm).
11. Use LOCTITE 271 (red) on lower fork clamp fasteners and tighten to 20-22 ft-lbs (27-30 Nm).
12. Repeat tightening sequence in two previous steps.
13. Install front modules. See 2.30 FRONT MODULES: LIGHTNING/ULYSSES.
14. Install handlebars. See 2.32 HANDLEBARS: LIGHTNING/ULYSSES.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STEERING HEAD BEARINGS 2.18

REMOVAL

1. Place a scissor jack under jacking point and raise front wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.
2. Remove brake lever housing. See 2.10 FRONT BRAKE: SIX PISTON CALIPER.
3. On Firebolt models, remove headlight assembly and support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
4. On Lightning and Ulysses models, remove front modules. See 2.30 FRONT MODULES: LIGHTNING/ULYSSES.
5. Remove front forks, lower fork clamp, brake and wheel as front-end assembly.
   a. Loosen steering stem pinch fastener (2) and upper and lower fork clamp pinch fasteners (3, 7).
   b. Brace wheel while removing steering stem capnut fastener (1).
   c. Remove upper fork clamp (4) and front-end assembly which includes front wheel, steering stem/lower fork clamp.
6. Remove upper and lower steering head bearings (5).
   a. See Figure 2-104. Locate notches inside steering head stem bore (upper bearing removed for clarity).
   b. Place a suitable tool in the notches of the steering stem bore and remove upper and lower steering head bearings.

NOTE

Discard steering head bearings and replace with new. Steering head bearings are not reusable.

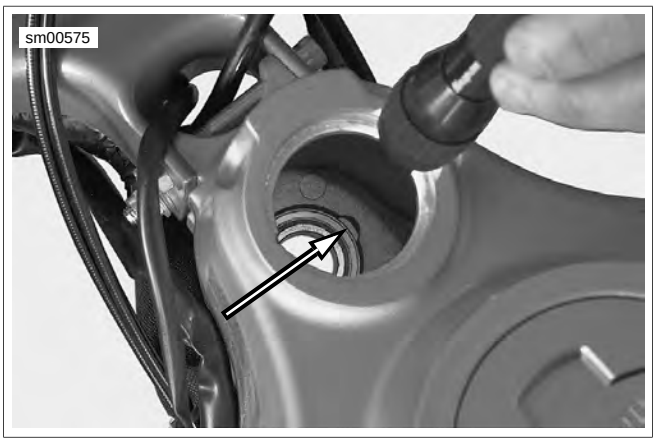


Figure 2-104. Lower Steering Head Bearing Notches (Upper Bearing Removed For Clarity)

INSTALLATION

PART NUMBER	TOOL NAME
B-43993-12	BACKING PLATE
B-45521	STEERING HEAD BEARING INSTALLATION TOOL
HD-39302	STEERING HEAD BEARING RACE INSTALLER

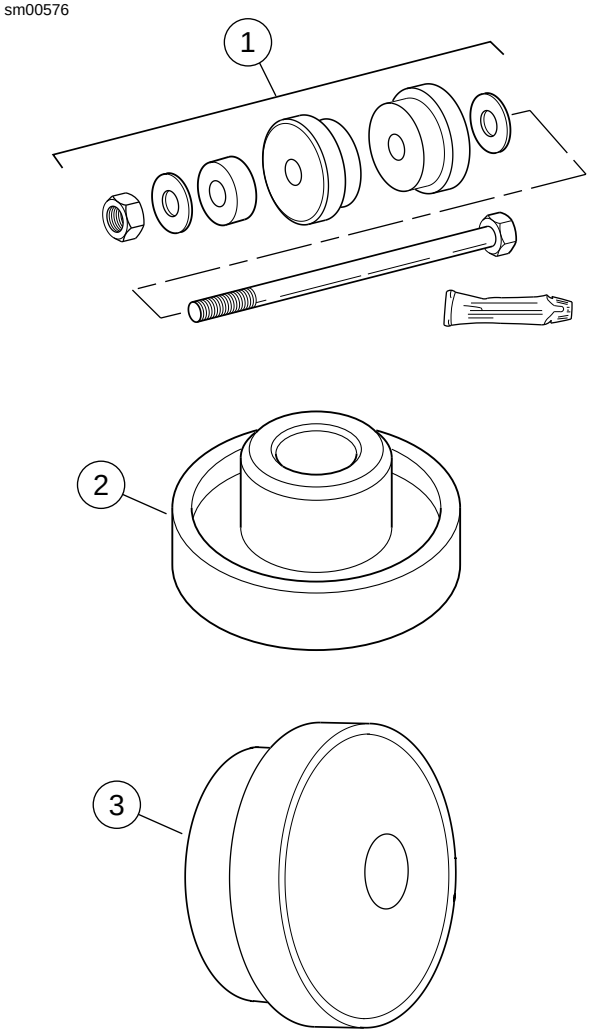
NOTES

- *Steering head bearings should be installed one at a time in order to verify proper alignment of bearing in bore.*
- *Use the backing plate for wheel bearing installation (B-43993-12) on the opposite side of the frame neck. By placing the large diameter of the backing plate against the frame neck it will prevent damage to the frame.*
- *For easier installation of bearing, lubricate the outer bearing with engine oil prior to installing into steering stem bore.*

1. See Figure 2-105. Install **new** upper steering head bearing into the frame neck using STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302), the BACKING PLATE (Part No. B-43993-12) from the wheel bearing installation kit.
   a. See Figure 2-106. Place the upper bearing squarely in the steering stem bore with the inner race lip pointing away from the steering head.
   b. See Figure 2-105. Insert the steering head bearing installation tool into the upper bearing, with the shoulder into the bearing bore.
   c. Insert the forcing screw from the steering head bearing race installer through the steering head bearing installation tool.

NOTE

For ease of steering head bearing installation, lubricate the outside of the steering head bearings.



1. **Steering head bearing race installer**
2. **Steering head bearing installer**
3. **Wheel bearing backing plate**

Figure 2-105. Steering Head Bearing Installation Tools

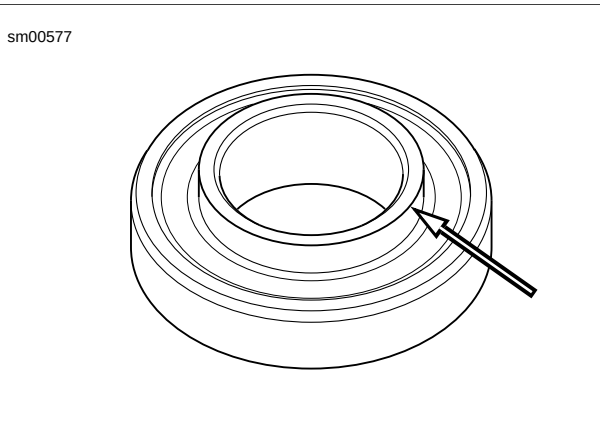
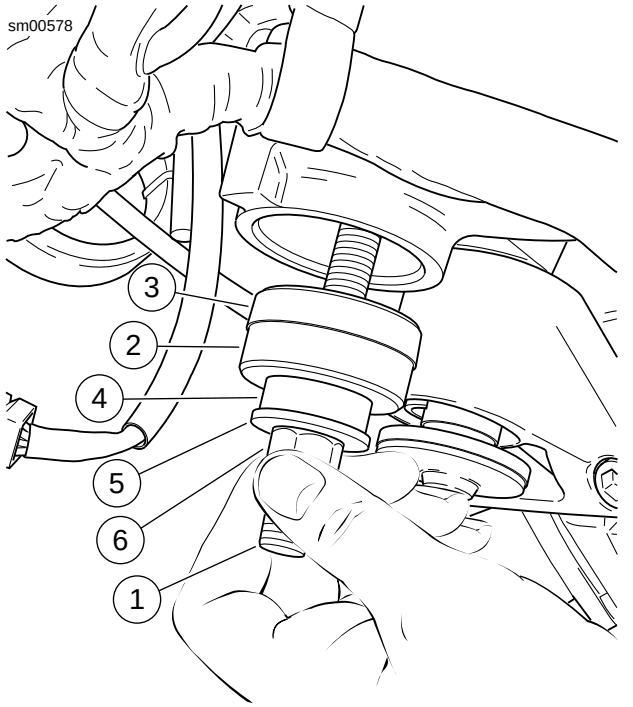


Figure 2-106. Steering Head Bearing Lip

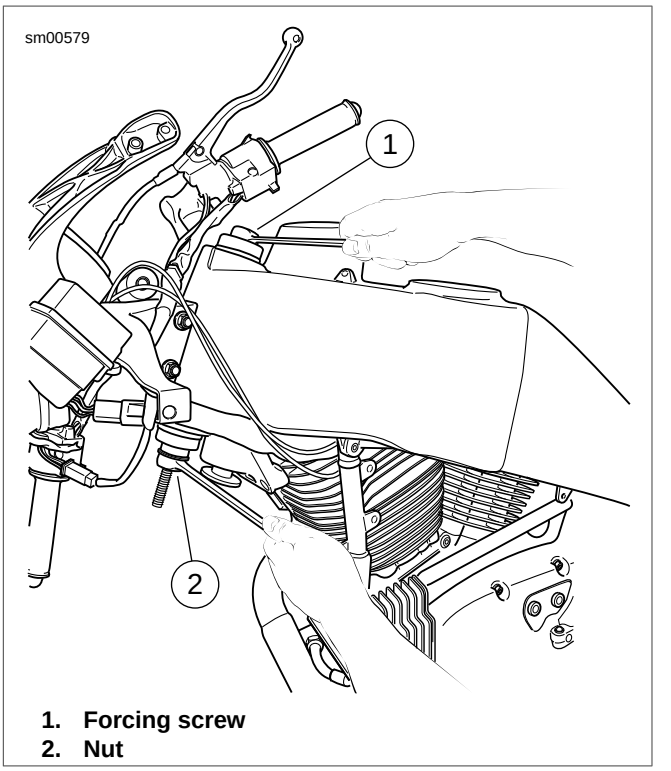


1. **Forcing screw**
2. **Steering Head Bearing Installation Tool**
3. **Lower bearing**
4. **Bearing**
5. **Washer**
6. **Nut**

Figure 2-107. Lower Bearing

2. See Figure 2-107. Sparingly apply EXTREME PRESSURE LUBRICANT (Part No. J-23444-A) to the threads of the forcing screw (1) from the steering head bearing race installer, to prolong service life and verify smooth operation. Insert the forcing screw (1) through the STEERING HEAD BEARING INSTALLATION TOOL (Part No. B-45521).
3. Place the WHEEL BEARING BACKING PLATE with the large diameter facing the frame over the forcing screw.
4. Install the bearing (4), washer (5) and nut (6) from the steering head bearing race installer onto the forcing screw (1).
5. Tighten the nut (6) by hand, until the bearing is started into the bore in the steering head.
6. See Figure 2-108. Hold the forcing screw while tightening the nut to draw the bearing into the steering head. Continue tightening until the bearing is fully seated.
7. Visually check to make sure the bearing is completely seated against the shoulder in the steering head.
8. Repeat this process for the lower bearing.
9. Install forks, front wheel, and lower fork clamp/steering stem as an assembly.
10. Install upper fork clamp.
11. Tighten steering stem capnut to 38-42 ft-lbs (52-57 Nm).

12. Install steering stem pinch bolt applying LOCTITE 271 (red) and tightening to 20-22 ft-lbs (27-30 Nm).
13. Apply LOCTITE 271 (red) to upper triple clamp fasteners and tighten to 23-25 ft-lbs (31.2-33.8 Nm).
14. On Lightning and Ulysses models, install front modules. See 2.30 FRONT MODULES: LIGHTNING/ULYSSES.
15. On Firebolt models, install headlight assembly and support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
16. Install front brake lever housing. See 2.10 FRONT BRAKE: SIX PISTON CALIPER.



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

Figure 2-108. Install Bearings

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SWINGARM AND BRACE 2.19

GENERAL

The swingarm also serves as the oil tank. For information on the swingarm function as the oil tank, see 3.11 OIL RESERVOIR AND OIL HOSE ROUTING.

The swingarm features a removable brace on the right side to allow drive belt replacement. Sealed bearings eliminate the need for preload adjustment.

BRACE

Removal

CAUTION

Relieve belt tension before removing swingarm to prevent brace damage. (00514b)

1. **For Firebolt/Lightning:** Remove right side rider footpeg mount. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.

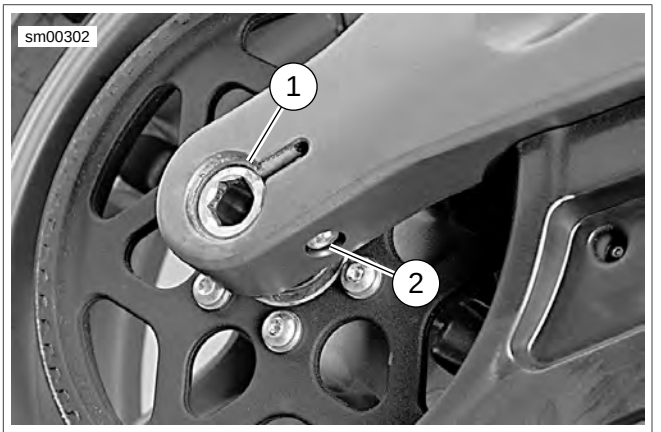
   For Ulysses: Remove right side rider/passenger footpeg heel guard and mount with the rider and passenger footpegs. See 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.

2. See Figure 2-109. Loosen rear axle (1) pinch bolt (2).
3. Loosen rear axle approximately 15 rotations to allow partial tension to be removed from rear drive system.
4. See Figure 2-110. Remove swingarm brace mounting fasteners (10).
5. Remove swingarm brace (11).

Installation

1. See Figure 2-110. Install swingarm brace (11) with swingarm brace mounting fasteners (10) loosely. Do not tighten.
2. Tighten swingarm brace fasteners (10) to 25-27 ft-lbs (34-37 Nm).
3. Tighten rear axle to 23-27 ft-lbs (31.2-36.6 Nm) . Back off two turns and then tighten to 48-52 ft-lbs (65-70.5 Nm).
4. Tighten rear axle pinch bolt (12) to 40-45 ft-lbs (54-61 Nm).
5. **For Firebolt/Lightning:** Install right side rider footpeg mount. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.

   For Ulysses: Install right side rider/passenger footpeg heel guard and mount with the rider and passenger footpegs. See 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.



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

Figure 2-109. Rear Axle

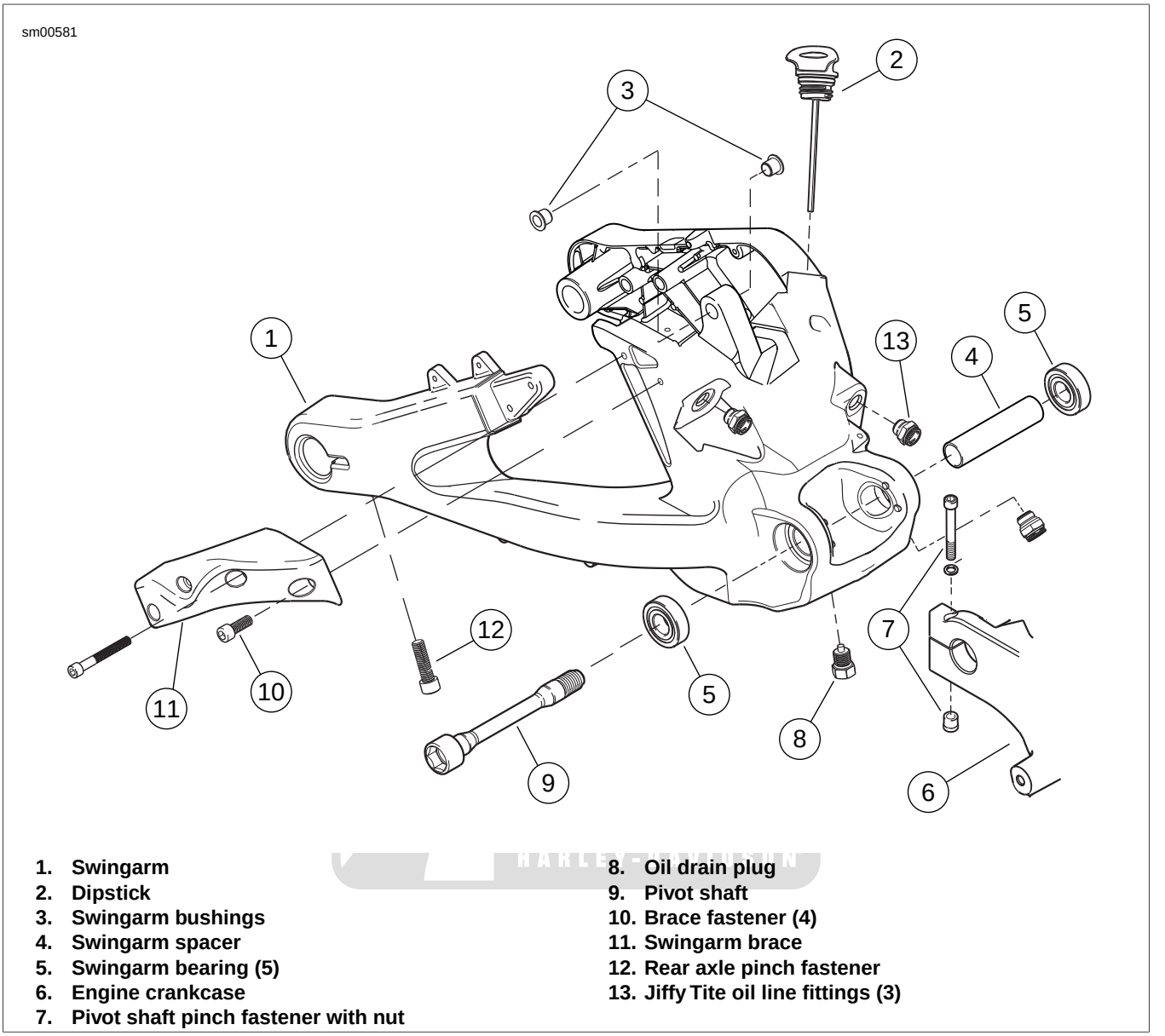
REMOVAL: SWINGARM

1. Remove seat.

WARNING

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

2. Disconnect battery by unthreading fasteners removing negative cable (black) from battery first. See 1.5 BATTERY MAINTENANCE.
3. See Figure 2-110. Remove oil drain plug (8) and drain oil from swingarm. See 1.6 ENGINE OIL AND FILTER.
4. Remove rear wheel. See 2.6 REAR WHEEL.
5. Remove p-clamp connecting rear brake line to swingarm.
6. Remove drive belt. See 5.7 DRIVE BELT AND IDLER PULLEY.
7. Remove p-clamps and washers that secure oil lines to swingarm.
8. Remove rear inner fender. See 2.15 FENDERS.
9. Disconnect the three oil lines from swingarm fittings. See 3.12 OIL LINE FITTINGS.
10. With vehicle supported remove lower shock absorber mounting fastener and spacer from shock absorber and swingarm.
11. See Figure 2-110. Loosen pivot shaft pinch fastener (7).
12. Remove pivot shaft (9) with a special 7/8 in. hex tool located in tool kit.
13. Remove swingarm from vehicle.



1. **Swingarm**
2. **Dipstick**
3. **Swingarm bushings**
4. **Swingarm spacer**
5. **Swingarm bearing (5)**
6. **Engine crankcase**
7. **Pivot shaft pinch fastener with nut**
8. **Oil drain plug**
9. **Pivot shaft**
10. **Brace fastener (4)**
11. **Swingarm brace**
12. **Rear axle pinch fastener**
13. **Jiffy Tite oil line fittings (3)**

Figure 2-110. Swingarm Assembly

DISASSEMBLY

PART NUMBER	TOOL NAME
SNAP-ON CJ1275	SLIDE HAMMER

NOTE

Carefully mark all bearing components as they are removed so that they may be returned to their original locations. Do not intermix bearing components.

Swingarm

1. Remove oil line fittings from swingarm. See 3.12 OIL LINE FITTINGS.

NOTE

See Figure 2-110. Remove swingarm bearings (5) only if replacement is required. The complete bearing assembly must be replaced as a unit when replacement is necessary. Do not intermix bearing components.

2. See Figure 2-110. Remove swingarm bearings (5) using SLIDE HAMMER (Part No. SNAP-ON CJ1275) or equivalent and 3/4 in. bearing remover and spacer.
3. Remove shock mount bushings (3) and sleeve.
4. Remove stone guard. See 2.37 BELT GUARDS.

CLEANING AND INSPECTION

⚠WARNING

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

1. Thoroughly clean all components in solvent. Blow dry with compressed air.
2. Carefully inspect all bearing components for wear and/or corrosion. Replace complete bearing assembly if any component is damaged.
3. Check that swingarm is not bent or twisted. Replace if damaged.

ASSEMBLY

PART NUMBER	TOOL NAME
HD-44060-6	BEARING INSTALLER

Swingarm

1. See Figure 2-110. Install **new** shock mount bushings (3).
2. Install **new** bearings (5) and spacer (4) with BEARING INSTALLER (Part No. HD-44060-6) by lightly seating spacer.

NOTES

- *The left side bearing must be installed first and fully seated.*
- *Swingarm bearings should be replaced as a unit. Do not intermix components. Mark all components so they may be correctly installed.*

3. See Figure 2-111. Install oil line fittings with **new** o-rings on swingarm. Tighten to 108-156 **in-lbs** (12-17.6 Nm). See 3.12 OIL LINE FITTINGS.
4. See Figure 2-110. Install drain plug (8). Tighten to 26-29 ft-lbs (35-39 Nm).

Figure 2-111. Jiffy Tite, Quick Disconnect Oil Line Fittings

INSTALLATION: SWINGARM

1. See Figure 2-110. Align swingarm (1) in pivot of engine crankcase (6).
2. Install pivot shaft (9) with a special 7/8 in. hex tool located in tool kit. Apply ANTI-SEIZE and tighten to 44-46 ft-lbs (59-62 Nm).
3. Apply LOCTITE 271 (red) to pivot shaft pinch fastener (7). Install and tighten fastener to 17-19 ft-lbs (23-26 Nm).
4. See Figure 2-118. Install lower shock absorber mounting fastener (7) and spacer from shock absorber and swingarm and tighten to 15-17 ft-lbs (20.3-23 Nm).
5. Install p-clamp and washer that secures rear brake line to swingarm and tighten to 36-60 **in-lbs** (4-7 Nm).

NOTE

Be careful to align the rear brake line with the rear inner fender. The rear inner fender captures the rear brake line to help maintain proper location.

6. Install rear fender. See 2.15 FENDERS.
7. Install rear inner fender and tighten fasteners to 12-36 **in-lbs** (1.4-4.0 Nm).
8. Connect three oil lines to swingarm fittings and install and tighten p-clamps to 48-72 **in-lbs** (5.4-8 Nm). See 3.12 OIL LINE FITTINGS.
9. Install rear wheel. See 2.6 REAR WHEEL.
10. Install stone guard. See 2.37 BELT GUARDS.

NOTE

Installing the rear wheel will include installation of the belt drive system. See 5.7 DRIVE BELT AND IDLER PULLEY.

11. Fill motorcycle with recommended oil. See 1.6 ENGINE OIL AND FILTER.
12. Install the belt drive. See 5.7 DRIVE BELT AND IDLER PULLEY.
13. Install swingarm brace. See 2.19 SWINGARM AND BRACE, Brace.

WARNING

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

14. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

WARNING

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

15. Install seat.
16. Check oil level after starting motorcycle and allowing it to reach operating temperature.

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)

17. Check rear brake operation.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FRONT AND REAR ISOLATORS 2.20

FRONT ISOLATOR

Removal

NOTE

Avoid cross-threading front isolator bolt or insert. Keep weight of motorcycle off front isolator by alternately loosening front isolator bolt and raising scissor jack to support engine.

1. Place a scissor jack under jacking point for supporting engine only. See 4.18 EXHAUST SYSTEM.
2. See Figure 2-112. Remove clutch cable bracket.
3. See Figure 2-113. Remove front isolator bolt (6).
4. Remove front isolator mount fasteners (5).
5. Remove front isolator bracket (4).
6. Remove upper snubber fastener (2) and remove upper snubber (1).

Installation

NOTE

See Figure 2-113. If the threaded insert (3) is damaged and needs to be replaced, install new insert with LOCTITE 271 (red) and tighten to 59-61 ft-lbs (80-82.7 Nm).

1. See Figure 2-113. Install upper snubber (1) tightening snubber fastener (2) to 12-36 **in-lbs** (1.4-4 Nm).
2. Loosely install front isolator bracket (4) with front isolator bolt (6).
3. Install front isolator bracket fasteners (5), and tighten to 49-51 ft-lbs (66-69 Nm).

NOTE

Avoid cross-threading front isolator bolt or insert. Keep weight of motorcycle off front isolator by alternately tightening front isolator bolt and raising scissor jack to support engine.

4. Tighten front isolator bolt (6) to 49-51 ft-lbs (66-69 Nm).
5. See Figure 2-112. Install clutch cable bracket. Tighten fastener to 84-92 **in-lbs** (9.5-10.4 Nm).

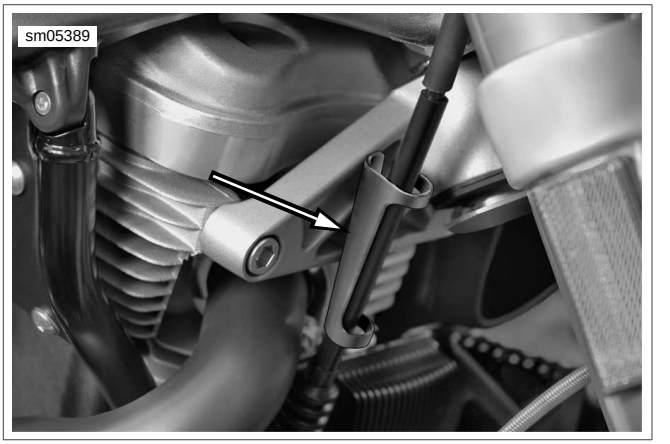
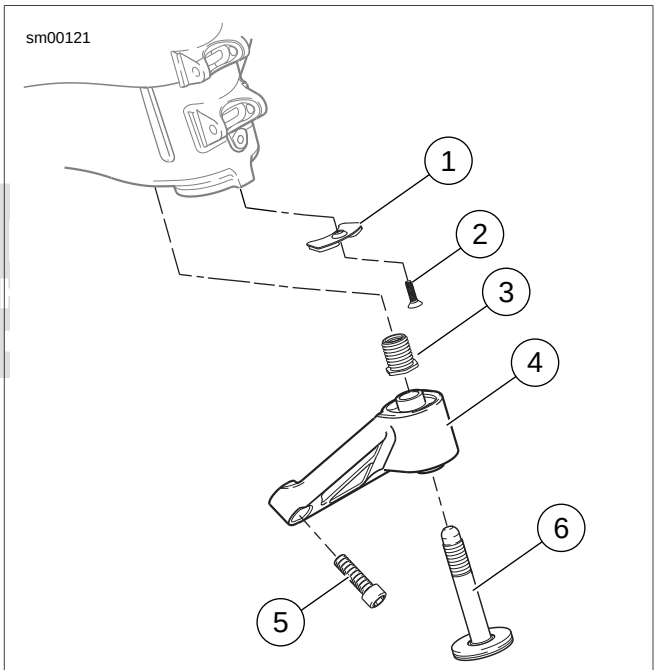


Figure 2-112. Clutch Cable Bracket



1. **Upper snubber**
2. **Upper snubber fastener**
3. **Insert**
4. **Front isolator bracket**
5. **Front isolator bracket fastener to engine**
6. **Front isolator bolt**

Figure 2-113. Front Isolator

REAR ISOLATOR

NOTE

The engine must be removed to access the rear isolator.

See 3.4 ENGINE ROTATION FOR SERVICE to access the rear isolator.

FRAME PUCKS 2.21

REMOVAL

WARNING

The aluminum frame of this motorcycle is the fuel tank. Drilling, welding, cutting, grinding, sanding, polishing or other modifications to this frame can weaken it or cause a fire, which could result in death or serious injury. (00126b)

1. To break the adhesive bond, apply isopropyl alcohol along the perimeter edge of the puck at the upper or lower rear corner. Wipe off excess alcohol.
2. Fit fingers under the corner edge and pry to loosen puck.

NOTE

If the puck fit prevents getting finger tips under puck, cover the blade of a putty knife or similar tool with duct tape, to prevent scraping the frame, and pry up one corner of the puck.

3. Slip fingers under the loose corner and slowly pull the puck away from the frame. Apply isopropyl alcohol as needed to loosen remaining adhesive bond.
4. Clean adhesive from painted finish with isopropyl alcohol. Wipe up excess alcohol with cloth.

INSTALLATION

1. Using isopropyl alcohol, clean the frame for the new puck. Wait a minimum of 5 minutes for the alcohol to evaporate.

NOTE

Do not sand or scuff the surface where the puck will be installed.

2. See Figure 2-114. Identify the left and right side pucks by forward facing directional point.
3. With the adhesive backing in place, locate the puck on the frame making contact all around its perimeter and fitting the horizontal crease and V-shaped edge.
4. See Figure 2-115. With a pencil, outline the upper rear and lower rear corners on the frame.

NOTE

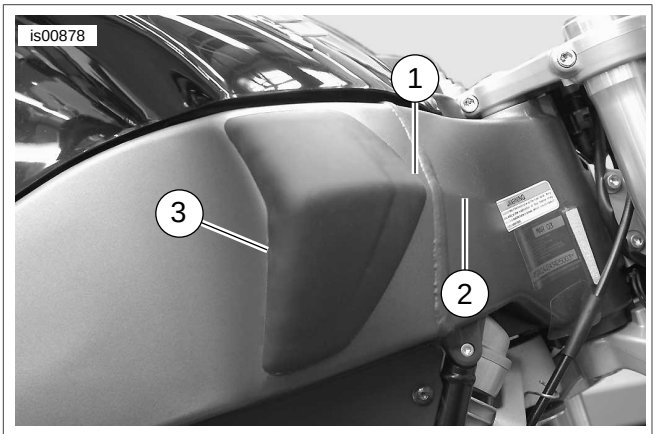
The puck can only be applied once. If the puck is peeled off, it will have reduced adhesive strength when it is re-applied to the frame.

5. Starting from the edge and working toward the center, carefully peel off the adhesive backing from the puck.

NOTE

Peeling away the backing may loosen the adhesive in the center of the puck. This will not affect the final seal.

6. Align the corners with the pencil marks and tack the puck to the frame at the corners.
7. From the tacked corners, pivot the puck onto the frame keeping the directional point aligned with the horizontal crease.



1. **Directional point**
2. **Horizontal crease**
3. **V-shaped edge**

Figure 2-114. Puck Orientation

Figure 2-115. Outline the Entire Puck

Figure 2-116. Pressing Puck to Frame

REMOVAL

1. Remove fuel from frame. See 4.14 FUEL PUMP, Draining Fuel Tank.
2. Rotate engine. See 3.4 ENGINE ROTATION FOR SERVICE.
3. Remove exhaust header. See 4.18 EXHAUST SYSTEM.
4. For Firebolt and Lightning models, remove subframe tail assembly. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
5. For Ulysses model, remove tail frame. See 2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING.
6. Remove rear shock. See 2.23 REAR SHOCK ABSORBER.
7. Remove upper and lower fork clamps. See 2.17 FORK CLAMPS: UPPER AND LOWER.
8. Remove main wire harness. See 6.27 MAIN WIRE HARNESS.
9. Remove rear isolator fastener. See 3.4 ENGINE ROTATION FOR SERVICE.
10. See Figure 2-117. Lift and remove frame from the motorcycle.

INSTALLATION

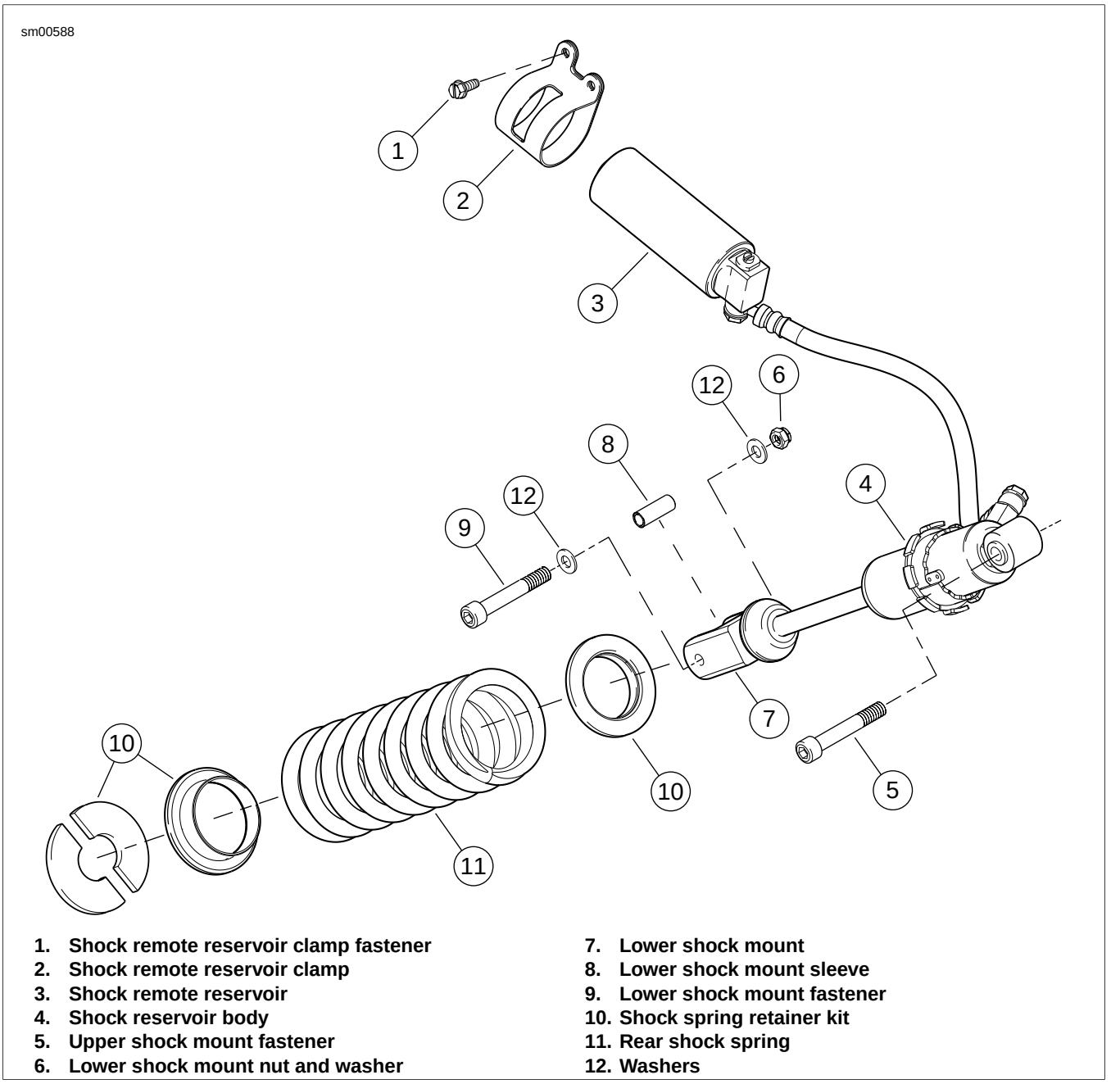
1. Place frame over the motorcycle.
2. Install rear isolator fastener. See 3.6 ENGINE INSTALLATION.
3. Install main wire harness. See 6.27 MAIN WIRE HARNESS.
4. Install upper and lower fork clamps. See 2.17 FORK CLAMPS: UPPER AND LOWER.
5. Install rear shock. See 2.23 REAR SHOCK ABSORBER.
6. For Firebolt and Lightning models, install subframe tail assembly. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
7. For Ulysses model, install tail frame. See 2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING.
8. Install exhaust header. See 4.18 EXHAUST SYSTEM.
9. Rotate engine. See 3.4 ENGINE ROTATION FOR SERVICE.

Figure 2-117. Lift Frame Off Motorcycle

REAR SHOCK ABSORBER 2.23

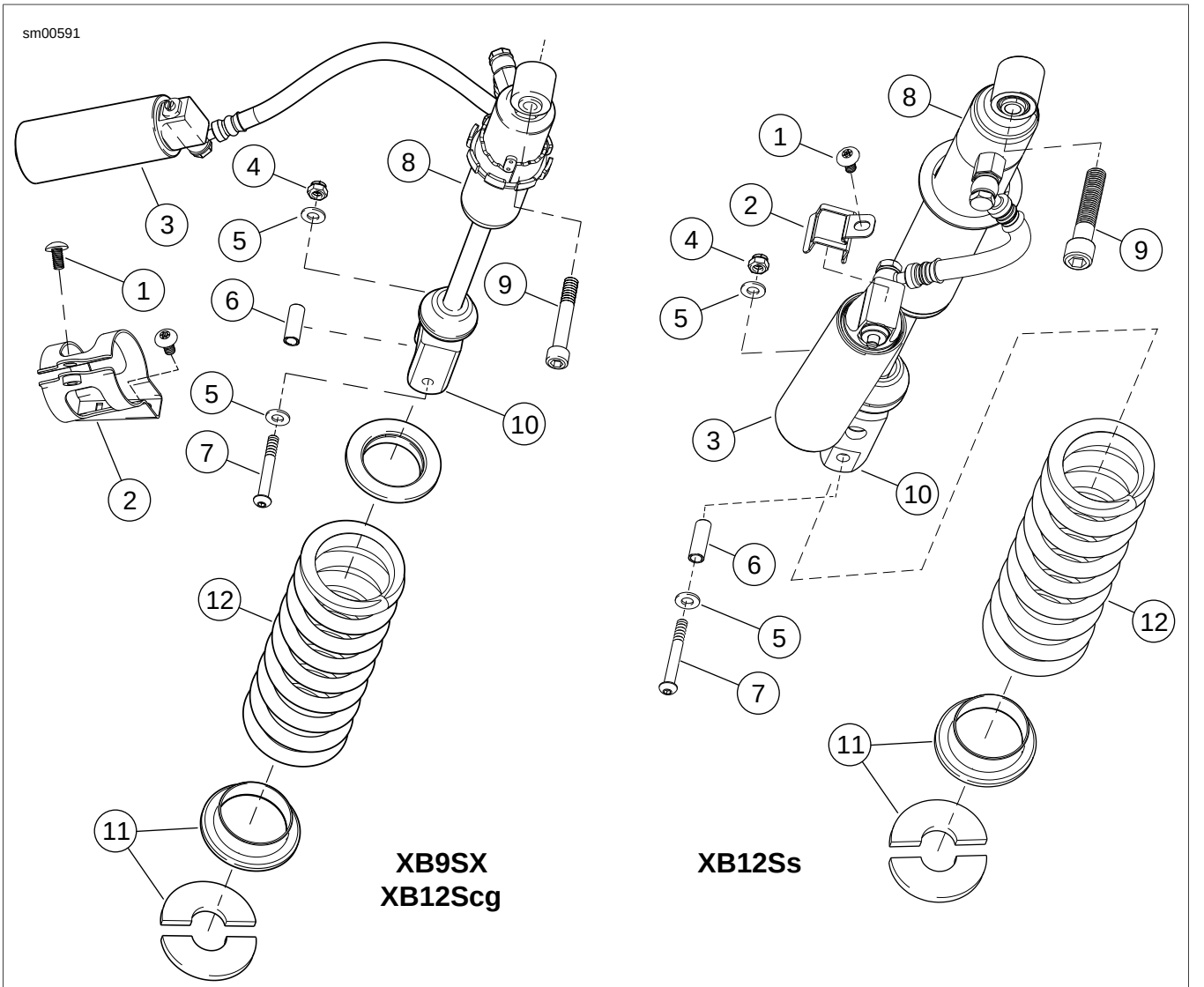
GENERAL

The rear suspension is controlled by the shock absorber. The shock allows adjustment of rear compression and rebound damping and spring preload.



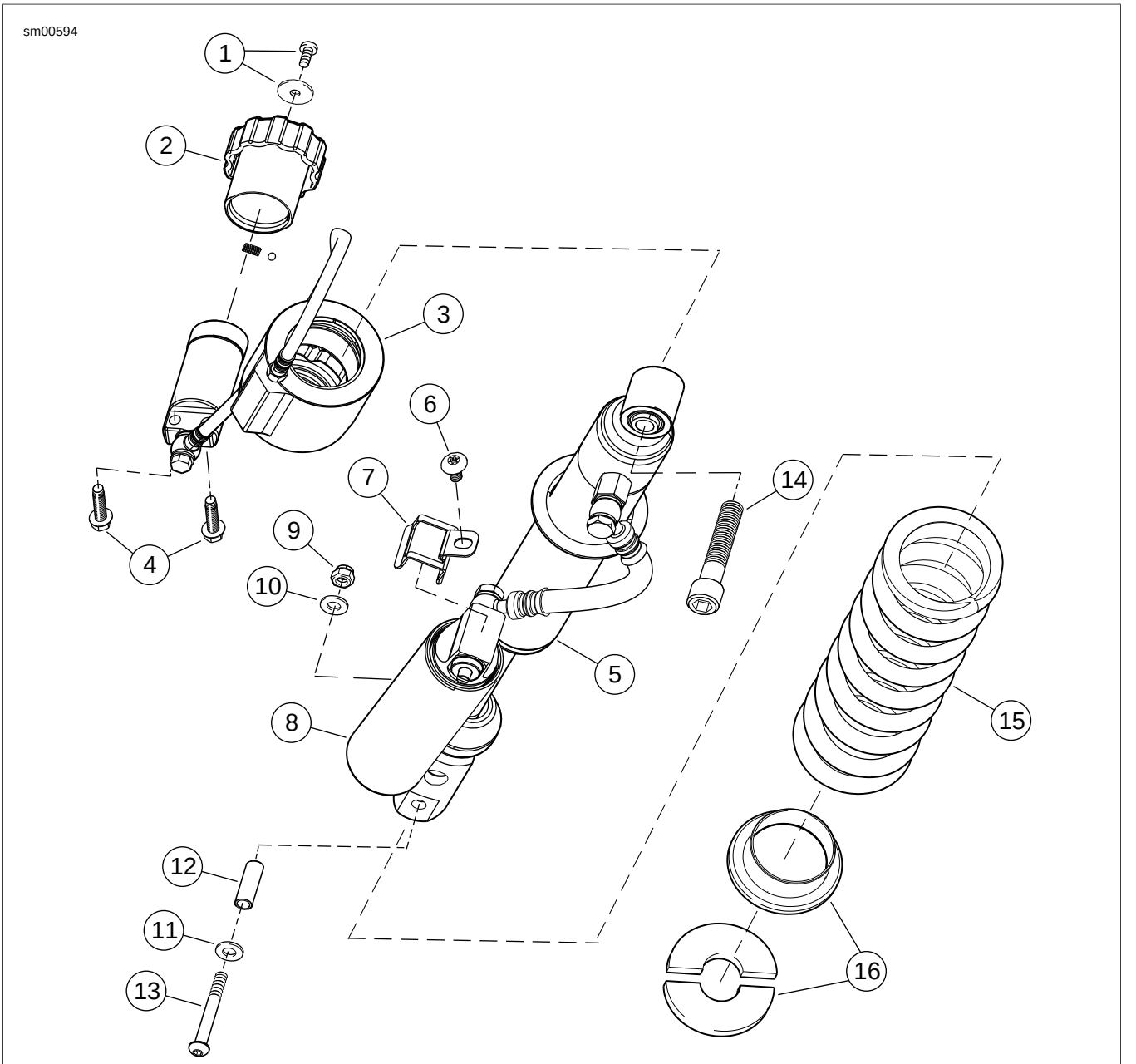
1. **Shock remote reservoir clamp fastener**
2. **Shock remote reservoir clamp**
3. **Shock remote reservoir**
4. **Shock reservoir body**
5. **Upper shock mount fastener**
6. **Lower shock mount nut and washer**
7. **Lower shock mount**
8. **Lower shock mount sleeve**
9. **Lower shock mount fastener**
10. **Shock spring retainer kit**
11. **Rear shock spring**
12. **Washers**

Figure 2-118. Rear Shock Absorber Assembly: Firebolt



1. Remote reservoir clamp fastener
2. Remote reservoir clamp
3. Remote reservoir
4. Lower shock mount nut
5. Washers (2)
6. Lower shock mount sleeve
7. Lower shock mount fastener
8. Shock reservoir body
9. Upper shock mount fastener
10. Lower shock mount
11. Shock spring retainer kit
12. Rear shock spring

Figure 2-119. Rear Shock Absorber Assembly: Lightning



1. **Screw and washer, preload adjuster knob**
2. **Preload adjuster knob**
3. **Preload adjust assembly**
4. **Preload adjuster fasteners (2)**
5. **Rear shock body**
6. **Remote reservoir clamp fastener**
7. **Remote reservoir clamp**
8. **Remote reservoir**
9. **Lower shock mount nut**
10. **Lower shock mount washer, thick**
11. **Lower shock mount washer, thin**
12. **Lower shock mount sleeve**
13. **Lower shock mount fastener**
14. **Upper shock mount fastener**
15. **Rear shock spring**
16. **Shock spring retainer kit**

Figure 2-120. Rear Shock Absorber Assembly: Ulysses Models

REMOVAL: FIREBOLT

1. Remove seat.

WARNING

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

2. Disconnect and remove battery. See 1.5 BATTERY MAINTENANCE.
3. Remove tail body work. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
4. Place a scissor jack under jacking point and raise rear wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.
5. See Figure 2-118. Remove upper shock (5) and lower shock mount fasteners (6 and 9) and lower shock mount sleeve (8).
6. Remove shock remote reservoir clamp (2).
7. See Figure 2-120. Cut cable strap.
8. Feed shock remote reservoir through tail section.
9. Remove rear shock.
10. Raise motorcycle up approximately an additional 2.0 in. (51 mm).
11. Remove shock through the top of the tail section (opening beneath rider seat).

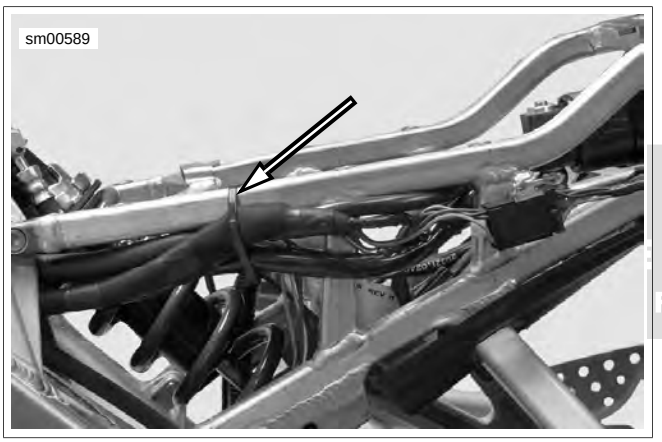


Figure 2-121. Cable Strap, Left Side Subframe Tail Assembly

REMOVAL: LIGHTNING

1. Remove seat.

⚠WARNING

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

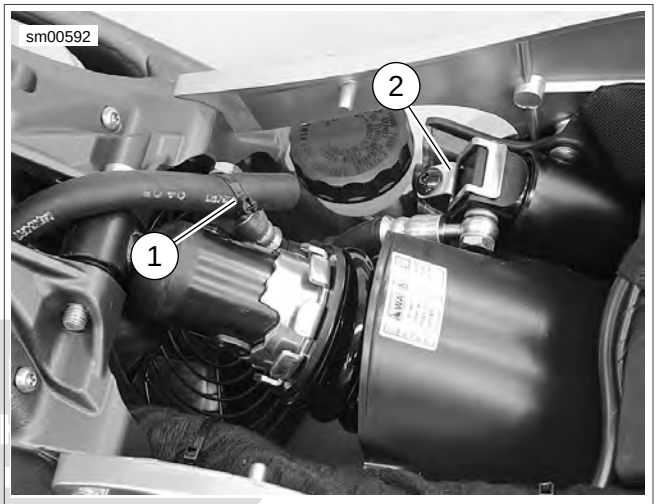
2. Disconnect and remove battery. See 1.5 BATTERY MAINTENANCE.
3. Place a scissor jack under jacking point at the rear muffler and raise chassis until load has been removed from the lower shock bolt (7). See 4.18 EXHAUST SYSTEM for jacking point.
4. See Figure 2-122. Cut the cable tie (2) securing vent hose to shock housing.
5. Remove the nut (4) and washer (5) from the lower shock bolt and raise scissor jack until the lower bolt can be removed by hand.
6. After removing both shock fasteners (7, 9) and reservoir clamp fastener (1), remove rear shock assembly and reservoir.

   For XB9SX, XB12S, and XB12Scg: The remote reservoir can be slid out of the clamp and the clamp left attached to the tail section.

   For the XB12Ss: The clamp is clipped to the remote reservoir and is removed from the tail section with the single fastener.

NOTE

Remove shock assembly through the top of the tail section (opening beneath rider seat).



1. **Remote reservoir clamp**
2. **Cable tie securing vent hose**

Figure 2-122. Rear Shock Absorber and Remote Reservoir (XB12Ss Shown)

REMOVAL: ULYSSES

1. Remove seat.

⚠WARNING

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

2. Disconnect and remove battery. See 1.5 BATTERY MAINTENANCE.
3. Place a scissor jack under jacking point at the rear muffler and raise chassis until load has been removed from the lower shock bolt (13). See 4.18 EXHAUST SYSTEM for jacking point.
4. Cut and remove cable strap holding transmission vent line to shock assembly.
5. Cut and remove cable strap holding the remote preload adjuster hose to main harness.

6. Remove ECM. See 4.4 ELECTRONIC CONTROL MODULE (ECM).

NOTE

When removing the ECM, the fastener closest to the shock assembly has a nut that is captured in the plastic shield below the ECM. You need to place your finger under the nut when removing the fastener to prevent the nut from falling out. Slide the ECM to one side and loosely install the fastener to retain the nut in the correct location. The rear fastener attaches directly to the battery pan.

7. See Figure 2-93. Remove reservoir retainer fastener (6) and retainer (7).
8. Remove the two fasteners (4) holding the preload adjuster in place.
9. Remove the nut (9) and thick washer (10) from the lower shock bolt and raise scissor jack until the lower bolt can be removed by hand.
10. After removing both shock fasteners (13, 14), remove rear shock assembly.

NOTES

- *Remove shock assembly through the top of the tail section (opening beneath rider seat).*
- *If preload knob is removed for any reason, there is a spring and check ball that is held in place by the knob. Use caution when removing knob in order to not lose spring and check ball.*
- *If it is necessary to remove the preload adjuster knob fastener, when reinstalling the fastener, tighten to 25-43* ***in-lbs*** *(2.8-4.9 Nm).*

INSTALLATION: FIREBOLT

1. See Figure 2-118. Install upper shock mount and tighten fastener (5) to 48-52 ft-lbs (65-70.5 Nm).
2. Install lower shock mount with fasteners, washers (6, 9, 12) and lower shock mount sleeve (8) and tighten to 15-17 ft-lbs (20.3-23 Nm).

NOTE

Verify that fan spins freely after shock is installed.

3. Feed rear shock reservoir through tail section. See D.1 APPENDIX D: HOSE AND WIRE ROUTING for correct routing.
   a. Loosely install reservoir in clamp.
   b. See Figure 2-123. Temporarily place upper body work onto tail section and adjust reservoir placement so the adjuster screw aligns with bodywork.
   c. Tighten clamp on reservoir to 120-144 **in-lbs** (13.5-16.2 Nm).
4. Install cable strap.

NOTE

See Figure 2-118. Verify compression adjuster screw is facing up.

5. Install upper body work. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.

⚠WARNING

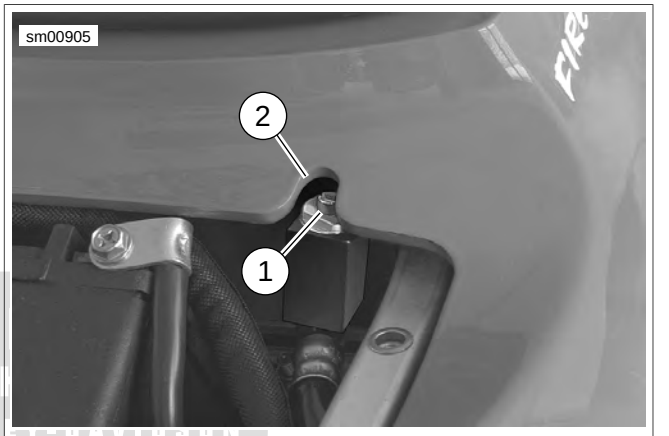
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

6. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

7. Install seat.



1. Adjuster screw
2. Adjuster screw alignment hole

Figure 2-123. Adjuster Screw Alignment

INSTALLATION: LIGHTNING

1. Slide shock absorber through top of tail section.
2. See Figure 2-119. Install rear shock assembly in upper shock mount. Install fastener (9) and tighten to 48-52 ft-lbs (65-70.5 Nm).
3. Install lower shock mount with fasteners (4, 5, 7) and lower shock mount sleeve (6) and tighten to 15-17 ft-lbs (20.3-23 Nm).

NOTE

Verify that fan spins freely after shock is installed.

4. Install rear shock reservoir and reservoir clamp. Tighten clamp on reservoir to 36-60 **in-lbs** (4-7 Nm) (all models except for XB12Ss). For XB12Ss models, tighten fastener to 80-88 **in-lbs** (9-10 Nm).

NOTE

For XB9SX, XB12S, and XB12Scg: *Verify compression dial is facing up. See Figure 2-124.*

5. Secure vent hose to shock housing with cable tie.

⚠WARNING

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

6. Install and connect battery. See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

7. Install seat.

Figure 2-124. Rear Shock Absorber Remote Reservoir Clamp (XB12S Shown) and Compression Dial

INSTALLATION: ULYSSES

1. See Figure 2-120. Lower rear shock assembly, preload adjuster assembly and remote reservoir into position.

NOTE

Rear brake switch wiring is routed over the remote reservoir.

2. Install fastener (14) and tighten to 48-52 ft-lbs (65-70.5 Nm).
3. Install lower shock mount with fasteners (9, 10,11, and 13) and lower shock mount sleeve (12) and tighten to 15-17 ft-lbs (20.3-23 Nm).

NOTES

- *See Figure 2-125. Verify preload adjuster knob is facing out.*
- *Verify that fan spins freely after shock is installed.*

4. Install the two fasteners holding the preload adjuster in place and tighten to 48-72 **in-lbs** (5.4-8 Nm).
5. Install rear shock reservoir clamp (7) and fastener (6) and tighten clamp fastener to 80-88 **in-lbs** (9.0-9.9 Nm).
6. Install ECM. See 4.4 ELECTRONIC CONTROL MODULE (ECM).
7. Install cable strap securing preload adjuster hose to main harness.
8. Install cable strap securing transmission vent line to shock assembly.
9. Lower scissor jack and remove from under vehicle.

⚠WARNING

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

10. Install and connect battery. See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

11. Install seat.

Figure 2-125. Rear Shock Absorber Preload Adjuster Knob: Ulysses

THROTTLE CONTROL 2.24

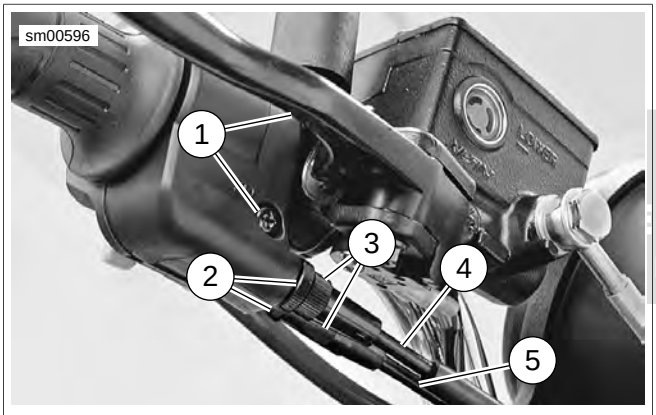
REMOVAL AND DISASSEMBLY

1. Remove right handlebar deflector if required. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.

NOTE

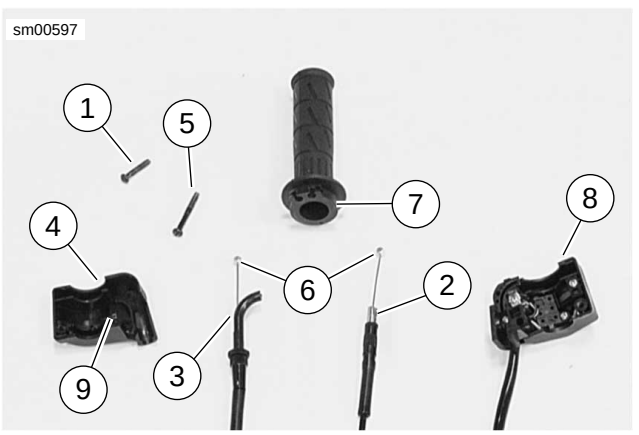
On Ulysses models, it will be necessary to disconnect and remove the heated handgrips. See 6.12 HEATED HAND GRIPS: ULYSSES MODELS.

2. See Figure 2-126. Loosen cable adjuster lock (thick disc) (2) on each cable.
3. Turn adjusters (3) in direction which will shorten cable housings to minimum length.
4. Remove fasteners (1) on right switch housing and separate housing from handlebar.
5. See Figure 2-127. Remove cables (2, 3) from notches in front housing (4).
6. Remove cables (2, 3) and ferrules (6) from cable wheel (7).



1. **Right switch housing fasteners (top fastener above brake lever)**
2. **Cable adjuster lock**
3. **Adjusters**
4. **Throttle control cable**
5. **Idle control cable**

Figure 2-126. Throttle Control Cables



1. **Screw (short, top)**
2. **Idle control cable**
3. **Throttle control cable with molded end**
4. **Front housing**
5. **Screw (long, bottom)**
6. **Ferrules**
7. **Cable wheel**
8. **Rear housing**
9. **Locating pin**

Figure 2-127. Cable Connections

CLEANING AND INSPECTION

⚠WARNING

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

Clean all parts except cables in a non-flammable cleaning solvent. Blow dry with compressed air. Replace cables if frayed, kinked or bent.

ASSEMBLY AND INSTALLATION

1. Install throttle grip and position ferrules into cable wheel.
2. Insert idle control into front switch housing.
3. Slide switch housing over throttle.
4. Insert throttle cable into front switch housing.
5. Attach rear switch housing and position housings on right handlebar by engaging locating pin on front housing with hole in handlebar. Attach housings with two fasteners, installing longer fastener on bottom. Tighten to 25-33 **in-lbs** (3-4 Nm).
6. Adjust cables. See 1.15 THROTTLE CABLE.
7. Install right handlebar deflector if removed. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.

THROTTLE CABLE REPLACEMENT

Removal

NOTE

On the Lightning and the Ulysses models it will be necessary to remove the windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.

1. Remove the air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.

NOTES

- *It will be necessary to loosen the bolted joints that attach the front wire guide to the front of the frame on the Lightning and the Ulysses models. If these are loose the cables can feed through the bracket without damaging the inner wires of the throttle cables. The front wire guides upper cavity is designed for the two throttle cables to route right through the space. The hand control end of the throttle cables need to be fed under the instrument cluster and along the handlebar.*
- *It will be necessary to remove the plastic clip securing the coil wire to the throttle cable bracket at the throttle body and move the harness out of the way in order to loosen the jamnuts on the throttle cables.*

2. Disconnect the coil and remove the fasteners that hold the coil to the coil bracket.

NOTE

The loose coil will allow room to access the throttle cable jamnuts and the plug wires should be left in place without disturbing their connections if possible.

3. Remove the old throttle cables.

Installation

1. Install the new throttle cables, by connecting them to the right hand grip first.

NOTE

This is to verify the cables can be routed correctly with no binding and maintain proper orientation.

2. Route both cables along the handle bar, under and through the instrument cluster area, through the front wire guide, where applicable, and up under the frame to the throttle body bracket.

NOTES

- *Keep the throttle cables parallel all the way along their path so they do not become twisted. If the cables are not kept parallel it can create binding when everything is tightened in place.*
- *When installing the throttle cables at the throttle body you need to avoid allowing the elbows of the throttle cables to rotate up when tightening the throttle cable jamnuts. This can cause the cable elbows to contact the frame. See Figure 2-130 for correct routing of the cables.*

3. Back the throttle cable jamnuts off that are closest to the 90° portion of the metal elbow on the throttle cables at the throttle body. Back the open end of the elbow nuts all the way off so they can float on the inner wires.
4. Position the lower idle control cable barrel in the throttle cam wheel of the throttle body and then slip the elbow into the slotted hole in the throttle cable mounting bracket. Position the throttle control cable in the same manner so both elbows are inserted into the bracket.
5. Tighten the cable adjustment nuts, that were removed for installation purposes, onto the threaded end of the elbows and thread them on until there is exposed thread beyond the nut about one sixteenth of an inch or more. Do this on both the throttle control and idle control cables.

NOTE

You need to verify there is enough slack in the cables at the throttle cable wheel. You want to push on the cable and have the sag at about one quarter of an inch. If you don't have enough slack, you need to thread the outer nuts further onto the elbow producing more sag.

6. See Figure 2-128. Install the throttle cable retaining clip and place it so the outside of the retaining clip is flat against the throttle body cable mounting bracket and covers the two nuts that are closest to the cable wheel. Tighten the two jamnuts closest to the 90° degree elbow to 36-40 in-lbs (4-4.5 Nm) to secure the retaining clip in place.

NOTE

See Figure 2-129. When this is done correctly, the retaining clip will cover the two inner nuts and prevent them from becoming loose and the retaining clip will be secured to the bracket.

7. With the throttle cables secure at the throttle body, you will be able adjust the cables at the right hand grip. See 1.15 THROTTLE CABLE.

NOTE

If, after the throttle cables have been adjusted, there is not enough slack in the cables the throttle plate will not be responsive and cleanly snap back to the closed position. The cables will feel like they are binding.

8. If there is binding, add more slack at the throttle end of the cable.

NOTE

When the adjustment is complete it will be necessary to turn the handlebars all the way in both directions and work the throttle to verify there is no binding. This is critical to the operation of the throttle control.

9. Install the ignition coil and apply Loctite 272 (red) to the ignition coil fasteners and tighten to 120-144 **in-lbs** (13.6-16.3 Nm).

NOTE

Verify that the spark plug wires were not disturbed and are tight on the coil and spark plug ends.

10. Tighten the bolted joints that attach the front wire guide to the front of the frame on Lightning and Ulysses models to 72-84 **in-lbs** (8-9.5 Nm).
11. Install the air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
12. Install the windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.

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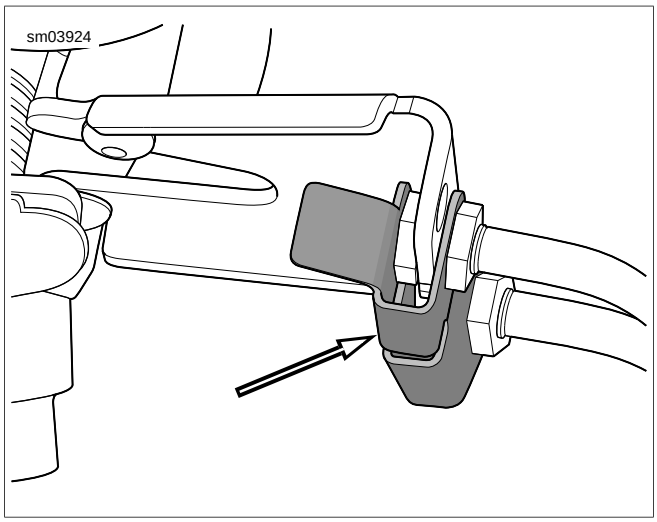


Figure 2-128. Throttle Cable Retention Clip

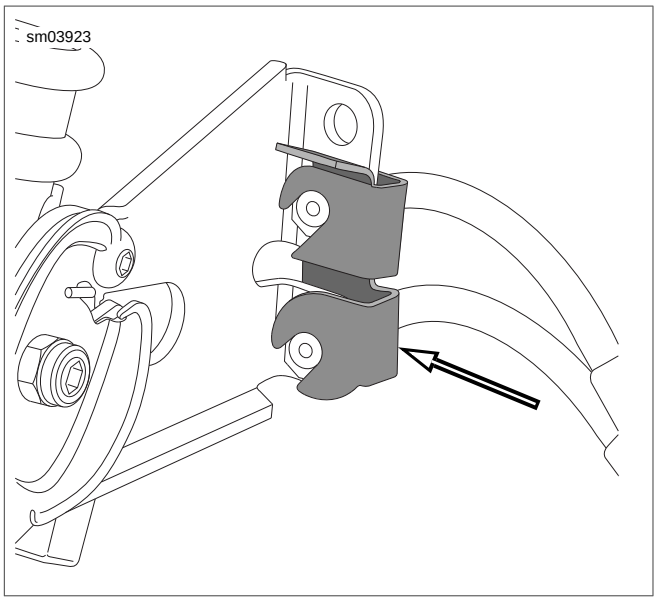


Figure 2-129. Throttle Cable Retention Clip, Inside View

Figure 2-130. Throttle cable elbow alignment

CLUTCH CONTROL 2.25

GENERAL

For clutch adjustment, see 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.

For clutch replacement, see 5.5 CLUTCH.

REMOVAL AND DISASSEMBLY

Clutch Cable

1. Remove seat.

⚠ WARNING

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

2. Disconnect negative battery cable. See 1.5 BATTERY MAINTENANCE.
3. Remove chin fairing. See 2.50 CHIN FAIRING.

NOTE

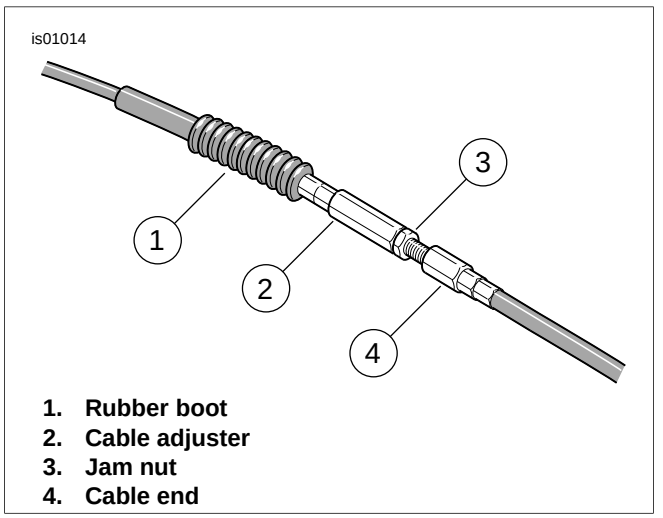
Always disconnect front tie bar from the "V" bracket first.

4. Remove front tie bar (1) from "V" bracket.
5. Remove front tie bar, P-clamp (2) and clutch cable from engine.
6. See Figure 2-131. Slide clutch cable adjuster boot (1) up to access clutch adjuster (2).
7. Loosen clutch adjuster (2) to release tension from hand lever and clutch release mechanism.
8. See Figure 2-133. Remove clutch cable ferrule (7) from hand lever (4).

NOTE

See D.1 APPENDIX D: HOSE AND WIRE ROUTING.

9. Pull clutch cable down and out of upper triple clamp.
10. Remove three TORX screws with washers securing clutch inspection cover.



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

Figure 2-131. Clutch Cable Adjuster

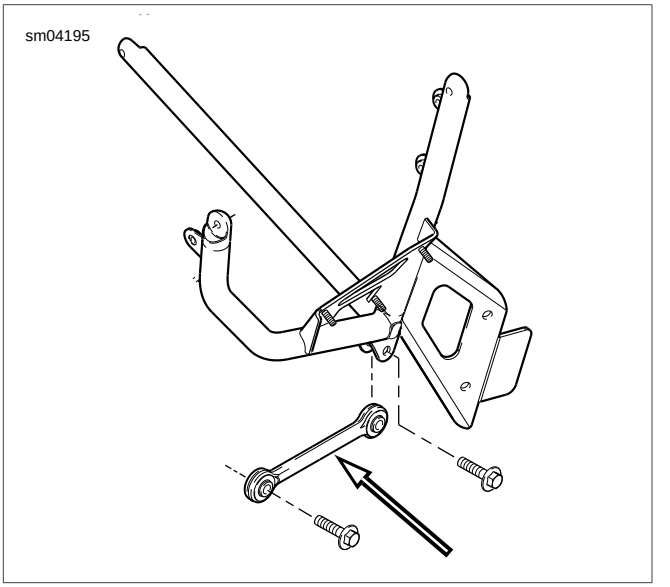
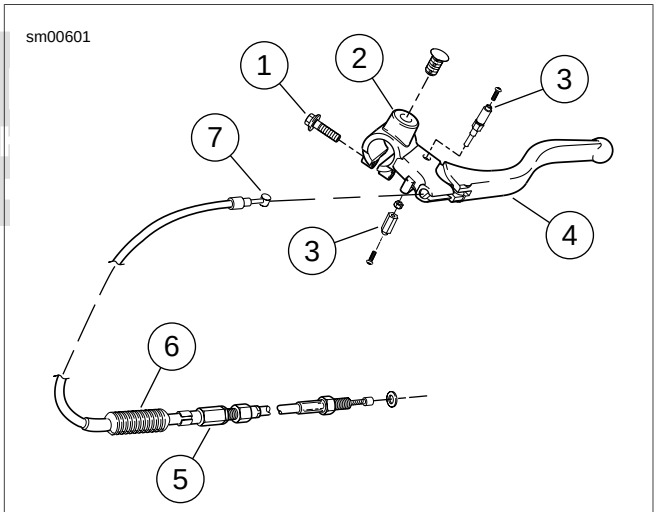


Figure 2-132. Front Tie Bar

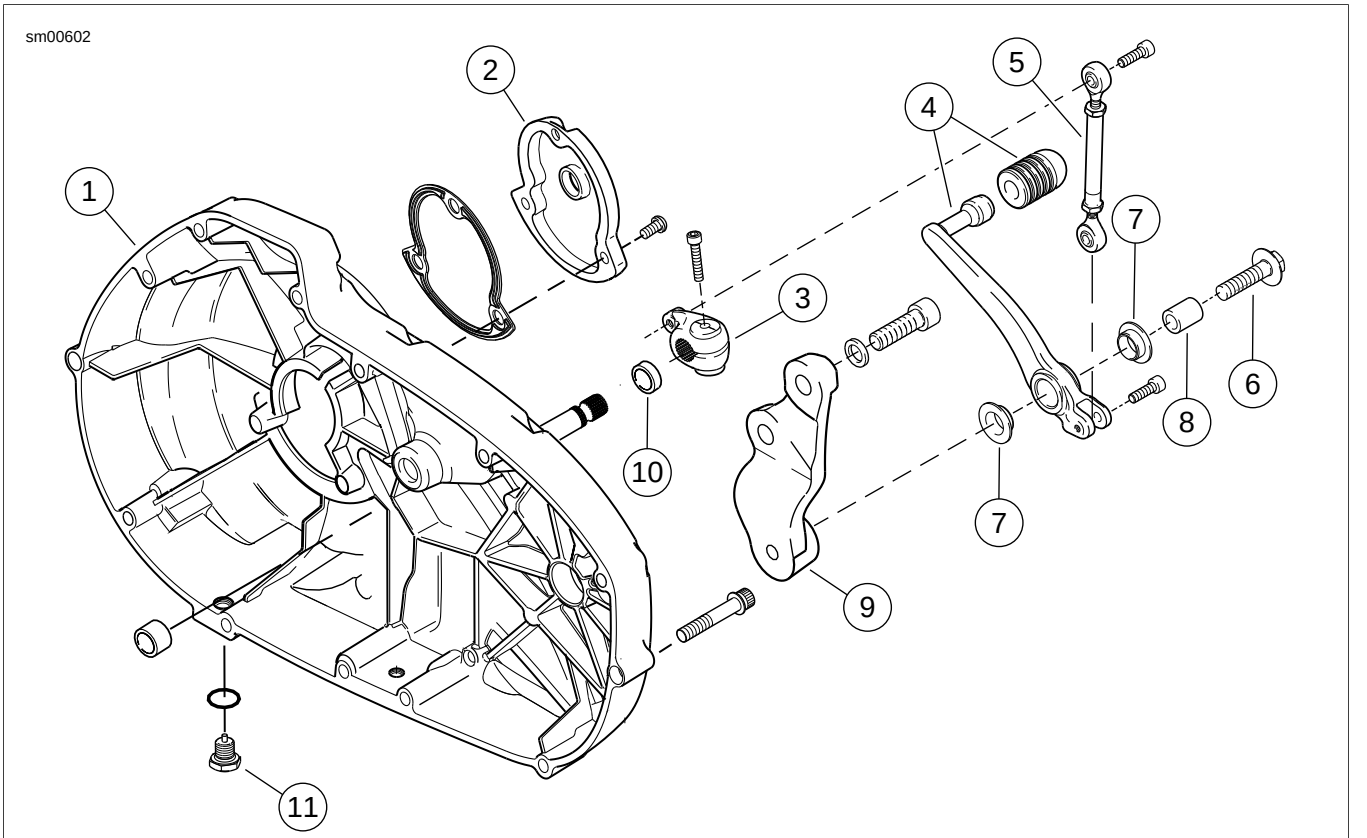


1. **Hand lever clamp pinch fastener**
2. **Hand lever clamp**
3. **Wind deflector standoff**
4. **Clutch hand lever**
5. **Clutch adjuster**
6. **Clutch cable adjuster boot**
7. **Clutch cable ferrule**

Figure 2-133. Clutch Hand Control Assembly

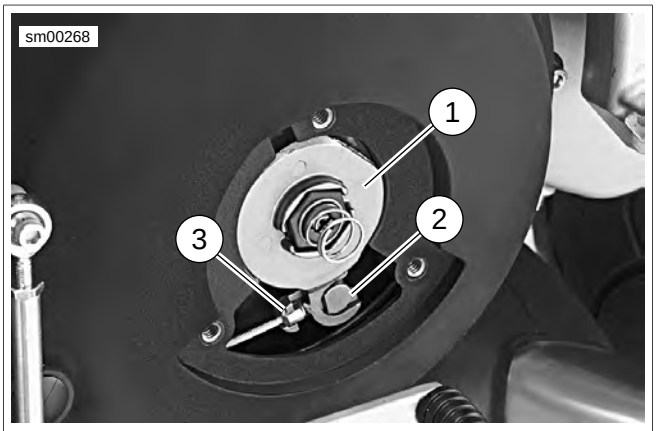
11. See Figure 2-134. Remove clutch inspection cover (2).
12. Remove complete shift assembly.
    a. Remove flange bolt (6) from primary cover.
    b. Remove engine shift lever assembly (3). Do not scratch primary cover.

13. See Figure 2-135. Remove the outer ramp and hook (1) from the cable end (3) and coupling (2). Remove cable end from slot in coupling. See 5.4 CLUTCH RELEASE MECHANISM.
14. See Figure 2-136. Unscrew the cable fitting from the primary cover. Remove clutch cable and fitting.
15. Remove and discard o-ring on the clutch cable fitting.



1. **Primary cover**
2. **Clutch inspection cover**
3. **Engine shift lever**
4. **Shift pedal assembly**
5. **Shift linkage assembly**
6. **Flange head bolt**
7. **Bearings, shift lever**
8. **Sleeve, shift lever**
9. **Shifter bracket (Ulysses only)**
10. **Oil seal (rubber washer)**
11. **Drain plug**

Figure 2-134. Shifter Linkage



1. **Outer ramp and hook**
2. **Coupling**
3. **Cable end**

Figure 2-135. Clutch Release Mechanism (Typical)

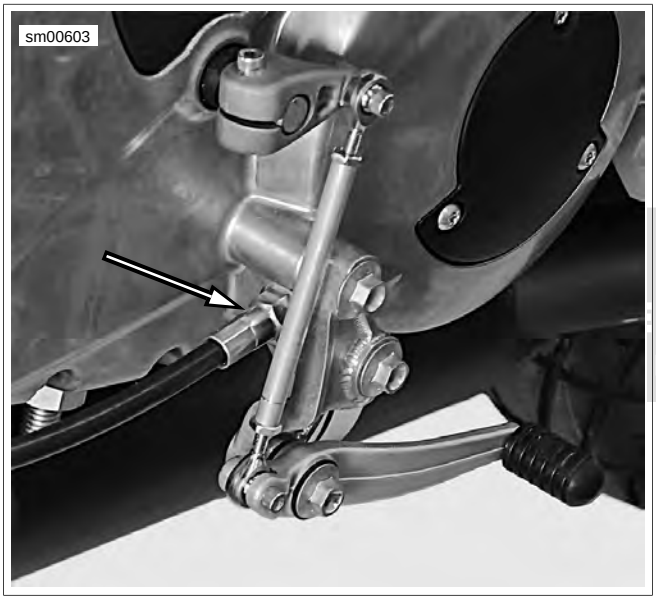


Figure 2-136. Clutch Cable and Fitting

ASSEMBLY AND INSTALLATION

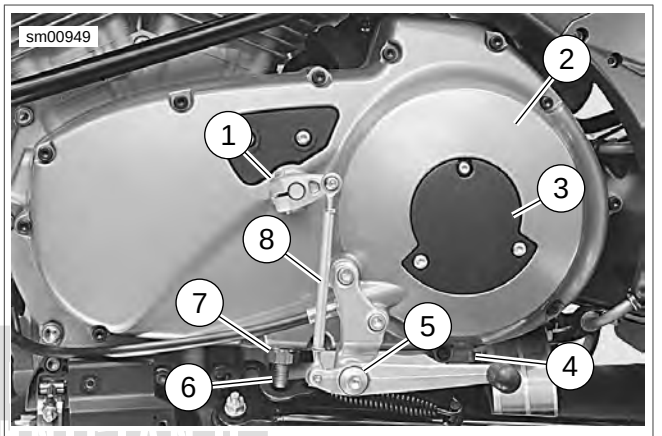
Clutch Cable

1. Install **new** o-ring on the clutch cable fitting before installing.
2. Apply 565 THREAD SEALER to fitting on clutch cable and screw the clutch cable fitting into the primary cover and tighten to 36-108 **in-lbs** (4-12.2 Nm).
3. See Figure 2-135. Install cable end into slot in coupling. Install the outer ramp and hook (1) onto the cable end (3) and coupling (2) and place assembly back into the clutch inspection area in the primary cover. See 5.4 CLUTCH RELEASE MECHANISM.
4. See Figure 2-134. Install oil seal (rubber washer) and engine shift lever assembly (10, 3).
5. See Figure 2-134. Install (7) bearings and (8) sleeve into the shift lever.
6. After applying LOCTITE 271 (red), install flange bolt (6) and shift pedal (4) to primary cover, and tighten to 22-24 ft-lbs (30-32.5 Nm).
7. After applying LOCTITE 271 (red), tighten engine shift lever pinch screw to 48-60 **in-lbs** (5.4-7 Nm).
8. See Figure 2-137. If the shift linkage assembly (8) was removed for any reason, apply LOCTITE 271 to fasteners and tighten to 36-60 **in-lbs** (4-7 Nm). Adjust to rider comfort.

NOTE

See D.1 APPENDIX D: HOSE AND WIRE ROUTING.

9. Route clutch cable through upper triple clamp.



1. **Lever, engine**
2. **Primary cover**
3. **Clutch inspection cover**
4. **Drain plug**
5. **Flange head bolt**
6. **Chain adjuster screw**
7. **Locknut**
8. **Shift linkage assembly**

Figure 2-137. Installing Shift Linkage (Typical)

10. See Figure 2-133. Connect clutch cable ferrule (7) to hand lever (4).
11. Adjust clutch adjusting screw. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
12. Add FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05) if needed as required until fluid level is even with bottom of clutch diaphragm spring. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid.

NOTE

Each time the clutch inspection cover is removed the gasket must be replaced.

13. Install **new** clutch cover gasket.
14. See Figure 2-134. Install clutch inspection cover (2) with three TORX screws with washers. Tighten screws in a crosswise pattern to 84-108 **in-lbs** (9.5-12 Nm).

NOTE

Always connect front tie bar to engine mount first.

15. Install front tie bar, p-clamp and clutch cable to front engine mount and tighten fastener to 25-27 ft-lbs (33.9-36.6 Nm).
16. Connect front tie bar to "V" bracket and tighten fastener to 25-27 ft-lbs (33.9-36.6 Nm).
17. Adjust clutch cable. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
18. Install chin fairing. See 2.50 CHIN FAIRING.
19. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

WARNING

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

20. Install seat.

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HEADLAMP ASSEMBLY AND SUPPORT BRACKET 2.26

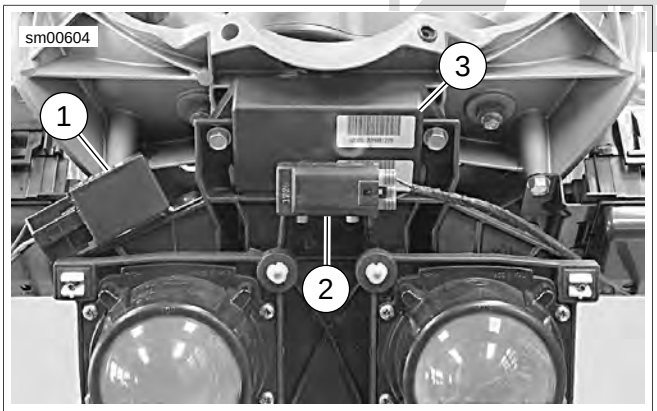
REMOVAL: FIREBOLT

1. Remove seat.

⚠WARNING

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

2. Disconnect battery cables from battery: negative cable (black) first. See 1.5 BATTERY MAINTENANCE.
3. Remove front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
4. See Figure 2-138. Disconnect flasher (1) and bank angle sensor (2). Remove electronic control module fasteners (3).
5. See Figure 2-138. Rotate headlamp support bracket.
   a. Loosen headlamp pivot fasteners (1).
   b. Rotate headlamp bracket (2) down.
6. See Figure 2-140. Disconnect headlamp connection.
7. Disconnect and remove electronic control module. See 4.4 ELECTRONIC CONTROL MODULE (ECM).
8. Remove headlamp support bracket.



1. **Flasher**
2. **Bank angle sensor**
3. **Electronic control module**

Figure 2-138. Headlamp Support Bracket: Firebolt

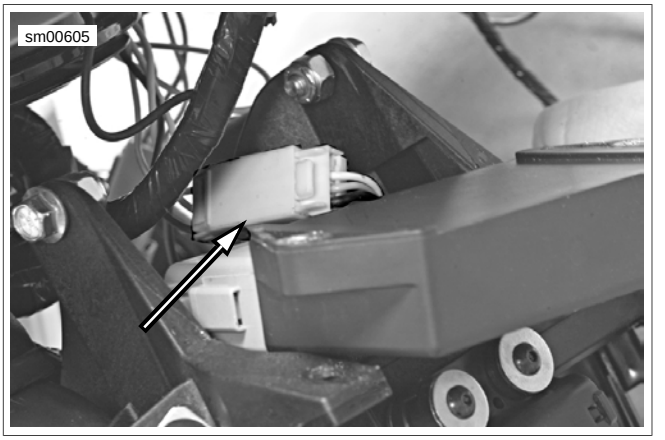


Figure 2-139. Headlamp Connector: Firebolt

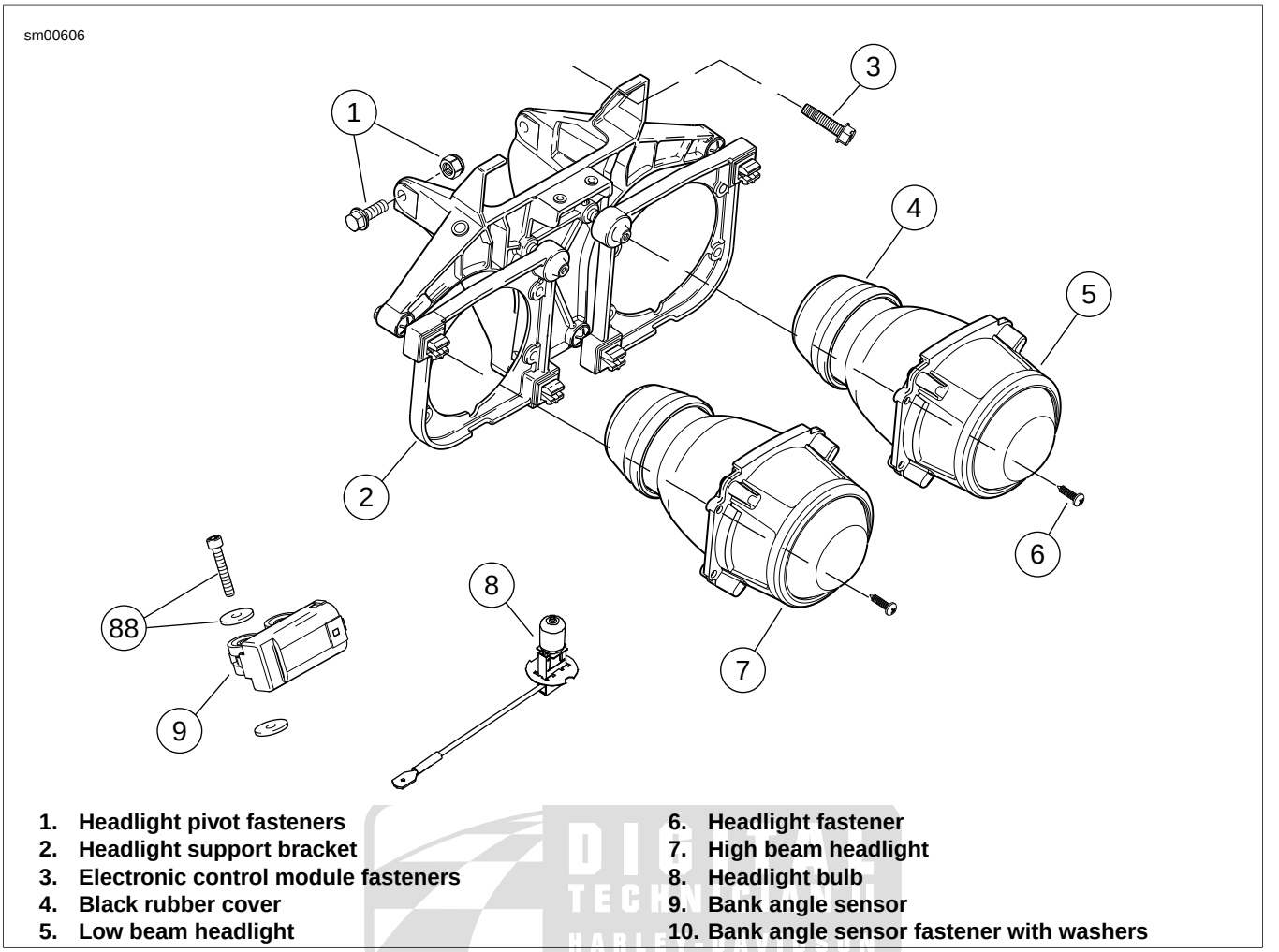
DISASSEMBLY: FIREBOLT

1. See Figure 2-138. Remove bank angle sensor (2).
2. Remove flasher (1).
3. See Figure 2-140. Remove black rubber cover (4) from rear of headlights.
4. Disconnect black connector from headlights.
5. Disconnect headlight bulb (8) connector (white) from wire harness.
6. Remove headlights (5, 7) from headlight support bracket (2) by removing headlight fasteners (6).

ASSEMBLY: FIREBOLT

1. See Figure 2-140. Align headlights (5, 7) into headlight support bracket (2). Tighten headlight fasteners (6) to 20-25 **in-lbs** (2.3-2.8 Nm).
2. Connect headlight bulb (8) connector (white) into wire harness.
3. Connect black headlight connector.
4. Install black rubber cover (4).
5. See Figure 2-138. Install bank angle sensor (2). Tighten to 12-36 **in-lbs** (1.4-4 Nm).
6. Install flasher (1) and tighten to 36-60 **in-lbs** (4-7 Nm).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Headlight pivot fasteners**
2. **Headlight support bracket**
3. **Electronic control module fasteners**
4. **Black rubber cover**
5. **Low beam headlight**
6. **Headlight fastener**
7. **High beam headlight**
8. **Headlight bulb**
9. **Bank angle sensor**
10. **Bank angle sensor fastener with washers**

Figure 2-140. Headlight Support Bracket Assembly: Firebolt

INSTALLATION: FIREBOLT

1. See Figure 2-141. Position headlight pivot fasteners into groove of the headlight support bracket, flat side of nut lined up with groove.
2. See Figure 2-140. Install headlight pivot fasteners (1) but do not tighten.
3. Connect electronic control module. See 4.4 ELECTRONIC CONTROL MODULE (ECM).
4. Attach headlight connector to headlight support bracket.
5. Connect headlight connections. See 6.18 HEADLIGHT.
6. See Figure 2-140. Rotate headlight support bracket up (2) and tighten pivot fasteners (1) to 72-96 **in-lbs** (8-11 Nm).
7. See Figure 2-138. Install electronic control module (3).
8. See Figure 2-140. Align electronic control module and headlight support bracket with fairing support bracket.
9. Tighten electronic control module fasteners to 72-96 **in-lbs** (8-11 Nm).
10. Connect flasher (1) and bank angle sensor (2).
11. Install front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.

⚠WARNING

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

12. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

13. Install seat.

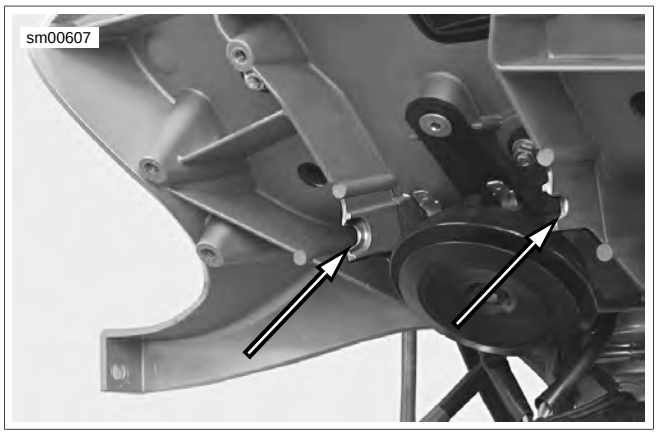


Figure 2-141. Headlamp Pivot Groove: Firebolt

REMOVAL: LIGHTNING/ULYSSES

1. Remove seat.

⚠WARNING

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

2. Disconnect battery cables from battery: negative cable (black) first. See 1.5 BATTERY MAINTENANCE.
3. Remove windscreen and windshield. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
4. Disconnect horn connectors [122] (2).
   a. **For Lightning Models:** See Figure 2-142.
   b. **For Ulysses:** See Figure 2-143.

NOTE

Horn (1) can remain attached to support bracket. The horn can be removed and replaced as needed.

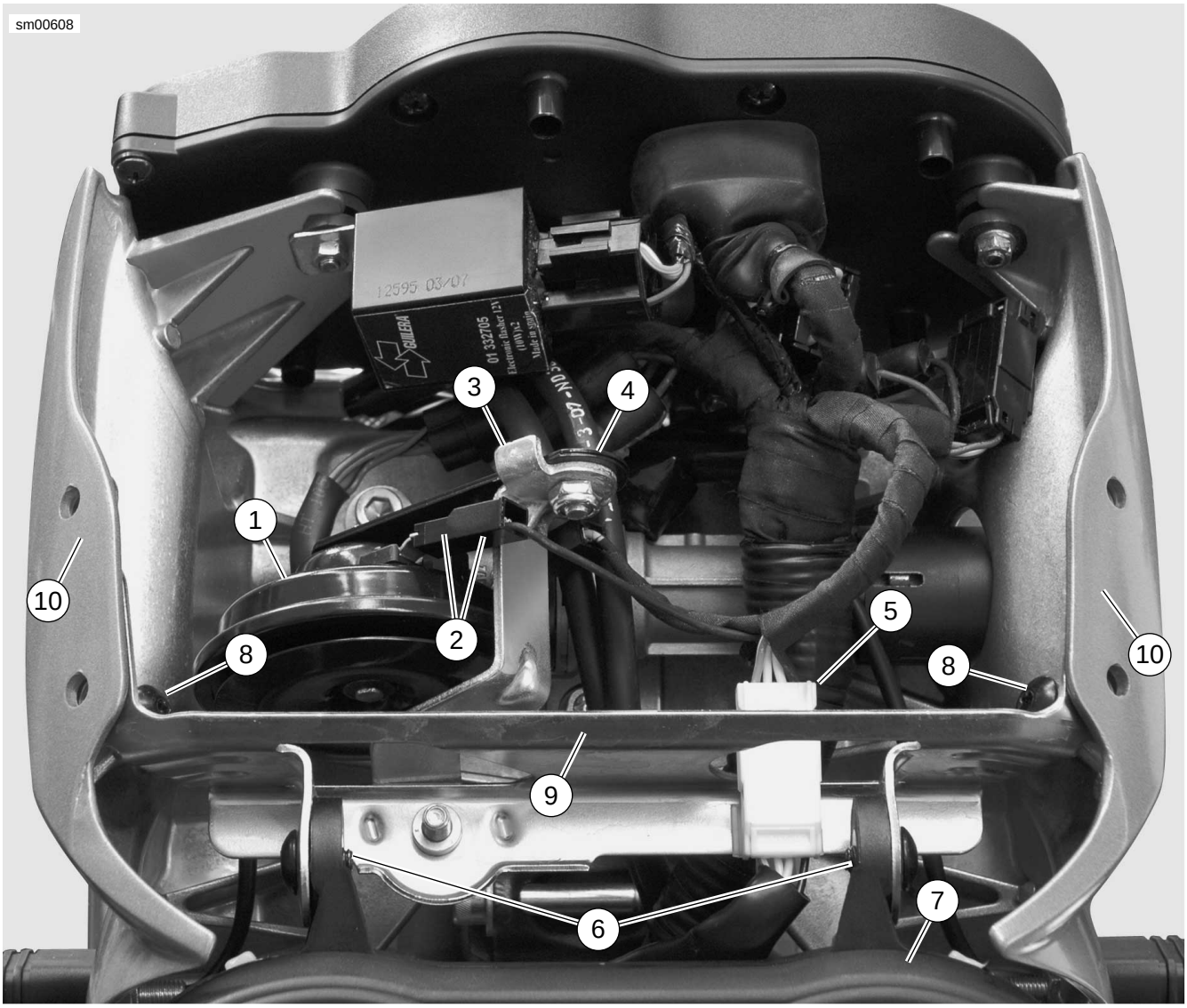
5. Separate headlight connector [38] (5).
6. Remove female connector [38B] from headlight support bracket (9) by sliding connector up and off of bracket clip.
7. Remove both upper headlight fasteners (6).

NOTES

- *Access the headlight fasteners with a socket extension through the openings in the sides of the front modules.*
- *On XB12X models it will be necessary to remove headlight alignment fastener from underside of front fender to remove headlights.*

8. Remove two fasteners (8) from in the left and right modules and remove support bracket.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Horn
2. Horn connectors [122]
3. Horn bracket
4. Horn fastener
5. Headlight connector [38]
6. Fasteners (2), upper headlight mounting
7. Headlight assembly
8. Fasteners (2), headlight support bracket
9. Headlight support bracket
10. Left and right front modules

Figure 2-142. Electrical Connectors Behind Windscreen: Lightning

1. **Horn**
2. **Horn connectors [122]**
3. **Horn bracket**
4. **Horn fastener**
5. **Headlight connector [38]**
6. **Screws (2), upper headlight mounting**
7. **Headlight assembly**
8. **Screws (2), headlight support bracket**
9. **Headlight support bracket**
10. **Left and right front modules**

Figure 2-143. Headlight and Support Bracket: Ulysses

DISASSEMBLY: LIGHTNING/ULYSSES

1. See Figure 2-144. Remove rubber boots (1) from rear of headlight housing.
2. Disconnect wiring harness (5) from headlight bulbs (3) and remove along with position bulb socket (6).
3. Remove bulb holders (2).
4. Remove headlight bulbs (3) from back of headlight housing (4).

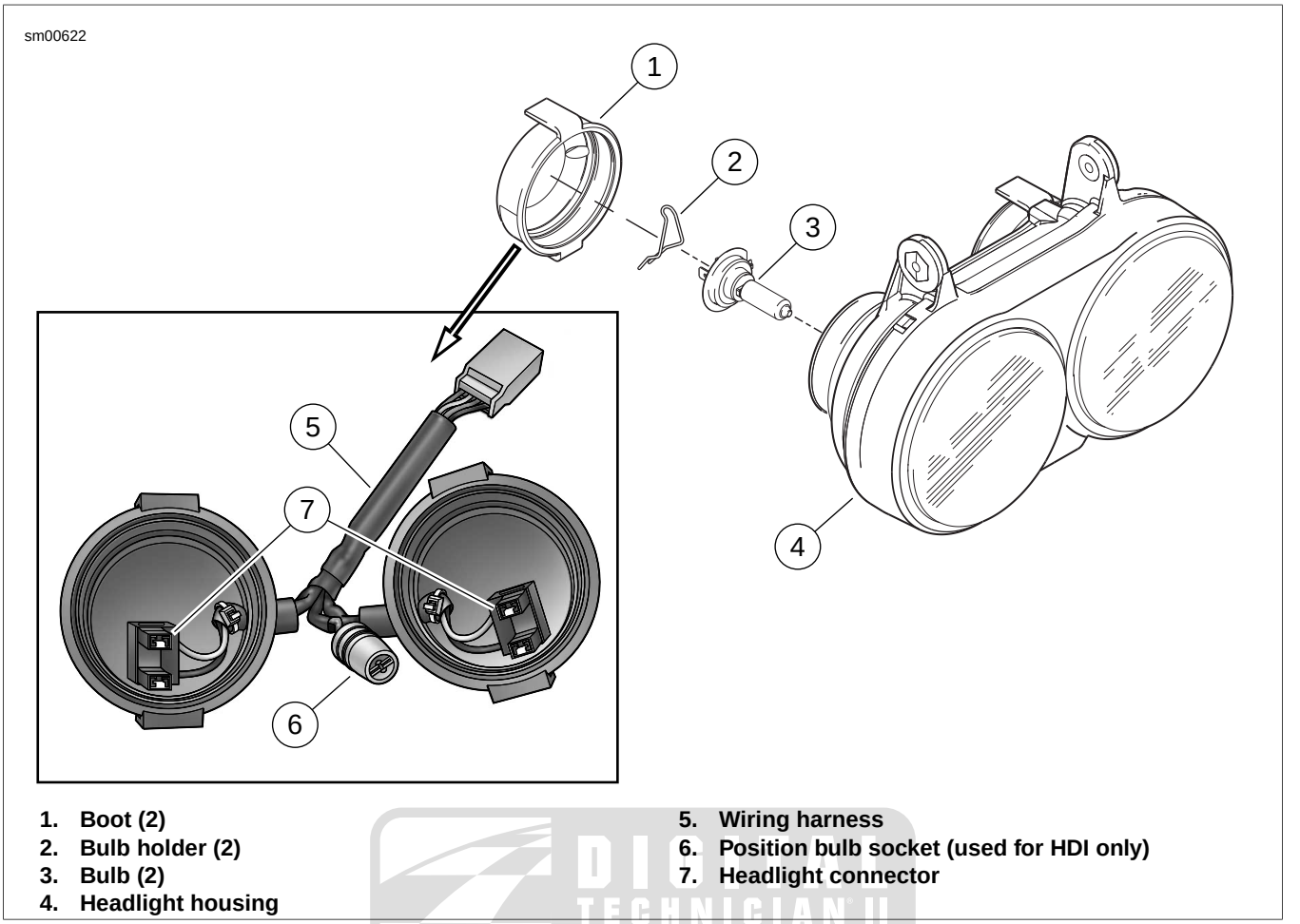
ASSEMBLY: LIGHTNING/ULYSSES

1. See Figure 2-144. Align and install headlight bulbs (3) into back of headlight housing (4).

NOTE

The tab on the base of the headlight bulb should rest between the two tabs located at the top of the hole on the back of the headlight assembly.

2. Install bulb holders (2).
3. Connect wiring harness (5) to headlight bulbs (3) and install rubber boots (1) and install position bulb socket (6) between the headlights. For alignment of rubber boots, see 6.18 HEADLIGHT.



1. **Boot (2)**
2. **Bulb holder (2)**
3. **Bulb (3)**
4. **Headlight housing**
5. **Wiring harness**
6. **Position bulb socket (used for HDI only)**
7. **Headlight connector**

Figure 2-144. Headlight Assembly

INSTALLATION: LIGHTNING/ULYSSES

1. Install headlight support bracket (9).
   a. **For Lightning Models:** See Figure 2-142.
   b. **For Ulysses:** See Figure 2-143.
2. Apply LOCTITE 271 (red) and install screws (8) securing headlight support bracket/turn signal flasher to left and right front modules (10) and tighten to 48-72 **in-lbs** (5.4-8 Nm).
3. Install headlight assembly.
   a. Install headlight assembly (7) into headlight support bracket (9).
   b. Install both upper headlight fasteners (6) but do not tighten.
   c. Install lower fastener, do not tighten.
4. Attach headlight connector to headlight support bracket.
5. Connect headlight connector [38] (5).
6. Install horn (1) and tighten fastener (4) to 36-60 **in-lbs** (4-7 Nm).
7. Connect horn connectors [122] (2).
8. Adjust headlights. See 1.17 HEADLAMP.
9. Install windshield and windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.

⚠WARNING

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

10. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

11. Install seat.

FAIRING SUPPORT BRACKET: FIREBOLT 2.27

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect battery cables from battery: negative cable (black) first. See 1.5 BATTERY MAINTENANCE.
3. Remove front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
4. Remove headlight support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
5. Remove fuse block and relay block and p-clamp. See 6.21 MAIN FUSE AND FUSES.
6. Disconnect and remove horn. See 6.13 HORN.
7. Disconnect and remove instrument cluster. See 6.26 INSTRUMENT MODULE.
8. See Figure 2-145. Remove fairing support bracket fasteners and washers (4), p-clamp (7) to remove fairing support bracket (5).

INSTALLATION

1. Route the wire harness. See D.1 APPENDIX D: HOSE AND WIRE ROUTING for wire harness routing.
2. See Figure 2-145. Install fairing support bracket with fasteners and washers (4, 8) and p-clamp (7). Tighten to 16-18 ft-lbs (22-26 Nm).
3. Connect instrument cluster connector and install instrument cluster. Tightening to 12-36 **in-lbs** (1.4-4 Nm). See 6.26 INSTRUMENT MODULE.
4. Install horn and tighten fasteners to 72-96 **in-lbs** (8-10 Nm). See 6.13 HORN.
5. Install fuse block, relay and p-clamp tightening fasteners to 72-96 **in-lbs** (8-11 Nm). See 6.21 MAIN FUSE AND FUSES.
6. Install lower headlight support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
7. Install front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.

⚠WARNING

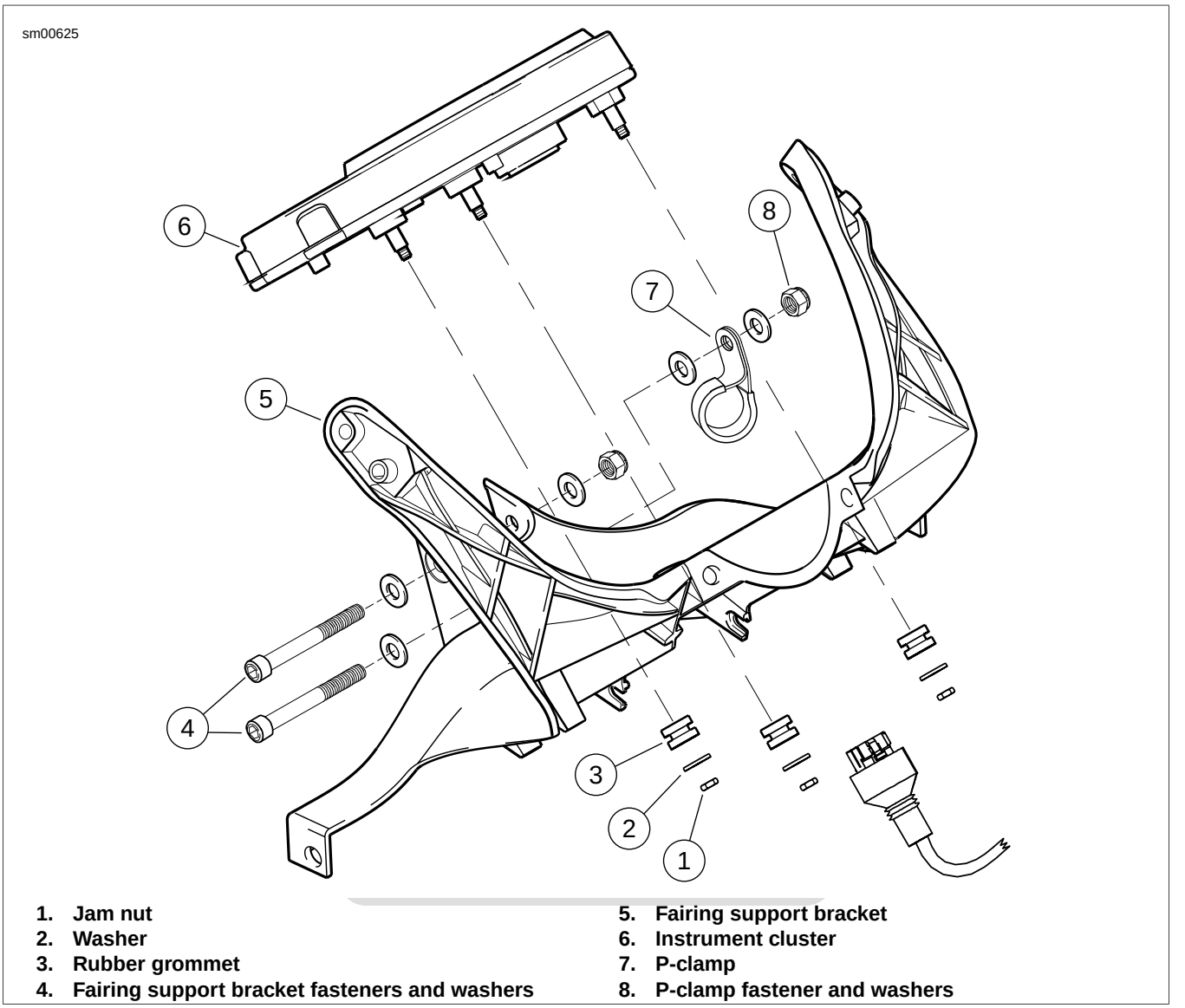
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

8. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

9. Install seat.



1. **Jam nut**
2. **Washer**
3. **Rubber grommet**
4. **Fairing support bracket fasteners and washers**
5. **Fairing support bracket**
6. **Instrument cluster**
7. **P-clamp**
8. **P-clamp fastener and washers**

Figure 2-145. Fairing Support Bracket Assembly: Firebolt

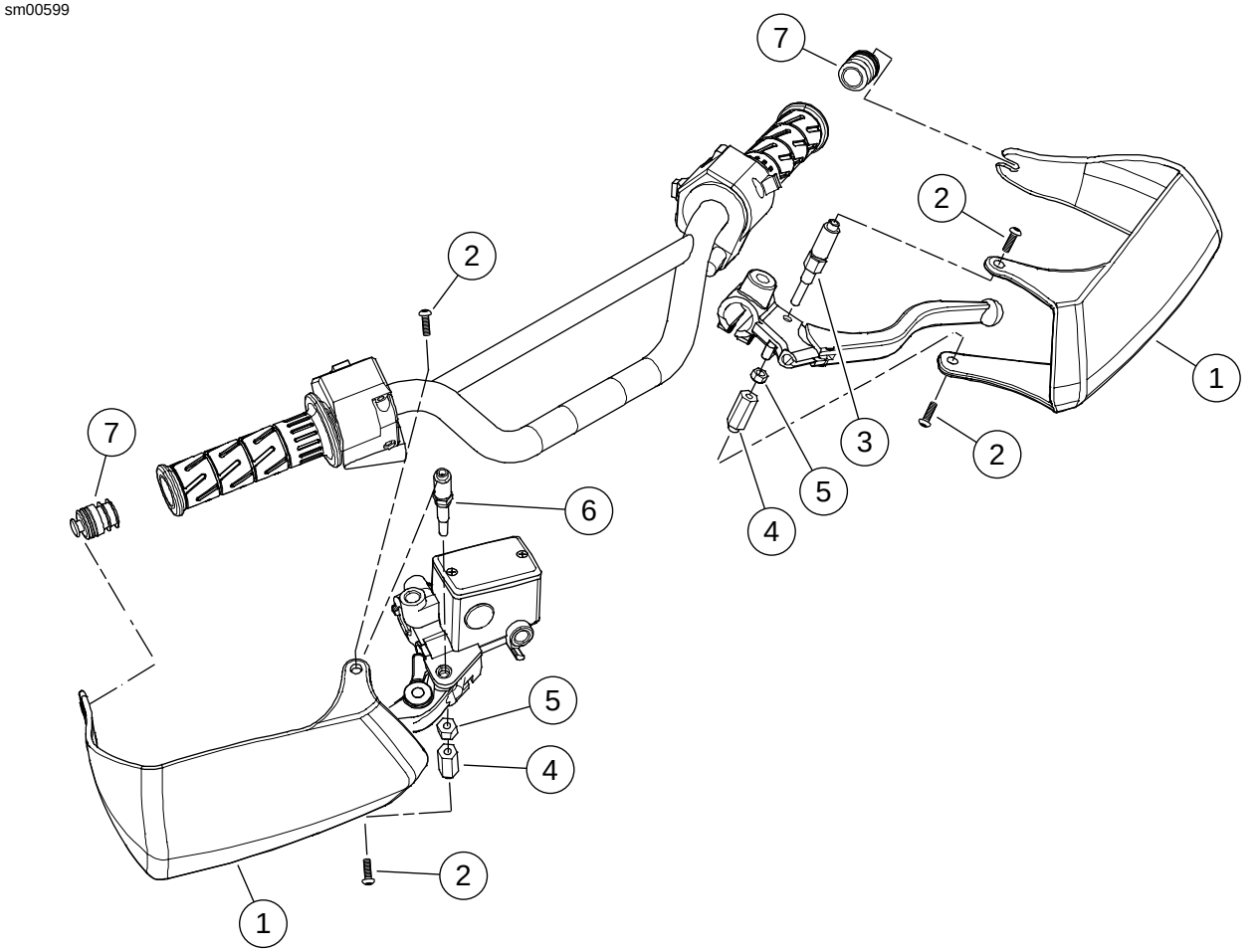
DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP 2.28

REMOVAL AND DISASSEMBLY

1. See Figure 2-146. Remove fasteners (2) from clutch and brake pivot shafts (3, 6) and pivot shaft risers (4).
2. Unsnap deflectors (1) from handlebar end caps (7).
3. Lift deflectors off of the pivot shafts (3, 6) and pivot shaft risers (4).
4. Loosen pivot shaft riser (4) and jam nut (5) and remove from both pivot shafts (3, 6).
5. Remove pivot shafts (3, 6) with levers.

ASSEMBLY AND INSTALLATION

1. Install brake and clutch levers with pivot shafts (3, 6). See 2.25 CLUTCH CONTROL and 2.10 FRONT BRAKE: SIX PISTON CALIPER.
2. Install jam nuts (5) and tighten to 39-48 **in-lbs** (4.4-5.4 Nm).
3. Install pivot shaft risers (4) and tighten to 43-49 **in-lbs** (4.8-5.5 Nm).
4. Spread deflectors (1) and place over the pivot shaft and riser ends.
5. Snap deflectors onto handlebar end caps (7).
6. Install **new** deflector fasteners (2) and tighten to 24-36 **in-lbs** (2.7-4 Nm).



1. **Deflectors**
2. **Deflector fasteners (4)**
3. **Clutch pivot shaft**
4. **Pivot shaft riser**
5. **Pivot shaft jam nut**
6. **Brake pivot shaft**
7. **Handlebar end caps**

Figure 2-146. Deflectors: XB9SX, XB12X and XB12XT Models

GRILLE: XB9SX/XB12X/XB12XP 2.29

GENERAL

See Figure 2-147. The headlamp grille is offered as a standard feature on the XB9SX, XB12X and XB12XP models to provide additional protection for the headlight assemblies.

REMOVAL AND INSTALLATION

1. See Figure 2-147. Grab headlamp grille on either side and spread to remove from headlamp assemblies.
2. Spread headlamp grille with hands and snap back in place over headlamp assemblies.

Figure 2-147. Headlamp Grille (Typical)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FRONT MODULES: LIGHTNING/ULYSSES 2.30

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect battery cables from battery: negative cable (black) first. See 1.5 BATTERY MAINTENANCE.
3. Remove windshield and windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
4. Remove headlamp assembly and support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
5. Disconnect and remove instrument module.
6. **Ulysses Models:** Disconnect and remove the auxiliary power outlet.
7. See Figure 2-150. **Ulysses Models:** Remove upper module fasteners and remove upper module.
8. Remove ignition switch. See 6.4 IGNITION/HEADLAMP KEY SWITCH.

NOTE

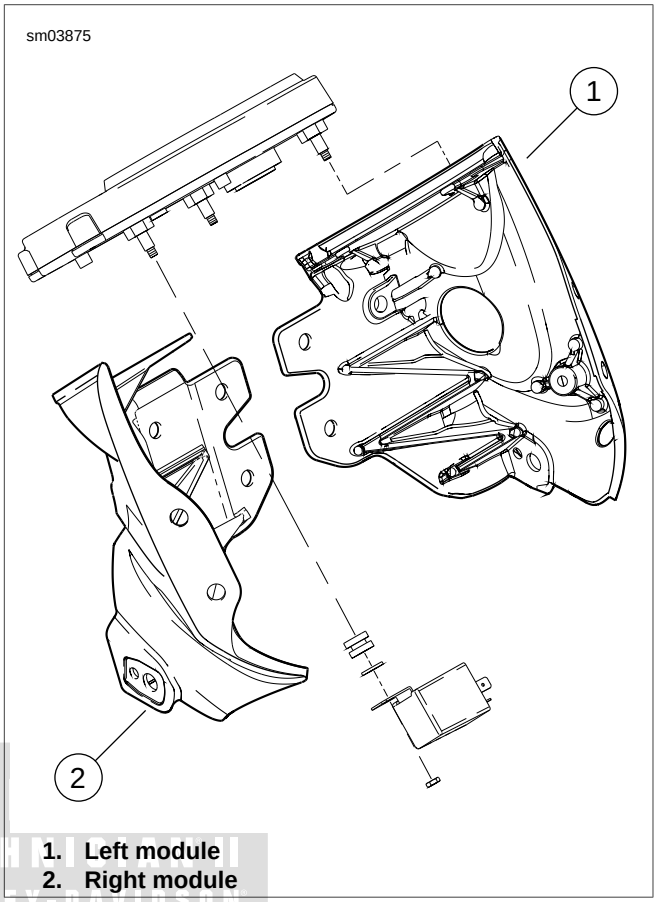
See Figure 2-149. Once the ignition switch has been removed there will be two remaining fasteners.

9. Disconnect front turn signals. See 6.15 FRONT TURN SIGNALS.
10. See Figure 2-149. Remove fastener attaching p-clamp to rear side of right front module.

NOTE

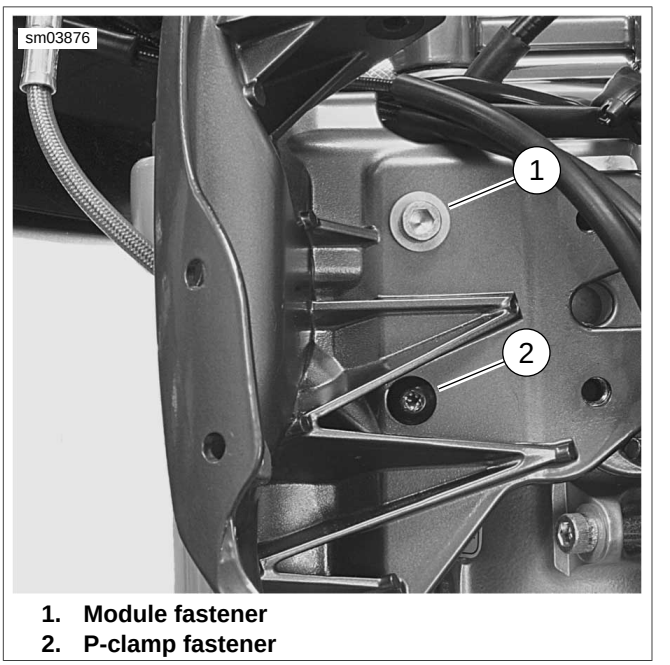
See Figure 2-148 (Lightning) or Figure 2-150 (Ulysses). Once the clamp load has been released on the final fastener securing the right front module to the upper triple clamp, the left front module can be removed.

11. See Figure 2-149. Loosen but do not remove final fastener securing the right front module to upper triple clamp.
12. See Figure 2-148 (Lightning) or Figure 2-150 (Ulysses). Remove the left front module.
13. See Figure 2-149. Remove the final fastener and the right front module.



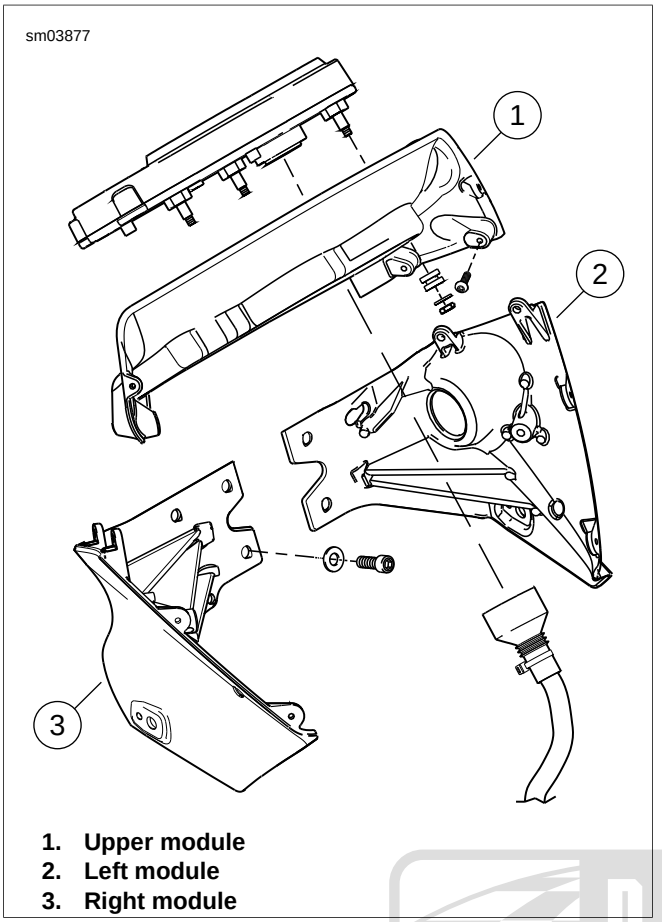
1. **Left module**
2. **Right module**

Figure 2-148. Front Modules: Lightning



1. **Module fastener**
2. **P-clamp fastener**

Figure 2-149. Front Module



1. **Upper module**
2. **Left module**
3. **Right module**

Figure 2-150. Front Modules: Ulysses

INSTALLATION

1. Install right front module leaving single fastener loose.
2. After installing the left front module and aligning with holes in upper triple clamp, tighten previously installed single fastener to 12-14 ft-lbs (16.3-19 Nm).
3. Attach front brake line p-clamp to rear of right front module and tighten fastener to 36-60 **in-lbs** (4-7 Nm).
4. Install ignition switch. See 6.4 IGNITION/HEADLAMP KEY SWITCH.
5. Install and connect instrument module. See 6.26 INSTRUMENT MODULE.
6. Connect turn signals. See 6.15 FRONT TURN SIGNALS.
7. See Figure 2-150. On Ulysses models, install upper module. Tighten fasteners to 36-60 **in-lbs** (4-7 Nm).
8. Connect speedometer.
9. On Ulysses model, connect auxiliary outlet.
10. Install headlamp assembly and support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
11. Install windshield and windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.

⚠WARNING

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

12. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

13. Install seat.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

HANDLEBARS: FIREBOLT 2.31

GENERAL

Firebolt handlebars are a clip-on assembly and are not adjustable.

REMOVAL

Right Clip-On

1. Remove right switch gear housing. See 2.24 THROTTLE CONTROL.
2. Remove front brake master cylinder and grip. See 2.10 FRONT BRAKE: SIX PISTON CALIPER.
3. See Figure 2-152. Remove right clip-on assembly.
   a. Partially loosen clip-on mounting fastener (4).
   b. Using a rubber mallet, tap the partially loosened fastener to push the clip-on (2) from the upper right fork clamp (3). Repeat this procedure until fastener and clip-on has been removed from fork clamp.
4. Remove clip-on end cap (1).

Left Clip-On

1. Remove left switch gear housing.
2. Remove clutch lever assembly. See 2.25 CLUTCH CONTROL.
3. Remove clip-on assembly.
   a. See Figure 2-152. Partially loosen clip-on mounting fastener.
   b. Using a rubber mallet, tap the partially loosened fastener to push the clip-on (2) from the upper left fork clamp (3). Repeat this procedure until fastener (4) and clip-on (2) has been removed from fork clamp.
4. Remove clip-on end cap (1).

INSTALLATION

Right Clip-On

1. Install right switch gear housing.
2. Install right clip-on into right fork clamp and tighten fastener to 24-26 ft-lbs (33-35 Nm).
3. Install front brake master cylinder. Tighten but do not torque.
4. Install throttle and grip onto right clip-on. See 2.24 THROTTLE CONTROL.
5. Install end cap onto right clip-on.
6. Position brake hand lever to rider preferences and tighten fastener to 80-90 **in-lbs** (9-10 Nm). See 2.10 FRONT BRAKE: SIX PISTON CALIPER.

Left Clip-On

1. Install clutch hand lever assembly onto clip-on. Tighten but do not torque.
2. Install left switch gear housing.
3. See Figure 2-152. Install grip and end cap (1).
4. Install left clip-on into upper fork clamp (3) and tighten fastener (4) to 24-26 ft-lbs (33-35 Nm).
5. Position clutch hand lever to rider preferences and tighten fastener (1) to 60-84 **in-lbs** (7-9.5 Nm). See 2.25 CLUTCH CONTROL.

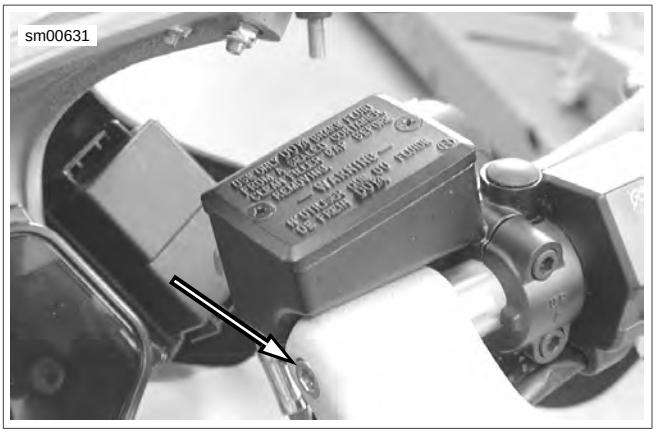
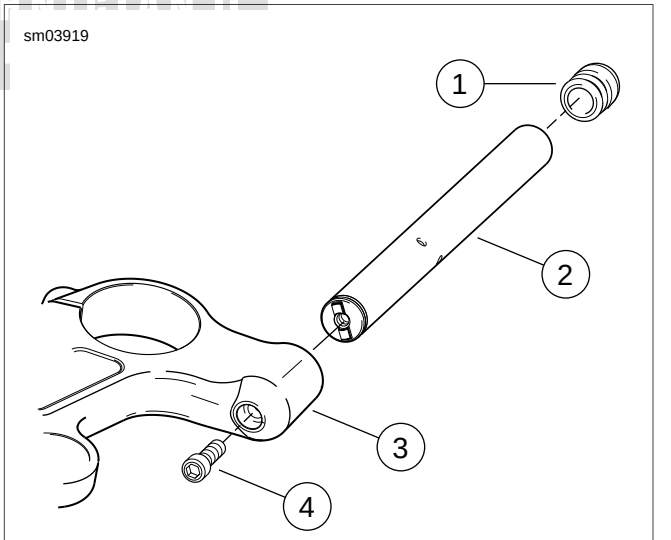


Figure 2-151. Handlebar Clip-On Mounting Fasteners (Right Clip-On Shown): Firebolt



1. **End cap**
2. **Clip-on**
3. **Upper fork clamp**
4. **Clip-on fastener**

Figure 2-152. Handlebar Clip-On Assembly (Left Clip-On Shown): Firebolt

HANDLEBARS: LIGHTNING/ULYSSES 2.32

REMOVAL

1. Remove seat.

NOTE

On Ulysses Models, it will be necessary to disconnect and remove the heated handgrips. See 6.12 HEATED HAND GRIPS: ULYSSES MODELS.

⚠WARNING

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

2. Disconnect battery cables from battery: negative cable (black) first.
3. **XB9SX, XB12X, XB12XT and XB12XP:** Remove deflectors. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.
4. Remove left handlebar switch housing.
5. Detach clutch hand control from handlebars. See 2.25 CLUTCH CONTROL.
6. Remove front brake master cylinder. See 2.10 FRONT BRAKE: SIX PISTON CALIPER.
7. Loosen screws on right handlebar switch housing, but do not detach throttle grip assembly from handlebar. See 2.24 THROTTLE CONTROL.
8. **Ulysses Models:** Remove four harness retainers securing switch housing harnesses to handlebars.
9. Remove clutch lever assembly. See 2.25 CLUTCH CONTROL.
10. See Figure 2-153. Remove the four screws holding upper handlebar clamp.

NOTE

Remove right hand control assembly from detached handlebar.

11. Remove handlebars without stretching throttle cables.
12. Remove end caps.

INSTALLATION

1. Slide handlebars into throttle grip assembly. Fasten right handlebar switch housing to handlebar. See 2.24 THROTTLE CONTROL.
2. See Figure 2-153. Attach handlebars.
   a. Position handlebar on lower clamp.
   b. Place the upper handlebar clamp in position and thread the four screws in place after applying LOCTITE 271 (red).
   c. Tighten both front screws to 10-12 ft-lbs (14-16 Nm).
   d. Then tighten both rear screws 10-12 ft-lbs (14-16 Nm).
3. Install clutch hand control. Tighten but do not torque. See 2.25 CLUTCH CONTROL.
4. Install left switch housing.
5. Check control wire routings. See D.1 APPENDIX D: HOSE AND WIRE ROUTING.
   a. Route right hand control wires between the lower clamp and fork tube and on the outside of the clutch cable.
   b. Route left hand control wires between the lower clamp and fork tube.
   c. **Ulysses Models:** Install harness retainers.

NOTE

On Ulysses models, with heated hand grips, it will be necessary to install the original hand grip from the removal process.

6. Install a **new** left hand grip.
7. Position clutch hand lever to rider preferences and tighten fastener to 60-84 **in-lbs** (7-9.5 Nm). See 2.25 CLUTCH CONTROL.
8. Install front brake master cylinder. See 2.10 FRONT BRAKE: SIX PISTON CALIPER.
9. **XB9SX, XB12X, XB12XT and XB12XP:** Install end caps and deflectors. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.
10. Check steering motion range to both fork stops.

⚠WARNING

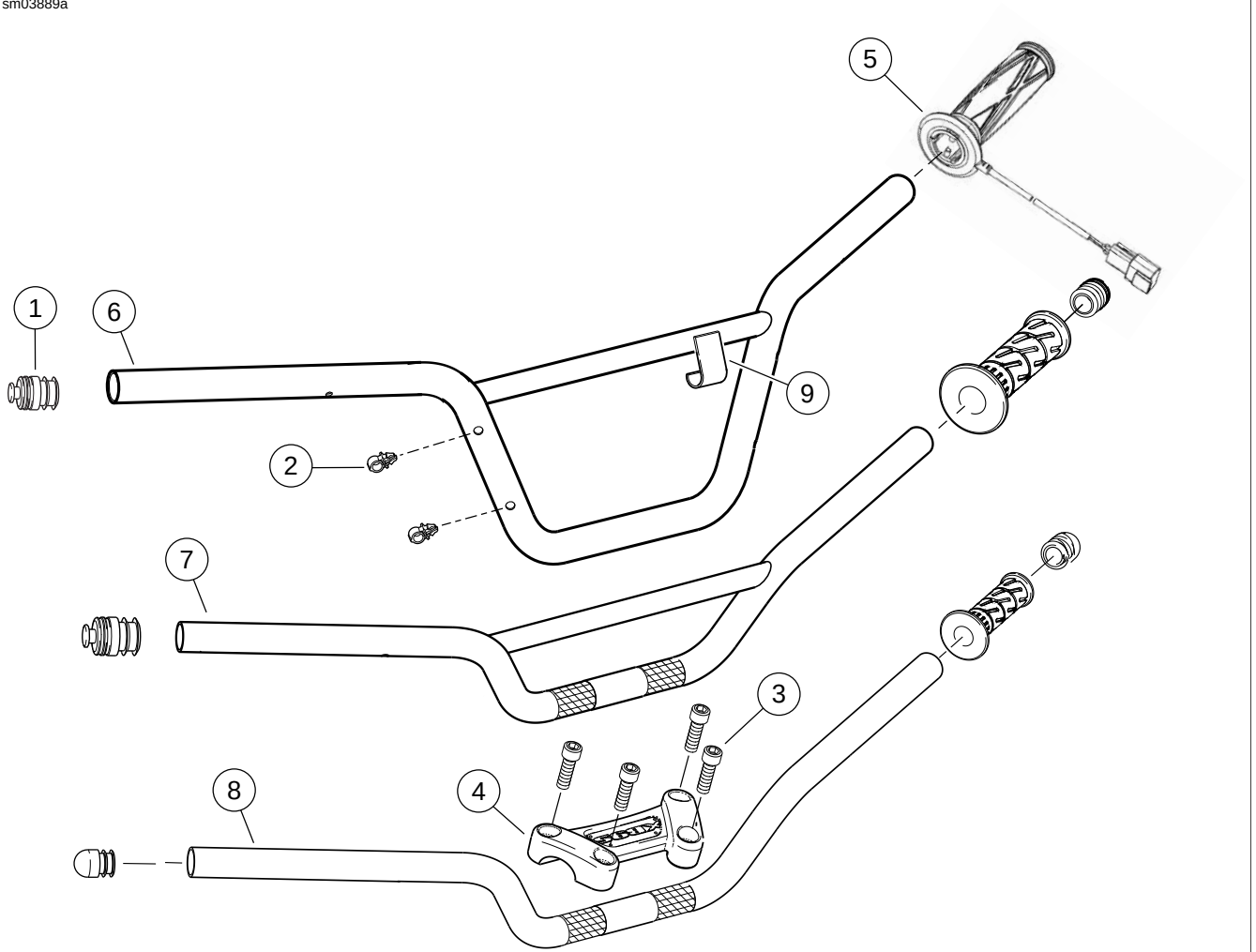
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

11. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

12. Install seat.



1. **End cap**
2. **Harness retainers**
3. **Clamp fasteners**
4. **Handlebar clamp**
5. **Left hand grip (XB12X models are OEM equipped with heated handgrips)**
6. **Handlebar (Ulysses models)**
7. **Handlebar (XB9SX)**
8. **Handlebar (XB12Scg, XB12Ss)**
9. **Clutch cable hook (Ulysses models)**

Figure 2-153. Handlebar Assembly: Lightning/Ulysses

MIRRORS 2.33

REMOVAL

1. See Figure 2-154. Loosen adjuster nut (2) and remove mirror (1) from mount (3).
2. Loosen mount (3) and remove from bracket (4).

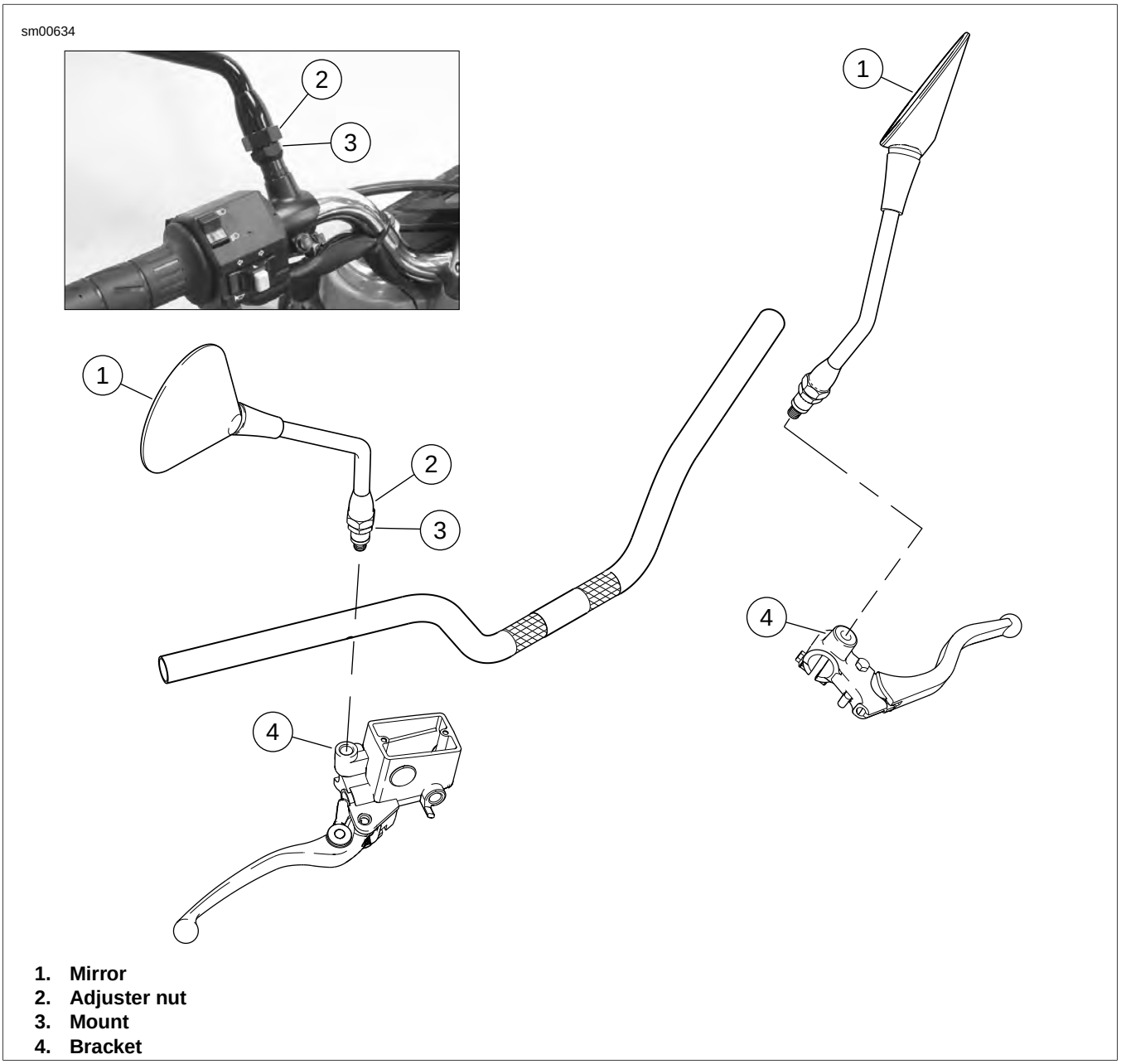
INSTALLATION

1. See Figure 2-154. Install mount (3) onto bracket (4) and tighten to 20-22 ft-lbs (27-30 Nm).

NOTES

- *In a convex mirror, cars and other objects will look smaller and farther away than they actually are. Adjust mirrors to see a small portion of the riders shoulders in each mirror. This helps the rider establish the relative distance of vehicles to the rear of the motorcycle.*
- *Before tightening adjuster nut, position mirrors for rider.*

2. Install mirror (1) and while holding in position for rider vision, tighten adjuster nut to 115-130 **in-lbs** (13-14.7 Nm).



1. **Mirror**
2. **Adjuster nut**
3. **Mount**
4. **Bracket**

Figure 2-154. Mirrors and Mounting Hardware: Lightning/Ulysses

FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING 2.34

RIDER

REMOVAL

1. See Figure 2-155. Remove wear peg (7) from end of footpeg assembly.
2. Remove clip (5).
3. Remove footpeg pin (9).
4. Remove footpeg (8).
5. Remove heel guard fasteners (4).
6. Remove heel guard (3).
7. Remove footpeg mount fasteners (2).
8. Remove footpeg mount (1).
9. Position footpeg mount (1).
10. Install footpeg mount with fasteners (2). Tighten to 132-144 **in-lbs** (14.9-16.2 Nm).

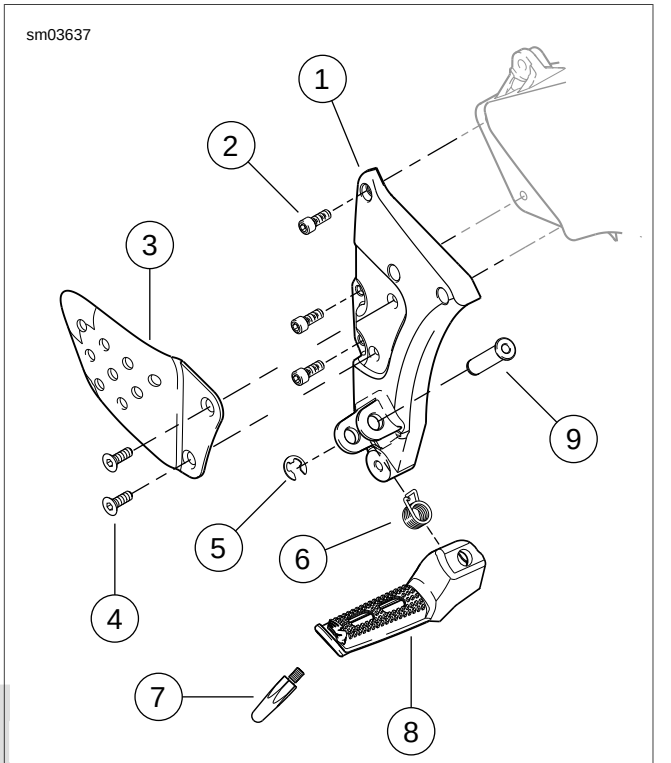
INSTALLATION

1. See Figure 2-155. Position heel guard (3) onto footpeg mount (1).

NOTE

There is one long fastener which installs on the lower left side in order to secure the non-California vent clamp.

2. Install heel guard (3) with fasteners (4). Tighten to 72-96 **in-lbs** (8-11 Nm).
3. Position spring (6) in footpeg (8).
4. Position footpeg (8) and spring in footpeg mount (1).
5. Install footpeg pin (9).
6. Install clip (5).
7. Apply LOCTITE 271 (red) and tighten to 36-48 **in-lbs** (4-5 Nm).



1. **Footpeg mount**
2. **Footpeg mount fasteners**
3. **Heel guard**
4. **Heel guard fasteners**
5. **Clip, footpeg**
6. **Spring**
7. **Wear peg**
8. **Footpeg**
9. **Pin**

Figure 2-155. Rider Footpeg, Mount and Heel Guard: Firebolt/Lightning

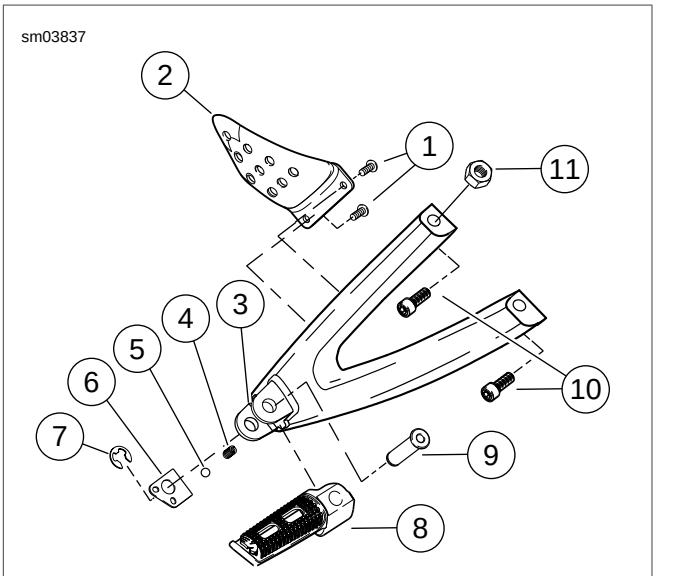
PASSENGER

REMOVAL

1. See Figure 2-156. Remove clip (7).
2. Remove footpeg pin (9).
3. Remove footpeg (8), detent plate (6), ball (5) and spring (4).
4. Remove heel guard fasteners (1).
5. Remove heel guard (2).
6. Remove footpeg mount fasteners (10).
7. Remove footpeg mount (3).

INSTALLATION

1. See Figure 2-156. Position footpeg mount (3) onto sub-frame tail assembly.
2. Install footpeg mount (3). Using LOCTITE 271 tighten, fasteners (10) to 25-28 ft-lbs (34-38 Nm).
3. Position heel guard (2) onto footpeg mounts (3).
4. Install heel guard (2).
5. Tighten heel guard fasteners to 72-96 **in-lbs** (8-11 Nm).
6. Position footpeg (8), detent plate (6), ball (5), and spring (4) on to footpeg mount (3).
7. Install footpeg pin (9).
8. Install clip (7).
9. Check that footpeg clicks in the up and down position.



1. **Heel guard fasteners**
2. **Heel guard**
3. **Footpeg mount**
4. **Spring**
5. **Ball**
6. **Detent plate**
7. **Clip**
8. **Footpeg**
9. **Pin**
10. **Footpeg mount fastener**
11. **Jamnut (Lightning only)**

Figure 2-156. Passenger Footpeg, Mount and Heel Guard Assembly: Lightning

DIGITAL TECHNICIAN HARLEY-DAVIDSON

HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS 2.35

RIDER FOOTPEGS

Footpeg Removal

1. See Figure 2-157. Remove clip (3).
2. Remove footpeg pin (8).
3. Remove footpeg (10) and spring (9).

Footpeg Installation

1. See Figure 2-157. Fit spring ends to footpeg mount and footpeg.
2. Hold footpeg (10), controlling spring, to footpeg mount (1).
3. Install footpeg pin (8) through mount, spring and footpeg.
4. Install clip (3).

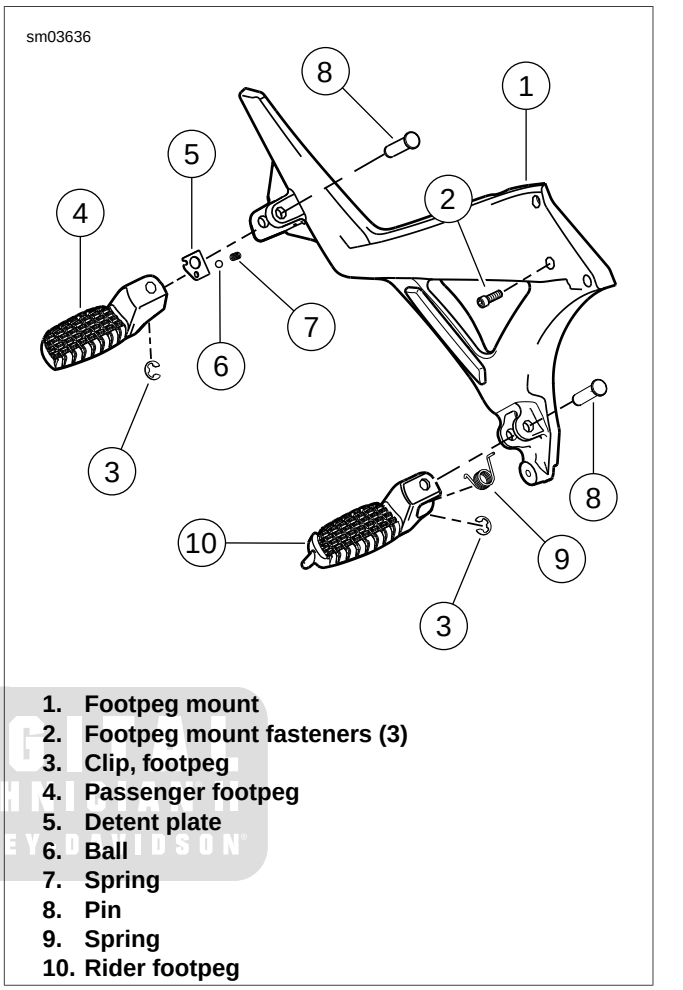
PASSENGER FOOTPEGS

Footpeg Removal

1. Remove clip (3).
2. Remove footpeg pin (8).
3. Remove footpeg (4), detent plate (5), ball (6) and spring (7).

Footpeg Installation

1. Position footpeg (4), detent plate (5), ball (6), and spring (7) on to footpeg mount (1).
2. Install footpeg pin (8).
3. Install clip (3).
4. Check that footpeg clicks in the up and down position.



1. **Footpeg mount**
2. **Footpeg mount fasteners (3)**
3. **Clip, footpeg**
4. **Passenger footpeg**
5. **Detent plate**
6. **Ball**
7. **Spring**
8. **Pin**
9. **Spring**
10. **Rider footpeg**

Figure 2-157. Rider Footpeg, Mount and Heel Guard Assembly: Ulysses

MOUNT REMOVAL

1. On the right side Remove the rear brake pedal fastener. See 2.11 BRAKE PEDAL.
2. See Figure 2-155. Remove footpeg mount fasteners (2).
3. See Figure 2-159. On the right side, remove the 2 fasteners holding the rear brake master cylinder to the mount.
4. Remove two fasteners from rear brake line bracket.
5. Remove footpeg mount (1).

MOUNT INSTALLATION

1. On the right side, install the rear brake master cylinder. See 2.12 REAR BRAKE MASTER CYLINDER.
2. Install rear brake line bracket. Tighten fasteners to 48-72 **in-lbs** (5.4-8 Nm).
3. See Figure 2-155. Position footpeg mount (1).

4. Install footpeg mount fasteners (2), and tighten to 132-144 **in-lbs** (15-16 Nm).
5. Install brake pedal fastener. See 2.11 BRAKE PEDAL.

Figure 2-158. Right Side Heel Guard and Footpeg Mount: Ulysses

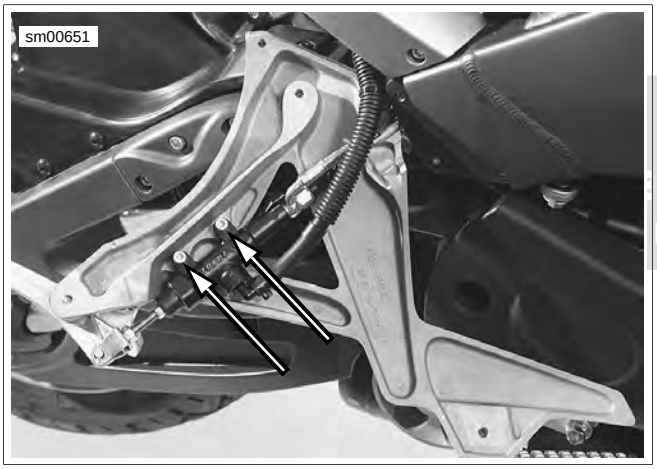


Figure 2-159. Rear Brake Master Cylinder Location: Ulysses

HEEL GUARD REPLACEMENT

1. See Figure 2-160. If necessary, cut the rubber heel guard tabs on the inside of the footpeg mount to remove the heel guard.
2. Pull rubber cones of replacement heel guard through the holes in footpeg mount.
3. Cut excess rubber from ends of cones capturing the heel guard to the footpeg mount.

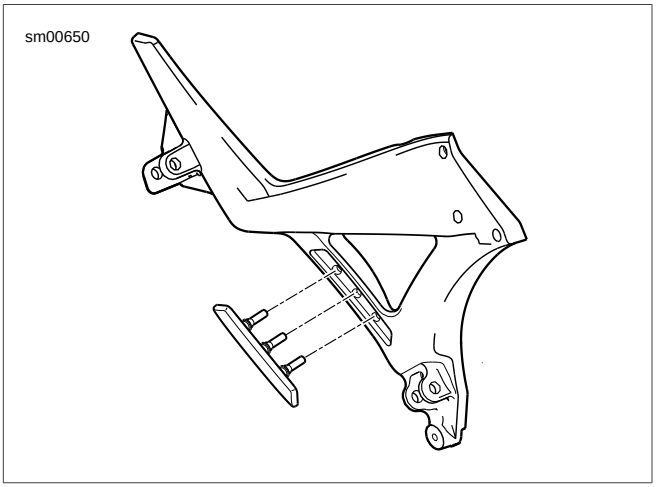


Figure 2-160. Heel Guard: Ulysses

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SPROCKET COVER 2.36

REMOVAL

1. See Figure 2-161. Remove rear right chin fairing fasteners.
2. See Figure 2-162. Remove sprocket cover fasteners and washers (1, 3).

INSTALLATION

NOTE

Apply LOCTITE 222 (purple) to long fastener (1) only.

1. See Figure 2-162. Install sprocket cover (2) using sprocket cover fasteners (1, 3) and tighten all fasteners and washers (1) to 12-36 **in-lbs** (1.4-4 Nm).
2. Install chin fairing. See 2.50 CHIN FAIRING.

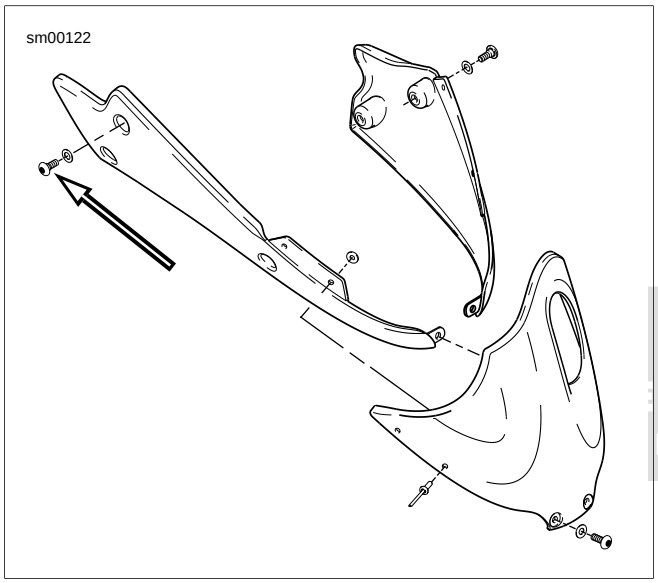
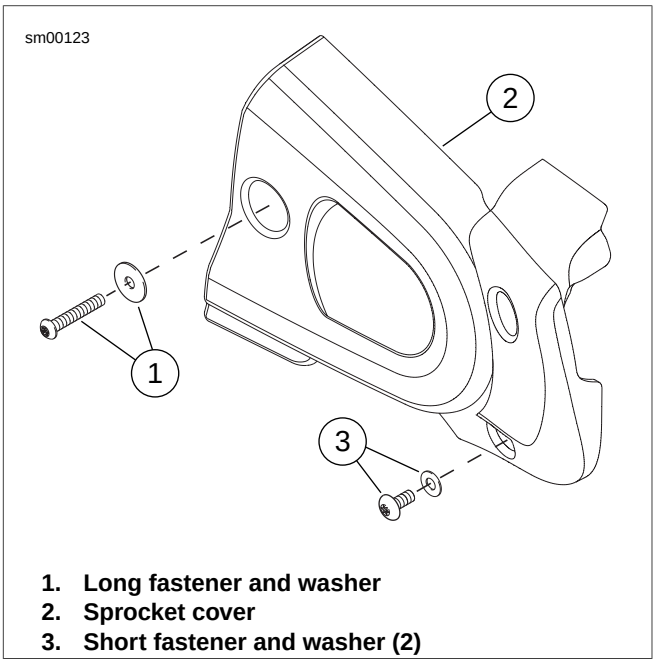


Figure 2-161. Chin Fairing Assembly, Right Rear Fasteners



1. **Long fastener and washer**
2. **Sprocket cover**
3. **Short fastener and washer (2)**

Figure 2-162. Sprocket Cover

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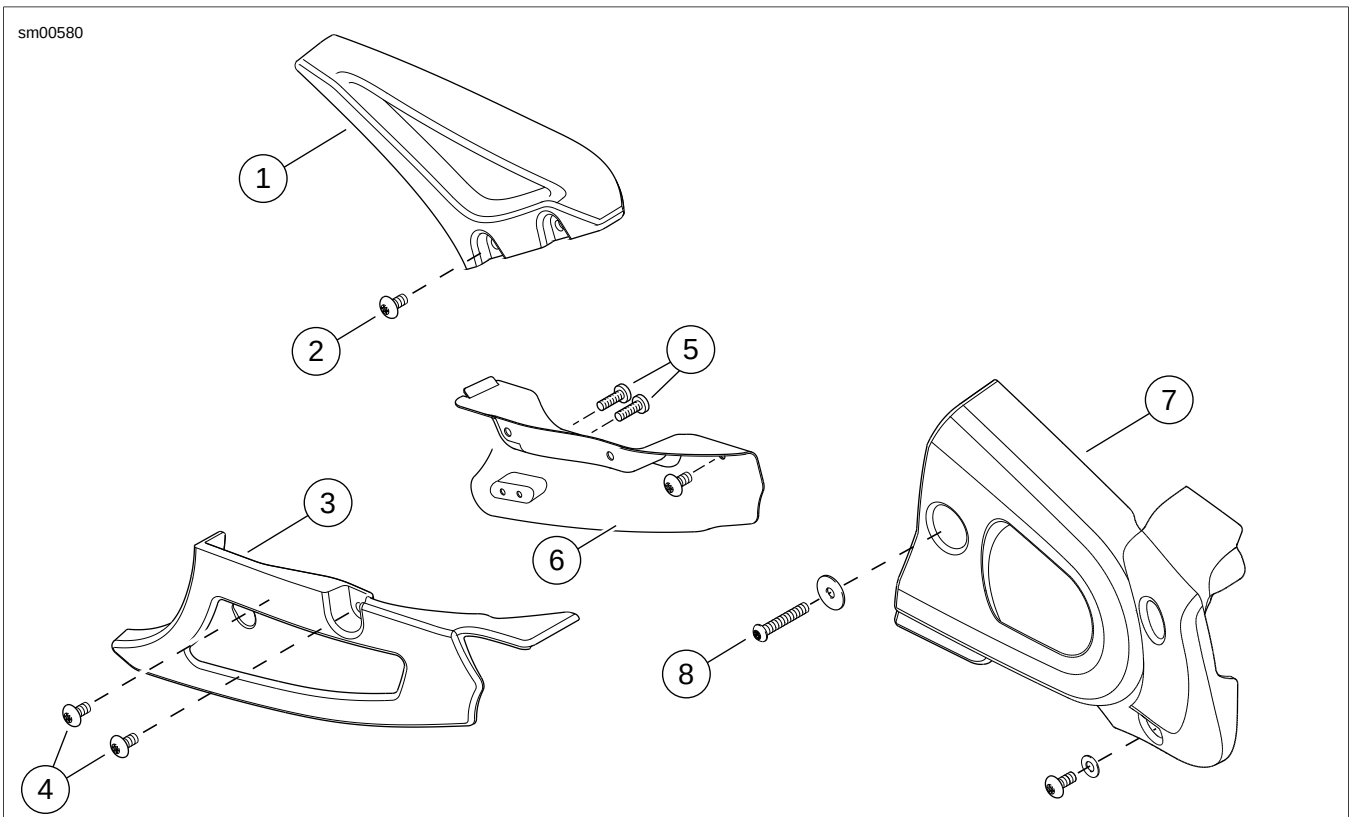
BELT GUARDS 2.37

REMOVAL

1. Place a scissor jack under jacking point and raise rear wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.
2. Remove right side rider footrest support bracket.
3. Loosen rear axle pinch fastener.
4. Loosen rear axle approximately 15 rotations to allow partial tension to be removed from rear drive system.
5. See Figure 2-163. Remove lower belt guard (3) by removing the fasteners (4).
6. Once the lower belt guard has been removed, remove the metal stone guard (6).
7. Remove upper belt guard (1) by removing fasteners (2) from swingarm.

INSTALLATION

1. See Figure 2-163. Install upper belt guard (1) to swingarm brace tightening fasteners (2) to 12-36 **in-lbs** (1.4-4 Nm).
2. Install stone guard (6) and tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm).
3. Install lower belt guard (3) and tighten fasteners (4) to 12-36 **in-lbs** (1.4-4 Nm).
4. Tighten rear axle. See 5.7 DRIVE BELT AND IDLER PULLEY.
5. Tighten rear axle pinch fastener to 40-45 ft-lbs (54-61 Nm).
6. Install right side rider footrest mount and tighten fasteners to 132-144 **in-lbs** (14.9-16.2 Nm).
7. Remove scissor jack from motorcycle.



1. **Upper belt guard**
2. **Upper belt guard and stone guard fasteners (2)**
3. **Lower belt guard**
4. **Lower belt guard fasteners (2)**
5. **Fasteners**
6. **Stone guard**
7. **Sprocket cover**
8. **Sprocket cover fasteners (2 short, 1 long)**

Figure 2-163. Belt Guard Assembly

INTAKE COVER 2.38

REMOVAL

NOTE

See Figure 2-164. The X-Guard (1) on the XB9SX model is a non-replaceable part.

1. Remove seat.
2. Remove the rear fasteners and nylon washers (3).

NOTE

Models with a translucent intake cover use a top hat bushing and two isolating washers for each front fastener (5). Other models with molded in color use a nylon washer with each front fastener (4).

3. Remove front fasteners.
   a. On models with a translucent intake cover, remove front fasteners with top hat bushings and isolator washers (5).
   b. On other models (with molded in color), remove front fasteners and nylon washers (4).
4. Remove intake cover assembly (2).

INSTALLATION

1. See Figure 2-164. Position intake cover assembly (2) over top of air cleaner cover.

NOTE

Front fasteners are installed at a slight angle.

2. Loosely install front fasteners (4, 5).
   a. On models with a translucent intake cover, start the two front fasteners with top hat bushings and isolator washers (5).
   b. On other models (with molded in color), start the two front fasteners with nylon washers (4).
3. Install the rear fasteners and nylon washers (3). Tighten all fasteners to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

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

4. Install seat.

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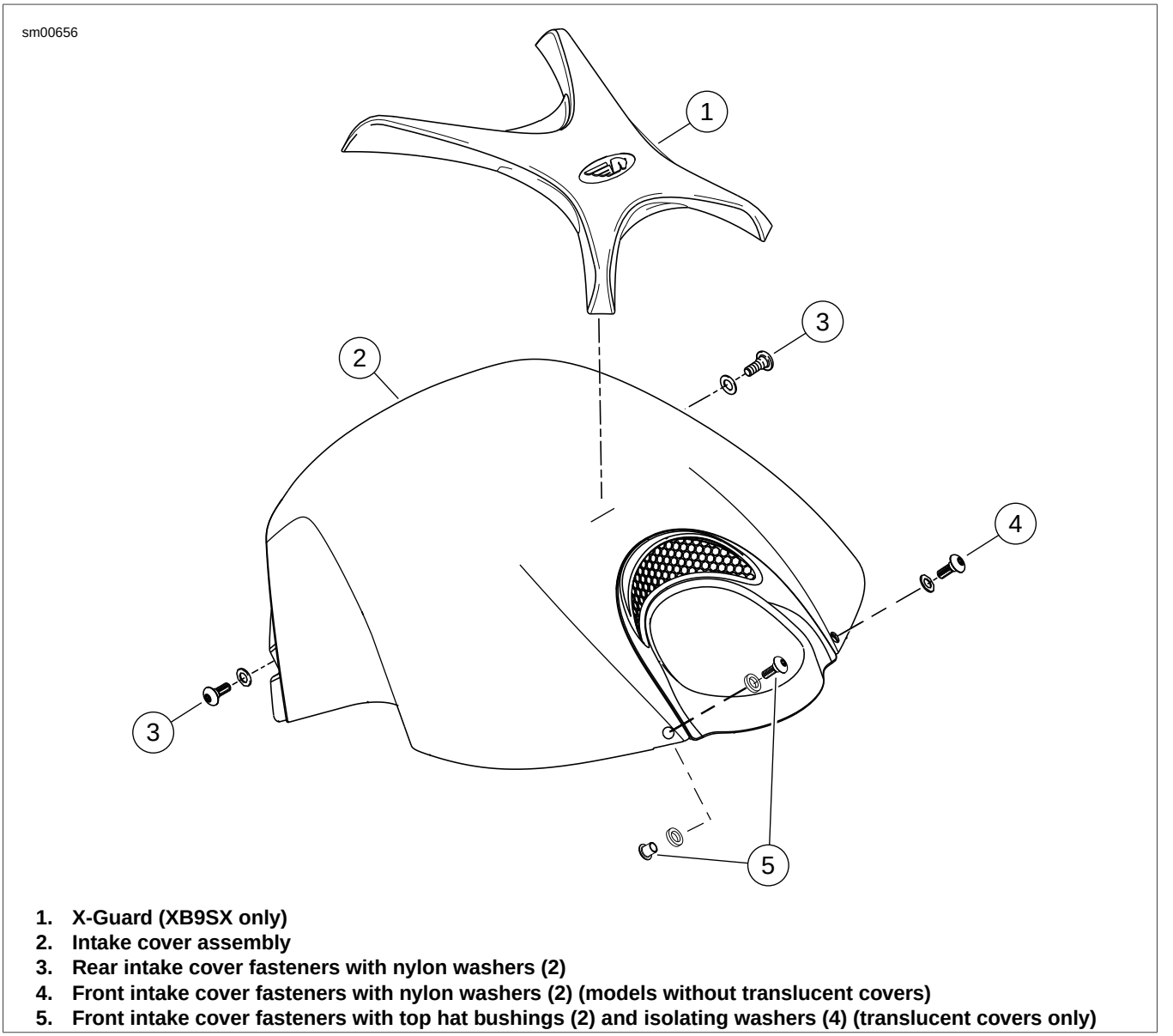

1. **X-Guard (XB9SX only)**
2. **Intake cover assembly**
3. **Rear intake cover fasteners with nylon washers (2)**
4. **Front intake cover fasteners with nylon washers (2) (models without translucent covers)**
5. **Front intake cover fasteners with top hat bushings (2) and isolating washers (4) (translucent covers only)**

Figure 2-164. Intake Cover Assembly

SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT 2.39

DISASSEMBLY

1. Remove seat and pillion.

⚠WARNING

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

2. Disconnect battery by unthreading fastener removing negative cable (black) from battery first. See 1.5 BATTERY MAINTENANCE.
3. See Figure 2-165. Remove upper body work (1) from subframe tail assembly (7).
   a. Remove body work fasteners (2).
   b. Disconnect passenger seat lock cable (6) by removing cable from seat lock plate (4) and ferrule from keylock (3).
   c. Lift upper tail body work (1) off subframe tail assembly (7).
4. Remove passenger seat latch (14) from rear of subframe tail assembly.

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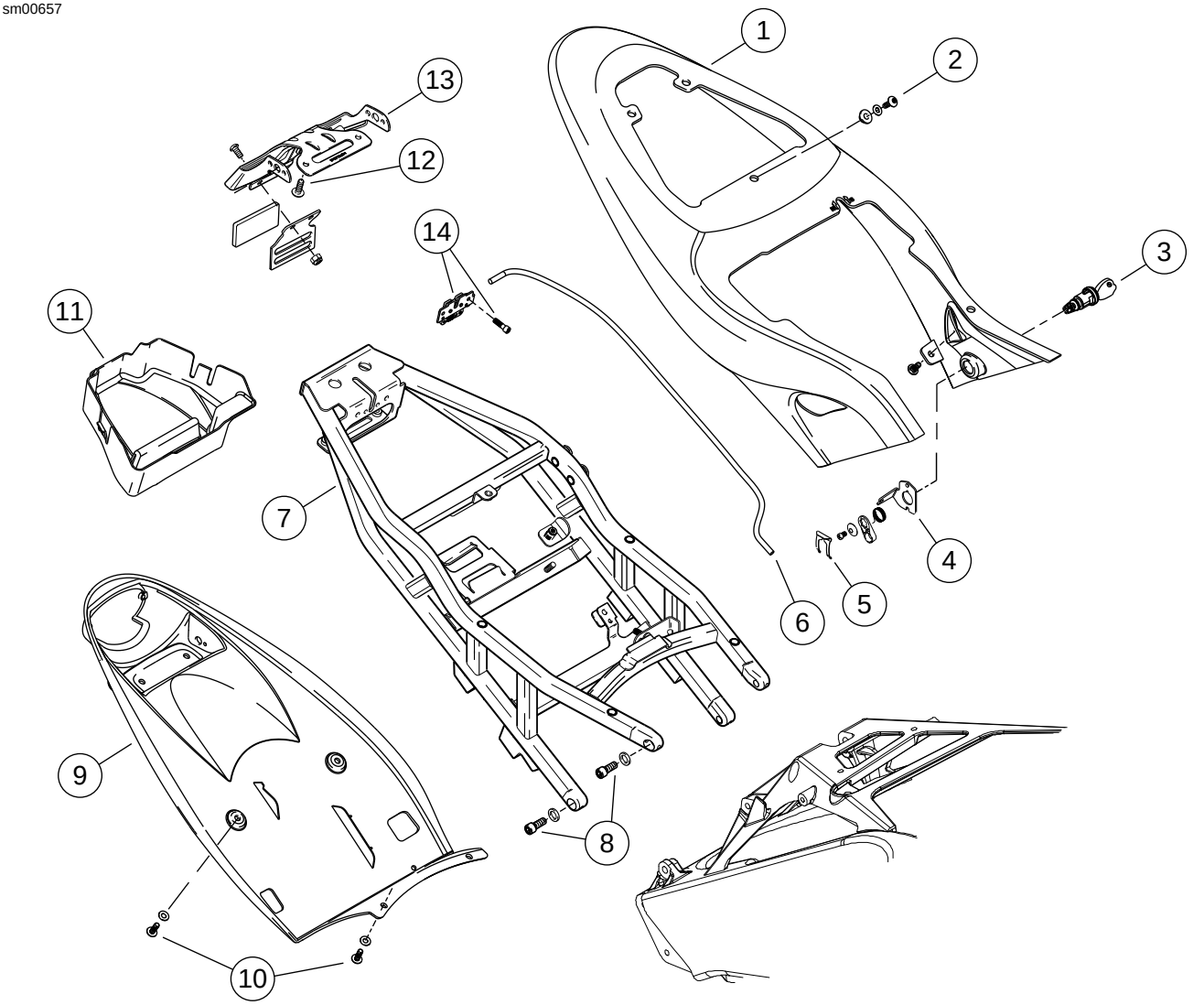
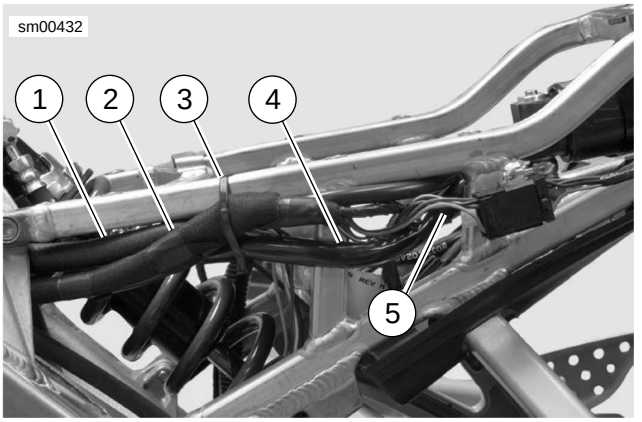


1. Upper tail body work
2. Upper tail body work fasteners
3. Passenger seat lock
4. Passenger seat lock plate
5. Passenger seat lock retainer
6. Passenger seat lock cable
7. Subframe tail assembly
8. Subframe tail assembly fasteners
9. Lower tail body work
10. Lower tail body work fasteners
11. Trunk
12. Fastener
13. License plate bracket
14. Passenger seat latch and fastener

Figure 2-165. Subframe Tail Assembly and Body Work Assembly: Firebolt



1. **Fuel vent hose**
2. **Main wire harness**
3. **Cable strap**
4. **Rear shock reservoir hose**
5. **Exhaust actuator harness connector [165]**

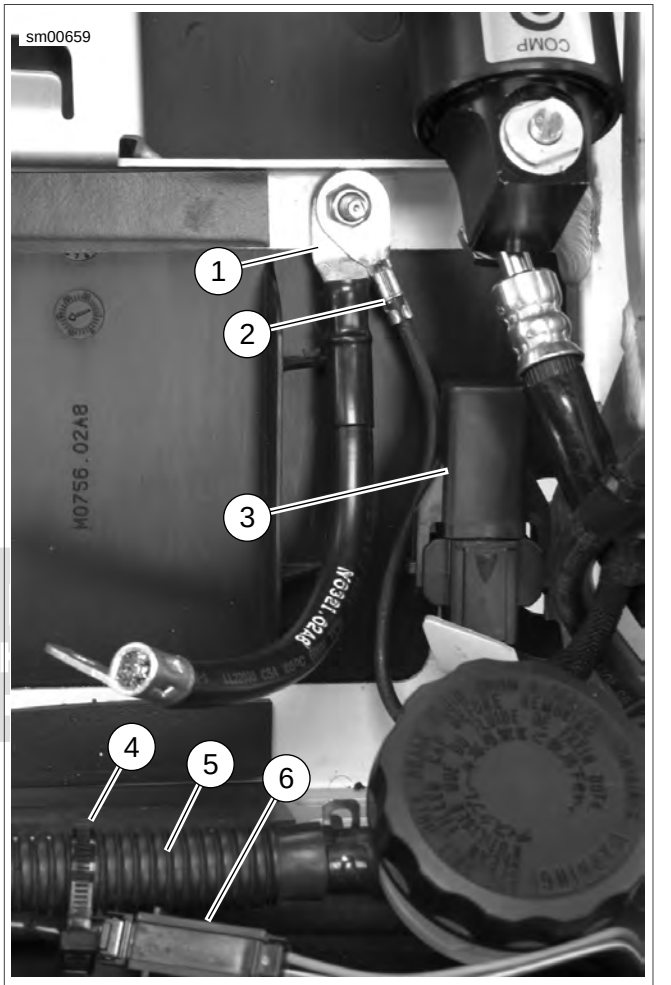
Figure 2-166. Left Side Subframe Hose and Wire Routing: Firebolt

5. See Figure 2-166. Cut cable strap (3) from subframe tail assembly holding vent hose (1), main wire harness (2) and shock reservoir hose (4).
6. Disconnect main wire harness connection (5).
7. Disconnect turn signal bullet connections and tail lamp connections. See 6.15 FRONT TURN SIGNALS and 6.19 TAIL LAMP.
8. Remove clip, cable strap, that holds the turn signals and tail lamp wire harness to subframe tail assembly.
9. Remove turn signals and reflectors from lower body work. See 6.15 FRONT TURN SIGNALS.
10. See Figure 2-165. Remove license plate fasteners (12) from lower tail body work (9) and remove license plate bracket (13).
11. Remove passenger footpeg mounts. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
12. Remove lower body work (9) and trunk (11) from subframe tail assembly (7).
    a. Remove lower body work (9) underneath subframe tail assembly by removing fasteners (10).
    b. Remove trunk (11).
13. See Figure 2-167. Disconnect main battery ground (1) and ground to wire harness (2).
14. Remove main fuse case (3) from subframe tail assembly.

NOTE

When removing the main fuse case from subframe tail assembly, be very careful not to bend the subframe.

15. Cut cable strap (4) holding rear brake reservoir hose (5) and rear brake lamp wire (6).
16. Disconnect rear brake lamp connection (6).
17. See Figure 2-168. Remove rear brake reservoir clamp nut.
18. Disconnect fuel pump connection and remove connector from subframe tail assembly. See 4.14 FUEL PUMP.
19. Remove shock reservoir fasteners and feed the reservoir out of subframe tail assembly. See 2.23 REAR SHOCK ABSORBER.
20. See Figure 2-165. Remove subframe tail assembly fasteners (8) and remove subframe tail assembly (7) from frame.



1. **Main battery ground**
2. **Wire harness ground**
3. **Main fuse case**
4. **Cable strap**
5. **Rear brake reservoir hose**
6. **Rear brake lamp wire and connector**

Figure 2-167. Inside Subframe Tail Assembly Hose and Wire Routing

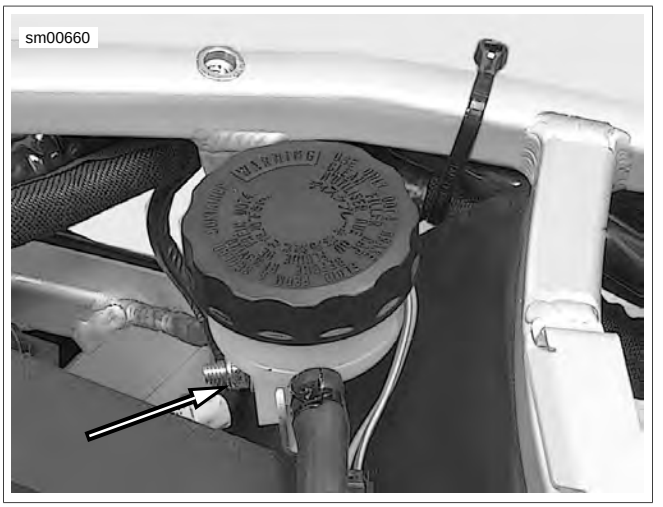


Figure 2-168. Remote Reservoir Clamp Nut

CLEANING

NOTE

Do not use wheel care products or other compounds developed specifically for cleaning and polishing powdercoat. These cleaners could potentially damage the tail section finish.

The cast aluminum tail section has a black powdercoat. The powdercoat must be cleaned using only mild soap and warm water. After washing, always dry the surface using a clean, soft cloth.

ASSEMBLY

1. See Figure 2-165. Install subframe tail assembly (7) to frame. Apply LOCTITE 271 (red) to fasteners (8) and tighten to 21-23 ft-lbs (28.5-31.2 Nm).
2. Connect fuel pump connection and install connector onto subframe tail assembly. See 4.14 FUEL PUMP.
3. See Figure 2-167. Feed rear brake lamp connector (6) into subframe tail assembly and connect.
4. Install main fuse case (3) onto subframe tail assembly.
5. Install main battery ground (1) and ground to wire harness (2) to subframe tail assembly. Tighten fastener to 48-72 **in-lbs** (5.4-8 Nm).
6. See Figure 2-166. Feed the rear shock reservoir hose (4) through second subframe tail assembly support.
7. Install rear shock reservoir into shock reservoir clamp and install clamp on to subframe tail assembly. Do not tighten. See 2.23 REAR SHOCK ABSORBER.
8. Check rear shock reservoir suspension screw alignment with upper body work.
   a. Install upper body work without tightening any fasteners.
   b. Move the rear shock canister in position to see the suspension screw through the upper body work.
   c. Remove upper body work and tighten rear shock reservoir clamp to 120-144 **in-lbs** (13.6-16.3 Nm).
9. See Figure 2-166. Feed fuel vent hose (1) through tail section, keeping the hose on top of rear shock reservoir hose. See D.1 APPENDIX D: HOSE AND WIRE ROUTING for hose and wire routing.
10. Install cable strap (3) holding shock reservoir hose, wire harness and fuel vent hose to subframe tail assembly.
11. See Figure 2-168. Feed rear brake reservoir hose underneath subframe tail assembly and install rear brake reservoir tightening fastener to 48-72 **in-lbs** (5.4-8 Nm).
12. See Figure 2-167. Install cable strap holding rear brake lamp wire and connector (6) and rear brake reservoir hose (5).
13. See Figure 2-165. Install lower body work (9) and trunk (11) onto subframe tail assembly (7).
    a. Install trunk (11).
    b. Install lower body work (9) underneath subframe tail assembly by tightening fasteners (10) to 12-36 **in-lbs** (1.4-4 Nm).
14. Install passenger footpeg mounts. Apply LOCTITE 271 (red) to fasteners and tighten to 25-28 ft-lbs (34-38 Nm). See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
15. See Figure 2-166. Connect rear power harness to tail lamp harness (5).
16. Install clip, cable strap, that holds the turn signals and tail light wire harness to subframe tail assembly. See 6.15 FRONT TURN SIGNALS.

⚠WARNING

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

17. See Figure 2-165. Install license plate bracket (13) to lower tail body work (9) and tighten fasteners (12) to 36-48 **in-lbs** (4-5 Nm).
18. Install turn signals and reflectors onto lower body work and tighten to 25-28 **in-lbs** (2-3 Nm). See 6.15 FRONT TURN SIGNALS.
19. Connect turn signal bullet connections and tail light connections. See 6.15 FRONT TURN SIGNALS and 6.19 TAIL LAMP.
20. Install passenger seat latch (14) from rear of subframe tail assembly and tighten to 60-96 **in-lbs** (7-11 Nm).
21. See Figure 2-165. Install upper body work onto subframe tail assembly.
    a. Connect passenger seat lock cable (6) by installing ferrule into lock lever.
    b. Starting on the left side of the subframe tail assembly cover the lock cable and wire harness and align upper body work (1) on subframe tail assembly (7).
    c. Install tail body work starting with the fastener in the center of upper body work and between the passenger and rider seat. Tighten all fasteners to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

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

22. Connect battery cables to battery: positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

23. Install seat and pillion.

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LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING 2.40

DISASSEMBLY

1. Remove seat.

⚠WARNING

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

2. See Figure 2-169. Disconnect battery cables from battery: negative cable (black) first.
3. Remove battery.
4. See Figure 2-169. Disconnect:
   a. Wire harness ground (2) [GRD 2].
   b. Rear brake light switch connector (5) [121].
   c. ECM connectors (7) [10 & 11] and [164] (on XB12 models).
   d. BAS (bank angle sensor) connector (9) [134].
   e. Right turn signal connector (10) [19].
   f. Left turn signal connector (11) [18].
   g. License plate lamp connector (12) [45].
   h. Tail light connectors (13) [93].
   i. Ground terminals on right side tail section (6) [GRD1] & [GRD 3].
5. Remove the rear shock absorber reservoir. See 2.23 REAR SHOCK ABSORBER.
6. Cut cable strap attaching BAS wire harness to seat latch cable.
7. See Figure 2-169. Remove fuse block and relay center from support bracket.
8. Move rear main harness and shock absorber reservoir to right side of vehicle.
9. Remove left side passenger footrest support assembly. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
10. See Figure 2-169. Remove the following fasteners:
    a. Left front trunk pan to left side tail section (14).
    b. Left rear tail section to center tail section (15).
    c. Left tail section to main frame/fuel tank assembly.
    d. Left tail section to battery tray.
11. Remove left tail section from vehicle.

NOTE

In order to remove trunk pan it will be necessary to remove the following fasteners and components.

12. Remove two fasteners securing trunk pan to center tail section.
13. See Figure 2-169. Remove fastener securing right front trunk pan to right side tail section.
14. Remove right side passenger footrest support assembly. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
15. Slide trunk pan with battery pan, seat latch, bank angle sensor, rear shock reservoir mounting bracket and ECM out left side of vehicle.
16. Remove remaining components on trunk pan as needed.

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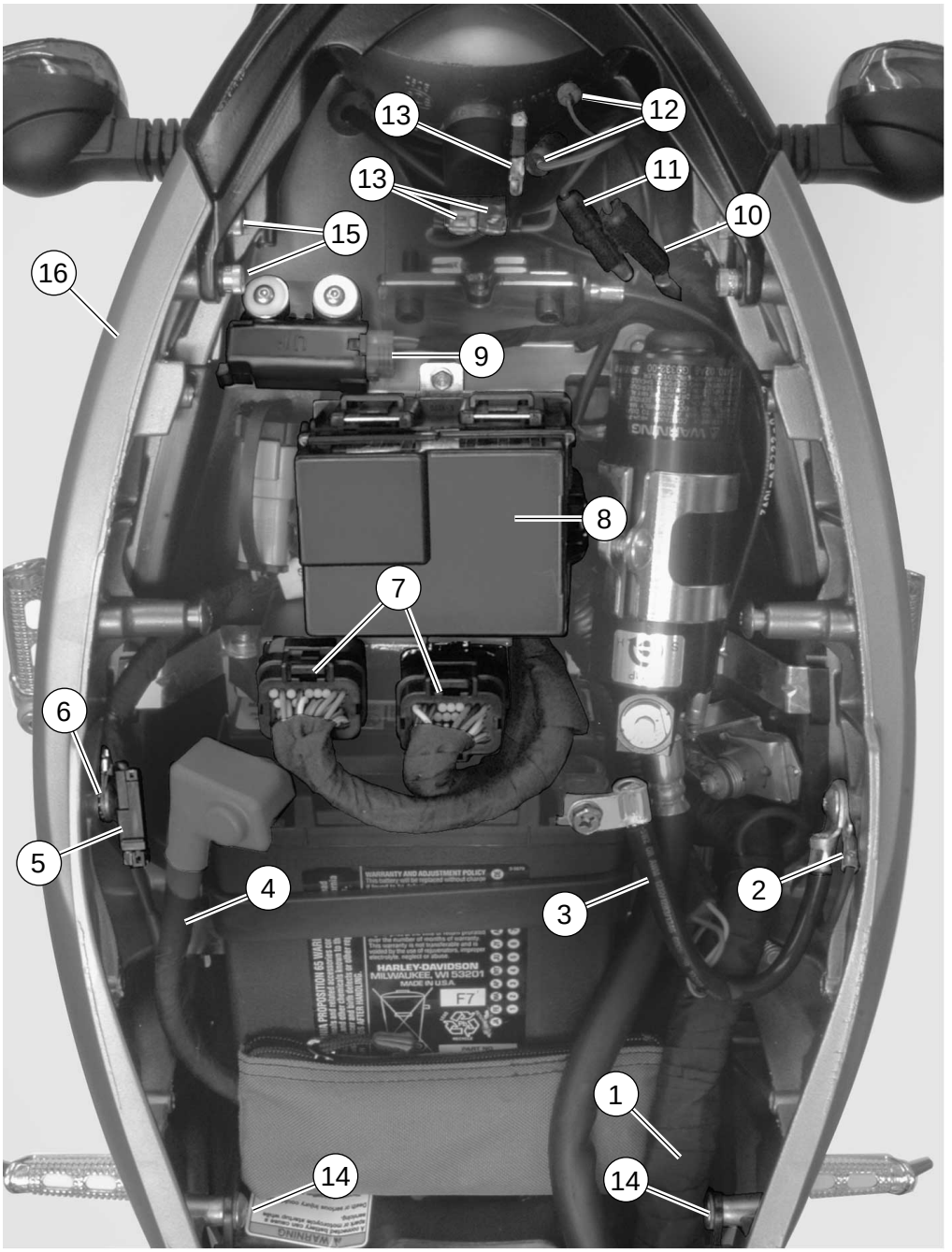


1. Main harness
2. Main harness ground (high voltage ground wire)
3. Battery negative cable
4. Battery positive cable
5. Rear brake light switch connector [121]
6. Ground terminals [GRD1] and [GRD3]
7. ECM connectors [10] and [11]
8. Fuse block and relay center
9. Bank angle sensor (BAS) connector [134]
10. Right turn signal connector [18]
11. Left turn signal connector [19] (under remote
12. License plate lamp connector [45]
13. Tail light connectors [93]
14. Left and right trunk pan fasteners
15. Center tail section fastener to rear tail section
16. Right tail section

Figure 2-169. Main Harness and Electrical Connectors Under Seat: Lightning

CLEANING

NOTE

Do not use wheel care products or other compounds developed specifically for cleaning and polishing powdercoat. These cleaners could potentially damage the tail section finish.

The cast aluminum tail section has a powder coat. Because the surface is not bare polished aluminum, it must be cleaned using only mild soap and warm water. After washing, always dry the surface using a clean, soft cloth.

ASSEMBLY

NOTE

See Figure 2-170. There are two threaded plastic lugs (14) on the trunk pan that are used for manufacturing purposes only.

1. Install trunk pan assembly (11) from left side of vehicle.
2. Install fastener (8) securing right front trunk pan to right side tail section and tighten to 12-36 **in-lbs** (1.4-4 Nm).
3. Install right side passenger footrest support assembly. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
4. Install two fasteners (12) securing trunk pan to center tail section and leave loose.
5. Install left tail section (5) onto vehicle.
   a. Install fastener (8) attaching left front trunk pan to left side tail section and tighten to 72-96 **in-lbs** (8-11 Nm).
   b. Apply LOCTITE 271 (red) and install fasteners (4) attaching left rear tail section to center tail section and tighten to 102-114 **in-lbs** (11.5-12.8 Nm).
   c. Apply LOCTITE 271 (red) and install fasteners (1) attaching left tail section to main frame/fuel tank assembly and tighten to 21-23 ft-lbs (28.5-31.2 Nm).
   d. Apply LOCTITE 271 (red) and install fasteners securing battery tray to side castings and tighten to 48-72 **in-lbs** (5.4-8 Nm).
6. Tighten fasteners (12) securing trunk pan to center tail section to 48-72 **in-lbs** (5.4-8 Nm).
7. Install left side passenger footrest support assembly. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
8. Move rear main harness and shock absorber reservoir back to left side of vehicle.

⚠WARNING

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

9. See Figure 2-169. Connect:
   a. Wire harness ground (2) [GRD 2].
   b. Rear brake light switch connector (5) [121].
   c. ECM connectors (7) [10, 11] and [164] (on XB12 models).
   d. BAS (bank angle sensor) connector (9) [134].
   e. Right turn signal connector (11) [18].
   f. Left turn signal connector (10) [19].
   g. License plate lamp connector (12) [45]
   h. Tail light connectors (13) [93].
   i. Ground terminals on right side tail section (6) [GRD 1] & [GRD 3].
10. Attach cable strap loosely securing the BAS harness to the seat latch cable.
11. Install the rear shock absorber reservoir into bracket and tighten fastener. See 2.23 REAR SHOCK ABSORBER.

⚠WARNING

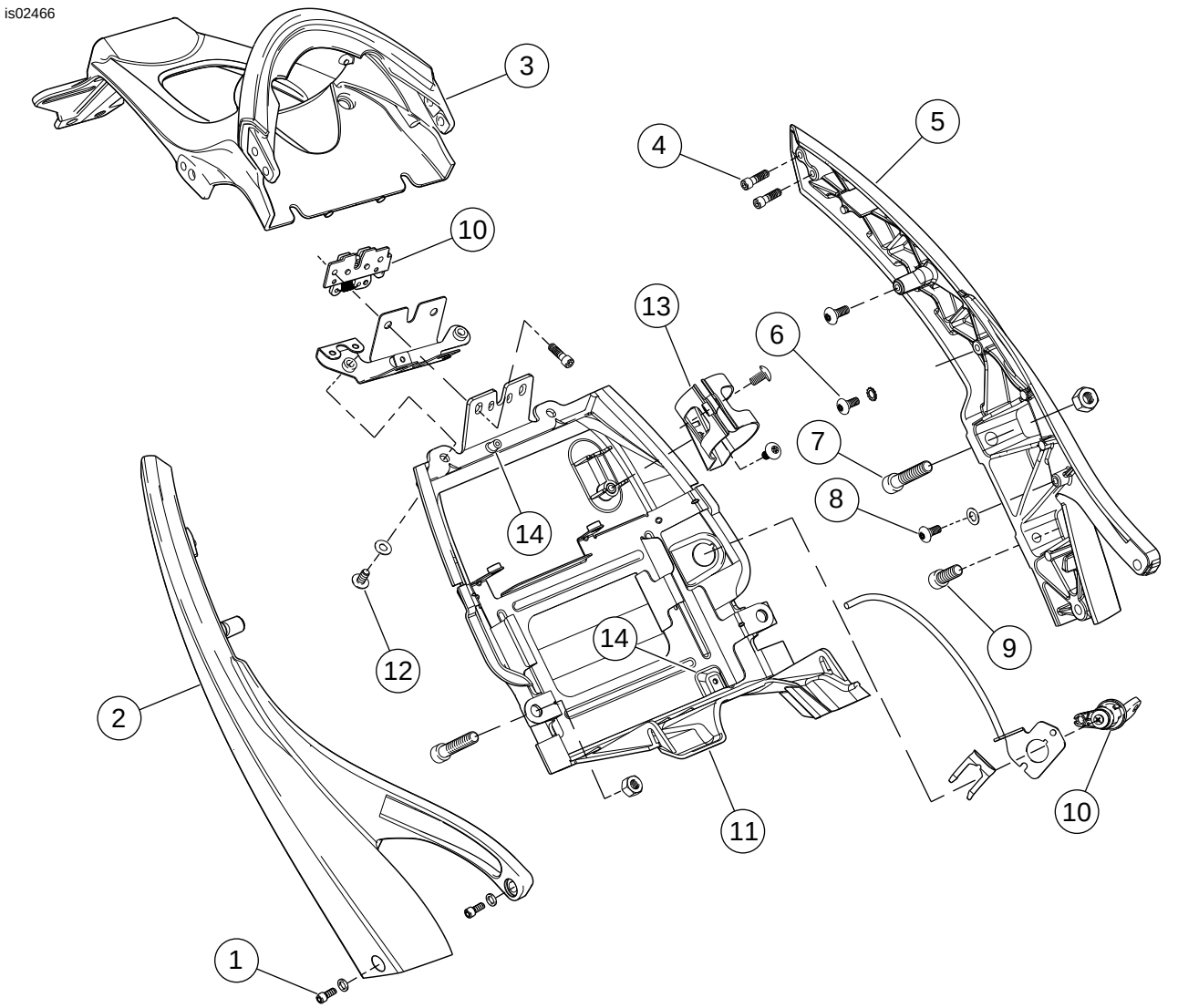
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

12. Install and connect battery. See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

13. Install seat.



1. **Left and right tail section fastener to main frame/fuel tank assembly (4)**
2. **Right tail section**
3. **Center tail section**
4. **Center tail section fastener to rear tail section (4)**
5. **Left tail section**
6. **Ground terminal fastener (2)**
7. **Passenger footrest support fastener with jam nut (2)**
8. **Front trunk pan fastener to side tail section (2)**
9. **Passenger footrest support fastener (no jam nut) (2)**
10. **Seat latch assembly**
11. **Trunk pan assembly**
12. **Rear trunk pan fastener to center tail section (2)**
13. **Rear shock reservoir bracket**
14. **Plastic lugs (for manufacturing purposes only)**

Figure 2-170. Tail Frame and Trunk Pan Assembly: Lightning

CENTER TAIL SECTION: LIGHTNING 2.41

DISASSEMBLY

1. Remove seat.

⚠WARNING

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

2. See Figure 2-169. Disconnect battery cables from battery: negative cable (black) first.
3. Disconnect:
   a. Right turn signal connector [18].
   b. Left turn signal connector [19].
   c. License plate lamp connector [45].
   d. Tail light connectors [93].
4. See Figure 2-170. Remove two fasteners (12) securing trunk pan to center tail section.
5. Remove fasteners (4) securing left and right tail sections to center tail section.
6. Remove center tail section from vehicle.

NOTE

To further disassemble center tail section see the following:

- *6.19 TAIL LAMP*
- *6.20 LICENSE PLATE LAMP ASSEMBLY*
- *6.15 FRONT TURN SIGNALS*

ASSEMBLY

1. See Figure 2-170. Install center tail section (3) between left and right tail sections (2, 5).
2. Install fasteners (4) securing left and right tail sections to center tail section but do not tighten.
3. Install two fasteners (12) securing trunk pan to center tail section but do not tighten.
4. Apply LOCTITE 271 (red) to threads of left and right rear tail sections fasteners (4) and tighten to 102-114 **in-lbs** (11.5-12.8 Nm).
5. Tighten fasteners (12) securing trunk pan to center tail section to 48-72 **in-lbs** (5.4-8 Nm).

⚠WARNING

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

6. See Figure 2-169. Connect:
   a. Right turn signal connector [18].
   b. Left turn signal connector [19].
   c. License plate lamp connector [45].
   d. Tail light connectors [93].

⚠WARNING

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

7. Install and connect battery. See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

8. Install seat.

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RIGHT TAIL SECTION: LIGHTNING 2.42

DISASSEMBLY

1. Remove seat.

⚠WARNING

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

2. See Figure 2-169. Disconnect battery cables from battery: negative cable (black) first.
3. Remove battery.
4. Disconnect:
   a. Right side ground terminals (3) [GRD1] & [GRD 3].
   b. Rear brake light switch connector (4) [121].
5. Remove right side passenger footrest assembly. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.
6. Remove master cylinder remote reservoir. See 2.12 REAR BRAKE MASTER CYLINDER.
7. See Figure 2-169. Remove right front trunk pan fastener (1).
8. Remove fastener securing battery tray to right side tail section (XB12Ss models only).
9. Remove fasteners securing center tail section to right tail section.
10. See Figure 2-170. Remove fasteners (1) securing right tail section to main frame/fuel tank assembly.
11. Remove right tail section.

ASSEMBLY

1. See Figure 2-169. Install right tail section (16) onto vehicle.
   a. Install fastener (14) attaching right front trunk pan to right side tail section and tighten to 12-36 **in-lbs** (1.4-4 Nm).
   b. On XB12Ss models, apply LOCTITE 271 (red) and install battery tray fasteners and tighten to 48-72 **in-lbs** (5.4-8 Nm).
   c. Apply LOCTITE 271 (red) and install center tail section fastener to rear tail section (15).Tighten to 102-114 **in-lbs** (11.5-12.8 Nm).
   d. Apply LOCTITE 271 (red) and install fasteners attaching left and right tail sections to main frame/fuel tank assembly and tighten to 21-23 ft-lbs (28.5-31.2 Nm).
2. Install master cylinder remote reservoir. See 2.12 REAR BRAKE MASTER CYLINDER.
3. Install right side passenger footrest support assembly. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.

⚠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)

4. Connect:
   a. Right side ground terminals (6) [GRD1] and [GRD 3].
   b. Rear brake light switch connector (5) [121].

⚠WARNING

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

5. Install and connect battery. See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

6. Install seat.

LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS 2.43

DISASSEMBLY

1. Remove seat.

⚠WARNING

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

2. See Figure 2-171. Disconnect battery cables from battery: negative cable (black) first.
3. Remove battery.

NOTES

- *Before removing left tail section, it will be necessary to remove certain components of the luggage system. See 2.54 LUGGAGE: XB12XT.*
- *The center tail loop must be removed before removing the left or right tail sections. See 2.44 CENTER TAIL LOOP: ULYSSES MODELS.*

4. Remove center tail loop. See 2.44 CENTER TAIL LOOP: ULYSSES MODELS.
5. See Figure 2-171. Disconnect ECM connectors (4) [10], [11] and [164].
6. Remove battery pan.
   a. Remove ECM (3).

NOTE

When removing the ECM, the fastener closest to the shock assembly has a nut that is captured in the plastic shield below the ECM. You need to place your finger under the nut when removing the fastener to prevent the nut from falling out. Slide the ECM to one side and loosely install the fastener to retain the nut in the correct location. The rear fastener attaches directly to the battery pan.

   b. Disconnect rear brake light switch connector [121].
   c. Disconnect and remove Bank Angle Sensor (2) [134].
   d. Remove fuse block and relay center (5).
   e. Remove main harness and plastic grommet (7) from battery pan.
   f. Remove fasteners securing battery tray to left and right tail sections.
   g. Lift battery pan straight up and out.
7. Remove fastener securing left front trunk pan to left side tail section.
8. Remove fasteners securing left tail section to main frame/fuel tank assembly.
9. Remove left tail section.
10. Remove the trunk pan.
    a. See Figure 2-171. Remove the two fasteners securing the preload adjuster to the trunk pan (13).
    b. Remove the shock reservoir fastener and retainer. Push the reservoir aside to access the fastener.
    c. Remove remaining fasteners securing right front trunk pan to right side tail sections.
    d. Remove remaining components on trunk pan as needed.

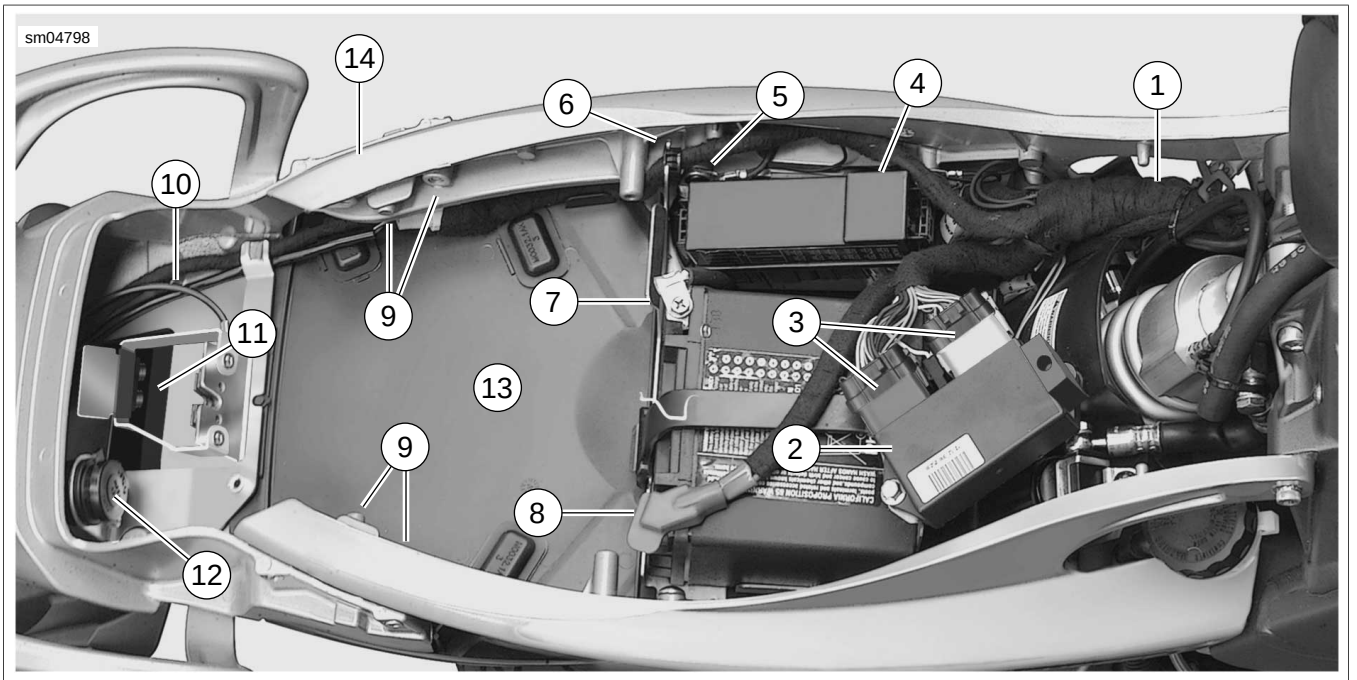
CLEANING

NOTE

Do not use wheel care products or other compounds developed specifically for cleaning and polishing powdercoat. These cleaners could potentially damage the tail section finish.

The cast aluminum tail section has a powder coat. Because the surface is not bare polished aluminum, it must be cleaned using only mild soap and warm water. After washing, always dry the surface using a clean, soft cloth.

BIG TWIN TECHNICIAN HARLEY-DAVIDSON



1. **Main harness**
2. **Electronic control module**
3. **ECM connectors [10] and [11]**
4. **Fuse block and relay center**
5. **Main harness ground wire [GRD2]**
6. **Main harness with plastic grommet**
7. **Battery ground cable**
8. **Battery positive cable**
9. **Left rear and right rear tail section fasteners (4)**
10. **Seat lock cable**
11. **Bank angle sensor (BAS) connector [134]**
12. **Auxiliary power outlet**
13. **Trunk pan**
14. **Left tail section**

Figure 2-171. Main Harness and Electrical Components Under Seat: Ulysses

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ASSEMBLY

1. See Figure 2-171. Install trunk pan assembly (13) from left side of vehicle.
2. Install fastener securing right front trunk pan to right side tail section and tighten to 12-36 **in-lbs** (1.4-4 Nm).
3. Install shock reservoir, retainer and fastener. Tighten fastener to 80-88 **in-lbs** (9.0-9.9 Nm).
4. Install left tail section (14) onto vehicle.
   a. Apply LOCTITE 271 (red) and install fasteners attaching left tail section to main frame/fuel tank assembly and tighten to 21-23 ft-lbs (28.5-31.2 Nm).
   b. Install fastener attaching left front trunk pan to left side tail section and tighten to 12-36 **in-lbs** (1.4-4 Nm).
5. Install two fasteners securing the preload adjuster to the trunk pan and tighten to 36-60 **in-lbs** (4-7 Nm).
6. Install battery pan:
   a. Install fasteners securing battery tray to left and right tail sections and tighten to 72-96 **in-lbs** (8-11 Nm).
   b. Install fuse block and relay center (5).
   c. Install main harness and plastic grommet (7) into battery pan.
   d. Install bank angle sensor (2), connect and tighten fastener to 12-36 **in-lbs** (1.4-4 Nm).
   e. Connect rear brake light switch connector [121].
   f. Install ECM and tighten fasteners to 36-60 **in-lbs** (4-7 Nm).
7. See Figure 2-171. Connect ECM connectors (4) [10], [11] and [164].
8. Install center tail loop. See 2.44 CENTER TAIL LOOP: ULYSSES MODELS.

⚠WARNING

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

9. Install battery. See 1.5 BATTERY MAINTENANCE.

WARNING

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

10. Install seat.

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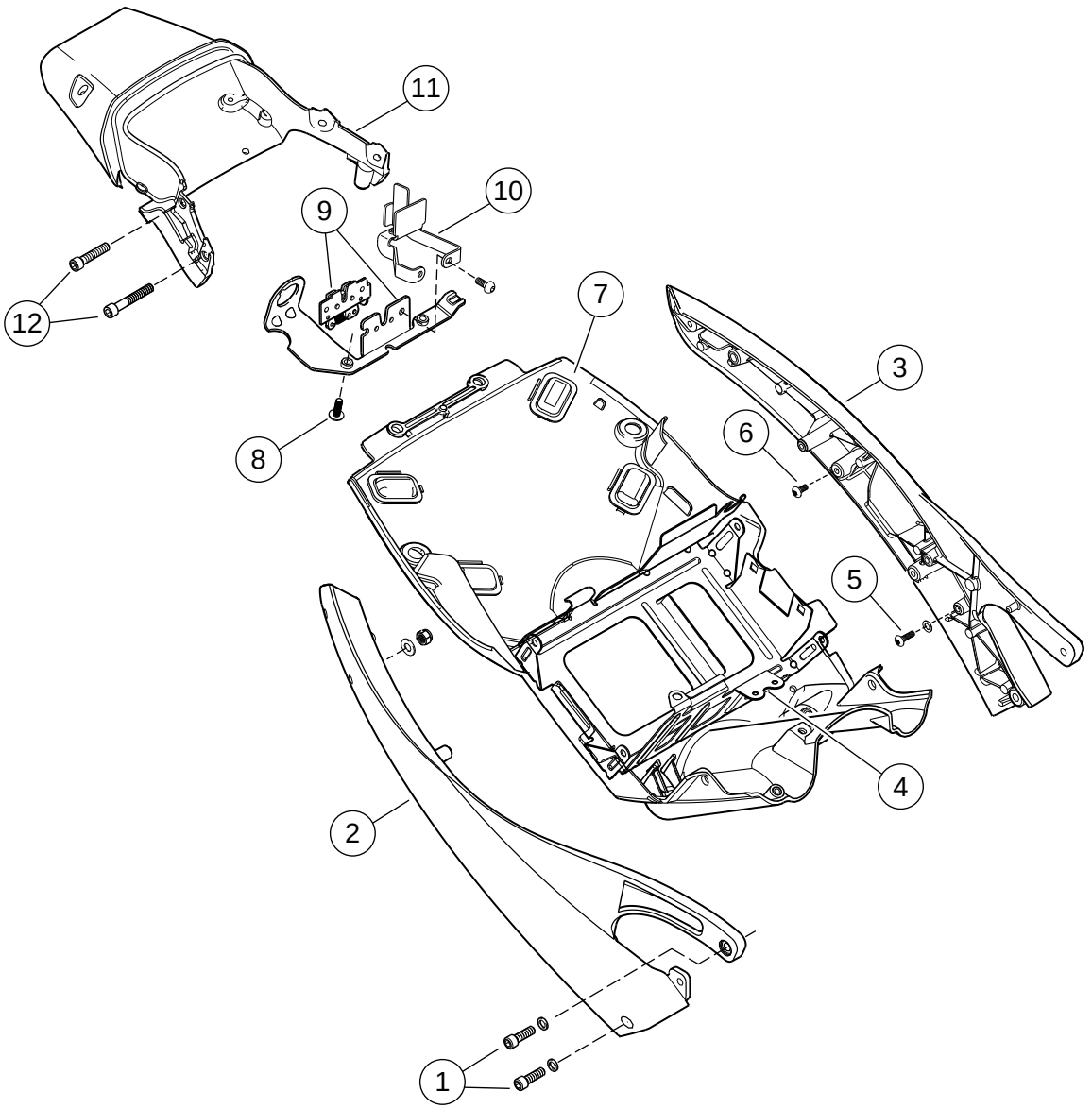


1. **Fastener, washer and nut to main frame/fuel tank assembly (4)**
2. **Right tail section**
3. **Left tail section**
4. **Battery pan**
5. **Front trunk pan fastener to side tail section (2)**
6. **Ground terminal fastener (2)**
7. **Trunk pan assembly**
8. **Rear trunk pan fastener to center tail loop (2)**
9. **Seat latch assembly**
10. **Bank angle sensor bracket**
11. **Center tail loop**
12. **Center tail loop fastener to rear tail section (4)**

Figure 2-172. Tail Frame and Trunk Pan Assembly: Ulysses

CENTER TAIL LOOP: ULYSSES MODELS 2.44

DISASSEMBLY

1. Remove seat.

⚠WARNING

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

2. Disconnect battery cables from battery: negative cable (black) first.

NOTE

Before removing center tail loop, it will be necessary to remove certain components of the luggage system. See 2.54 LUGGAGE: XB12XT.

3. See Figure 2-173. Remove two fasteners securing trunk pan to center tail loop (1).
4. Remove cable strap from wire harness and seat latch cable.
5. Remove wire cover (3) on bottom side of license plate bracket (2) in order to access wires.
6. Disconnect:
   a. Right turn signal connector [18].
   b. Left turn signal connector [19].
   c. License plate lamp connector [45].
   d. Tail light connectors [93].
   e. Auxiliary power outlet [180].
7. Remove rear trunk pan fasteners to center tail loop (10).
8. Remove fasteners securing left and right tail sections to center tail loop.
9. Remove center tail loop from vehicle.

NOTE

To further disassemble center tail loop see the following:

- *6.19 TAIL LAMP*
- *6.20 LICENSE PLATE LAMP ASSEMBLY*
- *6.15 FRONT TURN SIGNALS*
- *2.53 TRIPLE TAIL: ULYSSES*
- *4.9 BANK ANGLE SENSOR (BAS)*

ASSEMBLY

1. Install center tail loop around left and right tail sections.
2. Install fasteners securing left and right tail sections to center tail loop but do not tighten.
3. Install two fasteners securing trunk pan to center tail loop but do not tighten.
4. Route wire harness and auxiliary power outlet under seat latch bracket.
5. Tighten nuts of left and right tail sections to 20-22 ft-lbs (27-30 Nm). Repeat to verify torque.
6. Connect:
   a. Right turn signal connector [18].
   b. Left turn signal connector [19].
   c. License plate lamp connector [45].
   d. Tail light connectors [93].
   e. Auxiliary power outlet [180].
7. Install cable strap.
8. Install wire cover (3) on bottom side of tail loop (1) and license plate bracket (2).
9. Tighten fasteners.
   a. Wire cover screws to 36-48 **in-lbs** (4-5.4 Nm).
   b. Install license plate light fasteners and to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

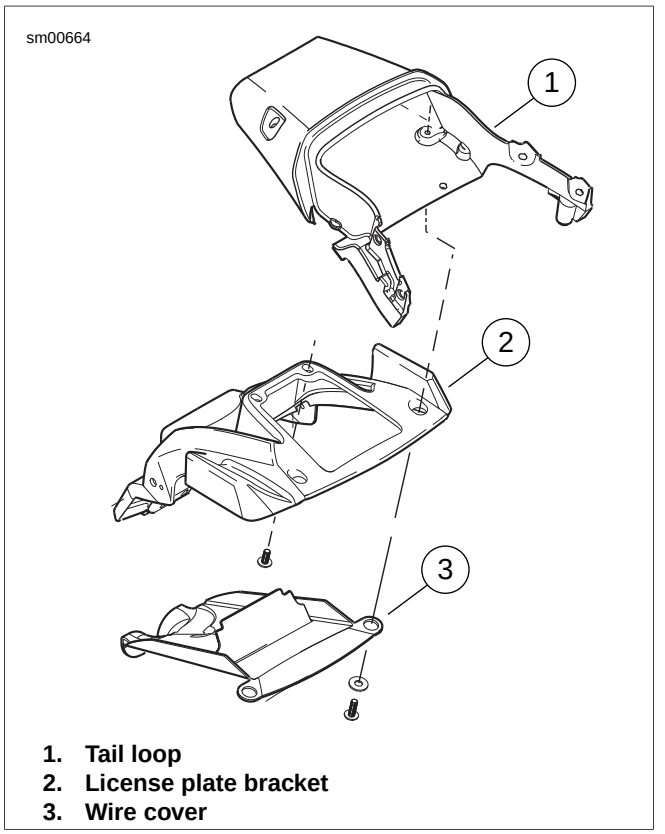
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

10. Connect battery cables to battery: Positive cable (red) first. Tighten to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

11. Install seat.



1. **Tail loop**
2. **License plate bracket**
3. **Wire cover**

Figure 2-173. Wire Cover, Tail Loop and License Plate Bracket: Ulysses

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

RIGHT TAIL SECTION: ULYSSES MODELS 2.45

DISASSEMBLY

1. Remove seat.

NOTES

- *Before removing right tail section, it will be necessary to remove certain components of the luggage system. See LUGGAGE: XB12XT.*
- *The center tail loop must be removed before removing the left or right tail sections. See 2.44 CENTER TAIL LOOP: ULYSSES MODELS.*

⚠WARNING

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

2. See 1.5 BATTERY MAINTENANCE. Disconnect battery cables from battery: negative cable (black) first.
3. Remove battery.

NOTE

See Figure 2-174. When removing the ECM, the fastener closest to the shock assembly has a nut that is captured in the plastic shield below the ECM. You need to place your finger under the nut when removing the fastener to prevent the nut from falling out. Slide the ECM to one side and loosely install the fastener to retain the nut in the correct location. The rear fastener attaches directly to the battery pan.

4. Remove ECM.
5. Remove rear shock reservoir fastener and retainer.
6. Disconnect the rear brake light switch.
7. Move the rear shock reservoir out of the way in order to access right tail section fastener.
8. Remove the rear brake master cylinder reservoir. See 2.12 REAR BRAKE MASTER CYLINDER.
9. See Figure 2-175. Remove the three fasteners on the inside of the right tail section.
10. See Figure 2-176. Remove the final two fasteners on the outside of the right tail section and remove the right side tail section.

Figure 2-174. ECM Fastener with Captured Nut

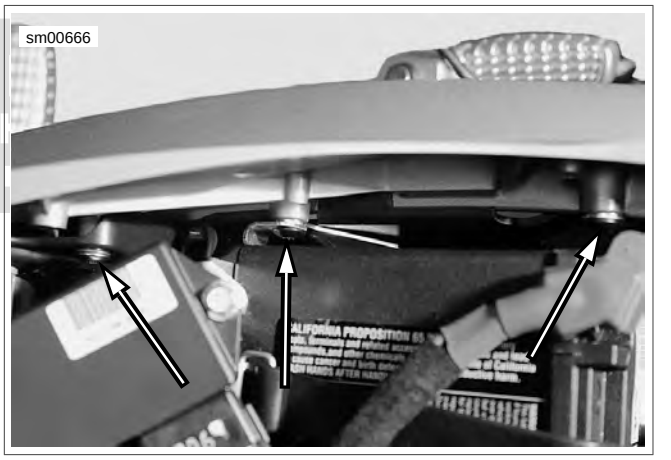


Figure 2-175. Internal Fasteners/Right Side Tail Section

Figure 2-176. Front Outside Fasteners Right Side Tail Section

ASSEMBLY

1. See Figure 2-172. Install right tail section (2) onto vehicle.
   a. Install fastener (1) attaching right front trunk pan to right side tail section and tighten to 12-36 **in-lbs** (1.4-4 Nm).
   b. Install fasteners (5) attaching right rear tail section to center tail loop and tighten to 20-22 ft-lbs (27-30 Nm).
   c. Apply LOCTITE 271 (red) and install fasteners attaching right tail section to main frame/fuel tank assembly and tighten to 21-23 ft-lbs (28.5-31.2 Nm).
   d. Install seat latch assembly and tighten to 60-96 **in-lbs** (7-11 Nm).
   e. Install battery tray and ground wire fasteners and tighten to 72-96 **in-lbs** (8-11 Nm).
2. Install master cylinder remote reservoir. See 2.12 REAR BRAKE MASTER CYLINDER.
3. Install shock reservoir, retainer, and fastener. Tighten to 80-88 **in-lbs** (9.0-9.9 Nm).
4. Connect rear brake light switch connector [121].

⚠WARNING

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

5. Install ECM and tighten fasteners to 36-60 **in-lbs** (4-7 Nm).

⚠WARNING

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

6. Install and connect battery. See 1.5 BATTERY MAINTENANCE.
7. Install air flow guides.

⚠WARNING

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

8. Install seat.

TECHNICIAN II HARLEY-DAVIDSON

SIDESTAND 2.46

GENERAL

⚠WARNING

This motorcycle does NOT have a locking sidestand. Park the motorcycle on a level, firm surface. An unbalanced motorcycle can fall, which could result in death or serious injury. (00122a)

The sidestand is located on the left side of the motorcycle. The sidestand swings outward to support the motorcycle for parking.

REMOVAL

1. Remove muffler. See 4.18 EXHAUST SYSTEM, Removal and Disassembly.
2. See Figure 2-179 or Figure 2-179. Remove fasteners (6) securing sidestand bracket (5) to engine.
3. Remove sidestand assembly.

DISASSEMBLY

PART NUMBER	TOOL NAME
HE-52B	SNAP-ON SPRING TOOL

NOTE

Sidestand assembly does not have to be removed from motorcycle in order to remove sidestand leg.

1. Remove two fasteners from the left side of chin fairing. See 2.50 CHIN FAIRING.
2. See Figure 2-178 or Figure 2-179. Remove sidestand leg.
3. Retract sidestand leg (9).
4. Remove sidestand spring (1) and spring extension plate (3) using SNAP-ON SPRING TOOL (Part No. HE-52B).
5. Remove sidestand pivot pin circlip (7) and remove sidestand pivot pin (2).
6. Extend sidestand leg (9) and remove.

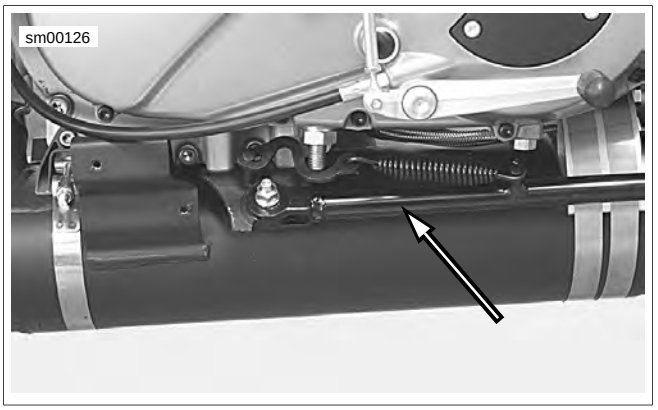
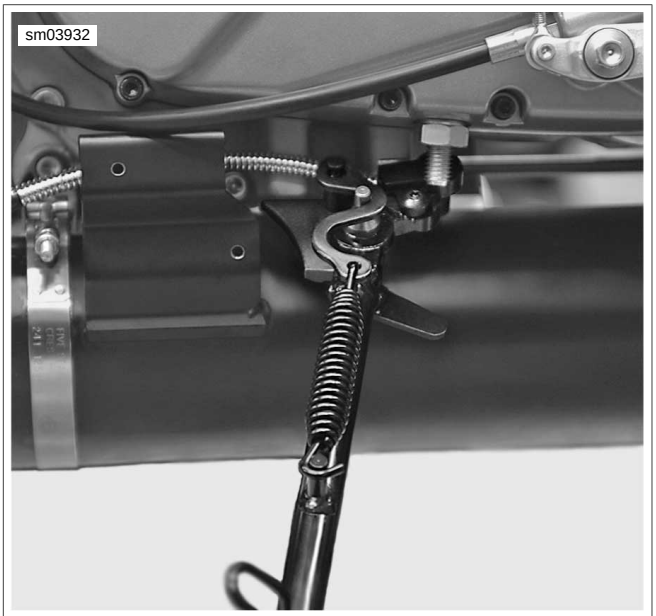
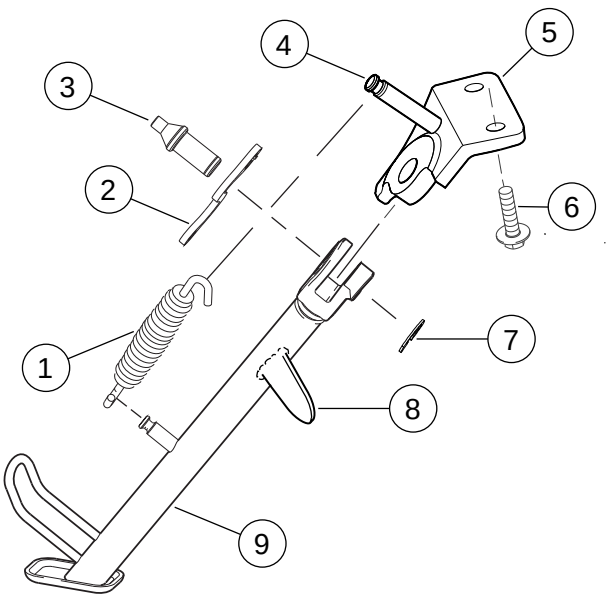


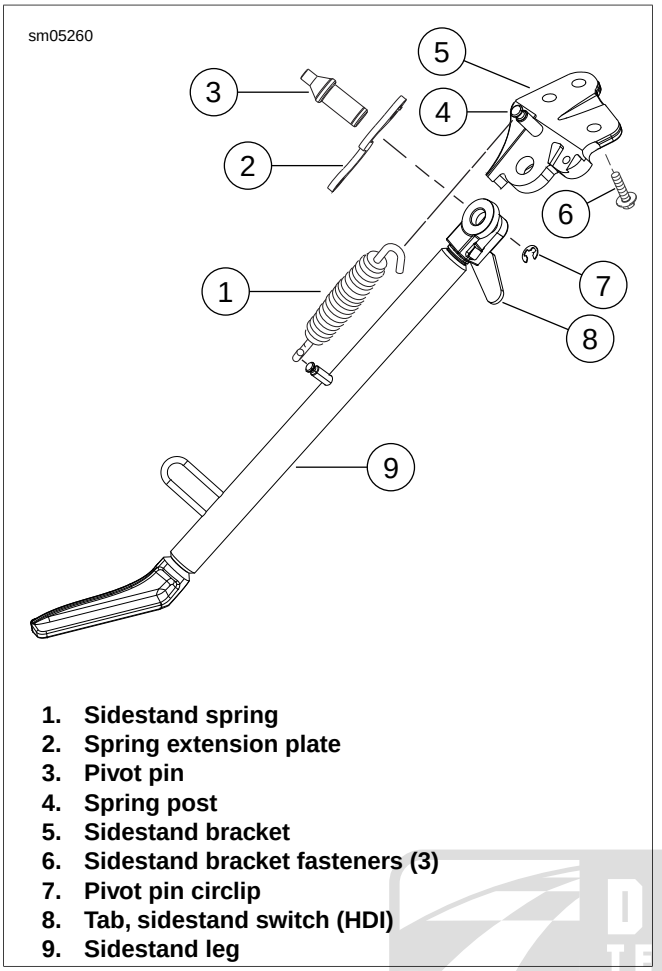
Figure 2-177. Sidestand (Retracted)





1. **Sidestand spring**
2. **Spring extension plate**
3. **Pivot pin**
4. **Spring post**
5. **Sidestand bracket**
6. **Sidestand bracket fasteners (2)**
7. **Pivot pin circlip**
8. **Tab, sidestand switch (HDI)**
9. **Sidestand leg**

Figure 2-178. Sidestand Assembly (Extended)



1. **Sidestand spring**
2. **Spring extension plate**
3. **Pivot pin**
4. **Spring post**
5. **Sidestand bracket**
6. **Sidestand bracket fasteners (3)**
7. **Pivot pin circlip**
8. **Tab, sidestand switch (HDI)**
9. **Sidestand leg**

Figure 2-179. Sidestand Assembly: Ulysses Models

ASSEMBLY

PART NUMBER	TOOL NAME
HE-52B	SNAP-ON SPRING TOOL

1. See Figure 2-179. Install sidestand leg (9).
2. Lubricate sidestand pivot pin and mating portions on sidestand bracket with WHEEL BEARING GREASE (Part No. 99855-89) as shown in Figure 2-180.
3. See Figure 2-179. Install sidestand leg (9) to bracket (5) by installing the pivot pin (3) and pivot pin circlip (7).
4. Retract sidestand leg (9).
5. Install spring extension plate (2) and sidestand spring (1) using SNAP-ON SPRING TOOL (Part No. HE-52B).
6. Extension plate should curve away from primary chain adjustment screw to allow for clearance around adjustment screw.

INSTALLATION

1. See Figure 2-179. Apply LOCTITE 271 (red) to the sidestand bracket fasteners (6). Loosely install the sidestand assembly to the crankcase with the sidestand bracket fasteners (6). Extend the sidestand leg (9) and hold forward in the fully extended position while tightening the sidestand bracket fasteners in the following sequence:
   a. Tighten the front fastener(s) to 25-27 ft-lbs (34-37 Nm).
   b. Tighten the rear fastener to 25-27 ft-lbs (34-37 Nm).
2. Repeat the tightening sequence in the previous step to verify proper clamp load.
3. Install muffler. See 4.18 EXHAUST SYSTEM, Assembly and Installation.
4. Install chin fairing fasteners. See 2.50 CHIN FAIRING.
5. Extend and retract sidestand leg to check for proper operation.

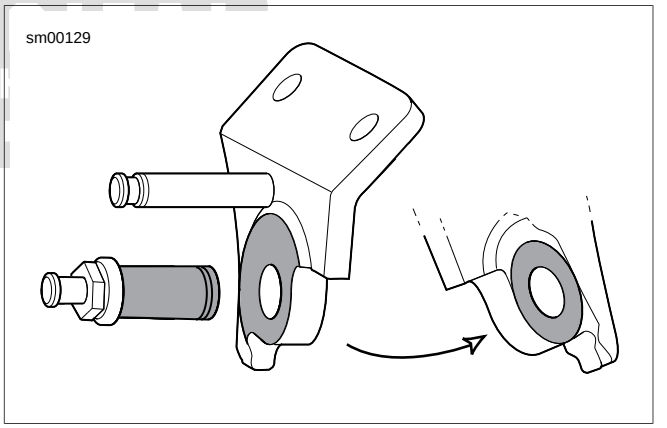


Figure 2-180. Sidestand Assembly Lubrication (Shaded Areas) (Typical)

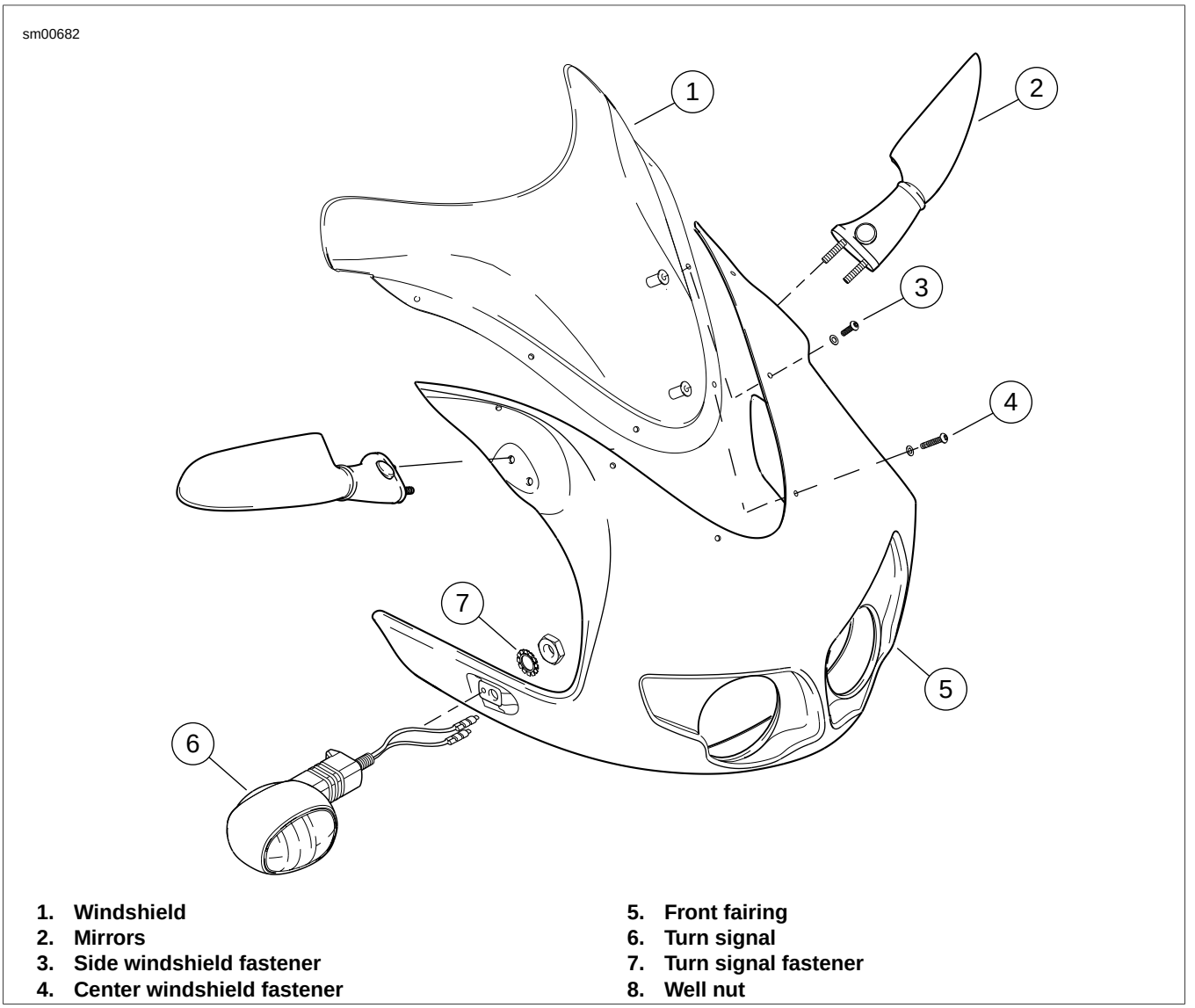
FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT 2.47

REMOVAL

1. See Figure 2-181. Remove two center (4) and four side windscreen fasteners (3) to remove windshield (1).
2. Remove mirrors (2).
3. Remove turn signals (6). See 6.15 FRONT TURN SIGNALS and remove front fairing (5).

INSTALLATION

1. See Figure 2-181. Position fairing (5) onto fairing support bracket and install turn signals (6, 7). See 6.15 FRONT TURN SIGNALS.
2. Install mirrors (2) with fasteners and tighten to 72-96 **in-lbs** (8-11 Nm).
3. Install two center (4) and four side windscreen fasteners (3) and tighten to 10-12 **in-lbs** (1-1.4 Nm).



1. **Windshield**
2. **Mirrors**
3. **Side windshield fastener**
4. **Center windshield fastener**
5. **Front fairing**
6. **Turn signal**
7. **Turn signal fastener**
8. **Well nut**

Figure 2-181. Front Fairing and Windscreen: Firebolt

WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES 2.48

LIGHTNING

Removal

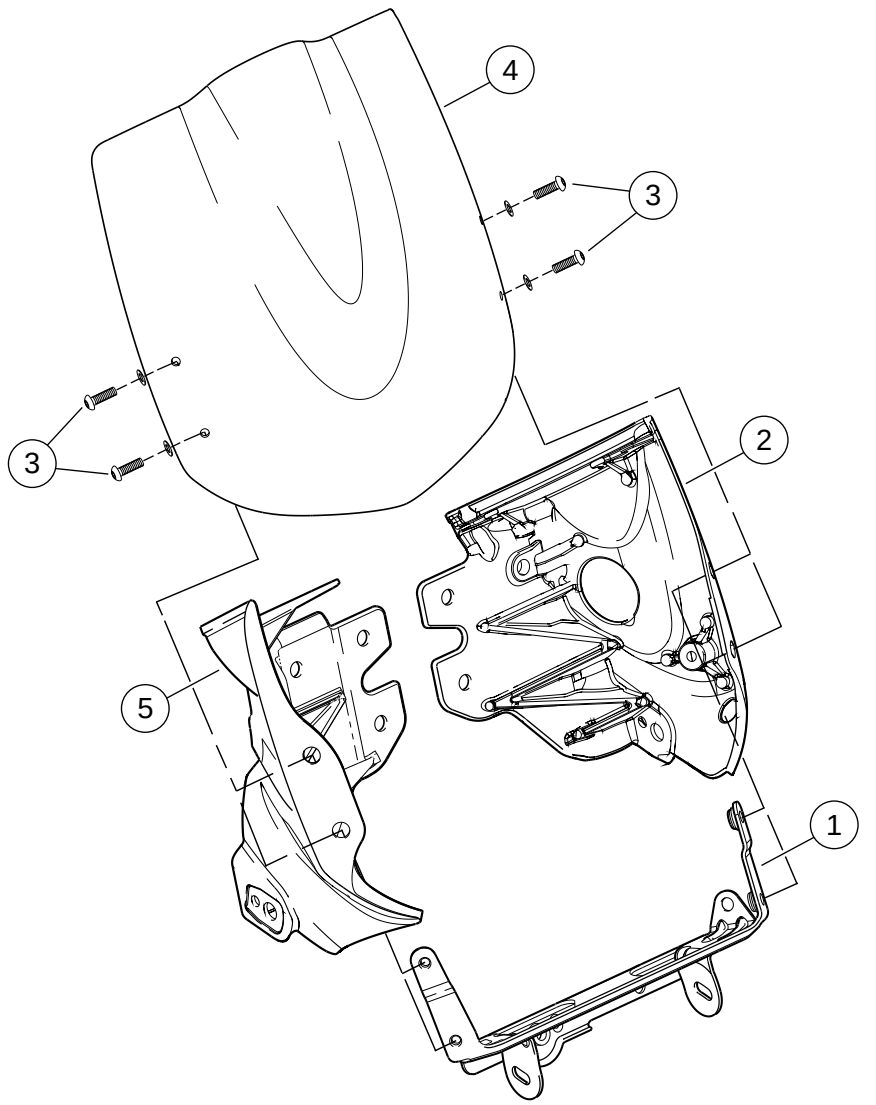
NOTE

See Figure 2-182. The windscreen fasteners (3) extend through the left and right front modules (2, 5) and thread into the headlight mounting bracket (1).

1. Remove four windscreen fasteners and washers (3).
2. Remove windscreen (4).

Installation

1. See Figure 2-182. Position windscreen (4) onto left and right front modules (2, 5).
2. Install four fasteners (3) and tighten to 10-12 **in-lbs** (1.1-1.4 Nm).



1. **Headlight mounting bracket**
2. **Left front module**
3. **Windscreen fastener and washer (4)**
4. **Windscreen**
5. **Right front module**

Figure 2-182. Front Windscreen: Lightning

ULYSSES XB12X

Removal

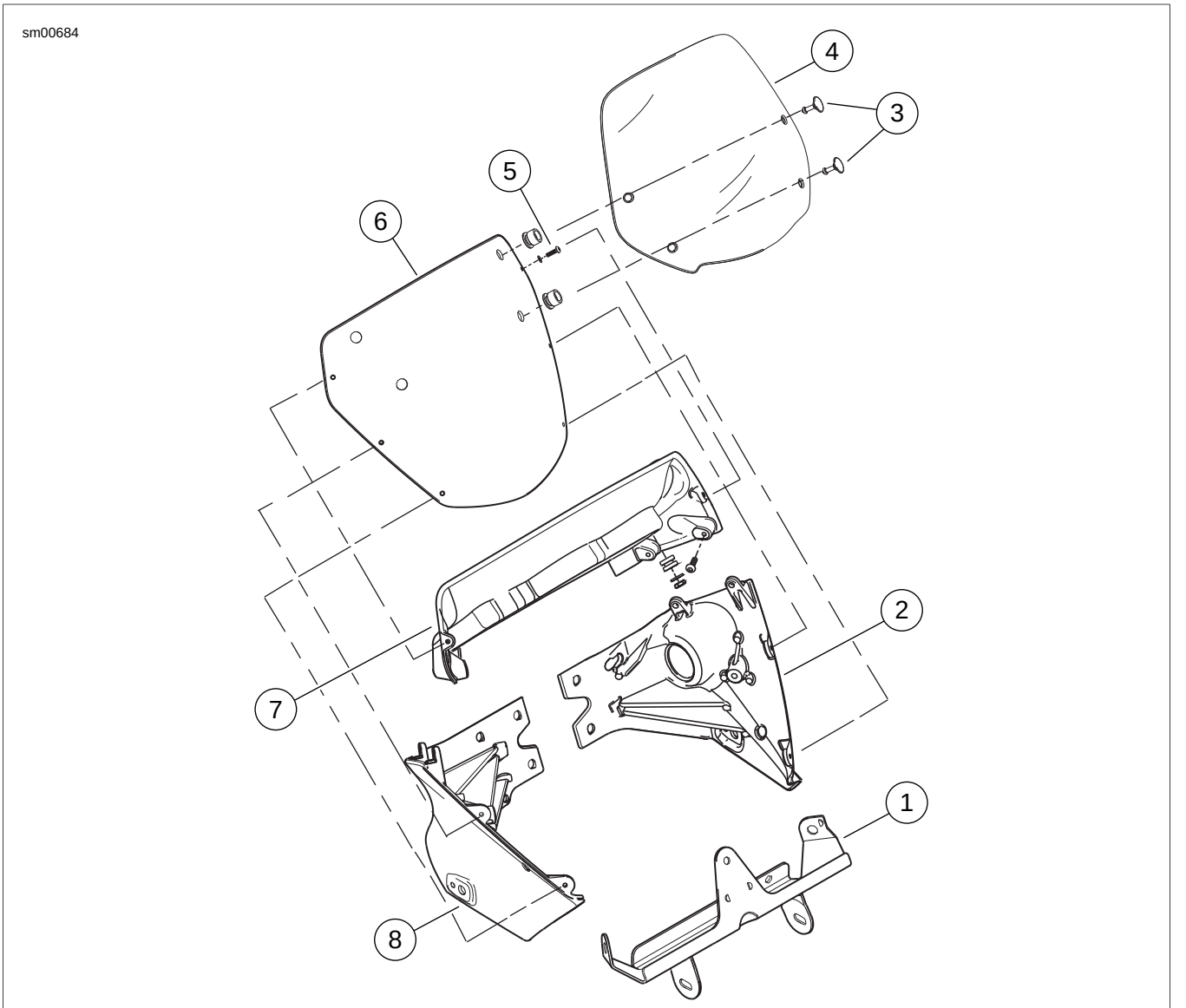
NOTES

- *The windshield releases from the windscreen by pulling outward and away from vehicle.*
- *See Figure 2-183. The windscreen fastens into the left and right front modules (2, 8) and the center fairing support (7).*

1. Remove windshield (4) by pulling loose from windscreen (6).
2. Remove six windscreen fasteners (5).
3. Remove windscreen (6).

Installation

1. See Figure 2-183. Position windscreen (6) onto left and right front modules (2, 8) and the center fairing support (7).
2. Install six fasteners and tighten to 10-12 **in-lbs** (1.1-1.4 Nm).
3. Install windshield (4) by pushing into place. Pull on windshield when installed to verify attachment.



1. **Headlight mounting bracket**
2. **Left front module**
3. **Windshield fastener (4)**
4. **Windshield**
5. **Windscreen fasteners (6)**
6. **Windscreen**
7. **Fairing support, center**
8. **Right front module**

Figure 2-183. Windshield and Windscreen: Ulysses XB12X

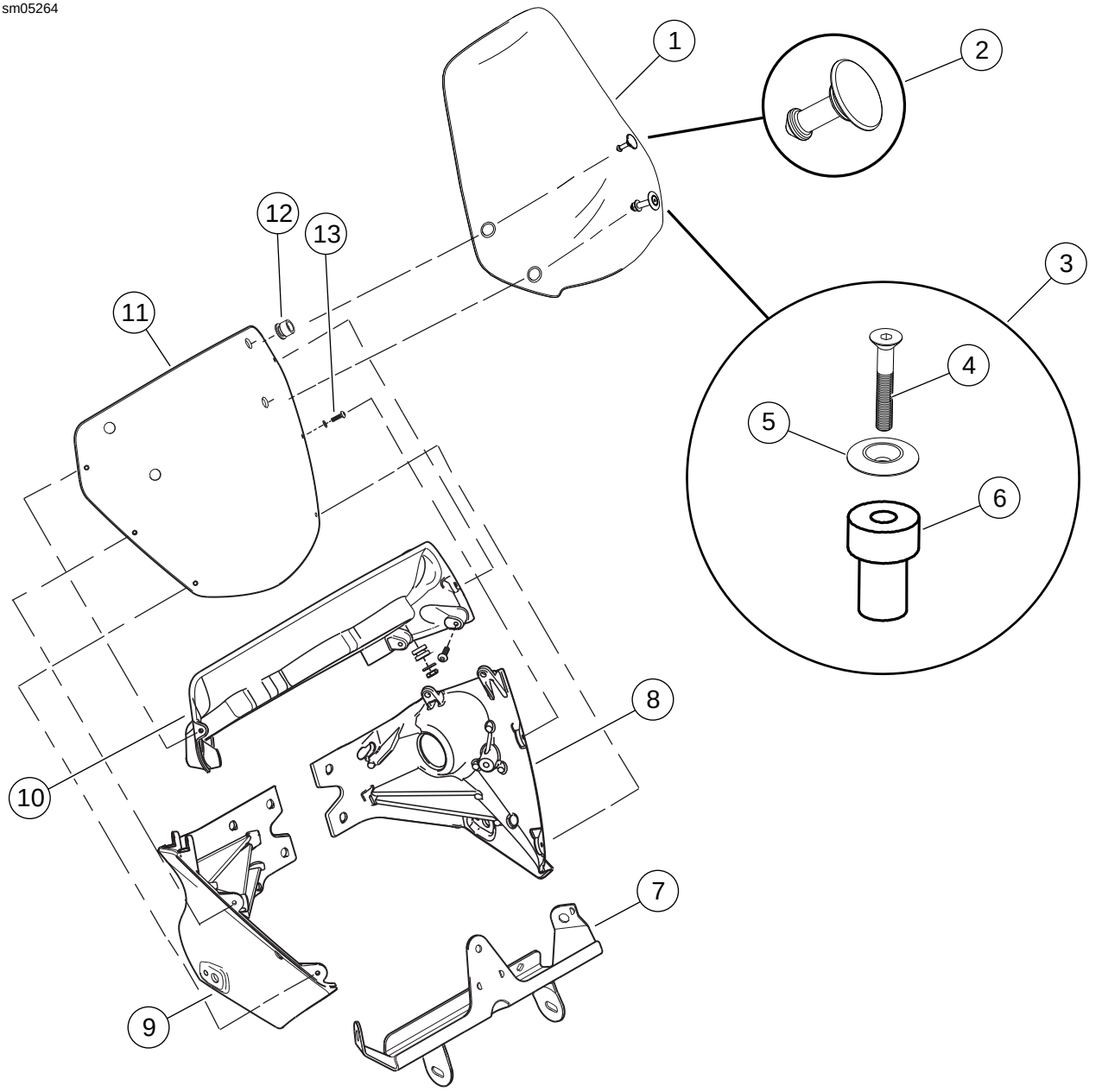
ULYSSES XB12XT/XB12XP

Removal

NOTES

- *See Figure 2-184. The windshield is secured to the windscreen using two screws (4) with well nuts (6) and two mounting pins (2).*
- *After removing the lower windshield mounting hardware it will be necessary to pull the windshield loose from the windscreen by pulling up sharply at the upper mounting pins.*

Remove windshield mounting hardware (3) securing the windshield to the windscreen and pull windshield from windscreen.



1. **Windshield**
2. **Windshield mounting pin, upper (2)**
3. **Windshield mounting hardware, lower (2)**
4. **Screw (2)**
5. **Washer (2)**
6. **Well nut (2)**
7. **Headlight mounting bracket**
8. **Left front module**
9. **Right front module**
10. **Fairing support, center**
11. **Windscreen**
12. **Mounting grommet (2)**
13. **Windscreen screws (6)**

Figure 2-184. Windshield and Windscreen: Ulysses XB12XT/XB12XP

Installation

1. See Figure 2-184. Install windshield onto windscreen by aligning the mounting pins (2) on the windshield with the mounting grommets (12) on the windscreen and pushing in place to install. Pull on windshield to verify attachment.
2. Insert well nuts (6) into the windshield and windscreen holes.
3. See Figure 2-185. Install mounting screws and tighten 8-10 revolutions into the well nuts.

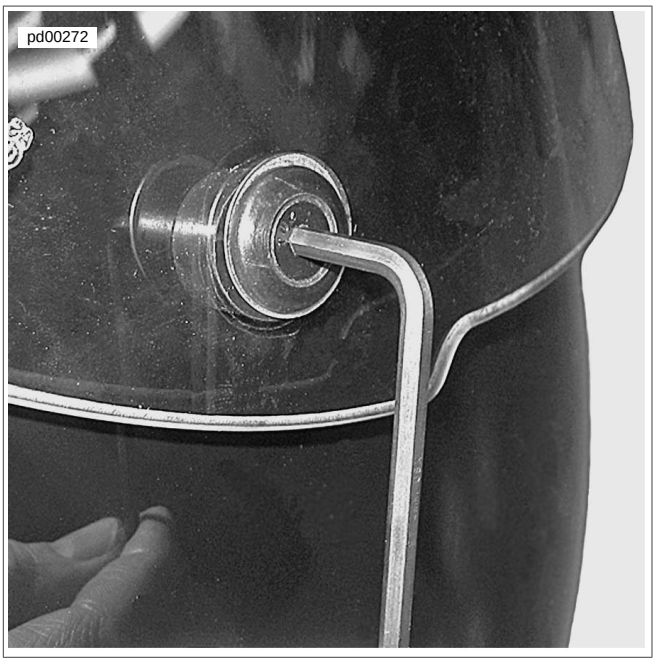


Figure 2-185. Turn Down 8-10 Turns

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AIR SCOOPS 2.49

RAM AIR SCOOP

Removal

NOTE

When removing and installing the left air scoop, the alternator and voltage regulator harnesses and connections are secured to the bottom of the air scoop with three cable straps.

1. See Figure 2-186. On left side of motorcycle, locate ram air scoop (4).
2. Remove three ram air scoop fasteners (3).
3. Remove ram air scoop (4).

Installation

NOTE

When installing the left side air scoop it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

1. See Figure 2-186. Position ram air scoop (4).
2. Install ram air scoop (4) with three fasteners (3). Tighten to 12-36 **in-lbs** (1.4-4 Nm).
3. Secure the voltage regulator and alternator wiring harnesses to the bottom of the left air scoop with three cable straps.

ENGINE SHROUD AIR SCOOP

Removal

1. See Figure 2-186. On right side of motorcycle, locate engine shroud air scoop (6).
2. Remove three engine shroud air scoop fasteners (5).
3. Remove engine shroud air scoop (6).

Installation

1. See Figure 2-186. Position engine shroud air scoop (6).
2. Install engine shroud air scoop (6) with three fasteners (5). Tighten to 12-36 **in-lbs** (1.4-4 Nm).

OIL COOLER AIR SCOOP

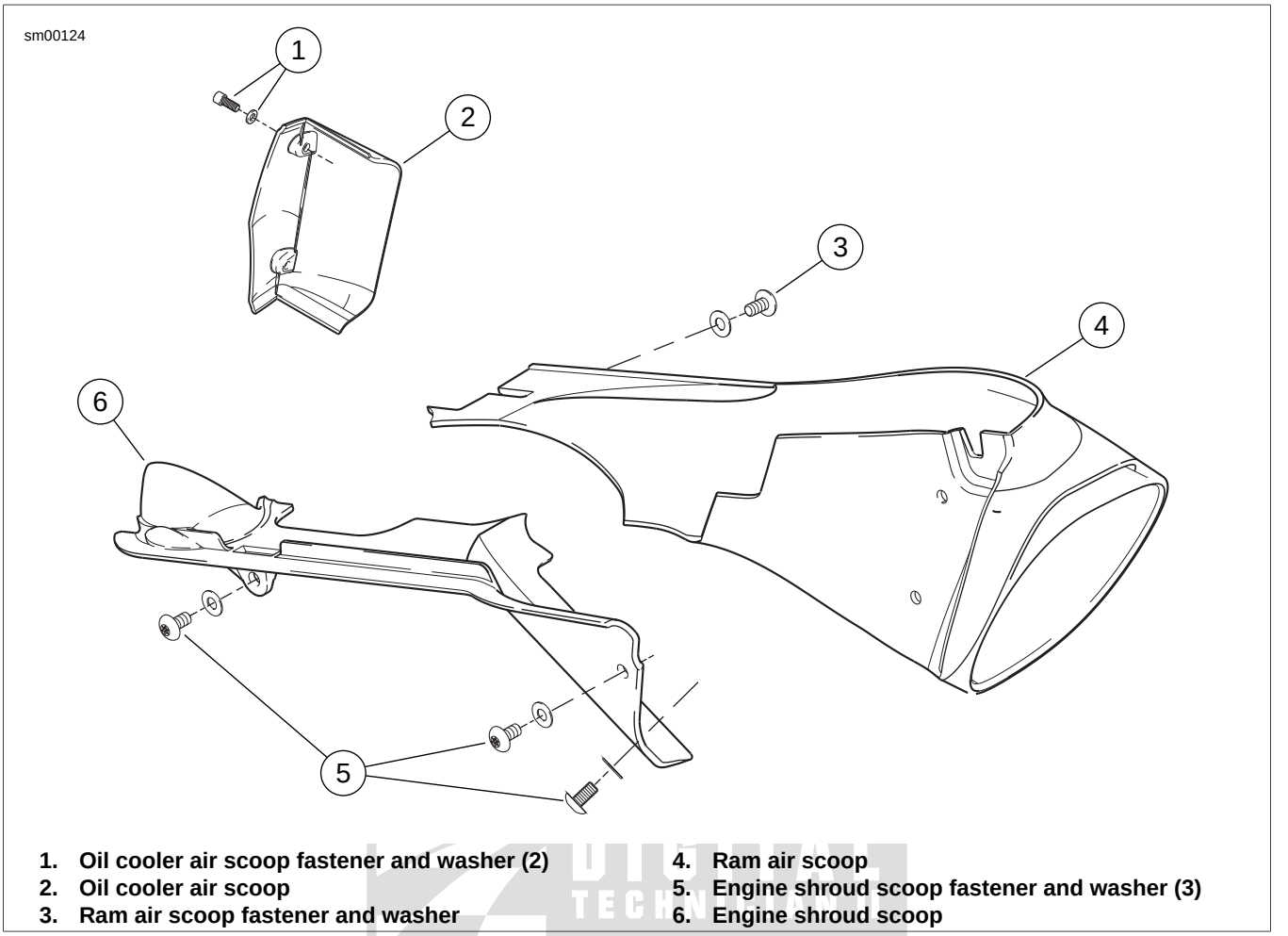
Removal

1. See Figure 2-186. On left side of motorcycle, locate oil cooler air scoop (2).
2. Remove two oil cooler air scoop fasteners (1).
3. Remove oil cooler air scoop (2).

Installation

1. See Figure 2-186. Position oil cooler air scoop (2).
2. Apply LOCTITE 271 (red) to oil cooler air scoop fasteners (1) and tighten to 48-72 **in-lbs** (5.4-8 Nm).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Oil cooler air scoop fastener and washer (2)
2. Oil cooler air scoop
3. Ram air scoop fastener and washer
4. Ram air scoop
5. Engine shroud scoop fastener and washer (3)
6. Engine shroud scoop

Figure 2-186. Ram Air Scoop, Engine Shroud, and Oil Cooler

CHIN FAIRING 2.50

REMOVAL

1. Turn wheel full right or left for easier access to center fasteners.
2. See Figure 2-187. Remove center section fasteners and washers (2).
3. Remove left section fasteners and washers (4).
4. Remove right section fasteners and washers (6).
5. Remove chin fairing.

NOTE

To separate the left, right and center sections, drill out the rivets.

INSTALLATION

PART NUMBER	TOOL NAME
MAR39200HD	MARSON THREAD-SETTER; TOOL KIT

NOTE

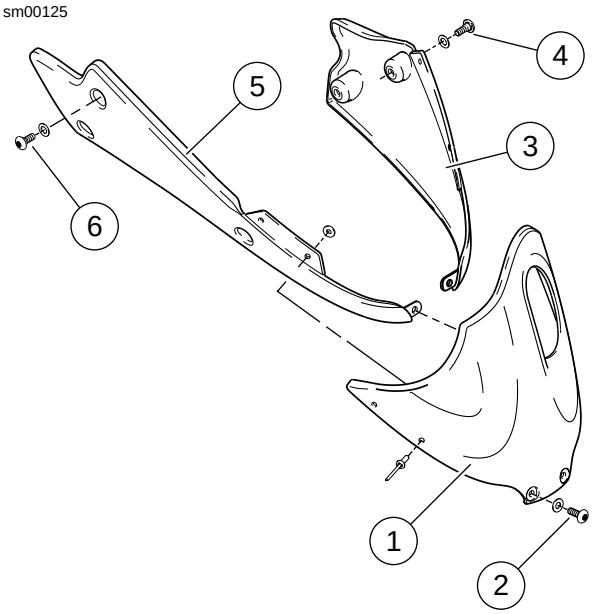
To join the left, right and center sections, use the rivet gun from a MARSON THREAD-SETTER; TOOL KIT (Part No. MAR39200HD).

1. Apply LOCTITE 271 (red) on all fasteners.
2. See Figure 2-187. Position the assembled chin fairing and loosely install right side fasteners and washers (6).
3. Align center section (1) and loosely install center section fasteners and washers (2).

NOTE

Turn wheel full right or left for easier access to center fasteners.

4. Align left section (3) and loosely install left side fasteners and washers (4).
5. Tighten all fasteners to 36-48 **in-lbs** (4-5 Nm).



1. **Center section**
2. **Center section fasteners and washers (2)**
3. **Left section**
4. **Left section fastener and washer (2)**
5. **Right section**
6. **Right section fastener and washer (2)**

Figure 2-187. Chin Fairing

FIREBOLT

Rider Seat

1. See Figure 2-188. Peel up rear corners of seat and remove two fasteners.
2. Pull seat back over tail section and remove.
3. See Figure 2-189. Position seat in mounting position with center tab aligned with slot on frame crossmember.
4. Slide seat forward to engage center tab in slot. Pull up on front of seat to verify tab/slot engagement.

⚠WARNING

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

5. Pull up rear corners of seat and tighten two fasteners to 12-36 **in-lbs** (1.4-4 Nm).

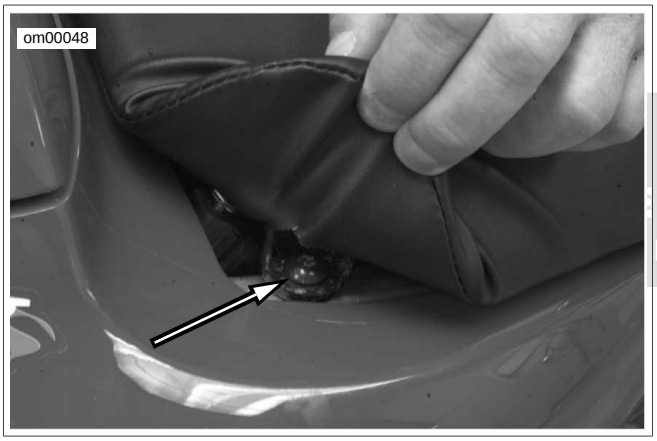
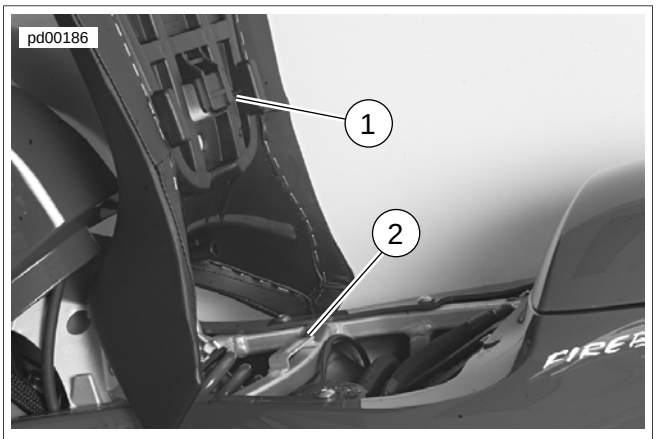


Figure 2-188. Rider Seat Screws: Firebolt



1. **Center tab**
2. **Frame slot**

Figure 2-189. Center Tab and Frame Slot: Firebolt

Pillion

NOTE

The trunk is located under the pillion.

1. See Figure 2-190. Insert ignition key into the pillion lock located on the left side of motorcycle. Turn key clockwise to disengage rear pillion latch.

NOTE

Do not place keys in the trunk. If pillion is installed, keys will not be accessible.

2. Lift and remove pillion.
3. Install pillion by sliding metal locating tab on front underside of the pillion into opening on motorcycle.
4. Align the rear tab with latch slot at rear of motorcycle.
5. Press down firmly on rear of pillion to engage latch. Pull up on rear of pillion to make sure latch is engaged.

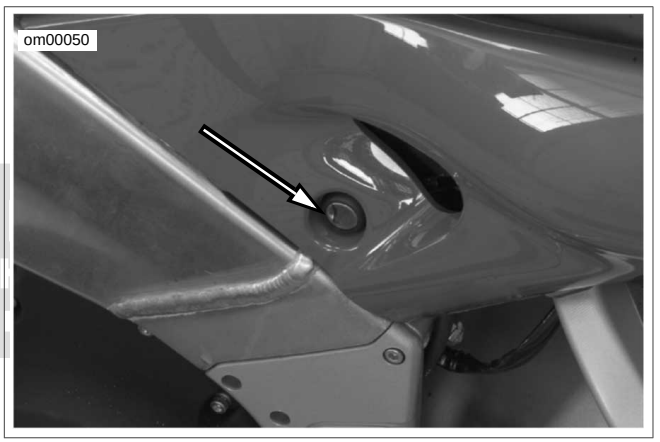


Figure 2-190. Pillion Lock: Firebolt Models (left side)

LIGHTNING

Removal

1. See Figure 2-191. Insert key into seat lock and rotate 1/4 turn clockwise.
2. See Figure 2-192. Grip the rear of seat and press firmly in the center of the seat in a back and up motion.

Figure 2-191. Seat Lock Location: Lightning Models

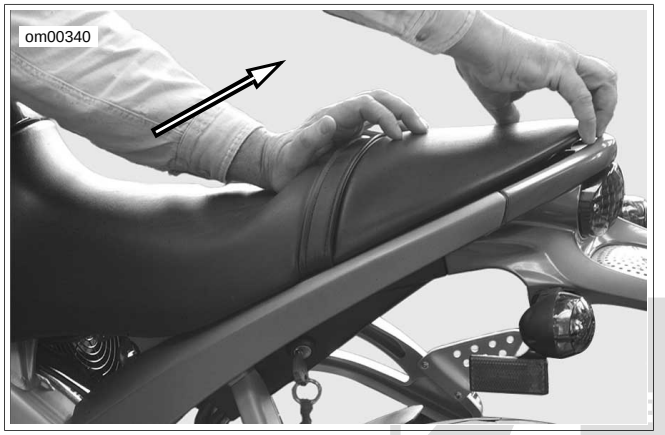
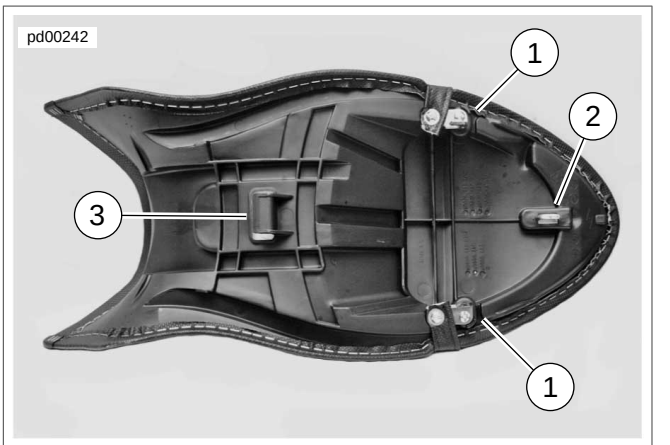
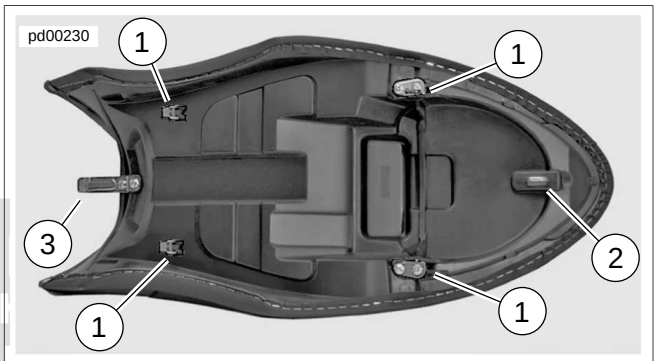


Figure 2-192. Seat Removal: Lightning Models



1. **Seat hooks (2)**
2. **Seat latch**
3. **Tab**

Figure 2-193. Seat Mounting Points: XB9SX/XB12Scg



1. **Seat hooks (4)**
2. **Seat latch**
3. **Tab**

Figure 2-194. Seat Mounting Points: XB12Ss

Installation

1. Install seat.
   a. **For XB9SX and XB12Scg:** Insert the front tab into the slot in the trunk pan. See Figure 2-193.
   b. **For XB12Ss:** Insert the front tab into the slot behind the air intake cover. See Figure 2-194.
2. See Figure 2-195. Align seat hooks (1) with mounting posts in tail section.

⚠WARNING

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

3. See Figure 2-196. Press down rapidly and firmly on rear of seat to engage seat latch. Pull up on rear of seat to make sure latch is engaged.

1. **Seat hooks**
2. **Tab**

Figure 2-195. Fitting Seat Hooks to Frame Mounting Posts

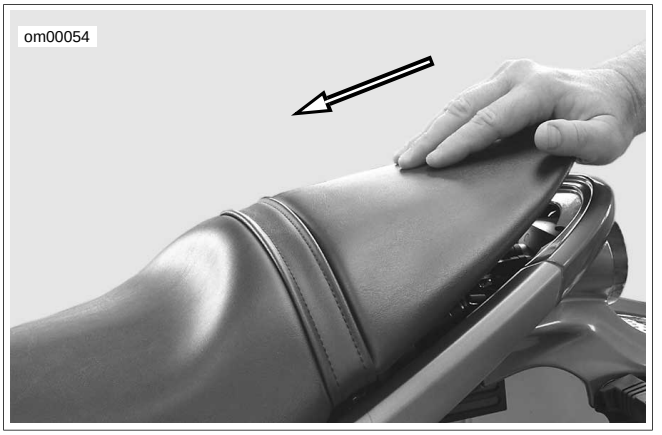


Figure 2-196. Seat Installation: Lightning Models

ULYSSES

Removal

1. Rotate Triple Tail to upright position. See 2.53 TRIPLE TAIL: ULYSSES for procedure.
2. See Figure 2-197. Insert key into seat lock and turn clockwise approximately 1/8 turn. Seat will unlatch at rear.
3. See Figure 2-198. Grip rear of seat and pull toward rear of motorcycle to remove.

Figure 2-197. Seat Lock: Ulysses Models

Figure 2-198. Seat Removal: Ulysses Models

Installation

1. See Figure 2-199. Position and slide seat forward on motorcycle to engage front tab (3) with slot in frame and engage all four seat hooks (1) with posts on tail section.

⚠WARNING

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

2. Press down firmly on rear of seat to engage seat lock latch. Pull up on rear of seat to make sure latch is engaged.

1. **Seat hook**
2. **Seat lock latch**
3. **Front tab**

Figure 2-199. Seat Tab/Hooks: Ulysses Models

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SEAT LOCKS 2.52

LIGHTNING

Removal

1. Remove seat.
2. Cut cable strap loosely securing BAS wiring harness to seat lock cable.
3. See Figure 2-200. Disconnect seat lock cable:
   a. Remove latch (9) from latch bracket (10) by removing two fasteners (6).
   b. Slide retainer (7) away from cable end (8).
   c. Remove cable end (8) and cable (5) from latch.
4. Remove seat lock:
   a. Remove seat lock retainer (3) from seat lock (1).
   b. Remove seat lock (1) from plate (2) and trunk pan (11).

NOTE

When removing seat lock (1), cable end (4) should release from seat lock.

5. Remove cable (5) from plate (2).

Installation

1. See Figure 2-200. Install cable (5) into plate (2).
2. Install the seat lock (1) into trunk pan (11) and plate (2).

NOTES

- *Once seat lock has been started through the hole in the trunk pan and plate, now is the time to connect the cable end to the seat lock.*
- *Seat lock plate must be aligned to tab on seat lock for proper installation.*

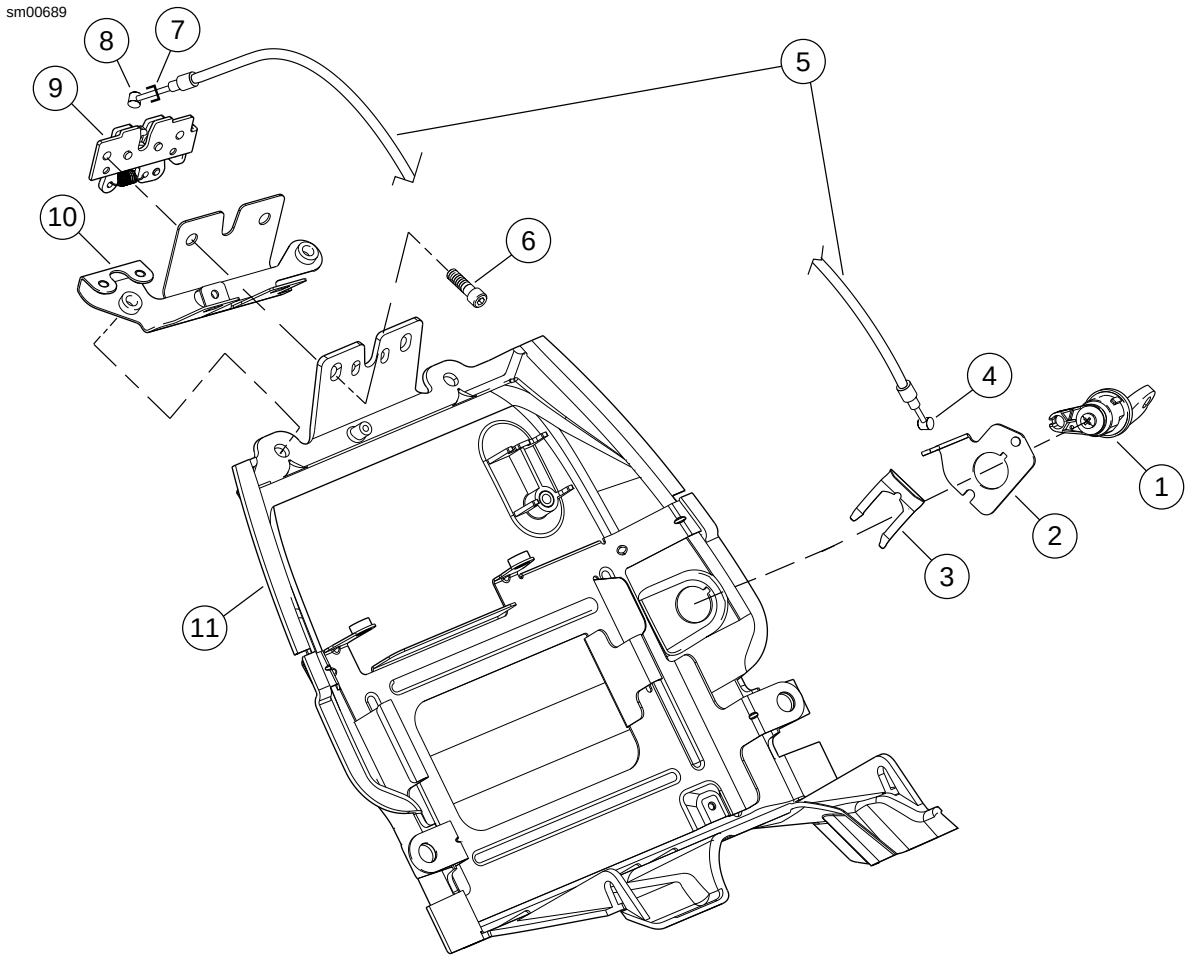
3. Install seat lock retainer (3) by aligning retainer to retainer grooves on back side of seat lock (1).
4. Connect seat lock cable to latch:
   a. Install cable end (8) and cable (5) onto latch.
   b. Slide retainer (7) over pin on latch to lock cable end (8) into place.
   c. Install latch (9) to latch bracket (10) and tighten fasteners (6) to 60-72 **in-lbs** (7-8 Nm).
   d. Install cable strap to loosely secure cable to BAS wiring harness.
5. Open and close the seat lock with ignition key to verify that cable is working properly.

⚠WARNING

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

6. Install seat.

PRO TECHNICIAN II HARLEY-DAVIDSON



1. **Seat lock**
2. **Plate**
3. **Retainer**
4. **Cable end**
5. **Cable**
6. **Latch screw**
7. **Retainer**
8. **Cable end**
9. **Latch**
10. **Latch bracket**
11. **Trunk pan**

Figure 2-200. Seat Lock Assembly: Lightning

REMOVAL: ULYSSES MODELS

1. Remove seat.
2. Cut cable strap securing wire harness to seat lock cable.
3. See Figure 2-201. Disconnect seat lock cable (5):
   a. Remove latch (8) from latch bracket (9) by removing two fasteners (7).
   b. Remove cable end (6) and cable (5) from latch (8).
4. Remove seat lock:
   a. Remove wire cover from bottom side of license plate bracket to access seat lock.
   b. Remove seat lock retainer (3) from seat lock (1).
   c. Remove seat lock (1) from plate (2) and license plate bracket.

NOTE

When removing seat lock (1), cable end (4) should release from seat lock.

5. Remove cable (5) from plate (2).

INSTALLATION: ULYSSES MODELS

1. See Figure 2-201. Install cable (5) into plate (2).

2. Install the seat lock (1) into license plate bracket and plate (2).

NOTES

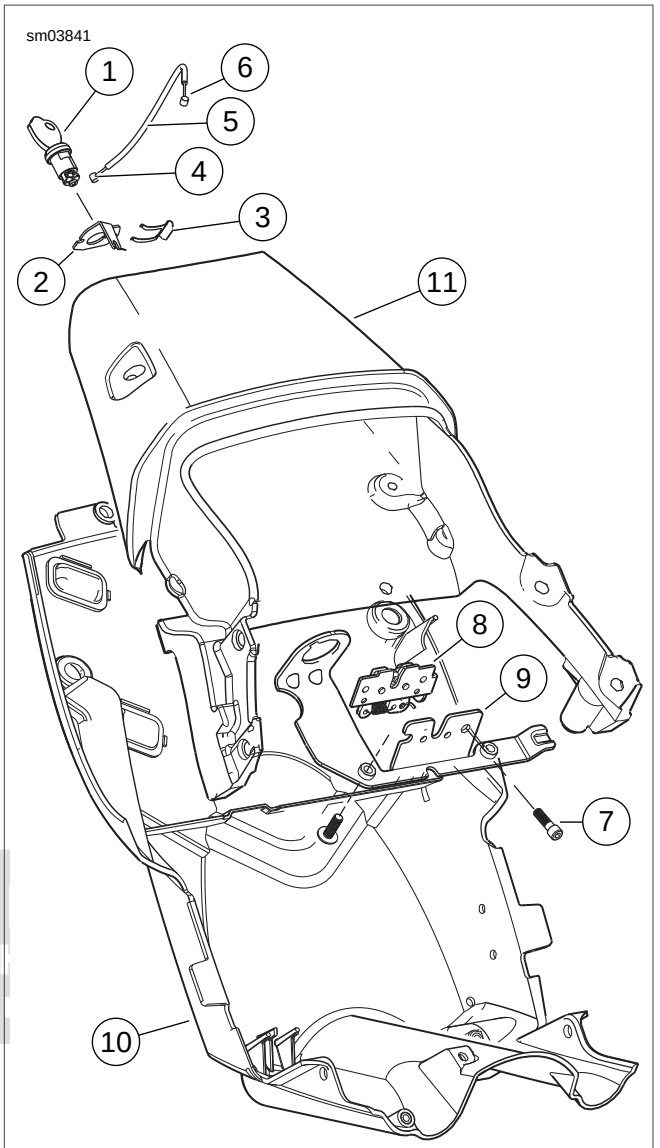
- *Once seat lock has been started through the hole in the license plate bracket and plate (2), now is the time to connect the cable end to the seat lock.*
- *Seat lock plate must be aligned to tab on seat lock for proper installation.*

3. Install seat lock retainer (3) by aligning retainer to retainer grooves on back side of seat lock (1).
4. Connect seat lock cable to latch:
   a. Install cable end (6) and cable (5) onto latch (8).
   b. Install latch (8) to latch bracket (9) and tighten fasteners (7) to 60-96 **in-lbs** (7-11 Nm).
5. Open and close the seat lock with ignition key to verify that cable is working properly.
6. Install the wire cover fasteners and tighten to 36-48 **in-lbs** (4-5.4 Nm).
7. Install license plate light fasteners and tighten to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

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

8. Install cable strap around seat lock cable in original location.
9. Install seat.



1. **Seat lock**
2. **Plate**
3. **Retainer**
4. **Cable end**
5. **Cable**
6. **Cable end**
7. **Latch screw (metric) (2)**
8. **Latch**
9. **Latch bracket**
10. **Trunk pan**
11. **Center tail loop**

Figure 2-201. Seat Lock Assembly: Ulysses

PILLION LOCK REMOVAL: XB12R

1. Remove rider and pillion seat.
2. Remove upper body work on tail section. See 2.39 SUB-FRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
3. See Figure 2-202. Disconnect passenger lock cable (9) by removing cable from seat lock plate (6) and ferrule (8) from seat lock lever (4).

4. Remove seat lock lever (4) by removing fastener (2) and washer (3) from seat lock (7).
5. Remove spring (5).
6. Remove seat lock clip (1) by sliding from seat lock plate (6).
7. Remove seat lock plate (6) and seat lock (7).

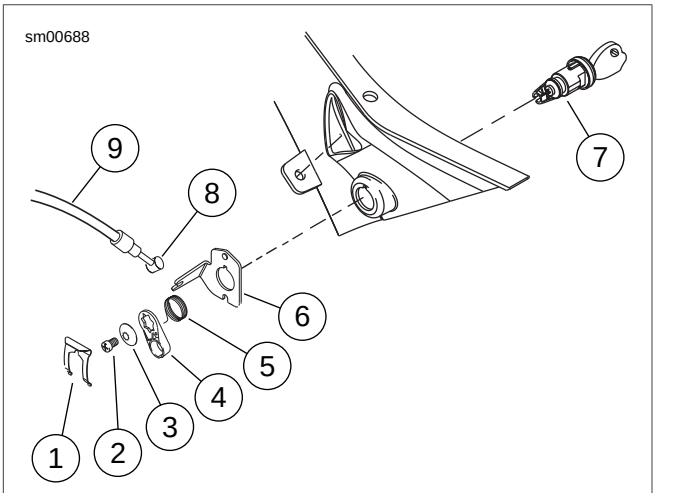
PILLION LOCK INSTALLATION: XB12R

1. See Figure 2-202. Install the seat lock (7) on to upper tail body work.
2. Install seat lock plate (6) by aligning plate tab onto seat lock (7).
3. Install seat lock clip (1) by sliding clip aligning clip groove onto seat lock plate (6) tab.
4. Position short tab of spring (5) into seat lock notch.
5. Position long end of spring into the seat lock lever (4).
6. Load the spring (5) by turning the seat lock lever (4) counterclockwise 1/4 turn.
7. Once the spring is loaded, install the seat lock lever (4) onto the lock aligning the lever to the square groove that is cast into the seat lock (7).
8. Fasten the lock lever (4) to the seat lock (7) with the washer (3) and fastener (2).
9. Install the ferrule (8) of the seat lock cable (9) into the seat lock lever (4).
10. Open and close the seat lock with ignition key to verify that cable is working properly.
11. Install the seat lock cable (9) into the seat lock plate (6).
12. Install upper body work on tail section. See 2.39 SUB-FRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.

⚠WARNING

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

13. Install rider and pillion seat.



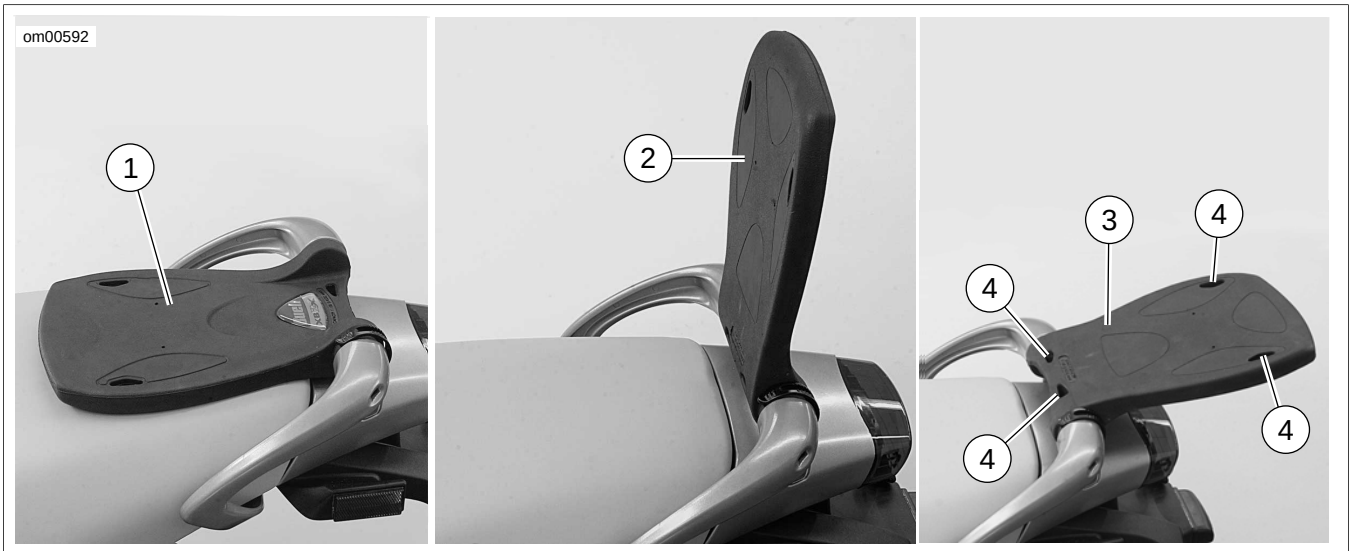
1. **Seat lock clip**
2. **Fastener**
3. **Washer**
4. **Seat lock lever**
5. **Spring**
6. **Seat lock plate**
7. **Seat lock**
8. **Ferrule**
9. **Seat lock cable**

Figure 2-202. Seat Lock and Cable Assembly: Firebolt

TRIPLE TAIL: ULYSSES 2.53

GENERAL

See Figure 2-203. The Triple Tail when folded forward acts as a luggage rack (1) with integrated tie-down hooks. When in the upright position, it is a passenger backrest (2) with subtle flex for passenger comfort. When in the rearward position, you can carry a passenger and have a luggage rack (3) for extra carrying capacity (XB12X only).



1. **Forward luggage rack**
2. **Passenger backrest**
3. **Rearward luggage rack**
4. **Integrated tie down locations**

Figure 2-203. Triple Tail: Ulysses Models

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

REMOVAL

NOTES

- *The portion of the grab handle closest to the front of the vehicle is slotted for easy access. The fastener does not need to be fully removed.*
- *Before removing the Triple Tail, it will be necessary to remove certain components of the luggage system. See 2.54 LUGGAGE: XB12XT.*

1. Remove the seat.
2. See Figure 2-204. To access fasteners (3, 11), remove the plastic wire cover under the license plate light. Remove the two screws and the two nuts to remove the plastic cover.
3. Remove the right hand rear fastener (3).
4. Loosen but do not remove the right hand front fastener (1).
5. Hold the triple tail rack (5) in place and remove the right hand grab handle (2).
6. Slowly, slide the tail towards the right.

NOTE

The spring (6) in the left hand grab handle is held under tension.

7. Loosen but do not remove the left hand front fastener (12).
8. Remove rear fastener (11) and the left hand grab handle (13).

DISASSEMBLY

1. See Figure 2-204. Remove the fastener (9) and the plastic collar (10) from the left hand grab handle (13).
2. To remove the bearings (4) from the grab handles, insert a 3/4 in. blind bearing collet and extract.
3. Remove the pin (7) and detent (8).
4. Inspect and replace the spring, pin and detent as necessary.

NOTE

*Replace the bearing with a **new** bearing, if removed from the grab handle.*

ASSEMBLY

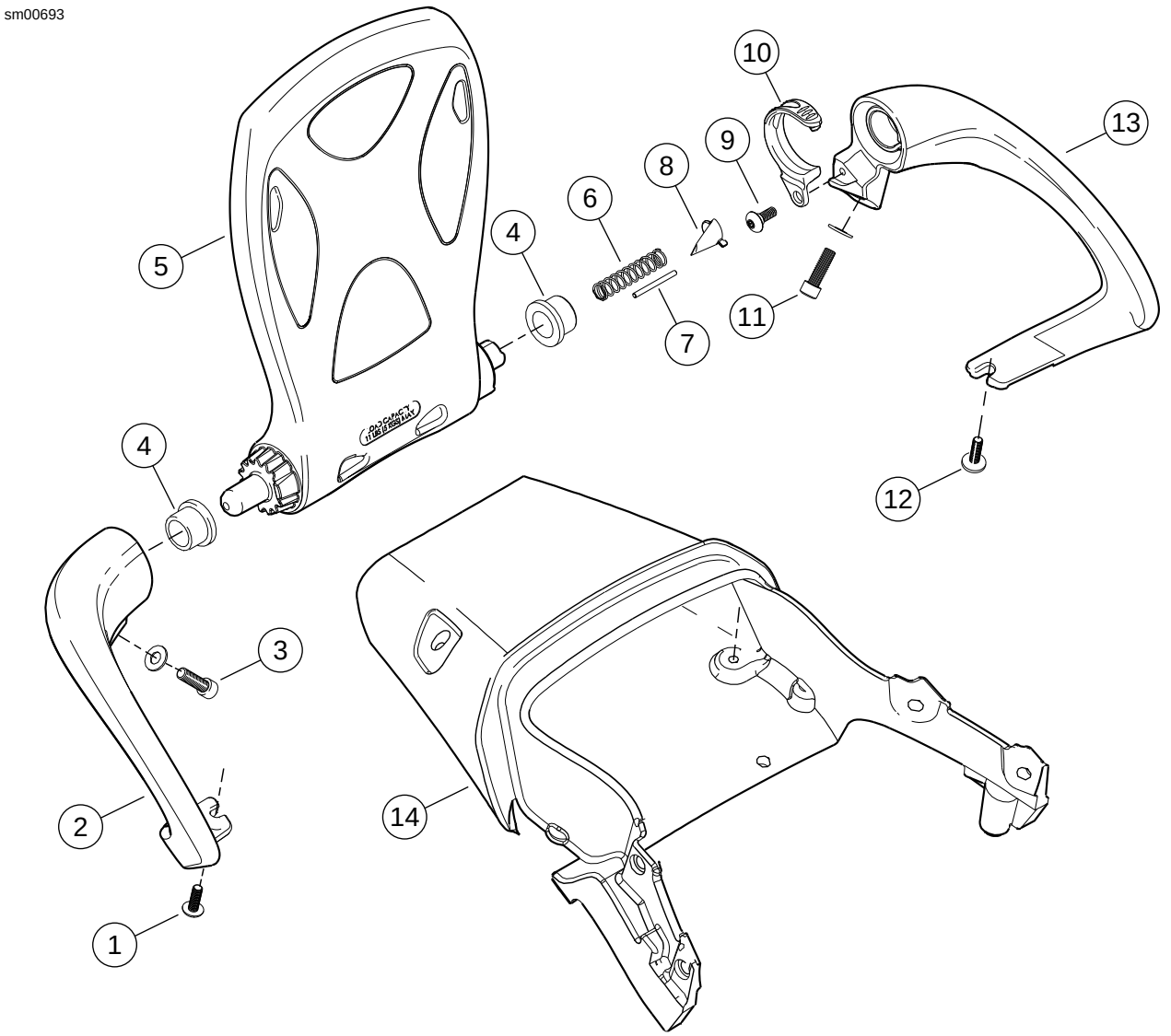
PART NUMBER	TOOL NAME
A157C	SNAP-ON SEAL AND BUSHING DRIVER

1. Hold the right hand grab handle and using a SNAP-ON SEAL AND BUSHING DRIVER (Part No. A157C), tap in the bearing.
2. Hold the left hand grab handle to assemble the detent and pin.

3. Using a Snap-on seal and bushing driver, tap in the bearing.

INSTALLATION

1. See Figure 2-204. Apply LOCTITE 271 (red) to LH and RH grab handle fasteners (1, 3, 11, 12).
2. Install the LH grab handle (13) unto the front fastener and install the rear fastener. Do not tighten.
3. Slide the spring (6) into the LH grab handle (13).
4. Press the spring with the shaft of the triple tail rack and hold the rack in place capturing the spring.
5. Install the plastic collar (10) and tighten the fastener to 36-48 **in-lbs** (4.0-5.4 Nm).
6. Holding the rack, fit the RH grab handle (2) unto the front fastener and install the rear fastener. Do not tighten.
7. Tighten front and rear fasteners to the following specifications:
   a. Tighten rear fasteners (3, 11) to 23-25 ft-lbs (31-34 Nm).
   b. Tighten front fasteners (1, 12) to 108-120 **in-lbs** (12-13.5 Nm).
8. Verify that the rack operates properly.
9. Install the plastic wire cover under the license plate lamp. Tighten the screws to 36-48 **in-lbs** (4.0-5.4 Nm) and tighten the nuts to 12-36 **in-lbs** (1.4-4 Nm).



1. **Front fastener, grab handle**
2. **RH grab handle**
3. **Rear fastener with washer, grab handle**
4. **Bearing (2)**
5. **Tail rack**
6. **Spring**
7. **Pin**
8. **Detent, tail rack**
9. **Screw, collar**
10. **Collar, tail rack**
11. **Rear fastener with washer, grab handle**
12. **Front fastener, grab handle**
13. **LH grab handle**
14. **Tail loop**

Figure 2-204. Triple Tail, Passenger Backrest and Luggage Rack: Ulysses

LUGGAGE: XB12XT 2.54

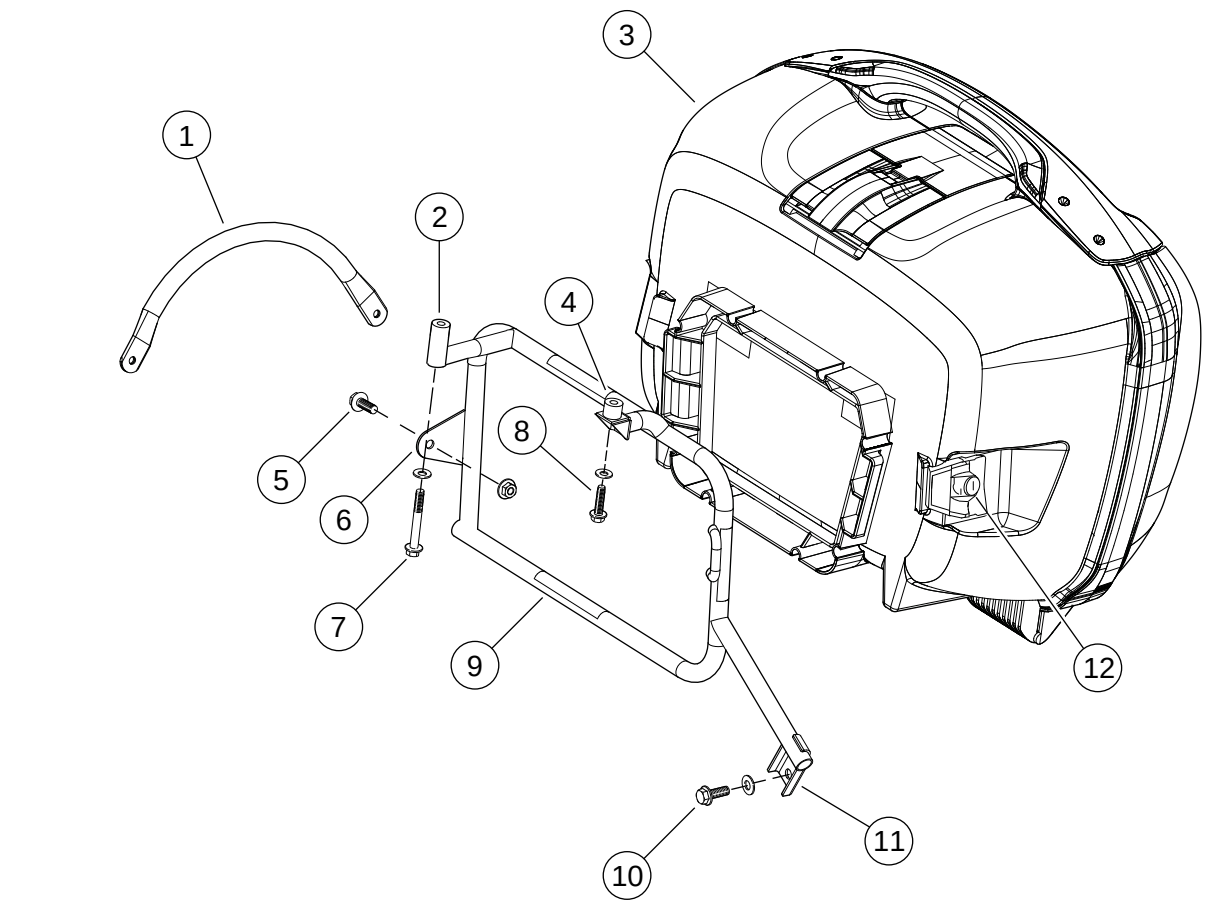
REMOVAL: SIDE CASE

⚠WARNING

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

NOTES

- *The side cases and brackets may be removed without removing the top case and bracket. This procedure is recommended for service only. The vehicle should never be operated with just the top case in place. This would result in a high stress situation on the left and right tailsection castings.*
- *This operation should be performed for one side case bracket at a time. It does not matter which side case bracket is removed first.*



1. **X-brace bracket**
2. **Rear mount, side case bracket**
3. **Side case**
4. **Forward mount, side case bracket**
5. **Fastener with locknut, X-brace mount (2)**
6. **X-brace mount**
7. **Fastener with Belleville washer, rear mount, side case bracket (2)**
8. **Fastener with Belleville washer, forward mount, side case bracket (2)**
9. **Side case bracket**
10. **Fastener with Belleville washer, attachment point, side case bracket (2)**
11. **Attachment point, side case bracket to passenger footrest bracket**
12. **Side case locking latch**

Figure 2-205. Side Case Assemby/Ulysses XB12XT

1. See Figure 2-205. Place key in side case locking latch (12), on front surface of side case, in open position. Open latch.
2. Remove side case by pulling away from vehicle.
3. Remove fastener (10) securing the side case bracket (11) to the back of the passenger footrest support bracket.
4. Remove fastener and locknut (5) securing the X-brace bracket (1) to the side case bracket (6).
5. Remove forward fastener (8) securing side case bracket (4) to trunk pan.
6. Remove rear fastener (7) securing side case bracket (2) to trunk pan and remove bracket from vehicle.
7. Repeat procedure for remaining side case bracket.

INSTALLATION: SIDE CASE

NOTE

To verify proper alignment of side case brackets, always loosen the passenger peg support bracket fasteners and leave loose until all side case bracket fasteners have been tightened and then tighten as a final step.

1. See Figure 2-205. Install rear fastener (7) securing side case support bracket (2) to trunk pan attaching bracket to vehicle, snug only.
2. Install forward fastener (8) attaching side case bracket (4) to trunk pan, snug only.
3. Install fastener with locknut (5) attaching the X-brace bracket (1) to the side case bracket (6), snug only.
4. Install bolt (10) attaching side case bracket (11) to the back of the passenger footrest support bracket, snug only.
5. Tighten the three fasteners securing the passenger peg support bracket to the main frame to 132-144 **in-lbs** (14.9-16.2 Nm).
6. Apply LOCTITE 271 (red) all other fasteners attaching the side case brackets to the vehicle and to tighten 108-120 **in-lbs** (12-13 Nm).

NOTE

Repeat this procedure for the remaining side.

REMOVAL: TOP CASE

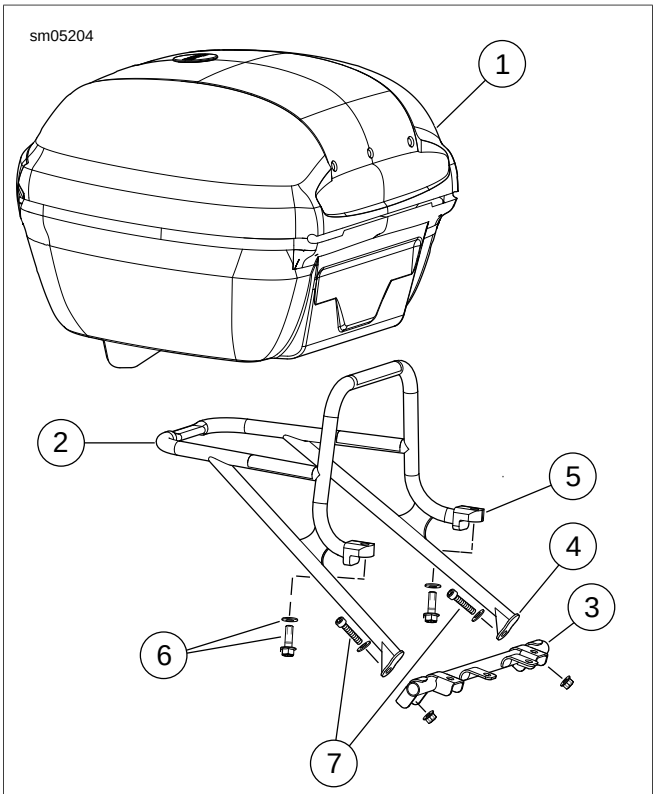
NOTE

The top case and bracket may be removed without removing side cases and brackets.

1. See Figure 2-206. Locate the mounting latch under the top case.
2. Turn the key to OPEN.

Figure 2-206. Top Case Mounting Latch

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Top case**
2. **Mounting bracket, top case**
3. **Cross bar mount**
4. **Lower mount (2)**
5. **Grab rail mounting points (2)**
6. **Fastener, top case mount to grab handles (2)**
7. **Fastener with nut, lower mount to cross bar mounts (2)**

Figure 2-207. Top Case Assembly: Ulysses

3. See Figure 2-207. Slide top case on mounting bracket to the rear of the motorcycle until top case can be removed from bracket.
4. Remove the fasteners with nuts securing the bracket lower mounts to the cross bar arms.
5. Remove fasteners securing the top case bracket to the passenger grab handle and remove bracket from vehicle.

INSTALLATION: TOP CASE

NOTE

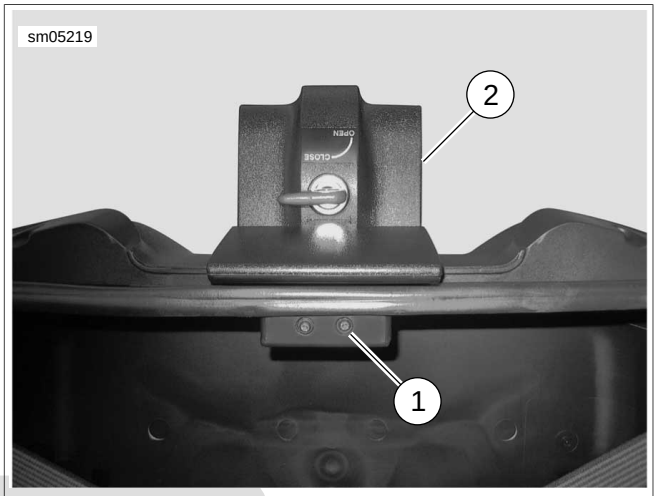
Before installing any bracket fasteners, always apply LOCTITE 271 (red) prior to installing.

1. See Figure 2-207. Install the top case mounting bracket (2) by attaching trunk pan mounts (5) to the grab handles by installing two fasteners with Belleville washers (6) into the lower grab handle. Thread the fasteners in but do not tighten at this time.
2. Install fasteners with nuts (7) securing the top case bracket lower mounts (4) to the cross bar mount (3). Do not tighten at this time.
3. Tighten the two fasteners (6) attaching the top case mounting bracket (2) to the grab handles (5) to 19-20 ft-lbs (26-27 Nm).
4. Tighten all remaining fasteners to 96-120 **in-lbs** (11-13 Nm).

LUGGAGE CASE LATCH MECHANISM

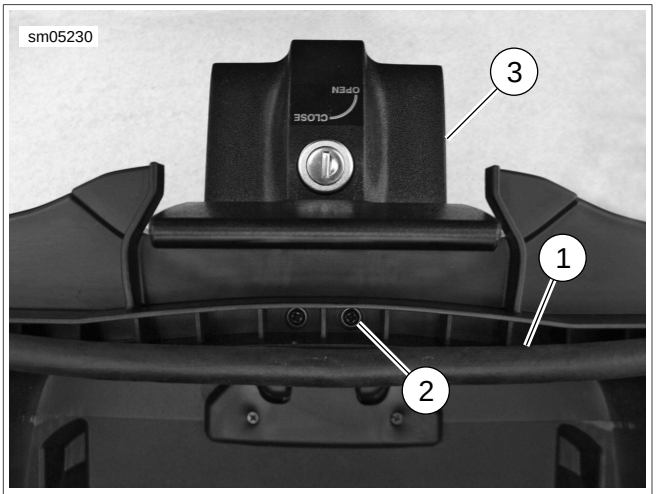
Removal

1. Open desired case in order to access the latch mechanism for replacement.



1. **Screw (2)**
2. **Latch mechanism**

Figure 2-208. Side Case and Latch Mechanism



1. **Lid gasket**
2. **Screw (2)**
3. **Latch mechanism**

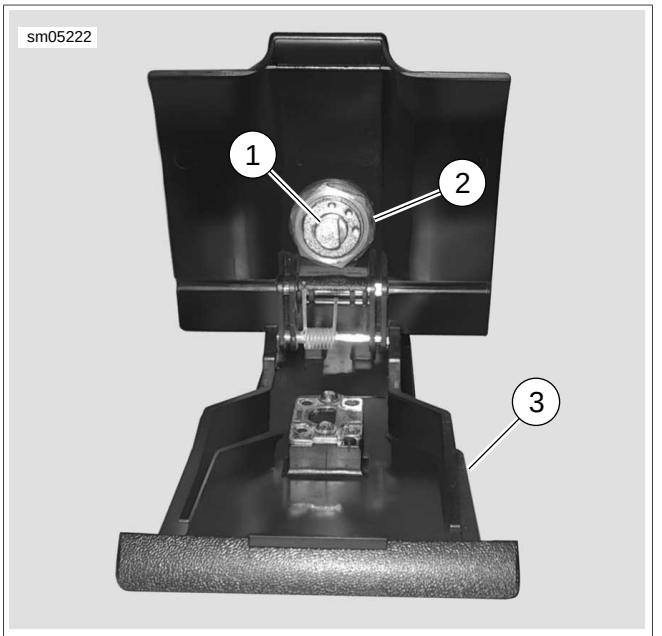
Figure 2-209. Top Case and Latch Mechanism

NOTE

See Figure 2-209. In order to access the two Phillips head screws securing the top latch to the top case it will be neces-

sary to lift the lid gasket above the middle of latch and out of the way.

2. See Figure 2-208. Remove and discard two Phillips head screws from existing latch mechanism.
3. Slide latch mechanism out of case.



1. **Lock**
2. **Large hex nut**
3. **Latch mechanism**

Figure 2-210. Latch Mechanism and Lock

4. See Figure 2-210. Loosen large hex nut and remove lock from latch mechanism.

Installation

1. See Figure 2-210. Install lock into **new** latch mechanism and secure with large hex nut.
2. Slide latch mechanism into luggage case.
3. See Figure 2-208 or Figure 2-209. Install two **new** Phillips head screws into latch mechanism and tighten.

NOTE

See Figure 2-209. On the top case it will be necessary to press lid gasket (1) back into place.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

LUGGAGE: XB12XP 2.55

SIDE CASE

Removal

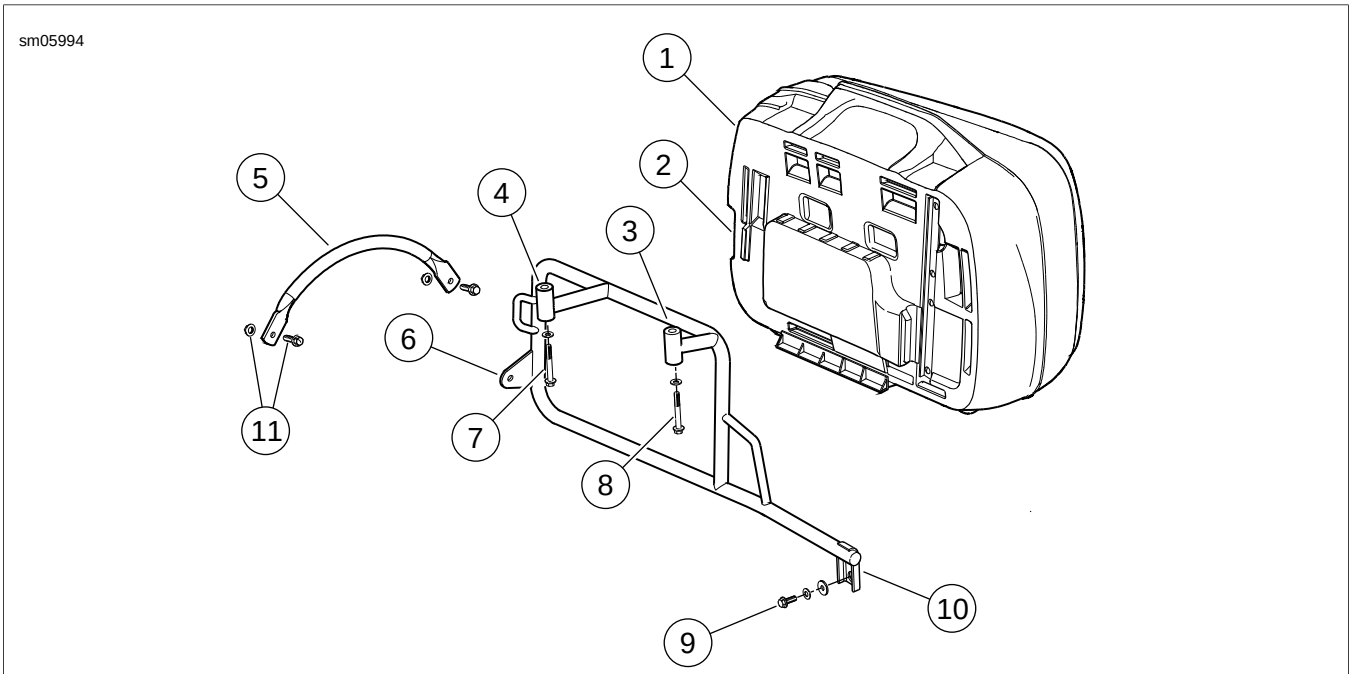
WARNING

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

NOTES

- *If the top case has been installed, the side cases and brackets may be removed without removing the top case and bracket. This procedure is recommended for service only. The vehicle should never be operated with just the top case in place. This would result in a high stress situation on the left and right tailsection castings.*
- *This operation should be performed for one side case bracket at a time. It does not matter which side case bracket is removed first.*

1. See Figure 2-211. Open side case locking latch (2), with key.
2. Remove side case by pulling away from vehicle.
3. Remove fastener (9) securing the side case bracket (10) to the back of the passenger footrest support bracket.
4. Remove fastener and locknut (11) securing the X-brace bracket (5) to the side case bracket (6).
5. Remove forward fastener (8) securing side case bracket (3) to trunk pan.
6. Remove rear fastener (7) securing side case bracket (4) to trunk pan and remove bracket from vehicle.
7. Repeat procedure for remaining side case bracket.



1. **Side case**
2. **Side case locking latch (not shown)**
3. **Forward mount, side case bracket**
4. **Rear mount, side case bracket**
5. **X-brace bracket**
6. **X-brace mount**
7. **Fastener with bellville washer (2)**
8. **Fastener with bellville washer (2)**
9. **Fastener with bellville washer (2)**
10. **Attachment point, side case bracket to passenger footrest bracket**
11. **Fastener with locknut (2)**

Figure 2-211. Side Case Assembly/XB12XP

Installation

NOTE

To make sure you have proper alignment of side case brackets, always loosen the passenger peg support bracket fasteners and leave loose until all side case bracket fasteners have been tightened and then tighten as a final step.

1. See Figure 2-211. Install rear fastener (7) securing side case support bracket (4) to trunk pan attaching bracket to vehicle, snug only.
2. Install forward fastener (8) attaching side case bracket (3) to trunk pan, snug only.
3. Install fastener with locknut (11) attaching the X-brace bracket (5) to the side case bracket (6), snug only.
4. Install bolt (9) attaching side case bracket (10) to the back of the passenger footrest support bracket, snug only.
5. Tighten the three fasteners securing the passenger peg support bracket to the main frame to 132-144 **in-lbs** (14.9-16.2 Nm).
6. Apply LOCTITE 271 (red) all other fasteners attaching the side case brackets to the vehicle and to tighten 108-120 **in-lbs** (12-13 Nm).

NOTE

Repeat this procedure for the remaining side.

LUGGAGE CASE LATCH MECHANISM

Removal

NOTE

The lock assembly is non-replaceable. If it is determined that a new lock is needed, the entire side case latch mechanism must now be replaced.

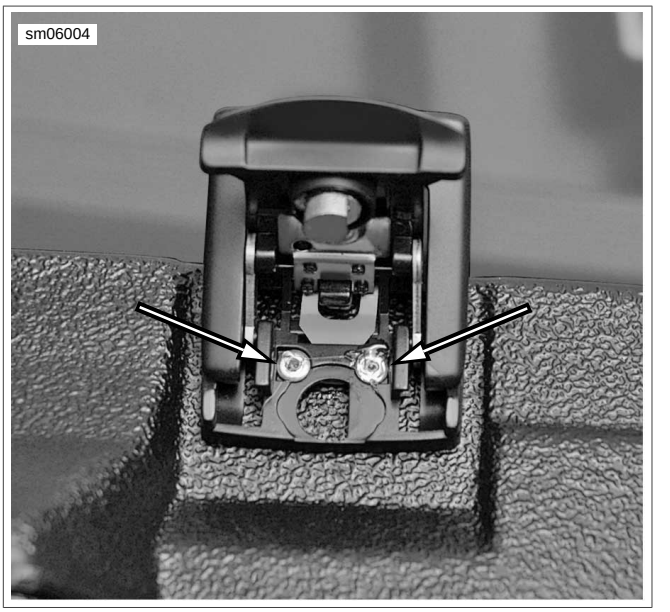


Figure 2-212. Side Case Latch Mechanism

NOTE

- *See Figure 2-212. In order to access the two rivets securing the latch to the side case it will be necessary to unlock the latch to expose the rivet heads.*
- *When drilling out the rivet heads try to make sure you do not spin the rivet in the plastic body of the side case. This could cause the rivet hole to enlarge due to excessive heat and make the hole unserviceable. If this happens, the side case must be replaced.*

1. Open desired case in order to access the latch mechanism for replacement.
2. Drill out the rivet heads using a 3/16 drill bit. Remove and discard two rivets from existing latch mechanism.
3. Slide latch mechanism out of case.

Installation

1. Slide **new** latch mechanism into side case.

NOTE

Before tightening each rivet verify that there is a flat washer on the inside on the rivet you are tightening.

2. See Figure 2-212. Install two **new** rivets into latch mechanism and tighten.

TABLE OF CONTENTS

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

FASTENER TORQUE VALUES 3.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Air scoop fastener at oil cooler	48-72 **in-lbs**	5.4-8 Nm	3.13 OIL COOLER, Installation/LOCTITE 271 (red)
Anti-rotation screws (lifter)	55-65 **in-lbs**	6-7 Nm	3.16 HYDRAULIC LIFTERS, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Center tie bar	30-33 ft-lbs	41-45 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Center tie bar mount to engine fasteners	30-33 ft-lbs	40.6-44.7 Nm	3.6 ENGINE INSTALLATION, Assembly
Crankcase 5/16 in. screws	15-19 ft-lbs	20-26 Nm	3.18 CRANKCASE, Assembly/LOCTITE 272
Cylinder head screws (final tightening)	13-15 ft-lbs	18-20 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder head screws (final tightening)	13-15 ft-lbs	18-20 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder head screws (initial tightening)	96-120 **in-lbs**	11-14 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder head screws (initial tightening)	96-120 **in-lbs**	11-14 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder studs	10-20 ft-lbs	14-27 Nm	3.18 CRANKCASE, Assembly/Special method required to tighten
Exhaust header nuts	72-96 **in-lbs**	8.1-10.8 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Exhaust header nuts	72-96 **in-lbs**	8.1-10.8 Nm	3.6 ENGINE INSTALLATION, Assembly
Front isolator bolt	49-51 ft-lbs	66.4-69.1 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Front isolator bolt	49-51 ft-lbs	66-69 Nm	3.6 ENGINE INSTALLATION, Assembly
Front isolator bracket mounting fasteners	49-51 ft-lbs	66.4-69.1 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Front isolator bracket mounting fasteners	49-51 ft-lbs	66-69 Nm	3.6 ENGINE INSTALLATION, Assembly
Ignition coil fasteners	120-144 **in-lbs**	13.6-16.3 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Ignition coil fasteners	120-144 **in-lbs**	13.6-16.3 Nm	3.6 ENGINE INSTALLATION, Assembly
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	3.6 ENGINE INSTALLATION, Assembly
Lower rocker box bolts (1/4-20 x 1-1/4)	135-155 **in-lbs**	15-17.5 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Lower rocker box bolts (5/16-18 x 2-1/2)	18-22 ft-lbs	24-30 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Lower rocker box screws with hex socket head (1/4-20 x 1-1/2)	135-155 **in-lbs**	15-17.5 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Oil cooler mounting screws	96-108 **in-lbs**	10.8-12.2 Nm	3.13 OIL COOLER, Installation/LOCTITE 271
Oil filter adapter	96-144 **in-lbs**	11-16 Nm	3.18 CRANKCASE, Oil Filter Adapter
Oil line clamp at starter motor	40-50 **in-lbs**	5-5.5 Nm	3.6 ENGINE INSTALLATION, Assembly
Oil line fittings at swingarm	108-156 **in-lbs**	12-17.6 Nm	3.12 OIL LINE FITTINGS, Installation
Oil line p-clamp fastener	40-50 **in-lbs**	4.5-5.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Oil line p-clamp fastener	40-50 **in-lbs**	4.5-5.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Oil pressure signal light switch	96-120 **in-lbs**	10.8-13.6 Nm	3.14 OIL PRESSURE INDICATOR SWITCH, Oil Pressure/LOCTITE 565 HIGH PERFORMANCE PIPE SEALANT WITH TEFLON

FASTENER	TORQUE VALUE		NOTES
Oil pump body and cover fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.10 OIL PUMP, Assembly/Installation
Oil pump body and cover fasteners	108-156 **in-lbs**	12.2-17.6 Nm	3.10 OIL PUMP, Assembly/Installation
Oil pump body and cover fasteners	96-120 **in-lbs**	11-13.8 Nm	3.10 OIL PUMP, Assembly/Installation
Oil pump body and cover fasteners	72-96 **in-lbs**	8-11 Nm	3.10 OIL PUMP, Assembly/Installation
Pinion shaft nut	19-21 ft-lbs	26-29 Nm	3.17 GEARCASE AND CAM GEARS, Assembly and Installation/Plus an additional 15° to 19° rotation
Piston jet assembly screws	25-35 **in-lbs**	2.8-4.0 Nm	3.18 CRANKCASE, Piston Jets/TORX, LOCTITE LOW STRENGTH THREADLOCKER 222 (purple)
Pushrod cover screws	30-40 **in-lbs**	3.4-4.5 Nm	3.7 CYLINDER HEAD, Push Rod Cover Installation
Pushrod cover screws	30-40 **in-lbs**	3-5 Nm	3.16 HYDRAULIC LIFTERS, Installation
Rear isolator assembly fasteners	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Rear isolator bolt	25-27 ft-lbs	33.9-36.6 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Rear isolator bolt	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Rear muffler bracket	32-36 ft-lbs	43.4-48.8 Nm	3.6 ENGINE INSTALLATION, Assembly/LOCTITE 271 (red)
Reed valve block fasteners	25-35 **in-lbs**	2.8-4.0 Nm	3.15 CRANKCASE BREATHING SYSTEM, Reed Valve Replacement/LOCTITE 222 (purple)
Reed valve stop fastener	5-7 **in-lbs**	0.6-0.8 Nm	3.15 CRANKCASE BREATHING SYSTEM, Reed Valve Replacement/LOCTITE 222 (purple)
Stabilizer bracket fastener	66-78 **in-lbs**	7.5-8.8 Nm	3.13 OIL COOLER, Installation
Swingarm pivot shaft	44-46 ft-lbs	60-62 Nm	3.6 ENGINE INSTALLATION, Assembly/ANTI-SEIZE
Swingarm pivot shaft pinch bolt	17-19 ft-lbs	23-25.8 Nm	3.6 ENGINE INSTALLATION, Assembly/LOCTITE 271 (red)
Throttle cable retention device fasteners	36-40 **in-lbs**	4-4.5 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Upper rocker cover screws	120-168 **in-lbs**	13.6-18.9 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
V bracket to main frame	120-144 **in-lbs**	13.6-16.3 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
V bracket to main frame	120-144 **in-lbs**	13.6-16.3 Nm	3.6 ENGINE INSTALLATION, Assembly

SPECIFICATIONS 3.2

GENERAL

NOTE

*Service wear limits are given as a guideline for measuring components that are **not new**. For measurement specifications not given under SERVICE WEAR LIMITS, see NEW COMPONENTS.*

Table 3-1. General Engine Specifications

ITEM	SPECIFICATION	
Type	2 cylinder, air cooled, four-stroke 45 degree V-twin	
Compression ratio	10:1	
Bore (all models)	3.50 in.	88.9 mm
Stroke (XB9SX)	3.125 in.	79.38 mm
Stroke (XB12 models)	3.812 in.	96.82 mm
Engine displacement (XB9SX)	60.05 cu. in.	984cc
Engine displacement (XB12 models)	73.4 cu. in.	1203cc
Oil capacity (with filter change)	2.5 quarts	2.37 liters

Table 3-2. Engine Ignition Specifications

ITEM	SPECIFICATION	
Type	Sequential, non-waste spark	
Regular idle	1050-1150 RPM	
Spark plug size	12 mm	
Spark plug type	Harley-Davidson No. 10R12X	
Spark plug gap	0.035 in.	0.8890 mm
Spark plug torque	12-18 ft-lbs	16-24 Nm

Table 3-3. Valve and Valve Seat Specifications

VALVE	NEW COMPONENTS		SERVICE WEAR LIMITS	
Fit in guide (exhaust)	0.001-0.003 in.	0.0254-0.0762 mm	0.0038 in.	0.965 mm
Fit in guide (intake)	0.001-0.003 in.	0.0254-0.0762 mm	0.0038 in.	0.965 mm
Seat width	0.040-0.062 in.	1.016-1.575 mm	0.090 in.	2.286 mm
Stem protrusion from cylinder valve pocket	2.028-2.064 in.	51.511-52.426 mm	2.082 in.	52.8828 mm

Table 3-4. Valve Spring Specifications

VALVE SPRING	NEW COMPONENTS		SERVICE WEAR LIMITS	
Free length	2.325 in.	59.1 mm	2.325 mm (min)	59.1 mm (min)
Intake 1.850 in. (closed)	135 lbs	61.2 kg		
Intake 1.300 in. (open)	312 lbs	141.5 kg		

Table 3-4. Valve Spring Specifications

VALVE SPRING	NEW COMPONENTS		SERVICE WEAR LIMITS	
Exhaust 1.850 in. (closed)	135 lbs	61.2 kg		
Exhaust 1.300 in. (open)	312 lbs	141.5 kg		

Table 3-5. Rocker Arm Specifications

ROCKER ARM	NEW COMPONENTS		SERVICE WEAR LIMITS	
Shaft fit in bushing (loose)	0.0005-0.0020 in.	0.0127-0.0508 mm	0.0035 in.	0.0889 mm
End clearance	0.003-0.013 in.	0.076-0.330 mm	0.025 in.	0.635 mm
Bushing fit in rocker arm (tight)	0.004-0.002 in.	0.102-0.0559 mm		
Rocker arm shaft fit in rocker cover (loose)	0.0007-0.0022 in.	0.018-0.056 mm	0.0035 in.	0.0889 mm

Table 3-6. Piston Ring and Piston Pin Specifications

PISTON	NEW COMPONENTS		SERVICE WEAR LIMITS	
Compression ring gap (top and 2nd)	0.007-0.020 in.	0.178-0.508 mm	0.032 in.	0.813 mm
Oil control ring rail gap	0.009-0.052 in.	0.229-1.321 mm	0.065 in.	1.651 mm
Compression ring side clearance (top)	0.0020-0.0045 in.	0.0508-0.1143 mm	0.0065 in.	0.1651 mm
Compression ring side clearance (2nd)	0.0016-0.0041 in.	0.0406-0.1041 mm	0.0065 in.	0.1651 mm
Oil control ring side clearance	0.0016-0.0076 in.	0.0406-0.1930 mm	0.0094 in.	0.2388 mm
Pin fit (loose, at room temperature)	0.00005-0.00045 in.	0.00127-0.01143 mm	0.00100 in.	0.02540 mm

Table 3-7. Cylinder Head Specifications

CYLINDER HEAD	NEW COMPONENTS		SERVICE WEAR LIMITS	
Valve guide in head (tight)	0.0033-0.0020 in.	0.0838-0.0508 mm		
Valve seat in head (tight)	0.0035-0.0010 in.	0.0889-0.0254 mm		
Head gasket surface (flatness)	0.006 in. total	0.152 mm total	0.006 in. total	0.152 mm total

Table 3-8. Cylinder Specifications

CYLINDER	NEW COMPONENTS		SERVICE WEAR LIMITS	
Taper			0.002 in.	0.051 mm
Out of round			0.003 in.	0.076 mm
Warpage, top (gasket surfaces)			0.006 in.	0.152 mm
Warpage, base (gasket surfaces)			0.008 in.	0.203 mm
Bore diameter ±0.0002 in., standard	3.4978 in.	88.8441 mm	3.5008 in.	88.9203 mm

Table 3-9. Connecting Rod Specifications

CONNECTING ROD	NEW COMPONENTS		SERVICE WEAR LIMITS	
Piston pin fit (loose)	0.00145-0.00155 in.	0.03683-0.03937 mm	0.00200 in.	0.0508 mm
Side play between flywheels	0.005-0.031 in.	0.1-0.8 mm	0.036 in.	0.9 mm
Fit on crankpin (loose)	0.0004-0.0017 in.	0.0102-0.0432 mm	0.0027 in.	0.0686 mm

Table 3-10. Hydraulic Lifter Specifications

HYDRAULIC LIFTER	NEW COMPONENTS		SERVICE WEAR LIMITS	
Fit in guide	0.008-0.0020 in.	0.0203-0.0508 mm	0.0030 in.	0.0762 mm
Roller fit	0.0006-0.0010 in.	0.0152-0.0254 mm	0.0015 in.	0.0381 mm
Roller end clearance	0.008-0.022 in.	0.203-0.559 mm	0.026 in.	0.660 mm

Table 3-11. Oil Pump Specifications

OIL PUMP	NEW COMPONENTS		SERVICE WEAR LIMITS	
Oil pressure @ idle (1050-1150 RPM)	10-16 PSI	69-110 kPa		
Oil pressure @ 3000 RPM	20-28 PSI	138-193 kPa		
Feed/scavenge inner/outer gerotor clearance	0.003 in.	0.076 mm	0.004 in.	0.102 mm

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Table 3-12. Gearcase Specifications

GEARCASE	NEW COMPONENTS		SERVICE WEAR LIMITS	
Cam gear shaft in bore (loose)	0.0007-0.0022 in.	0.018-0.056 mm	0.003 in.	0.076 mm
Cam gear shaft end play (min)	0.005-0.014 in.	0.127-0.356 mm	0.025 in.	0.635 mm
Front intake cam gear shaft end play (min)	0.005-0.022 in.	0.127-0.559 mm	0.033 in.	0.838 mm

Table 3-13. Flywheel Specifications

FLYWHEEL	NEW COMPONENTS		SERVICE WEAR LIMITS	
Runout (flywheels at rim)	0.000-0.010 in.	0.000-0.254 mm	0.010 in.	0.254 mm
Runout (shaft at flywheel end)	0.000-0.002 in.	0.000-0.051 mm	0.002 in.	0.051 mm
End play	0.003-0.013 in.	0.076-0.330 mm	0.013 in.	0.330 mm

Table 3-14. Pinion Shaft (Right Main) Bearing Specifications

PINION SHAFT BEARINGS	NEW COMPONENTS		SERVICE WEAR LIMITS	
Pinion shaft journal diameter	1.2496-1.2500 in.	31.740-31.750 mm	1.2496 in. (min)	31.7340 mm (min)
Outer race diameter in right crankcase	1.5646-1.5652 in.	39.741-39.756 mm	1.5656 in.(max)	39.776 mm (max)

Table 3-14. Pinion Shaft (Right Main) Bearing Specifications

PINION SHAFT BEARINGS	NEW COMPONENTS		SERVICE WEAR LIMITS	
Bearing running clearance	0.00012-0.00086 in.	0.003-0.022 mm		
Fit in oil pump body bore.	0.0023-0.0043 in.	0.058-0.109 mm	0.0050 in.	0.127 mm

Table 3-15. Sprocket Shaft Bearing Specifications

ITEM	SPECIFICATION (INTERFERENCE FIT)	
Outer race fit in crankcase (tight)	0.006 in.	0.152 mm
Inner race fit on shaft (tight)	0.006 in.	0.152 mm

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ADJUSTMENT/TESTING

General

When an engine needs repair, it is not always possible to determine definitely beforehand whether repair is possible with only cylinder head, cylinder and piston disassembled or whether complete engine disassembly is required for crankcase repair.

Most commonly, only cylinder head and cylinder repair is needed (valves, rings, piston, etc.) and it is recommended procedure to service these units first, allowing engine crankcase to remain in frame.

See 3.4 ENGINE ROTATION FOR SERVICE to strip motorcycle for removal of cylinder head, cylinder, and piston.

After disassembling "upper end" only, it may be found that crankcase repair is necessary. In this situation, remove the engine crankcase from the chassis.

NOTE

If engine is removed from chassis, do not lay engine on primary side. Placing engine on primary side will damage clutch cable end fitting. If fitting is damaged, clutch cable must be replaced.

See 1.20 TROUBLESHOOTING. Symptoms indicating a need for engine repair are often misleading, but generally, if more than one symptom is present, possible causes can be narrowed down to make at least a partial diagnosis. An above-normal consumption of oil, for example, could be caused by several mechanical faults. However, when accompanied by blue-gray exhaust smoke and low engine compression, it indicates the piston rings need replacing. Low compression by itself, however, may indicate improperly seated valves, in addition to or in lieu of worn piston rings.

Most frequently, valves, rings, pins, bushings, and bearings need attention at about the same time. If the possible causes can be narrowed down through the process of elimination to indicate any one of the above components is worn, it is best to give attention to all of the cylinder head and cylinder parts.

COMPRESSION TEST

PART NUMBER	TOOL NAME
HD-33223-1	CYLINDER COMPRESSION GAUGE

Combustion chamber leakage can result in unsatisfactory engine performance. A compression test can help determine the source of cylinder leakage. Use CYLINDER COMPRESSION GAUGE (Part No. HD-33223-1).

A proper compression test should be performed with the engine at normal operating temperature when possible. Proceed as follows:

NOTE

After completing the compression test(s), make sure that the throttle plate is in the closed position before starting engine. Engine will start at an extremely high RPM if throttle plate is left open.

1. Disconnect spark plug wire. Clean around plug base and remove spark plug.
2. Connect compression tester to cylinder.
3. With throttle body throttle plate in wide open position, crank engine continuously through 5-7 full compression strokes.
4. Note gauge readings at the end of the first and last compression strokes. Record test results.
5. Compression is normal if final readings are 120 psi (827 kPa) or more.
6. Inject approximately 1/2 oz. (15 ml) of SAE 30 oil into cylinder and repeat the compression test. Readings that are considerably higher during the second test indicate worn piston rings.

Table 3-16. Compression Test Results

DIAGNOSIS	TEST RESULTS
Ring trouble	Compression low on first stroke; tends to build up on the following strokes but does not reach normal; improves considerably when oil is added to cylinder.
Valve trouble	Compression low on first stroke; does not build up much on following strokes; does not improve considerably with the addition of oil.
Head gasket leak	Same reaction as valve trouble.

CYLINDER LEAKAGE TEST

PART NUMBER	TOOL NAME
HD-35667A	CYLINDER LEAKDOWN TESTER

The cylinder leakage test pinpoints engine problems including leaking valves, worn, broken or stuck piston rings and blown head gaskets. The cylinder leakage tester applies compressed air to the cylinder at a controlled pressure and volume, and measures the percent of leakage from the cylinder.

Use a CYLINDER LEAKDOWN TESTER (Part No. HD-35667A) and follow the instructions supplied with the tester.

The following are some general instructions that apply to Buell motorcycle engines:

1. Run engine until it reaches normal operating temperature.
2. Stop engine. Clean dirt from around spark plug and remove spark plug.
3. Remove air cleaner and set induction module throttle plate in wide open position.
4. The piston, in cylinder being tested, must be at top dead center of compression stroke during test.
5. To keep engine from turning over when air pressure is applied to cylinder, engage transmission in fifth gear and lock the rear brake.
6. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent leakdown. Any cylinder with 12% leakdown, or more, requires further attention.

7. Refer to Table 3-17. Listen for air leaks at induction intake, exhaust and head gasket.

NOTE

If air is escaping through valves, check push rod length.

8. Repeat procedure on rear cylinder.

NOTE

After completing the compression test(s), make sure that the throttle plate is in the closed position before starting engine. Engine will start at an extremely high RPM if throttle plate is left open.

Table 3-17. Air Leakage Test

AIR LEAK LOCATION	POSSIBLE CAUSES
Throttle body intake	Intake valve leaking.
Exhaust pipe	Exhaust valve leaking.
Head gasket	Leaking gasket.

DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION

Perform the Compression Test. See 3.3 ENGINE, Compression Test.

If further testing is needed, remove the suspect cylinder heads and inspect the following:

- Oil level
- Valve guide seals
- Valve guide-to-valve stem clearance
- Gasket surface of both the cylinder head and the cylinder
- Piston ring wear

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ENGINE ROTATION FOR SERVICE 3.4

GENERAL

The following process allows you to rotate engine down, pivoting on rear isolator mount, in order to service components in the top end.

NOTE

The engine does not need to be removed from chassis in order to perform top end repairs.

DISASSEMBLY

NOTES

- *Before vehicle is placed on the lift it is necessary to remove the chin fairing. See 2.50 CHIN FAIRING.*
- *Vehicle should be placed onto the lift with front tire placed in the wheel vise in order to successfully perform this procedure.*

1. Disconnect fuel pump electrical connector and run vehicle until it is out of fuel. See 4.14 FUEL PUMP.

NOTES

- *This step is always performed in order to purge fuel lines.*
- *The connection for fuel pump is just above the pump located at the rear of the fuel tank on the left side of the vehicle.*

WARNING

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

2. Remove seat and disconnect battery cables from battery: negative cable (black) first.
3. Remove intake cover. See 2.38 INTAKE COVER.
4. Remove air filter base plate. See 4.3 AIR CLEANER ASSEMBLY.

NOTE

When removing the left air scoop, the alternator and voltage regulator harnesses and connections are secured to the bottom of the air scoop with three cable straps.

5. Remove left and right air scoops. See 2.49 AIR SCOOPS.

NOTE

The velocity stack has a clamp ring securing it to the throttle body.

6. Remove throttle body velocity stack.
7. Cover throttle body to prevent objects from falling into the intake.
8. See Figure 3-1. Disconnect fuel line (7).
9. Disconnect the throttle position sensor [88] (8).
10. Disconnect the fuel injector connectors [84 & 85] (5).
11. Disconnect the intake air control (IAC).

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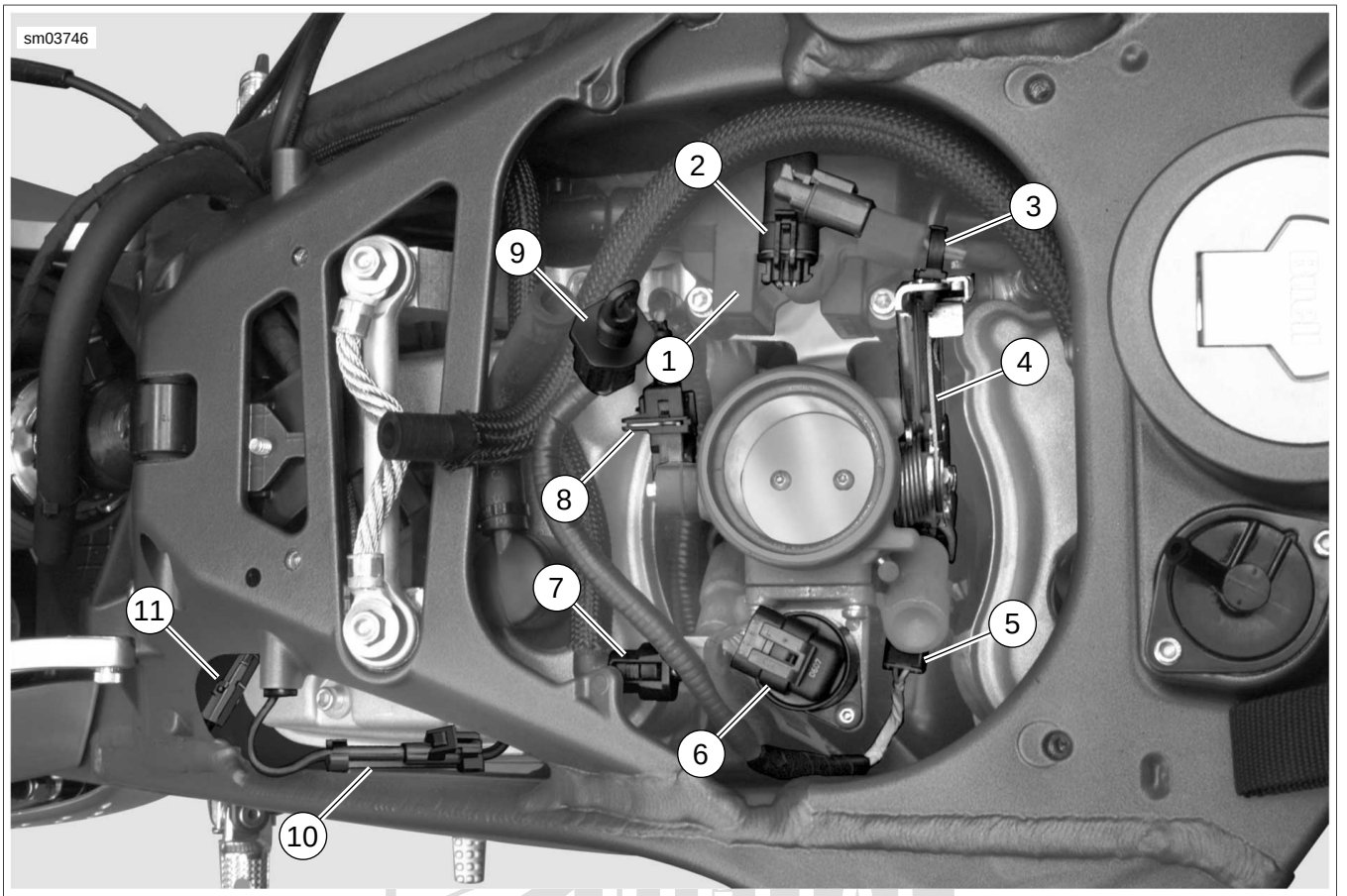


1. **Coil**
2. **Coil connection [83]**
3. **Coil wire harness retaining clip**
4. **Throttle cables**
5. **Fuel injector connections [84 & 85]**
6. **IAC sensor connection [87]**
7. **Fuel line connection**
8. **Throttle position sensor connection [88]**
9. **IAT sensor [89]**
10. **Engine temperature sensor connection [90]**
11. **Oxygen sensor connection [137]**

Figure 3-1. Fuel Line, Connections and Throttle Cables

12. Disconnect the ignition coil connector (2) [83] and remove ignition coil.

NOTE

It will be necessary to remove the sensor connectors from the retainer securing them to the main frame above the rear cylinder head.

13. Disconnect the following sensors:
    a. Temperature sensor (10) [90].
    b. Oxygen sensor (11) [137].
14. Remove idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY.

NOTE

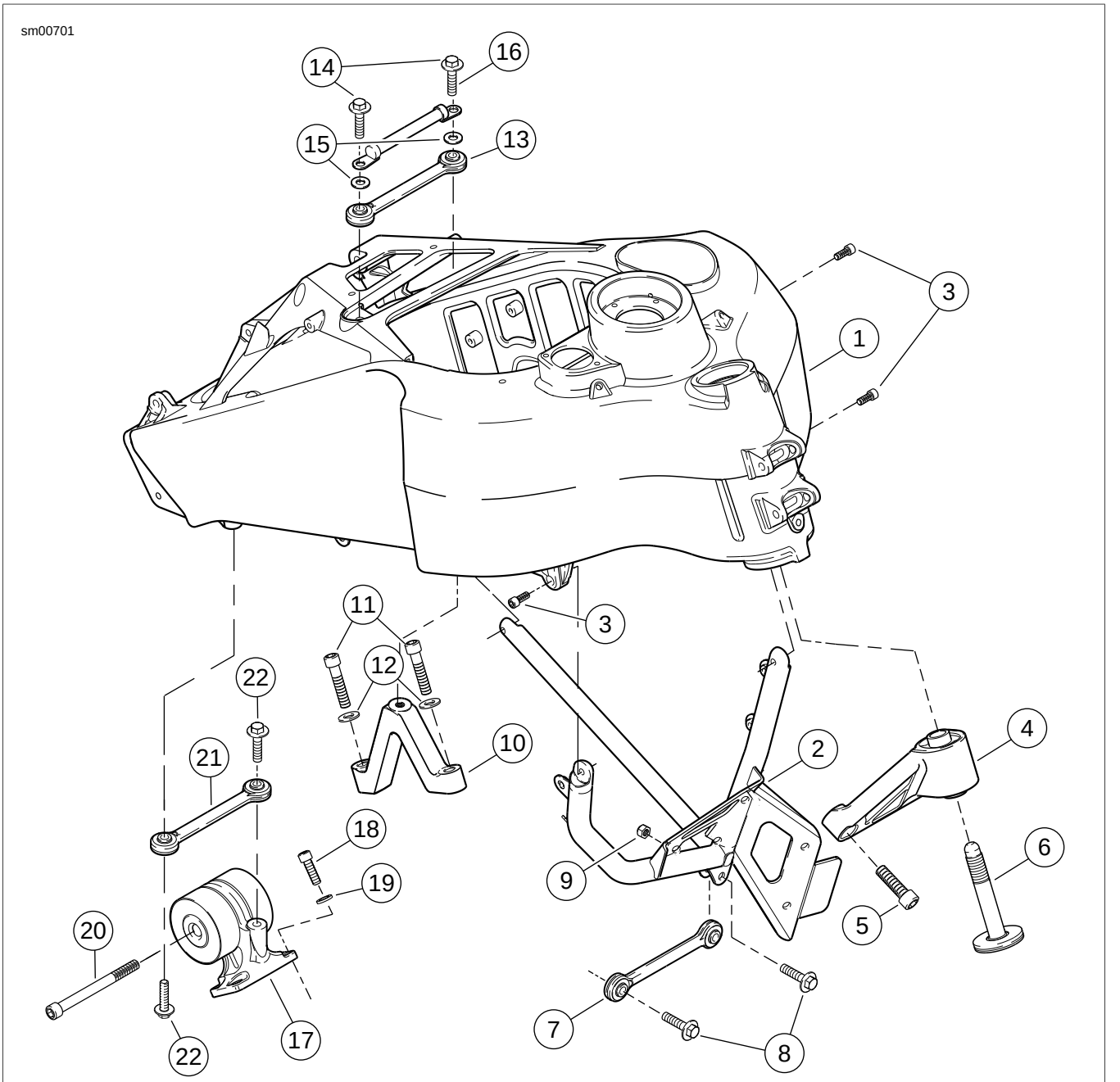
See 6.17 INTERACTIVE EXHAUST SYSTEM for specific details on removal of interactive components.

15. Remove muffler. See 4.18 EXHAUST SYSTEM.

NOTE

Secure right side rider footrest mount to the side to prevent cosmetic damage.

16. Remove left and right side rider footrest and support plate. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING or 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.
17. Disconnect clutch cable.
    a. Slide clutch cable adjuster boot up to access clutch adjuster.
    b. Loosen clutch adjuster to release tension from hand lever.
    c. Remove clutch cable ferrule from hand lever.



1. **Frame assembly**
2. **"V" bracket**
3. **Fasteners for "V" bracket (3)**
4. **Front isolator assembly**
5. **Fasteners (2)**
6. **Bolt**
7. **Front tie bar assembly**
8. **Fasteners for front tie bar assembly (2)**
9. **Nut for one fastener for front tie bar assembly**
10. **Center tie bar mount**
11. **Fasteners for center tie bar mount (2)**
12. **Washers for center tie bar mount (2)**
13. **Center tie bar assembly**
14. **Fasteners for center tie bar assembly (2)**
15. **Washers for center tie bar assembly (2)**
16. **Ground strap**
17. **Rear isolator assembly**
18. **Fasteners for rear isolator assembly (4)**
19. **Washers for rear isolator assembly (4)**
20. **Rear isolator bolt**
21. **Rear tie bar assembly**
22. **Fasteners for rear tie bar assembly (2)**

Figure 3-2. Engine Mounting System

18. Support engine with wide scissors jack.

NOTE

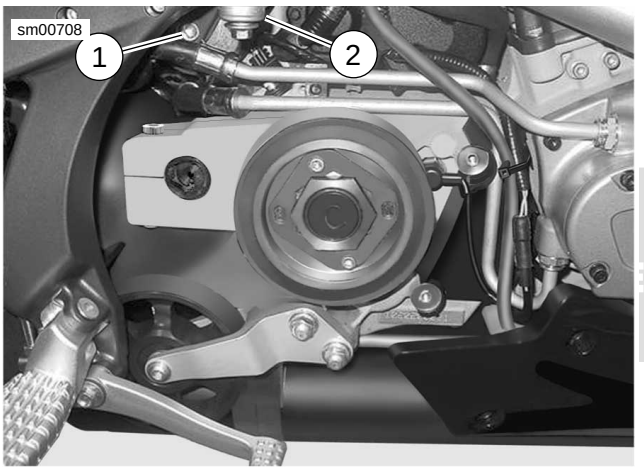
Cut the two cable straps securing the crank position sensor (CKP) wire to the "V" bracket.

19. Disconnect the CKP [79] on the left side of the "V" bracket.
20. See Figure 3-2. Remove "V" bracket (2) and fasteners (3) from main frame.
21. Remove center tie bar (13) from engine.
22. See Figure 3-3. Remove rear tie bar (2) from frame only.
23. Loosen rear isolator bolt. DO NOT REMOVE.
24. See Figure 3-2. Remove front isolator bolt (6).
25. Remove front isolator mount (4) from engine.

NOTE

It will be necessary to remove the plastic clip securing the coil wire to the throttle cable bracket and move harness out of the way in order to loosen jamnuts on the throttle cables for engine rotation.

26. Rotate engine down.



1. **Rear isolator bolt**
2. **Rear tie bar**

Figure 3-3. Rear Isolator Bolt and Rear Tie Bar (Typical)

ASSEMBLY

NOTES

- *If exhaust header was removed during service it must be torqued with the engine rotated in the down position. It is not possible to reach fasteners on the rear exhaust at the head with engine rotated in the up position.*
- *Tighten header nuts gradually, alternating between studs to verify that exhaust rings are flush with engine. Tighten fasteners to 72-96* ***in-lbs*** *(8.1-10.8 Nm).*

1. When repairs have been completed, rotate engine back up into frame.

NOTE

When installing and tightening isolator bolt it is important to keep load off of isolator bolt for installation purposes. Alternate between tightening isolator bolt and raising engine with scissors jack.

2. See Figure 3-2. Insert front isolator bolt (6) through front isolator (4) and loosely thread into frame. Do not tighten at this point.
3. Install isolator mounting fasteners (5) and tighten to 49-51 ft-lbs (66.4-69.1 Nm).
4. Tighten front isolator bolt to 49-51 ft-lbs (66.4-69.1 Nm).
5. See Figure 3-2. Tighten rear isolator bolt (20) to 25-27 ft-lbs (33.9-36.6 Nm).
6. Install rear tie bar (21) to frame and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
7. See Figure 3-2. Install center tie bar (13) to engine and tighten to 30-33 ft-lbs (41-45 Nm).
8. See Figure 3-2. Install front "V" bracket (2) with oil cooler to main frame.
   a. Install "V" bracket to main frame from the left side of the vehicle and tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
   b. See Figure 3-2. Install front tie-bar (3) to "V" bracket and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
9. Connect CKP [79] and attach CKP wiring harness to "V" bracket with two cable straps.
10. Remove scissors jack.
11. Connect clutch cable to handlebars and adjust to specifications. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.

NOTE

It will be necessary to install the sensor connectors into the retaining clips securing them to the main frame above the rear cylinder head.

12. See Figure 3-2. Attach the following connectors:
    a. Cylinder head temperature sensor connector [90] (10).
    b. Oxygen sensor connector [137] (11).
    c. Idle air control sensor [87] (6).
    d. Throttle position sensor [88] (8).
    e. Fuel injector leads [84 &85] (5).
    f. Spark plug cables to coil.

NOTE

When installing the throttle cables at the throttle body you need to avoid allowing the elbows of the throttle cables to rotate up when tightening the throttle cable jamnuts. This can cause the cable elbows to contact the frame. See Figure 3-4 for correct routing of the cables.

Figure 3-4. Throttle cable elbow alignment

13. Tighten the throttle cable jamnuts to 36-40 **in-lbs** (4-4.5 Nm).
14. Install the ignition coil (1) and coil connection [83] (2) and tighten fasteners to 120-144 **in-lbs** (13.6-16.3 Nm).
15. Attach plastic clip (3) securing the coil wire to the throttle cable bracket.

NOTE

Remove shop towel from entrance of throttle body to verify proper operation of induction module.

16. Connect fuel line (7).
17. Install throttle body velocity stack with retaining ring.
18. Install air filter base plate. See 4.3 AIR CLEANER ASSEMBLY.
19. Install muffler. See 4.18 EXHAUST SYSTEM.

NOTES

- *Due to the location of the CKP it will be necessary to align the Torca clamp to verify proper clearance between the chin fairing and the CKP and Torca clamp.*
- *For 1200 model motorcycles with interactive exhaust systems see 6.17 INTERACTIVE EXHAUST SYSTEM.*

20. Install idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY.
21. Install left and right side rider footpeg mount. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIRE-BOLT/LIGHTNING or 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.
22. Install sprocket cover. See 2.36 SPROCKET COVER.

NOTE

When installing the left side air scoop it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

23. Install air scoops, right and left sides. See 2.49 AIR SCOOPS.

NOTE

The connection for fuel pump is just above the pump located at the rear of the fuel tank on the left side of the vehicle.

24. Connect fuel pump. See 4.14 FUEL PUMP.
25. Install intake cover. See 2.38 INTAKE COVER.
26. Connect negative ground cable to battery and tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

27. Install seat.
28. Remove motorcycle from lift.
29. Install chin fairing. See 2.50 CHIN FAIRING.

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ENGINE REMOVAL 3.5

DISASSEMBLY

NOTES

- *Vehicle should be placed onto the lift with rear tire in the wheel vise in order to successfully perform this procedure.*
- *For 1200 models with interactive exhaust systems see 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING.*

1. Disconnect fuel pump electrical connector and run vehicle until it is out of fuel. See 4.14 FUEL PUMP.

NOTES

- *This step is always performed in order to purge fuel lines.*
- *The connection for fuel pump is just above the pump located at the rear of the fuel tank on the left side of the vehicle.*

2. Drain oil tank. See 1.6 ENGINE OIL AND FILTER.

⚠WARNING

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

3. Remove seat and disconnect battery: negative cable (black) first.
4. Remove intake cover and air cleaner assembly. See 2.49 AIR SCOOPS.

NOTE

When removing the left air scoop, the alternator and voltage regulator harnesses and connections are secured to the bottom of the air scoop with three cable straps.

5. Remove left and right side air scoops. See 2.50 CHIN FAIRING.
6. Remove chin fairing. See 2.50 CHIN FAIRING.

NOTES

- *A clamp ring secures the velocity stack to the throttle body.*
- *Install shop towel in entrance to throttle body to prevent objects from falling into the induction module.*

7. Remove throttle body velocity stack.
8. See Figure 3-5. Disconnect fuel line (7).
9. Disconnect the ignition coil connector [83] (2) and remove the ignition coil (1).
10. Disconnect throttle position sensor [88] (8).
11. Disconnect fuel injector leads [84], [85] (5).
12. Disconnect idle air control [87] (6).

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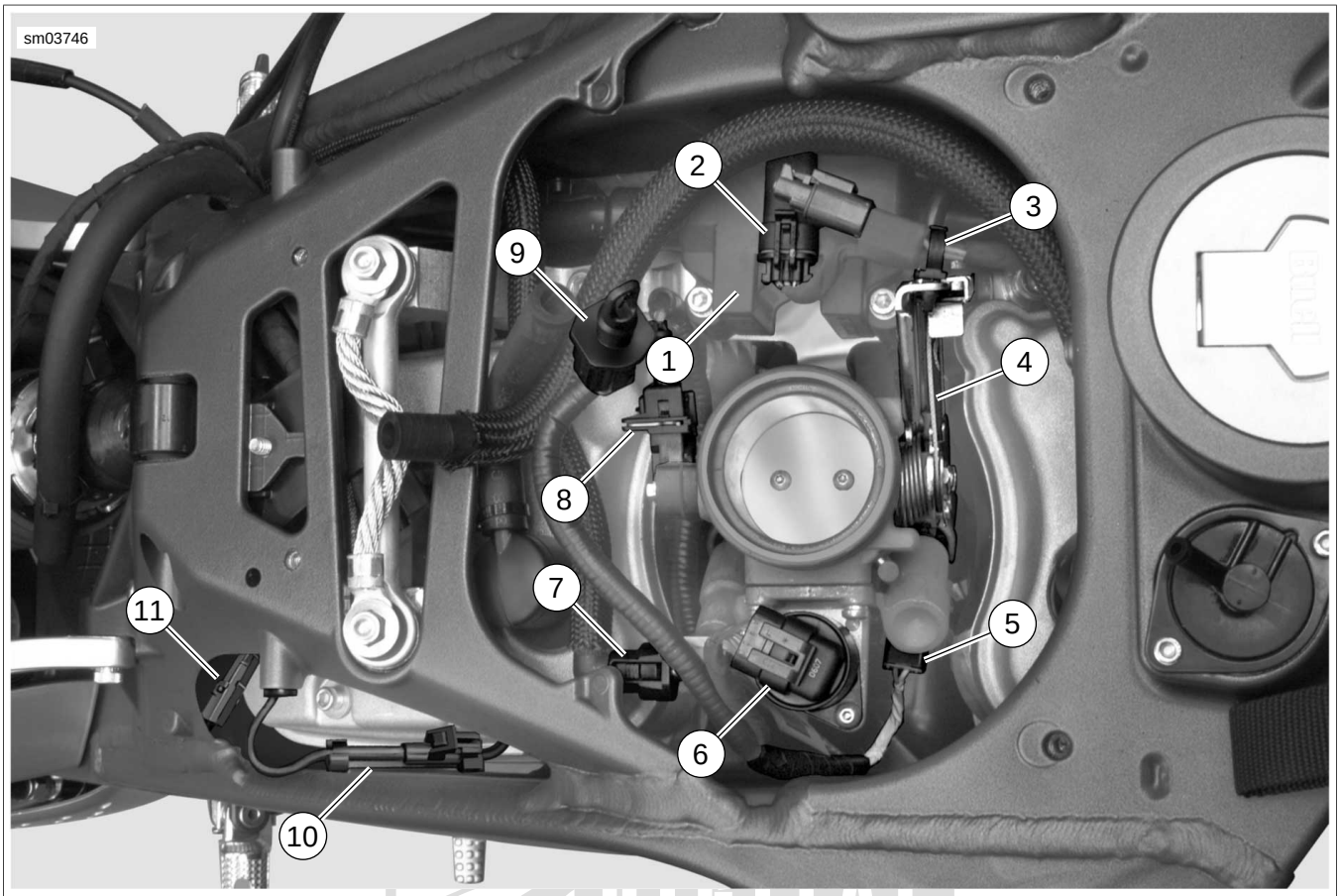


1. **Coil**
2. **Coil connection [83]**
3. **Coil wire harness retaining clip**
4. **Throttle cables**
5. **Fuel injector connections [84 & 85]**
6. **IAC sensor connection [87]**
7. **Fuel line connection**
8. **Throttle position sensor connection [88]**
9. **IAT sensor [89]**
10. **Engine temperature sensor connection [90]**
11. **Oxygen sensor connection [137]**

Figure 3-5. Fuel Line, Connections and Throttle Cables

NOTES

- *It will be necessary to remove plastic clip (3) securing coil wire to throttle cable bracket and move harness out of the way in order to loosen jamnuts on the throttle cables for engine removal.*
- *It will be necessary to remove the sensor connectors from the retainer securing them to the main frame above the rear cylinder head.*

13. Disconnect the following sensors:
    a. Temperature sensor [90] (10).
    b. Oxygen sensor [137] (11).
14. Disconnect throttle cables from induction module/throttle body.

NOTE

In order to remove the rear drive belt, it will be necessary to remove all existing belt guards.

15. Remove rear belt and idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY.
16. Remove transmission sprocket. See 5.17 TRANSMISSION SPROCKET.

NOTE

For details on the interactive exhaust system, see 6.17 INTERACTIVE EXHAUST SYSTEM.

17. Remove muffler. See 4.18 EXHAUST SYSTEM.
18. See Figure 3-8. Remove oil filter (4).

NOTE

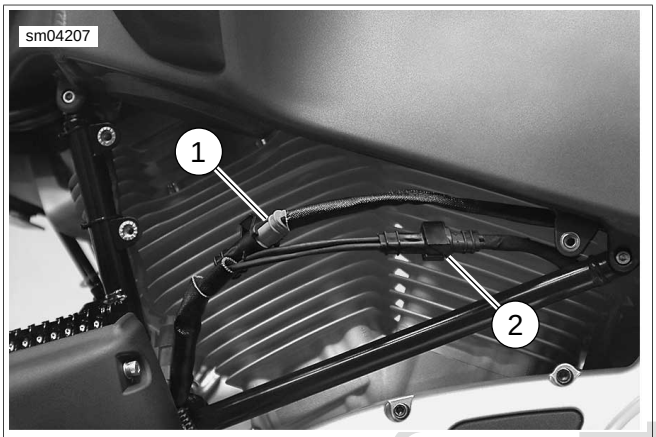
Secure right side rider footrest mount to the side of the motorcycle to prevent cosmetic damage.

19. Remove both side rider footrest and support plate. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING or 2.49 AIR SCOOPS.

20. Disconnect clutch cable.
    a. Slide clutch cable adjuster boot (2) up to access clutch adjuster.
    b. Loosen clutch adjuster to release tension from hand lever.
    c. Remove clutch cable ferrule from hand lever.

NOTE

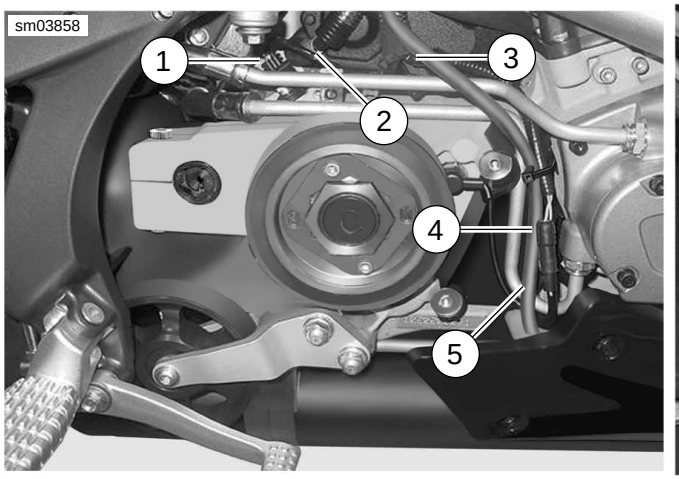
Anytime front tie-bar is removed, it must first be removed from the "V" bracket and then the engine. When installing the tie-bar, first mount to engine and then to "V" bracket in order to prevent damage to threaded area of crankcase.

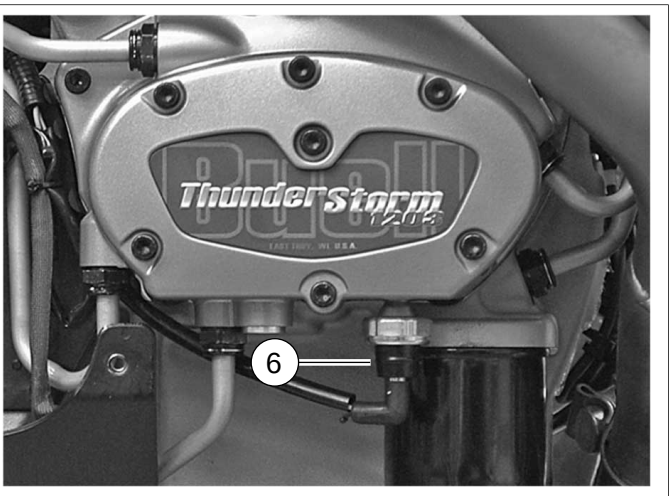


1. **Alternator connector**
2. **Voltage regulator connector**

Figure 3-6. Alternator and Voltage Regulator Connectors

21. See Figure 3-9. Remove front "V" bracket with oil cooler from main frame.
    a. Disconnect alternator connector [46] (1) and voltage regulator connector [77] (2) in order to remove the "V" bracket.
    b. Remove the two cable straps securing the CKP harness to the "V" bracket on the left side of the engine.
    c. Disconnect CKP.
    d. Disconnect oil cooler lines at oil cooler.
    e. Remove front tie-bar (7) from "V" bracket.
    f. Remove front tie-bar (7) from engine.
    g. Unbolt "V" bracket from main frame and remove "V" bracket.
22. Remove center tie-bar (13) from engine.
23. Remove rear tie bar (21) from frame.
24. Remove the cable strap securing the oil pressure wire, neutral safety wire and muffler actuator cable in a bundle on the right side of the motorcycle just behind the oil pump body.
25. Remove cable strap securing the positive cable from starter and the main harness to the transmission vent line.
26. See Figure 3-7. Disconnect electrical components:
    a. Neutral switch [131] (4).
    b. Speedometer sensor [65] (1) (remove cable strap).
    c. Positive battery cable at starter (2).
    d. Starter solenoid [128] (3).
    e. Oil pressure switch [120] (6).





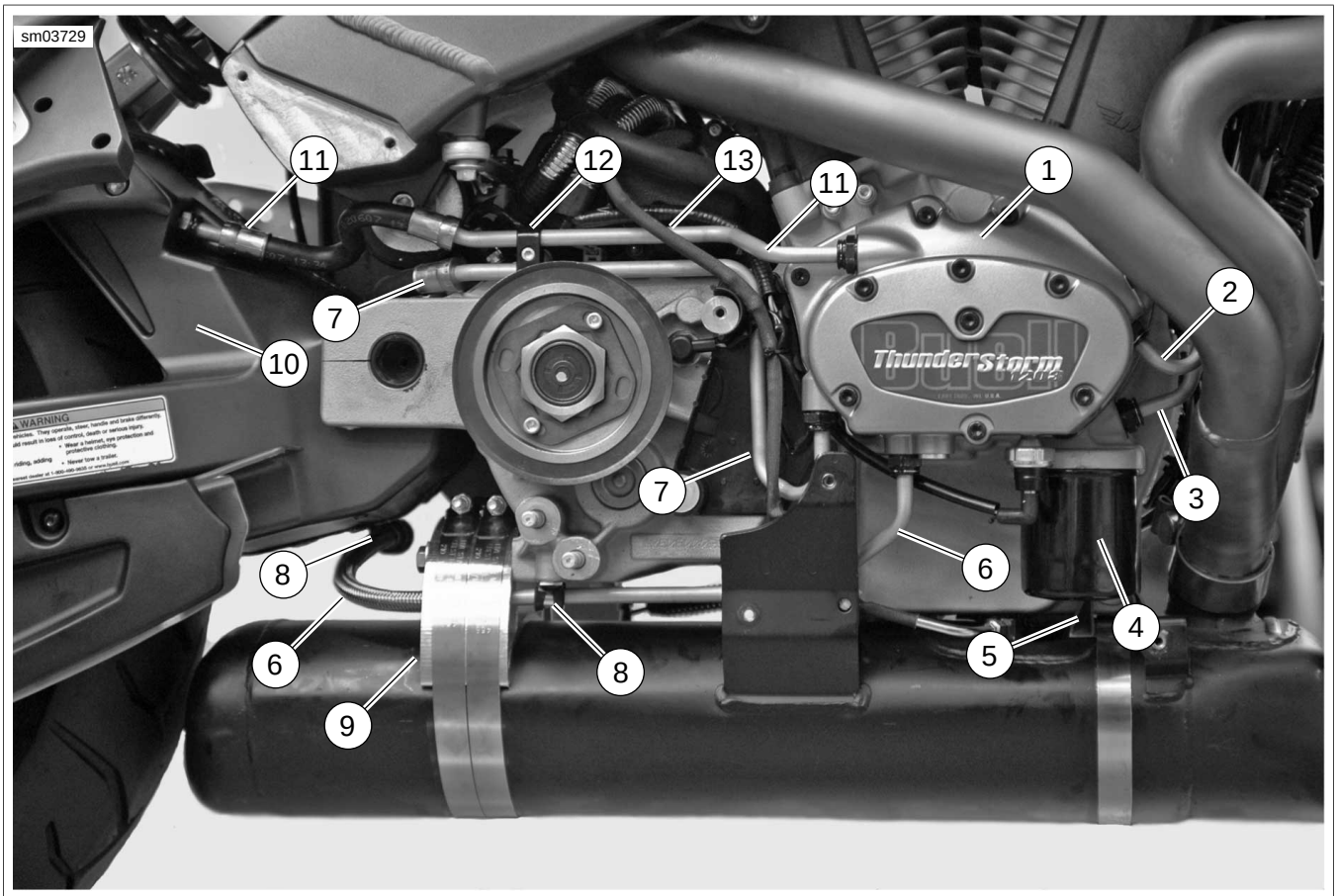
1. **Speedometer sensor [65]**
2. **Positive battery cable at starter**
3. **Starter solenoid [128]**
4. **Neutral switch [131] connection**
5. **Interactive exhaust cable**
6. **Oil pressure switch [120]**

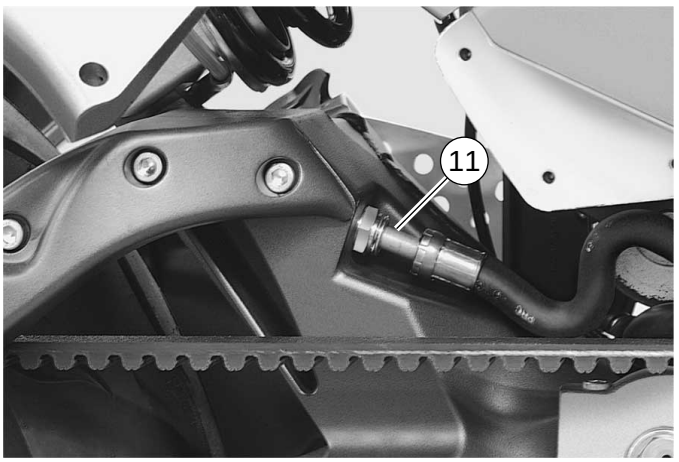
Figure 3-7. Electrical Connections on Right Side of Motorcycle

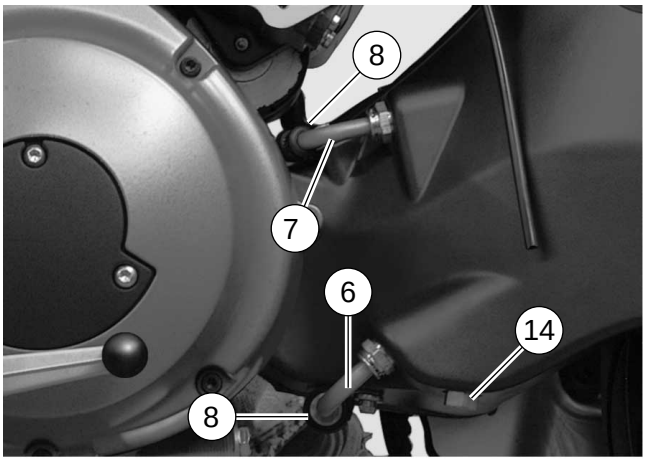
27. See 3.12 OIL LINE FITTINGS. Remove all oil lines (including lines to oil cooler).

28. See Figure 3-8. Remove vent oil line (11).
    a. Remove clamp (12) in front of starter securing vent oil line to return oil line.
    b. Disconnect vent oil line from oil pump.
    c. Disconnect vent oil line at swingarm/oil reservoir (10) and remove. See 3.12 OIL LINE FITTINGS.
29. Remove feed oil line (6).
    a. Remove two p-clamps (8) from feed oil line (one on crankcase and one on swingarm/oil reservoir.
    b. Remove feed oil line (6) at oil pump (1).
    c. Disconnect feed oil line at swingarm/oil reservoir and remove. See 3.12 OIL LINE FITTINGS.
30. Remove return oil line (7).
    a. Remove p-clamp (8) at swingarm/oil reservoir (10).
    b. Disconnect oil return line (7) at swingarm/oil reservoir (10). See 3.12 OIL LINE FITTINGS.
    c. Disconnect oil return line (7) at oil pump (1) and remove.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

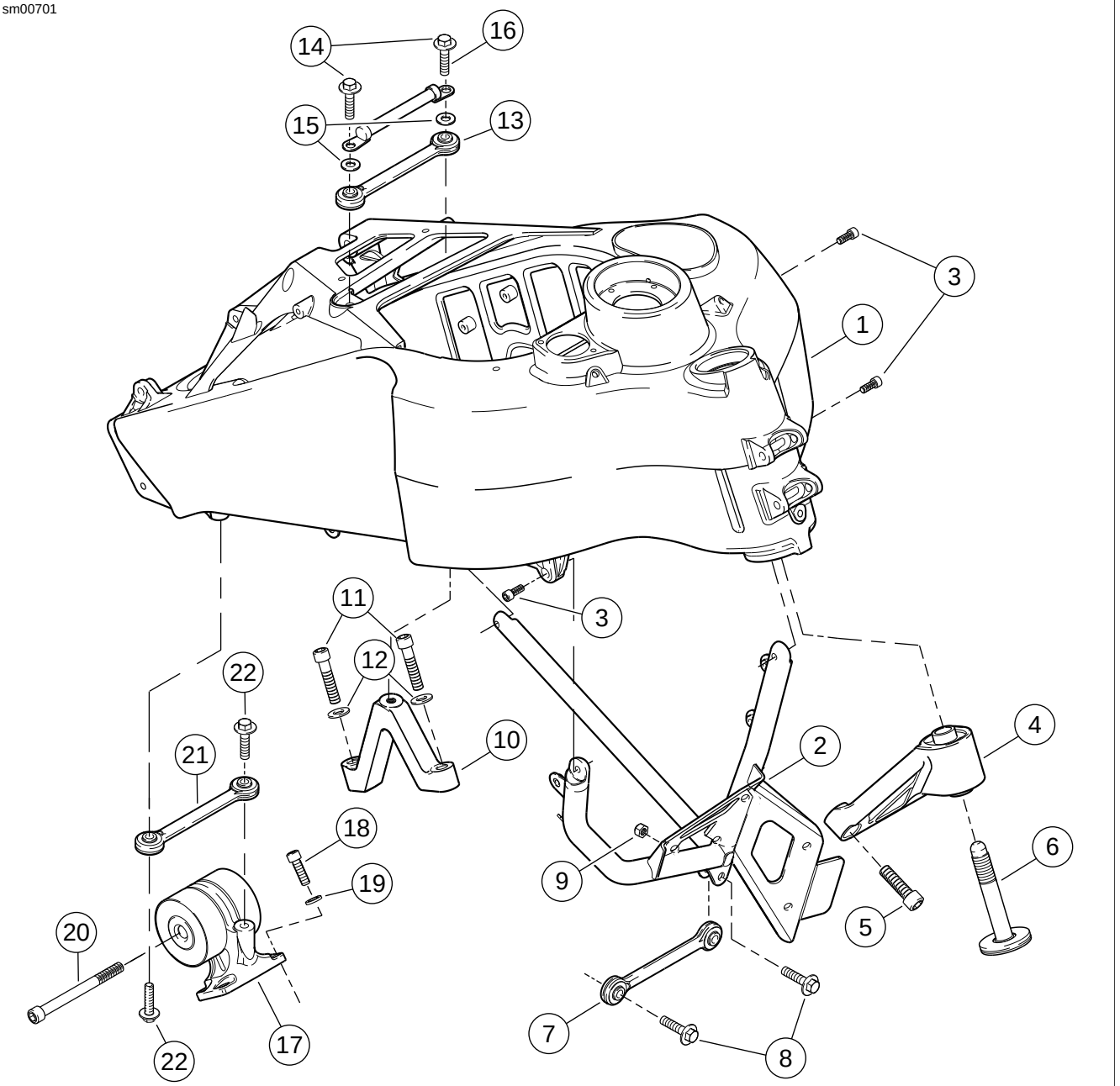






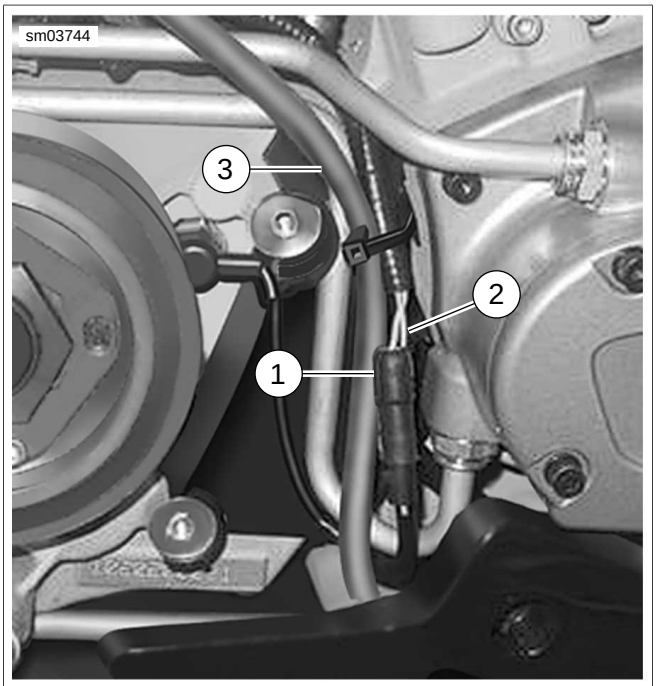
1. Oil pump
2. Oil cooler return line to crankcase
3. Oil cooler feed line from oil pump
4. Oil filter
5. Front muffler mount
6. Feed oil line
7. Return oil line
8. P-clamp
9. Rear muffler bracket
10. Swingarm/Oil reservoir
11. Vent oil line
12. Oil line clamp
13. Cable, interactive exhaust
14. Drain plug

Figure 3-8. Oil Lines and Connections



1. Frame assembly
2. "V" bracket
3. Fasteners for "V" bracket (3)
4. Front isolator assembly
5. Fasteners (2)
6. Bolt
7. Front tie bar assembly
8. Fasteners for front tie bar assembly (2)
9. Nut for one fastener for front tie bar assembly
10. Center tie bar mount
11. Fasteners for center tie bar mount (2)
12. Washers for center tie bar mount (2)
13. Center tie bar assembly
14. Fasteners for center tie bar assembly (2)
15. Washers for center tie bar assembly (2)
16. Ground strap
17. Rear isolator assembly
18. Fasteners for rear isolator assembly (4)
19. Washers for rear isolator assembly (4)
20. Rear isolator bolt
21. Rear tie bar assembly
22. Fasteners for rear tie bar assembly (2)

Figure 3-9. Engine Mounting System



1. **Neutral switch connection [131]**
2. **Oil pressure indicator switch wire**
3. **Interactive exhaust cable**

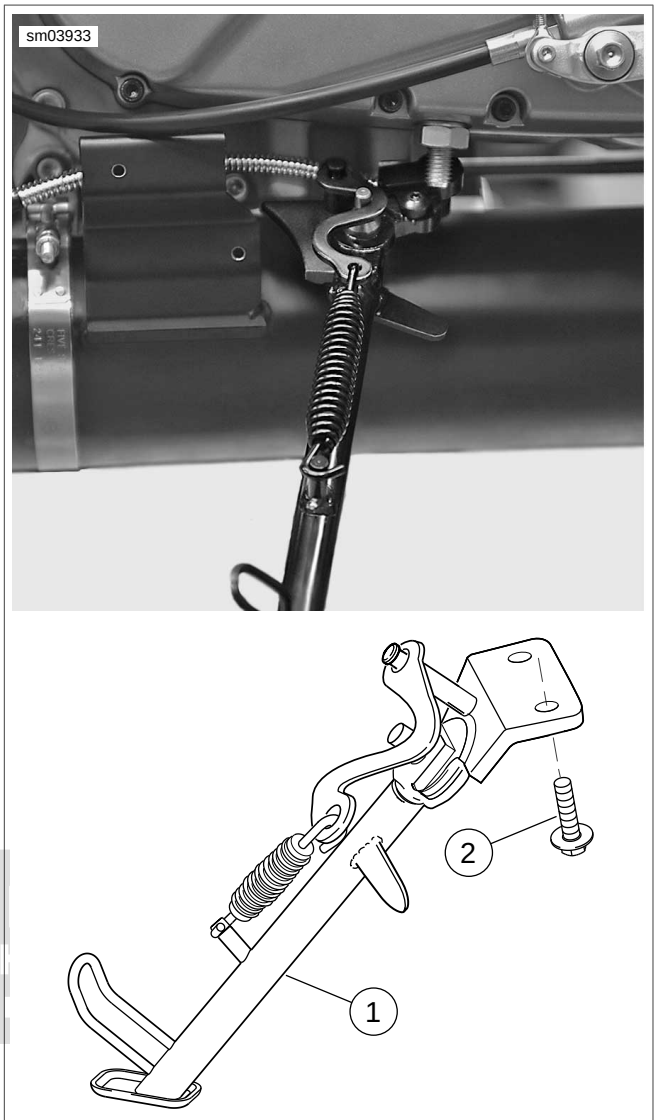
Figure 3-10. Electrical Connectors and Interactive Exhaust Cable Under Sprocket Cover

31. Remove front and rear muffler brackets.
32. See Figure 3-11. Remove two fasteners (2) and remove sidestand assembly.

NOTE

On Ulysses models it will be necessary to remove three fasteners in order to remove the sidestand assembly.

33. Support engine with wide scissors jack.



1. **Sidestand assembly**
2. **Bracket fasteners (2)**

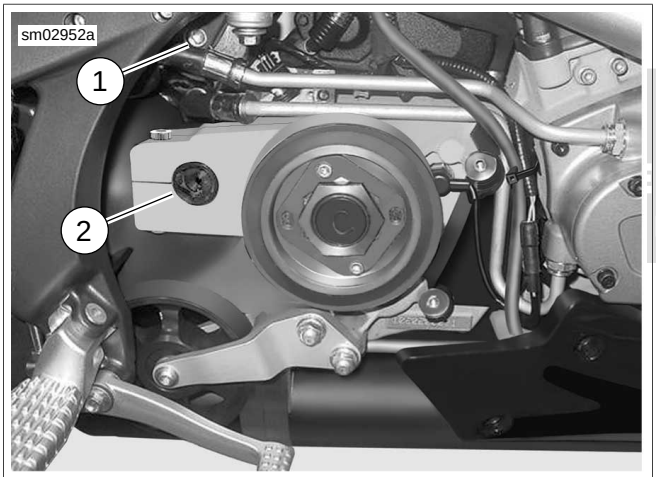
Figure 3-11. Sidestand Assembly (Extended)

NOTE

See Figure 3-12. At this point it is necessary to support main frame with overhead hoist in order to remove rear isolator bolt. Failure to do this will result in main frame dropping slightly.

Figure 3-12. Supporting Vehicle for Disassembly

34. See Figure 3-9. Remove front isolator bolt (6). Remove front isolator assembly fasteners (5).
35. See Figure 3-13. Remove:
    a. Rear isolator bolt (1).
    b. Swingarm pivot shaft (2).



1. **Rear isolator bolt**
2. **Swingarm pivot shaft**

Figure 3-13. Rear Isolator Bolt and Swingarm Pivot Shaft

36. See Figure 3-14. Cut the cable straps holding transmission vent line and pull vent line out of frame leaving it attached to engine.

NOTES

- *On Firebolt models, the transmission vent line runs up the left side of the frame and exits beneath the rear brake reservoir and hose.*
- *On Lightning and Ulysses models, the transmission vent line runs up the left side of the frame and exits underneath the left rear side of the intake cover assembly.*

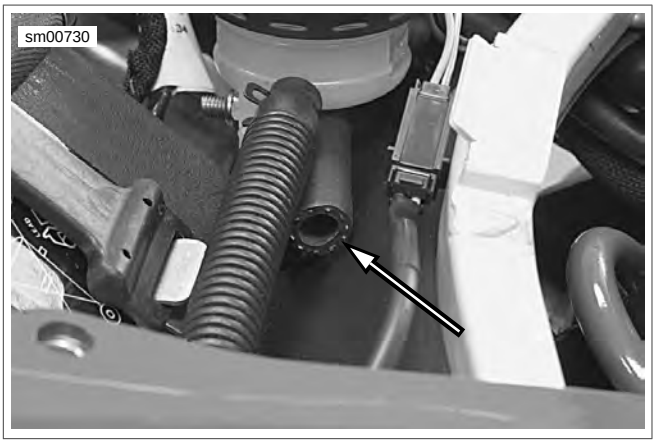


Figure 3-14. Transmission Vent Line: Firebolt

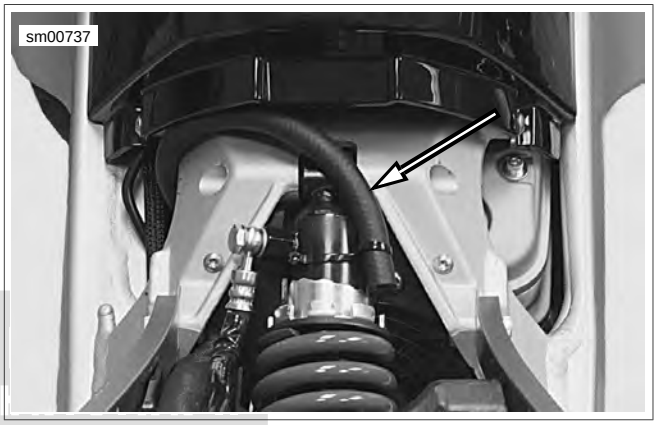


Figure 3-15. Transmission Vent Line: Lightning

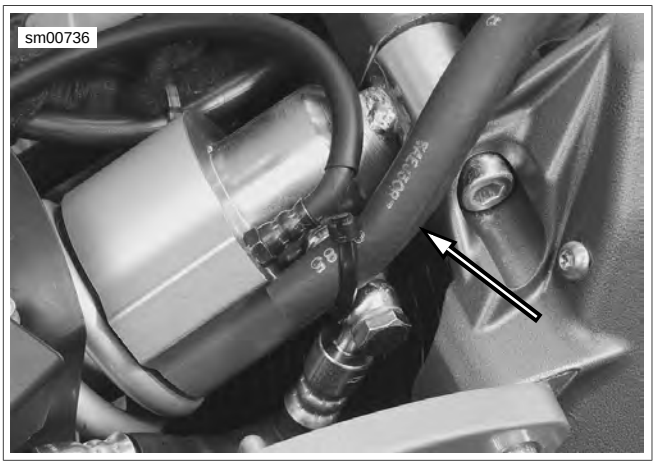


Figure 3-16. Transmission Vent Line: Ulysses

37. Lower engine with scissors lift all the way down.
38. Move the engine assembly from under the main frame to the right side of the lift.
39. Remove engine.

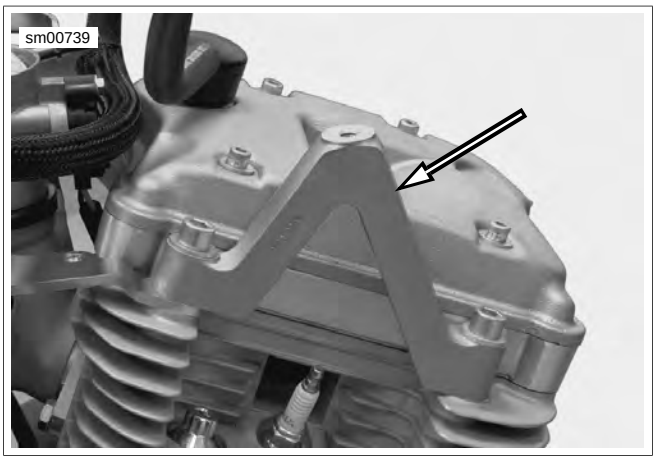
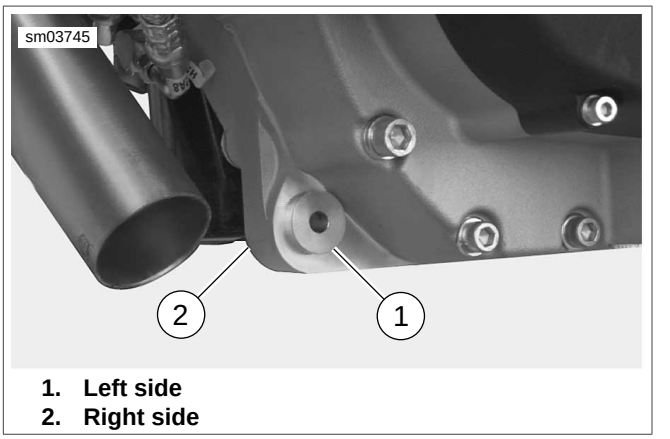


Figure 3-17. Center Tie Bar Mount



1. **Left side**
2. **Right side**

Figure 3-19. Front Exhaust Mount Bushings (2 piece)

40. Once engine has been removed from vehicle, finish removing the following items as required:
    a. Shifter assembly. See 5.3 PRIMARY COVER.
    b. See Figure 3-17. Center tie bar mount.
    c. See Figure 3-18. Swingarm pivot shaft pinch bolt threaded insert.
    d. See Figure 3-19. Aluminum bushings from front exhaust mount.
    e. See Figure 3-20. Wire guard located under the sprocket cover.

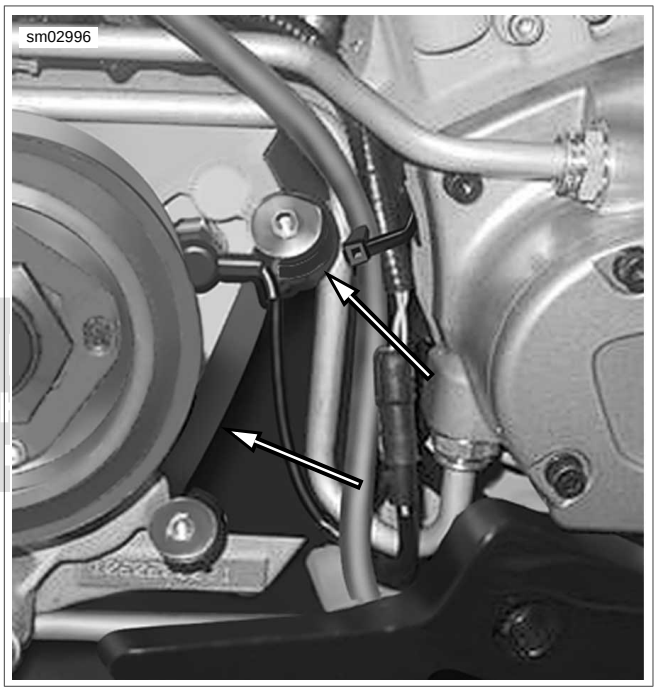


Figure 3-20. Wire Guard

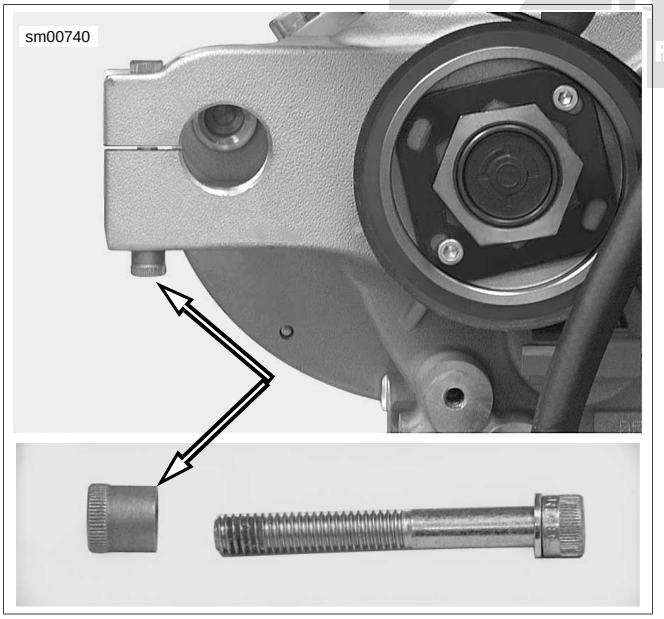


Figure 3-18. Threaded Insert

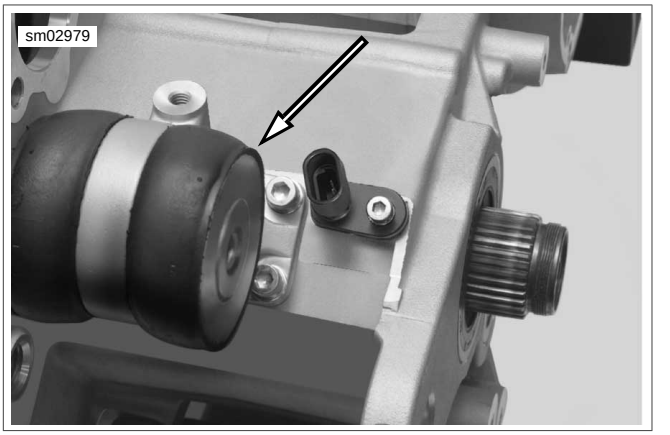


Figure 3-21. Rear Isolator Assembly

41. See Figure 3-21. If the crankcases are being separated it will be necessary to remove rear isolator assembly by removing the forward two fasteners first and then the two rear fasteners (re-install with **new** fasteners).
42. See Figure 3-22. Place a block of wood between rear isolator mount on main frame and swingarm/oil tank.
43. Route a ratcheting tie down through the swingarm bearings, up over the main frame, through the top stabilizer area, back down to the ratchet mechanism and secure swingarm to main frame.

NOTE

See Figure 3-23. This allows the vehicle to remain together as a rolling chassis to be removed from the lift and stored if necessary.

44. Remove overhead support.

Figure 3-22. Securing Vehicle for Relocation

Figure 3-23. Rolling Chassis

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ENGINE INSTALLATION 3.6

ASSEMBLY

Engine Preparation for Re-installation

NOTE

Install components that were removed from engine as were necessary for service prior to installing engine in frame.

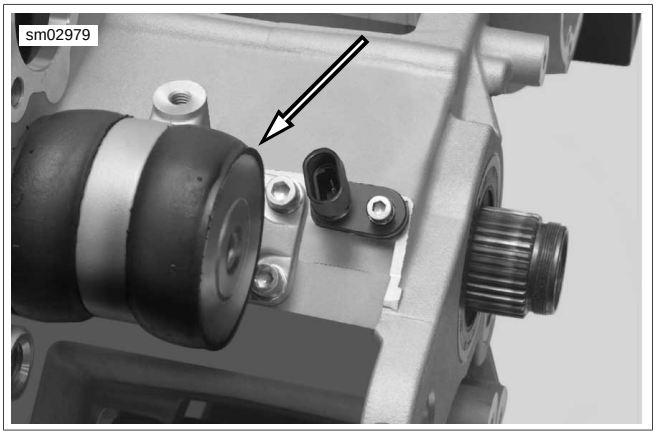


Figure 3-24. Rear Isolator Assembly

1. See Figure 3-24. Install rear isolator assembly by installing the two rear fasteners first and then the two forward fasteners (re-install with **new** fasteners). Tighten to 25-27 ft-lbs (33.9-36.6 Nm).

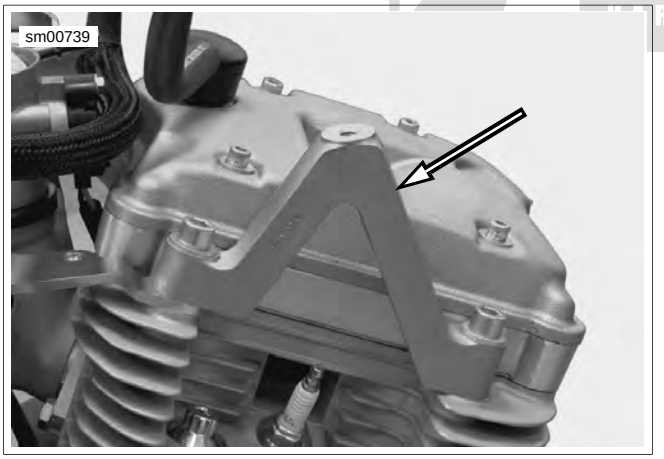


Figure 3-25. Center Tie Bar Mount

2. Install the following items on the engine assembly as required:
   a. Shifter assembly. See 5.3 PRIMARY COVER.
   b. See Figure 3-25. Install center tie bar mount with fasteners and tighten to 30-33 ft-lbs (40.6-44.7 Nm).

NOTE

Hand thread pivot shaft into crankcase prior to installing the threaded insert. Remove pivot shaft after installing the threaded insert.

   c. See Figure 3-26. Apply LOCTITE 242 (blue) to swingarm pivot shaft pinch bolt threaded insert and install.
   d. See Figure 3-27. Install aluminum bushings in front exhaust mount.
   e. Wire guard under the sprocket cover.

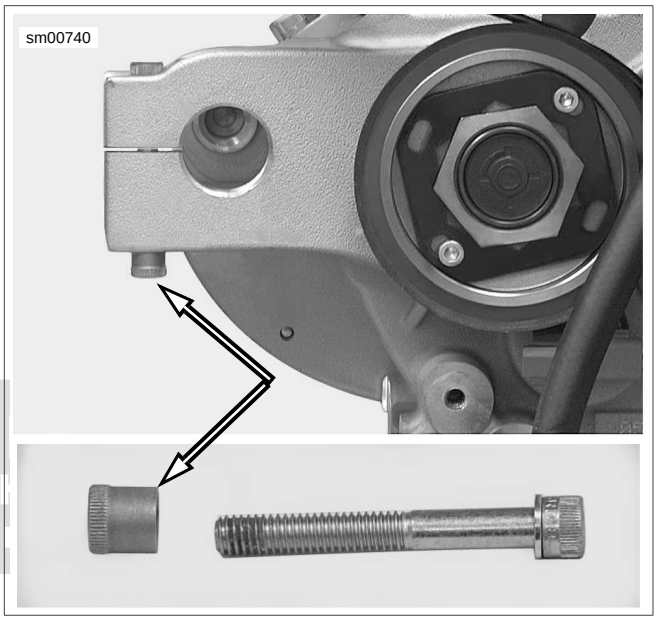
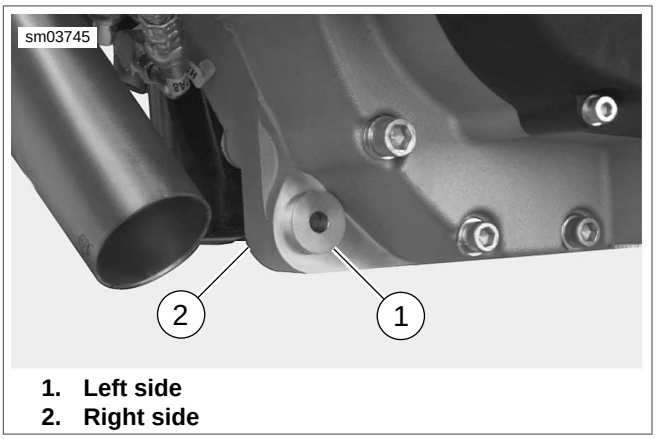


Figure 3-26. Threaded Insert



1. **Left side**
2. **Right side**

Figure 3-27. Front Exhaust Mount Bushings (2 piece)

Installing Engine in Frame

NOTES

- *Vehicle should be placed onto the lift with rear tire in the wheel vise in order to successfully perform this procedure.*
- *At this point it is necessary to support main frame with overhead hoist in order to install rear isolator bolt.*

1. Remove ratcheting tie down and block of wood between rear isolator mount on main frame and swingarm/oil reservoir.

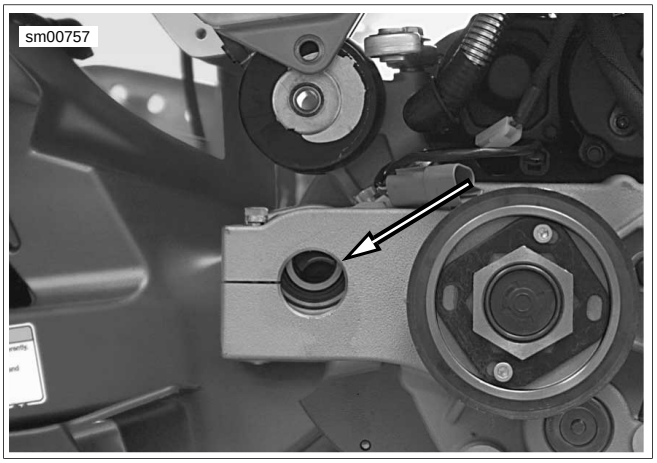


Figure 3-28. Aligning Swingarm to Crankcase for Pivot Shaft Installation (Typical)

Figure 3-29. Supporting Vehicle for Disassembly

2. See Figure 3-28. With engine on a flat scissors jack, raise engine and chassis until swingarm and rear isolator mount align and pivot shaft can be installed.
3. Apply ANTI-SEIZE to swingarm pivot shaft threads and tighten swingarm pivot shaft to 44-46 ft-lbs (60-62 Nm).
4. Apply LOCTITE 271 (red) and tighten swingarm pivot shaft pinch bolt to 17-19 ft-lbs (23-25.8 Nm).
5. Install transmission vent line.
   a. See Figure 3-30. On Firebolt models, route transmission vent line up through left side of frame exiting under the rear master cylinder under the rider's seat. Install two tie wraps to secure transmission vent line in place. Inspect vent line to verify space between vent line and rear exhaust.
   b. See Figure 3-31 (Lightning) or Figure 3-32 (Ulysses). On Lightning and Ulysses models, route transmission vent line up through the left side of frame exiting under the left rear side of the intake cover assembly. Install cable strap to secure transmission vent line in place. Inspect vent line to verify space between vent line and rear exhaust.

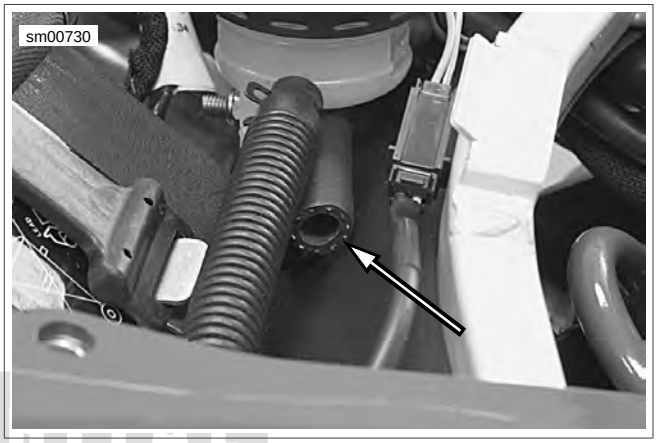


Figure 3-30. Transmission Vent Line: Firebolt

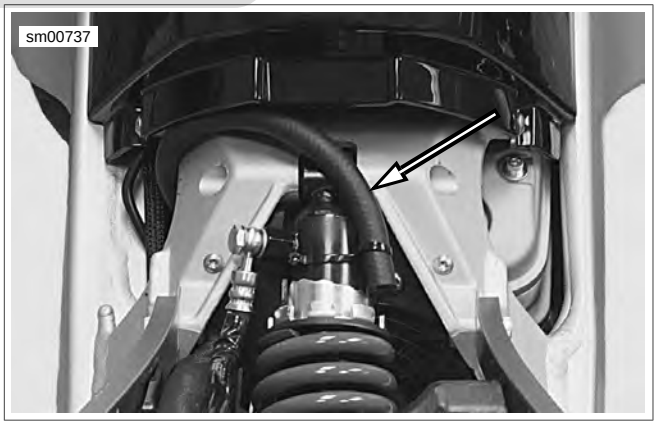


Figure 3-31. Transmission Vent Line: Lightning

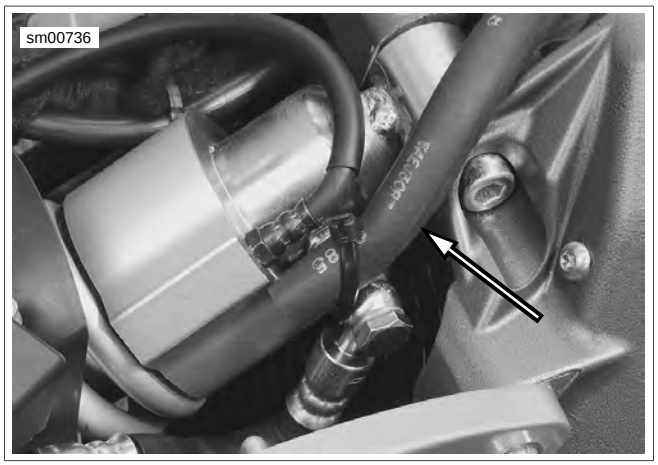


Figure 3-32. Transmission Vent Line: Ulysses

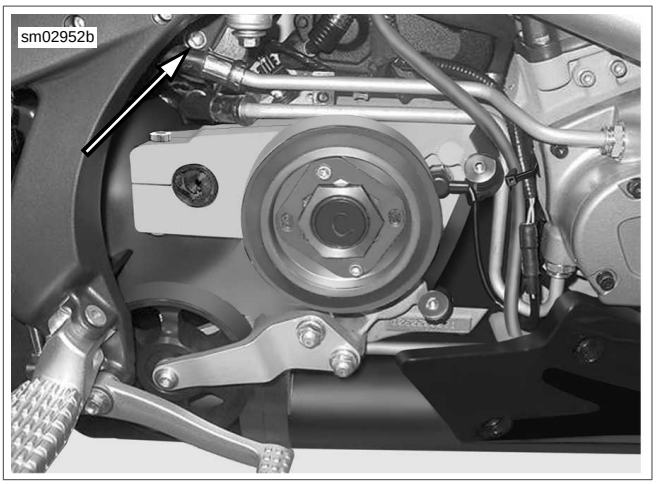
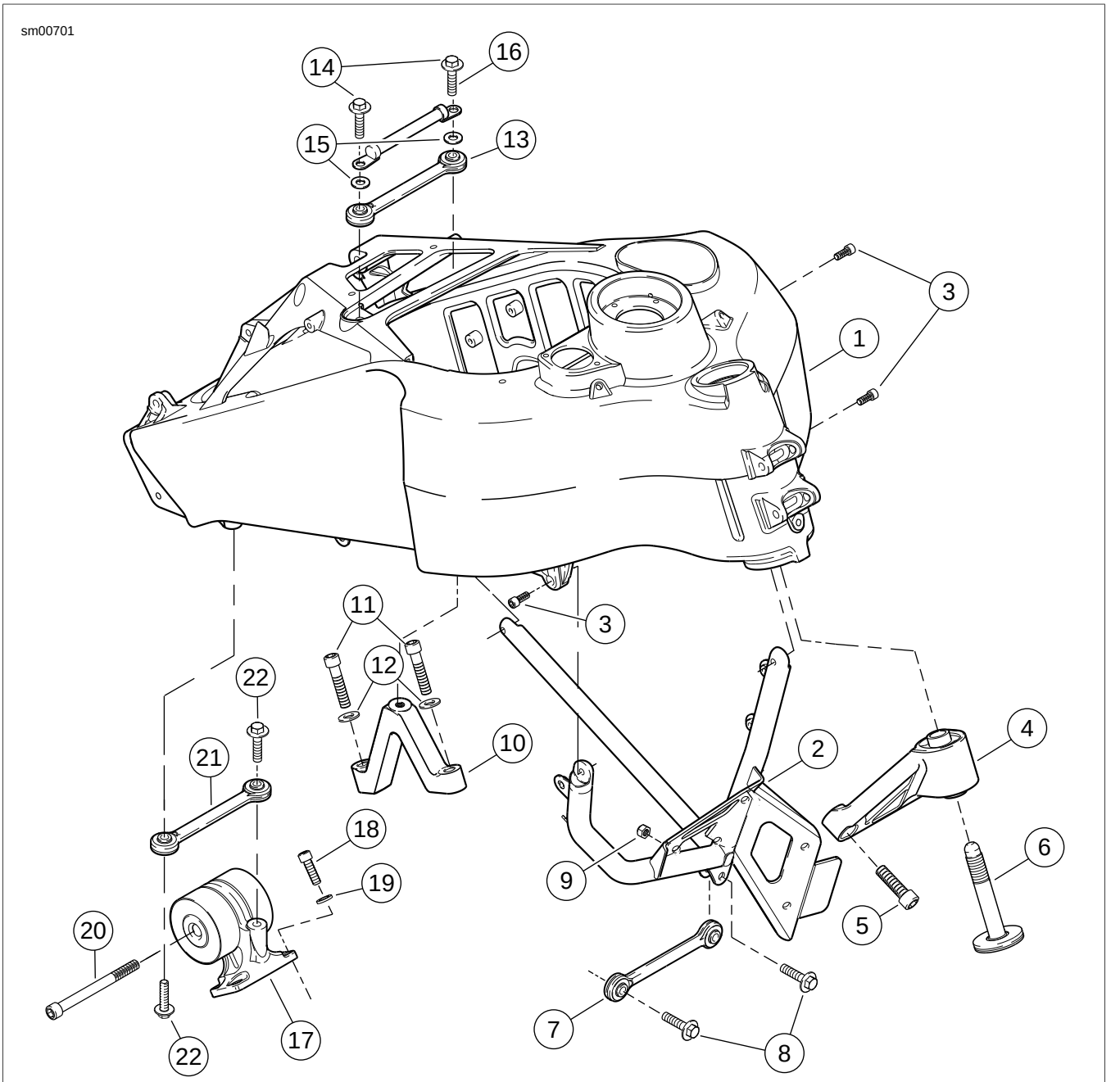


Figure 3-33. Rear Isolator Bolt

6. See Figure 3-33. Using the overhead hoist to align the frame to the rear isolator, install rear isolator bolt and leave loose at this time.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Frame assembly**
2. **"V" bracket**
3. **Fasteners for "V" bracket (3)**
4. **Front isolator assembly**
5. **Fasteners (2)**
6. **Bolt**
7. **Front tie bar assembly**
8. **Fasteners for front tie bar assembly (2)**
9. **Nut for one fastener for front tie bar assembly**
10. **Center tie bar mount**
11. **Fasteners for center tie bar mount (2)**
12. **Washers for center tie bar mount (2)**
13. **Center tie bar assembly**
14. **Fasteners for center tie bar assembly (2)**
15. **Washers for center tie bar assembly (2)**
16. **Ground strap**
17. **Rear isolator assembly**
18. **Fasteners for rear isolator assembly (4)**
19. **Washers for rear isolator assembly (4)**
20. **Rear isolator bolt**
21. **Rear tie bar assembly**
22. **Fasteners for rear tie bar assembly (2)**

Figure 3-34. Engine Mounting System

7. Rotate engine down and install exhaust header only and tighten fasteners to 72-96 **in-lbs** (8.1-10.8 Nm).

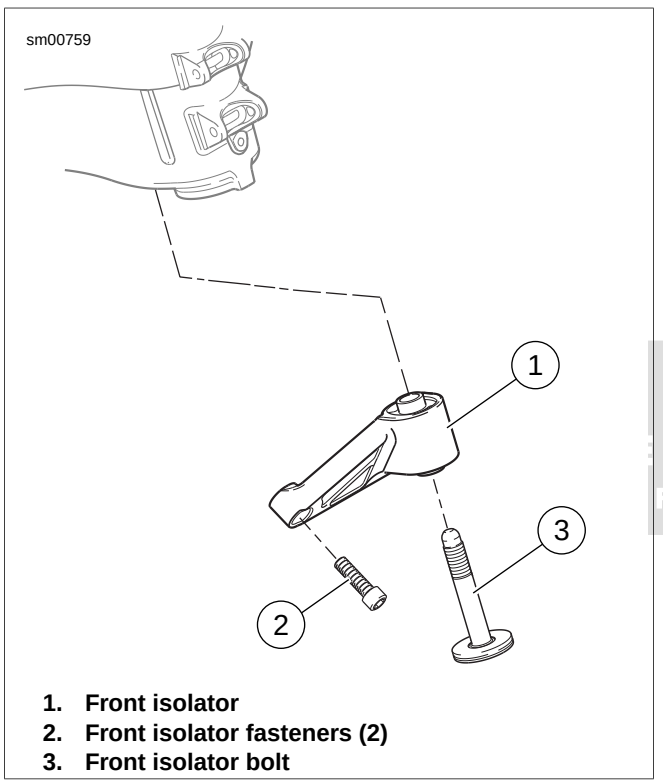
NOTES

- *Exhaust header must be tightened with the engine rotated in the down position. It is not possible to reach fasteners on the rear exhaust at the head with engine rotated in the up position.*
- *It is necessary to tighten the front head pipe first.*
- *Tighten header nuts gradually, alternating between studs to verify that exhaust rings are flush with engine.*

8. When the exhaust header has been tightened, rotate engine back up into frame.

NOTE

When tightening isolator bolt it is important to keep load off of isolator bolt for installation purposes. Alternate between tightening front isolator bolt and raising engine with scissors jack.



1. **Front isolator**
2. **Front isolator fasteners (2)**
3. **Front isolator bolt**

Figure 3-35. Front Isolator

9. See Figure 3-35. Insert front isolator bolt (3) through front isolator (1) and loosely thread into frame. Do not tighten at this point.
10. Install isolator mounting fasteners (2) and tighten to 49-51 ft-lbs (66-69 Nm).
11. Tighten front isolator bolt to 49-51 ft-lbs (66-69 Nm).

NOTE

When installing the tie bar, first mount to engine and then to "V" bracket in order to prevent damage to threaded area of crankcase.

12. Install front tie bar and clutch cable lower retaining clamp to engine and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
13. Install front "V" bracket with oil cooler to main frame.
    a. Install "V" bracket to main frame from the left side of the vehicle and tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
    b. Install front tie bar to "V" bracket and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
14. See Figure 3-34. Install rear tie bar (21) to frame and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
15. Install center tie bar (13) to engine and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
16. Tighten rear isolator bolt (20) to 25-27 ft-lbs (33.9-36.6 Nm).
17. Remove scissors jack.

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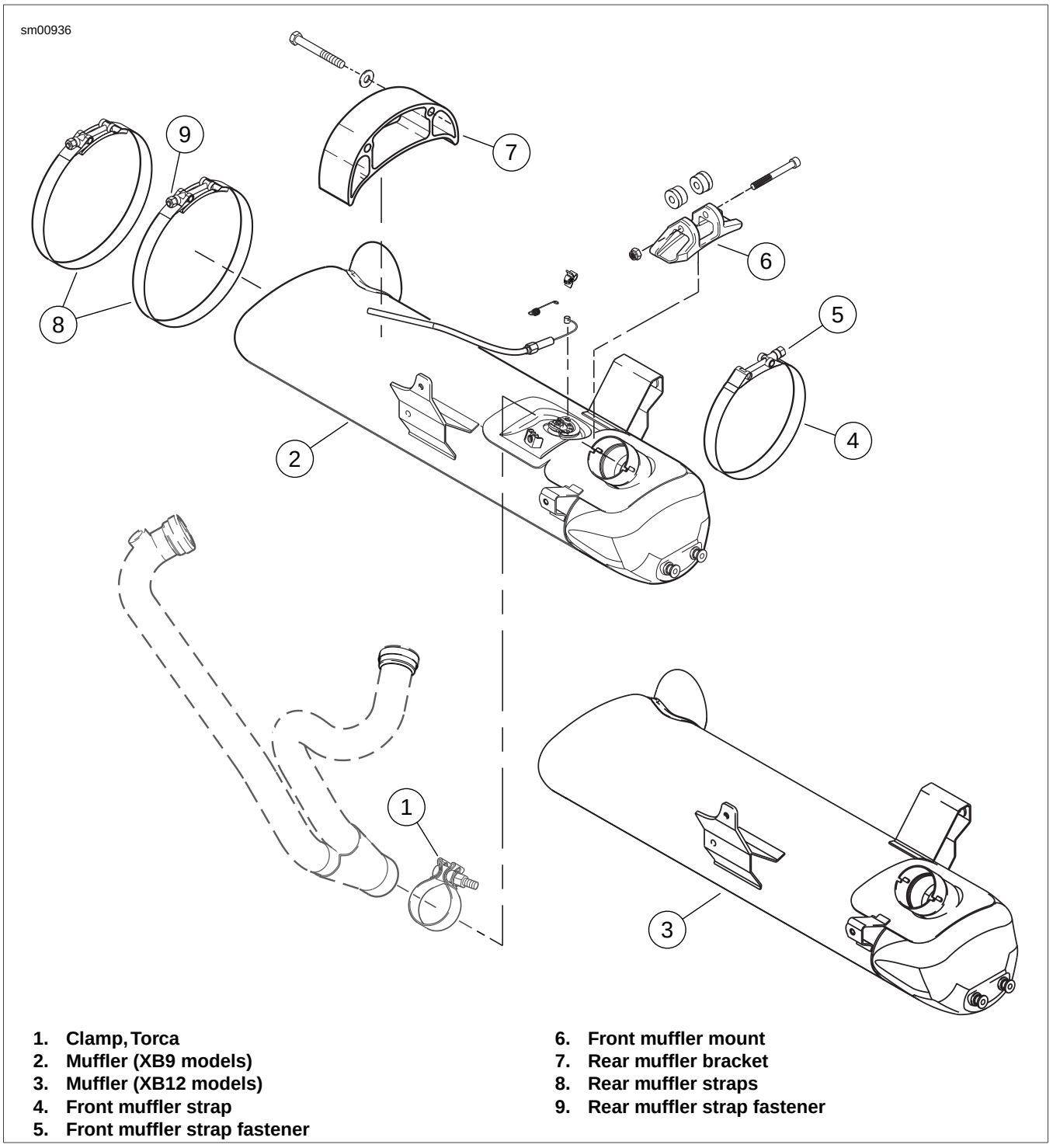


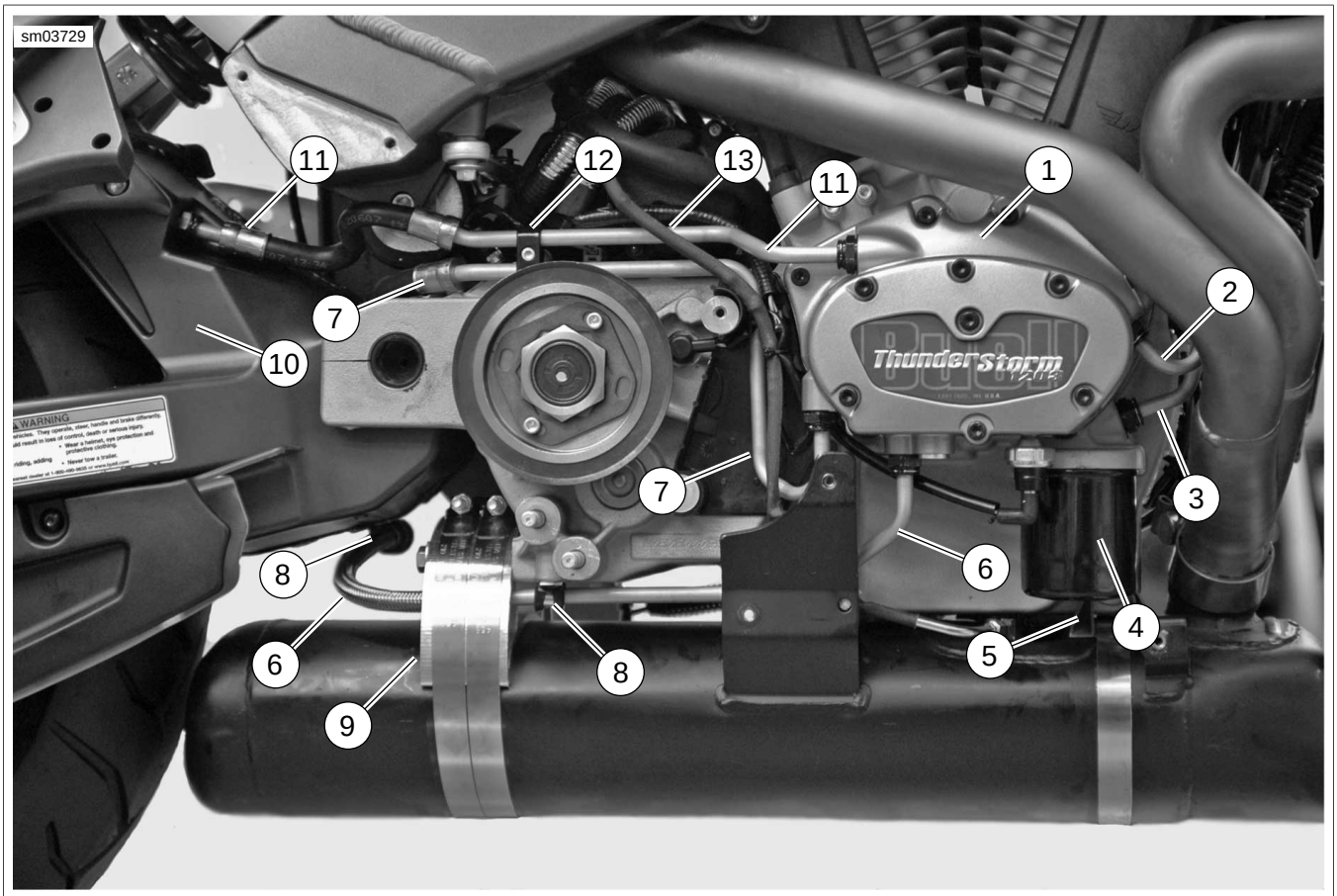
1. **Clamp, Torca**
2. **Muffler (XB9 models)**
3. **Muffler (XB12 models)**
4. **Front muffler strap**
5. **Front muffler strap fastener**
6. **Front muffler mount**
7. **Rear muffler bracket**
8. **Rear muffler straps**
9. **Rear muffler strap fastener**

Figure 3-36. Muffler Mounting System

18. See Figure 3-36. Apply LOCTITE 271 (red) to rear muffler bracket fasteners, install and tighten to 32-36 ft-lbs (43.4-48.8 Nm).
19. Install front muffler mount and leave loose at this time.

NOTES

- *DO NOT install muffler at this time. It is necessary to install muffler mounts first in order to properly install feed oil line.*
- *See Figure 3-37.The feed oil line is routed through the right side of the rear muffler bracket (7).*



1. **Oil pump**
2. **Oil cooler return line to crankcase**
3. **Oil cooler feed line from oil pump**
4. **Oil filter**
5. **Front muffler mount**
6. **Feed oil line**
7. **Return oil line**
8. **P-clamp**
9. **Rear muffler bracket**
10. **Swingarm/Oil reservoir**
11. **Vent oil line**
12. **Oil line clamp**
13. **Cable, interactive exhaust**
14. **Drain plug**

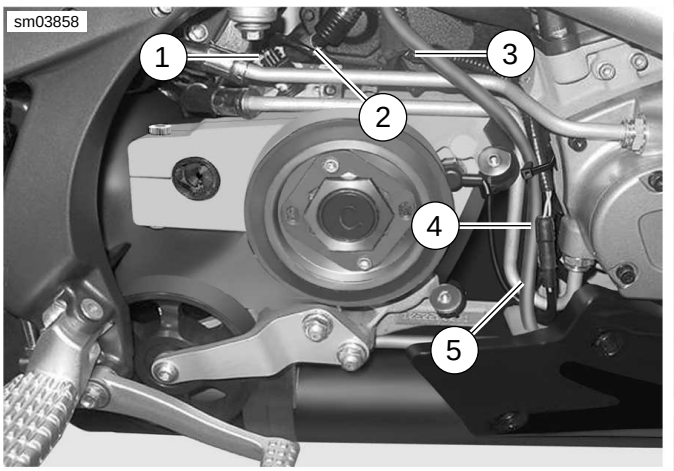
Figure 3-37. Oil Lines and Connections

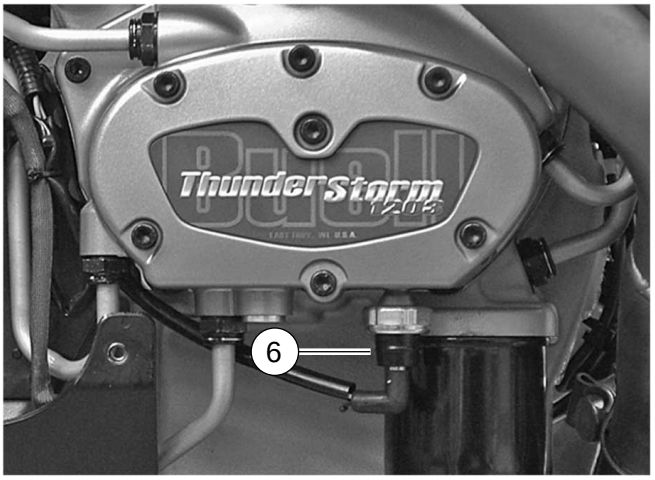
20. Install the feed oil line (6) starting at the engine working towards the rear of the vehicle. See 5.3 PRIMARY COVER.
21. Install p-clamps (8) on feed oil line (6) at crankcase and swingarm/oil reservoir and tighten fastener to 40-50 **in-lbs** (4.5-5.6 Nm).
22. Install the return oil line (7) in the same manner as the feed.

23. Install p-clamp (8) on return oil line (7) at the swingarm/oil reservoir and tighten fastener to 40-50 **in-lbs** (4.5-5.6 Nm).
24. Install the vent oil line (11) in the same manner as the feed.
25. Install oil line clamp (12) attaching vent oil line (11) to return oil line (7) in front of starter motor and tighten to 40-50 **in-lbs** (5-5.5 Nm).
26. Install oil cooler feed line (3) and oil cooler return line (2).

NOTE

See Figure 3-38. Route neutral indicator switch and the oil pressure indicator switch wiring behind the vent oil line. Route the interactive exhaust cable in front of the vent and return oil lines and bundle all three together with a cable strap as shown.





1. **Speedometer sensor [65]**
2. **Positive battery cable at starter**
3. **Starter solenoid [128]**
4. **Neutral switch [131] connection**
5. **Interactive exhaust cable**
6. **Oil pressure switch [120]**

Figure 3-38. Electrical Connections on Right Side of Motorcycle

DIGITAL TECHNICIAN II HARL

NOTE

The connections for the alternator and voltage regulator are routed on the left side of the vehicle under the air scoop. The harnesses are secured to the air scoop with 3 cable straps.

27. Connect the alternator [46] and voltage regulator [37].
28. See Figure 3-38 before connecting the following electrical components:
    a. Neutral switch [131] (4).
    b. Speedometer sensor [65] (1).
    c. Positive battery cable at starter (2).
    d. Starter solenoid [128] (3).
    e. Oil pressure switch [120] (6).
    f. CKP switch [79].

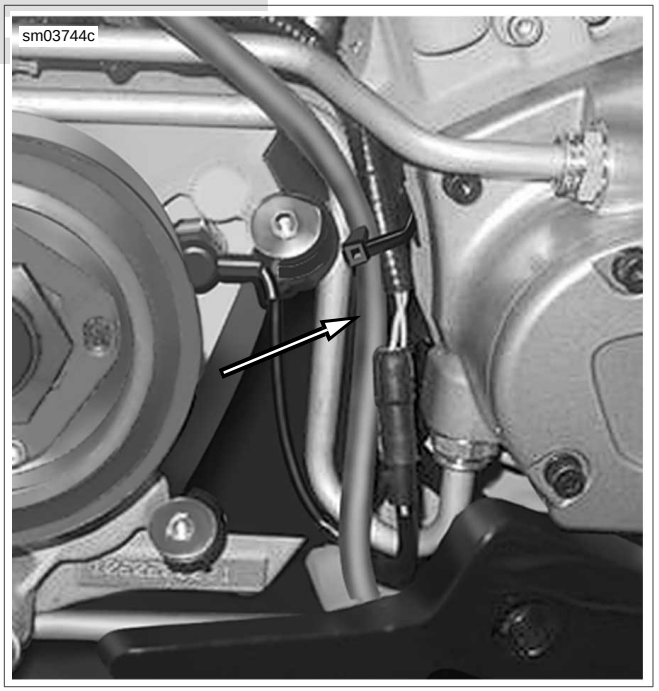


Figure 3-39. Correct Routing of Interactive Exhaust Cable

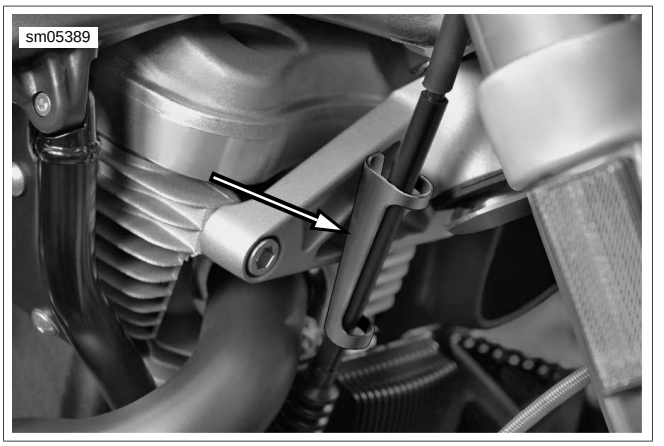


Figure 3-40. Clutch Cable Bracket

29. See Figure 3-40. Pull clutch cable back up into the proper position and connect to handlebars and adjust to specifications. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
30. Install sidestand assembly. See 2.46 SIDESTAND.

NOTES

- *Due to the location of the CKP it will be necessary to align the Torca clamp to verify proper clearance between the chin fairing and the CKP and Torca clamp.*
- *On 1200 models, always check to verify interactive cable is adjusted and routed properly before installing air box cover. See 1.16 INTERACTIVE EXHAUST CABLE.*

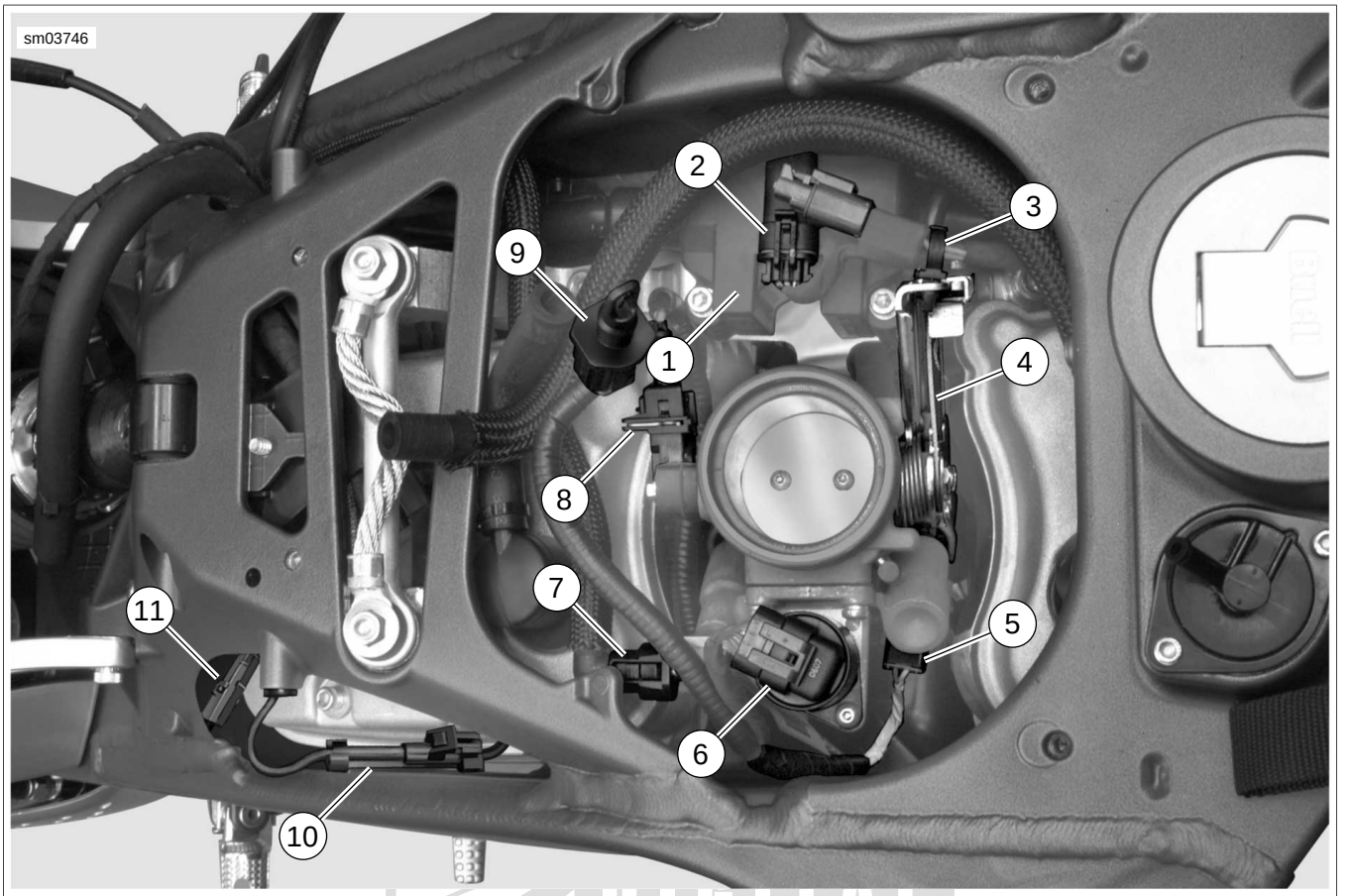
31. Install muffler. See 4.18 EXHAUST SYSTEM.
32. Install rear belt and idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY.
33. Install left and right side rider footrests and support plates. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING or 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.
34. Install sprocket cover. See 2.36 SPROCKET COVER.
35. See Figure 3-41. Connect throttle cables (4) to induction module/throttle body. See 1.15 THROTTLE CABLE.

NOTE

It will be necessary to install the temperature and oxygen sensor connectors into the retainer securing them to the main frame above the rear cylinder head.

36. Connect the following sensors:
    a. Temperature sensor [90] (10).
    b. Oxygen sensor [137] (11).
37. See Figure 3-41. Install the ignition coil (1) and spark plug wires and connect [83] (2). Tighten ignition coil fasteners to 120-144 **in-lbs** (13.6-16.3 Nm).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Coil**
2. **Coil connection [83]**
3. **Coil wire harness retaining clip**
4. **Throttle cables**
5. **Fuel injector connections [84 & 85]**
6. **IAC sensor connection [87]**
7. **Fuel line connection**
8. **Throttle position sensor connection [88]**
9. **IAT sensor [89]**
10. **Engine temperature sensor connection [90]**
11. **Oxygen sensor connection [137]**

Figure 3-41. Fuel Line, Connections and Throttle Cables

NOTE

Remove shop towel from entrance of throttle body to verify proper operation of induction module.

38. Connect throttle position sensor [88] (8).
39. Connect fuel injector leads [84] & [85] (5).
40. Connect fuel line (7).
41. Install throttle body velocity stack with retaining ring.

NOTES

- *The velocity stack attaches to the throttle body with a wire spring clamp.*
- *On 1200 models, always check to verify interactive cable is adjusted and routed properly before installing air box cover. See 1.16 INTERACTIVE EXHAUST CABLE.*

42. Install air cleaner cover assembly. See 4.3 AIR CLEANER ASSEMBLY.
43. Install intake cover assembly. Tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm). See 2.38 INTAKE COVER.
44. Install oil filter and fill oil tank. See 1.6 ENGINE OIL AND FILTER.

NOTE

The connection for fuel pump is just above the pump located at the rear of the fuel tank on the left side of the vehicle.

45. Connect fuel pump electrical connector.

NOTE

When installing the left side air scoop it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

46. Install air scoops, right and left sides. See 2.49 AIR SCOOPS.
47. Install chin fairing. See 2.50 CHIN FAIRING.

⚠WARNING

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

48. Install and connect battery. See 1.5 BATTERY MAINTENANCE.

WARNING

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

49. Install seat.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

CYLINDER HEAD 3.7

REMOVAL

Before removing the cylinder head assembly, it is necessary to rotate engine down as described in 3.4 ENGINE ROTATION FOR SERVICE. The rocker arm covers and internal components must be removed before removing cylinder heads.

NOTE

All washers and fasteners used in the engine are hardened. Do not mix or replace hardened washers and fasteners with unhardened parts. Do not re-use fiber cover seals. Engine damage may result.

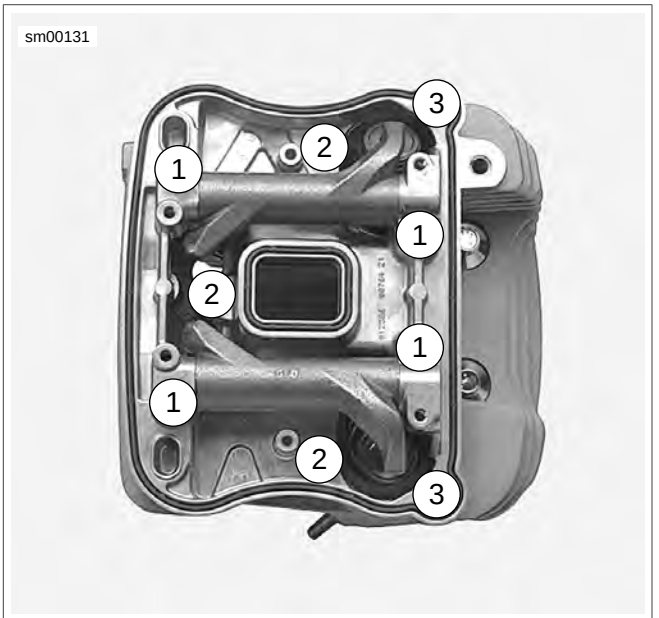
Rocker Box Assemblies

1. Remove spark plugs.
2. See Figure 3-44. Remove screws (3) with washers (4) and fiber cover seals (5). Discard fiber seals.
3. Remove top rocker covers (6).
4. Remove and discard gaskets (9,10).
5. Rotate crankshaft until both valves are closed on head being removed.
6. See Figure 3-42. Remove hardware holding lower rocker cover to cylinder head in the following order.
   a. Remove two screws and washers (3).
   b. Remove three bolts and washers (2).
   c. Loosen the four rocker arm fasteners (1) in 1/4-1/2 turn increments using a cross pattern in order to relieve valve spring pressure on the lower rocker box.
7. See Figure 3-44. Remove lower rocker cover (14).

NOTES

- *Remove lower rocker box as an assembly and then disassemble as required.*
- *Mark rocker arm shafts for reassembly in their original positions. Valve train components must be reinstalled in their original positions to prevent accelerated wear and increased valve train noise.*

8. See Figure 3-43. Remove rocker arm shafts by tapping them out using a hammer and a soft metal punch.
9. Remove rocker arms and **mark them for reassembly** in their original locations.
10. Mark the location and orientation (top/bottom) of each push rod. Remove push rods.



1. Screws and washers
2. Bolts and washers
3. Rocker arm fasteners

Figure 3-42. Lower Rocker Box Fasteners

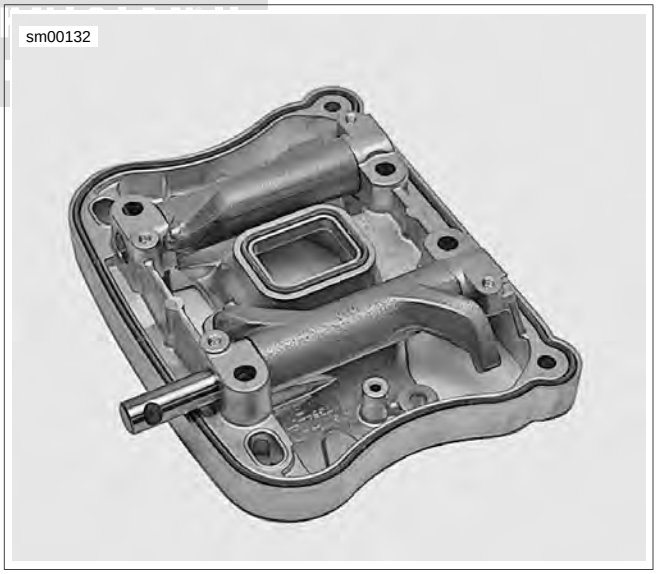
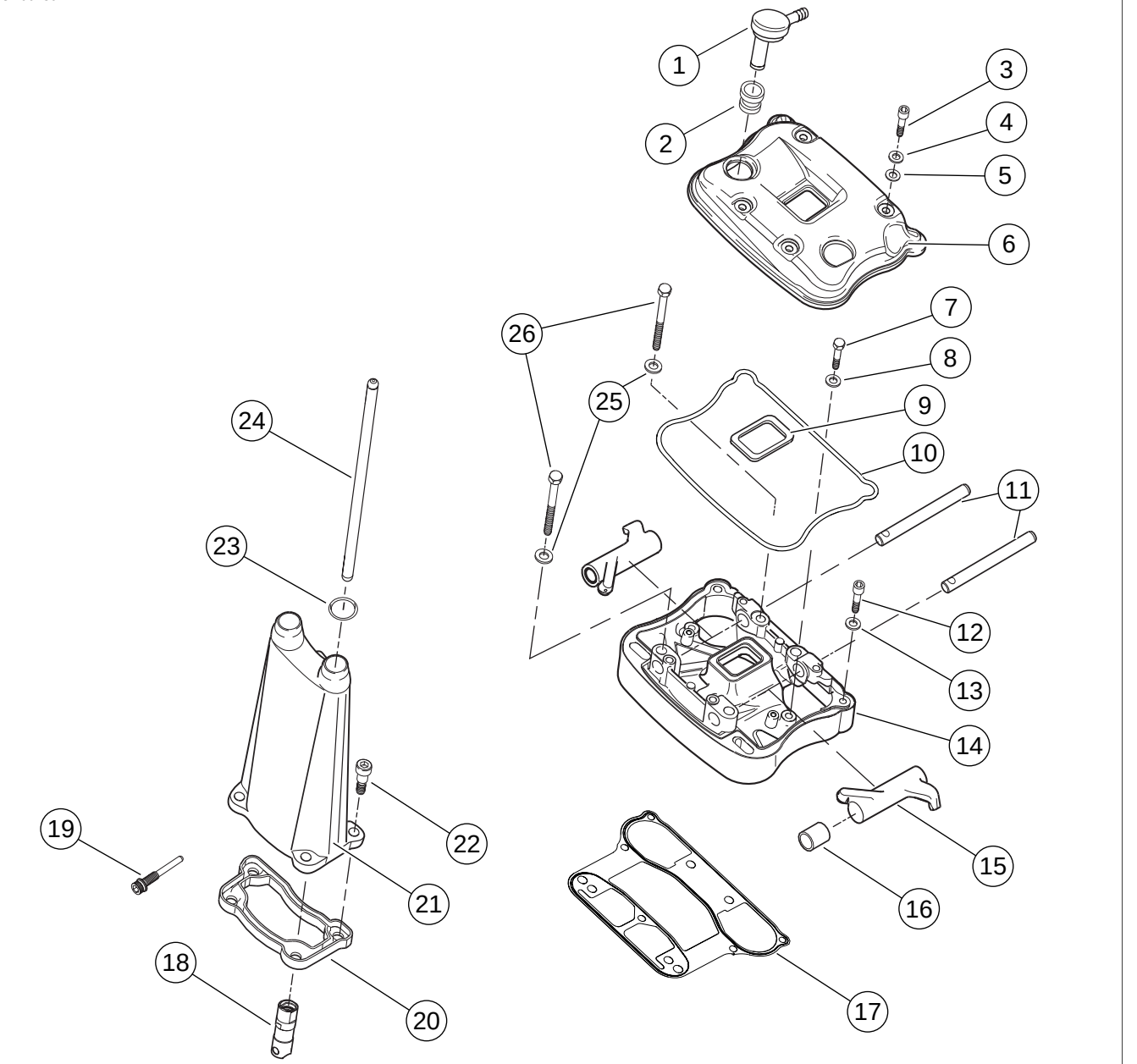


Figure 3-43. Removing Rocker Arm Shafts



1. Crankcase breather
2. Grommet
3. Screw (4)
4. Washer (4)
5. Fiber seal (4)
6. Rocker cover (top)
7. Bolt (3)
8. Washer (3)
9. Gasket (inner)
10. Gasket (lower)
11. Rocker arm shafts
12. Screw (2)
13. Washer (2)
14. Rocker cover (lower)
15. Rocker arm (2)
16. Bushing (rocker arm - 4)
17. Gasket (lower rocker cover)
18. Hydraulic lifter
19. Screw, tappet anti-rotation (2)
20. Gasket (push rod cover)
21. Push rod cover
22. Screw (4)
23. O-ring (push rod cover - 2)
24. Push rod
25. Washer (4)
26. Bolt (4)

Figure 3-44. Rocker Arm and Pushrod Cover Assemblies

Cylinder Head Assemblies

NOTE

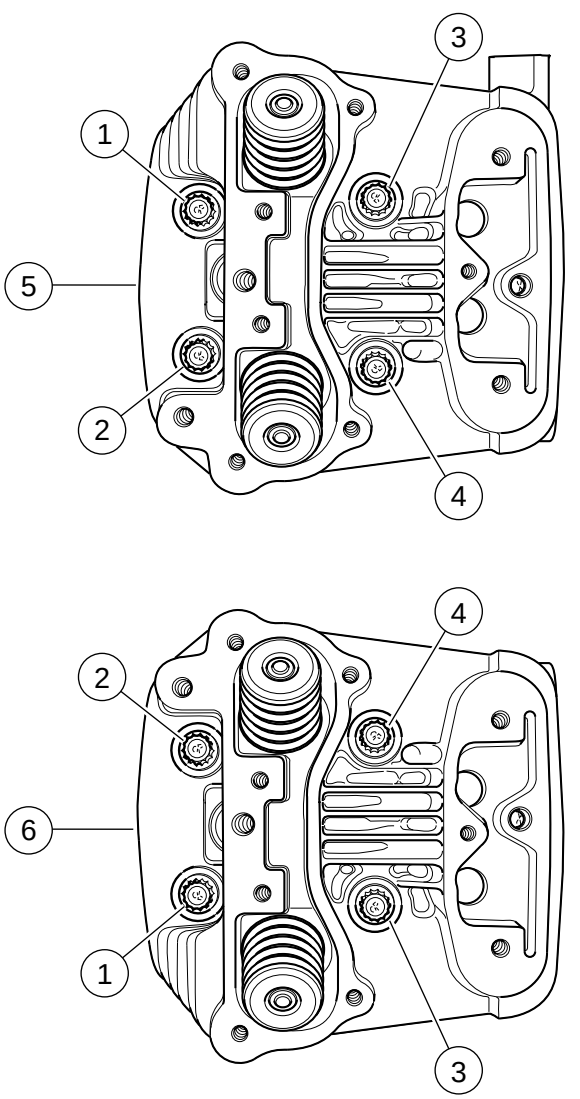
See Figure 3-45. Distortion to the head, cylinder and crankcase studs may result if head screws are not loosened (or tightened) gradually in the sequence shown.

1. Loosen each head screw 1/8-turn following the sequence shown.
   a. Continue loosening in 1/8-turn increments until screws are loose. Remove head screws.
   b. Remove cylinder head, head gasket.
2. Discard head gasket.
3. See Figure 3-44. Remove push rod cover (21), gasket (20) and lifters (18).

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-34736B	VALVE SPRING COMPRESSOR

1. See Figure 3-46. Clamp VALVE SPRING COMPRESSOR (Part No. HD-34736B) in vise.
2. Compress valve spring with VALVE SPRING COMPRESSOR.
3. See Figure 3-47. Remove valve retainers (3), upper collar (4) and valve spring (5). Mark valve retainers for reassembly in their original locations.
4. Use a fine tooth file to remove any burrs on the valve stem at the keeper groove.
5. Mark valve to verify that it will be reassembled in the same head. Remove valve (15), valve stem seal and lower collar assembly by hand. No special tools are required to remove valve stem seal and lower collar assembly.
6. Repeat the above procedure for the other valves.



1. Tighten/loosen first
2. Tighten/loosen second
3. Tighten/loosen third
4. Tighten/loosen fourth
5. Front cylinder
6. Rear cylinder

Figure 3-45. Head Screw Loosening/Tightening Sequence

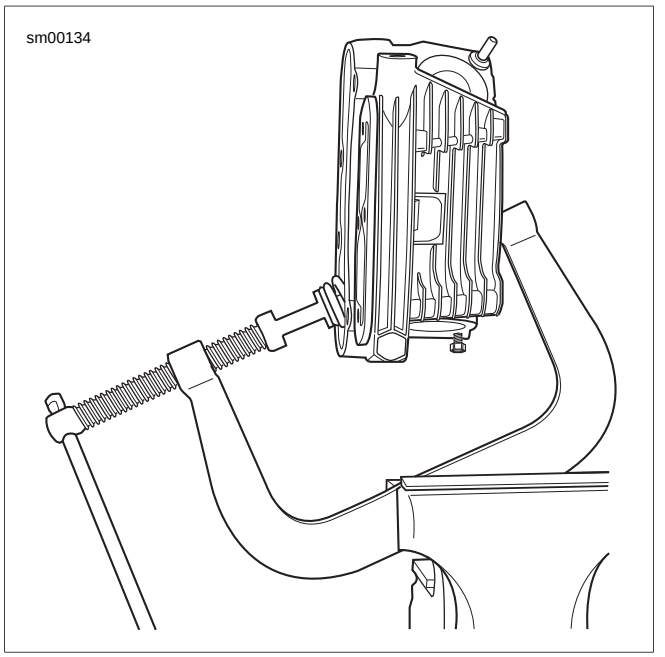
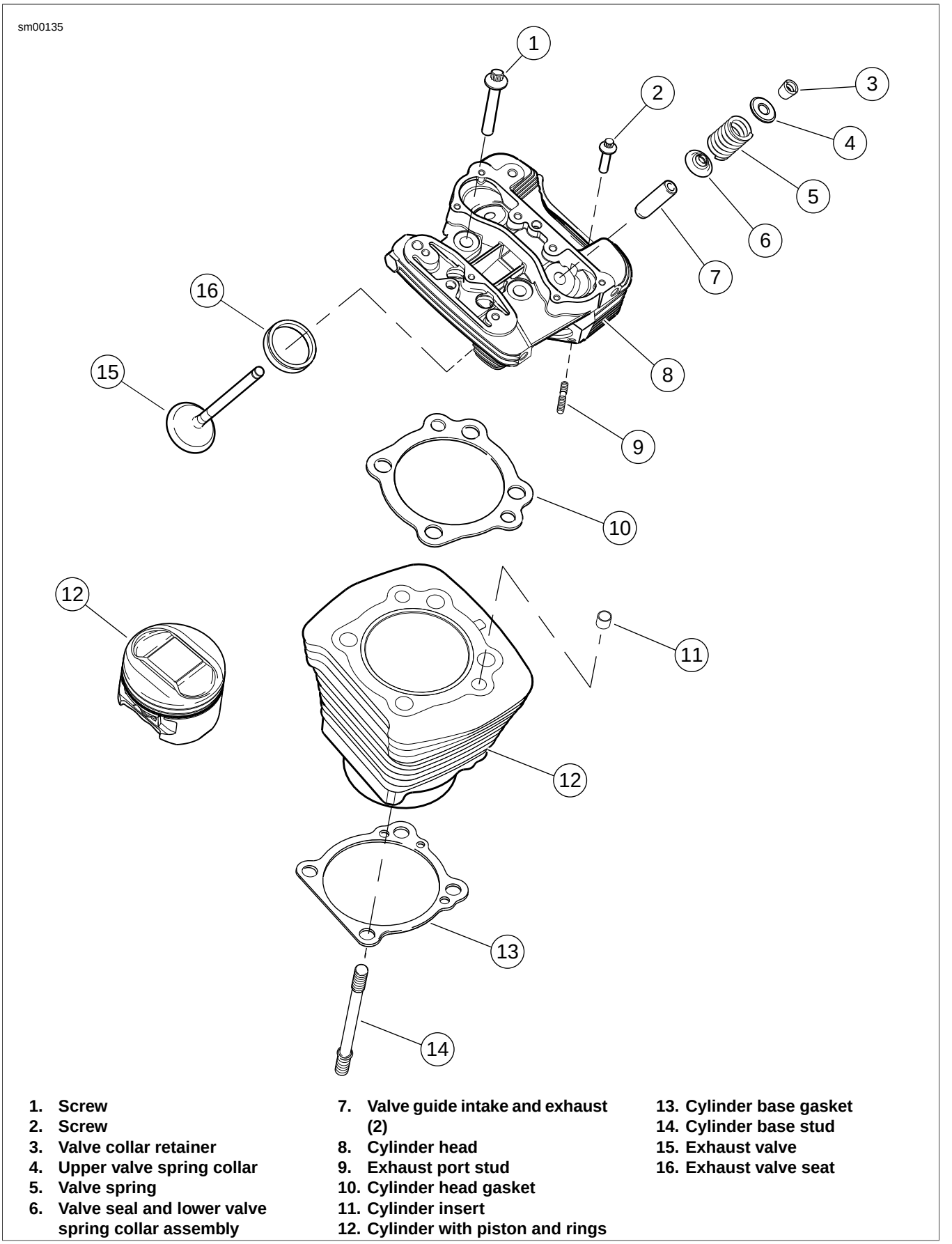


Figure 3-46. Valve Spring Compressor

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Screw
2. Screw
3. Valve collar retainer
4. Upper valve spring collar
5. Valve spring
6. Valve seal and lower valve spring collar assembly
7. Valve guide intake and exhaust (2)
8. Cylinder head
9. Exhaust port stud
10. Cylinder head gasket
11. Cylinder insert
12. Cylinder with piston and rings
13. Cylinder base gasket
14. Cylinder base stud
15. Exhaust valve
16. Exhaust valve seat

Figure 3-47. Cylinder Head, Cylinder and Piston Assembly

CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH

Cylinder Heads

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. Bead blast or scrape carbon from head, top of cylinder and valve ports. Be careful to avoid scratching or nicking cylinder head and cylinder joint faces. Blow off loosened carbon or dirt with compressed air.
2. Soak cylinder head in an aluminum-compatible cleaner/solvent to loosen carbon deposits.
3. Wash all parts in non-flammable solvent, followed by a thorough washing with hot, soapy water. Blow out oil passages in head. Be sure they are free of sludge and carbon particles. Remove loosened carbon from valve head and stem using a wire wheel. Never use a file or other hardened tool which could scratch or nick valve. Polish valve stem with very fine emery cloth or steel wool.
4. See Figure 3-48. Check head gasket surface on head for flatness. Machine or replace any head which exceeds SERVICE WEAR LIMIT of 0.006 in. (0.152 mm).

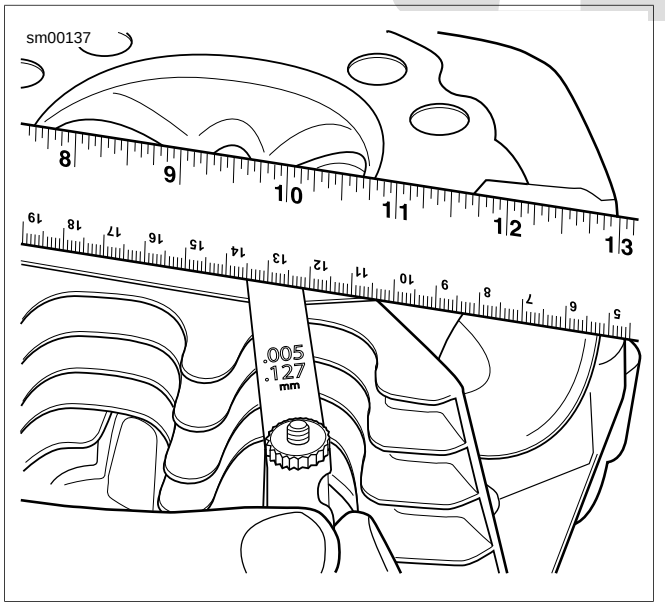


Figure 3-48. Checking Gasket Surface

Rocker Arm Assemblies

1. Check each rocker arm, at pad end and push rod end, for uneven wear or pitting. Replace rocker arm if either condition exists.
2. Measure and record rocker arm shaft diameter.
   a. See Figure 3-49. Measure where shaft fits in lower rocker arm cover.
   b. See Figure 3-50. Measure where rocker arm bushings ride. Measure twice at 90° apart. Record the smaller measurement.
3. Measure and record rocker arm shaft bore diameter.
   a. See Figure 3-51. Measure bore of lower rocker cover.
   b. See Figure 3-52. Measure rocker arm bushing inner diameter. Measure twice at 90° apart. Record the larger measurement.

Figure 3-49. Measuring Rocker Arm Shaft Diameter (Rocker Cover Position)

Figure 3-50. Measuring Rocker Arm Shaft Diameter (Rocker Arm Bushing Position)

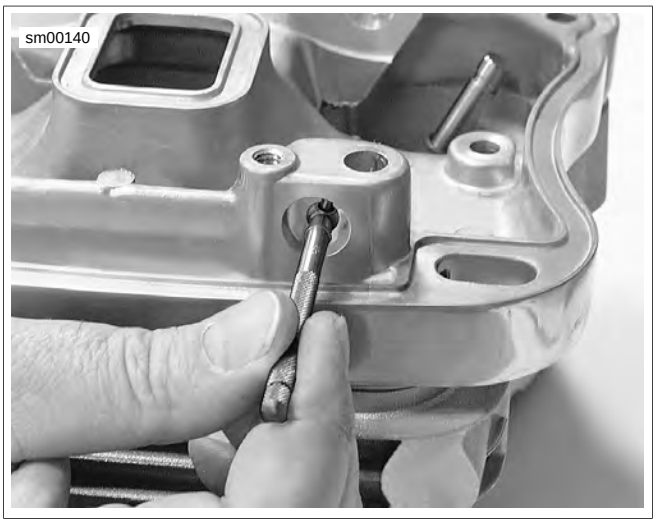


Figure 3-51. Measuring Rocker Arm Shaft Bore Diameter in Lower Rocker Cover (Typical)

Figure 3-52. Measuring Rocker Arm Bushing Inner Diameter

4. Check the measurements obtained in previous steps against the SERVICE WEAR LIMITS. Repair or replace parts exceeding limits.
5. Assemble rocker arms and rocker arm shafts into lower rocker cover.
6. Check end play of rocker arm with feeler gauge.
7. Replace rocker arm or lower cover or both if end play exceeds 0.025 in. (0.635 mm).

Valves

1. Replace the valve if there is evidence of burning or cracking.
2. Inspect the end of the valve stem for pitting or uneven wear. Replace the valve if either of these conditions are found.
3. Inspect for burrs around the valve stem keeper groove. Remove burrs with a fine tooth file if found.

Valve Seats

NOTE

Valve seats are also subject to wear. Resurface valve seats whenever valves are refinished.

1. Inspect seats for cracking, chipping or burning. Replace seats if any evidence of these conditions are found.
2. See Figure 3-53. Check seats for recession by measuring valve stem protrusion.
3. Wipe valve seats and valve faces clean.
4. Measure valve stem protrusion.
5. If valve stem protrudes more than 2.08 in. (52.88 mm), replace valve seat or cylinder head.

NOTE

Replacing a valve seat is a complex operation requiring special equipment. If the seat is loose or is not fully seated in the head, then seat movement will prevent the proper transfer of heat from the valve. The seat surface must be flush with (or below) the head surface. See 3.2 SPECIFICATIONS for valve seat-to-cylinder head fit.

Figure 3-53. Measuring Valve Stem Protrusion

Valve Guides

1. Clean valve guides by lightly honing with VALVE GUIDE HONE (Part No. B-45525).
2. Scrub guides with VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) and hot soapy water. Measure valve stem outer diameter and valve guide inner diameter. Check measurements against service wear limits. See 3.2 SPECIFICATIONS.

Valve Springs

1. Inspect valve springs for broken or discolored coils.

NOTE

A single valve spring is used for each valve. The inner and outer springs are combined into one tapered spring that is progressively wound.

2. See Figure 3-54. Check free length and compression force of each spring. Compare with 3.2 SPECIFICATIONS. If spring length is shorter than specification or if spring compression force is below specification, replace spring.

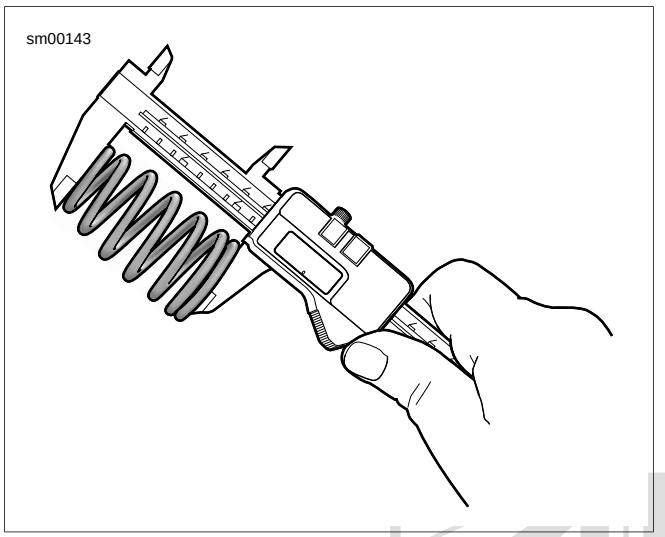


Figure 3-54. Checking Spring Free Length

Spark Plug Threads

Inspect spark plug threads for damage. If threads in head are damaged, a special thread repair insert can be installed using a 12 mm spark plug repair kit.

Push Rods

Examine push rods, particularly the ball ends. Replace any rods that are bent, worn, discolored or broken.

REPLACING ROCKER ARM BUSHINGS

PART NUMBER	TOOL NAME
HD-94804-57	ROCKER ARM BUSHING REAMER

1. See Figure 3-55. To replace worn bushings, press or drive them from the rocker arm.

NOTE

If bushing is difficult to remove, thread a 9/16-18 tap into bushing. From opposite side of rocker arm, press out bushing and tap using a discarded rocker arm shaft.

2. Press replacement bushing into rocker arm, flush with arm end, and split portion of bushing towards top of arm.
3. Using remaining old bushing as a pilot, line ream new bushing with ROCKER ARM BUSHING REAMER (Part No. HD-94804-57).
4. Repeat for other end of rocker arm.

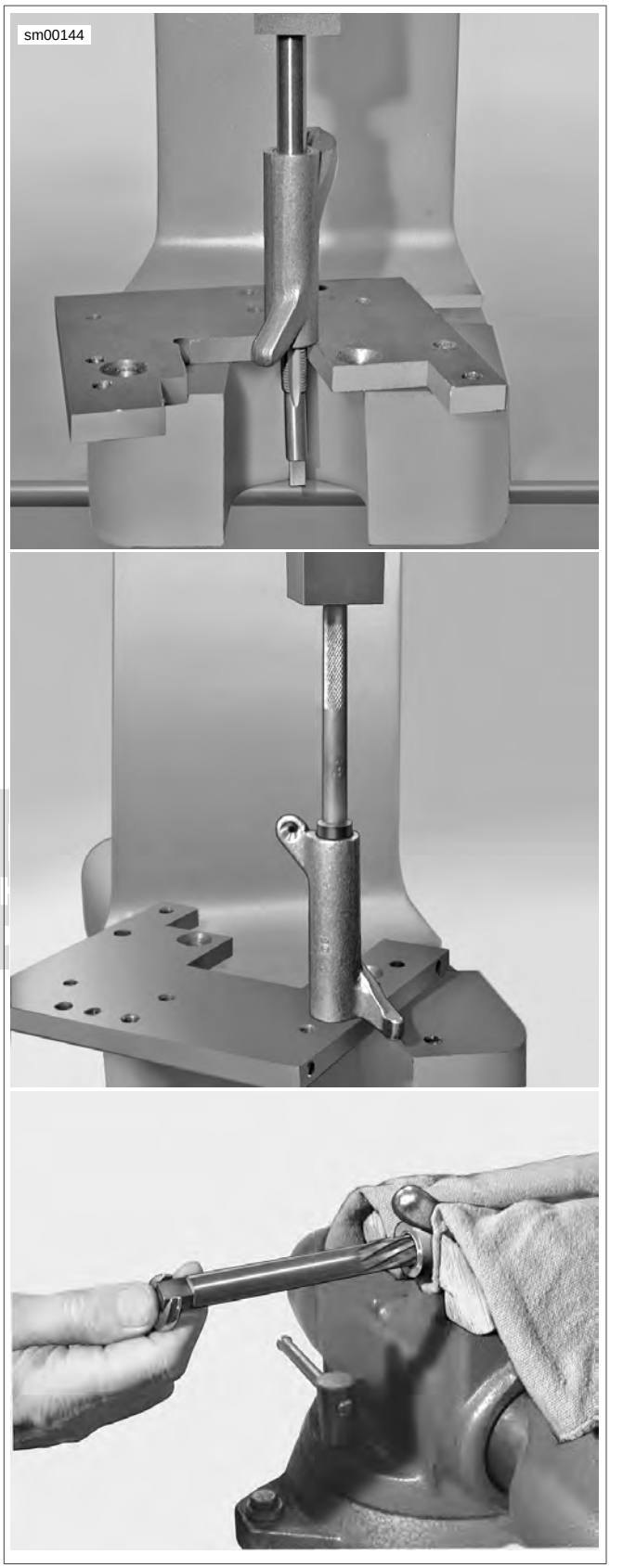


Figure 3-55. Replacing Rocker Arm Bushings

REPLACING VALVE GUIDES

PART NUMBER	TOOL NAME
B-45523	VALVE GUIDE REAMER
B-45524-A	VALVE GUIDE REMOVER/INSTALLER
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH

Valve guide replacement, if necessary, must be done before valve seat is ground. It is the valve stem hole in valve guide that determines seat grinding location. If valve stems and/or guides are worn beyond limits, install **new** parts. For valve stem to valve guide clearances, refer to Table 3-18.

1. To remove shoulderless guides, press or tap guides toward combustion chamber using VALVE GUIDE REMOVER/INSTALLER (Part No. B-45524-A).
2. Clean and measure valve guide bore in head.
3. Measure outer diameter of a **new** standard valve guide. The guide diameter should be 0.0020-0.0033 in. (0.0508-0.0838 mm) larger than bore in head. If clearance is not within specification, select oversize valve guide and machine valve guide O.D. as needed.
4. See Figure 3-56. Install shoulderless guides using VALVE GUIDE REMOVER/INSTALLER (Part No. B-45524-A). Press or drive guide until the tool touches the machined surface surrounding the guide. At this point, the correct guide height has been reached.
5. Ream guides to final size or within 0.0010 in. (0.0254 mm) of final size using VALVE GUIDE REAMER (Part No. B-45523). Use REAMER LUBRICANT (Part No. HD-39964) or liberal amounts of suitable cutting oil to prevent reamer chatter.

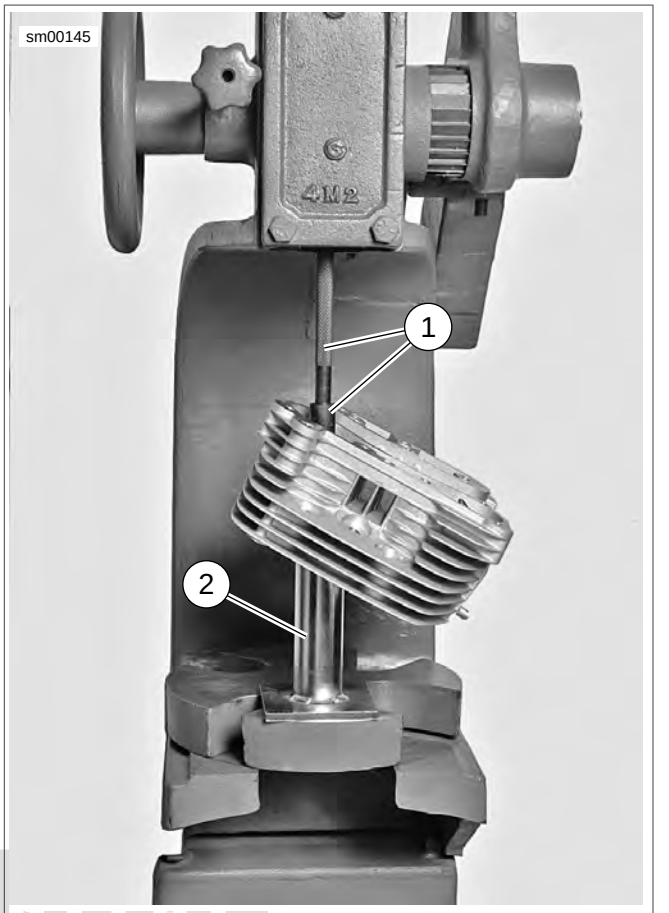
NOTE

The hone is not intended to remove material.

6. Apply the proper surface finish to the valve guide bores using the VALVE GUIDE HONE (Part No. B-45525). Lubricate hone with honing oil. Driving hone with an electric drill, work for a crosshatch pattern with an angle of approximately 60°.
7. See Figure 3-57. Thoroughly clean valve guide bores using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) and hot soapy water.

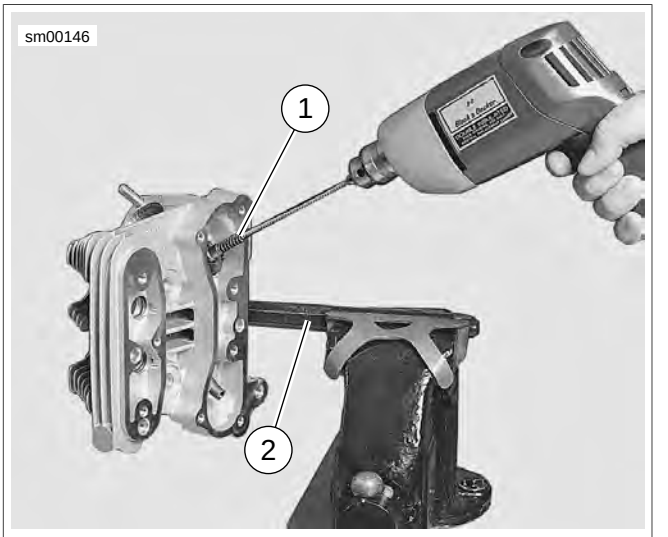
Table 3-18. Valve Stem Clearance and Service Wear Limits

VALVE	CLEARANCE		SERVICE WEAR LIMIT	
	IN.	MM	IN.	MM
Exhaust	0.001-0.003	0.025-0.076	0.0038	0.1
Intake	0.001-0.003	0.025-0.076	0.0038	0.1



1. **Valve guide remover/installer**
2. **Cylinder head stand**

Figure 3-56. Installing Shoulderless Valve Guide



1. **Valve guide brush (Part No. HD-34751)**
2. **Cylinder head holding fixture (Part No. HD-39786)**

Figure 3-57. Cleaning Valve Guides

PROCEDURE FOR USING THE NEWAY VALVE SEAT CUTTER

PART NUMBER	TOOL NAME
B-35758-52A	7.02 MM VALVE SEAT CUTTER PILOT
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-35758-C	NEWAY VALVE SEAT CUTTER SET
HD-39786	CYLINDER HEAD HOLDING FIXTURE

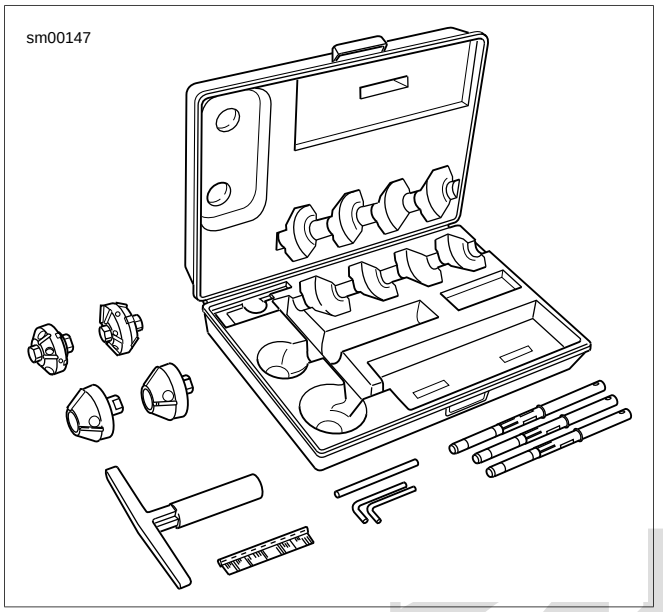


Figure 3-58. Neway Valve Seat Cutter

NOTES

- *Verify correct valve stem to valve guide clearance before refacing. Refer to Table 3-18. If new guides must be installed, complete that task before refacing valves and seats.*
- *This procedure is not based on the lapping of valves. The end result is an interference fit between the valve of 45° and the valve seat which will be 46°.*

1. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise and further tighten cylinder head onto the fixture to prevent any movement during operation.
   c. Place cylinder head at a 45° angle or one that offers a comfortable working position.
2. Obtain the NEWAY VALVE SEAT CUTTER SET (Part No. HD-35758-C) and cut valve seat angle to 46°. Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).
3. In order to determine the correct location of the 46° valve seat in the head, measure the diameter of the valve head to be used and subtract 0.080 in. (2.032 mm) from that number.
4. Set your dial caliper to the lesser measurement and lock down for quick reference. This is the location of your valve seat.
5. Use a permanent magic marker to highlight the valve seat area that is going to be cut and be sure to highlight all 3 angles. Allow marker to dry before proceeding.

NOTES

- *Always verify cutter blades and cutter pilot are clean before beginning the cutting process. The correct cleaning brush is supplied with the Neway tool set.*
- *Also verify the inside of the valve guide is clean by using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).*

6. Install the valve seat cutter pilot, 7.02 MM VALVE SEAT CUTTER PILOT (Part No. B-35758-52A), into the valve guide hole and securely seat the pilot by pushing down and turning using the installation tool supplied in the tool set.
7. Choose the proper 46° cutter (intake or exhaust) and gently slide the cutter onto the pilot being careful not to drop the cutter onto the seat.
8. While applying a constant and consistent pressure, remove just enough material to show a complete clean-up on the 46° angle.

NOTES

- *If the width of the clean-up angle is greater on one side of the seat than the other, the guide may need to be replaced due to improper installation.*
- *After making the 46° cut, if you discover a groove cut completely around the seat this means the blades of the cutter are in alignment and need to be staggered. This is accomplished by loosening all of the blades from the cutter body and moving each blade slightly in it's cradle in opposite directions on the cutter. The tool needed to loosen the blades is supplied in the tool set. A permanent magic marker mark every 90° will help in determining where new angles are.*

9. With your dial caliper locked to the predetermined setting, measure the 46° cut at the outer most edge at the widest point of the circle to determine what cut needs to be made next.
   a. If the 46° cut is too high (towards the combustion chamber), use the 31° cutter to lower the valve seat closer to the port.
   b. If the 46° cut is too low, use the 60° cutter to raise the valve seat or move it away from the port.

NOTES

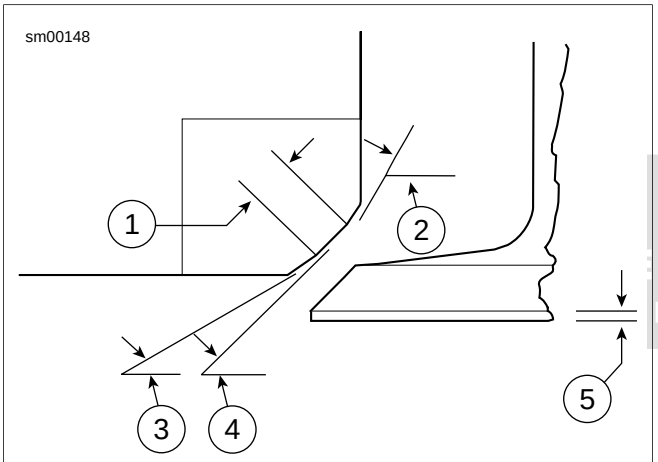
- *Due to using the top measurement of our valve seat as a reference point it will usually be necessary to use the 31° cutter following the initial 46° cut.*
- *Always highlight the valve seat with the permanent magic marker in order to verify the location of the 46° valve seat.*

10. If the location of the valve seat is not correct, repeat two previous steps.

11. When you accomplish a complete clean-up of the 46° angle and the width is at least 0.062 in. (1.575 mm), proceed to the next step.
12. Select the proper 60° cutter and gently slide the cutter down the cutter pilot to the valve seat.
13. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).
14. Remove cutter pilot and wash head thoroughly and dry completely.
15. Repeat the process on any valve seat that needs service.
16. Insert valve to be used in the valve guide and bottom on the valve seat. Positioning the cylinder head port upwards and with slight thumb pressure against the valve, completely fill the port with solvent to verify proper seal between the valve and the valve seat.

NOTE

Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve seat for irregularities or defects and if necessary repeat the above cutting process.



1. **Minimum: 0.040 in. (1.016 mm) / Maximum: 0.062 in. (1.575 mm)**
2. **60 degrees**
3. **31 degrees**
4. **46 degrees**
5. **Margin**

Figure 3-59. Valve and Seat Dimensions

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34736B	VALVE SPRING COMPRESSOR
HD-34751	VALVE GUIDE CLEANING BRUSH

1. Wash cylinder head and valves in warm, soapy water to remove all debris from cutting valve seats.
2. Scrub valve guide bores with VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) and hot, soapy water.

⚠WARNING

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

3. Blow dry with compressed air.
4. Apply a liberal amount of engine oil to the valve stem.
5. See Figure 3-47. Insert valve into valve guide and bottom valve on valve seat.
6. See Figure 3-60. Place a protective sleeve over the valve stem keeper groove.

NOTE

Failure to use a protective sleeve on the valve stem keeper groove when installing the valve stem seal and collar assembly will result in damage to the seal causing leakage around the valve stem, excessive oil consumption and valve sticking.

7. See Figure 3-62. Coat the sleeve with oil and place a **new** seal and lower collar assembly over the valve stem and onto valve guide.

NOTES

- *See Figure 3-61. The valve seal is incorporated into the lower collar and is installed by hand. NO SPECIAL TOOLS ARE REQUIRED.*
- *The seal is completely installed when the lower collar contacts the machined surface of the head.*
- *Do not remove valve after seal is installed. Repeated installations will damage seal.*

8. Install valve spring and upper collar.
9. See Figure 3-63. Compress spring with VALVE SPRING COMPRESSOR (Part No. HD-34736B).

NOTE

A single valve spring is used for each valve. The inner and outer springs are combined into one tapered spring that is progressively wound.

10. Insert valve retainers into upper collar, making sure they engage grooves in valve stem.
11. Release and remove from VALVE SPRING COMPRESSOR.
12. Repeat previous steps for the remaining valve.

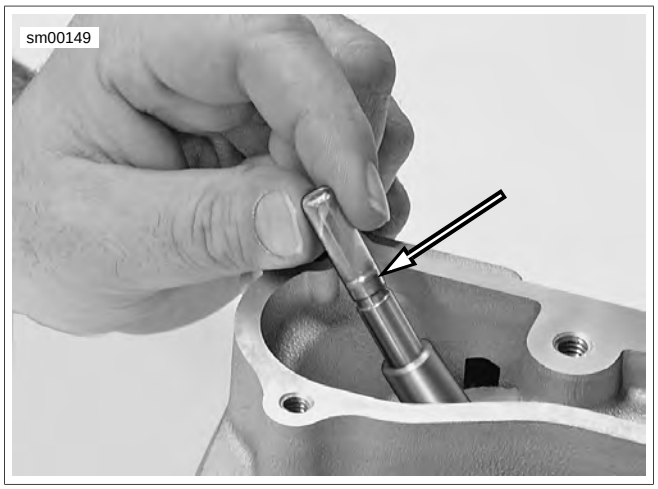


Figure 3-60. Valve Guide Seal Protector Sleeve

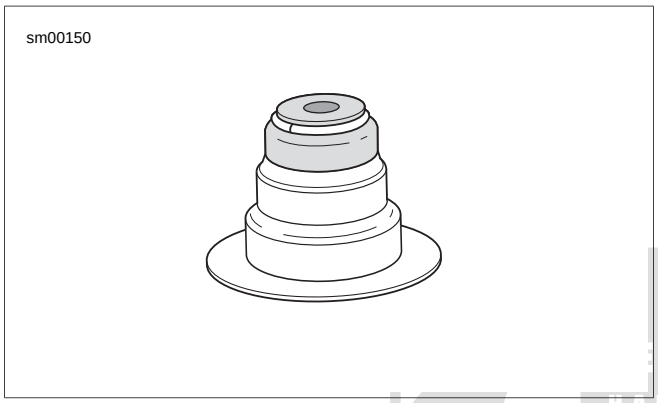


Figure 3-61. Valve Seal and Lower Collar Assembly (Seal and Lower Collar Replaced as Assembly Only)

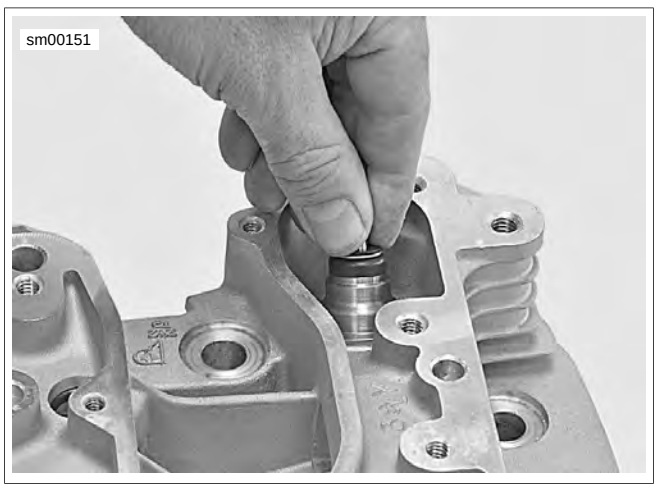


Figure 3-62. Valve Seal and Lower Collar Assembly Installation

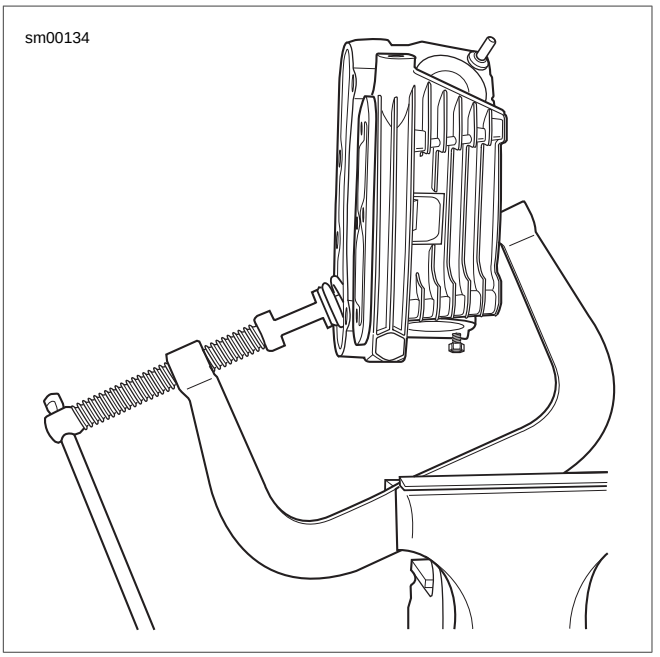


Figure 3-63. Valve Spring Compressor

PUSH ROD COVER INSTALLATION

1. See Figure 3-65. Install push rod covers.
   a. Install **new** o-rings (2) on top of each push rod cover (3).

   NOTE

   Before installing o-rings on the top of each pushrod cover be sure to apply a small amount of clean engine oil to each o-ring.

   b. Install **new** push rod cover gasket (5) onto bottom of each push rod cover.
   c. Install each push rod cover assembly and start the fasteners (4) securing the bottom of each cover to the crankcase.
   d. Tighten fasteners to 30-40 **in-lbs** (3.4-4.5 Nm).

NOTE

If installing original parts, be sure to install them in their original locations.

2. Refer to Table 3-19. Identify push rod color coding, length and respective push rod positions in engine. Dip both ends of push rods in clean engine oil. Place intake and exhaust push rods onto seat at top of tappet.

NOTE

After head(s) have been installed do not turn engine over until both push rods can be turned with fingers. Otherwise, damage to push rods or rocker arms may result.

Table 3-19. Push Rod Selection

POSITION	COLOR CODES	LENGTH
Exhaust	1 Band Pink	10.780 in. (274.320 mm)
Intake	1 Band Orange	10.726 in. (271.948 mm)

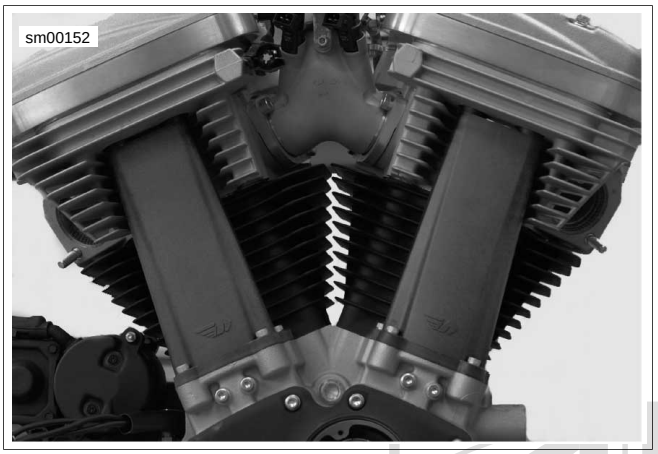
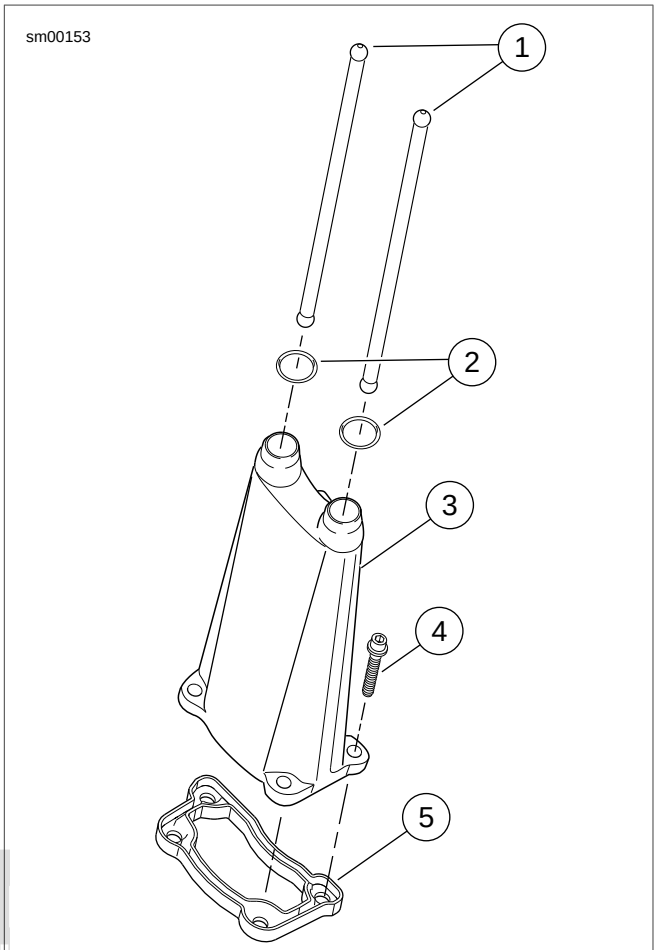


Figure 3-64. Push Rod Locations



1. **Push rod (2)**
2. **O-ring (2)**
3. **Push rod cover**
4. **Screws (4)**
5. **Push rod cover gasket**

Figure 3-65. Push Rods and Push Rod Cover Assembly

CYLINDER HEAD INSTALLATION

NOTES

- *Push rods and covers must be installed prior to installing cylinder heads.*
- *Short head screws will be installed in the 1 and 2 positions, and long head screws in the 3 and 4 positions.*
- *Thoroughly clean and lubricate the threads of the cylinder head screws before installation. Friction caused by dirt and grime will result in a false torque indication.*

1. Thoroughly clean and dry the gasket surfaces of cylinders and cylinder heads.
2. Install a **new** head gasket to cylinder.
3. Carefully lower cylinder head over studs and position on dowels. Use great care so as not to disturb head gasket.
4. Lightly coat the threads and bottom face of the cylinder head screws with clean H-D 20W50 engine oil. Wipe off any excess oil.

NOTE

The procedure for tightening the head screws is critical to proper distribution of pressure over gasket area. It prevents gasket leaks, stud failure, and head and cylinder distortion. Always tighten in sequence shown.

5. Start the cylinder head screws onto the cylinder studs, two short screws on the left side of the engine, two long bolts on the right.
6. See Figure 3-66. For each cylinder head, start with screw numbered one, as shown. In increasing numerical sequence (i.e. - 1, 2, 3 and 4):
   a. Tighten screws to 96-120 **in-lbs** (11-14 Nm).
   b. Tighten screws to 13-15 ft-lbs (18-20 Nm).
   c. Loosen all screws.
7. After screws are loosened from initial torque, tighten head screws in three stages. Tighten fasteners in increasing numerical sequence (i.e. - 1, 2, 3 and 4).
   a. Tighten screws to 96-120 **in-lbs** (11-14 Nm).
   b. Tighten screws to 13-15 ft-lbs (18-20 Nm).
   c. See Figure 3-61. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.
   d. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. Be sure to tighten the cylinder head bolts in the sequence shown in Figure 3-66.
8. Assemble rocker arms and shafts to rocker boxes.
   a. Generously lubricate rocker arms and shafts with clean engine oil.
   b. Assemble arms and shafts to boxes.
9. Lube push rod sockets of rocker arms with clean engine oil.

NOTE

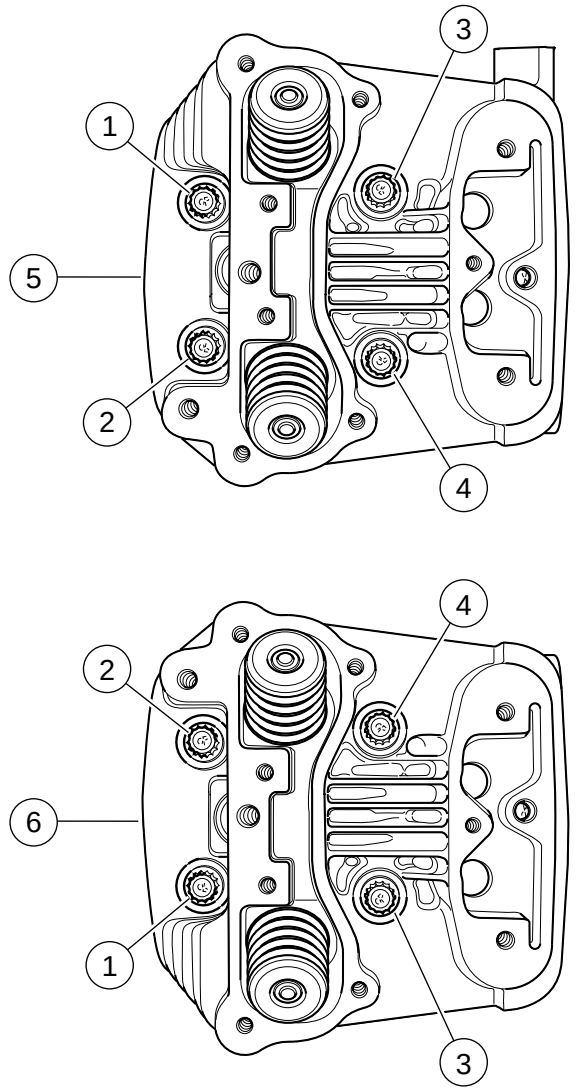
Turn engine over so that both lifters from the rocker box to be installed are on the base circle of the cam (the lowest position).

10. See Figure 3-68. Install **new** gaskets. Place lower rocker box assembly (with rocker arms and shafts) into position. Place push rods in rocker arm sockets.
11. See Figure 3-68. Install hardware attaching lower rocker cover to cylinder head in the following order. After loosely installing all fasteners, use a cross pattern on the four large bolts that fasten the lower rocker box to head to tighten and then torque to specifications. This will bleed the tappets. Finish tightening remaining fasteners.
    a. Tighten bolts (1) to 18-22 ft-lbs (24-30 Nm).
    b. Tighten bolts (3) to 135-155 **in-lbs** (15-17.5 Nm).
    c. Tighten screws (2) to 135-155 **in-lbs** (15-17.5 Nm).

NOTE

Do not stretch gaskets while installing; position gaskets in cover and use top rocker cover to press gaskets into position.

12. See Figure 3-69. Install upper rocker covers (6).
    a. Place a **new** inner gasket (9) on lower rocker box assemblies.
    b. Place a **new** lower gasket (10) on lower rocker cover.
    c. Install upper rocker cover using screws with washers and **new** fiber seals (5). Tighten screws to 120-168 **in-lbs** (13.6-18.9 Nm).



1. **Tighten/loosen first**
2. **Tighten/loosen second**
3. **Tighten/loosen third**
4. **Tighten/loosen fourth**
5. **Front cylinder**
6. **Rear cylinder**

Figure 3-66. Head Screw Loosening/Tightening Sequence

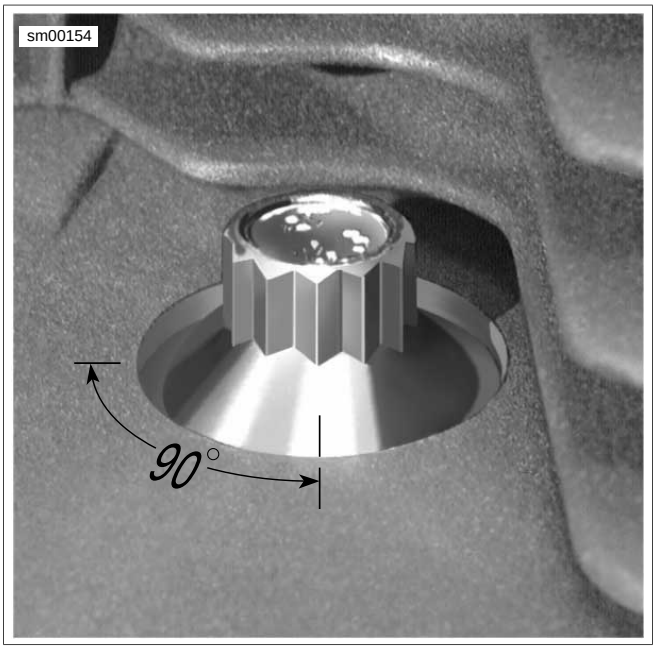
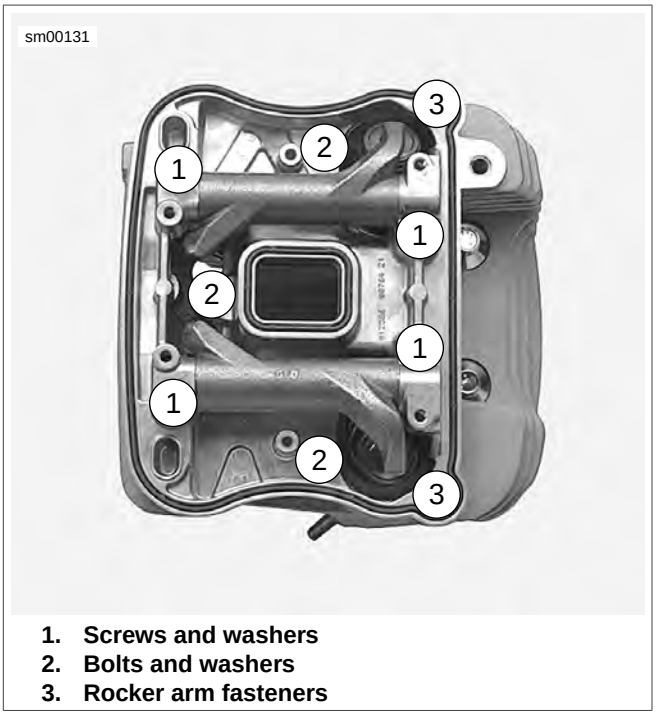


Figure 3-67. Tightening Head Screws



1. Screws and washers
2. Bolts and washers
3. Rocker arm fasteners

Figure 3-68. Lower Rocker Box Fasteners

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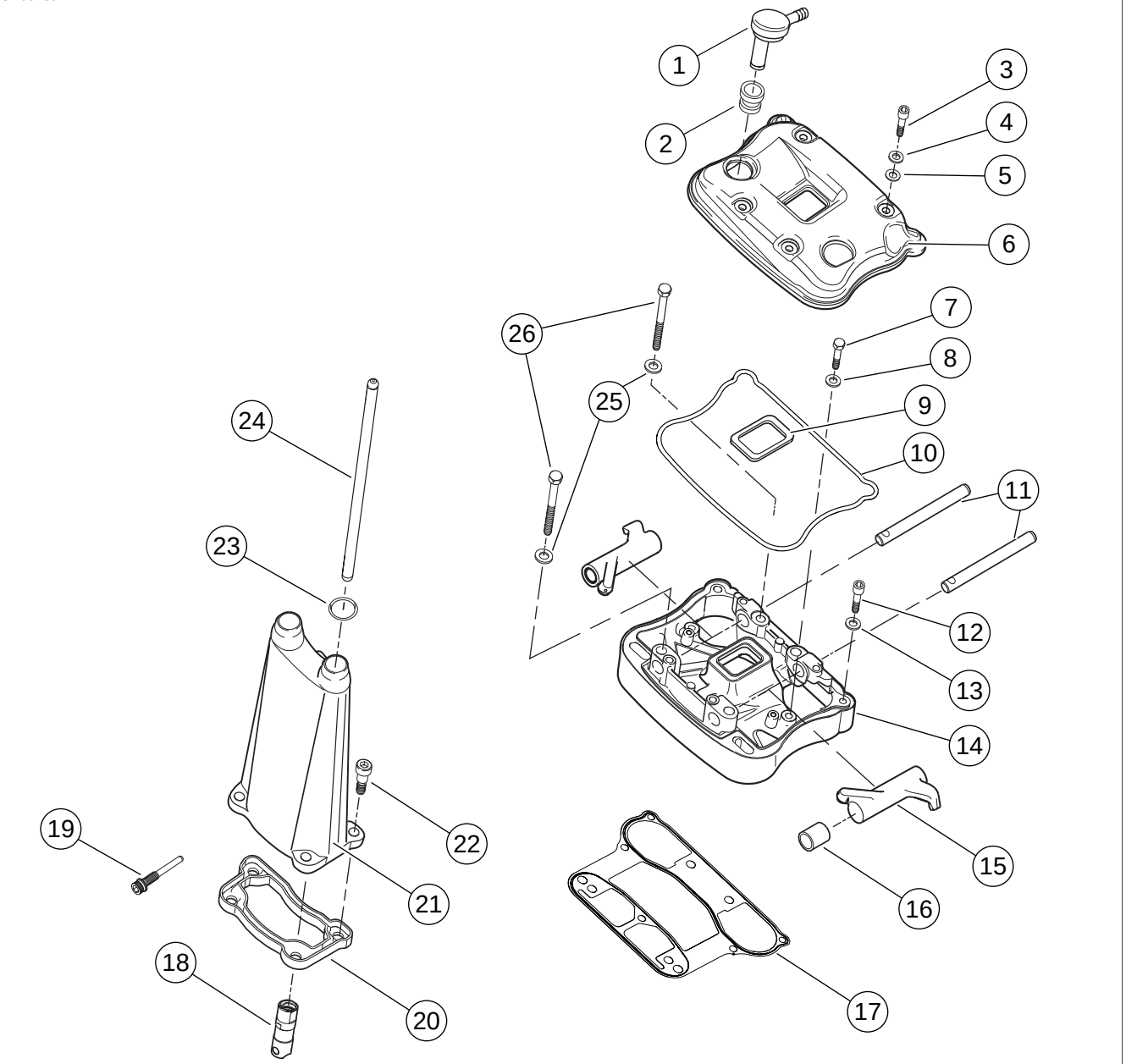


1. Crankcase breather
2. Grommet
3. Screw (4)
4. Washer (4)
5. Fiber seal (4)
6. Rocker cover (top)
7. Bolt (3)
8. Washer (3)
9. Gasket (inner)
10. Gasket (lower)
11. Rocker arm shafts
12. Screw (2)
13. Washer (2)
14. Rocker cover (lower)
15. Rocker arm (2)
16. Bushing (rocker arm - 4)
17. Gasket (lower rocker cover)
18. Hydraulic lifter
19. Screw, tappet anti-rotation (2)
20. Gasket (push rod cover)
21. Push rod cover
22. Screw (4)
23. O-ring (push rod cover - 2)
24. Push rod
25. Washer (4)
26. Bolt (4)

Figure 3-69. Rocker Arm and Pushrod Cover Assemblies

CYLINDER AND PISTON 3.8

REMOVAL/DISASSEMBLY

PART NUMBER	TOOL NAME
HD-34623C	PISTON PIN RETAINING RING INSTALLER

1. Strip motorcycle as described under 3.4 ENGINE ROTATION FOR SERVICE.
2. Remove cylinder head. See 3.7 CYLINDER HEAD.
3. Clean crankcase around cylinder base to prevent dirt and debris from entering crankcase while removing cylinder.
4. See Figure 3-70. Turn engine over until piston of cylinder being removed is at bottom of its stroke.
5. Carefully raise cylinder just enough to permit placing clean towel under piston to prevent any foreign matter from falling into crankcase.

NOTE

If cylinder does not come loose, lightly tap a plastic hammer perpendicular to the cylinder fins. Never try to pry a cylinder up.

6. Carefully lift cylinder over piston and cylinder studs. Do not allow piston to fall against cylinder studs. Discard cylinder base gasket.

NOTE

With cylinder removed, be careful not to bend the cylinder studs. The slightest bend could cause a stress riser and lead to stud failure.

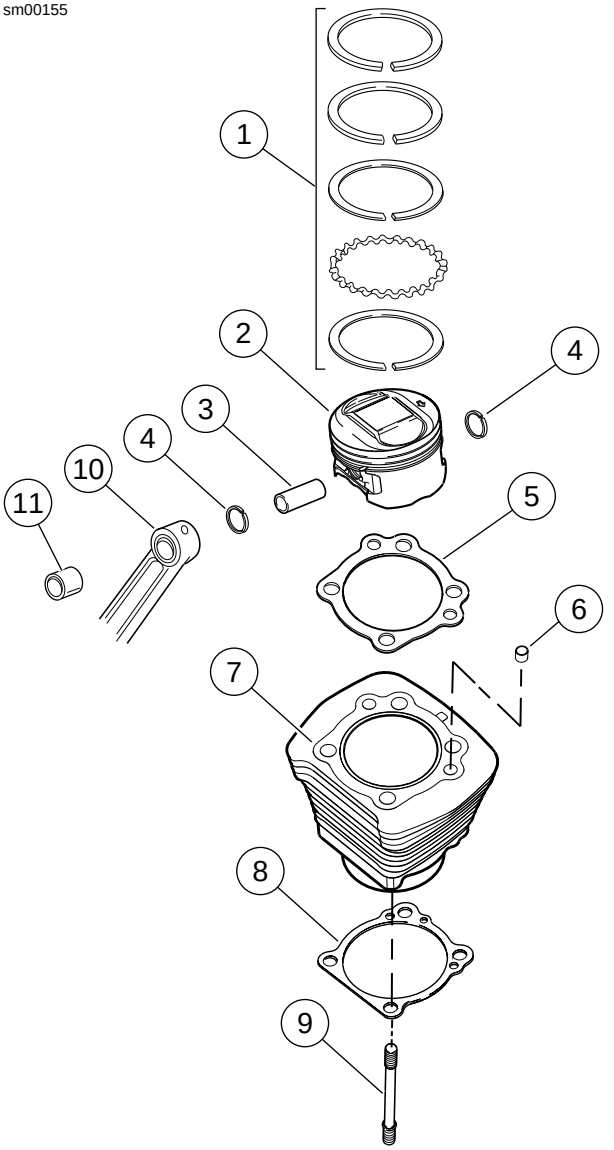
7. Install a 6 in. (152 mm) length of 1/2 in. (12.7 mm) ID plastic or rubber hose over each cylinder stud. This will protect the studs and the piston.

⚠WARNING

Wear safety glasses or goggles when removing or installing piston pin retaining rings. Piston pin retaining rings are compressed in the ring groove and can fly out when removed from the groove, which could result in serious eye injury. (00293a)

NOTE

DO NOT re-use piston pin retaining rings. Removal may weaken retaining rings and they may break or dislodge if reinstalled resulting in engine damage.



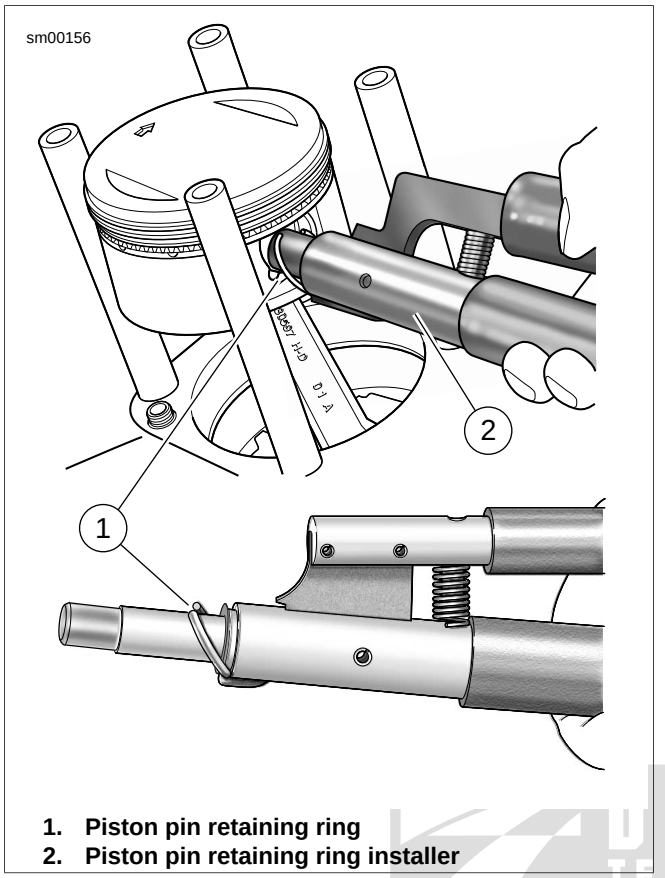
1. **Ring set**
2. **Piston**
3. **Piston pin**
4. **Retaining ring (2)**
5. **Head gasket**
6. **Dowel**
7. **Cylinder**
8. **Base gasket**
9. **Cylinder stud (4)**
10. **Connecting rod**
11. **Piston pin bushing**

Figure 3-70. Cylinder and Piston

NOTE

Handle the piston with extreme care. The alloy used in these pistons is very hard. Any scratches, gouges or other marks in

the piston could score the cylinder during engine operation and cause engine damage.



1. **Piston pin retaining ring**
2. **Piston pin retaining ring installer**

Figure 3-71. Removing Piston Pin Circlip

8. See Figure 3-71. Remove the piston pin circlip as follows:
   a. Insert the PISTON PIN RETAINING RING INSTALLER (Part No. HD-34623C) into the piston pin bore until claw on tool is positioned in slot of piston (directly under circlip).
   b. Squeeze the handles of the tool together and pull from bore. In the event that the circlip should fly out, hold a shop towel over the bore during removal. Remove circlip from claw and discard.

NOTES

- *It is not necessary to remove **both** piston pin circlips during piston removal. Leave the second circlip in the pin bore.*
- *Since the piston pin is a loose fit in the piston, the pin will easily slide out. The pin has tapered ends to help seat the round retaining rings.*

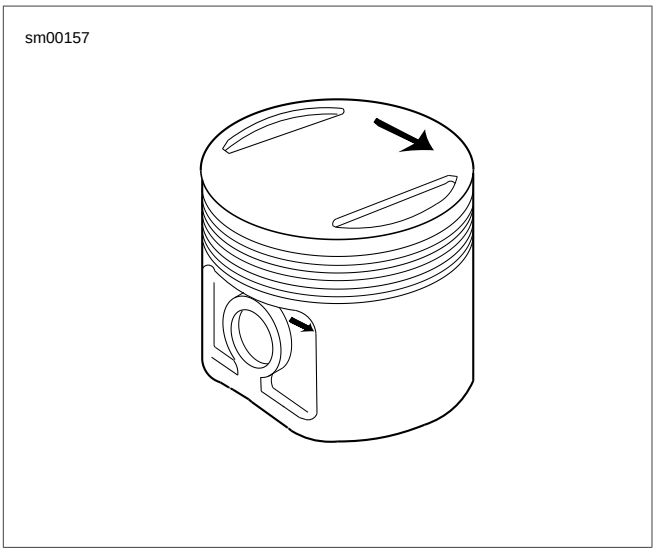


Figure 3-72. Piston Pin and Piston Identification

NOTE

See Figure 3-72. The arrows on the pistons must always point toward the front of the engine.

Figure 3-73. Removing Piston Rings

9. See Figure 3-73. Using a piston ring expander to remove piston rings, spread rings until they clear grooves in piston and lift off.

CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
HD-33446-86	XL EVOLUTION TORQUE PLATE BOLTS
HD-33446B	CYLINDER TORQUEPLATES

⚠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. Soak cylinder and piston in an aluminum-compatible cleaner/solvent until deposits are soft, then clean with a brush. Blow off loosened carbon and dirt particles and wash in solvent.
2. Clean oil passage in cylinder with compressed air.
3. Clean piston ring grooves with a piece of compression ring ground to a chisel shape.
4. Examine piston pin to see that it is not pitted or scored.
5. Check piston pin bushing to see that it is not loose in connecting rod, grooved, pitted or scored.
   a. A piston pin properly fitted to upper connecting rod bushing has a 0.00125-0.00175 in. (0.03175-0.04445 mm) clearance in bushing.
   b. See 3.8 CYLINDER AND PISTON, Connecting Rod Bushing. If piston pin-to-bushing clearance exceeds 0.00200 in. (0.05080 mm), replace worn parts.
6. Clean piston pin retaining ring grooves.
7. Examine piston and cylinder for cracks, burned spots, grooves and gouges.
8. Check connecting rod for up and down play in lower bearings. When up and down play is detected, lower bearing should be refitted. This requires removing and disassembling engine crankcase.

Checking Gasket Surface

NOTE

If cylinder gasket surface does not meet flatness specifications, replace cylinder and piston. Proper tolerances will extend component life and prevent leaks.

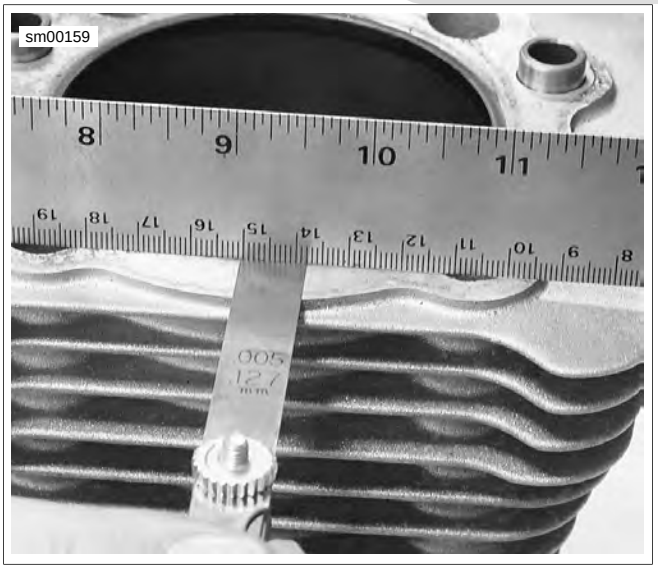


Figure 3-74. Checking Gasket Surface

1. See Figure 3-74. Check cylinder head gasket surface for flatness.
   a. Lay a straightedge across the surface.
   b. Try to insert a feeler gauge between the straightedge and the gasket surface.
   c. If cylinder head gasket surface is not flat within 0.006 in. (0.152 mm), replace cylinder and piston.
2. Check cylinder base gasket surface for flatness.
   a. Lay a straightedge across the surface.
   b. Try to insert a feeler gauge between the straightedge and the gasket surface.
   c. If cylinder base gasket surface is not flat within 0.008 in. (0.203 mm), replace cylinder and piston.

Measuring Cylinder Bore

1. Remove any burrs from the cylinder gasket surfaces.
2. See Figure 3-75. Install a head gasket, base gasket, and CYLINDER TORQUEPLATES (Part No. HD-33446B) and XL EVOLUTION TORQUE PLATE BOLTS (Part No. HD-33446-86). Tighten the bolts using the same method used when installing the cylinder head screws. See 3.2 SPECIFICATIONS.

NOTE

Torque plates, properly tightened and installed with gaskets, simulate engine operating conditions. Measurements will vary as much as 0.001 in. (0.025 mm) without torque plates.

3. See Figure 3-75. Take cylinder bore measurement in ring path, starting about 0.50 in. (12.7 mm) from top of cylinder, measuring from front to rear and then side to side. Record readings.
4. Repeat measurement at center and then at bottom of ring path. Record readings. This process will determine if cylinder is out-of-round and will also show any cylinder taper or bulge.
5. Refer to Table 3-20. If cylinder is not scuffed or scored and is within service limit, deglaze the cylinder.

NOTE

*If cylinder clearance exceeds service wear limit, cylinders and pistons should be replaced with **new** components. See 3.2 SPECIFICATIONS.*

Table 3-20. Cylinder Bore Service Wear Limit

STANDARD BORE	IN.	MM
XB models	3.5008	88.9203

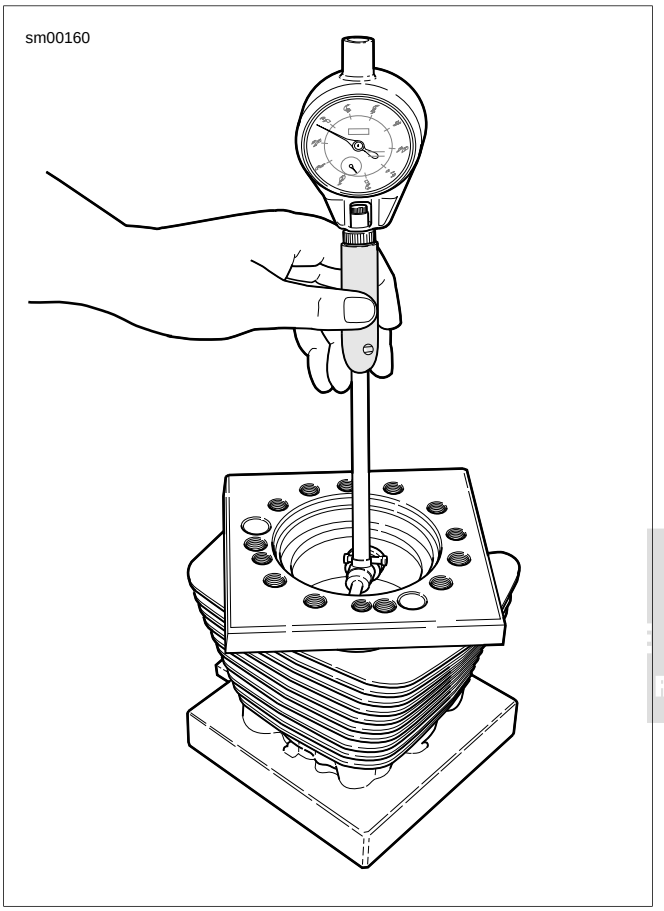


Figure 3-75. Measuring Cylinder Bore Using Torque Plates (Part No. HD-33446B)

Deglazing Cylinder

NOTE

Deglazing removes wear patterns, minor scuff marks and scratches without enlarging the bore diameter.

1. Lightly swab the cylinder bore with a cloth dipped in clean engine oil.
2. Obtain a 240 grit flexible ball-type deglazing tool with a bristle tip or finishing stone arrangement able to produce a 60° cross hatch pattern.
3. Install the deglazing tool in a slow-speed drill. The speed at which the tool rotates determines the speed at which it must be stroked up and down the bore to produce the desired cross hatch pattern.
4. Starting at the bottom of the cylinder, move the deglazing tool up and down the entire length of the cylinder bore for 10 to 12 complete strokes.

NOTES

- *Stop to examine the cylinder bore and/or take measurements. A precise 60° cross hatch pattern in the piston travel area is the most important.*
- *The angular cross hatch pattern verifies an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An Improper crosshatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption.*
- *Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and possible engine failure.*

5. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence or dirt or debris.
6. Hot rinse the cylinder and dry with moisture free compressed air.
7. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

8. With the cylinder at room temperature, check the cylinder clearance. See 3.2 SPECIFICATIONS.

FITTING PISTON RINGS

PART NUMBER	TOOL NAME
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

NOTE

See Figure 3-76. Piston rings are of two types: compression (1, 2) and oil control (3). The two compression rings are positioned in the two upper piston ring grooves. The dot (4) on the second compression ring must face upward.

1. See Figure 3-77. Insert the **new** ring into the cylinder, square it in the bore using the top of the piston and measure the ring end gap with a feeler gauge. Do not use the ring if the end gap does not fall within the following specifications, refer to Table 3-21.

NOTES

- *The same piston may be used if cylinder bore was not changed, unless it is scuffed or grooved. If re-using piston, replace piston rings and hone the cylinder walls with a No. 240 grit flexible hone to facilitate ring seating.*
- *Piston ring sets must be properly fitted to piston and cylinder.*

2. See Figure 3-78. Apply engine oil to piston grooves. Install rings on piston starting with the oil ring, second compres-

sion ring, then the top ring. Use TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586-A) to slip compression rings over piston into their respective grooves. Be extremely careful not to over expand, twist rings or damage piston surface when installing rings.

NOTE

Install second compression ring with dot towards top.

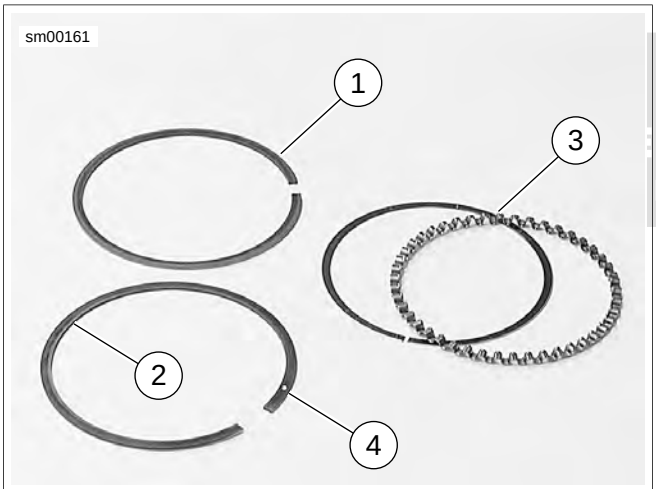
3. See Figure 3-79. Install rings so end gaps of adjacent rings are a minimum of 90° apart. Ring gaps are not to be within 10° of the thrust face centerline.
4. See Figure 3-80. Check for proper side clearance with thickness gauge, as shown. See 3.2 SPECIFICATIONS.

NOTE

If the ring grooves are clean and the side play is still not correct, replace the rings, the piston or both.

Table 3-21. Piston Ring End Gap

RING TYPE	IN.	MM
Top compression ring	0.007-0.020	0.18-0.51
2nd compression ring	0.007-0.020	0.18-0.51
Oil control ring rails	0.009-0.052	0.23-1.32



1. **Top compression ring (install either side up)**
2. **Second compression ring (install dot toward top)**
3. **Oil control rings**
4. **Dot**

Figure 3-76. Piston Rings

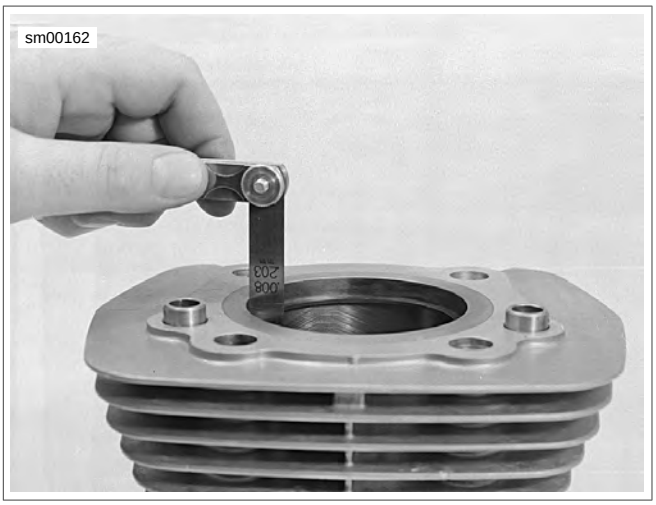
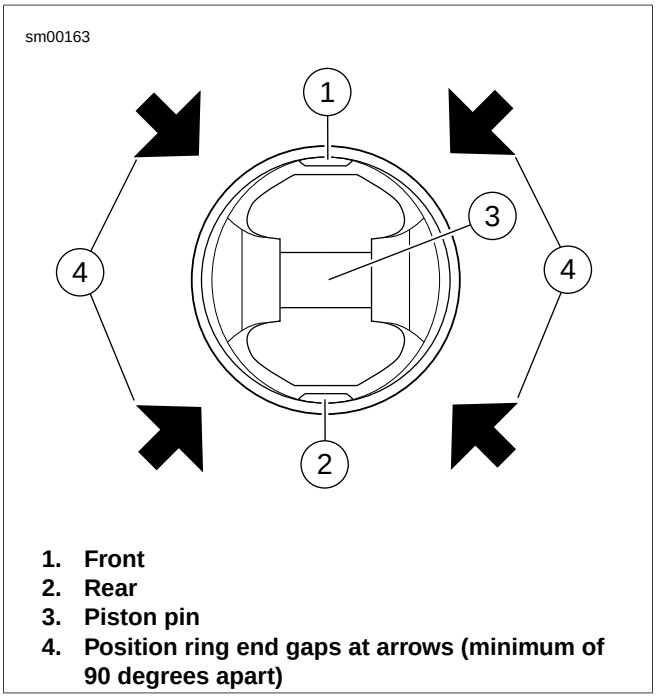


Figure 3-77. Measuring Ring End Gap

Figure 3-78. Installing Piston Rings Using Transmission Shaft Retaining Ring Pliers (Part No. J-5586-A)



1. **Front**
2. **Rear**
3. **Piston pin**
4. **Position ring end gaps at arrows (minimum of 90 degrees apart)**

Figure 3-79. Ring End Gap Position

Figure 3-80. Measuring Ring Clearance in Groove

CONNECTING ROD BUSHING

PART NUMBER	TOOL NAME
HD-35102	WRIST PIN BUSHING HONE
HD-94800-26A	REAMER
HD-95952-33C	CONNECTING ROD CLAMPING TOOL
HD-95970-32D	PISTON PIN BUSHING TOOL

When connecting rod bushing is worn to excessive pin clearance 0.002 in. (0.051 mm) or more, it must be replaced.

1. See Figure 3-81. Secure connecting rod with CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C).
2. See Figure 3-82. Attach PISTON PIN BUSHING TOOL (Part No. HD-95970-32D) to the connecting rod.

NOTE

See Figure 3-83. The receiver cup fits on one side of the rod while the driver fits on the opposite side as shown.

3. Use two box wrenches and push worn bushing from connecting rod.
4. Remove piston pin bushing tool from connecting rod.
5. Remove bushing from receiver cup.
6. See Figure 3-84. Place **new** bushing between connecting rod and driver.

NOTE

The driver must be attached facing the opposite direction as it was for removal of the bushing.

7. Clean up and size bushing to 0.0010-0.0005 in. (0.0254-0.0127 mm) undersize using REAMER (Part No. HD-94800-26A). Sizing bushing with less than 0.00125 in. (0.03175 mm) clearance can result in a bushing loosening and/or seized pin in rod.
8. Hone bushing to final size using WRIST PIN BUSHING HONE (Part No. HD-35102). Use a liberal amount of honing oil to prevent damage to hone or bushing. Use care to prevent foreign material from falling into the crankcase.
9. Clean bore.

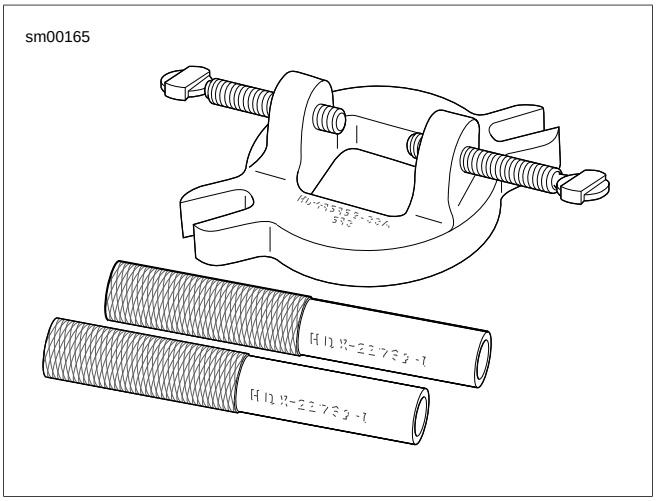
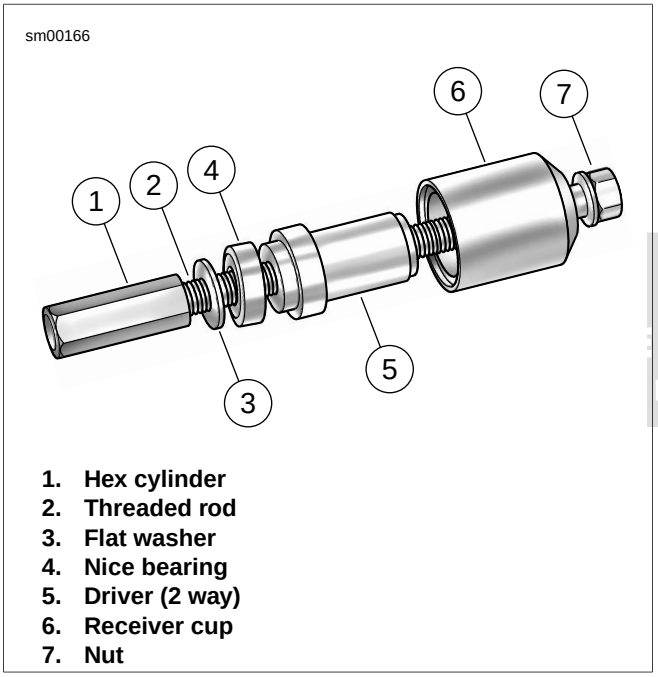
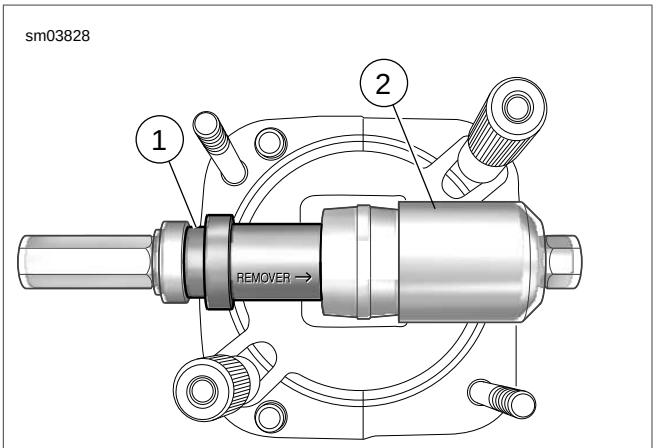


Figure 3-81. Connecting Rod Clamping Tool



1. **Hex cylinder**
2. **Threaded rod**
3. **Flat washer**
4. **Nice bearing**
5. **Driver (2 way)**
6. **Receiver cup**
7. **Nut**

Figure 3-82. Piston Pin Bushing Tool (Part No. HD-95970-32D)



1. **Remover side of driver**
2. **Receiver cup**

Figure 3-83. Removing Wrist Pin Bushing

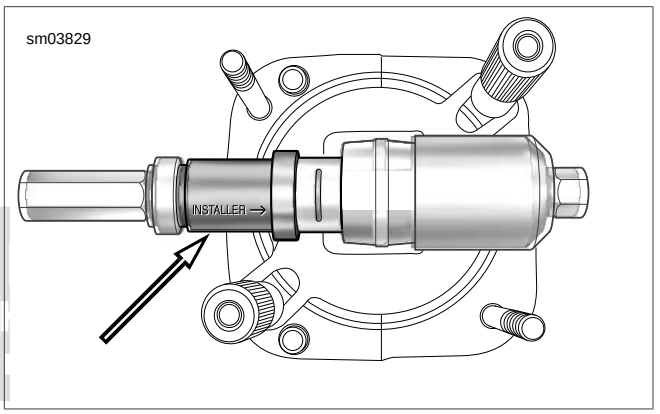


Figure 3-84. Installer Side of Driver

ASSEMBLY/INSTALLATION

PART NUMBER	TOOL NAME
HD-34623C	PISTON PIN RETAINING RING INSTALLER
HD-42322	PISTON SUPPORT PLATE
HD-96333-51E	PISTON RING COMPRESSOR

1. See Figure 3-85. Place PISTON SUPPORT PLATE (Part No. HD-42322) in position as shown.
2. Install piston assembly over connecting rod.

NOTE

See Figure 3-86. Piston must be installed with the arrows pointing towards the front of the engine.

3. Liberally lube piston pin with clean engine oil and install piston pin.

NOTE

*Always use **new** retaining ring. Make sure retaining ring groove is clean and that ring seats firmly in groove. If it does not, discard the ring. Never install a used retaining ring or a new one*

if it has been installed and then removed for any reason. A loosely installed ring will come out of the piston groove and damage cylinder and piston beyond repair.

4. See Figure 3-87. Install **new** piston pin retaining rings (1) using PISTON PIN RETAINING RING INSTALLER (Part No. HD-34623C). Place **new** retaining ring on tool with gap pointing up.

NOTE

Make sure the ring groove is clean. Ring must be fully seated in the groove with the gap away from the slot at the bottom.

5. See Figure 3-88. Make sure the piston ring end gaps are properly positioned as shown.
6. Turn engine until piston is resting on top of piston support plate.
7. Lubricate cylinder wall and piston with engine oil.
8. Remove protective sleeves from cylinder studs. Install a **new** cylinder base gasket. Make sure the piston does not bump the studs or crankcase.
9. See Figure 3-89. Compress the piston rings using PISTON RING COMPRESSOR (Part No. HD-96333-51E).
10. Install cylinder over piston.
11. Remove the ring compressor.

NOTE

Push rods and covers must be installed prior to installing cylinder heads.

12. Assembled and install cylinder head. See 3.7 CYLINDER HEAD.
13. Rotate engine back up into frame. See 3.4 ENGINE ROTATION FOR SERVICE.

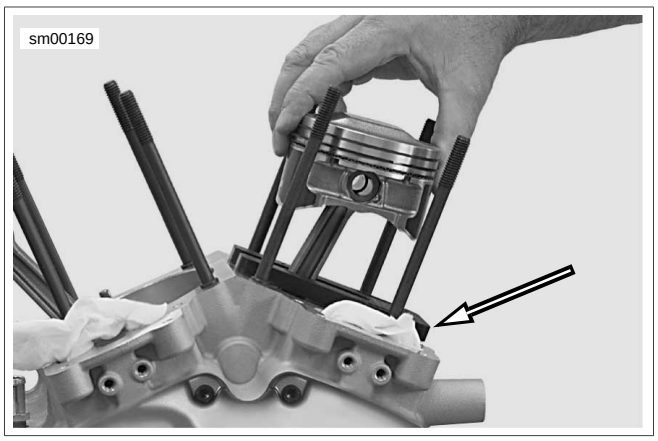


Figure 3-85. Piston Support Plate

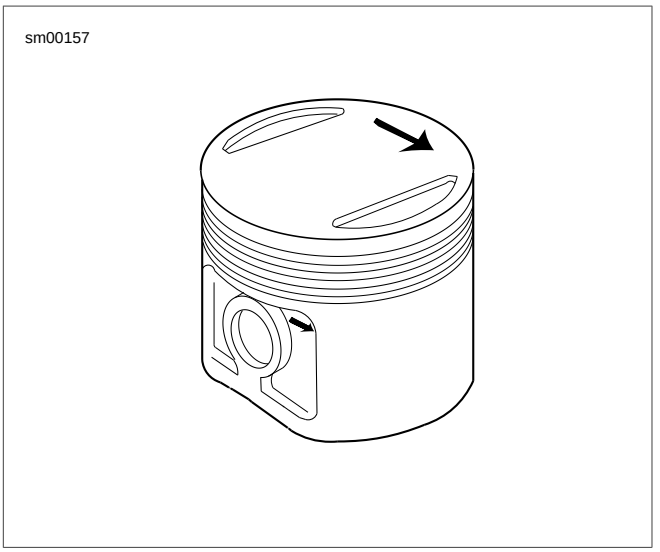
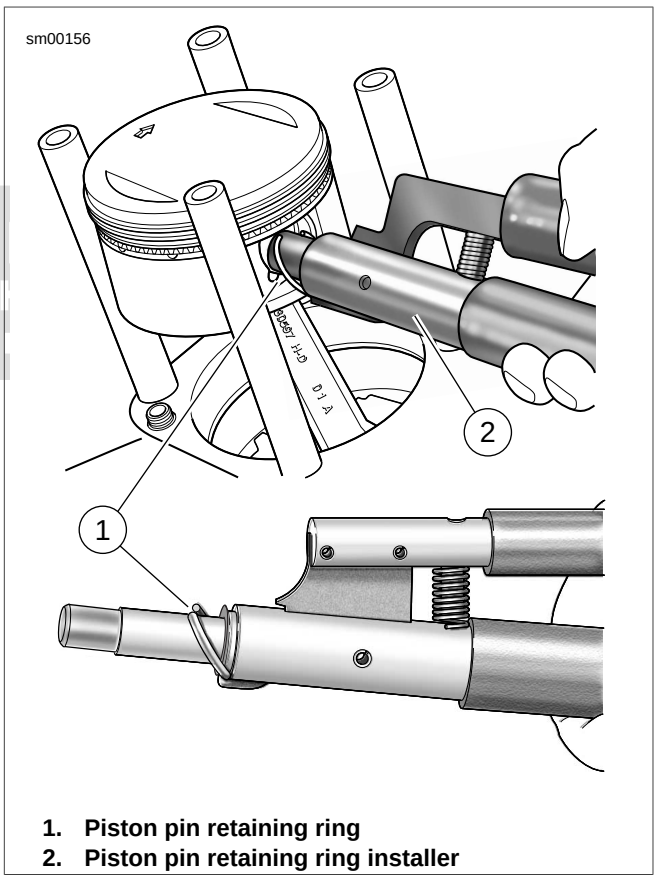
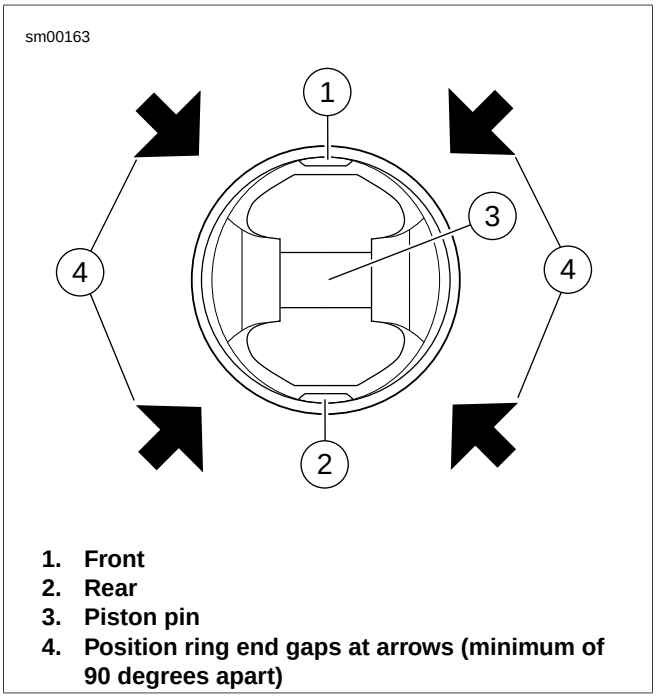


Figure 3-86. Piston Pin and Piston Identification



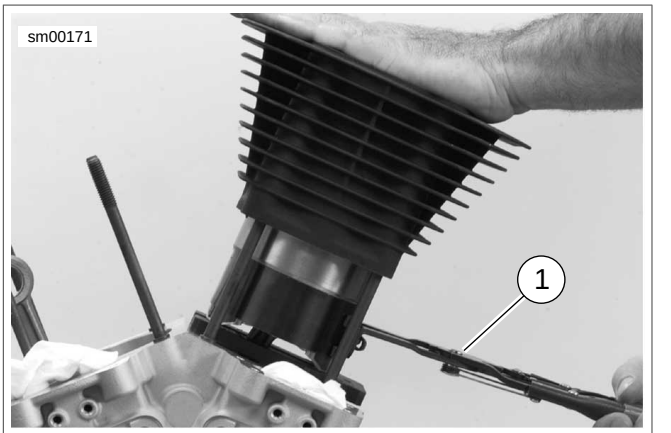
1. **Piston pin retaining ring**
2. **Piston pin retaining ring installer**

Figure 3-87. Installing Piston Pin Circlip



1. Front
2. Rear
3. Piston pin
4. Position ring end gaps at arrows (minimum of 90 degrees apart)

Figure 3-88. Ring End Gap Position



1. Piston ring compressor

Figure 3-89. Compressing Piston Rings

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OILING SYSTEM 3.9

GENERAL

1. The engine has a gravity/suction type oiling system, incorporating oil feed and return pumps in the same body and oil is supplied from the oil reservoir/swingarm to the feed side of the gerotor-style oil pump.
2. Oil enters and fills a cavity located in the feed gerotor.

NOTE

See 3.10 OIL PUMP for a complete explanation of the gerotor pump sets.

3. The feed gerotor of the pump forces oil through a passage in the oil pump body which contains a bypass valve. When the oil pressure exceeds the setting of the bypass valve spring, 25 PSI (172 kPa), a passage is opened and the surplus oil is returned back to the feed gerotor.
4. The remaining oil continues through a passage and enters the peripheral cavity of the oil filter, passes through the filtering medium into the central cavity of the oil filter, and flows into the filter adapter (fitting which connects filter to filter mount).
5. Through an external hose, oil then flows through the oil filter to the oil cooler.
6. From the oil cooler, oil flows through an external hose back to the oil pump body.
7. Oil then flows through a passage to the oil pressure signal light switch and when it reaches adequate oil pressure it activates the switch and shuts off the oil pressure signal light.
8. Oil enters an intersecting passage in the oil pump body and flow is then routed to each camshaft. Hollow camshafts allow pressurized oil to lubricate each camshaft bore with the exception of the outboard three and four cam bores which are lubricated with the oil feeding the gerotors.
9. Oil enters a hole in the end of the pinion shaft and travels to the right flywheel where it is routed through the flywheel to the crankpin. Oil is forced through the crankpin to properly lubricate the rod bearing assembly.
10. Oil flow then continues to the main feed galley at the top of the oil pump body. Passages in the crankcase intersect the main feed galley and carry oil to all hydraulic lifters and piston jets. The piston jets, which receive a supply of oil from the intake lifter bores, spray the underside of the pistons for cooling of the piston crown and skirt area. A check valve in each piston jet opens when the oil pressure reaches 12-15 PSI (83-103 kPa) oil pressure. Oil spray from each piston jet also enters a hole at the bottom of each pin boss for lubrication of the piston pin.
11. Surplus oil drains back to the bottom of the flywheel compartment where it collects in the sump area. Oil collected in the sump area is splash-fed to the pistons, cylinder walls and flywheel components. Oil collected in the sump area is drawn through an internal passage in the right crankcase that connects to the scavenge gerotor of the oil pump. Return oil flow from the sump is increased by the pressure created by the downward stroke of the pistons. Oil is returned to the oil reservoir/swingarm.
12. Oil flows from the hydraulic lifters up passages in the push rods to the rocker arm shafts and bushings. The valve stems are lubricated by oil supplied through drilled oil holes in the rocker arms.
13. Feed oil to the rocker arm/valve stem area is returned to the crankcase through passages in the heads and cylinders.
14. Oil collected in the push rod areas of the cylinder heads flows down the push rod covers, through drain holes in the tappet blocks and into the oil pump body.

NOTES

- *Engine oil should be at normal operating temperature 180° F (82° C) when testing, for an accurate reading.*
- *Oil pressure at proper operating temperature should be between 10-16 PSI (69-110 kPa) at idle.*
- *Oil pressure at 3000 RPMs, at proper operating temperature, should be between 20-28 PSI (138-193 kPa).*

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OIL PUMP 3.10

GENERAL

See Figure 3-90. The oil pump consists of two gerotor gear sets, feed and return, housed in one pump body. The feed set distributes oil to the engine, the scavenge set returns oil to the tank/swingarm reservoir.

A gerotor-type gear set has two parts, an inner and an outer gerotor. The inner gerotor has one less tooth than the outer gerotor. Both gerotors have fixed centers offset to each other.

In a gerotor gear set, oil is transferred from inlet to outlet as it is trapped between the rotating inner and outer gerotors.

Gravity-fed oil from the oil reservoir enters the pump through the feed line connector. It is forced by the gerotor feed set through a line to the oil cooler. Return oil from the flywheel compartment/gearcase is drawn back into the pump and is forced by the gerotor scavenge set back to the oil reservoir.

The oil pump seldom needs servicing. Before you disassemble an oil pump suspected of not producing adequate oil pressure, be sure that all possible related malfunctions have been eliminated.

1. Make sure all oil line connections are tight and that lines are not pinched or damaged.
2. Check level and condition of oil in reservoir/swingarm. Pressure will be affected if oil is diluted. In freezing weather, proper circulation of oil can be affected if the oil feed line becomes clogged with ice or sludge.
3. Check for a grounded oil pressure switch wire or faulty switch if oil indicator light fails to go out with engine running.
4. Possible stuck bypass valve. Remove and clean out debris, inspect for damage, reinstall and recheck oil pressure.

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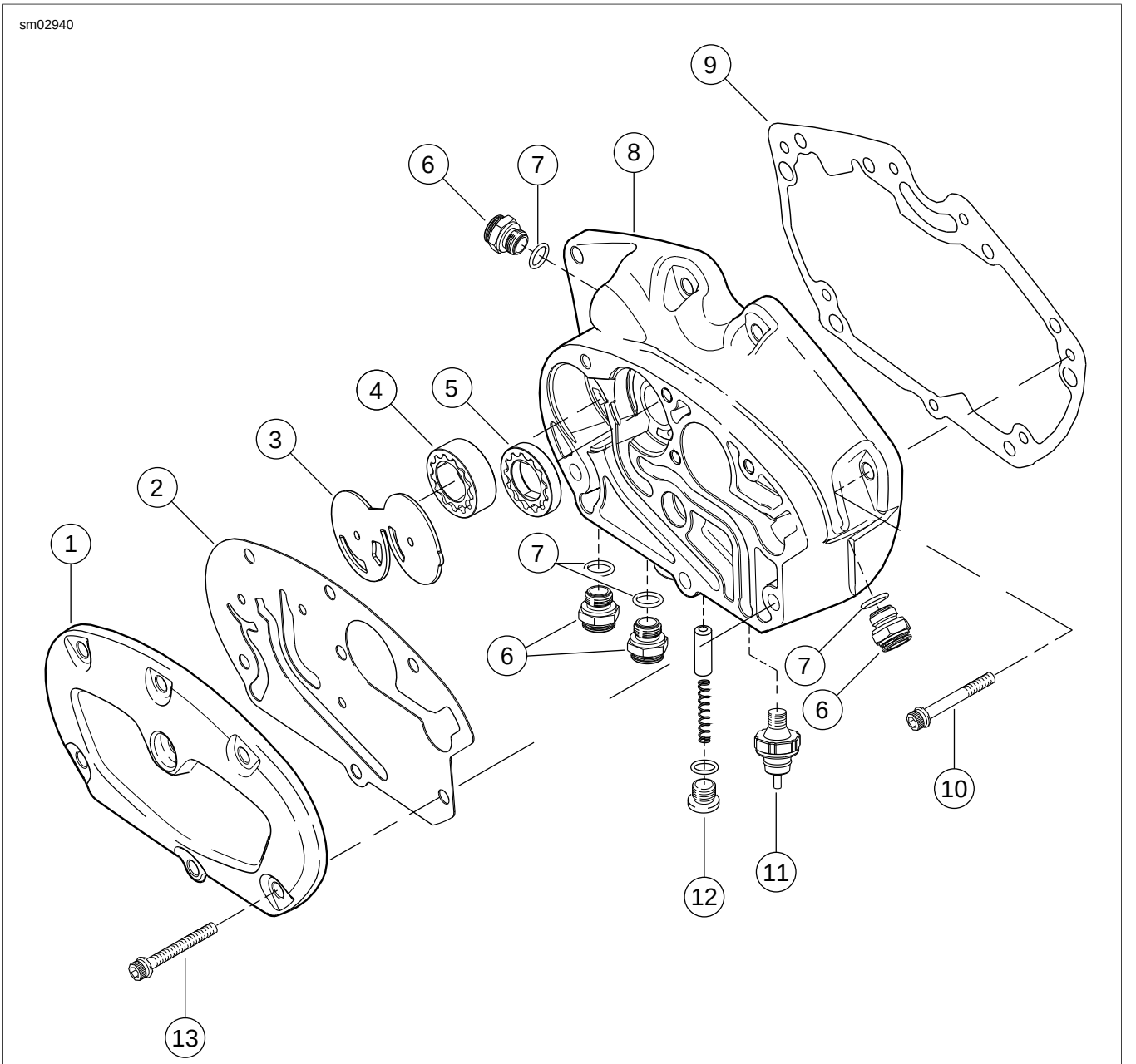

1. **Oil pump cover**
2. **Oil pump cover gasket**
3. **Separator plate**
4. **Scavenge gerotor gear set**
5. **Feed gerotor gear set**
6. **Oil line fittings**
7. **O-rings, oil line fittings**
8. **Oil pump body**
9. **Oil pump mounting gasket**
10. **Oil pump mounting screws (4)**
11. **Oil pressure indicator switch**
12. **Pressure relief valve**
13. **Oil pump cover screws (7)**

Figure 3-90. Oil Pump

REMOVAL/DISASSEMBLY

NOTE

Before vehicle is placed on the lift it will necessary to remove the chin fairing. See 2.50 CHIN FAIRING.

1. Remove seat. See 2.51 SEAT.

⚠WARNING

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

2. Disconnect negative battery cable.

3. Drain oil reservoir. See 1.6 ENGINE OIL AND FILTER.
4. Remove and discard oil filter.

NOTES

- *Oil pump can be removed with engine in frame.*
- *Before removing the oil pump body it will be necessary to unload the valve train to relieve pressure on the cam assemblies.*
- *Before removing the rocker box assemblies, in order to unload the valve train, it will be necessary to rotate the engine down for access. See 3.4 ENGINE ROTATION FOR SERVICE.*

5. Remove rocker box assemblies. See 3.7 CYLINDER HEAD.
6. Remove hydraulic lifters. See 3.16 HYDRAULIC LIFTERS.

NOTES

- *See Figure 3-91. Place a pan under oil pump body (5) and cover to collect oil.*
- *Before removing oil lines refer to 3.12 OIL LINE FITTINGS.*

7. Disconnect feed oil line connection (1) from the bottom and left side of the oil pump body.
8. Disconnect return oil line connection (2) from the bottom and left side of the oil pump body.
9. Disconnect the vent oil line connection (4) from the top left side of the oil pump body.
10. Disconnect the oil cooler return line from the oil pump.
11. Remove oil pressure switch (8).
12. Remove pressure relief valve (9).
13. See Figure 3-90. Carefully remove mounting screws and washers (13) retaining oil pump cover (1) to oil pump body(8).
14. Remove oil pump cover (1) and discard cover gasket (2).
15. Remove separator plate (3).
16. Slide both pieces of gerotor feed set (5) and both pieces of gerotor scavenge set (4) off cam shafts.

NOTE

Whenever the oil pump body is removed it is important not to disturb the cams.

17. Remove remaining fasteners (10) securing oil pump body (8) to right crankcase and remove oil pump body.

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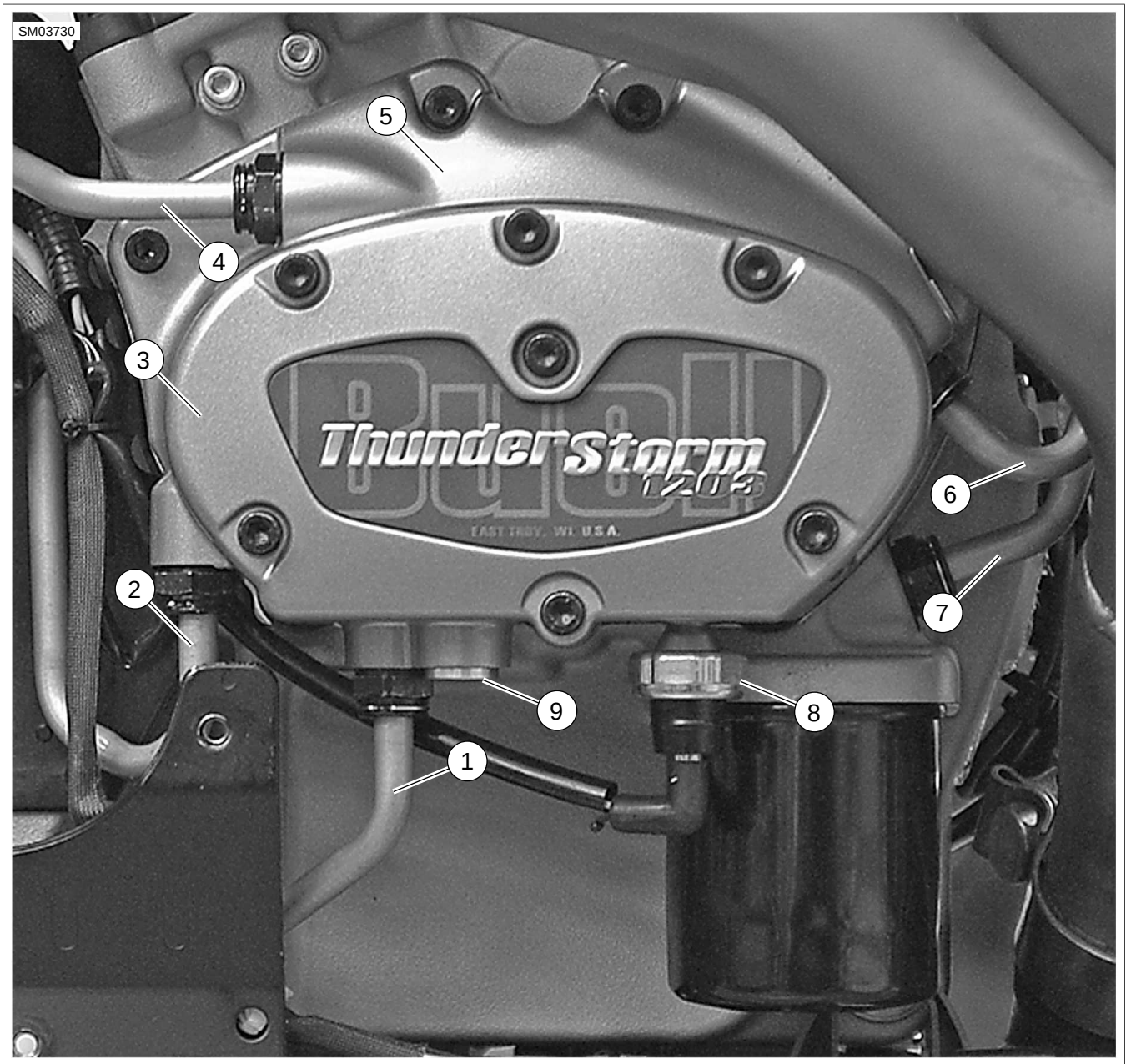


1. **Feed oil line**
2. **Return oil line**
3. **Oil pump cover**
4. **Vent oil line**
5. **Oil pump body**
6. **Return oil line from oil cooler**
7. **Feed oil line to oil cooler**
8. **Oil pressure switch**
9. **Pressure relief valve**

Figure 3-91. Oil Pump Connections

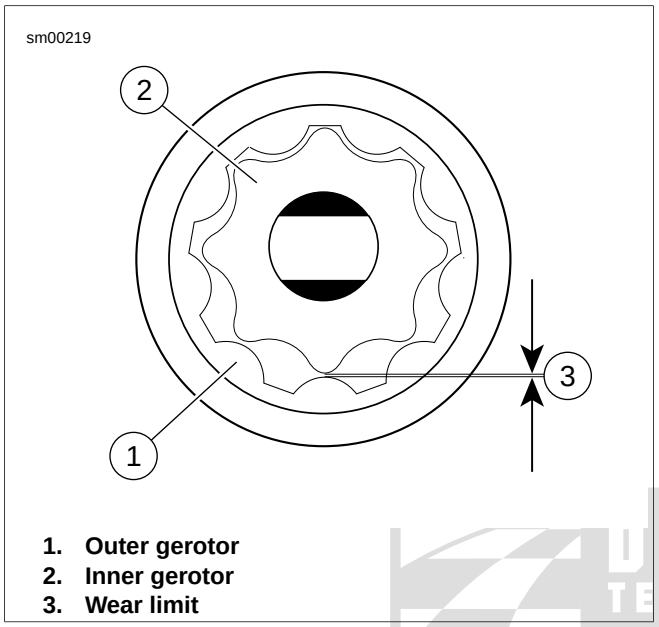
CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all parts in cleaning solvent. Blow out holes and oil passages with compressed air.

2. See Figure 3-92. Inspect both gerotor sets for wear.
   a. Mesh pieces of each set together as shown.
   b. Use a feeler gauge to determine clearance.
   c. The SERVICE WEAR LIMIT between gerotors is 0.004 in. (0.102 mm). Replace gerotors as a set if clearance exceeds this dimension.
   d. Measure thickness of feed gerotors with a micrometer. Replace gerotors as a set if they are not the same thickness.



1. Outer gerotor
2. Inner gerotor
3. Wear limit

Figure 3-92. Gerotor Wear Limits

ASSEMBLY/INSTALLATION

NOTE

Liberally coat all moving parts with clean engine oil to verify easy assembly and smooth operation at start-up.

1. Place new mounting gasket in position.
2. Install **new** oil pump body gasket and secure pump body onto right crankcase. Install fasteners with washers but do not tighten.
3. Slide both pieces of the gerotor feed set and both pieces of the gerotor scavenge set onto their respective cam shafts.
4. See Figure 3-93. Install the separator plate.
5. Install **new** oil pump cover gasket and oil pump cover.
6. See Figure 3-94. Install fasteners and tighten oil pump body and cover fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).

NOTE

After the torque sequence has been completed, it will be necessary to repeat the process to verify proper clamp load.

7. Install pressure relief valve assembly and tighten plug to 108-156 **in-lbs** (12.2-17.6 Nm).
8. Install oil pressure switch and tighten to 96-120 **in-lbs** (11-13.8 Nm).
9. Install hydraulic lifters and push rods. See 3.16 HYDRAULIC LIFTERS, Installation.
10. Install rocker box assemblies. See 3.7 CYLINDER HEAD, Cylinder Head Installation.

NOTE

Before attaching oil lines see 3.12 OIL LINE FITTINGS, Installation.

11. See Figure 3-91. Attach feed line connections on the bottom and right side of the oil pump body.
12. Attach return line connections on the bottom and right side of the oil pump body.
13. Attach the vent line connection to the top left side of the oil pump body.
14. Attach oil cooler return line to oil pump.
15. Install **new** oil filter and fill oil reservoir with proper oil. See 1.6 ENGINE OIL AND FILTER, Change Engine Oil and Filter.
16. Install chin fairing. See 2.50 CHIN FAIRING, Installation.

⚠WARNING

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

17. Connect negative ground cable to battery and tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

18. Install seat.

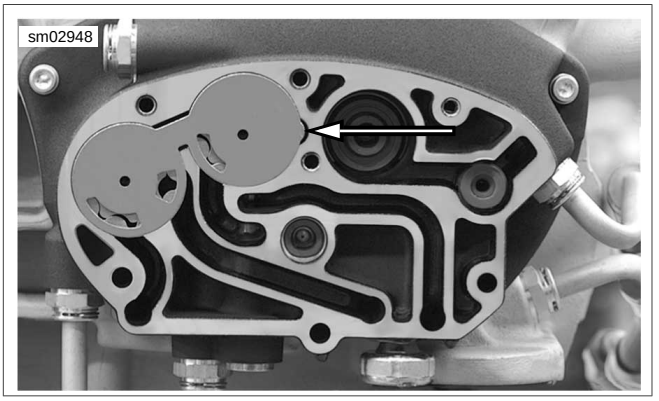


Figure 3-93. Oil Pump Separator Plate

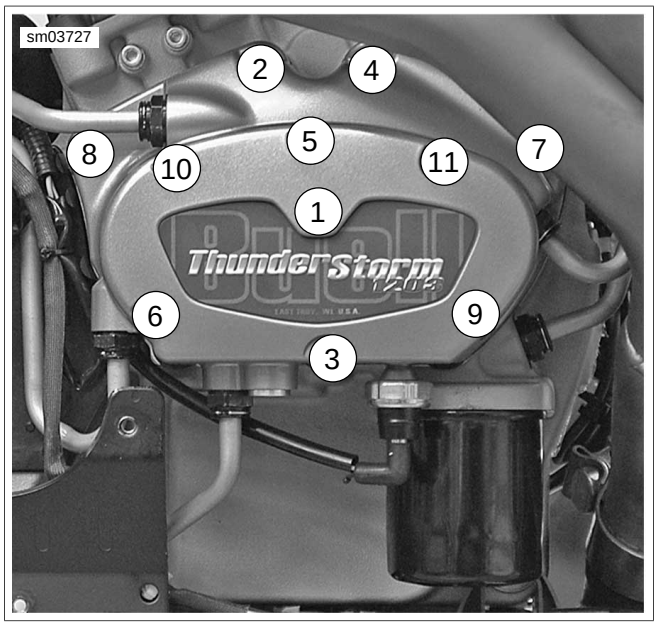


Figure 3-94. Oil Pump Body and Cover Mounting Screw Torque Sequence

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OIL RESERVOIR AND OIL HOSE ROUTING 3.11

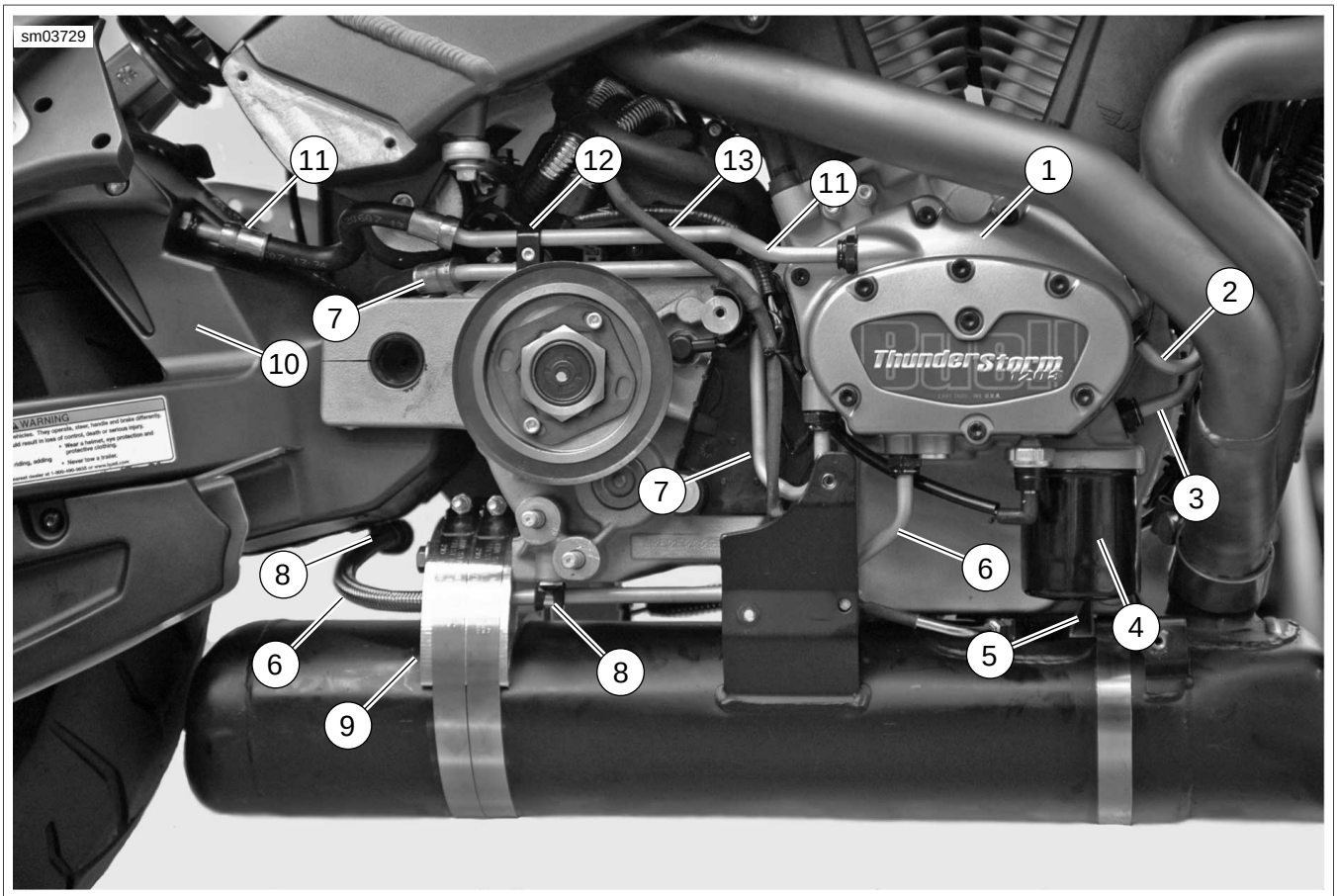
GENERAL

See Figure 3-95. Engine oil runs through the swingarm which serves as the oil reservoir. From the front of the reservoir, the vent line (11) runs to the rear of the oil pump body (1). The return oil line (7) and the feed oil line (6) run to the rear of the oil pump body (1). Three rubberized clamps (8) and one plastic clamp (12) secure the lines in place.

The oil cooler feed line (3) exits the front of the oil pump and routes across the front of the engine to the oil cooler on the left front side of the crankcases. The oil cooler return line (2) then exits the oil cooler and connects to the oil pump on the right front side of the crankcases.

For more information see 3.9 OILING SYSTEM.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Oil pump
2. Oil cooler return line to crankcase
3. Oil cooler feed line from oil pump
4. Oil filter
5. Front muffler mount
6. Feed oil line
7. Return oil line
8. P-clamp
9. Rear muffler bracket
10. Swingarm/Oil reservoir
11. Vent oil line
12. Oil line clamp
13. Cable, interactive exhaust
14. Drain plug

Figure 3-95. Oil Lines and Connections

OIL LINE FITTINGS 3.12

REMOVAL

PART NUMBER	TOOL NAME
B-41623-B	OIL LINE REMOVER

1. See Figure 3-96. Close the OIL LINE REMOVER (Part No. B-41623-B) over the oil line. Match the notches in the tool flange to the U-bends in the spring clip.
2. See Figure 3-97. Rotate the tool to expand the spring clip out of the groove in the oil fitting.
3. Using finger and thumb to hold the OIL LINE REMOVER (Part No. B-41623-B) squarely against the fitting to keep the spring clip expanded. Use only enough pressure to hold the tool square. Excess pressure will prevent simultaneously pulling the line and tool from the fitting.
4. Pull the oil line and the tool from the fitting.
5. Repeat to remove the remaining oil lines.
6. Remove oil line fittings and plug the holes until they can be replaced.

Figure 3-96. Oil Line Remover

Figure 3-97. Oil Line Fitting with Spring Clip

INSTALLATION

1. Install oil line fittings with o-ring into swingarm and tighten to 108-156 **in-lbs** (12-17.6 Nm).
2. See Figure 3-98. Push the correct flanged oil line into the correct fitting in the swingarm until each one clicks in place under the spring clip.
3. Lightly tug on oil line to verify that it is securely locked to fitting and the spring clip is seated in the oil line fitting groove.
4. Check oil level and add oil if required.
5. After running engine:
   a. Inspect oil fittings for oil leaks.
   b. Check oil level and add oil if required.

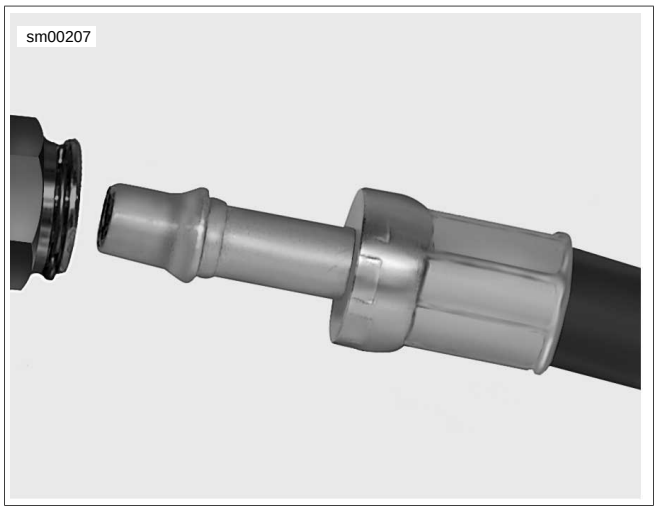


Figure 3-98. Flanged Oil Line

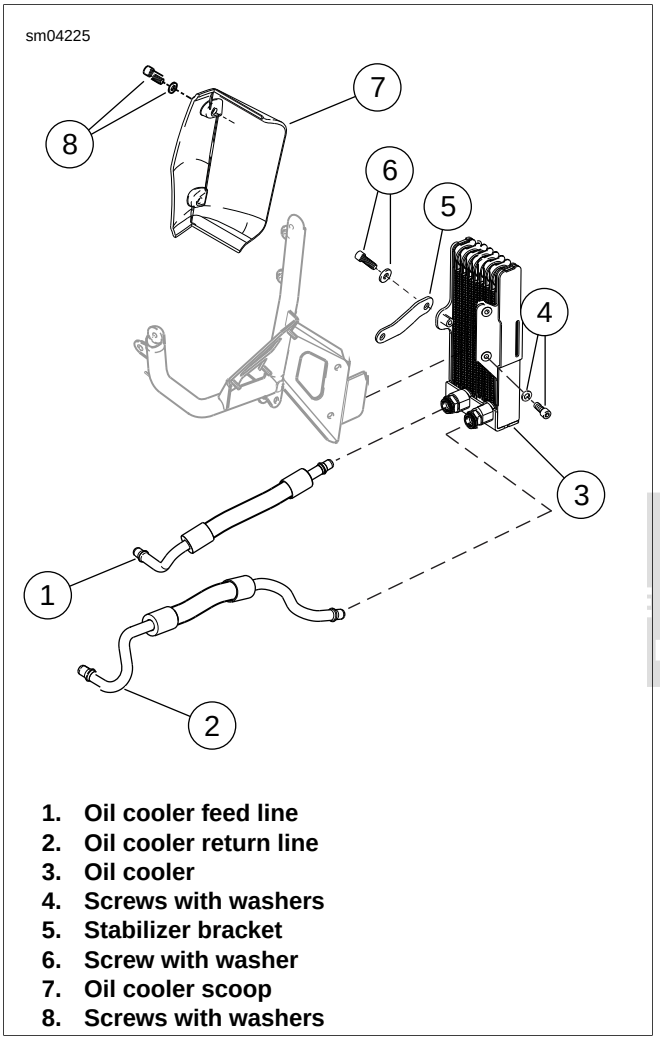
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

OIL COOLER 3.13

GENERAL

For engine oil flow through the engine, See 3.9 OILING SYSTEM.

Engine oil flows from the oil pump to the oil cooler through a supply hose. The oil circulates through the finned tubes of the cooler to dissipate heat and returns to the oil pump through a return hose.



1. **Oil cooler feed line**
2. **Oil cooler return line**
3. **Oil cooler**
4. **Screws with washers**
5. **Stabilizer bracket**
6. **Screw with washer**
7. **Oil cooler scoop**
8. **Screws with washers**

Figure 3-99. Oil Cooler: XB Models

REMOVAL

1. Cover the front chin fairing to protect finish.

NOTE

Dispose of oil in accordance with local regulations.

2. Place a container under the motorcycle to catch excess oil.
3. Disconnect oil cooler return line (2) at oil cooler.
4. Disconnect oil cooler feed line (1) at oil cooler.
5. Remove two fasteners (8) securing the oil cooler scoop (7) and remove scoop.

NOTE

Place protective covering over primary cover to prevent cosmetic damage when removing and installing fastener for stabilizer bracket.

6. Remove fastener (6) securing oil cooler to stabilizer bracket (5).
7. Remove the fasteners (4) holding the oil cooler (3) to mounting bracket.
8. Remove oil cooler from bracket.

NOTE

Check the oil cooler for dirt and debris.

INSTALLATION

1. Slide the oil cooler back onto the bracket.
2. After the oil cooler (3) is in place, apply LOCTITE 271 (red) to the two fasteners (4) and tighten to 96-108 **in-lbs** (10.8-12.2 Nm).
3. Install the stabilizer bracket fastener (6) and tighten to 66-78 **in-lbs** (7.5-8.8 Nm).
4. Install oil cooler scoop (7) and apply LOCTITE 271 (red) to the two fasteners (8) and tighten to 48-72 **in-lbs** (5.4-8 Nm).
5. Connect feed oil line (1) to oil cooler.
6. Connect return oil line (2) to oil cooler.

OIL PRESSURE INDICATOR SWITCH 3.14

GENERAL

The oil pressure indicator switch is a pressure-actuated diaphragm-type switch. When oil is not circulating through the system or when oil pressure is low, spring tension holds the switch contacts closed, thereby completing the signal light circuit and causing the indicator lamp to illuminate.

OIL PRESSURE SIGNAL LIGHT

The oil pressure signal light turns ON when:

- Ignition switch is turned on prior to starting engine.
- Oil is not circulating through the running engine.
- Oil pressure is abnormally low in the running engine.
- Engine is idling below 1000 RPM.

The oil pressure signal light turns OFF when:

- Oil is circulating with adequate pressure through the engine running at 1000 RPM or greater.

Troubleshooting information is listed in Table 3-22.

NOTE

If the ignition is turned back on immediately after the engine is stopped, the oil light may not turn on right away because of oil pressure retained in the filter housing.

OIL PRESSURE

PART NUMBER	TOOL NAME
HD-96925-52B	OIL PRESSURE GAUGE SET

1. See Figure 3-100. Unplug connector from oil pressure indicator lamp switch located under the oil pump next to the oil filter mount, unscrew and remove oil pressure switch from crankcase.
2. See Figure 3-101. Install adapter (2) from OIL PRESSURE GAUGE SET (Part No. HD-96925-52B) in oil pressure indicator lamp switch mounting hole. Tighten adapter snugly. DO NOT OVERTIGHTEN.

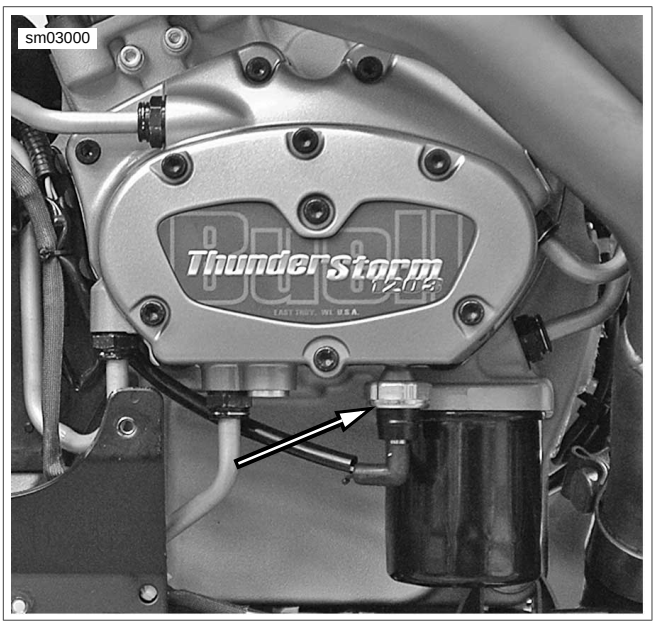


Figure 3-100. Oil Pressure Indicator Switch

Table 3-22. Troubleshooting Oil Pressure Signal Lamp

OIL PRESSURE SIGNAL LAMP	PROBABLE CAUSES
Stays on at speeds above idle	• Empty oil reservoir • Grounded oil switch wire • Malfunctioning signal switch • Diluted oil • Malfunctioning or improperly installed pressure relief valve
Flickers at idle	• Incorrect idle speed • Malfunctioning or improperly installed pressure relief valve
Does not glow when ignition is turned on (prior to operating engine)	• Malfunctioning signal switch • Malfunction in wiring • Burned-out signal bulb • Dead battery

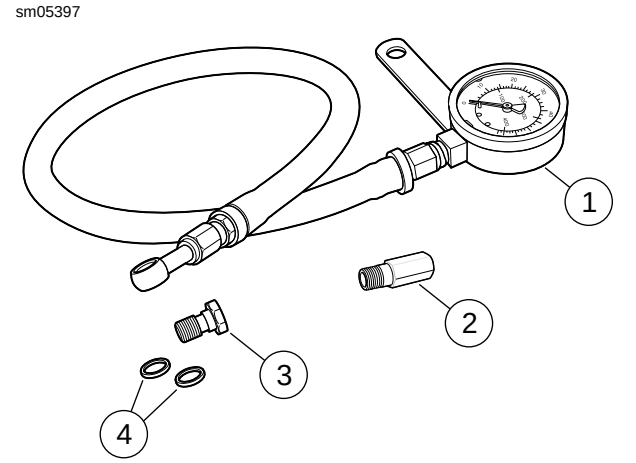
3. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten snugly.
4. Temporarily secure oil pressure gauge and hose to motorcycle frame with cable straps. Make sure gauge and hose assembly do not interfere with normal operation of the vehicle. Start engine and ride motorcycle at least 20 miles (32 km) at or above 50 mph (80 km/h) to allow engine to reach operating temperature of 180° F (82° C) .
   a. At 3000 RPM, oil pressure will vary from 20-28 psi (138-193 kPa).
   b. At idle speed (1050-1150 RPM), oil pressure will vary from 10-16 psi (69-110 kPa).

5. Stop engine. Remove oil pressure gauge assembly from oil pressure indicator lamp switch mounting hole in crankcase. Cut cable straps that you installed previously, and remove banjo bolt, gauge assembly, washers and adapter from vehicle.
6. Coat threads of oil pressure switch with LOCTITE 565 HIGH PERFORMANCE PIPE SEALANT with TEFLON. Reinstall oil pressure switch and tighten switch snugly to 96-120 **in-lbs** (10.8-13.6 Nm).
7. Plug in electrical connector (3) by pushing elbow connector straight onto stud on oil pressure switch.

NOTE

If an appreciable amount of oil leaked out when oil pressure switch was removed, it will have to be replaced with fresh oil.

8. Check oil level in oil tank. See 1.6 ENGINE OIL AND FILTER.
9. Start engine and test oil pressure switch for proper operation. Check oil pressure switch for leaks.



1. **Gauge**
2. **Adapter, pressure switch hole**
3. **Banjo bolt**
4. **Washers (2)**

Figure 3-101. Oil Pressure Test Gauge Set

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

CRANKCASE BREATHING SYSTEM 3.15

GENERAL

See Figure 3-102. Pressure created in the flywheel area on piston downstroke is released through the **reed valve** into the gearcase. From there a mixture of crankcase air and oil mist is vented up the push rod covers to the upper rocker box.

See Figure 3-103. Air is allowed to escape the rocker boxes by exiting the positive crankcase vent (PCV) valves (4) located on top of the rocker boxes. From the PCV valves the air enters the crankcase breather hoses (2, 3). The crankcase breather hoses route through the air cleaner base plate (1) to the air box where it is directed inside the air filter element and back into the engine, mixed with combustion air.

The oil mist collects and eventually returns to the crankcase through oil passageways in the cylinder head.

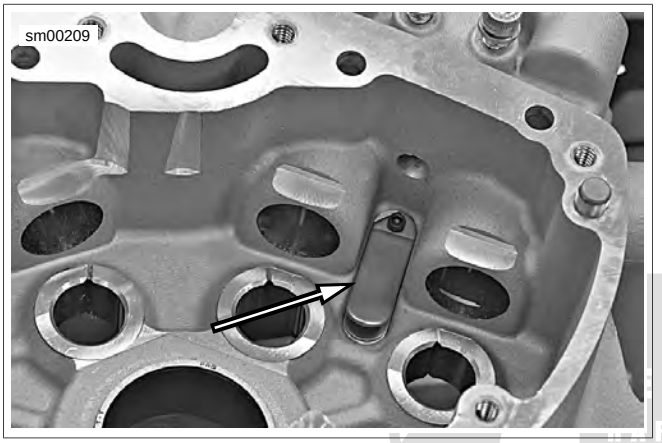
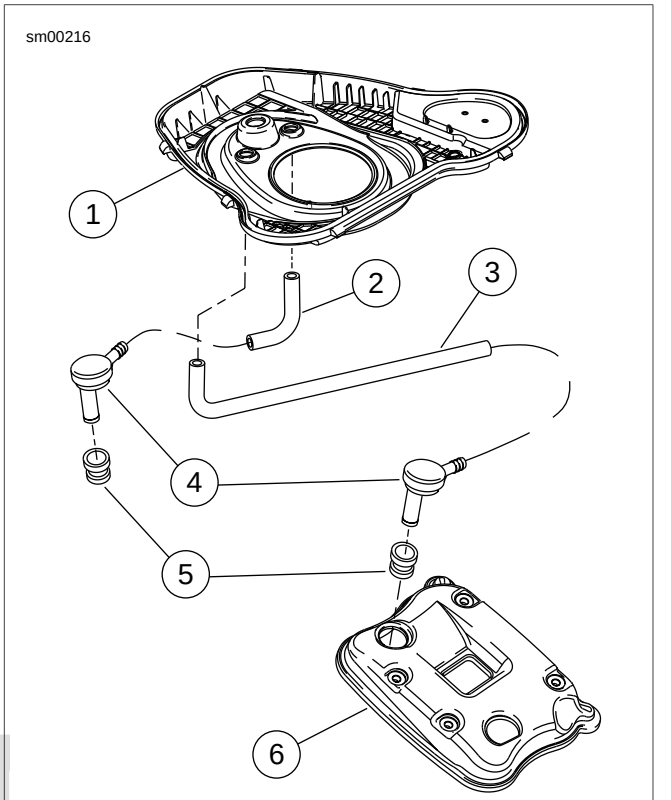


Figure 3-102. Reed Valve Assembly in Gearcase



1. **Base plate, air box**
2. **Breather hose, rear**
3. **Breather hose, front**
4. **PCV Valves (2)**
5. **Grommet**
6. **Rocker cover (2)**

Figure 3-103. Crankcase Breathing System

REED VALVE REPLACEMENT

NOTES

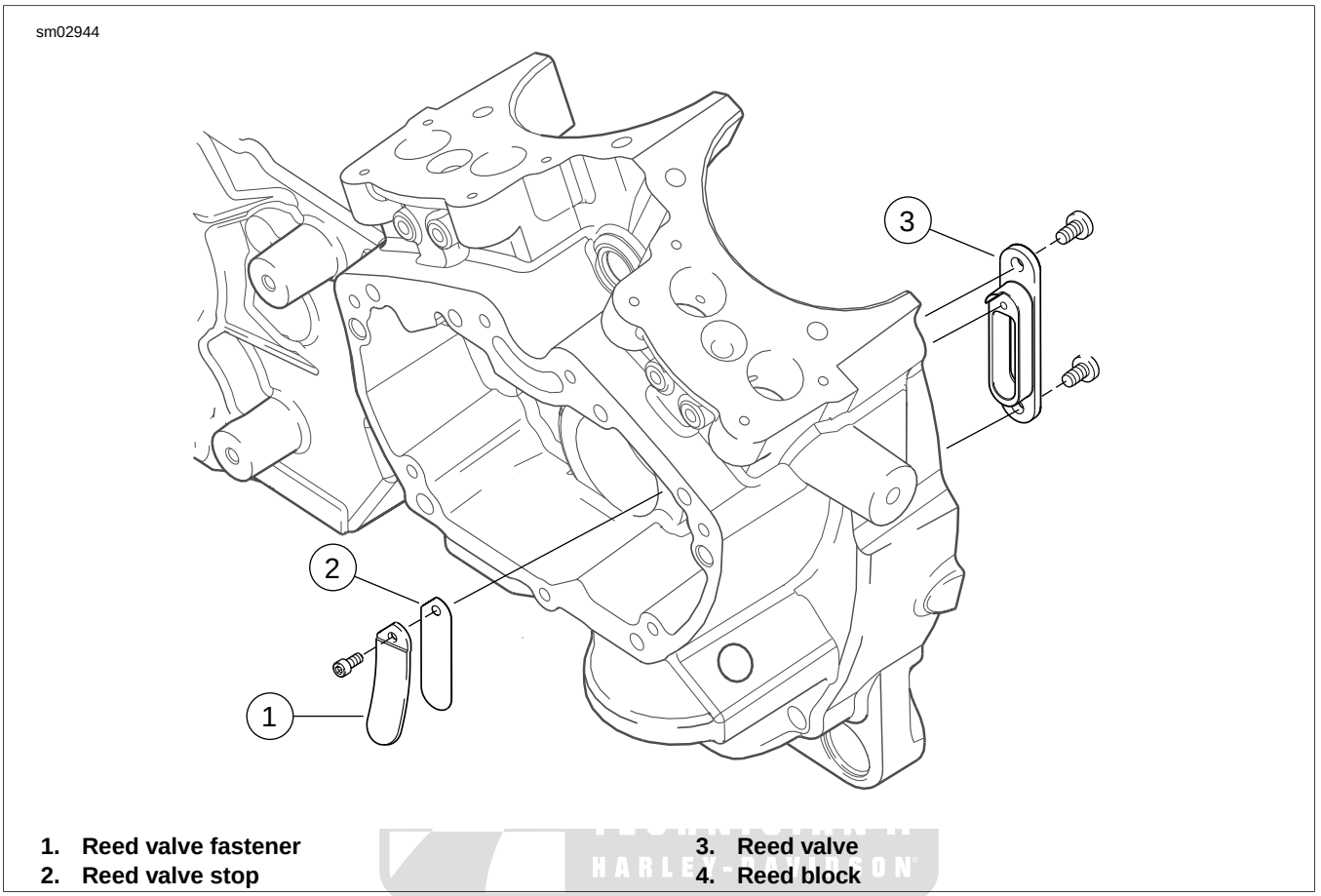
- *Whenever the gearcase cover is removed, inspect the reed valve for cracks, chips and breakage.*
- *See Figure 3-104. The reed valve (3) opens on the downstroke to relieve crankcase pressure and closes on the upstroke to prevent vapors returning to the crankcase. The curved reed valve stop (2) limits the movement of the reed valve.*

1. Remove the fastener (1), the reed valve stop (2) and the reed valve (3).
2. To replace the assembly, align the edges of the reed valve (3) and the reed valve stop (2) to prevent premature failure of the reed valve.

NOTE

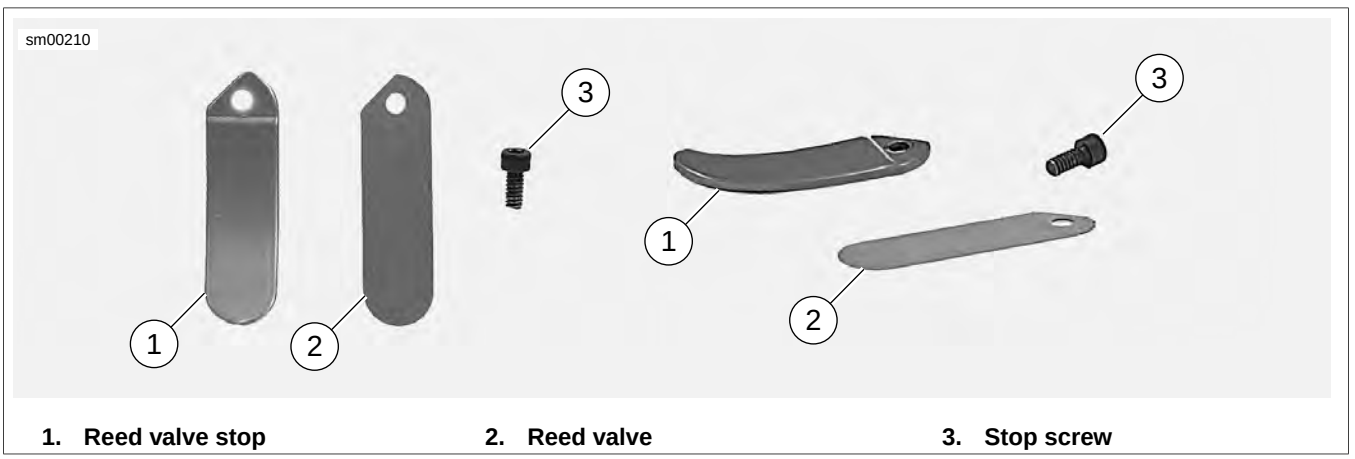
It is not necessary to replace the reed block (4) along with the reed valve. The block can only be replaced after separating the crankcase halves.

3. With the lower part of the curve on the reed valve stop (2) facing out, apply LOCTITE 222 (purple), install and tighten fastener to 5-7 **in-lbs** (0.6-0.8 Nm).
4. If it was necessary to replace the reed block, apply LOCTITE 222 (purple), install the fasteners and tighten to 25-35 **in-lbs** (2.8-4.0 Nm).



1. **Reed valve fastener**
2. **Reed valve stop**
3. **Reed valve**
4. **Reed block**

Figure 3-104. Reed Valve Assembly



1. **Reed valve stop**
2. **Reed valve**
3. **Stop screw**

Figure 3-105. Reed Valve Stop and Reed Valve

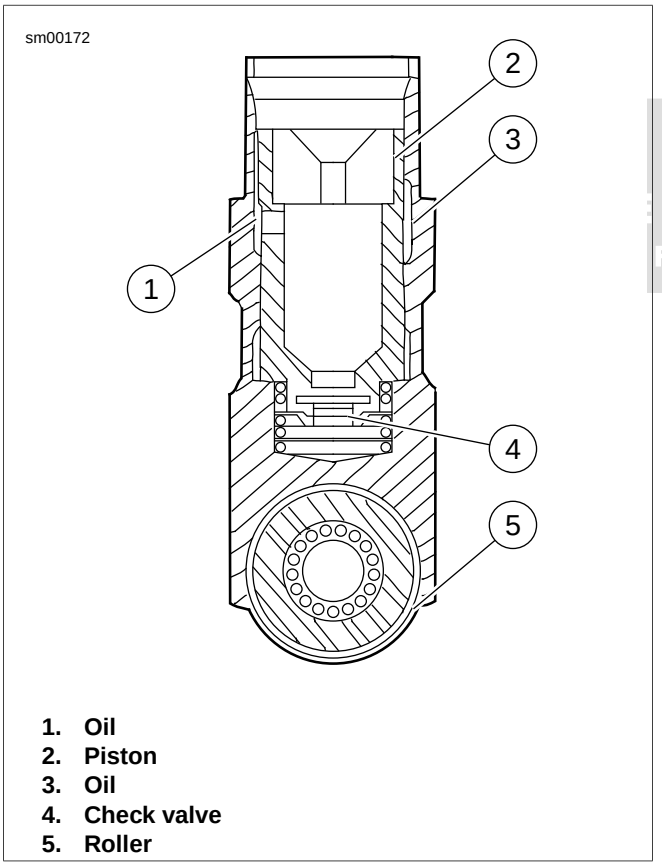
HYDRAULIC LIFTERS 3.16

GENERAL

See Figure 3-106. The lifter assembly consists of a hydraulic lifter and roller. The lifter and roller, under compression force from valve spring, follow the surface of the revolving cam. The up-and-down motion produced is transmitted to the valve by the push rod and rocker arm. The lifter contains a piston (or plunger) and cylinder; it also contains a check valve, which allows the unit to fill with engine oil, thereby reducing clearance in the valve train.

When a lifter is functioning properly, the assembly operates with minimal lifter clearance. The unit automatically compensates for heat expansion to maintain a no-clearance condition.

It is normal for lifters to click when engine is started after standing for some time. Hydraulic lifters have a definite leak-down rate which permits the oil in the lifters to escape. This is necessary to allow units to compensate for various expansion conditions of parts and still maintain correct clearance operation. Lifters are functioning properly if they become quiet after a few minutes of engine operation.



1. **Oil**
2. **Piston**
3. **Oil**
4. **Check valve**
5. **Roller**

Figure 3-106. Lifter Assembly (Typical)

REMOVAL

⚠WARNING

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

1. Clean all dirt from around crankcase. Blow loose particles from area with compressed air.
2. Remove cylinder head assemblies. See 3.7 CYLINDER HEAD.
3. See Figure 3-108. Remove push rod covers.
   a. Remove screws (4).
   b. Remove push rod covers (3).
   c. Remove gaskets and o-rings (6, 2). Discard parts.
4. Remove valve hydraulic lifters (7).
   a. Remove anti-rotation screws (8).
   b. Remove lifters from crankcase bore using a thin-bladed screwdriver. Mark the location and orientation (front/back) of each lifter.

CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all parts, except roller/lifter assembly, thoroughly in solvent. Blow dry with compressed air.

NOTE

Inside and outside micrometers used for measuring roller/lifters and bores must be calibrated to verify accurate readings.

2. Inspect valve lifters for excessive clearance in guide. Accurately measure lifter bore inner diameter with a gauge.
   a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
   b. Fit a **new** lifter and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in. (0.076 mm).
3. Check lifter roller freeplay.
   a. Roller clearance on pin should be within 0.0006-0.0010 in. (0.0152-0.0254 mm).
   b. Replace lifters if clearance exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).

4. Check lifter roller end clearance.
   a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
   b. Replace lifters if clearance exceeds SERVICE WEAR LIMIT of 0.026 in. (0.660 mm).
5. Soak lifters in clean engine oil. Keep covered until assembly.

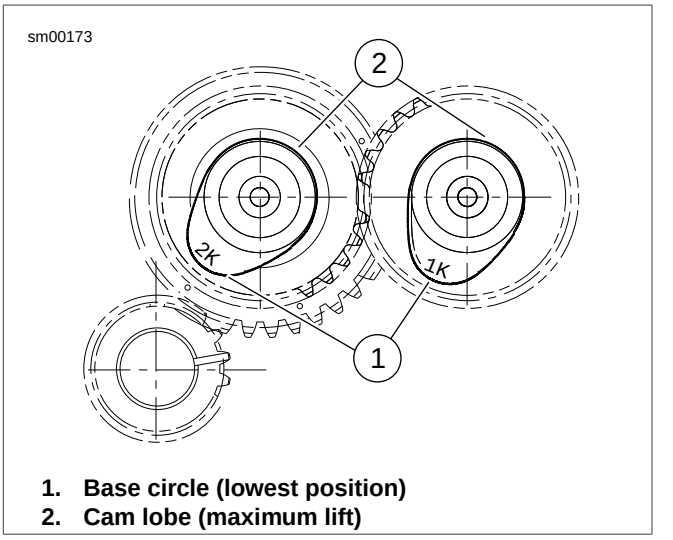
INSTALLATION

1. See Figure 3-107. Rotate engine so that both lifters from the cylinder will be installed on the base circle of the cam.
2. Apply a liberal amount of engine oil to each lifter assembly (especially the roller needles) for smooth initial operation.
3. See Figure 3-108. Insert lifter into bore in crankcase. Rotate lifter so that flats at upper end of lifter face the front and rear of the engine. If the lifter is installed incorrectly, anti-rotation screws cannot be inserted.
4. Secure lifters in place.
   a. Install anti-rotation screws with washers (8) in the holes in lifter block.
   b. Tighten anti-rotation screws to 55-65 **in-lbs** (6-7 Nm).

NOTE

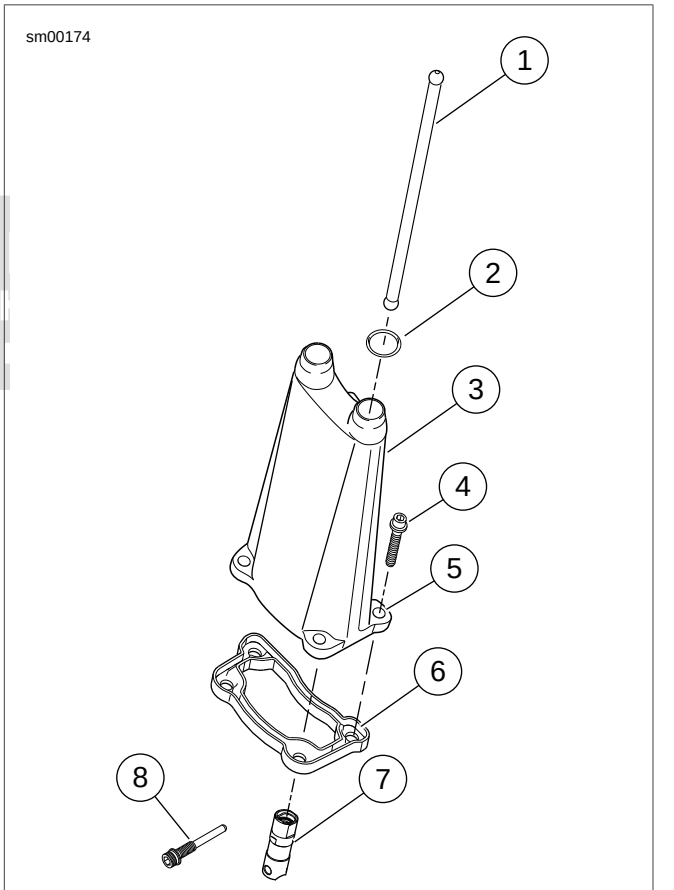
Before installing o-rings on the top of each pushrod cover be sure to apply a small amount of clean engine oil to each o-ring.

5. Install push rod cover.
   a. Place **new** push rod cover gasket (6) over bottom of pushrod cover.
   b. Position push rod cover (3) onto crankcase.
   c. Install screws (4) through holes in push rod cover into tapped holes in crankcase. Tighten screws evenly to 30-40 **in-lbs** (3-5 Nm).
   d. Place **new** o-rings (2) on top of push rod cover.
6. Install push rods, cylinder head, lower and upper rocker covers. See 3.7 CYLINDER HEAD.
7. Repeat process for remaining cylinder head.



1. **Base circle (lowest position)**
2. **Cam lobe (maximum lift)**

Figure 3-107. Base Circle



1. **Push rod (exhaust)**
2. **O-ring**
3. **Push rod cover**
4. **Screws (4)**
5. **Push rod cover**
6. **Push rod cover gasket**
7. **Hydraulic lifter (tappet)**
8. **Anti-rotation screw**

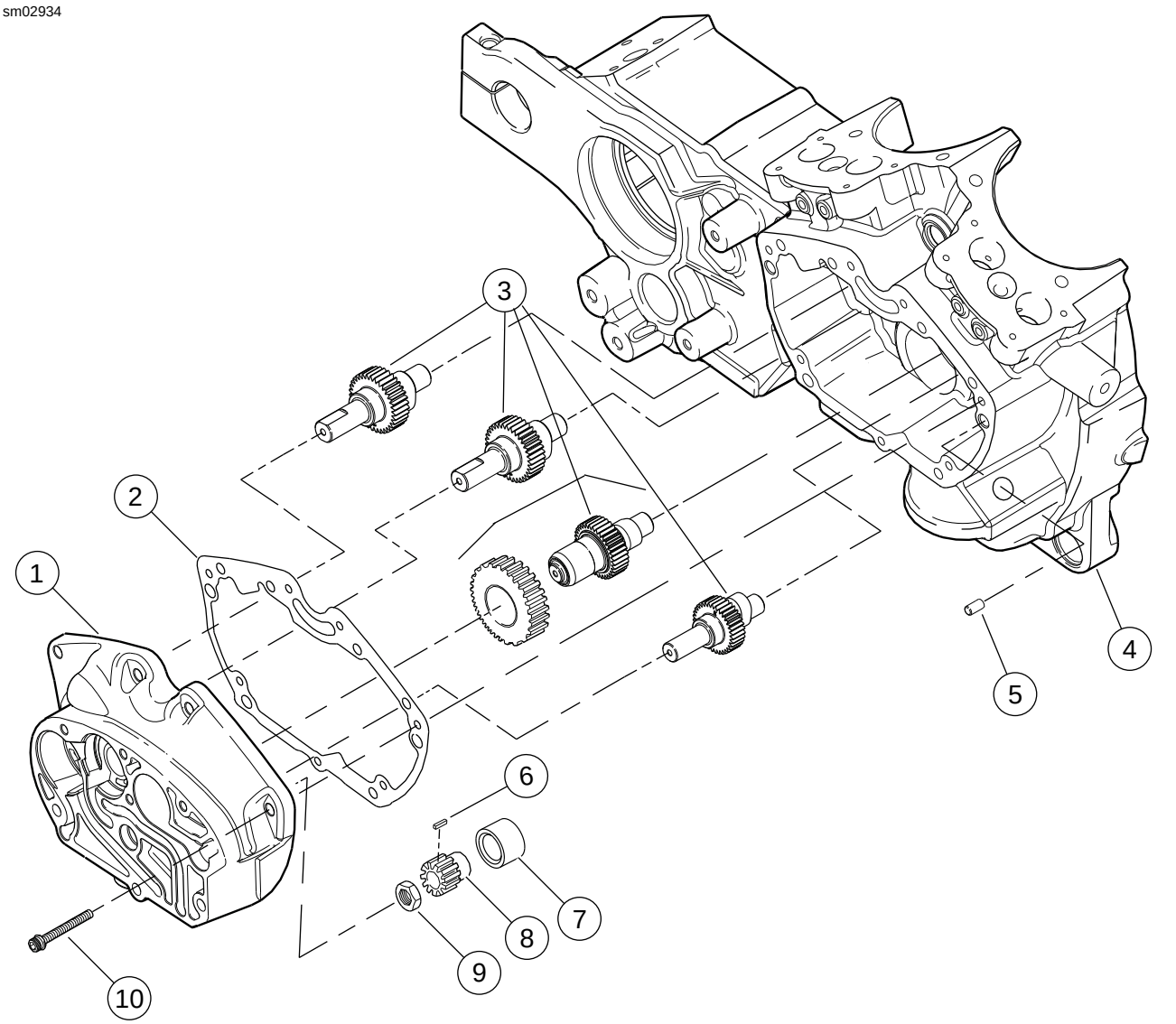
Figure 3-108. Valve Lifter Service

GEARCASE AND CAM GEARS 3.17

GENERAL

Read the complete gearcase section carefully before you begin any service work.

For the gearcase components to operate at their optimum, all components must be properly fitted and matched. Changing one component can affect many others. It is important to know and understand all inspection procedures and how components interact.



1. **Oil pump body**
2. **Oil pump body gasket**
3. **"K" cam gear set**
4. **Right crankcase half**
5. **Dowel pin**
6. **Key**
7. **Pinion gear spacer**
8. **Pinion gear**
9. **Nut**
10. **Screw (4)**

Figure 3-109. Oil Pump Body and Cam Assembly

REMOVAL AND DISASSEMBLY

⚠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. Thoroughly clean area around gearcase cover and tappets. Blow loose dirt from crankcase with compressed air.
2. Remove any parts that will interfere with gearcase disassembly.
3. Remove cylinder heads. See 3.7 CYLINDER HEAD.
4. Remove hydraulic lifters. See 3.16 HYDRAULIC LIFTERS.
5. Check for minimum cam gear end play. Record readings.
6. Remove oil pump. See 3.10 OIL PUMP.
7. See Figure 3-110. Rotate crankshaft until all timing marks (7, 8) are aligned as shown.

NOTE

DO NOT rotate camshafts or crankshaft while gears are removed.

8. See Figure 3-110. Remove cam gears (1, 2, 3 and 4).

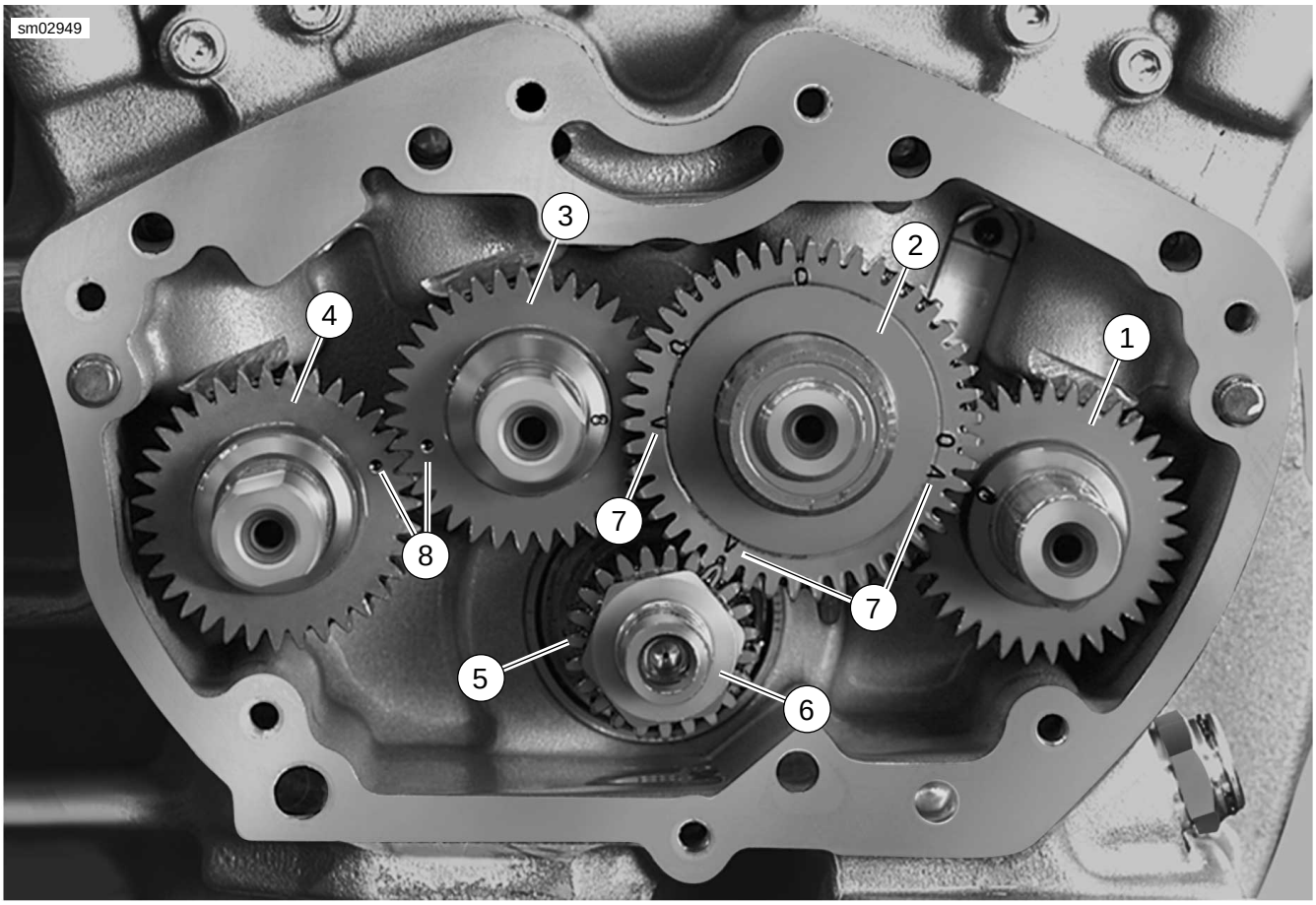
NOTE

Nut is secured by LOCTITE 271 (red) on the nut threads.

9. See Figure 3-109. Remove pinion nut (9). Slide pinion gear (8) and pinion gear spacer (7) off pinion shaft.

NOTE

See Figure 3-110. The timing marks are located on the front intake cam gear (2). Note the "V" marks (7).



1. **Front exhaust cam gear**
2. **Front intake cam gear**
3. **Rear intake cam gear**
4. **Rear exhaust cam gear**
5. **Pinion gear**
6. **Pinion nut**
7. **Timing V marks**
8. **Timing marks**

Figure 3-110. Cam and Pinion Gear Location and Timing Mark Indexing

CLEANING AND INSPECTION

1. Thoroughly clean gearcase compartment, gearcase cover and gears in solvent to remove oil and carbon deposits.

⚠WARNING

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

2. Blow out all cover oil passages and bushings with compressed air.
3. Clean old gasket material from gearcase and crankcase.

Cam and Pinion Gear Identification, Inspection and Selection

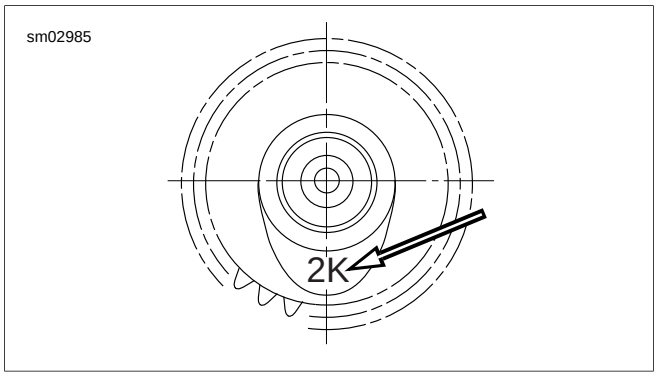


Figure 3-111. Cam Identification Stamp

See Figure 3-111. Cam lobes are stamped with a number (1, 2, 3 or 4) followed by a letter ("K"). The numbers identify the cam location/function and the letter ("K") indicates model application. Refer to Table 3-23.

Table 3-23. Cam Location Numbers

STAMP	LOCATION
1K	Front exhaust
2K	Front intake
3K	Rear intake
4K	Rear exhaust

NOTES

- *Prior to changing any cam gears, check gear shaft fit within corresponding bore. A worn bore can cause excessive backlash.*
- *If Service Wear Limits are exceeded, replace crankcase set and/or oil pump body as required. Refer to Table 3-24.*

Table 3-24. Gear Shaft Specifications

GEAR SHAFT	CORRECT CLEARANCE		SERVICE WEAR LIMIT	
	IN.	MM	IN.	MM
Cam	0.0007-0.0022	0.0178-0.0559	0.003	0.076
Pinion	0.0023-0.0043	0.0584-0.1092	0.0050	0.1270

ASSEMBLY AND INSTALLATION

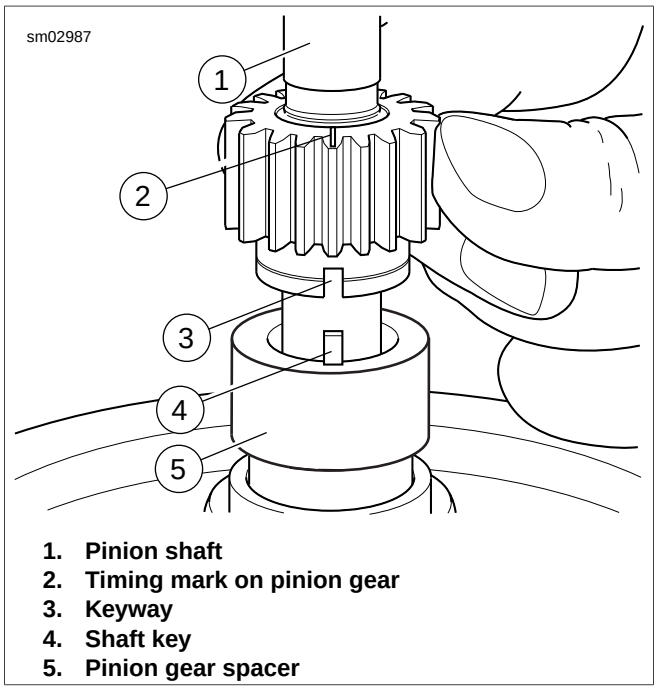
PART NUMBER	TOOL NAME
HD-43984	CRANKSHAFT LOCKING TOOL

1. See Figure 3-112. Install pinion gear spacer and pinion gear on pinion shaft.
   a. Install shaft key into pinion shaft slot.
   b. Slide pinion gear spacer over pinion shaft. Pinion gear spacer must align with shaft key.
   c. Align keyway in ID of pinion gear with shaft key.
   d. Slide pinion gear over shaft key and against pinion gear spacer.
2. See Figure 3-109. Install pinion nut (6).
   a. Clean threads on pinion shaft and nut.
   b. See Figure 3-110. Install CRANKSHAFT LOCKING TOOL (Part No. HD-43984) to gearcase with "Side B" facing out, over pinion shaft, with two screws.
   c. Apply several drops of LOCTITE 271 (red) to last few threads of nut.
   d. Install nut to pinion shaft. Tighten nut to 19-21 ft-lbs (26-29 Nm) plus an additional 15° to 19° rotation.
3. See Figure 3-109. Liberally apply engine oil to bores, shafts, and gears. Install all cam gears into bores of right crankcase half. Make sure to properly align timing marks (7, 8) of cam gears and pinion gear. See Figure 3-109.

NOTES

- *The XB uses "V" style timing marks on the front intake cam assembly. Please note the "V" design.*
- *Because of the larger diameter additional gear (which meshes with the pinion gear) on the outboard end of the cam, the front exhaust cam gear and the rear intake cam gear must be installed before the front intake cam gear is installed.*

4. See Figure 3-109. Install a **new** oil pump body gasket (2) on crankcase.



1. **Pinion shaft**
2. **Timing mark on pinion gear**
3. **Keyway**
4. **Shaft key**
5. **Pinion gear spacer**

Figure 3-112. Aligning Pinion Gear

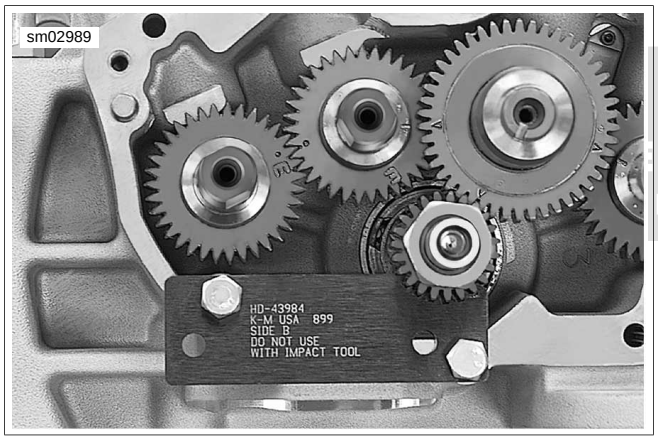


Figure 3-113. Crankshaft Locking Tool (Part No. HD-43984)

5. Install oil pump body and all gears and onto right crankcase half, install fasteners and tighten. See 3.10 OIL PUMP.
6. See Figure 3-114. Check cam gear end play for each cam gear as follows:
   a. Turn engine over until lobe of cam gear being checked is pointing toward its respective tappet guide hole.
   b. Gently pry the cam gear toward the oil pump body using a flat blade screwdriver.
   c. Measure gap between bore (in crankcase half) and cam gear shaft thrust face (shoulder) using a feeler gauge. This is cam gear end play.
   d. Compare cam gear end play measurements with the SERVICE WEAR LIMITS. Make repairs as required if end play does not meet specifications. See 3.2 SPECIFICATIONS.
7. Install hydraulic lifters. See 3.16 HYDRAULIC LIFTERS.
8. Install cylinder heads. See 3.7 CYLINDER HEAD.

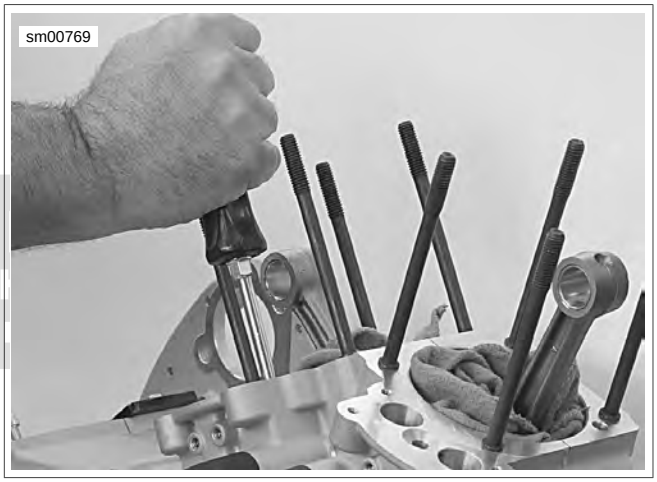


Figure 3-114. Checking Cam Gear End Play

CRANKCASE 3.18

GENERAL

When rod bearings, pinion shaft bearing, or sprocket shaft bearing are in need of repair, the engine must be removed from the chassis; see 3.5 ENGINE REMOVAL in this section. It is recommended procedure to check and make repairs to cylinder heads, cylinders, gear case and transmission at the same time (perform entire engine overhaul).

NOTE

Laying engine on primary side will damage clutch cable end fitting. If fitting is damaged, clutch cable must be replaced.

DISASSEMBLY

Crankcase Halves

1. Remove cylinder heads. See 3.7 CYLINDER HEAD.

NOTE

After removing cylinders, install plastic or rubber hose over cylinder studs. Lifting or moving crankcase by grasping studs will cause cylinder stud damage.

2. Remove cylinders and pistons. See 3.8 CYLINDER AND PISTON.
3. Remove oil pump. See 3.10 OIL PUMP.
4. Remove gearcase components. See 3.17 GEARCASE AND CAM GEARS.
5. Remove primary cover and primary drive/clutch components. See 5.3 PRIMARY COVER.
6. Remove starter motor. See {MISSING_XREF_C18-sectionC18S6}.
7. See Figure 3-115. Remove rear isolator assembly by removing the forward two fasteners first and then the two rear fasteners (re-install with **new** fasteners).
8. Remove right crankcase. See 5.9 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL.
9. If left crankcase requires repairs, proceed with transmission disassembly. See 5.10 TRANSMISSION DISASSEMBLY.

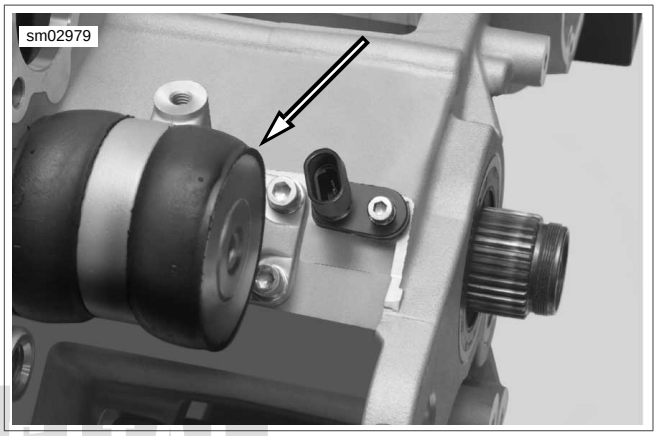
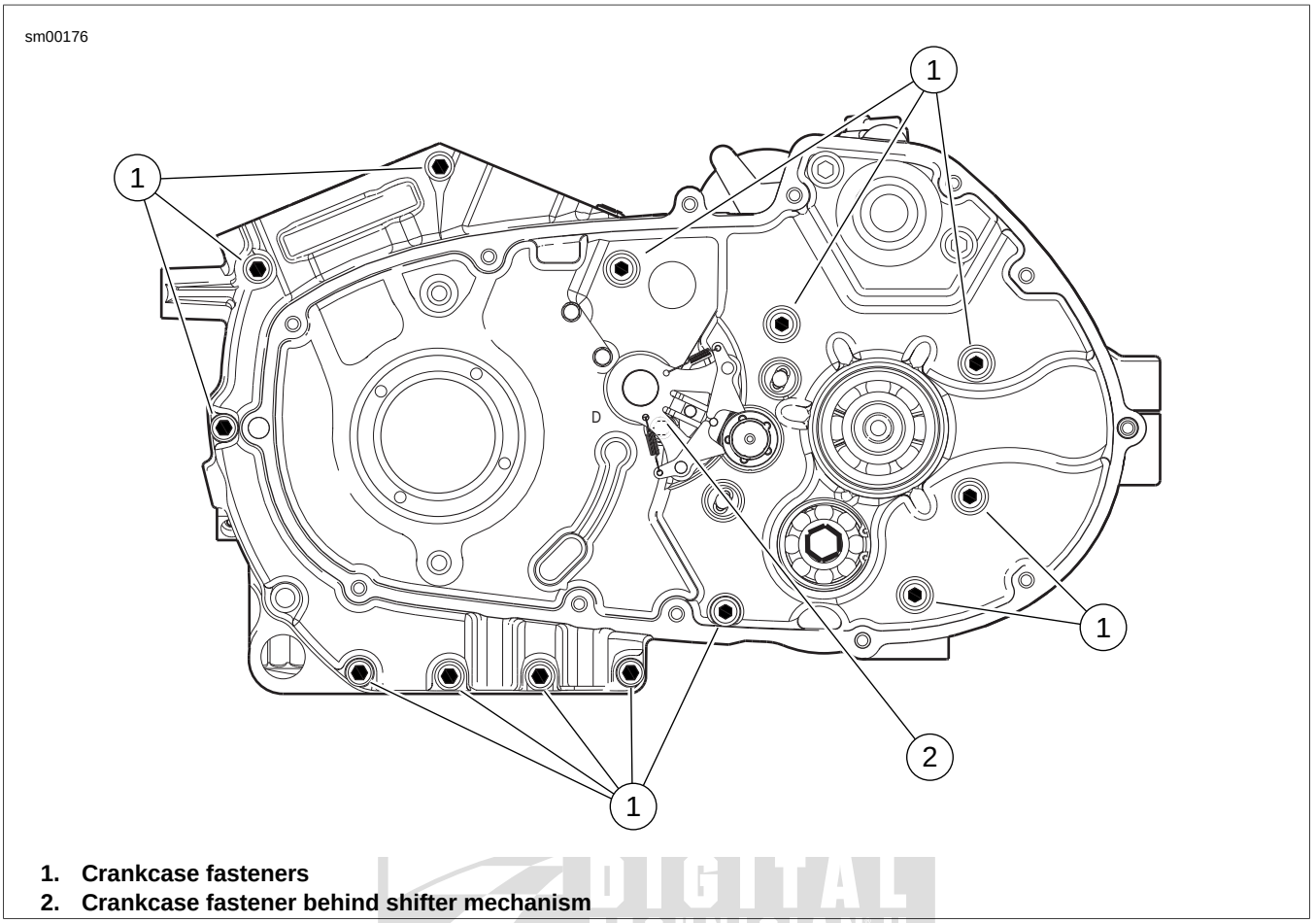


Figure 3-115. Rear Isolator Assembly

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Crankcase fasteners**
2. **Crankcase fastener behind shifter mechanism**

Figure 3-116. Crankcase Fasteners

OIL FILTER ADAPTER

NOTE

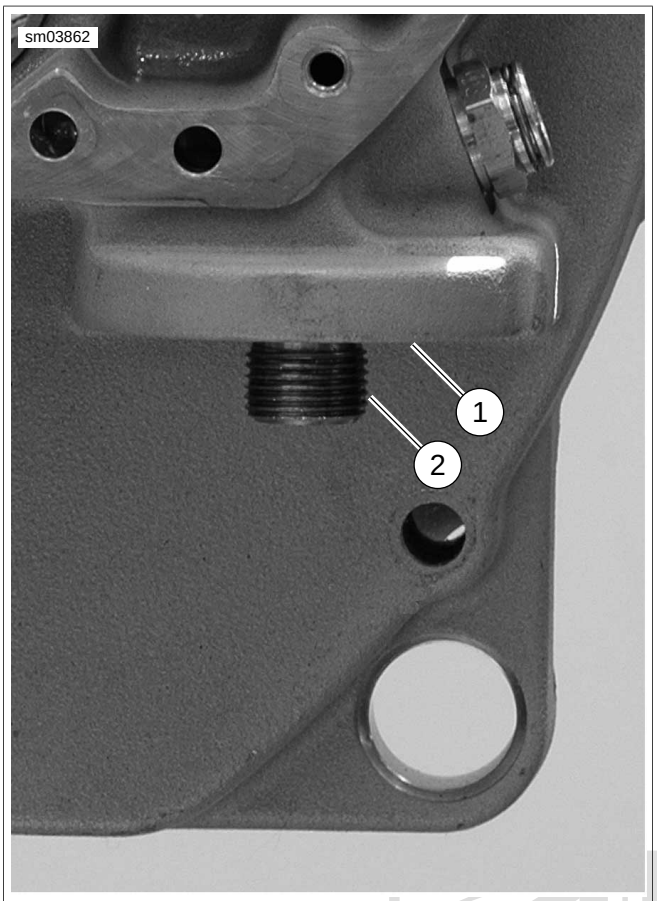
The oil filter adapter has identical ends. Either end may be installed into the filter mount.

1. See Figure 3-117. Remove the oil filter adapter from the oil filter mount.
2. Clean and replace components as necessary.
3. Apply several drops of LOCTITE 243 (blue) to last few threads on end of the oil filter adapter that is installed into filter mount.

NOTE

Do not apply LOCTITE to adapter threads on filter element side.

4. Thread oil filter adapter into filter mount.
5. Tighten to 96-144 **in-lbs** (11-16 Nm).



1. **Oil filter mount**
2. **Filter adapter**

Figure 3-117. Oil Filter Mount with Adapter

PISTON JETS

PART NUMBER	TOOL NAME
B-45655, HD-42720-2 AND HD-46663	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER
CJ114	SNAP-ON BODY DENT PULLER
HD-34902-7	END CAP
HD-34902B	BEARING RACE REMOVER/INSTALLER
HD-44358	FLYWHEEL SUPPORT FIXTURE
HD-95635-46	CLAW PULLER

Removal

1. See Figure 3-118. Remove two TORX screws from each piston jet assembly to free piston jets from right crankcase.
2. Remove piston jet gaskets from right crankcase.

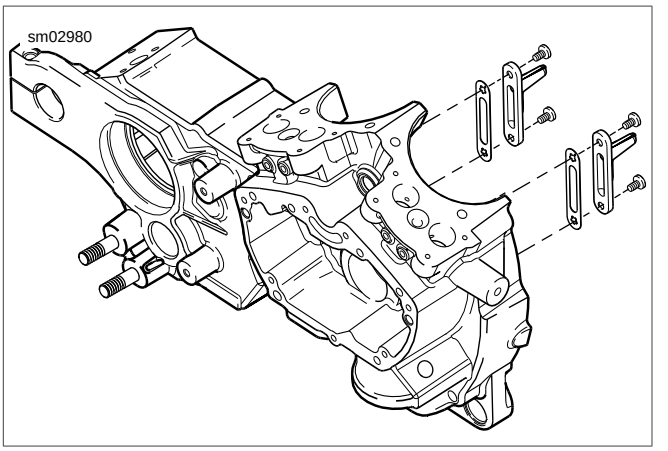


Figure 3-118. Piston Oil Jet Assemblies

Installation

NOTES

- *Gaskets that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure.*
- *Gasket is part of the piston jet assembly. Gasket not sold separately.*

1. Install **new** piston oil jet assemblies in right crankcase.
2. Apply LOCTITE LOW STRENGTH THREADLOCKER 222 (purple) to threads of TORX screws. With the jet pointed upward, install TORX screws to secure piston jet to crankcase. Tighten screws to 25-35 **in-lbs** (2.8-4.0 Nm).

Removing Cylinder Base Studs

If cylinder base studs require replacement, proceed as follows.

1. Thread a 3/8"-16 nut onto cylinder base stud.
2. Thread a second nut onto stud until it contacts the first nut.
3. Tighten nuts against each other.
4. Placing wrench on first (lower) nut installed, unscrew stud from cylinder deck.
5. Loosen nuts and remove from cylinder base stud.

Flywheel Assembly

1. See Figure 3-119. Remove the flywheel assembly from left crankcase half.

NOTES

- *Flywheel assembly slides out of the sprocket shaft bearing by hand. No tools are required for this operation.*
- *See Figure 3-120. If it is necessary to remove either the pinion shaft bearing or sprocket shaft bearing, proceed as follows:*

2. Pinion shaft bearing (12) will remain on flywheel pinion shaft. Remove retaining ring (13) and bearing can be slipped off pinion shaft.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

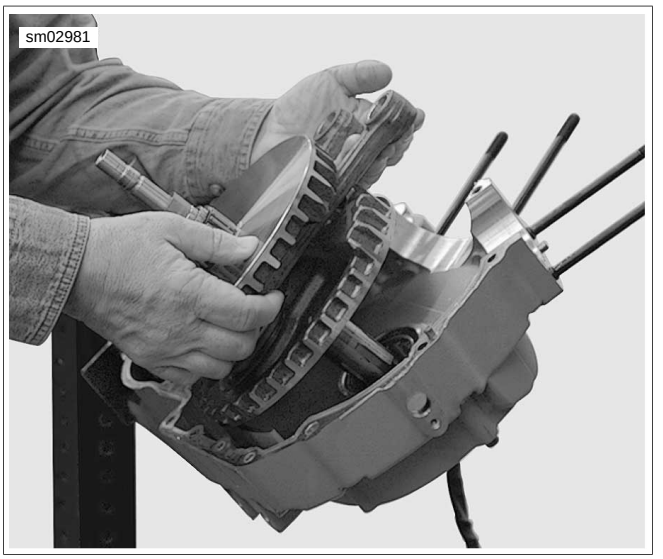
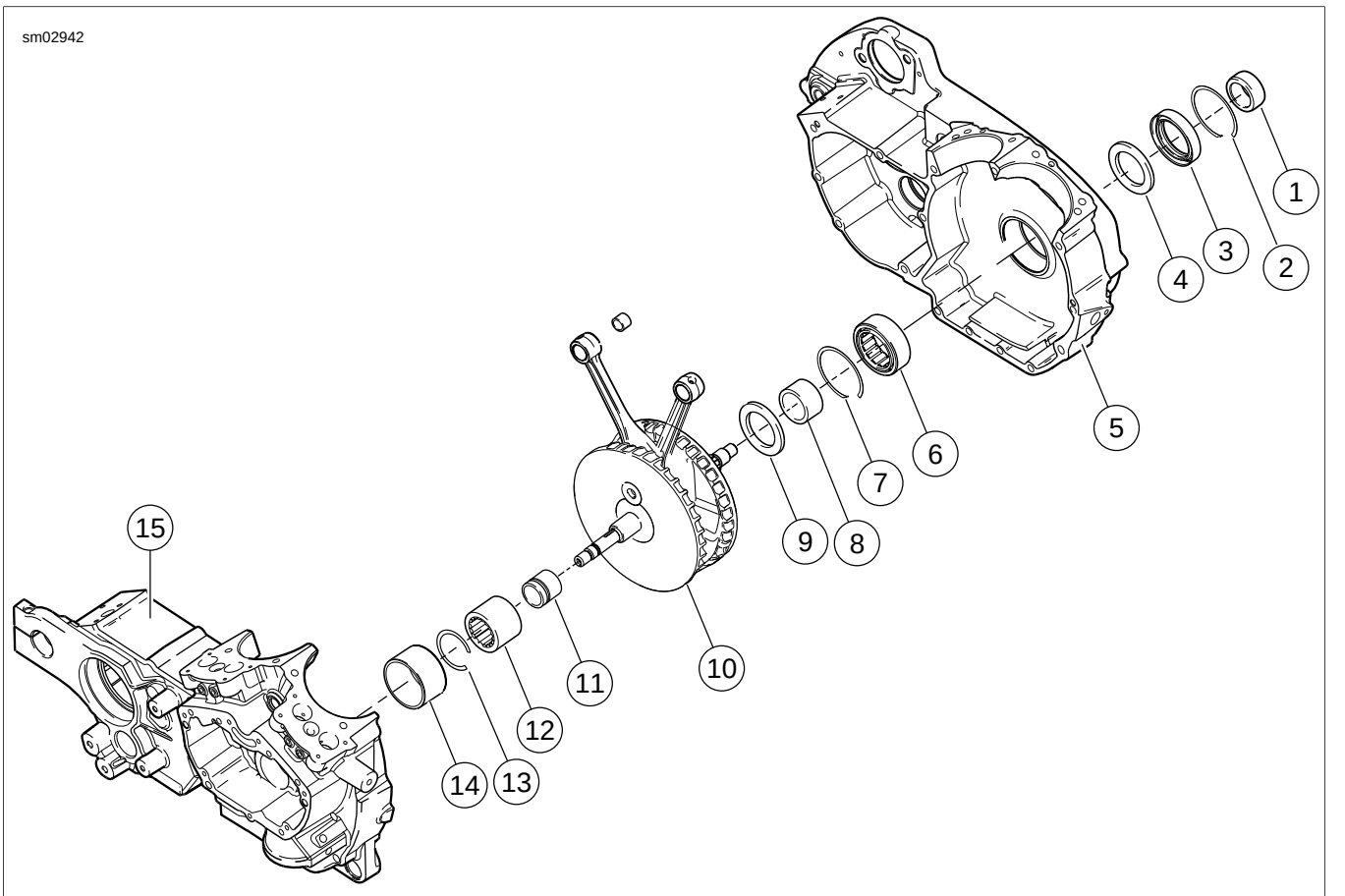


Figure 3-119. Removing Flywheels from Left Crankcase



1. Spacer, sprocket shaft
2. Retaining ring, oil seal
3. Oil seal
4. Thrust washer
5. Crankcase half
6. Bearing, sprocket shaft
7. Bearing retaining ring
8. Inner race, sprocket shaft bearing
9. Thrust washer
10. Connecting rod and flywheel assembly
11. Inner race
12. Pinion shaft bearing
13. Retaining ring
14. Outer bearing race
15. Crankshaft case

Figure 3-120. Crankcase and Flywheel Assembly

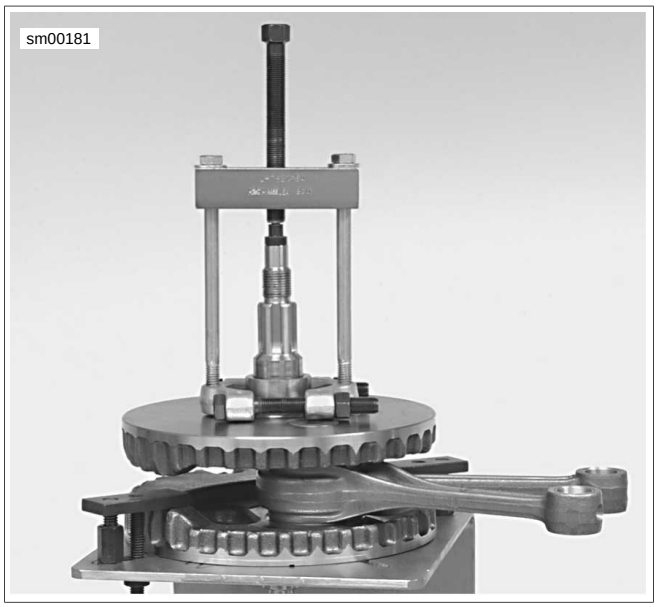


Figure 3-121. Removing Sprocket Shaft Inner Bearing Race

3. See Figure 3-121. Place flywheel assembly in FLYWHEEL SUPPORT FIXTURE (Part No. HD-44358). Pull sprocket shaft bearing inner race with WEDGE ATTACHMENT for CLAW PULLER (Part No. HD-95635-46) with BEARING RACE REMOVER/INSTALLER (Part No. HD-34902B) and END CAP (Part No. HD-34902-7).

NOTES

- *Sprocket shaft bearing inner race does not need to be ground once it is installed on the sprocket shaft.*
- *It is necessary to remove the stator replace the sprocket shaft bearing or seal. See 6.11 ALTERNATOR.*

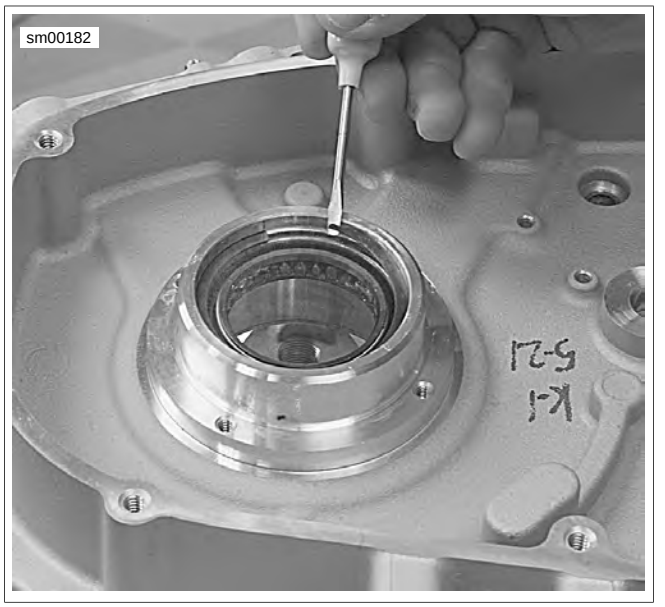


Figure 3-122. Sprocket Shaft Seal Retaining Ring

4. See Figure 3-122. Remove sprocket shaft oil seal retaining ring.

5. See Figure 3-120. Remove sprocket shaft oil seal (3) from crankcase using SNAP-ON BODY DENT PULLER (Part No. CJ114).

6. Remove outer thrust washer (4) next to sprocket shaft bearing (6).

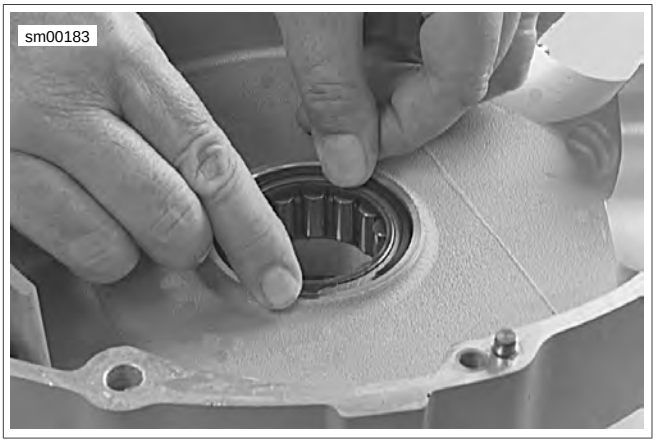


Figure 3-123. Removing Sprocket Shaft Bearing Retaining Ring

7. See Figure 3-123. Remove sprocket shaft bearing retaining ring from the inside of the left crankcase half.

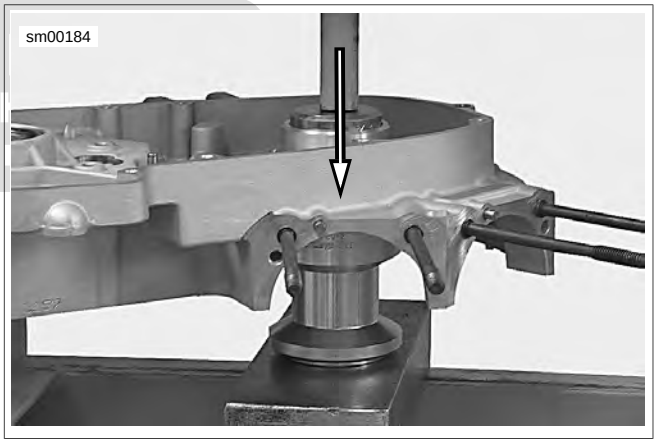


Figure 3-124. Direction of Bearing Removal From Left Crankcase

8. See Figure 3-124. Using CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER (Part No. B-45655, HD-42720-2 and HD-46663) press sprocket shaft bearing out of the left crankcase half.

NOTE

The bearing presses to the inside. There is a shoulder incorporated into the left crankcase half which allows the bearing to be removed in one direction only.

PINION SHAFT BEARING

PART NUMBER	TOOL NAME
HD-34902-7	END CAP
HD-34902B	BEARING RACE REMOVER/INSTALLER
HD-95635-46	CLAW PULLER
HD-95637-46B	WEDGE ATTACHMENT
HD-96710-40D	CRANKCASE MAIN BEARING LAP-PING TOOL
HD-96718-87	CRANKCASE MAIN BEARING LAP

General

See Figure 3-120. The right side pinion shaft bearing consists of an inner and outer race with rollers.

The inner race (11) is pressed onto the pinion shaft. The outer race (14) is a pressed into the right crankcase half (15).

NOTE

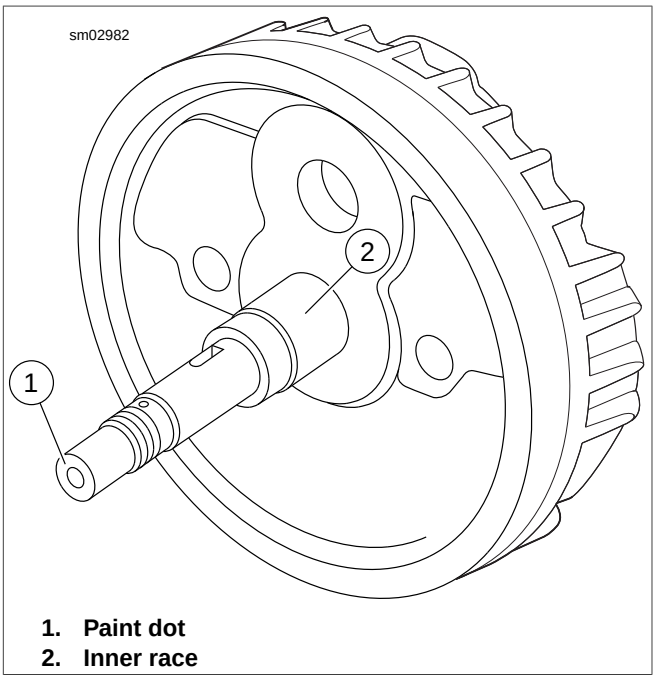
Refer to Table 3-25 and Table 3-26. If either inner or outer race show wear, measure both races to confirm correct bearing fit.

Table 3-25. Pinion Shaft Bearing Service Wear Limits

RACE	IN.	MM
Inner race OD	1.2496	31.734
Outer race ID	1.5656	39.76

NOTE

Pinion shaft bearing selection at the factory, during engine build, or replacement of crankcase set or flywheel assembly is based on the largest measured outside diameter (OD) of the inner race and the smallest measured inside diameter (ID) of the outer race (crankcase bushing). A running clearance of 0.0002-0.0008 in. (0.0051-0.0203 mm) is established during crankcase set or flywheel assembly replacement and engine rebuild.

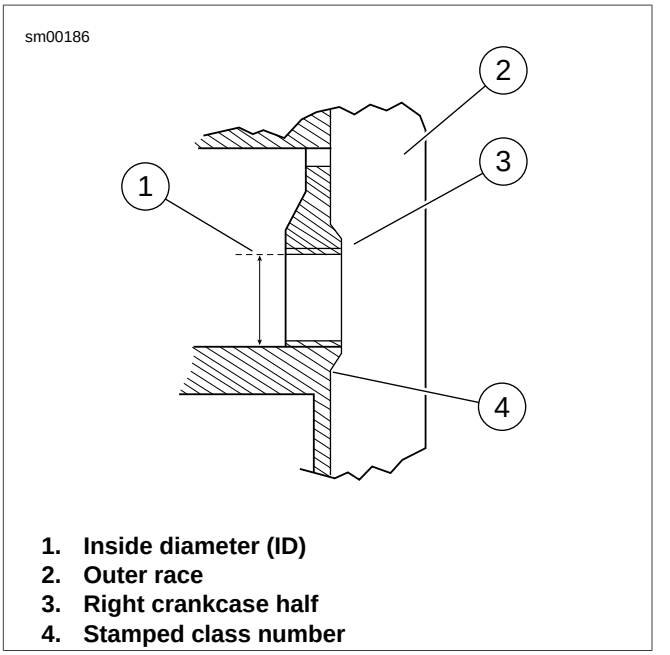


1. **Paint dot**
2. **Inner race**

Figure 3-125. Pinion Shaft Inner Race

Table 3-26. Pinion Shaft Inner Race Paint Dot Specifications

PAINT DOT COLOR	CLASS	INNER RACE OD	
		IN.	MM
White	A	1.2498-1.2500	31.7449-31.7500
Green	B	1.2496-1.2498	31.7398-31.7449



1. **Inside diameter (ID)**
2. **Outer race**
3. **Right crankcase half**
4. **Stamped class number**

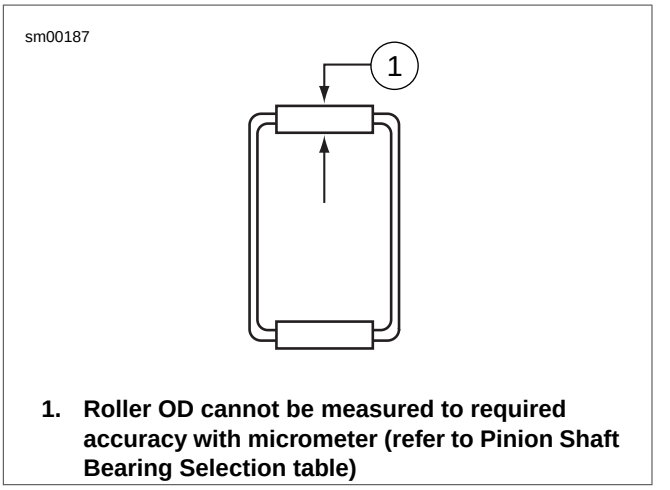
Figure 3-126. Pinion Shaft Outer Race

Table 3-27. Pinion Shaft Outer Race Stamp Specifications

OUTER RACE ID		CLASS NO.	STAMPED NO.
IN.	MM		
1.5646-1.5648	39.7408-39.7459	1	1
1.5648-1.5650	39.7459-39.7510	2	2
1.5650-1.5652	39.7510-39.7561	3	3

NOTE

The different sizes of crankcase sets and flywheel assemblies will not have separate part numbers. That is, a replacement crankcase set may have a class 1, 2 or 3 pinion bearing outer race. Replacement flywheel assemblies will have either a class A or B inner race which is identified by paint dots. Refer to Table 3-26.



1. **Roller OD cannot be measured to required accuracy with micrometer (refer to Pinion Shaft Bearing Selection table)**

Figure 3-127. Bearing Roller OD

Table 3-28. Pinion Bearing Roller Specifications

ROLLER OD	COLOR
Largest	Red
	Blue
	White (gray)
Smallest	Green

Selection

Refer to Table 3-29. Select bearings using the identification information given for inner and outer races.

Table 3-29. Pinion Shaft Bearing Selection

FACTORY STAMPED NO.	OUTER RACE ID	BEARING SIZE AS IDENTIFIED BY COLOR CODING		
	1.5654-1.5656 in. (39.761-39.766 mm)			Red
	1.5652-1.5654 in. (39.756-39.761 mm)		Red	Blue
3	**1.5650-1.5652 in. (39.751-39.756 mm)**	**Red**	**Blue**	White-Gray
2	**1.5648-1.5650 in. (39.746-39.751 mm)**	**Blue**	**White-Gray**	Green
1	**1.5646-1.5648 in. (39.741-39.746 mm)**	**White-Gray**	**Green**	
INNER RACE OD (In)		**1.2496-1.2498 in.**	**1.2498-1.2500 in.**	1.2500-1.2502 in.
		31.740-31.745 mm	31.745-31.750 mm	31.750-31.755 mm
FACTORY COLOR CODE		**Green**	**White**	

Replacement

NOTE

If either inner or outer race show wear, measure both races to confirm correct bearing fit.

1. Use a dial bore gauge to measure and record ID of outer race. Take four measurements on ID where bearing rollers ride.
   a. If the largest measurement is larger than 1.5656 in. (39.76 mm) or the required lapping to remove wear marks would enlarge bore beyond 1.5656 in., continue at Step 5.
   b. If largest measurement is 1.5656 in. (39.76 mm) or less, cover the cam bearings with masking tape to prevent debris from entering bearings. Assemble crankcase halves.

NOTE

The next step requires lapping the outer race. To keep sprocket shaft and pinion shaft bearings aligned the lap must be supported by an adaptor or pilot in the left crankcase half.

2. See LAPPING PINION SHAFT BEARING OUTER RACE. Lap race until all wear marks are removed.
3. Measure and record ID of race at four places.
4. Check measurements against the specifications listed in Table 3-30.
   a. If lapping increased bore ID to larger than 1.5656 in. (39.76 mm), go to next step.
   b. If roundness or taper do not meet specifications, continue lapping until specifications are met.
   c. If all specifications are met, continue at Step 7 to remove and size inner race.

Table 3-30. Outer Pinion Race Service Wear Limits

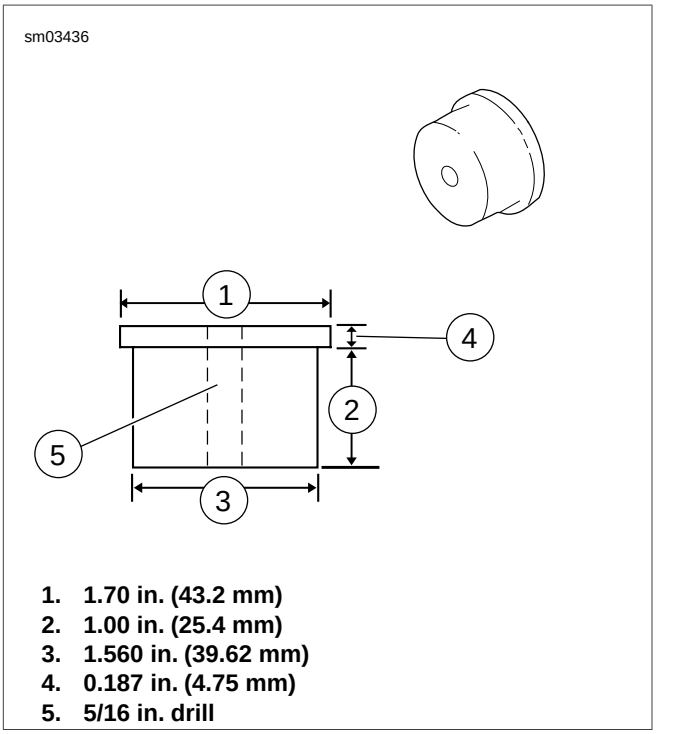
	IN.	MM
Largest ID measured	1.5672	39.8069
Roundness of ID	0.0002	0.0051
Taper	0.0002	0.0051

5. Press the outer race from the right crankcase.
6. Press **new** outer race into crankcase flush with inside edge of cast-in insert.

NOTE

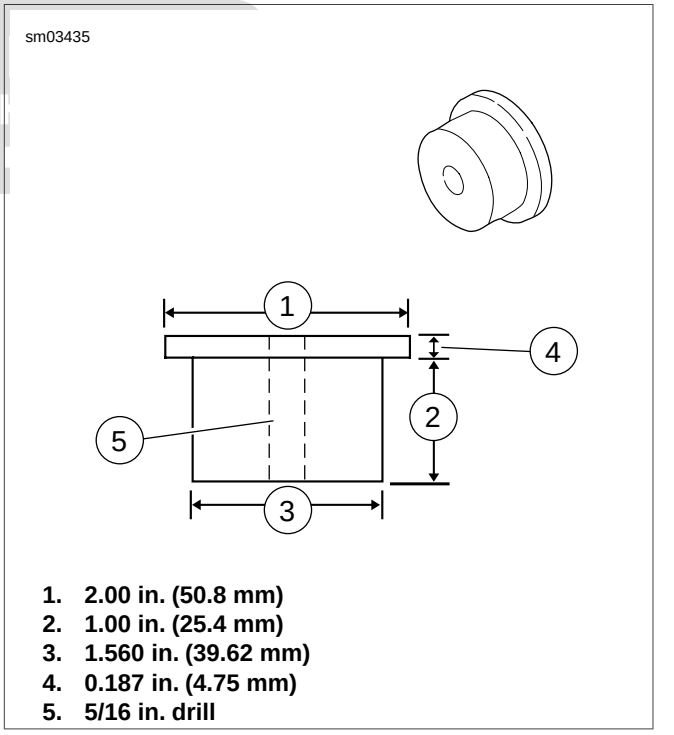
See Figure 3-129 and Figure 3-128. Dimensions are shown for fabrication of tools used in pressing the outer race into or out of crankcase.

7. The **new** outer race must be lapped slightly to true and align with left case bearing and to meet the following specifications in Table 3-31. See LAPPING PINION SHAFT BEARING OUTER RACE.



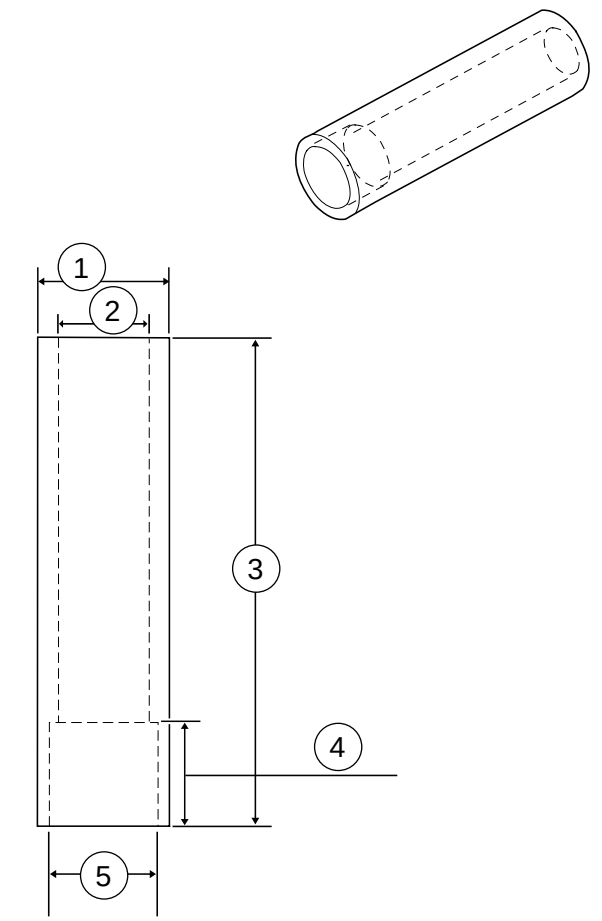
1. **1.70 in. (43.2 mm)**
2. **1.00 in. (25.4 mm)**
3. **1.560 in. (39.62 mm)**
4. **0.187 in. (4.75 mm)**
5. **5/16 in. drill**

Figure 3-128. Pinion Shaft Outer Race Removal Tool



1. **2.00 in. (50.8 mm)**
2. **1.00 in. (25.4 mm)**
3. **1.560 in. (39.62 mm)**
4. **0.187 in. (4.75 mm)**
5. **5/16 in. drill**

Figure 3-129. Pinion Shaft Outer Race Installation Tool



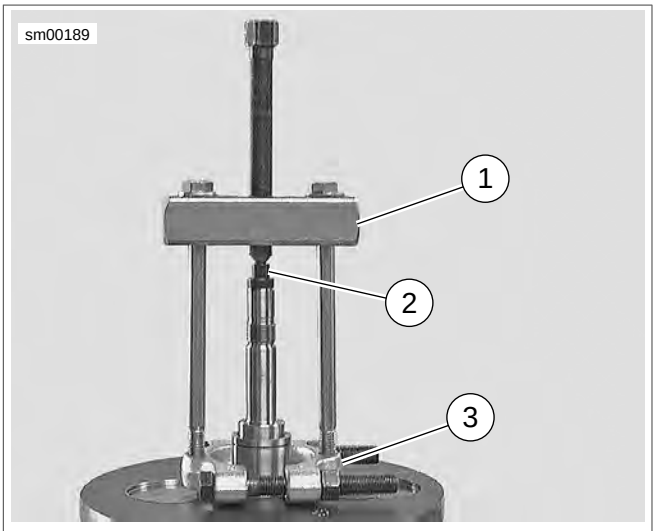
1. **1.50 in. (38.1 mm)**
2. **1.00 in. (25.4 mm)**
3. **5.50 in. (139.7 mm)**
4. **1.135-1.145 in. (28.83-29.08 mm)**
5. **1.262-1.272 in. (32.05-32.31 mm)**

Figure 3-130. Pinion Shaft Inner Race Installation Tool

Table 3-31. New Component Specifications

FEATURE	SPECIFICATIONS	
	IN.	MM
Outer Race ID	1.5646-1.5652	3.97408-39.7561
Roundness	within 0.0002	within 0.0051
Taper	within 0.0002	within 0.0051
Surface finish	16 RMS	

8. See Figure 3-131. Pull inner race from pinion shaft using WEDGE ATTACHMENT (Part No. HD-95637-46B) for CLAW PULLER (Part No. HD-95635-46) with BEARING RACE REMOVER/INSTALLER (Part No. HD-34902B) and END CAP (Part No. HD-34902-7). Apply heat to race to aid removal.



1. **Bearing race remover/installer**
2. **End cap**
3. **Wedge attachment for claw puller**

Figure 3-131. Removing Pinion Bearing Inner Race

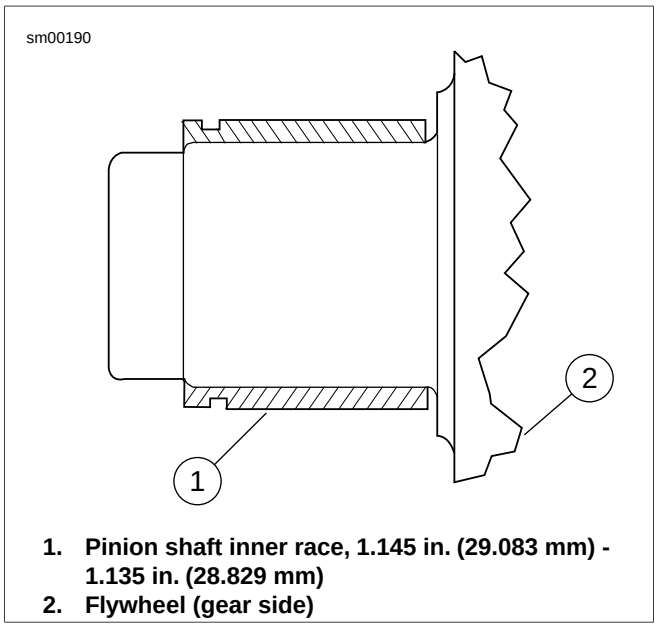
NOTES

- *For necessary dimensions for constructing a press on tool for the pinion bearing inner race, see Figure 3-130.*
- *The **new** inner race must be ground by a competent machinist to OD dimension range for the finished lapped ID of the outer race. Refer to Table 3-29.*

9. See Figure 3-132. Press new inner race on pinion shaft as shown. When the tool bottoms against the flywheel, correct inner race location is automatically established. The finished inner race must meet the specifications in Table 3-32.

Table 3-32. Pinion Inner Race Specifications

CONDITION	IN.	MM
Roundness	0.0002	0.005
Taper	0.0002	0.0051
Surface finish	16 RMS	



1. **Pinion shaft inner race, 1.145 in. (29.083 mm) - 1.135 in. (28.829 mm)**
2. **Flywheel (gear side)**

Figure 3-132. Inner Race Location

NOTES

- *Have machinist grind inner race to center or middle of required OD range in Table 3-29. This will prevent grinding outer race undersize and gives a more easily achieved tolerance range.*
- *If you are unable to perform this operation, Harley-Davidson Motor Company provides a flywheel refurbishing program as outlined in Tech Tip #38.*
- *Always use the smallest outer race ID measurement and the largest OD inner race measurement when selecting bearings.*

10. The following example illustrates how to determine the required inner race OD.
    a. Refer to Table 3-29. For example purposes, suppose the smallest outer race ID measurement is 1.5651 in. (39.754 mm). This requires an inner race OD range of 1.2496-1.2504 in. (31.740-31.760 mm).
    b. Grind inner race. Measure OD at four places. Refer to Table 3-32.
    c. For example purposes, suppose the largest inner race OD measurement after grinding is 1.2499 in. (31.747 mm) OD.
    d. With a 1.5651 in. (39.754 mm) ID outer race and a 1.2499 in. (31.747 mm) OD inner race, a blue bearing is required.

Lapping Pinion Shaft Bearing Outer Race

1. Secure right and left crankcase halves with three crankcase stud bolts (top center and bottom left and right). The sprocket shaft bearing outer races and large spacer must be installed in left crankcase.
2. See Figure 3-133. Obtain CRANKCASE MAIN BEARING LAPPING TOOL (Part No. HD-96710-40D). Assemble CRANKCASE MAIN BEARING LAP (Part No. HD-96718-87) to lapping handle. Assemble guide sleeve to sprocket shaft bearing bushing. Sleeves, for use with tapered bearing, are assembled to case with bearings and small spacer collar. Finger-tighten the sleeve parts.
3. Insert lap shaft with arbor assembled through pinion bearing bushing and into guide sleeve. Tighten arbor expansion collars using a length of 0.156 in. (3.962 mm) rod as spanner until arbor begins to drag. Do not adjust arbor snug in bushing or bushing will develop a condition where hole is larger at ends than it is in the center.
4. Withdraw arbor far enough to coat lightly with 220 grit lapping compound. Do not apply a heavy coat.
5. Reposition lap in bushing and turn handle at moderate hand speed. Work lap back and forth in bushing, as it is revolved, to avoid grooving and tapering.
6. At frequent intervals, remove lap from crankcase, wash and inspect bushing. Lapping is completed when entire bushing surface has a dull, satin finish rather than a glossy, smooth appearance. If necessary, flush off lap in cleaning solvent, air dry and apply fresh, light coat of fine lapping compound.

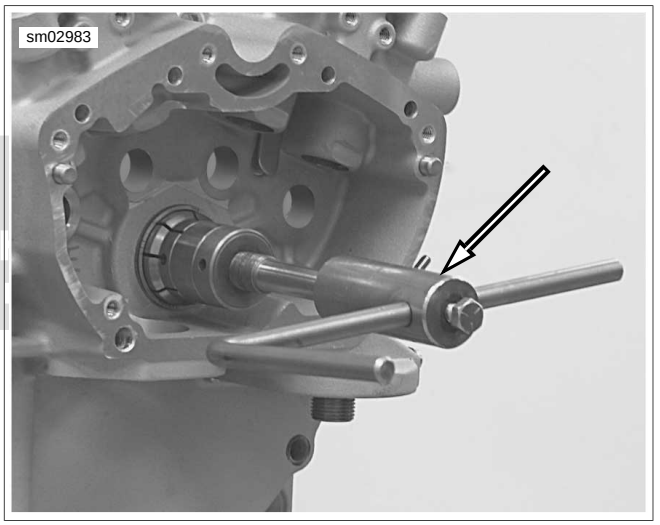


Figure 3-133. Lapping Pinion Shaft Bearing Outer Race with Crankcase Main Bearing Lapping Tool

CHECKING CONNECTING ROD SIDE PLAY

1. See Figure 3-134. Check connecting rod side play with a thickness gauge as shown.
2. If side play measurement is greater than the service wear limit, 0.036 in. (0.8 mm), replace the flywheel/connecting rod assembly.

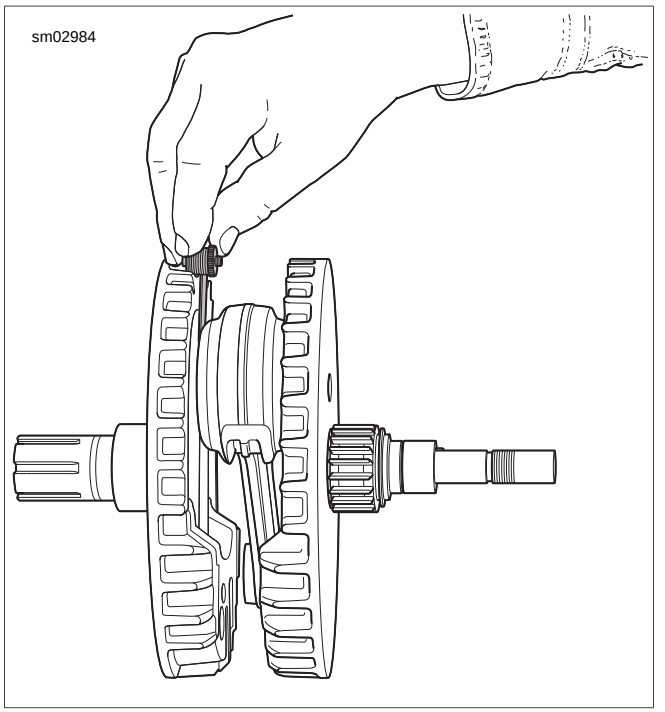


Figure 3-134. Checking Connecting Rod Side Play

ASSEMBLY

PART NUMBER	TOOL NAME
B-42579-6	SPROCKET SHAFT ADAPTER
B-42579-7	COLLAR
B-45655, HD-42720-2 AND HD-46663	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER
B-45676-A	SPROCKET SHAFT SEAL INSTALLER
HD-42326-B	CRANKSHAFT GUIDE
HD-42579	SPROCKET SHAFT BEARING INSTALLER
HD-97228-55A	COLLAR

Crankcase Halves

NOTE

Lubricate all parts with Harley-Davidson 20W50 engine oil, and proceed as follows:

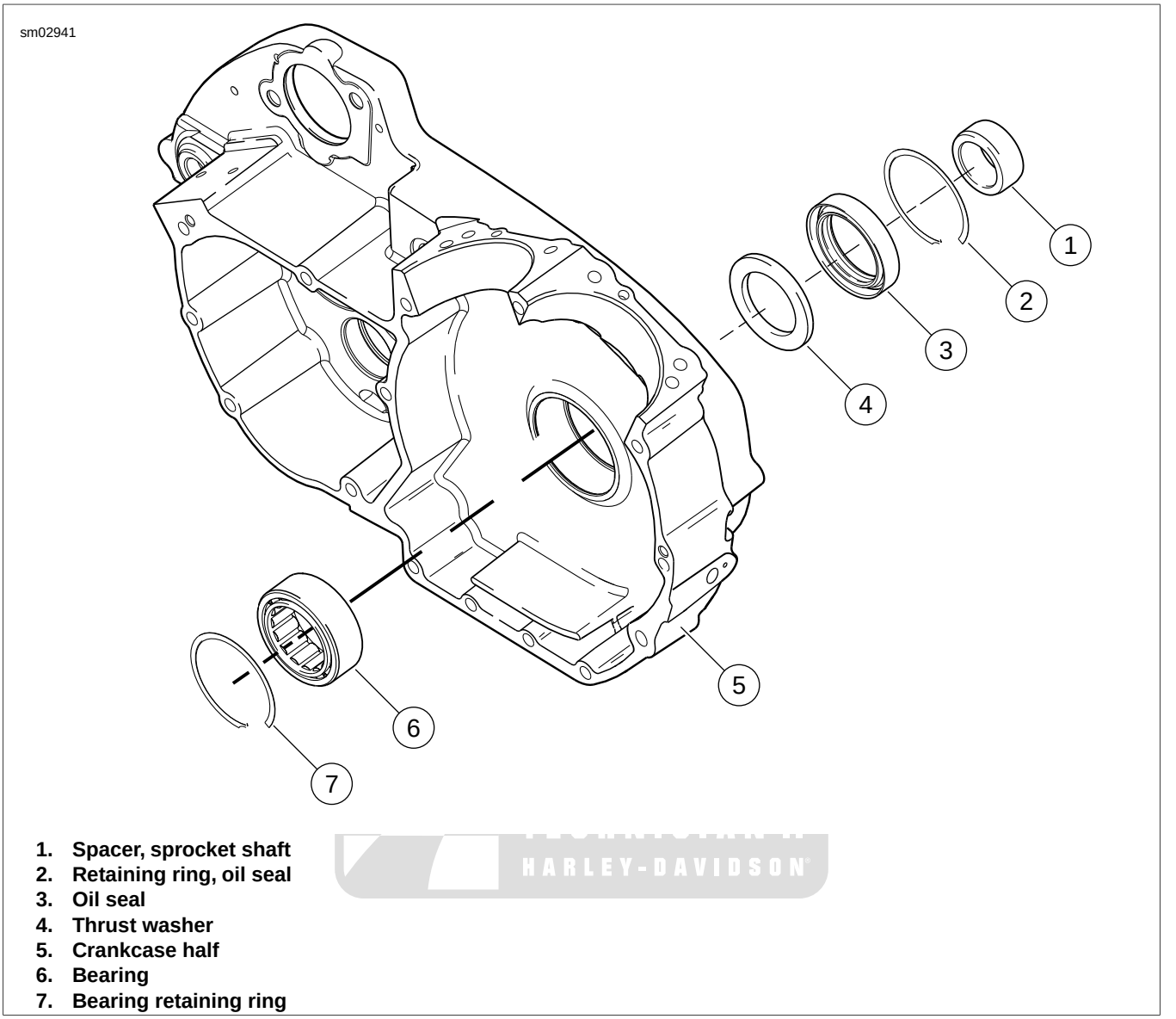
1. See Figure 3-136. Using CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER (Part No. B-45655, HD-42720-2 and HD-46663), install sprocket shaft bearing into left crankcase half from the inside.

NOTE

Make sure that the bearing assembly bottoms against the machined shoulder in the left crankcase half.

2. Install **new** bearing retaining ring (3) in left crankcase half.
3. Install transmission. See 5.15 TRANSMISSION INSTALLATION.

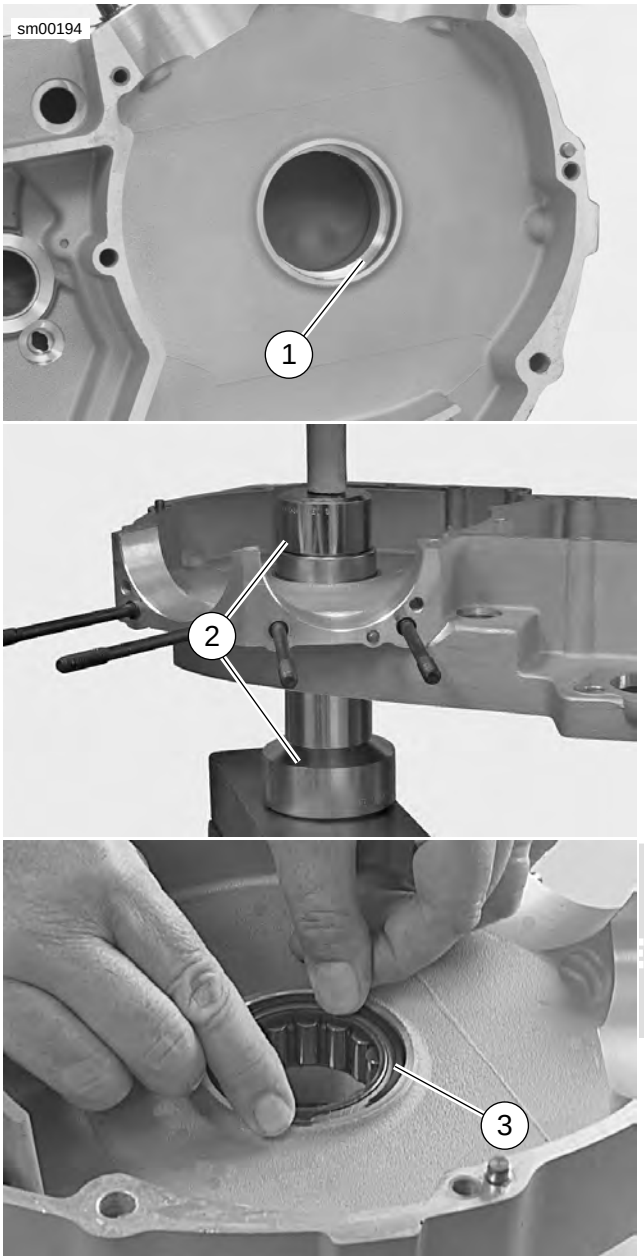
DIGITAL TECHNICIAN HARLEY-DAVIDSON®



1. **Spacer, sprocket shaft**
2. **Retaining ring, oil seal**
3. **Oil seal**
4. **Thrust washer**
5. **Crankcase half**
6. **Bearing**
7. **Bearing retaining ring**

Figure 3-135. Sprocket Shaft Bearing Assembly

4. See Figure 3-137. Attach left crankcase half to engine stand.
5. Install flywheel assembly using CRANKSHAFT GUIDE (Part No. HD-42326-B).
6. See Figure 3-138. Install pinion shaft bearing.
   a. Lubricate pinion shaft bearing with engine oil.
   b. Slip bearing on pinion shaft.
   c. Install **new** retaining ring in groove of pinion shaft bearing inner race.



1. Shoulder
2. Crankcase bearing remover/installer tool
3. Retaining ring

Figure 3-136. Sprocket Shaft Bearing Installation

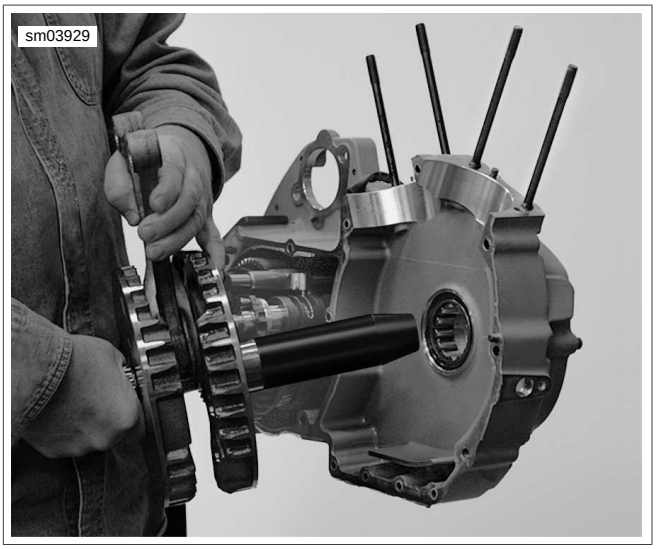


Figure 3-137. Installing Flywheel Assembly with CRANKSHAFT GUIDE

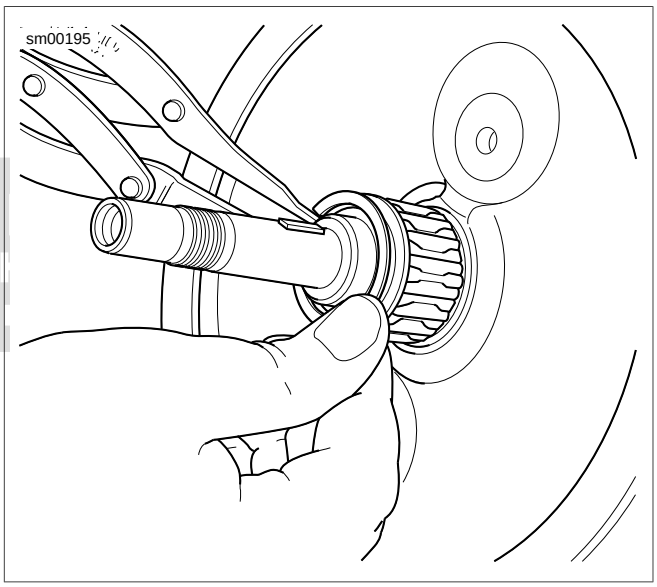
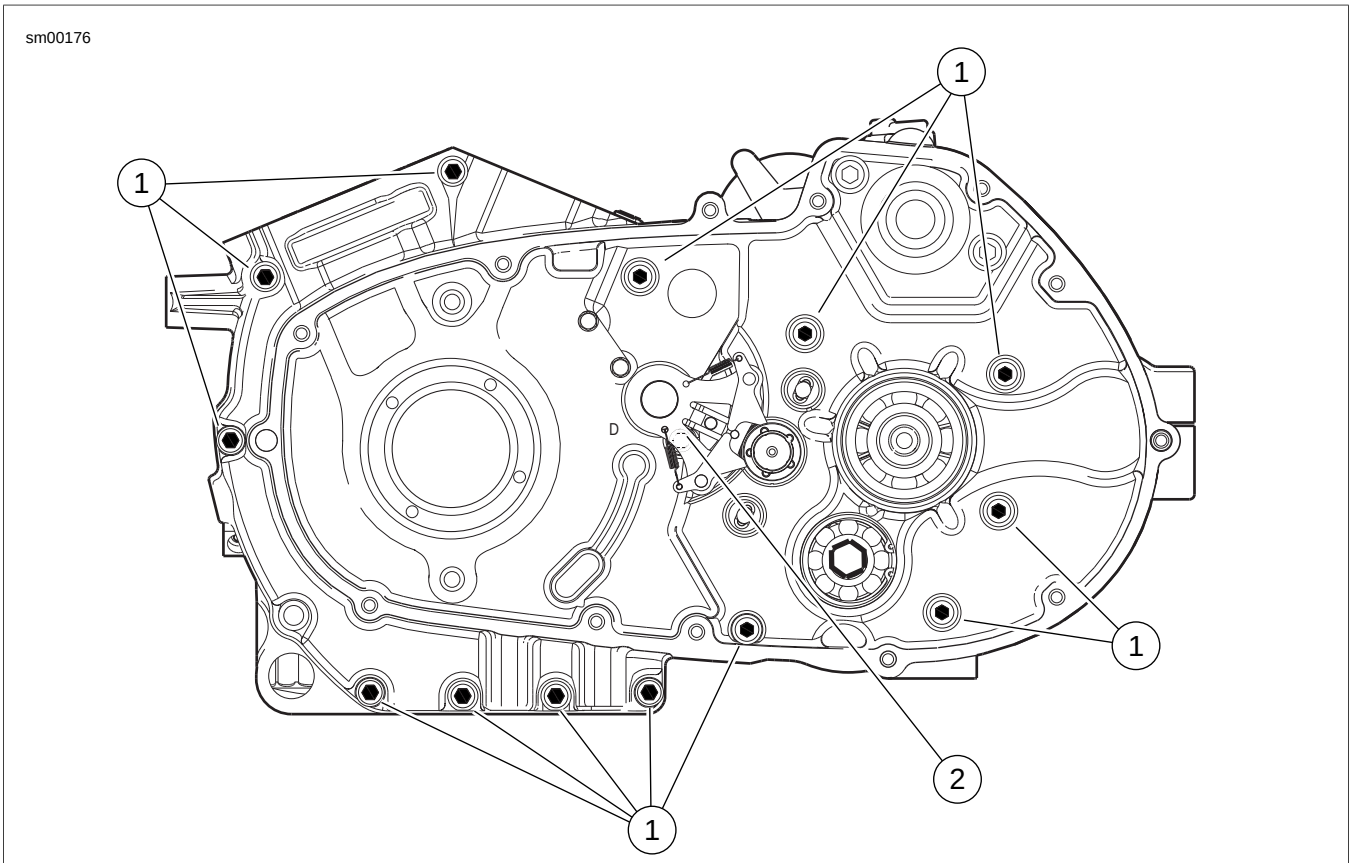


Figure 3-138. Pinion Shaft Bearing



1. **Crankcase fasteners**
2. **Crankcase fastener behind shifter mechanism**

Figure 3-139. Crankcase Fasteners

7. See Figure 3-139. Assemble crankcase halves together.
   a. Apply a thin coat of GREY HIGH-PERFORMANCE SEALANT (Part No. 99650-02) to crankcase joint faces.
   b. Slide outer race in right crankcase over pinion shaft and bearing assembly.
   c. Apply LOCTITE 271 (red) to the last few threads and tighten fasteners to 15-19 ft-lbs (20-26 Nm).

NOTES

- *According to manufacturing, there is no torque sequence to follow when tightening crankcase fasteners.*
- *See Figure 3-140. Kent-Moore has developed additional tools to be used with SPROCKET SHAFT BEARING INSTALLER (Part No. HD-42579). You will need SPROCKET SHAFT ADAPTER (Part No. B-42579-6) and COLLAR (Part No. B-42579-7). The addition of these tools will update HD-42579 SPROCKET SHAFT BEARING INSTALLER to HD-42579-A. In addition, you will need SPROCKET SHAFT SEAL INSTALLER (Part No. B-45676-A) to use with these additional tools to install the seal into the left crankcase. In order to install the sprocket shaft inner bearing race for sprocket shaft bearing, you will need to borrow from the Big Twin SPROCKET SHAFT SEAL INSTALLER, COLLAR (Part No. HD-97228-55A).*

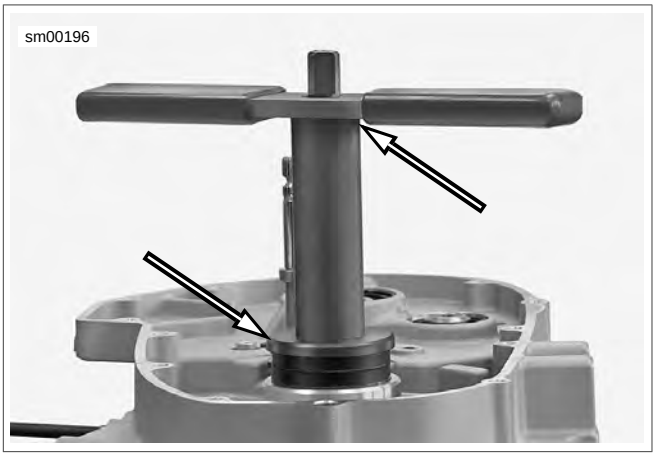


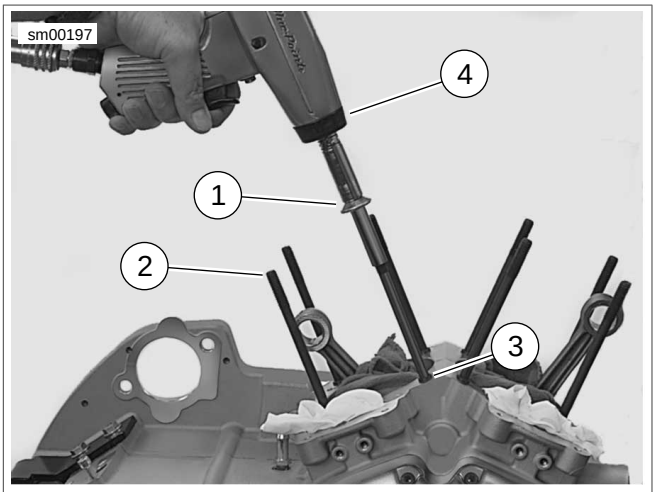
Figure 3-140. Sprocket Shaft Seal/Spacer Installer

8. Install sprocket shaft seal.
   a. Center seal/spacer driver over seal, so that the sleeve (smaller OD) seats between seal wall and garter spring.
   b. Sparingly apply graphite lubricant to threads of pilot shaft to verify smooth operation.
   c. Slide sleeve over pilot until sleeve contacts the oil seal. Install handle on top of sleeve.
   d. Rotate handle clockwise until tool bottoms on crankcase lip. Remove tool from sprocket shaft.
   e. Install **new** retaining ring in groove in left crankcase next to oil seal.
9. Install thrust washer from the outside against the sprocket shaft bearing.
10. Install **new** spacer in seal ID. With the thin (lipped) side facing outward, center seal/spacer assembly over bearing bore.

NOTE

*Do not remove the spacer after installation or the **new** seal will have to be discarded and the procedure repeated.*

11. See Figure 3-141. Install cylinder studs.
    a. Pack clean towels into crankcase opening.
    b. Place a steel ball into a head screw.
    c. The cylinder studs have a shoulder at the lower end. Place the end of the stud without the shoulder into the head screw.
    d. Install the stud in the crankcase with the shoulder end down. Use an air gun to drive the stud until the shoulder reaches the crankcase.
    e. Remove air gun. Use a torque wrench to tighten stud to 10-20 ft-lbs (14-27 Nm).



1. **Head screw with ball inside**
2. **Cylinder stud**
3. **Shoulder on cylinder stud**
4. **Air gun**

Figure 3-141. Cylinder Studs

12. Install piston and cylinder. See 3.8 CYLINDER AND PISTON.
13. Install cylinder head. See 3.7 CYLINDER HEAD.
14. Install cam gears, gearcase cover, lifter guides and lifters. See 3.17 GEARCASE AND CAM GEARS.
15. Install oil pump. See 3.10 OIL PUMP.
16. Install starter. See {MISSING_XREF_C18-sectionC18S6}.
17. Install shift shaft. See 5.16 SHIFTER SHAFT.
18. Install stator. See 6.11 ALTERNATOR.
19. Install all primary drive components. This includes engine sprocket, primary chain, complete clutch assembly, engine sprocket bolt and mainshaft nut. See 5.6 PRIMARY CHAIN.
20. Install primary cover. See 5.3 PRIMARY COVER.

NOTE

Be sure to refill transmission to proper level with fresh lubricant. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.

21. To install engine in frame see 3.6 ENGINE INSTALLATION.

TABLE OF CONTENTS

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

FASTENER TORQUE VALUES 4.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Air cleaner backplate fasteners	84-120 **in-lbs**	9.5-13.6 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Bank angle sensor	12-36 **in-lbs**	1.4-4 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Bank angle sensor	12-36 **in-lbs**	1.4-4 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Bank angle sensor	12-36 **in-lbs**	1.4-4 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
BAS fastener	60-96 **in-lbs**	7-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	4.14 FUEL PUMP, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), FIREBOLT
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), FIREBOLT
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), LIGHTNING
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), LIGHTNING
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), ULYSSES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), ULYSSES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.6 IGNITION COIL, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.10 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.11 COOLING FAN, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.12 FUEL TANK VENT VALVE, Installation
Cooling fan fasteners	12-36 **in-lbs**	1.4-4 Nm	4.11 COOLING FAN, Installation
Electronic control module fasteners, Lightning	48-72 **in-lbs**	5.4-8 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), LIGHTNING
Electronic control module fasteners, Ulysses	36-60 **in-lbs**	4-6.8 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), ULYSSES
Engine temperature sensor	120-168 **in-lbs**	13.6-19 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation
Exhaust header mounting nut	72-96 **in-lbs**	8-11 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Final rear axle	48-52 ft-lbs	65-70.5 Nm	4.14 FUEL PUMP, Installation
Fuel cap retaining ring fasteners	62-71 **in-lbs**	7-8 Nm	4.13 FUEL CAP RETAINING RING, Installation
Fuel pump drain plug	84-108 **in-lbs**	9.5-12 Nm	4.14 FUEL PUMP, Draining Fuel Tank
Fuel pump harness fastener	18-22 **in-lbs**	2.0-2.5 Nm	4.14 FUEL PUMP, Repair
Fuel pump harness fastener	18-22 **in-lbs**	2.0-2.5 Nm	4.14 FUEL PUMP, Repair

FASTENER	TORQUE VALUE		NOTES
Fuel pump harness fastener	18-22 **in-lbs**	2.0-2.5 Nm	4.14 FUEL PUMP, Repair
Fuel pump screws	48-51 **in-lbs**	5.4-5.8 Nm	4.14 FUEL PUMP, Installation
Fuel rail fasteners	24-28 **in-lbs**	2.8-3.2 Nm	4.15 THROTTLE BODY, Repair
Fuel supply line banjo fitting	84-108 **in-lbs**	9.5-12 Nm	4.14 FUEL PUMP, Installation
Fuel tank vent valve fasteners	39-41 **in-lbs**	4.4-4.6 Nm	4.12 FUEL TANK VENT VALVE, Installation
IAC actuator fasteners	25-30 **in-lbs**	2.9-3.5 Nm	4.15 THROTTLE BODY, Repair
Idler pulley assembly	33-35 ft-lbs	45-47 Nm	4.14 FUEL PUMP, Installation
Ignition coil mounting screws	120-144 **in-lbs**	13.6-16.3 Nm	4.6 IGNITION COIL, Installation
Initial rear axle	23-27 ft-lbs	31.2-36.6 Nm	4.14 FUEL PUMP, Installation
Intake flange screws	96-120 **in-lbs**	10.8-13.6 Nm	4.15 THROTTLE BODY, Installation
Interactive exhaust actuator fasteners	36-40 **in-lbs**	4-4.5 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Lower shock absorber	15-17 ft-lbs	20.3-23 Nm	4.14 FUEL PUMP, Installation
Manifold to engine mount fastener	90-120 **in-lbs**	10-13.6 Nm	4.15 THROTTLE BODY, Installation
Muffler mount fastener, front	16-18 ft-lbs	21.7-24.4 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Muffler mounting block fastener, rear	32-36 ft-lbs	43-49 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation/LOCTITE 27 (red)
Muffler strap fastener, front	108-120 **in-lbs**	12-14 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Muffler strap fastener, front	108-120 **in-lbs**	12-14 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Muffler strap fastener, rear	48-60 **in-lbs**	5.4-7 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation/You need to alternately tighten the fasteners to torque a total of three times to make sure the straps are evenly tightened.
Oil line p-clamp at swingarm	48-72 **in-lbs**	5.4-8 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Oxygen sensor	40-45 ft-lbs	54-61 Nm	4.7 OXYGEN SENSOR, Installation/ANTI-SEIZE
Rear axle pinch fastener	40-45 ft-lbs	54-61 Nm	4.14 FUEL PUMP, Installation
Rear shock absorber reservoir clamp rear	120-144 **in-lbs**	13.6-16.3 Nm	4.19 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Installation: Firebolt
Swingarm pivot	44-46 ft-lbs	60-62 Nm	4.14 FUEL PUMP, Installation
Swingarm pivot pinch fastener	17-19 ft-lbs	23-26 Nm	4.14 FUEL PUMP, Installation
Throttle position sensor	12-15 **in-lbs**	1.4-1.7 Nm	4.5 THROTTLE POSITION SENSOR (TPS), Installation/LOCTITE 222 (purple)
Torca clamp	45-50 ft-lbs	61-68 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Upper tie bar	25-27 ft-lbs	33.9-36.6 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation

SPECIFICATIONS 4.2

GENERAL

Table 4-1. Fuel Tank Specifications

FUEL TANK CAPACITY	GALLONS	LITERS
Total (including reserve) (XB12Ss, XB12XT, XB12X, XB12XP)	4.40	16.7
Reserve/Low fuel indicator at (XB12Ss, XB12XT, XB12X, XB12XP)	0.83	3.1
Total (including reserve) (XB9SX XB12Scg, XB12R)	3.82	14.5
Reserve/Low fuel indicator at (XB9SX, XB12Scg, XB12R)	0.75	2.8

Table 4-2. Fuel System Specifications

FUEL SYSTEM	TYPE
Intake (XB9 models)	45 mm downdraft manifold, ram air
Intake (XB12 models)	49 mm downdraft manifold, ram air
Fuel delivery	DDFI fuel injection
Fuel pressure	49-51 PSI (338-352 kPa)
Recommended fuel	91 octane

Table 4-3. Idle Speed: XB Models

SPECIFICATION	VALUE
Operating temperature	320 °F (160 °C)
Regular engine idle speed	1050-1150 RPM
Note: There is no adjustment of idle speed. Idle is controlled by the ECM.	

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AIR CLEANER ASSEMBLY 4.3

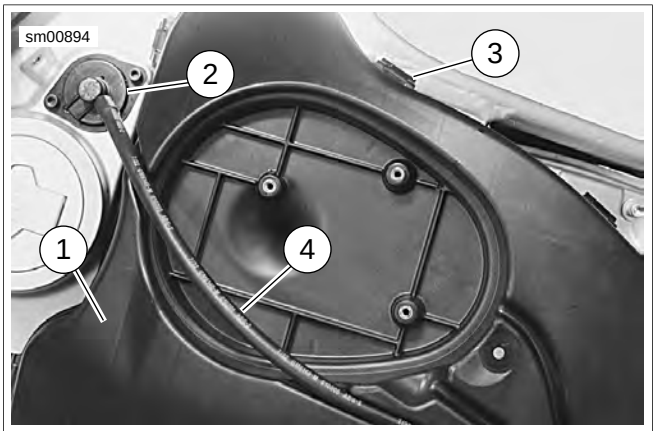
REMOVAL

1. Remove intake cover. See 2.38 INTAKE COVER.
2. See Figure 4-1 or Figure 4-2. Remove fuel tank vent tube (4) from fuel tank vent valve (5) and groove on top of air cleaner cover (3).

NOTE

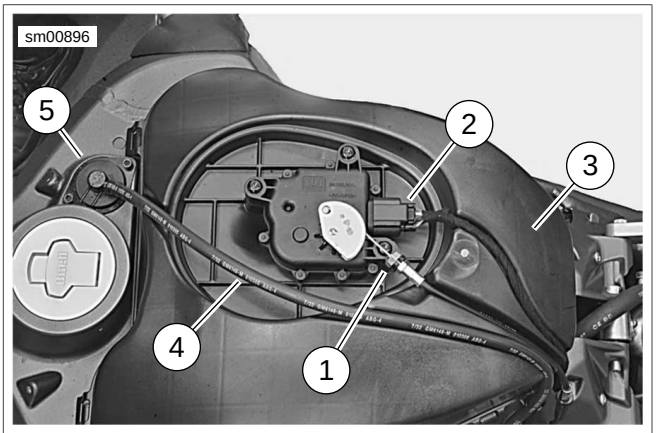
See Figure 4-3 or Figure 4-4. For 1200 model motorcycles with interactive exhaust systems see 6.17 INTERACTIVE EXHAUST SYSTEM.

3. See Figure 4-1. Unlatch six lock tabs (3) and remove air cleaner cover from baseplate.
4. Remove the filter element from baseplate. Inspect and replace if necessary.
5. See Figure 4-4. Remove air cleaner baseplate.
   a. Remove four fasteners (1) and raise baseplate (3).
   b. Disconnect longer breather hose from baseplate (pull out from bottom).
   c. Disconnect shorter breather hose from PVC valve located on top of rear cylinder.
   d. Remove IAT sensor (6) from grommet on bottom of baseplate.
   e. Lift baseplate off of frame, carefully disengaging baseplate from velocity stack sealing ring (5) on velocity stack (4).
   f. Remove baseplate from motorcycle.



1. **Cover, air cleaner**
2. **Fuel tank vent valve**
3. **Lock tab (6)**
4. **Fuel tank vent tube**

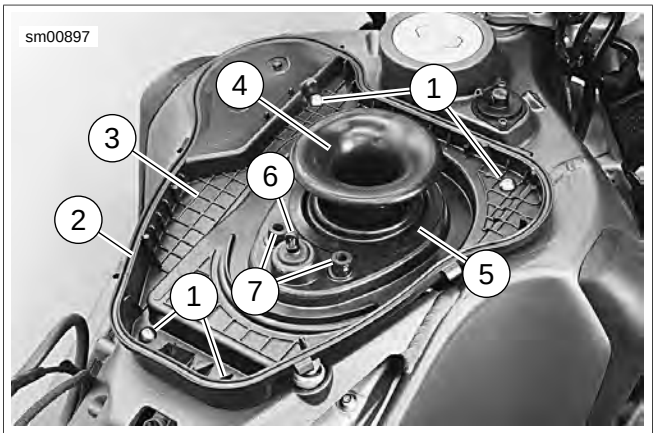
Figure 4-1. Air Cleaner Cover (XB9)



1. **Cable, interactive exhaust**
2. **Harness, interactive exhaust**
3. **Cover, air cleaner**
4. **Fuel tank vent tube**
5. **Fuel tank vent valve**

Figure 4-2. Air Cleaner Cover, Fuel Tank Vent Tube and Fuel Tank Vent Valve (XB12R)

Figure 4-3. Interactive Exhaust Actuator to be used with Translucid Intake Cover (XB12)



1. **Fasteners**
2. **Gasket**
3. **Baseplate**
4. **Velocity stack**
5. **Velocity stack sealing ring**
6. **Intake air temperature sensor (IAT)**
7. **Breather hoses**

Figure 4-4. Baseplate

INSPECTION

1. Inspect air cleaner cover. Check for dirt, torn filter material and general condition. Replace if necessary.
2. Inspect inside of backing plate and cover. Remove any dirt or debris.
3. Inspect condition of velocity stack and velocity stack sealing ring. If torn or damaged, replace.
4. Inspect IAT sensor and replace if faulty. See 4.10 INTAKE AIR TEMPERATURE SENSOR (IAT).
5. Inspect breather hoses, intake air temperature sensor grommet and baseplate gasket. Replace as necessary.

INSTALLATION

1. Hold baseplate above mounting position.
2. Insert IAT sensor into grommet on baseplate from underside.

NOTES

- *A small amount of soapy water applied to the inside diameter of grommet will make breather hose installation easier.*
- *In next step, be sure breather hoses do not extend past Intake air temperature sensor tower. If hoses extend past tower, damage to sensor may occur.*

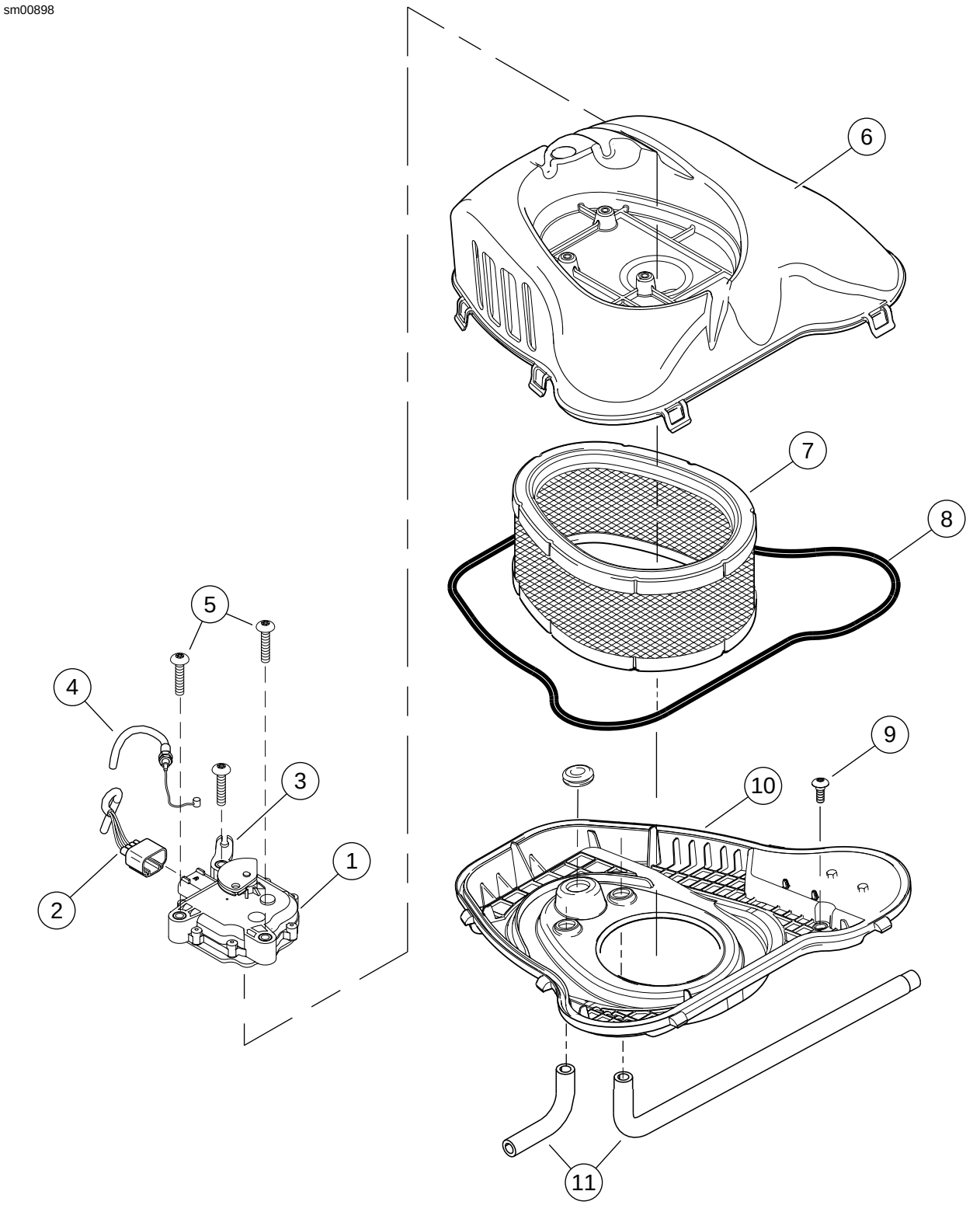
3. Insert longer breather hose into right baseplate grommet from underside.
4. Attach shorter breather hose onto crankcase breather located on top of rear cylinder.
5. Carefully lower baseplate into mounting position. verify rubber sealing ring on velocity stack completely engages baseplate. Baseplate should be sandwiched between upper and lower rubber sealing rings.
6. See Figure 4-5. Install baseplate to frame with four fasteners (10). Tighten fasteners to 84-120 **in-lbs** (9.5-13.6 Nm).
7. Position air cleaner filter on baseplate.
8. Install air cleaner to baseplate and latch six latches to secure.
9. If interactive exhaust actuator (XB12 models) was removed, install at this time and tighten fasteners to 36-40 **in-lbs** (4-4.5 Nm). See 1.16 INTERACTIVE EXHAUST CABLE.
10. Route vent hose through groove on air cleaner to vent valve.
11. Install intake cover assembly. See 2.38 INTAKE COVER.

WARNING

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

12. Install seat.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Actuator, interactive exhaust**
2. **Harness, interactive exhaust**
3. **Cable bracket**
4. **Interactive exhaust cable**
5. **Mounting fasteners, actuator**
6. **Cover, air cleaner**
7. **Filter element**
8. **Air cleaner seal**
9. **Shoulder screw (4)**
10. **Base plate assembly**
11. **Breather hoses, front and rear**

Figure 4-5. Air Cleaner Assembly with Interactive Exhaust (XB12 Models, Typical)

ELECTRONIC CONTROL MODULE (ECM) 4.4

FIREBOLT

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Removal

1. Remove seat.

⚠WARNING

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

2. Disconnect battery. See 1.5 BATTERY MAINTENANCE.
3. Remove front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
4. See Figure 4-6. Remove Electronic Control Module (ECM). See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
5. Disconnect ECM black connector [10] and gray connector [11].

Installation

1. Attach ECM connectors [10] and [11].
2. Install ECM between fairing and headlight bracket.
3. Install headlight bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
4. Install front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.

⚠WARNING

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

5. Connect battery positive cable (red) first, tightening to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.
6. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

NOTES

- *The Throttle Position Sensor Zero Procedure should be performed if the throttle position sensor or ECM have been replaced or if the ECM has been recalibrated. See 4.5 THROTTLE POSITION SENSOR (TPS).*
- *The throttle body has a throttle plate stop screw that is preset at the factory and has tamper proof paint applied to the head of the screw. Do NOT attempt to adjust this screw. Tampering with this screw will require throttle body replacement.*

⚠WARNING

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

7. Install seat.

NOTE

*If the ECM was replaced with a **new** component, it will be necessary to download the correct calibration using D.T. DIGITAL TECHNICIAN II (Part No. HD-48650) and perform the TPS zero procedure.*

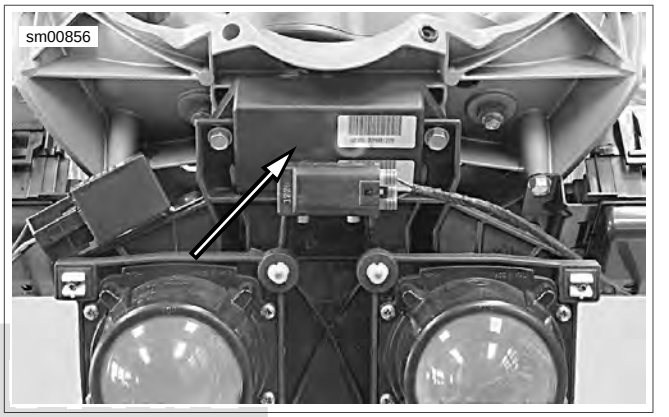


Figure 4-6. Electronic Control Module (ECM): Firebolt

LIGHTNING

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN

Removal

1. Remove seat.

⚠WARNING

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

2. Disconnect and remove battery. See 1.5 BATTERY MAINTENANCE.
3. See Figure 4-7. Disconnect ECM black connector [10] and gray connector [11].
4. Remove the two fasteners to detach electronic control module from bracket.

Installation

1. Align holes in ECM with those in electrical bracket. Install two fasteners and tighten to 48-72 **in-lbs** (5.4-8 Nm).
2. See Figure 4-7. Attach ECM connectors [10] and [11].

⚠WARNING

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

3. Connect battery positive cable (red) first, tightening to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.
4. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

NOTE

*If the ECM was replaced with a **new** component, it will be necessary to download the correct calibration using D.T. DIGITAL TECHNICIAN (Part No. HD-48650) and perform the TPS zero procedure.*

⚠WARNING

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

5. Install seat.

NOTES

- *The Throttle Position Sensor Zero Procedure should be performed if the throttle position sensor or ECM have been replaced or if the ECM has been recalibrated. See 4.5 THROTTLE POSITION SENSOR (TPS).*
- *The throttle body has a throttle plate stop screw that is preset at the factory and has tamper proof paint applied to the head of the screw. Do NOT attempt to adjust this screw. Tampering with this screw will require throttle body replacement.*

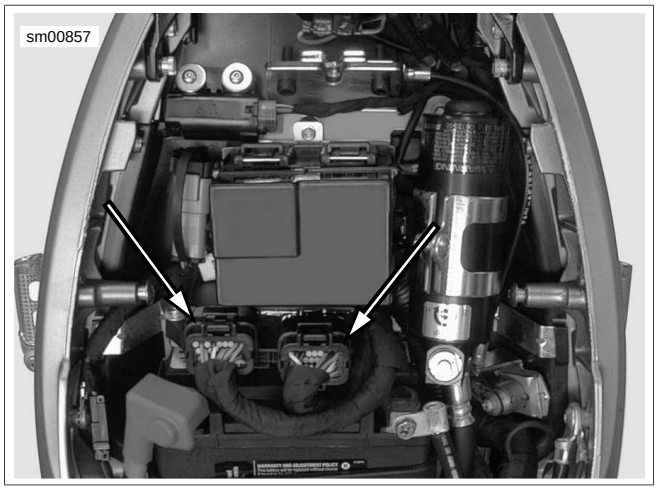


Figure 4-7. Electronic Control Module (ECM): Lightning (Typical)

Figure 4-8. Electronic Control Module (ECM): Lightning (XB12Ss)

ULYSSES

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN

Removal

1. Remove seat.

⚠WARNING

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

2. Disconnect battery. See 1.5 BATTERY MAINTENANCE.
3. Disconnect ECM black connector [10] and gray connector [11].
4. Remove the two fasteners to detach electronic control module from bracket.

NOTE

When removing the ECM, the fastener closest to the shock assembly has a nut that is captured in the plastic shield below the ECM. You need to place your finger under the nut when removing the fastener to prevent the nut from falling out. Slide the ECM to one side and loosely install the fastener to retain the nut in the correct location. The rear fastener attaches directly to the battery pan.

Installation

1. Align holes in ECM with those in electrical bracket. Install two fasteners and tighten to 36-60 **in-lbs** (4-6.8 Nm).
2. See Figure 4-9. Attach ECM connectors [10] and [11].

⚠WARNING

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

3. Connect battery positive cable (red) first, tightening to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.
4. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

NOTES

- *The Throttle Position Sensor Zero Procedure should be performed if the throttle position sensor or ECM have been replaced or if the ECM has been recalibrated. See 4.5 THROTTLE POSITION SENSOR (TPS).*
- *The throttle body has a throttle plate stop screw that is preset at the factory and has tamper proof paint applied to the head of the screw. Do NOT attempt to adjust this screw. Tampering with this screw will require throttle body replacement.*
- *If the ECM was replaced with a **new** component, it will be necessary to download the correct calibration using D.T. DIGITAL TECHNICIAN (Part No. HD-48650) and perform the TPS zero procedure.*

⚠WARNING

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

5. Install seat.

Figure 4-9. Electronic Control Module (ECM): Ulysses

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

THROTTLE POSITION SENSOR (TPS) 4.5

REMOVAL

1. Remove air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
2. Remove throttle body assembly. See 4.15 THROTTLE BODY.
3. See Figure 4-10. Disconnect throttle position sensor connector [88].
4. See Figure 4-11. Remove two screws and washers to detach TP sensor.

INSTALLATION

1. See Figure 4-11. Apply LOCTITE 222 (purple) to threads of fasteners.
2. Install fastener into lower mounting hole of sensor prior to installation.
3. Attach TP sensor with both fasteners and washers. Tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
4. Install throttle body. See 4.15 THROTTLE BODY.

NOTE

The Throttle Position Sensor Zero Procedure should be performed if the throttle position sensor or ECM are replaced or if the ECM has been recalibrated.

5. To zero the TPS:
   a. Set the Run/Stop switch to the Run position.
   b. Turn the ignition key to the On position.
   c. With the engine off, rotate the throttle grip from closed throttle position to wide-open throttle position and back to closed position 3 times holding the throttle grip against each stop for 1 full second.
   d. Cycle the key off and back on. A properly calibrated TPS sensor will indicate 3.7 to 4.2 degrees.

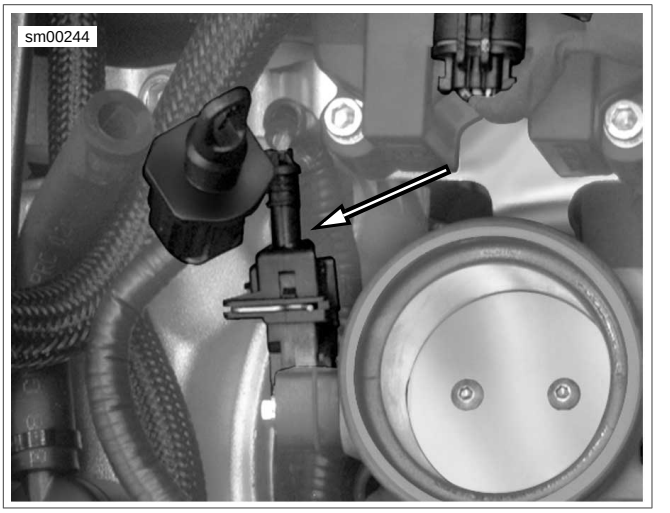


Figure 4-10. Throttle Position Sensor Connector Location

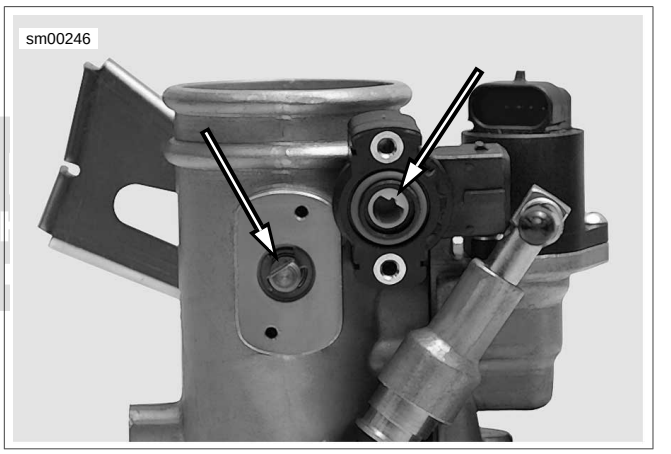


Figure 4-11. Throttle Position Sensor

IGNITION COIL 4.6

REMOVAL

WARNING

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

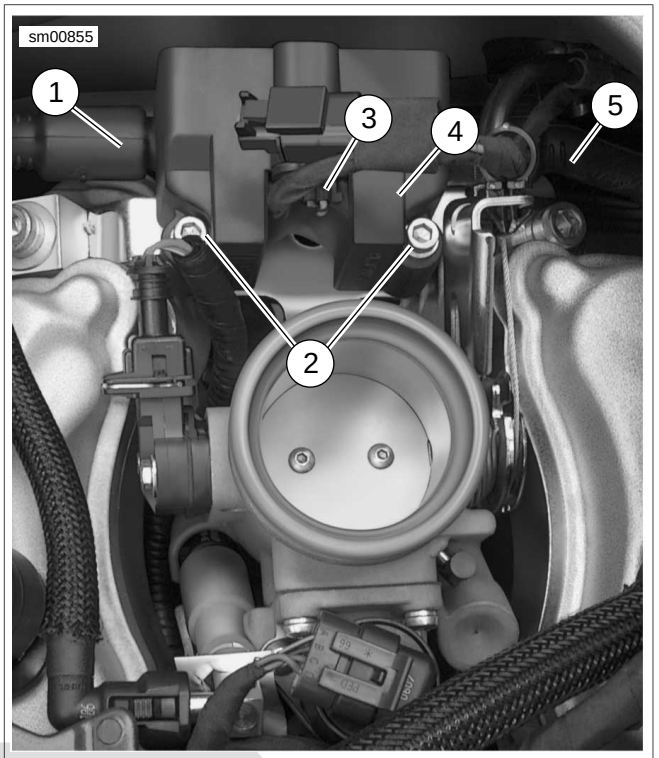
1. Disconnect negative battery cable.
2. Remove intake cover assembly. See 2.38 INTAKE COVER.
3. Remove air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
4. See Figure 4-12. Disconnect the spark plug cables from the coil plug posts (1, 5).
5. Detach connector [83] (3).
6. Remove coil fasteners (2).

INSTALLATION

NOTE

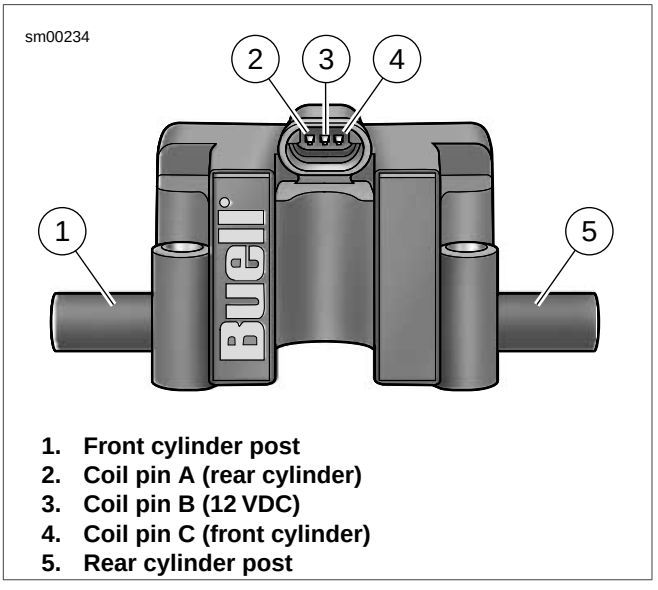
To ease installation, attach spark plug cables to ignition coil first.

1. Connect spark plug cables to ignition coil.
2. See Figure 4-12. Attach coil to frame with fasteners (2). Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
3. Attach front and rear spark plug cables to ignition coil posts.
4. Attach connector [83] (3).
5. Install air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
6. Install intake cover assembly. See 2.38 INTAKE COVER.
7. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).



1. **Rear cylinder post**
2. **Fasteners**
3. **Coil connector [83]**
4. **Coil**
5. **Front cylinder post**

Figure 4-12. Ignition Coil Location (Typical)



1. **Front cylinder post**
2. **Coil pin A (rear cylinder)**
3. **Coil pin B (12 VDC)**
4. **Coil pin C (front cylinder)**
5. **Rear cylinder post**

Figure 4-13. Ignition Coil

OXYGEN SENSOR 4.7

GENERAL

See Figure 4-14. The oxygen sensor (O2 Sensor), located in the rear header pipe, monitors oxygen content in the exhaust gas and converts it to a voltage reading. This voltage reading is used by the ECM to maintain the proper air/fuel ratio during closed loop operation.

REMOVAL

PART NUMBER	TOOL NAME
SNAP-ON YA8875	OXYGEN SENSOR SOCKET

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove intake cover assembly. See 2.38 INTAKE COVER.
4. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
5. Remove shock absorber. See 2.23 REAR SHOCK ABSORBER.
6. Remove cooling fan. See 4.11 COOLING FAN.
7. See Figure 4-15. Unplug 1-place connector [137].
8. Remove oxygen sensor from exhaust header using OXYGEN SENSOR SOCKET (Part No. SNAP-ON YA8875).

INSTALLATION

NOTES

- *Do not install sensors that have been dropped or impacted by other components. Damage to the sensing element may have occurred. Replacement sensor assemblies have threads coated with anti-seize lubricant and new seal rings.*
- *If reinstalling O2 sensor, apply a thin coat of anti-seize (Part No. 98960-97) to threads of each O2 sensor prior to installing in header. Do not use any other grease or sealant product on sensor threads. The electrical connector must also be clean and free of any dielectric grease.*

1. Apply LOCTITE ANTI-SEIZE LUBRICANT to threads of sensor.
2. See Figure 4-14. Thread sensor into exhaust header. Tighten sensor to 40-45 ft-lbs (54-61 Nm).
3. Install cooling fan. See 4.11 COOLING FAN.
4. Install shock absorber. See 2.23 REAR SHOCK ABSORBER.
5. See Figure 4-15. Connect 1-place connector [137] to wiring harness.
6. Install sensor lead into retainer.
7. Install air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
8. Install intake cover assembly. See 2.38 INTAKE COVER.
9. Connect negative battery cable.

⚠WARNING

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

10. Install seat.

Figure 4-14. Oxygen Sensor (Shock Absorber Removed)

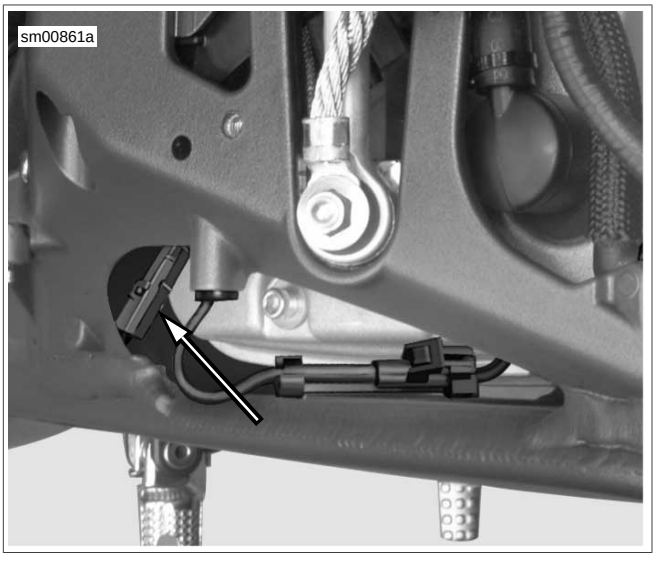


Figure 4-15. Oxygen Sensor Connector [137] (Typical)

ENGINE TEMPERATURE SENSOR (ET) 4.8

GENERAL

The Engine Temperature Sensor (ET Sensor), located in the rear cylinder head, monitors the engine temperature close to the combustion chamber. In addition to aiding the ECM in monitoring the operation of the engine, it is also used to warn the operator of potentially damaging temperatures by causing the CHECK ENGINE lamp to blink during operation.

REMOVAL

PART NUMBER	TOOL NAME
SNAP-ON M3503B	ENGINE TEMPERATURE SENSOR SOCKET

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove intake cover assembly. See 2.38 INTAKE COVER.
4. Remove air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
5. Remove right upper tie bar fastener. Rotate tie bar to provide access to sensor.

NOTES

- *Lightning/Ulysses models: Remove fastener securing rear wire guide to underside of frame to provide access to temperature sensor.*
- *Do not pull on engine temperature sensor wiring. Excess strain to sensor wiring will cause sensor damage.*

6. See Figure 4-17. Disconnect engine temperature sensor connector [90] above rear cylinder head.

NOTE

See Figure 4-18. All Buell engines come equipped with a piece of conduit approximately 3.94 in. (100mm) long to protect the engine temperature sensor lead from chafing on the inside of the rocker box. The conduit will be able to slide as much as 5 inches in order to move it out of the way to use the special socket to remove and install the sensor.

7. Slide rubber boot up ET sensor wire.
8. Remove sensor from rear cylinder head using ENGINE TEMPERATURE SENSOR SOCKET (Part No. SNAP-ON M3503B).

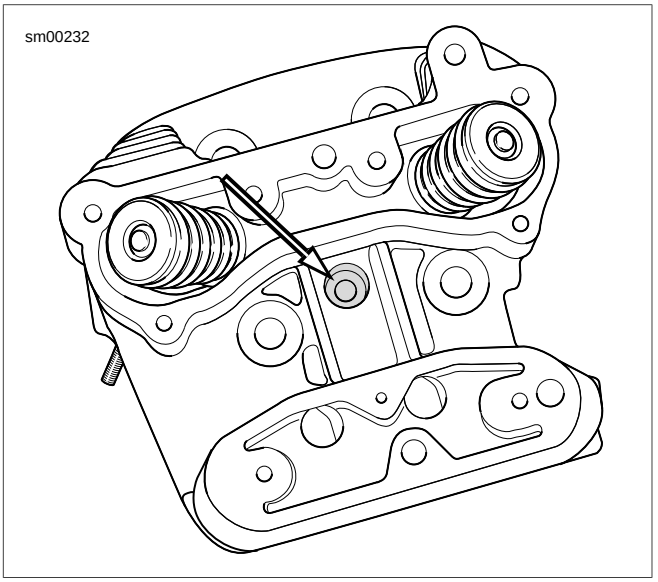


Figure 4-16. Location of Engine Temperature Sensor in Rear Cylinder Head

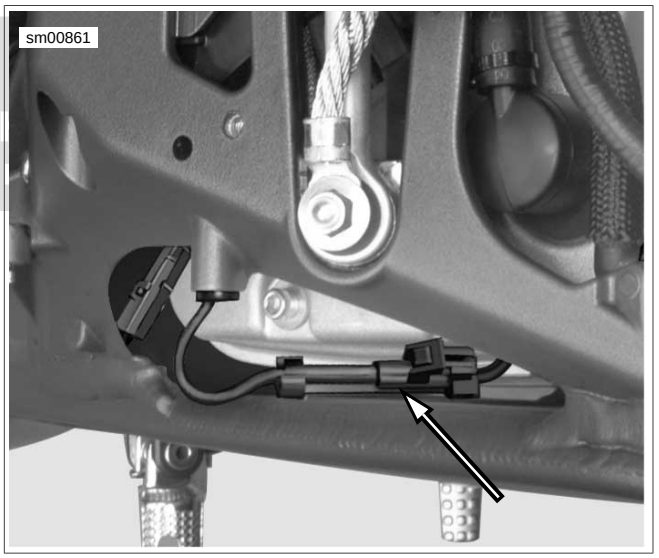


Figure 4-17. Engine Temperature Sensor Connector [90] (Typical)

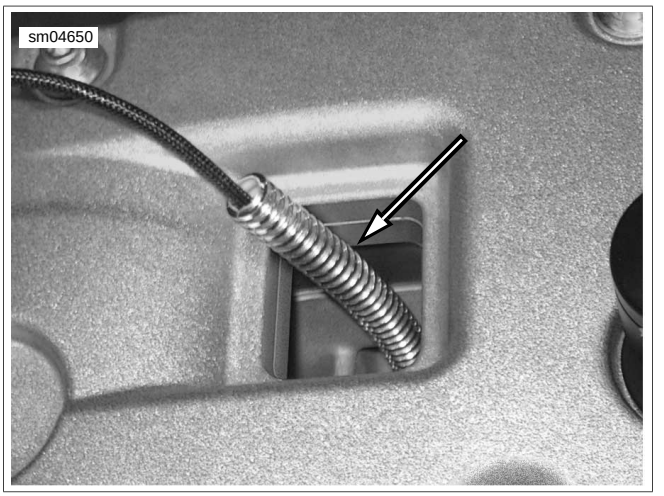


Figure 4-18. Protective Conduit for Engine Temperature Sensor Lead

INSTALLATION

PART NUMBER	TOOL NAME
SNAP-ON M3503B	ENGINE TEMPERATURE SENSOR SOCKET

NOTE

Do not pull on engine temperature sensor wiring. Excess strain to sensor wiring will cause sensor damage.

1. See Figure 4-16. Screw sensor into rear cylinder head.

NOTE

In next step, make sure wire is in cutout portion (slot) of socket to prevent damage.

2. Secure sensor with ENGINE TEMPERATURE SENSOR SOCKET (Part No. SNAP-ON M3503B). Tighten ET sensor to 120-168 **in-lbs** (13.6-19 Nm).

NOTE

Orient the rubber boot so the flat on the boot is towards the left side of the motorcycle.

3. Push rubber boot down sensor wire towards cylinder head until it seats in hole on top of ET sensor.
4. See Figure 4-17. Connect ET sensor connector [90] to wiring harness.
5. Install rear wire harness guide. Tighten fastener.
6. Install right upper tie bar fastener. Tighten fastener to 25-27 ft-lbs (33.9-36.6 Nm).
7. Install air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
8. Install intake cover assembly. See 2.38 INTAKE COVER.
9. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

10. Install seat.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®

BANK ANGLE SENSOR (BAS) 4.9

GENERAL

The Bank Angle Sensor (BAS) provides input to the ECM on lean angle. If lean angle exceeds the predetermined limit, the BAS will shut off power to the ignition and fuel pump.

REMOVAL

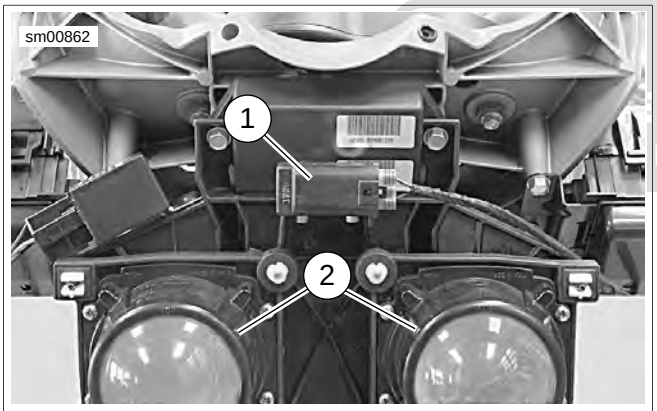
Firebolt

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
4. See Figure 4-21. Unplug bank angle sensor connector [134] (1).
5. Remove screws and washers to detach sensor from headlight bracket.



1. Bank angle sensor
2. Headlights

Figure 4-19. Bank Angle Sensor: Firebolt

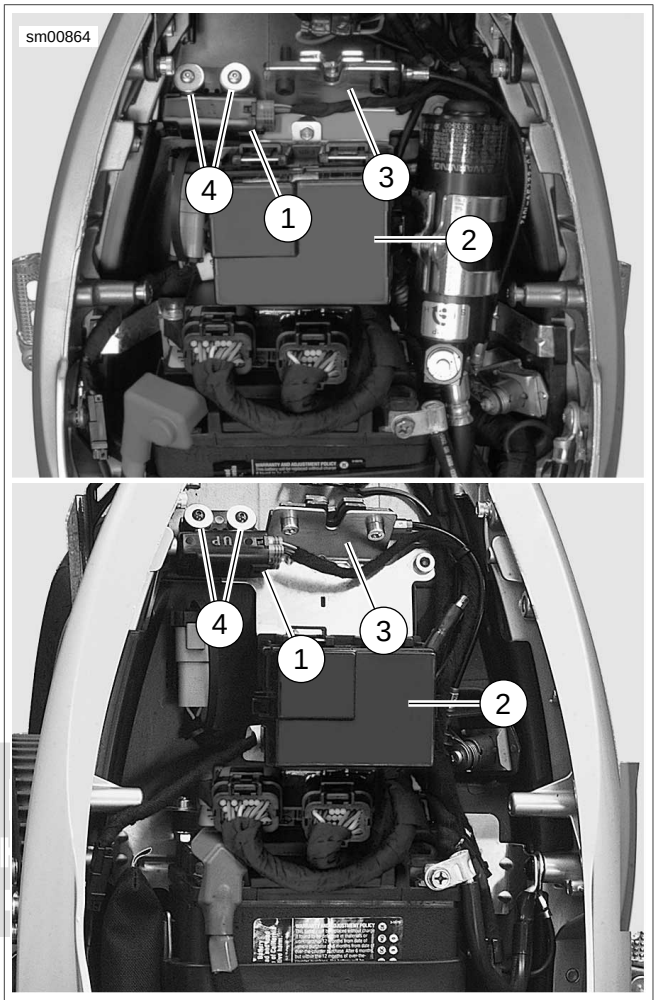
Lightning

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. See Figure 4-21. Remove screws and washers to detach sensor from seat latch bracket.
4. Unplug bank angle sensor connector [134] and remove.



1. Bank angle sensor
2. Fuse block and electrical relays
3. Seat latch bracket
4. BAS fasteners

Figure 4-20. Bank Angle Sensor: Lightning (Top), XB12Ss (Bottom)

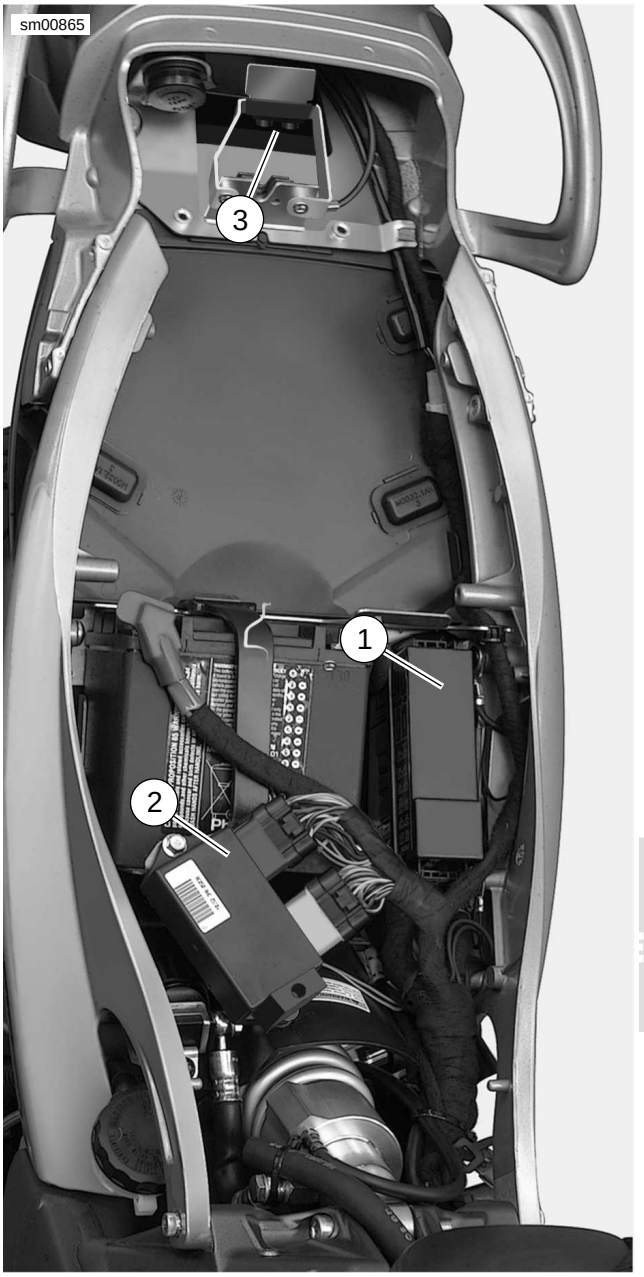
Ulysses

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove fasteners to detach BAS bracket from seat latch bracket.
4. See Figure 4-21. Remove screws and washers to detach sensor from BAS bracket.
5. Unplug bank angle sensor connector [134] and remove.



1. **Fuse block and electrical relays**
2. **Electronic control module**
3. **Bank angle sensor**

Figure 4-21. Bank Angle Sensor: Ulysses

INSTALLATION

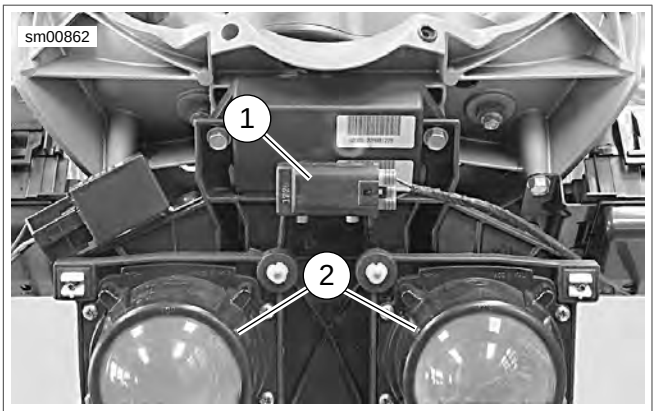
Firebolt

1. Position bank angle sensor on headlight bracket. Make sure locating post on sensor engages hole in mounting tab.
2. Install bank angle sensor to mounting tab with fasteners and new locknuts. Tighten fastener to 12-36 **in-lbs** (1.4-4 Nm).
3. See Figure 4-22. Install bank angle sensor connector [134] (1).
4. Install front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
5. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

6. Install seat.



1. **Bank angle sensor**
2. **Headlights**

Figure 4-22. Bank Angle Sensor: Firebolt

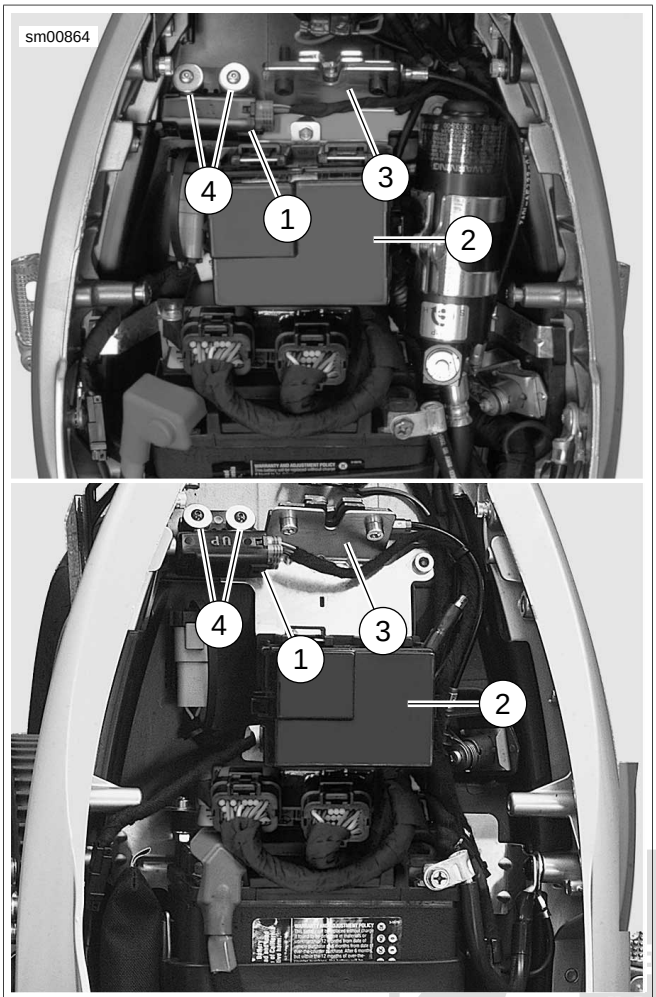
Lightning

1. See Figure 4-23. Install bank angle sensor connector [134].
2. Position bank angle sensor on seat latch bracket. Make sure locating post on sensor engages hole in mounting tab.
3. Install bank angle sensor to mounting tab with fasteners. Tighten fastener to 12-36 **in-lbs** (1.4-4 Nm).
4. Connect negative battery cable and tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

5. Install seat.



1. **Bank angle sensor**
2. **Fuse block and electrical relays**
3. **Seat latch bracket**
4. **BAS fasteners**

Figure 4-23. Bank Angle Sensor: Lightning (Top), XB12Ss (Bottom)

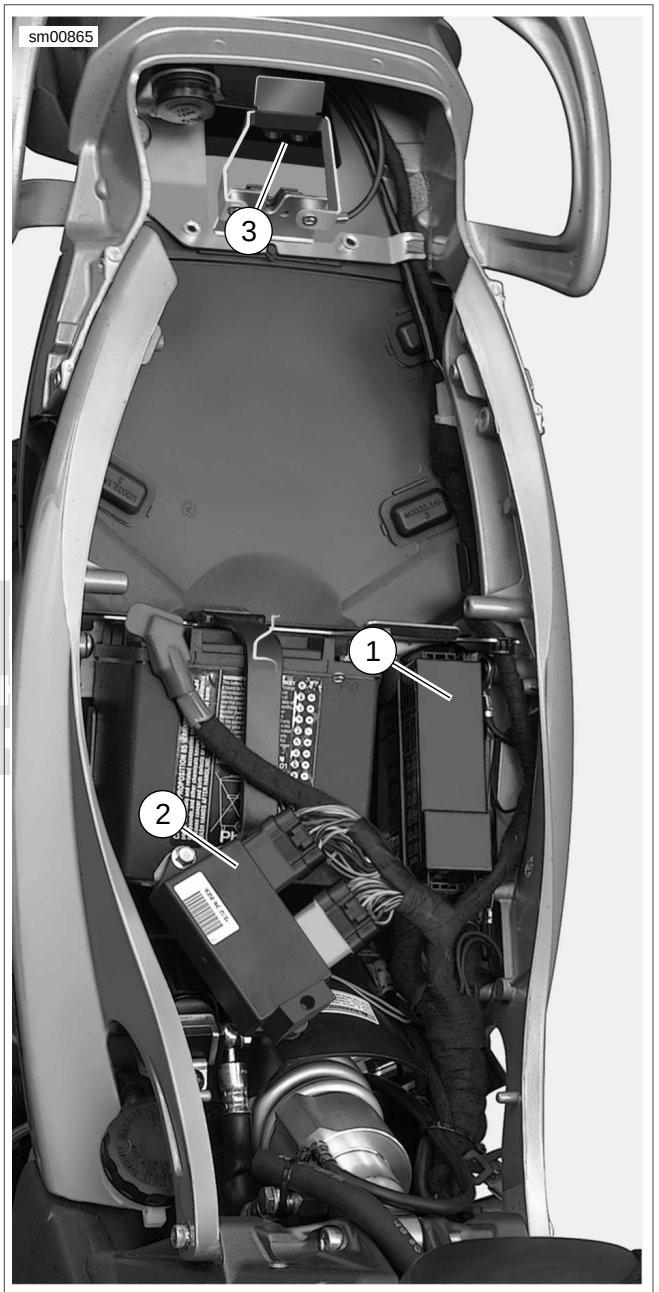
Ulysses

1. See Figure 4-24. Install bank angle sensor to mounting tab with fasteners and tighten to 12-36 **in-lbs** (1.4-4 Nm).
2. Install BAS bracket to seat latch bracket. Tighten fasteners to 60-96 **in-lbs** (7-11 Nm).
3. Install bank angle sensor connector [134].
4. Connect negative battery cable and tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

5. Install seat.



1. **Fuse block and electrical relays**
2. **Electronic control module**
3. **Bank angle sensor**

Figure 4-24. Bank Angle Sensor: Ulysses

INTAKE AIR TEMPERATURE SENSOR (IAT) 4.10

GENERAL

The intake air temperature sensor (IAT Sensor), located on the air cleaner cover baseplate, measures the air temperature allowing the ECM to calculate the density of the air entering the manifold. The IAT is a thermistor type sensor.

REMOVAL

⚠WARNING

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

1. Disconnect negative battery cable.
2. See Figure 4-25. Remove air cleaner cover and filter.
3. Remove fasteners securing base. See 4.3 AIR CLEANER ASSEMBLY.
4. Raise base and pull IAT sensor from sensor grommet.
5. Disconnect connector [89] from intake air temperature sensor.
6. Inspect sensor grommet for damage and replace as required.

INSTALLATION

1. Connect IAT sensor connector [89] to wiring harness.
2. Install IAT sensor into grommet on air cleaner base from beneath.
3. Install air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
4. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

Figure 4-25. Intake Air Temperature Sensor Installed

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

COOLING FAN 4.11

GENERAL

A computer-controlled cooling fan assists engine cooling during operation in high temperatures. Fan actuation is controlled by the ECM. Refer to Table 4-4.

Table 4-4. Cooling Fan Specifications

	FAN ON	FAN OFF
Key ON	455° F (235° C)	383° F (195° C)
Key ON (HDI models)	437° F (225° C)	383° F (195° C)
Key OFF	266° F (130° C)	230° F (110° C)

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove shock absorber. See 2.23 REAR SHOCK ABSORBER.
4. See Figure 4-26. Remove cooling fan fasteners (1).
5. Rotated fan clockwise (looking towards front of vehicle) to remove.
6. See Figure 4-27. Disconnect cooling fan connector [97].

INSTALLATION

1. See Figure 4-27. Connect cooling fan connector [97].

NOTES

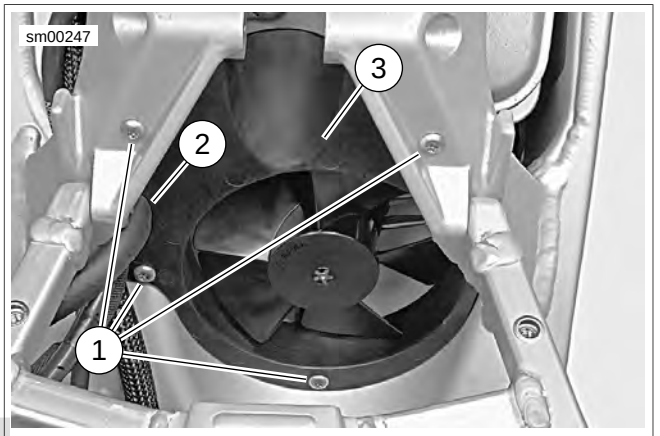
- *See Figure 4-26. When installing cooling fan (3), be sure wiring, transmission vent hose and fuel line are routed through notch (2) in fan body.*
- *On California models, both fuel tank and canister vent hoses are routed through notch in fan body.*

2. Install cooling fan and rotate counter-clockwise into position.
3. Install cooling fan fasteners. Tighten to 12-36 **in-lbs** (1.4-4 Nm).
4. Install shock absorber. See 2.23 REAR SHOCK ABSORBER.
5. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

6. Install seat.



1. **Cooling fan fasteners**
2. **Notch**
3. **Cooling fan**

Figure 4-26. Cooling Fan

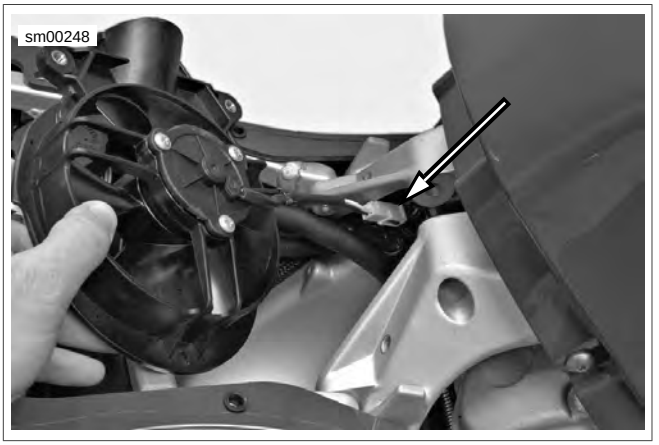


Figure 4-27. Cooling Fan Connector [97]

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FUEL TANK VENT VALVE 4.12

GENERAL

The fuel tank vent valve opens to allow gas vapor to escape the fuel tank and either vent to the atmosphere or to the charcoal canister on California Models (EVAP-equipped) and closes to prevent gasoline from leaking out of the fuel tank if the vehicle is tipped at an extreme angle.

NOTE

The fuel tank must be drained to perform this service.

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove intake cover assembly. See 2.38 INTAKE COVER.
4. Remove air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
5. Drain fuel tank. See 4.14 FUEL PUMP, Draining Fuel Tank.
6. Remove fuel tank vent line from vent valve.
7. See Figure 4-28. Remove fasteners (5).
8. Remove bracket (4), fuel tank vent valve (3) and o-ring (2) from fuel tank/frame (1).

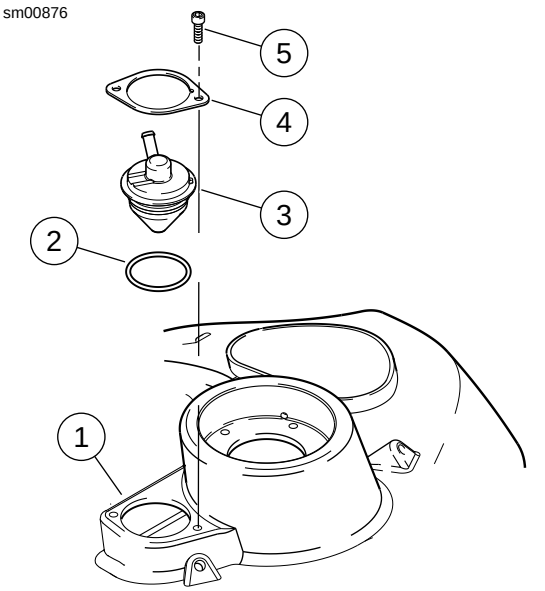
INSTALLATION

1. See Figure 4-28. Install **new** o-ring (2).
2. Install fuel tank vent valve (3) into fuel tank/frame. Vent valve nozzle should be at approximately the 7 o'clock position.
3. Install bracket over vent valve. Slot in bracket should line up with notch in valve.
4. Loosely install fasteners (5).
5. Tighten fasteners to 39-41 **in-lbs** (4.4-4.6 Nm).
6. Connect fuel tank vent line to vent valve.
7. Install air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
8. Install intake cover assembly. See 2.38 INTAKE COVER.
9. Connect negative battery cable. Tighten battery terminal hardware to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

10. Install seat.



1. **Fuel tank/frame**
2. **O-ring**
3. **Fuel tank vent valve**
4. **Bracket**
5. **Fastener (2)**

Figure 4-28. Fuel Tank Vent Valve

FUEL CAP RETAINING RING 4.13

REMOVAL

NOTE

The fuel tank must be drained to perform this service.

1. Drain fuel tank. See 4.14 FUEL PUMP, Draining Fuel Tank.
2. Remove fuel filler cap.
3. See Figure 4-29. Remove fasteners (4) securing fuel cap retaining ring (3) to fuel filler neck (1).
4. Remove fuel cap retaining ring and o-ring (2). Discard o-ring.

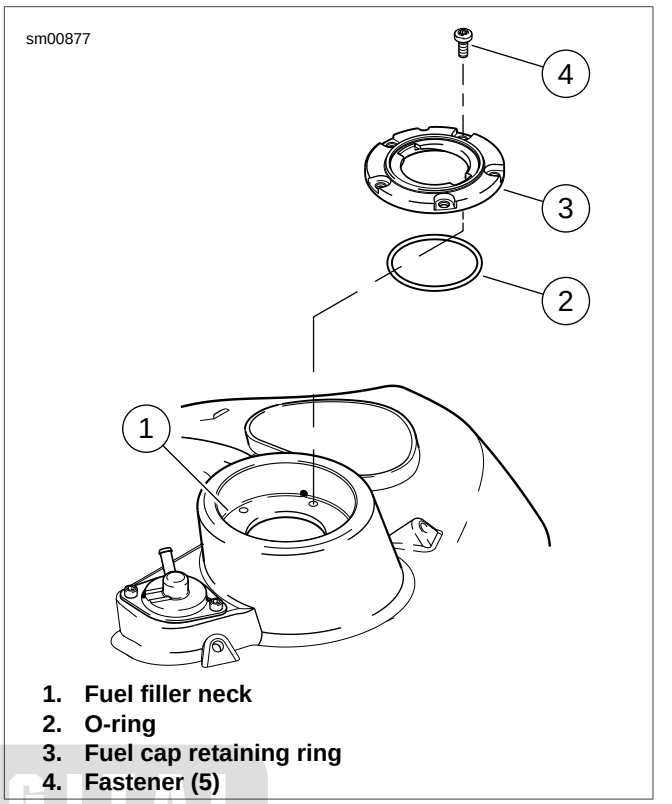
INSTALLATION

1. Coat **new** o-ring (2) with thin film of clean engine oil.
2. Place o-ring into groove in underside of fuel cap retaining ring (3).

NOTE

Be sure o-ring remains in groove of fuel cap retaining ring during installation.

3. Insert fuel cap retaining ring into fuel filler neck.
4. Install fasteners (4). Tighten to 62-71 **in-lbs** (7-8 Nm).
5. Install fuel filler cap.



1. **Fuel filler neck**
2. **O-ring**
3. **Fuel cap retaining ring**
4. **Fastener (5)**

Figure 4-29. Fuel Cap Retaining Ring

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FUEL PUMP 4.14

DRAINING FUEL TANK

WARNING

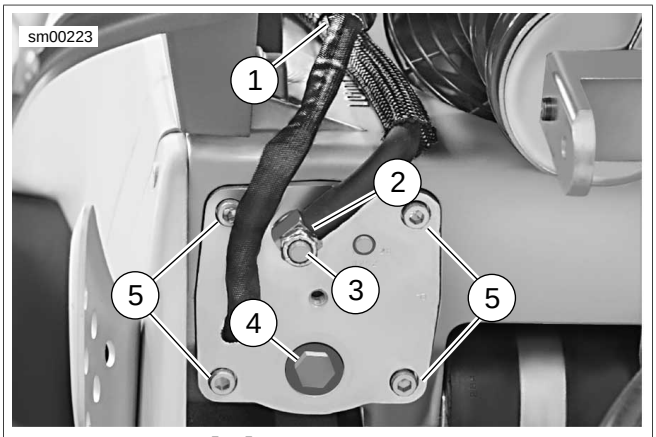
To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-30. Disconnect the 4-place fuel pump connector [86] (1). Connector is located inside the left rear portion of the fuel tank/frame.
   b. With the motorcycle in neutral, start the engine and allow vehicle to run.
   c. When the engine stalls, press the starter button for 3 seconds to remove any remaining fuel from fuel line.

WARNING

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

2. Remove drain plug (4) and drain fuel into appropriate container. Discard plug.
3. When fuel tank is empty, replace with **new** drain plug. Tighten to 84-108 **in-lbs** (9.5-12 Nm).



1. **Connector [86]**
2. **Fuel supply fitting**
3. **Fuel supply stud**
4. **Drain plug**
5. **Fasteners**

Figure 4-30. Fuel Pump Location

REMOVAL

NOTES

- *Before vehicle is placed on the lift it will necessary to remove the chin fairing. See 2.50 CHIN FAIRING.*
- *Vehicle should be placed onto the lift with the front tire placed in the wheel vise in order to successfully perform this procedure.*
- *Place a scissor jack under jacking point and raise until vehicle weight is removed from rear wheel.*

1. Remove seat. See 2.51 SEAT.
2. Drain fuel tank. See 4.14 FUEL PUMP, Draining Fuel Tank.

WARNING

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

3. Disconnect negative battery cable.
4. Remove rider footpeg mounts. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING and 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.

NOTE

Secure right side rider footrest mount to the side of vehicle to prevent cosmetic damage.

5. Remove idler pulley.
   a. Loosen rear axle pinch fastener.
   b. Unthread axle approximately 15 rotations to release tension from drive belt.
   c. Remove front sprocket cover. See 2.36 SPROCKET COVER.
   d. Remove lower belt guard. See 2.37 BELT GUARDS.
   e. Remove idler pulley bracket nuts and washers from studs and slide idler pulley bracket off studs.

NOTE

It is not necessary to remove the belt from the sprockets to perform this procedure.

6. Remove lower shock absorber fastener. Remove the nut and washer from the lower shock fastener and raise scissor jack until the lower fastener can be removed by hand. See 2.23 REAR SHOCK ABSORBER.

NOTE

Cover the muffler with a clean towel to prevent cosmetic damage from contact with the swingarm.

7. Loosen swingarm pivot shaft pinch fastener.
8. Remove pivot shaft with a special 7/8 in. hex tool located in tool kit.

⚠WARNING

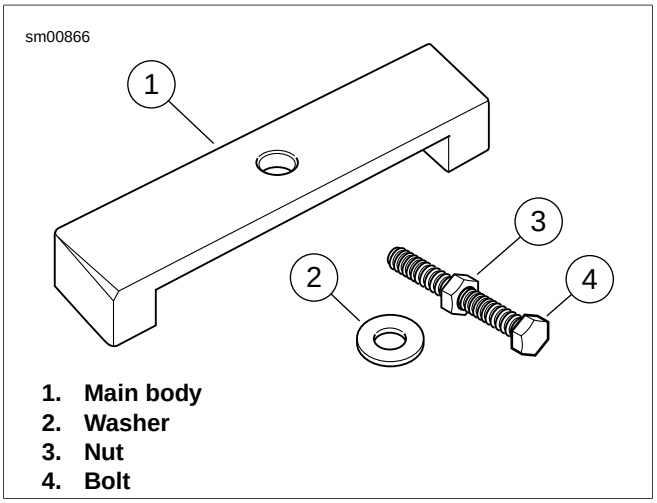
With fuel tank drained, gasoline can spill from bore when supply valve is loosened or removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00277a)

9. See Figure 4-38. Remove fuel supply line banjo fitting (2) from fuel supply stud (3).
10. Remove four fuel pump fasteners.
11. See Figure 4-31. Assemble fuel pump puller.
    a. Slide washer onto bolt.
    b. Thread bolt assembly into hole in main body (1).
12. See Figure 4-32. Place the main body of the fuel pump puller over the fuel pump assembly.
13. Thread bolt into the threaded hole in the center of the fuel pump assembly until snug.
14. Thread the nut down the shaft of the bolt until it makes contact with the main body of the fuel pump puller.
15. Place wrench onto nut and another wrench onto the bolt. Hold the bolt stationary and turn nut clockwise until fuel pump is pulled free from frame.
16. Remove tool from fuel pump.

NOTE

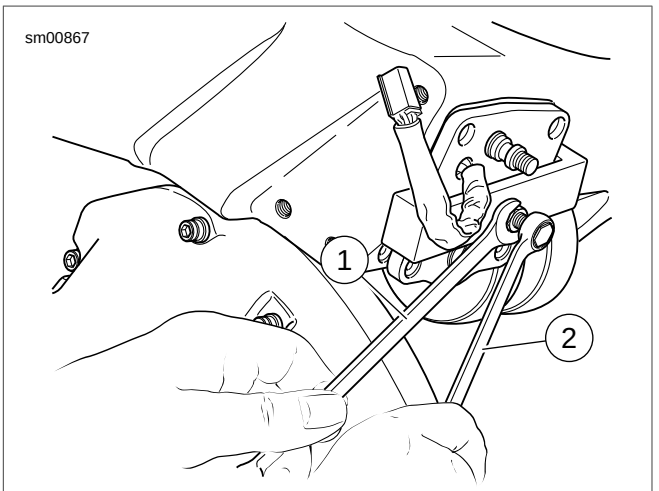
When pivoting the swingarm/rear wheel assembly it is necessary to note the location of the oil lines. Excessive movement may damage the oil lines.

17. Raise the scissor jack until the lower shock clevis clears the swingarm mount. Pivot the swingarm/rear wheel to gain adequate clearance and remove fuel pump.



1. **Main body**
2. **Washer**
3. **Nut**
4. **Bolt**

Figure 4-31. Fuel Pump Puller



1. **Turn clockwise**
2. **Hold stationary**

Figure 4-32. Fuel Pump Removal

REPAIR

Fuel Pressure Regulator Replacement

1. Remove fuel pump assembly from tank. See 4.14 FUEL PUMP, Removal.
2. See Figure 4-33. Remove the plastic retaining ring (1) securing the fuel pressure regulator (3) in place.
3. Remove and discard o-rings from regulator.
4. Install **new** o-rings on **new** regulator. Press **new** regulator into place.
5. Install plastic retaining ring (1).
6. Install fuel pump assembly. See 4.14 FUEL PUMP, Installation .

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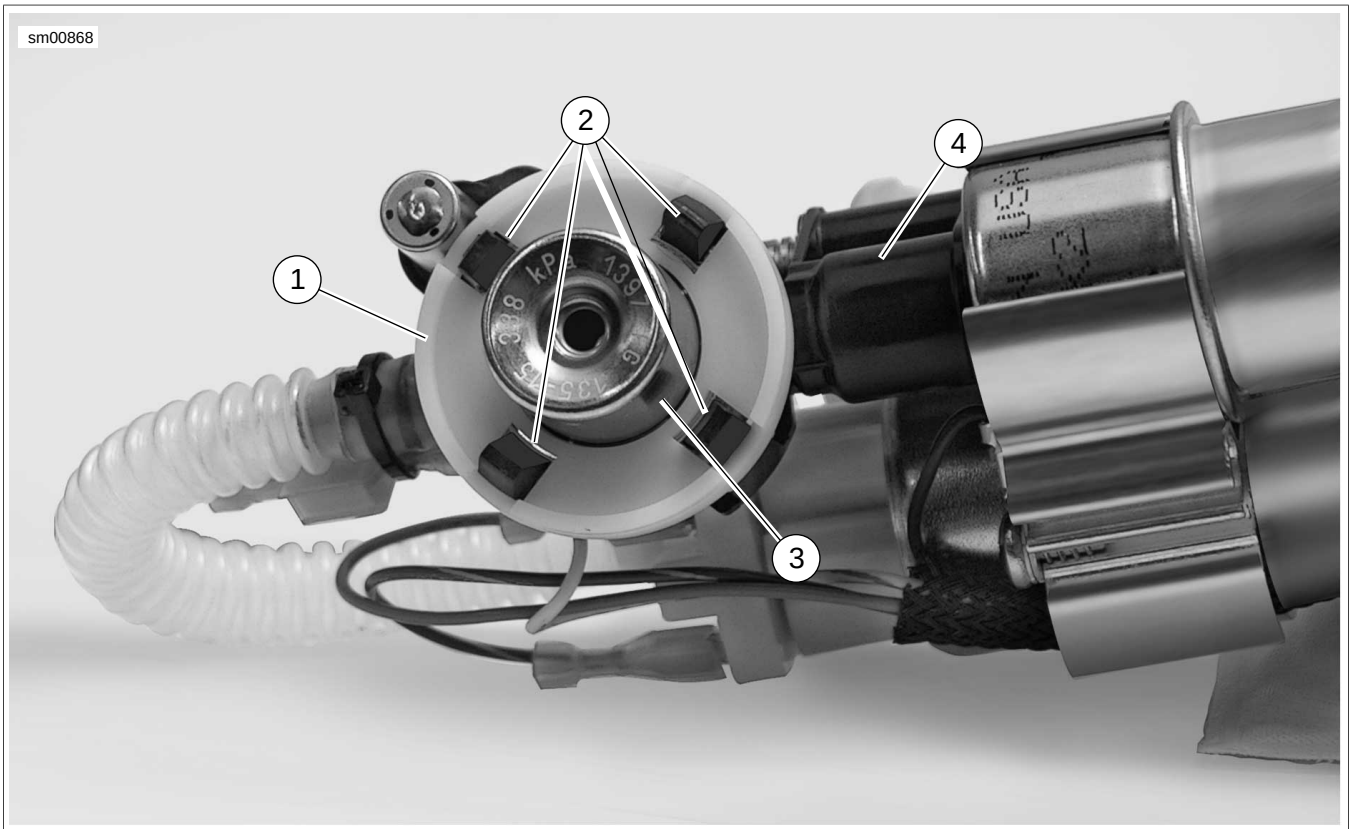
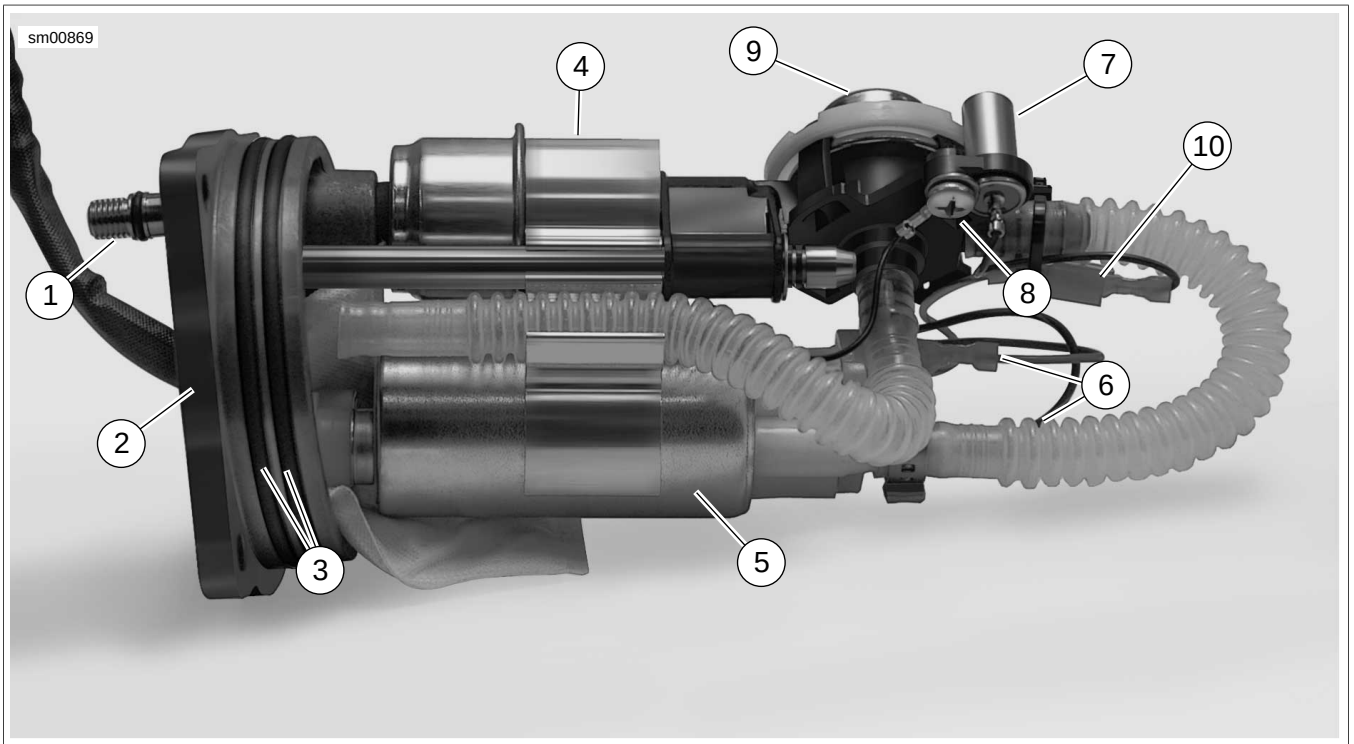


1. **Plastic retaining ring**
2. **Plastic retainers**
3. **Fuel pressure regulator**
4. **Fuel pressure regulator housing**

Figure 4-33. Fuel Pressure Regulator

Low Fuel Level Sensor Replacement

1. Remove fuel pump assembly from tank. See 4.14 FUEL PUMP, Removal.
2. See Figure 4-34. Disconnect low fuel level sensor connector (10).
3. Remove screw (8) securing low fuel level sensor (7) in place.
4. Install **new** sensor.
5. Install screw (8) securing sensor and tighten to 18-22 **in-lbs** (2.0-2.5 Nm).
6. Attach low fuel level sensor wire connector (10).
7. Install fuel pump assembly. See 4.14 FUEL PUMP, Installation.



1. **Fuel supply stud**
2. **Fuel pump housing**
3. **O-rings**
4. **Fuel filter**
5. **Fuel pump**
6. **Fuel pump connectors**
7. **Low fuel level sensor**
8. **Fastener**
9. **Fuel pressure regulator**
10. **Low fuel level sensor connector**

Figure 4-34. Fuel Pump Assembly

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Fuel Filter Replacement

1. Remove fuel pump assembly from tank. See 4.14 FUEL PUMP, Removal.
2. See Figure 4-35. Disconnect electrical connectors (5, 6).
3. Remove ground fastener (12) from the fuel pump and fuel filter bracket (9).
4. Remove fuel pressure regulator E-clip (7).
5. Pull regulator housing (3) and fuel pump (8) with bracket (9).
6. Remove fuel filter (2).

NOTE

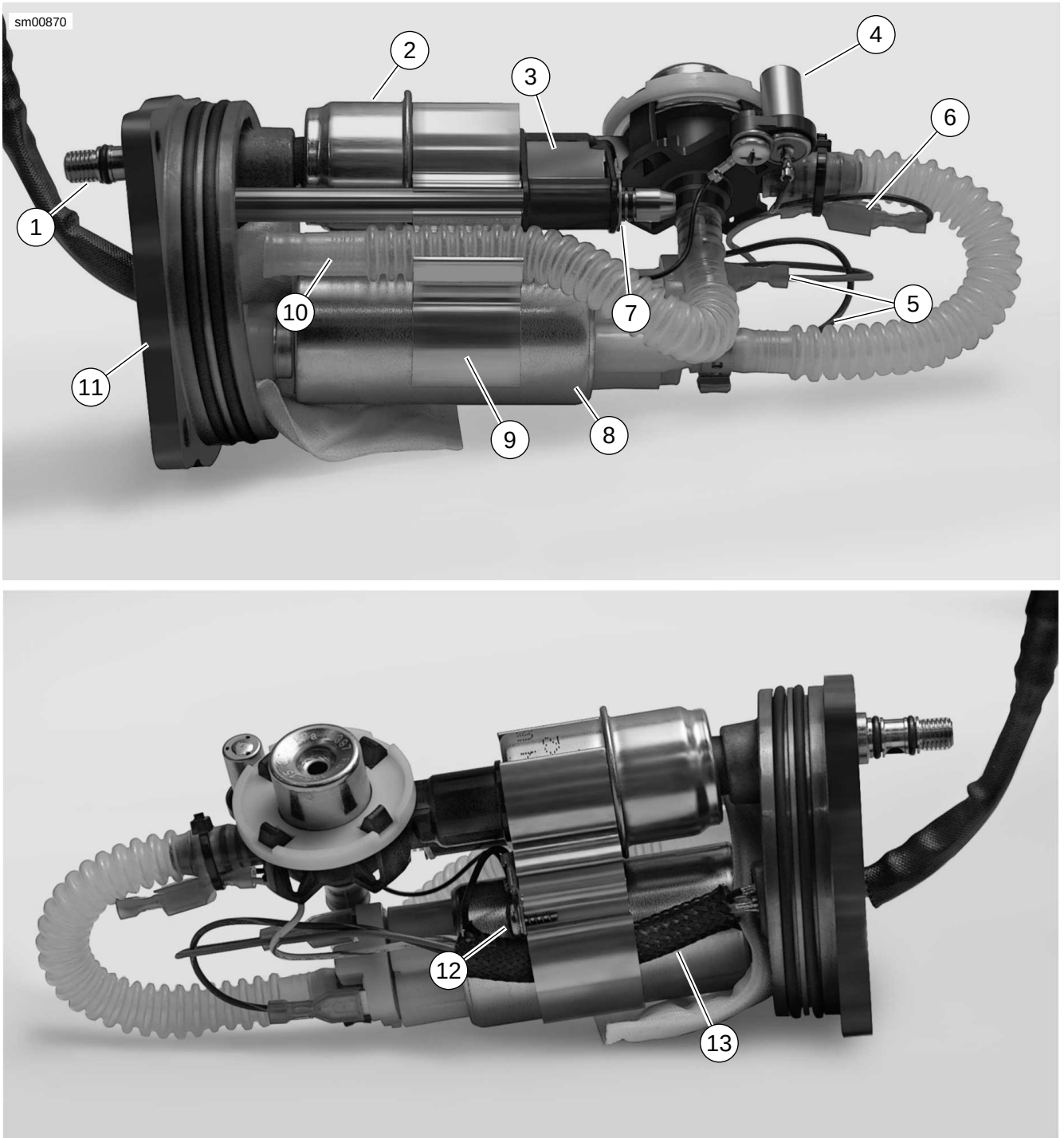
Remove the rubber seals from each end of the original fuel filter to be used on the new fuel filter.

7. Install rubber seals on new fuel filter and install filter into pump housing (11).
8. See Figure 4-35. Install regulator housing (3) and fuel pump (8) assembly.
9. Install E-clip (7) in bottom groove on shaft.
10. Install ground fastener (12) and connect ground wires to bracket (9) and tighten to 18-22 **in-lbs** (2.0-2.5 Nm).
11. Connect electrical connectors (5, 6).

NOTE

Fuel pump connectors are two different sizes to prevent incorrect installation.

12. Route overflow hose (10) through guide in bracket (9).
13. Install fuel pump assembly. See 4.14 FUEL PUMP, Installation.



1. **Fuel supply stud**
2. **Fuel filter**
3. **Pressure regulator housing**
4. **Low fuel level sensor**
5. **Fuel pump connectors**
6. **Low fuel level sensor connector**
7. **Pressure regulator E-clip (1)**
8. **Fuel pump**
9. **Bracket, fuel pump and fuel filter**
10. **Overflow hose**
11. **Fuel pump housing**
12. **Ground fastener**
13. **Protective sleeve**

Figure 4-35. Fuel Pump Assembly (Left and Right Sides)

Table 4-5. Fuel Pump Specifications

SPECIFICATION	DATA
Pressure Setting	49 PSI (338 kPa)
Operating Voltage	13.2 volts
Min. Fuel Delivery	60 LPH @ 45 PSI (310 kPa)
Current Draw	6.0 amps

Fuel Pump Wire Harness Replacement

1. Remove fuel pump assembly from tank. See 4.14 FUEL PUMP, Removal.
2. See Figure 4-35. Disconnect fuel pump connectors (5) and low fuel level sensor connector (6).
3. See Figure 4-36. Remove terminals from fuel pump connector [86].
4. See Figure 4-35. Remove ground fastener (12).

NOTE

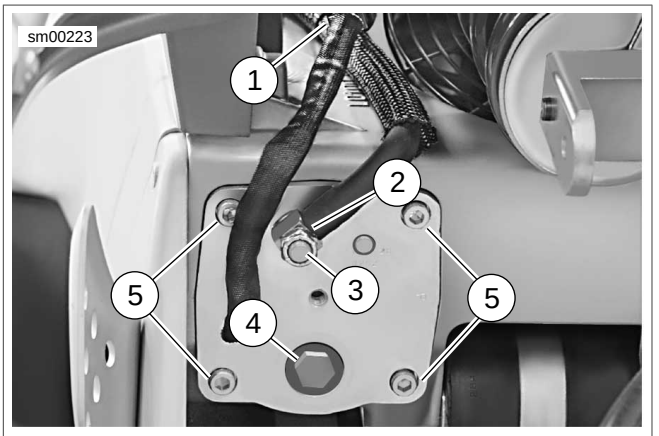
Note positions of wires in connector for correct assembly.

5. Remove fuel pump connector [86].
6. See Figure 4-37. From outer side of fuel pump assembly, push wire harness through assembly.
7. Lubricate **new** o-rings with **clean** engine oil. From inner side of fuel pump assembly, push new wire harness into assembly.
8. See Figure 4-35. Insert **new** ground fastener (12), through ground wire terminal and secure to bracket (9). Tighten to 18-22 **in-lbs** (2.0-2.5 Nm).

NOTE

After installing terminals, pull slightly on wire to make sure it is seated. If necessary, bend tab on terminal to aid in seating wire.

9. Install terminals into proper locations of fuel pump connector [86]. Install connector clips.
10. See Figure 4-35. Connect low fuel level sensor connector (6).
11. Connect fuel pump connectors (5). Connectors are two different sizes.
12. Install fuel pump assembly. See 4.14 FUEL PUMP, Installation.



1. **Connector [86]**
2. **Fuel supply fitting**
3. **Fuel supply stud**
4. **Drain plug**
5. **Fasteners**

Figure 4-36. Fuel Pump Installation

Figure 4-37. Wire Harness Removal Direction

INSTALLATION

1. Replace o-rings. Lubricate **new** o-rings with **clean** engine oil.
2. Insert fuel pump into frame until resistance is felt.
3. See Figure 4-38. Insert four screws (5) through fuel pump and into frame.

NOTE

Use all four screws to draw fuel pump into frame. Using less than four screws will damage fuel pump o-rings.

4. Using crosswise pattern, draw fuel pump into frame by tightening screws. Final tighten screws to 48-51 **in-lbs** (5.4-5.8 Nm).

⚠WARNING

Do not over-tighten fuel fitting nuts. Over-tightening can result in fuel leakage. Gasoline is extremely flammable and highly explosive which could result in death or serious injury. (00519b)

5. Install **new** o-rings on fuel supply stud (2). Larger o-ring is located in groove closer to fuel pump.

NOTE

Install fuel line onto fitting on fuel pump so that the fuel line is at approximately the one o-clock position. verify that the sheathing on the fuel line comes down to the bend as shown.

6. Install fuel supply line banjo fitting (2) over fuel supply stud (3). Install **new** fastener. Tighten to 84-108 **in-lbs** (9.5-12 Nm).
7. Fill tank with a small amount of fuel. Check for leaks.
8. Connect fuel pump connector [86] (1) and push cable strap tab into hole in frame.
9. Install swingarm onto vehicle.
   a. Align swingarm in pivot of engine crankcase.
   b. Install pivot shaft with a special 7/8 in. hex tool located in tool kit, apply ANTI-SEIZE and tighten to 44-46 ft-lbs (60-62 Nm).
   c. Apply LOCTITE 271 (red), install and tighten pivot shaft pinch fastener to 17-19 ft-lbs (23-26 Nm).
10. Install lower shock absorber mounting fastener and spacer from shock absorber and swingarm and tighten to 15-17 ft-lbs (20.3-23 Nm).
11. Install the idler pulley assembly tightening washers and nuts to 33-35 ft-lbs (45-47 Nm).
12. Tighten rear axle to 23-27 ft-lbs (31.2-36.6 Nm), back off two full turns and then retighten to 48-52 ft-lbs (65-70.5 Nm).
13. Tighten rear axle pinch fastener to 40-45 ft-lbs (54-61 Nm).
14. Install front sprocket cover. See 2.36 SPROCKET COVER.
15. Install chin fairing after vehicle has been removed from the lift. See 2.50 CHIN FAIRING.
16. Install lower belt guard. See 2.37 BELT GUARDS.
17. Install rider footpeg mounts. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING and 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.

⚠WARNING

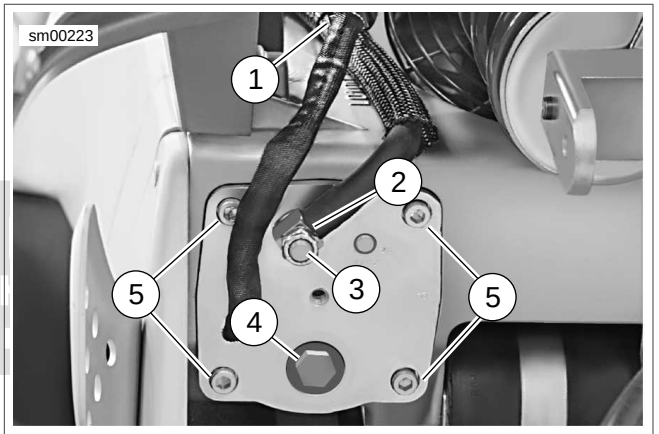
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

18. Connect negative battery cable. Tighten fastener 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

19. Install seat.
20. Remove scissor jack from motorcycle.



1. **Connector [86]**
2. **Fuel supply fitting**
3. **Fuel supply stud**
4. **Drain plug**
5. **Fasteners**

Figure 4-38. Fuel Pump Installation

THROTTLE BODY 4.15

GENERAL

The throttle body consists of the following components:

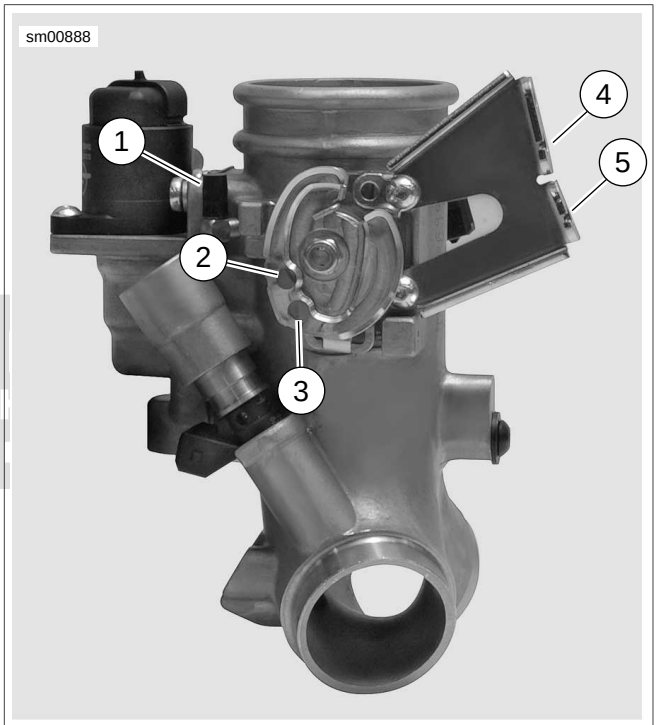
- Fuel supply fitting
- IAC sensor
- Fuel injectors
- Cable bracket
- Throttle position sensor
- Throttle lever

REMOVAL

⚠WARNING

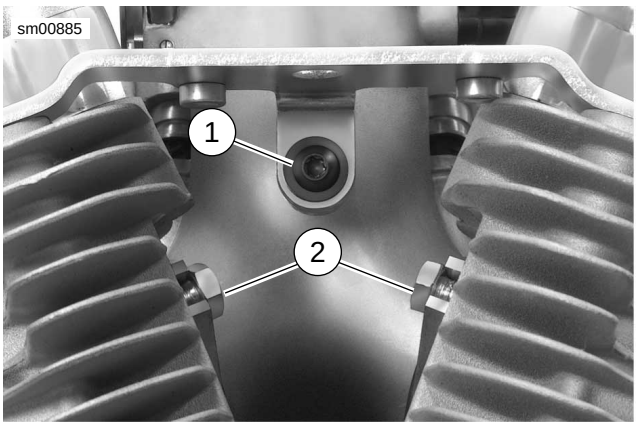
To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-38. Disconnect the 4-place fuel pump connector [86]. Connector is located on the left side, above the fuel pump.
   b. With the motorcycle in neutral, start the engine and allow vehicle to run.
   c. When the engine stalls, press the starter button for 3 seconds to remove any remaining fuel from fuel line.
   d. Reconnect fuel pump connector.
2. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
3. Label and detach throttle cables. See 2.24 THROTTLE CONTROL.
4. Remove coil wire retaining clip attached to throttle cable bracket.
5. See Figure 4-39. On California models, pull EVAP hose from fitting (1).
6. Remove left and right air scoops. See 2.49 AIR SCOOPS.
7. Remove ignition coil. See 4.6 IGNITION COIL.
8. See Figure 4-41. Remove fuel line from fuel rail (14).
9. Disconnect:
   a. TPS connector [88] (21).
   b. Fuel injector connectors [84] [85] (12).
   c. IAC connector [87] (18).
10. Remove assembly from motorcycle.
    a. See Figure 4-40. On primary side, loosen but do not remove the two front and rear intake flange fasteners (2).
    b. Remove fastener (1) holding manifold to cylinder brace.
    c. See Figure 4-41. On gearcase cover side, remove both intake flange fasteners (3) from cylinder heads.
    d. Slide the throttle body assembly through top of motorcycle frame.
11. See Figure 4-40. Remove intake flanges (2) from manifold. Remove and discard seals (1).



1. **EVAP hose fitting**
2. **Throttle control cable attachment**
3. **Idle control cable attachment**
4. **Throttle control cable slot**
5. **Idle control cable slot**

Figure 4-39. Throttle Cable Bracket



1. Manifold to cylinder brace fastener
2. Intake flange fastener (2)

Figure 4-40. Intake Manifold (Primary Side)

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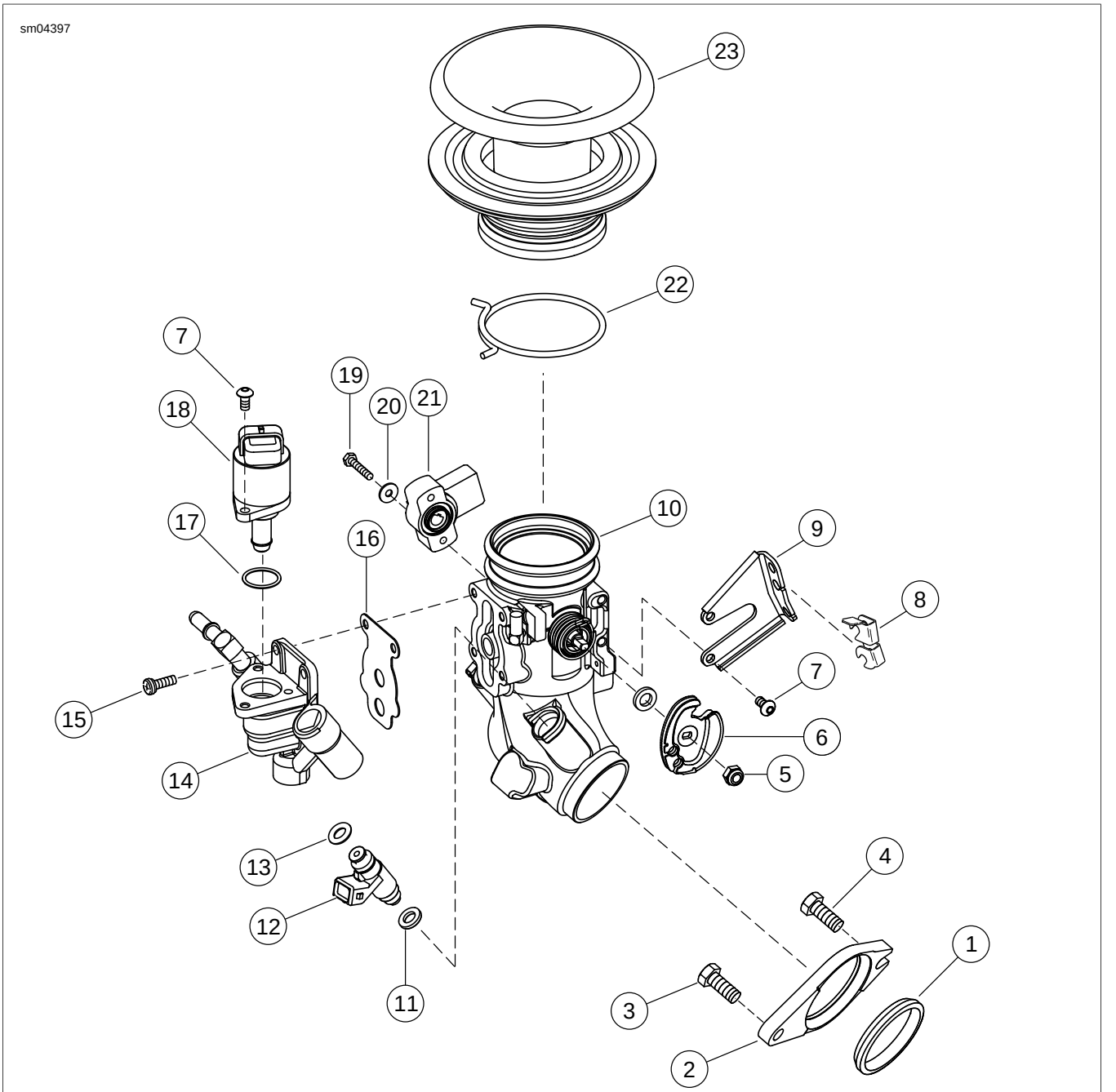


1. Seal, intake manifold (2)
2. Mounting flange, intake (2)
3. Bolt (2)
4. Bolt (2)
5. Nylock nut
6. Cable wheel
7. Screw (4)
8. Throttle cable retention clip
9. Cable bracket
10. Throttle body manifold assembly (45mm-984) (49mm-1203)
11. O-ring, fuel injector, outlet
12. Fuel injector, (1 front, 1 rear)
13. O-ring, fuel injector, inlet
14. Fuel rail
15. Screw (4)
16. Gasket, idle air control
17. O-ring, idle air control
18. Actuator, idle air control
19. Screw (2)
20. Washer, flat (2)
21. Throttle position sensor
22. Clamp, wire spring
23. Velocity stack

Figure 4-41. One Piece Throttle Body/Intake Manifold Assembly

REPAIR

Throttle Position Sensor

See 4.5 THROTTLE POSITION SENSOR (TPS) for removal, installation and calibration information.

Fuel Injectors

1. Remove throttle body. See 4.15 THROTTLE BODY, Removal in this section.
2. See Figure 4-41. Separate fuel rail assembly from throttle body.
   a. Remove IAC fasteners (7) and remove IAC (18).
   b. Remove fuel rail fastener (15) that holds the fuel rail to the throttle body and manifold.
   c. Separate fuel rail (14) from injectors (12) by gently rocking the fuel rail and pulling it away from the injectors.
3. Remove fuel injectors (12) from manifold by gently rocking and pulling it away from the manifold.

⚠WARNING

Injectors with damaged o-rings can leak fuel. Gasoline is extremely flammable and highly explosive which could result in death or serious injury. (00520b)

4. Inspect injector o-rings (11, 13) for cuts, tears or general deterioration. Replace injector o-rings if they have been damaged or have taken a definite set.

NOTE

Front and rear fuel injectors are not interchangeable.

5. See Figure 4-41. Coat **new** o-rings with thin film of clean engine oil and install both fuel injectors (12) into the throttle body.
6. Using a **new** idle air control gasket (16), press the fuel rail assembly (14) onto the top of the injectors.
7. Apply LOCTITE 272 (red) to the fasteners (15) for the fuel rail assembly.
8. While holding the fuel rail assembly against the throttle body (10), install the fasteners and tighten to 24-28 **in-lbs** (2.8-3.2 Nm).
9. Coat **new** o-ring (17) with thin film of clean engine oil and install on IAC actuator (18).
10. Place the actuator (18) onto the fuel rail assembly (14).
11. Install fasteners (7) and tighten to 25-30 **in-lbs** (2.9-3.5 Nm).

INSTALLATION

NOTES

- *The intake flanges have been extended to improve clamp load distribution.*
- *Intake flanges are interchangeable.*

1. See Figure 4-41. Install flanges onto throttle body with the counterbore (2) facing out.
2. Place a **new** seal in each intake flange with the beveled side against the counterbore.
3. Install throttle body/intake manifold assembly.
   a. See Figure 4-43. Slide the assembly toward the installed position. Manifold should engage fasteners (2) on primary cover side of engine.
   b. Align holes in opposite side or intake flanges with those in cylinder heads and start screws.
   c. Make sure throttle body is centered between cylinders and tighten all intake flange screws to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Install manifold to cylinder brace fastener (1) and tighten to 90-120 **in-lbs** (10-13.6 Nm).
5. Attach throttle cables. See 2.24 THROTTLE CONTROL.
6. Attach wiring.
   a. Injector cables are tagged (Front) and (Rear) for ease of assembly. Push connector halves together until latches click.
   b. Connect throttle position sensor connector.
   c. Connect IAC connector.
7. See Figure 4-40. Connect fuel line and EVAP hose to port at bottom of throttle body (California models only).
8. Calibrate throttle position sensor if replaced. See 4.5 THROTTLE POSITION SENSOR (TPS).
9. Install coil. See 4.6 IGNITION COIL.
10. Check throttle cable adjustment. See 2.24 THROTTLE CONTROL.

NOTE

When installing the left side air scoop, it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

11. Install air scoops. See 2.49 AIR SCOOPS.

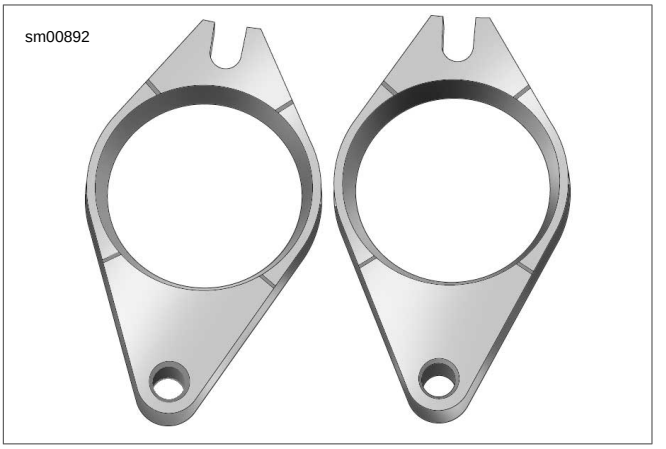
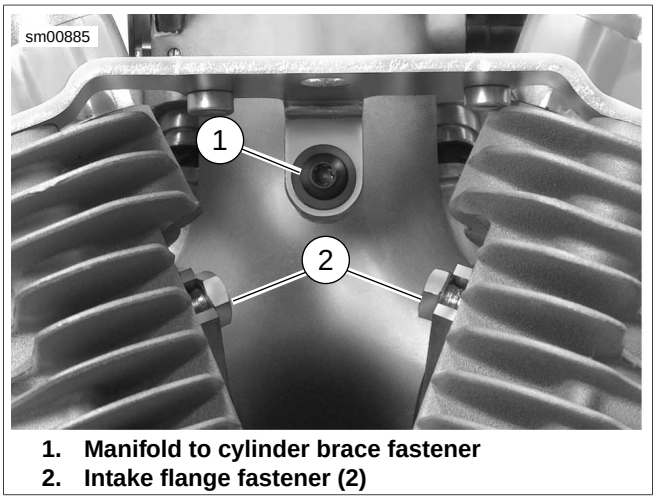
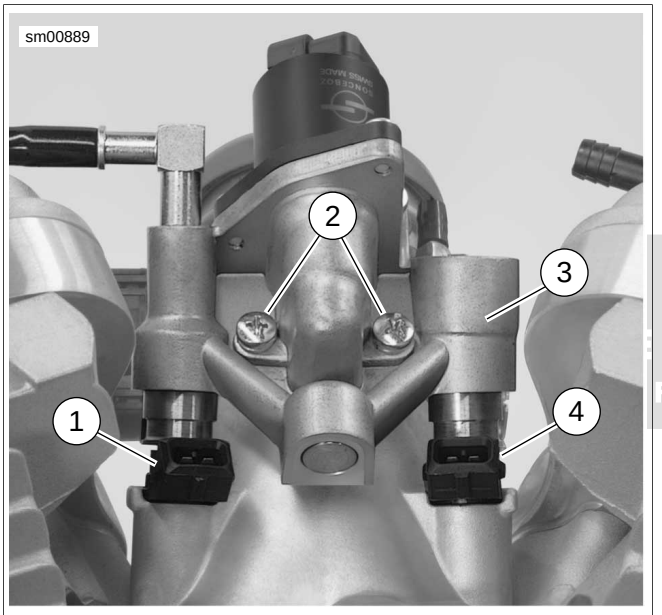


Figure 4-42. Extended Intake Flanges



1. **Manifold to cylinder brace fastener**
2. **Intake flange fastener (2)**

Figure 4-43. Intake Manifold (Primary Side)



1. **Rear fuel injector**
2. **Fuel rail fasteners (4)**
3. **Fuel rail assembly**
4. **Front fuel injector**

Figure 4-44. Fuel Injectors

Injector Leak Testing

1. Remove intake cover assembly. See 2.38 INTAKE COVER.
2. Remove air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
3. Conduct test.
   a. Turn key ON for two seconds.
   b. Turn key OFF for two seconds.
   c. Repeat Steps A and B five consecutive times.
   d. Open throttle and look for raw fuel in manifold. Replace fuel injectors if there is any evidence of raw fuel in throttle body manifold.
4. Install air cleaner cover. See 4.3 AIR CLEANER ASSEMBLY.
5. Install intake cover assembly. See 2.38 INTAKE COVER.

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FUEL PRESSURE TEST 4.16

INSPECTION

PART NUMBER	TOOL NAME
B-45522	FUEL PRESSURE GAUGE ADAPTER
HD-41182	FUEL PRESSURE GAUGE

⚠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. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-45. Disconnect the 4-place fuel pump connector [86]. The connector is located inside the left rear portion of the fuel tank/frame.
   b. With the motorcycle in neutral, start the engine and allow vehicle to run.
   c. When the engine stalls, press the starter button for 3 seconds to remove any remaining fuel from fuel line.

⚠WARNING

With fuel tank drained, gasoline can spill from bore when supply valve is loosened or removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00277a)

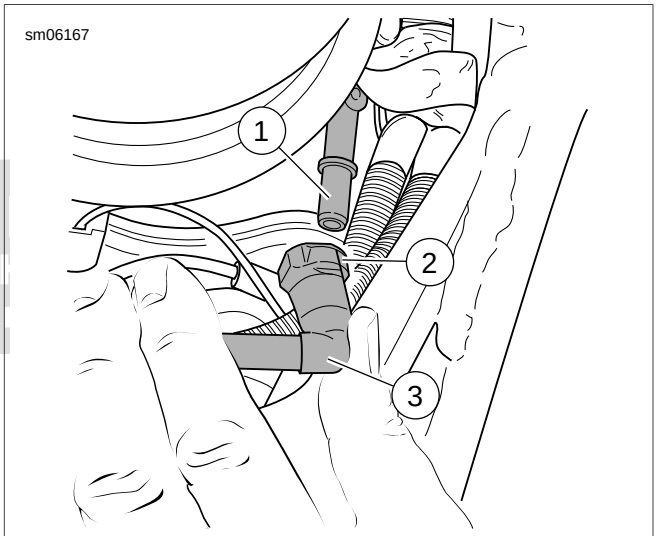
3. See Figure 4-46. Press button (2) of fuel line connector and disconnect the fuel line (3) from throttle body inlet (1).
4. See Figure 4-47. Attach FUEL PRESSURE GAUGE ADAPTER (Part No. B-45522) (2) to throttle body inlet (1).
5. Connect the fuel line (3) to fuel pressure gauge adapter.

NOTE

See Figure 4-48. Verify that fuel valve (2) and air bleed petcock (5) on the gauge are closed.

6. Attach FUEL PRESSURE GAUGE (Part No. HD-41182) (4) to fuel pressure gauge adapter (1).

Figure 4-45. Fuel Pump Connector [86] (Swingarm removed for illustration)



1. **Throttle body inlet**
2. **Button**
3. **Fuel line**

Figure 4-46. Fuel Line

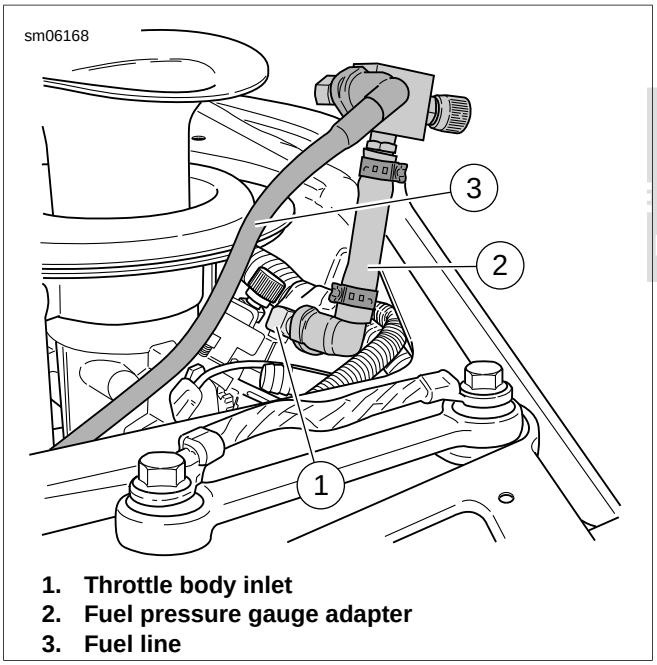
7. See Figure 4-45. Attach fuel pump connector [86] to main wiring harness.
8. See Figure 4-48. Pressurize the fuel system.
   a. Start and idle engine to pressurize the fuel system.
   b. Open fuel valve (2) on fuel pressure gauge to allow fuel to flow down the gauge hose.
   c. Position the air bleed tube (3) into proper container.
   d. Open and close the air bleed petcock (5) to purge the fuel pressure gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube.
   e. Close the air bleed petcock.

9. Open throttle and increase engine speed to 2500-3000 RPM. Note the reading on the pressure gauge.
   a. If pressure is 49-51 PSI (338-352 kPa) then system is operating within limits.
   b. If pressure is not within limits, see Electrical Diagnostic Manual.

⚠WARNING

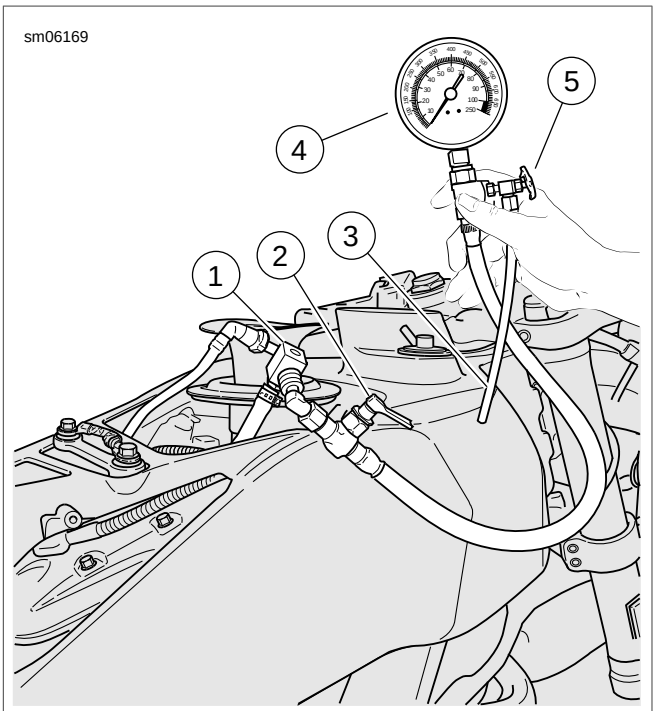
With fuel tank drained, gasoline can spill from bore when supply valve is loosened or removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00277a)

10. See Figure 4-48. Turn engine off. Detach pressure gauge (4) from adapter (1).
    a. Open the air bleed petcock (5) to relieve fuel system pressure and purge the pressure gauge of gasoline.
    b. Remove pressure gauge from adapter.
11. Detach adapter from vehicle.
12. Connect fuel line to throttle body inlet.



1. **Throttle body inlet**
2. **Fuel pressure gauge adapter**
3. **Fuel line**

Figure 4-47. Fuel Pressure Gauge Adapter



1. **Fuel pressure gauge adapter**
2. **Fuel valve (closed position)**
3. **Air bleed tube**
4. **Fuel pressure gauge**
5. **Air bleed petcock**

Figure 4-48. Fuel Pressure Gauge

INTAKE LEAK TEST 4.17

GENERAL

⚠WARNING

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

⚠WARNING

Read and follow warnings and directions on propane bottle. Failure to follow warnings and directions can result in death or serious injury. (00471b)

NOTES

- *To prevent false readings, keep air cleaner cover installed when performing test.*
- *Do not direct propane into air cleaner; false readings will result.*

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

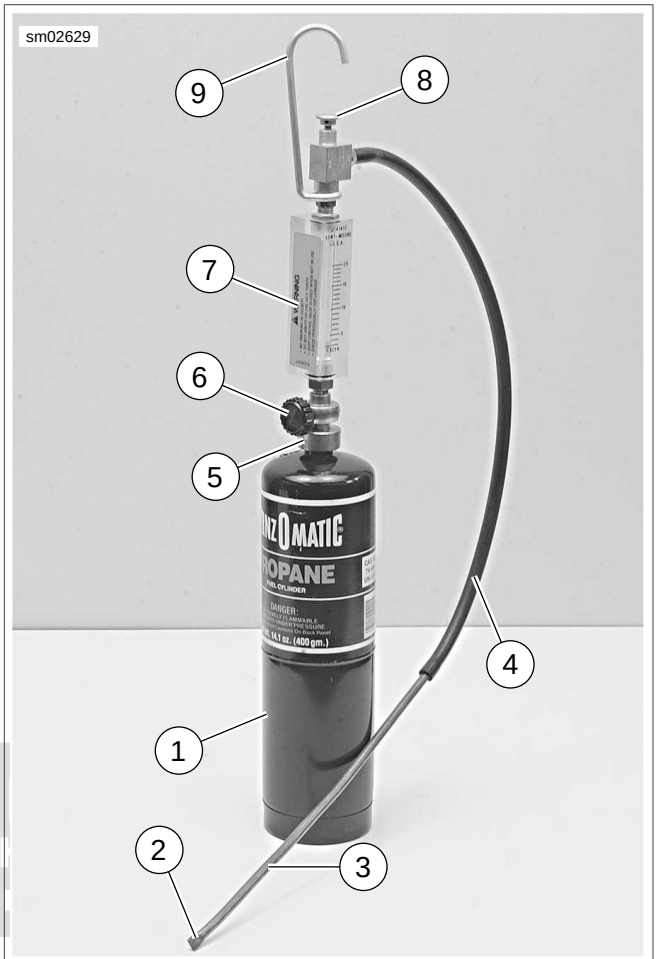
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

Tester Assembly

1. See Figure 4-49. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 4-49. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises to between 5 and 10 SCFH on gauge.
3. Release trigger button.



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

Figure 4-49. Leak Tester

PROCEDURE

1. Start engine.
2. Warm up engine to operating temperature.

NOTE

Do not direct propane stream toward air cleaner. If propane enters air cleaner, a false reading will be obtained.

3. See Figure 4-50. Aim nozzle toward possible sources of leak such as intake manifold mating surfaces.
4. See Figure 4-49. Press and release trigger button (8) to dispense propane. Tone of engine will change when propane enters source of leak. Repeat as necessary to detect leak.

5. When test is finished, close valve knob (turn knob fully clockwise).

Figure 4-50. Checking for Intake Leak

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EXHAUST SYSTEM 4.18

REMOVAL AND DISASSEMBLY

NOTE

For details on removal of components on XB12 models with interactive exhaust systems, see 6.17 INTERACTIVE EXHAUST SYSTEM, Removal.

Muffler

1. Remove chin fairing. See 2.50 CHIN FAIRING.
2. Remove front sprocket cover. See 2.36 SPROCKET COVER.
3. Remove idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Removal.
4. See Figure 4-51. Loosen front muffler mount fastener (8) but do not remove.
5. Remove front and rear muffler straps.
   a. **Front:** Remove front muffler strap fastener (6).
   b. **Rear:** Alternately loosen rear muffler strap fasteners (1) and remove rear muffler straps (2).
6. See Figure 4-52. Loosen Torca clamp (1) and lower muffler.
7. On XB12 models remove interactive exhaust cable from muffler.

NOTE

The muffler may be removed for replacement without removing the exhaust header.

8. Remove muffler.

Front Muffler Mount

1. Remove muffler.
2. See Figure 4-51. Remove front muffler mount fastener (8).
3. Remove front muffler strap (5) from front muffler mount (7).
4. Remove front muffler mount bushings (9) by punching out with suitable tool.

Rear Muffler Bracket

1. Remove muffler.
2. Drain oil. See 1.6 ENGINE OIL AND FILTER.
3. Remove feed oil line p-clamp and remove feed oil line from swingarm. See 3.11 OIL RESERVOIR AND OIL HOSE ROUTING and 3.12 OIL LINE FITTINGS.
4. See Figure 4-51. Remove rear muffler bracket fasteners (12).
5. Slide oil line from rear muffler bracket and remove rear muffler bracket (11).

Exhaust Header

1. Rotate engine down. See 3.4 ENGINE ROTATION FOR SERVICE.
2. Remove oxygen sensor. See 4.7 OXYGEN SENSOR.
3. See Figure 4-52. Remove exhaust header (2) by removing header mounting fasteners (3).
4. Remove exhaust ring (4), exhaust retaining ring (5) and exhaust port gasket (6).

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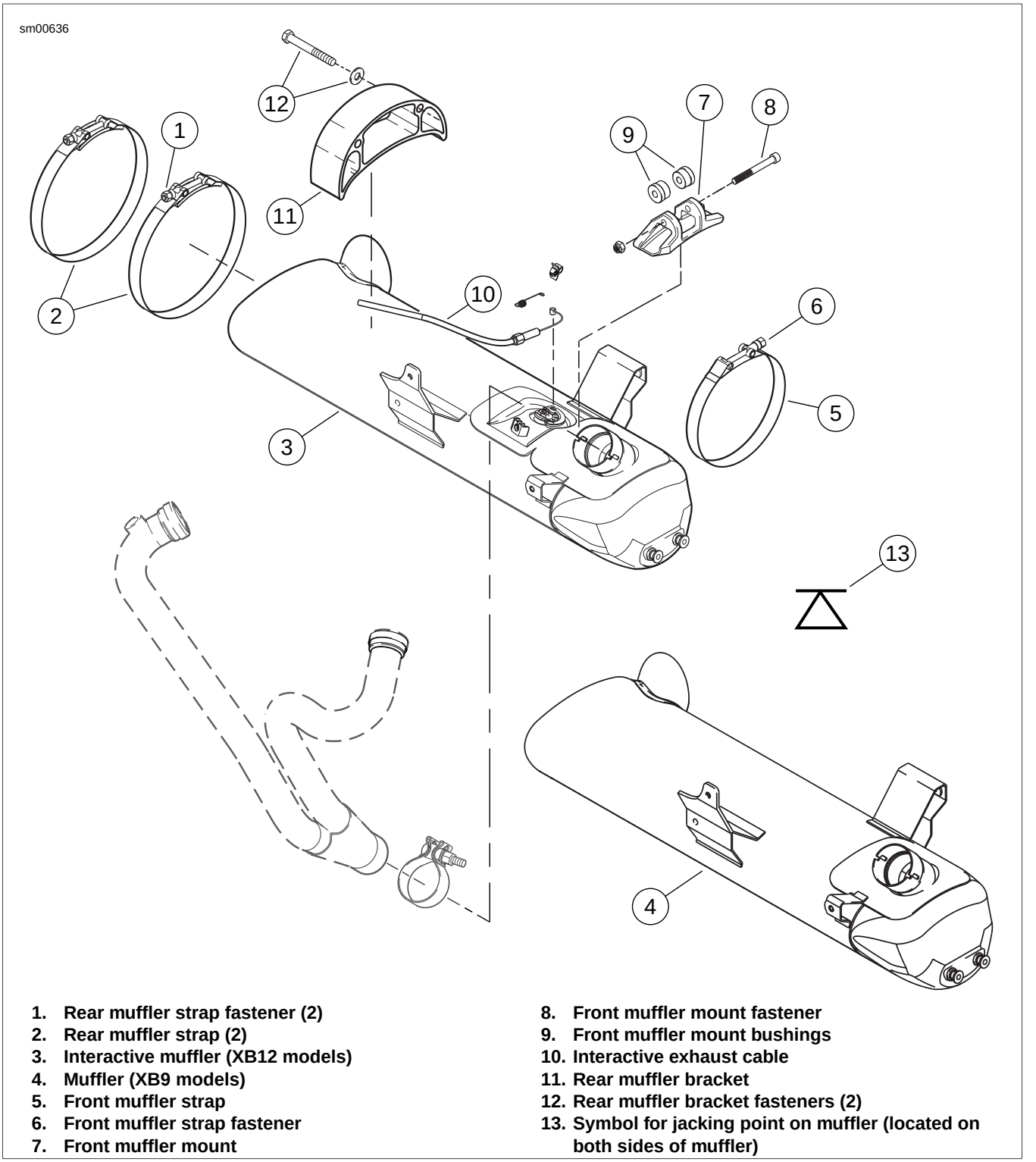

1. **Rear muffler strap fastener (2)**
2. **Rear muffler strap (2)**
3. **Interactive muffler (XB12 models)**
4. **Muffler (XB9 models)**
5. **Front muffler strap**
6. **Front muffler strap fastener**
7. **Front muffler mount**
8. **Front muffler mount fastener**
9. **Front muffler mount bushings**
10. **Interactive exhaust cable**
11. **Rear muffler bracket**
12. **Rear muffler bracket fasteners (2)**
13. **Symbol for jacking point on muffler (located on both sides of muffler)**

Figure 4-51. Muffler and Mounting System

ASSEMBLY AND INSTALLATION

Exhaust Header

1. See Figure 4-52. Install exhaust ring (4), exhaust retaining ring (5) and **new** exhaust port gasket (6).

NOTE

Tighten header nuts gradually, alternating between studs to verify that exhaust rings are flush with engine.

2. Install exhaust header (2). Tighten mounting fasteners (3) to 72-96 **in-lbs** (8-11 Nm).
3. Install oxygen sensor. See 4.7 OXYGEN SENSOR.

4. Rotate engine up. See 3.4 ENGINE ROTATION FOR SERVICE.

Rear Muffler Bracket

1. See Figure 4-51. Slide rear muffler bracket (11) over oil line.
2. Apply LOCTITE 271 (red) and install rear muffler bracket fasteners (12) and tighten to 32-36 ft-lbs (43-49 Nm).
3. Install oil line and p-clamp to swingarm. Tighten p-clamp fastener to 48-72 **in-lbs** (5.4-8 Nm) See 3.11 OIL RESERVOIR AND OIL HOSE ROUTING and 3.12 OIL LINE FITTINGS.
4. Fill swingarm/oil tank with 2.5 quarts (3.3 liters) oil. See 1.6 ENGINE OIL AND FILTER.

NOTE

For details on installing components on XB12 models with interactive exhaust systems, see 6.17 INTERACTIVE EXHAUST SYSTEM, Installation.

5. Install muffler.

Front Muffler Mount

1. See Figure 4-51. Install front muffler mount bushings (9).

NOTE

*Never re-use front muffler strap. Always replace front muffler strap with a **new** strap when removed from system.*

2. Install **new** strap on front muffler mount (7).
3. Install front muffler mount fastener (8) loosely. Do not tighten.
4. Install muffler.

Muffler and Straps

NOTES

- *Torca muffler clamps have eliminated the need for silicone or graphite tape during assembly. To verify sealing integrity of muffler clamps and prevent the possibility of leakage, Buell recommends that muffler clamp assemblies be discarded and replaced each time they are removed.*
- *Due to the location of the CKP it will be necessary to align the Torca Clamp to verify proper clearance between the chin fairing and the CKP and Torca clamp.*

1. Install muffler and **new** Torca clamp onto header.

NOTES

- *If necessary, use a fiber hammer to fit muffler on header.*
- *For details on installing components on XB12 models with interactive exhaust systems, see 6.17 INTERACTIVE EXHAUST SYSTEM, Installation.*

2. Install interactive exhaust cable to muffler.

NOTE

*Never re-use front muffler strap. Always replace front muffler strap with a **new** strap when removed from system.*

3. See Figure 4-51. Loosely install **new** front and rear muffler straps (2, 5).

NOTES

- *It is important that the front muffler mount is tightened last in order to verify proper alignment of the exhaust system.*
- *When rear muffler straps have been installed, it is important that strap fasteners do not contact idler pulley bracket.*
- *On the front muffler mount fastener, torque is applied to the head and not to the nut.*

4. Tighten front strap fastener and alternately tighten rear muffler strap fasteners evenly in the following sequence:
   a. Front strap fastener: Tighten around the muffler until snug.
   b. Rear strap fastener: 48-60 **in-lbs** (5.4-7 Nm).
   c. Once the fasteners on the rear muffler straps have been tightened to torque, you need to alternately tighten the fasteners to torque two more times to make sure the straps are evenly tightened.
   d. Front muffler mount fastener: 16-18 ft-lbs (21.7-24.4 Nm).
   e. Front strap fastener: 108-120 **in-lbs** (12-14 Nm). Back off fastener two full turns and then retighten to 108-120 **in-lbs** (12-14 Nm).
5. See Figure 4-52. Tighten the Torca clamp (1) to 45-50 ft-lbs (61-68 Nm).
6. Install idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY.
7. Install front sprocket cover. See 2.36 SPROCKET COVER.
8. Install chin fairing. See 2.50 CHIN FAIRING.
9. Adjust interactive exhaust cable. See 1.16 INTERACTIVE EXHAUST CABLE.

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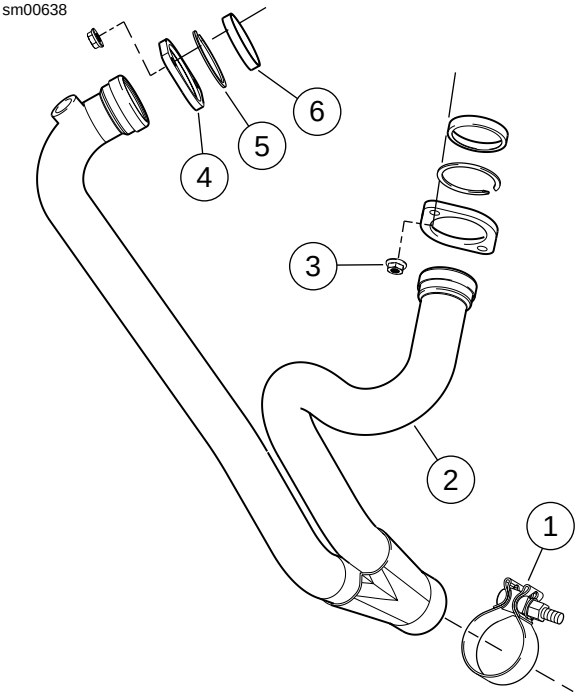


1. **Torca clamp**
2. **Header**
3. **Header mount fastener**
4. **Exhaust ring**
5. **Exhaust retaining ring**
6. **Exhaust port gasket**

Figure 4-52. Exhaust Header

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

EVAPORATIVE EMISSIONS CONTROL (CA MODELS) 4.19

GENERAL

Buell motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system. The EVAP system prevents fuel hydrocarbon vapors from escaping into the atmosphere and is designed to meet the California Air Resource Board (CARB) regulations in effect at the time of manufacture.

The EVAP functions in the following manner:

- Hydrocarbon vapors in the fuel tank are directed through the vent valve and stored in the carbon canister. If the vehicle is tipped at an abnormal angle, the vent valve closes to prevent liquid gasoline from leaking out of the fuel tank through the fuel tank vent hose.
- When the engine is running, manifold venturi negative pressure (vacuum) slowly draws off the hydrocarbon vapors from the carbon canister through the canister vent hose. These vapors pass through the throttle body manifold and are burned as part of normal combustion in the engine.

TROUBLESHOOTING

WARNING

Keep evaporative emissions vent lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00266a)

The system has been designed to operate with a minimum of maintenance. Check that all hoses are properly routed and connected and are not pinched or kinked.

REMOVAL: FIREBOLT

Vent Valve

1. Remove fuel tank vent valve. See 4.12 FUEL TANK VENT VALVE.
2. See Figure 4-53. If necessary, label fuel tank vent hose (2) at canister fitting and remove.

Canister

1. Remove upper tail body work. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
2. See Figure 4-53. The canister (1) mounts behind the battery in the tail section.
3. Label and disconnect the fuel tank vent hose (2) and canister vent hose (3) from the canister.
4. See Figure 4-54. Remove rear shock absorber reservoir fasteners (2). Move reservoir assembly away from canister.
5. Slide canister towards left side of vehicle to disengage from mounting plate (1).

1. **Canister**
2. **Fuel tank vent hose (to fuel tank vent valve)**
3. **Canister vent hose (to intake manifold)**

Figure 4-53. Carbon Canister

REMOVAL: LIGHTNING/ULYSSES

Vent Valve

1. Remove vent valve. See 4.12 FUEL TANK VENT VALVE.
2. If necessary, label fuel tank vent hose at canister fitting and remove.

Canister

1. See Figure 4-58. Label and disconnect the fuel tank vent hose (2) and canister vent hose (3) from the canister.
2. Slide canister towards rear of vehicle to disengage from mounting plate.

INSTALLATION: FIREBOLT

Vent Valve

WARNING

Keep vent and vapor valve lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00263a)

1. Install fuel tank vent valve. See 4.12 FUEL TANK VENT VALVE.
2. See Figure 4-54. Attach fuel tank vent hose (2) to canister if disconnected.

Canister

NOTE

In next step, be sure canister hose barbs are facing left side of vehicle and barb holes are facing toward front of vehicle.

1. See Figure 4-54. Slide canister into position on canister mounting plate (1).

2. Place rear shock reservoir assembly (3) into position.

NOTE

See Figure 4-55. To verify proper reservoir mounting, temporarily place upper body work onto tail section and adjust reservoir placement so adjuster screw (1) aligns with alignment hole (2).

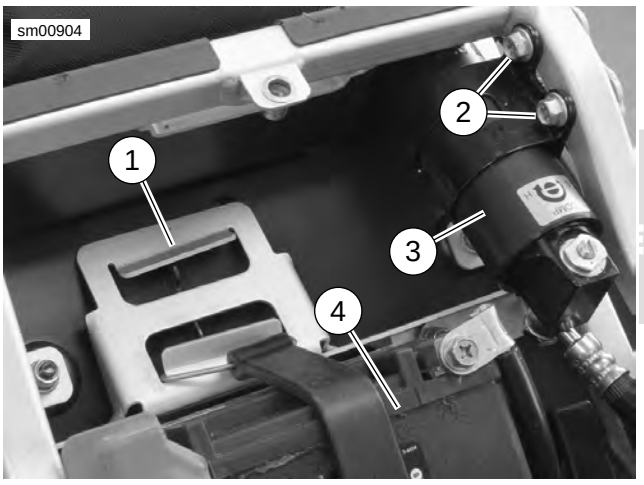
3. See Figure 4-54. Install reservoir mounting fasteners (2). Tighten fasteners to 120-144 **in-lbs** (13.6-16.3 Nm).

NOTES

- *Always make sure fuel hoses are seated against the component they connect to and that hose clamps are properly tightened and positioned on straight section of fitting and not on the fitting barb.*
- *The barb is the larger outside diameter portion (bump) on the fuel fitting.*

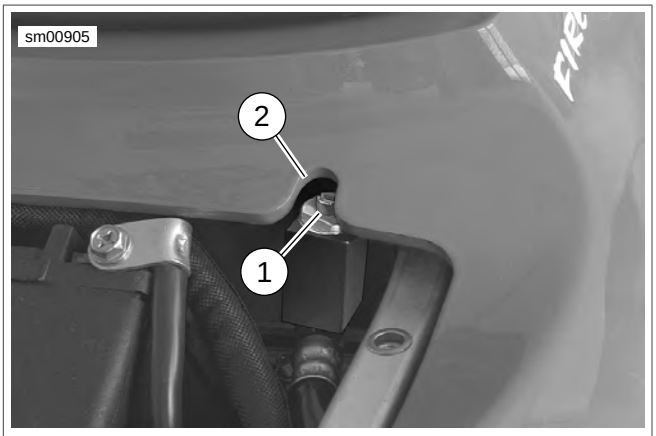
4. See Figure 4-54. Connect two hoses to the canister. Make sure to push hoses all the way on to carbon canister fittings.

5. Install upper tail body work. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.



1. **Mounting plate**
2. **Rear shock reservoir fasteners (2)**
3. **Rear shock reservoir**
4. **Battery**

Figure 4-54. Carbon Canister Mounting



1. **Adjuster screw**
2. **Adjuster screw alignment hole**

Figure 4-55. Adjuster Screw Alignment

INSTALLATION: LIGHTNING/ULYSSES

Vent Valve

WARNING

Keep vent and vapor valve lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00263a)

NOTE

For XB12 models, See 6.17 INTERACTIVE EXHAUST SYSTEM.

1. Install vent valve. See 4.12 FUEL TANK VENT VALVE.
2. See Figure 4-54. Attach fuel tank vent hose (2) to canister if disconnected.

Canister

NOTE

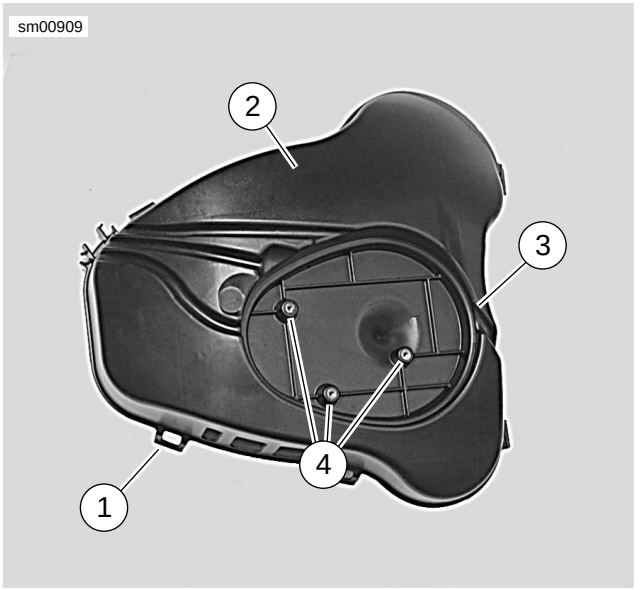
In next step, be sure canister hose barbs are facing rear of vehicle at approximately the 1 o'clock position.

1. See Figure 4-58. Slide canister into position on canister mounting plate and push towards front of vehicle.

NOTES

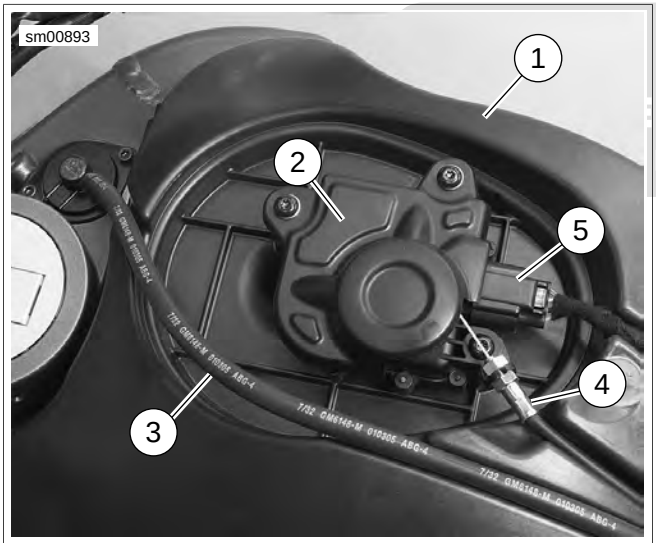
- *Always make sure fuel hoses are seated against the component they connect to and that hose clamps are properly tightened and positioned on straight section of fitting and not on the fitting barb.*
- *The barb is the larger outside diameter portion (bump) on the fuel fitting.*

2. See Figure 4-54. Connect two hoses to the canister. Make sure to push hoses all the way on to carbon canister fittings.



1. **Lock tab (6)**
2. **Air cleaner cover**
3. **Fuel tank vent hose location**
4. **Mounting towers for interactive exhaust actuator**

Figure 4-56. Air Cleaner Cover



1. **Air cleaner cover**
2. **Interactive exhaust actuator cover**
3. **Fuel vent tube**
4. **Cable, interactive exhaust**
5. **Harness, interactive exhaust**

Figure 4-57. Air Cleaner Cover, Fuel Vent Tube and Fuel Vapor Valve (XB12 "Translucid" models)

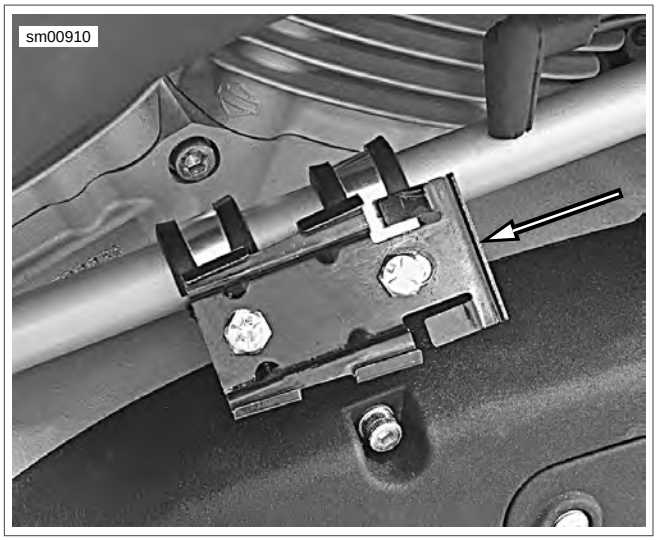


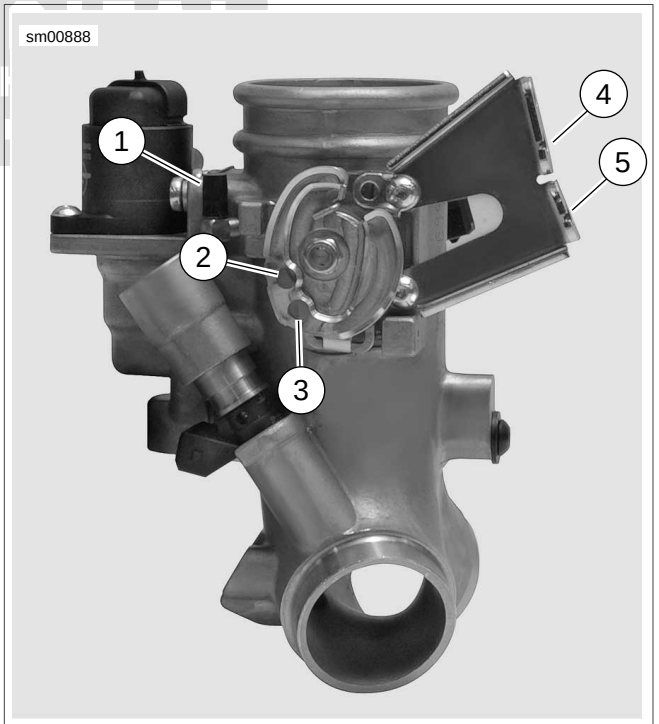
Figure 4-58. Canister Mounting Bracket

HOSE ROUTING

Both fuel tank and canister vent hoses are routed through notch in fan body.

NOTE

For information on vent hose routing, See D.1 APPENDIX D: HOSE AND WIRE ROUTING.



1. **EVAP hose fitting**
2. **Throttle control cable attachment**
3. **Idle control cable attachment**
4. **Throttle control cable slot**
5. **Idle control cable slot**

Figure 4-59. Throttle Cable Bracket

TABLE OF CONTENTS

NOTES

FASTENER TORQUE VALUES 5.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Axle, rear (final torque, see ANTI-SEIZE procedure)	48-52 ft-lbs	65-70.5 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (final torque)	48-52 ft-lbs	65-70.5 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (final torque)	48-52 ft-lbs	65-70.5 Nm	5.17 TRANSMISSION SPROCKET, Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	5.17 TRANSMISSION SPROCKET, Installation/Follow special ANTI-SEIZE procedure.
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	5.17 TRANSMISSION SPROCKET, Installation
Chin fairing fasteners	36-48 **in-lbs**	4-5 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation/LOCTITE 271 (red)
Clutch inspection cover fasteners	84-108 **in-lbs**	10-12 Nm	5.3 PRIMARY COVER, Installation
Clutch inspection cover fasteners	84-108 **in-lbs**	10-12 Nm	5.4 CLUTCH RELEASE MECHANISM, Assembly
Clutch mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.6 PRIMARY CHAIN, Installation/LOCTITE 271 (red) if using original mainshaft nut
Countershaft retaining screw	33-37 ft-lbs	44.8-50 Nm	5.16 SHIFTER SHAFT, Installation/LOCTITE 271 (red)
Crankcase 5/16 in. fasteners	15-19 ft-lbs	20.3-25.0 Nm	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase/Apply several drops of LOCTITE 271 (red) to last few threads.
Engine sprocket bolt	155-165 ft-lbs	210-224 Nm	5.6 PRIMARY CHAIN, Installation/LOCTITE 271 (red)
Idler pulley nut and washer	33-35 ft-lbs	45-47 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation
Idler pulley wheel fastener	33-35 ft-lbs	45-47 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation
Idler pulley wheel fastener	20-23 ft-lbs	27.1-31.2 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.3 PRIMARY COVER, Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.4 CLUTCH RELEASE MECHANISM, Assembly
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.5 CLUTCH, Assembly and Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.6 PRIMARY CHAIN, Installation
Neutral indicator switch (Firebolt)	60-84 **in-lbs**	6.7-9.5 Nm	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase/LOCTITE 242 (blue)
Neutral indicator switch (Lightning and Ulysses)	100-120 **in-lbs**	11-13 Nm	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase/LOCTITE 242 (blue)

FASTENER	TORQUE VALUE		NOTES
Primary cover fasteners	100-120 **in-lbs**	11.3-13.5 Nm	5.3 PRIMARY COVER, Installation
Primary magnetic drain plug	14-30 ft-lbs	19-40.7 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 565
Shifter bracket fasteners	22-24 ft-lbs	30.0-32.5 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shift lever pinch screw	48-60 **in-lbs**	5.4-7 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shift linkage fasteners	36-60 **in-lbs**	4.0-7 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shift pedal flange head bolt	22-24 ft-lbs	30.0-32.5 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Swingarm brace mounting fasteners	25-27 ft-lbs	34-37 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation
Transmission sprocket nut (initial torque)	50 ft-lbs	67.8 Nm	5.17 TRANSMISSION SPROCKET, Installation/Follow special torque procedure, left-hand threads, LOCTITE 272 (red).
Transmission sprocket screws	90-110 **in-lbs**	10.2-12.4 Nm	5.17 TRANSMISSION SPROCKET, Installation/Replace after three removals.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

SPECIFICATIONS 5.2

GENERAL

NOTE

Service wear limits are given as a guideline for measuring components that are not new. For measurement specifications not given under SERVICE WEAR LIMITS, see NEW COMPONENTS.

Table 5-1. Primary Drive (Engine-to-Transmission)

ITEM	(XB9SX)	(XB12 MODELS)
Engine sprocket	34 teeth	38 teeth
Clutch sprocket	57 teeth	57 teeth

Table 5-2. Final Drive (Transmission-to-Rear Wheel)

ITEM	MODEL	NEW COMPONENTS
Transmission sprocket	All	27 teeth
Rear wheel sprocket	All	65 teeth
Secondary drive belt	XB9SX, XB12Scg, XB9R, XB12R	128 teeth
Secondary drive belt	XB12Ss, XB12XT, XB12X, XB12XP	135 teeth

Table 5-3. Transmission Specifications: XB Models

OVERALL GEAR RATIOS	XB9SX	XB12 MODELS
First gear (low)	10.688	9.563
Second gear	7.635	6.831
Third gear	5.678	5.080
Fourth gear	4.706	4.211
Fifth gear	4.036	3.611

Table 5-4. Wet Clutch Multiple Disc-Clutch Plate Thickness

ITEM	NEW COMPONENTS	SERVICE WEAR LIMITS
Friction plate (fiber) (in.)	0.0866 ± 0.0031 in. (2.200 ± 0.079 mm)	N/A
Steel plate	0.0629 ± 0.0020 in. (1.598 ± 0.051 mm)	N/A
Clutch pack (in.)	N/A	0.661 in. (16.789 mm) (minimum)

Table 5-5. Wet Clutch Multiple Disc-Maximum Allowable Warpage

ITEM	NEW COMPONENTS	SERVICE WEAR LIMITS
Friction plate (fiber)	N/A	0.0059 in. (0.150 mm)
Steel plate	N/A	0.0059 in. (0.150 mm)

PRIMARY COVER 5.3

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable from battery.
3. Remove chin fairing. See 2.50 CHIN FAIRING.
4. See Figure 5-1. Place a drain pan under the engine/primary area. Remove drain plug (4) and drain lubricant from primary drive.
5. Remove engine shift lever assembly (1) and rubber washer. Use care not to scratch primary cover.
6. Remove flange head bolt (5).
7. For Ulysses only, remove shifter bracket fasteners (10) and shifter bracket (9) from primary cover.

NOTE

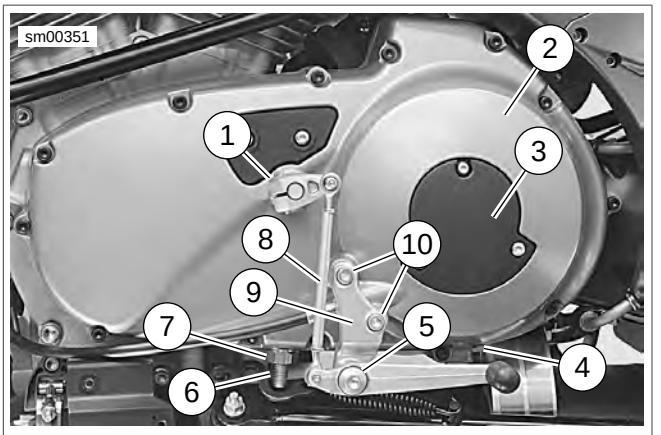
It is recommended that the shifter shaft seal be replaced whenever the primary cover is removed.

8. Add free play to clutch cable. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Adjustment.
9. See Figure 5-1. Loosen locknut (7). Turn chain adjuster screw (6) counterclockwise to remove tension on primary chain.
10. See Figure 5-1. Remove clutch inspection cover (3).
11. See Figure 5-2. Remove the outer ramp and hook (1) from the cable end (3) and coupling (2). Remove cable end from slot in coupling. See 5.4 CLUTCH RELEASE MECHANISM.
12. See Figure 5-1. Remove screws which secure primary cover (2). Remove cover and gasket.
13. Discard gasket.
14. See Figure 5-3. Remove and discard shifter lever oil seal (19).
15. Clean all parts in a non-volatile cleaning solution or solvent.

⚠WARNING

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

16. Blow parts dry with low pressure compressed air.

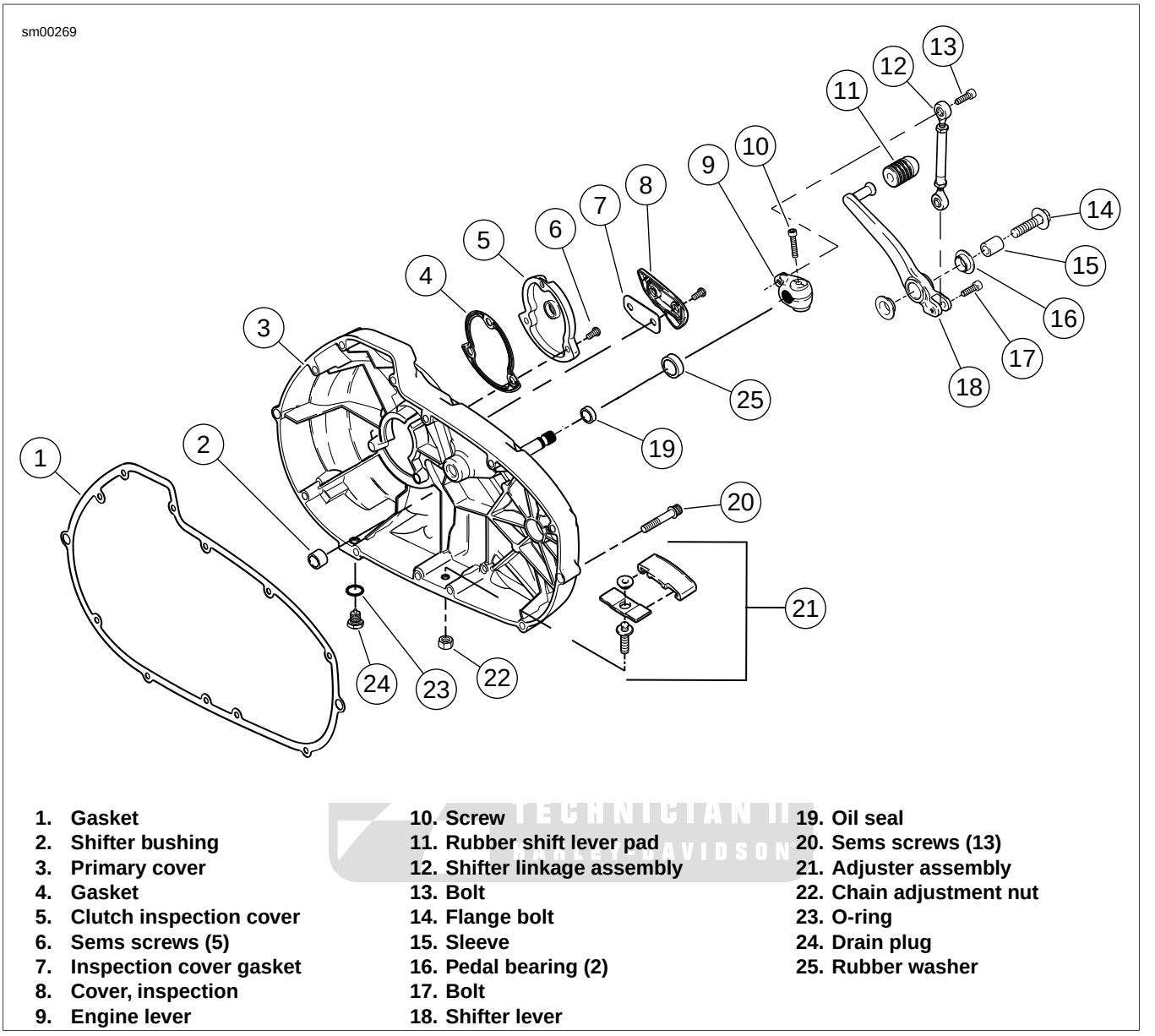


1. **Engine shift lever**
2. **Primary cover**
3. **Clutch inspection cover**
4. **Drain plug**
5. **Flange head bolt**
6. **Chain adjuster screw**
7. **Locknut**
8. **Shift linkage assembly**
9. **Bracket, shifter (Ulysses only)**
10. **Fasteners, shifter bracket (Ulysses only)**

Figure 5-1. Removing Primary Cover (Ulysses Shown)

1. **Outer ramp and hook**
2. **Coupling**
3. **Cable end**

Figure 5-2. Clutch Release Mechanism (Typical)

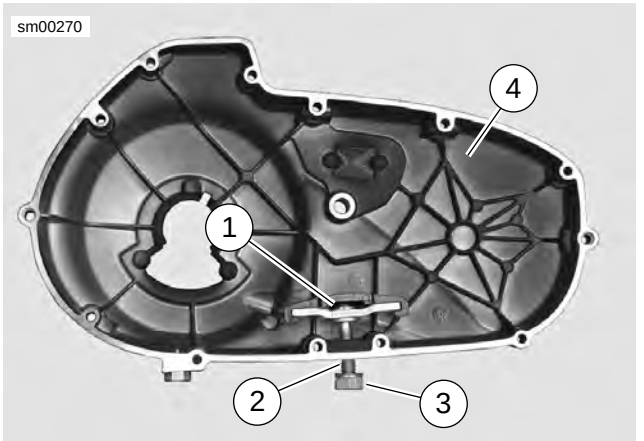


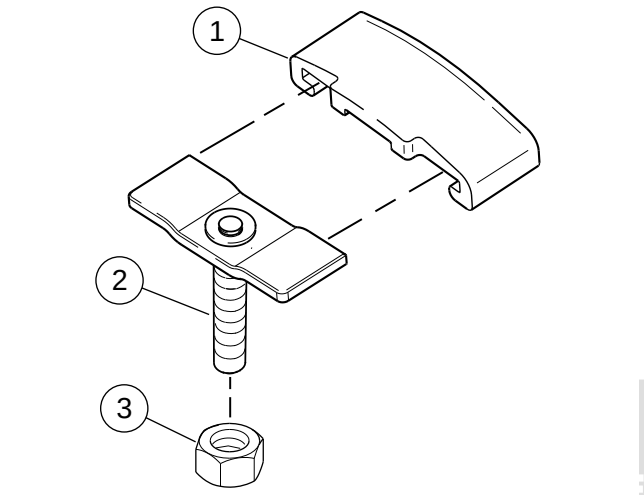
1. **Gasket**
2. **Shifter bushing**
3. **Primary cover**
4. **Gasket**
5. **Clutch inspection cover**
6. **Sems screws (5)**
7. **Inspection cover gasket**
8. **Cover, inspection**
9. **Engine lever**
10. **Screw**
11. **Rubber shift lever pad**
12. **Shifter linkage assembly**
13. **Bolt**
14. **Flange bolt**
15. **Sleeve**
16. **Pedal bearing (2)**
17. **Bolt**
18. **Shifter lever**
19. **Oil seal**
20. **Sems screws (13)**
21. **Adjuster assembly**
22. **Chain adjustment nut**
23. **O-ring**
24. **Drain plug**
25. **Rubber washer**

Figure 5-3. Primary Cover, Primary Chain Adjuster and Shifter Assembly

PRIMARY CHAIN ADJUSTER REPLACEMENT

1. See Figure 5-4. Remove locknut (3) from adjuster screw (2). Turn adjuster screw out of threaded boss in primary cover (4).
2. Remove chain adjuster as an assembly.
3. Inspect primary chain adjuster shoe (1). If badly worn or damaged, it must be replaced.
4. Replace adjuster shoe as an assembly.
5. Position adjuster inside primary cover (4) with closed side of shoe against cover. Thread adjuster screw (2) all the way into tapped boss at bottom of primary cover.
6. At outside of cover, thread locknut (3) onto adjuster screw with nylon sealing surface toward cover. A 1/4-inch allen wrench may be inserted into end of adjuster screw to hold it while threading lock nut.





1. **Shoe, chain adjuster**
2. **Chain adjuster screw**
3. **Chain adjusting locknut**
4. **Primary cover**

Figure 5-4. Primary Chain Adjuster

INSTALLATION

1. Remove foreign material from magnetic drain plug. Apply LOCTITE 565 thread sealant and install plug and tighten to 14-30 ft-lbs (19-40.7 Nm).
2. Wipe gasket surface clean. Install **new** gasket on primary cover.
3. Install primary cover and gasket onto left crankcase half using mounting bolts.

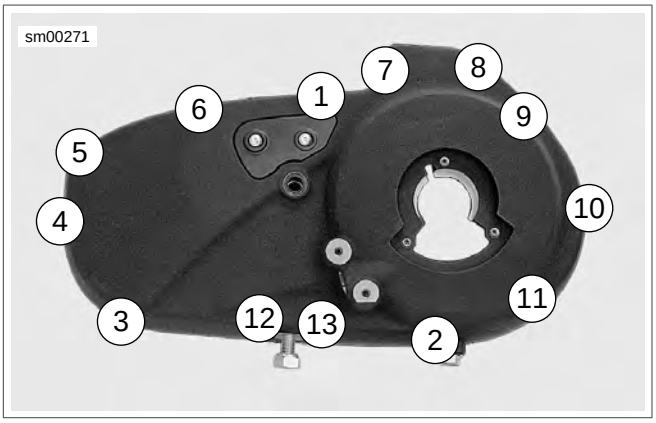
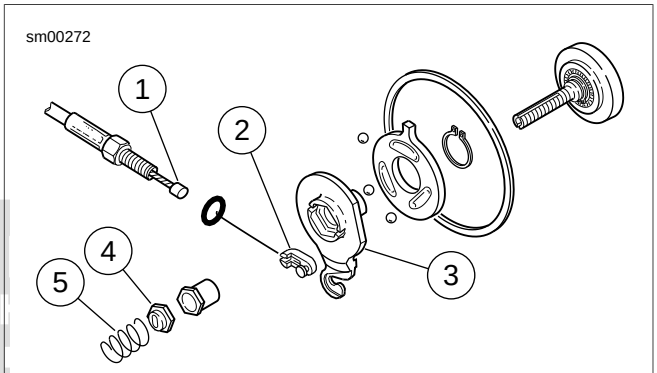


Figure 5-5. Primary Cover Tightening Sequence (Typical)

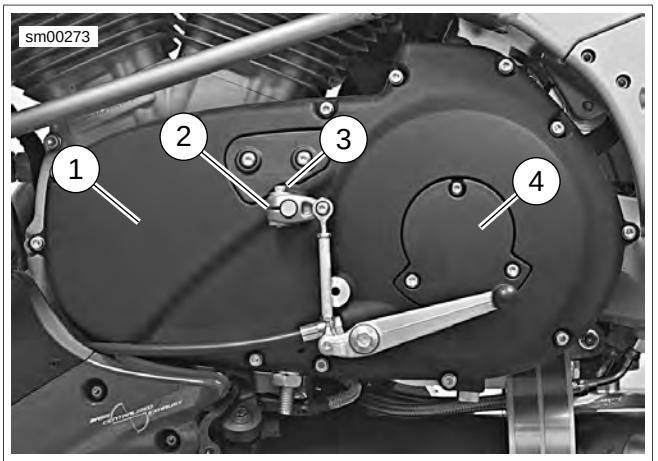
4. See Figure 5-5. Tighten fasteners to 100-120 **in-lbs** (11.3-13.5 Nm) in sequence shown.
5. See Figure 5-3. Install **new** shifter lever oil seal (19).



1. **Cable end**
2. **Coupling**
3. **Outer ramp and hook**
4. **Lockplate**
5. **Spring**

Figure 5-6. Clutch Release Mechanism

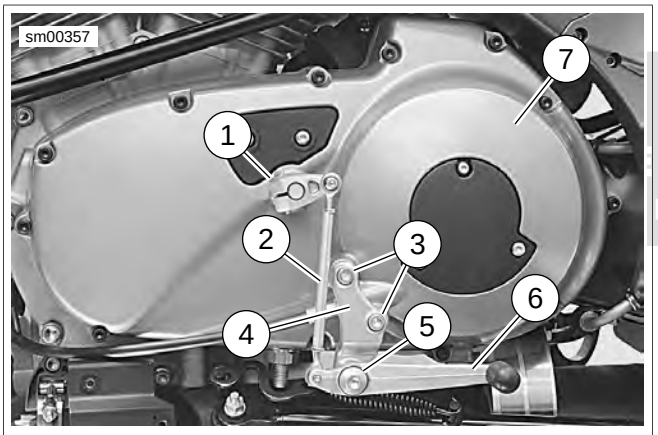
6. See Figure 5-6. Fit coupling (2) over cable end (1) with rounded side inboard and the ramp connector button outboard. With retaining ring side of ramp assembly facing inward, place hook of ramp (3) around coupling button and rotate assembly counterclockwise until tang on inner ramp fits in slot of primary cover.
7. Thread locknut on adjuster screw until slot of screw is accessible with a screwdriver. Fit nut hex into recess of outer ramp and turn adjuster screw counterclockwise.
8. Adjust clutch. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Adjustment.
9. Adjust primary chain tension. See 1.11 PRIMARY CHAIN.
10. Fill transmission to proper level with fresh lubricant. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.



1. **Primary cover**
2. **Lever, engine**
3. **Engine lever pinch screw**
4. **Clutch inspection cover**

Figure 5-7. Installing Primary Cover (Typical)

11. See Figure 5-7. Install clutch inspection cover (4) with **new** gasket and three TORX screws with washers. Tighten screws to 84-108 **in-lbs** (10-12 Nm).



1. **Engine shift lever**
2. **Shift linkage assembly**
3. **Shifter bracket fasteners (Ulysses only)**
4. **Shifter bracket (Ulysses only)**
5. **Flange bolt**
6. **Shift pedal**
7. **Primary cover**

Figure 5-8. Installing Shift Linkage (Ulysses Shown)

12. See Figure 5-8. For Ulysses only, install shifter bracket (4) on primary cover (7) by applying LOCTITE 271 (red) to fasteners and tightening to 22-24 ft-lbs (30.0-32.5 Nm). Lightning and Firebolt models do not have a shifter bracket.
13. Install rubber washer and engine shift lever assembly (1).
14. After applying LOCTITE 271 (red), install flange bolt (5) and shift pedal (6) and tighten to 22-24 ft-lbs (30.0-32.5 Nm).
15. After applying LOCTITE 271 (red), tighten engine shift lever pinch screw to 48-60 **in-lbs** (5.4-7 Nm).
16. If the shift linkage assembly (2) was removed for any reason, apply LOCTITE 271 (red) to fasteners and tighten to 36-60 **in-lbs** (4.0-7 Nm). Adjust to rider comfort.
17. Install chin fairing. See 2.50 CHIN FAIRING.
18. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

19. Install seat.

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CLUTCH RELEASE MECHANISM 5.4

DISASSEMBLY

NOTE

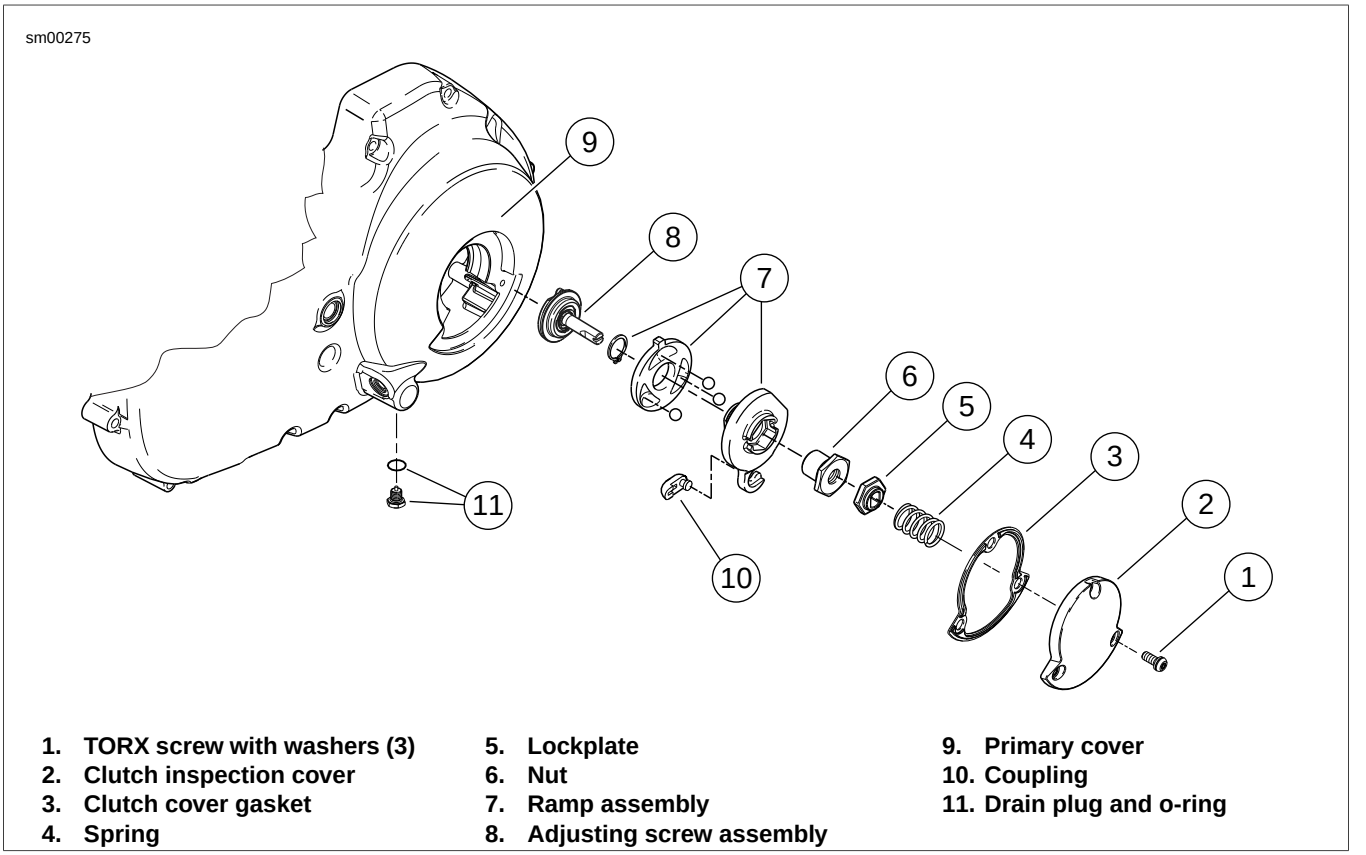
For clutch adjustment procedure, see 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.

1. Remove seat.

⚠ WARNING

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

2. Disconnect negative battery cable.
3. Slide rubber boot on clutch cable adjuster upward to expose adjuster mechanism. Loosen jam nut from adjuster. Turn adjuster to shorten cable housing until there is a large amount of free play at clutch hand lever. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
4. See Figure 5-9. Remove three TORX screws with washers (1) and clutch inspection cover (2).
5. Slide spring (4) with attached screw lockplate (5) from flats of adjusting screw.
6. Turn adjusting screw clockwise to release ramp assembly (7) and coupling (10). As the adjusting screw is turned, ramp assembly moves forward. Unscrew nut (6) from end of adjusting screw.
7. Remove hook of ramp from cable end coupling (10). Remove cable end from slot in coupling.
8. Remove and discard retaining ring from ramp assembly to separate inner and outer halves. Remove three balls from ramp sockets.



1. **TORX screw with washers (3)**
2. **Clutch inspection cover**
3. **Clutch cover gasket**
4. **Spring**
5. **Lockplate**
6. **Nut**
7. **Ramp assembly**
8. **Adjusting screw assembly**
9. **Primary cover**
10. **Coupling**
11. **Drain plug and o-ring**

Figure 5-9. Clutch Release Mechanism

CLEANING AND INSPECTION

1. Thoroughly clean all parts in cleaning solvent.
2. See Figure 5-9. Inspect three balls of release mechanism and ball socket surfaces of inner and outer ramps for wear, pitting, surface breakdown and other damage. Replace parts as necessary.
3. Check hub fit of inner and outer ramps. Replace ramps if excessively worn.
4. Check clutch cable for frayed or worn ends. Replace cable if damaged or worn.
5. Change or add transmission fluid if necessary. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.

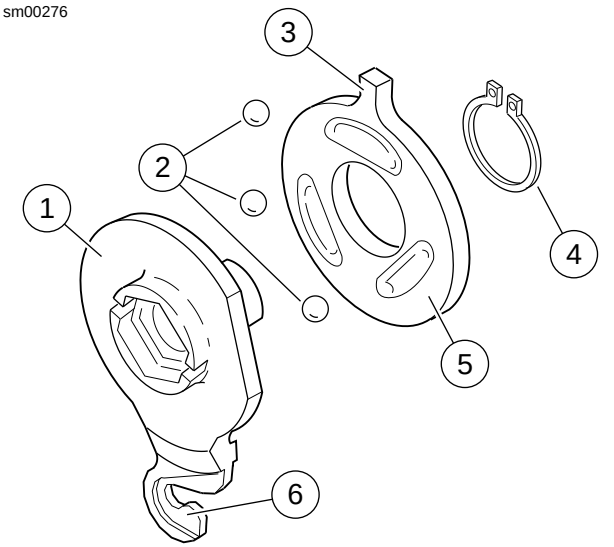
ASSEMBLY

1. See Figure 5-10. Assemble inner and outer ramps.
   a. Apply multi-purpose grease to balls (2) and ramps (1, 5).
   b. Insert balls in sockets of outer ramp (1).
   c. Install inner ramp on hub of outer ramp with tang (3) rotated 180° from hook (6) of outer ramp.
   d. Install new retaining ring in groove of outer ramp hub.
2. See Figure 5-11. Install ramp assembly.
   a. Fit coupling (3) over cable end (4) with rounded side inboard, the ramp connector button outboard.
   b. With retaining ring side of ramp assembly facing inward, place hook of ramp around coupling button.
   c. Rotate assembly counterclockwise until tang on inner ramp fits in slot of primary cover.
3. Secure assembly in place.
   a. Thread nut on adjusting screw (2) until slot of screw is accessible with a screwdriver.
   b. Turn adjusting screw counterclockwise until resistance is felt.
   c. Adjust clutch release mechanism. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
   d. Fit nut hex into recess of outer ramp.
   e. Install clutch adjusting lockplate (5) and spring.
4. Install clutch inspection cover and new gasket with three TORX screws with washers. Tighten to 84-108 **in-lbs** (10-12 Nm).
5. Adjust clutch cable. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
6. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

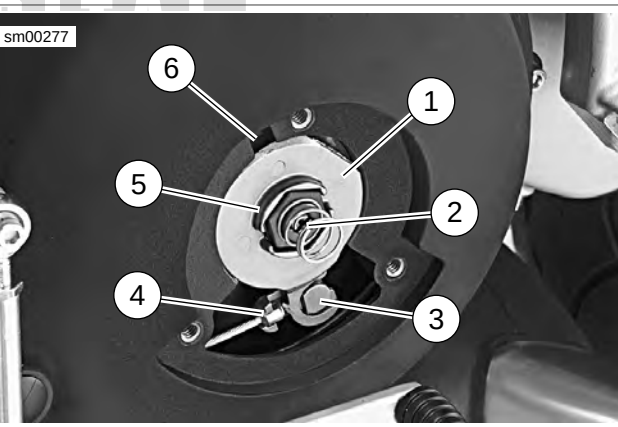
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

7. Install seat.



1. **Outer ramp**
2. **Balls (3)**
3. **Tang**
4. **Retaining ring**
5. **Inner ramp**
6. **Hook**

Figure 5-10. Inner and Outer Ramp



1. **Outer ramp**
2. **Adjusting screw**
3. **Coupling**
4. **Cable end**
5. **Lockplate**
6. **Slot in primary cover**

Figure 5-11. Nut and Outer Ramp

CLUTCH 5.5

GENERAL

The purpose of the clutch is to smoothly disengage and engage the engine from the rear wheel for starting, stopping and shifting gears.

See Figure 5-12. The clutch is a wet, multiple-disc clutch with steel plates and fiber (friction) plates stacked alternately in the clutch shell. The pack consists of seven fiber plates, seven steel plates, one narrow fiber plate, one damper spring and one damper spring seat. The fiber plates (clutch driving plates) are keyed to the clutch shell, which is driven by the engine through the primary chain. The steel plates (clutch driven plates) are keyed to the clutch hub, which drives the rear wheel through the transmission and secondary drive belt.

When the clutch is engaged (clutch lever released), the diaphragm spring applies strong force against the pressure plate. The pressure plate then presses the clutch plates together causing the plates to turn as a single unit. The result is that the rotational force of the clutch shell is transmitted through the clutch plates to the clutch hub. As long as the transmission is set in a forward gear, power from the engine will be transmitted to the rear wheel.

When the clutch is disengaged (clutch lever pulled to left handlebar grip), the pressure plate is pulled outward (by clutch cable action) against the diaphragm spring, thereby compressing the diaphragm spring. With the pressure plate retracted, strong inward force no longer squeezes the clutch plates together. The fiber plates are now free to rotate at a different relative speed than that of the steel plates (i.e. Slippage between the clutch plates occurs). The result is that the rotational force of the clutch shell is no longer fully transmitted through the "unlocked" clutch plates to the clutch hub. The engine is free to rotate at a different speed than the rear wheel.

Table 5-6. Clutch Troubleshooting

SYMPTOM	CHECK ORDER	CAUSE	REMEDY
Clutch slips	1	Incorrect clutch release adjustment.	Check and adjust clutch release mechanism.
	2	Worn clutch plates.	Check service wear limits. Replace plates.
Clutch drags	1	Incorrect clutch release adjustment.	Check and adjust clutch release mechanism.
	2	Worn clutch release ramps or balls.	Replace release ramps and/or balls.
	3	Warped clutch steel plates.	Replace clutch steel plates.
	4	Blade worn or damaged clutch gear splines.	Replace clutch gear or hub as required.
	5	Overfilled primary.	Drain lubricant to correct level.

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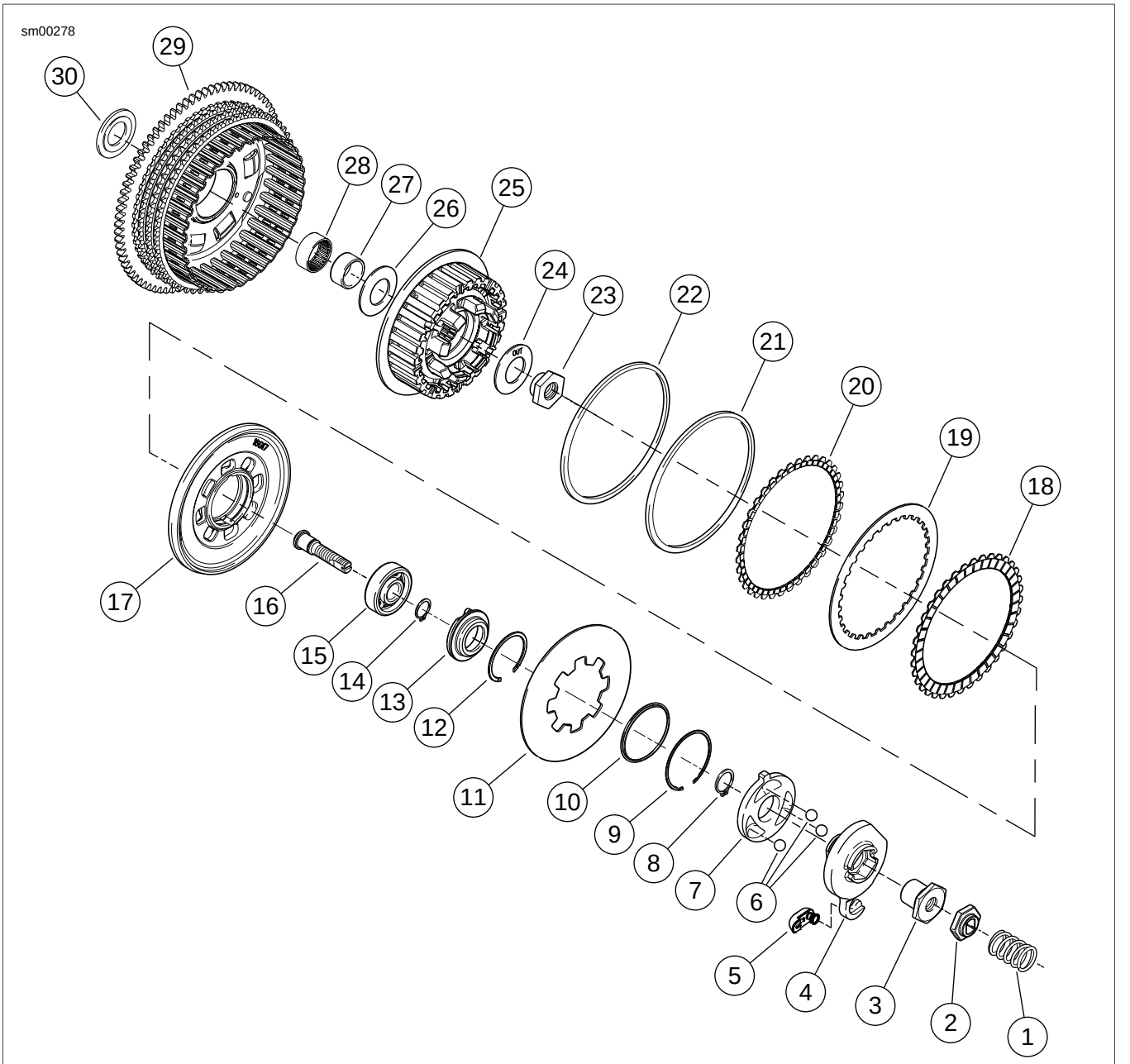


1. Spring
2. Lockplate
3. Nut
4. Outer ramp
5. Coupling
6. Ball (3)
7. Inner ramp
8. Retaining ring
9. Retaining ring
10. Spring seat
11. Diaphragm spring
12. Retaining ring
13. Release plate
14. Retaining ring
15. Bearing
16. Adjusting screw
17. Pressure plate
18. Friction plate, fiber (7)
19. Steel plate (7)
20. Friction plate, narrow, fiber
21. Damper spring
22. Damper spring seat
23. Mainshaft nut
24. Washer
25. Clutch hub
26. Inner thrust washer
27. Needle bearing inner race
28. Needle bearing
29. Clutch shell and sprocket
30. Outer thrust washer

Figure 5-12. Clutch Assembly

REMOVAL

PART NUMBER	TOOL NAME
HD-38515-91	CLUTCH SPRING FORCING SCREW
HD-38515-A	SPRING COMPRESSING TOOL

⚠WARNING

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

1. Remove negative battery cable from battery.
2. Drain the transmission fluid. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid.
3. Remove primary cover. See 5.3 PRIMARY COVER.

⚠WARNING

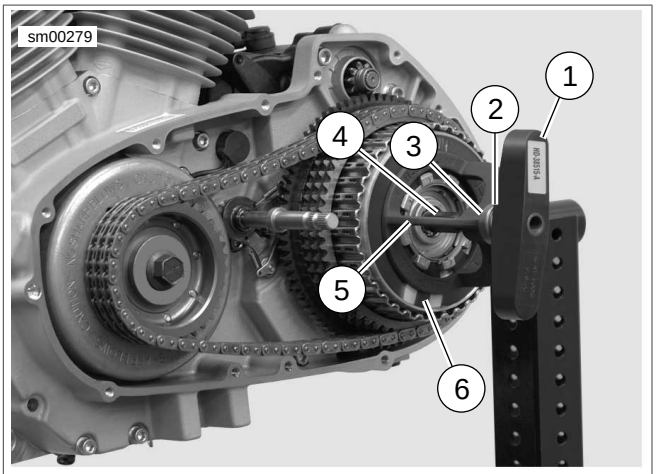
Disassemble clutch using a spring compressing tool. The diaphragm spring is compressed and, if removed without proper tools can fly out, which could result in death or serious injury. (00292a)

4. See Figure 5-13. Attach tools to compress clutch diaphragm spring.
   a. Thread the CLUTCH SPRING FORCING SCREW (Part No. HD-38515-91) (4) onto the clutch adjusting screw.
   b. Place the bridge (5) of SPRING COMPRESSING TOOL (Part No. HD-38515-A) against diaphragm spring (6).
   c. Install bearing (3) and washer (2).
   d. Thread the tool handle (1) onto end of forcing screw.

NOTE

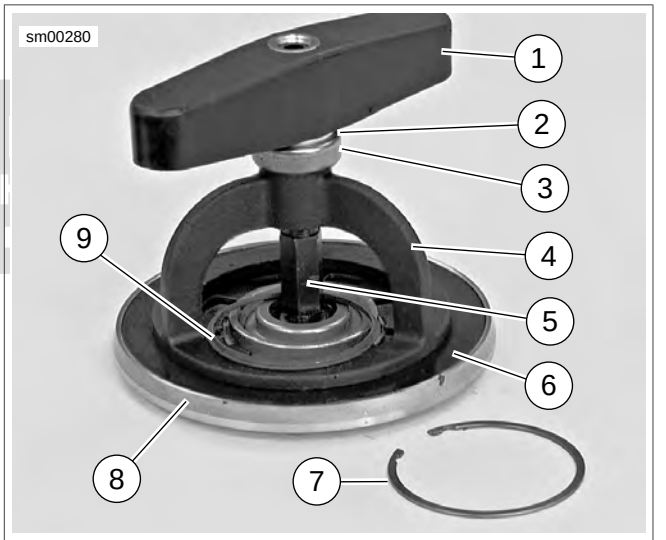
See Figure 5-14. Turn compressing tool handle only the amount required to release spring seat and remove snap ring (7). Excessive compression of diaphragm spring could damage clutch pressure plate.

5. See Figure 5-14. Remove pressure plate assembly.
   a. Place a wrench on the clutch spring forcing screw (5) flats to prevent the forcing screw from turning.
   b. Turn compressing tool handle (1) clockwise until tool relieves pressure on retaining ring (7) and spring seat (9). Remove and discard retaining ring.
   c. Unseat spring seat from the groove in clutch hub prongs.
   d. Remove pressure plate assembly.
6. Remove the clutch pack from the shell/hub assembly.



1. **Tool handle**
2. **Washer**
3. **Bearing**
4. **Clutch spring forcing screw**
5. **Bridge**
6. **Diaphragm spring**

Figure 5-13. Compressing Clutch Diaphragm Spring



1. **Tool handle**
2. **Washer**
3. **Bearing**
4. **Bridge**
5. **Forcing screw**
6. **Diaphragm spring**
7. **Snap ring**
8. **Pressure plate**
9. **Spring seat**

Figure 5-14. Pressure Plate Assembly

CLUTCH PACK CLEANING AND INSPECTION

1. Separate the pack in to the following components:
   a. Seven fiber plates.
   b. Seven steel plates.
   c. One narrow fiber plate.
   d. One damper spring.
   e. One damper spring seat.

⚠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. Wash all parts, except fiber (friction) plates and bearing in the clutch hub/shell, in cleaning solvent. Blow dry with compressed air.
3. Examine the clutch components as follows:
   a. Check all clutch plates for wear and discoloration.
   b. Inspect each steel (drive) plate for grooves.
   c. Place each steel plate on a flat surface. Using a feeler gauge, check for flatness in several places. Replace any plates that are damaged or are warped more than 0.006 in. (0.15 mm).
4. Inspect the damper spring for cracks or distortion. Install a **new** spring if either condition exists.
5. See Figure 5-15. Check fiber plates for thickness.
   a. Wipe the lubricant from the eight fiber plates (7 regular and 1 narrow) and stack them on top of each other.
   b. Measure the thickness of the eight stacked fiber plates with a dial caliper or micrometer. The minimum thickness must be 0.661 in. (16.789 mm).
   c. If the thickness is less than specified, discard the fiber plates and steel plates. Install a new set of both friction and steel plates.
6. See Figure 5-16. Inspect primary chain sprocket (1) and the starter ring gear (2) on the clutch shell. If either sprocket or ring gear are badly worn or damaged, replace the clutch shell. See 5.6 PRIMARY CHAIN.
7. Inspect slots that mate with the clutch plates on both clutch shell (4) and hub (3). If slots are worn or damaged, replace shell and/or hub. See 5.6 PRIMARY CHAIN.

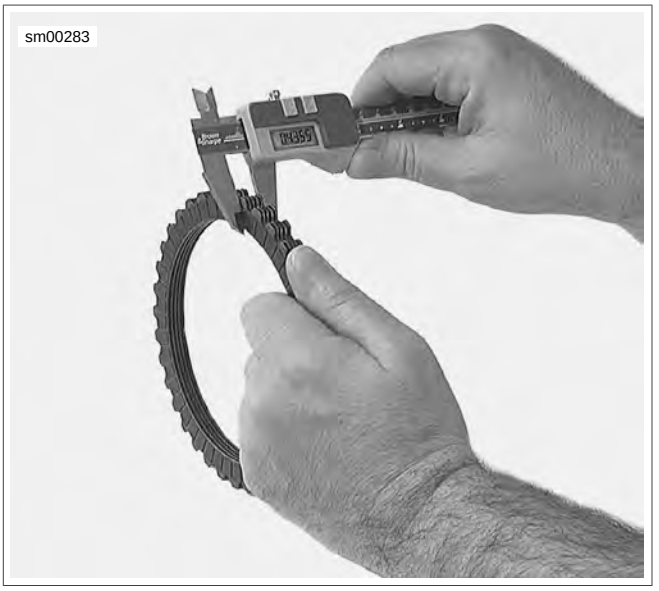
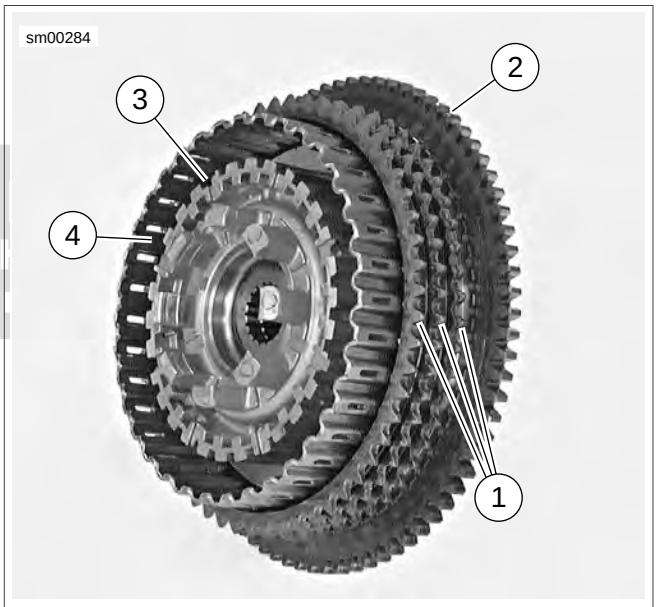


Figure 5-15. Measuring Friction Plates



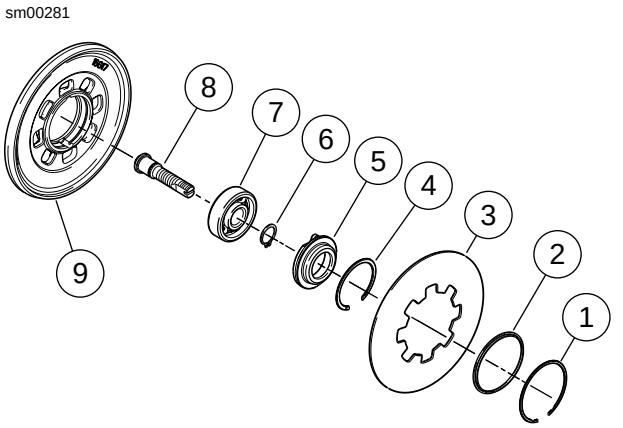
1. **Primary chain sprocket**
2. **Starter ring gear**
3. **Slots on clutch hub**
4. **Slots on clutch shell**

Figure 5-16. Checking Clutch Shell (Shell Removed from Primary Shaft)

ADJUSTING SCREW DISASSEMBLY/ASSEMBLY

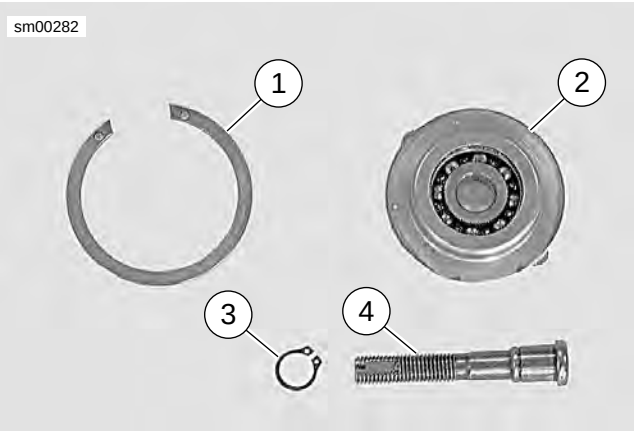
1. See Figure 5-17. Remove adjusting screw assembly.
   a. Remove large retaining ring.
   b. Remove adjusting screw assembly from pressure plate.

2. If necessary, disassemble adjusting screw assembly.
   a. Remove and discard small retaining ring (6).
   b. Separate the adjusting screw (8) from the bearing (7) and release plate (5).
   c. Remove bearing (7) from release plate (5).
3. Replace components as required and reassemble adjusting screw assembly in reverse order.
4. Install adjusting screw assembly into pressure plate.
   a. See Figure 5-23. Align two tabs on perimeter of release plate with corresponding recesses (3) in pressure plate.
   b. Secure the adjusting screw assembly with **new** retaining ring.



1. **Retaining ring**
2. **Spring seat**
3. **Diaphragm spring**
4. **Retaining ring**
5. **Release plate**
6. **Retaining ring**
7. **Bearing**
8. **Adjusting screw**
9. **Pressure plate**

Figure 5-17. Adjusting Screw Assembly



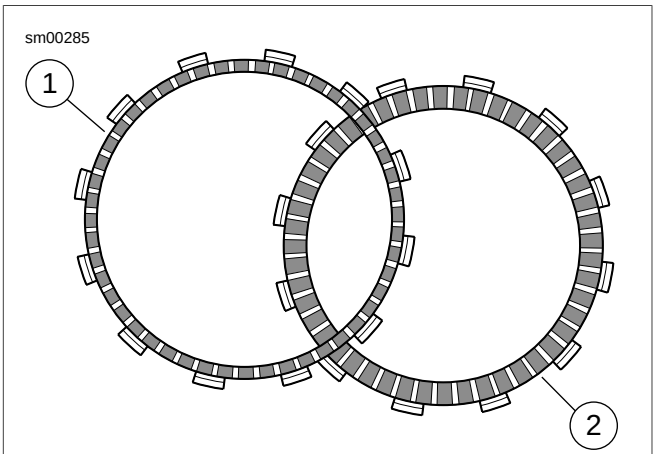
1. **Retaining ring**
2. **Bearing and release plate**
3. **Retaining ring**
4. **Adjusting screw**

Figure 5-18. Adjusting Screw Assembly

ASSEMBLY AND INSTALLATION

PART NUMBER	TOOL NAME
HD-38515-A	SPRING COMPRESSING TOOL

1. Submerge and soak all friction and steel plates in GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT for at least five minutes.
2. See Figure 5-19. Install narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
3. See Figure 5-20. Install damper spring seat (5) on clutch hub so that it seats inboard of narrow friction plate (4).
4. Install damper spring (1) on clutch hub with the concave side up (facing opposite damper spring seat).
5. Install a steel plate and then a friction plate on the clutch hub. Install six remaining sets in the same manner, alternating between steel plates and friction plates.



1. **Narrow plate**
2. **Regular plate**

Figure 5-19. Friction Plates

6. Place pressure plate, diaphragm spring, adjusting screw assembly with **new** retaining ring and spring seat onto clutch pack.
   a. See Figure 5-21. Align square openings of pressure plate and diaphragm spring so that the assembly can be installed over prongs on clutch hub.
   b. Position spring seat with its larger outer diameter side toward diaphragm spring.

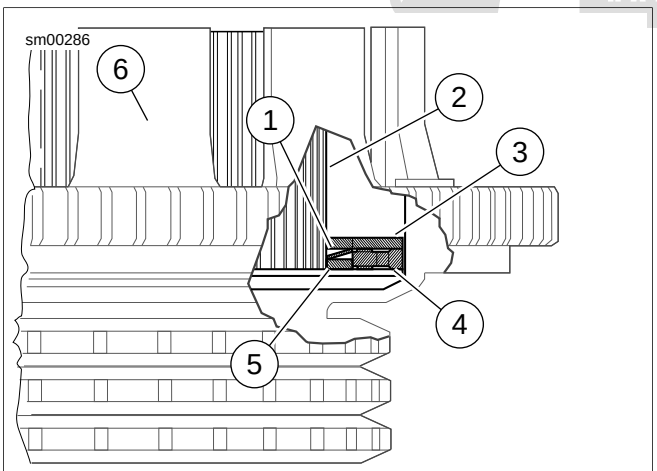
NOTE

See Figure 5-22. Turn compressing tool handle only the amount required to install spring seat and snap ring. Excessive compression of diaphragm spring could damage clutch pressure plate.

   c. See Figure 5-22. Install SPRING COMPRESSING TOOL (Part No. HD-38515-A)onto clutch hub against diaphragm spring.
   d. Place a wrench on the clutch spring forcing screw flats to prevent the forcing screw from turning.
   e. Turn compressing tool handle clockwise until diaphragm spring compresses just enough to install new retaining ring into the groove in clutch hub prongs.
   f. With retaining ring fully seated in groove of clutch hub, carefully loosen and remove compression tool.

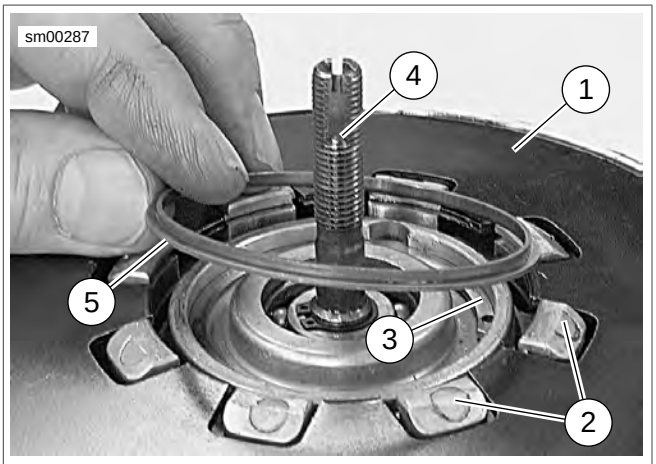
NOTE

When the compressing tool is removed, the diaphragm spring will move outward forcing the spring seat up into the inside of the retaining ring. The spring seat provides an operating surface for the diaphragm spring at the same time preventing the retaining ring from coming out during operation.



1. **Damper spring**
2. **Clutch hub**
3. **Steel plate**
4. **Narrow friction plate**
5. **Damper spring seat**
6. **Clutch shell**

Figure 5-20. Clutch Pack Stack-Up (Cut-Away View)

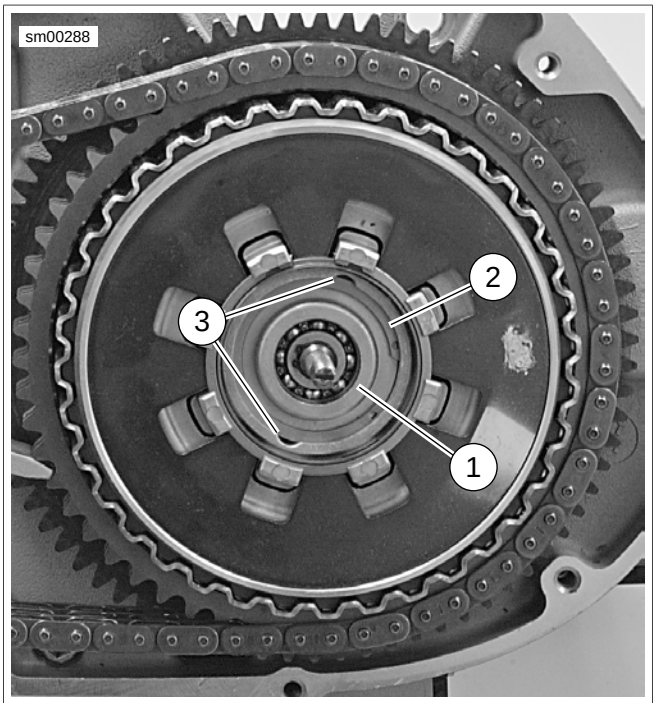


1. **Diaphragm spring (pressure plate below)**
2. **Prongs on clutch hub**
3. **Retaining ring**
4. **Adjusting screw assembly**
5. **Spring seat**

Figure 5-21. Spring Seat Installation

1. **Tool handle**
2. **Washer**
3. **Bearing**
4. **Bridge**
5. **Forcing screw**
6. **Diaphragm spring**
7. **Snap ring**
8. **Pressure plate**
9. **Spring seat**

Figure 5-22. Pressure Plate Assembly



1. **Adjusting screw assembly**
2. **Retaining ring**
3. **Tab recesses**

Figure 5-23. Clutch Adjusting Screw Assembly and Retaining Ring

7. Install primary cover. See 5.3 PRIMARY COVER.
8. Adjust clutch. See 5.5 CLUTCH.
9. Fill with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05). See 5.5 CLUTCH.
10. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

WARNING

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

11. Install seat.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

PRIMARY CHAIN 5.6

GENERAL

Since the primary chain runs in lubricant, little service will be required other than checking lubricant level and chain tension. If, through hard usage, the primary chain does become worn and cannot be adjusted to within specifications, it must be replaced. See 1.11 PRIMARY CHAIN.

An opening between the primary drive and transmission compartments allows the same lubricant supply to lubricate moving parts in both areas.

REMOVAL

PART NUMBER	TOOL NAME
HD-38362 FOR XB9 MODELS	SPROCKET LOCKING LINK
HD-46283 FOR XB12 MODELS	SPROCKET LOCKING LINK
HD-97292-61	TWO CLAW PULLER

⚠WARNING

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

1. Remove negative battery cable from battery.
2. Drain the transmission fluid. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid.
3. Remove primary cover. See 5.3 PRIMARY COVER.
4. Loosen engine sprocket.
   a. See Figure 5-24. Install SPROCKET LOCKING LINK (Part No. HD-38362 for XB9 models) or SPROCKET LOCKING LINK (Part No. HD-46283 for XB12 models).
   b. Remove the engine sprocket bolt.
   c. Loosen but do not remove engine sprocket. If necessary, use the slotted portion of TWO CLAW PULLER (Part No. HD-97292-61) and two bolts to loosen the engine sprocket.
5. See Figure 5-25. Remove adjusting screw assembly.
   a. Remove large retaining ring (1).
   b. Remove adjusting screw assembly from pressure plate.

NOTE

See Figure 5-26. Mainshaft nut has left-hand threads. To prevent damage, turn nut clockwise to loosen and remove from mainshaft.

6. Remove mainshaft nut and washer.
7. Remove the clutch, clutch shell/hub, primary chain and engine sprocket as a unit.

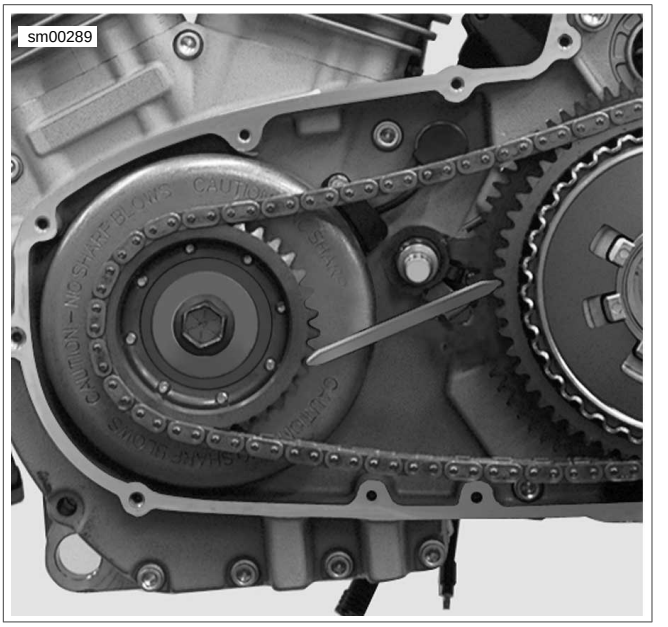
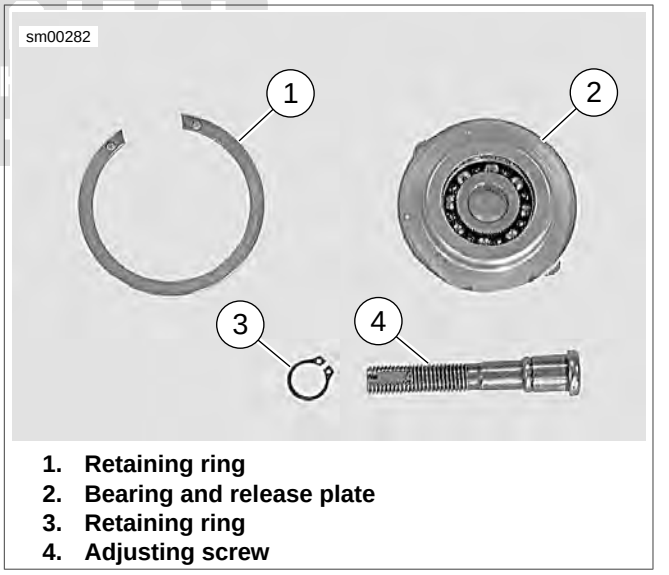
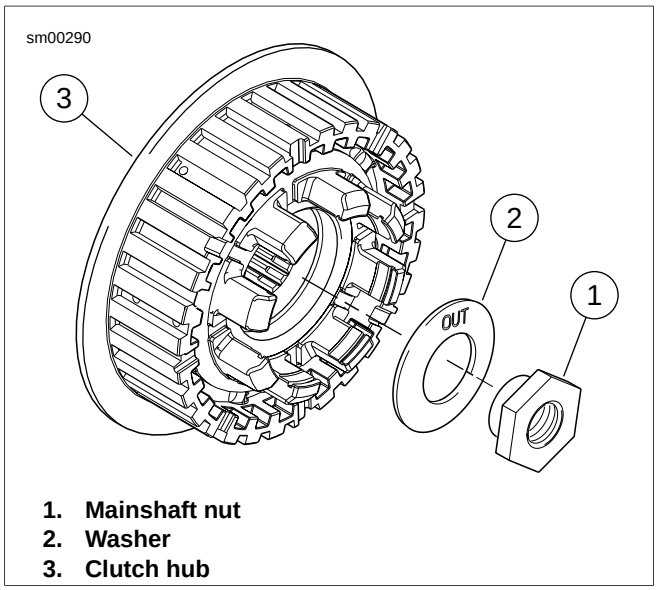


Figure 5-24. Sprocket Locking Link Tool (Specific tool for XB9 models, Specific tool for XB12 models)



1. **Retaining ring**
2. **Bearing and release plate**
3. **Retaining ring**
4. **Adjusting screw**

Figure 5-25. Adjusting Screw Assembly



1. **Mainshaft nut**
2. **Washer**
3. **Clutch hub**

Figure 5-26. Mainshaft Nut and Washer

CLUTCH SHELL/HUB INSPECTION

1. Separate primary chain, engine sprocket and clutch shell/hub assembly.
2. Inspect engine sprocket for damage or excessive wear. Replace as required.
3. Attach tools to compress clutch diaphragm spring and remove pressure plate assembly. See 5.5 CLUTCH.

NOTE

The clutch hub and clutch shell are no longer pressed together. There are no retaining rings securing the clutch hub to the clutch shell. Once the pressure plate assembly has been removed the clutch hub will slide out of the clutch shell.

4. Remove clutch pack. Disassemble, clean and inspect clutch pack. See 5.5 CLUTCH, Clutch Pack Cleaning and Inspection.
5. Disassemble adjusting screw assembly and inspect bearing, release plate, and adjusting screw. See 5.5 CLUTCH, General.
6. Remove clutch hub from clutch shell. Inspect primary chain sprocket and the starter ring gear on the clutch shell.
7. Inspect slots that mate with the clutch plates on both clutch shell and hub.
8. See Figure 5-27. Inspect the clutch shell compensating spring set.

NOTE

As you proceed around the back of the clutch shell, the compensating springs go from being loaded to unloaded so it is possible for the clutch springs to float and move during inspection. This condition is normal.

9. See Figure 5-28. Inspect clutch shell needle bearing for smoothness. Rotate the clutch shell while holding the clutch hub. If bearing is rough or binds, it must be replaced. See 5.6 PRIMARY CHAIN, Clutch Shell Bearing Replacement.
10. See Figure 5-29. Inspect clutch shell bearing inner race on the back side of the clutch hub for pitting and wear. If the inner race shows any of these signs the complete hub assembly must be replaced.
11. Replace damaged parts as necessary.

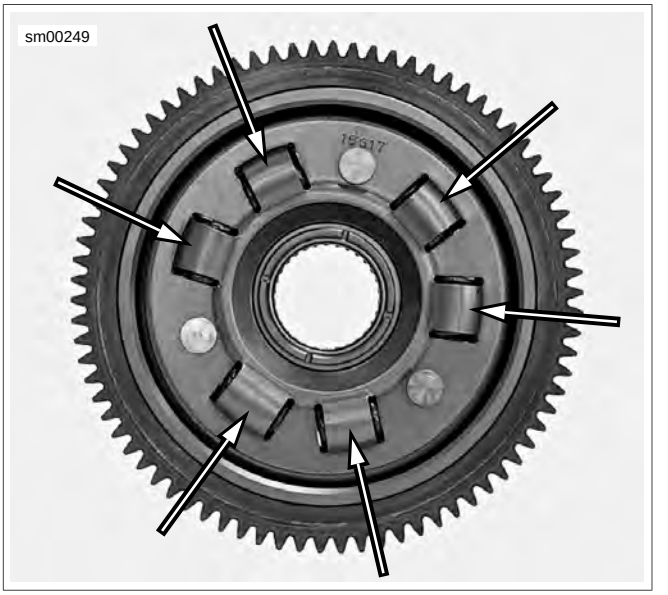
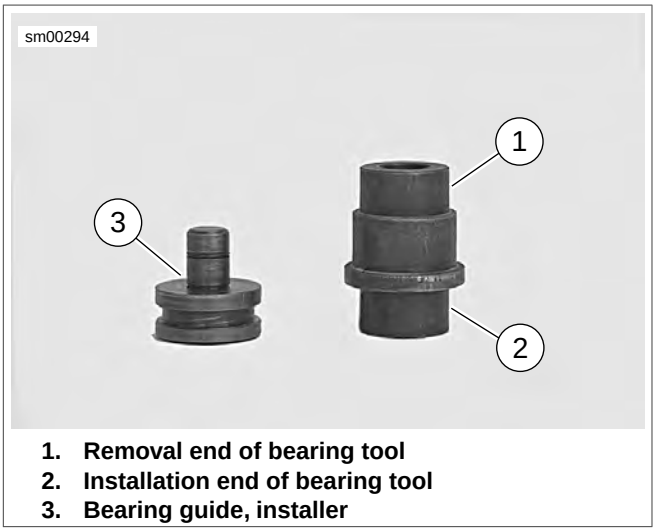


Figure 5-27. Compensating Spring Set

Figure 5-28. New Needle Bearing in Clutch Shell

Figure 5-29. Clutch Hub Bearing Race



1. **Removal end of bearing tool**
2. **Installation end of bearing tool**
3. **Bearing guide, installer**

Figure 5-30. Clutch Shell Bearing Remover/Installer

CLUTCH SHELL BEARING REPLACEMENT

PART NUMBER	TOOL NAME
B-45926	CLUTCH SHELL BEARING REMOVER/INSTALLER

NOTE

The clutch shell uses a caged needle bearing that corresponds to an inner race installed on the clutch hub.

1. See Figure 5-31. Place clutch shell on support blocks with sprocket side facing up.

NOTE

The CLUTCH SHELL BEARING REMOVER/INSTALLER (Part No. B-45926) is clearly marked for removal and installation purposes.

2. See Figure 5-31. Insert removal end of tool into bearing assembly and remove bearing from clutch shell.
3. See Figure 5-32. Remove bearing guide from end of CLUTCH SHELL BEARING REMOVER/INSTALLER (Part No. B-45926).
4. Place **new** needle bearing onto installer end of tool and insert the bearing guide to prevent the bearing from falling off during installation and to align bearing with clutch shell.
5. See Figure 5-33. Place clutch shell on support blocks with sprocket side facing up.
6. Press bearing into clutch shell until tool bottoms on the shell. This will be the correct installed height.

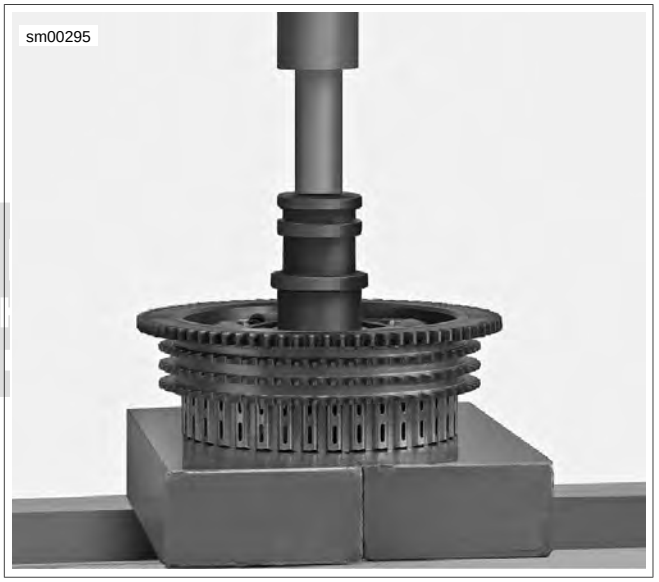
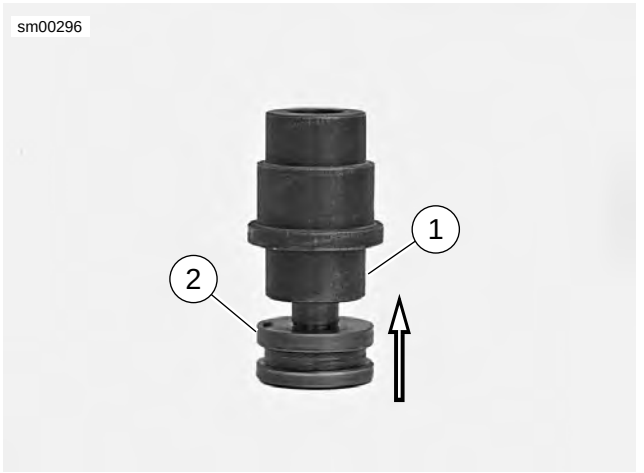
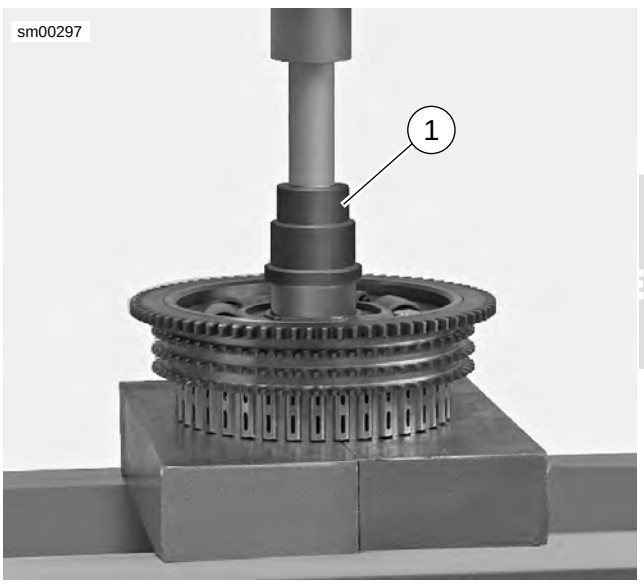


Figure 5-31. Removing Clutch Shell Needle Bearing



1. **Place needle bearing on tool in this location**
2. **Bearing guide**

Figure 5-32. Bearing Installer



1. **Needle bearing**

Figure 5-33. Installing Clutch Shell Needle Bearing

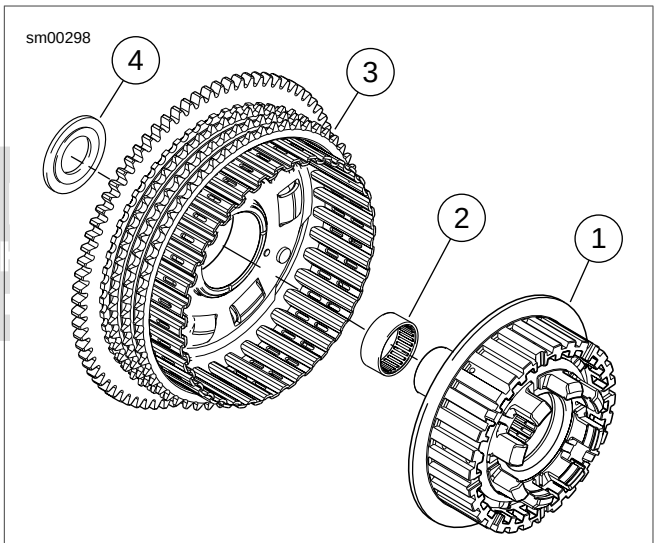
INSTALLATION

PART NUMBER	TOOL NAME
HD-38362 FOR XB9 MODELS	SPROCKET LOCKING LINK
HD-46283 FOR XB12 MODELS	SPROCKET LOCKING LINK

NOTE

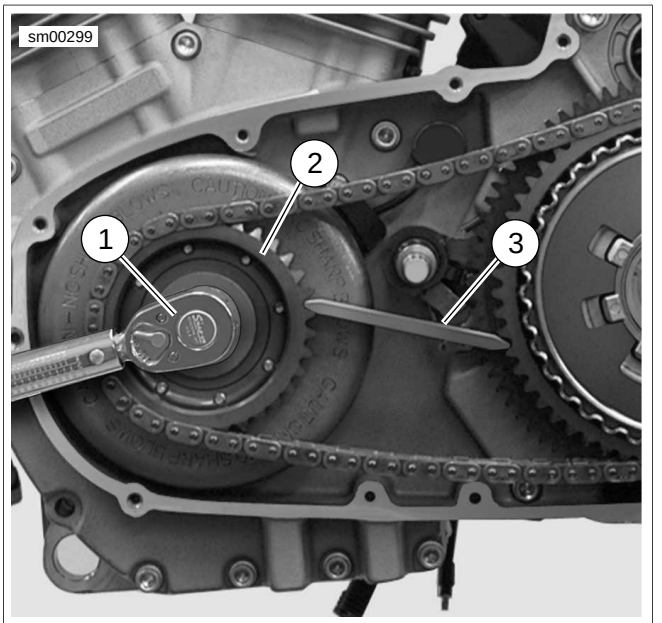
Prior to installing engine sprocket bolt and the clutch hub nut, the threads on the sprocket shaft, sprocket bolt, mainshaft and clutch hub nut must be thoroughly cleaned to remove any oil that might contaminate and interfere with the locking agent.

1. See Figure 5-34. Assemble clutch hub (1) and shell (3) by sliding inboard end of clutch hub into shell bearing (2) by hand. No tools are required.
2. Submerge and soak all friction and steel plates in FORMULA+ PRIMARY/TRANSMISSION LUBRICANT for at least five minutes and assemble clutch pack in sequence in the clutch hub. See 5.5 CLUTCH, General.
3. Verify that outer thrust washer (4) is installed on transmission shaft.
4. Install the engine sprocket, clutch assembly and primary chain as a unit into primary chaincase.
5. See Figure 5-35. Install the engine sprocket bolt.
   a. Install SPROCKET LOCKING LINK (Part No. HD-38362 for XB9 models) or SPROCKET LOCKING LINK (Part No. HD-46283 for XB12 models).
   b. Apply two or three drops of LOCTITE 271 (red) onto threads of sprocket shaft.
   c. Install engine sprocket bolt. Tighten to 155-165 ft-lbs (210-224 Nm).



1. **Clutch hub**
2. **Needle bearing**
3. **Clutch shell**
4. **Thrust washer, outer**

Figure 5-34. Clutch Hub and Shell Assembly

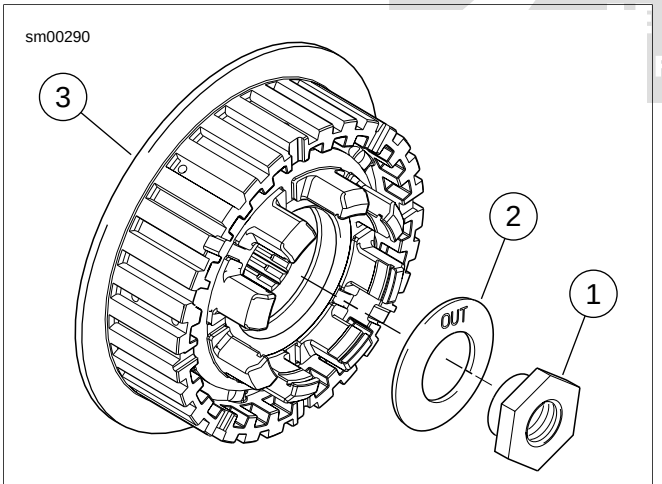


1. **Torque wrench**
2. **Engine sprocket**
3. **Sprocket locking link**

Figure 5-35. Sprocket Locking Link Tool

NOTE

See Figure 5-36. Washer must be installed with the word "out" facing the mainshaft nut or transmission may be damaged.



1. **Mainshaft nut**
2. **Washer**
3. **Clutch hub**

Figure 5-36. Mainshaft Nut and Washer

NOTE

New mainshaft nut comes with a chemical lock patch making it unnecessary to use LOCTITE with new fastener.

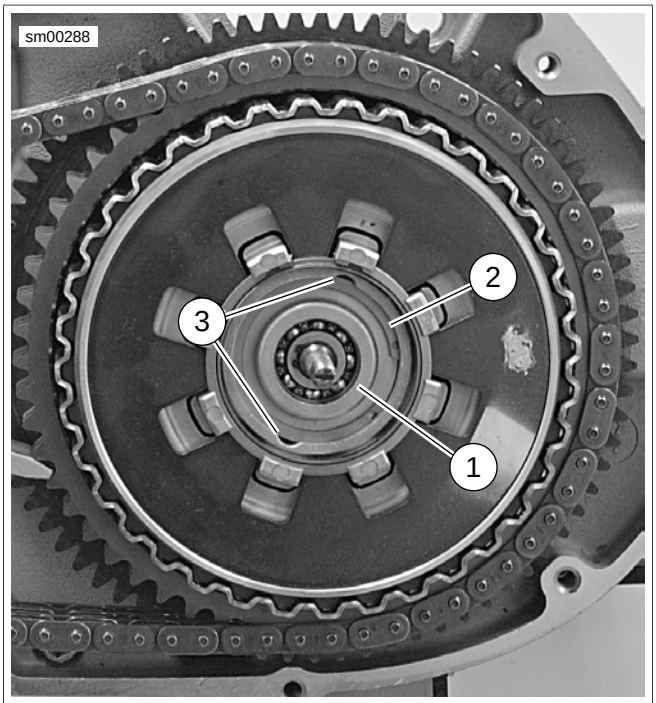
6. See Figure 5-36. Install mainshaft washer (2) and nut (1).
   a. If using original mainshaft nut apply two or three drops of LOCTITE 271 (red) onto threads on end of mainshaft.
   b. Place washer (2) on mainshaft with the word "out" facing away from clutch hub.
7. Install nut (left-hand threads) (1). Tighten to 70-80 ft-lbs (94.9-108.5 Nm). Remove SPROCKET LOCKING LINK.
8. Install the pressure plate assembly. See 5.5 CLUTCH.
9. Install adjusting screw assembly into pressure plate.
   a. See Figure 5-38. Align two tabs on perimeter of release plate with corresponding recesses (3) in pressure plate.
   b. Secure the adjusting screw assembly with **new** retaining ring.
10. Install primary cover. See 5.3 PRIMARY COVER.
11. Adjust clutch. See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID.
12. Add GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05). See 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid.
13. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠ WARNING

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

14. Install seat.

Figure 5-37. Adjusting Screw Assembly Aligning Tabs



1. Adjusting screw assembly
2. Retaining ring
3. Tab recesses

Figure 5-38. Clutch Adjusting Screw Assembly and Retaining Ring

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

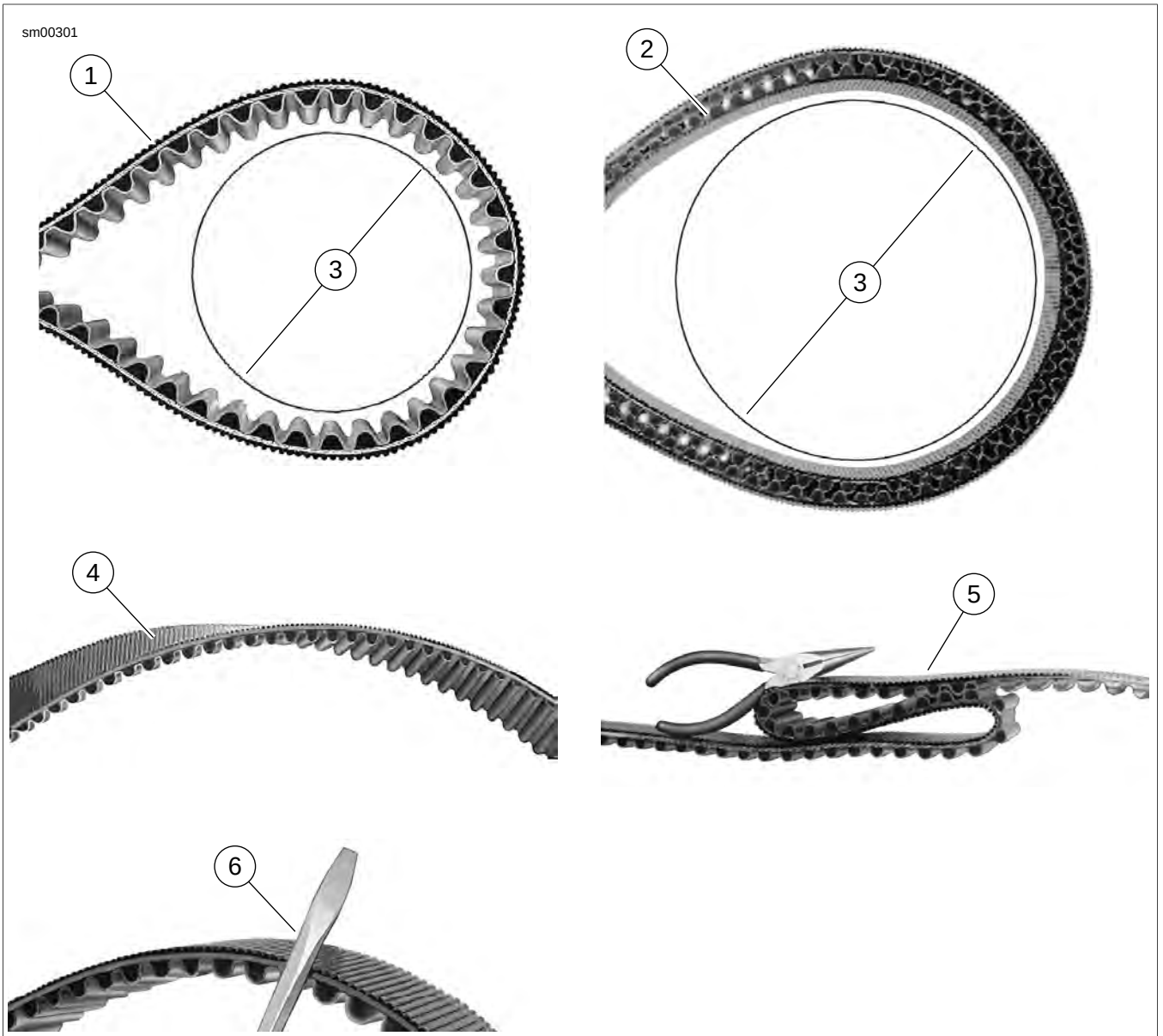
DRIVE BELT AND IDLER PULLEY 5.7

GENERAL

There is no drive belt adjustment required. The system utilizes a fixed idler pulley that maintains the desired tension throughout suspension travel and life of the belt.

NOTE

See Figure 5-39. Mishandling drive belt will result in premature failure. For maximum strength, integrity and longevity, avoid over bending, twisting, crimping, pinching, kinking or prying the drive belt.



1. **Forward bend must not be less than 5 in. (127 mm)**
2. **Reverse bend must not be less than 10 in. (254 mm)**
3. **Minimum diameter**
4. **Do not twist belt**
5. **Do not crimp, pinch or kink belt**
6. **Do not pry belt**

Figure 5-39. Proper Drive Belt Handling

DRIVE BELT REMOVAL

1. Place a scissor jack under jacking point and raise rear wheel off ground. For location of jacking point, see 4.18 EXHAUST SYSTEM.
2. Remove right side rider footpeg support bracket. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING or 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.

NOTE

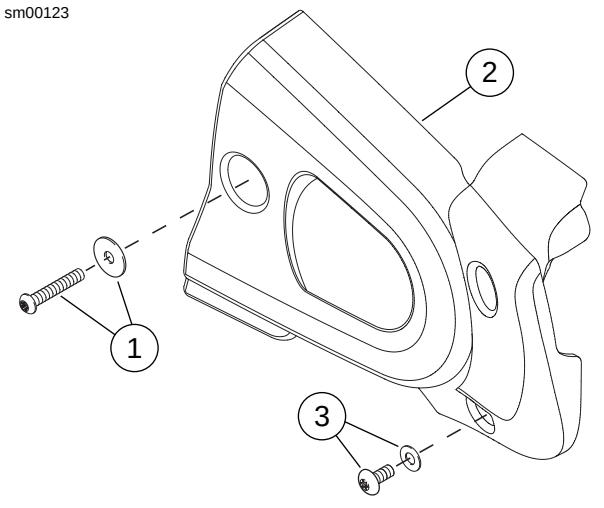
The right rear chin fairing fasteners must be removed to access the front sprocket cover.

3. Remove right rear chin fairing fasteners. See 2.50 CHIN FAIRING.
4. Remove the rear fender (XB12Ss, XB12XT, XB12X and XB12XP models only). See 2.15 FENDERS.
5. Remove lower belt guard. See 2.37 BELT GUARDS.
6. See Figure 5-40. Remove sprocket cover (2) by removing fasteners. See 2.36 SPROCKET COVER.
7. See Figure 5-41. Loosen rear axle pinch bolt (2).
8. Loosen rear axle (1) approximately 15 rotations to allow partial tension to be removed from rear drive system.
9. Remove idler pulley assembly by removing nuts and washers. See in 5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Removal.
10. Remove swingarm brace. See 2.19 SWINGARM AND BRACE.

NOTE

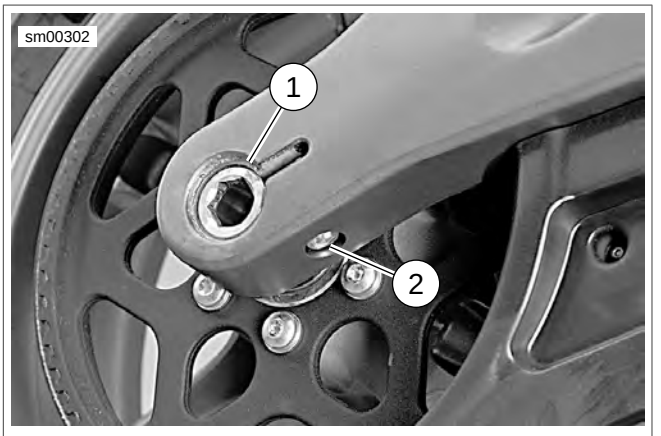
When removing or installing belt, do not bend or twist belt. Partially slide belt onto sprocket and rotate wheel or belt damage will occur.

11. Slide belt from sprocket and remove.



1. **Long fastener and washer**
2. **Sprocket cover**
3. **Short fastener and washer (2)**

Figure 5-40. Sprocket Cover



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

Figure 5-41. Rear Axle

DRIVE BELT INSTALLATION

NOTES

- *When removing or installing belt, do not bend or twist belt. Partially slide belt onto sprocket and rotate wheel or belt damage will occur.*
- *Never tighten rear axle with swingarm brace removed.*

1. Slide belt onto sprocket.
2. Install swingarm brace and tighten fasteners to 25-27 ft-lbs (34-37 Nm). See 2.19 SWINGARM AND BRACE.

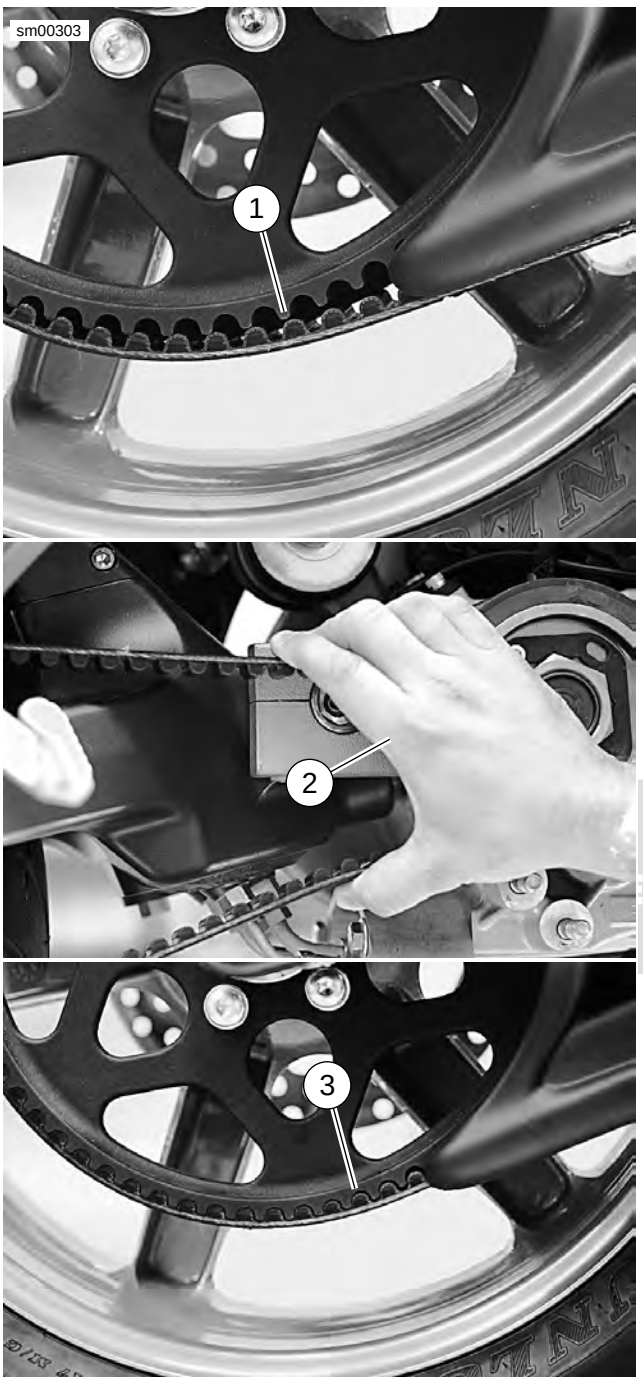
NOTE

See Figure 5-42. Occasionally the drive belt is not fully seated in rear sprocket making it difficult to install the idler pulley. It will be necessary to follow the outlined procedure in order to easily install idler pulley.

3. See Figure 5-42. Grasp top and bottom of drive belt and squeeze together until belt teeth are fully seated in rear sprocket.
4. While keeping tension on lower belt, install idler pulley assembly tightening washers and nuts to 33-35 ft-lbs (45-47 Nm).
5. See Figure 5-43. Tighten rear axle (1) to 23-27 ft-lbs (31.2-36.6 Nm), back off two full turns and then retighten to 48-52 ft-lbs (65-70.5 Nm).
6. Tighten rear axle pinch fastener (2) to 40-45 ft-lbs (54-61 Nm).
7. See Figure 5-41. Install front sprocket cover. See 2.36 SPROCKET COVER.
8. Install chin fairing. See 2.50 CHIN FAIRING.
9. Install right side rider footpeg mount. See 2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING or 2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS.
10. Install lower belt guard. See 2.37 BELT GUARDS.
11. Install rear fender (XB12Ss, XB12XT, XB12X and XB12XP models only). See 2.15 FENDERS.

DIGITAL TECHNICIAN II

12. Remove scissor jack from motorcycle.



1. **Drive belt not fully seated in rear sprocket**
2. **Squeezing drive belt in order to seat in pulleys**
3. **Drive belt fully seated in rear sprocket**

Figure 5-42. Seating Drive Belt Into Pulley Teeth

IDLER PULLEY REMOVAL

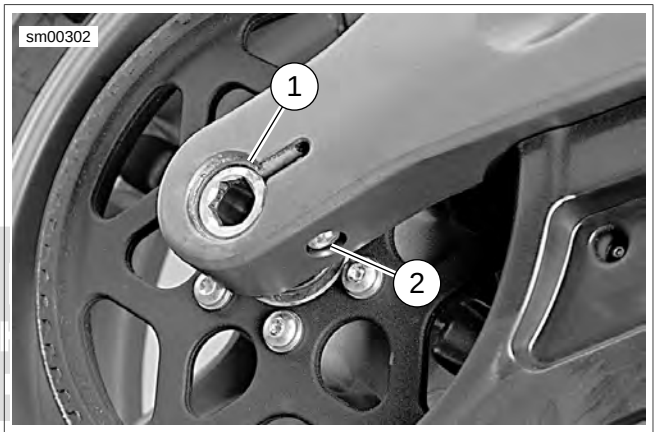
NOTE

On the Ulysses models, it is necessary to remove the right side rider footrest support in order to remove the idler pulley.

1. See Figure 5-43. Loosen rear axle pinch bolt (2).
2. Unthread axle approximately 15 rotations to release tension from drive belt.
3. Remove chin fairing fasteners. See 2.50 CHIN FAIRING.
4. Remove front sprocket cover. See 2.36 SPROCKET COVER.
5. See Figure 5-44. Remove idler pulley bracket nuts and washers (5) from studs (3).
6. Slide idler pulley bracket (4) off studs (3).
7. Inspect pulley by spinning wheel (1) and checking for wheel bearing wear. See 1.10 DRIVE BELT MAINTENANCE, Inspection.
8. If pulley wheel needs replacement, remove fastener (6), washer and nut (2) from idler pulley bracket (4) and discard wheel. Replace with **new** pulley wheel (1).

NOTE

The pulley wheel bearings can not be replaced separately.



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

Figure 5-43. Rear Axle

IDLER PULLEY INSTALLATION

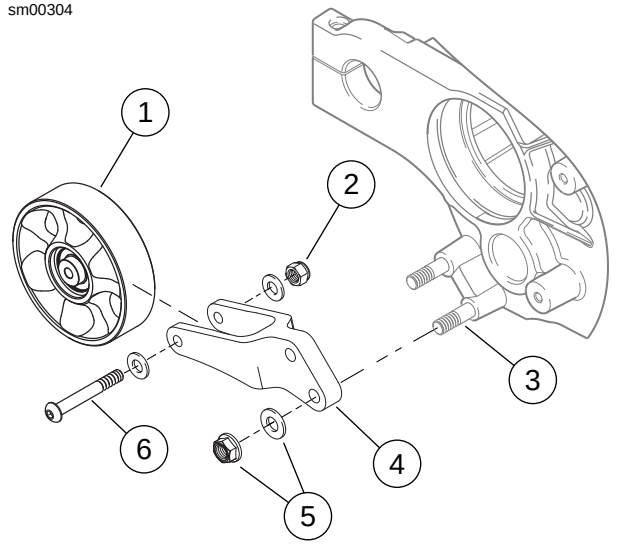
1. See Figure 5-44. Install **new** or existing pulley wheel (1), if removed, and tighten washer and nut (2) to wheel fastener (6) to 20-23 ft-lbs (27.1-31.2 Nm).
2. Slide idler pulley bracket (4). Install washer and nuts (5) on to studs (3) and tighten to 33-35 ft-lbs (45-47 Nm). See 5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation.
3. Install front sprocket cover. See 2.36 SPROCKET COVER.
4. Apply LOCTITE 271 (red) and install chin fairing fasteners. Tighten to 36-48 **in-lbs** (4-5 Nm). See 2.50 CHIN FAIRING.

NOTE

Never tighten rear axle with swingarm brace removed.

5. See Figure 5-43. Install and tighten rear axle (1) to 23-27 ft-lbs (31.2-36.6 Nm), back off two full turns and then retighten to 48-52 ft-lbs (65-70.5 Nm). See 2.6 REAR WHEEL.

6. Tighten rear axle pinch fastener (2) to 40-45 ft-lbs (54-61 Nm).



1. **Wheel**
2. **Wheel nut**
3. **Stud (2)**
4. **Idler pulley bracket**
5. **Idler pulley bracket nut and washer (2)**
6. **Wheel fastener**

Figure 5-44. Idler Pulley Assembly

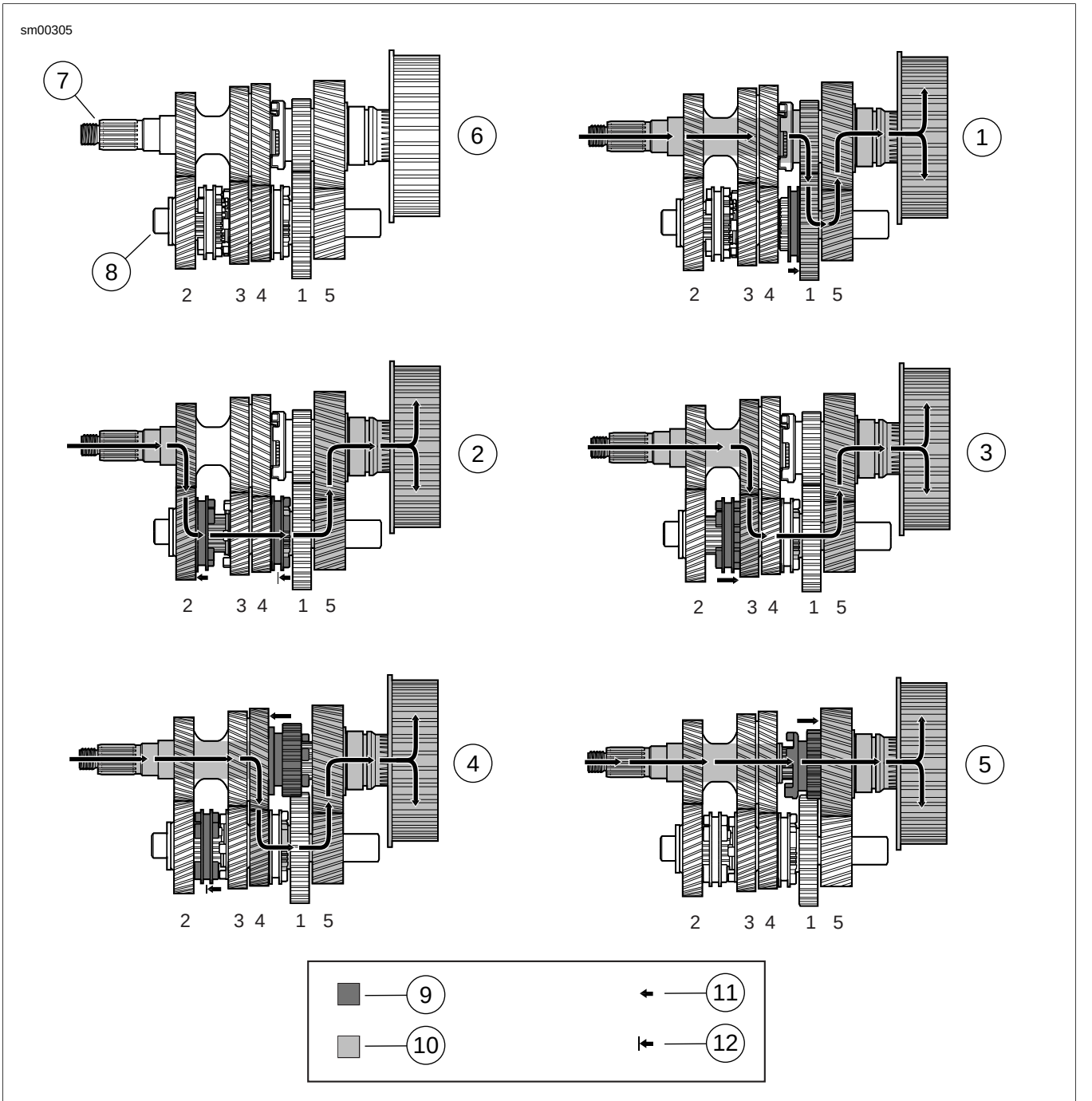
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TRANSMISSION 5.8

GENERAL

See Figure 5-45. The transmission is a five-speed constant-mesh type housed in an extension of the crankcase. The transmission permits the rider to vary the ratio of engine speed-to-rear driving wheel speed in order to meet the varying conditions of operation.

The transmission is foot-operated by the gear shifter lever, which transmits the force through a gear shifter shaft. The shifter shaft actuates a pawl and a shifter fork drum. The shifter fork drum moves shifter forks, which slide a series of shifter dogs on the mainshaft and countershaft, into and out of mesh with the other gears.



1. First gear
2. Second gear
3. Third gear
4. Fourth gear
5. Fifth gear
6. Neutral
7. Mainshaft
8. Countershaft
9. Sliding members (dark gray)
10. Power flow (light gray)
11. Shifter dog engaging
12. Shifter dog disengaging

Figure 5-45. Transmission Power Flow

CASE DISASSEMBLY FOR TRANSMISSION REMOVAL 5.9

GENERAL

The rear compartment of the left and right crankcase halves form the transmission case. Servicing of transmission components requires removing the engine and disassembling (splitting) the crankcase.

RIGHT CRANKCASE REMOVAL

PART NUMBER	TOOL NAME
HD-42310/HD-43646 OR HD-43682	ENGINE SUPPORT STAND

1. Remove transmission sprocket. See 5.17 TRANSMISSION SPROCKET.
2. Remove engine from chassis. See 3.5 ENGINE REMOVAL.
3. Support engine using ENGINE SUPPORT STAND (Part No. HD-42310/HD-43646 or HD-43682).
4. Disassemble top end. See 3.7 CYLINDER HEAD.
5. Disassemble gearcase. See 3.17 GEARCASE AND CAM GEARS.
6. Remove primary cover. See 5.3 PRIMARY COVER.
7. Remove clutch assembly, primary chain and engine sprocket. See 5.6 PRIMARY CHAIN and 5.5 CLUTCH.

Figure 5-46. Hex Fastener Countershaft Retainer

8. See Figure 5-46. Place transmission in first gear. Remove hex fastener.

Figure 5-47. Shifter Drum Neutral Detent

9. See Figure 5-47. Place transmission in neutral. Remove neutral switch to verify shifter drum detent is visible indicating transmission is in correct location.

Figure 5-48. Shifter Drum and Mainshaft (Transmission in Neutral)

10. See Figure 5-48. With transmission still in neutral, scribe a line on the end of the shifter drum at the 12 o' clock position for later reference.

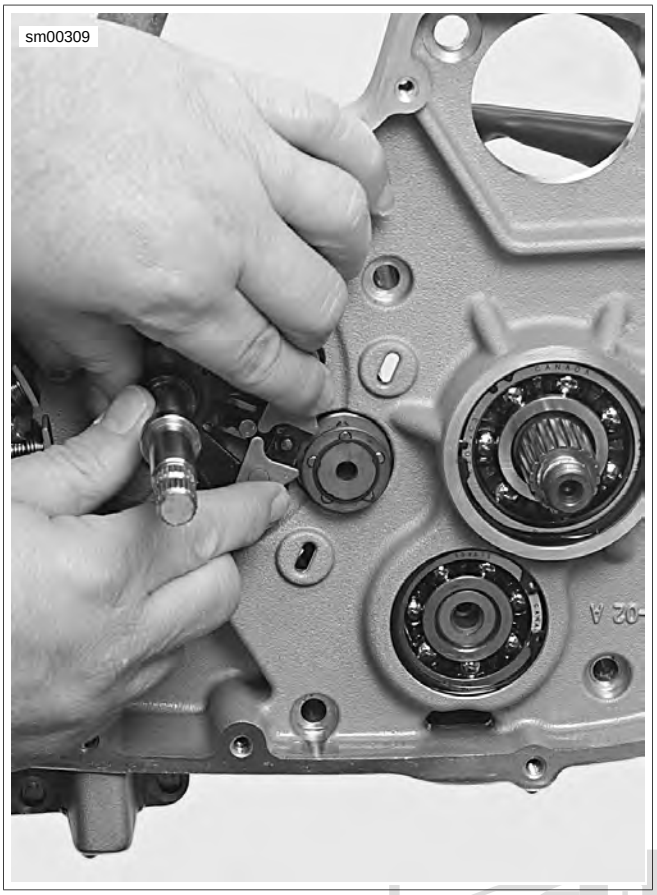
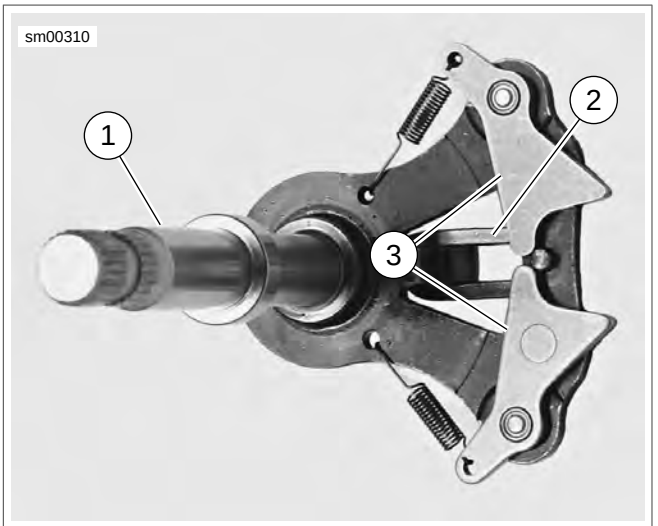


Figure 5-49. Removing Shifter Shaft Assembly

11. See Figure 5-49. Remove shifter shaft assembly.



1. **Shifter shaft**
2. **Return spring**
3. **Ratchet arms**

Figure 5-50. Shifter Shaft Assembly

12. See Figure 5-50. Depress ratchet arms (3) in order to clear the shifter drum and remove shifter shaft assembly from left crankcase half.
13. Remove starter. See {MISSING_XREF_C18-sectionC18S6}.

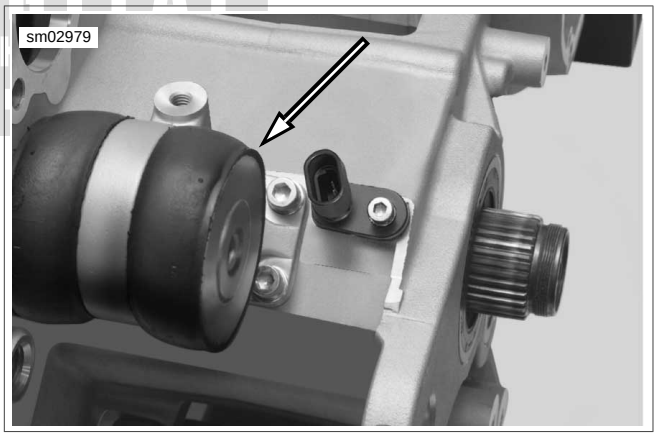
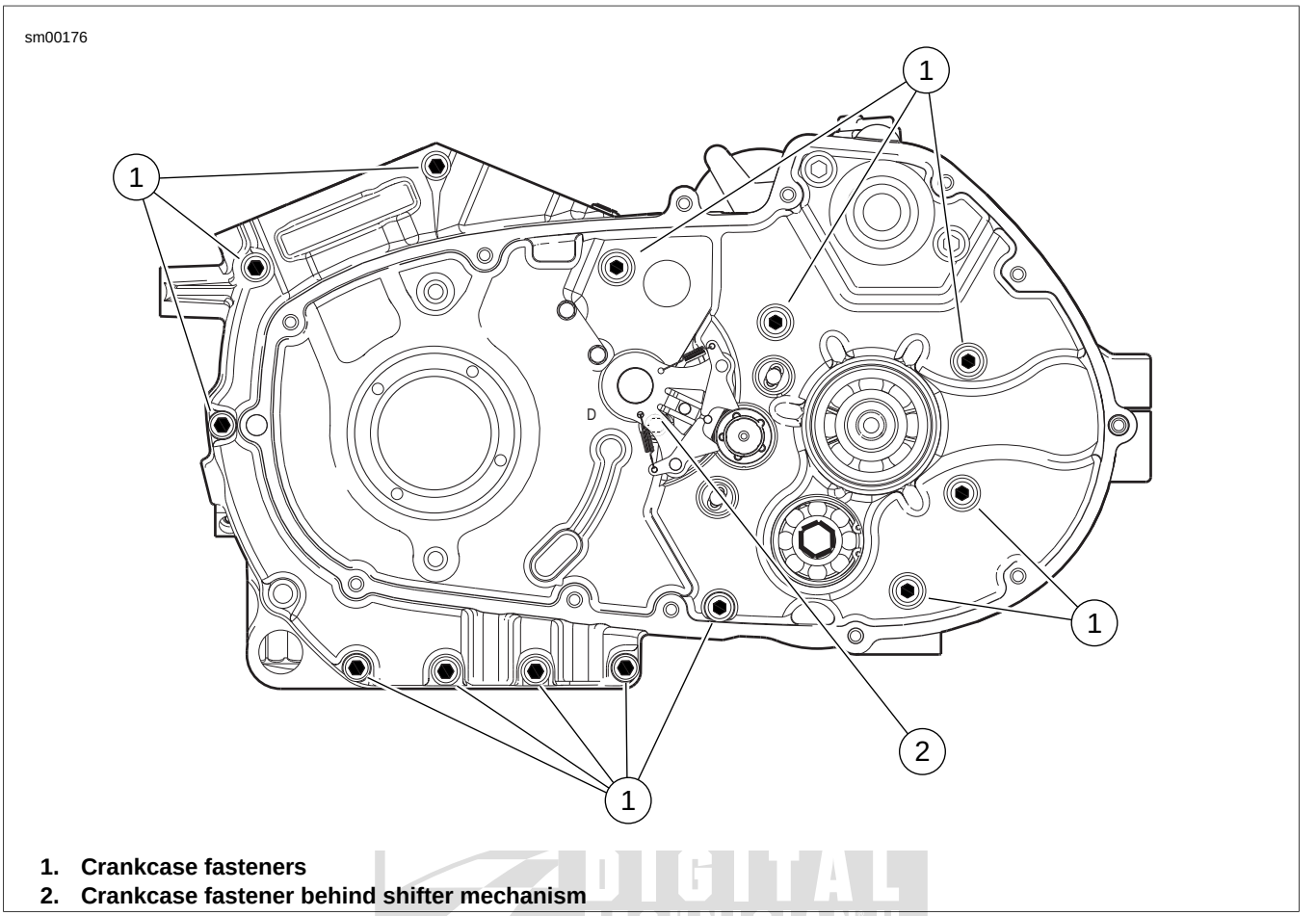


Figure 5-51. Rear Isolator Assembly

14. See Figure 5-51. Remove rear isolator assembly by removing the forward two fasteners first and then the two rear fasteners (re-install with **new** fasteners).



1. **Crankcase fasteners**
2. **Crankcase fastener behind shifter mechanism**

Figure 5-52. Crankcase Fasteners

15. See Figure 5-52. Remove crankcase bolt set (14 fasteners).

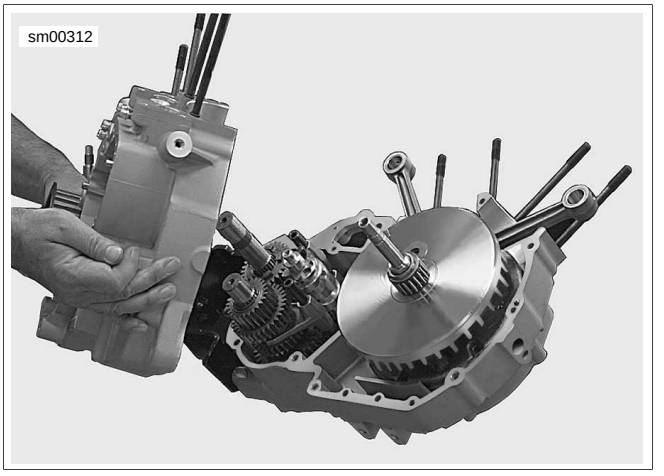


Figure 5-53. Separating Crankcase Halves

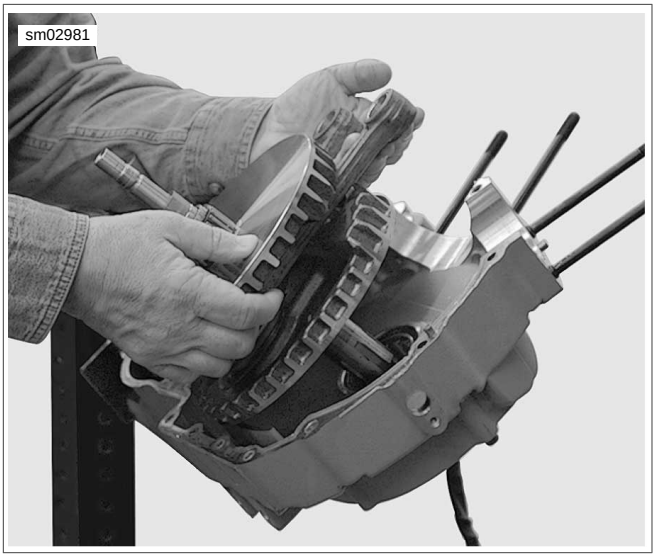


Figure 5-54. Removing Flywheels from Left Crankcase

16. See Figure 5-53. Separate crankcase halves.

NOTE

Flywheel assembly slides out of the left main bearing by hand. No tools are required for this operation.

17. See Figure 5-54. Remove the flywheel assembly from left crankcase half.

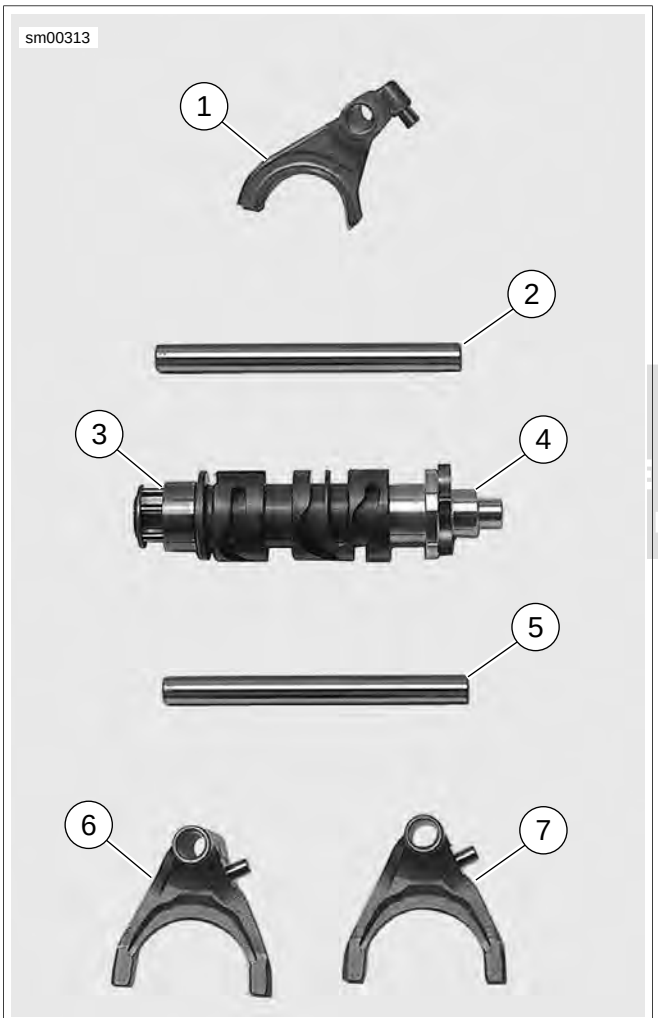
TRANSMISSION DISASSEMBLY 5.10

TRANSMISSION REMOVAL FROM LEFT CRANKCASE

PART NUMBER	TOOL NAME
B-43895-1	TRANSMISSION REMOVER

NOTE

See Figure 5-55. Shifter design allows for one common part number for both countershaft shifter forks. As the transmission runs, each shifter fork develops a certain wear pattern with its mating parts. For this reason, it is important that each shifter fork be reinstalled in its original location.



1. **Shifter fork (4th-5th)**
2. **Shifter fork shaft**
3. **Shifter drum (left side)**
4. **Shifter drum (right side)**
5. **Shifter fork shaft**
6. **Shifter fork (2nd-3rd)**
7. **Shifter fork (1st)**

Figure 5-55. Shifter Forks, Drum and Shafts

1. See Figure 5-56. Remove shifter fork shafts by inserting a small flat punch in the slots and tapping on the end of each shaft until it falls free.

NOTE

Carefully tap on alternate sides of the shaft using the provided slots.

2. See Figure 5-57. Remove shifter drum (1) and shifter forks (2). Mark each shifter fork as it is removed, so it can be reinstalled in the same location.

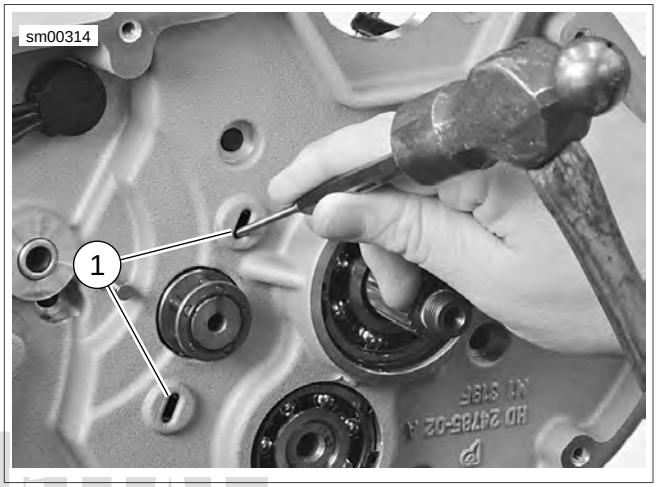
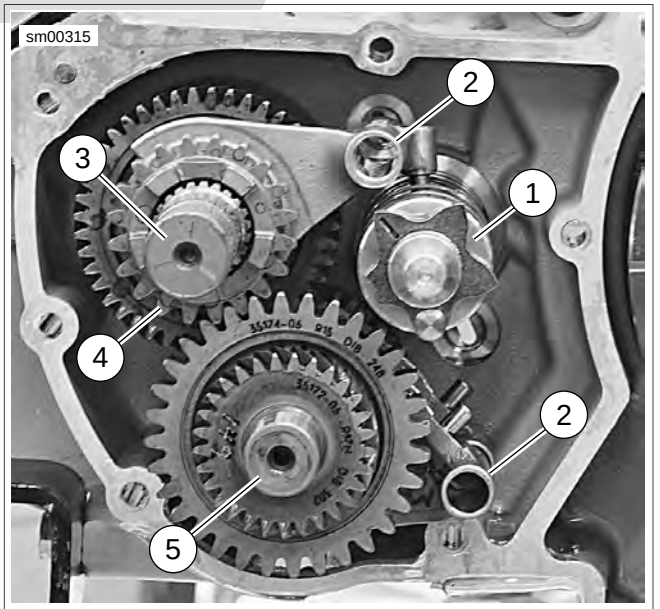
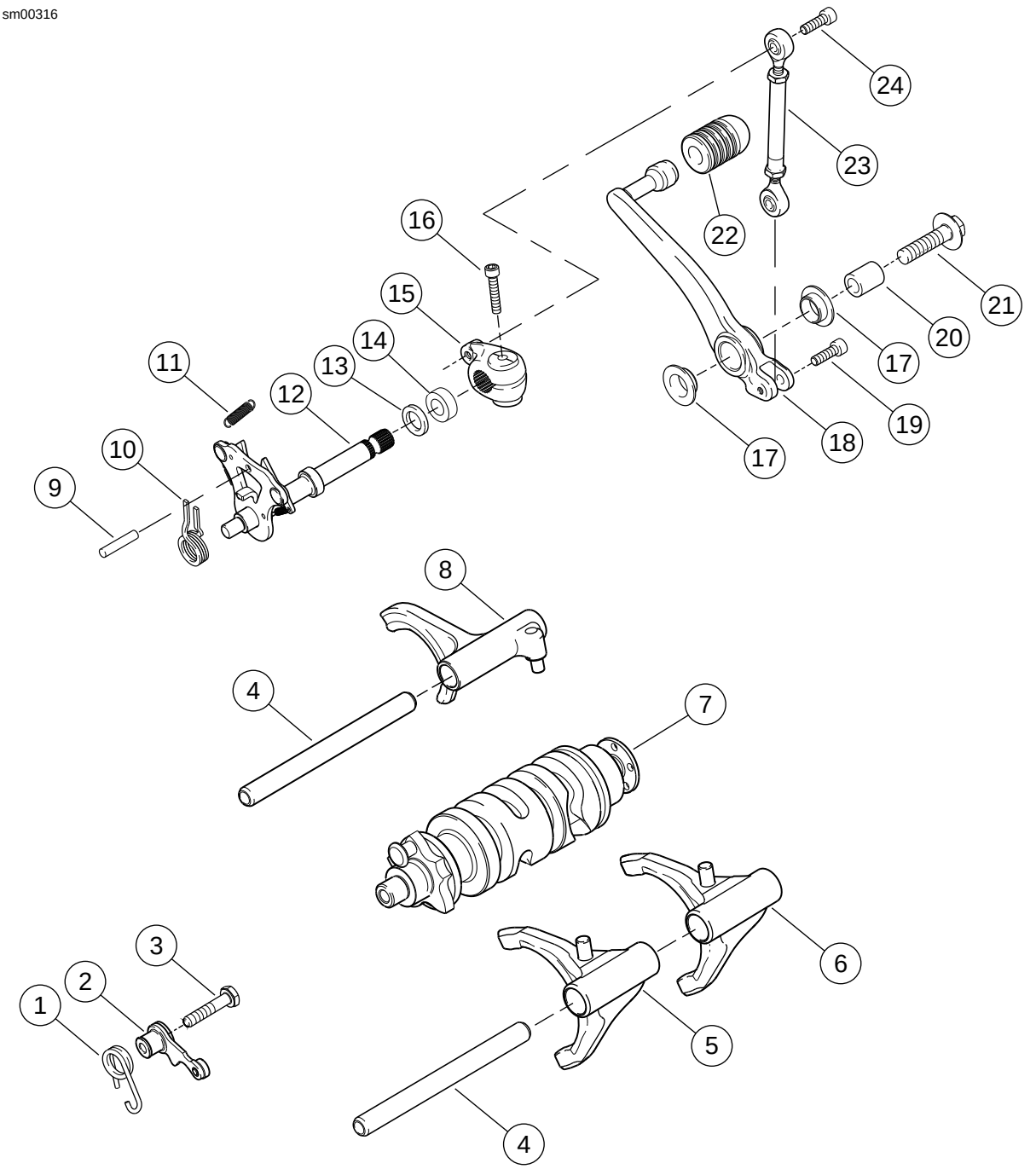


Figure 5-56. Slots for Removing Shifter Fork Shafts



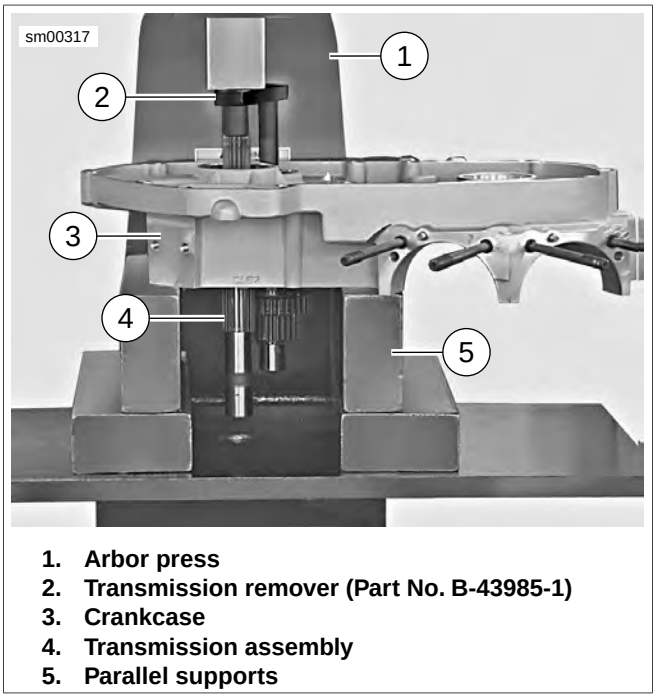
1. **Shifter drum**
2. **Shifter fork (3)**
3. **Mainshaft**
4. **Mainshaft 2nd gear**
5. **Countershaft**

Figure 5-57. Transmission Assembly



1. Spring, detent
2. Detent spring sleeve assembly
3. Screw, detent assembly
4. Shaft, shifter forks (2)
5. Fork assembly, shifter (2nd-3rd)
6. Fork assembly, shifter (1st)
7. Shifter cam assembly
8. Fork assembly, shifter (4th-5th)
9. Pin, shifter stop
10. Spring, shifter return
11. Spring, extension
12. Shifter lever assembly
13. Oil seal
14. Rubber washer
15. Lever, engine
16. Bolt, engine lever
17. Bearing, shift lever assembly (2)
18. Shift lever
19. Bolt, linkage assembly
20. Sleeve, shift/brake lever
21. Bolt, shift lever
22. Pad, rubber, shift lever
23. Linkage assembly, shifter
24. Bolt, linkage assembly

Figure 5-58. Shifter Mechanism



1. **Arbor press**
2. **Transmission remover (Part No. B-43985-1)**
3. **Crankcase**
4. **Transmission assembly**
5. **Parallel supports**

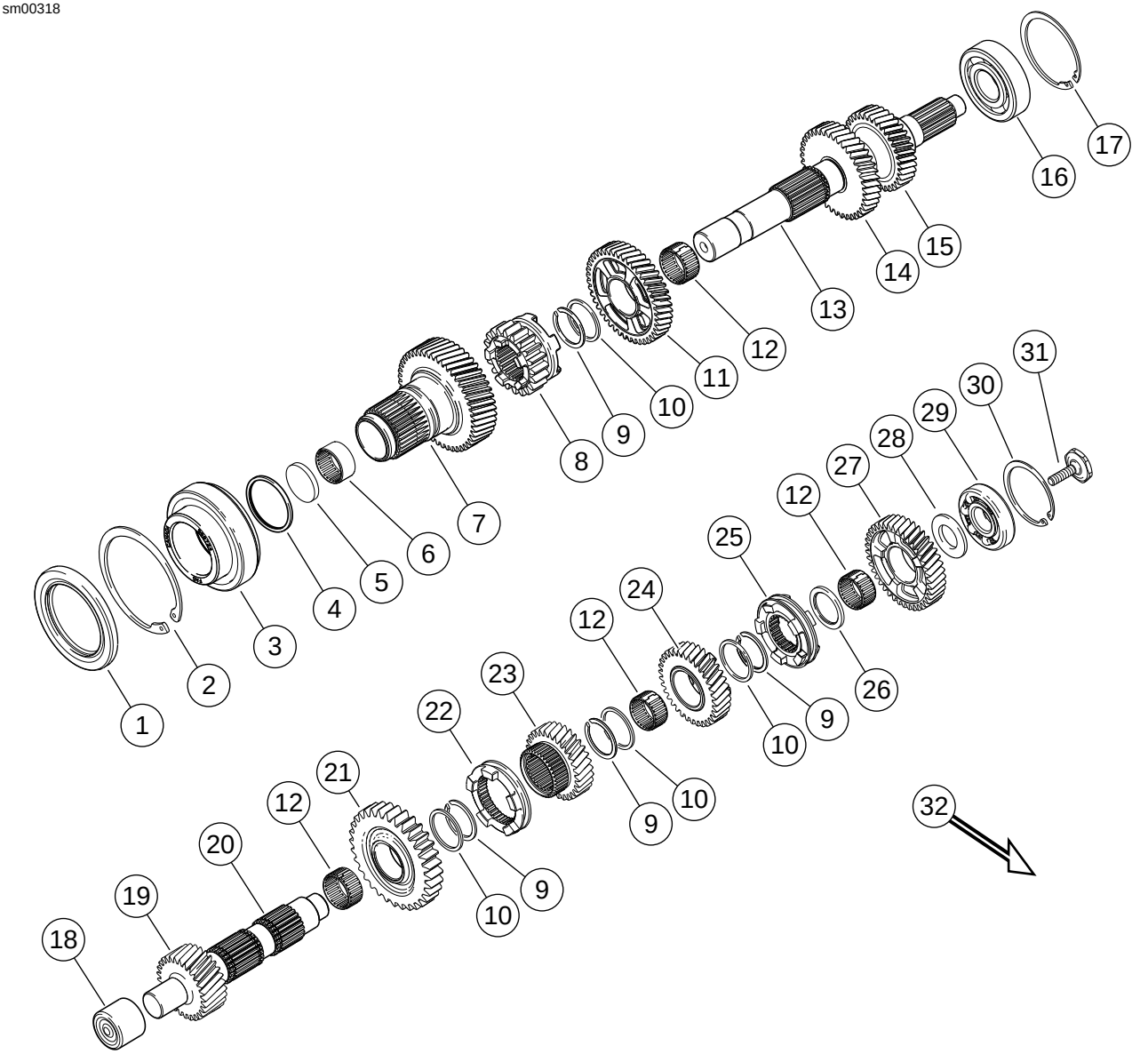
Figure 5-59. Removing Transmission Assembly from Left Case Half

⚠WARNING

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

3. See Figure 5-59. Remove left crankcase half and transmission assembly (4) from engine stand.
   a. Place crankcase half (3) and transmission assembly (4) on arbor press (1) and support transmission assembly on parallel supports (5).
   b. Press transmission assembly using TRANSMISSION REMOVER (Part No. B-43895-1) (2) to remove transmission assembly from crankcase half.
   c. Remove crankcase from press.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Oil seal
2. Retaining ring
3. Ball bearing
4. O-ring
5. Oil seal
6. Needle bearing (2)
7. Mainshaft 5th gear
8. Mainshaft 1st gear
9. Retaining ring (4)
10. Thrust washer (4)
11. Mainshaft 4th gear
12. Split bearing (4)
13. Mainshaft
14. Mainshaft 3rd gear (integral to shaft)
15. Mainshaft 2nd gear (integral to shaft)
16. Mainshaft bearing
17. Retaining ring
18. Closed end bearing
19. Countershaft 5th gear (integral to shaft)
20. Countershaft
21. Countershaft 1st gear
22. Dog ring
23. Countershaft 4th gear
24. Countershaft 3rd gear
25. Dog ring
26. Thrust washer
27. Countershaft 2nd gear
28. Spacer
29. Countershaft bearing
30. Retaining ring
31. Countershaft retaining screw
32. Front of motorcycle

Figure 5-60. Transmission Assembly

MAINSHAFT/COUNTERSHAFT

NOTES

- *As the transmission runs, each part develops a certain wear pattern and a kind of "set" with its mating parts. For this reason, it is important that each component be reinstalled in its original location and facing its original direction.*
- *See Figure 5-61. As each component is removed, place it on a clean surface in the exact order of removal.*

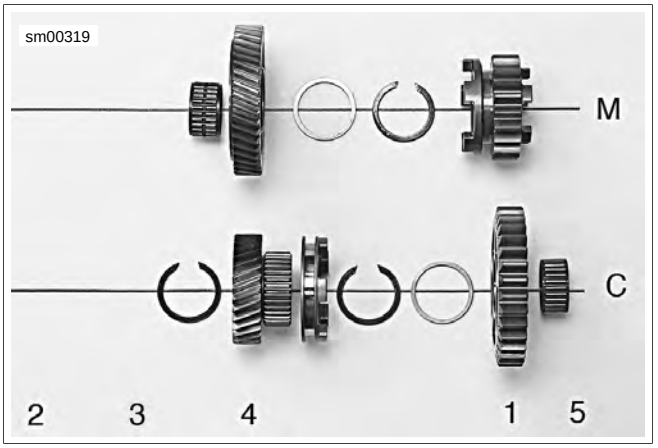


Figure 5-61. Transmission Parts Identification

MAINSHAFT DISASSEMBLY

PART NUMBER	TOOL NAME
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

NOTES

- *Mainshaft 2nd and 3rd gears are integral to the shaft.*
- *Mainshaft 1st gear is directional. Mark gear when removed for correct installation.*
- *Once the transmission assembly has been pressed out of the left crankcase half, the mainshaft and countershaft assemblies can be serviced separately.*
- *All thrust washers are one common part number. This transmission requires no shimming.*

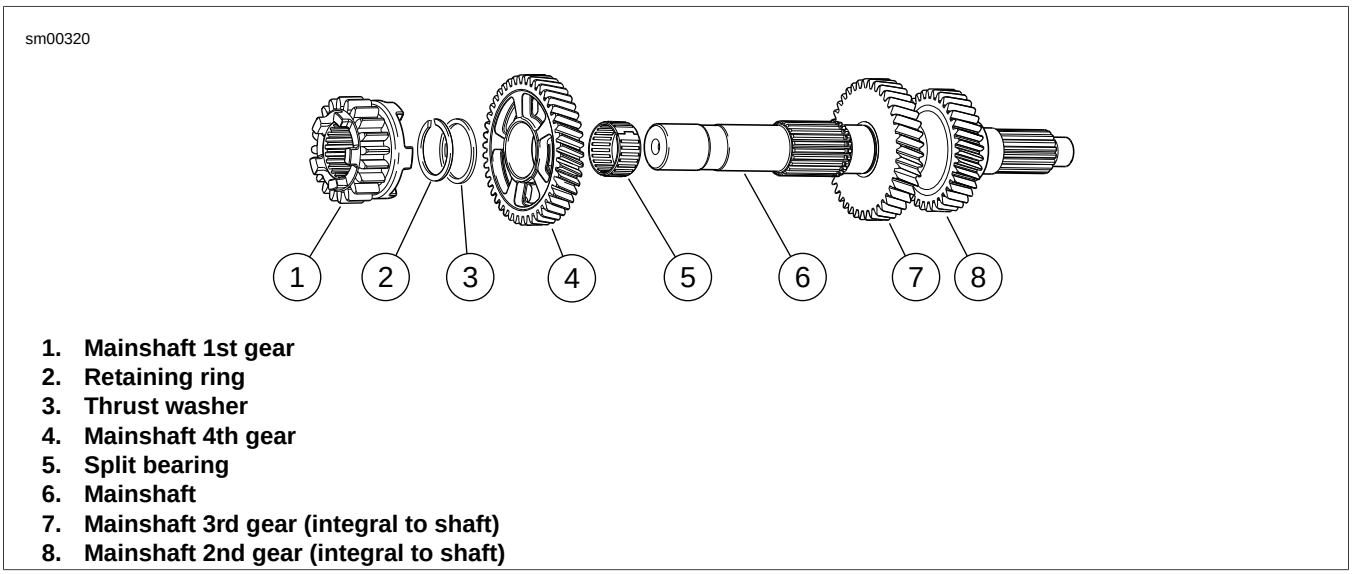
⚠WARNING

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

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

1. See Figure 5-62. Remove 1st gear (1).
2. Use TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586-A) to expand and remove retaining ring (2). Discard retaining ring.
3. Slide thrust washer (3) off end of mainshaft.
4. Remove 4th gear (4) and split bearing (5). Discard bearing.



1. **Mainshaft 1st gear**
2. **Retaining ring**
3. **Thrust washer**
4. **Mainshaft 4th gear**
5. **Split bearing**
6. **Mainshaft**
7. **Mainshaft 3rd gear (integral to shaft)**
8. **Mainshaft 2nd gear (integral to shaft)**

Figure 5-62. Transmission Mainshaft

Cleaning and Inspection

⚠WARNING

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

1. Clean all parts in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, cracked, battered, chipped or dimpled.

COUNTERSHAFT DISASSEMBLY

PART NUMBER	TOOL NAME
J-5586-A	RETAINING RING PLIERS

NOTES

- *Countershaft 5th gear is integral to the shaft.*
- *Once the transmission assembly has been pressed out of the left crankcase half, the mainshaft and countershaft assemblies can be serviced separately.*
- *All thrust washers are one common part number. This transmission requires no shimming.*
- *Use correct retaining ring pliers with correct tips. Verify that tips are not excessively worn or damaged.*

⚠WARNING

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

1. See Figure 5-63. Remove spacer (19) and 2nd gear (18) from the end of the of the countershaft (2). Remove and discard split bearing (17).
2. Remove spacer (16).

NOTE

When removing the dog ring (15), it is important to mark the direction of the ring on the shaft as parts establish wear patterns.

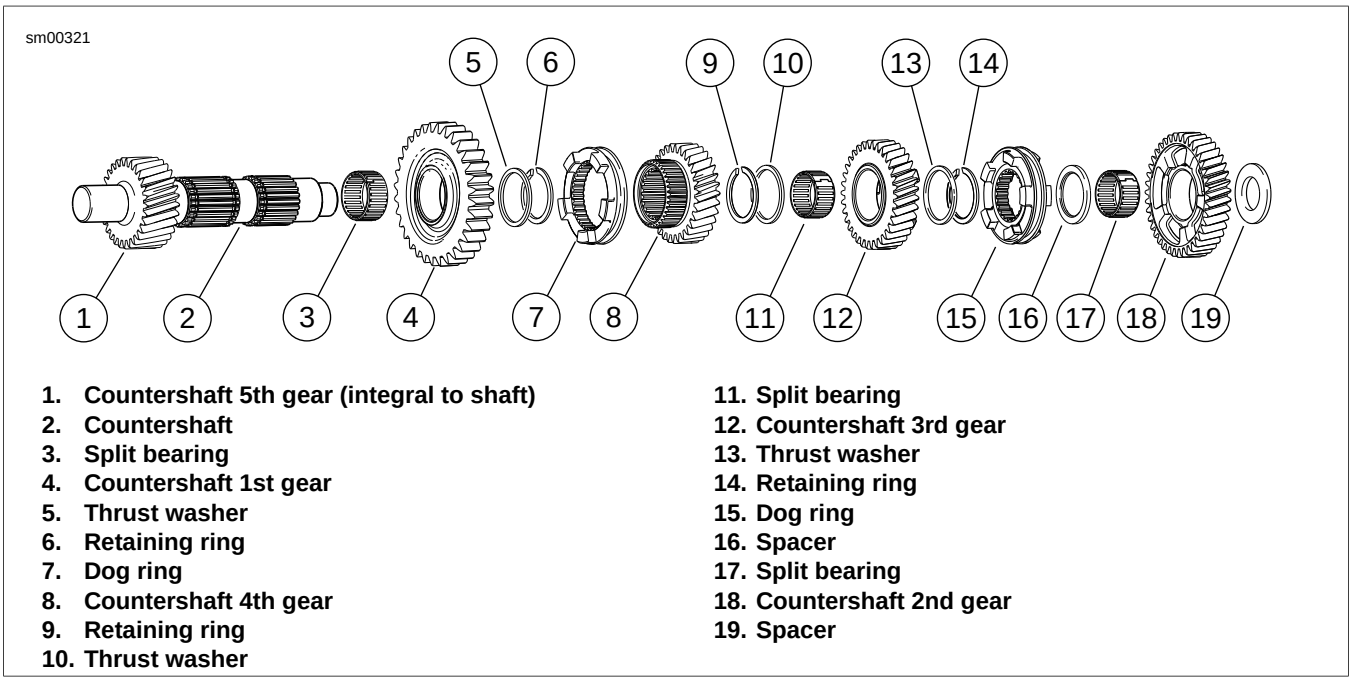
3. Remove dog ring (15).
4. Using RETAINING RING PLIERS (Part No. J-5586-A), expand and remove retaining ring (14). Discard retaining ring.
5. Remove thrust washer (13), 3rd gear (12), and split bearing (11). Discard bearing.
6. Remove thrust washer (10).
7. Expand, remove and discard retaining ring (9).
8. Remove 4th gear (8) and dog ring (7).
9. Expand, remove and discard retaining ring (6).
10. Remove thrust washer (5), 1st gear (4) and split bearing (3). Discard bearing.

Cleaning and Inspection

⚠WARNING

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

1. Clean all parts (except bearings) in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, cracked, battered, chipped or dimpled.



1. Countershaft 5th gear (integral to shaft)
2. Countershaft
3. Split bearing
4. Countershaft 1st gear
5. Thrust washer
6. Retaining ring
7. Dog ring
8. Countershaft 4th gear
9. Retaining ring
10. Thrust washer
11. Split bearing
12. Countershaft 3rd gear
13. Thrust washer
14. Retaining ring
15. Dog ring
16. Spacer
17. Split bearing
18. Countershaft 2nd gear
19. Spacer

Figure 5-63. Transmission Countershaft

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TRANSMISSION ASSEMBLY 5.11

MAINSHAFT ASSEMBLY

PART NUMBER	TOOL NAME
J-5586-A	RETAINING RING PLIERS

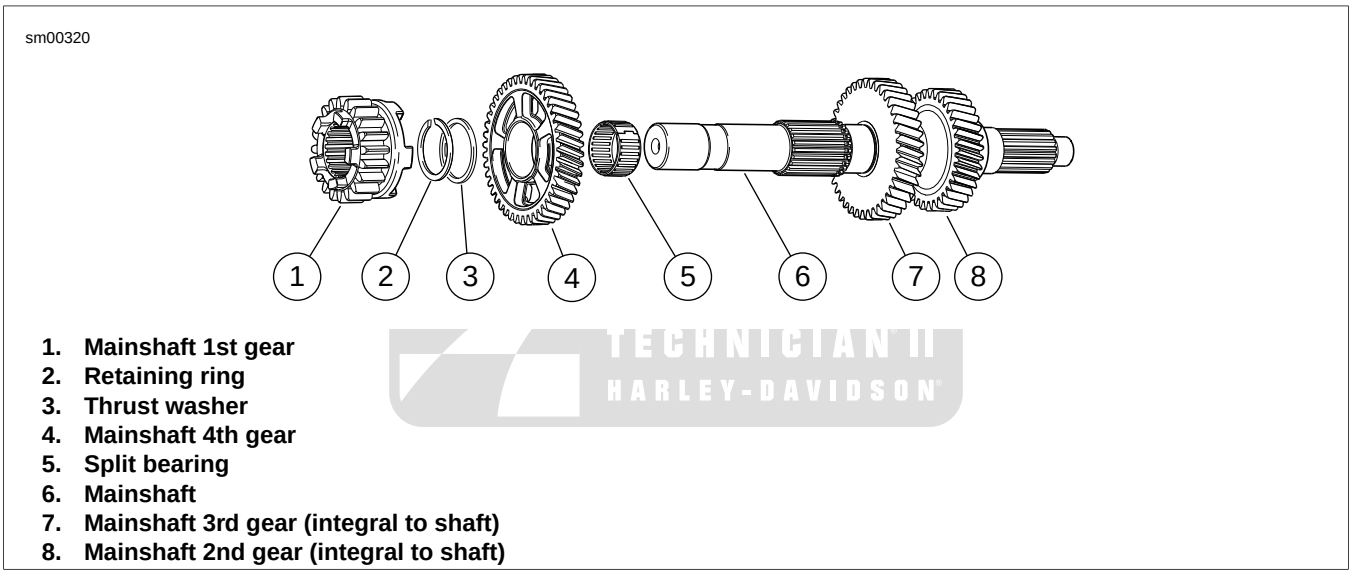
WARNING

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

NOTES

- *Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.*
- *During assembly, the split bearings and the internal bores of the gears must be lubricated with Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAIN-CASE LUBRICANT prior to assembly. Leaving these parts dry could accelerate wear at start-up.*

1. See Figure 5-64. Install **new** split bearing (5) in 4th gear position on mainshaft.
2. Install 4th gear (4) and thrust washer (3).
3. Using RETAINING RING PLIERS (Part No. J-5586-A), expand and install new retaining ring (2).
4. Install 1st gear (1).



1. **Mainshaft 1st gear**
2. **Retaining ring**
3. **Thrust washer**
4. **Mainshaft 4th gear**
5. **Split bearing**
6. **Mainshaft**
7. **Mainshaft 3rd gear (integral to shaft)**
8. **Mainshaft 2nd gear (integral to shaft)**

Figure 5-64. Transmission Mainshaft

COUNTERSHAFT ASSEMBLY

PART NUMBER	TOOL NAME
J-5586-A	RETAINING RING PLIERS

WARNING

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

NOTES

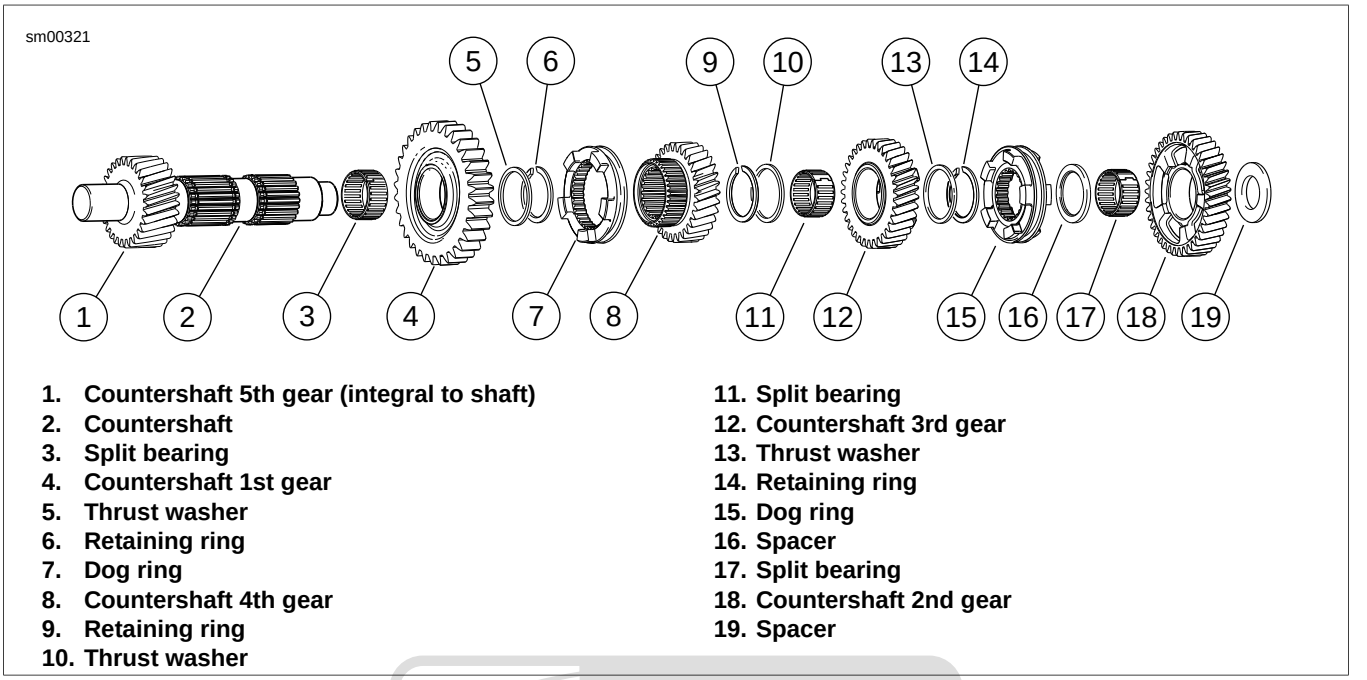
- *Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.*
- *During assembly, the split bearings and the internal bores of the gears must be lubricated with Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAIN-CASE LUBRICANT prior to assembly. Leaving these parts dry could accelerate wear at start-up.*

1. See Figure 5-65. Install **new** split bearing (3) in 1st gear position on mainshaft.
2. Install 1st gear (4) and thrust washer (5).
3. Using RETAINING RING PLIERS (Part No. J-5586-A), expand and install **new** retaining ring (6).
4. Install dog ring (7) onto 4th gear (8). Now install dog ring and gear assembly onto countershaft.
5. Expand and install **new** retaining ring (9).
6. Install thrust washer (10).
7. Install **new** split bearing (11) in 3rd gear position on mainshaft.
8. Install 3rd gear (12) and thrust washer (13).

9. Expand and install **new** retaining ring (14).
10. Install dog ring (15). Make sure to install with dog ring facing same direction as when it was removed.
11. Install spacer (16).
12. Install **new** split bearing (17) in 2nd gear position on shaft.
13. Install 2nd gear (18) and spacer (19).

NOTE

At this point both mainshaft and countershaft sub-assemblies are ready to be pressed into the left crankcase half.



1. **Countershaft 5th gear (integral to shaft)**
2. **Countershaft**
3. **Split bearing**
4. **Countershaft 1st gear**
5. **Thrust washer**
6. **Retaining ring**
7. **Dog ring**
8. **Countershaft 4th gear**
9. **Retaining ring**
10. **Thrust washer**
11. **Split bearing**
12. **Countershaft 3rd gear**
13. **Thrust washer**
14. **Retaining ring**
15. **Dog ring**
16. **Spacer**
17. **Split bearing**
18. **Countershaft 2nd gear**
19. **Spacer**

Figure 5-65. Transmission Countershaft

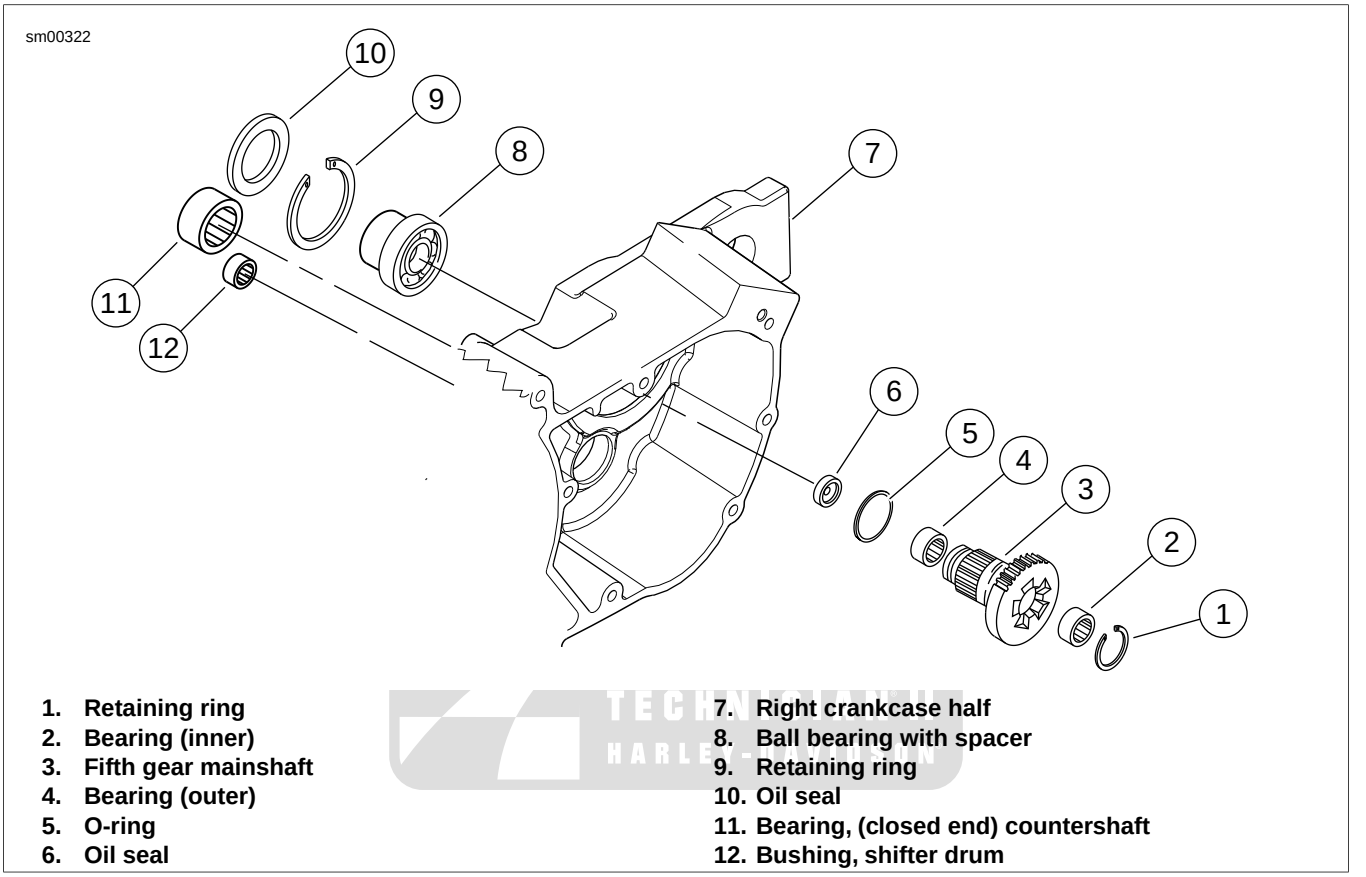
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

MAIN DRIVE GEAR AND BEARING 5.12

GENERAL

NOTE

See Figure 5-66. When removing the main drive gear (3), the gear is pressed out against the resistance of the ball bearing with spacer (8) inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed, the main drive gear bearing must be replaced.



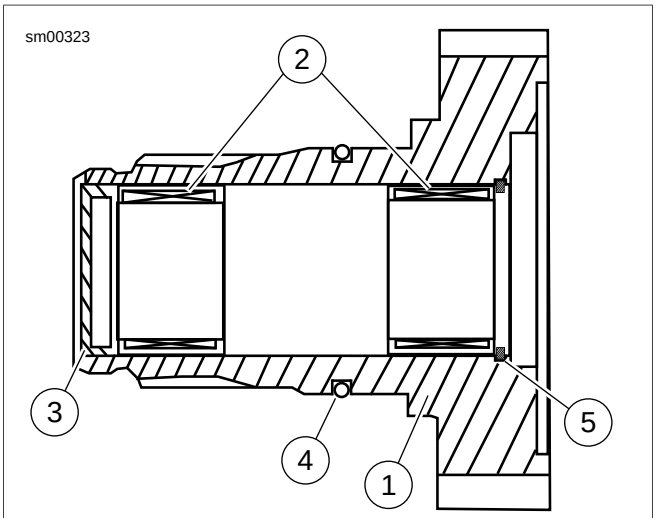
1. **Retaining ring**
2. **Bearing (inner)**
3. **Fifth gear mainshaft**
4. **Bearing (outer)**
5. **O-ring**
6. **Oil seal**
7. **Right crankcase half**
8. **Ball bearing with spacer**
9. **Retaining ring**
10. **Oil seal**
11. **Bearing, (closed end) countershaft**
12. **Bushing, shifter drum**

Figure 5-66. Transmission Assembly - Right Crankcase Half

REMOVAL

PART NUMBER	TOOL NAME
B-45847	CROSS PLATE
HD-35316-11	RECEIVER CUP
HD-35316-4A	8 IN. BOLT
HD-35316-7	WASHER
HD-35316-9	BEARING DRIVER

1. Split crankcases in half. See 5.9 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL.
2. Remove transmission as an assembly. See 5.10 TRANSMISSION DISASSEMBLY.
3. See Figure 5-67. From inside case tap out seal (3) at end of mainshaft 5th gear. Discard seal.
4. Obtain MAIN DRIVE GEAR REMOVER AND INSTALLER SET. See Figure 5-68. Place CROSS PLATE (Part No. B-45847) on right crankcase as shown. Position cross plate so that roll pins fit into crankcase mating screw holes and bolt hole in cross plate is centered over main drive gear.
5. See Figure 5-69. Insert bolt (2) through cross plate (1) and main drive gear (3).
6. At outside of case, place WASHER (Part No. HD-35316-7) (4), nice bearing (5), flat washer (6) and nut (7) over end of bolt. Tighten nut until main drive gear is free.



1. Main drive gear
2. Needle bearing (2)
3. Seal
4. O-ring
5. Retaining ring

Figure 5-67. Main Drive Gear Assembly

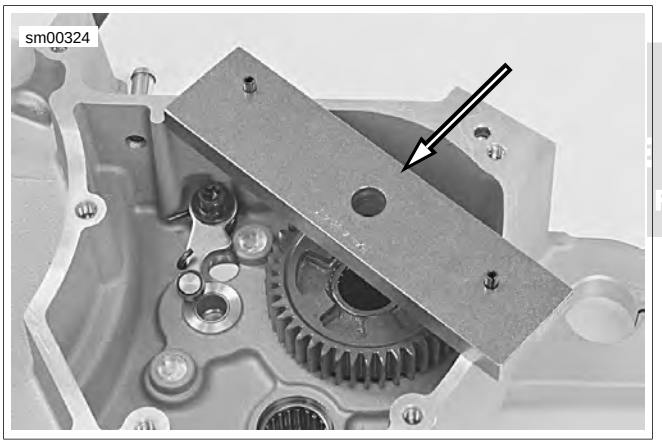
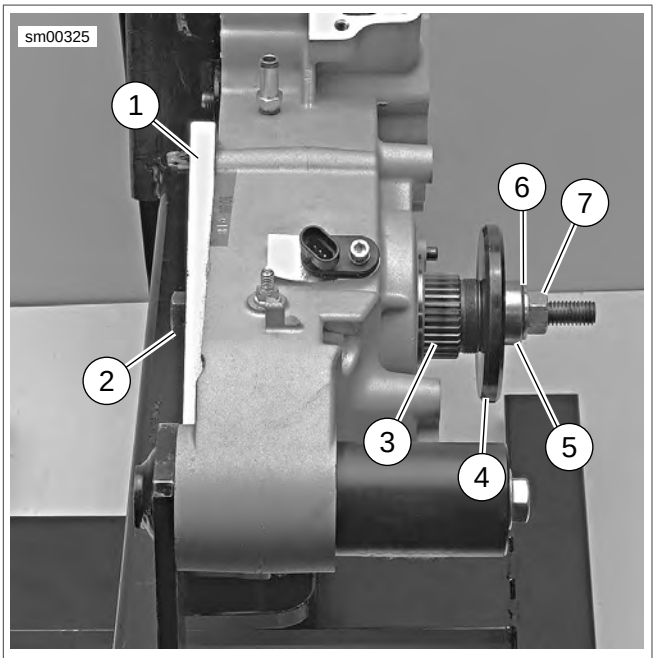


Figure 5-68. Bearing Remover Cross Plate Mounting



1. Cross plate
2. 8 in. bolt
3. Main drive gear
4. Washer
5. Nice bearing
6. Washer
7. Nut

Figure 5-69. Removing Main Drive Gear Bearing (Typical)

Main Drive Gear Bearing

⚠WARNING

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

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

1. See Figure 5-66. At outside of case remove and discard oil seal (10). Remove and discard main drive gear bearing retaining ring (9).
2. See Figure 5-69. From inside crankcase, position BEARING DRIVER (Part No. HD-35316-9) (2) over main drive gear bearing.
3. Insert 8 IN. BOLT (Part No. HD-35316-4A) (1) through bearing driver and bearing.
4. At outside of case, slide RECEIVER CUP (Part No. HD-35316-11) (3) onto bolt and over bearing. Install nice bearing (4), flat washer (5) and nut (6) over end of bolt.

NOTE

Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of crankcase when bearing comes free.

5. Tighten nut until main drive gear bearing is free.
6. Discard main drive gear bearing.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-95635-46	CLAW PULLER
HD-95637-46B	WEDGE ATTACHMENT

1. See Figure 5-67. Remove and discard retaining ring (5).
2. Drive out needle bearings (2) from inside bore of main drive gear (1) using appropriate bearing and bushing puller. Discard bearings. Do not reuse bearings after removal.
3. Remove o-ring (4) from outside of main drive gear and discard. Do not reuse o-ring after removal.

NOTE

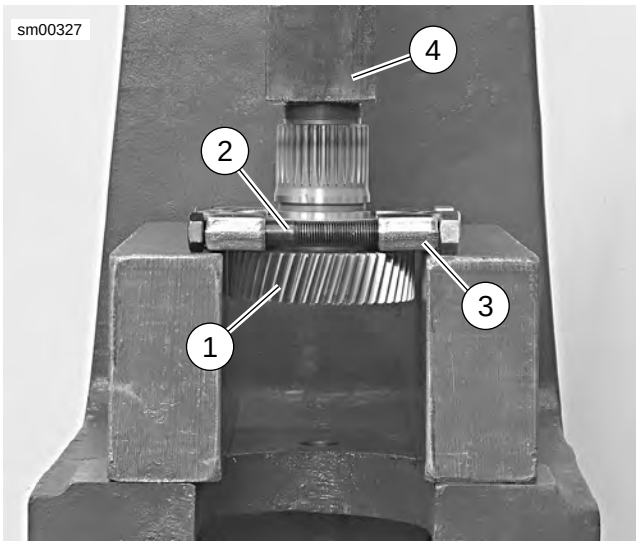
When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. This inner race must be removed before the main drive gear can be re-installed.

4. See Figure 5-70. Attach WEDGE ATTACHMENT (Part No. HD-95637-46B) for CLAW PULLER (Part No. HD-95635-46) (3) to inner race (2) on main drive gear (1).
5. Place main drive gear with wedge attachment onto press bed as shown in the photo.

NOTE

Provide a soft surface to catch the main drive gear when it falls free in the next step.

6. Press main drive gear out of inner bearing race. Discard inner bearing race.



1. **Main drive gear**
2. **Inner bearing race (not visible in this photo)**
3. **Wedge attachment for claw puller**
4. **Press ram**

Figure 5-70. Removing Inner Bearing Race from Main Drive Gear

ASSEMBLY

PART NUMBER	TOOL NAME
HD-47855	INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL

1. Use INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL (Part No. HD-47855) for assembly. Assemble parts. The installation tool will automatically bottom on the gear when the correct depth is reached.
2. See Figure 5-71. Place main drive gear (4) on press bed with gear end facing up.
3. Place needle bearing (3) squarely into end of drive gear. Insert installation tool (2) with end stamped "INNER" facing needle bearing.
4. Press in the inner bearing until the installation tool bottoms on the main drive gear.

NOTE

The surface of the needle bearing will be at the prescribed depth from the face of the shifter dogs on the main drive gear. Refer to Table 5-7.

Table 5-7. Inner Needle Bearing Depth

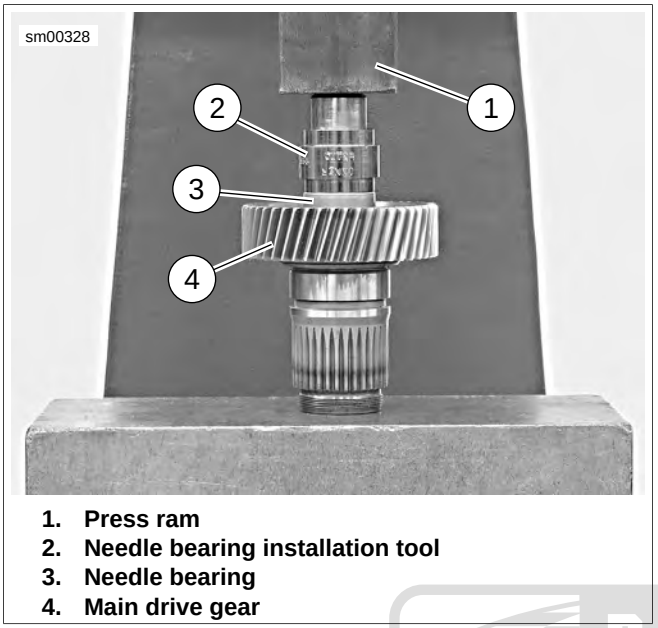
MODEL	DEPTH
All Models	0.418 in. (10.6 mm)

5. Install **new** retaining ring.
6. See Figure 5-72. Place main drive gear (4) on press bed with gear end facing down.
7. Place needle bearing (3) squarely into end of drive gear. Insert installation tool (2) with end stamped "OUTER" facing needle bearing.
8. Press in the outer bearing until the installation tool bottoms on the main drive gear. The surface of the needle bearing

will be at the prescribed depth from the end of the main drive gear. Refer to Table 5-8.

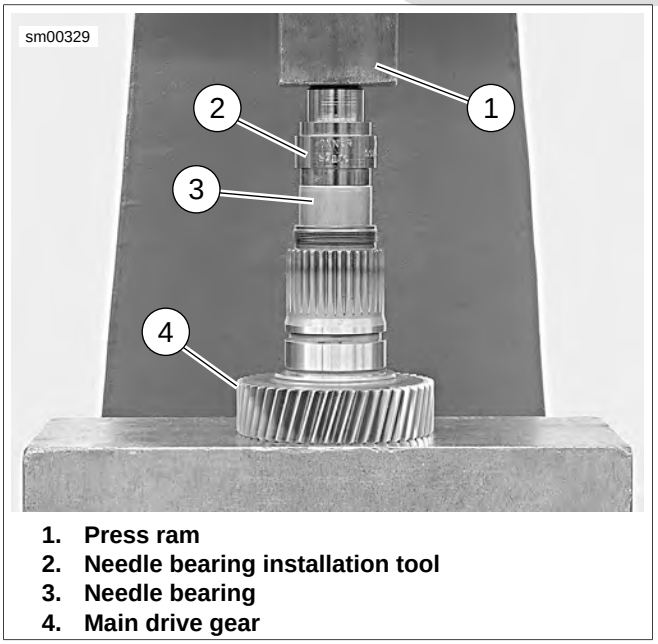
Table 5-8. Outer Needle Bearing Depth

MODEL	DEPTH
All Models	0.285 in. (7.2 mm)



1. **Press ram**
2. **Needle bearing installation tool**
3. **Needle bearing**
4. **Main drive gear**

Figure 5-71. Pressing Inner Needle Bearing Assembly into Main Drive Gear



1. **Press ram**
2. **Needle bearing installation tool**
3. **Needle bearing**
4. **Main drive gear**

Figure 5-72. Pressing Outer Needle Bearing Assembly into Main Drive Gear

INSTALLATION

PART NUMBER	TOOL NAME
B-45847	CROSS PLATE
HD-35316-12	INSTALLER CUP
HD-35316-4A	8 IN. BOLT
HD-35316-7	WASHER
HD-35316-8	BEARING DRIVER
HD-47856-1	INSTALLER
HD-47856-2	PILOT
HD-47856-4	ADAPTER
HD-47856-5	NUT
HD-47856-7	CROWFOOT WRENCH

Main Drive Gear Ball Bearing

1. See Figure 5-73. Place CROSS PLATE (Part No. B-45847) (1) on right crankcase as shown. Position cross plate so that roll pins (2) fit into crankcase mating screw holes and bolt hole (3) in cross plate is centered over crankcase bearing bore (4).
2. See Figure 5-74. Insert 8 IN. BOLT (Part No. HD-35316-4A) (2) through cross plate (1) and main drive gear bearing bore.
3. At outside of case, place main drive gear ball bearing (3), BEARING DRIVER (Part No. HD-35316-8) (4), nice bearing (5), flat washer (6) and nut (7) over end of bolt.

NOTE

Do not continue to tighten nut after ball bearing bottoms against lip in crankcase bearing bore. Tightening nut too much can break lip in bearing bore casting.

4. Tighten nut until main drive gear ball bearing bottoms against lip cast into crankcase bearing bore.
5. Remove main drive gear bearing installer tool.

WARNING

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

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

6. See Figure 5-66. At outside of case install **new** beveled retaining ring (9) in groove inside bearing bore with beveled side facing outside of case.
7. Lubricate main drive gear ball bearing with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05).

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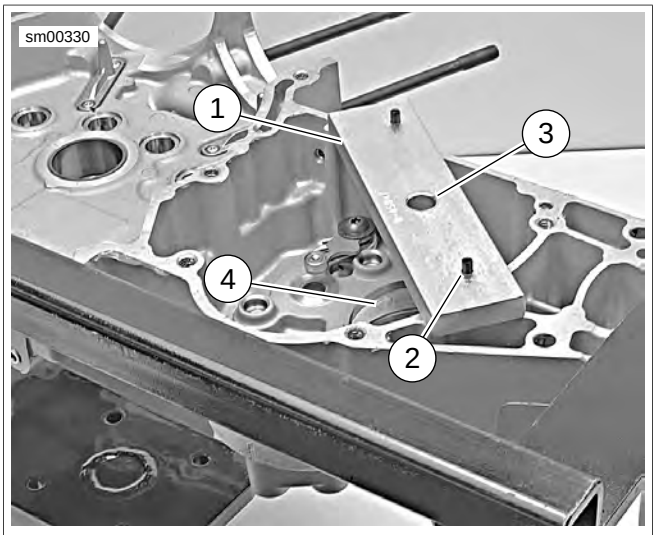
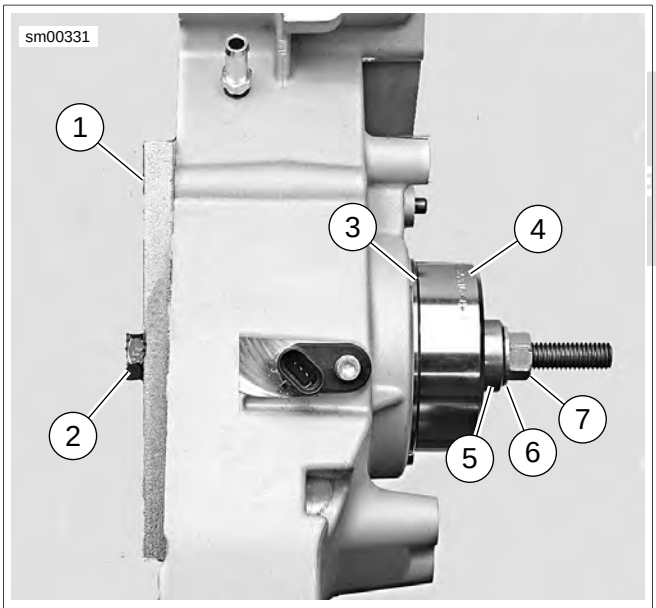


1. **Cross plate**
2. **Roll pin (2)**
3. **Bolt hole**
4. **Crankcase bearing bore**

Figure 5-73. Positioning Cross Plate (Typical)



1. **Cross plate**
2. **8 in. bolt**
3. **Main drive gear bearing**
4. **Bearing driver**
5. **Nice bearing**
6. **Flat washer**
7. **Nut**

Figure 5-74. Installing Main Drive Gear Bearing

Main Drive Gear

NOTE

When removing the main drive gear, the gear is pressed out against the resistance of the ball bearing with spacer inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed, the main drive gear bearing must be replaced.

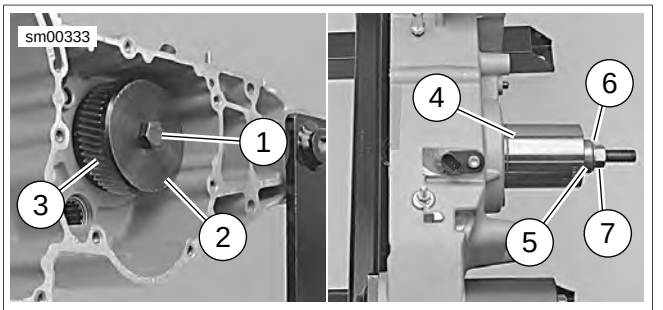
1. See Figure 5-75. Lubricate both main drive gear needle bearing assemblies and the mating surface of the mainshaft with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE (Part No. 99857-97).
2. See Figure 5-66. Install **new** o-ring (5) into groove in main drive gear (2). Lubricate o-ring with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT.

NOTE

*See Figure 5-66. Make sure to install **new** o-ring (5) onto main drive gear before installing main drive gear into crankcase.*

3. See Figure 5-76. Insert 8 IN. BOLT (Part No. HD-35316-4A) (1) through WASHER (Part No. HD-35316-7) (2) and main drive gear (3). From inside of case insert bolt with washer and main drive gear through inner race of main drive gear bearing.
4. At outside of case, place INSTALLER CUP (Part No. HD-35316-12) (4), nice bearing (5), flat washer (6) and nut (7) over end of bolt. Tighten nut until main drive gear bottoms against main drive gear bearing.
5. Remove MAIN DRIVE GEAR REMOVER AND INSTALLER set.
6. See Figure 5-66. Tap in **new** oil seal (6) at threaded end of main drive gear to a depth of 0.060-0.030 in. (1.524-0.762 mm).

Figure 5-75. Lubricating Main Drive Gear Needle Bearing



1. **8 in. bolt**
2. **Washer**
3. **Main drive gear**
4. **Installer cup**
5. **Nice bearing**
6. **Flat washer**
7. **Nut**

Figure 5-76. Installing Main Drive Gear (Typical)

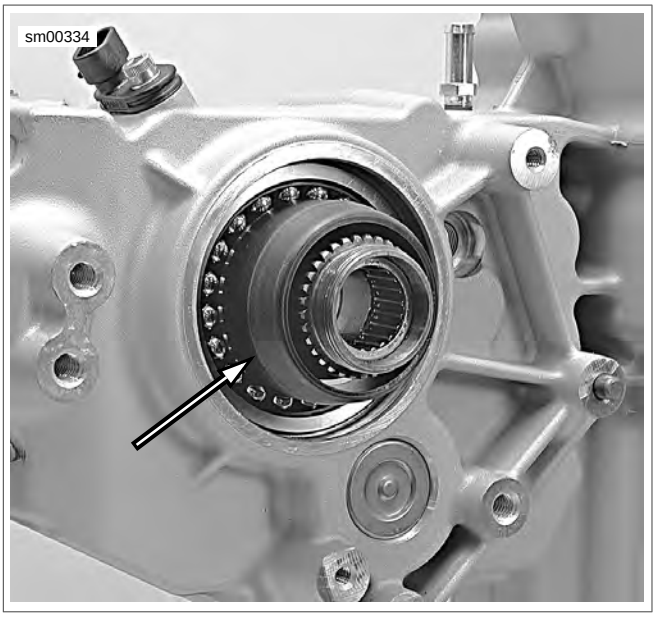


Figure 5-77. Install Pilot (Typical)

Main Drive Gear Seal

1. See Figure 5-77. From outside of crankcase, install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.
2. Coat lips of new main drive gear seal with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT.

NOTE

ADAPTER (Part No. HD-47856-4) and main drive gear have left-hand threads.

3. See Figure 5-78. Place seal over pilot and position seal squarely in end of crankcase bore.
4. See Figure 5-79. Thread ADAPTER (Part No. HD-47856-4) onto end of main drive gear several turns. Do NOT tighten. Doing so could make it difficult to remove adapter after seal has been installed.
5. See Figure 5-80. Slide INSTALLER (Part No. HD-47856-1) over adapter until cupped end of installer is flat against seal.
6. See Figure 5-81. Thread NUT (Part No. HD-47856-5) onto end of adapter, until it tightens against installer.
7. See Figure 5-82. Place CROWFOOT WRENCH (Part No. HD-47856-7) (1) with 1/2 inch drive breaker bar (2) on large nut. Place an adjustable wrench (3) on flats of hex head cast into end of adapter.
8. Holding smaller wrench, tighten nut with larger wrench until outer face of seal is flush with outer edge of crankcase bore.

NOTE

It is acceptable to recess seal to about 0.030 in. (0.762 mm) below outer edge of bore. Seal will be controlled by tool.

9. Remove nut, installer, adapter and pilot.

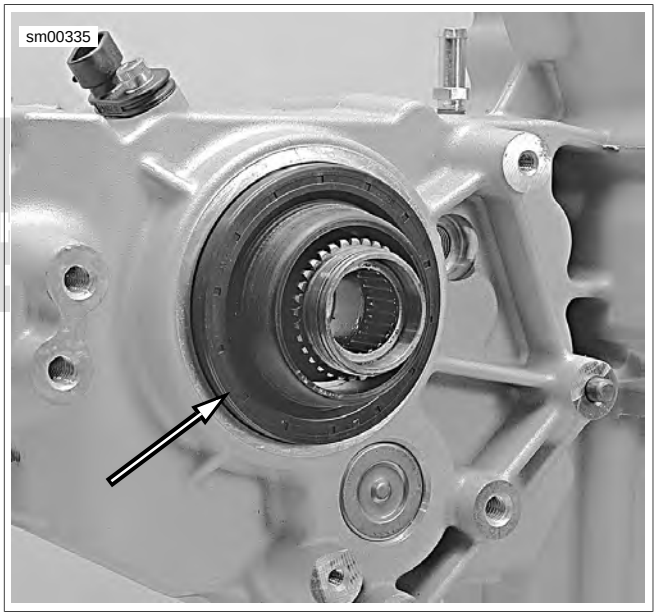


Figure 5-78. Install Main Drive Gear Seal (Typical)

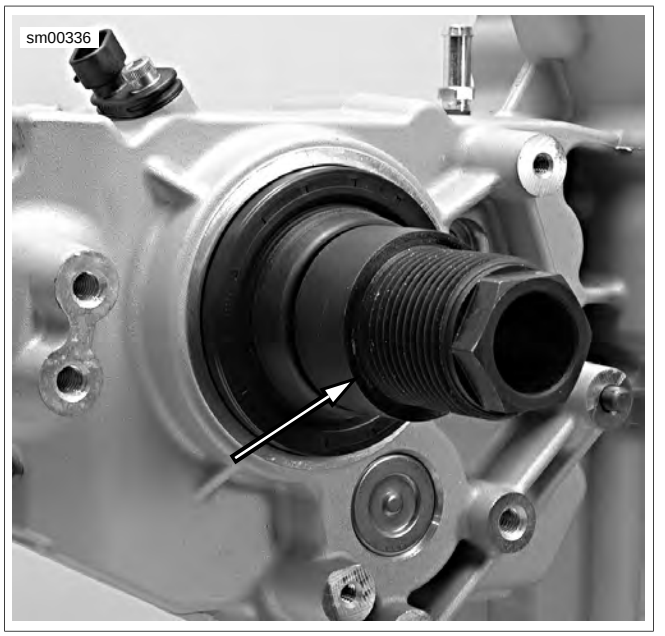


Figure 5-79. Install Adapter (Typical)

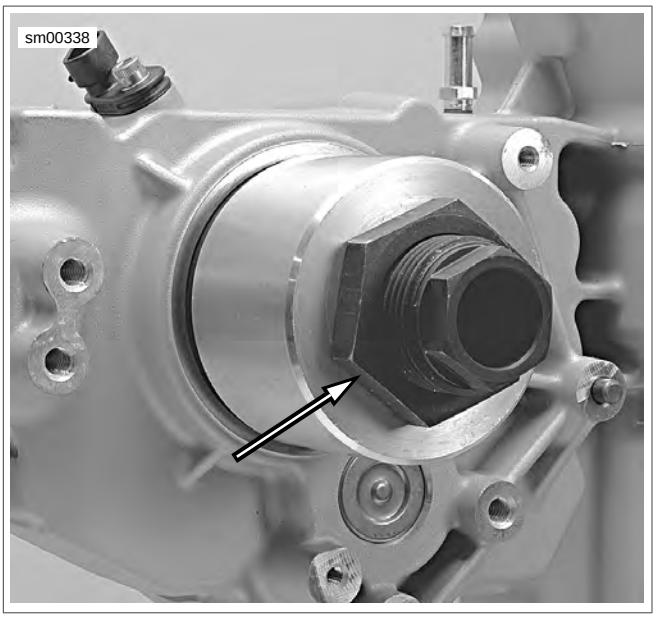


Figure 5-81. Install Nut (Typical)

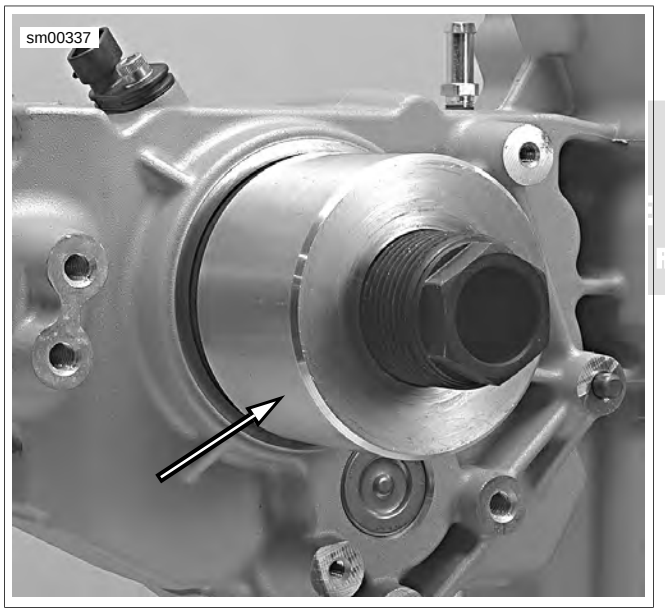
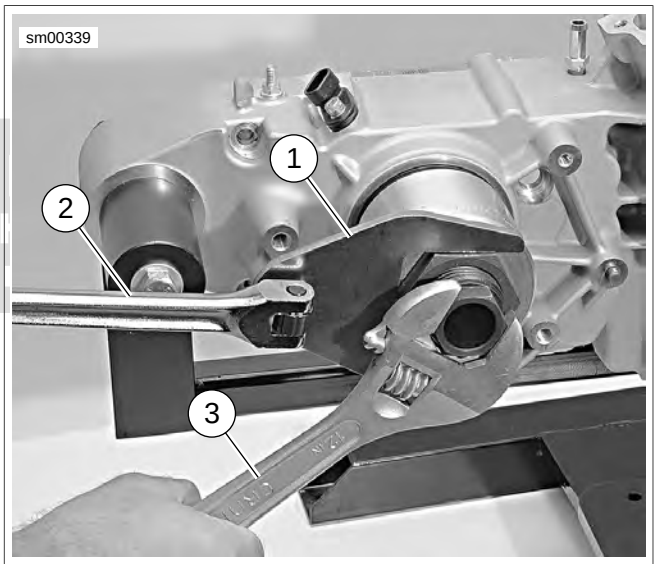


Figure 5-80. Place Installer over Adapter (Typical)



1. Crowfoot wrench
2. 1/2-inch breaker bar
3. Adjustable wrench

Figure 5-82. Press Seal Into Crankcase

TRANSMISSION RIGHT CASE BEARINGS 5.13

REMOVAL

PART NUMBER	TOOL NAME
HD-95760-69A	BUSHING AND BEARING PULLER
HD-95765-69A	1/2 IN. COLLET

1. Split crankcases in half. See 5.9 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL.
2. Remove transmission as an assembly. See 5.10 TRANSMISSION DISASSEMBLY.

Countershaft Needle Bearing

See Figure 5-83. From inside transmission case use a common bearing puller to remove countershaft bearing (11) from crankcase bore.

Shifter Drum Bushing

1. The shifter drum bushing (12) is a press fit in the right crankcase half. Inspect the bushing against the corresponding end of the shifter drum for proper fit and wear.
2. If bushing is to be replaced, use BUSHING AND BEARING PULLER (Part No. HD-95760-69A) with 1/2 IN. COLLET (Part No. HD-95765-69A) to remove bushing from crankcase bore.

INSTALLATION

PART NUMBER	TOOL NAME
A157-8	SNAP-ON BUSHING DRIVER 1/2-INCH ADAPTER
A157C	SNAP-ON BUSHING DRIVER SET

Countershaft Needle Bearing

1. Find a suitable bearing driver 1-1/4 in. (31.75 mm) in diameter.
2. See Figure 5-83. From the outside of the case place the closed end needle bearing (11) open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven flush or 0.030 in. (0.762 mm) below the outside surface of the case.
3. Lubricate bearing with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05).

Shifter Drum Bushing

1. See Figure 5-83. Using SNAP-ON BUSHING DRIVER SET (Part No. A157C) with a SNAP-ON BUSHING DRIVER 1/2-INCH ADAPTER (Part No. A157-8), install **new** bushing (12).
2. Lubricate bushing with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05).

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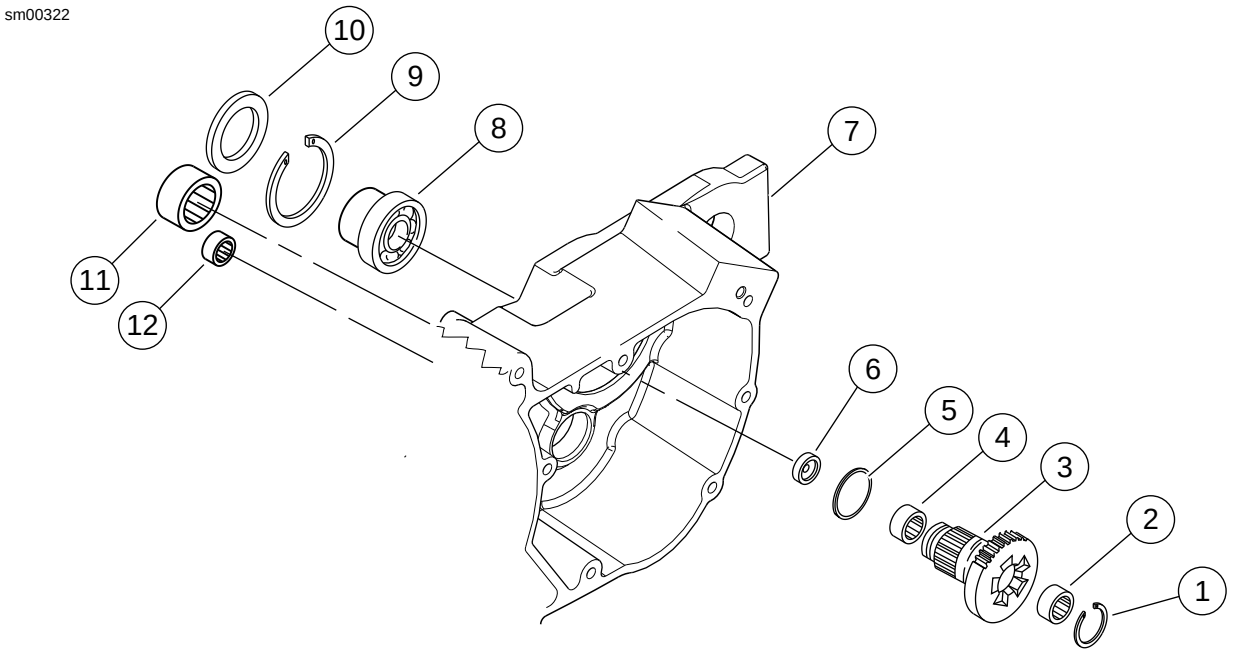


1. Retaining ring
2. Bearing (inner)
3. Fifth gear mainshaft
4. Bearing (outer)
5. O-ring
6. Oil seal
7. Right crankcase half
8. Ball bearing with spacer
9. Retaining ring
10. Oil seal
11. Bearing, (closed end) countershaft
12. Bushing, shifter drum

Figure 5-83. Transmission Assembly - Right Crankcase Half

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TRANSMISSION LEFT CASE BEARINGS 5.14

REMOVAL

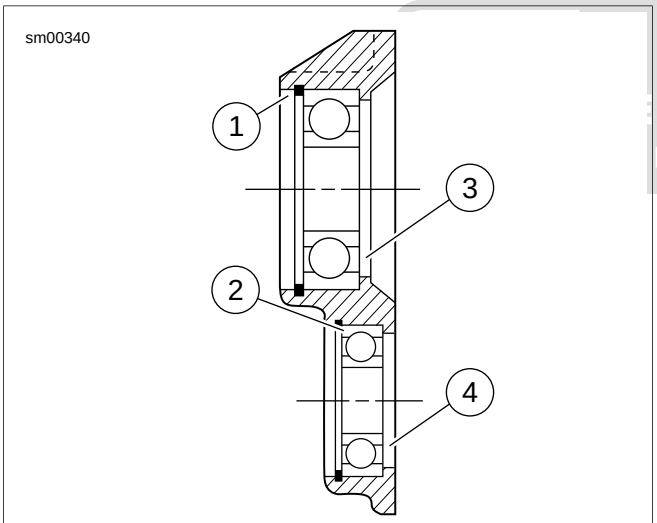
PART NUMBER	TOOL NAME
SNAP-ON PR-36	SNAP RING PLIERS

Mainshaft and Countershaft Bearings

1. Split crankcases in half. See 5.9 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL.
2. Remove transmission as an assembly. See 5.10 TRANSMISSION DISASSEMBLY.
3. See Figure 5-84. Inspect the mainshaft (3) and countershaft (4) ball bearings for pitting, scoring, discoloration or other damage.
4. If bearing replacement is required, remove retaining rings (1, 2) using SNAP RING PLIERS (Part No. Snap-on PR-36).
5. Press out bearings from the inside of the crankcase.

Shift Drum Bearing

Inspect the shifter drum bushing for pitting, scoring, discoloration or excessive wear. If bushing requires replacement press bushing out of crankcase from either side.



1. **Retaining ring**
2. **Retaining ring**
3. **Bearing, mainshaft**
4. **Bearing, countershaft**

Figure 5-84. Ball Bearing Assembly

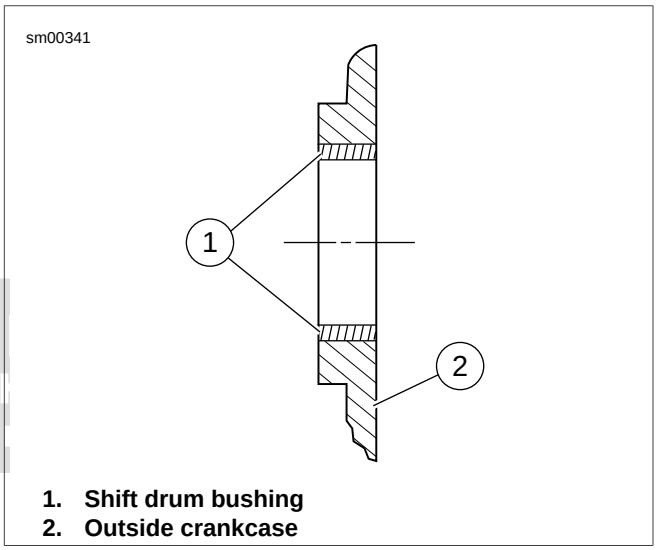
INSTALLATION

Mainshaft and Countershaft Bearings

1. Place crankcase on press with inside surface of crankcase downward.
2. Lay bearing squarely over bore with printed side of bearing upward. Place a pressing tool (slightly smaller than outside diameter of bearing) against outer race. Press bearing into bore until bearing bottoms against shoulder.
3. Install **new** retaining ring with beveled side facing away from bearing.

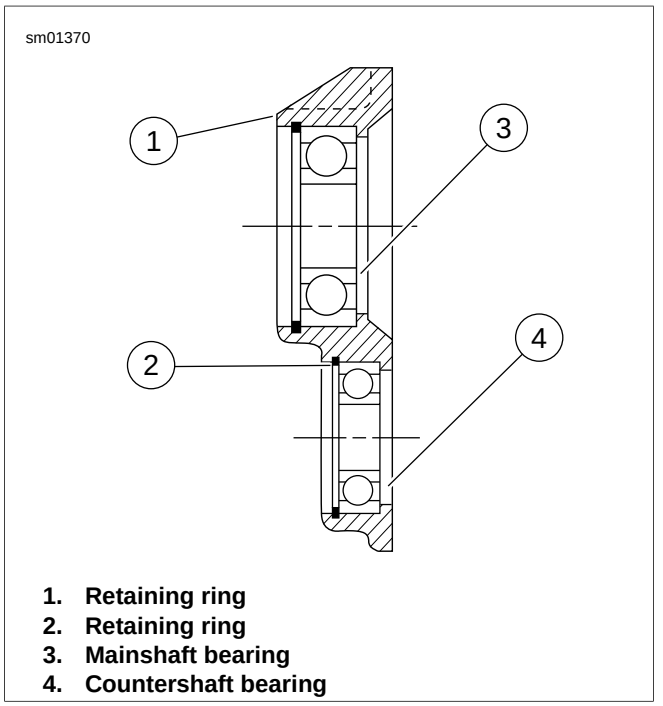
Shift Drum Bushing

1. Place crankcase on press with outside surface of crankcase downward.
2. See Figure 5-85. Lay bushing squarely over bore. Using a pressing tool larger than diameter of bushing, press bushing into bore until bushing contacts shoulder in left crankcase half. If using a pressing tool larger than diameter of bushing, the pressing tool will bottom against crankcase when bushing is flush with top surface.



1. **Shift drum bushing**
2. **Outside crankcase**

Figure 5-85. Shift Drum Bushing Assembly



1. **Retaining ring**
2. **Retaining ring**
3. **Mainshaft bearing**
4. **Countershaft bearing**

Figure 5-86. Ball Bearing Assembly

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TRANSMISSION INSTALLATION 5.15

INSTALLATION

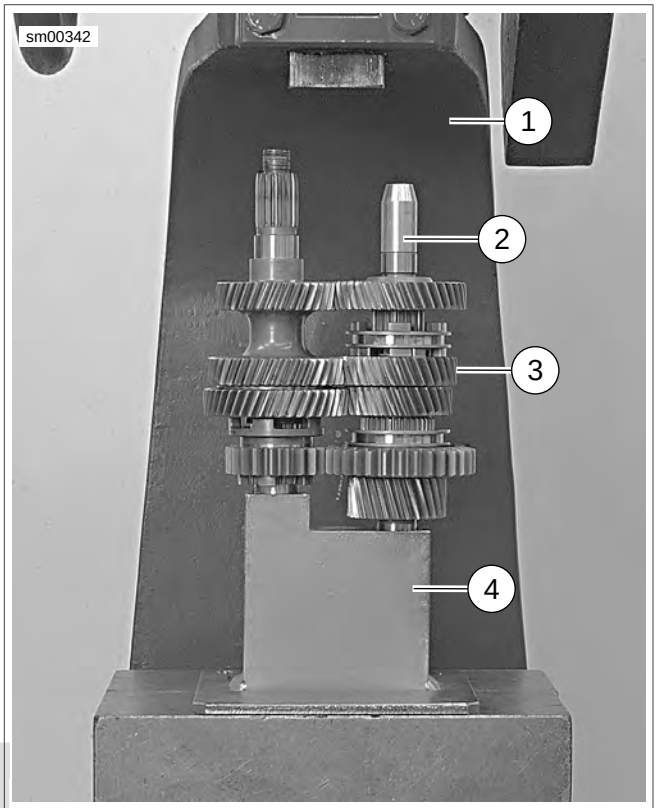
PART NUMBER	TOOL NAME
B-43985-3	INSTALLER
B-43985-4	GUIDE
B-46285 (4)	TRANSMISSION FIXTURE

NOTES

After re-installing the transmission assembly, verify that all parts have been properly installed. See:

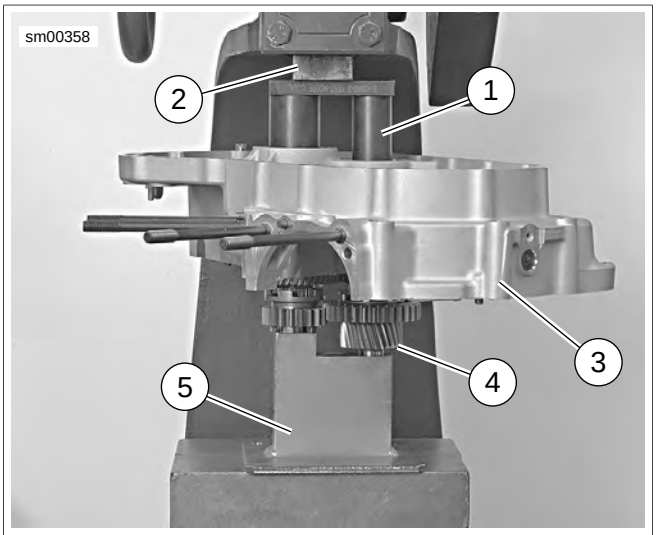
- *5.12 MAIN DRIVE GEAR AND BEARING*
- *5.11 TRANSMISSION ASSEMBLY*
- *5.14 TRANSMISSION LEFT CASE BEARINGS*
- *5.13 TRANSMISSION RIGHT CASE BEARINGS*
- *Make sure crankcase does not begin to tilt when pressed onto transmission assembly. It may be necessary to place press ram on transmission installer closer to mainshaft to keep the crankcase level.*
- *When removing crankcase and transmission assembly from fixture, make sure mainshaft 1st gear does not fall off shaft. Gear could be damaged if it strikes a hard surface.*

1. See Figure 5-87. Place transmission assembly onto TRANSMISSION FIXTURE (Part No. B-46285 (4)) on arbor press (1).
2. Install transmission remover/installer tool GUIDE (Part No. B-43985-4) (2) over the end of the countershaft.
3. See Figure 5-88. Place left case half over transmission assembly and install transmission remover/installer tool INSTALLER (Part No. B-43985-3) (1) into crankcase.
4. Press crankcase onto transmission assembly until it bottoms out.
5. Remove GUIDE (Part No. B-43985-4) from end of countershaft.
6. Remove left crankcase half and transmission assembly from fixture (5).
7. Install left crankcase half and transmission assembly in engine stand.



1. **Arbor press**
2. **Guide**
3. **Countershaft and gears**
4. **Transmission fixture**

Figure 5-87. Transmission Assembly in Fixture (Typical)



1. **Installer**
2. **Press ram**
3. **Crankcase**
4. **Countershaft and gears**
5. **Transmission fixture**

Figure 5-88. Pressing Transmission Into Left Crankcase (Typical)

SHIFTER FORKS AND DRUM ASSEMBLY

NOTES

- *See Figure 5-89. Shifter design allows for one common part number for both countershaft shifter forks. As the transmission runs, each shifter fork develops a certain wear pattern with its mating parts. For this reason, it is important that each shifter fork be reinstalled in its original location.*
- *Always lubricate the shaft bore in each shifter fork with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05) before assembly.*

1. Place 2nd/3rd gear shifter fork onto dog ring between countershaft 2nd and 3rd gears.
2. Install shifter drum into left case half with previously scribed line at 12 o'clock position. This will place shifter drum in neutral position.

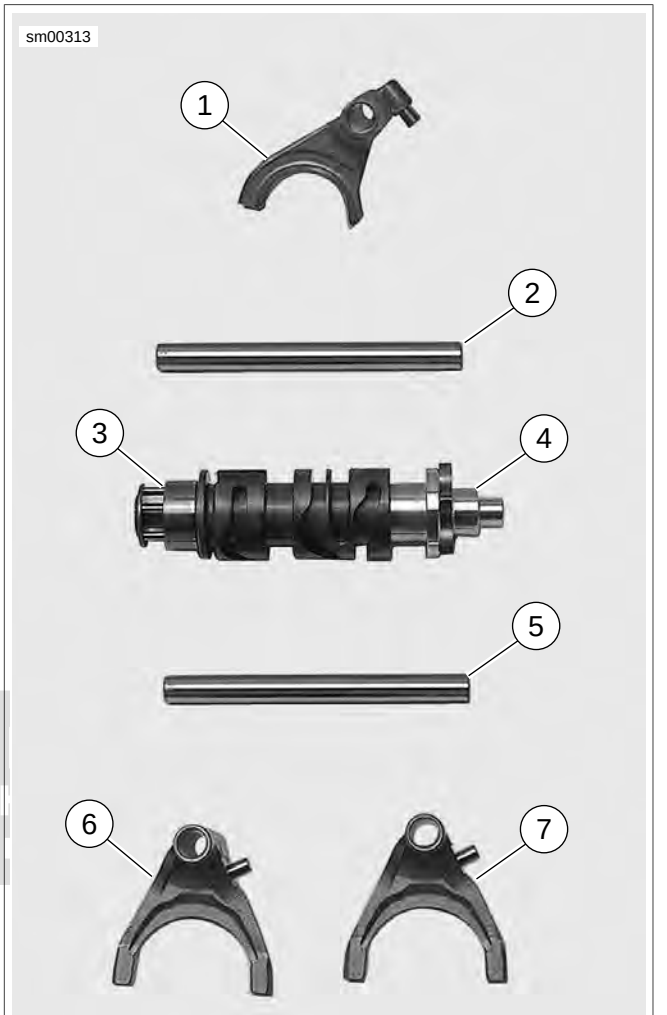
NOTE

See Figure 5-90. Install shifter fork shafts in the left case half by lightly tapping on the end of the shaft with a brass or hard plastic hammer until shaft is seated in bore.

3. Place 1st gear shifter fork onto dog ring between countershaft 1st and 4th gear gears. Install shifter fork shaft through two installed shifter forks and into left crankcase half.
4. Install 4th/5th gear shifter fork onto sliding gear with dogs located on mainshaft. Install remaining shifter fork shaft through last installed shifter fork and into left crankcase half.

NOTE

See Figure 5-90. Install shifter fork shafts in the left case half by lightly tapping on the end with a brass hammer until seated in bore.



1. **Shifter fork (4th-5th)**
2. **Shifter fork shaft**
3. **Shifter drum (left side)**
4. **Shifter drum (right side)**
5. **Shifter fork shaft**
6. **Shifter fork (2nd-3rd)**
7. **Shifter fork (1st)**

Figure 5-89. Shifter Forks, Drum and Shafts

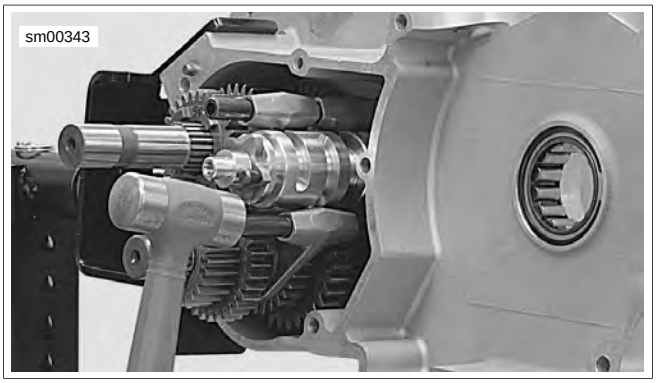


Figure 5-90. Installing Shift Fork Shafts

INSTALLING RIGHT CRANKCASE

PART NUMBER	TOOL NAME
B-45520	GEAR DETENT ASSEMBLY AID
HD-42326-B	CRANKSHAFT GUIDE

1. See Figure 5-91. Install the flywheel assembly into the left crankcase half using CRANKSHAFT GUIDE (Part No. HD-42326-B).

NOTE

The Gear Detent Assembly Aid is used to move the gear detent lever clear of the shifter drum for assembly purposes.

2. See Figure 5-92. Retract detent assembly in right case half and install GEAR DETENT ASSEMBLY AID (Part No. B-45520) until it has bottomed in right case half.
3. Place Transmission in the 1st gear position.
4. Lubricate main drive gear needle bearing assemblies and the mating surfaces of the mainshaft and countershaft with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE (Part No. 99857-97).
5. See Figure 5-93. Assemble crankcase halves together.
   a. Apply a thin coat of GRAY HIGH-PERFORMANCE SEALANT (Part No. 99650-02) to crankcase joint faces.
   b. See Figure 5-94. Apply several drops of LOCTITE 271 (red) to last few threads and tighten crankcase fasteners (1, 2) to 15-19 ft-lbs (20.3-25.0 Nm).
   c. Remove GEAR DETENT ASSEMBLY AID and install neutral indicator switch and washer. Apply LOCTITE 242 to switch. For Firebolt models, tighten to 60-84 **in-lbs** (6.7-9.5 Nm). For Lightning and Ulysses models, tighten to 100-120 **in-lbs** (11-13 Nm).

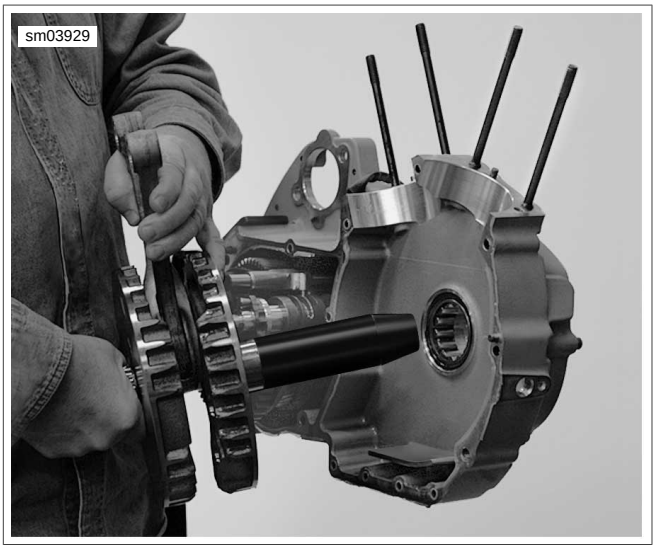
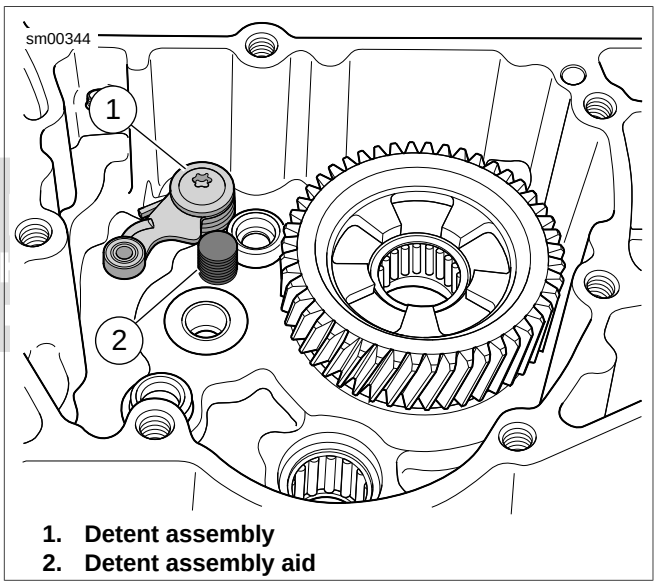


Figure 5-91. Installing Flywheel Assembly with CRANKSHAFT GUIDE



1. Detent assembly
2. Detent assembly aid

Figure 5-92. Using Gear Detent Assembly Aid

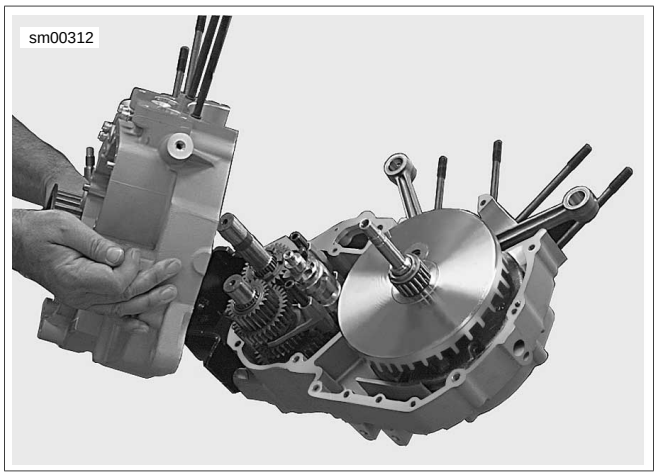
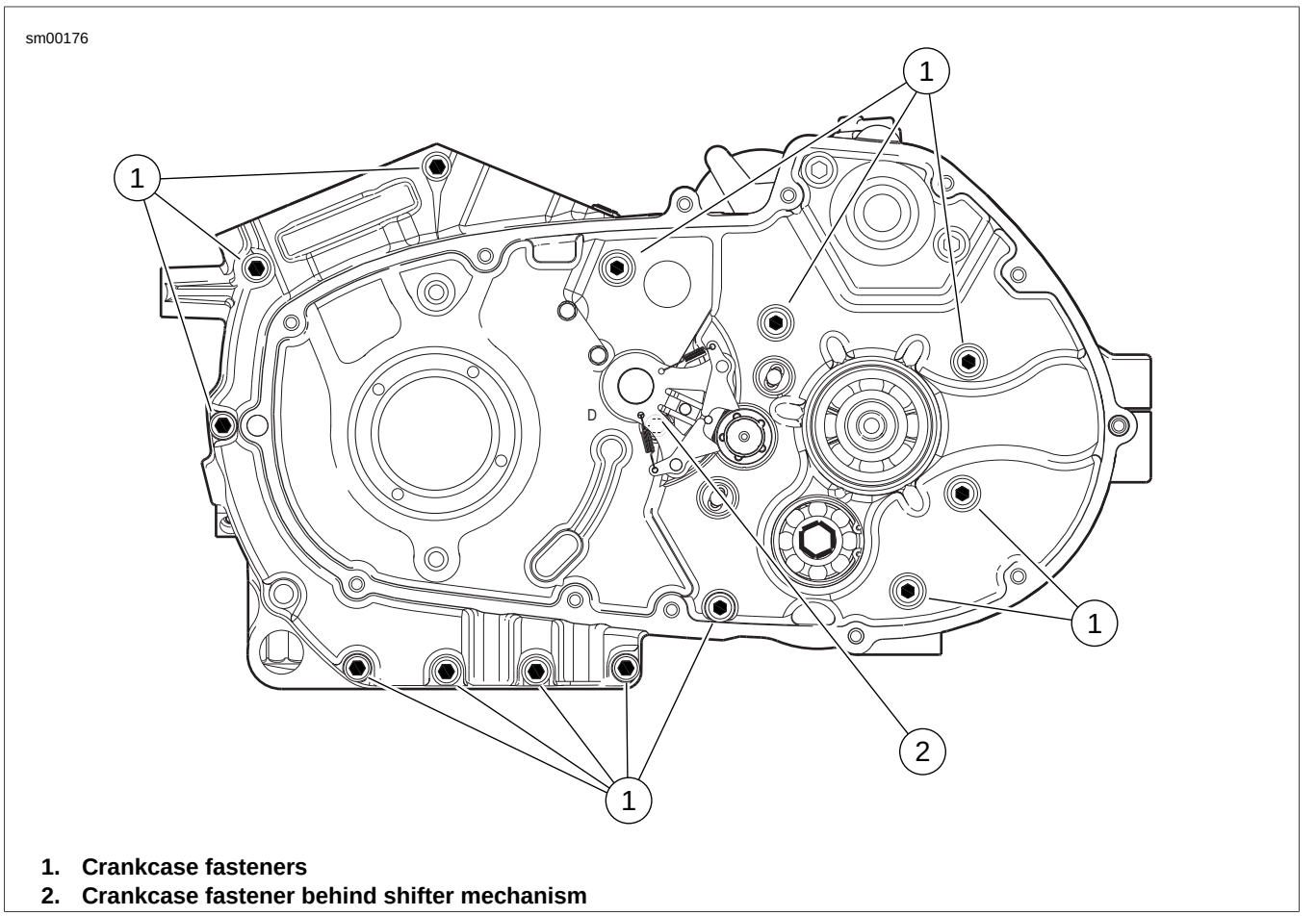


Figure 5-93. Crankcase Halves



1. **Crankcase fasteners**
2. **Crankcase fastener behind shifter mechanism**

Figure 5-94. Crankcase Fasteners

SHIFTER SHAFT 5.16

INSTALLATION

1. See Figure 5-95. Correctly install shifter return spring onto the reverse side of the shifter shaft assembly before placing shaft in left crankcase half.

NOTE

See Figure 5-96. The shifter shaft return spring can be installed incorrectly and then assembled in the left crankcase half. Failure to install the spring properly will result in improper shifting.

2. See Figure 5-98. Depress ratchet arms and insert shaft assembly into the bushing in the left case half and release. Ratchet arms should now be inside the end plate of the shifter drum contacting the shifter drum pins.
3. See Figure 5-99. Apply several drops of LOCTITE 271 (red) to last few threads of countershaft retaining screw. Thread screw into end of shaft.
4. Place transmission in gear and tighten hex head fastener to 33-37 ft-lbs (44.8-50 Nm).
5. Install transmission sprocket. See 5.17 TRANSMISSION SPROCKET.
6. Continue assembling engine. See the following:

- 3.18 CRANKCASE, Assembly
- 3.7 CYLINDER HEAD, Assembly
- 3.7 CYLINDER HEAD, Cylinder Head Installation
- 3.8 CYLINDER AND PISTON, Assembly/Installation

7. Install primary chain and engine sprocket, clutch assembly and primary cover. See 5.6 PRIMARY CHAIN.
8. Install engine in chassis. See 3.6 ENGINE INSTALLATION.

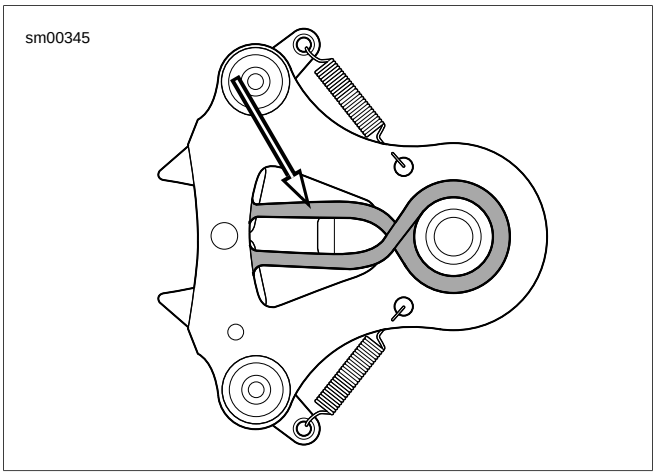


Figure 5-95. Shifter Shaft Return Spring (Correctly Installed)

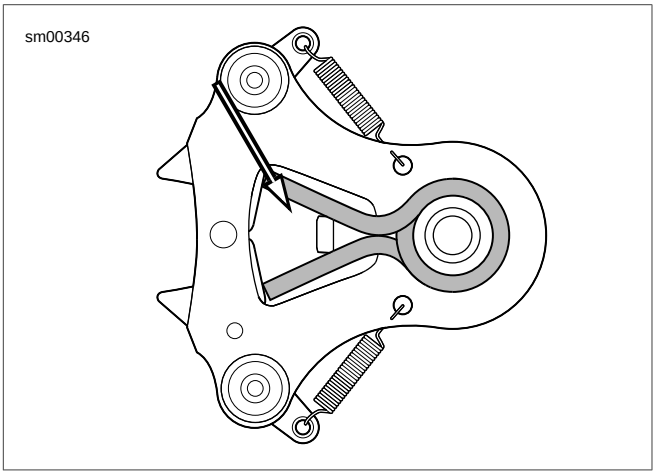
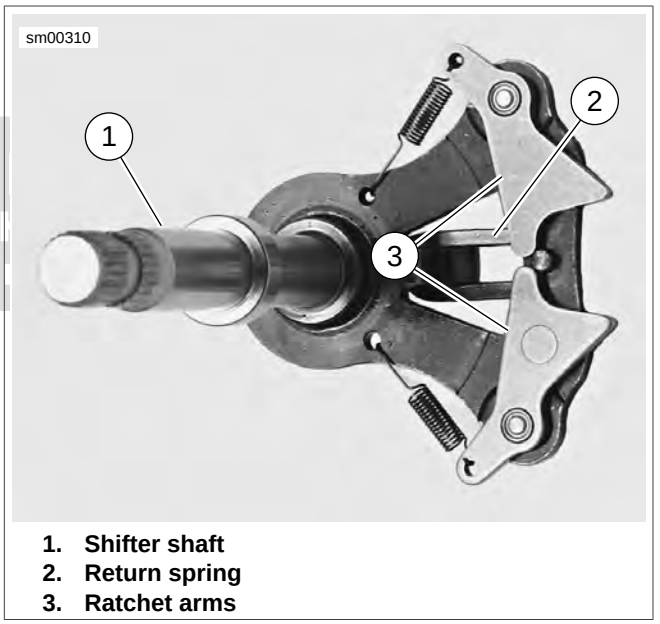


Figure 5-96. Shifter Shaft Return Spring (Incorrectly Installed)



1. **Shifter shaft**
2. **Return spring**
3. **Ratchet arms**

Figure 5-97. Shifter Shaft Assembly

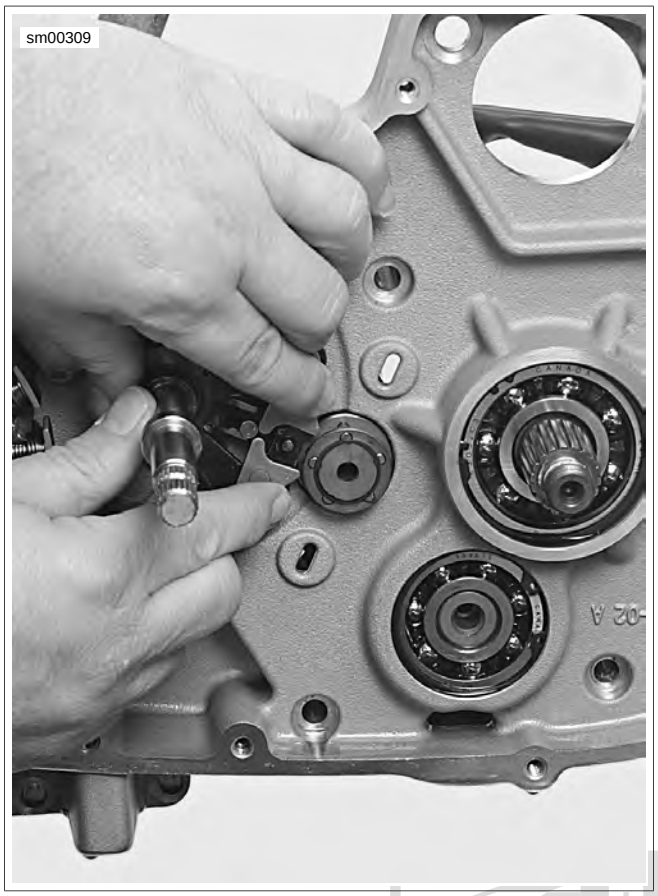


Figure 5-98. Installing Shifter Shaft Assembly

Figure 5-99. Hex Fastener Countershaft Retainer

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

TRANSMISSION SPROCKET 5.17

REMOVAL

PART NUMBER	TOOL NAME
B-43982	SPROCKET HOLDING TOOL
B-45659	SPROCKET LOCKING TOOL
HD-46288	MAINSHAFT LOCKNUT WRENCH
HD-94660-37B	MAINSHAFT LOCKNUT WRENCH

NOTE

Use spacer and fastener from B-45659 to install sprocket locking tool.

1. Loosen rear axle pinch fastener.
2. Unthread axle approximately 15 threads to release tension from drive belt. See 5.7 DRIVE BELT AND IDLER PULLEY.
3. Remove front sprocket cover. See 2.36 SPROCKET COVER.
4. See Figure 5-100. Remove pulley and bracket. See 5.7 DRIVE BELT AND IDLER PULLEY.
5. Inspect pulley by spinning wheel (1) and checking for excessive wheel bearing wear. See 1.10 DRIVE BELT MAINTENANCE, Inspection.
6. If pulley wheel needs replacement, remove fastener (6) and nut (2) from idler pulley bracket (4) and discard. Replace with **new** pulley wheel (1).

NOTE

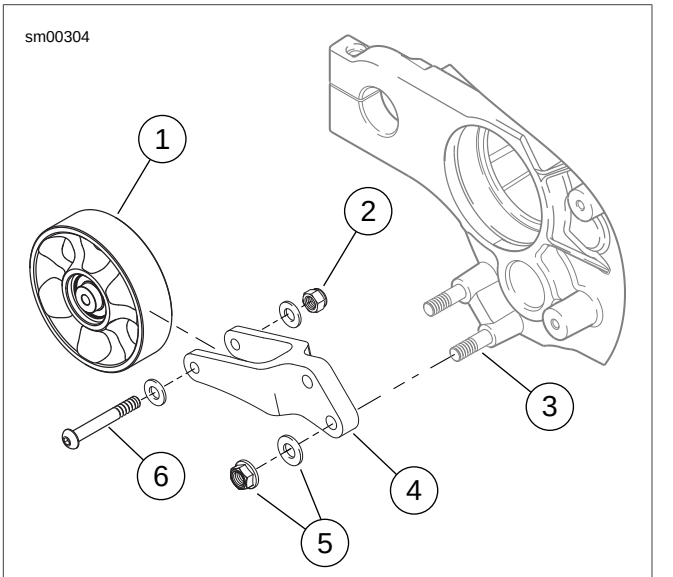
*The pulley wheel bearings can not be replaced separately. A **new** pulley wheel must be installed.*

7. See Figure 5-101. Place transmission in first gear. Remove two socket head screws (1) and lockplate (2).

NOTES

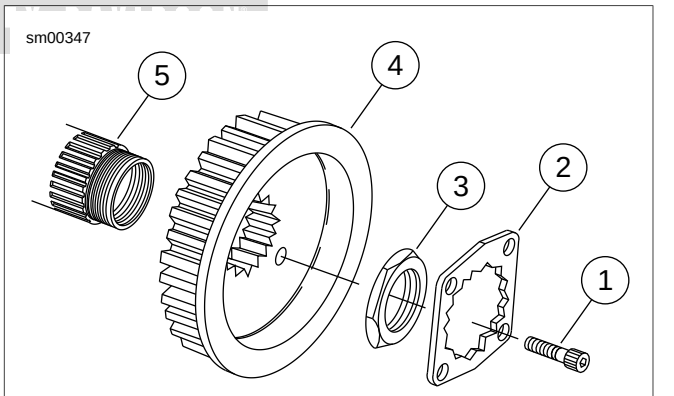
- *Transmission sprocket nut has left-hand threads. Turn nut clockwise to loosen and remove from main drive gear shaft.*
- *Use the P3/Blast SPROCKET HOLDING TOOL (Part No. B-43982) with the spacer and fastener from the Fire-bolt SPROCKET LOCKING TOOL (Part No. B-45659) to hold the sprocket.*

8. See Figure 5-102. Place transmission in neutral. Install the P3/Blast sprocket holding tool (1) to hold the sprocket.
9. See Figure 5-101. Remove transmission sprocket nut (3) from main drive gear (5) using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) or MAINSHAFT LOCKNUT WRENCH (Part No. HD-46288) and a breaker bar.
10. Remove secondary drive belt from transmission sprocket. Remove transmission sprocket (4) from mainshaft (5).



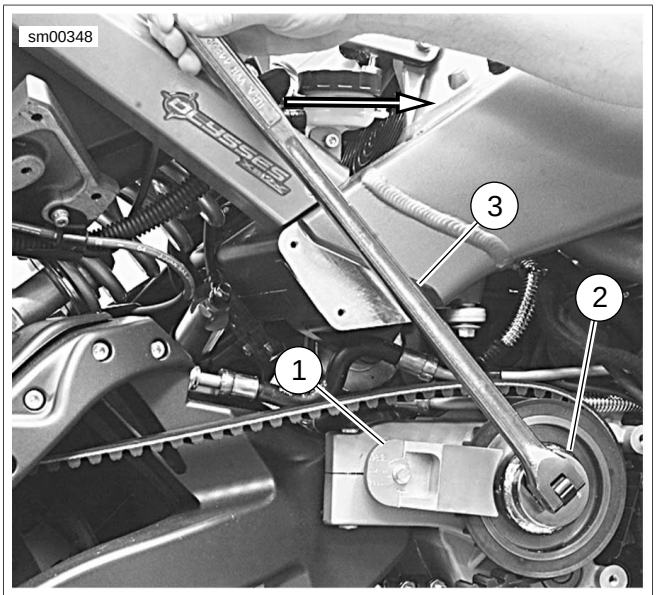
1. **Wheel**
2. **Wheel nut**
3. **Stud (2)**
4. **Idler pulley bracket**
5. **Idler pulley bracket nut and washer (2)**
6. **Wheel fastener**

Figure 5-100. Idler Pulley Assembly



1. **Socket head screw (2)**
2. **Lockplate**
3. **Transmission sprocket nut (left-hand threads)**
4. **Transmission sprocket**
5. **Main drive gear**

Figure 5-101. Transmission Sprocket



1. **Transmission sprocket holding tool**
2. **Mainshaft locknut wrench**
3. **Breaker bar**

Figure 5-102. Removing Transmission Sprocket Locknut

INSTALLATION

PART NUMBER	TOOL NAME
B-43982	SPROCKET HOLDING TOOL
B-45659	SPROCKET LOCKING TOOL
H-D-46288	MAINSHAFT LOCKNUT WRENCH
HD-94660-37B	MAINSHAFT LOCKNUT WRENCH

1. See Figure 5-101. Install transmission sprocket (4) with secondary drive belt onto main drive gear (5).
2. Place transmission in neutral.
3. Apply a few drops of LOCTITE 271 (red) to the **left-hand threads** of transmission sprocket nut (3) and lightly coat the washer-faced side with clean H-D 20W50 engine oil. Wipe off any excess oil.
4. Position nut with washer-faced side facing transmission sprocket. Turn the nut **counterclockwise** to install it onto main drive gear.

NOTE

Use the P3/Blast SPROCKET HOLDING TOOL (Part No. B-43982) with the spacer and fastener from the 2003 Firebolt SPROCKET LOCKING TOOL (Part No. B-45659) to hold the sprocket.

5. Install the P3/Blast sprocket holding tool.
6. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) or MAINSHAFT LOCKNUT WRENCH (Part No. H-D-46288) and a torque wrench, apply LOCTITE 271 (red) and tighten sprocket nut to 50 ft-lbs (67.8 Nm) INITIAL TORQUE ONLY.
7. See Figure 5-102. Scribe a line on the transmission sprocket nut and continue the line on the transmission sprocket as shown.
8. Tighten the transmission sprocket nut an additional 30°-40°.

NOTE

Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation, after initially tightening to 50 ft-lbs. Do not loosen sprocket nut while attempting to align the screw holes. The lockplate has four screw holes and can be turned to either side, so you should be able to find a position without having to additionally tighten the nut. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened to 45° as specified above. Tightening too much or too little may cause the nut to come loose during vehicle operation. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened until screw holes align. NEVER LOOSEN nut to align the screw holes.

9. See Figure 5-101. Install lockplate over nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes.
10. Install two socket head screws through aligned holes of lockplate and into tapped holes of sprocket. Tighten to 90-110 **in-lbs** (10.2-12.4 Nm).

NOTE

*The original equipment socket head screws (1) have thread-locking compound applied to them. Since this compound remains effective for about three removal/installation cycles, the original screws may be reused up to three times. After the third removal/installation cycle, replace both screws with **new** screws identical to the original.*

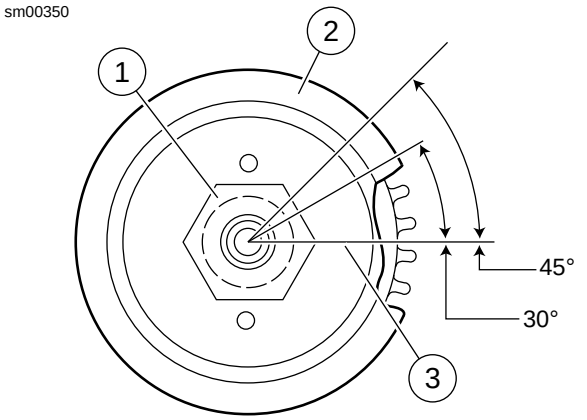
11. Install idler pulley. See 5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation.

NOTES

- *Never tighten rear axle with swingarm brace removed.*
- *If axle was removed for any reason, coat the axle with ANTI-SEIZE LUBRICANT and apply ANTI-SEIZE LUBRICANT to hole in right side of swingarm where the rear axle slides through.*

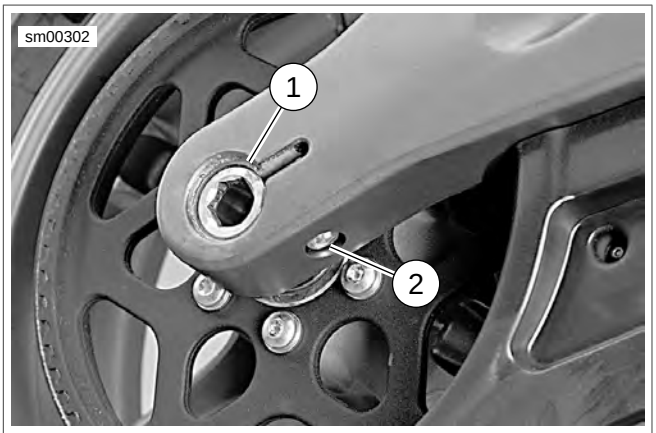
12. See Figure 5-104. Tighten rear axle (1) to 23-27 ft-lbs (31.2-36.6 Nm), back off two full turns and then retighten to 48-52 ft-lbs (65-70.5 Nm).
13. Tighten pinch fastener (2) on right side of swingarm to 40-45 ft-lbs (54-61 Nm).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Transmission sprocket nut
2. Transmission sprocket
3. Line scribed on nut and sprocket

Figure 5-103. Aligning Transmission Sprocket



1. Axle
2. Pinch bolt

Figure 5-104. Rear Axle

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

TABLE OF CONTENTS

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

FASTENER TORQUE VALUES 6.1

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Actuator fasteners	36-40 **in-lbs**	4-4.5 Nm	6.17 INTERACTIVE EXHAUST SYSTEM, Installation
Battery (+) to starter fastener	60-85 **in-lbs**	7-10 Nm	6.7 BATTERY CABLES, Installation
Battery ground cable and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.7 BATTERY CABLES, Installation
Battery ground cable and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Firebolt
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.7 BATTERY CABLES, Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.7 BATTERY CABLES, Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.12 HEATED HAND GRIPS: ULYSSES MODELS, Heated Hand Grips
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.18 HEADLIGHT, Headlight Bulbs: Lightning and Ulysses
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.10 VOLTAGE REGULATOR, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.11 ALTERNATOR, Assembly and Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.13 HORN, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.24 CRANKSHAFT POSITION SENSOR (CKP), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.24 CRANKSHAFT POSITION SENSOR (CKP), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.27 MAIN WIRE HARNESS, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.27 MAIN WIRE HARNESS, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Lightning
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Ulysses
Cooling fan fasteners	12-36 **in-lbs**	1.4-4 Nm	6.27 MAIN WIRE HARNESS, Installation
Crank position sensor screw	80-100 **in-lbs**	9.0-11.3 Nm	6.24 CRANKSHAFT POSITION SENSOR (CKP), Installation
Fork clamp fastener, upper	23-25 ft-lbs	31-34 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT/LOCTITE 271 (red)
Fuse block mounting fasteners	72-96 **in-lbs**	8.1-10.8 Nm	6.27 MAIN WIRE HARNESS, Installation
Ground terminal on front of steering head (Lightning)	48-72 **in-lbs**	5.4-8 Nm	6.27 MAIN WIRE HARNESS, Installation

DIGITAL TECHNICIAN HARLEY-DAVIDSON

FASTENER	TORQUE VALUE		NOTES
Headlight housing fasteners (Lightning/Ulysses)	48-72 **in-lbs**	5.4-8 Nm	6.18 HEADLIGHT, Headlight Bulbs: Lightning and Ulysses
heated grip fasteners	14-16 **in-lbs**	1.6-1.8 Nm	6.12 HEATED HAND GRIPS: ULYSSES MODELS, Heated Hand Grips
Horn fastener	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Horn fastener	72-96 **in-lbs**	8.1-10.8 Nm	6.13 HORN, Installation
Ignition switch body fastener	12-36 **in-lbs**	1.4-4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT
Ignition switch body fastener	12-36 **in-lbs**	1.4-4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Ignition switch body fastener	12-36 **in-lbs**	1.4-4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES
Ignition switch fastener	18-20 ft-lbs	24.4-27.1 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT/LOCTITE 271 (red)
Ignition switch fastener	18-20 ft-lbs	24.4-27.1 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING/LOCTITE 271 (red)
Ignition switch fastener	18-20 ft-lbs	24.4-27.1 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES/LOCTITE 271 (red)
Instrument module fasteners	12-36 **in-lbs**	1.4-4 Nm	6.26 INSTRUMENT MODULE, Installation
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Firebolt
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Lightning
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Ulysses
License plate lamp assembly fastener (Lightning)	12-36 **in-lbs**	1.4-4 Nm	6.20 LICENSE PLATE LAMP ASSEMBLY, Lightning
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	6.9 STARTER SOLENOID, Solenoid Contacts
Lower headlight fastener	36-48 **in-lbs**	4-5.5 Nm	6.18 HEADLIGHT, Headlight Bulbs: Lightning and Ulysses
Main battery ground to frame and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Lightning
Main battery ground to frame and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Ulysses
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	6.17 INTERACTIVE EXHAUST SYSTEM, Installation
Negative battery terminal cable at battery terminal	72-96 **in-lbs**	8-11 Nm	6.18 HEADLIGHT, Headlight Bulbs: Firebolt
Neutral indicator switch	60-84 **in-lbs**	6.7-9.5 Nm	6.22 NEUTRAL INDICATOR SWITCH, Removal and Installation/LOCTITE THREADLOCKER 243 (blue)
Rear reflector bracket	48-72 **in-lbs**	5.4-8 Nm	6.16 REAR TURN SIGNALS, Turn Signal Relocation Bracket: XB12XP
Retainer plate	56 **in-lbs**	6.3 Nm	6.11 ALTERNATOR, Assembly and Installation
Rotor mounting fasteners	120-140 **in-lbs**	13.5-15.8 Nm	6.11 ALTERNATOR, Assembly and Installation
Sidestand switch fastener	96-120 **in-lbs**	11-13.6 Nm	6.23 SIDESTAND SWITCH (HDI), SIDESTAND SWITCH (HDI)
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	6.8 STARTER, Field Coil Assembly
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	6.8 STARTER, Field Coil Assembly
Starter mounting bolt	13-20 ft-lbs	17.6-27.1 Nm	6.8 STARTER, Installation

DIGITAL TECHNICIAN HARLEY-DAVIDSON

FASTENER	TORQUE VALUE		NOTES
Starter positive terminal nut	60-85 **in-lbs**	7-9.6 Nm	6.8 STARTER, Installation
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	6.8 STARTER, Field Coil Assembly
Stator TORX mounting screws	30-40 **in-lbs**	3-4 Nm	6.11 ALTERNATOR, Assembly and Installation/T-27 TORX with retaining compound, replace with new after each removal
Steering head clamp fastener	16-18 ft-lbs	21.7-24.4 Nm	6.27 MAIN WIRE HARNESS, Installation
Steering head wiring clamp	16-18 ft-lbs	21.7-24.4 Nm	6.27 MAIN WIRE HARNESS, Installation
Steering stem cap	38-42 ft-lbs	52-57 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT
Steering stem pinch fastener	20-22 ft-lbs	27-30 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT/LOCTITE 271 (red)
Tail lamp fasteners (Lightning)	6-7 **in-lbs**	0.7-0.8 Nm	6.19 TAIL LAMP, Firebolt/Lighting
Tail lamp fasteners (Ulysses)	12-36 **in-lbs**	1.4-4 Nm	6.19 TAIL LAMP, Ulysses
Turn signal fastener, front (Lightning)	25-28 **in-lbs**	2.8-3.2 Nm	6.15 FRONT TURN SIGNALS, Lightning
Turn signal fastener, front (Ulysses)	25-28 **in-lbs**	2.8-3.2 Nm	6.15 FRONT TURN SIGNALS, Ulysses
Turn signal fastener, rear (Lightning)	25-28 **in-lbs**	2.8-3.2 Nm	6.16 REAR TURN SIGNALS, Lightning
Turn signal fastener, rear (Ulysses)	25-28 **in-lbs**	2.8-3.2 Nm	6.16 REAR TURN SIGNALS, Ulysses
Turn signal fastener (rear)	25-28 **in-lbs**	2.8-3.2 Nm	6.16 REAR TURN SIGNALS, Firebolt
Turn signal fasteners (front)	25-28 **in-lbs**	2.8-3.2 Nm	6.15 FRONT TURN SIGNALS, Firebolt
Turn signal flasher fastener	36-60 **in-lbs**	4-7 Nm	6.14 TURN SIGNAL FLASHER, Installation
Turn signal flasher fastener	12-36 **in-lbs**	1.4-4 Nm	6.14 TURN SIGNAL FLASHER, Installation
Turn signal flasher fastener	36-60 **in-lbs**	4-7 Nm	6.14 TURN SIGNAL FLASHER, Installation
Turn signal housing screw	4.4-4.3 **in-lbs**	0.5-0.6 Nm	6.15 FRONT TURN SIGNALS, Bulbs
Turn signal housing screw	4.4-4.3 **in-lbs**	0.5-0.6 Nm	6.16 REAR TURN SIGNALS, Bulbs
Turn signal relocation bracket	60-72 **in-lbs**	7-8 Nm	6.16 REAR TURN SIGNALS, Turn Signal Relocation Bracket: XB12XP
Vehicle speed sensor fastener	90-110 **in-lbs**	10.0-12.4 Nm	6.25 VEHICLE SPEED SENSOR (VSS), Installation
Voltage regulator mounting fasteners	36-60 **in-lbs**	3.5-7 Nm	6.10 VOLTAGE REGULATOR, Installation
Windscreen fasteners	10-12 **in-lbs**	1.1-1.4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Windscreen fasteners	10-12 **in-lbs**	1.1-1.4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES
Wire cover front fasteners	36-48 **in-lbs**	4.1-5.4 Nm	6.20 LICENSE PLATE LAMP ASSEMBLY, Ulysses
Wire cover rear fasteners	12-36 **in-lbs**	1.4-4 Nm	6.20 LICENSE PLATE LAMP ASSEMBLY, Ulysses
Wire harness guide	72-84 **in-lbs**	8-9 Nm	6.27 MAIN WIRE HARNESS, Installation

SPECIFICATIONS 6.2

GENERAL

Table 6-1. Battery Specifications

BATTERY	
Size	12 VDC/12 AH/200CCA
Type	Sealed, AGM

Table 6-2. Spark Plug Specifications

SPARK PLUGS		
Size	12 mm	
Type	10R12X	
Gap	0.035 in.	0.9 mm
Torque	12-18 ft-lbs	16-24 Nm
Cable resistance (front and rear)	1,350-3,465 ohms	

Table 6-3. General Specifications

ITEM	883 cc	1200 cc
Number of cylinders	2	2
Type	4-cycle, 45° V	4-cycle, 45° V
Bore	3.0005 in. (76.20 mm)	3.498 in. (88.85 mm)
Stroke	3.812 in. (96.82 mm)	3.812 in. (96.82 mm)
Piston displacement	53.86 cu. in. (883 cc)	73.2 cu. in. (1203 cc)
Torque	51.0 ft-lbs (69.2 Nm) @ 4300 RPM	79.0 ft-lbs (107.2 Nm) @ 3500 RPM
Compression ratio	8.9:1	9.7:1
Oil tank capacity (with filter)	2.8 qt. (2.65 Liters)	2.8 qt. (2.65 Liters)

Table 6-4. Service Wear Specifications

SERVICE WEAR LIMITS	IN.	MM
Brush length (minimum)	0.433	11.0
Commutator diameter (minimum)	1.141	28.981

Table 6-5. Alternator Specifications

ALTERNATOR	
AC voltage output	20-28 VAC per 1000 engine RPM
Stator coil resistance	0.1-0.3 ohms

Table 6-6. Regulator Specifications

REGULATOR	
Voltage output @ 3600 RPM	14.3-14.7 VDC @ 75° F (24° C)
Amperes @ 3600 RPM	32 Amps

Table 6-7. Ignition Coil Specifications

IGNITION COIL RESISTANCE	
Primary winding	0.5-0.7 ohms
Secondary winding	5500-7500 ohms

Table 6-8. Electrical System Specifications

ELECTRICAL SYSTEM	AMPERES
Main fuse/battery fuse	30
Ignition fuse	15
Light fuse	15
Accessory fuse	10
Brake/horn/active muffler fuse (XB12 models only)	10
ECM fuse	10
Key switch fuse	15
Cooling fan fuse	10
Auxiliary fuse	10

Table 6-9. Bulb Chart: 2009 XB Models

BULBS		BULBS REQUIRED	WATTS	AMPS	PART NUMBER
Headlamps	Bulb (H3) (Firebolt)	2	55	4.58	68918-98
	Bulb (H7) (Lightning/Ulysses)	2	55	4.58	Y0148.1AD
	Position lamp (Firebolt) (Europe, Japan, Australia models only)	1	3	0.25	Y0026.02A8
	Position lamp (Lightning/Ulysses) (Europe, Japan, Australia models only)	1	5	0.37	53436-97
Marker lamps	Tail/stop lamp (Firebolt/Lightning)	1	5/21	0.42/1.75	68169-90A
	Tail/stop lamp (Ulysses)	Illuminated with LEDs. Replace entire assembly upon failure.			
	Front and rear turn signal lamps (1 bulb each)	4	10	0.74	Y0042.K
	License plate illumination lamp (Lightning/Ulysses only)	1	5	0.37	53436-97
Instruments	Turn signal indicator	1	1.12	0.08	Y0163.02A8
	Check engine	1	1.12	0.08	Y0163.02A8
	High beam	1	0.7	0.05	Y0162.02A8
	Oil indicator	1	1.12	0.08	Y0163.02A8
	Neutral	1	1.12	0.08	Y0163.02A8
	Backlight	2	1.12	0.08	Y0163.02A8
		1	0.7	0.05	Y0162.02A8
	Low fuel	Replace instrument cluster if low fuel warning lamp fails.			

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

IGNITION SYSTEM 6.3

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

The vehicle uses a breakerless inductive-discharge ignition system. The system has both a primary and secondary circuit. The primary circuit consists of the battery, main fuse, ignition switch, primary coil windings, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, spark plugs and associated wiring. See Figure 6-1.

DIGITAL TECHNICIAN II (Part No. HD-48650) can access the information received by and stored in the electronic control module.

The electronic control module (ECM) is located in the fairing (Firebolt models) or under the seat (Lightning and Ulysses models). The module has three primary functions. First, it computes the spark advance for proper ignition timing based on sensor input. Second, it controls the independent, primary windings of the spark coil and is thus able to provide sequential and independent firing of the spark plugs (non waste spark). Third, it calculates the correct air/fuel ratio based on input from the sensors.

The electronic control module contains all the solid-state components used in the ignition system. The dwell time for the ignition coil is also calculated by the ECM microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to keep battery drain to a minimum and to adequately charge the coil at all speeds. The ECM has added protection against transient voltages, continuous reverse voltage protection and damage due to jump starts. The ECM is fully enclosed to protect it from vibration, dust, water and oil. The module is not repairable. Replace the unit if it fails.

The ECM uses the following sensors to monitor rider demands and engine conditions:

- Throttle Position (TP) Sensor
- Crank Position Sensor (CKP) Sensor
- Intake Air Temperature (IAT) Sensor
- Engine Temperature (ET) Sensor
- Oxygen (O2) Sensor
- Bank Angle Sensor (BAS)
- Interactive Muffler Valve Position Sensor (XB12 models only, except Ulysses) (Built-in to the actuator)

The ECM uses the information provided by the throttle position sensor to calculate how much air is entering the engine. The throttle position sensor monitors the amount of air entering the engine by how far the throttle is open, whether it is opening or closing and how fast it is opening or closing. The IAT sensor measures the temperature of the air entering the engine, providing the rest of the information necessary to determine the density of the air entering the engine. The ECM also monitors the crank position sensor to determine the exact position of both cylinders in the combustion cycle and the engine speed.

The ET sensor provides the ECM the current engine temperature. Proper fuel and spark delivery are dependent on the temperature of the engine. The ECM will provide a richer fuel mixture on start up and a higher degree of spark advance. As the vehicle warms up to operating temperature the fuel mixture will lean and the spark advance will decrease.

On XB12 models, an interactive exhaust system utilizes an actuator valve in the muffler which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

Cooling fan actuation is controlled by the ECM. For cooling fan specifications refer to Table 6-10.

Table 6-10. Cooling Fan Specifications

KEY	FAN ON		FAN OFF	
	° F	° C	° F	° C
ON	455	235	383	195
ON (HDI models)	437	225	383	195
OFF	266	130	230	110

The information provided by the O2 sensor allows the ECM to verify a proper air/fuel mixture by monitoring the final combustion efficiency in the exhaust system. This verifies optimum engine performance at any altitude or barometric pressure. The O2 sensor input to the ECM is required to verify a stoichiometric (14.7:1) air/fuel ratio during closed loop operation.

The Bank Angle Sensor (BAS) provides input to the ECM on whether the vehicle lean is greater than the predetermined bank angle limit. As long as lean angle does not exceed limit, fuel supply and ignition operation are unaffected. If the vehicle exceeds the predetermined bank angle limit, the BAS will interrupt the operation of the ignition system and fuel supply. To reset system, return vehicle to the upright position and switch key OFF.

The ECM-controlled ignition coil fires each spark plug independently on the compression stroke of each cylinder (no waste spark). The spark plug in the front cylinder fires at the end of that cylinder's compression stroke, thereby igniting the air/fuel mixture. The same sequence occurs at the end of the rear cylinder's compression stroke (thereby igniting the air/fuel mixture in the rear cylinder).

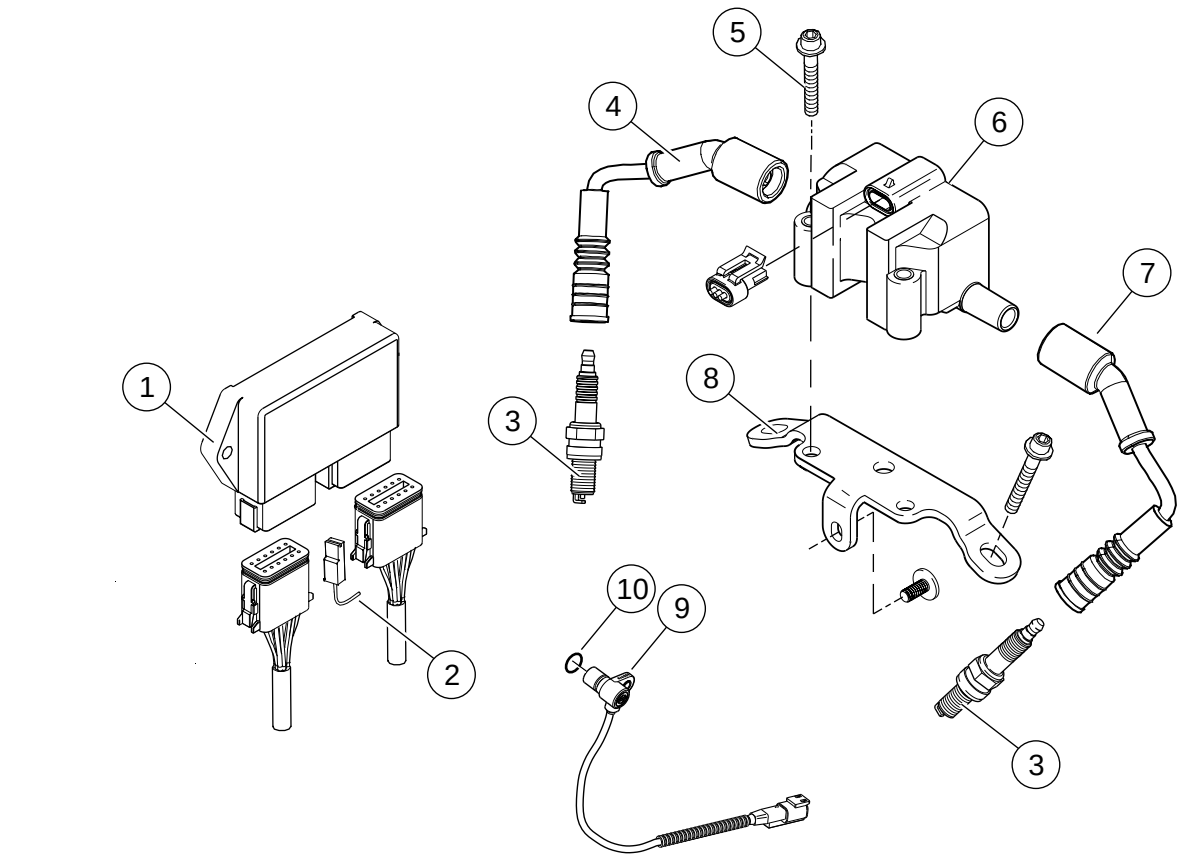
The crank position sensor is located in the left front side of the crankcase. Readings are taken off the 30 teeth on the left side of the flywheel (two teeth are missing to establish a reference point). The CKP generates an AC signal which is sent to the ECM where it is used to reference engine position (TDC) and speed.

For more information on the sensors used in conjunction with the ECM see the Electrical Diagnostic Manual.

See the wiring diagrams in the Appendix for additional information on ignition system circuits.

TROUBLESHOOTING

See Electrical Diagnostic Manual for troubleshooting information.



1. **Electronic control module (ECM)**
2. **Connector, interactive exhaust system**
3. **Spark plug (2)**
4. **Rear spark plug cable**
5. **Mounting fastener**
6. **Ignition coil**
7. **Front spark plug cable**
8. **Cylinder brace**
9. **Crank position sensor (CKP)**
10. **O-ring**

Figure 6-1. Ignition Components

IGNITION/HEADLAMP KEY SWITCH 6.4

GENERAL

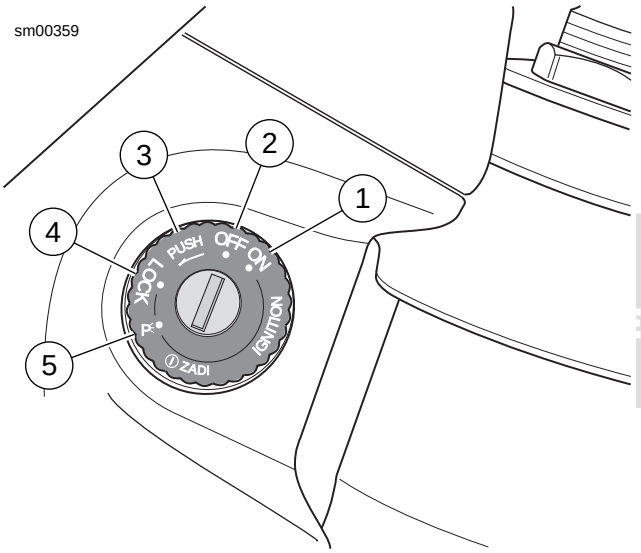
⚠WARNING

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

Switch positions are explained in Table 6-11.

NOTE

The key locks the ignition system and is removable in both the LOCK and P positions. The P position is located counterclockwise from the LOCK position and allows the rider to remove the key while leaving the lights on. When the key is placed in the P position, several indicator markers are or can be activated. Refer to Table 6-12.



1. **ON position**
2. **OFF position**
3. **PUSH DETENT**
4. **LOCK position**
5. **PARKING LIGHT position**

Figure 6-2. Ignition/Headlight Key Switch

Table 6-11. Ignition Key Switch Positions

LABEL	IGNITION	LAMPS	REMOVE KEY
OFF	Off	Off	Yes
P	Off	See note and Table 6-12.	Yes
ON	On		No
LOCK	Off	Off	Yes

Table 6-12. Indicator Markers

ITEM	P	ON
Headlight position marker lamps (European models only)	On	On
Headlight high beam	Off	Can be activated
Headlight low beam	Off	On
Instrument module illumination lamps	Off	On
Stop lamp	Off	Can be activated
Front and rear turn signals	Can be activated	
Horn	Cannot be activated	Can be activated
Aux power outlets	Off	On

FIREBOLT

PART NUMBER	TOOL NAME
FTXR45E	SNAP-ON TAMPER-RESISTANT T45 TORX DRIVER

Removal

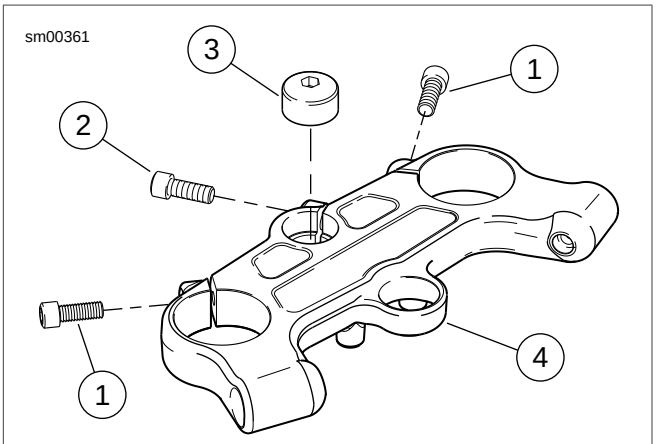
1. Remove seat.

⚠WARNING

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

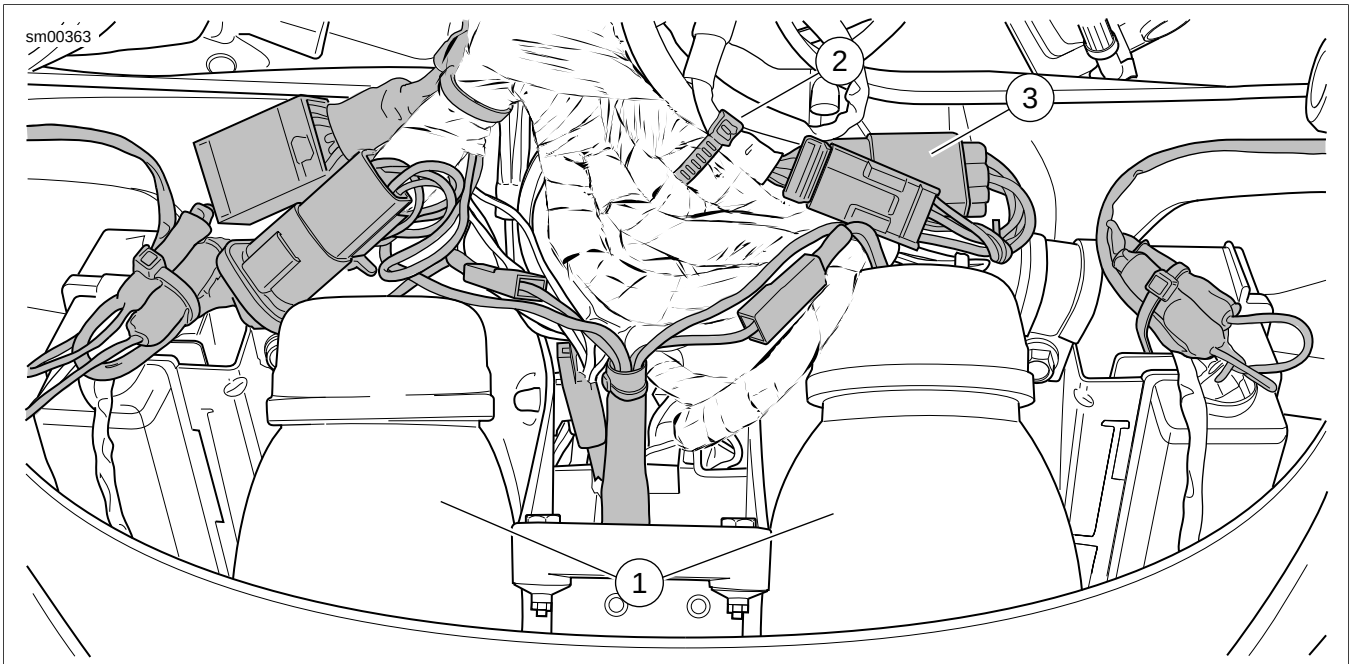
2. Disconnect negative battery cable.
3. Cut cable strap holding ignition switch, fuse block and right handlebar switch wires.
4. Disconnect ignition switch connector [33].
5. See Figure 6-3. Remove cable straps attached to the upper fork clamp.
6. Remove air cleaner cover. See 2.38 INTAKE COVER.
7. See Figure 6-4. Remove steering stem pinch fastener (2).
8. Remove upper fork clamp pinch fasteners (1).
9. Hold or brace the lower fork clamp and remove steering stem capnut (3).
10. Remove the upper fork clamp (4) from forks.
11. See Figure 6-6. Use SNAP-ON TAMPER-RESISTANT T45 TORX DRIVER (Part No. FTXR45E) to remove ignition switch fasteners (3) securing ignition switch (4) to upper fork clamp. Slide ignition switch out of upper fork clamp.

Figure 6-3. Cable Straps On Upper Fork Clamp: Firebolt



1. **Upper fork clamp pinch fastener (2)**
2. **Stem pinch fastener**
3. **Stem capnut**
4. **Upper fork clamp**

Figure 6-4. Upper Fork Clamp: Firebolt



1. **Headlights (2)**
2. **Cable strap**
3. **Ignition switch connector [33]**

Figure 6-5. Ignition Switch Connector (Viewed From Beneath Fairing): Firebolt

Disassembly

1. See Figure 6-6. Remove ignition switch housing (5) from ignition switch (4) by prying tabs on side of housing.
2. Remove ignition switch body fasteners (1). Separate ignition switch body (2) from ignition switch (4).

Assembly

NOTE

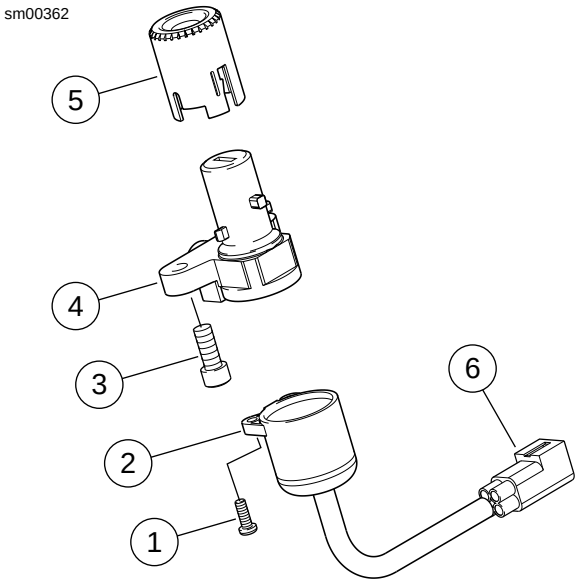
See Figure 6-6. In next step, be sure wide slot in ignition switch housing (5) is installed over wide boss on ignition switch (4).

1. Push ignition switch housing (5) on to ignition switch (4).

NOTE

In next step, do not force ignition switch (4) into ignition switch body (2). If ignition switch does not easily slide into ignition switch body, rotate slot in ignition switch body with screwdriver until proper installation can be achieved.

2. Mate ignition switch to ignition switch body.
3. Install ignition switch body fasteners (1). Tighten to 12-36 **in-lbs** (1.4-4 Nm).



1. **Body fastener (2)**
2. **Body**
3. **Fastener (2)**
4. **Ignition switch**
5. **Housing**
6. **Connector [33]**

Figure 6-6. Ignition Switch Assembly: Firebolt

Installation

1. See Figure 6-4. From beneath upper triple clamp (4), insert ignition switch assembly into hole. The word "OFF" stamped on the switch housing should face front of vehicle.
2. See Figure 6-6. Attach ignition switch assembly to upper triple clamp using ignition switch fasteners (3). USE LOCTITE 271 (red) on fasteners. Tighten to 18-20 ft-lbs (24.4-27.1 Nm).
3. See Figure 6-4. Install steering stem cap (3). Tighten but do not tighten.
4. Install upper clamp on fork assembly.
   a. Apply LOCTITE 271 to upper fork clamp pinch fasteners (1).
   b. Tighten but do not torque upper fork clamp pinch fasteners.
   c. Tighten steering stem cap to 38-42 ft-lbs (52-57 Nm).
   d. Install steering stem pinch fastener (2) applying LOCTITE 271 and tightening to 20-22 ft-lbs (27-30 Nm).
   e. Tighten upper fork clamp fasteners to 23-25 ft-lbs (31-34 Nm).
   f. Repeat torque sequence in steps d and e.
5. See Figure 6-5. Connect ignition key switch connector (3) to wiring harness. Install cable strap (2) around ignition switch, fuse block and right handlebar switch wires.
6. Install intake cover assembly. See 2.38 INTAKE COVER.
7. See Figure 6-3. Attach cable straps to upper fork clamp.
   a. Install cable strap to the right of ignition switch securing right hand switch and brake line wires to upper fork clamp.
   b. Install cable strap to the left of ignition switch securing left hand switch and clutch cable wires to upper fork clamp.
8. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

9. Check ignition key switch for proper operation. If operation fails, reread procedure and verify that all steps were performed.

⚠WARNING

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

10. Install seat.

LIGHTNING

PART NUMBER	TOOL NAME
FTXR45E	SNAP-ON TAMPER RESISTANT T45 TORX DRIVER

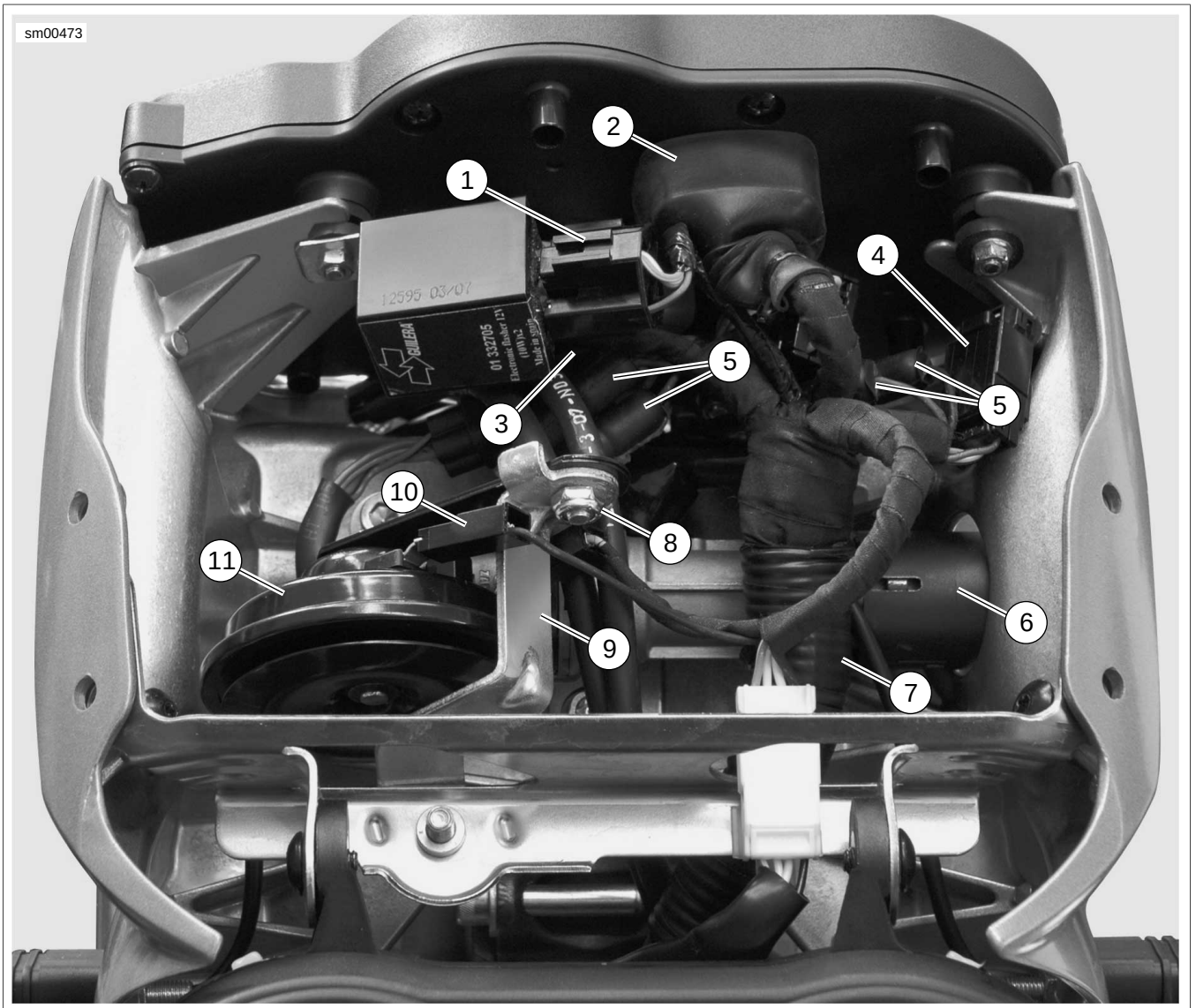
Removal

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove windscreen.
4. See Figure 6-7. Disconnect:
   a. Turn signal flasher connector [30] (1)
   b. Turn signals connector [31] (5)
   c. Left [24] (4) and right [22] (3) handlebar wiring harnesses connectors
   d. Instrument cluster connector [39] (2)
   e. Horn connector [122] (10)
5. Remove horn (11) from horn mount (9).
6. Cut cable strap that loosely holds main wiring harness (7) to the ignition switch (6) and disconnect ignition switch connector [33].



1. **Turn signal flasher connector [30]**
2. **Instrument cluster connector [39]**
3. **Right handlebar connector [22]**
4. **Left handlebar connector [24]**
5. **Turn signal connectors [31]**
6. **Ignition switch [33]**
7. **Main harness**
8. **Horn fastener**
9. **Horn mount**
10. **Horn connector [122]**
11. **Horn**

Figure 6-7. Electrical Connectors Behind Windscreen: Lightning

7. See Figure 6-8. Use SNAP-ON TAMPER RESISTANT T45 TORX DRIVER (Part No. FTXR45E) to remove the two tamper-resistant Torx fasteners (2) securing ignition switch to upper fork clamp.
8. Remove the final ignition switch fastener (1) along with spacer located behind the ignition switch.
9. While holding the throttle cables (3) to your left (the right side of the vehicle), pull the ignition switch (4) toward you and roll the assembly away from you until the fork stop pin (5) is pointing down.
10. Slide the ignition switch assembly out to your left (the right side of the vehicle).

1. **Socket head fastener (1) with spacer behind switch**
2. **Tamper-resistant Torx fasteners (2)**
3. **Throttle cables**
4. **Ignition switch as positioned on vehicle**
5. **Fork stop pin (retracted)**

Figure 6-8. Ignition Switch: Lightning (Typical)

Disassembly

1. See Figure 6-9. Remove ignition switch housing (5) from ignition switch (4) by prying tabs on side of housing.
2. Remove ignition switch body fasteners (1). Separate ignition switch body (2) from ignition switch (4).

Assembly

NOTE

See Figure 6-9. In next step, be sure wide slot in ignition switch housing (5) is installed over wide boss on ignition switch (4).

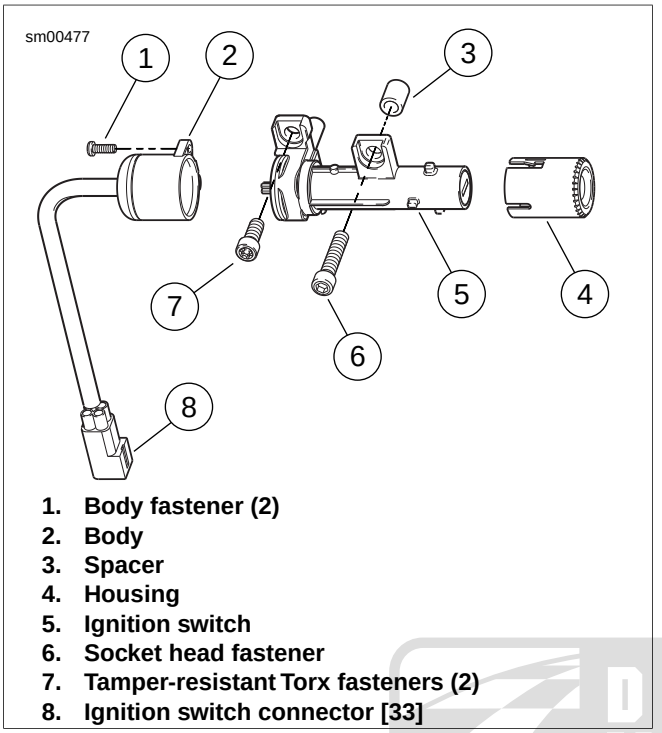
1. Push ignition switch housing (4) on to ignition switch (5).

NOTE

In next step, do not force ignition switch (5) into ignition switch body (2). If ignition switch does not easily slide into ignition

switch body, rotate slot in ignition switch body with screwdriver until proper installation can be achieved.

2. Mate ignition switch to ignition switch body.
3. Install ignition switch body fasteners (1). Tighten to 12-36 **in-lbs** (1.4-4 Nm).



1. **Body fastener (2)**
2. **Body**
3. **Spacer**
4. **Housing**
5. **Ignition switch**
6. **Socket head fastener**
7. **Tamper-resistant Torx fasteners (2)**
8. **Ignition switch connector [33]**

Figure 6-9. Ignition Switch Assembly

Installation

NOTE

When installing the ignition switch it is important to have the fork lock pin pointing down while sliding the switch into place.

1. See Figure 6-9. While holding the throttle cables (3) to your left (the right side of the vehicle), slide the ignition switch assembly in to your right (the left side of the vehicle).
2. Install the ignition switch (4) with the fork stop pin (5) pointing down and, once in place, roll the assembly toward you and insert the fork stop pin into the upper triple clamp.
3. See Figure 6-9. Apply LOCTITE 271 (red) to ignition switch fasteners (6, 7).
4. Install spacer (3) onto fastener (6), and attach ignition switch assembly to upper triple clamp.
5. Tighten fasteners to 18-20 ft-lbs (24.4-27.1 Nm).
6. See Figure 6-7. Connect ignition key switch connector [33] (6) to wiring harness.
7. Install horn connectors [122] (10) and install horn assembly (11) tightening fastener to 72-96 **in-lbs** (8-11 Nm).
8. Connect:
   a. Instrument cluster connector [39] (2)
   b. Left [24] (4) and right [22] (3) handlebar wiring harness connectors
   c. Turn signal connectors [31] (5)
   d. Turn signal flasher connector [30] (1)
9. Loosely install cable strap around the main wiring harness and the ignition switch.
10. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

11. Check ignition switch for proper operation. If operation fails, verify that all steps were performed.

⚠WARNING

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

12. Install seat.
13. Install windscreen and tighten fasteners to 10-12 **in-lbs** (1.1-1.4 Nm).

ULYSSES

PART NUMBER	TOOL NAME
FTXR45E	SNAP-ON TAMPER-RESISTANT T45 TORX DRIVER

Removal

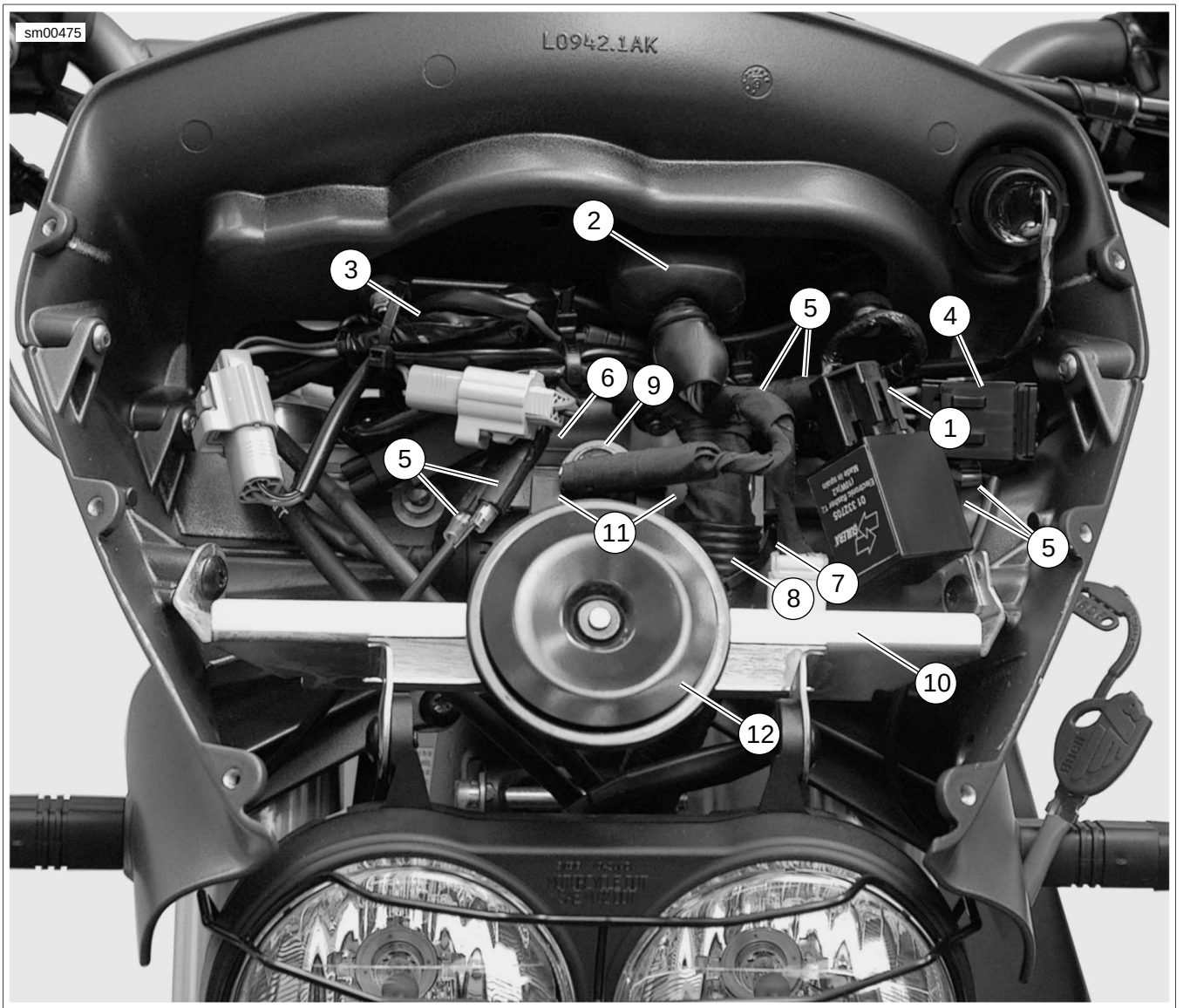
1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove windscreen.
4. See Figure 6-10 and Figure 6-11. Cut cable strap (7) that loosely holds main wiring harness to the ignition switch and disconnect ignition switch connector [33].
5. Figure 6-11. Use SNAP-ON TAMPER-RESISTANT T45 TORX DRIVER (Part No. FTXR45E) to remove the two tamper-resistant Torx fasteners (7) securing ignition switch to upper fork clamp.
6. Remove the final ignition switch fastener (6) along with spacer (3) located behind the ignition switch.

7. While holding the throttle cables to your left (the right side of the vehicle), pull the ignition switch toward you and roll the assembly away from you until the fork stop pin is pointing down.
8. Slide the ignition switch assembly out to your left (the right side of the vehicle).



1. **Turn signal flasher connector [30]**
2. **Instrument cluster connector [39]**
3. **Right handlebar connector [22]**
4. **Left handlebar connector [24]**
5. **Turn signal connectors [31]**
6. **Ignition switch**
7. **Cable strap**
8. **Main harness**
9. **Horn fastener**
10. **Horn mount**
11. **Horn connector [122]**
12. **Horn**

Figure 6-10. Electrical Connectors Behind Windscreen: Ulysses

Disassembly

1. See Figure 6-11. Remove housing (4) from ignition switch (5) by prying tabs on side of housing.
2. Remove body fasteners (1). Separate body (2) from ignition switch (5).

Assembly

NOTE

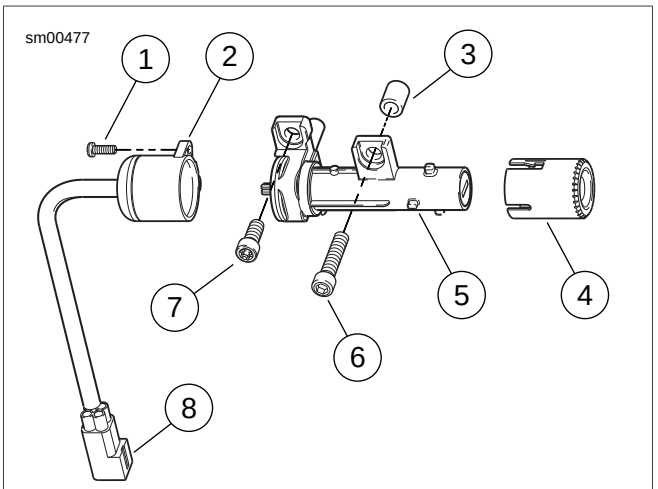
See Figure 6-11. In next step, be sure wide slot in housing (4) is installed over wide boss on ignition switch (5).

1. Push housing (4) on to ignition switch (5).

NOTE

In next step, do not force ignition switch (5) into body (2). If ignition switch does not easily slide into ignition switch body, rotate slot in ignition switch body with screwdriver until proper installation can be achieved.

2. Mate ignition switch (5) to body (2).
3. Install body fasteners (1). Tighten to 12-36 **in-lbs** (1.4-4 Nm).



1. **Body fastener (2)**
2. **Body**
3. **Spacer**
4. **Housing**
5. **Ignition switch**
6. **Socket head fastener**
7. **Tamper-resistant Torx fasteners (2)**
8. **Ignition switch connector [33]**

Figure 6-11. Ignition Switch Assembly

Installation

NOTE

When installing the ignition switch it is important to have the fork lock pin pointing down while sliding the switch into place.

1. While holding the throttle cables to your left (the right side of the vehicle), slide the ignition switch assembly in to your right (the left side of the vehicle).
2. Install the ignition switch with the fork stop pin pointing down and, once in place, roll the assembly toward you and insert the fork stop pin into the upper triple clamp.
3. See Figure 6-11. After applying LOCTITE 271 (red), attach ignition switch assembly to upper triple clamp using ignition switch fasteners (7, 6) install spacer (3) onto fastener (6) and tighten to 18-20 ft-lbs (24.4-27.1 Nm).
4. Connect ignition switch connector [33] to wiring harness.
5. Loosely install cable strap around the main wiring harness and the ignition switch.
6. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

WARNING

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

7. Check ignition switch for proper operation. If operation fails, verify that all steps were performed properly.

WARNING

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

8. Install seat.
9. Install windscreen and tighten fasteners to 10-12 **in-lbs** (1.1-1.4 Nm).

SPARK PLUG CABLES 6.5

GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

REMOVAL

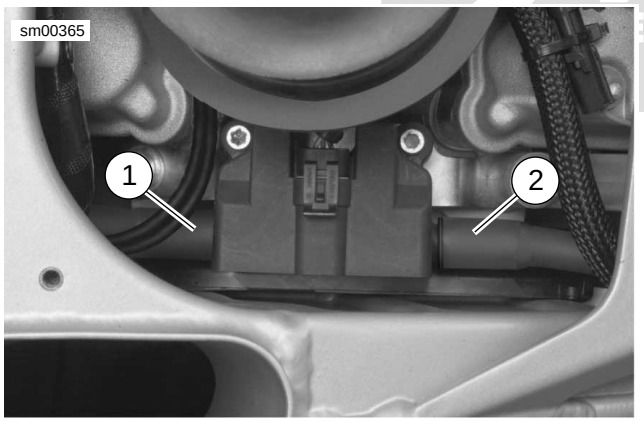
⚠WARNING

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

NOTE

When disconnecting each spark plug cable from its spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close as possible to the spark plug terminal). Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

1. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
2. Remove left side air scoop. See 2.49 AIR SCOOPS.
3. See Figure 6-12. Disconnect spark plug cables (1, 2) from ignition coil and spark plug terminals.



1. **Front spark plug cable**
2. **Rear spark plug cable**

Figure 6-12. Spark Plug Cable Location

INSPECTION

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

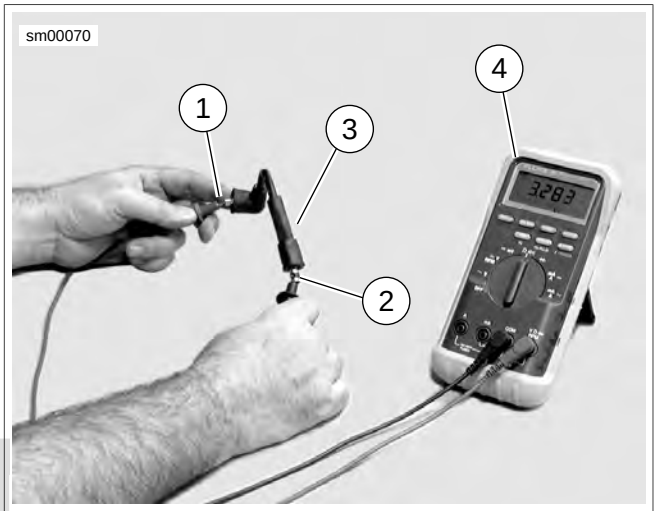
NOTE

Both cables are the same length.

3. See Figure 6-13. Check spark plug cable resistance with an ohmmeter (4). Replace cables not meeting resistance specifications.

Table 6-13. Spark Plug Cable Resistance

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



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

Figure 6-13. Testing Spark Plug Cable Resistance

INSTALLATION

NOTES

- *To ease installation, install spark plug cables to ignition coil first and apply ELECTRICAL CONTACT GREASE (Part No. 99861-90) to the inside of spark plug boot.*
- *See Figure 6-14. When assembling the spark plug boots onto the spark plugs, make sure the boot is slid all the way down over the spark plug insulator. The gap should not exceed 1/8 in. (3.2 mm).*
- *For spark plug information, see 1.13 SPARK PLUGS.*

1. Connect spark plug cables to ignition coil and spark plugs. Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.
2. Install air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
3. Install left air scoop. See 2.49 AIR SCOOPS.

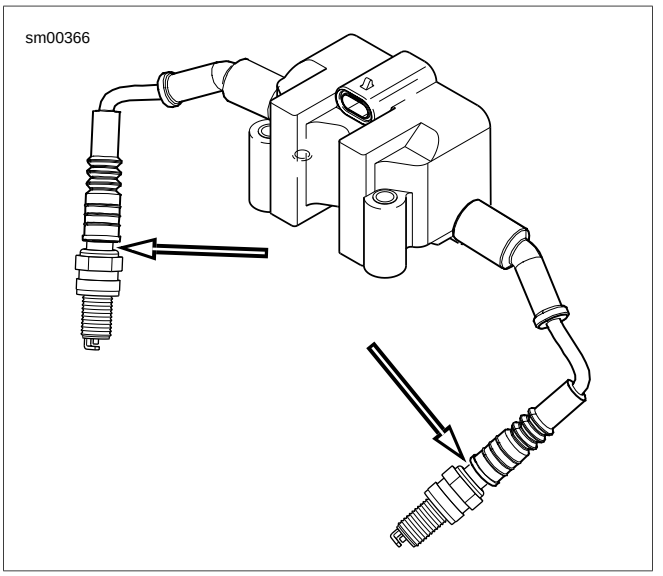


Figure 6-14. Boot Gap

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

CHARGING SYSTEM 6.6

GENERAL

The charging system consists of the alternator and regulator. Charging system circuits are shown in Figure 6-15 or Figure 6-16.

NOTE

Never install accessory wiring between battery post and battery cable. Installing wire between battery post and battery cable could cause damage to electrical system.

When installing electrical accessories, install longer battery post fasteners. Install wiring between battery cable and fastener.

Alternator

The alternator consists of two main components:

- The rotor which mounts to the engine sprocket shaft.
- The stator which bolts to the engine crankcase.

Voltage Regulator

NOTE

For troubleshooting and diagnostic see Electrical Diagnostic Manual.

See 6.10 VOLTAGE REGULATOR. The voltage regulator is a series regulator with shunt control. The voltage regulator combines the functions of rectifying (converting AC voltage to DC) and regulating (controlling voltage output).

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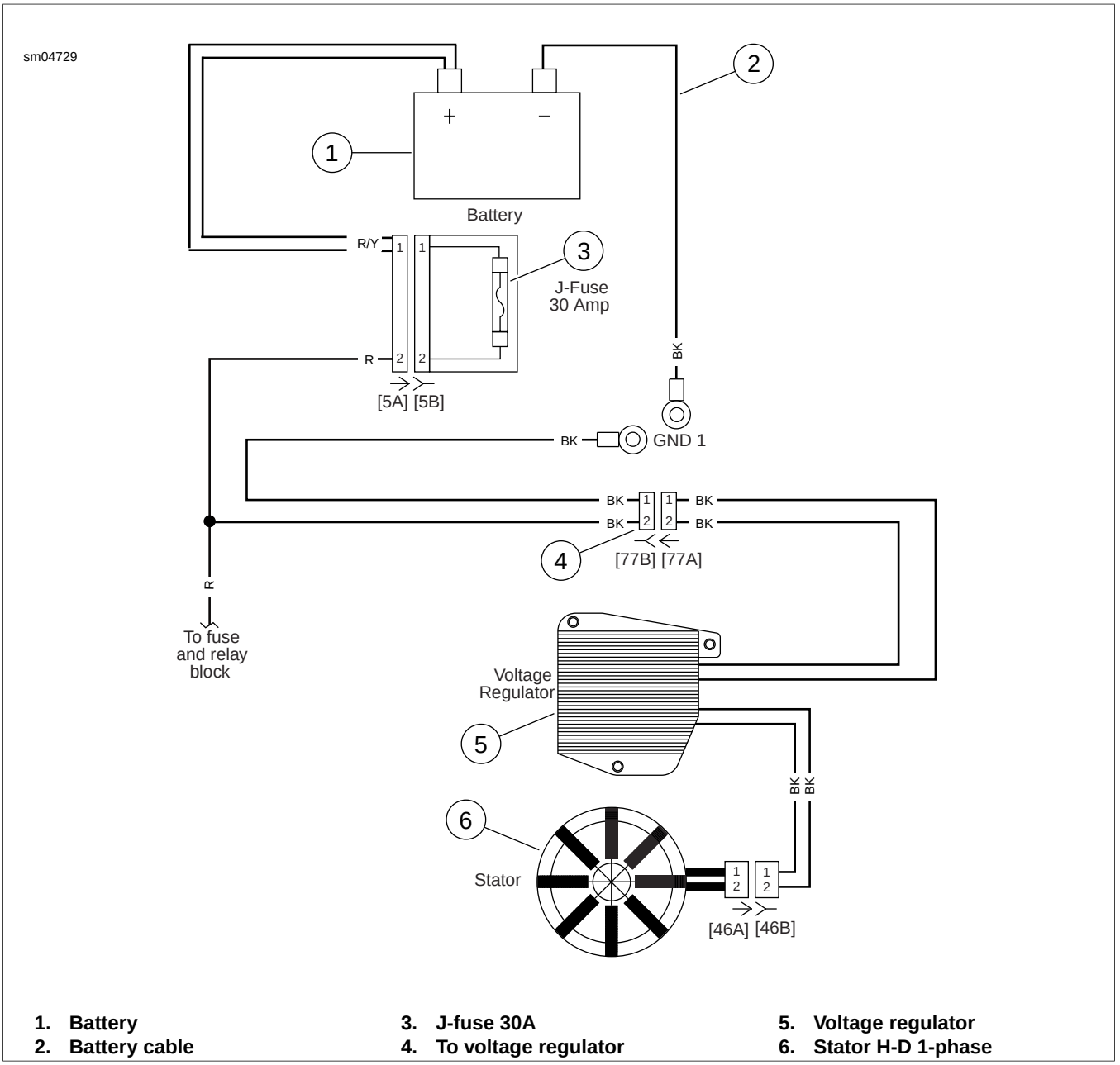
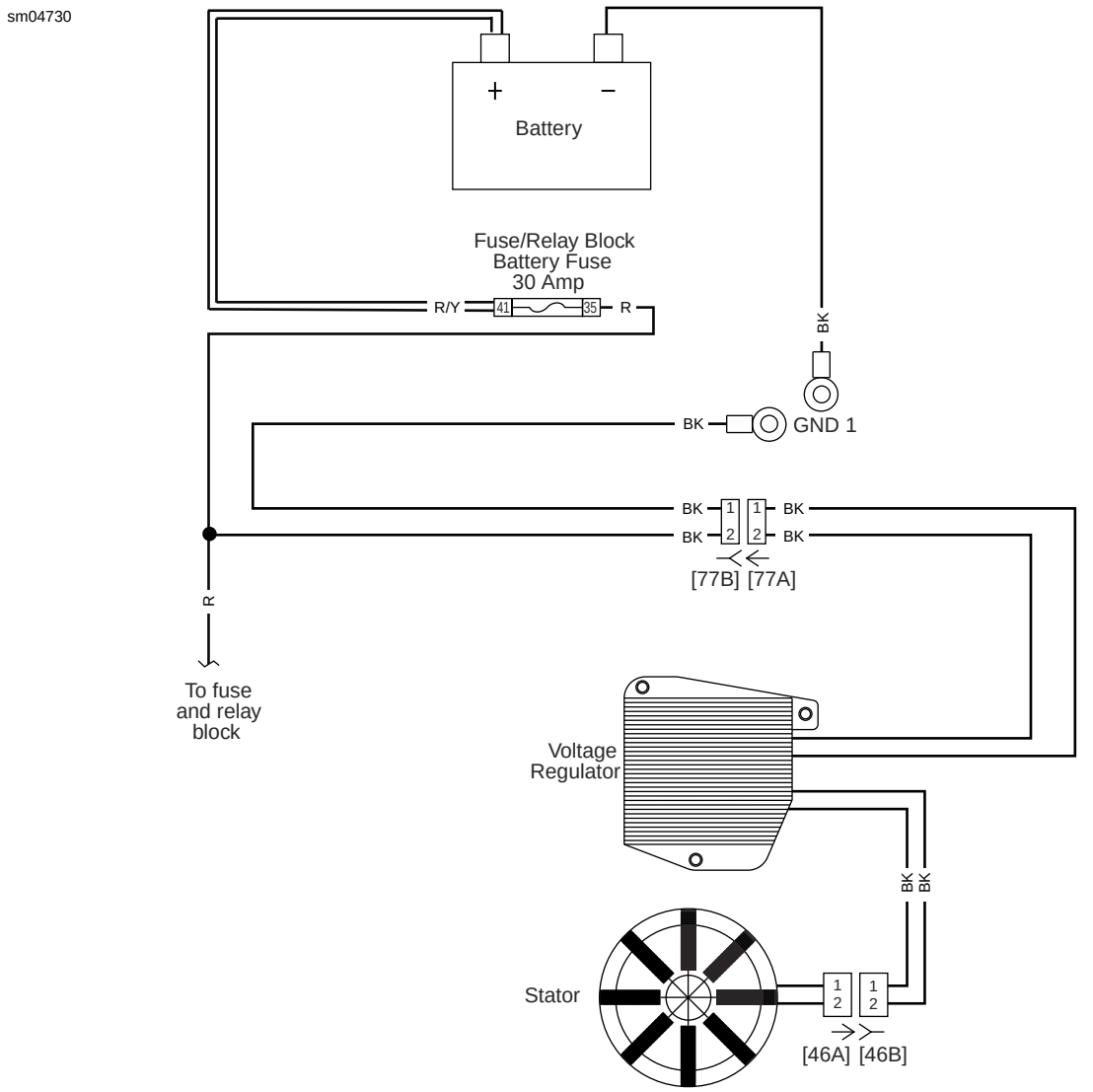


1. **Battery**
2. **Battery cable**
3. **J-fuse 30A**
4. **To voltage regulator**
5. **Voltage regulator**
6. **Stator H-D 1-phase**

Figure 6-15. Charging System Circuit (Firebolt)



1. **Battery**
2. **Battery cable**
3. **30A battery fuse**
4. **To voltage regulator**
5. **Voltage regulator**
6. **Stator H-D 1-phase**

Figure 6-16. Charging System Circuit (Ulysses, Lightning)

BATTERY CABLES 6.7

REMOVAL

WARNING

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

WARNING

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

1. See Figure 6-17 (Firebolt) or Figure 6-18 (Lightning/Ulysses). Disconnect negative and positive cables from battery, negative cable first.
   a. Remove fastener holding negative cable to negative terminal.
   b. Remove fastener holding positive cable to positive battery terminal.
2. See Figure 6-19. Remove fastener to detach negative battery cable from frame.
3. See Figure 6-20. Remove protective rubber boot from starter fastener. Remove fastener with washer to detach positive battery cable from starter.

NOTE

The cutting of the 14 gauge Red/Yellow wire is made to allow splicing to the new positive cable.

4. Cut 14 gauge Red/Yellow wire.
   a. For Firebolt models, cut the 14 gauge Red/Yellow wire approximately 6 in. (152.4 mm) below the positive battery terminal.
   b. For Lightning and Ulysses models, cut the 14 gauge Red/Yellow wire approximately 6 in. (152.4 mm) above the point where it enters the main harness bundle.

INSTALLATION

1. Clean cable connectors and battery terminals using a wire brush or sandpaper to remove any oxidation.

WARNING

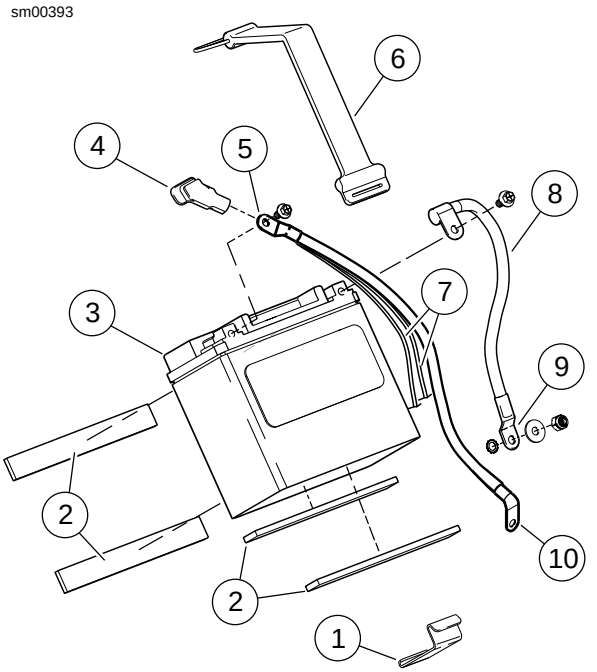
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

CAUTION

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

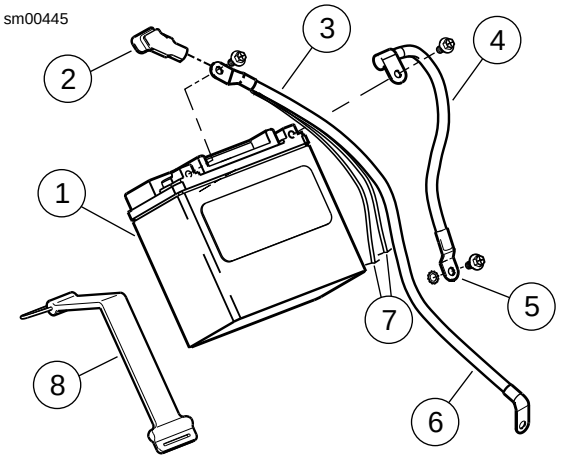
2. Connect cables to frame and starter.
   a. See Figure 6-20. First, connect positive battery cable to starter using fastener with washer. Tighten fastener to 60-85 **in-lbs** (7-10 Nm).
   b. Reinstall protective rubber boot.
   c. See Figure 6-19. Attach negative battery cable to frame. Tighten to 48-72 **in-lbs** (5.4-8 Nm).
   d. Splice the 14 gauge Red/Yellow wire from positive battery cable to main fuse wire (Firebolt models) or to main harness bundle (Lightning and Ulysses models).
3. Apply light coat of petroleum jelly or corrosion-retardant material to both battery terminals.
4. Connect cables to battery.
   a. Connect positive battery cable to positive (+) battery terminal using fastener. Tighten terminal fasteners to 72-96 **in-lbs** (8-11 Nm).
   b. Connect negative battery cable to negative (-) battery terminal using fastener. Tighten terminal fasteners to 72-96 **in-lbs** (8-11 Nm).

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Battery strap bracket
2. Battery pad (4)
3. Battery
4. Battery boot
5. Positive battery cable
6. Battery strap
7. Red/yellow wires (14 gauge, to be spliced)
8. Negative battery cable
9. To frame
10. To starter

Figure 6-17. Battery: Firebolt



1. Battery
2. Battery boot
3. Positive battery cable
4. Negative battery cable
5. To frame
6. To starter
7. Red/yellow wires (14 gauge, to be spliced)
8. Battery strap

Figure 6-18. Battery: Lightning/Ulysses

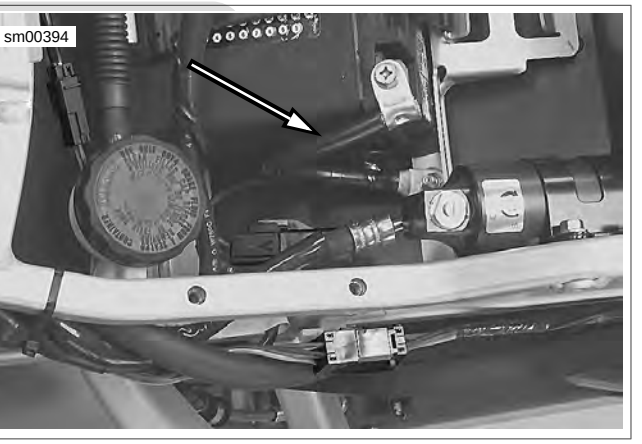
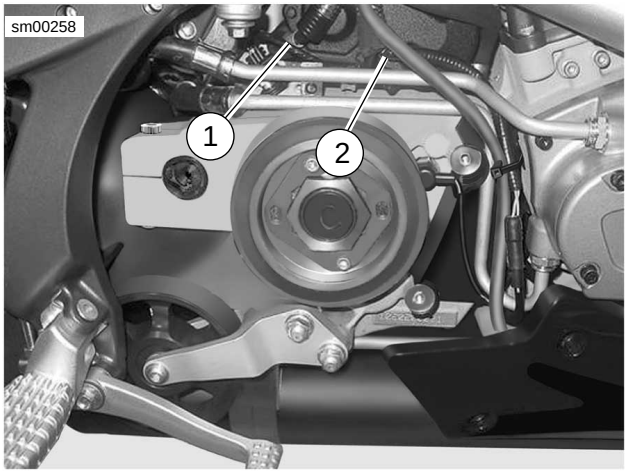


Figure 6-19. Negative Battery Cable (Typical)



1. **Positive battery cable**
2. **Solenoid wire**

Figure 6-20. Starter Wires (Protective Boot Not Shown)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

STARTER 6.8

GENERAL

The starter is made up of a field coil assembly, solenoid assembly and drive assembly. The repair instructions contained in this section are divided into three major service areas accordingly.

NOTE

For troubleshooting and diagnostic information, see the electrical diagnostic manual for this motorcycle.

Wiring Diagrams

The starting circuit wiring diagram contains information about wiring configuration. For additional information, see the electrical diagnostic manual for this motorcycle.

Paint Touch-Up

On painted starters, paint is applied to the starter after assembly. Many of the procedures in this section involve disassembly of several painted joints. When servicing the starter, paint damage or flaking may occur in the area of these joints. Any damaged paint should be touched up after assembly prior to installation using the appropriate touch up paint. Follow the directions provided with the paint. Paint flaking does not require the starter to be replaced.

REMOVAL

1. Remove seat.

⚠WARNING

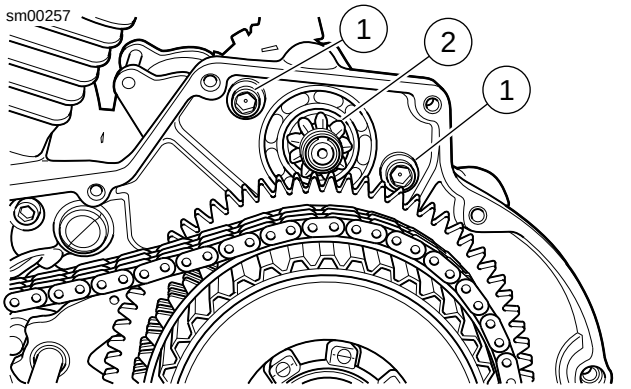
Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

2. Disconnect battery. See 1.5 BATTERY MAINTENANCE.
3. Drain transmission lubricant and remove primary cover. See 2.36 SPROCKET COVER.
4. Remove sprocket cover. See 2.36 SPROCKET COVER.

NOTE

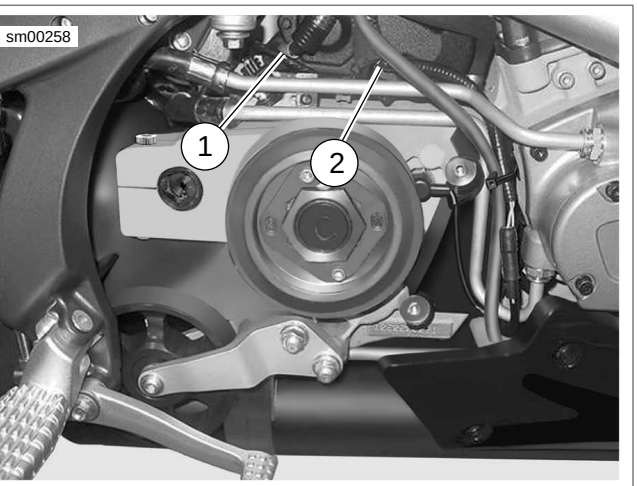
A ball hex driver may be required to gain access to the starter mounting bolts.

5. See Figure 6-21. Remove two starter mounting bolts and washers (1).
6. See Figure 6-22. Lift rubber boot remove fastener with washer (metric).
   a. Remove protective boot.
   b. Remove positive battery cable (1).
   c. Detach solenoid wire (2).
7. Remove starter and gasket from right side of motorcycle.



1. Mounting bolts and washers
2. Starter

Figure 6-21. Starter Mounting



1. Positive battery cable
2. Solenoid wire

Figure 6-22. Starter Wires (Protective Boot Not Shown)

FIELD COIL ASSEMBLY

Disassembly

1. Pull up rubber boot and remove hex nut with captive lockwasher to release field wire ring terminal from post on solenoid housing.
2. Using a 5/16 inch socket, loosen two thru bolts to release field coil from solenoid housing.
3. Pull field coil with end cap from solenoid housing.
4. Remove armature from field coil. Separating end cap and field coil flanges will facilitate removal.
5. Placing field coil on wooden block to prevent damage, use impact driver to remove two Phillips screws with captive washers from end cap. Discard screws.
6. Remove end cap from field coil.

7. Locate the two brushes attached to the field coil winding. Pushing on inboard side of one brush, grasp free end of brush spring on outboard side with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to free brush from brush holder. Repeat step to release second brush and then remove brush holder from field coil.

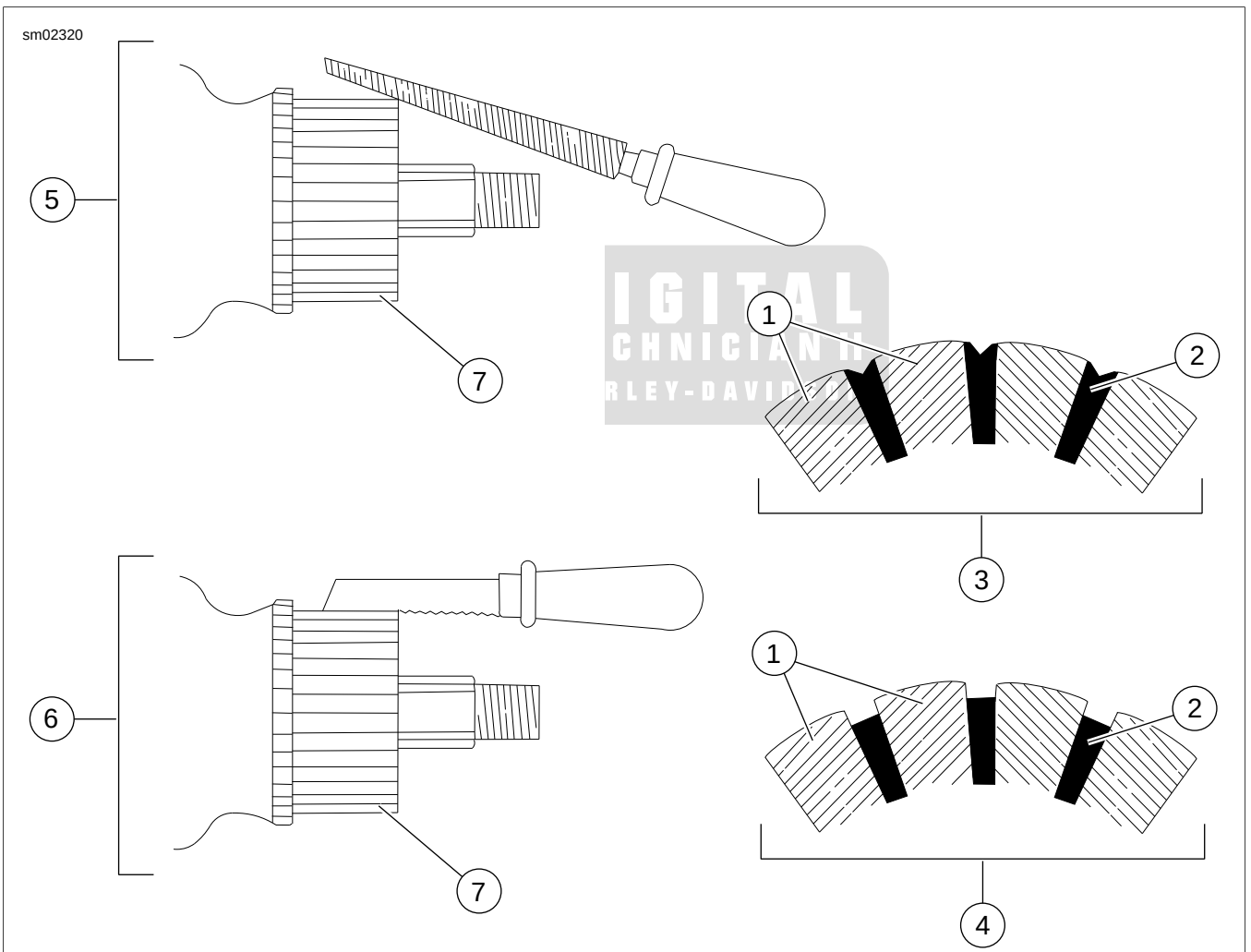
Inspection

1. For testing procedures, see the ELECTRICAL DIAGNOSTIC MANUAL.
2. Inspect two o-rings in field coil bore for cuts, tears or signs of deterioration.
3. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in. (29.98 mm).
4. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.20 mm), use an undercutting machine to undercut the mica to 1/32 in. (0.79 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

NOTES

- *See Figure 6-23. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.*
- *Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.*

5. Inspect armature roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
6. Replace brush springs if bent or distorted.



1. **Segments**
2. **Mica**
3. **Incorrect (Mica must not be left with a thin edge next to segments)**
4. **Correct (Mica must be cut away clean between segments)**
5. **Starting groove in mica with 3 cornered file**
6. **Undercutting mica with piece of hacksaw blade**
7. **Commutator**

Figure 6-23. Undercutting Mica Separators

Assembly

1. Attach brush holder to field coil. Locate the two brushes attached to the field coil winding. Catch free end of brush spring with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to install brush into brush holder. Repeat step to install second brush.
2. Retract all four brushes for armature installation. For good results, obtain four paper clips. Bend free end of each paper clip outward approximately 90°. Then, pushing on inboard side of brush, insert straight end of paper clip between outboard side of brush and inboard side of brush spring. Properly installed, the paper clip contacts the framework of the brush holder to keep spring pressure off the brush. Repeat step on remaining three brushes as shown in Figure 6-24.
3. Install armature in solenoid housing so that larger bearing on splined end seats in counterbore. Lubricate armature bearings with high temperature grease, such as LUBRI-PLATE 110, before installation.
4. Mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
5. Carefully place brush holder over armature. If additional clearance is needed, use a small flat blade screwdriver to gently push back the brushes slightly.
6. When the brush holder is centered over the armature, remove four paper clips to release brush springs. Verify that ends of brush springs make proper contact with brush sides.
7. Install end cap aligning holes in cap with those in brush holder. Start two **new** Phillips screws with captive washers. Alternately tighten Phillips screws until snug.
8. Install thru bolts to fasten field coil to solenoid housing. Using a 5/16 inch socket, alternately tighten thru bolts to 39-65 **in-lbs** (4.4-7.3 Nm).
9. Attach field wire ring terminal to short post on solenoid housing and install hex nut with captive lockwasher. Tighten hex nut to 70-90 **in-lbs** (7.9-10.2 Nm). Cover field wire ring terminal with rubber boot.
10. Install end cover bracket onto threaded end of thru bolts, if equipped. For proper orientation, be sure that the longest end of the bracket (before the bend) is on the field wire side. Install two Keps nuts and alternately tighten until snug.
11. Install allen head screw to fasten chrome end cover to end cover bracket, if equipped. Tighten screw to 90-110 **in-lbs** (10.2-12.4 Nm).

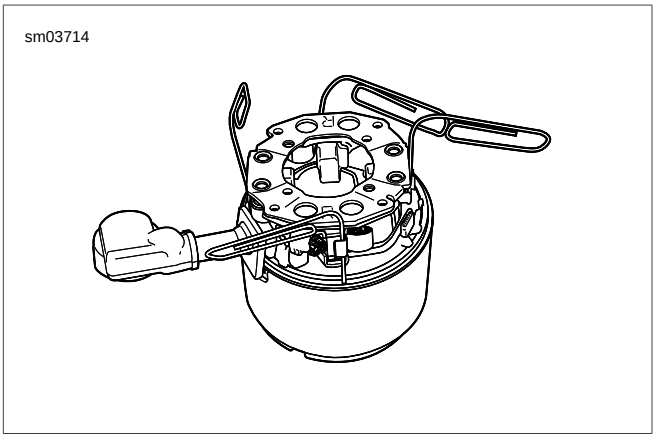


Figure 6-24. Install Paper Clips to Hold Brush Springs

DRIVE ASSEMBLY

Disassembly

1. Remove field coil. See 6.8 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release drive housing from solenoid housing.
4. Use a rubber mallet to separate drive and solenoid housings, if necessary.
5. Remove idler gear from bearing cage in drive housing. Remove bearing cage with five steel cylinders from shaft in drive housing.
6. Push on end of drive shaft to remove starter clutch assembly from drive housing.
7. Compressing internal springs, remove snap ring from groove at end of drive shaft.
8. Remove cup, pinion gear, short spring and spring seat from splined end of drive shaft.
9. Push on splined end of drive shaft to remove from starter clutch bore.
10. Remove long spring from drive shaft. Remove steel ball from drive shaft bore.
11. Remove return spring from solenoid plunger shaft.

Inspection

1. Inspect two o-rings in drive housing bore for cuts, tears or signs of deterioration.
2. Replace springs if kinked, elongated or distorted.
3. Inspect pinion gear and drive shaft gear. Replace if pitted, scored, rounded, cracked, chipped or worn.
4. Inspect roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
5. Inspect the steel ball for wear, pitting, surface breakdown or other damage.

6. Replace snap ring if bent or distorted.

Assembly

1. Install long spring onto drive shaft. Install steel ball in drive shaft bore. Insert splined end of drive shaft into starter clutch bore (gear side).
2. Insert a deepwell socket into starter clutch bore and stand assembly upright on work bench with the socket side down.
3. Push down on starter clutch, so that installed socket pushes against the drive shaft gear to compress the spring. Holding assembly with spring compressed, install spring seat, short spring, pinion gear and cup on splined end of drive shaft. Be sure that the collar on the pinion gear and the concave side of the cup both face the splined end of the drive shaft.
4. While pushing down to simultaneously compress both the long and short springs installed, install snap ring in groove at splined end of drive shaft. Verify that snap ring is fully seated in the groove and that it resides in concave portion of cup when spring tension is released.
5. Remove deepwell socket from starter clutch bore.
6. Install bearing cage with five steel cylinders onto shaft in drive housing. Be sure that all five steel cylinders are installed in grooves of bearing cage. Install idler gear over bearing cage. Lubricate parts with high temperature grease, such as LUBRIPLATE 110, during assembly.
7. Install starter clutch assembly in drive housing seating the larger bearing in the counterbore. Lubricate bearings with LUBRIPLATE 110 before installation.
8. Apply a light film of Lubriplate 110 to solenoid plunger shaft. Install return spring on solenoid plunger shaft.
9. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
10. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
11. Install field coil. See 6.8 STARTER, Field Coil Assembly.

INSTALLATION

1. Install starter and starter gasket from right side of motorcycle.
2. See Figure 6-23. Install two starter mounting bolts and washers. Tighten to 13-20 ft-lbs (17.6-27.1 Nm).
3. Install positive (+) battery cable and solenoid wire to solenoid stud. Tighten nut to 60-85 **in-lbs** (7-9.6 Nm). Place rubber boot securely over terminal.
4. Install primary cover. See 5.6 PRIMARY CHAIN.
5. Fill primary chaincase / transmission with proper lubricant; see 1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID for details.

⚠WARNING

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

6. Connect positive (+) battery cable to battery positive (+) terminal. See 1.5 BATTERY MAINTENANCE. Close left side cover.
7. Connect negative (-) battery cable to stud on engine crankcase behind starter motor assembly. See 1.5 BATTERY MAINTENANCE.

⚠WARNING

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

8. Install seat.

DIGITAL TECHNICIAN HARLEY-DAVIDSON

STARTER SOLENOID 6.9

SOLENOID ASSEMBLY

Disassembly

1. Remove field coil. See 6.8 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release solenoid housing from drive housing.
4. Use a rubber mallet to separate solenoid and drive housings, if necessary.
5. Remove return spring from solenoid plunger shaft.

Assembly

1. Install return spring on solenoid plunger shaft.
2. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
3. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
4. Install field coil. See 6.8 STARTER, Field Coil Assembly.

SOLENOID PLUNGER

Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.

Assembly

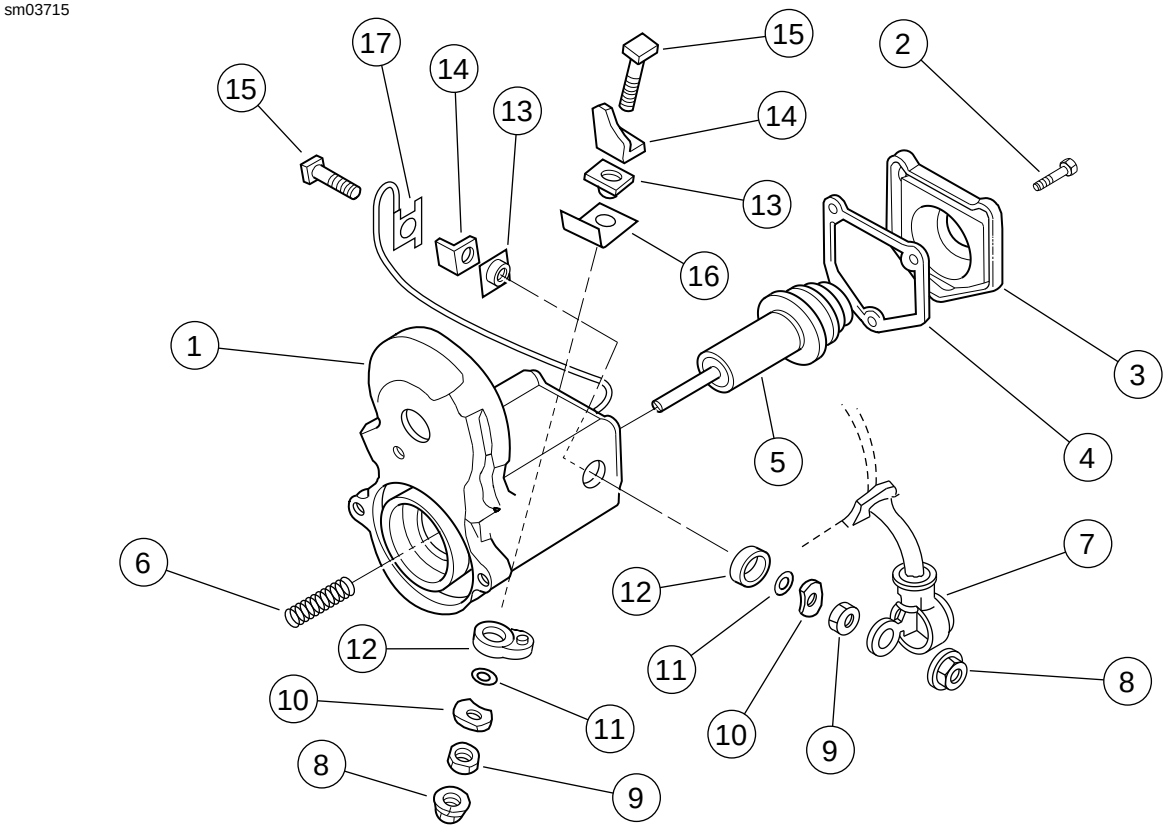
1. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.
2. Install **new** rubber gasket on solenoid cover flange.
3. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

SOLENOID CONTACTS

Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.
4. Obtain Solenoid Contact Repair Kit.
5. Disassemble short post (field coil):
   a. See Figure 6-25. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
   b. On inside of solenoid housing, remove post bolt, hold-in terminal, contact plate and square bushing.
6. Disassemble long post (battery):
   a. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
   b. On inside of solenoid housing, remove post bolt, contact plate, square bushing and paper insulator washer.

DIGITAL TECHNICIAN HARLEY-DAVIDSON



1. **Solenoid**
2. **Hex screw**
3. **Solenoid cover**
4. **Rubber gasket**
5. **Plunger**
6. **Return spring**
7. **Rubber boot**
8. **Hex nut**
9. **Jam nut**
10. **Wave washer**
11. **O-ring**
12. **Round bushing**
13. **Square bushing**
14. **Contact plate**
15. **Post bolt**
16. **Paper insulator washer**
17. **Hold-in terminal**

Figure 6-25. Solenoid Assembly

Assembly

1. Assemble short post (field coil):
   a. From inside solenoid housing, insert sleeve on square bushing into hole in solenoid housing.
   b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
   c. Slide short post bolt through holes in hold-in terminal, contact plate, square bushing and solenoid housing.
   d. At outside of solenoid housing, install round bushing, O-ring and wave washer onto end of post. Install jam nut, but do not tighten.
2. Assemble long post (battery):
   a. On inside of solenoid housing, align hole in paper insulator washer with hole in solenoid housing. Insert sleeve on square bushing into holes.
   b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
   c. Slide long post bolt through holes in contact plate, square bushing, paper insulator washer and solenoid housing.
   d. At outside of solenoid housing, install round bushing, o-ring and wave washer onto end of post. Verify that index pin on round bushing engages blind hole in solenoid housing. Install jam nut, but do not tighten.
3. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.

4. While depressing plunger, alternately tighten jam nuts to 65-80 **in-lbs** (7.3-9.0 Nm). Verify that contact plates have not rotated out of alignment with plunger.
5. Install **new** rubber gasket on solenoid cover flange.
6. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

VOLTAGE REGULATOR 6.10

GENERAL

The voltage regulator is mounted to the front of the crankcase. The voltage regulator is not repairable. Replace the unit if it fails.

REMOVAL

1. Remove seat.

⚠WARNING

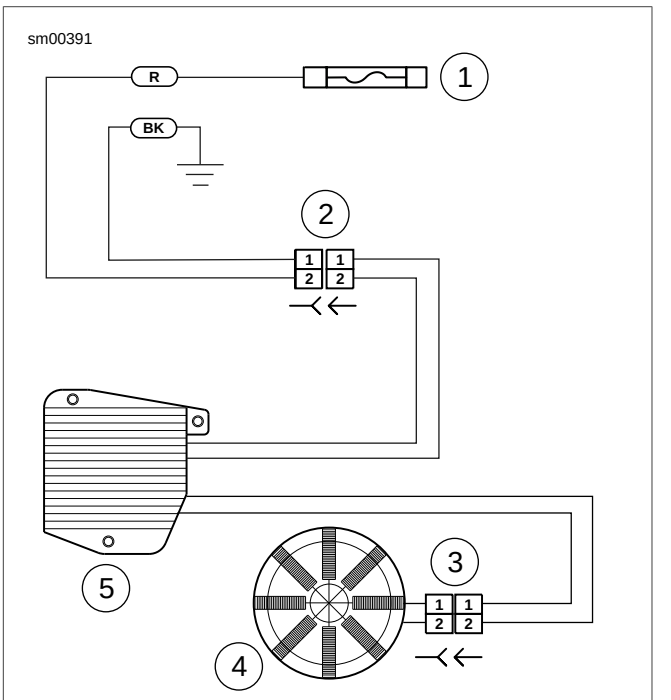
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable from battery.

NOTES

- *The connections for the alternator and voltage regulator are routed on the left side of the vehicle under the air scoop. The harnesses are secured to the air scoop with 3 cable straps.*
- *When disconnecting the alternator stator wiring, pull apart the connector by firmly grasping both connector halves. Do not pull on leads or damage to the wires and/or terminals may result.*

3. See Figure 6-27. Disconnect stator connector [46] (1) and voltage regulator connector [77] (2) located under the left ram air scoop. See 6.30 SPROCKET COVER WIRING.
4. Remove fasteners (5) and voltage regulator (4) from bracket (3).



1. **30A J fuse (Firebolt) or battery fuse (Lightning/Ulysses)**
2. **Voltage regulator connector [77]**
3. **Stator connector [46]**
4. **Stator**
5. **Voltage regulator**

Figure 6-26. Voltage Regulator Connector [77]

INSTALLATION

1. See Figure 6-27. Attach **new** voltage regulator (4) to bracket (3). Tighten fasteners (5) to 36-60 **in-lbs** (3.5-7 Nm).

NOTE

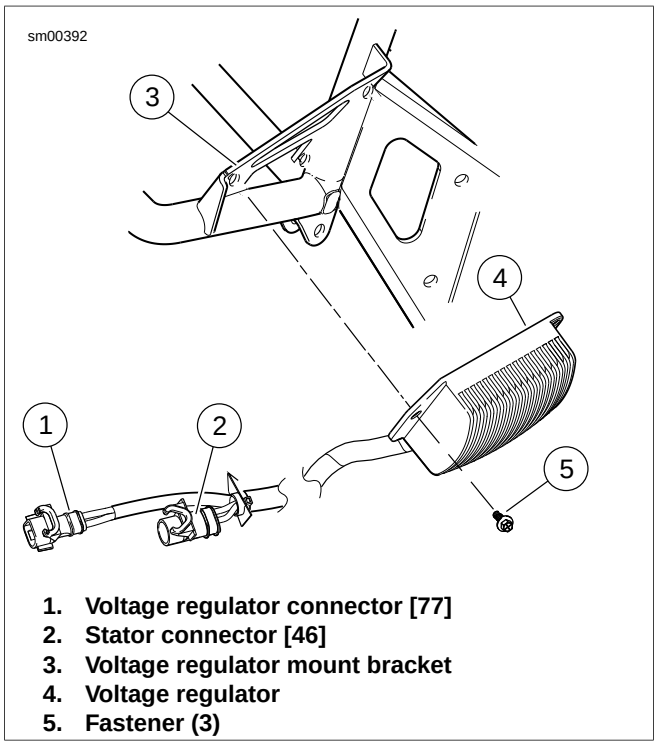
When installing the left side air scoop it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

2. Connect stator connector [46] (1) and voltage regulator connector [77] (2) located under left ram air scoop. See 6.30 SPROCKET COVER WIRING.
3. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

4. Install seat.
5. Test charging system. See 6.6 CHARGING SYSTEM.



1. **Voltage regulator connector [77]**
2. **Stator connector [46]**
3. **Voltage regulator mount bracket**
4. **Voltage regulator**
5. **Fastener (3)**

Figure 6-27. Voltage Regulator

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

ALTERNATOR 6.11

REMOVAL AND DISASSEMBLY

⚠WARNING

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

1. Disconnect negative battery cable.
2. Remove primary cover. See 5.3 PRIMARY COVER.
3. Remove clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See 5.6 PRIMARY CHAIN.
4. Remove/disassemble rotor and/or stator, as required. Refer to the following procedures.

Rotor

1. See Figure 6-28. Remove the eight fasteners which secure alternator rotor to engine sprocket.
2. See Figure 6-29. Position blocking under rotor. Press sprocket free of rotor.

NOTE

Resistance to sprocket/rotor disassembly is due in part to the magnetic force of the permanent rotor magnets.

Stator

NOTE

The connections for the alternator and voltage regulator are routed on the left side of the vehicle under the air scoop. The harnesses are secured to the air scoop with 3 cable straps.

1. See Figure 6-30. Disconnect stator wiring (4) from voltage regulator wiring at connector (5) [46] under the left ram air scoop. See 6.30 SPROCKET COVER WIRING.
2. Remove cable straps holding stator wire to the left ram air scoop.

NOTE

Stator fasteners contain a thread locking compound. Do not reuse existing screws. Always use new screws with the proper thread locking compound. Loss of torque on fasteners could result in alternator damage.

3. Remove and discard the four stator fasteners (1) which secure stator (2) to left crankcase half.
4. Remove retainer plate fasteners.
5. Remove stator wiring grommet (3) from left crankcase half.
6. Withdraw stator wiring (4) from grommet hole in left crankcase half. Remove stator.

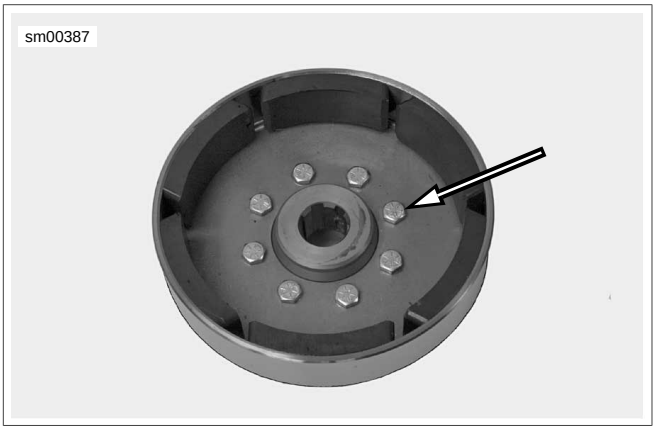


Figure 6-28. Rotor Assembly

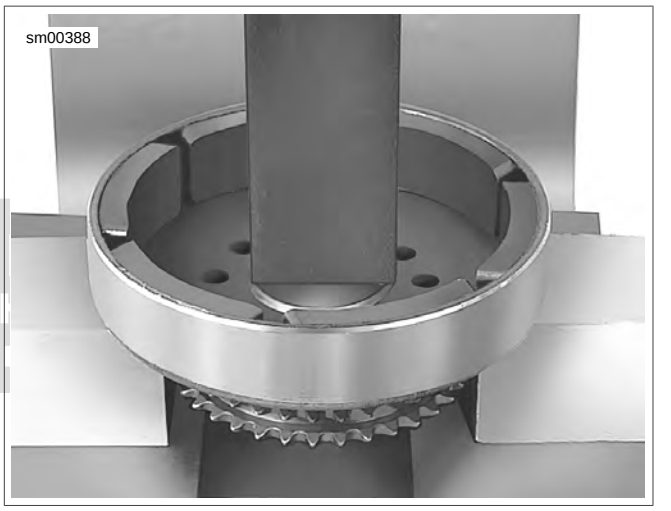
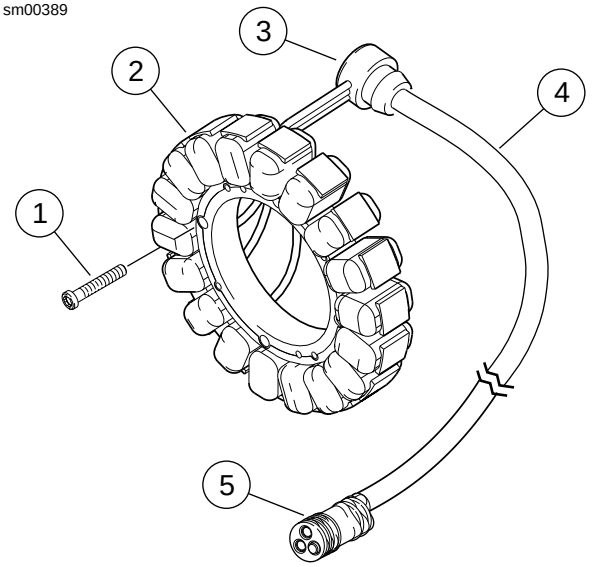


Figure 6-29. Removing Rotor From Sprocket



1. **Stator fastener (4)**
2. **Stator**
3. **Grommet**
4. **Stator wiring**
5. **Connector [46]**

Figure 6-30. Stator Assembly

CLEANING AND INSPECTION

NOTE

Do not strike or drop alternator rotor or damage to magnet adhesive may occur. Magnet adhesive damage can result in rotor failure.

1. Clean rotor with a petroleum-base solvent. Remove all foreign material from rotor magnets. Replace rotor if rotor magnets are cracked or loose.
2. Clean stator by wiping with a clean cloth.
3. Examine stator leads for cracked or damaged insulation.

NOTE

The rotor and stator can be replaced individually if either is damaged.

ASSEMBLY AND INSTALLATION

Depending on whether the rotor, the stator, or both the rotor and stator were removed/disassembled, perform the applicable procedures which follow:

1. See Figure 6-30. Feed stator wiring (4) with attached grommet (3) into open grommet hole in left crankcase half.
2. Apply a light coating of clean engine oil or chaincase lubricant to grommet. Install grommet into hole in left crankcase half.

NOTE

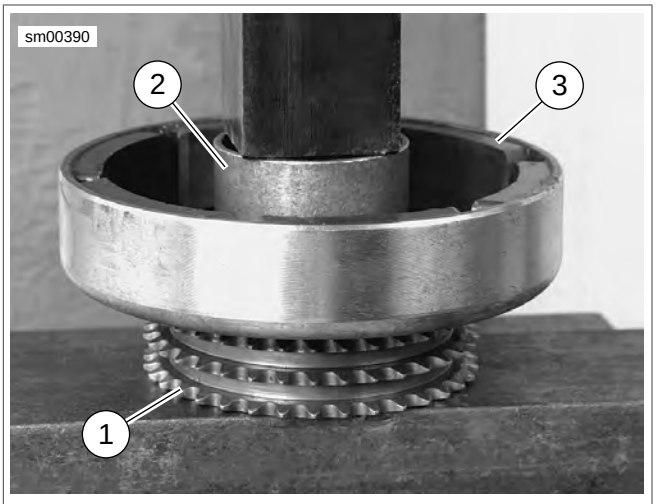
Stator fasteners contain a thread locking compound. Do not reuse existing screws. Always use new screws with the proper thread locking compound. Loss of torque on fasteners could result in alternator damage.

3. Position stator (2) on left crankcase half. Secure stator using four **new** stator fasteners (1). Tighten to 30-40 **in-lbs** (3-4 Nm).
4. Install retainer plate with **new** fasteners and tighten to 56 **in-lbs** (6.3 Nm).

NOTE

When installing the left side air scoop it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

5. See Figure 6-30. Route stator wiring (4) behind rear cylinder along the bottom of the left ram air scoop. Connect wires and install cable straps to air scoop. Install air scoop. 2.49 AIR SCOOPS.
6. Route stator wire (4) between the vent oil line and the return oil line.
7. See Figure 6-31. Attach rotor to sprocket.
   a. Position rotor (3) on sprocket (1). Align holes in sprocket with holes in rotor.
   b. Insert eight **new** mounting fasteners through rotor and start fasteners into tapped holes in sprocket.
   c. Position a section of pipe (2) with an inside diameter larger than the sprocket mounting hub over center of rotor. Press rotor onto sprocket. Tighten fasteners to 120-140 **in-lbs** (13.5-15.8 Nm).
8. Install clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See 5.6 PRIMARY CHAIN.
9. Install primary cover. See 5.3 PRIMARY COVER.
10. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).
11. Test charging system. See 6.6 CHARGING SYSTEM.



1. **Sprocket**
2. **Pipe section**
3. **Rotor**

Figure 6-31. Pressing Rotor onto Sprocket

HEATED HAND GRIPS: ULYSSES MODELS 6.12

HEATED HAND GRIPS

Removal

1. Remove seat.

⚠WARNING

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

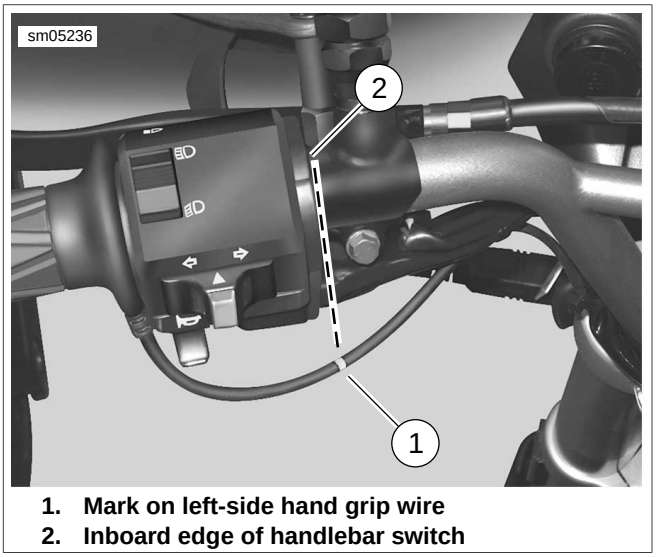
2. Disconnect battery negative cable.
3. Remove the windscreen/windshield assembly from the vehicle. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
4. Unsnap the deflectors from the handlebar end caps, and loosen the deflector attaching screws if necessary to swivel the deflectors forward. See 2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP.
5. Cut and discard the two cable straps on the right side of the vehicle securing the heated hand grip wire to the throttle cables and handlebar wiring harness.
6. Cut and discard the cable strap securing the heated hand grip wire to the handlebar wiring harness below the right side instrument cluster.
7. Cut and discard the cable strap securing the left side heated hand grip wire to the instrument module connector.
8. Disconnect the two heated hand grip connectors below the instrument cluster.
9. Remove the two fasteners that retain the left heated grip to the handlebars and save fasteners for installation.
10. Remove left heated hand grip.
11. Remove right side heated hand grip. See 2.24 THROTTLE CONTROL.

Installation

1. Install the left heated grip and tighten fasteners to 14-16 **in-lbs** (1.6-1.8 Nm).
2. Install the right side heated hand grip to the handlebar. See 2.24 THROTTLE CONTROL.

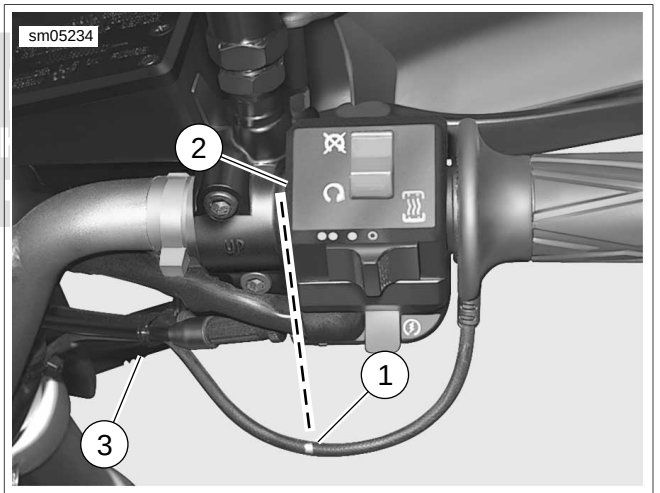
NOTES

- *See Figure 6-32. The paint mark needs to be lined up visually with the inside edge of the right (and left) hand control.*
- *See Figure 6-33. The hanging loop is critical to the life of the heated grip wire, especially on the right hand grip, as it is in motion when the motorcycle is ridden. In order to maintain the wire loop, secure the right hand grip wire to the throttle cables.*



1. **Mark on left-side hand grip wire**
2. **Inboard edge of handlebar switch**

Figure 6-32. Painted Alignment Mark for Hanging Wire Loop, Left Side



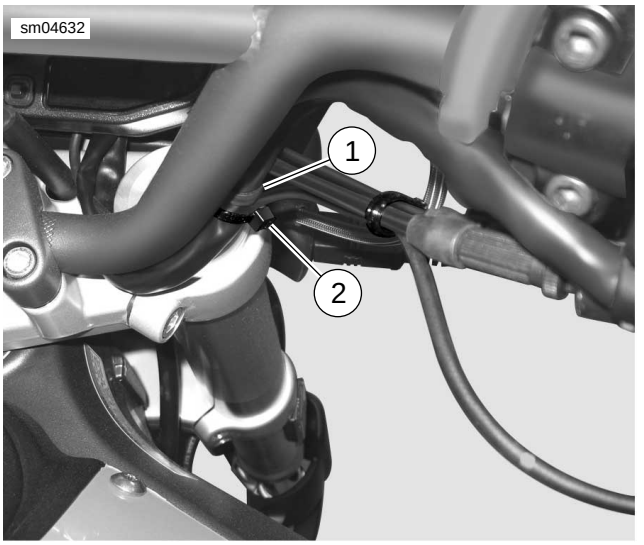
1. **Mark on right-side hand grip wire**
2. **Inboard edge of handlebar switch**
3. **Strap wire to throttle cables**

Figure 6-33. Painted Alignment Mark for Hanging Wire Loop with Cable Strap, Right Side

NOTE

With the first cable strap in place on the right hand heated grip wire, rotate the throttle grip and make sure the wire loop can not touch any part of the hand control. If it does, make the loop slightly larger until it can no longer makes contact when rotated.

3. See Figure 6-34. Install the next cable strap on the right side just below the second handle bar wire harness retainer.



1. **Handlebar wire harness retainer**
2. **Cable strap for heated hand grip wire**

Figure 6-34. Location of Second Cable Strap, Right Side

4. See Figure 6-35. Secure the left heated hand grip wire to the hand control wire bundle.
5. Install the next cable strap on the left side just below the second handle bar wire harness retainer.

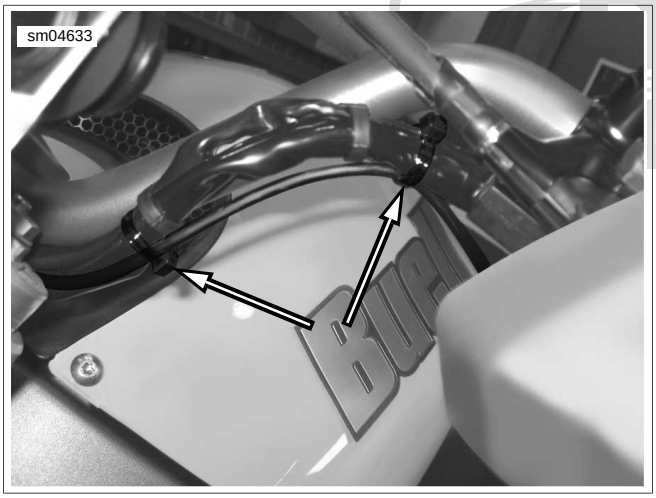


Figure 6-35. Location of Cable Straps, Left Side

6. See Figure 6-36. On the right side, install a cable strap securing the heated grip lead and hand control wires together under the right hand side of the instrument cluster.

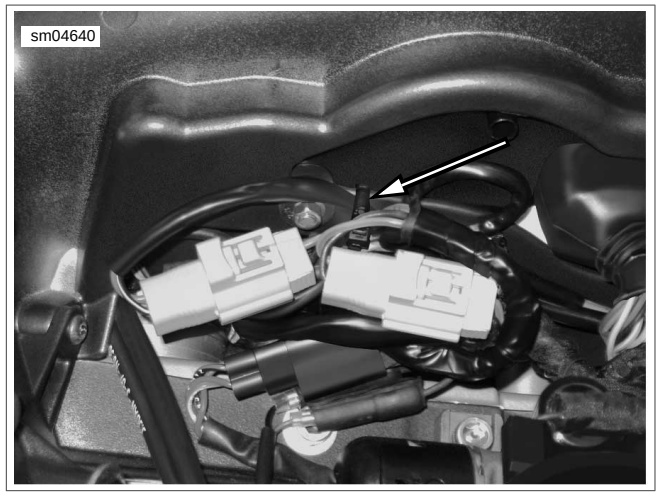
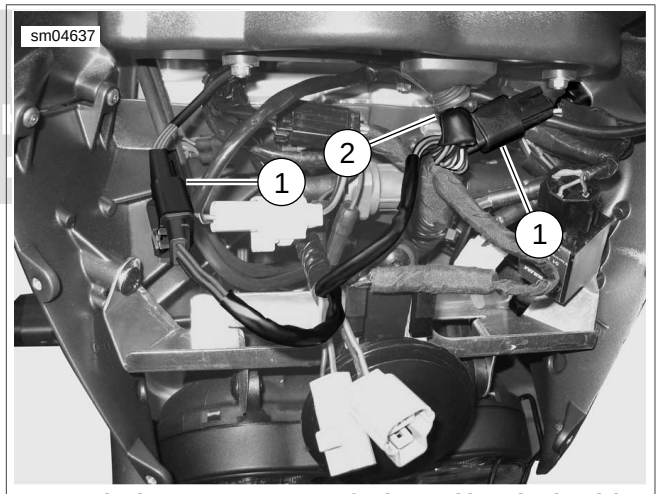


Figure 6-36. Location of Cable Strap Securing the Right Side Hand Grip Wire Below the Instrument Cluster

7. See Figure 6-37. On the left side, install a cable strap securing the hand grip wire to the instrument module connector under the left hand side of the instrument cluster.
8. Connect the two black 3-way connectors for the heated grip leads.



1. **Black 3-way connector for heated hand grips (2)**
2. **Cable strap securing the left hand grip wire to the instrument module connector**

Figure 6-37. Heated Hand Grip Connections and Cable Strap

9. See Figure 6-38. To verify the wire bundles and connectors are not just hanging. Apply one more wire tie beneath the upper dash casting and around the bundle of wires and connectors to secure them up against the upper casting.

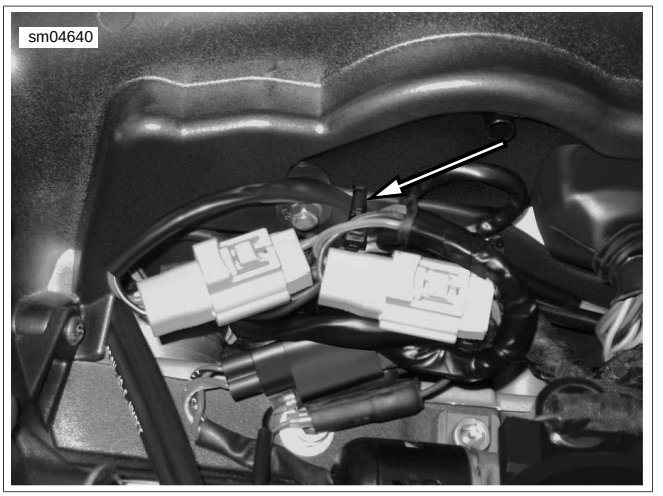


Figure 6-38. Location of Cable Strap Attached to Instrument Cluster

NOTE

After installation is complete, return to the right hand grip wire and rotate the throttle grip to verify the loop has not changed and the moving wire on the heated grip does not make contact with anything when the throttle is rotated.

10. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

WARNING

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

11. Install seat.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

HORN 6.13

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Access horn:
   a. For Firebolt, remove headlight support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
   b. For Lightning/Ulysses, remove windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
4. See Figure 6-39 (Firebolt), Figure 6-40 (Lightning) or Figure 6-41 (Ulysses). Remove fastener (3).
5. Remove horn (1) from support bracket (4).
6. See Figure 6-42. Detach Y/BK power wire and BK ground wire from terminal clips on horn.

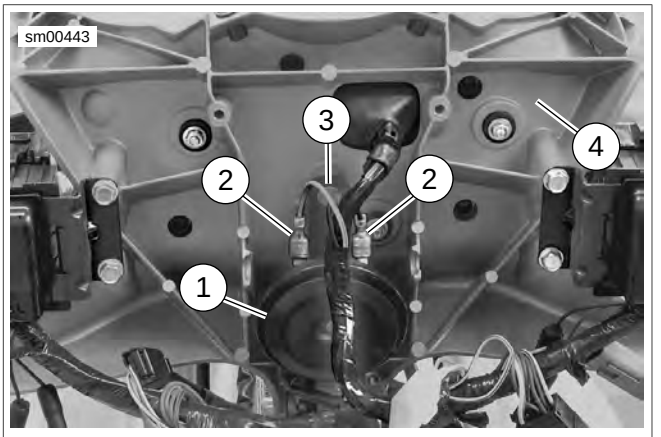
INSTALLATION

1. See Figure 6-42. Connect Y/BK power wire and BK ground wire to terminal clips on horn.
2. See Figure 6-39 (Firebolt), Figure 6-40 (Lightning) or Figure 6-41 (Ulysses). Attach horn (1) to support bracket (4) using fastener (3). Tighten to 72-96 **in-lbs** (8.1-10.8 Nm).
3. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).
4. Check horn operation. If horn does not sound or fails to function satisfactorily, see 6.13 HORN, Troubleshooting.
   a. Turn ignition key switch ON.
   b. Press horn switch to activate horn.
   c. Turn ignition key switch OFF.
5. For Firebolt, install headlight support bracket and install front fairing. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
6. For Lightning, install windscreen and for Ulysses, install windscreen/windshield. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.

⚠WARNING

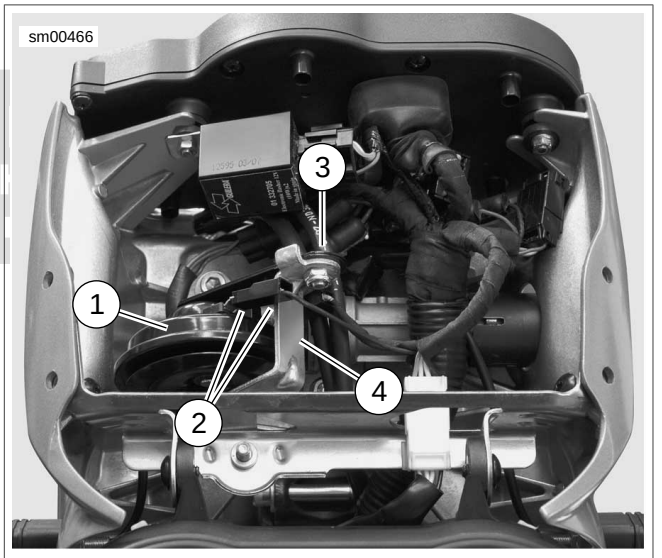
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

7. Install seat.



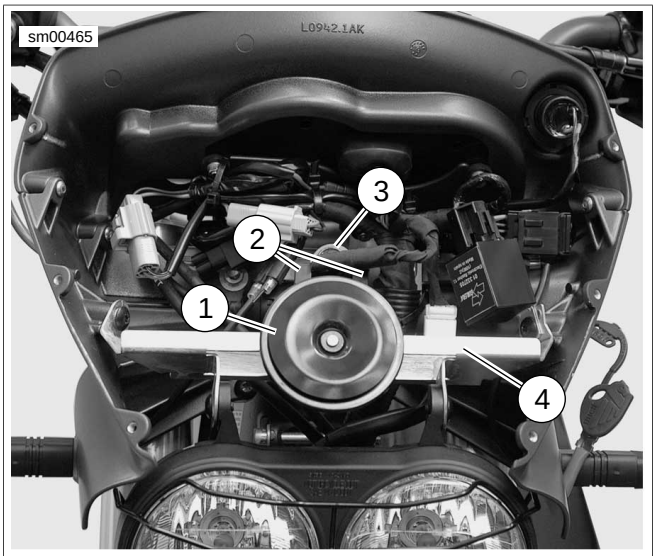
1. **Horn**
2. **Horn connectors [122 A & B]**
3. **Horn fastener**
4. **Fairing support bracket**

Figure 6-39. Horn Assembly: Firebolt (Typical)



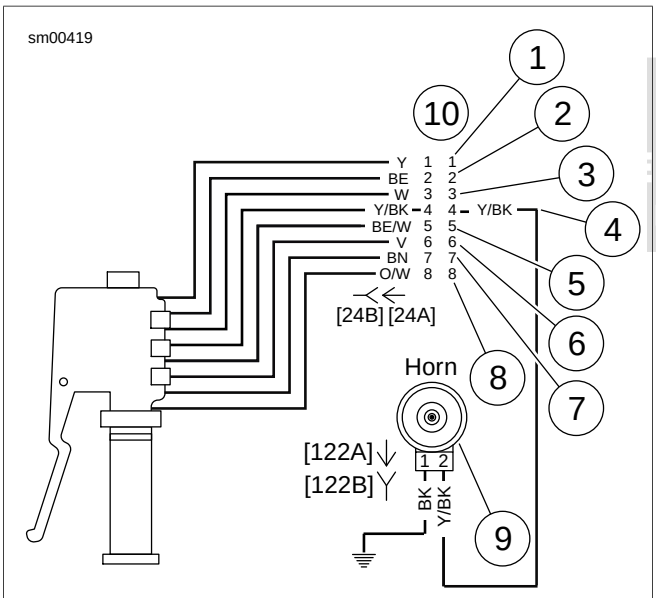
1. **Horn**
2. **Horn connectors [122]**
3. **Horn fastener**
4. **Support bracket**

Figure 6-40. Horn Assembly: Lightning



1. **Horn**
2. **Horn connectors [122]**
3. **Horn fastener**
4. **Support bracket**

Figure 6-41. Horn Assembly: Ulysses



1. **Low/unused**
2. **Light power**
3. **High beam**
4. **Horn**
5. **From flasher**
6. **Left turn**
7. **Right turn**
8. **Horn power**
9. **Horn [122]**
10. **Left handlebar switch [24]**

Figure 6-42. Horn Wiring

TROUBLESHOOTING

1. If the horn does not sound or fails to function satisfactorily, check for the following conditions:
   a. Discharged battery.
   b. Loose, frayed, or damaged wiring leading to horn terminal.
   c. Verify horn is not making contact with wiring or other components.
2. If battery has a satisfactory charge and wiring appears to be in good condition, test horn ground and switch using voltmeter.
   a. See Figure 6-42. Remove Y/BK power and BK ground wires from terminal clips.
   b. Connect voltmeter positive (+) lead to Y/BK wire.
   c. Connect voltmeter negative (-) lead to ground.
   d. Turn ignition key switch ON.
3. See Figure 6-43. Depress horn switch and observe voltmeter reading.
   a. If battery voltage is present, horn or horn grounding is faulty. If horn is faulty, replace unit as an assembly. The horn is not repairable.
   b. If battery voltage is not present, either horn switch or wiring to horn is faulty. If horn switch is faulty, replace left handlebar switch.

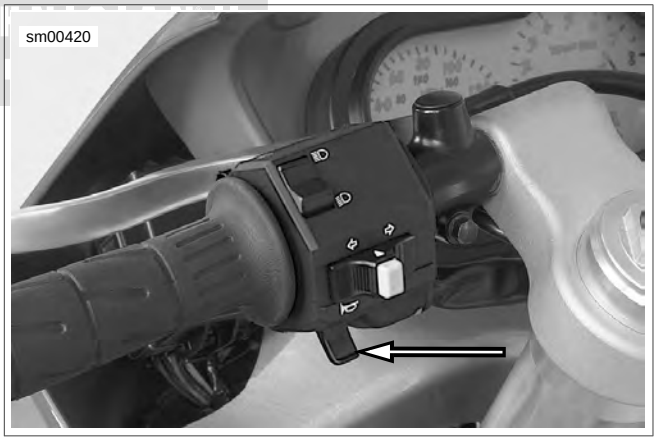


Figure 6-43. Horn Switch

TURN SIGNAL FLASHER 6.14

REMOVAL

NOTE

The turn signal flasher is not repairable. Replace flasher upon failure.

1. Remove front fairing or windshield/windscreen. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT (Firebolt) or 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES (Lightning and Ulysses).
2. See Figure 6-44 (Firebolt), Figure 6-45 (Lightning) or Figure 6-46 (Ulysses). Remove fastener securing turn signal flasher to headlight support bracket (Firebolt) or front module (Lightning and Ulysses).
3. Detach 5-place connector [30] from flasher body.

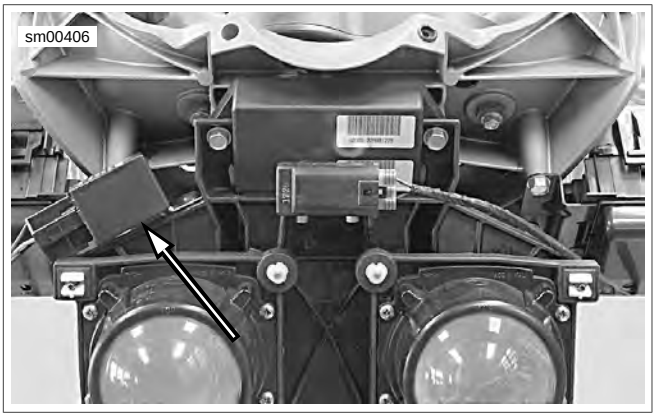


Figure 6-44. Turn Signal Flasher: Firebolt (Typical)

INSTALLATION

1. See Figure 6-44 (Firebolt), Figure 6-45 (Lightning) or Figure 6-46 (Ulysses). Attach 5-place connector [30] to flasher.
2. Install turn signal flasher to headlight support bracket (Firebolt) or front module (Lightning and Ulysses). Tighten fastener to 36-60 **in-lbs** (4-7 Nm).
3. Install turn signal flasher to instrument module (Lightning). Tighten fastener to 12-36 **in-lbs** (1.4-4 Nm).
4. Install turn signal flasher to front headlight module (Ulysses). Tighten fastener to 36-60 **in-lbs** (4-7 Nm).
5. Install front fairing or windshield/windscreen. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT (Firebolt) or 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES (Lightning and Ulysses).

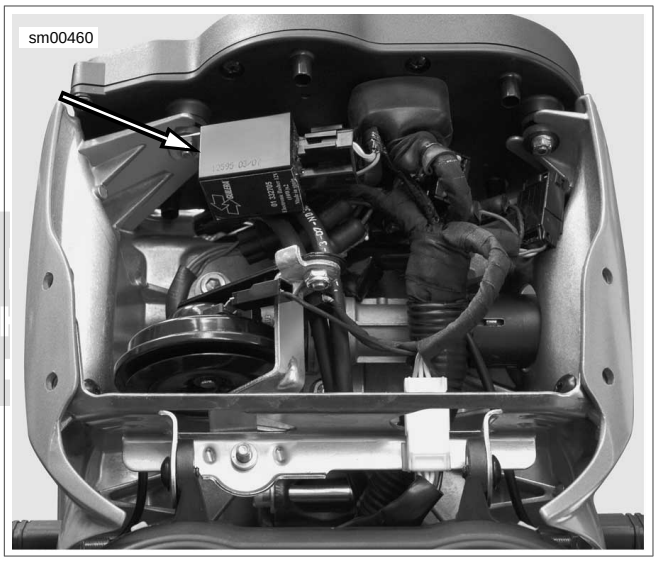


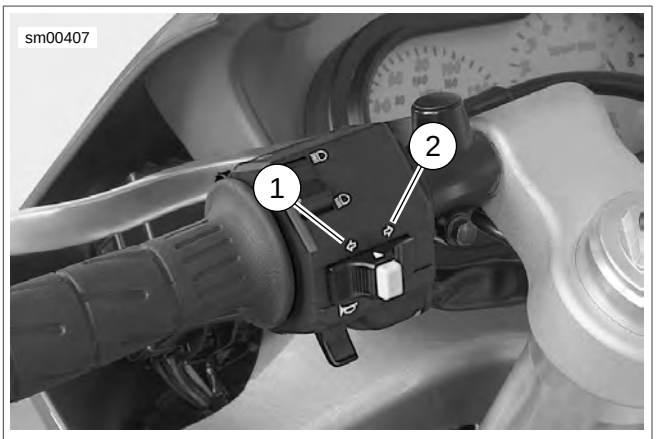
Figure 6-45. Turn Signal Flasher: Lightning

⚠WARNING

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

6. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to IGN.
   b. See Figure 6-47. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
   c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
   d. Turn ignition key switch to OFF.

Figure 6-46. Turn Signal Flasher: Ulysses



1. Left turn signal
2. Right turn signal

Figure 6-47. Turn Signal Controls

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FRONT TURN SIGNALS 6.15

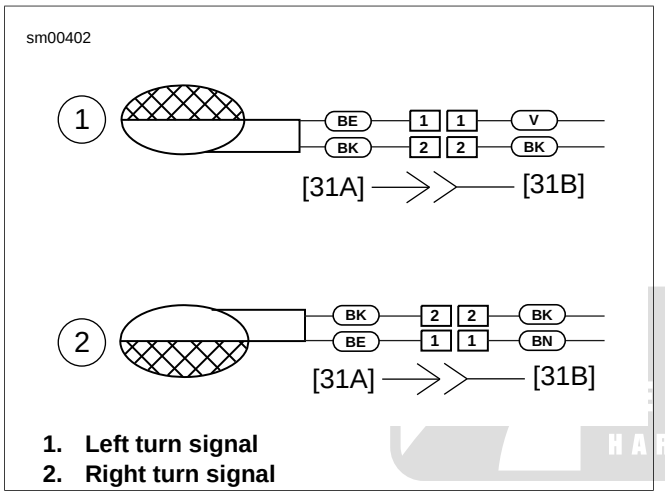
BULBS

Repair

1. Remove screw on back of housing to access turn signal bulbs.
2. Rotate bulb a 1/4 turn and remove.
3. Before replacing, apply a light coat of dielectric grease on the bulb contact terminals.
4. Install screw and tighten to 4.4-4.3 **in-lbs** (0.5-0.6 Nm).

Connections and Wire Routing

To verify correct installation, make note of wire routing and cable strap locations before removing turn signals.



1. **Left turn signal**
2. **Right turn signal**

Figure 6-48. Front Turn Signal Connections

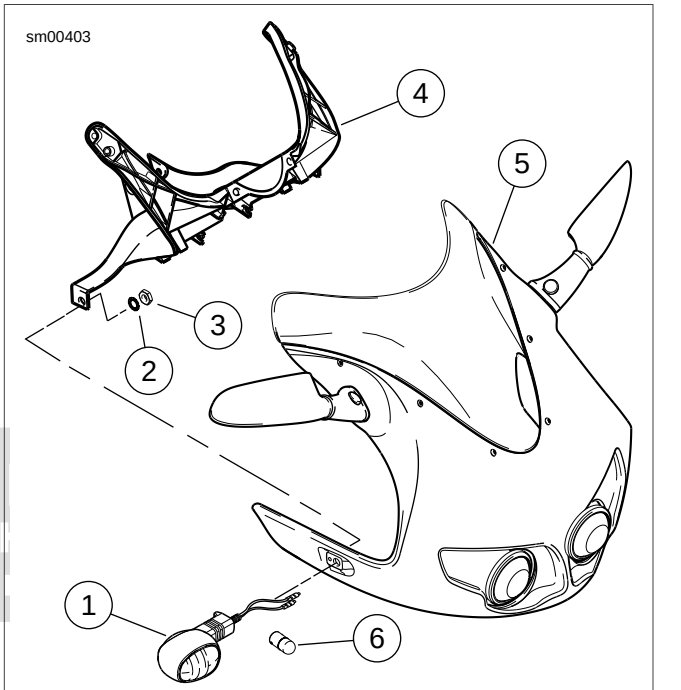
FIREBOLT

Removal

1. Disconnect bullet connectors on turn signal wires.
2. See Figure 6-49. Remove fastener (3) and lockwasher (2) from fairing support bracket (4).
3. Pull bullet connectors and wiring through hole in fairing support bracket (4) and fairing (5).

Installation

1. See Figure 6-49. Insert bullet connectors and wiring through hole in fairing (5) and fairing support bracket (4).
2. Install turn signal (1) using lockwasher (2) and fastener (3). Tighten fastener to 25-28 **in-lbs** (2.8-3.2 Nm).
3. Attach bullet connectors on turn signal wires as shown in Figure 6-48.
4. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition/key switch to ON.
   b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
   c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
   d. Turn ignition/key switch to OFF.



1. **Turn signal (2)**
2. **Lockwasher (2)**
3. **Fastener (2)**
4. **Fairing support bracket**
5. **Fairing**
6. **Bulb**

Figure 6-49. Front Turn Signals: Firebolt

LIGHTNING

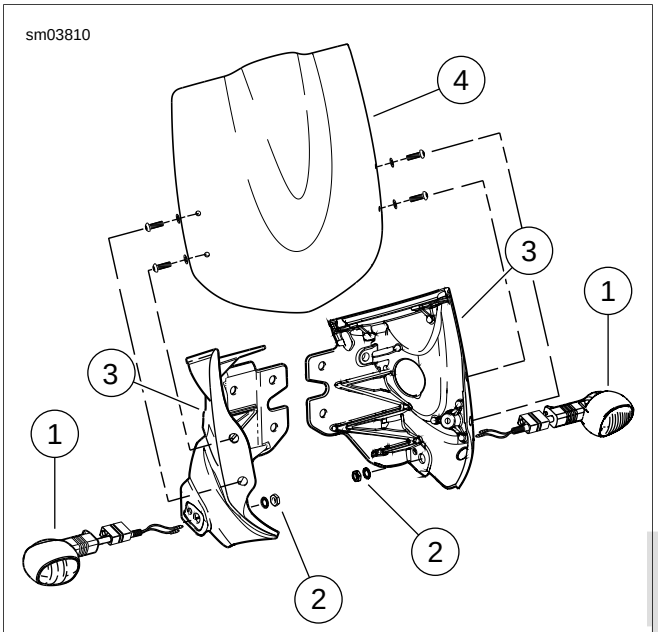
Removal

1. Remove windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
2. Disconnect bullet connectors on turn signal wires.
3. See Figure 6-50. Remove jam nut and lockwasher (2) from inside of front module (3).
4. Pull bullet connectors and wiring through hole in front module (3) and remove turn signal (1).

Installation

1. See Figure 6-50. Insert bullet connectors and wiring through hole in front module.

2. Install turn signal using lockwasher and jam nut. Tighten fastener to 25-28 **in-lbs** (2.8-3.2 Nm).
3. Attach bullet connectors on turn signal wires as shown in Figure 6-48.
4. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
5. Install windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.



1. **Turn signal**
2. **Jam nut and lockwasher**
3. **Front module, left and right**
4. **Windscreen**

Figure 6-50. Front Turn Signals: Lightning

ULYSSES

Removal

1. Remove windshield and windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
2. See Figure 6-48. Disconnect bullet connectors on turn signal wires.
3. See Figure 6-51. Remove jam nut and lockwasher (2) from inside of front module (3).
4. Pull bullet connectors and wiring through hole in front module (3) and remove turn signal (1).

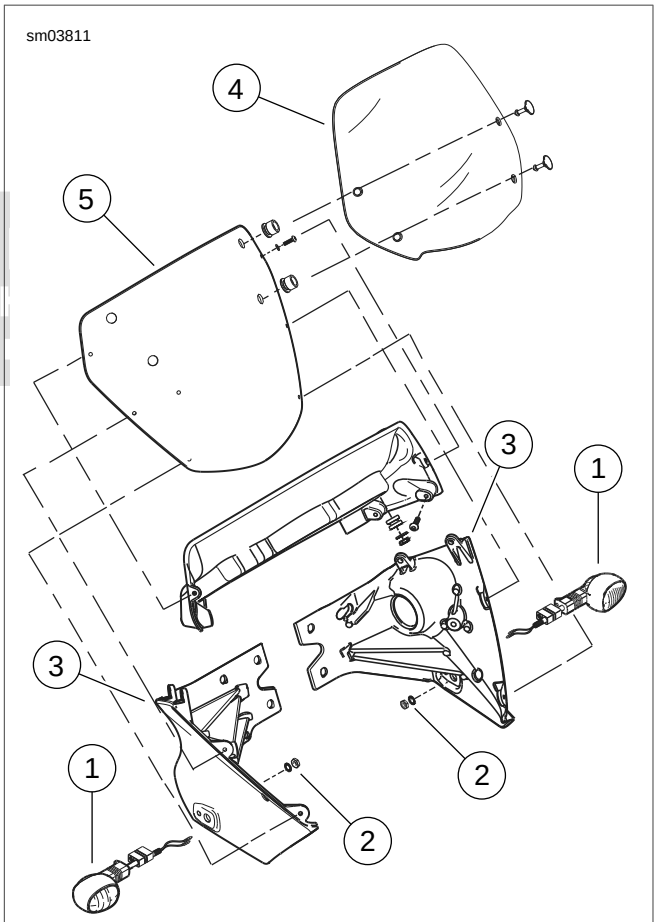
Installation

1. See Figure 6-51. Insert bullet connectors and wiring through hole in front module.
2. Install turn signal using lockwasher and jam nut. Tighten fastener to 25-28 **in-lbs** (2.8-3.2 Nm).
3. Attach bullet connectors on turn signal wires as shown in Figure 6-48.

⚠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)

4. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
   c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
   d. Turn ignition key switch to OFF.
5. Install windscreen and windshield. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.



1. **Turn signal**
2. **Jam nut and lockwasher**
3. **Front module, left and right**
4. **Windshield**
5. **Windscreen**

Figure 6-51. Front Turn Signals: Ulysses

REAR TURN SIGNALS 6.16

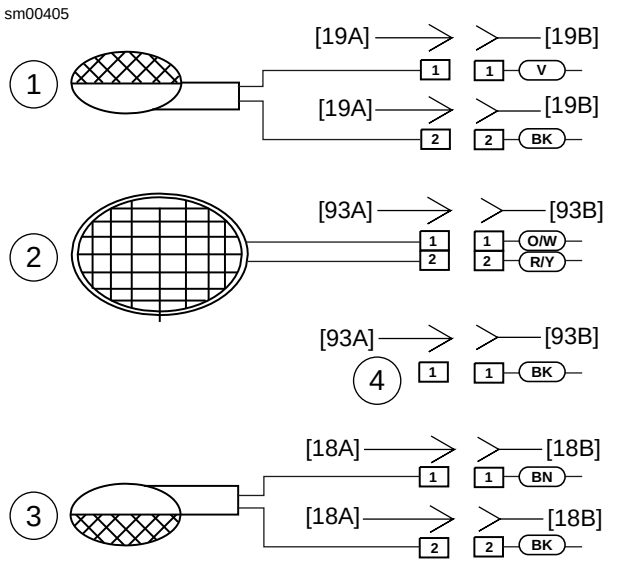
BULBS

1. Remove screws on back of housing to access turn signal bulbs.
2. Rotate bulb 1/4 turn and remove.
3. Before replacing, apply a light coat of dielectric grease on the bulb contact terminals.
4. Install screw and tighten to 4.4-4.3 **in-lbs** (0.5-0.6 Nm).

Connections and Wire Routing

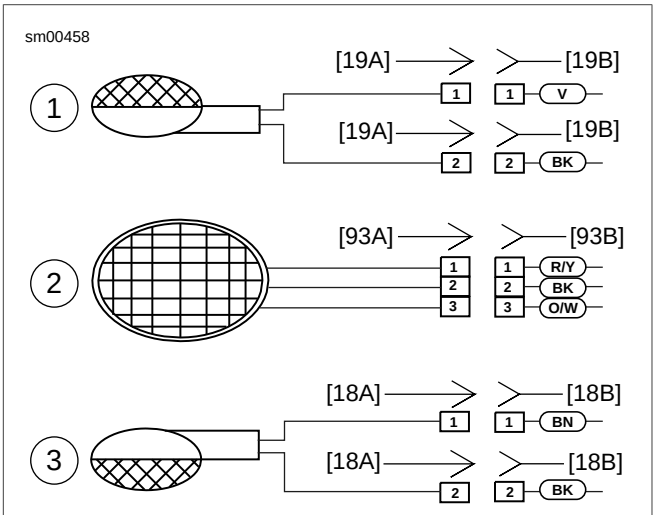
NOTE

To verify correct installation, make note of wire routing and cable strap locations before removing turn signals.



1. **Left turn signal**
2. **Tail lamp**
3. **Right turn signal**
4. **Tail lamp ground**

Figure 6-52. Rear Turn Signal Connections: Firebolt/Lightning



1. **Left turn signal**
2. **Tail lamp**
3. **Right turn signal**

Figure 6-53. Rear Turn Signal Connections: Ulysses

FIREBOLT

Removal

1. Remove seat. See 2.51 SEAT.
2. Remove tail frame upper body work. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
3. See Figure 6-52. Disconnect bullet connectors on turn signal wires.
4. See Figure 6-54. Remove fastener (6) and lockwasher (5).
5. Remove turn signal from tail section (7) and license plate bracket (4).

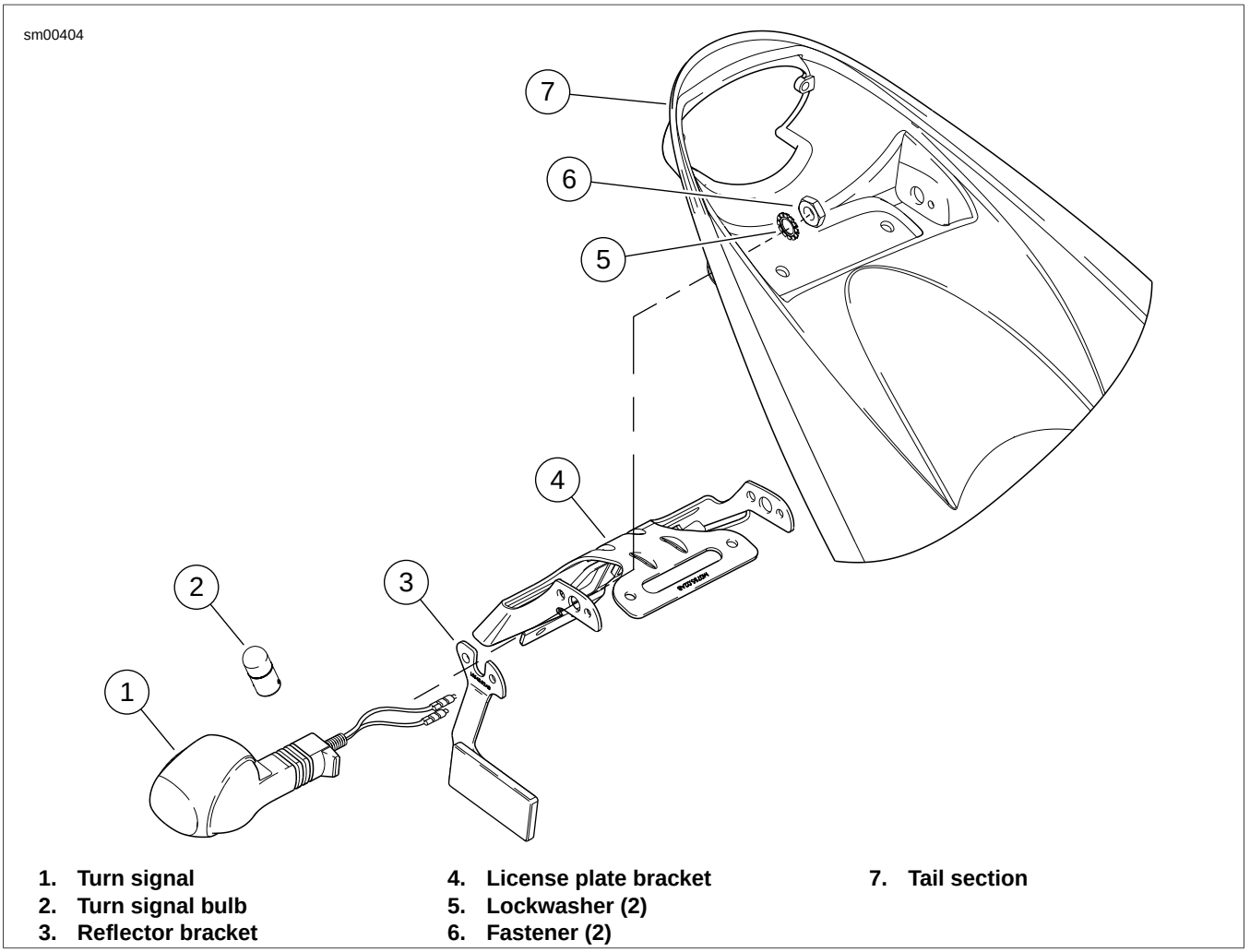
Installation

1. Insert bullet connectors through license plate bracket (4) and tail section.
2. Install reflector bracket.
   a. Place license plate bracket into position over threads on turn signal.
   b. Be sure tab on turn signal fits into hole in reflector bracket and tab on reflector bracket fits into hole in license plate bracket.
3. Attach turn signal using lockwasher and fastener. Tighten fastener to 25-28 **in-lbs** (2.8-3.2 Nm).
4. Attach bullet connectors on turn signal wires as shown in Figure 6-52.

⚠WARNING

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

5. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition/key switch to ON.
   b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
   c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
   d. Turn ignition/key switch to OFF.
6. Install tail frame upper bodywork. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
7. Install seat. See 2.51 SEAT.



1. **Turn signal**
2. **Turn signal bulb**
3. **Reflector bracket**
4. **License plate bracket**
5. **Lockwasher (2)**
6. **Fastener (2)**
7. **Tail section**

Figure 6-54. Rear Turn Signals: Firebolt

LIGHTNING

Removal

1. Remove seat. See 2.51 SEAT.
2. See Figure 6-52. Disconnect bullet connectors [18] and [19] on turn signal wires.
3. See Figure 6-55. Remove jam nut and lockwasher (4).

NOTE

In next step, reflector bracket (3) will be removed with turn signal (1).

4. Remove turn signal from center tail section (5).

Installation

1. See Figure 6-52. Insert bullet connectors through center tail section.

2. Install reflector bracket.

NOTE

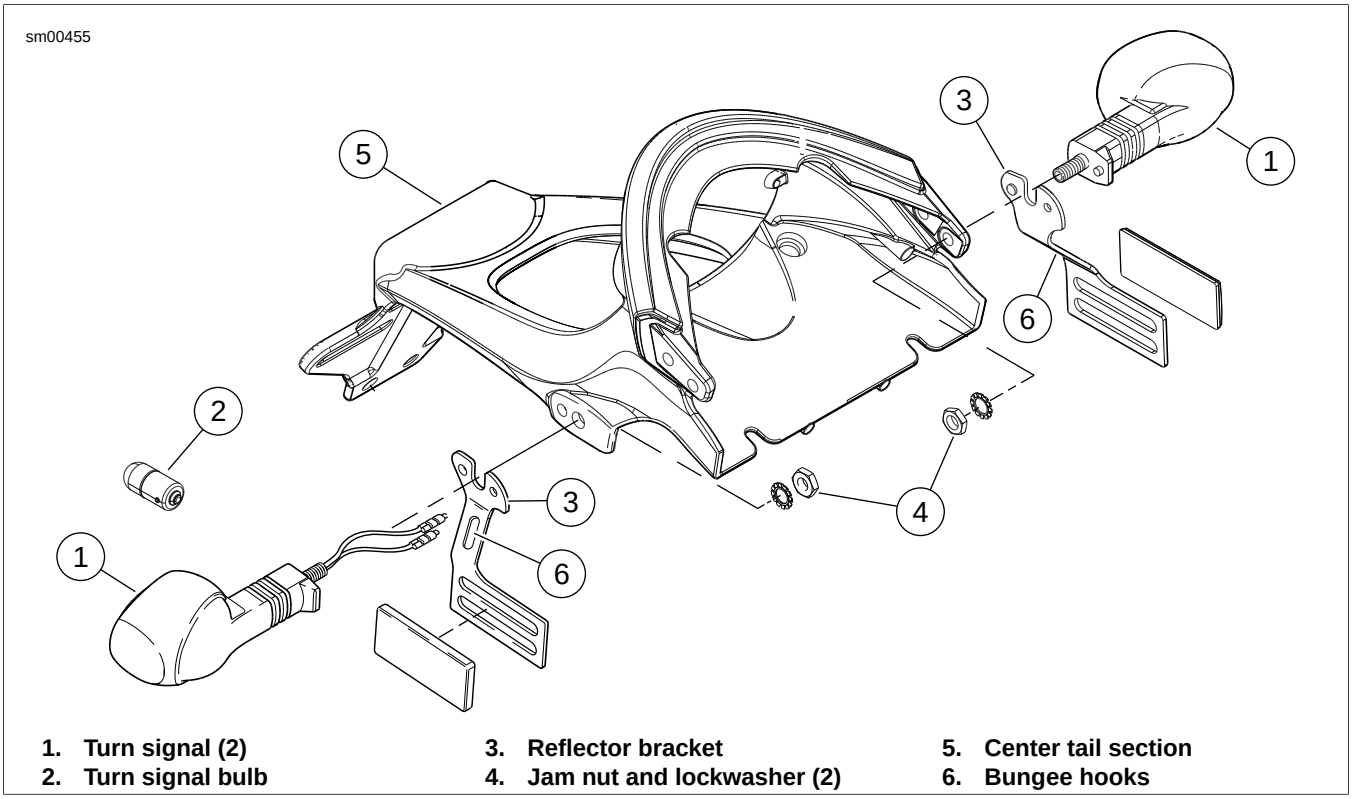
Be sure tab on turn signal fits into hole in reflector bracket and tab on reflector bracket fits into hole in enter tail section.

3. See Figure 6-55. Attach turn signal using lockwasher and jam nut (4). Tighten to 25-28 **in-lbs** (2.8-3.2 Nm).
4. Attach bullet connectors on turn signal wires as shown in Figure 6-52.

⚠WARNING

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

5. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
   c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
   d. Turn ignition key switch to OFF.
6. Install seat. See 2.51 SEAT.



1. **Turn signal (2)**
2. **Turn signal bulb**
3. **Reflector bracket**
4. **Jam nut and lockwasher (2)**
5. **Center tail section**
6. **Bungee hooks**

Figure 6-55. Rear Turn Signals: Lightning

ULYSSES

Remove

1. Remove seat. See 2.51 SEAT.
2. See 6.20 LICENSE PLATE LAMP ASSEMBLY, Ulysses. Remove rear wire cover.
3. See Figure 6-53. Separate left turn signal connector [18] and right turn signal connector [19].
4. See Figure 6-56. Remove jam nut and lockwasher (4).
5. Remove turn signal from license plate bracket (5).

Installation

1. See Figure 6-56. Insert bullet connectors through license plate bracket.

NOTE

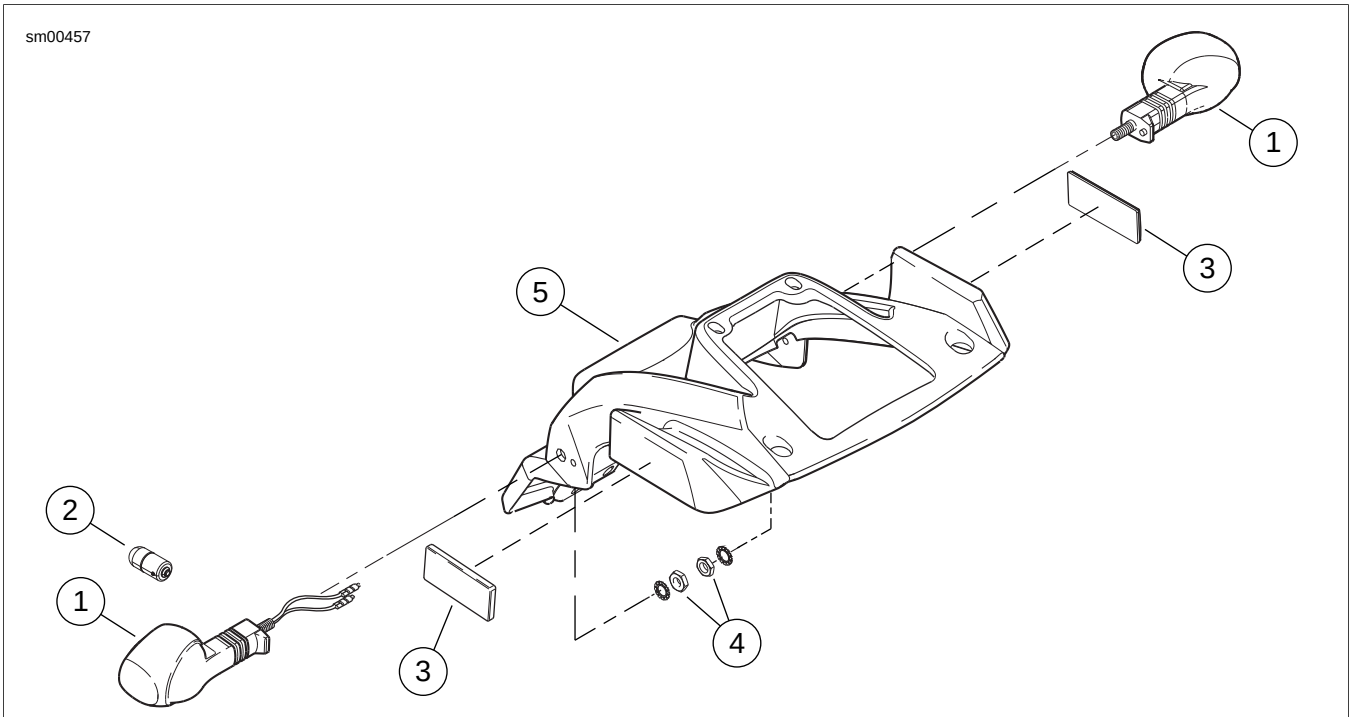
Be sure tab on turn signal fits into hole in reflector bracket and tab on reflector bracket fits into hole in enter tail section.

2. Attach turn signal using lockwasher and jam nut (4). Tighten fastener to 25-28 **in-lbs** (2.8-3.2 Nm).
3. Attach bullet connectors on turn signal wires as shown in Figure 6-53.
4. Install wire cover. See 6.20 LICENSE PLATE LAMP ASSEMBLY, Ulysses.

⚠WARNING

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

5. Check turn signals for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Activate left turn signals using switch on left handlebar. Front and rear left turn signals must flash.
   c. Activate right turn signals using switch on left handlebar. Front and rear right turn signals must flash.
   d. Turn ignition key switch to OFF.
6. Install seat. See 2.51 SEAT.



1. **Turn signal (2)**
2. **Turn signal bulb**
3. **Reflector**
4. **Jam nut and lockwasher (2)**
5. **License plate bracket**

Figure 6-56. Rear Turn Signals: Ulysses

TURN SIGNAL RELOCATION BRACKET: XB12XP

Removal

1. Remove side case brackets. See 2.55 LUGGAGE: XB12XP.
2. See Figure 6-57. Remove turn signal relocation bracket (1) and let hang by the wires.
3. Remove rear reflector bracket (7).
4. Remove grommet for the emergency light connector wires from wire cover (6).
5. Disconnect emergency light connectors at the rear of the lighting/siren control module and pull connectors through hole in rear wire cover (6) one connector at a time.
6. Remove license plate lamp (8).
7. Remove rear wire cover (6).
8. Unplug turn signals and remove with bracket (1).

Installation

1. See Figure 6-57. Install wire cover (6) and secure in place with license plate lamp (8). Leave fasteners loose.

NOTE

The emergency light connectors will only fit through the hole in the wire cover one at a time.

2. Insert emergency light connectors through hole in wire cover and install rubber grommet.

NOTE

.

3. Install side case brackets, but do not install side cases at this time. See 2.55 LUGGAGE: XB12XP.
4. Tighten the fasteners on the license plate lamp. See 6.20 LICENSE PLATE LAMP ASSEMBLY.

5. Install the rear reflector bracket (7) and tighten to 48-72 **in-lbs** (5.4-8 Nm).
6. Install turn signal relocation bracket (1) and tighten to 60-72 **in-lbs** (7-8 Nm).
7. Install side cases.

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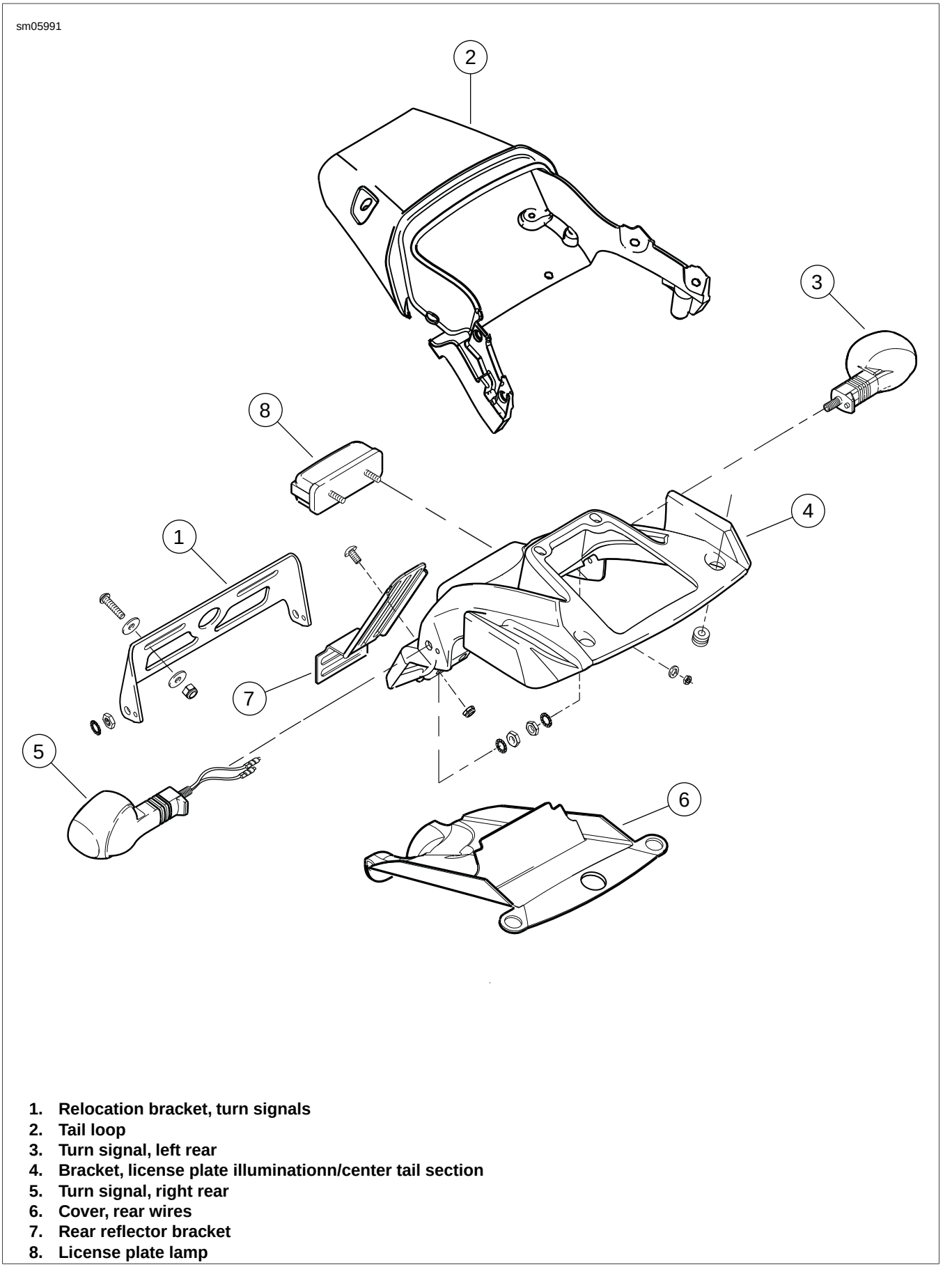


1. **Relocation bracket, turn signals**
2. **Tail loop**
3. **Turn signal, left rear**
4. **Bracket, license plate illuminationn/center tail section**
5. **Turn signal, right rear**
6. **Cover, rear wires**
7. **Rear reflector bracket**
8. **License plate lamp**

Figure 6-57. Rear Turn Signal Relocation Bracket: XB12XP

INTERACTIVE EXHAUST SYSTEM 6.17

GENERAL

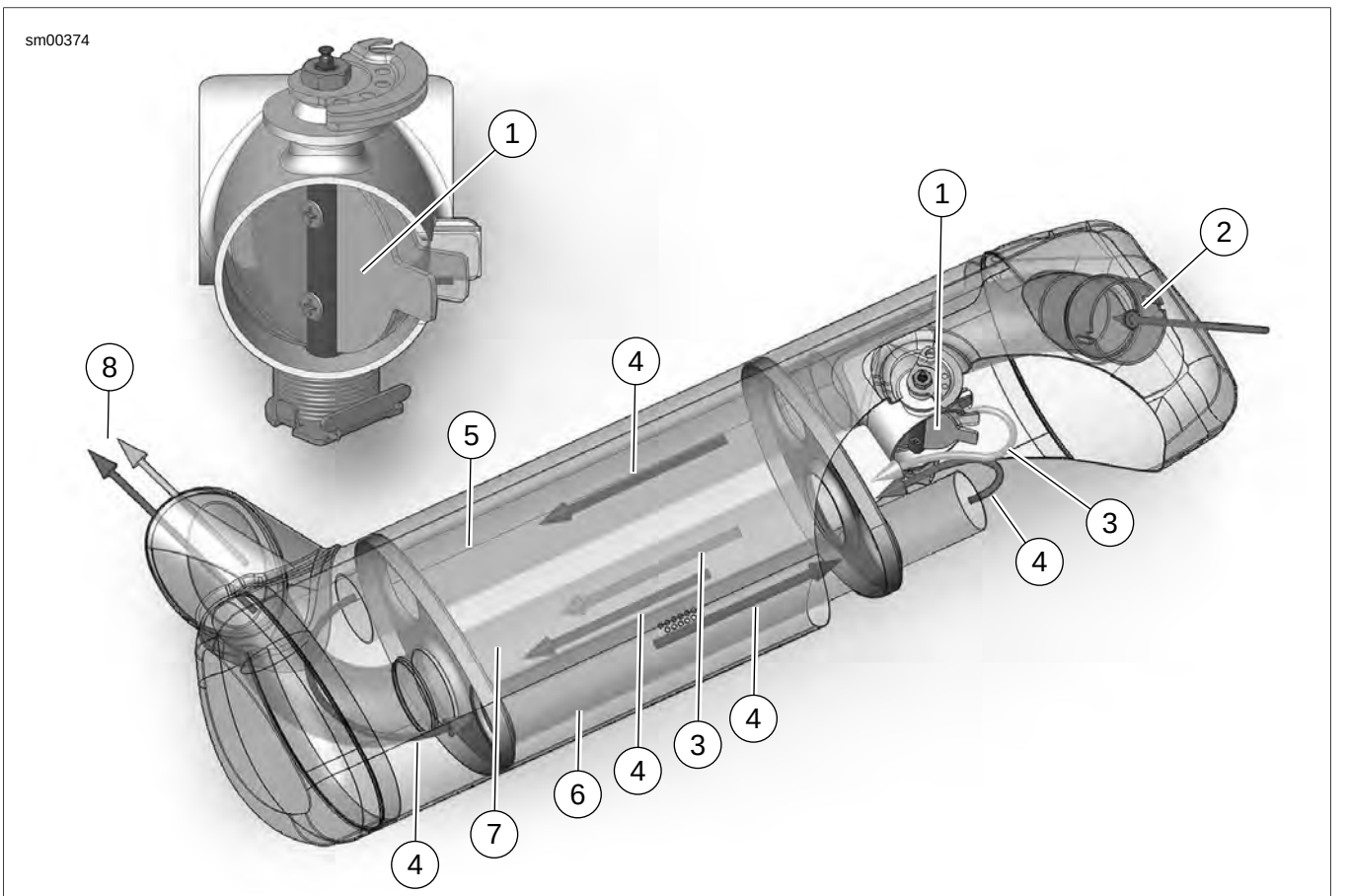
NOTE

The interactive exhaust system is standard equipment on the XB12 models only.

See Figure 6-58. An electronically controlled actuator opens or closes a butterfly valve (1) that controls exhaust flow in a multi-chamber muffler.

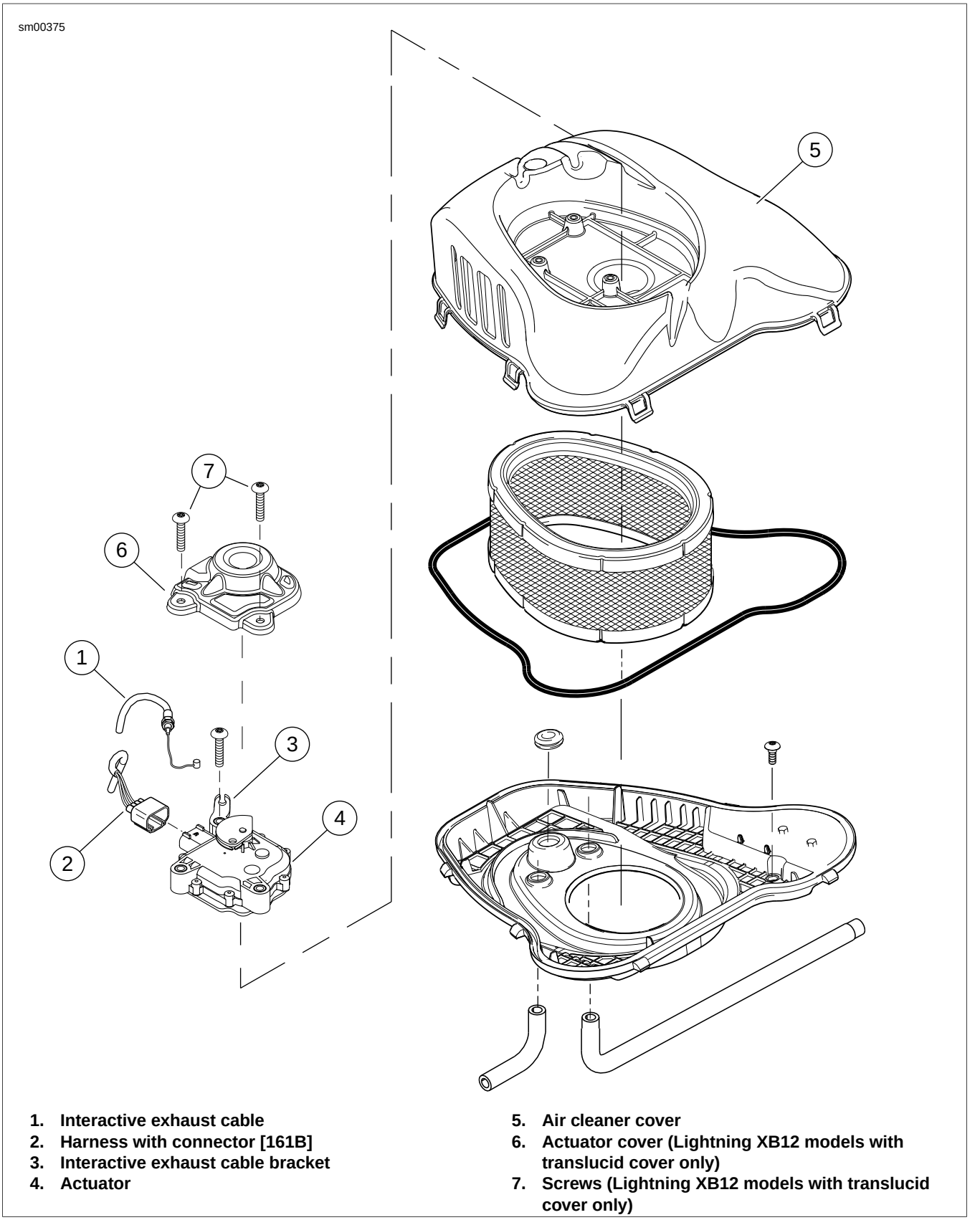
The ECM monitors engine speed and throttle position while alternating flow paths between the chambers to adjust back-pressure optimizing torque and horsepower for the riding condition.

1. At low RPM with a wide-open throttle, the valve (1) is opened to reduce back-pressure so the engine can gain RPM quickly. The exhaust enters (2) the muffler and flows (3) through the open valve (1) into chamber C (7) and then exits (8).
2. In the mid-range, the valve is closed to increase acceleration torque. The exhaust flows (4) through chamber A, around to chamber B and then through chamber C and exits.
3. At high RPM, the valve opens again to maximize horsepower. The exhaust enters (2) the muffler and flows (3) through the open valve (1) into chamber C (7) and then exits (8).



1. **Butterfly valve**
2. **Exhaust in**
3. **Valve open (exhaust flow - chamber C)**
4. **Valve closed (exhaust - chamber A to B to C)**
5. **Chamber A**
6. **Chamber B**
7. **Chamber C**
8. **Exhaust exit**

Figure 6-58. Interactive Exhaust System Muffler



1. **Interactive exhaust cable**
2. **Harness with connector [161B]**
3. **Interactive exhaust cable bracket**
4. **Actuator**
5. **Air cleaner cover**
6. **Actuator cover (Lightning XB12 models with translucid cover only)**
7. **Screws (Lightning XB12 models with translucid cover only)**

Figure 6-59. Interactive Control System (XB12 Models)

REMOVAL

PART NUMBER	TOOL NAME
HS0020.02A8A	HOSE ASSEMBLY

1. Remove seat.

⚠WARNING

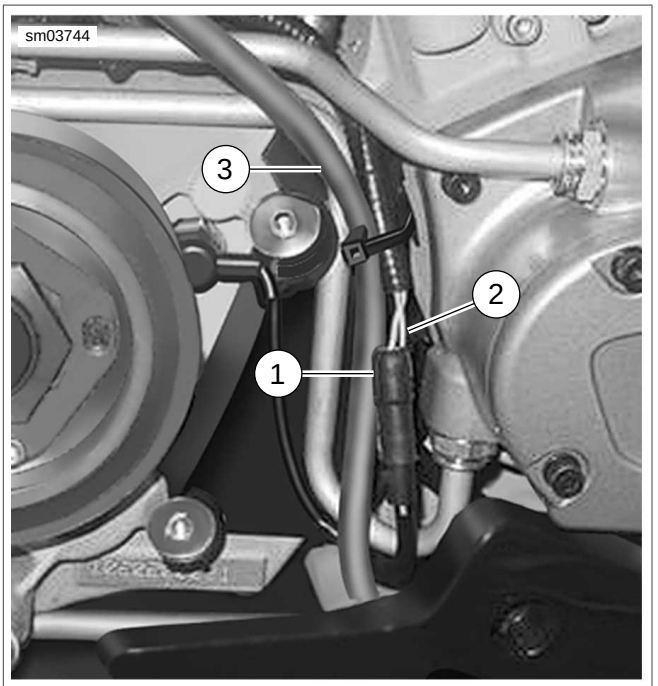
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. Remove chin fairing. See 2.50 CHIN FAIRING.
4. Remove front sprocket cover. See 2.36 SPROCKET COVER.
5. Remove intake cover assembly. See 2.38 INTAKE COVER.
6. See Figure 6-61. Disconnect harness connector [161B] from actuator (4).
7. Add free play to interactive exhaust cable (5), loosen jam nut and remove cable from bracket on actuator.
8. Remove interactive exhaust cable from cable wheel on actuator.
9. Remove actuator.
10. Remove tree fastener securing interactive exhaust cable to inside of muffler bracket on right side.

NOTE

To remove interactive exhaust cable from muffler, partially remove and support muffler until interactive exhaust cable is removed.

11. Remove cable strap above starter securing actuator cable, vent line, main harness and positive battery cable.



1. **Neutral switch connection [131]**
2. **Oil pressure indicator switch wire**
3. **Interactive exhaust cable**

Figure 6-60. Electrical Connectors and Interactive Exhaust Cable Under Sprocket Cover

12. Remove cable strap securing interactive exhaust cable, neutral switch and oil pressure wiring.
13. Remove muffler. See 4.18 EXHAUST SYSTEM.
14. Loosen jam nut and remove interactive exhaust cable from bracket on muffler.
15. Remove interactive exhaust cable from cable wheel on muffler.

NOTE

To replace interactive cable on vehicle it will be necessary to use HOSE ASSEMBLY (Part No. HS0020.02A8A) to aid in removal and installation.

16. Remove interactive cable from vehicle.
    a. Slip end of hose over upper end of cable and attach with tape.
    b. Gently pull cable assembly down and out.
    c. Remove hose from interactive exhaust cable assembly.

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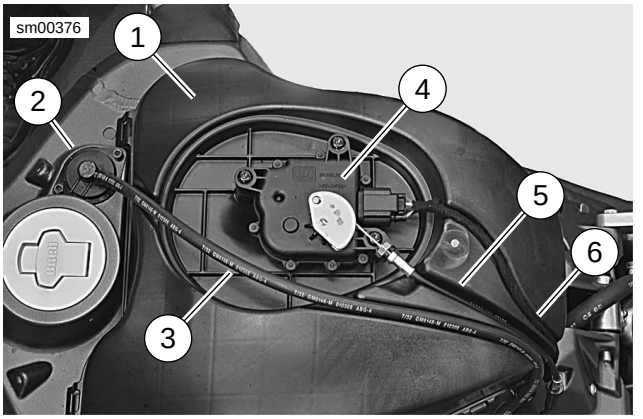


1. **Air cleaner cover**
2. **Fuel tank vent assembly**
3. **Fuel tank vent tube**
4. **Actuator, interactive exhaust**
5. **Cable, interactive exhaust**
6. **Harness, interactive exhaust**

Figure 6-61. Air Cleaner Cover (XB12 Models)

INSTALLATION

NOTES

- *Never reuse front muffler strap. Always replace front muffler strap with a new strap when removed from system.*
- *It is necessary to install interactive exhaust cable to muffler with muffler only partially installed.*

1. Install muffler. See 4.18 EXHAUST SYSTEM.
2. Install interactive cable onto vehicle.
   a. Slip end of hose over upper end of cable and attach with tape.
   b. See Figure 6-62. Gently pull cable assembly up through the wire harness strap and guide at the left rear corner of the frame/fuel tank assembly. See 1.16 INTERACTIVE EXHAUST CABLE.
3. Install actuator. Tighten fasteners to 36-40 **in-lbs** (4-4.5 Nm).
4. Attach interactive exhaust cable to cable wheel on actuator.
5. Connect interactive exhaust harness to actuator [161B].
6. Attach interactive exhaust cable to bracket and cable wheel on actuator and adjust. See 1.16 INTERACTIVE EXHAUST CABLE.
7. Install cable strap above starter securing actuator cable, vent line, main harness and positive battery cable.
8. Install cable strap securing actuator cable, neutral switch and oil pressure wiring.
9. Install front sprocket cover. See 2.36 SPROCKET COVER.
10. Install chin fairing. See 2.50 CHIN FAIRING.
11. Install intake cover. See 2.38 INTAKE COVER.
12. Install negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

13. Install seat.

Figure 6-62. Interactive Exhaust Cable Behind Wire Harness Strap and Guide

HEADLIGHT 6.18

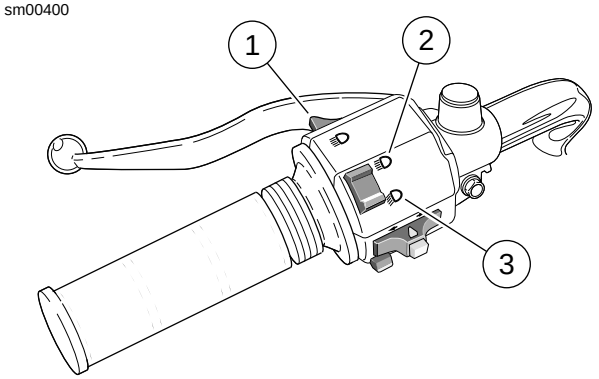
GENERAL

Dual headlights are equipped with replaceable bulbs.

- High beam headlight is located on the left side of vehicle. and turns on and off with headlight switch.
- Low beam headlight is located on the right side of vehicle.
- **Firebolt Models:** Adjustment of individual headlight projection is accomplished by adjusting two screws located in the headlight support.
- **Lightning and Ulysses Models:** Adjustment of individual headlight projection is accomplished by adjusting the entire headlight assembly.

NOTES

- ***Lightning/Ulysses**: Low beam does not remain on when high beam is activated. Only one headlight remains on at any given time unless the passing lamp switch is depressed while low beam is activated causing the high beam to temporarily flash.*
- ***Firebolt**: Low beam will remain on when high beam is activated.*



1. **Passing lamp switch**
2. **HIGH beam**
3. **LOW beam (always on when motorcycle is running)**

Figure 6-63. Headlight Controls

HEADLIGHT BULBS: FIREBOLT

Removal

WARNING

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

1. Disconnect negative battery cable.

WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

2. See Figure 6-64. Disconnect headlight connection (1).
3. Remove rubber boot from headlight housing.
4. Release wire retaining latch (5) from headlight housing clips.
5. Pull bulb housing from headlight housing.

Installation

NOTE

Not using the specified bulb may cause charging system problems.

WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

CAUTION

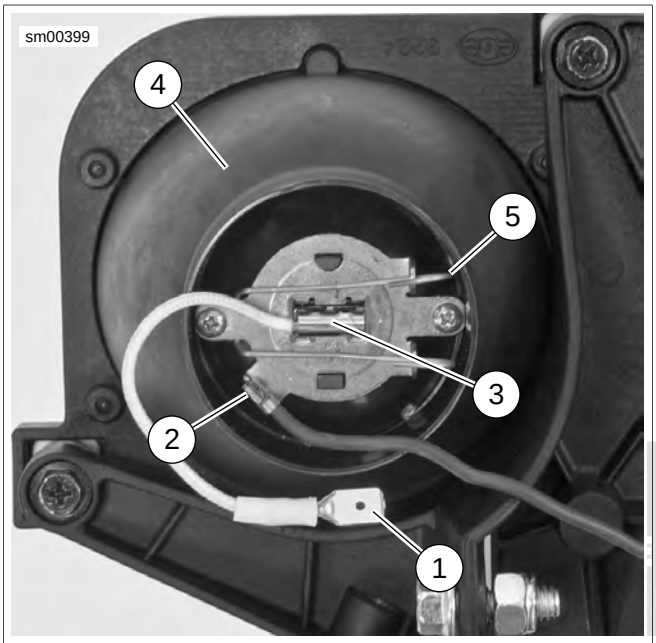
Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

1. See Figure 6-64. Align tabs on bulb (3) with tabs on headlight (4). Insert bulb.
2. Close the wire retaining latch (5).
3. Install rubber boot on headlight housing.
4. Connect the headlight bulb connector.
5. Connect negative battery cable and tighten fastener to 72-96 **in-lbs** (8-11 Nm).

WARNING

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

6. Check headlight for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. See Figure 6-63. Check headlight LOW beam (3) and HIGH beam (2) settings.
   c. Set headlight to LOW beam. Press passing lamp switch (1). Headlight should flash HIGH beam for as long as the switch is pressed.
   d. Turn ignition key switch to OFF.
7. Align headlight. See 1.17 HEADLAMP.



1. **Headlight connection**
2. **Ground connection**
3. **Headlight bulb (headlight boot removed)**
4. **Headlight**
5. **Wire retaining latch**

Figure 6-64. Headlight Bulb: Firebolt

HEADLIGHT BULBS: LIGHTNING AND ULYSSES

Removal

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.

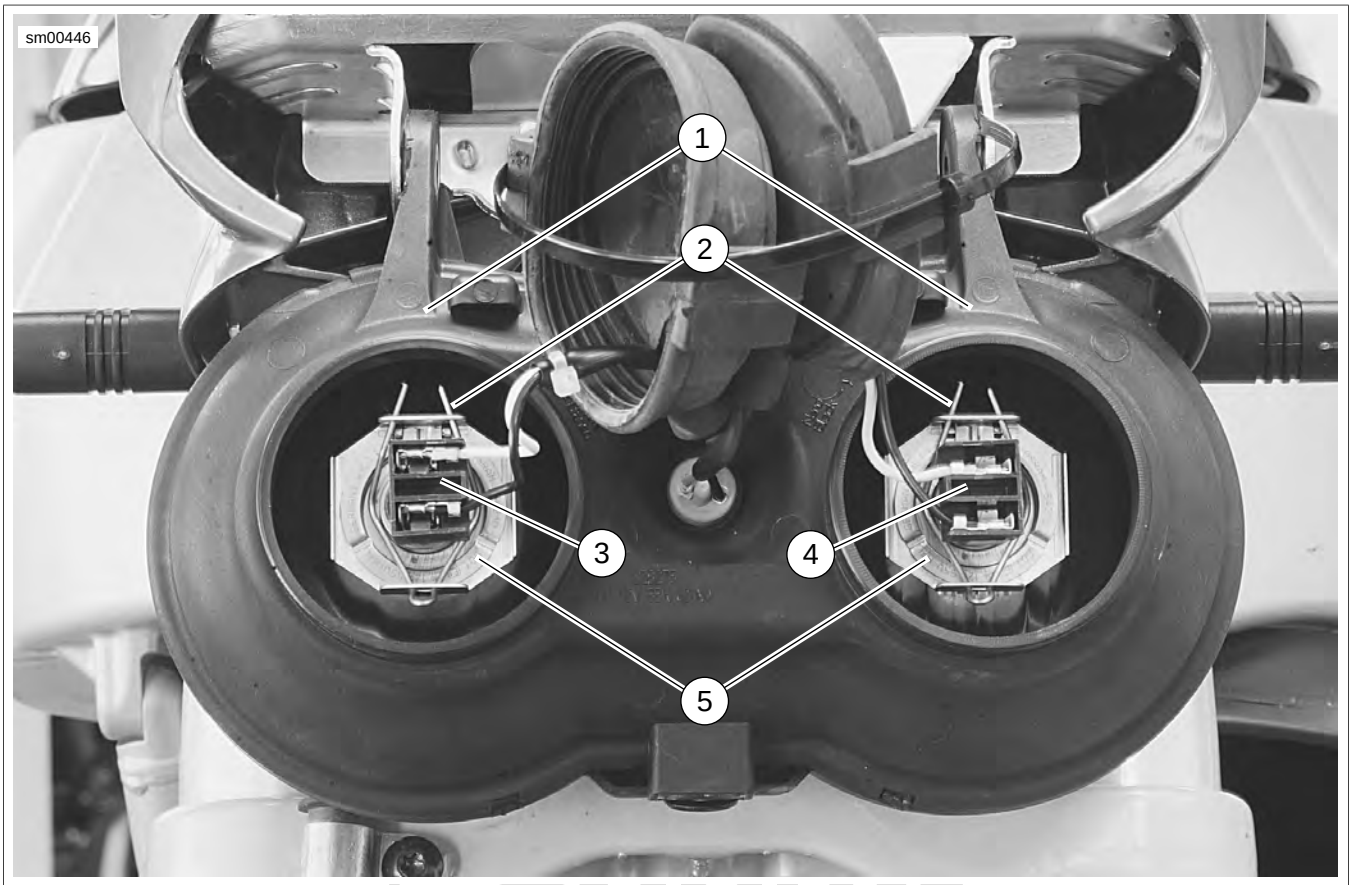
⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

3. Remove windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
4. Remove headlight housing fasteners.
5. Disconnect headlight connector [38] and remove headlight assembly.
6. Remove rubber boot from headlight housing.
7. See Figure 6-65. Disconnect high beam connector (3) or low beam connector (4), or both.
8. Release bulb holder (2) from headlight housing clips.
9. Remove bulb housing from headlight housing.



1. **Headlight**
2. **Bulb holder (2)**
3. **High beam connection [38] (left side) with ground**
4. **Low beam connection [38] (right side) with ground**
5. **Headlight bulbs**

Figure 6-65. Headlight Assembly: Lightning/Ulysses (Rear View)

Installation

NOTE

Not using the specified bulb may cause charging system problems.

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

1. See Figure 6-65. Align tabs on bulb (5) with tabs on headlight (1). Insert bulb.
2. Secure the bulb holder (2) to the headlight housing clips.
3. Connect the headlight bulb connector (3, 4).

NOTE

If the rubber boots are not installed correctly the wiring harnesses can contact the edge of the forward frame mount. The wiring harness guides must be installed at a 20 degree angle.

4. See Figure 6-65. Install rubber boot.
   a. When installing the rubber boots on the back of the headlight housing, be sure to align the harness guides or spigots with the casting marks on the headlight housing.
   b. When the spigots are aligned with the casting marks the wiring harness will be at approximately 20 degrees.
5. Connect headlight connector [38].

NOTE

On XB12SXP and XB12X models the lower headlight fastener should be tightened to 36-48 ***in-lbs*** *(4-5.5 Nm).*

6. Install headlight housing and fasteners and tighten to 48-72 **in-lbs** (5.4-8 Nm).
7. Install windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
8. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

9. See Figure 6-65. Check headlight for proper operation. If operation fails, verify that all steps were performed properly.
   a. Turn ignition key switch to ON.
   b. Check headlight LOW beam (3) and HIGH beam (2) settings.
   c. Set headlight to LOW beam. Press passing lamp switch (1). Headlight should flash HIGH beam for as long as the switch is pressed.
   d. Turn ignition key switch to OFF.

⚠WARNING

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

10. Install seat.
11. Align headlight. See 1.17 HEADLAMP.

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Figure 6-66. Headlight Housing 20 Degree Alignment Marks for Rubber Boot Wiring Harness Guides or Spigots

TAIL LAMP 6.19

FIREBOLT/LIGHTING

Removal

1. **Lightning Models:** Remove seat.
2. See Figure 6-67. Remove two screws (2) to detach tail lamp lens (4) and tail lamp (5). If replacing bulb (3), turn counterclockwise and remove.
3. Disconnect tail lamp harness (6) connectors [93].

Installation

1. See Figure 6-67. Attach the tail lamp harness (6) connectors [93] and install boot.

NOTE

The R/Y wire is installed facing the left side of the vehicle.

2. If removed, install tail lamp bulb (3). Turn bulb clockwise to install.
3. Install tail lamp lens (4) and tail lamp (5) with two screws (2). Tighten to 6-7 **in-lbs** (0.7-0.8 Nm).

⚠WARNING

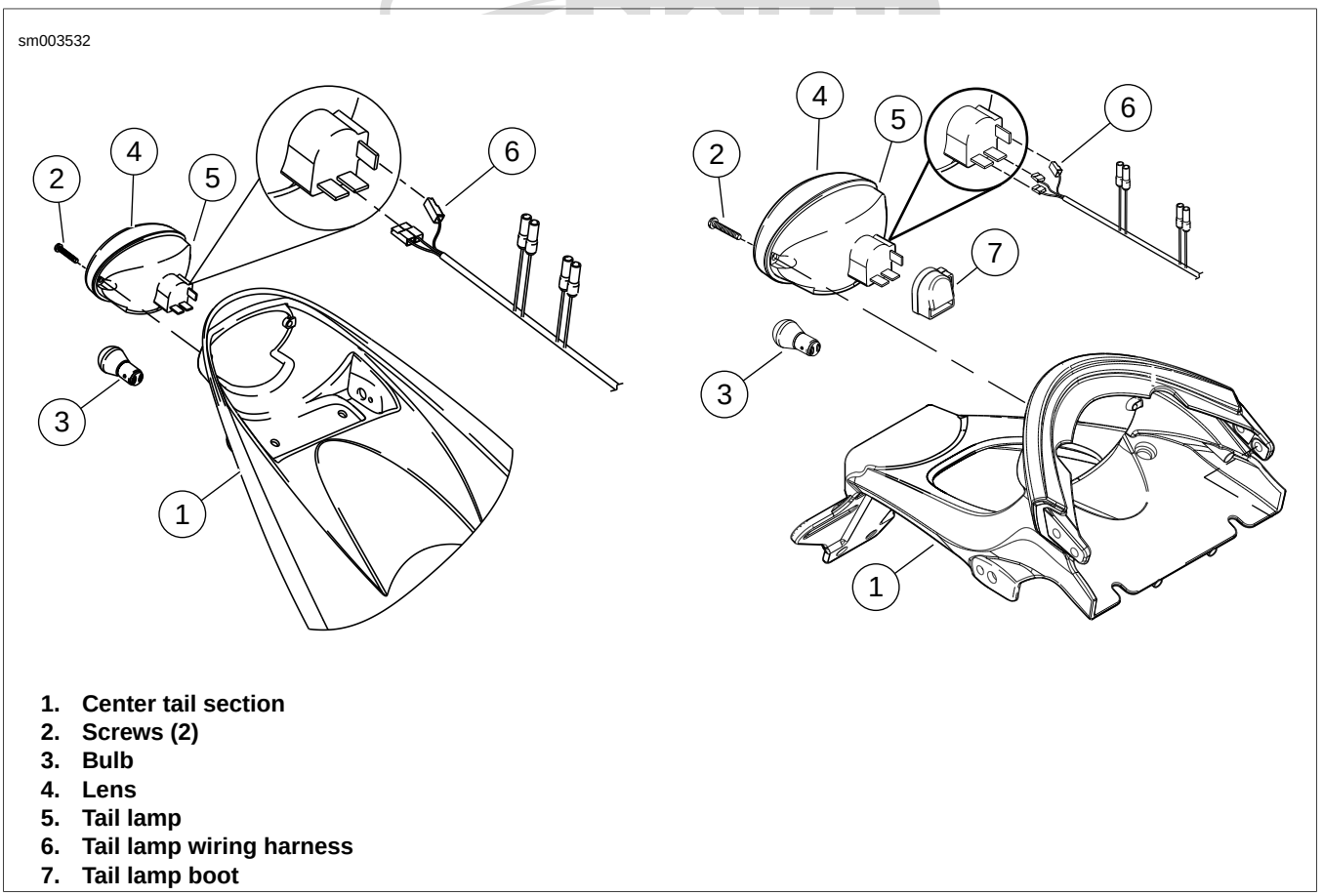
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

4. Check tail lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Check for tail lamp illumination.
   c. Squeeze front brake hand lever. Check for brake lamp illumination. Release front brake hand lever.
   d. Press rear brake pedal. Check for brake lamp illumination. Release rear brake pedal.
   e. Turn ignition key switch to OFF.

⚠WARNING

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

5. **Lightning Models:** Install seat.



1. **Center tail section**
2. **Screws (2)**
3. **Bulb**
4. **Lens**
5. **Tail lamp**
6. **Tail lamp wiring harness**
7. **Tail lamp boot**

Figure 6-67. Tail Lamp Assembly: Firebolt/Lightning

ULYSSES

Removal

1. Remove seat.
2. Disconnect connector [93] from tail lamp.
3. See Figure 6-68. Remove nuts and washers (2) securing tail lamp (3) to center tail section (1) and remove tail lamp.

Installation

1. See Figure 6-68. Install tail lamp (3) with nuts and washers (2) to the center tail section (1).
2. Tighten nuts to 12-36 **in-lbs** (1.4-4 Nm).
3. Attach the tail lamp harness connector [93].

WARNING

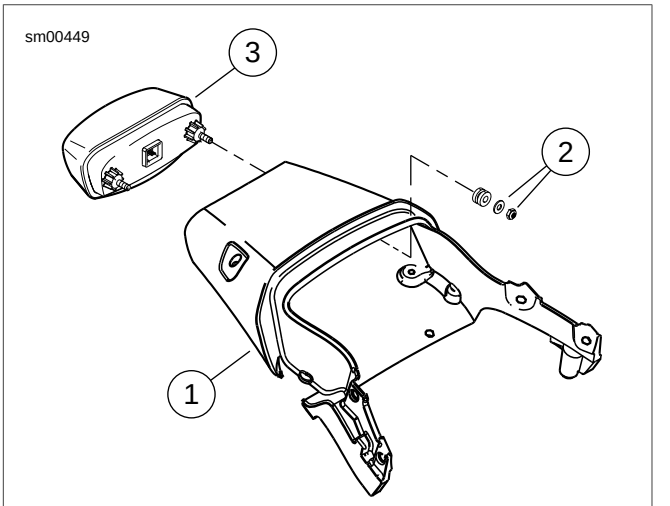
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

4. Check tail lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Check for tail lamp illumination.
   c. Squeeze front brake hand lever. Check for brake lamp illumination. Release front brake hand lever.
   d. Press rear brake pedal. Check for brake lamp illumination. Release rear brake pedal.
   e. Turn ignition key switch to OFF.

WARNING

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

5. Install seat.



1. **Center tail section**
2. **Nuts and washers (2)**
3. **Tail lamp**

Figure 6-68. Tail Lamp Assembly: Ulysses

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LICENSE PLATE LAMP ASSEMBLY 6.20

LIGHTNING

Removal

1. Remove seat.
2. See Figure 6-69. Disconnect the two connectors [45] from license plate lamp harness (2).
3. Remove two jam nuts and washers (1) to detach license plate lamp from center tail section (3).
4. Pull the lamp assembly away from center tail section pulling the harness out between the tail screen and the center tail section.

NOTE

See Figure 6-70. If replacing bulb only, remove both lamp lens screws (3), remove lamp lens (4) and remove bulb. Replace bulb and install lens and tighten screws.

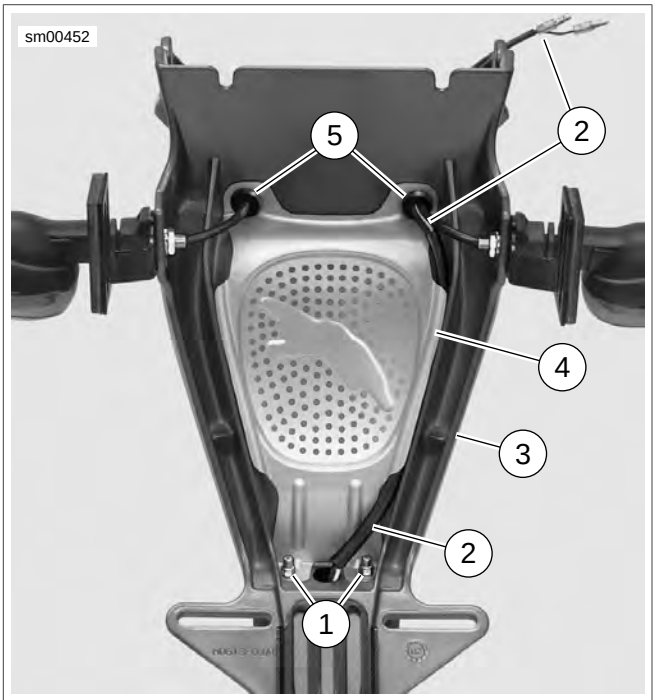
Installation

1. See Figure 6-69. Install license plate lamp assembly.
   a. Insert license plate lamp wiring harness and connections (2) through hole at rear of center tail section (3) and route between the tail section and the tail screen (4).
   b. Attach lamp assembly to tail section using jam nuts and washers (1) and tighten to 12-36 **in-lbs** (1.4-4 Nm).
   c. Attach the two connectors [45] from license plate lamp wiring harness and connectors (2) to main harness.
2. Check lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Check for license plate lamp illumination.
   c. Turn ignition key switch to OFF.

⚠WARNING

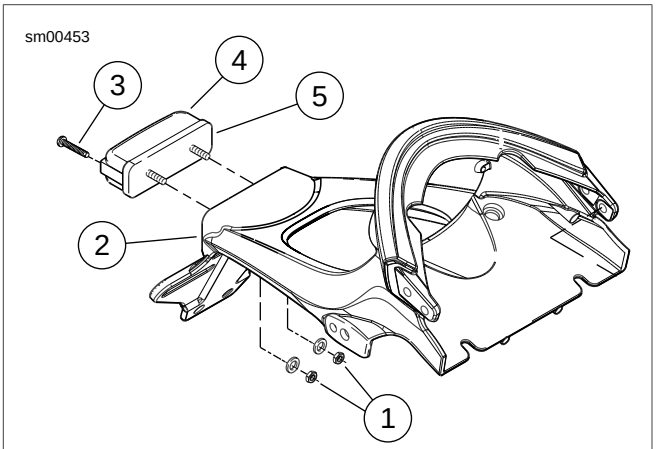
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

3. Install seat.



1. **Jam nuts and washers (2)**
2. **Lamp wiring harness and connectors [45]**
3. **Center tail section**
4. **Tail screen**
5. **Grommets (2)**

Figure 6-69. License Plate Lamp Mounting: Lightning



1. **Jam nuts with washers (2)**
2. **Center tail section**
3. **Screws (2)**
4. **Lamp lens**
5. **License plate lamp**

Figure 6-70. License Plate Lamp: Lightning

ULYSSES

Removal and Disassembly

1. Remove seat.
2. See Figure 6-71. Remove the cover for the rear wiring (3).
3. Disconnect the two connectors [45] from license plate lamp harness.
4. Pull the lamp assembly away from license plate bracket (1) pulling the harness out of the license plate bracket.

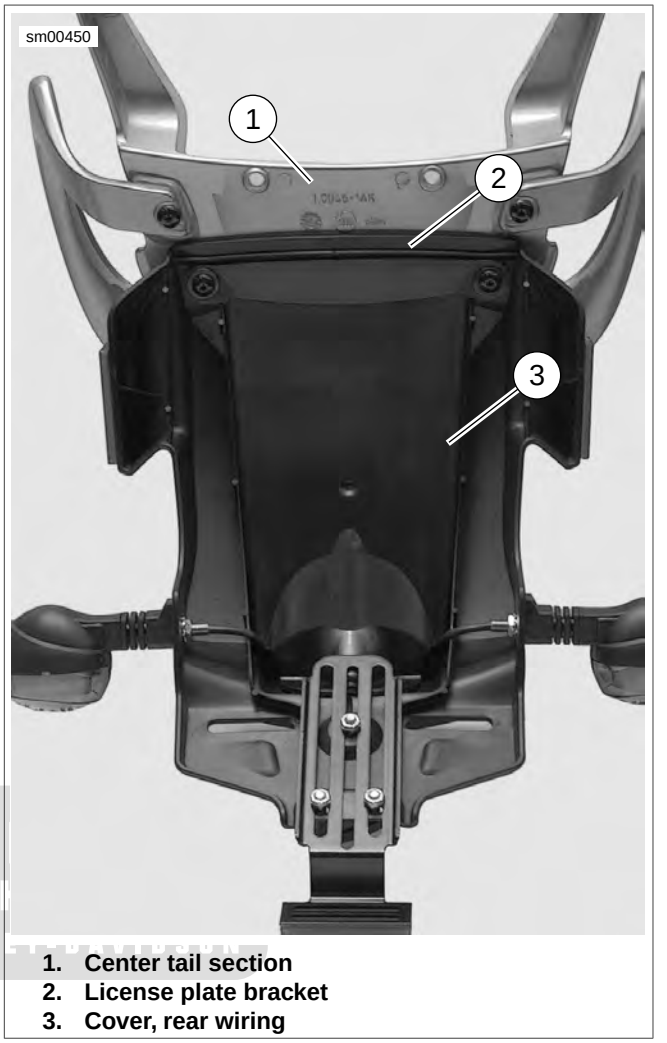
Assembly and Installation

1. See Figure 6-71. Install **new** license plate lamp assembly.
   a. Insert license plate lamp wiring harness through hole and route into the center tail section (2) and the license plate bracket (4).
   b. Attach the two connectors [45] from license plate lamp to main harness.
   c. Attach lamp (3) and wire cover (5) to tail section using washers and jam nuts (1) and tighten to 12-36 **in-lbs** (1.4-4 Nm).
   d. See Figure 6-71. Attach front of wire cover by installing remaining fasteners (6) and tightening to 36-48 **in-lbs** (4.1-5.4 Nm).
2. Check lamp for proper operation. If operation fails, reread procedure and verify that all steps were performed.
   a. Turn ignition key switch to ON.
   b. Check for license plate lamp illumination.
   c. Turn ignition key switch to OFF.

⚠WARNING

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

3. Install seat.



1. **Center tail section**
2. **License plate bracket**
3. **Cover, rear wiring**

Figure 6-71. License Plate Lamp Mounting: Ulysses

MAIN FUSE AND FUSES 6.21

GENERAL

Buell motorcycles feature two components which protect the electrical system.

Fuses

Firebolt: See Figure 6-72 and Figure 6-73. The covered fuse block is under the seat.

Lightning: See Figure 6-74 and Figure 6-75. The covered fuse block is under the seat.

Ulysses: See Figure 6-76 and Figure 6-77. The covered fuse block is under the seat.

Always investigate the cause of blown fuses before replacing them.

Main Fuse

Firebolt: See Figure 6-78 and the 30 amp main fuse is located under the seat immediately behind the rear brake fluid reservoir. To disable the motorcycle's ignition system, pull the main fuse.

Lightning and Ulysses: The 30 amp main fuse is located under the seat in the fuse block. To disable the motorcycle's ignition system, pull the main fuse.

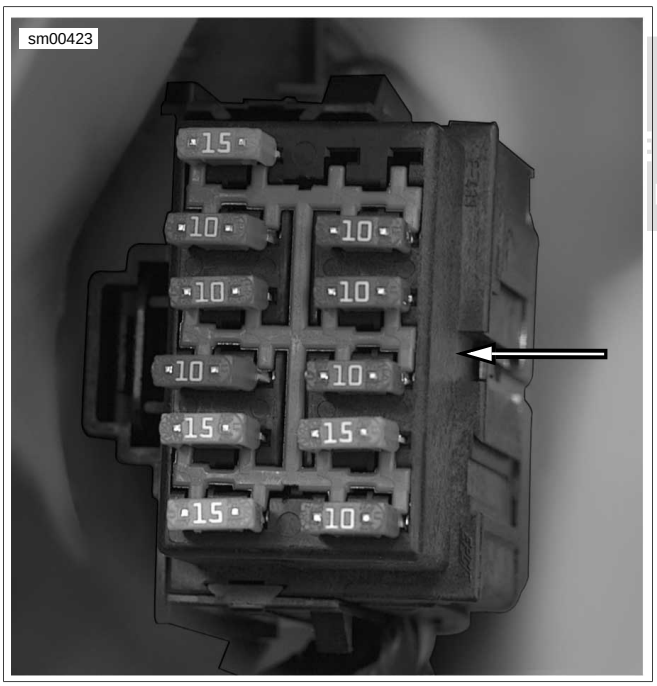
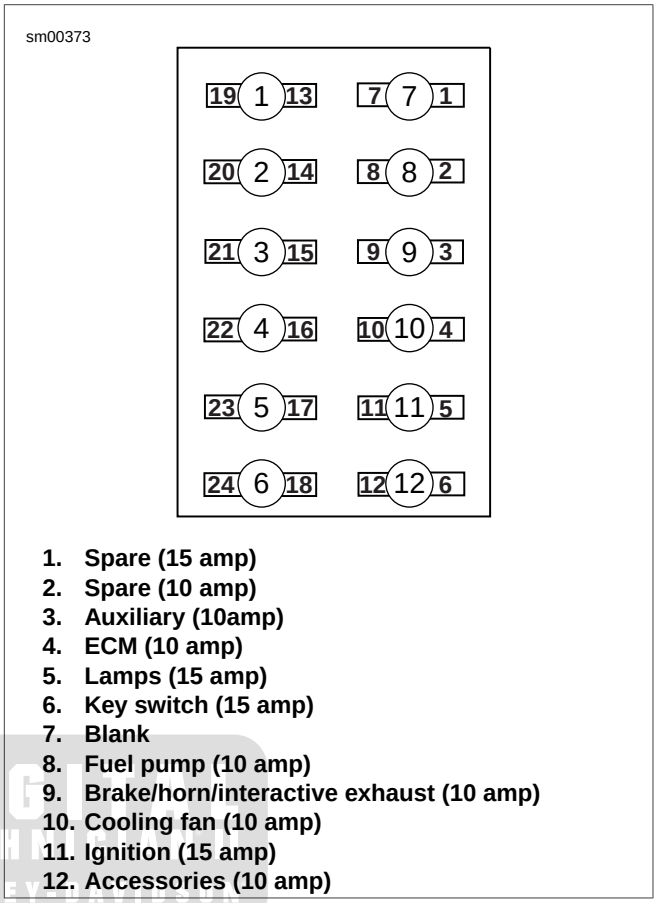
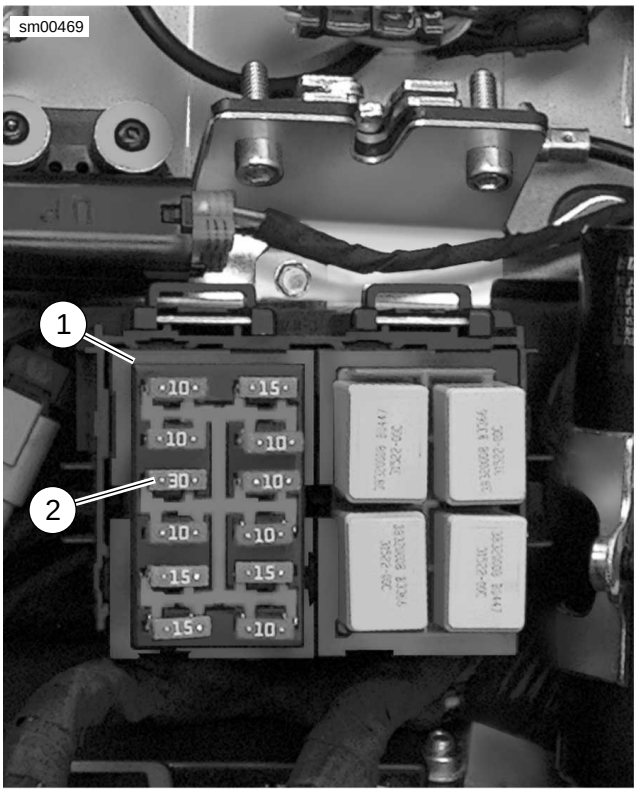


Figure 6-72. Fuse Block: Firebolt



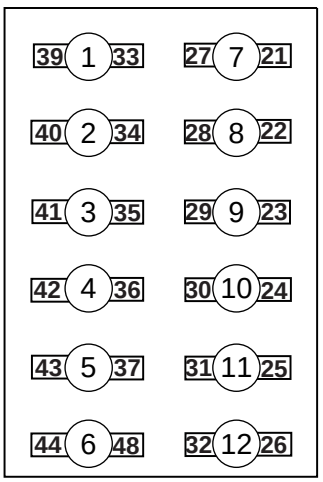
1. **Spare (15 amp)**
2. **Spare (10 amp)**
3. **Auxiliary (10amp)**
4. **ECM (10 amp)**
5. **Lamps (15 amp)**
6. **Key switch (15 amp)**
7. **Blank**
8. **Fuel pump (10 amp)**
9. **Brake/horn/interactive exhaust (10 amp)**
10. **Cooling fan (10 amp)**
11. **Ignition (15 amp)**
12. **Accessories (10 amp)**

Figure 6-73. Fuse Block: Firebolt



1. Fuse block (cover removed)
2. Battery fuse (30 amp)

Figure 6-74. Fuse Block and Battery Fuse Location: Lightning



1. Fuel pump (10 amp)
2. Auxiliary (10 amp)
3. Main (30 amp)
4. ECM (10 amp)
5. Lamps (15 amp)
6. Key switch (15 amp)
7. Ignition (15 amp)
8. Accessories (10 amp)
9. Brake/horn/interactive exhaust (10 amp)
10. Cooling fan (10 amp)
11. Spare (15 amp)
12. Spare (10 amp)

Figure 6-75. Fuse Block: Lightning

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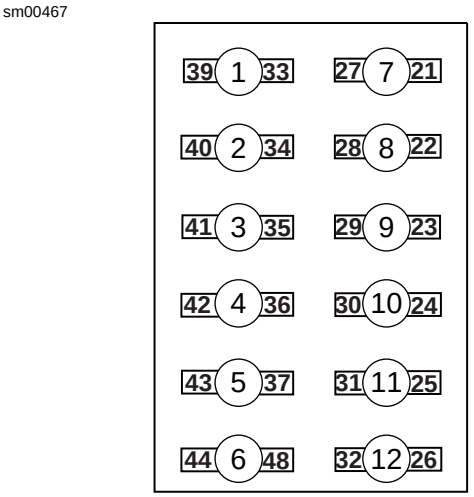
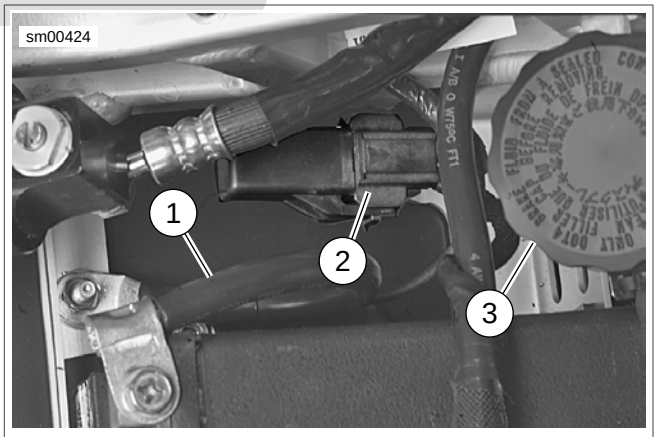
Figure 6-76. Fuse Block and Main Fuse Location: Ulysses



1. Fuel pump (10amp)
2. Auxiliary (10amp)
3. Battery (30 amp)
4. ECM (10 amp)
5. Lamps (15 amp)
6. Key switch (15 amp)
7. Ignition (15 amp)
8. Accessory (10 amp)
9. Brake/horn/interactive exhaust (10 amp)
10. Fan (10 amp)
11. Spare (15 amp)
12. Spare (10 amp)

Figure 6-77. Fuse Block: Ulysses



1. Negative battery cable
2. Main fuse holder
3. Rear brake fluid reservoir

Figure 6-78. 30A Main Fuse Location: Firebolt

NEUTRAL INDICATOR SWITCH 6.22

GENERAL

See Figure 6-79. The neutral indicator switch (2) is threaded into the transmission portion of the right crankcase half. It is immediately forward of the transmission sprocket (1). The sprocket cover must be removed to test the switch.

A pin on the shifter drum contacts the neutral indicator switch plunger, completing the neutral indicator circuit. The switch is not repairable. Replace the switch if it malfunctions.

TESTING

1. Remove sprocket cover. See 2.36 SPROCKET COVER.
2. See Figure 6-79. Disconnect wire lead from neutral indicator switch (2). See 6.30 SPROCKET COVER WIRING.
3. Turn ignition key switch to ON. Touch the neutral indicator wire lead to a suitable ground.
   a. If indicator lamp lights, then problem is at indicator switch. Replace switch.
   b. If indicator lamp does not light, then problem is elsewhere in circuit. Check for loose connections, burned out indicator lamps or faulty wiring.
   c. After testing and repair, connect wire lead to indicator switch.
4. Install sprocket cover. See 2.36 SPROCKET COVER.

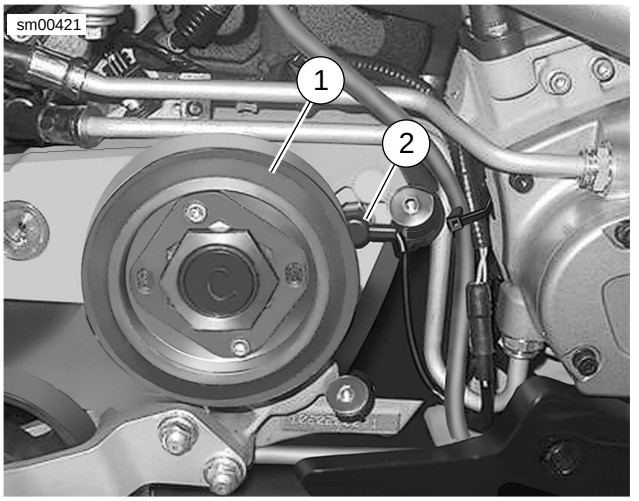
REMOVAL AND INSTALLATION

1. Verify that the ignition key switch is turned to OFF.
2. Remove sprocket cover. See 2.36 SPROCKET COVER.

NOTE

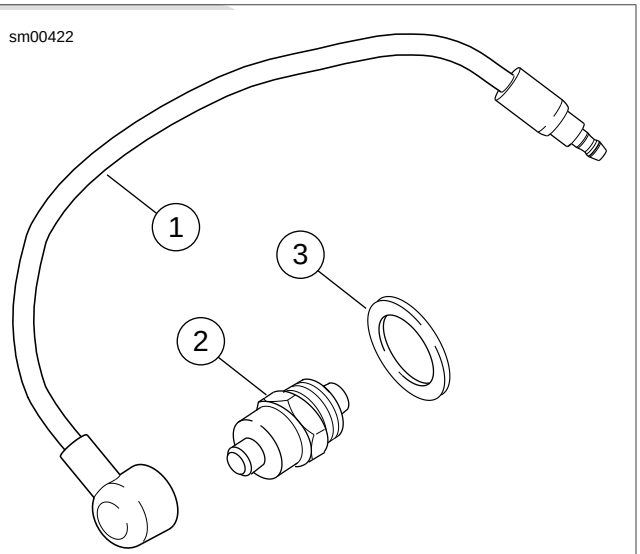
If replacing neutral indicator switch wiring, see 6.30 SPROCKET COVER WIRING for correct wire routing.

3. See Figure 6-80. Remove neutral indicator switch wire lead (1) from neutral indicator switch (2).
4. Remove neutral indicator switch and washer (3).
5. Install **new** neutral indicator switch.
   a. Apply a light coating of LOCTITE THREADLOCKER 243 (blue) to **new** neutral indicator switch (2) threads.
   b. Install washer (3) over neutral indicator switch (2) threads.
   c. Install switch in crankcase. Tighten switch to 60-84 **in-lbs** (6.7-9.5 Nm).
   d. Connect neutral indicator switch wire lead (1) to switch.
6. Install sprocket cover. See 2.36 SPROCKET COVER.



1. Transmission sprocket
2. Neutral indicator switch

Figure 6-79. Neutral Indicator Switch Location



1. Neutral indicator switch wire lead
2. Neutral indicator switch
3. Washer

Figure 6-80. Neutral Indicator Switch

SIDESTAND SWITCH (HDI) 6.23

SIDESTAND SWITCH (HDI)

Removal

1. Disconnect the sidestand switch from the harness between the left ram air scoop and cylinder head next to the front V-bracket to frame bolt.
2. Remove the two cable straps securing the sidestand harness to the vertical leg of the V-bracket.
3. Remove the cable strap securing the sidestand switch lead to the crank position sensor next to its own re-closeable tree fastener clip.
4. Remove the sidestand switch harness from along the inside of the vertical leg of the V-bracket from behind the rear oil cooler bracket.
5. Pull the switch wire harness through the re-closeable tree fastener clip on the muffler and route harness out the left side of the vehicle.
6. Remove fastener securing the sidestand switch to the sidestand bracket and remove sidestand switch and harness.

Installation

1. Install fastener through the sidestand switch into the sidestand bracket and tighten to 96-120 **in-lbs** (11-13.6 Nm).
2. Route the switch wire harness through the re-closeable tree fastener clip on the muffler in order to secure the switch harness from damage.
3. Continue routing the sidestand switch harness along the front contour of the primary cover to the crank position sensor wire.
4. Install a cable strap around the sidestand switch lead to the crank position sensor next to its own re-closeable tree fastener clip, which holds the crank sensor lead in place, and then route the sidestand switch wire behind the rear oil cooler bracket and up along the inside of the vertical leg of the V-bracket and secure it with two more cable straps.
5. The sidestand switch connection is on the harness between the left ram air scoop and cylinder head next to the front V-bracket to frame bolt.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

CRANKSHAFT POSITION SENSOR (CKP) 6.24

GENERAL

The crank position (CKP) sensor is a variable reluctance (VR) sensor that generates an AC signal by sensing the passing of the 30 teeth cast into the engine's left side flywheel. Two consecutive teeth are missing in the flywheel to establish a reference point. The CKP sensor sends a signal to the Electronic Control Module (ECM). This signal is used to reference engine position (TDC) and engine speed. The CKP sensor is located near the lower front left corner of the engine crankcase.

NOTE

The crank position sensor cannot be repaired. Replace the unit if it fails.

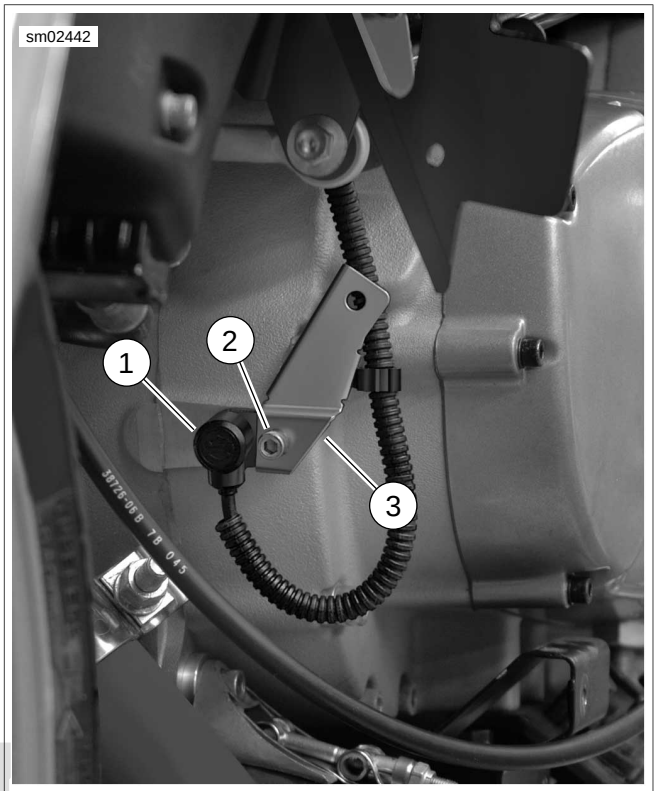
REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect battery. See 1.5 BATTERY MAINTENANCE.
3. Remove the two cable straps securing the CKP wire to the "V" bracket on the left side of the engine.
4. Disconnect CKP.
5. See Figure 6-81. Remove screw (2) securing the CKP wire bracket (3) and sensor (1) to the left crankcase. Carefully remove CKP sensor (1) and o-ring along with the harness bracket (3) from engine crankcase.
6. Remove the plastic clip securing the CKP wire to the harness bracket.



1. **Crank position (CKP) sensor**
2. **Screw**
3. **CKP harness bracket**

Figure 6-81. Crank Position (CKP) Sensor

INSTALLATION

NOTE

The CKP sensor o-ring has a blue teflon coating that provides lubrication during installation. It is not necessary to coat the o-ring with engine oil or other lubricant to install it.

1. See Figure 6-81. Carefully install CKP sensor (1) and o-ring into engine crankcase along with the CKP harness bracket (3).
2. Apply LOCTITE 272 (red) to screw (2), install and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
3. Install plastic clip securing the CKP harness onto harness bracket.
4. Connect CKP.
5. Install the two cable straps securing the CKP harness to the "V" bracket on the left side of the engine.

⚠WARNING

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

6. Connect battery positive cable (red) first, tightening to 72-96 **in-lbs** (8-11 Nm). See 1.5 BATTERY MAINTENANCE.
7. Connect negative battery cable, tightening to 72-96 **in-lbs** (8-11 Nm).

⚠WARNING

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

8. Install seat.

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

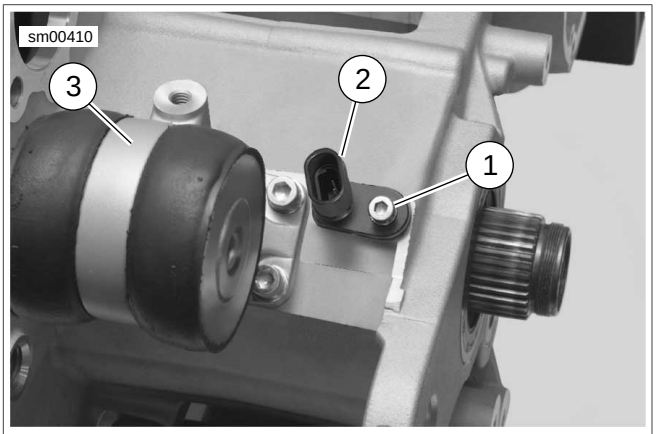
VEHICLE SPEED SENSOR (VSS) 6.25

REMOVAL

1. Remove sprocket cover. See 2.36 SPROCKET COVER.
2. Disconnect 3-place Deutsch connector [65] under sprocket cover. See 6.30 SPROCKET COVER WIRING.
3. See Figure 6-82. Remove fastener (1) to detach vehicle speed sensor (2) from crankcase.

INSTALLATION

1. See Figure 6-82. Lubricate o-ring with engine oil and install fastener (1) to attach vehicle speed sensor (2) to crankcase and tighten to 90-110 **in-lbs** (10.0-12.4 Nm).
2. Connect vehicle speed sensor connector [65] to wiring harness.
3. Install sprocket cover. See 2.36 SPROCKET COVER.



1. **Fastener**
2. **Vehicle speed sensor**
3. **Rear isolator assembly**

Figure 6-82. Speedometer Sensor

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

INSTRUMENT MODULE 6.26

GENERAL

Replace the instrument module if the unit is not working properly. However, before replacing a component, check that the problem is not caused by a loose wire connection.

NOTES

- *Replacement bulbs are available for indicator, check engine light and backlights.*
- *Replace instrument module if low fuel warning indicator fails.*

Figure 6-83. Instrument Module

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Access instrument module connector [39]:
   a. For Firebolt, remove headlight support bracket. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
   b. For Lightning/Ulysses, remove windscreen. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
4. Disconnect instrument module connector [39]:
5. Remove fasteners and washers.
6. See Figure 6-89 (Firebolt), Figure 6-90 (Lightning) or Figure 6-91 (Ulysses). Pull instrument module from support (1).

Bulb Replacement

1. Once the instrument module has been removed from the vehicle place face down on a work surface.
2. Remove the nine fasteners securing the back of the module housing to the display and remove back cover.

NOTE

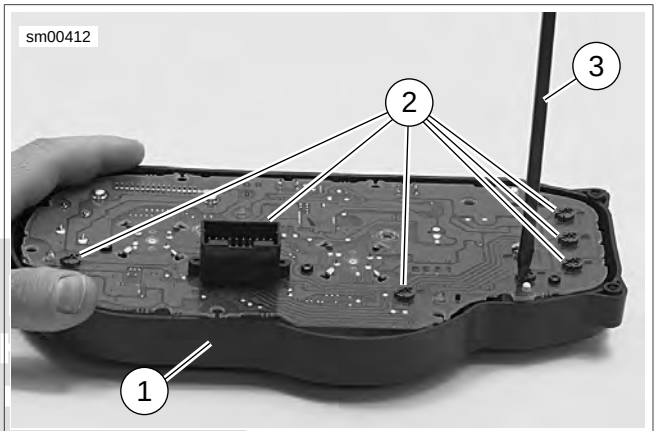
Do not turn display over. The speedometer and tachometer will fall out possibly causing damage to instruments.

3. See Figure 6-84. Insert screwdriver blade into the slot on the back of the bulb to be replaced and lightly turn counterclockwise and remove bulb.

NOTE

See Figure 6-85. Bulbs are identified both by color and length.

4. Select correct replacement bulb and install into back of instrument cluster.
5. Reinstall back cover and insert and tighten the nine fasteners originally removed.



1. Instrument module
2. Bulbs
3. Screwdriver

Figure 6-84. Bulb Replacement for Instrument Module

1. Light gray/taller bulb-Y0162.02A8
2. Dark gray/shorter bulb-Y0163.02A8

Figure 6-85. Instrument Module Bulbs

INSTALLATION

1. See Figure 6-89 (Firebolt), Figure 6-90 (Lightning) or Figure 6-91 (Ulysses). Place instrument module (2) into position in support (1).
2. Install washers (4) and fasteners (5). Tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm).
3. See Figure 6-86 (Firebolt), Figure 6-87 (Lightning), or Figure 6-88 (Ulysses). Connect instrument module connector [39].
4. For Firebolt, install headlight support bracket and install front fairing. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
5. For Lightning, install windscreen and for Ulysses, install windscreen/windshield. See 2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET.
6. Install negative battery cable.

⚠WARNING

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

7. Install seat.

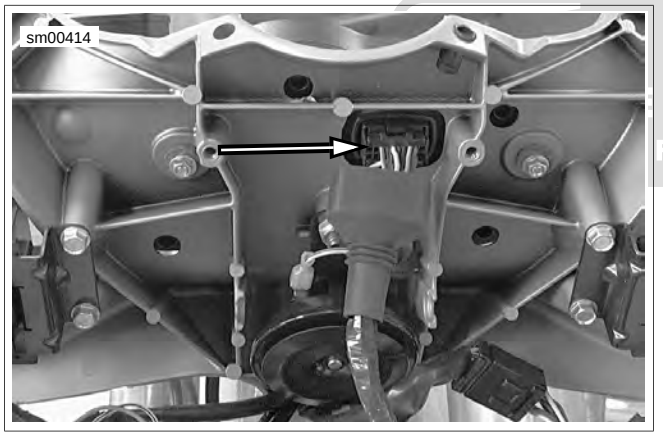


Figure 6-86. Instrument Module Connector [39]: Firebolt

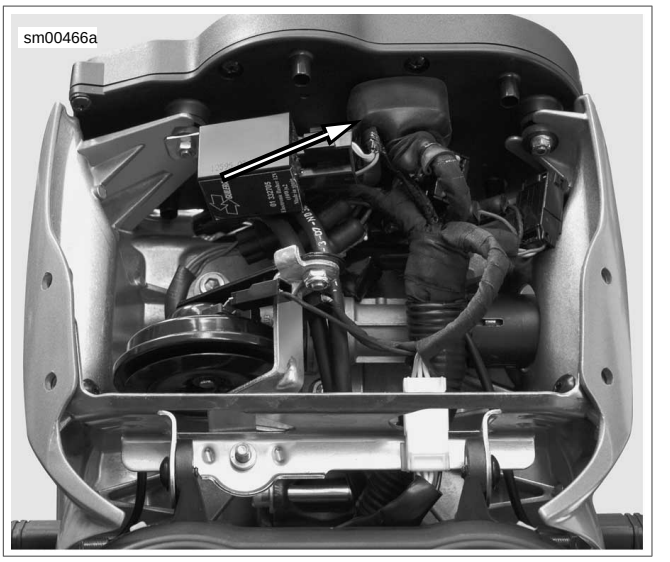
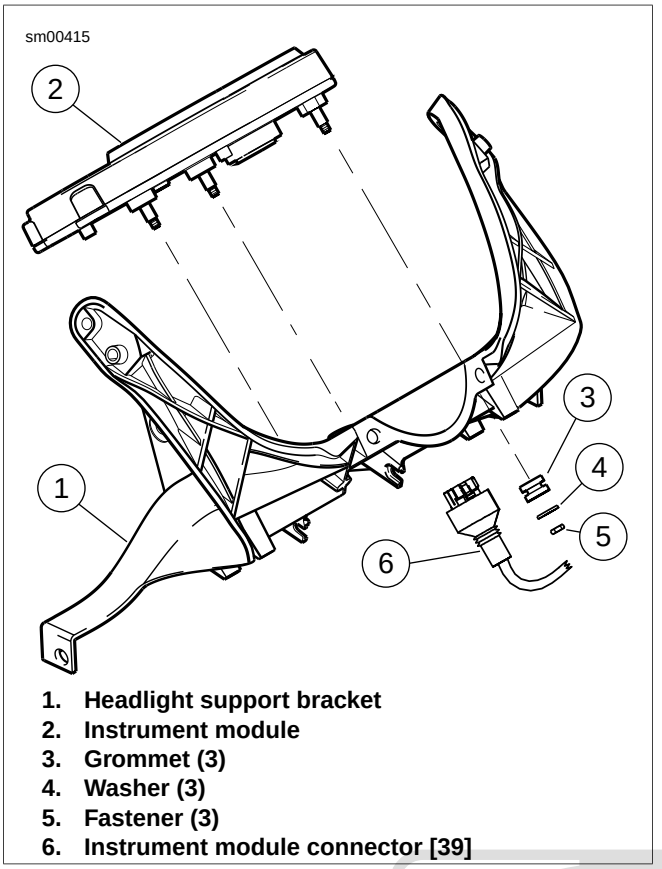


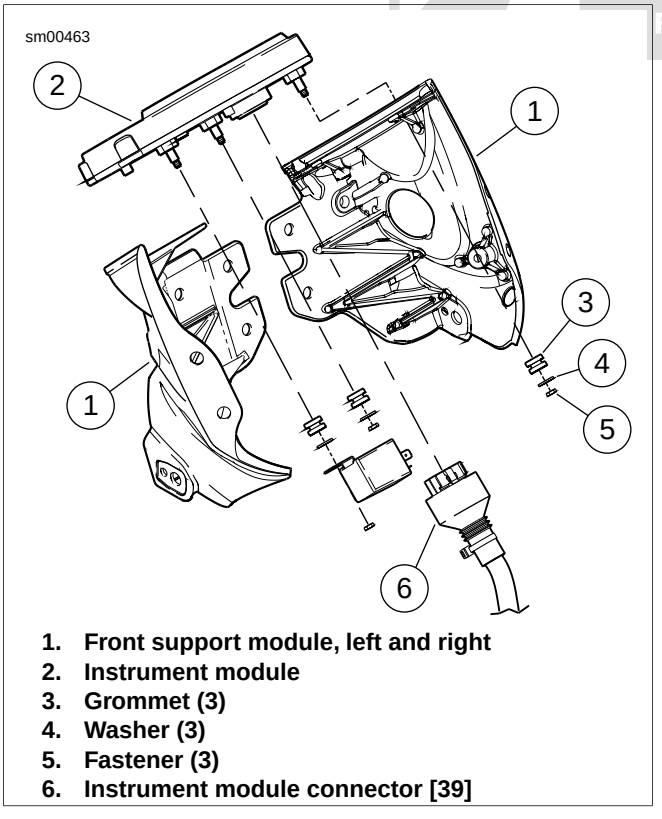
Figure 6-87. Instrument Module Connector [39]: Lightning

Figure 6-88. Instrument Module Connector [39]: Ulysses



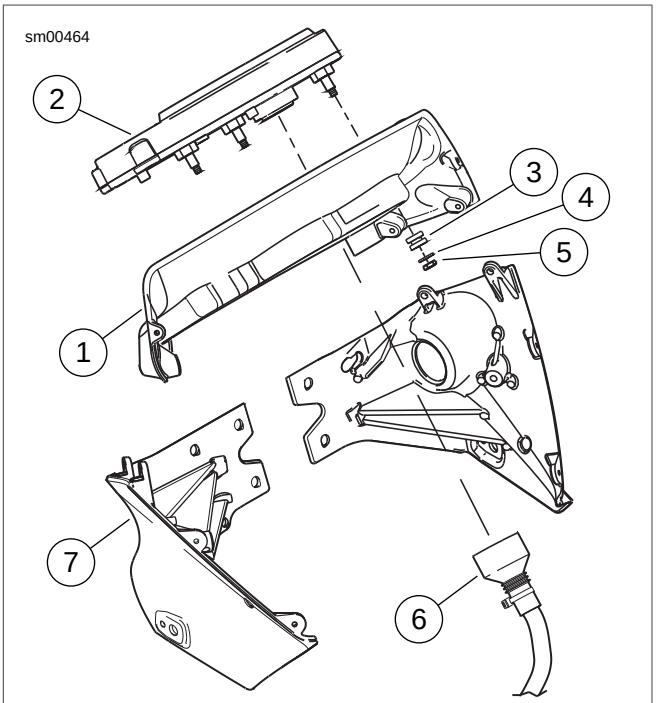
1. Headlight support bracket
2. Instrument module
3. Grommet (3)
4. Washer (3)
5. Fastener (3)
6. Instrument module connector [39]

Figure 6-89. Instrument Module Assembly: Firebolt



1. Front support module, left and right
2. Instrument module
3. Grommet (3)
4. Washer (3)
5. Fastener (3)
6. Instrument module connector [39]

Figure 6-90. Instrument Module Assembly: Lightning



1. Fairing support, center
2. Instrument module
3. Grommet (3)
4. Washer (3)
5. Fastener (3)
6. Instrument module connector [39]
7. Front support module, left and right

Figure 6-91. Instrument Module Assembly: Ulysses

DIGITAL TECHNICIAN II
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MAIN WIRE HARNESS 6.27

GENERAL

The main wire harness runs from the front of the motorcycle to the tail section.

Always replace plastic tree fasteners when replacing main wire harness. Remove tree fasteners carefully, do not leave any of fastener in frame.

REMOVAL

NOTES

- *To verify correct installation, make note of wire routing and cable strap locations before removing main wire harness.*
- *Main wire harness is removed from rear of vehicle through fan section of frame.*

1. Remove seat.
2. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.
3. Remove sprocket cover. See 2.36 SPROCKET COVER.

⚠WARNING

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

4. Remove battery.
   a. Disconnect battery negative cable (black) from battery negative (-) terminal.
   b. Pull back terminal cover boot on battery positive cable (red).
   c. Disconnect battery positive cable from battery positive (+) terminal.

NOTE

On Firebolt models it will be necessary to remove tail frame upper body work. See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.

5. See Figure 6-92. Disconnect positive battery cable (1) and starter solenoid connection [128] (3) from starter.
6. Disconnect vehicle speed sensor [65] (2).

NOTES

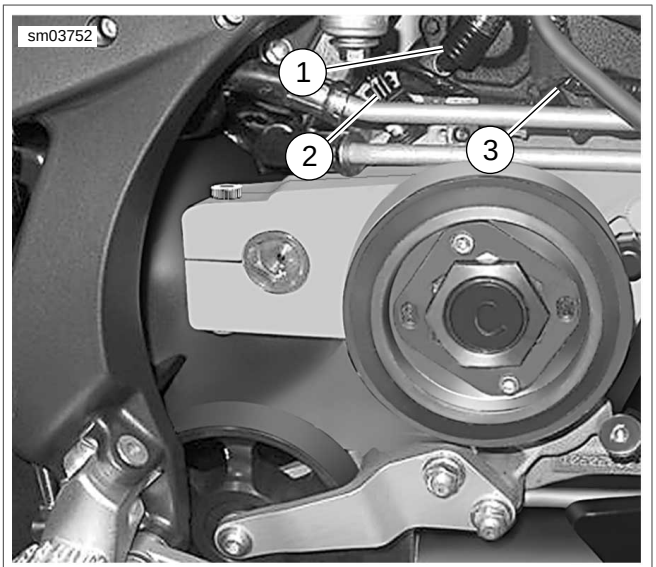
- *On Firebolt models the rear brake switch connector is located under the seat in front of the rear break reservoir hose.*
- *On Firebolt models the fuse block and relay block are attached to the fairing support bracket.*

7. On Firebolt models, remove the main fuse case located to the right of the battery towards the left side of the vehicle.

NOTES

- *Reference the correct figure for the vehicle you are servicing:*
- ***Lightning:*** *See Figure 6-101.*
- ***XB12Ss:*** *See Figure 6-94.*
- ***Firebolt:*** *See Figure 6-100.*
- ***Ulysses:*** *See Figure 6-95.*

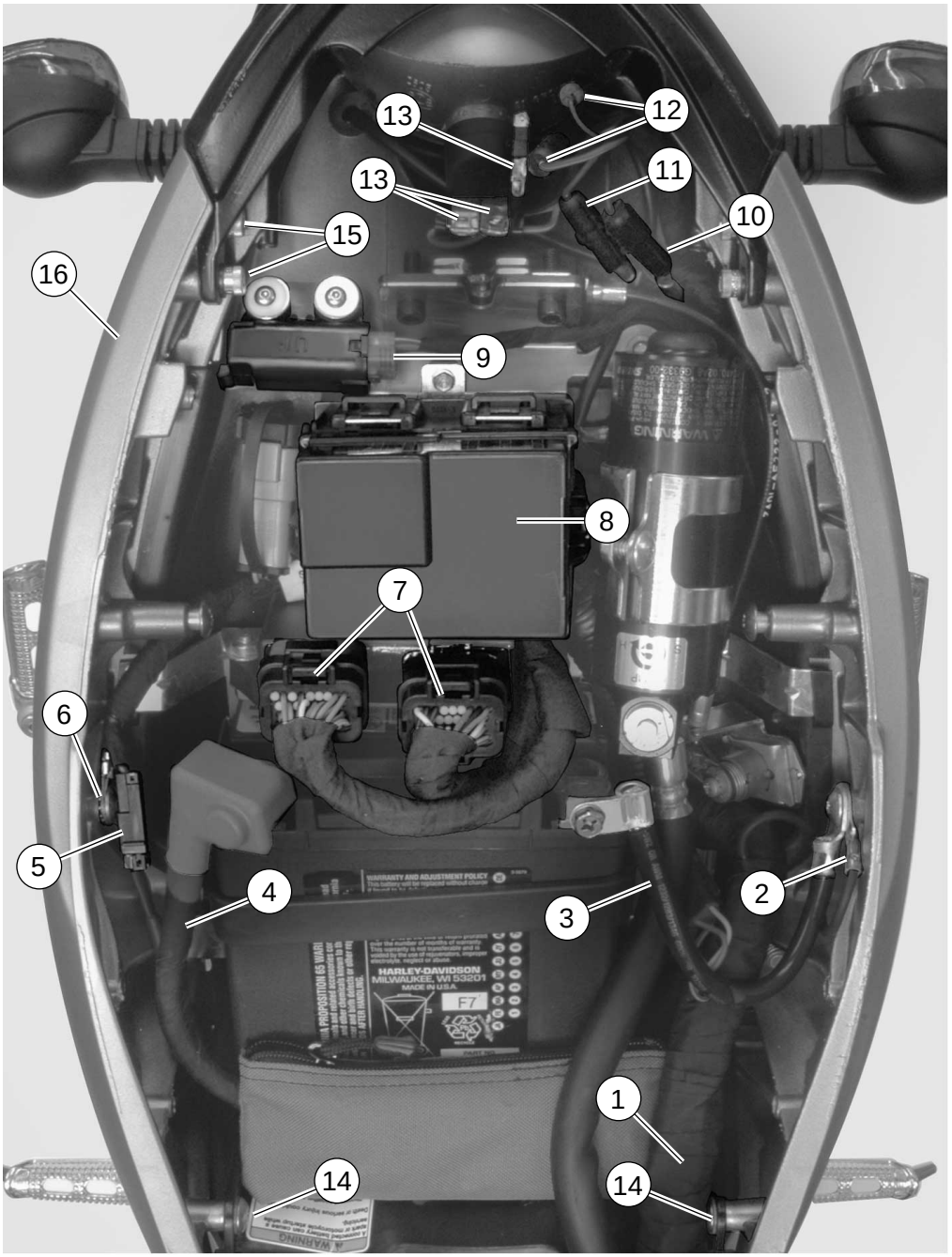
8. Disconnect:
   a. Main harness ground [GRD 2] (2).
   b. Rear brake light switch connector [121] (5).
   c. ECM connectors [10] and [11] (7).
   d. BAS (bank angle sensor) connector [134] (9).
   e. Right turn signal connector [18] (10).
   f. Left turn signal connector [19] (11).
   g. License plate lamp connector [45] (12).
   h. Tail light connectors [93] (13).
   i. Low voltage ground terminals on right side tail section [GRD 1] and [GRD 3] (6).
   j. Interactive exhaust connector [165B], (located under main wiring harness).
9. Remove fuse block and relay center from support bracket.
10. Remove the rear shock absorber assembly and reservoir. See 2.23 REAR SHOCK ABSORBER.
11. Remove fan. See 4.11 COOLING FAN.



1. Positive battery cable
2. Vehicle speed sensor
3. Starter solenoid

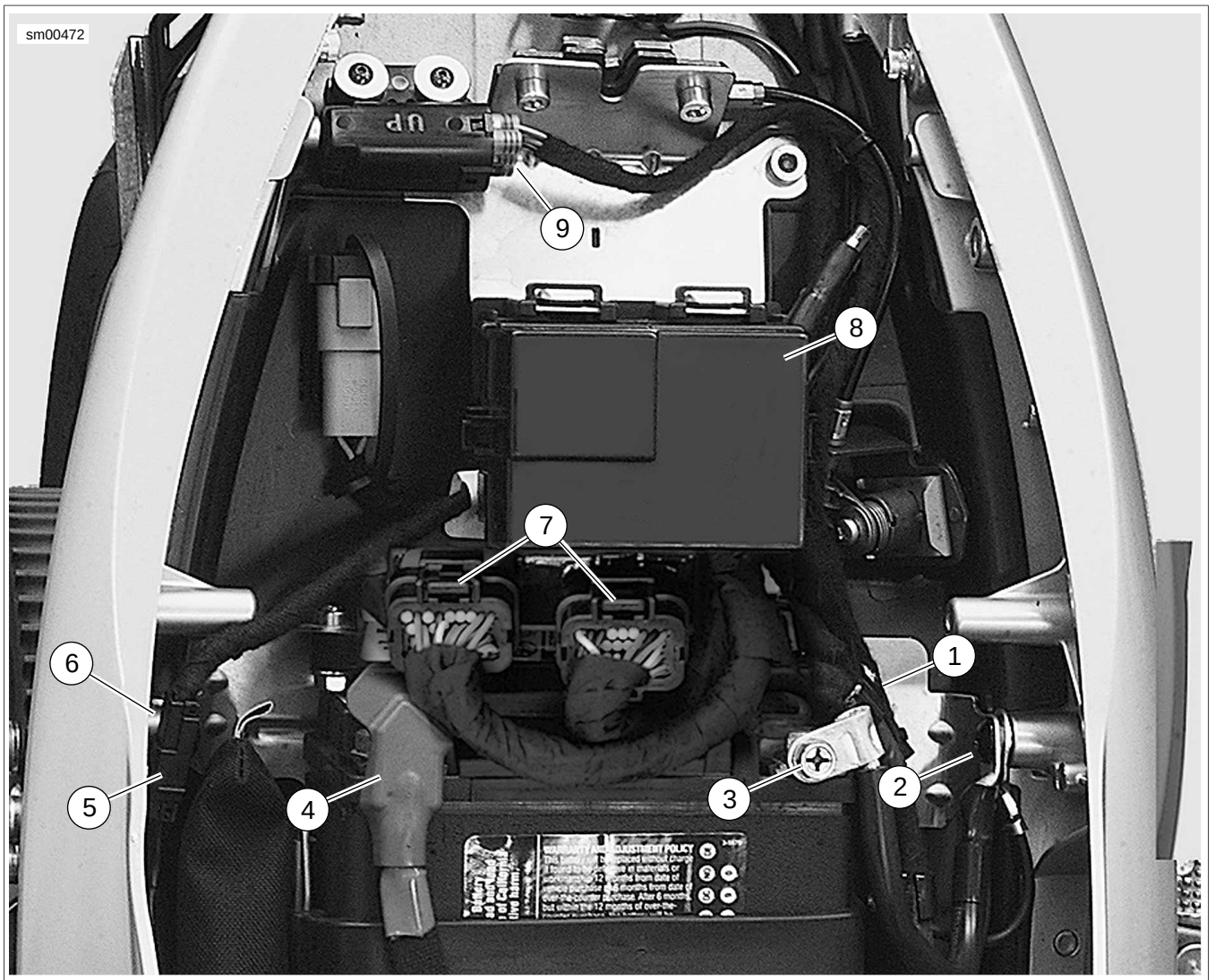
Figure 6-92. Positive Battery Cable (Protective Boot Not Shown)

sm00661



1. Main harness
2. Main harness ground (high voltage ground wire)
3. Battery negative cable
4. Battery positive cable
5. Rear brake light switch connector [121]
6. Ground terminals [GRD1] and [GRD3]
7. ECM connectors [10] and [11]
8. Fuse block and relay center
9. Bank angle sensor (BAS) connector [134]
10. Right turn signal connector [18]
11. Left turn signal connector [19] (under remote
12. License plate lamp connector [45]
13. Tail light connectors [93]
14. Left and right trunk pan fasteners
15. Center tail section fastener to rear tail section
16. Right tail section

Figure 6-93. Main Harness and Electrical Connectors Under Seat: Lightning

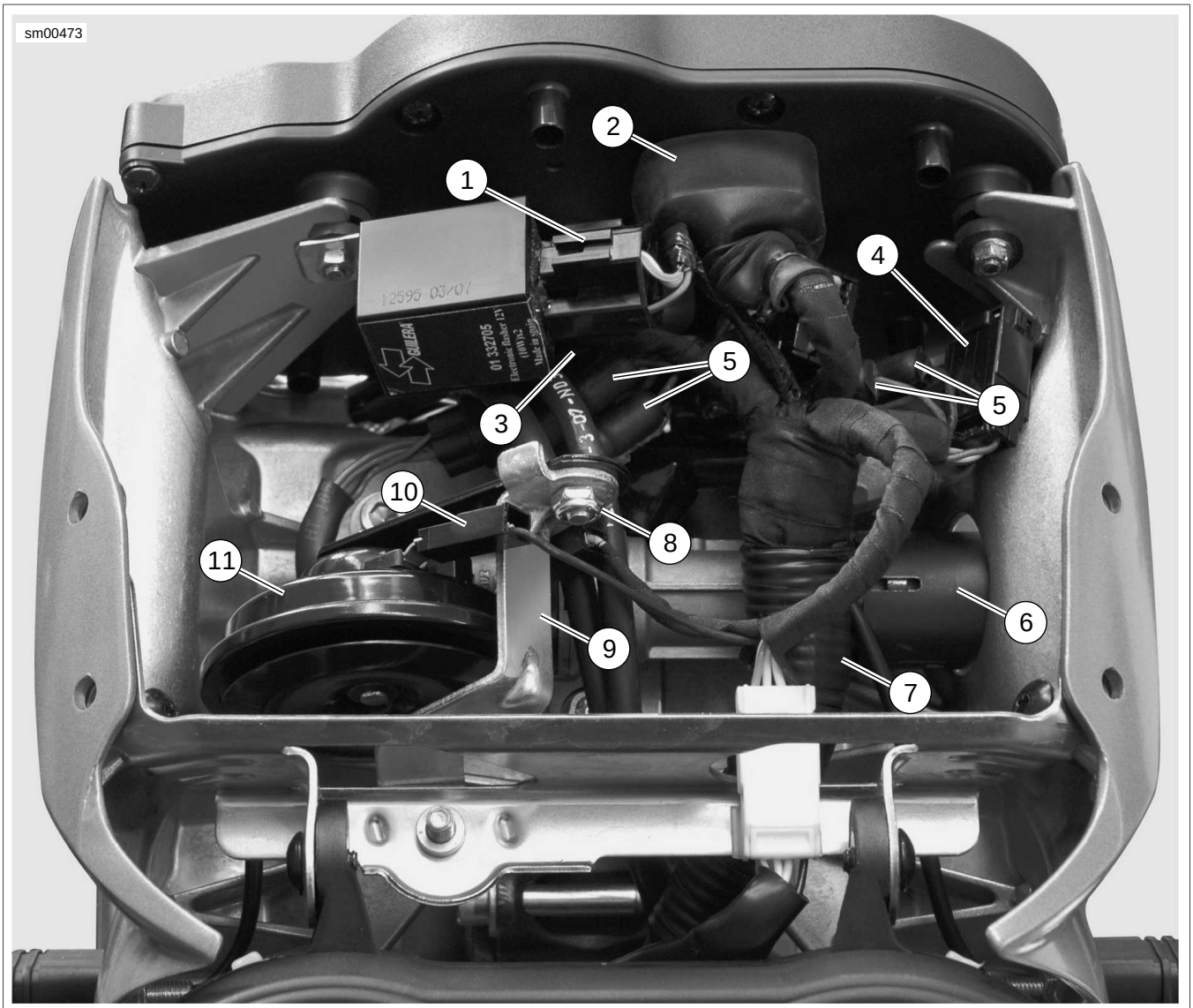


1. Main harness
2. Main harness ground (high voltage ground wire)
3. Battery negative cable
4. Battery positive cable
5. Rear brake light switch connector [121]
6. Ground terminals (low voltage ground wires)
7. ECM connectors [10] and [11]
8. Fuse block and relay center
9. Bank angle sensor (BAS) connector [134]

Figure 6-94. Main Harness and Electrical Connectors Under Seat: Lightning XB12Ss

1. Turn signal flasher connector [30]
2. Instrument cluster connector [39]
3. Right handlebar connector [22]
4. Left handlebar connector [24]
5. Turn signal connectors [31]
6. Ignition switch
7. Cable strap
8. Main harness
9. Horn fastener
10. Horn mount
11. Horn connector [122]
12. Horn

Figure 6-95. Electrical Connectors Behind Windscreen: Ulysses



1. **Turn signal flasher connector [30]**
2. **Instrument cluster connector [39]**
3. **Right handlebar connector [22]**
4. **Left handlebar connector [24]**
5. **Turn signal connectors [31]**
6. **Ignition switch [33]**
7. **Main harness**
8. **Horn fastener**
9. **Horn mount**
10. **Horn connector [122]**
11. **Horn**

Figure 6-96. Electrical Connectors Behind Windscreen: Lightning

12. Remove fairing and windscreen:
    a. For Firebolt see 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
    b. For Lightning/Ulysses see 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
13. See:
    Lightning: Figure 6-100.
    Ulysses: Figure 6-95.

Disconnect:

a. Ignition switch [33] (6).

b. Turn signal flasher connector [30] (1).

c. Instrument module connector [39] (2).

d. Left handlebar connector [24] (4) and right handlebar connector [22] (3).

e. Turn signal connectors [31] (5).

f. Headlight connector [38].

g. Horn connector [122] (11).

h. Clutch switch [95] from left switch housing.

i. Front brake switch [121] from right switch housing.

14. **Firebolt:** See Figure 6-104. Disconnect:
    a. Flasher connector [30].
    b. Bank angle sensor connector [134].
    c. Electronic control module (ECM). See 4.4 ELECTRONIC CONTROL MODULE (ECM).
    d. Instrument module connector [39].
    e. Horn connectors [122].
    f. Ground terminals on front of steering head.
    g. Left switch housing connector [24] and right switch housing connector [22].
    h. Clutch switch [95] from left switch housing.
    i. Front brake switch [121] from right switch housing.
    j. Headlight connector [38].
    k. Ignition switch [33].
15. Cut and remove cable strap (7) securing main harness (8) to ignition switch.
16. Remove ground terminals on front of steering head.
17. Remove wire harness guide from steering neck.
18. Remove all tree fasteners from frame.
19. Disconnect wiring located under sprocket cover. See 6.30 SPROCKET COVER WIRING.
20. Remove connector from oil pressure switch [120]. See 3.14 OIL PRESSURE INDICATOR SWITCH.
21. Disconnect:
    a. Intake air temperature sensor [89].
    b. Throttle position sensor [88].
    c. O2 sensor [137].
    d. Temperature sensor [90].
    e. Fuel injectors [84] & [85].
    f. Fuel pump connector [86].
    g. Idle air control [87].
22. Disconnect and remove ignition coil.

NOTE

When removing the left air scoop, the alternator and voltage regulator harnesses and connections are secured to the bottom of the air scoop with three cable straps.

23. Remove left side air scoop. See 2.49 AIR SCOOPS.
24. Disconnect alternator connector [46] (1) and voltage regulator connector [77] (2).
25. Remove the two cable straps securing the CKP harness to the "V" bracket on the left side of the engine and disconnect CKP.

NOTES

- *It will be necessary to remove fastener securing rear harness guide to underside of frame.*
- *On Firebolt models it will be necessary to remove fastener securing harness clamp to fairing support bracket.*

26. Remove any remaining cable straps and clamps securing wire harness and remove harness from rear of vehicle.
27. Pull the main harness out through the rear of the frame/fuel tank assembly between the trunk pan and the rear tire.

NOTE

Using scissors jack, raise vehicle higher to gain more clearance between the trunk pan and tire.

28. Remove all tree fasteners.

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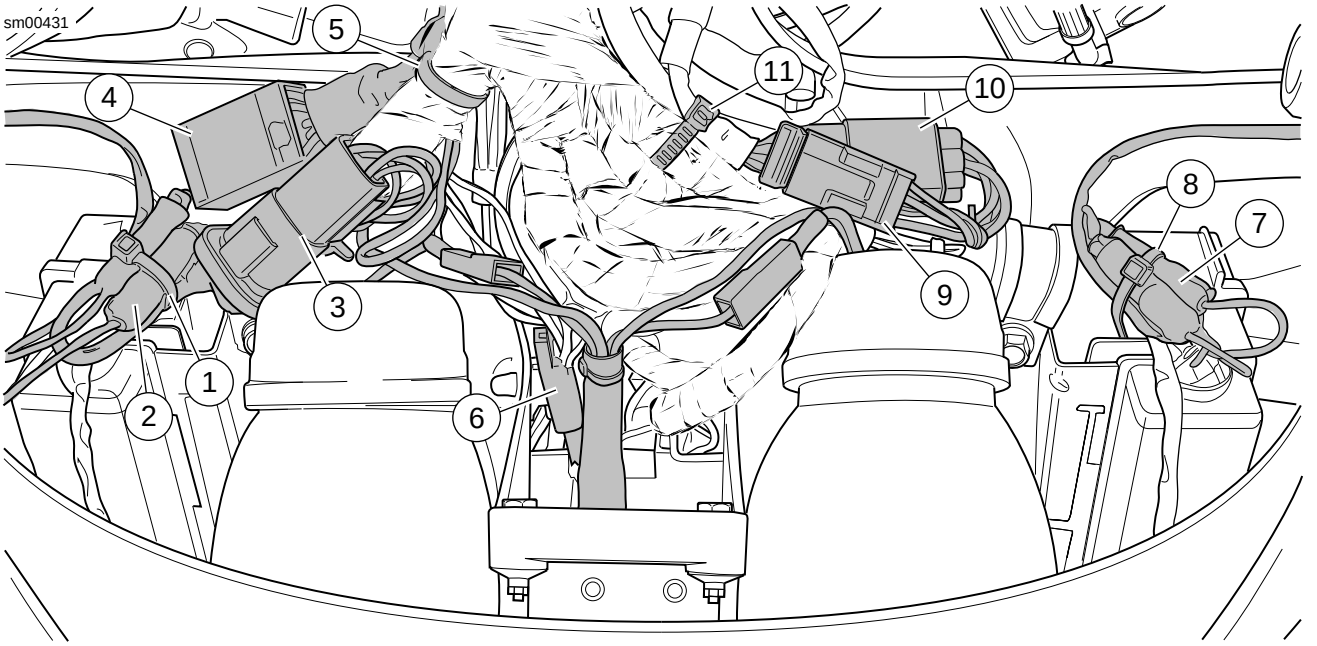

1. Cable strap
2. Left turn signal connectors
3. Data link [91]
4. Left switch housing connector [24]
5. Cable strap
6. Headlight connector [38]
7. Right turn signal connectors
8. Cable strap
9. Right switch housing connector [22]
10. Ignition switch connector [33]
11. Cable strap

Figure 6-97. Fairing Wiring (Viewed From Beneath Fairing): Firebolt

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1. **Turn signal flasher connector [30]**
2. **Instrument cluster connector [39]**
3. **Right handlebar connector [22]**
4. **Left handlebar connector [24]**
5. **Turn signal connectors [31]**
6. **Ignition switch**
7. **Cable strap**
8. **Main harness**
9. **Horn fastener**
10. **Horn mount**
11. **Horn connector [122]**
12. **Horn**

Figure 6-98. Electrical Connectors Behind Windscreen: Ulysses

INSTALLATION

NOTES

- *See Figure 6-101 or Figure 6-102 or Figure 6-103. Always align harness when installing in the frame and tail section. Align the harness so both ECM wire bundles, the dyno loop and the main ground all face upward so when they are installed the harness will not be twisted.*
- *For more information on wire harness and hose routing, see D.1 APPENDIX D: HOSE AND WIRE ROUTING.*

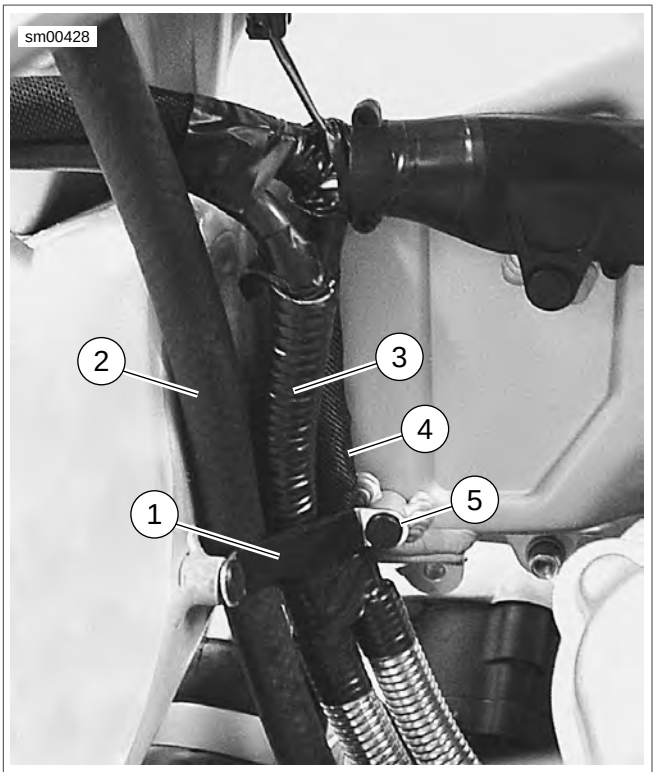
1. On Lightning and Ulysses models, install the **new** harness from the rear of the vehicle working towards the front.
2. Feed front and center portion of harness between the trunk pan and tire through opening at rear of frame/fuel tank assembly.
3. On Firebolt models, install the rear portion of **new** harness between the left front fork and frame.
4. Place connectors in general location of installation.
5. Secure plastic harness holder to left inside portion of frame using **new** plastic tree fasteners.
6. See Figure 6-99. Be careful to route the interactive exhaust cable behind the mounting strap and guide (2) along with main harness.

NOTE

Fuel line is installed under engine connector portion of wire harness.

7. Route portion of main wire harness that contains the positive battery cable (3), sprocket cover wiring (4) and transmission vent hose (2) through corner mounting strap and guide (1) at rear of frame. Install **new** plastic tree fasteners.

8. See Figure 6-100. Connect:
   a. Front brake switch [121] from right switch housing.
   b. Clutch switch [95] from left switch housing.
   c. Horn connector [122] (11).
   d. Headlight connector [38].
   e. Turn signal connectors [31] (5).
   f. Left handlebar connector [24] (4) and right handlebar connector [22] (3).
   g. Instrument module connector [39] (2).
   h. Turn signal flasher connector [30] (1).
   i. Install electronic control module.



1. **Mounting strap and guide**
2. **Transmission vent hose**
3. **Positive battery cable**
4. **Sprocket cover wiring**
5. **Tree fastener (2)**

Figure 6-99. Wire Harness Strap and Guide

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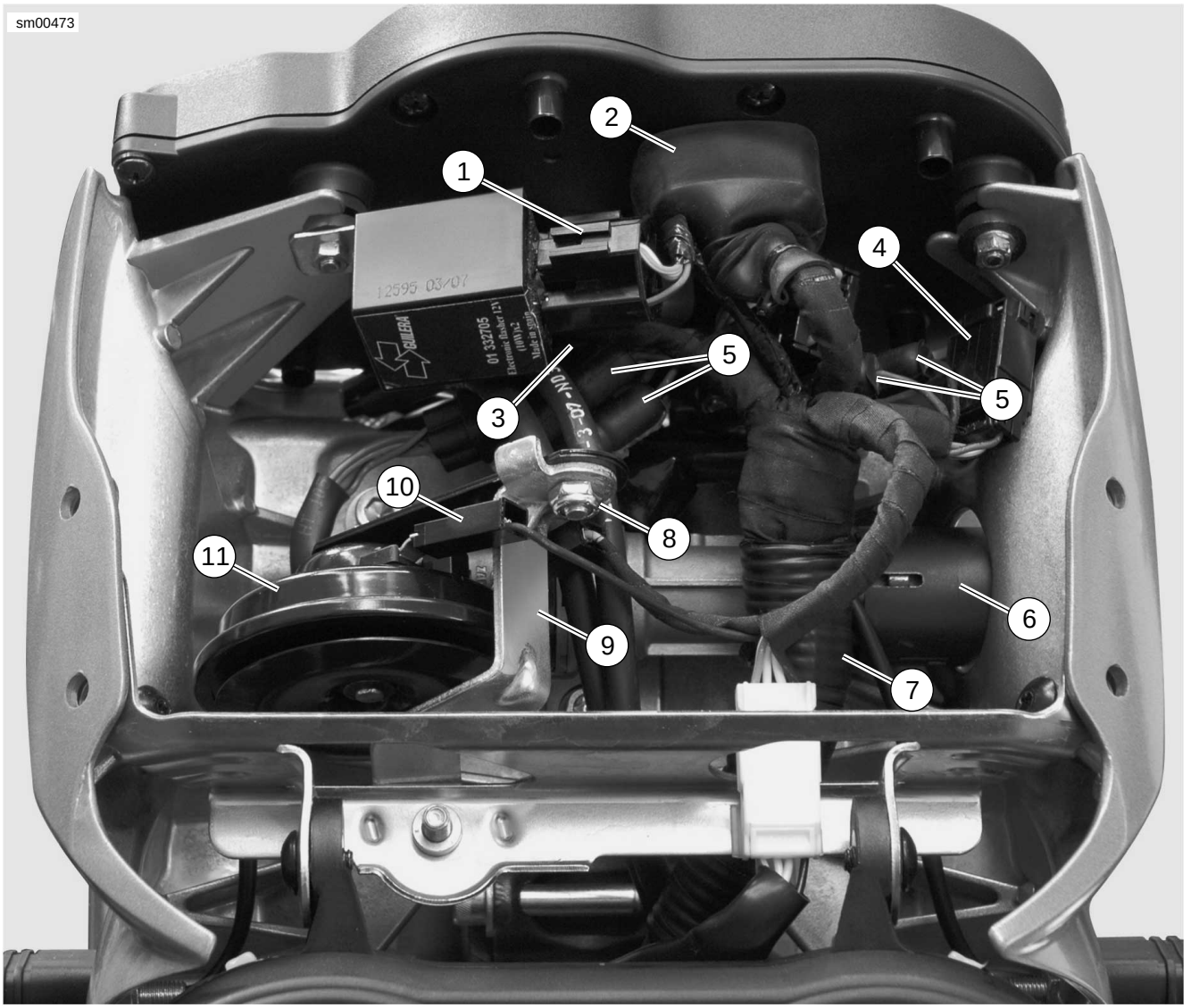


1. **Turn signal flasher connector [30]**
2. **Instrument cluster connector [39]**
3. **Right handlebar connector [22]**
4. **Left handlebar connector [24]**
5. **Turn signal connectors [31]**
6. **Ignition switch [33]**
7. **Main harness**
8. **Horn fastener**
9. **Horn mount**
10. **Horn connector [122]**
11. **Horn**

Figure 6-100. Electrical Connectors Behind Windscreen: Lightning

9. Install cable strap loosely around main harness (7) and ignition switch (6).
10. Install ground terminal on front of steering head and tighten to 48-72 **in-lbs** (5.4-8 Nm).

11. Connect:
    a. Throttle position sensor [88].
    b. Intake air temperature sensor [89].
    c. O2 sensor [137].
    d. Temperature sensor [90].
    e. Fuel injectors [84] and [85].
    f. Idle air control [87].
    g. (Ulysses models) rear auxiliary power outlet [180].
    h. (Ulysses models) heated hand grips [206].
    i. (Ulysses models) Heated grip connectors [189L] and [189R].
12. Install and connect ignition coil.
13. Install connector on oil pressure switch [120]. See 3.14 OIL PRESSURE INDICATOR SWITCH.
14. Install sprocket cover wiring. See 6.30 SPROCKET COVER WIRING.
15. Install sprocket cover. See 2.36 SPROCKET COVER.
16. Connect fuel pump connector [86].
17. Install fan and tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm). See 4.11 COOLING FAN.
18. Install rear shock absorber assembly. See 2.23 REAR SHOCK ABSORBER.
19. Pull rear section of main harness up over trunk pan towards the rear of the vehicle and place connectors in general location of installation.

NOTE

On Firebolt models, snap fuse and relay blocks into mounting brackets before installing blocks to fairing mounting bracket.

20. Install fuse block and relay center on support bracket.
21. Place clamp around fuse block wiring. Mount fuse block and clamp to fairing support bracket using top fastener and bottom fastener. Tighten fasteners to 72-96 **in-lbs** (8.1-10.8 Nm).
22. Repeat previous steps for relay block.
23. Install steering head clamp around wire harness and secure clamp to fairing support bracket with loop facing vehicle. Tighten fastener to 16-18 ft-lbs (21.7-24.4 Nm).

NOTE

On Firebolt models, the bank angle sensor is behind the fairing and above the headlight.

24. See Figure 6-101 and Figure 6-102. Connect:
    a. Ground terminals (6) on right side tail section [GRD 1] and [GRD 3].
    b. Tail light connectors [93] (13).
    c. Left turn signal connector [19] (11).
    d. Right turn signal connector [18] (10).
    e. Bank angle sensor (BAS) connector [134] (9).
    f. ECM connectors [10] and [11] (7) ([164] on XB12 models).
    g. Rear brake light switch connector [121].
    h. Main harness ground [GRD 2] (2).
    i. Front auxiliary power outlet [160].
25. Install starter side of positive battery cable and starter solenoid connector [128] to starter.
26. Connect vehicle speed sensor [65].
27. On Lightning and Ulysses models, install wire harness guide on steering neck and tighten to 72-84 **in-lbs** (8-9 Nm).
28. On Firebolt models, install steering head clamp around wire harness and secure clamp to fairing support bracket with loop facing vehicle. Tighten fastener to 16-18 ft-lbs (21.7-24.4 Nm).
29. Verify that front forks can be turned from full left to full right lock without wire harness binding or pinching.

NOTE

The connections for the alternator and voltage regulator are routed on the left side of the vehicle under the air scoop. The harnesses are secured to the air scoop with 3 cable straps.

30. Connect the alternator [46] and voltage regulator [77].
31. Connect crank position sensor [79].

NOTE

When installing the left side air scoop it is necessary to verify that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

32. Install left air scoop. See 2.49 AIR SCOOPS.
33. Install fastener securing rear harness guide to under side of frame.

⚠WARNING

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

34. Install positive battery cable (red) to positive terminal of battery. Tighten to 72-96 **in-lbs** (8-11 Nm).
35. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).
36. Verify operation of all electrical components.

37. For Firebolt, install headlight support bracket and install front fairing. See 2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT.
38. For Lightning, install windscreen and for Ulysses, install windscreen/windshield. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
39. Install air cleaner assembly. See 2.36 SPROCKET COVER.

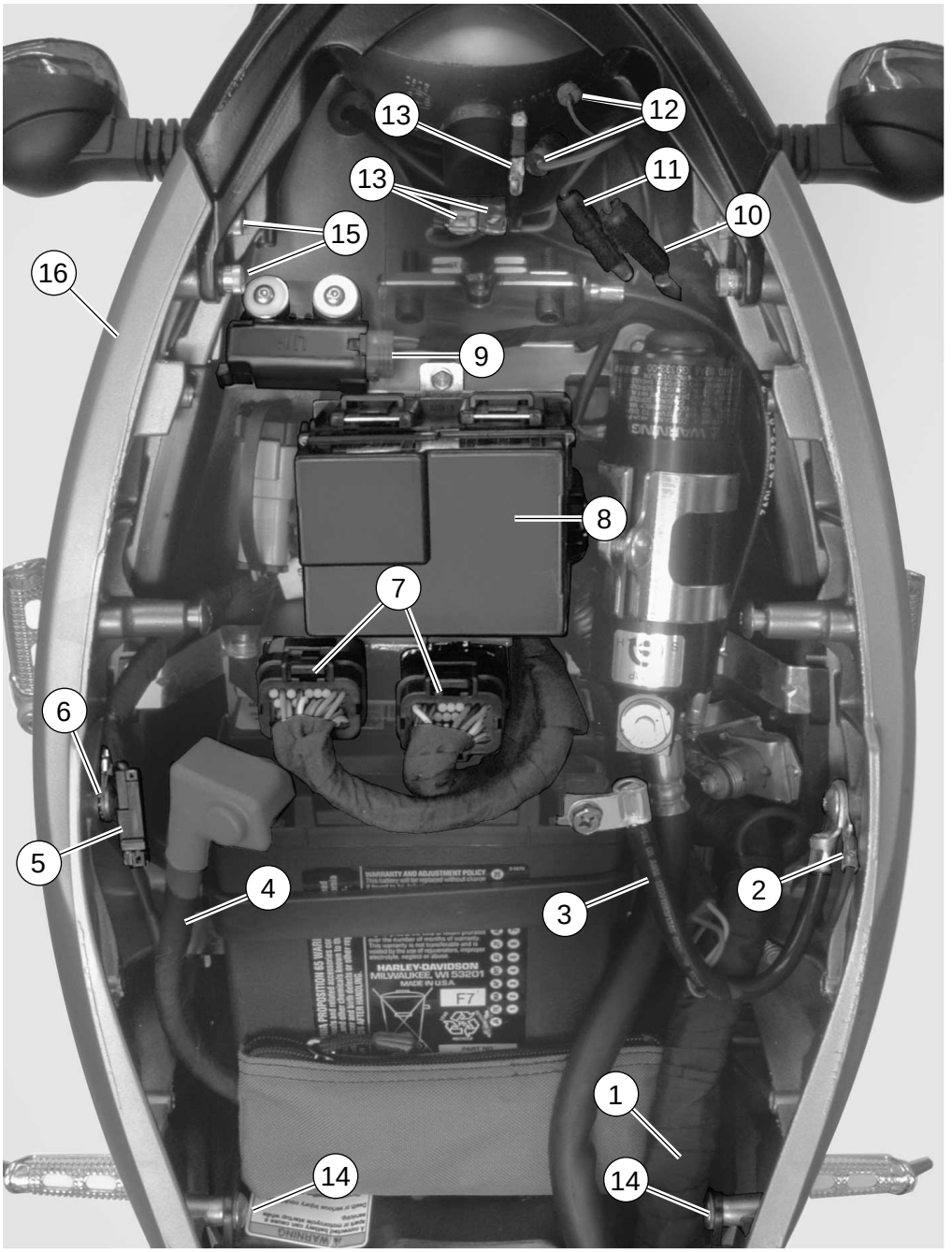
WARNING

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

40. Install seat.

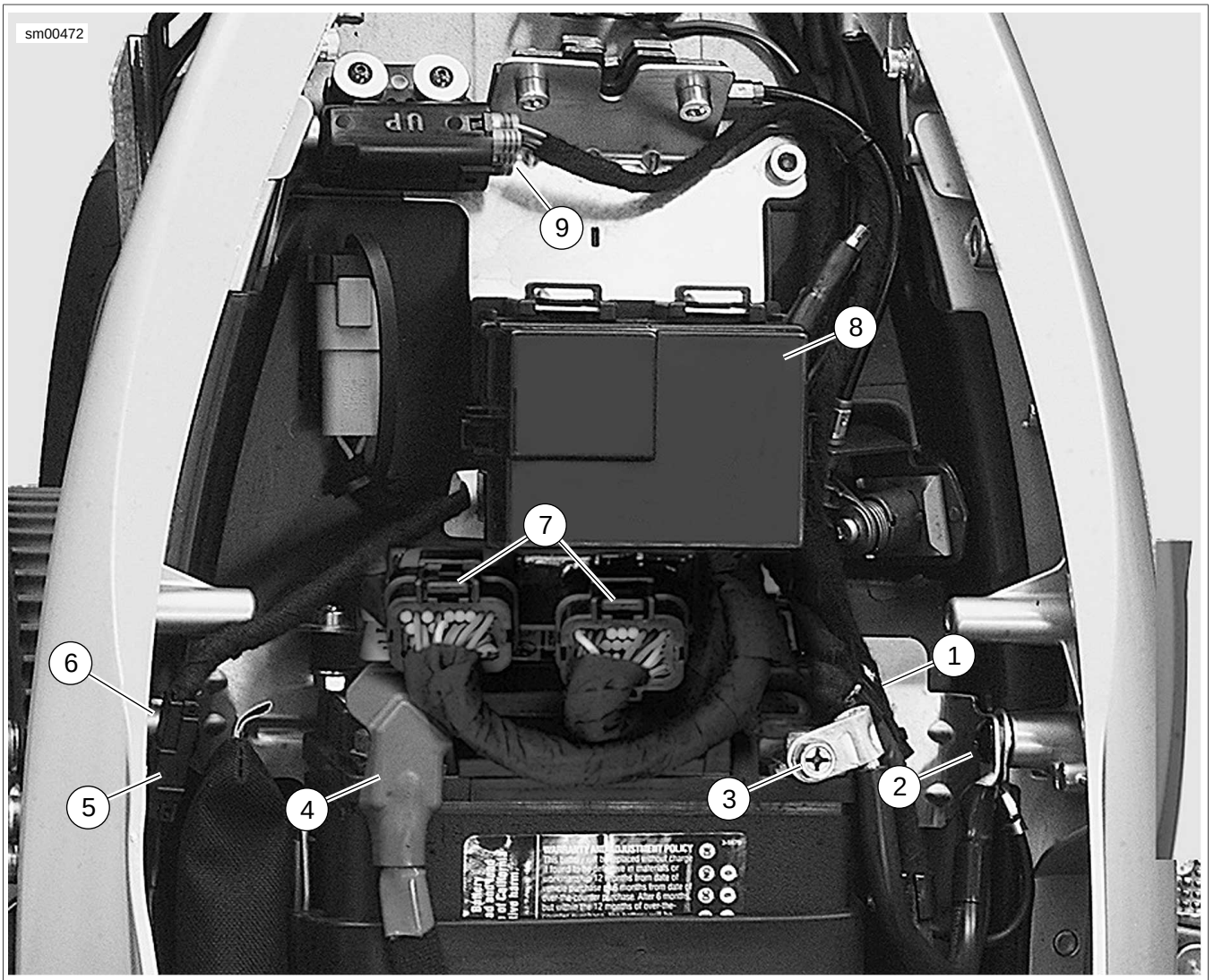
DIGITAL TECHNICIAN II HARLEY-DAVIDSON

sm00661



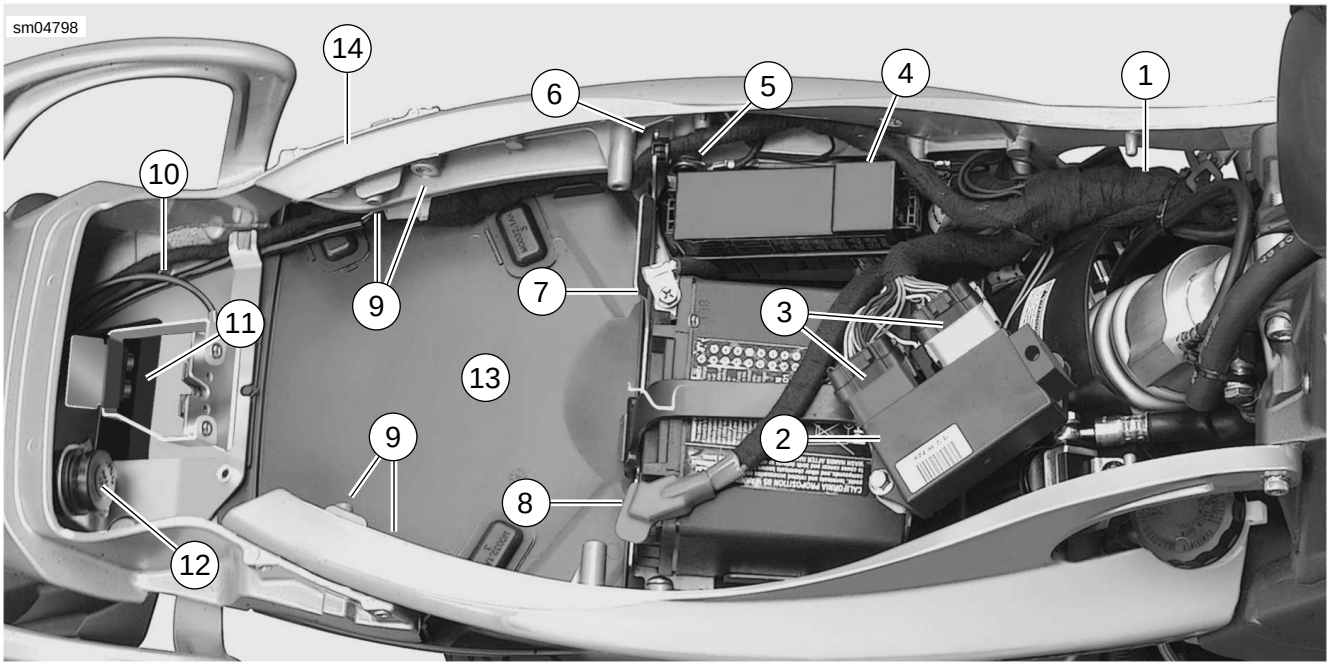
1. Main harness
2. Main harness ground (high voltage ground wire)
3. Battery negative cable
4. Battery positive cable
5. Rear brake light switch connector [121]
6. Ground terminals [GRD1] and [GRD3]
7. ECM connectors [10] and [11]
8. Fuse block and relay center
9. Bank angle sensor (BAS) connector [134]
10. Right turn signal connector [18]
11. Left turn signal connector [19] (under remote
12. License plate lamp connector [45]
13. Tail light connectors [93]
14. Left and right trunk pan fasteners
15. Center tail section fastener to rear tail section
16. Right tail section

Figure 6-101. Main Harness and Electrical Connectors Under Seat: Lightning



1. Main harness
2. Main harness ground (high voltage ground wire)
3. Battery negative cable
4. Battery positive cable
5. Rear brake light switch connector [121]
6. Ground terminals (low voltage ground wires)
7. ECM connectors [10] and [11]
8. Fuse block and relay center
9. Bank angle sensor (BAS) connector [134]

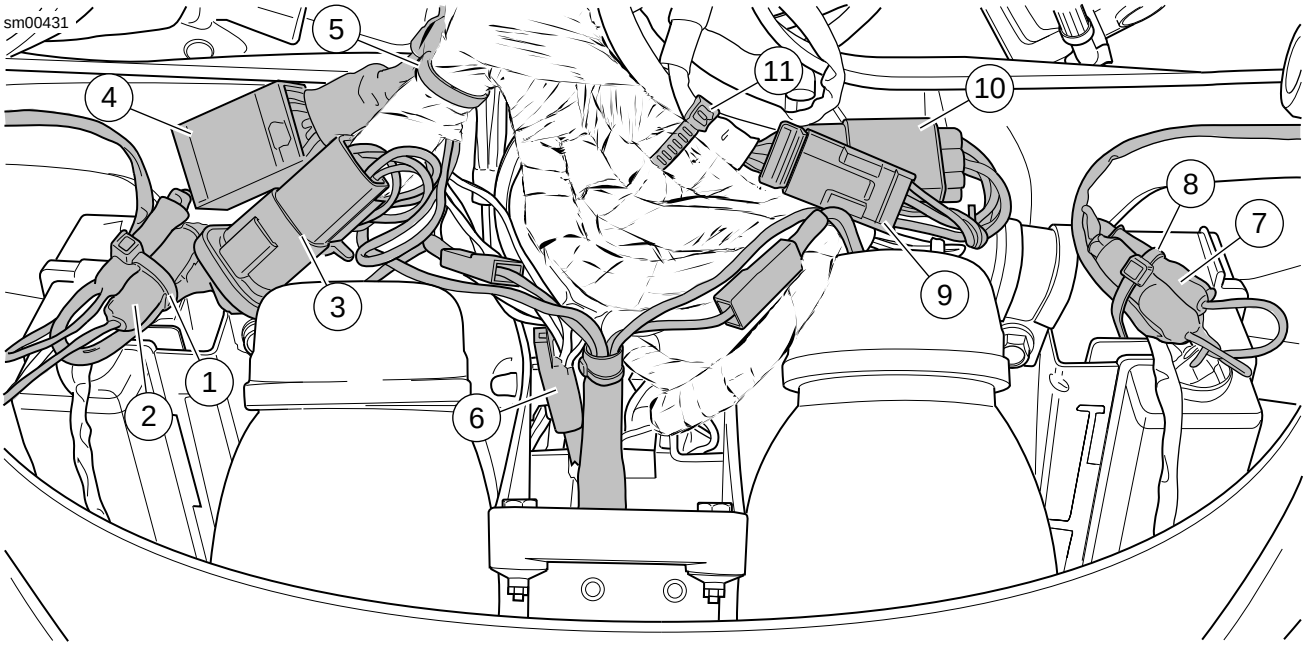
Figure 6-102. Main Harness and Electrical Connectors Under Seat: Lightning XB12Ss



1. Main harness
2. Electronic control module
3. ECM connectors [10] and [11]
4. Fuse block and relay center
5. Main harness ground wire [GRD2]
6. Main harness with plastic grommet
7. Battery ground cable
8. Battery positive cable
9. Left rear and right rear tail section fasteners (4)
10. Seat lock cable
11. Bank angle sensor (BAS) connector [134]
12. Auxiliary power outlet
13. Trunk pan
14. Left tail section

Figure 6-103. Main Harness and Electrical Components Under Seat: Ulysses

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Cable strap
2. Left turn signal connectors
3. Data link [91]
4. Left switch housing connector [24]
5. Cable strap
6. Headlight connector [38]
7. Right turn signal connectors
8. Cable strap
9. Right switch housing connector [22]
10. Ignition switch connector [33]
11. Cable strap

Figure 6-104. Fairing Wiring (Viewed From Beneath Fairing): Firebolt

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AUXILIARY HARNESS: XB12XP 6.28

XB12XP ULYSSES POLICE MODEL AUXILIARY HARNESS

Removal

NOTE

To make sure you properly install the auxiliary harness, make note of wire routing, component bundles and cable strap locations before removing auxiliary harness in order to properly install and maintain component clearances during reassembly.

1. Remove seat.
2. Remove air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.

WARNING

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

3. Disconnect battery negative cable (black) from battery negative (-) terminal.
4. Pull back terminal cover boot on battery positive cable (red).
5. Disconnect battery positive cable from battery positive (+) terminal.
6. Remove battery.
7. Remove electronic control module. See 4.4 ELECTRONIC CONTROL MODULE (ECM).
8. Remove windscreen and windshield. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
9. Remove left side air scoop. See 2.49 AIR SCOOPS.

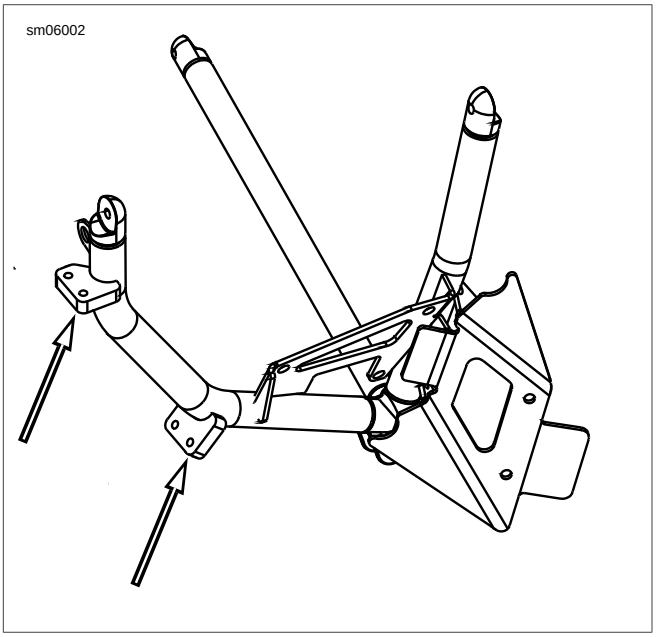
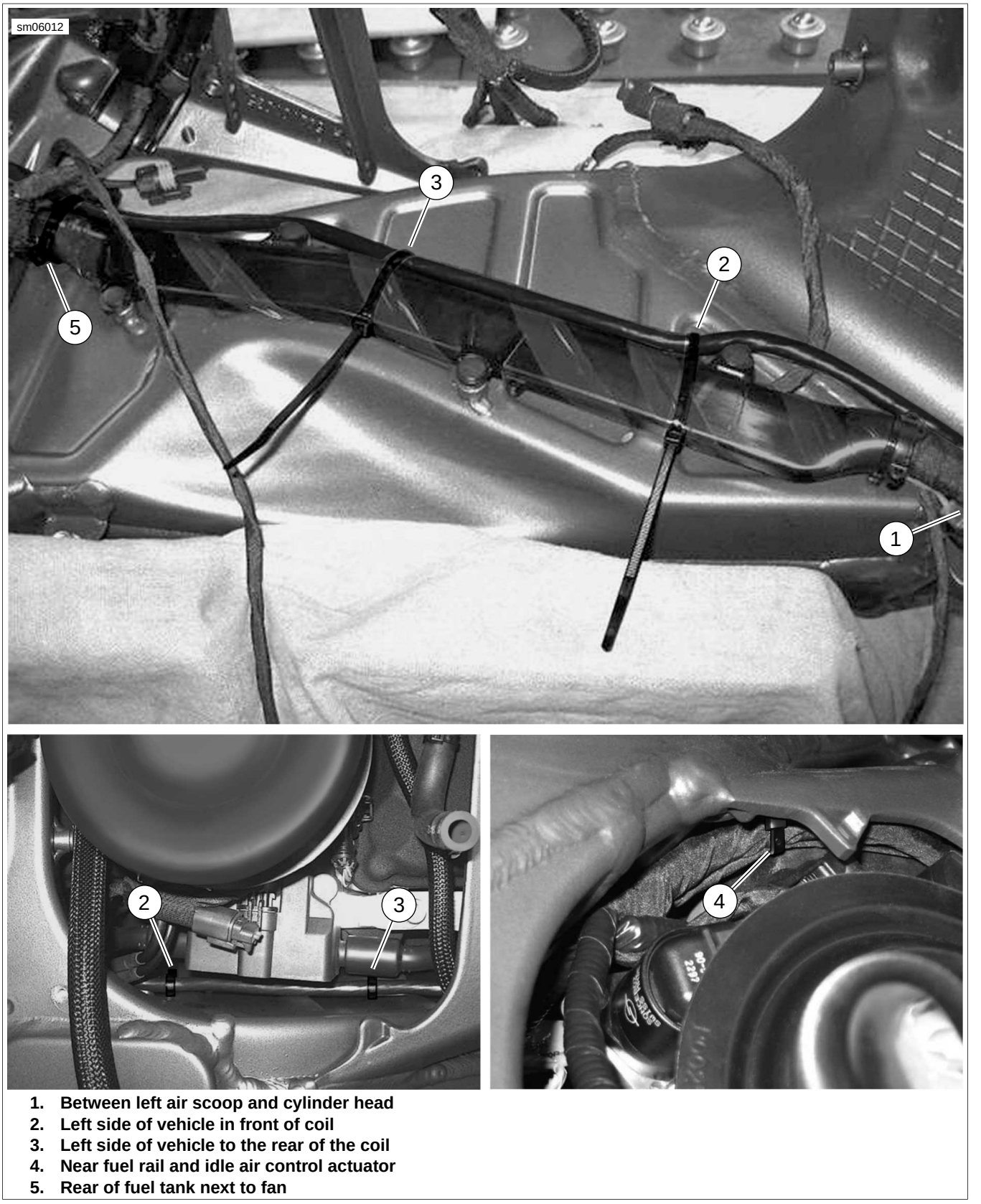


Figure 6-105. "V" Bracket with Siren Mounts for XB12XP Ulysses Police Model

10. See Figure 6-105. Remove Siren from "V"-bracket if installed.
11. Remove right side engine shroud air scoop. See 2.49 AIR SCOOPS.
12. Place a scissor jack under jacking point and raise rear wheel off ground. For location of jacking point see 4.18 EXHAUST SYSTEM.
13. Remove rear shock absorber assembly and reservoir. See 2.23 REAR SHOCK ABSORBER.
14. Remove fan. See 4.11 COOLING FAN.
15. Remove ignition coil. See 4.6 IGNITION COIL.

DIGITAL TECHNICIAN HARLEY-DAVIDSON



1. **Between left air scoop and cylinder head**
2. **Left side of vehicle in front of coil**
3. **Left side of vehicle to the rear of the coil**
4. **Near fuel rail and idle air control actuator**
5. **Rear of fuel tank next to fan**

Figure 6-106. Auxiliary Harness Cable Strap Locations

16. See Figure 6-106. Remove five cable straps securing auxiliary harness and main harness to frame.

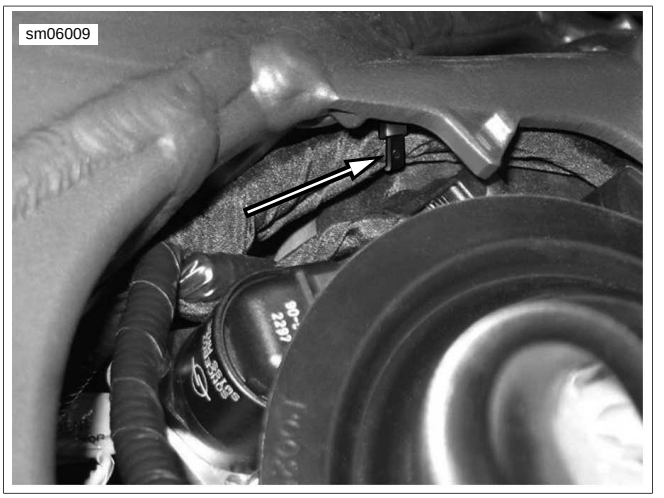
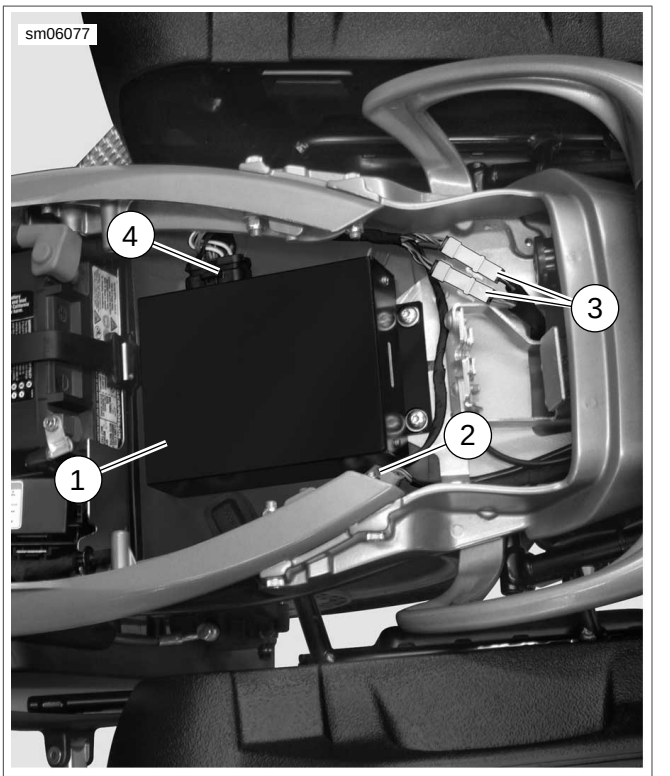


Figure 6-107. Cable Strap: Siren Lead/Auxiliary Harness to Main Harness

17. See Figure 6-107. Remove one cable strap securing siren harness lead to main harness on top of the rear cylinder head close to the fuel rail and the idle air control actuator.
18. Loosen and remove wire harness guide at steering head.

Figure 6-108. Auxiliary Harness Connections

19. See Figure 6-108. Disconnect auxiliary harness behind windscreen.
20. See Figure 6-109. Disconnect rear auxiliary harness at triple tail and lighting/siren control module.
21. Remove auxiliary harness starting at the front of vehicle, guiding and pulling it out towards to seat area.



1. **Lighting/Siren control module**
2. **Auxiliary harness connection to main harness**
3. **Lighting/Siren control module connectors to rear emergency lights**
4. **Auxiliary harness connectors to lighting/siren control module**

Figure 6-109. Lighting/Siren Control Module and Connectors

Installation

NOTE

Make sure to properly install the bundle components in the auxiliary harness in order to maintain component clearances.

1. Install auxiliary harness starting at the seat area and guiding and pulling it towards the front of vehicle.

NOTE

When routing the harness through the shock tower, the siren lead break out on the auxiliary harness will line up with the sensor leads on the main harness. If the auxiliary harness is laid out in this manner it will make sure that you have the harness installed in the correct location.

2. See Figure 6-109. Connect rear auxiliary harness at triple tail and lighting/siren control module.
3. Route harness through shock tower towards front of vehicle.
4. Connect auxiliary harness behind windscreen.
5. Tighten wire harness guide at steering head.
6. Install one cable straps securing siren harness lead to harness routing tray across frame behind the intake assembly.

7. Install four cable straps securing auxiliary harness and main harness to frame.
8. Install ignition coil. See 4.6 IGNITION COIL.

NOTES

- *Make sure the spark plug wires are fully seated on coil towers before proceeding.*
- *Do not force the fan into position or attempt to use fasteners to draw fan into position as damage to the fan housing may occur. Wire bundle positioned correctly will allow fan to be fully seated without force.*

9. Install fan. See 4.11 COOLING FAN.
10. Install rear shock absorber assembly and reservoir. See 2.23 REAR SHOCK ABSORBER.
11. Lower rear wheel to ground and remove scissor jack from under muffler.
12. Install right side engine shroud air scoop. See 2.49 AIR SCOOPS.
13. Install Siren to V-bracket if previously installed.

NOTE

When installing the left side air scoop it is necessary to make sure that the voltage regulator and alternator wiring harnesses are not trapped between the air scoop and cylinder head.

14. Install left side air scoop. See 2.49 AIR SCOOPS.
15. Install windscreen and windshield. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.
16. Install electronic control module. See 4.4 ELECTRONIC CONTROL MODULE (ECM).
17. Install battery.
    a. Connect battery positive cable from battery positive (+) terminal.
    b. Install terminal cover boot on battery positive cable (red).
    c. Connect battery negative cable (black) to battery negative (-) terminal.

NOTE

In order to perform the next step in this procedure, you need to make sure that you have a fully charged battery in order to energize the Lighting/Siren Control Module.

18. Verify operation of all emergency components.
19. Install air cleaner assembly. See 4.3 AIR CLEANER ASSEMBLY.

WARNING

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

20. Install seat.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

INTERACTIVE EXHAUST HARNESS: XB12 MODELS 6.29

FIREBOLT

Removal

1. Remove seat and pillion.
2. Remove intake cover assembly. See 2.38 INTAKE COVER.

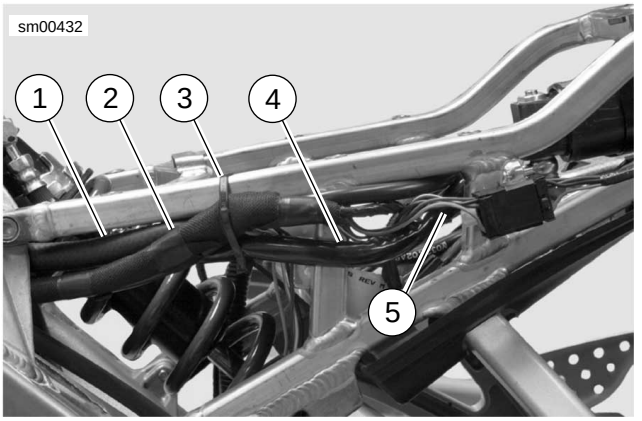
⚠WARNING

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

3. Remove negative battery cable from battery.
4. Remove main battery ground and the exhaust actuator ground.
5. Remove the subframe tail body work. See 2.39 SUB-FRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.
6. See Figure 6-110. Separate exhaust actuator harness connector [165] (5) at main harness.
7. Note location of cable strap and cut as required.
8. Pull actuator harness through frame.
9. Disconnect connector [161B] from actuator.

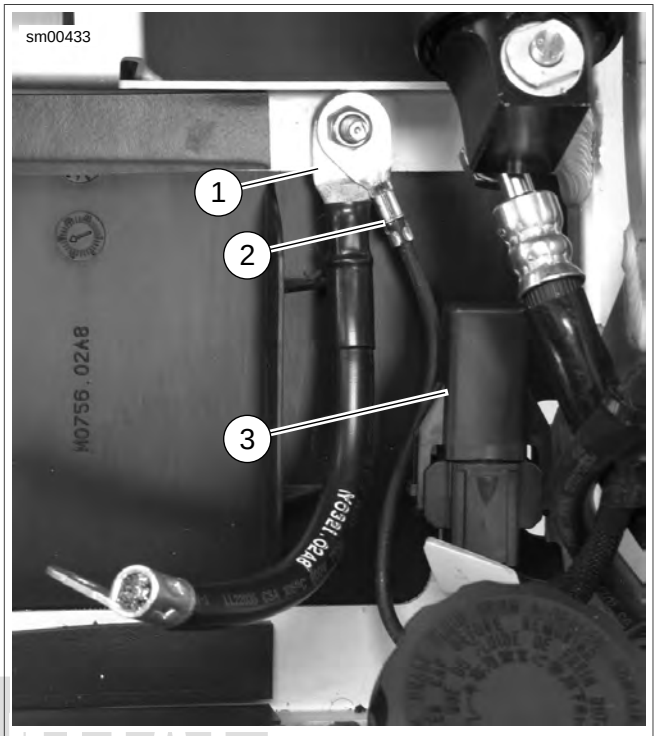
NOTE

For actuator and actuator cable replacement see 6.17 INTERACTIVE EXHAUST SYSTEM.



1. **Fuel vent hose**
2. **Main wire harness**
3. **Cable strap**
4. **Rear shock reservoir hose**
5. **Exhaust actuator harness connector [165]**

Figure 6-110. Left Side Subframe Hose and Wire Routing: Firebolt



1. **Main battery ground**
2. **Wire harness ground**
3. **Main fuse case**

Figure 6-111. Battery and Harness Ground (Battery Removed for Clarity)

Installation

1. Mate actuator connector [161B] to actuator.
2. Route harness along channel in air cleaner under frame and under main wiring harness.

NOTE

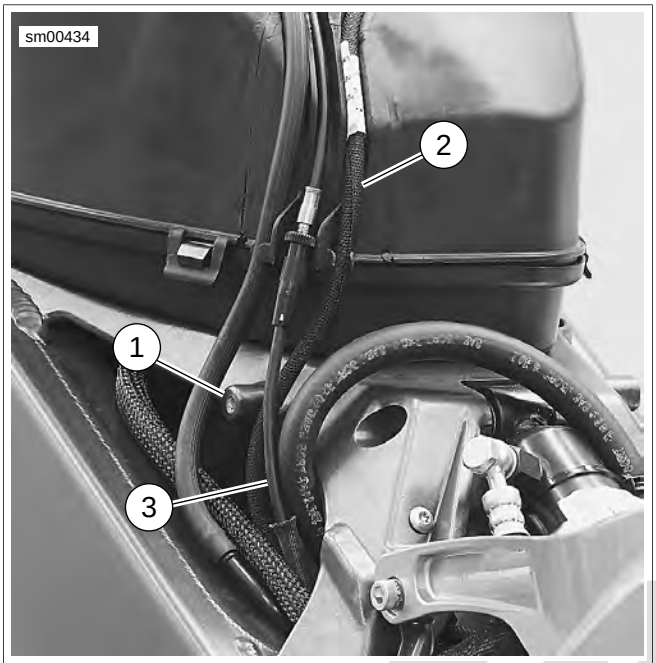
If cable is routed in front of the frame lug it will cause the muffler valve to stay open not allowing it to work properly.

3. See Figure 6-112. Verify that the interactive exhaust wiring harness (2) is routed behind the frame lug (1) before installing air intake cover.
4. Mate exhaust actuator harness connector halves [165].
5. Install cable straps where noted.
6. Install ground bolt through main battery ground cable and actuator ground wire. Tighten to 48-72 **in-lbs** (5.4-8 Nm).
7. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).
8. Install subframe tail body work. See 2.38 INTAKE COVER.
9. Install intake cover. Tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm). See 2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT.

WARNING

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

10. Install seat and pillion.



1. **Frame lug**
2. **Wire harness**
3. **Cable**

Figure 6-112. Correct Cable Routing Behind Frame Lug (Typical)

LIGHTNING

Removal

1. Remove seat.
2. Remove intake cover assembly. See 2.38 INTAKE COVER.

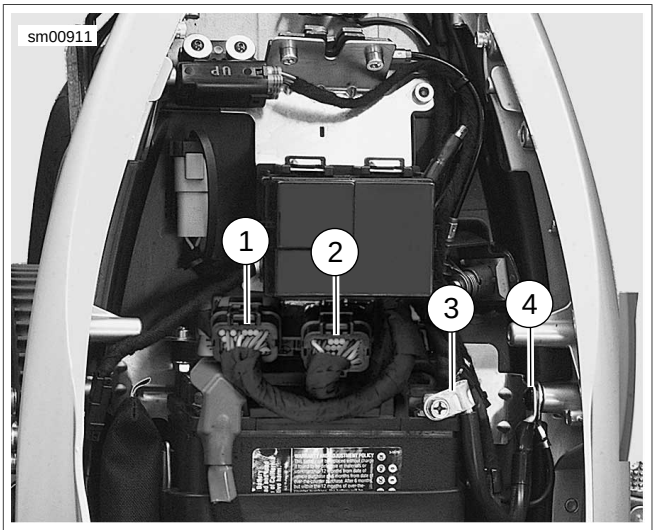
WARNING

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

3. See Figure 6-113. Remove negative battery cable (3) from battery. See 1.5 BATTERY MAINTENANCE.
4. See Figure 6-114. Separate exhaust actuator harness connector [161B] (2) at main harness.
5. See Figure 6-113. Remove the exhaust actuator ground (4).
6. Pull actuator harness through frame.
7. See Figure 6-114. Disconnect connector [161B] (2) from actuator.

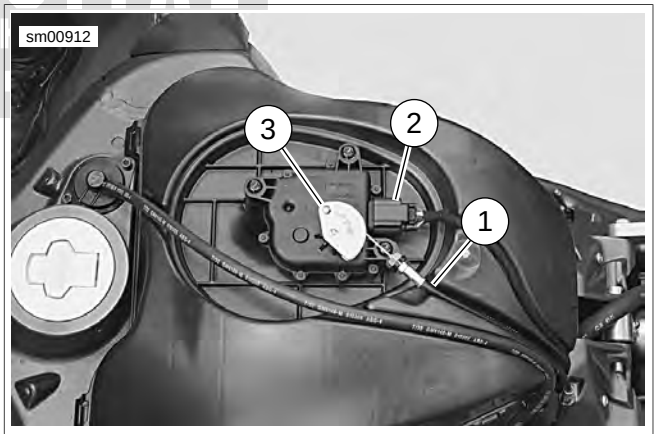
NOTE

For actuator or actuator cable replacement see 6.17 INTERACTIVE EXHAUST SYSTEM.



1. **ECM connector [10]**
2. **ECM connector [11]**
3. **Negative battery cable**
4. **Battery and actuator ground**

Figure 6-113. Harness and Cable Routing: Lightning (XB12 Models)



1. **Interactive exhaust cable**
2. **Actuator connector [161B]**
3. **Interactive exhaust cable wheel**

Figure 6-114. Exhaust Actuator (XB12 Models)

Installation

1. See Figure 6-114. Connect actuator connector [161B] (2) to actuator.
2. Route harness along channel in airbox under frame and over main wiring harness.

NOTE

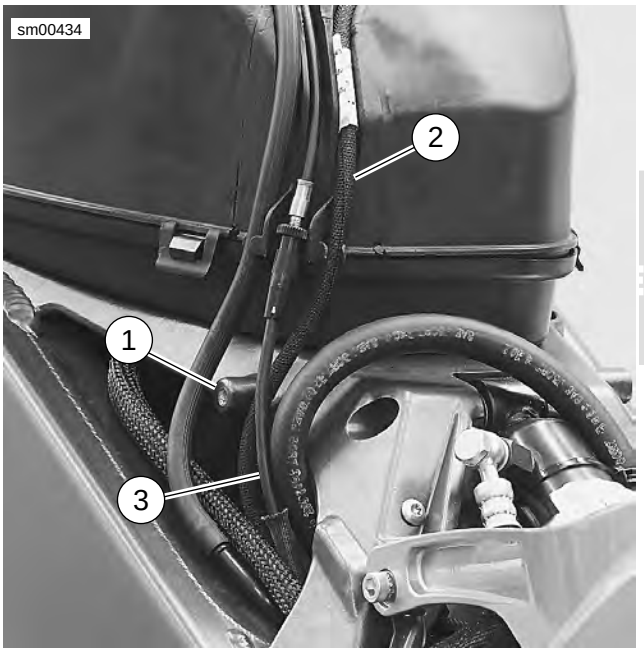
If cable is routed in front of the frame lug it will cause the muffler valve to stay open not allowing it to work properly.

3. See Figure 6-115. Verify that the interactive exhaust cable (3) is routed behind the frame lug (1) before installing air intake cover.
4. See Figure 6-114. Connect exhaust actuator harness connector [161B] (5).
5. Install ground bolt through main battery ground cable and actuator ground wire. Tighten to 48-72 **in-lbs** (5.4-8 Nm).
6. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).
7. Install intake cover. Tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

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

8. Install seat.



1. **Frame lug**
2. **Wire harness**
3. **Cable**

Figure 6-115. Correct Cable Routing Behind Frame Lug (Typical)

ULYSSES

Removal

1. Remove seat.
2. Remove intake cover assembly. See 2.38 INTAKE COVER.

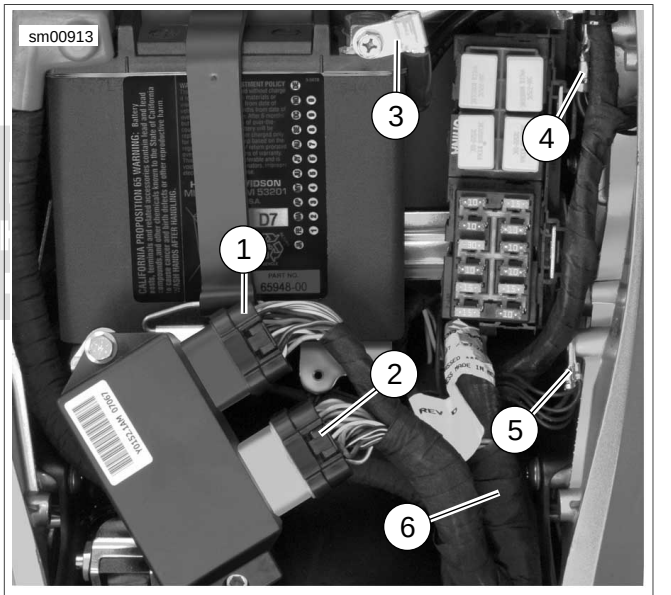
⚠WARNING

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

3. See Figure 6-116. Remove negative battery cable (3) from battery. See 1.5 BATTERY MAINTENANCE.
4. Remove the fuse block from the battery tray to access the actuator harness ground (5).
5. Remove the exhaust actuator ground (5).
6. See Figure 6-116. Separate exhaust actuator harness connector [165] beneath the main harness (6) under the seat.
7. Pull actuator harness through frame.
8. See Figure 6-113. Disconnect connector [161B] from actuator.

NOTE

For actuator or actuator cable replacement see 6.17 INTERACTIVE EXHAUST SYSTEM.



1. **ECM connector [10]**
2. **ECM connector [11]**
3. **Negative battery cable**
4. **Battery ground**
5. **Actuator ground**
6. **Main harness**

Figure 6-116. Harness and Cable Routing: Ulysses

Installation

1. See Figure 6-113. Mate actuator connector [161B] (2) to actuator.
2. Route harness along channel in airbox under frame and over main wiring harness.

NOTE

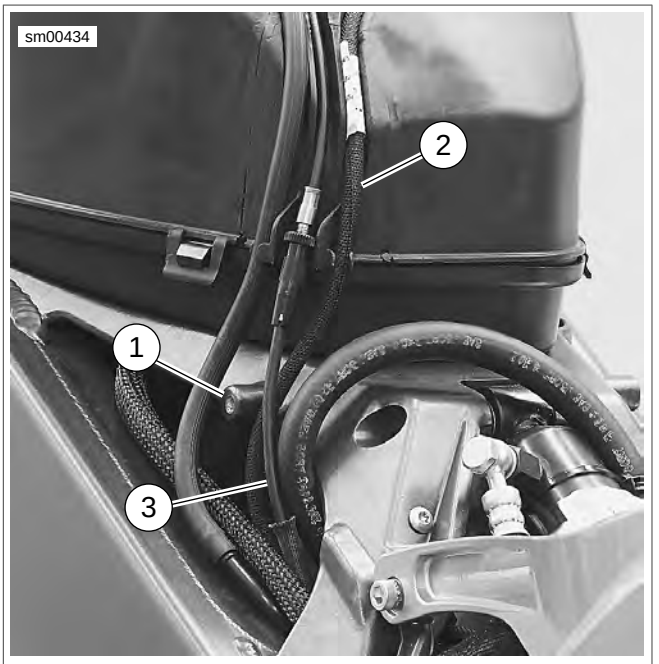
If cable is routed in front of the frame lug it will cause the muffler valve to stay open not allowing it to work properly.

3. See Figure 6-117. Verify that the interactive exhaust cable (3) is routed behind the frame lug (1) before installing air intake cover.
4. See Figure 6-116. Mate exhaust actuator harness connector [165] beneath main harness (6) under seat.
5. Install ground bolt through main battery ground cable and actuator ground wire. Tighten to 48-72 **in-lbs** (5.4-8 Nm).
6. Install fuse block on the battery tray.
7. Connect negative battery cable to battery terminal. Tighten fastener to 72-96 **in-lbs** (8-11 Nm).
8. Install intake cover. Tighten fasteners to 12-36 **in-lbs** (1.4-4 Nm).

⚠WARNING

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

9. Install seat.



1. **Frame lug**
2. **Wire harness**
3. **Cable**

Figure 6-117. Correct Cable Routing Behind Frame Lug (Typical)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

SPROCKET COVER WIRING 6.30

GENERAL

Connectors for the neutral switch [131] and the oil pressure indicator switch [120] are located under the sprocket cover.

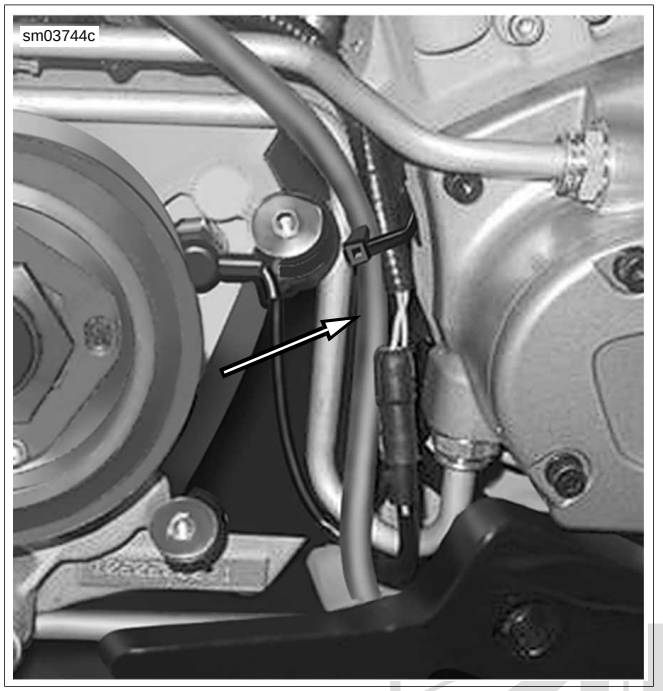


Figure 6-118. Correct routing of Interactive Exhaust Cable

REMOVAL

1. Remove sprocket cover. See 2.36 SPROCKET COVER.
2. Disconnect appropriate connector(s).

NOTE

The actuator cable, neutral switch connector and the oil pressure switch wire is located under the sprocket cover.

3. Route oil pressure switch wiring from main harness, to oil pressure switch located on the bottom front of the oil pump body and connect to the oil pressure switch.
4. Connect the neutral safety switch (single bullet).
5. See Figure 6-118. Route the interactive exhaust cable behind the oil pump body beside the neutral switch connection and the oil pressure switch wire and install a cable strap.
6. Install sprocket cover. See 2.36 SPROCKET COVER.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

AUXILIARY POWER OUTLETS: ULYSSES MODELS 6.31

GENERAL

The 12-volt auxiliary power outlet circuit consists of two power outlets for 12-volt electrical accessories. The forward power outlet is located in the dash to the left of the speedometer assembly. The rearward power outlet is located in the tail section under the seat.

ACCESSORY LOAD TEST

The 12-volt auxiliary power outlets function with the ignition switch key in the ON position with the engine OFF/RUN switch in the RUN position.

The 12-volt auxiliary power outlet circuit contains a 10 amp fuse to protect overloading of the circuit. Verify that the combined accessory load of both power outlets does not exceed the amperage rating of the circuit.

Remove the windscreen to access the forward power outlet electrical connector. See 2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES.

Remove the seat to access the rearward power outlet electrical connector.

Figure 6-119. 12-Volt Power Outlet (On Dash)

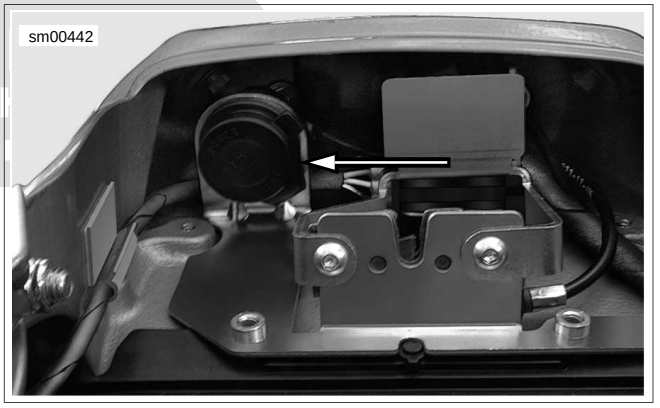


Figure 6-120. Auxiliary Power Outlet (Under Seat)

NOTES

TABLE OF CONTENTS

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

NOTES

AMP MULTILOCK CONNECTORS A.1

AMP MULTILOCK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTILOCK CRIMPER

General

AMP Multilock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-1. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

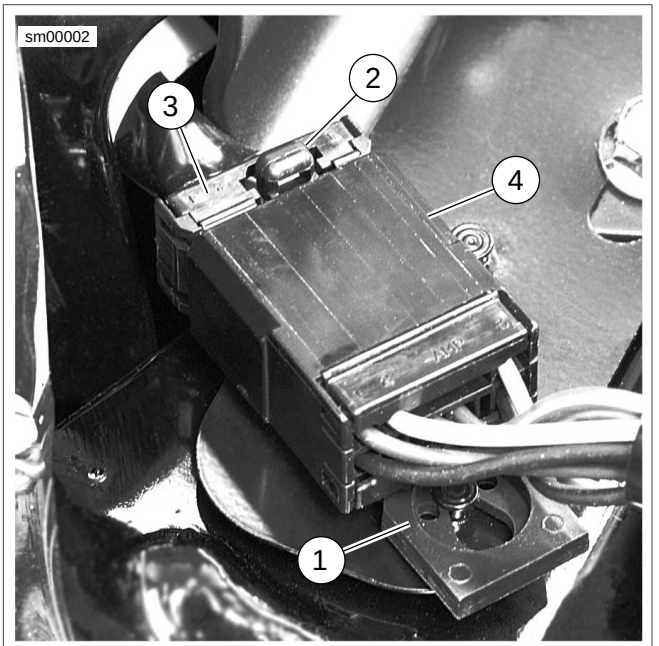
For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-1. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.



1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

Figure A-1. AMP Multilock Connector

Removing Terminals from Housing

1. See Figure A-2. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

If socket/pin terminal tool is not available, a push pin/safety pin or a Snap-on pick (Part No. TT600-3) may be used.

4. Press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang (8) up.
   b. **Pin:** Press the pin tang (7) down.

NOTE

A "click" is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.

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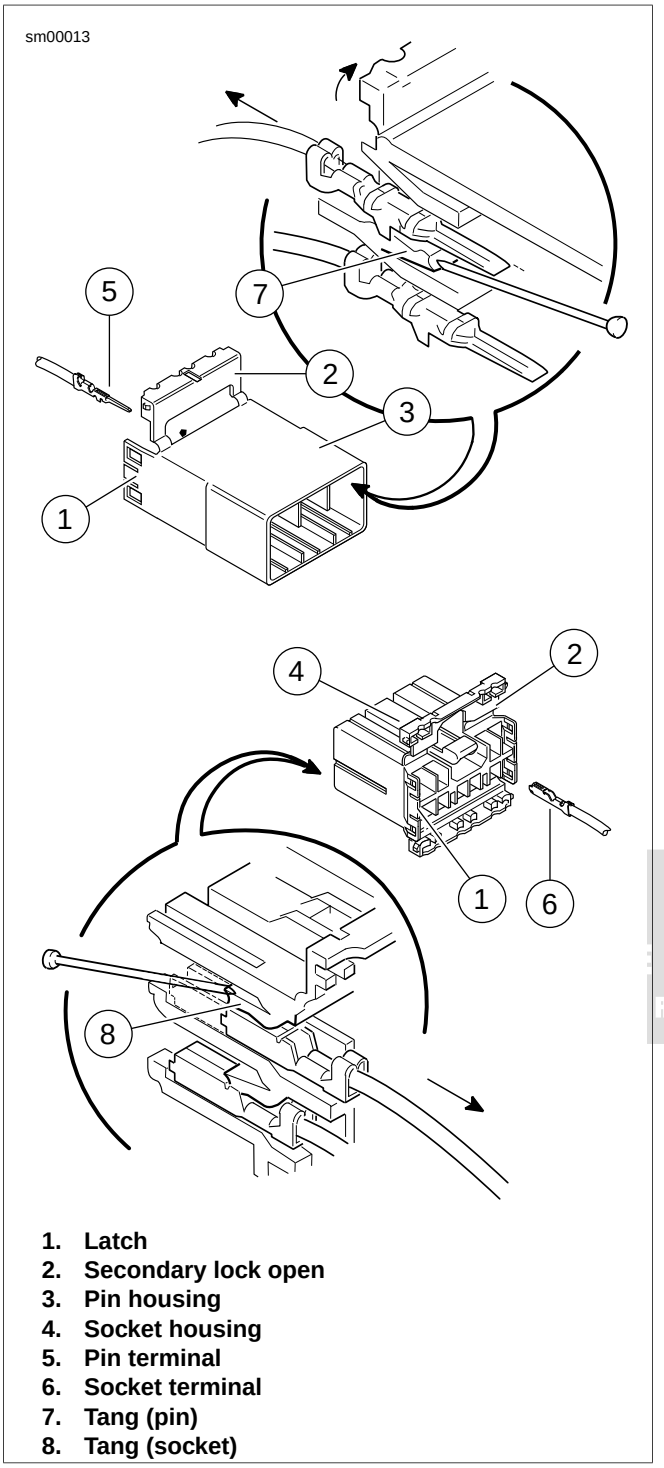


1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-2. AMP Multilock Connector: Socket and Pin Housings

Inserting Terminals into Housing

NOTE

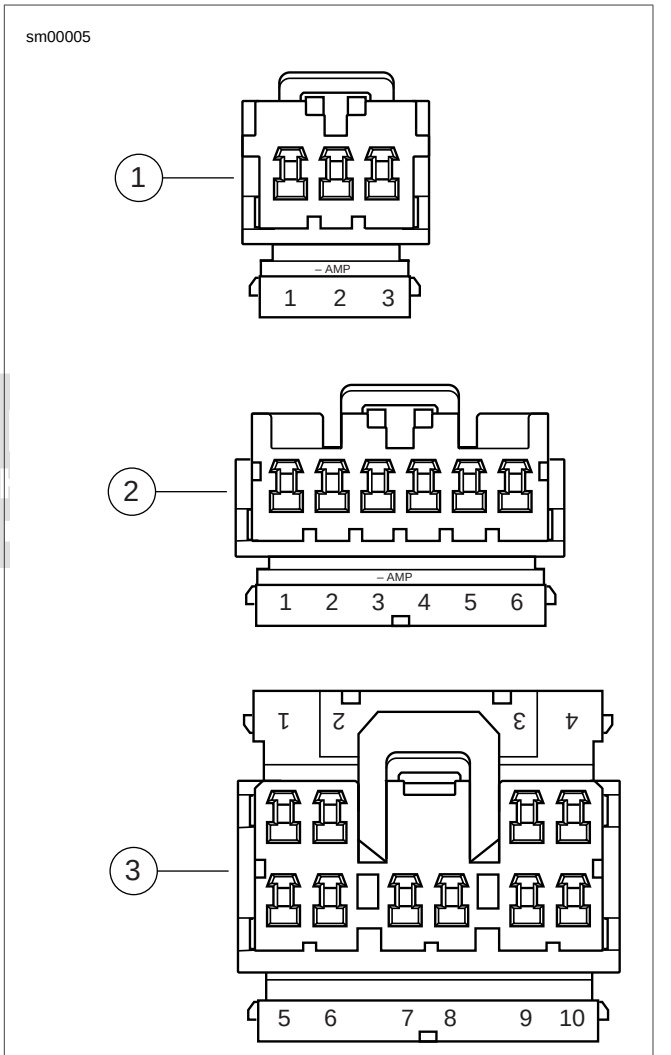
See Figure A-3. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

NOTES

- *Up and down can be determined by the position of the release button, the button is the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.



1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

Figure A-3. AMP Multilock Connector: Cavity Numbers on Secondary Locks (Socket Housings Shown)

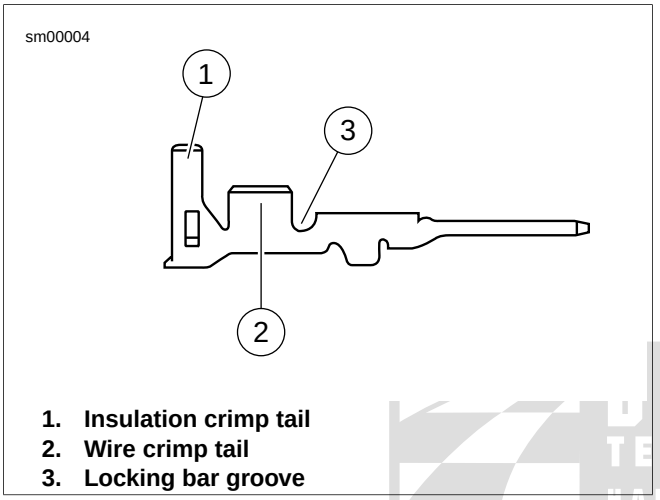
Preparing Wire Leads for Crimping

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

2. See Figure A-4 and Figure A-5. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).
3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

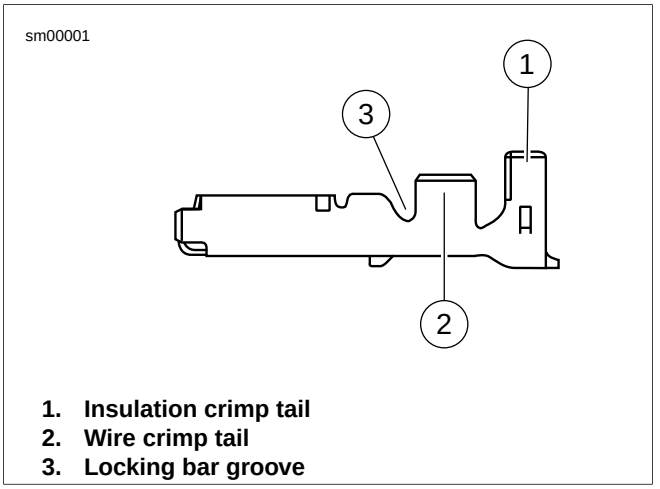
Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

WIRE GAUGE	NEST
20	Front
16	Middle
18	Rear



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-4. AMP Multilock Connector: Pin Terminal



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-5. AMP Multilock Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.

1. See Figure A-6. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

NOTE

See Figure A-4 and Figure A-5. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.

3. See Figure A-6. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (7) and remove crimped terminal.

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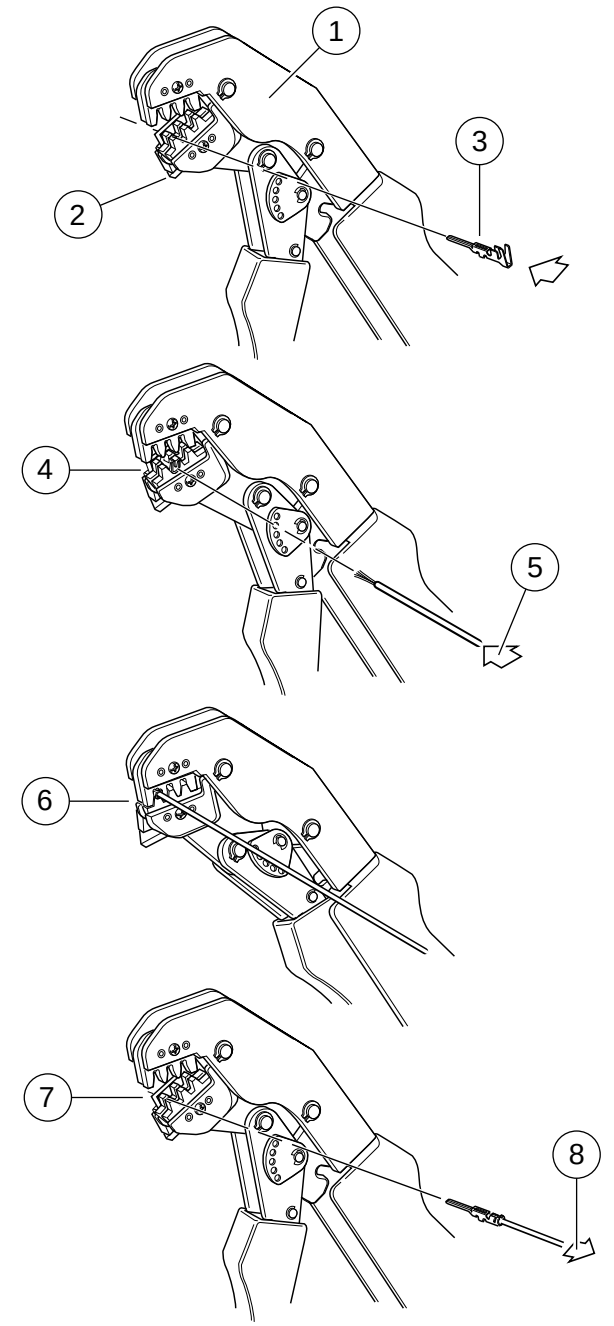
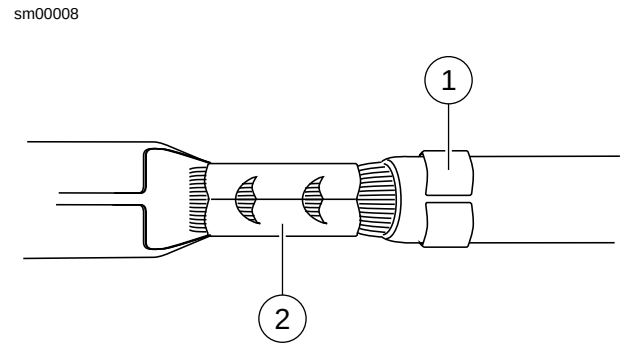


1. Open position
2. Locking bar flange
3. Insert contact
4. Release locking bar
5. Insert lead
6. Squeeze
7. Raise locking bar
8. Remove crimped terminal

Figure A-6. AMP Multilock Connector: Terminal Crimping Procedure

Inspecting Crimped Terminals

See Figure A-7. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.



1. Insulation crimp
2. Wire core crimp

Figure A-7. AMP Multilock Connector: Terminal Crimp

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AUTOFUSE ELECTRICAL CONNECTORS A.2

AUTOFUSE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
GA500A	SNAP-ON TERMINAL PICK

General

Autofuse electrical connector terminals are found in ignition switches and some fuse blocks.

Disassembly

1. Obtain SNAP-ON TERMINAL PICK (Part No. GA500A).
2. See Figure A-8 or Figure A-9. Insert smallest pair of pins into chamber on mating end of socket housing to depress tangs on each side of terminal simultaneously.
3. Gently pull on wire to remove terminal from wire end of socket housing.
4. If necessary, crimp **new** terminals on wires.

Assembly

1. Using a thin flat blade, like that on a hobby knife, carefully bend tang on each side of terminal outward away from terminal body.
2. With the open side of the terminal facing rib on wire end of socket housing, insert terminal into chamber until it locks in place.

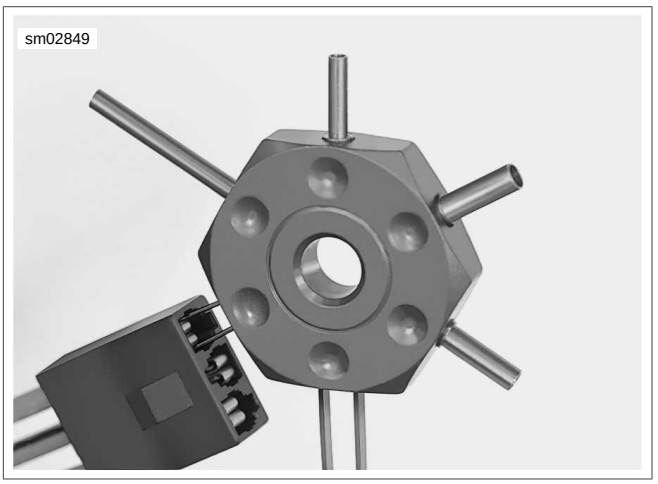

Figure A-8. Removing Autofuse Terminal from Ignition Switch

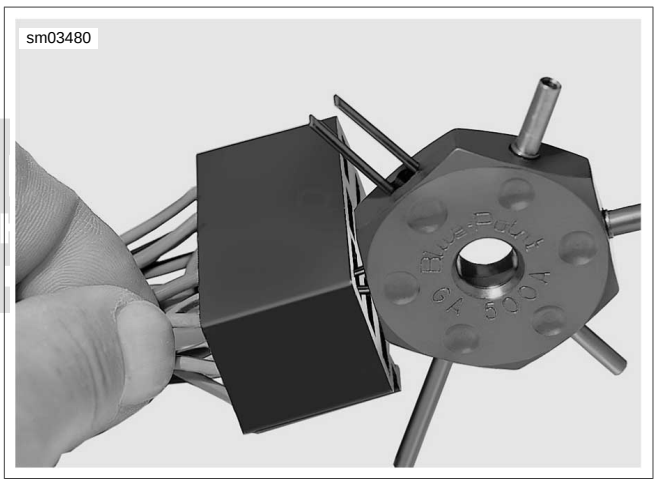

Figure A-9. Removing Autofuse Terminal from Fuse Block

DELPHI CONNECTORS A.3

DELPHI CONNECTOR REPAIR

General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

Separating Pin and Socket Housings

See Figure A-10. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE

Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector [139B], the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.9 PACKARD 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.

1. See Figure A-11. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

Installing Socket Terminals

NOTE

For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

Figure A-10. Delphi Connector: Socket Housing Latch

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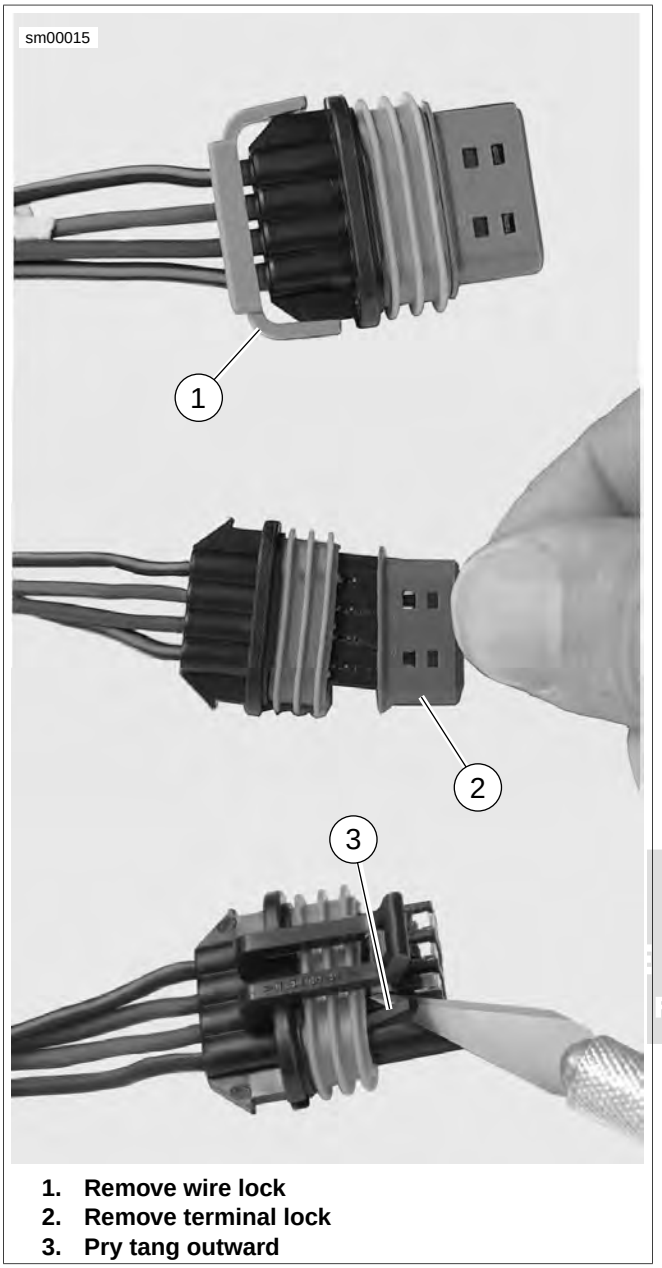

1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

Figure A-11. Delphi Connector: Removing Socket Terminals

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DEUTSCH ELECTRICAL CONNECTORS A.4

DEUTSCH CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41475	DEUTSCH CONNECTOR SERVICE KIT
HD-41475-100	FLAT BLADE L-HOOK

General

Deutsch connectors are colored coded for location purposes. Those connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other connectors, including those associated with right side accessories, are **black**.

NOTE

A DEUTSCH CONNECTOR SERVICE KIT (Part No. HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.

Separating Pin and Socket Housings

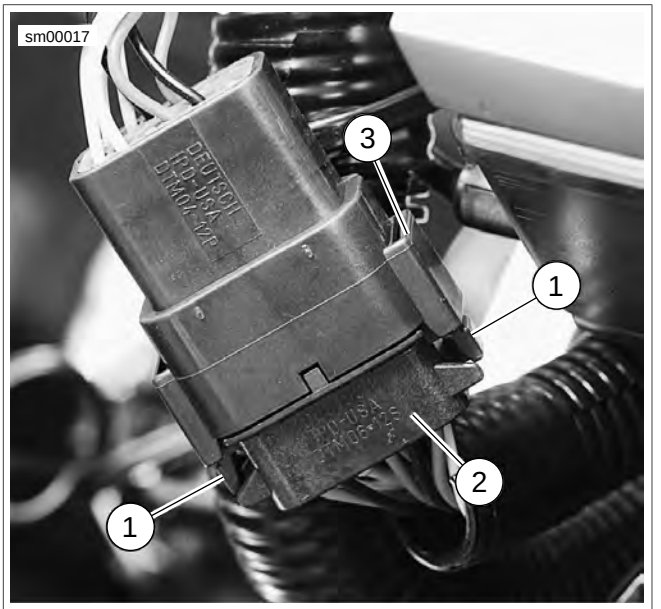
See Figure A-12. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

NOTES

- *Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.*
- *Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
   a. **For One External Latch:** Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.
   b. **For Two External Latches:** (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.
   For Two External Latches: (8-place and 12-place) If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.



1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure A-12. Deutsch Connector

Removing Socket Terminals

1. See Figure A-13. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-16. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

NOTE

*If wire leads require **new** terminals, see the instructions for crimping terminals.*

Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-15. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

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NOTE

Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.

5. Install internal seal (4) on lip of socket housing, if removed.
6. Insert tapered end of secondary locking wedge (5) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTES

- *See Figure A-14. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*

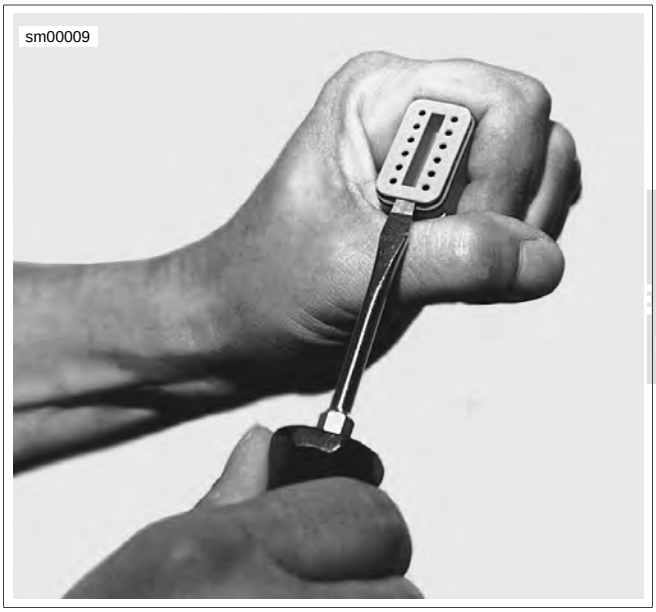
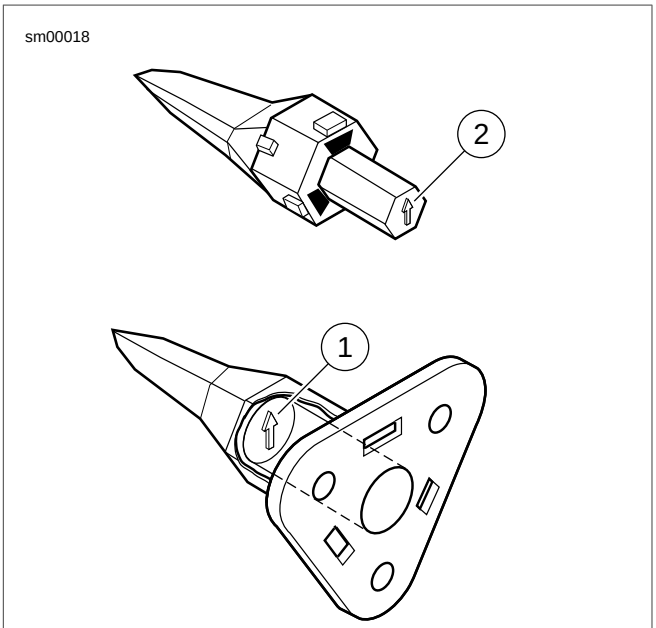


Figure A-13. Deutsch Connector: Remove Secondary Locking Wedge



1. Arrow on socket locking wedge
2. Arrow on pin locking wedge

Figure A-14. Deutsch Connector: 3-Place Locking Wedges

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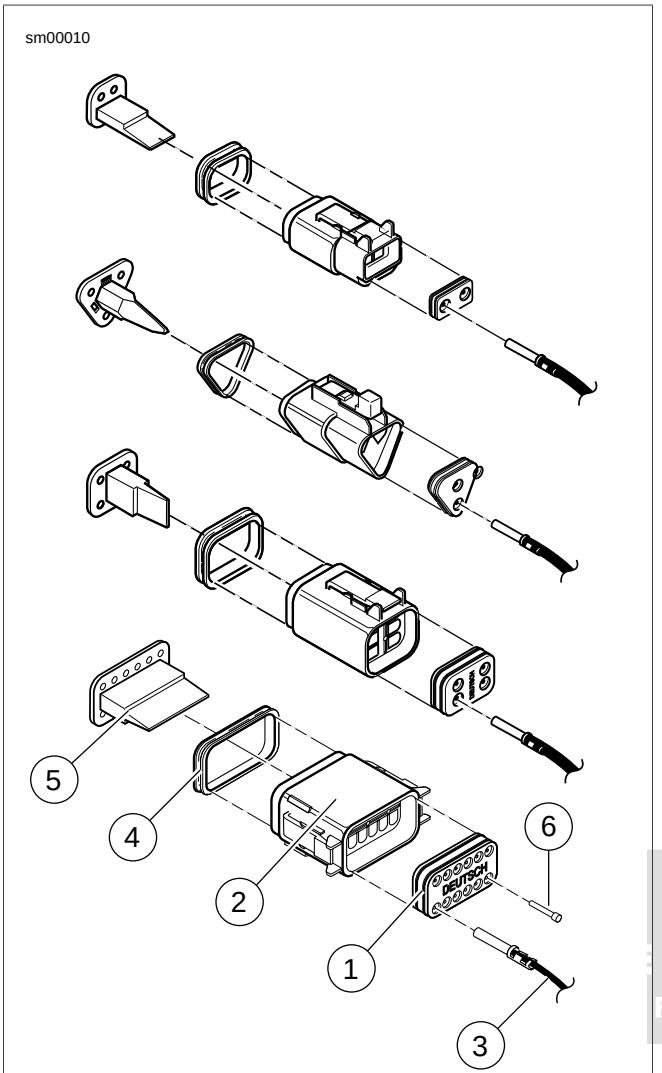


1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-15. Deutsch Connector: 2, 3, 4 and 12-Place Socket Housings

Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTES

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *If it should become necessary to replace a pin or socket housing, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color.*
- *When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.*

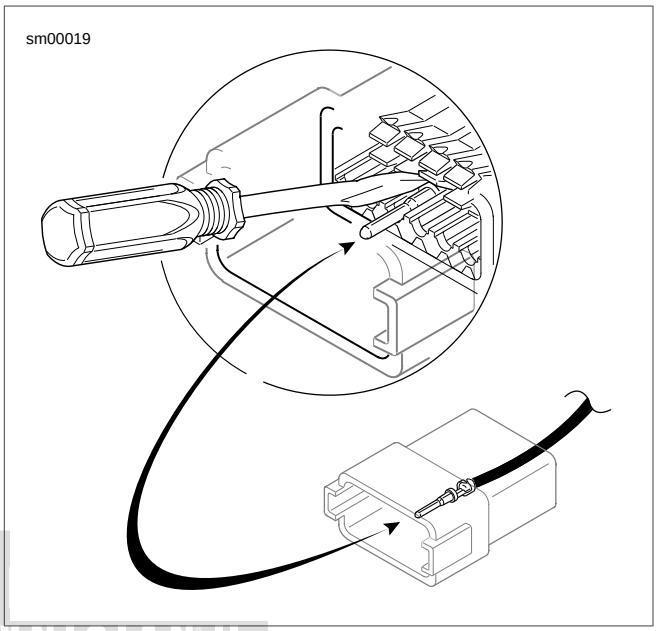


Figure A-16. Deutsch Connector: Depress Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-17. Fit wire seal (1) into back of pin housing (2).
2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

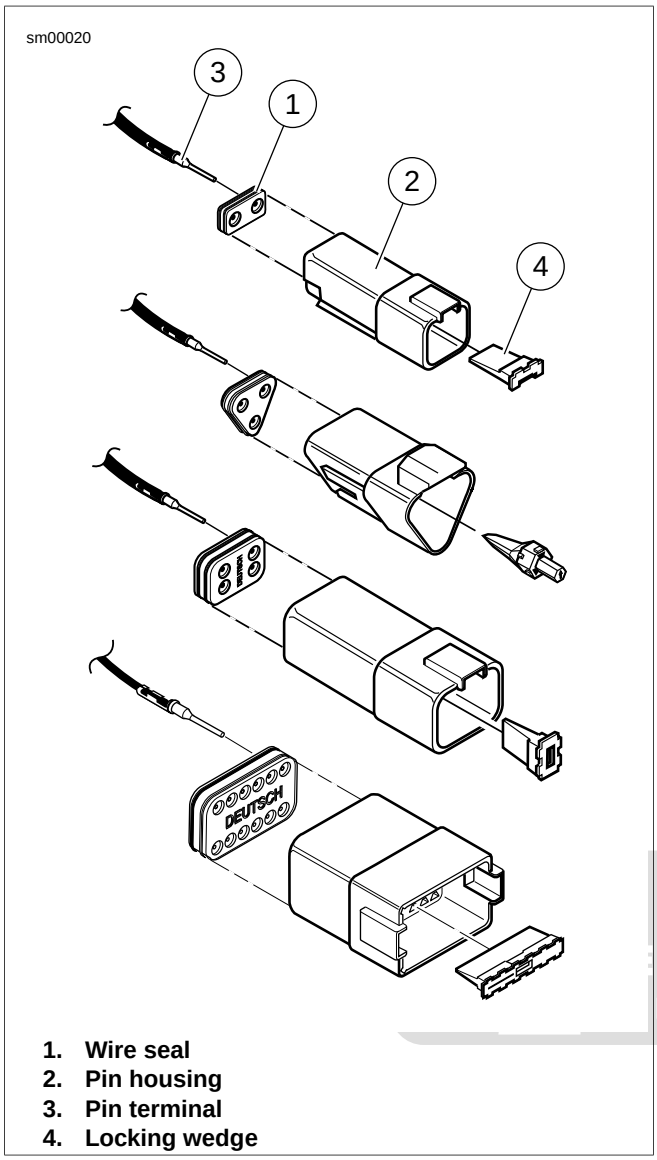
NOTE

A tug on the wire lead will confirm that a pin is locked in place.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

NOTES

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-14. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-17. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

Table A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
Standard (with crimp tails)	A.5 DEUTSCH STANDARD TERMINAL REPAIR
Mini Terminal (solid barrel)	A.6 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR
Mini Terminal (with crimp tails)	A.7 DEUTSCH MINI TERMINAL REPAIR

DEUTSCH STANDARD TERMINAL REPAIR A.5

DEUTSCH STANDARD TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

Crimping Terminal to Lead

1. See Figure A-18. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

NOTE

If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

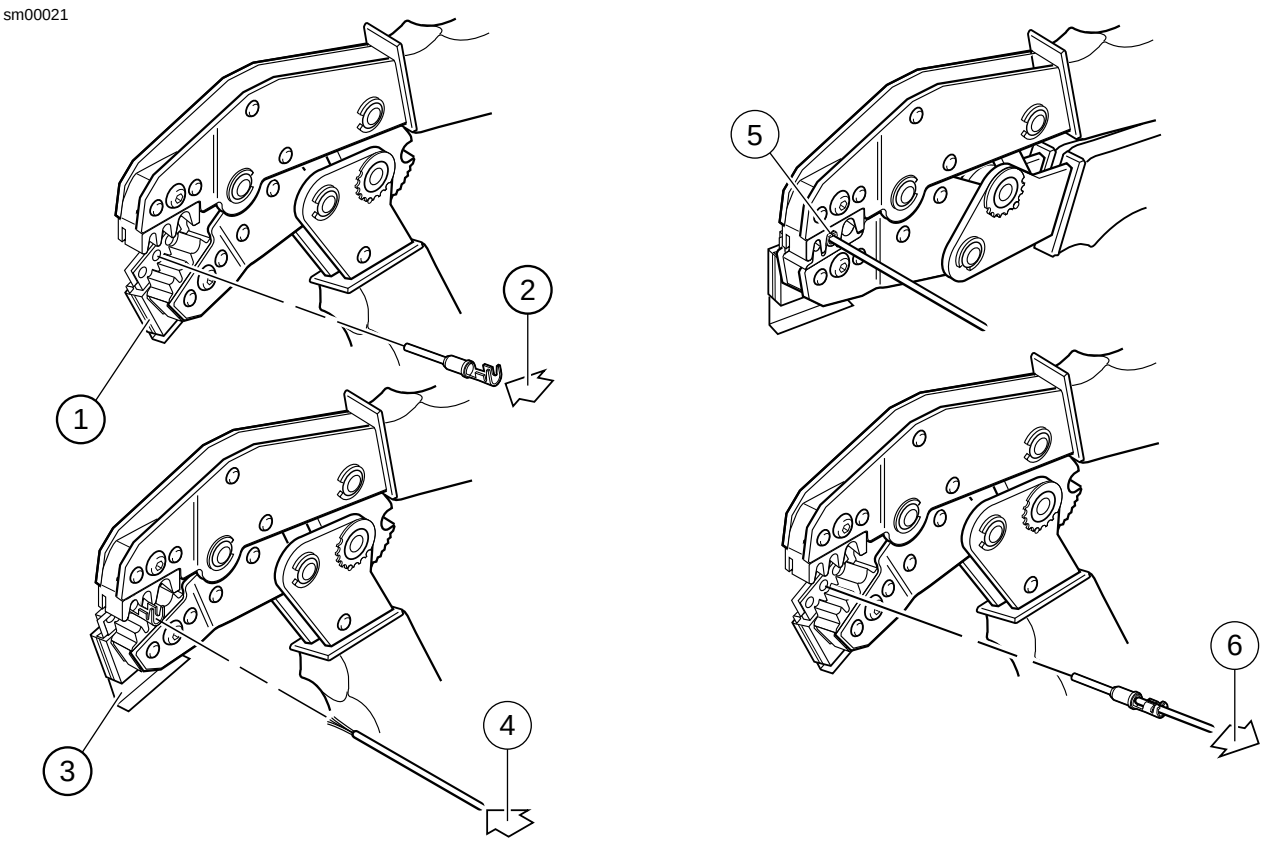
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die

WIRE GAUGE (AWG)	CRIMP TOOL DIE
20	Front
16-18	Middle



1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar and remove terminal**

Figure A-18. Crimping a Deutsch Standard Terminal

DEUTSCH SOLID BARREL MINI TERMINAL REPAIR A.6

DEUTSCH SOLID BARREL TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-42879	ELECTRICAL CRIMPER TOOL

Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip wire lead removing 1/4 in. (6.4 mm) of insulation.

Adjusting Crimper Tool

1. See Figure A-19. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

Crimping a Barrel Contact To Wire Lead

1. See Figure A-20. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact is centered between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

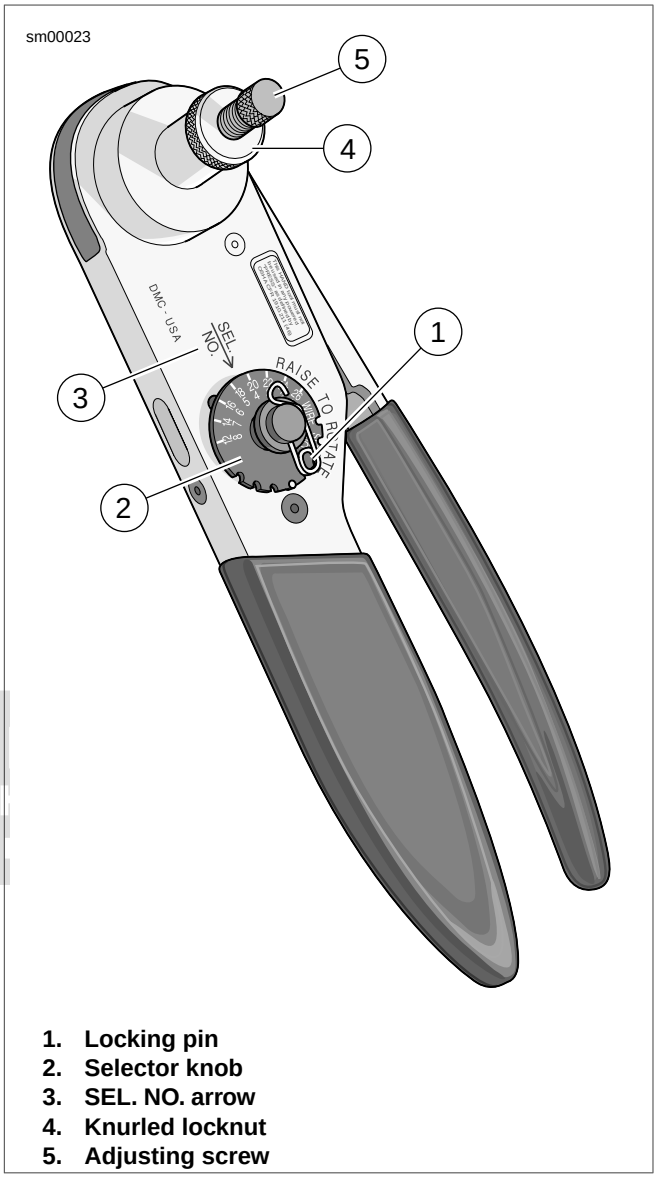
NOTE

Tool must be readjusted when changing contact size/type.

6. Install pin to lock selector knob.

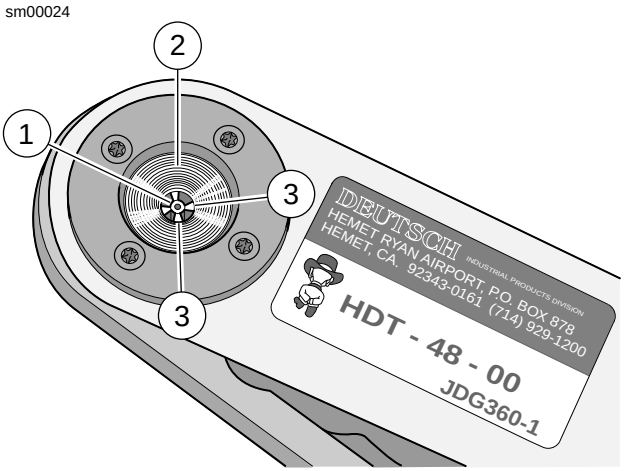
Inspecting Crimps

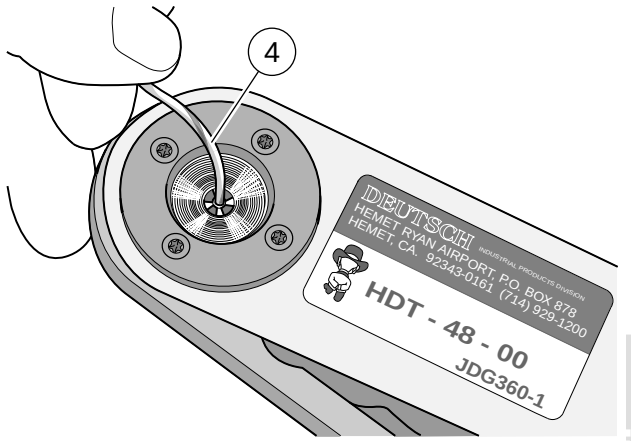
Inspect the crimp. All core wire strands are to be crimped in the barrel.



1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

Figure A-19. Electrical Crimper Tool (HD-42879)





1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

Figure A-20. Deutsch Solid Barrel

IGITAL
ECHNICIAN® II
HARLEY-DAVIDSON®

DEUTSCH MINI TERMINAL REPAIR A.7

DEUTSCH MINI TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER

Preparing Wire Leads for Crimping

Strip wire lead removing 5/32 in. (4.0 mm) of insulation.

Crimping a Mini Terminal to Wire Lead

1. See Figure A-21. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

Always perform core crimp before insulation crimp.

2. Position the core crimp on die E (1) of the crimper. Be sure the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire so that short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

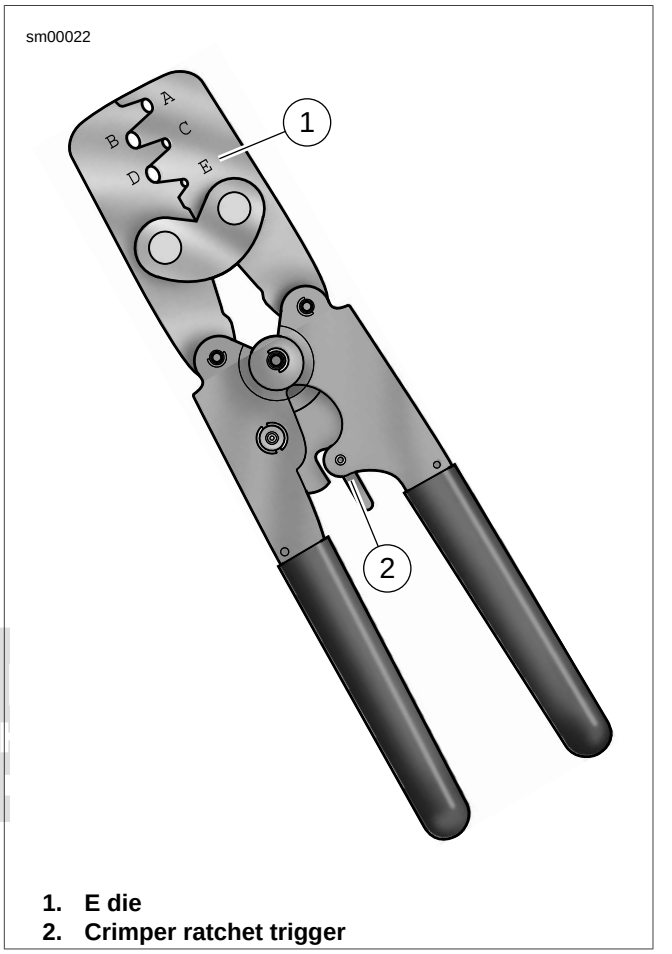
NOTE

If the crimper does not open, it can be opened by squeezing the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimper. Be sure the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.



1. E die
2. Crimper ratchet trigger

Figure A-21. Packard Terminal Crimper (HD-38125-7)

MOLEX CONNECTORS A.8

MOLEX CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-22. Depress the latch while pulling the pin and socket housings apart.

Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
   a. **Socket Housing:** See Figure A-23. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
   b. **Pin Housing:** See Figure A-24. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

NOTE

Do not remove the secondary lock from the connector housing.

2. See Figure A-25. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
   a. **Socket Housing:** The pin holes are inside the terminal openings.
   b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

Installing Terminals

1. See Figure A-26. From the wiring diagram, match the wire color to its numbered terminal cavity.

NOTE

Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

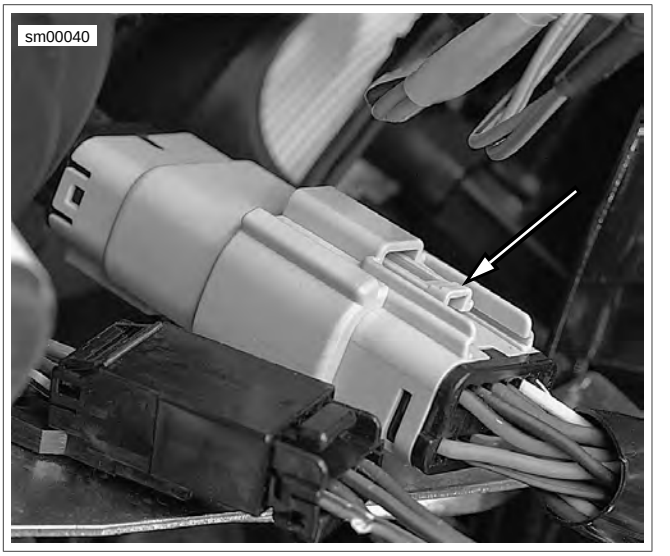


Figure A-22. Molex Connector: Latch

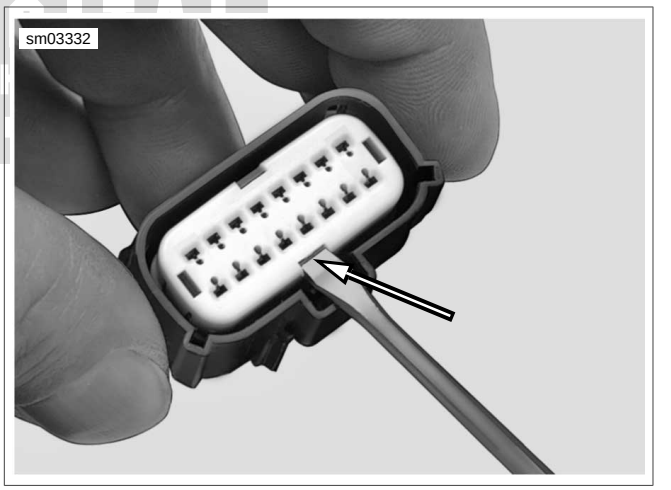


Figure A-23. Secondary Lock Pry Slot (Socket Housing)

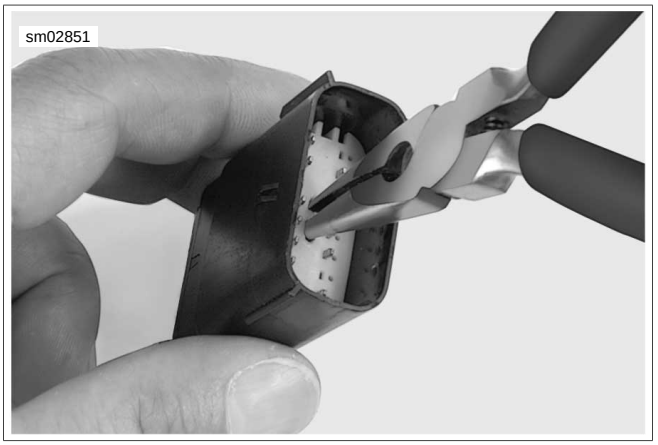


Figure A-24. Pull Up Secondary Lock (Pin Housing)

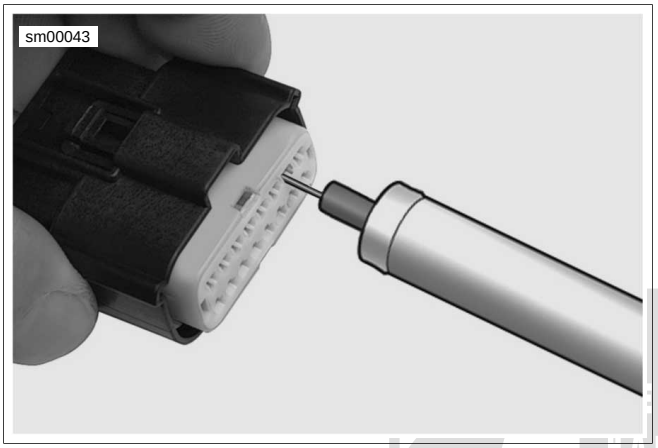
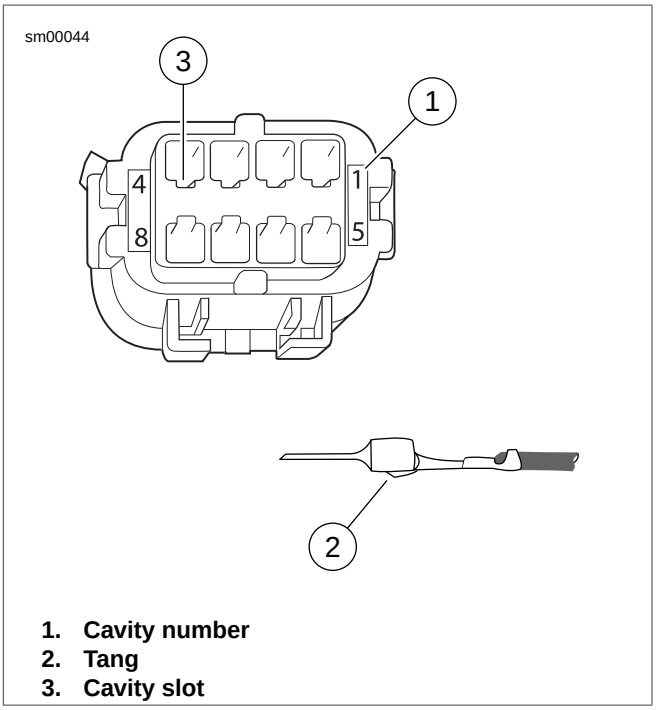


Figure A-25. Molex Connector: Terminal Remover (HD-48114)



1. **Cavity number**
2. **Tang**
3. **Cavity slot**

Figure A-26. Molex Connector: Pin Cavities and Wire Terminal

CRIMP TERMINAL TO LEAD

PART NUMBER	TOOL NAME
HD-48119	ELECTRICAL CRIMP TOOL

Prepare Lead

1. Cut the damaged terminal close to the back of the terminal to leave as much wire length as possible.
2. Strip approximately 3/16 in. (4.70-5.60 mm) of insulation from the end of the wire lead.

NOTE

The strip length is the same for both pin and socket terminals and for wire gauges from 22 to 14.

Prepare Tool

1. Identify the punch/die in the jaws of the ELECTRICAL CRIMP TOOL (Part No. HD-48119) for the wire gauge. Refer to Table A-4.
2. Squeeze and release the handles to open the tool.

NOTE

The crimp tool automatically opens when the handles are released.

3. See Figure A-27. Hold fully open tool at approximately 45 degrees.

NOTE

Do NOT tighten the locknut holding the locator bars. The bars must float to accommodate the different terminal gauges.

Table A-4. Crimp Tool Wire Gauge Punch/Die

AWG (WIRE GAUGE)	PUNCH/DIE
22	Left
18-20	Middle
14-16*	Right
* Crimp 16 AWG **pin** terminals in the 18-20 middle die.	

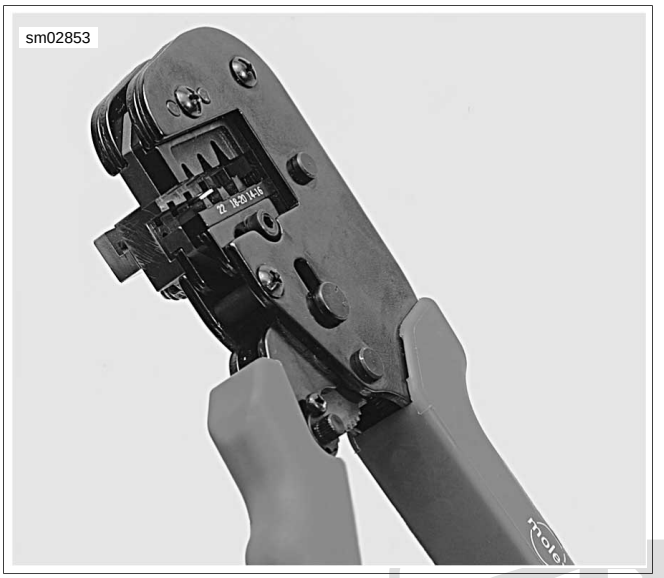
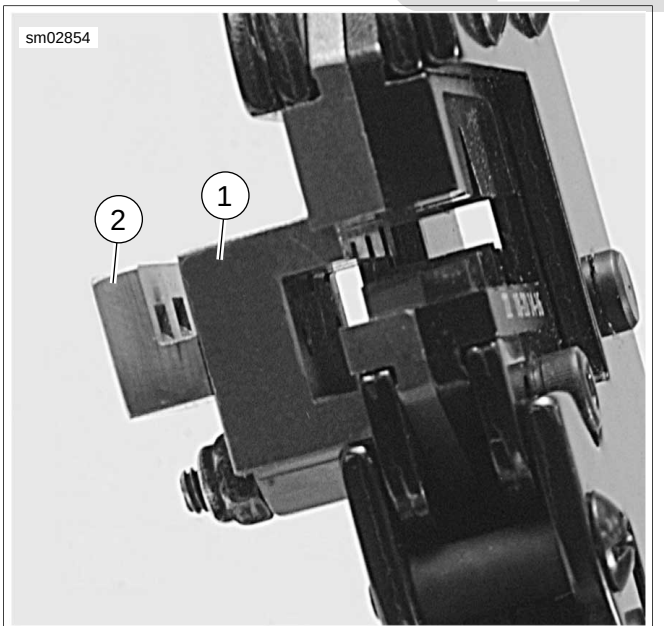


Figure A-27. Open Electrical Crimp Tool (HD-48119) at 45 Degrees



1. **Socket locator bar**
2. **Pin locator bar**

Figure A-28. Terminal Locator Bars

Position Terminal in the Punch/Die

1. See Figure A-29. With the crimp tails up, place the terminal through the punch/die into the square opening in the socket locator bar.
   a. **Socket Terminal:** See Figure A-28. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-30. The tip of a pin terminal passes through the socket locator bar and stops in the notch in the face of the pin locator bar.
2. See Figure A-31. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

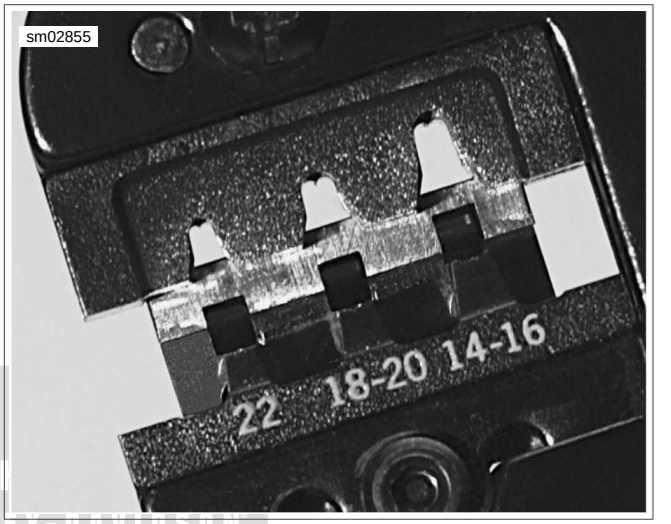


Figure A-29. Square Openings in Socket Locator Bar

Insert Stripped Lead

See Figure A-32. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

NOTES

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

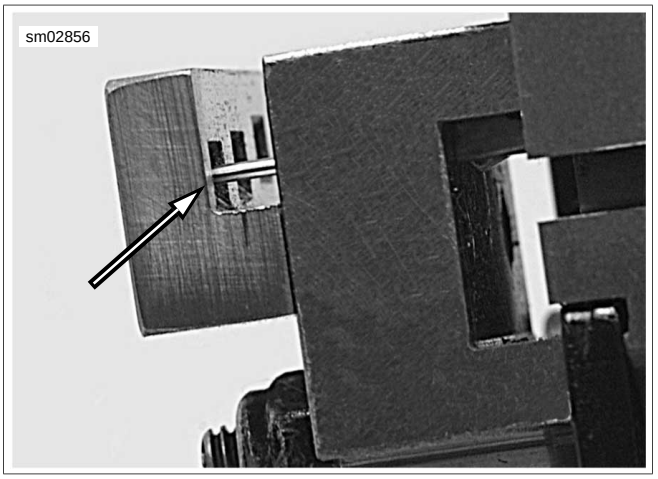


Figure A-30. Pin Terminal against Pin Locator Bar

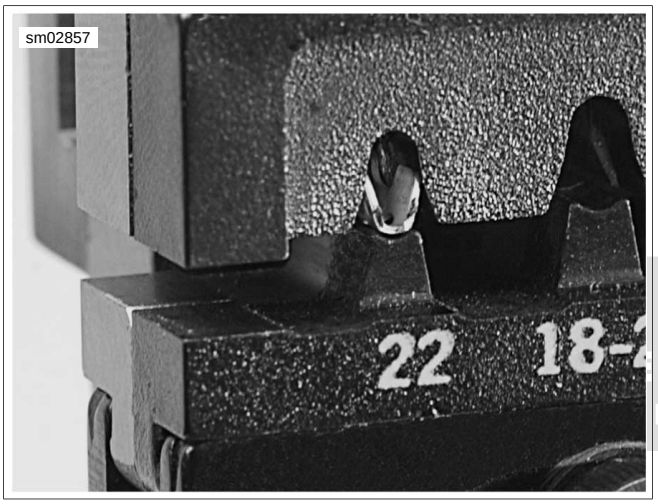


Figure A-31. Crimp Tails in Vertical Alignment between Punch and Die

Crimp Terminal to Lead

1. Holding the wire lead in position touching the locator face at an angle, quickly and smoothly squeeze the crimp tool closed.
2. Final squeeze the handles to open the tool and release the terminal.

NOTE

*A stuck or jammed tool can be opened by pressing the ratchet release lever found between the handles. Do **not** force the handles open or closed.*

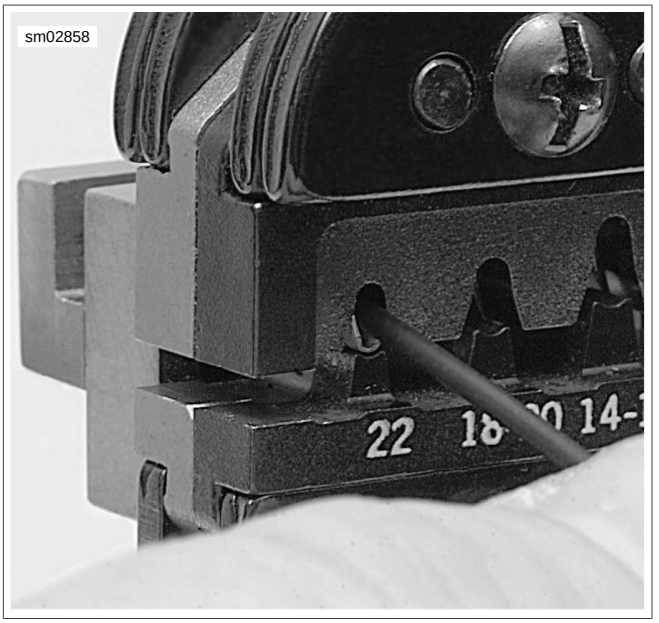
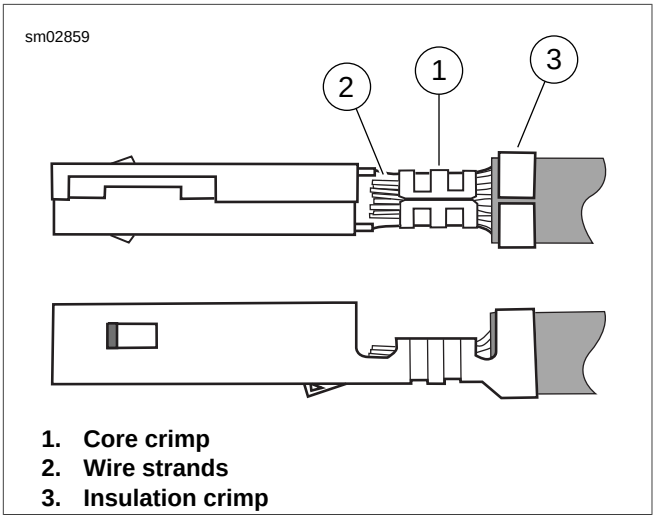


Figure A-32. Stripped Lead at Up Angle

Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
   a. See Figure A-33. The core tails should be creased into the wire strands at the core crimp (1).
   b. Strands (2) of wire should be visible beyond the core crimp but not forward into the terminal shell.
   c. The insulation tails should be folded into the insulation (3) without piercing or cutting the insulation.
   d. Distortion should be minimal.
2. **Test Crimp:** Hold the terminal and pull the lead.



1. **Core crimp**
2. **Wire strands**
3. **Insulation crimp**

Figure A-33. Terminal Crimp

PACKARD 150 METRI-PACK CONNECTORS A.9

150 METRI-PACK CONNECTOR REPAIR

General

Metri-Pack connectors are embossed with the initials (P.E.D.).

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

Separating Pin and Socket Housings

Bend back the external latch slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Align the wire colors and push the pin and socket halves of the connector together.

Removing Socket Terminal

1. See Figure A-34 for pull-to-seat connector or Figure A-35 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

NOTE

For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

NOTE

The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
   a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

NOTE

On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.

6. Remove the pin.
   a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
   b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

Inserting Socket Terminal

NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. See Figure A-34 for pull-to-seat connector or Figure A-35 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Gently pull or push on the lead to verify that the terminal is locked in place.

   For push-to-seat: See Figure A-35. Seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

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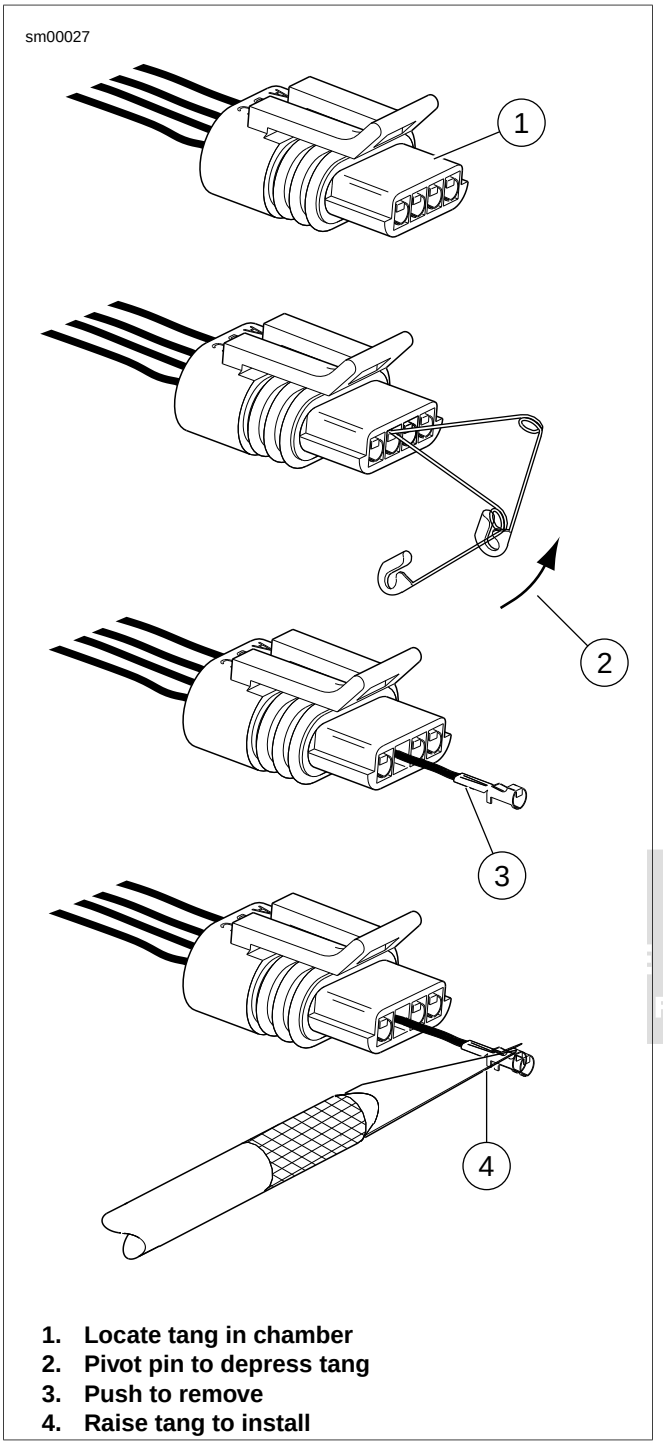
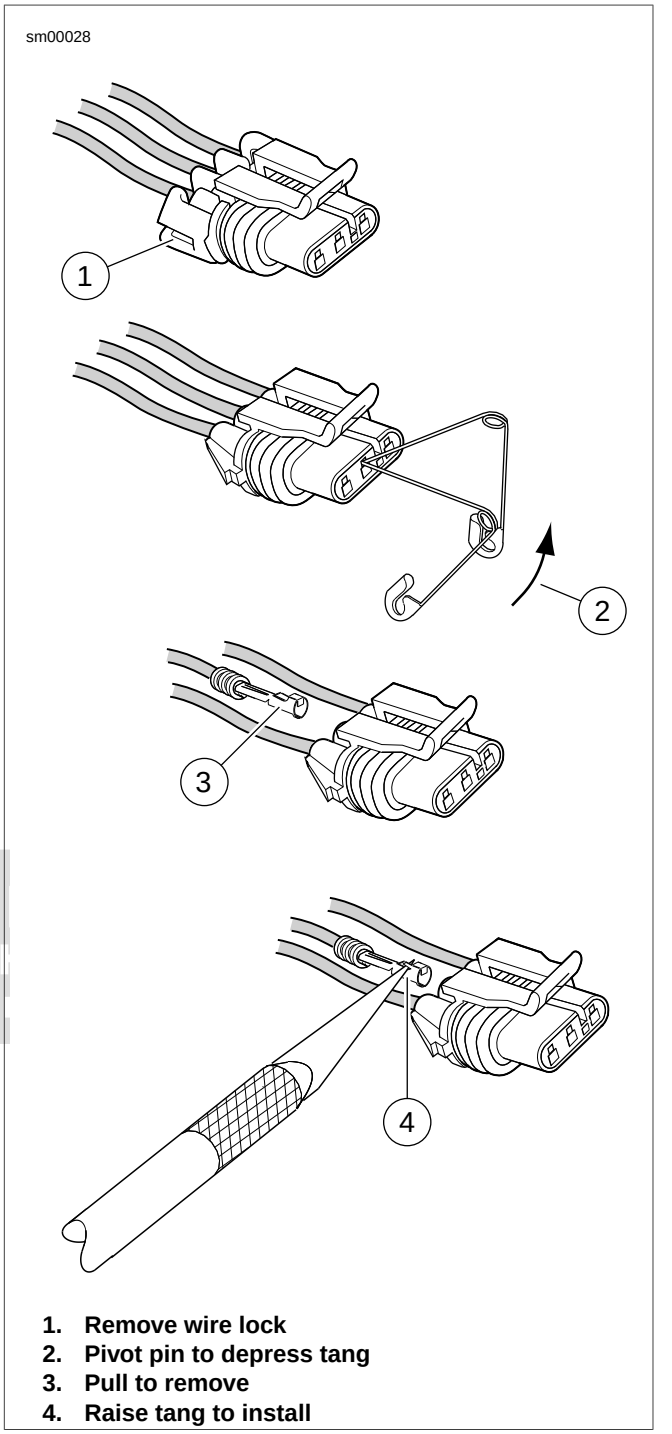


1. Locate tang in chamber
2. Pivot pin to depress tang
3. Push to remove
4. Raise tang to install

Figure A-34. 150 Metri-Pack Connector: Pull-to-Seat



1. Remove wire lock
2. Pivot pin to depress tang
3. Pull to remove
4. Raise tang to install

Figure A-35. 150 Metri-Pack Connector: Push-to-Seat

PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS A.10

FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-36. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

NOTE

For best results, start with locking wedge on outboard side of secondary lock.

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Using a thin flat blade, like that on a hobby knife, gently push tang away from terminal, and then tug on wire to back terminal out.

Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

NOTES

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-37. The main fuse block terminal cavity is identified as alpha (1) and numeric (2) coordinates. Refer to the main harness wiring diagram for fuse block terminal cavity coordinates.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place and will not back out of the chamber.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot (between rows), and push down until it bottoms.

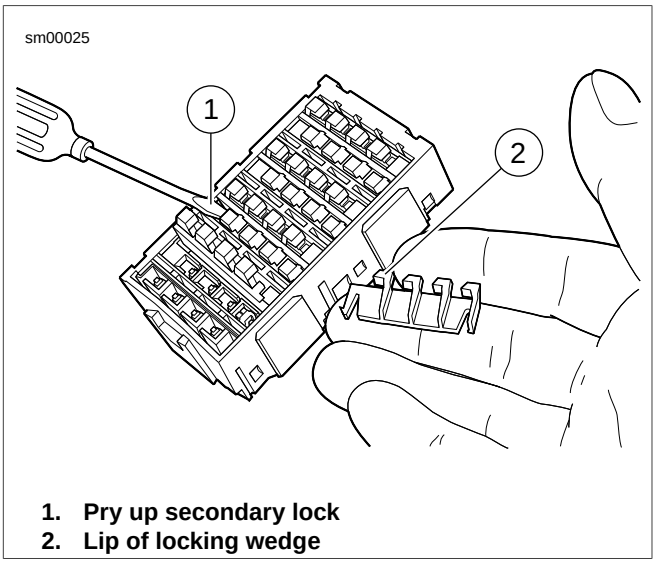
Crimping Terminals

Terminals are crimped twice; once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

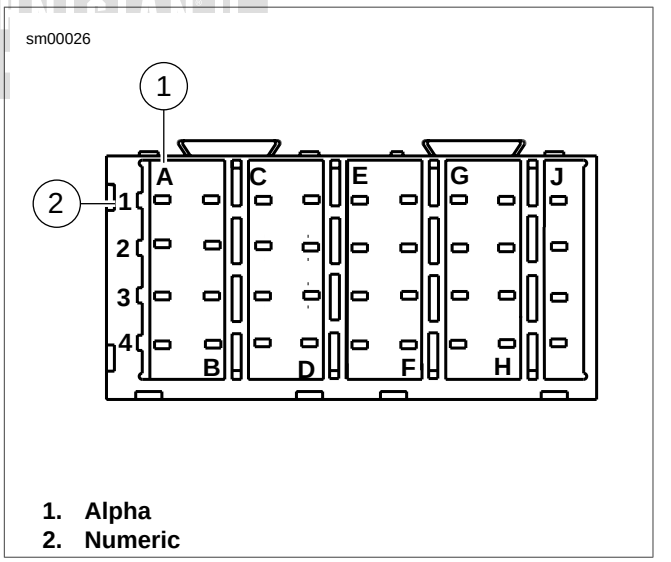
NOTE

The wiring diagram indicates when one socket terminal is be crimped to two wire leads.



1. Pry up secondary lock
2. Lip of locking wedge

Figure A-36. Fuse Block: Remove Secondary Locks



1. Alpha
2. Numeric

Figure A-37. Fuse Block: Coordinates (typical)

PACKARD 480 METRI-PACK CONNECTORS A.11

480 METRI-PACK CONNECTOR REPAIR

General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

See Figure A-38. An AFL housing (5) is used on many ignition/light switches. The secondary lock (4) must be opened before removing the terminal from the housing.

Separating Pin and Socket Housings

NOTE

Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-38. Using small flat blade screwdriver, press button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

Removing Socket Terminals

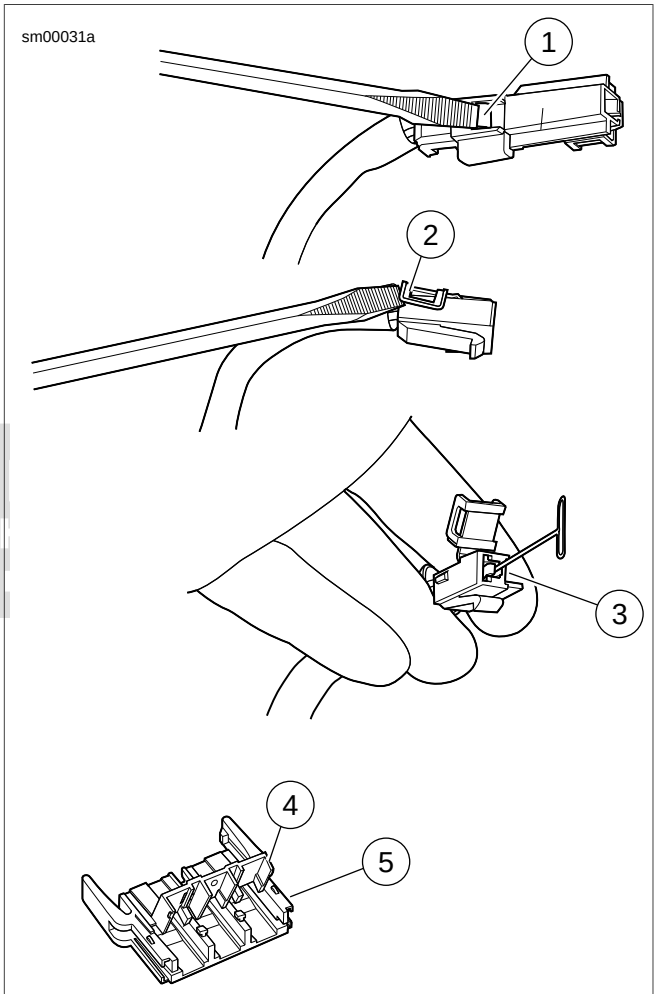
1. See Figure A-38. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to press the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.13 PACKARD METRI-PACK TERMINALS.

Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

NOTE

*If removed, install **new** anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.*



1. **Button on pin housing**
2. **Secondary lock latch**
3. **Opening between tang and chamber wall**
4. **Secondary Lock (shown open)**
5. **AFL housing**

Figure A-38. 480 Metri-Pack Connector: Remove Socket Terminal

PACKARD 630 METRI-PACK CONNECTORS A.12

630 METRI-PACK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
SNAP-ON TT600-3	SNAP-ON PICK

General

Referred to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

If necessary, remove connector from barbed anchor or other retaining device.

Bend back the external latch slightly and separate pin and socket halves of the connector.

Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

NOTE

If removed, install connector on barbed anchor or other OE retaining device.

Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.
3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. SNAP-ON TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
6. If necessary, crimp **new** terminals on wires. Refer to A.13 PACKARD METRI-PACK TERMINALS.

Installing Socket Terminal

NOTE

Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that of a hobby knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

PACKARD METRI-PACK TERMINALS A.13

METRI-PACK TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-6	PACKARD TERMINAL CRIMP TOOL
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-38125-8	PACKARD CRIMPING TOOL

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-39. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

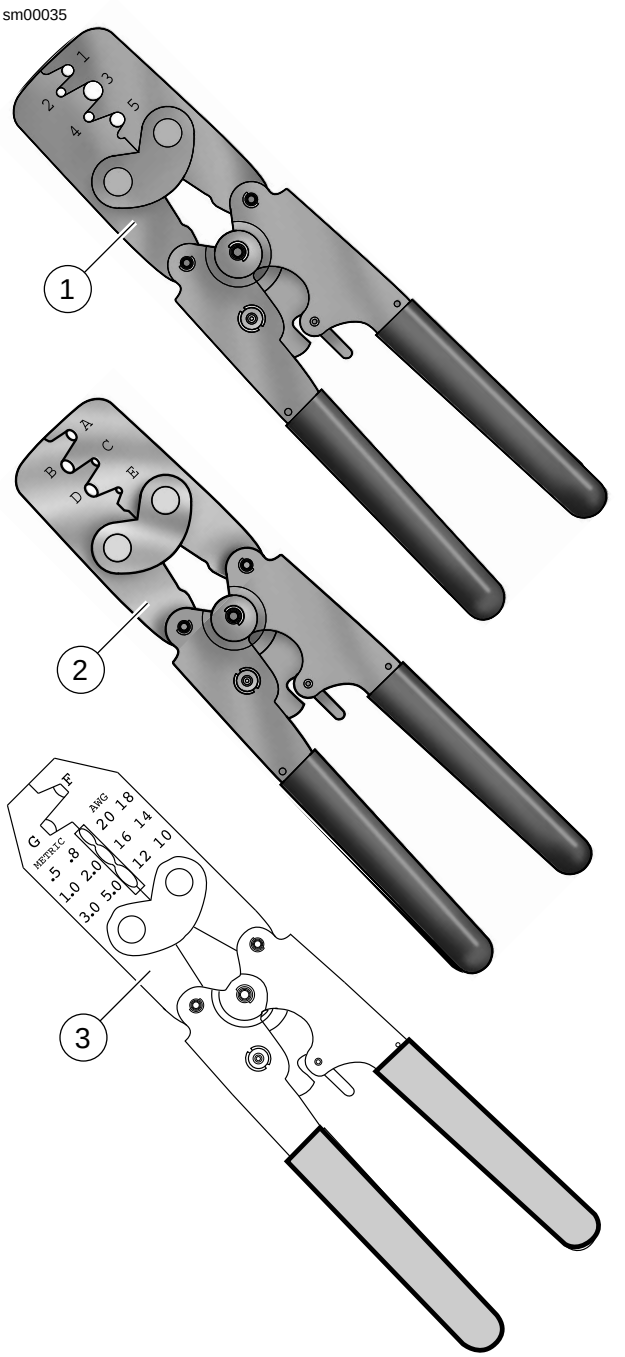
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

Crimping Wire Core

NOTE

*Metri-Pack terminal crimps require two steps. Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized nest for the core crimp.
3. Position the core crimp in the die. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.



1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

Figure A-39. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

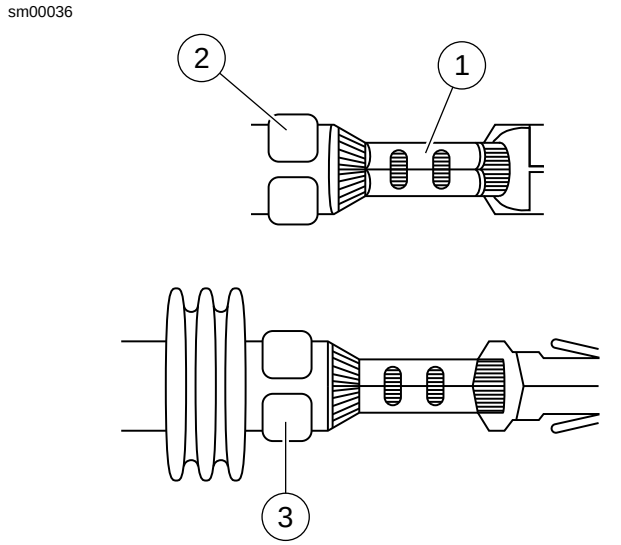
NOTE

*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-40. Identify the correct die for the insulation/seal crimp (2).
2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

Inspecting Crimps

1. See Figure A-40. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.



1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

Figure A-40. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

PACKARD ECM CONNECTOR A.14

PACKARD 100W CONNECTOR REPAIR

General

A Packard 100W connector connects the electronic control module (ECM) to the main harness.

NOTE

For vehicles with 73-pin connectors, see A.15 PACKARD MICRO-64 CONNECTORS and A.13 PACKARD METRI-PACK TERMINALS.

Separating Socket Housing From ECM

See Figure A-41. While pressing the connector into the ECM, press the thumb lever (1) against the connector until the latch (2) pops out of the catch (3) on the ECM.

Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.

Removing Socket Terminal

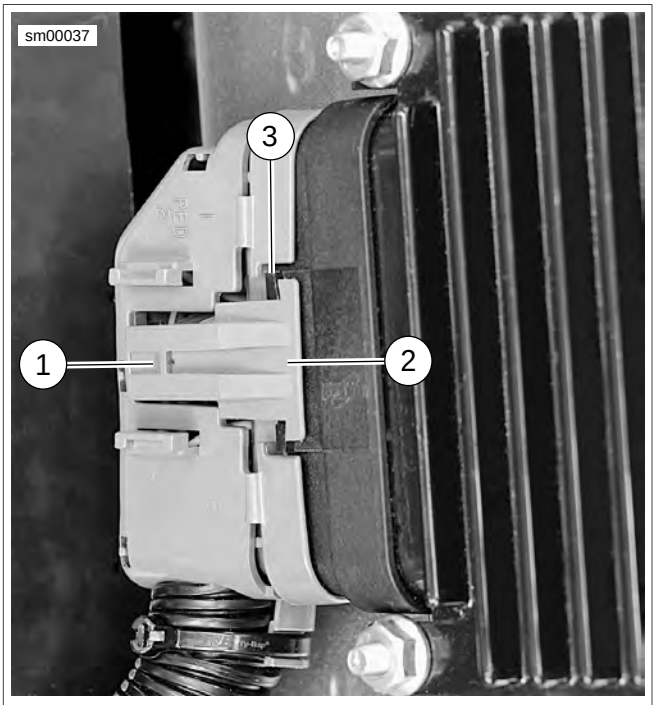
1. See Figure A-42. Gently press latch (1) on each side of the clear plastic secondary lock (2) and remove. For best results, release one side at a time.
2. Carefully cut cable strap (3) to free strain relief collar (4) from conduit (5).
3. See Figure A-43. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins (1) from slots in housing. Separate and spread halves of socket housing.
4. Push on wire lead to free terminal from chamber.

Installing Socket Terminal

1. From inside socket housing, gently pull on wire to draw terminal into chamber.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit.
4. With the two ribs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.

Crimping Terminals

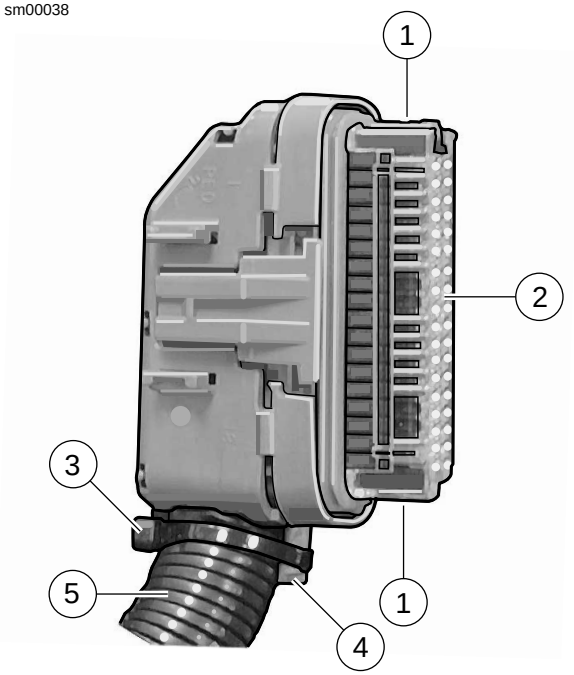
If necessary, crimp new terminals on wire leads. See A.13 PACKARD METRI-PACK TERMINALS.



1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

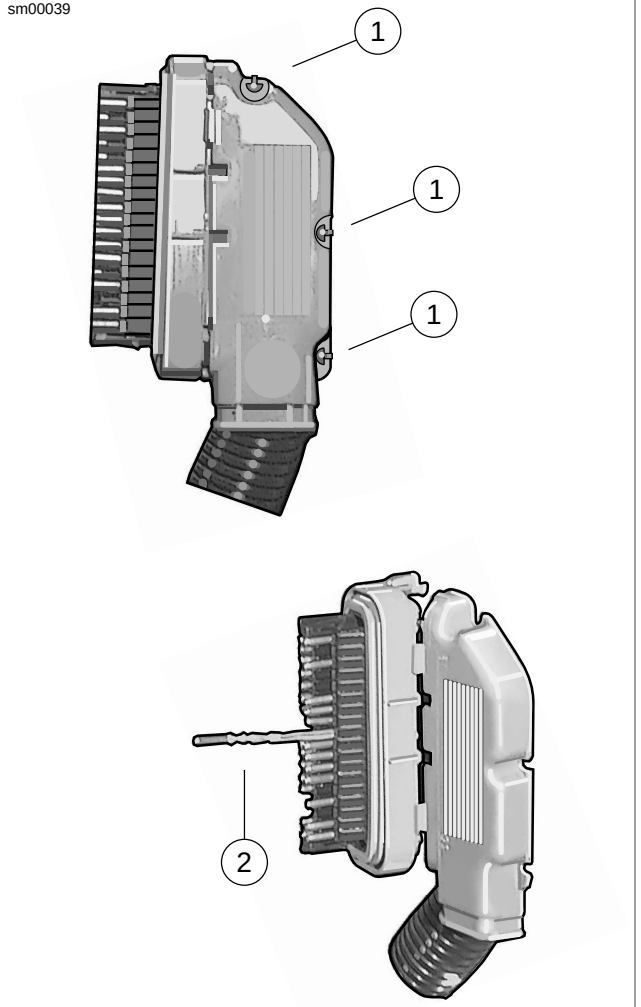
Figure A-41. Packard 100W to ECM (Typical)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. Latch
2. Secondary lock
3. Cable strap
4. Strain relief collar
5. Conduit

Figure A-42. Packard 100W Connector



1. Pins
2. Socket terminal

Figure A-43. Packard 100W Connector: Separate Halves of Socket Housing

PACKARD MICRO-64 CONNECTORS A.15

PACKARD MICRO-64 CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER

General

Packard Micro-64 connectors are frequently found on speedometers, tachometers and the ECM of Touring Models. For pin 73 of these ECMs, see A.9 PACKARD 150 METRI-PACK CONNECTORS.

Separating Pin and Socket Housings

Bend back the external latches slightly and separate the pin and socket housings.

Mating Pin and Socket Housings

Orient the wire lead colors and push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-46. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.
4. See Figure A-44. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-45. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.

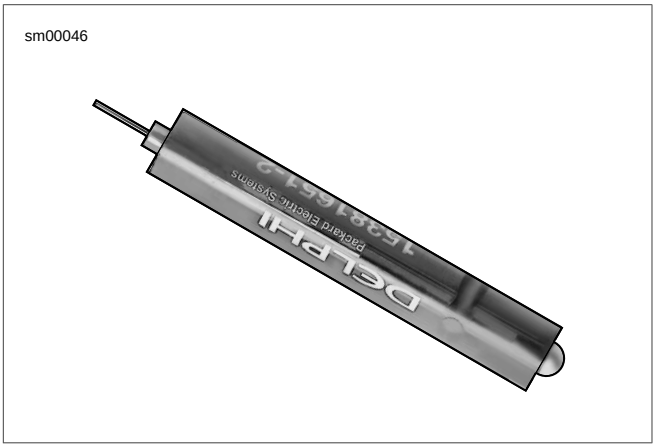


Figure A-44. Packard Micro 64 Terminal Remover (HD-45928)

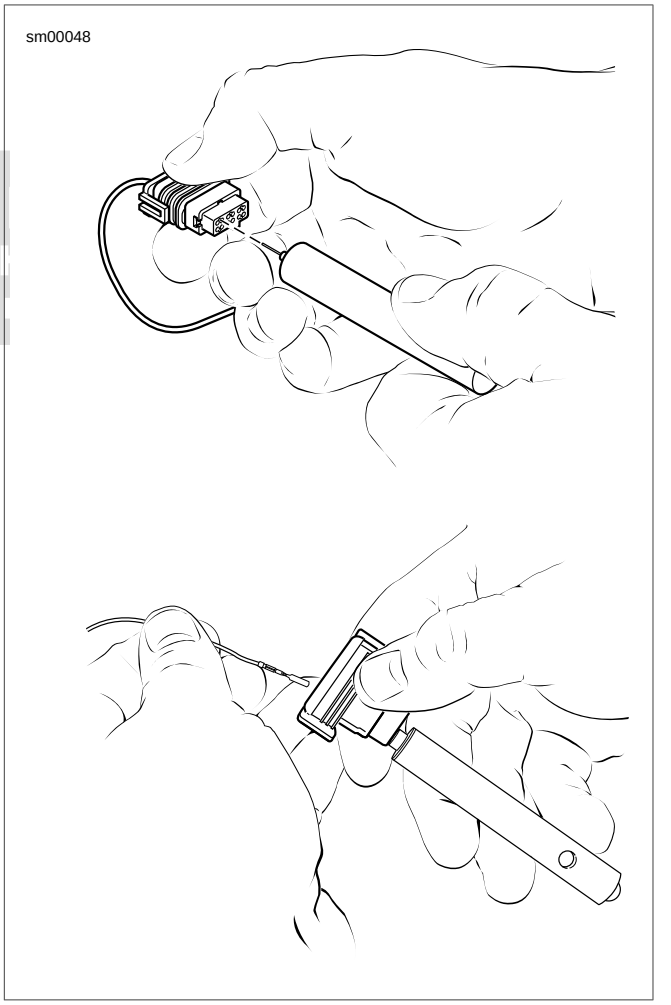


Figure A-45. Packard Micro 64 Connector: Insert Tool and Remove Terminal

Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

NOTE

See Figure A-46. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

NOTE

Once the terminal is removed it may not lock in place when first reinstalled. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

Strip lead removing 1/8 in. (3.0 mm) of insulation.

Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.

2. See Figure A-48. Squeeze the handles of the PACKARD MICRO-64 TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).

3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).

4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).

5. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails and the closed side of the terminal rests on the outer nest of the crimp tool.

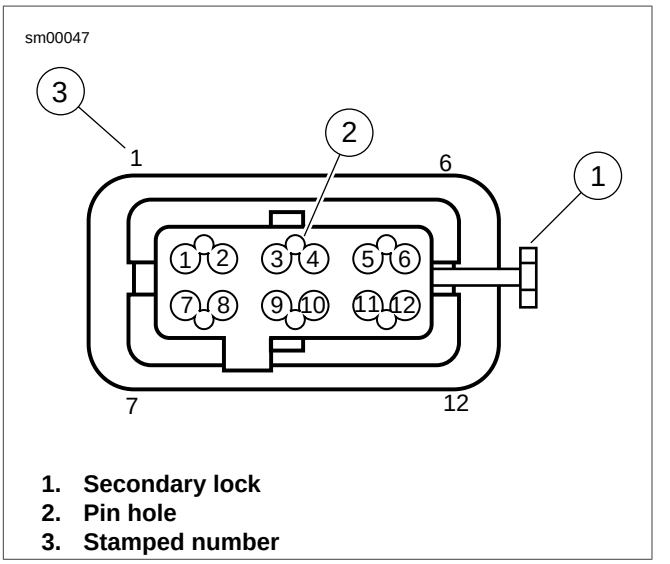
6. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.

7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.

8. Raise locking bar and barrel holder to remove contact.

Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-46. Packard Micro 64 Connector: Housing

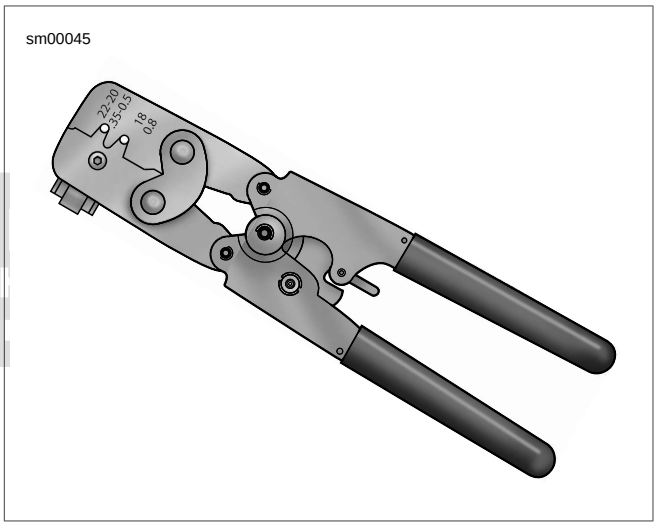
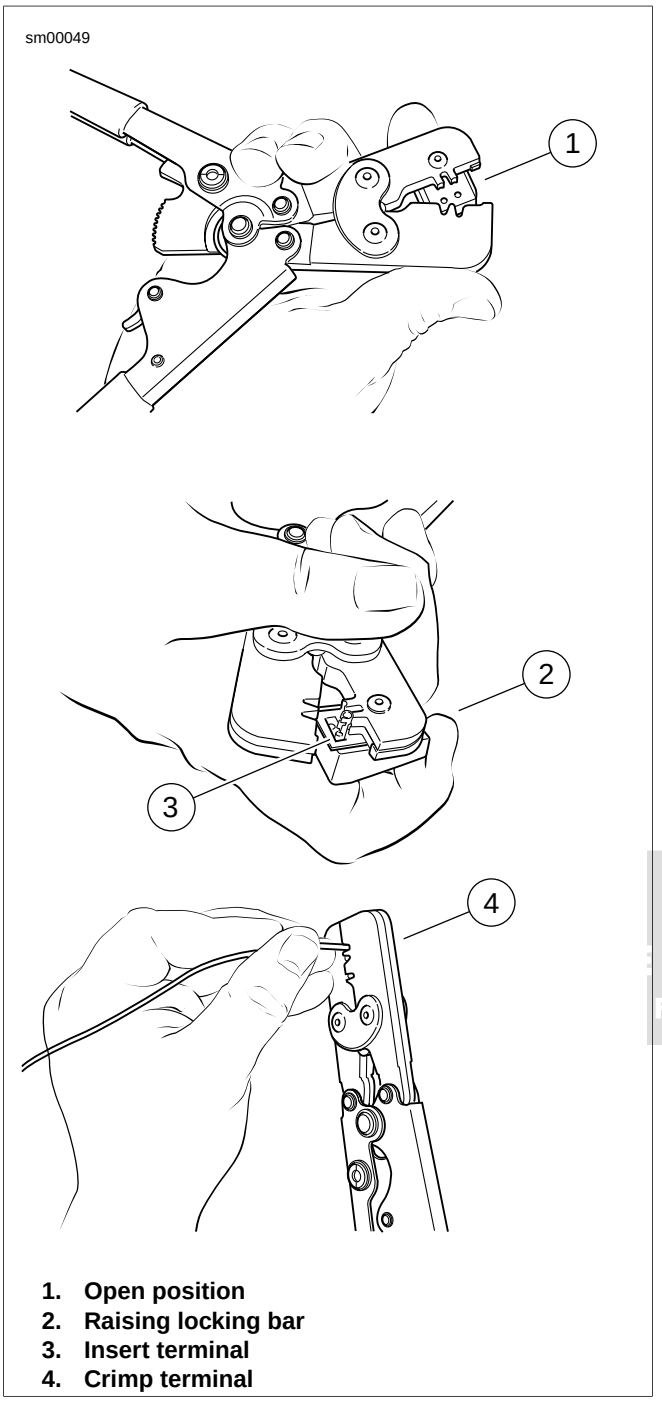


Figure A-47. Packard Micro 64 Terminal Crimper (HD-45929)



1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

Figure A-48. Packard Micro 64 Connector: Terminal in Crimper

IGITAL
CHNICIAN II
RLEY-DAVIDSON

SEALED SPLICE CONNECTORS A.16

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-5.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-5 for the strip length.

Table A-5. Sealed Splice Connectors

WIRE GAUGE	COLOR	PART NO.	STRIP LENGTH
18-20 (0.5-0.8 mm)	Red	70585-93	3/8 in. (9.5 mm)
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8 in. (9.5 mm)
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8 in. (9.5 mm)

NOTE

If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE

See Figure A-50. The connector is crimped twice - one side and then the other.

1. See Figure A-49. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-50. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

⚠WARNING

Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

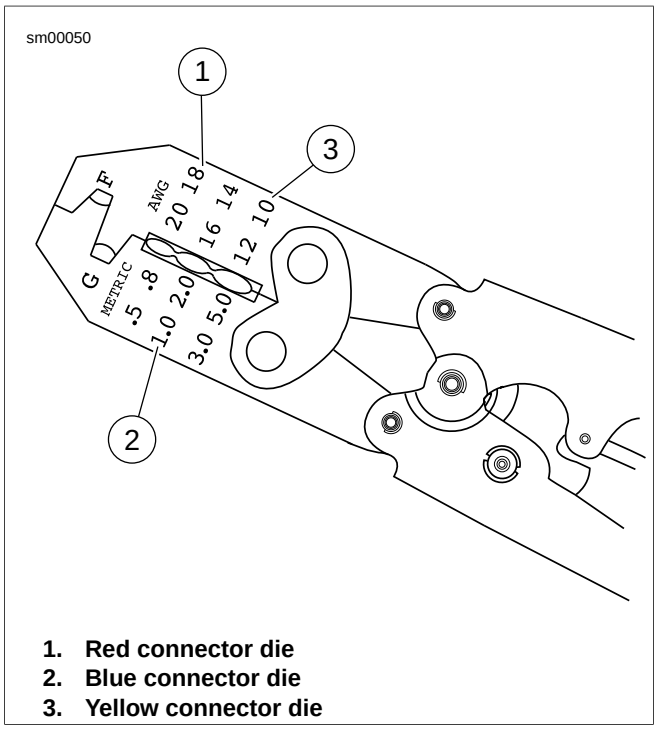
7. Use an ULTRA TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

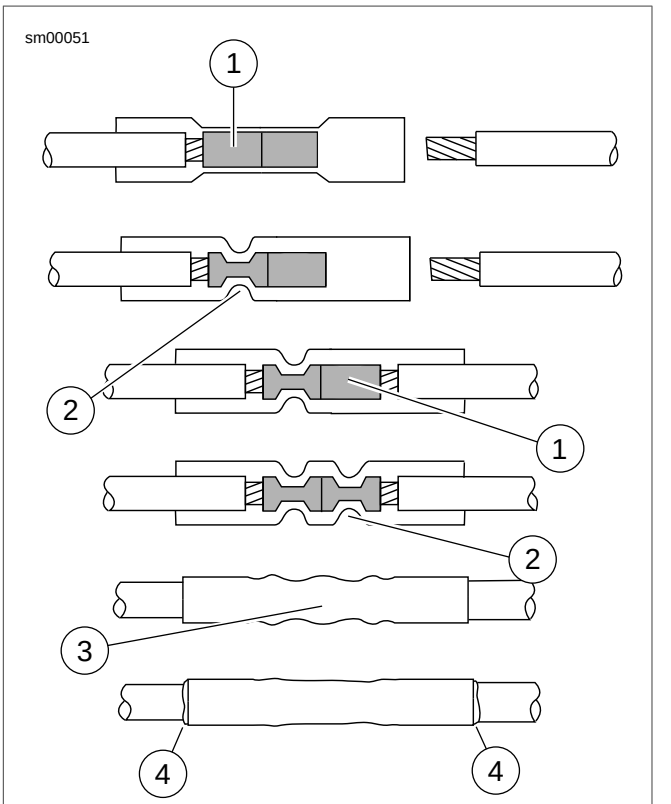
Inspecting Seals

See Figure A-50. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.



1. Red connector die
2. Blue connector die
3. Yellow connector die

Figure A-49. Packard Crimping Tool (HD-38125-8)



1. Wire lead in metal insert
2. Crimp metal insert
3. Center of crimp
4. Melted sealant

Figure A-50. Sealed Splice Connector

DIGITAL TECHNICIAN HARLEY-DAVIDSON

NOTES

TABLE OF CONTENTS

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

CONNECTORS B.1

CONNECTOR LOCATIONS

Function/Location

On the motorcycle, a connector can be identified by its function and location. Refer to Table B-1.

Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in Appendix A are by connector type. Refer to Table B-1.

Table B-1. Buell Connector Locations

No.	Description	Type	Location
[5]	J-Fuse	Spade terminals	Under seat (Firebolt only)
[7]	Tail harness	8-place Amp Multilock	Left side under tail section (Firebolt only)
[10]	Electronic Control Module (ECM) (black)	34-place Amp (Tyco)	Under seat (Ulysses, Lightning)
			In fairing (Firebolt)
[11]	Electronic Control Module (ECM) (gray)	34-place Amp (Tyco)	Under seat (Ulysses, Lightning)
			In fairing (Firebolt)
[18]	Right rear turn signal	2 1-place bullet	Under rear wire cover (Ulysses)
			Under seat (Lightning)
			Under tail section (Firebolt)
[19]	Left rear turn signal	2 1-place bullet	Under rear wire cover (Ulysses)
			Under seat (Lightning)
			Under tail section (Firebolt)
[22]	Right hand controls	4-place Amp Multilock	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[24]	Left hand controls	8-place Amp Multilock	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[30]	Flasher	5-place Amp	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[31R]	Right front turn signal	2 1-place bullet	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[31L]	Left front turn signal	2 1-place bullet	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[33]	Ignition switch	4-place Augat	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[38]	Headlight connector	4-place Amp Multilock	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[39]	Instrument module	20-place Amp Multilock	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[45]	License plate lamp	2 1-place bullet	Under rear wire cover (Ulysses, Lightning)
			Under tail section (Firebolt)
[46]	Stator	2-place Dekko	Below left ram air scoop
[61]	Fuse assembly	Socket terminals	Under seat (Ulysses, Lightning)
			Right side of fairing (Firebolt)

DIGITAL TECHNICIAN HARLEY-DAVIDSON®

Table B-1. Buell Connector Locations

No.	Description	Type	Location
[62]	Relay assy	Spade terminals	Under seat (Ulysses, Lightning)
			Left side of fairing (Firebolt)
[65]	Vehicle Speed Sensor (VSS)	3-place Delphi	Right rear top of crankcase
[77]	Voltage regulator	2-place Dekko	Behind left ram air scoop
[79]	Crank Position (CKP) sensor	2-place Mini-Deutsch	Below left ram air scoop
[83]	Ignition coil	3-place Delphi	Beneath aircleaner baseplate
[84]	Front fuel injector	2-place Packard	Beneath aircleaner baseplate
[85]	Rear fuel injector	2-place Packard	Beneath aircleaner baseplate
[86]	Fuel pump	4-place Amp Multilock	Left side of frame
[87]	Idle air control	4-place Delphi	Beneath air cleaner baseplate
[88]	Throttle Position (TP) sensor	3-place Amp	Beneath air cleaner baseplate
[89]	Intake Air Temperature (IAT) sensor	2-place Amp	In air cleaner baseplate
[90]	Engine Temperature (ET) sensor	1-place Delphi Metri-pack	Beneath aircleaner baseplate
[91A]	Data link connector	4-place Deutsch	Beneath left airflow guide (Ulysses)
			Under seat (Lightning)
			Under fairing (Firebolt)
[93]	Tail light	3-place Amp (Tyco) (Ulysses)	Back of tail light, under seat
		3 spade terminals (Lightning, Firebolt)	
[95]	Clutch switch	2-place Sumitomo	Underside of clutch lever assembly
[97]	Cooling fan	2-place Amp Multilock	Behind rear cylinder under seat
[120]	Oil pressure switch	Post terminal	Bottom of oil pump
[121]	Rear brake switch	2-place Amp Multilock	Under seat
[122]	Horn	Spade terminals	Behind windscreen (Ulysses, Lightning)
			In fairing (Firebolt)
[128]	Starter solenoid	Spade terminal	Top of starter
[131]	Neutral switch	1-place bullet	Under sprocket cover
[133]	Side stand sensor	3-place Deutsch	Behind left ram air scoop
[134]	Bank angle sensor	6-place Sumitomo	Under seat (Ulysses, Lightning)
			In fairing (Firebolt)
[137]	Oxygen sensor	1-place Delphi	Above rear cylinder head
[160]	Front auxiliary power outlet	2-place Sumitomo	Behind windscreen (Ulysses, Lightning)
			Beneath fairing (Firebolt)
[161]	Interactive exhaust to actuator	4-place EPC	Under intake cover
[165]	Interactive exhaust subharness to main harness	3-place Deutsch	Under seat
[178]	Active intake system to solenoid	2-place Deutsch	Under air cleaner cover
[180]	Rear auxiliary power outlet	2-place Sumitomo	Under seat (Ulysses only)
[189L]	Left heated grip	3-place Deutsch	Behind windscreen (Ulysses only)
[189R]	Right heated grip	3-place Deutsch	Behind windscreen (Ulysses only)
[206]	Heated grip subharness connector	3-place Sumitomo	Behind windscreen (Ulysses only)

WIRING DIAGRAMS B.2

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-2.

For Solid Color Wires: See Figure B-1. The alpha code identifies wire color (3).

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

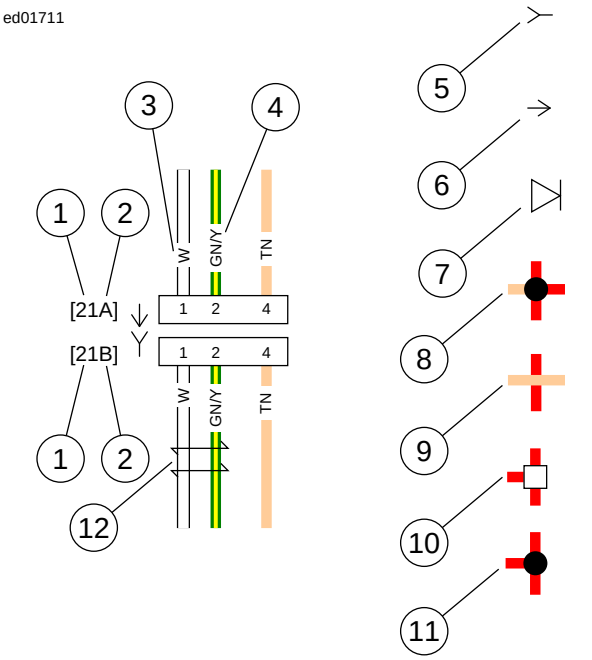
See Figure B-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A after a connector number and the pin symbol (6) identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol verifying that no connection (9) between two wire traces exists, symbols for actual (10) and virtual (11) splices, and a symbol identifying two wires that are twisted together (12).

Actual splices (10) are splices where two wires are connected together at a specific location along a wire. Virtual splices (11) are splices shown connected anywhere along a wire, usually used in a wiring or schematic diagram for clarity.



1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Connection**
9. **No connection**
10. **Physical splice**
11. **Virtual splice**
12. **Twisted pair**

Figure B-1. Connector/Wiring Diagram Symbols (typical)

Table B-2. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Gray
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

2009 XB WIRING DIAGRAMS

Wiring Diagram List

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

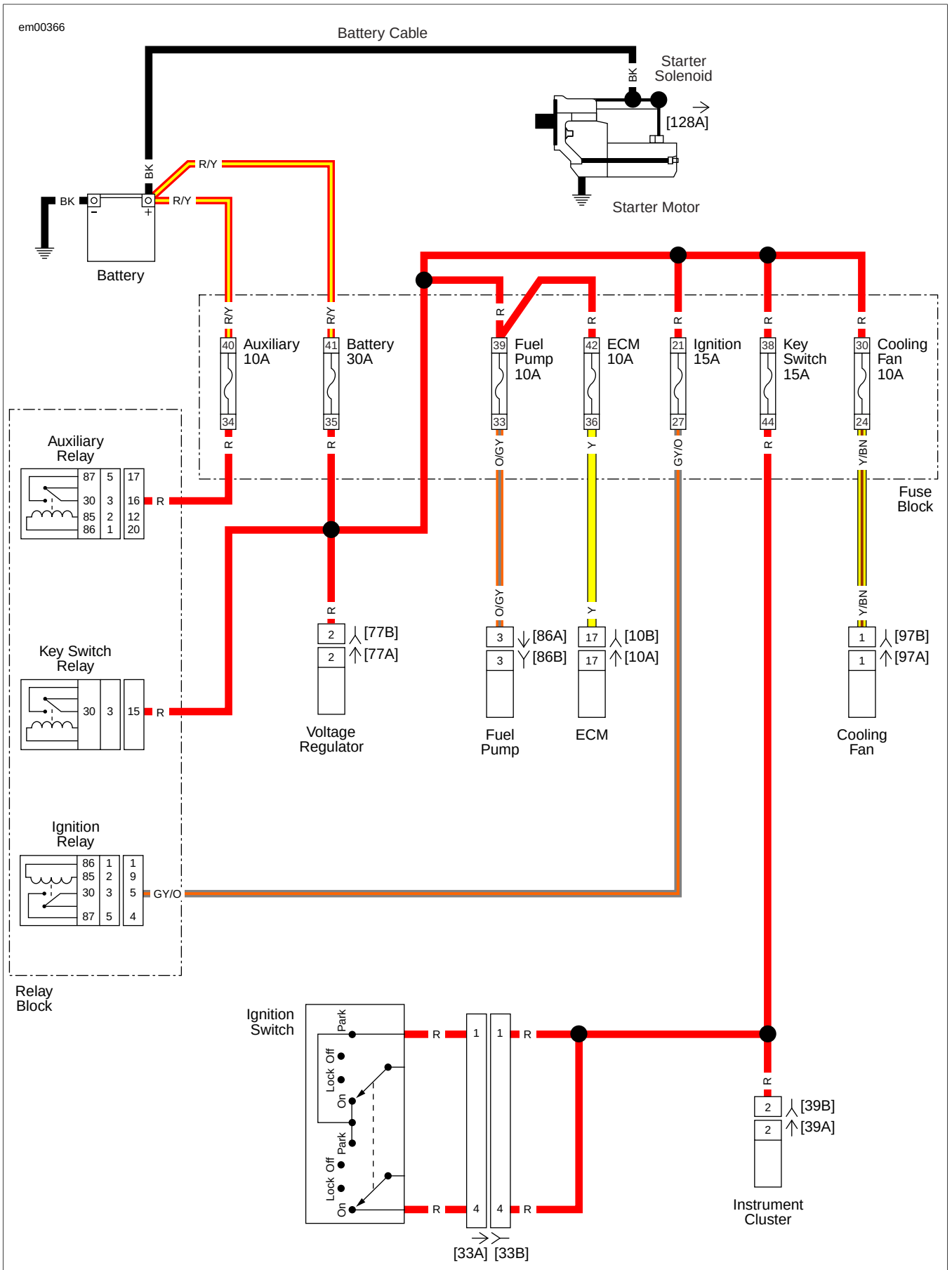


Figure B-2. Battery Power: 2009 XB Model (Ulysses, Lightning)

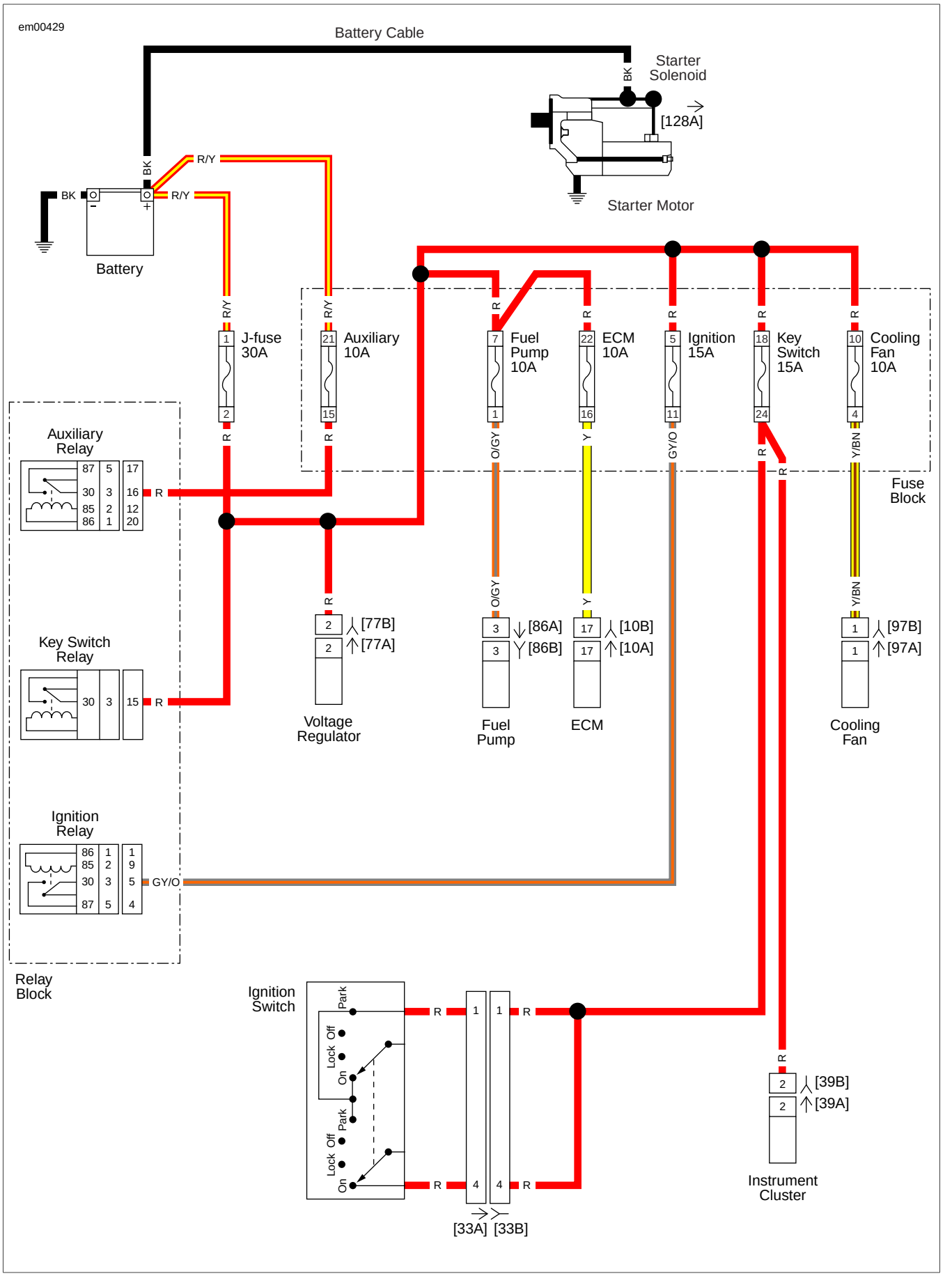


Figure B-3. Battery Power: 2009 XB Model (Firebolt)

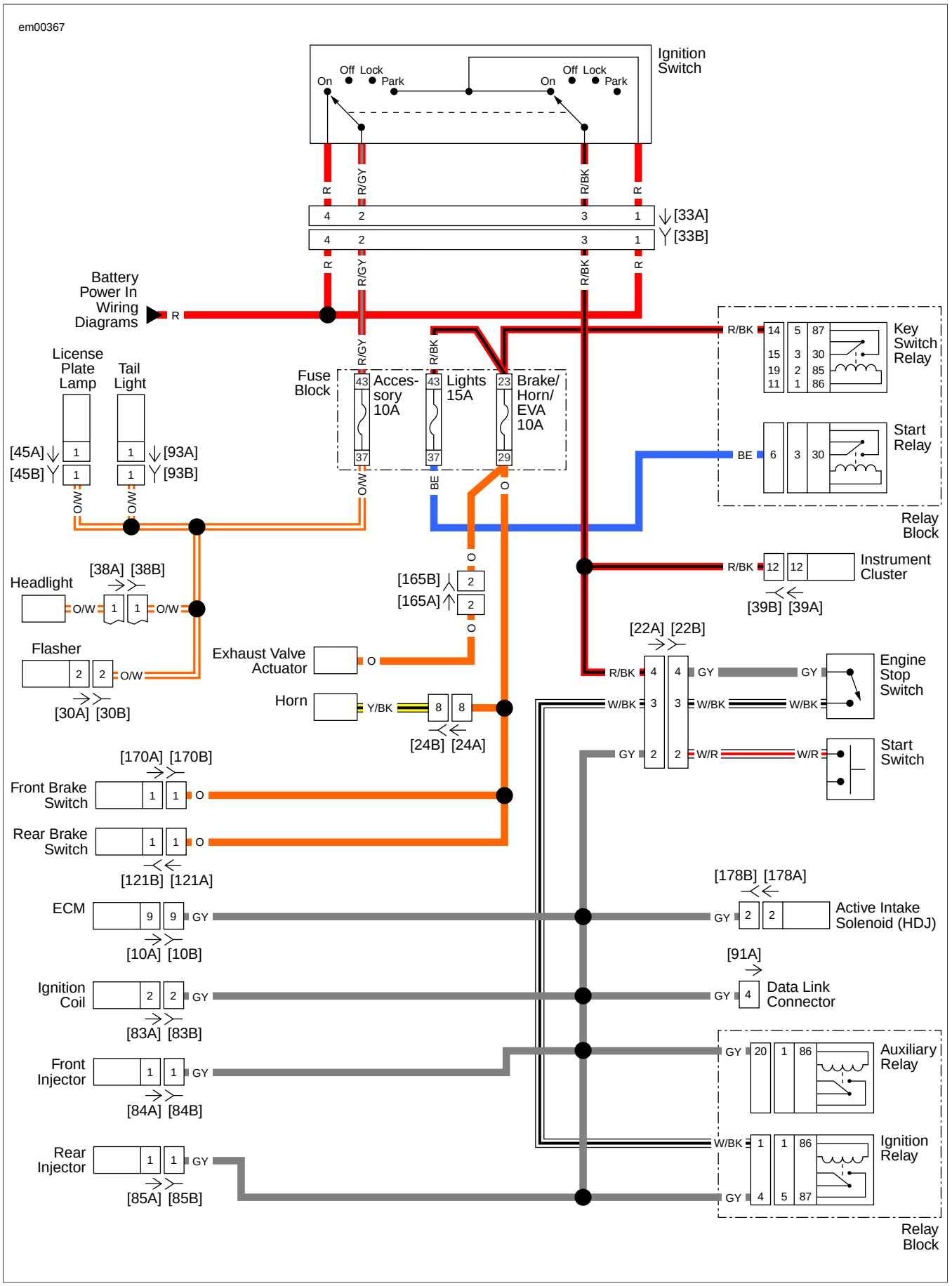


Figure B-4. Ignition/Accessory Power: 2009 XB Model (Ulysses, Lightning)

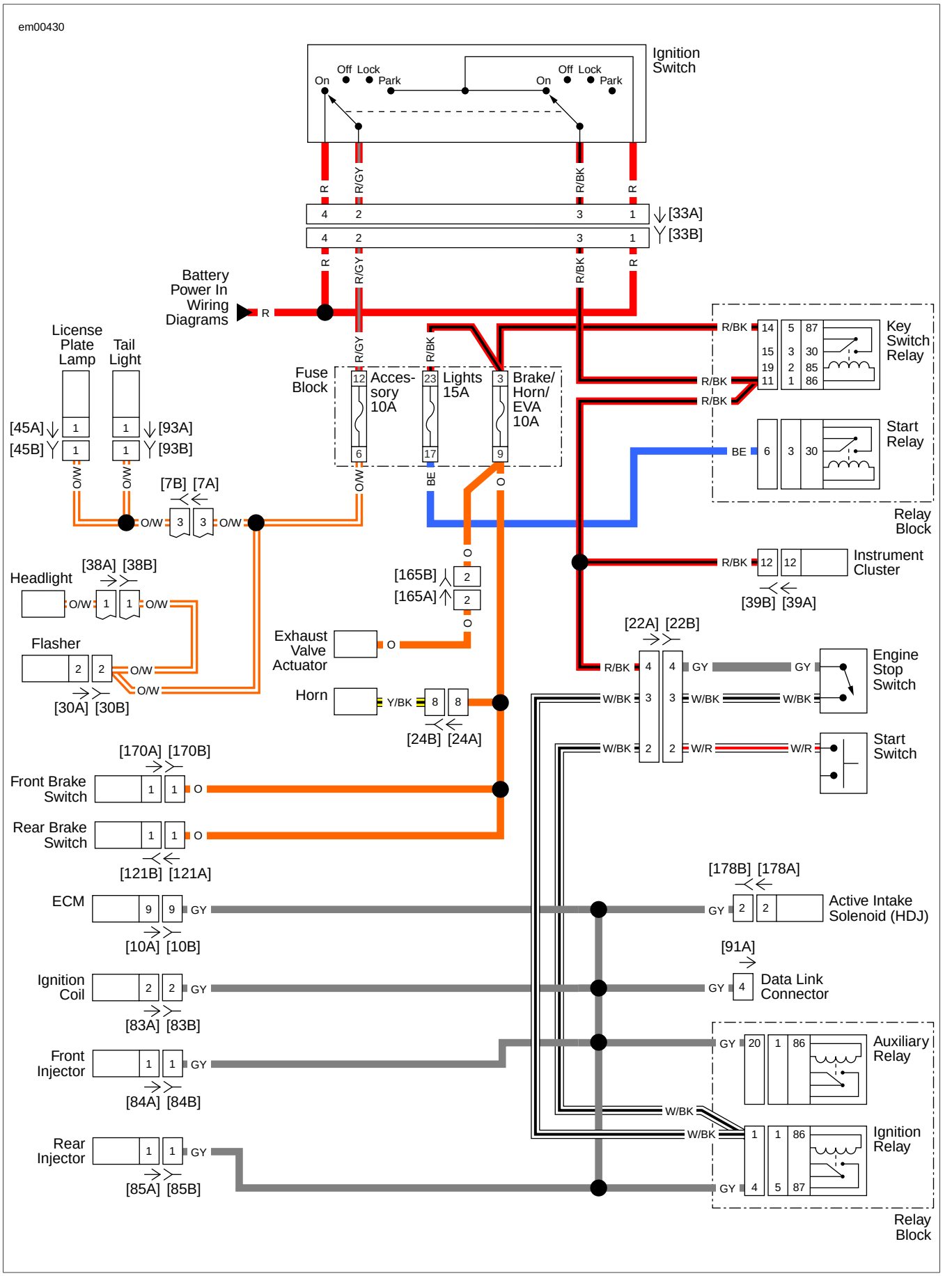


Figure B-5. Ignition/Accessory Power: 2009 XB Model (Firebolt)

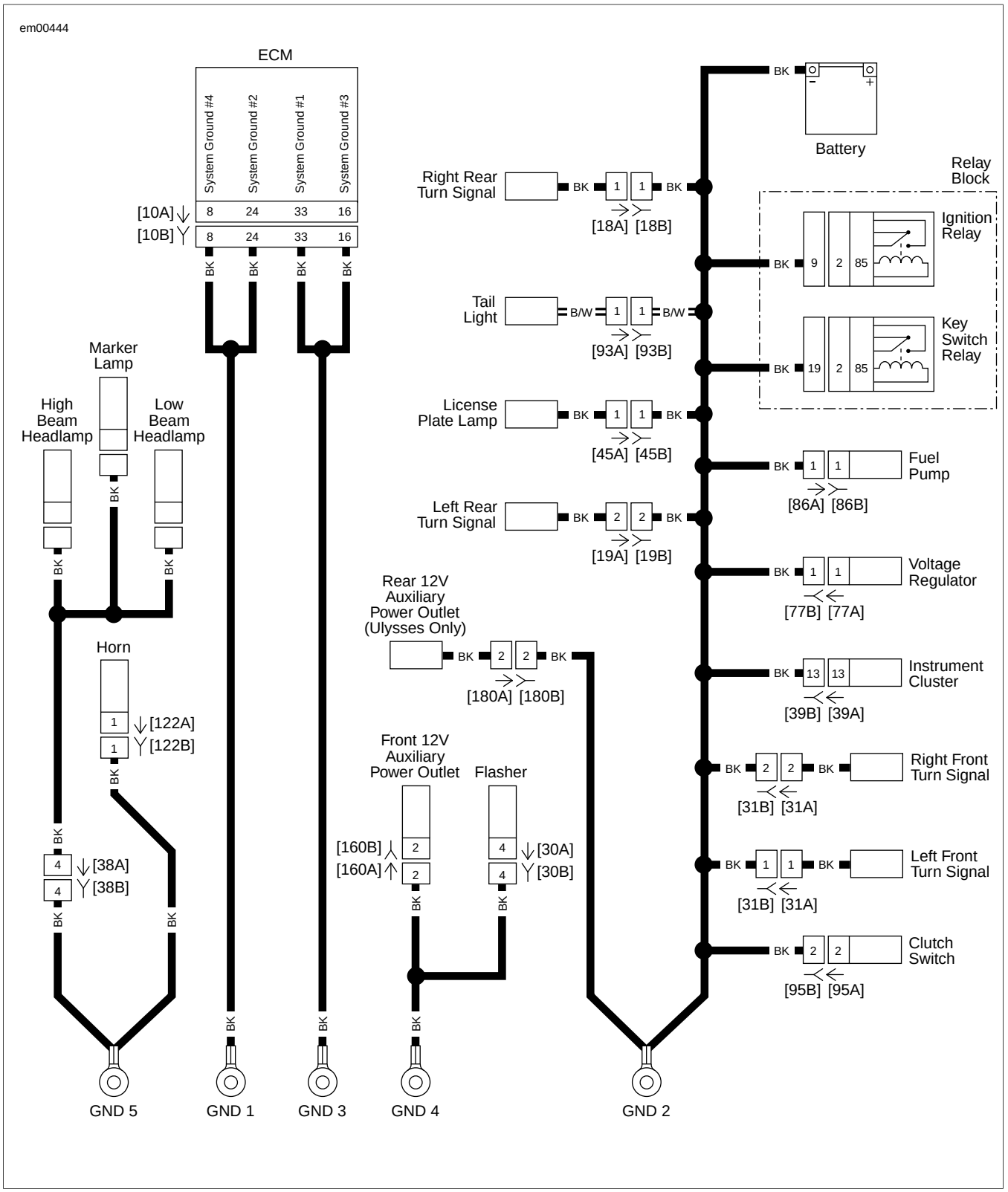


Figure B-6. Chassis Grounds: 2009 XB Model (Ulysses, Lightning)

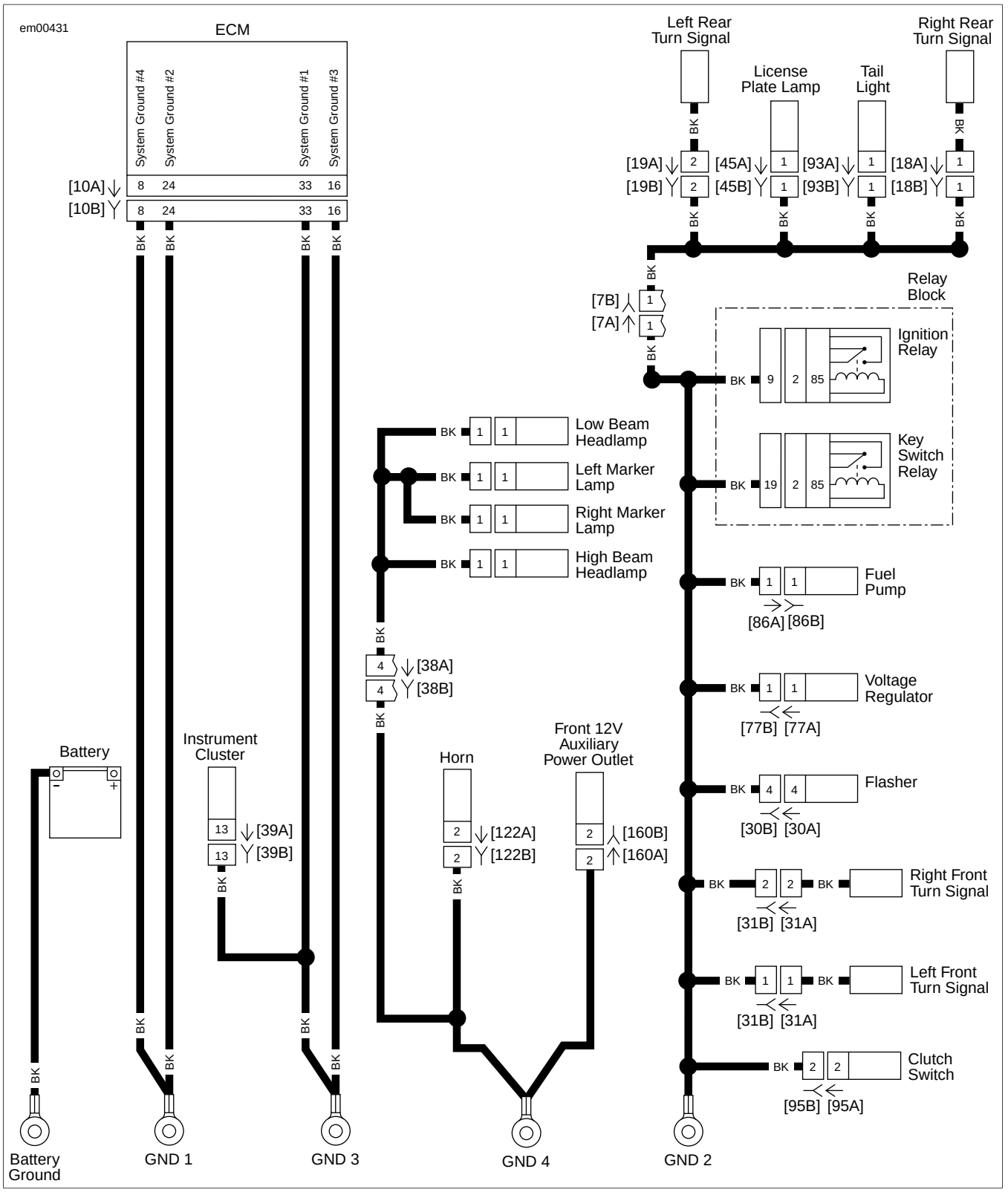


Figure B-7. Chassis Grounds: 2009 XB Model (Firebolt)

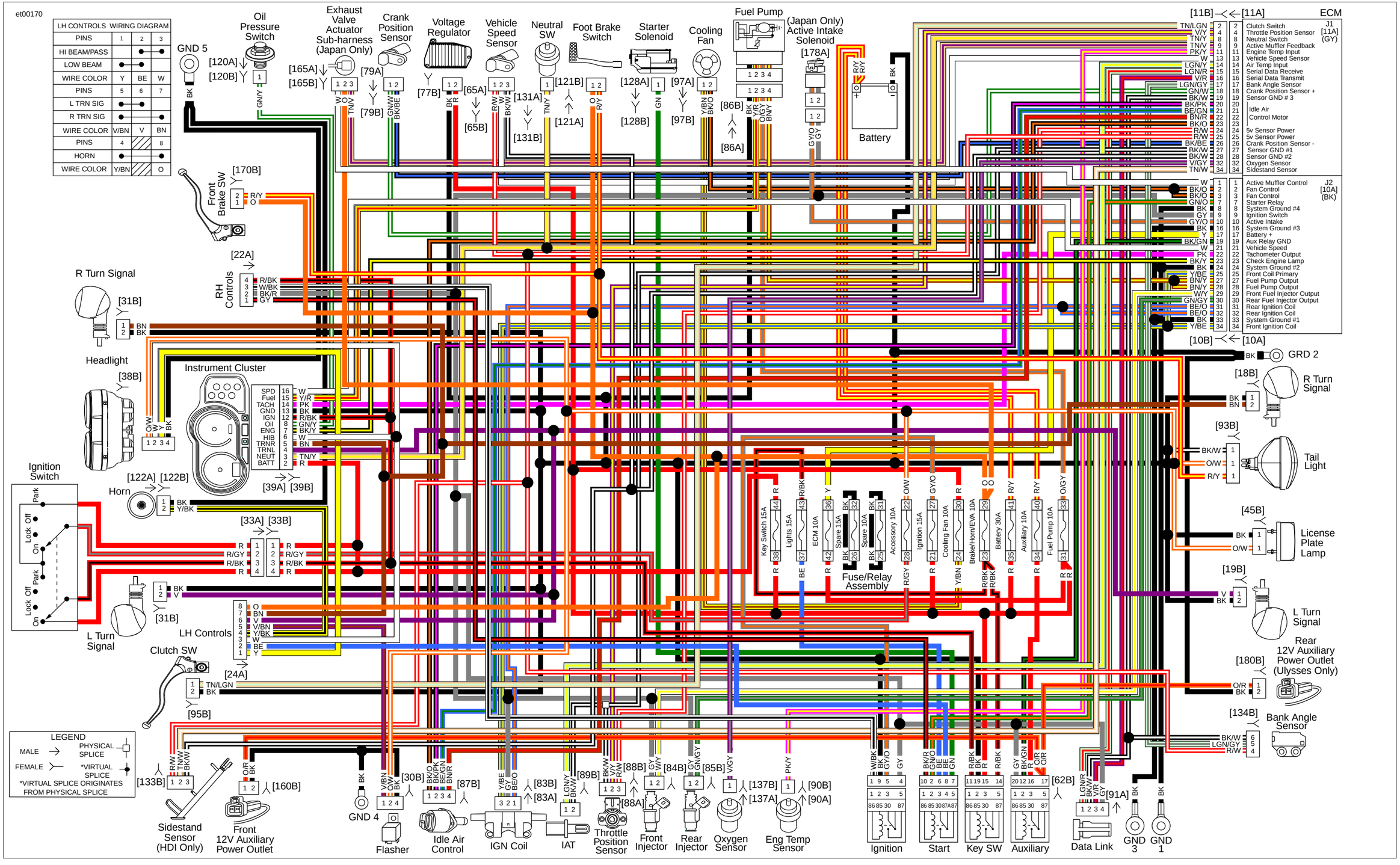


Figure B-8. Main Harness: 2009 XB Model (Ulysses and Lightning)

Figure B-8.
Main Harness: 2009 XB Model (Ulysses and Lightning)

Figure B-8.
Main Harness: 2009 XB Model (Ulysses and Lightning)

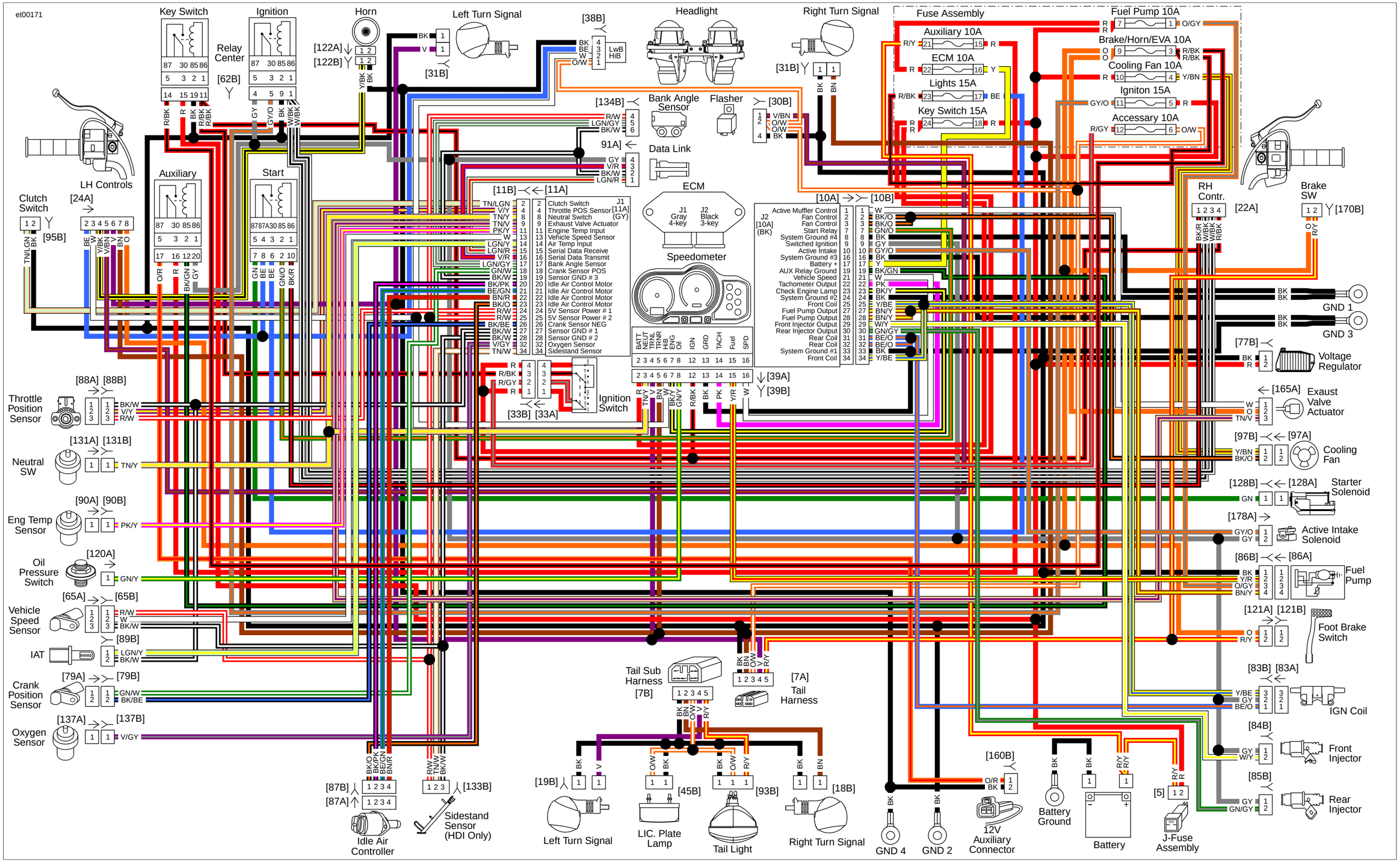


Figure B-9. Main Harness: 2009 XB Model (Firebolt)

Figure B-9.
Main Harness: 2009 XB Model (Firebolt)

Figure B-9.
Main Harness: 2009 XB Model (Firebolt)

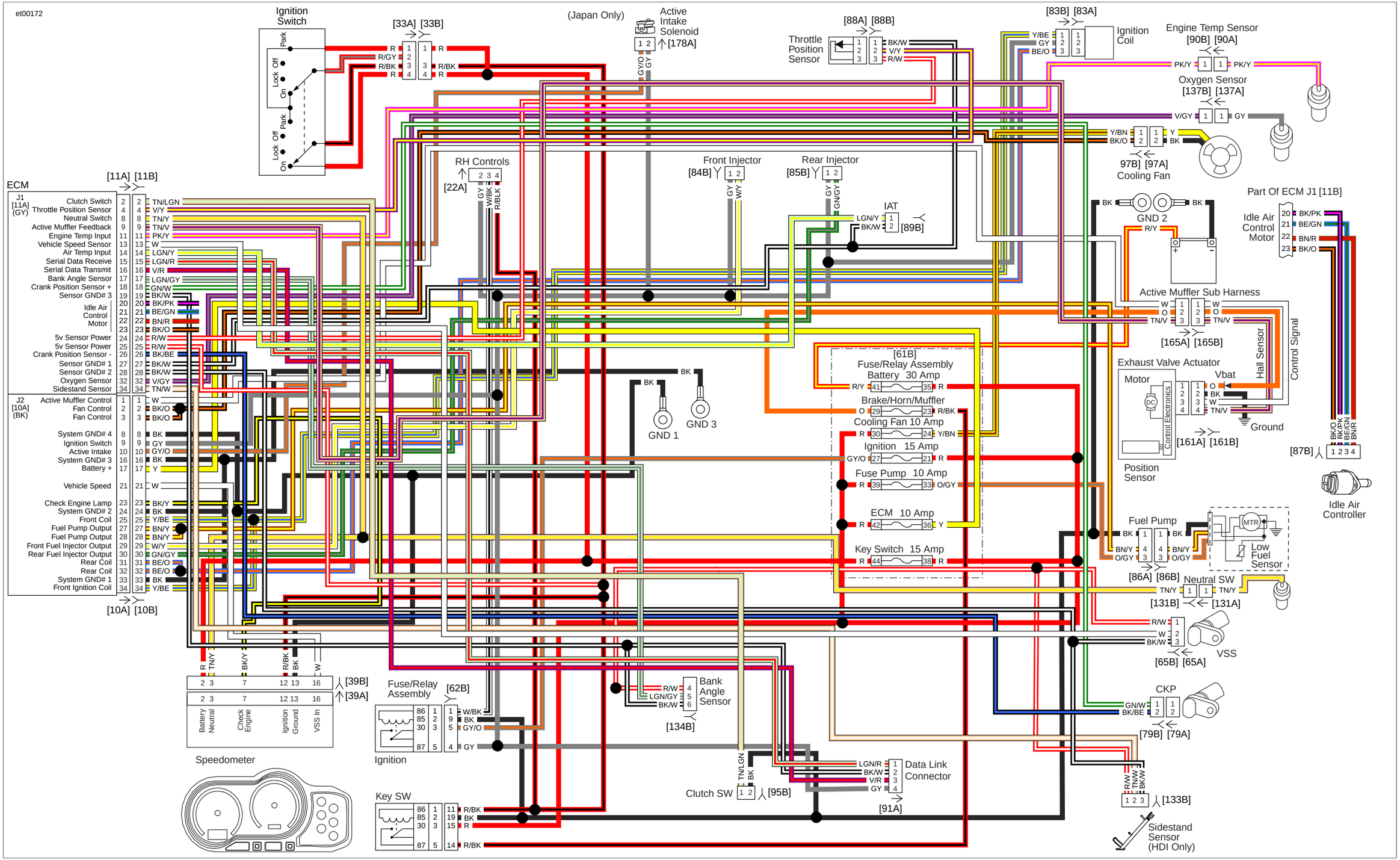
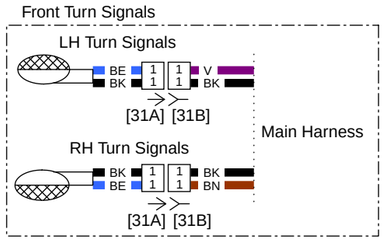


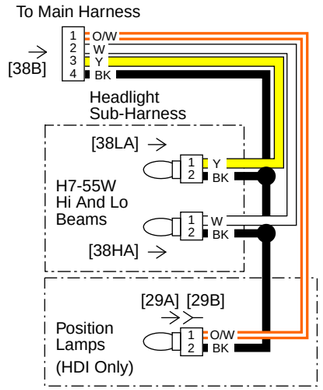
Figure B-10. Engine Management Circuit: 2009 XB Model

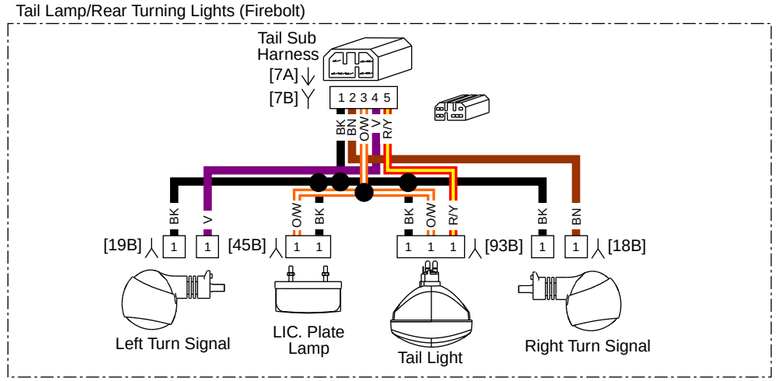
Figure B-10.
Engine Management Circuit: 2009 XB Model

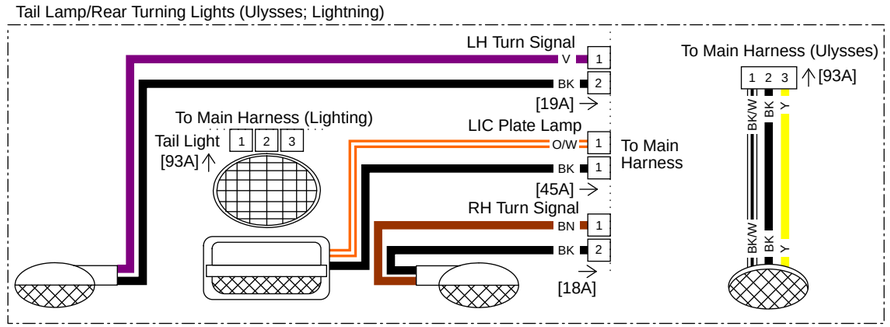
Figure B-10.
Engine Management Circuit: 2009 XB Model

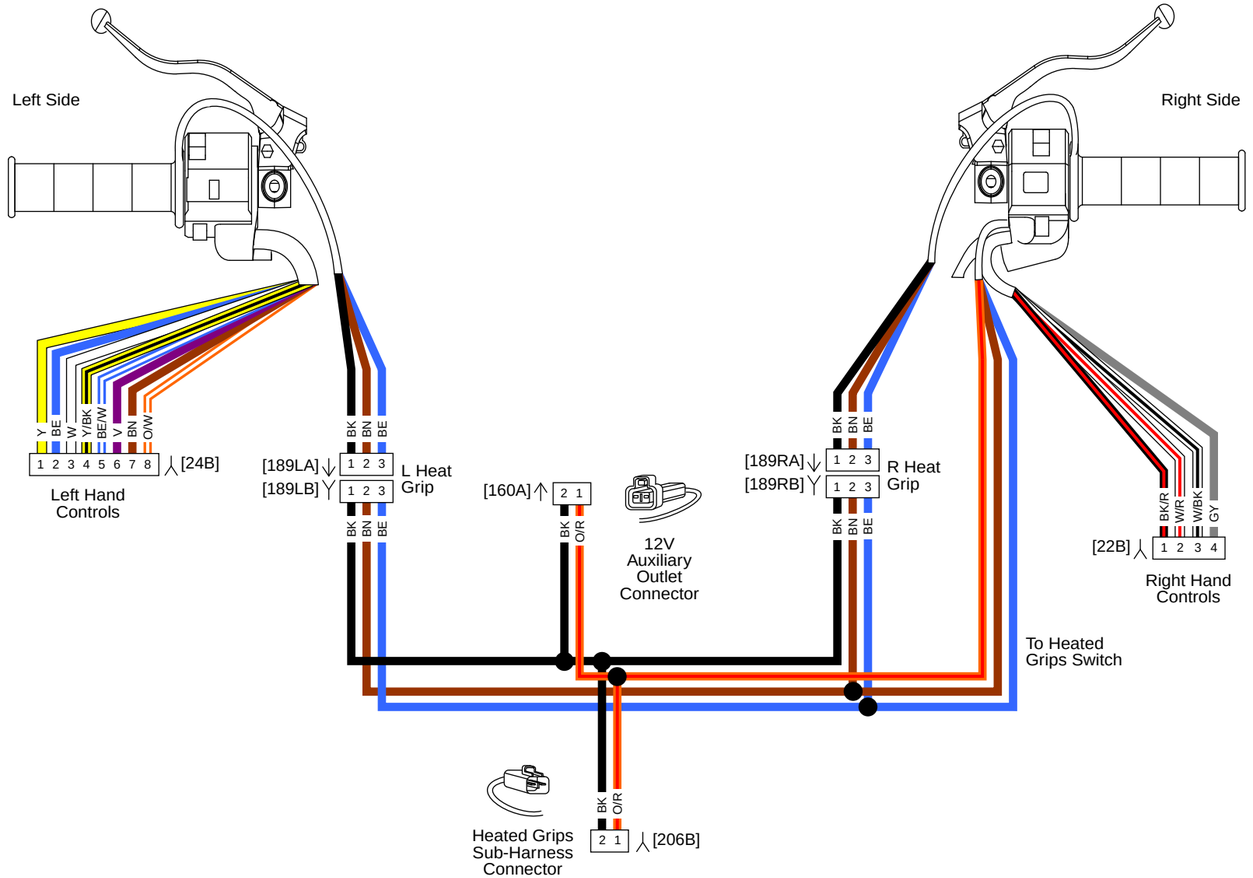
et00173

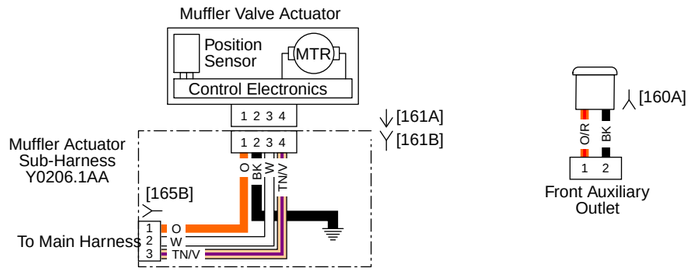












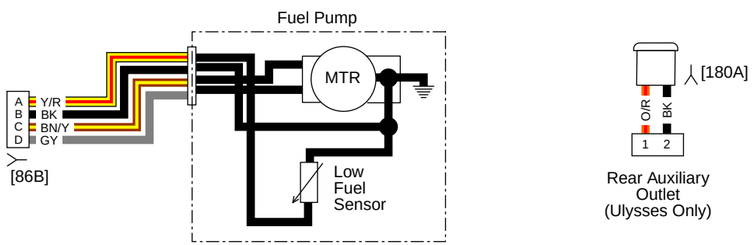


Figure B-11. Component Wiring Diagrams: 2009 XB Model

Figure B-11.
Component Wiring Diagrams: 2009 XB Model

Figure B-11.
Component Wiring Diagrams: 2009 XB Model

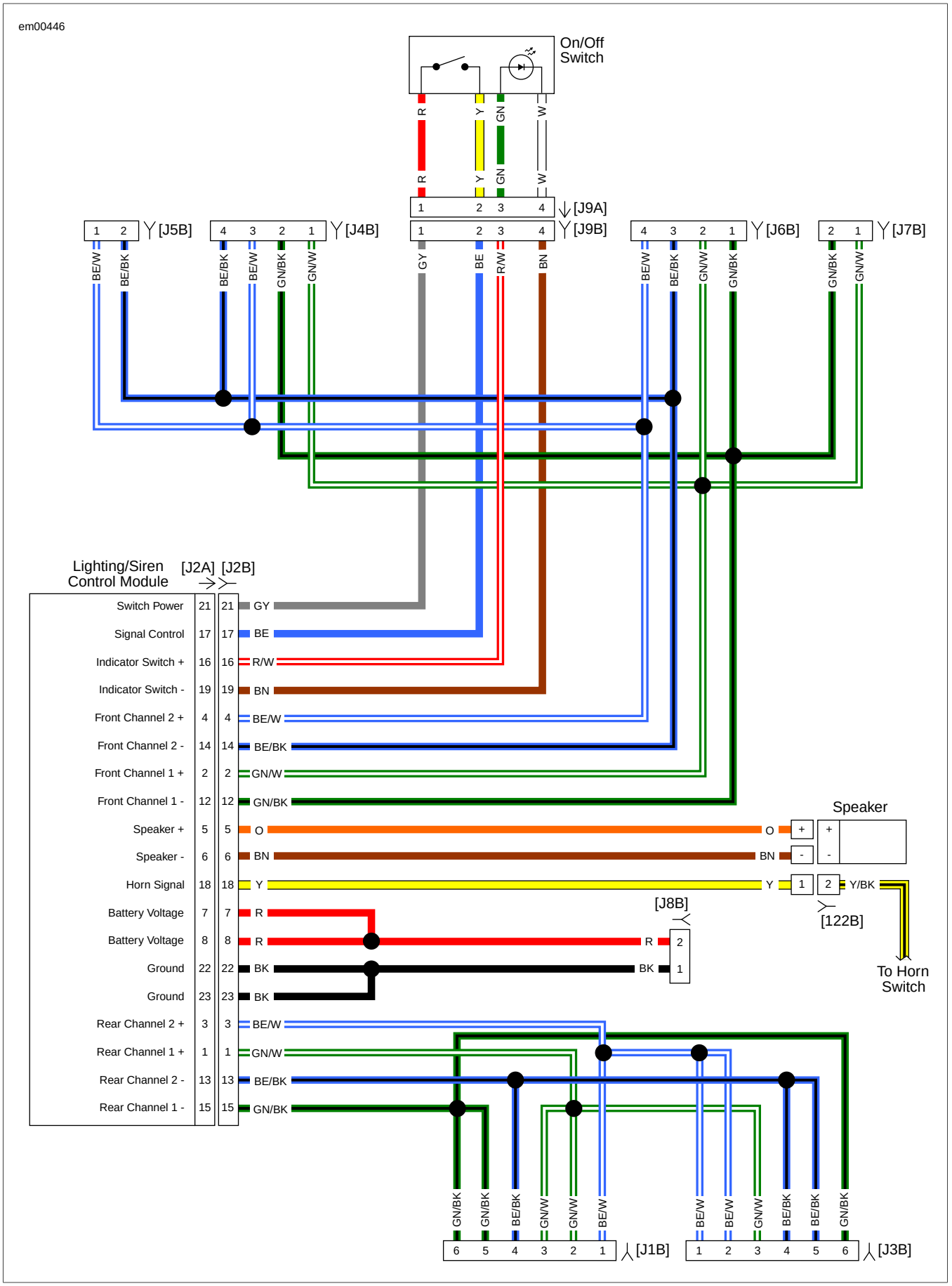


Figure B-12. Police Harness: 2009 XB Model (Ulysses)

NOTES

TABLE OF CONTENTS

SUBJECT **PAGE NO.**

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

LENGTH CONVERSION C.1

CONVERSION TABLE

Table C-1. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN)								INCHES to MILLIMETERS (IN x 25.40 = MM)							
mm	in	mm	in	mm	in	mm	in	in	mm	in	mm	in	mm	in	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

FLUID CONVERSION C.2

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON®

TORQUE CONVERSION C.3

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

NOTES

TABLE OF CONTENTS

SUBJECT **PAGE NO.**

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

NOTES

APPENDIX D: HOSE AND WIRE ROUTING D.1

FIREBOLT

sm04328

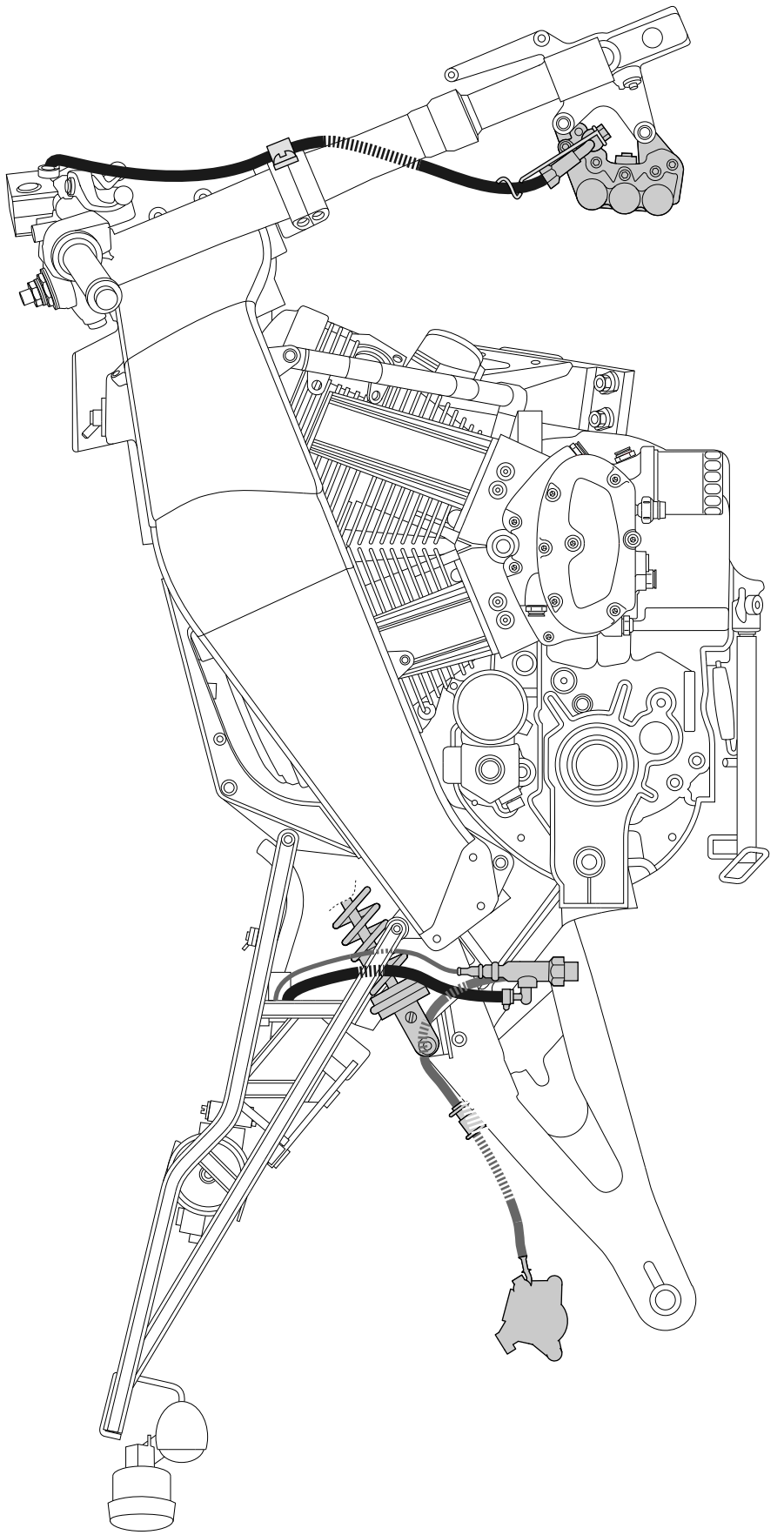


Figure D-1. Front and Rear Brake Systems, Right Side View

sm04332

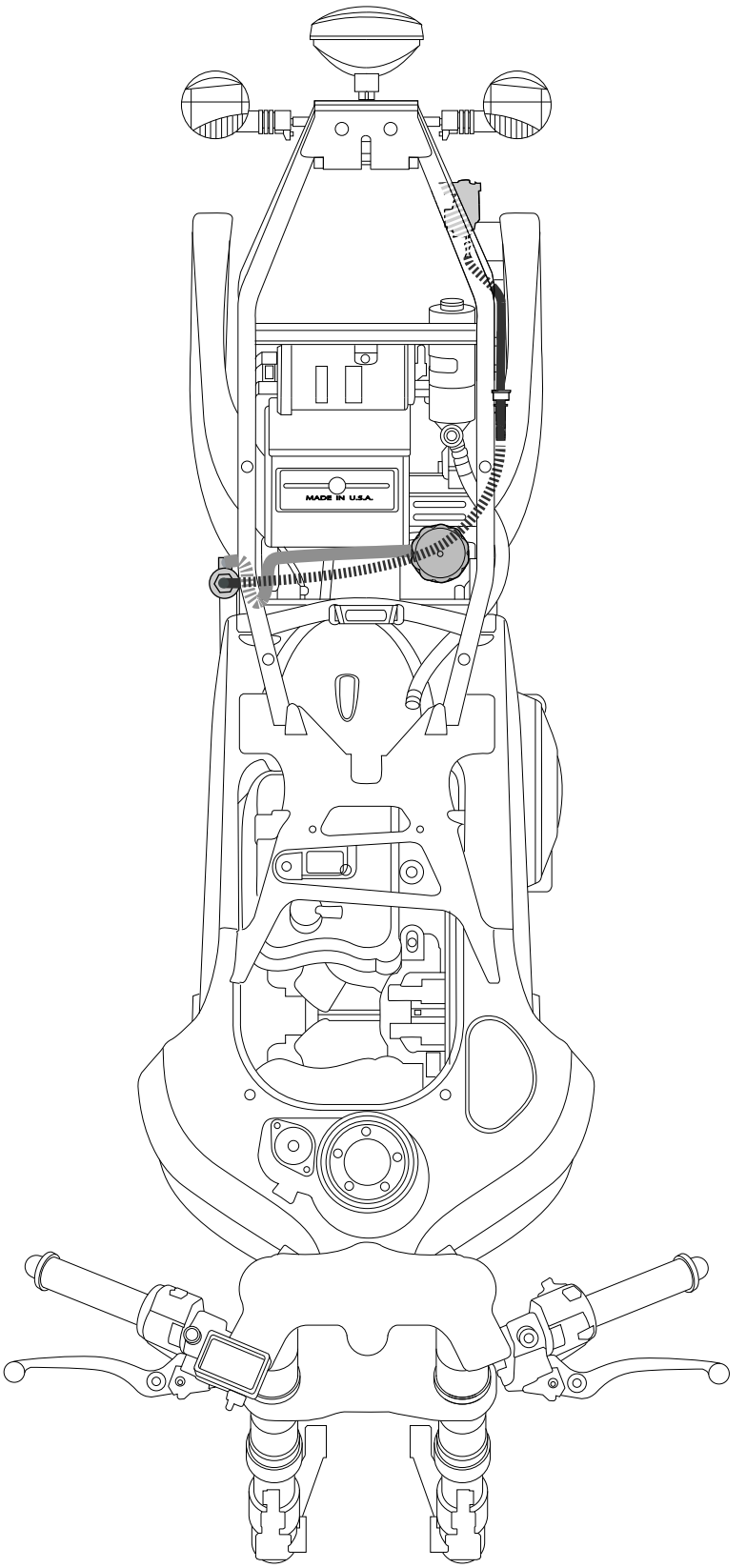


Figure D-2. Rear Brake Systems, Top View

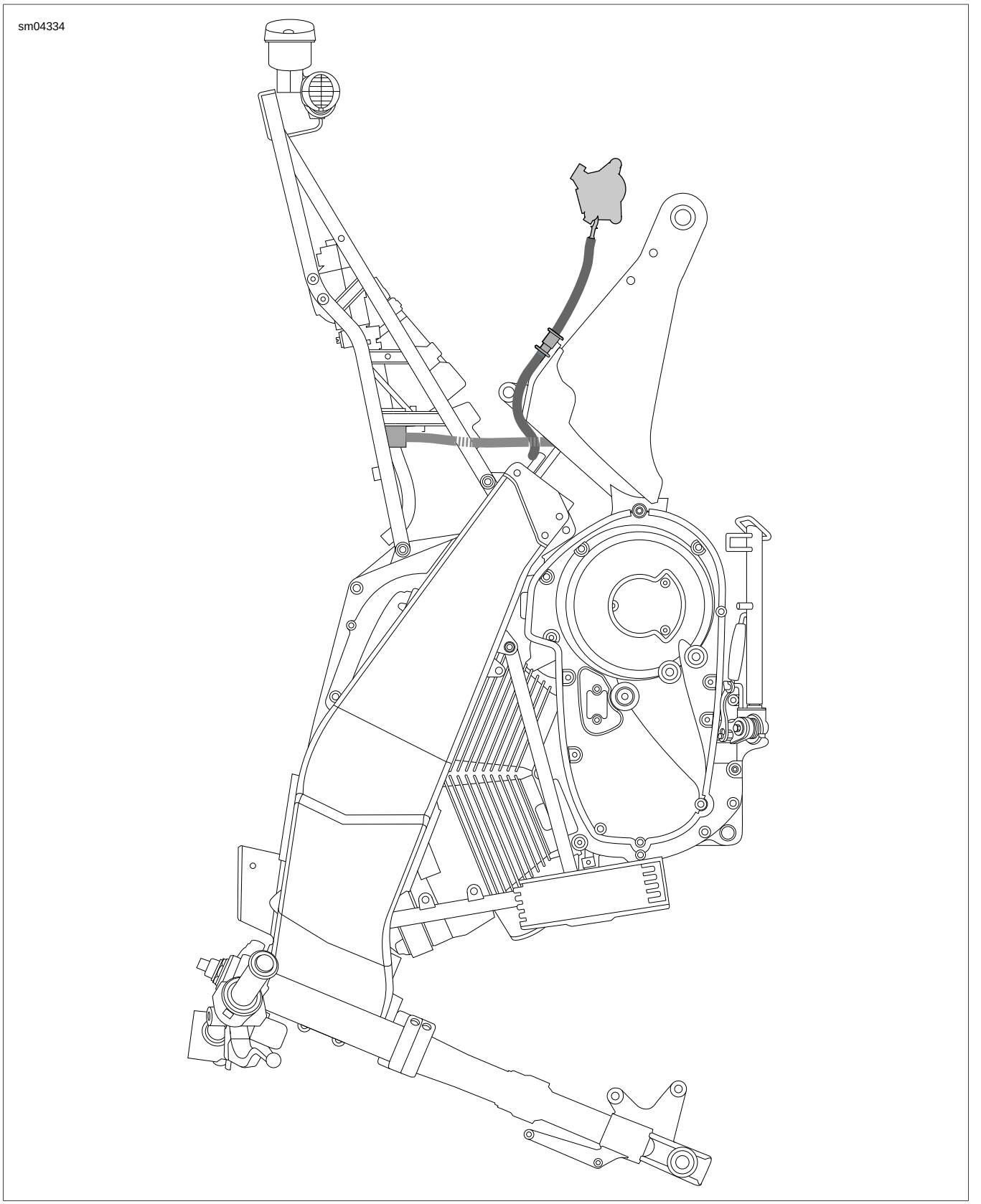
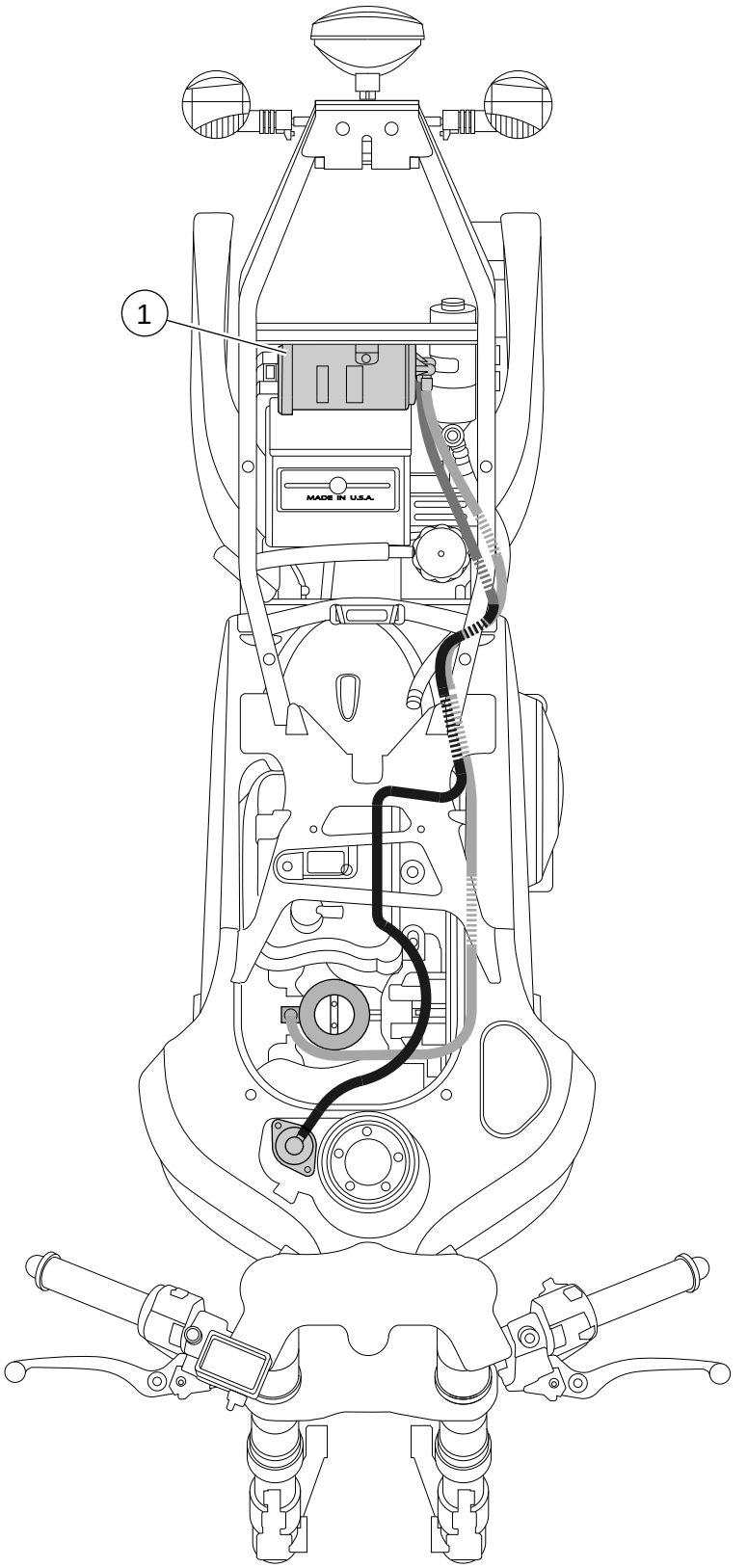


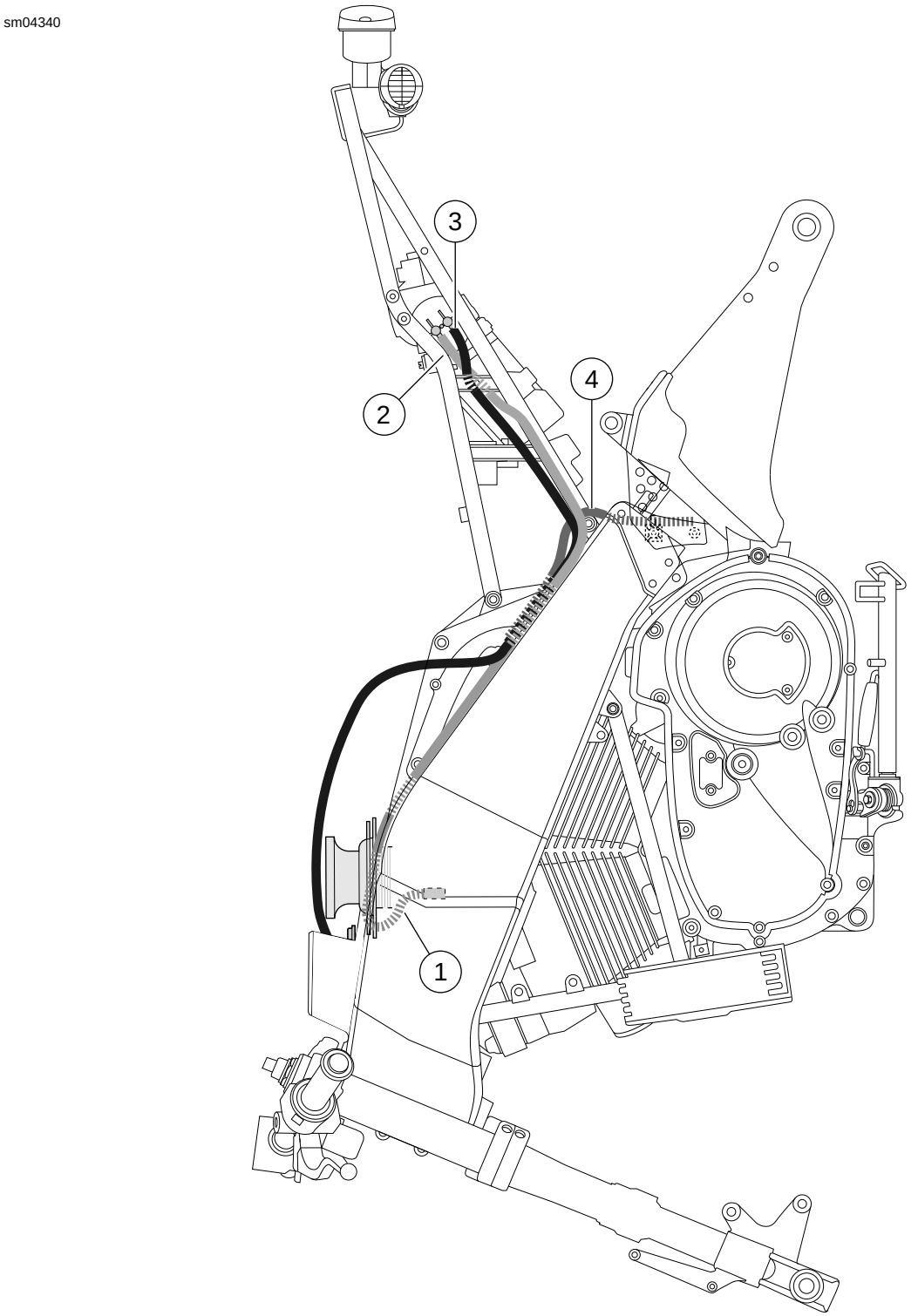
Figure D-3. Rear Brake Systems, Left Side View

sm04337



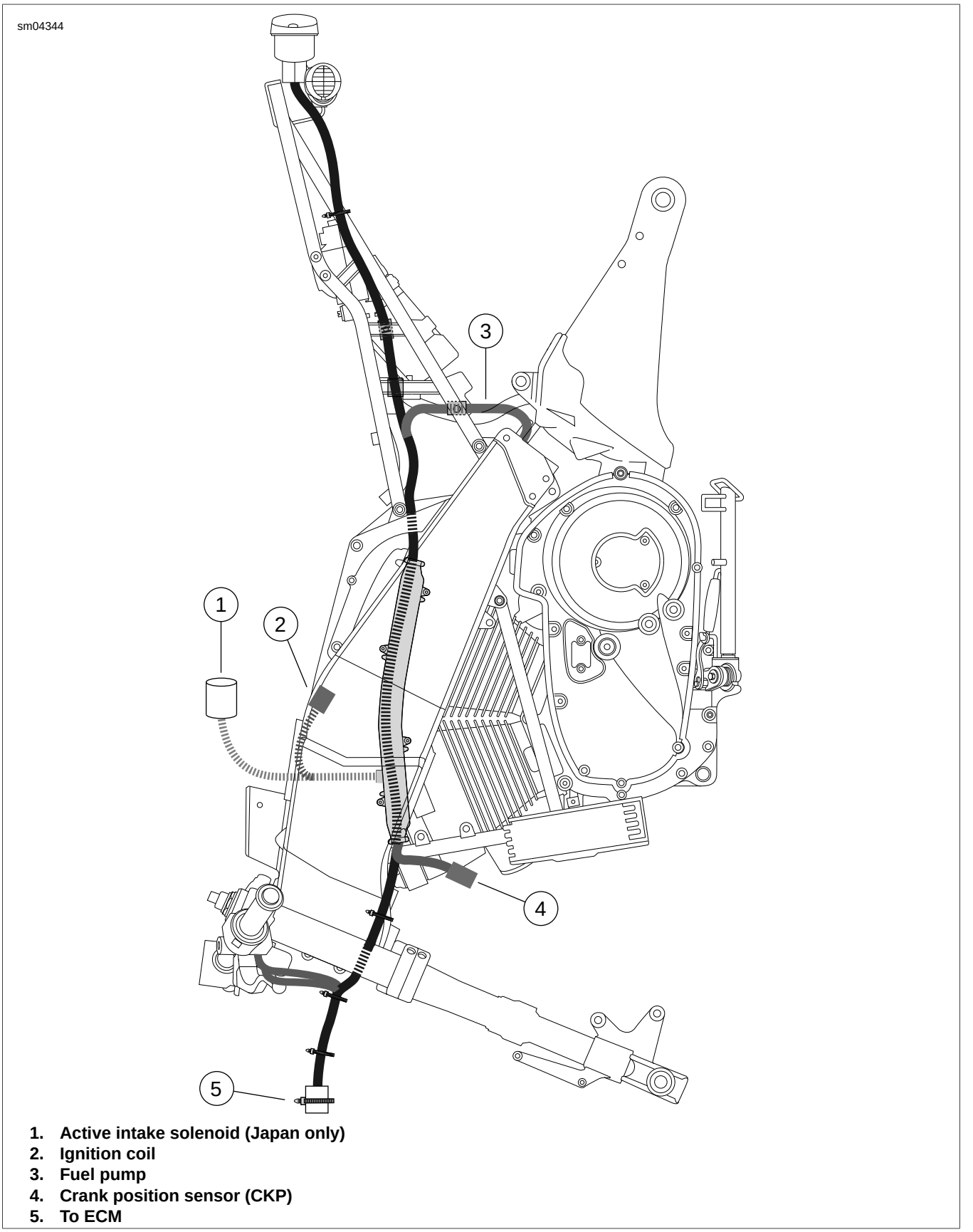
1. **Carbon canister**

Figure D-4. Evaporative Emissions Control, California Models, Top View



1. **To induction module**
2. **From induction module (California)**
3. **From fuel tank (California)**
4. **From fuel tank to atmosphere (49 state)**

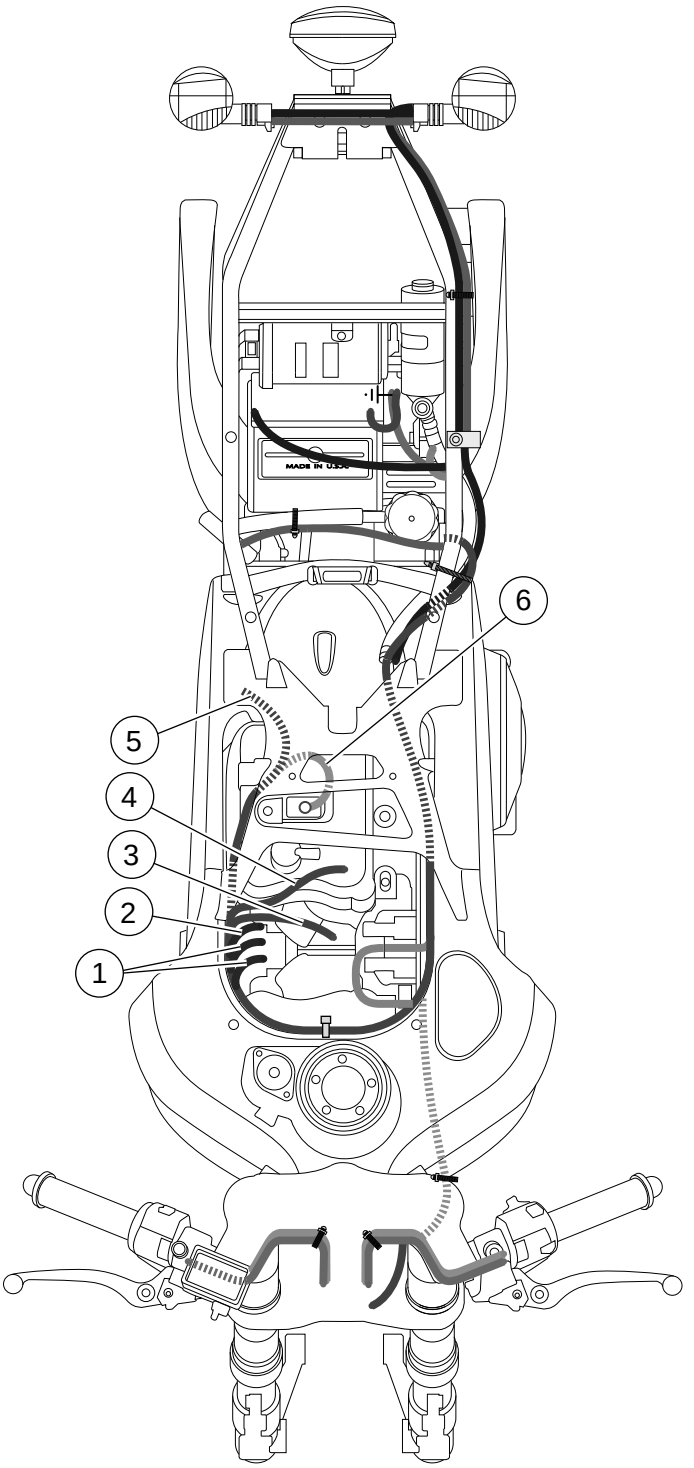
Figure D-5. Evaporative Emissions Control, California and 49 State Models, Left Side View



1. **Active intake solenoid (Japan only)**
2. **Ignition coil**
3. **Fuel pump**
4. **Crank position sensor (CKP)**
5. **To ECM**

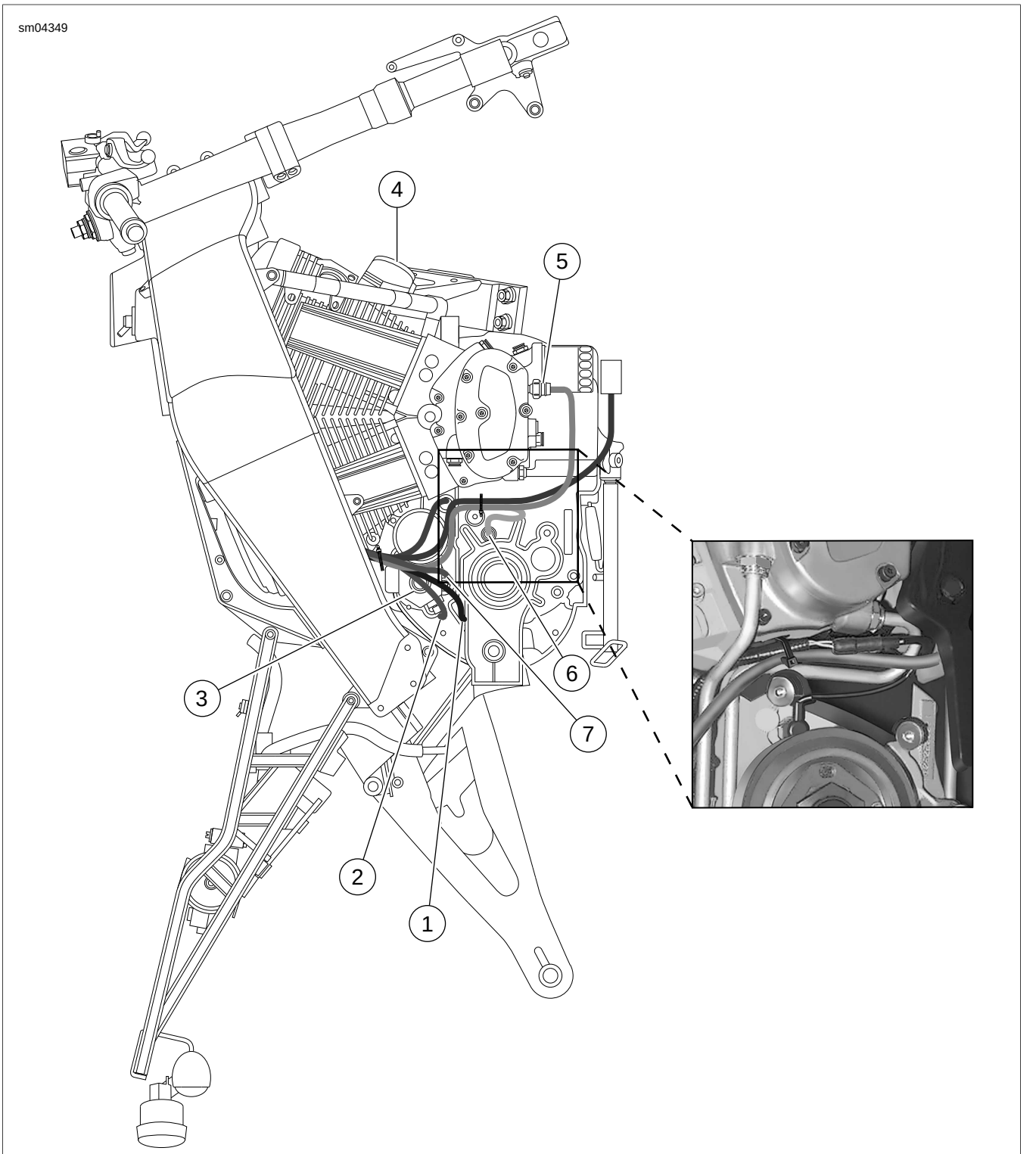
Figure D-6. Wiring Harness, Left Side View

sm04346



1. **Fuel injector (2)**
2. **Idle air control (IAC)**
3. **Throttle position sensor (TPS)**
4. **Intake air temperature sensor (IAT)**
5. **Oxygen sensor (O2)**
6. **Engine temperature sensor**

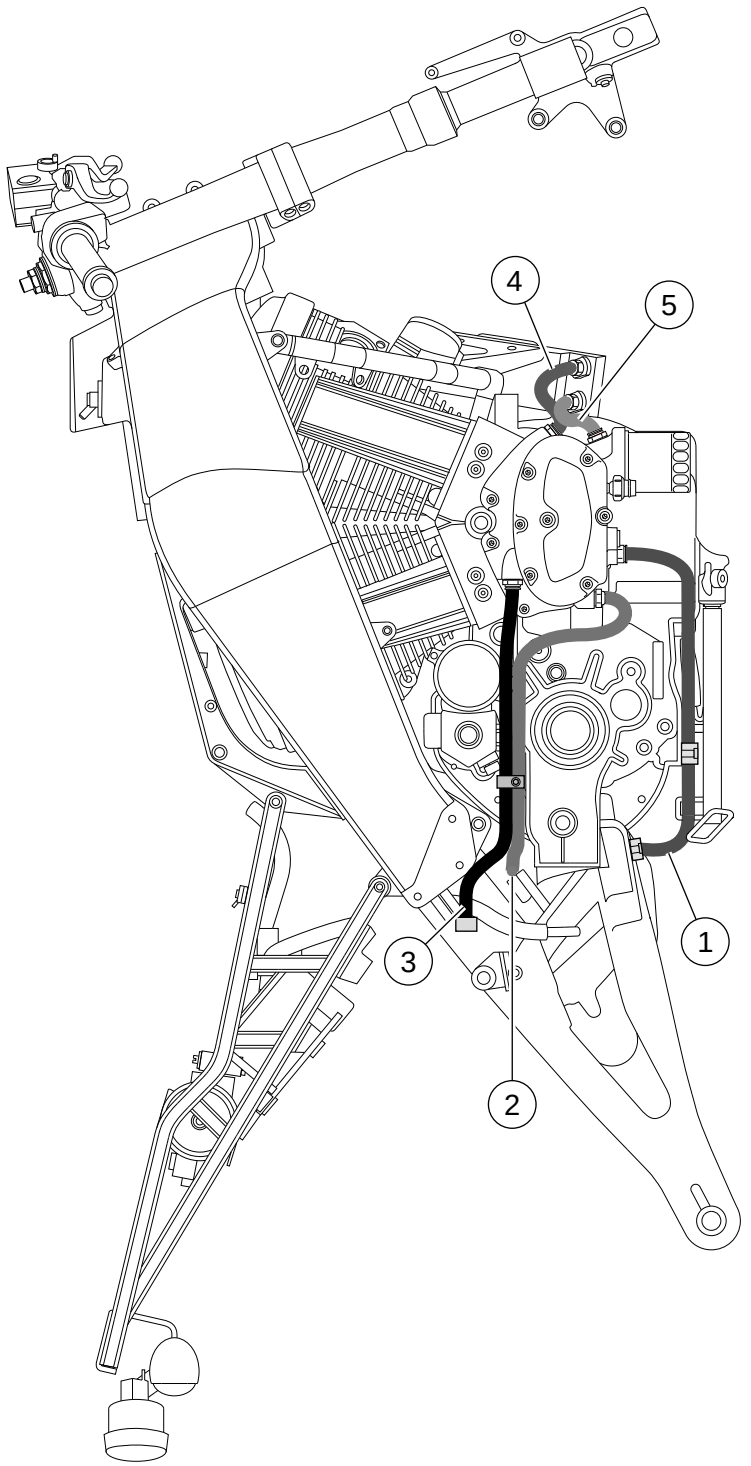
Figure D-7. Wiring Harness, Top View



1. **Vehicle speed sensor (VSS)**
2. **Cable, starter to battery positive**
3. **Solenoid**
4. **Voltage regulator**
5. **Oil pressure switch**
6. **Neutral switch**
7. **Relay terminal**

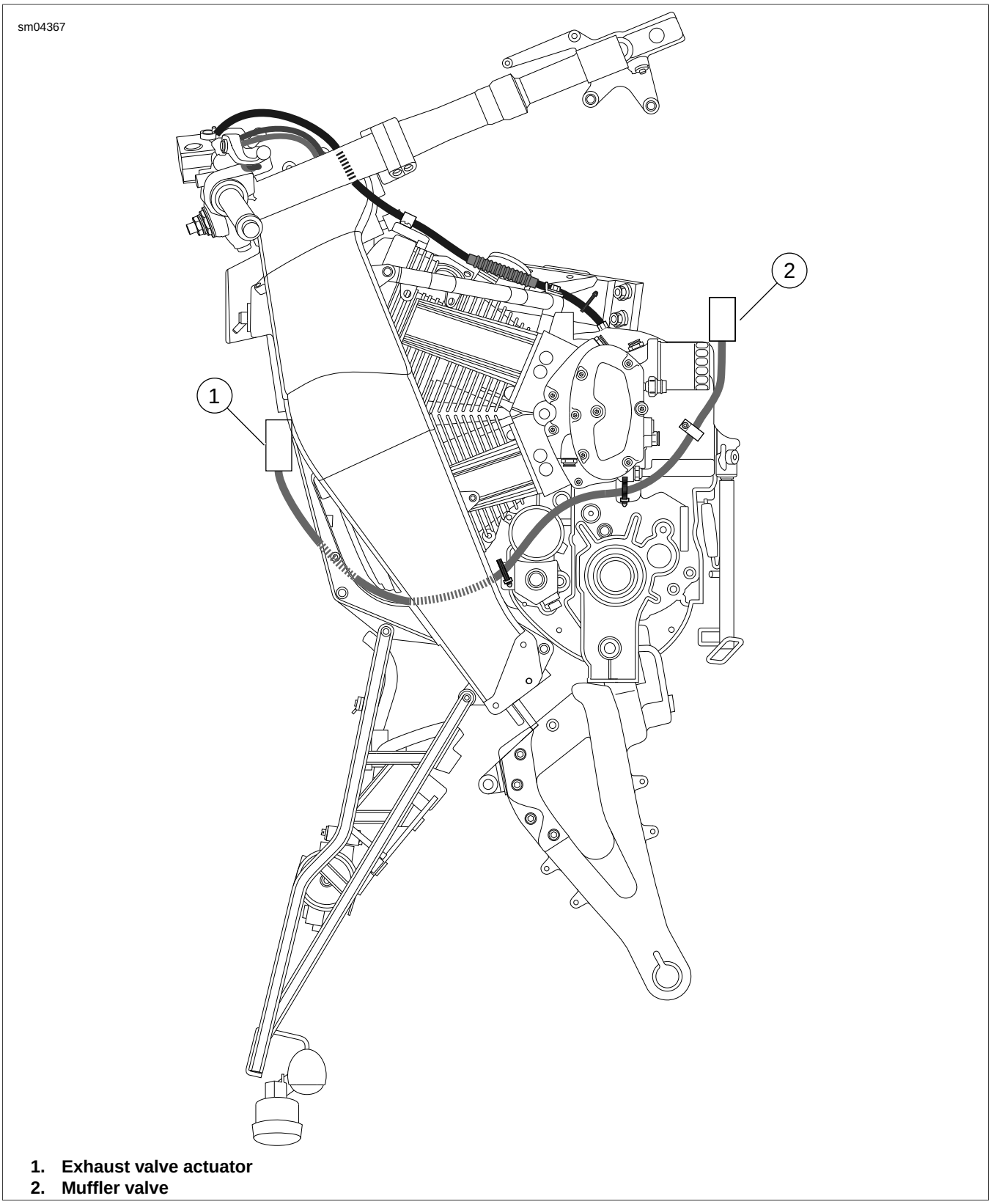
Figure D-8. Wiring Harness, Right Side View

sm04322



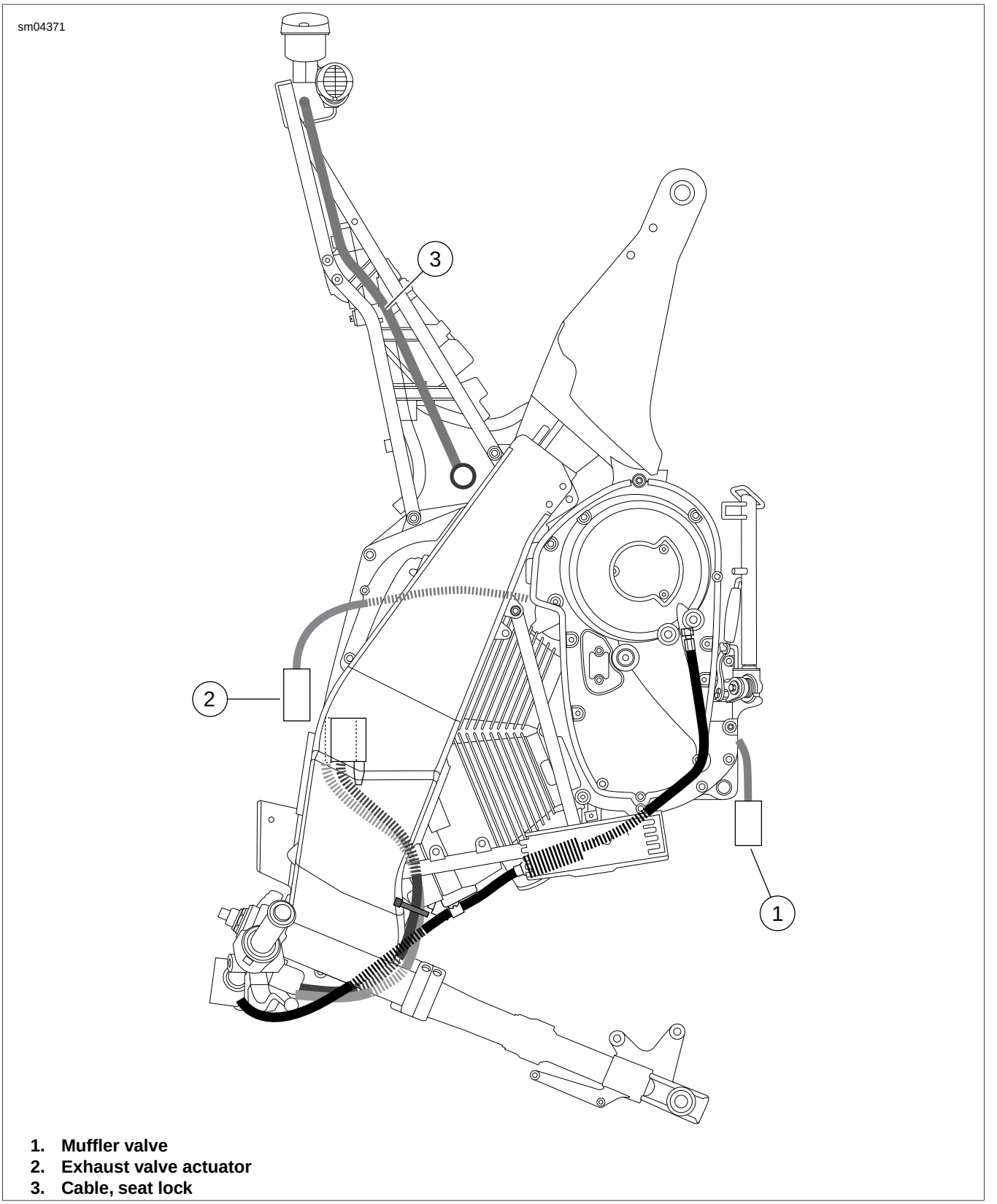
1. **Feed oil line**
2. **Return oil line**
3. **Vent line**
4. **Oil cooler return line**
5. **Oil cooler feed line**

Figure D-9. Oil Lines, Right Side View



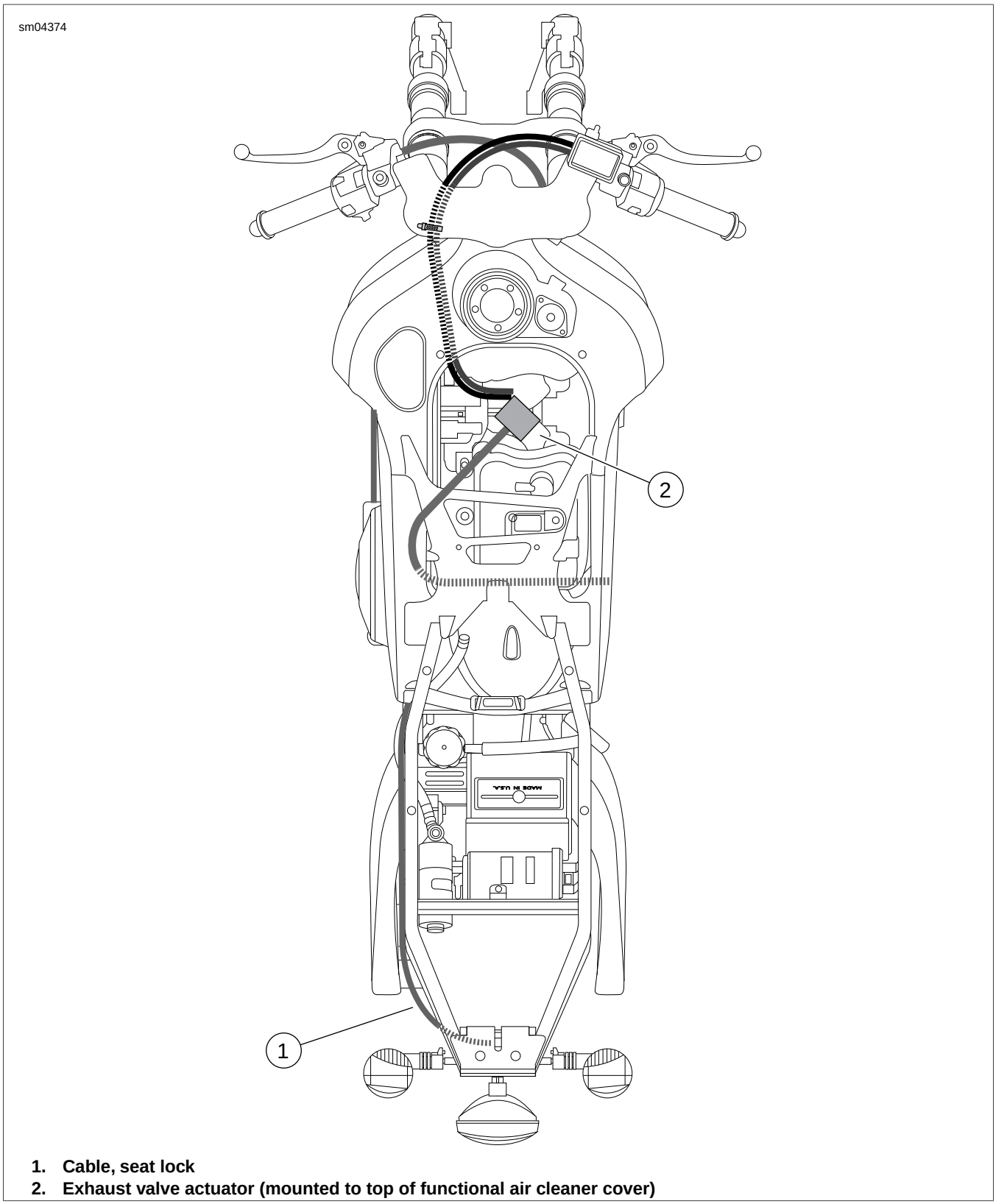
1. **Exhaust valve actuator**
2. **Muffler valve**

Figure D-10. Clutch Cable and Exhaust Valve Actuator, Right Side View



1. **Muffler valve**
2. **Exhaust valve actuator**
3. **Cable, seat lock**

Figure D-11. Clutch, Throttle, Seat Release Cable and Exhaust Valve Actuator, Left Side View



1. **Cable, seat lock**
2. **Exhaust valve actuator (mounted to top of functional air cleaner cover)**

Figure D-12. Clutch, Throttle, Seat Release Cable and Exhaust Valve Actuator (XB12 Models), Top View

LIGHTNING

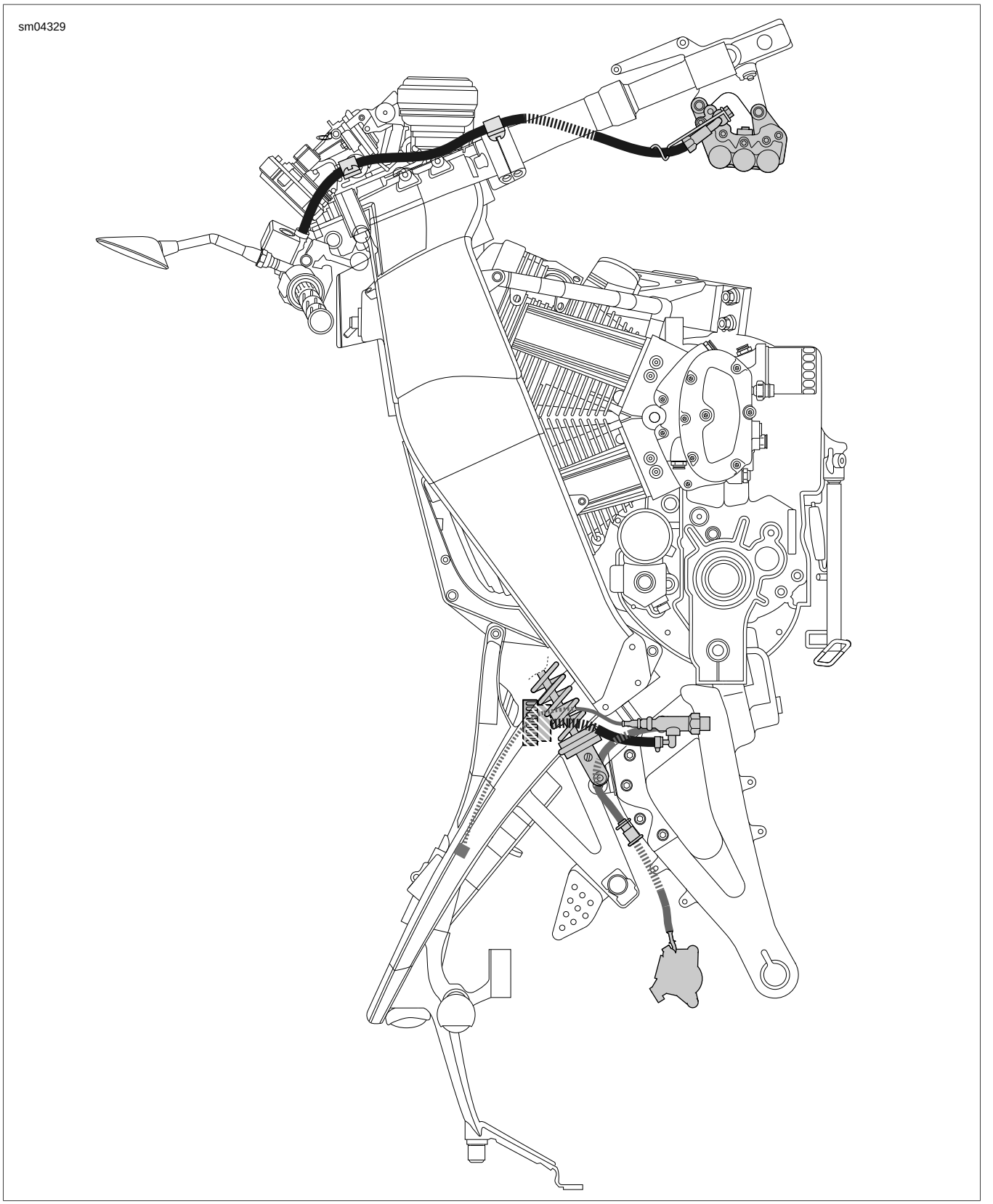


Figure D-13. Front and Rear Brake Systems, Right Side View

sm04331

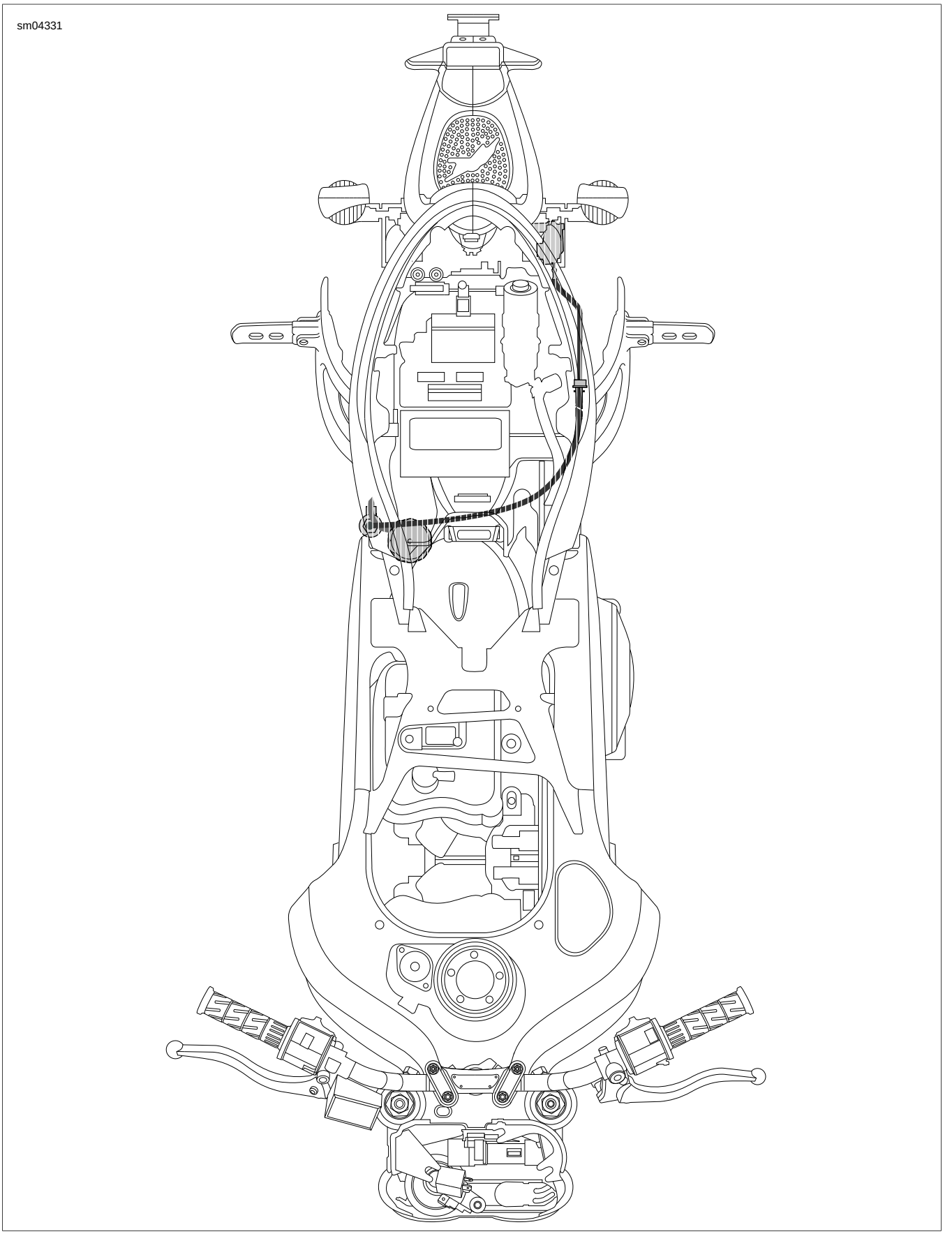


Figure D-14. Rear Brake Systems, Top View

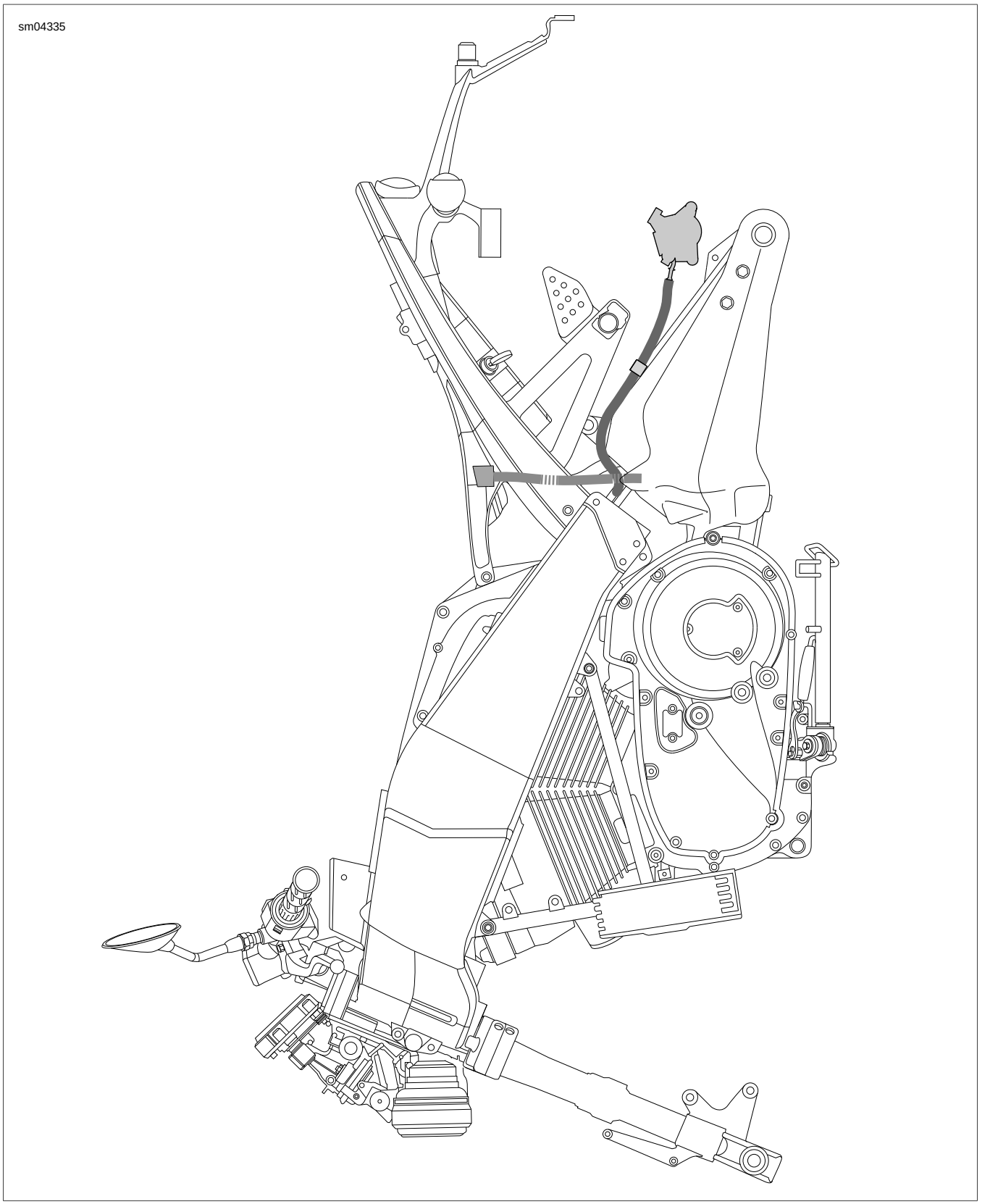
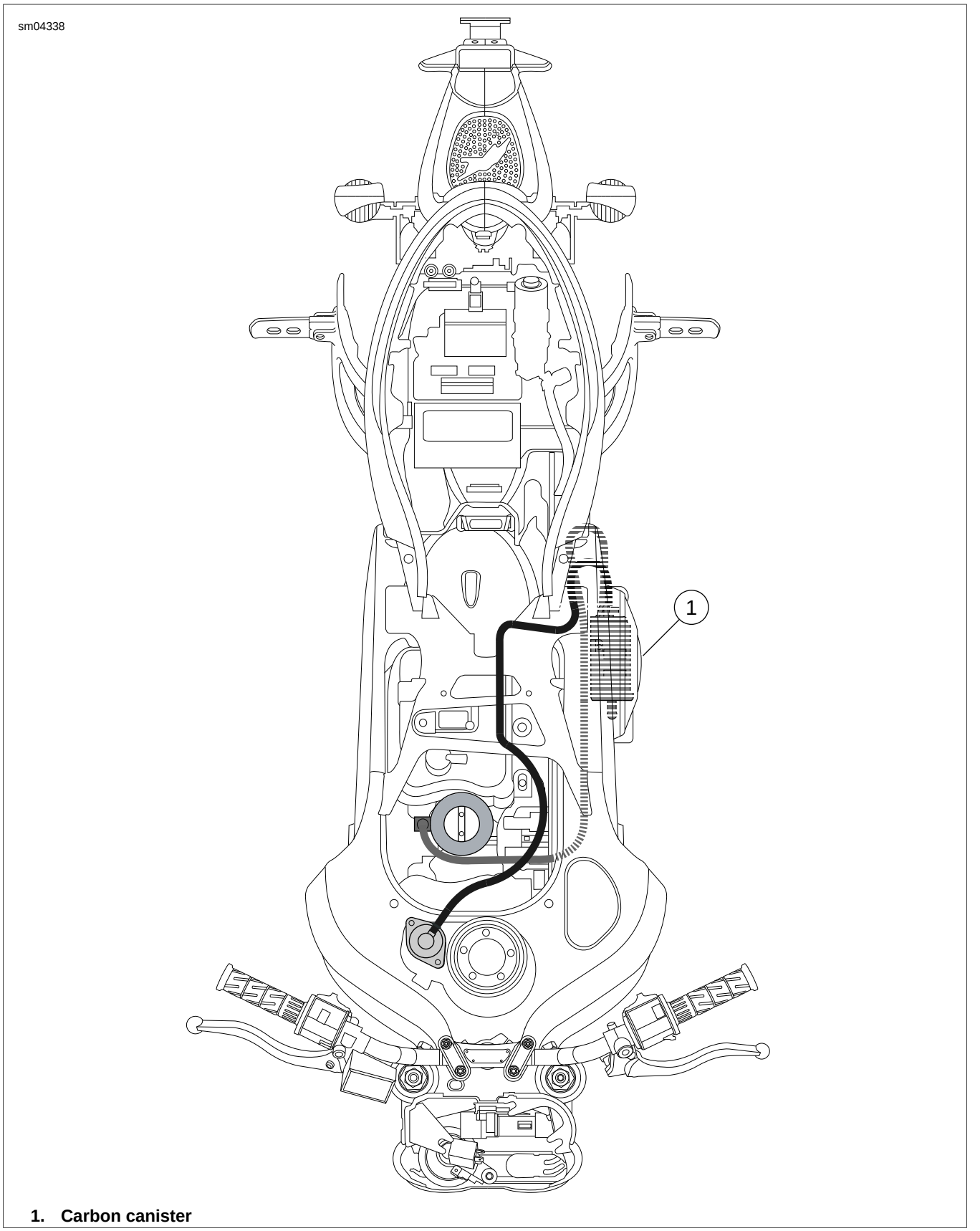
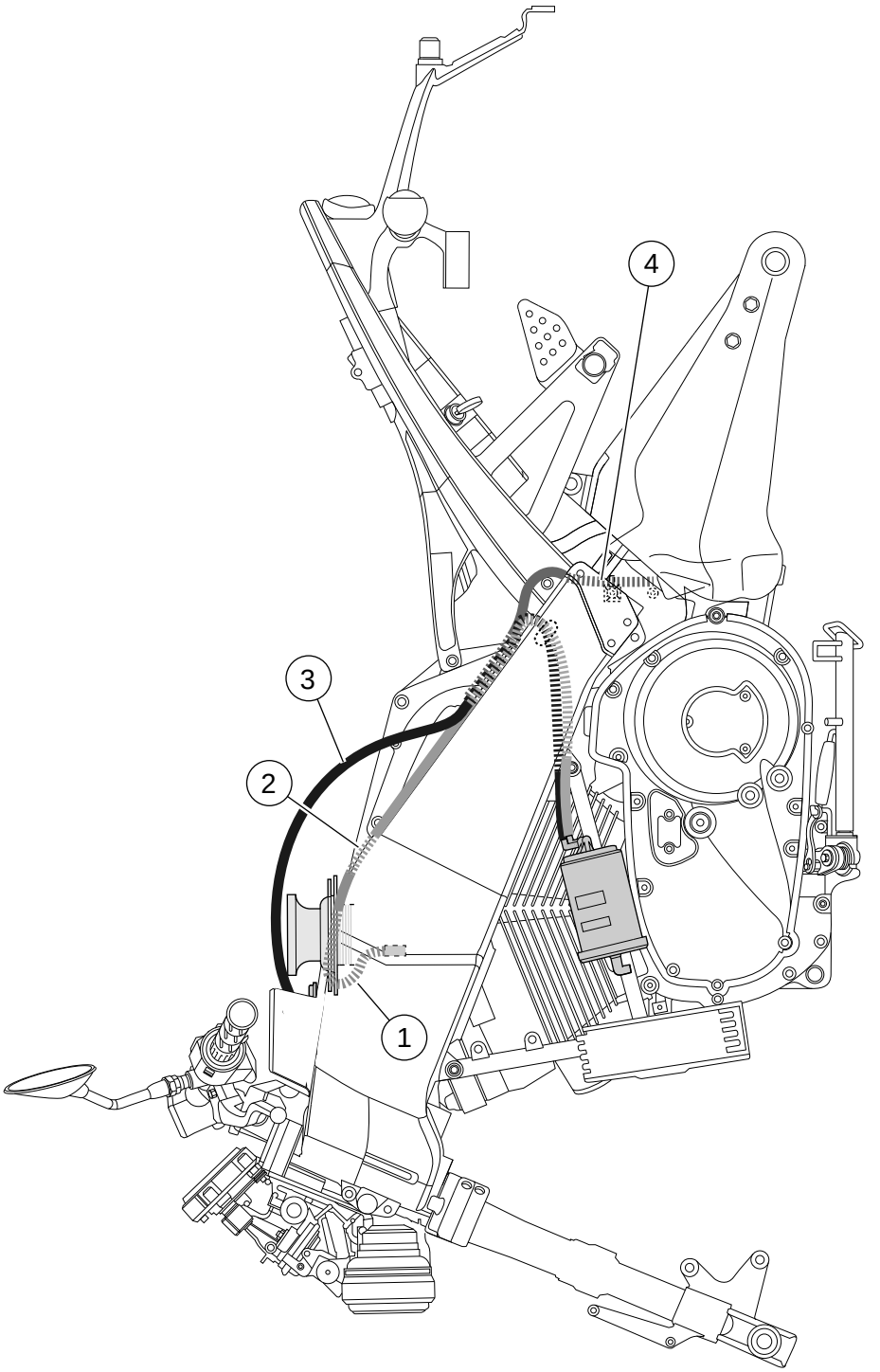


Figure D-15. Rear Brake Systems, Left Side View



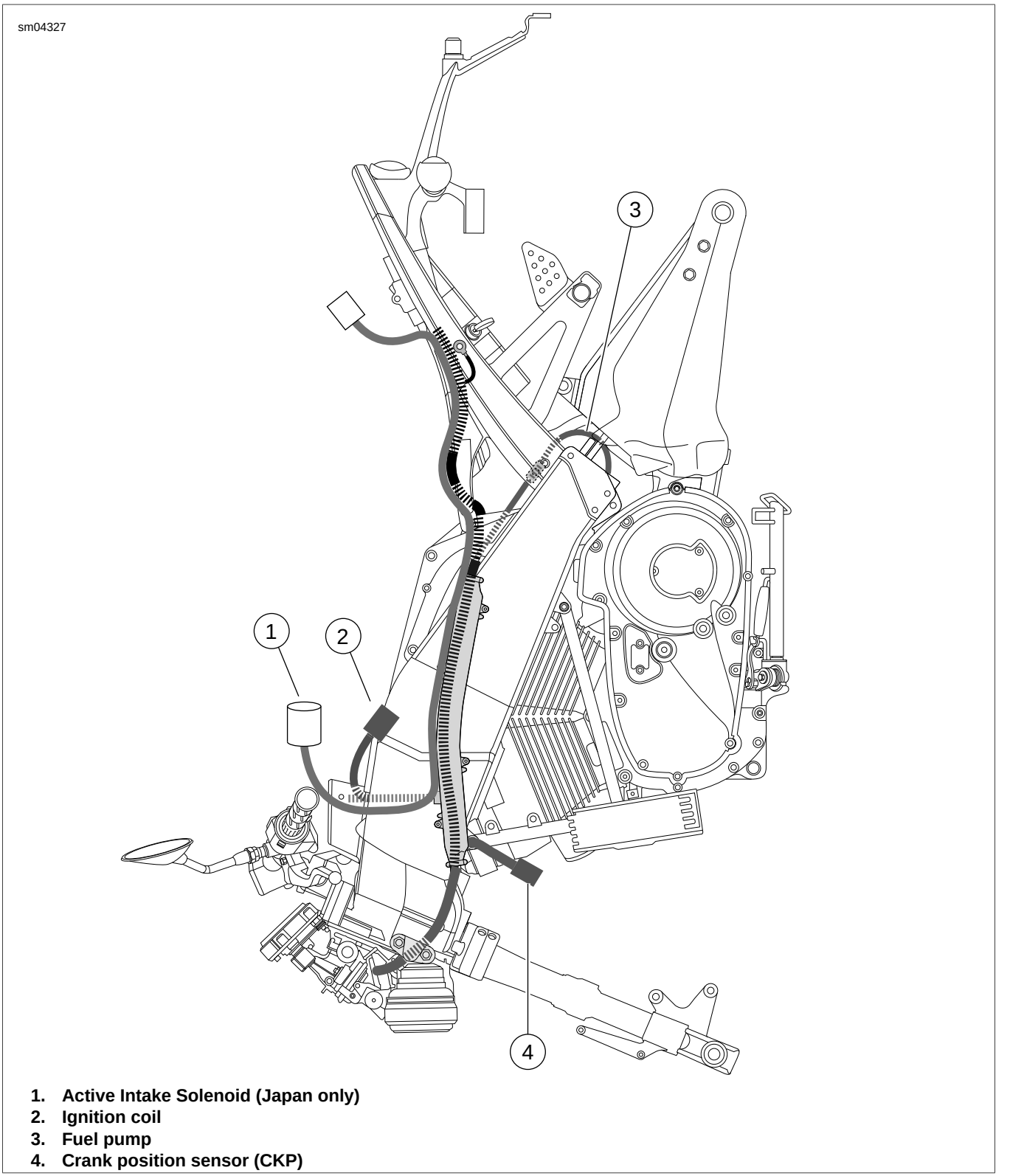
1. **Carbon canister**

Figure D-16. Evaporative Emissions Control, California Models, Top View



1. To induction module
2. From induction module (California)
3. From fuel tank (California)
4. From fuel tank to atmosphere (49 state)

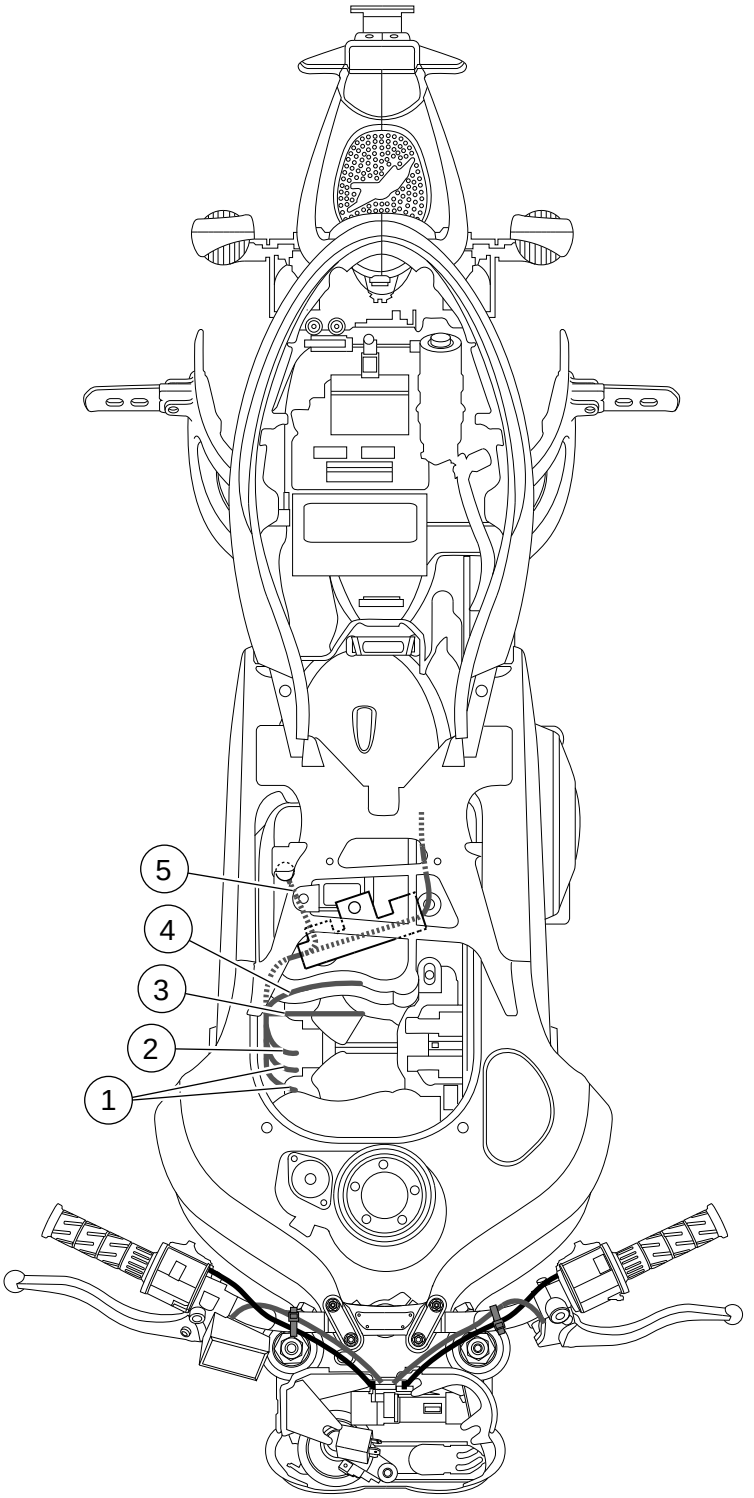
Figure D-17. Evaporative Emissions Control, California and 49 State Models, Left Side View



1. **Active Intake Solenoid (Japan only)**
2. **Ignition coil**
3. **Fuel pump**
4. **Crank position sensor (CKP)**

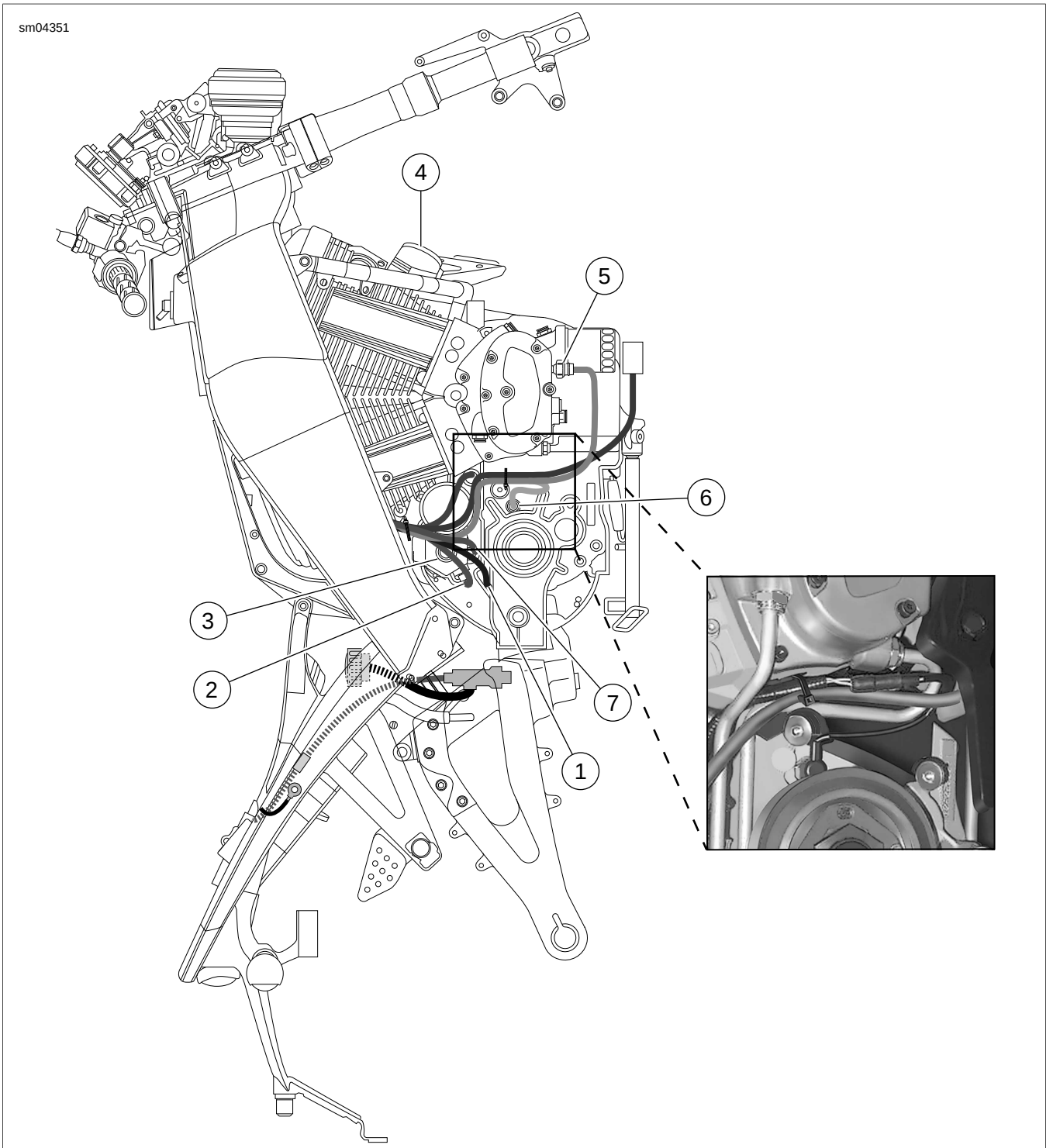
Figure D-18. Wiring Harness, Left Side View

sm04347



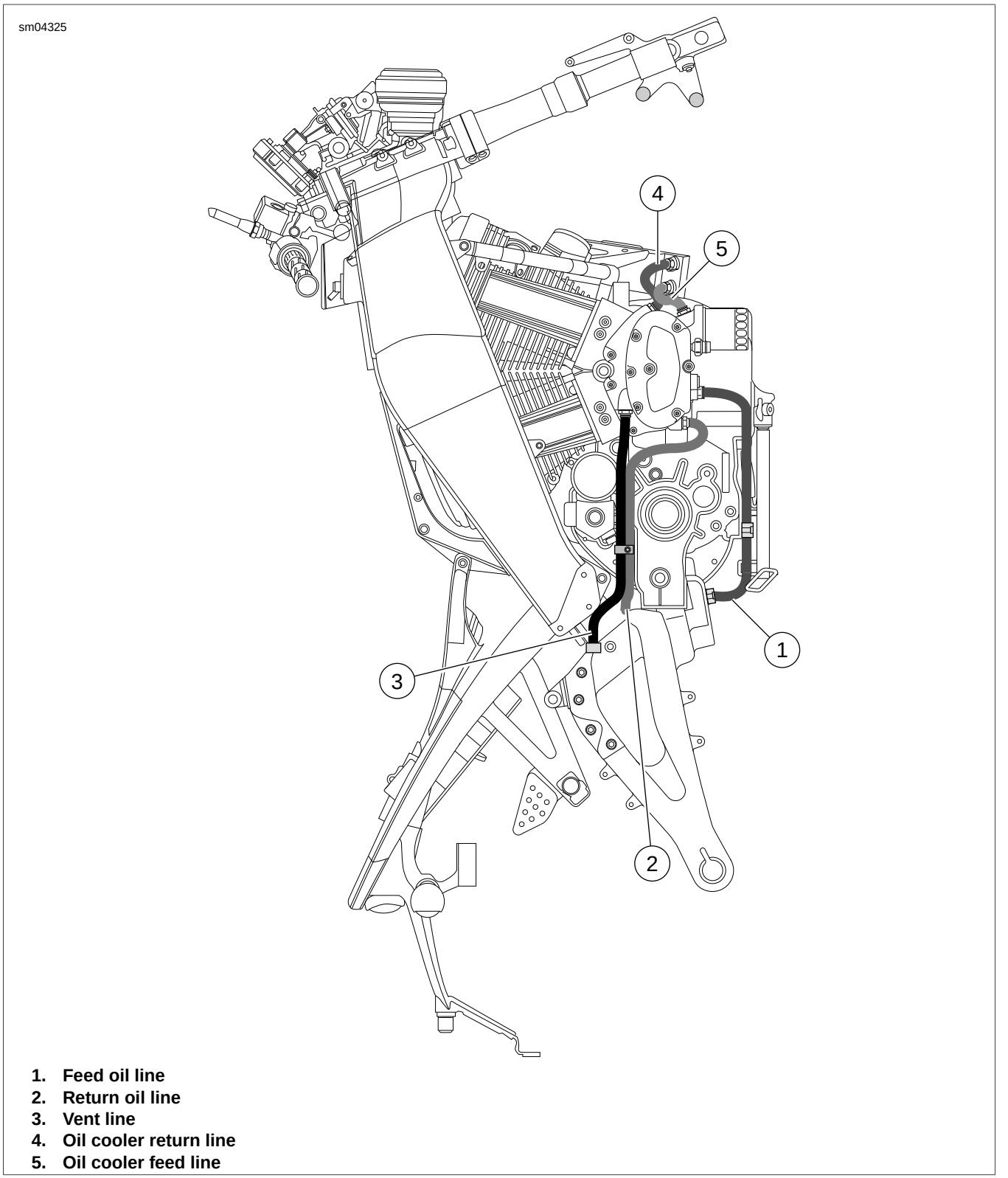
1. **Fuel injector (2)**
2. **Idle air control (IAC)**
3. **Throttle position sensor (TPS)**
4. **Intake air temperature sensor (IAT)**
5. **Oxygen sensor (02)**

Figure D-19. Wiring Harness, Top View



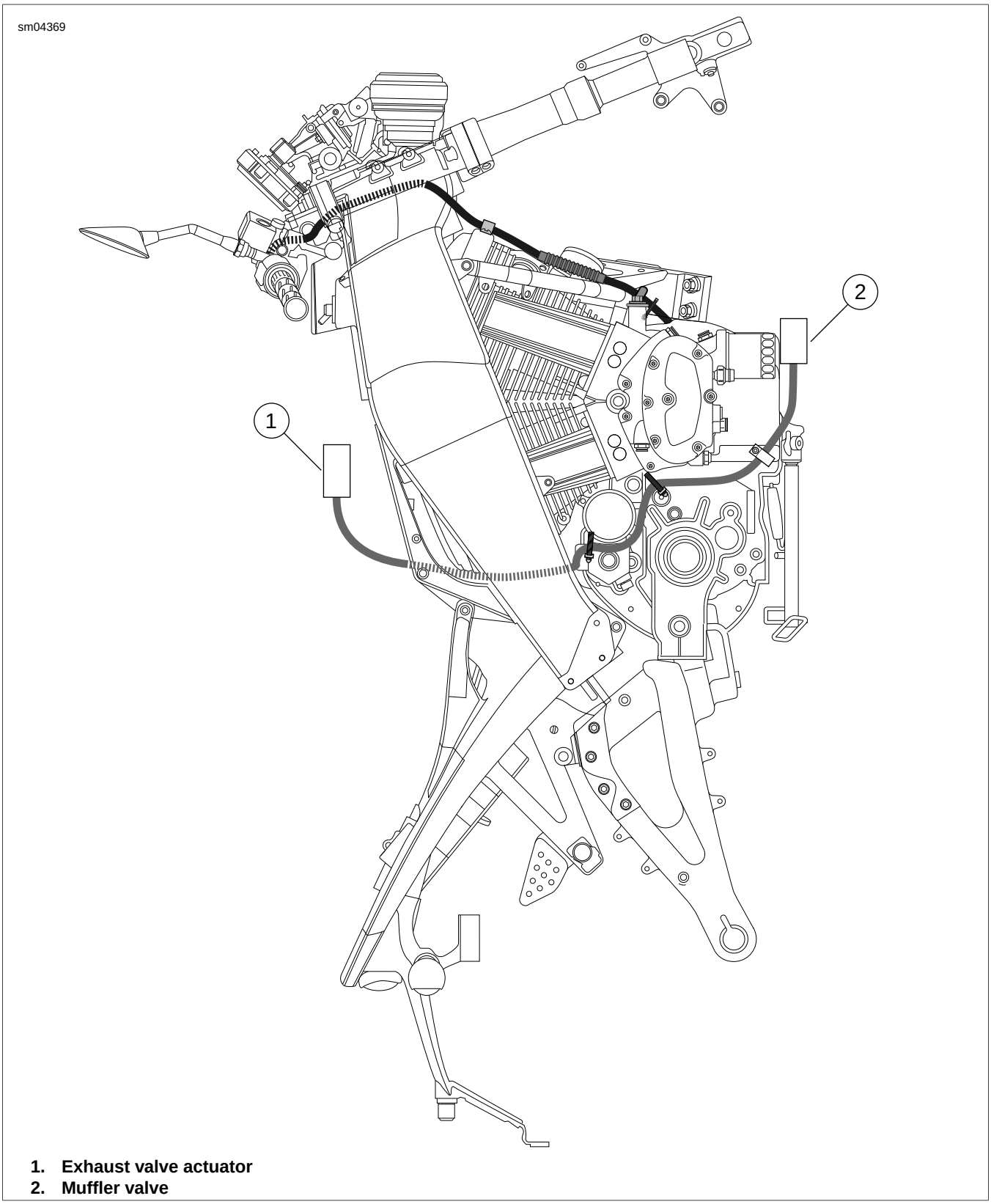
1. **Vehicle speed sensor (VSS)**
2. **Cable, starter to battery positive**
3. **Solenoid**
4. **Voltage regulator**
5. **Oil pressure switch**
6. **Neutral switch**
7. **Relay terminal**

Figure D-20. Wiring Harness, Right Side View



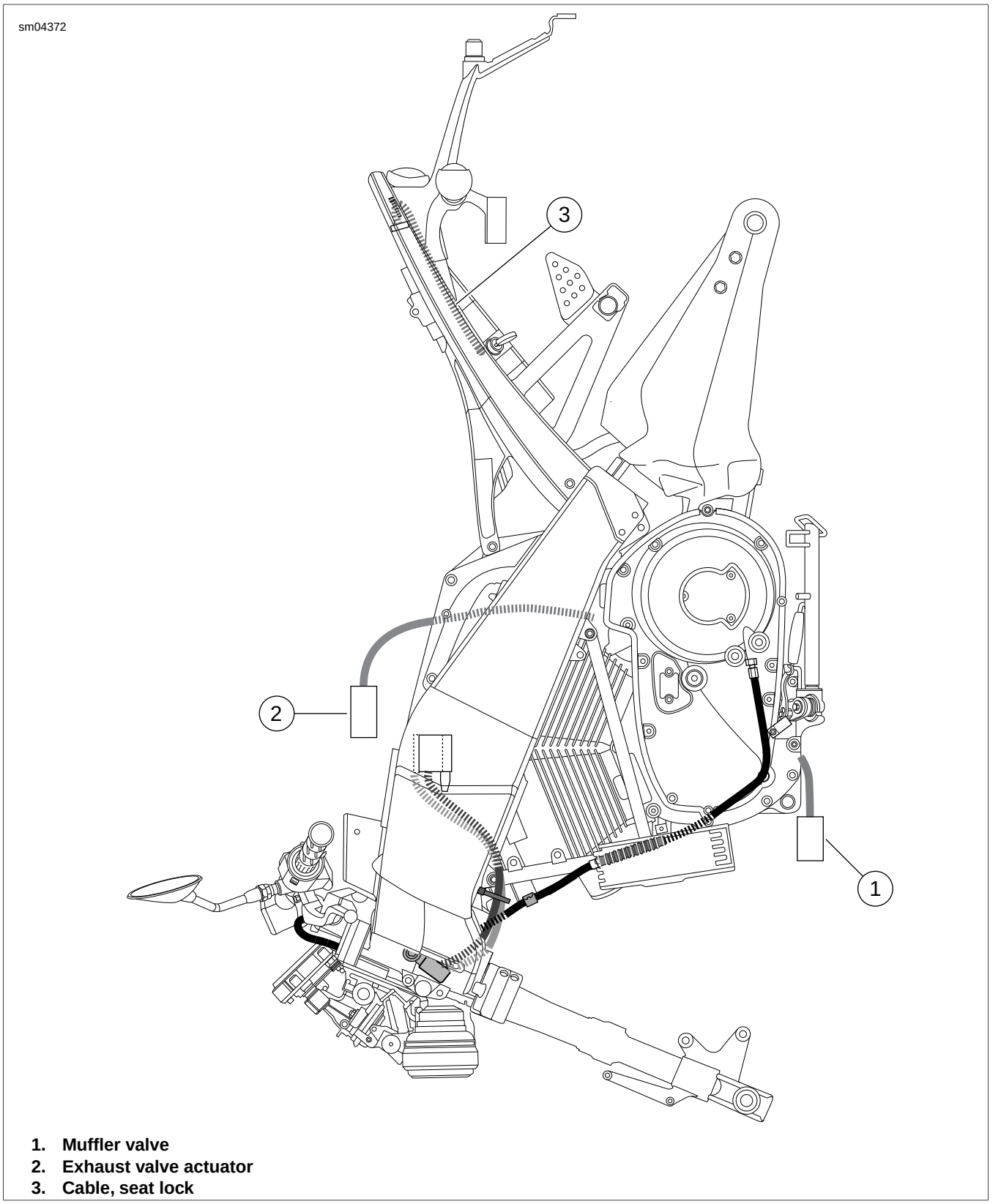
1. **Feed oil line**
2. **Return oil line**
3. **Vent line**
4. **Oil cooler return line**
5. **Oil cooler feed line**

Figure D-21. Oil Lines, Right Side View



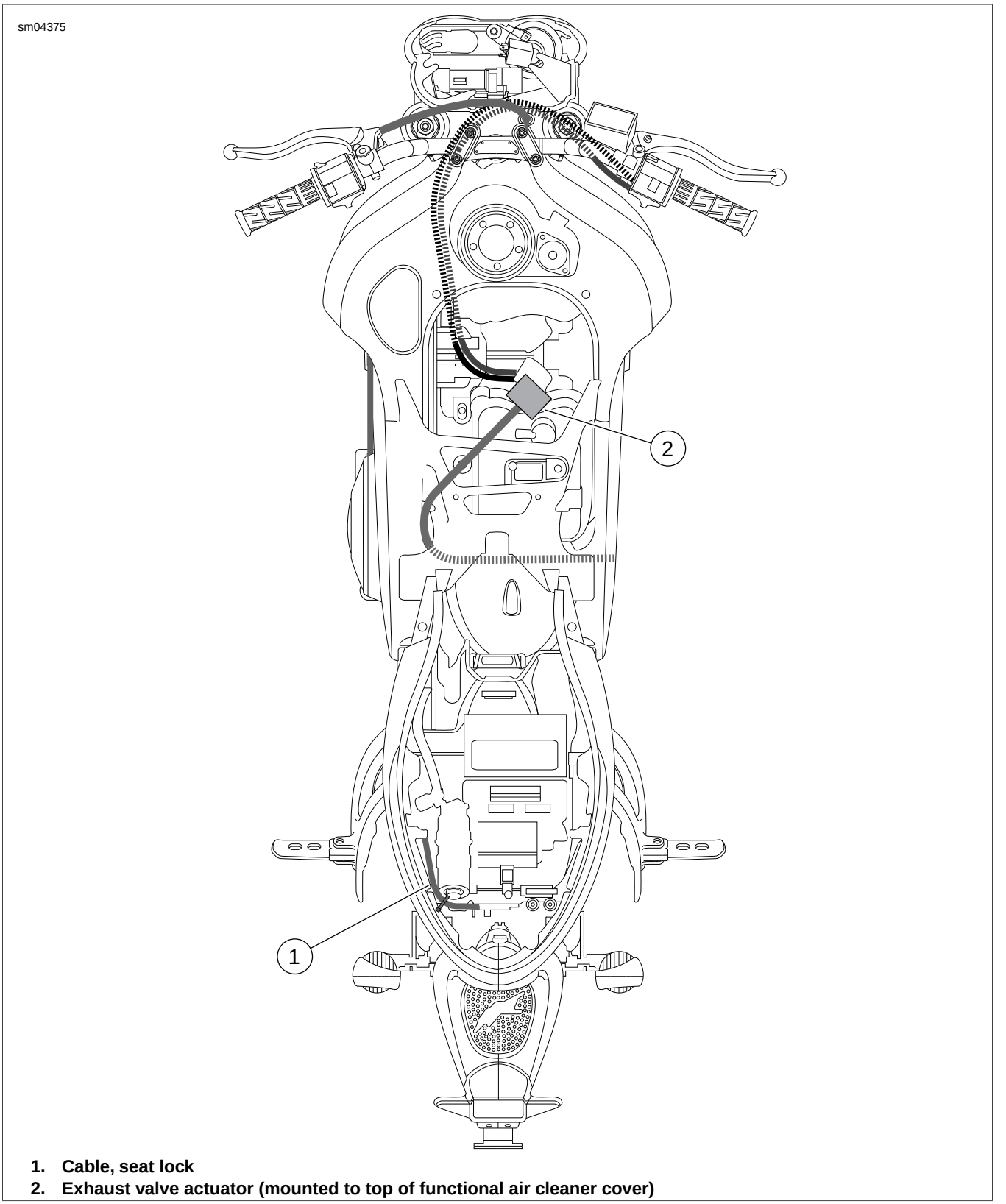
1. **Exhaust valve actuator**
2. **Muffler valve**

Figure D-22. Clutch Cable and Exhaust Valve Actuator (XB12 Models), Right Side View



1. **Muffler valve**
2. **Exhaust valve actuator**
3. **Cable, seat lock**

Figure D-23. Clutch, Throttle, Seat Release Cable and Exhaust Valve Actuator (XB12 Models), Left Side View



1. **Cable, seat lock**
2. **Exhaust valve actuator (mounted to top of functional air cleaner cover)**

Figure D-24. Clutch, Throttle, Seat Release Cable and Exhaust Valve Actuator (XB12 Models), Top View

ULYSSES

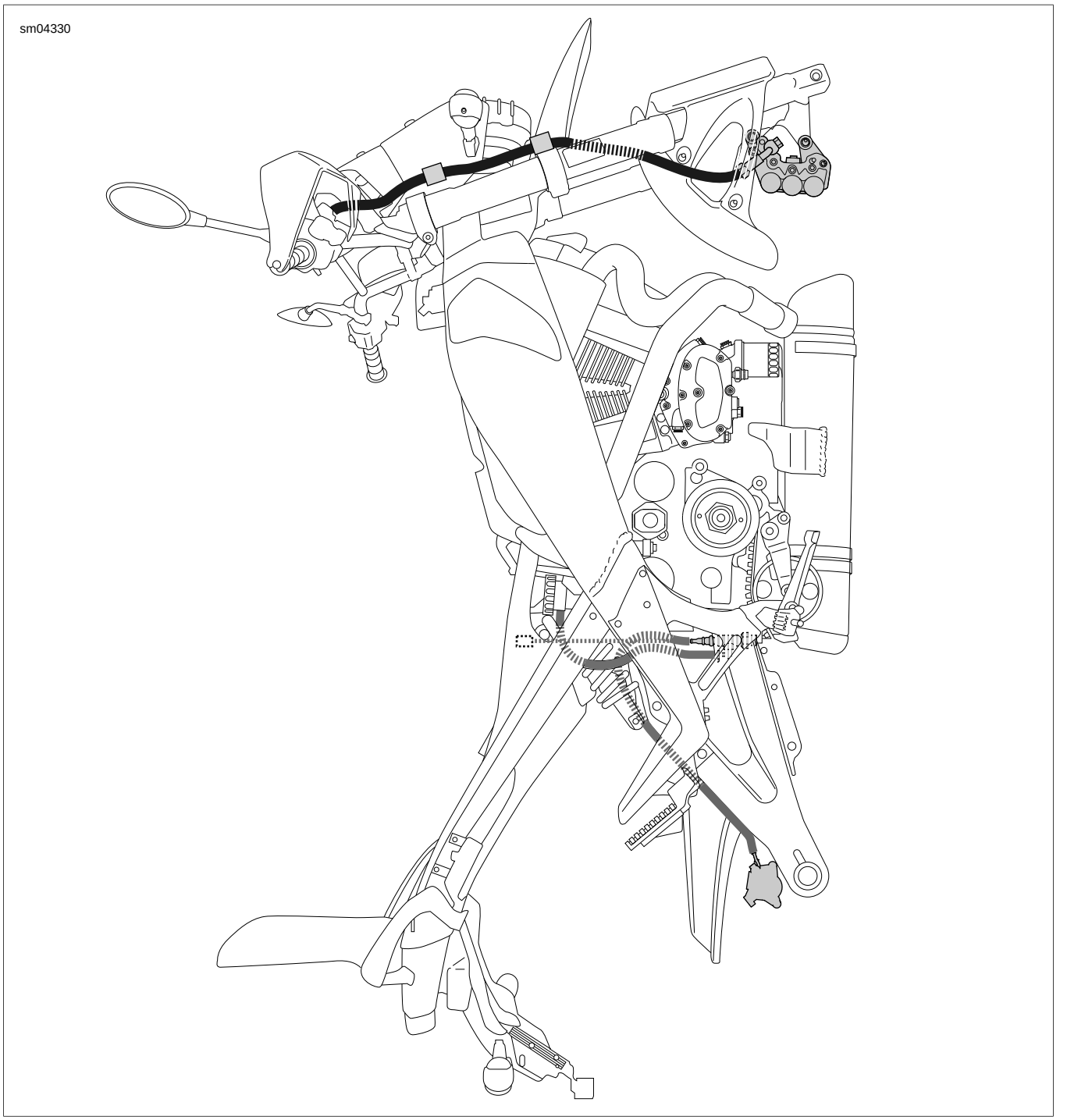


Figure D-25. Front and Rear Brake Systems, Right Side View

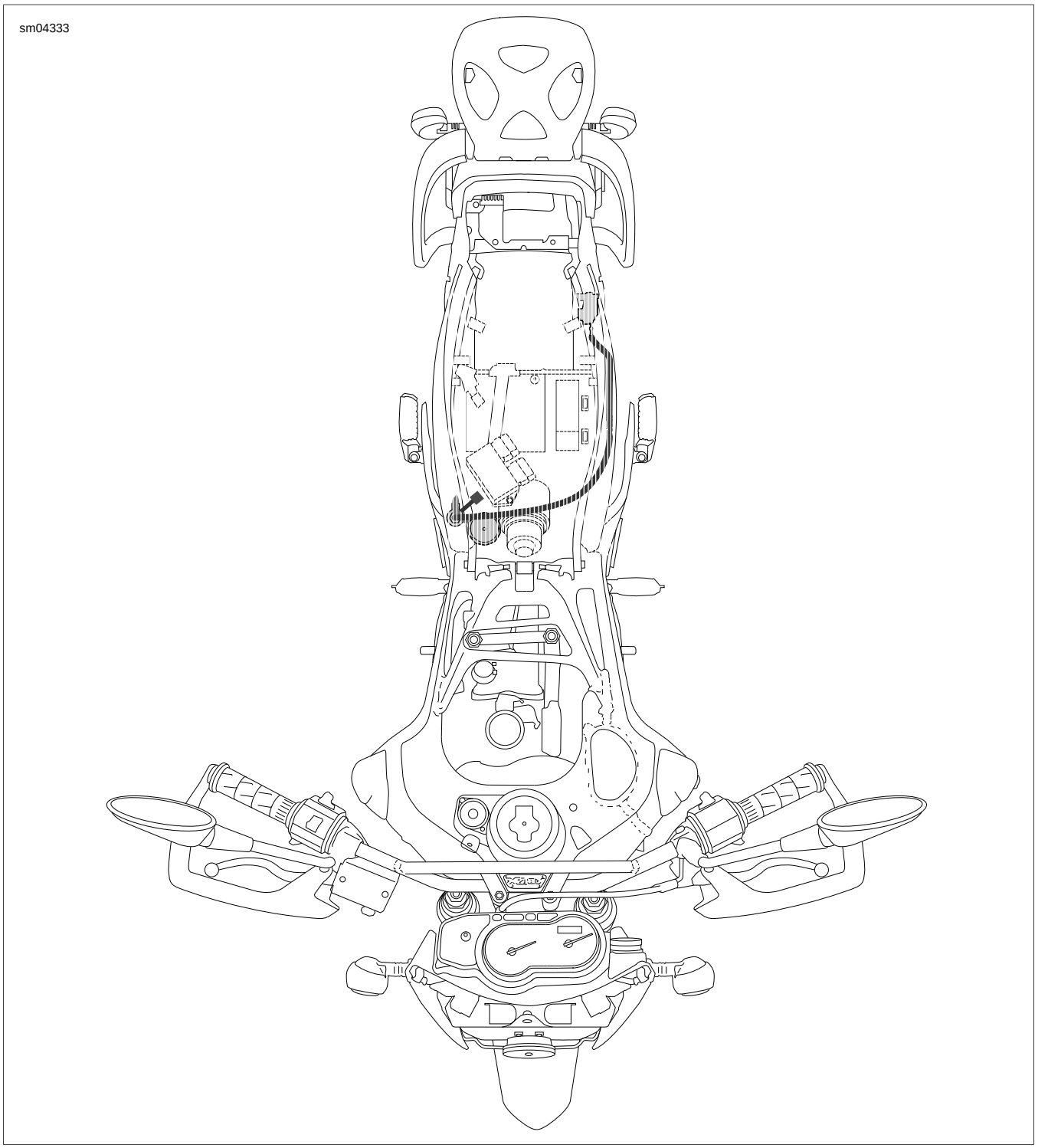


Figure D-26. Rear Brake Systems, Top View

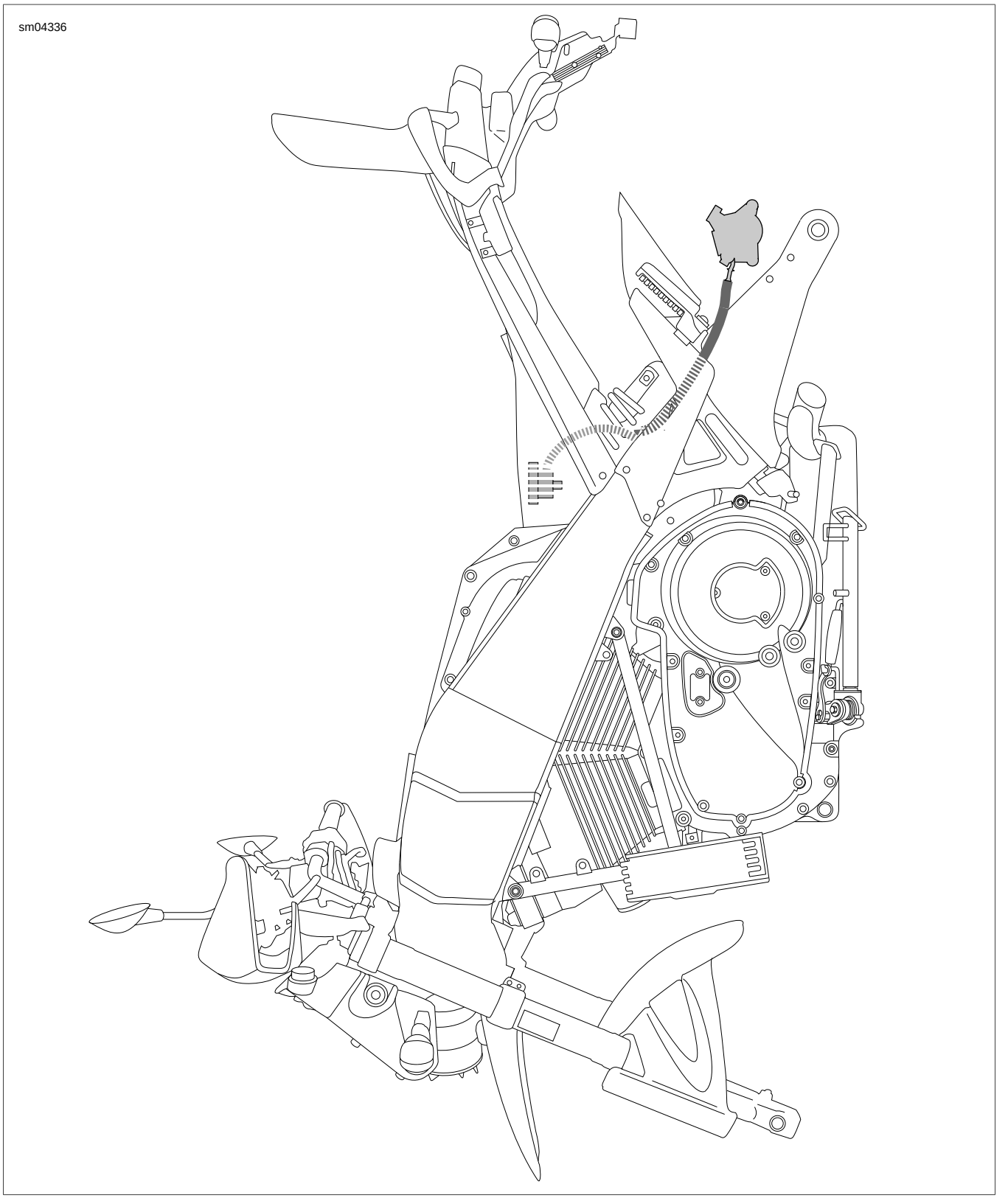


Figure D-27. Rear Brake Systems, Left Side View

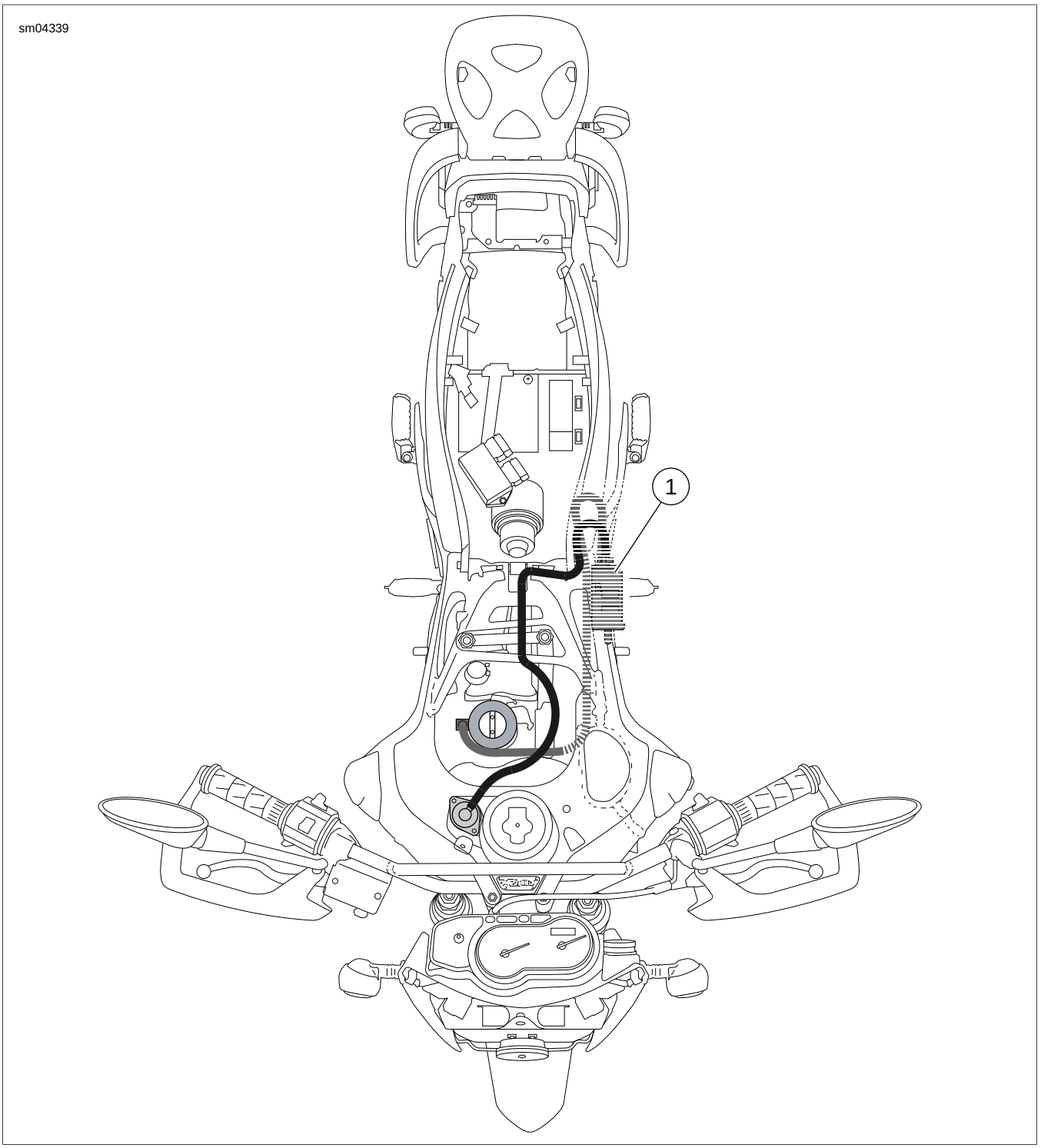
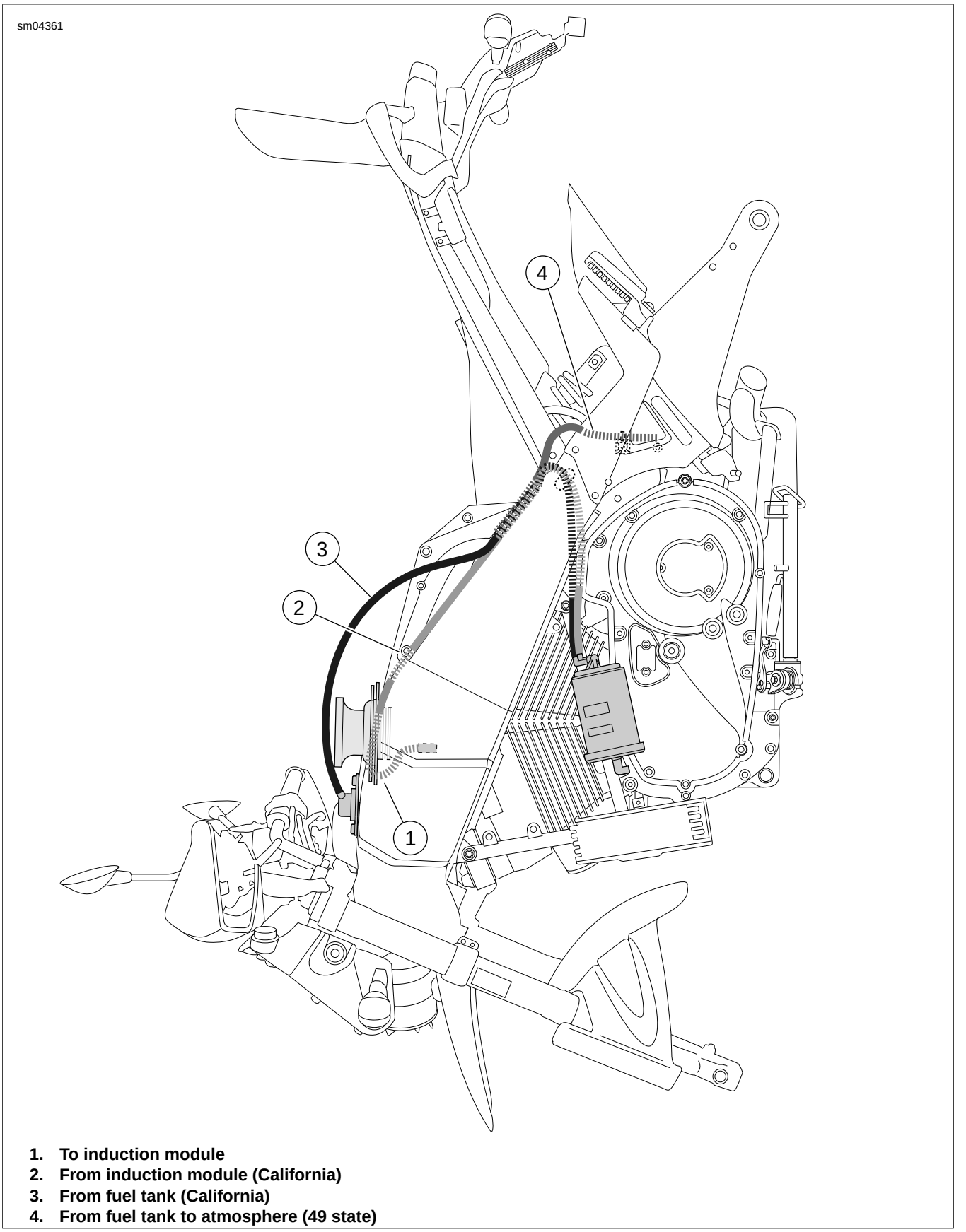
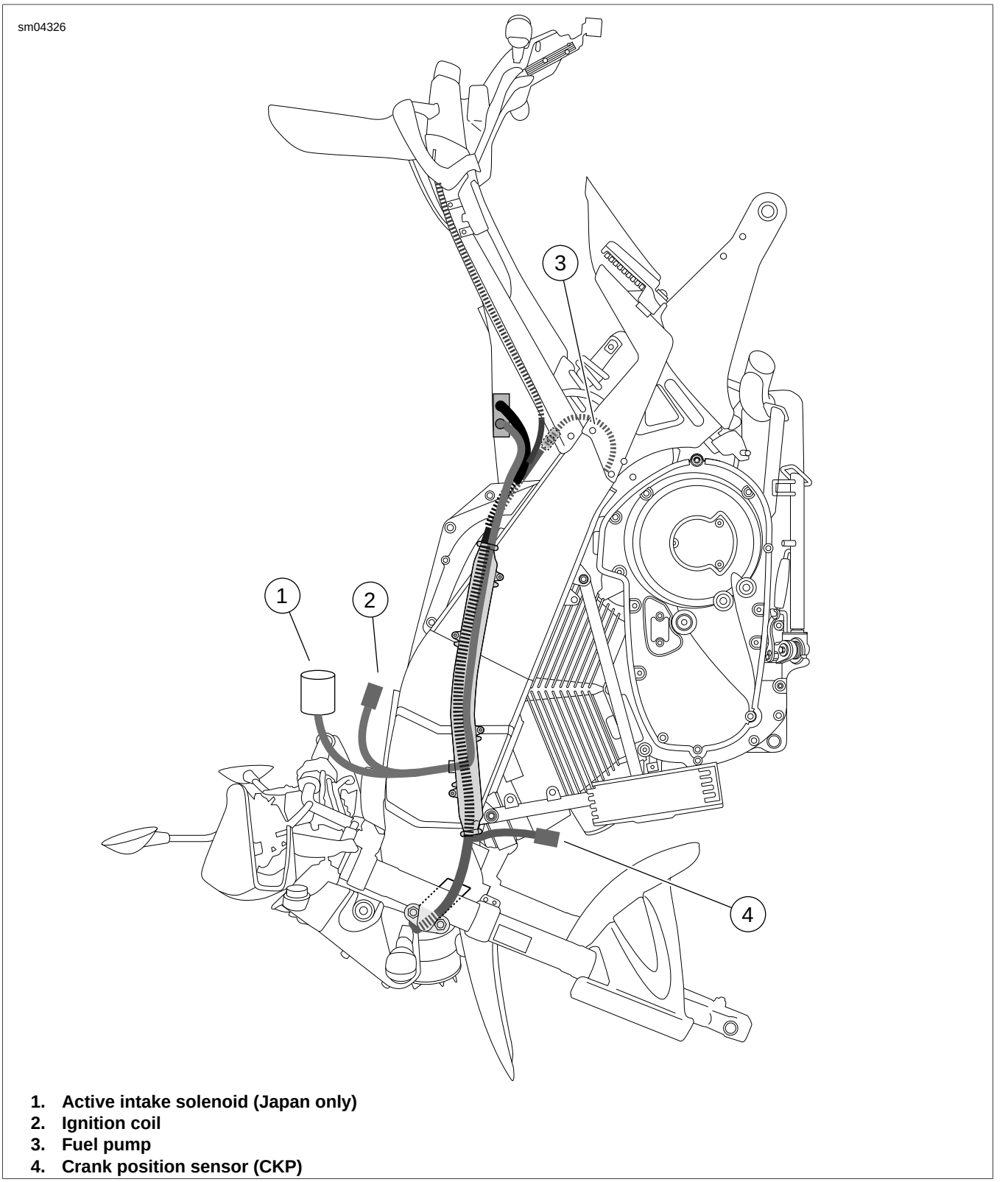


Figure D-28. Evaporative Emissions Control, California Models, Top View



1. **To induction module**
2. **From induction module (California)**
3. **From fuel tank (California)**
4. **From fuel tank to atmosphere (49 state)**

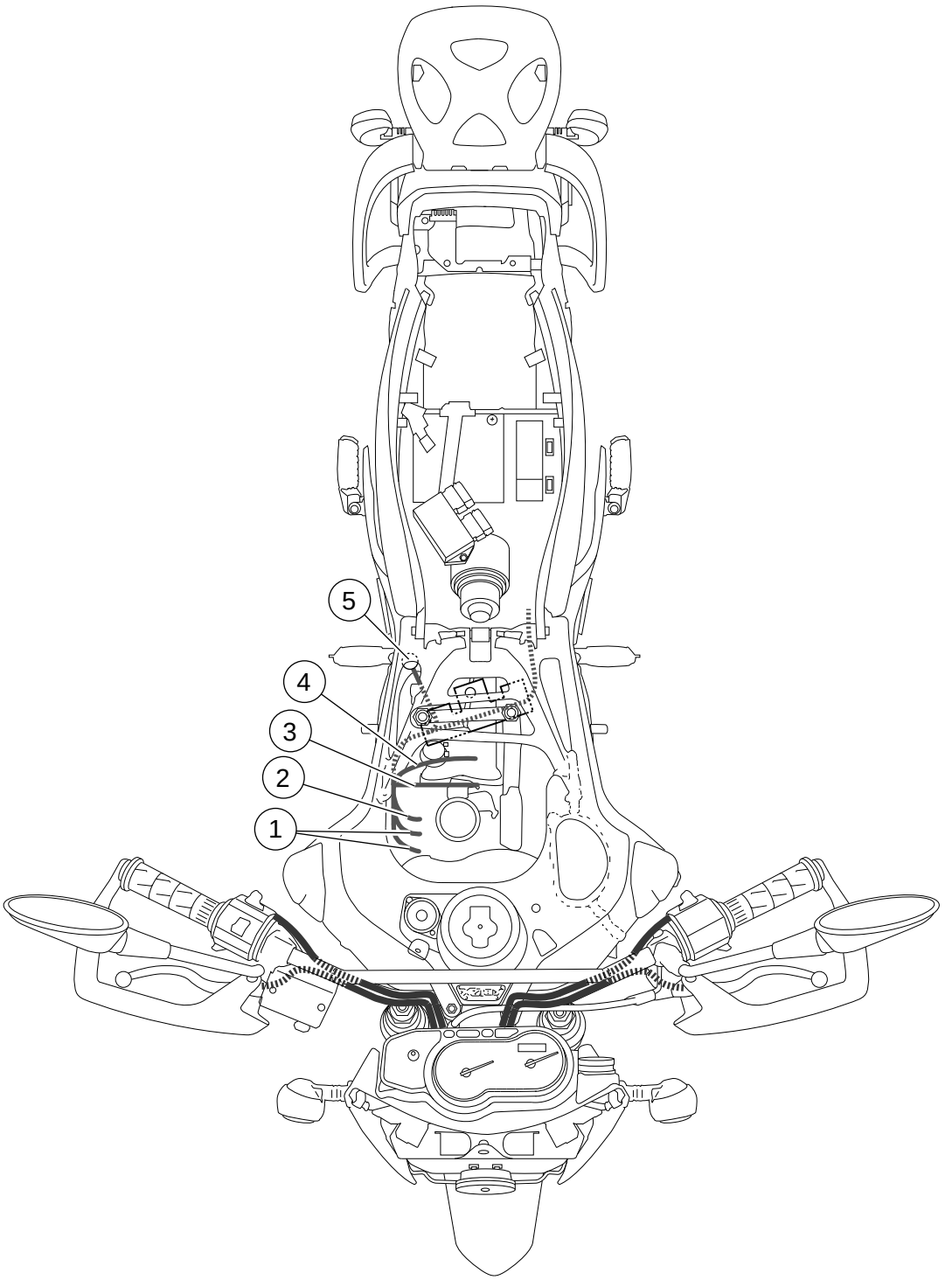
Figure D-29. Evaporative Emissions Control, California and 49 State Models, Left Side View



1. **Active intake solenoid (Japan only)**
2. **Ignition coil**
3. **Fuel pump**
4. **Crank position sensor (CKP)**

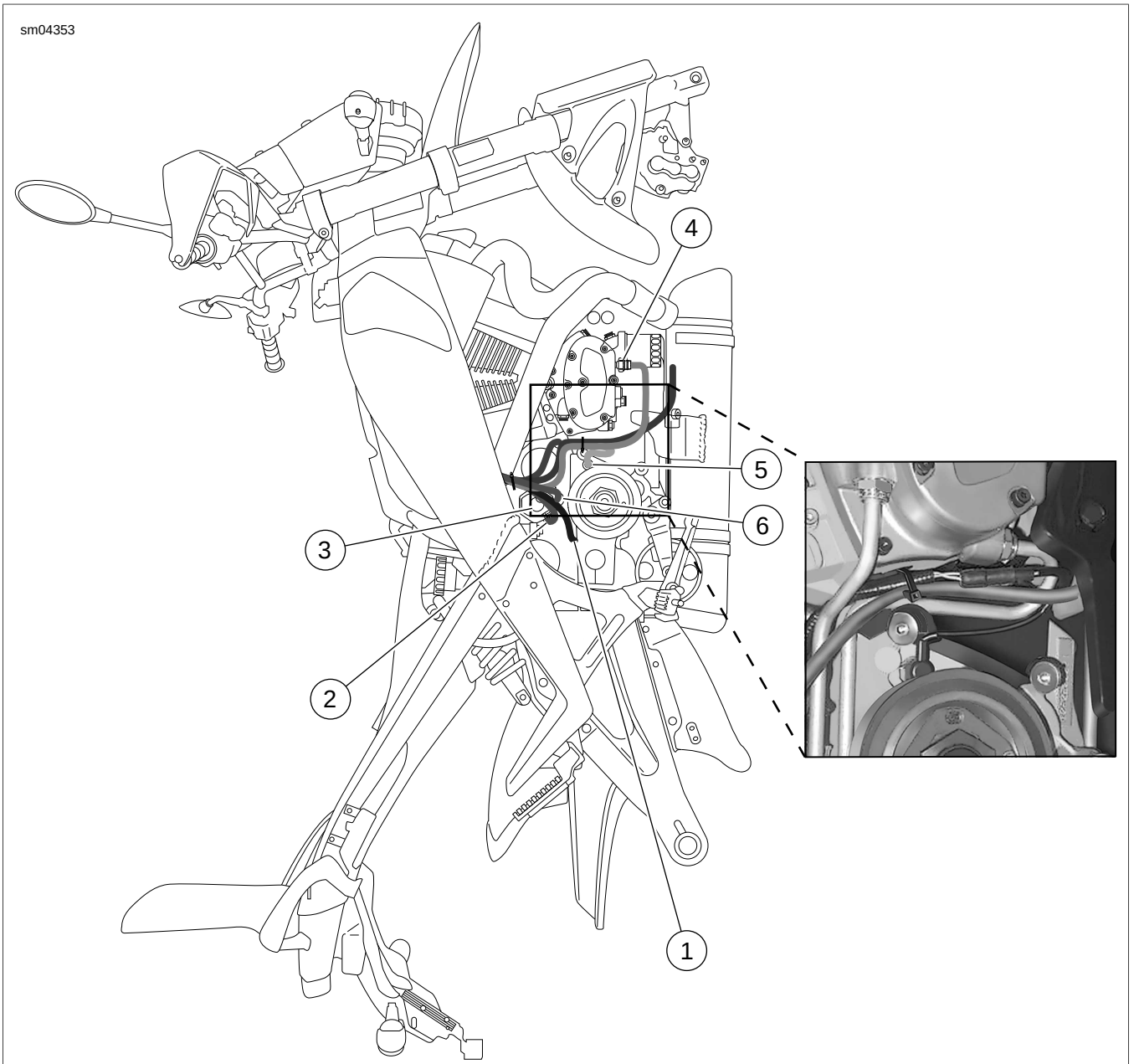
Figure D-30. Wiring Harness, Left Side View

sm04348



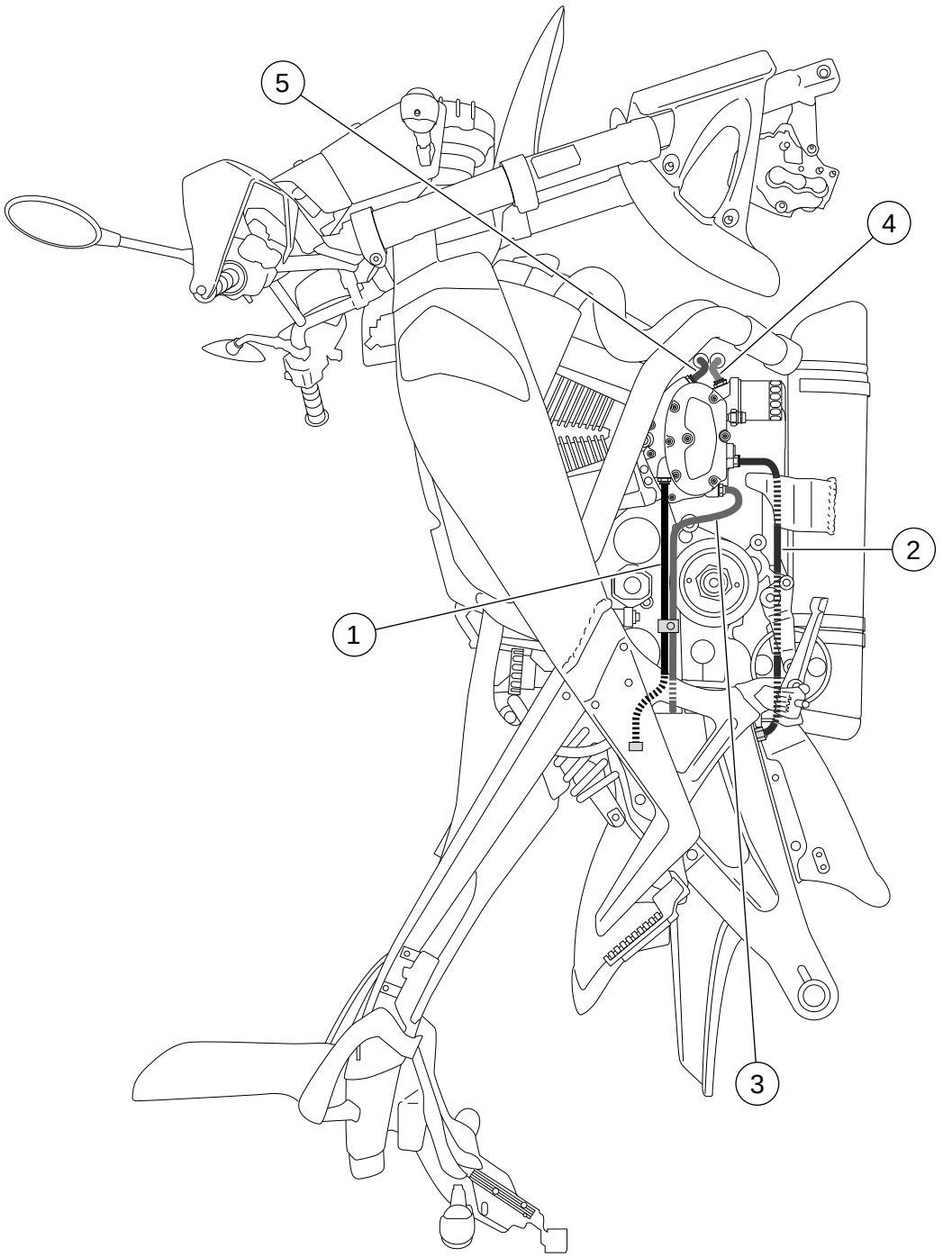
1. **Fuel injector (2)**
2. **Idle air control (IAC)**
3. **Throttle position sensor (TPS)**
4. **Intake air temperature sensor (IAT)**
5. **Oxygen sensor (O2)**

Figure D-31. Wiring Harness, Top View



1. **Vehicle speed sensor (VSS)**
2. **Cable, starter to battery positive**
3. **Solenoid**
4. **Oil pressure switch**
5. **Neutral switch**
6. **Relay terminal**

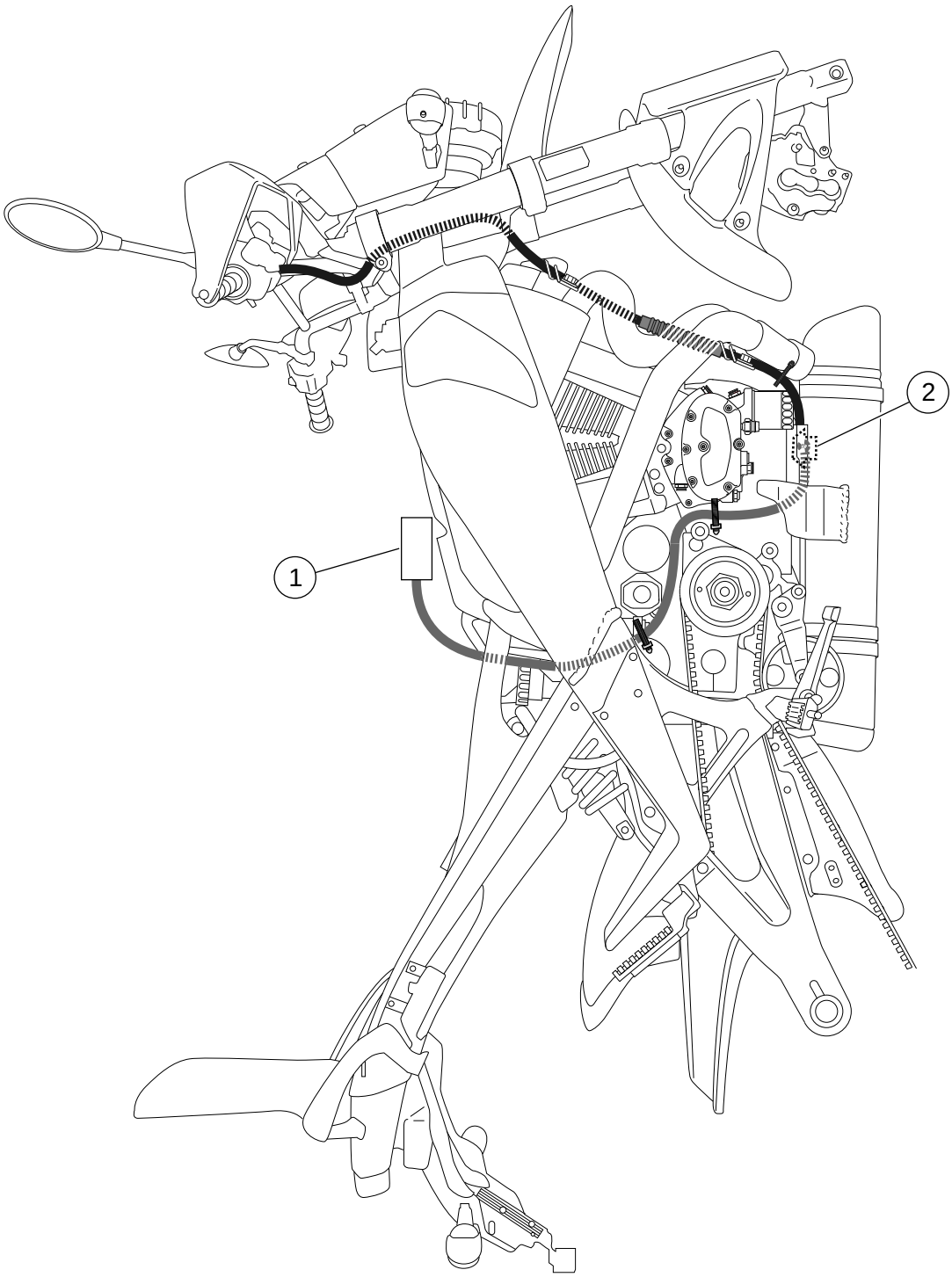
Figure D-32. Wiring Harness, Right Side View



1. **Vent line**
2. **Feed oil line**
3. **Return oil line**
4. **Feed oil line from the oil pump to the oil cooler**
5. **Return oil line from the oil cooler to the oil filter housing**

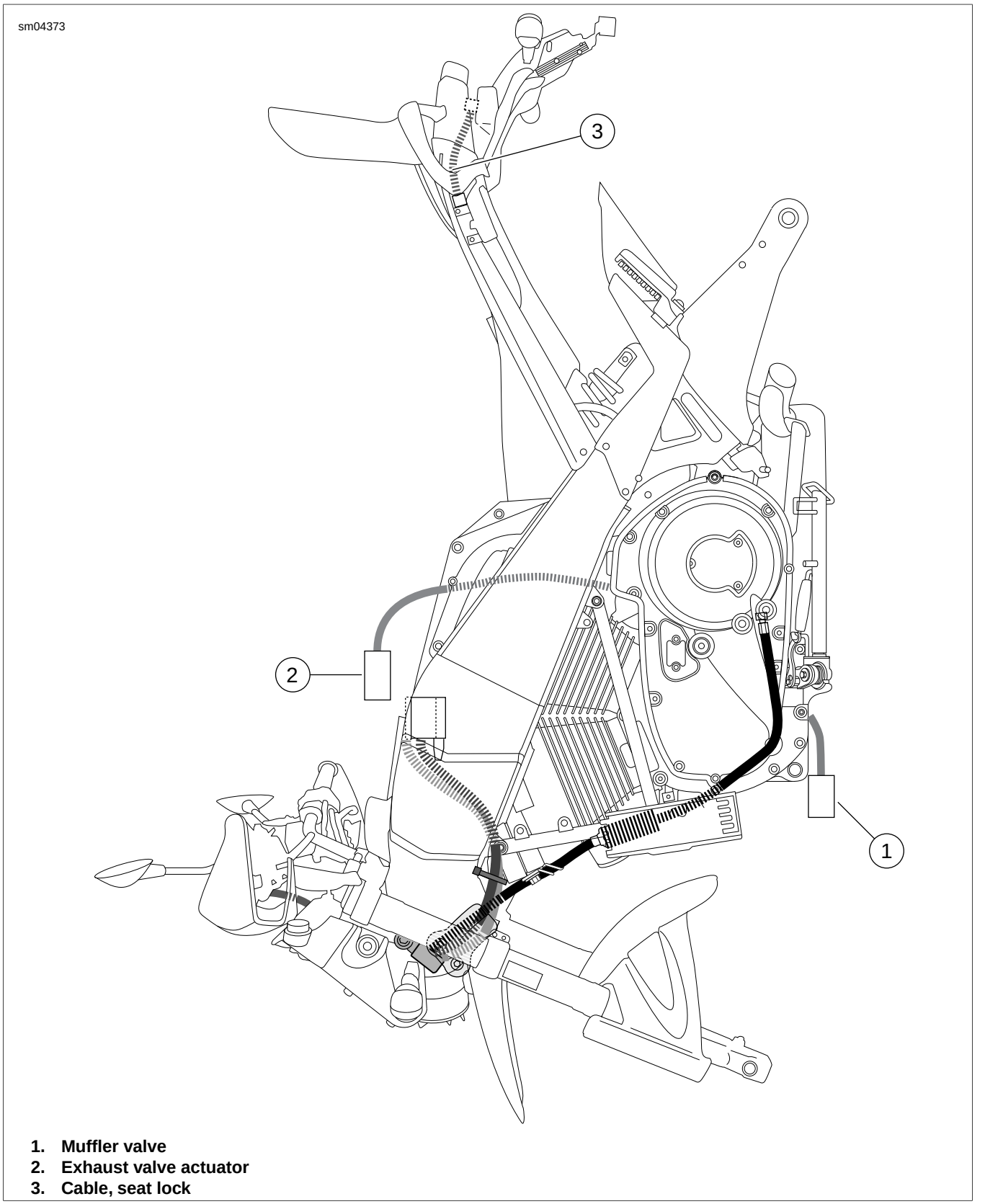
Figure D-33. Oil Lines, Right Side View

sm04370



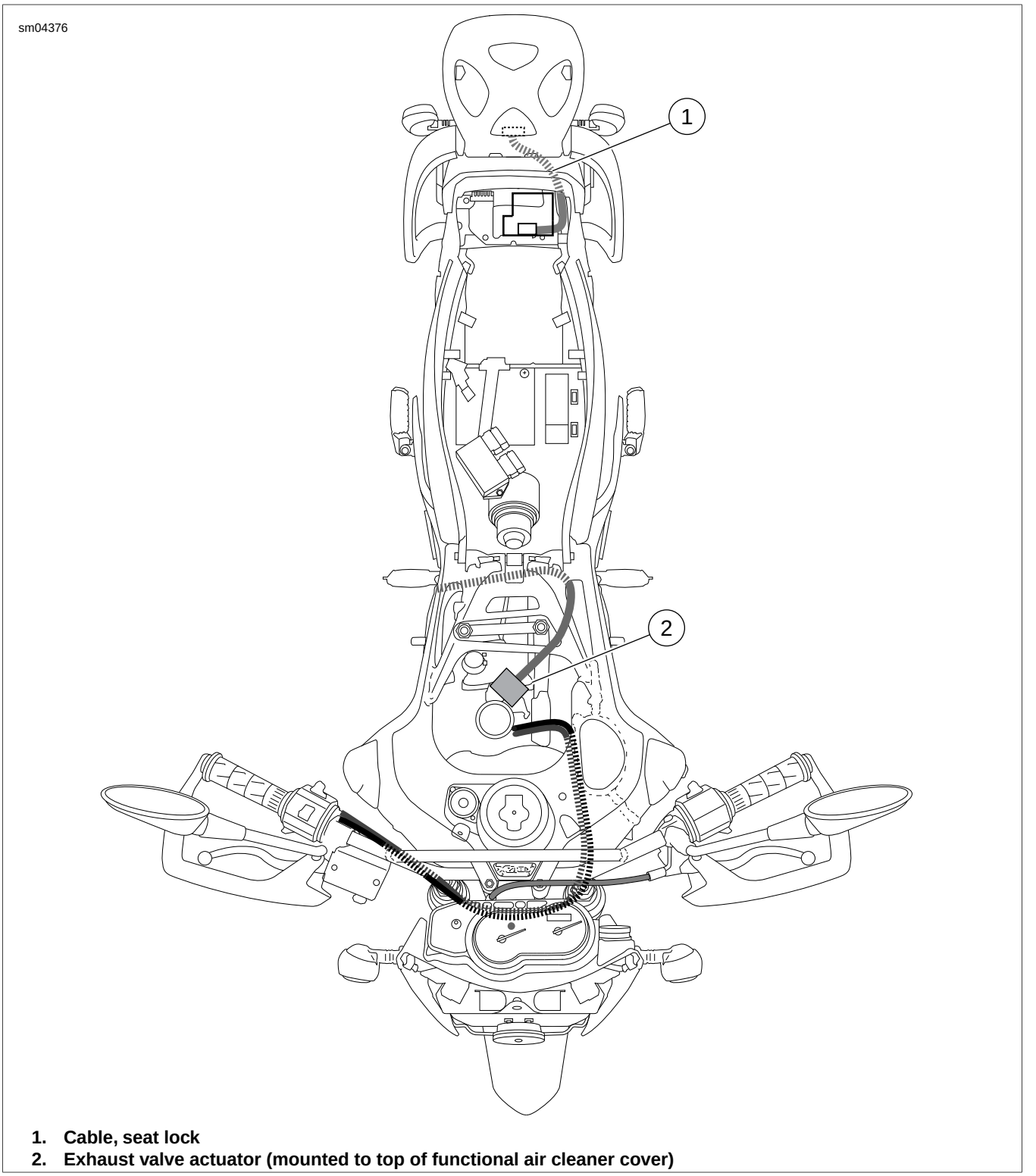
1. **Exhaust valve actuator**
2. **Muffler valve**

Figure D-34. Clutch Cable and Exhaust Valve Actuator, Right Side View



1. **Muffler valve**
2. **Exhaust valve actuator**
3. **Cable, seat lock**

Figure D-35. Clutch, Throttle, Seat Release Cable and Exhaust Valve Actuator, Left Side View



1. **Cable, seat lock**
2. **Exhaust valve actuator (mounted to top of functional air cleaner cover)**

Figure D-36. Clutch, Throttle, Seat Release Cable and Exhaust Valve Actuator (XB12 Models), Top View

NOTES

TABLE OF CONTENTS

SUBJECT **PAGE NO.**

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY) E.1

GENERAL

PART NUMBER	TOOL NAME
HD-41404	TEST CONNECTOR KIT

Active Intake System

The active intake system utilizes a solenoid in the airbox which is connected to the throttle valve via a cable. The throttle valve is automatically closed by the solenoid under certain conditions to reduce engine noise.

A code 22 will set if the ECM detects that the output for the active intake control is not in agreement with the feedback circuit (minimum TP sensor voltage when actuated).

Likely causes for a code 22 are:

- Mechanical fault in the active intake solenoid, throttle valve, or cable.
- Electrical fault in the solenoid circuit.
- Electrical fault in the throttle position sensor circuit.
- When TPS reading is not between 10.4-10.9 when activated.

Diagnostic Notes

The reference numbers below correlate with the circled numbers on the Code 22 flow charts.

Using TEST CONNECTOR KIT (Part No. HD-41404), attach Brown pin probe and patch cord to [179] (1,2).

VERIFY SETTINGS

1. Prior to verifying the active intake system, check the throttle position sensor (TPS) zero and adjust if necessary. See **Throttle Position Sensor".
2. Leave Digital Technician attached to vehicle.
3. In Digital Technician, go to Active Intake test screen.
4. Rotate throttle grip to wide open throttle (WOT).
   a. Check that when the throttle plate reaches WOT, TPS should read above 82°.
   b. If not, see WOT CHECK listed below.
5. While holding the throttle wide open, activate the active intake tab on Digital Technician.
   a. Verify that the TPS setting is between 10.4-10.9 degrees.
   b. If settings are not correct proceed to cable adjustment procedure.

WOT CHECK

1. Remove cosmetic intake cover assembly and functional air cleaner cover. See 2.38 INTAKE COVER and 1.14 AIR CLEANER AND EXHAUST SYSTEM.
2. While holding the throttle grip to the WOT position, verify that the throttle plate is fully open.

If the throttle plate does not fully open, see E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Cable this section.

CABLE

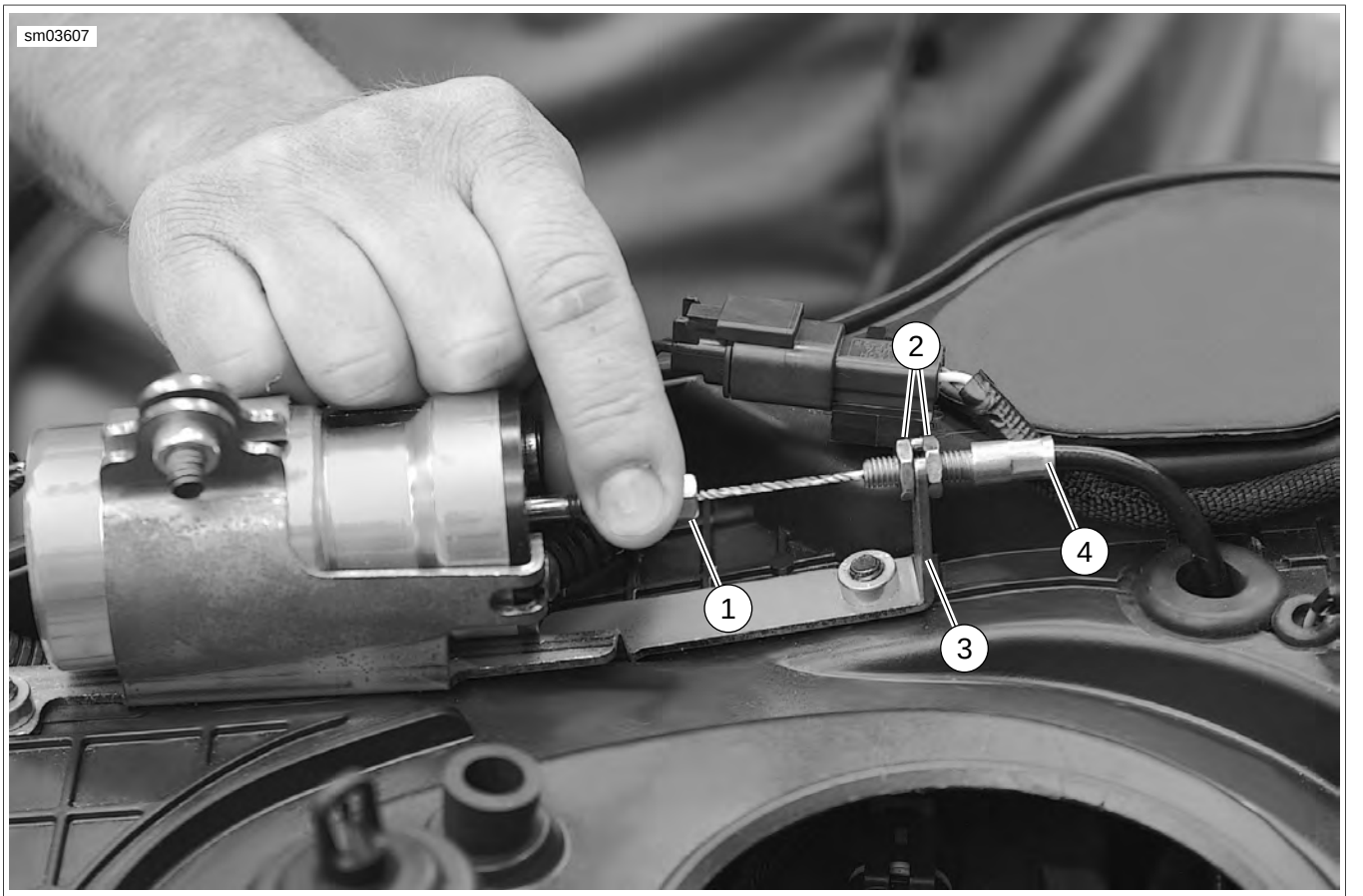
Adjustment

1. Remove cosmetic intake cover assembly and functional air cleaner cover. See 2.38 INTAKE COVER and 1.14 AIR CLEANER AND EXHAUST SYSTEM.
2. See Figure E-1. Inspect for proper retraction freeplay in solenoid shaft:
   a. Open the throttle to the WOT position, push solenoid shaft (1) inward to the fully retracted position.
   b. While slowly rolling off the throttle you should be able to move the solenoid shaft slightly inward until the shaft bottoms out. This slight travel will be the retraction freeplay.
   c. If you have no travel in the shaft, adjust cable housing (4) away from the solenoid bracket (3) until freeplay is achieved.

NOTE

This freeplay is necessary for the solenoid to properly function. Freeplay should be 1/32 in. (0.79 mm) or greater.

DIGITAL TECHNICIAN II HARLEY-DAVIDSON



1. **Solenoid shaft**
2. **Cable adjusting and jam nuts**
3. **Solenoid bracket**
4. **Cable housing**

Figure E-1. Checking for Freeplay in the Solenoid Shaft in the Fully Retracted Position

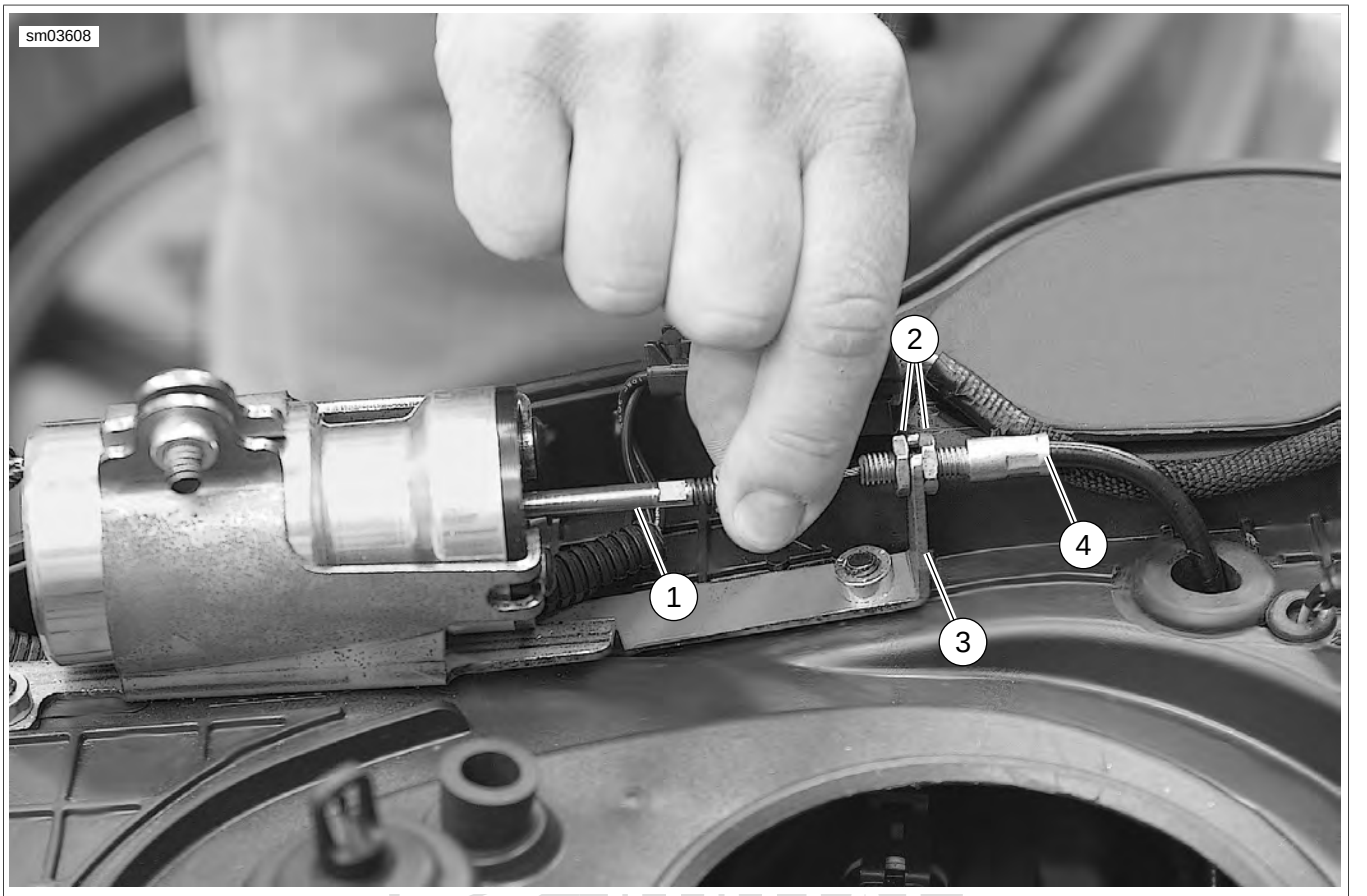
3. See Figure E-2. Inspect for proper extension freeplay in solenoid shaft:
   a. Open the throttle to the WOT position.
   b. Pull solenoid shaft (1) outward to the fully extended position.
   c. If you have no travel in the shaft, loosen jam nuts (2) and adjust cable housing (4) towards the solenoid bracket (3) until freeplay is achieved.

NOTE

You should be able to move the solenoid shaft slightly outward until the shaft is fully extended. This slight travel will be the freeplay which should be 1/32 in. (0.79 mm) or greater.

4. See E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Verify Settings. Once freeplay has been set, it will be necessary to verify settings and adjustments again.

If values are not between 10.4-10.9 degrees, see Throttle Stop Screw.



1. **Solenoid shaft**
2. **Cable adjusting and jam nuts**
3. **Solenoid bracket**
4. **Cable housing**

Figure E-2. Checking for Freeplay in the Solenoid Shaft in the Fully Extended Position

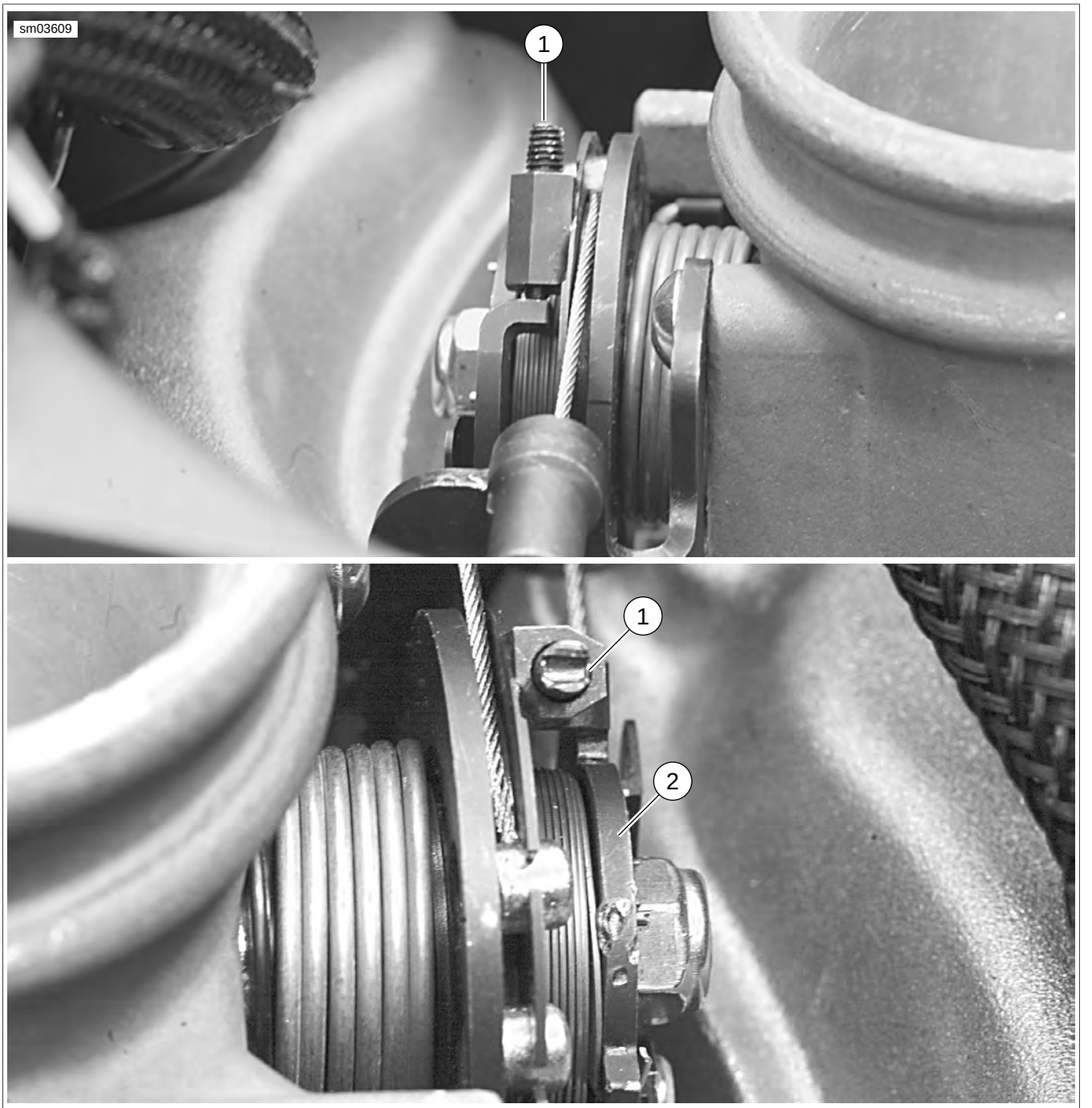
Throttle Stop Screw

1. Remove cosmetic intake cover assembly and functional air cleaner cover. See 2.38 INTAKE COVER and 1.14 AIR CLEANER AND EXHAUST SYSTEM.
2. Hold throttle to wide open position and use cable strap to free hands.

NOTE

It is necessary to pull velocity stack out of the way to access set screw.

3. Activate Active Intake System using DIGITAL TECHNICIAN.
4. Adjust stop screw, while reading the TPS on Digital Technician, until setting is between the range of 10.4 to 10.9.
   a. If the reading is below 10.4, adjust screw clockwise.
   b. If the reading is above 10.9, adjust screw counterclockwise.
5. Confirm the TPS setting. Repeat process if needed.
6. Adjust active intake cable assembly. See E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Cable.
7. Verify active intake TPS settings.
8. Install cosmetic intake cover assembly and functional air cleaner cover. See 2.38 INTAKE COVER and 1.14 AIR CLEANER AND EXHAUST SYSTEM.



1. **Cable stop screw**
2. **Active cable wheel**

Figure E-3. Active Intake Cable Stop Screw

REMOVAL

NOTE

If solenoid bracket needs to be replaced, remove the baseplate assembly, turn it over and remove the three fasteners securing the bracket to the baseplate.

1. See Figure E-4. Disconnect electrical connector [178] (1).
2. Hold solenoid shaft by flat spot provided and break cable connector (6) loose.
3. Unthread cable connector and disconnect cable from solenoid (8).
4. Loosen jam nut (5) and disconnect active cable (2) from cable bracket (4).

NOTE

Follow next step only is solenoid is to be replaced.

5. Loosen pinch fastener on solenoid bracket (9).

6. Remove the two fasteners at the front on the solenoid bracket (9) and slide solenoid (8) out of bracket.

NOTE

When removing baseplate it will be necessary to feed the electrical connector and active cable and grommets through the baseplate.

7. Remove baseplate (10). See 4.3 AIR CLEANER ASSEMBLY

8. See Figure E-3. If the active cable needs to be replaced disconnect from cable wheel (2).

INSTALLATION

NOTE

*If solenoid bracket was removed, install using the three fasteners and tighten to 48-60 **in-lbs** (5.4-7 Nm).*

1. See Figure E-4. When installing baseplate assembly (10) see 4.3 AIR CLEANER ASSEMBLY

NOTE

When installing the backing plate it is important to verify that the active cable remains in the tower on the cable wheel on the throttle body. If the cable comes out the cable will not work properly and will not be able to be adjusted.

NOTES

- *When installing baseplate be sure to feed the electrical connector (1) through hole in baseplate first and then insert active cable and then grommet.*
- *Follow next step only if solenoid was removed.*

2. Install solenoid (8) into bracket (9) and tighten pinch fastener to 48-60 **in-lbs** (5.4-7 Nm) and bracket to solenoid fasteners to 20-24 in lbs (2.3-2.7 Nm).

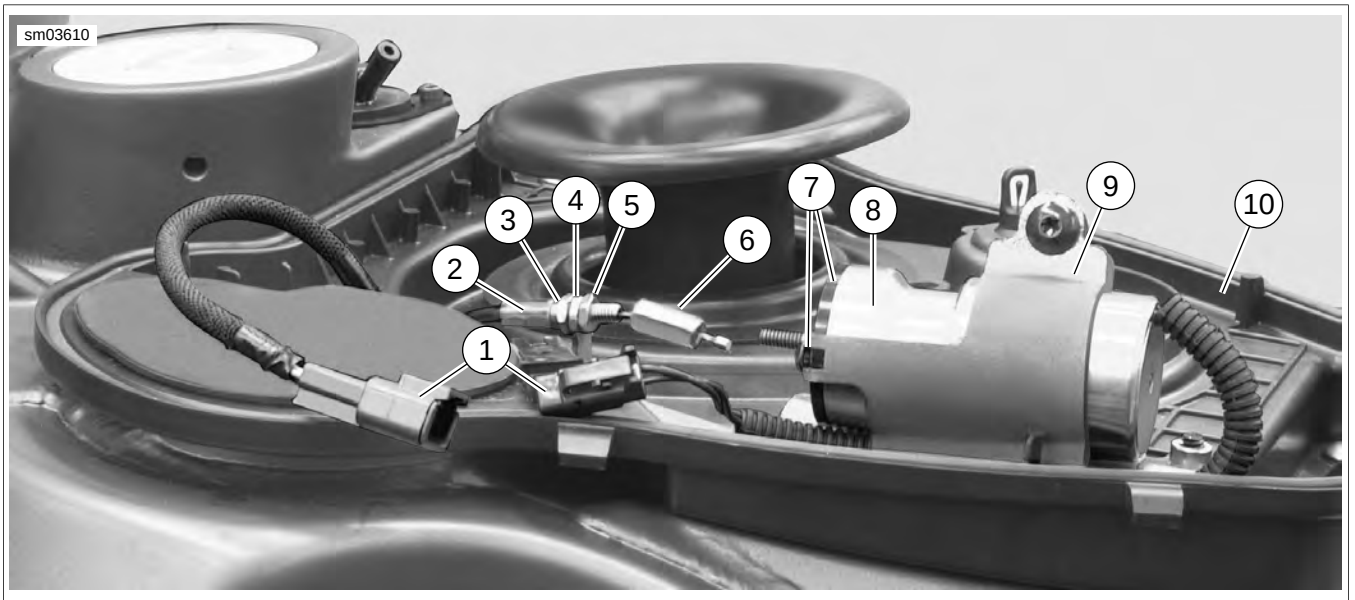
3. Install active cable (2) into bracket (4) and leave jam nut (5) loose until the setting can be verified.

4. Connect active cable (2) to solenoid shaft and tighten cable connector (6) to 20-24 in lbs (2.3-2.7 Nm).

5. Connect electrical connector [178].

6. See E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Cable and verify active cable setting.

7. Tighten jam nuts to 48-60 **in-lbs** (5.4-7 Nm).



1. **Electrical connector [178]**
2. **Active intake cable**
3. **Cable adjusting nut**
4. **Cable bracket**
5. **Active cable jam nut**
6. **Cable connector**
7. **Fasteners (2), bracket to solenoid**
8. **Active intake solenoid**
9. **Solenoid bracket**
10. **Air cleaner baseplate assembly**

Figure E-4. Disconnecting Active Intake System

NOTES

TABLE OF CONTENTS

SUBJECT **PAGE NO.**

DIGITAL TECHNICIAN® II
HARLEY-DAVIDSON®

NOTES

GLOSSARY F.1

ACRONYMS AND ABBREVIATIONS

Table F-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AC	Alternating Current
ACC	Accessory
ACR	Automatic Compression Release
AGM	Absorbed Glass Mat (battery)
Amp	Ampere
AWG	American Wire Gauge
B+	Battery Voltage
BAS	Bank Angle Sensor
BTDC	Before Top Dead Center
C	Celsius (Centigrade)
CA	California
CAL	Calibration
CC	Cubic Centimeters
CCA	Cold Cranking Amps
CKP	Crankshaft Position
cm	Centimeter
DC	Direct Current
DLC	Data Link Connector
DOM	Domestic
DTC	Diagnostic Trouble Code
DVOM	Digital Volt Ohm Meter
ECM	Electronic Control Module
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EFI	Electronic Fuel Injection
ET	Engine Temperature
EVAP	Evaporative Emissions Control System
F	Fahrenheit
ft-lbs	Foot-Pounds
fl oz.	Fluid Ounce
g	Gram
GAL	Gallon
GAWR	Gross Axle Weight Rating
GND	Ground (electrical)
GVWR	Gross Vehicle Weight Rating
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson Smart Security System
HFSM	Hands Free Security Module
Hg	Mercury

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table F-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
IAC	Idle Air Control
IAT	Intake Air Temperature
IC	Instrument Cluster
ID	Inside Diameter
IGN	Ignition Light/Key Switch
In.	Inch
INJ PW	Injector Pulse Width
in-lbs	Inch-Pounds
Kg	Kilogram
Km	Kilometer
kPa	Kilopascal
km/hr	Kilometers Per Hour
L	Liter
LCD	Liquid Crystal Display
LED	Light Emitting Diode
mA	Milliampere
MAP	Manifold Absolute Pressure
ml	milliliter
mm	millimeter
MPH	Miles Per Hour
ms	millisecond
Nm	Newton-Meter
N/A	Not Applicable
no.	Number
O2	Oxygen
OD	Outside Diameter
OEM	Original Equipment Manufacturer
oz	Ounce
P&A	Parts and Accessories
PN	Part Number
PSI	Pounds per Square Inch
PWM signal	Pulse Width Modulated signal
RES	Reserve
RPM	Revolutions Per Minute
SCFH	Cubic Feet per Hour at Standard Conditions
TCA	Throttle Control Actuator
TDC	Top Dead Center
TGS	Twist Grip Sensor
TP	Throttle Position
TMAP	Intake Air Temperature/Manifold Absolute Pressure
TSM	Turn Signal Module
TSSM	Turn Signal/Security Module
V	Volt

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Table F-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
VAC	Volts of Alternating Current
VDC	Volts of Direct Current
VIN	Vehicle Identification Number
VSS	Vehicle Speed Sensor

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

NOTES

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
94654-98	SUPERSMART BATTERY TENDER	1.5 BATTERY MAINTENANCE, Storage
A157-8	SNAP-ON BUSHING DRIVER 1/2-INCH ADAPTER	5.13 TRANSMISSION RIGHT CASE BEARINGS, Installation
A157C	SNAP-ON SEAL AND BUSHING DRIVER	2.53 TRIPLE TAIL: ULYSSES, Assembly
A157C	SNAP-ON BUSHING DRIVER SET	5.13 TRANSMISSION RIGHT CASE BEARINGS, Installation
B-35758-52A	7.02 MM VALVE SEAT CUTTER PILOT	3.7 CYLINDER HEAD, Procedure For Using The Neway Valve Seat Cutter
B-41623-B	OIL LINE REMOVER	3.12 OIL LINE FITTINGS, Removal
B-42571-43MM	FORK SEAL DRIVER AND DUST BOOT INSTALLER	2.16 FRONT FORKS: ALL MODELS, Assembly
B-42579-6	SPROCKET SHAFT ADAPTER	3.18 CRANKCASE, Assembly
B-42579-7	COLLAR	3.18 CRANKCASE, Assembly
B-42887	BRAKE CALIPER PISTON REMOVER	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Repair
B-42887	BRAKE CALIPER PISTON REMOVER	2.14 REAR BRAKE CALIPER, Disassembly
B-43721-41MM	FORK SEAL DRIVER AND DUST BOOT INSTALLER	2.16 FRONT FORKS: ALL MODELS, Assembly
B-43895-1	TRANSMISSION REMOVER	5.10 TRANSMISSION DISASSEMBLY, Transmission Removal From Left Crankcase
B-43982	SPROCKET HOLDING TOOL	5.17 TRANSMISSION SPROCKET, Removal
B-43982	SPROCKET HOLDING TOOL	5.17 TRANSMISSION SPROCKET, Installation
B-43985-3	INSTALLER	5.15 TRANSMISSION INSTALLATION, Installation
B-43985-4	GUIDE	5.15 TRANSMISSION INSTALLATION, Installation
B-43985-4	GUIDE	5.15 TRANSMISSION INSTALLATION, Installation
B-43993-10	FRONT WHEEL BEARING INSTALLER	2.5 FRONT WHEEL, Assembly
B-43993-10	FRONT WHEEL BEARING INSTALLER	2.6 REAR WHEEL, Assembly
B-43993-11 FRONT WHEEL	BACKING PLATE	2.5 FRONT WHEEL, Assembly
B-43993-11 FRONT WHEEL AND B-43993-12 REAR WHEEL	BACKING PLATES	2.6 REAR WHEEL, Assembly
B-43993-12	BACKING PLATE	2.18 STEERING HEAD BEARINGS, Installation
B-43993-50A	WHEEL BEARING REMOVER/INSTALLER KIT	2.5 FRONT WHEEL, Disassembly
B-43993-50A	WHEEL BEARING REMOVER/INSTALLER KIT	2.5 FRONT WHEEL, Assembly
B-43993-50A	WHEEL BEARING REMOVER/INSTALLER KIT	2.6 REAR WHEEL, Assembly
B-43993-7	FRONT WHEEL BEARING REMOVER COLLET	2.5 FRONT WHEEL, Assembly
B-43993-7	FRONT WHEEL BEARING REMOVER COLLET	2.6 REAR WHEEL, Assembly
B-43993-7, FROM KIT PART NO. B-43993-50A	FRONT WHEEL BEARING REMOVER COLLET	2.5 FRONT WHEEL, Disassembly
B43993-8	BUSHING AND BEARING PULLER	2.6 REAR WHEEL, Disassembly
B-43993-8	REAR WHEEL BEARING REMOVER COLLET	2.6 REAR WHEEL, Assembly
B-43993-9	FRONT BEARING INSTALLER	2.5 FRONT WHEEL, Assembly
B-43993-9	REAR WHEEL BEARING INSTALLER	2.6 REAR WHEEL, Assembly

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
B-43993-9, FROM KIT PART NO. B-43993-50A	FRONT BEARING INSTALLER	2.5 FRONT WHEEL, Assembly
B-45520	GEAR DETENT ASSEMBLY AID	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase
B-45521	STEERING HEAD BEARING INSTALLATION TOOL	2.18 STEERING HEAD BEARINGS, Installation
B-45522	FUEL PRESSURE GAUGE ADAPTER	4.16 FUEL PRESSURE TEST, Inspection
B-45523	VALVE GUIDE REAMER	3.7 CYLINDER HEAD, Replacing Valve Guides
B-45524-A	VALVE GUIDE REMOVER/INSTALLER	3.7 CYLINDER HEAD, Replacing Valve Guides
B-45525	VALVE GUIDE HONE	3.7 CYLINDER HEAD, Cleaning and Inspection
B-45525	VALVE GUIDE HONE	3.7 CYLINDER HEAD, Replacing Valve Guides
B-45655, HD-42720-2 AND HD-46663	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER	3.18 CRANKCASE, Piston Jets
B-45655, HD-42720-2 AND HD-46663	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER	3.18 CRANKCASE, Assembly
B-45659	SPROCKET LOCKING TOOL	5.17 TRANSMISSION SPROCKET, Removal
B-45659	SPROCKET LOCKING TOOL	5.17 TRANSMISSION SPROCKET, Installation
B-45676-A	SPROCKET SHAFT SEAL INSTALLER	3.18 CRANKCASE, Assembly
B-45847	CROSS PLATE	5.12 MAIN DRIVE GEAR AND BEARING, Removal
B-45847	CROSS PLATE	5.12 MAIN DRIVE GEAR AND BEARING, Installation
B-45926	CLUTCH SHELL BEARING REMOVER/INSTALLER	5.6 PRIMARY CHAIN, Clutch Shell Bearing Replacement
B-46285 (4)	TRANSMISSION FIXTURE	5.15 TRANSMISSION INSTALLATION, Installation
B-48867-47MM	FORK SEAL DRIVER AND DUST BOOT INSTALLER	2.16 FRONT FORKS: ALL MODELS, Assembly
B-59000A	FRONT FORK OIL LEVEL GAUGE	2.16 FRONT FORKS: ALL MODELS, Assembly
CJ114	SNAP-ON BODY DENT PULLER	3.18 CRANKCASE, Piston Jets
FTXR45E	SNAP-ON TAMPER-RESISTANT T45 TORX DRIVER	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT
GA500A	SNAP-ON TERMINAL PICK	A.2 AUTOFUSE ELECTRICAL CONNECTORS, Autofuse Connector Repair
HD-25070	ROBINAIR HEAT GUN	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-33223-1	CYLINDER COMPRESSION GAUGE	3.3 ENGINE, Compression Test
HD-33446-86	XL EVOLUTION TORQUE PLATE BOLTS	3.8 CYLINDER AND PISTON, Cleaning and Inspection
HD-33446B	CYLINDER TORQUEPLATES	3.8 CYLINDER AND PISTON, Cleaning and Inspection
HD-34623C	PISTON PIN RETAINING RING INSTALLER	3.8 CYLINDER AND PISTON, Removal/Disassembly
HD-34623C	PISTON PIN RETAINING RING INSTALLER	3.8 CYLINDER AND PISTON, Assembly/Installation
HD-34736B	VALVE SPRING COMPRESSOR	3.7 CYLINDER HEAD, Disassembly
HD-34736B	VALVE SPRING COMPRESSOR	3.7 CYLINDER HEAD, Assembly
HD-34751	VALVE GUIDE CLEANING BRUSH	3.7 CYLINDER HEAD, Cleaning and Inspection
HD-34751	VALVE GUIDE CLEANING BRUSH	3.7 CYLINDER HEAD, Replacing Valve Guides
HD-34751	VALVE GUIDE CLEANING BRUSH	3.7 CYLINDER HEAD, Procedure For Using The Neway Valve Seat Cutter
HD-34751	VALVE GUIDE CLEANING BRUSH	3.7 CYLINDER HEAD, Assembly

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-34902-7	END CAP	3.18 CRANKCASE, Piston Jets
HD-34902-7	END CAP	3.18 CRANKCASE, Pinion Shaft Bearing
HD-34902B	BEARING RACE REMOVER/INSTALLER	3.18 CRANKCASE, Piston Jets
HD-34902B	BEARING RACE REMOVER/INSTALLER	3.18 CRANKCASE, Pinion Shaft Bearing
HD-35102	WRIST PIN BUSHING HONE	3.8 CYLINDER AND PISTON, Connecting Rod Bushing
HD-35316-11	RECEIVER CUP	5.12 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-12	INSTALLER CUP	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	5.12 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-4A	8 IN. BOLT	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-7	WASHER	5.12 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-7	WASHER	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-8	BEARING DRIVER	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-9	BEARING DRIVER	5.12 MAIN DRIVE GEAR AND BEARING, Removal
HD-35457	BLACK LIGHT LEAK DETECTOR	1.20 TROUBLESHOOTING, Lubrication System
HD-35667A	CYLINDER LEAKDOWN TESTER	3.3 ENGINE, Cylinder Leakage Test
HD-35758-C	NEWAY VALVE SEAT CUTTER SET	3.7 CYLINDER HEAD, Procedure For Using The Neway Valve Seat Cutter
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.13 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.7 DEUTSCH MINI TERMINAL REPAIR, Deutsch Mini Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.13 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.13 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-38362 FOR XB9 MODELS	SPROCKET LOCKING LINK	5.6 PRIMARY CHAIN, Removal
HD-38362 FOR XB9 MODELS	SPROCKET LOCKING LINK	5.6 PRIMARY CHAIN, Installation
HD-38515-91	CLUTCH SPRING FORCING SCREW	5.5 CLUTCH, Removal
HD-38515-A	SPRING COMPRESSING TOOL	5.5 CLUTCH, Removal
HD-39302	STEERING HEAD BEARING RACE INSTALLER	2.6 REAR WHEEL, Assembly
HD-39302	STEERING HEAD BEARING RACE INSTALLER	2.18 STEERING HEAD BEARINGS, Installation
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.7 CYLINDER HEAD, Procedure For Using The Neway Valve Seat Cutter
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.5 DEUTSCH STANDARD TERMINAL REPAIR, Deutsch Standard Terminal Crimps
HD-39969	ULTRA TORCH UT-100	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41177	FORK HOLDING TOOL	2.16 FRONT FORKS: ALL MODELS, Disassembly
HD-41182	FUEL PRESSURE GAUGE	4.16 FUEL PRESSURE TEST, Inspection

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41183	HEAT SHIELD ATTACHMENT	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41404	TEST CONNECTOR KIT	E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), General
HD-41417	PROPANE ENRICHMENT KIT	4.17 INTAKE LEAK TEST, Leak Tester
HD-41475	DEUTSCH CONNECTOR SERVICE KIT	A.4 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	A.4 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-42310/HD-43646 OR HD-43682	ENGINE SUPPORT STAND	5.9 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL, Right Crankcase Removal
HD-42322	PISTON SUPPORT PLATE	3.8 CYLINDER AND PISTON, Assembly/Installation
HD-42326-B	CRANKSHAFT GUIDE	3.18 CRANKCASE, Assembly
HD-42326-B	CRANKSHAFT GUIDE	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase
HD-42579	SPROCKET SHAFT BEARING INSTALLER	3.18 CRANKCASE, Assembly
HD-42879	ELECTRICAL CRIMPER TOOL	A.6 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR, Deutsch Solid Barrel Terminal Crimps
HD-43984	CRANKSHAFT LOCKING TOOL	3.17 GEARCASE AND CAM GEARS, Assembly and Installation
HD-44060-6	BEARING INSTALLER	2.19 SWINGARM AND BRACE, Assembly
HD-44060A	WHEEL BEARING REMOVER/INSTALLER	2.5 FRONT WHEEL, Disassembly
HD-44060A	WHEEL BEARING INSTALLER/REMOVER	2.5 FRONT WHEEL, Assembly
HD-44060A	WHEEL BEARING REMOVER AND INSTALLER	2.6 REAR WHEEL, Disassembly
HD-44358	FLYWHEEL SUPPORT FIXTURE	3.18 CRANKCASE, Piston Jets
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER	A.15 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER	A.15 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-45966	FRONT FORK COMPRESSOR	2.16 FRONT FORKS: ALL MODELS, Disassembly
HD-46283 FOR XB12 MODELS	SPROCKET LOCKING LINK	5.6 PRIMARY CHAIN, Removal
HD-46283 FOR XB12 MODELS	SPROCKET LOCKING LINK	5.6 PRIMARY CHAIN, Installation
HD-46288	MAINSHAFT LOCKNUT WRENCH	5.17 TRANSMISSION SPROCKET, Removal
H-D-46288	MAINSHAFT LOCKNUT WRENCH	5.17 TRANSMISSION SPROCKET, Installation
HD-47855	INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL	5.12 MAIN DRIVE GEAR AND BEARING, Assembly
HD-47856-1	INSTALLER	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-2	PILOT	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-4	ADAPTER	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-5	NUT	5.12 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-7	CROWFOOT WRENCH	5.12 MAIN DRIVE GEAR AND BEARING, Installation

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER	A.8 MOLEX CONNECTORS, Molex Connector Repair
HD-48119	ELECTRICAL CRIMP TOOL	A.8 MOLEX CONNECTORS, Crimp Terminal to Lead
HD-48650	DIGITAL TECHNICIAN II	4.4 ELECTRONIC CONTROL MODULE (ECM), FIREBOLT
HD-48650	DIGITAL TECHNICIAN II	6.3 IGNITION SYSTEM, General
HD-94660-37B	MAINSHAFT LOCKNUT WRENCH	5.17 TRANSMISSION SPROCKET, Removal
HD-94660-37B	MAINSHAFT LOCKNUT WRENCH	5.17 TRANSMISSION SPROCKET, Installation
HD-94800-26A	REAMER	3.8 CYLINDER AND PISTON, Connecting Rod Bushing
HD-94804-57	ROCKER ARM BUSHING REAMER	3.7 CYLINDER HEAD, Replacing Rocker Arm Bushings
HD-95635-46	CLAW PULLER	3.18 CRANKCASE, Piston Jets
HD-95635-46	CLAW PULLER	3.18 CRANKCASE, Pinion Shaft Bearing
HD-95635-46	CLAW PULLER	5.12 MAIN DRIVE GEAR AND BEARING, Disassembly
HD-95637-46B	WEDGE ATTACHMENT	3.18 CRANKCASE, Pinion Shaft Bearing
HD-95637-46B	WEDGE ATTACHMENT	5.12 MAIN DRIVE GEAR AND BEARING, Disassembly
HD-95760-69A	BUSHING AND BEARING PULLER	5.13 TRANSMISSION RIGHT CASE BEARINGS, Removal
HD-95765-69A	1/2 IN. COLLET	5.13 TRANSMISSION RIGHT CASE BEARINGS, Removal
HD-95952-33C	CONNECTING ROD CLAMPING TOOL	3.8 CYLINDER AND PISTON, Connecting Rod Bushing
HD-95970-32D	PISTON PIN BUSHING TOOL	3.8 CYLINDER AND PISTON, Connecting Rod Bushing
HD-96333-51E	PISTON RING COMPRESSOR	3.8 CYLINDER AND PISTON, Assembly/Installation
HD-96710-40D	CRANKCASE MAIN BEARING LAPPING TOOL	3.18 CRANKCASE, Pinion Shaft Bearing
HD-96718-87	CRANKCASE MAIN BEARING LAP	3.18 CRANKCASE, Pinion Shaft Bearing
HD-96925-52B	OIL PRESSURE GAUGE SET	3.14 OIL PRESSURE INDICATOR SWITCH, Oil Pressure
HD-97228-55A	COLLAR	3.18 CRANKCASE, Assembly
HD-97292-61	TWO CLAW PULLER	5.6 PRIMARY CHAIN, Removal
HD-99500-80	WHEEL TRUING AND BALANCING STAND	2.7 TIRES, Adjustment
HE-52B	SNAP-ON SPRING TOOL	2.46 SIDESTAND, Disassembly
HS0020.02A8A	HOSE ASSEMBLY	6.17 INTERACTIVE EXHAUST SYSTEM, Removal
J-23444-A	EXTREME PRESSURE LUBRICANT	2.5 FRONT WHEEL, Disassembly
J-23444-A	EXTREME PRESSURE LUBRICANT	2.5 FRONT WHEEL, Assembly
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS	3.8 CYLINDER AND PISTON, Fitting Piston Rings
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS	5.10 TRANSMISSION DISASSEMBLY, Mainshaft Disassembly
MAR39200HD	MARSON THREAD-SETTER; TOOL KIT	2.50 CHIN FAIRING, Installation
SNAP-ON CJ1275	SLIDE HAMMER	2.19 SWINGARM AND BRACE, Disassembly
SNAP-ON FRXB14	FLARE NUT SOCKET	2.13 REAR BRAKE LINE, Installation: Lightning
SNAP-ON FRXM14	FLARE NUT SOCKET	2.13 REAR BRAKE LINE, Installation: Firebolt
SNAP-ON M3503B	ENGINE TEMPERATURE SENSOR SOCKET	4.8 ENGINE TEMPERATURE SENSOR (ET), Removal
SNAP-ON PR-36	SNAP RING PLIERS	5.14 TRANSMISSION LEFT CASE BEARINGS, Removal

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
SNAP-ON TT600-3	SNAP-ON PICK	A.12 PACKARD 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair
SNAP-ON YA8875	OXYGEN SENSOR SOCKET	4.7 OXYGEN SENSOR, Removal
TBFT 02S	FORK BLEED TOOL SET	2.16 FRONT FORKS: ALL MODELS, Assembly

DIGITAL TECHNICIAN® II HARLEY-DAVIDSON®

FASTENER	TORQUE VALUE		NOTES
Active cable jam nut	48-60 **in-lbs**	5.4-7 Nm	E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Installation
Active intake cable connector	20-24 in lbs	2.3-2.7 Nm	E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Installation
Actuator fasteners	36-40 **in-lbs**	4-4.5 Nm	6.17 INTERACTIVE EXHAUST SYSTEM, Installation
Air cleaner backplate fasteners	84-120 **in-lbs**	9.5-13.6 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Air scoop fastener at oil cooler	48-72 **in-lbs**	5.4-8 Nm	3.13 OIL COOLER, Installation/LOCTITE 271 (red)
Anti-rotation screws (lifter)	55-65 **in-lbs**	6-7 Nm	3.16 HYDRAULIC LIFTERS, Installation
Axle, rear (final torque, see ANTI-SEIZE procedure)	48-52 ft-lbs	65-70.5 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (final torque)	48-52 ft-lbs	65-70.5 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (final torque)	48-52 ft-lbs	65-70.5 Nm	5.17 TRANSMISSION SPROCKET, Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation/Follow special ANTI-SEIZE procedure.
Axle, rear (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	5.17 TRANSMISSION SPROCKET, Installation/Follow special ANTI-SEIZE procedure.
Axle (front)	39-41 ft-lbs	53-56 Nm	2.5 FRONT WHEEL, Installation/ANTI-SEIZE, left handed thread
Axle (rear, final torque)	48-52 ft-lbs	65-70.5 Nm	2.6 REAR WHEEL, Installation/Follow special instructions, ANTI-SEIZE
Axle (rear, initial torque)	23-27 ft-lbs	31.2-36.6 Nm	2.6 REAR WHEEL, Installation/Follow special instructions, ANTI-SEIZE
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	2.37 BELT GUARDS, Installation
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation
Axle pinch fastener, rear	40-45 ft-lbs	54-61 Nm	5.17 TRANSMISSION SPROCKET, Installation
Axle pinch fasteners, front	20-22 ft-lbs	27-30 Nm	2.5 FRONT WHEEL, Installation
Axle pinch fasteners, rear	40-45 ft-lbs	54-61 Nm	2.6 REAR WHEEL, Installation
Bank angle sensor	12-36 **in-lbs**	1.4-4 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Bank angle sensor	12-36 **in-lbs**	1.4-4 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Bank angle sensor	12-36 **in-lbs**	1.4-4 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Bank angle sensor fastener	12-36 **in-lbs**	1.4-4 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Bank angle sensor fastener, Firebolt	12-36 **in-lbs**	1.4-4 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Assembly: Firebolt
BAS fastener	60-96 **in-lbs**	7-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery (+) to starter fastener	60-85 **in-lbs**	7-10 Nm	6.7 BATTERY CABLES, Installation
Battery ground cable and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.7 BATTERY CABLES, Installation
Battery ground cable and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Firebolt
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	1.5 BATTERY MAINTENANCE, Battery Installation and Connection

DIGITAL TECHNICIAN HARLEY-DAVIDSON

2009 Buell XB Models Service Manual

FASTENER	TORQUE VALUE		NOTES
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	1.5 BATTERY MAINTENANCE, Battery Installation and Connection
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	4.14 FUEL PUMP, Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.7 BATTERY CABLES, Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.7 BATTERY CABLES, Installation
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.12 HEATED HAND GRIPS: ULYSSES MODELS, Heated Hand Grips
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.18 HEADLIGHT, Headlight Bulbs: Lightning and Ulysses
Battery terminal fastener	72-96 **in-lbs**	8-11 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	1.4 MAINTENANCE SCHEDULE , General
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Firebolt
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Lightning/Ulysses
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), FIREBOLT
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), FIREBOLT
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), LIGHTNING
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), LIGHTNING
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), ULYSSES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), ULYSSES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.6 IGNITION COIL, Installation

FASTENER	TORQUE VALUE		NOTES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.9 BANK ANGLE SENSOR (BAS), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.10 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.11 COOLING FAN, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	4.12 FUEL TANK VENT VALVE, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.10 VOLTAGE REGULATOR, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.11 ALTERNATOR, Assembly and Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.13 HORN, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.24 CRANKSHAFT POSITION SENSOR (CKP), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.24 CRANKSHAFT POSITION SENSOR (CKP), Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.27 MAIN WIRE HARNESS, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.27 MAIN WIRE HARNESS, Installation
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Lightning
Battery terminal fasteners	72-96 **in-lbs**	8-11 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Ulysses
Battery tray and ground wire fasteners, Ulysses	72-96 **in-lbs**	8-11 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Battery tray fasteners	48-72 **in-lbs**	5.4-8 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Battery tray fasteners, Lightning	48-72 **in-lbs**	5.4-8 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly/LOCTITE 271 (red)
Battery tray fasteners, Ulysses	72-96 **in-lbs**	8-11 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Belt guard fasteners	12-36 **in-lbs**	1.4-4 Nm	2.37 BELT GUARDS, Installation
Belt guard fasteners	12-36 **in-lbs**	1.4-4 Nm	2.37 BELT GUARDS, Installation
Bracket to solenoid fasteners	20-24 in lbs	2.3-2.7 Nm	E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Installation
Brake caliper bleeder valve	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Brake hand lever fastener, Firebolt	80-90 **in-lbs**	9-10 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Brake hand lever housing fasteners	80-90 **in-lbs**	9-10 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Brake lamp switch fastener, front	7-10 **in-lbs**	0.8-1 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Brake lever pivot bolt	4.4-13.2 **in-lbs**	0.5-1.5 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Hand Lever

FASTENER	TORQUE VALUE		NOTES
Brake lever pivot bolt nut	43-61 **in-lbs**	4.9-6.9 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Hand Lever
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Firebolt/Lightning
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Ulysses
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Brake light switch/master cylinder banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Brake light switch fastener, front	7-10 **in-lbs**	0.8-1 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake line P-clamp, front	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Brake line p-clamp fastener, front	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Brake line p-clamp fastener, rear	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Brake line p-clamp fastener, rear	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Brake line p-clamp fastener, rear	36-60 **in-lbs**	4-7 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Brake line p-clamp fastener on inside of lighting module	36-60 **in-lbs**	4-7 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Brake line P-clamp on inside of front module (Lightning and Ulysses)	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Brake pedal fastener	22-24 ft-lbs	30-33 Nm	2.11 BRAKE PEDAL, Installation
Brake pin hanger set, front	11-15 ft-lbs	15-19.6 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Removal and Installation
Brake pin hanger set, front	11-14 ft-lbs	15-19 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Installation
Brake pin hanger set, rear	11-14 ft-lbs	15-19 Nm	2.14 REAR BRAKE CALIPER, Assembly
Brake pin plug, rear	24 **in-lbs**	2.7 Nm	2.14 REAR BRAKE CALIPER, Assembly
Brake reservoir banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake reservoir banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Brake reservoir clamp fasteners, front	80-90 **in-lbs**	9.0-10.2 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake reservoir cover fasteners, front	9-18 **in-lbs**	1-2 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Installation
Brake reservoir fastener, rear	48-72 **in-lbs**	5.4-8 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Firebolt/Lightning
Brake reservoir fastener, rear	48-72 **in-lbs**	5.4-8 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly

FASTENER	TORQUE VALUE		NOTES
Caliper banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Front Brake Fluid Line
Caliper banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Caliper banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Caliper banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Caliper banjo bolt, rear	16-20 ft-lbs	22-27 Nm	2.14 REAR BRAKE CALIPER, Installation
Caliper bleeder valve, front	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Removal and Installation
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Reservoir Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Caliper Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.12 REAR BRAKE MASTER CYLINDER, Removal: Firebolt/Lightning
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.12 REAR BRAKE MASTER CYLINDER, Removal: Ulysses
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Removal: Firebolt
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Removal: Lightning
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.13 REAR BRAKE LINE, Removal: Ulysses
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.14 REAR BRAKE CALIPER, Removal
Caliper bleeder valves	36-60 **in-lbs**	4-7 Nm	2.14 REAR BRAKE CALIPER, Assembly
Caliper bleeder valves, front	36-60 **in-lbs**	4-7 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Master Cylinder/Reservoir: Removal
Caliper carrier, rear	24-26 ft-lbs	32-35 Nm	2.6 REAR WHEEL, Installation
Caliper fasteners, front	18-22 ft-lbs	24.5-29.4 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Repair
Caliper fasteners, front	15-19 ft-lbs	20-26 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Caliper Assembly
Caliper mounting fasteners, front	35-37 ft-lbs	47-50 Nm	2.9 FRONT BRAKE: EIGHT PISTON CALIPER, Caliper: Removal and Installation/LOCTITE 271 (red)
Caliper mounting fasteners, front	35-37 ft-lbs	47-50 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Installation/LOCTITE 271 (red)
Caliper mounting large fastener, rear	18-21 ft-lbs	24-28 Nm	2.14 REAR BRAKE CALIPER, Installation
Caliper mounting small fastener, rear	14-18 ft-lbs	19-24 Nm	2.14 REAR BRAKE CALIPER, Installation
Center cap bolt	20-30 ft-lbs	27-40.6 Nm	2.16 FRONT FORKS: ALL MODELS, Assembly
Center tie bar	30-33 ft-lbs	41-45 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Center tie bar mount to engine fasteners	30-33 ft-lbs	40.6-44.7 Nm	3.6 ENGINE INSTALLATION, Assembly
Chain tensioner nut	20-25 ft-lbs	27-34 Nm	1.4 MAINTENANCE SCHEDULE , General
Chin fairing fasteners	36-48 **in-lbs**	4-5 Nm	2.50 CHIN FAIRING, Installation
Chin fairing fasteners	36-48 **in-lbs**	4-5 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation/LOCTITE 271 (red)
Clutch cable bracket	84-92 **in-lbs**	9.5-10.4 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator

FASTENER	TORQUE VALUE		NOTES
Clutch cable fitting at primary	36-108 **in-lbs**	4-12.2 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Clutch hand lever fastener, Firebolt	60-84 **in-lbs**	7-9.5 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Clutch hand lever fasteners	60-84 **in-lbs**	7-9.5 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.4 MAINTENANCE SCHEDULE , General
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Inspection
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Adjustment
Clutch inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	2.25 CLUTCH CONTROL, Assembly and Installation/Tighten in a crosswise pattern
Clutch inspection cover fasteners	84-108 **in-lbs**	10-12 Nm	5.3 PRIMARY COVER, Installation
Clutch inspection cover fasteners	84-108 **in-lbs**	10-12 Nm	5.4 CLUTCH RELEASE MECHANISM, Assembly
Clutch mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.6 PRIMARY CHAIN, Installation/LOCTITE 271 (red) if using original mainshaft nut
Cooling fan fasteners	12-36 **in-lbs**	1.4-4 Nm	4.11 COOLING FAN, Installation
Cooling fan fasteners	12-36 **in-lbs**	1.4-4 Nm	6.27 MAIN WIRE HARNESS, Installation
Countershaft retaining screw	33-37 ft-lbs	44.8-50 Nm	5.16 SHIFTER SHAFT, Installation/LOCTITE 271 (red)
Crankcase 5/16 in. fasteners	15-19 ft-lbs	20.3-25.0 Nm	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase/Apply several drops of LOCTITE 271 (red) to last few threads.
Crankcase 5/16 in. screws	15-19 ft-lbs	20-26 Nm	3.18 CRANKCASE, Assembly/LOCTITE 272
Crank position sensor screw	80-100 **in-lbs**	9.0-11.3 Nm	6.24 CRANKSHAFT POSITION SENSOR (CKP), Installation
Cylinder head screws (final tightening)	13-15 ft-lbs	18-20 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder head screws (final tightening)	13-15 ft-lbs	18-20 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder head screws (initial tightening)	96-120 **in-lbs**	11-14 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder head screws (initial tightening)	96-120 **in-lbs**	11-14 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation/Special procedure and pattern required for tightening
Cylinder studs	10-20 ft-lbs	14-27 Nm	3.18 CRANKCASE, Assembly/Special method required to tighten
Damper rod jamnut	22-30 ft-lbs	30-41 Nm	2.16 FRONT FORKS: ALL MODELS, Assembly
Deflector fasteners	24-36 **in-lbs**	2.7-4 Nm	2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP, Assembly and Installation
Deflector jam nuts	39-48 **in-lbs**	4.4-5.4 Nm	2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP, Assembly and Installation

FASTENER	TORQUE VALUE		NOTES
Deflector pivot shaft risers	43-49 **in-lbs**	4.8-5.5 Nm	2.28 DEFLECTORS: XB9SX/XB12X/XB12XT/XB12XP, Assembly and Installation
ECM fasteners	36-60 **in-lbs**	4-7 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
ECM fasteners, Ulysses	36-60 **in-lbs**	4-7 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Electronic control module fasteners	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Firebolt
Electronic control module fasteners, Lightning	48-72 **in-lbs**	5.4-8 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), LIGHTNING
Electronic control module fasteners, Ulysses	36-60 **in-lbs**	4-6.8 Nm	4.4 ELECTRONIC CONTROL MODULE (ECM), ULYSSES
Engine oil drain plug	26-29 ft-lbs	35-39 Nm	1.6 ENGINE OIL AND FILTER, Change Engine Oil and Filter/LOCTITE 565 THREAD SEALANT
Engine shift lever pinch screw	48-60 **in-lbs**	5.4-7 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Engine shroud air scoop fasteners	12-36 **in-lbs**	1.4-4 Nm	2.49 AIR SCOOPS, Engine Shroud Air Scoop
Engine sprocket bolt	155-165 ft-lbs	210-224 Nm	5.6 PRIMARY CHAIN, Installation/LOCTITE 271 (red)
Engine temperature sensor	120-168 **in-lbs**	13.6-19 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation
Exhaust header mounting nut	72-96 **in-lbs**	8-11 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Exhaust header nuts	72-96 **in-lbs**	8.1-10.8 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Exhaust header nuts	72-96 **in-lbs**	8.1-10.8 Nm	3.6 ENGINE INSTALLATION, Assembly
Fairing support bracket fasteners, Firebolt	16-18 ft-lbs	22-26 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Fender fasteners	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Rear Fender: XB12Ss/XB12XT/XB12X
Final rear axle	48-52 ft-lbs	65-70.5 Nm	4.14 FUEL PUMP, Installation
Flasher fastener	36-60 **in-lbs**	4-7 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Assembly: Firebolt
Footpeg mount	132-144 **in-lbs**	15-16 Nm	2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS, Mount Installation
Footpeg mount, Firebolt and Lightning	25-28 ft-lbs	34-38 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Passenger/LOCTITE 271 (red)
Footpeg mount, Firebolt and Lightning	25-28 ft-lbs	34-38 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly/LOCTITE 271 (red)
Footpeg mount fasteners, rider	132-144 **in-lbs**	14.9-16.2 Nm	2.37 BELT GUARDS, Installation
Footpeg mount fasteners, rider, Firebolt and Lightning	132-144 **in-lbs**	14.9-16.2 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Rider
Footpeg support bracket	132-144 **in-lbs**	14.9-16.2 Nm	2.54 LUGGAGE: XB12XT, Installation: Side Case
Footpeg support bracket	132-144 **in-lbs**	14.9-16.2 Nm	2.55 LUGGAGE: XB12XP, SIDE CASE
Fork cap	22-30 ft-lbs	30-41 Nm	2.16 FRONT FORKS: ALL MODELS, Assembly
Fork clamp, lower	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/LOCTITE 271 (red)

DIGITAL TECHNICIAN II HARLEY-DAVIDSON

FASTENER	TORQUE VALUE		NOTES
Fork clamp, lower	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Fork clamp, upper	23-25 ft-lbs	31-34 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/LOCTITE 271 (red)
Fork clamp, upper	23-25 ft-lbs	31-34 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Fork clamp, upper	23-25 ft-lbs	31.2-33.8 Nm	2.18 STEERING HEAD BEARINGS, Installation/LOCTITE 271 (red)
Fork clamp fastener, upper	23-25 ft-lbs	31-34 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT/LOCTITE 271 (red)
Front brake caliper fasteners	35-37 ft-lbs	47-50 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement/LOCTITE 271 (red)
Front caliper bleeder valve	36-60 **in-lbs**	4-7 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes
Front caliper pin hanger	11-14 ft-lbs	15-19 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Front fender fasteners	36-48 **in-lbs**	4-5.4 Nm	2.15 FENDERS, Front Fender: XB12R/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4-5.4 Nm	2.15 FENDERS, Front Fender: XB9SX/XB12Scg/XB12XT/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4.0-5.4 Nm	2.15 FENDERS, Front Fender: XB12X/LOCTITE 271 (red)
Front fender fasteners	36-48 **in-lbs**	4.0-5.4 Nm	2.15 FENDERS, Front Fender: XB12X/LOCTITE 271 (red)
Front fender fasteners and washers	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Front Fender: XB12XP
Front fender fasteners and washers	36-48 **in-lbs**	4.0-5.4 Nm	2.15 FENDERS, Front Fender: XB12XP
Front isolator bolt	49-51 ft-lbs	66-69 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front isolator bolt	49-51 ft-lbs	66.4-69.1 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Front isolator bolt	49-51 ft-lbs	66-69 Nm	3.6 ENGINE INSTALLATION, Assembly
Front isolator bracket mounting fastener	49-51 ft-lbs	66-69 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front isolator bracket mounting fasteners	49-51 ft-lbs	66.4-69.1 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Front isolator bracket mounting fasteners	49-51 ft-lbs	66-69 Nm	3.6 ENGINE INSTALLATION, Assembly
Front isolator snubber, upper	12-36 **in-lbs**	1.4-4 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front isolator threaded frame insert	59-61 ft-lbs	80-82.7 Nm	2.20 FRONT AND REAR ISOLATORS, Front Isolator
Front master cylinder reservoir cover fasteners	9-13 **in-lbs**	1.0-1.5 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes
Front master cylinder reservoir cover fasteners	9-13 **in-lbs**	1.0-1.5 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Front module fastener, right	12-14 ft-lbs	16.3-19 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Front tie bar to V bracket	25-27 ft-lbs	33.9-36.6 Nm	2.25 CLUTCH CONTROL, Assembly and Installation

FASTENER	TORQUE VALUE		NOTES
Front wire guide fasteners	72-84 **in-lbs**	8-9.5 Nm	2.24 THROTTLE CONTROL, Throttle Cable Replacement
Fuel cap retaining ring fasteners	62-71 **in-lbs**	7-8 Nm	4.13 FUEL CAP RETAINING RING, Installation
Fuel pump drain plug	84-108 **in-lbs**	9.5-12 Nm	4.14 FUEL PUMP, Draining Fuel Tank
Fuel pump harness fastener	18-22 **in-lbs**	2.0-2.5 Nm	4.14 FUEL PUMP, Repair
Fuel pump harness fastener	18-22 **in-lbs**	2.0-2.5 Nm	4.14 FUEL PUMP, Repair
Fuel pump harness fastener	18-22 **in-lbs**	2.0-2.5 Nm	4.14 FUEL PUMP, Repair
Fuel pump screws	48-51 **in-lbs**	5.4-5.8 Nm	4.14 FUEL PUMP, Installation
Fuel rail fasteners	24-28 **in-lbs**	2.8-3.2 Nm	4.15 THROTTLE BODY, Repair
Fuel supply line banjo fitting	84-108 **in-lbs**	9.5-12 Nm	4.14 FUEL PUMP, Installation
Fuel tank vent valve fasteners	39-41 **in-lbs**	4.4-4.6 Nm	4.12 FUEL TANK VENT VALVE, Installation
Fuse block and relay fasteners	72-96 **in-lbs**	8-11 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Fuse block mounting fasteners	72-96 **in-lbs**	8.1-10.8 Nm	6.27 MAIN WIRE HARNESS, Installation
Grab rail fasteners	19-20 ft-lbs	26-27 Nm	2.54 LUGGAGE: XB12XT, Installation: Top Case
Ground terminal on front of steering head (Lightning)	48-72 **in-lbs**	5.4-8 Nm	6.27 MAIN WIRE HARNESS, Installation
Handlebar clamp screw	60-84 **in-lbs**	6.8-9.5 Nm	1.4 MAINTENANCE SCHEDULE , General
Handlebar clamp screws, Lightning and Ulysses	10-12 ft-lbs	14-16 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation/LOCTITE 271 (red), Tighten front screws first
Handlebar clamp screws, Lightning and Ulysses	10-12 ft-lbs	14-16 Nm	2.32 HANDLEBARS: LIGHTNING/ULYSSES, Installation/LOCTITE 271 (red), Tighten front screws first
Handlebar clip-on fastener, Firebolt	24-26 ft-lbs	33-35 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Handlebar clip-on fastener, Firebolt	24-26 ft-lbs	33-35 Nm	2.31 HANDLEBARS: FIREBOLT, Installation
Handlebar switch housing screw	25-33 **in-lbs**	3-4 Nm	1.4 MAINTENANCE SCHEDULE , General
Hand lever pivot fastener (all models except XB9SX, XB12XT and XB12X)	80-120 **in-lbs**	9-13.5 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder and Hand Lever Assembly
Hand lever pivot fastener (XB9SX, XB12XT, XB12XP and XB12X models)	39-48 **in-lbs**	4.4-5.4 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder and Hand Lever Assembly
Headlamp alignment fasteners (Lightning)	48-72 **in-lbs**	5-8 Nm	1.17 HEADLAMP, Headlamp Adjustment: Lightning
Headlamp horizontal alignment fasteners (Ulysses)	48-72 **in-lbs**	5-8 Nm	1.17 HEADLAMP, Headlamp Adjustment: Ulysses
Headlamp vertical alignment fastener (Ulysses)	36-48 **in-lbs**	4-5 Nm	1.17 HEADLAMP, Headlamp Adjustment: Ulysses
Headlight fasteners, Firebolt	20-25 **in-lbs**	2.3-2.8 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Assembly: Firebolt
Headlight housing fasteners (Lightning/Ulysses)	48-72 **in-lbs**	5.4-8 Nm	6.18 HEADLIGHT, Headlight Bulbs: Lightning and Ulysses
Headlight support bracket fastener, Ulysses	48-72 **in-lbs**	5.4-8 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Headlight support bracket pivot fasteners, Firebolt	72-96 **in-lbs**	8-11 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Firebolt

FASTENER	TORQUE VALUE		NOTES
heated grip fasteners	14-16 **in-lbs**	1.6-1.8 Nm	6.12 HEATED HAND GRIPS: ULYSSES MODELS, Heated Hand Grips
Heel guard fasteners, passenger, Firebolt and Lightning	72-96 **in-lbs**	8-11 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Passenger
Heel guard fasteners, rider, Firebolt and Lightning	72-96 **in-lbs**	8-11 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Rider
Horn fastener	72-96 **in-lbs**	8-11 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Horn fastener	72-96 **in-lbs**	8.1-10.8 Nm	6.13 HORN, Installation
Horn fastener, Firebolt	72-96 **in-lbs**	8-10 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Horn fastener, Ulysses	36-60 **in-lbs**	4-7 Nm	2.26 HEADLAMP ASSEMBLY AND SUPPORT BRACKET, Installation: Lightning/Ulysses
IAC actuator fasteners	25-30 **in-lbs**	2.9-3.5 Nm	4.15 THROTTLE BODY, Repair
Idler pulley assembly	33-35 ft-lbs	45-47 Nm	4.14 FUEL PUMP, Installation
Idler pulley nut and washer	33-35 ft-lbs	45-47 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation
Idler pulley wheel fastener	33-35 ft-lbs	45-47 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation
Idler pulley wheel fastener	20-23 ft-lbs	27.1-31.2 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Idler Pulley Installation
Ignition coil fasteners	120-144 **in-lbs**	13.6-16.3 Nm	2.24 THROTTLE CONTROL, Throttle Cable Replacement
Ignition coil fasteners	120-144 **in-lbs**	13.6-16.3 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Ignition coil fasteners	120-144 **in-lbs**	13.6-16.3 Nm	3.6 ENGINE INSTALLATION, Assembly
Ignition coil mounting screws	120-144 **in-lbs**	13.6-16.3 Nm	4.6 IGNITION COIL, Installation
Ignition switch body fastener	12-36 **in-lbs**	1.4-4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT
Ignition switch body fastener	12-36 **in-lbs**	1.4-4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Ignition switch body fastener	12-36 **in-lbs**	1.4-4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES
Ignition switch fastener	18-20 ft-lbs	24.4-27.1 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT/LOCTITE 271 (red)
Ignition switch fastener	18-20 ft-lbs	24.4-27.1 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING/LOCTITE 271 (red)
Ignition switch fastener	18-20 ft-lbs	24.4-27.1 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES/LOCTITE 271 (red)
Initial rear axle	23-27 ft-lbs	31.2-36.6 Nm	4.14 FUEL PUMP, Installation
Instrument module fastener	12-36 **in-lbs**	1.4-4 Nm	2.27 FAIRING SUPPORT BRACKET: FIREBOLT, Installation
Instrument module fasteners	12-36 **in-lbs**	1.4-4 Nm	6.26 INSTRUMENT MODULE, Installation
Intake cover assembly fasteners	12-36 **in-lbs**	1.4-4 Nm	1.14 AIR CLEANER AND EXHAUST SYSTEM, Installation
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	2.38 INTAKE COVER, Installation
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	3.6 ENGINE INSTALLATION, Assembly

FASTENER	TORQUE VALUE		NOTES
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Firebolt
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Lightning
Intake cover fasteners	12-36 **in-lbs**	1.4-4 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Ulysses
Intake cover screw	12-36 **in-lbs**	1.4-4 Nm	1.4 MAINTENANCE SCHEDULE , General
Intake flange screws	96-120 **in-lbs**	10.8-13.6 Nm	4.15 THROTTLE BODY, Installation
Interactive exhaust actuator fasteners	36-40 **in-lbs**	4-4.5 Nm	4.3 AIR CLEANER ASSEMBLY, Installation
Left front trunk pan fastener, Lightning	72-96 **in-lbs**	8-11 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly
Left front trunk pan fastener, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
License plate bracket, Firebolt	36-48 **in-lbs**	4-5 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
License plate lamp assembly fastener (Lightning)	12-36 **in-lbs**	1.4-4 Nm	6.20 LICENSE PLATE LAMP ASSEMBLY, Lightning
License plate lamp nuts, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
License plate light fasteners, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.52 SEAT LOCKS, Installation: Ulysses Models
License plate light nuts, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	6.9 STARTER SOLENOID, Solenoid Contacts
Lower fork clamp fasteners	20-22 ft-lbs	27-30 Nm	2.16 FRONT FORKS: ALL MODELS, Installation
Lower headlight fastener	36-48 **in-lbs**	4-5.5 Nm	6.18 HEADLIGHT, Headlight Bulbs: Lightning and Ulysses
Lower rocker box bolts (1/4-20 x 1-1/4)	135-155 **in-lbs**	15-17.5 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Lower rocker box bolts (5/16-18 x 2-1/2)	18-22 ft-lbs	24-30 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Lower rocker box screws with hex socket head (1/4-20 x 1-1/2)	135-155 **in-lbs**	15-17.5 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Lower shock absorber	15-17 ft-lbs	20.3-23 Nm	4.14 FUEL PUMP, Installation
Lower triple clamp fasteners	20-22 ft-lbs	27-30 Nm	1.12 STEERING HEAD BEARINGS, Determining Proper Resistance
Main battery ground fastener	48-72 **in-lbs**	5.4-8 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Main battery ground to frame and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Lightning
Main battery ground to frame and actuator ground wire	48-72 **in-lbs**	5.4-8 Nm	6.29 INTERACTIVE EXHAUST HARNESS: XB12 MODELS, Ulysses
Manifold to engine mount fastener	90-120 **in-lbs**	10-13.6 Nm	4.15 THROTTLE BODY, Installation
Master cylinder banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Master cylinder banjo bolt, front	16-20 ft-lbs	22-27 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Brake Line Installation
Master cylinder cover fasteners, front	9-13 **in-lbs**	1.0-1.5 Nm	2.10 FRONT BRAKE: SIX PISTON CALIPER, Master Cylinder Installation
Master cylinder mounting fasteners, rear	72-96 **in-lbs**	8-11 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Firebolt/Lightning

FASTENER	TORQUE VALUE		NOTES
Master cylinder mounting fasteners, rear	72-96 **in-lbs**	8-11 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Ulysses
Master cylinder reservoir cover screws	9-13 **in-lbs**	1.0-1.5 Nm	1.4 MAINTENANCE SCHEDULE , General
Mirror adjuster nut	115-130 **in-lbs**	13-14.7 Nm	2.33 MIRRORS, Installation
Mirror fasteners, Firebolt	72-96 **in-lbs**	8-11 Nm	2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT, Installation
Mirror mount onto bracket	20-22 ft-lbs	27-30 Nm	2.33 MIRRORS, Installation
Muffler mount fastener, front	16-18 ft-lbs	21.7-24.4 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Muffler mounting block fastener, rear	32-36 ft-lbs	43-49 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation/LOCTITE 27 (red)
Muffler strap fastener, front	108-120 **in-lbs**	12-14 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Muffler strap fastener, front	108-120 **in-lbs**	12-14 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Muffler strap fastener, rear	48-60 **in-lbs**	5.4-7 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation/You need to alternately tighten the fasteners to torque a total of three times to make sure the straps are evenly tightened.
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	2.13 REAR BRAKE LINE, Installation: Firebolt
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	2.13 REAR BRAKE LINE, Installation: Lightning
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.3 PRIMARY COVER, Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.4 CLUTCH RELEASE MECHANISM, Assembly
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.5 CLUTCH, Assembly and Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	5.6 PRIMARY CHAIN, Installation
Negative battery cable at battery terminal	72-96 **in-lbs**	8-11 Nm	6.17 INTERACTIVE EXHAUST SYSTEM, Installation
Negative battery terminal cable at battery terminal	72-96 **in-lbs**	8-11 Nm	6.18 HEADLIGHT, Headlight Bulbs: Firebolt
Neutral indicator switch	60-84 **in-lbs**	6.7-9.5 Nm	6.22 NEUTRAL INDICATOR SWITCH, Removal and Installation/LOCTITE THREADLOCKER 243 (blue)
Neutral indicator switch (Firebolt)	60-84 **in-lbs**	6.7-9.5 Nm	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase/LOCTITE 242 (blue)
Neutral indicator switch (Lightning and Ulysses)	100-120 **in-lbs**	11-13 Nm	5.15 TRANSMISSION INSTALLATION, Installing Right Crankcase/LOCTITE 242 (blue)
Oil cooler air scoop fasteners	48-72 **in-lbs**	5.4-8 Nm	2.49 AIR SCOOPS, Oil Cooler Air Scoop
Oil cooler mounting screws	96-108 **in-lbs**	10.8-12.2 Nm	3.13 OIL COOLER, Installation/LOCTITE 271
Oil drain plug	26-29 ft-lbs	35-39 Nm	1.4 MAINTENANCE SCHEDULE , General
Oil drain plug	26-29 ft-lbs	35-39 Nm	2.19 SWINGARM AND BRACE, Assembly
Oil filter adapter	96-144 **in-lbs**	11-16 Nm	3.18 CRANKCASE, Oil Filter Adapter
Oil line clamp at starter motor	40-50 **in-lbs**	5-5.5 Nm	3.6 ENGINE INSTALLATION, Assembly
Oil line fittings at swingarm	108-156 **in-lbs**	12-17.6 Nm	3.12 OIL LINE FITTINGS, Installation
Oil line fittings on swingarm	108-156 **in-lbs**	12-17.6 Nm	2.19 SWINGARM AND BRACE, Assembly
Oil line p-clamp at swingarm	48-72 **in-lbs**	5.4-8 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation

FASTENER	TORQUE VALUE		NOTES
Oil line p-clamp fastener	40-50 **in-lbs**	4.5-5.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Oil line p-clamp fastener	40-50 **in-lbs**	4.5-5.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Oil line p-clamps at swingarm	48-72 **in-lbs**	5.4-8 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Oil pressure signal light switch	96-120 **in-lbs**	10.8-13.6 Nm	3.14 OIL PRESSURE INDICATOR SWITCH, Oil Pressure/LOCTITE 565 HIGH PERFORMANCE PIPE SEALANT WITH TEFLON
Oil pump body and cover fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.10 OIL PUMP, Assembly/Installation
Oil pump body and cover fasteners	108-156 **in-lbs**	12.2-17.6 Nm	3.10 OIL PUMP, Assembly/Installation
Oil pump body and cover fasteners	96-120 **in-lbs**	11-13.8 Nm	3.10 OIL PUMP, Assembly/Installation
Oil pump body and cover fasteners	72-96 **in-lbs**	8-11 Nm	3.10 OIL PUMP, Assembly/Installation
Oxygen sensor	40-45 ft-lbs	54-61 Nm	4.7 OXYGEN SENSOR, Installation/ANTI-SEIZE
Passenger grab handle, front fasteners	108-120 **in-lbs**	12-13.5 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
Passenger grab handle, rear fasteners	23-25 ft-lbs	31-34 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation/LOC-TITE 271 (red)
Passenger seat latch, Firebolt	60-96 **in-lbs**	7-11 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
P clamp, front tie bar and clutch cable	25-27 ft-lbs	33.9-36.6 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Pinch fastener	48-60 **in-lbs**	5.4-7 Nm	E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Installation
Pinch fastener	48-60 **in-lbs**	5.4-7 Nm	E.1 ACTIVE INTAKE SYSTEM (JAPANESE MODELS ONLY), Installation
Pinion shaft nut	19-21 ft-lbs	26-29 Nm	3.17 GEARCASE AND CAM GEARS, Assembly and Installation/Plus an additional 15° to 19° rotation
Piston jet assembly screws	25-35 **in-lbs**	2.8-4.0 Nm	3.18 CRANKCASE, Piston Jets/TORX, LOCTITE LOW STRENGTH THREADLOCKER 222 (purple)
Preload adjuster knob fastener	25-43 **in-lbs**	2.8-4.9 Nm	2.23 REAR SHOCK ABSORBER, Removal: Ulysses
Preload adjuster mounting	48-72 **in-lbs**	5.4-8 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Preload adjuster to trunk pan	36-60 **in-lbs**	4-7 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 Nm	1.4 MAINTENANCE SCHEDULE , General
Primary chain inspection cover fasteners	84-108 **in-lbs**	9.5-12 Nm	1.11 PRIMARY CHAIN, Inspection
Primary chain tension locknut	20-25 ft-lbs	27-34 Nm	1.11 PRIMARY CHAIN, Adjustment
Primary cover fasteners	100-120 **in-lbs**	11.3-13.5 Nm	5.3 PRIMARY COVER, Installation
Primary drain plug	14-30 ft-lbs	19-41 Nm	1.9 CLUTCH/TRANSMISSION/PRIMARY FLUID, Transmission Fluid
Primary magnetic drain plug	14-30 ft-lbs	19-40.7 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 565
Pushrod adjustment locknut	130-173.5 **in-lbs**	14.7-19.6 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pedal Adjustment
Pushrod cover screws	30-40 **in-lbs**	3.4-4.5 Nm	3.7 CYLINDER HEAD, Push Rod Cover Installation
Pushrod cover screws	30-40 **in-lbs**	3-5 Nm	3.16 HYDRAULIC LIFTERS, Installation
Ram air scoop fasteners	12-36 **in-lbs**	1.4-4 Nm	2.49 AIR SCOOPS, Ram Air Scoop
Rear axle (final torque)	48-52 ft-lbs	65-70.5 Nm	2.19 SWINGARM AND BRACE, Brace

FASTENER	TORQUE VALUE		NOTES
Rear axle (initial torque)	23-27 ft-lbs	31.2-36.6 Nm	2.19 SWINGARM AND BRACE, Brace/After initial torque, back off two turns and tighten to final torque.
Rear axle pinch bolt	40-45 ft-lbs	54-61 Nm	2.19 SWINGARM AND BRACE, Brace
Rear axle pinch fastener	40-45 ft-lbs	54-61 Nm	4.14 FUEL PUMP, Installation
Rear brake caliper mounting fasteners	24-26 ft-lbs	32.5-35 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear brake line assembly fastener	36-60 **in-lbs**	4.1-7 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear brake line bracket fasteners	48-72 **in-lbs**	5.4-8 Nm	2.13 REAR BRAKE LINE, Installation: Ulysses
Rear brake line bracket fasteners	48-72 **in-lbs**	5.4-8 Nm	2.35 HEEL GUARD AND FOOTPEG MOUNTS: ULYSSES MODELS, Mount Installation
Rear brake reservoir fastener	48-72 **in-lbs**	5.4-8 Nm	2.12 REAR BRAKE MASTER CYLINDER, Installation: Ulysses
Rear caliper bleeder valve	36-60 **in-lbs**	4-7 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Bleeding Brakes
Rear caliper pin hanger	11-14 ft-lbs	14.9-18.9 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear caliper pin plug	24 **in-lbs**	3 Nm	1.7 BRAKE SYSTEM MAINTENANCE, Brake Pad Replacement
Rear fender fasteners	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Rear Fender: XB12R
Rear fender fasteners	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Rear Fender: XB9SX/XB12Scg
Rear fender fasteners	12-36 **in-lbs**	1.4-4.0 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Rear isolator assembly fasteners	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Rear isolator bolt	25-27 ft-lbs	33.9-36.6 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Rear isolator bolt	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Rear muffler bracket	32-36 ft-lbs	43.4-48.8 Nm	3.6 ENGINE INSTALLATION, Assembly/LOCTITE 271 (red)
Rear reflector bracket	48-72 **in-lbs**	5.4-8 Nm	6.16 REAR TURN SIGNALS, Turn Signal Relocation Bracket: XB12XP
Rear shock absorber reservoir clamp rear	120-144 **in-lbs**	13.6-16.3 Nm	4.19 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Installation: Firebolt
Rear shock reservoir clamp, Firebolt	120-144 **in-lbs**	13.6-16.3 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Rear shock reservoir fastener	80-88 **in-lbs**	9.0-9.9 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Rear shock reservoir fastener, Ulysses	80-88 **in-lbs**	9.0-9.9 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Rear shock reservoir fastener, Ulysses	80-88 **in-lbs**	9.0-9.9 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Rear tail sides to center tail section, Lightning	102-114 **in-lbs**	11.5-12.8 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly/LOCTITE 271 (red)
Rear tail sides to center tail section, Lightning	102-114 **in-lbs**	11.5-12.8 Nm	2.41 CENTER TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Rear tail sides to center tail section, Lightning	102-114 **in-lbs**	11.5-12.8 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)

2009 Buell XB Models Service Manual

FASTENER	TORQUE VALUE		NOTES
Reed valve block fasteners	25-35 **in-lbs**	2.8-4.0 Nm	3.15 CRANKCASE BREATHING SYSTEM, Reed Valve Replacement/LOCTITE 222 (purple)
Reed valve stop fastener	5-7 **in-lbs**	0.6-0.8 Nm	3.15 CRANKCASE BREATHING SYSTEM, Reed Valve Replacement/LOCTITE 222 (purple)
Reservoir clamp fastener	120-144 **in-lbs**	13.5-16.2 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Retainer plate	56 **in-lbs**	6.3 Nm	6.11 ALTERNATOR, Assembly and Installation
Retaining clip jamnuts	36-40 in-lbs	4-4.5 Nm	2.24 THROTTLE CONTROL, Throttle Cable Replacement
Rider seat screws	12-36 **in-lbs**	1.4-4 Nm	2.51 SEAT, Firebolt
Right front trunk pan fastener, Lightning	12-36 **in-lbs**	1.4-4 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly
Right front trunk pan fastener, Lightning	12-36 **in-lbs**	1.4-4 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly
Right front trunk pan fastener, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly
Right tail section to trunk pan, Ulysses	12-36 **in-lbs**	1.4-4 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Rotor mounting fasteners	120-140 **in-lbs**	13.5-15.8 Nm	6.11 ALTERNATOR, Assembly and Installation
Rotor mounting fasteners, front	25-27 ft-lbs	34-37 Nm	2.5 FRONT WHEEL, Assembly/Metric, replace with new
Rotor mounting fasteners, rear	25-27 ft-lbs	34-37 Nm	2.6 REAR WHEEL, Assembly/Replace with new
Screw, primary chain inspection cover	84-108 **in-lbs**	9.5-12 Nm	1.4 MAINTENANCE SCHEDULE , General
Seat latch fastener	60-96 **in-lbs**	7-11 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Seat lock bracket fasteners, Ulysses	60-96 **in-lbs**	7-11 Nm	2.52 SEAT LOCKS, Installation: Ulysses Models
Seat lock latch fasteners, Lightning	60-72 **in-lbs**	7-8 Nm	2.52 SEAT LOCKS, LIGHTNING
Shifter bracket fasteners	22-24 ft-lbs	30.0-32.5 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shift lever pinch screw	48-60 **in-lbs**	5.4-7 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shift linkage fasteners	36-60 **in-lbs**	4-7 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Shift linkage fasteners	36-60 **in-lbs**	4.0-7 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shift pedal flange head bolt	22-24 ft-lbs	30-32.5 Nm	2.25 CLUTCH CONTROL, Assembly and Installation/LOCTITE 271 (red)
Shift pedal flange head bolt	22-24 ft-lbs	30.0-32.5 Nm	5.3 PRIMARY COVER, Installation/LOCTITE 271 (red)
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Shock mounting fastener, lower	15-17 ft-lbs	20.3-23 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses

FASTENER	TORQUE VALUE		NOTES
Shock mounting fastener, upper	48-52 ft-lbs	65-70.5 Nm	2.23 REAR SHOCK ABSORBER, Installation: Firebolt
Shock mounting fastener, upper	48-52 ft-lbs	65-70.5 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Shock mounting fastener, upper	48-52 ft-lbs	65-70.5 Nm	2.23 REAR SHOCK ABSORBER, Installation: Ulysses
Shock reservoir clamp, rear (Lightning except XB12Ss)	36-60 **in-lbs**	4-7 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Shock reservoir clamp, rear (XB12Ss)	80-88 **in-lbs**	9-10 Nm	2.23 REAR SHOCK ABSORBER, Installation: Lightning
Side case brackets	108-120 **in-lbs**	12-13 Nm	2.54 LUGGAGE: XB12XT, Installation: Side Case
Side case brackets	108-120 **in-lbs**	12-13 Nm	2.55 LUGGAGE: XB12XP, SIDE CASE
Sidestand bracket fasteners	25-27 ft-lbs	34-37 Nm	2.46 SIDESTAND, Installation
Sidestand bracket fasteners	25-27 ft-lbs	34-37 Nm	2.46 SIDESTAND, Installation
Sidestand switch fastener	96-120 **in-lbs**	11-13.6 Nm	6.23 SIDESTAND SWITCH (HDI), SIDESTAND SWITCH (HDI)
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	6.8 STARTER, Field Coil Assembly
Spark plug	12-18 ft-lbs	16-24 Nm	1.4 MAINTENANCE SCHEDULE , General
Spark plug	12-18 ft-lbs	16-24 Nm	1.13 SPARK PLUGS, Inspection
Sprocket cover fastener	12-36 **in-lbs**	1.4-4 Nm	2.36 SPROCKET COVER, Installation
Sprocket fasteners	35-37 ft-lbs	47-50 Nm	2.6 REAR WHEEL, Assembly/Replace with new
Stabilizer bracket fastener	66-78 **in-lbs**	7.5-8.8 Nm	3.13 OIL COOLER, Installation
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	6.8 STARTER, Field Coil Assembly
Starter mounting bolt	13-20 ft-lbs	17.6-27.1 Nm	6.8 STARTER, Installation
Starter positive terminal nut	60-85 **in-lbs**	7-9.6 Nm	6.8 STARTER, Installation
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	6.8 STARTER, Field Coil Assembly
Stator TORX mounting screws	30-40 **in-lbs**	3-4 Nm	6.11 ALTERNATOR, Assembly and Installation/T-27 TORX with retaining compound, replace with new after each removal
Steering head clamp fastener	16-18 ft-lbs	21.7-24.4 Nm	6.27 MAIN WIRE HARNESS, Installation
Steering head wiring clamp	16-18 ft-lbs	21.7-24.4 Nm	6.27 MAIN WIRE HARNESS, Installation
Steering stem cap	38-42 ft-lbs	52-57 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIRE-BOLT
Steering stem capnut	38-42 ft-lbs	52-57 Nm	1.12 STEERING HEAD BEARINGS, Determining Proper Resistance
Steering stem capnut	38-42 ft-lbs	52-57 Nm	2.18 STEERING HEAD BEARINGS, Installation
Steering stem cap nut	38-42 ft-lbs	52-57 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses
Steering stem cap nut (final torque)	38-42 ft-lbs	52-57 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/Follow special instructions, ANTI-SEIZE
Steering stem cap nut (initial torque)	38-42 ft-lbs	52-57 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/Installation/Follow special instructions
Steering stem pinch bolt	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Firebolt/LOCTITE 271 (red)

FASTENER	TORQUE VALUE		NOTES
Steering stem pinch bolt	20-22 ft-lbs	27-30 Nm	2.17 FORK CLAMPS: UPPER AND LOWER, Installation: Lightning/Ulysses/LOCTITE 271 (red)
Steering stem pinch bolt	20-22 ft-lbs	27-30 Nm	2.18 STEERING HEAD BEARINGS, Installation/LOCTITE 271 (red)
Steering stem pinch fastener	20-22 ft-lbs	27-30 Nm	1.12 STEERING HEAD BEARINGS, Determining Proper Resistance
Steering stem pinch fastener	20-22 ft-lbs	27-30 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, FIREBOLT/LOCTITE 271 (red)
Stone guard fasteners	12-36 **in-lbs**	1.4-4 Nm	2.37 BELT GUARDS, Installation
Swingarm brace mounting fasteners	25-27 ft-lbs	34-37 Nm	2.19 SWINGARM AND BRACE, Brace
Swingarm brace mounting fasteners	25-27 ft-lbs	34-37 Nm	5.7 DRIVE BELT AND IDLER PULLEY, Drive Belt Installation
Swingarm pivot	44-46 ft-lbs	60-62 Nm	4.14 FUEL PUMP, Installation
Swingarm pivot pinch fastener	17-19 ft-lbs	23-26 Nm	4.14 FUEL PUMP, Installation
Swingarm pivot shaft	44-46 ft-lbs	59-62 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm/ANTI-SEIZE
Swingarm pivot shaft	44-46 ft-lbs	60-62 Nm	3.6 ENGINE INSTALLATION, Assembly/ANTI-SEIZE
Swingarm pivot shaft pinch bolt	17-19 ft-lbs	23-25.8 Nm	3.6 ENGINE INSTALLATION, Assembly/LOCTITE 271 (red)
Swingarm pivot shaft pinch fastener	17-19 ft-lbs	23-26 Nm	2.19 SWINGARM AND BRACE, Installation: Swingarm/LOCTITE 271 (red)
Switch housing fasteners, right	25-33 **in-lbs**	3-4 Nm	2.24 THROTTLE CONTROL, Assembly and Installation
Tail body work, lower, Firebolt	12-36 **in-lbs**	1.4-4 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Tail body work, upper, Firebolt	12-36 **in-lbs**	1.4-4 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Tail frame to frame, Firebolt	21-23 ft-lbs	28.5-31.2 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly/LOCTITE 271 (red)
Tail lamp fasteners (Lightning)	6-7 **in-lbs**	0.7-0.8 Nm	6.19 TAIL LAMP, Firebolt/Lighting
Tail lamp fasteners (Ulysses)	12-36 **in-lbs**	1.4-4 Nm	6.19 TAIL LAMP, Ulysses
Tail sections to main frame/fuel tank assembly, Ulysses	21-23 ft-lbs	28.5-31.2 Nm	2.43 LEFT TAIL SECTION AND BATTERY PAN: ULYSSES MODELS, Assembly/LOCTITE 271 (red)
Tail sections to main frame/fuel tank assembly, Ulysses	21-23 ft-lbs	28.5-31.2 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly/LOCTITE 271 (red)
Tail sections to tail loop, Ulysses	20-22 ft-lbs	27-30 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Tail sections to tail loop, Ulysses	20-22 ft-lbs	27-30 Nm	2.45 RIGHT TAIL SECTION: ULYSSES MODELS, Assembly
Tail section to main frame/fuel tank assembly, Lightning	21-23 ft-lbs	28.5-31.2 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly/LOCTITE 271 (red)
Tail section to main frame/fuel tank assembly, Lightning	21-23 ft-lbs	28.5-31.2 Nm	2.42 RIGHT TAIL SECTION: LIGHTNING, Assembly/LOCTITE 271 (red)
Throttle cable retention device fasteners	36-40 **in-lbs**	4-4.5 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly

FASTENER	TORQUE VALUE		NOTES
Throttle position sensor	12-15 **in-lbs**	1.4-1.7 Nm	4.5 THROTTLE POSITION SENSOR (TPS), Installation/LOCTITE 222 (purple)
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Tie bars	25-27 ft-lbs	33.9-36.6 Nm	3.6 ENGINE INSTALLATION, Assembly
Top case fasteners	96-120 **in-lbs**	11-13 Nm	2.54 LUGGAGE: XB12XT, Installation: Top Case
Torca clamp	45-50 ft-lbs	61-68 Nm	4.18 EXHAUST SYSTEM, Assembly and Installation
Transmission sprocket nut (initial torque)	50 ft-lbs	67.8 Nm	5.17 TRANSMISSION SPROCKET, Installation/Follow special torque procedure, left-hand threads, LOCTITE 272 (red).
Transmission sprocket screws	90-110 **in-lbs**	10.2-12.4 Nm	5.17 TRANSMISSION SPROCKET, Installation/Replace after three removals.
Triple tail plastic collar screw	36-48 **in-lbs**	4.0-5.4 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
Trunk pan to center tail section, Lightning	48-72 **in-lbs**	5.4-8 Nm	2.40 LEFT TAIL SECTION AND BATTERY PAN: LIGHTNING, Assembly
Trunk pan to center tail section, Lightning	48-72 **in-lbs**	5.4-8 Nm	2.41 CENTER TAIL SECTION: LIGHTNING, Assembly
Turn signal fastener, front (Lightning)	25-28 **in-lbs**	2.8-3.2 Nm	6.15 FRONT TURN SIGNALS, Lightning
Turn signal fastener, front (Ulysses)	25-28 **in-lbs**	2.8-3.2 Nm	6.15 FRONT TURN SIGNALS, Ulysses
Turn signal fastener, rear (Lightning)	25-28 **in-lbs**	2.8-3.2 Nm	6.16 REAR TURN SIGNALS, Lightning
Turn signal fastener, rear (Ulysses)	25-28 **in-lbs**	2.8-3.2 Nm	6.16 REAR TURN SIGNALS, Ulysses
Turn signal fastener (rear)	25-28 **in-lbs**	2.8-3.2 Nm	6.16 REAR TURN SIGNALS, Firebolt
Turn signal fasteners, rear	25-28 **in-lbs**	2-3 Nm	2.39 SUBFRAME TAIL ASSEMBLY AND BODY WORK: FIREBOLT, Assembly
Turn signal fasteners (front)	25-28 **in-lbs**	2.8-3.2 Nm	6.15 FRONT TURN SIGNALS, Firebolt
Turn signal flasher fastener	36-60 **in-lbs**	4-7 Nm	6.14 TURN SIGNAL FLASHER, Installation
Turn signal flasher fastener	12-36 **in-lbs**	1.4-4 Nm	6.14 TURN SIGNAL FLASHER, Installation
Turn signal flasher fastener	36-60 **in-lbs**	4-7 Nm	6.14 TURN SIGNAL FLASHER, Installation
Turn signal housing screw	4.4-4.3 **in-lbs**	0.5-0.6 Nm	6.15 FRONT TURN SIGNALS, Bulbs
Turn signal housing screw	4.4-4.3 **in-lbs**	0.5-0.6 Nm	6.16 REAR TURN SIGNALS, Bulbs
Turn signal relocation bracket	60-72 **in-lbs**	7-8 Nm	6.16 REAR TURN SIGNALS, Turn Signal Relocation Bracket: XB12XP
Upper fork clamp fasteners	23-25 ft-lbs	31.2-33.8 Nm	2.16 FRONT FORKS: ALL MODELS, Installation
Upper front fender fasteners/XB12X	12-36 **in-lbs**	1.4-4 Nm	2.15 FENDERS, Front Fender: XB12X/LOCTITE 271 (red)
Upper module fasteners, Ulysses	36-60 **in-lbs**	4-7 Nm	2.30 FRONT MODULES: LIGHTNING/ULYSSES, Installation
Upper rocker cover screws	120-168 **in-lbs**	13.6-18.9 Nm	3.7 CYLINDER HEAD, Cylinder Head Installation
Upper tie bar	25-27 ft-lbs	33.9-36.6 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation
Valve stem nut	40-44 **in-lbs**	4.5-4.9 Nm	2.7 TIRES, Installation

FASTENER	TORQUE VALUE		NOTES
V bracket to main frame	120-144 **in-lbs**	13.6-16.3 Nm	3.4 ENGINE ROTATION FOR SERVICE, Assembly
V bracket to main frame	120-144 **in-lbs**	13.6-16.3 Nm	3.6 ENGINE INSTALLATION, Assembly
Vehicle speed sensor fastener	90-110 **in-lbs**	10.0-12.4 Nm	6.25 VEHICLE SPEED SENSOR (VSS), Installation
Voltage regulator mounting fasteners	36-60 **in-lbs**	3.5-7 Nm	6.10 VOLTAGE REGULATOR, Installation
Wear peg, rider, Firebolt and Lightning	36-48 **in-lbs**	4-5 Nm	2.34 FOOTPEG, HEEL GUARD AND MOUNT: FIREBOLT/LIGHTNING, Rider/LOCTITE 271 (red)
Windscreen fasteners	10-12 **in-lbs**	1.1-1.4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, LIGHTNING
Windscreen fasteners	10-12 **in-lbs**	1.1-1.4 Nm	6.4 IGNITION/HEADLAMP KEY SWITCH, ULYSSES
Windscreen fasteners, Firebolt	10-12 **in-lbs**	1-1.4 Nm	2.47 FRONT FAIRING, WINDSHIELD, AND MIRRORS: FIREBOLT, Installation
Windscreen fasteners, Lightning	10-12 **in-lbs**	1.1-1.4 Nm	2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES, LIGHTNING
Windscreen fasteners, Ulysses	10-12 **in-lbs**	1.1-1.4 Nm	2.48 WINDSHIELD AND WINDSCREEN: LIGHTNING AND ULYSSES, ULYSSES XB12X
Wire cover front fasteners	36-48 **in-lbs**	4.1-5.4 Nm	6.20 LICENSE PLATE LAMP ASSEMBLY, Ulysses
Wire cover rear fasteners	12-36 **in-lbs**	1.4-4 Nm	6.20 LICENSE PLATE LAMP ASSEMBLY, Ulysses
Wire cover screws, Ulysses	36-48 **in-lbs**	4-5.4 Nm	2.44 CENTER TAIL LOOP: ULYSSES MODELS, Assembly
Wire cover screws, Ulysses	36-48 **in-lbs**	4-5.4 Nm	2.52 SEAT LOCKS, Installation: Ulysses Models
Wire cover screws, Ulysses	36-48 **in-lbs**	4.0-5.4 Nm	2.53 TRIPLE TAIL: ULYSSES, Installation
Wire harness guide	72-84 **in-lbs**	8-9 Nm	6.27 MAIN WIRE HARNESS, Installation

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