2010 Harley-Davidson Softail Models Service Manual

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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 Harley-Davidson product and assist in the performance of basic maintenance and repair. Secondly, it will introduce to the professional Harley-Davidson Technician the latest field-tested and factory-approved major repair methods. We sincerely believe that this Service Manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

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

NO.	CHAPTER
1	Maintenance
2	Chassis
3	Engine
4	Fuel System
5	Drive
6	Transmission
7	Electrical
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C Conversions
D	Appendix D 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 D.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.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), you must first disarm the security system. Either keep the fob in close proximity to the vehicle, or use Digital Technician II to disable the security system while the vehicle is being serviced and re-enable the system after service is completed.*

SERVICE BULLETINS

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

USE GENUINE REPLACEMENT PARTS

⚠WARNING

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 ensure satisfactory and lasting repairs, carefully follow the Service Manual instructions and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON stand more than 100 years of design, research, manufacturing, testing and inspecting experience. This is your assurance that the parts you are using will fit right, operate properly and last longer.

WARNINGS AND CAUTIONS

Statements in this service 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 service 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 service manual. However, please remember that these warnings are not all-inclusive. Inadequate safety precautions could result in death or serious injury.

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

PRODUCT REFERENCES

⚠WARNING

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

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

Kent-Moore Products

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

Loctite Sealing and Threadlocking Products

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

PRODUCT REGISTERED MARKS

Alcantara S.p.A., Allen, Amp Multilock, Bluetooth, Brembo, Delphi, Deutsch, Dunlop, Dynojet, Fluke, G.E. Versilube, Gunk, Hydroseal, Hylomar, Kevlar, Lexan, Loctite, Lubriplate, Keps, K&N, Magnaflux, Marson Thread-Setter Tool Kit, MAXI fuse, Molex, Michelin, MPZ, Mulitilock, NGK, Novus, Packard, Pirelli, Permatex, Philips, PJ1, Pozidriv, Robinair, S100, Sems, Snap-on, Teflon, Threadlocker, Torca, Torco, TORX, Tufoil, Tyco, Ultratorch, Velcro, X-Acto, and XM Satellite Radio are among the trademarks of their respective owners.

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CONTENTS

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

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

MAINTENANCE

1.1 FASTENER TORQUE VALUES

1.2 GENERAL

1.3 FUEL AND OIL

1.4 BULB REQUIREMENTS

1.5 MAINTENANCE SCHEDULE

1.6 ENGINE OIL AND FILTER

1.7 AIR CLEANER AND EXHAUST SYSTEM

1.8 TIRES AND WHEELS

1.9 PRIMARY CHAINCASE LUBRICANT

1.10 TRANSMISSION LUBRICANT

1.11 CLUTCH

1.12 DRIVE BELT AND SPROCKETS

1.13 THROTTLE CABLES

1.14 CABLE AND CHASSIS LUBRICATION

1.15 BRAKES

1.16 BLEEDING BRAKES

1.17 BRAKE PADS AND DISCS

TABLE OF CONTENTS

TABLE OF CONTENTS

2.6 REAR WHEEL

2.7 SEALED WHEEL BEARINGS

2.8 WHEEL LACING

2.9 TRUING LACED WHEELS

2.10 CHECKING CAST WHEEL RUNOUT

2.11 VEHICLE ALIGNMENT

2.12 FRONT BRAKE MASTER CYLINDER

2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB

2.14 FRONT BRAKE CALIPER: FLSTSB

2.15 REAR BRAKE MASTER CYLINDER

2.16 REAR BRAKE CALIPER

2.17 TIRES

2.18 FRONT FORK: TELESCOPIC

2.19 FRONT FORK: SPRINGER

2.20 STEERING HEAD

TABLE OF CONTENTS

3.21 ROCKER ARM SUPPORT PLATE

3.22 PUSH RODS, LIFTERS AND COVERS

3.23 CYLINDER HEAD

3.24 CYLINDER

3.25 PISTON

3.26 CAM SUPPORT PLATE AND COVER

3.27 OIL PUMP

3.28 CRANKCASE

3.29 FLYWHEEL AND CONNECTING RODS

3.30 COUNTERBALANCER ASSEMBLY

3.31 OIL TANK: ALL BUT FXCWC

TABLE OF CONTENTS

4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS)

DRIVE

5.1 FASTENER TORQUE VALUES

5.2 SPECIFICATIONS: DRIVE

5.3 PRIMARY CHAINCASE COVER

5.4 DRIVE COMPONENTS

5.5 PRIMARY CHAINCASE HOUSING

5.6 CLUTCH

5.7 TRANSMISSION SPROCKET

5.8 DRIVE BELT

TRANSMISSION

6.1 FASTENER TORQUE VALUES

6.2 SPECIFICATIONS: TRANSMISSION

6.3 TRANSMISSION

6.4 SHIFTER LINKAGE

6.5 CLUTCH RELEASE COVER

6.6 TRANSMISSION ASSEMBLY

6.7 MAIN DRIVE GEAR AND BEARING

6.8 TRANSMISSION CASE

ELECTRICAL

7.1 FASTENER TORQUE VALUES

7.2 SPECIFICATIONS: ELECTRICAL

7.3 ELECTRICAL PANEL

7.4 ELECTRONIC CONTROL MODULE (ECM)

7.5 TURN SIGNAL AND SECURITY MODULE (TSM/TSSM/HFSM)

7.6 VOLTAGE REGULATOR

7.7 FRONT ELECTRICAL CADDY

7.8 FUSES

7.9 RELAYS

7.10 MAIN FUSE

7.11 IGNITION AND LIGHT SWITCH

7.12 BATTERY CABLES

7.13 STARTER

7.14 STARTER SOLENOID

7.15 HEADLAMP

7.16 TAIL LAMP: ALL BUT FLSTN

7.17 TAIL LAMP: FLSTN

7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN

7.40 HFSM MAINTENANCE

7.41 PERSONAL IDENTIFICATION NUMBER (PIN)

7.42 H-DSSS ACTUATION

7.43 TSM/HFSM: PASSWORD LEARN

APPENDIX A CONNECTOR REPAIR

A.1 AMP MULTILOCK CONNECTORS

A.2 AUTOFUSE ELECTRICAL CONNECTORS

A.3 DELPHI CONNECTORS

A.4 DELPHI MAIN FUSE HOUSING

A.5 DEUTSCH ELECTRICAL CONNECTORS

A.6 DEUTSCH STANDARD TERMINAL REPAIR

A.7 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR

A.8 DEUTSCH MINI TERMINAL REPAIR

A.9 MOLEX CONNECTORS

A.10 PACKARD 150 METRI-PACK CONNECTORS

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.11 CLUTCH, Adjustment
Air cleaner bracket screws	40-60 **in-lbs**	4.5-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	1.25 BATTERY MAINTENANCE, Installation and Connection
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	1.25 BATTERY MAINTENANCE, Installation and Connection
Battery terminal fastener	60-72 **in-lbs**	6.8-8.1 Nm	1.5 MAINTENANCE SCHEDULE, General
Bearing retainer	25-35 **in-lbs**	2.8-4.0 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Bearing retainer	25-35 **in-lbs**	2.8-4.0 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Bearing retainer jam nut	95-105 ft-lbs	128.8-142.4 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	1.16 BLEEDING BRAKES, Procedure
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Cable adjuster jam nut	120 **in-lbs**	13.6 Nm	1.11 CLUTCH, Adjustment
Chrome aluminum laced wheel spoke nipple	55 **in-lbs**	6.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch adjustment screw locknut	72-120 **in-lbs**	8-14 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.11 CLUTCH, Adjustment
Clutch inspection cover fastener torque	84-108 **in-lbs**	10-12 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
Engine oil drain plug	14-21 ft-lbs	19-28 Nm	1.5 MAINTENANCE SCHEDULE, General
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Front engine mounting nuts	70-80 ft-lbs	94.9-108.5 Nm	1.26 ENGINE MOUNTS, Inspection
Handlebar clamp screw torque	12-15 ft-lbs	16.3-20.3 Nm	1.5 MAINTENANCE SCHEDULE, General
Handlebar switch housing screw	35-45 **in-lbs**	4-5 Nm	1.5 MAINTENANCE SCHEDULE, General
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	1.13 THROTTLE CABLES, Cable Inspection, Lubrication and Adjustment

FASTENER	TORQUE VALUE		NOTES
Headlamp horizontal adjustment fastener	30-35 ft-lbs	40.7-47.5 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp vertical adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment/FXSTC, FXCWC
Headlamp vertical adjusting bolt	25-35 ft-lbs	33.9-47.5 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment/FLSTSB
Headlamp vertical adjusting bolt	35-45 ft-lbs	47.5-61.0 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment/All but FLSTSB, FXSTC, FXCWC
Lower fork stem pinch bolts	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Lower fork stem pinch bolts: FLST, FLSTC, FLSTF/B, FLSTN	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Lower triple tree pinch bolt	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Lower triple tree pinch bolt	35-40 ft-lbs	47.5-54.3 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Lower triple tree pinch bolt: FXCWC	35-40 ft-lbs	47.5-54.3 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Lower triple tree pinch bolt: FXST, FXSTC	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Master cylinder cover screw torque: front	12-15 **in-lbs**	1.4-1.7 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder cover screw torque: rear	6-8 **in-lbs**	0.7-0.9 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover screw: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.15 BRAKES, Fluid Inspection
Master cylinder reservoir cover screw: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.16 BLEEDING BRAKES, Procedure
Master cylinder reservoir cover screw: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.15 BRAKES, Fluid Inspection
Master cylinder reservoir cover screw: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.16 BLEEDING BRAKES, Procedure
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir cover screws: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Mounting bolt and slider pin, rear caliper	10-14 ft-lbs	13.6-18.9 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Primary chaincase drain plug	14-21 ft-lbs	19-28 Nm	1.5 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm	1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection
Rear fork pivot nut	90-110 ft-lbs	122.0-149.1 Nm	1.26 ENGINE MOUNTS, Inspection
Rigid fork pivot stud	25-35 **in-lbs**	2.8-4.0 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Rocker pivot stud acorn nut	45-50 ft-lbs	61.0-67.8 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Spark plug	12-18 ft-lbs	16-24 Nm	1.5 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.18 SPARK PLUGS, Inspection
Spoke nipple	55 **in-lbs**	6.2 Nm	1.8 TIRES AND WHEELS, Wheel Spokes

FASTENER	TORQUE VALUE		NOTES
Starter nut	70-90 **in-lbs**	7.9-10.2 Nm	1.25 BATTERY MAINTENANCE, Installation and Connection
Steel laced wheel spoke nipple	55 **in-lbs**	6.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19-28 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission filler plug	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission filler plug torque	25-75 **in-lbs**	3-9 Nm	1.5 MAINTENANCE SCHEDULE, General
Upper engine mounting to cylinder head bolts	35-40 ft-lbs	47.5-54.3 Nm	1.26 ENGINE MOUNTS, Inspection
Upper engine to frame mounting bolt	45-50 ft-lbs	61.0-67.8 Nm	1.26 ENGINE MOUNTS, Inspection
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.21 STEERING HEAD BEARINGS: FLSTSB, Adjustment: FLSTSB
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.21 STEERING HEAD BEARINGS: FLSTSB, Adjustment: FLSTSB

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 1.5 MAINTENANCE SCHEDULE.

SAFE OPERATING MAINTENANCE

NOTES

- *Do not attempt to tighten engine head bolts or engine damage may result.*
- *During the initial break-in period, use only 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. Drive belt tension and condition.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and discs for wear.
5. Cables for fraying, crimping and free operation.
6. Engine oil and transmission fluid levels.
7. Headlamp, auxiliary 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 multiple 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 parts are to be reused, follow good shop practice and thoroughly clean the parts before assembly. Keep all dirt out of parts to promote better component operation and longer life. Seals, filters and covers are used in this vehicle to keep out extraneous dirt and dust. These items must be kept in good condition to guarantee satisfactory operation.

When instructed to clean fastener threads or threaded holes, proceed as follows: Clean all threadlocking material from fastener threads and threaded holes. Use a wire brush to clean fastener threads. Use a thread chaser or other suitable tool to clean threaded holes. Use PJ1 cleaner or equivalent to remove all traces of oil and contaminants from threads. Clean 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. Check your work when finished to 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

Attempt to turn the fastener using a torque wrench set to the minimum torque specification for that fastener. If the fastener does not rotate, the fastener torque has been maintained. If the fastener rotates, remove it to determine if it has a thread-locking agent.

If it has a threadlocking agent, clean all threadlocking material from the threaded hole. Replace the fastener with a **new** one or clean the original fastener threads and apply the appropriate threadlocking product (see the specific procedure). Install and tighten the fastener to specification.

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

Magnetic Parts Trays

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

However, hardened steel parts can become magnetized when held in magnetic parts trays. Metal fragments 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 thread repair inserts when threaded holes in castings are stripped, damaged or not capable of withstanding specified torque.

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

Replace all damaged or missing lubrication fittings.

Use 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. Always use the recommended threadlocking agent for the 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 damaged or defective instruments and gauges.

Bearings

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

When bearings are installed against shoulders, 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.

Only remove bearings if necessary. Removal usually damages bearings requiring them to be replaced with new parts.

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 mating parts for oil holes before installation, and be sure all oil holes are properly aligned during installation.

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.

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.

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 (Pre-Formed Packings)

Always discard O-rings after removal. Replace with **new** O-ring. 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 to remove.

Shafts fitted to tapered splines should be very tight. If shafts are not tight, disassemble and inspect tapered splines. Discard parts that are worn. 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 the leak still exists, disassemble and repair the leak by applying a bead of Permatex Ultra Copper or LOCTITE 5920 Flange Sealant (or an equivalent oxygen sensor/catalyst-safe alternative). Assemble 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

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

⚠WARNING

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

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

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

TOOL SAFETY

Air Tools

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

Wrenches

- Never use an extension on a wrench handle.
- If possible, always pull on a wrench handle and adjust your stance to prevent a fall if something suddenly releases.
- Always keep the wrench squarely installed on the fastener.
- Never use a hammer on any wrench other than a STRIKING FACE wrench.
- Discard any wrench with 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 them on live electrical circuits.
- Do not use pliers or cutters for cutting hardened wire unless they were designed for that purpose.
- Always cut at right angles.
- Do not use any pry bar as a chisel, punch or hammer.

Hammers

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

Punches/Chisels

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

Screwdrivers

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

Ratchets and Handles

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

Sockets

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

Storage Units

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

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

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.
- Do not use race gas or octane boosters. Use of these fuels will damage the fuel system.

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
Screamin' Eagle SYN3 Synthetic Motorcycle Lubricant	SAE 20W50	HD 360	Above 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 mi (24 km), in ambient temperatures below 60 °F (16 °C), oil change intervals should be reduced to 1500 mi (2400 km). 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.

BULB REQUIREMENTS 1.4

GENERAL

Refer to Table 1-3. This table gives the location and bulb requirements for all Harley-Davidson Softail motorcycles.

NOTES

- *See Softail models parts catalog for part numbers.*
- *All Softail model speedometers, tachometers indicator lamps and odometers are illuminated with LEDs.*
- *All FXCWC model rear turn signal lamps are illuminated with LEDs.*
- *LEDs are non-repairable. Entire assembly must be replaced if LED fails.*

Table 1-3. Bulb Chart

LAMP	DESCRIPTION (ALL LAMPS 12 VOLT)	BULBS REQUIRED	CURRENT DRAW (AMPERAGE)		HARLEY-DAVIDSON PART NUMBER
			FL MODELS	FX MODELS	
Headlamp	high beam/low beam	1	4.7	4.3	68329-03
	position lamp international	1	0.32		53436-97
Tail and stop lamp (all models except FLSTN, FXCWC)	tail/stop lamp	1	0.59/2.10		68167-04
	tail/stop lamp international	1	0.59/2.10		68167-04
Tail and stop lamp (FLSTN)	tail/stop lamp	1	0.59/2.10		68168-89A
	tail/stop lamp international	1	0.59/2.10		68169-90A
Rear turn signal, tail/stop lamp (FXCWC)	Illuminated with LEDs. Replace entire assembly upon failure.				
Turn signal lamp (all models except rear lamps on FXCWC)	front/running	2	2.25	0.59	68168-89A
	front international, FLSTC	2	1.75		68572-64B
	front international	2	1.75		68163-84
	rear	2	2.25		68572-64B
	rear international	2	1.75		68163-84
Auxiliary lamps	FLST/FLSTC/FLSTN	2	2.50		68453-05
	Fog lamp international	2	2.92		68453-05
Fender tip lamp	FLST/FLSTC	2	0.10		68193-95
Instrument panel lamps	Illuminated with LEDs. Replace entire assembly upon failure.				

GENERAL

The table below lists the periodic maintenance requirements for Softail model motorcycles. If you are familiar with the procedures, just refer to the table for the recommended service interval. If necessary, see the quick reference table (Table 1-5) for the required specifications.

If more detailed information is needed, turn to the sections which follow for step-by-step instructions.

Also, throughout this manual, you will be instructed to use various lubricants, greases and sealants. Refer to Table 1-6. for the correct part numbers of these items.

Table 1-4. Regular Service Intervals: 2010 Softail 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	30,000 MI. 48,000 KM	NOTES
Engine oil and filter	Replace	X	X	X	X	X	X	X	
Oil lines and brake system	Inspect for leaks, contact, or abrasion	X	X	X	X	X	X	X	1, 3
Air cleaner	Inspect, service as required	X	X	X	X	X	X	X	
Exhaust system	Inspect for leaks, cracks, and loose or missing fasteners or heat shields	X	X	X	X	X	X	X	3
Tires	Check pressure, inspect tread	X	X	X	X	X	X	X	
Wheel spokes (if equipped)	Check tightness	X	X			X			1, 5
Primary chaincase lubricant	Replace	X		X		X		X	
Transmission lubricant	Replace	X				X			
Clutch	Check adjustment	X	X	X	X	X	X	X	1
Drive belt and sprockets	Inspect, adjust belt	X	X	X	X	X	X	X	1
Throttle, brake, and clutch controls	Check, adjust and lubricate	X	X	X	X	X	X	X	1
Jiffy stand	Inspect and lubricate	X		X		X		X	1
Fuel lines and fittings	Inspect for leaks, contact or abrasion	X	X	X	X	X	X	X	1, 3
Fuel filter in fuel tank	Replace						X		1
Brake fluid	Check levels and condition	X	X	X	X	X	X	X	4
Brake pads and discs	Inspect for wear	X	X	X	X	X	X	X	
Spark plugs	Inspect	X	X	X	X	X	X	X	
	Replace					X			
Electrical equipment and switches	Check operation	X	X	X	X	X	X	X	
Front fork oil	Replace	Replace at 50,000 miles (80,000 kilometers).							1, 6
Steering head bearings (Softail models)	Adjust	X		X		X		X	1
	Lubricate			X		X		X	2
Steering head bearings (Springer models)	Adjust	X		X		X		X	1
	Lubricate	Lubricate every 2500 miles (4000 kilometers).							1, 8
Windshield bushings (if equipped)	Inspect			X		X		X	1
Springer rocker bearings	Adjust	X		X		X		X	1, 7
Critical fasteners	Check tightness	X		X		X		X	1, 3
Battery	Check battery and clean connections								3
Road test	Verify component and system functions	X	X	X	X	X	X	X	

NOTES:

1. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified.
2. Disassemble, lubricate and inspect every 30,000 miles (48,000 kilometers).
3. Perform annually or at specified intervals, whichever comes first.
4. Change D.O.T. 4 brake fluid and flush system every two years.
5. Perform speke tension check at the 1000, 5000, 20,000 mile services and every 15,000 mile interval thereafter. Not all vehicles are equipped with spoke wheels. Consult appropriate topic in service manual.
6. Replace fork oil and inspect every 50,000 miles (80,000 kilometers).
7. Adjust at 500 miles (800 kilometers).
8. Disassemble, lubricate and inspect every 20,000 miles (32,000 kilometers).

Table 1-5. Softail Quick Reference Maintenance Chart

ITEM SERVICED	SPECIFICATION	DATA
Engine oil and filter	Drain plug torque	14-21 ft-lbs (19-28 Nm)
	Oil capacity (with filter)	3.5 qt (3.31 L)
	Filter	Hand tighten 1/2-3/4 turn after gasket contact
	Chrome filter part number	63798-99
	Black filter part number	63731-99
Primary chain lubricant	Lubricant type	FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION (Part No. 99851-05)
	Lubricant capacity	32 oz (0.95 L) wet 40 oz (1.18 L) dry
	Primary chaincase drain plug torque	14-21 ft-lbs (19-28 Nm)
Clutch adjustment	Free play at adjuster screw	1/2-1 turn
	Adjuster screw locknut torque	72-120 **in-lbs** (8-14 Nm)
	Free play at hand lever	1/16-1/8 in. (1.6-3.2 mm)
	Clutch inspection cover torque	84-108 **in-lbs** (10-12 Nm)
Transmission lubricant	Lubricant type	FORMULA+ TRANSMISSION AND PRIMARY CHAIN LUBRICATION (Part No. 99851-05)
	Lubricant level	Dipstick at FULL with motorcycle on jiffy stand and filler plug resting on threads
	Lubricant capacity	32 oz (0.95 L)
	Transmission drain plug torque	14-21 ft-lbs (19-28 Nm)
	Filler plug torque	25-75 **in-lbs** (3-9 Nm)
Spark plugs	Type	HD-6R12
	Gap	0.038-0.043 in. (0.97-1.09 mm)
	Torque	12-18 ft-lbs (16-24 Nm)
Engine idle speed	Idle speed	950-1050 RPM
Front fork oil	Type	HYDRAULIC FORK OIL (TYPE E) Part No. 99884-80 (16 oz) See 2.18 FRONT FORK: TELESCOPIC, Replacing Fork Oil.
Battery	Lubricant	ELECTRICAL CONTACT LUBRICANT Part No. 99861-02 (1 oz)
	Battery terminal torque	60-72 **in-lbs** (6.8-8.1 Nm)
Tire condition and pressure	Pressure for rider and passenger	FLST, FLSTC, FLSTN Models: Front: 36 psi (248 kPa) Rear: 40 psi (276 kPa)
		FXST, FXSTC Models: Front: 30 psi (207 kPa) Rear: 42 psi (290 kPa)
		FLSTF/B Models: Front: 36 psi (248 kPa) Rear: 42 psi (290 kPa)
		FXCWC Models: Front: 30 psi (207 kPa) Rear: 42 psi (290 kPa)
	Wear	Replace tire if 1/32 in. (0.8 mm) or less of tread pattern remains
Wheel spokes	Spoke nipple torque (minimum)	Steel laced wheel: 55 **in-lbs** (6.2 Nm)
		Chrome aluminum laced wheel: 55 **in-lbs** (6.2 Nm)

Table 1-5. Softail Quick Reference Maintenance Chart

ITEM SERVICED	SPECIFICATION	DATA
Steering head bearings	Lubricant for neck fitting	SPECIAL PURPOSE GREASE Part No. 99857-97 (14oz cartridge)
Brake fluid reservoir level	DOT 4 hydraulic brake fluid part number	99953-99A (12 oz)
	Proper fluid level	1/4 ± 1/8 in. (6.35 ± 3.18 mm) from top
	Master cylinder cover screw torque: front	12-15 **in-lbs** (1.4-1.7 Nm)
	Master cylinder cover screw torque: rear	6-8 **in-lbs** (0.7-0.9 Nm)
Brake pad linings and discs	Minimum brake pad thickness	0.04 in. (1.02 mm)
	Minimum brake disc thickness	See stamp on side of disc
Drive belt	Upward measurement force applied at midpoint of bottom off belt strand	10 lb (4.5 kg)
	With motorcycle on Jiffy Stand without rider or luggage	FLSTN, FLSTSB: 1/4-5/16 in. (6.4-7.9 mm) FXST, FLST, FLSTC, FLSTF/B, FXCWC, FXSTC: 9/16-5/8 in. (14.3-15.9 mm)
	Vehicle upright with rear wheel in air	FLSTN, FLSTSB: 5/16-3/8 in. (7.9-9.5 mm) FXST, FLST, FLSTC, FLSTF/B, FXCWC, FXSTC: 11/16-3/4 in. (17.5-19.1 mm)
Air cleaner	Air cleaner cover bracket screw torque	40-60 **in-lbs** (4.5-6.8 Nm)
	Air cleaner cover screw torque	36-60 **in-lbs** (4.1-6.8 Nm)
	Adhesive for air cleaner cover screw	LOCTITE THREADLOCKER 243 Part No. 99642-97 (6 ml)
Clutch and throttle cables	Lubricant	Harley Lube Part No. 94968-09 (1/4 fl oz)
	Handlebar clamp screw torque	12-15 ft-lbs (16.3-20.3 Nm)
	Handlebar switch housing screw torque	35-45 **in-lbs** (4-5 Nm)

Table 1-6. Lubricants, Greases, Sealants

ITEM	PART NUMBER	PACKAGE
SILVER GRADE ANTI-SEIZE	98960-97	1 oz squeeze tube
CCI #20 Brake Grease	42830-05 (included in master cylinder rebuild kit)	squeeze packet
D.O.T. 4 Brake Fluid	99953-99A	12 oz. bottle
Electrical Contact Lubricant	99861-02	1 oz squeeze tube
Genuine Harley-Davidson Formula+ Transmission and Primary Chaincase Lubricant	99851-05	1 qt bottle
SYN3 20W50 Oil	99824-03/00QT	1 qt bottle
G40M Brake Grease	42820-04	squeeze packet
Gray High Performance Sealant	99650-02	1.9 oz squeeze tube
HYLOMAR Gasket and Thread Sealant	99653-85	3.5 oz tube
Loctite Pipe Sealant With Teflon 565	99818-97	6 ml squeeze tube
Loctite Prism Primer (770)		
Loctite Prism Superbonder (411)		
Loctite Superbonder 420 Adhesive		
Loctite Threadlocker 243 (blue)	99642-97	6 ml squeeze tube
Loctite Threadlocker 262 (red)	94759-99	6 ml squeeze tube

Table 1-6. Lubricants, Greases, Sealants

Loctite Threadlocker 272	98618-03	10 ml bottle
Screamin' Eagle Assembly Lube	94971-09	4 oz. bottle
Special Purpose Grease	99857-97	14 oz. cartridge
Harley® Lube	94968-09	1/4 fl. oz
Type "E" Hydraulic Fork Oil	99884-80	16 oz bottle

CHECKING AND ADDING OIL

See Figure 1-1. Checking engine oil level:

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

Type of Oil

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

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 20W-50, 15W-40 and 10W-40. At the first opportunity, see a Harley-Davidson dealer to change back to 100 percent Harley-Davidson oil.

Checking Oil Level

CAUTION

Oil level cannot be accurately measured on a cold engine. For pre-ride inspection, with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick between arrows when engine is cold. Do not add oil to bring the level to the FULL mark on a COLD engine. (00185a)

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

1. Idle motorcycle on jiffy stand for 1-2 minutes.
2. Shut motorcycle off and leave motorcycle **resting on jiffy stand**.
3. See Figure 1-2. Check oil level on dipstick. If necessary, add oil until oil registers at upper groove on dipstick. Do not overfill oil tank.

Figure 1-1. Checking Oil Tank Level

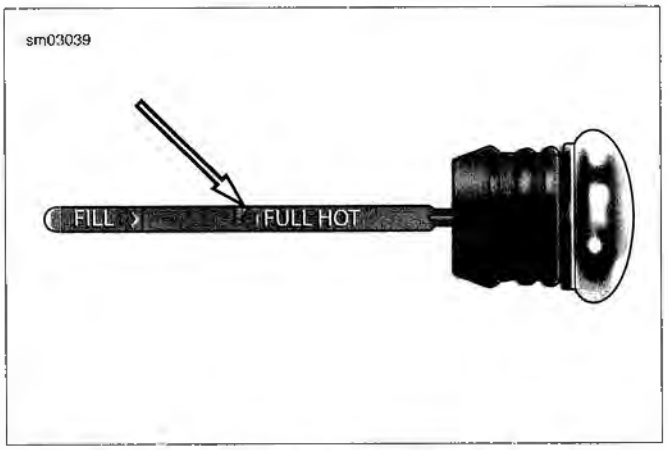


Figure 1-2. Oil Tank Dipstick Upper Groove

CHANGING OIL AND FILTER

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

NOTES

- *If the motorcycle is ridden hard, under dusty conditions, or in cold weather, the oil and filter should be changed more often.*
- *All Softail models are shipped from the factory with SAE 20W50 Harley-Davidson 360 Motor Oil.*
- *All Softail models come equipped from the factory with a premium 5 micron synthetic media oil filter, Part No. 63798-99 (Chrome) or 63731-99 (Black). These are the only recommended replacement filters.*

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. See Figure 1-1. Remove the engine oil filler plug/dipstick by pulling steadily while moving plug back and forth.
3. See Figure 1-3. Remove the engine oil drain plug with o-ring (2). Allow oil to drain into a suitable container.

CAUTION

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

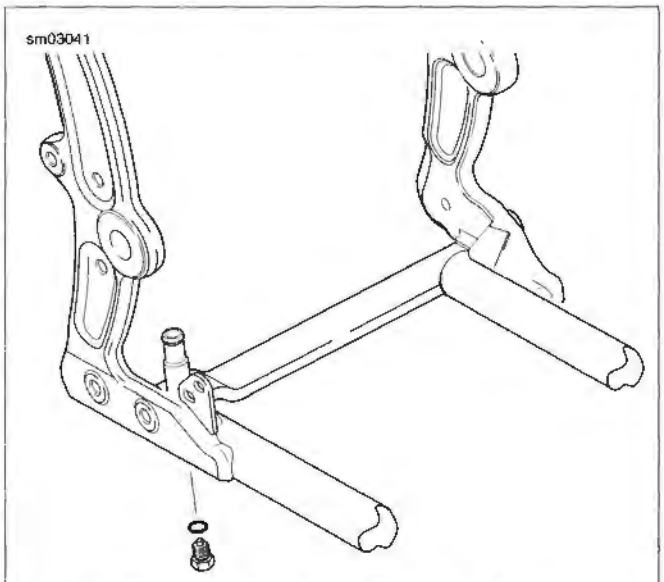
4. See Figure 1-4. Remove the oil filter using the OIL FILTER WRENCH (Part No. HD-42311) or OIL FILTER WRENCH (Part No. HD-44067). Clean the oil filter mounting surface of any old gasket material.
5. See Figure 1-5. Lube the gasket on **new** oil filter with engine oil and install **new** filter. Hand tighten oil filter 1/2 to 3/4 turn after gasket contacts filter mounting surface. DO NOT use oil filter wrench for oil filter installation.

6. See Figure 1-3. Install oil tank drain plug (2).
   a. Inspect o-ring for tears or damage. Replace if required. Wipe any foreign material from plug.
   b. Install o-ring and drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
7. Fill oil tank with the correct amount of oil. Use the proper grade of oil for the lowest temperature expected before next oil change. Refer to Table 1-2.
   a. Use 3.5 quarts (3.31 liters) of engine oil for a wet capacity refill.
   b. Use 4.0 quarts (3.79 liters) for a dry capacity refill.

NOTE

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

8. Check engine oil level using cold check procedure.
9. Start engine and carefully check for oil leaks around drain plug and oil filter.
10. Check engine oil level using hot check procedure.



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

Figure 1-3. Oil Tank Drain Plug

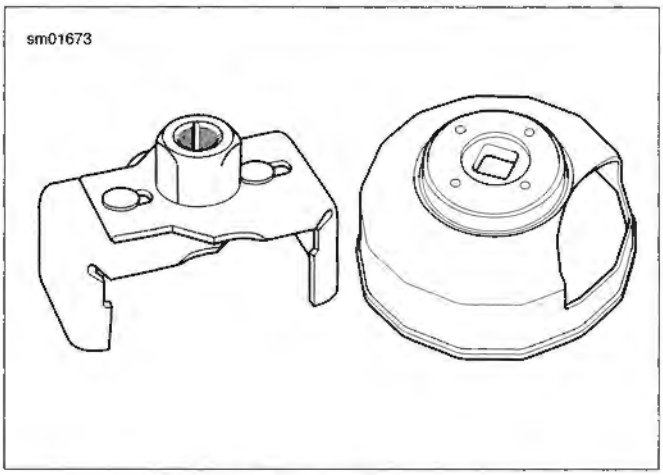


Figure 1-4. Oil Filter Wrenches

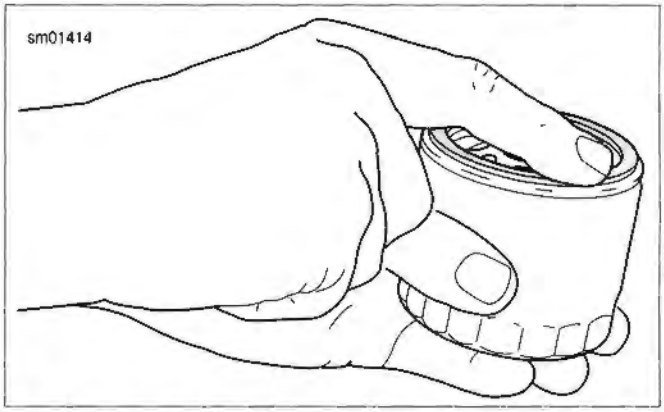


Figure 1-5. Lubricating New Oil Filter Gasket

REMOVAL

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

⚠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)

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

⚠WARNING

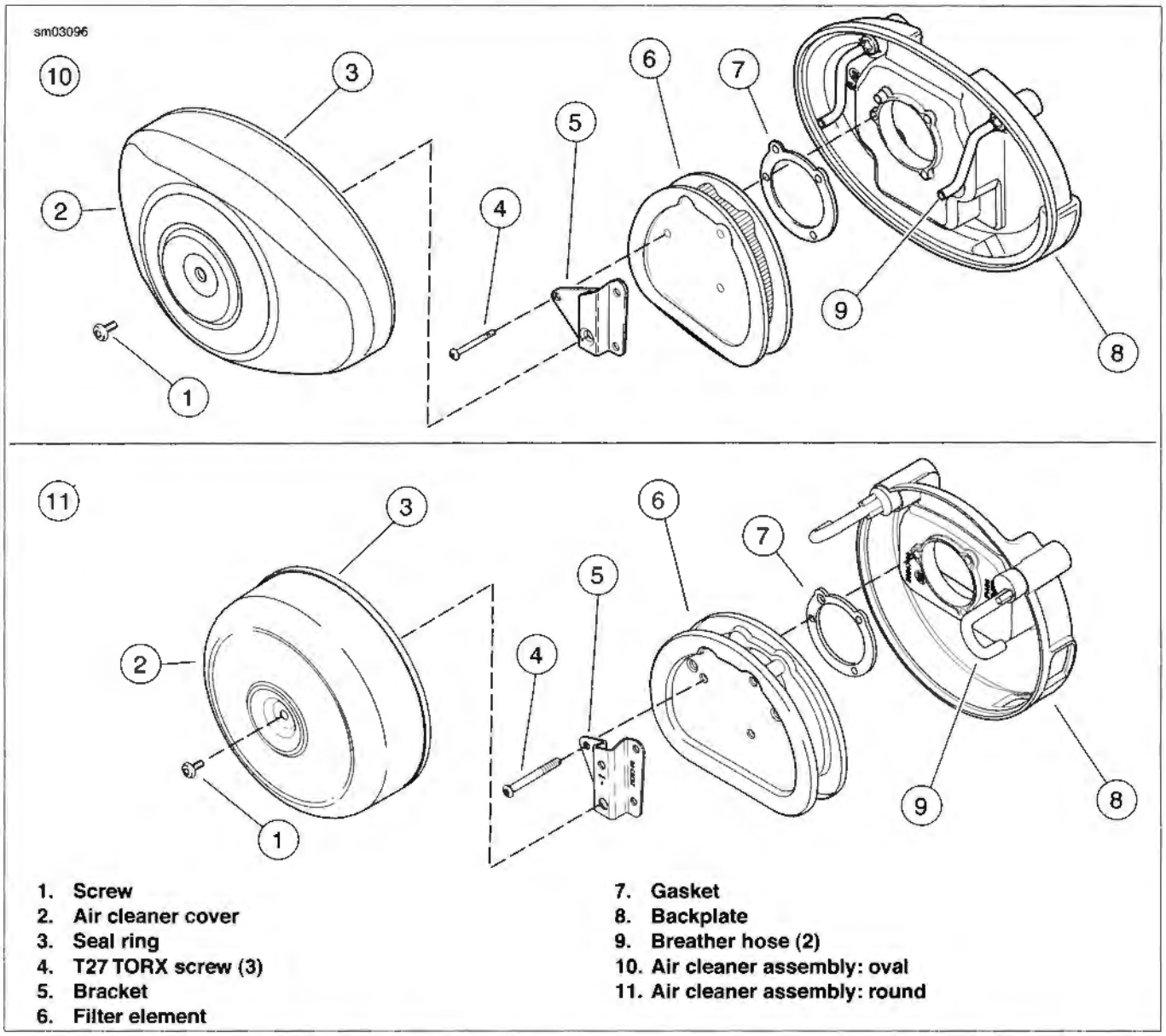
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

6. Clean filter element.
   a. Wash the paper/wire mesh air filter element and breather hoses in lukewarm water with a mild detergent. Do not strike filter element on a hard surface to dislodge dirt.
   b. Allow filter to either air dry or blow it dry, from the inside, with low pressure air. Do not use air cleaner filter oil on the Harley-Davidson paper/wire mesh air filter element.
   c. Hold the filter element up to a strong light source. If light is uniformly visible through the element, it is sufficiently clean.
7. Inspect seal ring (3) on cover for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
8. Inspect breather hoses for tears, cuts, holes or other damage. Replace as necessary.

NOTE

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

9. Wipe inside of air cleaner cover and backplate with damp cloth to remove dust.



1. **Screw**
2. **Air cleaner cover**
3. **Seal ring**
4. **T27 TORX screw (3)**
5. **Bracket**
6. **Filter element**
7. **Gasket**
8. **Backplate**
9. **Breather hose (2)**
10. **Air cleaner assembly: oval**
11. **Air cleaner assembly: round**

Figure 1-6. Air Cleaner Assembly

INSTALLATION

1. See Figure 1-7. Position **new** gasket on backplate.
2. **Oval air cleaner:** see Figure 1-8. Insert two breather hoses into the holes in back of the filter element and place the element back into position. Attach breather hoses to breather screws on backplate.
3. **Round air cleaner:** place filter element back into position on backplate and then insert two breather hoses into the holes on front of the filter element. Place breather hoses on breather screws on backplate.
4. See Figure 1-6. Install air filter element and bracket.
   a. Make sure gasket holes are aligned with backplate holes.
   b. Use three TORX screws (4) to secure bracket and filter element. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm).
5. Install air filter cover (2).
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of air cleaner cover screw (1).
   b. Install air cleaner cover using screw. Tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

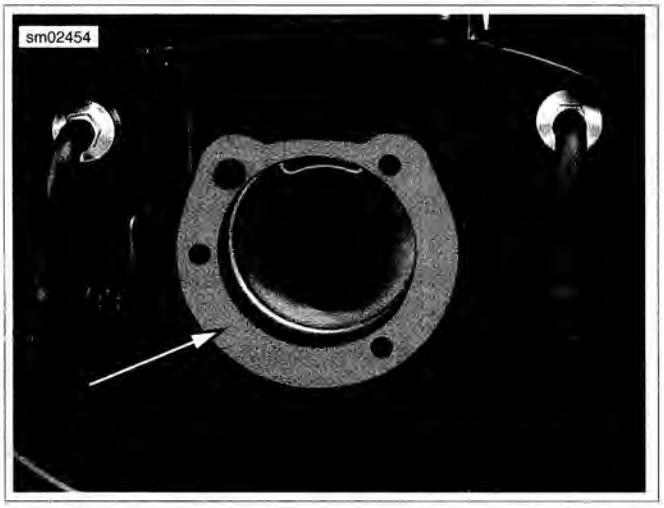


Figure 1-7. Gasket (Typical)

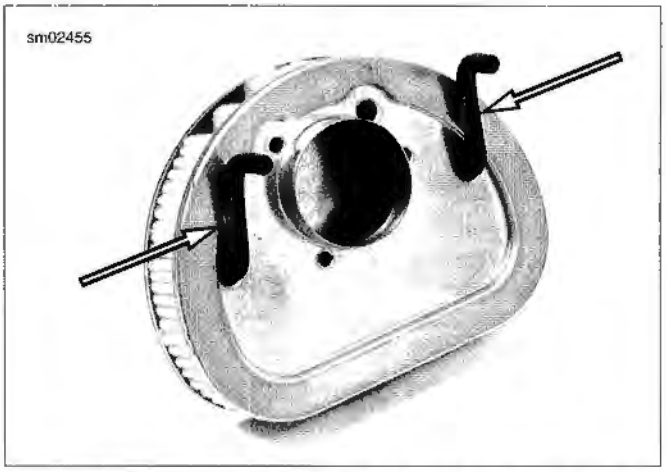


Figure 1-8. Breather Tubes on Backside of Filter: All But FLSTSB Domestic

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 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB for exhaust system removal and installation procedures.

TIRES

⚠WARNING

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

⚠WARNING

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

⚠WARNING

Use inner tubes on laced (wire spoked) wheels. Using tubeless tires on laced wheels can cause air leaks, which could result in death or serious injury. (00025a)

NOTES

- *Tubeless tires fitted with the correct size inner tubes may be used on all Harley-Davidson laced (wire spoked) wheels. Protective rubber rim strips must be used with tubeless tires (fitted with correct size inner tubes) when mounted on laced (wire spoked) wheels.*
- *Tubeless tires are used on all Harley-Davidson cast and disc wheels.*
- *Tire sizes are molded on the tire sidewall. Inner tube sizes are printed on the tube.*
- *New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.*

Check tire pressure and tread:

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

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

NOTE

Missing indicator wear bars represent less than 1/32 in. (0.8 mm) tread pattern depth remaining.

3. Check for proper front and rear tire pressures when tires are cold. Compare results against Table 1-7.

Table 1-7. Tires

MODEL	MOUNT	SIZE	NUMBER	PRESSURE (COLD)	
				PSI	kPa
FLSTSB, FLSTC, FLST, FLSTN	front	16 in.	Dunlop D402F MT90B16	36	248
FLSTF	front	17 in.	Dunlop D408F 140/75R17	36	248
FXSTC	front	21 in.	Dunlop D407F MH90-21	30	206
FXCWC	front	19 in.	Dunlop D408F 90/90-19	30	206
FLSTSB	rear	17 in.	Dunlop D401 200/55R17	42	290
FLST, FLSTC	rear	16 in.	Dunlop D401 150/80B16	40	276
FLSTN, FLSTC	rear	16 in.	Dunlop D402 MU85B16	40	276
FLSTF, FXSTC, FLSTFB	rear	17 in.	Dunlop D407 200/55R17	42	290
FXCWC	rear	18 in.	Dunlop D407 240/40R18	42	290

TIRE REPLACEMENT

Inspection

⚠WARNING

Harley-Davidson 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 Harley-Davidson approved replacement tires. (00090b)

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

Tread wear indicator bars will appear on tire tread surfaces when 1/32 in (0.8 mm) or less of tire tread remains. See Figure 1-10 . Always replace tires before the tread wear indicator bars appear.

When To Replace Tires

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

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

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

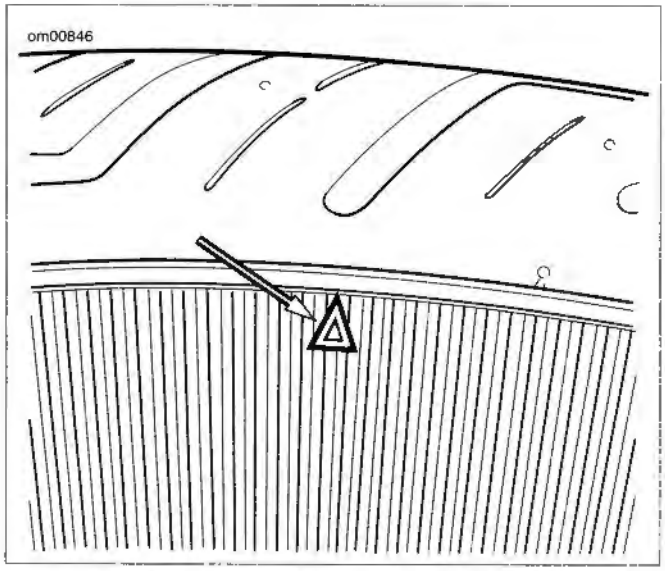


Figure 1-9. Tire Sidewall Wear Bar Locator (Typical)

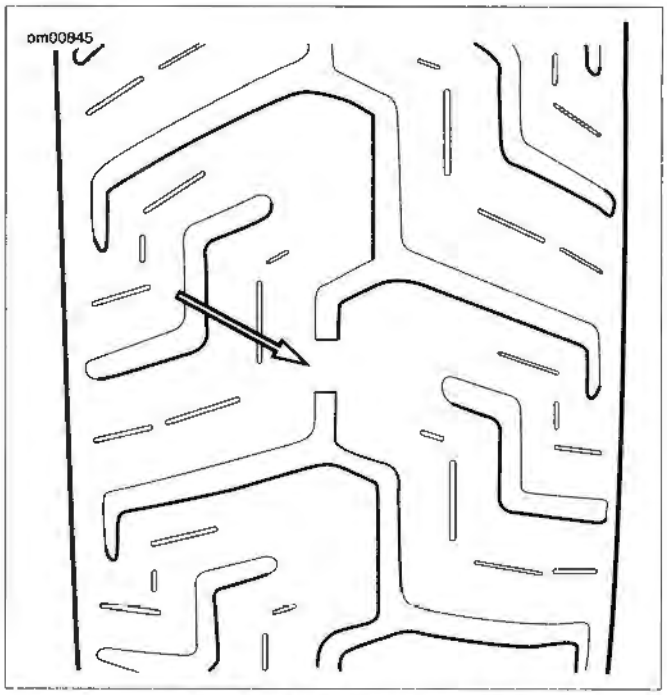


Figure 1-10. Wear Bar Appearance (Typical)

WHEEL BEARINGS

1. Replace when bearings exceed end play service wear limit of 0.002 in. (0.051 mm).
2. Inspect any time the wheels are removed.
   a. Inspect the play of the wheel bearings by finger while they are in the wheel.
   b. Rotate the inner bearing race and check for abnormal noise.
   c. Make sure bearing rotates smoothly.
3. Check wheel bearings and axle spacers for wear and corrosion. Excessive play or roughness indicates worn bearings. Replace bearings in sets only. See 2.7 SEALED WHEEL BEARINGS, Inspection.

WHEEL SPOKES

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

⚠WARNING

Spokes that are too tight can draw nipples through the rim or distort hub flanges. Spokes that are too loose can continue to loosen when put in service. Either condition can adversely affect stability and handling, which could result in death or serious injury. (00286a)

CAUTION

If nipples require more than one full turn to tighten spoke, remove tire to check that spoke protrusion has not damaged tube. (00526b)

CAUTION

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

1. Raise wheel with a suitable lifting device.

Identify Wheel Spoke Groups

NOTE

Spokes are grouped in sets of four.

1. See Figure 1-11. Starting at the valve stem, identify the first group of four spokes (1-4).
2. Using a different color for each spoke in the group, draw an alignment mark across the spoke nipple and onto the rim.
3. Continue around the wheel marking the rest of the spokes the same as they were marked in the previous step.

Wheel Spoke Adjustment

NOTES

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

1. See Figure 1-11. Starting with the first group of spokes, loosen spoke (1) using SPOKE NIPPLE WRENCH (Part No. HD-94681-80) 1/4 turn.
2. Using SPOKE TORQUE WRENCH (Part No. HD-48985) tighten spoke (1) to the value listed in Table 1-8.
   a. While tightening, if the torque wrench clicks before the alignment marks align, continue to turn the spoke nipple until the marks align.
   b. If the alignment marks align and the torque spec has not been reached, continue to tighten the spoke nipple until the correct torque is achieved, but do not turn spoke nipple more then 1/4 turn past alignment mark.
3. Repeat previous two steps for spoke (4) in the same group.
4. Continue around the wheel checking spokes 1 and 4 until all groups are done.
5. Repeat procedure for spokes (2, 3) in each group.

NOTE

When checking any spokes that were labeled, make sure to use the original alignment mark.

6. Check spokes, if any, that were labeled as not reaching the proper torque value after tigtening 1/4 turn past alignment mark.
   a. Loosen spoke 1/4 turn past original alignment mark using SPOKE NIPPLE WRENCH (Part No. HD-94681-80).
   b. While tightening, if the torque wrench clicks before the alignment marks align, continue to turn the spoke nipple until the marks align.
   c. If the alignment marks align and the torque spec has not been reached, continue to tighten the spoke nipple until the correct torque is achieved, but do not turn spoke nipple more then 1/4 turn past alignment mark.
7. True the wheel. See 2.9 TRUING LACED WHEELS.

Table 1-8. Spoke Nipple Torque Specification

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

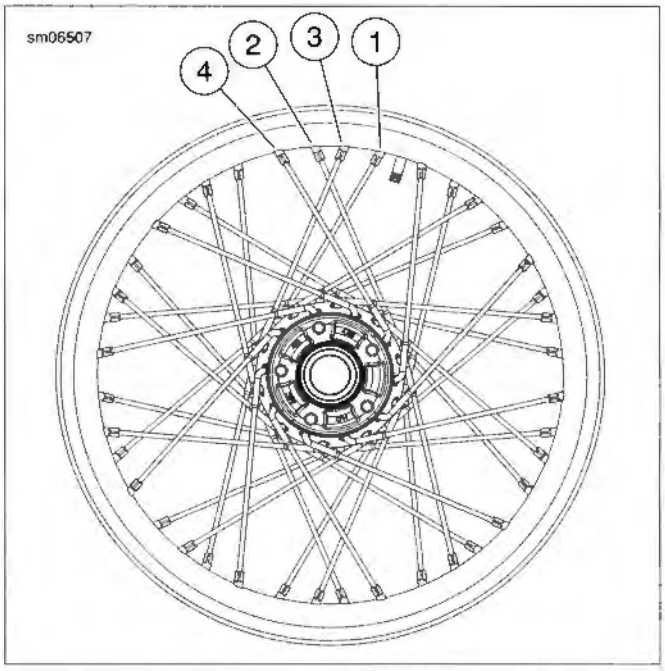


Figure 1-11. Tightening Laced Wheels (Typical)

GENERAL

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

CHANGING PRIMARY CHAINCASE LUBRICANT

1. Run motorcycle until engine is warmed up to normal operating temperature.

CAUTION

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

⚠WARNING

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

2. See Figure 1-12. Remove magnetic drain plug at bottom of primary chaincase. Drain lubricant into suitable container.

NOTE

Dispose of lubricant in accordance with local regulations.

3. Clean drain plug. If plug has accumulated a lot of debris, inspect the condition of chaincase components.
4. Install **new** O-ring on drain plug.
5. Install drain plug back into primary chaincase cover. Tighten plug to 14-21 ft-lbs (19.0-28.5 Nm).
6. See Figure 1-13. Remove five TORX screws with captive washers (3) to detach clutch inspection cover (2) from primary chaincase cover.
7. Remove the seal (1). Wipe oil from groove in chaincase cover and mounting surface.

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)

8. Refer to Table 1-9. Pour the specified amount of GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05 quart) in through the clutch inspection cover opening.

Table 1-9. Primary Chaincase Lubricant Refill Capacity

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

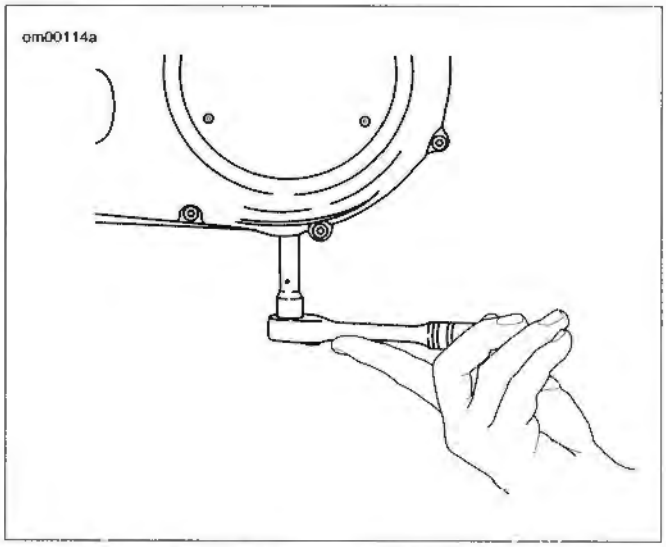
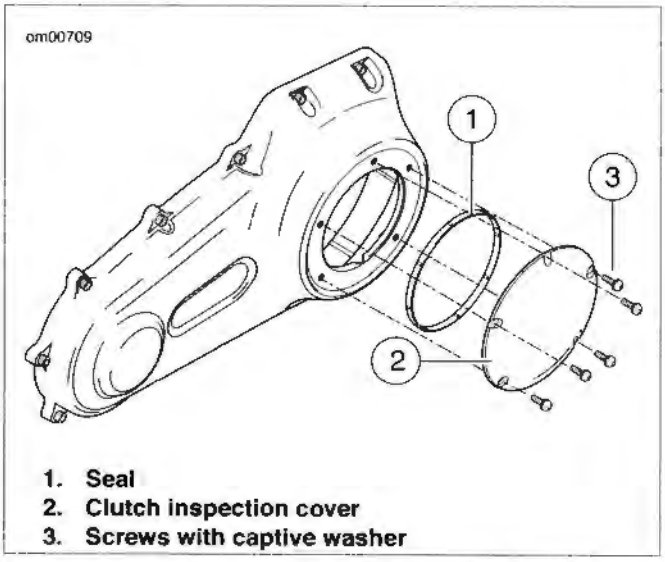


Figure 1-12. Removal/Installation of Chaincase Drain Plug



1. **Seal**
2. **Clutch inspection cover**
3. **Screws with captive washer**

Figure 1-13. Clutch Cover

9. Install clutch inspection cover and **new** seal as follows:
   a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase.
   b. See Figure 1-13. Position **new** seal (1) in groove in clutch inspection cover and press each of the nubs on seal into the groove. The nubs will retain seal in position.
   c. See Figure 1-14. Insert screw (with captive washer) through clutch inspection cover and carefully thread it into the top cover screw hole.
   d. Start the remaining four screws (with captive washers).
   e. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) following torque sequence shown in Figure 1-14.

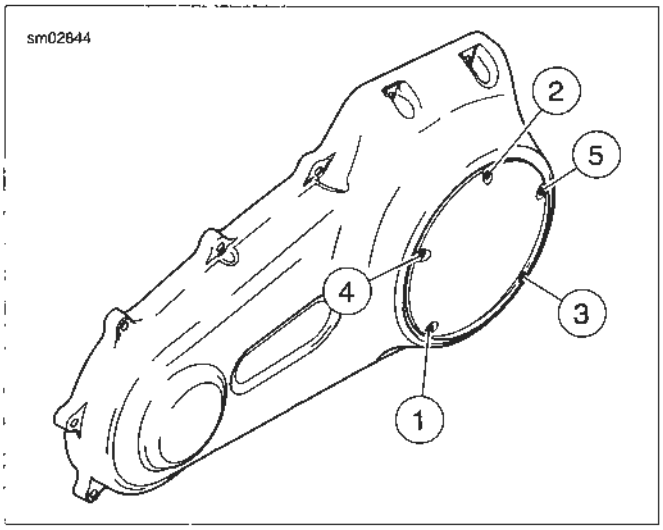


Figure 1-14. Clutch Cover Torque Sequence

CHANGING TRANSMISSION LUBRICANT

1. See Figure 1-15. Remove transmission filler plug.
2. See Figure 1-16. Remove transmission drain plug and drain lubricant into a suitable container.

CAUTION

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

3. Install drain plug.
   a. Inspect o-ring on drain plug for tears or damage. Replace as required. Wipe any foreign material from plug.
   b. Install o-ring and drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Do not over-tighten.

⚠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)

4. Fill the transmission with 32 oz. (0.95 liter) of Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, quart size).
5. See Figure 1-17. Check lubricant level.
   a. Place motorcycle on jiffy stand.
   b. Wipe dipstick clean. Place dipstick inside fill hole. Dipstick should rest on top thread of filler hole. Remove dipstick and check level.
   c. Lubricant level should be at the FULL mark (1) on dipstick when removed.
6. Install filler plug/dipstick.
   a. Check o-ring (3) on dipstick for tears or damage. Replace as required. Wipe any foreign material from plug.
   b. Install filler plug/dipstick. Tighten to 25-75 **in-lbs** (2.8-8.5 Nm).

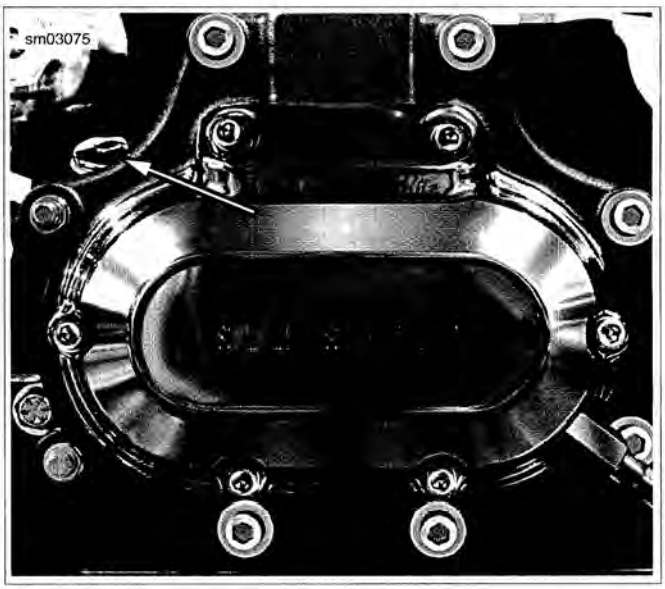


Figure 1-15. Transmission Lubricant Check/Fill

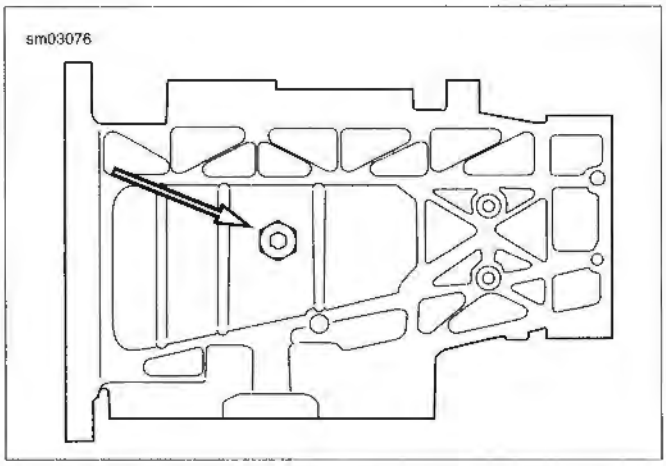
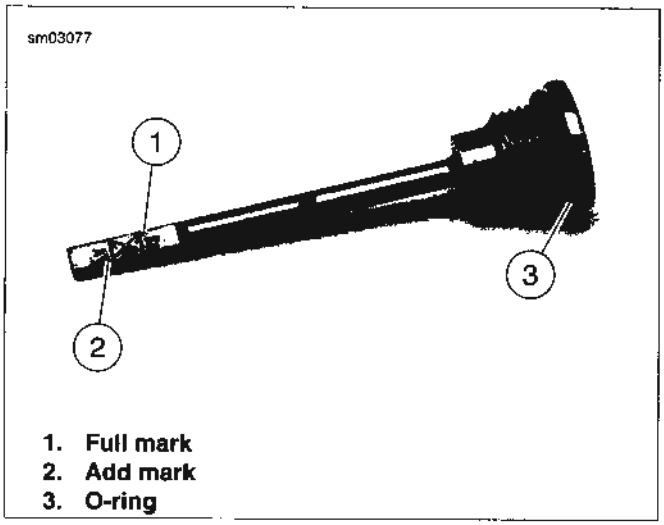


Figure 1-16. Transmission Drain Plug (Bottom View)



1. Full mark
2. Add mark
3. O-ring

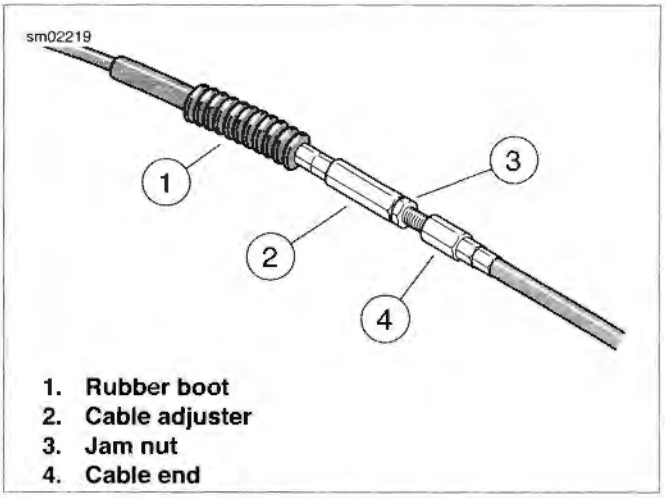
Figure 1-17. Filler Plug/Dipstick

ADJUSTMENT

NOTE

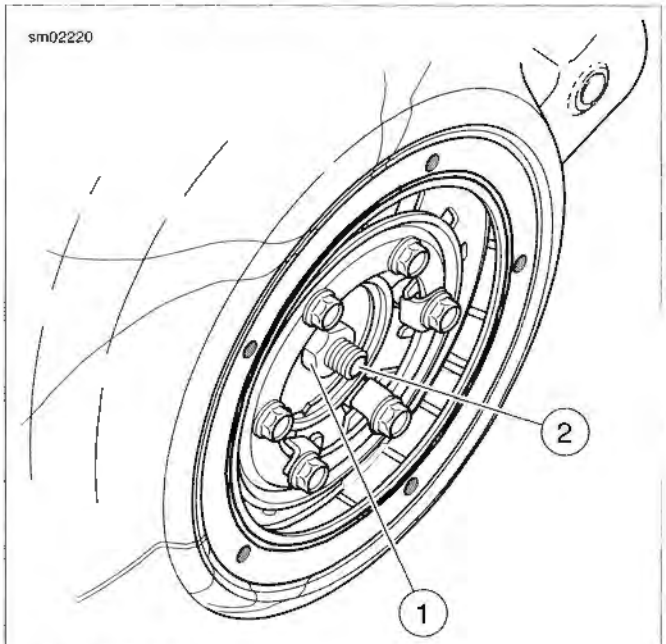
Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the powertrain temperature increases. If adjuster screw is adjusted with power train hot, clearance at push rod bearing could be insufficient with power train cold and clutch slippage could occur.

1. Position motorcycle on a suitable lift, upright and level. Point front wheel straight ahead.
2. Remove five TORX screws with captive washers to detach clutch inspection cover from primary chaincase cover.
3. Remove and discard seal.
4. See Figure 1-18. Add free play to cable.
   a. Slide rubber boot (1) off cable adjuster.
   b. Holding cable adjuster (2) with 1/2 in. wrench, loosen jam nut (3) using a 9/16 in. wrench.
   c. Turn cable adjuster (2) until there is a large amount of free play at clutch hand lever.
5. See Figure 1-19. Loosen jam nut (1) on clutch adjuster screw (2). To take up all free play, turn screw inward (clockwise) until lightly seated. Activate the clutch lever to verify the balls are seated in the ramps.
6. Back out adjusting screw (counterclockwise) 1/2 to 1 full turn. Tighten jamnut to 72-120 **in-lbs** (8.1-13.6 Nm), while holding adjusting screw with an Allen wrench.
7. Squeeze clutch lever to maximum limit three times, to set ball and ramp release mechanism.
8. Check free play.
   a. Turn cable adjuster away from jam nut until slack is eliminated at hand lever.
   b. See Figure 1-20. Pull clutch cable ferrule (2) away from clutch lever bracket (3) to check free play. Turn cable adjuster as necessary to obtain 1/16-1/8 in. (1.6-3.2 mm) free play between end of cable ferrule and clutch lever bracket.
9. Hold adjuster with 1/2 in. wrench. Using 9/16 in. wrench, tighten jam nut against cable adjuster to 120 **in-lbs** (13.6 Nm). Cover cable adjuster mechanism with rubber boot.



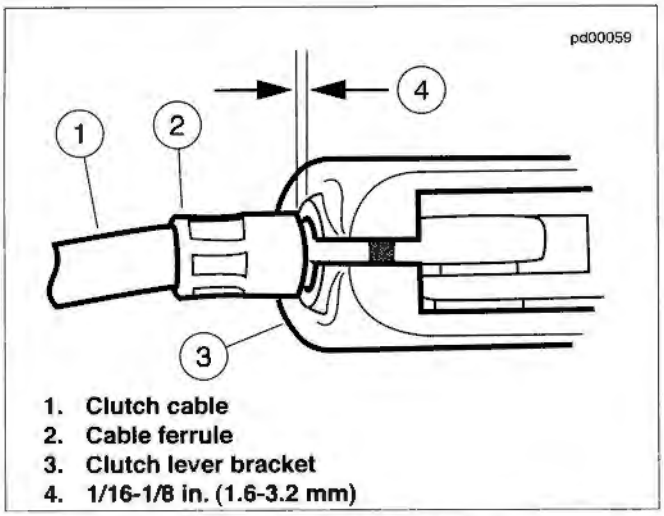
1. **Rubber boot**
2. **Cable adjuster**
3. **Jam nut**
4. **Cable end**

Figure 1-18. Clutch Cable Adjuster



1. **Jam nut**
2. **Clutch adjuster screw**

Figure 1-19. Clutch Adjuster Screw



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

Figure 1-20. Clutch Hand Lever

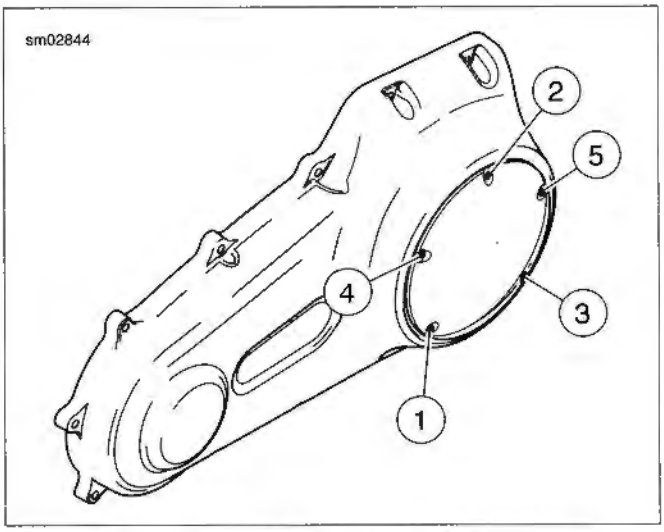


Figure 1-21. Clutch Cover Torque Sequence

10. Install clutch inspection cover and **new** seal as follows:
    a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase.
    b. Position **new** seal in groove in clutch inspection cover and press each of the nubs on seal into the groove. The nubs will retain seal in position.
    c. Insert screw (with captive washer) through clutch inspection cover and carefully thread it into the top cover screw hole.
    d. Start the remaining four screws (with captive washers).
    e. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) following torque sequence shown in Figure 1-21.

GENERAL

When a drive belt is replaced for any reason other than stone damage, it is recommended that both the transmission sprocket and rear sprocket also be replaced to increase the longevity of the new drive belt. In the case of stone damage, inspect sprockets for damage and replace as required.

⚠WARNING

Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)

CLEANING

Keep dirt, grease, oil, and debris off the drive belt and sprockets. Clean the belt with a rag slightly dampened with a light cleaning agent.

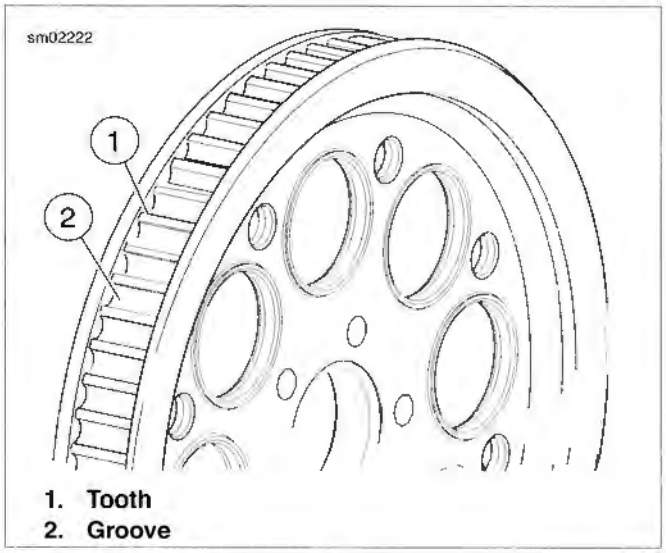
INSPECTION

Sprockets

NOTE

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

1. See Figure 1-22. Inspect each tooth (1) of rear sprocket for:
   a. Major tooth damage.
   b. Large chrome chips with sharp edges.
   c. Gouges caused by hard objects.
   d. Excessive loss of chrome plating (see next step).
2. To check if chrome plating has worn off, drag a scribe or sharp knife point across the bottom of a groove (2) (between two teeth) with medium pressure.
   a. If scribe or knife point slides across groove without digging in or leaving a visible mark, chrome plating is still good.
   b. If scribe or knife points digs in and leaves a visible mark, it is cutting the bare aluminum. A knife point will not penetrate the chrome plating.
3. Replace rear sprocket if major tooth damage or loss of chrome exists.



1. **Tooth**
2. **Groove**

Figure 1-22. Rear Sprocket

Drive Belt

See Figure 1-23. Inspect drive belt for:

- Cuts or unusual wear patterns.
- Outside edge bevelling (8). Some bevelling is common, but it indicates that sprockets are misaligned.
- Outside ribbed surface for signs of stone puncture (7). If cracks/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 nylon layer and polyethylene layer). This condition will result in belt failure and indicates worn transmission sprocket teeth. Replace belt and transmission sprocket.
- Signs of puncture or cracking at the base of the belt teeth. Replace belt if either condition exists.
- Replace belt if conditions 2, 3, 6 or 7 (on edge of belt) exist.

NOTE

Condition 1 may develop into 2 or 3 over time. Condition 1 is not grounds for replacing the belt, but it should be watched closely before condition 2 develops which will require belt replacement.

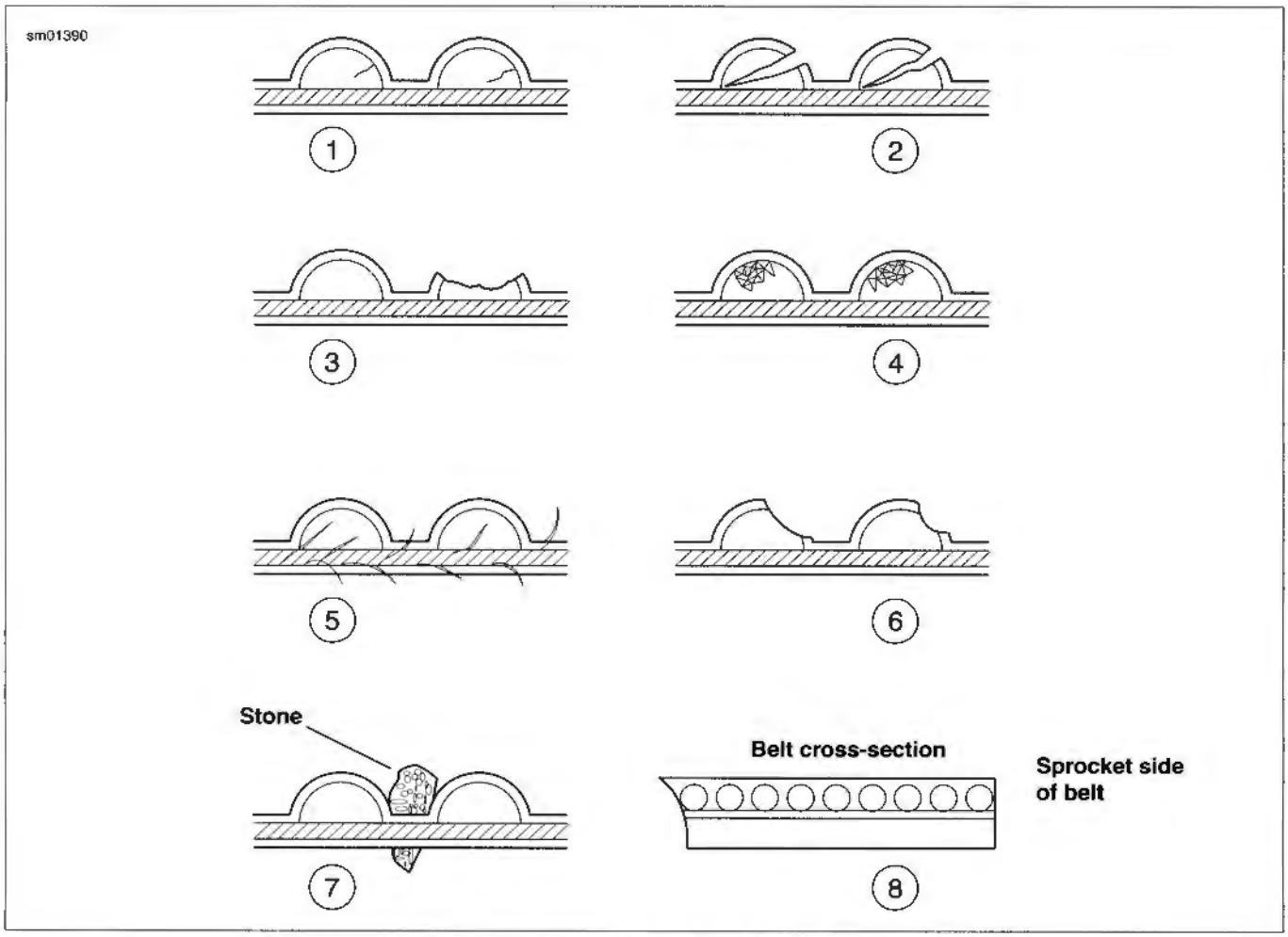


Figure 1-23. Drive Belt Wear Patterns

Table 1-10. Drive Belt Wear Analysis

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

CHECKING BELT DEFLECTION

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

NOTE

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

Check drive belt deflection:

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

When checking belt deflection:

- Set belt tension at loosest point in belt.
- Perform procedure with motorcycle cold.

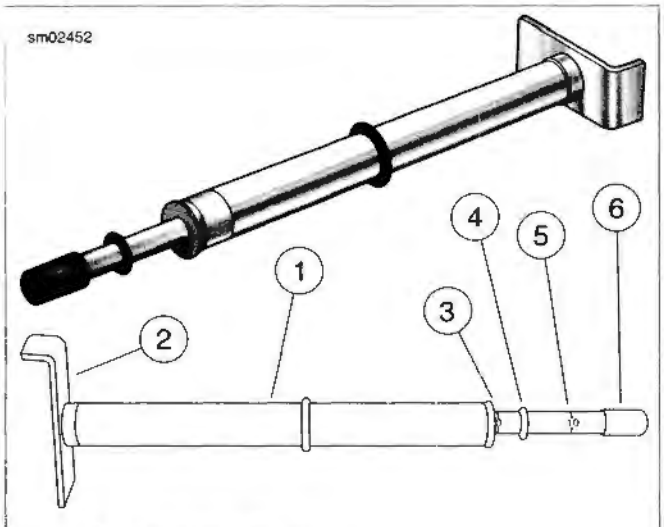
NOTE

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

1. See Figure 1-24. Obtain BELT TENSION GAUGE (Part No. HD-35381-A).
2. To use the belt tension gauge:
   a. Slide o-ring (4) toward 0 lbs (0 kg) mark (3).
   b. Fit belt cradle (2) against bottom of drive belt half-way between drive pulleys (point 1 in Figure 1-27.)
   c. Press upward on knob (6) until o-ring slides down to 10 lbs (4.5 kg) mark (5).
3. See Figure 1-25. Check Drive belt deflection. Apply 10 lbs (4.5 kg) of force upward at point 1.
4. See Table 1-11. Compare drive belt deflection with specifications listed in the table.

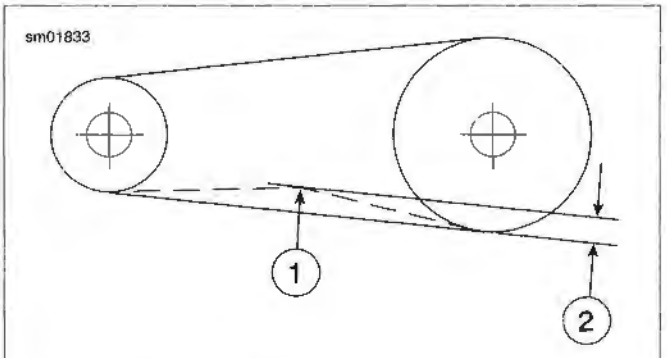
Table 1-11. Drive Belt Deflection

VEHICLE	FLSTN, FLSTSB, FLSTFB (Lo)	ALL BUT FLSTN, FLSTSB, FLSTFB (Lo)
With motorcycle on jiffy stand without rider or luggage	1/4-5/16 in. (6.4-7.9 mm)	9/16-5/8 in. (14.3-15.9 mm)
Vehicle upright with rear wheel in air	5/16-3/8 in. (7.9-9.5 mm)	11/16-3/4 in. (17.5-19.1 mm)



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

Figure 1-24. Belt Tension Gauge (Part No. HD-35381-B)



1. **10 lbs (4.5 kg) of force**
2. **Amount of deflection**

Figure 1-25. Checking Belt Deflection

ADJUSTING BELT DEFLECTION

If belt adjustment is necessary, perform the following procedure:

NOTE

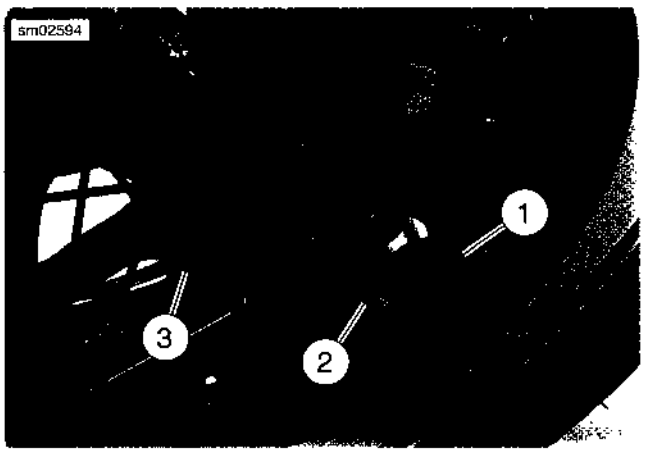
The axle nut retainer used on FXCWC models will remain in the axle nut and does not need to be removed.

1. **All but FXCWC:** See Figure 1-26. Remove e-clip (1). Loosen rear axle nut (2).
2. **FXCWC:** See Figure 1-27. Loosen rear axle nut (2).
3. Adjust belt tension by turning the axle adjusters (3) an equal number of turns to keep the wheel aligned until the specification in Table 1-11 is achieved.
4. Tighten axle nut (2) to 95-105 ft-lbs (128.8-142.4 Nm).
5. **All but FXCWC:** install e-clip.
6. Verify rear wheel alignment. See 2.11 VEHICLE ALIGNMENT.

⚠WARNING

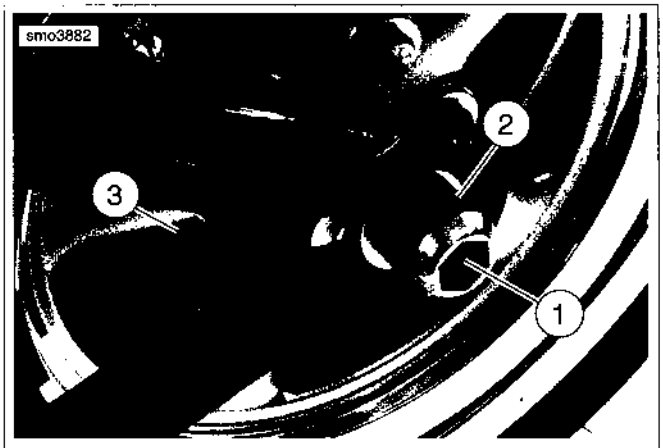
Check wheel bearing end play after tightening axle nut to specified torque. Excessive end play can adversely affect stability and handling and can cause loss of control, which could result in death or serious injury. (00285b)

7. Check wheel bearing end play. See 2.7 SEALED WHEEL BEARINGS, Inspection.



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

Figure 1-26. Axle Adjusters: All But FXCWC



1. Retainer
2. Axle nut
3. Axle adjuster

Figure 1-27. Axle Adjusters: FXCWC

CABLE INSPECTION, LUBRICATION AND ADJUSTMENT

Inspection and Lubrication

1. See Figure 1-28. Remove two screws (1) to separate the upper handlebar housing from the lower housing.
2. Unhook each ferrule and cable from the throttle grip and remove the throttle sleeve.
3. Apply a light coat of graphite to the handlebar and replace throttle grip.
4. Put one or two drops of Harley Lube (Part No. 94968-09) into the housing of each cable.
5. When assembling the handlebar housing, tighten both screws (1) to 35-45 **in-lbs** (4.0-5.1 Nm).

Adjustment

The throttle control must operate freely without binding. With the throttle friction adjustment screw backed off, the throttle grip must freely return to the closed (idle) position. The throttle control also must open and close freely when the front wheel is turned to both the right and left fork stops. If the throttle grip does not return to the idle position freely, check the throttle friction adjustment screw tension. If the adjuster screw is backed off, inspect the cables for short bends.

⚠WARNING

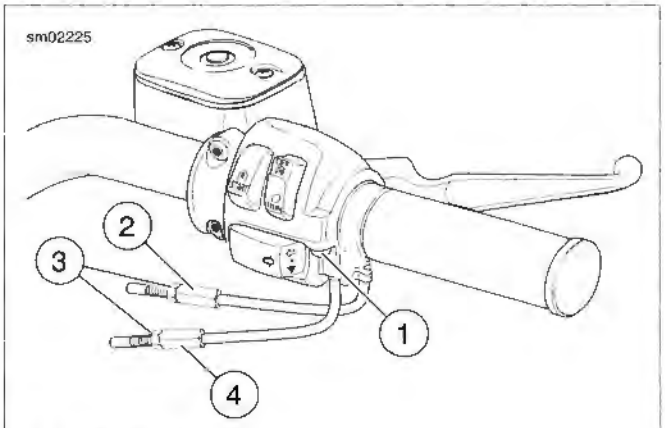
Before starting engine, be sure throttle control will snap back to idle position when released. A throttle control that prevents engine from automatically returning to idle can lead to loss of control, which could result in death or serious injury. (00390a)

⚠WARNING

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

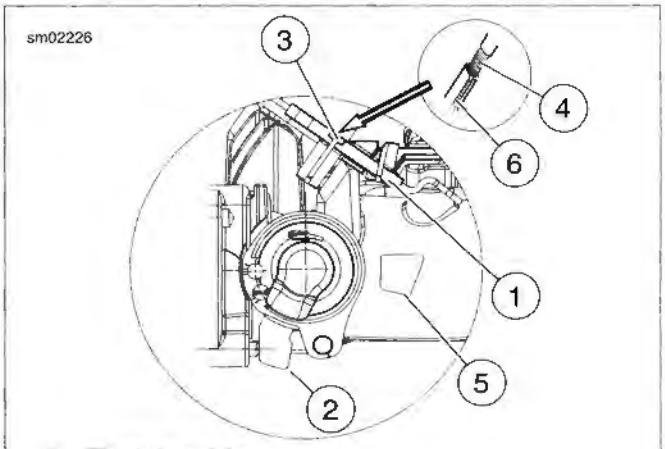
Adjust throttle cables:

1. See Figure 1-28. Slide rubber boot off throttle cable adjuster mechanism (2).
2. Holding cable adjuster with a 3/8 inch wrench, loosen jam nut turning in a clockwise direction.
3. Back jam nut (3) away from cable adjuster until it stops. Turn cable adjuster clockwise until it contacts jam nut. Repeat procedure on idle cable adjuster.
4. See Figure 1-29. Point the front wheel straight ahead. Gently turn the throttle grip so that the throttle is wide open (fully counterclockwise) and then hold in position. Now turn the throttle cable adjuster counterclockwise until the throttle cam (2) just touches the cam stop (5) on the induction module.
5. Release the throttle grip, turn throttle cable adjuster counterclockwise an additional 1/2-1 full turn, and then tighten the jam nut against the cable adjuster. Cover cable adjuster mechanism with rubber boot.
6. Turn the front wheel full right. Turn the idle cable adjuster counterclockwise until the cable housing (4) just touches the spring (6) in the cable guide (as seen through slot).
7. Work the throttle grip to verify that the throttle cable returns to the idle position when released. If the cable does not return to idle, turn the cable adjuster clockwise slightly until the correct response is achieved.
8. Tighten jam nut against the cable adjuster and cover cable adjuster mechanism with rubber boot.



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

Figure 1-28. Throttle Cable Adjusters



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

Figure 1-29. Induction Module Cable Connection

GENERAL

Inspect and lubricate the following at scheduled service intervals as specified in 1.5 MAINTENANCE SCHEDULE.

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

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

CABLES AND HAND LEVERS

For throttle cables, see 1.13 THROTTLE CABLES.

Use Harley Lube (Part No. 94968-09) for clutch lever and cable.

Use G40M BRAKE GREASE on front brake lever pin pivot hole and on the end of piston that contacts brake lever.

JIFFY STAND

Clean and lubricate the jiffy stand. For more information, see 2.38 JIFFY STAND.

STEERING HEAD BEARINGS

Lubricate the steering head bearings with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE. See 1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB or 1.21 STEERING HEAD BEARINGS: FLSTSB for procedure.

FLUID INSPECTION

⚠CAUTION

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

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. See Figure 1-30. Check level in rear brake master cylinder reservoir. Level should be 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface.

CAUTION

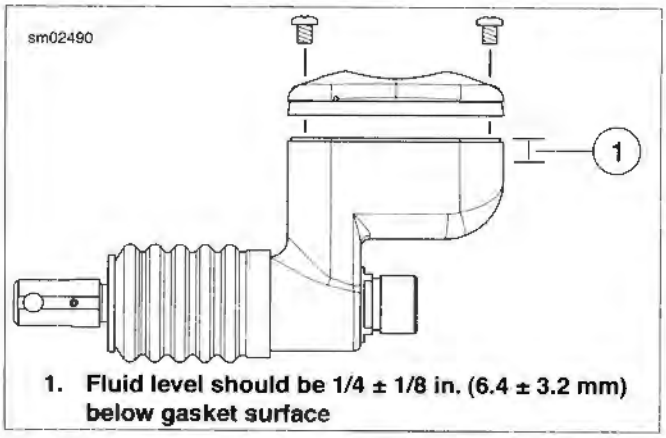
Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)

2. See Figure 1-31. Check level in front brake master cylinder reservoir. Level should be 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface.
3. Install gaskets and covers. Tighten reservoir cover screws to the following torques.
   a. Front cover screws: 12-15 **in-lbs** (1.4-1.7 Nm).
   b. Rear cover screws: 6-8 **in-lbs** (0.7-0.9 Nm).

⚠WARNING

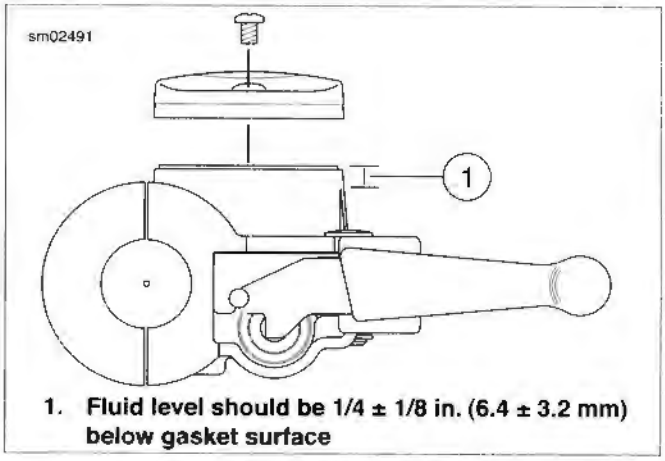
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

4. Front brake hand lever and rear brake foot pedal must have a firm feel when applied. If not, bleed system using only D.O.T. 4 BRAKE FLUID. See 1.16 BLEEDING BRAKES.



1. **Fluid level should be 1/4 ± 1/8 in. (6.4 ± 3.2 mm) below gasket surface**

Figure 1-30. Rear Brake Master Cylinder Reservoir



1. **Fluid level should be 1/4 ± 1/8 in. (6.4 ± 3.2 mm) below gasket surface**

Figure 1-31. Front Brake Master Cylinder Reservoir

REAR BRAKE PEDAL

Pedal Height

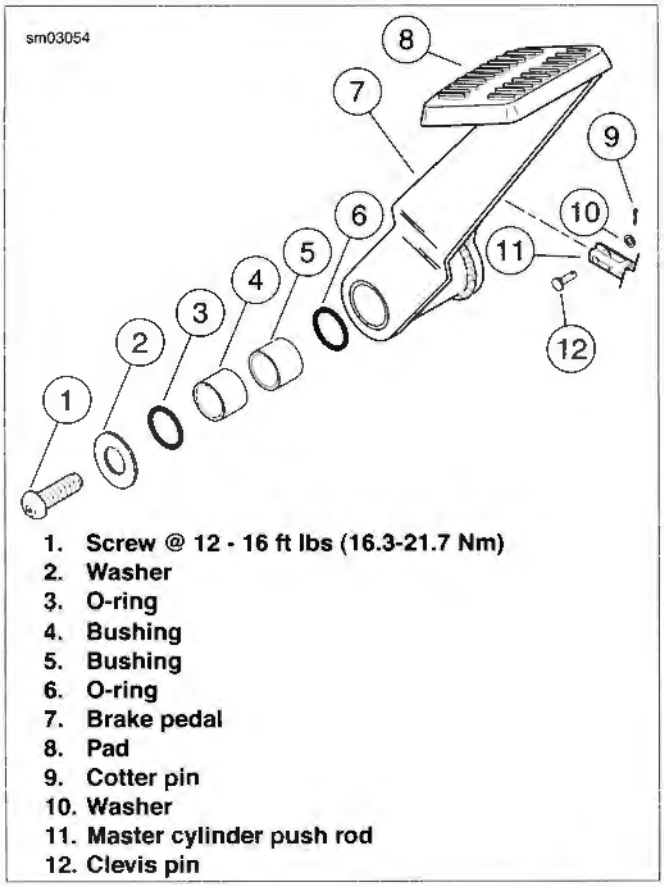
The rear brake pedal is nonadjustable. When brake system components are properly assembled, brake pedal is correctly adjusted.

Pedal Lubrication

See Figure 1-32. Rear brake pedal contains greaseless bushings (4, 5). Replace bushings if worn.

Pedal Pad

If replacing brake pedal pad (8), slide old pad off brake pedal (7) then slide new pad on pedal.



1. Screw @ 12 - 16 ft lbs (16.3-21.7 Nm)
2. Washer
3. O-ring
4. Bushing
5. Bushing
6. O-ring
7. Brake pedal
8. Pad
9. Cotter pin
10. Washer
11. Master cylinder push rod
12. Clevis pin

Figure 1-32. Rear Brake Pedal (typical)

GENERAL

⚠WARNING

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

⚠CAUTION

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

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)

CAUTION

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

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

PROCEDURE

NOTE

Hydraulic brake fluid bladder-type pressure equipment can be used to fill brake master cylinder through the bleeder valve. Remove master cylinder reservoir cover so that system cannot pressurize. Do not use pressure bleeding equipment when the hydraulic system is sealed with master cylinder reservoir cover and gasket in place.

1. Remove bleeder valve cap. Install end of a length of clear plastic tubing over caliper bleeder valve; place other end in a clean container. Stand motorcycle upright.
   a. Front brake bleeder valve-see Figure 1-33.
   b. Rear brake bleeder valve-see Figure 1-34.
2. Add D.O.T. 4 BRAKE FLUID to master cylinder reservoir. Fluid level should be 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface. Press and hold brake lever/pedal to build up hydraulic pressure.
3. Open bleeder valve slowly about 1/2-turn counterclockwise; brake fluid will flow from bleeder valve and through tubing. When brake lever/pedal has moved its full range of travel, close bleeder valve (clockwise). Allow brake lever/pedal to return slowly to its released position.

Figure 1-33. Front Brake Bleeder Valve (Typical)

Figure 1-34. Rear Brake Bleeder Valve

4. Repeat two previous steps until all air bubbles are purged.
5. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install bleeder valve cap.
6. Verify master cylinder fluid level as described in previous step.

⚠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. Install gaskets and covers. Tighten reservoir cover screws to the following torques.
   a. Front cover screws: 12-15 **in-lbs** (1.4-1.7 Nm).
   b. Rear cover screws: 6-8 **in-lbs** (0.7-0.9 Nm).

INSPECTION

Check brake pads and discs:

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

Brake Pads

⚠CAUTION

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

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)

⚠WARNING

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

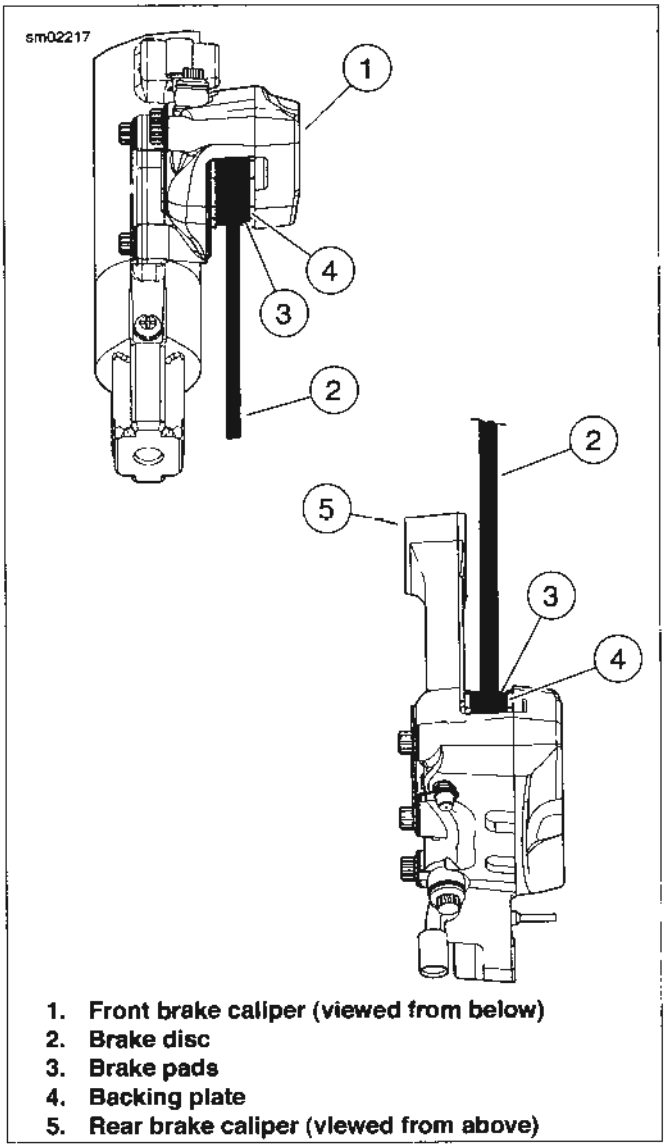
See Figure 1-35. Replace brake pads (3) if brake pad friction material on either the front or rear caliper is worn to 0.04 in. (1.02 mm) or less above the backing plate (4). Always replace both pads in a caliper as a set. See 1.17 BRAKE PADS AND DISCS, Brake Pad Replacement.

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

Brake Disc

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

Replace disc if badly scored or warped. See 2.4 FRONT WHEEL: ALL BUT FLSTSB, 2.5 FRONT WHEEL: FLSTSB, or 2.6 REAR WHEEL.



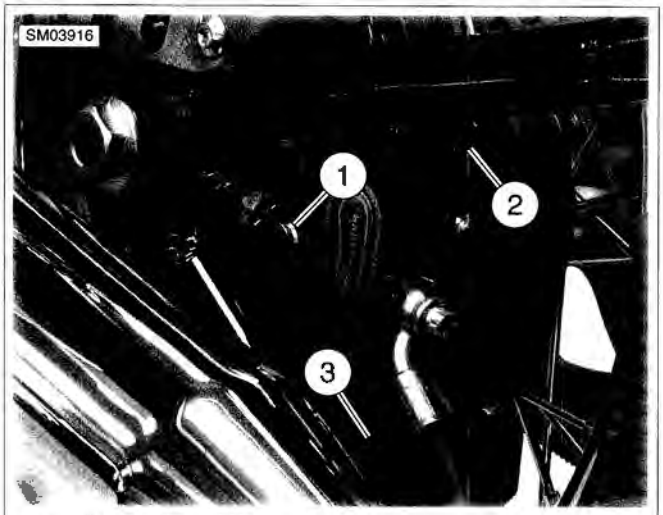
1. **Front brake caliper (viewed from below)**
2. **Brake disc**
3. **Brake pads**
4. **Backing plate**
5. **Rear brake caliper (viewed from above)**

Figure 1-35. Brake Pad Inspection

BRAKE PAD REPLACEMENT

Rear Brake Caliper

1. Remove right saddlebag, if present.
2. See Figure 1-36. Loosen, but do not remove, pad pin (2) (metric).
3. Remove mounting bolt (1) and slider pin (3). Pull rear caliper with pads away from brake disc.
4. Remove pad pin and pads. Note the pad's original orientation for replacement purposes.



1. **Mounting bolt**
2. **Pad pin**
3. **Slider pin**

Figure 1-36. Rear Brake Caliper

5. Remove the rear master cylinder reservoir cap.

NOTE

As the pistons are pushed back into the caliper, fluid level may rise above the recommended 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface. Fluid may have to be removed to allow for this.

6. Using the old brake pad and a C-clamp, retract the pistons fully into the caliper.
7. Place cover over rear master cylinder to help prevent contamination.

⚠WARNING

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

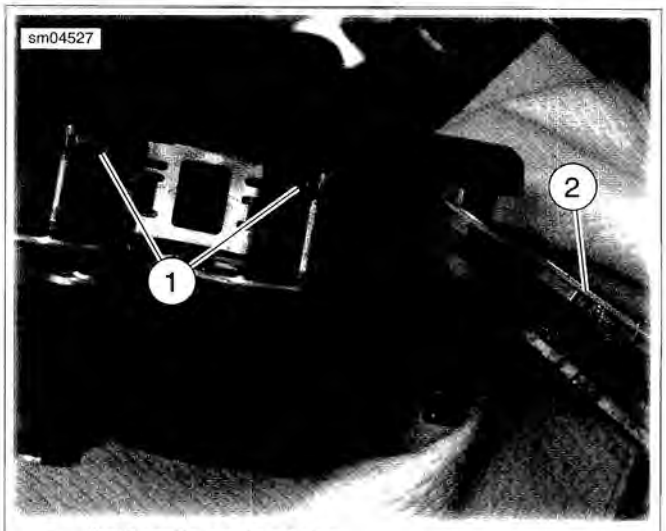
8. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace pin.
9. See Figure 1-37. Inspect torque clip. Replace if worn or damaged.
10. See Figure 1-38. Inspect anti-rattle spring. Replace if worn, damaged, or corroded.

NOTE

When installing brake pads, make sure inner brake pad tabs (2) mount between caliper and anti-rattle spring tabs (1).

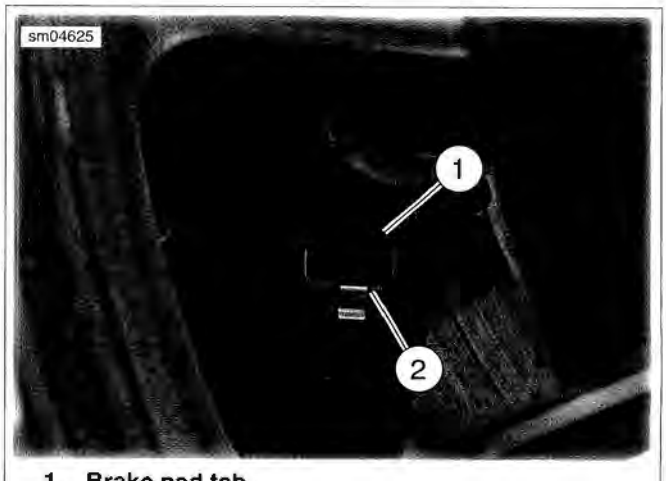
11. See Figure 1-36. Install **new** brake pads with pad pin (2) onto caliper using the same orientation as the ones previously removed. Tighten pad pin to 80-120 **in-lbs** (9.0-13.6 Nm).
12. See Figure 1-39 Install caliper with brake pads on either side of brake disc. Make sure brake pad tab (1) is properly inserted into torque clip (2) for each brake pad.
13. See Figure 1-36. Install mounting bolt (1) and slider pin (3). Tighten both to 10-14 ft-lbs (13.6-18.9 Nm).

Figure 1-37. Torque Clip



1. **Anti-rattle spring tabs**
2. **Inner brake pad tab**

Figure 1-38. Anti-rattle Spring



1. **Brake pad tab**
2. **Torque clip**

Figure 1-39. Rear Brake Pad Installation

⚠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)

14. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
15. Check brake fluid level in master cylinder. Fill to proper level if necessary using D.O.T. 4 BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 6-8 **in-lbs** (0.7-0.9 Nm).
16. Install right saddlebag if necessary.

⚠WARNING

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

17. Test brake system.
    a. Turn ignition switch ON. Pump brake pedal to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See 1.16 BLEEDING BRAKES.

NOTE

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

Front Brake Caliper

NOTE

To change the front brake pads on FLSTSB, see 2.14 FRONT BRAKE CALIPER: FLSTSB.

1. Remove the front master cylinder reservoir cap. As the pistons are pushed back into the caliper, fluid level may rise above the recommended 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface. Fluid may need to be removed to allow for this.
2. See Figure 1-40. Loosen, but do not remove bridge bolt/pad pin (3) (metric).
3. Remove both caliper mounting bolts (1, 2) (metric). Detach caliper from front forks and brake disc.
4. Pry the pads back to force all four caliper pistons into their bores.

NOTE

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

5. With the pistons retracted, remove the bridge bolt/pad pin and remove brake pads.
6. Inspect bridge bolt/pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace the pin.

⚠WARNING

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

NOTES

- *See Figure 1-41. Ensure the pad spring tabs (1) on brake pad engage the pad springs in the pistons.*
- *If the directional tab (2) does not face down when caliper is installed, brake noise may develop.*

7. Install **new** pads into caliper. The directional tab (2) must face down when caliper is installed.
8. Loosely install the center bridge bolt/pad pin.
9. Attach caliper to front fork.
    a. See Figure 1-40. Place caliper over brake disc with bleeder valve facing upward.
    b. Loosely install long mounting bolt (1) (metric) into upper hole on fork leg.
    c. Install short mounting bolt (2) (metric) into lower hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
    d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
    e. Final tighten center bridge bolt/pad pin (3) to 15-16 ft-lbs (20.3-22.6 Nm).
10. Pump brake hand lever to move pistons out until they contact both brake pads. Verify piston location against pads. If the front wheel is off the ground, rotate wheel to check for excessive brake pad drag.
11. Check brake fluid level in master cylinder. Fill to proper level if necessary using D.O.T. 4 BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 12-15 **in-lbs** (1.4-1.7 Nm).

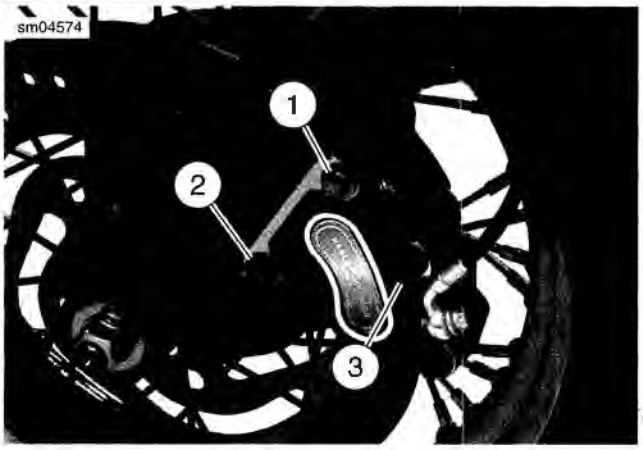
⚠WARNING

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

12. Test brake system.
    a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See 1.16 BLEEDING BRAKES.

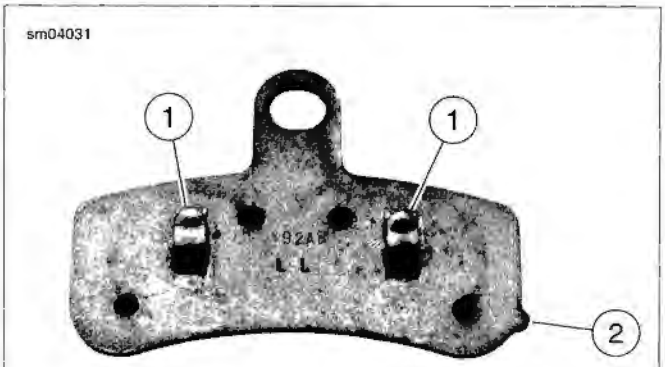
NOTE

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



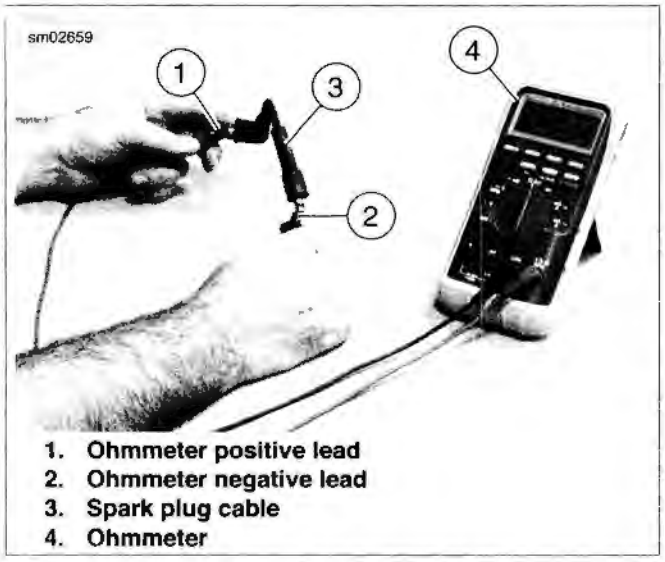
1. Long mounting bolt (metric)
2. Short mounting bolt (metric)
3. Pad pin (metric)

Figure 1-40. Front Brake Caliper (Left Side Shown)



1. Pad spring tabs
2. Directional tab

Figure 1-41. Front Brake Pad



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

Figure 1-43. Testing Resistance

SHOCK ABSORBERS

PART NUMBER	TOOL NAME
94455-89	SPANNER WRENCH

Softail models feature rear shock absorbers that can be adjusted. Rear shock spring preload may be varied to suit your own personal comfort.

NOTE

Rear shocks are located under vehicle. Adjust shocks with the vehicle resting on the jiffy stand.

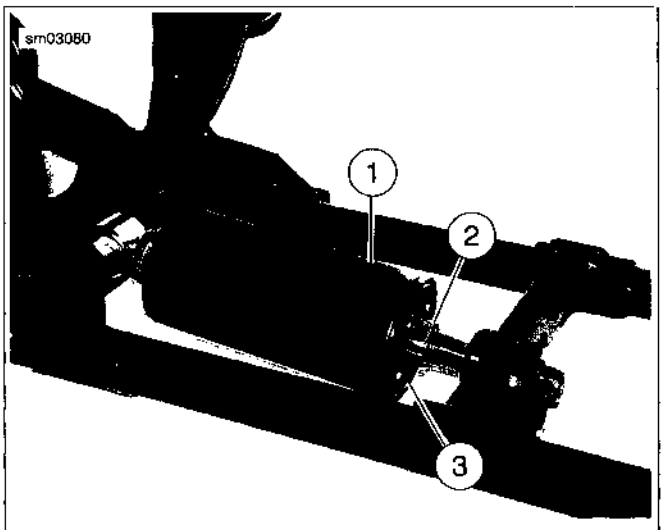
Adjustment

1. Loosen jam nut.

⚠WARNING

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

2. See Figure 1-44. Use a SPANNER WRENCH (Part No. 94455-89) to turn the spring adjuster plate to the desired position.
   a. Turning the adjuster plates out (toward locknut) increases the spring preload to carry a heavier load.
   b. Turning the adjuster plates in (away from the locknut) decreases the spring preload to carry a lighter load.
3. Tighten jam nut.



1. **Rear shock canister**
2. **Jam nut**
3. **Spring adjuster plate**

Figure 1-44. Rear Shock Adjustment

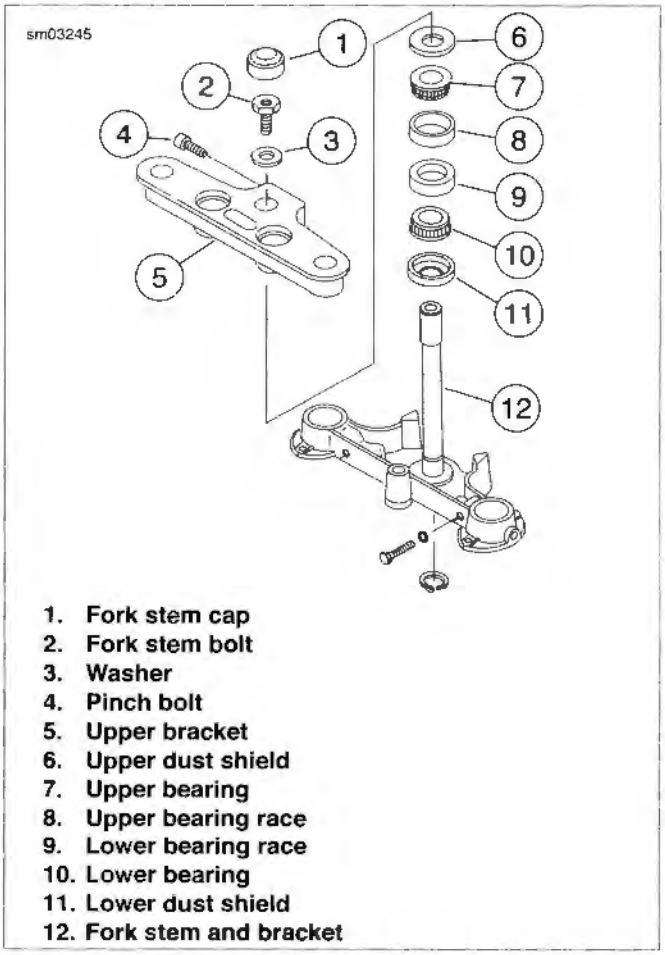
ADJUSTMENT: FLST, FLSTC, FLSTF/B, FLSTN

Bearing Adjustment (Fall-away)

1. Support motorcycle in an upright position so the front end is completely suspended and the vehicle is level.
2. Remove all accessory weight, such as a windshield, that may influence the way the front end swings. If clutch cable is routed so it pulls the front end one way or the other, disconnect it.
3. Place a suitable marking material, such as masking tape, over the fender tip.
4. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front end should be straight ahead, however the balance point may be slightly off center.
5. Check steering head bearing tension.
   a. Rotate the front end from steering stop to steering stop three times. Center front end moving from the left steering stop to the center.
   b. Tap the fender on right side toward the left steering stop until the front end begins to fall-away by itself. Label this point on the marking material.
   c. Rotate the front end from steering stop to steering stop three times. Center front end moving from the right steering stop to the center.
   d. Repeat steps a through d until the points become consistent.
   e. Measure distance between the two marks. This is the fall-away measurement.
6. The distance between the fall-away marks must be 1.0-2.0 in. (25.4-50.8 mm).
   a. If the distance is more than 2.0 in. (50.8 mm), proceed to step 7.
   b. If it is less than 1.0 in. (25.4 mm), proceed to step 8.
7. Distance is more than 2.0 in. (50.8 mm).
   a. See Figure 1-45. Loosen the upper fork stem pinch bolt (4).
   b. Loosen lower fork stem pinch bolts.
   c. Loosen the fork stem bolt (2) slightly.
   d. Tighten the upper fork stem pinch bolt to 25-30 ft-lbs (33.9-40.7 Nm).
   e. Tighten the lower fork stem pinch bolts to 55-60 ft-lbs (74.6-81.4 Nm).
   f. Repeat procedure to determine if fall-away is within specifications.
8. Distance is less than 1.0 in. (25.4 mm).
   a. See Figure 1-45. Loosen the pinch bolt (4).
   b. Loosen lower fork stem pinch bolts.
   c. Tighten the fork stem bolt (2) slightly.
   d. Tighten the upper fork stem pinch bolt to 25-30 ft-lbs (33.9-40.7 Nm)
   e. Tighten the lower fork stem pinch bolts to 55-60 ft-lbs (74.6-81.4 Nm).
   f. Repeat procedure to determine if fall-away is within specifications.

NOTE

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



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

Figure 1-45. Steering Head: FLST, FLSTC, FLSTF/B, FLSTN

ADJUSTMENT: FXST, FXSTC, FXCWC

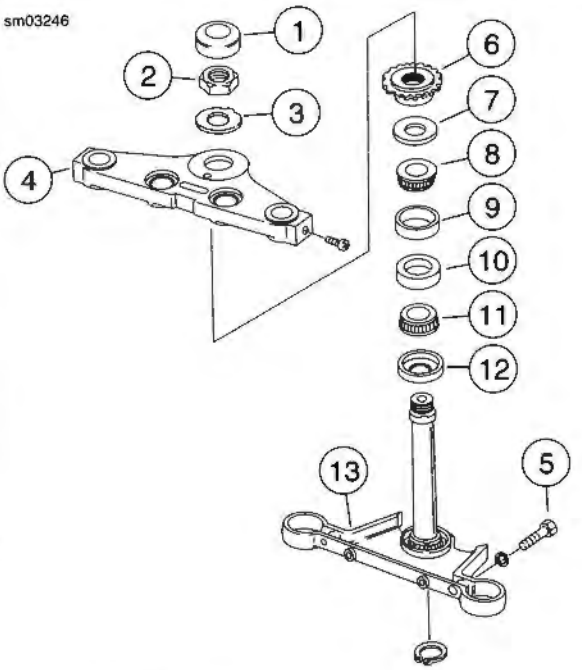
Bearing Adjustment (Fall-away)

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

2. Remove all accessory weight, such as a windshield, that may influence the way the front end swings. If clutch cable is routed so it pulls the front end one way or the other, disconnect it.
3. Place a suitable marking material, such as masking tape, over the fender tip.
4. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front end should be straight ahead, however the balance point may be slightly off center.
5. Check steering head bearing tension.
   a. Rotate the front end from steering stop to steering stop three times and then center the front end.
   b. Tap the fender on one side until the front end begins to "fall-away" by itself. Label this point on the marking material.
   c. Repeat the previous step in the other direction.
   d. Repeat until marks are consistent. If marks vary, use the average.
   e. Measure distance between marks.
6. The distance between the "fall-away" marks must be 1.0-2.0 in. (25.4-50.8 mm).
   a. If the distance is more than 2.0 in. (50.8 mm), proceed to step 7.
   b. If it is less than 1.0 in. (25.4 mm), proceed to step 8.
7. Distance is more than 2.0 in. (50.8 mm).
   a. See Figure 1-46. Loosen the upper fork stem bracket pinch bolts (5).
   b. Loosen the lower fork stem pinch bolts.
   c. Loosen the fork stem nut (2).
   d. Loosen the bearing adjustment nut (6) slightly.
   e. Tighten the fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm)
   f. **FXST, FXSTC:** tighten lower triple tree bracket pinch bolts to: 55-60 ft-lbs (74.6-81.4 Nm).
   g. **FXCWC:** tighten lower triple tree bracket pinch bolts to: 35-40 ft-lbs (47.5-54.3 Nm).
   h. Repeat procedure to determine if fall-away is within specifications.
8. Distance is less than 1.0 in. (25.4 mm).
   a. See Figure 1-46. Loosen the upper fork stem bracket pinch bolts (5).
   b. Loosen the lower fork stem pinch bolts.
   c. Loosen the fork stem nut (2).
   d. Tighten the bearing adjustment nut (6) slightly.
   e. Tighten the fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm)
   f. **FXST, FXSTC:** tighten lower triple tree bracket pinch bolts to: 55-60 ft-lbs (74.6-81.4 Nm).
   g. **FXCWC:** tighten lower triple tree bracket pinch bolts to: 35-40 ft-lbs (47.5-54.3 Nm).
   h. Repeat procedure to determine if fall-away is within specifications.

NOTE

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



1. **Fork stem cap**
2. **Fork stem nut**
3. **Lockwasher**
4. **Upper bracket**
5. **Pinch bolt**
6. **Adjusting nut**
7. **Upper dust shield**
8. **Upper bearing**
9. **Upper bearing race**
10. **Lower bearing race**
11. **Lower bearing**
12. **Lower dust shield**
13. **Fork stem and bracket**

Figure 1-46. Steering Head: FXST/FXSTC

LUBRICATION

See Figure 1-47. Use SPECIAL PURPOSE GREASE (Part No. 99857-97) every 10,000 mile (16,000 km) service interval. Fill grease fitting on steering neck until grease begins to come out the top and bottom of the steering head.

Figure 1-47. Grease Fitting

GENERAL

⚠WARNING

Modifying the Springer front end can adversely affect stability and handling, which could result in death or serious injury. (00299a)

NOTES

- *Do not alter the fender brackets to lower the fender. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.*
- *Do not replace the O.E.M. tire with a higher-aspect ratio tire. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.*
- *Do not replace the O.E.M. tire with a traditional-looking 21 in. front wheel, tire and front fender. In addition to above, this could adversely affect the handling characteristics of this motorcycle.*
- *Harley-Davidson has designed and manufactured this special, custom front end according to our very stringent and well-tested standards. If you modify the Springer front end in any way that changes our original design, Harley-Davidson cannot and will not assume responsibility.*

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

NOTE

The springer fork was NOT designed for sidecar use. DO NOT use the FLSTSB motorcycle, or any springer fork-equipped vehicle for this purpose.

Lubrication

Use SPECIAL PURPOSE GREASE (Part No. 99857-97) at every 2500 mi (4000 km). Fill grease fitting on steering neck until grease begins to come out the top and bottom of the steering head.

ADJUSTMENT: FLSTSB

PART NUMBER	TOOL NAME
HD-47255	SPRINGER STEERING HEAD BEARING TOOL

Bearing Adjustment (Fall-away)

⚠WARNING

Do not use tool to seat upper bearing retainer nut. High torque will bend pins in the tool. (00527b)

This tool can be used to adjust the steering head bearings by removing only the acorn nut and rubber washer. Without the tool, you will have to remove the handlebars, risers, rigid fork leg studs and upper triple clamp to adjust the steering head bearing.

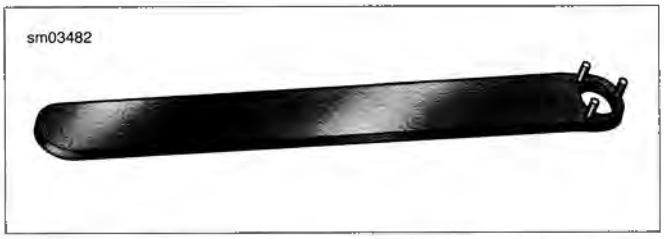
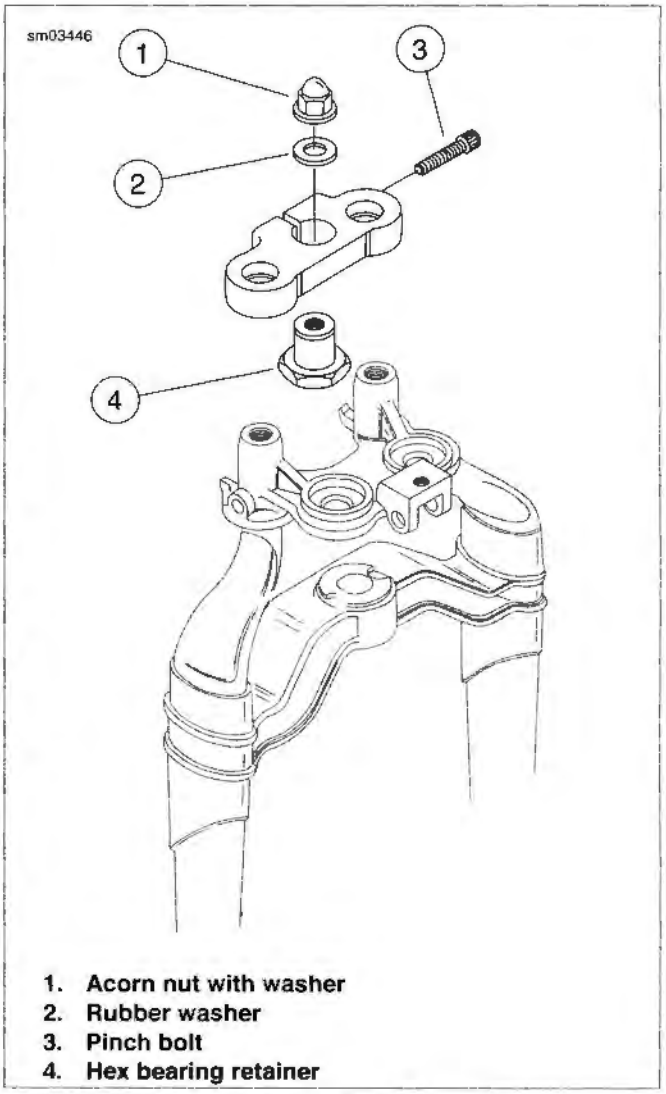


Figure 1-48. Springer Steering Head Bearing Tool (HD-47255)

1. Support motorcycle in an upright position so the front end is completely suspended and the vehicle is level.
2. Remove all accessory weight, such as a windshield, that may influence the way the front end swings. If clutch cable is routed so it pulls the front end one way or the other, disconnect it.
3. See Figure 1-49. Remove the acorn nut with washer (1) and rubber washer (2).
4. Place a suitable marking material, such as masking tape, over the fender tip.
5. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front end should be straight ahead, however the balance point may be slightly off center.
6. Check steering head bearing tension.
   a. Rotate the front end from steering stop to steering stop three times and then center the front end.
   b. Tap the fender on one side until the front end begins to "fall-away" by itself. Label this point on the marking material.
   c. Repeat the previous step in the other direction.
   d. Repeat until marks are consistent. If marks vary, use the average.
   e. Measure distance between marks.
7. The distance between the "fall-away" marks must be 1.0-2.0 in. (25.4-50.8 mm).
   a. If the distance is more than 2.0 in. (50.8 mm), proceed to step 8.
   b. If it is less than 1.0 in. (25.4 mm), proceed to step 9.

8. Distance is more than 2.0 in. (50.8 mm).
   a. Loosen the upper fork stem pinch bolt (3).
   b. See Figure 1-48. Insert the SPRINGER STEERING HEAD BEARING TOOL (Part No. HD-47255) into the upper triple clamp and hex bearing retainer holes.
   c. See Figure 1-49. Loosen the hex bearing retainer (4) slightly.
   d. Tighten the upper fork stem pinch bolt to 25-30 ft-lbs (33.9-40.7 Nm)
   e. Repeat procedure to determine if fall-away is within specifications.
9. Distance is less than 1.0 in. (25.4 mm).
   a. Loosen the pinch bolt (3).
   b. See Figure 1-48. Insert the SPRINGER STEERING HEAD BEARING TOOL (Part No. HD-47255) into the upper triple clamp and hex bearing retainer holes.
   c. See Figure 1-49. Tighten the hex bearing retainer (4) slightly.
   d. Tighten the upper fork stem pinch bolt to 25-30 ft-lbs (33.9-40.7 Nm)
   e. Repeat procedure to determine if fall-away is within specifications.



1. **Acorn nut with washer**
2. **Rubber washer**
3. **Pinch bolt**
4. **Hex bearing retainer**

Figure 1-49. Fork Adjustment

INSPECTION

NOTE

To perform this adjustment, the spring fork must be secured to the rigid fork. Use cable ties to tie wrap the fork legs in place as shown in Figure 1-50. The spring fork can be disconnected from the rockers without removing the front end from the motorcycle.

1. Remove front brake caliper and brake line. See 2.14 FRONT BRAKE CALIPER: FLSTSB.
2. Remove front wheel. See 2.5 FRONT WHEEL: FLSTSB.

⚠WARNING

Use cable straps to secure spring fork legs to rigid fork legs. If spring fork legs are not held in place, spring pressure could snap them forward, resulting in death or serious injury. (00305b)

3. See Figure 1-50. Use cable ties to secure the spring fork legs to the rigid fork legs.
4. See Figure 1-51. Loosen, but do not remove, the bearing retainer jam nut (7) and bearing retainer (6) on each rocker.
5. Remove acorn nut (1) and washer (2) from each spring fork to rocker pivot stud (thick head) (5). Do not remove the pivot stud from the rocker at this time.
6. Tighten bearing retainers (6) to 25-35 **in-lbs** (2.8-4.0 Nm).
7. Hold the bearing retainer in place with a hex driver while tightening jam nut (7) to 95-105 ft-lbs (128.8-142.4 Nm).
8. Remove the pivot studs (5) from the spring fork (8).

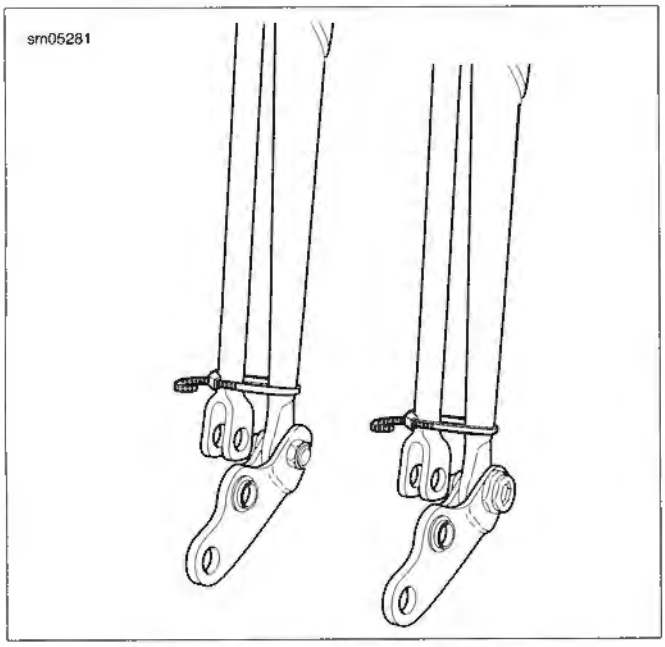
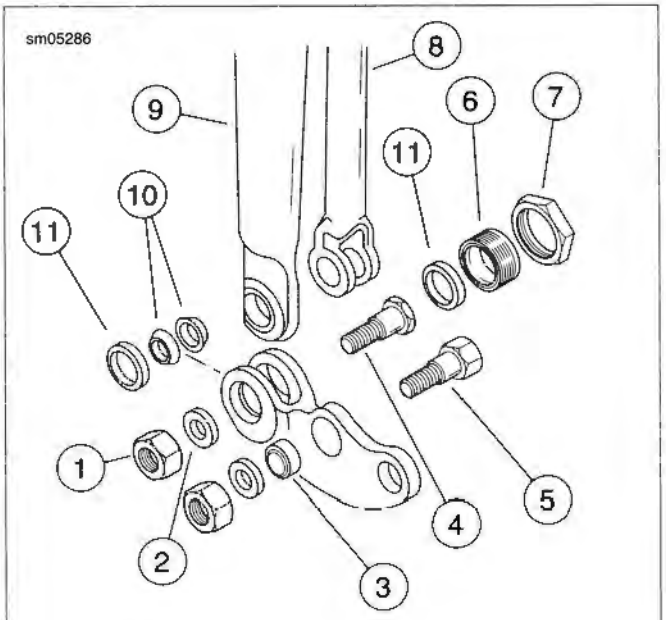


Figure 1-50. Nylon Ties on Fork Legs



1. **Nut (2)**
2. **Washer (2)**
3. **Spherical bearing, fork to rocker**
4. **Pivot stud, rigid fork to rocker**
5. **Pivot stud, spring fork to rocker (thick head)**
6. **Bearing retainer, rigid fork**
7. **Bearing retainer jam nut**
8. **Spring fork leg**
9. **Rigid fork leg**
10. **Spherical bearing ball, fork to rocker (2)**
11. **Spherical bearing race, fork to rocker**

Figure 1-51. Fork Rocker

9. See Figure 1-52. Using a dial or beam type torque wrench, rotate the rigid fork pivot stud and rocker through the arc shown. The torque reading should be 25-35 **in-lbs** (2.8-4.0 Nm).
10. If the torque reading in the previous step is out of specification, adjust the bearing retainer to obtain a 25-35 **in-lbs** (2.8-4.0 Nm) reading.

NOTE

If you feel metal to metal contact (grinding while moving the rocker), replace the spherical bearings.

11. See Figure 1-51. Attach the spring fork legs (8) to the rockers by installing the pivot studs (5) (thick head), from the outboard side, with washers (2) and nuts (1). Tighten nuts to 45-50 ft-lbs (61.0-67.8 Nm).
12. Install front wheel. See 2.5 FRONT WHEEL: FLSTSB.
13. Install front brake caliper and brake line. See 2.14 FRONT BRAKE CALIPER: FLSTSB.

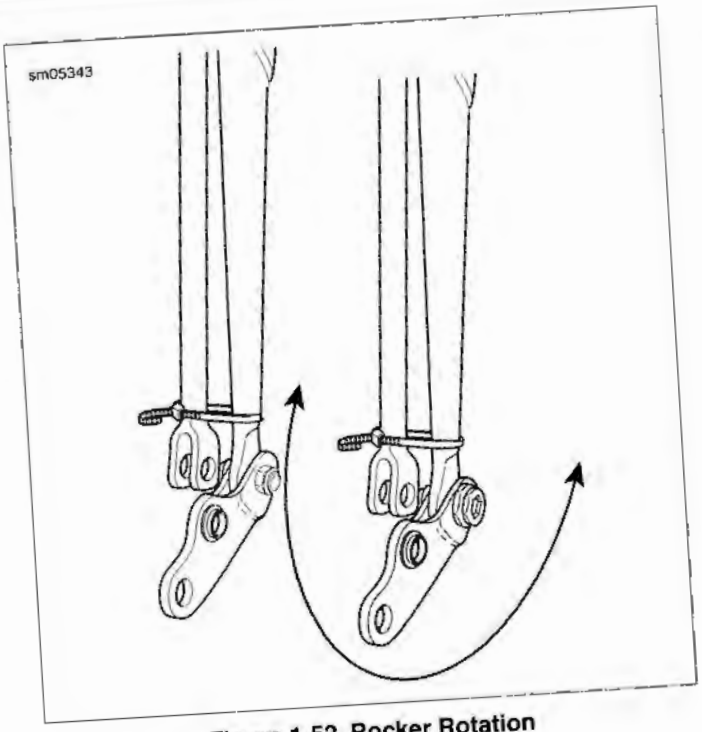


Figure 1-52. Rocker Rotation

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

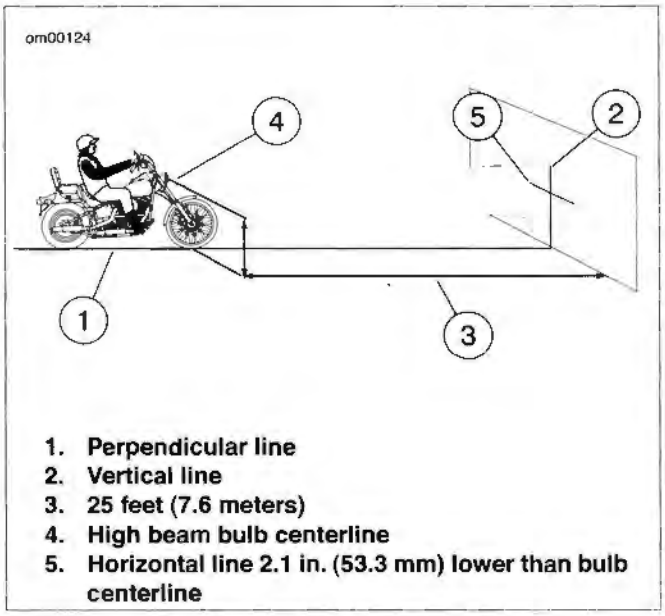
See Figure 1-53. To aid in properly placing the motorcycle, a perpendicular line (1) can be drawn on the floor. For best results, choose an area with minimum light.

3. Draw a vertical line (2) on the wall.
4. Position motorcycle so that front axle is 25 ft (7.6 m) 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.



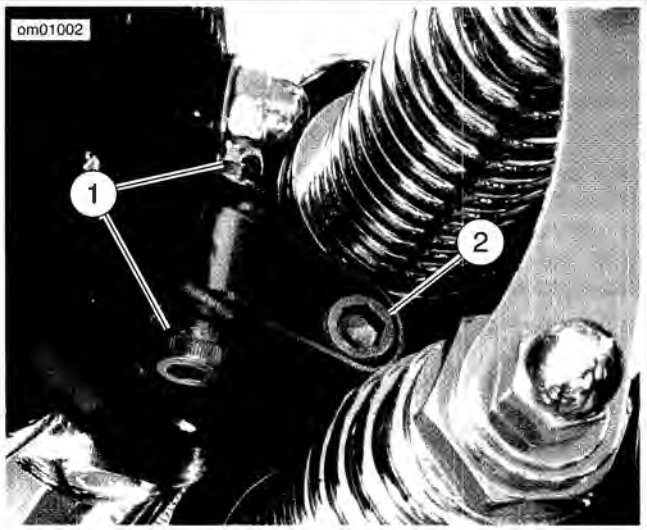
1. **Perpendicular line**
2. **Vertical line**
3. **25 feet (7.6 meters)**
4. **High beam bulb centerline**
5. **Horizontal line 2.1 in. (53.3 mm) lower than bulb centerline**

Figure 1-53. Headlamp Alignment

7. 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.

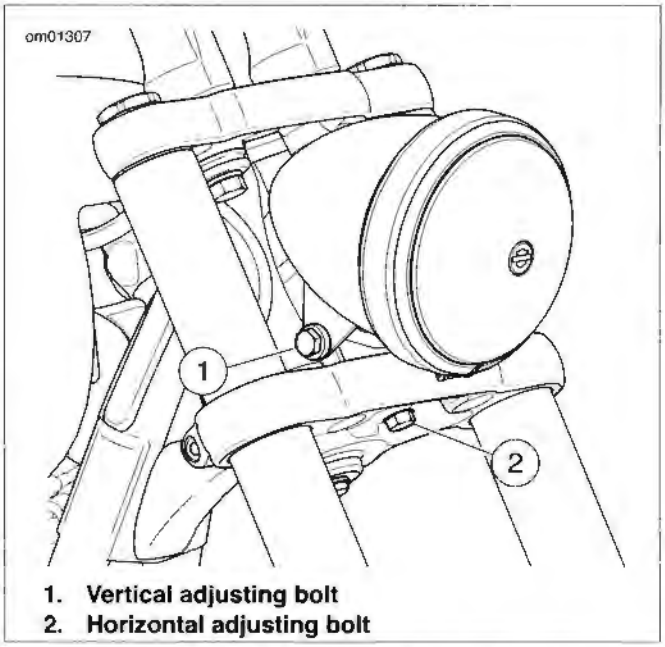
HEADLAMP ADJUSTMENT

1. See Figure 1-54 (FLSTSB) and Figure 1-55 (other models). Loosen horizontal adjustment fastener (2). Tilt headlamp left or right to direct light beam straight ahead.
2. Tighten horizontal adjustment fastener (2) to 30-35 ft-lbs (40.7-47.5 Nm).
3. Loosen vertical adjustment fastener (1). Tilt headlamp up or down in relationship to the horizontal line from the headlamp alignment inspection.
4. Tighten vertical adjustment fastener (1) to:
   a. FXSTC, FXCWC: 25-30 ft-lbs (33.9-40.7 Nm).
   b. FLSTSB: 25-35 ft-lbs (33.9-47.5 Nm).
   c. All other models: 35-45 ft-lbs (47.5-61.0 Nm).



1. Vertical adjusting fastener (with acorn nut)
2. Horizontal adjusting fastener

Figure 1-54. Headlamp Adjustment: FLSTSB



1. Vertical adjusting bolt
2. Horizontal adjusting bolt

Figure 1-55. Headlamp Adjustment: Softail Models Except FLSTSB (typical)

INSPECTION

Inspect critical fasteners at the scheduled service intervals.

Replace any fasteners that are damaged or missing.

Checking Torques on Fasteners

Refer to Table 1-13. Attempt to turn the fastener using a torque wrench set to the minimum torque specification for that fastener. If the fastener does not rotate, the fastener torque has been maintained. If the fastener rotates, remove it to determine if it has a locking agent.

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

If the fastener does not have a locking agent, install and tighten to specification.

Table 1-13. Critical Fasteners

SYSTEM	FASTENER	TORQUE	
Hand controls	Upper and lower switch housing screws	35-45 **in-lbs**	3.9-5.1 Nm
	Clutch lever handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
	Master cylinder handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
Brakes	Banjo bolts	17-22 ft-lbs	23.1-29.9 Nm
	Front brake caliper mounting bolts	28-38 ft-lbs	38.0-51.5 Nm
	Front brake bridge bolt/pad pin	15-16 ft-lbs	20.3-22.6 Nm
	Rear brake caliper mounting bolts	10-14 ft-lbs	13.6-18.9 Nm
	Rear brake pad pin	80-120 **in-lbs**	9.0-13.6 Nm
	Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm
	Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm
	Reservoir cover screws: front	12-15 **in-lbs**	1.4-1.7 Nm
	Reservoir cover screws: rear	6-8 **in-lbs**	0.7-0.9 Nm
	Rear master cylinder mounting nut	30-40 ft-lbs	40.7-54.2 Nm
Axle nuts	Front axle	60-65 ft-lbs	81.42-88.2 Nm
	Rear axle	95-105 ft-lbs	128.1-142.4 Nm
Front fork/handlebars	Lower fork pinch bolts: all but FXCWC	55-60 ft-lbs	74.6-81.4 Nm Nm
	Lower fork pinch bolts: FXCWC	35-40 ft-lbs	47.5-54.3 Nm
	Axle cap fasteners: FXCWC	10-14 ft-lbs	13.6-19.0 Nm
	Upper bracket pinch bolt: FLSTC, FLSTN, FLSTF/B	25-30 ft-lbs	33.9-40.7 Nm
	Handlebar clamp mounting screws	12-15 ft-lbs	16.3-20.3 Nm
	Lower clamp (riser) bolts	30-40 ft-lbs	40.7-54.2 Nm
Rear Fender: FXCWC*	Upper mounting bolts-initial torque	30-35 ft-lbs	40.7-47.5 Nm
	Lower mounting bolts	28-32 ft-lbs	38.0-43.4 Nm
	Upper mounting bolts-final torque	48-52 ft-lbs	65.1-70.6 Nm
Notes:	* See 2.35 REAR FENDER: FXCWC, Installation for proper torque sequence of upper and lower mounting bolts.		

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

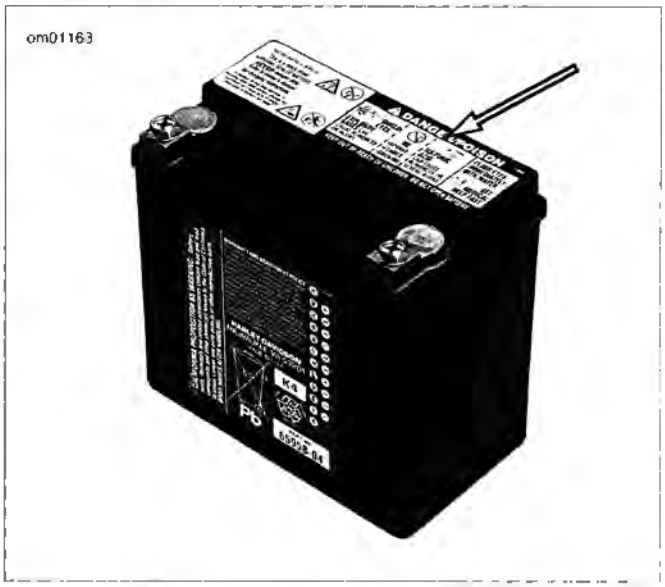


Figure 1-56. Battery Warning Label

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

Figure 1-57. Battery Warning label

Table 1-14. Antidotes for Battery Acid

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

CLEANING AND INSPECTION

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.

VOLTMETER TEST

⚠WARNING

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

⚠WARNING

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

Voltmeter Test

Refer to Table 1-15. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is fully charged. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and check the voltage after the battery has set for one to two hours. If the voltage reading is 12.7V or above, perform a load test. See the electrical diagnostic manual for the load test procedure.

Table 1-15. Voltmeter Test For Battery Charge Conditions

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

CHARGING BATTERY

Safety Precautions

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 or disconnecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery; red positive (+) lead to the positive (+) terminal 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 temperature exceeds 110 °F (43 °C) during charging, discontinue charger and allow the battery to cool.

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 below show typical charging times. Charge times may vary. When using an appropriate automatic charger, allow the charger to determine when charging is complete.

Table 1-16. 19 Amp-Hour Battery Charging Rates/Times (Approximate)

READING (VOLTS)	PERCENT OF CHARGE	5 AMP CHARGER	2 AMP CHARGER	1.5 AMP CHARGER	0.75 AMP CHARGER
12.7	100	-	-	-	-
12.6	75	2 hours	3 hours 24 minutes	4 hours 12 minutes	7 hours 18 minutes
12.3	50	2 hours 54 minutes	5 hours 48 minutes	7 hours 18 minutes	13 hours 42 minutes
12.0	25	3 hours 54 minutes	8 hours 6 minutes	10 hours 30 minutes	20 hours
11.8	0	4 hours 48 minutes	10 hours 30 minutes	13 hours 42 minutes	26 hours 18 minutes

NOTE

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

⚠WARNING

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

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 and black battery charger lead to the negative (-) terminal of the battery.

NOTE

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

3. Step away from the battery and turn on the charger. See the charging instructions in Table 1-16.

⚠WARNING

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

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

DISCONNECTION AND REMOVAL

⚠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. Remove the seat.
2. **FXCWC models:** see Figure 1-58. Remove the battery cover.
3. **FLSTSB models:** see Figure 1-59. Remove thumbscrew (2) and frame fairing (1).
4. See Figure 1-60. Remove battery negative cable (black) from battery negative (-) terminal.
5. Remove battery positive cable (red) from battery positive (+) terminal.
6. Remove battery.

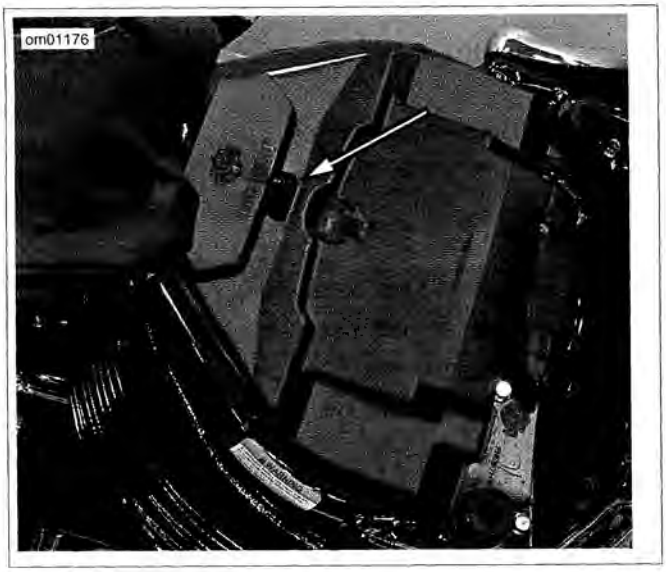
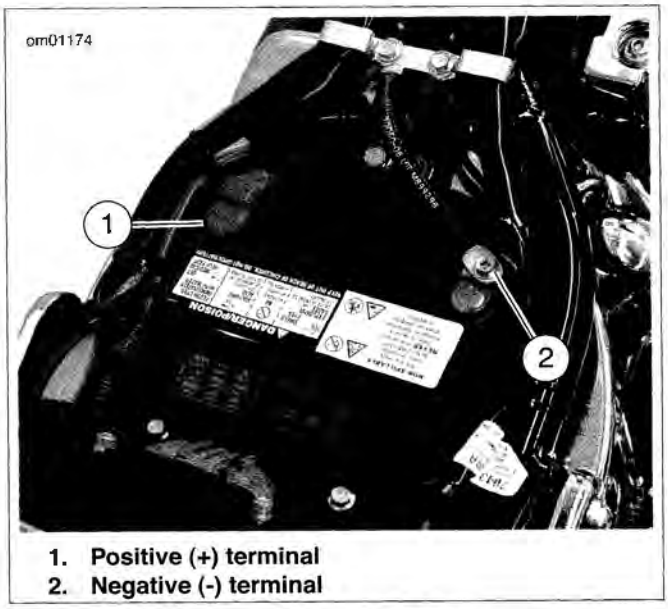
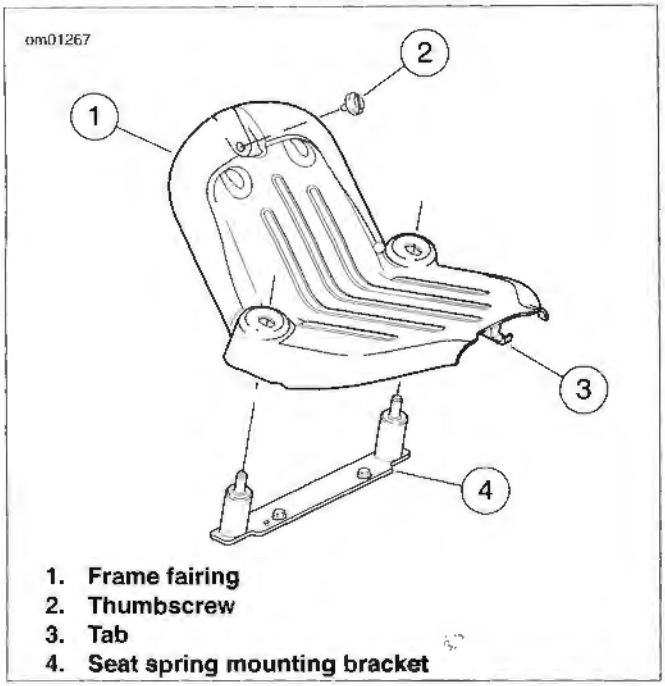


Figure 1-58. Battery Cover (Removal Slot Shown): FXCWC Models



1. Positive (+) terminal
2. Negative (-) terminal

Figure 1-60. Battery: Softail Models



1. Frame fairing
2. Thumbscrew
3. Tab
4. Seat spring mounting bracket

Figure 1-59. Frame Fairing: FLSTSB Models

STORAGE

PART NUMBER	TOOL NAME
99863-01A	GLOBAL BATTERY CHARGER

⚠WARNING

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

If the motorcycle is to be stored with the security system armed, connect a GLOBAL BATTERY CHARGER (Part No. 99863-01A) to maintain battery charge.

If the motorcycle is to be stored with the battery installed, without a GLOBAL BATTERY CHARGER, and with the security system **not** armed, remove the main fuse.

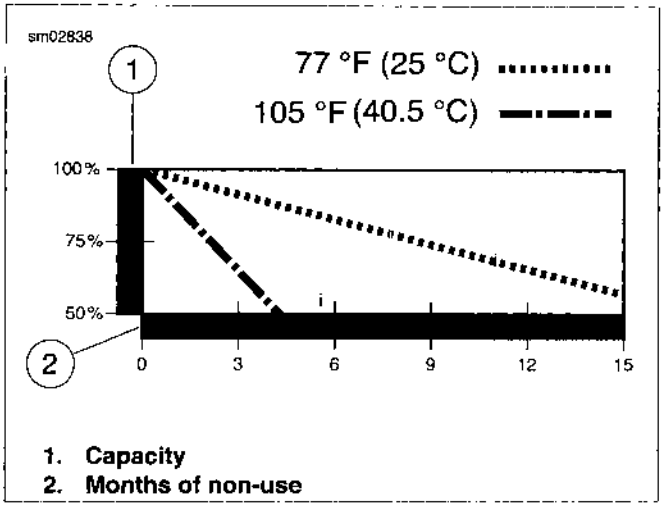
If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge.

See Figure 1-61. A battery that is removed from the vehicle is affected by self-discharge. A battery that is stored in the vehicle is affected by self-discharge and, more significantly, by parasitic loads. A parasitic load is generated by such things as diode leakage or maintaining computer memory with the vehicle turned off. Batteries self-discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool, dry place.

Charge the battery once per month if stored in the vehicle. Charge the battery every three months if stored out of the vehicle.

NOTES

- *The GLOBAL BATTERY CHARGER (Part No. 99863-01A) 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, see the electrical diagnostic manual.*



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

Figure 1-61. Battery Self-Discharge Rate

INSTALLATION AND CONNECTION

1. See Figure 1-62. Position positive battery cable properly at starter. Cable end must face 35° +/-10° forward from left side of vehicle.

⚠WARNING

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

2. Tighten starter nut to 70-90 **in-lbs** (7.9-10.2 Nm) and cover with boot.
3. See Figure 1-63. Place battery caddy into position and install battery caddy clip (1) under front of battery tray (3). Make sure tabs (2) of battery caddy fit over rear of batter tray.
4. See Figure 1-64. Install positive battery cable (1) into clip in caddy. Place an S-shaped bend in the positive battery cable at the starter end of the cable. This will help properly position the terminal end for battery installation.
5. Route rear oxygen sensor harness (2) through clip (3).

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)

6. See Figure 1-65. Install battery. Tighten positive battery terminal fastener to 60-72 **in-lbs** (6.8-8.1 Nm).
7. Install negative battery cable (2) at battery frame ground before any accessory ground wires.
8. Install negative battery cable (2) at battery. Tighten negative battery terminal fastener to 60-72 **in-lbs** (6.8-8.1 Nm).
9. **FLSTSB models:** install the frame fairing and thumbscrew.
10. **FXCWC models:** install the battery cover.

⚠WARNING

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

11. Install seat.

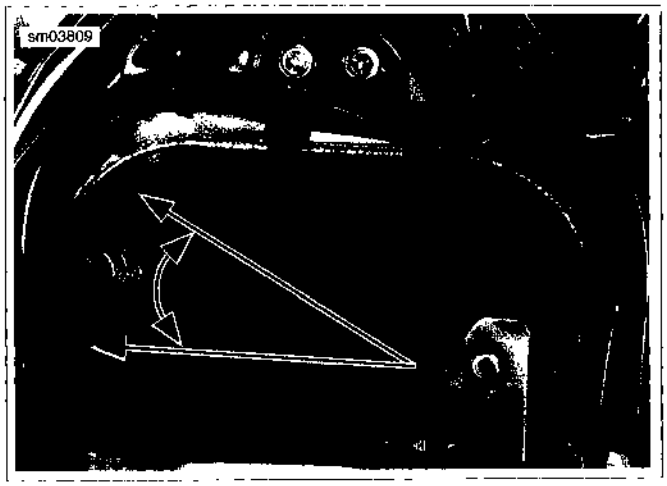
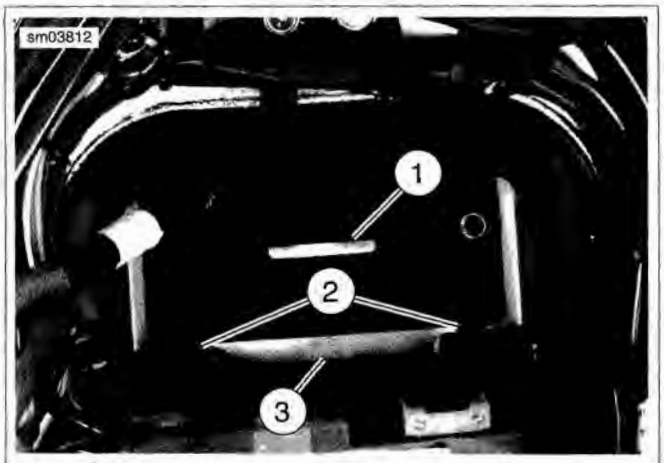
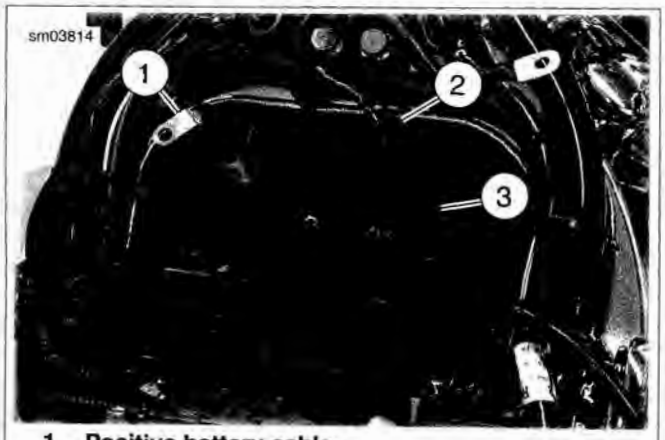


Figure 1-62. Positive Battery Cable Routing



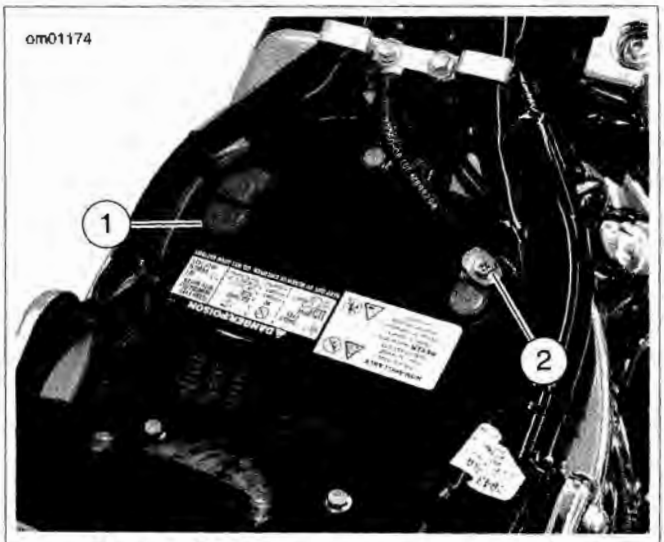
1. Clip
2. Tabs
3. Battery tray

Figure 1-63. Battery Caddy



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

Figure 1-64. Battery Caddy Wire Routing



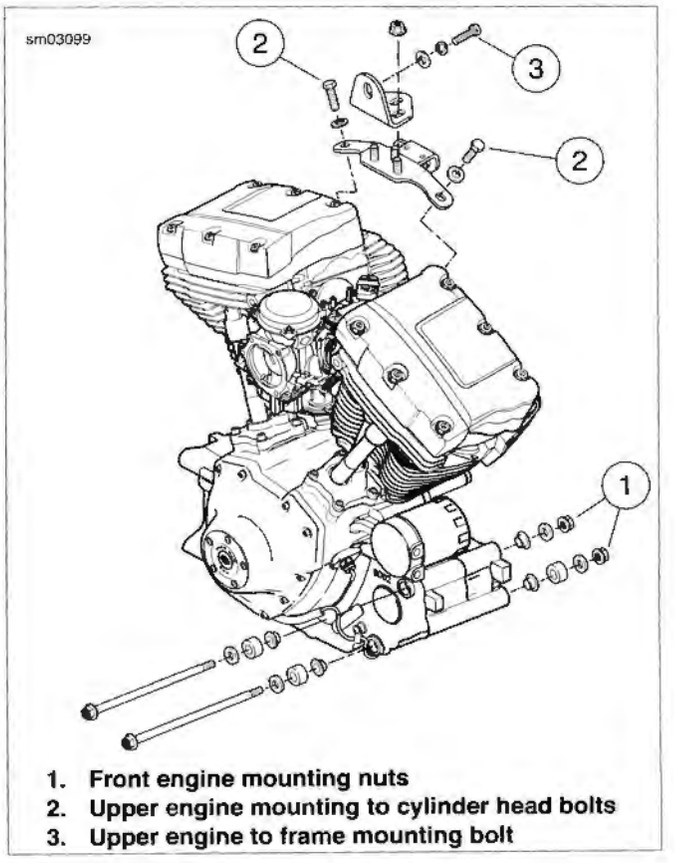
1. Positive (+) terminal
2. Negative (-) terminal

Figure 1-65. Battery: Softail Models

INSPECTION

1. See Figure 1-66. Tighten the rear fork pivot nut to 90-110 ft-lbs (122.0-149.1 Nm).
2. See Figure 1-67. Tighten front engine mounting nuts (1) to 70-80 ft-lbs (94.9-108.5 Nm).
3. Tighten the upper engine mounting to cylinder head bolts (2) to 35-40 ft-lbs (47.5-54.3 Nm).
4. Tighten the upper engine to frame mounting bolt (3) to 45-50 ft-lbs (61.0-67.8 Nm).
5. Inspect all the engine mounting hardware for damage.

Figure 1-66. Pivot Nut



1. **Front engine mounting nuts**
2. **Upper engine mounting to cylinder head bolts**
3. **Upper engine to frame mounting bolt**

Figure 1-67. Engine Mounts

GENERAL

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.

This work should be performed following Service Manual procedures.

PLACING IN STORAGE

PART NUMBER	TOOL NAME
98716-87A	STORAGE COVER

⚠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)

1. Run motorcycle until engine is at normal operating temperature. Stop the engine then drain the oil tank, install a new oil filter, and fill oil tank with the proper grade oil. Check the transmission lubricant level.

⚠WARNING

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

⚠WARNING

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

2. Prepare your fuel system by filling fuel tank and adding a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions.
3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Reinstall spark plugs.
4. Inspect drive belt deflection. See 1.12 DRIVE BELT AND SPROCKETS.
5. Inspect drive belt and sprockets. See 1.12 DRIVE BELT AND SPROCKETS.
6. Inspect air cleaner filter. See 1.7 AIR CLEANER AND EXHAUST SYSTEM.
7. Lubricate controls. See 1.14 CABLE AND CHASSIS LUBRICATION.
8. Inspect operation of all electrical equipment and switches.
9. Check tire inflation and inspect tires for wear and/or damage. See 1.8 TIRES AND WHEELS. If the motorcycle will be stored for an extended period of time, securely support the motorcycle under the frame so that all weight is off the tires.

⚠WARNING

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

10. Wash painted and chrome-plated surfaces. Apply a light film of oil to exposed unpainted surfaces.

⚠WARNING

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

⚠WARNING

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

11. Remove battery from vehicle. Charge battery until the correct voltage is obtained. Charge the battery every other month if it is stored at temperatures below 60° F (16° C). Charge battery once a month if it is stored at temperatures above 60° F (16° C). See 1.25 BATTERY MAINTENANCE.

⚠WARNING

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

12. If the motorcycle is to be covered, use a material that will breathe, such as STORAGE COVER (Part No. 98716-87A) or light canvas. Plastic materials that do not breathe promote the formation of condensation, which leads to corrosion.

REMOVAL FROM STORAGE

⚠WARNING

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

1. Charge and install the battery.
2. Remove and inspect the spark plugs. Replace if necessary.

3. Clean the air cleaner element.
4. If fuel tank was drained, fill fuel tank with fresh gasoline.
5. Start the engine and run until it reaches normal operating temperature.
6. Check engine oil level. Check the transmission lubricant level. Fill to proper levels with correct fluids, if required.
7. Perform all of the checks in the PRE-RIDING CHECKLIST in the Owner's Manual.

GENERAL

⚠WARNING

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

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.

NOTE

For further troubleshooting information, see the electrical diagnostic manual.

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Ignition switch not in IGNITION position.
2. Engine run switch in OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay, or solenoid faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.
6. TSM/TSSM/HFSM Bank Angle Sensor tripped and ignition/light key switch not cycled OFF then back to IGNITION.
7. Security system activated.
8. Motorcycle in gear and clutch not pulled in.
9. Jiffy stand down and transmission in gear (HDI models only)
10. Main fuse not in place

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fouled spark plugs.
3. Discharged battery, loose or 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* sensors.
8. Bank Angle Sensor tripped and ignition switch not cycled OFF then back to IGNITION.
9. Fuel filter clogged.
10. Sticking or damaged valve(s) or wrong length push rod(s).
11. Plugged fuel injectors.

Starts Hard

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

NOTE

For cold weather starts, always disengage clutch.

9. Ignition not functioning properly (possible sensor failure).
10. Faulty ignition coil.
11. Valves sticking.
12. Partially plugged fuel injector(s).

Starts But Runs Irregularly or Misses

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

17. Air cleaner EVAP flapper (if equipped) stuck closed or inoperative.

A Spark Plug Fouls Repeatedly

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

Pre-Ignition or Detonation (Knocks or Pings)

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

Overheating

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

Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Faulty hydraulic lifter(s).
3. Bent push rod(s).
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Chain tensioning spring or shoe worn.
8. Cam(s), cam gear(s) or cam bushing(s) worn.
9. Cam timing incorrect.

Excessive Vibration

1. Wheels bent or damaged and/or tires worn or damaged.
2. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
3. Engine to transmission mounting bolts loose.
4. Upper engine mounting bracket loose.
5. Ignition timing advanced due to faulty sensor inputs (MAP, CKP)/poorly tuned engine.
6. Internal engine problem.
7. Broken frame.
8. Engine counterbalancer out of time or bearing failed.
9. Rear fork pivot shaft fasteners loose.
10. Front engine mounting bolts loose.

Check Engine Light Illuminates During Operation

1. Fault detected. See the ELECTRICAL DIAGNOSTIC MANUAL for more information.

LUBRICATION SYSTEM

Oil Does Not Return To Oil Tank

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

Engine Uses Too Much Oil Or Smokes Excessively

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

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

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

8. Porosity.

Low Oil Pressure

1. Oil tank underfilled.
2. Faulty low oil pressure switch.
3. Oil pump o-ring damaged or missing.
4. Bypass valve stuck in open position.
5. Ball missing or leaking in cam support plate.
6. Worn oil pump gerotor(s).
7. Restricted feed hose from oil tank.
8. Oil diluted with gasoline.

High Oil Pressure

1. Bypass valve stuck in closed position.

ELECTRICAL SYSTEM

NOTE

For diagnostic information see the electrical diagnostic manual.

Alternator Does Not Charge

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

Alternator Charge Rate Is Below Normal

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

Speedometer Operates Erratically

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

TRANSMISSION

Shifts Hard

1. Primary chaincase overfilled with lubricant.
2. Clutch not fully disengaging.
3. Transmission lubricant too heavy (winter operation).
4. Shifter return spring (inside transmission) bent or broken.
5. Bent shifter rod.
6. Shifter forks (inside transmission) sprung.
7. Corners worn off shifter clutch dog rings (inside transmission).

Jumps Out Of Gear

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

Clutch Slips

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

Clutch Drags Or Does Not Release

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

Clutch Chatters

Friction discs or steel discs worn or warped.

HANDLING

Irregularities

1. Improperly loaded motorcycle. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
2. Damaged tire(s) or improper front-rear tire combination.
3. Irregular or peaked front tire tread wear.
4. Incorrect tire pressure. See 1.8 TIRES AND WHEELS
5. Shock absorber not functioning normally.
6. Loose wheel axle nuts. Tighten to recommended torque specification.
7. Rear wheel out of alignment with frame and front wheel.
8. Steering head bearings improperly adjusted. Correct adjustment and replace pitted or worn bearings and races.
9. Loose spokes (laced wheel vehicles only).
10. Tire and wheel unbalanced.
11. Rims and tires out-of-round or eccentric with hub.
12. Rims and tires out-of-true sideways.
13. Rear fork pivot-improper torque.

BRAKES

Brake Does Not Hold Normally

1. Brake fluid reservoir low, system leaking or pads worn.
2. Brake system contains air bubbles.
3. Master cylinder/caliper piston seals worn or parts damaged.

4. Brake pads contaminated with grease or oil.
5. Brake pads badly worn.
6. Brake disc badly worn or warped.
7. Brake drags - insufficient brake pedal or hand lever free-play, caliper piston worn or damaged, or excessive brake fluid in reservoir.
8. Brake fades due to heat build up - brake pads dragging or excessive braking.
9. Brake fluid leak when under pressure.

NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Bearing retainer	25-35 **in-lbs**	2.8-4.0 Nm	2.19 FRONT FORK: SPRINGER, Fork Rockers/LOCTITE ANTI-SEIZE
Bearing retainer jam nut	95-105 ft-lbs	128.8-142.4 Nm	2.19 FRONT FORK: SPRINGER, Fork Rockers
Belt sprocket screws-final torque	77-83 ft-lbs	104.5-112.6 Nm	2.6 REAR WHEEL, Assembly
Belt sprocket screws-initial torque	60 ft-lbs	81.4 Nm	2.6 REAR WHEEL, Assembly/After initial torque, loosen screws 1/2 turn (180 degrees)
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Assembly
Brake caliper/master cylinder banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.16 REAR BRAKE CALIPER, Assembly
Brake caliper bridge bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Assembly
Brake caliper mounting bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Installation
Brake caliper mounting bolt, rear	10-14 ft-lbs	13.6-18.9 Nm	2.16 REAR BRAKE CALIPER, Installation
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.5 FRONT WHEEL: FLSTSB, Assembly
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm	2.6 REAR WHEEL, Assembly
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	2.16 REAR BRAKE CALIPER, Assembly
Brake reaction link-to-fork leg bracket acorn nut	35-40 ft-lbs	47.5-54.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Fender Support Studs: FLSTC	21-27 ft-lbs	28.5-36.6 Nm	2.47 SADDLEBAGS: FLSTC, Installation
FLSTSB handlebar riser locknut	25-35 ft-lbs	33.9-47.5 Nm	2.28 HANDLEBARS: FLSTSB, Installation
Fork drain screw, all models but FXCWC	52-78 **in-lbs**	5.9-8.9 Nm	2.18 FRONT FORK: TELESCOPIC, Replacing Fork Oil
Fork drain screw, FXCWC	12-18 **in-lbs**	1.4-2.0 Nm	2.18 FRONT FORK: TELESCOPIC, Replacing Fork Oil
Fork stem acorn nut	30-35 **in-lbs**	3.4-4.0 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Fork stem nut: FXCWC	70-80 ft-lbs	94.9-108.4 Nm	2.20 STEERING HEAD, Installation
Fork stem nut: FXST, FXSTC	70-80 ft-lbs	94.9-108.4 Nm	2.20 STEERING HEAD, Installation
Fork stem upper bracket pinch bolt: FLST, FLSTC, FLSTF/B, FLSTN	25-30 ft-lbs	33.9-40.7 Nm	2.20 STEERING HEAD, Installation
Fork tube cap	60-70 ft-lbs	81.3-94.9 Nm	2.18 FRONT FORK: TELESCOPIC, Replacing Fork Oil
Fork tube plug	60-70 ft-lbs	81.4-95.0 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Fork tube plug	60-70 ft-lbs	81.4-95.0 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Front axle nut	60-65 ft-lbs	81.3-88.1 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Installation
Front axle nut	60-65 ft-lbs	81.3-88.1 Nm	2.5 FRONT WHEEL: FLSTSB, Installation/Discard upon removal

FASTENER	TORQUE VALUE		NOTES
Front axle slider cap nuts	11-15 ft-lbs	14.9-20.3 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Installation
Front brake caliper banjo bolt	17-22 ft-lbs	23.0-29.8 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Front brake hose bracket bolt	96-120 **in-lbs**	10.8-13.6 Nm	2.20 STEERING HEAD, Installation
Front brake hose bracket bolt	96-120 **in-lbs**	10.8-13.6 Nm	2.20 STEERING HEAD, Installation
Front brake hose bracket bolt	96-120 **in-lbs**	10.8-13.6 Nm	2.20 STEERING HEAD, Installation
Front brake lower caliper screw/guide pin	25-30 ft-lbs	33.9-40.7 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front brake upper caliper mounting bolt	25-30 ft-lbs	33.9-40.7 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Front caliper self-tapping retainer screw	40-50 **in-lbs**	4.5-5.6 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Assembly
Front fender acorn stud assembly	35-40 ft-lbs	47.5-54.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front fender acorn stud assembly	35-40 ft-lbs	47.5-54.3 Nm	2.31 FRONT FENDER: FLSTSB, Installation
Front fender fasteners	15-21 ft-lbs	20.3-28.5 Nm	2.30 FRONT FENDER: ALL BUT FLSTSB, Installation
Front fender locknut	25-30 ft-lbs	33.9-40.7 Nm	2.31 FRONT FENDER: FLSTSB, Installation
Front fender screw	18-22 ft-lbs	24.4-29.9 Nm	2.31 FRONT FENDER: FLSTSB, Installation
Front fork damper tube screw	29.5-36.8 ft-lbs	40-50 Nm	2.18 FRONT FORK: TELESCOPIC, Assembly
Front fork damper tube screw	10.8-18 ft-lbs	14.7-24.5 Nm	2.18 FRONT FORK: TELESCOPIC, Assembly
Front fork leg bracket screws	35-40 ft-lbs	47.5-54.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front shock absorber acorn nuts	45-50 ft-lbs	61.0-67.8 Nm	2.19 FRONT FORK: SPRINGER, Front Shock Absorber/LOCTITE THREADLOCKER 243 (blue)
Handlebar clamp front fasteners	12-15 ft-lbs	16.3-20.3 Nm	2.26 HANDLEBARS: ALL BUT FLSTF/FLSTFB/FLSTSB/FXCWC, Installation
Handlebar clamp rear fasteners	12-15 ft-lbs	16.3-20.3 Nm	2.26 HANDLEBARS: ALL BUT FLSTF/FLSTFB/FLSTSB/FXCWC, Installation
Handlebar clamp screws: FLSTSB	15-18 ft-lbs	20.3-24.4 Nm	2.28 HANDLEBARS: FLSTSB, Installation
Handlebar lower clamp fastener; FLSTF/B	30-40 ft-lbs	40.7-54.2 Nm	2.27 HANDLEBARS: FLSTF/B, Installation
Handlebar lower clamp fastener; FXCWC	30-40 ft-lbs	40.7-54.2 Nm	2.29 HANDLEBARS: FXCWC, Installation
Handlebar switch clamp screw	60-80 **in-lbs**	6.8-9.0 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Handlebar upper clamp fasteners; FLSTF/B	12-18 ft-lbs	16.3-24.4 Nm	2.27 HANDLEBARS: FLSTF/B, Installation
Handlebar upper clamp screw; FXCWC	12-15 ft-lbs	16.3-20.3 Nm	2.29 HANDLEBARS: FXCWC, Installation/Follow torque sequence
Jiffy stand bracket assembly screws	25-30 ft-lbs	33.9-40.7 Nm	2.38 JIFFY STAND, Installation

FASTENER	TORQUE VALUE		NOTES
Jiffy stand sensor screw	96-144 **in-lbs**	10.8-16.3 Nm	2.38 JIFFY STAND, Sensor (HDI Models)
Jounce bumper bolts	84-108 **in-lbs**	9.5-12.2 Nm	2.23 REAR FORK, Installation
Lower fork stem pinch bolts: all but FXCWC	55-60 ft-lbs	74.6-81.4 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Lower fork stem pinch bolts: FXCWC	35-40 ft-lbs	47.5-54.3 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Lower handlebar clamp fasteners	30-40 ft-lbs	40.7-54.3 Nm	2.26 HANDLEBARS: ALL BUT FLSTF/FLSTFB/FLSTSB/FXCWC, Installation
Lower rear fender mounting bolts	28-32 ft-lbs	38.0-43.4 Nm	2.35 REAR FENDER: FXCWC, Installation
Luggage Rack Front Fasteners: FLSTN	96-120 **in-lbs**	10.8-13.6 Nm	2.46 LUGGAGE RACK: FLSTN, Removal and Installation
Luggage Rack Rear Fasteners: FLSTN	12-14 ft-lbs	16.3-19.0 Nm	2.46 LUGGAGE RACK: FLSTN, Removal and Installation
Master cylinder cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Master cylinder reservoir cover screws: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	2.15 REAR BRAKE MASTER CYLINDER, Installation
Pivot shaft nut	90-110 ft-lbs	122-149.1 Nm	2.23 REAR FORK, Installation
Pivot stud (thin head) acorn nut	45-50 ft-lbs	61.0-67.8 Nm	2.19 FRONT FORK: SPRINGER, Fork Rockers/LOCTITE THREADLOCKER 243 (blue)
Rear axle nut	95-105 ft-lbs	128.8-142.5 Nm	2.6 REAR WHEEL, Installation
Rear caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.16 REAR BRAKE CALIPER, Installation
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.32 REAR FENDER: FLST/FLSTC, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.32 REAR FENDER: FLST/FLSTC, Installation/Final torque
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.33 REAR FENDER: FLSTF/B, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.33 REAR FENDER: FLSTF/B, Installation/Final torque
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.34 REAR FENDER: FXST/FXSTC/FLSTSB, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.34 REAR FENDER: FXST/FXSTC/FLSTSB, Installation/Final torque
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.36 REAR FENDER: FLSTN, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.36 REAR FENDER: FLSTN, Installation/Final torque
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.32 REAR FENDER: FLST/FLSTC, Installation
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.33 REAR FENDER: FLSTF/B, Installation
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.34 REAR FENDER: FXST/FXSTC/FLSTSB, Installation
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.36 REAR FENDER: FLSTN, Installation
Rear master cylinder banjo bolt	17-22 ft-lbs	23-30 Nm	2.15 REAR BRAKE MASTER CYLINDER, Installation
Rear master cylinder nut	30-40 ft-lbs	40.7-54.2 Nm	2.15 REAR BRAKE MASTER CYLINDER, Installation
Rear shock bolt	121-136 ft-lbs	164.0-184.4 Nm	2.22 REAR SHOCK ABSORBERS, Installation

FASTENER	TORQUE VALUE		NOTES
Rear shock locknut	32-39 ft-lbs	43.4-52.9 Nm	2.22 REAR SHOCK ABSORBERS, Installation
Rigid fork leg stud	60-65 ft-lbs	81.3-88.1 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Rocker pivot stud acorn nut	45-50 ft-lbs	61.0-67.8 Nm	2.19 FRONT FORK: SPRINGER, Spring Fork
Saddlebag Flange Nuts: FLSTC	120-144 **in-lbs**	13.6-16.3 Nm	2.47 SADDLEBAGS: FLSTC, Installation
Saddlebag Lower Bracket Acorn Nut: FLSTC	120-144 **in-lbs**	13.6-16.3 Nm	2.47 SADDLEBAGS: FLSTC, Installation
Seat Fasteners: FXSTC	60-80 **in-lbs**	6.8-9.0 Nm	2.42 SEAT: FXSTC, Removal and Installation
Seat hinge nut	20-25 ft-lbs	27.1-33.9 Nm	2.45 SEAT: FLSTSB, Seat: FLSTSB
Seat hinge screw	90-110 **in-lbs**	10.2-12.4 Nm	2.43 SEAT: FXCWC, Removal and Installation
Seat hinge screw	14-16 ft-lbs	19.0-21.7 Nm	2.45 SEAT: FLSTSB, Seat: FLSTSB
Seat pillion support fastener	30-35 ft-lbs	40.7-47.5 Nm	2.43 SEAT: FXCWC, Removal and Installation/Initial torque
Seat pillion support fastener	38-42 ft-lbs	51.5-56.9 Nm	2.43 SEAT: FXCWC, Removal and Installation/Final torque
Seat spring support bracket bolts	15-20 ft-lbs	20.3-27.1 Nm	2.45 SEAT: FLSTSB, Seat: FLSTSB
Slider Tube Cap	60-70 ft-lbs	81.3-95.0 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Spoke nipple	55 **in-lbs**	6.2 Nm	2.9 TRUING LACED WHEELS, Truing Wheels
Spring bridge acorn nut	30-35 ft-lbs	40.7-47.5 Nm	2.19 FRONT FORK: SPRINGER, Spring Fork
Spring rod acorn nut (spring fork)	20-25 ft-lbs	27.1-33.9 Nm	2.19 FRONT FORK: SPRINGER, Spring Fork
Steering head bearing retainer final torque	120-144 **in-lbs**	13.6-16.3 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Steering head bearing retainer initial torque	20-25 ft-lbs	27.1-33.9 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Throttle control housing screws	35-45 **in-lbs**	4.0-5.1 Nm	2.24 THROTTLE CONTROL, Assembly/Installation
Upper rear fender mounting bolts-final torque	48-52 ft-lbs	65.1-70.6 Nm	2.35 REAR FENDER: FXCWC, Installation
Upper rear fender mounting bolts-initial torque	30-35 ft-lbs	40.7-47.5 Nm	2.35 REAR FENDER: FXCWC, Installation
Upper triple clamp pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.17 TIRES, Installation

SPECIFICATIONS

Chassis Specifications

Table 2-1. Capacities

ITEM	U.S.	LITERS
Fuel tank (total): All Models but FXCWC	5.00 gal	18.93
Fuel tank (total): FXCWC	4.90 gal	18.54
Low fuel warning light on	1.00 gal	3.79
Oil tank with filter	3.50 qt.	3.31
Transmission (approximate)	1.00 qt.	0.95
Primary chaincase (approximate)	1.00 qt.	0.95

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

ITEM	FLSTFB		FLSTC		FLSTF		FLSTN		FLSTSB	
	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
Wheel base	64.50	1638.30	64.50	1638.30	64.50	1638.30	64.50	1638.30	64.50	1638.30
Overall length	94.30	2395.22	94.50	2400.30	94.30	2395.22	94.70	2405.38	90.50	2298.70
Overall width	39.20	995.68	37.60	955.04	39.20	995.68	38.60	980.44	38.10	967.74
Road clearance	4.80	121.92	5.10	129.54	5.10	129.54	4.80	121.92	4.90	124.46
Overall height	44.30	1125.22	55.20	1402.08	44.50	1130.30	44.30	1125.22	52.6	1336.64
Saddle height*	24.25	615.95	25.50	647.70	25.40	645.16	24.50	622.30	26.6	675.64
*With 180 lb. (81.6 kg) rider on seat										

Table 2-3. Dimensions: FXCWC, FXSTC and FLST

ITEM	FXCWC		FXSTC		FLST	
	IN	MM	IN	MM	IN	MM
Wheel base	69.20	1757.68	66.90	1699.26	64.50	1638.30
Overall length	95.00	2413.00	94.50	2400.30	94.50	2400.30
Overall width	35.10	891.54	36.50	927.10	36.20	919.48
Road clearance	5.10	129.54	5.10	129.54	5.10	129.54
Overall height	46.00	1168.40	51.70	1313.18	46.40	1178.56
Saddle height*	25.2	640.08	26.4	670.56	25.5	647.7
*With 180 lb. (81.6 kg) rider on seat.						

Table 2-4. Weights: FLSTC, FLSTF, FLSTN, FLSTSB and FLST

ITEM	FLSTC		FLSTF		FLSTN		FLSTSB		FLST	
	LB	KG	LB	KG	LB	KG	LB	KG	LB	KG
Weight as shipped from factory	730.00	331.12	694.00	314.79	695.00	315.25	700.00	317.52	694.00	314.79
GVWR	1160.00	526.17	1160.00	526.17	1160.00	526.17	1150.00	521.64	1160.00	526.17
GAWR front	430.00	195.04	430.00	195.04	430.00	195.04	426.00	193.23	430.00	195.04
GAWR rear	730.00	331.12	730.00	331.12	730.00	331.12	724.00	328.40	730.00	331.12

Table 2-5. Weights: FXCWC, FXSTC and FLSTFB

ITEM	FXCWC		FXSTC		FLSTFB	
	LB	KG	LB	KG	LB	KG
Weight as shipped from factory	686.30	311.30	672.00	304.81	700.00	317.52
GVWR	1175.00	532.97	1125.00	510.30	1160.00	526.17
GAWR front	415.00	188.24	415.00	188.24	430.00	195.05
GAWR rear	760.00	344.73	710.00	322.05	730.00	331.12

NOTES

- *Gross vehicle weight rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding gross axle weight rating (GAWR) are given on a label located on the frame steering head.*
- *For important information regarding tire data and tire inflation, see 1.8 TIRES AND WHEELS.*

Tire Specifications

⚠WARNING

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

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

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

Table 2-6. Fitment - Tubeless Cast Wheels

WHEEL SIZE AND POSITION	RIM SIZE AND CONTOUR	RIM VALVE HOLE DIA.	TIRE SIZE
17 in. - Front	T17 x 3.50 MT	0.35 in.	**Dunlop D408F** 140/75R17 67V
17 in. - Rear	T17 x 6.00 MT	0.35 in.	**Dunlop D407** 200/55R17 78V
19 in. - Front (FXCWC)	T19 x 2.15 MT	0.35 in.	**Dunlop D408F** 90/90-19 52H
18 in. - Rear (FXCWC)	T18 x 8.00 MT	0.35 in.	**Dunlop D407** 240/40R18 79V

Table 2-7. Tire Fitment - Tube Type Steel Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE	TIRE SIZE
16 in - Front	T16x3.00D	MT90-16	**Dunlop D402F** MT90B16 72H
16 in - Rear (FLSTN)	T16x3.00 D	MT90-16/MU85-16	**Dunlop D402** MU85B16 77H
16 in - Rear (all but FLSTN)	T16x3.00D	MT90-16	**Dunlop D401** 150/80B16 71H
21 in - Front	T21x2.15 TLA	MH90-21	**Dunlop D407F** MH90-21 54H
17 in - Rear (FXST)	T17x6.00 MT	200/55R17 M/C	**Dunlop D407** 200/55R17 78V
17 in - Rear (FLSTSB)	T17x6.00 MT	200/55R17 M/C	**Dunlop D401** 200/55R17 78V

Table 2-8. Tire Fitment - Tube Type Chrome Aluminum Profile Laced Wheels

WHEEL SIZE & POSITION	RIM SIZE & CONTOUR	TUBE SIZE	TIRE SIZE
16 in - Front	T16x3.0 MT	MT90-16	**Dunlop D402F** MT90B16 72H
16 in - Rear (FLSTN and FLSTC Option)	T16x3.0 MT	MT90-16/MU85-16	**Dunlop D402** MU85B16 77H
16 in - Rear (all but FLSTN and FLSTC Option)	T16x3.0 MT	MT90-16	**Dunlop D401** 150/80B16 71H
21 in - Front	T21x2.15 MT	MH90x21	**Dunlop D407F** MH90-21 54H

Table 2-9. Tires

MODEL	MOUNT	SIZE	NUMBER	PRESSURE (COLD)	
				PSI	kPa
FLSTSB, FLSTC, FLST, FLSTN	front	16 in.	Dunlop D402F MT90B16	36	248
FLSTF	front	17 in.	Dunlop D408F 140/75R17	36	248
FXSTC	front	21 in.	Dunlop D407F MH90-21	30	206
FXCWC	front	19 in.	Dunlop D408F 90/90-19	30	206
FLSTSB	rear	17 in.	Dunlop D401 200/55R17	42	290
FLST, FLSTC	rear	16 in.	Dunlop D401 150/80B16	40	276
FLSTN, FLSTC	rear	16 in.	Dunlop D402 MU85B16	40	276
FLSTF, FXSTC, FLSTFB	rear	17 in.	Dunlop D407 200/55R17	42	290
FXCWC	rear	18 in.	Dunlop D407 240/40R18	42	290

VEHICLE IDENTIFICATION NUMBER

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

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

NOTE

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

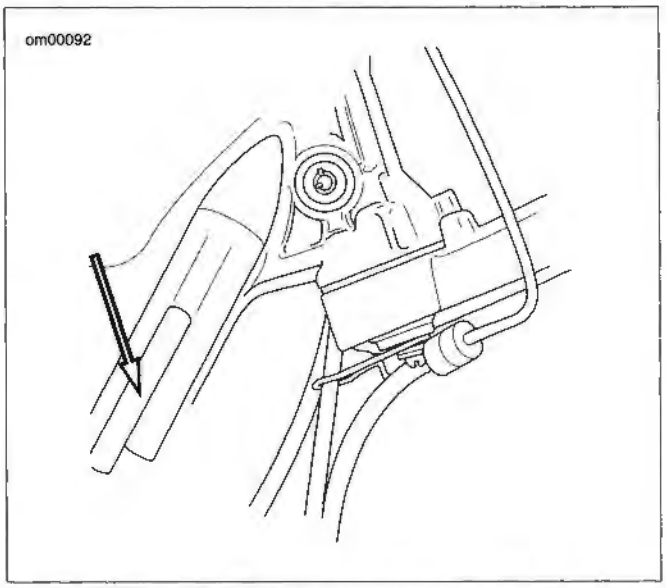


Figure 2-1. V.I.N. Stamping Location

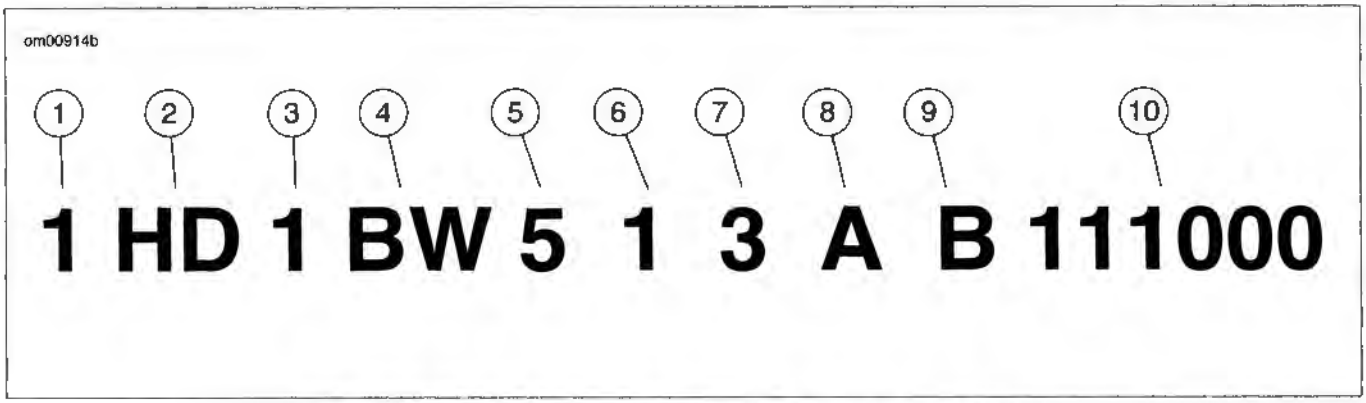


Figure 2-2. Typical Harley-Davidson V.I.N.: 2010 Softail Models

Table 2-10. Harley-Davidson V.I.N. Breakdown: 2010 Softail Models

POSITION	DESCRIPTION	POSSIBLE VALUES
1	Market designation	1=Originally manufactured for sale **within** the United States 5=Originally manufactured for sale **outside** of the United States
2	Manufacturer/vehicle type	HD=Harley-Davidson motorcycle
3	Motorcycle type	1=Heavyweight motorcycle (901 cc and larger)
4	Model	See V.I.N. model table
5	Engine type	5=Twin Cam 96B™, 1584 cc air-cooled, fuel-injected,balanced

Table 2-10. Harley-Davidson V.I.N. Breakdown: 2010 Softail Models

POSITION	DESCRIPTION	POSSIBLE VALUES	
6	Introduction date/calibration	**Normal Introduction** 1=Domestic 3=California A=Canada C=HDI E=Japan G=Australia J=Brazil	**Mid-year or Special Introduction** 2, 4=Domestic 5, 6=California B=Canada D=HDI F=Japan H=Australia K=Brazil
7	V.I.N. check digit	Can be 0-9 or X	
8	Model year	A=2010	
9	Assembly plant	B=York, PA U.S.A.	
10	Sequential number	Varies	

Table 2-11. V.I.N. Model Codes: 2010 Softail Models

CODE	MODEL	CODE	MODEL
BV	FXST Softail® Standard (JPN, AUS markets)	JG	FLSTF Shrine
BW	FLSTC Heritage Softail® Classic	JH	FLSTC Shrine
BX	FLSTF Fat Boy®	JK	FXCWC Softail Rocker™ C
JD	FLSTN Softail® Deluxe	JL	FXSTC Softail Custom™
JE	FLST Heritage Softail® (Brazil only)	JM	FLSTSB Softail® Cross Bones™
		JN	FLSTFB Softail® Fat Boy® Lo (CAL, CAN, DOM, JPN markets) FLSTFB Softail® Fat Boy® Special (HDI, HDE markets)

REMOVAL

1. Block motorcycle underneath frame so front wheel is raised off the ground.
2. Inspect wheel bearing end play and service bearings if necessary. See 2.7 SEALED WHEEL BEARINGS.
3. See Figure 2-3. Remove brake caliper. Support caliper using a rubber bungee cord. Be careful not to scratch the fender paint.

NOTE

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

4. Remove axle nut, lockwasher and washer (3).
5. Label wheel spacers for location (left or right) and orientation (fork side or wheel side).
6. See Figure 2-4. Loosen the slider cap fasteners (2) and pull the axle (1) free.
7. Remove wheel from forks.

NOTE

On FLST and FLSTC models, the hub cap will come off with the wheel.

DISASSEMBLY

Disc Wheel

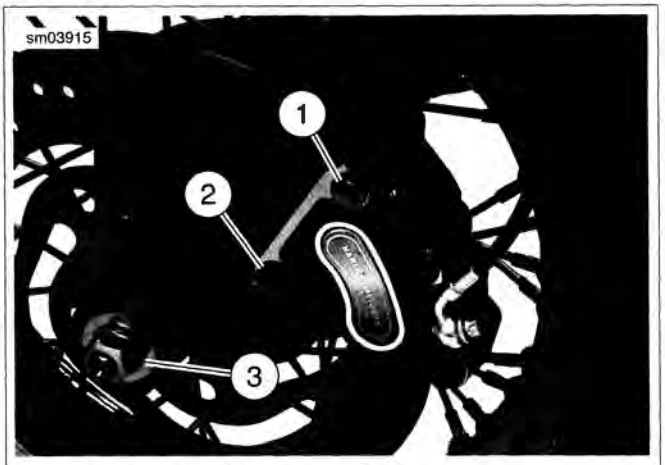
NOTE

See 2.17 TIRES to service tire or valve stem assembly.

1. See Figure 2-5. Remove spacers (2, 6) from left and right sides.
2. If necessary, remove brake disc (7). On left side of wheel, remove five screws (8) to detach brake disc. Discard screws.

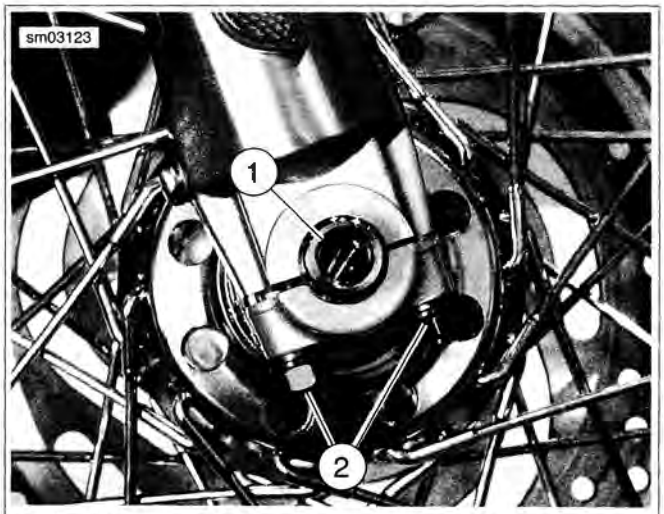
Laced Wheel

1. See Figure 2-6. On all models with laced wheels except FLST and FLSTC, remove spacers (3, 7) from left and right sides. All FLST and FLSTC models use a spacer within the hub cap assembly (2) on the right side.
2. If necessary, remove brake disc (8). On left side of wheel, remove five screws (11) to detach left brake disc. Discard screws.
3. To disassemble FLST and FLSTC hub cap, remove snap ring from hub spacer. Discard snap ring.



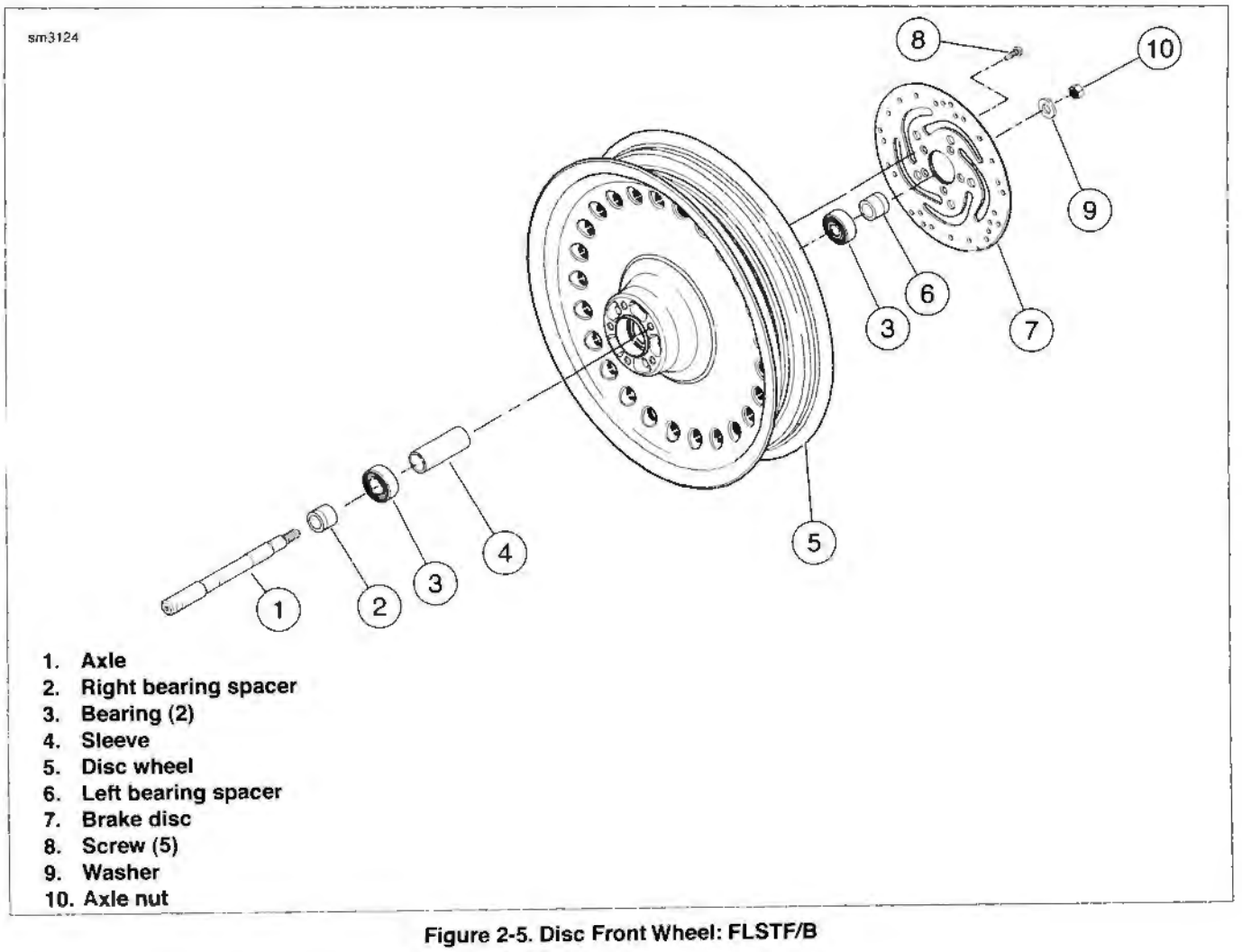
1. Long mounting bolt (metric)
2. Short mounting bolt (metric)
3. Axle nut, lockwasher, and washer

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



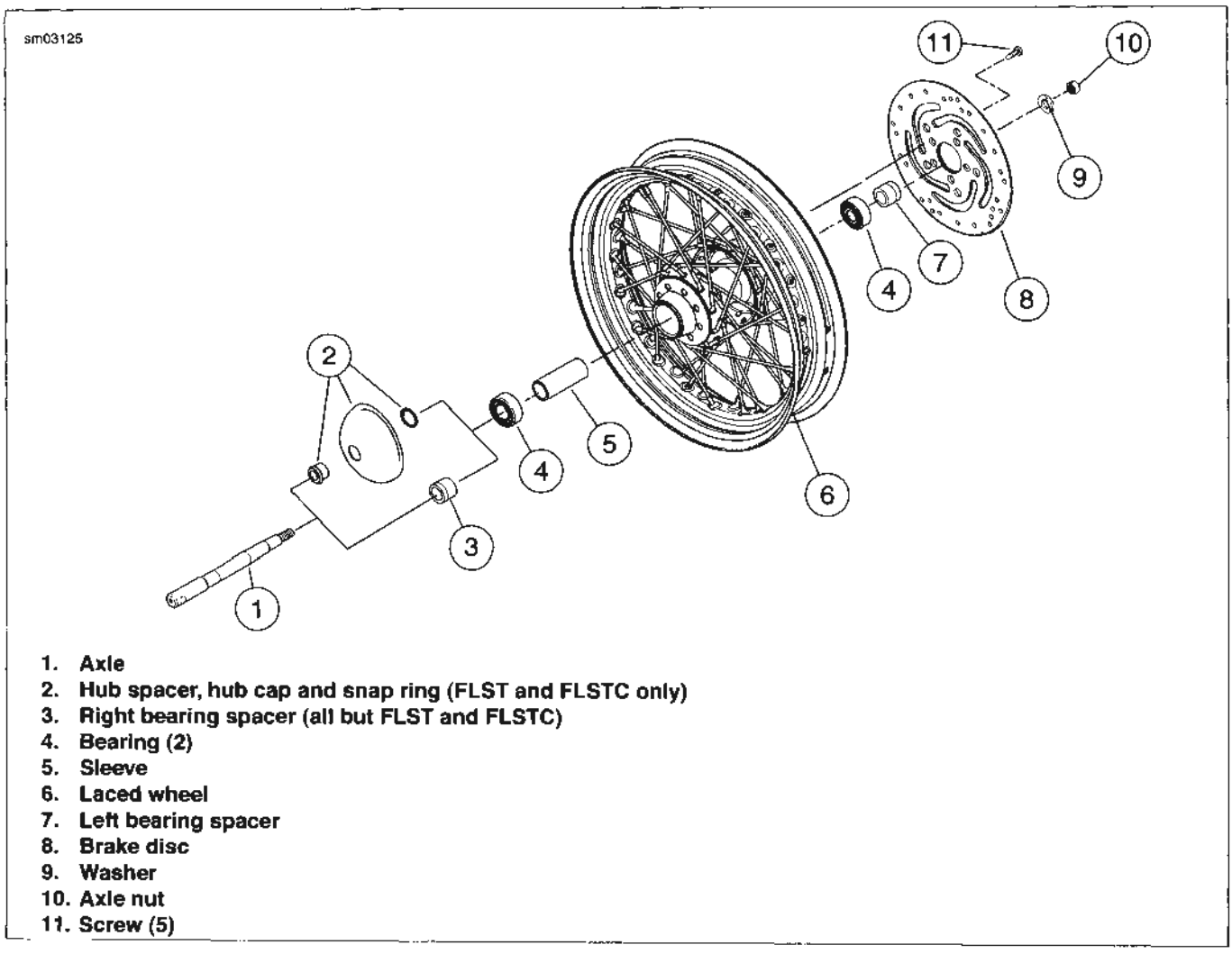
1. Axle
2. Slider cap fasteners and washers

Figure 2-4. Front Wheel Mounting



1. Axle
2. Right bearing spacer
3. Bearing (2)
4. Sleeve
5. Disc wheel
6. Left bearing spacer
7. Brake disc
8. Screw (5)
9. Washer
10. Axle nut

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



1. **Axle**
2. **Hub spacer, hub cap and snap ring (FLST and FLSTC only)**
3. **Right bearing spacer (all but FLST and FLSTC)**
4. **Bearing (2)**
5. **Sleeve**
6. **Laced wheel**
7. **Left bearing spacer**
8. **Brake disc**
9. **Washer**
10. **Axle nut**
11. **Screw (5)**

Figure 2-6. Laced Front Wheel: All but FLSTF/B

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear. If sealed wheel bearings must be serviced, see 2.7 SEALED WHEEL BEARINGS.

⚠WARNING

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

2. Inspect brake disc and pads. See 1.17 BRAKE PADS AND DISCS.

ASSEMBLY

⚠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)

Disc Wheel

1. Verify that wheel and tire are true. See 2.10 CHECKING CAST WHEEL RUNOUT.

CAUTION

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

2. See Figure 2-5. If removed, install brake disc (7). Verify that brake disc is clean. Install five **new** screws (8) to attach brake disc. Tighten screws to 16-24 ft-lbs (21.7-32.5 Nm).
3. Install spacers (2, 6) with largest chamfered end facing away from wheel.

Laced Wheel

1. If hub and rim were disassembled, see 2.8 WHEEL LACING, 2.8 WHEEL LACING, or 2.8 WHEEL LACING.
2. Verify that wheel and tire are true. See 2.9 TRUING LACED WHEELS.

3. On FLST and FLSTC models, attach hub cap to spacer with **new** snap ring.
4. See Figure 2-6. If necessary, install brake disc in its original position. Verify that brake disc is clean. Install five **new** screws (11) to attach brake disc (8). Tighten screws to 16-24 ft-lbs (21.7-32.5 Nm).
5. Install hub assembly (2) or spacers (3, 7) with largest chamfered end facing away from wheel.

INSTALLATION

1. Apply a light coat of LOCTITE ANTI-SEIZE LUBRICANT to the axle, bearing bores, and bore of inner sleeve.
2. Place wheel into front fork and install axle. Verify that axle spacers on right and left side are properly installed.
3. See Figure 2-3. Install the washer and axle nut (3). Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, tighten axle nut to 60-65 ft-lbs (81.3-88.1 Nm).

NOTE

In next step, make sure front and rear gaps between slider cap and slider is even.

4. See Figure 2-4. Tighten the slider cap nuts to 11-15 ft-lbs (14.9-20.3 Nm).
5. See Figure 2-3. Install the brake caliper to the fork leg using the long mounting bolt (1) (metric) in top hole and the short mounting bolt (2) (metric) in bottom hole on fork leg.
6. Tighten fasteners to 28-38 ft-lbs (38.0-51.5 Nm).

⚠WARNING

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

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

REMOVAL

1. Block motorcycle underneath frame so front wheel is raised off the ground.
2. Inspect wheel bearing end play and replace bearings if necessary. See 2.7 SEALED WHEEL BEARINGS.
3. Remove front brake caliper. Support caliper using a rubber bungee cord. Be careful not to scratch the fender paint. See 2.14 FRONT BRAKE CALIPER: FLSTSB.

NOTE

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

4. Remove front fender. See 2.31 FRONT FENDER: FLSTSB.
5. See Figure 2-7. Remove locknut (15) and washer (16). Discard nut.
6. Place a towel under hub to catch any loose parts which may fall from hub.
7. Slide axle (1) out of hub and rockers to remove front wheel.

DISASSEMBLY

NOTE

See 2.17 TIRES to service tire or valve stem assembly.

If necessary, remove brake disc. Label components so they may be installed in their original locations. On left side of wheel, remove five screws to detach brake disc.

NOTE

To service rocker bearings, see 1.22 ROCKER BEARINGS: FLSTSB.

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear. If sealed wheel bearings must be replaced, see 2.7 SEALED WHEEL BEARINGS.

⚠WARNING

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

2. Inspect brake disc and pads.
   a. Minimum brake pad thickness: 0.06 in. (1.6 mm) or less above the backing plate.
   b. Minimum brake disc thickness is stamped on the side of the disc. Replace disc if badly scored.
   c. Maximum brake disc lateral runout and warpage is 0.008 in. (0.2 mm).

ASSEMBLY

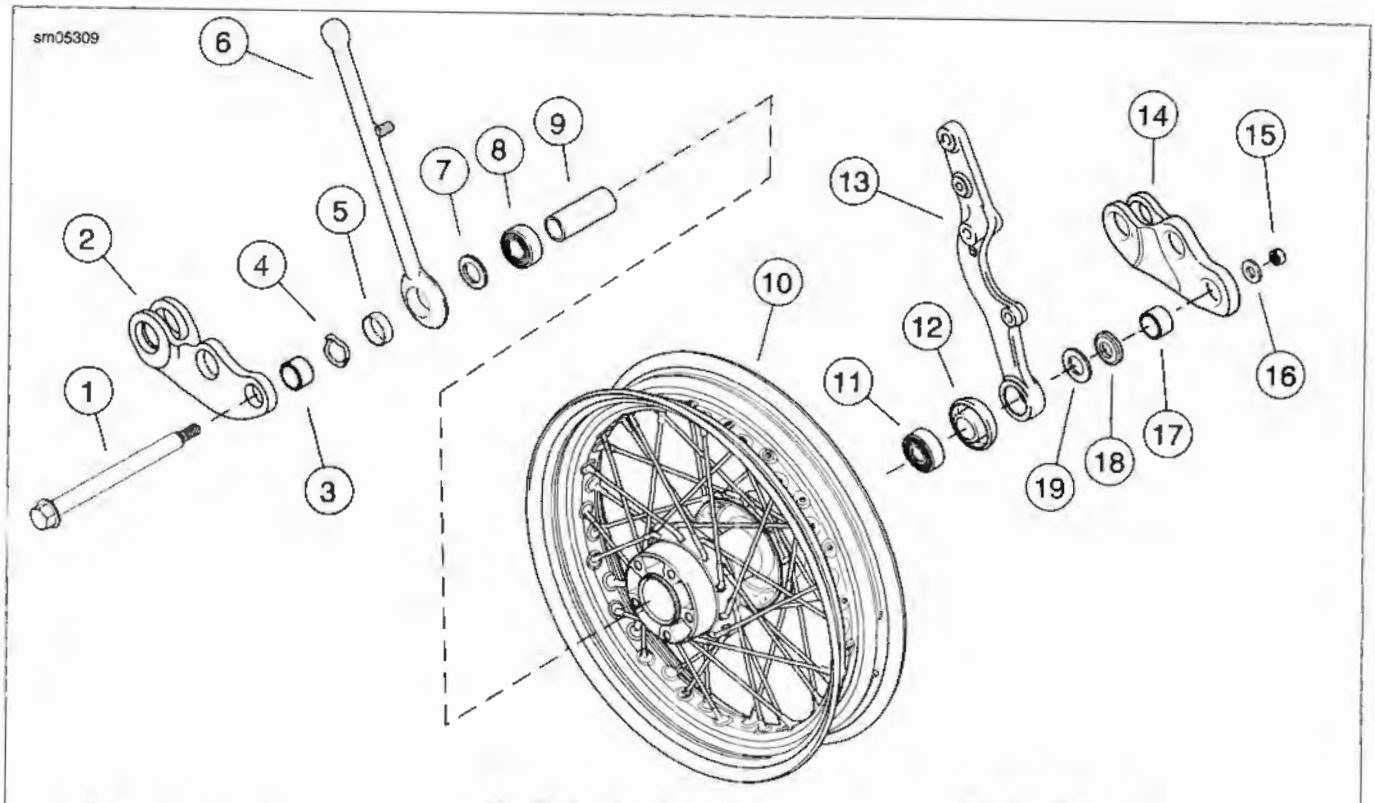
⚠WARNING

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)

CAUTION

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

1. If previously removed, install brake disc in its original position. Verify that brake disc is clean. Install five **new** screws to attach brake disc. Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
2. If bearings were removed, verify that sleeve (8) is installed.



1. **Axle**
2. **Right rocker**
3. **Pivot sleeve**
4. **Wave washer**
5. **Bearing**
6. **Strut**
7. **Strut spacer**
8. **Right side bearing**
9. **Sleeve**
10. **Wheel**
11. **Left side bearing**
12. **Spacer**
13. **Bracket**
14. **Left rocker**
15. **Locknut**
16. **Washer**
17. **Pivot sleeve**
18. **Rubber spacer**
19. **Washer**

Figure 2-7. Front Wheel: FLSTSB

INSTALLATION

1. See Figure 2-7. Install axle (1).
   a. Apply a light coat of LOCTITE ANTI-SEIZE LUBRICANT to the right side bearing (8) inside diameter.
   b. From right side of wheel, insert axle through right rocker (2), pivot sleeve (3), wave washer (4), bearing (5), strut (6), strut spacer (7), right side bearing (8), and sleeve (9).
   c. Continue through wheel, left side bearing (11), spacer (12), bracket (13), washer (19), rubber spacer (18), pivot sleeve (17), and left rocker (14).
2. Install washer (16) and **new** axle locknut (15). Tighten locknut to 60-65 ft-lbs (81.3-88.1 Nm) while holding axle stationary.
3. Install front fender. See 2.31 FRONT FENDER: FLSTSB.
4. Install front brake caliper. See 2.14 FRONT BRAKE CALIPER: FLSTSB.

⚠WARNING

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

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

REMOVAL

1. Block motorcycle underneath frame so weight of motorcycle is off of rear wheel.
2. Remove saddlebags if equipped.
3. Remove belt guard and debris deflector from rear fork. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.
4. Inspect wheel bearing end play and service bearings if necessary. See 2.7 SEALED WHEEL BEARINGS.
5. Label wheel spacers for location (left or right) and orientation (fork side or wheel side).
6. Remove rear brake caliper from caliper mount and support using an elastic cord or similar. See 2.16 REAR BRAKE CALIPER.

NOTES

- *The axle nut retainer used on FXCWC models will remain in the axle nut and does not need to be removed.*
- *If the axle nut retainer on FXCWC modes is removed, it must be replaced.*

7. **All but FXCWC:** See Figure 2-8. Remove e-clip (1). Remove rear axle nut (2).
8. **FXCWC:** See Figure 2-9. Remove rear axle nut (2).
9. Loosen both axle adjuster screws (3) an equal number of turns to remove tension from drive belt.

NOTE

Support rear wheel from underneath during removal.

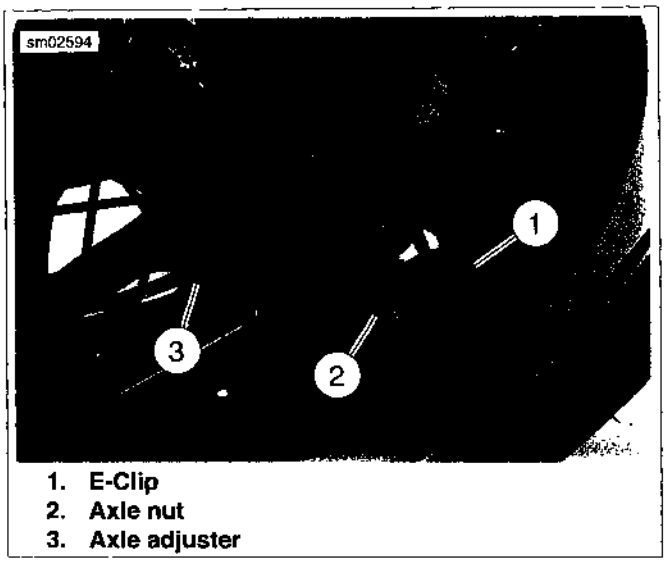
10. Tap axle towards right side and remove. Remove spacers and caliper mounting bracket.
11. Move wheel forward and slip belt off sprocket.
12. Raise motorcycle to allow enough clearance for removal of rear wheel.
13. Pull wheel with belt sprocket from rear fork.

NOTE

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

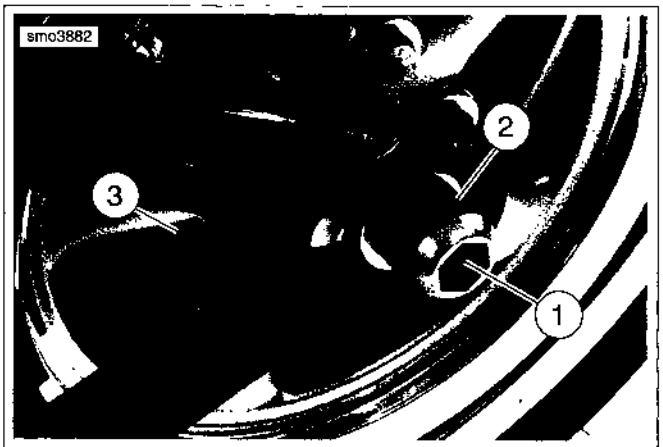
DISASSEMBLY

1. See Figure 2-10. Remove spacers (5, 6, 13) from left and right sides, if not already previously removed.
2. If necessary, remove brake disc and/or rear sprocket.
   a. Remove five screws (19) to detach rear sprocket (12). Discard screws.
   b. Remove five screws (3) to remove rear brake disc (7). Discard screws.



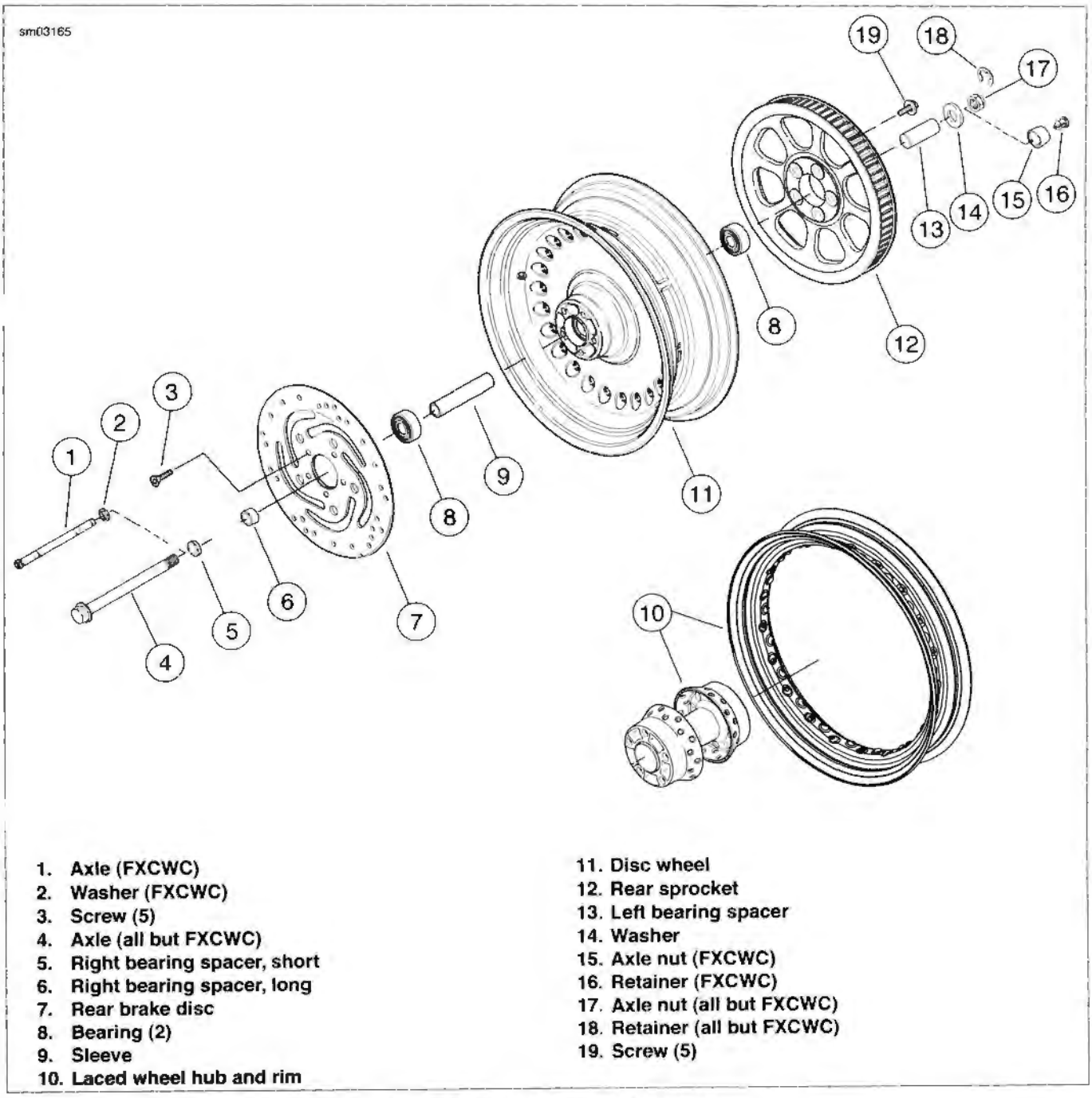
1. **E-Clip**
2. **Axle nut**
3. **Axle adjuster**

Figure 2-8. Axle Adjusters: All But FXCWC



1. **Retainer**
2. **Axle nut**
3. **Axle adjuster**

Figure 2-9. Axle Adjusters: FXCWC



1. Axle (FXCWC)
2. Washer (FXCWC)
3. Screw (5)
4. Axle (all but FXCWC)
5. Right bearing spacer, short
6. Right bearing spacer, long
7. Rear brake disc
8. Bearing (2)
9. Sleeve
10. Laced wheel hub and rim
11. Disc wheel
12. Rear sprocket
13. Left bearing spacer
14. Washer
15. Axle nut (FXCWC)
16. Retainer (FXCWC)
17. Axle nut (all but FXCWC)
18. Retainer (all but FXCWC)
19. Screw (5)

Figure 2-10. Rear Wheel/Hub (typical)

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear.
2. Inspect brake disc and pads. See 1.17 BRAKE PADS AND DISCS.
3. Inspect drive belt and sprocket. See 1.12 DRIVE BELT AND SPROCKETS.

ASSEMBLY

1. See Figure 2-10. If laced wheel (10) was disassembled, see 2.8 WHEEL LACING, 2.8 WHEEL LACING, or 2.8 WHEEL LACING.

CAUTION

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

2. Using **new** screws (3), install brake disc (7) if removed. Tighten screws to 30-45 ft-lbs (40.7-61.0 Nm).

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)

3. Using **new** screws (19), install belt sprocket (12) if removed. Tighten screws to using the following sequence:
   a. Tighten screws (19) to an initial torque of 60 ft-lbs (81.4 Nm).
   b. Back screws off 1/2 turn (180 degrees).
   c. Tighten screws (19) to a final torque of 77-83 ft-lbs (104.5-112.6 Nm).
4. Verify that wheel and tire are true.
   a. For laced wheels, see 2.9 TRUING LACED WHEELS.
   b. For cast wheels, see 2.10 CHECKING CAST WHEEL RUNOUT.

INSTALLATION

1. See Figure 2-10. Apply a light coat of LOCTITE ANTI-SEIZE LUBRICANT to the axle (1, 4), bearing bores, and the bore of the inner sleeve (9).
2. Roll wheel into rear fork and slide drive belt over drive sprocket.
3. Position left bearing spacer (13) between wheel and fork.
4. From right side, carefully insert axle [with washer (2) for FXCWC] through right rear fork, short spacer (5), rear caliper mounting bracket, long spacer (6) and into bearing bore.

   Continue sliding axle through wheel hub sleeve, left side spacer and left rear fork.
5. Install washer (14), axle nut (15, 17), and retainer (16, 18)
6. Verify correct axle alignment (see 2.11 VEHICLE ALIGNMENT) and check belt deflection (see 1.12 DRIVE BELT AND SPROCKETS).

⚠WARNING

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

7. Tighten axle nut to 95-105 ft-lbs (128.8-142.5 Nm).
8. Install belt guard and debris deflector. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.
9. Install brake caliper and pads. See 2.16 REAR BRAKE CALIPER.
10. Install saddlebags, if equipped.

⚠WARNING

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

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

INSPECTION

1. Block motorcycle underneath frame, so that the wheel is raised off the ground.
2. Turn the wheel through several rotations.
3. See Figure 2-11. Mount a magnetic base dial indicator to the brake disc with the dial contact point on the end of the axle.
4. Move the wheel from side to side to check end play.
   a. Bearing passes inspection if the end play is less than 0.002 in. (0.051 mm).
   b. Replace the bearings if end play is not within specification, or if there is drag, rough rotation, abnormal noise or anything unusual.

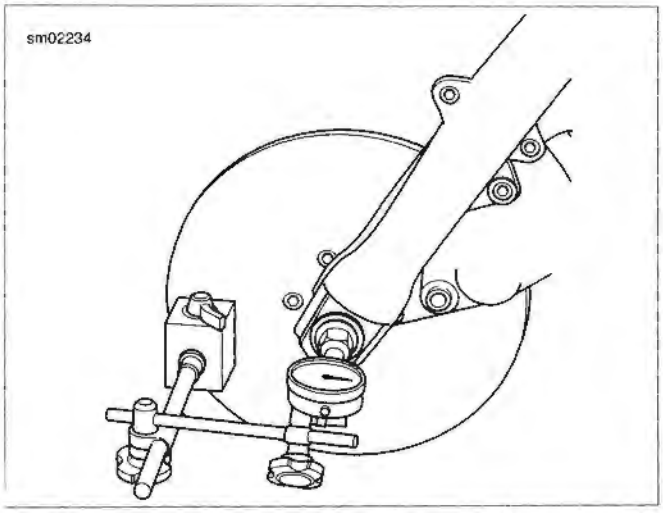


Figure 2-11. Wheel Bearing Inspection (Front Wheel Shown)

REMOVAL

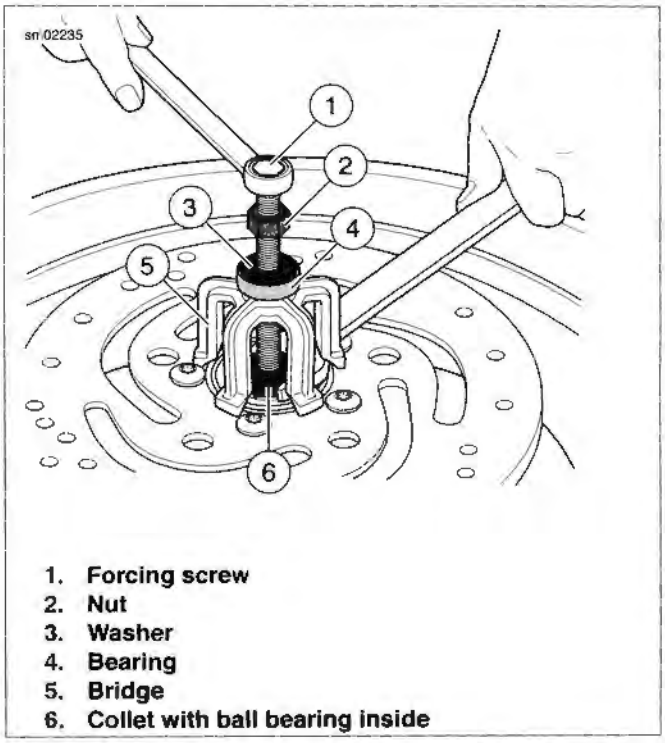
PART NUMBER	TOOL NAME
HD-44060-10	25 MM COLLET
HD-44060A	WHEEL BEARING INSTALLER/REMOVER

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

NOTE

See Figure 2-13. Some wheel hubs may not provide adequate support for the puller bridge. In these cases center a used brake disc over the hub to support the puller bridge while removing the bearings.

3. See Figure 2-12. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060A) and assemble using 25 MM COLLET (Part No. HD-44060-10) (6).
   a. Sparingly apply graphite lubricant to threads of forcing screw (1) to prolong service life and verify smooth operation.
   b. Install nut (2), washer (3) and bearing (4) on screw. Insert assembly through hole in bridge (5).
   c. Drop ball bearing inside 25 mm collet (6). Fasten collet and ball bearing to forcing screw.
4. Hold end of forcing screw and turn collet to expand edges of collet.
5. See Figure 2-14. When expanded collet has gripped bearing edges, hold end of forcing screw and turn the nut to remove bearing from wheel.
6. Remove spacer from inside wheel hub.
7. Repeat procedure for opposite side bearing. Discard all bearings upon removal.



1. **Forcing screw**
2. **Nut**
3. **Washer**
4. **Bearing**
5. **Bridge**
6. **Collet with ball bearing inside**

Figure 2-12. Removal Tool

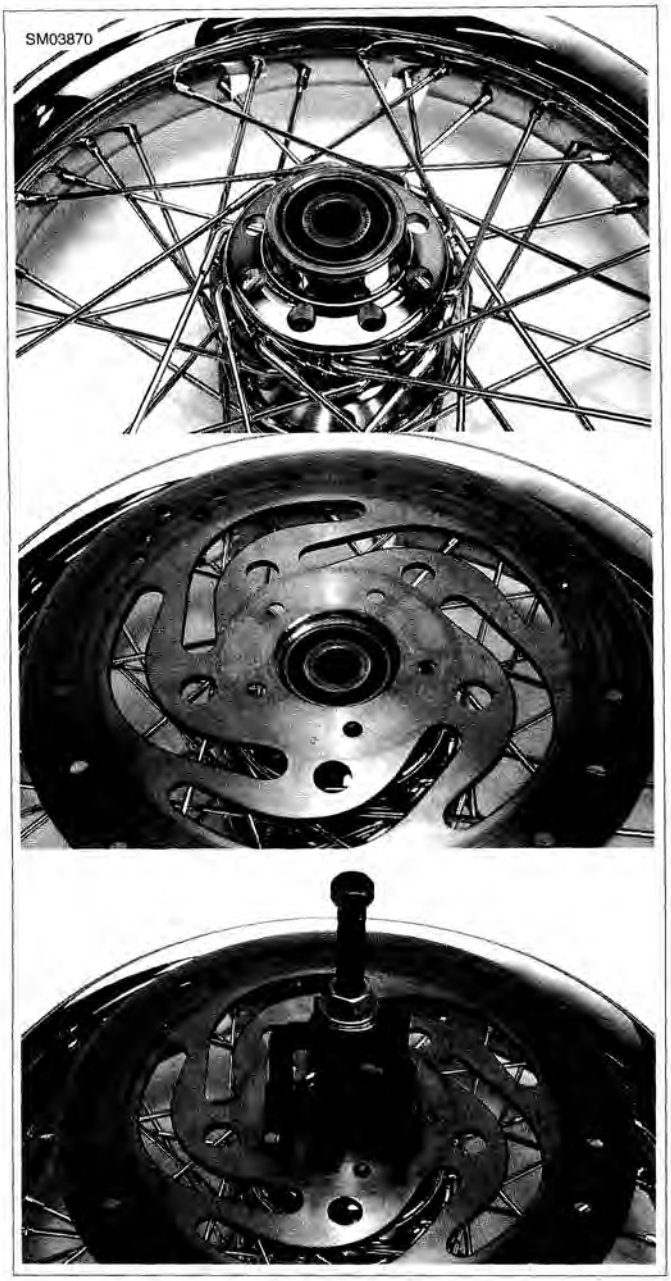
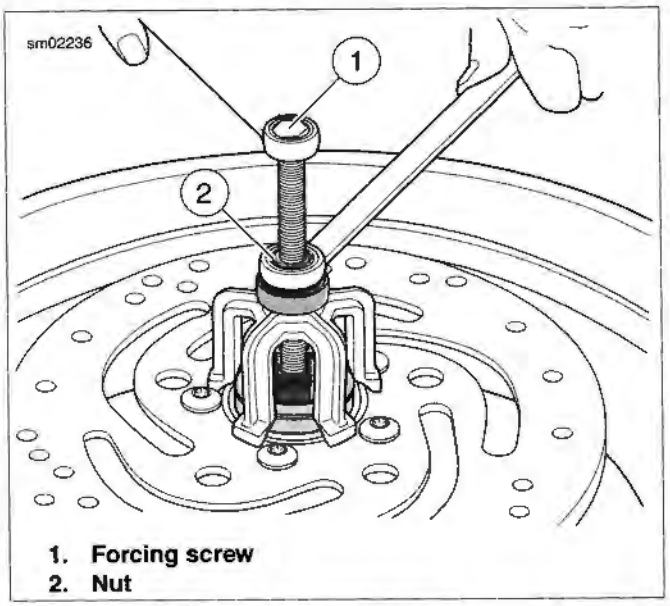


Figure 2-13. Brake Disk as Puller Aid



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

Figure 2-14. Remove Bearing

INSTALLATION

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

NOTE

Install first bearing on primary brake disc side of hub, which is identified by having one or two grooves cut into the disc mounting surface.

1. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060A) and assemble.
   a. Sparingly apply graphite lubricant to threads of threaded rod to prolong service life and verify smooth operation.
   b. See Figure 2-15. Place threaded rod through support plate. Insert assembly through wheel.
   c. See Figure 2-16. Place the **new** bearing (6) on rod (1) with lettered side facing away from wheel centerline.
   d. Install pilot (5), bearing (4), washer (3) and nut (2) over rod.
2. Hold hex end of threaded rod (1) and turn nut (2) to install bearing (6) into primary side of hub. Bearing will be fully seated when nut can no longer be turned. Remove tool.
3. Install spacer inside wheel hub.
4. Reverse tool and install opposite side bearing until bearing contacts inner spacer.

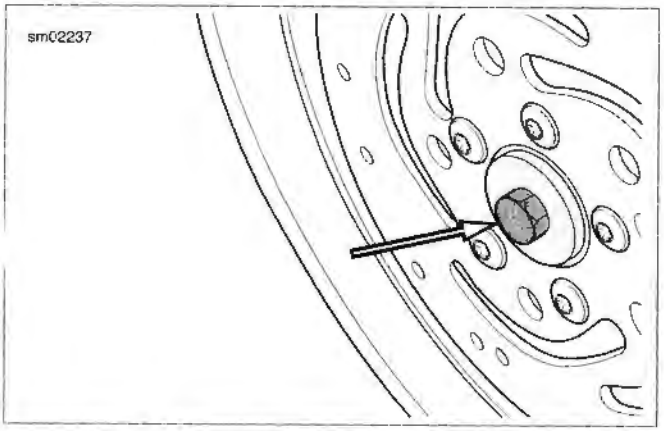
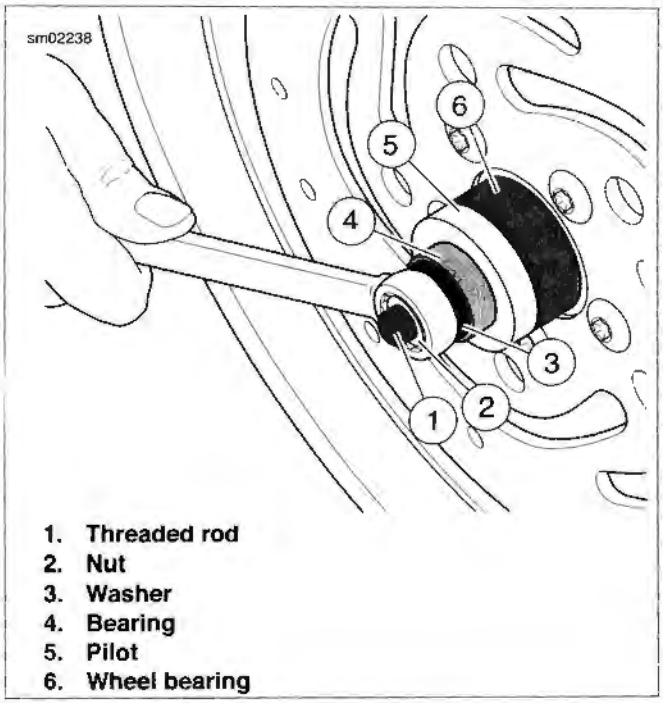
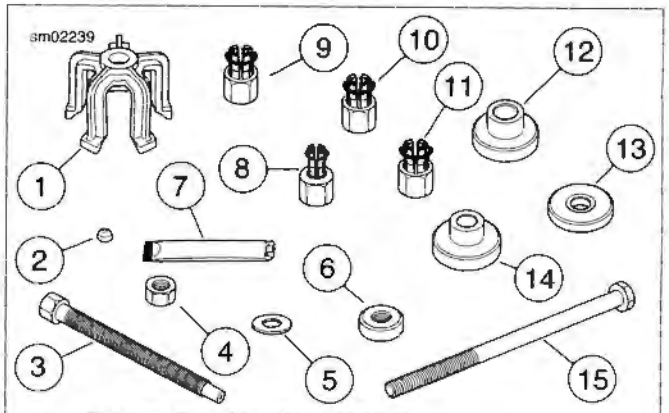


Figure 2-15. Installation Tool Support Plate



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

Figure 2-16. Installing Bearing



1. **Bridge, Part No. HD-44060-5**
2. **Steel ball, Part No. 12547**
3. **Forcing screw, Part No. HD-44060-4**
4. **Nut, Part No. 10210**
5. **Washer, Part No. 12004**
6. **Bearing, Part No. 217801**
7. **Lubricant, Part No. J-23444A**
8. **Collet, 3/4 in., Part No. HD-44060-3A**
9. **Collet (ABS), 25 mm, Part No. HD-44060-11**
10. **Collet, 1.0 in., Part No. HD-44060-7**
11. **Collet, 25 mm, Part No. HD-44060-10**
12. **Pilot, 1.0 in., Part No. HD-44060-8**
13. **Support plate, Part No. HD-44060-1**
14. **Pilot, 3/4 in., Part No. HD-44060-6**
15. **Threaded rod, Part No. 280856**

Figure 2-17. Wheel Bearing Installer/Remover Components

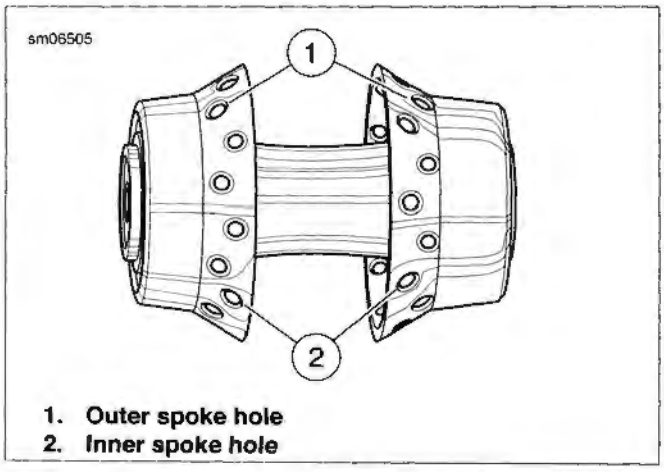
NOTES

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

WHEEL LACING: ANGLE FLANGE HUB

NOTES

- *See Figure 2-18. The following procedure is valid for 40-spoke wheels that use an angle flange hub regardless of rim style or diameter.*
- *The primary brake side of the hub can be identified as having one or two grooves cut into the disc mounting surface.*



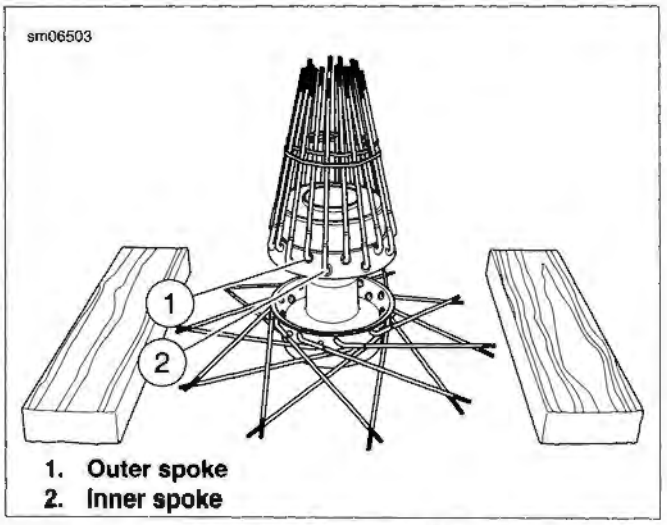
1. **Outer spoke hole**
2. **Inner spoke hole**

Figure 2-18. Angle Flange Hub

1. Place hub on workbench:
   a. Front: primary brake side up.
   b. Rear: brake side down.
2. Install all spokes in the lower flange.
3. See Figure 2-19. Flip hub over. Gather all outer spokes and hold upright with a rubber band. Repeat with the inner spokes using a second rubber band.
4. Install spokes in remaining flange.
5. Rotate the lower flange spokes as far as they will go:
   a. Outer spokes clockwise.
   b. Inner spokes counterclockwise.
6. Center the rim over the hub and spokes assembly and support on wooden blocks approximately 1.5 in (38.1 mm) thick.
   a. If valve is not located in the center of the rim, place valve hole facing up
   b. 19 in. and 21 in. with the valve located in the center of the rim can be placed either side up.

NOTE

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



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

Figure 2-19. Spokes Gathered

7. Install lower flange outer spokes and loosely install spoke nipples:
   a. See Figure 2-20. Rim with side valve hole: start at the valve stem hole (1).
   b. See Figure 2-21. Rim with center valve hole: start at the first hole counterclockwise (1) from valve stem hole.
   c. Install remaining outer spokes in every 4th hole.
8. Install lower flange inner spokes and loosely install spoke nipples:
   a. Starting at the 2nd hole counterclockwise (2) from first spoke installed, install inner spoke.
   b. Install remaining inner spokes in every 4th hole.
9. Carefully release upper flange inner spokes and fan out around rim, rotating them clockwise.
10. Starting at the first hole counterclockwise (3) from first spoke installed, install inner spoke. Install all remaining inner spokes in every 4th hole.
11. Carefully release upper flange outer spokes and fan out around rim, rotating them counterclockwise
12. Install outer spokes in remaining holes (4).
13. Verify spoke heads are seated. Evenly hand-tighten spoke nipples until snug. Only tighten until slack is removed. Proper torque will be applied when the wheel is trued. Adjust offset and true the wheel. See 2.9 TRUING LACED WHEELS.

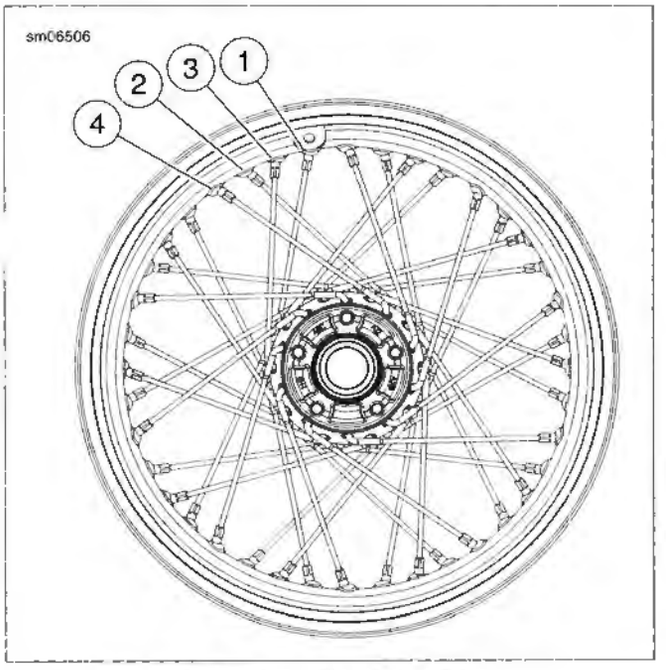


Figure 2-20. Side Valve Rim

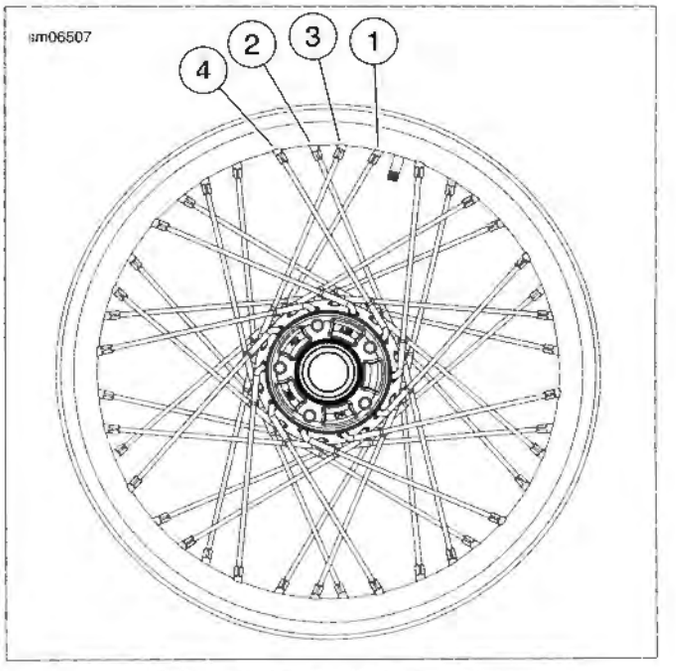


Figure 2-21. Center Valve Rim

GENERAL

The rim must be trued both laterally and radially. If **new** bearings were installed, wheels may be trued with only the bearings and center spacer installed.

SETTING RIM OFFSET

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

1. See Figure 2-22. Place a piece of tape to mark the center of each group of four spokes as shown. The groups should be directly opposite one another and approximately 90 degrees apart. Using different colors of tape or numbering each group is helpful.

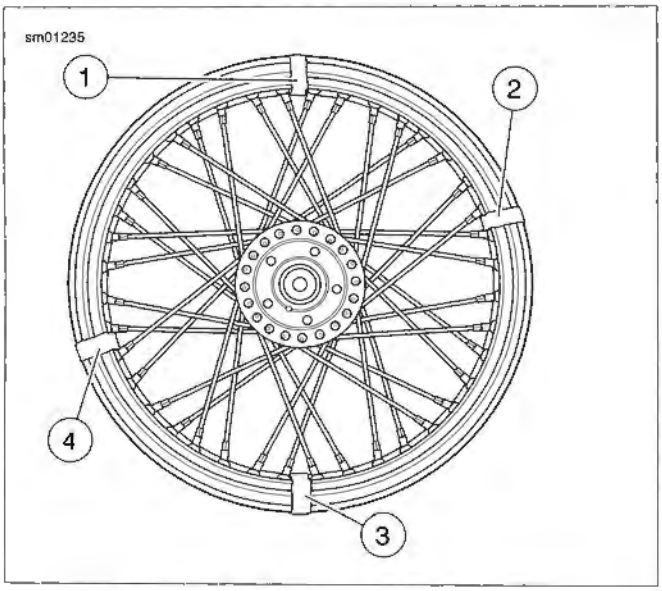


Figure 2-22. Marking Spoke Groups

2. See Figure 2-23. Mount wheel in WHEEL TRUING STAND (Part No. HD-99500-80) using truing arbor. Tighten arbor nuts so hub will turn on its bearings.

NOTE

The primary brake disc side of the hub can be identified by having one or two grooves cut into the disc mounting surface.

3. Lay a straightedge across the primary brake disc mounting surface of hub and one of the marked spoke groups.
4. See Figure 2-24. Measure the distance from the straightedge to the location shown, based on rim design, to determine distance "A". The measured offset should be within that shown in Table 2-12.

NOTES

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

5. If the dimension is not correct, adjust the four spokes using SPOKE WRENCH (Part No. HD-94681-80). For example, if the measurement on the rim **right** side is **less** than it should be, **loosen** the two spokes attached to the hub **right** side and **tighten** the two spokes attached to the hub **left** side. Turn all four spokes an equal number of turns until offset dimension is correct.
6. Repeat the previous step for all groups on the wheel.
7. Once offset is verified, proceed to 2.9 TRUING LACED WHEELS, Truing Wheels.

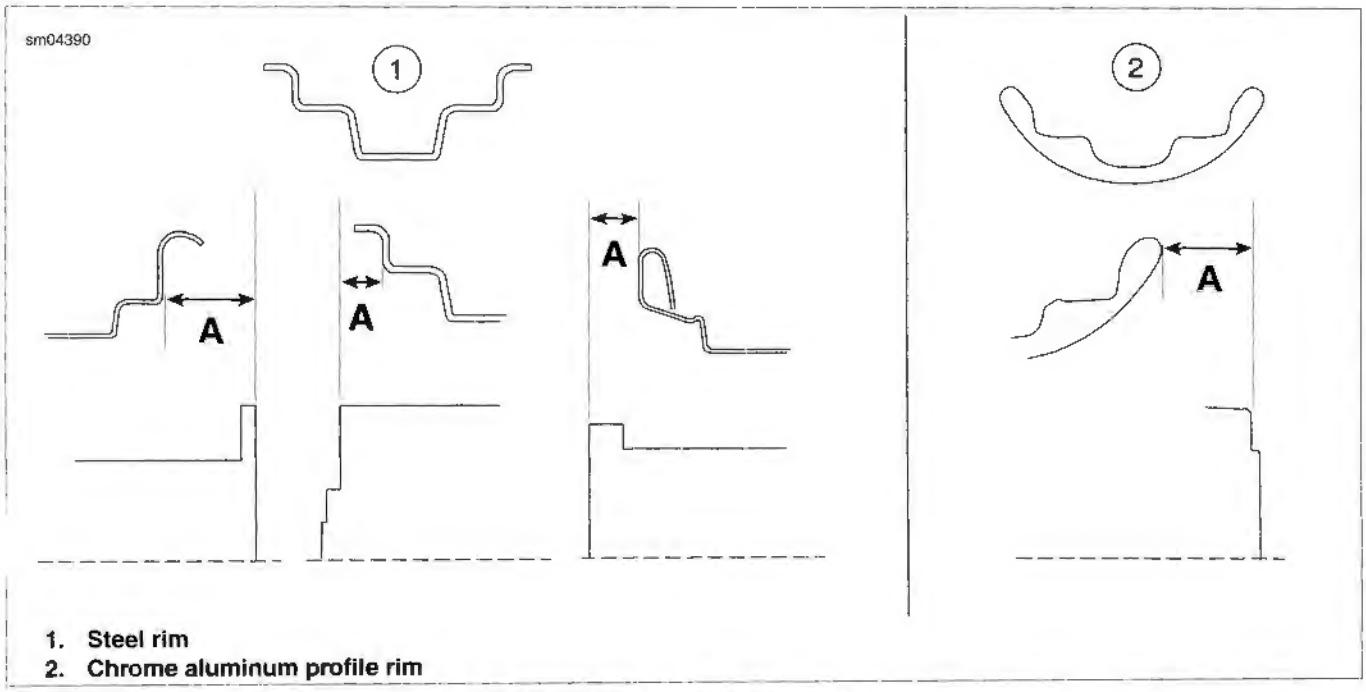
Figure 2-23. Front Wheel Hub Offset Dimension

Table 2-12. Wheel Offset Dimensions

RIM TYPE	MODEL	SIZE	WHEEL	IN	MM
Steel Laced (1)	FXST	21 x 2.15	Front	1.660-1.690	42.16-42.93
	FLST, FLSTC, FLSTN, FLSTSB	16 x 3	Front	1.267-1.297	32.18-32.94
	FLST, FLSTC, FLSTN	16 x 3	Rear	1.387-1.417	35.23-35.99
	FXST, FLSTSB	17 x 6	Rear	0.105-0.135	2.67-3.43

Table 2-12. Wheel Offset Dimensions

RIM TYPE	MODEL	SIZE	WHEEL	IN	MM
Chrome Aluminum Profile Laced (2)	FXST, FXSTC (including anniversary models)	21 x 2.15	Front	1.690-1.720	42.93-43.69
	FLSTC, FLSTN ANNIVERSARY	16 x 3	Front	0.983-1.013	24.97-25.73
	FLSTC, FLSTN ANNIVERSARY	16 x 3	Rear	1.103-1.133	28.02-28.78
	FXST	17 x 6	Rear	0.373-0.403	9.47-10.24



1. Steel rim
2. Chrome aluminum profile rim

Figure 2-24. Laced Wheel Hub Offset Dimensions

TRUING WHEELS

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

NOTES

- *To more accurately measure runout, a dial indicator can be used in place of the gauge rod.*
- *Radial truing should be performed before lateral truing.*

Radial Truing

1. See Figure 2-25. With the wheel mounted in WHEEL TRUING STAND (Part No. HD-99500-80), adjust the truing stand gauge (3) near to the rim's tire bead safety hump (4). If using a dial indicator, place the tip on the safety bead hump.
2. If working with a straight flange hub, seat each spoke head in the hub flange using a flat nose punch and mallet.

NOTES

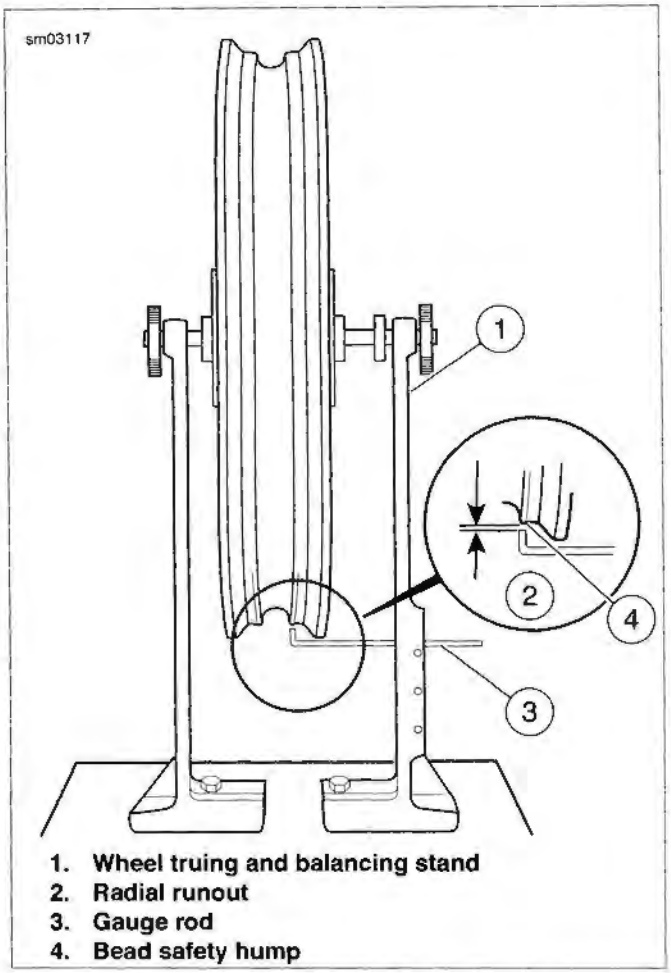
- *Always loosen the appropriate spokes, using SPOKE NIPPLE WRENCH (Part No. 94681-80), before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.*
- *Tighten or loosen spoke, one flat at a time, and recheck measurement. Small changes in the spokes can make large changes in the runout.*
- *Always work on groups that are opposite each other to maintain radial runout.*

3. Spin the rim slowly and check distance (2). The rim should be true within 0.030 in. (0.76 mm).
   a. If the rim contacts the gauge on or near a marked group of spokes, loosen the spokes in the group on the opposite side of the rim. Then tighten the spokes in the group where the rim makes contact an equal number of turns.
   b. If the rim contacts the gauge between two marked groups, loosen the spokes in both groups on the opposite side of the rim. Then tighten the spoke groups on the side of the rim that makes contact an equal number of turns.

4. When the wheel is centered and trued, start at the valve stem hole and tighten any loose spoke nipples one turn at a time until they are snug.
5. Working alternately across the wheel, use SPOKE TORQUE WRENCH (Part No. HD-48985) evenly tighten all spokes to specification listed in Table 2-13.
6. If working with a straight flange hub, verify each spoke head is seated in the hub flange using a flat nose punch and mallet.
7. Verify radial runout is still within specification.
8. Proceed to Lateral Truing.

⚠WARNING

Spokes that are too tight can draw nipples through the rim or distort hub flanges. Spokes that are too loose can continue to loosen when put in service. Either condition can adversely affect stability and handling, which could result in death or serious injury. (00286a)



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

Figure 2-25. Checking Radial Runout

Table 2-13. Spoke Nipple Torque Specification

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

Lateral Truing

NOTE

To more accurately measure runout, a dial indicator can be used in place of the gauge rod.

1. See Figure 2-26. With the wheel mounted in WHEEL TRUING STAND (Part No. HD-99500-80), adjust the gauge rod (3) near the rim bead flange.
2. Rotate the rim slowly and check lateral runout (2). If runout exceeds 0.030 in. (0.76 mm), adjust spokes as follows.

NOTES

- *Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.*
- *Tighten or loosen spoke, one flat at a time, and recheck measurement. Small changes in the spokes can make large changes in the runout.*

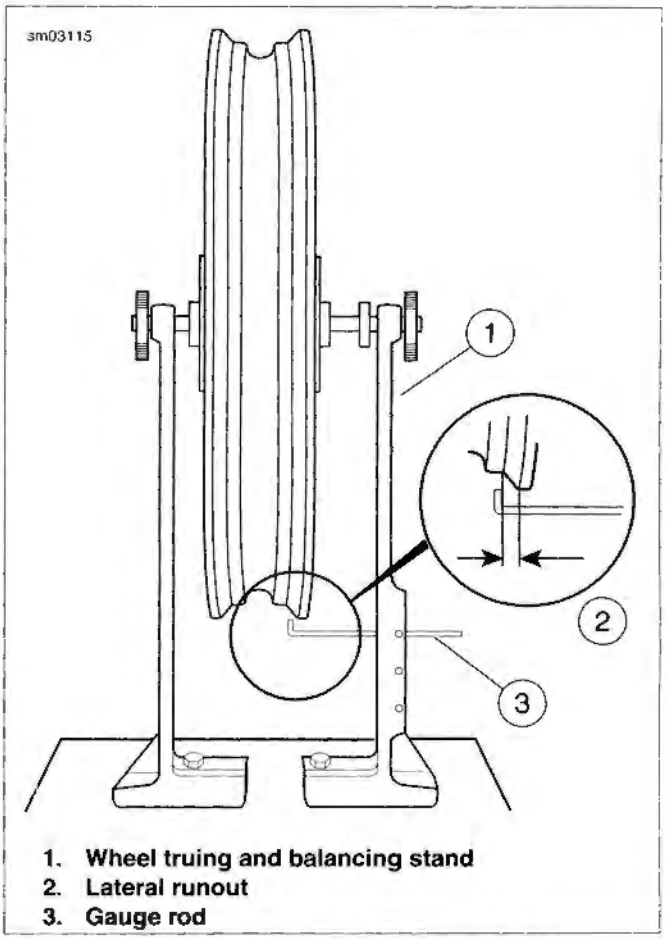
3. Again working in groups of four, loosen two spokes on the tight side and tighten the two spokes on the loose side.
4. Repeat with each group until wheel is within specification.

5. Verify all spoke nipples are tightened to the specification shown in Table 2-13.

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

NOTE

After installation of the front wheel, visually check that it is approximately centered between the fork fender bosses.



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

Figure 2-26. Checking Lateral Runout

GENERAL

Wheels should be checked for lateral and radial runout before installing a new tire or tube. Checking cast or laced wheels is performed using the same procedure.

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

Always check condition of the wheel bearings before checking or adjusting wheel runout. See 2.7 SEALED WHEEL BEARINGS, Inspection.

CHECKING WHEEL RUNOUT

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

Lateral Runout

See Figure 2-27. Mount wheel in WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80).

NOTE

To more accurately measure runout, a dial indicator can be used in place of the gauge rod.

To check lateral runout, place a gauge rod near, or dial indicator on the rim bead flange and measure distance at several locations. Lateral runout must not exceed 0.030 in. (0.76 mm).

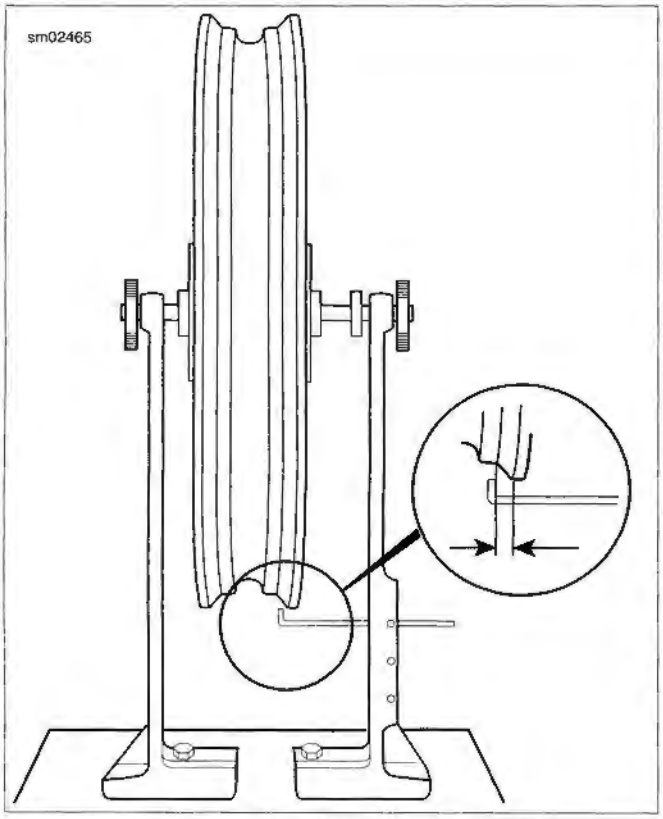
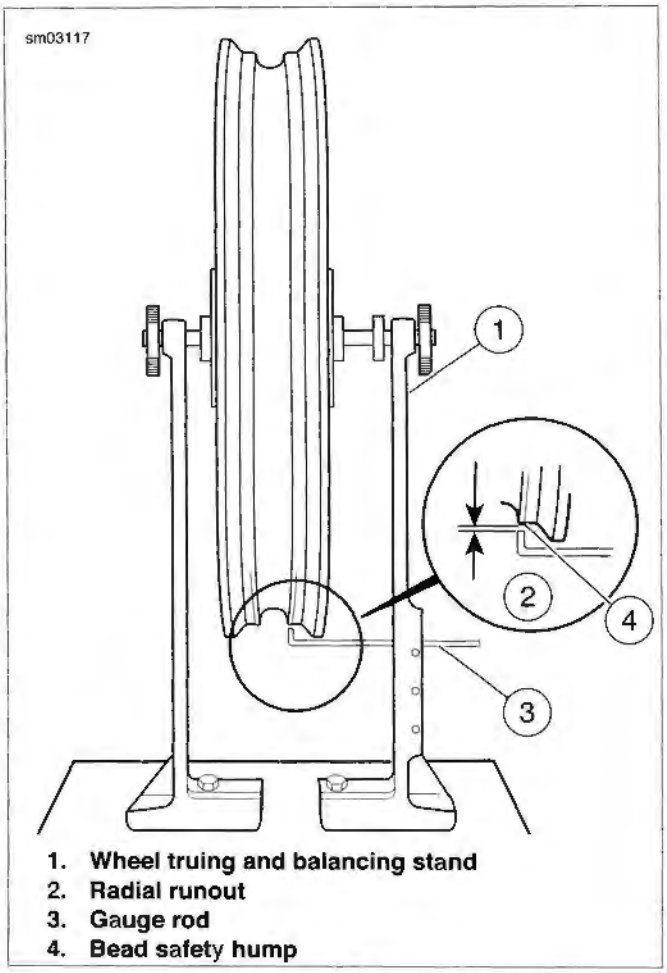


Figure 2-27. Checking Lateral Runout

Radial Runout

See Figure 2-28. Adjust truing stand gauge to the rim's tire bead safety hump. Rotate wheel and measure distance at several locations. Runout must not exceed 0.030 in. (0.76 mm).



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

Figure 2-28. Checking Radial Runout

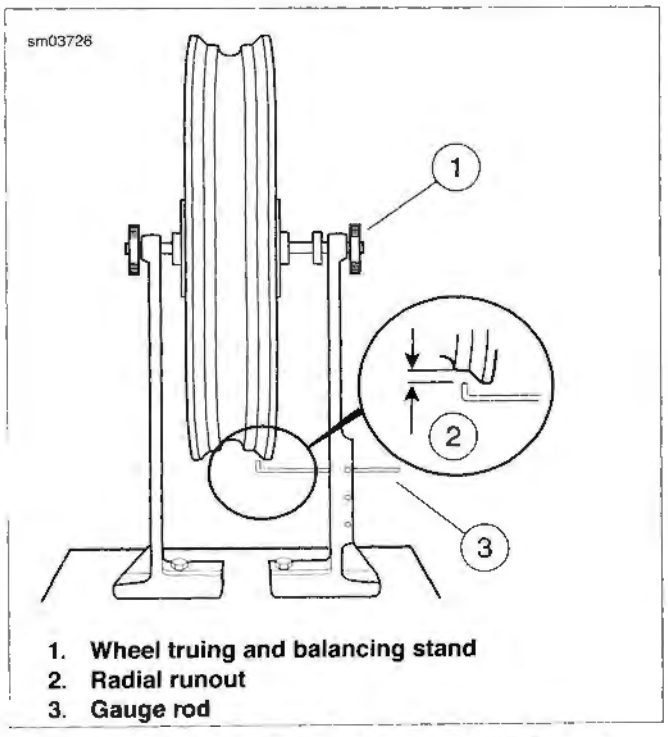
If either measurement is not within specification:

- Cast wheel: Replace the wheel.
- Laced wheel: Adjust spokes to true the wheel. See 2.9 TRUING LACED WHEELS.

RADIAL RUNOUT

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

See Figure 2-29. Using WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80), check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in. (0.76 mm).



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

Figure 2-29. Checking Cast Wheel Radial Runout

INSPECTION

⚠WARNING

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

⚠WARNING

Check vehicle alignment according to following procedures. Incorrect alignment can adversely affect stability and handling, which could result in death or serious injury. (00287a)

1. Verify wheels are true to specifications. See 2.9 TRUING LACED WHEELS or 2.10 CHECKING CAST WHEEL RUNOUT.
2. Check steering head bearing adjustment and adjust if necessary. See 1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB or 1.21 STEERING HEAD BEARINGS: FLSTSB.
3. Check that center of rear axle is equidistant from the center of the rear fork pivot shaft. Check measurements on both sides of vehicle. The measurement must be equal to within 1/32 in. (0.794 mm) on both sides of vehicle. Adjust if necessary.

GENERAL

⚠WARNING

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

CAUTION

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)

CAUTION

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

See Figure 2-30. Master cylinders designed for dual disc (two caliper) operation have an 11/16 in. (17.5 mm) bore, while those that are designed for single disc (one caliper) operation have a 9/16 in. (14.3 mm) bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket.

REMOVAL AND DISASSEMBLY

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

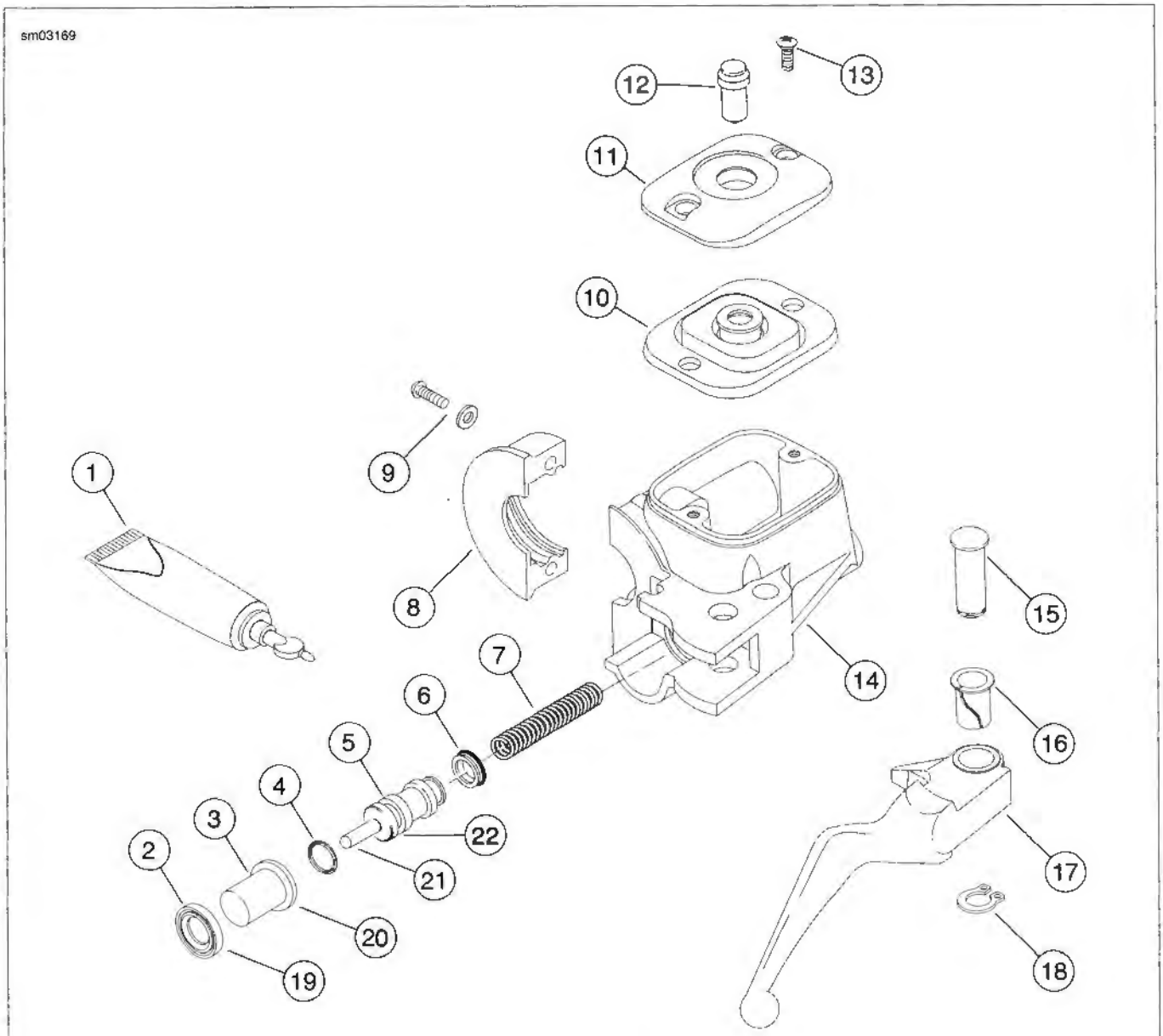
CAUTION

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

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

CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)

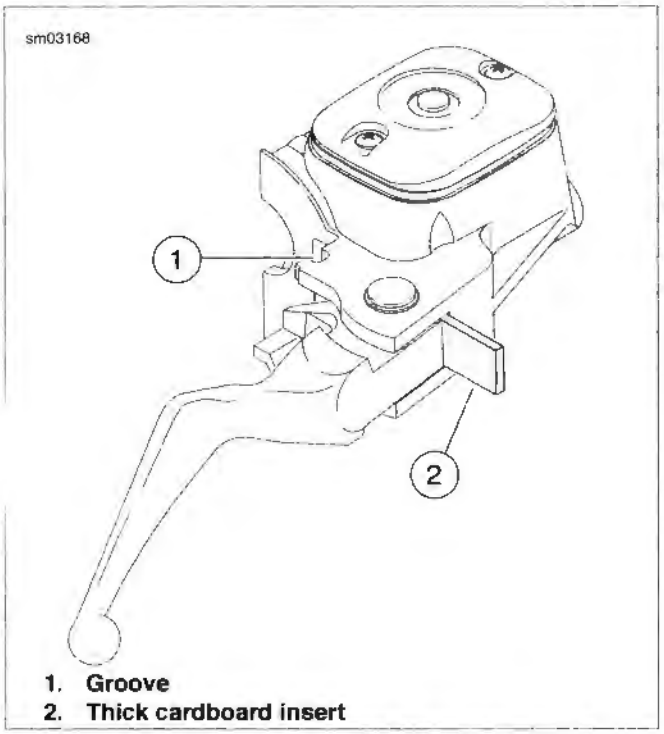


1. Lubricant
2. Wiper
3. Piston cap
4. O-ring
5. Piston
6. Primary cup
7. Spring
8. Handlebar clamp
9. T27 TORX screw and washer (2)
10. Gasket
11. Cover
12. Site glass
13. Screw (2)
14. Master cylinder reservoir
15. Pivot pin
16. Bushing
17. Brake hand lever
18. Retaining ring
19. Flat side
20. Shoulder
21. Pin
22. O-ring groove

Figure 2-30. Front Brake Master Cylinder

3. See Figure 2-31. Place the cardboard insert between the brake lever and lever bracket.
4. See Figure 2-30. Loosen both switch housing clamp screws. Remove the two T27 TORX screws with flat washers (9) to detach the handlebar clamp (8) from the master cylinder reservoir (14).
5. Remove retaining ring (18) from pivot pin groove at bottom of master cylinder bracket.
6. Remove pivot pin (15) and brake hand lever (17).
7. Carefully remove wiper (2) with pick or similar tool.
8. Remove piston cap (3).

9. Remove piston (5) with O-ring (4) and primary cup (6).
10. Remove spring (7).
11. Remove both screws (13), cover (11) and the cover gasket (10).



1. **Groove**
2. **Thick cardboard insert**

Figure 2-31. Cardboard Insert

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. 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. Carefully inspect all parts for wear or damage and replace as necessary.
3. Inspect the piston bore in the master cylinder housing for scoring, pitting or corrosion. Replace the housing if any of these conditions are found.
4. Inspect the outlet port that mates with the brake line fitting. As a critical sealing surface, replace the housing if any scratches, dents or other damage is noted.
5. Inspect the cover gasket for cuts, tears or general deterioration. Replace as necessary.

ASSEMBLY AND INSTALLATION

NOTE

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

1. See Figure 2-30. Fit o-ring (4) into groove on outboard side of piston (5) (pin side).
2. Fit primary cup (6) over lip on inboard side of piston, so that closed side (smaller OD) contacts shoulder.
3. Coat piston bore of master cylinder reservoir with special lubricant (1) supplied in the service parts kit. Also apply the lubricant to OD of installed o-ring (4) and primary cup (6).
4. Insert spring (7) into piston bore, so that it seats against counterbore (recess) at bottom.
5. Slide piston over spring.
6. Fit wiper (2) over piston cap (3) so that flat side of wiper contacts cap shoulder.
7. Fit piston cap over piston pin (5).
8. Press down on wiper until it contacts the counterbore. Larger OD of wiper must be completely seated in groove on outlet side of piston bore.
9. Install the master cylinder reservoir cover (11). Secure with two screws, but do not tighten at this time.
10. Align hole in brake hand lever (17) with hole in master cylinder bracket. From the top of the assembly, slide pivot pin (15) through bracket and hand lever.

⚠WARNING

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

11. Install **new** retaining ring (18) in pivot pin groove. Verify that retaining ring is completely seated in groove.

CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)

12. See Figure 2-32. Position the brake lever/master cylinder assembly inboard of the switch housing assembly, engaging the tab (2) on the lower switch housing (1) in the groove (3) at the top of the brake lever bracket (4).
13. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two T27 TORX screws (with flat washers). Position hand lever and controls

for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm).

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

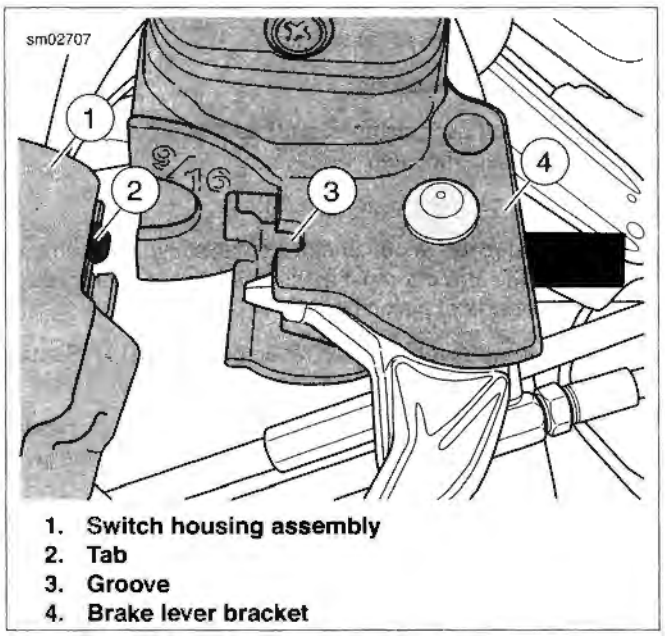
CAUTION

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

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

⚠WARNING

Use fresh D.O.T. 4 fluid. Contaminated fluid can adversely affect braking, which could result in death or serious injury. (00504b)



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

Figure 2-32. Attach Master Cylinder to Right Handlebar Switches

NOTE

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

16. Remove the master cylinder reservoir cover. Stand motorcycle up so master cylinder is level. Add brake fluid to master cylinder reservoir until fluid level is 1/4 ± 1/8 in. (6.35 ± 3.18 mm) from the top.

NOTE

Use only Harley-Davidson DOT 4 BRAKE FLUID, Part No. 99953-99A (12 ounce bottle), from a sealed container.

⚠WARNING

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

17. Bleed front brake system. See 1.16 BLEEDING BRAKES.
18. Verify proper operation of the master cylinder relief port. Actuate the brake hand lever. A slight spurt of fluid will break the fluid surface in the reservoir compartment if all internal components are working properly.
19. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/4 ± 1/8 in. (6.35 ± 3.18 mm) from the top.
20. Install the master cylinder reservoir cover and gasket. Tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
21. With the Ignition/Light Key Switch turned to IGNITION, actuate the front brake hand lever to verify operation of the brake lamp.

⚠WARNING

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

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

NOTE

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

REMOVAL

NOTE

If only replacing brake pads, see 1.17 BRAKE PADS AND DISCS.

⚠CAUTION

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

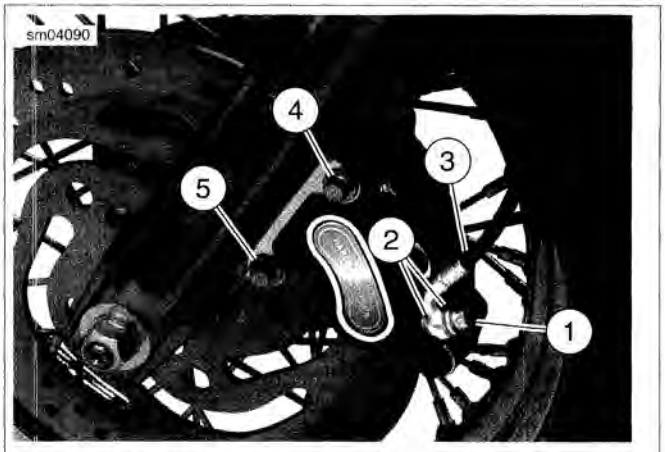
CAUTION

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

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. See Figure 2-33. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach front brake line (3) from caliper. Discard washers.
2. Remove the upper (4) and lower (5) mounting bolts (metric). Lift caliper upward to remove from brake disc.



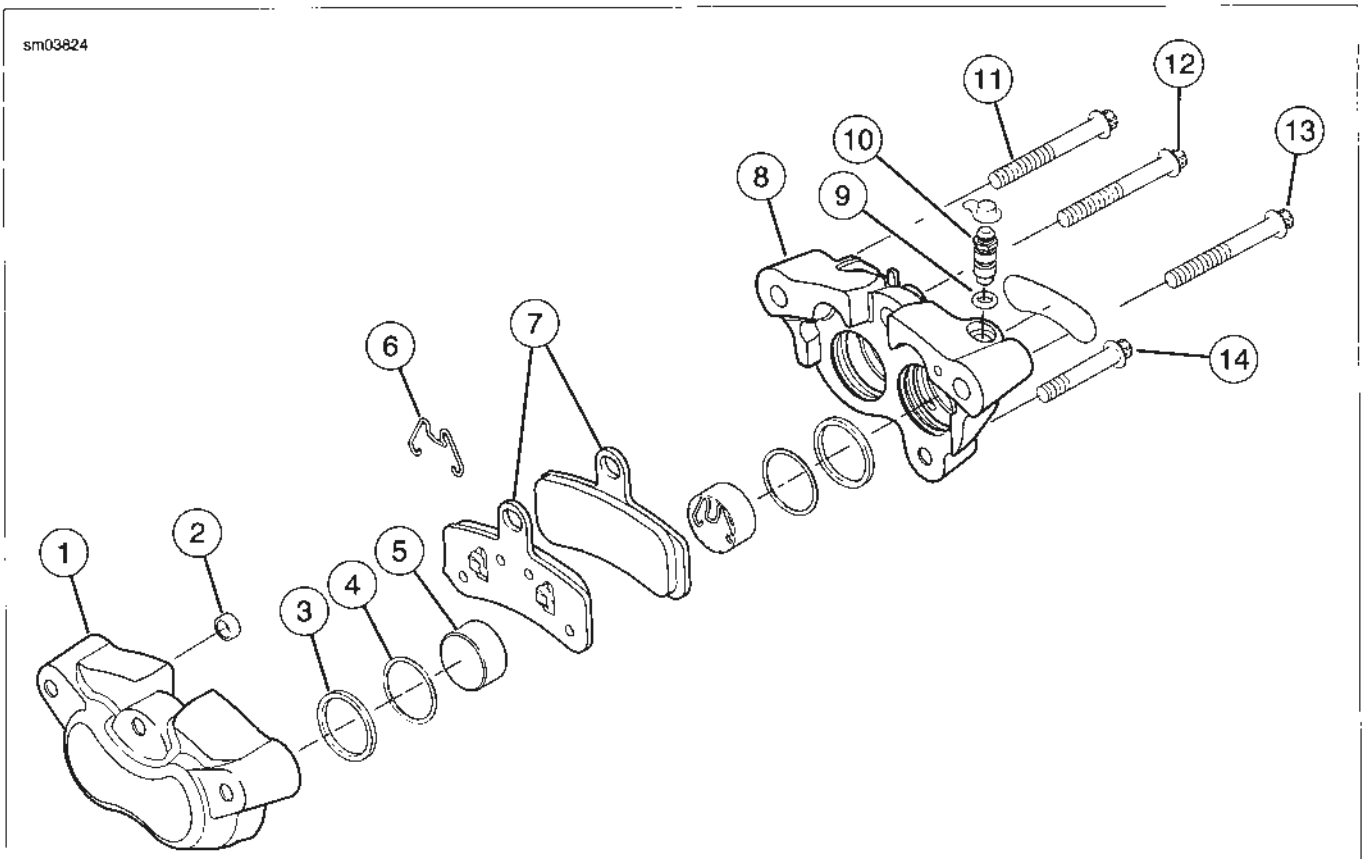
1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Front brake line**
4. **Upper mounting bolt (metric)**
5. **Lower mounting bolt (metric)**

Figure 2-33. Front Caliper

DISASSEMBLY

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

1. See Figure 2-34. Remove bridge bolt/pad pin (12) (metric), brake pads (7) and bridge bolt (11) (metric) to separate caliper housings (1, 8).



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

Figure 2-34. Front Brake Caliper

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

⚠WARNING

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

3. See Figure 2-35 and Figure 2-36. Remove pistons.
   a. Place FRONT BRAKE CALIPER PISTON REMOVER (Part No. HD-48649) (3) between caliper housings.

   NOTE

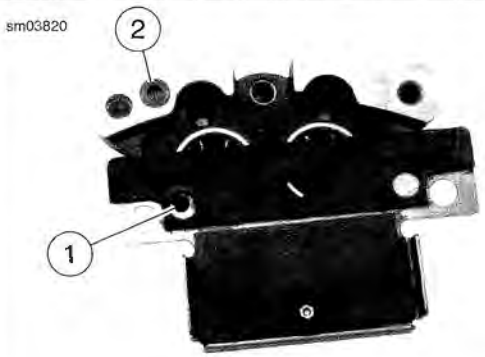
   Ensure the hole in the tool (1) aligns with the crossover holes (2) in the caliper housings.

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

CAUTION

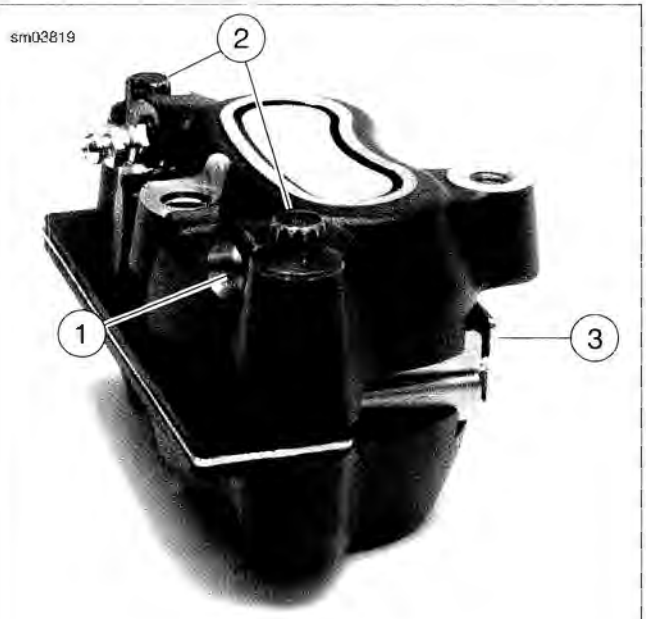
Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (00529d)

6. See Figure 2-37. Remove and discard crossover seal (1) from inside caliper housing.
7. Using a wooden toothpick (2), remove a wiper (3) and square seal (4) from each caliper bore. Discard all removed parts.



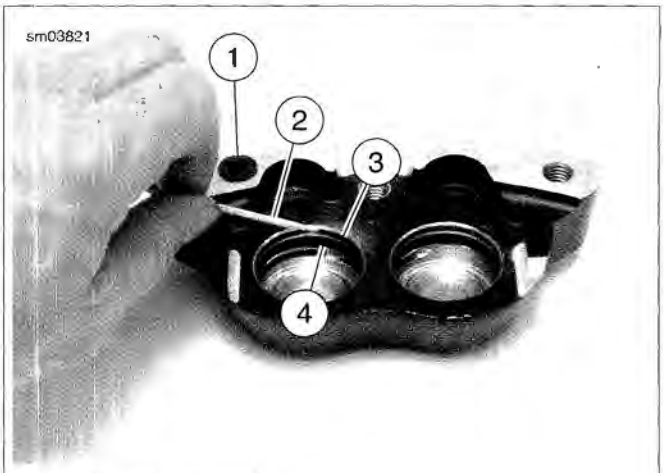
1. Hole in tool
2. Crossover hole in caliper housing

Figure 2-35. Installing Tool



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

Figure 2-36. Removing Pistons



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

Figure 2-37. Wipers and Seals

CLEANING, INSPECTION AND REPAIR

⚠WARNING

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

⚠WARNING

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

1. Clean all parts with denatured alcohol or D.O.T. 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe parts 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, worn, or corroded.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect caliper piston bore. Do not hone bore. If bore should show pitting or corrosion, replace caliper.
   c. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace both pins.
   d. Always replace wipers, square seals and crossover seal after disassembly.

3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.
4. Inspect brake pads and brake disc. See 1.17 BRAKE PADS AND DISCS.

ASSEMBLY

NOTE

Do not use D.O.T. 4 brake fluid for lubrication. Use of D.O.T. 4 brake fluid will result in increased lever travel.

1. Lubricate the following parts prior to assembly using a light coat of G.E. VERSILUBE® #G322 L SILICONE GREASE (marked "Piston Lube") from the service parts kit. All other surfaces must be dry for assembly.
   a. Lubricate nose radius and outside diameter of piston. Apply lube to inside of caliper piston bores.
   b. Apply lube to inside diameter of seals and wipers.

CAUTION

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

2. See Figure 2-34. Install a **new** square seal (3) and a **new** wiper (4) into each piston bore. Use a wooden toothpick to aid installation, if needed.
3. See Figure 2-38. Install pad spring (2) in each piston. Ensure spring is securely installed in the groove in the piston.
4. Turn the piston so the pad spring (2) is oriented as shown. Carefully insert pistons, by hand, into bores of both caliper housings. Press pistons squarely into place until they bottom in the bores. If installation shows resistance, remove piston and check that seals and wipers are properly installed.
5. Place a **new** crossover seal (1) on inside caliper housing.
6. Assemble caliper housings.
   a. Install bleeder valve and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
   b. Verify that **new** crossover seal is installed on inside caliper housing.
   c. See Figure 2-34. Mate inside and outside caliper housings using bridge bolt (11) and upper mounting bolt (long) (13) (metric).
   d. Tighten bridge bolt to 28-38 ft-lbs (38.0-51.5 Nm).

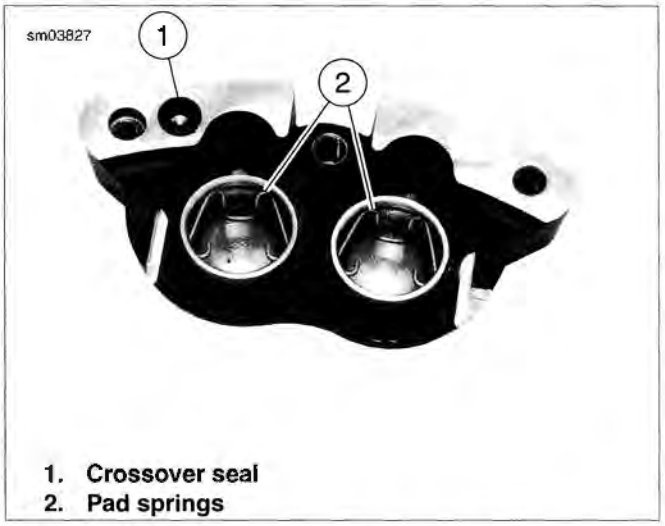
⚠WARNING

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

NOTES

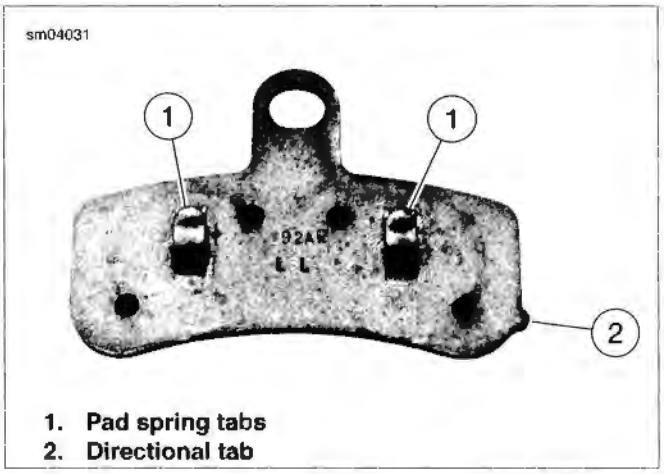
- *See Figure 2-39. Ensure the pad spring tabs (1) on brake pad engage the pad springs in the pistons.*
- *If the directional tab (2) does not face down when caliper is installed, brake noise may develop.*

7. Install **new** pads into caliper. The directional tab (2) must face down when caliper is installed.
8. See Figure 2-34. Install pad pin/bridge bolt (12) (metric). Tighten to 15-16 ft-lbs (20.3-22.6 Nm).



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

Figure 2-38. Front Caliper Pad Springs



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

Figure 2-39. Front Brake Pad

INSTALLATION

1. See Figure 2-40. Attach caliper to fork leg.
   a. Place caliper over brake disc with bleeder valve facing upwards.
   b. Loosely install upper mounting bolt (4) (metric) into top hole on fork leg.
   c. Install lower mounting bolt (5) (metric) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).

CAUTION

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

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

⚠CAUTION

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

3. Remove cover from front brake master cylinder. Fill master cylinder with D.O.T. 4 BRAKE FLUID. Verify that fluid level is 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below top of reservoir with master cylinder in a level position.

⚠WARNING

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

4. Bleed brake system. See 1.16 BLEEDING BRAKES.

⚠WARNING

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

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

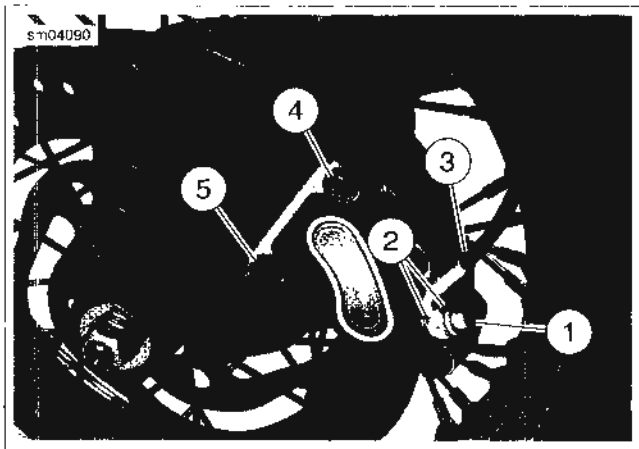
⚠WARNING

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

8. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 1.16 BLEEDING BRAKES.

NOTE

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



1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Front brake line**
4. **Upper mounting bolt (metric)**
5. **Lower mounting bolt (metric)**

Figure 2-40. Front Caliper

REMOVAL

⚠CAUTION

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

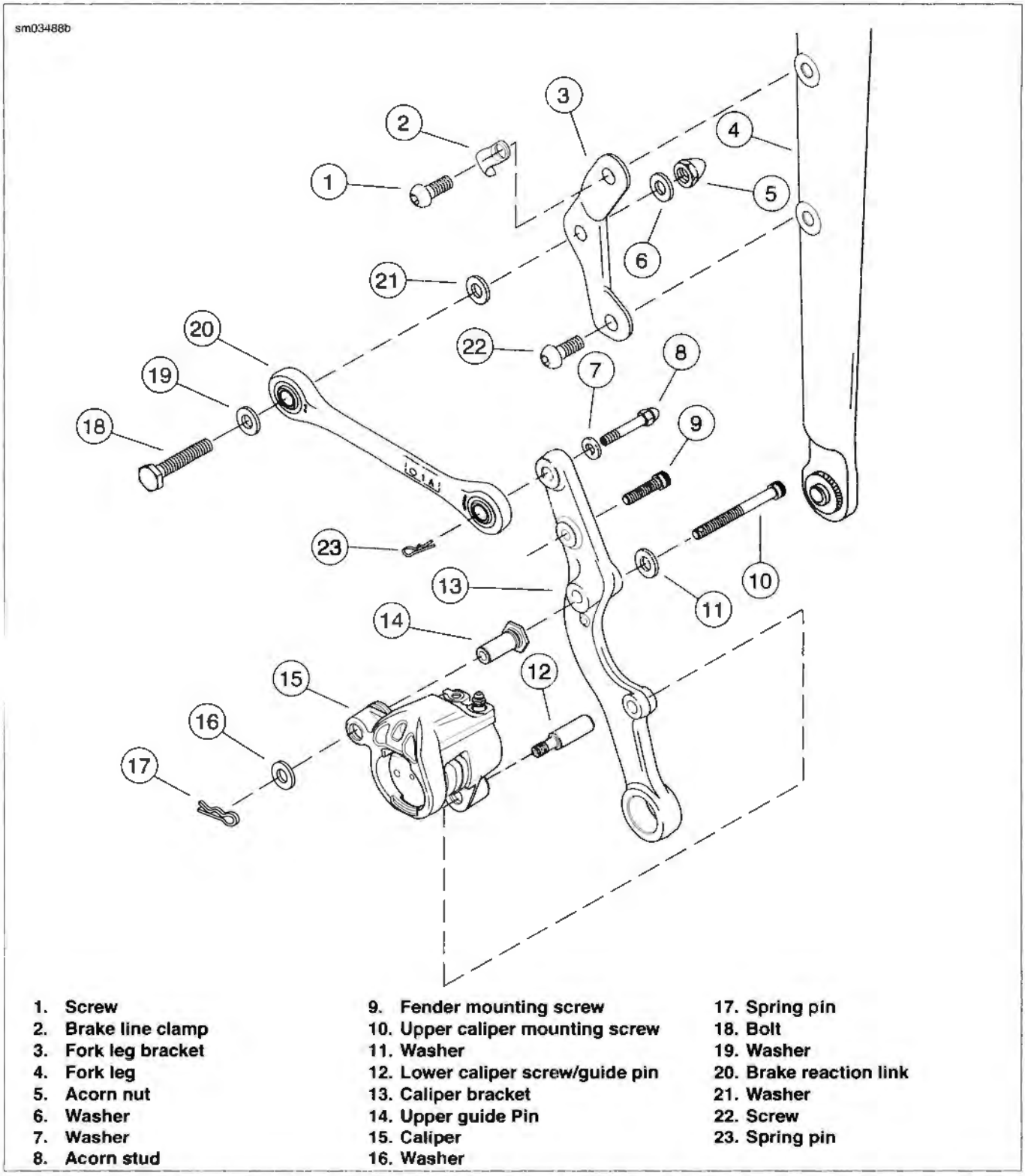
CAUTION

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

CAUTION

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

1. Remove banjo bolt and two steel/rubber washers to disconnect brake line from caliper. Discard washers.
2. See Figure 2-41. Remove lower caliper screw/guide pin (12).
3. Remove spring pin (17), washer (16), upper caliper mounting screw (10), and washer (11).
4. Remove caliper (15) with pads from brake disc.
5. If the front brake caliper support assembly needs to be removed, perform the following steps:
   a. Remove acorn stud (8), washer (7), and spring pin (23).
   b. Remove screws (1, 22) with brake line clamp (2), fork leg bracket (3), and brake reaction link (20).



1. Screw
2. Brake line clamp
3. Fork leg bracket
4. Fork leg
5. Acorn nut
6. Washer
7. Washer
8. Acorn stud
9. Fender mounting screw
10. Upper caliper mounting screw
11. Washer
12. Lower caliper screw/guide pin
13. Caliper bracket
14. Upper guide Pin
15. Caliper
16. Washer
17. Spring pin
18. Bolt
19. Washer
20. Brake reaction link
21. Washer
22. Screw
23. Spring pin

Figure 2-41. Front Brake Caliper

DISASSEMBLY

1. See Figure 2-42. Remove retainer screw (10), retainer pad (9) and inside pad of brake pad set (11).
2. Remove the outer pad of brake pad set (11), mounting bracket (17) and spring clip (14) as an assembly. Remove pad from mounting bracket by pushing the pad free of the spring clip.
3. Pry out the piston retaining ring (8) by inserting a small screwdriver into the notched groove at the bottom of the piston bore.

⚠CAUTION

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

NOTE

Be sure piston is not dropped on hard surface.

4. Remove the piston dust boot (7). Then remove the piston by applying air pressure to the hydraulic brake line inlet.
5. Pull guide pin (16) out, then remove dust boot (15) from groove in caliper.
6. Pry seal (5) and the three o-rings (2) out of their grooves.

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 parts 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.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect caliper piston bore. Do not hone bore. If bore shows pitting or corrosion, replace caliper.
   c. Always replace seals and o-rings after disassembly.

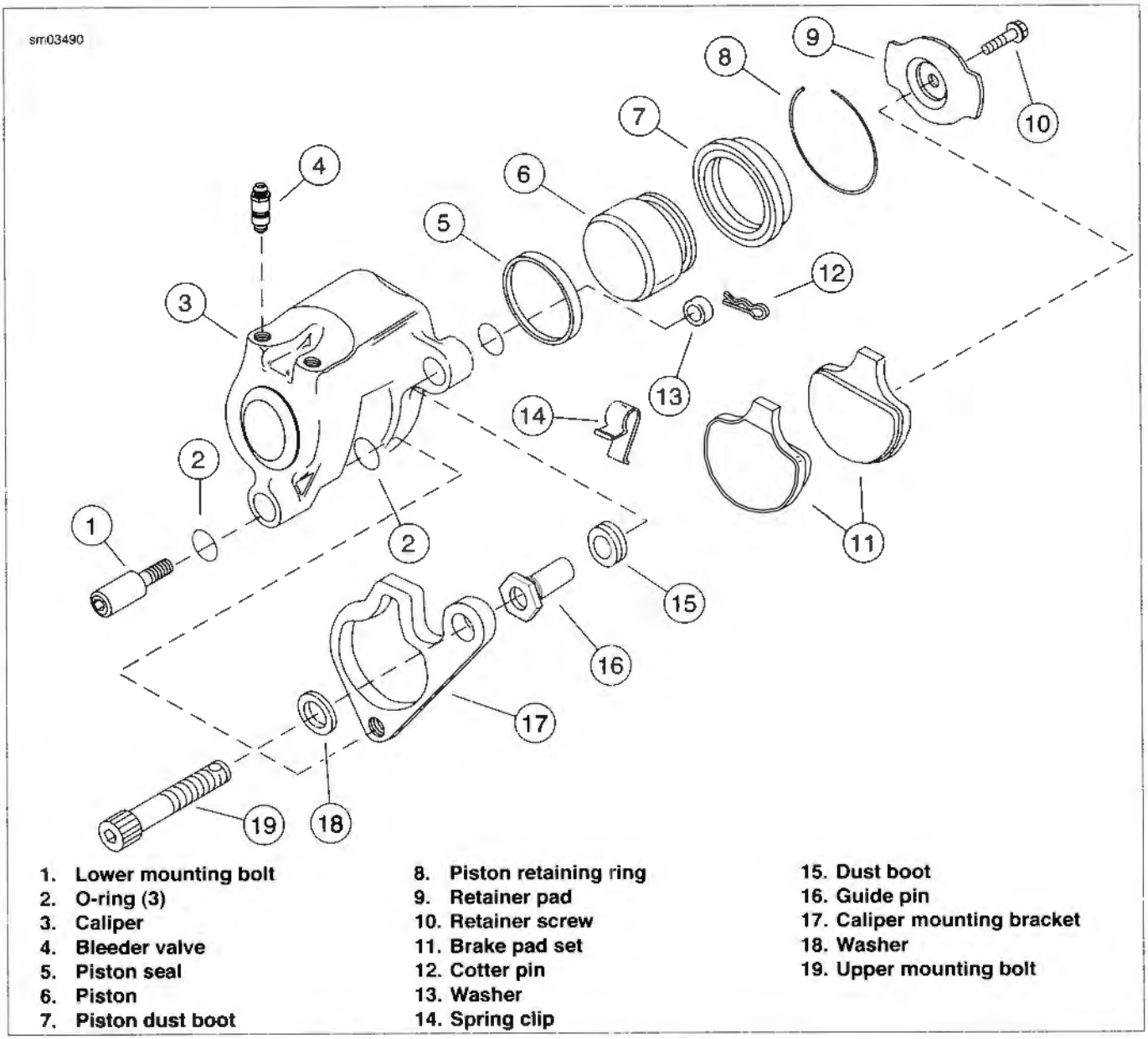
⚠WARNING

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

3. Inspect brake pads and brake disc. If brake pad friction material is worn to 1/16 in. (1.6 mm) or less, replace entire set. After the brake pads are installed, burnish by making normal stops.

NOTE

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



1. **Lower mounting bolt**
2. **O-ring (3)**
3. **Caliper**
4. **Bleeder valve**
5. **Piston seal**
6. **Piston**
7. **Piston dust boot**
8. **Piston retaining ring**
9. **Retainer pad**
10. **Retainer screw**
11. **Brake pad set**
12. **Cotter pin**
13. **Washer**
14. **Spring clip**
15. **Dust boot**
16. **Guide pin**
17. **Caliper mounting bracket**
18. **Washer**
19. **Upper mounting bolt**

Figure 2-42. Caliper Assembly

ASSEMBLY

CAUTION

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

1. See Figure 2-42. Apply a thin coating of G.E. VERSILUBE® #G322 L SILICONE GREASE to the exterior surfaces of piston seal (5) and o-rings (2) in their respective grooves.
2. Push the piston dust boot (7), with the open side downward, over the top of the piston. Push downward on the boot until the inner lip seats in the groove at the top of the piston.
3. Coat the outside diameter and bottom chamfer of piston (6) with GE Silicone Versilube grease (G322L) and push the piston with dust boot into the piston bore. If necessary, press the piston in with a "C" clamp.

NOTE

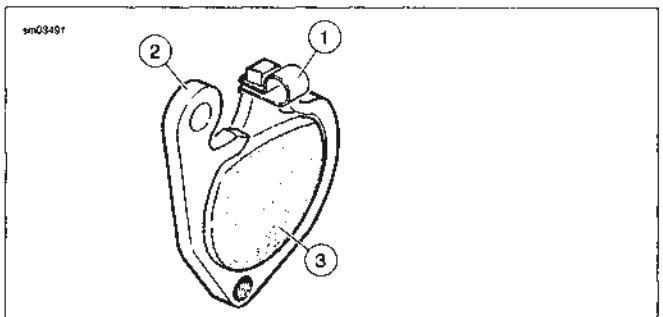
Piston must be pressed all the way into the bore when new brake pads have been installed to ensure proper clearance when calipers are assembled to vehicle.

4. Position the gap of the retaining ring (8) at the top of the caliper and compress the retaining wire into the piston bore. Push the retaining wire firmly against the piston dust boot.
5. Lightly coat the bores of the caliper mounting lugs with Dow Corning MOLY 44 grease (Part No. 94674-99).

6. Lightly coat the cavity of dust boot (15) with Dow Corning 44 grease. Insert the flanged end of dust boot into the internal groove of the top caliper mounting lug.
7. Push the guide pin (16) into dust boot. Push guide pin until the dust boot seats in the grooved shoulder of the pin.
8. Place the inner pad of brake pad set (11) (without insulator backing) in the recessed seat, machined into the caliper.
9. Position the retainer pad (9) within the counterbore at the inside end of the caliper. Insert self-tapping retainer screw (10) through the hole in the center of pad retainer and thread into the hole in the pad. Tighten the screw to 40-50 **in-lbs** (4.5-5.6 Nm).
10. Lay the mounting bracket (17) down on a firm flat surface. The upper mounting bolt hole must be positioned at the upper right.
11. See Figure 2-43. Install the spring clip at the top of mounting plate as shown.
12. See Figure 2-42. Take the outer pad of the brake pad set (11) (with insulator backing) and place it on top of the spring clip with the lower end of the pad slightly entering the opening of the mounting plate. With the pad centered within the mounting plate and the insulated back facing downward, push down on the pad until it is against the flat surface and is held firmly by spring tension from the spring clip.
13. Insert the outer pad of the brake pad set (11), mounting bracket (17), and spring clip (14) assembly into place with the backside of the pad against the face of the piston.

NOTE

The spring clip loop and friction material must always face away from the piston. If it is wrong, the pad must be removed, the mounting plate reversed and the parts assembled again.



1. **Spring clip**
2. **Mounting plate**
3. **Pad**

Figure 2-43. Spring Clip Installation

INSTALLATION

1. See Figure 2-41. Coat the outside diameter of lower caliper screw/guide pin (12) with Dow Corning MOLY 44 light grease (Part No. 94674-99).
2. Position the caliper with the disc between the friction pads. Align the two mounting holes in the caliper with the mounting holes in the bracket.
3. Place flat washer (11) on upper mounting bolt (10). Then insert mounting bolt through caliper bracket (13) and upper guide pin (14).

NOTE

See Figure 2-44. The Springer caliper bracket has a cast-in nub that engages a hole in the mounting plate.

4. See Figure 2-41. Insert the lower caliper screw/guide pin (12). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).
5. Tighten upper caliper mounting bolt (12) to 25-30 ft-lbs (33.9-40.7 Nm). Install washer (16) and **new** spring pin (17).
6. Install bleeder valve into the caliper, if removed. Tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
7. Install screw (1) with brake line clamp (2) and screw (22). Tighten screws to 35-40 ft-lbs (47.5-54.3 Nm).
8. Place brake reaction link (20) in position on fork leg bracket (3). Install washer (19), bolt (18), washers (21, 6), and acorn nut (5). Tighten acorn nut (5) to 35-40 ft-lbs (47.5-54.3 Nm).
9. Install washer (7), acorn stud (8), and **new** spring pin (23), if removed. Tighten acorn stud to 35-40 ft-lbs (47.5-54.3 Nm)

CAUTION

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

10. Install the brake line if removed. Lubricate **new** banjo washers with D.O.T. 4 BRAKE FLUID and cennect the brake line to the caliper. Tighten banjo bolt to 17-22 ft-lbs (23.0-29.8 Nm). Install brake line clamp and brake line clamp bolt.

⚠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)

11. Add D.O.T. 4 BRAKE FLUID to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top. Do not reuse old brake fluid. Use only D.O.T. 4 fluid from a sealed container.

⚠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)

12. Bleed brake system and tighten bleeder valve as directed. See Service Manual.

⚠WARNING

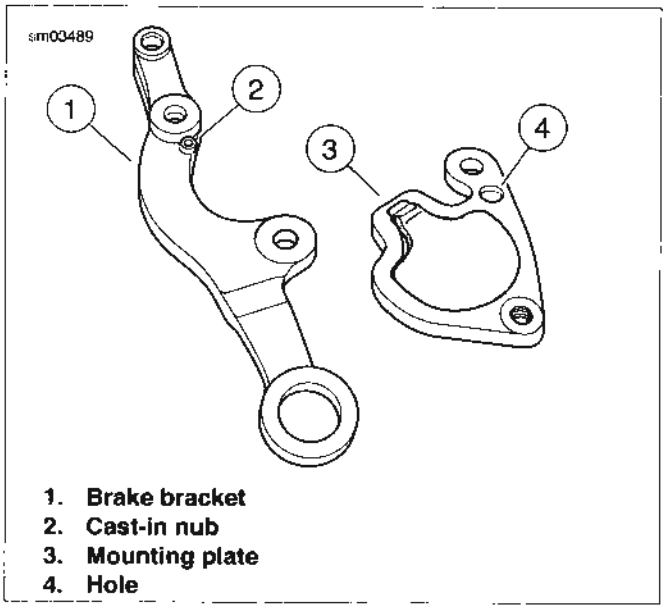
A plugged or covered relief port can cause brake drag or lock-up, which could lead to loss of control, resulting in death or serious injury. (00288a)

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

⚠WARNING

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

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



1. **Brake bracket**
2. **Cast-in nub**
3. **Mounting plate**
4. **Hole**

Figure 2-44. Springer Brake Bracket

GENERAL

⚠WARNING

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

⚠CAUTION

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

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)

CAUTION

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

REMOVAL

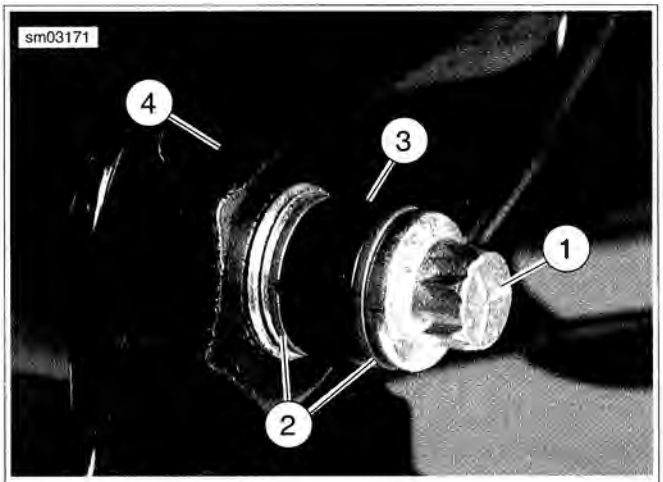
CAUTION

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. See Figure 2-45. Remove banjo bolt (1) and two steel/rubber washers (2) to disconnect brake line from master cylinder. Discard washers.
2. Remove nut (4) to free assembly from mounting bracket.
3. Figure 2-46. Remove cotter pin (4) and washer (5) from clevis pin (6). Remove master cylinder assembly from brake pedal.
4. If disassembling master cylinder, remove retaining ring (3).

INSTALLATION

1. See Figure 2-46. If master cylinder was disassembled, install **new** retaining ring (3).
2. Install master cylinder assembly on brake pedal. Install washer (5) and **new** cotter pin (4) on clevis pin (6).
3. See Figure 2-45. Fit collar on cartridge body into hole of mounting bracket. Apply LOCTITE THREADLOCKER 243 (blue) to threads of nut (4). Install nut on cartridge body until finger tight. Tighten to 30-40 ft-lbs (40.7-54.2 Nm).
4. Lubricate **new** steel/rubber washers (2) with D.O.T. 4 BRAKE FLUID. Position new steel/rubber washers on each side of brake line (3). Insert the banjo bolt (1) through washers and fitting. Tighten to 17-22 ft-lbs (23-30 Nm).
5. Install length of clear plastic tubing over caliper bleeder valve. Place free end of tube in a clean container.
6. Stand the motorcycle upright so that the master cylinder is in a level position. Remove the master cylinder cover.



1. **Banjo bolt**
2. **Steel/rubber washers (2)**
3. **Brake line**
4. **Nut**

Figure 2-45. Rear Brake Control: Front Mount

⚠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)

7. Add D.O.T. 4 BRAKE FLUID to the master cylinder reservoir until the fluid level is 1/4 ± 1/8 in. (6.35 ± 3.18 mm) from the top. Do not reuse old brake fluid. Use only D.O.T. 4 fluid from a sealed container.

⚠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)

8. Bleed brake system and tighten bleeder valve as directed. See 1.16 BLEEDING BRAKES.

9. Install gasket and cover on master cylinder. Tighten cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).

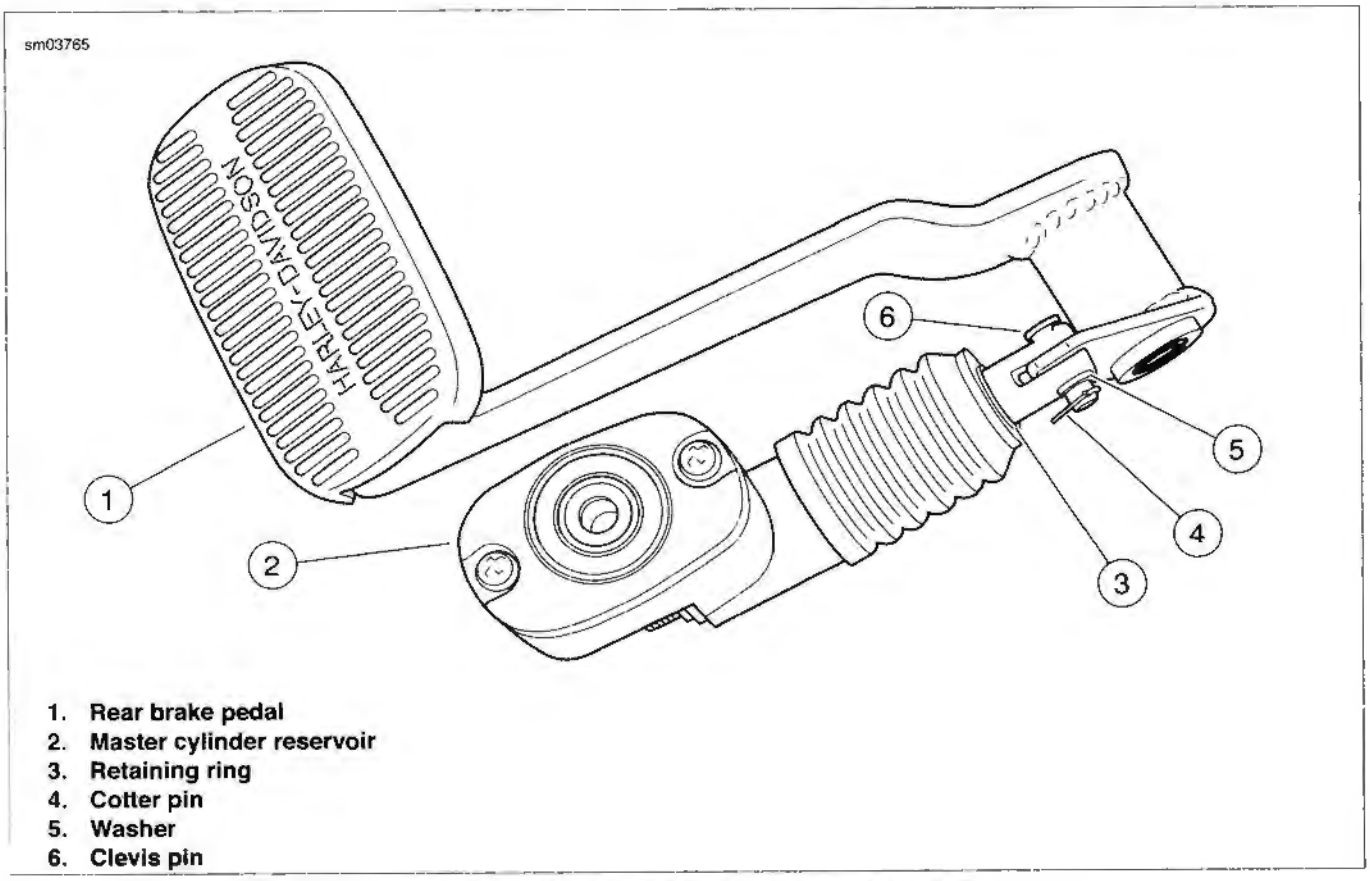
⚠WARNING

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

10. Test brake system.
    a. Turn ignition switch ON. Pump brake foot pedal to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 1.16 BLEEDING BRAKES.

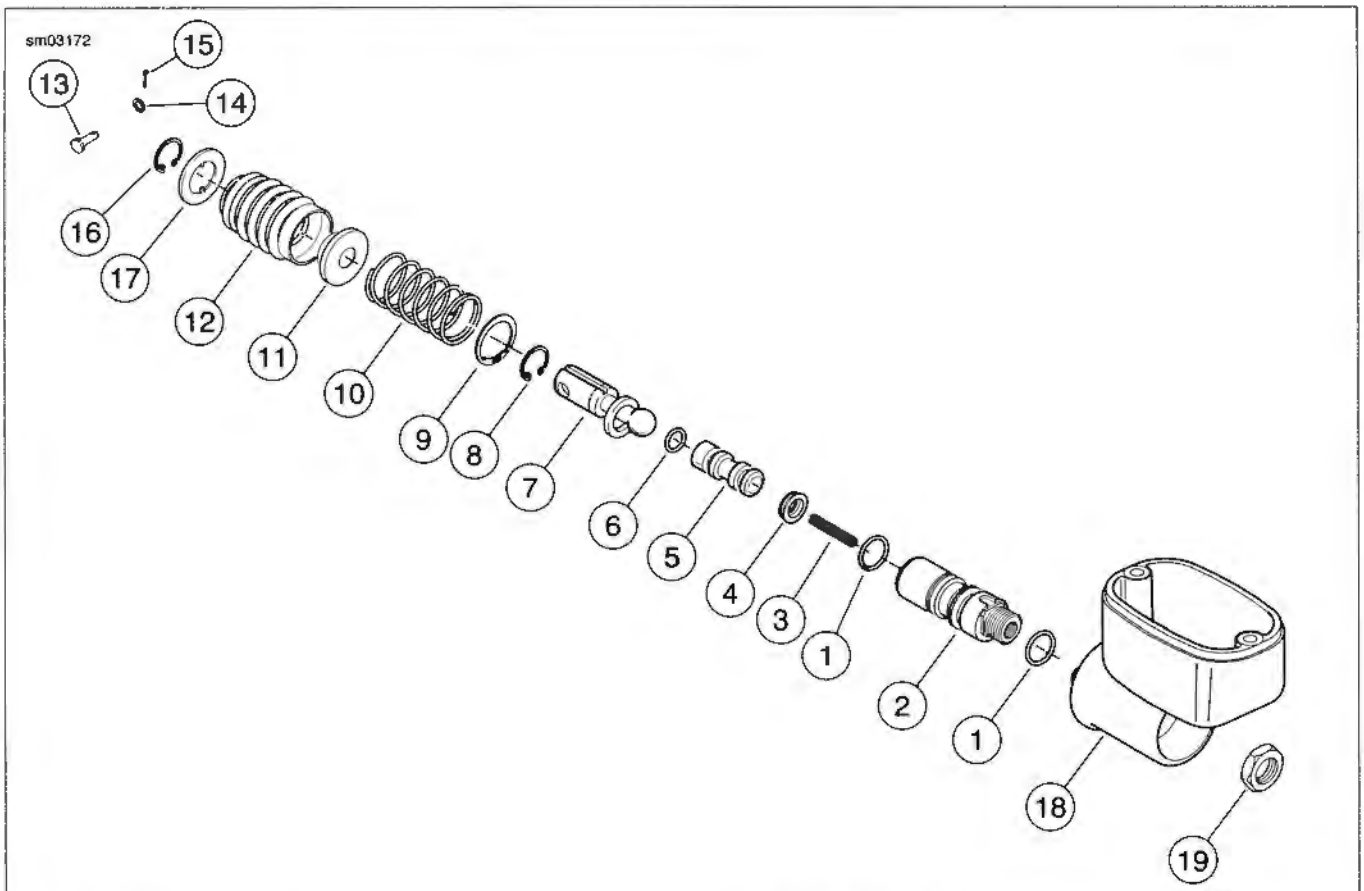
NOTE

A sight glass enables the rider to visually check the brake fluid level without removing the master cylinder cover. When the reservoir is full, the sight glass is dark. As the fluid level drops, the glass lightens up to indicate this condition to the rider.



1. **Rear brake pedal**
2. **Master cylinder reservoir**
3. **Retaining ring**
4. **Cotter pin**
5. **Washer**
6. **Clevis pin**

Figure 2-46. Rear Brake Control: Rear Mount



1. **O-ring**
2. **Cartridge body**
3. **Spring**
4. **Primary cup**
5. **Piston**
6. **O-ring**
7. **Push rod/Clevis/Spacer washer (one piece assembly)**
8. **Retaining ring**
9. **Retaining ring**
10. **Spring**
11. **Spring retainer**
12. **Dust boot**
13. **Clevis pin**
14. **Flat washer**
15. **Cotter pin**
16. **Retaining ring**
17. **Washer**
18. **Reservoir**
19. **Hex nut**

Figure 2-47. Rear Master Cylinder Assembly

DISASSEMBLY

NOTE

Do not disassemble the cartridge body. The cartridge body components are not sold separately, so if piston seal leakage is evident, replace the entire cartridge body assembly.

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

⚠WARNING

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

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

NOTE

See Figure 2-47. Push rod/clevis/spacer washer (7) are a one-piece assembly.

4. Remove the large flat washer (17), dust boot (12) and spring (10) from push rod/clevis/spacer washer (7) end of

cartridge body (2). Remove spring (10) and spring retainer (11) from dust boot (12).

5. See Figure 2-49. Push on threaded end of cartridge body to remove from reservoir adapter. Use hand pressure only. Exercise care to keep cartridge body free of dirt and grease.
6. See Figure 2-47. Carefully remove two o-rings (1) from outside of cartridge body (2). Exercise caution to avoid scratching o-ring grooves.
7. Remove small retaining ring (8) from push rod end of cartridge body. Assembly is spring loaded so be sure to hold the parts together as retaining ring is removed.
8. Remove push rod/clevis/spacer washer (7) from cartridge body. Remove small retaining ring (8) from push rod, if attached. Discard retaining ring.

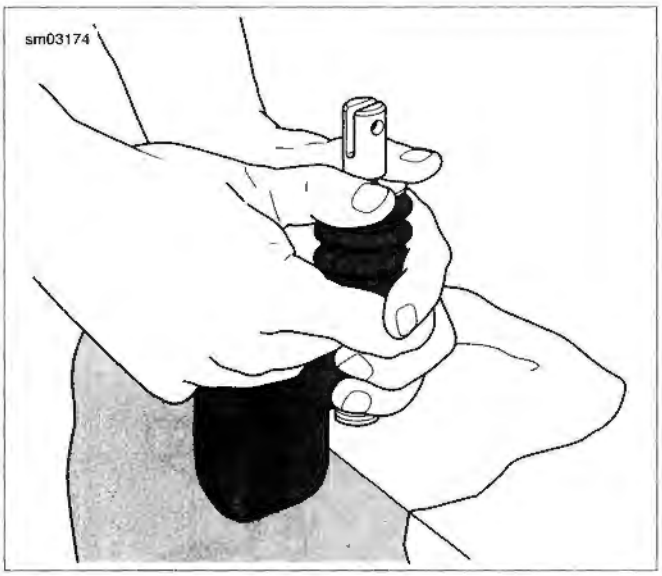


Figure 2-48. Removing Clevis

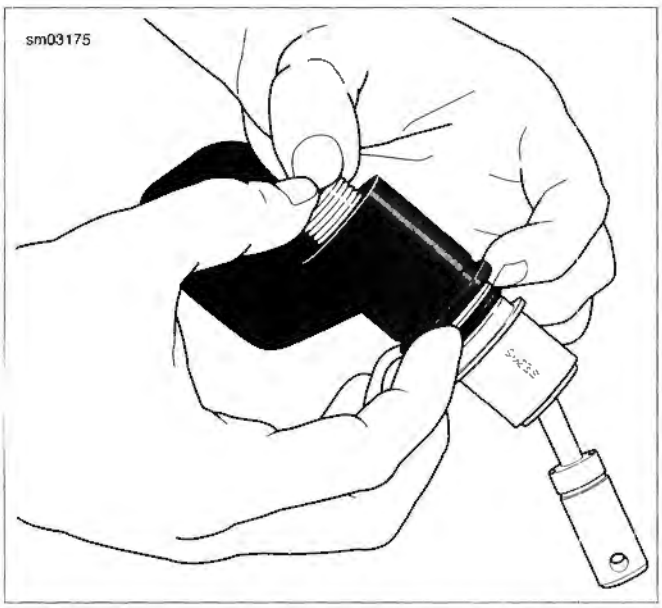


Figure 2-49. Removing Cartridge

CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all metal parts, except the cartridge body assembly, and blow dry with compressed air. Clean all rubber parts using denatured alcohol.
2. Inspect the reservoir adapter bore for scratches. Replace the reservoir if scratches are present.
3. Check the dust boot for cuts or tears. Replace as necessary.
4. Inspect the threads on the cartridge body and push rod. Replace part if threads are damaged.
5. Inspect the spring for cracks or broken coils. Replace as necessary.
6. Inspect o-ring grooves on the cartridge body for dirt. Carefully clean o-ring grooves using a soft cotton cloth moistened with alcohol and allow to dry. Inspect o-ring grooves for scratches. Replace cartridge body if grooves are scratched.
7. Inspect the reservoir cover gasket for cuts, tears or general deterioration. If gasket and/or sight glass replacement is necessary, proceed as follows:
   a. From inboard side, push sight glass toward top of cover until free.
   b. Pull rubber gasket from cover.
   c. Fit nipple of **new** gasket into hole of cover aligning gasket and cover through holes.
   d. From bottom of gasket, push flat end of sight glass through nipple until top of glass is flush with top of gasket. Verify that glass is square in bore. If some lubrication is necessary, use a small quantity of clean brake fluid.

ASSEMBLY

1. See Figure 2-47. To install piston (5) in cartridge body (2), proceed as follows:
   a. Install small spring (3) into cartridge body (2) making sure that spring is seated in counterbore.
   b. Lightly lubricate primary cup (4) and o-ring (6) on piston (5) with D.O.T. 4 BRAKE FLUID.
   c. Install piston (5) over spring (3).
2. Install **new** large retaining ring (9) in groove on push rod/clevis/spacer washer (7) side of cartridge body (2).
3. Position **new** retaining ring (8) on push rod between spacer washer and clevis, or on clevis inboard of the retaining ring groove.

Figure 2-50. Compress Spring and Retaining Ring

4. See Figure 2-50. Stand cartridge body upright on banjo sealing surface. Lay down a clean shop cloth to protect the sealing surface from damage.

⚠WARNING

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

5. Insert ball end of push rod into piston cup. Pushing down on push rod to compress spring, fit captured spacer washer into cartridge body. Further compressing spring as necessary, install retaining ring positioned in step 3 in groove of cartridge body bore.
6. Verify that retaining ring is completely seated in groove and that push rod rotates freely.
7. See Figure 2-47. Lubricate **new** o-rings (1) with D.O.T. 4 BRAKE FLUID and carefully install in grooves on outside of cartridge body (2).
8. Wipe bore of reservoir (18) adapter with D.O.T. 4 BRAKE FLUID.
9. Insert cartridge body (2) into reservoir adapter. Align tab on adapter with slot on threaded end of cartridge. Use hand pressure only. Cartridge body is fully installed when reservoir adapter contacts large retaining ring.
10. See Figure 2-51. Stand master cylinder assembly upright on banjo sealing surface. For best results, suspend reservoir over edge of table. Be sure to lay down a clean shop cloth to protect the sealing surface from damage.
11. Install spring over push rod and cartridge body until it contacts side of large retaining ring.
12. Place concave side of spring retainer over end of spring fitting inside tabs in slot of clevis.
13. Slide dust boot over spring and spring retainer.
14. Place large flat washer on top of dust boot fitting inside tabs in slot of clevis.
15. Push down on large flat washer to compress spring. While holding spring in a compressed state, install new retaining ring in groove of clevis.
16. Pull down dust boot as necessary to seat over lip on reservoir adapter.
17. Rotate boot so that hole is at the bottom. Bottom is the side opposite the index tab on reservoir adapter.

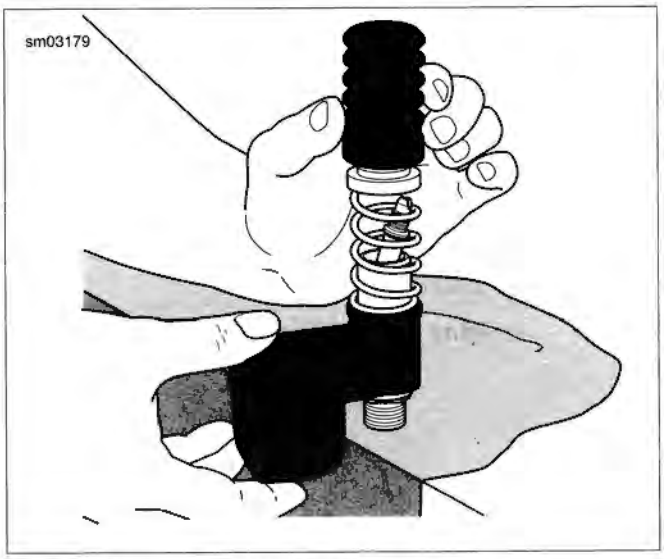


Figure 2-51. Master Cylinder Assembly

REMOVAL

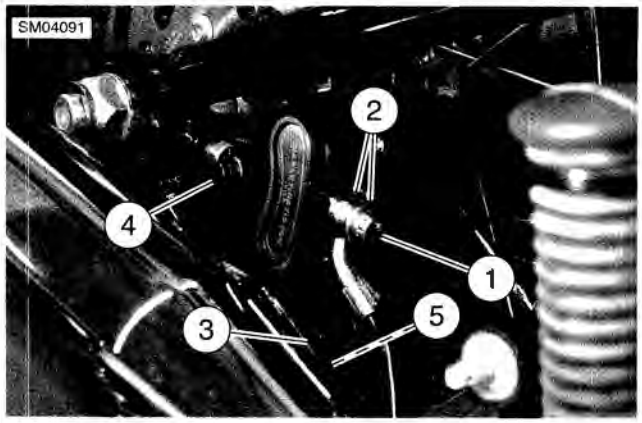
NOTE

If only replacing brake pads, do not remove rear brake caliper. Should pad replacement be necessary, see 1.17 BRAKE PADS AND DISCS.

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. Remove right saddlebag, if equipped.
2. See Figure 2-52. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach rear brake line from caliper. Discard washers.
3. Remove both the slider pin (3) and mounting bolt (4) (metric). Remove caliper assembly from brake disc.
4. To remove rear caliper mount:
   a. Remove axle from rear wheel. See 2.6 REAR WHEEL.
   b. Lift rear caliper mount away from axle and rear fork. Notch in caliper mount must clear tab on rear fork.



1. **Banjo bolt**
2. **Steel/rubber washers**
3. **Slider pin**
4. **Mounting bolt**
5. **Tab slot**

Figure 2-52. Rear Caliper

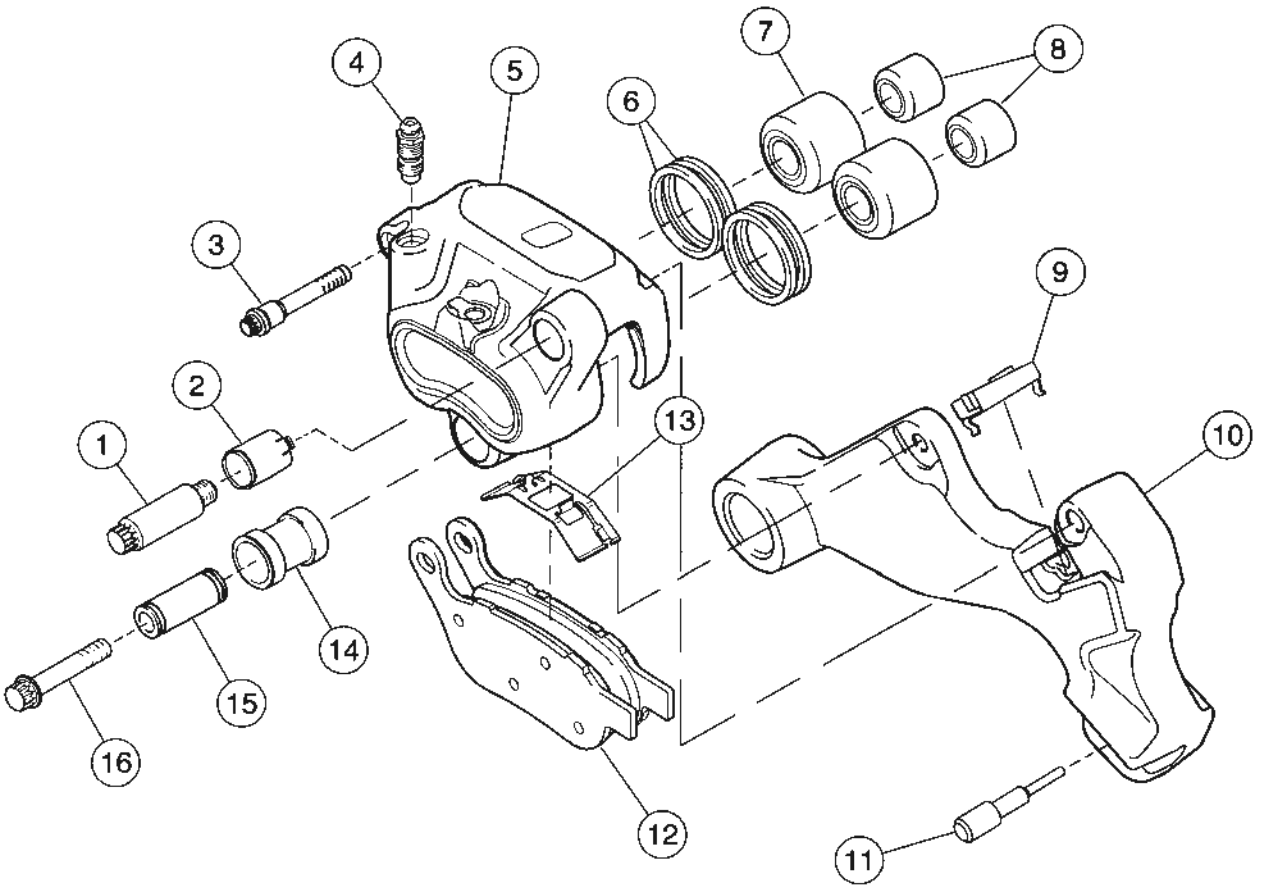
DISASSEMBLY

PART NUMBER	TOOL NAME
HD-48648	BRAKE CALIPER PISTON REMOVER

1. See Figure 2-53. Remove pad pin (3) and brake pads (12).
2. If necessary, remove bleeder valve (4).

NOTE

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



1. **Slider pin**
2. **Bushing (upper)**
3. **Pad pin**
4. **Bleeder valve with o-ring**
5. **Caliper housing**
6. **Square seals (4)**
7. **Piston (2)**
8. **Phenolic insulator (available only in repair kit)**
9. **Torque clip**
10. **Rear caliper mount**
11. **Rubber bumper**
12. **Brake pads (2)**
13. **Anti-rattle spring**
14. **Rubber boot**
15. **Bushing (lower)**
16. **Mounting bolt**

Figure 2-53. Rear Brake Caliper

⚠WARNING

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

⚠CAUTION

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

NOTE

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

3. See Figure 2-54. Remove pistons.
   a. Place BRAKE CALIPER PISTON REMOVER (Part No. HD-48648) (3) into caliper housing. Install bolt (2) only enough to hold tool in place.

   NOTE

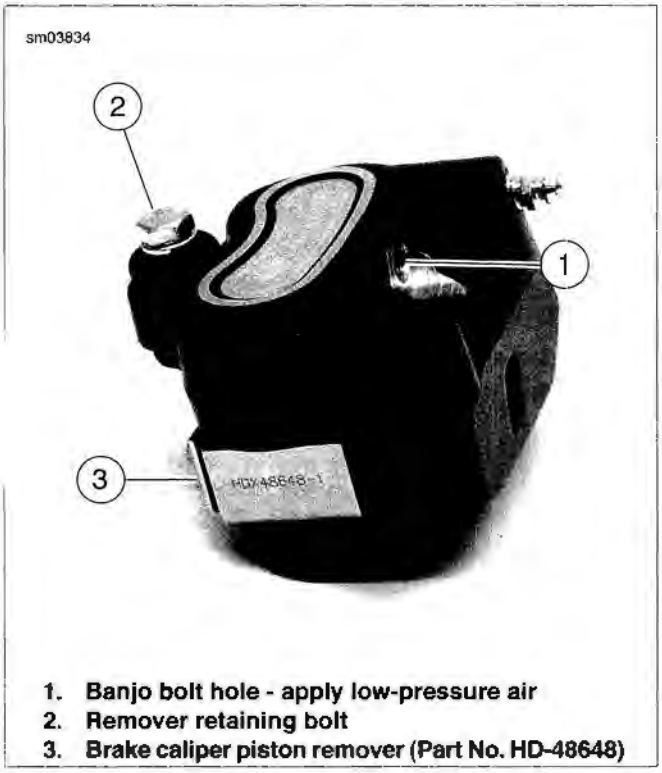
   Tool retaining bolt (2) is used only to keep tool from slipping out of the caliper during piston removal, and does not need to be tight. Do not use a wrench to tighten.

   b. If the bleeder valve was removed, install it finger-tight.
   c. Apply **low pressure** compressed air to banjo bolt hole (1) to remove pistons from caliper bores. Listen for both pistons to "pop" against the tool.
   d. Remove piston remover tool.
4. Wiggle pistons from caliper bores to completely remove.

CAUTION

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

5. See Figure 2-55. Using a wooden toothpick (1), remove two square seals (2) from each caliper bore. Discard all removed parts.
6. Pull anti-rattle spring (3) straight out to remove.



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

Figure 2-54. Removing Pistons

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

Figure 2-55. Seals and Spring

CLEANING, INSPECTION AND REPAIR

⚠WARNING

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

⚠WARNING

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

1. Clean all parts with denatured alcohol or D.O.T. 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe parts 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.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect phenolic insulators for damage.
   c. Inspect caliper piston bore. Do not hone bore. If bore should show pitting or corrosion, replace caliper.
   d. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace both pins.
   e. See Figure 2-53. Inspect rubber boot (14) for cracks and damage. Inspect bushing (15) for free movement. Inspect bushing (2) for free movement or damage.
   f. Always replace square seals after disassembly.
3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.
4. Inspect brake pads and brake disc. See 1.17 BRAKE PADS AND DISCS.

ASSEMBLY

NOTE

Do not use D.O.T. 4 brake fluid for lubrication. Use of D.O.T. 4 brake fluid will result in increased lever travel.

1. Lubricate the following parts prior to assembly using a light coat of G.E. VERSILUBE® #G322 L SILICONE GREASE (marked "Piston Lube") from the service parts kit. All other surfaces must be dry for assembly.
   a. Lubricate nose radius and outside diameter of piston. Apply lube to inside of caliper piston bores.
   b. Apply lube to inside diameter of square seals.

CAUTION

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

2. See Figure 2-55. Install two **new** square seals (2) into each piston bore. Use a wooden toothpick (1) to aid installation if needed.
3. Install anti-rattle spring (3). Ensure it is oriented correctly.
4. Carefully insert pistons, by hand, into bores of caliper housing. Press pistons squarely into place until they bottom in the bores. If installation shows resistance, remove piston and check that seals are properly installed.
5. See Figure 2-53. Install bleeder valve (4) (with o-ring) in caliper housing, if removed, and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).

NOTE

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

6. Insert brake pads into caliper with friction material facing opening for brake disc.
7. Install pad pin (3) and tighten to 80-120 **in-lbs** (9.0-13.6 Nm).

NOTE

If pad pins do not fit, check the following:

- *You are using a set of pads, not two identical pads.*
- *Anti-rattle spring orientation matches Figure 2-53.*

INSTALLATION

1. Install rear axle and caliper mount if removed. Ensure notch in mount engages tab on rear fork. See 2.6 REAR WHEEL.
2. See Figure 2-53. Ensure torque clip (9) is in place in caliper mount.
3. See Figure 2-52. Install caliper with pads on caliper mount. Tighten slider pin (3) and mounting bolt (4) (metric) to 10-14 ft-lbs (13.6-18.9 Nm). Ensure tabs on brake pads engage slot (5) in caliper mount.

CAUTION

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

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

⚠CAUTION

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

5. Remove cover from rear brake master cylinder. Fill master cylinder with D.O.T. 4 BRAKE FLUID. Verify that fluid level is 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below top of reservoir with master cylinder in a level position.

⚠WARNING

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

6. Bleed brake system. See 1.16 BLEEDING BRAKES.

⚠WARNING

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

7. Test brake system.
   a. Turn ignition switch ON. Pump brake foot pedal to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 1.16 BLEEDING BRAKES.

NOTE

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

GENERAL

⚠WARNING

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

⚠WARNING

Be sure tires are properly inflated, balanced and have adequate tread. Inspect your tires regularly and see a Harley-Davidson 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. (00014a)

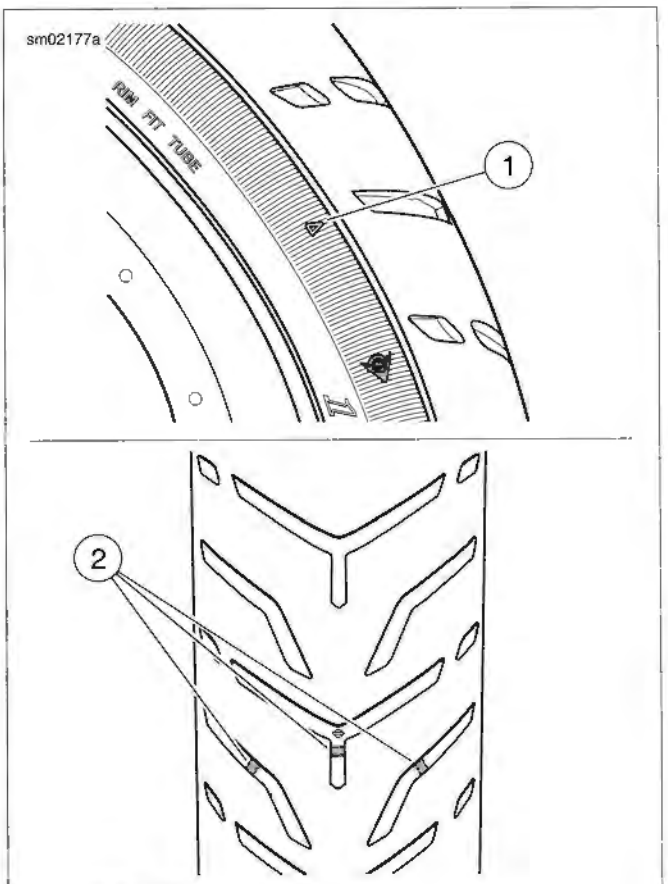
New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.

Tires should be inspected for punctures, cuts, breaks and wear at least weekly.

See Figure 2-56. The tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tread remains. Always remove tires from service before they reach the tread wear indicator bars.

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

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



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

Figure 2-56. Tread Wear Indicators (Typical)

REMOVAL

NOTE

Care must be taken when removing and installing tire to prevent cosmetic damage to wheel. This is especially true with wheels that feature painted surfaces.

1. Remove wheel from motorcycle:
   a. **Front wheel:** see 2.4 FRONT WHEEL: ALL BUT FLSTSB, Removal or 2.5 FRONT WHEEL: FLSTSB, Removal.
   b. **Rear wheel:** see 2.6 REAR WHEEL, Removal.
2. Deflate tire.

NOTE

On tube type wheels, it is not necessary to completely remove tire from rim to replace tube. Removing one side allows the tube to be replaced and allows for inspection of tire.

3. Loosen both tire beads from rim flange. In most cases, a bead breaker machine will be required to loosen the beads from the rim.
4. Remove tire.

CLEANING, INSPECTION AND REPAIR

1. Clean the inside of tire and outer surface of tube.
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Check wheels for lateral and radial runout before installing a new tire. See 2.9 TRUING LACED WHEELS.
4. Inspect the tire and tube for wear and damage. Inspect tread depth. Replace worn tires. Replace damaged tubes.

⚠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 Harley-Davidson dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (130 km/h). Failure to follow this warning could result in death or serious injury. (00015a)

5. Tubeless tires may be repaired in the tread area only if the puncture is 1/4 in. (6.4 mm) or smaller. All repairs must be made from inside the tire.
6. Acceptable repair method involves the use of a patch and plug combination.

INSTALLATION

⚠WARNING

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

⚠WARNING

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

⚠WARNING

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)

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

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

Tube Type Tires

⚠WARNING

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

⚠WARNING

Use inner tubes on laced (wire spoked) wheels. Using tubeless tires on laced wheels can cause air leaks, which could result in death or serious injury. (00025a)

NOTES

- *For correct tire and tube types, see 2.2 SPECIFICATIONS.*
- *Whenever a tube type tire is replaced, the tube should also be replaced. Inner tubes should be patched only as an emergency measure. Replace a damaged or patched tube as soon as possible. Rim bands must be used on all laced wheels.*

1. See Figure 2-57. On laced wheels, install a rim strip into the rim well. Make sure no spokes protrude through nipples, and be sure to align the valve stem hole in rim strip with valve stem hole in rim.
2. Install tube and tire.

Figure 2-57. Installing Rim Strip

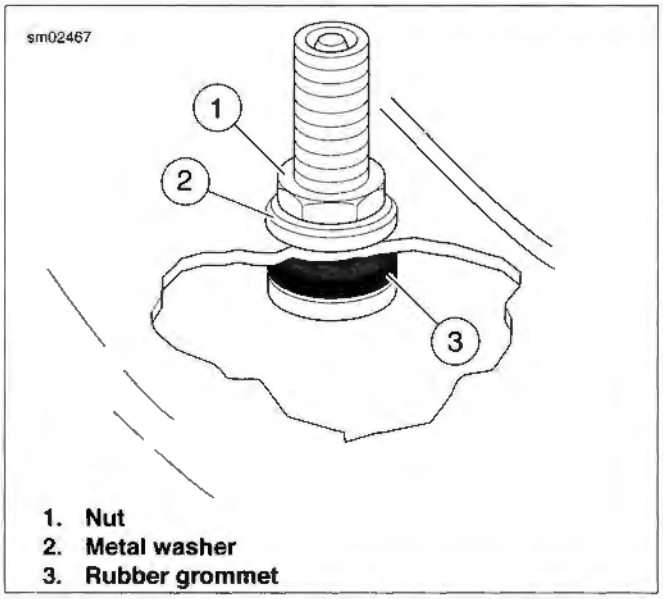
Tubeless Tires

⚠WARNING

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

1. See Figure 2-58. On tubeless wheels, damaged or leaking valve stems must be replaced. Install rubber grommet (3) on valve stem.
2. Insert valve stem into rim hole.

3. Install metal washer (2).
4. Install nut and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
5. Install tire.



1. **Nut**
2. **Metal washer**
3. **Rubber grommet**

Figure 2-58. Tubeless Tire Valve Stem

CHECKING TIRE RUNOUT

Lateral Runout

1. Verify that the tire is inflated to the proper pressure.
2. See Figure 2-59. Turn the wheel on the axle and measure tire lateral runout from a fixed point to a smooth area on the tire sidewall. Avoid measuring on raised letters or vents.
3. Tire lateral runout should not exceed 0.090 in. (2.29 mm). If tire runout exceeds specification, remove tire from rim and check rim lateral runout. See 2.10 CHECKING CAST WHEEL RUNOUT.
4. If rim lateral runout is within specification, the tire is at fault and must be replaced. If rim lateral runout is not within specification, correct by adjusting selected spokes on laced wheels (see 2.9 TRUING LACED WHEELS) or replace cast wheels.
5. Install the tire and recheck tire lateral runout.

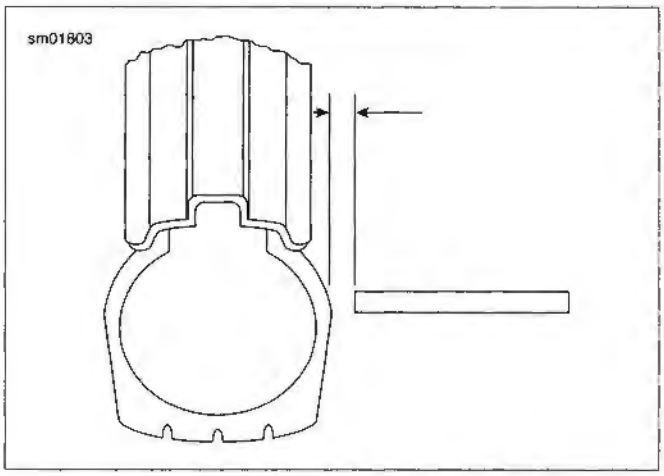


Figure 2-59. Checking Tire Lateral Runout

Radial Runout

1. Verify that the tire is inflated to the proper pressure.
2. See Figure 2-60. Turn the wheel on the axle and measure tire radial runout at the tread centerline.
3. Tire radial runout should not exceed 0.090 in. (2.29 mm). If tire runout exceeds this specification, remove tire from rim. and check rim radial runout. See 2.10 CHECKING CAST WHEEL RUNOUT.
4. If rim radial runout is within specification, the tire is at fault and must be replaced. If rim bead radial runout is not within specification, correct by adjusting selected spokes on laced wheels (see 2.9 TRUING LACED WHEELS) or replace cast wheels.
5. Install the tire and recheck tire radial runout.

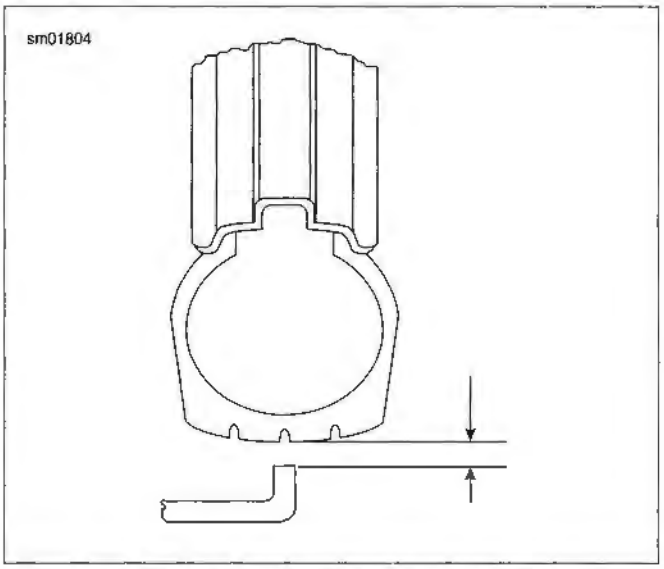


Figure 2-60. Checking Tire Radial Runout

WHEEL BALANCING

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

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

Static balancing using WHEEL TRUING STAND (Part No. HD-99500-80) will produce satisfactory results for normal highway speeds. Dynamic balancing can produce better results for high speed operation but is not typically required.

The maximum weight permissible to accomplish balance is 3.5 oz. (99.2 g) (total weight applied to the rim). If more than 3.5 oz. (99.2 g) of weight is required to accomplish balance, rotate the tire 180 degrees on the rim and again balance the assembly. Wheels should be balanced to within 0.5 oz. (14 g).

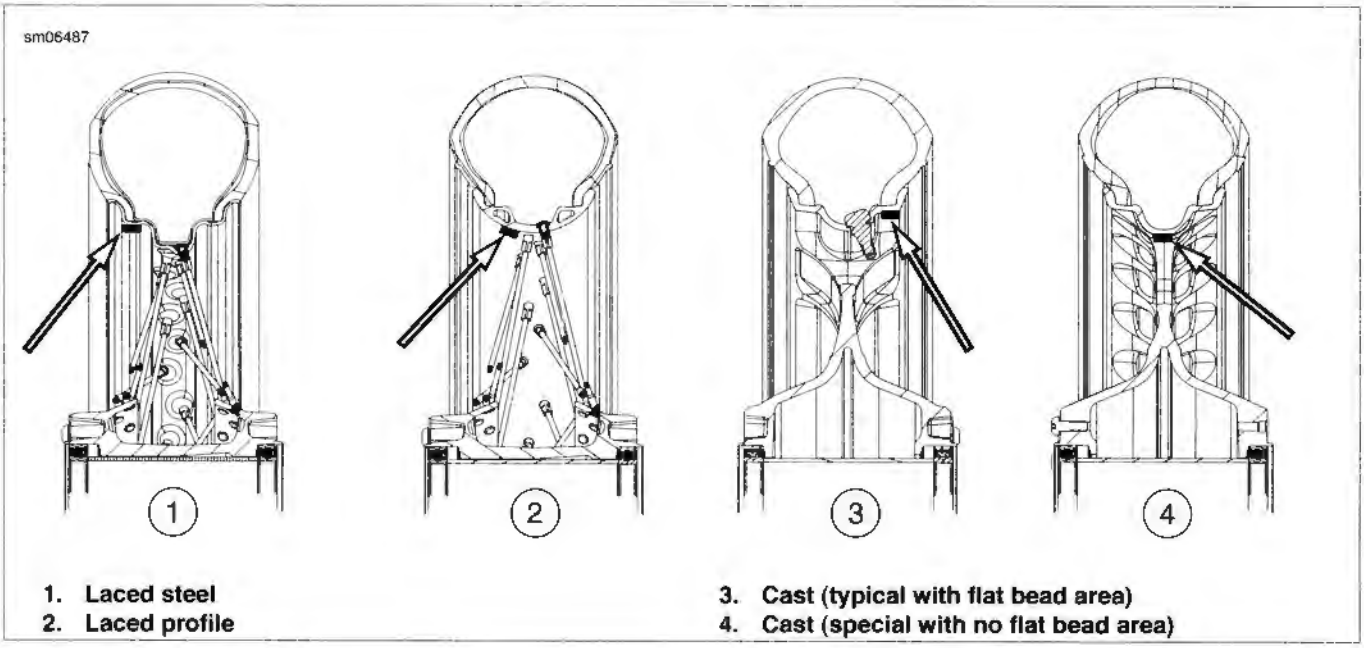
Weights

Use self-adhesive wheel balance weights for all Harley-Davidson wheels, placed as indicated in Figure 2-61 depending on wheel style.

NOTES

- *If 1 oz. (28 g) or more of weight must be added at one location, split the amount so that half is applied to each side of rim.*
- *On cast wheels without a flat area near the bead, such as the cast special wheel (4) shown in Figure 2-61, it is acceptable to place them crosswise through the opening.*

1. See Figure 2-61. Place weights on a smooth surface of the wheel rim such that centrifugal force will help keep them in place. Make sure the area of application is completely clean, dry, and free of oil and grease.
2. Remove paper backing from the weight. Press firmly in place and hold for ten seconds.



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

Figure 2-61. Wheel Weight Placement

GENERAL

There are three varieties of hydraulic forks:

- All FLST, FLSTC, FLSTF/B and FLSTN models use the type shown in Figure 2-64.
- All FXST and FXSTC models use the type shown in Figure 2-65.
- All FXCWC models use the type shown in Figure 2-66.

Use the following information to service the models listed above.

REPLACING FORK OIL

NOTE

At the specified fork oil change service interval, inspect the front fork assembly. Look for oil leakage past the seals and excessive wear on slider tubes. Disassemble, clean and repair or replace components as necessary. See 2.18 FRONT FORK: TELESCOPIC.

1. Support the motorcycle so the front wheel is off the floor and the forks are fully extended.

⚠WARNING

Wear safety glasses or goggles when servicing fork assembly. Do not remove slider tube caps without relieving spring preload or caps and springs can fly out, which could result in death or serious injury. (00297a)

NOTE

The FLST, FLSTC, and FLSTF/B models have a preloaded fork spring.

2. See Figure 2-62. Remove the fork tube caps.
3. Drain fork oil.
   a. FXCWC models require the fork tubes be removed. Remove the forks and drain the fork oil. See 2.18 FRONT FORK: TELESCOPIC.
   b. All models except FXCWC, see Figure 2-63. Remove and discard the drain screws and washers from each fork and drain the fork oil.
4. Install **new** drain screws and washers.
   a. FXCWC models, apply LOCTITE THREADLOCKER 243 (blue) to drain screws and tighten to 12-18 **in-lbs** (1.4-2.0 Nm).
   b. All models but FXCWC, tighten drain screws to 52-78 **in-lbs** (5.9-8.9 Nm).

Figure 2-62. Fork Tube Cap

5. Refer to Table 2-14. Fill the fork with Harley-Davidson TYPE E FORK OIL (Part No. HD-99884-80).
6. Tighten fork tube caps to 60-70 ft-lbs (81.3-94.9 Nm).

Table 2-14. Type E Fork Oil Amounts

MODEL	OZ	CC	IN	MM
FLST, FLSTC, FLSTN	13.4	395	4.41	112.0
FLSTF/B	13.4	397	5.04	128.0
FXST, FXSTC	12.5	370	6.69	170.0
FXCWC	24.5	725	4.80	122.0

NOTE

Refer to Table 2-14. Fork oil amounts can be measured two ways.

- *Use oz./cc measurement if fork is left in frame.*
- *Use in./mm measurement if fork is disassembled. In this case, oil level is measured from top of fork tube, with spring removed and fork fully compressed.*

Figure 2-63. Fork Drain Screw: All Models Except FXCWC (Left Side Shown)

REMOVAL

1. Support the vehicle so the front end is off floor and the forks are fully extended.
2. Remove front wheel and brake caliper. See 2.4 FRONT WHEEL: ALL BUT FLSTSB.
3. Remove front fender. See 2.30 FRONT FENDER: ALL BUT FLSTSB.
4. Remove the slider tube cap (1) from the top of one fork side.
5. **All but FXCWC:** remove spacer (2) and oil seal (3) from top of one fork side
6. Loosen pinch bolt (4) and pull the fork side from the brackets.
7. Repeat two previous steps for the other fork side.

DISASSEMBLY

⚠WARNING

Wear safety glasses or goggles when servicing fork assembly. Do not remove slider tube caps without relieving spring preload or caps and springs can fly out, which could result in death or serious injury. (00297a)

1. See Figure 2-64, Figure 2-65, Figure 2-66. Remove the fork tube plug (5) and o-ring (6). Pull spring (7) out of slider tube (8).
2. **All but FXCWC:** Remove drain screw (9) and washer (10), and drain the fork.
3. **FXST/FXSTC:** See Figure 2-65. Remove dust cover (23) and dust shield (47).
4. **FXCWC:** See Figure 2-66. Remove dust cover (23) and dust shield (38).
5. See Figure 2-64, Figure 2-65, Figure 2-66. Compress retaining ring (11) and remove the clip from the internal groove at the top of slider (12).

NOTE

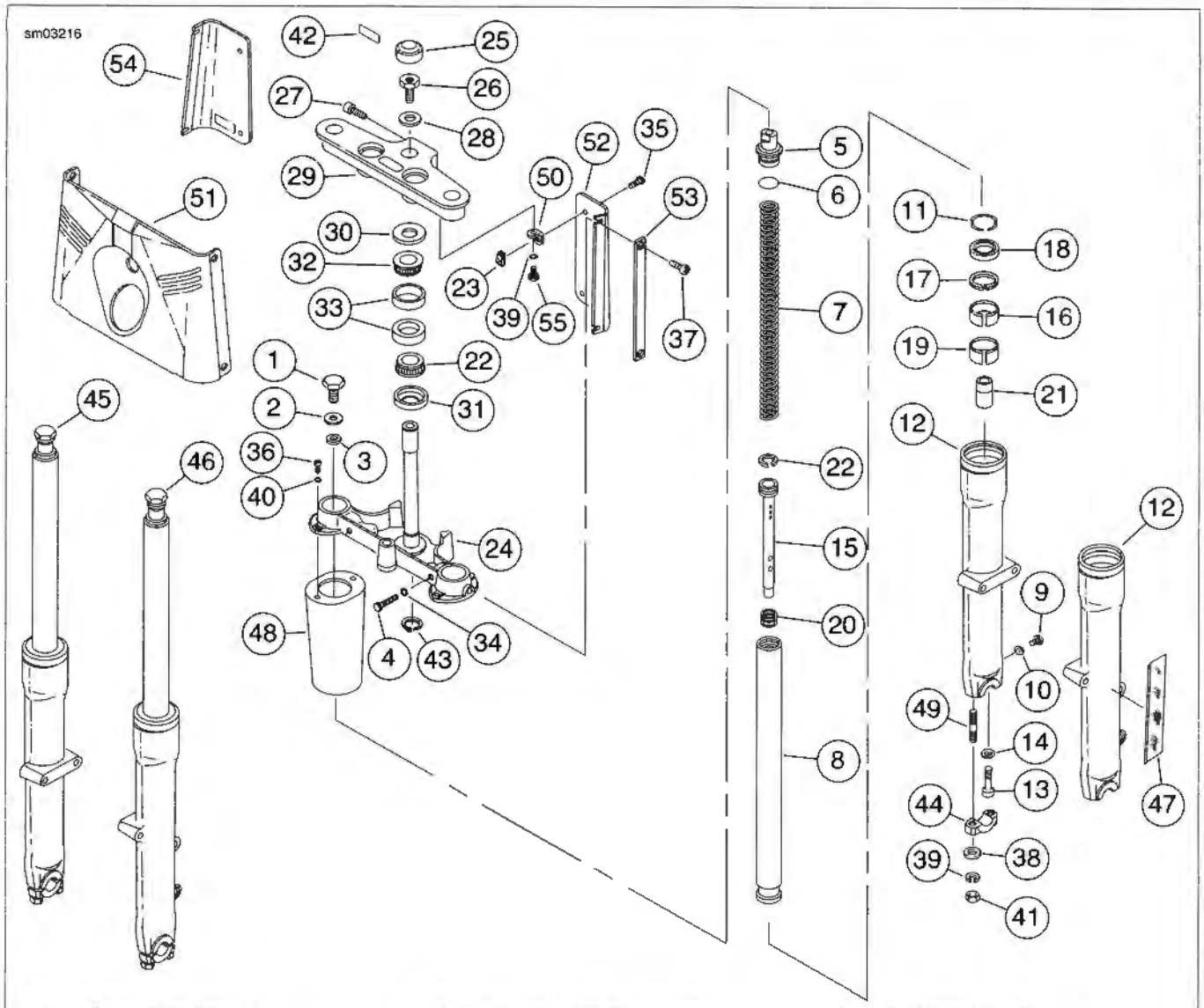
Since there is little resistance to rotation when removing socket screw (13), the job is done more easily with an air impact wrench.

6. Remove socket head screw (13) with washer (14) from the bottom end of fork slider (12). This will free damper tube (15) and fork slider tube (8) so that they can be removed from slider.
7. The upper slider tube bushing (16) is a slight interference fit in slider (12). The upper bushing together with seal spacer (17) and slider oil seal (18) are removed by lightly hitting the upper bushing with the lower slider bushing (19) as the fork tube is pulled free of the fork slider in a quick continuous stroke. Continue this slide hammer action until the components are freed.
8. **FXCWC:** Drain the slider (12) and allow the lower stop (21) to fall free.
9. Push the damper tube (15) and damper tube spring (20) free of slider tube (8) by inserting a small diameter rod through the opening in the bottom of tube.
10. Remove lower stop (21) from the lower end of damper tube (15).
11. Damper tube ring (22) can now be removed from the grooves at the top end of damper tube (15). Lower slider bushing (19) should not be removed unless it is to be replaced. When replacing lower slider bushing (19), expand the **new** split bushing diameter only enough to fit over slider tube (8) and slide bushing into the bushing groove.

CLEANING AND INSPECTION

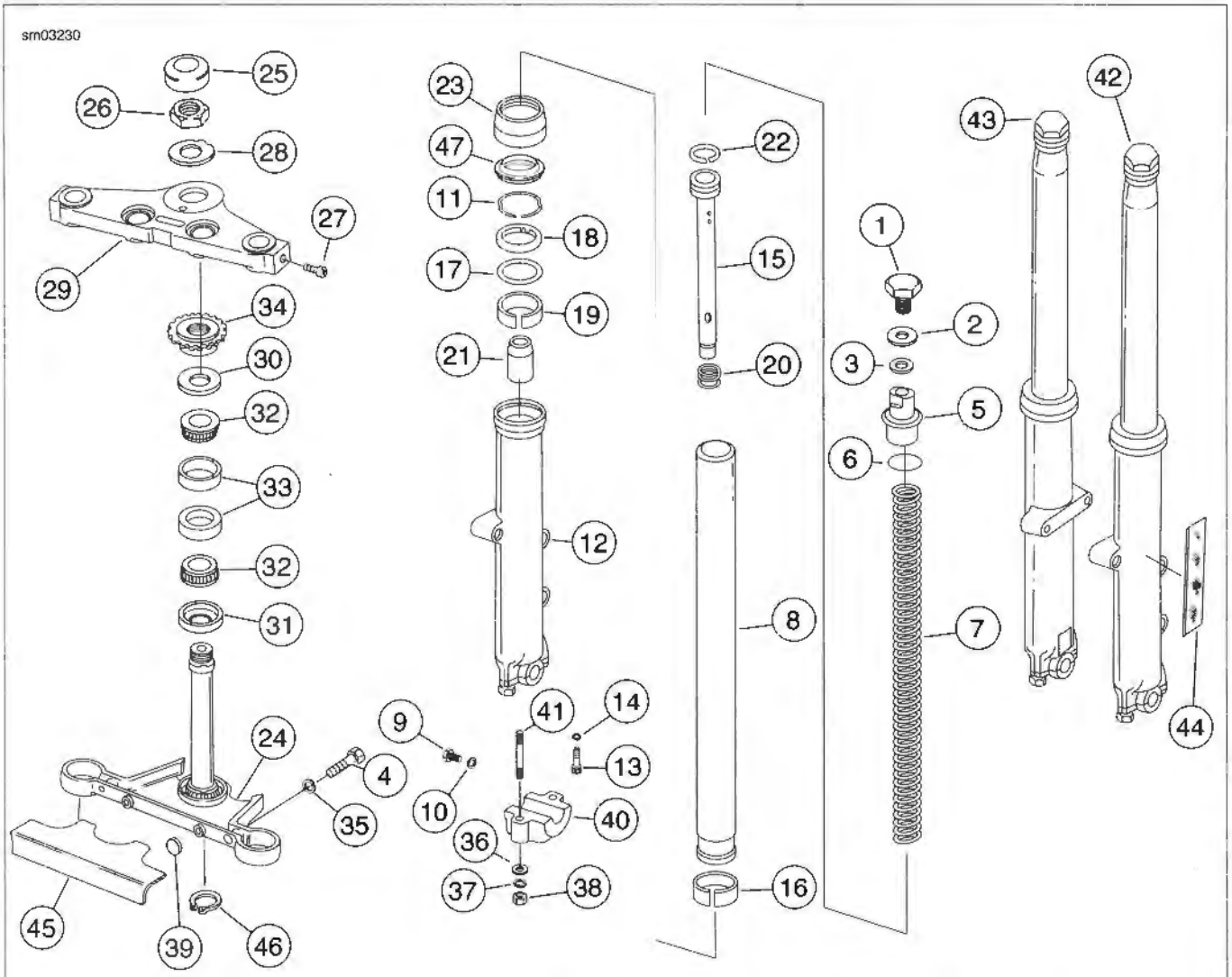
Thoroughly clean and inspect each part. If inspection shows that any parts are bent, inoperative or damaged, those parts should be replaced.

1. Inspect damper tube rings (22) on damper tube (15) and replace if worn excessively or damaged.
2. Replace either of the springs (7 or 20) if damaged.
3. Inspect small hole(s) in lower end of slider tube (8) and be sure it is not obstructed.
4. Be sure fork tub plug o-ring (6) is in good condition, without irregularities, and that it provides proper sealing when in place.
5. **All but FXCWC:** Install **new** screw (9) and washer (10).
6. Install **new** screw (13) and washer (14).
7. Replace bent or damaged slider tube (8).



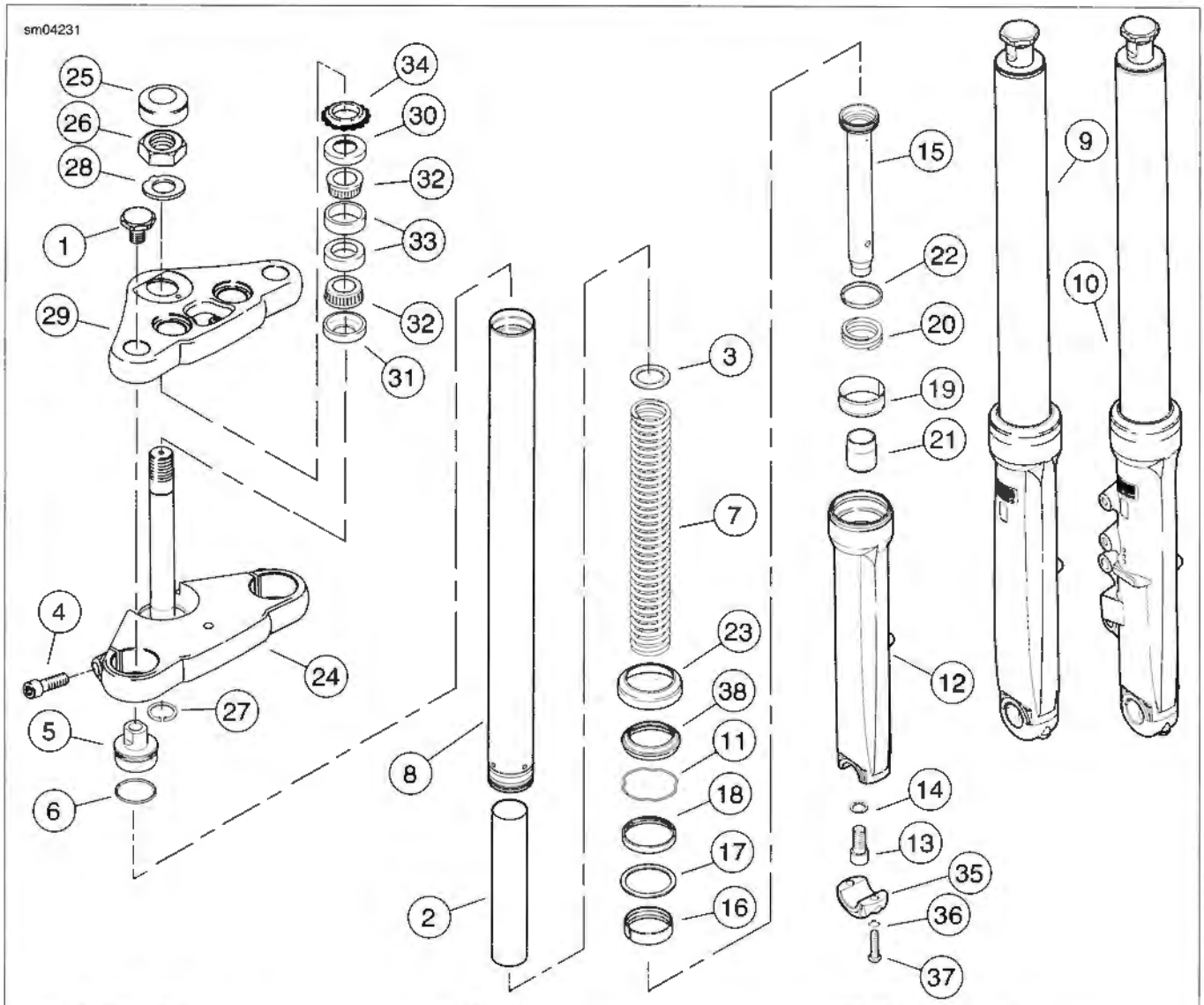
1. Slider tube cap (2)
2. Spacer (2)
3. Oil seal (2)
4. Bolt (2)
5. Fork tube plug (2)
6. Fork tube plug o-ring (2)
7. Spring (2)
8. Slider tube (2)
9. Drain screw (2)
10. Washer (2)
11. Oil seal retaining ring (2)
12. Slider
13. Screw (2)
14. Washer (2)
15. Damper tube (2)
16. Upper slider tube bushing (2)
17. Seal spacer
18. Slider oil seal (2)
19. Lower slider bushing
20. Damper tube spring (2)
21. Lower stop (2)
22. Damper tube spring (2)
23. Clip nut
24. Stem and bracket
25. Fork stem cap
26. Bolt
27. Screw (2)
28. Fork stem washer
29. Upper bracket
30. Upper dust shield
31. Lower dust shield
32. Roller bearing (2)
33. Bearing cup (2)
34. Adjusting nut
35. Screw (4)
36. Screw (4)
37. Screw (4)
38. Washer (2)
39. Lockwasher (2)
40. Lockwasher (4)
41. Nut (2)
42. Warning label
43. Fork stem retaining ring
44. Axle cap (2)
45. Fork slider/tube asmb. right
46. Fork slider/tube asmb. left
47. Reflector (2)
48. Slider cover (2)
49. Stud (4)
50. Front panel bracket (2)
51. Front panel
52. Left rear back panel
53. Trim strip (2)
54. Right rear back panel
55. Bolt (2)

Figure 2-64. Front Forks: FLST, FLSTC, FLSTF/B, FLSTN



1. Slider tube cap (2)
2. Spacer (2)
3. Oil seal (2)
4. Bolt (2)
5. Fork tube plug (2)
6. Fork tube plug o-ring (2)
7. Spring (2)
8. Slider tube (2)
9. Drain screw (2)
10. Washer (2)
11. Oil seal retaining ring (2)
12. Slider
13. Screw (2)
14. Washer (2)
15. Damper tube (2)
16. Upper slider tube bushing (2)
17. Seal spacer
18. Slider oil seal (2)
19. Lower slider bushing
20. Damper tube spring (2)
21. Lower stop (2)
22. Damper tube ring (2)
23. Dust cover (2)
24. Stem and bracket
25. Fork stem cap
26. Fork stem nut
27. Screw (2)
28. Fork stem lockwasher
29. Upper bracket
30. Upper dust shield
31. Lower dust shield
32. Roller bearing (2)
33. Bearing race (2)
34. Adjusting nut
35. Lockwasher (2)
36. Washer (2)
37. Lockwasher (2)
38. Nut (2)
39. Pad (2)
40. Axle cap
41. Stud (2)
42. Fork slider and tube assy. left
43. Fork slider and tube assy. right
44. Reflector (2)
45. Headlamp mounting plate
46. Fork stem retaining ring
47. Dust shield (2)

Figure 2-65. Front Forks: FXST and FXSTC



1. Slider tube cap
2. Spring Collar
3. Washer
4. Pinch bolt
5. Fork tube plug
6. Fork tube plug o-ring
7. Spring
8. Slider tube
9. Fork slider and tube assembly, right
10. Fork slider and tube assembly, left
11. Oil seal retaining ring
12. Slider
13. Screw
14. Washer
15. Damper tube
16. Upper slider tube bushing
17. Seal spacer
18. Slider oil seal
19. Lower slider bushing
20. Damper tube spring
21. Lower stop
22. Damper tube ring
23. Dust cover
24. Stem and bracket
25. Fork stem cap
26. Fork stem nut
27. Retaining ring
28. Fork stem lockwasher
29. Upper bracket
30. Upper dust shield
31. Lower dust shield
32. Roller bearing (2)
33. Bearing race (2)
34. Adjusting nut
35. Axle cap
36. Lockwasher (2)
37. Screw (2)
38. Dust shield

Figure 2-66. Front Forks: FXCWC

ASSEMBLY

PART NUMBER	TOOL NAME
PART NO. HD-34634	FORK SEAL INSTALLER
PART NO. HD-45305	FORK SEAL DRIVER

1. Install damper tube ring (22). Place damper tube spring (20) on damper tube (15). Insert damper tube into slider tube (8).
2. Insert spring (7) into slider tube (8), tapered side toward damper tube (15), and push bottom of damper tube through the opening at the bottom end of the fork tube. Place lower stop (21) over end of damper tube (15).
3. **FXCWC:** Insert washer (3) and spring collar (2).
4. Position slider tube (8) and damper tube (15) in slider (12). Hold the assembly in place by exerting pressure on the spring and install socket screw (13) with washer (14).
5. **All but FXCWC:** tighten screw (13) to 29.5-36.8 ft-lbs (40-50 Nm).
6. **FXCWC:** tighten screw (13) to 10.8-18 ft-lbs (14.7-24.5 Nm).
7. Place upper slider tube bushing (16), seal spacer (17) and a **new** slider oil seal (18) (in that order) over fork slider (12). Be sure that the flanged surface of the seal spacer (17) is up and lettered side of the seal is facing upward.
8. Place FORK SEAL INSTALLER (Part No. Part No. HD-34634) for all but FXCWC or FORK SEAL DRIVER (Part No. Part No. HD-45305) for FXCWC over fork slider (12). Seat upper slide tube bushing (16), seal spacer (17), and slider oil seal (18) into the slider bore by lightly tapping the components into place with the installation tool.
9. Install oil seal retaining ring (11).
10. **FXST/FXSTC:** Install dust cover (23) and dust shield (47).
11. **FXCWC:** Install dust cover (23) and dust shield (38).
12. Fill forks with Harley-Davidson TYPE E FORK OIL. See 2.18 FRONT FORK: TELESCOPIC.

INSTALLATION

1. Insert both fork side assemblies up through the fork stem and bracket (24) and upper bracket (29).
2. **All but FXCWC:** Install spacer (2), fork tube plug (5) and **new** oil seal (3). Tighten plug (5) to 60-70 ft-lbs (81.4-95.0 Nm). Be sure one flat on each fork tube plug (5) faces toward the inside of the fork.
3. **FXCWC:** Install fork tube plug (5). Tighten plug (5) to 60-70 ft-lbs (81.4-95.0 Nm). Be sure one flat on each fork tube plug (5) faces toward the inside of the fork.
4. Install slider tube cap(s) (1). Tighten to 60-70 ft-lbs (81.3-95.0 Nm).
5. Tighten fork stem bracket pinch bolt(s) (4) to the following:
   a. **All but FXCWC:** 55-60 ft-lbs (74.6-81.4 Nm).
   b. **FXCWC:** 35-40 ft-lbs (47.5-54.3 Nm).
6. Install front fender. See 2.30 FRONT FENDER: ALL BUT FLSTSB.
7. Install front wheel and brake caliper. See 2.4 FRONT WHEEL: ALL BUT FLSTSB.
8. Check steering head bearing adjustment if fork stem was removed. See 1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB.

GENERAL

This topic is divided as follows:

- 2.19 FRONT FORK: SPRINGER, Front Shock Absorber
- 2.19 FRONT FORK: SPRINGER, Rigid Fork
- 2.19 FRONT FORK: SPRINGER, Spring Fork
- 2.19 FRONT FORK: SPRINGER, Fork Rockers
- 2.19 FRONT FORK: SPRINGER, Fork Stem Bearings

Other important information related to the front fork can be found under the following topics:

- 2.28 HANDLEBARS: FLSTSB
- 1.21 STEERING HEAD BEARINGS: FLSTSB
- 1.22 ROCKER BEARINGS: FLSTSB

FRONT SHOCK ABSORBER

Removal

NOTE

The shock absorber does not have a spring, so there is no pre-load.

1. See Figure 2-67. Remove acorn nuts and washers (1).
2. Remove both screws and washers (2). Remove front shock absorber (3).

Installation

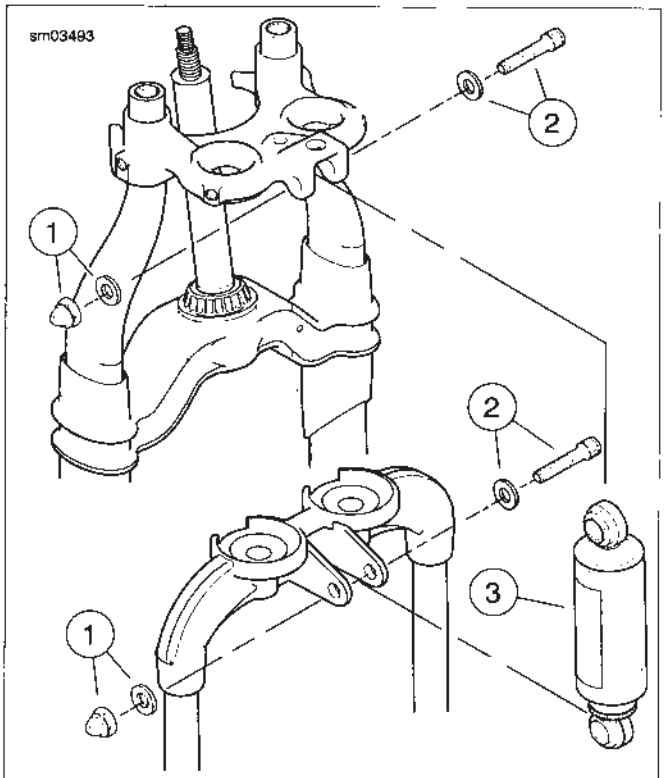
⚠WARNING

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)

1. See Figure 2-67. Apply LOCTITE THREADLOCKER 243 (blue) to screws (2).
2. Place shock absorber (3) in position in bracket holes and install screws, washers, and acorn nuts. Tighten acorn nuts to 45-50 ft-lbs (61.0-67.8 Nm).

NOTE

Be sure there is no free play between shock absorber eyes and shock absorber brackets. Free play between shock absorber eyes and shock absorber brackets indicates incorrect shock absorber usage.



1. **Acorn nuts and washers**
2. **Screws and washers**
3. **Front shock absorber**

Figure 2-67. Shock Absorber

RIGID FORK

Removal

NOTE

It is possible to remove the spring fork without removing the entire fork assembly, if you follow steps 1-6 under RIGID FORK REMOVAL and then steps 1-10 under SPRING FORK DISASSEMBLY. Block up front of vehicle so front wheel is off the floor.

1. Remove headlamp and mounting block. See 7.15 HEADLAMP. Move headlamp out of the way and let wire support it.
2. Remove handlebar and risers. See 2.28 HANDLEBARS: FLSTSB.
3. Remove front brake caliper and brake line. See 2.14 FRONT BRAKE CALIPER: FLSTSB.
4. Remove wheel. See 2.5 FRONT WHEEL: FLSTSB.
5. Remove front fender. See 2.31 FRONT FENDER: FLSTSB.
6. See Figure 2-68. Remove fork stem acorn nut (2) and rubber washer (3). Loosen the upper triple clamp pinch bolt (4).
7. Remove the rigid fork leg studs (1).

8. Remove upper triple clamp (5).
9. Remove steering head bearing retainer (6) and upper bearing dust shield (7).
10. Remove fork stem and fork from steering head.

Installation

1. Insert fork stem and fork lock in steering head.

NOTE

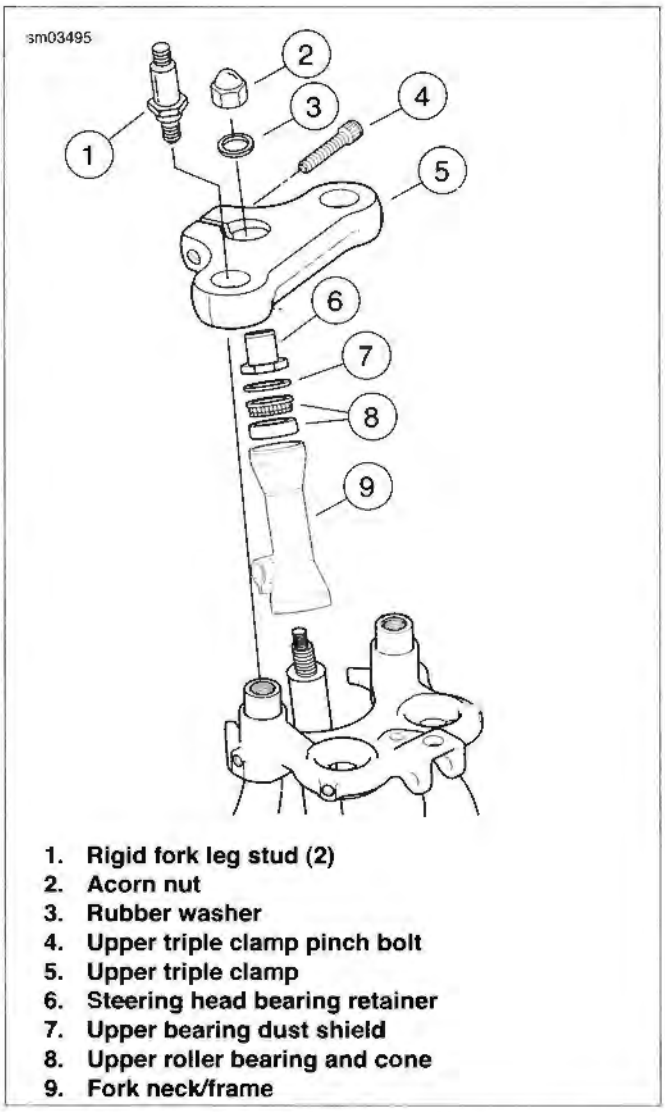
Steering head bearing retainer is installed with hex DOWN as shown.

2. See Figure 2-68. Install upper bearing dust shield (7) and steering head bearing retainer (6).
3. Seat steering head bearing by tightening bearing retainer (6) to 20-25 ft-lbs (27.1-33.9 Nm). Loosen and then re-torque bearing retainer to 120-144 **in-lbs** (13.6-16.3 Nm).
4. Place upper triple clamp (5) in position on stem and rigid fork legs.

NOTE

Install rigid fork leg studs (1) in next three steps.

5. Start threads of both studs in fork leg.
6. Tighten both studs.
7. Torque both studs to 60-65 ft-lbs (81.3-88.1 Nm).
8. Install the upper triple clamp pinch bolt (4). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).
9. Install fork stem rubber washer (3) and acorn nut (2). Tighten to 30-35 **in-lbs** (3.4-4.0 Nm).
10. Adjust fall-away. See 1.21 STEERING HEAD BEARINGS: FLSTSB.



1. **Rigid fork leg stud (2)**
2. **Acorn nut**
3. **Rubber washer**
4. **Upper triple clamp pinch bolt**
5. **Upper triple clamp**
6. **Steering head bearing retainer**
7. **Upper bearing dust shield**
8. **Upper roller bearing and cone**
9. **Fork neck/frame**

Figure 2-68. Steering Head/Fork Stem Assembly

SPRING FORK

Disassembly

⚠WARNING

Use cable straps to secure spring fork legs to rigid fork legs. If spring fork legs are not held in place, spring pressure could snap them forward, resulting in death or serious injury. (00305b)

1. Remove front shock absorber.
2. See Figure 2-70. Make a spring fork compression tool as shown.
   a. Slide rod, without steel coupling nut (2) and washers (3), into the hole above the upper shock eye mount.
   b. Install block in the bottom shock absorber eye using the shock absorber mounting bolt and washers.
   c. Install the washers and steel coupling nut on the rod.
3. See Figure 2-69. Use cable ties to secure the fork legs in place as shown.

4. Use the tool and compress the compression (lower) springs until they bottom on the travel bumpers. This will release the pressure on the rebound (upper) springs.

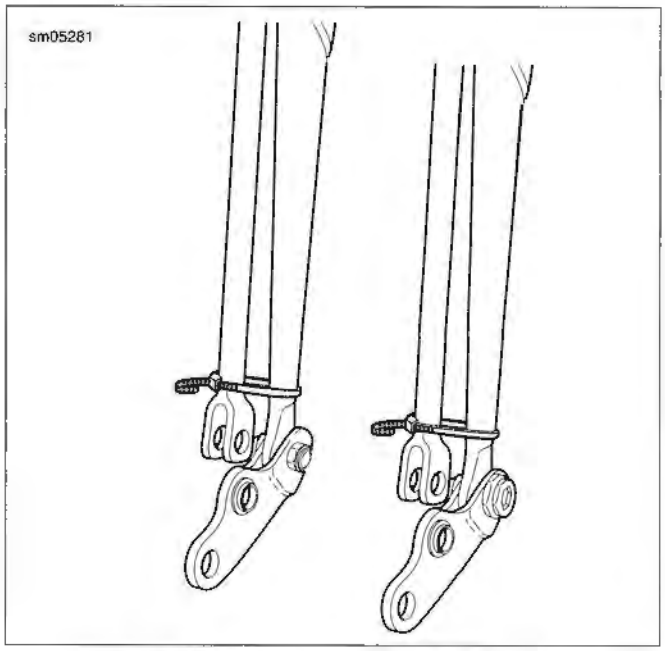
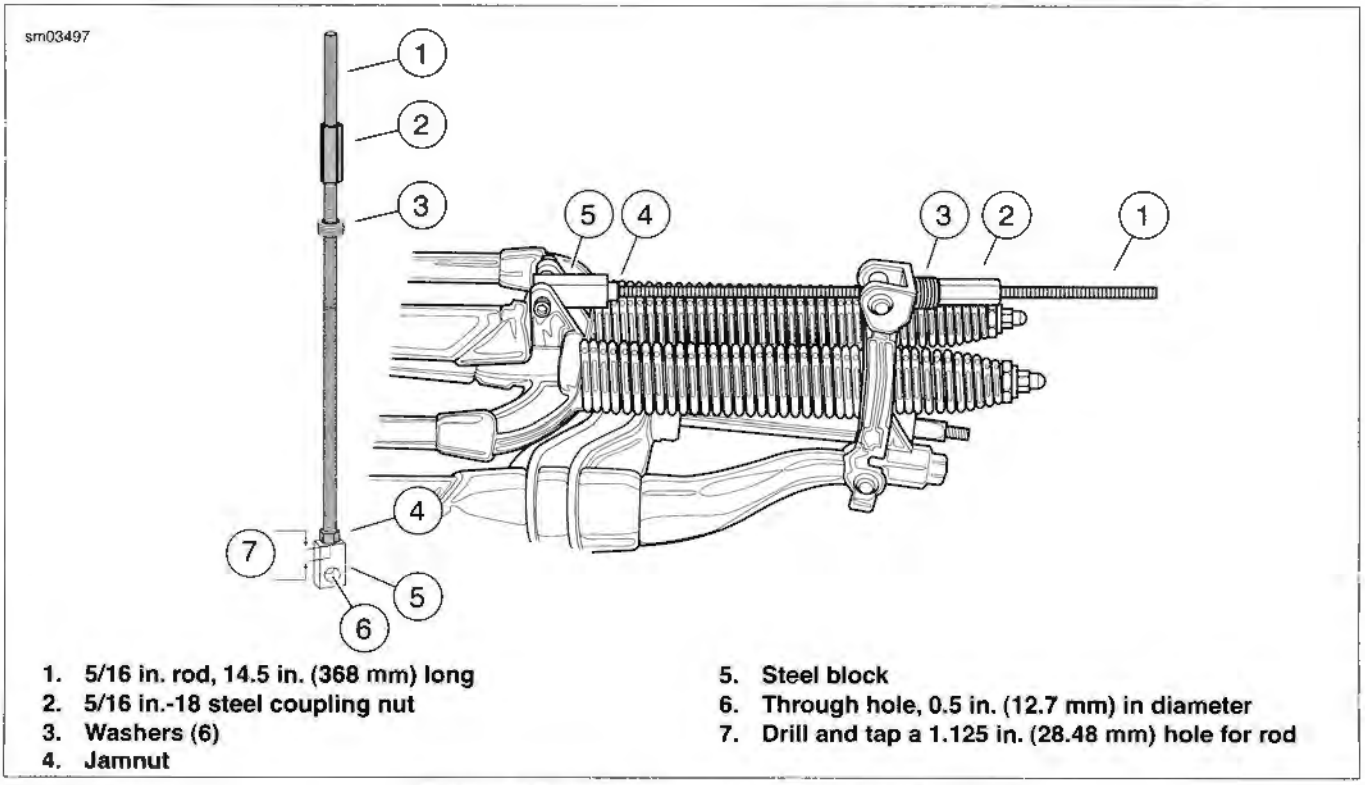


Figure 2-69. Nylon Ties on Fork Legs



1. **5/16 in. rod, 14.5 in. (368 mm) long**
2. **5/16 in.-18 steel coupling nut**
3. **Washers (6)**
4. **Jamnut**
5. **Steel block**
6. **Through hole, 0.5 in. (12.7 mm) in diameter**
7. **Drill and tap a 1.125 in. (28.48 mm) hole for rod**

Figure 2-70. Fork Spring Compression Tool

5. See Figure 2-71. Remove acorn nuts (1), washers (2) and spring bridge (3).
6. Remove upper spring restraints (4).
7. Remove upper rebound springs (5).
8. Remove rebound spring cups (6).
9. Remove upper rubber travel bumpers (7).
10. Remove spring rod bushings (8).

NOTE

Label hardware for orientation before removing to aid during installation.

11. See Figure 2-72. Remove rocker pivot studs (3), washers (6) and nuts (7) from rockers (4).
12. Inspect bearing (5) and replace if necessary.
13. Unscrew the tool, gradually releasing the tension on the lower (compression) springs.

14. Remove spring fork assembly from rigid fork assembly and rockers. Slide legs out of nylon tie wraps.
15. See Figure 2-73. Remove compression spring cups (2) and lower rubber travel bumpers (1). Remove outer compression springs (3).
16. Remove inner/upper compression springs (4).

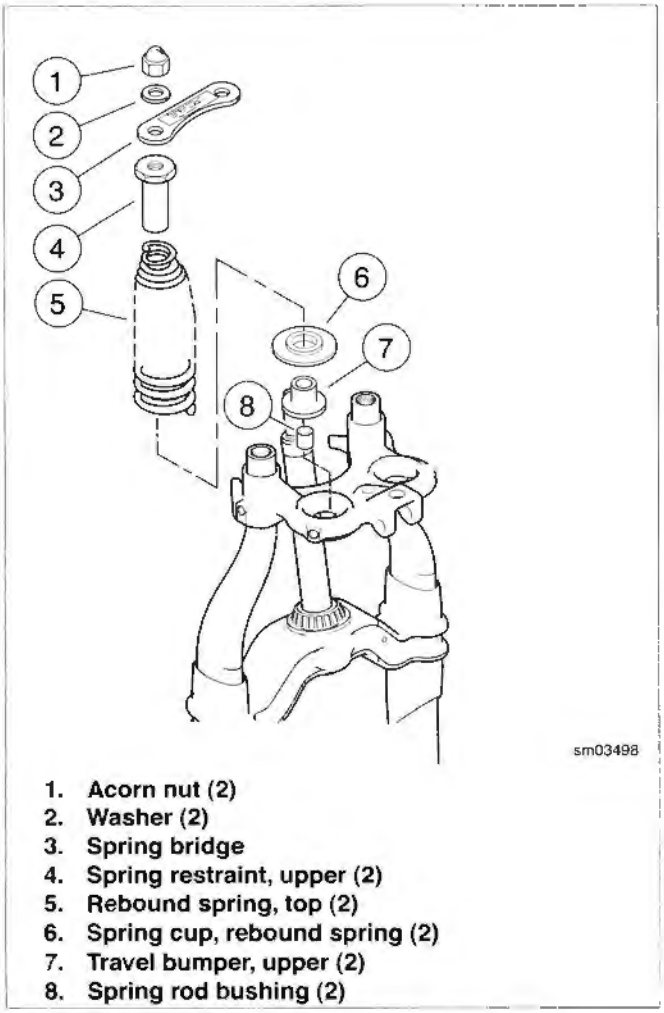
NOTE

Rotate spring to position that allows the easiest access through the coils to cross-hole at the bottom of the lower spring rod.

17. Insert a #2 Phillips head screwdriver in the cross-hole at the bottom of the lower spring rod assembly (5) and loosen the lower spring rod acorn nuts (8). Remove screwdriver. Remove the lower spring rod acorn nuts and spring rod assemblies.
18. Remove spring seats (6) and inner/lower compression springs (7) from spring rod assembly (5).

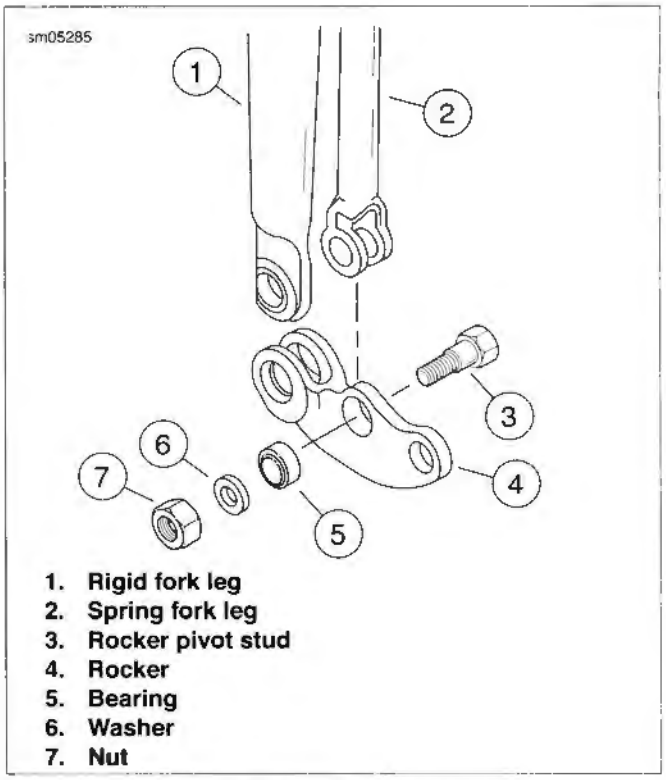
NOTE

DO NOT remove the upper spring rods from the lower spring rods. If either the upper spring rod(s) or the lower spring rod(s) are damaged, replace as an assembly.



1. **Acorn nut (2)**
2. **Washer (2)**
3. **Spring bridge**
4. **Spring restraint, upper (2)**
5. **Rebound spring, top (2)**
6. **Spring cup, rebound spring (2)**
7. **Travel bumper, upper (2)**
8. **Spring rod bushing (2)**

Figure 2-71. Rebound Spring: Disassembly



1. **Rigid fork leg**
2. **Spring fork leg**
3. **Rocker pivot stud**
4. **Rocker**
5. **Bearing**
6. **Washer**
7. **Nut**

Figure 2-72. Rocker Assembly

Assembly

1. See Figure 2-73. Place both spring seats (6) on the spring rod assembly (5).
2. Place inner/lower compression spring (7) over lower spring rod and spring seats.
3. Position spring rods assembly in spring fork bracket.
4. Install lower spring rod acorn nut (8).
5. Use a #2 Phillips head screwdriver in the cross-hole at the bottom of the spring rod assembly (5). Tighten lower spring rod acorn nut to 20-25 ft-lbs (27.1-33.9 Nm).
6. Place inner/upper compression spring (4) on spring seats.
7. Place outer compression spring (3) over the inside compression springs.
8. Install compression spring cup (2) and lower rubber travel bumpers (1).
9. Repeat previous steps for other side.
10. Position spring fork assembly in rigid fork assembly so lower springs, lower rubber travel bumpers, and spring cups are at the bottom of the rigid fork spring brace. Make sure lower rubber travel bumpers are seated in the rigid fork, and make sure the spring fork legs are in the nylon cable ties.
11. Use the compression tool and compress the compression (lower) springs.
12. See Figure 2-72. Place spring fork lower end in position in rocker (4).
13. Make sure bearing (5) is properly inserted in rocker (4).

14. Install thick head pivot stud (3), from outboard side, with thick washer (6) and nut (7). Tighten nut to 45-50 ft-lbs (61.0-67.8 Nm).
15. Repeat two previous steps for other side.
16. See Figure 2-74. Lubricate spring rod bushing (8) and place on spring rod. Slide bushing down until it bottoms in lower rubber travel bumpers (9).
17. Install upper rubber travel bumpers (7) over spring rod and bushing.
18. Install rebound spring cup (6).
19. Install rebound spring (5).
20. Repeat four previous steps for other side.
21. Apply LOCTITE ANTI-SEIZE to top 0.5 in. (12.7 mm) of upper spring rods.

⚠WARNING

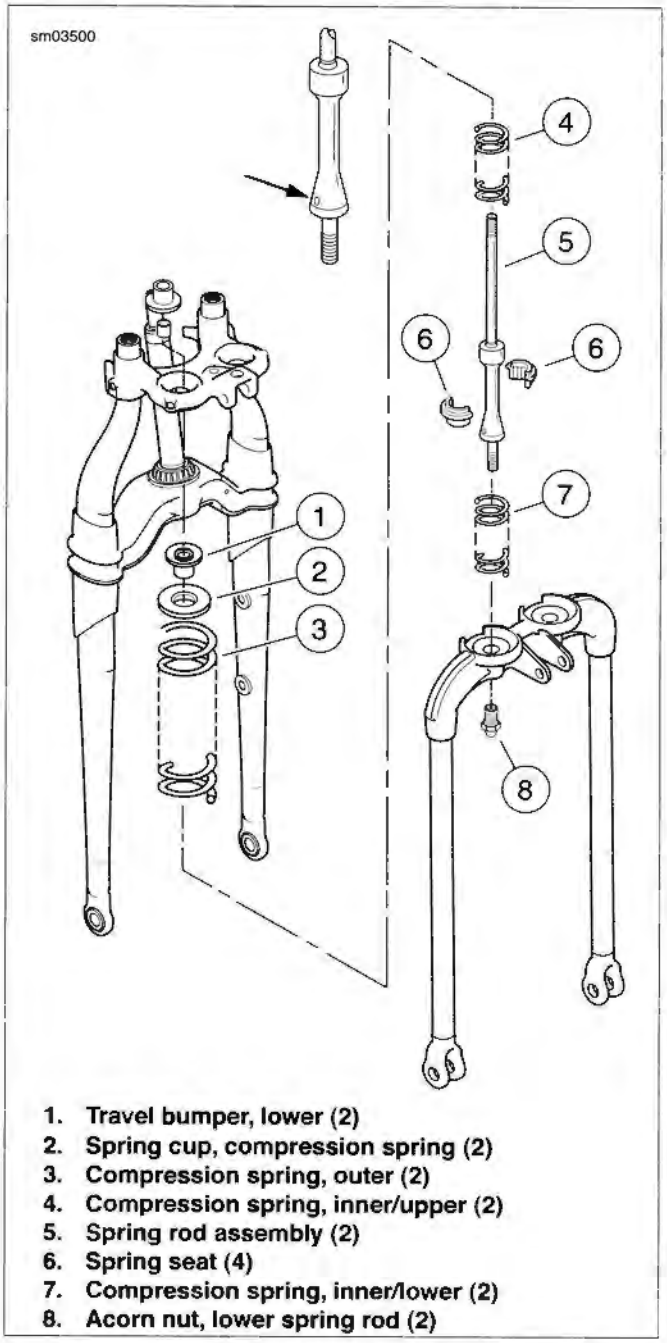
Be sure spring restraints are adjusted evenly. Uneven adjustments can adversely affect stability and handling, which could result in death or serious injury. (00300a)

22. See Figure 2-75. Place upper spring restraints (2) in position. Tighten spring bridge restraints until the spring rods protrude 0.625-0.750 in. (16-19 mm) from the tops of the spring restraints.

NOTES

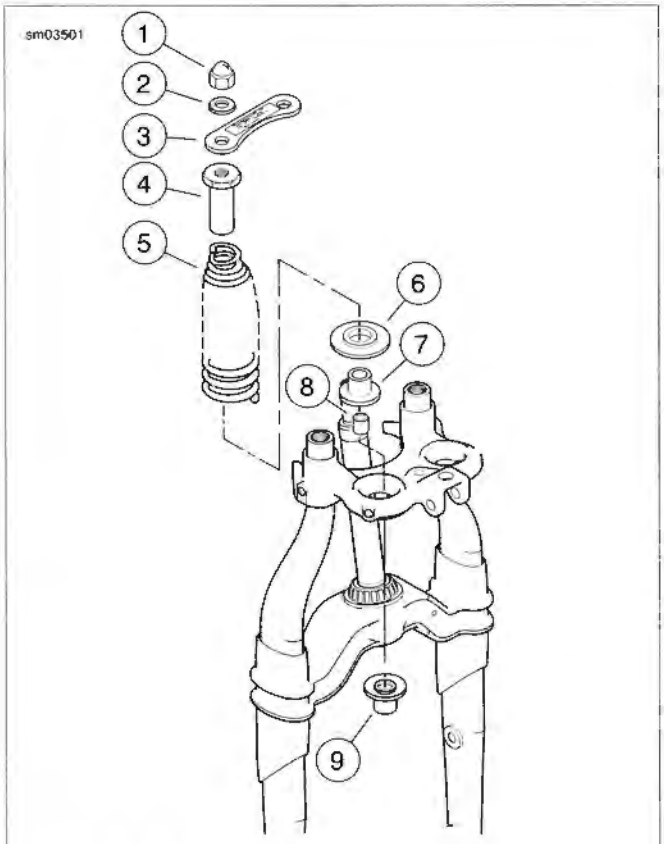
- *Be sure headlamp wire is between rebound springs before installing upper triple clamp or spring bridge.*
- *Curved edge of spring bridge goes forward.*

23. See Figure 2-74. Place spring bridge (3) in position. Install washers (2) and acorn nuts (1). Tighten acorn nuts to 30-35 ft-lbs (40.7-47.5 Nm).
24. Install front shock absorber. See 2.19 FRONT FORK: SPRINGER, Front Shock Absorber.
25. Install front fender. See 2.31 FRONT FENDER: FLSTSB.
26. Install wheel. See 2.5 FRONT WHEEL: FLSTSB.
27. Install front brake caliper and brake line. See 2.14 FRONT BRAKE CALIPER: FLSTSB.
28. Install handlebar and risers. See 2.28 HANDLEBARS: FLSTSB.
29. Install headlamp and mounting block. See 7.15 HEADLAMP.



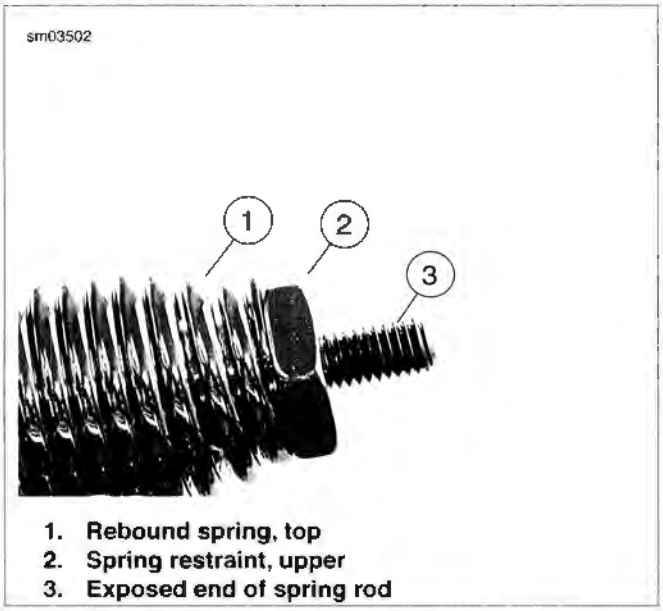
1. **Travel bumper, lower (2)**
2. **Spring cup, compression spring (2)**
3. **Compression spring, outer (2)**
4. **Compression spring, inner/upper (2)**
5. **Spring rod assembly (2)**
6. **Spring seat (4)**
7. **Compression spring, inner/lower (2)**
8. **Acorn nut, lower spring rod (2)**

Figure 2-73. Compression Spring



1. **Acorn nut (2)**
2. **Washer (2)**
3. **Spring bridge**
4. **Spring restraint, upper (2)**
5. **Rebound spring, top (2)**
6. **Spring cup, rebound spring (2)**
7. **Travel bumper, upper (2)**
8. **Spring rod bushing (2)**
9. **Travel bumper, lower (2)**

Figure 2-74. Rebound Spring: Assembly



1. **Rebound spring, top**
2. **Spring restraint, upper**
3. **Exposed end of spring rod**

Figure 2-75. Checking Spring Rod

FORK ROCKERS

Removal

1. Remove front brake caliper. See 2.14 FRONT BRAKE CALIPER: FLSTSB.
2. Remove front wheel. See 2.5 FRONT WHEEL: FLSTSB.

⚠WARNING

Use cable straps to secure spring fork legs to rigid fork legs. If spring fork legs are not held in place, spring pressure could snap them forward, resulting in death or serious injury. (00305b)

3. See Figure 2-69. Use cable ties to secure the fork legs in place as shown.

NOTE

Label hardware for orientation before removing to aid during installation.

4. See Figure 2-76. Remove the spring fork to rocker pivot studs (5), washers (2), and nuts (1) from rocker.
5. Remove bearing retainer jam nuts (7).
6. Remove bearing retainers (6).
7. Remove nuts (1) from rigid fork pivot studs. Remove rigid fork thin head pivot studs (4) from rockers and rigid fork legs. Remove bearings (10) from thin head pivot studs (4).
8. Remove rockers.

Installation

NOTE

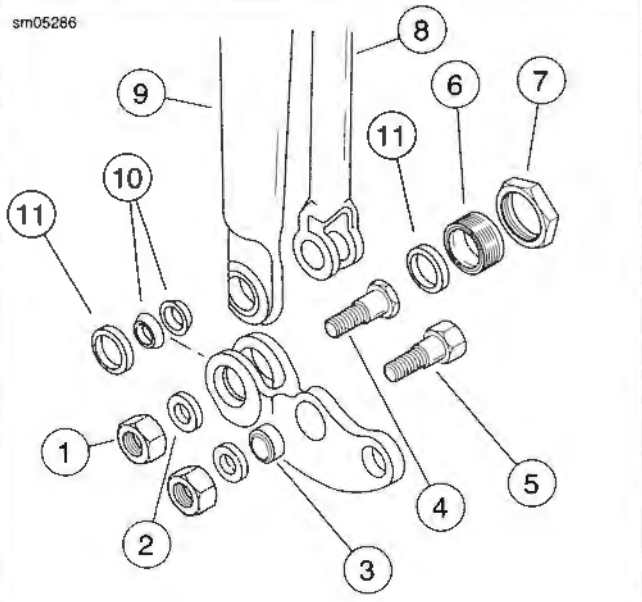
*The **threaded side** of the rocker and jam nut (7) is installed **outboard** of the rigid fork.*

1. If bearing races were removed, press races into rockers.
2. See Figure 2-76. Grease rocker bearing race with a finger full of grease. Place one bearing half (10) in rocker race with spherical surface against the race.
3. Place other half of bearing on pivot stud (4) with spherical surface towards stud head.
4. Place rocker in position, in rigid fork leg, with rocker facing forward.
5. Install pivot stud (thin head) assembly, from bearing retainer side, through the rigid fork leg, bearing, and other side of rocker.
6. Install thick washer (2) and nut (1). Use LOCTITE THREADLOCKER 243 (blue) on acorn nut. Tighten nut to 45-50 ft-lbs (61.0-67.8 Nm).
7. Apply LOCTITE ANTI-SEIZE to threads of bearing retainer (6). Apply a finger full of grease on the bearing race. Install bearing retainer. Tighten the retainer to 25-35 **in-lbs** (2.8-4.0 Nm).
8. Secure bearing retainer by installing jam nut (7). Tighten to 95-105 ft-lbs (128.8-142.4 Nm).

NOTE

Hold retainer in place with hex driver while tightening jam nut.

9. To adjust rockers, see 1.22 ROCKER BEARINGS: FLSTSB.



1. Nut (2)
2. Washer (2)
3. Spherical bearing, fork to rocker
4. Pivot stud, rigid fork to rocker
5. Pivot stud, spring fork to rocker (thick head)
6. Bearing retainer, rigid fork
7. Bearing retainer jam nut
8. Spring fork leg
9. Rigid fork leg
10. Spherical bearing ball, fork to rocker (2)
11. Spherical bearing race, fork to rocker

Figure 2-76. Fork Rocker

FORK STEM BEARINGS

Removal and Installation

NOTE

Cover rigid fork legs when prying bearing off to protect from nicks and damage.

1. See Figure 2-77. Remove bearing (1) and dust shield (2) from fork stem.

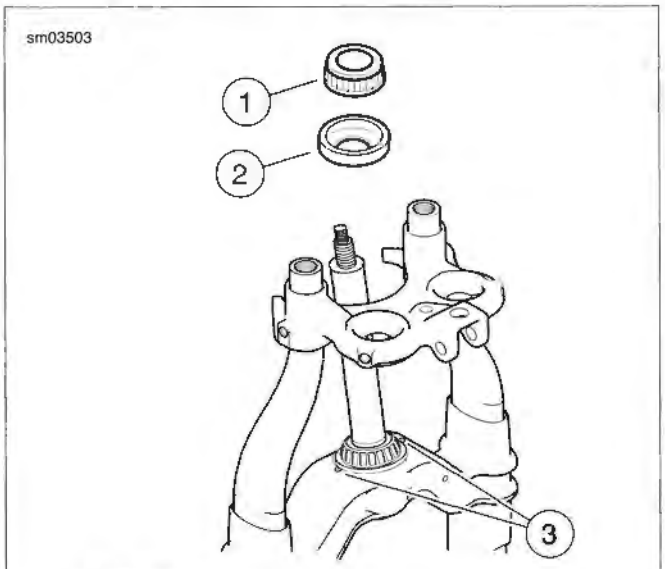
NOTE

Springer rigid fork stem bracket has notches (3) machined into the pad on the bracket. These notches make it possible to use a pair of pry bars to pry the lower dust shield and bearing off the fork stem.

2. Press dust shield (2) and bearing (1) onto fork stem.

NOTE

See 2.20 STEERING HEAD to replace lower bearing race within steering neck.



1. Bearing cone
2. Dust shield
3. Pry points for removal

Figure 2-77. Fork Stem Bearings

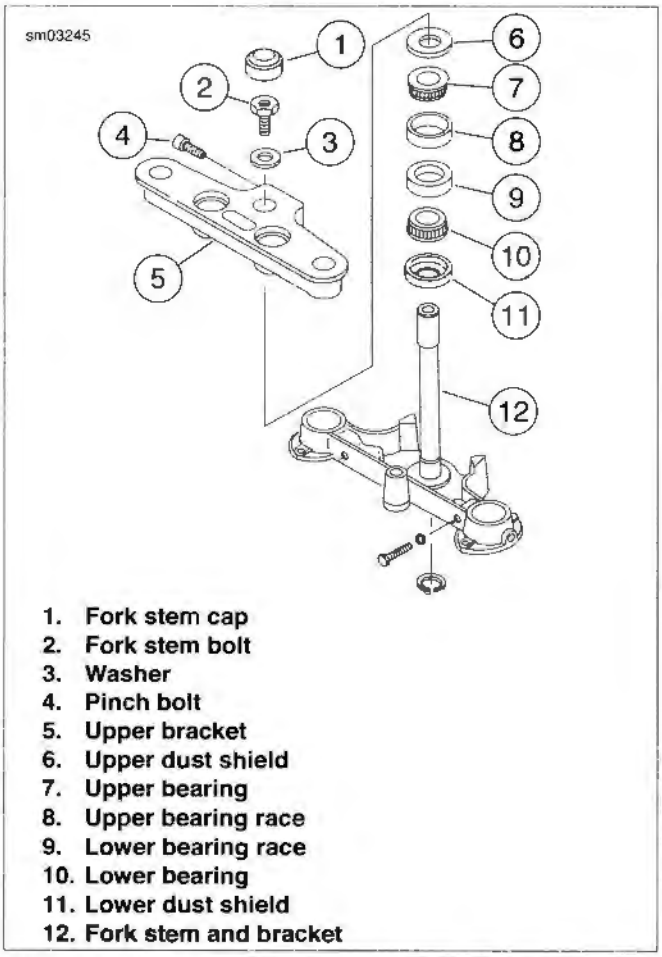
REMOVAL

NOTE

If bearing races are removed, the bearings cannot be reused-they must be replaced. See Removing Lower Bearings From Fork Stem under 2.20 STEERING HEAD, Disassembly, which follows.

FLST, FLSTC, FLSTF/B, FLSTN Models

1. Remove fork shrouds.
2. Remove the fork sides. See 2.18 FRONT FORK: TELESCOPIC.
3. Remove the headlamp and headlamp bracket.
4. See Figure 2-78. Remove the brake hose bracket from the bottom of the fork stem and bracket (12).
5. Remove the fork stem cap (1). Loosen pinch bolt (4) and remove fork stem bolt (2). Remove washer (3) with the handlebar and upper bracket (5) assembly.
6. Remove the fork stem and bracket (12) from the steering head. Remove the upper dust shield (6).
7. Remove upper bearing (7).

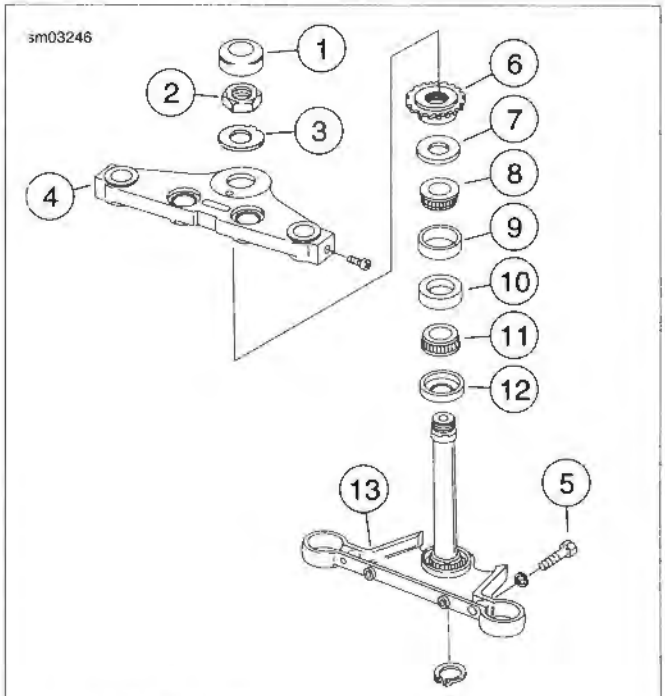


1. **Fork stem cap**
2. **Fork stem bolt**
3. **Washer**
4. **Pinch bolt**
5. **Upper bracket**
6. **Upper dust shield**
7. **Upper bearing**
8. **Upper bearing race**
9. **Lower bearing race**
10. **Lower bearing**
11. **Lower dust shield**
12. **Fork stem and bracket**

Figure 2-78. Steering Head: FLST, FLSTC, FLSTF/B, FLSTN

FXST, FXSTC Models

1. Remove the fork sides. See 2.18 FRONT FORK: TELESCOPIC.
2. Remove the headlamp and headlamp bracket.
3. See Figure 2-79. Remove the brake hose bracket from the bottom of the fork stem and bracket (13).
4. Remove the fork stem cap (1). Remove the fork stem nut (2) with the handlebar and upper bracket (4) as an assembly.
5. Remove the adjusting nut (6) and pull the fork stem and bracket (13) out of the steering head.
6. Remove the upper dust shield (7) and upper bearing (8) from steering head.



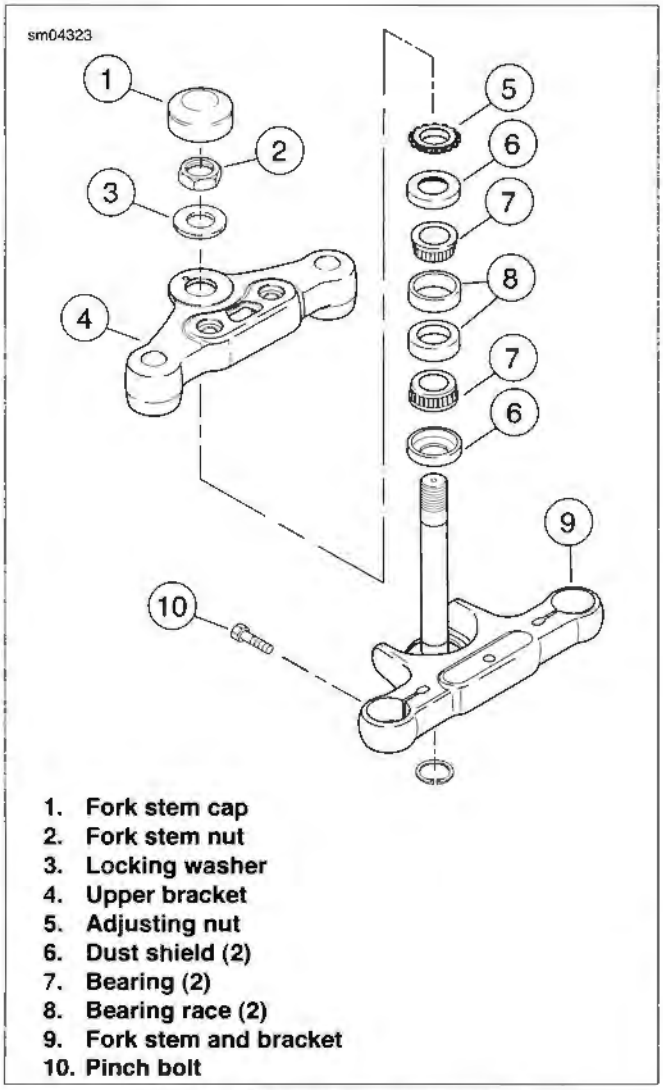
1. **Fork stem cap**
2. **Fork stem nut**
3. **Lockwasher**
4. **Upper bracket**
5. **Pinch bolt**
6. **Adjusting nut**
7. **Upper dust shield**
8. **Upper bearing**
9. **Upper bearing race**
10. **Lower bearing race**
11. **Lower bearing**
12. **Lower dust shield**
13. **Fork stem and bracket**

Figure 2-79. Steering Head: FXST/FXSTC

FXCWC Models

1. Remove the fork sides. See 2.18 FRONT FORK: TELESCOPIC.

2. Remove the headlamp and headlamp bracket.
3. See Figure 2-80. Remove the brake hose bracket from the bottom of the fork stem and bracket (9).
4. Remove the fork stem cap (1). Remove the fork stem nut (2) with the handlebar and upper bracket (4) as an assembly.
5. Remove the adjusting nut (5) and pull the fork stem and bracket (9) out of the steering head.
6. Remove the upper dust shield (6) and bearings (7) from steering head.

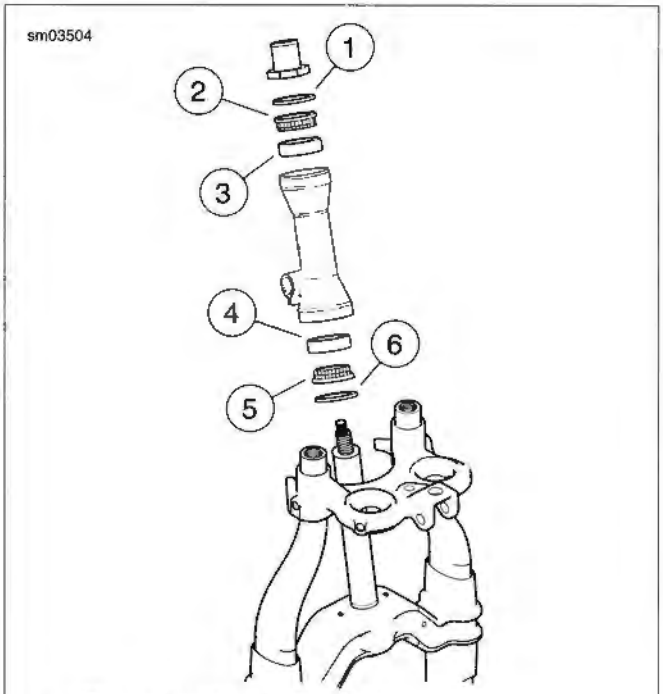


1. **Fork stem cap**
2. **Fork stem nut**
3. **Locking washer**
4. **Upper bracket**
5. **Adjusting nut**
6. **Dust shield (2)**
7. **Bearing (2)**
8. **Bearing race (2)**
9. **Fork stem and bracket**
10. **Pinch bolt**

Figure 2-80. Steering Head: FXCWC

FLSTSB Models

1. Remove fork from steering head. See 2.19 FRONT FORK: SPRINGER.
2. See Figure 2-81. Remove upper bearing dust shield (1).
3. Remove upper bearing (2).



1. **Upper bearing dust shield**
2. **Upper bearing**
3. **Upper bearing race**
4. **Lower bearing race**
5. **Lower bearing**
6. **Lower bearing dust shield**

Figure 2-81. Steering Head

INSPECTION

All Models

1. Check upper and lower bearing races in steering head. If they are pitted or grooved, replace the bearings and races in sets.
2. Check the roughness of the bearings by turning them in the race. Replace bearings if they do not turn freely and smoothly.

DISASSEMBLY

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

CAUTION

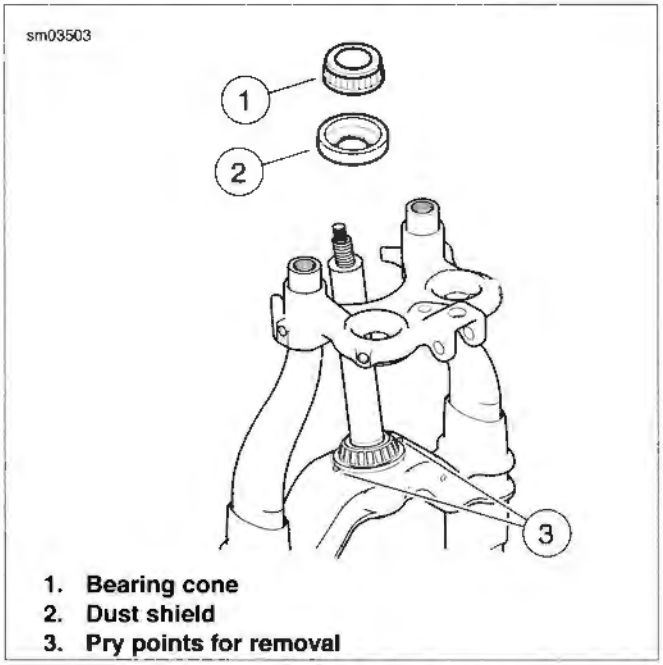
Replace both bearing assemblies even if one assembly appeares to be good. Mismatched bearings can lead to excessive wear and premature replacement. (00532b)

Removing Lower Bearings From Fork Stem

1. Chisel cage that holds rollers on bearing.
2. Turn the fork stem upside down and heat the inner race. The race will expand and fall off fork stem. Once the race is removed, you will be able to remove the lower dust shield.

NOTE

See Figure 2-82. The springer rigid fork stem bracket has notches machined into the pad on the bracket. These notches make it possible to use a pair of pry bars to pry the lower dust shield and bearing off the fork stem.



1. **Bearing cone**
2. **Dust shield**
3. **Pry points for removal**

Figure 2-82. Fork Stem Bearings

Steering Head Bearing Race Removal

1. See Figure 2-83. With the tapered side down, seat the two-piece removal tool from the STEERING HEAD BEARING RACE REMOVER (Part No. HD-39301a) on the upper bearing race leaving a gap in the middle.
2. Install the driver handle adapter on the UNIVERSAL DRIVER HANDLE (Part No. HD-33416).
3. Insert the driver at the bottom of the steering head tube, and while holding the remover tool on the race, center the collet in the gap. Tap the driver to remove the upper race.
4. Reverse the tool and repeat the procedure to remove the lower bearing race.

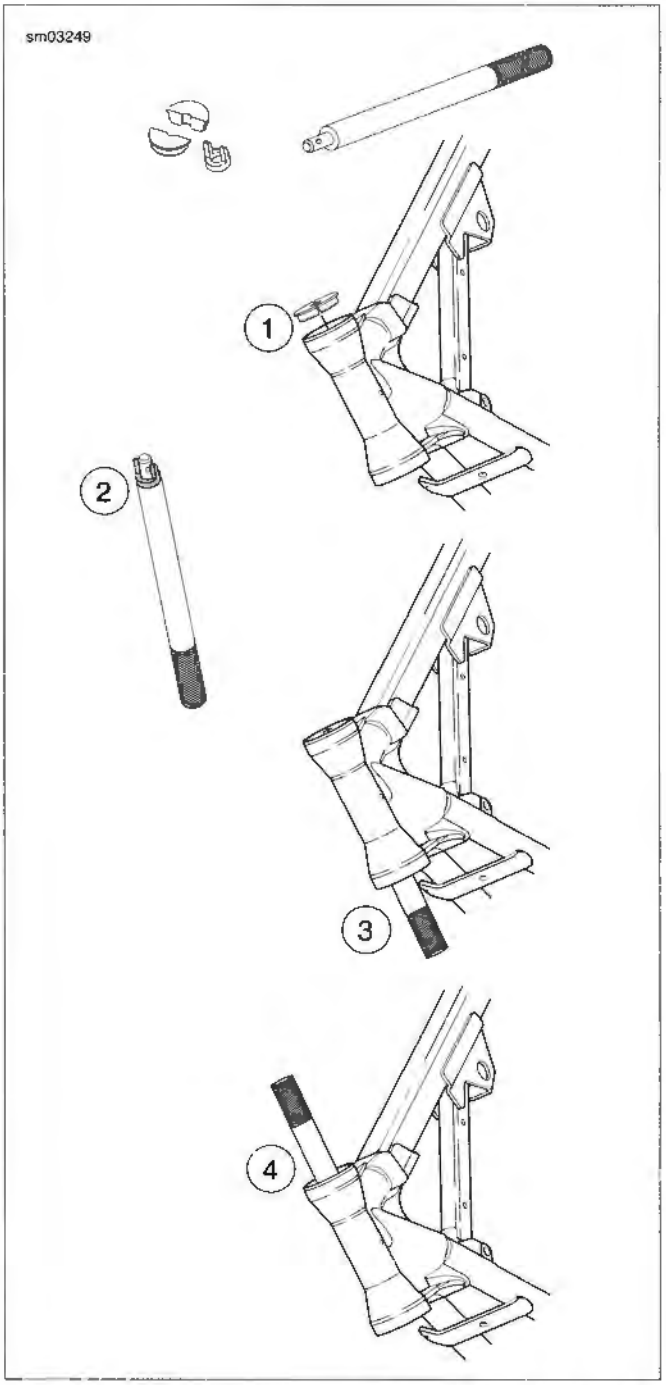


Figure 2-83. Remove Upper and Lower Steering Head Bearing Races

ASSEMBLY

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

1. Lubricate outside of the bearing races with engine oil.
2. Install the **new** races using STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).

NOTE

Use care not to damage the new races' tapered surface. The race should be firmly seated against the shoulder in the bore.

3. Pack the **new** bearings with Harley-Davidson Special Purpose Grease.
4. Install the lower dust shield on the fork stem. Press the lower bearing into place. Use a sleeve that will contact only the inner race of the **new** bearing.

INSTALLATION

FLST, FLSTC, FLSTF/B, FLSTN Models

1. See Figure 2-78. Insert the fork stem and bracket assembly (12) (with lower dust shield and bearing) into the frame steering head. Install the upper bearing (7) and dust shield (6).
2. Install the upper bracket (5), a **new** washer (3), and fork stem bolt (2). Tighten the fork stem bolt until the bearings have no noticeable shake. Fork stem must turn freely from side to side.
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Install the headlamp assembly.
5. Install the fork sides.
6. Fill neck with Harley-Davidson Special Purpose Grease through grease fitting located in the steering head.

⚠WARNING

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

7. Adjust fall-away. See 1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB.
8. Apply LOCTITE ANTI-SEIZE to upper bracket pinch bolt (4). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).
9. Install the fork stem cap (1).

FXST, FXSTC Models

1. See Figure 2-79. Insert the fork stem bracket assembly (13) (with lower dust shield and bearing) into the frame steering head and install the upper bearing (8) and dust shield (7). Secure with the adjusting nut (6).
2. Install the upper bracket (4), a **new** lockwasher (3), and fork stem nut (2). Be sure pin on lockwasher is engaged in upper bracket hole.
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Install the headlamp assembly.
5. Install the fork sides.
6. Fill neck with Harley-Davidson Special Purpose Grease through grease fitting located in the steering head.

⚠WARNING

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

7. Adjust fall-away. See 1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB.
8. Tighten fork stem nut (2) to 70-80 ft-lbs (94.9-108.4 Nm). Bend the lockwasher (3) tab against the nut flat.
9. Install the fork stem cap (1).

FXCWC Models

1. See Figure 2-80. Insert the fork stem bracket assembly (9) (with lower dust shield and bearing) into the frame steering head and install the upper bearing (7) and dust shield (6). Secure with the adjusting nut (5).
2. Install the upper bracket (4), a **new** locking washer (3), and fork stem nut (2). Be sure pin on locking washer is engaged in upper bracket hole.
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Install the headlamp assembly.
5. Install the fork sides.
6. Fill neck with Harley-Davidson Special Purpose Grease through grease fitting located in the steering head.

⚠WARNING

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

7. Adjust fall-away. See 1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB.
8. Tighten fork stem nut (2) to 70-80 ft-lbs (94.9-108.4 Nm). Bend the locking washer (3) tab against the nut flat.
9. Install the fork stem cap (1).

FLSTSB Models

See 2.19 FRONT FORK: SPRINGER to install front fork assembly.

REMOVAL

Belt Guard

1. Remove left saddlebag if present.
2. See Figure 2-84. Remove acorn bolt (9) from tee nut (7).
3. Remove acorn nut (4) to detach belt guard (5).

Debris Deflector

1. Remove left saddlebag if present.
2. Remove lower acorn bolt (3).
3. Loosen, but do not remove, bolt (1) at front (slotted) portion of deflector.
4. Remove acorn nut (4). Lift debris deflector up and away from frame.

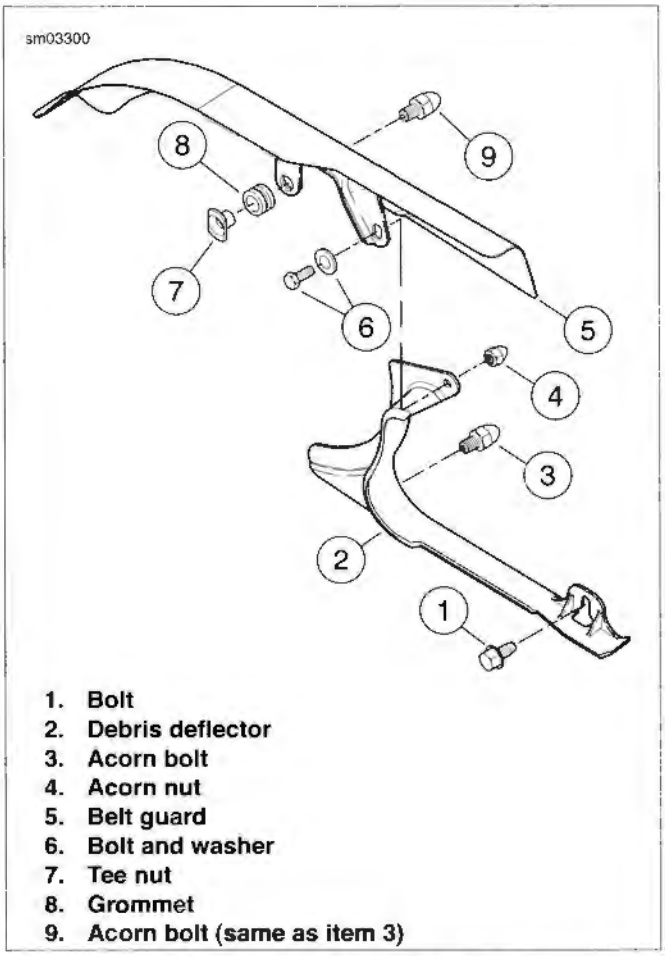
INSTALLATION

Belt Guard

1. See Figure 2-84. Place the belt guard (5) into position. Tab for bolt and washer (6) must fit inboard of tab on debris deflector (2).
2. Install bolt and washer (6) through belt guard (5), debris deflector (2) and rear fork. Install acorn nut (4) securely.
3. Install acorn bolt (9) onto tee nut (7).
4. Install left saddlebag if removed.

Debris Deflector

1. Place debris deflector (2) into position. Slotted opening on front of deflector slides over bolt (1). Do not tighten bolt at this time.
2. Install bolt and washer (6) through belt guard (5), debris deflector (2) and rear fork. Install acorn nut (4) securely.
3. Install lower acorn bolt (3) and tighten bolt (1) at front of deflector.
4. Install left saddlebag if removed.



1. **Bolt**
2. **Debris deflector**
3. **Acorn bolt**
4. **Acorn nut**
5. **Belt guard**
6. **Bolt and washer**
7. **Tee nut**
8. **Grommet**
9. **Acorn bolt (same as item 3)**

Figure 2-84. Belt Guard/Debris Deflector

GENERAL

The rear shock absorbers are not repairable. If either shock absorber becomes damaged, it must be replaced as an assembly.

NOTE

See 1.19 SUSPENSION ADJUSTMENTS for information regarding setting up the suspension for carrying cargo.

REMOVAL

PART NUMBER	TOOL NAME
SRES24	SNAP-ON-ADAPTER

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System.
2. Using a suitable lift, support motorcycle under frame until rear tire is slightly off the ground.
3. See Figure 2-85. Remove bolt and washer (1) attaching shock to rear fork.

NOTE

SNAP-ON-ADAPTER (Part No. SRES24) is necessary to gain access to shock bolt.

4. Remove flange locknut (5) and washer with grommet (4) at front of shock.

INSTALLATION

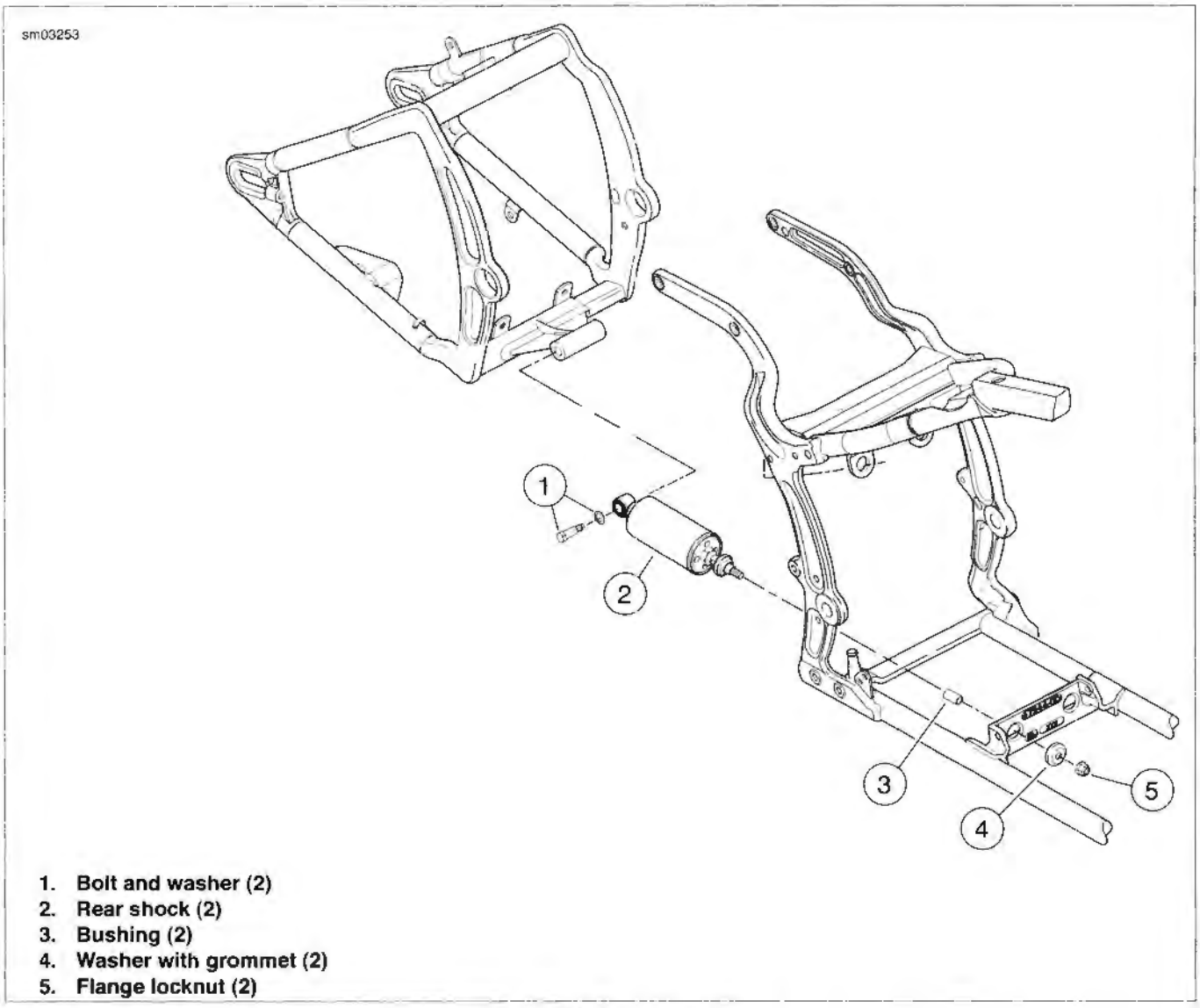
PART NUMBER	TOOL NAME
SRES24	SNAP-ON-ADAPTER
SS-306G	SNAP-ON TORQUE COMPUTER

1. See Figure Figure 2-85. Place washer with grommet (4) inside frame. Install bushing (3) over stud end of shock. Insert stud end through keyed frame tab and loosely install the flange locknut (5).
2. Coat shoulder of bolt (1) with LOCTITE ANTI-SEIZE and threads of bolt with LOCTITE THREADLOCKER 243 (blue). Insert bolt and washer (1) through shock end. Pivot shock absorber to align bolt with hole in rear fork.

NOTE

Softail shock absorber bolt torquing procedure requires the use of a SNAP-ON-ADAPTER (Part No. SRES24). Since the adapter lengthens the torque wrench, torque must be computed with a SNAP-ON TORQUE COMPUTER (Part No. SS-306G).

3. Tighten rear shock hardware.
   a. Tighten bolt and washer (1) at rear of shock to 121-136 ft-lbs (164.0-184.4 Nm).
   b. Tighten the flange locknut (5) to 32-39 ft-lbs (43.4-52.9 Nm).
4. Adjust both shock absorbers equally. See 1.19 SUSPENSION ADJUSTMENTS.
5. Install exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System.



1. **Bolt and washer (2)**
2. **Rear shock (2)**
3. **Bushing (2)**
4. **Washer with grommet (2)**
5. **Flange locknut (2)**

Figure 2-85. Rear Shocks

SHOCK DISPOSAL

1. Disassemble the shock absorber.

NOTE

The damper reservoir contains nitrogen gas and oil under pressure. Do not drill into the oil chamber.

2. See Figure 2-86. Center punch the reservoir between the weld and the reservoir can.
3. Support the reservoir in a vise.

⚠WARNING

Do not expose shock absorber to heat source. Exposure to heat source can build excessive gas pressure, which could cause explosion and result in death or serious injury. (00600b)

- Use sharp drill bit to prevent excessive heat when discharging.

4. Install a 6/64-1/8 bit in a drill.

⚠WARNING

Discharging pressurized oil and gas can pierce skin and cause flying debris, which could cause serious injury. Wear safety glasses and gloves. (00601b)

5. Drill at the punch mark retracting the drill as it penetrates the shell.
6. Allow the gas to escape.
7. Dispose of the shock absorber.

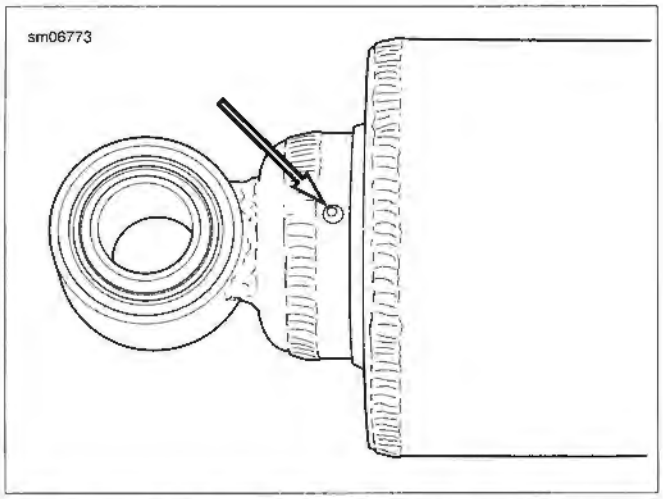


Figure 2-86. Center Punch/Drill Hole Location

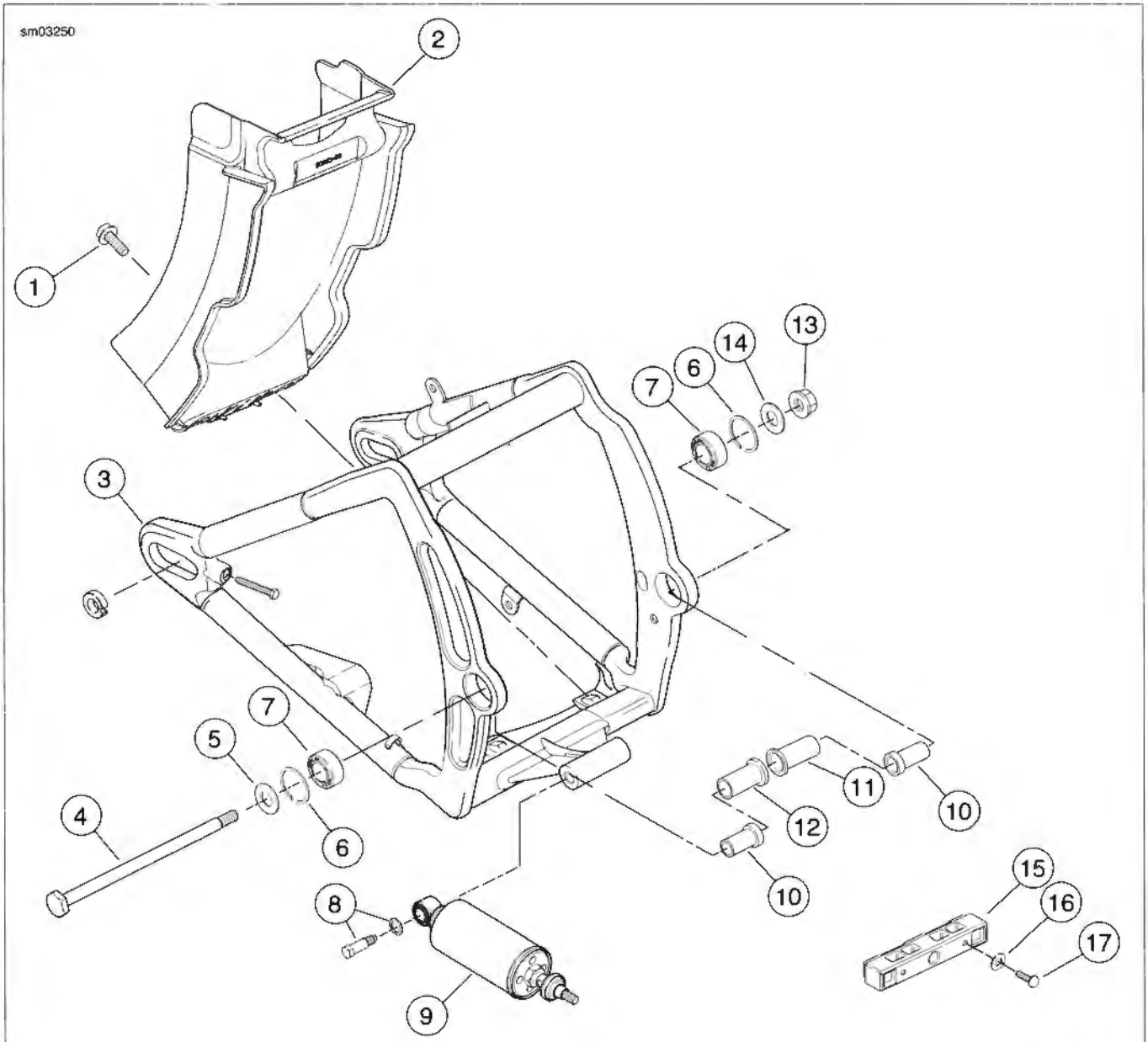
REMOVAL

1. Remove the rear wheel, rear brake caliper, and caliper mounting bracket. See 2.6 REAR WHEEL.
2. Remove the belt guard. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.
3. **All but FXCWC:** see Figure 2-87. Remove bolt (1) from splash guard (2). Lift up on lower tabs and pull lower end of splash guard rearward. Remove splash guard from rear fork.
4. **FXCWC:** Remove rear fender. See 2.35 REAR FENDER: FXCWC.
5. See Figure 2-87. Remove the rear shock absorber bolts and washers (8) only. See 2.22 REAR SHOCK ABSORBERS.
6. On California models, detach evaporative canister from transmission.

NOTE

Refer to Table 2-15. When removing pivot shaft, make note of spacer position on each side of transmission. Spacers differ slightly in length from each other and must be installed on the same side from which they were removed.

7. Remove pivot shaft (4) and two spacers (11, 12). Remove the two bushings (10) inside the spherical bearings (7). The rear fork can now be removed from the frame.



1. Bolt (2)
2. Splash guard (all but FXCWC)
3. Rear fork
4. Pivot shaft
5. Washer
6. Retaining ring (2)
7. Bearing (2)
8. Bolt and washer (2)
9. Rear shock (2)
10. Bushing (2)
11. Spacer, left
12. Spacer, right
13. Pivot shaft nut
14. Washer
15. Jounce bumper
16. Washer
17. Bolt

Figure 2-87. Rear Fork

CLEANING AND INSPECTION

The spherical bearings are lifetime lubricated and will require no further attention other than cleaning. The sleeve type spherical bearings, if not damaged, will last the life of the motorcycle. Clean the bearing bore with a clean shop towel, removing any dirt or grit adhering to the bearing surface.

Rough check the rear fork for correct alignment. A bent rear fork must be replaced.

PIVOT BEARING REPLACEMENT

1. Remove the rear fork from the vehicle. See 2.23 REAR FORK, Removal.

NOTE

The bearing has a groove built into it that the retaining ring fits into, so the retaining ring will come out with the bearing

2. Press out the fork pivot bearing with a suitable driver from the center of the fork toward the outside.
3. Install a **new** retaining ring onto a **new** bearing.
4. Position the bearing assembly against the outboard side of the rear fork pivot boss with the retaining ring outboard.
5. Press the bearing assembly into the rear fork pivot boss using a suitable driver.
6. Repeat for the other side.
7. Install rear fork on vehicle. See 2.23 REAR FORK, Installation.

INSTALLATION

1. See Figure 2-87. If Jounce bumper (15) was removed, install with washers (16) and bolts (17). Tighten bolts (17) to 84-108 **in-lbs** (9.5-12.2 Nm).
2. See Table 2-15. Place rear fork (3) in the frame so that the bores in the frame align with the bores in the fork. Insert the bushings (10) into the spherical bearings (7) from the inside.
3. Install pivot shaft (4).
   a. Apply LOCTITE ANTI-SEIZE to pivot shaft.

   NOTE

   Spacers differ slightly in length from each other and must be installed on the same side from which they were removed.

   b. From the right side, install pivot shaft (4) and spacers (11, 12) with spacer collars facing transmission case.
   c. Apply LOCTITE THREADLOCKER 262 (red) to threads of pivot shaft nut. Install and tighten pivot shaft nut to 90-110 ft-lbs (122-149.1 Nm).

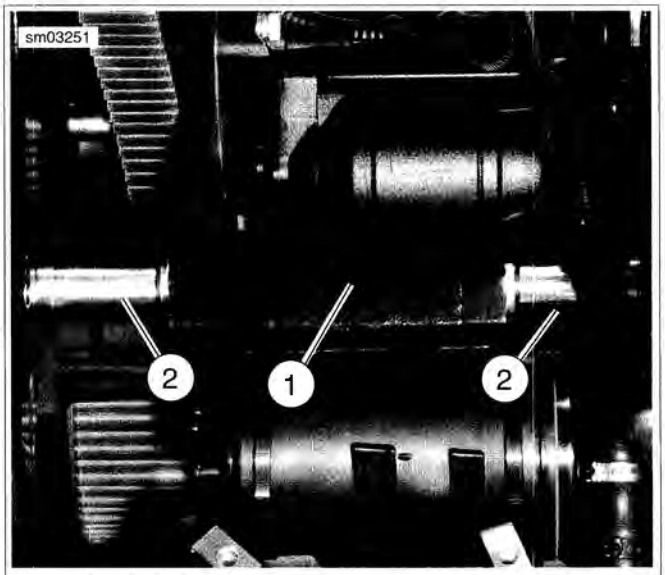
NOTE

Proper pivot shaft tightening is important to maintain rear fork alignment.

4. Check for freedom of rotation of the rear fork around the bearings and that the fork and frame side members have not been distorted when the pivot shaft nut was tightened.
5. Install the evaporative canister (California models). See 4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS).
6. **All but FXCWC:** Install splash guard (2).
7. **FXCWC:** Install rear fender. See 2.35 REAR FENDER: FXCWC.
8. Install caliper mounting bracket, rear wheel and brake caliper. See 2.6 REAR WHEEL.
9. Install both rear shock absorbers (9) using bolts and washers (8). See 2.22 REAR SHOCK ABSORBERS.

Table 2-15. Transmission Spacer Sizes

VEHICLE LEFT OR RIGHT SIDE	IN.	MM	NUMBER OF MACHINED LINES
All but FXCWC: Left side	1.946	49.43	2
All but FXCWC: Right side	1.569	39.85	1
FXCWC: Left side	2.420	61.47	4
FXCWC: Right side	2.530	64.26	3

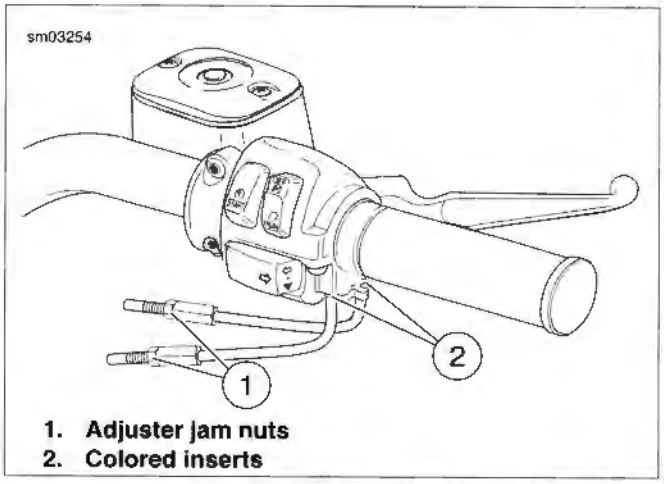


1. **Back of transmission**
2. **Spacer collar against transmission**

Figure 2-88. Spacer Collars (Electrical Panel Removed For Illustration)

REMOVAL/DISASSEMBLY

1. See Figure 2-89. Loosen cable adjuster jam nuts (1). Screw throttle cable adjuster until it is as short as possible. Remove the two screws that hold the handlebar housing together to separate the upper and lower housings.
2. Unhook the ferrules and cables from the throttle grip and lower housing.
3. Remove air cleaner assembly. See 4.5 AIR CLEANER ASSEMBLY.
4. Disconnect throttle cables from induction module. See 4.10 INDUCTION MODULE, Removal.
5. See Figure 2-90 Pull the cables from the housing by placing a drop of oil on the retaining ring that holds the cable in the housing, then firmly pull the bent tubing portion of the cable out of the housing using a rocking motion.



1. **Adjuster jam nuts**
2. **Colored inserts**

Figure 2-89. Handlebar Throttle Control

CLEANING AND INSPECTION

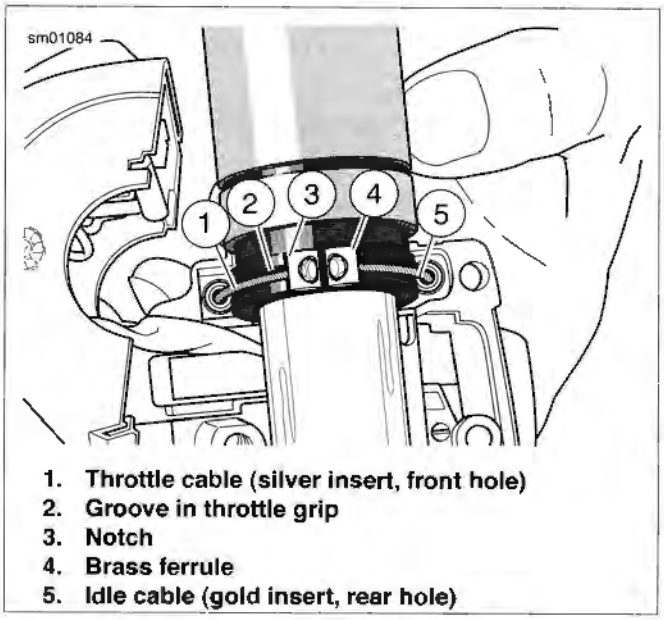
⚠WARNING

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

1. Wash all components in non-flammable cleaning solvent. Blow parts dry with low pressure compressed air.
2. Replace the control cables if frayed, kinked or bent.
3. Put one or two drops of oil into the housing of each control cable.

ASSEMBLY/INSTALLATION

1. Apply a light coating of graphite to the handlebar and inside surface of the housings.
2. See Figure 2-90. Attach the control cable assemblies to the lower housing.
   a. Push the silver insert of the throttle cable (1) housing into the hole in front of the tension adjuster screw.
   b. Push the gold diameter insert of the idle cable (5) housing into the hole at the rear of the tension adjuster screw.
   c. Install adjusting screw, spring and friction pad in the lower housing if they were removed.
3. Position the throttle grip on the handlebar. Place the lower housing on the throttle. Position the ferrules and retaining rings over the cable balls and seat them in the throttle notches.



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

Figure 2-90. Throttle Cable Attachment

⚠WARNING

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

4. Fasten upper housing to lower housing using two screws. Tighten to 35-45 **in-lbs** (4.0-5.1 Nm).
5. Check throttle cable routing. See 2.24 THROTTLE CONTROL, Cable Routing which follows.
6. Install throttle cables on induction module. See 4.10 INDUCTION MODULE, Installation.
7. Adjust throttle cables. See 1.13 THROTTLE CABLES.
8. Install air cleaner. See 4.5 AIR CLEANER ASSEMBLY.

CABLE ROUTING

⚠WARNING

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

The throttle cables are routed below the handlebars and behind the triple tree. They continue under the fuel tank through two cable clamps and back to throttle body.

REMOVAL

1. Loosen clutch adjuster so clutch cable is fully slack. See 1.11 CLUTCH.
2. See Figure 2-91. Remove the retaining ring (2) and pivot pin (4). Remove the clutch cable anchor pin (1) from the hand lever.

⚠WARNING

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

3. Drain transmission lubricant and remove fill plug dipstick. Remove transmission side cover. See 6.5 CLUTCH RELEASE COVER.
4. See Figure 2-92. Note position of retaining ring (1) opening. Retaining ring opening must be positioned in approximately the same location during assembly. Remove retaining ring.
5. Pull inner ramp (2) and ramp coupling (3) out of side cover. Hold inner and outer ramps together to keep balls from falling free.
6. Rotate the inner ramp to a position which will allow the coupling to be disconnected from the inner ramp lever arm. Disconnect coupling from inner ramp. Disconnect cable end (4) from coupling.
7. Back out threaded cable fitting (5) from side cover.

INSTALLATION

1. See Figure 2-92. Install **new** o-ring on end of clutch cable threads. Apply a drop of Loctite Threadlocker 243 (blue) to clutch cable fitting and screw fitting into clutch release cover. Do not tighten at this time.
2. Connect cable end to ramp coupling (3). Rotate ramps for best access and install coupling on inner ramp (2). Place ramp assembly in position in side cover.

⚠WARNING

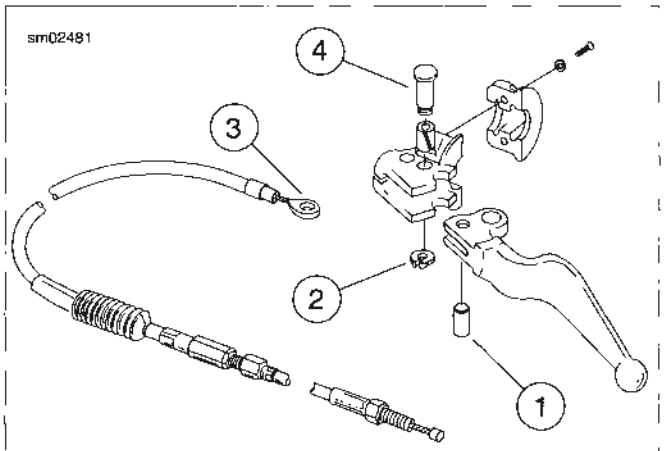
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

3. Install retaining ring (1). Position retaining ring opening to the right of the outer ramp tang (the stop that prevents rotation).
4. Place new gasket on side cover and install, fully tightening the clutch cable fitting. See 6.5 CLUTCH RELEASE COVER.
5. Place a few drops of oil inside cable housing.

NOTE

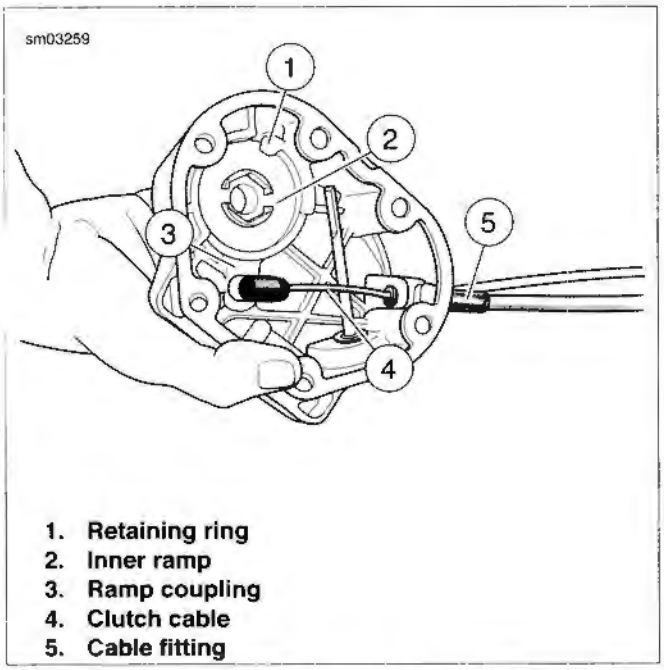
Anchor pin does not require lubrication.

6. Check that clutch cable is properly routed.
   a. Route clutch cable across the front of handlebars for the following models: FXSTC, FXST, FXCWC. Route clutch cable behind handlebars for the following models: FLSTF/B, FLST, FLSTC, FLSTN.
   b. Route cable down to clamp on left frame downtube.
   c. Route cable under engine mount spacer, gear cover, and through bracket.
   d. Route cable to transmission cover.
7. See Figure 2-91. Insert anchor pin (1) through handle and clutch cable clevis (3).
8. Place handle in bracket and install pivot pin (4) and retaining ring (2).
9. Adjust clutch cable. See 1.11 CLUTCH.



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

Figure 2-91. Clutch Cable Installation



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

Figure 2-92. Clutch Cable Connection

REMOVAL

⚠WARNING

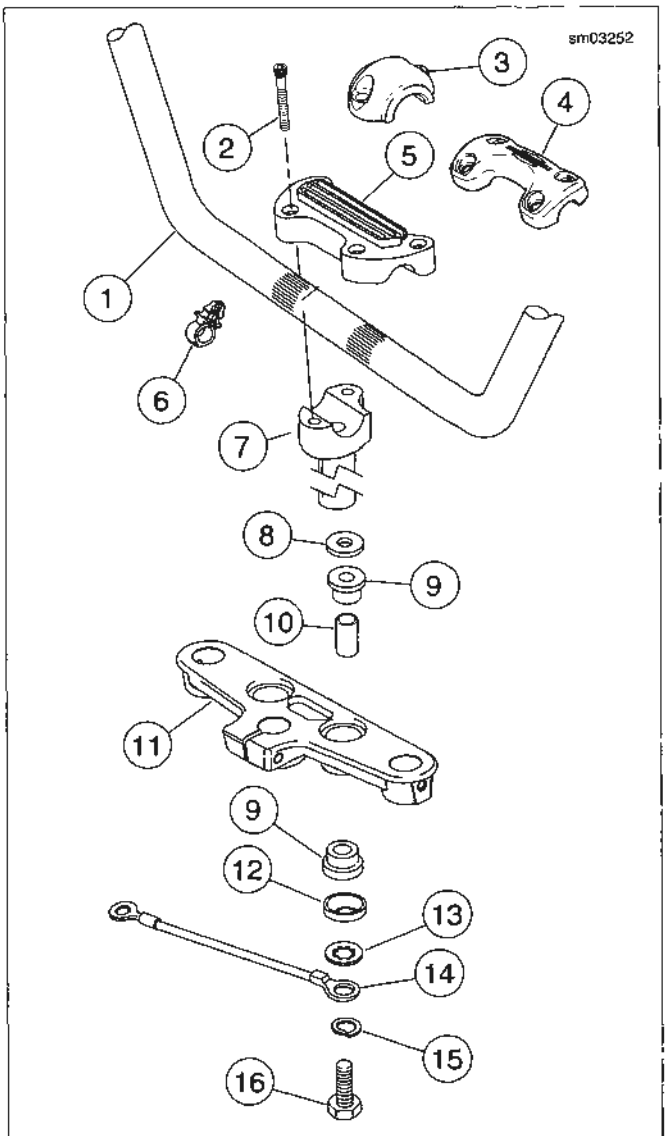
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove maxi-fuse.
2. Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.
3. Remove front master cylinder, right handlebar switch assembly, and throttle. See 7.38 RIGHT HANDLEBAR SWITCH.
4. Remove clutch control and left handlebar switch assembly. See 7.39 LEFT HANDLEBAR SWITCH.

NOTE

Original equipment grip is glued in place and must be cut off. Remove grip only if necessary.

5. Remove left handlebar grip.
6. See Figure 2-93. Remove upper handlebar clamp fasteners (2).
   a. **FLST/FLSTC/FXST:** remove upper handlebar clamp (5).
   b. **FLSTN:** remove upper handlebar clamp (4).
   c. **FXSTC:** remove upper handlebar clamp (3).
7. Remove handlebar (1).
8. If removing lower handlebar clamps (7), remove two lower handlebar clamp fasteners (16), lockwashers (15), ground cable (14) and ground cable washer (13) and lower handlebar clamps from upper fork bracket (11). Replace bushings (9) if necessary.



1. **Handlebar**
2. **Upper handlebar clamp fastener (4)**
3. **Upper handlebar clamp (FXSTC)**
4. **Upper handlebar clamp (FLSTN)**
5. **Upper handlebar clamp (FLST/FLSTC/FXST)**
6. **Wire harness retainer (4)**
7. **Lower handlebar clamp (2)**
8. **Upper cup washer (2)**
9. **Bushing (2)**
10. **Spacer (2)**
11. **Upper fork bracket (typical)**
12. **Lower cup washer (2)**
13. **Ground cable washer (right side only)**
14. **Ground cable (right side only)**
15. **Lockwasher (2)**
16. **Lower handlebar clamp fastener (2)**

Figure 2-93. Handlebars: All but FLSTF/FLSTFB/FXCWC

INSTALLATION

1. See Figure 2-93. If lower handlebar clamps (7) were removed, install lockwashers (15) on lower handlebar clamp fasteners (16). Install ground cable (14) and ground cable washer (13) on right-side fastener.

NOTE

In next step, make sure cup washers (8, 12), bushings (9) and spacer (10) are in position in upper fork bracket (11).

2. Slide lower handlebar clamp fasteners through upper fork bracket.
3. Loosely install lower handlebar clamps to upper fork bracket using lower handlebar clamp fasteners.
4. See Figure 2-94. Place handlebars on lower handlebar clamps. Install upper handlebar clamps. Install but do not tighten clamp fasteners.
5. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

NOTE

On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp and will not be visible at all when handlebar is centered properly.

6. Raise handlebars to normal riding position and hold in position.
7. Secure handlebars in clamp:
   a. Hand tighten two front screws (4).
   b. Tighten rear fasteners (3) to 12-15 ft-lbs (16.3-20.3 Nm).
   c. Final tighten two front screws (4) to 12-15 ft-lbs (16.3-20.3 Nm). Slight gap between upper and lower clamps should exist at front.
8. See Figure 2-93. Tighten lower handlebar clamp fasteners (16) to 30-40 ft-lbs (40.7-54.3 Nm).
9. Install right and left switch assemblies, throttle control, clutch lever assembly, and front master cylinder assembly. See 7.38 RIGHT HANDLEBAR SWITCH and 7.39 LEFT HANDLEBAR SWITCH.
10. Test front brake lever for pressure and operation.
11. Test throttle for correct operation. Adjust as required. See Adjustment under 1.13 THROTTLE CABLES.
12. Install maxi-fuse.

⚠WARNING

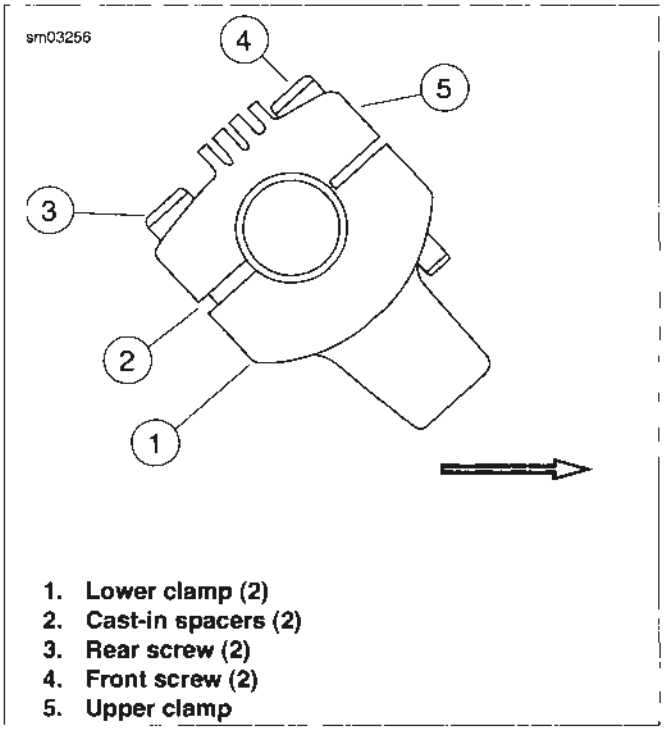
After installing seat, pull upward on seat to be sure it is locked in position. White riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

13. Install seat.

⚠WARNING

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

14. Turn the ignition/light key switch to IGNITION and test lights and switches for proper operation.
15. Apply brake lever to test stop light lamp.



1. **Lower clamp (2)**
2. **Cast-in spacers (2)**
3. **Rear screw (2)**
4. **Front screw (2)**
5. **Upper clamp**

Figure 2-94. Handlebar Riser

REMOVAL

⚠WARNING

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

1. Remove maxi-fuse.
2. See Figure 2-95. Remove acorn nut (1) and washer (2).
3. Remove instrument console and allow to hang off the left side. Suspend console using an elastic cord or piece of small rope to prevent strain on the harness.
4. Unplug fuel gauge connector located under the fuel tank.
5. Remove fuel tank fasteners, vent hose, and fuel supply fitting. Slide fuel tank back to access electrical connectors. See 4.6 FUEL TANK.
6. Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.
7. Disconnect all left and right side hand control connectors from main harness.

NOTE

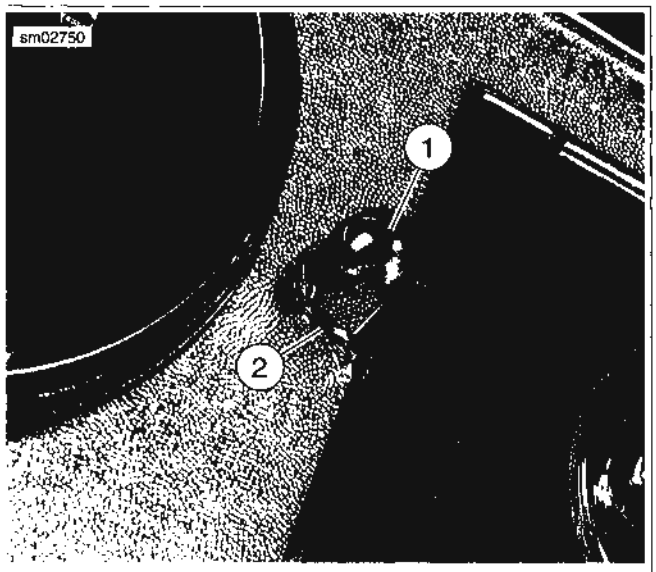
Make note of wire colors and locations in connector before removal. This will ensure proper wire location in connector during installation.

8. Identify wire locations and remove terminals from hand control connector housings (left hand control connector [24], right hand control connector [22]). See A.9 MOLEX CONNECTORS for connector information.
9. Remove terminals from turn signal lamp multilock connector. See A.1 AMP MULTILOCK CONNECTORS for connector information.
10. Remove front master cylinder, right handlebar switch assembly, and throttle. See 7.38 RIGHT HANDLEBAR SWITCH.
11. Remove clutch control and left handlebar switch assembly. See 7.39 LEFT HANDLEBAR SWITCH.

NOTE

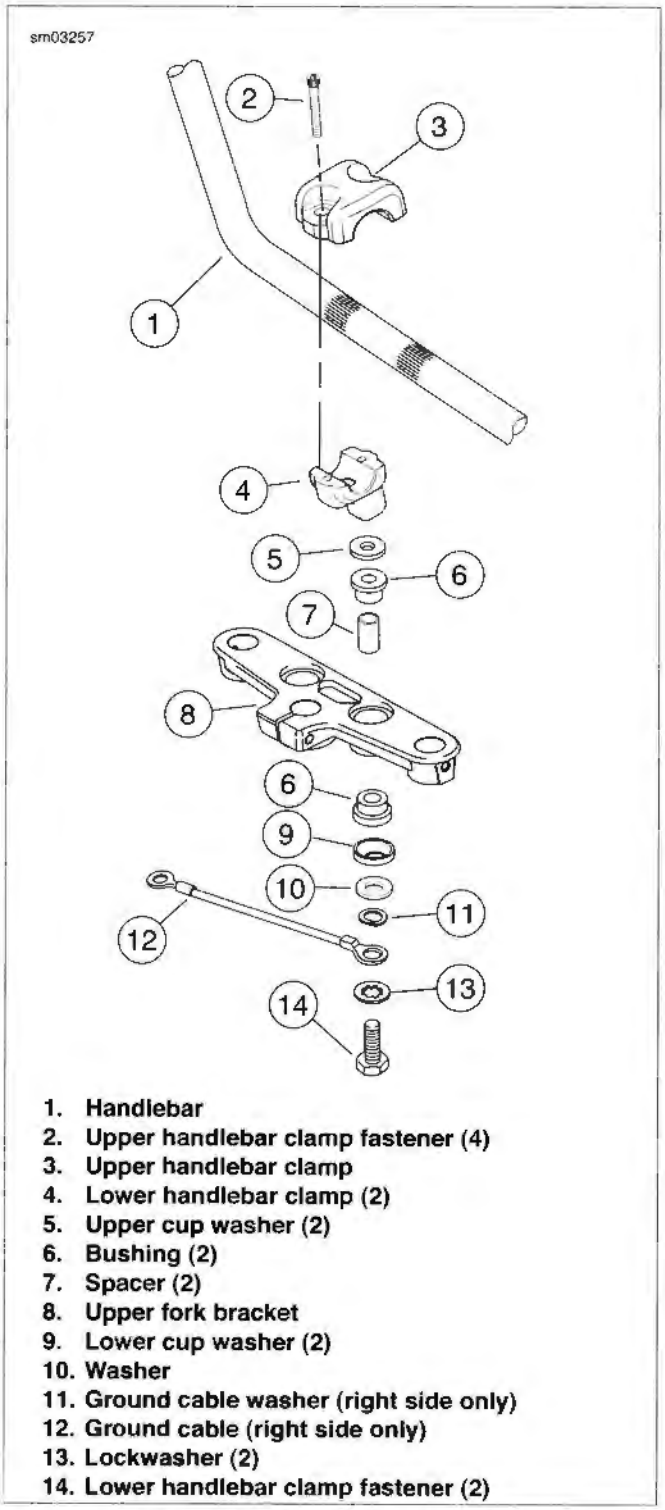
Original equipment grip is glued in place and must be cut off to remove. Remove grip only if necessary.

12. Remove left handlebar grip.
13. Remove switch housings, turn signals and wiring from handlebars.
14. See Figure 2-96. Remove upper handlebar clamp fasteners (2) and upper handlebar clamps (3).
15. Remove handlebars.
16. If removing lower handlebar clamps (4), remove two lower handlebar clamp fasteners (14), lockwashers (13), ground cable (12), ground cable washer (11), washers (10) and lower handlebar clamps from upper fork bracket (8).



1. **Acorn nut**
2. **Washer**

Figure 2-95. Instrument Console



1. **Handlebar**
2. **Upper handlebar clamp fastener (4)**
3. **Upper handlebar clamp**
4. **Lower handlebar clamp (2)**
5. **Upper cup washer (2)**
6. **Bushing (2)**
7. **Spacer (2)**
8. **Upper fork bracket**
9. **Lower cup washer (2)**
10. **Washer**
11. **Ground cable washer (right side only)**
12. **Ground cable (right side only)**
13. **Lockwasher (2)**
14. **Lower handlebar clamp fastener (2)**

Figure 2-96. Handlebars: FLSTF/B

INSTALLATION

NOTE

The turn signal wires enter the switch housings through a relief grommet in the housing. The turn signals must be supported throughout this procedure to prevent pulling the grommet or the turn signal wires out of the housing.

1. Repair or replace switches, turn signal switches, wires and grommets as necessary.

NOTE

For handlebar switch repair procedures, see 7.37 HANDLEBAR SWITCH ASSEMBLIES.

2. Wrap wire ends and open ends of conduit with electrical tape.
3. Cut a length of mechanics wire to use as a leader.
4. Lay mechanics wire along the wire harnesses so a few inches overlap and secure using electrical tape.

⚠WARNING

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

5. If necessary, replace grommets on handlebars wire openings.
6. Lubricate wire conduits with glass cleaner.
7. See Figure 2-97. Thread the wire leaders through the handlebar grommets and out the center hole.
8. Pull wire bundles through to the handlebar center hole.
9. Loosely install left and right switch housings.
10. Pull slack from wire harnesses and remove the tape and mechanics wire.

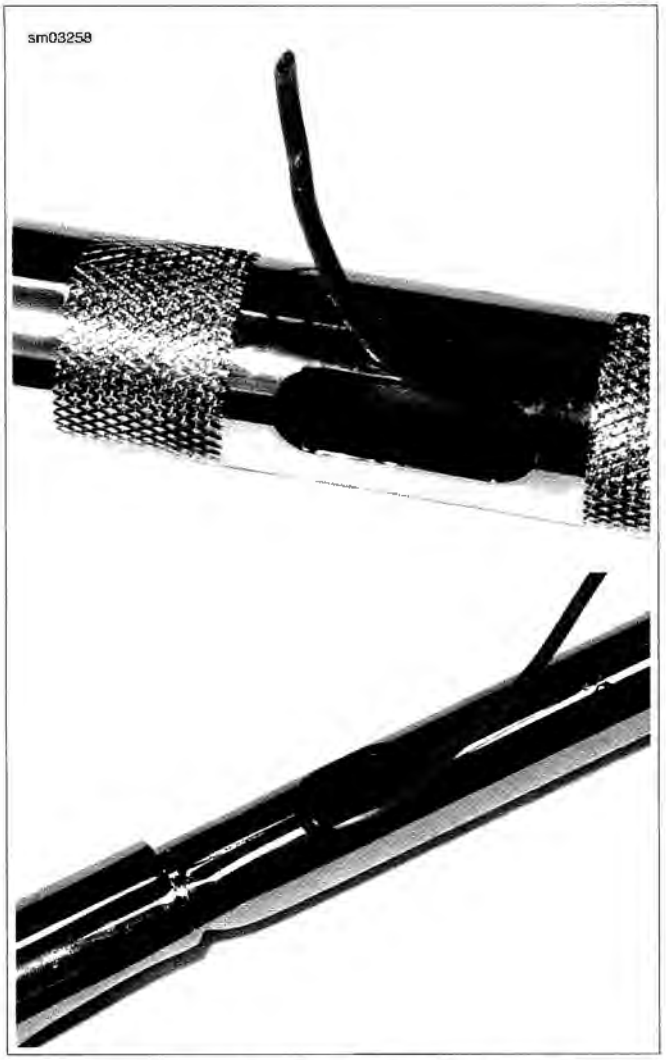


Figure 2-97. Wire Leader in Handlebars (handlebars removed from motorcycle)

11. See Figure 2-96. If lower handlebar clamps (4) were removed, install washers (10), ground cable washer (11), ground cable (12), and lockwashers (13) on lower handlebar clamp fasteners (14).
12. Slide lower handlebar clamp fasteners through upper fork bracket (8).
13. Loosely install lower handlebar clamps to upper fork bracket using lower handlebar clamp fasteners.
14. Place handlebars (1) on lower handlebar clamps. Install upper handlebar clamps (3). Install but do not tighten clamp fasteners.
15. Insert wires into proper locations in wire connector housings. See B.2 WIRING DIAGRAMS for connector/wire assignments.
16. Connect left and right hand control connectors [22, 24].
17. Connect turn signal connector [31].
18. Slide fuel tank into position and install fuel tank fasteners. Connect vent hose and fuel supply fitting. See 4.6 FUEL TANK.
19. Connect fuel gauge connector [117].
20. Install instrument console and secure with washer and acorn nut.
21. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

NOTE

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

22. Raise handlebars to normal riding position and hold in position.

NOTE

Gap between upper and lower clamps should be equal front and rear.

23. Tighten front and rear fasteners to 12-18 ft-lbs (16.3-24.4 Nm).
24. See Figure 2-96. Remove one lower handlebar clamp fastener (14). Apply LOCTITE HIGH STRENGTH THREADLOCKER 271 (red) to fastener threads.
25. Install fastener and tighten to 30-40 ft-lbs (40.7-54.2 Nm). Repeat for other fastener.
26. Install clutch control, front master cylinder, left handlebar switch assembly, and right handlebar switch assembly. Align housings and tighten fasteners. See 7.39 LEFT HANDLEBAR SWITCH or 7.38 RIGHT HANDLEBAR SWITCH.
27. Install maxi-fuse.

⚠WARNING

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

28. Install seat.
29. Test throttle for correct operation. Adjust as required. See Adjustment under 1.13 THROTTLE CABLES.

⚠WARNING

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

30. Turn the ignition/light key switch to IGNITION and test lights and switches for proper operation.
31. Apply brake lever to test stop light lamp.

⚠WARNING

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

32. Test front brake lever for pressure and operation.

REMOVAL

⚠WARNING

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

1. Remove maxi-fuse.
2. Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.
3. Remove front master cylinder, right handlebar switch assembly, and throttle. See 7.38 RIGHT HANDLEBAR SWITCH.
4. Remove clutch control and left handlebar switch assembly. See 7.39 LEFT HANDLEBAR SWITCH.

NOTE

Original equipment grip is glued in place and must be cut off. Remove grip only if necessary.

5. Remove left handlebar grip.
6. See Figure 2-98. Remove upper handlebar clamp screws (1).

NOTE

Ground spring (3) is on right side only.

7. Remove handlebar.
8. If removing risers (7), remove both lower handlebar clamp locknuts (4), washers (5), and upper rubber bushings (6), risers (7), and lower rubber bushings (6).

INSTALLATION

1. See Figure 2-98. If risers (7) were removed, install lower rubber bushings (6) on rigid fork leg stud (8). Install risers (7), upper rubber bushings (6), washers (5), and locknuts (4).
2. Tighten locknuts (4) to 25-35 ft-lbs (33.9-47.5 Nm)
3. On right side, install ground spring (3).

NOTE

Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

4. Place handlebars on lower handlebar clamps. Install upper handlebar clamps with screws (1), but do not tighten. Make gap between clamps and risers even, front and rear.
5. Raise handlebars to normal riding position and hold in position. Tighten screws (1) to 15-18 ft-lbs (20.3-24.4 Nm)
6. Install right and left switch assemblies, throttle control, clutch lever assembly, and front master cylinder assembly. See 7.38 RIGHT HANDLEBAR SWITCH and 7.39 LEFT HANDLEBAR SWITCH.
7. Test front brake lever for pressure and operation.
8. Test throttle for correct operation. Adjust as required. See Adjustment under 1.13 THROTTLE CABLES.
9. Install maxi-fuse.

⚠WARNING

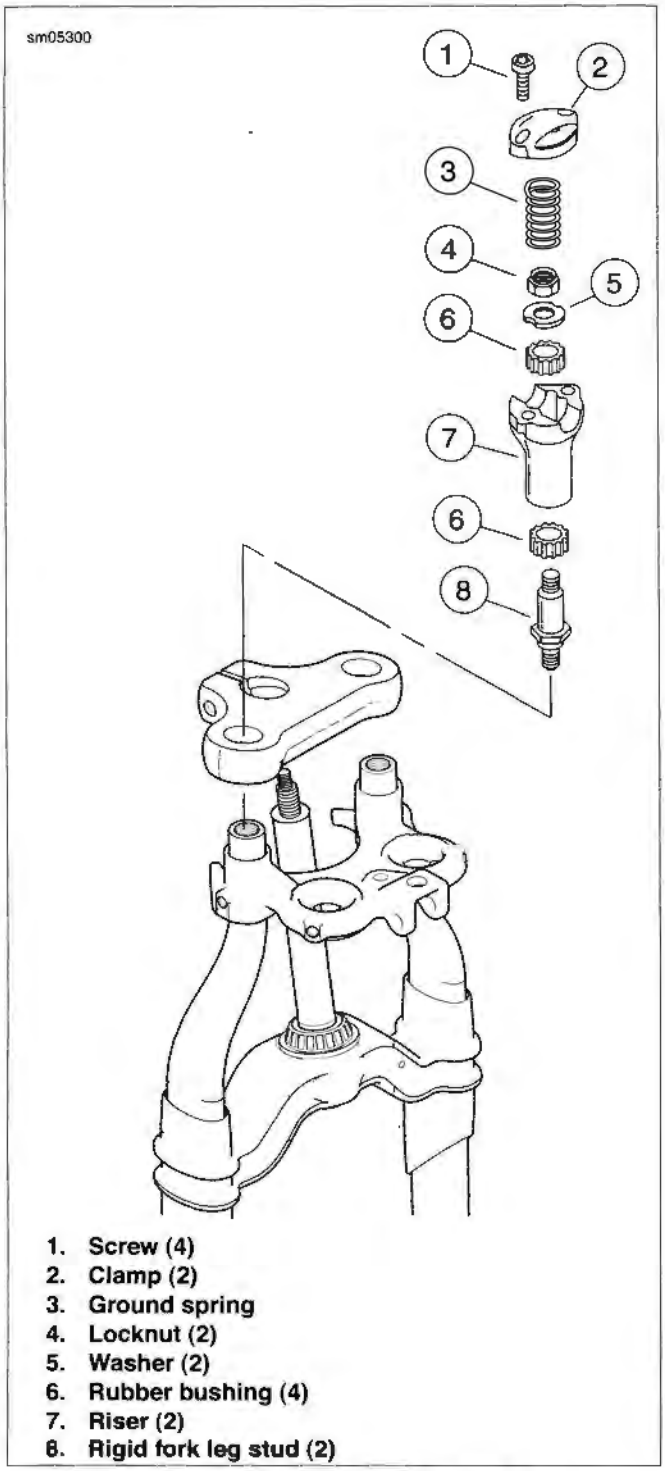
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

10. Install seat.

⚠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 the ignition/light key switch to IGNITION and test lights and switches for proper operation.
12. Apply brake lever to test stop light lamp.



1. Screw (4)
2. Clamp (2)
3. Ground spring
4. Locknut (2)
5. Washer (2)
6. Rubber bushing (4)
7. Riser (2)
8. Rigid fork leg stud (2)

Figure 2-98. Handlebars: FLSTSB

REMOVAL

1. Remove seat. See 2.43 SEAT: FXCWC.

⚠WARNING

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

2. Remove maxi-fuse.
3. Remove instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.
4. Remove fuel gauge harness from wire retainer attached to frame under the fuel tank. Disconnect fuel gauge connector.

NOTE

Cut wire ties as needed.

5. Disconnect fuel vent hose from top of tank and fuel supply fitting from bottom fuel tank. Remove fuel tank fasteners and slide fuel tank back to access the connectors located under the tank. See 4.6 FUEL TANK.
6. Place blankets or protective covers over front of fuel tank and front fender to protect against scratches and other damage.
7. Remove 6-way hand control harness connector [22] (black) and 6-way turn signal harness connector [31] from right side of electrical connector bracket located behind the steering head. Remove 8-way hand control harness connector [24] (grey) from left side. Disconnect connectors.

NOTE

Make note of wire colors and locations in connector before removal. This will ensure proper wire location in connector during installation.

8. Identify wire locations and remove terminals from hand control connector housings. See A.9 MOLEX CONNECTORS for connector information.
9. Identify wire locations and remove turn signal lamp wire terminals from multilock connector. See A.1 AMP MULTILOCK CONNECTORS for connector information.
10. Remove turn signal lamps from clutch control housing and front master cylinder. Let lamps hang from switch housings.
11. Remove front master cylinder assembly from handlebar and support using an elastic cord or piece of small rope. See 2.12 FRONT BRAKE MASTER CYLINDER.
12. Remove right handlebar switch housing and throttle control from handlebar as an assembly, while pulling wiring out of handlebar. See 7.38 RIGHT HANDLEBAR SWITCH. Support the housing and throttle using an elastic cord or piece of small rope.
13. Remove clutch control assembly from left side of handlebar and support using an elastic cord or piece of small rope. See 2.25 CLUTCH CONTROL.
14. Remove left switch housing, turn signals and wiring from handlebars. See 7.39 LEFT HANDLEBAR SWITCH.

NOTE

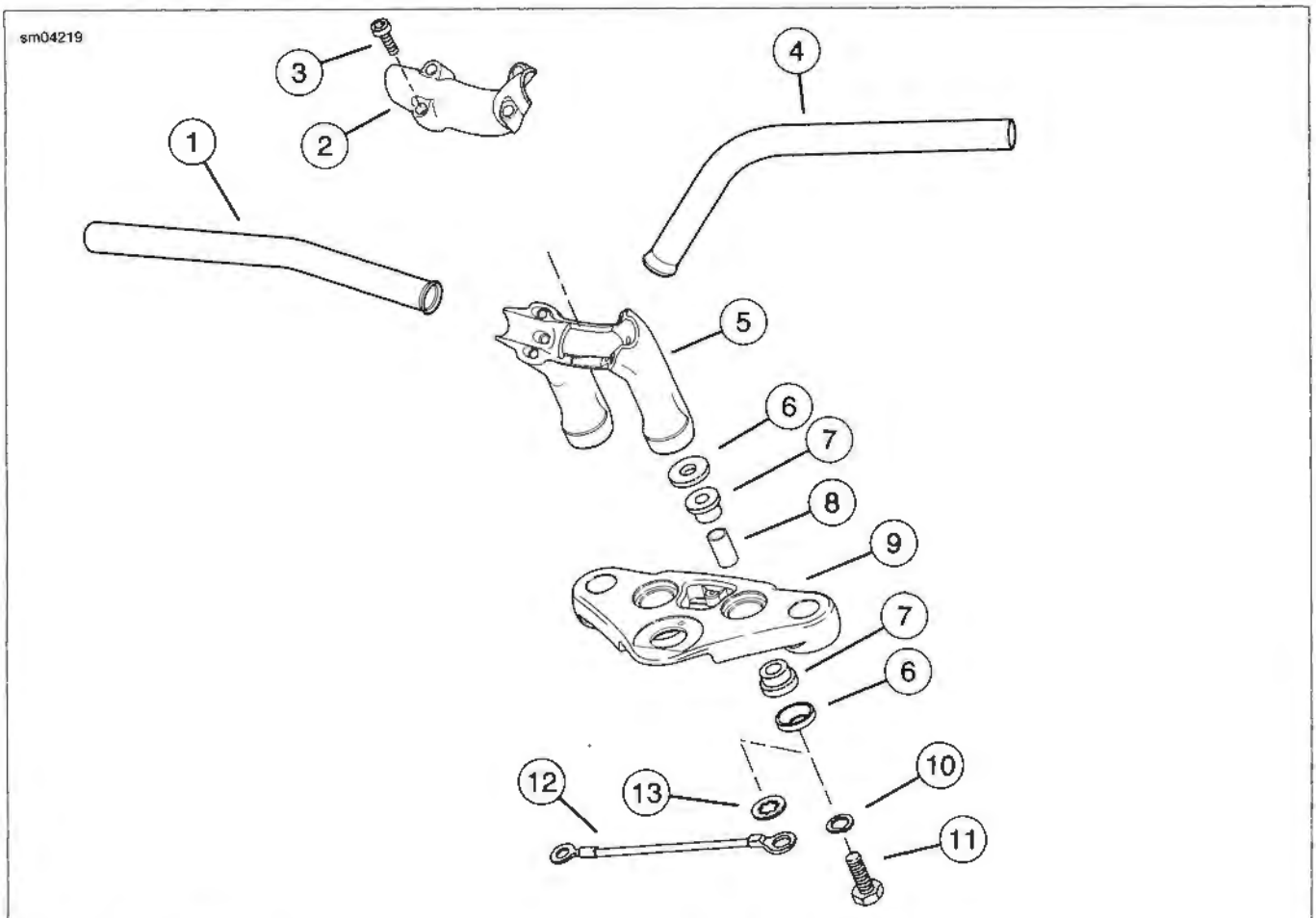
Original equipment grip is glued in place and must be cut off to remove. Remove grip only if necessary.

15. Remove left handlebar grip if necessary.

NOTE

Handlebars are a two-piece design. Once the handlebar clamp is loosened, the handlebars will begin to fall separately from each other. Make sure each handlebar is supported prior to loosening the handlebar clamp.

16. See Figure 2-99. Remove upper handlebar clamp fasteners (3) and upper handlebar clamp (2).
17. Remove handlebars.
18. If removing lower handlebar clamp (5), remove two lower handlebar clamp fasteners (11), lockwashers (10), ground cable (12), star washer (13) and lower handlebar clamp from upper fork bracket (9).



1. **Left Handlebar**
2. **Upper handlebar clamp**
3. **Upper handlebar clamp fastener**
4. **Right handlebar**
5. **Lower handlebar clamp (riser)**
6. **Cup washer (4)**
7. **Bushing (4)**
8. **Spacer (2)**
9. **Upper fork bracket**
10. **Lockwasher (2)**
11. **Lower handlebar clamp fastener (2)**
12. **Ground cable (left side only)**
13. **Star washer (left side only)**

Figure 2-99. Handlebars: FXCWC

INSTALLATION

NOTE

The turn signal wires enter the switch housings through a relief grommet in the housing. The turn signals must be supported throughout this procedure to prevent pulling the grommet or the turn signal wires out of the housing.

1. See Figure 2-99. Loosely install lower handlebar clamp (5) if it was removed.
   a. Install lockwashers (10), ground cable (12), and star washer (13) on lower handlebar clamp fasteners (11).
   b. Slide lower handlebar clamp fasteners through upper fork bracket (9).
   c. Loosely install lower handlebar clamp fasteners.
2. Repair or replace switches, turn signal switches, wires and grommets as necessary.

NOTE

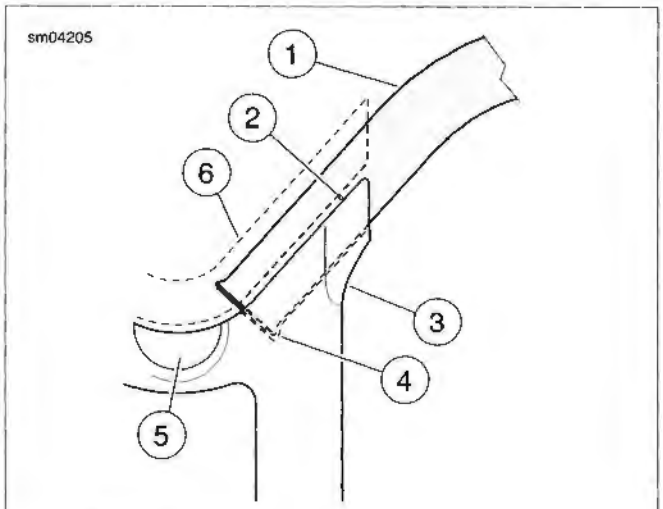
For handlebar switch repair procedures, see 7.37 HANDLEBAR SWITCH ASSEMBLIES.

3. Wrap wire ends with electrical tape to keep terminals gathered.
4. Lubricate wire conduits with glass cleaner.
5. Push wire bundles through holes near hand grip end, and out through the flared end of the handlebars.
6. Loosely install left and right switch housings, and throttle control.
   a. Install throttle control and switch housing on right handle bar. See 7.38 RIGHT HANDLEBAR SWITCH.
   b. Install left switch housing. See 7.39 LEFT HANDLEBAR SWITCH.
7. Pull slack from wire bundles through the end of handlebars.

NOTE

The following step is easier with the help of an assistant.

8. See Figure 2-100. Place handlebars (1) on lower handlebar clamp (3). Route the wire bundles through the notch (5) in the lower handlebar clamp and down through the opening in the center of the upper steering bracket.
9. Install upper handlebar clamp (6) but do not tighten clamp fasteners at this time. Ensure the flare (4) at the end of each handle bar is properly seated in the handlebar clamp.
10. Align the dimple (2) on each handlebar with the lower gap between the lower clamp (3) and upper clamp (6).
11. Tighten handlebar clamp screws in sequence shown in Figure 2-101. Tighten to 12-15 ft-lbs (16.3-20.3 Nm)



1. **Right handlebar**
2. **Dimple (visible in gap)**
3. **Lower handlebar clamp**
4. **Flared end of handlebar**
5. **Wire notch**
6. **Upper handlebar clamp**

Figure 2-100. Aligning Handlebar

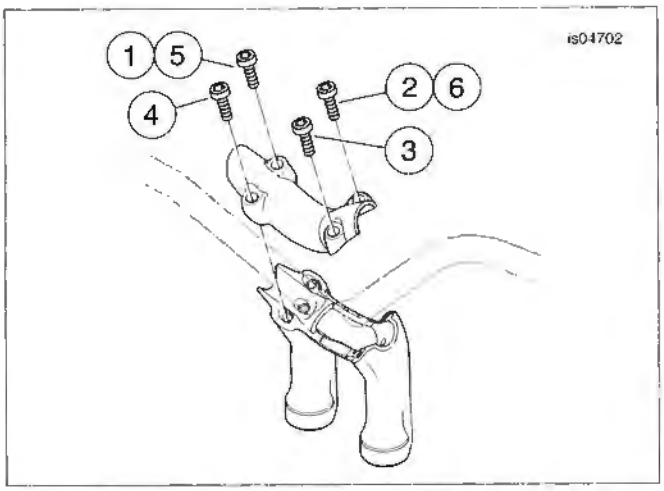


Figure 2-101. Handlebar Clamp Screw Tightening Sequence

12. Tighten lower handlebar clamp (5) fasteners, if clamp was removed.
    a. Apply LOCTITE HIGH STRENGTH THREADLOCKER 271 (red) to threads of lower handlebar clamp fasteners.
    b. Tighten fasteners to 30-40 ft-lbs (40.7-54.2 Nm).
13. Insert wires into proper locations in wire connector housings. See B.2 WIRING DIAGRAMS, 2010 Softail Wiring Diagrams for connector/wire assignments.
14. Connect turn signal connectors [31].
15. Connect hand control connectors [22, 24].
16. Secure connectors to electrical connector bracket.
17. Install wire ties (two each side) to secure harnesses together near the steering head.

NOTE

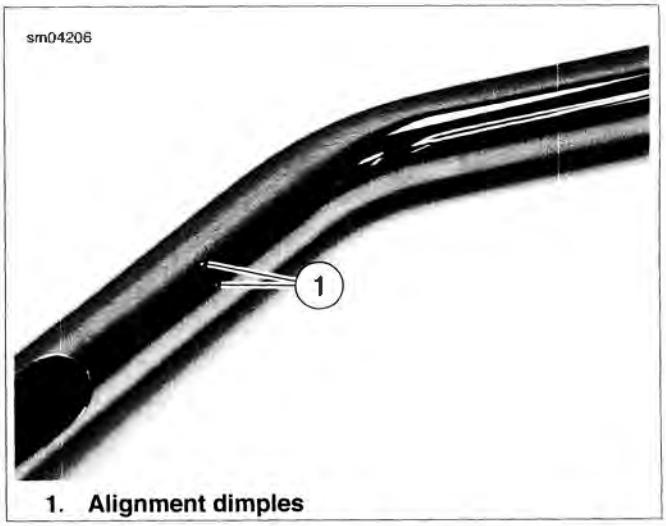
See Figure 2-102. Two dimples (1) are stamped in the handle bars near the location where the clutch and front master cylinder housings will mount. The location of the joint between the clamp and housing of each should fall between the two dimples for correct alignment.

18. Install clutch lever and housing. Align the clutch bracket so gap is between dimples and tighten screws to specification. See 2.25 CLUTCH CONTROL.
19. Tighten left switch housing fasteners.

NOTE

Ensure throttle control is pushed completely on to the handlebar before securing.

20. Install front brake control. Align master cylinder housing so gap is between dimples and tighten screws to specification. See 2.12 FRONT BRAKE MASTER CYLINDER.
21. Tighten right switch housing fasteners.
22. Attach and adjust turn signal lamps.



1. **Alignment dimples**

Figure 2-102. Switch Housing Alignment Dimples

23. Slide fuel tank into position and install fuel tank fasteners, vent hose, and fuel supply fitting. See 4.6 FUEL TANK.

24. Install instrument console. 7.25 INSTRUMENT CONSOLE: FXCWC.

25. Install maxi-fuse.

⚠WARNING

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

26. Install seat.

27. Test throttle for correct operation. Adjust as required. See Adjustment under 1.13 THROTTLE CABLES.

⚠WARNING

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

28. Turn the ignition/light key switch to IGNITION and test lights and switches for proper operation.

29. Apply brake lever to test stop light lamp.

⚠WARNING

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

30. Test front brake lever for pressure and operation.

REMOVAL

NOTE

Refer to the appropriate drawing for the model being serviced.

1. Remove front wheel. See 2.4 FRONT WHEEL: ALL BUT FLSTSB.
2. **FLST/FLSTC/FLSTN:** Disconnect fender tip lamp.
3. Remove fasteners that hold fender in place and remove fender.

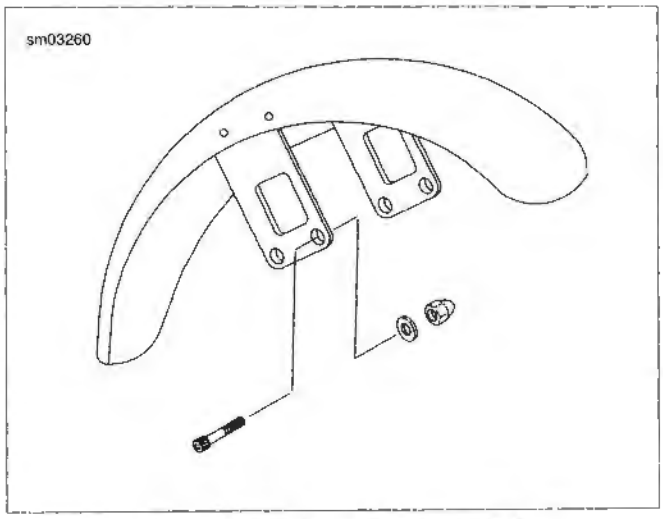


Figure 2-103. Front Fender: FXST

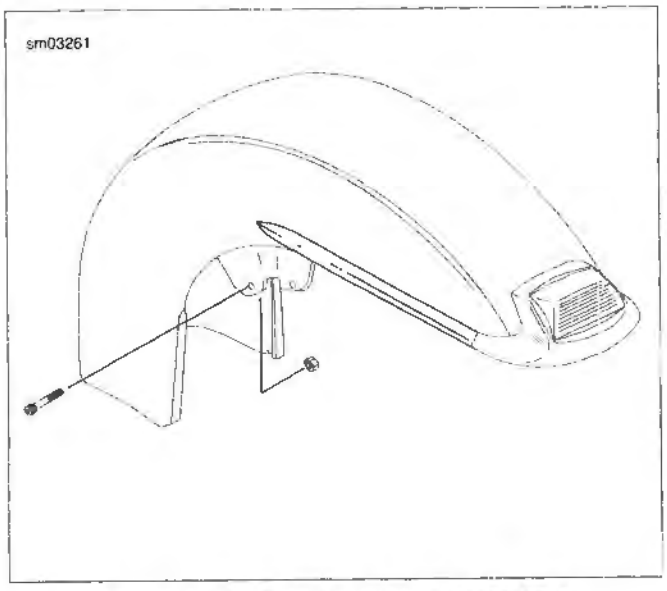


Figure 2-104. Front Fender: FLST/FLSTC

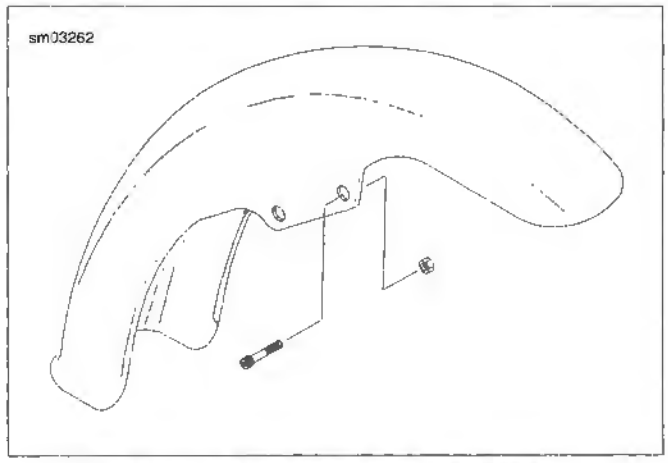


Figure 2-105. Front Fender: FLSTF/B

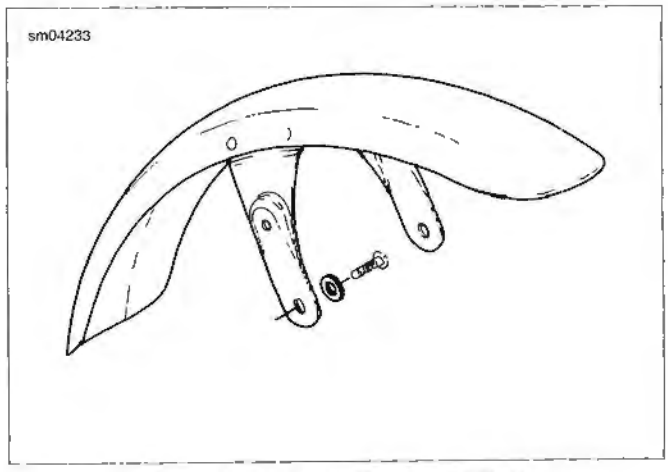


Figure 2-106. Front Fender: FXCWC

INSTALLATION

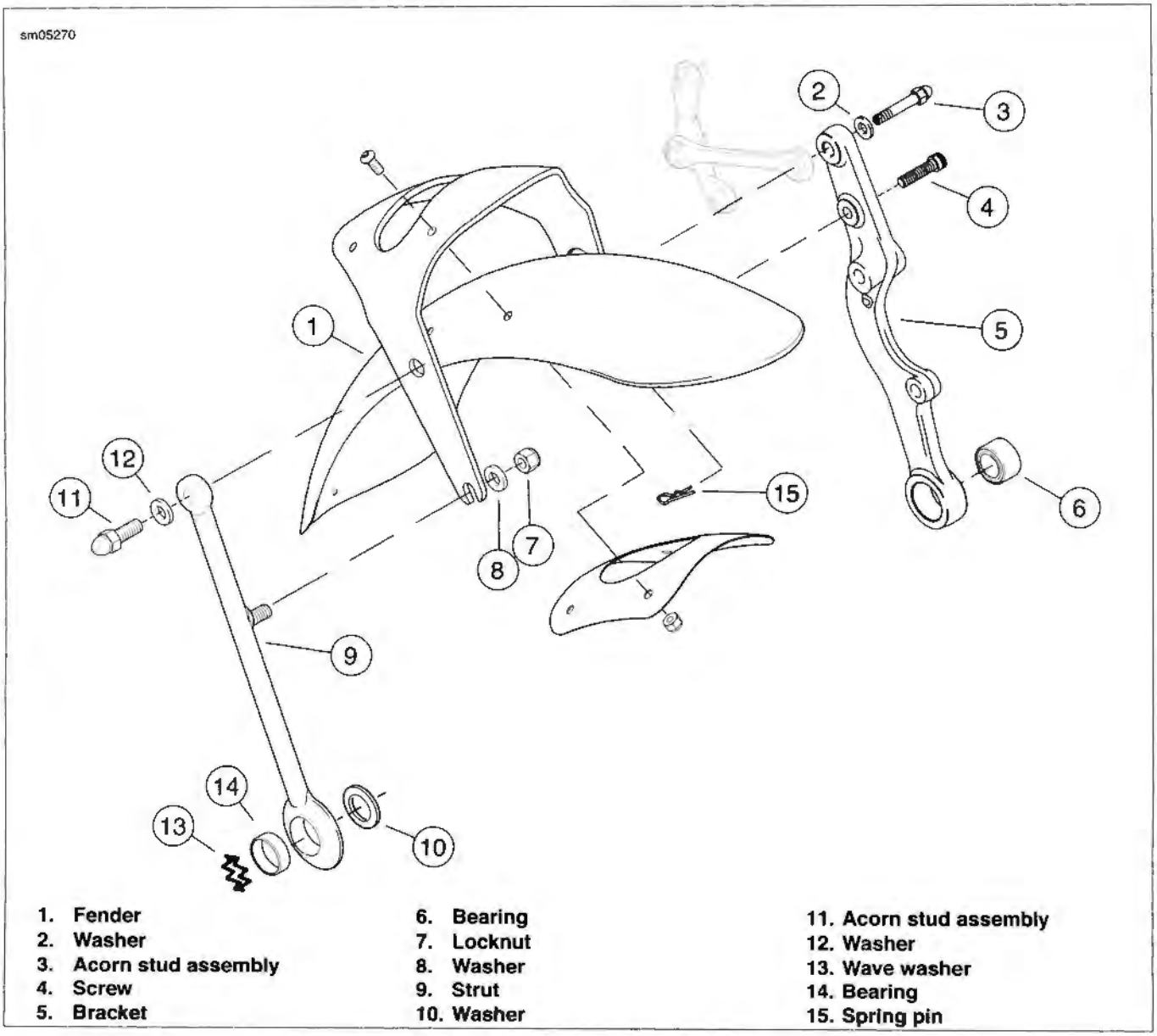
1. Put fender in position and install fasteners. Tighten to 15-21 ft-lbs (20.3-28.5 Nm).
2. **FLST/FLSTC/FLSTN:** Connect fender tip lamp.
3. Install front wheel. See 2.4 FRONT WHEEL: ALL BUT FLSTSB.

REMOVAL

NOTE

When lifting fender out of fork, be careful not to scratch the paint. If necessary, cover fender with suitable material to prevent damage.

1. See Figure 2-107. Loosen locknut (7).
2. Remove screw (4).
3. Remove spring pin (15) and acorn stud assemblies (3, 11). Pull fender away from front fork.



1. Fender
2. Washer
3. Acorn stud assembly
4. Screw
5. Bracket
6. Bearing
7. Locknut
8. Washer
9. Strut
10. Washer
11. Acorn stud assembly
12. Washer
13. Wave washer
14. Bearing
15. Spring pin

Figure 2-107. Front Fender: FLSTSB

INSTALLATION

⚠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)

DO NOT:

- **Alter the fender brackets to lower the fender. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.**
- **Replace the O.E.M. tire with a higher-aspect ratio tire. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.**
- **Replace the O.E.M. tire with a traditional-looking 16 in. front wheel, tire and front fender. In addition to above, this could adversely affect the handling characteristics of this motorcycle.**

Harley-Davidson has designed and manufactured this special, custom front end according to our very stringent and well-tested standards. If you modify the Springer front end in any way that changes our original design, Harley-Davidson cannot and will not assume responsibility.

1. See Figure 2-107. Place fender into position and loosely install acorn stud assemblies (3, 11).
2. Install screw (4) and tighten to 18-22 ft-lbs (24.4-29.9 Nm).
3. Tighten acorn stud assemblies to 35-40 ft-lbs (47.5-54.3 Nm).
4. Tighten locknut (7) to 25-30 ft-lbs (33.9-40.7 Nm).
5. Install **new** spring pin (15).

REMOVAL

1. Remove seat.

⚠WARNING

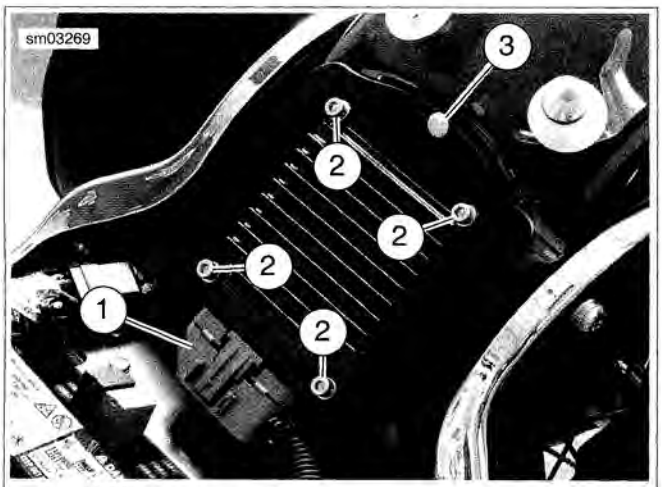
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove maxi-fuse.
3. **FLSTC:** Remove saddlebags. See 2.47 SADDLEBAGS: FLSTC.

NOTE

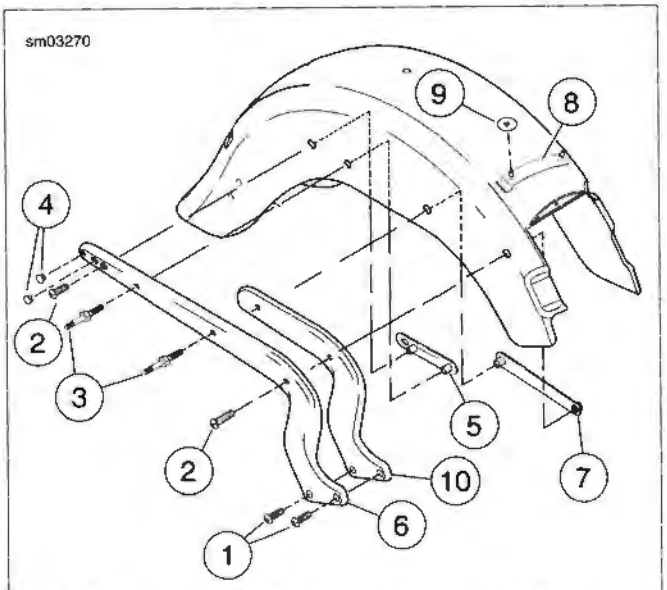
To ensure proper installation, make note of fender wire routing and hardware locations before removal.

4. Disconnect rear wiring harness connector under seat.
5. Disconnect left and right turn signal connectors from within tail lamp. See 7.16 TAIL LAMP: ALL BUT FLSTN.
6. See Figure 2-108. Remove nylon fastener (3) from electrical box.
7. See Figure 2-109. Remove fasteners (2) and saddlebag support studs (3) from front (7) and rear (5) fender mounting brackets.
8. Lift fender from frame.



1. **ECM connector [78]**
2. **Screw (4)**
3. **Nylon fastener**

Figure 2-108. ECM Mount



1. **Fender support fasteners, lower-front (4)**
2. **Fastener**
3. **Saddlebag stud: FLSTC (4)**
4. **Plug**
5. **Fender mounting bracket (rear, 2)**
6. **Fender support cover (2)**
7. **Fender mounting bracket (front, 2)**
8. **Stud plate**
9. **Plastic washer**
10. **Fender support (2)**

Figure 2-109. Rear Fender: FLST/FLSTC

INSTALLATION

1. Route turn signal wires through holes in fender. Install wires inside connector terminals.
2. See Figure 2-109. Carefully place the fender into position. Install fender supports using hardware shown. Tighten fasteners (2, 3) to 21-27 ft-lbs (28.5-36.6 Nm). Tighten fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners (1) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).
3. Connect the turn signal wiring harness at connector [7] under the seat. Also attach wiring for left and right turn signals.
4. See Figure 2-108. Install nylon fastener (3) into electrical box (2) and fender. Install saddlebags if equipped.
5. Install maxi-fuse.

⚠WARNING

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

6. Install seat.

⚠WARNING

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

7. Check turn signal and lamp operation.

REMOVAL

1. Remove seat.

⚠WARNING

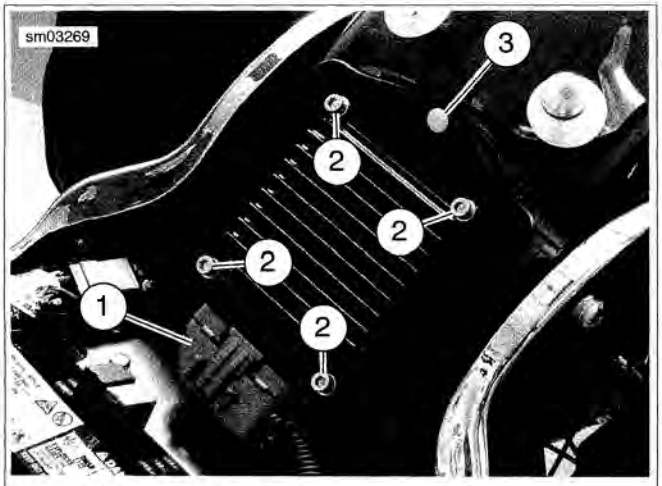
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Remove maxi-fuse.

NOTE

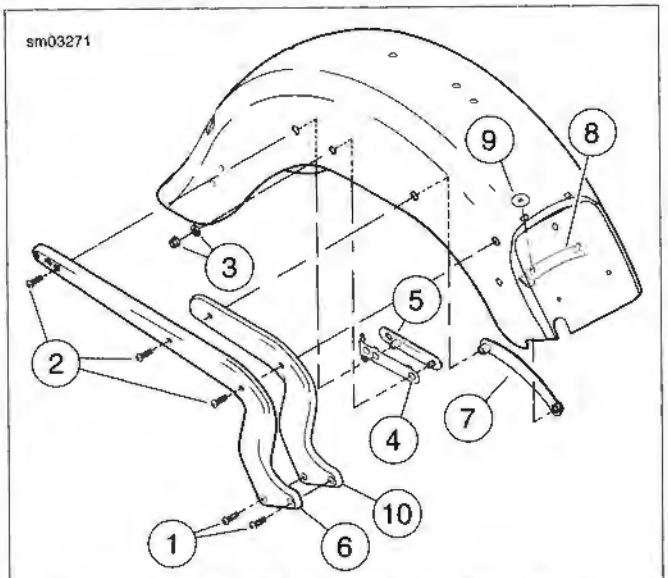
To ensure proper installation, make note of fender wire routing and hardware locations before removal.

3. Disconnect rear wiring harness connector [7] under seat.
4. Disconnect left and right turn signal connectors from within tail lamp. See 7.16 TAIL LAMP: ALL BUT FLSTN.
5. See Figure 2-110. Remove nylon fastener (3) from electrical box.
6. See Figure 2-111. Remove fasteners (2) from front fender mounting brackets (7), rear fender mounting brackets (5) and wire retainer plates (4).
7. Lift fender from frame.



1. **ECM connector [78]**
2. **Screw (4)**
3. **Nylon fastener**

Figure 2-110. ECM Mount



1. **Fender support fasteners, lower-front (4)**
2. **Fastener**
3. **Locknut and washer (2)**
4. **Wire retainer plate**
5. **Fender mounting bracket (rear, 2)**
6. **Fender support cover (2)**
7. **Fender mounting bracket (front, 2)**
8. **Stud plate**
9. **Plastic washer**
10. **Fender support (2)**

Figure 2-111. Rear Fender: FLSTF/B

INSTALLATION

1. Route turn signal wires through holes in fender. Install wires inside connector terminals.
2. Carefully place the fender into position. Install fender supports using hardware shown. Tighten fasteners (2) to 21-27 ft-lbs (28.5-36.6 Nm). Tighten fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners (1) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).
3. Connect the turn signal wiring harness at connector [7] under the seat. Also attach wiring for left and right turn signals.
4. See Figure 2-110. Install nylon fastener (3) into electrical box and fender.
5. Install maxi-fuse.

⚠WARNING

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

6. Install seat.

⚠WARNING

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

7. Check turn signal and lamp operation.

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove maxi-fuse.
3. Remove saddlebags, if equipped.

NOTE

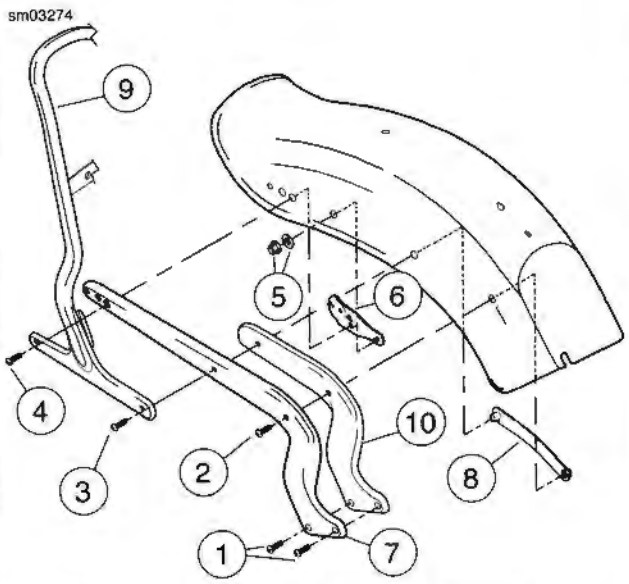
To verify proper installation, make note of fender wire routing and hardware locations before removal.

4. Disconnect rear wiring harness connector [7] under seat.
5. Disconnect left and right turn signal connectors from within tail lamp. See 7.16 TAIL LAMP: ALL BUT FLSTN.
6. Remove electronic control module. See 7.4 ELECTRONIC CONTROL MODULE (ECM).
7. See Figure 2-112. Loosen but do not remove fender support fasteners (1).
8. Remove front fender screw (2) from front fender mounting bracket (8).
9. Remove middle fender mounting screw (3) from front fender mounting bracket.
10. Remove rear fender mounting screw (4) from rear fender mounting bracket (6).
11. **FXSTC:** remove sissy bar.
12. Remove fender support fasteners (1). Remove fender support cover (7) and fender support (10).
13. Repeat for opposite side.

NOTE

After removing both fender supports and support covers, support fender by installing a long screwdriver through frame and fender holes.

14. Remove locknuts and washers (5) from rear fender mounting bracket.
15. Lift fender from frame.



1. **Fender support fasteners, lower-front (4)**
2. **Screw, front**
3. **Screw, middle**
4. **Screw rear**
5. **Locknut and washer (2)**
6. **Fender mounting and bracket (rear, 2)**
7. **Fender support cover (2)**
8. **Fender mounting bracket (front, 2)**
9. **Sissy bar (FXSTC models)**
10. **Fender support (2)**

Figure 2-112. Rear Fender: FXST and FXSTC

INSTALLATION

NOTE

In next step, be sure wire harness is routed so tire will not contact wiring.

1. Route turn signal wires through holes in fender. Install wires inside connector terminals.
2. See Figure 2-112. Carefully place the fender into position.
3. Place fender supports into position.
4. **FXSTC:** place sissy bar into position.
5. Install fender supports hardware. Tighten fasteners (2, 3, 4) to 21-27 ft-lbs (28.5-36.6 Nm). Tighten fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners (1) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).
6. Connect the turn signal wiring harness at connector [7] under the seat. Also attach wiring for left and right turn signals.
7. Install electronic control module.
8. Install saddlebags if equipped.
9. Install maxi-fuse.

⚠WARNING

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

10. Install seat.

⚠WARNING

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

11. Check turn signal and lamp operation.

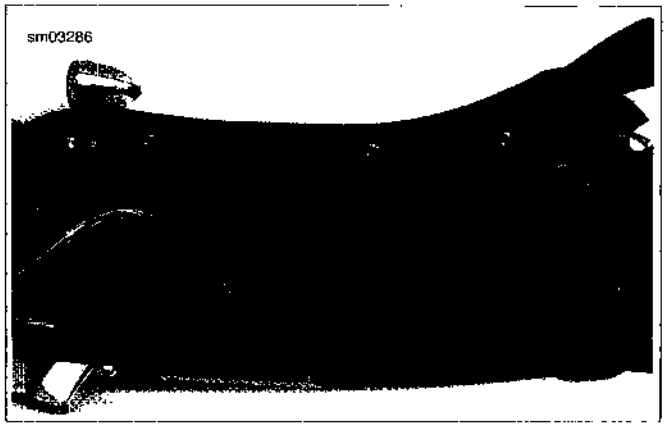


Figure 2-113. FXST/FXSTC Rear Fender Wire Routing

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove maxi-fuse.

NOTE

To verify proper installation, make note of fender wire routing and hardware locations before removal.

3. Disconnect rear wiring harness connector under seat.
4. See Figure 2-114. Remove lower mounting bolts (8, 6).

NOTE

To avoid scratches to painted fender and swing arm, wedge a clean shop rag between the fender and tire. This will prevent the fender from dropping on the tire when the remaining mounting bolts are removed.

5. Remove upper mounting bolts (10, 3).
6. Carefully remove fender (2) from motorcycle.
7. Remove license plate bracket (1) and turn/running/stop lamps (11), if needed. See 7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement.

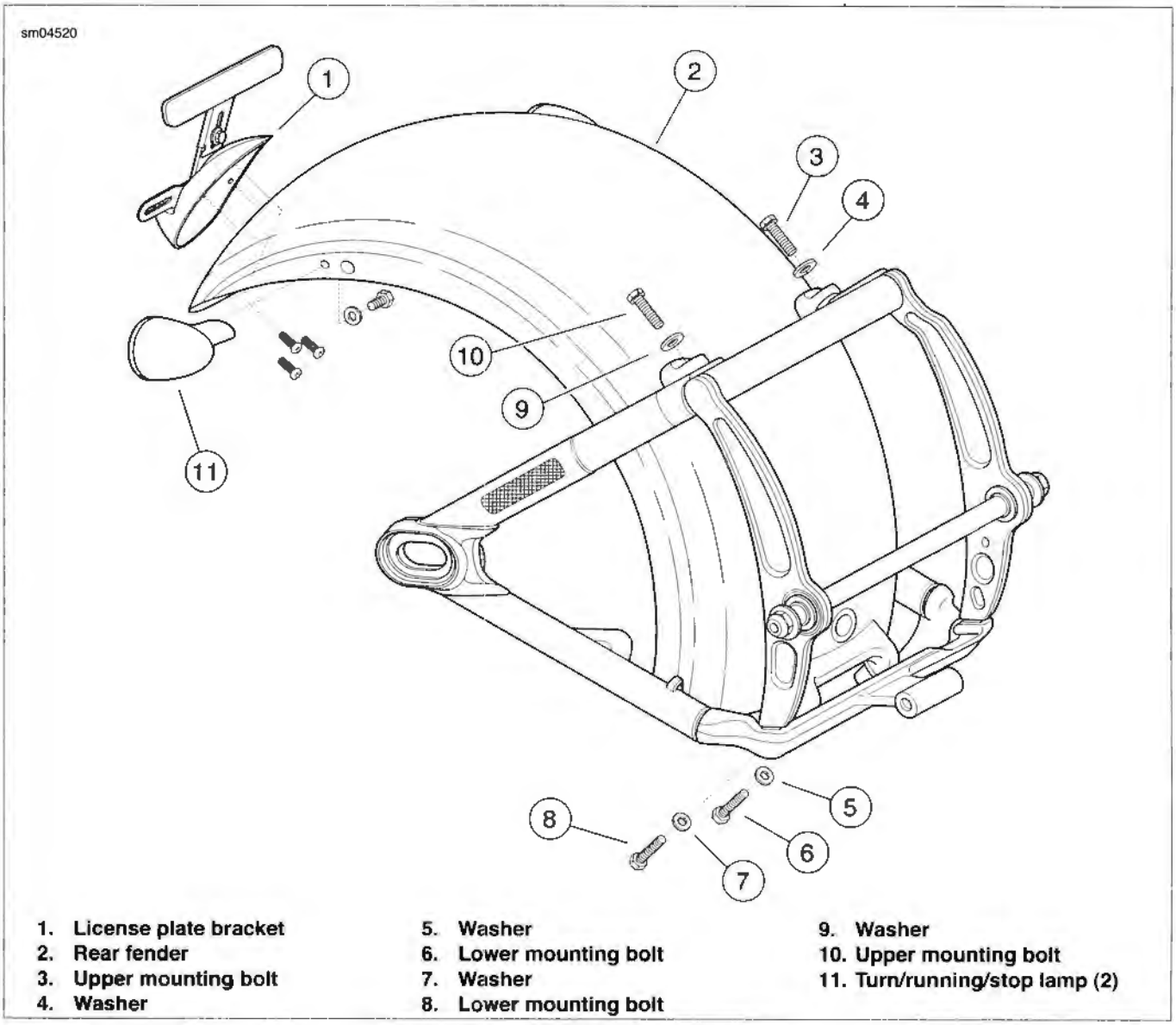
INSTALLATION

1. See Figure 2-114. Install license plate bracket (1) and turn/running/stop lamps (11), if removed. See 7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement.
2. Carefully place fender (2) into position on motorcycle. Support rear of fender with a clean, folded shop cloth.
3. Loosely install upper mounting bolts (10, 3) with washers (9, 4).
4. Loosely install lower mounting bolts (8, 6) with washers (7, 5).
5. Torque upper mounting bolt (10), then upper mounting bolt (3) to 30-35 ft-lbs (40.7-47.5 Nm).
6. Torque lower mounting bolt (8), then lower mounting bolt (6) to 28-32 ft-lbs (38.0-43.4 Nm).
7. Loosen upper mounting bolts (10, 3), and re-torque upper mounting bolt (10), then upper mounting bolt (3) to 48-52 ft-lbs (65.1-70.6 Nm).
8. Connect rear wiring harness connector under seat.
9. Install maxi-fuse.

⚠WARNING

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

10. Install seat.



1. License plate bracket
2. Rear fender
3. Upper mounting bolt
4. Washer
5. Washer
6. Lower mounting bolt
7. Washer
8. Lower mounting bolt
9. Washer
10. Upper mounting bolt
11. Turn/running/stop lamp (2)

Figure 2-114. Rear Fender: FXCWC

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove maxi-fuse.
3. See Figure 2-115. Disconnect rear wiring harness connector [7] (1) under seat.
4. Remove nylon fastener (3) from electronic control module tray (2).

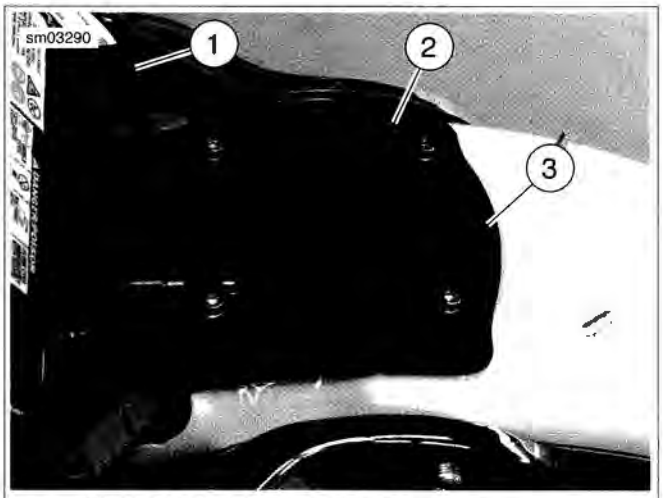
NOTE

Note location of hardware for correct installation.

5. See Figure 2-116. Remove fender mounting bracket (19) by removing fender mounting fasteners (3). Insert rods through forward-most holes created by fastener removal. Rods will keep fender in place during next step.
6. Remove fender mounting fasteners (2).
7. Remove rods.
8. Slide fender towards rear of vehicle to disengage fender from frame rails.

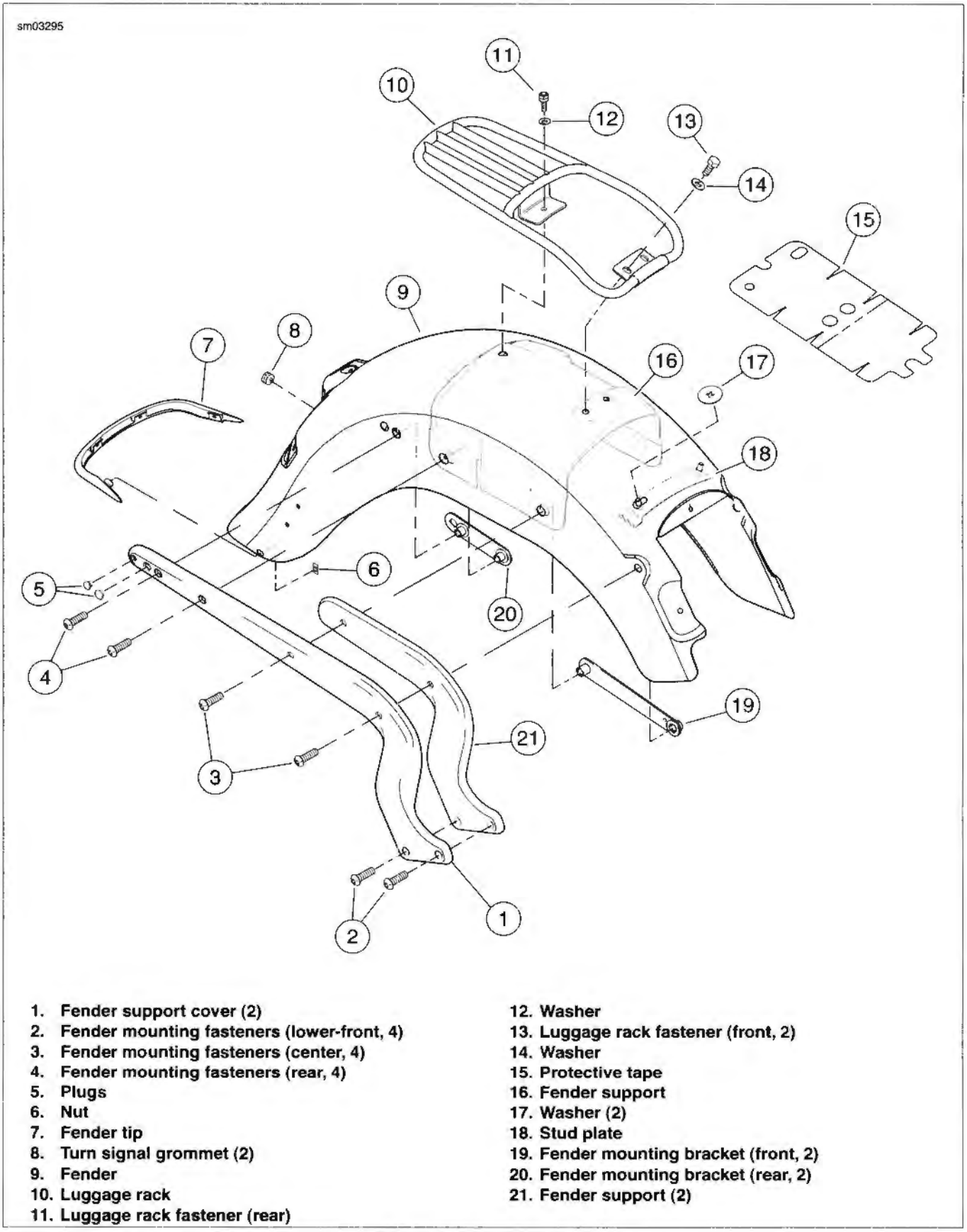
DISASSEMBLY

1. See Figure 2-116. If rear fender is to be completely disassembled, detach fender support covers (1) by removing fender mounting fasteners (4).
2. Remove luggage rack (10). See 2.46 LUGGAGE RACK: FLSTN.
3. Remove fender support (16) and fender mounting brackets (20).
4. Remove tail lamp. See 7.17 TAIL LAMP: FLSTN.
5. Remove turn signal lamps. See 7.19 TURN SIGNALS AND RUNNING LIGHTS.



1. **Rear wiring harness connector [7]**
2. **Electronic control module tray**
3. **Nylon fastener**

Figure 2-115. Electrical Box: Typical



1. Fender support cover (2)
2. Fender mounting fasteners (lower-front, 4)
3. Fender mounting fasteners (center, 4)
4. Fender mounting fasteners (rear, 4)
5. Plugs
6. Nut
7. Fender tip
8. Turn signal grommet (2)
9. Fender
10. Luggage rack
11. Luggage rack fastener (rear)
12. Washer
13. Luggage rack fastener (front, 2)
14. Washer
15. Protective tape
16. Fender support
17. Washer (2)
18. Stud plate
19. Fender mounting bracket (front, 2)
20. Fender mounting bracket (rear, 2)
21. Fender support (2)

Figure 2-116. Rear Fender: FLSTN

ASSEMBLY

1. See 7.17 TAIL LAMP: FLSTN for tail lamp assembly.
2. See 7.19 TURN SIGNALS AND RUNNING LIGHTS for turn signal bracket assembly.

NOTE

See Figure 2-116. If fender support (16) has been removed, do not tighten luggage rack hardware until rest of fender has been installed.

3. Assemble fender:
   a. Place fender support (16) into position in fender (9).
   b. Install but do not tighten luggage rack hardware. See 2.46 LUGGAGE RACK: FLSTN.
4. Install fender support covers (1) using fender mounting fasteners (4). Snug but do not fully tighten fasteners at this time.

INSTALLATION

1. See Figure 2-116. Carefully place the fender into position. Install fender supports using hardware and brackets shown. Tighten fasteners (3, 4) to 21-27 ft-lbs (28.5-36.6 Nm). Tighten fasteners (2) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners (2) and final-tighten to 38-42 ft-lbs (51.5-56.9 Nm).
2. Tighten luggage rack fasteners. See 2.46 LUGGAGE RACK: FLSTN.
3. See Figure 2-115. Install nylon fastener (3) into electronic control module tray (2) and fender.
4. Connect the harness at connector [7] (1).
5. Install maxi-fuse.

⚠WARNING

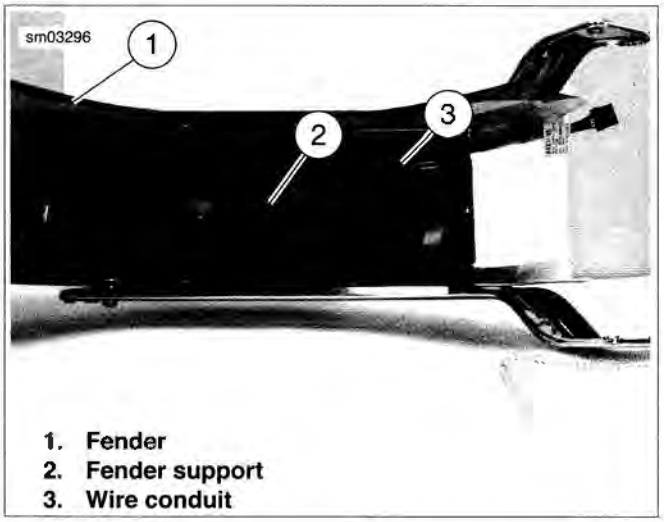
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

6. Install seat.

⚠WARNING

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

7. Check turn signal and lamp operation.



1. **Fender**
2. **Fender support**
3. **Wire conduit**

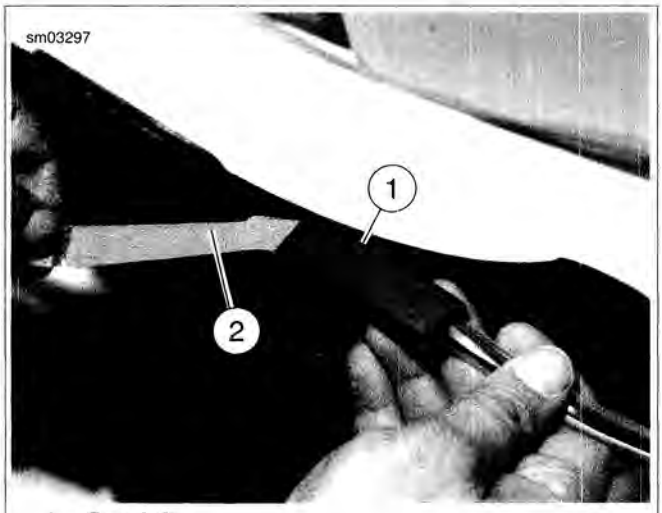
Figure 2-117. Rear Fender Wire Routing: FLSTN

INSTALLATION

1. Remove wire terminals from harness connectors.
2. Remove wire harness from conduit.
3. Remove old conduit from fender.
4. Thoroughly clean inside surface of fender with soap and water until it is free of dirt, oil, or other debris.
5. Dry the surface, then wipe the area where conduit will be placed with isopropyl alcohol. Allow to dry completely.
6. Slide tail lamp wiring harness through new conduit and install wire terminals into connector housings. See B.2 WIRING DIAGRAMS for more information.
7. See Figure 2-118. Remove protective strip covering adhesive on conduit.
8. See Figure 2-120. Lightly position the conduit in place.
9. See Figure 2-119. Using a wallpaper corner roller (available at most home improvement stores), roll along conduit to purge the air from between the adhesive and the fender.

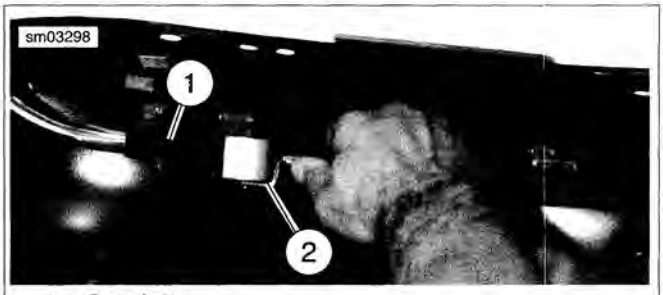
NOTES

- *Do NOT rub the conduit to make it adhere to the fender. This will not do an adequate job of purging the air from between the adhesive and fender.*
- *Once the adhesive is in place, it requires 72 hours to fully cure. Continue with installation but do NOT pull or try to reposition the conduit during this period.*



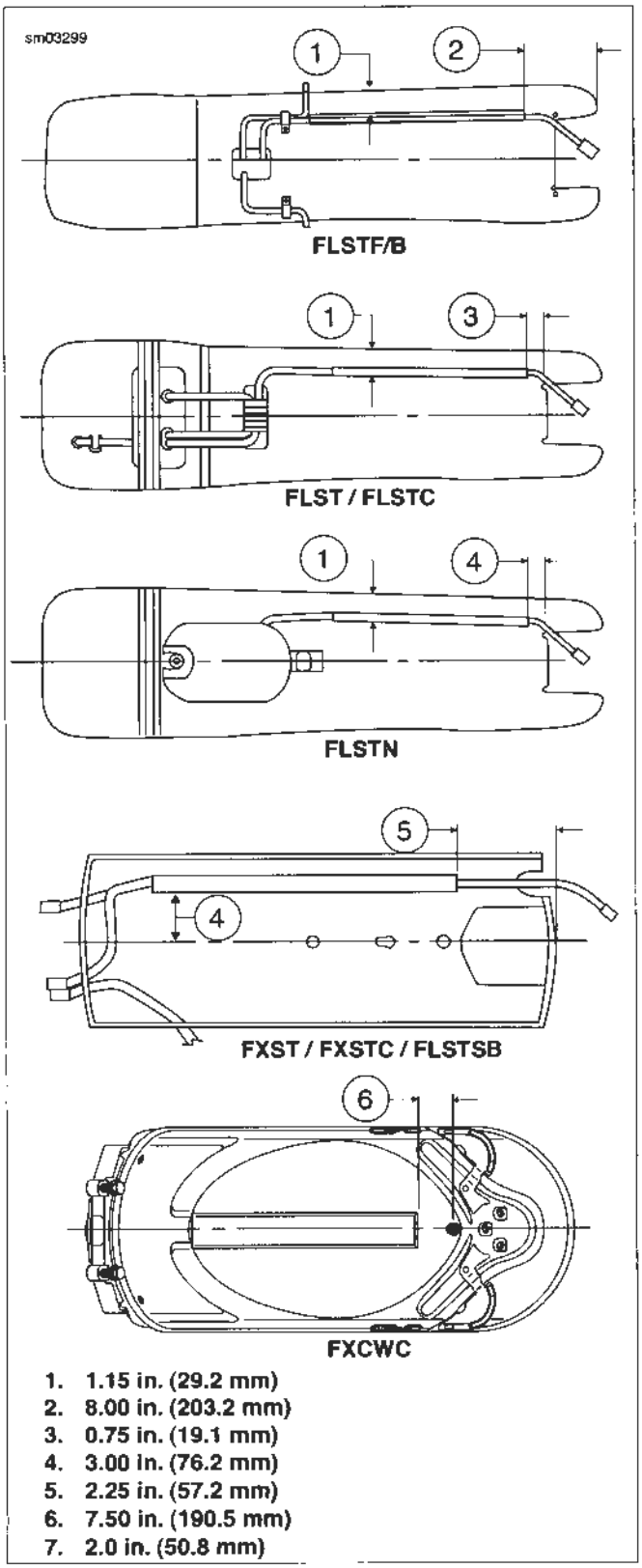
1. **Conduit**
2. **Protective strip**

Figure 2-118. Removing Protective Strip From Conduit



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

Figure 2-119. Purging Air Between Adhesive and Fender



1. 1.15 in. (29.2 mm)
2. 8.00 in. (203.2 mm)
3. 0.75 in. (19.1 mm)
4. 3.00 in. (76.2 mm)
5. 2.25 in. (57.2 mm)
6. 7.50 in. (190.5 mm)
7. 2.0 in. (50.8 mm)

Figure 2-120. Conduit Placement

CLEANING

⚠WARNING

The jiffy stand locks when placed in the full forward (down) position with vehicle weight on it. If the jiffy stand is not in the full forward (down) position with vehicle weight on it, the vehicle can fall over which could result in death or serious injury. (00006a)

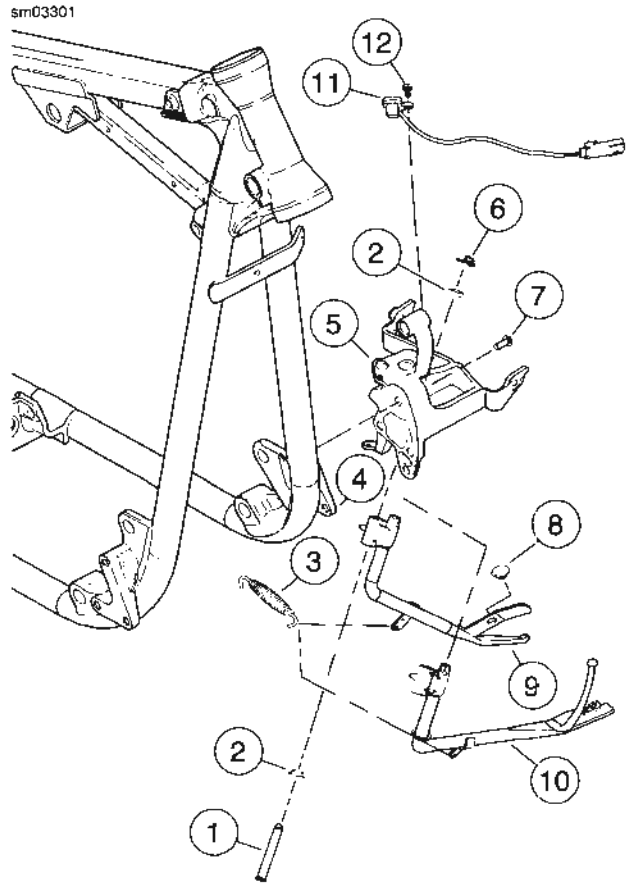
⚠WARNING

Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)

⚠WARNING

Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted, it can contact the road surface causing a loss of vehicle control, which could result in death or serioua injury. (00007a)

1. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-121. Inspect clevis pin (1) and bushings (2). If covered with dirt, wipe dirt off with a shop towel and spray clevis pin and bushings with LUBRIPLATE 110.
3. Move jiffy stand (9, 10) forward and back to infuse LUBRIPLATE 110 into mating parts.
4. Check that jiffy stand operates correctly before using.



1. **Clevis pin**
2. **Bushing (2)**
3. **Spring**
4. **Spring bracket**
5. **Jiffy stand bracket**
6. **Pretzel clip**
7. **Fastener (3)**
8. **Bumper**
9. **Jiffy stand (all but FLSTN)**
10. **Jiffy stand (FLSTN)**
11. **Sensor (HDI models)**
12. **Screw, sensor (HDI models)**

Figure 2-121. Jiffy Stand

SENSOR (HDI MODELS)

1. See Figure 2-121. Make a note of harness routing for ease of assembly. Disconnect sensor connector located in the front electrical caddy.
2. Remove any cable anchors and tie straps.
3. Remove screw (12) and remove sensor (11).
4. Installation is in reverse of removal. Tighten screw (12) to 96-144 **in-lbs** (10.8-16.3 Nm).

REMOVAL

⚠WARNING

Block vehicle under frame such that vehicle will not fall when jiffy stand is removed. Failure to properly block vehicle could result in death or serious injury. (00462b)

1. Detach shifter linkage.
2. See Figure 2-121. Remove the three fasteners (7) from jiffy stand bracket (5).
3. Detach spring (3) from jiffy stand and spring bracket (4).
4. Remove pretzel clip (6) from clevis pin (1).
5. Remove clevis pin and bushings (2) to free jiffy stand from jiffy stand bracket.

INSTALLATION

⚠WARNING

If leg stop is incorrectly installed, excessive wear can allow vehicle to fall when rested on jiffy stand, which could result in death or serious injury. (00479b)

1. See Figure 2-121. Install bracket.
   a. Apply LUBRIPLATE 110 to clevis pin (1).
   b. Place jiffy stand into position.
   c. Install lower bushing (2) on clevis pin (1).
   d. Install clevis pin (1) through jiffy stand (9, 10) and jiffy stand bracket (5).
   e. Place top bushing (2) on clevis pin (1).
   f. Install pretzel clip (6) in clevis pin (1).
   g. Attach spring (3) to jiffy stand (9,10) and spring bracket (4). When properly installed, hook on spring side connected to bracket faces upward.
   h. Install jiffy stand and bracket assembly with three fasteners (7). Tighten to 25-30 ft-lbs (33.9-40.7 Nm).
2. Attach shifter linkage.
3. Check that jiffy stand operates correctly before using.

REMOVAL

1. Remove steering stem. See 2.20 STEERING HEAD.
2. See Figure 2-122. Remove set screw (1).
3. Insert key (3) in lock (2) and turn partially.
4. Wiggle lock and pull until enough of the lock comes out to get a grip with pliers or other suitable tool.
5. Remove fork lock by pulling on lock until it is removed.

INSTALLATION

NOTES

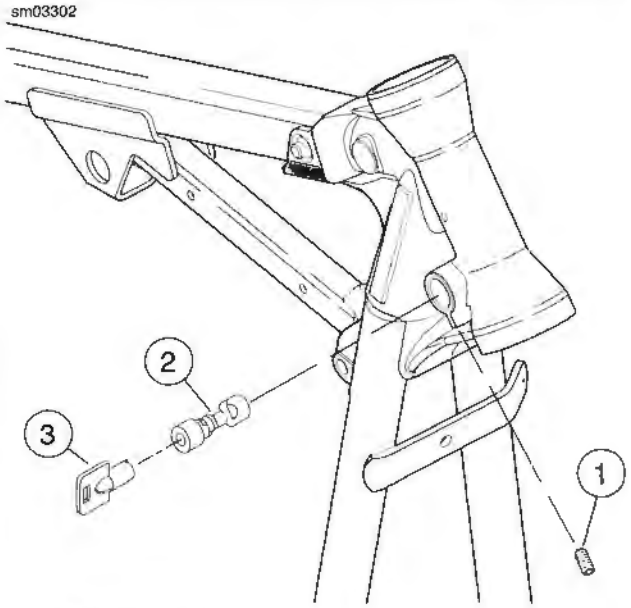
- *There is an internal boss in the left side of the steering head opposite the external boss. The end of the lock fits into this internal boss.*
- *See Figure 2-123. There is a flat (1) in the bottom of the lock into which the set screw fits. This flat must be at the bottom when the lock is installed.*
- *When the lock is correctly installed, a forward-facing flat (2) on the lock will fit against a flat inside the external lock boss and the face of the lock will be flush with the face of the external boss.*

1. Grease the end of the lock (the part that goes into the internal boss) and slide lock into external boss.
2. Insert steering stem into frame. See 2.20 STEERING HEAD.

NOTE

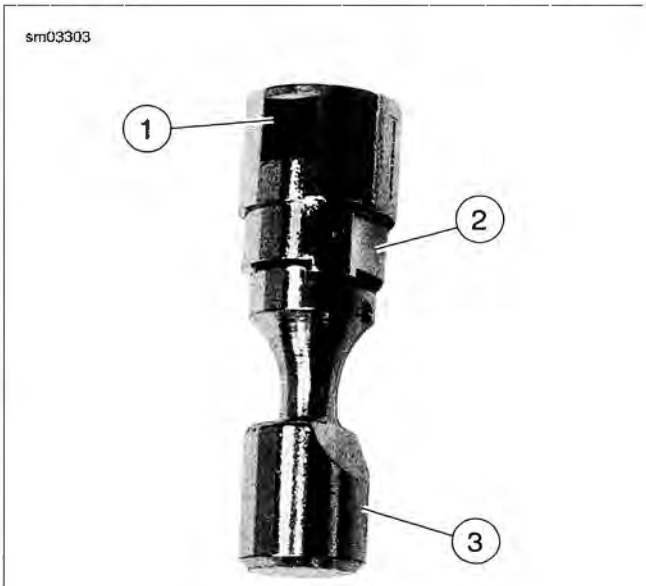
Stem must be in locked fork position.

3. Move steering stem into locked fork position. Rotate steering stem slightly, while fully installing lock.
4. See Figure 2-122. Apply LOCTITE THREADLOCKER 243 (blue) to set screw (1) and install.
5. Insert key in the lock and tighten set screw (1) until lock begins to bind; then back set screw out 1/2 turn.
6. Seal screw with a good quality sealant.
7. Finish steering stem installation including installing upper triple clamp and handlebars. See 2.20 STEERING HEAD.



1. **Set screw**
2. **Lock**
3. **Key**

Figure 2-122. Fork Lock Installation



1. **Set screw flat**
2. **Flat**
3. **Lock left side**

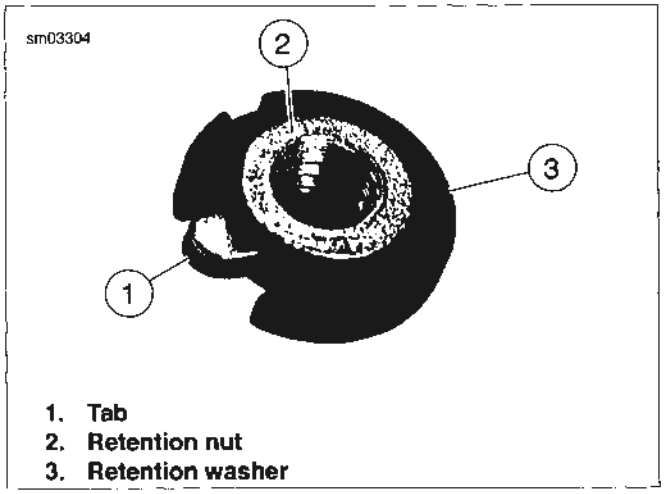
Figure 2-123. Fork Lock

REPLACEMENT

NOTE

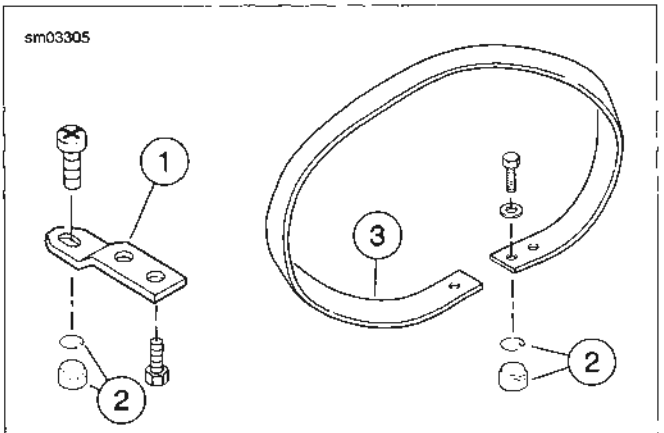
If the retention washer is removed, the retention nut will fall through the fender. The procedure below lifts the retention nut up through the fender on the cable tie strap for ease of replacement.

1. Slide retention nut over tapered end of cable tie strap so that larger O.D. of nut rests on cable tie strap eyelet.
2. From bottom of rear fender, feed cable tie strap up through fender hole.
3. See Figure 2-124. With tab (1) on retention nut (2) seated in notch of fender hole, pull up on cable tie strap to hold nut snug against underside of rear fender.
4. From the side opposite the tab, slide on the retention washer (3) to lock the position of the retention nut.



1. **Tab**
2. **Retention nut**
3. **Retention washer**

Figure 2-124. Seat Retention Nut



1. **Bracket for seat/pillion**
2. **Retention nut and retention nut washer**
3. **Seat strap (FXST/C/B/D style shown)**

Figure 2-125. Retention Nut In Use

REMOVAL AND INSTALLATION

PART NUMBER	TOOL NAME
HD-47190	SEAT MOUNTING SCREW TOOL

Seat Strap

Install bolt in appropriate hole according to Figure 2-126.

Seat

⚠WARNING

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

NOTE

Thumbscrew can be removed and installed using the SEAT MOUNTING SCREW TOOL (Part No. HD-47190).

See Figure 2-127. Seat attaches with a single thumbscrew on the seat bracket (1). When installing seat, insert tang at front of seat into the channel in the frame and install rear thumbscrew.

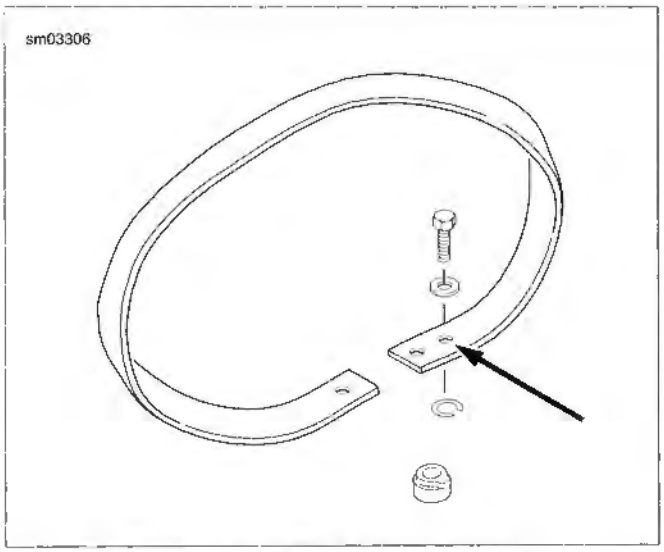
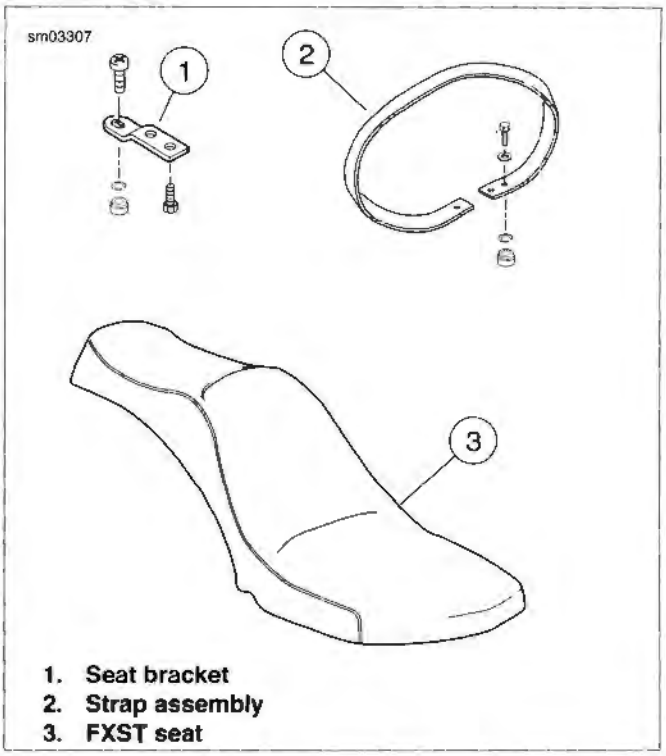


Figure 2-126. Seat Strap: FXST



1. **Seat bracket**
2. **Strap assembly**
3. **FXST seat**

Figure 2-127. Seat: FXST

REMOVAL AND INSTALLATION

Seat Strap

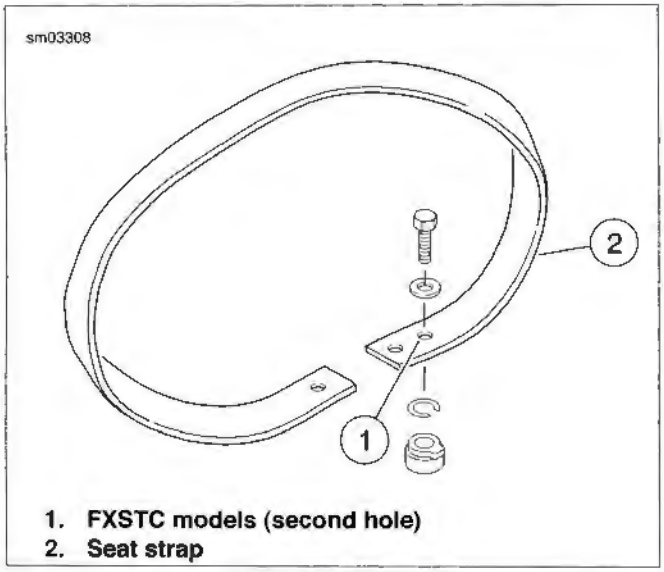
Seat strap installation depends upon model being serviced. Install bolt in appropriate hole according to Figure 2-128.

Seat

⚠WARNING

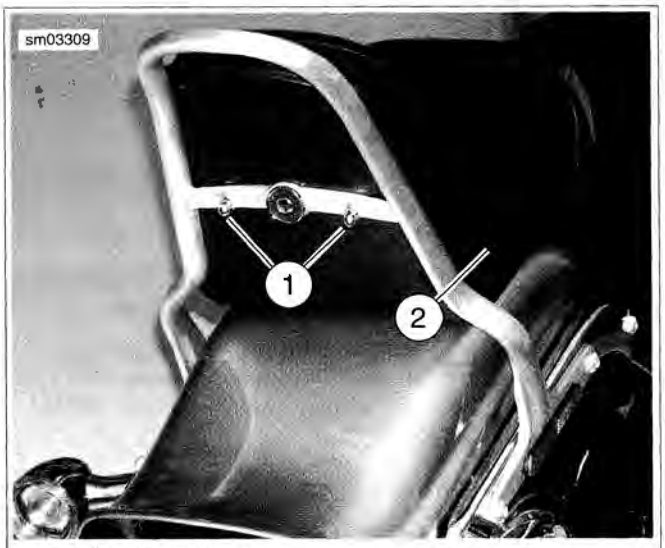
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

See Figure 2-129. Seat (2) attaches with two fasteners (1) through the sissy bar. When installing seat, insert tang at front of seat into the channel in the frame and install rear fasteners through sissy bar. Tighten fasteners to 60-80 **in-lbs** (6.8-9.0 Nm).



1. **FXSTC models (second hole)**
2. **Seat strap**

Figure 2-128. Seat Strap: FXSTC



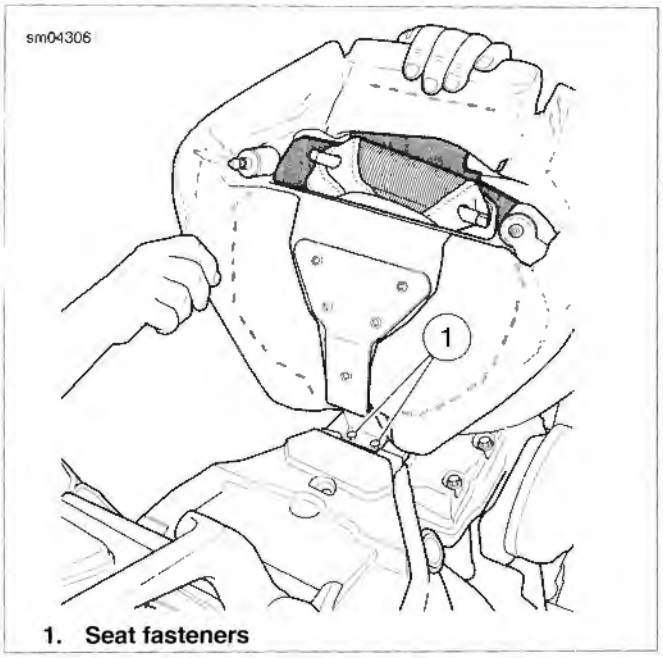
1. **Seat fasteners**
2. **Seat**

Figure 2-129. Seat: FXSTC

REMOVAL AND INSTALLATION

Rider Seat

1. Tip seat up and toward fuel tank.
2. See Figure 2-130. Remove two fasteners (1). Remove seat.
3. Installation is done in the reverse of removal. Tighten fasteners to 90-110 **in-lbs** (10.2-12.4 Nm).

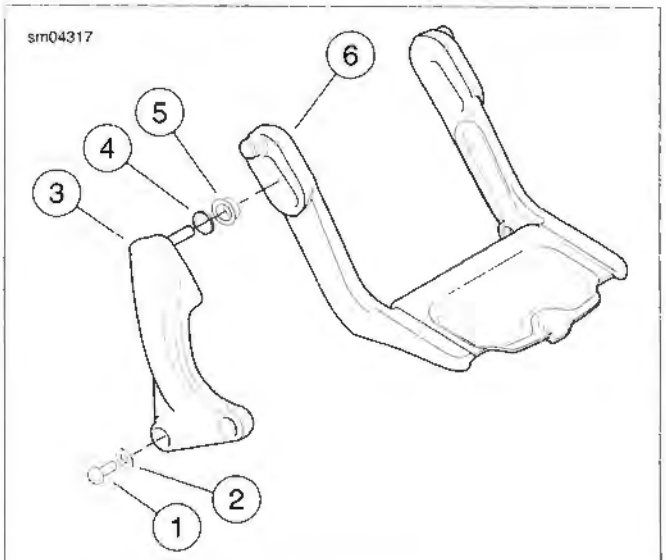


1. **Seat fasteners**

Figure 2-130. Rider Seat: FXCWC Models

Passenger Seat Support

1. Tip rider seat up and toward fuel tank.
2. See Figure 2-131. Remove two screws (1) and washers (2) from one pillion support (3).
3. Remove pillion support (3) and rear seat pillion (6).
4. Remove remaining pillion support.
5. Install one pillion support but do not tighten fasteners at this time.
6. Install wave washer (4) and bushing (5) on each pillion support.
7. Install pillion (6) and second pillion support. Tighten all fasteners (1) to an initial torque of 30-35 ft-lbs (40.7-47.5 Nm). Loosen fasteners (1) and final tighten to 38-42 ft-lbs (51.5-56.9 Nm).
8. Check rider seat operation.
9. Lower rider seat into position and engage locating pins in grommets.



1. **Pillion Support fastener (4)**
2. **Washer (4)**
3. **Pillion support (2)**
4. **Wave washer (2)**
5. **Bushing (2)**
6. **Pillion**

Figure 2-131. Passenger Seat: FXCWC Models

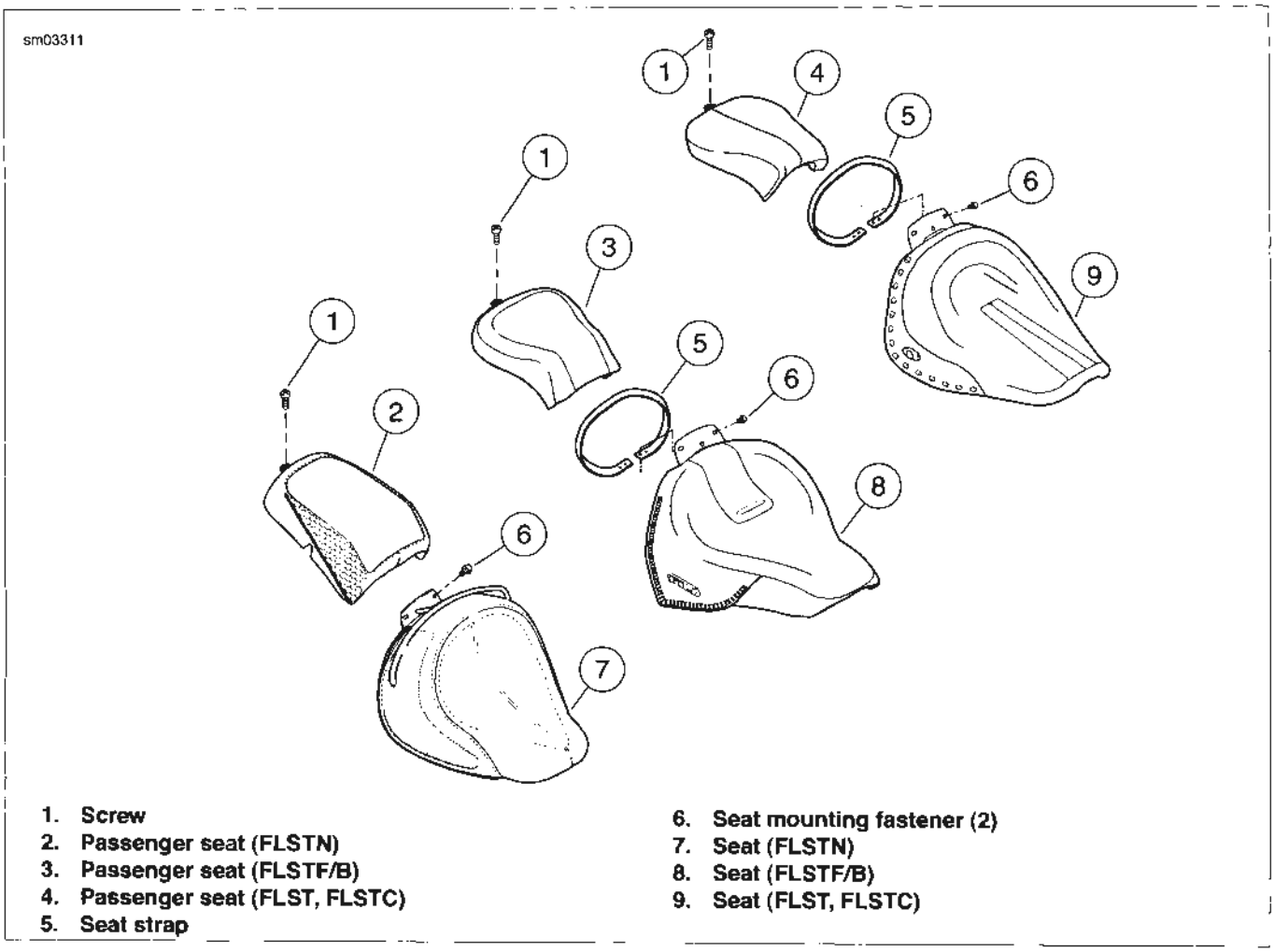
REMOVAL AND INSTALLATION

⚠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)

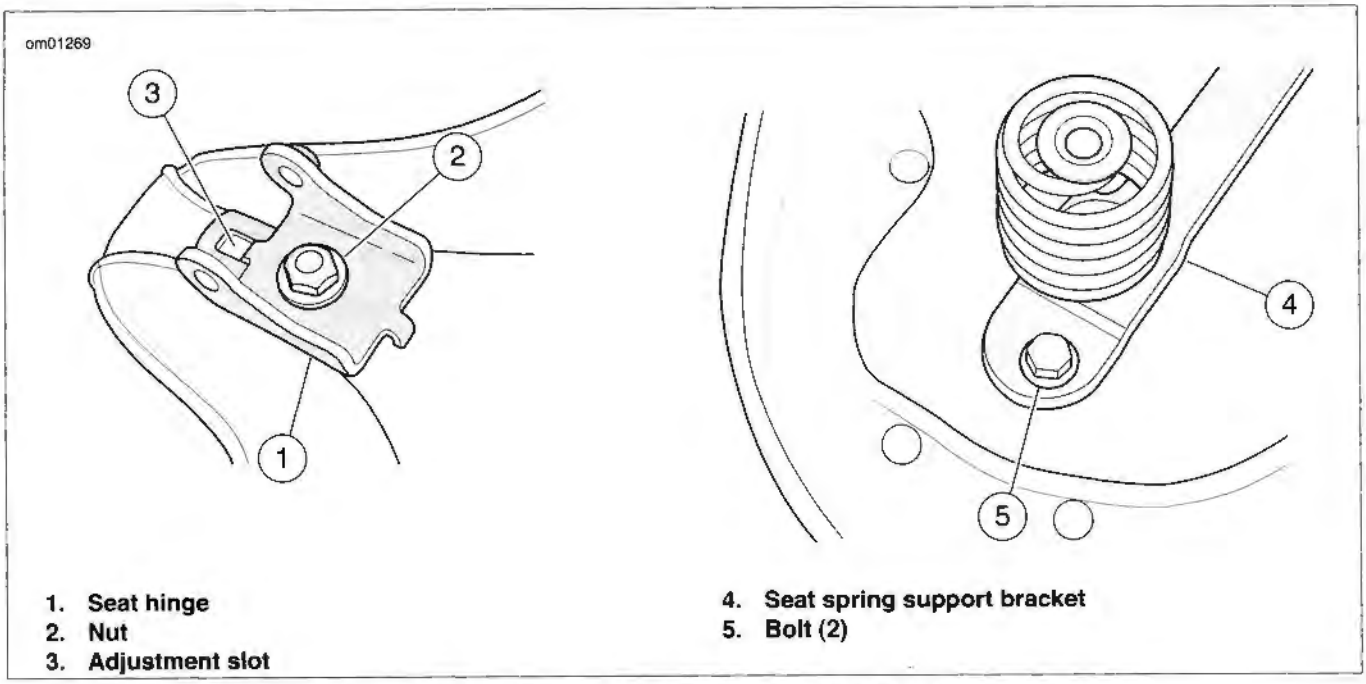
See Figure 2-132. The passenger seat attaches with a single screw (1) at the rear and engages the seat mounting fasteners (6) at the front.

To remove seat (7, 8, 9), remove passenger seat (2, 3, 4) and seat mounting fasteners (6). When installing seat, insert tang at front of seat into the channel in the frame and install seat mounting nuts. Install passenger seat.



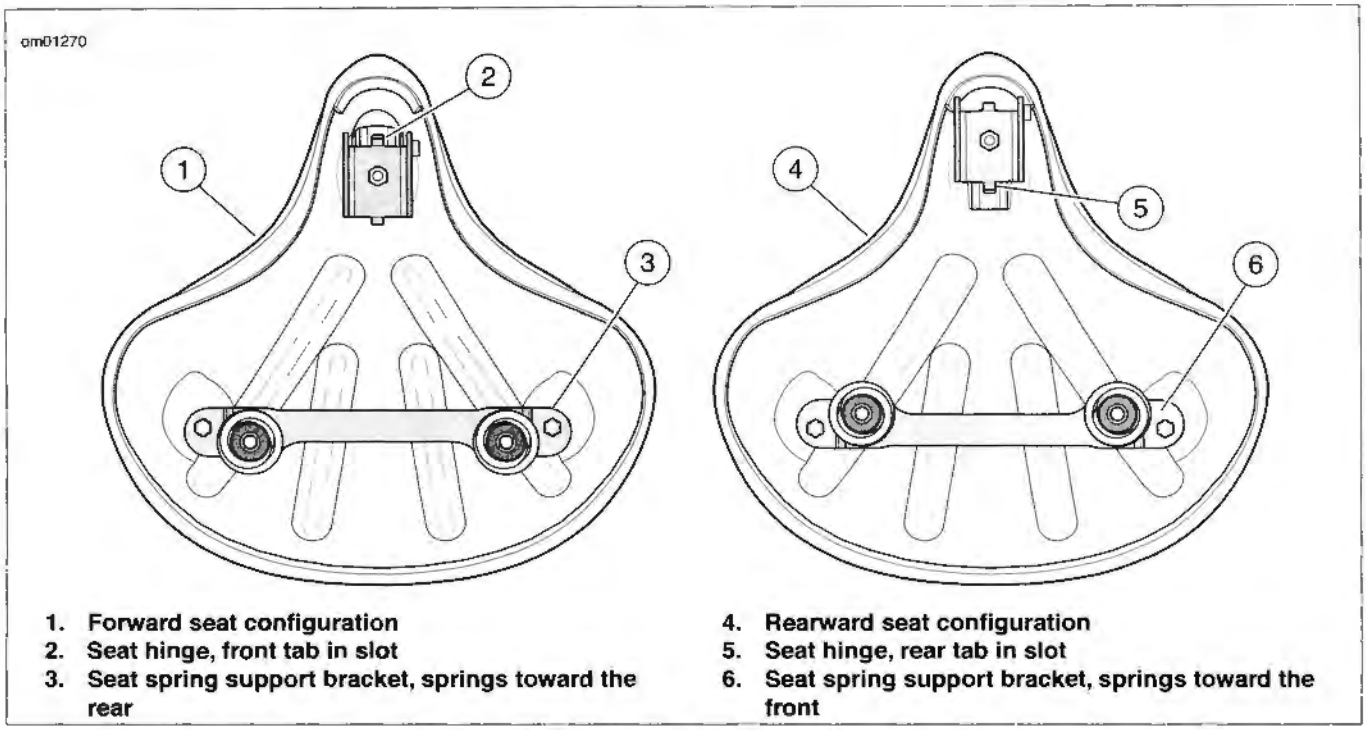
1. Screw
2. Passenger seat (FLSTN)
3. Passenger seat (FLSTF/B)
4. Passenger seat (FLST, FLSTC)
5. Seat strap
6. Seat mounting fastener (2)
7. Seat (FLSTN)
8. Seat (FLSTF/B)
9. Seat (FLST, FLSTC)

Figure 2-132. Seat: FLSTN/FLSTF/FLSTFB/FLST/FLSTC



1. Seat hinge
2. Nut
3. Adjustment slot
4. Seat spring support bracket
5. Bolt (2)

Figure 2-134. Seat Adjustment: FLSTSB Models

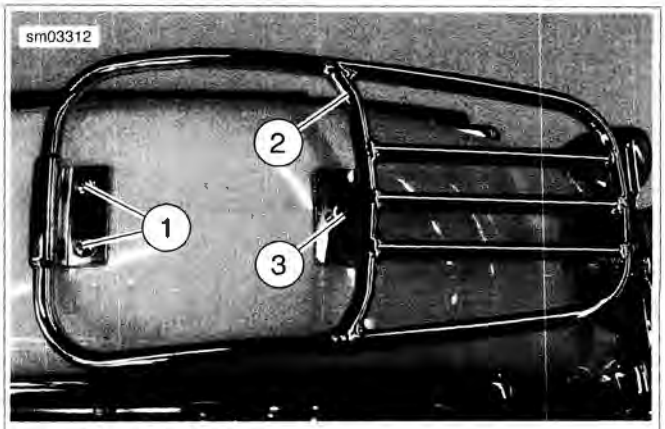


1. Forward seat configuration
2. Seat hinge, front tab in slot
3. Seat spring support bracket, springs toward the rear
4. Rearward seat configuration
5. Seat hinge, rear tab in slot
6. Seat spring support bracket, springs toward the front

Figure 2-135. Seat Configurations: FLSTSB Models

REMOVAL AND INSTALLATION

1. Remove seat. See 2.44 SEAT: FLSTN/FLSTF/FLSTFB/FLST/FLSTC.
2. Remove front fasteners (1) and rear fasteners (3) to detach luggage rack (2) from fender.
3. Place luggage rack on fender.
4. Install, but do not tighten front fasteners.
5. Install rear fastener. Tighten to 12-14 ft-lbs (16.3-19.0 Nm).
6. Tighten front fasteners to 96-120 **in-lbs** (10.8-13.6 Nm).



1. **Front fasteners**
2. **Luggage rack**
3. **Rear fastener**

Figure 2-136. Luggage Rack

REMOVAL

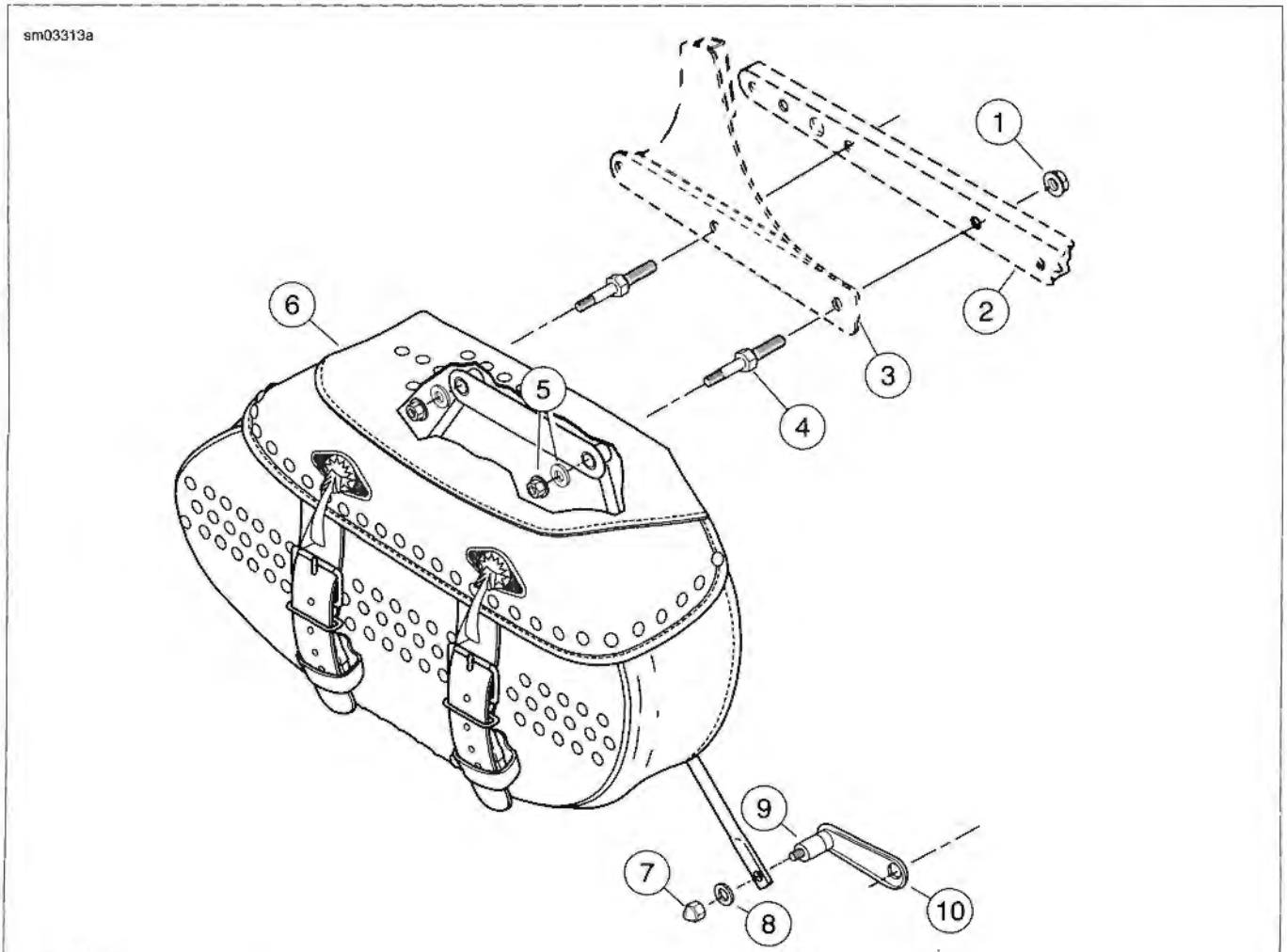
1. See Figure 2-137. Remove acorn nut (7) and washer (8) from lower support.
2. Remove flange nuts and washers (5) from inside saddlebag.
3. Lift saddlebag away from motorcycle. Remove nuts (1) and studs (4) if necessary.

INSTALLATION

NOTES

- *See Figure 2-137. On FLSTC models, there are no washers between studs (4) and sissybar sideplate (3).*
- *If replacing isolator (9), long (silver) threads face saddlebag and short (yellow) threads face support.*

1. If removed, install studs (4) and tighten nuts (1) behind fender support (2) to 21-27 ft-lbs (28.5-36.6 Nm).
2. Install flange nuts and washers (5) inside saddlebags. Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).
3. Install lower bracket acorn nut (7) and washer (8). Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).



1. **Nut**
2. **Fender support**
3. **Sissy bar sideplate**
4. **Stud**
5. **Flange nut and washer**
6. **Saddlebag**
7. **Acorn nut**
8. **Washer**
9. **Isolator**
10. **Lower front support**

Figure 2-137. Saddlebags: FLSTC

SEAT: FLSTSB

NOTE

Raise rear of seat only slightly during removal or installation. Pivoting rear of seat up too high can cause the nose of the seat to damage the leather trim panel on the fuel tank.

Removal

1. See Figure 2-133. Remove screw (1) from the seat hinge at the front of the seat.
2. Raise the rear of the seat to disengage the springs (2) from the seat spring mounting pins (3). Remove seat.

Installation

1. See Figure 2-133. Align seat hinge with the mounting bracket on the frame.
2. From the right side of the motorcycle, insert the screw (1) into the seat hinge and tighten to 14-16 ft-lbs (19.0-21.7 Nm).
3. Align bushings on seat springs (2) with the mounting pins (3). Push rear of seat down to engage the seat spring mounting pins.

Adjusting Seat Position

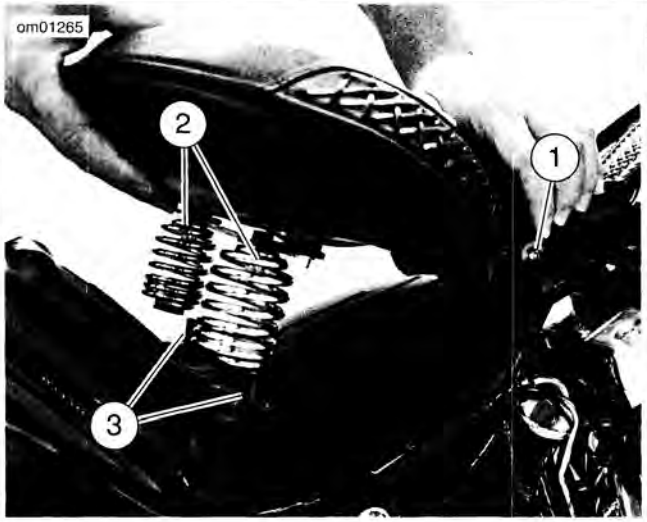
Seat position may be adjusted forward or rearward for rider comfort.

1. Remove the seat.
2. See Figure 2-134. Remove the nut on the seat hinge.
3. Remove the bolts from the seat spring support bracket.

NOTE

See Figure 2-135. The seat hinge and seat spring support bracket must be installed in the same position (forward or rearward configuration) for the seat to fit properly on the motorcycle.

4. To position seat forward:
   a. See Figure 2-135. Install hinge with the front tab in the slot.
   b. Install seat spring support bracket with springs toward the rear of the seat.
5. To position seat rearward:
   a. See Figure 2-135. Install hinge with the rear tab in the slot.
   b. Install seat spring support bracket with springs toward the front of the seat.
6. Install nut on seat hinge and tighten to 20-25 ft-lbs (27.1-33.9 Nm).
7. Install screws for seat spring support bracket and tighten to 15-20 ft-lbs (20.3-27.1 Nm).
8. Install seat.



1. **Screw**
2. **Seat springs**
3. **Seat spring mounting pins**

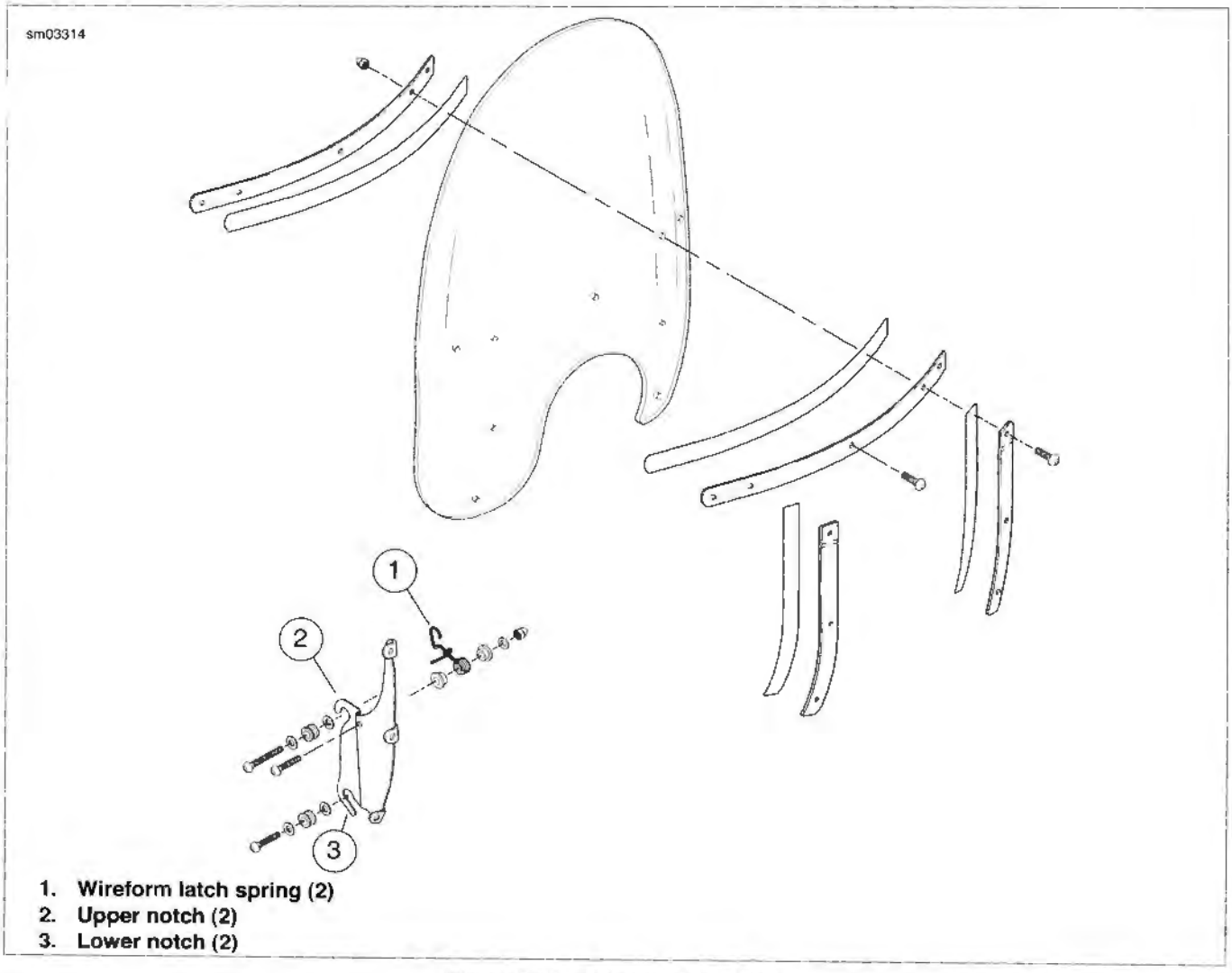
Figure 2-133. Seat: FLSTSB Models

REMOVAL

1. See Figure 2-138. Use a finger to raise the wireform latch springs on each side of the windshield.
2. Standing at the front of the vehicle, gently pull the top of the windshield until the upper notches (2) on the side brackets are free of the upper grommets.
3. Carefully raise the windshield until the lower notches (3) in the side brackets are free of the lower grommets.
4. Remove windshield from vehicle.

INSTALLATION

1. See Figure 2-138. Lower the windshield into position until the lower notches (3) are seated on the lower grommets.
2. Standing at the front of the vehicle, gently push the top of the windshield toward the rear until the upper notches (2) fully engage the upper grommets.
3. Push down on the wireform latch springs (1) so that they overhang the rubber grommets. If some adjustment is necessary, loosen the retaining bolts and rotate the latch springs into the proper position.



1. **Wireform latch spring (2)**
2. **Upper notch (2)**
3. **Lower notch (2)**

Figure 2-138. Windshield: FLSTC

NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Automatic compression release (ACR)	11-15 ft-lbs	14.9-20.3 Nm	3.23 CYLINDER HEAD, Installation Overview/Apply three equally spaced dots of LOCTITE 246 THREADLOCKER MEDIUM STRENGTH/HIGH TEMPERATURE around lower third of threads
Balance shaft bolts	42-47 ft-lbs	56.9-63.7 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
Balance shaft housing screws	18-22 ft-lbs	24.4-29.8 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
Breather assembly bolts	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Cam chain tensioner fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam cover screws	125-155 **in-lbs**	14.1-17.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Counterbalance assembly bearing	40-70 **in-lbs**	4.5-7.9 Nm	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair
Crankcase bolt (final torque)	15-19 ft-lbs	20.3-25.8 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase bolt (initial torque)	120 **in-lbs**	13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase oil fittings	120-168 **in-lbs**	13.6-19.0 Nm	3.28 CRANKCASE, Pipe Plugs and Oil Fittings
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.28 CRANKCASE, Pipe Plugs and Oil Fittings
Crank sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.1 Nm	3.24 CYLINDER, Inspection
Cylinder head bolts, initial	120-144 **in-lbs**	13.5-16.2 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, initial	120-144 **in-lbs**	13.6-16.3 Nm	3.24 CYLINDER, Inspection
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Cylinder stud	10-20 ft-lbs	3.6-27.1 Nm	3.28 CRANKCASE, Cylinder Studs
Electrical panel fastener	36-60 **in-lbs**	4.1-6.8 Nm	3.32 OIL TANK: FXCWC, Installation
Electrical panel fasteners	36-60 **in-lbs**	4.1-6.8 Nm	3.31 OIL TANK: ALL BUT FXCWC, Installation
Engine/transmission bracket bolts	30-35 ft-lbs	40.7-47.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Engine mounting bolts, front	70-80 ft-lbs	94.9-108.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure

FASTENER	TORQUE VALUE		NOTES
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers
Oil pump screws, initial torque	40-45 **in-lbs**	4.5-5.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Piston jet screw	25-35 **in-lbs**	2.8-3.9 Nm	3.28 CRANKCASE, Right Crankcase Half
Pivot shaft nut	90-110 ft-lbs	122-149.1 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Primary cam sprocket flange bolts, final torque	34 ft-lbs	46.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover bolts	15-18 ft-lbs	20.3-24.4 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Secondary cam chain tensioner fastener	100-120 **in-lbs**	11.3-13.6 Nm	3.26 CAM SUPPORT PLATE AND COVER, Camshafts
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	3.8 TROUBLESHOOTING, Compression Test
Splash guard fastener (All But FXCWC)	36-48 **in-lbs**	4.1-5.4 Nm	3.31 OIL TANK: ALL BUT FXCWC, Installation
Splash guard fasteners: FXCWC	36-60 **in-lbs**	4.1-6.8 Nm	3.32 OIL TANK: FXCWC, Installation
Top engine mount bolt	45-50 ft-lbs	61.0-67.8 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts (final torque)	34-39 ft-lbs	46.1-52.9 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts (initial torque)	15 ft-lbs	20.3 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Upper engine mounting bolt	45-50 ft-lbs	61.0-67.8 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure

SPECIFICATIONS

Table 3-1. General Specifications

GENERAL	DATA
Number of cylinders	2
Type	4-cycle, 45 degree, air-cooled V-twin
Torque (with shorty, dual exhaust)	91 ft-lbs @ 3000 RPM
	123 Nm @ 3000 RPM
Bore	3.75 in.
	95.25 mm
Stroke	4.375 in.
	111.13 mm
Piston displacement (approx.)	96 cubic in.
	1584 cc
Maximum sustained engine speed	5500 RPM
Idle speed	1000 RPM +/- 50

Table 3-2. Oiling System

OIL PUMP	DATA
Type	Twin geroter, dual scavenge, crank mounted and driven, internal oil pump, dry sump
Pressure	30-38 PSI (207-262 kN/m^2) at 2000 RPM and normal operating temperature of 230° F (110° C)
Filtration	5 micron media, filtered between pump and engine

Table 3-3. Rocker Arms Specifications

ROCKER ARMS	IN.	MM
Shaft fit in bushing (loose)	0.0005-0.0020	0.013-0.051
End clearance	0.003-0.013	0.08-0.33
Bushing fit in rocker arm (tight)	0.002-0.004	0.051-0.102

Table 3-4. Rocker Arm Shaft Specifications

ROCKER ARM SHAFTS	IN.	MM
Shaft fit in rocker arm support plate (loose)	0.0007-0.0022	0.018-0.056

Table 3-5. Hydraulic Lifter Specifications

HYDRAULIC LIFTERS	IN	MM
Fit in crankcase (loose)	0.0009-0.0026	0.002-0.066

Table 3-6. Cylinder Head Specifications

CYLINDER HEAD	IN.	MM
Valve guide in head (tight)	0.0022-0.0033	0.051-0.084
Valve seat in head (tight)	0.003-0.0045	0.076-0.114
Valve stem protrusion (min)	2.022	51.36
Head gasket surface (flatness)	0-0.006	0-0.152

Table 3-7. Valve Specifications

VALVES	IN.	MM
Exhaust: fit in guide	0.001-0.003	0.0254-0.0762
Intake: fit in guide	0.001-0.003	0.0254-0.0762
Seat Width	0.040-0.062	1.02-1.58
Stem protrusion from cylinder head boss	2.012-2.032	51.10-51.61

Table 3-8. Valve Springs Specifications

VALVE SPRINGS	IN.	MM
Closed	135 lbs @ 1.850 in.	61.2 kg @ 47.0 mm
Open	312 lbs @ 1.300 in.	141.5 kg @ 33.0 mm
Free length	2.325 in.	59.1 mm

Table 3-9. Piston: Twin Cam 96™

PISTON		IN.	MM
Fit in cylinder (loose)		0.0014-0.0025	0.036-0.064
Piston pin fit (loose)		0.0002-0.0005	0.005-0.013
Ring end gap	Top compression	0.010-0.020	0.254-0.508
	2nd compression	0.014-0.024	0.356-0.610
	Oil control ring	0.010-0.050	0.254-1.27
Ring side clearance	Top compression	0.0012-0.0037	0.030-0.094
	2nd compression	0.0012-0.0037	0.030-0.094
	Oil control rails	0.0031-0.0091	0.079-0.231

Table 3-10. Connecting Rod Specifications

CONNECTING ROD	IN.	MM
Piston pin fit (loose)	0.0007-0.0012	0.018-0.030
Side play between flywheels	0.005-0.015	0.13-0.38
Connecting rod to crankpin (loose)	0.0004-0.0017	0.0102-0.0432

Table 3-11. Flywheel Specifications

FLYWHEELS	IN.	MM
Runout (shaft measured in case)	0.000-0.010	0.0-0.254
Runout (measured in truing stand)	0.000-0.004	0.0-0.102
End play	0.003-0.013	0.076-0.330

Table 3-12. Crankshaft/Sprocket Shaft Bearing Specifications

CRANKSHAFT/SPROCKET SHAFT BEARINGS	IN.	MM
Roller bearing fit (loose)	0.0002-0.0015	0.005-0.038
Bearing fit in crankcase (tight)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0004-0.0014	0.010-0.036

GENERAL

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed values listed here.

Table 3-13. Rocker Arm/Rocker Arm Shaft

ROCKER ARM/ROCKER ARM SHAFT	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Shaft fit in bushing (loose)	0.0035	0.089
End clearance	0.025	0.635
Shaft fit in rocker arm support (loose)	0.0035	0.089

Table 3-14. Hydraulic Lifter

HYDRAULIC LIFTER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Fit in crankcase	0.003	0.076
Roller fit	0.0015	0.038
Roller end clearance	0.022	0.559

Table 3-15. Cam Support Plate (Twin Cam 96™)

CAM SUPPORT PLATE	REPLACE IF	
	IN.	MM
Cam chain tensioner shoe	More than 0.060	More than 1.52
Crankshaft bushing maximum ID	More than 0.8545	More than 21.704
Camshaft bore	1.1023	27.998

Table 3-16. Cylinder Head

CYLINDER HEAD	REPLACE IF	
	IN.	MM
Valve guide in head (tight)	Less than 0.002	Less than 0.051
Valve seat in head (tight)	Less than 0.002	Less than 0.051
Valve stem protrusion	More than 2.069	More than 52.553
Head warpage	More than 0.006	More than 0.152

Table 3-17. Cylinder

CYLINDER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Taper	0.002	0.051
Out of round	0.002	0.051
Warpage of gasket surfaces: top	0.006	0.152
Warpage of gasket or O-ring surfaces: base	0.004	0.102

Table 3-18. Cylinder Bore (Twin Cam 96™)

CYLINDER BORE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Standard	3.752	95.301
0.005 in. oversize	3.757	95.428
0.010 in. oversize	3.762	95.555

Table 3-19. Piston

PISTON		REPLACE IF WEAR EXCEEDS	
		IN.	MM
Fit in cylinder (loose)		0.003	0.076
Piston pin fit (loose)		0.0008	0.020
Ring end gap	Top compression	0.030	0.762
	2nd compression	0.034	0.864
	Oil control rails	0.050	1.27
Ring side clearance	Top compression	0.0045	0.114
	2nd compression	0.0045	0.114
	Oil control rails	0.010	0.254

Table 3-20. Connecting Rod (Twin Cam 96™)

CONNECTING ROD	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Piston pin fit (loose)	0.002	0.051
Side play between flywheels	0.020	0.508
Fit on crankpin (loose)	0.002	0.051

Table 3-21. Breather Assembly

BREATHER ASSEMBLY	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Breather cover warpage	0.005	0.13
Breather baffle warpage	0.005	0.13

Table 3-22. Valve Stem to Guide (Twin Cam 96™)

VALVE STEM TO GUIDE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Table 3-23. Flywheel

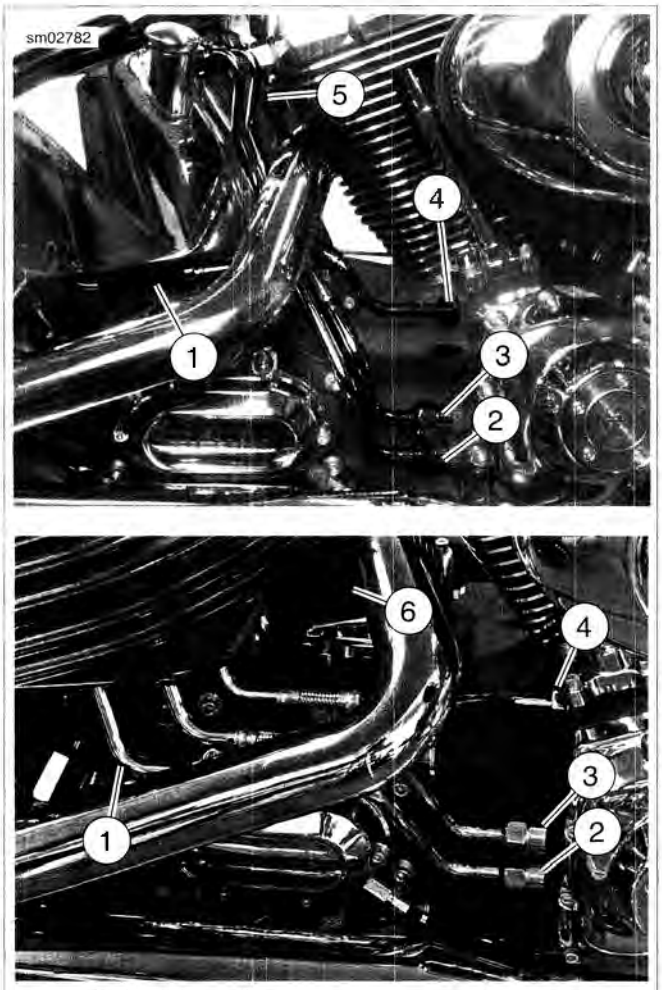
FLYWHEEL	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Runout (shaft measured in case)	0.012	0.305
Runout (measured in truing stand)	0.005	0.127
End play	0.013	0.330

Table 3-24. Crankshaft Roller Bearing (Twin Cam 96™)

CRANKSHAFT ROLLER BEARING	REPLACE IF	
	IN.	MM
Roller bearing fit (loose)	More than 0.0015	More than 0.038
Bearing fit in crankcase (tight)	Less than 0.0038	Less than 0.097
Inner race on crankshaft (tight)	Less than 0.0004	Less than 0.010

OIL FEED

See Figure 3-1. Oil flows from the oil tank feed line (1) to the engine feed connection (2) at the rear right side of the crankcase.



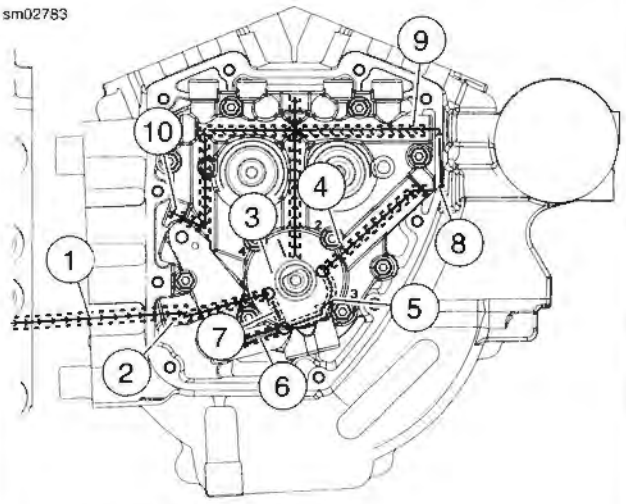
1. Oil tank feed line
2. Feed connection on engine
3. Return line
4. Vent line
5. Oil tank: all but FXCWC
6. Oil tank: FXCWC

Figure 3-1. Oil Flow from Tank

See Figure 3-2. Running through a passageway in the crankcase (1), oil exits a hole in the crankcase flange and enters a hole on the inboard side of the cam support plate (2). Passing through a channel in the cam support plate, the oil enters the feed side of the oil pump (3). See 3.5 OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate.

A passage (5) connects to a pressure relief valve (6) mounted in the bypass port of the cam support plate. When the oil pressure exceeds the setting of the valve spring (35 PSI), the orifice opens to bypass (7) excess oil back to the feed side of the pump (3).

Oil not returned to the feed side exits a hole on the inboard side of the cam support plate and passes through a hole in the crankcase flange. Flowing through a passageway in the crankcase, where a reading is taken by the oil pressure sending unit (8), the oil exits the lower hole in the oil filter mount. See Figure 3-3.



1. Crankcase passage
2. Cam support plate/crankcase connection
3. Feed side of oil pump
4. Oil pump output
5. Overflow passage
6. Pressure relief valve
7. Bypass passage
8. Oil pressure sending unit
9. Return from oil filter into cam support plate
10. Feed to chain guide bracket

Figure 3-2. Cam Support Plate Oil Flow

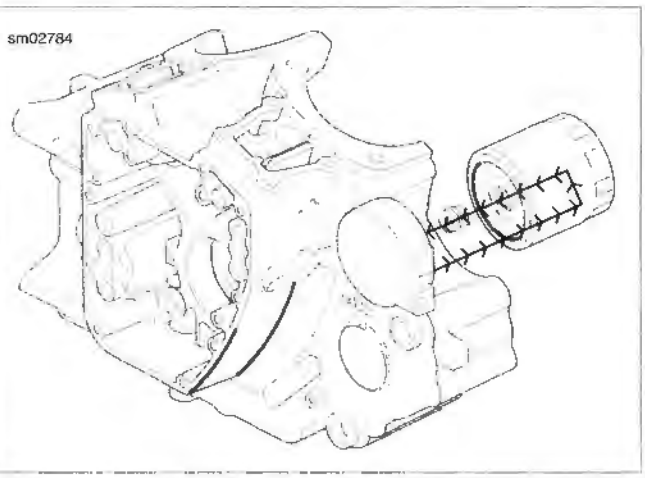


Figure 3-3. Oil Filter Flow

After circulating through the oil filter, the flow of oil is directed back into the crankcase through the spigot in the oil filter mount. See Figure 3-2. Exiting a passageway in the crankcase through

a hole in the crankcase flange, the flow of oil reenters the cam support plate (9).

Filtered oil is then routed to the top and bottom ends of the engine. See 3.4 ENGINE OIL FLOW, Top End, 3.4 ENGINE OIL FLOW, Bottom End and 3.4 ENGINE OIL FLOW, Chain Guide Bracket.

TOP END

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-4.
- Top end oil flow is shown in Figure 3-5.

Oil passes through a channel in the cam support plate exiting the inboard side through two holes near the top (A11, A12). Entering two holes in the crankcase flange (B13, B14), one leading to the front cylinder and the other to the rear, the oil travels through passageways in the crankcase to the hydraulic lifter bores (D15).

Exiting a hole in each lifter bore (E16), the oil flows around the lifter and enters a hole at the side of the lifter body. As the chamber inside the lifter body is filled, the push rod socket rises to achieve the no-lash fit of the valve train components. The flow of oil then exits a hole centered in the lifter socket and runs up the hollow push rods.

NOTE

Note that there is one additional hole drilled into the inside lifter bores while the oblong hole circulates oil around the lifter body as described, the round hole (E17) feeds oil to the piston jets in the flywheel compartment.

Exiting holes at the top of the hollow push rods, oil enters a hole at the bottom of the intake and exhaust rocker arms. Lubricating the rocker arm bushings, oil flows down the rocker arm shafts and exits a pin hole in the outboard side of each rocker arm housing (F18) where it sprays the valve springs and the top of the valve stem.

Oil runs down to the low side of the rocker housing and enters the exhaust valve spring pocket where a drain hole (G19) leads to a passageway in the cylinder head casting.

Oil exits the bottom of the cylinder head and passes through a dowel pin (H20) on the "down side" of the cylinder flange. The oil runs through a vertical passageway in the cylinder, passes through a second dowel pin on the "down side" of the cylinder deck (I21) and enters the left crankcase half.

Flowing through a horizontal passageway in the left crankcase half (J22), oil runs through a third dowel pin (K23) to the right crankcase half where it travels through another passageway before emptying into the cam compartment (B23, B24).

Oil collecting in the cam compartment is picked up by one of two scavenge lobes on the oil pump (B25).

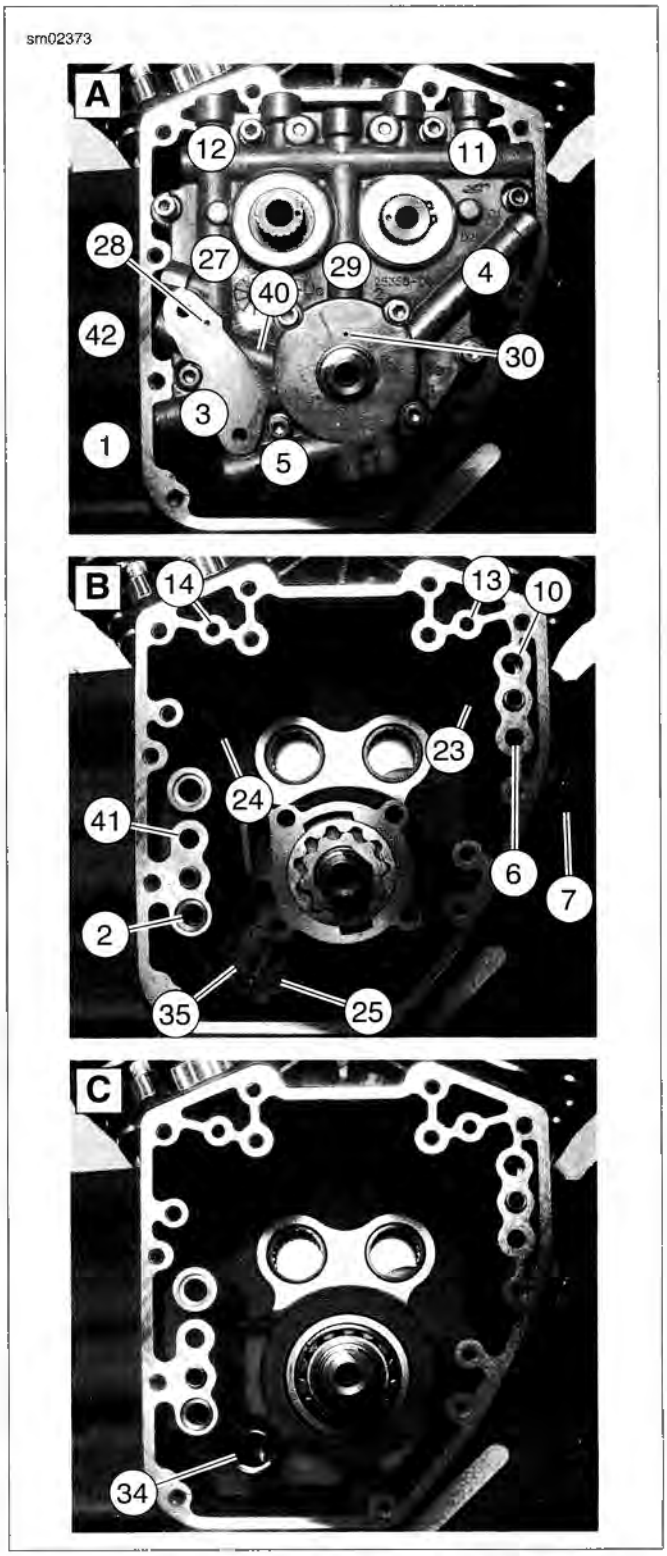


Figure 3-4. Engine Oil Flow - Cam Support Plate/Right Crankcase Half

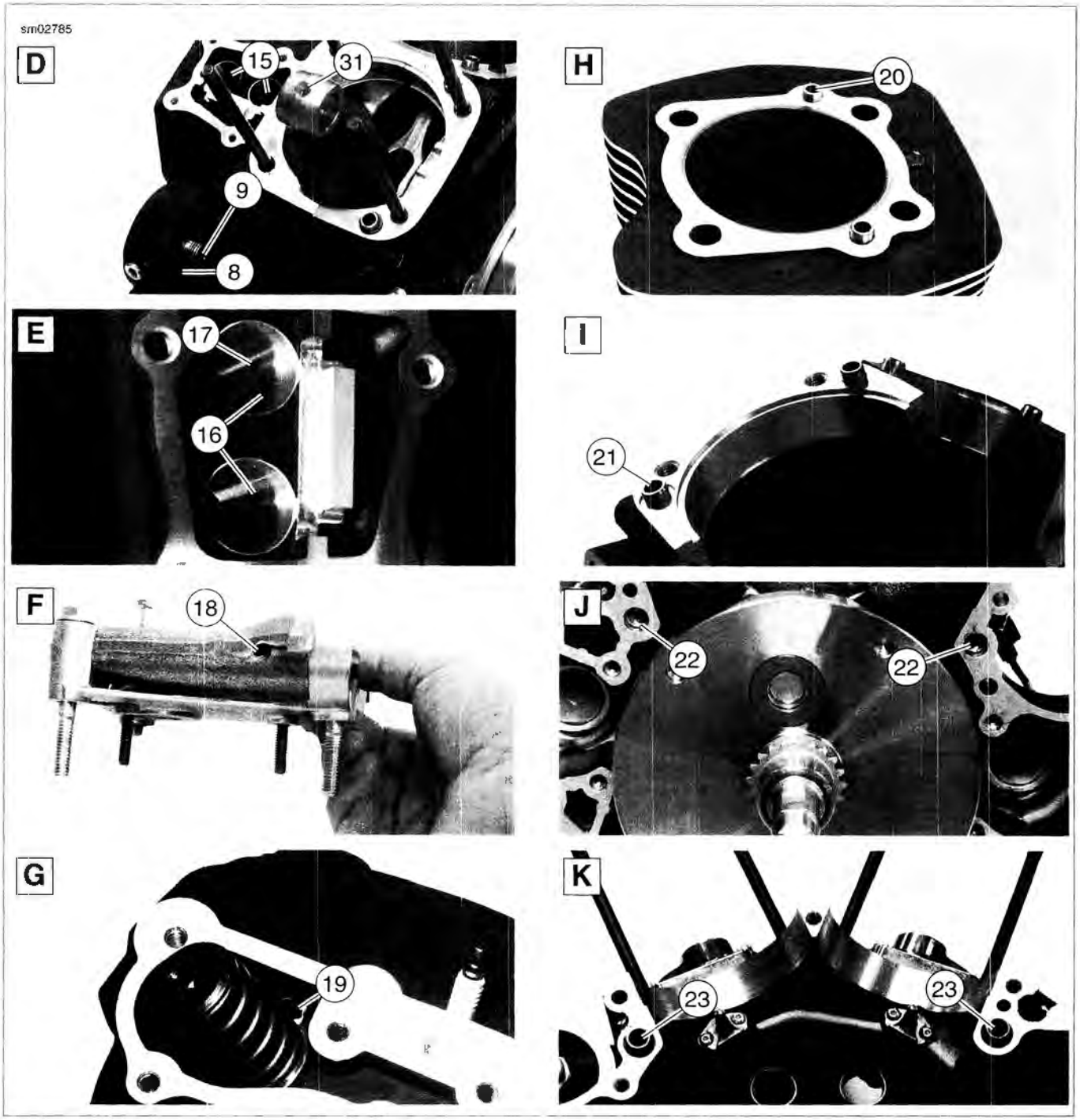


Figure 3-5. Engine Oil Flow: Top End

BOTTOM END

Three illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-4.
- Top end oil flow is shown in Figure 3-5.
- Bottom end oil flow is shown in Figure 3-6.

Oil traveling through the horizontal passage at the top of the cam support plate (A11, A12) (enroute to the front and rear cylinders) also passes through a hole at the top of each camshaft bore to lubricate the journals of the plain bearing cams.

On the inboard side of the passage leading to the rear cylinder, oil sprays out through a pin hole to lubricate the secondary cam chain. The flow of oil to the rear cylinder also travels down the vertical passage at the rear of the cam support plate (A27) and exits a hole on the outboard side to supply oil to the primary cam chain tensioner (A28).

The flow of oil in the vertical passage at the center of the cam support plate (A29) passes through a hole on the inboard side to supply oil to the secondary cam chain tensioner and also sprays out through a pin hole on the outboard side to lubricate the primary cam chain (A30). The flow of oil then passes

through a hole in the crankshaft bushing where it enters a drilling in the crankshaft (L27).

Oil runs down the center of the crankshaft and then up a cross drilling into the right side of the flywheel. The flow exits a drilling in the crank pin bore, enters the crank pin and then sprays out through three holes to lubricate the lower rod bearing set.

The oil splash and mist created by the action of the flywheel lubricates the crankshaft bearing and the camshaft needle bearings in the right crankcase half. This same action serves to lubricate the sprocket shaft bearing in the left crankcase half (M28).

Since the oil mist also lubricates the cylinder walls, three holes on each side of the piston (in the area of the third ring land) evacuates excess oil scraped from the walls on the piston downstroke.

The piston jets (N29), which receive a supply of oil from the intake lifter bores, spray the underside of the piston for cooling of the piston crown and skirt area. A check valve in each jet opens only when the oil pressure reaches 12-18 PSI (82.74-124.11 kPa), at which point the engine is operating above idle speed. At idle speeds 9-12 PSI (62.05-82.74), the orifice remains closed to prevent over oiling and to provide proper system operating pressure.

Oil spray from each piston jet also enters slots in each pin boss (O30) for lubrication of the piston pin.

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P32). Oil in the sump is drawn to the cam compartment through an internal channel (P33, C38) that connects with the second scavenge lobe of the oil pump (B39).

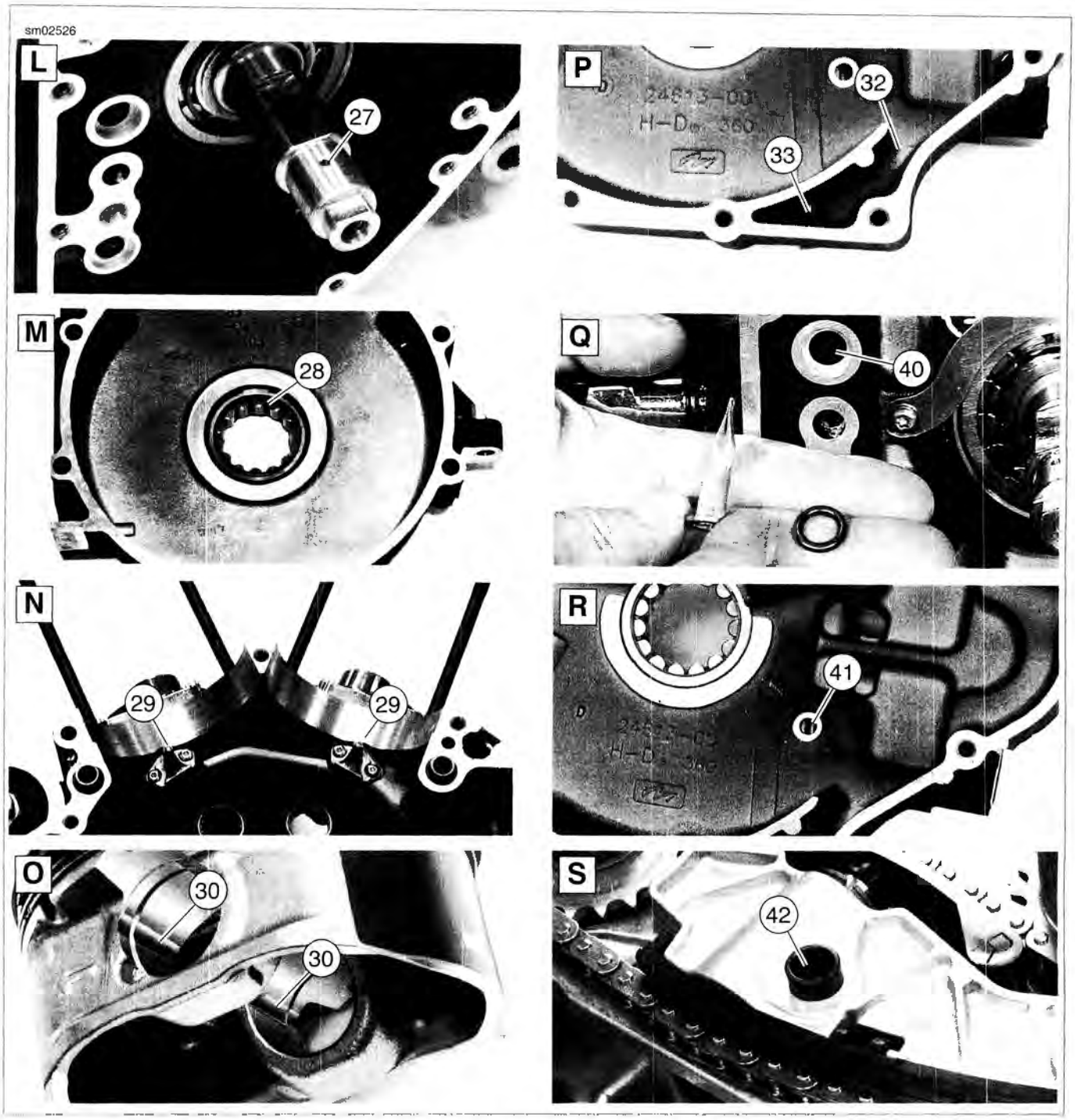


Figure 3-6. Engine Oil Flow: Bottom End

CHAIN GUIDE BRACKET

Three illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-4.
- Bottom end oil flow is shown in Figure 3-6.
- Chain guide bracket oil flow is shown in Figure 3-7.

The flow of oil travels down the vertical passage at the rear of the cam support plate (A27).

As oil exits the inboard side of the cam support plate, it enters a crankcase dowel. The hole contains the chain guide screen and o-ring (Q40).

NOTE

This screen blocks any debris which might enter the chain guide bracket. The screen has no regular maintenance schedule. However, clean the screen and replace the o-ring every time the engine is disassembled.

Oil travels through the right side crankcase (R41) and goes into the chain guide bracket rubber interconnect (S42). Inside the chain guide (T43), oil travels to both the front and rear

hydraulic tensioners (T45, T44). The tensioners sit underneath the front and rear tensioner guides which provide support for the counterbalancer chain. A small hole at the top of each tensioner vents any trapped air into the flywheel compartment.

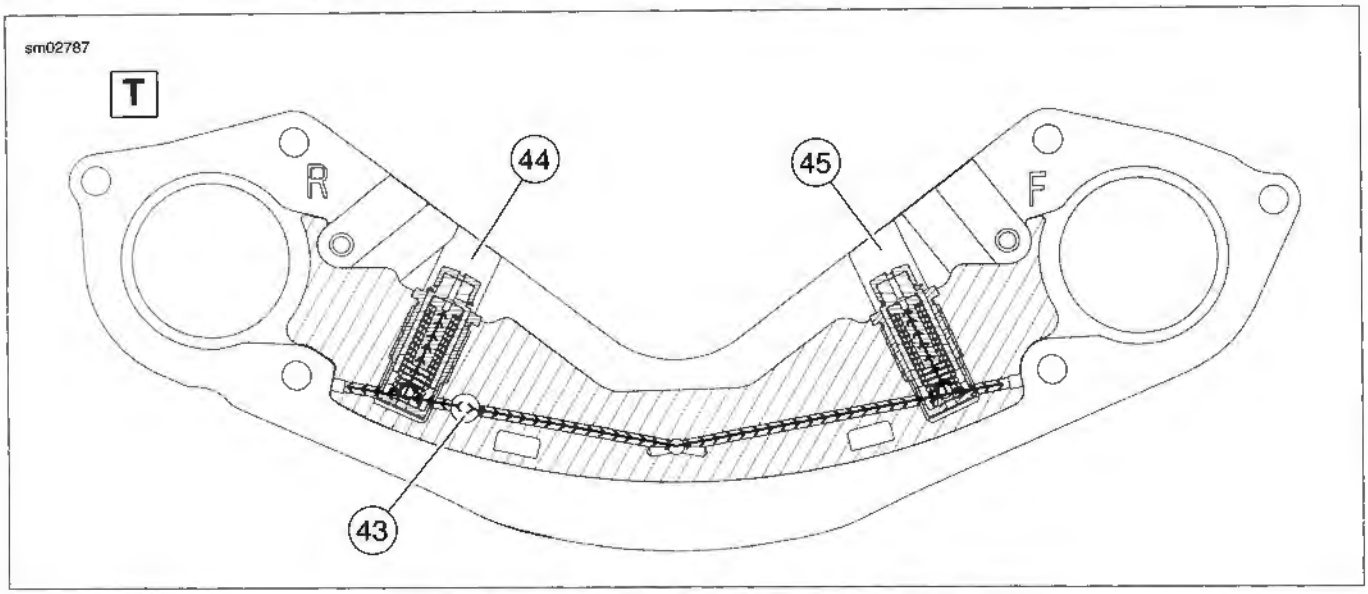


Figure 3-7. Engine Oil Flow: Chain Guide Bracket

OIL RETURN

The "dual kidney" designation given to the oil pump refers to its two scavenging functions, whereby it simultaneously draws oil from both the cam and flywheel compartments.

Oil sucked up by the scavenge lobes passes through the scavenge gerotors of the oil pump and is directed through a return channel (A40) in the cam support plate. See 3.5 OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate, the oil enters a hole in the crankcase flange (B41).

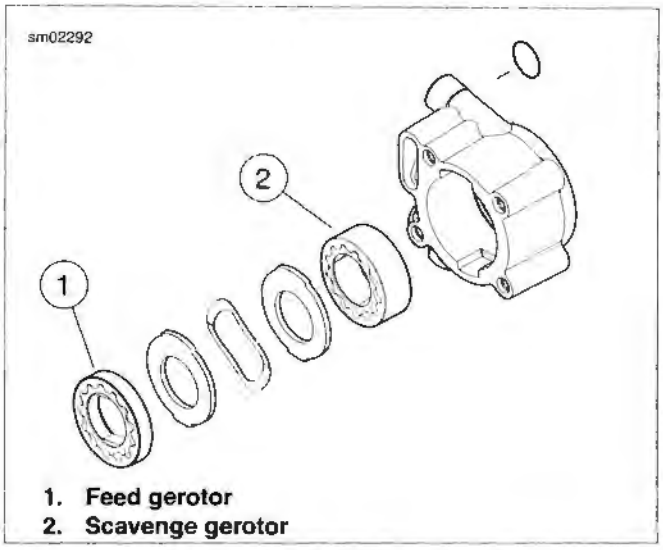
The oil flows through a passageway in the crankcase and exits the upper fitting (3) at the rear right side of the crankcase as shown in Figure 3-1. Passing through a flexible hose, the flow of oil returns to the oil tank.

Also note that a third hose (4) clamped to a fitting behind the rear lifter cover connects the cam compartment with the oil tank via a third drilling in the transmission case. This crankcase breather connection provides the pressure balance necessary for oil circulation.

GENERAL

See Figure 3-8. The oil pump consists of a housing containing two gerotor gear sets, one feed and the other scavenge. Driven by the crankshaft, the feed gerotor set distributes oil to the engine, while the scavenge gerotor set draws oil from the cam and flywheel compartments and returns it to the oil pan.

Each gerotor gear set has two parts, an inner and outer gerotor. The inner and outer gerotors have fixed centers that are slightly offset to one another. Also, the inner gerotor has one less tooth.



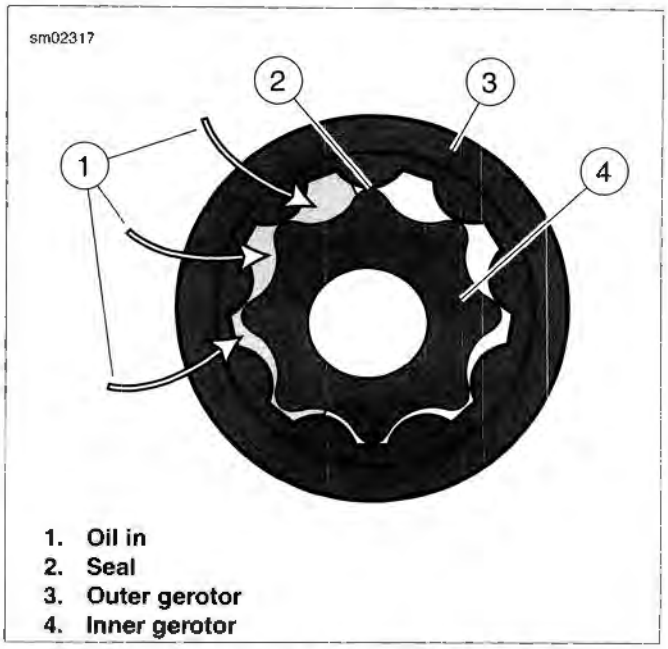
1. Feed gerotor
2. Scavenge gerotor

Figure 3-8. Oil Pump Gerotors

OPERATION

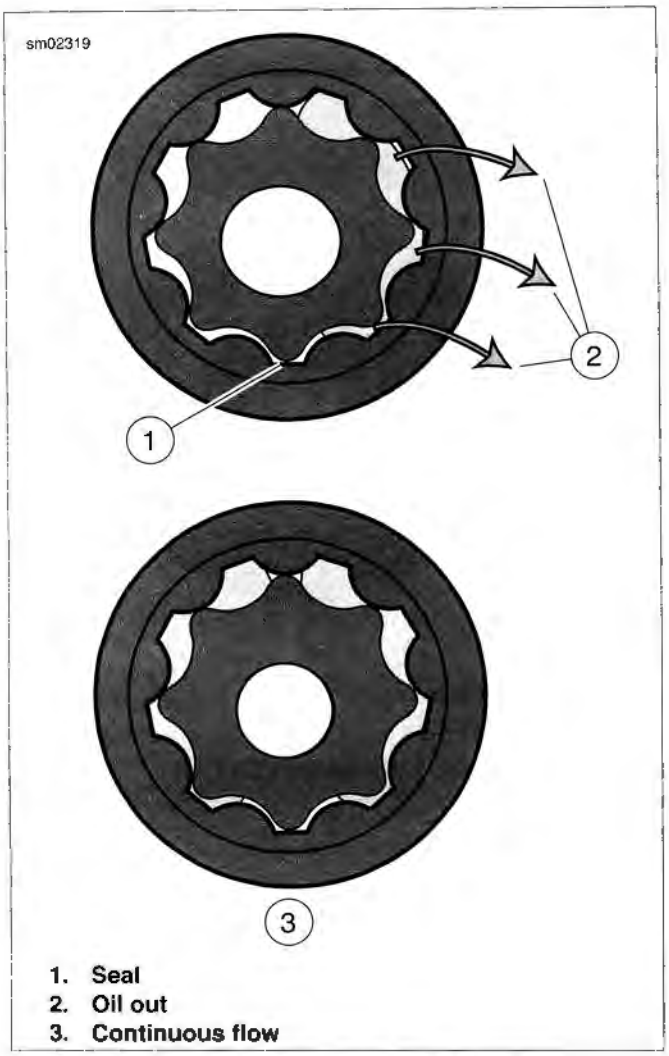
See Figure 3-9. As the crankshaft rotates, the cavity between the inner and outer gerotors on the inlet side of the pump increases in volume. This creates a vacuum causing oil to be drawn in. The cavity continues to increase until the volume is equivalent to that of the missing tooth on the inner gerotor. Note that the inlet and outlet sides of the pump are sealed by the tips and lobes of the inner and outer gerotors.

See Figure 3-10. Continued rotation moves the pocket of oil to the outlet side of the pump. In this area, the cavity decreases in volume as the gerotor teeth mesh causing the oil to be squeezed out the discharge port. As the cavity on the outlet side is emptied, a second seal formed by the tips and lobes of the inner and outer gerotors prevents oil on the outlet side (high pressure) from being transferred to the inlet side (low pressure). In operation, the gerotors provide a continuous flow of oil.



1. Oil in
2. Seal
3. Outer gerotor
4. Inner gerotor

Figure 3-9. Inlet Side Oil Flow



1. Seal
2. Oil out
3. Continuous flow

Figure 3-10. Outlet Side Oil Flow

GENERAL

The crankcase breather system relieves crankcase pressure produced by the downstroke of the pistons and allows crankcase vapors to be directed into the intake air stream to be burned during normal combustion. Through effective recirculation of crankcase vapors, the system serves to eliminate the pollutants normally discharged from the crankcase.

See Figure 3-11. As each piston pushes downward, displaced air in the crankcase is vented through the crankshaft roller bearing into the cam compartment and then up the push rod covers (1) into the rocker housing. The moving air absorbs a small amount if oil vapor as it travels through the engine.

The oil/air vapor rushes under the rocker arm support plate, which is elevated slightly, and passes through an opening at the bottom of the plate to enter the breather baffle compartment (2).

In the baffle compartment, the flow of air passes upward through the oil filter gauze, where the oil is removed from the air. Two pin holes in the rocker arm support plate allow the separated oil to drain back into the crankcase.

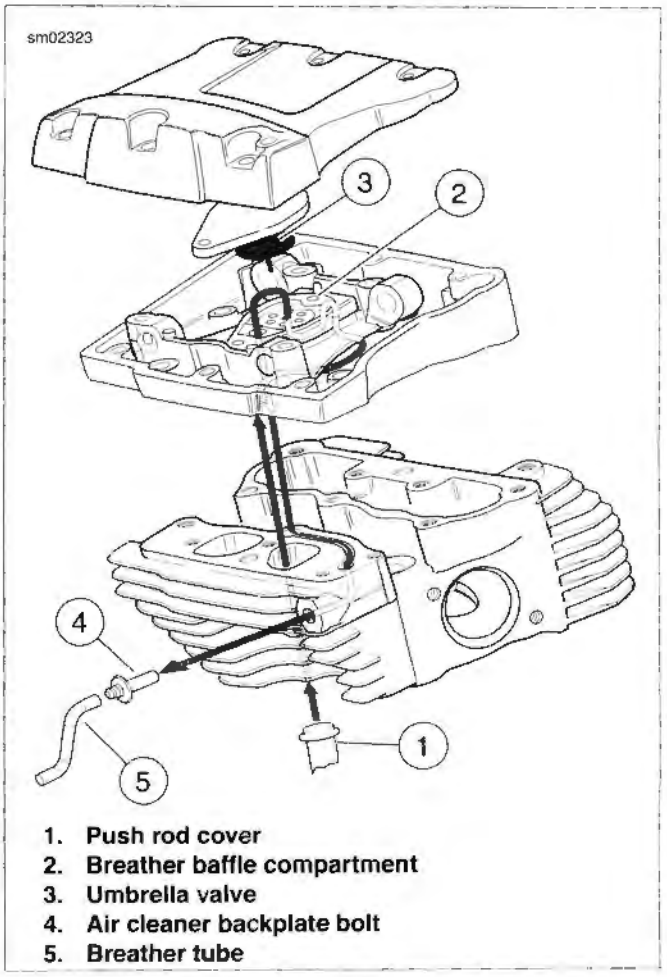
Passing through the oil filter gauze, the vapor passes through the umbrella valve (3) into the breather compartment. The flaps of the umbrella valve only allow air to be vented one way, rising to allow the passage of air, then falling back into place to seal the vent holes as the flow of air stops.

In the breather compartment, the air flows downward through holes aligned in the breather baffle, rocker arm support plate and rocker housing. Exiting the rocker housing, the air enters a passageway cast into the top of the cylinder head. Proper orientation of the rocker housing gasket is critical for effective sealing of this passageway.

Flowing through the cylinder head passageway, the air passes through a drilling in the air cleaner backplate bolt (4) and then through a breather tube (5) into the air filter element where it joins with the intake air stream and is burned during normal combustion.

NOTE

Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.



1. **Push rod cover**
2. **Breather baffle compartment**
3. **Umbrella valve**
4. **Air cleaner backplate bolt**
5. **Breather tube**

Figure 3-11. Breather Air Flow

OIL PRESSURE INDICATOR LAMP

See Figure 3-12. The red OIL PRESSURE indicator lamp illuminates to indicate improper circulation of the engine oil. The lamp illuminates when the ignition is first turned on (before the engine is started), but should be extinguished once the engine is running.

CAUTION

If the oil pressure indicator lamp remains lit, always check the oil supply first. If the oil supply is normal and the lamp is still lit, stop the engine at once and do not ride further until the trouble is located and the necessary repairs are made. Failure to do so may result in engine damage. (00157a)

If the indicator lamp is not extinguished, it may be the result of a low oil level or diluted oil supply. In freezing weather, the oil feed and return lines can clog with ice or sludge. A problem in the lamp wiring, faulty oil pressure sending unit, damaged oil pump, plugged oil filter element, incorrect oil viscosity, broken or weak spring in the oil pressure relief valve and/or damaged or incorrectly installed O-rings in the engine may also cause the indicator lamp to remain on.

To troubleshoot the problem, always check the engine oil level first. If the oil level is OK, determine if oil returns to the oil pan. If oil does not return, shut off the engine until the problem is located and corrected.

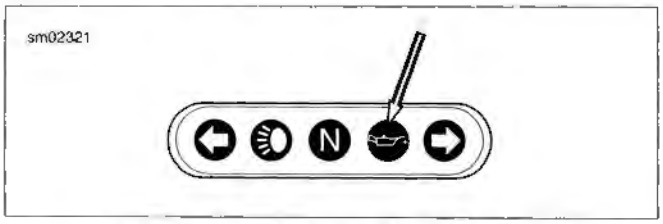


Figure 3-12. Oil Pressure Indicator Lamp

CHECKING OIL PRESSURE

PART NUMBER	TOOL NAME
HD-96921-52D	OIL PRESSURE GAUGE SET

Check operating oil pressure as follows:

1. Ensure engine oil is at the proper level. See 1.6 ENGINE OIL AND FILTER.
2. See Figure 3-13. Remove oil pressure switch from crankcase. See 7.32 OIL PRESSURE SWITCH.
3. See Figure 3-14. Install OIL PRESSURE GAUGE SET (Part No. HD-96921-52D).
   a. Install adapter (2) in oil pressure switch mounting hole. Tighten adapter until snug.
   b. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten until snug.
4. Start engine and allow to reach operating temperature.

NOTE

Engine oil should be at normal operating temperature, 230° F (110° C), for an accurate reading.

5. Oil pressure should be 30-38 PSI (207-262 kPa) at 2000 RPM and normal operating temperature.
6. Stop engine. Remove oil pressure gauge assembly from oil pressure switch mounting hole in crankcase.
7. Install oil pressure switch. See 7.32 OIL PRESSURE SWITCH.

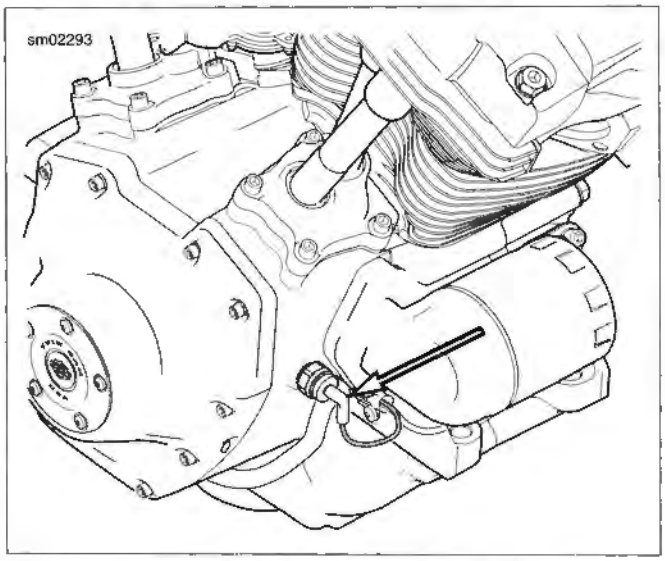
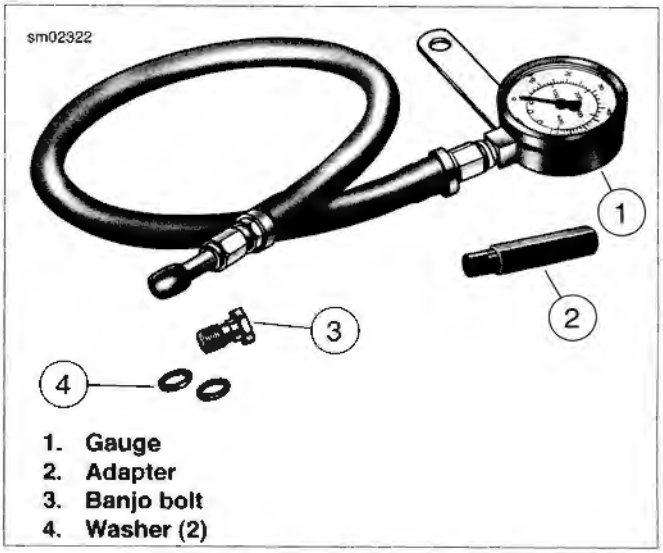


Figure 3-13. Oil Pressure Switch



1. **Gauge**
2. **Adapter**
3. **Banjo bolt**
4. **Washer (2)**

Figure 3-14. Oil Pressure Gauge Set

DIAGNOSING VALVE TRAIN NOISE

To diagnose and correct noisy hydraulic lifters and valve train components, use the following procedures:

1. With engine and oil at normal operating temperature, check oil pressure at 2000 RPM. If oil pressure is above 50 PSI (345 kPa) or below 5 PSI (34 kPa), inspect oil pump, crankcase passages, and oil hoses for restrictions or blockage. Repair or replace parts as necessary.
2. If oil is not reaching the hydraulic lifters, remove and inspect. See 3.22 PUSH RODS, LIFTERS AND COVERS, Lifter Inspection. Clean lifter bore of all foreign material. Replace hydraulic lifter if required.
3. Examine push rod, lifter and lifter block for proper fit and any signs of unusual wear. Replace parts as necessary.
4. Visually inspect camshaft lobes for abnormal wear.
5. Check cam chain tensioning shoe for wear.
6. Remove cylinder head and rocker box assemblies. Check rocker arm end play and check for binding. Inspect valve stems for scuffing and check stem to guide clearance. Check valve seats for signs of looseness or shifting.
7. Grind valves and valve seats. See 3.23 CYLINDER HEAD, Valve and Seat Refacing.

COMPRESSION TEST

PART NUMBER	TOOL NAME
HD-33223-1	CYLINDER COMPRESSION GAUGE

A compression test can help determine the source of cylinder leakage. Use CYLINDER COMPRESSION GAUGE (Part No. HD-33223-1) with a screw-in type adapter.

NOTE

All twin cam engines use a 12 mm adapter with the compression gauge.

1. Operate engine to normal operating temperature.
2. Disconnect spark plug wires, clean around plug base and remove plugs.
3. Remove air cleaner. See 4.5 AIR CLEANER ASSEMBLY.
4. Connect compression tester to front cylinder per manufacturer's instructions.
5. Make sure transmission is in neutral. Hold throttle at WOT position and crank engine continuously through 5 to 7 full compression strokes and note gauge readings at the end of the first and last compression strokes. Record test results.
6. Repeat test on rear cylinder.

NOTE

Verify throttle is closed before assembling air cleaner.

7. Assemble the air cleaner. See 4.5 AIR CLEANER ASSEMBLY.
8. If the final readings are a minimum of 125 psi (862 kPa) and do not indicate more than a 10% variance between cylinders, compression is considered normal. If compression does not meet specifications, refer to Table 3-25 for possible causes.
9. If readings do not meet specifications, inject approximately 1/2 oz. ((15 ml)) engine oil into each cylinder and repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.
10. Install the spark plugs and tighten to 12-18 ft-lbs (16.3-24.4 Nm). Connect spark plug wires.

Table 3-25. Compression Test Results

DIAGNOSIS	TEST RESULTS
Ring trouble	Compression low on first stroke, tends to build up on the following strokes, but does not reach normal. Improves considerably when oil is added to cylinder.
Valve trouble	Compression low on first stroke, does not build up much on following strokes. Does not improve considerably with the addition of oil. Check for correct push rod length.
Head gasket leak	Same reaction as valve trouble.

CYLINDER LEAKDOWN TEST

PART NUMBER	TOOL NAME
HD-35667-A	CYLINDER LEAKDOWN TESTER

NOTE

On vehicles with automatic compression release (ACR), make sure the ACRs are closed for this test. Either perform the test with the ignition/light switch in the off position or with the system relay removed.

The cylinder leakdown test will pinpoint engine problems including leaking valves, worn, damaged or stuck piston rings and blown head gaskets. The cylinder leakage tester applies compressed air to the cylinder at a controlled pressure and volume and measures the percent of leakage from the cylinder.

Use the CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A) and follow the specific instructions supplied with the tester.

The following are some general instructions that apply to Harley-Davidson V-twin engines:

1. Run engine until it reaches normal operating temperature.
2. Stop engine. Clean dirt from around spark plugs and remove the spark plugs.

NOTE

Never use a metal object to hold the throttle plate open. Damage to the throttle plate or throat of the induction module may result.

3. Remove the air cleaner and set the throttle to the wide open position. On models having electronic throttle control, open the throttle plate by hand and insert a wooden or plastic dowel approximately 0.75 in. (19 mm) diameter by

approximately 12 in. (305 mm) long to hold the throttle valve open.

4. The piston in the cylinder being tested must be at top dead center of compression stroke (both valves closed) during the test.

5. To keep the engine from turning over when air pressure is applied to the cylinder, engage transmission in highest gear and lock the rear brake.

NOTE

Before performing the cylinder leakdown test, verify that the tester itself is free from leakage to obtain the most accurate test results. With a soap solution (applied around all tester fittings), connect the cylinder leakdown tester to the compressed air source and look for any bubbles that would indicate leakage from the tester.

6. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent of leakage. Leakage greater than 10% indicates internal engine problems.

7. Listen for air leaks at throttle body intake, exhaust pipe, and head gasket. Air escaping through the throttle body indicates a leaking intake valve. Air escaping through the exhaust pipe indicates a leaking exhaust valve.

NOTE

If air is escaping through valves, verify that piston is still at TDC or check for correct push rod length.

8. Repeat procedure on rear cylinder.

NOTE

After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.

DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION

Perform both a compression test and a cylinder leakage test. See 3.8 TROUBLESHOOTING, Compression Test and 3.8 TROUBLESHOOTING, Cylinder Leakdown Test. If further testing is needed, remove suspect head(s) and inspect for the following:

Check Prior To Cylinder Head Removal

1. Oil level overfull.
2. Oil carryover.
3. Breather hose restricted.
4. Restricted oil filter.

Check After Cylinder Head Removal

1. Oil return passages for clogging.
2. Valve guide seals.
3. Valve guide to valve stem clearance.
4. Gasket surface of both head and cylinder.
5. Cylinder head casting's porosity allowing oil to drain into combustion chamber.
6. O-ring damaged or missing from oil pump/crankcase junction.

TOP END REPAIR

NOTE

During top end disassembly, the engine may be left in the chassis for service.

If servicing only cylinder head components, pistons, cylinders and/or upper rod bushings, two options are available depending upon engine status. See 3.14 REMOVING ENGINE FROM CHASSIS.

- 3.10 TOP END SERVICE, Engine in Chassis.
- 3.10 TOP END SERVICE, Engine Removed from Chassis.

BOTTOM END REPAIR

NOTE

Servicing components in the cam compartment requires only partial disassembly. This can be done with the engine left in the chassis.

After disassembling as far as the cylinder heads you may find that bottom end repair is necessary. Bottom end service may require either partial or complete disassembly of the engine.

- To service the cam compartment, see 3.11 BOTTOM END SERVICE, Engine in Chassis.
- To service components in the flywheel compartment, the engine must be removed and the crankcase halves split. See 3.11 BOTTOM END SERVICE, Engine Removed From Chassis.

TYPICAL SYMPTOMS

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 (see 1.28 TROUBLESHOOTING). But when accompanied by a blue-gray smoke from the exhaust, and when low compression is present, it indicates the rings need replacing. Low compression by itself, however, indicates improperly seated valves, not worn rings.

Certain "knocking" noises may be caused by loose bearings, others by piston slap, a condition where piston or cylinder or both out of tolerance, allowing the piston to slap from front to rear of the cylinder as it moves up and down.

Most frequently, valves, rings, pins, bushings, and bearings need attention at about the same time. If the symptoms can be narrowed down through the process of elimination to indicate that any one of the above components is worn, it is best to give attention to all of the cylinder head and cylinder parts.

NOTE

Some illustrations may depict a simple looking crankcase or cam support plate. Individual features which do not apply to service procedures, such as oil connect lines, are shown for reference only.

ENGINE IN CHASSIS

Table 3-26. Engine In Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.20 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE*.
	PUSH RODS, LIFTERS AND COVERS	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.23 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.24 CYLINDER*.
	PISTON	Inspect and repair. See 3.25 PISTON*.
Assemble top end. See 3.17 TOP END OVERHAUL: ASSEMBLY.		
Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.17 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.		

ENGINE REMOVED FROM CHASSIS

Table 3-27. Engine Removed From Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.		
Disassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.20 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE*.
	PUSH RODS, LIFTERS AND COVERS	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.23 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.24 CYLINDER*.
	PISTON	Inspect and repair. See 3.25 PISTON.
Assemble top end. See 3.17 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.		
Note: * If no other work is to be done, you may advance to 3.17 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.		

ENGINE IN CHASSIS

Table 3-28. Engine In Chassis: Cam Compartment Service

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove parts to gain access to all components above cylinder deck. See 3.12 STRIPPING MOTORCYCLE FOR SERVICE.		
Dissassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.20 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE.
	PUSH RODS, LIFTERS AND COVERS.	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS.
Disassemble bottom end. See 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.26 CAM SUPPORT PLATE AND COVER*.
	OIL PUMP	Inspect and repair. See 3.27 OIL PUMP.
Assemble bottom end. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY.		
Assemble motorcycle. See 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.19 BOTTOM END OVERHAUL: ASSEMBLY when this step is completed during bottom end service.		

Table 3-29. Engine Removed: Flywheel Compartment Service or Complete Engine Overhaul

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove engine from motorcycle. See 3.14 REMOVING ENGINE FROM CHASSIS.		
Dissassemble top end. See 3.16 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.20 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.21 ROCKER ARM SUPPORT PLATE.
	PUSH RODS, LIFTERS AND COVERS.	Inspect and repair. See 3.22 PUSH RODS, LIFTERS AND COVERS.
	CYLINDER HEAD	Inspect and repair. See 3.23 CYLINDER HEAD.
	CYLINDER	Inspect and repair. See 3.24 CYLINDER.
	PISTON	Inspect and repair. See 3.25 PISTON.
Disassemble bottom end. See 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.26 CAM SUPPORT PLATE AND COVER.
	CRANKCASE	Inspect crankcase and repair. See 3.28 CRANKCASE.
		Inspect and repair flywheel/connecting rod assembly. See 3.29 FLYWHEEL AND CONNECTING RODS.
Assemble bottom end. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY.		
Assemble top end. See 3.17 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.15 INSTALLING ENGINE IN CHASSIS.		

PROCEDURE

NOTE

If performing top end service (or both cam compartment and top end), follow all the steps listed. If servicing cam compartment components only, perform steps 1 though 8.

1. Position motorcycle on a suitable lift.
2. Remove seat.

⚠WARNING

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

3. Disconnect negative battery cable.
4. Drain engine oil. See 1.6 ENGINE OIL AND FILTER.
5. Remove right footboard.
6. Remove exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
7. Remove air cleaner cover and backplate. See 4.5 AIR CLEANER ASSEMBLY.

⚠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)

8. Drain and remove fuel tank. See 4.6 FUEL TANK.
9. Loosen and remove throttle control cables from induction module.
10. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
11. Remove bolts from top engine mount and frame. Remove top engine mount and horn bracket as an assembly.
12. Remove induction module connectors and induction module. See 4.10 INDUCTION MODULE.

PROCEDURE

NOTE

If top end service was performed (or both cam compartment and top end), follow all the steps listed. If only cam compartment components were serviced, start with step 5.

1. Install induction module. See 4.10 INDUCTION MODULE. Install induction module connectors.
2. Install horn bracket assembly to frame tab and cylinder heads.
   a. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
   b. Tighten the upper engine to frame mounting bolt to 45-50 ft-lbs (61.0-67.8 Nm).
3. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.18 SPARK PLUGS.
4. Install throttle cables to induction module.
5. Install fuel tank, fuel gauge connector, fuel tank crossover tube and instrument console. See 4.6 FUEL TANK.
6. Fill fuel tank with fuel.
7. Install backplate and air cleaner cover. See 4.5 AIR CLEANER ASSEMBLY.
8. Install heat shields and exhaust. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
9. Install right floorboard.
10. Fill engine oil to proper level. See 1.6 ENGINE OIL AND FILTER.
11. Connect negative battery cable.

⚠WARNING

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

12. Install seat.
13. Remove motorcycle from lift.

PROCEDURE

1. Position motorcycle on a suitable lift.
2. Remove seat.

⚠WARNING

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

3. Disconnect both battery cables, negative cable first. Remove battery.
4. Disconnect rear oxygen sensor connector underneath oil tank.
5. Drain primary chaincase and oil tank. See 1.6 ENGINE OIL AND FILTER and 1.9 PRIMARY CHAINCASE LUBRICANT.

⚠WARNING

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

6. Drain fuel tank. Remove instrument panel and fuel tank. See 4.6 FUEL TANK.
7. Remove left and right footboards.
8. Remove front electrical caddy See 7.7 FRONT ELECTRICAL CADDY.
9. Remove exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
10. Remove belt guard.
11. Loosen rear axle. Loosen belt adjusters. Remove drive belt from rear pulley. move rear wheel back to provide access to electrical panel.
12. Remove the two bolts at the top of the electrical panel. Remove bolt from bottom of electrical panel. Remove electrical panel.
13. Remove oil tank. See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC.
14. Remove starter. See 7.13 STARTER.
15. Unplug the vehicle speed sensor (VSS).
16. Remove primary chaincase cover and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
17. Remove upper and lower fasteners from seat post. Disconnect coil connector and remove the post with the coil attached.
18. Position a jack with a wooden block under the engine. Remove the shift arm.
19. Remove the bracket (right side) connecting the frame to the transmission case.
20. Remove the four fasteners connecting the engine to the transmission.
21. Note routing of clutch cable before removing. Disconnect clutch cable from clutch lever. Unclip cable at left side frame downtube and pull cable through chassis to right side of motorcycle. Leave cable installed on transmission.
22. On California models, remove the three hoses from the evaporative emissions canister.
23. Remove the pivot shaft. Disconnect neutral switch wires and slide the transmission back and then out the right side.
24. Remove bolts from horn bracket and cylinder heads. Remove bracket as an assembly. Disconnect horn wire.
25. Remove induction module connectors. Remove air cleaner cover and backplate. See 4.5 AIR CLEANER ASSEMBLY. Disconnect throttle cables.
26. Detach oil pressure sending unit connector.
27. Remove two bolts on front engine mount. Lift engine out from right side of frame.

PROCEDURE

1. Using a suitable hoist, position engine in chassis from the right side.
2. Loosely install the front two mounting bolts and spacers from the right side. The shorter top bolt has a spacer installed on the right side between the frame and the engine. The longer lower bolt has a spacer on both sides. Loosely install corresponding washers and nuts.
3. Attach induction module connectors and horn wire. Install top engine mount using bolt, lockwasher and flat washer. Loosely tighten all bolts connecting engine to mount.

NOTE

*Use **new** transmission mounting bolts when installing transmission case. Do not reuse old bolts.*

4. See Figure 3-15. Install transmission case from the right side. Align all four transmission mounting holes verifying that the two lower locating dowels engage their holes in crankcase. Tighten the four transmission mounting bolts in a crisscross pattern as follows.
   a. Tighten finger tight.
   b. Tighten to 15 ft-lbs (20.3 Nm).
   c. Tighten to 34-39 ft-lbs (46.1-52.9 Nm).
5. Apply LOCTITE ANTI-SEIZE to pivot shaft. From the right side, install pivot shaft and spacers with spacer collars facing transmission case.
6. Apply LOCTITE THREADLOCKER 262 (red) to threads of pivot shaft nut. Install and tighten pivot shaft nut to 90-110 ft-lbs (122-149.1 Nm).
7. Apply LOCTITE THREADLOCKER 262 (red) to both front mounting bolts. Tighten bolts to 70-80 ft-lbs (94.9-108.5 Nm).
8. Install lower bracket (right side). Apply LOCTITE THREADLOCKER 262 (red). Tighten bracket bolts to 30-35 ft-lbs (40.7-47.5 Nm).
9. Final tighten upper engine mount hardware.
   a. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
   b. Tighten the upper engine to frame mounting bolt to 45-50 ft-lbs (61.0-67.8 Nm).
10. Attach throttle cables. Adjust throttle cables. Connect fuel hose to fuel tank.
11. Install air cleaner backplate and cover. See 4.5 AIR CLEANER ASSEMBLY.
12. Install front electrical caddy See 7.7 FRONT ELECTRICAL CADDY.
13. Move the panel into position and tighten the two upper bolts. Verify that all wiring is in place and not twisted or kinked.

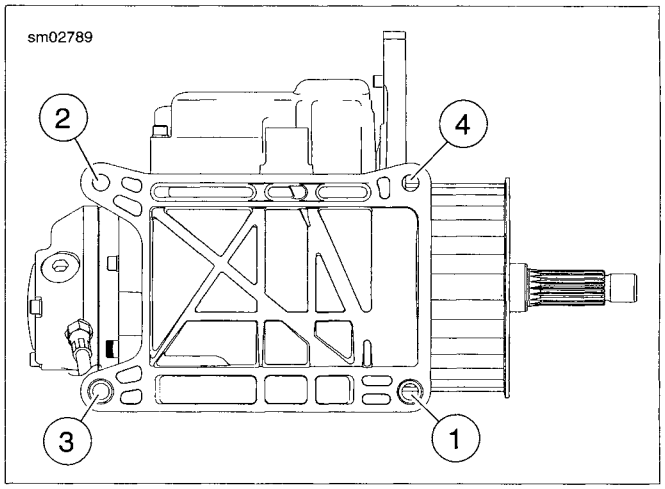


Figure 3-15. Transmission Case Hardware

14. Attach vapor valve bracket to rear of transmission case. On California models, see 4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS) to route evaporative emission hoses.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket could cause primary chaincase leaks.

15. Install primary chaincase. Attach the clutch cable, adjust the clutch and fill with lubricant. Start with 5.5 PRIMARY CHAINCASE HOUSING and follow all necessary steps.
16. Install the left floorboard.
17. Install the seat post. Connect the coil connector and the neutral switch wires.
18. Connect vehicle speed sensor to transmission.
19. Install starter. See 7.13 STARTER.
20. Install oil tank and connect all oil lines. See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC.
21. Install belt guard.
22. Tighten axle nut.
23. Install heat shields, exhaust and right floorboard. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
24. Install instrument console, fuel tank, fuel gauge connector, and fuel tank crossover tube. See 4.6 FUEL TANK.

⚠WARNING

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

25. Install battery and connect battery cables, positive cable first.

⚠WARNING

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

26. Install seat.
27. Install **new** oil filter and fill oil tank to proper level. See 1.6 ENGINE OIL AND FILTER.
28. Remove motorcycle from lift.
29. Verify vehicle alignment. See 2.11 VEHICLE ALIGNMENT.
30. Check drive belt deflection and alignment. See 1.12 DRIVE BELT AND SPROCKETS.
31. Check rear brakes, clutch and throttle for proper operation.
32. Check oil level after running motorcycle on side stand. See 1.6 ENGINE OIL AND FILTER.

GENERAL

It is assumed that each step performed on one cylinder is automatically repeated on the other.

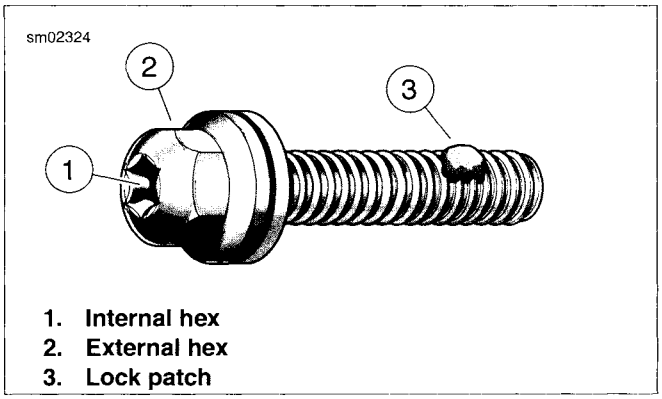
To perform a complete top end overhaul, follow all steps listed in this section including inspection and repair procedures.

ROCKER COVERS

NOTE

Dirt caked on cooling fins and other areas can fall into crankcase bore or stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways. Remove all dirt and particles before disassembly to prevent component damage.

1. Use low pressure spray to thoroughly clean exterior surfaces of engine prior to disassembly.
2. See Figure 3-17. Following the sequence shown, alternately loosen the six rocker cover bolts. Remove the rocker cover bolts and their captive washers.
3. Remove the rocker cover and gasket. Discard gasket.



1. **Internal hex**
2. **External hex**
3. **Lock patch**

Figure 3-16. Rocker Cover Bolt (Rocker Housing Bolt Similar)

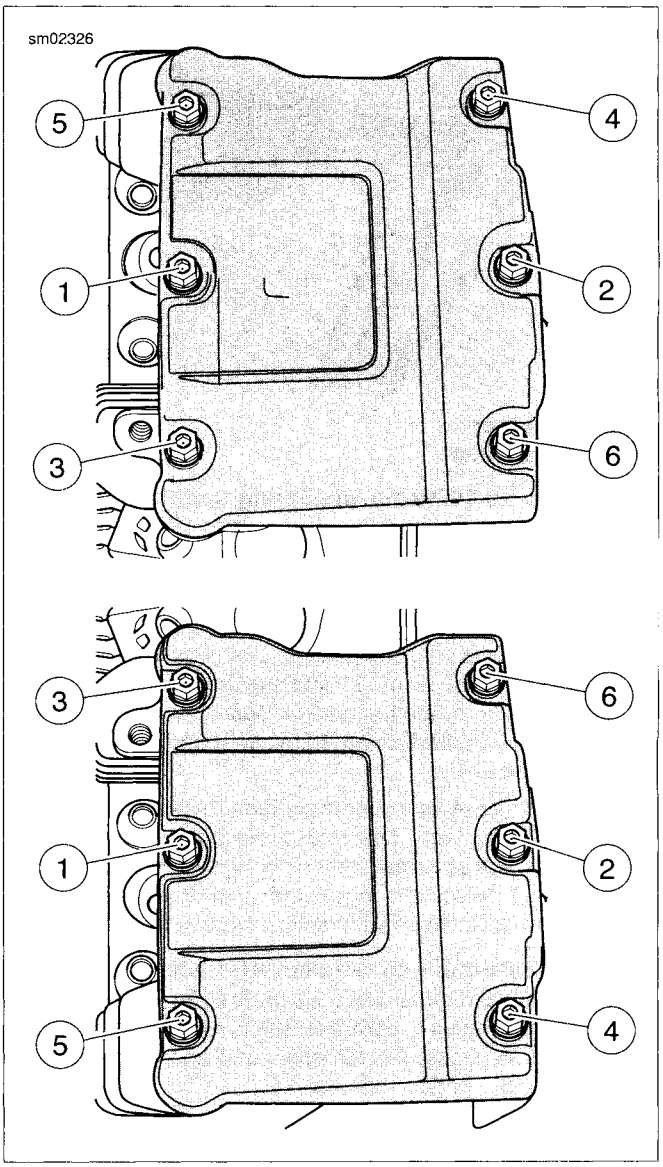
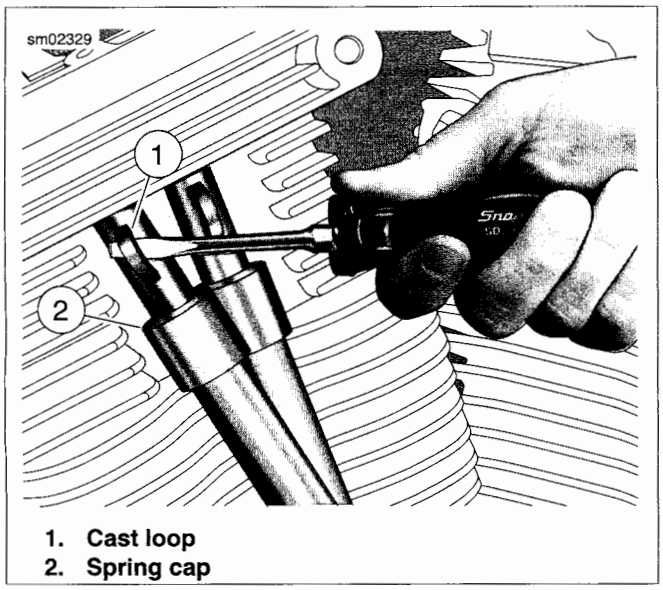


Figure 3-17. Rocker Cover Bolt Removal Sequence

ROCKER ARM SUPPORT PLATE

PART NUMBER	TOOL NAME
HD-48283	CRANKSHAFT ROTATING WRENCH

1. See Figure 3-18. Insert the blade of a small screwdriver into cast loop (1) of spring cap retainer (at top of upper push rod cover). While pushing down on spring cap (2), rotate bottom of screwdriver toward outboard side to remove. Repeat step on second push rod cover.



1. **Cast loop**
2. **Spring cap**

Figure 3-18. Removing Spring Cap Retainer

2. Collapse upper and lower push rod covers.
3. To remove the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (lowest position) of the cam. To find the base circle, it is first necessary to rotate the engine. Based on the level of disassembly required, three methods of engine rotation are presented below.
   a. **With primary cover installed -** Remove spark plugs. With the rear wheel raised, place the transmission in 6th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. Continue with next numbered step.
   b. **With primary cover removed -** Remove spark plugs. Place the transmission in neutral. Fit a socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. Continue with step 4.

   NOTE

   Do not attempt to rotate engine by removing cam cover and placing socket on crank or primary cam sprocket flange bolt. Head of flange bolt can break off possibly resulting in damage to flywheel or camshaft.

   c. See Figure 3-19. **With engine mounted in engine stand -** Install CRANKSHAFT ROTATING WRENCH (Part No. HD-48283) on sprocket shaft and rotate in a counterclockwise direction until the base circle is found.

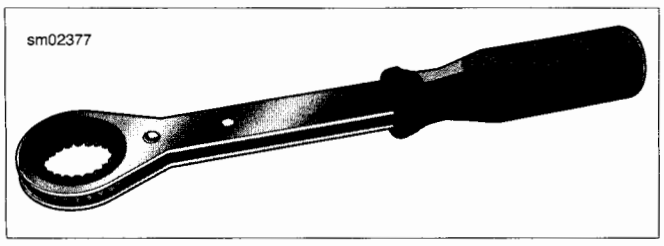


Figure 3-19. Crankshaft Rotating Wrench

4. Using one of the methods above, rotate engine until piston is at top dead center (TDC) of compression stroke.
   a. To accomplish this, first raise lower push rod cover to access intake lifter (inside hole of lifter cover).
   b. Place index finger on top of the intake lifter. While rotating engine, feel lifter rise (valve open) and fall (valve closed).
   c. Now place finger tightly over spark plug hole and rotate engine again. In the compression stroke, air will be forced out against your finger until the piston reaches the TDC position. Stop engine rotation when the flow of air through the spark plug hole stops.
   d. Direct the beam of a small flashlight into spark plug hole to verify piston is at TDC. Both intake and exhaust valves are now closed and the push rods are in the unloaded (loose) position.
5. See Figure 3-20. Remove two bolts to release breather assembly (arrow) and filter element from the rocker arm support plate. For inspection and repair information, see 3.20 BREATHER ASSEMBLY.
6. Alternately loosen each of the four rocker arm support plate bolts 1/4 turn in the pattern shown the figure. Continue turning the bolts in these increments until loose. Remove the rocker arm support plate bolts with flat washers.
7. Remove the rocker arm support plate assembly from the rocker housing. For inspection and repair information, see 3.21 ROCKER ARM SUPPORT PLATE.

NOTE

Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

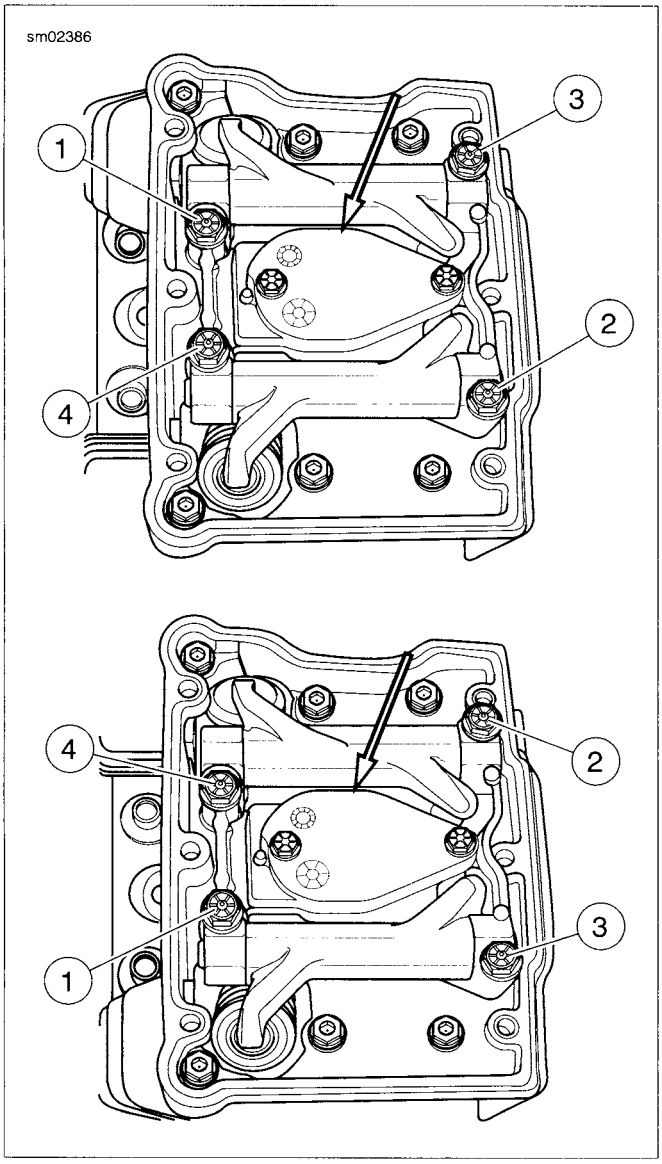
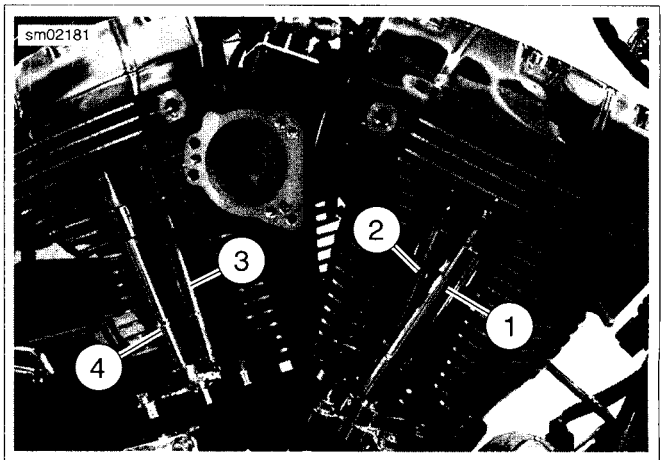


Figure 3-20. 1/4 Turn Rocker Arm Bolts in Sequence

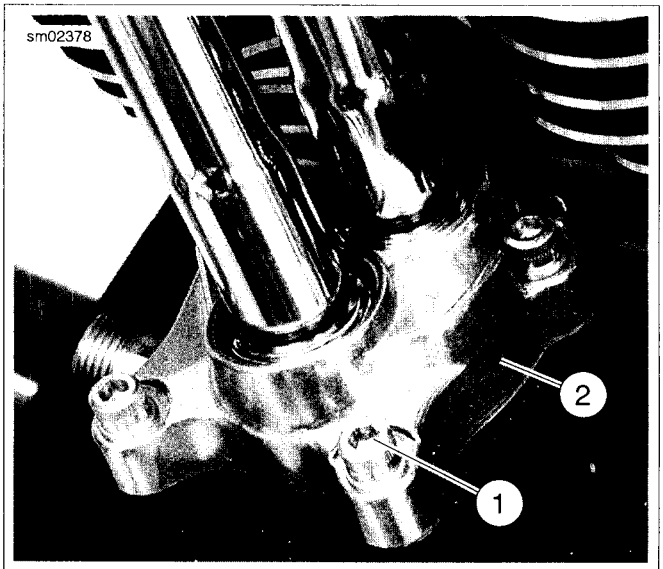
PUSH RODS, LIFTERS AND COVERS

1. See Figure 3-21. Remove the intake and exhaust push rods and push rod covers.
   a. Tag the push rods for location (front/rear cylinder), and orientation (top/bottom) as they are removed. This will simplify installation.
   b. Remove push rod covers from cylinder head and lifter cover bores.
   c. Remove three O-rings from push rod covers and discard. If O-ring is missing from upper push rod cover, be sure to dislodge it from the cylinder head bore.
2. See Figure 3-22. Remove lifter covers.
   a. Using a crosswise pattern, remove four screws with captive washers (1) to release the lifter cover (2).
   b. Remove the lifter cover and gasket. Discard gasket.
3. Remove lifters.
   a. Remove the anti-rotational pin to free the hydraulic lifters.
   b. Tag the lifters for location (front/rear cylinder) and function (intake/exhaust) as they are removed. This will simplify installation.
   c. Place the lifters in clean plastic bags to keep out dust, dirt and debris.
4. See Figure 3-23. Remove and discard O-ring from groove around breather baffle hole in rocker housing.
5. For inspection and repair information, see 3.22 PUSH RODS, LIFTERS AND COVERS.



1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

Figure 3-21. Push Rod Locations



1. **Screw with captive washer (4)**
2. **Lifter cover**

Figure 3-22. Lifter Cover

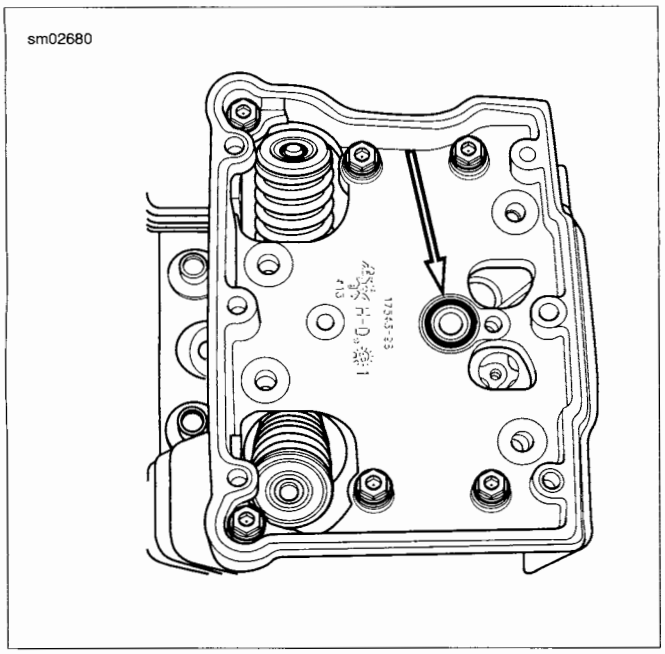


Figure 3-23. Breather Baffle Hole O-Ring

CYLINDER HEAD

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

1. See Figure 3-24. Following the sequence shown, alternately loosen the six rocker housing bolts. Remove rocker housing bolts and their captive washers.
2. Remove rocker housing and gasket. Discard gasket.

NOTE

To prevent distortion of the cylinder head, cylinder and cylinder studs, gradually loosen the cylinder head bolts in the specified sequence.

3. See Figure 3-25. Remove cylinder head bolts.
   a. Following the sequence shown, alternately loosen each of the four cylinder head bolts just 1/4 turn.
   b. Continue turning the bolts in these increments until loose.
   c. Remove the cylinder head bolts.
4. Remove cylinder head and head gasket.

NOTE

Save the cylinder head gasket (if salvageable) for use with the CYLINDER TORQUE PLATES (Part No. HD-42324-A) when measuring, boring or honing of the cylinder is required.

5. For inspection and repair information, see 3.23 CYLINDER HEAD.

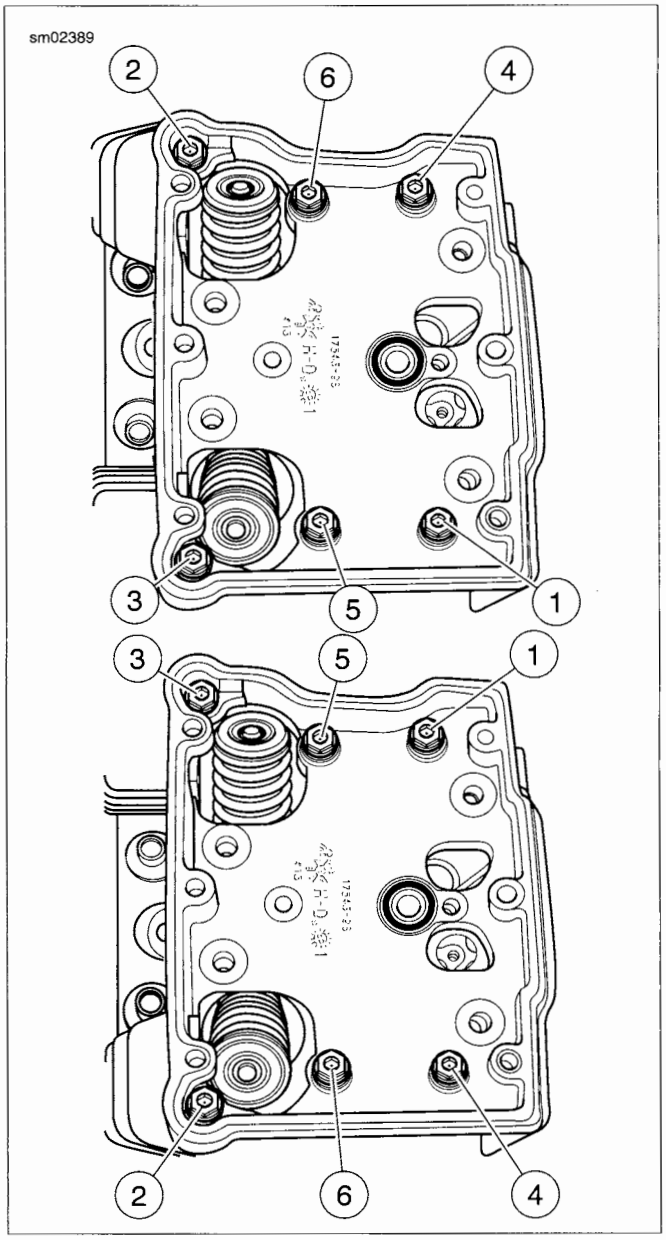


Figure 3-24. Rocker Housing Bolts Removal Sequence

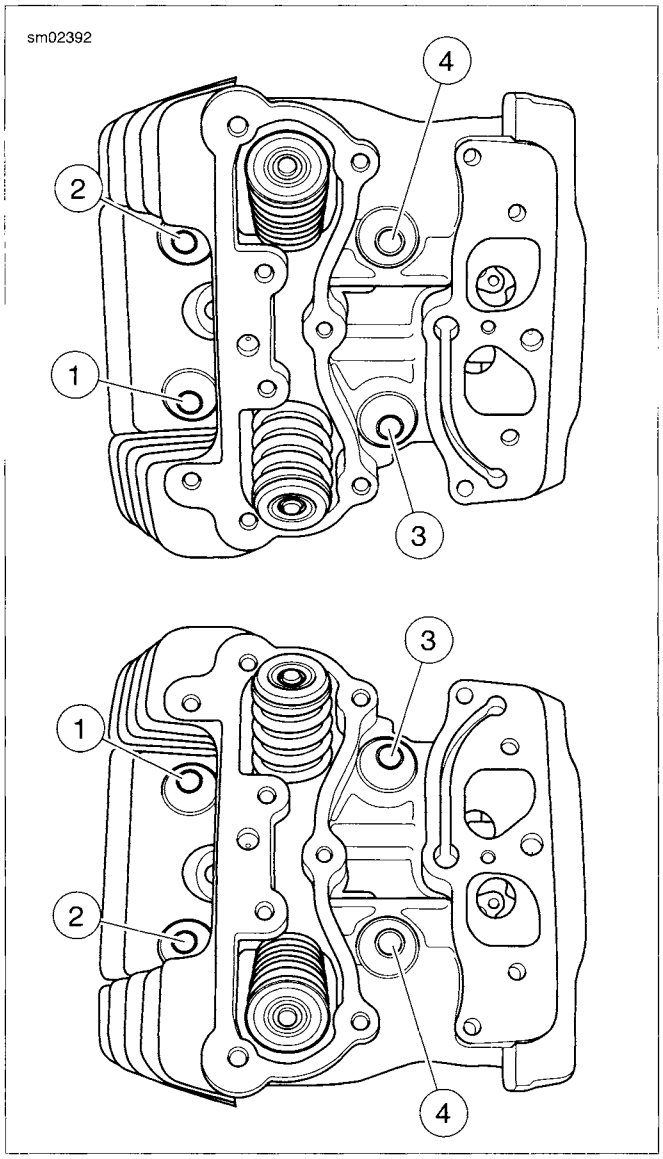


Figure 3-25. 1/4 Turn Head Bolts in Sequence

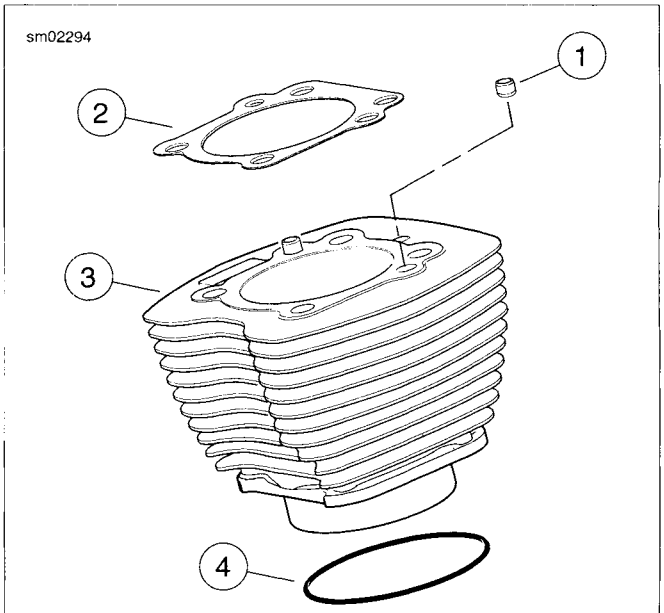
CYLINDER

1. Raise the cylinder just enough to place clean shop towels under the piston. This will prevent any dirt or debris, such as broken ring pieces, from falling into the crankcase bore.

NOTE

Exercise caution to avoid bending the cylinder studs. Even a slight bend or nick can cause a stress riser leading to stud failure.

2. Carefully remove the cylinder. Exercise caution to avoid bending the cylinder studs. As the piston becomes free of the cylinder, hold it upright to prevent it from striking the studs or dragging across the stud thread area.
3. Mark cylinder FRONT or REAR as appropriate.
4. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
5. See Figure 3-26. Remove O-ring seal (4) from the bottom of the cylinder liner. Discard O-ring seal.
6. See Figure 3-27. Remove O-ring from dowel pin (4) on base of cylinder deck. Discard O-ring.
7. For inspection and repair information, see 3.24 CYLINDER.



1. **Dowel pin**
2. **Head gasket**
3. **Cylinder**
4. **O-ring seal**

Figure 3-26. Cylinder Assembly

PISTON

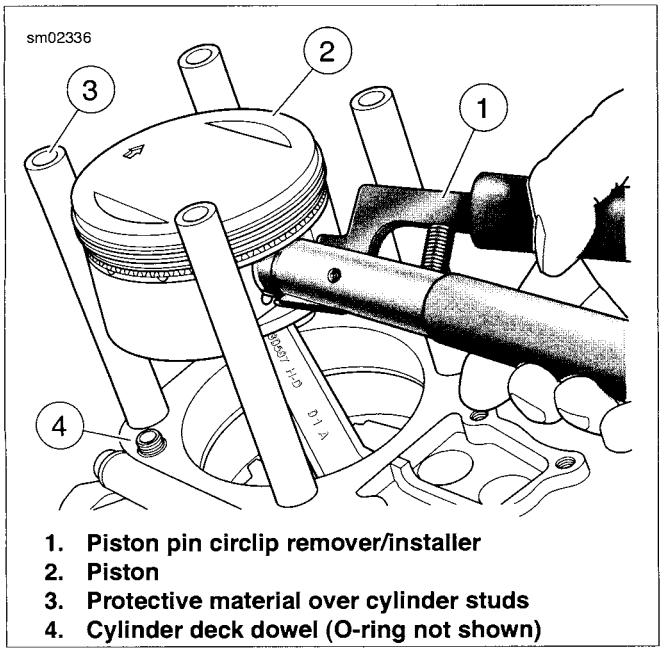
PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER
HD-42320-B	PISTON PIN REMOVER

1. Verify that clean shop towels are properly positioned over the crankcase bore to prevent the piston pin circlip from falling into the crankcase.

⚠WARNING

Wear safety glasses or goggles when removing or installing piston pin retaining rings. Piston pin retaining rings are compressed in the ring groove and can fly out when removed from the groove, which could result in serious eye injury. (00293a)

2. See Figure 3-27. Remove the piston pin circlip.
   a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A) (1) into the piston pin bore. Position claw on tool in slot of piston (2) (directly under circlip).
   b. Hold a shop towel over the piston pin bore in case a circlip should fly out during removal. Squeeze the handles of the tool together and pull from bore. Remove circlip from claw and discard.



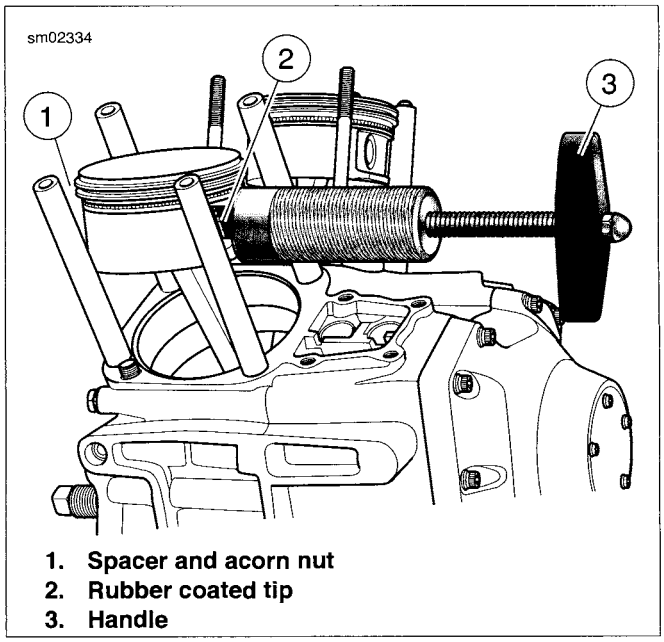
1. **Piston pin circlip remover/installer**
2. **Piston**
3. **Protective material over cylinder studs**
4. **Cylinder deck dowel (O-ring not shown)**

Figure 3-27. Piston Pin Circlip Removal (Part No. HD-42317)

NOTE

It is not necessary to remove both piston pin circlips during piston removal. Leave the second circlip in the pin bore.

3. See Figure 3-28. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-B).
   a. Remove acorn nut and spacer from rod end of tool.
   b. Slide rod end through piston pin. Install spacer and acorn nut (1) on end of rod.
   c. Position rubber-coated tips (2) of tool on flat each side of pin bore.
   d. Turn handle (3) in a clockwise direction until piston pin is pulled free of bore.
4. Remove the piston. Be sure to hold the connecting rod shank upright to prevent it from striking the crankcase. Place a 3.0 in. (76.2 mm) long piece of foam-type water pipe insulation around each connecting rod. Use material with an O.D. of 2.25 in. (57.1 mm) and an I.D. of 1.0 in. (25.4 mm) to prevent damage.
5. Turn the piston over. Mark the pin boss with the letters F(ront) or R(ear) to identify location.
6. Service as needed. For inspection and repair information, see 3.25 PISTON.
7. Complete engine work.
   a. If performing a top end overhaul only, see 3.17 TOP END OVERHAUL: ASSEMBLY.
   b. If performing a complete engine overhaul, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.



1. **Spacer and acorn nut**
2. **Rubber coated tip**
3. **Handle**

Figure 3-28. Piston Pin Remover (Part No. HD-42320-B)

GENERAL

NOTES

- *It is assumed that each step performed on one cylinder is automatically repeated on the other.*
- *Do not use 2006 and earlier connecting rods with 2007 and later pistons. 2007 and later pistons have a tapered wrist pin boss. The wrist pin portion of the 2007 and later connecting rod is tapered to match the boss on the piston.*

This section provides a sequential process for engine reassembly after a complete 3.16 TOP END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Piston installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Piston.
- Cylinder installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder.
- Cylinder head installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head.
- Push rods, lifters and covers installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers.
- Rocker arm support plate installation-see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.
- Breather assembly installation-see 3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

PISTON

PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER

1. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
2. Apply clean H-D 20W50 engine oil to piston pin, piston bosses and upper connecting rod bushing.
3. Remove water pipe insulation from connecting rod shank.
4. See Figure 3-29. Place piston over rod end so that the arrow stamped at the top of the piston points toward the front of the engine.
5. See Figure 3-30. Insert piston pin (1) through pin bore and upper connecting rod bushing. Push pin until it contacts circlip installed in opposite pin boss. Verify that end gap (3) for circlip is 180 degrees from opening (2).
6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin circlip from falling into the crankcase. Verify that the circlip groove is clean and free of dirt and grime.

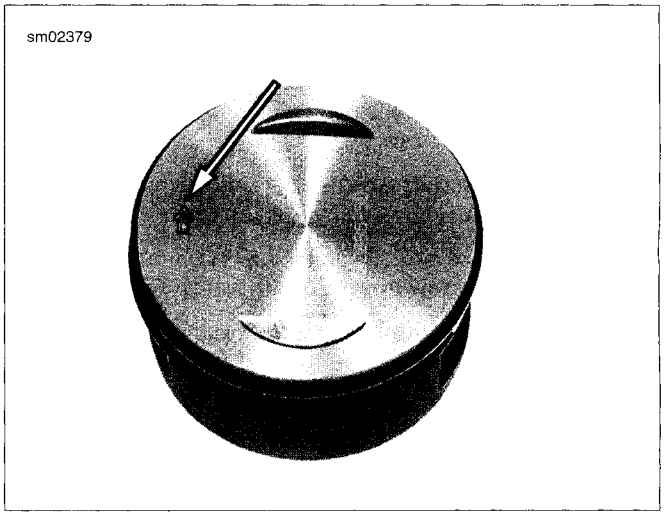
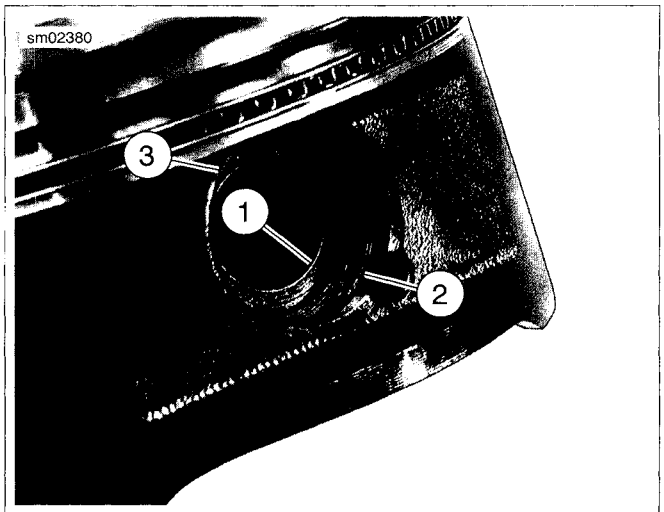


Figure 3-29. Piston Installation Arrow



1. **Piston pin**
2. **Circlip opening**
3. **End gap location**

Figure 3-30. Preinstalled Circlip

NOTE

Do not reuse piston pin circlips. The circlips could weaken during removal causing them to break or dislodge during engine operation, a condition that will result in engine damage.

7. Install **new** piston pin circlip with the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A).
   a. See Figure 3-31. Slide circlip down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture circlip in claw.
   b. Releasing pressure on handles, rotate circlip so that the end gap is centered at top of tool and then recapture in claw.
   c. Tilt the circlip forward until the end gap contacts nose of tool.
   d. See Figure 3-32. Insert the tool (1) into the piston pin bore until claw is aligned with slot (2) in piston.
   e. Firmly push the tool into the piston pin bore until it bottoms. Release handles and remove tool.
   f. Inspect the circlip to verify that it is fully seated in the groove.

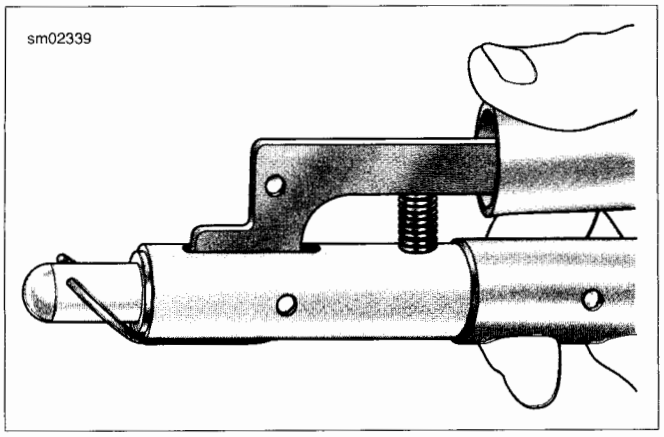
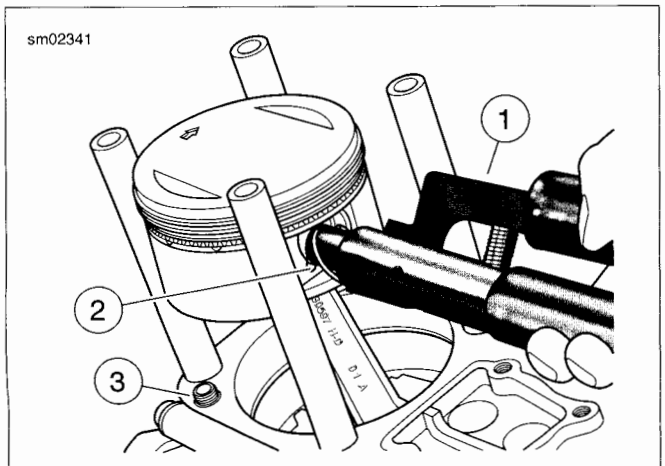


Figure 3-31. Aligning Circlip



1. **Piston pin circlip remover/installer**
2. **Slot**
3. **Cylinder deck dowel (O-ring not shown)**

Figure 3-32. Pin Circlip Remover/Installer (Part No. HD-42317)

CYLINDER

PART NUMBER	TOOL NAME
HD-42322	PISTON SUPPORT PLATE
HD-95952-1	THREADED CYLINDERS
HD-95952-33C	CONNECTING ROD CLAMPING TOOL
HD-96333-51F	PISTON RING COMPRESSOR

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use **new** O-rings, keeping them packaged until use to avoid confusion.*

1. See Figure 3-32. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-rings for both lower cylinder deck dowels. Install and verify that O-ring is properly seated in groove.
2. See Figure 3-33. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring seal for the bottom of the cylinder liner. Install **new** O-ring seal.

NOTE

Excessive lubrication of cylinder sleeve O-ring seal will result in oil weepage between cylinder and crankcase as engine is run. This condition may be incorrectly diagnosed as an oil leak.

3. See Figure 3-34. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.
4. Apply clean H-D 20W50 engine oil to piston, piston rings and cylinder bore.
5. Remove protective covers from cylinder studs. Rotate engine until piston is at top dead center. If necessary, see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate for three methods of engine rotation.
6. See Figure 3-35. Install the PISTON SUPPORT PLATE (Part No. HD-42322).
   a. Slide both adjustable knobs (2) on support plate (1) down away from forked end. Tighten knobs when contact is made with flats at end of slots.
   b. With the forked end of the tool pointing towards the center of the engine and the adjustable knobs facing downward, capture shank of connecting rod in fork. Lay tool on cylinder deck so that adjustable knobs contact wall of cylinder bore.
   c. Rotate engine until piston skirt is centered and firmly seated on top of support plate.

7. See Figure 3-36. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96333-51F).
   a. Fit tabs on pliers (1) into slots of ring compressor band (2). The arrow stamped on the band indicates the side that faces up, so disregard the word "bottom". Place band around piston. Press the lever on the right side of the pliers to open the jaws for band expansion.
   b. Orient tool so that the top of the band is positioned between the top compression ring and the piston crown. Tightly squeeze handles of tool to compress piston rings. The ratcheting action of the tool allows release of the handles after the rings are compressed.
   c. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder over the cylinder studs and the piston crown resting it on the top of the ring compressor band.
   d. Place the palms of both hands at the top of the cylinder. Push down on the cylinder with a sharp, quick motion to pass the piston ring area.
   e. Rotate the engine slightly to raise piston off support plate. Remove pliers from band and then remove band from around shank of connecting rod. Remove piston support plate.
8. Remove shop towels from around the crankcase bore exercising caution to keep out any dirt or debris.
9. Carefully set the cylinder over the two dowel pins in the cylinder deck. Push down on the cylinder until it is fully seated in the crankcase bore.

NOTE

See Figure 3-37. To hold the first cylinder in position while installing the second, install THREADED CYLINDERS (Part No. HD-95952-1) from CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C) onto cylinder studs with the knurled side down. This will prevent the piston rings from raising the cylinder as the engine is rotated to bring the other piston into position for installation of the second cylinder.

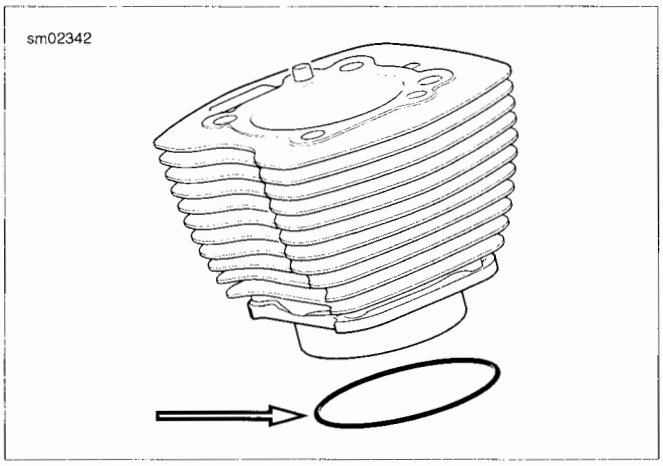
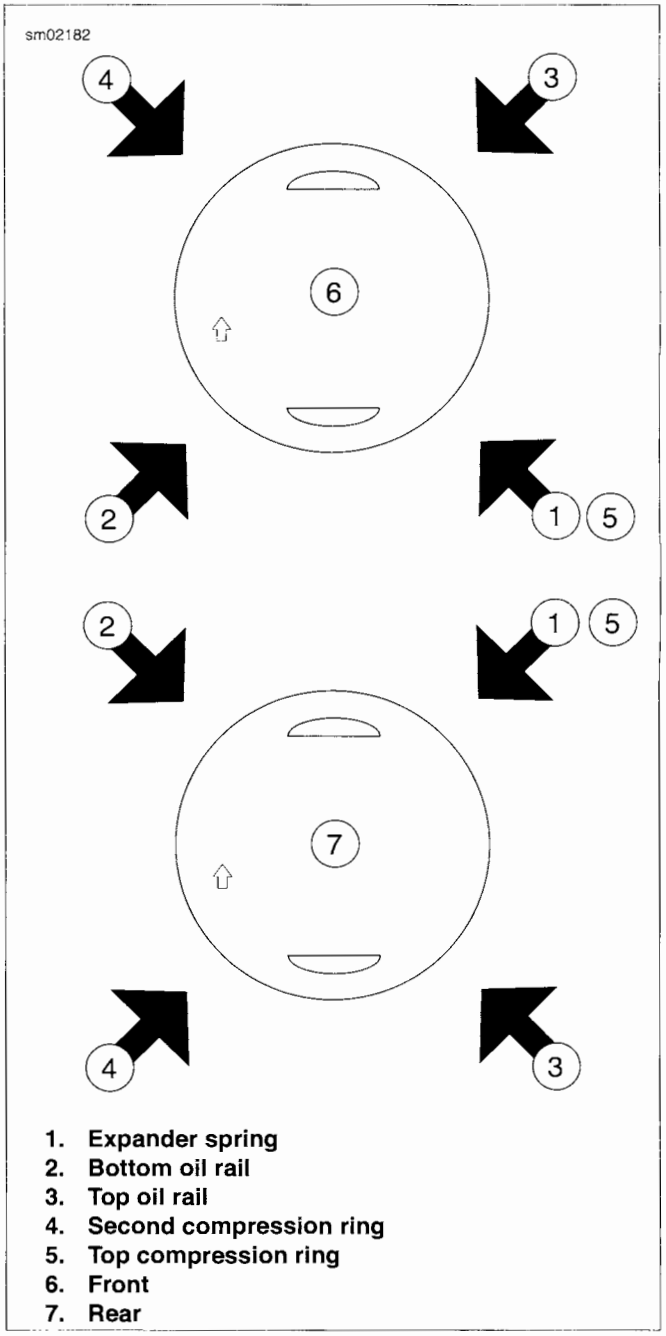
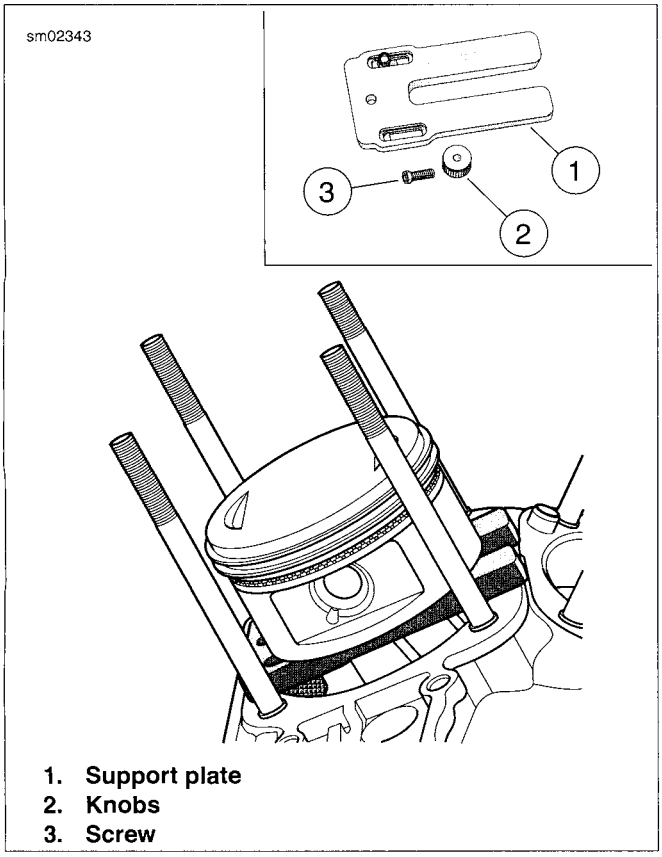


Figure 3-33. O-ring Seal For Cylinder



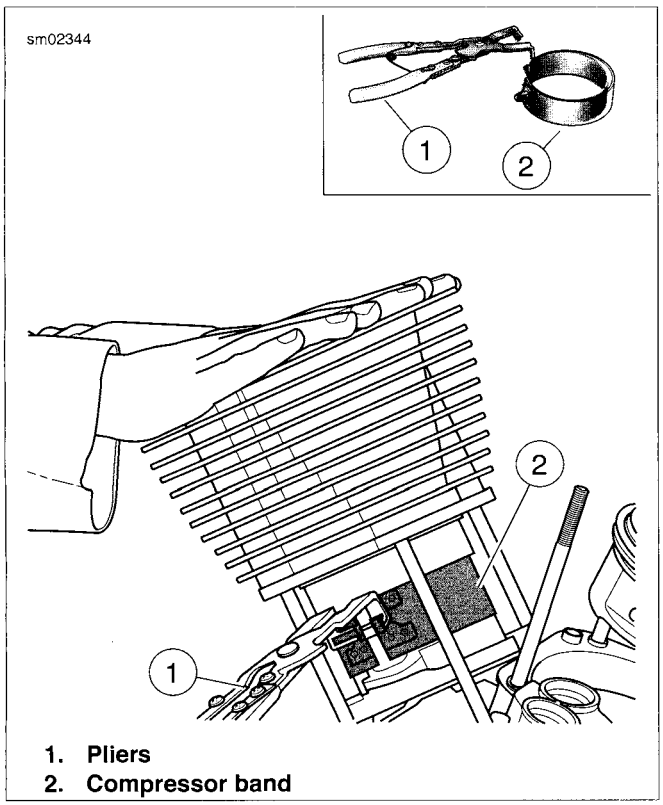
1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-34. Piston Ring Alignment



1. Support plate
2. Knobs
3. Screw

Figure 3-35. Piston Support Plate



1. Pliers
2. Compressor band

Figure 3-36. Piston Ring Compressor

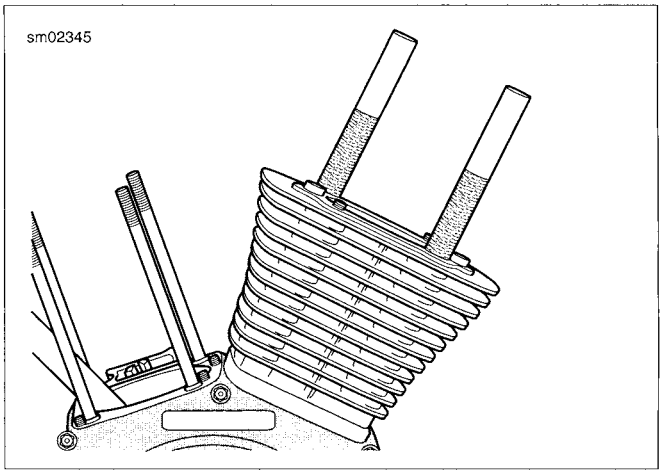


Figure 3-37. Install Threaded Cylinders to Studs

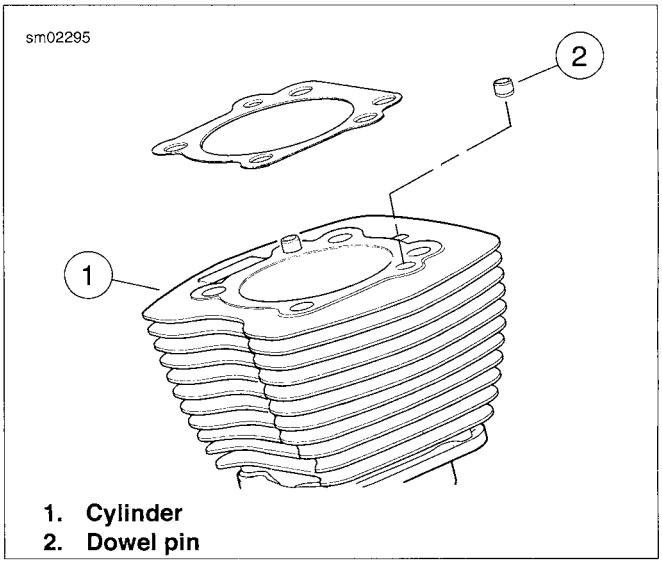
CYLINDER HEAD

1. See Figure 3-38. With the part number face up, place the head gasket over the two dowel pins in the upper flange of the cylinder.
2. Note that the word "Front" or "Rear" is cast into the top of the cylinder head to verify proper installation. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder head over the two cylinder flange dowel pins. Lower the cylinder head at an angle that closely approximates the angle of the crankcase to avoid damage to machined surfaces or the dowel pins.

NOTE

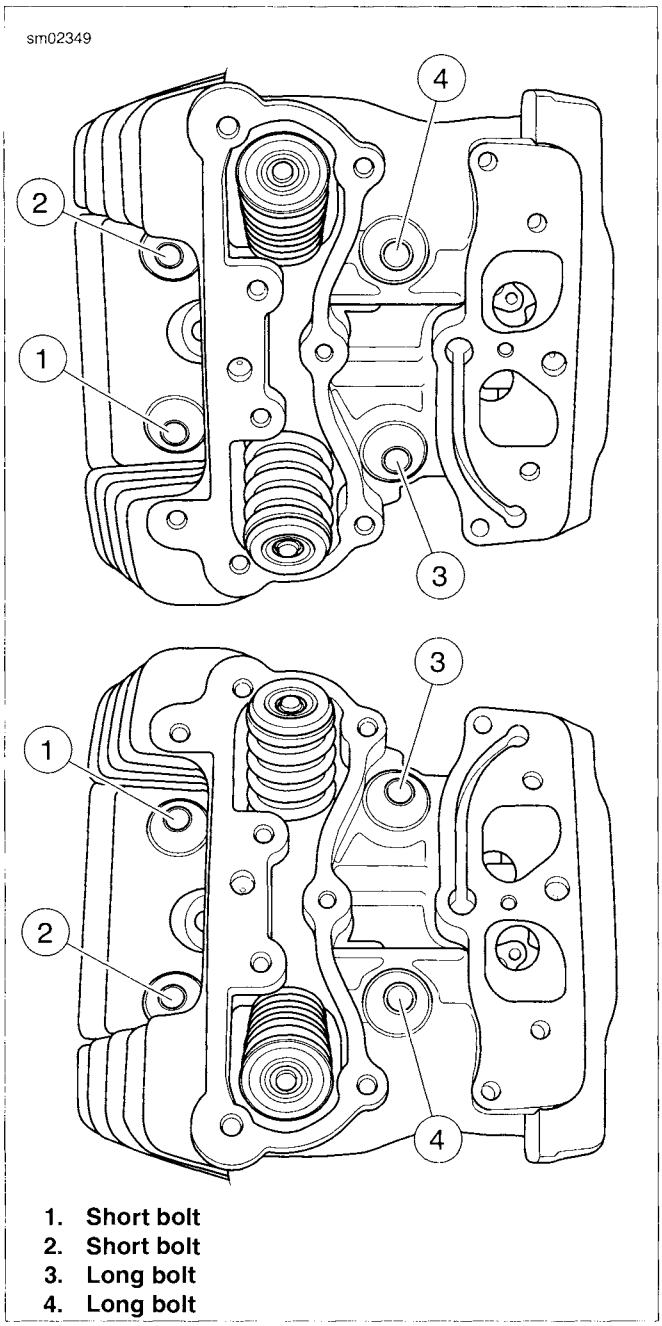
Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.

3. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.
4. See Figure 3-39. Loosely install the cylinder head bolts onto the cylinder studs. Place two short bolts on the left side of the engine and two long bolts on the right.



1. Cylinder
2. Dowel pin

Figure 3-38. Cylinder Dowel Pins



1. **Short bolt**
2. **Short bolt**
3. **Long bolt**
4. **Long bolt**

Figure 3-39. Cylinder Head Bolt Torque Sequence (Top: Front Cylinder Head, Bottom: Rear Cylinder Head)

NOTE

Improperly tightened cylinder head bolts may result in gasket leaks, stud failure and distortion of the cylinder and/or cylinder head.

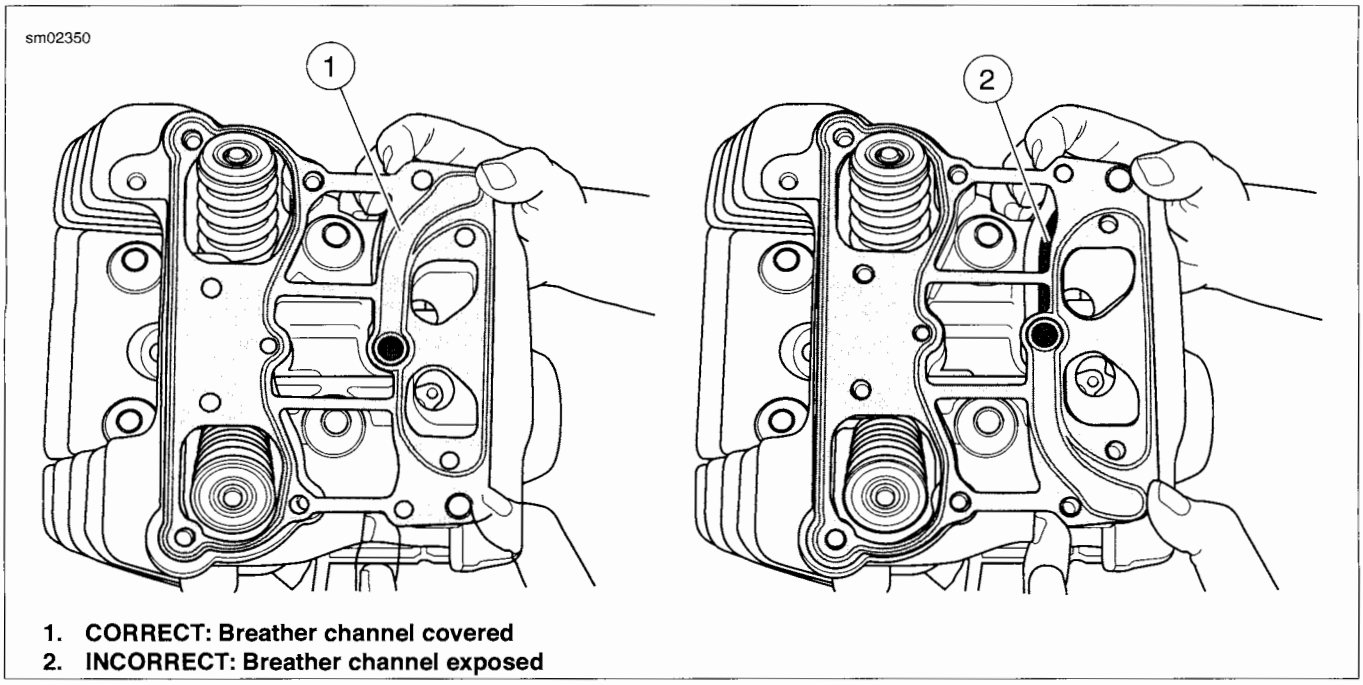
5. Tighten the four cylinder head bolts.
   a. Following sequence shown, alternately turn each cylinder head bolt until finger tight.
   b. Following the same sequence, tighten the cylinder head bolts to 120-144 **in-lbs** (13.5-16.2 Nm).
   c. Continuing the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).
   d. See Figure 3-40. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.
   e. 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 3-39.

Figure 3-40. Final Tightening for Cylinder Head Bolts

NOTES

- *For best results, use SNAP-ON TORQUE ANGLE GAUGE TA360.*
- *Even though all bolt holes (rocker housing, rocker arm support plate and breather assembly) may appear to be in alignment, the rocker housing gasket may be installed upside down. An upside down gasket will result in an open breather channel causing a major oil leak when the vehicle is started, possibly resulting in engine and/or property damage.*
- *On front cylinder head, install side of gasket marked "front" facing up. On rear cylinder head, install side of gasket marked "rear" facing up.*

6. See Figure 3-41. Install a **new** rocker housing gasket on the cylinder head. Verify that the rocker housing gasket covers the breather channel.



1. **CORRECT: Breather channel covered**
2. **INCORRECT: Breather channel exposed**

Figure 3-41. Install Rocker Housing Gasket (Rear Cylinder Shown)

7. See Figure 3-43. With the indent (1) facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.
8. See Figure 3-42. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker housing bolts. Loosely install the rocker housing bolts. Place two long bolts on the left side of the engine and four intermediate bolts in the interior. Alternately tighten the bolts to 120-168 **in-lbs** (13.6-19.0 Nm) in the sequence shown.

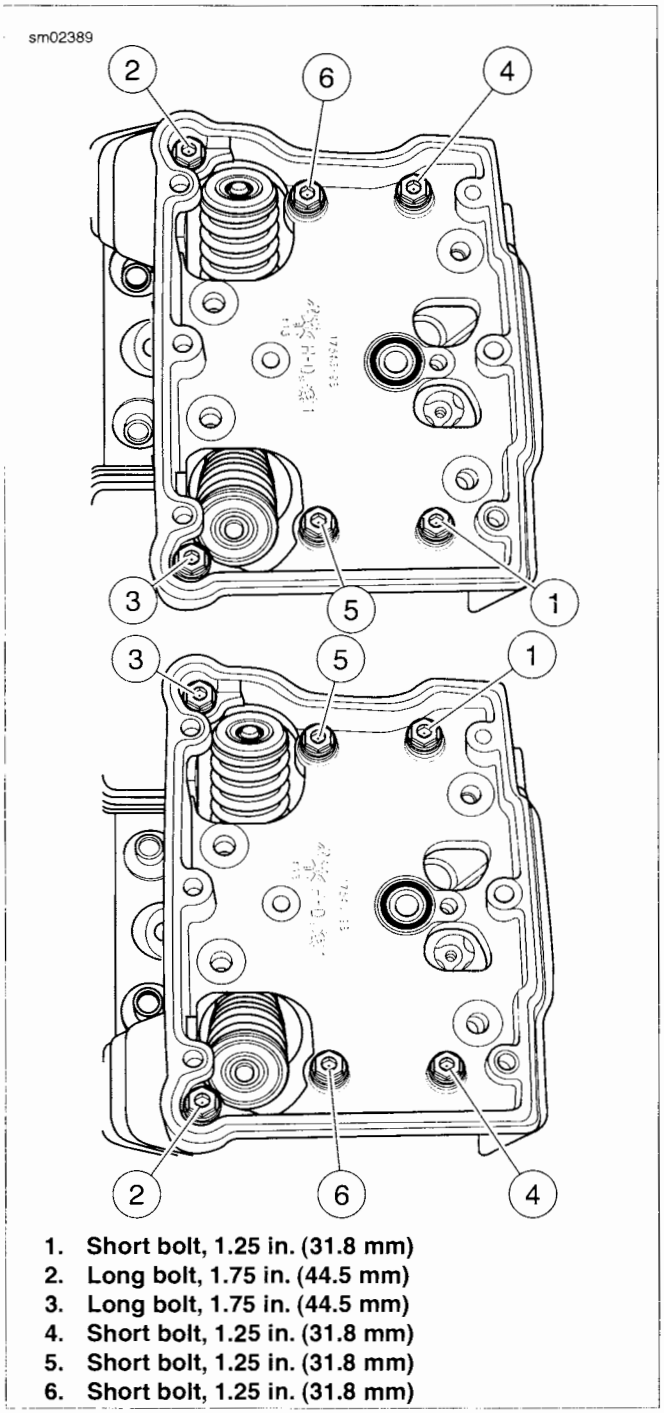
NOTES

- *If the engine was left in the chassis for service, final tighten the rear left rocker housing bolt (rear cylinder) using a torque wrench with a 1/4 in. drive.*
- *O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use **new** O-rings, keeping them packaged until use to avoid confusion.*

9. See Figure 3-43. Apply a very thin film of clean H-D 20W50 engine oil to **new** baffle hole O-ring (2). Install **new** O-ring in groove around breather baffle hole in rocker housing.

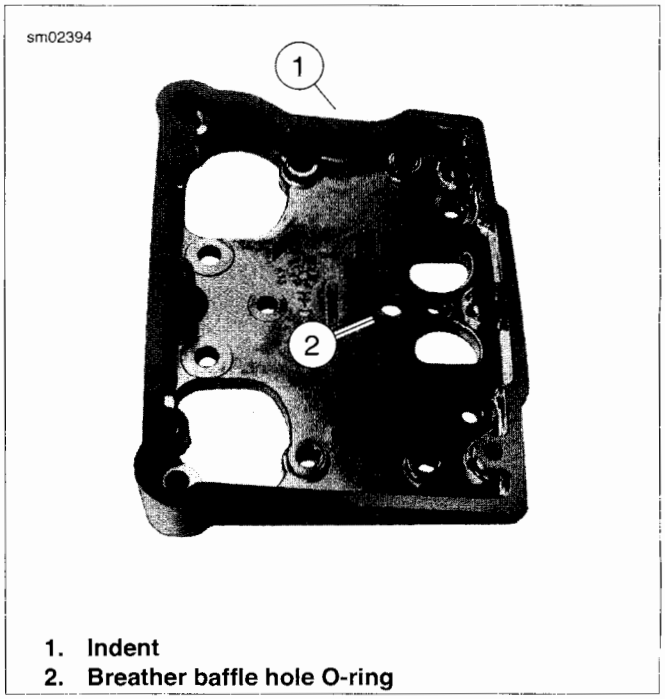
NOTE

Do not confuse breather baffle hole O-ring (Part No. 11270, large inner diameter) with the top push rod O-ring (Part No. 11293, small inner diameter).



1. **Short bolt, 1.25 in. (31.8 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Long bolt, 1.75 in. (44.5 mm)**
4. **Short bolt, 1.25 in. (31.8 mm)**
5. **Short bolt, 1.25 in. (31.8 mm)**
6. **Short bolt, 1.25 in. (31.8 mm)**

Figure 3-42. Rocker Housing Torque Sequence and Bolt Size



1. **Indent**
2. **Breather baffle hole O-ring**

Figure 3-43. Rocker Housing Alignment

PUSH RODS, LIFTERS AND COVERS

1. Remove any labels used on the hydraulic lifters. Install lifters in the crankcase bores with the oil hole on the inboard side and the flats on the lifters facing forward and rearward. To avoid damage, do not drop lifters onto cam lobes.
2. See Figure 3-44. Place the anti-rotational pin (4) on the machined flat between the blocks cast into the crankcase.
3. Install a **new** lifter cover gasket (2) aligning the holes in the gasket with those in the cover (1).

NOTE

Movement or loss of the pin can result in lifter rotation causing engine damage.

4. Install the lifter cover and start the four allen head socket screws (1/4 x 1.0 in). During installation, verify that the anti-rotational pin (4) is held in place by the ribs (3) cast into the inboard side of the lifter cover. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a cross-wise pattern.
5. Install push rod covers.
   a. Hand compress the push rod cover assembly and fit the O-ring end of the lower push rod cover into the lifter cover bore.
   b. Extending the assembly, fit the O-ring end of the upper push rod cover into the cylinder head bore.
   c. Do not install the spring cap retainers at this time.

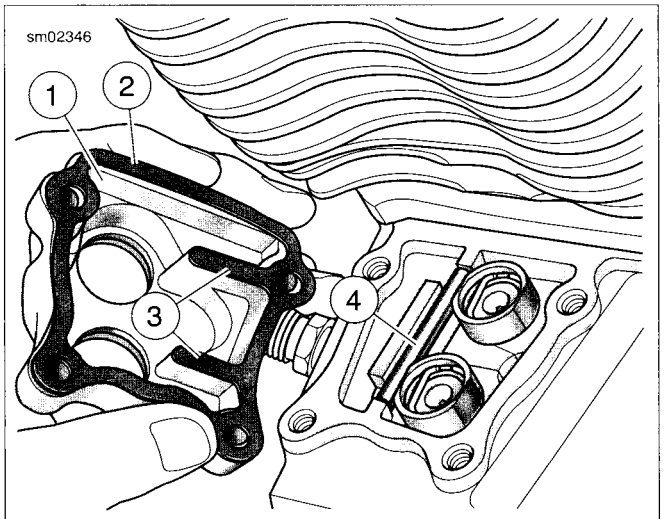
NOTE

To install spring cap retainers, see 3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.

6. Refer to Table 3-30. Install the push rods in their original positions. Be sure to remove any tags that may have been used for identification.
   a. See Figure 3-45. For example, if reassembling the rear cylinder, slide the intake push rod (silver) through the front hole in the rocker housing engaging the lifter socket in the inside hole of the lifter cover.
   b. Slide the exhaust push rod (black) through the rear hole in the rocker housing engaging the lifter socket in the outside hole of the lifter cover.

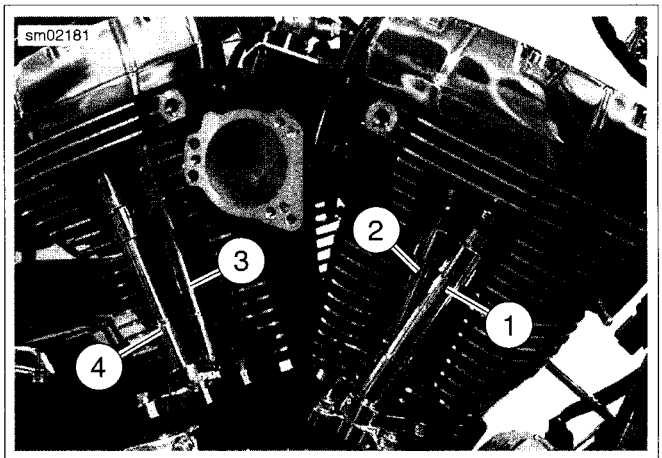
Table 3-30. Push Rod/Lifter Locations

CYL-INDER	COVER & PUSH ROD	LIFTER BORE COVER	CYLINDER HEAD/ROCKER HOUSING BORE
Front	Intake	Inside	Rear
	Exhaust	Outside	Front
Rear	Intake	Inside	Front
	Exhaust	Outside	Rear



1. **Cover**
2. **Gasket**
3. **Ribs on cover**
4. **Anti-rotational pin**

Figure 3-44. Installing Lifters



1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

Figure 3-45. Push Rod Locations

ROCKER ARM SUPPORT PLATE

Installing the rocker arms and rotating the engine with the valve train loaded can result in bent push rods, damaged bushings or a warped support plate.

1. To install the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (or lowest position) of the cam. To rotate engine, see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.
2. See Figure 3-46. Place the rocker arm support plate assembly into the rocker housing. Loosely install the four rocker arm support plate bolts with flat washers.

NOTE

If the engine was left in the chassis for service, final tighten the rocker arm support plate bolt on the rear left side of the rear cylinder using a 3/8 in. drive torque wrench with a 1/2 in. flank drive "dog bone" torque adapter (Snap-on FRDH161). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker housing.

3. Tighten rocker arm support plate bolts.
   a. Following the sequence shown, alternately tighten each of the four rocker arm support plate bolts just 1/4 turn. Continue turning the bolts in these increments until snug.
   b. Following the same sequence, tighten the bolts to 18-22 ft-lbs (24.4-29.8 Nm).
4. Lift up lower push rod covers and verify that both push rods spin freely.

NOTE

Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

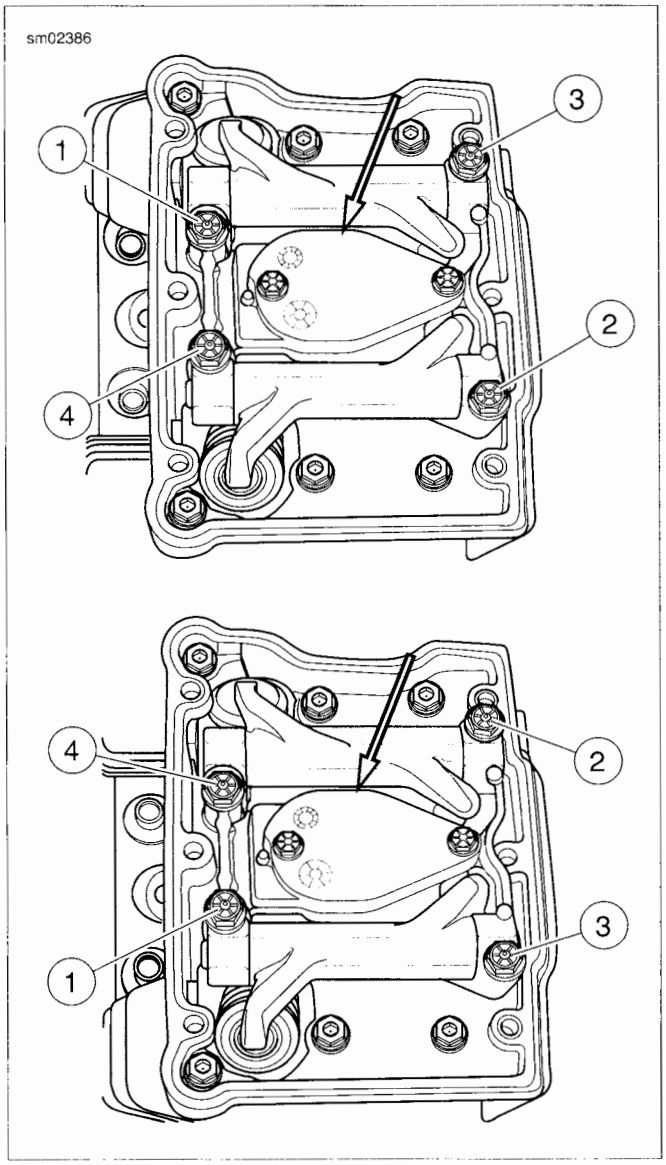


Figure 3-46. Rocker Arm Torque Sequence

5. Complete installation of the push rod covers.
   a. Verify that the O-ring ends of the upper and lower push rod covers fit snugly into the cylinder head and lifter cover bores.
   b. Insert the upper edge of spring cap retainer into the cylinder head bore leaving the bottom edge free.
   c. Insert blade of small screwdriver between bottom edge of spring cap retainer and top of spring cap.

NOTE

For best results, be sure that screwdriver, spring cap and spring cap retainer are free of grease and oil.

   d. See Figure 3-47. While simultaneously depressing spring cap with tip of screwdriver, use forefinger to slide bottom edge of spring cap retainer down shaft towards tip of screwdriver blade. As spring cap reaches its full length of travel, spring cap retainer should be in approximate position against upper push rod cover.
   e. Verify that spring cap retainer is seated tightly against upper push rod cover.

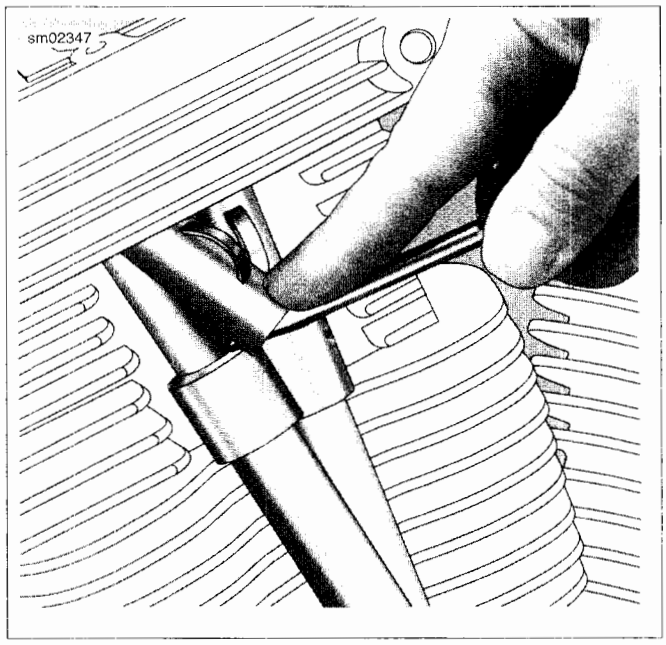


Figure 3-47. Install Spring Cap Retainers

BREATHER ASSEMBLY

NOTE

For breather assembly service procedures, see 3.20 BREATHER ASSEMBLY.

1. See Figure 3-49. Alternately tighten the two bolts to secure breather assembly to 90-120 **in-lbs** (10.2-13.6 Nm).
2. See Figure 3-48. Install a **new** rocker cover gasket with indent facing forward on the rocker housing flange. Place the rocker cover into position aligning the holes in the cover with those in the gasket.

NOTE

If the engine was left in the chassis for service, final tighten the three rocker cover bolts on the left side of the rear cylinder using a 3/8 in. drive torque wrench with a 7/16 in. flank drive "dog bone" torque adapter (Snap-on FRDH141). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker cover.

3. See Figure 3-49. Install rocker cover bolts.
   a. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker cover bolts.
   b. Loosely install bolts in the rocker cover.
   c. Following the sequence shown, tighten bolts to 15-18 ft-lbs (20.3-24.4 Nm).
4. Complete motorcycle assembly.
   a. If engine was left in the chassis for service, see 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.
   b. If engine was removed for service, see 3.15 INSTALLING ENGINE IN CHASSIS.

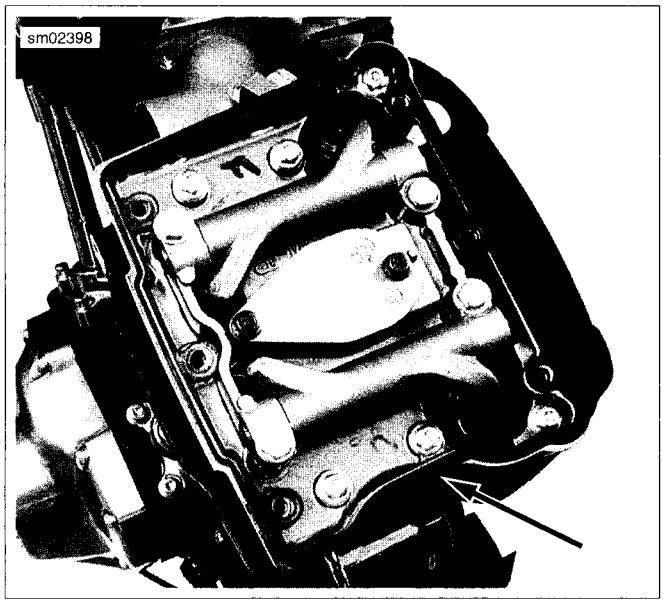
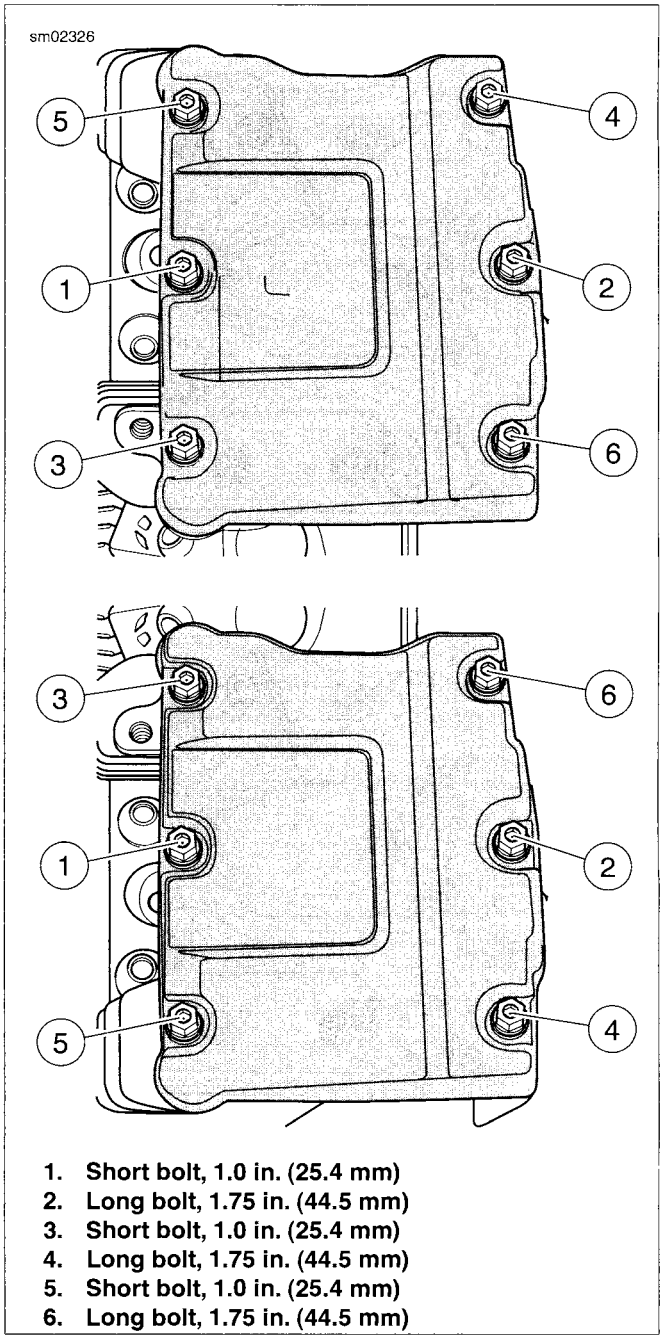


Figure 3-48. Rocker Cover Gasket Indent (Front Cylinder Shown)



1. **Short bolt, 1.0 in. (25.4 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Short bolt, 1.0 in. (25.4 mm)**
4. **Long bolt, 1.75 in. (44.5 mm)**
5. **Short bolt, 1.0 in. (25.4 mm)**
6. **Long bolt, 1.75 in. (44.5 mm)**

Figure 3-49. Rocker Cover Bolts Torque Sequence

GENERAL

To perform a complete bottom end overhaul, follow all steps listed in this section including inspection and repair procedures.

CAM SUPPORT PLATE AND COVER

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

Prepare Engine

1. If performing a complete engine overhaul, perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. If only servicing cam compartment components, partial top end disassembly is required. Remove breather assembly, rocker arm support plate, push rods and push rod covers. Do not remove lifters. See appropriate topics under 3.16 TOP END OVERHAUL: DISASSEMBLY.
3. Support lifters using improvised tool as described under 3.26 CAM SUPPORT PLATE AND COVER.
4. See Figure 3-50. Remove the ten allen head socket screws with captive washers to release the cam cover. Remove and discard the cam cover gasket.

NOTE

The cam support plate, lifter cover and crankshaft position sensor mount all use the same short allen head socket screw (1/4 x 1 in.). Only the cam cover uses the longer screw (1/4 x 1-1/4 in.). For ease of assembly, do not mix the short and long screws. Store the long screws inside the cam cover to avoid confusion. The short screws are interchangeable.

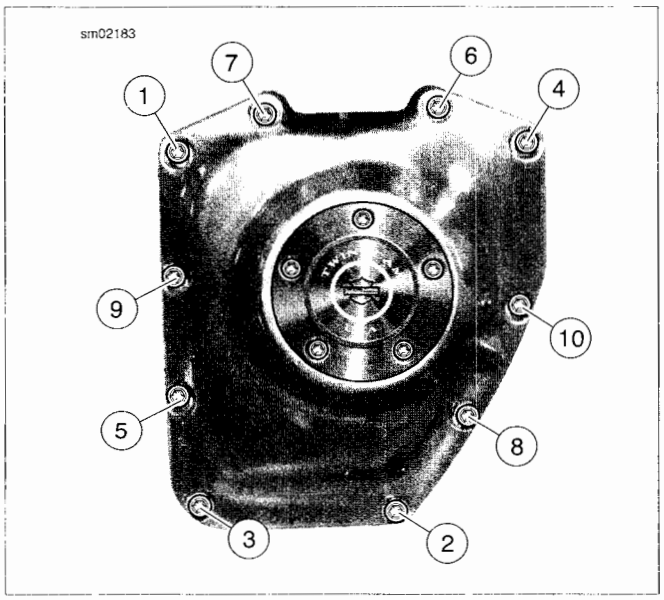


Figure 3-50. Cam Cover Screws

Cam Chain and Sprockets

1. See Figure 3-51. Using a colored marker, mark one of the links (1) of the primary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.

⚠WARNING

Be sure to follow manufacturer's instructions when using propane torches. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00465c)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

NOTE

A piece of wire can be inserted into retention hole (6) to keep cam chain tensioner components assembled.

2. Remove primary cam chain tensioner fasteners (4) and primary cam chain tensioner (3).

NOTE

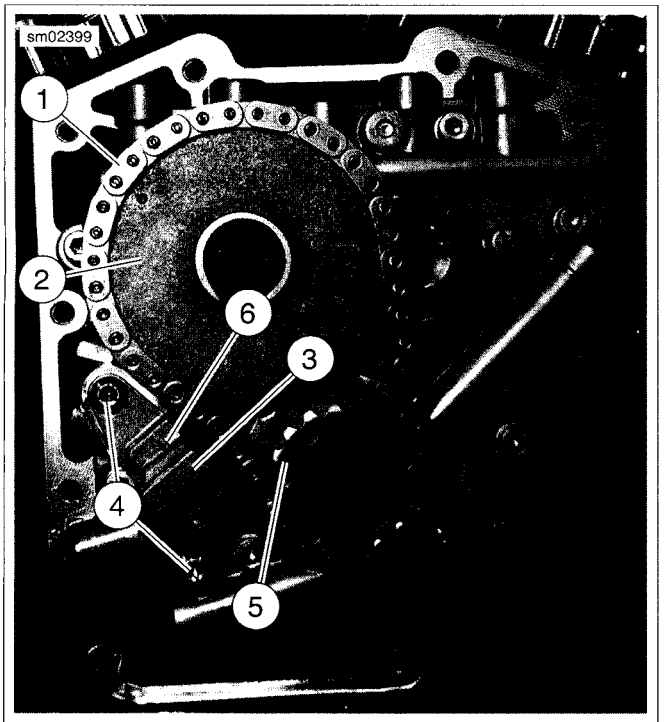
In next step, be sure side of tool labeled "crank side" faces crank sprocket.

3. See Figure 3-52. Install CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between cam sprocket (2) and crank sprocket (5).

NOTES

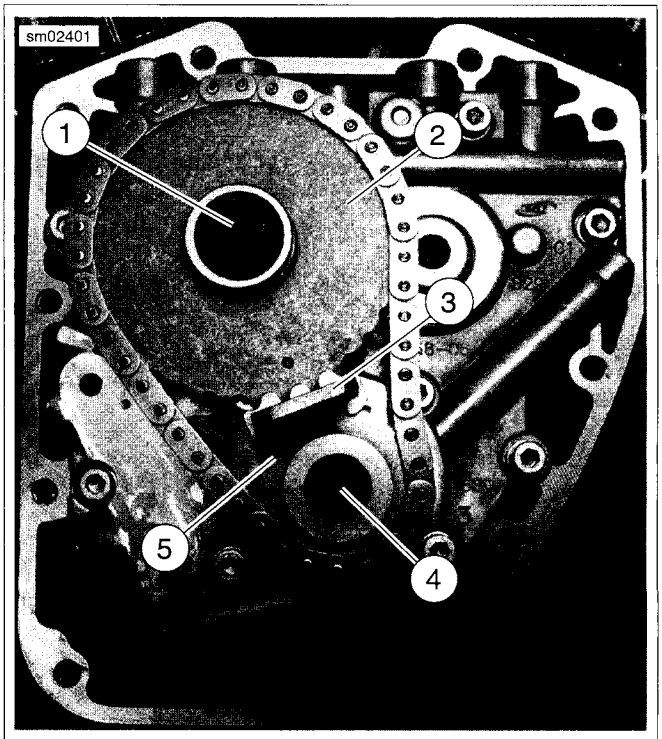
- *Only use approved methods for removing rear cam bolt. Other methods of removal, such as the use of a large breaker bar, may result in damage to chain drive and other components.*
- *If too much LOCTITE or perhaps the wrong LOCTITE was used to install the rear cam bolt, it may be very difficult to remove. In these cases, break down LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but not for so long as to turn bolt blue.*

4. Remove the rear cam sprocket bolt and flat washer (1) from the rear cam sprocket (2).
5. Remove the crank sprocket bolt and flat washer (4) from the crank sprocket (5).
6. Remove CAMSHAFT LOCKING TOOL.
7. Insert small pry bar (seal remover) between inboard side of rear cam sprocket and cam support plate. Working around its circumference, carefully ease off rear cam sprocket until loose on camshaft.
8. Ease off crank sprocket with a slightly smaller pry bar (seal remover). Remove the rear cam sprocket, primary cam chain and crank sprocket.



1. Link
2. Rear cam sprocket
3. Primary cam chain tensioner
4. Primary cam chain tensioner fasteners
5. Crank sprocket
6. Retention hole

Figure 3-51. Cam Support Plate Assembly



1. Rear cam sprocket bolt (large) and flat washer
2. Rear cam sprocket
3. Camshaft locking tool (HD-47941)
4. Crank sprocket bolt (small) and flat washer
5. Crank sprocket

Figure 3-52. Cam Support Plate Assembly

Cam Support Plate

1. See Figure 3-53. Following the sequence shown, alternately loosen and then remove the four allen head socket screws with captive washers to release the cam support plate from the oil pump flange.
2. See Figure 3-54. Following the sequence shown, alternately loosen and then remove the six allen head socket screws with captive washers to release the cam support plate from the crankcase flange.

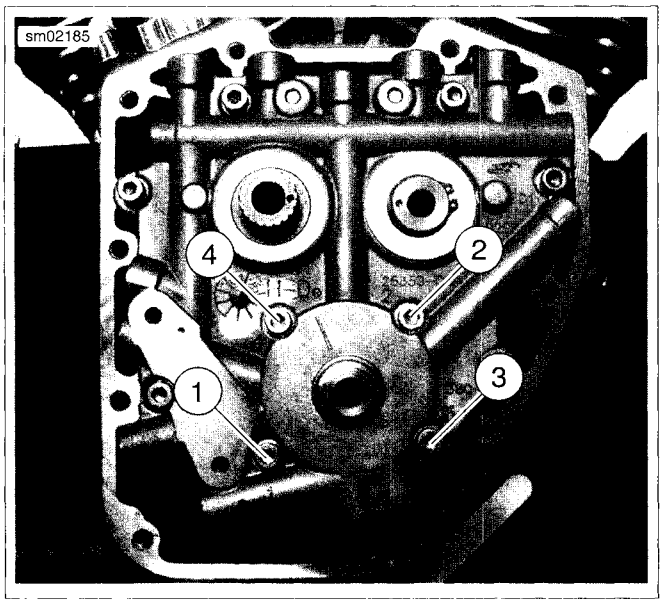


Figure 3-53. Oil Pump Torque Sequence

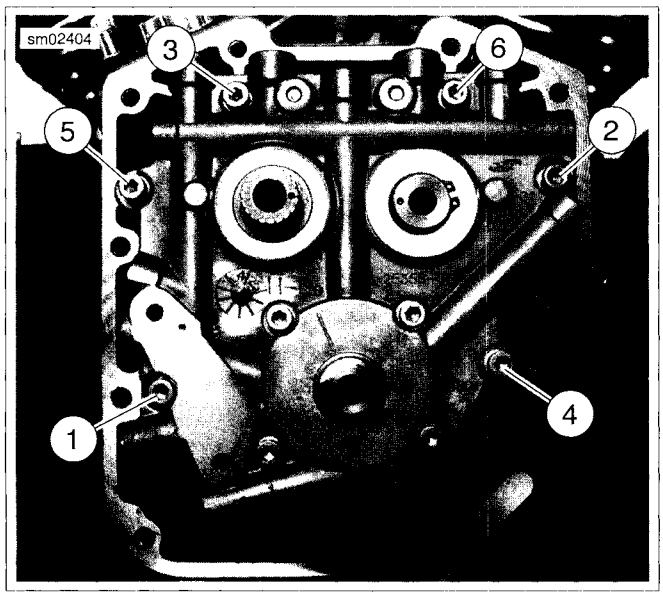
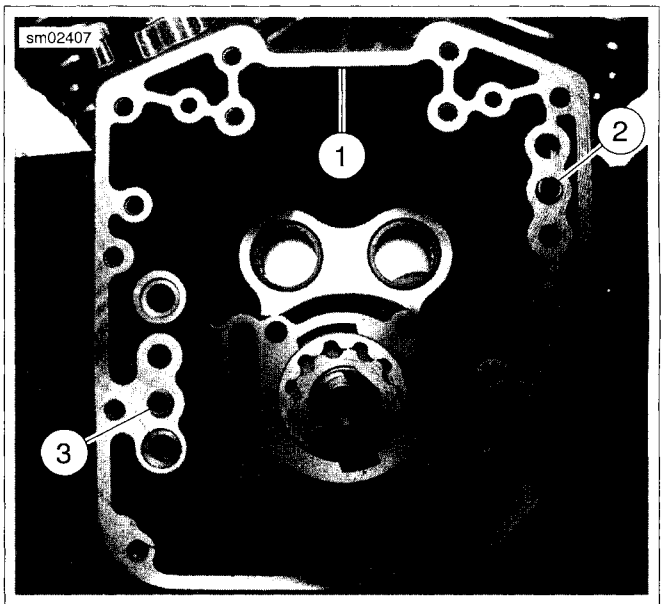


Figure 3-54. Cam Support Plate Torque Sequence

3. See Figure 3-55. Two ring dowels (2, 3) in crankcase flange locate cam support plate.
   a. Insert small pry bar (seal remover) between inboard side of cam support plate and crankcase flange in area adjacent to ring dowels.
   b. Alternately work each side free and then carefully ease cam support plate and camshafts from end of crankshaft.
4. See 3.26 CAM SUPPORT PLATE AND COVER for inspection and repair information.



1. **Right crankcase half**
2. **Forward ring dowel**
3. **Rear ring dowel**

Figure 3-55. Ring Dowels

CRANKCASE

PART NUMBER	TOOL NAME
HD-42310-25A	SOFTAIL ENGINE CRADLE

NOTE

Be sure engine is in SOFTAIL ENGINE CRADLE (Part No. HD-42310-25A).

1. Carefully pull oil pump from crankshaft.
2. See Figure 3-56. Remove o-ring (2) from outboard side of oil pump housing. Remove o-ring from scavenge port stub. Discard o-rings. See 3.27 OIL PUMP for inspection and repair information.

NOTE

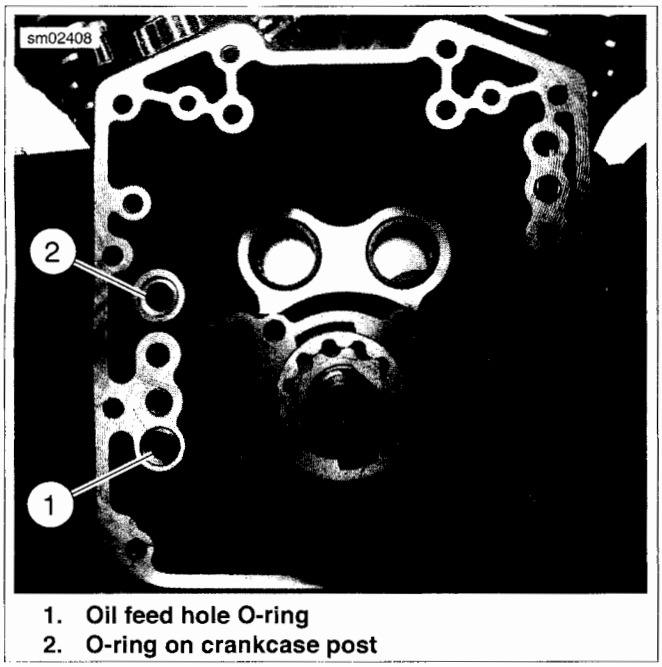
Do NOT rotate left crankcase half in the engine stand so the flywheel sprocket shaft is facing up. The flywheel assembly will fall out of the case.

3. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward.
4. See Figure 3-57. Remove the twelve crankcase bolts in the sequence shown.

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner.

5. Separate crankcase halves.
6. See 3.28 CRANKCASE for inspection and repair information.



1. Oil feed hole O-ring
2. O-ring on crankcase post

Figure 3-56. Oil Pump O-rings

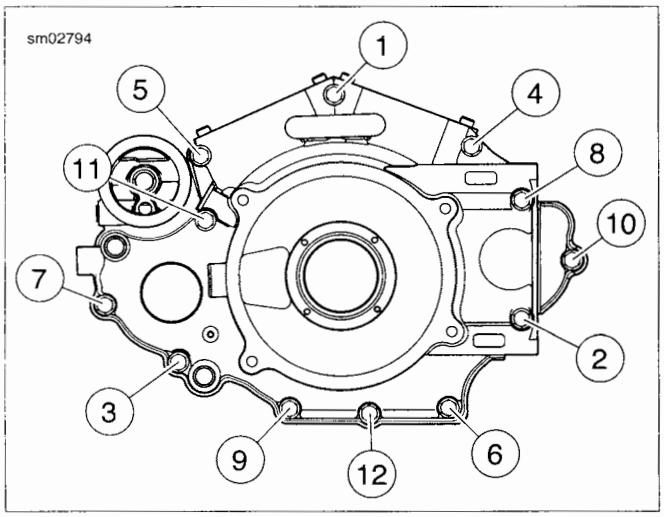


Figure 3-57. Crankcase Bolt Sequence

7. See Figure 3-58. Remove and discard rubber interconnect from chain guide bracket assembly.
8. See 3.28 CRANKCASE for right crankcase inspection and repair information. Continue with 3.30 COUNTERBALANCER ASSEMBLY to service flywheel or any of the left crankcase components.

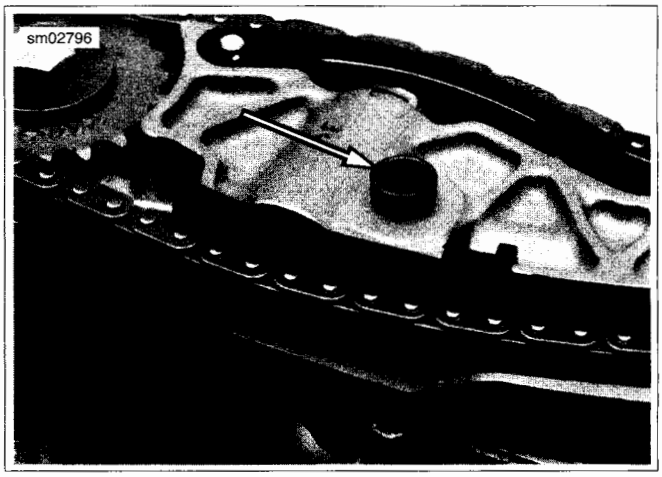
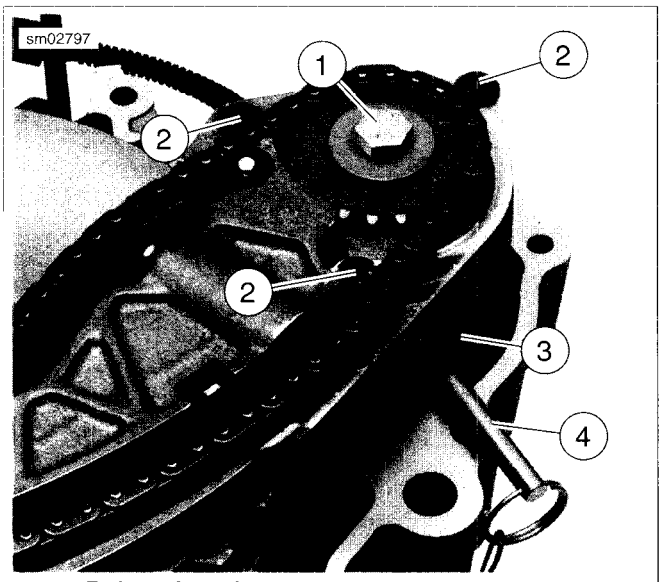


Figure 3-58. Rubber Interconnect

COUNTERBALANCER ASSEMBLY

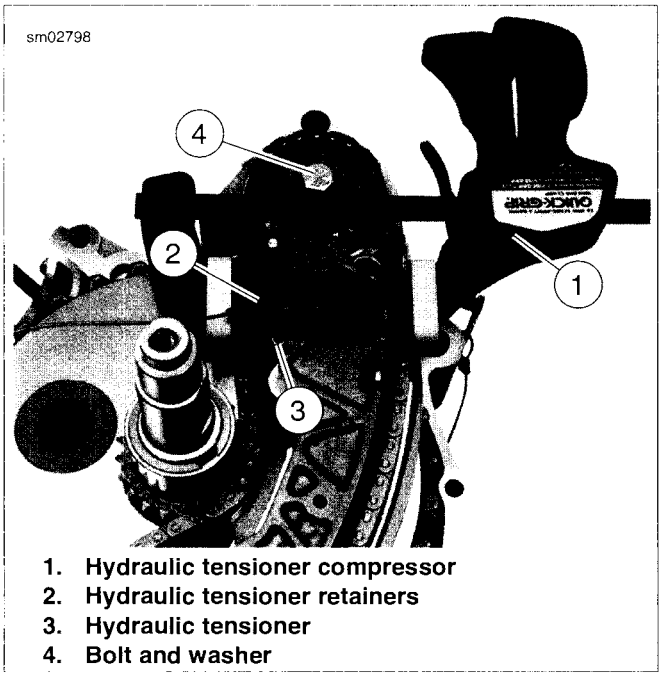
PART NUMBER	TOOL NAME
HD-44062	BALANCE SHAFT RETENTION PINS
HD-44063	HYDRAULIC TENSIONER COMPRESSOR
HD-44408	HYDRAULIC TENSIONER RETAINERS

1. See Figure 3-59. Rotate flywheel assembly to align holes in balance shafts with holes in balance shaft housing (3). Insert BALANCE SHAFT RETENTION PINS (Part No. HD-44062) inside front and rear shaft supports to lock balance shafts in place. Locking the balancers in this position times the balancers to the engine.
2. See Figure 3-60. Compress both hydraulic tensioners.
   a. Clamp rubber tip of HYDRAULIC TENSIONER COMPRESSOR (Part No. HD-44063) (1) over balance chain and bottom of chain guide bracket assembly.
   b. Pump handle on tool to compress hydraulic tensioner.
   c. Slide HYDRAULIC TENSIONER RETAINERS (Part No. HD-44408) over lip of tensioner (3).
   d. Release pressure on tool (1) and remove.
   e. Repeat procedure on remaining tensioner assembly.



1. **Bolt and washer**
2. **T40 TORX screws (3)**
3. **Balance shaft housing**
4. **Retention pin**

Figure 3-59. Balance Shaft Support (Front Balance Assembly Shown)



1. **Hydraulic tensioner compressor**
2. **Hydraulic tensioner retainers**
3. **Hydraulic tensioner**
4. **Bolt and washer**

Figure 3-60. Hydraulic Tensioner Tools (Front Tensioner Shown)

⚠WARNING

Be sure to follow manufacturer's instructions when using propane torches. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00465c)

3. Loosen the bolts (4) on the front and rear balance shafts.

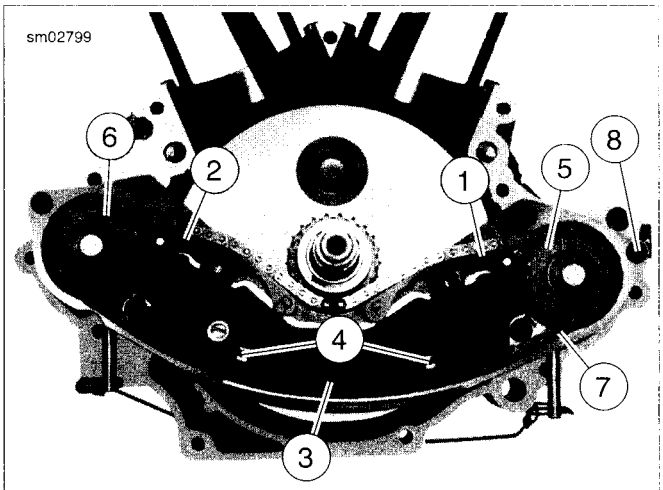
NOTE

If too much LOCTITE or perhaps the wrong LOCTITE was used to install the bolts, they may be very difficult to remove. In these cases, break down LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but not for so long as to turn bolt blue.

4. See Figure 3-61. Pry tab on front tensioner guide (1) clear of locking post. Use a small screwdriver to pry front chain tensioner guide upward from locking post. Repeat procedure on rear chain tensioner guide (2).
5. Pry lower chain tensioner guide (3) away from chain guide bracket assembly. Note the two retention tabs (4) on the lower chain tensioner guide which must be freed.
6. See Figure 3-60. Remove the bolts and washers (4) on the front and rear balance shafts.
7. See Figure 3-61. Remove front (5) and rear (6) sprockets from chain guide bracket assembly to release balance chain (7). Remove spacers from front and rear balance shafts.
8. Remove six T40 TORX screws (8) from balance shaft housing to free chain guide bracket assembly.

NOTE

See Figure 3-62. Inspect tip of BALANCE SHAFT RETENTION PINS (Part No. HD-44062) after removal. If the ball at the end of the tool should separate and become loose in the engine assembly, severe engine damage could occur.



1. **Front tensioner guide**
2. **Rear tensioner guide**
3. **Lower guide**
4. **Retention tabs**
5. **Front sprocket**
6. **Rear sprocket**
7. **Balance chain**
8. **T40 TORX screws (6)**

Figure 3-61. Chain Tensioner Guides

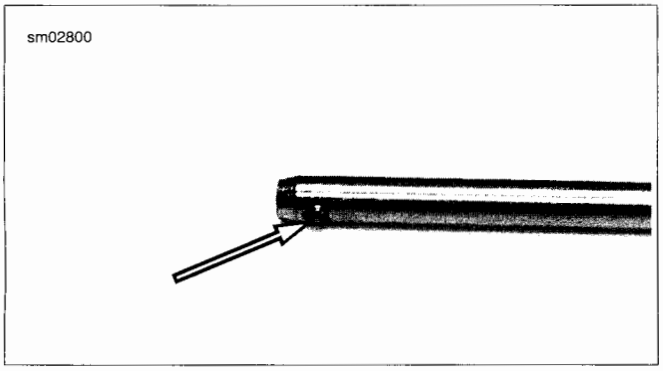
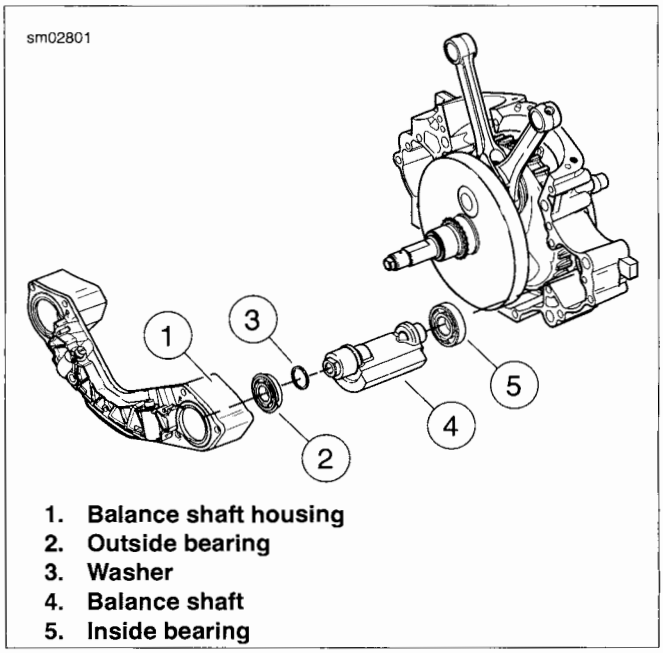


Figure 3-62. Balance Shaft Retention Pin

9. Remove both BALANCE SHAFT RETENTION PINS (Part No. HD-44062) from front and rear shaft supports. Check that ball on tip of tool has not separated from pin.
10. See Figure 3-63. Remove balance shaft housing (1) from left crankcase half.
11. Inspect and repair components as necessary.
    a. See 3.30 COUNTERBALANCER ASSEMBLY for chain guide bracket assembly and outside balance shaft bearings (2).
    b. See 3.28 CRANKCASE for balance shaft support bearings in left crankcase half.
    c. See 3.29 FLYWHEEL AND CONNECTING RODS for flywheel inspection and repair information.



1. **Balance shaft housing**
2. **Outside bearing**
3. **Washer**
4. **Balance shaft**
5. **Inside bearing**

Figure 3-63. Balance Shaft Assembly (Front Balance Assembly Shown)

GENERAL

This section provides a sequential process for engine reassembly after a complete 3.18 BOTTOM END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Counterbalancer assembly: see below.
- Crankcase installation: see 3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase.
- Cover and cam support plate installation: see 3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover.

COUNTERBALANCER ASSEMBLY

PART NUMBER	TOOL NAME
HD-44062	BALANCE SHAFT RETENTION PINS
HD-44063	HYDRAULIC TENSIONER COMPRESSOR
HD-44408	HYDRAULIC TENSIONER RETAINERS
HD-48615	BALANCE SHAFT SPROCKET ALIGNMENT TOOL

1. Install balance shafts and bearings. See 3.30 COUNTERBALANCER ASSEMBLY for balancer shaft installation information.

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner.

2. Rotate left crankcase in the engine stand so that the balance sprocket on the flywheel is facing straight upward

NOTE

Do not apply crankcase sealant to edge surface of balance shaft housing. Improper preparation of housing could cause balance sprocket misalignment and result in engine damage.

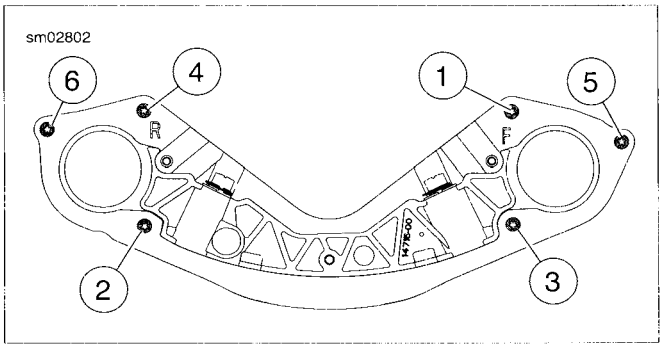


Figure 3-64. Balance Shaft Housing Torque Sequence

3. See Figure 3-64. Install chain guide bracket assembly.
   a. With hydraulic tensioners compressed, slide chain guide bracket assembly over front and rear balance shafts.
   b. Apply LOCTITE THREADLOCKER 262 (red) to threads of T40 TORX screws for each balance shaft housing.
   c. Insert three T40 TORX screws into each balance shaft housing. Tighten screws to 18-22 ft-lbs (24.4-29.8 Nm) in the sequence shown.
4. See Figure 3-65. Locate alignment mark on flywheel sprocket.
5. Rotate flywheel assembly to align the mark (1) on flywheel balance sprocket to be directly below (6 o'clock position) the crankpin hole (3).
6. Insert BALANCE SHAFT RETENTION PINS (Part No. HD-44062) inside front and rear shaft supports to lock balance shafts in place. Locking the balancers in this position times the engine.
7. Place spacer over front balance shaft.
8. Install front sprocket (labeled "F") and rear sprocket (labeled "R") over balance shafts. Labels must face away from chain guide bracket.
9. Loosely install a bolt and washer on each balance shaft.
10. See Figure 3-66. Check flywheel sprocket to balance shaft alignment using BALANCE SHAFT SPROCKET ALIGNMENT TOOL (Part No. HD-48615).
    a. Slide tool over crankshaft and shoulder on timing chain gear. Tighten screw onto crankshaft until it bottoms on shoulder screw.
    b. Swing tool to each sprocket face.
    c. Alignment must be within 0.019 in. (0.48 mm) as indicated by the steps on the bottom of the tool. The tool's outside step must clear the top surface of the sprocket while the inside step must not pass over the sprocket edge. To adjust alignment, replace spacer behind front sprocket using a **new** spacer listed in Table 3-31.
    d. Remove bolts, washers and front and rear sprockets from balance shafts.

11. See Figure 3-67. Install balance chain.
    a. Apply a very thin film of clean H-D 20W50 engine oil to balance chain.
    b. Inspect balance chain for timing marks. Insert front sprocket (labeled "F") and rear sprocket (labeled "R") inside chain. Colored links on chain should be next to marks on sprockets.
    c. Slide chain/sprocket assembly over balance shafts. Start with rear sprocket, then align middle sprocket to mark on balance chain with flywheel balance sprocket mark and then install front sprocket.
    d. Verify that marks on sprockets and chain face away from balance shaft housing.
    e. Check that the middle chain mark is directly below alignment mark on flywheel balance sprocket.
12. Install **new** bolt and washer in each balance shaft. Tighten both bolts to 42-47 ft-lbs (56.9-63.7 Nm).
13. Verify correct position of all three timing marks on chain and timing mark on flywheel balance sprocket.
14. See Figure 3-68. Install chain tensioner guides. A small screwdriver may be used to aid installation.
    a. Obtain chain tensioner guide (1) labeled "F" for front. With label facing away from chain guide bracket, install guide on post by pushing down until guide snaps into place.
    b. Obtain chain tensioner guide (2) labeled "R" for rear. With label facing away from chain guide bracket, install guide on post by pushing down until guide snaps into place.
    c. Install lower chain tensioner guide (3) by snapping both retention tabs (4) into place on chain guide bracket assembly.
15. See Figure 3-60. Release both hydraulic tensioners.
    a. Clamp rubber tip of HYDRAULIC TENSIONER COMPRESSOR (Part No. HD-44063) (1) over balance chain and bottom of chain guide bracket assembly.
    b. Pump handle on tool to compress hydraulic tensioner.
    c. Remove HYDRAULIC TENSIONER RETAINERS (Part No. HD-44408) (2) from lip of tensioner.
    d. Slowly release pressure on tool and remove.
    e. Repeat procedure on remaining tensioner assembly.

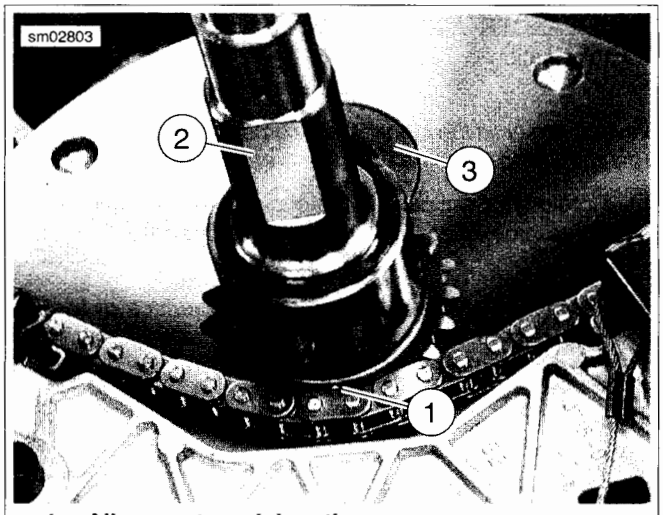
NOTE

See Figure 3-70. Inspect tip of each BALANCE SHAFT RETENTION PIN (Part No. HD-44062) after removal. If the ball at the end of the tool should separate and become loose in the engine assembly, severe engine damage could occur.

16. Remove both BALANCE SHAFT RETENTION PINS (Part No. HD-44062) from front and rear shaft supports. Check that ball on tip of tool has not separated from pin.

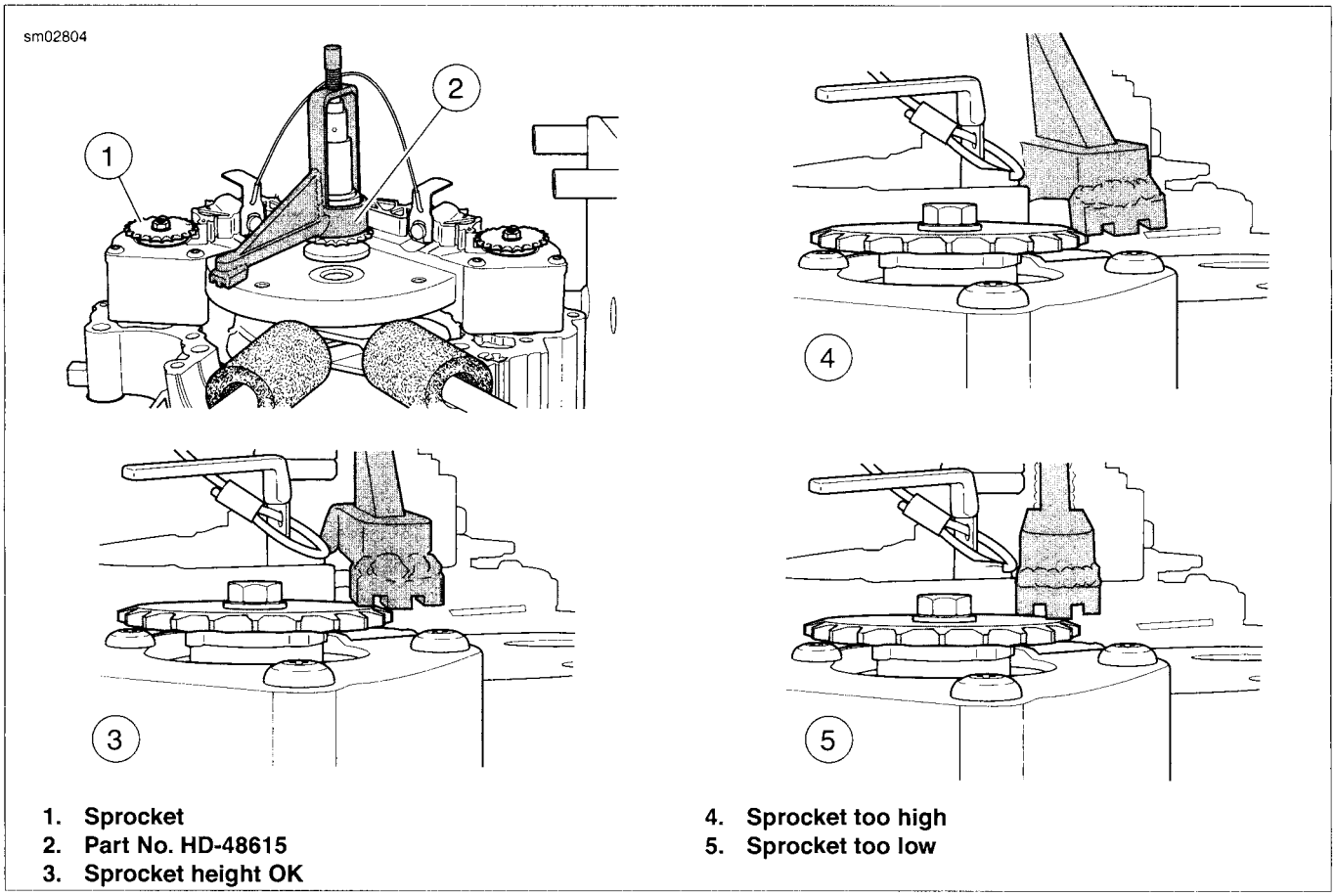
Table 3-31. Balance Sprocket Spacer

PART NO.	IN.	MM
14784-07	0.039	0.991



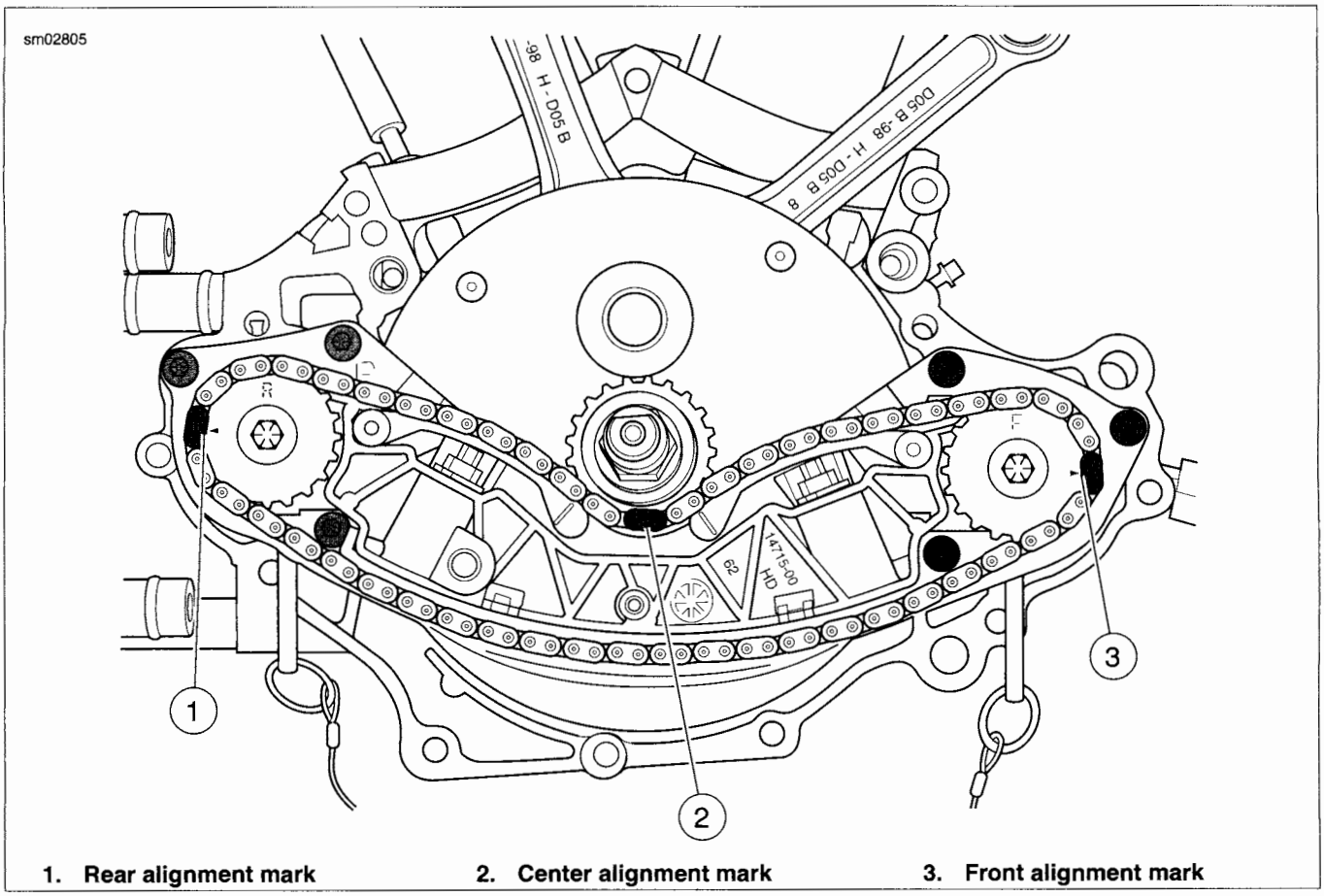
1. **Alignment mark location**
2. **Crankshaft flat**
3. **Crankpin hole**

Figure 3-65. Flywheel Alignment Mark



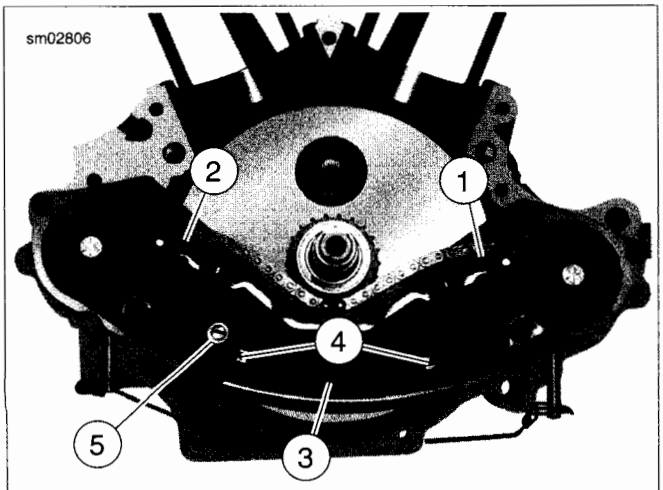
1. Sprocket
2. Part No. HD-48615
3. Sprocket height OK
4. Sprocket too high
5. Sprocket too low

Figure 3-66. Sprocket Alignment



1. Rear alignment mark
2. Center alignment mark
3. Front alignment mark

Figure 3-67. Balance Chain



1. Front guide
2. Rear guide
3. Lower guide
4. Retention tabs
5. Rubber interconnect

Figure 3-68. Chain Tensioner Guides

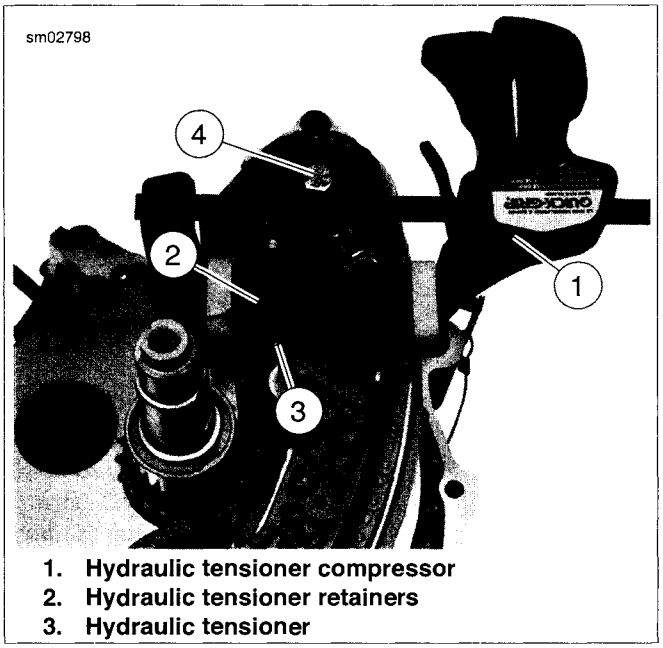
CRANKCASE

PART NUMBER	TOOL NAME
HD-35667-A	CYLINDER LEAKDOWN TESTER
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER
HD-42326-B	CRANKSHAFT GUIDE
HD-97225-55C	SPROCKET SHAFT BEARING TOOL

NOTE

O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use ***new*** *o-rings keeping them packaged until use to avoid confusion.*

1. Bolt left crankcase half upright in engine stand.
2. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the left crankcase half, slide CRANKSHAFT GUIDE (Part No. HD-42326-B) tool onto flywheel sprocket shaft.
3. Slide flywheel assembly into left crankcase half. Remove CRANKSHAFT GUIDE (Part No. HD-42326-B) tool.
4. Tip crankcase assembly in engine stand so that flywheel pinion shaft is pointing straight up.



1. **Hydraulic tensioner compressor**
2. **Hydraulic tensioner retainers**
3. **Hydraulic tensioner**

Figure 3-69. Hydraulic Tensioner Tools (Front Tensioner Shown)

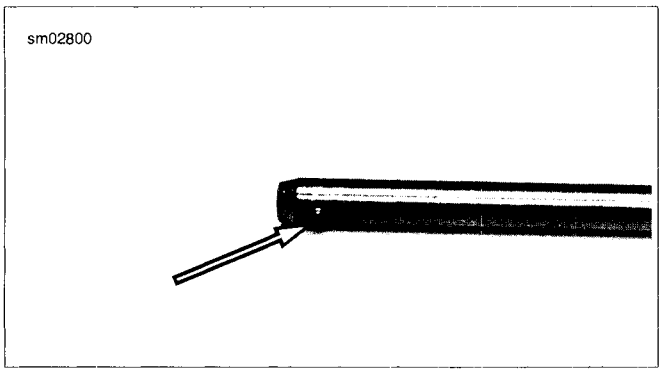
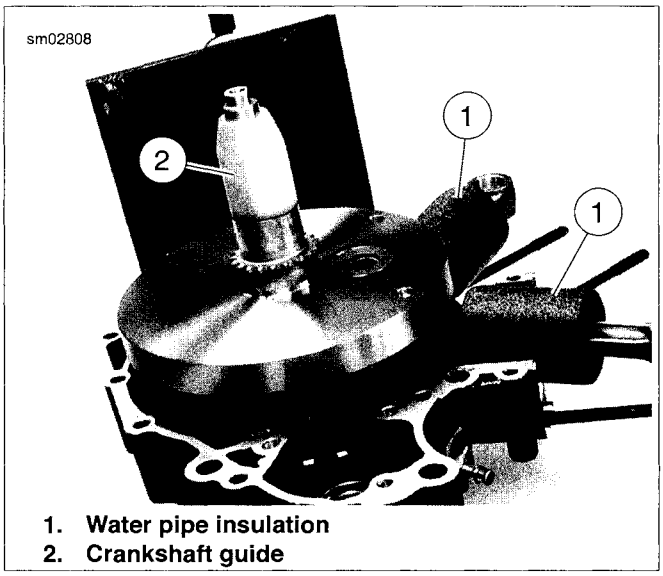


Figure 3-70. Balance Shaft Retention Pin

5. See Figure 3-68. Install **new** rubber interconnect (5) on chain guide bracket assembly.
6. See Figure 3-67. Verify correct position of all three timing marks on chain and timing mark on flywheel balance sprocket.
7. With the right crankcase half resting on the cam cover flange, apply a bead of sealant approximately 0.056 in. (1.42 mm) wide to the split line face. For best results, use HIGH-PERFORMANCE SEALANT, GRAY (Part No. 99650-02).
8. See Figure 3-71. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the right crankcase half, place CRANKSHAFT GUIDE (Part No. HD-42326-B) (2) over end of crankshaft until it contacts shoulder on shaft.
9. Mate case halves sliding bearing roller in right crankcase half over end of crankshaft. Remove tool.
10. See Figure 3-72. Start the twelve crankcase bolts and tighten in the following sequence.
    a. Alternately turn each crankcase bolt until finger tight.
    b. Tighten the crankcase bolts to 120 **in-lbs** (13.6 Nm) in the order shown.
    c. Following the same sequence, tighten each bolt to 15-19 ft-lbs (20.3-25.8 Nm).
11. Tip crankcase assembly so that sprocket shaft is pointing straight up.
12. Install thrust washer on sprocket shaft with "OUT" facing out (and the chamfer inboard). If using OE part without markings, orient as required to preserve existing wear pattern.



1. **Water pipe insulation**
2. **Crankshaft guide**

Figure 3-71. Crankshaft Guide (Part No. HD-42326-B)

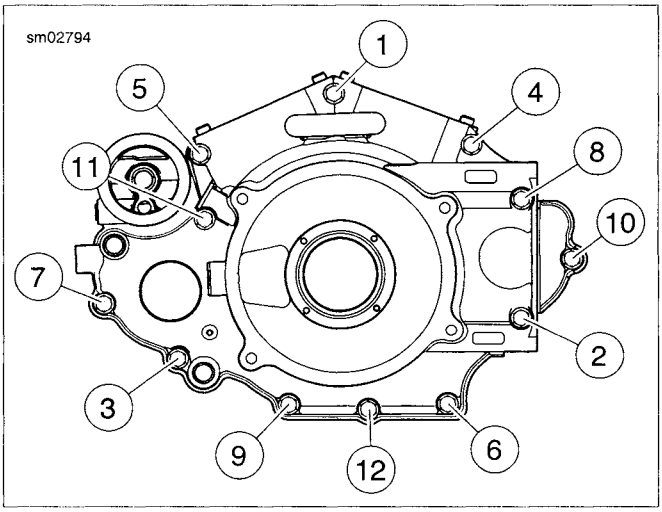


Figure 3-72. Tighten in Sequence Shown

13. See Figure 3-73. Install **new** oil seal into bearing bore. Obtain pilot adapter, pilot shaft, short collar, bearing, large

flat washer and handle from SPROCKET SHAFT BEARING TOOL (Part No. HD-97225-55C).

a. Thread pilot adapter into sprocket shaft.

b. Thread pilot shaft onto pilot adapter.

c. Verify that lip garter spring is in place on both sides of oil seal.

d. Thread pilot onto sprocket shaft until contact is made with shoulder.

e. With the lettering facing outside, slide oil seal over pilot until it contacts bearing bore.

f. Set SPROCKET SHAFT OIL SEAL INSTALLER (Part No. HD-39361-B) (1) over pilot until it contacts oil seal.

g. Slide bearing and large flat washer over pilot until contact is made with seal installer.

h. Thread handle onto pilot shaft.

i. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount.

j. Remove handle, flat washer, bearing, seal installer and pilot from sprocket shaft.

14. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount.

15. Remove handle, flat washer, bearing, short collar, seal installer, pilot shaft and pilot adapter from sprocket shaft.

⚠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. See Figure 3-74. Remove screen and o-ring from chain guide oil passage (2). Perform leakdown test to verify proper assembly.

a. Obtain CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A) and a leakdown tester nipple which will fit inside the chain guide oil passage.

b. Allow compressed air to run to discharge any water.

c. Regulate air pressure to 35 PSI (241 kN/m^2). Feed shop air into leakdown tester and test for calibration. Place your gloved thumb on and off the adapter outlet and watch the pressure change.

d. Apply a light coat of clean H-D 20W50 engine oil to nipple. Insert nipple into chain guide oil passage (2).

e. Record the change in pressure. A typical system will read a 1-8 PSI (7-55 kN/m^2) drop on a MAC meter or a 6-16% drop (SNAP-ON meter reads 56-66) from 35 PSI (241 kN/m^2).

f. If a pressure drop higher than 11 PSI (75 kN/m^2) on a MAC meter or greater than a 20% drop (SNAP-ON meter reads 70 or greater) is detected, disassemble the engine and inspect the rubber interconnect. Replace if missing or damaged. If the interconnect is fine, replace the chain guide bracket.

g. Reinstall chain guide screen and o-ring.

NOTES

- *Individuals not using MAC leakdown testers supplied by KENT-MOORE TOOLS must also calibrate line pressure to 35 PSI (241 kN/m^2) using a remote pressure regulator if necessary.*
- *All SNAP-ON meters will use a baseline of a 50% change when outlet is plugged.*
- *O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

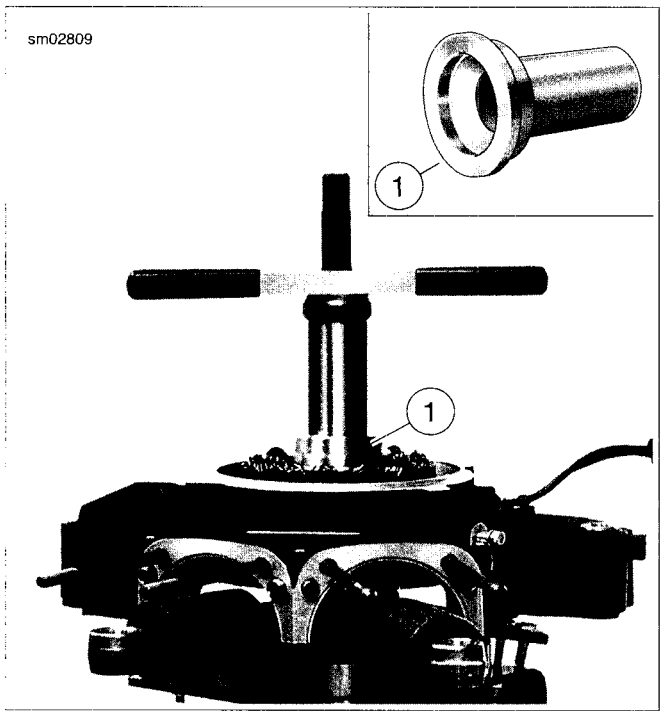
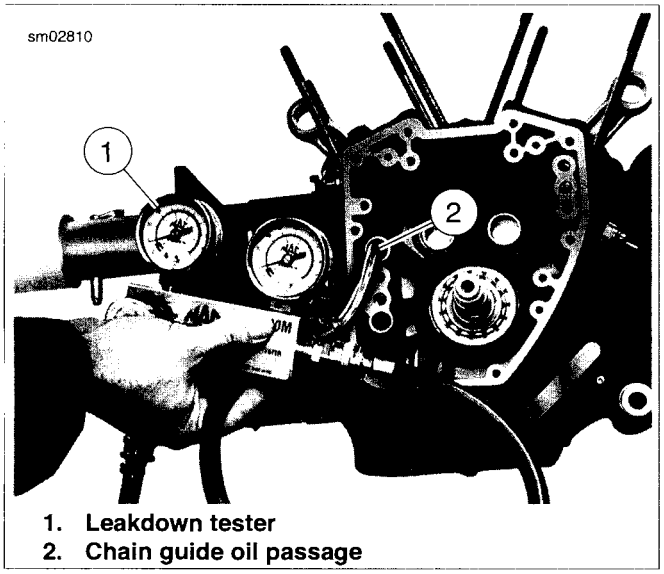


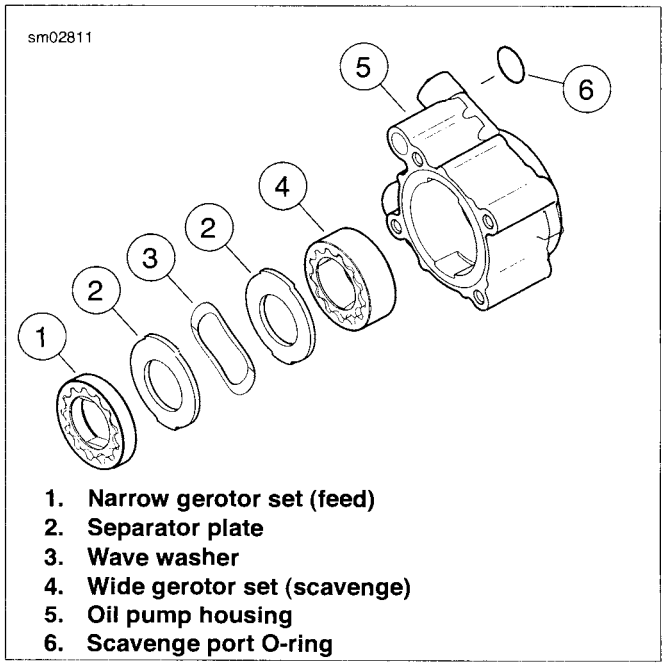
Figure 3-73. Sprocket Shaft Oil Seal Installer (Part No. HD-39361-A)



1. **Leakdown tester**
2. **Chain guide oil passage**

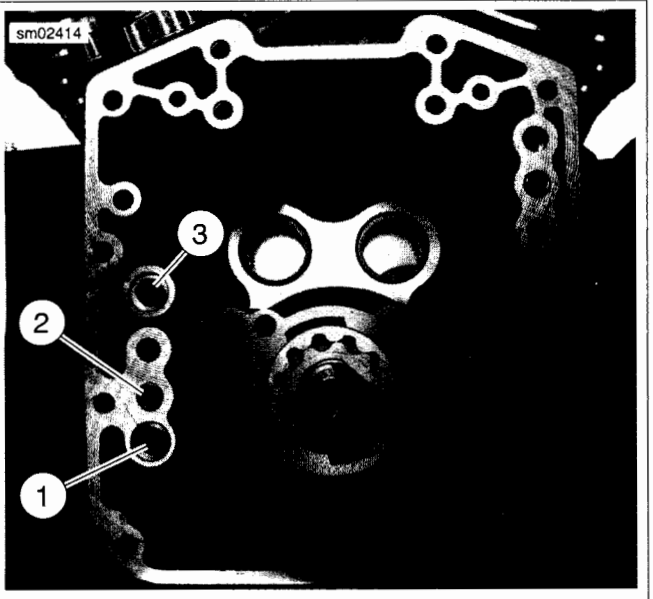
Figure 3-74. Leakdown Test

17. See Figure 3-75. Assemble and install oil pump. Lubricate parts with clean H-D 20W50 engine oil during assembly.
    a. Apply a very thin film of clean H-D 20W50 engine oil to **new** scavenge port stub o-ring (6). Install **new** o-ring on scavenge port stub of oil pump housing.
    b. Slide oil pump housing (5) onto crankshaft fitting o-ring on scavenge port stub into crankcase bore at back of cam compartment. Firmly push on scavenge port stub with thumb to be sure that it is snug in bore. Inspect o-ring on stub to verify that it is not pinched or distorted.
    c. Separate the gerotor gears into two sets, one wide (4) (scavenge) and the other narrow (1) (feed).
    d. Fit the smaller of the wide gerotor gears into the larger. Slide the wide gerotor set (4) down the crankshaft until it bottoms in the oil pump housing.
    e. Slide inside separator plate (2) down the crankshaft until it contacts the wide gerotor set (4). Install wave washer (3) and outside separator plate (2).
    f. Fit the smaller of the narrow gerotor gears into the larger. Slide the narrow gerotor set (1) down the crankshaft until it contacts the outside separator plate (2).
    g. See Figure 3-76. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for crankcase post. Install **new** o-ring in groove on crankcase post.



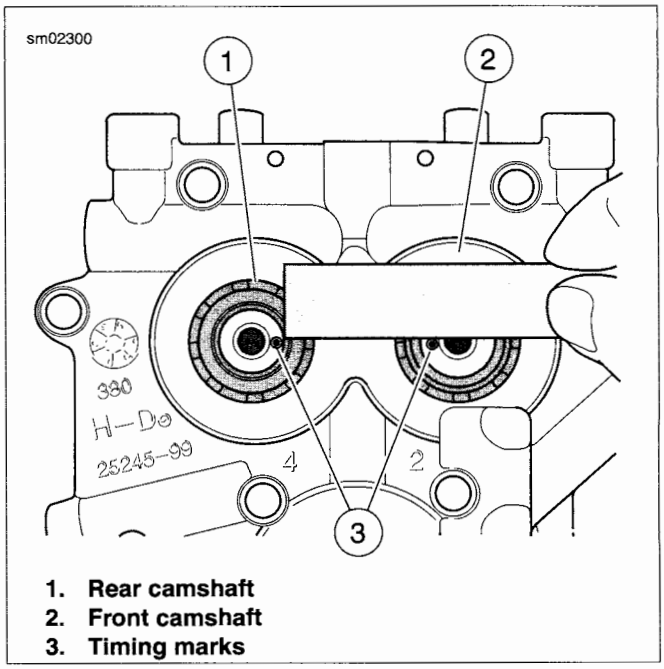
1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-75. Assembling Oil Pump



1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on crankcase post**

Figure 3-76. Oil Feed Hole



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-77. Verify Alignment of Timing Marks

CAM SUPPORT PLATE AND COVER

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use **new** O-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-76. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring (1) for crankcase flange. Install **new** O-ring in groove around oil feed hole directly below rear ring dowel (2).
2. Lubricate cam needle bearings with clean H-D 20W50 engine oil.
3. See Figure 3-77. Using a straightedge, verify that the timing marks on the ends of the front and rear camshafts are in alignment. If necessary, rotate camshafts in order to make this observation.
4. Aligning bushing in cam support plate with end of crankshaft, slide cam support plate over crankshaft onto two ring dowels in crankcase flange. Use a rubber mallet to fully seat cam support plate on ring dowels.
5. See Figure 3-78. Install cam support plate screws.
   a. Loosely install the six screws (1/4 x 1.0 in.) to secure the cam support plate to the crankcase flange.
   b. Tighten screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown.
6. See Figure 3-79. Install oil pump.
   a. Start four screws (1/4 x 1.0 in.) to secure oil pump.

   NOTE

   For methods of engine rotation, see 3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.

   b. While rotating the engine, enabling the pump to find its natural center, alternately tighten screws (1 and 2) until snug.
   c. Tighten the screws (3 and 4) until snug.
   d. Tighten all four screws to 40-45 **in-lbs** (4.5-5.1 Nm) in sequence shown.
   e. Final tighten all four screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown. Numbers cast adjacent to the bolt holes also indicate the oil pump torque sequence.
7. With the lettering facing inboard, install rear cam sprocket spacer onto the rear camshaft.

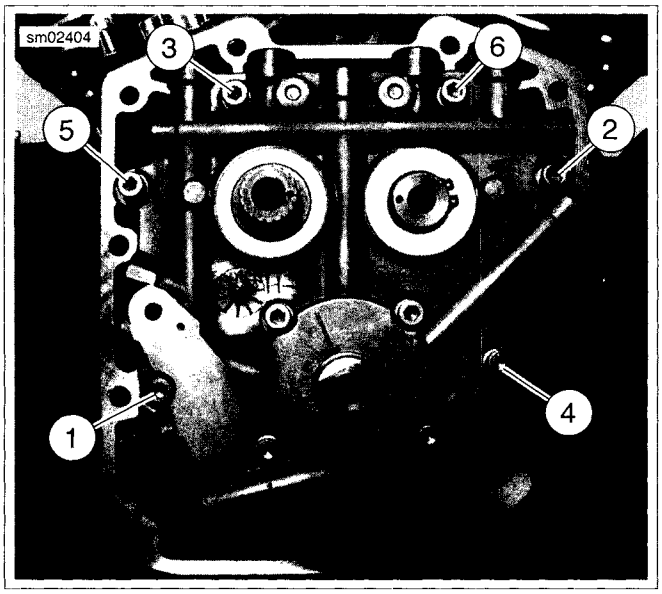


Figure 3-78. Cam Support Plate Torque Sequence

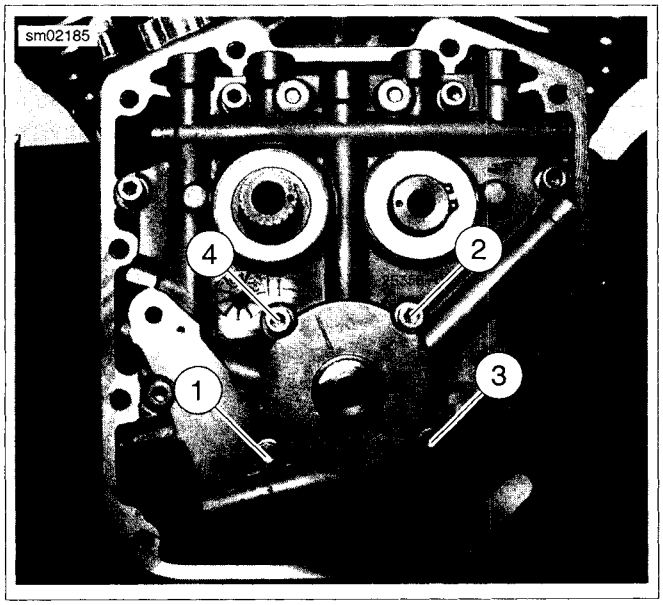


Figure 3-79. Oil Pump Torque Sequence

8. If using the original cam support plate, camshafts, primary cam sprocket, crank sprocket and flywheel assembly, then move to next step. However, if any of these parts have been replaced, then proceed as follows:
   a. Install primary cam sprocket onto splines of rear camshaft. Install long flange bolt with thicker flat washer to secure sprocket to end of camshaft.
   b. Install crank sprocket onto crankshaft. Install short flange bolt with a temporary smaller diameter flat washer from bulk inventory.

NOTE

Use of smaller diameter flat washer with crank sprocket flange bolt allows room on sprocket face for placement of straightedge.

   c. See Figure 3-80. To prevent rotation, position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and primary cam sprockets. The handle of the tool is stamped "Crank" and "Cam" to verify proper orientation. Tighten the crank and primary cam sprocket flange bolts to 15 ft-lbs (20.3 Nm). Remove the sprocket locking tool.
   d. Rotate engine stand so cam compartment is pointing upward. Push on crankshaft and rear camshaft to eliminate endplay.

      If engine was not removed from motorcycle, install compensating sprocket assembly to pull the crankshaft to the left side of the engine. Push on crankshaft and rear camshaft to eliminate endplay.
   e. See Figure 3-81. Place a straightedge across the crank and primary sprocket faces. Attempt to insert a 0.010 in. (0.254 mm) feeler gauge between the straightedge and the each sprocket face. If the feeler gauge will not fit at either location, sprocket offset is within specification. Remove both sprockets and discard temporary small washer.

NOTE

Height differences between rear cam sprocket and crank sprocket can be addressed by changing the spacer behind the rear cam sprocket. See spacer sizes in Table 3-32.

   f. If the crank sprocket rises above the face of the rear cam sprocket more than 0.010 in. (0.254 mm), remove the flange bolt and rear cam sprocket. Note the part number stamped on the existing spacer behind rear cam sprocket. Replace spacer with the next larger size.

      If the rear cam sprocket rises above the face of the crank sprocket more than 0.010 in. (0.254 mm), replace the spacer with the next smaller size only.
   g. Repeat height inspection with the **new** spacer installed. Remove both sprockets when measurement is within specification and discard temporary small washer.

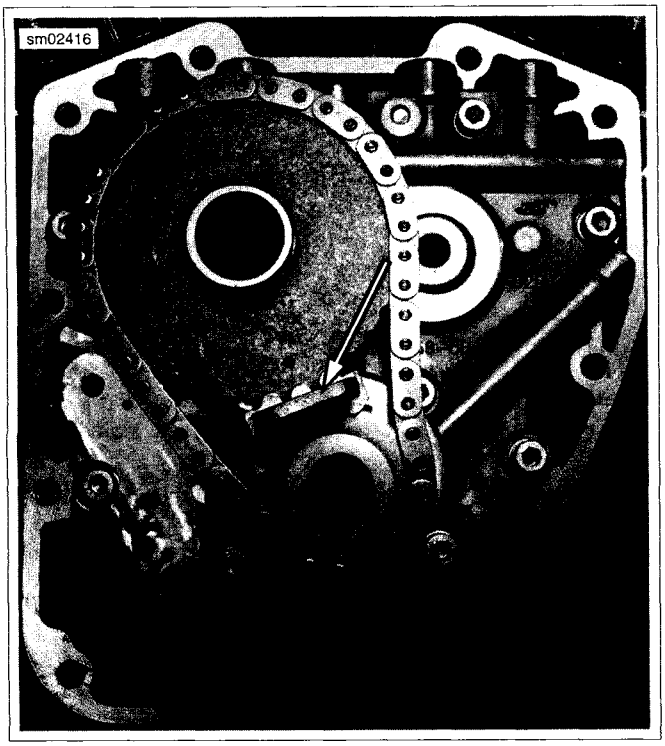


Figure 3-80. Camshaft Locking Tool

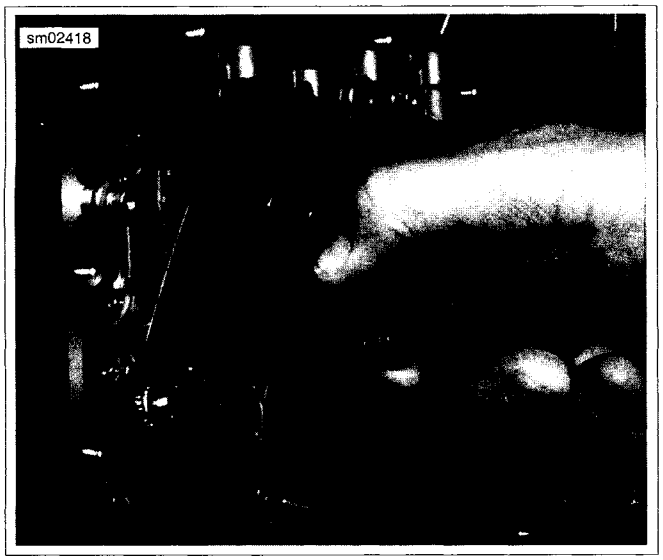


Figure 3-81. Check Alignment of Crank and Rear Cam Sprocket Faces

Table 3-32. Rear Cam Sprocket Spacers

PART NO.	IN.	MM.
25729-06	0.100	2.54
25731-06	0.110	2.79
25734-06	0.120	3.05
25736-06	0.130	3.30
25737-06	0.140	3.56
25738-06	0.150	3.81

9. See Figure 3-82. Apply a light amount of clean H-D 20W50 oil to splines on rear cam. Install the primary cam chain and sprocket assembly.
   a. Place the rear cam sprocket (2) in the primary chain. Hold the sprocket allowing the chain to hang loose. Rotate the sprocket so that the timing mark on the sprocket root faces straight downward.

NOTE

To maintain the original direction of rotation, verify that the colored mark placed on the chain link (7) and crank sprocket (4) is visible during installation.

   b. Place the crank sprocket (4) in the opposite end of the chain with the timing mark on the sprocket tooth facing straight upward (directly toward the cam sprocket timing mark).
   c. Maintaining the position of the sprockets on the chain with the timing marks in alignment, start the rear cam sprocket onto the end of the rear camshaft. Note that the sprocket has an integral key that must be aligned with the keyway in the camshaft.
   d. Maintaining the position of the crank sprocket on the chain, rotate the rear cam sprocket in a clockwise direction until the flat on the crank sprocket is aligned with the flat on the crankshaft. Install the crank sprocket.
10. Rotate the rear cam sprocket in a clockwise direction until the timing mark on the root is aligned with the timing mark on the crank sprocket tooth. Locate alignment mark (5) on cam support plate to verify that the timing marks are in alignment.

NOTES

- *If the timing marks are not in alignment, then the sprockets must be removed and reinstalled. Misaligned sprockets will make the engine run erratically.*
- *Rear sprocket bolt and crank sprocket bolt must install freely by hand. Before installing bolts, remove any build-up of LOCTITE THREADLOCKER from the bolt holes with the proper sized thread chaser.*
- *Both crank and rear cam sprocket flange bolts are specially hardened while the flat washers are of a special diameter. Use only genuine Harley-Davidson parts when replacement is necessary. If **new** flange bolts are not available, thoroughly clean both internal and external threads and apply a **small** amount LOCTITE THREADLOCKER 262 (red) before installation. The crank and rear cam sprocket flange bolts and flat washers are **not** interchangeable.*

11. Apply oil to bottom of **new** crank flange bolt head and washer (3). Loosely install to secure crank sprocket (4) to end of crankshaft.
12. Apply oil to bottom of **new** rear cam sprocket bolt head and washer (1). Loosely install to secure rear cam sprocket (2) to end of camshaft.
13. Position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and rear cam sprockets to prevent rotation. The handle

of the tool is stamped "Crank" and "Cam" to verify proper orientation.

a. Tighten both sprocket bolts (1, 3) to 15 ft-lbs (20.3 Nm).

b. Loosen both bolts one revolution (360 degrees).

c. Final tighten the rear cam sprocket bolt (1) to 34 ft-lbs (46.1 Nm).

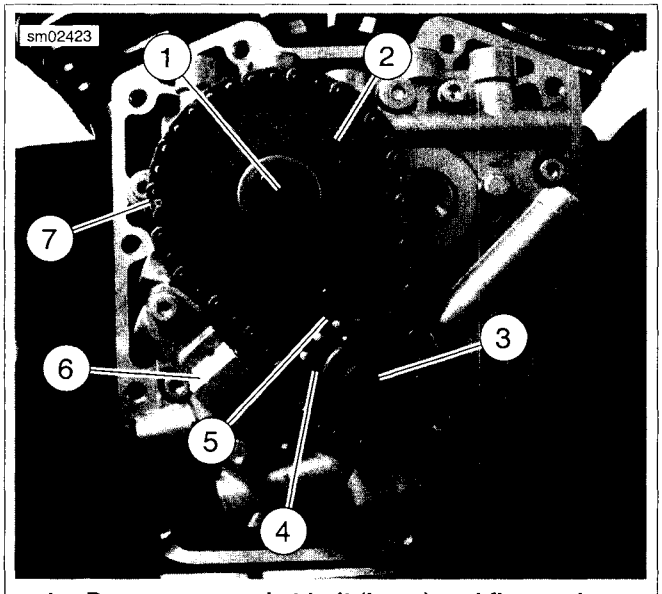
d. Final tighten the crank sprocket bolt (3) to 24 ft-lbs (32.5 Nm).

e. Remove the sprocket locking tool.

14. Install primary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).

15. Apply clean H-D 20W50 engine oil to crank and rear cam sprockets.

16. See Figure 3-83. Align holes in **new** cam cover gasket with those in the crankcase flange.



1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Crank sprocket bolt (small) and flat washer**
4. **Crank sprocket**
5. **Alignment mark on support plate**
6. **Primary chain tensioner**
7. **Marked link**

Figure 3-82. Primary Chain and Sprockets

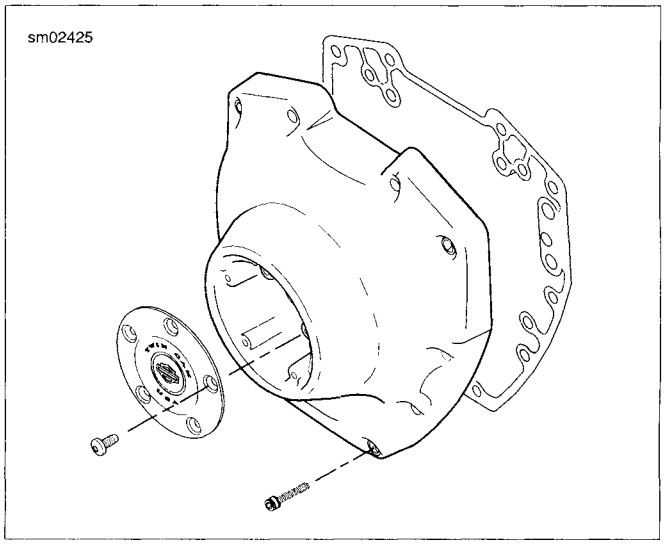


Figure 3-83. Cam Cover Gasket

NOTE

Before installing cam cover, verify cleanliness of blind holes in the crankcase flange. Tightening a screw with dirt, water or oil in the hole can cause the casting to crack or break. Damage to the casting requires replacement of the right crankcase half.

17. See Figure 3-84. Install the cam cover using socket head screws (1/4 x 1-1/4 in.). Following the sequence shown, tighten the screws to 125-155 **in-lbs** (14.1-17.5 Nm).

18. Complete motorcycle assembly.

a. If engine was completely overhauled, see 3.17 TOP END OVERHAUL: ASSEMBLY. Perform all steps.

b. If only cam compartment components were serviced, install push rod covers, push rods, rocker arm support plate and breather assembly. See appropriate topics under 3.17 TOP END OVERHAUL: ASSEMBLY.

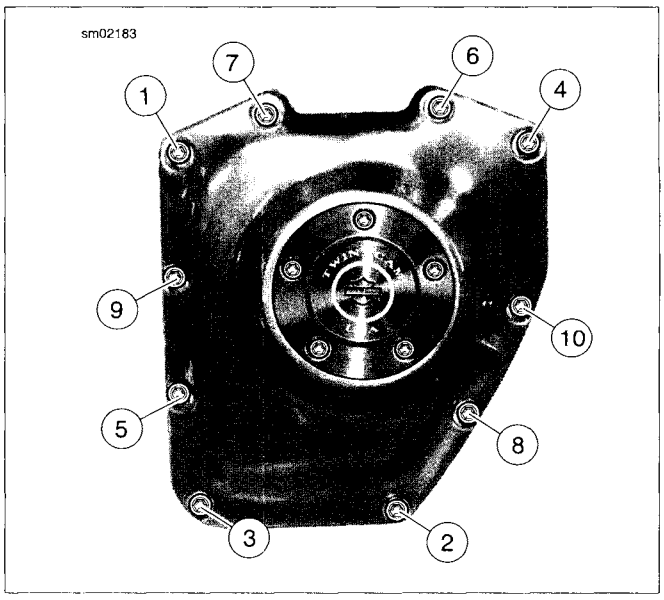


Figure 3-84. Cam Cover Screws

REMOVAL OVERVIEW

To remove breather assembly, see 3.16 TOP END OVERHAUL: DISASSEMBLY.

DISASSEMBLY

1. See Figure 3-85. Remove two fasteners (1) from the breather assembly cover (2) and remove breather assembly from rocker arm support plate (8).
2. Remove the breather cover and cover gasket (3). Discard gasket. Remove breather baffle (5) and breather baffle gasket (7). Discard gasket. Pull filter element (6) from bore on underside of breather baffle. Pull umbrella valve (4) from hole at top of breather baffle. Discard both filter element and umbrella valve.

CLEANING AND INSPECTION

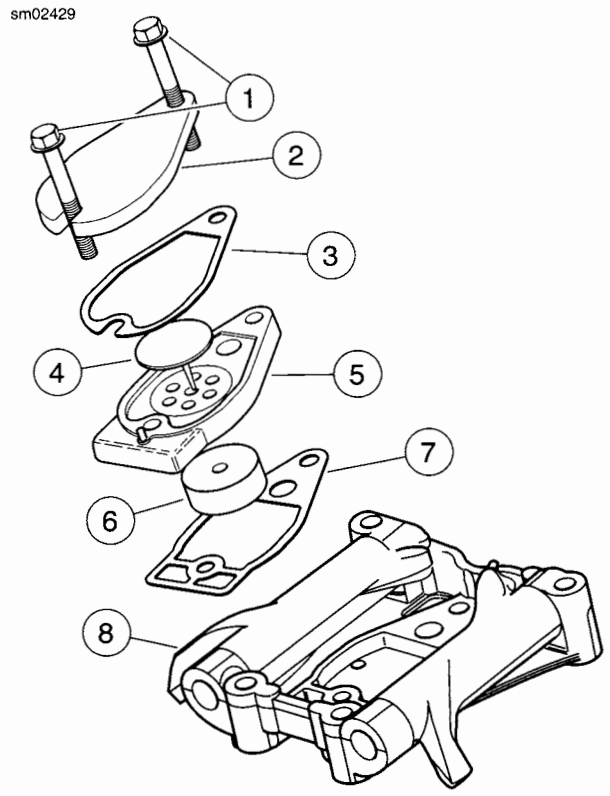
⚠WARNING

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 a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-85. Set a straightedge diagonally across the length of the breather cover (2) intersecting the opposite corners of the gasket surface. Slide a feeler gauge beneath the straightedge to check the breather cover for warpage. Repeat the step checking the opposite diagonal. Discard the breather cover if any low spot exceeds 0.005 in. (0.13 mm).
3. Using method outlined in previous step, inspect the breather baffle (5) gasket surface for flatness. Discard the breather baffle if any low spot exceeds 0.005 in. (0.13 mm).

ASSEMBLY

1. See Figure 3-85. Insert stem of **new** umbrella valve (4) through center hole at top of breather baffle (5). Carefully pull rubber bead on stem through hole in baffle. Use denatured alcohol or glass cleaner to lubricate stem, if necessary. Verify that rubber bead is pulled completely through hole and resides on bottom side of baffle.
2. Press **new** filter element (6) into bore at bottom of baffle. Hole in filter element accommodates umbrella valve stem.
3. Place breather baffle gasket (7) on a clean flat surface.
   a. Aligning holes, place breather baffle (5), cover gasket (3) and breather cover (2) on top of breather baffle gasket.
   b. Slide two fasteners (1) through stackup to keep assembly together until time of installation.



1. **Fasteners (2)**
2. **Breather cover**
3. **Cover gasket**
4. **Umbrella valve**
5. **Breather baffle**
6. **Filter element**
7. **Breather baffle gasket**
8. **Rocker arm support plate**

Figure 3-85. Breather Assembly

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

1. Install breather assembly.
2. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.

DISASSEMBLY

1. See Figure 3-86. Remove four bolts with flat washers (1) from the rocker arm support plate (5). The rocker arm shafts (4) on the push rod side (right) are notched to lock them in position.
2. Using a hammer and brass drift, tap left side of rocker arm shafts (4) so that the notched ends exit the rocker arm support plate (5) first. Mark the shafts so that they are installed in their original locations at time of assembly.
3. Remove the rocker arms from the rocker arm support plate. Mark the rocker arms to indicate location.

CLEANING AND INSPECTION

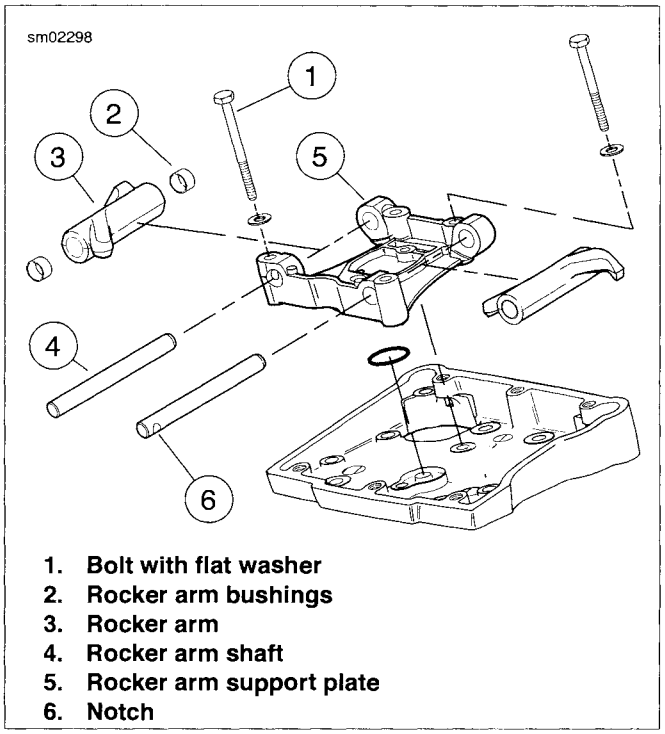
PART NUMBER	TOOL NAME
HD-94804-57	ROCKER ARM BUSHING REAMER

Inspection

⚠WARNING

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

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-86. Check rocker arms (3) for uneven wear or pitting where contact is made with the valve stem tips. Check for concave wear where rocker arms contact the push rod ends. Replace rocker arm if excessive wear is found at either location.
3. Verify that oil holes in rocker arms and rocker arm support plate (5) are clean and open.
4. Inspect rocker arm shafts (4) for scratches, burrs, scoring or excessive wear. Replace as necessary.



1. **Bolt with flat washer**
2. **Rocker arm bushings**
3. **Rocker arm**
4. **Rocker arm shaft**
5. **Rocker arm support plate**
6. **Notch**

Figure 3-86. Rocker Arm Assembly

Rocker Shaft Fit

1. See Figure 3-87. Measure the inside diameter of the rocker arm support plate bore.
2. See Figure 3-88. Measure the outside diameter of the rocker arm shaft where it fits in the bore.
3. Repeat the measurement on opposite side of support plate and shaft. Replace shaft or support plate if clearance equals or exceeds 0.0035 in. (0.089 mm).

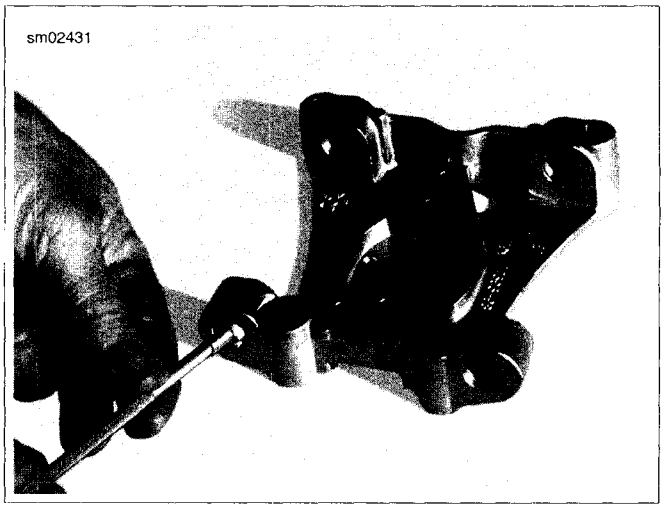


Figure 3-87. Checking Support Plate Bore

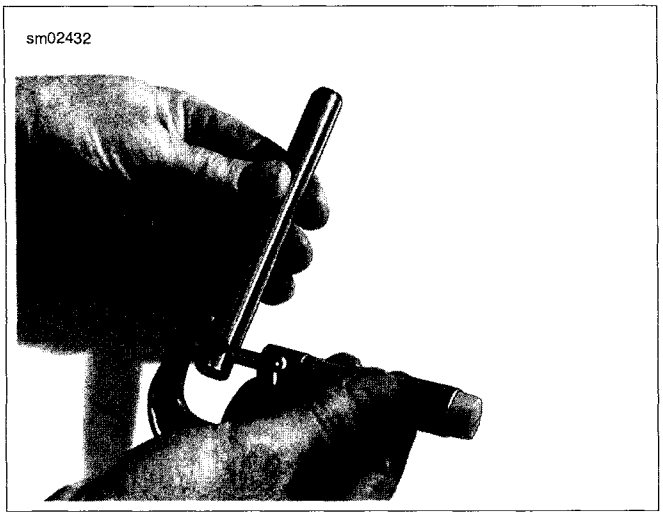


Figure 3-88. Checking Shaft to Support Plate Fit

Rocker Arm Shaft to Bushing

1. Check rocker arm shaft to bushing fit.
   a. See Figure 3-89. Measure the inside diameter of the rocker arm bushing.
   b. See Figure 3-90. Measure the outside diameter of the rocker arm shaft where it rides in the bushing.
2. Repeat measurement on opposite side of rocker arm and shaft. Replace shaft or bushings if clearance equals or exceeds service wear limit of 0.0035 in. (0.089 mm).

Figure 3-89. Checking Bushings

Figure 3-90. Checking Shaft to Bushing Fit

Replace Rocker Arm Bushings

NOTE

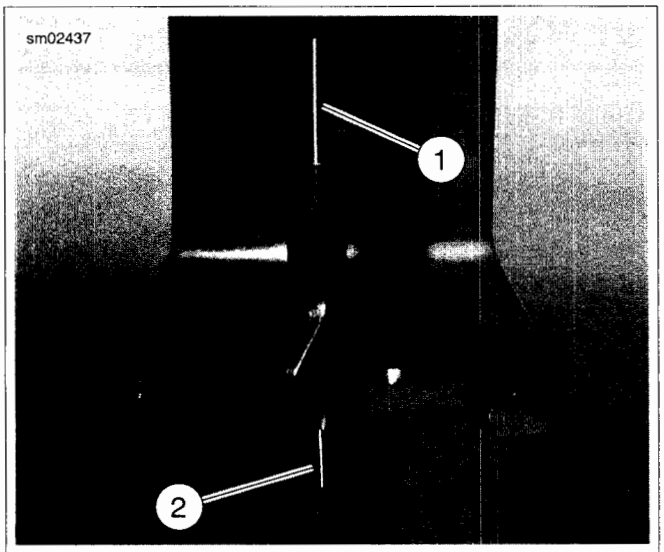
Bushing replacement and reaming must be done one at a time to ensure proper alignment. Follow all steps for one bushing and then repeat for the other bushing.

1. See Figure 3-91. Turn a 9/16"-18 tap (2) into bushing until tight. Place rocker arm under ram of arbor press with tap at bottom. Slide a discarded rocker arm shaft (1) through open end of rocker arm until contact is made with tap. Using shaft as driver (and untapped bushing as pilot), press against shaft until both tap and bushing are free.
2. See Figure 3-92. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. Be sure to orient bushing so that split line faces top of rocker arm.

NOTE

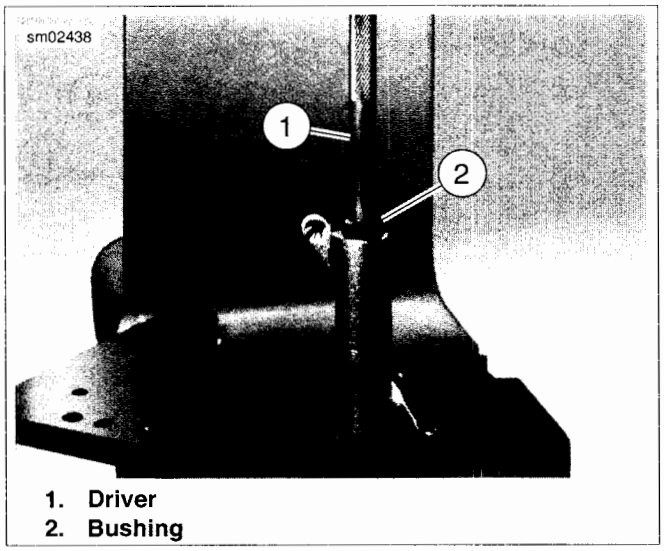
Never back reamer out of rocker arm or new bushing will be damaged.

3. See Figure 3-93. Lock rocker arm in a vise using brass jaw inserts or shop towels to prevent casting damage. Insert tapered end of ROCKER ARM BUSHING REAMER (Part No. HD-94804-57) into old bushing in rocker arm. Note that old bushing on drive side of reamer as pilot. Rotate reamer until the **new** bushing on the far side is reamed, and then continuing in the same direction, draw drive side of reamer from **new** bushing.
4. Repeat steps to remove, install and ream second bushing.



1. **Discarded shaft used as driver**
2. **Tap**

Figure 3-91. Removing Bushing



1. **Driver**
2. **Bushing**

Figure 3-92. Installing Bushing

Figure 3-93. Ream Bushing

ASSEMBLY

1. Place the rocker arms into position on the rocker arm support plate.
2. Push the un-notched ends of the rocker arm shafts into the right side of the support plate and then into the rocker arms. As they approach their fully installed positions, rotate the shafts so that the notches are aligned with the bolt holes in the support plate.
3. See Figure 3-94. Check for proper end play.
   a. Insert a feeler gauge between the rocker arm and support plate.
   b. Repeat measurement on other rocker arm.
   c. Replace the rocker arm, rocker arm support plate or both if end play exceeds 0.025 in. (0.635 mm).
4. Install the four bolts with flat washers in the rocker arm support plate. Remember that the two bolts on the push rod side (right) must engage the notches in the rocker arm shafts for proper assembly.

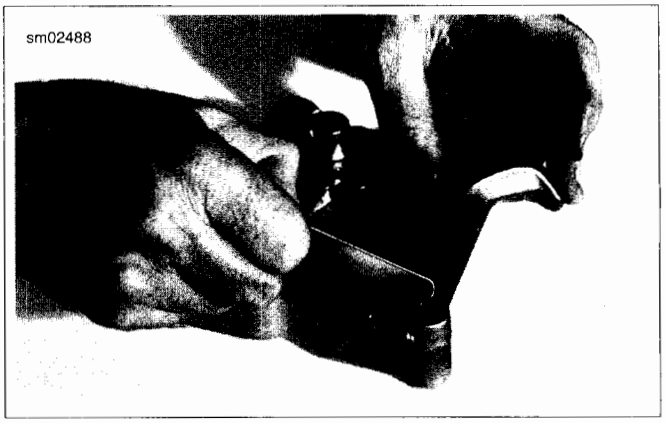


Figure 3-94. Check End Play

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install rocker arm support plate.
2. Install breather assembly.
3. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods, lifters and covers.

DISASSEMBLY

See Figure 3-95. With the exception of the lifter covers, all parts should have been disassembled and marked during the removal procedure. Disassemble the lifter covers as follows:

1. Separate upper (2) and lower push rod covers (8).
2. Remove O-ring (9) from seat at bottom of lower push rod cover. Discard O-ring.
3. Remove O-ring (1) from seat at top of upper push rod cover. Slide O-ring (7), flat washer (6), spring (5) and spring cap (4) from body of upper push rod cover (2). Discard O-rings.

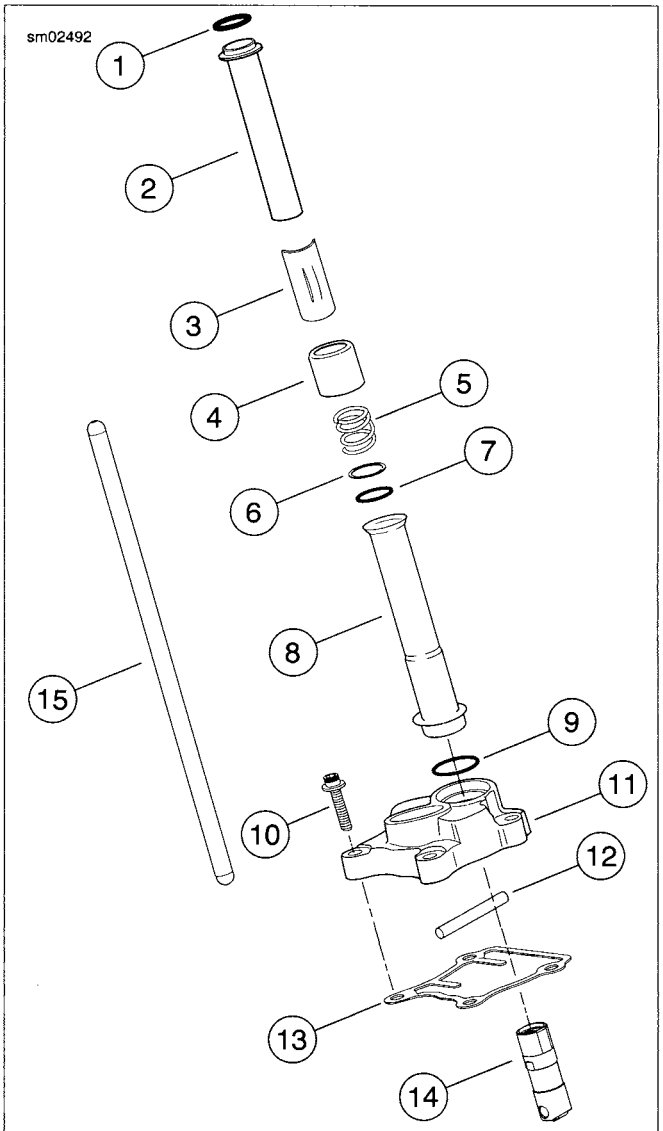
CLEANING AND INSPECTION

1. See Figure 3-95. Scrape old gasket material from the lifter cover (11) flange. Old gasket material left on mating surfaces will cause leaks.
2. With the exception of the hydraulic lifters (14), clean all parts in a non-volatile cleaning solution or solvent. Verify that the o-ring seats and contact surfaces of the push rod covers (2, 8) are completely clean.

⚠WARNING

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

3. Blow parts dry with low pressure compressed air. Verify that all oil holes are clean and open.
4. Verify that the hydraulic lifter rollers turn freely and are free of flat spots, scuff marks and pitting. If flat spots exist, examine the cam lobe on which the lifter operates.
5. Inspect the lifter socket for signs of wear. Verify that the plunger of the hydraulic lifter is fully extended up against the C-clip. Use index finger to pump plunger to verify lifter operation.
6. Examine the push rods (15). Replace any push rods that are bent, dented, broken or discolored. Replace the rod if the ball ends show signs of excessive wear or damage.
7. Cover all parts with a clean plastic sheet to protect them from dust and dirt.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Lifter cover screw**
11. **Lifter cover**
12. **Anti-rotational pin**
13. **Lifter cover gasket**
14. **Hydraulic lifter**
15. **Push rod**

Figure 3-95. Push Rods, Lifters and Covers

LIFTER INSPECTION

NOTE

Inside and outside micrometers used for measuring lifters and lifter bores must be calibrated to take accurate readings.

1. Inspect lifters for excessive clearance in bores. Accurately measure the lifter outer diameter and record the measurement.
2. Accurately measure lifter bore inner diameter with a snap gauge. Subtract this measurement from the lifter measurement to determine clearance.
   a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
   b. Install **new** lifters and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in (0.076 mm).
3. Check lifter roller radial play.
   a. Roller radial movement should be within 0.0006-0.0010 in (0.0152-0.0254 mm).
   b. Replace lifters if radial movement exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).
4. Check lifter roller end clearance.
   a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
   b. Replace lifters if end clearance exceeds SERVICE WEAR LIMIT of 0.022 in. (0.559 mm).
5. Soak lifters in clean engine oil. Keep covered until assembly.

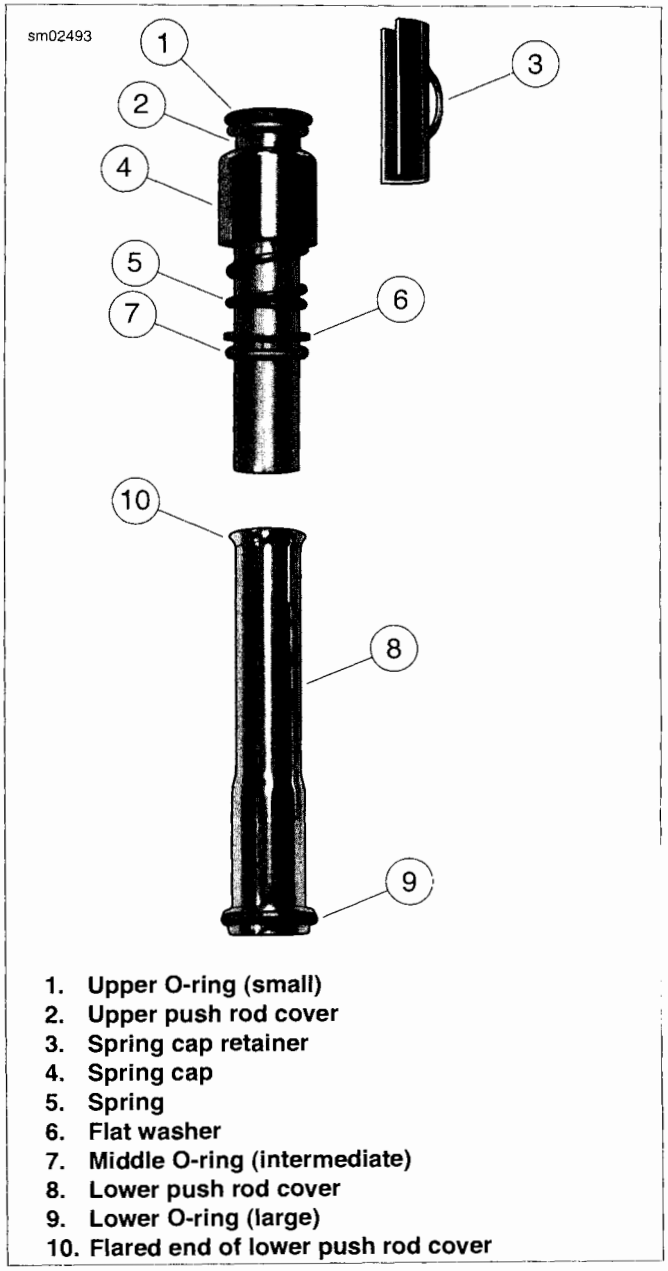
ASSEMBLY

With the exception of the push rod covers, all parts will be assembled during the installation procedure. Assemble the push rod covers as follows:

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use **new** O-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-96. Obtain three **new** O-rings (1, 7 and 9). Apply a very thin film of clean H-D 20W50 engine oil to O-rings before installation.
2. Install **new** small O-ring (1) on seat at the top of the upper push rod cover (2).
3. Slide the spring cap (4), spring (5), flat washer (6) and **new** intermediate size O-ring (7) onto the body of the upper push rod cover. Move parts up body until spring cap (4) contacts upper O-ring seat.
4. Fit the straight end of the upper push rod cover into the flared end of the lower push rod cover (8).
5. Install **new** large O-ring (9) on seat at bottom of lower push rod cover.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Flared end of lower push rod cover**

Figure 3-96. Assembled Push Rod Cover

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install push rods, lifters and lifter covers.
2. Install rocker arm support plate.
3. Install breather assembly.
4. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

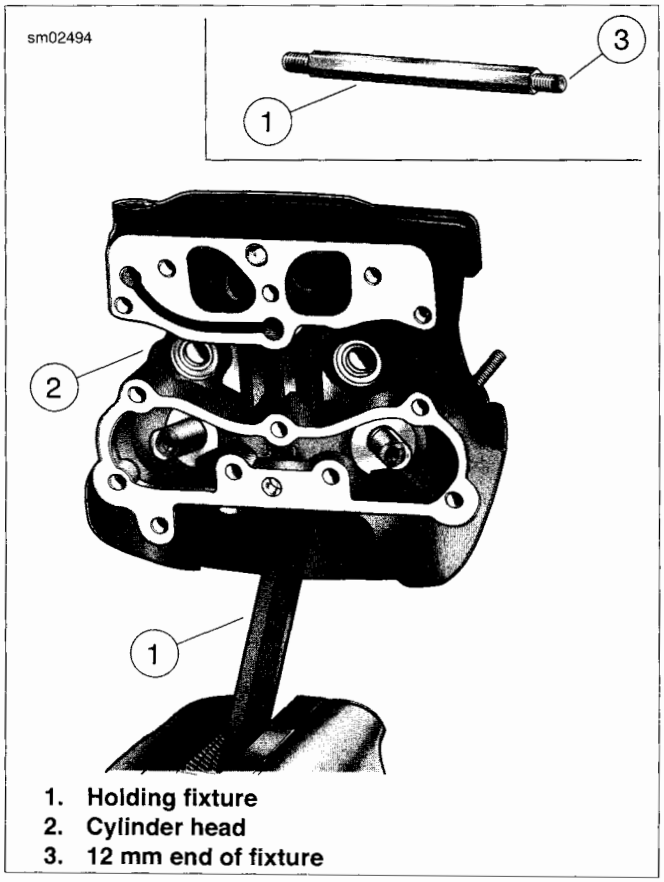
See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. If equipped, disconnect and remove ACR.
5. Remove cylinder head.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Before proceeding with the disassembly procedure, determine if cylinder head reconditioning is necessary.
   a. Raise valve ports of cylinder head to strong light source. If light is visible around edges of seats, then move to step 2 to recondition cylinder head.
   b. Fill ports at top of cylinder head with solvent. Wait ten full seconds and then check for leakage into combustion chamber. If solvent leakage into combustion chamber is evident, then move to step 2 to recondition cylinder head.
2. See Figure 3-97. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) (1) into cylinder head (2) spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

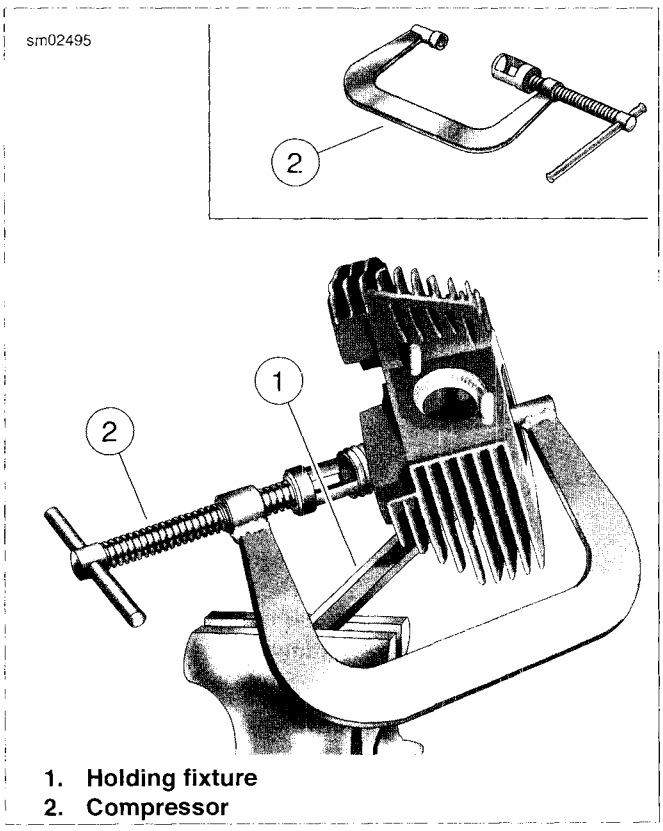


1. Holding fixture
2. Cylinder head
3. 12 mm end of fixture

Figure 3-97. Cylinder Head Holding Fixture

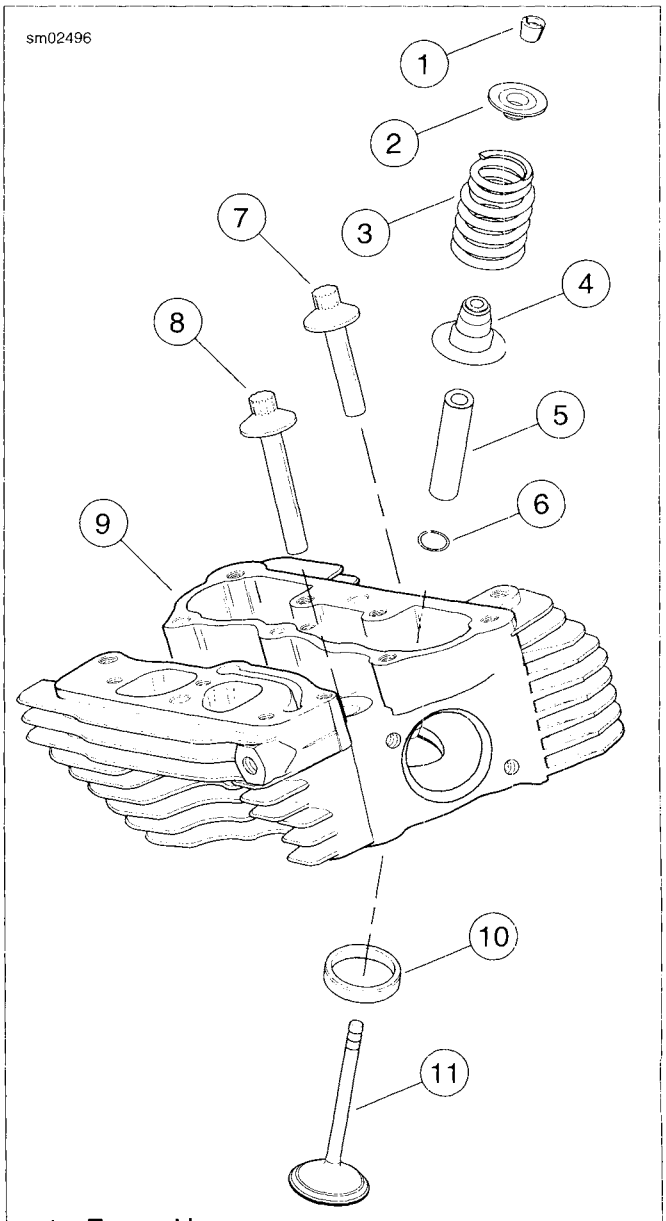
3. See Figure 3-98. Release valve spring compression.
   a. Place VALVE SPRING COMPRESSOR (Part No. HD-34736-B) (2) over cylinder head. Center blunt end on the valve head. Seat adapter at end of forcing screw on the valve spring retainer.
   b. Rotate forcing screw to compress valve spring.
   c. See Figure 3-99. If spring retainer (2) is not free of tapered keepers (1), give head of tool a sharp tap with a soft mallet. Using magnetic rod or small screwdriver, remove the keepers (1) from the valve stem (11) groove.
   d. Rotate forcing screw to release the valve spring compression.
4. Remove the spring retainer (2) and valve spring (3).
5. Slide the valve (11) from the valve guide (5).
6. Remove valve seal assembly.
7. Mark the bottom of the valve F(ront) or R(ear) for identification. Also, separate and tag tapered keepers, valve spring and spring retainer so that they are installed on the same valve at time of assembly.
8. Repeat previous steps to remove the other valve components.

9. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.



1. Holding fixture
2. Compressor

Figure 3-98. Valve Spring Compressor (Part No. HD-34736-B)



1. Tapered keepers
2. Spring retainer
3. Valve spring
4. Spring seat/valve stem seal
5. Valve guide
6. Lock ring
7. Cylinder head bolt, short
8. Cylinder head bolt, long
9. Cylinder head
10. Valve seat
11. Valve

Figure 3-99. Cylinder Head Assembly

CLEANING

1. See Figure 3-99. Remove old gasket material from cylinder head (9). Gasket material left on sealing surfaces will cause leaks.

CAUTION

Do not use glass or sand to bead blast surfaces exposed to engine oil. Blasting materials can lodge in pores of the casting. Heat expansion releases this material which can contaminate oil resulting in engine damage. (00534b)

NOTE

Bead blasting materials could also enter threaded holes adversely affecting fastener engagement and torque indication. Cover all threaded holes before bead blasting.

2. Remove all carbon deposits from combustion chamber and machined surfaces of cylinder head. Exercise caution to avoid removing any metal material. For best results, use an air tool with a **worn** wire brush. Scraping may result in scratches or nicks.
3. To soften stubborn deposits, soak the cylinder head in a chemical solution, such as GUNK HYDRO-SEAL or other carbon and gum dissolving agent. Repeat step 2 as necessary.
4. Thoroughly clean the cylinder head, spring retainers, tapered keepers, valves and valve springs in a non-volatile cleaning solution or solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

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

5. Blow parts dry with low pressure compressed air.

INSPECTION

PART NUMBER	TOOL NAME
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-42324-A	CYLINDER TORQUE PLATES
HD-96796-47	VALVE SPRING TESTER

Cylinder Head

1. Check for scratches and nicks on all gasket sealing surfaces.
2. Check for warpage.
   a. With the combustion chamber side facing upward, set a straightedge diagonally across the length of the cylinder head intersecting the upper and lower corners of the gasket surface.
   b. Slide a feeler gauge beneath the straightedge to check the head for warpage.
   c. Checking the opposite diagonal, repeat the procedure to verify that the gasket surface is flat (especially if a head gasket was blown). Discard the head if any low spot is 0.006 in. (0.152 mm) or greater.

NOTE

For best results, use one of the CYLINDER TORQUE PLATES (Part No. HD-42324-A) in lieu of the straightedge. Lay the upper plate (without vise grip) flat on the machined surface of the head. As a preliminary check, see if the plate rocks from side to side. A head on which the plate rocks is immediately suspect. Insert a feeler gauge between the plate and head at various locations to see if warpage exceeds above specification.

3. Verify that oil passageways are open and clean.

Valve Guides

1. Inspect external surfaces, particularly the combustion chamber side, for cracks. Replace the guide if any cracks are found.
2. Prepare valve guides for inspection.
   a. Lightly hone bore using the VALVE GUIDE HONE (Part No. B-45525).
   b. Scrub with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) to remove any dust or debris.
   c. Polish the valve stem with fine emery cloth or steel wool to remove carbon buildup.
3. Check valve stem to guide clearance:
   a. Carefully measure the **inside** diameter of the valve guide using an inside ball micrometer.
   b. Measure the **outside** diameter of the valve stem with an outside micrometer.
   c. Refer to Table 3-33. If the clearance between stem and guide exceeds the limits shown, the valve stem and/or guide are excessively worn.
   d. Repeat measurements with a **new** valve to determine if the guide must be replaced.

Table 3-33. Valve Stem to Guide Clearance Service Wear Limits

VALVE	IN.	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Valves

1. Replace the valve if there is evidence of burning or cracking.
2. Inspect the end of the valve stem for pitting or uneven wear. Replace 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.
4. To determine if the valve stem is excessively worn, see valve guide inspection.

Valve Springs

1. Inspect springs for cracked or discolored coils. Replace springs if either of these conditions are found.
2. Set the intake and exhaust valve springs on a level surface and use a straightedge to check for proper squareness

and height. Too much height corresponds to a reduction in spring pressure which results in sluggish valve action.

3. Check free length of springs using a dial vernier caliper or load test with the VALVE SPRING TESTER (Part No. HD-96796-47). Replace springs if free length or compression force do not meet specifications. See 3.2 SPECIFICATIONS.

Tapered Keepers

1. Inspect parts for damage or rust pits. Replace as necessary.
2. Inspect inboard side of tapered keepers for excessive wear. Upraised center must be pronounced and fit snugly in valve stem groove. Place keepers into groove and verify that they grip tightly without sliding.

Valve Seats

1. Inspect seats for cracking, chipping or burning. Replace seats if any evidence of these conditions are found.
2. Check seats for recession by measuring valve stem protrusion. See 3.23 CYLINDER HEAD, Valve and Seat Refacing.

VALVE GUIDE REPLACEMENT

PART NUMBER	TOOL NAME
B-45523	VALVE GUIDE REAMER
B-45524-1	VALVE GUIDE DRIVER
B-45524-2A	VALVE GUIDE INSTALLER SLEEVE
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39782-1	CYLINDER HEAD SUPPORT STAND
HD-39782-3	INTAKE SEAT ADAPTER
HD-39782-4	EXHAUST SEAT ADAPTER
HD-39782-B	CYLINDER HEAD SUPPORT STAND KIT
HD-39786	CYLINDER HEAD HOLDING FIXTURE
HD-39847	REAMER T-HANDLE
HD-39964	REAMER LUBRICANT

Removal

NOTES

- *If valve guide replacement is necessary, always install* ***new*** *guide before refacing valve seat.*
- *CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-B) ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, the cylinder head valve guide bore will be damaged during the press procedure.*

1. See Figure 3-100. Prepare cylinder head for valve guide replacement.
   a. Obtain CYLINDER HEAD SUPPORT STAND KIT (Part No. HD-39782-B).
   b. Insert sleeve of INTAKE SEAT ADAPTER (Part No. HD-39782-3) (3) or EXHAUST SEAT ADAPTER (Part No. HD-39782-4) (4) seat adapter into tube at top CYLINDER HEAD SUPPORT STAND (Part No. HD-39782-1) (2).
   c. Position cylinder head so that valve seat is centered on seat adapter.

NOTE

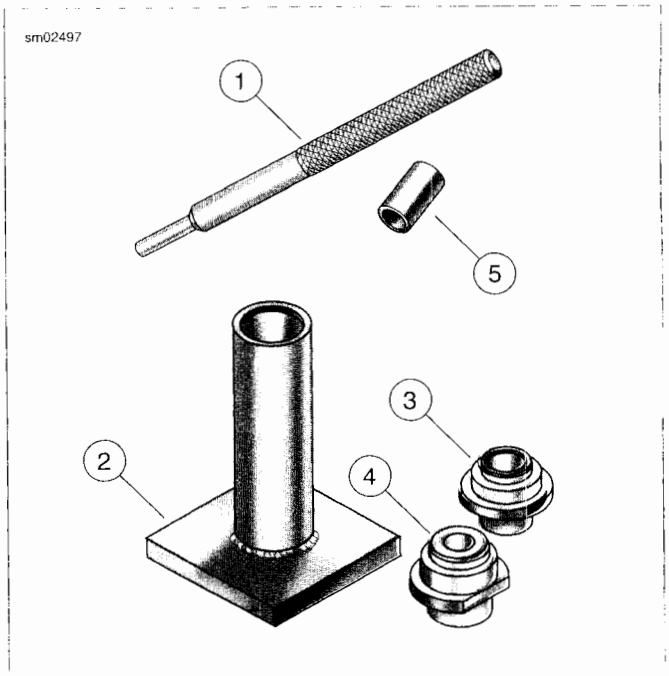
Do not press out the valve guide from the bottom of the cylinder head. Carbon buildup on the combustion chamber side of the guide can deeply gouge the cylinder head bore diminishing the likelihood of achieving the proper interference fit and possibly requiring replacement of the cylinder head casting.

2. Remove and discard lock ring from valve guide groove.

NOTE

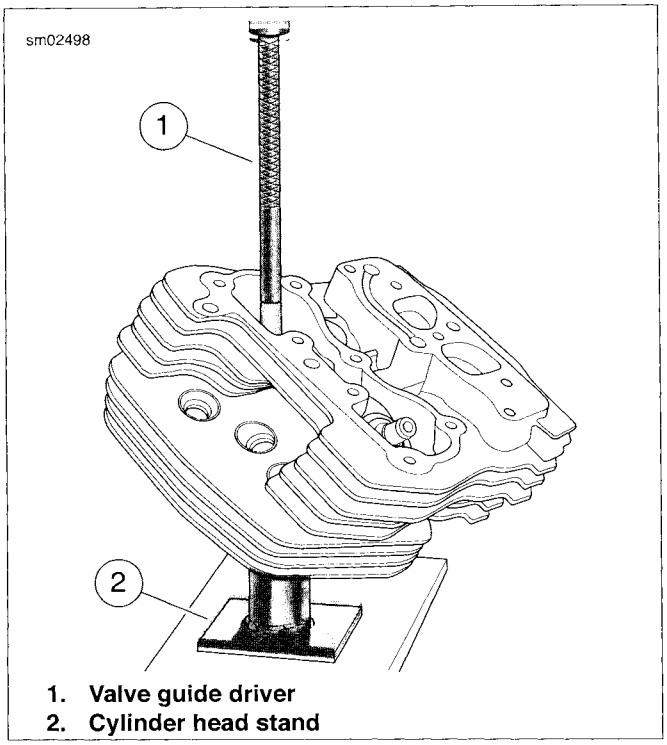
Lock ring is present on OEM intake and exhaust valve guides.

3. At top of the cylinder head, insert VALVE GUIDE DRIVER (Part No. B-45524-1) (1) into valve guide bore until stopped by shoulder.
4. See Figure 3-101. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.



1. **Valve guide driver**
2. **Cylinder head support stand**
3. **Intake seat adapter**
4. **Exhaust seat adapter**
5. **Valve guide installer sleeve**

Figure 3-100. Valve Guide Replacement Tools



1. **Valve guide driver**
2. **Cylinder head stand**

Figure 3-101. Remove Valve Guide

Installation

1. Check valve guide to valve bore clearance.
   a. Measure the outside diameter of a **new** standard valve guide.
   b. Measure the cylinder head valve guide bore. The valve guide should be 0.0020-0.0033 in. (0.051-0.084 mm) larger than the bore.
   c. If clearance is not within specification, then select one of the following oversize guides: 0.001 in. (0.025 mm), 0.002 in. (0.05 mm) or 0.003 in. (0.08 mm).

NOTE

Since some material is typically removed when the guide is pressed out, it is normal to go to the next larger size for the proper interference fit.

2. Measure cylinder head bore and outside diameter of selected oversize guide to verify correct interference fit.

NOTE

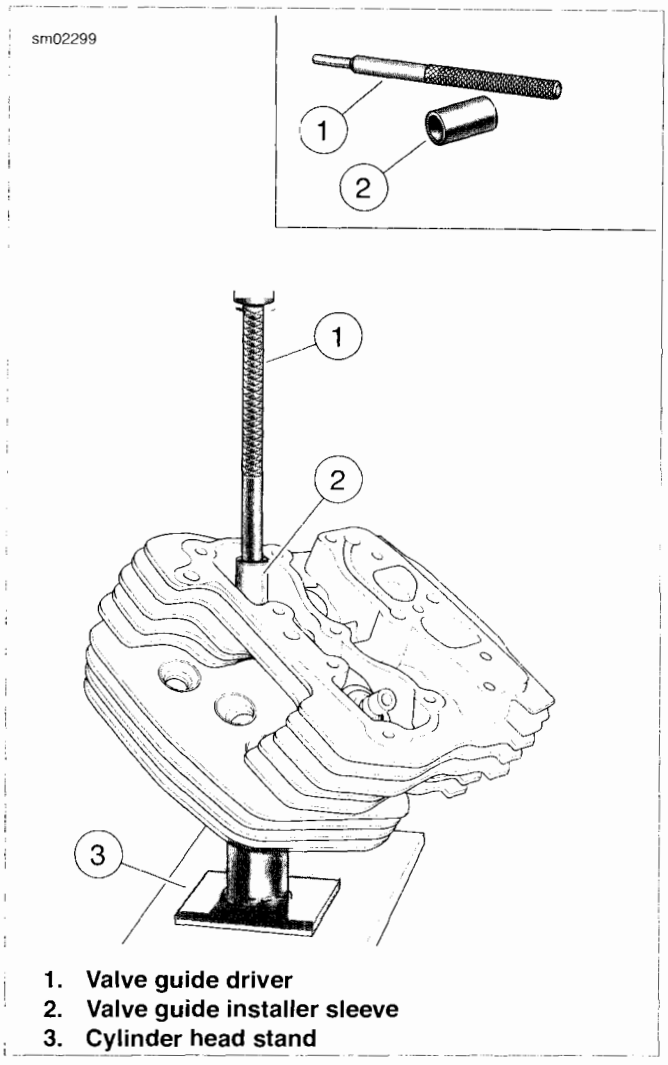
Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, cylinder head valve guide bore will be damaged during the press procedure.

3. Prepare cylinder head for valve guide replacement.
   a. See Figure 3-100. Insert sleeve of INTAKE SEAT ADAPTER (Part No. HD-39782-3) (3) or EXHAUST SEAT ADAPTER (Part No. HD-39782-4) (4) into tube at top of support stand (2). Position cylinder head so that valve seat is centered on seat adapter.
   b. Apply Vaseline to lightly lubricate external surfaces of valve guide. Spread lubricant so that thin film covers entire surface area.
   c. At top of cylinder head, start valve guide into bore.
   d. See Figure 3-102. Place VALVE GUIDE INSTALLER SLEEVE (Part No. B-45524-2A) (2) over valve guide and then insert tapered end of valve guide driver (1) into sleeve.
   e. Center valve guide driver under ram of arbor press and apply pressure only until valve guide is started in bore and then back off ram slightly to allow guide to center itself.

NOTE

Always back off ram to allow the valve guide to find center. Pressing guide into cylinder head in one stroke can bend driver, break guide, distort cylinder head casting and/or damage cylinder head valve guide bore.

   f. Verify that support stand (3) and driver (1) are square. Center driver under ram and press valve guide further into bore, but then back off ram again to allow valve guide to find center.
   g. Repeat previous step and then apply pressure to driver until installer sleeve contacts machined area of cylinder head.
   h. Install **new** lock ring into valve guide groove. Verify that lock ring is square and fully seated in the groove.



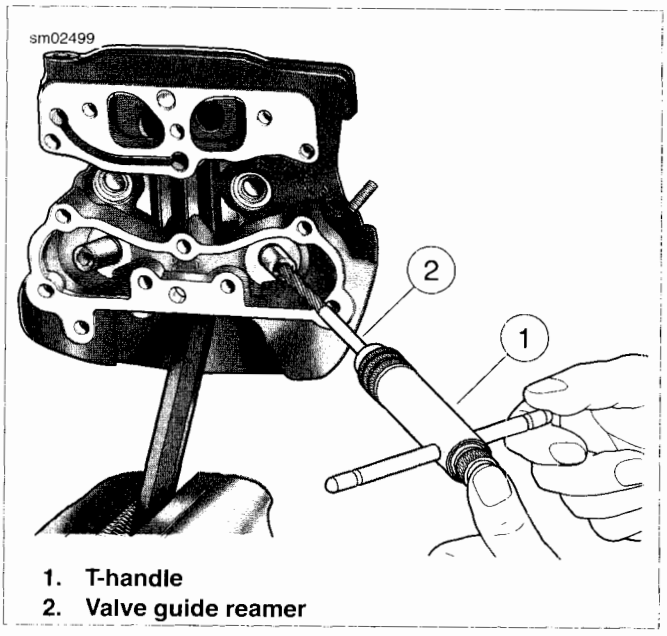
1. **Valve guide driver**
2. **Valve guide installer sleeve**
3. **Cylinder head stand**

Figure 3-102. Install Valve Guide

4. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

Valve guides must be reamed to within 0.0005-0.0001 in. (0.013-0.0025 mm) of finished size.



1. **T-handle**
2. **Valve guide reamer**

Figure 3-103. Reaming Valve Guide Bore

5. See Figure 3-103. Obtain the VALVE GUIDE REAMER (Part No. B-45523), REAMER T-HANDLE (Part No. HD-39847) and REAMER LUBRICANT (Part No. HD-39964).
   a. Install T-handle (1) on reamer (2).
   b. Apply a liberal amount of reamer lubricant to valve guide bore and bit of reamer. Start bit of reamer into bore at top of cylinder head.
   c. Placing thumb on drive socket of reamer T-handle, apply slight pressure on reamer while rotating in a clockwise direction. Squirt additional lubricant onto reamer and into guide as necessary.

NOTE

For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bore will be tapered if pressure is not centrally applied.

   d. Continue rotating reamer T-handle until entire bit has passed through valve guide bore and shank of reamer rotates freely.
   e. Remove T-handle from reamer, and carefully pulling on bit, draw shaft of reamer out combustion chamber side of valve guide.

⚠WARNING

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

6. Direct compressed air into the valve guide bore to remove any metal shavings or debris.
7. See Figure 3-104. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

8. See Figure 3-105. Obtain the VALVE GUIDE HONE (Part No. B-45525) and REAMER LUBRICANT (Part No.HD-39964).
   a. Install hone in a high speed electric drill.
   b. Apply reamer lubricant to finishing stones of hone and valve guide bore.
   c. Start finishing stones of hone into bore.
   d. Activating the drill, move the entire length of the finishing stone arrangement forward and backward through the bore for 10 to 12 complete strokes. Work for a crosshatch pattern of approximately 60°.
9. Direct compressed air into the valve guide bore to remove any debris. Clean with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

NOTE

Always verify valve stem to valve guide clearance after honing, since a worn reamer may cut the bore undersize.

10. Check valve stem to valve guide clearance.
    a. Measure the inside diameter of the valve guide with an inside ball micrometer.
    b. Measure the outside diameter of the valve stem with an outside micrometer.
    c. Refer to Table 3-34. If the clearance between stem and guide is not within the limits shown, the low end being preferable, then the valve stem may be excessively worn or the valve guide bore undercut.

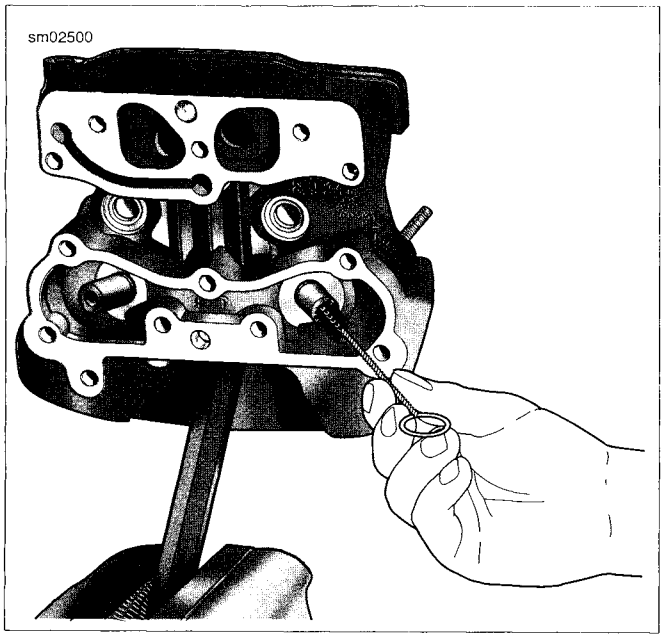


Figure 3-104. Scrubbing Valve Guide Bore

Figure 3-105. Honing Valve Guide Bore

11. Clean cylinder head assembly again.
    a. Using cleaning solvent, thoroughly clean cylinder head and valve guide bore.
    b. Scrub valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751). For best results, use a thin engine oil and clean valve guide bore with the type of swabs or patches found in gun cleaning kits.
    c. Continue to wipe bore until clean cloth shows no evidence of dirt or debris. Follow up with a thorough wash in hot soapy water.

⚠WARNING

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

12. Blow parts dry with low pressure compressed air.

Table 3-34. Valve Stem to Guide Clearance

VALVE	IN.	MM
Intake	0.001-0.003	0.0254-0.0762
Exhaust	0.001-0.003	0.0254-0.0762

VALVE AND SEAT REFACING

PART NUMBER	TOOL NAME
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-35758-C	NEWAY VALVE SEAT CUTTER SET
HD-39786	CYLINDER HEAD HOLDING FIXTURE

NOTES

- *Verify correct valve stem to valve guide clearance before refacing. Refer to Table 3-34. If **new** guides must be installed, complete that task before refacing valve seats.*
- *This procedure is not based on the lapping of valves. The end result is an interference fit between the 45° valve face and the valve seat which will be 46°.*

1. Hold the valve firmly against a wire wheel in a bench grinder. Remove all carbon deposits from the valve head, face and stem, but exercise caution to avoid removing any metal. Carbon left on the stem may affect alignment in the valve refacer. Polish the valve stem with steel wool or crocus cloth to remove any marks that might be left by the wire wheel.
2. Install valve (both intake and exhaust) in a valve refacer set to a 45° angle. The valve refacer is required equipment, since accuracy in matching the angle of the valve face with the angle of the valve seat is critical.

NOTES

- *Do not remove any more metal than is necessary to clean up and true the valve face. Removing metal reduces the service life of the valve. The amount of grinding needed to retrue the valve is a clear indication of its condition. Discard the valve if it cannot be quickly refaced while maintaining a good margin. See Figure 3-108. Valves that do not clean up quickly are either warped, excessively worn or too deeply pitted to be used.*
- *Obtain a **new** valve if grinding leaves the margin less than 0.0313 in (0.795 mm). A valve in this condition does not seat normally, burns easily and may crack or cause pre-ignition.*

3. Wipe valve seats and valve faces clean. From the bottom of the cylinder head, insert the valve stem into the valve guide. Push on head of valve until it contacts the valve seat.
4. See Figure 3-106. Measure valve stem protrusion. Seat wear causes the valve stem protrusion to change.
   a. Placing finger at bottom of valve to keep valve seated, use a dial vernier caliper to check the distance from the top of the valve stem to the machined area on the cylinder head.
   b. Seat wear and valve refacing causes the valve stem protrusion to change. If protrusion exceeds 2.069 in. (52.553 mm), then replace the valve, valve seat or cylinder head as necessary.

NOTE

Do not shorten the valve by grinding on the end of the stem. Grinding replaces the hardened case with mild steel which results in accelerated wear.

5. Secure cylinder head for servicing.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp fixture in vise and further tighten cylinder head onto the fixture to prevent any movement during operation.
   c. Place cylinder head at a 45° angle or one that offers a comfortable working position.
6. In order to determine the correct location of the 46° valve seat in the head, measure the width of the valve to be used and subtract 0.080 in. (2.032 mm) from that number.
7. Set your dial caliper to the lesser measurement and lock down for quick reference. This is the location of your valve seat.
8. Use a permanent magic marker to highlight the valve seat area that is going to be cut. Be sure to highlight all three angles. Allow marker to dry before proceeding.

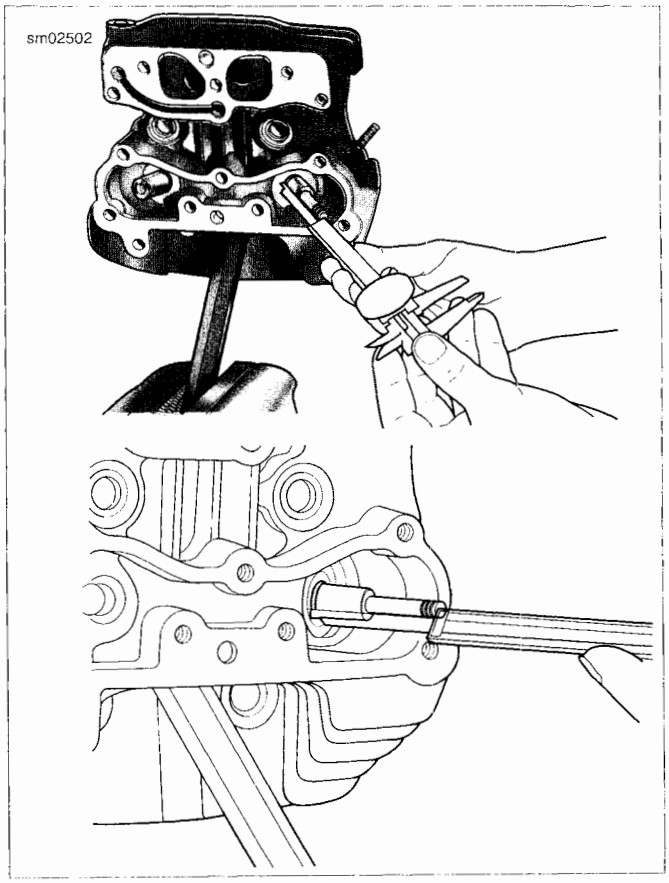


Figure 3-106. Checking Valve Stem Protrusion

NOTES

- *Always ensure cutter blades and cutter pilot are clean before beginning the cutting process. The correct cleaning brush is supplied with the Neway tool set.*
- *Always ensure the inside of the valve guide is clean by using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).*

9. See Figure 3-107. Obtain the NEWAY VALVE SEAT CUTTER SET (Part No. HD-35758-C). Choose the cutter pilot that fits properly into the valve guide hole. Securely seat the pilot by pushing down and turning using the installation tool supplied in the tool set.
10. Choose the proper 46° cutter (intake or exhaust) and gently slide the cutter onto the pilot. Be careful not to drop the cutter onto the seat.
11. While applying a constant and consistent pressure, remove just enough material to show a complete clean-up on the 46° angle. Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).

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 its 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.*

12. Next, with your dial caliper locked to the predetermined setting, measure the 46° cut at the outermost 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

- *Because you are using the top measurement of the 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 ensure the location of the 46° valve seat.*

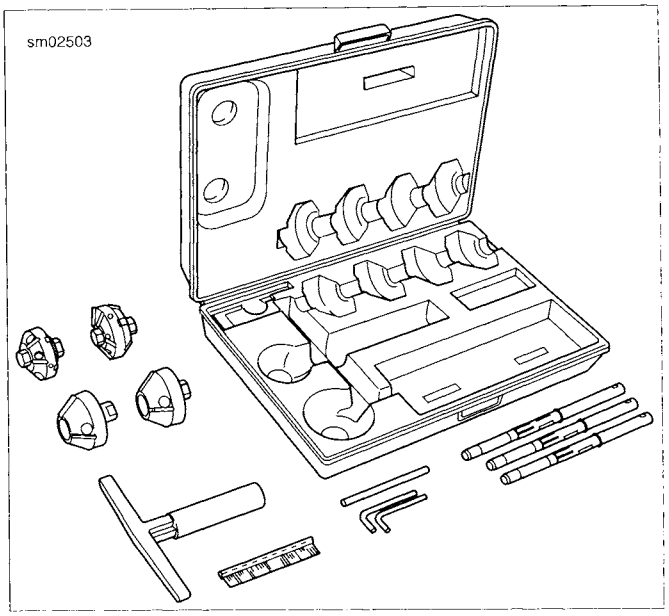


Figure 3-107. Neway Valve Seat Cutter Set

13. If the location of the valve seat is not correct, repeat steps 10 and 11.
14. 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.
15. Select the proper 60° cutter and gently slide the cutter down the cutter pilot to the valve seat.
16. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).
17. Remove cutter and cutter pilot.
18. 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

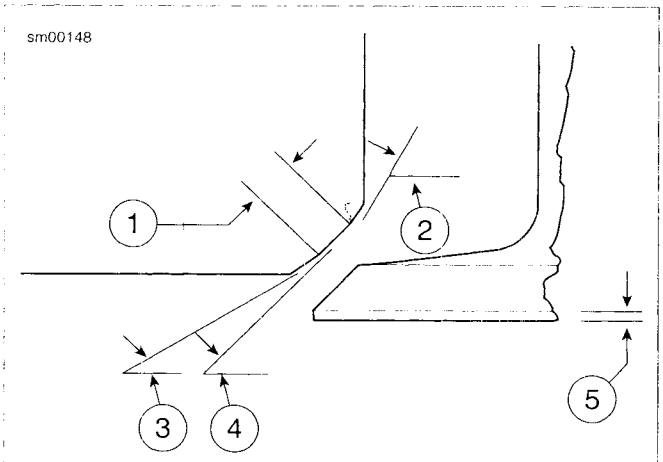
Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve and valve seat for irregularities or defects and if necessary repeat the above valve grinding or valve seat cutting process.

19. Repeat the process on any valve seat that needs service.
20. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

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

21. Blow parts dry with low pressure compressed air.



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 3-108. Valve and Seat Dimensions

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

At the time of disassembly, all parts should have been marked or tagged so that they are installed on the same valve (and in the same head).

2. Run the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) through the valve guide bore to verify cleanliness.
3. Using TORCO MPZ or another suitable product, apply a liberal amount of engine assembly lube to valve stem.
4. From the bottom of the cylinder head, insert the valve stem into the valve guide.
5. To distribute the assembly lube evenly around the valve stem and guide, hand spin the valve as it is installed. Work the valve back and forth in the bore to verify that it slides smoothly and seats properly.
6. Remove the valve and apply a second coat of assembly lube to the valve stem. Install the valve in the valve guide.

CAUTION

Failure to install plastic capsule can cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage can cause leakage around the valve stem, excessive oil consumption and valve sticking. (00535b)

7. See Figure 3-109. Push on bottom of valve until it contacts the valve seat. Placing finger at bottom of valve to keep valve seated, slide plastic capsule over valve stem tip and keeper groove.
8. Apply a very thin film of clean H-D 20W50 engine oil to capsule.
9. See Figure 3-110. Obtain **new** valve stem seal.
10. Slide new valve stem seal/spring seat over capsule and down valve stem until contact is made with top of valve guide and machined area of cylinder head casting. Remove capsule from valve stem tip.

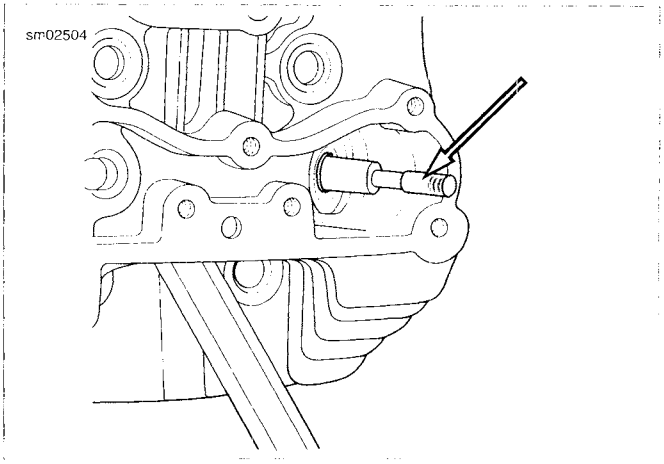


Figure 3-109. Plastic Capsule

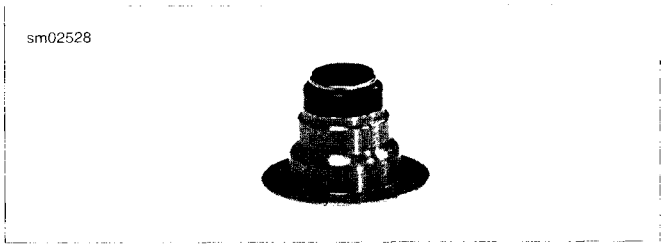
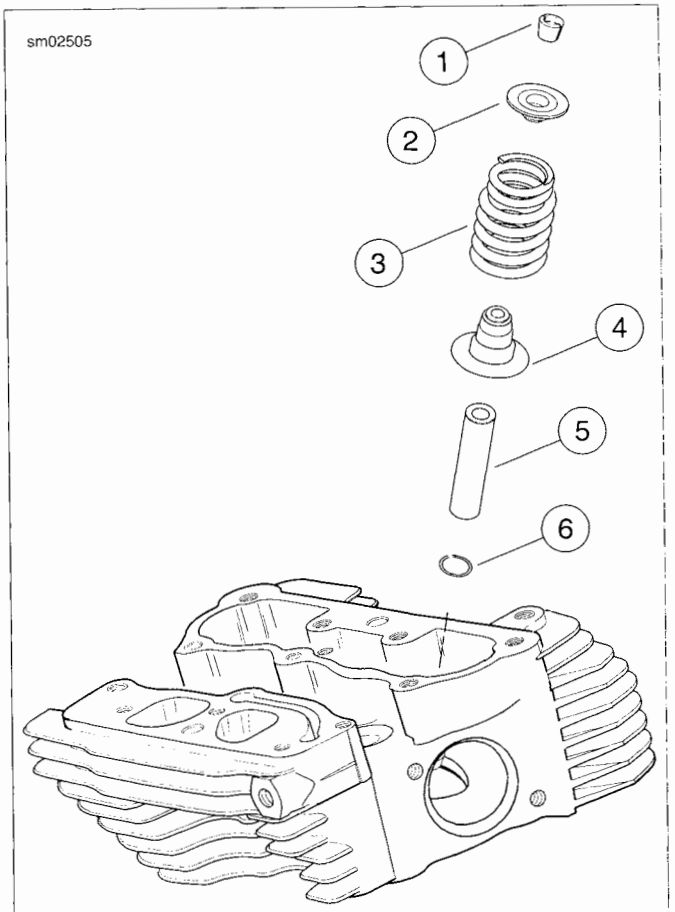


Figure 3-110. Valve Stem Seal/Spring Seat Assembly

11. See Figure 3-111. Apply a liberal amount of assembly lube to valve stem tip and keeper groove (1).
12. With the smaller diameter coils topside, install the valve spring (3) over the valve guide (5). Place the spring retainer (2) on top of the valve spring.

13. Obtain the VALVE SPRING COMPRESSOR (Part No. HD-34736-B) and proceed as follows:
    a. Place tool over cylinder head so that the blunt end is centered on the valve head and adapter at end of forcing screw is seated on the valve spring retainer.
    b. Rotate forcing screw to compress valve spring.
    c. With the tapered side down, fit the keepers into the valve stem groove. For best results, apply a dab of grease to the inboard side of the keepers before installation and use a magnetic rod for easy placement.
    d. Arranging tapered keepers so that the gaps are evenly spaced, turn forcing screw to release valve spring compression.
14. Tap the end of the valve stem once or twice with a soft mallet to ensure that tapered keepers are tightly seated in the valve stem groove.
15. Repeat previous steps to install the other valve components.
16. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.
17. Cover the cylinder head to protect it from dust and dirt until time of installation.



1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem set seal**
5. **Valve guide**
6. **Lock ring**

Figure 3-111. Valve Assembly

INSTALLATION OVERVIEW

PART NUMBER	TOOL NAME
HD-48498-A	ACR SOLENOID SOCKET

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder head.
2. Install push rod covers and push rods.
3. Install rocker arm support plate.
4. Install breather assembly.
5. If ACR equipped, apply three equally spaced drops of LOCTITE 246 THREADLOCKER MEDIUM STRENGTH/HIGH TEMPERATURE around lower third of threads and install ACR. Using ACR SOLENOID SOCKET (Part No. HD-48498-A), tighten to 11-15 ft-lbs (14.9-20.3 Nm).
6. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.

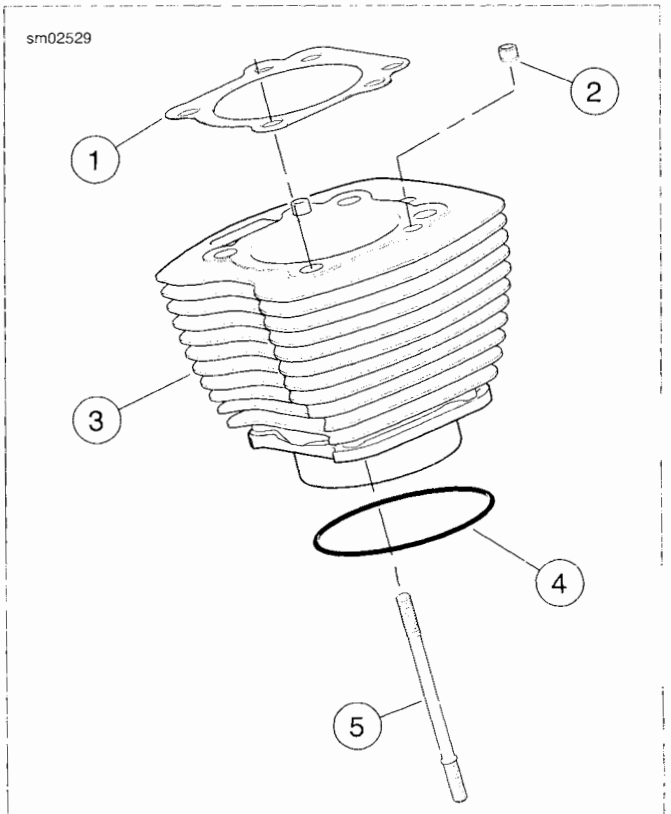
CLEANING

1. See Figure 3-112. Scrape any remaining cylinder head gasket material from the gasket surface at the top of the cylinder (3).

⚠WARNING

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

2. Clean cylinder in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air. Verify that oil passageways are clean and open.
3. Inspect the cylinder bore for obvious defects or damage in the ring travel area. Replace cylinders that are severely scored, scuffed, scratched, burnt or gouged.
4. Use a file to carefully remove any nicks or burrs from the machined surfaces of the cylinder.



1. **Cylinder head gasket**
2. **Dowel pin**
3. **Cylinder**
4. **O-ring seal**
5. **Cylinder stud**

Figure 3-112. Cylinder Assembly

INSPECTION

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES
TA360	SNAP-ON TORQUE ANGLE GAUGE

1. Using Magnaflux Dye Penetrant, inspect the cylinder for cracks. If no cracks are found, thoroughly wash cylinder to remove traces of dye.

2. See Figure 3-113. Check the machined surfaces for flatness using a feeler gauge and CYLINDER TORQUE PLATES (Part No. HD-42324-A) as follows:
   a. Lay gasket side of the upper torque plate (3) flat against the head gasket surface of the cylinder.
   b. As a preliminary check, see if the plate rocks from side to side. A cylinder on which the plate rocks is immediately suspect.
   c. Insert a feeler gauge between the plate and cylinder at various locations.
   d. The head gasket surface must be flat within 0.006 in. (0.15 mm).
   e. Lay the seal side of the lower torque plate (2) flat against the O-ring seal surface and check flatness using a feeler gauge.
   f. The O-ring seal surface must be flat within 0.004 in. (0.102 mm).
   g. Replace the cylinder (and piston) if either surface is not within specification.

NOTE

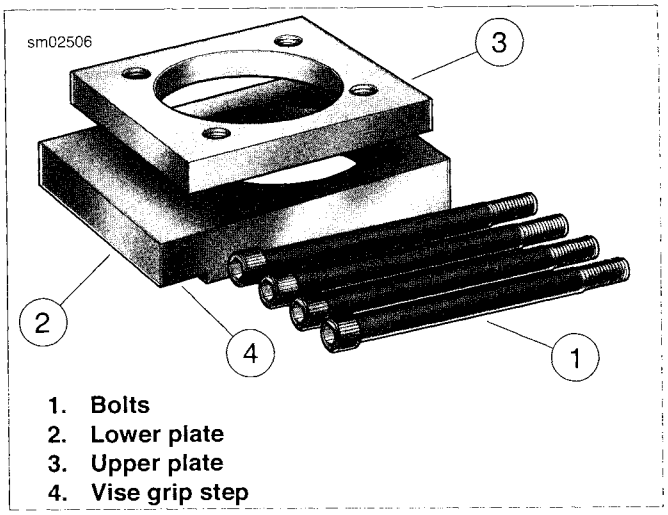
Failure to use cylinder torque plates can produce measurements that vary by as much as 0.001 in. (0.025 mm), possibly resulting in the use of parts that are not suitable for service.

3. Install CYLINDER TORQUE PLATES (Part No. HD-42324-A) as follows:
   a. Remove O-ring seal from cylinder sleeve, if installed.
   b. See Figure 3-114. Clamp the stepped side of the lower plate in a vise with soft jaws.
   c. Lightly oil threads and shoulders of four bolts (1) with clean H-D 20W50 engine oil and slide through holes of lower plate (2).
   d. Slide cylinder onto bolts with the indent in the cooling fins facing upward.
   e. Place a used head gasket on cylinder and install upper plate with blind holes aligned with dowel pins in cylinder. Secure with bolts (1).
   f. See Figure 3-115. Tighten the bolts to 120-144 **in-lbs** (13.6-16.3 Nm) in the sequence shown.
   g. Following the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.1 Nm).

NOTE

For best results use SNAP-ON TORQUE ANGLE GAUGE (Part No. TA360). If the tool is not available, mark a straight line on each bolt head continuing the line onto the lower plate.

   h. Turn each bolt an additional 90 degrees in the sequence shown in Figure 3-115.



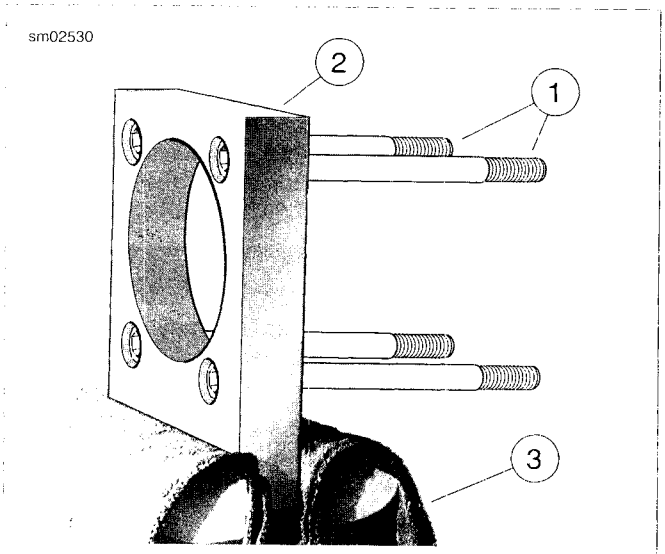
1. **Bolts**
2. **Lower plate**
3. **Upper plate**
4. **Vise grip step**

Figure 3-113. Cylinder Torque Plates (Part No. HD-42324-A)

NOTE

Maximum cylinder wear occurs at the top of top ring travel. Minimum wear occurs below ring travel. Failure to measure the cylinder at these points may result in a faulty decision regarding the suitability of the cylinder for continued use.

4. See Figure 3-116. Using an inside micrometer or dial bore gauge, check cylinder bore for out-of round and taper:
   a. At the top of the piston ring travel zone, measure the cylinder diameter at two locations; parallel and perpendicular to the crankshaft. Record the readings.
   b. Repeat the two measurements at the center of the piston ring travel zone and again at the bottom of the bore at a point below the piston ring travel zone.
   c. Refer to 3.3 SERVICE WEAR LIMITS. If the out-of-round or taper measurements are not within specification, the cylinder must be rebored and/or honed to accept the next standard oversize piston. See 3.24 CYLINDER, Boring and Honing Cylinder.
   d. If cylinders are not scuffed or scored and are not worn beyond the service limits, see 3.24 CYLINDER, Deglazing Cylinder.



1. Bolt (4)
2. Lower plate
3. Vise

Figure 3-114. Attaching Cylinder Torque Plates

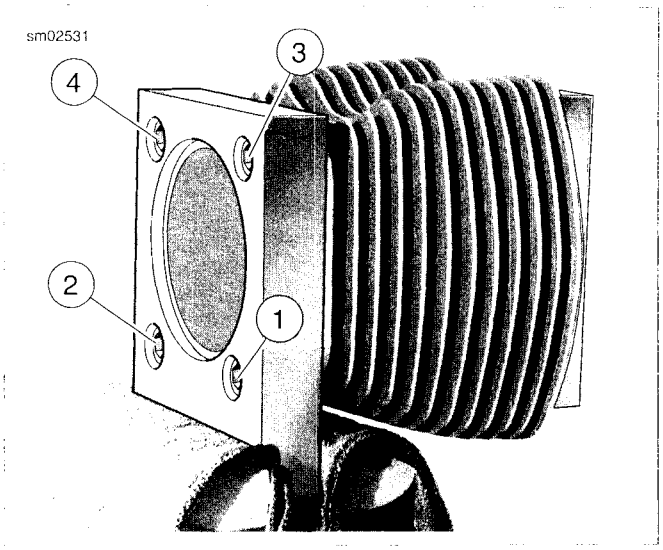


Figure 3-115. Cylinder Torque Plate Bolt Sequence

Figure 3-116. Measure for Out-of-Round and Taper

DEGLAZING CYLINDER

NOTE

Deglazing removes wear patterns, minor scuff marks and scratches without enlarging the bore diameter.

1. Lightly swab the cylinder bore with a cloth dipped in clean engine oil.
2. Obtain a 240 grit flexible ball-type deglazing tool with a bristle tip or finishing stone arrangement able to produce a 60° 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.
5. 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.

CAUTION

The angular cross hatch pattern ensures an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An incorrect cross hatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00536b)

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .

6. 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 of dirt or debris.
7. Hot rinse the cylinder and dry with moisture free compressed air. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder to prevent the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

8. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.25 PISTON, Inspection.

BORING AND HONING CYLINDER

1. Bore cylinder with gaskets and torque plates attached. Refer to Table 3-35. Bore the cylinder to 0.003 in. (0.08 mm) under the desired finished size.

CAUTION

An incorrect cross hatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00538b)

2. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60° crosshatch pattern.
3. Stop frequently to examine the cylinder bore and/or take measurements. Remember, a precise 60° crosshatch pattern in the piston travel area is important.

NOTE

Example: A 0.005 in. (0.13 mm) oversize piston for a Twin Cam 96™ will have the proper running clearance with a cylinder bore size of 3.7550-3.7555 in. (95.377-95.390 mm).

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .

4. 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 of dirt or debris.
5. Hot rinse the cylinder and dry with moisture free compressed air.
6. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder. This prevents the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

7. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.25 PISTON, Inspection.

Table 3-35. Oversize Pistons/Cylinder Bores, Twin Cam 110™

PISTON			CYLINDER BORE FINISHED SIZE	
SIZE	IN.	MM	IN.	MM
Standard	N/A	N/A	3.7500-3.7505	95.250-95.263
Oversize	0.005	0.13	3.7550-3.7555	95.377-95.390
	0.010	0.25	3.7600-3.7605	95.504-95.517

Table 3-36. Oversize Pistons and Cylinder Bores, Twin Cam 103™

PISTON		CYLINDER BORE FINISHED SIZE	
TYPE	SIZE	MINIMUM	MAXIMUM
Standard	STD	3.8750 in (98.425 mm)	3.8755 in (98.438 mm)
Oversize	0.005 in (0.13 mm)	3.8800 in (98.552 mm)	3.8805 in (98.565 mm)
	0.010 in (0.25 mm)	3.8850 in (98.679 mm)	3.8855 in (98.692 mm)

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder.
2. Install cylinder head.
3. Install push rod covers and push rods.
4. Install rocker arm support plate.

5. Install breather assembly.
6. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

NOTE

Do not use 2006 and earlier connecting rods with 2007 and later pistons. 2007 and later pistons have a tapered wrist pin boss. The wrist pin portion of the 2007 and later connecting rod is tapered to match the boss on the piston.

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.
6. Remove piston.

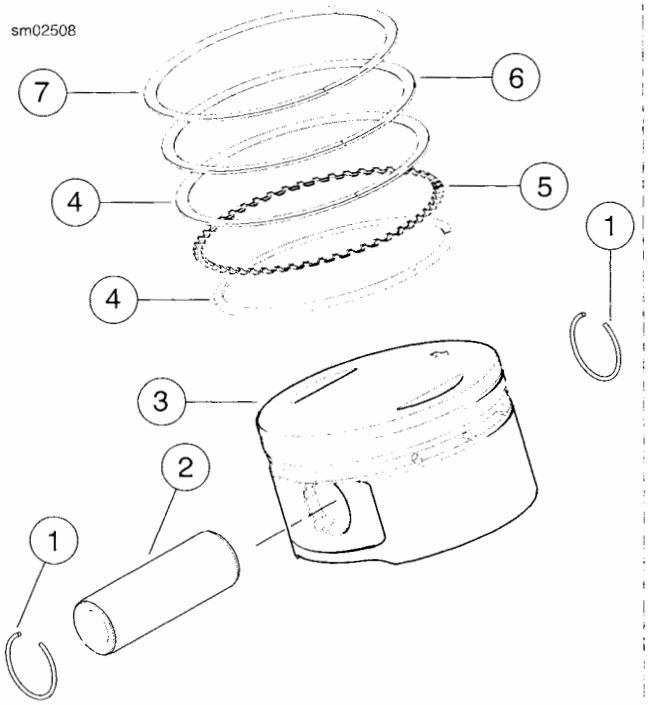
DISASSEMBLY

Piston Rings

⚠WARNING

Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)

1. See Figure 3-117. Carefully remove top (7) and second (6) compression rings using the proper piston ring expander (Snap-on PRS8).
2. Using your fingers, remove top and bottom oil rails (4) from the third ring groove. Remove the oil rail expansion ring (5).
3. Discard the piston rings.



1. **Circlip**
2. **Piston pin**
3. **Piston**
4. **Oil rail**
5. **Expansion ring**
6. **Second compression ring**
7. **Top compression ring**

Figure 3-117. Piston Assembly

CLEANING

1. To remove all carbon and combustion deposits, soak the pistons in a special detergent that will not corrode aluminum. Maintain the temperature of the cleaning solution well below 212° F (100° C).

NOTE

Do not sand blast or glass bead blast pistons. Bead blasting rounds off ring lands and will result in oil contamination leading to accelerated wear.

⚠WARNING

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

2. Thoroughly rinse the pistons. Blow parts dry with moisture free compressed air.
3. Clean the oil drain holes leading from the oil control ring groove to the underside of the piston crown. Run a small bristle brush through the passageways to ensure their cleanliness, but be careful not to damage or enlarge the holes. Do not use a wire brush.

4. Verify that all other oil holes are clean and open.

NOTE

Exercise care to avoid scratching the sides of the piston ring grooves.

5. Thoroughly clean the three piston ring grooves of all carbon deposits. A broken compression ring properly ground to a sharp chisel-like edge may be used for this purpose.

6. Using Magnaflux Dye Penetrant, inspect the piston for surface cracks. Pay special attention to the area around the pin bores, ring lands and oil drain holes beneath the piston crown. If no cracks are found, thoroughly wash piston to remove traces of dye.

INSPECTION

1. See Figure 3-118. Check piston pin. Pin must slide without binding.
   a. Lightly oil a good piston pin and insert it into the piston pin bore to feel for the proper interference fit. The pin should slide in and out without binding, but also without pivoting or rocking.
   b. Replace piston and/or pin if clearance exceeds 0.0008 in. (0.02 mm).

NOTE

Pistons with superficial wear marks, minor scratching or mild scoring may continue to be used.

2. Carefully inspect the pistons for damage or excessive wear.
   a. Discard pistons with cracked, worn or bent ring lands.
   b. Check the piston skirt for cracks, gouges, deep scratches or heavy scoring.
   c. Check the piston heads for evidence of burning, etching or melting.
   d. Look for marks or imprints caused by contact with valves.

3. Run your index finger around the edge of the piston crown to feel for dings, nicks or burrs. Lightly file the edge of the crown to remove any defects.

NOTE

Worn ring grooves result in high oil consumption and blow-by of exhaust gases. Blow-by of exhaust gases contaminates the engine oil supply with acids and leaves sludge in the crankcase. It also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.

4. See Figure 3-119. Measure piston ring side clearance.
   a. Insert the edge of a **new** ring into the piston ring groove. Insert a feeler gauge between the upper surface of the ring and the ring land.
   b. Since the grooves wear unevenly, repeat this check at several locations around the piston groove circumference.
   c. Discard the piston if the side clearance of either compression ring exceeds 0.0045 in. (0.11 mm).
   d. Discard the piston if the oil control ring side clearance exceeds 0.010 in. (0.25 mm).

NOTES

- *Check the piston clearance in the cylinder in which the piston will run. The torque plates must be installed on the cylinder and it must be deglazed and suitable for continued service.*
- *This inspection is very heat sensitive. Do not check piston running clearance immediately after honing or deglazing cylinder. Even holding the piston in your hand for too long can cause measurements to vary by as much as 0.0002 in. (0.0051 mm). Both piston and cylinder must be at room temperatures before proceeding.*
- *Piston measurement is taken on the bare aluminum to avoid measuring errors. An oval-shaped opening is present on each side of the piston for proper placement of the micrometer. See upper frame of Figure 3-120. The oval openings are too small for a standard flat anvil micrometer which would result in measuring errors. Use a 3-4 inch blade or ball anvil style micrometer, or a 4-5 inch micrometer with spherical ball anvil adapters. See lower frame of Figure 3-120.*

5. See Figure 3-120. Measure running clearance of pistons as follows:
   a. Holding outside micrometer, measure piston skirt diameter across the thrust faces (perpendicular to piston pin bore). Start below the bottom ring land and move micrometer towards bottom of skirt. Micrometer will be loose, then tight, about 0.5 in. (12.7 mm), from bottom and then loose again.
   b. Measure the piston skirt at the tightest spot and then transfer that measurement to dial bore gauge.
   c. Using a grease pencil, mark the top, middle and bottom of the piston ring travel zone in the cylinder bore. Measure at markings in cylinder parallel and perpendicular to crankshaft.
   d. Replace piston and/or cylinder if running clearance exceeds 0.003 in. (0.076 mm).

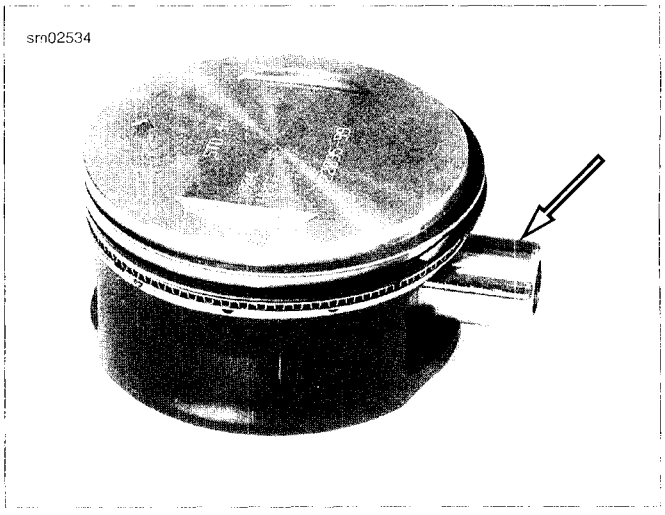


Figure 3-118. Piston Pin Clearance

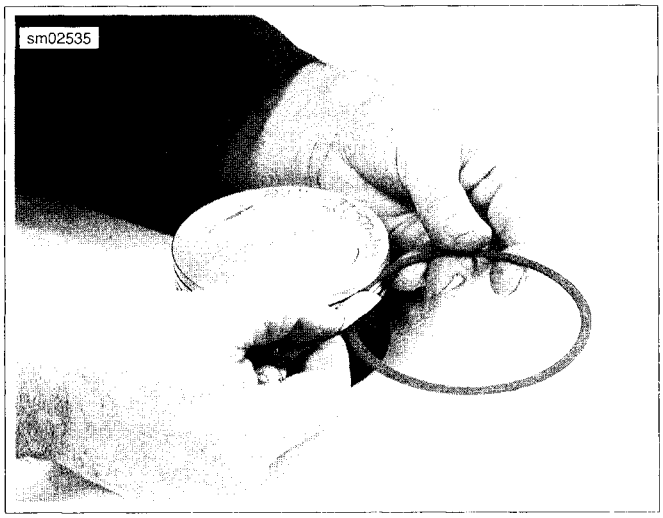
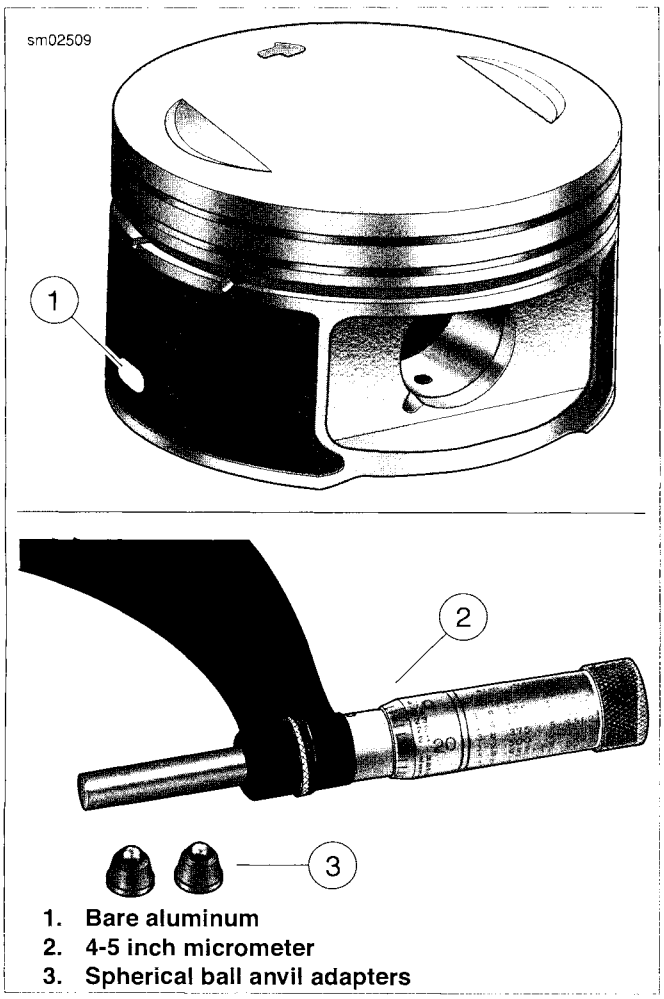


Figure 3-119. Measure Piston Ring Side Clearance



1. **Bare aluminum**
2. **4-5 inch micrometer**
3. **Spherical ball anvil adapters**

Figure 3-120. Measuring Running Clearance of Piston

ASSEMBLY

Checking Piston Ring Gap

NOTES

- *Always use **new** piston rings. Piston rings take a definite set and must not be reused if the engine has been operated. Always deglaze (or hone) the cylinder before installing **new** rings. Ring sets are available to fit oversize pistons.*
- *Insufficient ring gap may cause the ends to abut at engine operating temperatures, resulting in ring breakage, cylinder scuffing and/or piston seizure.*
- *Excessive ring gap results in high oil consumption and blow-by of exhaust gases. While blow-by contaminates the oil supply and leaves sludge in the crankcase, it also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.*

1. See Figure 3-121. Check ring end gap of each ring before placing on the piston. Insert the **new** ring into the cylinder and square it in the bore using the top of the piston. Measure the ring end gap with a feeler gauge. Refer to Table 3-37.

NOTE

Ring end gap dimensions also apply to oversize rings. Replace ring if end gap exceeds specification. If end gap is under specification, filing is permissible.

⚠WARNING

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

2. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.

Table 3-37. Piston Ring End Gap

PISTON		IN.	MM
Twin Cam 96™	Top compression	0.010-0.020	0.254-0.508
	2nd compression	0.014-0.024	0.356-0.610
	Oil control ring	0.010-0.050	0.254-1.27

sm02536

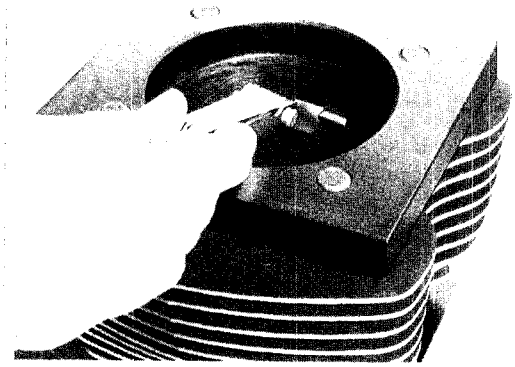


Figure 3-121. Measuring Ring Gap

Installing Piston Rings

1. See Figure 3-122. Apply clean H-D 20W50 engine oil to three piston ring grooves.
2. Install expansion ring (4) into third ring groove.
3. Spiral bottom oil rail (5) into space below expansion ring (4). Position gap 90° from the gap in the expansion ring.
4. Spiral top oil rail (3) into space above expansion ring (4). Position gap 180° from the gap in the bottom oil rail.

⚠WARNING

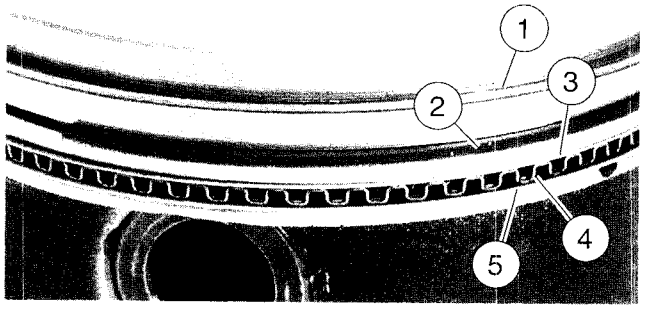
Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)

NOTES

- *Use the proper piston ring spreader to prevent excessive ring twist and expansion. Over expansion may cause the ring to crack opposite the ring gap. Damaged or distorted rings result in blow-by of exhaust gases, increased oil consumption and lower service life on valves and other components.*
- *Installing the second compression ring upside down will cause oil to be scraped up into the combustion chamber resulting in excessive oil consumption and low service life on valves and other components.*

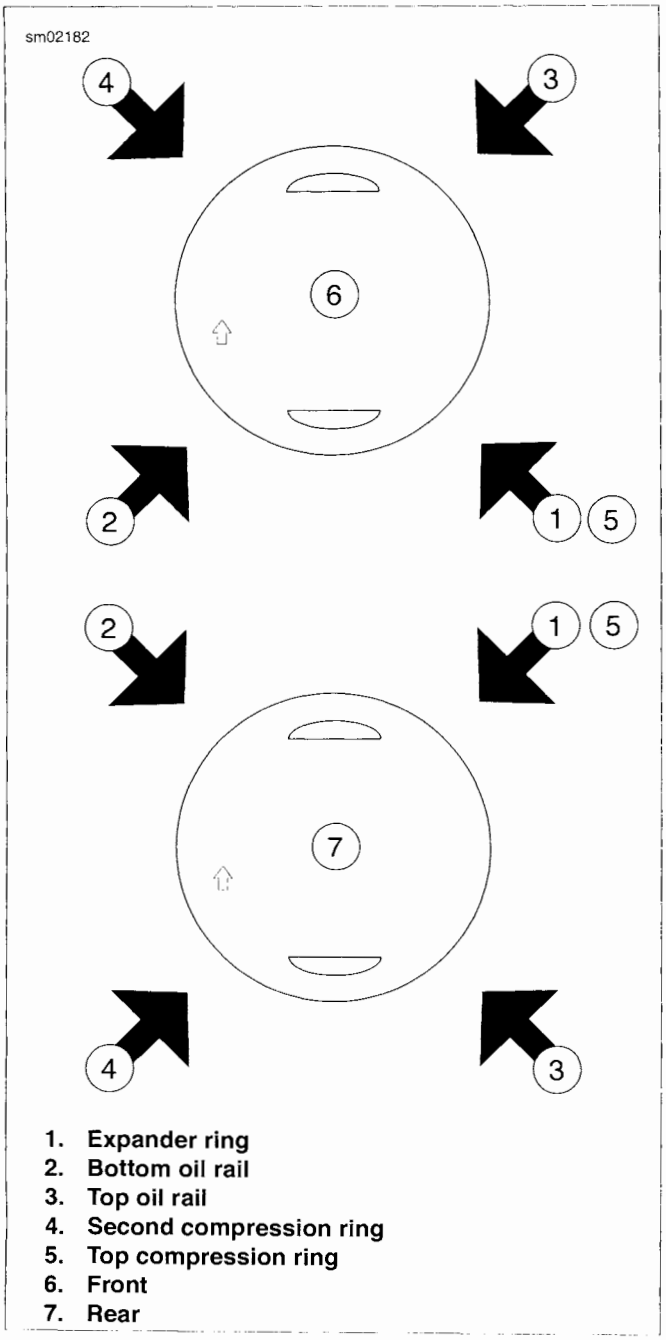
5. Using the proper piston ring expander (Snap-on PRS8), carefully install the second compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the expansion ring.
6. Using the proper piston ring expander (Snap-on PRS8), carefully install the top compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the second compression ring.
7. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.
8. See Figure 3-123. Verify the ring gaps are still properly staggered.

sm02537



1. **Top compression ring**
2. **Second compression ring**
3. **Top oil rail**
4. **Expansion ring**
5. **Bottom oil rail**

Figure 3-122. Piston Rings



1. **Expander ring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-123. Piston Ring Gap Alignment

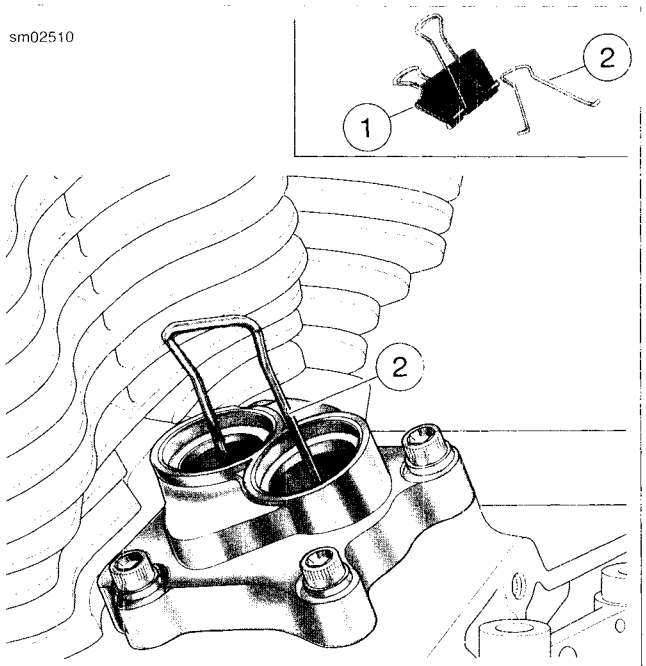
INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Attach piston to connecting rod.
2. Install cylinder.
3. Install cylinder head.
4. Install push rod covers and push rods.
5. Install rocker arm support plate.
6. Install breather assembly.
7. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. See Figure 3-124. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal.
   a. Obtain a large binder clip (1) which is available at any office supply store. Squeeze wireforms (2) to remove from binder clip.
   b. Compress wireform (2) slightly and insert free ends into outer and inner lifter cover bores so that legs engage walls of both hydraulic lifter sockets.
3. To remove cover and cam support plate, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.



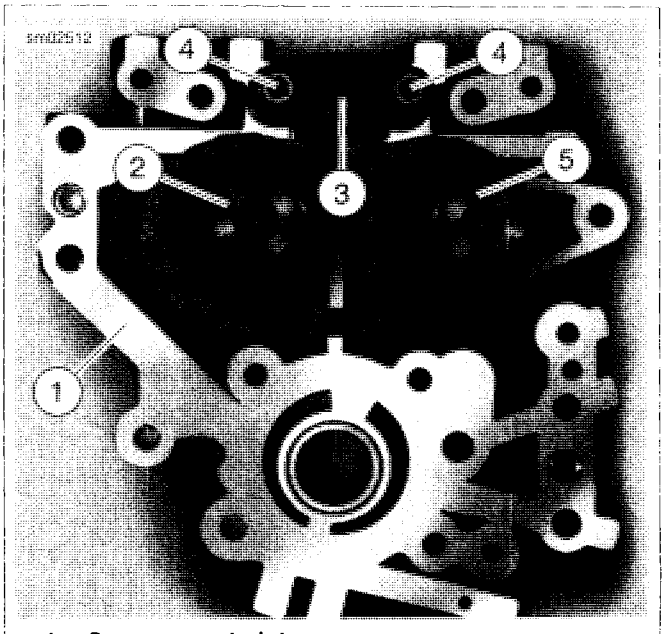
1. **Binder clip**
2. **Wireform**

Figure 3-124. Hydraulic Lifter Holding 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)

2. Remove retaining ring from groove at end of front camshaft. Discard retaining ring.
3. Remove spacer from front camshaft. Do not mix front and rear camshaft spacers. Front spacer is 0.100 in. (2.54 mm) thick.
4. Using a colored marker, mark one of the links of the secondary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.
5. Slide camshafts and secondary cam chain out of cam support plate.
6. Remove secondary cam chain from cam sprockets.



1. **Cam support plate**
2. **Front cam**
3. **Secondary cam chain tensioner**
4. **Secondary cam chain tensioner fasteners**
5. **Rear cam**

Figure 3-125. Camshafts

CAMSHAFTS

PART NUMBER	TOOL NAME
HD-47956	CAMSHAFT ASSEMBLY TOOL

Removal

1. See Figure 3-125. Remove screws (4) and remove secondary cam chain tensioner (3).

Assembly

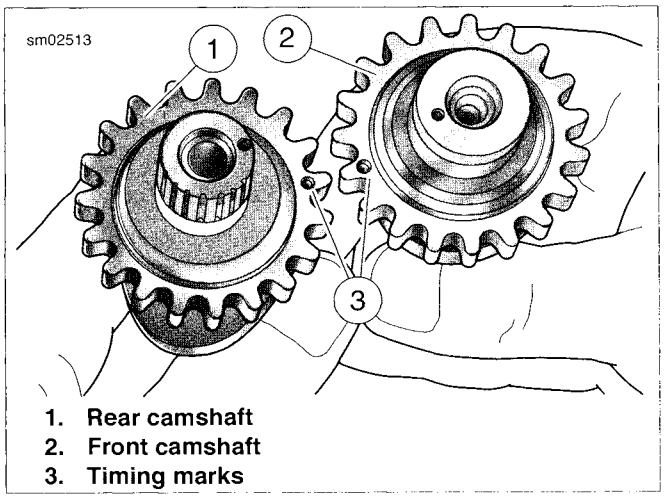
1. See Figure 3-126. Align timing marks on teeth of secondary cam sprockets (outboard faces).

NOTE

Do not mix camshafts during the installation procedure. The rear camshaft, which can be identified by the splined shaft, must go into the hole at the rear of the cam support plate.

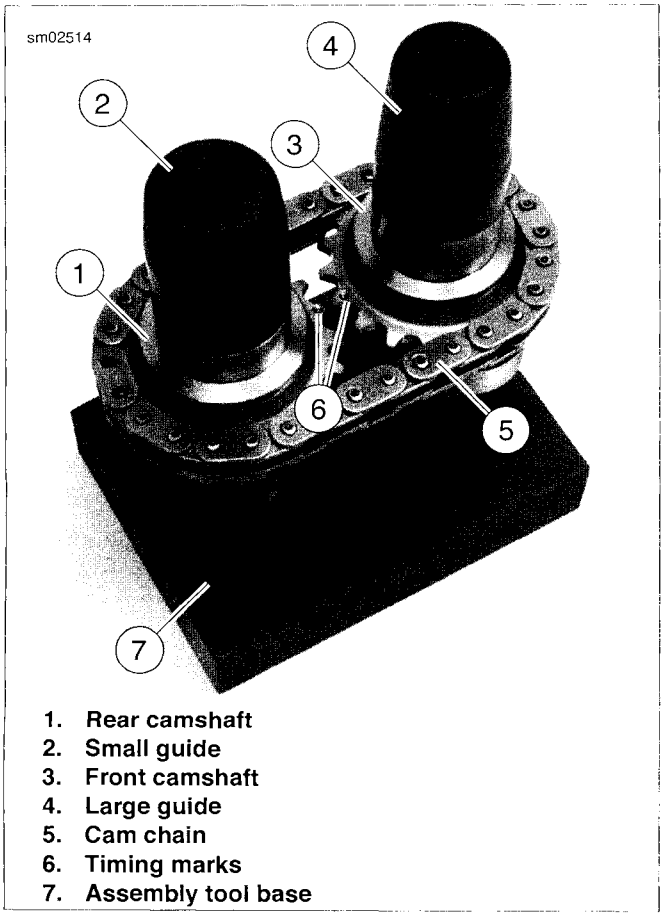
2. Place the secondary cam chain around the sprockets of both the front and rear camshafts while keeping the timing

marks (3) in alignment. To maintain the original direction of rotation, be sure that the mark placed on the chain link during disassembly is visible during installation.



1. Rear camshaft
2. Front camshaft
3. Timing marks

Figure 3-126. Camshaft Timing Marks



1. Rear camshaft
2. Small guide
3. Front camshaft
4. Large guide
5. Cam chain
6. Timing marks
7. Assembly tool base

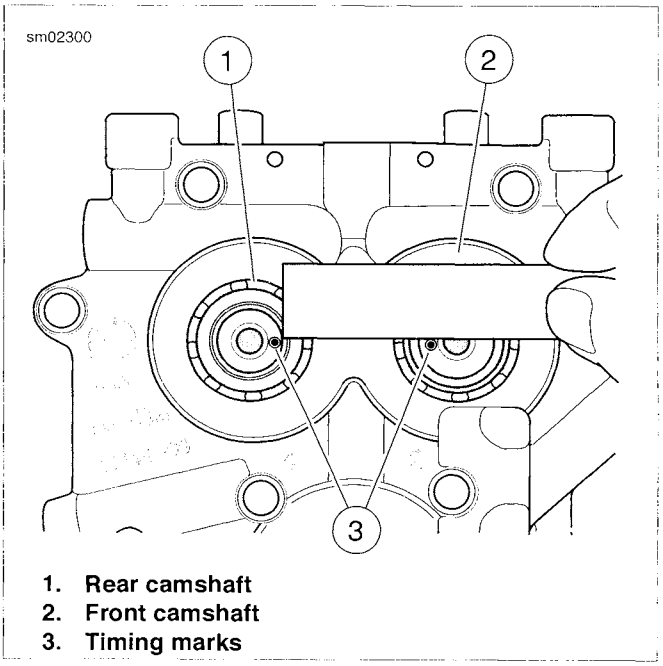
Figure 3-127. Camshaft Assembly Tool

3. See Figure 3-127. Obtain CAMSHAFT ASSEMBLY TOOL (Part No. HD-47956). Place crankcase side of camshaft/cam chain assembly into assembly tool base (7) while maintaining cam timing mark (6) alignment.
4. Place small guide (2) on rear camshaft (1). Place large guide (4) on front camshaft (3).
5. Lubricate support plate camshaft cavities with clean H-D 20W50 engine oil.
6. Install cam support plate over guides.
7. Remove guides and base.
8. See Figure 3-128. Using a straightedge, verify that the timing marks are in alignment. If they are not, then the camshafts must be removed, realigned and reinstalled.

⚠WARNING

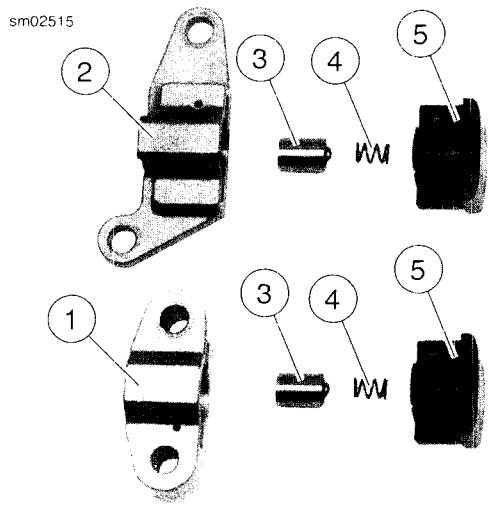
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

9. Install 0.100 in. (2.54 mm) thick front camshaft spacer over end of front camshaft.
10. With the sharp edge out, install **new** retaining ring in groove at end of front camshaft.
11. Inspect primary and secondary cam chain tensioners.
    a. Inspect tensioners for wear. Replace tensioners if damaged or if chain contact portion of shoe material is less than 0.060 in. (1.52 mm) thick.
    b. See Figure 3-129. Be sure primary and secondary cam chain tensioners are assembled as shown. If assembled incorrectly, tensioners will not function properly.
12. Install secondary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).



1. Rear camshaft
2. Front camshaft
3. Timing marks

Figure 3-128. Verify Alignment of Timing Marks



1. Secondary cam chain tensioner
2. Primary cam chain tensioner
3. Piston
4. Spring
5. Shoe

Figure 3-129. Cam Chain Tensioner Assemblies

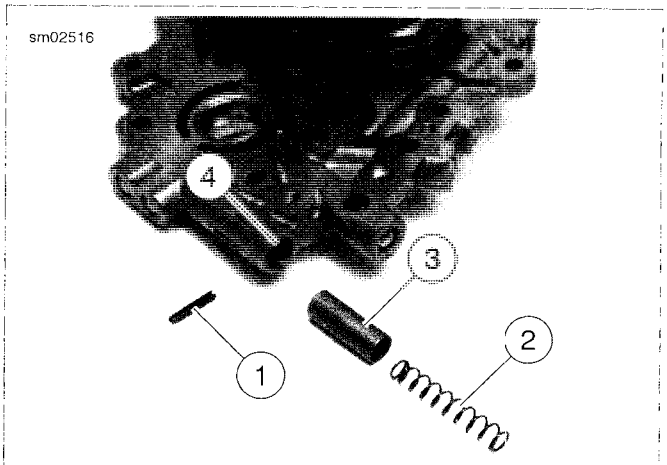
OIL PRESSURE RELIEF VALVE

Removal

1. Before removal, see 3.27 OIL PUMP, Cleaning and Inspection.
2. Secure the cam support plate in a vise with access to the roll pin. Be sure to install a pair of brass jaw inserts in the vise to avoid damage to the casting.
3. See Figure 3-130. Using a 1/8 in. punch with a small hammer, carefully tap roll pin (1) from pin hole in cam support plate. Discard roll pin.
4. Remove spring (2) and valve body (3) from bypass port.

Installation

1. Secure the cam support plate in a vise. Be sure to install a pair of brass jaw inserts to avoid damage to the casting.
2. See Figure 3-130. Lubricate valve body (3) with clean H-D 20W50 engine oil. Slide valve body into bypass port of cam support plate with the open side facing outward.
3. Slide spring (2) into bypass port until seated in open side of valve body.
4. Start **new** roll pin (1) into hole in cam support plate. Compress spring in port using the blade of a small screwdriver.
5. Holding spring compressed, tap roll pin into cam support plate until it approaches pin hole on opposite side.
6. Remove screwdriver to release spring. Verify that spring is straight and square in bore.
7. Using a 1/8 in. punch with a small hammer, carefully tap roll pin until flush with casting.



1. Roll pin
2. Spring
3. Valve body
4. Bypass port

Figure 3-130. Oil Pressure Relief Valve Assembly

Inspection

NOTE

If diagnosing low oil pressure, start with step 1. If diagnosing high oil pressure, then begin with step 2.

1. Insert straight stiff wire into unplugged hole outboard of roll pin until it bottoms. Mark wire and measure distance from edge of cam support plate to inboard side of piston. With piston fully seated in the bore, depth should be approximately 2.25 in. (57.15 mm). If it is not, continue with next step.
2. Remove oil pressure relief valve.
3. Inspect spring for stretching, kinks, or distortion.
4. Inspect piston and bore for burrs, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.
5. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 in. (0.076 mm), install **new** piston and measure again. Replace cam support plate if running clearance still exceeds specification.

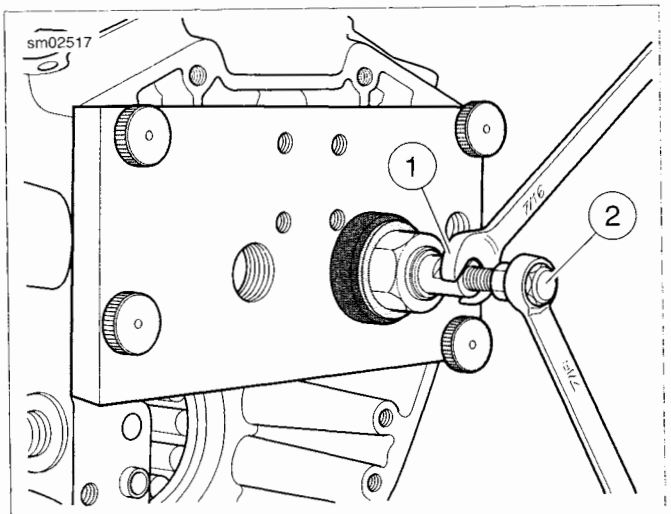
CAM NEEDLE BEARINGS

PART NUMBER	TOOL NAME
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER

Removal

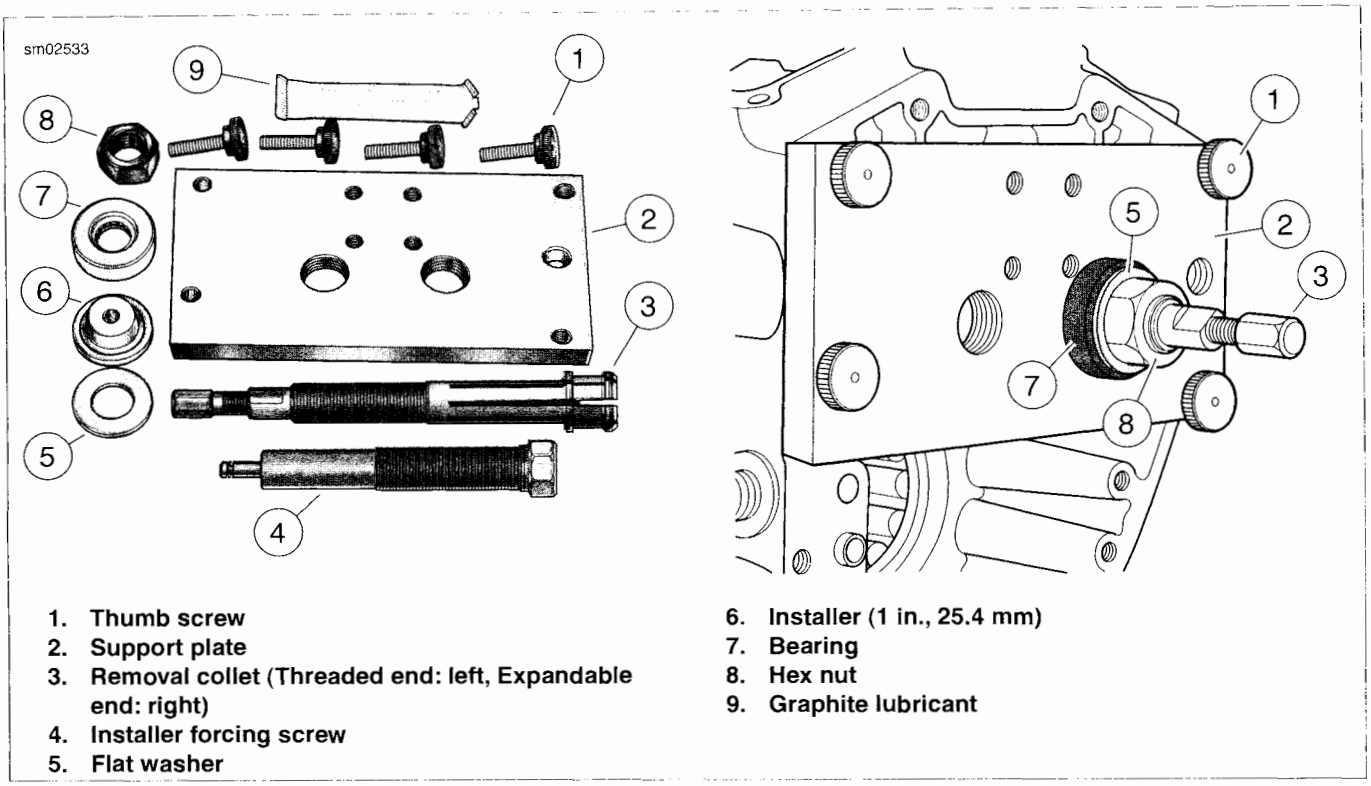
1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).
2. See Figure 3-132. Remove four thumb screws (1) from threaded holes in support plate (2), if installed.
3. Sparingly apply graphite lubricant (9) to threads of collet (3) to prolong service life and verify smooth operation.
4. Slide collet through support plate so that threaded end exits stamped side of plate.

5. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
6. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.
7. Center expandable end of collet in bearing bore and slide bearing (7) and flat washer (5) on threaded end. Start hex nut (8) on threaded end.
8. Push expandable end of collet through bearing bore into flywheel compartment. Feel for inside edge of needle bearing using end of collet and then back off slightly.



1. **Flat**
2. **Hex**

Figure 3-131. Expanding Collet by Turning Hex Clockwise



1. **Thumb screw**
2. **Support plate**
3. **Removal collet (Threaded end: left, Expandable end: right)**
4. **Installer forcing screw**
5. **Flat washer**
6. **Installer (1 in., 25.4 mm)**
7. **Bearing**
8. **Hex nut**
9. **Graphite lubricant**

Figure 3-132. Camshaft Needle Bearing Remover/Installer (Part No. HD-42325-A)

9. Holding collet to prevent lateral movement, finger tighten hex nut until bearing contacts support plate.
10. See Figure 3-131. Using a 7/16 in. open end wrench, hold flat on collet to prevent rotation. Using a second 7/16 in. open end wrench, expand collet by turning hex at end of shaft in a clockwise direction. Expandable end of collet makes contact with needle bearing ID.
11. See Figure 3-133. Using a 15/16 in. open end wrench, turn hex nut in a clockwise direction until bearing is free. If necessary, hold flat on collet to prevent rotation.
12. Remove four thumb screws and pull support plate from crankcase.
13. Holding flat on collet, turn hex at end of shaft in a counter-clockwise direction to close collet. Remove and discard needle bearing.
14. Remove hex nut, flat washer and bearing from threaded end of collet. Pull collet from support plate.
15. Repeat this procedure to remove second needle bearing.

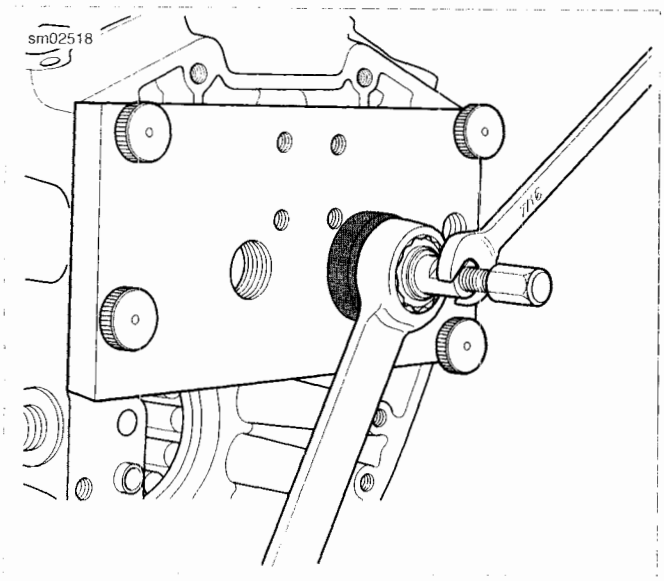


Figure 3-133. Bearing Removal

Installation

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).

NOTE

To avoid engine damage, care must be taken to install needle bearings to the correct depth. The correct depth is achieved only when the edge of the needle bearing is 3.10 in. (78.7 mm) from the cam cover flange.

2. Since measuring from the top of the support plate is easier and produces the most accurate and consistent results, proceed as follows:
   a. See Figure 3-134. Using a dial caliper, measure thickness of support plate.
   b. To determine the required distance from the top of the support plate to the edge of the installed needle bearing, add measurement obtained in the previous step to 3.10 in. (78.7 mm).

NOTE

For example, if the support plate is 0.50 in. (12.7 mm) thick, then the measurement from the top of the support plate to the edge of the needle bearing should be 3.60 in. (91.4 mm).

3. See Figure 3-132. Sparingly apply graphite lubricant (9) to threads of installer forcing screw (4) to prolong service life and verify smooth operation.
4. Thread installer forcing screw into stamped side of support plate (2) until threads begin to emerge from opposite side.
5. Place installer (6) at end of installer forcing screw.
6. Place **new** needle bearing on installer with lettered side facing shoulder of installer.
7. See Figure 3-135. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
8. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.

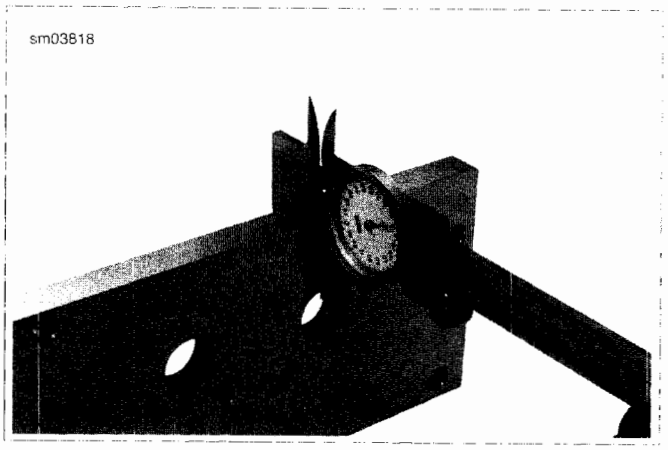


Figure 3-134. Measure Thickness of Support Plate

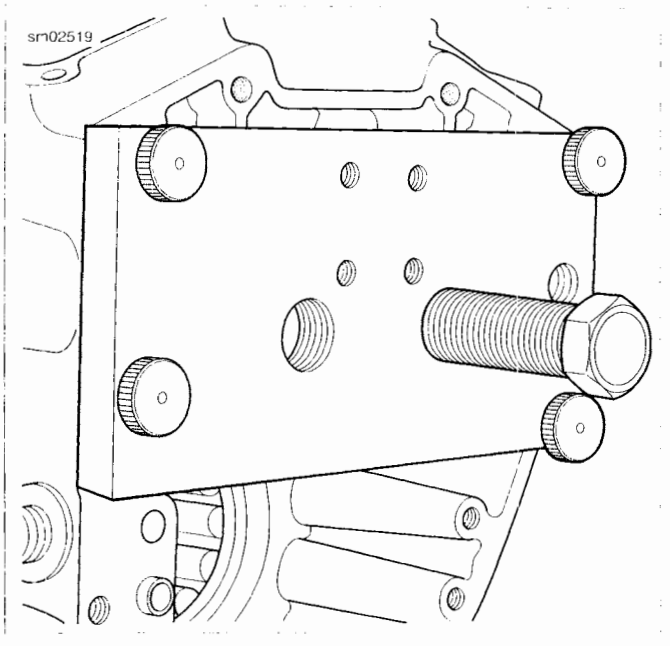


Figure 3-135. Installer Forcing Screw Installation

9. Install first needle bearing as follows:
   a. See Figure 3-136. Turn hex at end of installer forcing screw in a clockwise direction to press needle bearing into bore.
   b. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.
   c. See Figure 3-137. Inserting dial caliper through forcing screw bore, measure distance from top of support plate to edge of needle bearing.
   d. If bearing is not installed to the correct depth (as calculated earlier), install forcing screw and installer and repeat the three previous steps.
   e. Install forcing screw back into support plate. Reaching into crankcase, place installer at end of forcing screw. Hand turn forcing screw until shoulder on installer makes contact with edge of needle bearing.

NOTE

In the next step, a measurement will be taken of the distance from the head of the installer forcing screw to the support plate. This measurement will be used for installing the second needle bearing. For an accurate measurement, be sure the shoulder on the installer is in contact with the edge of the needle bearing.

10. See Figure 3-138. Using a dial caliper, measure from head (top) of installer forcing screw to support plate. Record this measurement.
11. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.
12. Install forcing screw in support plate over second needle bearing bore. Reaching into crankcase, place installer at end of forcing screw. Place **new** needle bearing on installer with lettered side facing shoulder of installer.
13. Turn hex on forcing screw in a clockwise direction until distance from head (top) of forcing screw to support plate equals measurement obtained previously.

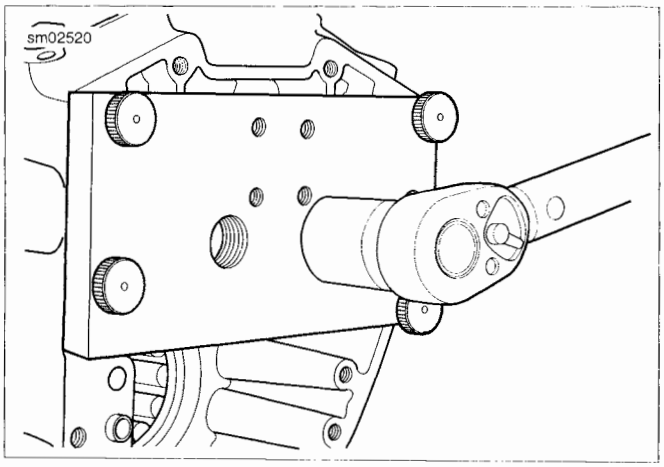


Figure 3-136. Bearing Installation

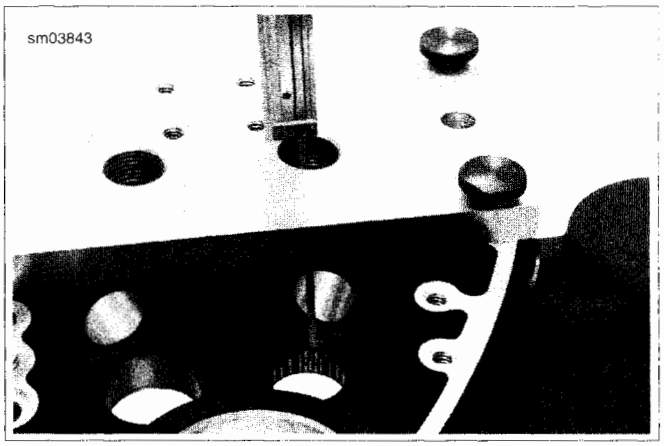


Figure 3-137. Measure from Top of Support Plate to Edge of Needle Bearing

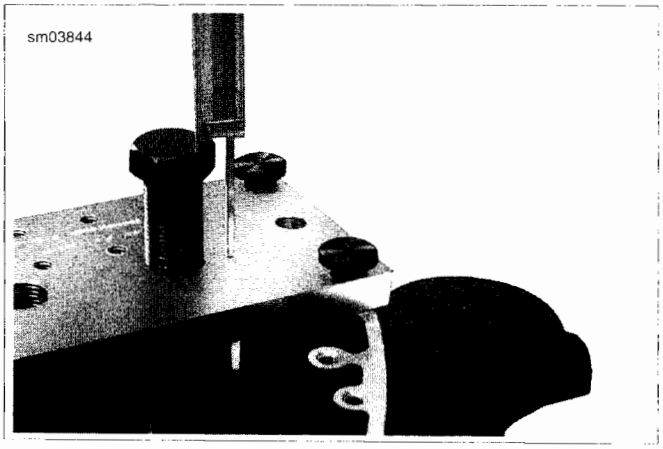


Figure 3-138. Measure from Top of Forcing Screw to Support Plate

CLEANING AND INSPECTION

Oil Pressure Valve

See 3.26 CAM SUPPORT PLATE AND COVER, Oil Pressure Relief Valve.

Cam Support Plate

Verify that all oil holes are clean and open.

NOTE

Exercise caution to avoid enlarging the oil holes or oil pressure will be adversely affected.

INSTALLATION OVERVIEW

1. Begin with 3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover.
2. Continue with 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal. See 3.26 CAM SUPPORT PLATE AND COVER.
3. To remove cover and cam support plate, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY. Remove oil pump after removing cam support plate.

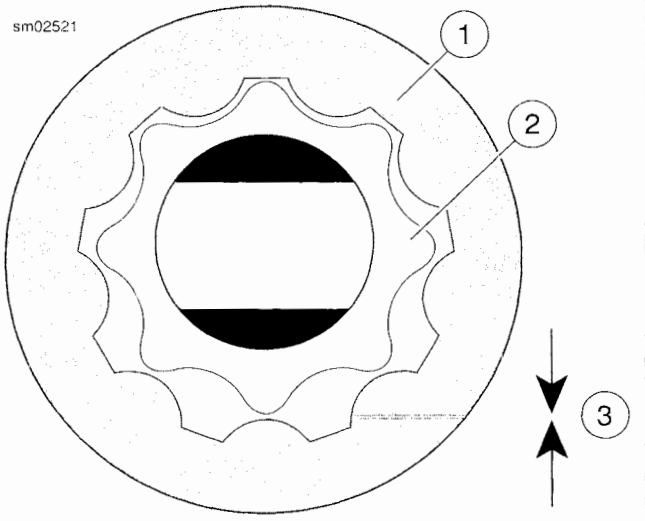
CLEANING AND INSPECTION

1. Clean all parts in a non-volatile cleaning solution or solvent.

⚠WARNING

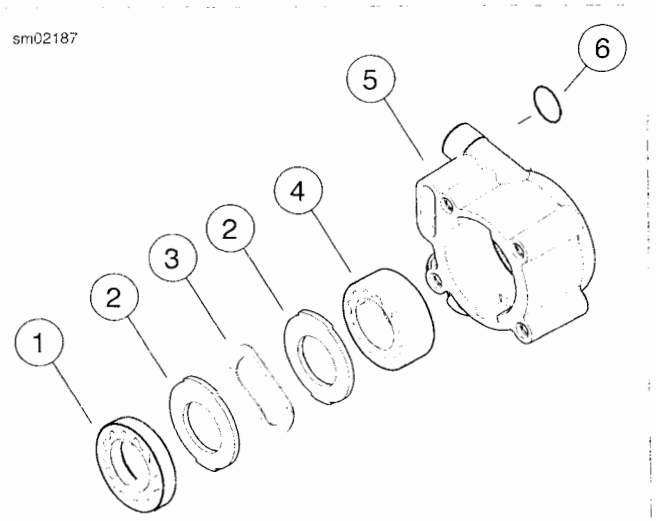
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

2. Blow parts dry with low pressure compressed air. Verify that all oil passages are clean and open.
3. Look for scoring, gouging or cracking caused by foreign material that may have passed through the oil pump.
4. Look for grooves or scratches on the cam support plate, which serves as the outboard side of the oil pump.
5. Check for excessive wear or damage on lobes of outer gerotor gears and between lobes on inner gerotor gears.
6. See Figure 3-139. Check gerotor wear.
   a. Mesh pieces of one gerotor set together.
   b. Use a feeler gauge to determine clearance between tips of lobes on inner and outer gerotors.
   c. Replace gerotors as a set if clearance exceeds 0.004 in. (0.10 mm). Inspect second gerotor set in the same manner.
7. Measure thickness of inner gerotor of one set with a micrometer. Measure the outer gerotor of the same set. Replace the gerotor set if the difference exceeds 0.001 in. (0.025 mm). Inspect second gerotor set in the same manner.
8. See Figure 3-140. Assemble the oil pump. Verify that feed gerotors stand proud of the oil pump surface 0.015-0.025 in. (0.38-0.64 mm). If measurement is less than 0.015 in. (0.38 mm), remove feed gerotor set and reassemble using **new** wave washer. Repeat measurement and replace oil pump body if still not within specification.



1. **Outer gerotor**
2. **Inner gerotor**
3. **Wear limit**

Figure 3-139. Measure Gerotor Sets for Wear



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-140. Assembling Oil Pump

INSTALLATION OVERVIEW

1. See 3.26 CAM SUPPORT PLATE AND COVER, Installation Overview.
2. Continue with 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

RIGHT CRANKCASE HALF

PART NUMBER	TOOL NAME
HD-44065-1	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER
HD-44065-4	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE

Chain Guide Screen

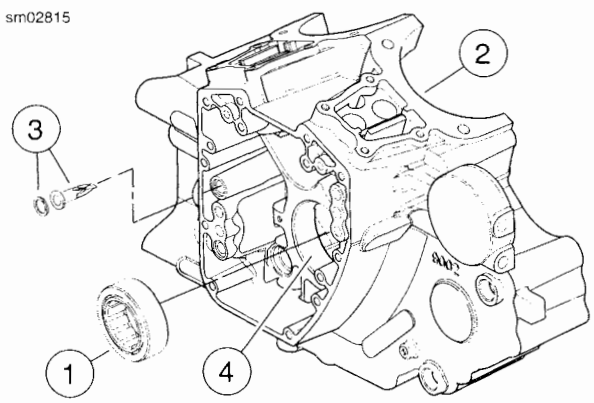
See Figure 3-141. Remove, clean and reinstall screen (3). Replace screen o-ring with each removal.

Crankshaft (Roller) Bearing Removal

NOTE

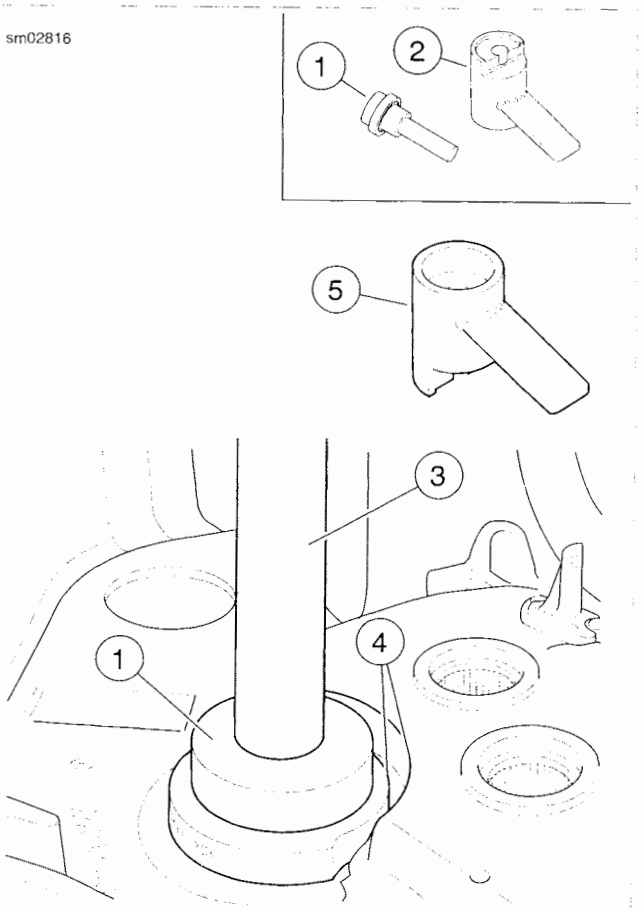
Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner.

1. See Figure 3-142. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. HD-44065-1) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-44065-4).
2. Place support tube (2) on hydraulic press table with the REMOVAL end up. Note that the sides of the support tube are stamped to ensure proper orientation.
3. With the inboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube. During removal it is important that the curved edges on the pilot/driver (1) match the curved edges of the crankcase (4).
4. Slide pilot/driver (1) through bearing into support tube.
5. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until bearing is free.
6. Remove crankcase, pilot/driver and bearing from support tube. Discard bearing.



1. **Crankshaft (roller) bearing**
2. **Right crankcase half**
3. **Chain guide screen and O-ring**
4. **Crankshaft bearing bore**

Figure 3-141. Right Crankshaft (Roller) Bearing



1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Curved edges**
5. **Support tube REMOVAL end up**

Figure 3-142. Right Crankshaft (Roller) Bearing Removal

Crankshaft (Roller) Bearing Installation

1. See Figure 3-143. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. HD-44065-1) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-44065-4).
2. Obtain **new** crankshaft (roller) bearing (4). Spread a thin film of clean H-D 20W50 engine oil on O.D. of **new** bearing.
3. Place support tube (2) on hydraulic press table with the INSTALL end up. The sides of the support tube are stamped to ensure proper orientation.
4. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube. Lip on support tube (5) must contact edge of crankcase as shown. This allows the curved portion of the inboard crankcase to contact the top curved portion of the support tube (2).
5. Lubricate leading edge of **new** crankshaft (roller) bearing before placement. Start crankshaft (roller) bearing in bearing bore, letter side up.
6. Slide pilot/driver (1) through bearing into support tube.
7. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until resistance is felt. Tool is now bottomed against support tube flange and has properly positioned the crankshaft (roller) bearing in crankcase bearing bore.
8. Remove pilot/driver and crankcase half from support tube.

Piston Jets Removal

1. See Figure 3-144. Remove two T20 TORX screws (1) to free piston jet (2) from crankcase.
2. Remove o-ring (3) from groove in mounting flange of jet. Discard o-ring.

Piston Jets Installation

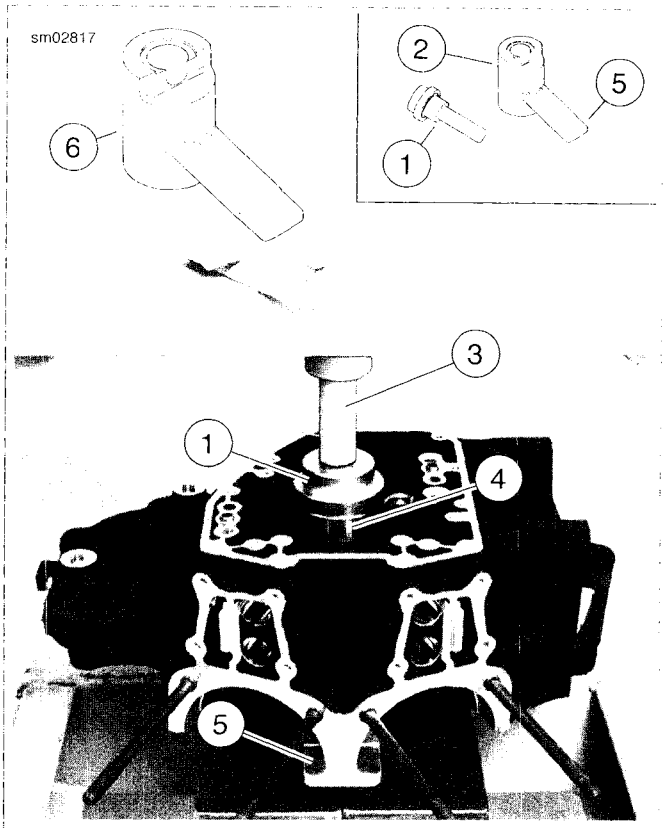
NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-144. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for piston jet. Install **new** o-ring in groove of jet mounting flange.
2. With jet pointed upward, start two T20 TORX screws (1) to secure piston jet (2) to crankcase. Tighten to 25-35 **in-lbs** (2.8-3.9 Nm).

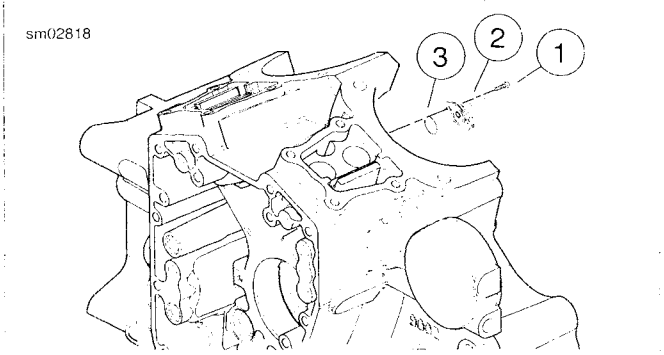
NOTE

If piston jet is being reused, apply LOCTITE THREADLOCKER 222 (purple) to threads of TORX screws before installation.



1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Crankshaft (roller) bearing**
5. **Support tube lip**
6. **Support tube INSTALL end up**

Figure 3-143. Right Crankshaft (Roller) Bearing Installation



1. **T20 TORX screw @ 25-35 in-lbs (2.8-3.9 Nm)**
2. **Piston jet**
3. **O-ring**

Figure 3-144. Piston Jets

LEFT CRANKCASE HALF

PART NUMBER	TOOL NAME
B-45655	CRANKCASE BEARING REMOVER/INSTALLER
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE

Main Bearing Removal

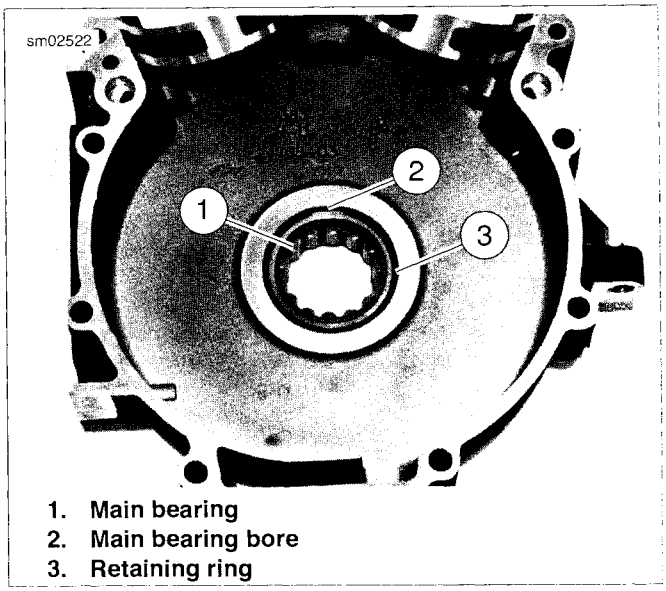
NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

⚠CAUTION

Do not rotate left crankcase half in engine stand such that flywheel sprocket shaft is facing up. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552b)

1. While holding flywheel assembly so that it does not fall out of left crankcase half, rotate bottom end assembly in engine stand so assembly is upright and flywheel shafts are horizontal.
2. Carefully slide flywheel assembly out of left crankcase and place it in a clean safe place.
3. Unbolt left crankcase half from stand and move it to bench area. Remove thrust washer from outboard side of crankcase half by pulling it past oil seal. Set thrust washer aside for inspection or reuse.
4. Remove oil seal from crankcase bore. Discard oil seal.
5. See Figure 3-145. The left main bearing (1) is press-fit into the main bearing bore (2) in the left crankcase and secured with a retaining ring (3) on the inboard side. See Figure 3-146. Using the tip of a flat blade screwdriver, carefully lift the edge of the retaining ring up out of its groove in the crankcase. Slide the screwdriver tip around the edge of the bearing, lifting the retaining ring up and out of the groove. Be careful not to damage the lip of the groove in the crankcase.



1. Main bearing
2. Main bearing bore
3. Retaining ring

Figure 3-145. Left Main Bearing Assembly

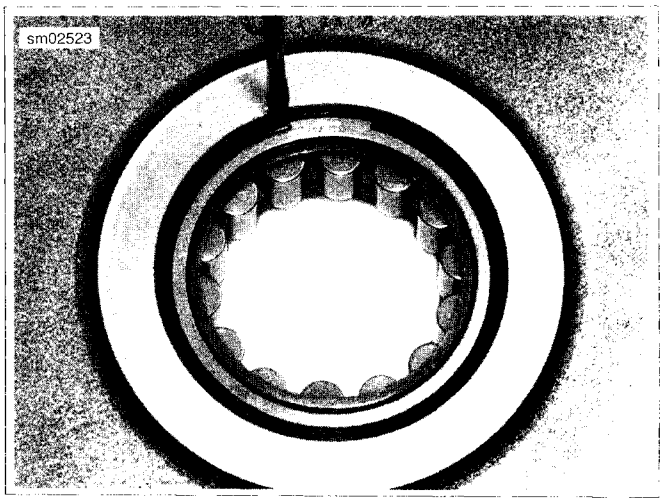
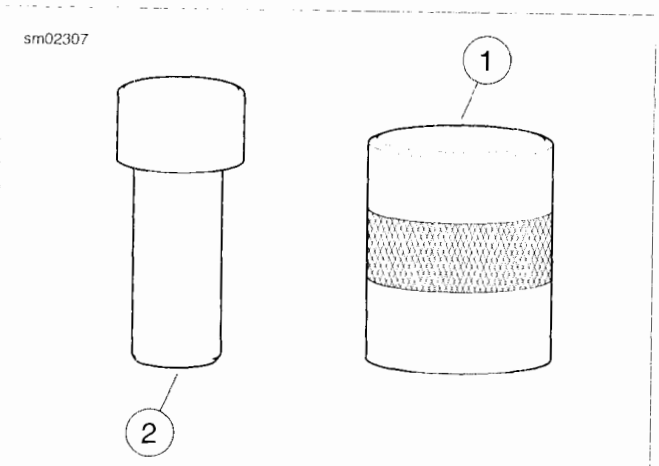
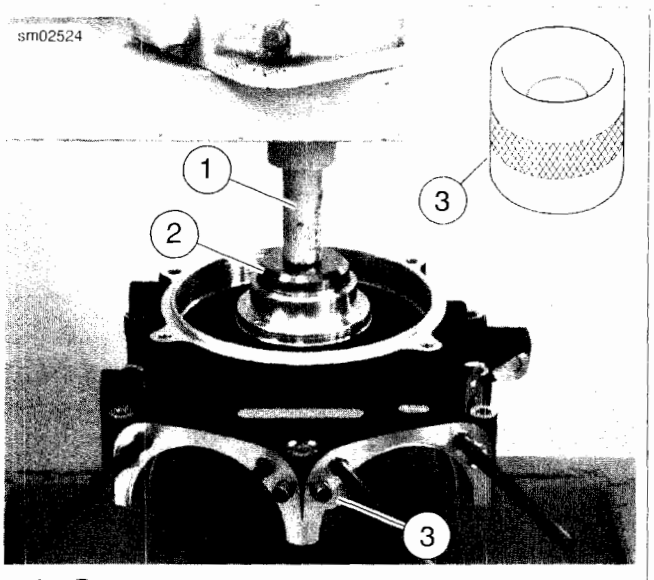


Figure 3-146. Removing Retaining Ring



1. **Support tube**
2. **Pilot/driver**

Figure 3-147. Left Main Bearing Remover and Installer Tools



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("B" end up)**

Figure 3-148. Left Main Bearing Removal

NOTE

See Figure 3-147. If the ram of the press is wider than the head of pilot/driver (2), a suitable press plug will be needed in order to remove the main bearing.

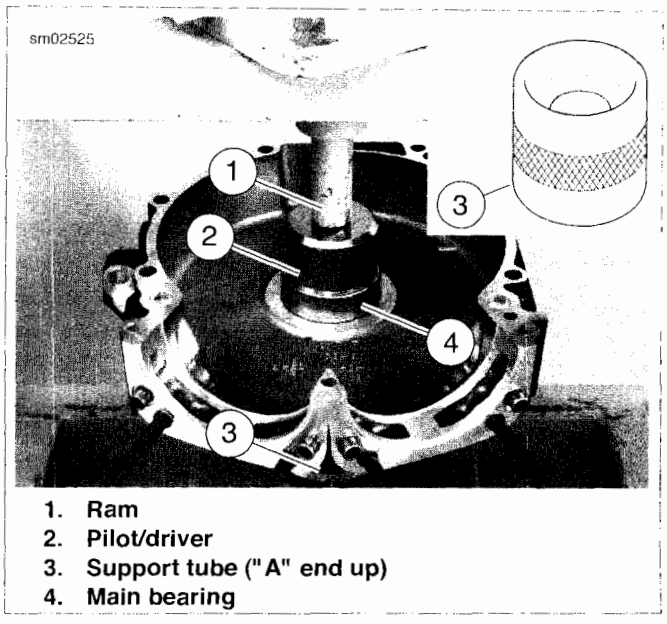
6. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).
7. See Figure 3-148. Place support tube (3) on hydraulic press table with "B" end up. Note that sides of support tube are stamped "A" and "B" to verify proper orientation.
8. With the outboard side of the left crankcase half facing upward, position main bearing bore over support tube.
9. Slide pilot/driver (2) through main bearing into support tube (3).
10. If the ram of the press is wider than the head of pilot/driver (2), place a suitable press plug on top of pilot/driver (2).
11. Center pilot/driver under ram (1) of press. Apply pressure to pilot/driver until bearing is free.
12. Remove crankcase half, pilot/driver and bearing from support tube. Discard bearing.

Main Bearing Installation

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

1. See Figure 3-147. Obtain CRANKCASE BEARING REMOVER/INSTALLER (Part No. B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (Part No. HD-42720-5).



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**
4. **Main bearing**

Figure 3-149. Left Main Bearing Installation

2. See Figure 3-149. Obtain **new** main bearing (4). Place a thin film of clean engine oil on outer diameter of bearing.
3. Place support tube (3) on hydraulic press table with the "A" end up.
4. With the inboard side of the left crankcase half facing upward, position main bearing bore over support tube.
5. Lubricate leading edge of **new** main bearing before placement. Start **new** main bearing in bearing bore, letter side down.
6. Slide pilot/driver (2) through bearing into support tube.
7. Center pilot/driver (2) under ram (1) of press. Apply pressure to pilot/driver until bearing is lightly bottomed in main bearing bore.
8. Remove crankcase half and pilot/driver from support tube.

9. Obtain **new** retaining ring and install in bearing bore in inboard side of crankcase half. Work retaining ring into groove, being careful not to damage edges of groove. Make sure retaining ring is fully seated in groove.

NOTE

If retaining ring will not fit into groove in bearing bore, it is a sign that the bearing is not fully seated in the bore. Examine the bearing and bore. If necessary, remove bearing, clean bore and install bearing. Then install retaining ring.

SPROCKET SHAFT BEARING INNER RACE

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-34902-B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER
HD-44358	FLYWHEEL SUPPORT FIXTURE
HD-95637-46B	WEDGE ATTACHMENT
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER

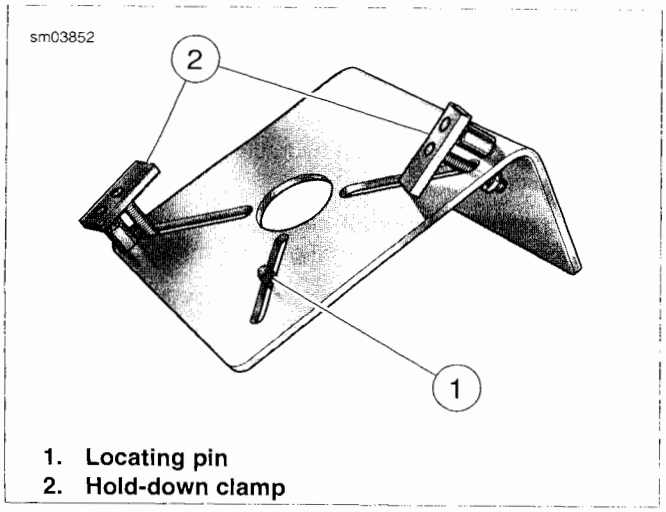
Removal

If reusing flywheel, remove bearing inner race and thrust washer as follows:

1. Obtain FLYWHEEL SUPPORT FIXTURE (Part No. HD-44358). See Figure 3-150. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp tool in vise with the round hole topside.
2. Insert crankshaft end through hole resting flywheel assembly on fixture. Slide knurled locating pin down slot in tool to engage crank pin hole. Hand tighten locating pin.
3. Slide hold-down clamp down slot to engage inboard side of right flywheel half, and then hand tighten knurled nut at bottom to secure. Repeat step to secure hold-down clamp on opposite side of flywheel.

NOTE

For proper clamping force, hold-down clamp must not be tilted. Rotate hex on outboard stud until clamp is level.



1. **Locating pin**
2. **Hold-down clamp**

Figure 3-150. Flywheel Fixture (Part No. HD-44358)

4. Position WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of thrust washer and turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

5. Obtain two 3/8-16 inch bolts 7-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge and forcing screw from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (Part No. HD-34902-B). Also obtain a suitable hardened washer to use between the puller screw and the end of the shaft.
6. Slide one bolt into channel on each side of bridge so that flat washer is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns.
7. Sparingly apply graphite lubricant to threads of forcing screw to prolong service life and verify smooth operation. Start forcing screw into center hole of bridge.

NOTE

Failure to use hardened washer may result in damage to forcing screw and/or sprocket shaft.

8. Place hardened washer against end of sprocket shaft. Thread forcing screw into bridge until the steel ball at the end of the screw makes firm contact with hardened washer.

⚠WARNING

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

9. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

10. Turn forcing screw until thrust washer and bearing inner race move approximately 1/8 in. (3.2 mm).
11. Turn hex nuts an equal number of turns to separate halves of WEDGE ATTACHMENT (Part No. HD-95637-46B).
12. After bottoming thrust washer on shaft, reposition WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of bearing inner race. Turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

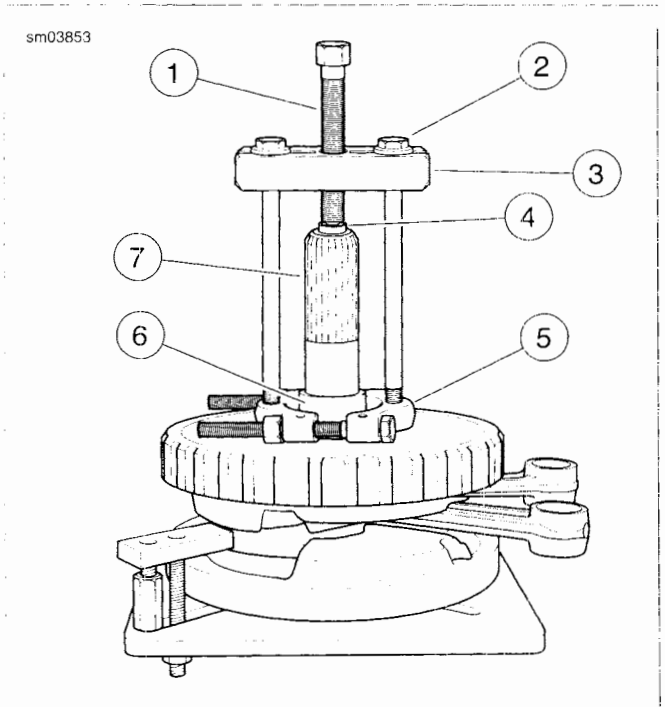
Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

13. See Figure 3-151. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal.
14. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

15. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.
16. Remove thrust washer from sprocket shaft.



1. **Forcing screw**
2. **3/8-16 in. bolt with flat washer**
3. **Bridge**
4. **Hardened washer**
5. **Wedge attachment**
6. **Bearing inner race**
7. **Sprocket shaft**

Figure 3-151. Remove Inner Race from Sprocket Shaft

Installation

1. Place **new** thrust washer over sprocket shaft.
2. Place **new** bearing inner race on bench top. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat bearing inner race for about 60 seconds using a circular motion.
3. Wearing suitable gloves to protect hands from burns, place heated bearing inner race over sprocket shaft.

⚠WARNING

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

NOTE

To facilitate installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

4. See Figure 3-152. Obtain the SPROCKET SHAFT BEARING INSTALLER (Part No. HD-97225-55C). Assemble tool as described below.
   a. See Figure 3-153. Thread pilot adapter into sprocket shaft.
   b. Thread pilot shaft onto pilot adapter.
   c. Slide long collar over pilot shaft until it contacts bearing inner race.
   d. Slide short collar over pilot shaft until it contacts long collar.
   e. Slide bearing and large flat washer over pilot shaft.
   f. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and verify smooth operation.
   g. See Figure 3-154.Thread handle onto pilot shaft.
5. See Figure 3-155. Rotate handle of tool in a clockwise direction until bearing inner race makes firm contact with thrust washer. Verify that thrust washer cannot be rotated by hand.
6. Remove handle, flat washer, bearing, short collar, long collar, pilot shaft and pilot adapter from sprocket shaft.

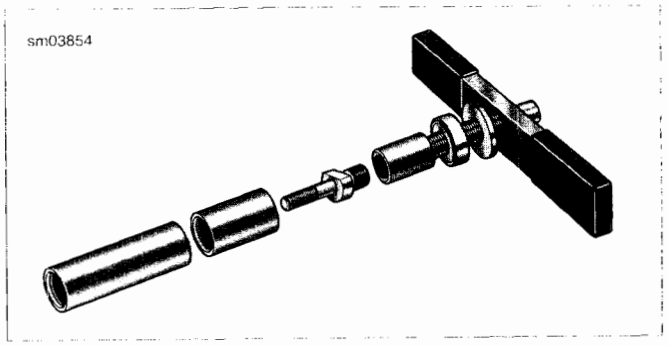


Figure 3-152. Sprocket Shaft Bearing Installer (Part No. HD-97225-55C)

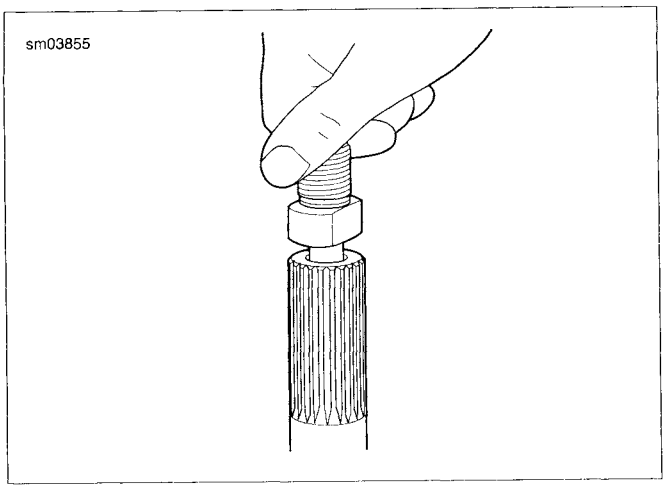
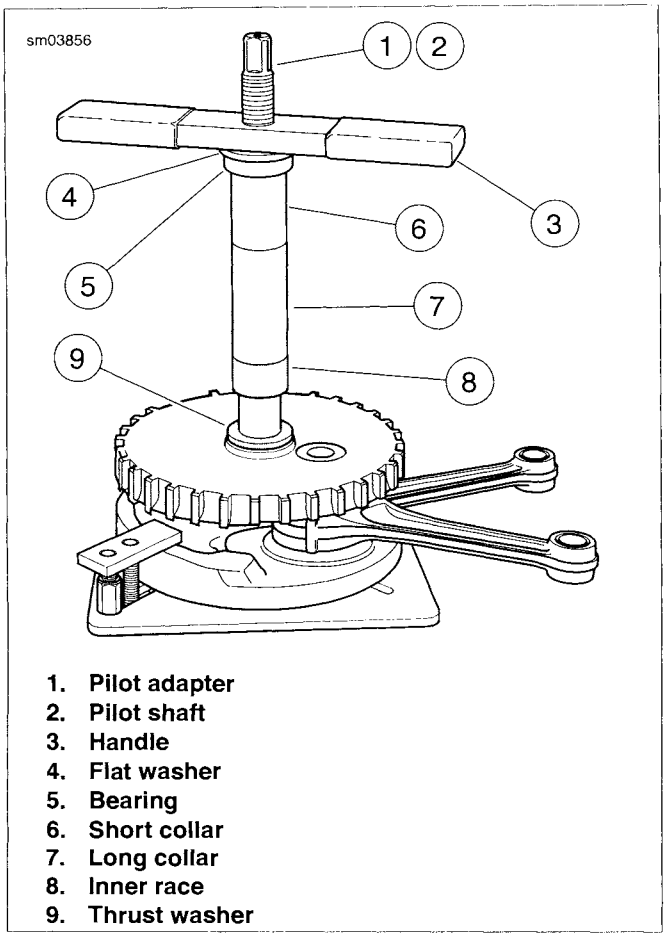


Figure 3-153. Thread Pilot Adapter into Sprocket Shaft



1. **Pilot adapter**
2. **Pilot shaft**
3. **Handle**
4. **Flat washer**
5. **Bearing**
6. **Short collar**
7. **Long collar**
8. **Inner race**
9. **Thrust washer**

Figure 3-154. Press Inner Race onto Sprocket Shaft: Setup

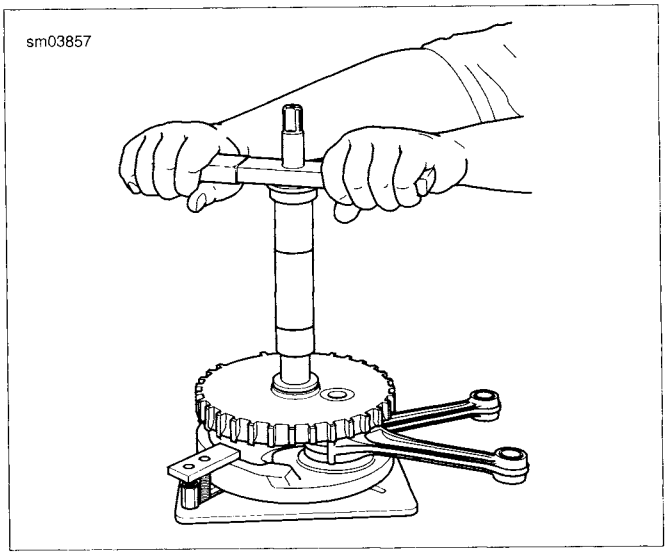


Figure 3-155. Press Inner Race onto Sprocket Shaft: Operation

CYLINDER STUDS

Removal

1. Thread a 3/8"-16 nut onto cylinder stud.
2. Thread a second nut onto stud until it contacts the first.
3. Placing wrench on first nut installed, remove stud.

Installation

1. Place a steel ball inside a head screw. Put the head screw on the end of the cylinder stud without the collar.
2. Start the stud in the cylinder deck with the collar side down. Tighten using air gun until collar reaches crankcase.
3. Hand tighten stud to 10-20 ft-lbs (3.6-27.1 Nm).

PIPE PLUGS AND OIL FITTINGS

Removal/Installation

NOTE

See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC for information on replacing o-rings and retainers within oil tank fittings.

1. See Figure 3-157. Remove parts.
   a. Turn hex on oil fittings (1, 2, 3) in a counterclockwise direction until free.
   b. Turn pipe plugs (4, 5) counterclockwise until free.
2. Apply LOCTITE PIPE SEALANT 565 to fitting threads.
3. See Figure 3-157. Install parts.
   a. Turn hex on oil fittings (1, 2, 3) in a clockwise direction until snug. Tighten to oil fittings to 120-168 **in-lbs** (13.6-19.0 Nm).
   b. Install pipe plugs (4, 5). Tighten to 120-144 **in-lbs** (13.6-16.3 Nm).

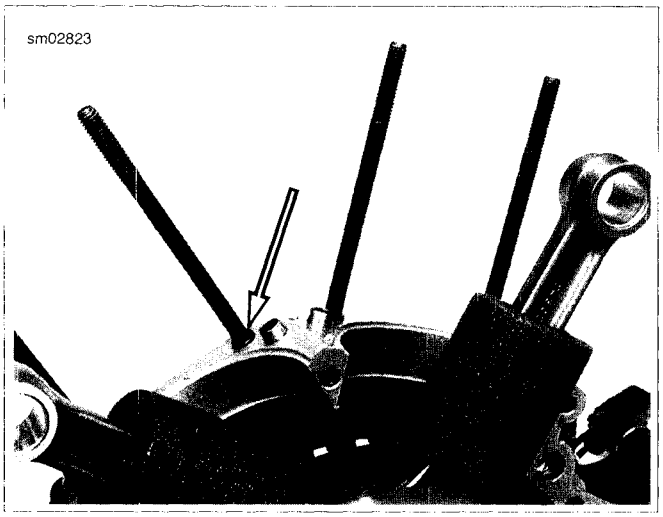
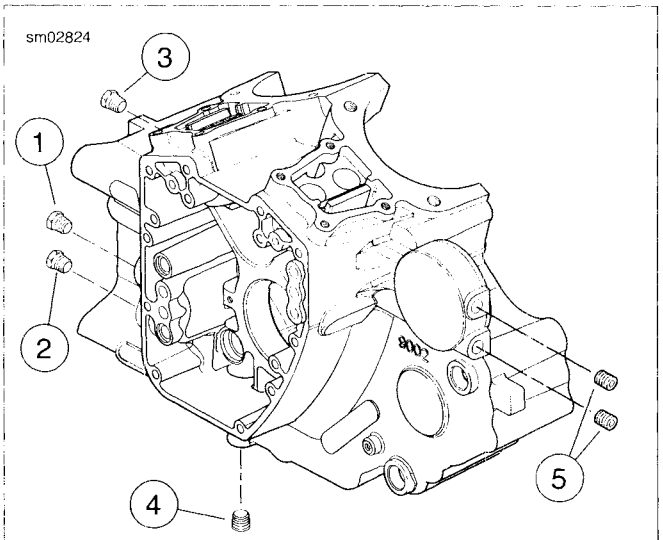


Figure 3-156. Collar Side Down



1. **Oil return fitting**
2. **Oil feed fitting**
3. **Oil vent fitting**
4. **Pipe plug**
5. **Pipe plugs (2)**

Figure 3-157. Oil Fittings and Pipe Plugs

CLEANING AND INSPECTION

1. Scrape old gasket material from the crankcase flanges. Old gasket material left on mating surfaces will cause leaks.
2. Clean all parts in a non-volatile cleaning solution or solvent.

⚠WARNING

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

3. Blow parts dry with low pressure compressed air.
4. Verify that all oil holes and passageways are clean and open.
5. Check ring dowels for looseness, wear or damage. Replace as necessary.
6. Use a file to carefully remove any nicks or burrs from machined surfaces.
7. Clean out tapped holes and clean up damaged threads.
8. Check the top of the crankcase for flatness with a straightedge and feeler gauge. Replace if warped.
9. Spray all machined surfaces with clean engine oil.

INSTALLATION OVERVIEW

1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.

INSPECTION

NOTE

Do not attempt to straighten connecting rods. Straightening rods will damage both the upper bushing and lower bearing.

1. Replace the flywheel/connecting rod assembly if any of the following conditions are noted:
   a. Connecting rods are bent or twisted.
   b. Connecting rods do not fall under their own weight or are in a bind.
   c. Sprocket teeth are worn in an irregular pattern or chipped.
   d. The crankshaft (roller) bearing inner races are brinelled, burnt, scored, blued or damaged.

NOTE

Bluing on connecting rods is part of the hardening process and is considered a normal condition.

2. Check connecting rod bearing clearance. Orient the assembly as shown in Figure 3-158.
   a. Holding the shank of each rod just above the bearing bore, pull up and down on the connecting rods.
   b. Any discernible up and down movement indicates excessive lower bearing clearance. Replace the flywheel/connecting rod assembly.
3. See Figure 3-159. Check connecting rod side play.
   a. Insert a feeler gauge between the thrust washer and the outboard side of the connecting rod.
   b. Replace the assembly if rod side play exceeds 0.020 in. (0.51 mm).

NOTE

If the flywheel, connecting rods or right side bearing inner race need to be replaced, then replace the entire flywheel assembly.

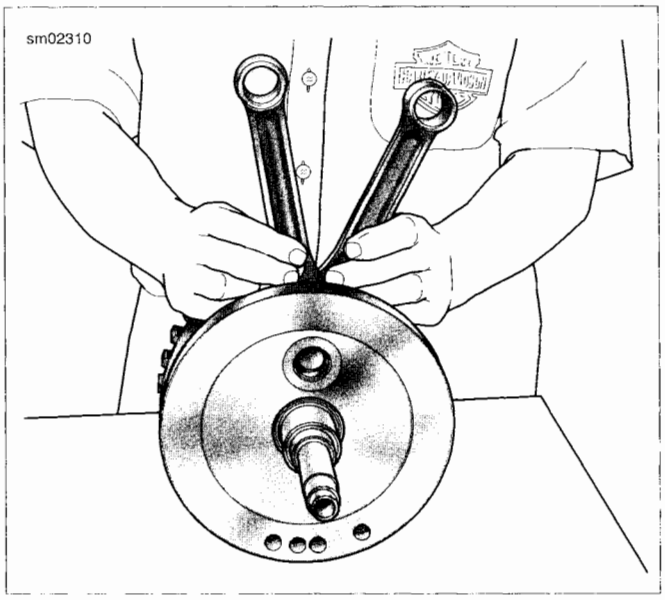


Figure 3-158. Connecting Rod Bearing Clearance

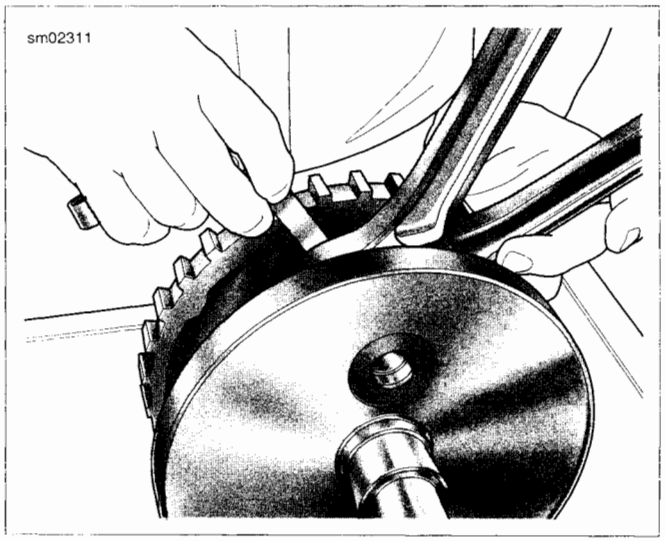


Figure 3-159. Connecting Rod Side Play

INSTALLATION OVERVIEW

1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

NOTE

Always replace all four bearings (crankcase and housing, front and rear) during a complete bottom end overhaul.

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

CLEANING, INSPECTION, AND REPAIR

PART NUMBER	TOOL NAME
HD-48309	BALANCER SHAFT INSTALLER
HD-48457	BALANCER SHAFT REMOVER
HD-48474	BALANCE SHAFT SUPPORT BEARING REMOVER/INSTALLER
HD-95635-46	ALL-PURPOSE CLAW PULLER
HD-95937-46B	WEDGE ATTACHMENT

General

1. Clean all parts but bearings in a non-volatile cleaning solution or solvent.

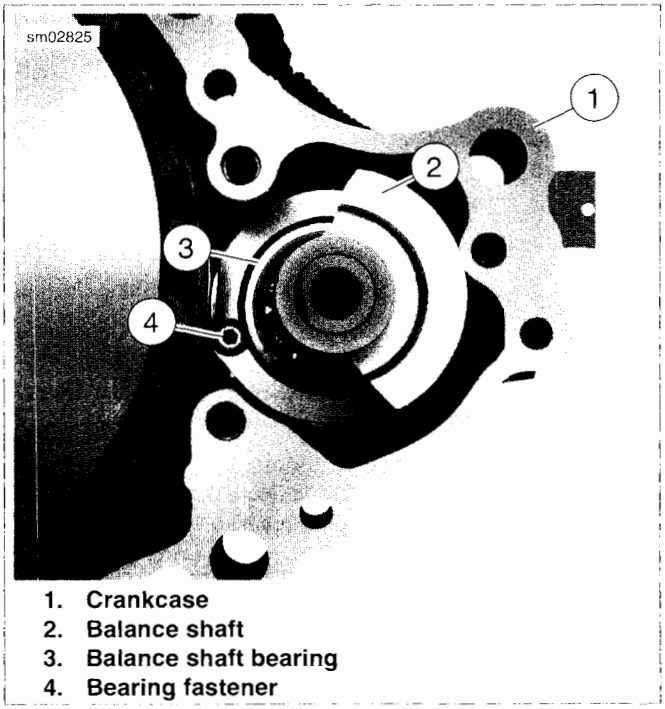
⚠WARNING

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

2. Blow parts dry with low pressure compressed air.

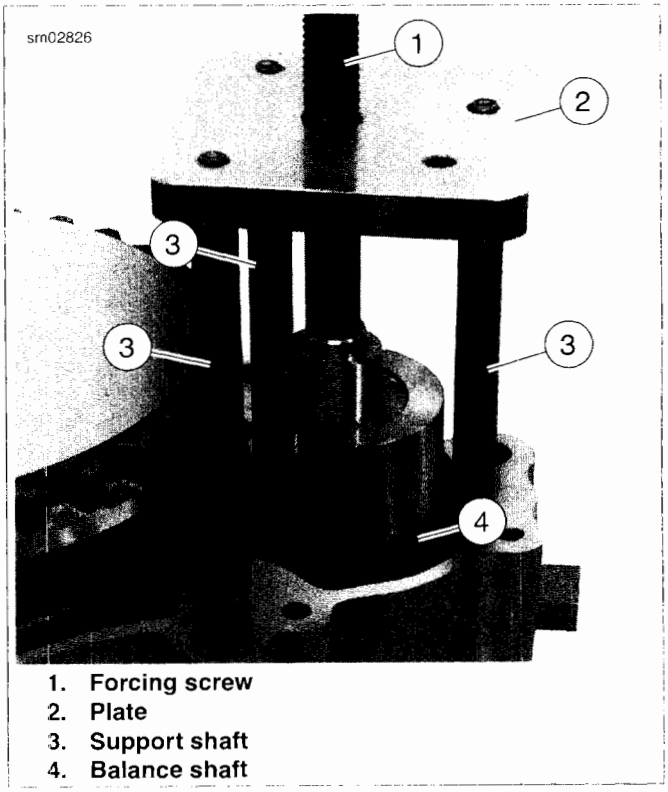
Balance Shaft Removal

1. See Figure 3-160. Remove bearing fastener (4) from crankcase (1).
2. See Figure 3-161. Assemble BALANCER SHAFT REMOVER (Part No. HD-48457).
   a. Sparingly apply graphite lubricant along threads of forcing screw (1) to prolong service life and verify smooth operation.
   b. Install support shafts (3) in crankcase.
   c. If replacing front shaft, install plate (2) over support shafts with side marked "Front" facing up. If replacing rear shaft, install plate over support shafts with side marked "Rear" facing up.
   d. Install forcing screw in balance shaft (4).
   e. Install washer, bearing and nut on forcing screw.



1. **Crankcase**
2. **Balance shaft**
3. **Balance shaft bearing**
4. **Bearing fastener**

Figure 3-160. Balance Shaft Bearing



1. **Forcing screw**
2. **Plate**
3. **Support shaft**
4. **Balance shaft**

Figure 3-161. Balance Shaft Remover

3. See Figure 3-162. While holding forcing screw (1) from turning, turn nut (2) to remove balance shaft (4) and bearing from crankcase.

4. Using ALL-PURPOSE CLAW PULLER (Part No. HD-95635-46) and WEDGE ATTACHMENT (Part No. HD-95937-46B), remove bearing from balance shaft. Discard bearing.
5. Repeat removal on other shaft.

Balance Shaft Installation

1. With lettering side facing up, press balancer shaft into**new** bearing.
2. See Figure 3-163. Place balancer shaft (3) and bearing in crankcase (4).
3. Place BALANCER SHAFT INSTALLER (Part No. HD-48309) (2) over balancer shaft.

NOTE

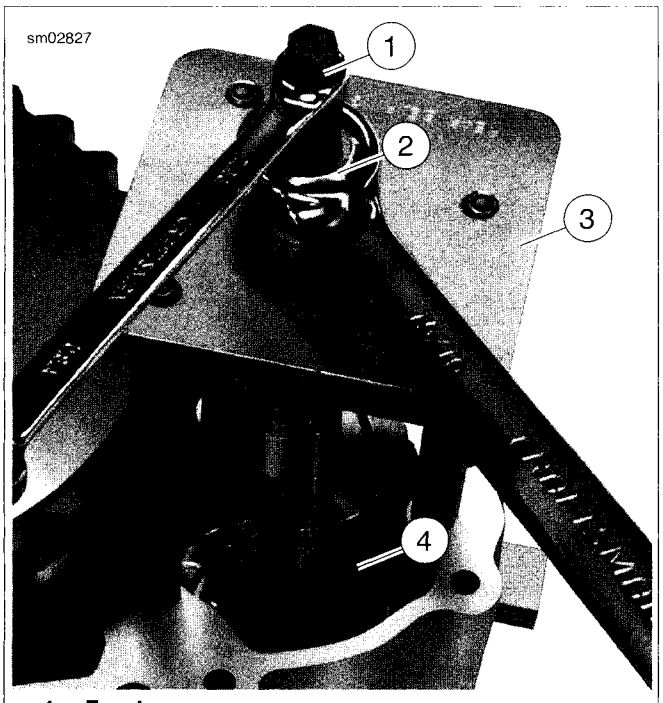
Use caution when supporting crankcase half. Failure to have adequate support may cause damage to crankcase.

4. Support crankcase half in a press using wooden blocks covered with clean shop towels. Note that uneven surfaces on crankcase may need different size supports.
5. With crankcase level and perpendicular to the balance shaft, press balance shaft and bearing into crankcase.

NOTE

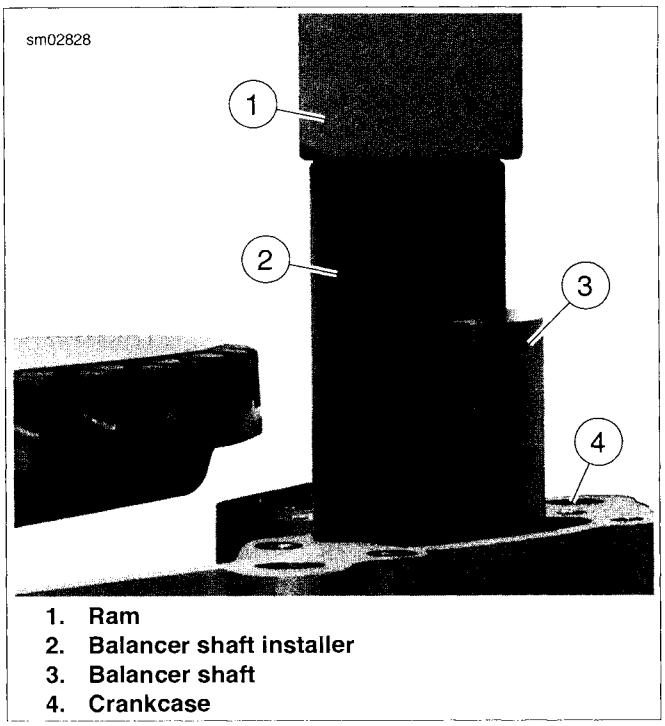
*If **new** bearing fastener is not available, apply LOCTITE THREADLOCKER 243 (blue) to threads of fastener before installation.*

6. See Figure 3-160. Install **new** bearing fastener (4). Tighten to 40-70 **in-lbs** (4.5-7.9 Nm).
7. Repeat installation on other shaft.



1. **Forcing screw**
2. **Nut**
3. **Plate**
4. **Balance shaft**

Figure 3-162. Removing Balance Shaft



1. **Ram**
2. **Balancer shaft installer**
3. **Balancer shaft**
4. **Crankcase**

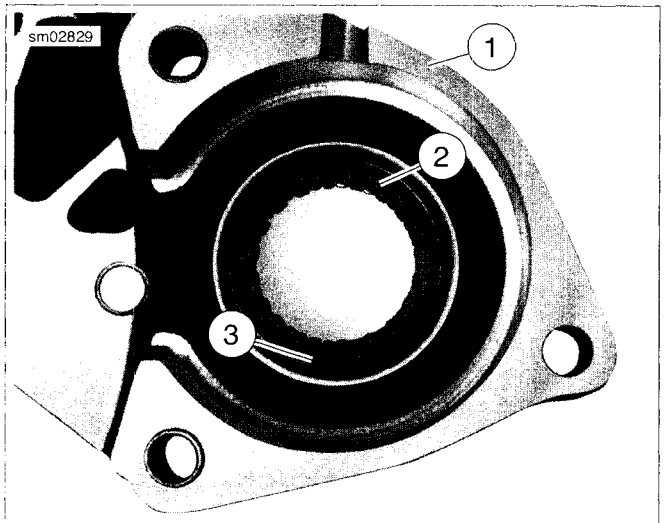
Figure 3-163. Balance Shaft Installation

Balance Shaft Support Bearings Removal

1. Inspect bearing for rough spots or binding. Always replace all four bearings (crankcase and housing, front and rear) during a complete bottom end overhaul.
2. See Figure 3-164. Remove retaining ring (3)
3. See Figure 3-165. Place housing (3) on a suitable support with top surface facing up.
4. Place bearing remover end of BALANCE SHAFT SUPPORT BEARING REMOVER/INSTALLER (Part No. HD-48474) (2) over bearing.
5. Center bearing remover under ram (1) of press. Slowly lower ram to remove bearing.
6. Discard retaining ring and bearing.

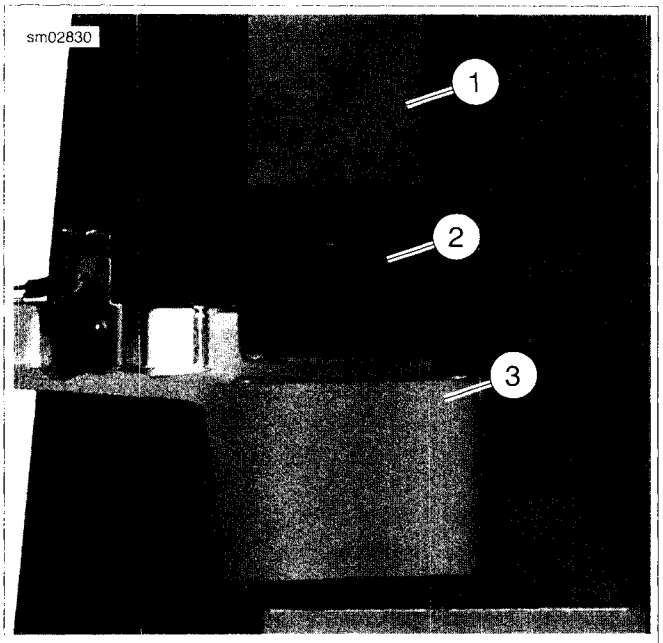
Balance Shaft Support Bearings Installation

1. See Figure 3-166. Place balance shaft support (4) upside down on a suitable support.
2. Set bearing on housing with letters on bearing facing up. Place bearing installer end of BALANCE SHAFT SUPPORT BEARING REMOVER/INSTALLER (Part No. HD-48474) (2) over bearing (3).
3. Center installer under ram (1) of press. Slowly lower ram to seat bearing until it fits flush against support.
4. See Figure 3-164. Install a **new** retaining ring (3).



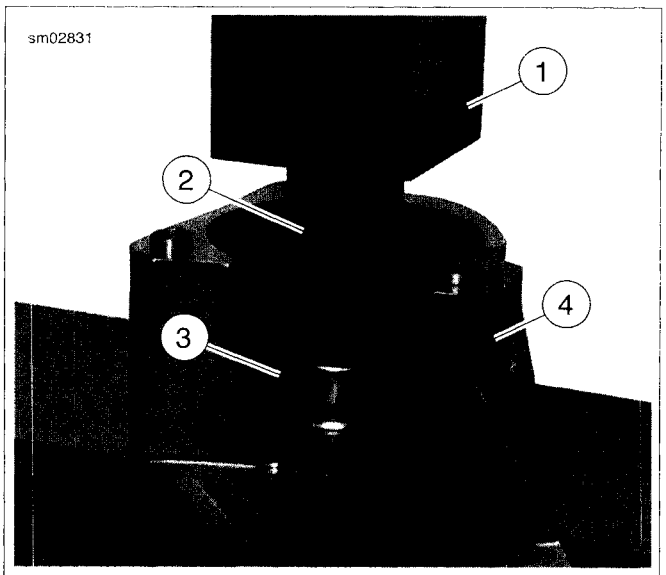
1. Balance shaft support
2. Bearing
3. Retaining ring

Figure 3-164. Balance Shaft Support Bearing



1. Ram
2. Bearing
3. Balance shaft support

Figure 3-165. Removing Bearing from Shaft Support



1. Ram
2. Bearing installer
3. Bearing
4. Balance shaft support

Figure 3-166. Installing Bearing in Shaft Support

Front and Rear Balance Sprockets

1. See Figure 3-167. Sprockets must be flat within 0.008 in. (0.203 mm).
2. Inspect sprocket teeth for any irregular wear patterns or chipping.
   a. The most common type of sprocket wear is polishing. This results from the chain contacting the sprocket surface and creating a shiny, mirror-like surface. Moderate polishing is not grounds for replacement.
   b. Sprocket teeth may exhibit surface deformations or areas where the material has been compressed. This is known as brinelling. If small chunks of metal are removed from the surface, it is known as pitting. Replace sprockets showing pitting or brinelling.
   c. Inspect base of each sprocket tooth for hooking. Hooking occurs when chain wears away the tooth in a scalloped shape pattern. Replace sprockets showing signs of severe hooking.
3. Check the mating surface that fits around the balance shaft. Improperly installed sprockets may show wear on inside edges.
4. Replace sprockets during a major bottom end overhaul. Always replace sprockets in sets, including the sprocket on the flywheel.

Hydraulic Tensioners

1. Test hydraulic tensioners using the leakdown test for the chain guide bracket on an assembled engine. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Check to see if more air is flowing from the front or rear tensioner by placing your hand over the piston while applying compressed air to the interconnect passage. See Figure 3-168. Disassemble components and verify that

the plastic vent cap (2) is on the spring (3) and seated under the tensioner piston (1). Minimum free length for spring (3) is 1.85 in. (47.0 mm).

3. Inspect exterior surface of piston (1) for damage. While some moderate amount of polishing is normal, surface pitting is grounds for piston replacement.

Chain Tensioner Guides

Inspect tensioner guide surface. Replace any guide with grooves deeper than 0.080-0.090 in. (2.03-2.29 mm) or signs of melting, burning or cracking.

Chain Guide Bracket

Replace the rubber interconnect on the outside of the chain guide bracket each time the right crankcase is removed. Beyond the hydraulic tensioner piston, plastic vent cap and spring, there are no internal service parts available for the chain guide bracket. If the bracket fails the leak down test and the rubber interconnect has been replaced, replace the chain guide bracket as an assembly.

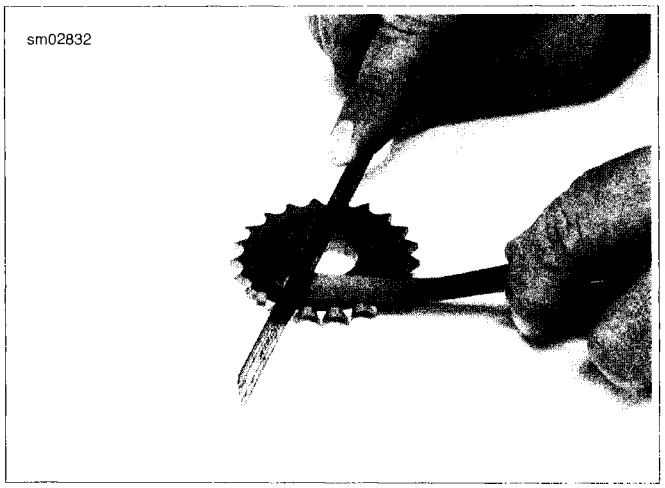
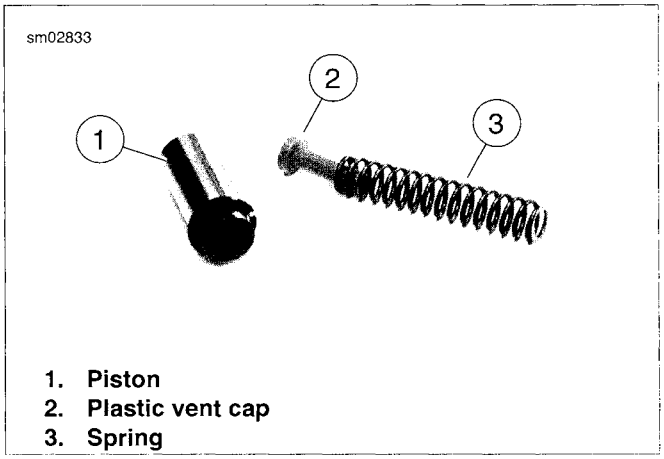


Figure 3-167. Sprocket Inspection



1. **Piston**
2. **Plastic vent cap**
3. **Spring**

Figure 3-168. Hydraulic Tensioners

Balance Chain

1. Check balance chain for missing bushings, side plates and turning marks. Inspect for tooth hooking or burn marks. Replace as necessary.
2. Chains will darken in color as the result of wear and exposure to engine oil. This darkening will almost always be some hue of brown. If the chain turns blue, it may be the result of heat exposure.
3. Replace balance chain any time the sprockets are replaced. Always apply a thin film of clean H-D 20W50 engine oil before installation.

INSTALLATION OVERVIEW

1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL AND DISASSEMBLY

PART NUMBER	TOOL NAME
HD-44455	OIL LINE REMOVING TOOL

Oil Tank

1. Remove seat.

⚠WARNING

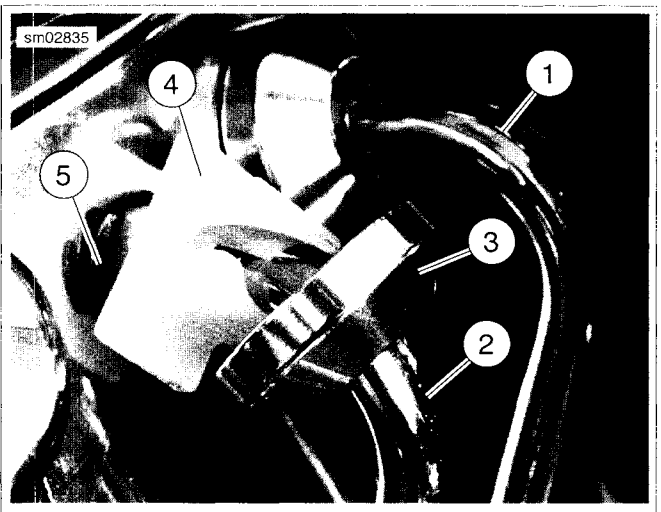
Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

2. Disconnect both battery cables, negative cable first, and remove battery. See 1.25 BATTERY MAINTENANCE.
3. Remove battery caddy. See 7.12 BATTERY CABLES.
4. Remove rear exhaust pipe. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
5. Drain oil tank. See 1.6 ENGINE OIL AND FILTER.
6. Remove rear fender assembly.
7. Remove splash guard.
   a. Remove fastener securing bottom of splash guard.
   b. Pull bottom of splash guard from frame tabs.
   c. Detach top of splash guard from rear fork tube.

NOTE

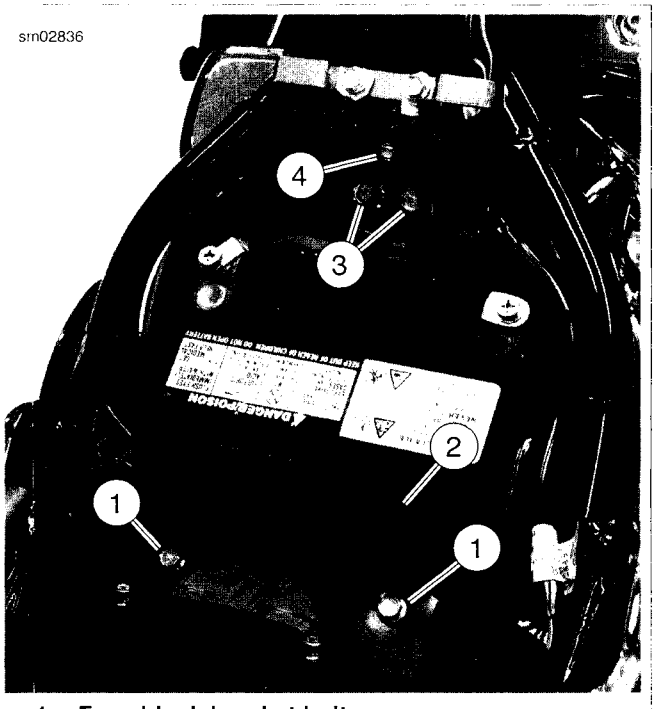
To ease installation, make note of wire and hose routing before removing electrical panel and oil tank.

8. Remove EVAP hose and wiring from clip on left side of electrical panel.
9. Remove fasteners securing electrical panel. Move panel aside.
10. See Figure 3-170. Remove two bolts (1) from behind fuse block (2). Lift fuse block bracket and set aside.
11. Remove two bolts with washers (3) on top front bracket.
12. See Figure 3-171. Remove two bolts (25).
13. Cut lower drain hose clamp (2) from frame.
14. Cut clamp (7) from either side of oil feed hose (8).
15. Remove positive battery cable from starter motor post.
16. See Figure 3-169. Detach vent (1) and return (2) oil lines at front of tank using OIL LINE REMOVING TOOL (Part No. HD-44455).
   a. Slide cover (3) away from oil line.
   b. Insert tool (4) inside retainer (5).
   c. Pull oil line straight out from tank leaving oil line retainer (5) inside tank.
17. Remove oil tank from right side of vehicle.



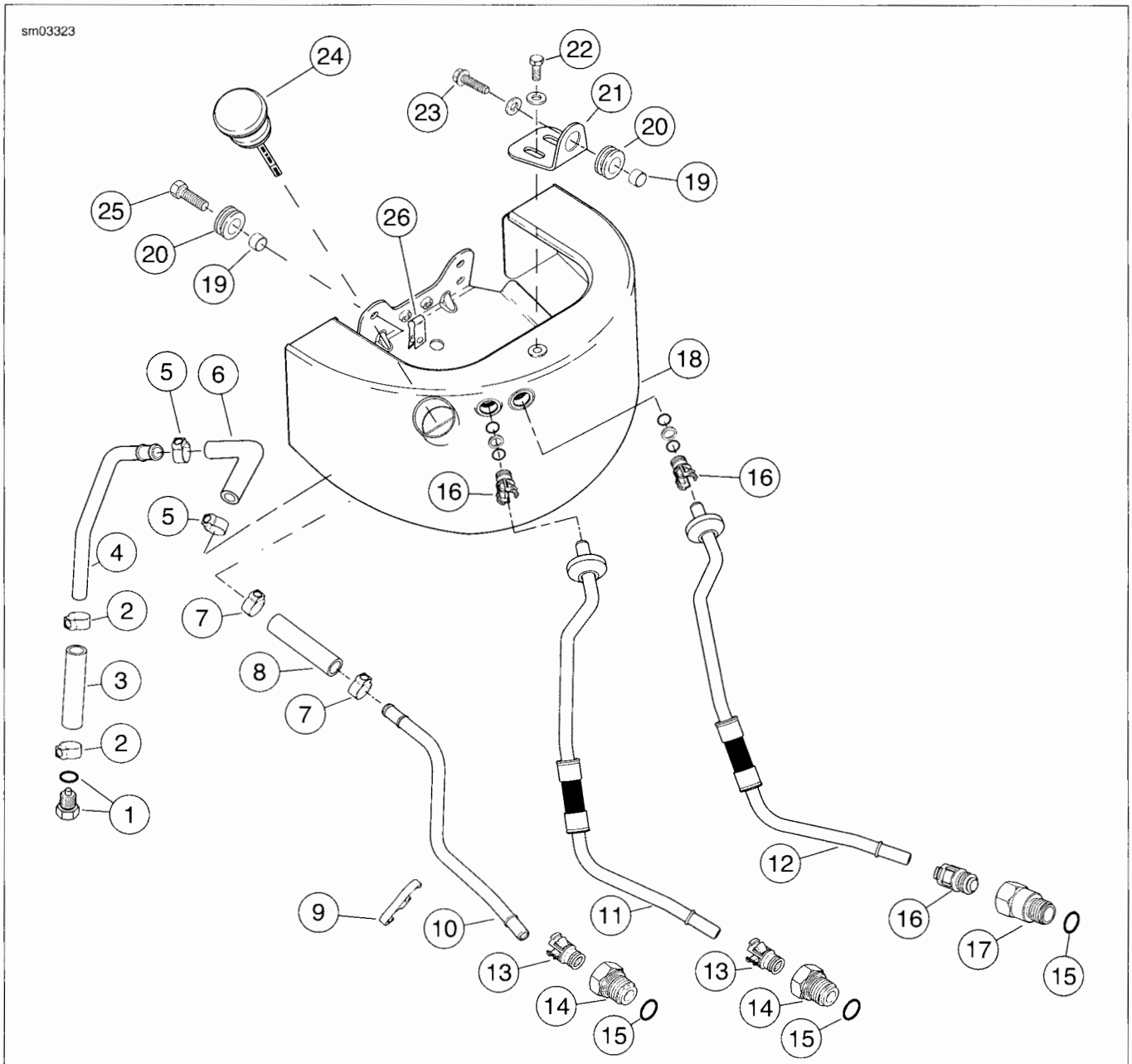
1. **Vent line**
2. **Return line**
3. **Cover**
4. **Oil line removing tool**
5. **Oil line retainer**

Figure 3-169. Line Cover



1. **Fuse block bracket bolts**
2. **Fuse block and cover**
3. **Top bracket bolts**
4. **Front bracket bolt**

Figure 3-170. Top View of Oil Tank



1. Drain plug and O-ring
2. Clamp (2)
3. Lower drain hose
4. Drain hose
5. Clamp (2)
6. Oil drain elbow
7. Clamp (2)
8. Oil feed hose
9. Oil line clip
10. Feed line
11. Return line
12. Vent line
13. Oil line retainer (large) (2)
14. Oil line fiitting (large) (2)
15. O-ring (3)
16. Oil line retainer (small) (3)
17. Oil line fitting (small)
18. Oil tank
19. Spacer (3)
20. Grommet (3)
21. Top bracket
22. Bolt
23. Bolt
24. Dipstick
25. Bolt (2)
26. Clip nut (2)

Figure 3-171. Oil Tank

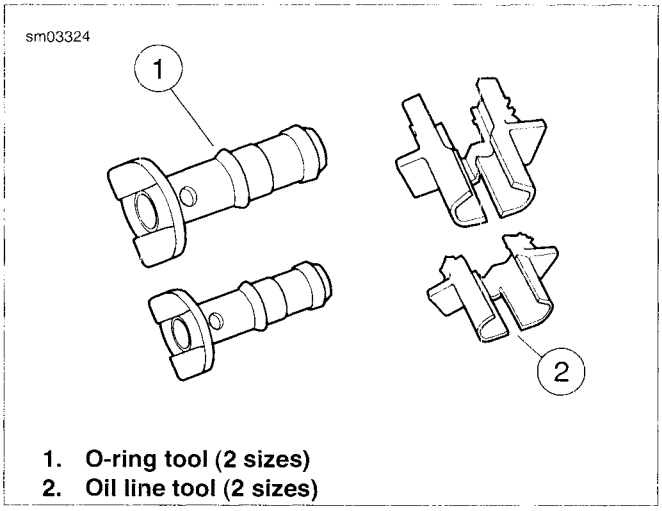
Oil Line Fittings/Retainers

NOTES

There are two sizes of oil line retainers and fittings. Use the appropriate sized oil line tool for all service procedures. See Figure 3-172.

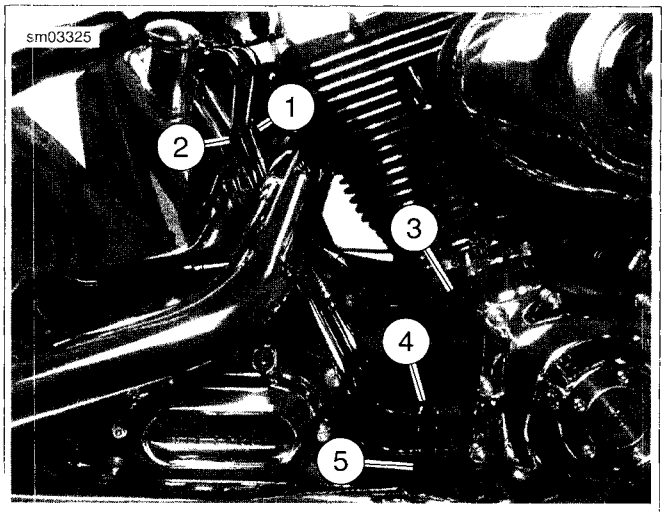
- *See Figure 3-173. Small retainers connect the vent (1) and return lines (2) to the oil tank. A small retainer and fitting also connects the vent line (3) to the engine.*
- *Large retainers and fittings attach the return (4) and feed lines (5) to the engine.*
- *See Figure 3-174. Do not remove oil line retainers from engine fittings or oil tank unless retainers, o-rings, and/or spacers are damaged.*
- *See Figure 3-175. O-rings (1) and spacer (2) are not sold separately. If either o-rings or spacer are damaged, oil line retainer assembly must be replaced.*

1. Insert OIL LINE O-RING TOOL (Part No. HD-44455)(4) inside retainer (3).
2. Squeeze tabs on retainer and withdraw tool, retainer, both o-rings and spacer. Discard retainer, o-rings and spacer.
3. Insert tool (4) through **new** retainer (3).
4. Insert tool, retainer, spacer and o-rings into engine fitting or oil tank until tabs on retainer lock into place. Do not damage o-rings during installation.
5. Carefully withdraw tool leaving retainer assembly in place.



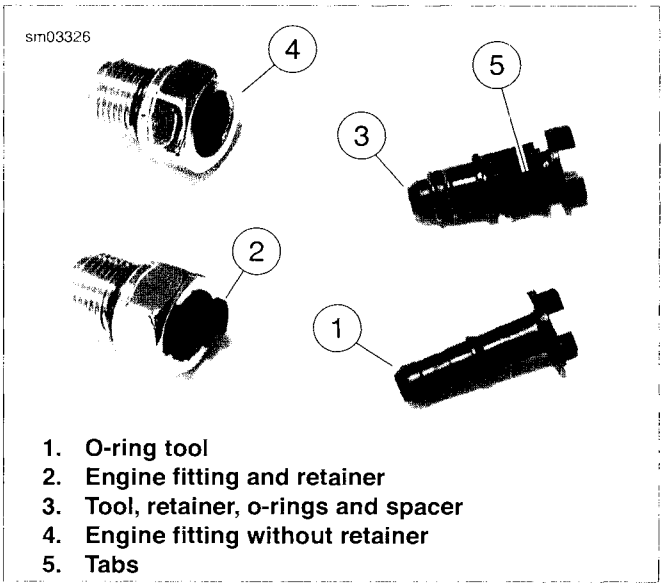
1. **O-ring tool (2 sizes)**
2. **Oil line tool (2 sizes)**

Figure 3-172. Oil Line Tools



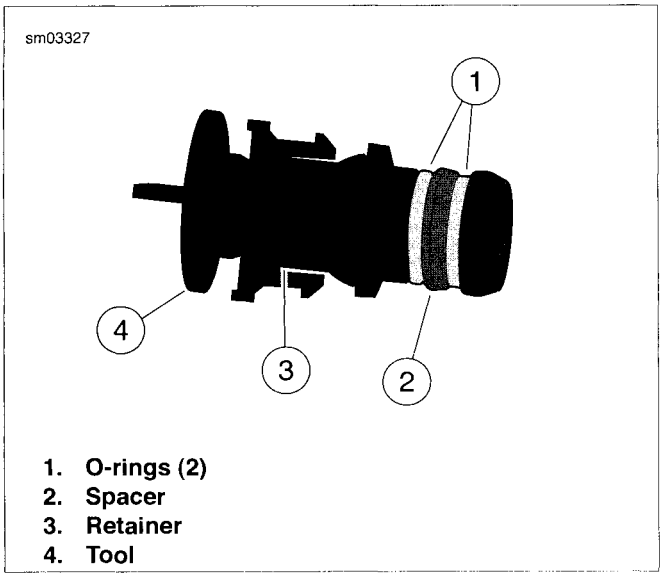
1. **Vent line to oil tank (small retainer)**
2. **Return line to oil tank (small retainer)**
3. **Vent line to engine (small retainer and fitting)**
4. **Return line to engine (large retainer and fitting)**
5. **Feed line to engine (large retainer and fitting)**

Figure 3-173. Oil Line Fittings/Retainers: All But FXCWC



1. **O-ring tool**
2. **Engine fitting and retainer**
3. **Tool, retainer, o-rings and spacer**
4. **Engine fitting without retainer**
5. **Tabs**

Figure 3-174. Oil Line Retainers (Parts Removed From Engine for Clarity)



1. **O-rings (2)**
2. **Spacer**
3. **Retainer**
4. **Tool**

Figure 3-175. O-rings and Spacer

INSTALLATION

PART NUMBER	TOOL NAME
HD-97087-65B	HOSE CLAMP PLIERS

1. See Figure 3-171. Slide oil tank into position within frame. Install two bolts (22) through top bracket to hold tank in place.
2. Install two bolts (25) from back side of tank.
3. Install **new** clamp (7) to attach oil feed hose (8) to oil tank.
4. Crimp clamp using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
5. Position drain hose outboard of the electrical panel and inboard of the brake line and frame harness. Attach drain hose to frame.
6. Install **new** clamp (2) over oil drain line and install drain line.
7. Crimp clamp using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
8. See Figure 3-169. Connect vent and return lines to tank. No tools are necessary for this step. Insert lines straight into fittings without digging or gouging o-rings. Remove any labels used to identify lines during removal process.

NOTE

In next step, make sure electrical box is located under fuse block bracket.

9. See Figure 3-176. Install two bolts (1) to attach fuse block bracket.
10. Install the three fasteners securing the electrical panel and torque to 36-60 **in-lbs** (4.1-6.8 Nm).
11. Install EVAP hose and wiring into clip on left side of electrical panel.
12. Install splash guard.
    a. Attach top of splash guard to rear fork tube.
    b. Push in bottom of splash guard until it snaps into place over frame tabs.
    c. Install fastener securing bottom of splash guard and torque to 36-48 **in-lbs** (4.1-5.4 Nm).
13. Install rear fender.
14. Install exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
15. Install positive battery cable to starter and install battery caddy. See 7.12 BATTERY CABLES.

⚠WARNING

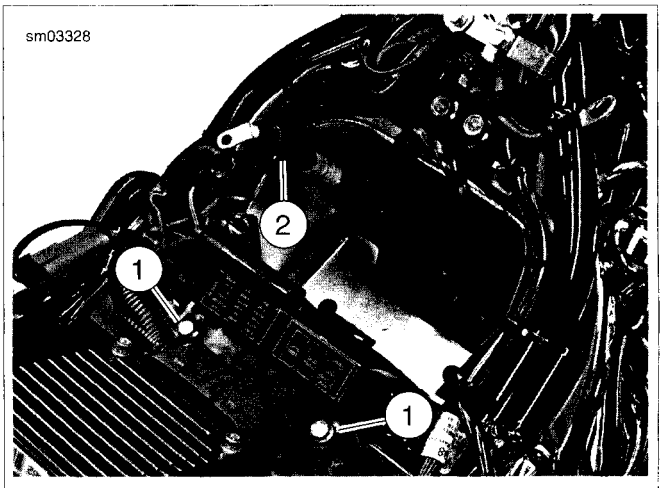
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

16. Install battery and connect cables, positive cable first.

⚠WARNING

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

17. Install seat.
18. Fill oil tank and check oil level after running motorcycle on side stand. See 1.6 ENGINE OIL AND FILTER.



1. **Fuse block bolts**
2. **Positive battery cable**

Figure 3-176. Positive Battery Cable

REMOVAL AND DISASSEMBLY

PART NUMBER	TOOL NAME
HD-44455	OIL LINE REMOVING TOOL

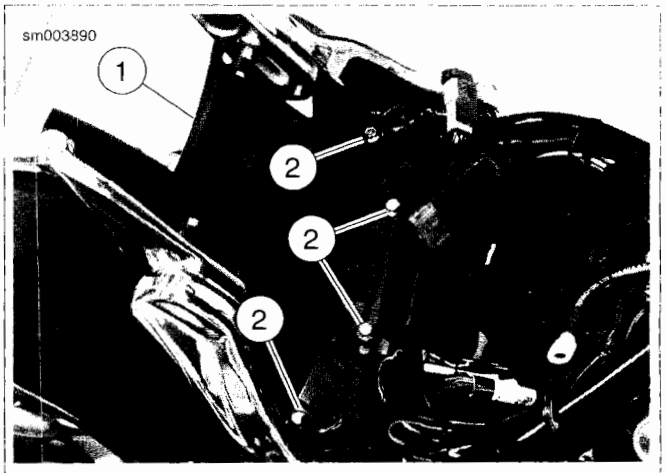
Oil Tank

1. Remove seat.

⚠WARNING

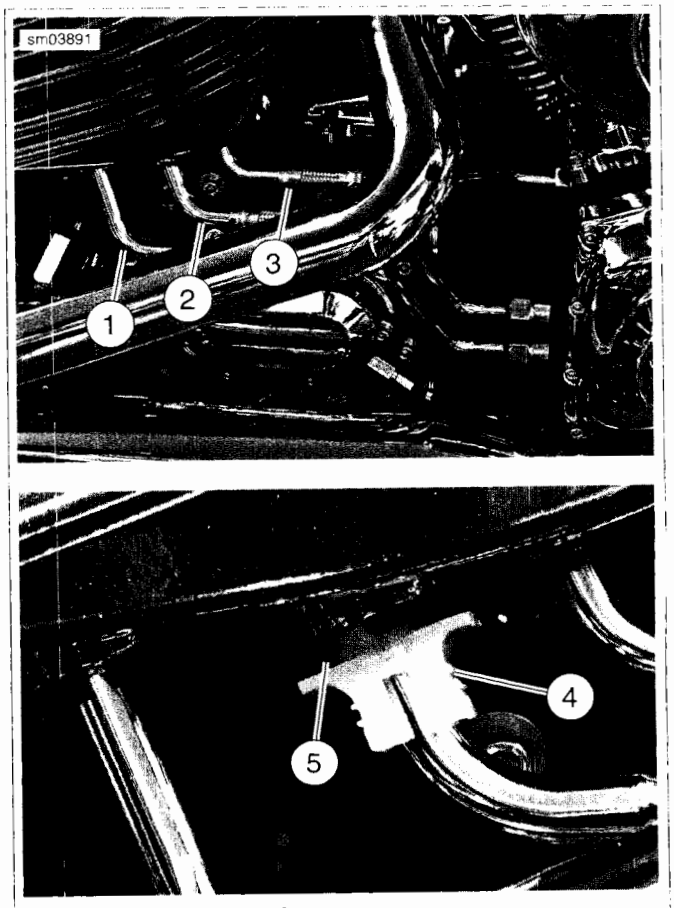
Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

2. Disconnect both battery cables, negative cable first, and remove battery. See 1.25 BATTERY MAINTENANCE.
3. Remove battery caddy. See 7.12 BATTERY CABLES.
4. Remove rear exhaust pipe. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB.
5. Drain oil tank. See 1.6 ENGINE OIL AND FILTER.
6. Remove rear fender assembly. See 2.35 REAR FENDER: FXCWC.
7. Remove splash guard.
8. Remove fastener securing top of electrical panel to oil tank.
9. See Figure 3-177. Remove seat cover (1) to allow for movement of fuse block and harness when removing oil tank.
10. See Figure 3-179. Remove two bolts (21) securing rear of oil tank.
11. Remove two bolts with washers (18) on top front of oil tank.
12. Cut lower drain hose clamp (2) from frame.
13. See Figure 3-178. Detach feed line to engine (1), return line to oil tank (2), and vent line (3) using OIL LINE REMOVING TOOL (Part No. HD-44455).
    a. Insert oil line removing tool (4) inside retainer (5).
    b. Pull oil line straight out, leaving oil line retainer inside tank.
14. Remove oil tank from right side of vehicle.



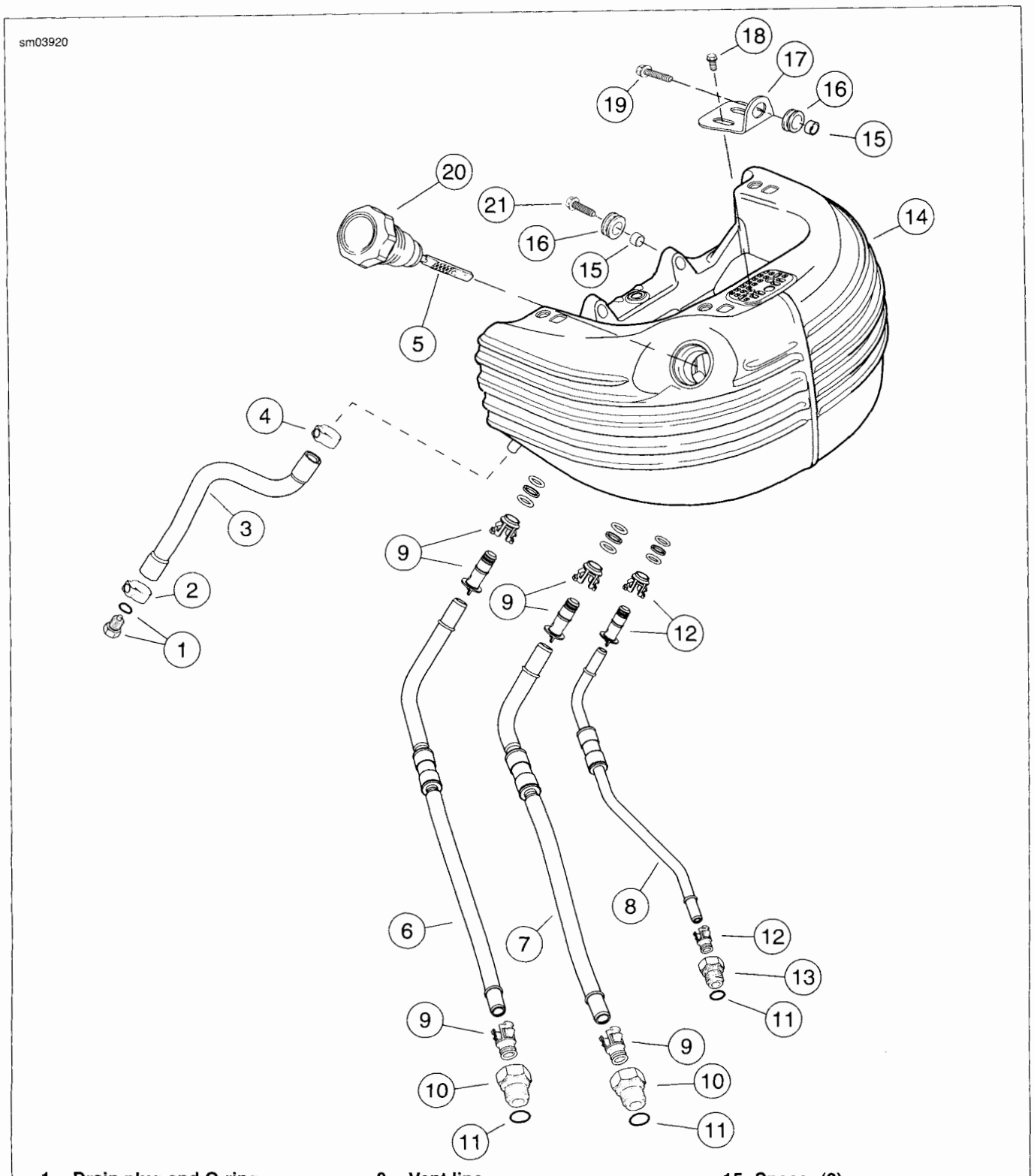
1. Seat back cover
2. Fasteners (4)

Figure 3-177. Seat Back Cover



1. Feed line to engine
2. Return line to oil tank
3. Vent line
4. Oil line removing tool
5. Retainer

Figure 3-178. Oil Lines: FXCWC



1. Drain plug and O-ring
2. Clamp
3. Drain hose
4. Clamp
5. Dipstick
6. Feed line
7. Return line
8. Vent line
9. Oil line retainer (large) (4)
10. Oil line fiitting (large) (2)
11. O-ring (3)
12. Oil line retainer (small) (2)
13. Oil line fitting (small)
14. Oil tank
15. Spacer (3)
16. Grommet (3)
17. Top bracket
18. Bolt (2)
19. Bolt
20. Cap
21. Bolt (2)

Figure 3-179. Oil Tank

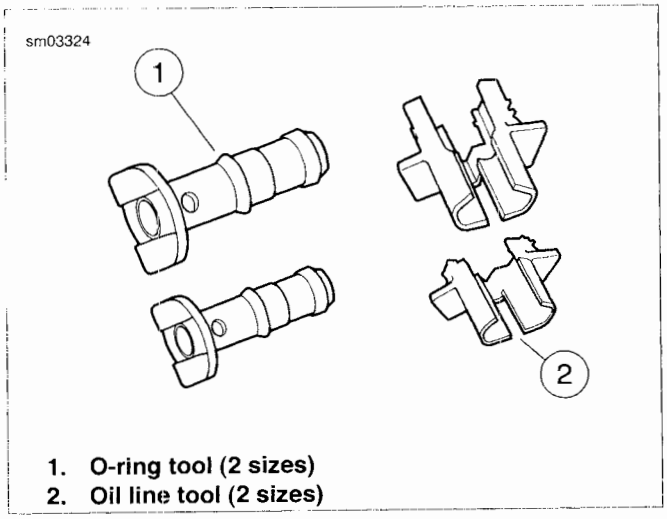
Oil Line Fittings/Retainers

NOTES

There are two sizes of oil line retainers and fittings. Use the appropriate sized oil line tool for all service procedures. See Figure 3-180.

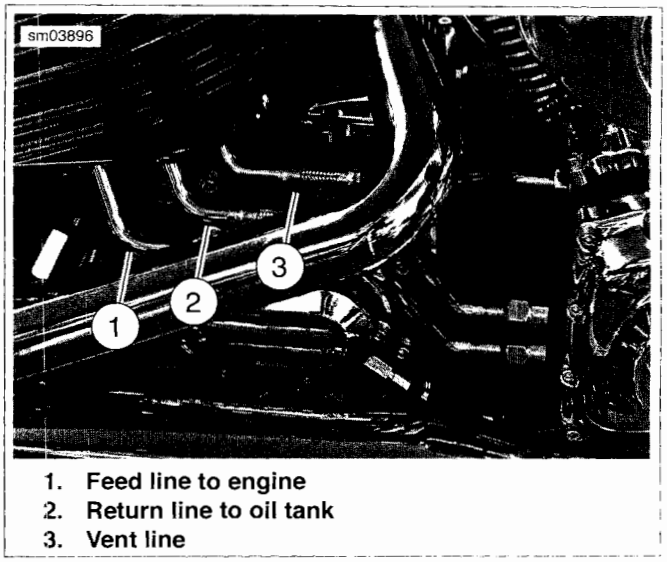
- *See Figure 3-181. Small retainers connect the vent line (3) to the oil tank and to the engine.*
- *Large retainers connect the feel line to engine (1) and return line to oil tank (2) to the oil tank and to the engine.*
- *See Figure 3-182. Do not remove oil line retainers from engine fittings or oil tank unless retainers, o-rings, and/or spacers are damaged.*
- *See Figure 3-183. O-rings (1) and spacer (2) are not sold separately. If either o-rings or spacer are damaged, oil line retainer assembly must be replaced.*

1. Insert OIL LINE O-RING TOOL (Part No. HD-44455)(4) inside retainer (3).
2. Squeeze tabs on retainer and withdraw tool, retainer, both o-rings and spacer. Discard retainer, o-rings and spacer.
3. Insert tool (4) through **new** retainer (3).
4. Insert tool, retainer, spacer and o-rings into engine fitting or oil tank until tabs on retainer lock into place. Do not damage o-rings during installation.
5. Carefully withdraw tool leaving retainer assembly in place.



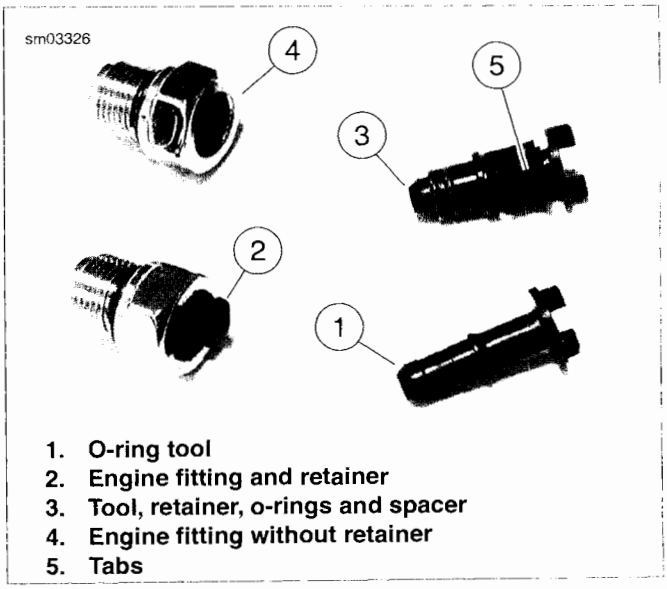
1. **O-ring tool (2 sizes)**
2. **Oil line tool (2 sizes)**

Figure 3-180. Oil Line Tools



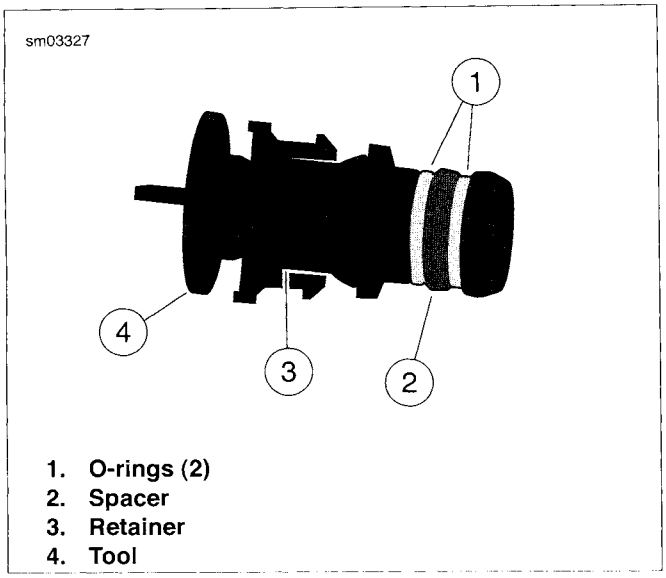
1. **Feed line to engine**
2. **Return line to oil tank**
3. **Vent line**

Figure 3-181. Oil Line Fittings/Retainers: FXCWC



1. **O-ring tool**
2. **Engine fitting and retainer**
3. **Tool, retainer, o-rings and spacer**
4. **Engine fitting without retainer**
5. **Tabs**

Figure 3-182. Oil Line Retainers (Parts Removed From Engine for Clarity)



1. **O-rings (2)**
2. **Spacer**
3. **Retainer**
4. **Tool**

Figure 3-183. O-rings and Spacer

INSTALLATION

PART NUMBER	TOOL NAME
HD-97087-65B	HOSE CLAMP PLIERS

1. See Figure 3-179. Slide oil tank into position within frame. Install two bolts (18) through top bracket to hold tank in place.
2. Install two bolts (21) from back side of tank.
3. Attach drain hose and install **new** clamp (2) to frame. Crimp clamp using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
4. Secure wire harness and rear brake line to drain at frame with a wire tie.
5. See Figure 3-184. Install seat cover (1). Make sure fuse block bracket is properly positioned under seat cover.
6. See Figure 3-178. Connect vent line, return line to oil tank, and feed line to engine. No tools are necessary for this step. Insert lines straight into fittings without digging or gouging o-rings. Remove any labels used to identify lines during removal process.
7. Install fastener securing top of electrical panel to oil tank and torque to 36-60 **in-lbs** (4.1-6.8 Nm).
8. Install splash guard and tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).
9. Install rear fender. See 2.35 REAR FENDER: FXCWC.
10. Install exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB.
11. Install battery caddy. See 7.12 BATTERY CABLES.

⚠WARNING

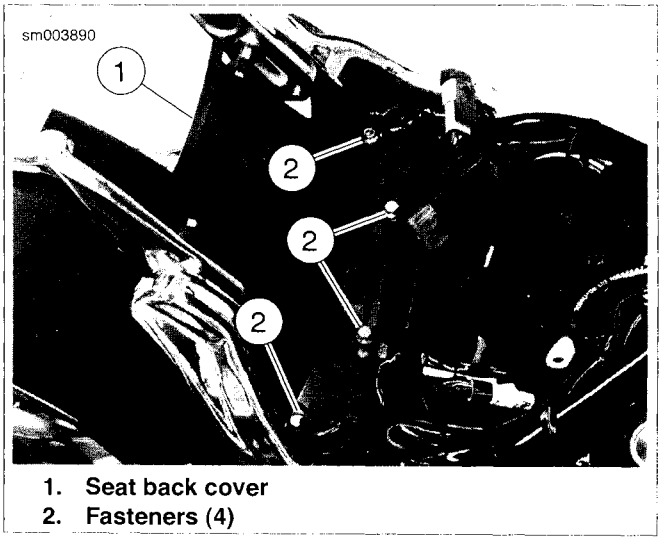
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

12. Install battery and connect cables, positive cable first.

⚠WARNING

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

13. Install seat.
14. Fill oil tank and check oil level after running motorcycle on side stand. See 1.6 ENGINE OIL AND FILTER.



1. **Seat back cover**
2. **Fasteners (4)**

Figure 3-184. Seat Back Cover

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.5 AIR CLEANER ASSEMBLY, Installation
Air cleaner filter element screw	40-60 **in-lbs**	4.5-6.8 Nm	4.5 AIR CLEANER ASSEMBLY, Installation
Cylinder head breather bolts	22-24 ft-lbs	29.9-32.6 Nm	4.5 AIR CLEANER ASSEMBLY, Installation
Engine Temperature (ET) sensor	10-15 ft-lbs	13.6-20.3 Nm	4.9 ENGINE TEMPERATURE SENSOR (ET), Installation
Exhaust carriage bolt flange locknut	20-25 ft-lbs	27.1-33.9 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust interconnect clamp	15-19 ft-lbs	20.4-27.1 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut final torque	100-120 **in-lbs**	11.3-13.6 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut final torque	100-120 **in-lbs**	11.3-13.6 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut initial torque	9-18 **in-lbs**	1.0-2.0 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut initial torque	9-18 **in-lbs**	1.0-2.0 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp upper nut	100-120 **in-lbs**	11.3-13.6 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp upper nut	100-120 **in-lbs**	11.3-13.6 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust pipe clamp locknut	20-25 ft-lbs	27.1-33.9 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Exhaust system interconnect tube fasteners	20-25 ft-lbs	27.14-33.93 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Fuel Pump/Fuel Gauge Sending Unit T20 TORX screws	18-24 **in-lbs**	2.0-2.7 Nm	4.15 FUEL PUMP AND FUEL GAUGE SENDING UNIT, Installation
Fuel supply tube fastener	90-110 **in-lbs**	10.2-12.4 Nm	4.14 FUEL INJECTORS, Installation
Fuel tank front screw	28-32 ft-lbs	38.0-43.4 Nm	4.6 FUEL TANK, Installation/all but FXCWC
Fuel tank mount acorn nut	28-32 ft-lbs	38.0-43.4 Nm	4.6 FUEL TANK, Installation/FXCWC
Fuel tank rear mount nut	14-18 ft-lbs	19.0-24.4 Nm	4.6 FUEL TANK, Installation/FXCWC
Fuel tank T40 TORX screw	18-22 ft-lbs	24.4-29.8 Nm	4.6 FUEL TANK, Installation/all but FXCWC
Instrument console acorn nut	7-11 ft-lbs	9.5-14.9 Nm	4.6 FUEL TANK, Installation/all but FXCWC
Intake air temperature sensor (IAT) fastener	15-20 **in-lbs**	1.7-2.3 Nm	4.8 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Manifold mounting screws	96-144 **in-lbs**	10.8-16.3 Nm	4.10 INDUCTION MODULE, Installation
Muffler clamp	38-43 ft-lbs	51.6-58.4 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Muffler clamps: all but FLSTF/FLSTFB/FLSTN	38-43 ft-lbs	51.6-58.4 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Muffler fasteners: all but FLSTF/FLSTFB/FLSTN	96-120 **in-lbs**	10.86-13.57 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Muffler support fastener	96-120 **in-lbs**	10.8-13.6 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers

FASTENER	TORQUE VALUE		NOTES
Oxygen sensor	29-44 ft-lbs	39.3-59.7 Nm	4.13 OXYGEN SENSOR, Installation
Splash guard fastener (all but FXCWC)	36-48 **in-lbs**	4.1-5.4 Nm	4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister
Splash guard fasteners (FXCWC)	36-60 **in-lbs**	4.1-6.8 Nm	4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.11 IDLE AIR CONTROL (IAC), Installation
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.12 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), Installation/Use new screws
Throttle position sensor fasteners	18 **in-lbs**	2.0 Nm	4.7 THROTTLE POSITION SENSOR (TPS), Installation

SPECIFICATIONS

Table 4-1. Fuel Capacity

FUEL TANK CAPACITY	GALLONS	LITERS
Total	5.0	18.93

TROUBLESHOOTING

See the electrical diagnostic manual for troubleshooting and diagnostic information.

GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

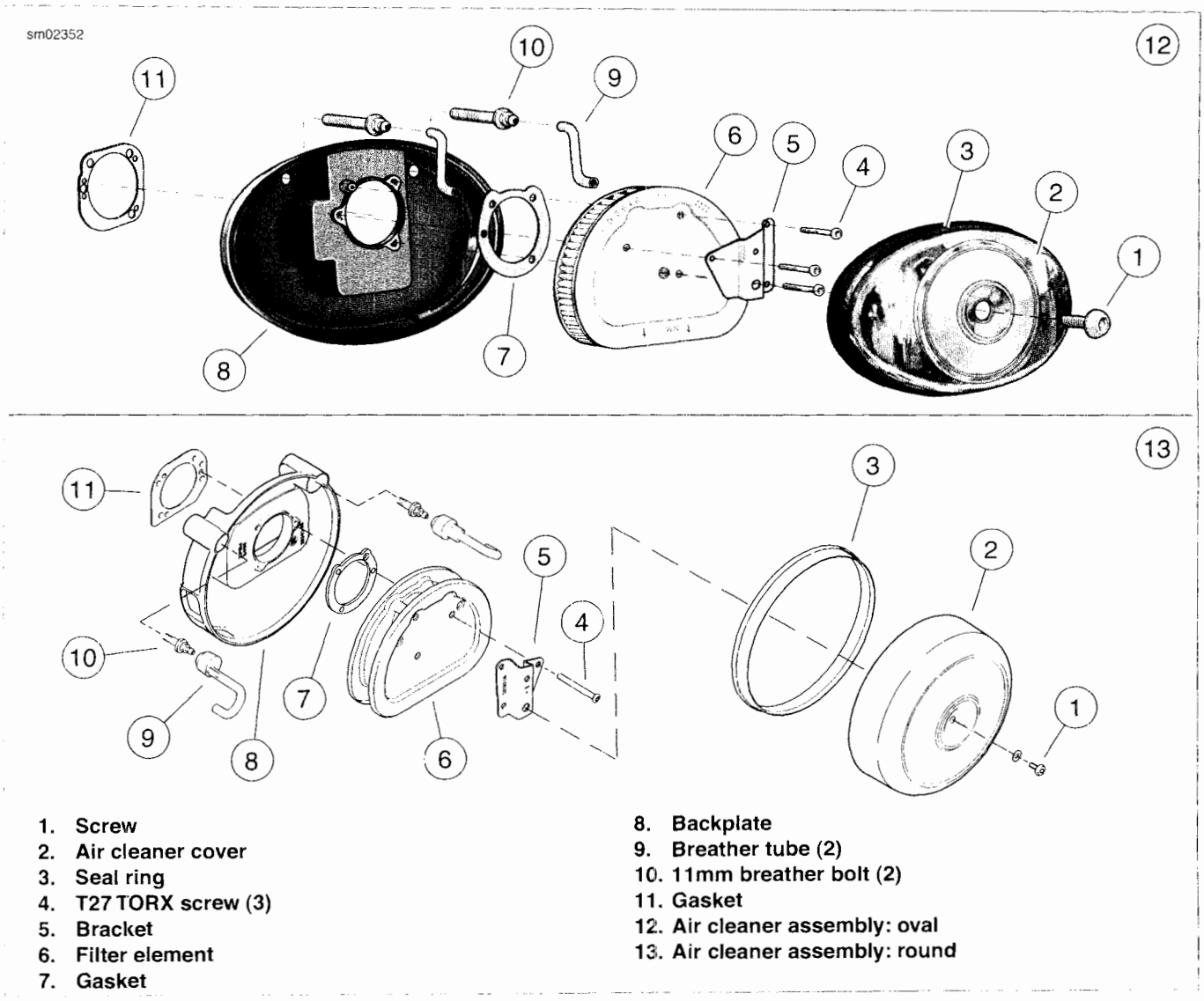
Idle speed can only be set using a computer based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750), available only to Harley-Davidson dealers.

REMOVAL

1. See Figure 4-1. Remove screw (1) and air cleaner cover (2).
2. Remove three TORX screws (4) and bracket (5) from filter element (6).
3. Gently pull both rubber breather tubes (9) from the element. Remove filter element (6) and gasket (7).
4. Replace the filter element if damaged or if filter media cannot be adequately cleaned.
5. Gently pull breather tubes (9) from breather bolts (10) on the backplate.
6. Check filter element. See 4.5 AIR CLEANER ASSEMBLY.
7. Inspect seal ring (3) for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
8. Alternately back out both breather bolts (10) a few turns a time while pulling backplate (8) away from induction module.
9. Continue previous step until breather bolts are clear. Remove backplate (8) and gasket (11). Discard gasket.
10. Wipe inside of air cleaner cover (2) and backplate (8) with damp cloth to remove dust.

INSTALLATION

1. See Figure 4-1. Position **new** gasket (11) on backplate. Insert two breather bolts (10) into backplate. Thread bolts loosely into each cylinder head. Final tighten bolts to 22-24 ft-lbs (29.9-32.6 Nm).
2. Insert two breather tubes (9) into the holes in the filter element. Place the element back into position and attach breather tubes to breather bolts.
3. Install air filter element (6) and bracket (5).
   a. Make sure gasket (7) holes are aligned with backplate holes.
   b. Use three TORX screws (4) to secure bracket and filter element. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm).
4. Install air filter cover (2).
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of air cleaner cover screw (1).
   b. Install screw to secure air cleaner cover. Tighten to 36-60 **in-lbs** (4.1-6.8 Nm).



1. Screw
2. Air cleaner cover
3. Seal ring
4. T27 TORX screw (3)
5. Bracket
6. Filter element
7. Gasket
8. Backplate
9. Breather tube (2)
10. 11mm breather bolt (2)
11. Gasket
12. Air cleaner assembly: oval
13. Air cleaner assembly: round

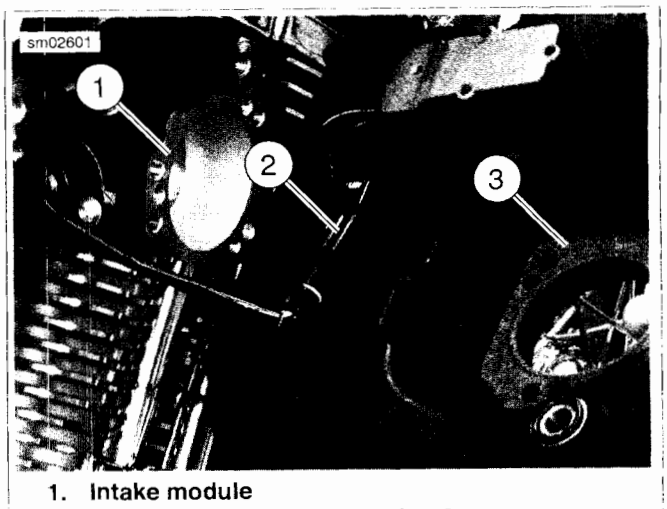
Figure 4-1. Air Cleaner Assembly

BACKPLATE ASSEMBLY: HDI MODELS

See Figure 4-2. HDI models have unique backplates. These parts may be distinguished by:

- A different intake with a solenoid-operated trap door assembly at the mouth of the intake.
- An intake solenoid connector (2) on the backplate.

Perform the same routine maintenance on HDI models, but also check that the trap door in the backplate operates properly.



1. Intake module
2. Intake solenoid connector [178]
3. Air cleaner backing plate

Figure 4-2. Backplate: HDI Models

GENERAL

⚠WARNING

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

The fuel tank is treated to resist rusting. However, when the motorcycle is not operated for a long period of time, see 1.27 STORAGE for specific information regarding fuel tank treatment.

For information on the tank-mounted fuel gauge, see the electrical diagnostic manual and 7.24 FUEL GAUGE.

REMOVAL

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Remove seat.
2. Remove fuse block cover.
3. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-3. Disconnect the fuel pump fuse from the main wiring harness.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

4. See Figure 4-4. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

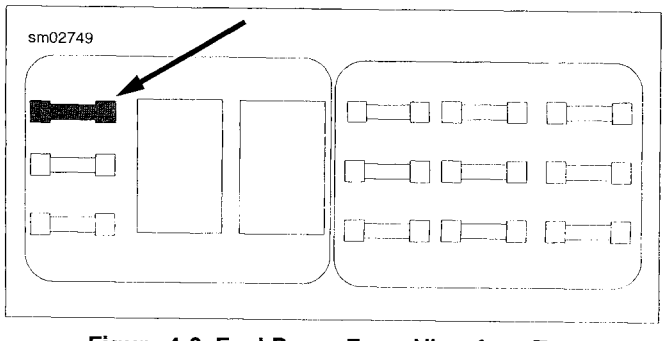
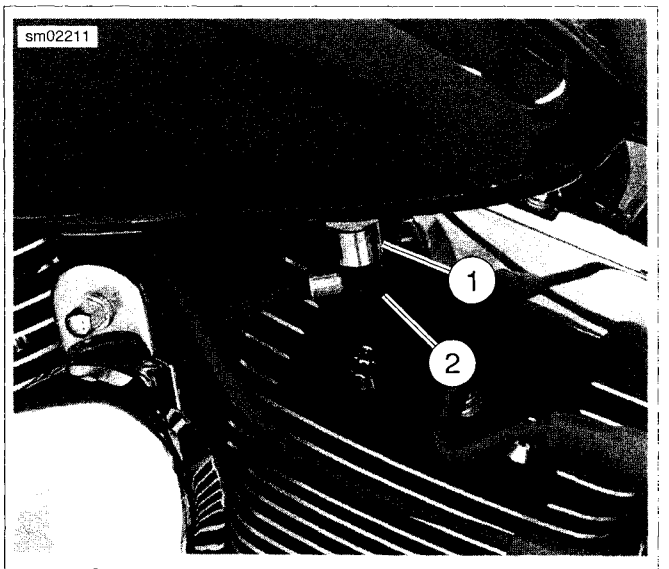


Figure 4-3. Fuel Pump Fuse: View from Top



1. **Quick connect fitting**
2. **Fuel supply line**

Figure 4-4. Fuel Supply Line Fitting

⚠WARNING

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

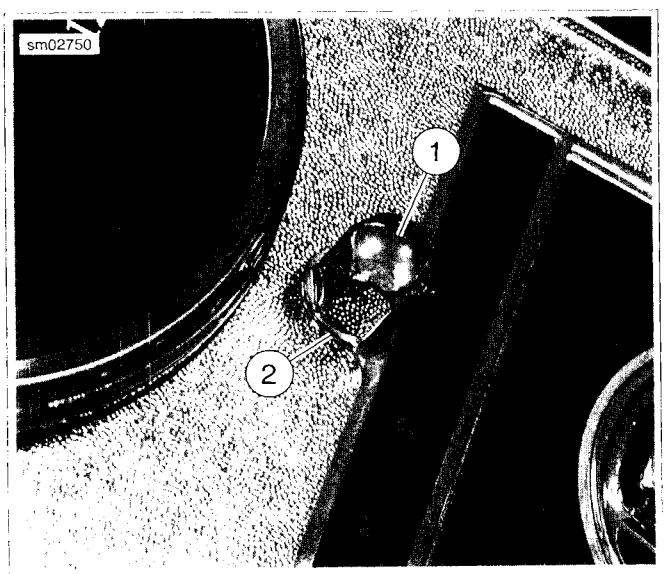
5. Disconnect negative battery cable.
6. Remove instrument console.
   a. **All but FXCWC:** see Figure 4-5. Remove acorn nut (1) and washer (2) on instrument console to separate console from fuel tank.
   b. **FXCWC:** see 7.25 INSTRUMENT CONSOLE: FXCWC.
7. Disconnect console wiring.
8. See Figure 4-6. Unplug fuel pump module connector [86].

⚠WARNING

Gasoline can drain from the crossover line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00259a)

9. Drain fuel tank.
   a. Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to verify that end is securely plugged.
   b. Cut clamp from one end of crossover hose. Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.

10. **All but FXCWC:** remove fuel tank.
    a. See Figure 4-8. Remove the rear T40 TORX screw and washer (7).
    b. Remove the acorn nut (6), washers (2), and front mounting screw (1).
    c. Remove continuous vent line (12) from nipple on front of tank.
    d. See Figure 4-7. Disconnect fuel gauge connector [117] located under left side of fuel tank.
    e. See Figure 4-8. Remove fuel tank from motorcycle. Remove rubber trim (13) to access connectors along frame. Remove bushings and grommets (3) if necessary.
11. **FXCWC:** remove fuel tank.
    a. See Figure 4-9. Remove nut and washer (14) on rear mounting tab.
    b. Remove the acorn nut (6), washers (2), and front mounting screw (1).
    c. Remove continuous vent line (12) from nipple on front of tank.
    d. See Figure 4-7. Disconnect fuel gauge connector [117] located under left side of fuel tank.
    e. Remove fuel tank from motorcycle.



1. **Acorn nut**
2. **Washer**

Figure 4-5. Instrument Console

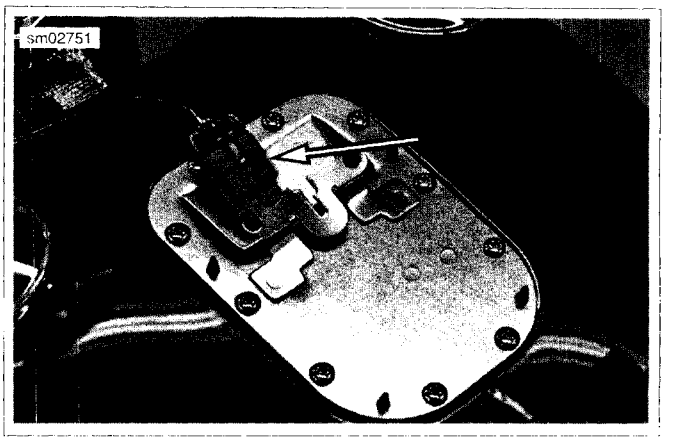


Figure 4-6. Fuel Pump Module Connector (Typical)

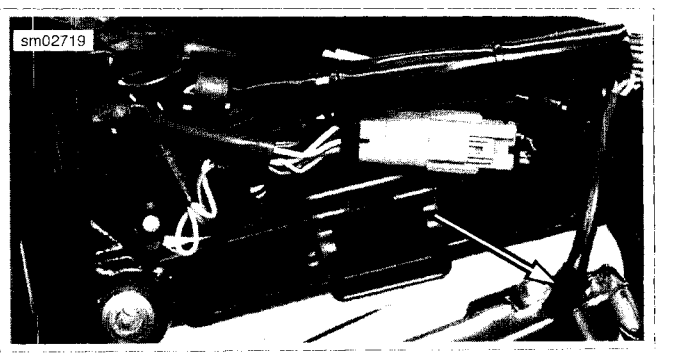
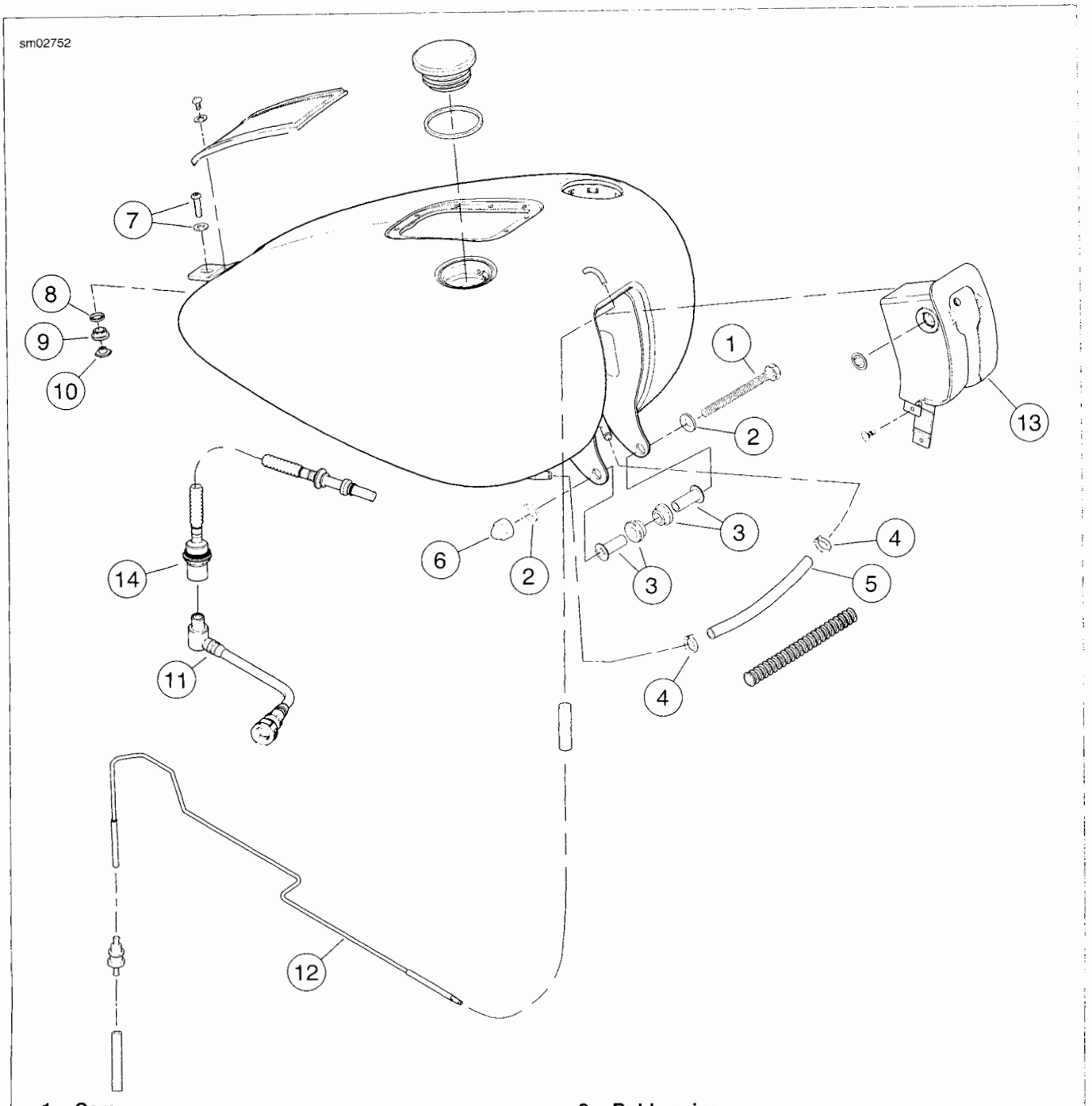
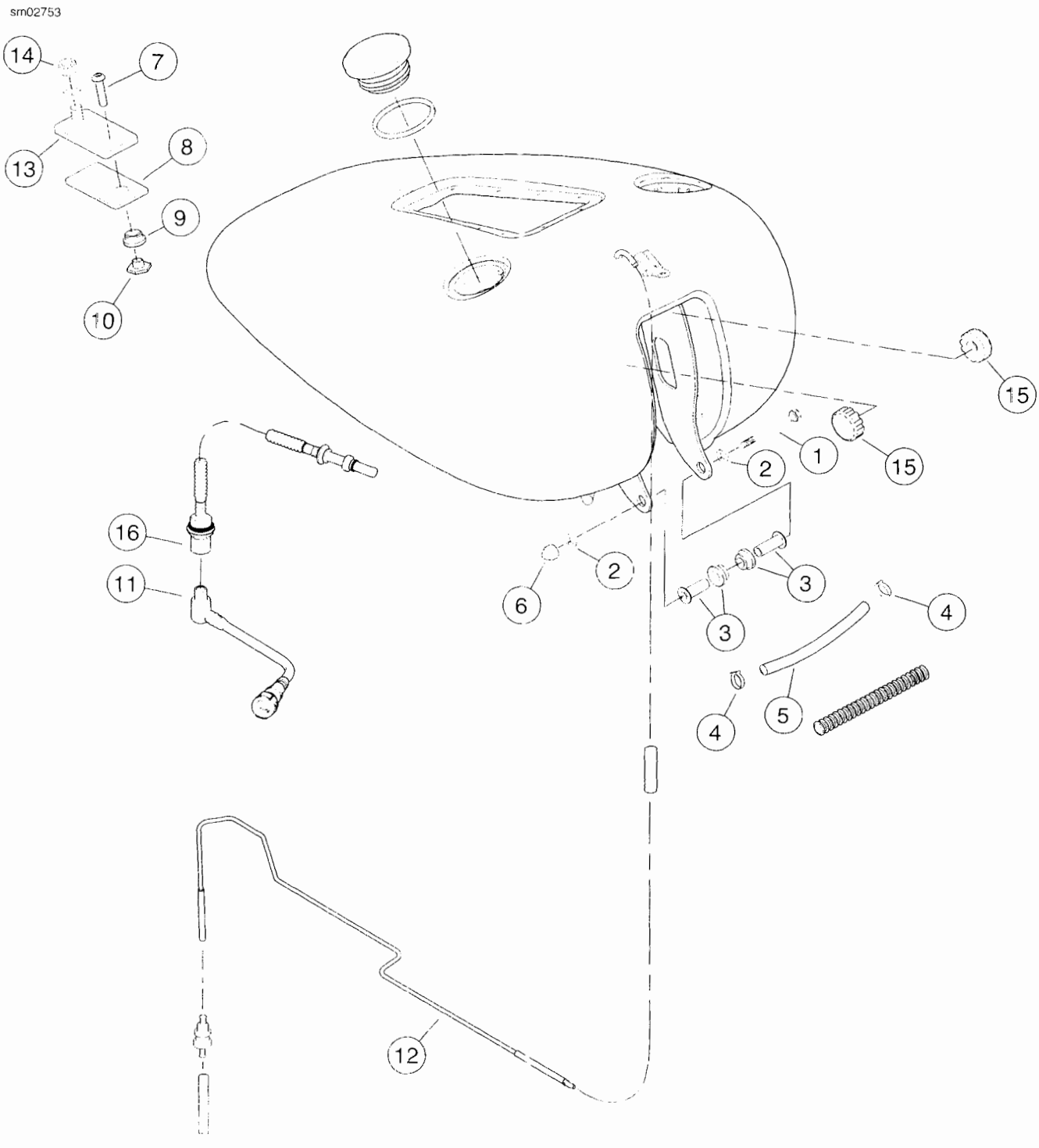


Figure 4-7. Fuel Gauge Connector [117] Location



1. Screw
2. Washer
3. Bushing and grommet
4. Clamp
5. Crossover line
6. Acorn nut
7. Rear T40 TORX screw
8. Rubber ring
9. Grommet (same a grommet #3)
10. Tee nut
11. Fuel line
12. Continuous vent line
13. Rubber trim
14. Check valve

Figure 4-8. Fuel Tank: All But FXCWC



1. Screw
2. Washer
3. Bushing and grommet
4. Clamp
5. Crossover line
6. Acorn nut
7. Rear T40 TORX bolt
8. Rubber ring
9. Grommet (same a grommet #3)
10. Tee nut
11. Fuel line
12. Continuous vent line
13. Mount
14. Nut
15. Front tank mount
16. Check valve

Figure 4-9. Fuel Tank: FXCWC

CLEANING AND INSPECTION

1. Remove fuel pump. See 4.15 FUEL PUMP AND FUEL GAUGE SENDING UNIT.
2. Clean the tank interior with commercial cleaning solvent or a soap and water solution. Shake the tank to agitate the cleaning agent.
3. Flush the tank thoroughly after cleaning and allow it to air dry.
4. Inspect the interconnect lines, evaporative emissions system vent line (California models) and fuel line for cuts, cracks or holes. Replace lines as needed.
5. Inspect the tank for leaks and other damage. If a damaged tank cannot be successfully repaired, replace it.
6. Install fuel pump. See 4.15 FUEL PUMP AND FUEL GAUGE SENDING UNIT.

INSTALLATION

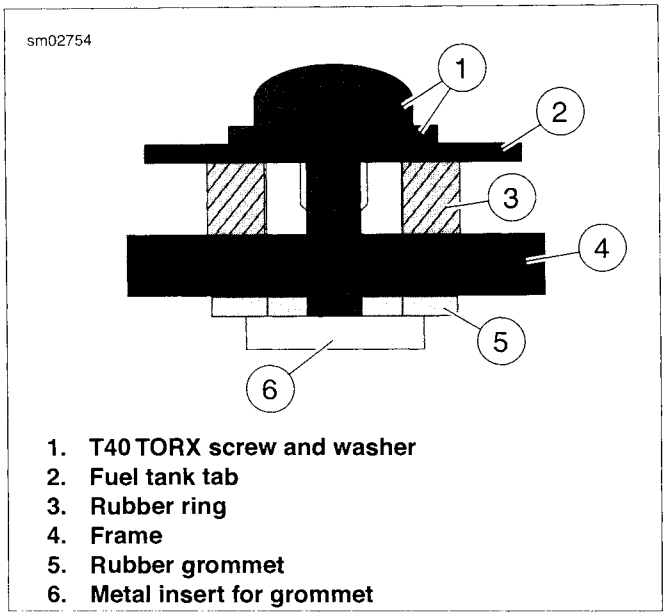
All But FXCWC

1. See Figure 4-8. Install continuous vent line (12) to nipple on front of tank. Make sure vent line runs along right side of frame backbone under rubber trim (13).
2. See Figure 4-7. Connect the fuel gauge connector [117] located under left side of fuel tank.
3. Attach tank mounts
   a. See Figure 4-8. Place a washer (2) over front screw (1). Starting on left side, loosely install screw and washer through tank, bushings and grommets (3) and frame. Place washer (2) and acorn nut (6) on right side.
   b. See Figure 4-10. Verify that rubber grommet (5) and metal insert (6) are protruding through frame (4). Metal insert has flats on bottom for positioning. Place rubber ring (3) around grommet/insert and lower fuel tank tab (2).
   c. Install washer and rear T40 TORX screw (1) through fuel tank tab. Tighten to 18-22 ft-lbs (24.4-29.8 Nm).
   d. Tighten the front screw to 28-32 ft-lbs (38.0-43.4 Nm).
4. See Figure 4-8. Connect crossover line (5) with new clamps (4).
5. See Figure 4-4. Connect fuel supply line (2).
6. See Figure 4-6. Connect fuel pump module connector [86].
7. Install instrument console wiring.
8. See Figure 4-5. Install instrument console with acorn nut and washer. Tighten to 7-11 ft-lbs (9.5-14.9 Nm).
9. See Figure 4-3. Connect the fuel pump fuse to the main wiring harness.
10. Connect negative battery cable.
11. Fill tank with gasoline and check for leaks.

⚠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. **T40 TORX screw and washer**
2. **Fuel tank tab**
3. **Rubber ring**
4. **Frame**
5. **Rubber grommet**
6. **Metal insert for grommet**

Figure 4-10. Rear Tank Screw: All But FXCWC

FXCWC

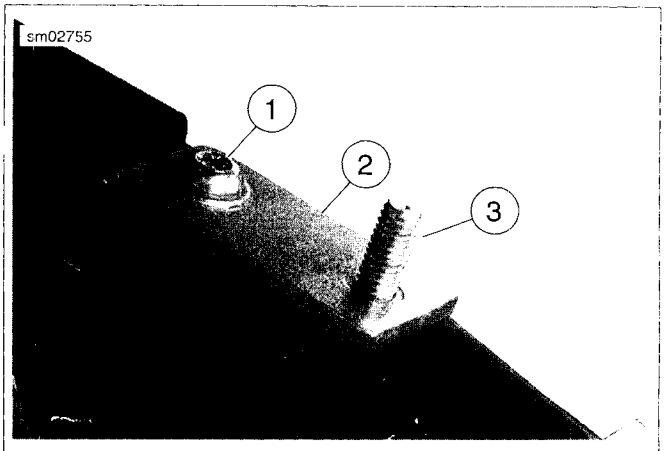
1. See Figure 4-9. Install continuous venting system vent line (12) to nipple on front of tank. Make sure vent line runs along right side of frame backbone.
2. See Figure 4-7. Connect the fuel gauge connector [117] located under left side of fuel tank.
3. Attach tank mounts.
   a. Place a washer over front screw. Starting on left side, loosely install screw and washer through tank, bushings and grommets and frame. Place washer and acorn nut on right side.
   b. See Figure 4-11. Align end of tank over stud (3) on frame. Install nut and washer. Tighten to 14-18 ft-lbs (19.0-24.4 Nm).
   c. See Figure 4-9. Tighten acorn nut (6) to 28-32 ft-lbs (38.0-43.4 Nm).
4. Connect crossover line with new clamps.
5. Connect fuel gauge connector [117] located under left side of fuel tank.
6. See Figure 4-6. Connect fuel pump module connector.
7. See Figure 4-4. Connect fuel supply line (2).
8. Install instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.
9. See Figure 4-3. Connect the fuel pump fuse to the main wiring harness.

10. Connect negative battery cable.
11. Fill tank with gasoline and check for leaks.

⚠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. Screw and washer
2. Mount
3. Stud

Figure 4-11. Rear Mount: FXCWC

GENERAL

Refer to the electrical diagnostics manual for information on the function and testing of the throttle position sensor (TP sensor).

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 air cleaner backplate. See 4.5 AIR CLEANER ASSEMBLY.
4. See Figure 4-12. Unplug TP sensor connector [88].
5. Remove two fasteners to detach TP sensor from throttle body. Discard fasteners.

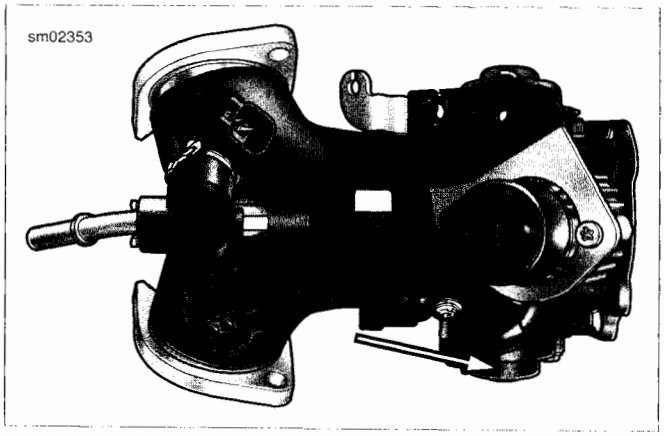


Figure 4-12. Throttle Position Sensor

INSTALLATION

NOTE

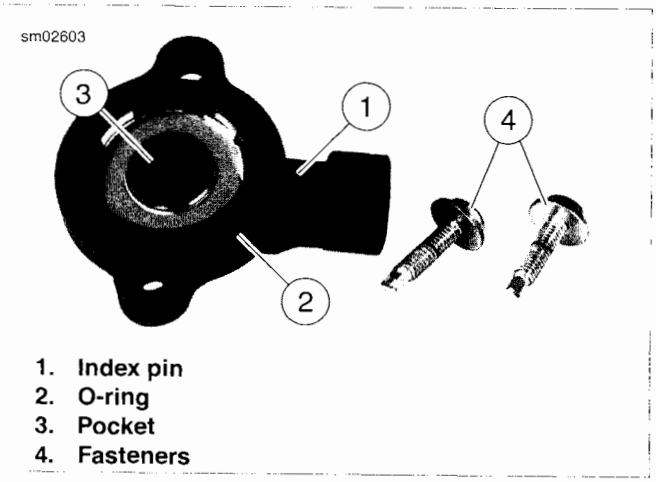
Throttle must be closed for proper installation of throttle position sensor.

1. See Figure 4-13. Inspect O-ring (2) in groove of throttle position sensor for cuts, tears or signs of deterioration. Install **new** O-ring if necessary.
2. Fit pocket (3) of throttle position sensor over throttle shaft while engaging index pin (1) with hole on machined flange of induction module.
3. Install two **new** fasteners (4) to fasten throttle position sensor to induction module. Tighten screws to 18 **in-lbs** (2.0 Nm).
4. Using the throttle lever mechanism, open and close the throttle plates to check for proper operation. Be sure that the mechanism operates smoothly without binding or sticking.
5. Connect TP sensor connector [88].
6. Install air cleaner assembly. See 4.5 AIR CLEANER ASSEMBLY.
7. Connect negative battery cable.

⚠WARNING

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

8. Install seat.



1. **Index pin**
2. **O-ring**
3. **Pocket**
4. **Fasteners**

Figure 4-13. Throttle Position Sensor Installation

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the intake air temperature sensor (IAT sensor).

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. Remove air cleaner backplate. See 4.5 AIR CLEANER ASSEMBLY.
4. See Figure 4-14. Unplug IAT sensor connector [89].
5. Remove fastener to detach IAT sensor. Discard fastener.

INSTALLATION

1. See Figure 4-15. Inspect O-ring (1) in groove of intake air temperature sensor for cuts, tears or signs of deterioration. Install new O-ring if necessary.
2. See Figure 4-14. Insert sensor into induction module with electrical connector facing toward the left side of the motorcycle.
3. See Figure 4-15. Install fastener (2) and tighten to 15-20 **in-lbs** (1.7-2.3 Nm).
4. Connect IAT sensor connector [89].
5. Install air cleaner assembly. See 4.5 AIR CLEANER ASSEMBLY.
6. Install main fuse.

⚠WARNING

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

7. Install seat.

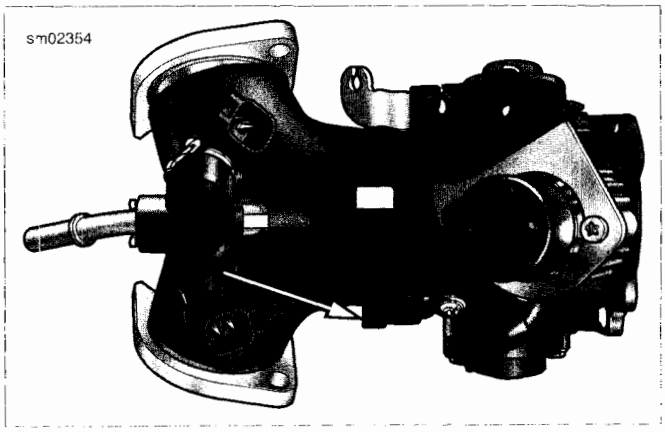
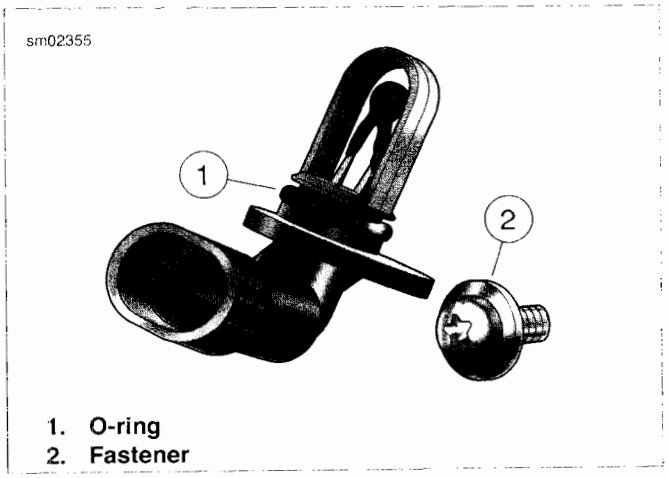


Figure 4-14. Intake Air Temperature Sensor Location



1. **O-ring**
2. **Fastener**

Figure 4-15. Intake Air Temperature Sensor

GENERAL

⚠WARNING

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

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the engine temperature sensor (ET sensor).

REMOVAL

1. Remove seat.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-16. Disconnect the fuel pump fuse from the main wiring harness.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

3. See Figure 4-17. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

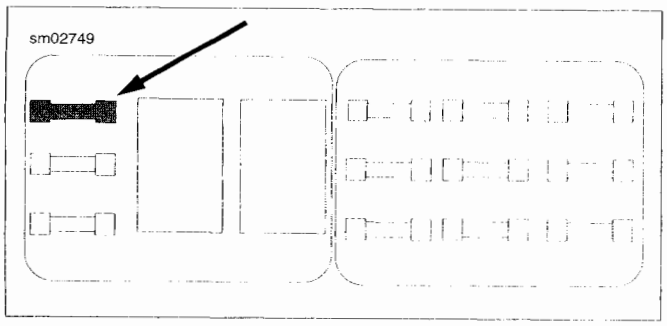
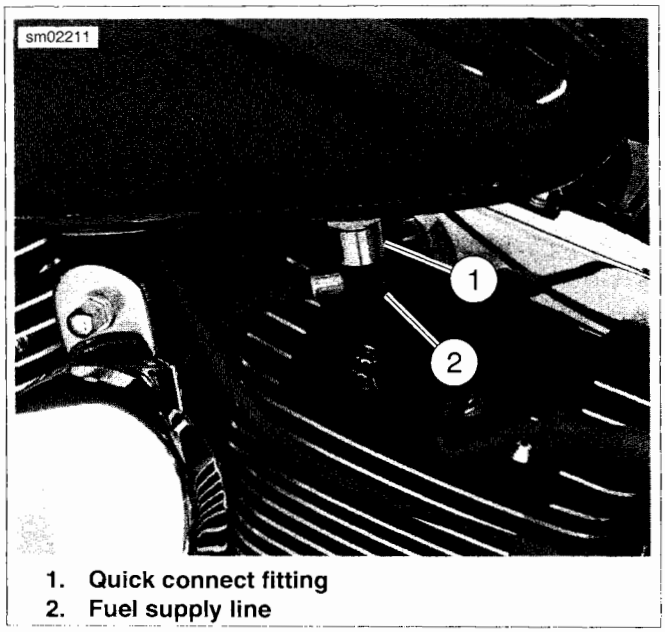


Figure 4-16. Fuel Pump Fuse: View from Top



1. **Quick connect fitting**
2. **Fuel supply line**

Figure 4-17. Fuel Supply Line Fitting

⚠WARNING

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

4. Disconnect negative battery cable.

NOTE

On some models, horn may have to be removed to ease removal/installation.

5. See Figure 4-18. Pull back boot to reveal ET sensor at back of front cylinder.
6. Unplug ET sensor connector [90] by pulling external latch outward and using rocking motion to remove.
7. See Figure 4-19. Loosen ET sensor using socket. When sensor starts to turn easily, finish removing by hand.

INSTALLATION

1. Hand start **new** ET sensor into cylinder head bore 2-3 turns.
2. Tighten sensor to 10-15 ft-lbs (13.6-20.3 Nm).
3. Connect ET sensor connector [90].
4. Pull boot over connector.
5. See Figure 4-17. Install fuel line fitting.
6. See Figure 4-16. Install fuel pump fuse.
7. Connect negative battery cable.

⚠WARNING

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

8. Install seat.

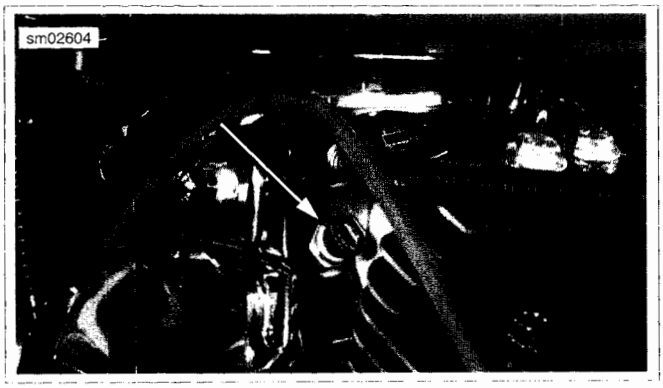


Figure 4-18. Engine Temperature Sensor

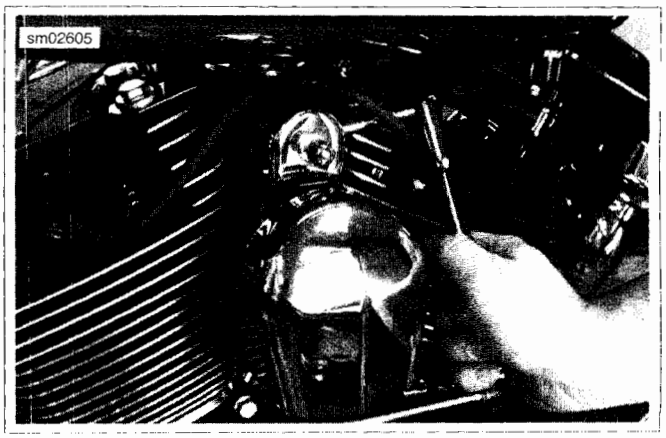


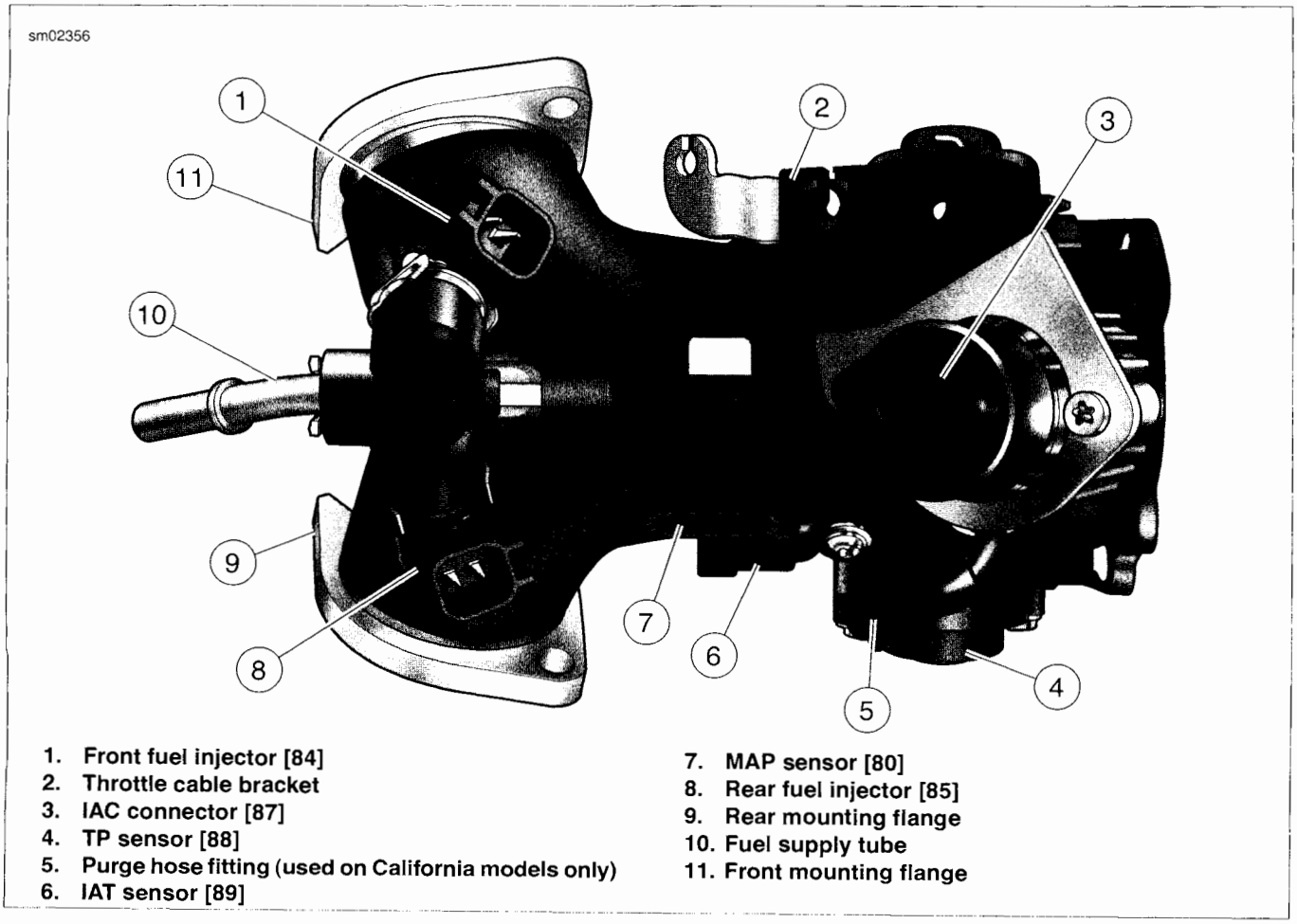
Figure 4-19. Engine Temperature Sensor Removal

REMOVAL

⚠WARNING

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

1. Gain access to the induction module by removing fuel tank hardware and fuel line. Carefully pivot tank upward and prop in position. See 4.6 FUEL TANK.
2. Loosen cable adjusters on throttle cables.
3. Remove air cleaner backplate. See 4.5 AIR CLEANER ASSEMBLY.
4. See Figure 4-20. Pull purge hose from fitting (5) at top of induction module (California models only).
5. See Figure 4-21. Pull idle cable barrel (1) from upper hole in throttle wheel. Pull throttle cable barrel (2) from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.
6. See Figure 4-20. Remove idle air control connector (3) [87] and manifold absolute pressure sensor connector (7) [80].



1. **Front fuel injector [84]**
2. **Throttle cable bracket**
3. **IAC connector [87]**
4. **TP sensor [88]**
5. **Purge hose fitting (used on California models only)**
6. **IAT sensor [89]**
7. **MAP sensor [80]**
8. **Rear fuel injector [85]**
9. **Rear mounting flange**
10. **Fuel supply tube**
11. **Front mounting flange**

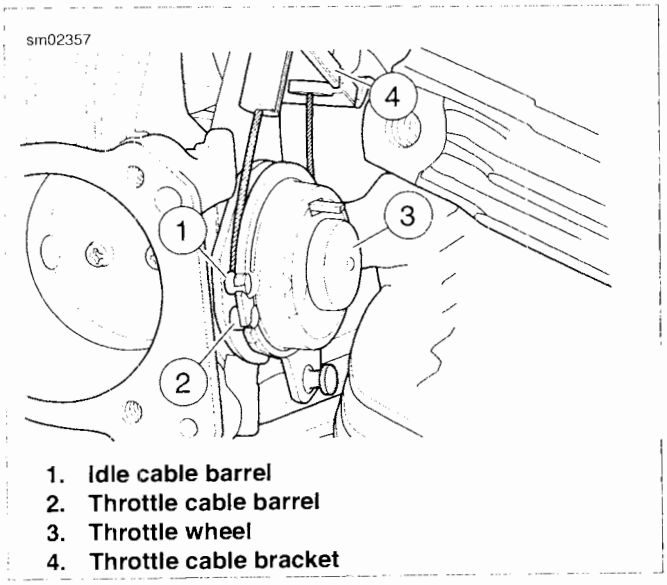
Figure 4-20. Induction Module

7. Remove front fuel injector connector (1) [84] and rear fuel injector connector (8) [85].
8. Remove throttle position sensor connector (4) [88] and intake air temperature sensor connector (6) [89].
9. On left side of vehicle, loosen two hex screws holding front and rear mounting flanges (9, 11) to cylinder head.
10. On right side of vehicle, remove two Allen screws holding front and rear mounting flanges to cylinder head. Remove induction module from vehicle.

⚠WARNING

Gasoline can drain from the fuel line when disconnected from induction module. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00269a)

11. See Figure 4-22. If fuel supply line (2) is being replaced, squeeze ends of tab (1) and pull tab away from fuel supply line to release from fuel supply tube (3).
12. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.



1. **Idle cable barrel**
2. **Throttle cable barrel**
3. **Throttle wheel**
4. **Throttle cable bracket**

Figure 4-21. Throttle/Idle Cables

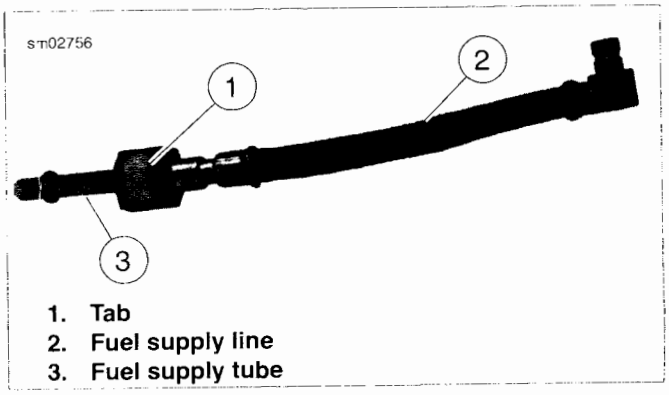
INSTALLATION

1. See Figure 4-20. Place a **new** seal in each mounting flange (9, 11) with the beveled side in against the counterbore.

NOTE

When induction module is positioned on manifold mounting screws, be sure the mounting flanges are installed correctly on the manifold. Be sure the rubber seals are in place.

2. Place intake manifold seal, flanges, and induction module in position. Install the manifold mounting screws finger tight.
3. See Figure 4-22. Slide fuel supply line (2) onto fuel supply tube (3). Push in on tab until it locks the fuel supply line (2) on fuel supply tube (3). Tug on fuel supply line (2) to verify it is locked into place.
4. See Figure 4-21. Install sleeve on throttle cable housing into cable guide at top of throttle cable bracket (4). Drawing throttle cable downward, fit barrel end (2) into lower hole in throttle wheel (3). Install sleeve and spring on idle cable housing into cable guide at bottom of throttle cable bracket inserting barrel end (1) into upper hole in throttle wheel.
5. Adjust throttle cables. See 1.13 THROTTLE CABLES.
6. See Figure 4-20. On California models, attach purge hose to fitting (5) on throttle body.
7. Connect front (1) and rear (8) fuel injector connectors, IAC (3) connector, MAP sensor (7) connector, TP sensor (4) connector and IAT (6) sensor connector.
8. Install air cleaner backplate. See 4.5 AIR CLEANER ASSEMBLY.
9. Tighten manifold mounting screws to 96-144 **in-lbs** (10.8-16.3 Nm).
10. Turn the Ignition/Light Key Switch to ON and then back to OFF to reset idle air control to park position.
11. Install air cleaner filter and cover.
12. Secure fuel tank. See 4.6 FUEL TANK.
13. Check throttle and idle cable adjustment.



1. **Tab**
2. **Fuel supply line**
3. **Fuel supply tube**

Figure 4-22. Fuel Supply Line

GENERAL

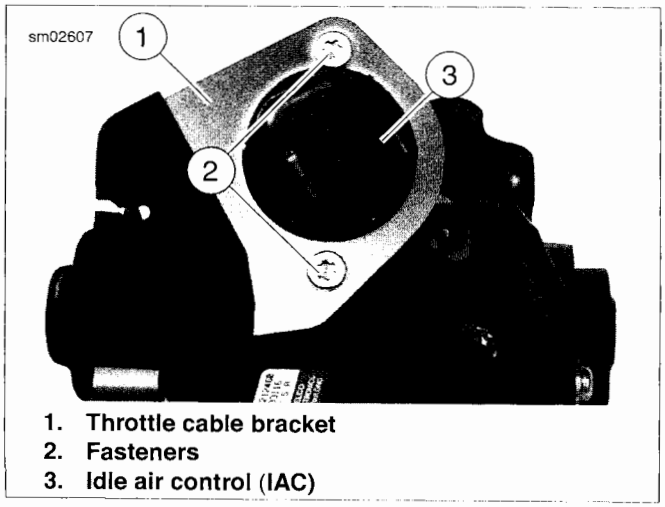
⚠WARNING

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

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the idle air control (IAC).

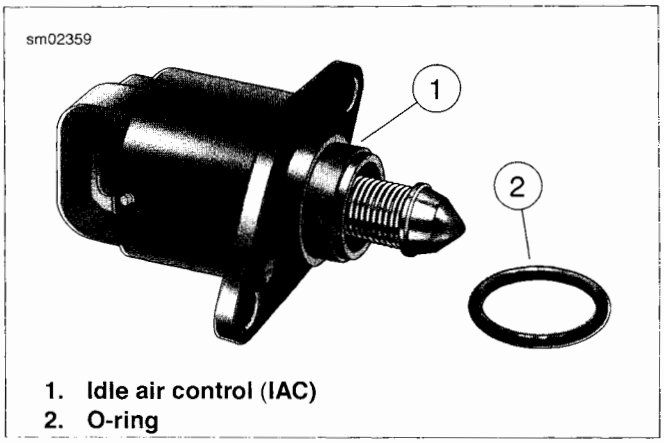
REMOVAL

1. Remove induction module. See 4.10 INDUCTION MODULE.
2. See Figure 4-23. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. See Figure 4-24. Pull IAC (1) and O-ring (2) from throttle body.



1. **Throttle cable bracket**
2. **Fasteners**
3. **Idle air control (IAC)**

Figure 4-23. Idle Air Control Location

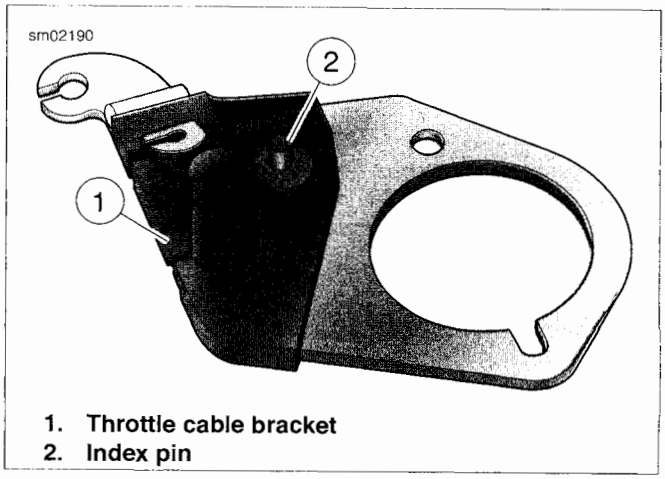


1. **Idle air control (IAC)**
2. **O-ring**

Figure 4-24. Idle Air Control

INSTALLATION

1. See Figure 4-24. Apply **clean** engine oil to IAC O-ring (2). Install O-ring in counterbore of induction module.
2. With the electrical connector facing the rear left side of the induction module, install idle air control into bore.
3. Place idle air control and o-ring into throttle body. Be sure o-ring is properly seated in throttle body groove.
4. See Figure 4-25. Insert index pin (2) at bottom of throttle cable bracket (1) into hole in boss at top of induction module.
5. See Figure 4-23. Install **new** throttle cable bracket fasteners (2). Tighten to 20-35 **in-lbs** (2.3-4.0 Nm).
6. Install induction module. See 4.10 INDUCTION MODULE.



1. **Throttle cable bracket**
2. **Index pin**

Figure 4-25. Throttle Cable Bracket

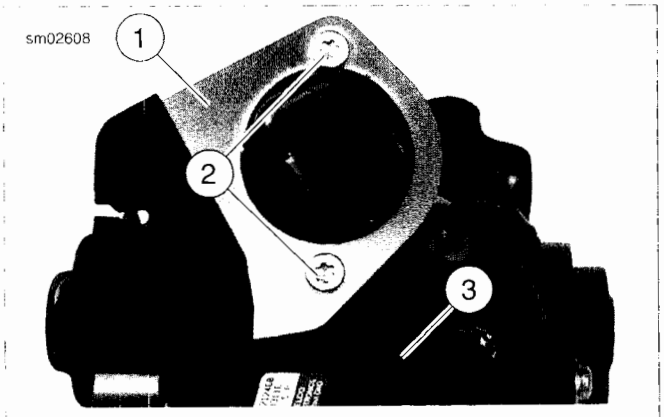
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP) 4.12

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the temperature/manifold absolute pressure (TMAP) sensor.

REMOVAL

1. Remove induction module. See 4.10 INDUCTION MODULE.
2. See Figure 4-26. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. Using appropriate tool, gently push up on MAP sensor and attached seal to remove from intake manifold.



1. **Throttle cable bracket**
2. **Fasteners**
3. **Manifold Absolute Pressure Sensor (MAP)**

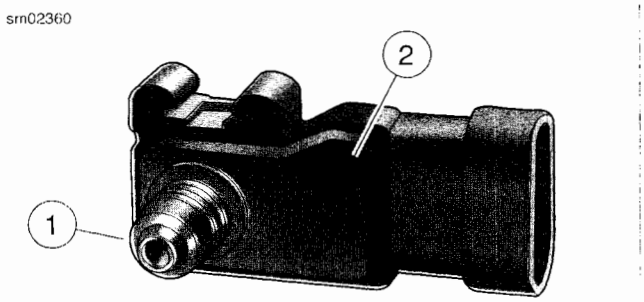
Figure 4-26. Throttle Cable Bracket Location

INSTALLATION

NOTE

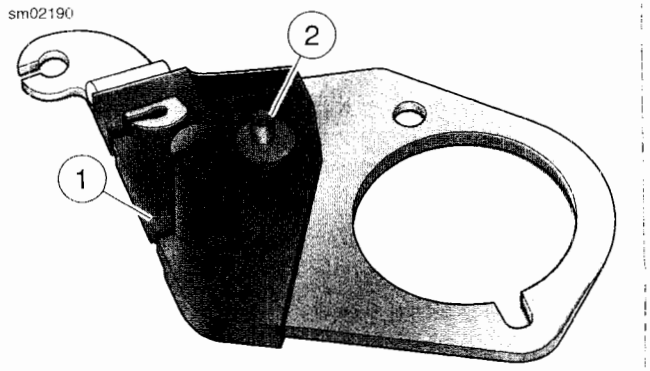
*See Figure 4-27. If the original sensor is re-installed, the seal (1) must be inspected. Seals not in good condition could cause vacuum leaks. Install **new** seal if necessary.*

1. Push MAP sensor and seal into intake manifold.
2. With the electrical connector facing toward the rear of the induction module (side opposite throttle wheel), insert MAP sensor into hole in induction module.
3. See Figure 4-28. Insert index pin (2) at bottom of throttle cable bracket into hole in boss at top of induction module.
4. See Figure 4-26. Install **new** throttle cable bracket fasteners (2). Tighten to 20-35 **in-lbs** (2.3-4.0 Nm).
5. Install induction module. See 4.10 INDUCTION MODULE.



1. **Seal**
2. **MAP sensor**

Figure 4-27. MAP Sensor



1. **Throttle cable bracket**
2. **Index pin**

Figure 4-28. Throttle Cable Bracket

GENERAL

Refer to the electrical diagnostic manual for information on the function and testing of the oxygen sensor (O2).

REMOVAL

PART NUMBER	TOOL NAME
HD-48262	OXYGEN SENSOR SOCKET

1. See Figure 4-29. The O2 sensors are installed in threaded bosses on the inboard side of front and rear exhaust pipes.
2. Disconnect front O2 sensor connector. See 7.7 FRONT ELECTRICAL CADDY for front O2 sensor connector information.
3. Use OXYGEN SENSOR SOCKET (Part No. HD-48262) to remove front O2 sensor.
4. Disconnect rear O2 sensor connector. Rear O2 sensor connector is located underneath oil tank on right side of vehicle.
5. Use OXYGEN SENSOR SOCKET (Part No. HD-48262) to remove rear O2 sensor.

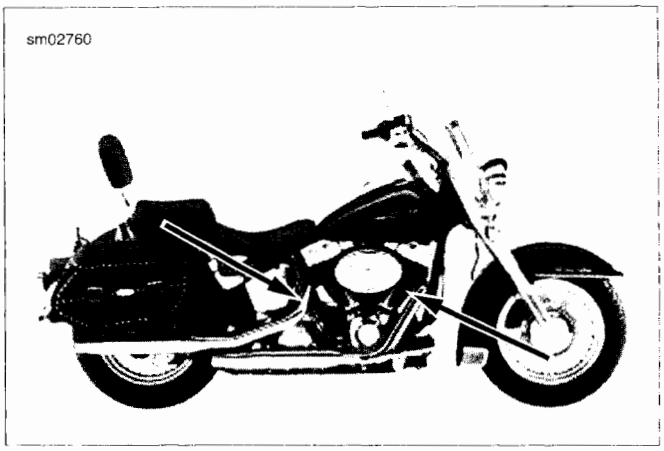


Figure 4-29. Oxygen Sensors (Inboard Side of Exhaust Pipes)

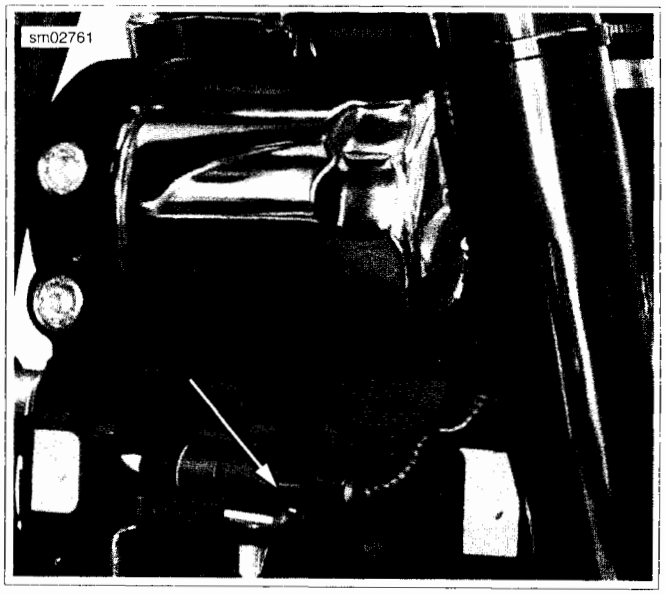


Figure 4-30. Front O2 Connector Location

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 LOCTITE ANTI-SEIZE (Part No. 98960-97) to threads of each oxygen sensor prior to installing in header. Do not use any other grease or sealant product on sensor threads. The electrical connector must also be clean and free of any dielectric grease.*

1. If sensor is being reinstalled, replace seal ring and coat threads on sensor with LOCTITE ANTI-SEIZE.
2. Thread sensor into threaded boss on exhaust pipe and tighten to 29-44 ft-lbs (39.3-59.7 Nm).

NOTE

Ensure both connector halves are clean and free of any dielectric grease. Never use dielectric grease on sealed connectors.

3. Route sensor harness to mating connector and connect. Install cable straps that were removed during removal.
4. Repeat above for other sensor.

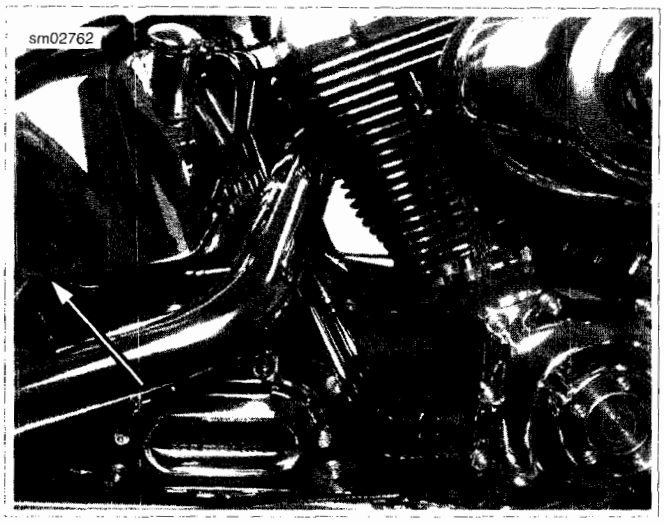


Figure 4-31. Rear O2 Connection Location

GENERAL

⚠WARNING

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

Refer to the electrical diagnostic manual for information on the function and testing of the fuel injectors.

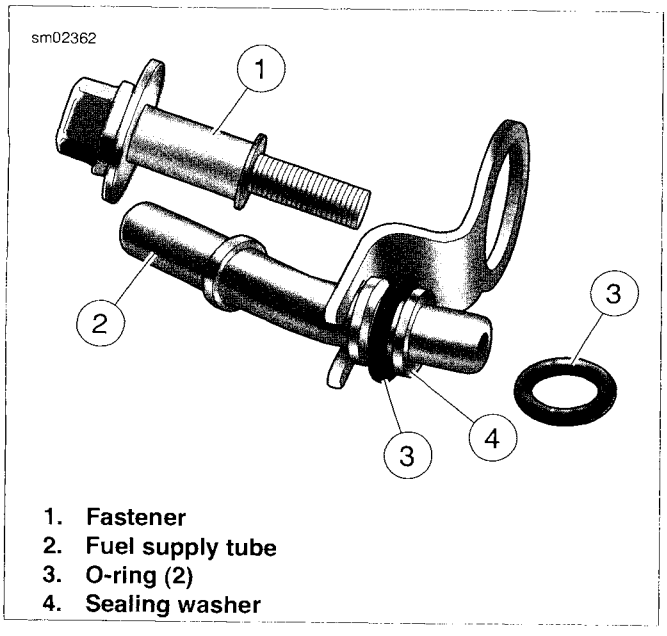
REMOVAL

1. Remove induction module. See 4.10 INDUCTION MODULE.

NOTE

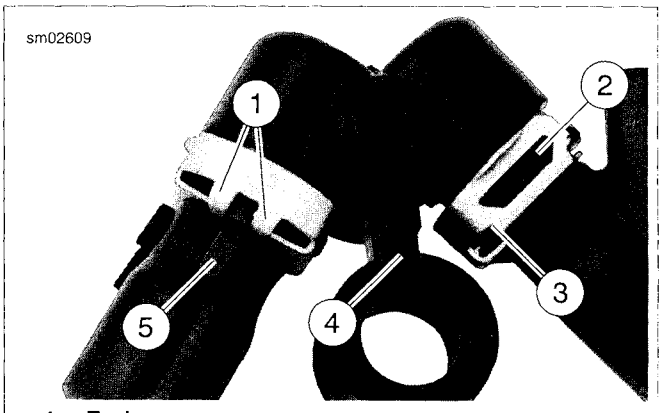
If not replacing fuel supply tube or o-rings, do not remove.

2. See Figure 4-32. Remove fastener (1) retaining fuel supply tube (2).
3. Pull fuel supply tube from fuel rail. Remove sealing washer (4) and o-ring (3) from fuel supply tube. Remove second o-ring from fuel rail bore. Discard sealing washer and o-rings.
4. See Figure 4-33. Pull fuel injectors with attached fuel rail from induction module. To overcome the resistance of the bottom O-ring on both fuel injectors, gently rock assembly back and forth while pulling.
5. See Figure 4-34. Remove spring clips (2) from fuel injectors. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.
6. Remove o-rings (1) from fuel injectors. Discard O-rings.



1. **Fastener**
2. **Fuel supply tube**
3. **O-ring (2)**
4. **Sealing washer**

Figure 4-32. Fuel Supply Tube

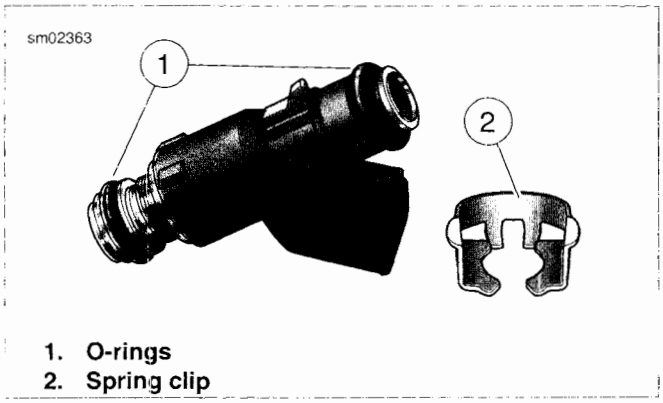


1. **Fork**
2. **Lip**
3. **Opening**
4. **Rail tab**
5. **Injector tab**

Figure 4-33. Fuel Rail

INSTALLATION

1. See Figure 4-34. Apply a thin coat of clean engine oil to **new** fuel injector o-rings (1). Install on fuel injectors.
2. See Figure 4-33. Push electrical connector side of fuel injectors into fuel rail.
3. With the concave side toward the fuel rail, install spring clip into slot on fuel injector. In the installed position, openings (3) in sides of clip engage lip (2) on fuel rail, while fork (1) at back of clip captures rail tab (4) on fuel injector.
4. Rotate fuel injectors, so that the electrical connectors are on the outboard side. Push fuel injectors into induction module bores until tab on fuel rail engages machined slot at top of induction module.
5. See Figure 4-32. Slide **new** o-ring (3) down shorter neck of the fuel supply tube until it contacts the collar. Slide **new** sealing washer (4) down tube until it contacts O-ring. Install second o-ring (3) in fuel rail bore.
6. Push fuel supply tube (2) into fuel rail bore until clamp is seated on round step of fuel rail. Install fastener (1) and tighten to 90-110 **in-lbs** (10.2-12.4 Nm).
7. Install induction module. 4.10 INDUCTION MODULE.



1. O-rings
2. Spring clip

Figure 4-34. Fuel Injector

GENERAL

⚠WARNING

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

Refer to the Softail Models ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the fuel pump.

REMOVAL

1. Remove seat.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-35. Disconnect the fuel pump fuse from the main wiring harness.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

⚠WARNING

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

3. Disconnect negative battery cable.
4. Remove instrument console.
   a. **All but FXCWC:** see Figure 4-36. Remove acorn nut and washer on instrument console to separate console from fuel tank.
   b. **For FXCWC:** see 7.25 INSTRUMENT CONSOLE: FXCWC
5. Disconnect console wiring.

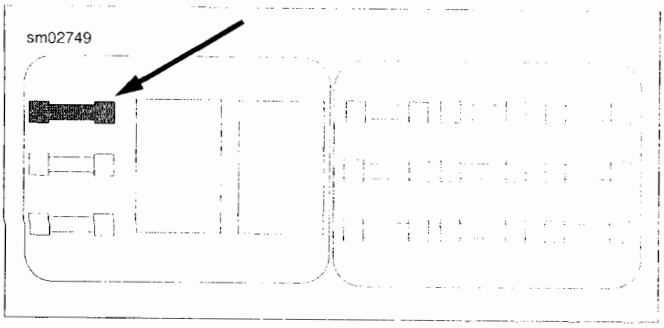
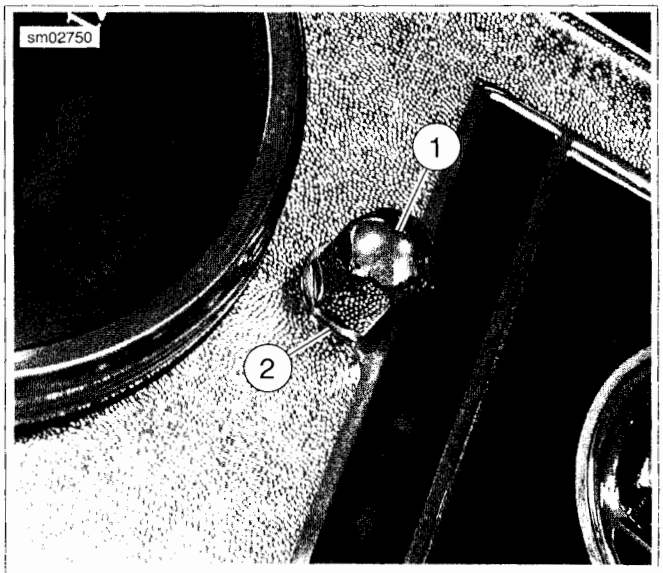


Figure 4-35. Fuel Pump Fuse: View from Top



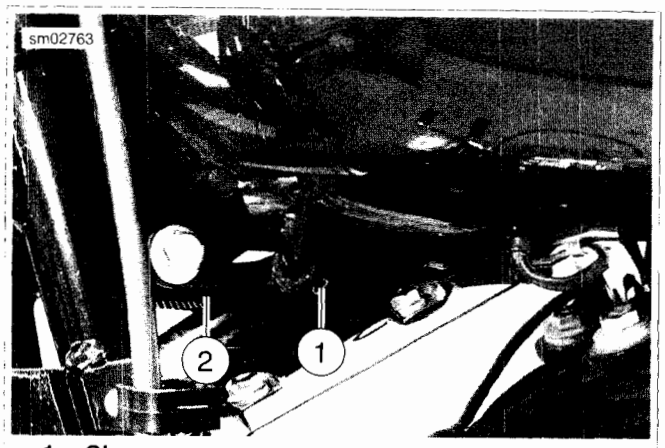
1. **Acorn nut**
2. **Washer**

Figure 4-36. Acorn Nut and Washer

⚠WARNING

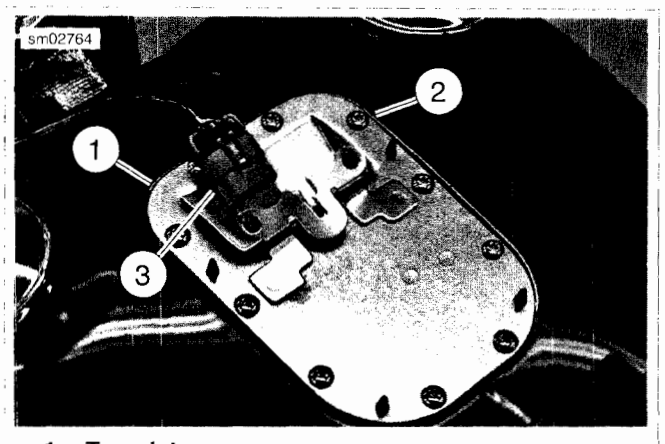
Gasoline can drain from the crossover line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00259a)

6. Drain fuel tank.
   a. Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to verify that end is securely plugged.
   b. See Figure 4-37. Cut clamp (1) from one end of crossover hose (2). Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.
7. See Figure 4-38. Unplug fuel pump module connector [86] (3).
8. Remove top plate screws (2) and discard.



1. Clamp
2. Crossover hose

Figure 4-37. Crossover Hose



1. Top plate
2. Fasteners (10)
3. Fuel pump module connector [86]

Figure 4-38. Top Plate Fasteners

9. See Figure 4-39. Pull top plate (2) out of fuel tank enough to expose fuel hoses (1, 3).
10. Disconnect hoses (1, 3) from filter housing (2).

⚠WARNING

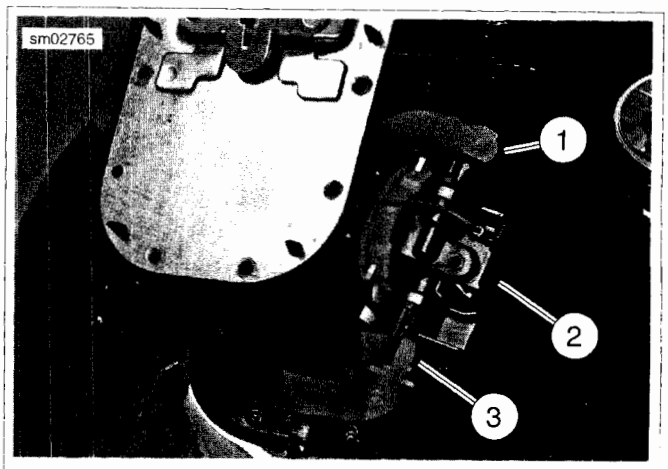
Do not replace the special Teflon coated fuel pump wiring with ordinary bulk wire. Ordinary insulation materials can deteriorate when put in contact with gasoline and cause an explosion, which could result in death or serious injury. (00566b)

11. See Figure 4-40. Disconnect electrical connectors (1-4). Remove top plate with filter and regulator from motorcycle.
12. See Figure 4-41. Pull up on bracket (2) and slide forward. Remove fuel pump assembly (1) from fuel tank.

NOTE

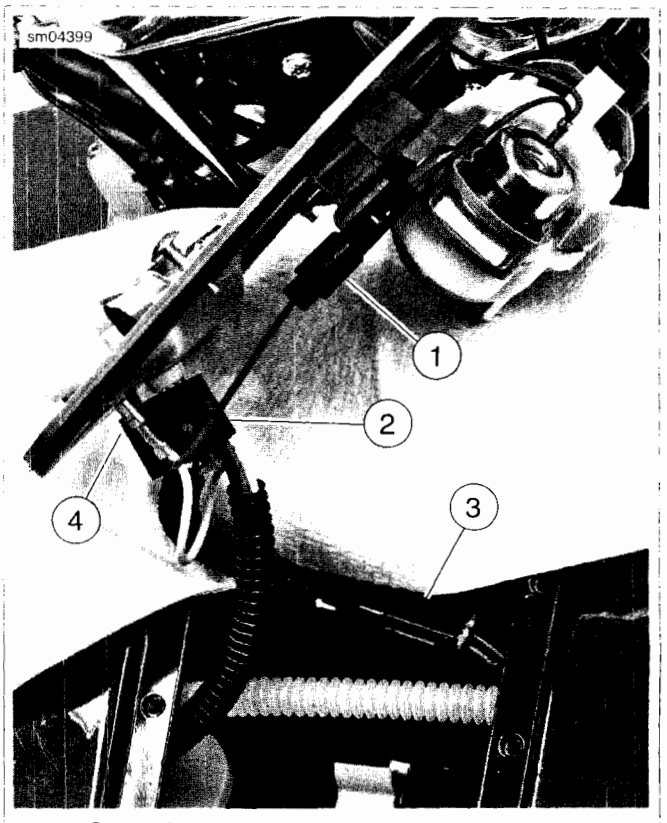
Exercise care to avoid bending float rod of fuel level sender. A bent float rod will result in erroneous gauge readings.

13. See Figure 4-42. Pull out and up on fuel sending unit and remove from fuel tank.



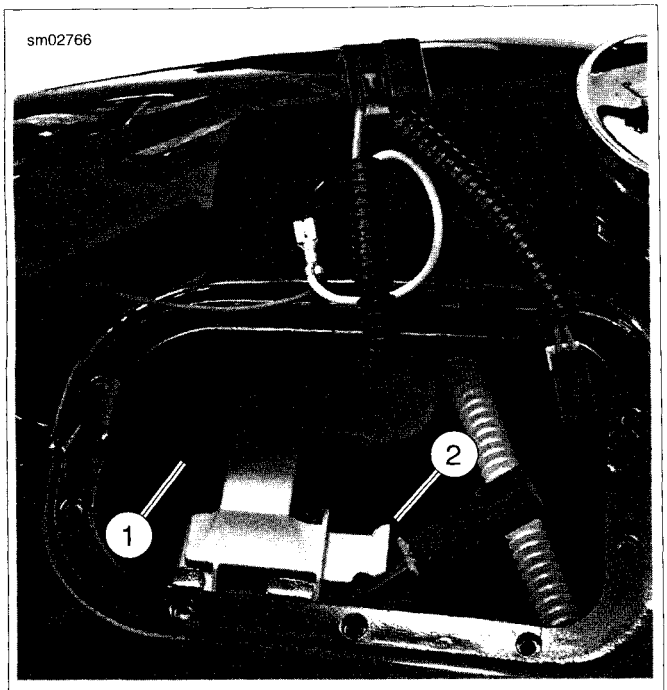
1. Hose
2. Filter housing
3. Hose

Figure 4-39. Fuel Pump Hoses



1. Ground connector
2. Top plate connector
3. Fuel level sender connector
4. Ground connector

Figure 4-40. Fuel Pump and Sending Unit Wire Connectors



1. **Fuel Pump Assembly**
2. **Bracket**

Figure 4-41. Fuel Pump

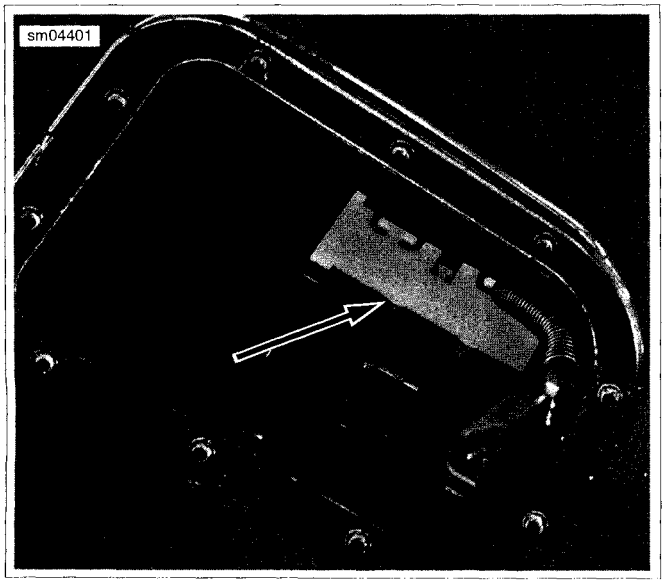
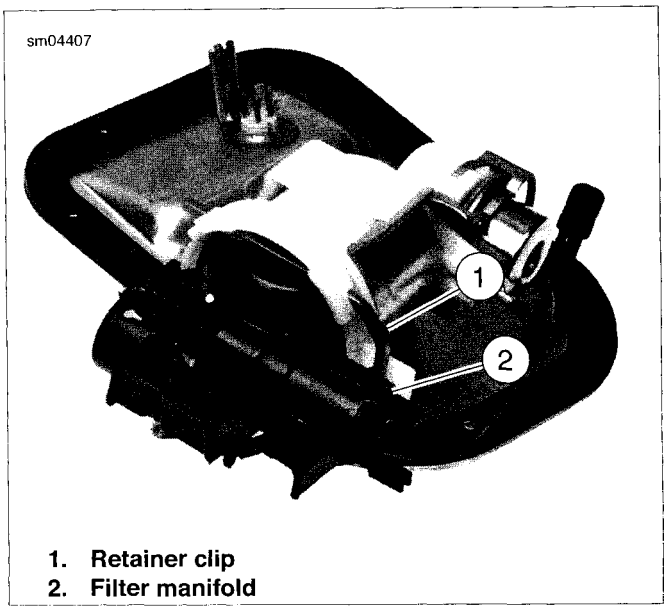


Figure 4-42. Fuel Sending Unit Removal

DISASSEMBLY/ASSEMBLY

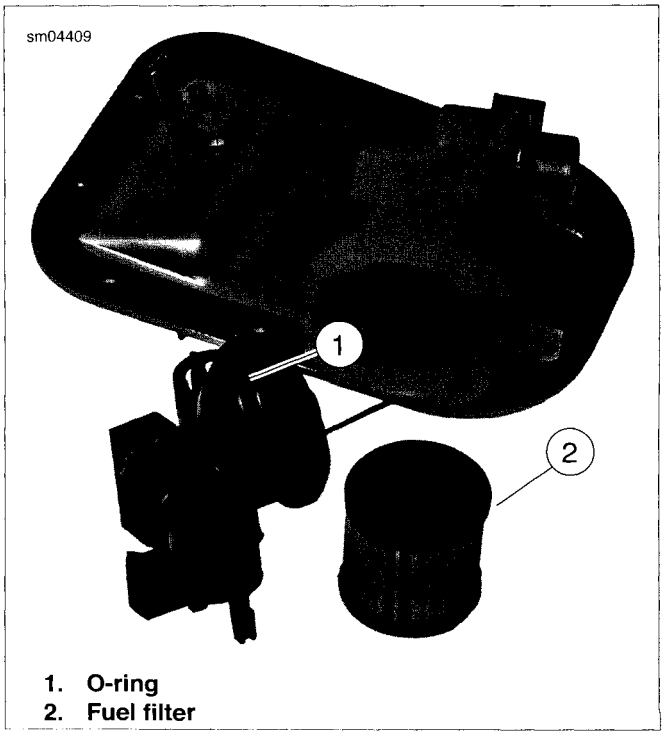
Fuel Filter

1. See Figure 4-43. Remove retainer clip (1).
2. Separate filter manifold (2) from fuel filter housing.
3. See Figure 4-44. Remove o-ring (1) and fuel filter (2).
4. Install **new** fuel filter.
5. Install **new** o-ring.
6. See Figure 4-43. Install filter manifold (2) and retainer clip (1).



1. **Retainer clip**
2. **Filter manifold**

Figure 4-43. Fuel Filter Housing



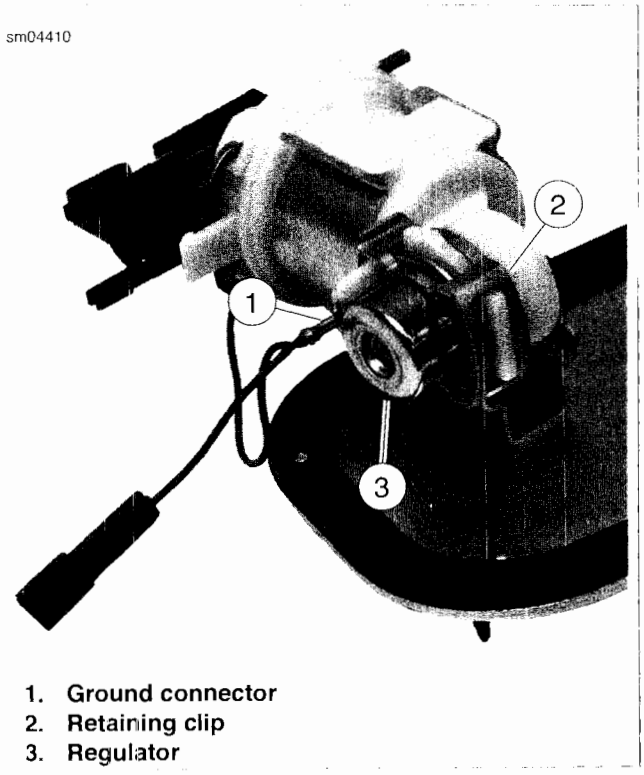
1. **O-ring**
2. **Fuel filter**

Figure 4-44. Fuel Filter

Regulator

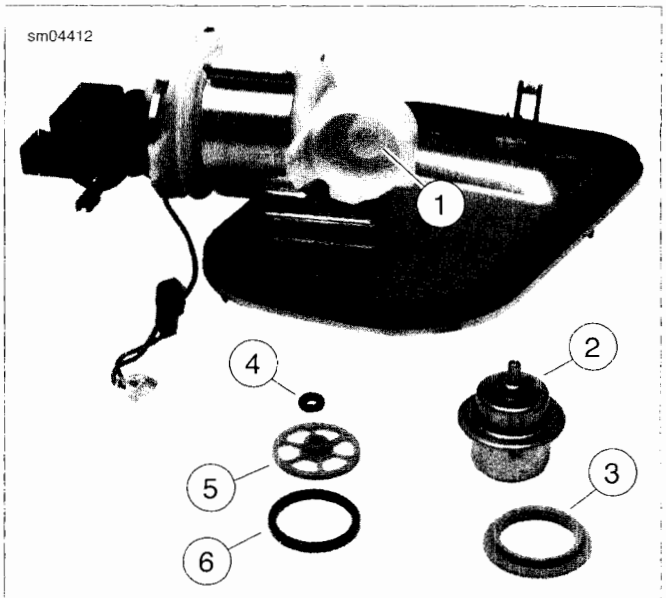
1. See Figure 4-45. Remove ground connector (1).
2. Remove retaining clip (2).
3. Remove regulator (3).
4. See Figure 4-46. Check seal (3), o-rings (4, 6), and screen (5) for damage. Replace if necessary.

5. Install o-ring (4) in regulator housing outlet port (1).
6. Install screen (5) with inner shoulder facing o-ring (4).
7. Install o-ring (6) in regulator housing.
8. Place seal (3) on regulator (2) with shoulder facing away from regulator.
9. See Figure 4-45. Place regulator in housing and secure with retaining clip (2).
10. Secure ground connector (1) against regulator (3). Make sure ground connector lock is engaged in regulator housing.



1. **Ground connector**
2. **Retaining clip**
3. **Regulator**

Figure 4-45. Fuel Regulator



1. **Regulator housing outlet Port**
2. **Regulator**
3. **Seal**
4. **O-ring**
5. **Screen**
6. **O-ring**

Figure 4-46. Regulator Assembly

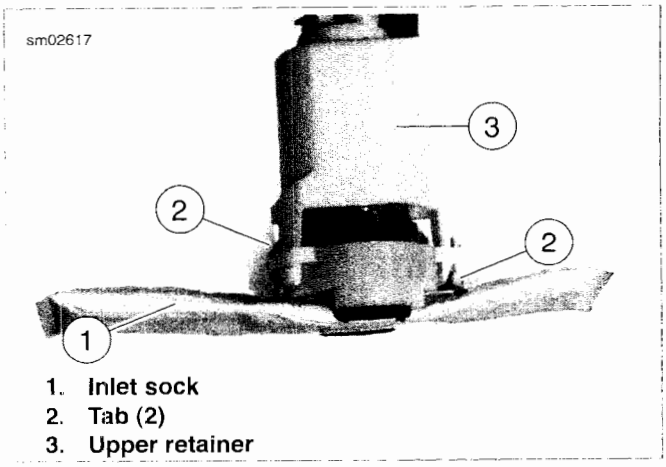
Inlet sock

1. See Figure 4-47. Depress tabs (2) securing inlet sock (1) to upper retainer (3).
2. Remove inlet sock from upper retainer.

NOTE

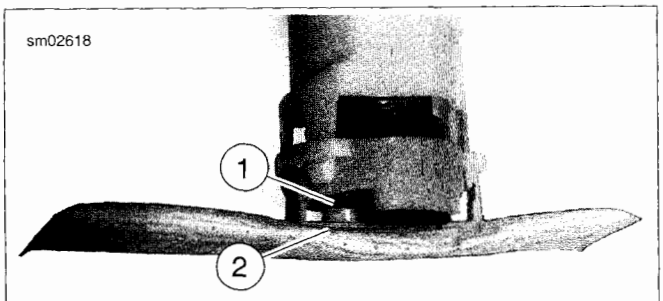
See Figure 4-48. In next step, be sure inlet sock (2) engages fuel pump inlet (1).

3. See Figure 4-47. Install inlet sock (1) on upper retainer (3). Be sure tabs (2) engage slots in body.



1. **Inlet sock**
2. **Tab (2)**
3. **Upper retainer**

Figure 4-47. Fuel Sock

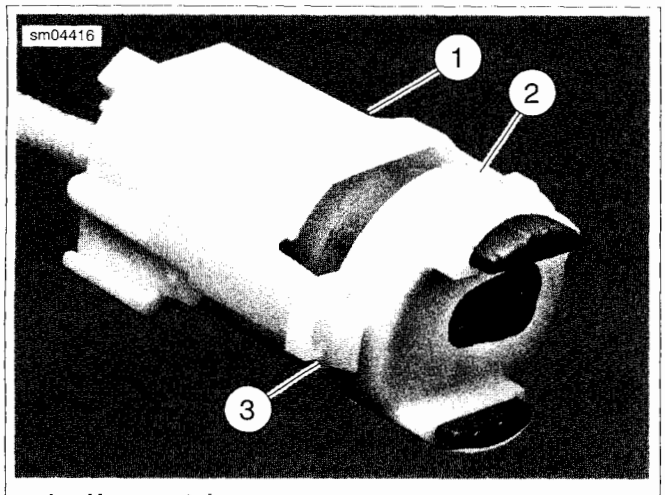


1. **Fuel pump inlet**
2. **Inlet sock**

Figure 4-48. Fuel Sock Installation

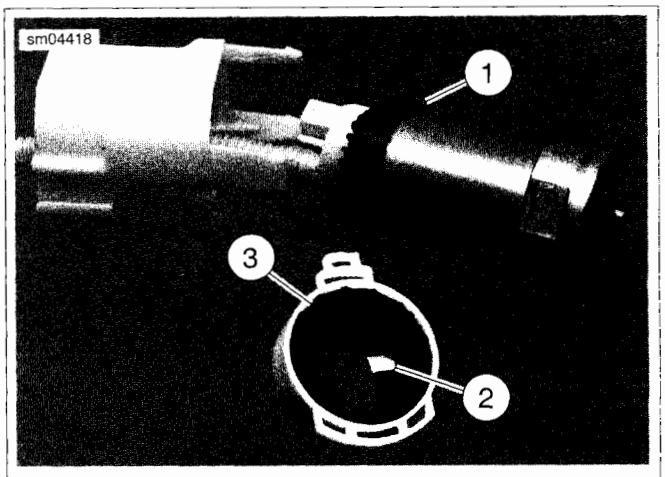
Fuel Pump

1. Disconnect electrical harness from fuel pump.
2. Remove mounting bracket.
3. See Figure 4-47. Remove fuel sock.
4. See Figure 4-49. Depress tabs (3) and remove lower retainer (2) from upper retainer (1).
5. See Figure 4-50. Remove upper isolator (1) from fuel pump and replace pump.
6. Install upper isolator (1) onto fuel pump.
7. Install fuel pump into upper retainer.
8. Make sure lower isolator (3) is properly positioned in lower retainer. Groove in lower retainer (2) should be visible with lower isolator installed.
9. See Figure 4-49. Install lower retainer.
10. See Figure 4-47. Install fuel sock.
11. Install mounting bracket onto upper retainer.
12. Connect wiring harness to fuel pump.



1. **Upper retainer**
2. **Lower retainer**
3. **Tabs (3)**

Figure 4-49. Fuel Pump



1. **Upper isolator**
2. **Groove in lower retainer**
3. **Lower isolator**

Figure 4-50. Fuel Pump Isolators

INSTALLATION

⚠WARNING

Do not replace the special Teflon coated fuel pump wiring with ordinary bulk wire. Ordinary insulation materials can deteriorate when put in contact with gasoline and cause an explosion, which could result in death or serious injury. (00566b)

NOTE

Exercise care to avoid bending float rod of fuel level sender. A bent float rod will result in erroneous gauge readings.

1. See Figure 4-42. Slide fuel sending unit down into welded bracket on right side of fuel tank until it snaps into position.
2. See Figure 4-41. Install fuel pump assembly (1) into fuel tank. Slide bracket (2) rearward into welded bracket until it snaps into place.

NOTE

Do not apply any type of sealant to gasket.

3. Install **new** gasket under top plate.
4. See Figure 4-40. Place top plate with filter housing and regulator on fuel tank. Connect electrical connectors (1-4).
5. See Figure 4-39. Install **new** o-rings on hoses (1,3).
6. Attach hoses (1, 3) to filter housing (2).
7. See Figure 4-38. Install top plate (1) on top of fuel tank.
8. See Figure 4-51 Install **new** T20 TORX screws and tighten using the pattern shown, to 18-24 **in-lbs** (2.0-2.7 Nm).
9. See Figure 4-38. Connect fuel pump module connector (3) [86].
10. Connect console wiring and install console.
11. See Figure 4-37. Connect crossover hose (2) with new clamps (1).

12. See Figure 4-35. Install the fuel pump fuse in the main wiring harness.
13. Connect negative battery cable.
14. Fill tank with gasoline and check for leaks.
15. Check fuel system pressure. See 4.16 FUEL PRESSURE TEST.

⚠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.

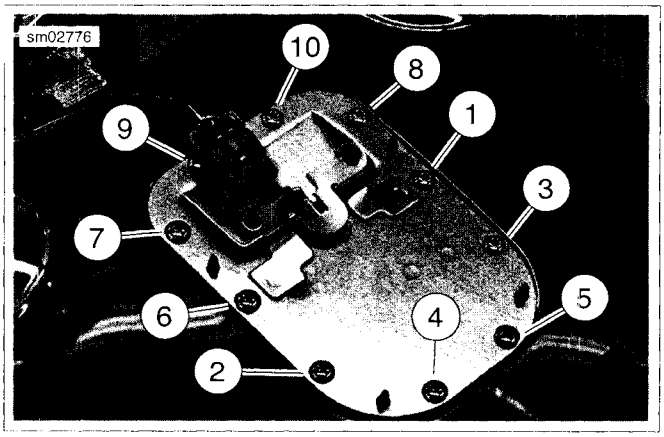


Figure 4-51. Top Plate Torque Sequence

GENERAL

The fuel pump delivers fuel to the fuel line, to a cavity in the induction module that supplies the fuel injectors and to the pressure regulator, where the system pressure is controlled. Excess fuel pressure is bypassed to the fuel tank through the pressure regulator.

See Figure 4-52. The fuel pump fuse is located under the seat. The fuel pump can be turned on with Digital Technician or by applying battery voltage to the fuel pump fuse.

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but won't run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

NOTE

Refer to the electrical diagnostic manual for further information on the function and testing of the fuel system.

TESTING

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

The fuel pressure gauge allows for fuel injector and fuel system pressure diagnosis. A special adapter allows the gauge to be attached to the external fuel supply line.

NOTE

Be sure to avoid crimping of fuel line when installing/removing fuel pressure gauge and adapter.

1. Remove seat.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge the fuel supply line of high pressure gas.
   a. See Figure 4-52. Disconnect the fuel pump fuse from the main wiring harness.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

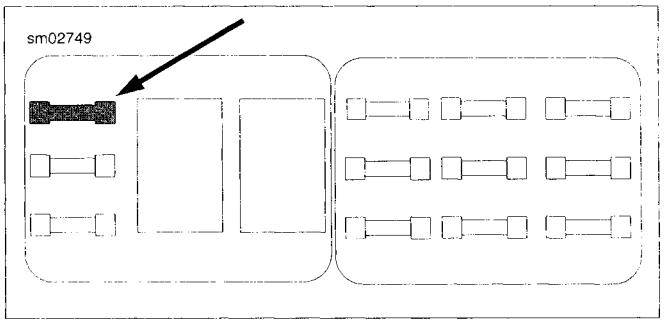


Figure 4-52. Fuel Pump Fuse: View from Top

⚠WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

3. Pull up on chrome sleeve of quick-connect fitting (fitting on left side of fuel tank) and pull down on fuel supply line to disconnect.

NOTE

The next step requires two fuel pressure gauge adapters. Failure to use two adapters will cause the fuel line to twist. This may result in a broken fuel line or fuel line fitting.

4. Attach fuel line to gauge assembly.
   a. See Figure 4-53. Install a second adapter in series with the first.
   b. See Figure 4-54. Pull up on chrome sleeve of quick-connect fitting and insert neck of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061) into fuel supply line.
   c. While pushing up on bottom of adapter, pull down on chrome sleeve until it "clicks" into the locked position. Tug on adapter to be sure that it will not come free.
   d. See Figure 4-55. In the same manner, install neck of second fuel supply line fitting into quick-connect fitting on fuel tank. Tug on fuel supply line to be sure that it will not come free.

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

5. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
6. See Figure 4-53. Remove protective cap from free end of fuel pressure gauge adapter. Connect fuel pressure gauge to Schroeder valve.

7. See Figure 4-52. Install fuel pump fuse.
8. Start and idle engine to pressurize the fuel system. Open the fuel valve to allow the flow of fuel down the hose of the pressure gauge.
9. Position the clear air bleed tube in a suitable container and open and close the air bleed petcock to purge the gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube. Close the petcock.
10. Open and close throttle to change engine speed. Note the reading of the pressure gauge. Fuel pressure should remain steady at 55-62 psi (380-425 kPa).

NOTE

If fuel pressure gauge reading is not within specifications, see Softail Models Electrical Diagnostic Manual for further diagnosis.

11. Turn the engine off. Position the air bleed tube in a suitable container. Open the air bleed petcock to relieve the fuel system pressure and purge the pressure gauge of gasoline.

⚠WARNING

Gasoline can drain from the adapter when gauge is removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00254a)

12. Remove fuel pressure gauge from the adapter. Install protective cap over Schroeder valve.

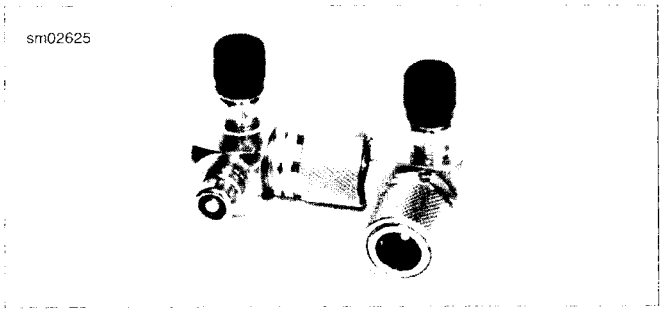
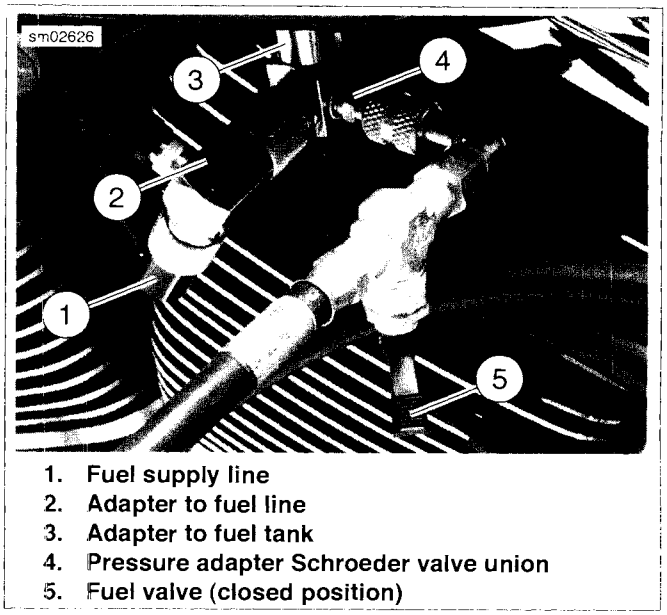


Figure 4-53. Fuel Pressure Gauge Adapters



1. **Fuel supply line**
2. **Adapter to fuel line**
3. **Adapter to fuel tank**
4. **Pressure adapter Schroeder valve union**
5. **Fuel valve (closed position)**

Figure 4-54. Fuel Line

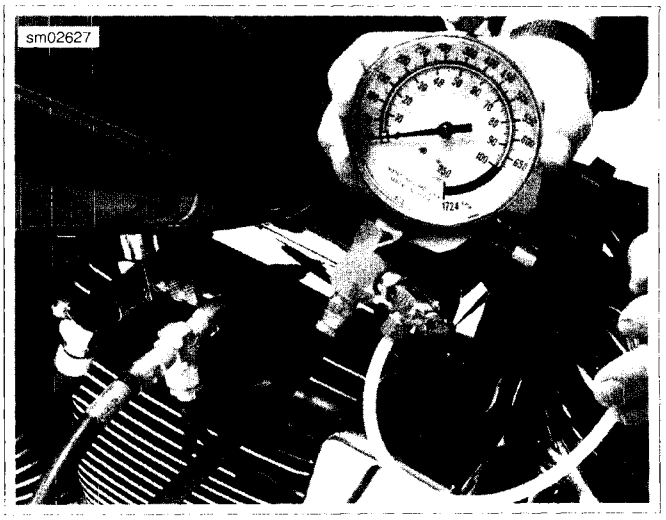


Figure 4-55. Fuel Pressure Gauge Installed (Typical)

⚠WARNING

Gasoline can drain from the fuel line and adapter when removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00255a)

13. Pull up on sleeve of quick-connect fitting and remove fuel supply line from fuel pressure gauge adapter. Release adapter from fuel tank in the same manner.

⚠WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

14. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it "clicks" into the locked position. Tug on fuel supply line to be sure that it will not come free.

⚠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.

MUFFLERS

Removal

1. See Figure 4-56. Apply penetrating oil to seams of mufflers and exhaust pipes (7, 23).
2. Remove muffler shield clamps (30) to detach muffler shields (29) from mufflers.
3. Remove muffler fasteners (24).
4. Remove and discard muffler clamps (3) to separate mufflers from exhaust pipes (7, 23).
5. Slide mufflers rearward off of pipes.

Assembly

1. Install **new** muffler clamps (3) to attach front (28) and rear (1) mufflers to exhaust pipes. Tighten clamps to 38-43 ft-lbs (51.6-58.4 Nm).
2. Install muffler fasteners (24). Tighten to 96-120 **in-lbs** (10.86-13.57 Nm).
3. Open muffler shield clamps (30) and install the muffler shields (29). Position clamps so the screws are on the outboard side in the most accessible position.

SYSTEM

Removal

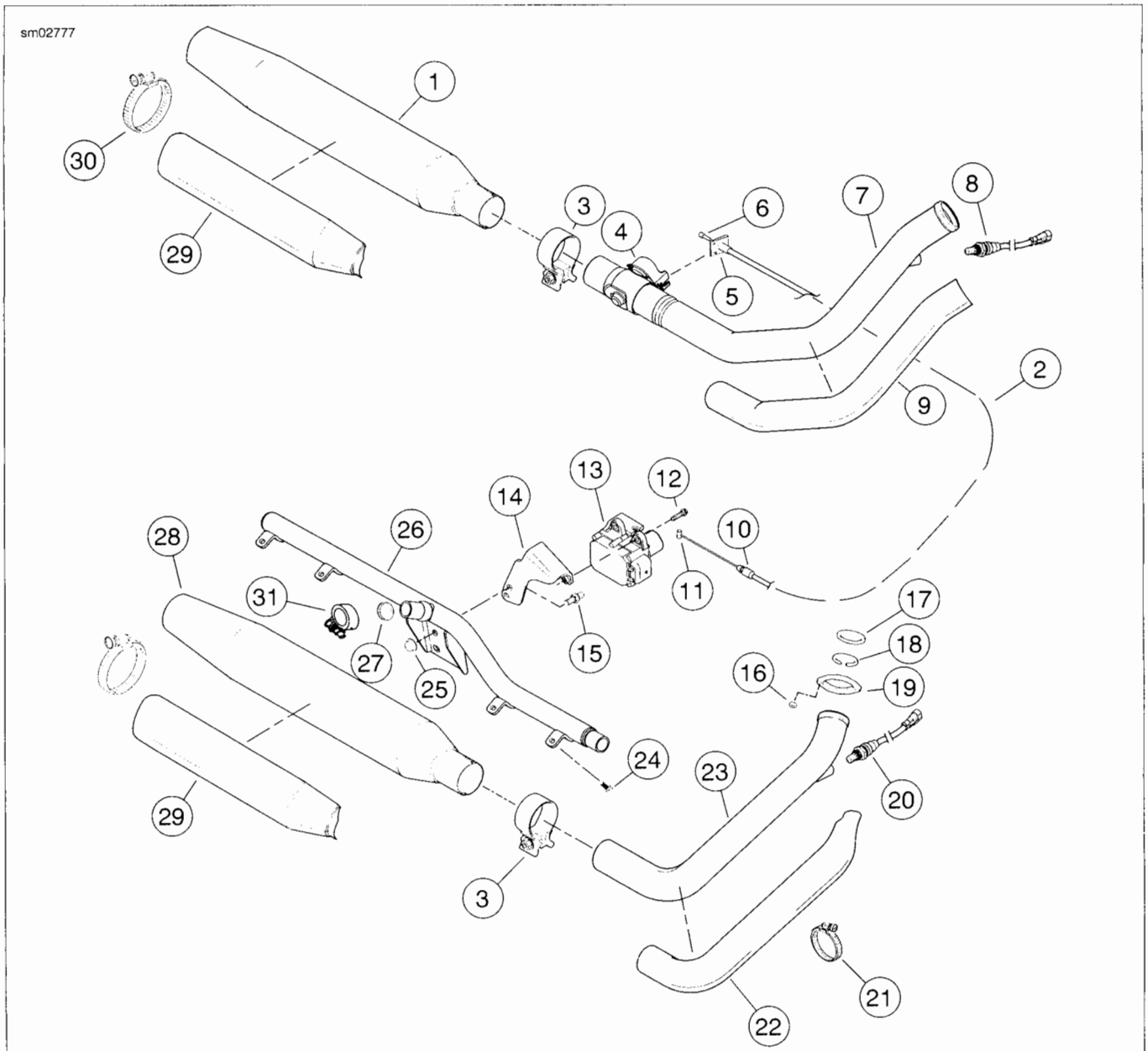
1. Disconnect O2 sensor wiring. See 4.13 OXYGEN SENSOR.
2. See Figure 4-56. Remove heat shields (9, 22) by opening exhaust shield clamps (21).
3. Remove nuts (16) from front and rear cylinder head exhaust studs.
4. Remove two locknuts (25) attaching interconnect tube assembly (26) to frame.
5. Remove exhaust system as an assembly. Disengage rear pipe from port, then front pipe. Replace interconnect gaskets (27) and clamps (31) anytime the connections are disassembled.

Installation

NOTE

Replacement cylinder head exhaust port gaskets (17) are tapered internally. Be sure the tapered side is facing exhaust pipes. Also check condition of retaining ring (18) before installation.

1. If either exhaust tube was removed from the interconnect tube, replace exhaust interconnect gasket (27) and exhaust interconnect clamp (31). Tighten **new** clamp to 15-19 ft-lbs (20.4-27.1 Nm).
2. Install **new** gaskets in both the front and rear cylinder heads with the tapered side facing exhaust pipes.
3. Position ends of exhaust pipes into front, then rear cylinder head exhaust ports placing holes in exhaust manifold clamp (19) over cylinder head exhaust studs. Loosely thread on flange nuts (16).
4. Loosely install locknuts (25) to attach interconnect tube assembly (26) to frame.
5. Tighten nuts (16) at cylinder studs as follows:
   a. Install upper nut and tighten finger tight.
   b. Install lower nut and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
   c. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
6. Align exhaust system and tighten all nuts and bolts; beginning at cylinder head exhaust ports and working backwards. Tighten interconnect fasteners to 20-25 ft-lbs (27.14-33.93 Nm).
7. Open the muffler shield clamps (21) and install front and rear heat shields (9, 22).
8. Connect O2 sensor wiring. See 4.13 OXYGEN SENSOR.



1. Rear muffler
2. Active exhaust cable
3. Muffler clamp (2)
4. Bellcrank
5. Cable retainer
6. Ferrule
7. Rear exhaust pipe
8. Rear oxygen sensor
9. Rear exhaust shield
10. Cable housing
11. Ferrule
12. Fastener
13. Active exhaust module
14. Active exhaust module bracket
15. Spacer stud (2)
16. Nut (4)
17. Exhaust port gasket (2)
18. Exhaust gasket retaining ring (2)
19. Exhaust manifold clamp (2)
20. Front oxygen sensor
21. Exhaust shield clamp (4)
22. Front exhaust shield
23. Front exhaust pipe
24. Fastener
25. Locknut (2)
26. Interconnect tube assembly
27. Exhaust interconnect gasket (2)
28. Front muffler
29. Muffler shield (2 on HDI vehicles)
30. Muffler shield clamp (2, 4 on HDI vehicles)
31. Exhaust interconnect clamp (2)

Figure 4-56. Exhaust System: FXST, FLST, FLSTC, FXSTC, FXCWC

MUFFLERS

Removal

1. See Figure 4-57. Loosen clamps (21).
2. Apply penetrating oil to seams of mufflers and exhaust pipe (2).
3. Loosen flange locknut (12) on carriage bolt (17).
4. Remove muffler fasteners (29) to detach mufflers from muffler support (30).
5. Remove muffler shield clamps (23) to detach muffler shields (22, 26) from mufflers.
6. Remove mufflers. Discard clamps.

Assembly

1. See Figure 4-57. Place **new** clamps (21) over exhaust pipe (2).
2. Slide mufflers (24, 25), onto exhaust pipe.
3. Loosely attach mufflers to muffler support (30) using muffler fasteners (29).
4. Loosely install flange locknut (12) on carriage bolt (17).
5. Tighten all muffler fasteners.
   a. Tighten muffler clamps to 38-43 ft-lbs (51.6-58.4 Nm).
   b. Tighten flange locknut (12) on carriage bolt (17) to 20-25 ft-lbs (27.1-33.9 Nm).
   c. Tighten muffler support fasteners to 96-120 **in-lbs** (10.8-13.6 Nm).
6. Open muffler shield clamps (23) and install the muffler shields (22, 26). Position clamps so the screws are on the outboard side in the most accessible position.

SYSTEM

Removal

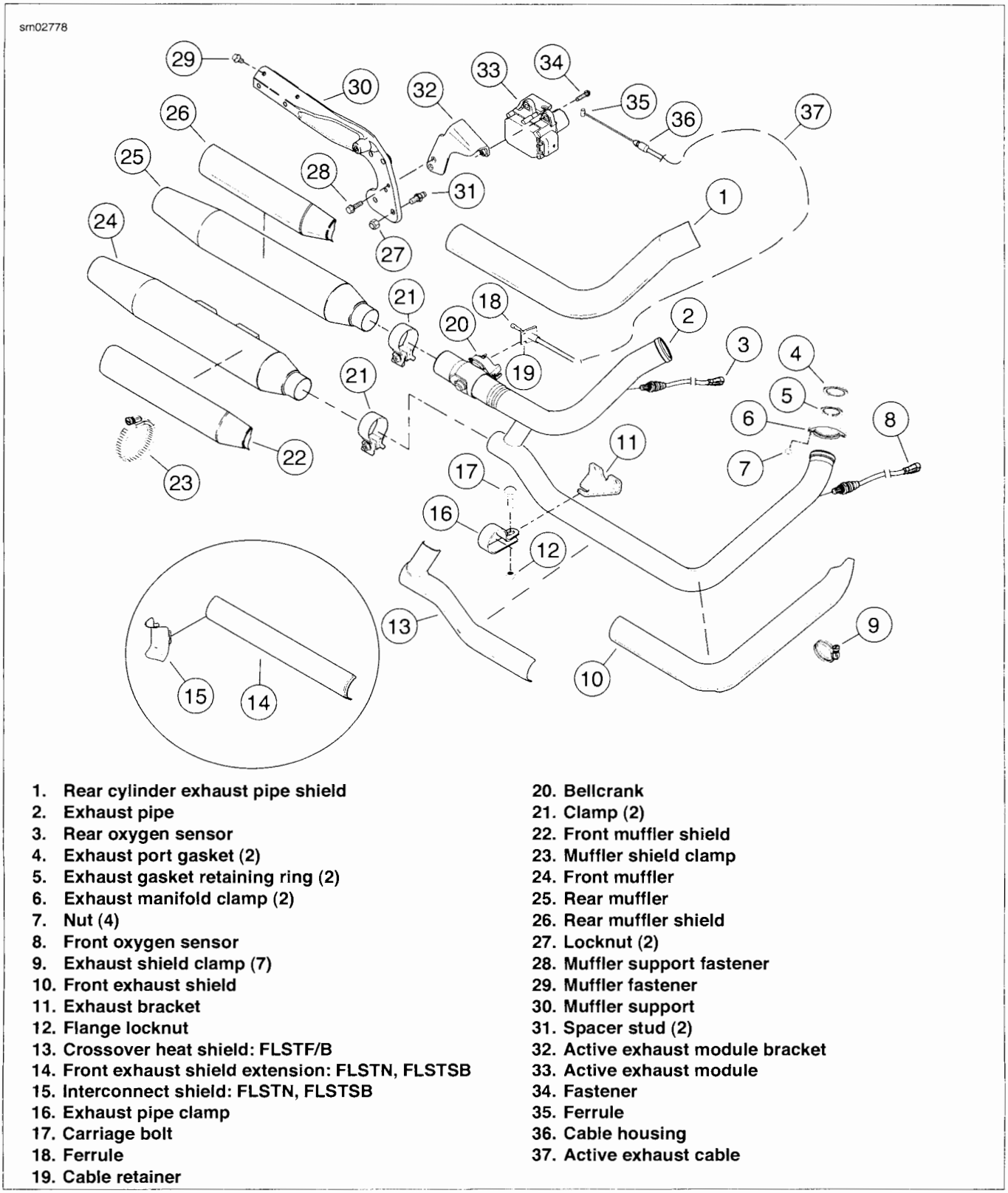
1. Disconnect O2 sensor wiring. See 4.13 OXYGEN SENSOR.
2. Remove two bolts and nuts to detach right side floorboard from mount.
3. See Figure 4-57. Detach heat shields (1, 10, 13, 14, 15) from exhaust pipe (2) by removing clamps (9).
4. Remove all four exhaust header nuts (7).
5. Loosen flange locknut (12) from carriage bolt (17). Slide exhaust pipe clamp (16) from the exhaust bracket (11).
6. Remove two locknuts (27) and bolt (28) to detach exhaust system from frame.

Installation

NOTE

See Figure 4-57. Replacement cylinder head exhaust port gaskets (4) are tapered internally. Be sure the tapered side is facing exhaust pipes. Also check condition of retaining ring (5) before installation.

1. Install **new** gaskets (4) in both the front and rear cylinder heads with the tapered side facing exhaust pipes.
2. Position ends of exhaust pipes into front, then rear cylinder head exhaust ports placing holes in exhaust manifold clamp (6) over cylinder head exhaust studs. Loosely thread on flange nuts (7).
3. Loosely attach exhaust system to frame using locknuts (27).
4. Loosely attach exhaust pipe clamp (16) to exhaust bracket (11) using flange locknut (12) and carriage bolt (17).
5. Align exhaust system and tighten all nuts and bolts; beginning at cylinder head exhaust ports and working backwards.
   a. Install upper nut and tighten finger tight.
   b. Install lower nut and tighten to 9-18 **in-lbs** (1.0-2.0 Nm).
   c. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
6. Tighten flange locknut (12) on carriage bolt (17) to 20-25 ft-lbs (27.1-33.9 Nm).
7. Open clamps (9) and install heat shields (1, 10, 13, 14, 15).
8. Install right side floorboard with two bolts and nuts.
9. Connect O2 sensor wiring. See 4.13 OXYGEN SENSOR.



1. Rear cylinder exhaust pipe shield
2. Exhaust pipe
3. Rear oxygen sensor
4. Exhaust port gasket (2)
5. Exhaust gasket retaining ring (2)
6. Exhaust manifold clamp (2)
7. Nut (4)
8. Front oxygen sensor
9. Exhaust shield clamp (7)
10. Front exhaust shield
11. Exhaust bracket
12. Flange locknut
13. Crossover heat shield: FLSTF/B
14. Front exhaust shield extension: FLSTN, FLSTSB
15. Interconnect shield: FLSTN, FLSTSB
16. Exhaust pipe clamp
17. Carriage bolt
18. Ferrule
19. Cable retainer
20. Bellcrank
21. Clamp (2)
22. Front muffler shield
23. Muffler shield clamp
24. Front muffler
25. Rear muffler
26. Rear muffler shield
27. Locknut (2)
28. Muffler support fastener
29. Muffler fastener
30. Muffler support
31. Spacer stud (2)
32. Active exhaust module bracket
33. Active exhaust module
34. Fastener
35. Ferrule
36. Cable housing
37. Active exhaust cable

Figure 4-57. Exhaust System: FLSTF/B, FLSTN, FLSTSB

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.*
- *Be careful when testing vehicle with Screamin' Eagle air cleaner assembly. This type of air cleaner has an open backing plate. Even with air cleaner cover on, directing nozzle too close to backing plate can give false readings.*

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

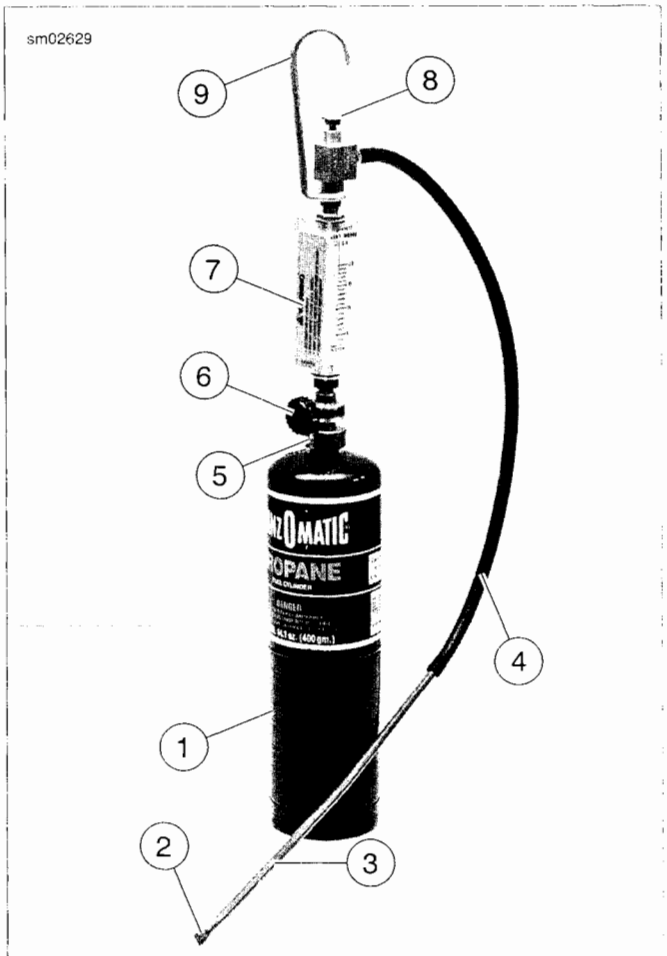
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

Tester Assembly

1. See Figure 4-58. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 4-58. 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 4-58. Leak Tester

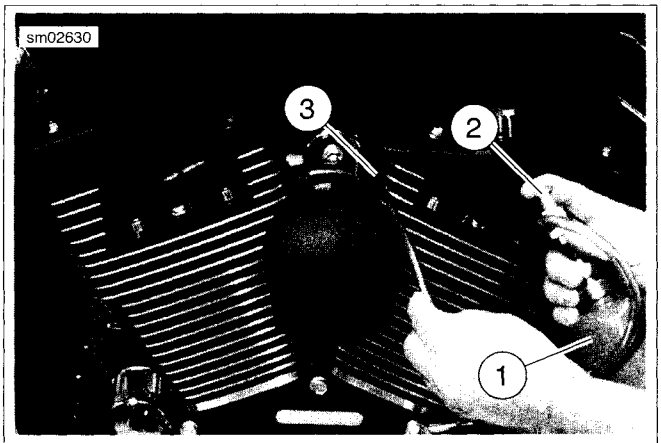
PROCEDURE

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 4-59. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.
4. Press and release trigger button (2) to dispense propane. Tone of engine will change when propane enters source of leak. Repeat as necessary to detect leak.
5. When test is finished, close valve knob (turn knob fully clockwise).



1. Propane bottle
2. Trigger button
3. Nozzle

Figure 4-59. Checking for Leaks

EVAPORATIVE EMISSIONS CONTROL (CA MODELS) 4.20

GENERAL

Harley-Davidson 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:

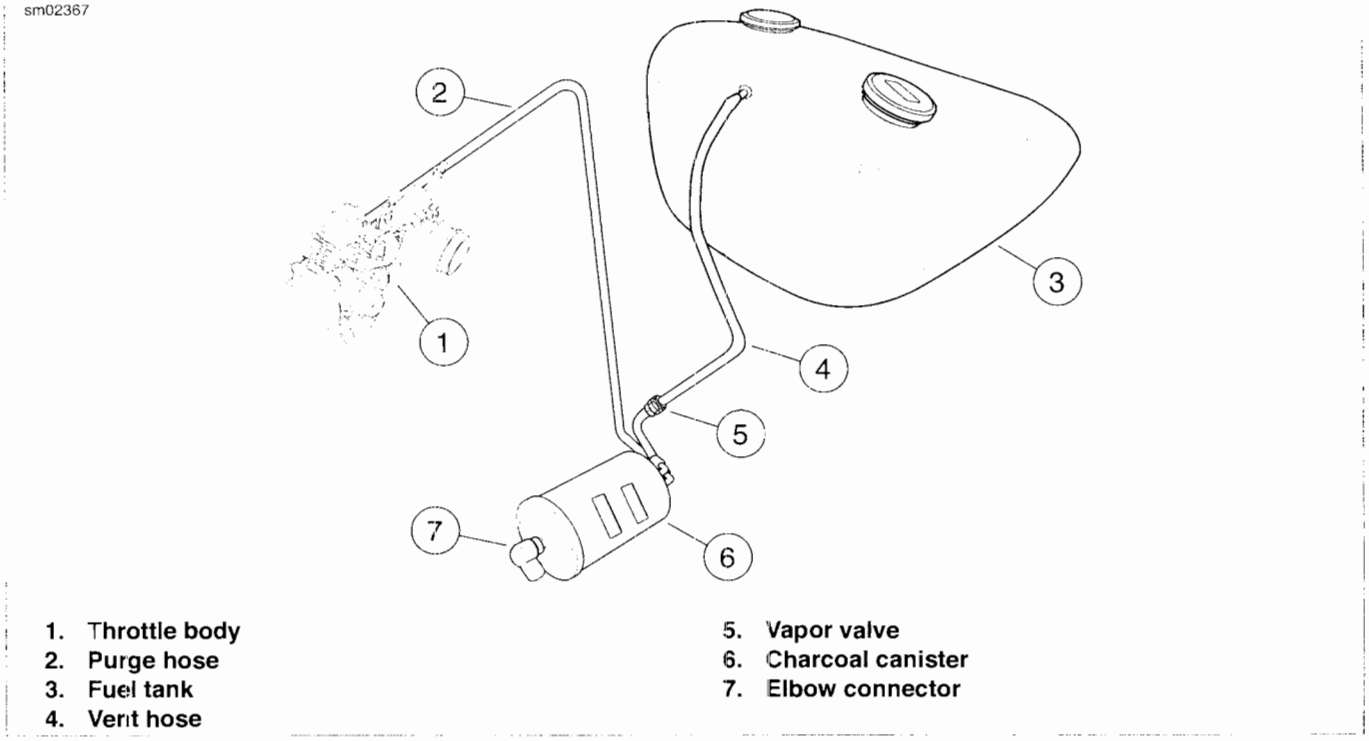
- Hydrocarbon vapors in the fuel tank are directed through the vapor valve and stored in the charcoal canister. If the vehicle is tipped at an abnormal angle, the vapor valve closes to prevent liquid gasoline from leaking out of the fuel tank through the vent hose.
- On all models, when the engine is running, intake venturi negative pressure (vacuum) slowly draws off the hydrocarbon vapors from the charcoal canister through the canister-to-intake purge hose. These vapors pass through the intake and are burned as part of normal combustion in the engine.

⚠WARNING

Keep evaporative emissions vent lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00266a)

NOTE

The EVAP system has been designed to operate with a minimum of maintenance. Check that all hoses are properly connected, are not pinched or kinked and are routed properly. Improper connections could leak charcoal from canister.



1. **Throttle body**
2. **Purge hose**
3. **Fuel tank**
4. **Vent hose**
5. **Vapor valve**
6. **Charcoal canister**
7. **Elbow connector**

Figure 4-60. Schematic-CA Evaporative Emissions Control System

CHARCOAL CANISTER

Removal

⚠WARNING

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

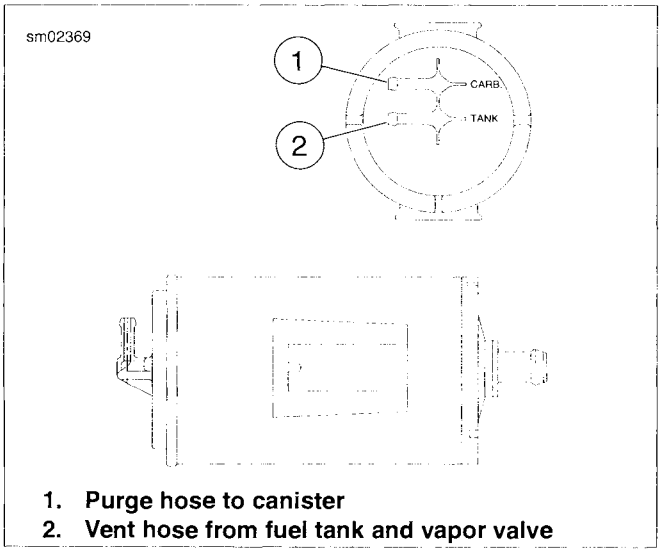
The EVAP charcoal canister is mounted below the rear fork pivot.

1. Support motorcycle so rear wheel is off the floor. Remove the cotter pin from the rear wheel axle, loosen the axle nut and turn the axle adjusting bolts all the way forward.
2. Move the wheel forward and slip the drive belt off the sprocket. Then move the wheel as far as it will go towards the rear of the motorcycle.
3. Remove rear splash guard.
4. Cut cable straps securing the canister.

5. See Figure 4-61. Note the two hose connections on the left side of the canister. To verify correct assembly, mark the hose to match the stamps on the canister. After hoses are marked, gently pull hoses off the canister.
6. Remove canister.

Installation

1. Place canister into position and secure with cable straps.
2. See Figure 4-61. Attach hoses to left side canister nipples as marked.
3. Move rear wheel forward and place belt on sprocket. Then move wheel back and make sure brake disc is centered between brake pads.
4. Tighten axle nut and adjust belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
5. Install splash guard:
   a. **All but FXCWC:** Tighten fastener to 36-48 **in-lbs** (4.1-5.4 Nm)
   b. **FXCWC:** Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm)



1. **Purge hose to canister**
2. **Vent hose from fuel tank and vapor valve**

Figure 4-61. Charcoal Canister Connections

HOSE ROUTING/REPLACEMENT

NOTE

Record location of cable ties before removal. Install cable ties in same location when installing.

⚠WARNING

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

1. Remove console and fuel tank. See 4.6 FUEL TANK.
2. Route vacuum or purge hose.
   a. See Figure 4-60. Attach the preformed purge hose to the intake purge fitting.
   b. Route purge hose under fuel tank along backbone. Route purge hose down frame to canister.
   c. See Figure 4-61. Attach the purge hose to the canister fitting marked CARB on left side of canister.
3. Route fuel tank vent hose.
   a. Route fuel tank vent hose along left side of frame (cable tie loosely to frame) to vapor valve on transmission housing.
   b. Attach one end of the hose to the top (long) fitting on the vapor valve.
   c. See Figure 4-61. Connect hose attached to bottom end of vapor valve to fitting marked TANK on left side of canister.
4. Install fuel tank and attach the fuel tank vent hose to the fuel tank vent nipple. Install console. See 4.6 FUEL TANK.
5. Install **new** EVAP system label on front frame down tube.

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Chain tensioner fasteners	15-19 ft-lbs	20.3-25.8 Nm	5.4 DRIVE COMPONENTS, Installation
Clutch diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm	5.6 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-final torque	140 ft-lbs	190.0 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-final torque	140 ft-lbs	190.0 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-initial torque	100 ft-lbs	135.7 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-initial torque	100 ft-lbs	135.7 Nm	5.4 DRIVE COMPONENTS, Installation
Diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm	5.6 CLUTCH, Clutch Pack and Bearing
Primary cover fasteners	108-120 **in-lbs**	12.2-13.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Sealing fasteners	26-28 ft-lbs	35.3-38.0 Nm	5.5 PRIMARY CHAINCASE HOUSING, Installation
Transmission lockplate screws	84-108 **in-lbs**	9.5-12.2 Nm	5.7 TRANSMISSION SPROCKET, Installation/LOC-TITE patch, use 3-5 times
Transmission sprocket nut: final torque	35 ft-lbs + 35-40 degrees	47.5 Nm + 35-40 degrees	5.7 TRANSMISSION SPROCKET, Installation
Transmission sprocket nut: initial torque	35 ft-lbs	47.5 Nm	5.7 TRANSMISSION SPROCKET, Installation/Right hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 271 (red) to last few threads.

SPECIFICATIONS

Table 5-1. Sprocket Specifications

SPROCKETS	NO. OF TEETH
	DOM/HDI
Compensating	34
Clutch	46
Transmission	32
Rear Wheel	66

Table 5-2. Clutch Specifications

CLUTCH	DESCRIPTION
Type	Wet-multiple disc
Clutch lever freeplay (after internal adjustment)	1/16-1/8 in. (1.6-3.2 mm)

Table 5-3. Gear Specifications

GEAR	OVERALL GEAR RATIO	
	DOM/HDI	Japan
First (low)	9.311	9.029
Second	6.454	6.259
Third	4.793	4.648
Fourth	3.882	3.764
Fifth	3.307	3.207
Sixth (high)	2.790	2.706

NOTE

Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

GENERAL

The primary chaincase is a sealed housing containing the primary chain, chain tensioner, clutch, engine compensating sprocket and alternator.

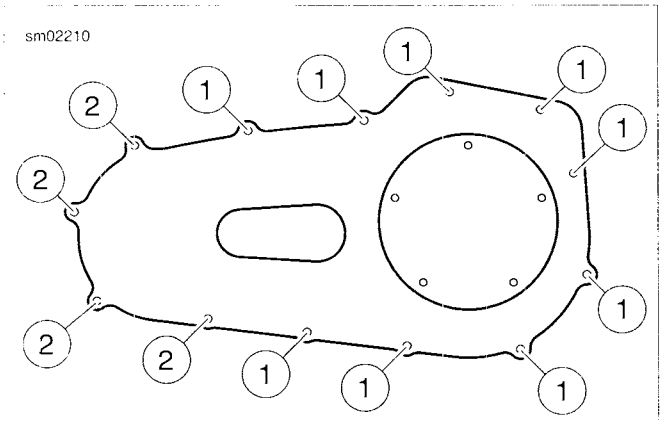
For information on primary chain lubrication, see 1.9 PRIMARY CHAINCASE LUBRICANT.

REMOVAL

⚠WARNING

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

1. Disconnect negative battery cable.
2. Drain the primary chaincase lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.
3. See Figure 5-1. When lubricant has drained, remove short (1) and long (2) cover fasteners and cover.



1. **Short cover fasteners**
2. **Long cover fasteners**

Figure 5-1. Primary Chaincase Cover

INSTALLATION

NOTE

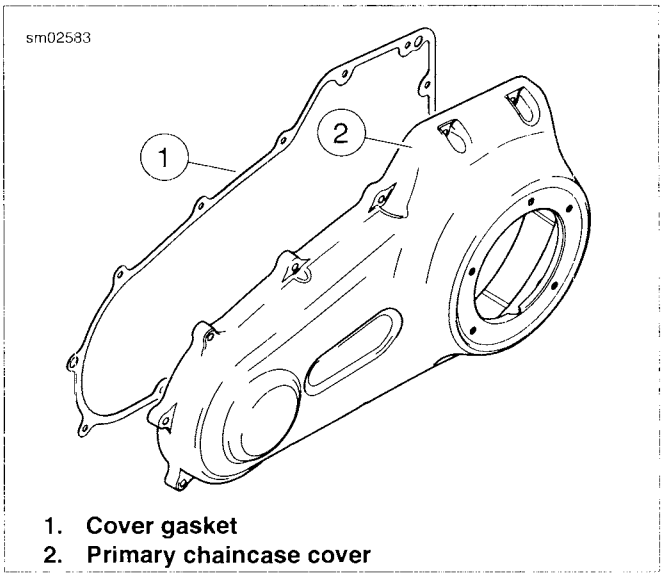
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

1. See Figure 5-2. Install **new** cover gasket (1).
2. See Figure 5-1. Apply a drop of Loctite Threadlocker 243 (blue) (Part no. 99642-97) to each primary cover fastener. Install short (1) and long (2) primary cover fasteners in positions shown. Snug fasteners.
3. See Figure 5-3. Tighten primary cover fasteners (1-13) to 108-120 **in-lbs** (12.2-13.6 Nm) in the sequence shown.

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)

4. Place motorcycle in an upright position and fill primary chaincase. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.
5. Connect negative battery cable.



1. **Cover gasket**
2. **Primary chaincase cover**

Figure 5-2. Primary Chaincase Cover Gasket

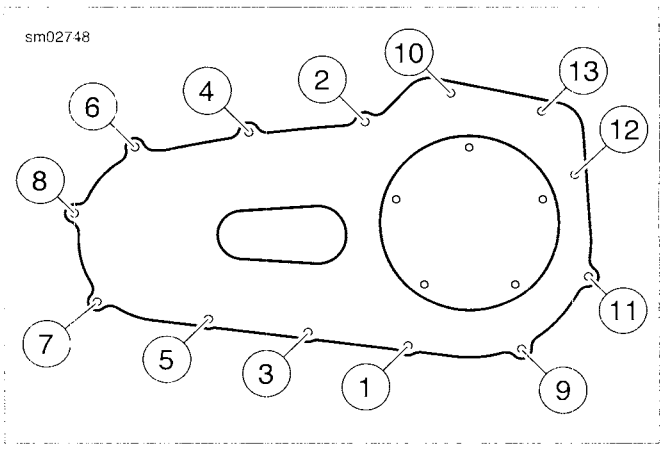


Figure 5-3. Primary Chaincase Cover Torque Sequence

REMOVAL

PART NUMBER	TOOL NAME
HD-47977	PRIMARY DRIVE LOCKING TOOL

NOTES

To remove the primary chain, remove compensating sprocket, clutch assembly and primary chain as an assembly:

1. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 5-4. Remove chain tensioner fasteners (2) then remove chain tensioner (1).
3. Using a colored marker, mark one of the links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.

⚠WARNING

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

4. See Figure 5-5. Loosen locknut (3).
5. Remove retaining ring (1) and release plate (2).

⚠WARNING

Do not apply heat to remove the clutch hub nut. Fuel vapor and possible fuel mixture in crankcase oil is extremely flammable and highly explosive, which could result in death or serious injury. (00440b)

NOTES

- *See Figure 5-7. When removing the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.*
- *The mainshaft nut has left handed threads, so turn clockwise to remove.*
- *Do not use PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) to remove or install components. Damage to components can occur if this tool is used. Use only PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) to remove and install components.*

6. Using a breaker bar, rotate clutch hub mainshaft nut in direction shown to remove.

NOTE

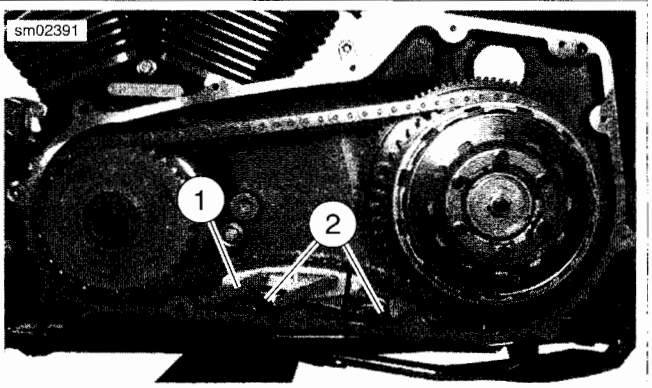
See Figure 5-8. When removing the compensating sprocket bolt, the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.

7. Using a breaker bar, rotate compensating sprocket bolt in direction shown to remove.
8. **All but FXCWC:** see Figure 5-9. Remove bolt (6) and washer (5).
9. **FXCWC:** see Figure 5-10. Remove bolt (9), sprocket retainer (8), and thrust washer (7).

NOTE

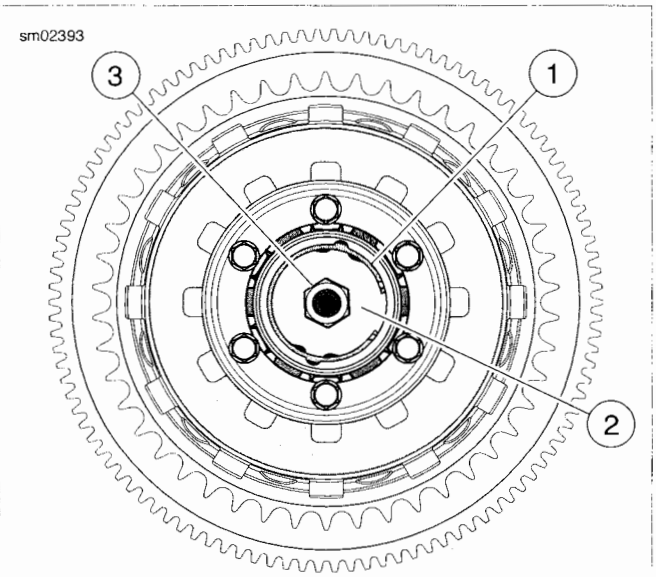
Using a colored marker or paint pen, mark one of the outboard links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.

10. See Figure 5-6. Remove clutch assembly, primary chain and compensating sprocket assembly as a single assembly.



1. **Chain tensioner**
2. **Chain tensioner fasteners**

Figure 5-4. Chain Tensioner



1. **Retaining ring**
2. **Release plate**
3. **Locknut**

Figure 5-5. Clutch

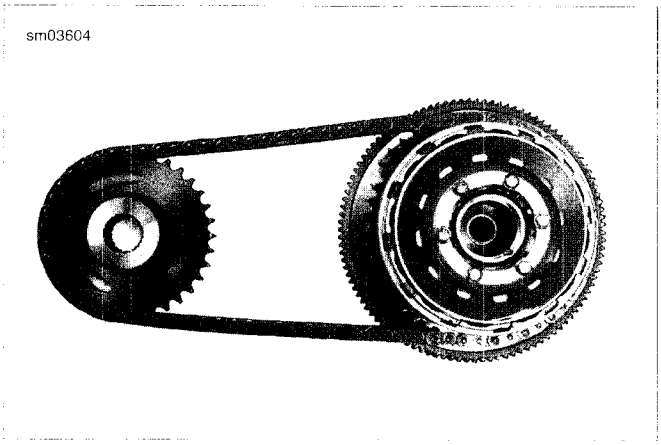
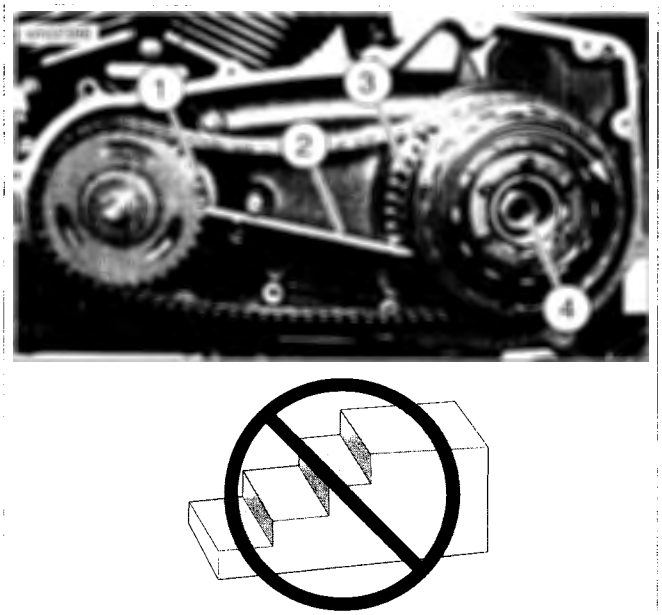
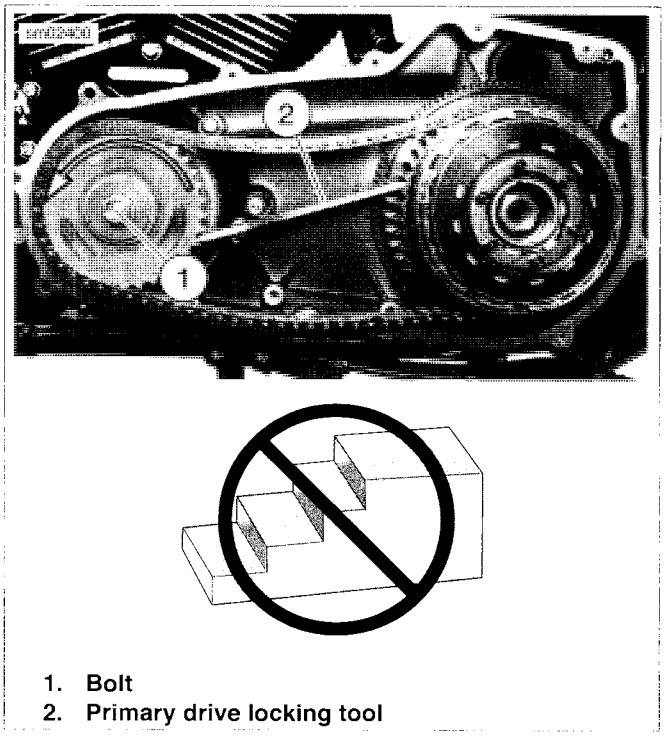


Figure 5-6. Remove Drive Components



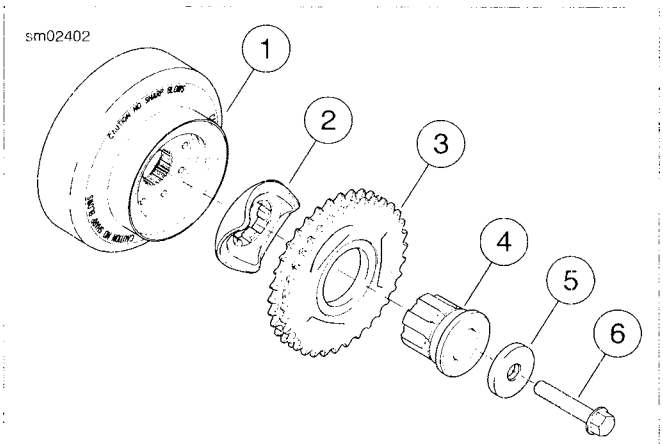
1. Engine sprocket
2. Primary drive locking tool
3. Clutch sprocket
4. Clutch hub nut

Figure 5-7. Removing Clutch Hub Mainshaft Nut



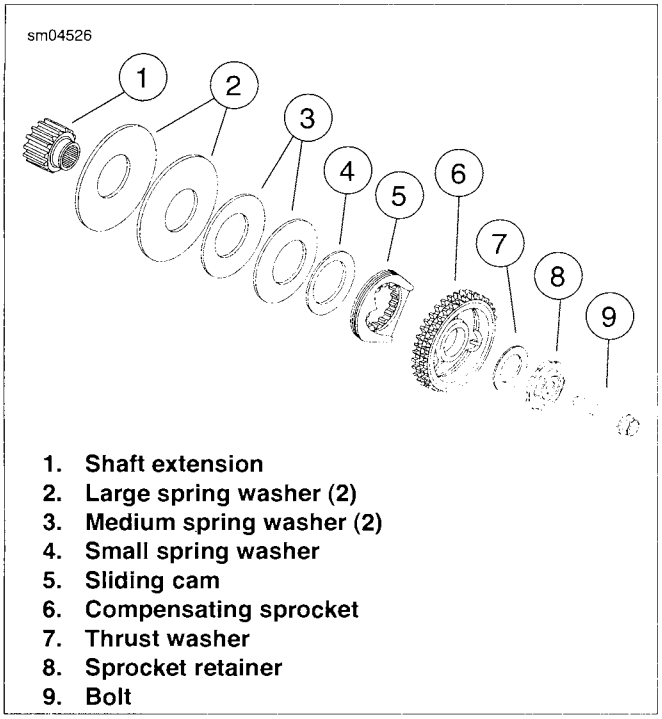
1. Bolt
2. Primary drive locking tool

Figure 5-8. Removing Compensating Sprocket Bolt



1. Rotor
2. Sliding cam
3. Compensating sprocket
4. Shaft extension
5. Washer
6. Bolt

Figure 5-9. Compensating Sprocket: All But FXCWC



1. **Shaft extension**
2. **Large spring washer (2)**
3. **Medium spring washer (2)**
4. **Small spring washer**
5. **Sliding cam**
6. **Compensating sprocket**
7. **Thrust washer**
8. **Sprocket retainer**
9. **Bolt**

Figure 5-10. Compensating Sprocket: FXCWC

INSTALLATION

PART NUMBER	TOOL NAME
HD-47977	PRIMARY DRIVE LOCKING TOOL

NOTE

The primary chain, compensating sprocket and clutch assembly must be installed as an assembly.

1. **All but FXCWC:** see Figure 5-11. Install compensating sprocket assembly.
   a. Apply a thin layer of primary chaincase oil to the inner diameter of the compensating sprocket (3), the outside of the splines of shaft extension (4) and the bearing surface of the shaft extension. Assemble shaft extension, compensating sprocket and sliding cam (2). Place primary chain over compensating sprocket assembly.
   b. Place drive components (primary chain, compensating sprocket assembly, and clutch assembly) into position. The clutch hub and shaft extension are splined, so a slight rotation of the chain drive will aid installation.
   c. Install **new** bolt (6) and washer (5) hand tight.

NOTE

Clutch hub mainshaft nut has left handed threads, so turn counterclockwise to install.

   d. Clean and prime threads of nut. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads of the clutch hub mainshaft nut. Start nut onto mainshaft and tighten hand tight.

NOTE

See Figure 5-13. When tightening the compensating sprocket bolt, the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.

   e. Tighten compensating sprocket to 100 ft-lbs (135.7 Nm).
   f. Loosen compensating sprocket back one full turn (360 degrees).
   g. Re-tighten compensating sprocket to 140 ft-lbs (190.0 Nm).

2. **FXCWC:** see Figure 5-12. Install compensating sprocket assembly.
   a. Install shaft extension (1) with bearing journal facing away from vehicle. Apply a thin layer of primary chaincase oil to the splines and bearing journal.
   b. Install large spring washers (2). Outer diameter of spring washers should be contacting each other.
   c. Install medium spring washers (3). Outer diameter of spring washers should be contacting each other.
   d. Install small spring washer (4) so that outer diameter will contact sliding cam (5), once installed.
   e. Install sliding cam with flat face contacting small spring (4). Lubricate sliding cam ramps with primary chaincase oil.
   f. Place drive components [primary chain, compensating sprocket (6) (with text "this side out" facing away from motorcycle), and clutch assembly] into position. The clutch hub and shaft extension are splined, so a slight rotation of the chain drive will aid installation.

NOTE

When installing sprocket retainer (8) make sure that thrust washer (7) does not fall off sprocket retainer or that it does not get pinched between the sprocket retainer and extension shaft. A small amount of white lithium grease will help hold the thrust washer to the sprocket retainer.

   g. Install thrust washer (7) and sprocket retainer (8).

NOTES

When installing bolt (9), make sure the spring washers are properly aligned and that spring nearest rotor assembly has not slipped between extension and rotor hub.

Make sure the thrust washer has not slipped between the sprocket and sprocket retainer.

   h. Install **new** bolt (9) by hand and snug against sprocket retainer. Using a 1 3/4 in. box-end wrench to hold crankshaft, tighten compensating sprocket to 100 ft-lbs (135.7 Nm).
   i. Loosen compensating sprocket back one full turn (360 degrees).
   j. Re-tighten compensating sprocket to 140 ft-lbs (190.0 Nm).
   k. Rotate compensating sprocket to make sure there is a light pressure on sprocket from the springs, no clearance should be felt. A slight rotation should be possible by hand with transmission in neutral.

NOTE

Clutch hub mainshaft nut has left handed threads, so turn counterclockwise to install.

l. Clean and prime threads of nut. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads of the clutch hub mainshaft nut. Start nut onto mainshaft and tighten hand tight.

NOTE

See Figure 5-14. When tightening the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL must be placed between the teeth of the engine and clutch sprockets.

3. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-108.5 Nm). Remove primary drive locking tool.

4. See Figure 5-15. Install release plate (5) with locknut (2) and adjuster screw (3) into clutch hub bore. The word "OUT" stamped on the release plate should face outward.

⚠WARNING

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

5. Inspect retaining ring (4) and replace if necessary. Install retaining ring in clutch hub bore to lock release plate in position. Verify that the retaining ring is completely seated in the groove.

6. Adjust clutch. See 1.11 CLUTCH, Adjustment.

NOTE

Primary chain tensioner is non-repairable. If tensioner is worn or damaged, assembly must be replaced.

7. See Figure 5-16. Although primary chain tensioner is sold as an assembly, tensioner parts can be disassembled. If primary chain tensioner becomes disassembled, assemble in order shown.

8. See Figure 5-17. Locate end of spring rod (2) on roll pin (3).

9. See Figure 5-18. Slide wedge (2) of primary chain tensioner in direction of arrow until all travel is removed.

10. Push shoe (1) down until it contacts wedge. Keep tension on shoe so wedge stays in place.

11. See Figure 5-19. Insert cable tie (2) as shown to hold wedge in place. Make sure end of cable tie is located below primary chain tensioner. If cable tie is installed this way, it will hang below primary cover gasket surface and serve as a reminder to remove cable tie before installing primary cover.

NOTE

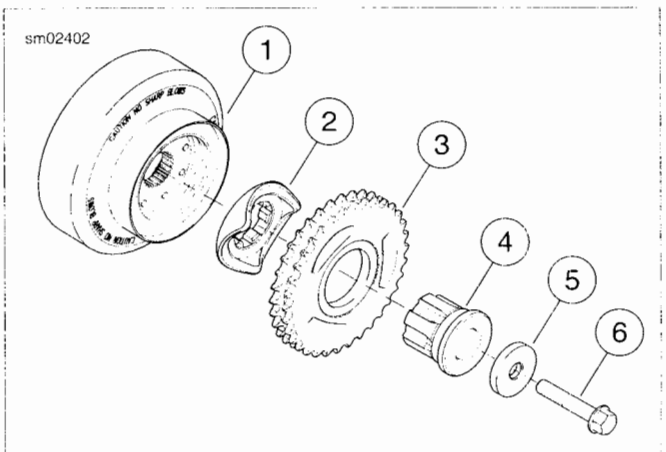
Primary chain tensioner will not complete chain adjustment until vehicle is ridden. Vehicle must be test ridden after tensioner removal/installation to be sure of proper adjustment.

12. See Figure 5-20. Install primary chain tensioner (1) into place. Install chain tensioner fasteners (2) and tighten to 15-19 ft-lbs (20.3-25.8 Nm). Remove cable tie.

NOTE

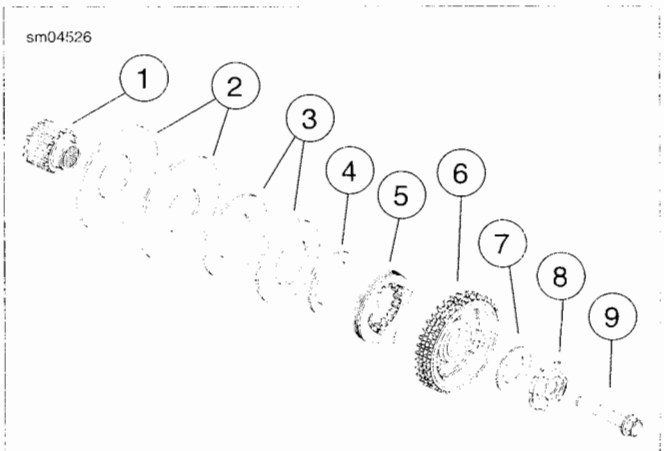
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

13. Install primary chaincase cover and fill with lubricant. See 5.3 PRIMARY CHAINCASE COVER, Installation.



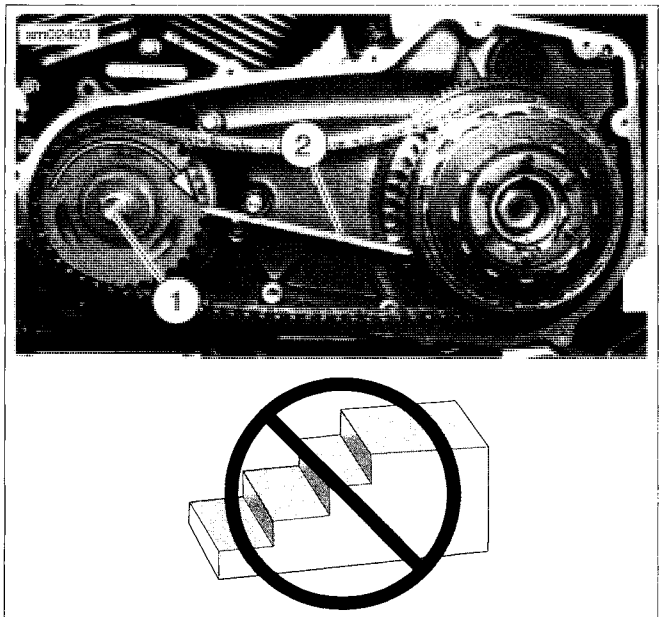
1. **Rotor**
2. **Sliding cam**
3. **Compensating sprocket**
4. **Shaft extension**
5. **Washer**
6. **Bolt**

Figure 5-11. Compensating Sprocket: All But FXCWC



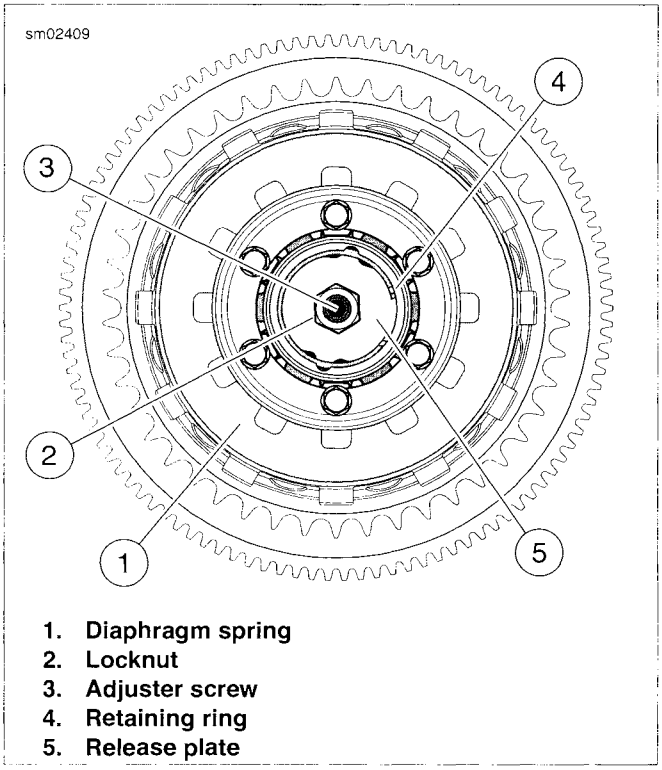
1. **Shaft extension**
2. **Large spring washer (2)**
3. **Medium spring washer (2)**
4. **Small spring washer**
5. **Sliding cam**
6. **Compensating sprocket**
7. **Thrust washer**
8. **Sprocket retainer**
9. **Bolt**

Figure 5-12. Compensating Sprocket: FXCWC



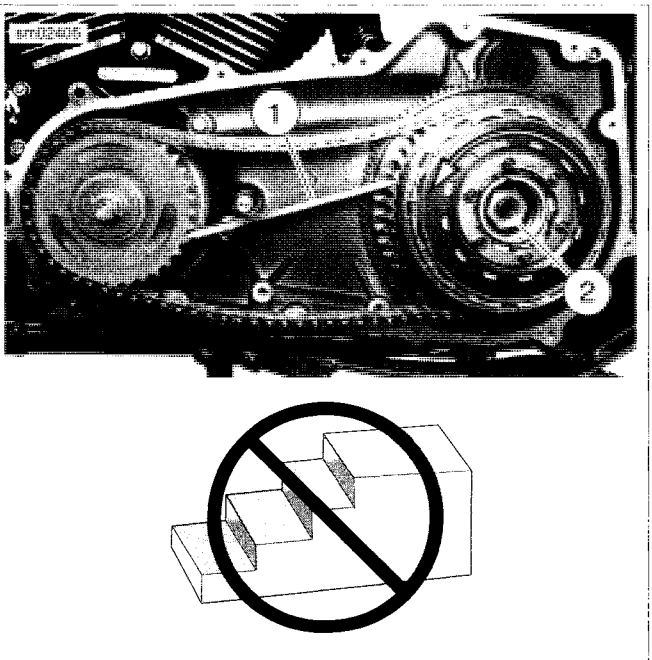
1. Bolt
2. Primary drive locking tool

Figure 5-13. Installing Compensating Sprocket Bolt



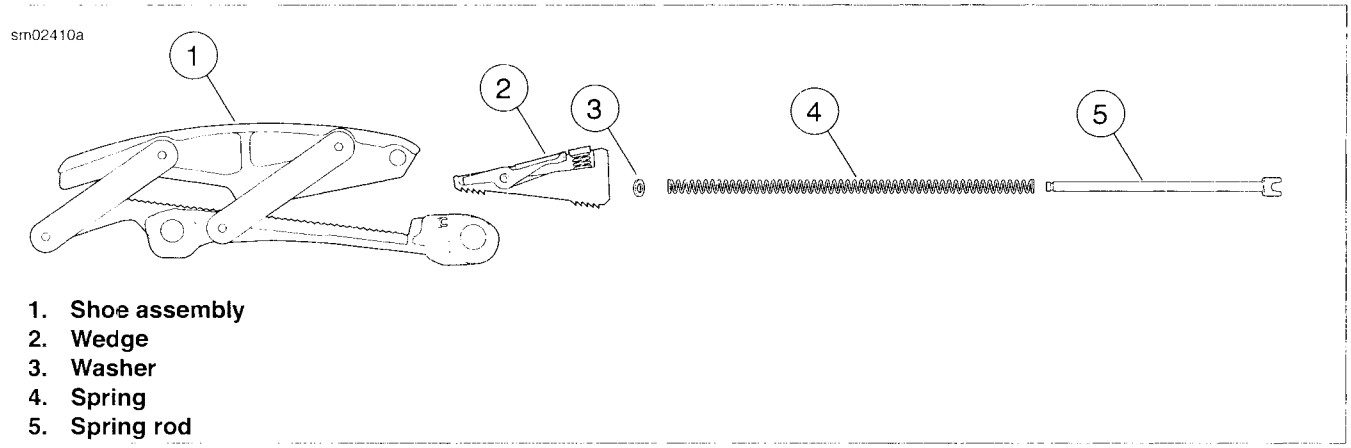
1. Diaphragm spring
2. Locknut
3. Adjuster screw
4. Retaining ring
5. Release plate

Figure 5-15. Clutch



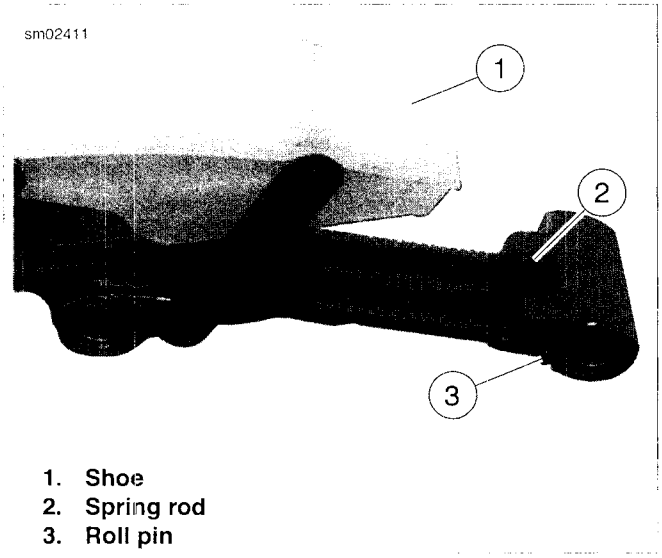
1. Primary drive locking tool
2. Clutch hub nut

Figure 5-14. Installing Clutch Hub Mainshaft Nut



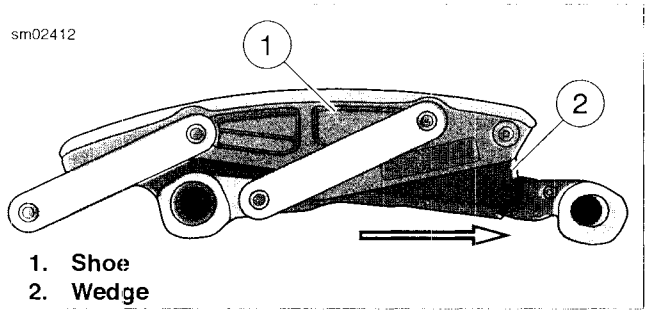
1. Shoe assembly
2. Wedge
3. Washer
4. Spring
5. Spring rod

Figure 5-16. Primary Chain Tensioner Assembly



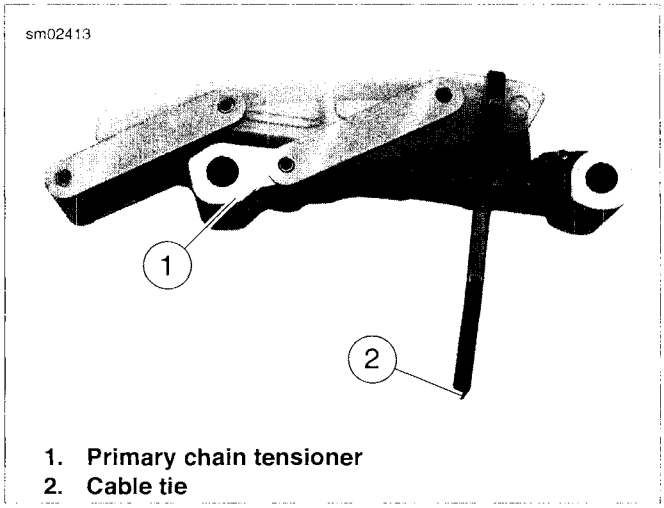
1. Shoe
2. Spring rod
3. Roll pin

Figure 5-17. Spring Rod Location



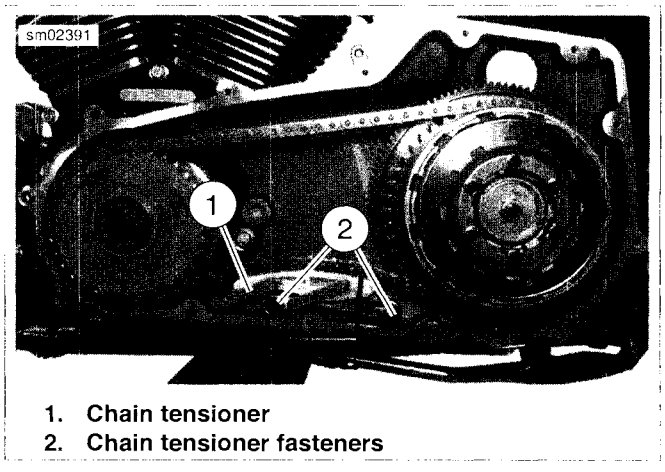
1. Shoe
2. Wedge

Figure 5-18. Primary Chain Tensioner



1. Primary chain tensioner
2. Cable tie

Figure 5-19. Securing Primary Chain Tensioner



1. Chain tensioner
2. Chain tensioner fasteners

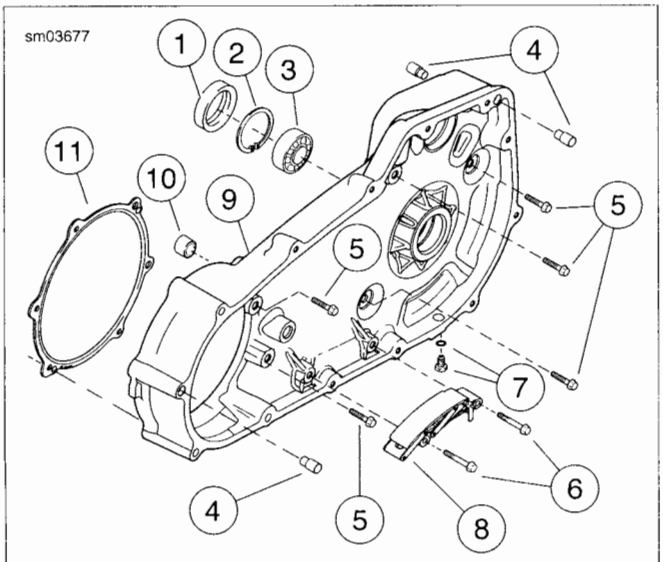
Figure 5-20. Chain Tensioner

REMOVAL

⚠WARNING

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

1. Disconnect negative battery cable.
2. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
3. Remove starter. See 7.13 STARTER, Removal.
4. Remove primary chain, clutch, and compensating sprocket. See 5.4 DRIVE COMPONENTS, Removal.
5. See Figure 5-21. Remove sealing fasteners (5) securing primary chaincase housing (9) to crankcase and transmission. Discard the crankcase gasket (11) and sealing fasteners (5).



1. **Seal**
2. **Lock ring**
3. **Bearing**
4. **Dowel pin**
5. **Sealing fastener**
6. **Chain tensioner fasteners**
7. **Drain plug and o-ring**
8. **Chain tensioner**
9. **Primary chaincase housing**
10. **Shifter shaft bushing**
11. **Crankcase gasket**

Figure 5-21. Primary Chaincase Housing

INSPECTION

1. Inspect primary chaincase for cracks or damaged gasket surface.
2. Check the mainshaft bearing. Replace if bearing does not rotate freely. Replace the lip seal. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing and Lip Seal in this section.

MAINSHAFT BEARING AND LIP SEAL

Removal

⚠WARNING

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

1. Remove lip seal from bearing bore on transmission side of primary chaincase. Use a seal remover or rolling head pry bar for best results.
2. Remove retaining ring from groove on transmission side of bearing.
3. Support inner primary chaincase on transmission side of bearing.

NOTE

Support inner primary chain case area on transmission side while pressing bearing out of primary chaincase. The force needed to remove bearing may cause damage to primary chain case.

4. Place primary chaincase in arbor press. Press out bearing from clutch side applying pressure to the outer race.

Installation

1. Inspect the bearing bore to verify that it is clean and smooth. Install retaining ring in groove on pulley side of primary chaincase.
2. Place primary chaincase in arbor press with the transmission side up.
3. Support the bearing support area on the clutch side of the primary chaincase.

NOTE

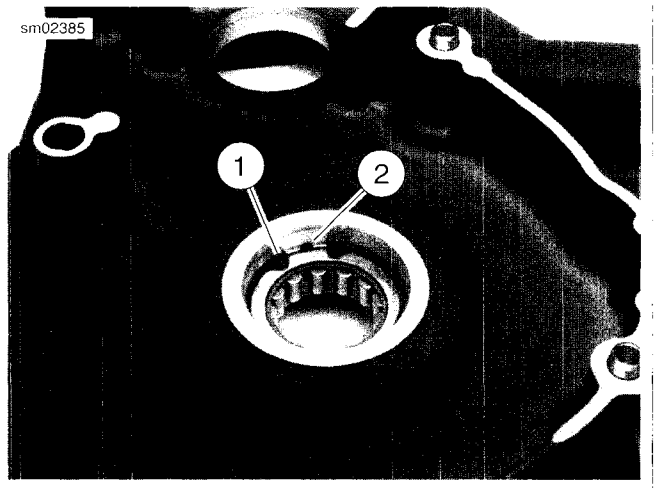
Support the bearing support area on clutch side while pressing bearing into bore. The force needed to press bearing into position may force and unsupported primary chain case to become damaged.

4. Apply a thin film of oil to outer diameter of bearing.
5. Applying pressure to the outer race, press **new** bearing letter side up, into bore until it makes solid contact with the bearing support area.
6. See Figure 5-22. Retaining ring (1) must be oriented as shown to prevent blocking of oil passage (2). Install retaining ring to lock position of bearing in bore. Verify that the ring is fully seated in the groove and is in proper orientation.

NOTES

- *The lip garter spring side of the oil seal is also identified by the words "OIL SIDE".*
- *Install oil seal with a seal driver that will press only against outer rim of oil seal, NOT against the inner area.*
- *The minimum allowable depth of the seal is reached when the outer edge of the seal carrier is flush with the machined surface of the primary housing. The maximum allowable depth of the seal is reached when the seal carrier contacts the mainshaft bearing snap ring.*

7. Install mainshaft oil seal:
   a. Lubricate the O.D. of the **new** seal with clean engine oil.
   b. See Figure 5-23. With the lip garter spring side (stamped "oil side") facing toward the bearing, press squarely on the outer edge of oil seal until outer edge of seal is flush with machined surface of inner primary housing.
8. Lubricate the bearing and seal lip with multi-purpose grease or clean engine oil.



1. **Retaining ring**
2. **Oil passage**

Figure 5-22. Retaining Ring Orientation

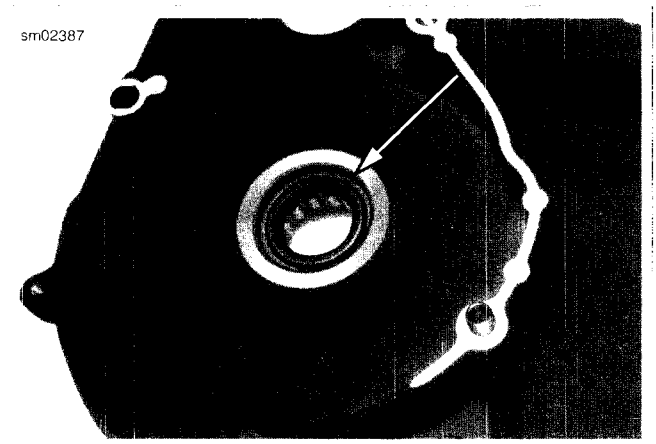


Figure 5-23. Oil Seal

MAINSHAFT BEARING INNER RACE

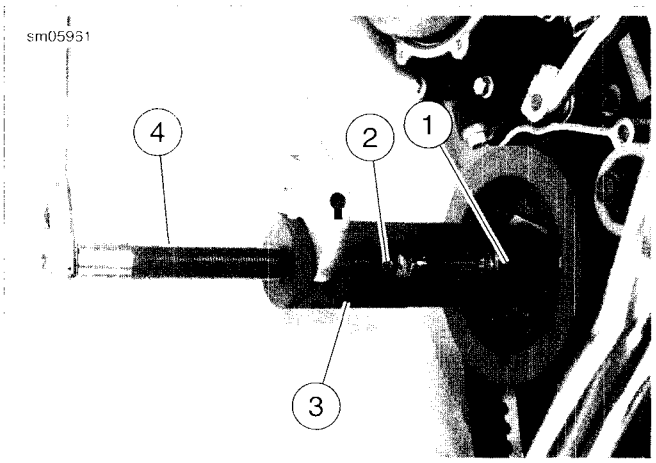
PART NUMBER	TOOL NAME
HD-34902-C	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER

Removal

NOTE

The bearing inner race must be positioned on the shaft a precise distance to properly align with the bearing outer race in the primary chaincase. To remove and install the bearing inner race, use the combination MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER (Part No. HD-34902-C).

1. See Figure 5-24. Install end cap (2) into end of mainshaft.
2. Position puller (3) around mainshaft, under bearing inner race.
3. Turn forcing screw (4) clockwise while holding puller to remove bearing.



1. **Bearing inner race**
2. **End cap**
3. **Puller**
4. **Forcing screw**

Figure 5-24. Pulling Mainshaft Inner Bearing Race

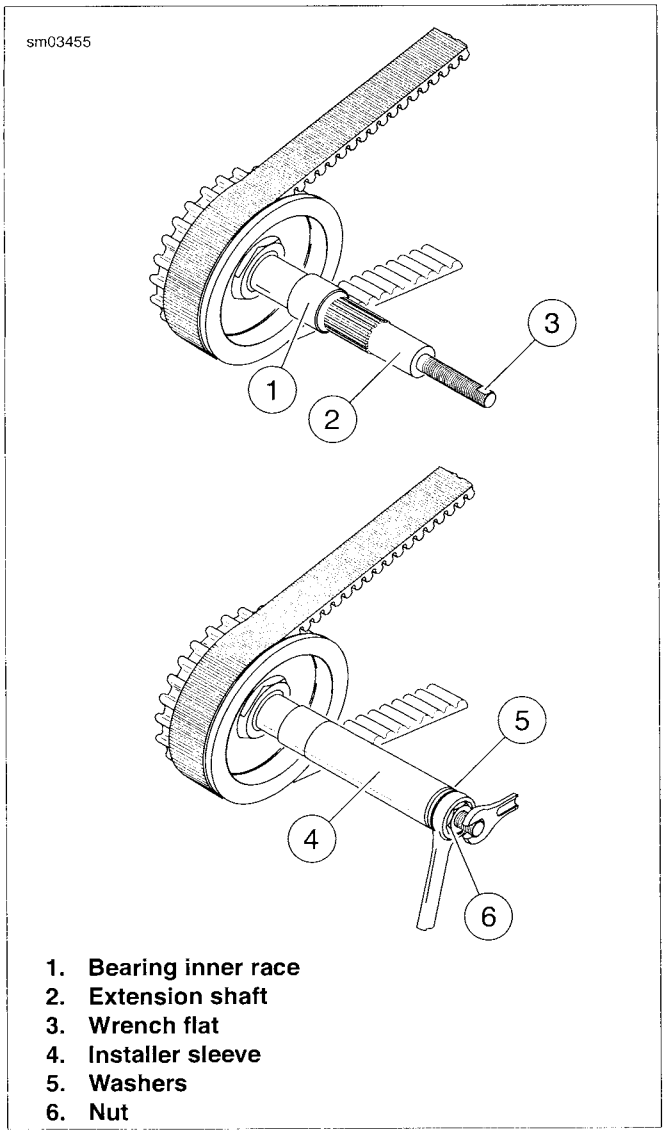
Installation

1. See Figure 5-25. Slide bearing inner race (1), chamfered edge first, onto mainshaft.

NOTE

Extension shaft has left-hand threads.

2. Thread extension shaft (2) onto end of mainshaft .
3. Position installer sleeve (4) over extension shaft and against bearing inner race. Apply graphite lubricant to threads of extension shaft.
4. Place two washers (5) over threaded portion of extension shaft and install nut.
5. Tighten nut (6) while holding extension shaft stationary with wrench on flats (3) at end of screw threads. Press race onto shaft so inside edge is 0.100-0.125 in. (2.540-3.180 mm) from main drive gear.
6. Lubricate race with primary chaincase lubricant.



1. **Bearing inner race**
2. **Extension shaft**
3. **Wrench flat**
4. **Installer sleeve**
5. **Washers**
6. **Nut**

Figure 5-25. Installing Bearing Race

INSTALLATION

NOTES

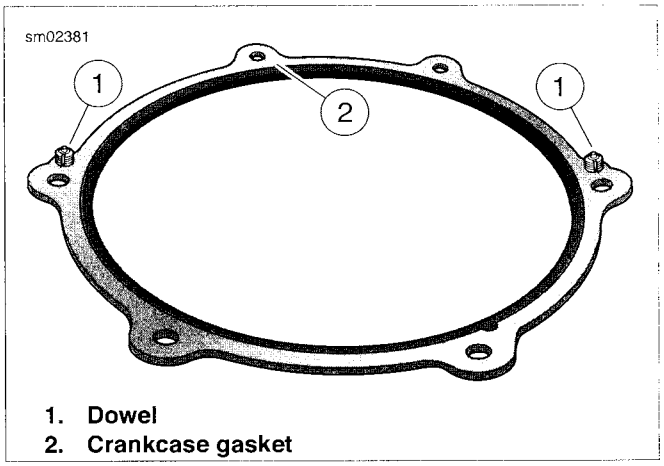
- *Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.*
- *See Figure 5-26. In next step, be sure dowels (1) in crankcase gasket (2) engage holes in crankcase.*

1. See Figure 5-27. Place crankcase gasket in place on gasket surface (2). Be sure dowels in gasket engage dowel holes (3).
2. Spread a thin film of oil on mainshaft oil seal lip and rubber portion of crankcase gasket. Be careful not to damage mainshaft seal when installing chaincase over the primary bearing inner race on the mainshaft.
3. See Figure 5-28. Insert **new** sealing fasteners.
4. See Figure 5-29. Tighten fasteners in sequence shown to 26-28 ft-lbs (35.3-38.0 Nm).
5. Install the primary chain, clutch, and compensating sprocket as an assembly. See 5.4 DRIVE COMPONENTS, Installation.
6. Install chain tensioner assembly.
7. Install starter. See 7.13 STARTER, Installation.

NOTE

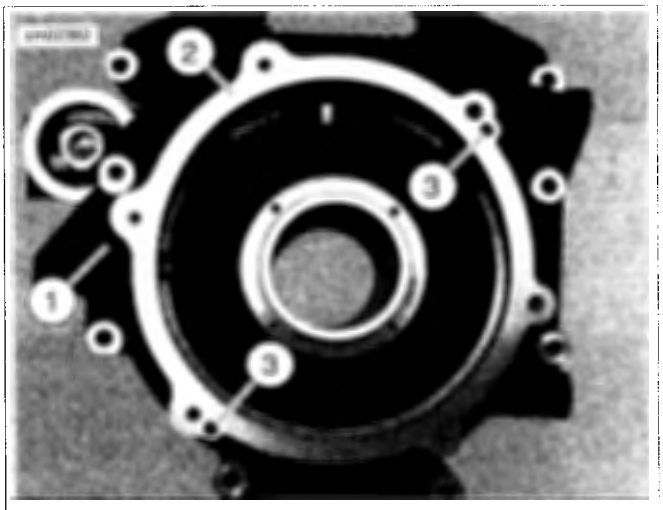
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks .

8. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
9. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.
10. Adjust drive belt tension.
11. Connect negative battery cable.



1. **Dowel**
2. **Crankcase gasket**

Figure 5-26. Crankcase Gasket



1. **Crankcase**
2. **Gasket surface**
3. **Dowel holes**

Figure 5-27. Crankcase

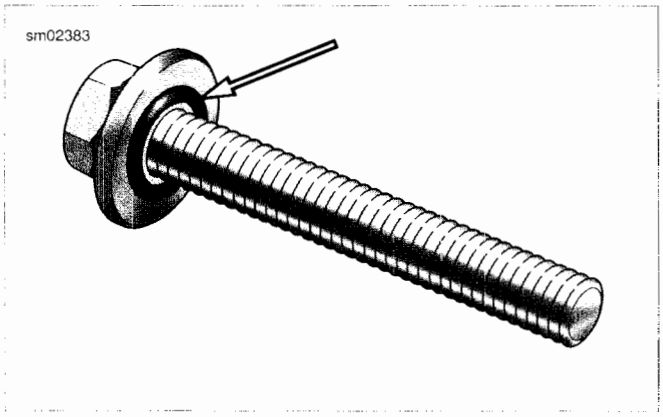


Figure 5-28. Sealing Fastener

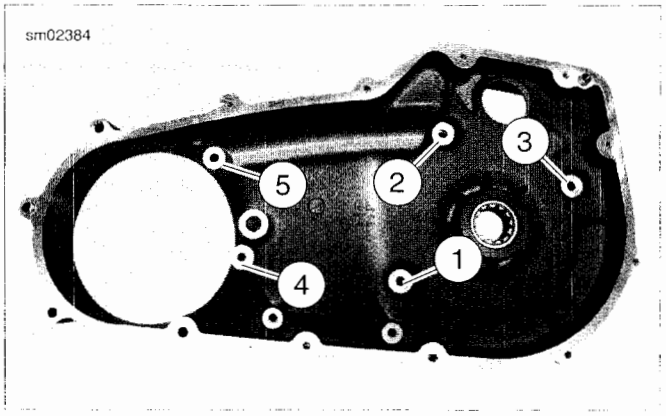


Figure 5-29. Sealing Fastener Torque Sequence

REMOVAL AND INSTALLATION

To remove the clutch without disassembly or for installation instructions, see 5.4 DRIVE COMPONENTS, Removal.

CLUTCH PACK ONLY

Partial Disassembly

This procedure can be performed on the motorcycle without removing the clutch shell or hub.

1. Remove primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 5-30. Remove six bolts (1) (metric) to release diaphragm spring retainer (2) from clutch hub. Loosen each bolt gradually and in a star sequence around the hub.
3. Remove diaphragm spring retainer, diaphragm spring (3) and pressure plate (4) from clutch hub.
4. Remove friction plates (5, 7), steel plates (6), damper spring (8) and damper spring seat (9) from clutch hub (11). Continue with Cleaning And Inspection.

Cleaning And Inspection

⚠WARNING

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

1. Wash all parts in cleaning solvent, except for friction plates and bearing, if removed. Blow parts dry with low pressure compressed air.
2. Check **friction plates** as follows:
   a. Blow off all lubricant from the friction plates. Do not wipe off with a rag.
   b. Measure the thickness of each plate with a dial caliper or micrometer.
   c. If the thickness of any plate is less than 0.143 in. (3.62 mm), discard all friction plates and replace with an entirely **new** set.
   d. Look for worn or damaged fiber surface material (both sides).

NOTE

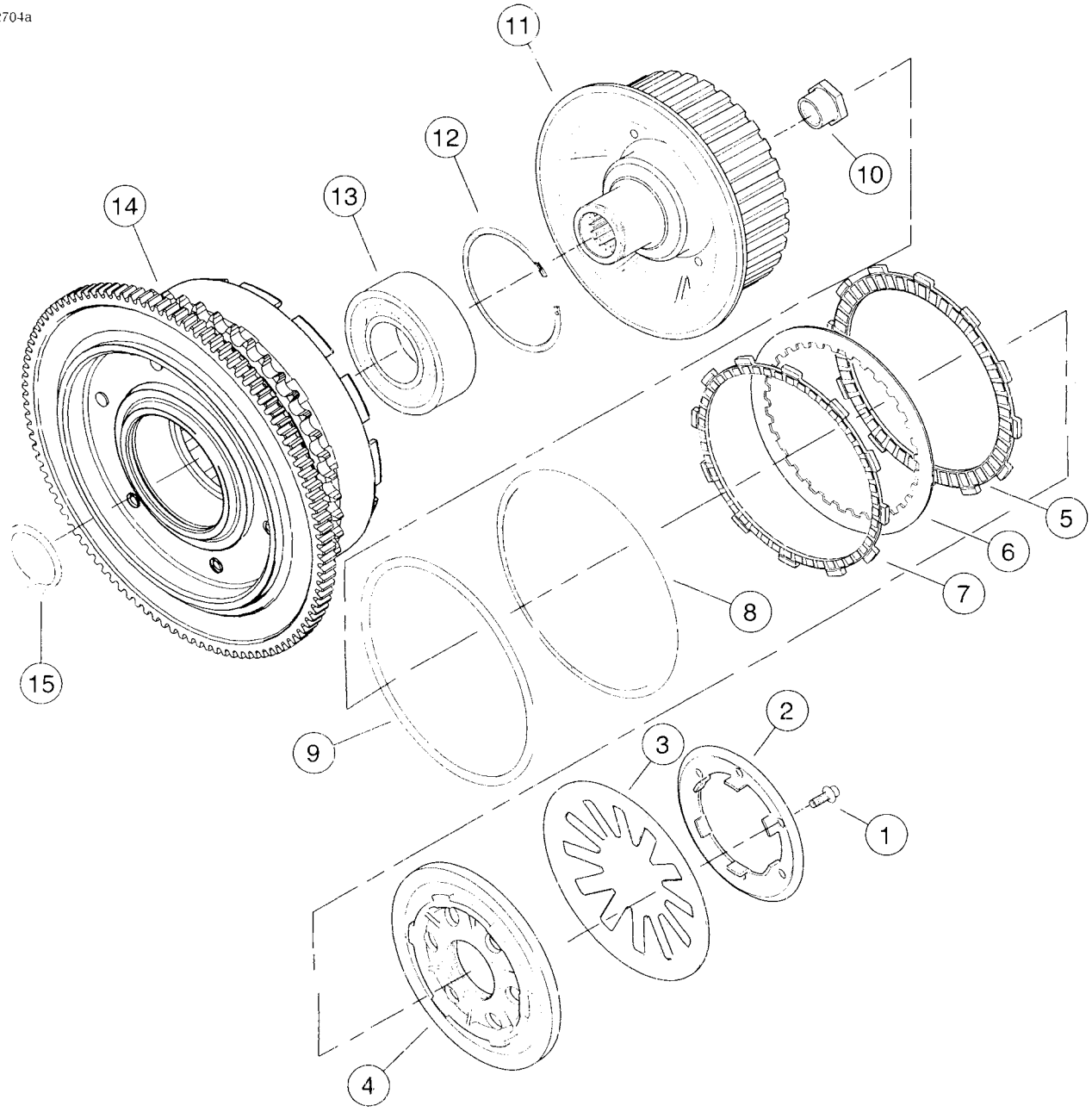
Replace all nine friction plates with an entirely new set if any individual plate shows evidence of wear or damage. Submerge and soak all friction plates in primary chaincase lubricant for at least five minutes.

3. Check the **steel plates** as follows:
   a. Discard any plate that is grooved or bluish in color. Blue plates are likely warped or distorted.
   b. Check each plate for distortion. Lay the plate on a precision flat surface. Insert a feeler gauge between the plate and the flat surface in several places. Replace any steel plate that is warped more than 0.006 in. (0.15 mm).
4. Holding the clutch hub, rotate the clutch shell to check bearing for smoothness. Replace the bearing if it runs rough, binds or has any end play.
5. Check the primary chain sprocket and the starter ring gear on the clutch shell. Replace the clutch shell if either sprocket or ring gear are badly worn or damaged.
6. Check the slots that mate with the clutch plates on both the clutch shell and hub. Replace shell or hub if slots are worn or damaged.

NOTE

Springs are identified by a dab of paint on one face. Refer to the parts catalog to verify the correct spring is installed.

7. Check the diaphragm spring and diaphragm spring retainer for cracks or bent tabs. Obtain a **new** diaphragm spring or diaphragm spring retainer if either condition exists.



1. Bolt (6) (metric)
2. Diaphragm spring retainer
3. Diaphragm spring
4. Pressure plate
5. Friction plate (9)
6. Steel plate (8)
7. Narrow friction plate
8. Damper spring
9. Damper spring seat
10. Mainshaft nut (metric)
11. Clutch hub
12. Retaining ring
13. Bearing
14. Clutch shell
15. Retaining ring

Figure 5-30. Clutch Shell Assembly

Assembly

NOTE

Submerge and soak all friction plates in primary chaincase lubricant for at least five minutes.

1. See Figure 5-31. Install the narrow friction plate on the clutch hub. Engage tabs on plate with slots in clutch shell.
2. See Figure 5-30. Install damper spring seat (9) on clutch hub (11). It must sit inboard of narrow friction plate (7).

NOTE

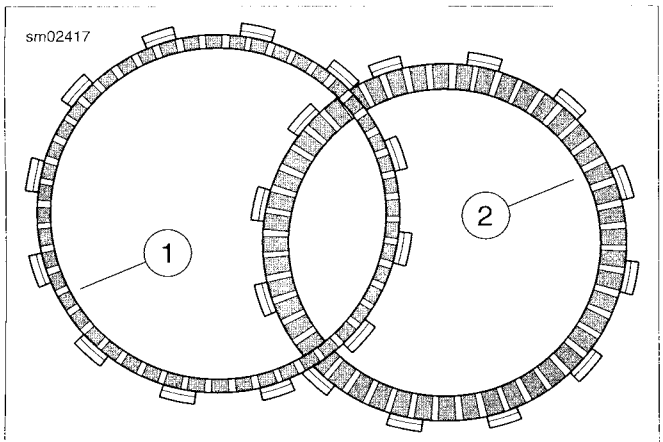
See Figure 5-36. Notice damper spring (4) orientation with respect to damper spring seat (3).

3. See Figure 5-30. Install damper spring (8) on clutch hub with the concave side out (facing away from damper spring seat).
4. Install a steel plate (6) with round edge outward and then a friction plate (5) on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.
5. Install pressure plate (4) on clutch hub aligning holes in plate with threaded bosses on hub.
6. Seat diaphragm spring (3) in recess of pressure plate with the concave side inward.
7. Align holes in diaphragm spring retainer (2) with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
8. Install six bolts (1) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten the bolts to 70-100 **in-lbs** (7.9-11.3 Nm).

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

9. Install primary chaincase cover and gasket. See 5.3 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.



1. **Narrow plate**
2. **Regular plate**

Figure 5-31. Friction Plates

CLUTCH PACK AND BEARING

Complete Disassembly

1. Remove the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Removal.
2. Remove clutch assembly. See 5.4 DRIVE COMPONENTS, Removal.
3. Follow all partial disassembly information under 5.6 CLUTCH, Clutch Pack Only.

NOTE

To avoid possible bearing damage, do not disassemble the clutch shell and hub assembly unless the bearing, hub or shell require replacement. Replace the bearing if disassembled.

⚠WARNING

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

4. See Figure 5-32. With the transmission side up, remove retaining ring from clutch hub groove.
5. See Figure 5-33. Supporting clutch shell in same orientation, use arbor press and a suitable press plug to press hub from bearing in clutch shell.
6. See Figure 5-34. With the transmission side up, remove retaining ring from groove in clutch shell bore.
7. See Figure 5-35. Turn clutch shell over so that transmission side is down. Using arbor press and a suitable press plug, press on inner race to remove bearing from clutch shell bore.
8. Continue with Cleaning and Inspection found under 5.6 CLUTCH, Clutch Pack Only.

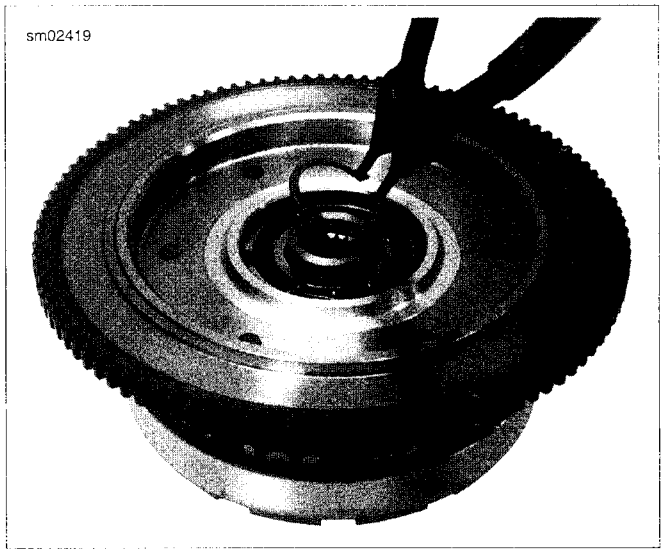


Figure 5-32. Clutch Hub Retaining Ring

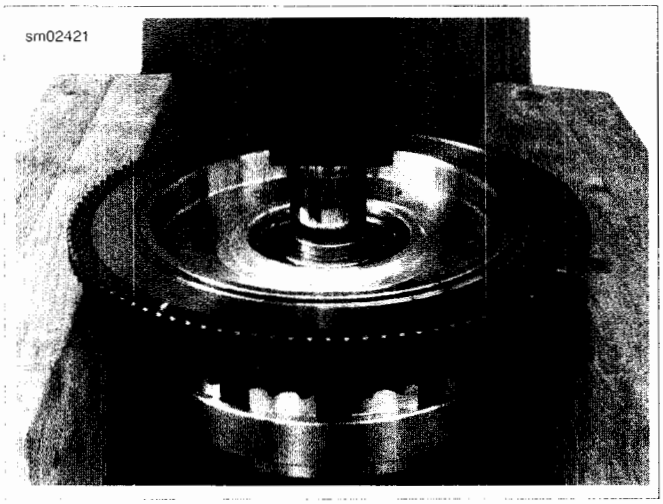


Figure 5-33. Pressing Clutch Hub From Bearing

Assembly

1. Orient clutch shell in arbor press with transmission side up. Be sure to support clutch shell bore on sprocket side to avoid damage to ears on clutch basket. Using a suitable press plug, press against outer race until bearing contacts shoulder in clutch shell bore.

⚠WARNING

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

2. See Figure 5-34. Install retaining ring in groove of clutch shell bore so that flat side of retaining ring is towards bearing.
3. Turn clutch shell over so sprocket side is up. Center hub in bearing. Be sure that bearing inner race is supported with sleeve on transmission side. Press hub into bearing until hub shoulder contacts bearing inner race.
4. See Figure 5-32. Turn assembly over so that the transmission side is up. Install retaining ring in groove of clutch hub.
5. Place clutch assembly on bench oriented with the transmission side down.
6. Soak all friction and steel plates in primary chaincase lubricant for at least five minutes.
7. See Figure 5-36. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
8. Install damper spring seat on clutch hub so that it seats inboard of narrow friction plate.
9. Install damper spring on clutch hub with the concave side up (facing opposite damper spring seat).
10. Install a steel plate and than a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and frictions plates.
11. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
12. See Figure 5-37. Seat diaphragm spring (1) in recess of pressure plate with the concave side down.
13. Align holes in diaphragm spring retainer with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
14. Install six bolts (5) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten 70-100 **in-lbs** (7.9-11.3 Nm).
15. Install clutch. See 5.4 DRIVE COMPONENTS, Installation.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

16. Install primary chaincase cover and gasket. See 5.3 PRIMARY CHAINCASE COVER, Installation.
17. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant.

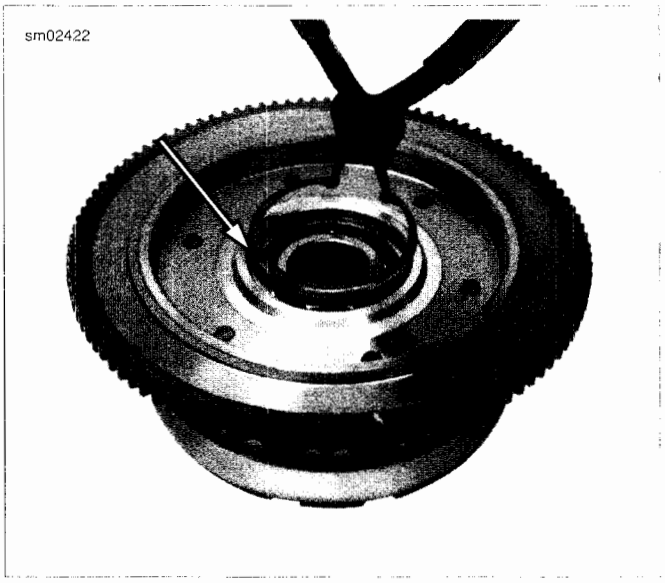


Figure 5-34. Install Clutch Shell Retaining Ring with Flat Side Against Bearing

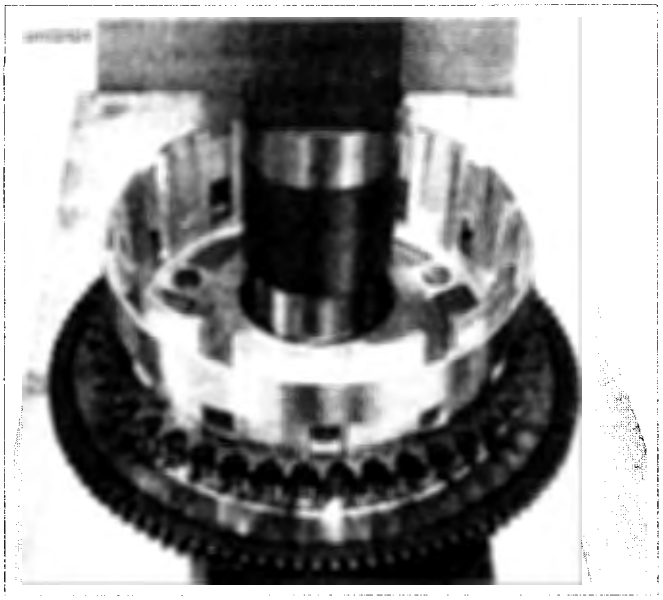
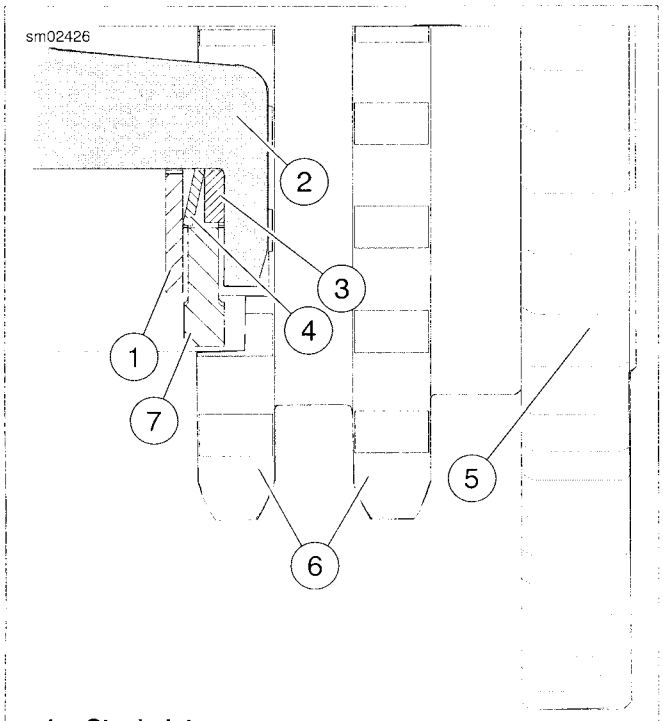
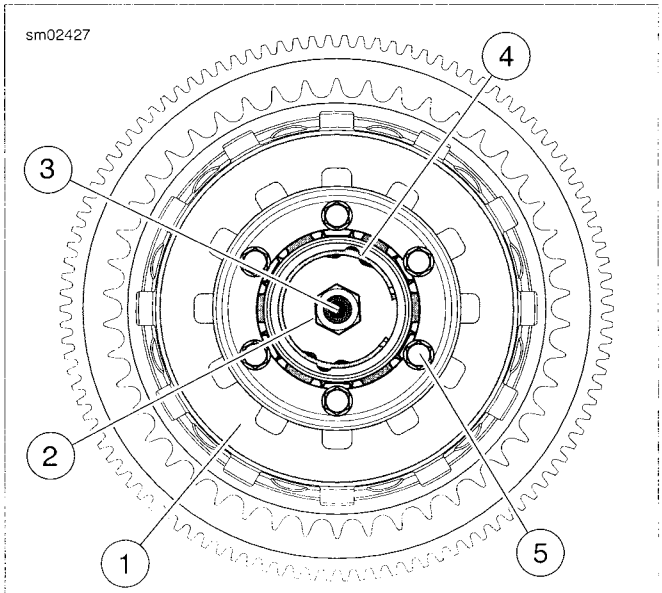


Figure 5-35. Pressing Bearing From Clutch Shell



1. Steel plate
2. Clutch hub
3. Damper spring seat
4. Damper spring
5. Starter ring gear
6. Primary chain sprocket
7. Narrow friction plate

Figure 5-36. Clutch Stackup



1. Diaphragm spring
2. Jam nut
3. Adjuster screw
4. Retaining ring
5. Bolt (6) (metric)

Figure 5-37. Assembled Clutch

REMOVAL

PART NUMBER	TOOL NAME
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

1. Remove primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
2. Remove debris deflector. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.

NOTES

- *Loosen both axle adjusters an equal number of turns to maintain wheel alignment.*
- *The axle nut retainer for FXCWC will remain in the axle nut and does not need to be removed.*

3. **All but FXCWC:** See Figure 5-38. Remove e-clip (1). Loosen rear axle nut (2). Loosen both axle adjusters (3) to release tension on the drive belt.
4. **FXCWC:** See Figure 5-39. Loosen rear axle nut (2). Loosen both axle adjusters (3) to release tension on the drive belt.

NOTE

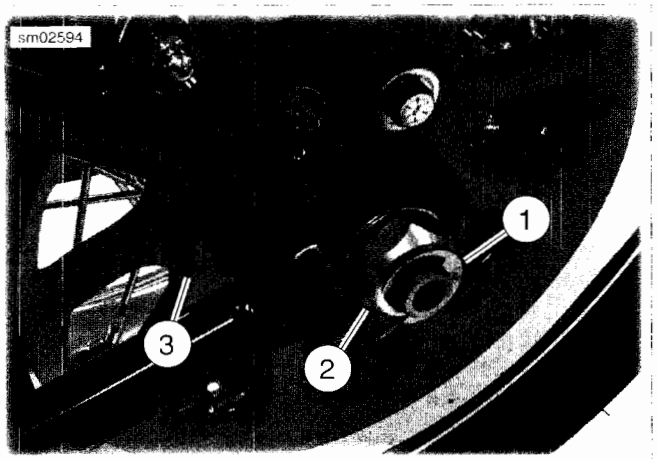
Only remove sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.

5. Remove transmission sprocket.
   a. See Figure 5-40. Remove both screws (1) and lockplate (2).
   b. See Figure 5-41. Secure sprocket using FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282)(3). Final drive sprocket locking tool must rest against lower portion of rear fork pivot nut (2).

NOTE

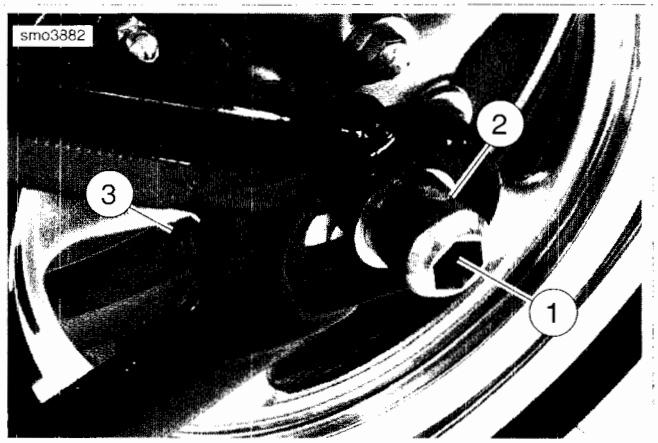
*Sprocket nut has a **right-hand** thread.*

   c. Install PILOT (Part No. HD-94660-2) on mainshaft.
   d. Remove the sprocket nut using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1).
6. Remove belt from sprocket as sprocket is removed.



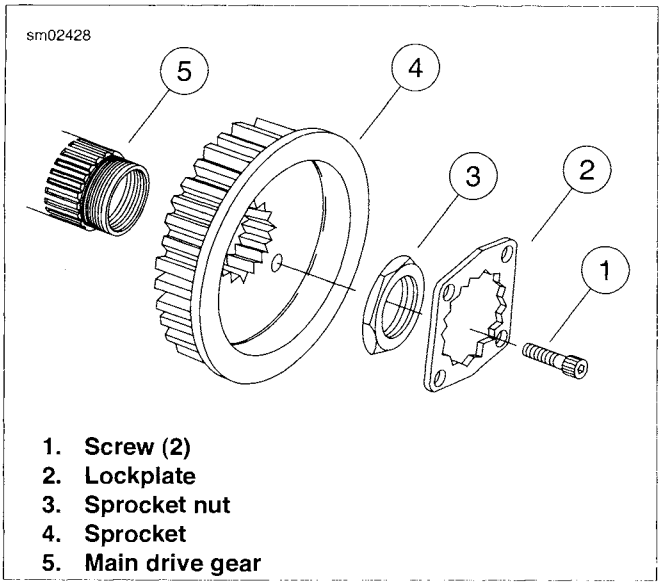
1. **E-Clip**
2. **Axle nut**
3. **Axle adjuster**

Figure 5-38. Axle Adjusters: All But FXCWC



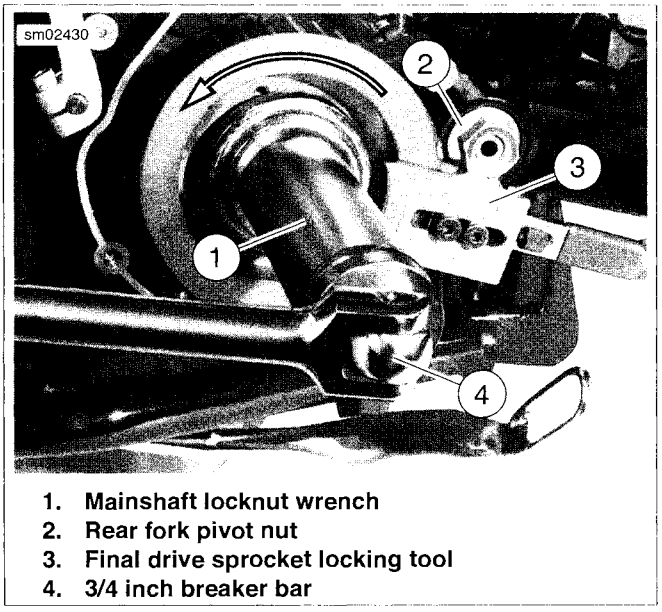
1. **Retainer**
2. **Axle nut**
3. **Axle adjuster**

Figure 5-39. Axle Adjusters: FXCWC



1. **Screw (2)**
2. **Lockplate**
3. **Sprocket nut**
4. **Sprocket**
5. **Main drive gear**

Figure 5-40. Transmission Sprocket



1. **Mainshaft locknut wrench**
2. **Rear fork pivot nut**
3. **Final drive sprocket locking tool**
4. **3/4 inch breaker bar**

Figure 5-41. Sprocket Nut Removal (Typical)

CLEANING AND INSPECTION

1. Using a non-volatile cleaning solvent, clean sprocket of all grease and dirt.
2. Inspect belt and sprocket. See 1.12 DRIVE BELT AND SPROCKETS, Inspection.
3. Inspect both main drive gear and mainshaft seals. Replace if damaged.

INSTALLATION

PART NUMBER	TOOL NAME
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

NOTE

Only install sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.

1. Place transmission sprocket in position. Install the belt on the sprocket as the sprocket is installed on the main drive gear.

NOTES

- *Exercise caution to avoid getting oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.*
- *The transmission sprocket nut has **right-handed** threads. Turn the nut **clockwise** to install on the main drive gear.*

2. See Figure 5-40. Install the sprocket nut. The following procedure is based on whether a new or used nut is being used.
   a. **New sprocket nut:** spread a small quantity of clean engine oil on the inside face of the sprocket nut and the outside face of the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.
   b. **Used sprocket nut:** apply LOCTITE HIGH STRENGTH THREADLOCKER 271 (red) to the threads of the sprocket nut. Also spread a small quantity of clean engine oil on the inside face of the sprocket nut and the outside face of the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.
3. See Figure 5-42. Lock transmission sprocket with the FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282) (2). Final drive sprocket locking tool must rest against upper portion of rear fork pivot nut (3).
4. Install PILOT (Part No. HD-94660-2) on mainshaft.
5. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1), tighten sprocket nut to 35 ft-lbs (47.5 Nm) initial torque.
6. Loosen sprocket nut to remove initial torque.
7. Tighten sprocket nut to 35 ft-lbs + 35-40 degrees (47.5 Nm + 35-40 degrees).

CAUTION

Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)

8. See Figure 5-43. Scribe a line (3) on the transmission sprocket nut (1). Continue the line on the transmission sprocket (2) as shown.

9. Tighten the transmission sprocket nut an additional 35° to 45°.

10. Install lockplate over transmission sprocket nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes. To find the best fit, lockplate can be rotated to a number of positions and can be placed with either side facing sprocket.

NOTE

Maximum allowable tightening of sprocket nut is 45° of clockwise rotation after a torque of 35 ft-lbs (47.5 Nm). Do not loosen sprocket nut to align holes or nut will be under tightened.

11. If holes in lockplate do not align with those in sprocket, tighten sprocket nut as necessary (up to the 45° maximum) until sprocket and lockplate holes are in alignment.

12. See Figure 5-40. Install screws (1) through two of the four holes in lockplate (2), then into two corresponding tapped holes in sprocket (4).

NOTES

- *The screws have LOCTITE patches. With LOCTITE HIGH STRENGTH THREADLOCKER 271 (red) reapplied before installation, the screws can be re-used up to three times.*
- *To ensure the lockplate's security, you must use BOTH screws when you install the lockplate.*

13. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm).

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

14. Install primary chain assembly. See 5.4 DRIVE COMPONENTS.

15. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER.

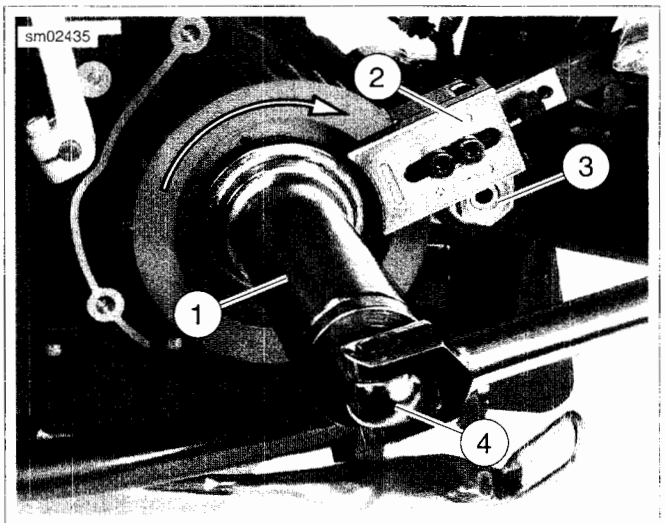
16. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT.

17. Verify pivot shaft torque. See 2.23 REAR FORK.

18. Adjust belt tension. See 1.12 DRIVE BELT AND SPROCKETS.

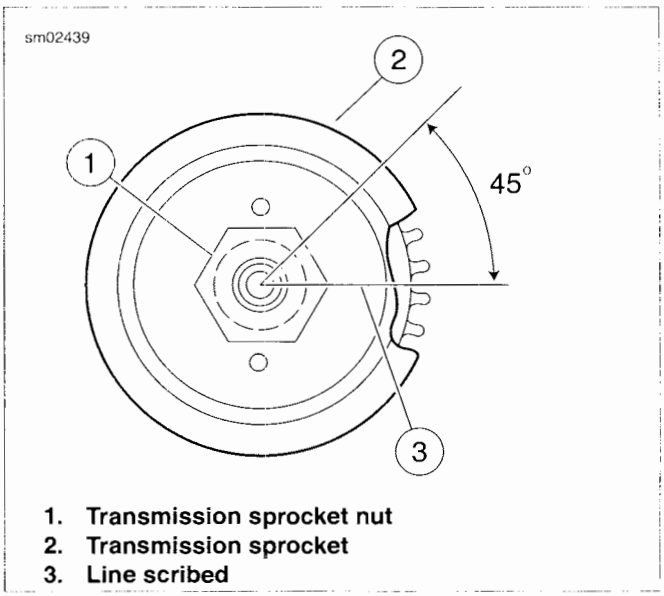
19. Verify vehicle alignment and tighten rear axle. See 2.11 VEHICLE ALIGNMENT.

20. Install debris deflector. See 2.21 BELT GUARD AND DEBRIS DEFLECTOR.



1. **Mainshaft locknut wrench**
2. **Final drive sprocket locking tool**
3. **Rear fork pivot nut**
4. **1/2 inch breaker bar**

Figure 5-42. Sprocket Nut Installation (Typical)

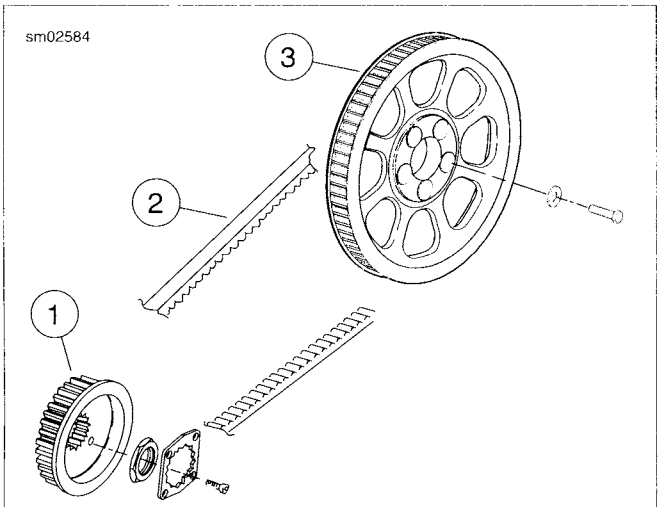


1. **Transmission sprocket nut**
2. **Transmission sprocket**
3. **Line scribed**

Figure 5-43. Transmission Sprocket Nut Final Tightening

REMOVAL

1. Remove rear wheel. See 2.6 REAR WHEEL.
2. Remove primary chain, clutch, engine compensating sprocket, and chain adjuster as an assembly. See 5.4 DRIVE COMPONENTS.
3. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
4. Place a support under rear fork and engine. Remove pivot shaft and spacer. See 2.23 REAR FORK.
5. See Figure 5-44. Slip drive belt (2) from transmission sprocket (1).



1. **Transmission sprocket**
2. **Belt**
3. **Rear wheel sprocket**

Figure 5-44. Belt and Transmission Sprocket

INSPECTION

See 1.12 DRIVE BELT AND SPROCKETS, Inspection.

INSTALLATION

⚠WARNING

Never bend belt forward into a loop smaller than the drive sprocket diameter. Never bend belt into a reverse loop. Over bending can damage belt resulting in premature failure, which could cause loss of control and death or serious injury. (00339a)

NOTE

FXST, FXSTC and FLSTF/B models use a 20 mm wide belt.

1. See Figure 5-44. Install belt (2) over transmission sprocket (1).
2. Install pivot shaft and spacer. Remove support holding engine and rear fork. See 2.23 REAR FORK.
3. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

4. Install primary chain assembly. See 5.4 DRIVE COMPONENTS.
5. Install primary chaincase cover. See 5.4 DRIVE COMPONENTS.
6. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAINCASE LUBRICANT.
7. Install rear wheel. See 2.6 REAR WHEEL.
8. Align vehicle. See 2.11 VEHICLE ALIGNMENT.
9. Adjust belt tension. See 1.12 DRIVE BELT AND SPROCKETS.

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Clutch cable fitting	90-120 **in-lbs**	10.18-13.57 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Clutch release cover screws	84-108 **in-lbs**	9.5-12.2 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Mainshaft/countershaft nuts	85-95 ft-lbs	115.3-128.8 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shifter rod lever screw	18-22 ft-lbs	24.4-29.8 Nm	6.8 TRANSMISSION CASE, Assembly
Shifter rod locknut	80-120 **in-lbs**	9.0-13.6 Nm	6.4 SHIFTER LINKAGE, Shifter Rod
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts-final torque	34-39 ft-lbs	46.1-52.9 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts-initial torque	15 ft-lbs	20.3 Nm	6.8 TRANSMISSION CASE, Installation
Transmission side door screw	13-18 ft-lbs	17.6-24.4 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission top cover	84-132 **in-lbs**	9.5-14.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation

SPECIFICATIONS

Table 6-1. Transmission Specifications

TRANSMISSION	DATA
Type	6-speed forward constant mesh
FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT	Part No. 99851-05 (qt)
SYN3 20W50 Oil	Part No. 99824-03/00QT (qt)
Capacity	32 oz.
	946.4 ml

Table 6-2. Transmission Gear Ratios

GEAR	GEAR RATIO
First (low)	3.34
Second	2.31
Third	1.72
Fourth	1.39
Fifth	1.19
Sixth (high)	1.00

NOTE

Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.

SERVICE WEAR LIMITS

Table 6-3. Main Drive Gear Specifications

MAIN DRIVE GEAR (6th)	IN.	MM
Bearing fit in transmission case (loose)	0.0003-0.0017	0.0076-0.043
Fit in bearing (press-fit)	0.001-0.003	0.025-0.076
End play	none	none

Table 6-4. Mainshaft Tolerance Specifications

MAINSHAFT TOLERANCE	IN.	MM
Mainshaft runout	0.000-0.003	0.00-0.08
Mainshaft end play	none	none
5th gear end play (axial)	0.002-0.026	0.05-0.66
5th gear clearance (radial)	0.0004-0.0020	0.009-0.052
Main drive gear (6th) fit	0.0009-0.0022	0.023-0.056

Table 6-5. Countershaft Tolerance Specifications

COUNTERSHAFT TOLERANCE	IN.	MM
Countershaft runout	0.000-0.003	0.00-0.08
Countershaft end play	0.001-0.003	0.025-0.08
1st gear end play (axial)	0.001-0.023	0.03-0.58
1st gear clearance (radial)	0.0004-0.0020	0.010-0.052
2nd gear end play (axial)	0.001-0.40	0.03-1.02
2nd gear clearance (radial)	0.0004-0.0020	0.010-0.052
3rd gear end play (axial)	0.001-0.042	0.03-1.07
3rd gear clearance (radial)	0.0004-0.0020	0.010-0.052
4th gear end play (axial)	0.001-0.028	0.03-0.71
4th gear clearance (radial)	0.0004-0.0020	0.010-0.052

Table 6-6. Shifter Dog Wear Limit Specifications

SHIFTER DOG	IN.	MM
1st	0.015-0.112	0.381-2.845
2nd	0.021-0.136	0.533-3.454
3rd	0.014-0.118	0.356-2.997
4th	0.033-0.115	0.838-2.921
5th	0.016-0.115	0.406-2.921
6th	0.026-0.123	0.660-3.124

Table 6-7. Side Door Bearing Specifications

SIDE DOOR BEARING	IN.	MM
Fit in side door (tight)	0.0001-0.0014	0.0025-0.0356
Fit on countershaft (tight)	-0.0004	-0.010
Fit on countershaft (loose)	+0.0012	+0.030
Fit on mainshaft (tight)	-0.0004	-0.010
Fit on mainshaft (loose)	+0.0012	+0.030

Table 6-8. Shifter Fork Specifications

SHIFTER FORKS	IN.	MM
Shifter fork to cam groove end play	0.004-0.012	0.102-0.305
Shifter fork to dog ring end play	0.004-0.016	0.102-0.4060
First and second gear shift fork pad thickness wear limit	0.258	6.55
Third and fourth gear shift fork pad thickness wear limit	0.198	5.03
Fifth and sixth gear shift fork pad thickness wear limit	0.258	6.55

POWER FLOW

See Figure 6-1. The 6-speed transmission consists of two parallel shafts supporting six gears each. The longer, or mainshaft (7), also supports the clutch and serves as the input shaft. The shorter shaft is called the countershaft (8).

Each gear on the mainshaft is in constant mesh with a corresponding gear on the countershaft. Each of these six pairs of gears makes up a different speed in the transmission.

The transmission gears are divided into two types, gears that rotate with the shaft, and freewheeling gears that ride on bearings and spin freely on the shaft. A gear that rotates with the shaft always meshes with a freewheeling gear. Also, three dog rings are able to slide sideways on the shaft. These dog rings are used to change transmission speeds. The dogs, or projections, on the sides of the dog rings, engage dogs on adjacent freewheeling gears, transmitting power through the transmission.

Gear shifting is accomplished by three forks which fit into grooves machined into the dog rings that slide on the guide hubs. The position of the shifter forks is controlled by a drum-shaped shifter cam located in the transmission side door.

Neutral

Power is introduced to the transmission through the clutch. In neutral, with the clutch engaged, the mainshaft 1st, 2nd, 3rd and 4th gears are rotating, but no power is transferred to the countershaft since countershaft 1st, 2nd, 3rd and 4th gears are freewheeling gears.

1st Gear

When the transmission is shifted into first gear, the dog ring between countershaft 1st and 2nd, which rotates with the countershaft, engages countershaft 1st, which has been spinning freely on the countershaft driven by mainshaft 1st.

Now countershaft 1st is no longer freewheeling, but locked to the countershaft causing the countershaft and countershaft 6th to turn. Countershaft 6th transmits the power to the main drive gear and the sprocket as shown (1).

2nd Gear

Second gear is engaged when the dog ring between countershaft 1st and 2nd is shifted out of countershaft 1st and engages countershaft 2nd. This locks countershaft 2nd to the countershaft to complete the power flow as shown (2).

3rd Gear

Two shifter forks are used to make the shift from second to third. One fork moves the dog ring between countershaft 1st and 2nd to its neutral position, while another fork engages the dog ring between countershaft 3rd and 4th with countershaft 3rd. This locks countershaft 3rd to the countershaft to complete the power flow as shown (3).

4th Gear

Fourth gear is engaged when the dog ring between countershaft 3rd and 4th is shifted out of countershaft 3rd and engages countershaft 4th. This locks countershaft 4th to the countershaft to complete the power flow as shown (4).

5th Gear

Two shifter forks are used to make the shift from fourth to fifth. One fork moves the dog ring between countershaft 3rd and 4th to its neutral position, while another fork engages the dog ring between mainshaft 5th and 6th with mainshaft 5th. This locks mainshaft 5th to the mainshaft to complete the power flow as shown (5).

6th Gear

The shift from fifth to sixth gear occurs when the dog ring between mainshaft 5th and 6th is shifted out of mainshaft 5th, and is shifted directly into the main drive gear (6th gear). The main drive gear is locked to the mainshaft resulting in a direct one-to-one drive ratio from the clutch to the sprocket as shown (6).

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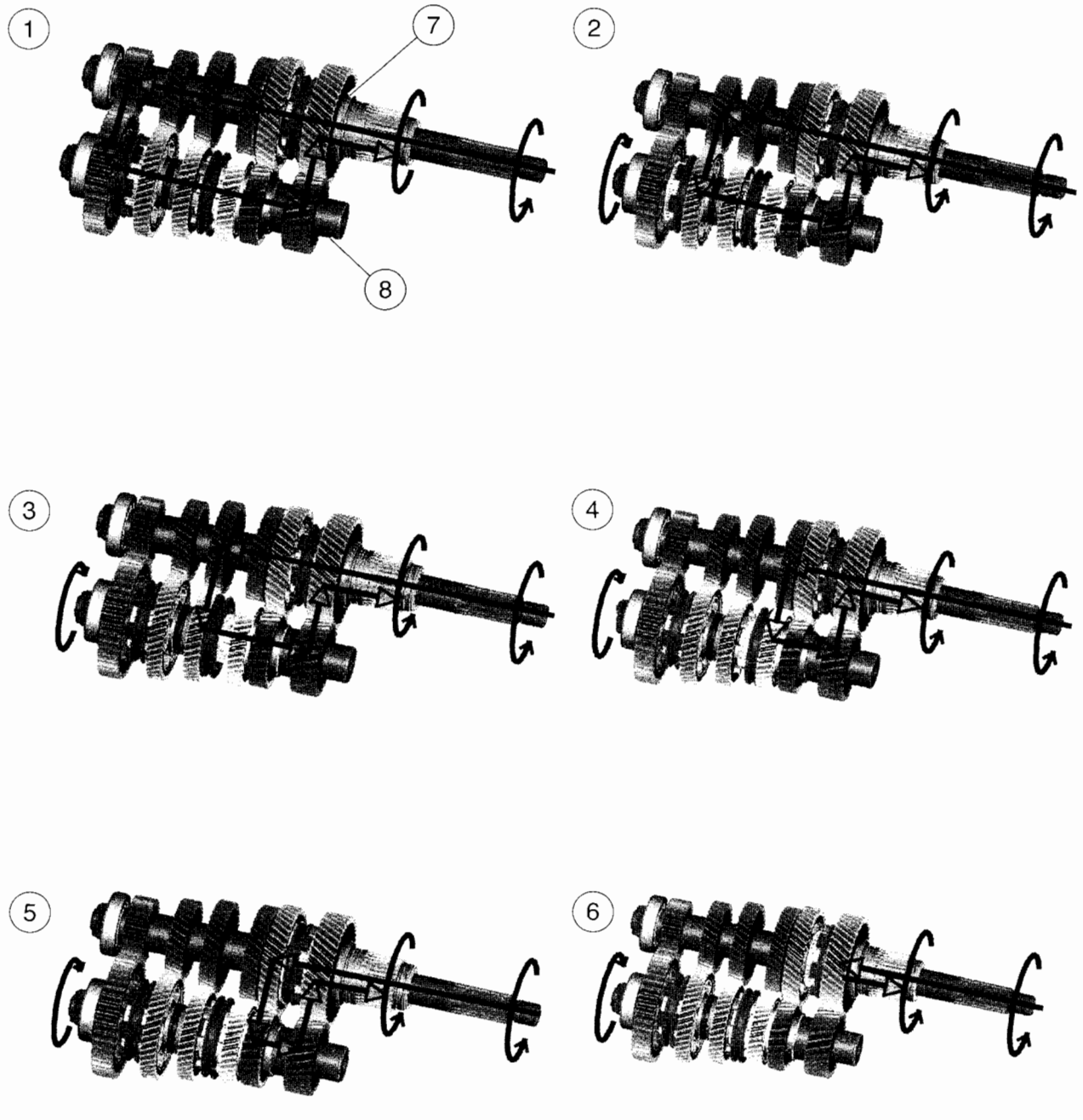


1. First gear
2. Second gear
3. Third gear
4. Fourth gear
5. Fifth gear
6. Sixth gear
7. Mainshaft
8. Countershaft

Figure 6-1. Transmission Power Flow

ADJUSTMENT

If operating problems exist, check the shift linkage for wear, interference or adjustment. Adjust if necessary.

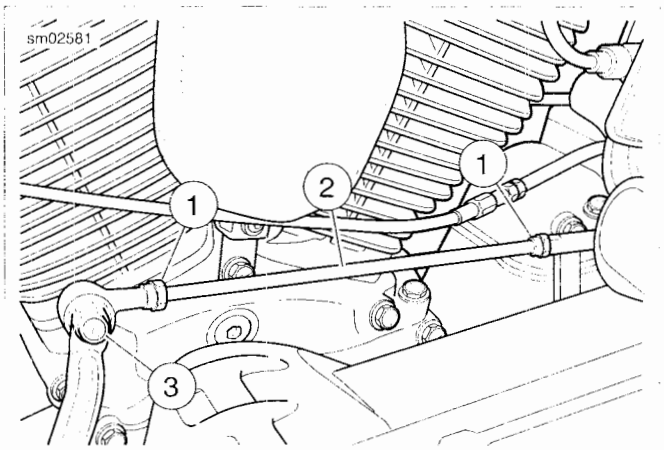
SHIFTER ROD

The shifter rod is set at the factory and should not need adjustment under normal circumstances. However, if full engagement or full lever travel is not achieved, adjust the shifter rod.

NOTE

To ensure proper gear engagement and avoid possible damage to transmission, the shift levers should not contact the footboard when shifting.

1. See Figure 6-2. Remove locknut, lockwasher and flat washer to free front end of shifter rod from inner shift arm.
2. Loosen locknuts (1) and adjust rod (2) as necessary.
3. Install flat washer, lockwasher and locknut to fasten front end of shifter rod to inner shift arm.
4. Tighten locknuts (1) to 80-120 **in-lbs** (9.0-13.6 Nm).



1. **Locknut (2)**
2. **Shifter rod**
3. **Locknut, lock washer, flat washer**

Figure 6-2. Shifter Rod

REMOVAL AND DISASSEMBLY

1. Remove maxi-fuse.
2. Remove exhaust system if needed. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.
3. Drain transmission. See 1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant.

NOTE

Actuating the clutch hand lever after removing the six screws will help break the cover free.

4. See Figure 6-3. Remove the six screws that hold the clutch release cover in place. Remove the clutch release cover and discard the gasket.
5. Add freeplay to clutch cable. See 1.11 CLUTCH, Adjustment.

⚠WARNING

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

6. See Figure 6-4. Remove retaining ring (4). Lift inner ramp (5) and ramp coupling (3) out of clutch release cover. Disconnect clutch cable end (2) from the ball and ramp coupling.
7. See Figure 6-5. Remove balls (4) and outer ramp (2).
8. Unscrew clutch cable fitting from clutch release cover.

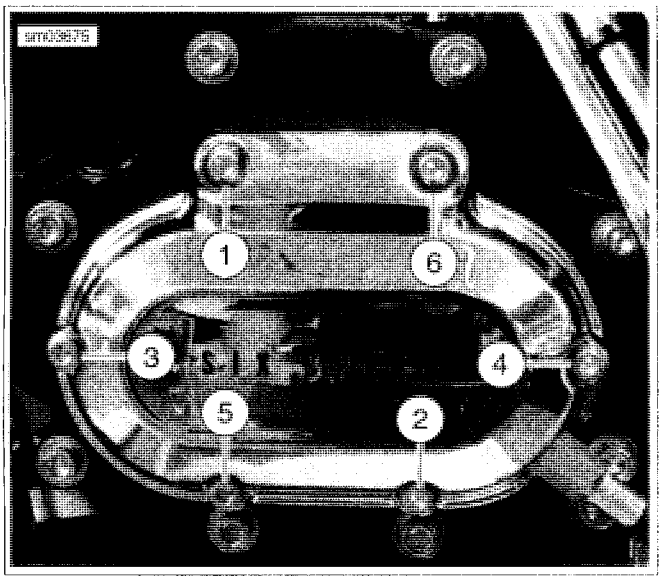
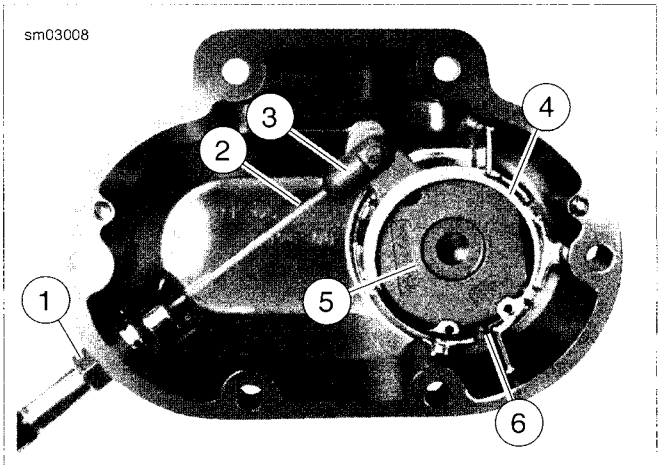
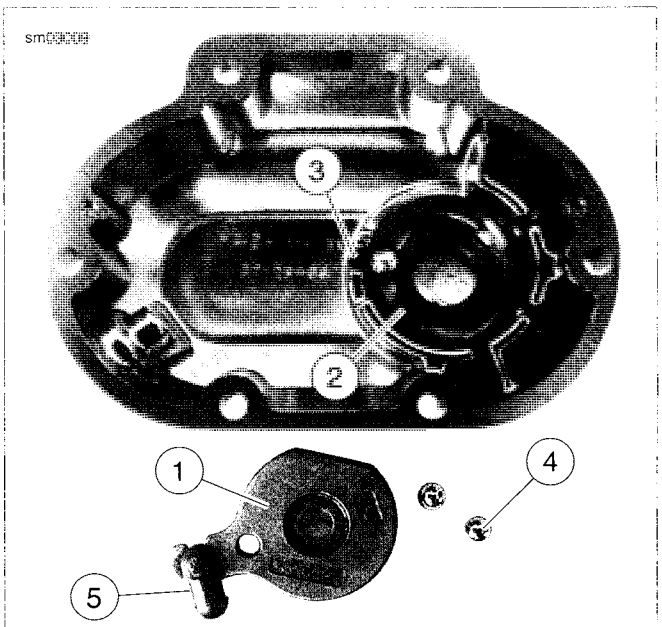


Figure 6-3. Cover Screws



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

Figure 6-4. Clutch Cable Connection



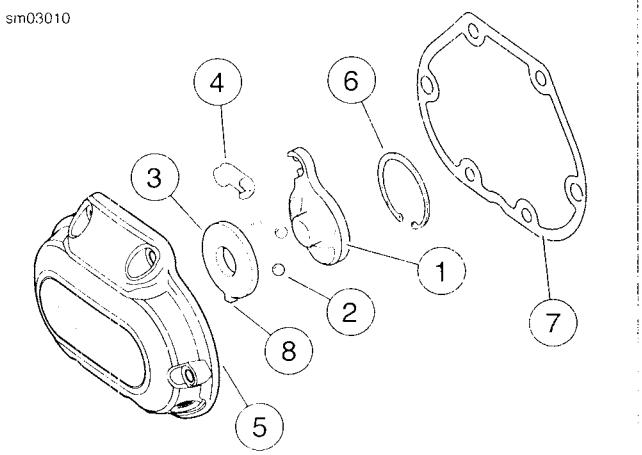
1. **Inner ramp**
2. **Outer ramp**
3. **Outer ramp tab**
4. **Balls (3)**
5. **Ramp coupling**

Figure 6-5. Coupling and Ramp Assembly

CLEANING AND INSPECTION

1. See Figure 6-6. Wash the ball and ramp mechanism components in cleaning solvent.

2. Inspect the three balls (2) and ball socket surfaces on ramps (1, 3) for wear, pitting, surface breakdown and other damage. Replace damaged parts.
3. Check fit of the ramp coupling (4) on inner ramp (1). Replace both parts if there is excessive wear.
4. Inspect the retaining ring (6) for damage or distortion.
5. Check clutch cable end for frayed or worn ends. Replace cable if damaged or worn. Check cable fitting O-ring for cuts, tears or signs of deterioration.
6. Check the bore in the cover (5) where the ramps (1, 3) are retained. There should be no wear that would cause the ramps to cock, causing improper clutch adjustment.



1. **Inner ramp**
2. **Balls (3)**
3. **Outer ramp**
4. **Ramp coupling**
5. **Clutch release cover**
6. **Retaining ring**
7. **Gasket**
8. **Tab**

Figure 6-6. Release Mechanism Assembly

ASSEMBLY AND INSTALLATION

NOTE

Replace cable fitting o-ring if damaged or deformed.

1. See Figure 6-4. Apply a drop of Loctite Threadlocker 243 (blue) to clutch cable fitting and screw fitting into clutch release cover. Do not tighten at this time.
2. See Figure 6-6. Place outer ramp (3) with ball socket side up in clutch release cover. Be sure tab (8) is in clutch release cover slot.
3. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of the outer ramp sockets.
4. Connect cable end to ramp coupling (4). Install coupling on inner ramp (1) and place inner ramp and coupling in position in clutch release cover (5).

⚠WARNING

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

NOTE

See Figure 6-4. Retaining ring opening must be centered above the break in the ribbing at bottom of the clutch release cover.

5. Figure 6-6. Install retaining ring (6).
6. Verify that two dowel pins are in place on transmission side door flange. Place a **new** gasket (7) on dowel pins.

NOTE

See Figure 6-3. Clutch release cover screws in positions (1) and (6) are shorter than the others.

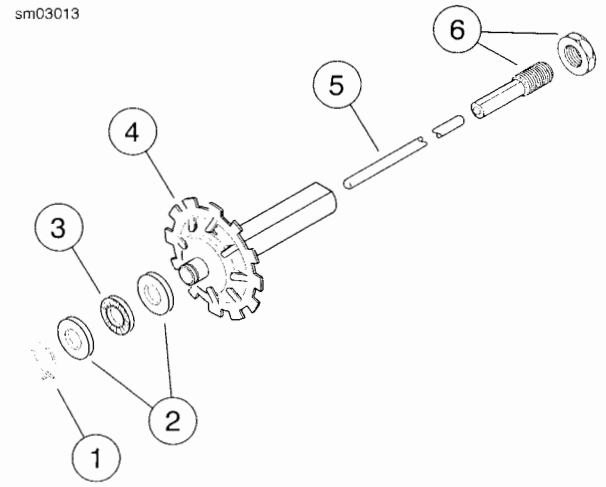
7. See Figure 6-3. Install clutch release cover. Tighten all six screws to 84-108 **in-lbs** (9.5-12.2 Nm) in sequence shown.
8. Tighten clutch cable fitting to 90-120 **in-lbs** (10.18-13.57 Nm).
9. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.
10. Adjust clutch cable. See 1.11 CLUTCH.
11. Install exhaust system if removed. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.
12. Install maxi-fuse.

REMOVAL

NOTE

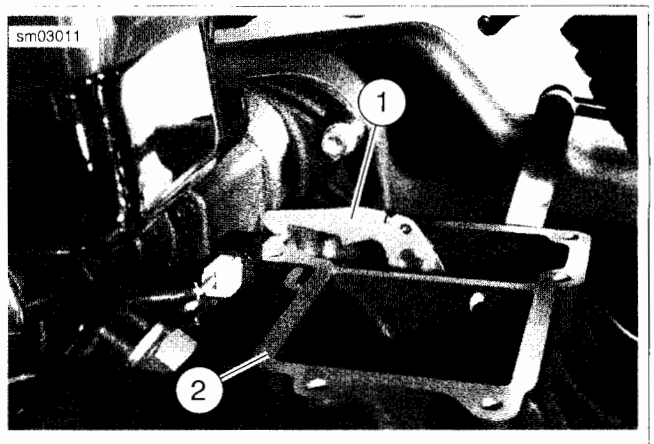
Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed. For information on case removal see 6.8 TRANSMISSION CASE.

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.
2. Remove oil tank. See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC.
3. Relieve drive belt tension. See 1.12 DRIVE BELT AND SPROCKETS.
4. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket assembly and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING, Removal.
5. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
6. Remove the clutch release cover from the transmission side door. See 6.5 CLUTCH RELEASE COVER, Removal and Disassembly.
7. See Figure 6-7. Remove oil slinger assembly from mainshaft. Remove push rod.
8. Remove transmission top cover, leaving the cover gasket in place.
9. See Figure 6-8. Place shifter cam pawl on top cover gasket.



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

Figure 6-7. Push Rod Assembly



1. **Shifter pawl**
2. **Top cover gasket surface**

Figure 6-8. Set Shifter Pawl on Gasket

NOTE

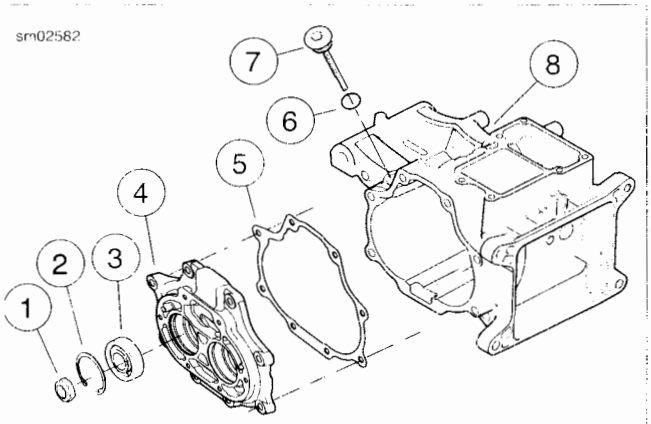
Only remove and install sprocket nut while transmission is in vehicle frame. Trying to remove and install sprocket nut with transmission in transmission stand may cause damage to transmission or stand.

10. If main drive gear is to be removed, see 6.7 MAIN DRIVE GEAR AND BEARING, Removal.

NOTES

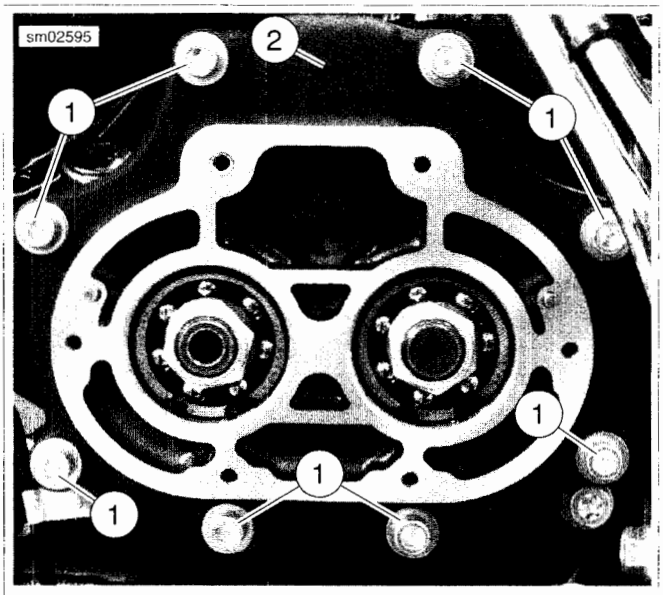
- *The main drive gear bearing and retainer must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *Do not attempt to remove shafts by tapping them out from opposite side. If you try to remove the shafts by tapping them with a hammer, you will damage the side door bearings. If the side door sticks or binds on the ring dowels, pry open using indents at each side of side door.*

11. Cover mainshaft clutch hub splines with tape to prevent the splines from damaging the main drive gear bearings.
12. See Figure 6-10. Remove the transmission side door mounting hardware. Remove exhaust bracket, if equipped. Pry the side door loose and remove side door, mainshaft, countershaft and shifter cam from transmission case as an assembly. Discard gasket.



1. **Locknut (2)**
2. **Retaining ring (2)**
3. **Bearing (2)**
4. **Side door**
5. **Side door gasket**
6. **O-ring**
7. **Transmission dipstick**
8. **Transmission case**

Figure 6-9. Side Door Bearings



1. **Bolt (8)**
2. **Side door**

Figure 6-10. Side Door Hardware

DISASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

Shifter Cam/Shifter Forks

1. See Figure 6-11. With side door on end (shafts pointing upward), remove shift fork shafts using easy-out screw extractor (14) (non-flute design). Shafts have slight interference fit. Shafts can be reused, do not damage end of shaft. Mark end of shaft so same end can be reinserted during reassembly.

NOTE

Shifter shafts have a slight interference fit. Shifter shafts can be reused, so avoid damaging end of shaft. Mark shafts so they can be reinstalled in original position during assembly.

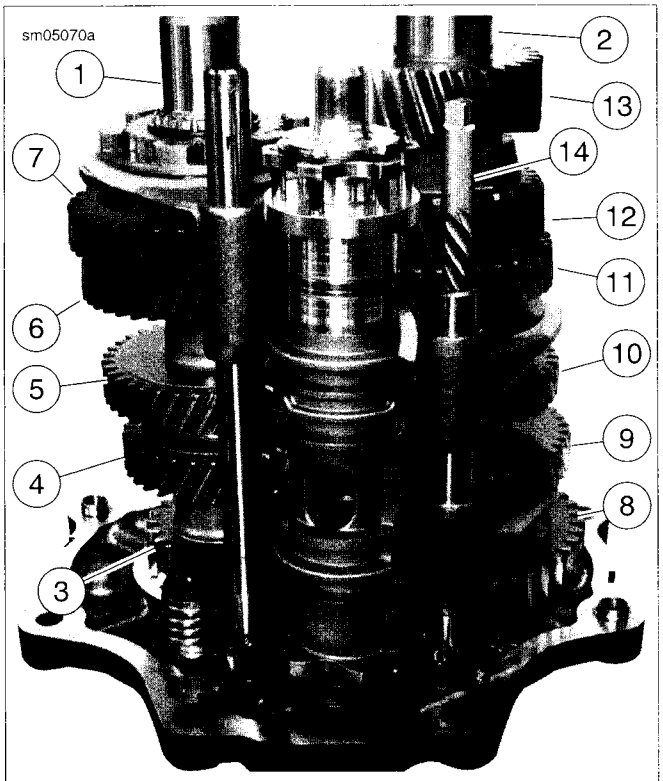
2. Remove shift forks from dog rings.
3. See Figure 6-12. Remove lock plate fasteners (3) from lock plate (2). Discard fasteners.
4. See Figure 6-13. Insert screwdriver and gently pry back detent arm (4) to remove detent spring (3) tension from shift cam (5). Remove shift cam.
5. If servicing detent assembly, remove detent screw (2), detent arm (4), sleeve and detent spring (3). Discard detent screw.

NOTE

Although many transmission parts can be installed in either direction, make sure used parts are installed in same direction as when removed to prolong usable life.

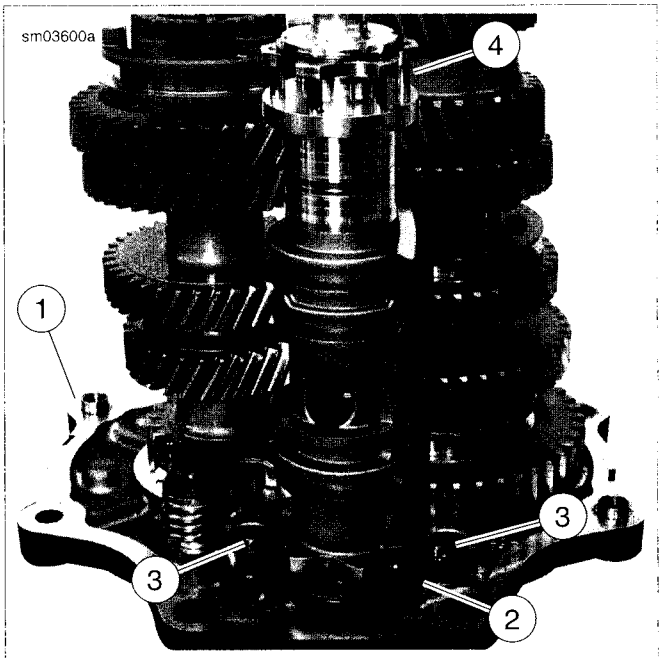
6. See Figure 6-14. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
7. Remove mainshaft and countershaft locknuts.

8. Remove transmission assembly from transmission case.



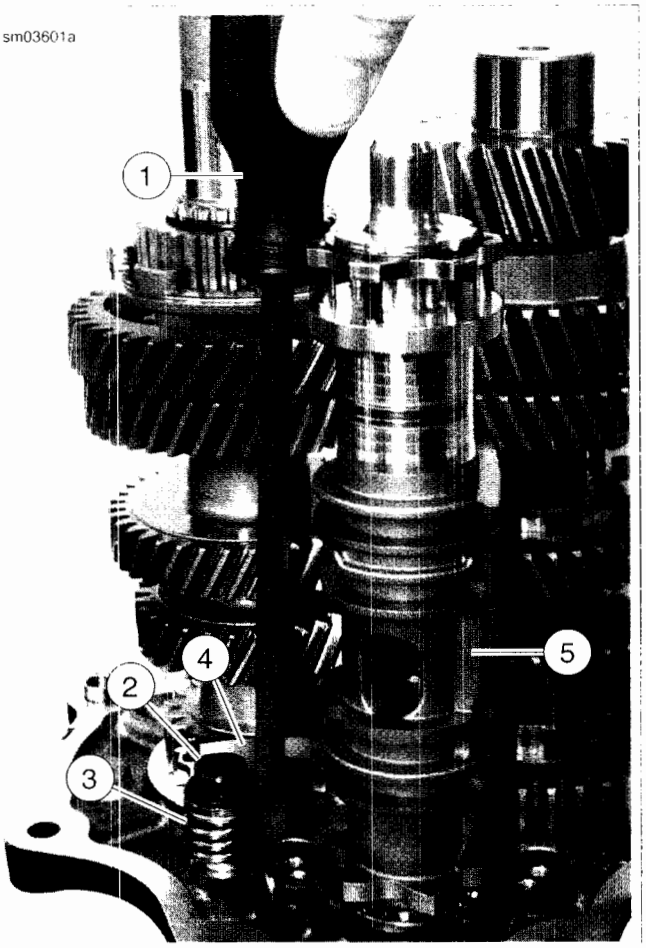
1. Mainshaft
2. Countershaft
3. Mainshaft 1st gear
4. Mainshaft 2nd gear
5. Mainshaft 3rd gear
6. Mainshaft 4th gear
7. Mainshaft 5th gear
8. Countershaft 1st gear
9. Countershaft 2nd gear
10. Countershaft 3rd gear
11. Countershaft 4th gear
12. Countershaft 5th gear
13. Countershaft 6th gear
14. Screw extractor

Figure 6-11. Gear Set



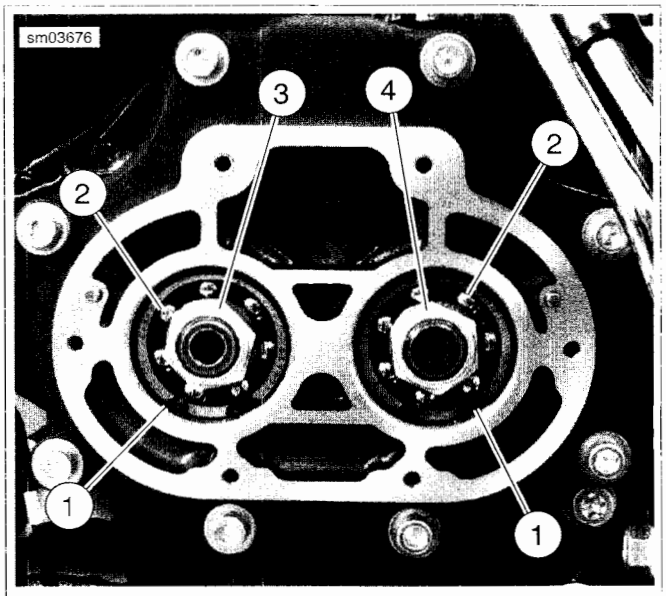
1. Side door
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

Figure 6-12. Shift Drum



1. Screwdriver
2. Detent fastener
3. Detent spring
4. Detent arm
5. Shift cam

Figure 6-13. Detent Assembly



1. Retaining ring (2)
2. Bearing (2)
3. Mainshaft locknut
4. Countershaft locknut

Figure 6-14. Side Door Locknuts

Mainshaft

⚠WARNING

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

NOTE

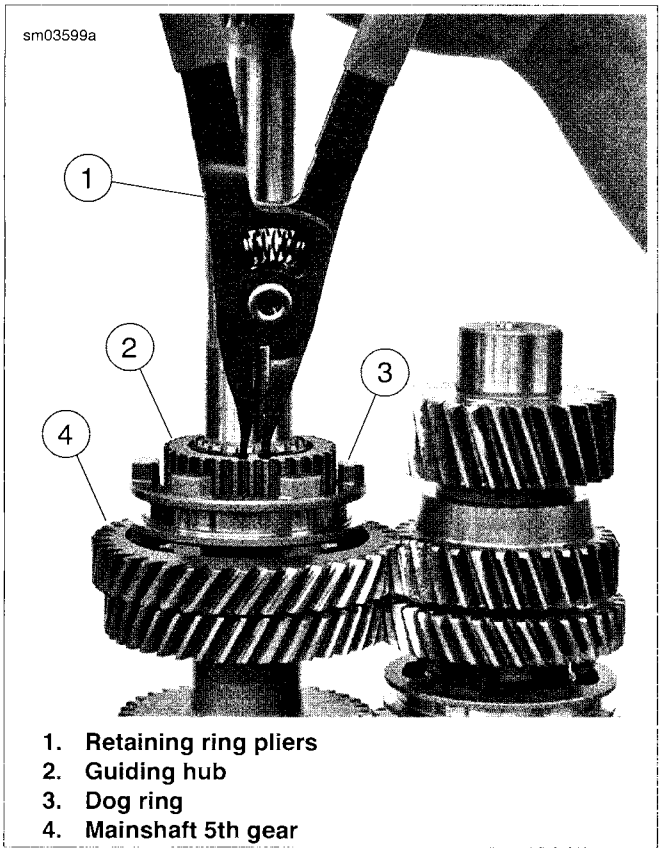
As mainshaft 4th gear, 3rd gear, 2nd gear and 1st gear are an integral part of the shaft, damage to any gear requires mainshaft replacement.

1. See Figure 6-15. Using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A), remove retaining ring. Remove dog ring (3), guiding hub (2), mainshaft 5th gear (4) and bearing.

NOTE

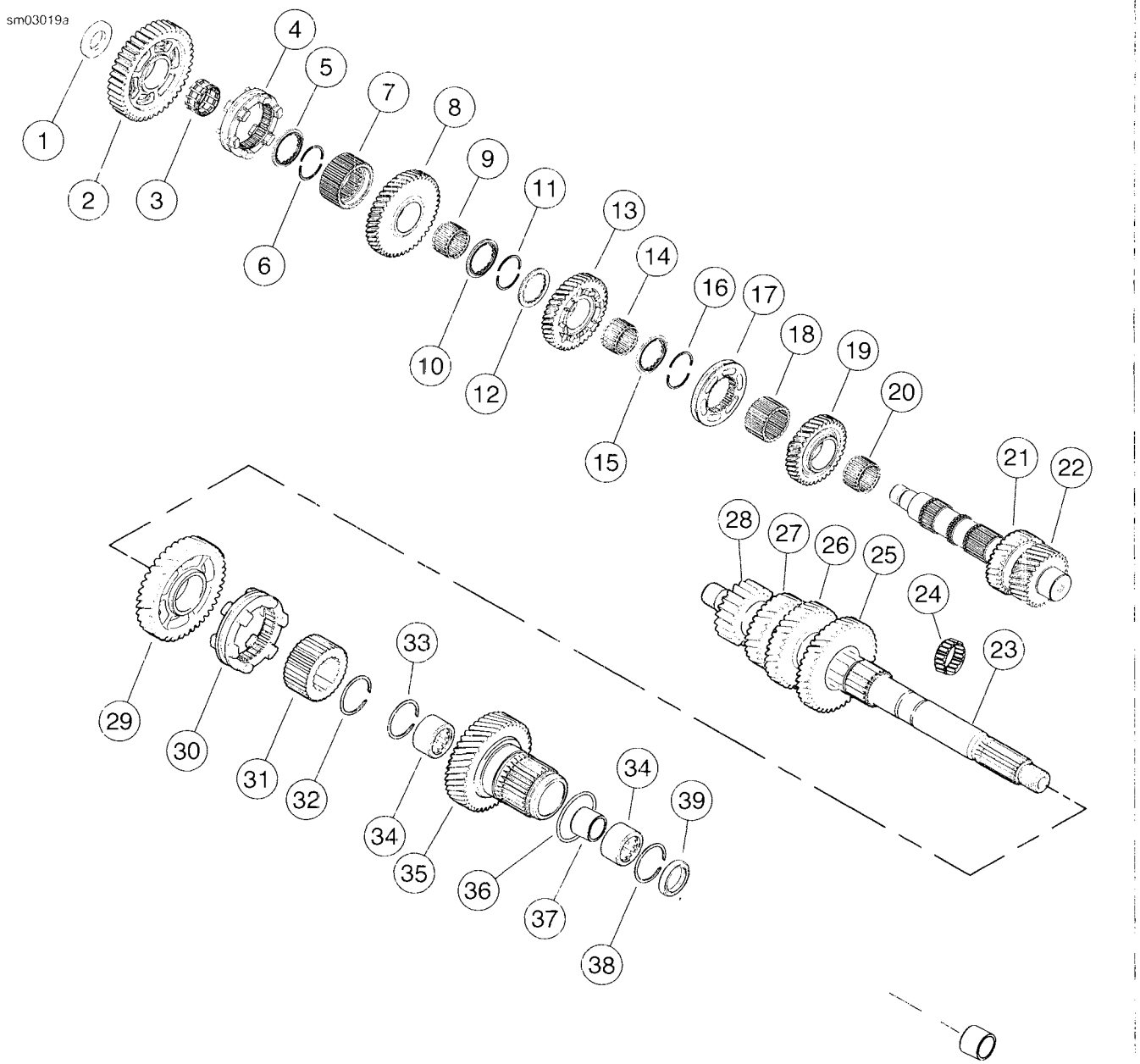
Do not press directly on the end of the mainshaft. Place a spacer such as a washer between the end of the mainshaft and the press ram.

2. Place transmission assembly in arbor press and press mainshaft out of side door bearings.



1. Retaining ring pliers
2. Guiding hub
3. Dog ring
4. Mainshaft 5th gear

Figure 6-15. Mainshaft Retaining Ring



1. Spacer
2. Countershaft 1st gear
3. Bearing
4. Dog ring
5. Lock ring
6. Securing segment (2)
7. Guiding hub
8. Countershaft 2nd gear
9. Bearing
10. Lock ring
11. Securing segment (2)
12. Internal spline washer
13. Countershaft 3rd gear
14. Bearing
15. Lock ring
16. Securing segment (2)
17. Dog ring
18. Guiding hub
19. Countershaft 4th gear
20. Bearing
21. Countershaft 5th gear (part of countershaft)
22. Countershaft 6th gear (part of countershaft)
23. Mainshaft
24. Bearing
25. Mainshaft 4th gear
26. Mainshaft 3rd gear
27. Mainshaft 2nd gear
28. Mainshaft 1st gear
29. Mainshaft 5th gear
30. Dog ring
31. Guiding hub
32. Retaining ring
33. Retaining ring
34. Main drive gear bearing (2)
35. Main drive gear
36. O-ring
37. Bearing spacer
38. Retaining ring
39. Oil seal

Figure 6-16. Mainshaft and Countershaft Assembly

Countershaft

NOTES

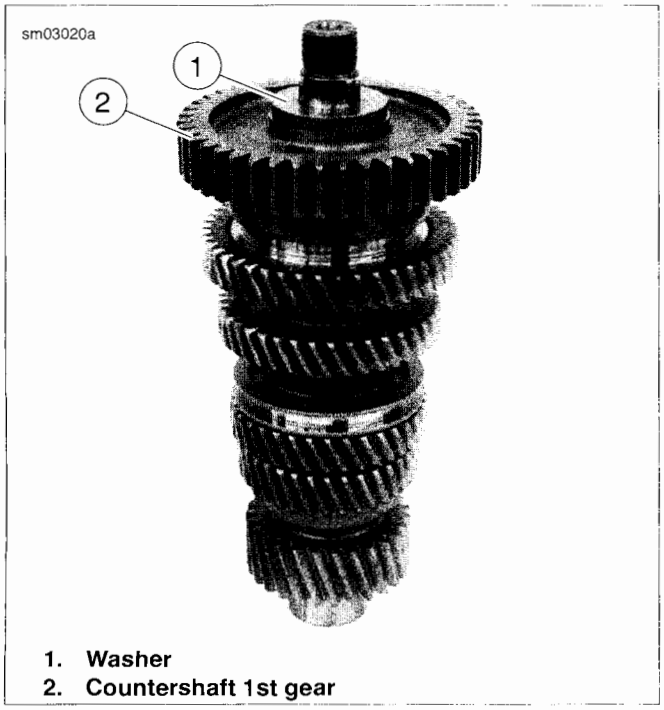
- *If removing countershaft without removing the mainshaft, hold countershaft 3rd and 4th gear shift dog up while pressing countershaft out of side door bearings.*
- *Do not press directly on the end of the countershaft. Place a spacer such as a washer between the end of the countershaft and the press ram.*

1. Press countershaft out of side door bearings.
2. See 6.6 TRANSMISSION ASSEMBLY, Disassembly, Replacing Side Door Bearings for side door bearing replacement.
3. See Figure 6-17. Remove washer (1), countershaft 1st gear (2) and bearing.

NOTE

See Figure 6-18. Note the direction that the 2nd gear locking ring is installed.

4. Remove countershaft 2nd gear lock ring.
5. See Figure 6-19. Remove securing segments (1). Remove dog ring (3), guiding hub (2), countershaft 2nd gear (4) and bearing.



1. **Washer**
2. **Countershaft 1st gear**

Figure 6-17. Countershaft 1st Gear

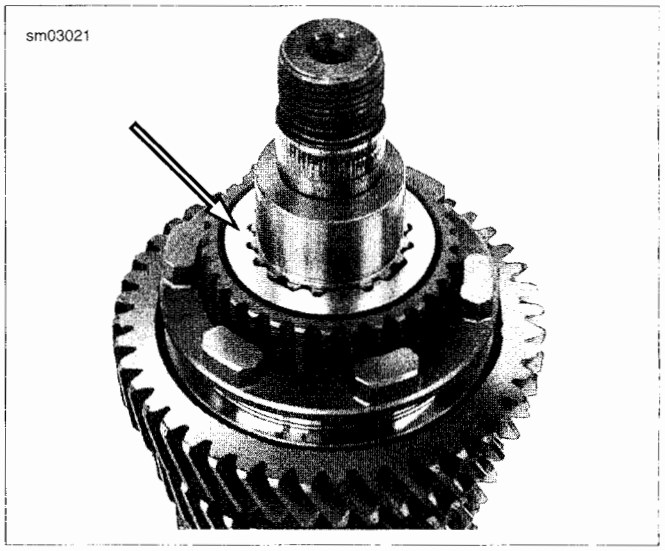
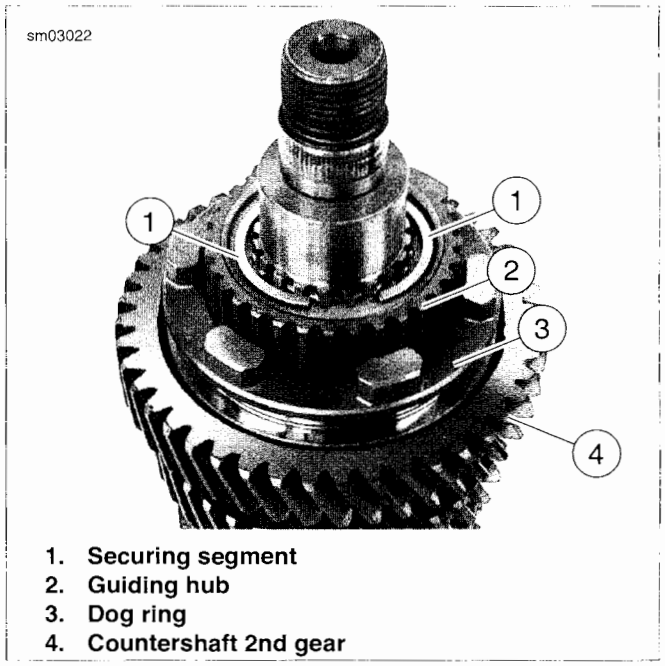


Figure 6-18. Lock Ring



1. **Securing segment**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 2nd gear**

Figure 6-19. Securing Segment

NOTE

See Figure 6-20. Note the direction that the 3rd gear locking ring is installed.

6. Remove countershaft 3rd gear lock ring.
7. See Figure 6-21. Remove securing segments (1), internal spline washer (2), countershaft 3rd gear (3) and bearing.

NOTE

See Figure 6-22. Note the direction that the 4th gear locking ring is installed.

8. Remove 4th gear lock ring (1), securing segments, dog ring (3), guiding hub (2), and countershaft 4th gear (4) and bearing.

NOTE

As countershaft 5th gear and 6th gear are an integral part of the shaft, damage to either gear requires countershaft replacement.

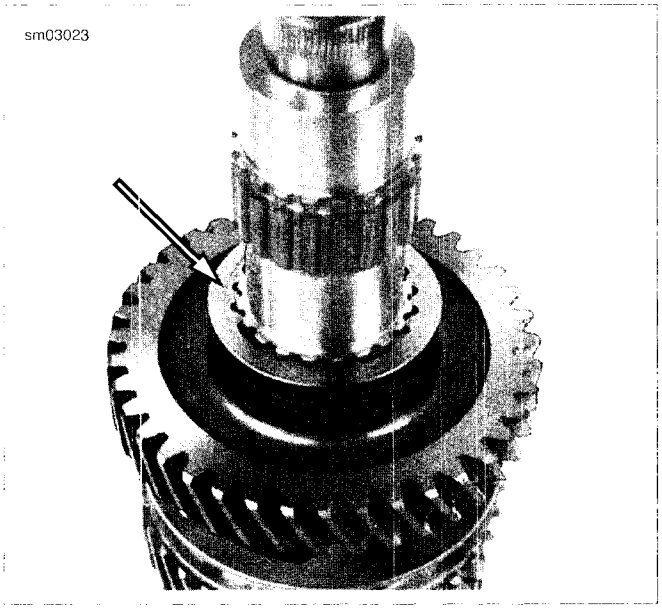
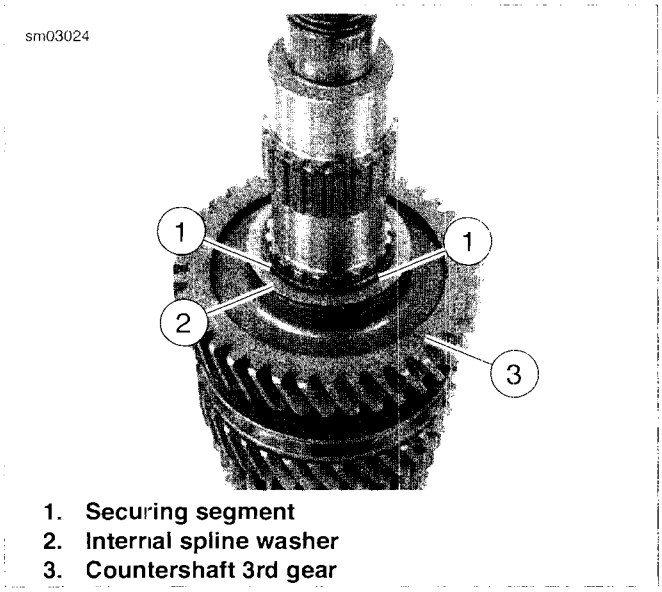
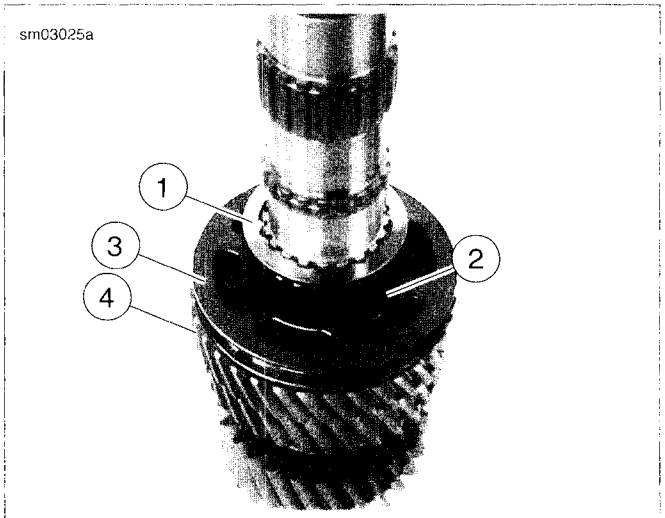


Figure 6-20. Third Gear Lock Ring



1. **Securing segment**
2. **Internal spline washer**
3. **Countershaft 3rd gear**

Figure 6-21. Countershaft Third Gear



1. **4th gear lock ring**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 4th gear**

Figure 6-22. Countershaft Assembly

Replacing Side Door Bearings

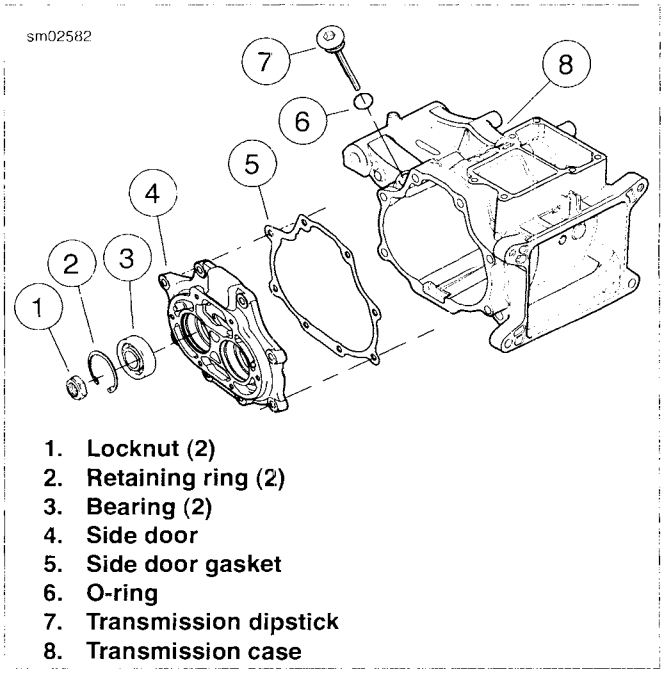
NOTE

Always replace side door bearing if the shaft is pressed out.

⚠WARNING

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

1. See Figure 6-23. Remove the retaining rings (2).
2. Press the bearings out of the side door.



1. **Locknut (2)**
2. **Retaining ring (2)**
3. **Bearing (2)**
4. **Side door**
5. **Side door gasket**
6. **O-ring**
7. **Transmission dipstick**
8. **Transmission case**

Figure 6-23. Side Door Bearings

CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all parts with solvent. Blow parts dry with low pressure 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 and pockets on the dog rings. Replace the dog rings if dogs and/or pockets are rounded, battered or chipped.
4. Inspect guiding hubs. Replace guiding hubs if splines are rounded, battered or chipped.
5. Inspect shift fork shafts. Replace if bent or damaged.
6. Inspect shift forks for wear or signs of overheating. Replace a shift fork if it is excessively worn or shows signs of overheating.
7. See Figure 6-24. Using a small carpenter's square, verify the shift forks are square. If shift fork does not rest directly on the square, then it is bent and must be replaced.
8. Inspect shift drum and bearing. Replace shift drum assembly if drum or bearing are damaged.
9. Clean shift cam lock plate mounting holes in transmission bearing housing.
10. Inspect side door bearings. Bearings must rotate freely without drag. Replace the bearings if pitted, grooved or if the shafts were removed.

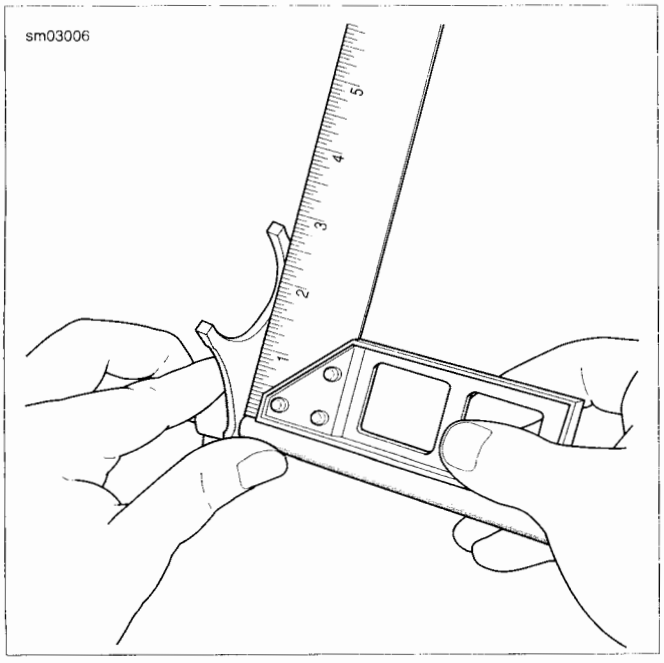


Figure 6-24. Checking Fork

ASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

Installing Side Door Bearings

NOTES

- *Always replace side door bearing if the shaft was pressed out.*
- *To perform the next step, you must use a plate for support or the bearing door will be damaged.*
- *When pressing **new** bearings into side door, press on the outside diameter of the bearing side with the numbers stamped on it.*

1. Support the door from the opposite side at the bearing bores with a flat plate.
2. Position **new** bearing over bore with number side UP.
3. Using a press, apply pressure to the outer diameter of the bearing until the bearing is seated in the bore.

⚠WARNING

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

4. See Figure 6-23. Install beveled retaining ring (2) with the flat side next to the bearing.

Countershaft

NOTES

- *Replace retaining ring and all gear roller bearings with **new** parts during assembly. Lubricate needle bearings and races with clean transmission lubricant before installation.*
- *Install securing segments so the side with the rounded edge is facing up and the side with the straight edge is down. Be sure segments fully engage grooves in countershaft.*
- *One side of the 2nd, 3rd, and 4th gear lock rings have a waved, stepped face. The waved, stepped face always faces the securing segments.*

1. See Figure 6-22. Install **new** needle bearing, countershaft 4th gear (4), guiding hub (2), dog ring (3) securing segments and internal splined washer (1) on countershaft.
2. See Figure 6-21. Install **new** needle bearing, countershaft 3rd gear (3), internal spline washer (2) and securing segments (1).
3. See Figure 6-20. Place countershaft 3rd gear lock ring over securing segments.

NOTES

- *In next step, the side of the guiding hub with the deeper counterbore faces countershaft 2nd gear.*
- *Countershaft 2nd gear bearing is wider than other bearings on the countershaft.*

4. See Figure 6-19. Install **new** needle bearing, countershaft 2nd gear (4), guiding hub (2), dog ring (3) and securing segments (1) on countershaft.
5. See Figure 6-18. Place lock ring over securing segments with the stepped face of the lock ring against the securing segments.
6. See Figure 6-17. Install **new** needle bearing, countershaft 1st gear (2) and washer (1).

NOTES

- *If installing countershaft only, hold countershaft 3rd and 4th gear shift dog up while pressing side door bearing on to countershaft.*
- *Failure to press on inner bearing races while pressing bearings on the shafts will damage the bearings.*

7. See Figure 6-25. Place countershaft in an arbor press supporting countershaft 6th gear. Using a suitable socket, press on inner bearing race until side door bearing contacts countershaft 1st gear washer.

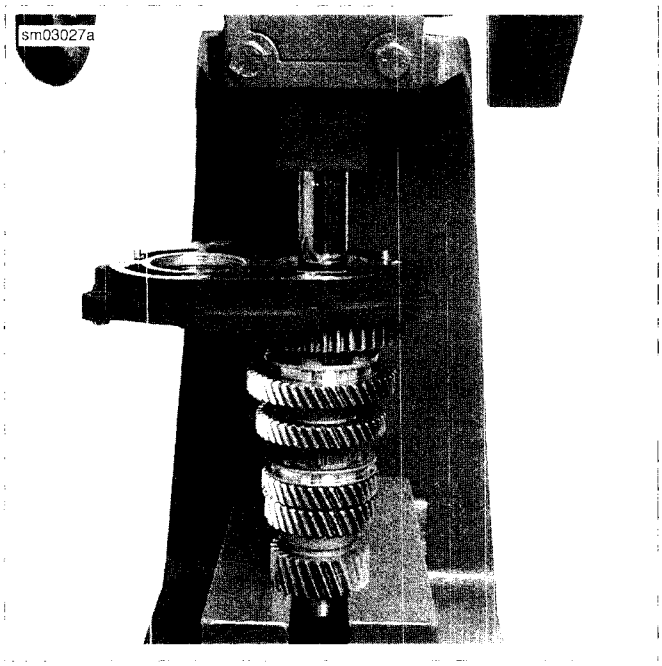


Figure 6-25. Installing Countershaft

Mainshaft

NOTES

- *Failure to press on inner bearing race while pressing bearing on the shaft will damage the bearing.*
- *See Figure 6-26. Hold dog ring so that it is engaged with countershaft 3rd gear during the press procedure. If press is performed with dog ring engaged with countershaft 4th gear, contact with mainshaft 4th gear will push shafts out of alignment and result in possible bearing and gear damage.*

1. Place mainshaft in an arbor press, supporting mainshaft 4th gear.
2. Place rear side door bearing over mainshaft. Using a suitable socket, press on inner bearing race until side door bearing contacts mainshaft 1st gear.
3. See Figure 6-15. With side door on end (shafts pointing upward), install **new** bearing and mainshaft 5th gear (4).
4. Be sure guiding hub counterbore is facing mainshaft 5th gear and install guiding hub (2) and dog ring (3).
5. Install **new** retaining ring using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A) (1).

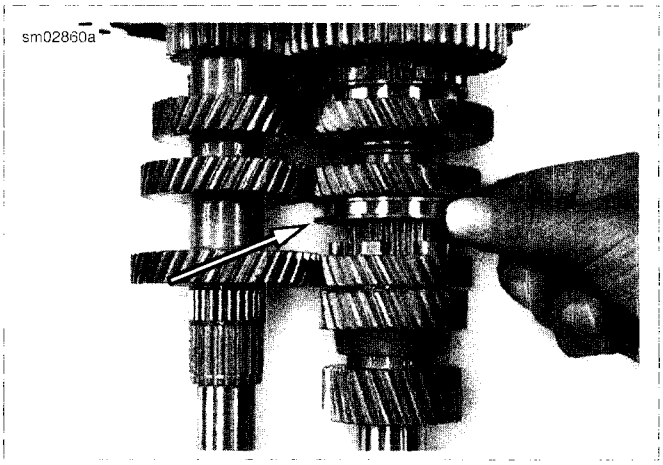


Figure 6-26. Raise and Hold Dog Ring

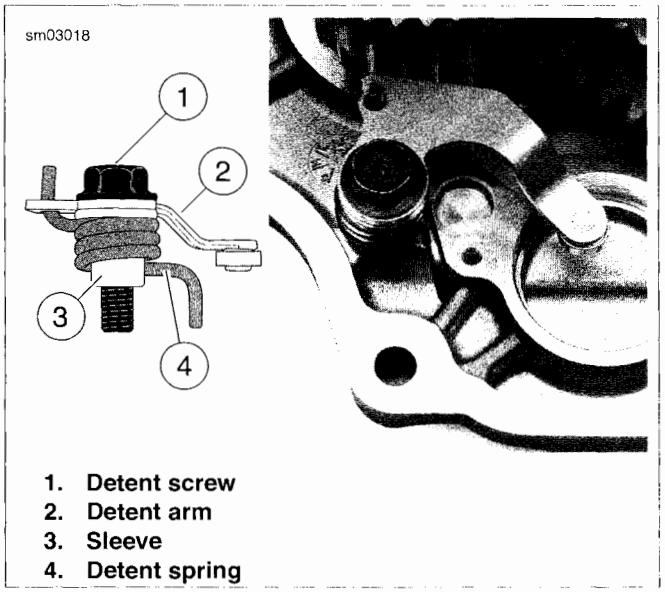
Shifter Cam/Shifter Forks

1. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
2. Install **new** nuts on mainshaft and countershaft. Tighten nuts to 85-95 ft-lbs (115.3-128.8 Nm).
3. Remove transmission assembly from case.
4. Place side door on bench with shafts pointing upward.
5. If removed, install detent arm assembly:
   a. See Figure 6-27. Clean detent screw mounting hole in transmission side door.
   b. Assemble **new** detent screw, detent arm, sleeve and detent spring. Mount detent assembly in bearing housing as shown. Make certain to orient spring and detent arm as shown in the figure. Tighten screw to 120-150 **in-lbs** (13.6-17.0 Nm).
6. See Figure 6-28. Using screwdriver (1), pull detent arm back to allow installation of shift cam assembly.
7. Install shift cam assembly (5).
8. See Figure 6-29. Install lock plate (2) and **new** lock plate fasteners (3). Tighten fasteners to 57-63 **in-lbs** (6.4-7.1 Nm).
9. See Figure 6-30. The forks are different from each other and are identified as shown.
10. See Figure 6-31. Insert shifter fork (2) into the slot of the dog ring in between mainshaft 5th and 6th gear. Slide long shift shaft through 5th and 6th gear shifter fork and install shaft in hole in side door.
11. Insert shifter fork (6) into the slot of the dog ring in between countershaft 3rd and 4th gear. Insert shifter fork (9) into the slot of the dog ring in between countershaft 1st and

2nd gear. Slide short shift shaft through countershaft shifter forks and install shaft in hole in side door.

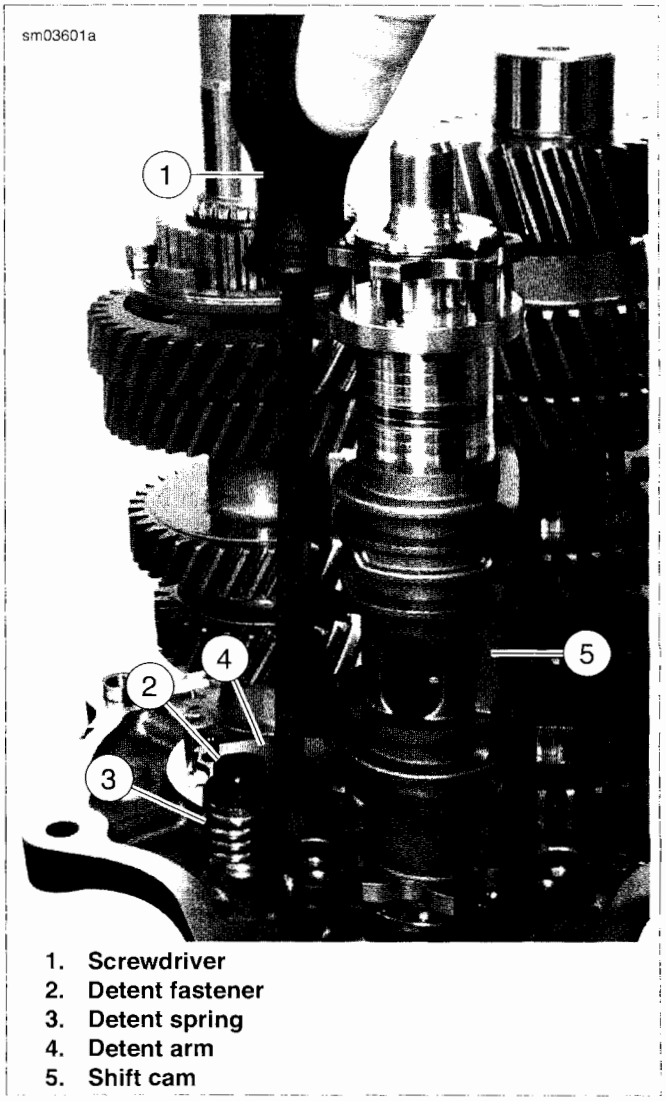
NOTE

If main drive gear was removed, install it now. See 6.7 MAIN DRIVE GEAR AND BEARING.



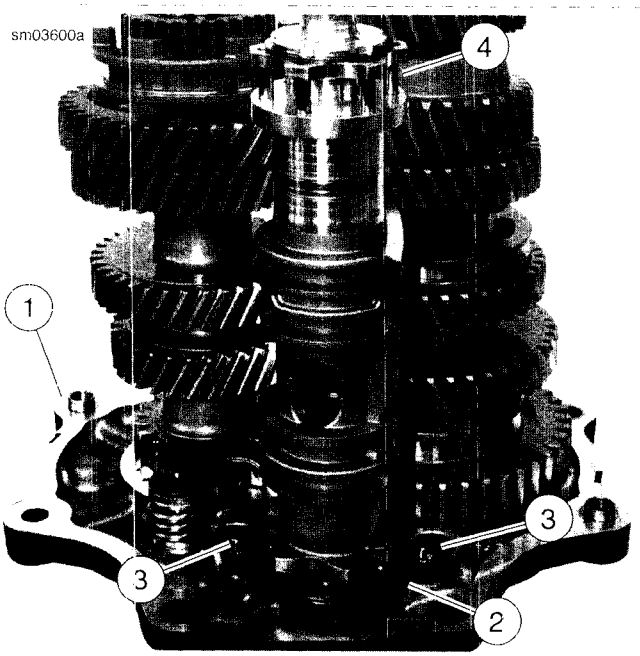
1. **Detent screw**
2. **Detent arm**
3. **Sleeve**
4. **Detent spring**

Figure 6-27. Detent Assembly



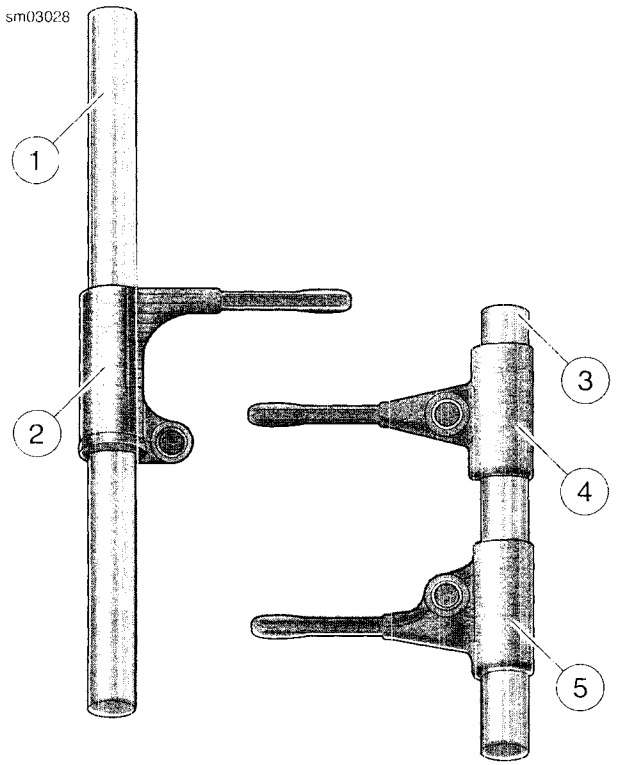
1. **Screwdriver**
2. **Detent fastener**
3. **Detent spring**
4. **Detent arm**
5. **Shift cam**

Figure 6-28. Detent Assembly



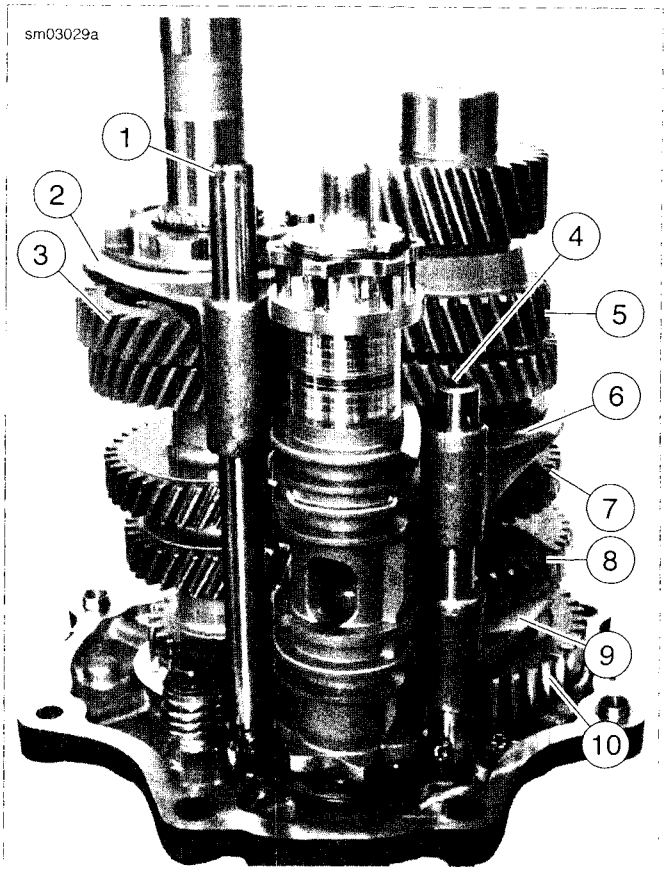
1. Side door
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

Figure 6-29. Shift Drum



1. Long shift shaft
2. 5th and 6th gear shifter fork
3. Short shift shaft
4. 3rd and 4th gear shifter fork
5. 1st and 2nd gear shifter fork

Figure 6-30. Shifter Forks and Shafts



1. Long shift shaft
2. 5th and 6th gear shifter fork
3. 5th gear
4. Short shift shaft
5. 5th gear
6. 3rd and 4th gear shifter fork
7. 3rd gear
8. 2nd gear
9. 1st and 2nd gear shifter fork
10. 1st gear

Figure 6-31. Transmission Gears and Shifter Forks

INSTALLATION

1. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.
2. Verify that two ring dowels are in place on side door flange. place a **new** gasket on the ring dowels.
3. Apply clean transmission lubricant to the main drive gear bearings.

NOTE

Be sure the transmission filler plug/dipstick is removed before installing transmission assembly. Contact with the filler plug/dipstick will prevent installation of transmission assembly.

4. Install the transmission assembly in the transmission case.
5. If equipped, place exhaust bracket into position. Install side door fasteners.
6. See Figure 6-32. Tighten all side door hardware in the sequence shown to 13-18 ft-lbs (17.6-24.4 Nm).

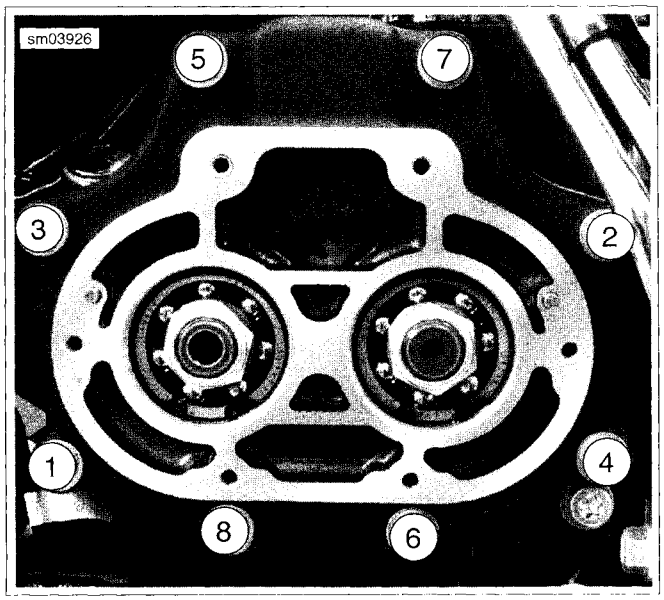


Figure 6-32. Side Door Hardware Torque Sequence

7. Install mainshaft bearing inner race. See 5.7 TRANSMISSION SPROCKET.
8. See Figure 6-7. Install push rod assembly (items 2-5) in mainshaft hole. Secure with **new** retaining ring (1) if removed.

NOTE

The two top side cover fasteners are shorter in length than the others.

9. Install the clutch release cover, using a **new** gasket. See 6.5 CLUTCH RELEASE COVER.
10. Remove shifter cam pawl from top cover gasket surface and place on shift cam. Install **new** transmission top cover gasket. Install transmission top cover. Install top cover fasteners and tighten to 84-132 **in-lbs** (9.5-14.9 Nm).
11. Install vent hose to top cover fitting, if removed.
12. Install transmission sprocket nut. See 5.7 TRANSMISSION SPROCKET.
13. Install primary chaincase, clutch assembly and primary cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
14. Replace o-ring on plug. Clean and install transmission drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
15. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.
16. Install oil tank. See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC.
17. Install exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.

REMOVAL

PART NUMBER	TOOL NAME
HD-35316-10	PILOT
HD-35316-11	RECEIVER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-9	BEARING DRIVER
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER
HD-95637-10	LONG BOLTS
HD-95637-46B	WEDGE ATTACHMENT
RS-25100-200	BEARING

NOTE

Leave the transmission case in the frame unless the case itself must be replaced. For illustration purposes, some photographs may show the case removed.

1. Remove the exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.
2. Remove the primary chaincase cover, clutch assembly, primary chain, compensating sprocket and primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.
3. Remove the bearing inner race from the transmission mainshaft. See 5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
4. Remove the transmission side door. See 6.6 TRANSMISSION ASSEMBLY.

CAUTION

Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)

NOTE

Main drive gear and bearing can be removed with the transmission case in the frame after removing door assembly. Use MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER (Part No. HD-35316-C).

5. Remove retaining ring.

NOTES

- *The main drive gear bearing and retaining ring must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *The CROSS PLATE (Part No. HD-35316-3A) is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up.*

6. See Figure 6-33. Place CROSS PLATE (Part No. HD-35316-3A) (1) on right side of transmission case as shown, and secure with two screws (2). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear (4).
7. Apply a light coat of graphite lubricant to the threads of the 12 IN. BOLT (Part No. HD-35316-5) (3) and insert through cross plate and main drive gear.
8. At left side of transmission case, place WASHER (Part No. HD-35316-7), BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt. Tighten nut until main drive gear is free.

NOTES

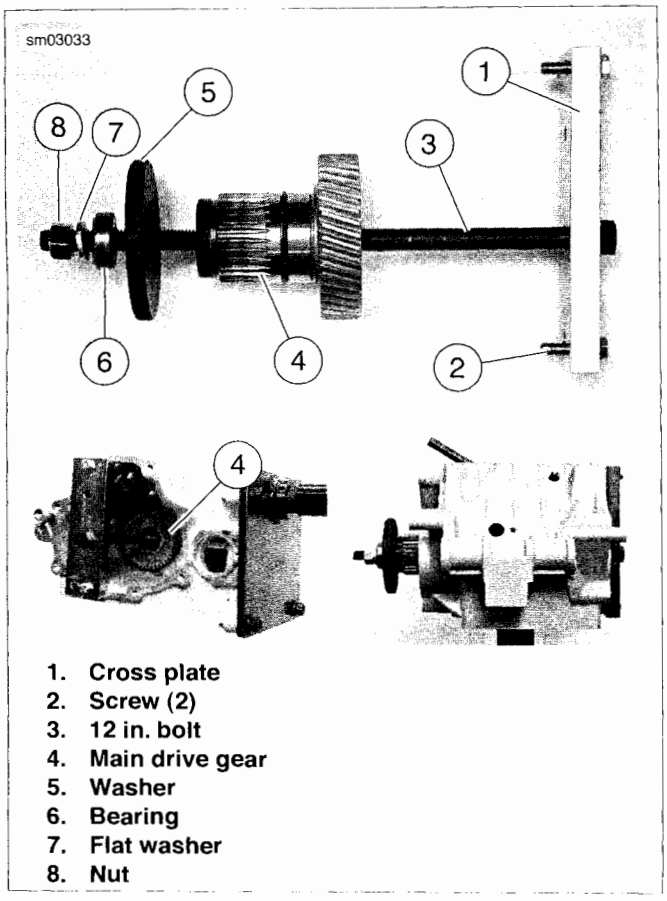
- *When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing must also be replaced.*
- *See Figure 6-34. When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. If the main drive gear is to be re-used, this inner race must be removed first.*

9. Remove tool and remove gear from gearcase.
10. See Figure 6-34. Use WEDGE ATTACHMENT (Part No. HD-95637-46B) and LONG BOLTS (Part No. HD-95637-10) to remove inner race from main drive gear.
11. Remove large main drive gear oil seal.
12. Remove retaining ring from bearing bore.
13. See Figure 6-35. Slide PILOT (Part No. HD-35316-10) (3) over small end of BEARING DRIVER (Part No. HD-35316-9) (2).
14. Apply a light coat of graphite lubricant to the threads of the 8 IN. BOLT (Part No. HD-35316-4A) (1) and insert through bearing driver and pilot.
15. Insert bolt with bearing driver and pilot into right side of transmission case, through main drive gear bearing (4). Make sure bearing driver fits up against main drive gear bearing and pilot is centered in bearing bore.
16. At left side of case, slide RECEIVER CUP (Part No. HD-35316-11) (5) onto bolt and over main drive gear bearing. Install BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt.

NOTE

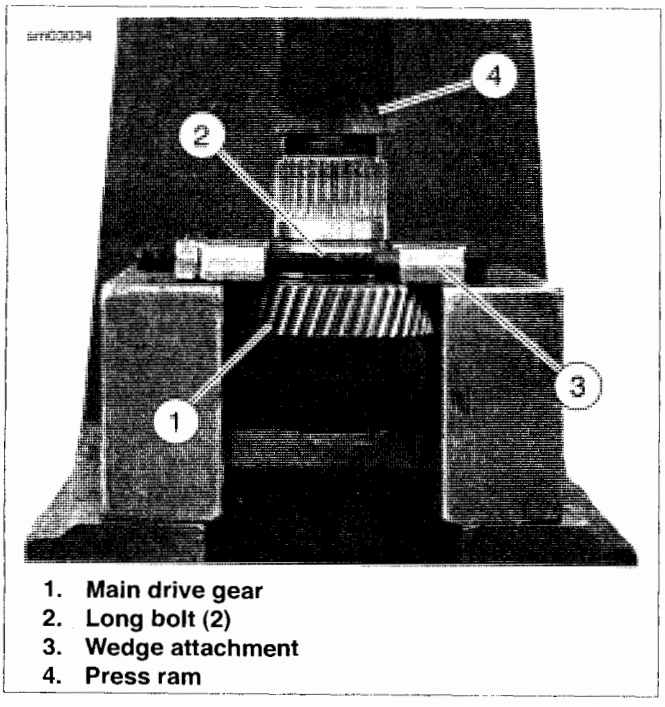
Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of transmission case when bearing comes free.

17. Tighten nut until main drive gear bearing is free.
18. Discard main drive gear bearing.



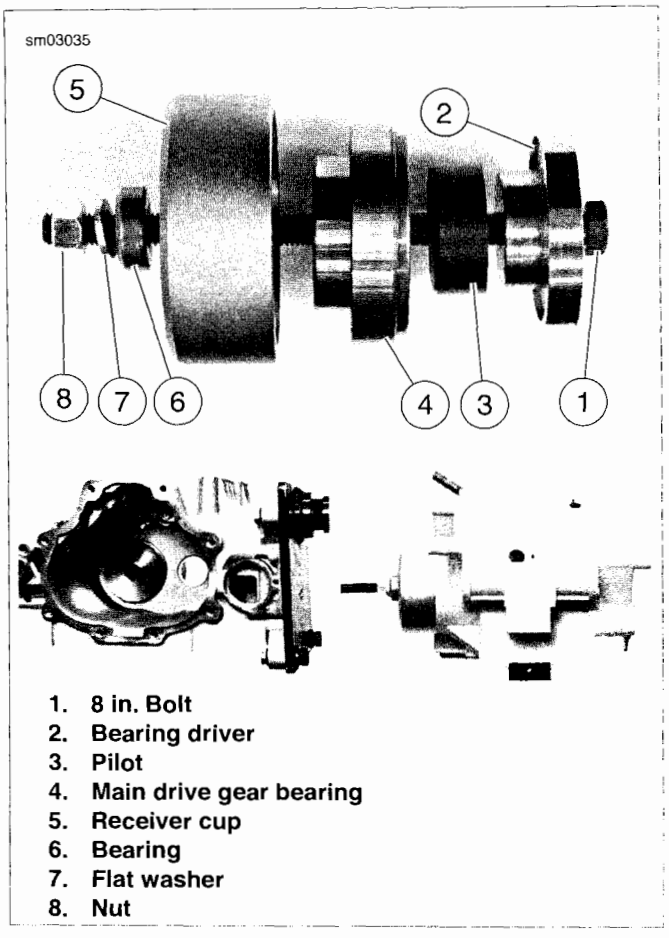
1. Cross plate
2. Screw (2)
3. 12 in. bolt
4. Main drive gear
5. Washer
6. Bearing
7. Flat washer
8. Nut

Figure 6-33. Removing Main Drive Gear



1. Main drive gear
2. Long bolt (2)
3. Wedge attachment
4. Press ram

Figure 6-34. Removing Inner Bearing Race From Main Drive Gear



1. 8 in. Bolt
2. Bearing driver
3. Pilot
4. Main drive gear bearing
5. Receiver cup
6. Bearing
7. Flat washer
8. Nut

Figure 6-35. Removing Main Drive Gear Bearing

CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL

⚠WARNING

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

1. Clean all parts in solvent except the transmission case and needle bearings. Blow dry with compressed air.

NOTE

Never wash the transmission case and needle bearings with solvent unless the needle bearings are to be replaced. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and leads to bearing failure.

2. Inspect the main drive gear for pitting and wear. Replace if necessary.
3. Inspect the needle bearings inside the main drive gear. Replace the needle bearings if the mainshaft race is pitted or grooved.

4. Replace the sprocket if teeth are cracked or worn. See 5.7 TRANSMISSION SPROCKET, Cleaning and Inspection for more information.

5. Inspect the needle bearings on the inside of the main drive gear. If mainshaft race surface appears pitted or grooved, replace these bearings.

NOTE

If the main drive gear needle bearings and/or seal need to be replaced, continue as follows. Otherwise, proceed to 6.8 TRANSMISSION CASE, Assembly.

Needle Bearing Replacement

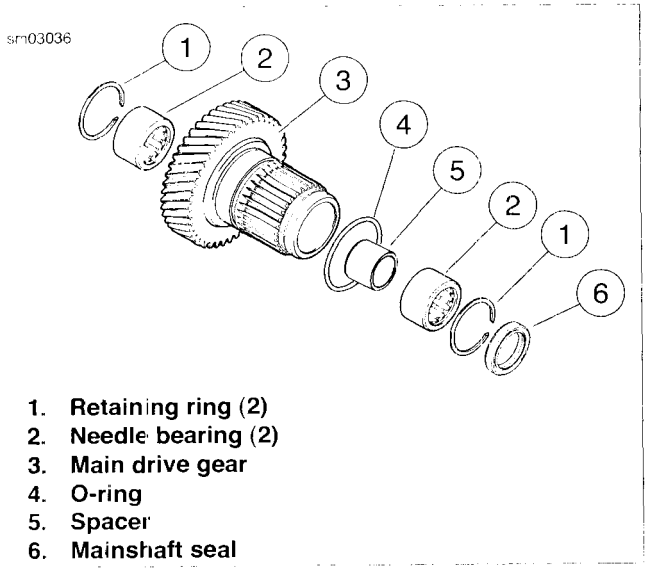
⚠WARNING

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

NOTES

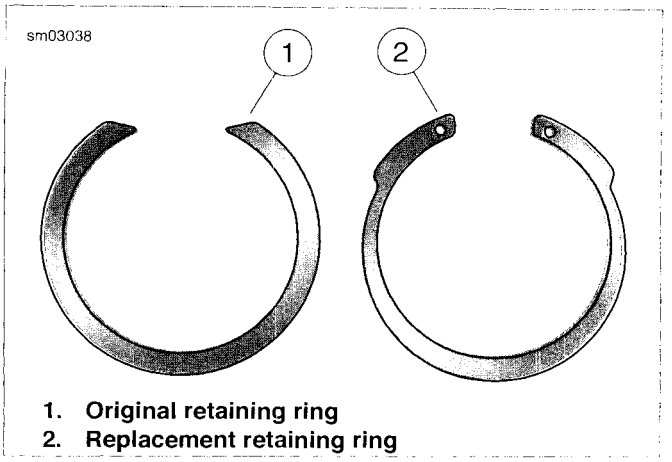
- *See Figure 6-37. When replacing needle bearings, discard original retaining rings (1) and install replacement retaining rings (2).*
- *To install the inner main drive gear needle bearings and mainshaft seal, use MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL (Part No. HD-47932).*

1. See Figure 6-36. Remove mainshaft seal (6). Remove retaining rings (1), needle bearings (2) and spacer (5) from main drive gear (3). Discard retaining rings.
2. Remove and discard O-ring (4).



1. **Retaining ring (2)**
2. **Needle bearing (2)**
3. **Main drive gear**
4. **O-ring**
5. **Spacer**
6. **Mainshaft seal**

Figure 6-36. Main Drive Gear Assembly



1. **Original retaining ring**
2. **Replacement retaining ring**

Figure 6-37. Main Drive Gear Retaining Rings

3. See Figure 6-38. Install clutch side needle bearing using an arbor press and the 0.400 in. step end of tool as shown. Press until tool contacts gear.

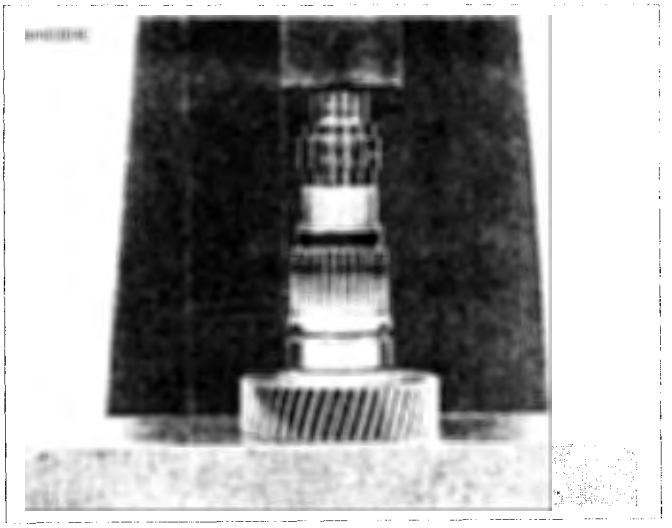


Figure 6-38. Installing Clutch Side Needle Bearing in Main Drive Gear

NOTE

An alternative method is provided which allows the mainshaft seal to be pressed into place after installation of the main drive gear. See 6.7 MAIN DRIVE GEAR AND BEARING, Installation.

4. See Figure 6-39. Turn over tool and press in mainshaft seal using the 0.090 in. step with garter spring side down.
5. Install spacer.
6. See Figure 6-40. Turn over the main drive gear in the arbor press. With the tool at the 0.188 in. step, press inner bearing until tool contacts gear.

⚠WARNING

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

7. See Figure 6-36. Install **new** retaining rings (1).
8. Install **new** O-ring (4) into groove in main drive gear.

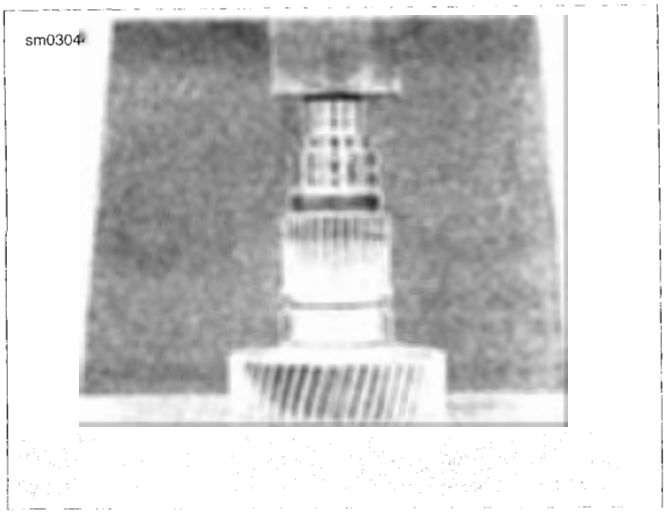


Figure 6-39. Pressing in Seal

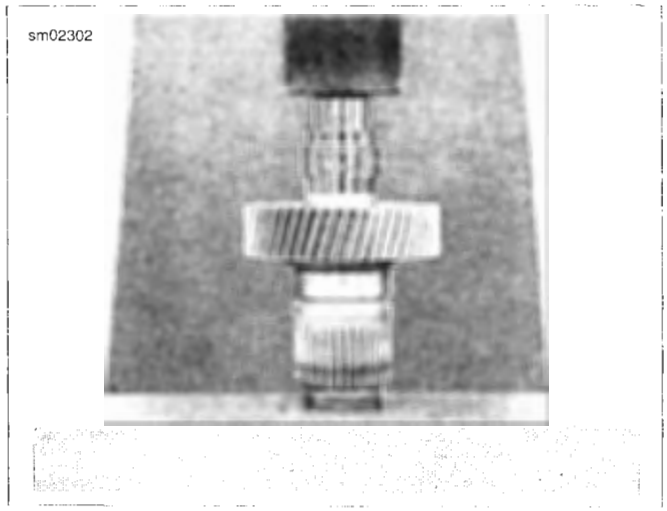


Figure 6-40. Installing Transmission Side Needle Bearing in Main Driver Gear

INSTALLATION

PART NUMBER	TOOL NAME
HD-35316-12	INSTALLER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-8	BEARING DRIVER
HD-47856-1	INSTALLER
HD-47856-2	PILOT
HD-47856-3	ADAPTER
HD-47856-6	NUT
HD-47856-7	CROW'S FOOT WRENCH

CAUTION

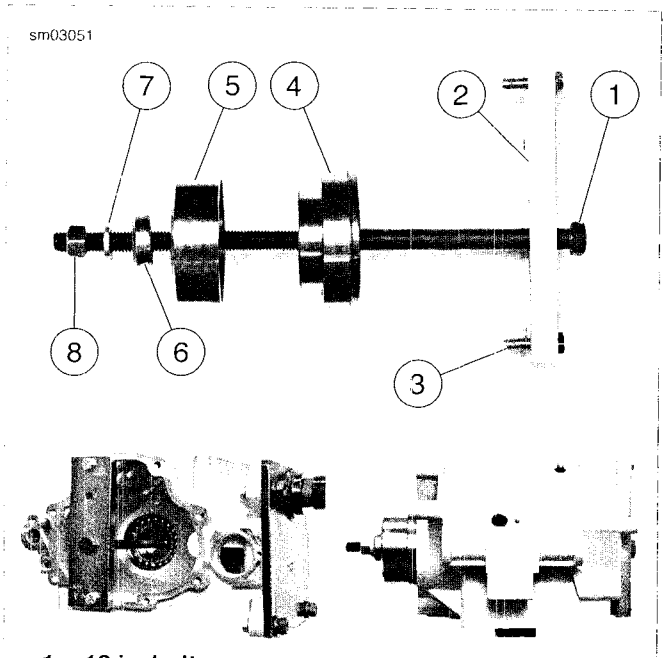
Improper tightening of sprocket nut can cause drive component damage. (00541b)

Installing Main Drive Gear Bearing

NOTE

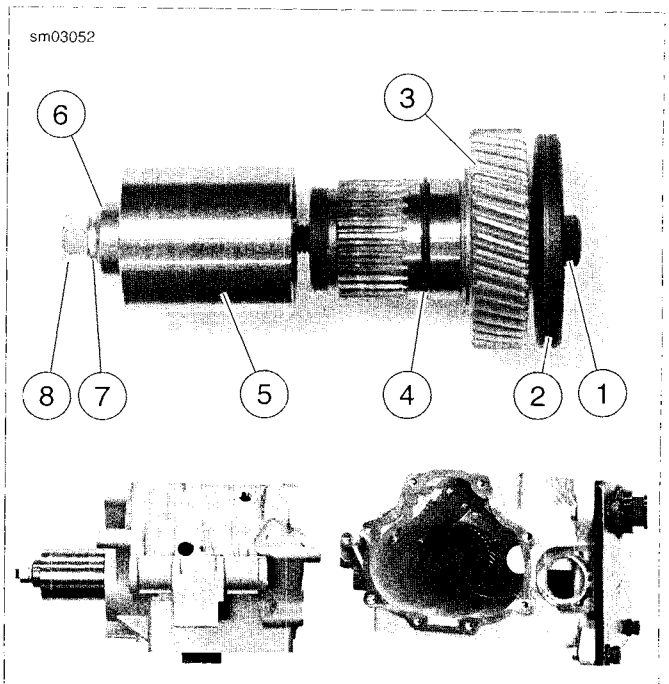
CROSS PLATE (Part No. HD-35316-3A) will retrofit to earlier transmissions. Note that one end of cross plate is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up for 6 speed transmissions.

1. See Figure 6-41. Place CROSS PLATE (Part No. HD-35316-3A) (2) on right side of transmission case as shown, and secure with two screws (3). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear bearing bore in left side of transmission case.
2. Apply a light coat of graphite lubricant to the threads of 12 IN. BOLT (Part No. HD-35316-5) (1) and install through cross plate and main drive gear bearing bore.
3. At left side of case, place main drive gear bearing (4), BEARING DRIVER (Part No. HD-35316-8) (5), BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.
4. Tighten nut until main drive gear bearing bottoms against lip cast into transmission case bearing bore.



1. 12 in. bolt
2. Cross plate
3. Screw (2)
4. Main drive gear bearing
5. Bearing driver
6. Bearing
7. Flat washer
8. Nut

Figure 6-41. Installing Main Drive Gear Bearing (Typical)



1. 8 in. bolt
2. Washer
3. Main drive gear
4. O-ring
5. Installer cup
6. Bearing
7. Flat washer
8. Nut

Figure 6-42. Installing Main Drive Gear (Typical)

Installing Main Drive Gear

NOTE

See Figure 6-42. Make sure ***new*** *o-ring (4) is installed onto main drive gear (3). Lubricate o-ring with clean engine oil before installing drive gear into transmission case.*

1. See Figure 6-42. Apply a light coat of graphite lubricant to the threads of 8 IN. BOLT (Part No. HD-35316-4A) (1) and insert through WASHER (Part No. HD-35316-7) (2) and main drive gear (3). Insert assembly into transmission case, through main drive gear bearing.
2. At outside of case, place INSTALLER CUP (Part No. HD-35316-12) (5), BEARING (6), FLAT WASHER (7) and NUT (8) over end of bolt.
3. Tighten nut until main drive gear contacts main drive gear bearing.

NOTE

See Figure 6-43. In next step, bearing retaining ring must be installed with the flat side facing the bearing and the opening in the ninety degree range shown.

⚠WARNING

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

4. See Figure 6-44. Install **new** retaining ring (2).

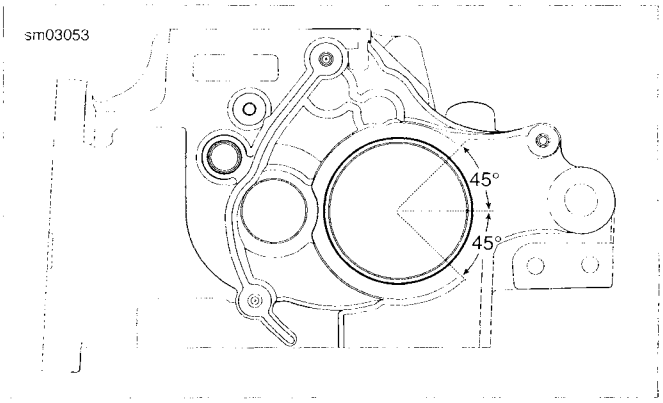


Figure 6-43. Retaining Ring Opening

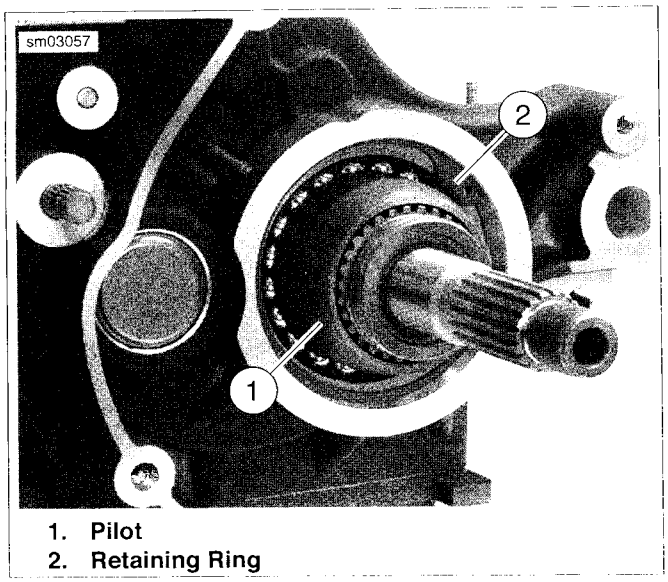
Installing Main Drive Gear Large Seal

1. See Figure 6-44. 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 FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt).
3. See Figure 6-45. Place seal over pilot with garter spring facing bearing, and position seal squarely in end of crankcase bore.

NOTE

ADAPTER (Part No. HD-47856-3) and main drive gear have right-hand threads.

4. See Figure 6-46. Thread ADAPTER (Part No. HD-47856-3) onto end of main drive gear until it contacts main drive gear.



1. **Pilot**
2. **Retaining Ring**

Figure 6-44. Install Pilot

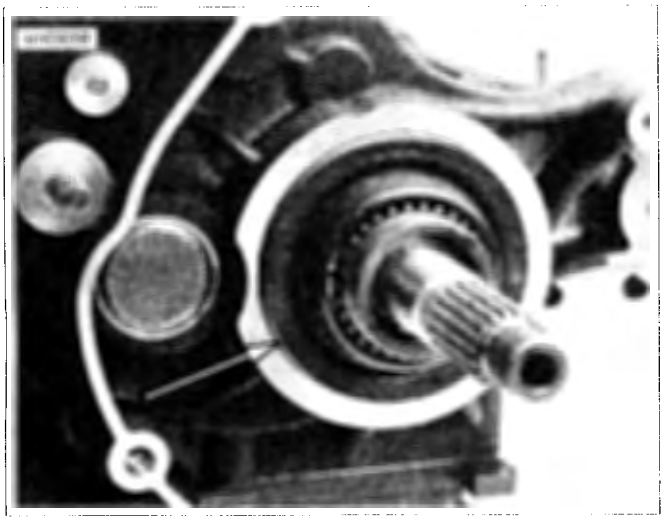


Figure 6-45. Place Main Drive Gear Seal Over Pilot

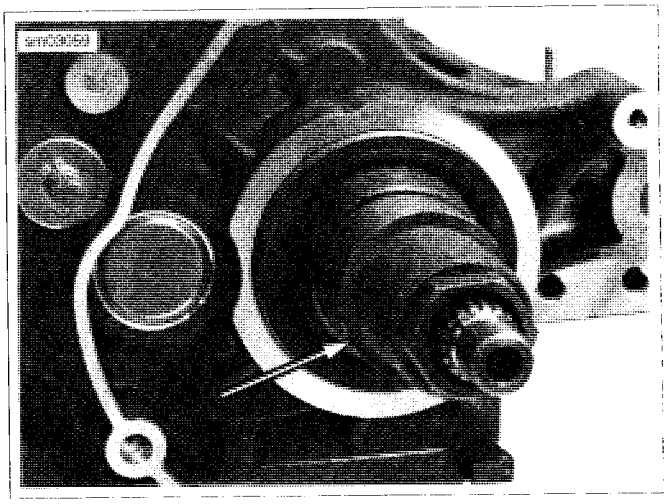


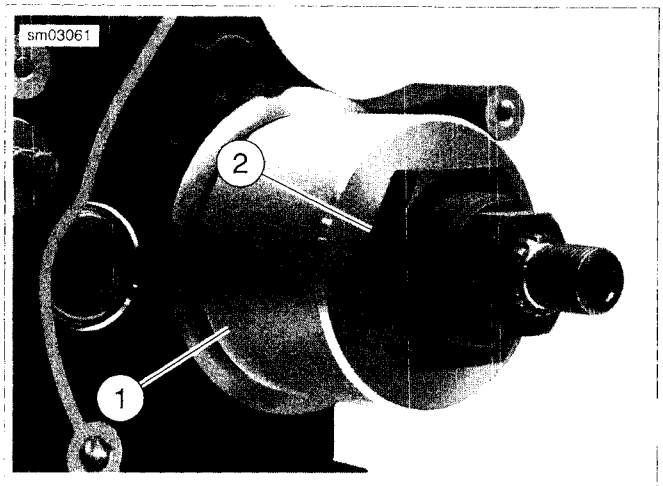
Figure 6-46. Install Adapter

5. See Figure 6-47. Slide INSTALLER (Part No. HD-47856-1) (1) over adapter until cupped end of installer is flat against seal.
6. Thread NUT (Part No. HD-47856-6) (2) onto end of adapter, until it tightens against installer.
7. See Figure 6-48. Place CROW'S FOOT WRENCH (Part No. HD-47856-7) (1) with 1/2 inch drive breaker bar (2) on large nut. Place an adjustable wrench (3) on flats of hex head cast into end of adapter.
8. Holding adjustable wrench, tighten large nut with crow's foot wrench until outer face of seal is flush with outer edge of transmission bore.

NOTE

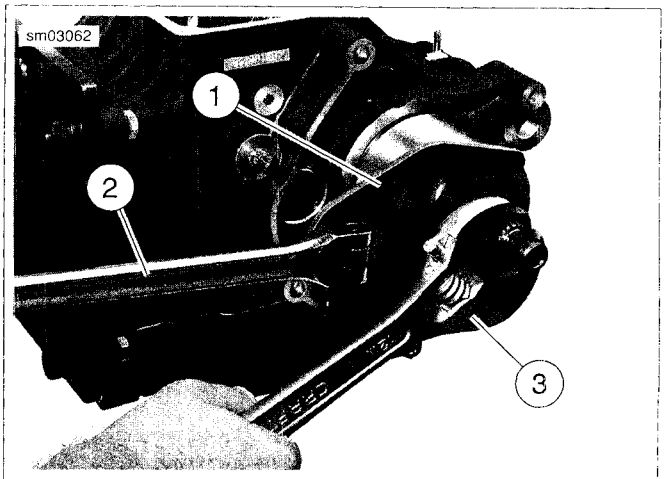
It is acceptable to recess seal as much as 0.030 in. (0.762 mm) below outer edge of bore. Seal depth will be controlled by tool.

9. Remove nut, installer, adapter and pilot.
10. Install side door and transmission components. See 6.6 TRANSMISSION ASSEMBLY, Installation.
11. Install sprocket and drive belt. See 5.7 TRANSMISSION SPROCKET. Do not adjust belt at this time.
12. Install the bearing inner race on the transmission mainshaft. See 6.8 TRANSMISSION CASE, Assembly.
13. Install the primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING, Installation.
14. Install the clutch assembly, primary chain, chain tensioner assembly and compensating sprocket components See 5.4 DRIVE COMPONENTS, Installation.
15. Install the primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER, Installation.
16. Adjust the drive belt. See 1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection.
17. Install exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System.



1. Installer
2. Nut

Figure 6-47. Installer and Nut



1. Crow's foot wrench
2. 1/2 inch breaker bar
3. Adjustable wrench

Figure 6-48. Press Seal Into Crankcase

REMOVAL

For information on pulling transmission case from frame, see 3.14 REMOVING ENGINE FROM CHASSIS.

⚠WARNING

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

1. Disconnect battery, negative cable first. See 1.25 BATTERY MAINTENANCE, Disconnection and Removal.
2. Drain engine oil. See 1.6 ENGINE OIL AND FILTER, Changing Oil and Filter.
3. Drain transmission lubricant. See 1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant.
4. Remove starter. See 7.13 STARTER, Removal.
5. Remove upper and lower fasteners from seat post. Disconnect coil connector and remove the post with coil attached.
6. Remove transmission assembly. See 6.6 TRANSMISSION ASSEMBLY, Removal.
7. Position jack under lower frame crossmember to support rear of motorcycle. Slide wooden blocks beneath the crankcase to support the weight of the engine and transmission assembly.

NOTE

When removing pivot shaft, make note of spacer position on each side of transmission. Spacers differ slightly in length from each other and must be installed on the same side from which they were removed.

8. Remove pivot shaft. See 2.23 REAR FORK, Removal.
9. Disconnect vehicle speed sensor (VSS). See 7.28 VEHICLE SPEED SENSOR (VSS), Removal.
10. Disconnect neutral switch. See 7.31 NEUTRAL SWITCH, Removal.
11. Mark splines on shift arm and shift shaft to assist in assembly. Remove shift arm from shift shaft.
12. Remove four fasteners that connect transmission to engine.

NOTE

See Figure 6-49. Do not use a hammer to remove transmission. If the transmission sticks or binds on the ring dowels, gently pry away from crankcase using the pry point.

13. Move transmission rearward until two ring dowels in lower flange are free of crankcase. Remove transmission case from left side of the motorcycle.

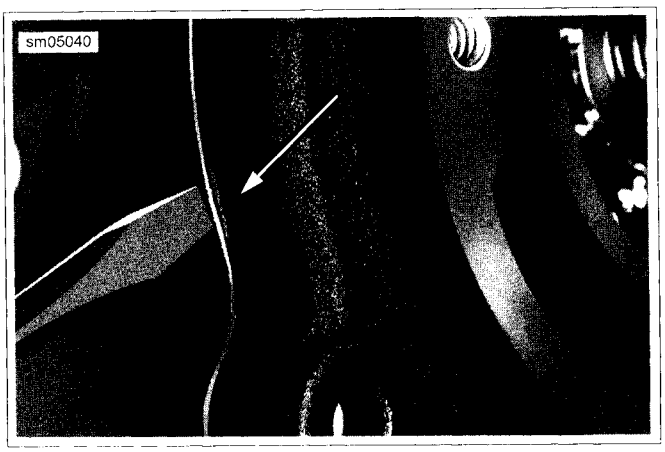


Figure 6-49. Side Door Pry Point

INSTALLATION

1. Install **new** ground post at top of transmission case. Tighten ground post until snug.

NOTE

*A **new** transmission case comes with the shifter shaft sleeve and seal, centering screw, countershaft needle bearing and main drive gear bearing and seal installed.*

2. Thoroughly wipe all engine oil from pockets in crankcase flange.
3. Install **new** gasket engaging two index pins in holes of transmission flange.
4. See Figure 6-50. Verify that transmission dowels are seated. Place transmission case into position behind crankcase. Mate engine and transmission flanges.

NOTE

*Use **new** transmission mounting bolts when installing transmission case. Do not reuse old bolts.*

5. Tighten fasteners.
   a. Using a crosswise pattern, **hand tighten** fasteners. Shorter bolts are installed at the top, longer bolts are installed at the bottom.
   b. Alternately tighten bolts to 15 ft-lbs (20.3 Nm) in the same crosswise pattern.
   c. Final tighten bolts to 34-39 ft-lbs (46.1-52.9 Nm).

NOTE

When installing pivot shaft, make sure spacers are installed on the same side from which they were removed. Spacers differ slightly in length from each other.

6. Install pivot shaft. See 2.23 REAR FORK, Installation.
7. Install shift shaft on shift arm.
8. Install transmission assembly and main drive gear. See 6.6 TRANSMISSION ASSEMBLY, Installation.
9. Adjust drive belt tension. See 1.12 DRIVE BELT AND SPROCKETS.

10. Install primary chaincase. See 5.5 PRIMARY CHAINCASE HOUSING.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

11. Install primary chaincase cover. See 5.3 PRIMARY CHAINCASE COVER.
12. Install the exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.
13. Clean transmission drain plug and install. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Place motorcycle in an upright position. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.

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)

14. Fill primary. See 1.9 PRIMARY CHAINCASE LUBRICANT.
15. Fill engine oil. See 1.6 ENGINE OIL AND FILTER.

⚠WARNING

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

16. Connect battery cables.

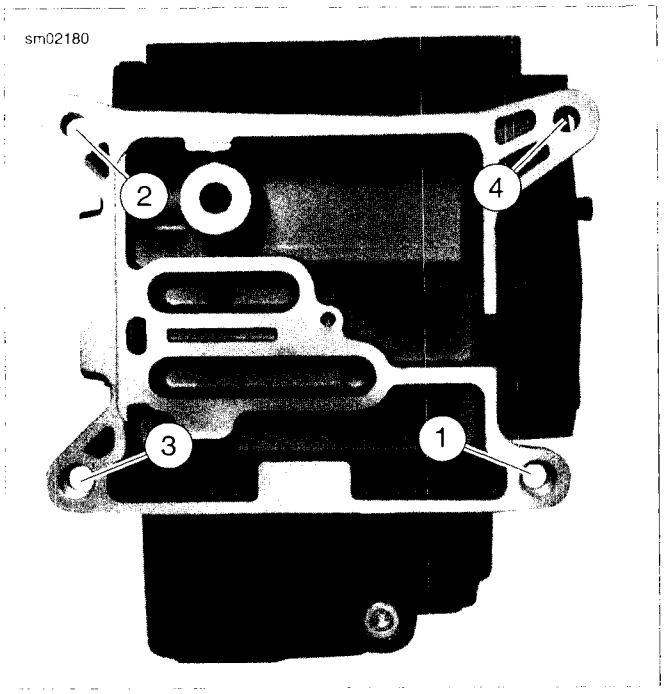


Figure 6-50. Transmission Housing to Crankcase Torque Sequence

DISASSEMBLY

Shifter Arm Assembly

1. See Figure 6-51. After removing door assembly, remove screw (8) and shifter rod lever (9) from the shifter pawl lever assembly (1).
2. Remove retaining ring (7), washer (6) and seal (5). Discard retaining ring and seal. Pull shifter pawl lever assembly out of the transmission case.
3. Inspect sleeve (2) inside transmission case.

CLEANING AND INSPECTION

⚠WARNING

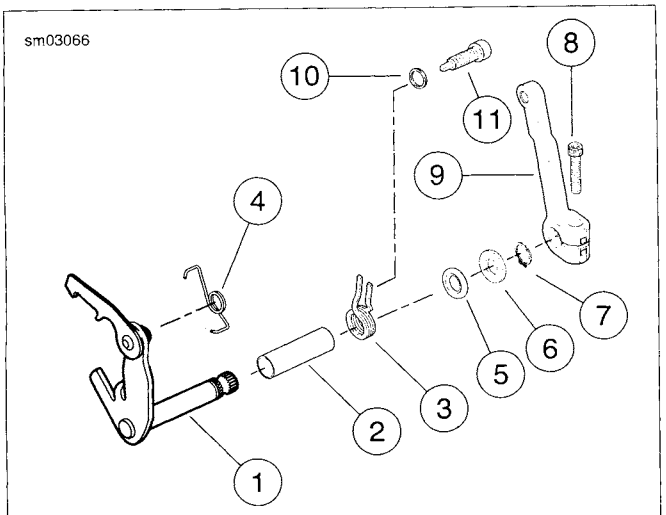
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Clean all parts in solvent except the case and main drive gear needle bearings. Blow parts dry with low pressure compressed air.

NOTE

Never wash the transmission case and needle bearings with solvent. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) leading to bearing failure.

2. See Figure 6-51. Inspect the shifter pawl lever assembly (1) for wear. Replace assembly if pawl ends are damaged. Replace centering spring (3) if elongated.
3. Inspect the shifter spring (4). Replace if the spring fails to hold the pawl on the cam pins.
4. Thoroughly clean the oil pan with solvent.
5. Inspect preformed transmission top cover vent hose for nicks, cuts or general deterioration. Replace as necessary. Use low-pressure compressed air to verify that hose and fitting are unobstructed.



1. **Shifter pawl lever assembly**
2. **Sleeve (inside transmission case)**
3. **Shift lever centering spring**
4. **Shifter shaft lever spring**
5. **Seal**
6. **Washer**
7. **Retaining ring**
8. **Screw**
9. **Shifter rod lever**
10. **Washer**
11. **Screw**

Figure 6-51. Shifter Arm Assembly

ASSEMBLY

Countershaft Needle Bearing Replacement

1. Find a suitable bearing driver 1.25 in. (31.75 mm) in diameter.
2. From the outside of the transmission case place the needle bearing 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 inward flush with the outside surface of the case or to a maximum depth of 0.030 in. (0.76 mm).
3. Lubricate the bearing with transmission lubricant.

Shifter Pawl Lever Assembly

1. See Figure 6-51. Verify that sleeve (2) is inside transmission case.
2. See Figure 6-52. Slide shifter lever centering spring (3) over shaft of shifter pawl lever assembly (2). Align opening on spring with tab on lever.
3. Place shifter shaft lever spring (4) on shifter pawl lever assembly.

NOTE

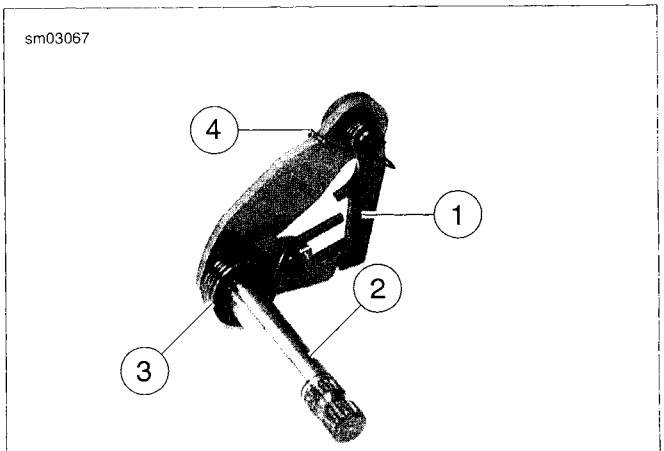
Do not bend shifter shaft lever spring more than necessary for assembly.

4. See Figure 6-53. Insert the assembly into the transmission case.
5. See Figure 6-54. Verify that pin sits inside shifter shaft lever spring.
6. See Figure 6-53. Install a **new** seal. Install washer (1) and a **new** retaining ring (2).

NOTE

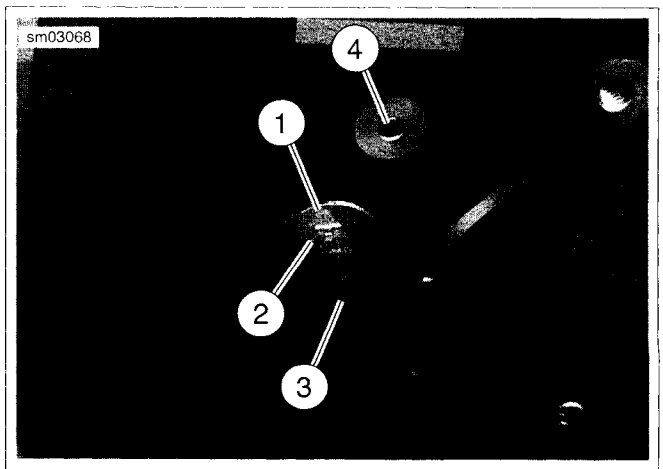
In next step, shifter rod lever must be installed so angle of lever is toward front of vehicle, one spline from vertical.

7. See Figure 6-51. Install shifter rod lever (9) on the shifter pawl lever assembly shaft end using screw (8). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).



1. **Pawl (part of shifter pawl lever assembly)**
2. **Shifter pawl lever assembly**
3. **Shifter lever centering spring**
4. **Shifter shaft lever spring**

Figure 6-52. Shifter Pawl Lever Assembly



1. **Washer (with seal behind)**
2. **Retaining ring**
3. **Shifter shaft lever**
4. **Pin**

Figure 6-53. Shifter Shaft Lever, Exterior View

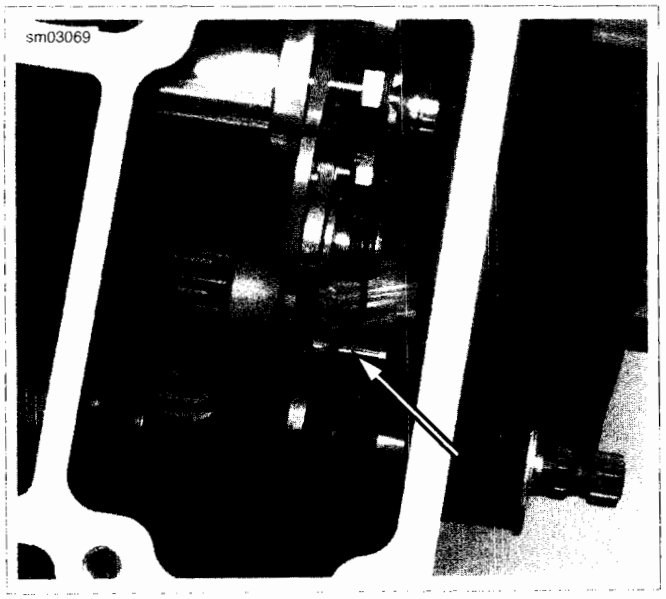


Figure 6-54. Shifter Shaft Lever Spring

NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

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

FASTENER	TORQUE VALUE		NOTES
Active exhaust module fasteners	32-40 **in-lbs**	3.6-4.5 Nm	7.35 ACTIVE EXHAUST, Installation
Auxiliary lamp bracket	72-120 **in-lbs**	8.1-13.6 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, FLST and FLSTC Models
Auxiliary lamp bracket hardware	72-120 **in-lbs**	8.1-13.6 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, FLSTN Models
Auxiliary lamp nut	15-18 ft-lbs	20.3-24.4 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	7.12 BATTERY CABLES, Routing Procedure
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	7.12 BATTERY CABLES, Routing Procedure
Coil cover screw: all but FXCWC	30-40 **in-lbs**	3.4-4.5 Nm	7.21 IGNITION COIL, Installation
Crank Position Sensor (CKP)	90-120 **in-lbs**	10.2-13.6 Nm	7.20 CRANK POSITION SENSOR (CKP), Installation
ECM fasteners: FXCWC	45-55 **in-lbs**	5.1-6.2 Nm	7.3 ELECTRICAL PANEL, Installation: FXCWC
ECM mounting screws: FLST/FLSTC/FLSTN	45-55 **in-lbs**	5.1-6.2 Nm	7.4 ELECTRONIC CONTROL MODULE (ECM), Installation: All But FXCWC
ECM mounting screws: FXST/FXSTC/FLSTF/FLSTFB	30-35 **in-lbs**	3.4-4.0 Nm	7.4 ELECTRONIC CONTROL MODULE (ECM), Installation: All But FXCWC
Electrical panel fasteners	36-60 **in-lbs**	4.1-6.8 Nm	7.3 ELECTRICAL PANEL, Installation: All But FXCWC
Electrical panel fasteners: FXCWC	36-60 **in-lbs**	4.1-6.8 Nm	7.3 ELECTRICAL PANEL, Installation: FXCWC
Flare nut socket locknut	18 ft-lbs	24.4 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Front instrument panel screw	30-40 **in-lbs**	3.4-4.5 Nm	7.25 INSTRUMENT CONSOLE: FXCWC, Installation
Handlebar switch clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.38 RIGHT HANDLEBAR SWITCH, Installation
Handlebar switch clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.39 LEFT HANDLEBAR SWITCH, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.38 RIGHT HANDLEBAR SWITCH, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.39 LEFT HANDLEBAR SWITCH, Installation
Headlamp circuit board/pin housing screw	40-48 **in-lbs**	4.5-5.4 Nm	7.16 TAIL LAMP: ALL BUT FLSTN, Base Replacement
Headlamp lens base screws	20-24 **in-lbs**	2.3-2.7 Nm	7.16 TAIL LAMP: ALL BUT FLSTN, Base Replacement
Horn bracket clamp	80-100 **in-lbs**	9.0-11.3 Nm	7.34 HORN, Removal and Installation: All But FXCWC
Horn bracket mounting bolt: FXCWC	13-15 ft-lbs	17.64-20.36 Nm	7.34 HORN, Removal and Installation: FXCWC
Horn bracket nut	80-100 **in-lbs**	9.0-11.3 Nm	7.34 HORN, Removal and Installation: All But FXCWC
Horn bracket screws	35-55 **in-lbs**	4.0-6.2 Nm	7.34 HORN, Removal and Installation: All But FXCWC
Horn cover screws: FXCWC	40-50 **in-lbs**	4.52-5.65 Nm	7.34 HORN, Removal and Installation: FXCWC
Ignition/light switch bracket locknuts	12-15 ft-lbs	16.3-20.4 Nm	7.11 IGNITION AND LIGHT SWITCH, Removal and Installation: FXCWC

FASTENER	TORQUE VALUE		NOTES
Ignition/light switch nut	115-135 **in-lbs**	13.0-15.3 Nm	7.11 IGNITION AND LIGHT SWITCH, Removal and Installation: FXCWC
Ignition coil nut (FXCWC only)	115-135 **in-lbs**	13.0-15.3 Nm	7.21 IGNITION COIL, Installation
Ignition coil screws (all except FXCWC)	120-180 **in-lbs**	13.6-20.3 Nm	7.21 IGNITION COIL, Installation
Indicator lamp console nut	7-11 ft-lbs	9.5-14.9 Nm	7.29 INDICATOR LAMPS: ALL BUT FXCWC, Installation
Instrument panel acorn nut	7-11 ft-lbs	9.5-14.9 Nm	7.11 IGNITION AND LIGHT SWITCH, Removal and Installation: All But FXCWC
License plate bracket (tail lamp for HDI) fasteners: FXCWC	57-63 **in-lbs**	6.45-7.12 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
License plate bracket fasteners	30-50 **in-lbs**	3.4-5.6 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
License plate support fasteners	60-90 **in-lbs**	6.8-10.2 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	7.14 STARTER SOLENOID, Solenoid Contacts
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	7.31 NEUTRAL SWITCH, Installation
Oil pressure switch	96-144 **in-lbs**	10.8-16.3 Nm	7.32 OIL PRESSURE SWITCH, Installation
Rear instrument panel acorn nut	30-40 **in-lbs**	3.4-4.5 Nm	7.25 INSTRUMENT CONSOLE: FXCWC, Installation
Rear stoplight switch	12-15 ft-lbs	16.3-20.3 Nm	7.33 REAR STOPLIGHT SWITCH, Installation
Signal lamp mounting bracket screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Signal lamp mounting bracket screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	7.13 STARTER, Field Coil Assembly
Speedometer console nut	7-11 ft-lbs	9.5-14.9 Nm	7.26 SPEEDOMETER: ALL BUT FXCWC, Installation
Speedometer housing cup	50-60 **in-lbs**	5.7-6.8 Nm	7.25 INSTRUMENT CONSOLE: FXCWC, Installation
Splash guard fasteners: FXCWC	36-60 **in-lbs**	4.1-6.8 Nm	7.3 ELECTRICAL PANEL, Installation: FXCWC
Splash guard screw: all but FXCWC	36-48 **in-lbs**	4.1-5.4 Nm	7.3 ELECTRICAL PANEL, Installation: All But FXCWC
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	7.13 STARTER, Field Coil Assembly
Starter mounting bolts	25-27 ft-lbs	33.9-36.6 Nm	7.13 STARTER, Installation
Starter nut	70-90 **in-lbs**	7.9-10.2 Nm	7.12 BATTERY CABLES, Routing Procedure
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	7.13 STARTER, Field Coil Assembly
Stator screws	55-75 **in-lbs**	6.2-8.4 Nm	7.23 ALTERNATOR, Installation/T27 TORX, use only once
Tail lamp connector cover fastener	8-30 **in-lbs**	0.9-3.4 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
Tail lamp fastener: FLSTN	8-30 **in-lbs**	0.9-3.4 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
Tail lamp fasteners	60-90 **in-lbs**	6.8-10.2 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm	7.16 TAIL LAMP: ALL BUT FLSTN, Bulb Replacement
Turn/running/stop lamp fastener: FXCWC	10-12 ft-lbs	13.57-16.28 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
Turn signal bar screws: FLSTN	15-19 ft-lbs	20.4-25.8 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
Vehicle speed sensor mounting bolt	84-108 **in-lbs**	9.5-12.2 Nm	7.28 VEHICLE SPEED SENSOR (VSS), Installation
Voltage regulator	50-80 **in-lbs**	5.7-9.0 Nm	7.7 FRONT ELECTRICAL CADDY, Assembly

FASTENER	TORQUE VALUE		NOTES
Voltage regulator bracket to crankcase fasteners	70-100 **in-lbs**	7.9-11.3 Nm	7.7 FRONT ELECTRICAL CADDY, Assembly

SPECIFICATIONS

Table 7-1. Ignition System Specifications

IGNITION	DATA
Idle speed	950-1050 RPM
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in.
	0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance	0.5-0.7 ohms
Ignition coil secondary resistance	5500-7500 ohms

Table 7-2. Circuit Breaker/Fuses

CIRCUIT BREAKER/FUSES	RATING (AMPERES)
Main fuse	40
Ignition fuse	15
Lights fuse	15
Accessory fuse	15
Instruments fuse	15
Battery fuse	15
Fuel pump fuse	15
ECM power fuse	15
Engine control fuse	15
Headlamp fuse	15
P&A Fuse	2

Table 7-3. Charging System

CHARGING SYSTEM	DATA
Battery	19 amp hour/270 CCA
Alternator AC voltage output	16-23 VAC per 1000 RPM
Alternator stator coil resistance	0.1-0.2 ohms
Regulator voltage output @ 3600 RPM	14.3-14.7 @ 75° F (24° C)
Regulator amperes @ 3000 RPM	35-50 amps

Table 7-4. Starter Specifications

STARTER DATA	
Free speed	3000 RPM (min.) @ 11.5 V
Free current	90 amp (max.) @ 11.5 V
Cranking current	200 amp (max.) @ 68°F
Stall torque	8.0 ft-lbs (10.8 Nm) @ 2.4 V

Table 7-5. Starter Service Wear Limits

ITEM	IN.	MM.
Brush length (minimum)	0.443	11.0
Commutator runout	0.016	0.41
Commutator diameter (minimum)	1.141	28.98
Commutator mica depth (minimum)	0.008	0.203

GENERAL

All Softail models use a panel under the rear fender to mount important electrical components. This electrical panel contains:

- Turn signal module (TSM), turn signal security module (TSSM) and connector or hands free security module HFSM [30].
- Security siren connector [142].

Use the following removal and installation information to service electrical panel components.

REMOVAL: ALL BUT FXCWC

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 right side saddlebag if present.

NOTE

Rear wheel may have to be raised slightly to allow for splash guard removal.

4. Remove bolt from lower end of splash guard. Lift up on tabs and pull lower end of splash guard toward rear tire.
5. Pull upper end of splash guard off rear fork and move splash guard from motorcycle.
6. Remove turn signal, turn signal security or hands free security module and vapor valve from tabs in electrical panel.

NOTE

If security siren is not installed, remove security siren connector [142] from receptacle in electrical panel.

7. If installed, remove security siren from tabs in electrical panel.
8. On California models, remove canister and tubing from electrical panel.
9. Remove electrical panel fasteners and remove electrical panel by disengaging tab at bottom of panel from slot in transmission case.

INSTALLATION: ALL BUT FXCWC

1. Place electrical panel into position by installing tab on panel into slot in bottom of transmission case.
2. Install electrical panel fasteners. Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).

NOTE

On California models, connect canister tubing to electrical panel before installing vapor valve. Canister tubing is installed to the right of vapor valve tubing.

3. Install vapor valve.
4. Install turn signal, turn signal security or hands free security module.

NOTE

See Figure 7-1. If security siren is not installed, install security siren connector [142] into receptacle in electrical panel.

5. If vehicle is equipped with a security siren, install security siren.
6. Place splash guard into position and snap upper end onto rear fork.
7. Press lower end against swing arm until the tabs snap *into* place.
8. Install screw to secure splash guard. Tighten to 36-48 **in-lbs** (4.1-5.4 Nm).
9. Install right side saddlebag if removed.
10. Connect negative battery cable.

⚠WARNING

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

11. Install seat.

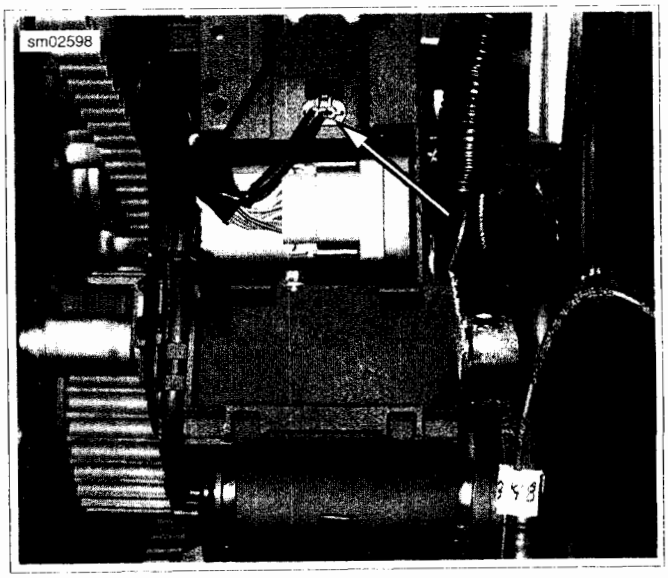


Figure 7-1. Siren Connector Receptacle

REMOVAL: FXCWC

1. Remove rear fender. See 2.35 REAR FENDER: FXCWC.
2. Remove splash guard.
3. See Figure 7-3. Remove TSM/TSSM/HFSM (3) and vapor valve (5).
4. Remove optional security siren, if equipped; or detach security siren connector (2) from electrical panel.

5. On California models, remove canister and tubing from electrical panel.
6. Remove bolts (1, 4).
7. Pull electrical panel toward rear tire and detach ECM connector from ECM.
8. See Figure 7-2. Remove electrical panel from motorcycle and remove ECM from electrical panel, if needed.

INSTALLATION: FXCWC

1. See Figure 7-2. Install ECM to electrical panel. Tighten fasteners to 45-55 **in-lbs** (5.1-6.2 Nm).
2. See Figure 7-3. Place electrical panel into position and secure with bolts (1, 4). Tighten fasteners to 36-60 **in-lbs** (4.1-6.8 Nm).
3. On California models, install canister and tubing to electrical panel.
4. Install optional security siren, if equipped; or attach security siren connector (2) to electrical panel.
5. Install TSM/TSSM/HFSM (3) and vapor valve (5).
6. Install splash guard. Tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
7. Install rear fender. See 2.35 REAR FENDER: FXCWC.

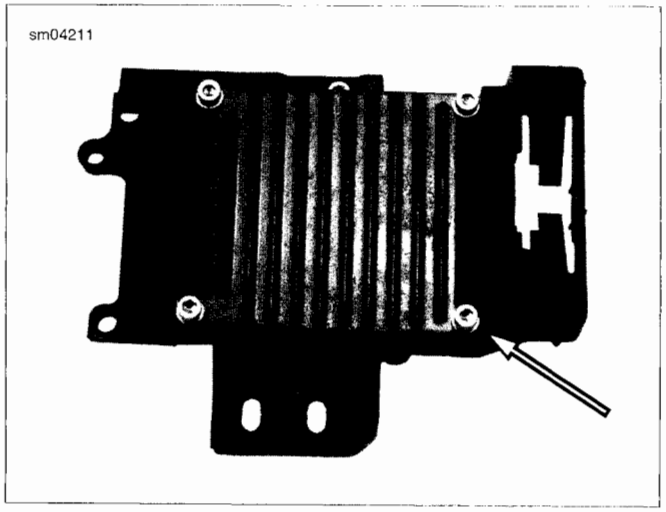
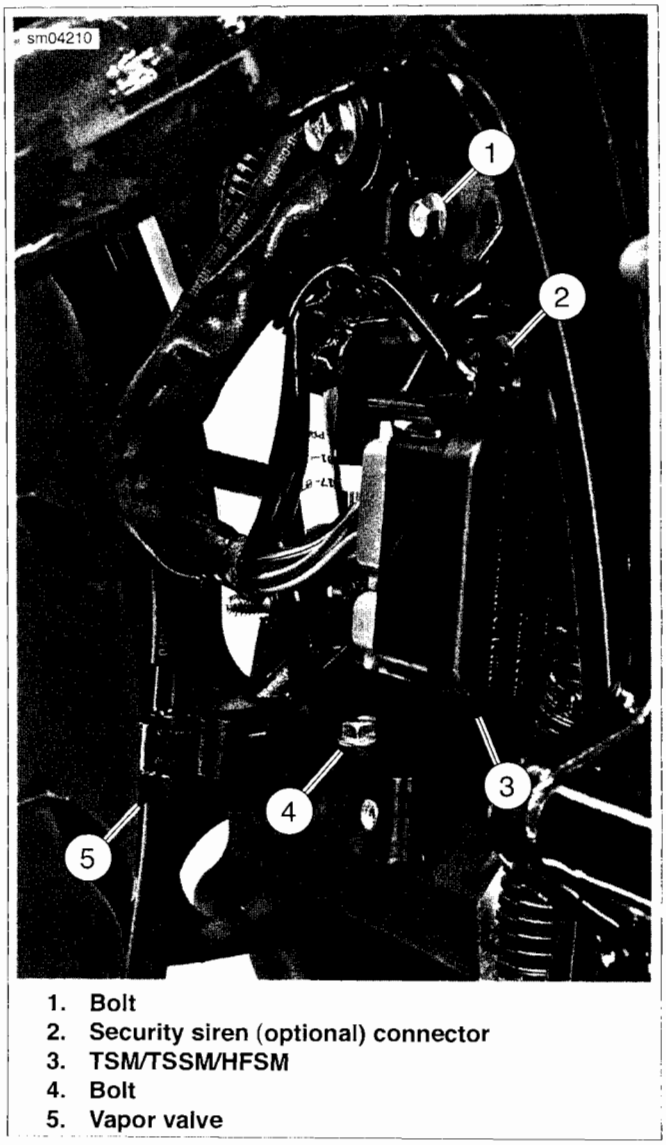


Figure 7-2. ECM: FXCWC



1. **Bolt**
2. **Security siren (optional) connector**
3. **TSM/TSSM/HFSM**
4. **Bolt**
5. **Vapor valve**

Figure 7-3. Electrical Panel: FXCWC

GENERAL

All but FXCWC: The electronic control module (ECM) is mounted under the seat.

FXCWC: The electronic control module (ECM) is mounted on the forward facing side of the rear electrical panel.

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the electronic control module.

NOTE

The ECM cannot be repaired. Replace the unit if it fails.

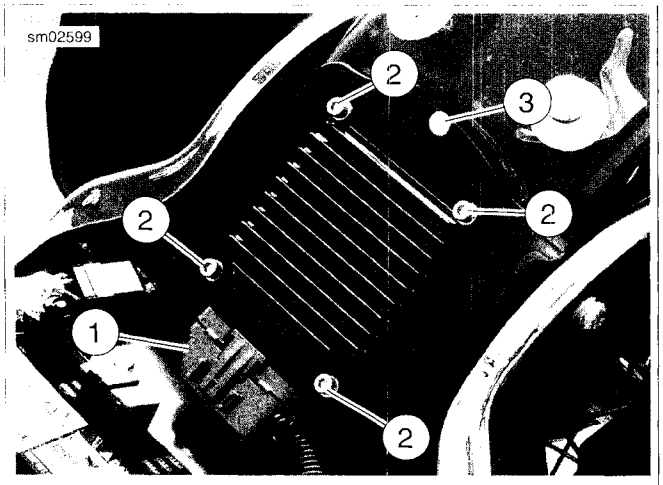
REMOVAL: ALL BUT FXCWC

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. Remove ECM from mounting bracket.
   a. For FLST/FLSTC/FLSTN, see Figure 7-4. Remove four screws (2) holding ECM to mounting bracket. Press latch on connector [78] and disconnect from ECM.
   b. For FXST/FXSTC/FLSTF/FLSTFB/FLSTSB, see Figure 7-5. Remove four nuts and washers holding ECM to mounting bracket. Press latch on connector [78] and disconnect from ECM.



1. **ECM connector [78]**
2. **Screw (4)**
3. **Nylon fastener**

Figure 7-4. ECM Mount: FLST/FLSTC/FLSTN

INSTALLATION: ALL BUT FXCWC

1. Attach ECM connector [78] to ECM.
2. Install ECM on mounting bracket.
   a. For FLST/FLSTC/FLSTN, see Figure 7-4. Install four screws (2) that secure ECM to mounting bracket. Tighten to 45-55 **in-lbs** (5.1-6.2 Nm).
   b. For FXST/FXSTC/FLSTF/FLSTFB/FLSTSB, see Figure 7-5. Install four nuts and washers that secure ECM to mounting bracket. Tighten to 30-35 **in-lbs** (3.4-4.0 Nm).
3. Install main fuse.

⚠WARNING

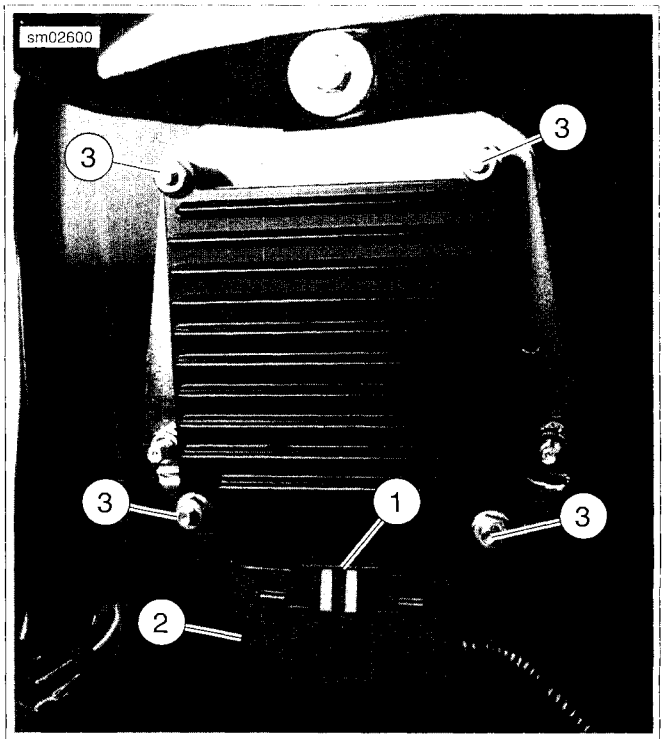
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

4. Install seat.

NOTE

After installing ECM, the password learn procedure must be performed.

5. Perform password learn procedure. See 7.43 TSM/HFSM: PASSWORD LEARN.



1. **ECM connector [78A]**
2. **ECM connector [78B]**
3. **Nut (4)**

Figure 7-5. ECM Mount: FXST/FXSTC/FLSTF/FLSTFB/FLSTSB

REMOVAL: FXCWC

See 7.3 ELECTRICAL PANEL, Removal: FXCWC for ECM removal.

INSTALLATION: FXCWC

1. Install ECM. See 7.3 ELECTRICAL PANEL, Installation: FXCWC for ECM Installation.

NOTE

After installing ECM, the password learn procedure must be performed.

2. Perform password learn procedure. See 7.43 TSM/HFSM: PASSWORD LEARN.

TURN SIGNAL AND SECURITY MODULE (TSM/TSSM/HFSM) 7.5

GENERAL

The turn signal module (TSM) has two major functions:

- Control turn signals.
- Serve as bank angle sensor.

The optional, factory-installed, Harley-Davidson Smart Security System (**H-DSSS**) includes a Hands-Free Security Module (**HFSM**) which provides the same functions as the TSM, but also includes security and immobilization functions.

Security systems sold in Japan and Korea meet those country's regulatory requirements. These systems are identified as Turn Signal Security Modules (**TSSM**) which provides the same functions as the TSM, but also includes security and immobilization functions.

TSM/HFSM/TSSM CONFIGURATION

- After replacing TSSM, check if a password learning process is necessary. For more information, refer to Table 7-6. For information on the password learning procedure, see 7.43 TSM/HFSM: PASSWORD LEARN.
- After replacement of TSM/TSSM/HFSM, always perform key fob assignment and personal code entry. See 7.42 H-DSSS ACTUATION, Actuation.

Table 7-6. Password Learning Needed?

Device Replaced	Is Password Learn Necessary?
ECM	Yes
TSM	No*
TSM/HFSM	Yes

*If a TSM has been replaced by an HFSM, or an HFSM has been replaced by a TSM, password learn **is** necessary.

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. See Figure 7-6. Follow removal instructions under 7.3 ELECTRICAL PANEL.
4. Unplug turn signal module connector [30].

INSTALLATION

1. See Figure 7-6. Connect turn signal module connector [30]. Follow installation instructions under 7.3 ELECTRICAL PANEL.
2. Install main fuse.

⚠WARNING

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

3. Test for correct operation.
4. Perform steps listed under TSM/HFSM/TSSM CONFIGURATION in this 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)

5. Install seat.

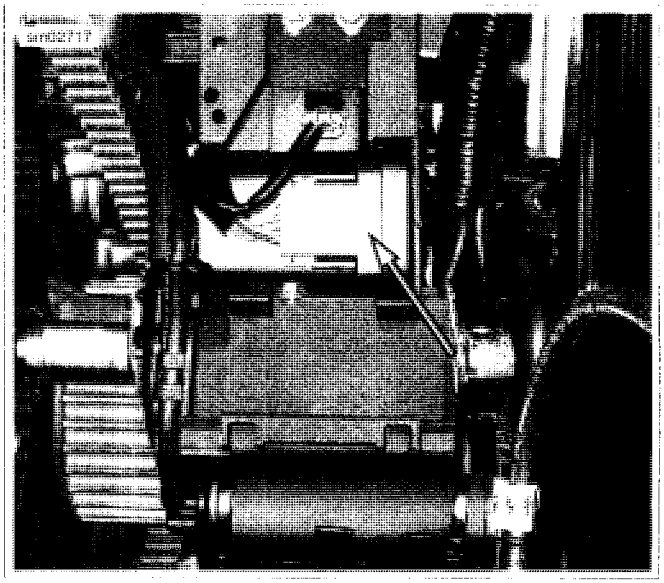


Figure 7-6. Turn Signal/Security Module Location

GENERAL

NOTE

The voltage regulator cannot be repaired. Replace the unit if it fails. For diagnostic information see the ELECTRICAL DIAGNOSTIC MANUAL.

See 7.7 FRONT ELECTRICAL CADDY for voltage regulator removal and installation procedures.

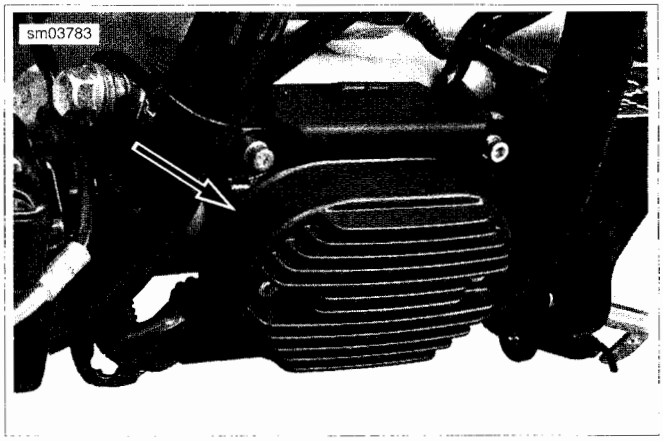


Figure 7-7. Voltage Regulator

GENERAL

The front electrical caddy is located in front of the engine. It contains the voltage regulator, crank position sensor connector, stator connector, voltage regulator connector, front oxygen sensor connector, and jiffy stand interlock connector (HDI only).

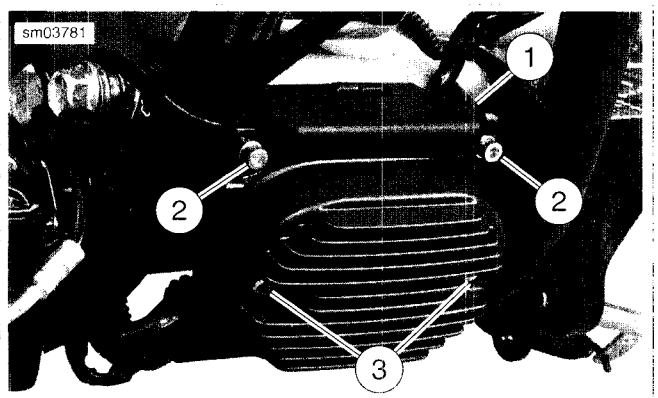
DISASSEMBLY

1. Remove seat.

⚠WARNING

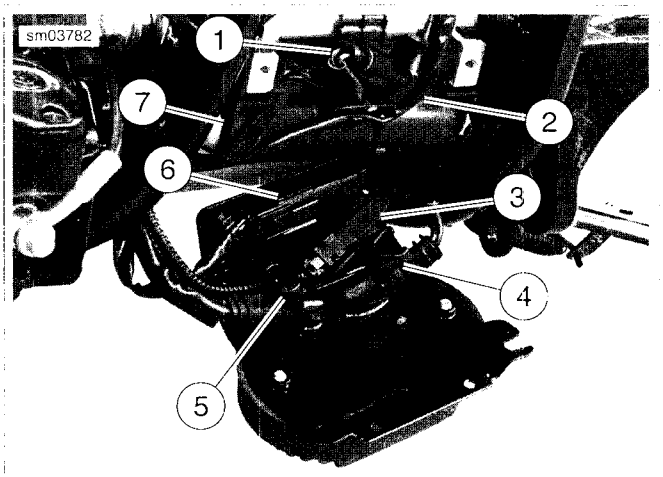
To prevent accidental vehicle start-up, which could cause death or serious injury, remove main fuse before proceeding. (00251b)

2. Disconnect main fuse. See 7.10 MAIN FUSE.
3. See Figure 7-8. Remove cover (1).
4. Loosen fasteners (3) securing voltage regulator.
5. Remove fasteners (2) securing voltage regulator bracket to crankcase.
6. See Figure 7-9. Rotate connector locks (4, 5) out of the way and disconnect voltage regulator connectors.
7. Remove fasteners securing voltage regulator and remove voltage regulator.
8. Remove crank position sensor connector (3) and jiffy stand interlock connector (6) from voltage regulator bracket.
9. Remove front oxygen sensor connector (1) and horn wiring (FXCWC) (2) from caddy (7). Remove caddy.



1. **Cover**
2. **Fasteners**
3. **Fasteners**

Figure 7-8. Front Electrical Caddy Access



1. **Front oxygen sensor connector**
2. **Horn wiring (FXCWC)**
3. **Crank position sensor connector**
4. **Stator connector lock**
5. **Voltage regulator connector lock**
6. **Jiffy stand interlock connector**
7. **Caddy**

Figure 7-9. Electrical Caddy Connectors

ASSEMBLY

1. See Figure 7-9. Install caddy (7). Route horn wiring (FXCWC) (2) and place front oxygen sensor connector (1) into position shown.
2. Install crank position sensor connector (3) and jiffy stand interlock connector (6) on voltage regulator bracket. Replace connector clips as necessary.
3. See Figure 7-8. Install voltage regulator with fasteners (3). Do not tighten fasteners at this time.
4. See Figure 7-9. Connect voltage regulator connectors and rotate connector locks (4, 5) down into position to secure connections .
5. See Figure 7-8. Install fasteners (2) securing voltage regulator bracket to crankcase. Tighten fasteners to 70-100 **in-lbs** (7.9-11.3 Nm).
6. Tighten fasteners (3) securing voltage regulator to regulator bracket to 50-80 **in-lbs** (5.7-9.0 Nm).
7. Install cover (1).
8. Connect main fuse. See 7.10 MAIN FUSE.

⚠WARNING

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

9. Install seat.

GENERAL

See Figure 7-10. The fuse block is below the seat and behind the battery. The block contains eleven 15-ampere replaceable fuses.

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. See Figure 7-11 (all but FXCWC) or Figure 7-12 (FXCWC). Pull cover away from fuse block.
4. See Figure 7-13. Replace suspect fuse.

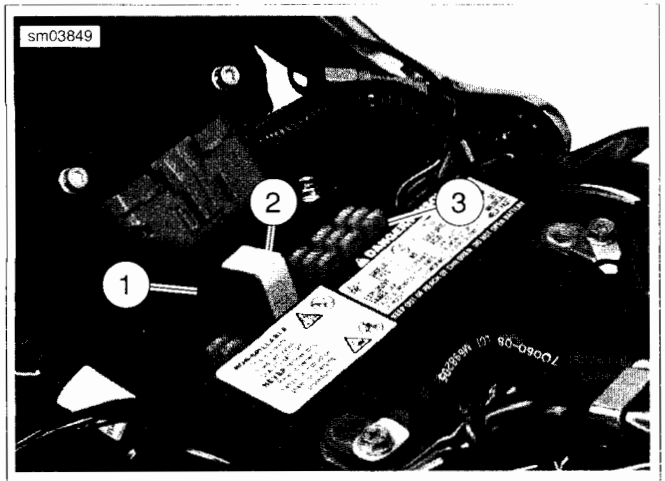
INSTALLATION

1. Place cover over fuse block.
2. 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)

3. Install seat.



1. System relay
2. Starter relay
3. Fuse block

Figure 7-10. Fuse Block

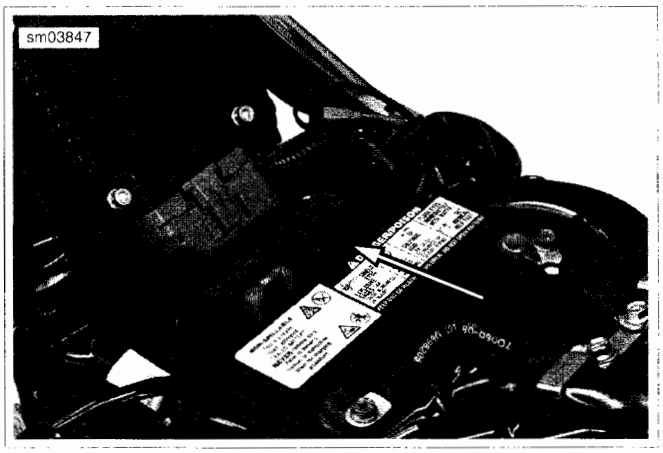


Figure 7-11. Fuse Block Cover (All Except FXCWC)

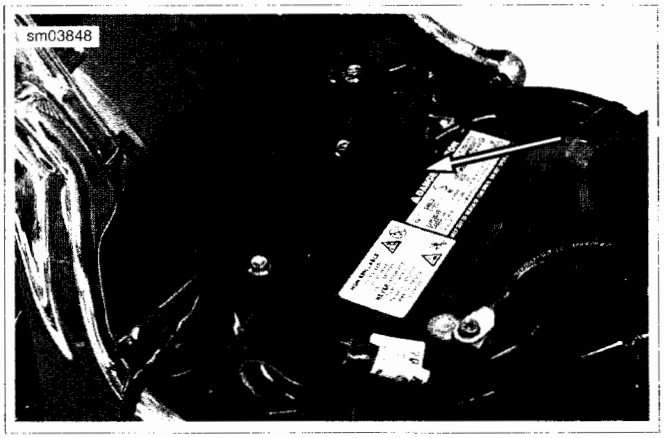
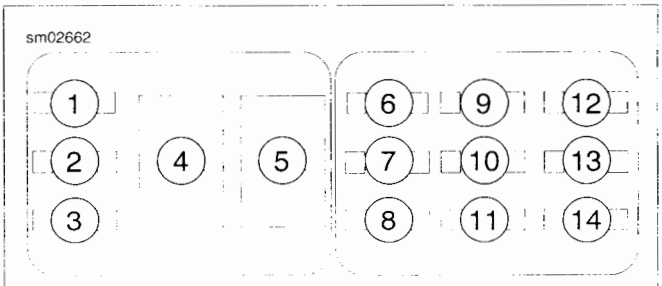


Figure 7-12. Fuse Block Cover (FXCWC)



1. Fuel pump fuse
2. Spare 15 amp fuse
3. Spare 15 amp fuse
4. System relay
5. Start relay
6. Lights fuse
7. Ignition fuse
8. Instruments fuse
9. Accessories fuse
10. Battery fuse
11. P&A fuse (2 amp max)
12. Headlamp fuse
13. Engine control fuse
14. ECM power fuse

Figure 7-13. Fuse Block: Top View

GENERAL

The starter relay and EFI system relay are located in the fuse block which is below the seat and behind the battery.

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. Pull cover away from fuse block.
4. See Figure 7-14. Replace suspect relay (1) or (2).

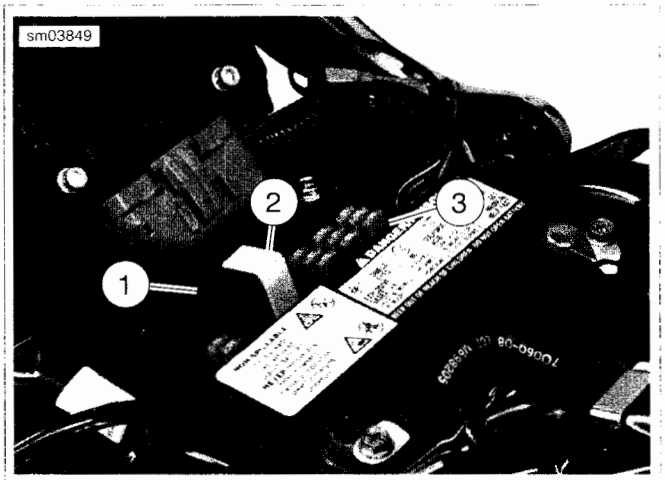
INSTALLATION

1. Place cover over fuse block.
2. 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)

3. Install seat.



1. **System relay**
2. **Starter relay**
3. **Fuse block**

Figure 7-14. Fuse Block

REMOVAL

1. Remove seat.
2. See Figure 7-15 (all but FXCWC) or Figure 7-16 (FXCWC). Remove main fuse holder from storage position.
3. Pull main fuse from fuse holder.

INSTALLATION

1. Push main fuse into fuse holder.
2. See Figure 7-15 (all but FXCWC) or Figure 7-16 (FXCWC). Place fuse holder with fuse in proper storage location.
   a. **All except FXCWC:** storage location is molded into fuse block cover.
   b. **FXCWC only:** storage location is molded into battery caddy on left side of 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)

3. Install seat.

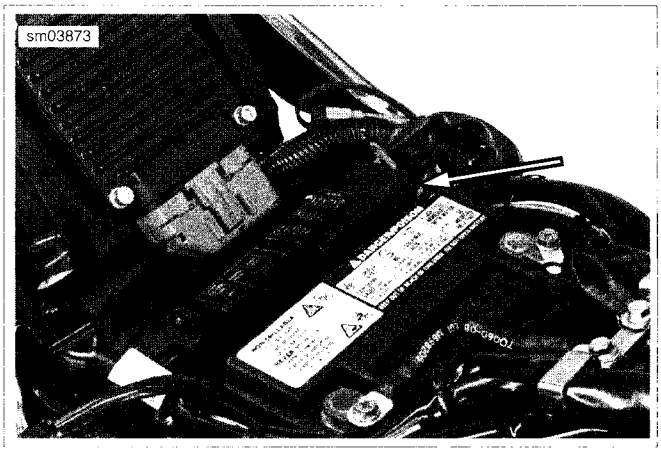


Figure 7-15. Main Fuse Location (All Except FXCWC)

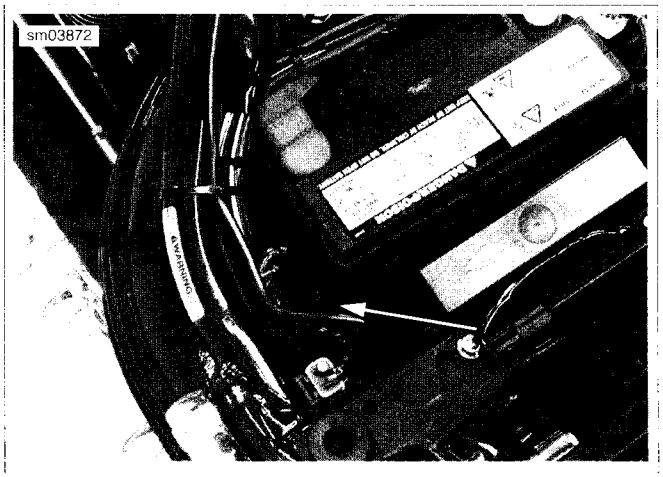


Figure 7-16. Main Fuse Location (FXCWC Only)

GENERAL

⚠WARNING

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

Softail model ignition/light/key switches are non-repairable. If a switch is damaged, it must be replaced. Key switch functions and locations are listed in Table 7-7.

REMOVAL AND INSTALLATION: ALL BUT FXCWC

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. See Figure 7-17. Remove acorn nut and washer (1) from panel (2 or 5) and remove panel. Note position and color of the switch wire connectors. Disconnect wires.
4. Remove mounting screws (4). Replace switch.
5. Install mounting screws (4).
6. Reconnect switch wire connectors in their original positions.
7. Install instrument panel using acorn nut and washer. Tighten to 7-11 ft-lbs (9.5-14.9 Nm).
8. Install main fuse.

⚠WARNING

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

9. Install seat.

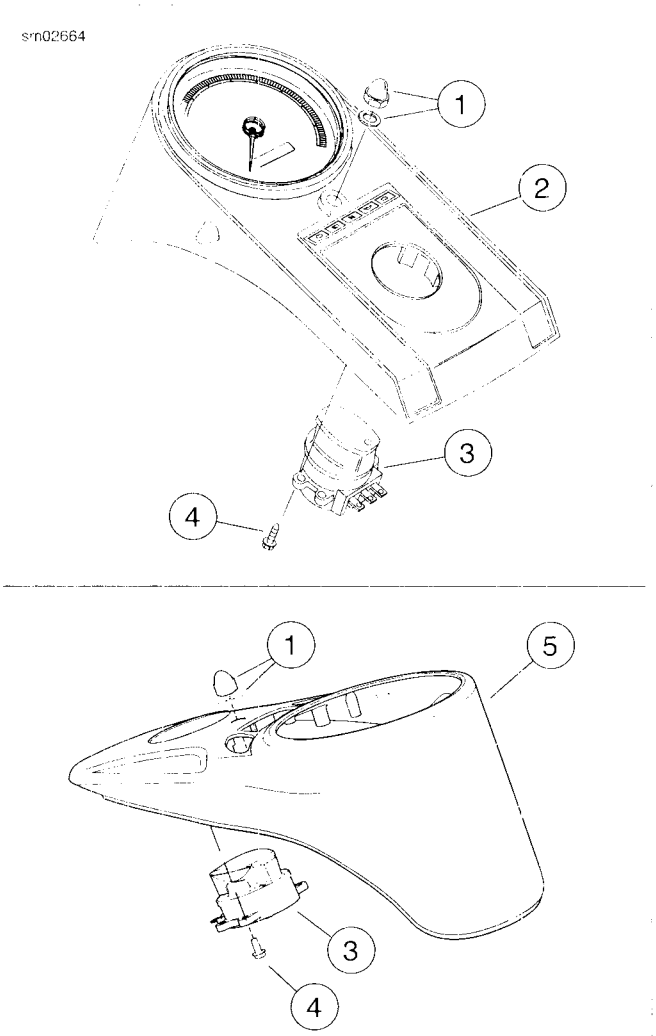
⚠WARNING

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. Refer to Table 7-7. Test vehicle operation.

NOTE

Harley-Davidson recommends removing key from lock before operating motorcycle. If you do not remove key, key can fall out during operation.



1. Nut and washer
2. Panel: all but FLSTSB
3. Ignition switch
4. Mounting screws
5. Panel: FLSTSB

Figure 7-17. Ignition Switch: All But FXCWC

Table 7-7. Key Switch Functions and Positions

Model and Location	Domestic Switch	HDI Switch
All but FXCWC: tank console. **FXCWC:** right side of engine.	OFF - Ignition and lights are off. Key may be removed.	Same
	ACC. - Instrument lights are on. Brake light and horn can be activated.	Same; in addition, position lamp, tail lamp are ON.
	IGNITION - Hazard warning flasher can be turned on. Ignition, lights and accessories are on.	Same; in addition, position lamp is ON.

REMOVAL AND INSTALLATION: FXCWC

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. See Figure 7-18. Remove screw (7).
4. Remove nut (6) and washer (5). Slide ignition coil out of the way.
5. Remove locknuts (9) and slide bracket (3) away from ignition/light switch (2).
6. Remove fuel tank. See 4.6 FUEL TANK.

NOTE

Make note of proper wire routing for ignition/light switch harness before removing it from the motorcycle.

7. Disconnect ignition/light switch electrical connector.
8. Replace ignition/light switch.
9. Connect ignition/light switch electrical connector.
10. Install fuel tank. See 4.6 FUEL TANK.
11. See Figure 7-18. Slide bracket (3) over ignition/light switch (2) and install locknuts (9). Tighten locknuts to 12-15 ft-lbs (16.3-20.4 Nm)
12. Place ignition coil into position and install washer (5) and nut (6). Tighten nut to 115-135 **in-lbs** (13.0-15.3 Nm).
13. Install screw (7).
14. Install main fuse.

⚠WARNING

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

15. Install seat.

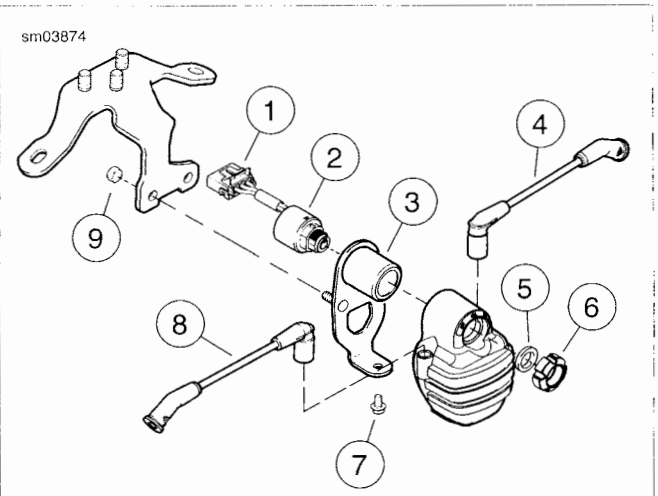
⚠WARNING

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

16. Refer to Table 7-7. Test vehicle operation.

NOTE

Harley-Davidson recommends removing key from lock before operating motorcycle. If you do not remove key, key can fall out during operation.



1. **Ignition/light switch connector**
2. **Ignition/light switch**
3. **Bracket**
4. **Rear cylinder spark plug cable**
5. **Washer**
6. **Nut**
7. **Screw**
8. **Rear cylinder spark plug cable**
9. **Locknut (2)**

Figure 7-18. Ignition/Light Switch: FXCWC Only

ROUTING PROCEDURE

1. See Figure 7-19. Position positive battery cable properly at starter. Cable end must face 35° +/-10° forward from left side of vehicle.

⚠WARNING

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

2. Tighten starter nut to 70-90 **in-lbs** (7.9-10.2 Nm) and cover with boot.
3. See Figure 7-20. Place battery caddy into position and install battery caddy clip (1) under front of battery tray (3). Make sure tabs (2) of battery caddy fit over rear of battery tray.
4. See Figure 7-21. Install positive battery cable (1) into clip in caddy.
5. Route rear oxygen sensor harness (2) through clip (3).

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)

6. See Figure 7-22. Install battery. Tighten positive battery terminal fastener to 60-72 **in-lbs** (6.8-8.1 Nm).
7. Install negative battery cable (2) at battery frame ground (1 or 4) before any accessory ground wires.
8. Install negative battery cable (2) at battery. Tighten negative battery terminal fastener to 60-72 **in-lbs** (6.8-8.1 Nm).

⚠WARNING

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

9. Install seat.

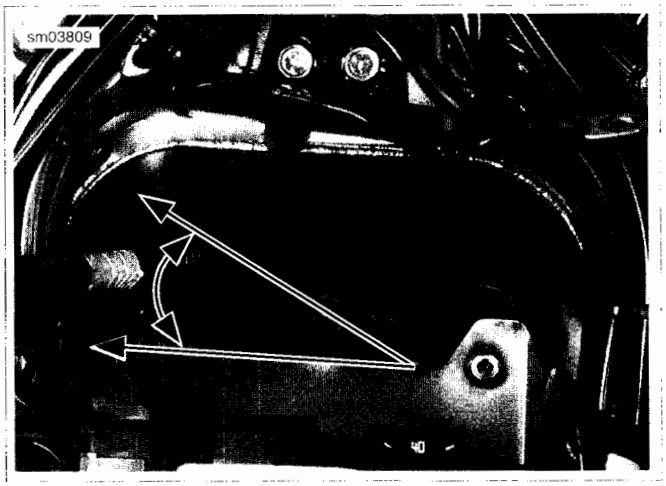
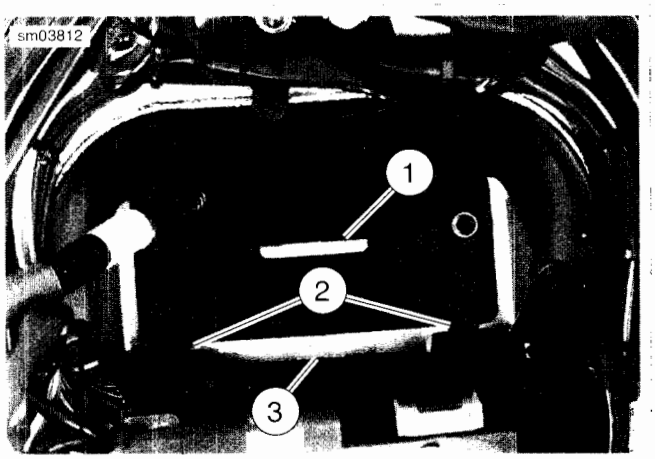
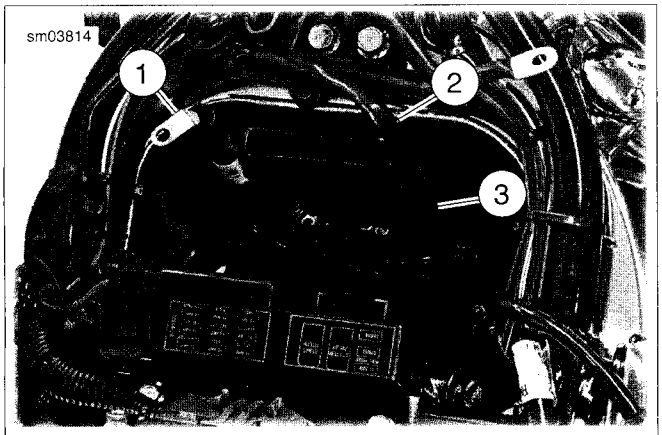


Figure 7-19. Positive Battery Cable Routing



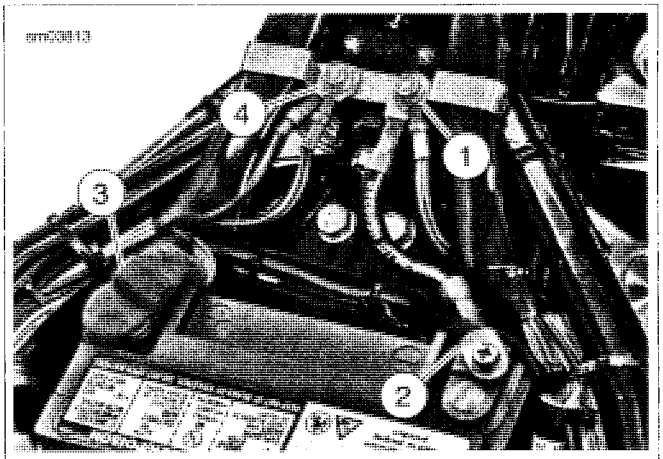
1. **Clip**
2. **Tabs**
3. **Battery tray**

Figure 7-20. Battery Caddy



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

Figure 7-21. Battery Caddy Wire Routing



1. Battery frame ground: All but FXCWC
2. Negative battery cable
3. Positive battery cable
4. Battery frame ground: FXCWC

Figure 7-22. Battery Connections

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

⚠WARNING

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

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.
2. Remove oil tank to provide clearance for starter removal. See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC.
3. See Figure 7-25. Remove both starter mounting fasteners (2).
4. Detach solenoid wire (4).
5. Remove starter from right side of motorcycle.
6. Before disassembling the starter, perform diagnostics listed in the ELECTRICAL DIAGNOSTIC MANUAL.

FIELD COIL ASSEMBLY

Disassembly

1. Remove screw to release end cover, if equipped.
2. Remove two nuts to release end cover bracket from thru bolts, if equipped.
3. Pull up rubber boot and remove hex nut with captive lockwasher to release field wire ring terminal from post on solenoid housing.
4. Loosen two thru bolts to release field coil from solenoid housing.
5. Pull field coil with end cap from solenoid housing.
6. Remove armature from field coil. Separating end cap and field coil flanges will facilitate removal.
7. Placing field coil on wooden block to prevent damage, use impact driver to remove two screws with captive washers from end cap. Discard screws.
8. Remove end cap from field coil.
9. 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.

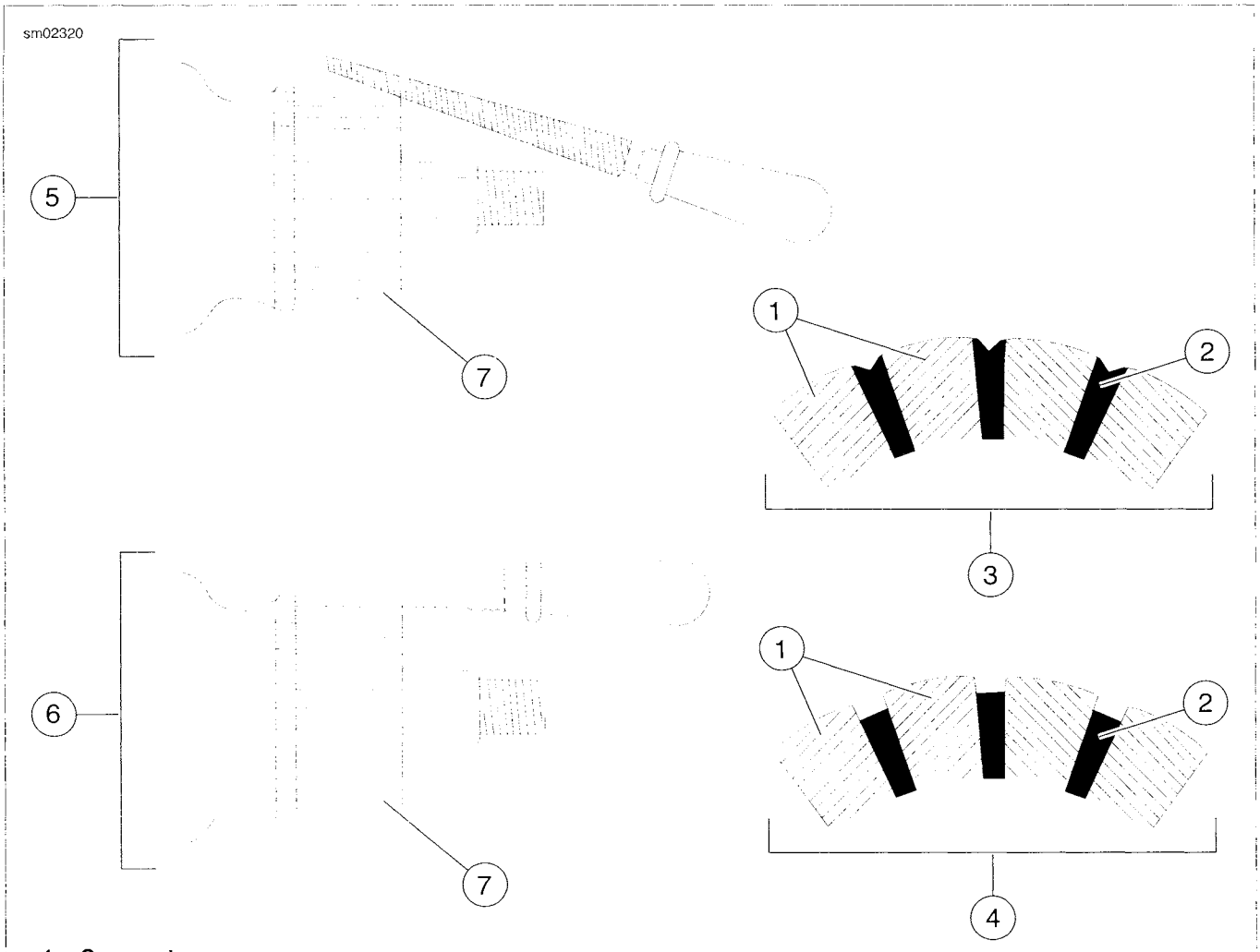
Inspection

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 7-23. 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 7-23. 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 degrees. 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 7-24.
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** screws with captive washers. Tighten screws until snug.

8. Install thru bolts to fasten field coil to solenoid housing. 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 nuts and tighten until snug.
11. Install screw to fasten end cover to end cover bracket, if equipped. Tighten screw to 90-110 **in-lbs** (10.2-12.4 Nm).

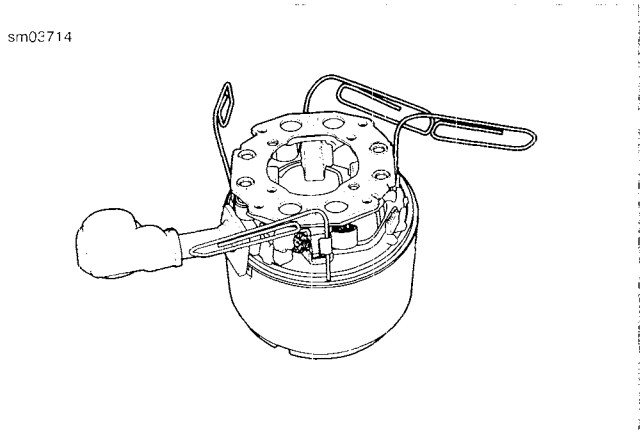


Figure 7-24. Install Paper Clips to Hold Brush Springs

DRIVE ASSEMBLY

Disassembly

1. Remove field coil. See 7.13 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

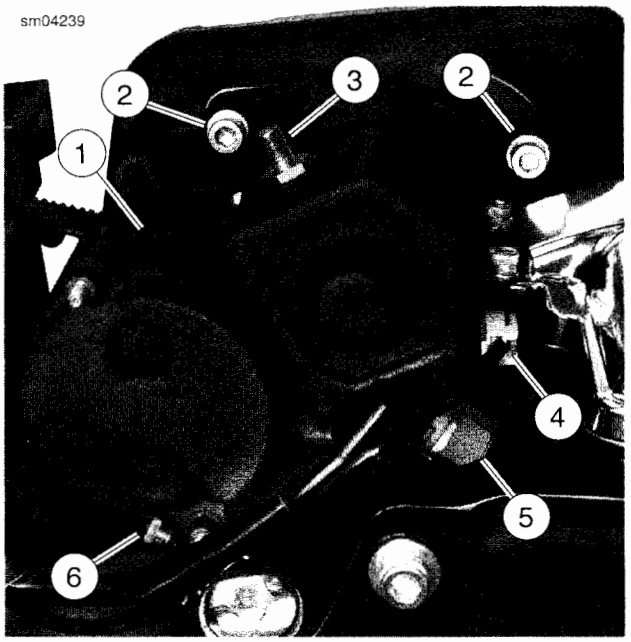
1. Inspect two O-rings in drive housing bore for cuts, tears or signs of deterioration.
2. Replace springs if kinked, elongated or distorted.
3. Inspect pinion gear and drive shaft gear. Replace if pitted, scored, rounded, cracked, chipped or worn.
4. Inspect roller bearings. Bearings must rotate freely 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 7.13 STARTER, Field Coil Assembly.

INSTALLATION

1. Install starter from right side of motorcycle.
2. See Figure 7-25. Apply LOCTITE THREADLOCKER 243 (blue) to threads of both starter mounting fasteners (2). Install and tighten to 25-27 ft-lbs (33.9-36.6 Nm).
3. Install oil tank. See 3.31 OIL TANK: ALL BUT FXCWC or 3.32 OIL TANK: FXCWC.
4. Attach solenoid wire (4).
5. Install rear exhaust pipe. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB as appropriate.



1. Starter
2. Starter mounting fasteners
3. Positive battery cable post
4. Solenoid wire
5. Neutral switch
6. Vehicle speed sensor

Figure 7-25. Starter

SOLENOID ASSEMBLY

Disassembly

1. Remove field coil. See 7.13 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. Remove two hex screws (metric) 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 (metric). 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 7.13 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.

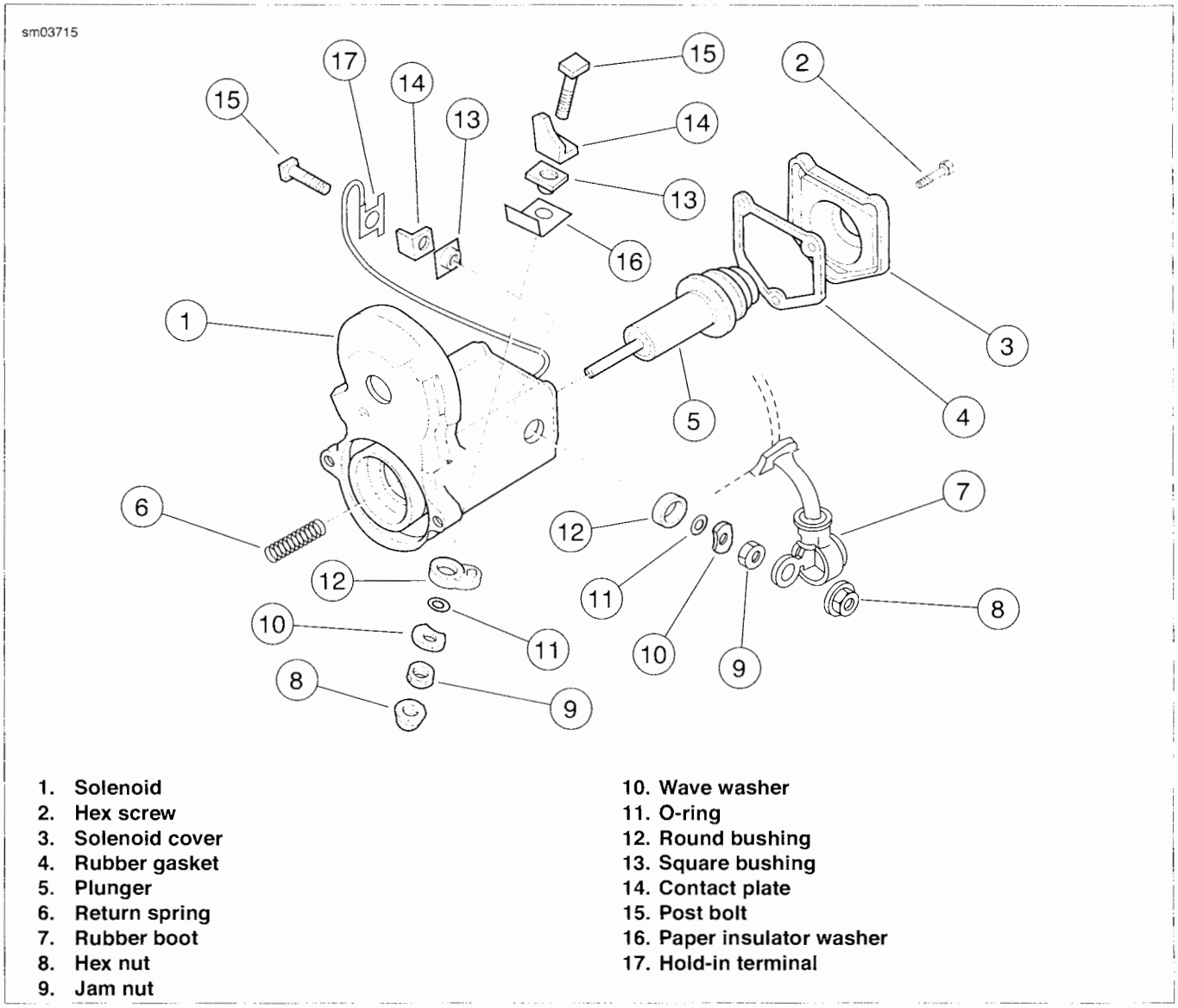
Assembly

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 7-26. 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, holdin 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.



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 7-26. 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.

GENERAL

CAUTION

When replacement is required, use only the specified sealed beam unit or bulb, available from a Harley-Davidson dealer. An improper wattage sealed beam or bulb, can cause charging system problems. (00209a)

If either headlamp bulb filament burns out, the bulb must be discarded and a **new** bulb installed. Use only direct replacement bulbs as specified in the Parts Catalogs and 1.4 BULB REQUIREMENTS.

NOTE

When reassembling headlamp, make sure slots and tabs in headlamp, mounting ring, and trim ring are aligned.

⚠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)

REMOVAL AND INSTALLATION

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Handle the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210b)

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

FXSTC Models

1. See Figure 7-28. Remove trim ring screw (13) and trim ring (6).
2. Pull wiring connector block from bulb prongs.
3. Remove rubber boot (2) from back of headlamp assembly (4).
4. See Figure 7-27. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.
5. Pivot wire retaining clip away from bulb. Replace old bulb with **new** bulb.
6. Assemble headlight components. See 1.23 HEADLAMP ALIGNMENT to adjust light beam.

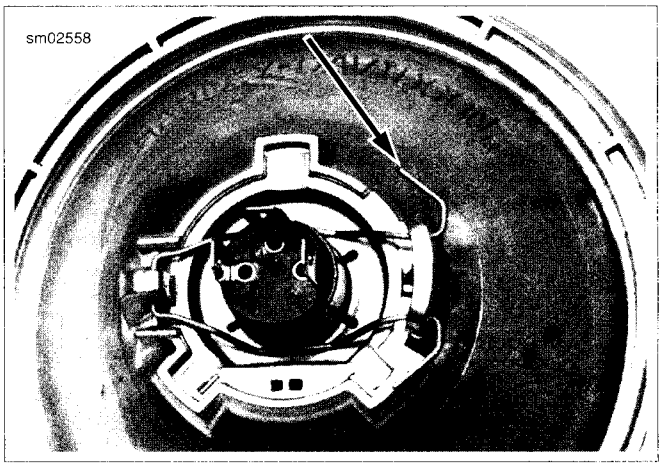


Figure 7-27. Wire Retaining Clip

FXCWC Models

1. See Figure 7-29. Loosen trim ring screw (13) and then remove trim ring (6).
2. Pull wiring connector block from bulb prongs.
3. Remove rubber boot (2) from back of headlamp assembly (4).
4. See Figure 7-27. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.
5. Pivot wire retaining clip away from bulb. Replace old bulb with **new** bulb.
6. Assemble headlight components. See 1.23 HEADLAMP ALIGNMENT to adjust light beam.

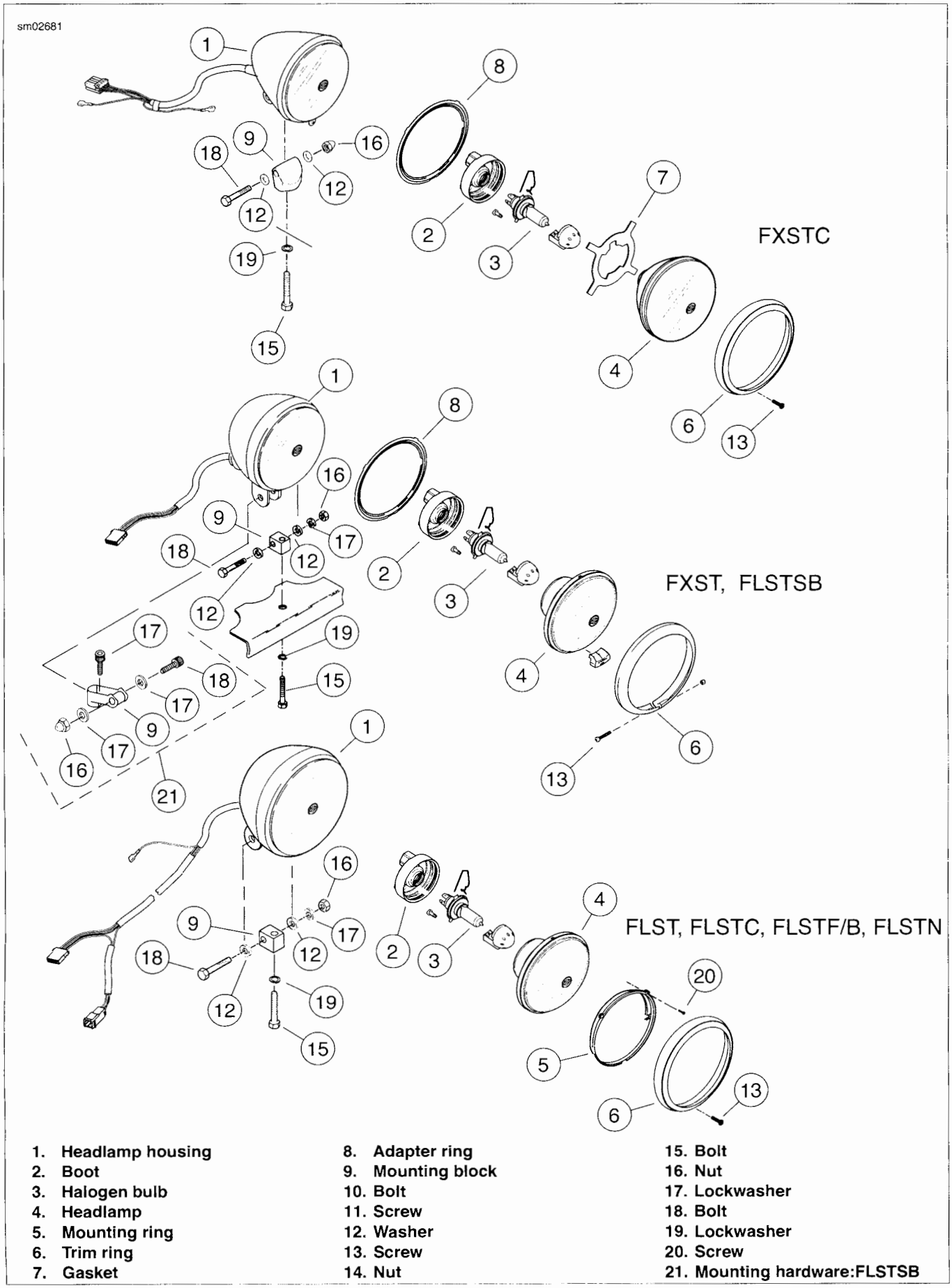
FXST and FLSTSB Models

1. See Figure 7-28. Loosen trim ring screw (13) and then remove trim ring (6).
2. Pull wiring connector block from bulb prongs.
3. Remove rubber boot (2) from back of headlamp assembly (4).
4. See Figure 7-27. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.
5. Pivot wire retaining clip away from bulb. Replace old bulb with **new** bulb.
6. Assemble headlight components. See 1.23 HEADLAMP ALIGNMENT to adjust light beam.

FLST, FLSTC, FLSTF/B, and FLSTN Models

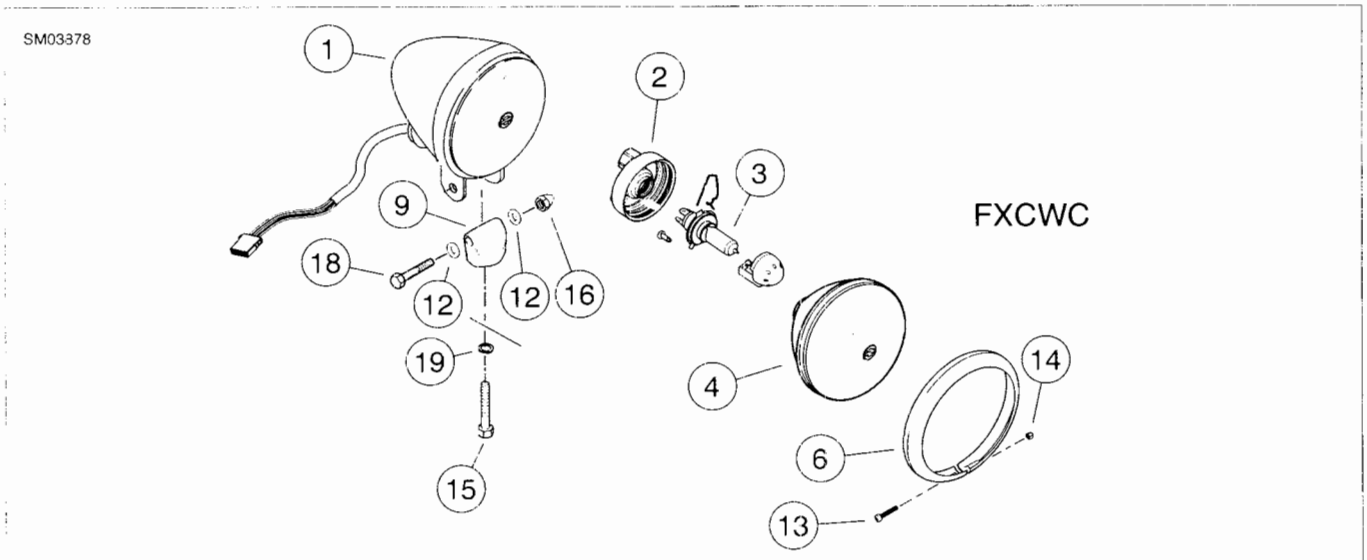
1. See Figure 7-28. Remove trim ring screw (13) and trim ring (6). Be careful not to bend the two tabs that hold the top of the trim ring in place.
2. Remove mounting ring screws (20) and mounting ring that holds sealed beam headlamp in place.
3. Pull wiring connector block from bulb prongs.

4. Remove rubber boot (2) from back of headlamp assembly (4).
5. See Figure 7-27. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.
6. Pivot wire retaining clip away from bulb. Replace old bulb with **new** bulb.
7. Assemble headlight components. See 1.23 HEADLAMP ALIGNMENT to adjust light beam.



1. Headlamp housing
2. Boot
3. Halogen bulb
4. Headlamp
5. Mounting ring
6. Trim ring
7. Gasket
8. Adapter ring
9. Mounting block
10. Bolt
11. Screw
12. Washer
13. Screw
14. Nut
15. Bolt
16. Nut
17. Lockwasher
18. Bolt
19. Lockwasher
20. Screw
21. Mounting hardware:FLSTSB

Figure 7-28. Headlamps: All But FXCWC



1. Headlamp housing
2. Boot
3. Halogen bulb
4. Headlamp
5. Mounting ring
6. Trim ring
7. Gasket
8. Adapter ring
9. Mounting block
10. Bolt
11. Screw
12. Washer
13. Screw
14. Nut
15. Bolt
16. Nut
17. Lockwasher
18. Bolt
19. Lockwasher
20. Screw

Figure 7-29. Headlamp: FXCWC

GENERAL

FXCWC license plate lamp (with tail lamp for HDI) uses a non-replaceable LED bulb. The entire lamp assembly must be replaced. See 7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement for license plate lamp (with tail lamp for HDI) replacement.

FLST, FLSTC, and FLSTF/B Softail models are equipped with a tail lamp that uses a mini harness and circuit board to simplify replacement.

The FXSTC and FXST use the same type assembly, but the lens and base are oriented 180 degrees different from the other models. These models also use a different mini-harness than the other models.

BULB REPLACEMENT

1. See Figure 7-30. Remove two screws and lens (1) from base.
2. Press locking tab and remove 4-Pin multilock connector (3) from circuit board.
3. Rotate bulb socket 1/4 turn counterclockwise and remove from tail lamp assembly. Gently pull bulb from socket.
4. Coat base of **new** bulb with ELECTRICAL CONTACT GREASE (Part No. 99861-02). Install **new** bulb into socket.
5. Insert socket into tail lamp assembly and rotate 1/4 turn clockwise.
6. Connect 4-Pin multilock connector to circuit board.
7. Install lens to base with two screws. Tighten screws to 20-24 **in-lbs** (2.3-2.7 Nm).

⚠WARNING

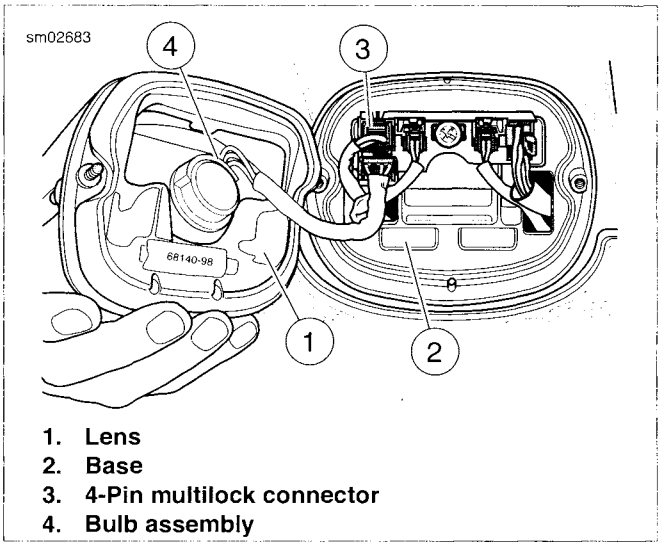
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

8. Turn ignition on and test for proper tail lamp operation.

BASE REPLACEMENT

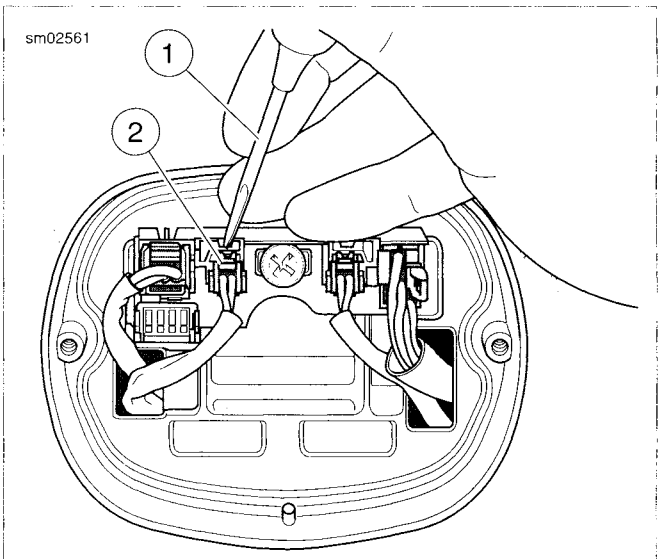
PART NUMBER	TOOL NAME
HD-41475-100	TERMINAL PICK TOOL

1. Remove two screws and lens from base.
2. Depress locking tab and remove 4-Pin multilock connector from circuit board.
3. See Figure 7-31. Using a TERMINAL PICK TOOL (Part No. HD-41475-100), depress locking tabs and remove two 2-Pin turn signal connectors and 6-Pin Power In connector from circuit board.
4. See Figure 7-32. Remove screw, pin housing (1) and circuit board (2) from base.
5. Remove base from rear fender.



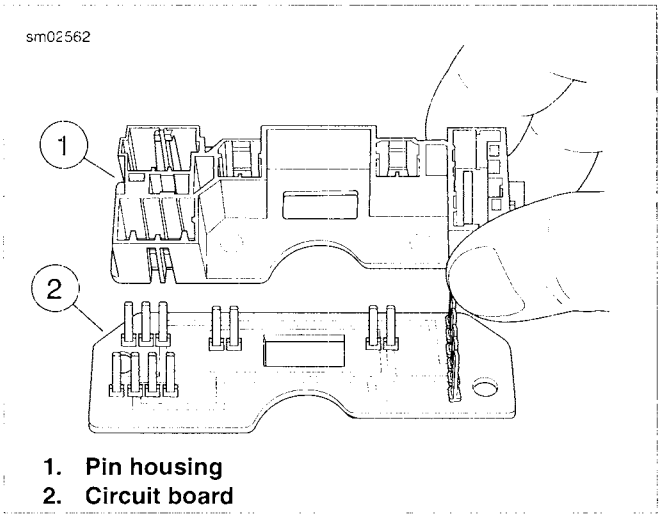
1. **Lens**
2. **Base**
3. **4-Pin multilock connector**
4. **Bulb assembly**

Figure 7-30. Tail Lamp: FLST, FLSTC, FLSTF/B



1. **Terminal pick**
2. **2-Pin connector**

Figure 7-31. Removing 2-Pin Connectors



1. **Pin housing**
2. **Circuit board**

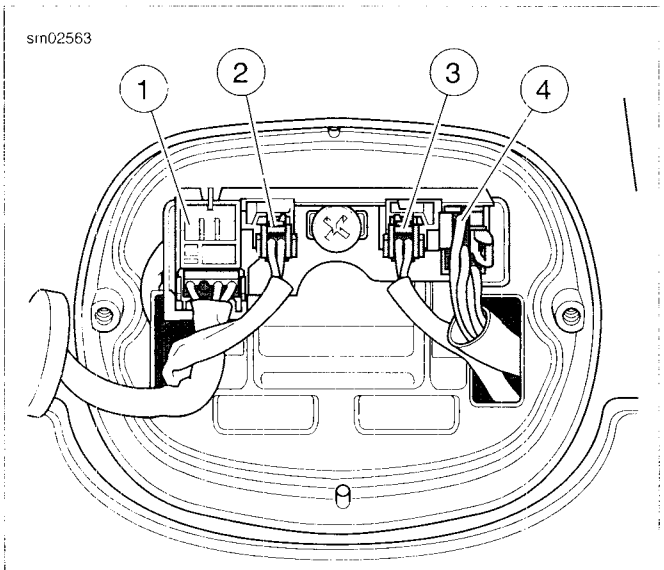
Figure 7-32. Pin Housing and Circuit Board

6. Install **new** base to rear fender. Install circuit board/pin housing to base with screw, nut and washer. Tighten screw to 40-48 **in-lbs** (4.5-5.4 Nm).
7. See Figure 7-33. Install connectors to circuit board.
8. Install lens to base with two screws. Tighten screws to 20-24 **in-lbs** (2.3-2.7 Nm).

⚠WARNING

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

9. Turn ignition on and test for proper tail lamp and turn signal operation.



1. **Tail lamp [93]**
2. **Left turn signal [18]**
3. **Right turn signal [19]**
4. **Power in [94]**

Figure 7-33. Wire Location at Connectors

NOTE

Refer to Table 7-8. Cavity numbers are on back side of secondary locks. All FXST/C/B components are oriented 180 degrees from above and the turn signal connectors are reversed.

Table 7-8. Tail Lamp Wires

FUNCTION	NO.	TYPE	WIRE COLOR	CAVITY
Right turn signal	[18]	2-pin Multilock	V	1
			BK	2
Left turn signal	[19]	2-pin Multilock	V	1
			BK	2
Tail lamp	[93]	4-pin Multilock	BE	1
			HDI only-O/W or open on domestic models	2
			R/Y	3
			BK	4
Power in	[40]	6-pin Multilock	O/W	1
			BN (V on FXST/S/B)	2
			BE	3
			R/Y	4
			V (BN on FXST/S/B)	5
			BK	6

BULB REPLACEMENT

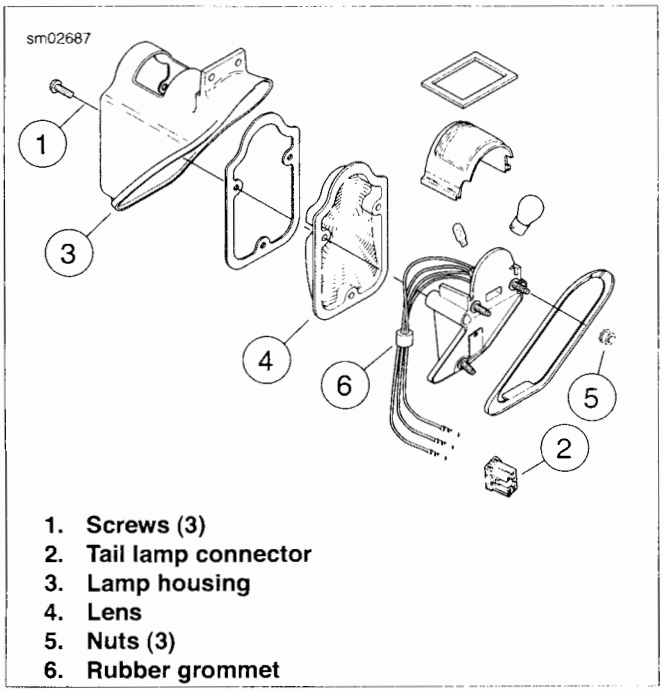
See Figure 7-34. To change a bulb, remove the lens (4), turn the bulb 1/4 turn counterclockwise while pressing the bulb into the lamp housing (3), and remove the bulb. Replace the bulb and install the lens.

NOTE

If after replacing a bulb, the tail lamp will not light, check the wiring, the ground at the socket, and/or the switch.

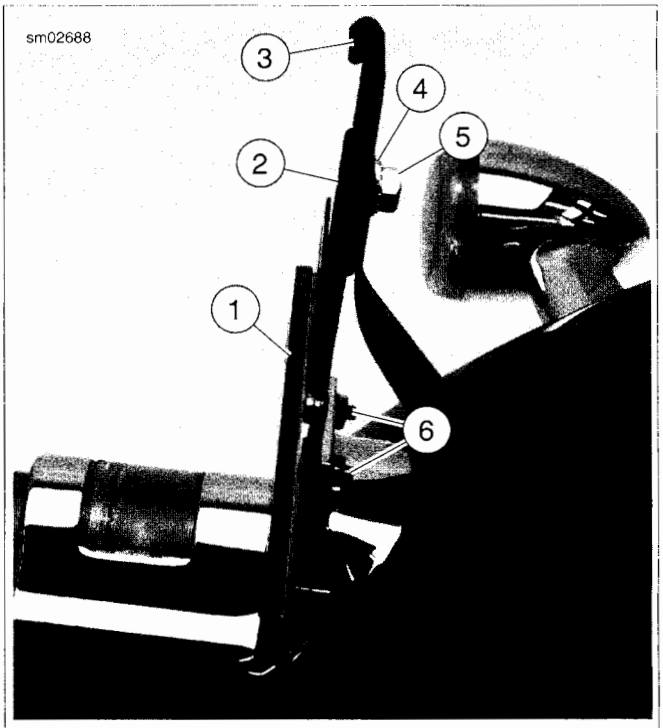
TAIL LAMP REPLACEMENT

1. Remove rear fender. See 2.36 REAR FENDER: FLSTN.
2. See Figure 7-35. Remove reflector (1). Remove license plate bracket fasteners (6).
3. Remove bolt (2), washer (4) and nut (5) securing clamp to license plate bracket.
4. See Figure 7-36. Remove fastener (1). Disengage tail lamp connector cover (2) from clip (3).



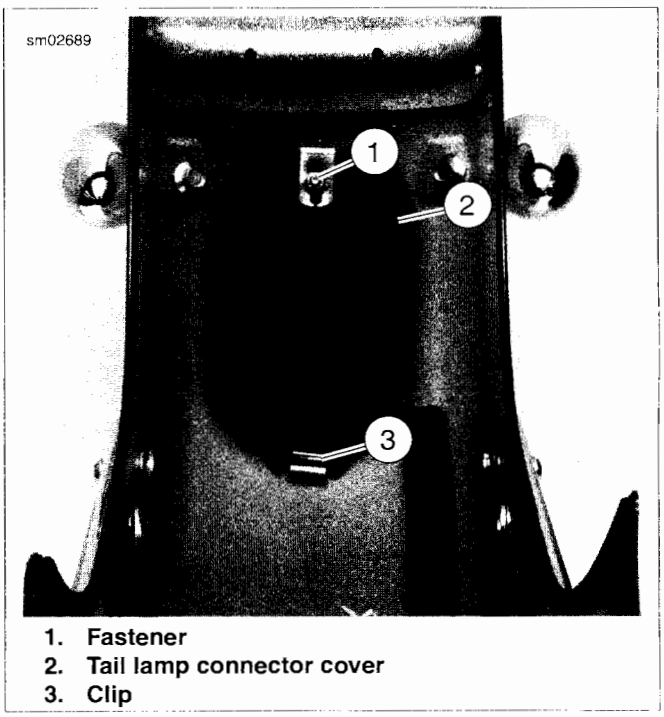
1. Screws (3)
2. Tail lamp connector
3. Lamp housing
4. Lens
5. Nuts (3)
6. Rubber grommet

Figure 7-34. Tail Lamp Assembly



1. Reflector
2. Bolt
3. Clamp
4. Washer
5. Nut
6. Fasteners (2)

Figure 7-35. License Plate Bracket



1. Fastener
2. Tail lamp connector cover
3. Clip

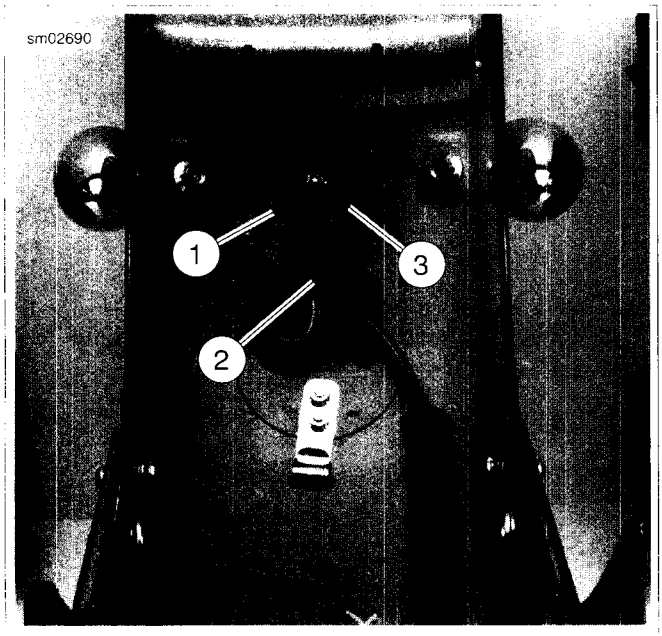
Figure 7-36. Tail Lamp Connector Cover

5. See Figure 7-37. Disconnect tail lamp connector (2).
6. See Figure 7-38. Remove plastic covers (3) from tail lamp threads. Remove fasteners (1).
7. Push grommet (2) to outside of fender.
8. See Figure 7-39. If license plate support (1) was removed, install clip on inside of fender and tighten fasteners (2) to 60-90 **in-lbs** (6.8-10.2 Nm).

NOTE

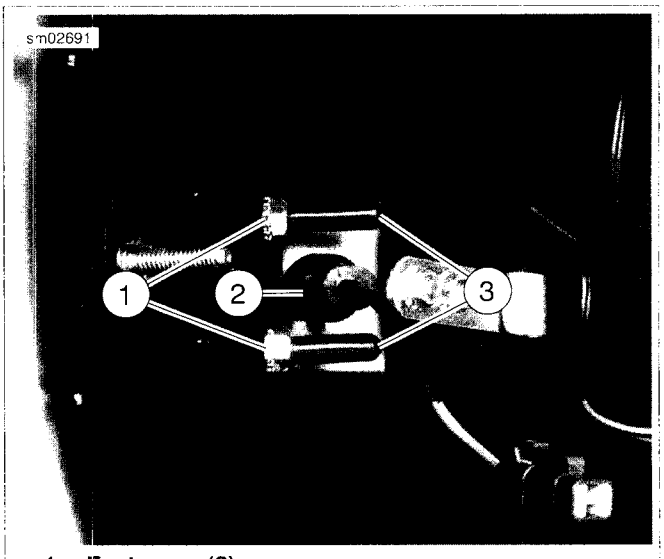
Before removing tail lamp wires from connector, or harness from fender clips, carefully note routing for reinstallation.

9. Remove tail lamp wire terminals from connectors. See A.5 DEUTSCH ELECTRICAL CONNECTORS.
10. Install **new** terminals into connector. See A.5 DEUTSCH ELECTRICAL CONNECTORS.
11. See Figure 7-38. To install tail lamp, route harness through hole in fender and lubricate rubber grommet (2) with alcohol or glass cleaner. Place grommet into position.
12. Place tail lamp into position and install fasteners (1). Tighten fasteners to 60-90 **in-lbs** (6.8-10.2 Nm). Install plastic covers (3).
13. See Figure 7-37. Connect tail lamp connector (2).
14. Figure 7-36. Slide tail lamp connector cover (2) into clip (3). Install fastener (1) and tighten to 8-30 **in-lbs** (0.9-3.4 Nm).
15. See Figure 7-35. Place license plate bracket in place on tail lamp. Install but do not tighten license plate bracket fasteners (6). Install clamp (3). Install bolt (2), washer (4) and nut (5).
16. Tighten license plate bracket fasteners to 30-50 **in-lbs** (3.4-5.6 Nm).



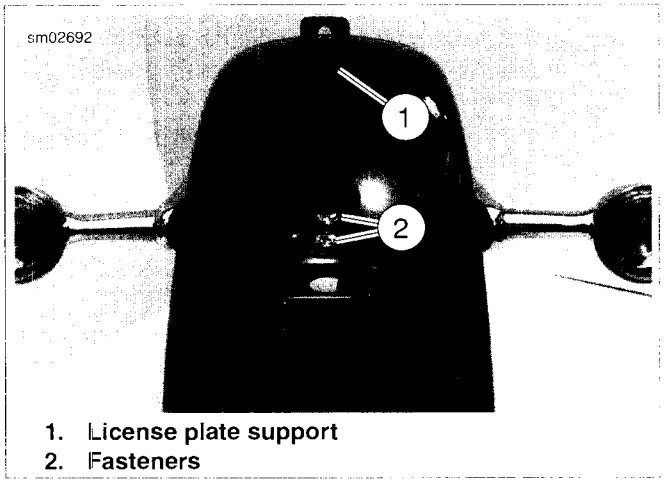
1. **Left turn signal connector [19]**
2. **Tail lamp connector [93]**
3. **Right turn signal connector [18]**

Figure 7-37. Tail Lamp Connector



1. **Fasteners (2)**
2. **Grommet**
3. **Plastic covers**

Figure 7-38. Tail Lamp



1. **License plate support**
2. **Fasteners**

Figure 7-39. License Plate Support

AUXILIARY LAMP BULB

Removal

1. See Figure 7-40. Loosen trim ring fastener (1) as required to pull trim ring (2) from lip of auxiliary lamp housing (5).
2. Disconnect auxiliary lamp connector (4) from bulb (6).
3. Remove nesting ring (7) at back of auxiliary lamp (8).

⚠WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

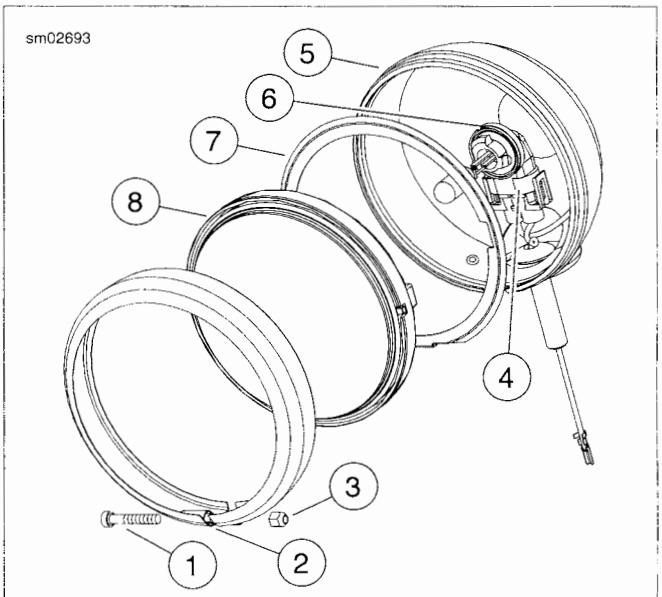
4. See Figure 7-41. Rotate bulb/pin housing 1/4 turn counterclockwise and remove from auxiliary lamp. Discard bulb/pin housing.

Installation

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Handle the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210b)

1. See Figure 7-41. Install **new** bulb/pin housing in auxiliary lamp and rotate 1/4 turn clockwise.
2. See Figure 7-40. Place nesting ring (7) at back of auxiliary lamp (8) with the concave side up.
3. Connect auxiliary lamp connector (4) to bulb (6).
4. Place nesting ring over edge of lamp housing (5). Rotate nesting ring until index tab engages slot at bottom of lamp housing.
5. Holding nesting ring in place, rotate auxiliary lamp so that index tabs at back engage slots in nesting ring.
6. Install trim ring (2) over lip of lamp housing. Rotate trim ring so that fastener (1) is centered at bottom, and then tighten fastener until snug.



1. **Trim ring fastener**
2. **Trim ring**
3. **Nut**
4. **Connector**
5. **Auxiliary lamp housing**
6. **Bulb**
7. **Nesting ring**
8. **Auxiliary lamp**

Figure 7-40. Auxiliary Lamp Bulb: Typical

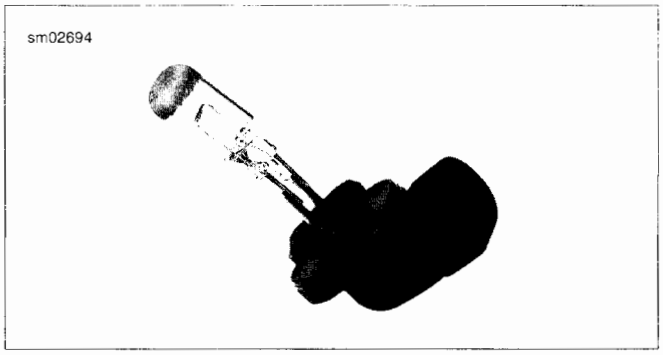


Figure 7-41. Auxiliary Lamp Bulb/Pin Housing

FLST AND FLSTC MODELS

Auxiliary Lamp Bracket Removal

1. Detach quick release windshield. See 2.48 WINDSHIELD: FLSTC.

2. Detach wiring.
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Disconnect 6-place Multilock front turn signal connector [31] under fuel tank.
3. See Figure 7-42. Remove upper and lower bracket hardware (6, 7) and spacer (8). Remove auxiliary lamp bracket (9).

Auxiliary Lamp Bracket Installation

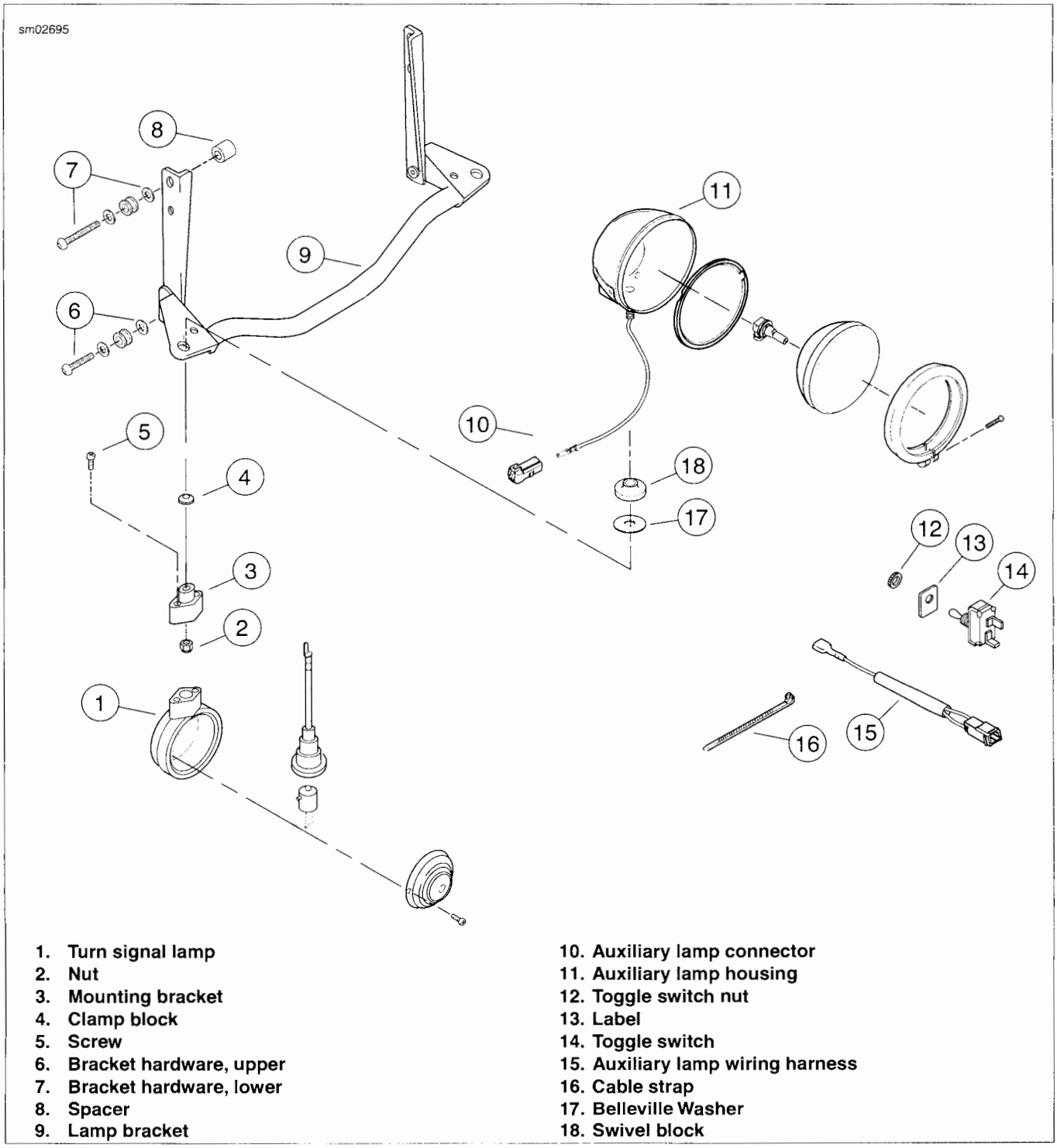
1. See Figure 7-42. Place auxiliary lamp bracket (9) in position. Loosely install upper and lower bracket hardware (6, 7). Verify that spacers (8) are installed on upper fasteners.
2. Attach auxiliary lamp housings (11) to bracket if necessary. See Auxiliary Lamp Housing Installation later in this section.
3. Connect wiring for front turn signals [31] and auxiliary lamps [73].
4. Tighten the auxiliary lamp bracket hardware (6, 7) to 72-120 **in-lbs** (8.1-13.6 Nm).
5. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.
6. Place windshield in position. Adjust windshield height so that top of windshield is at rider's eye level while seated on motorcycle and fasten securely. See 2.48 WINDSHIELD: FLSTC.

Auxiliary Lamp Housing Removal

1. See Figure 7-42. Remove screws (5) that secure the turn signal lamps (1) to the mounting bracket (3).
2. Detach auxiliary lamp connector [73].
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Remove auxiliary lamp terminals. See A.1 AMP MULTILOCK CONNECTORS in the appendix.
3. Remove appropriate terminal(s) from socket housing.
4. Use a flare nut socket to remove the nuts (2) that secure the auxiliary lamp housings (11) to bracket. Remove auxiliary lamp and pull wires through vinyl conduit.

Auxiliary Lamp Housing Installation

1. See Figure 7-42. Place auxiliary lamp housings (11) in position. Use a flare nut socket to snug the nut (2) that secures the lamp to the bracket.
2. Push lamp wires back into the vinyl conduit. Insert wire terminals into connector. Route the harness back into position and mate connectors.
3. Aim auxiliary lamps. See 7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models in this section.
4. Install the screws (5) that secure the turn signal lamps to the mounting bracket (3).



1. Turn signal lamp
2. Nut
3. Mounting bracket
4. Clamp block
5. Screw
6. Bracket hardware, upper
7. Bracket hardware, lower
8. Spacer
9. Lamp bracket
10. Auxiliary lamp connector
11. Auxiliary lamp housing
12. Toggle switch nut
13. Label
14. Toggle switch
15. Auxiliary lamp wiring harness
16. Cable strap
17. Belleville Washer
18. Swivel block

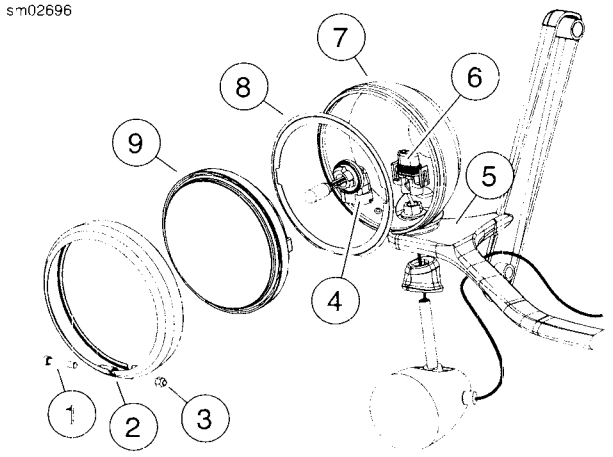
Figure 7-42. Auxiliary Lamp Bracket: FLST/FLSTC

Auxiliary Lamp Bracket Removal

1. Detach wiring.
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Disconnect 6-place Multilock front turn signal connector [31] under fuel tank.
2. See Figure 7-44. Remove upper and lower bracket hardware (8, 9) Remove auxiliary lamp bracket.

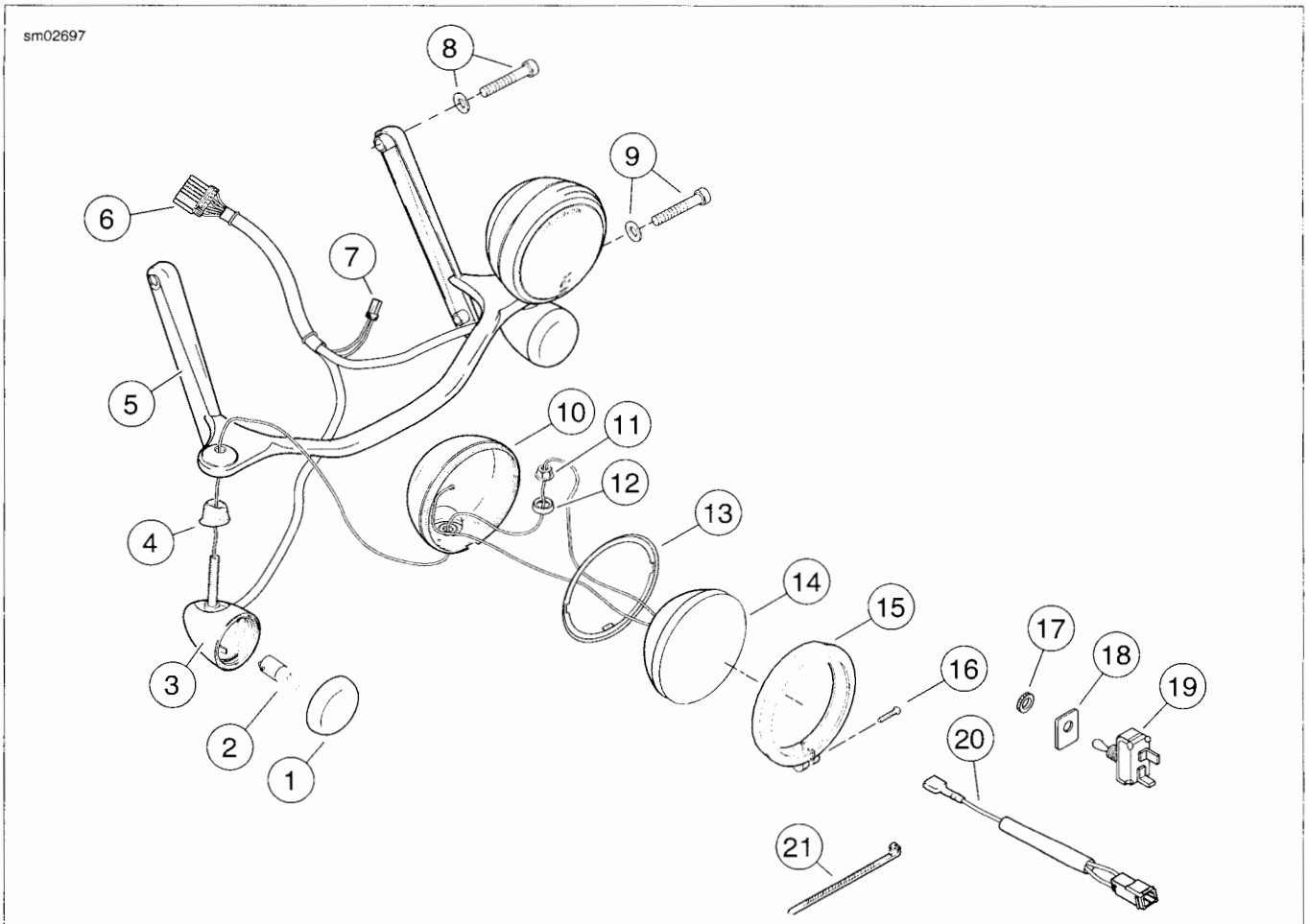
Auxiliary Lamp Bracket Installation

1. See Figure 7-44. Place auxiliary lamp bracket (5) in position. Loosely install upper and lower bracket hardware (8, 9).
2. Attach auxiliary lamps to bracket if necessary. See 7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, FLSTN Models later in this section.
3. Connect wiring for front turn signals [31] and auxiliary lamps [73].
4. See Figure 7-44. Tighten the auxiliary lamp bracket hardware (8, 9) to 72-120 **in-lbs** (8.1-13.6 Nm).
5. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.



1. **Trim ring fastener**
2. **Trim ring**
3. **Nut**
4. **Bulb**
5. **Auxiliary lamp bracket**
6. **Connector**
7. **Auxiliary lamp housing**
8. **Nesting ring**
9. **Auxiliary lamp**

Figure 7-43. Auxiliary Lamp Bracket: Typical



1. **Turn signal lens**
2. **Turn signal bulb**
3. **Turn signal lamp**
4. **Adapter (2)**
5. **Auxiliary lamp bracket**
6. **Main harness connector [31]**
7. **Auxiliary lamp connector [73]**
8. **Bracket hardware, upper (2)**
9. **Bracket hardware, lower (2)**
10. **Auxiliary lamp housing**
11. **Nut (2)**
12. **Collar (2)**
13. **Nesting ring (2)**
14. **Auxiliary lamp**
15. **Trim ring**
16. **Trim ring fastener**
17. **Toggle switch nut**
18. **Label**
19. **Toggle switch**
20. **Auxiliary lamp wiring harness**
21. **Cable strap**

Figure 7-44. Auxiliary Lamp Bracket: FLSTN

Auxiliary Lamp Housing Removal

1. Remove auxiliary lamp bulb. See 7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Auxiliary Lamp Bulb in this section.
2. Detach auxiliary lamp connector [73].
   a. Remove fuel tank fasteners and slide tank back to reveal connectors. See 4.6 FUEL TANK.
   b. Disconnect 2-place Multilock auxiliary lamp connector [73] under fuel tank, left side.
   c. Remove auxiliary lamp terminals. See A.1 AMP MULTILOCK CONNECTORS in the appendix.
3. Remove appropriate terminal(s) from auxiliary lamp bulb socket housing.
4. See Figure 7-44. Remove nut (11) that secures auxiliary lamp housing (10) and turn signal lamp (3) to auxiliary lamp bracket (5). Remove auxiliary lamp and turn signal lamp.
5. Remove adapter (4) from turn signal lamp.

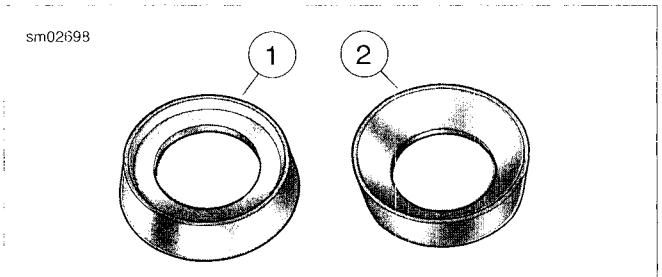
Auxiliary Lamp Housing Installation

1. See Figure 7-44. Install adapter (4) on turn signal lamp (3). Install turn signal lamp in auxiliary lamp bracket (5).
2. Install auxiliary lamp housing (10) over turn signal lamp threads.

NOTE

See Figure 7-45. In next step, be sure top of collar (1) is facing up.

3. See Figure 7-44. Install collar (12) and nut (11) over turn signal lamp wire. Tighten nut finger tight. Do not fully tighten nut at this time.
4. Place auxiliary lamp ring at back of **new** lamp with the concave side up.
5. Install terminals into auxiliary lamp bulb socket housing.
6. Install lamp fitting auxiliary lamp ring over edge of lamp housing. Rotate auxiliary lamp ring so that index tab engages slot at bottom of lamp housing.
7. Holding auxiliary lamp ring in place, rotate lamp so that index tab at back engages slot in auxiliary lamp ring.
8. Install lamp door over lip of lamp housing. Rotate lamp door so that screw is centered at bottom, and then tighten door screw until snug.
9. Adjust auxiliary lamps. See 7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models.



1. **Top of collar**
2. **Bottom of collar**

Figure 7-45. Collar

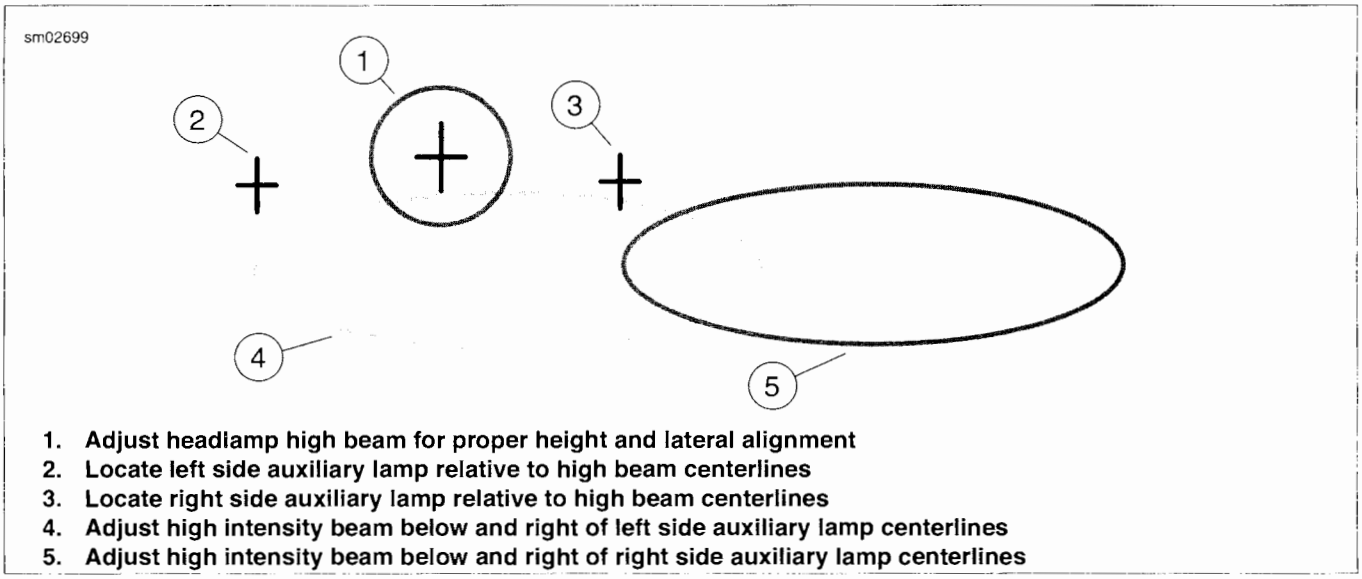
ADJUSTMENT: FLST/FLSTC/FLSTN MODELS

1. Check headlamp alignment. Adjust if necessary. See 7.15 HEADLAMP.
2. With a rider seated on the motorcycle and the front wheel pointed straight ahead, turn on the headlamp high beam.
3. See Figure 7-46. Mark the center of the headlamp high beam by making a vertical line through the horizontal line already drawn on the wall. Properly adjusted, the beam should project an equal area of light to the left and right of the vertical centerline (1).
4. Turn the headlamp off and move to the front of the motorcycle.
5. Measure the distance from the headlamp horizontal centerline down to the horizontal centerline of the left side auxiliary lamp. Now measure the distance from the headlamp vertical centerline out to the vertical centerline of the same lamp.
6. Repeat measurements performed in previous step on right side auxiliary lamp.
7. From the headlamp high beam centerlines, perform the measurements taken in previous steps to locate the left and right side auxiliary lamp centerlines on the wall (2, 3).
8. Turn on the headlamp high beam again, and with a rider seated on the motorcycle, verify that it is still aligned with the horizontal and vertical centerlines.
9. Turn on the headlamp low beam and then cover both the headlamp and the right side auxiliary lamp. Adjust the left side auxiliary lamp as necessary so that the entire high intensity zone is both below and to the right of the left side auxiliary lamp centerlines (4).
10. Leaving the headlamp covered, remove cover from right side auxiliary lamp and place over left side auxiliary lamp. Adjust the right side auxiliary lamp as necessary so that the entire high intensity zone is both below and to the right of the right side auxiliary lamp centerlines (5).
11. Tighten auxiliary lamps on FLST and FLSTC models.
    a. See Figure 7-42. Loosen screws (5) to detach turn signal lamps (1) from mounting bracket (3).
    b. Insert flare nut socket at bottom of turn signal mounting bracket and tighten locknut to 18 ft-lbs (24.4 Nm).
    c. Start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
12. Tighten auxiliary lamps on FLSTN models.
    a. See Figure 7-44. Loosen trim ring fastener (16) and remove trim ring (15) from auxiliary lamp housing (10).

    NOTE

    In next step, be sure to minimize auxiliary lamp movement while tightening. If excessive movement is permitted, auxiliary lamp aim will be incorrect.

    b. While holding auxiliary lamp steady, tighten nut (11) to 15-18 ft-lbs (20.3-24.4 Nm).
    c. Install lamp fitting auxiliary lamp ring over edge of lamp housing. Rotate auxiliary lamp ring so that index tab engages slot at bottom of lamp housing.
    d. Start two screws to secure turn signal lamp to mounting bracket. Verify that conduit fits in slot at back of bracket and is not pinched. Alternately tighten screws to 36-60 **in-lbs** (4.1-6.8 Nm).
13. Recheck auxiliary lamp alignment.



1. Adjust headlamp high beam for proper height and lateral alignment
2. Locate left side auxiliary lamp relative to high beam centerlines
3. Locate right side auxiliary lamp relative to high beam centerlines
4. Adjust high intensity beam below and right of left side auxiliary lamp centerlines
5. Adjust high intensity beam below and right of right side auxiliary lamp centerlines

Figure 7-46. Auxiliary Lamp Aiming

BULB REPLACEMENT: BULLET STYLE

NOTE

FXCWC rear lamps use LEDs instead of bulbs and are not replaceable. See 7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement to replace the lamp.

1. Locate latch slot on circumference of turn signal lamp lens. Insert a small flat blade screw driver or coin and turn 1/4 turn to remove lens.
2. Push bulb in and rotate 1/4 turn counterclockwise to remove.
3. Inspect contacts in socket. If necessary, clean contacts with a small wire brush and electrical contact cleaner.
4. Evenly apply dielectric grease to the contacts and bottom of the **new** bulb.
5. Push and rotate **new** bulb into socket.
6. Snap-in and rotate lens to position latch slot on bottom.

NOTE

If after replacing a bulb, the turn signal or running lamp will not light, check the wiring, the ground at the socket and/or the switch.

BULB REPLACEMENT: FLAT LENS STYLE

To change a bulb, remove the lens, turn the bulb 1/4 turn counterclockwise while pressing the bulb into the housing, and remove the bulb. Replace the bulb and install the lens.

NOTE

If after replacing a bulb, the turn signal or running lamp will not light, check the wiring, the ground at the socket and/or the switch

LAMP REPLACEMENT

All Models

NOTE

See 7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN for front turn signal replacement on FLST, FLSTC, and FLSTN models. For all other models, follow the instructions below.

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. Change turn signal lamp following the steps under Front Turn Signals: All But FLST, FLSTC, and FLSTN; Rear Turn Signals: All But FXCWC, FLSTN; Rear Turn Signals: FXCWC; or Rear Turn Signals: FLSTN.
4. Install main fuse.

⚠WARNING

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

5. Install seat.

⚠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. Turn ignition on and test for proper turn signal operation.

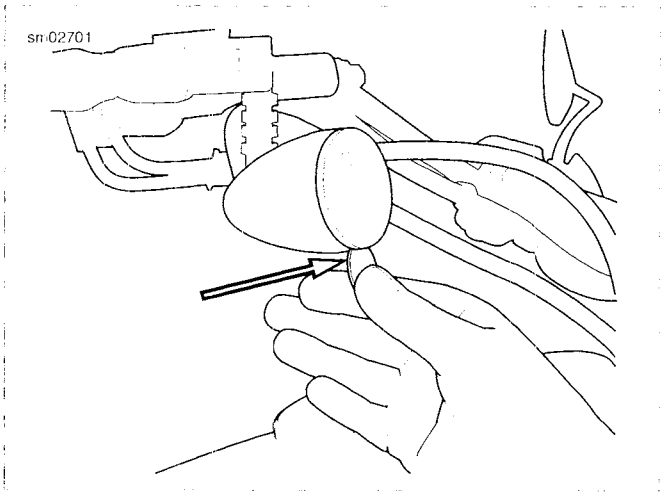


Figure 7-47. Lens Cap Removal

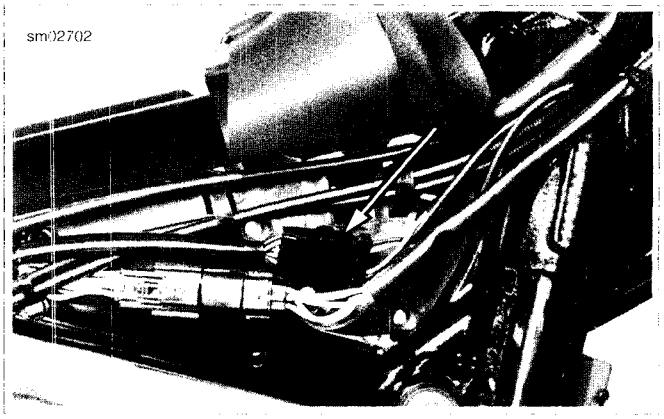


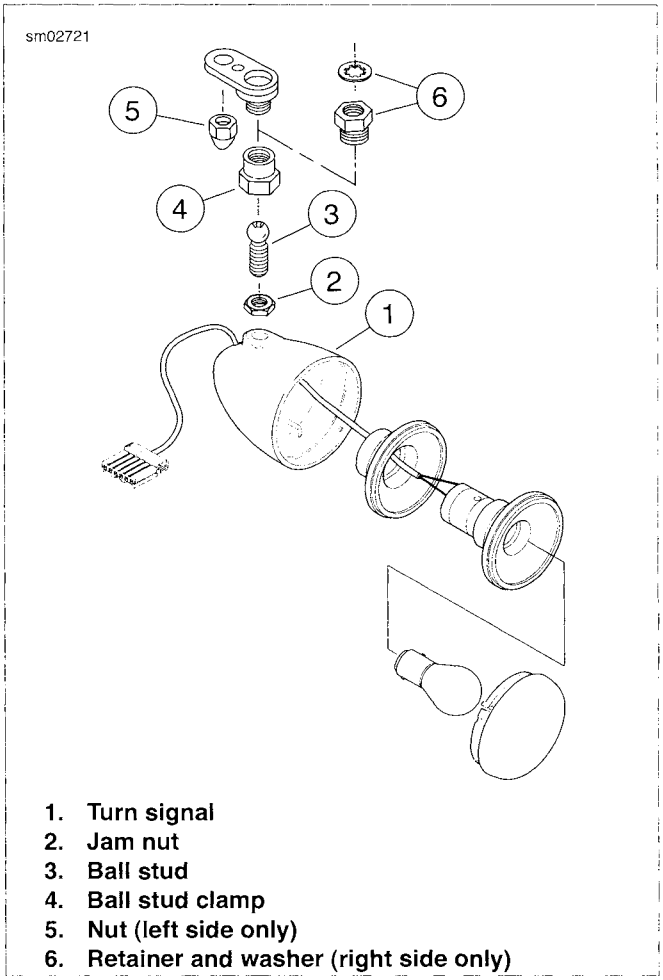
Figure 7-48. Front Turn Signal Connector [31]

Front Turn Signals: All But FLST, FLSTC, FLSTN

NOTE

Before removing turn signal wires, carefully note routing. In particular, pay close attention to the locations of cable straps which must be replaced.

1. Remove fuel tank to reveal front turn signal connector [31]. See 4.6 FUEL TANK.
2. Disconnect [31] and remove terminals from turn signal connector.
3. Detach front turn signals from mounting point.
   a. See Figure 7-49. On right side, hold retainer (6) and loosen ball stud clamp (4) to remove turn signal.
   b. On left side, remove nut (5) from mirror, loosen jam nut and remove ball stud clamp (4) to detach turn signal.
4. **FXCWC:** The turn signal wiring is routed through the lower switch housings. Remove wiring from handlebars. See 7.37 HANDLEBAR SWITCH ASSEMBLIES and 2.29 HANDLEBARS: FXCWC.
5. **FXCWC:** Install turn signal lamp wiring, handlebars, switch housing.
6. Install **new** front turn signal.
   a. Attach signal to mounting point as appropriate to model being serviced.
   b. Route wiring to connector [31] location and install terminals in connector. Attach connectors.
   c. Verify that turn signal points straight ahead.
7. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.



1. **Turn signal**
2. **Jam nut**
3. **Ball stud**
4. **Ball stud clamp**
5. **Nut (left side only)**
6. **Retainer and washer (right side only)**

Figure 7-49. Front Turn Signals: FXST, FXCWC, FXSTC, FLSTF/B, FLSTSB

Front Turn Signals: FLST, FLSTC, FLSTN

For lamp replacement of FLST, FLSTC, and FLSTN models, see 7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN.

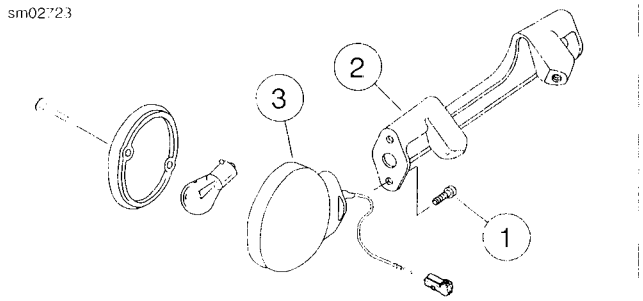
Rear Turn Signals: All But FXCWC, FLSTN

NOTE

Before removing turn signal wires, carefully note routing. In particular, pay close attention to the locations of cable straps which must be replaced.

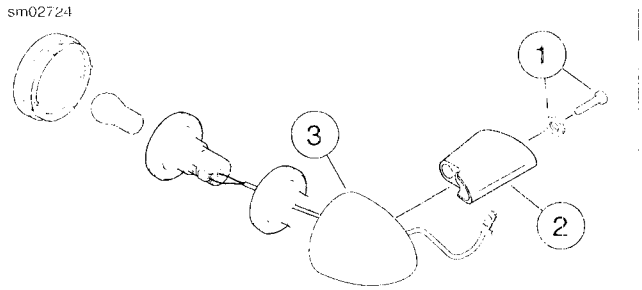
1. Disconnect turn signal wiring.
   a. Disconnect right turn signal [18] and left turn signal [19] connectors from within tail lamp. See 7.16 TAIL LAMP: ALL BUT FLSTN.
   b. Remove wire terminals from turn signal connectors.
2. Detach turn signal from mount.
   a. For FLST and FLSTC models, see Figure 7-50. Remove the screw (1) to detach turn signal from mount (2).
   b. For all other models, see Figure 7-51. Detach fender support hardware. See 2.34 REAR FENDER: FXST/FXSTC/FLSTSB. Remove screw and washer (1) from inside fender support to detach turn signal from mount (2).

3. Install **new** rear turn signal.
   a. Attach signal to mounting point as appropriate to model being serviced. On all models but FLST and FLSTC, install rear fender support.
   b. Route wiring to connector location and install terminals in connector. Attach connectors.
   c. Verify that turn signal points straight behind.



1. **Screw**
2. **Turn signal mount**
3. **Turn signal**

Figure 7-50. Rear Turn Signals: FLST/FLSTC



1. **Screw and washer**
2. **Turn signal mount: all but FLST/FLSTC**
3. **Turn signal**

Figure 7-51. Rear Turn Signals: All but FLST/FLSTC

Rear Turn Signals: FXCWC

1. Remove rear fender. See 2.35 REAR FENDER: FXCWC.
2. See Figure 7-52 and Table 7-9. Disconnect pins from 12-Pin connector (5) as needed. For connector pin removal procedure, see A.9 MOLEX CONNECTORS.
3. Remove fastener securing lamp assembly to fender.

NOTE

Before removing the electrical wires from the fender, attach an electrical fish tape or long thin wire to the ends of the electrical wires to aid during installation.

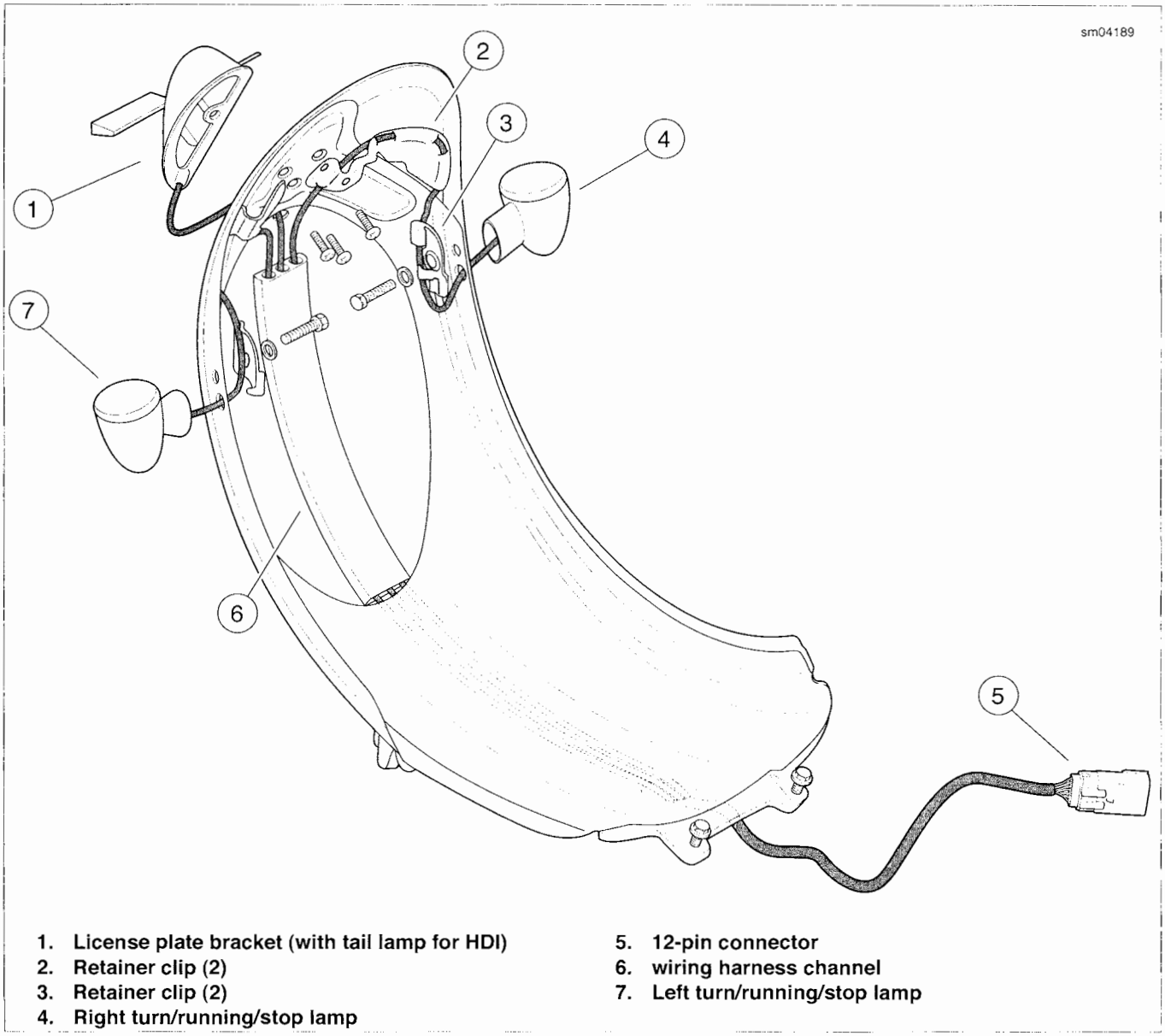
4. Carefully remove lamp and wires from fender.
5. Route wires of new lamp through fender. Make sure the new wires are properly positioned in the retaining clips (2,3).
6. See Table 7-9 or Table 7-10. Attach new wires to 12-pin connector. See A.9 MOLEX CONNECTORS for proper pin installation procedure.
7. Attach turn/running/stop lamp to fender. Tighten fastener to 10-12 ft-lbs (13.57-16.28 Nm).
8. If replacing license plate bracket (with tail lamp for HDI), tighten fasteners to 57-63 **in-lbs** (6.45-7.12 Nm).
9. Check wiring installation for proper routing and make sure there is no excess slack in the wires. Also check the retaining clips and wire harness channel for looseness and damage. Loose wiring, retaining clips, or the wire harness channel can get caught on the rear tire during operation and cause the turn/running/stop lamps or tail lamp (HDI) to become inoperative.
10. Install rear fender. See 2.35 REAR FENDER: FXCWC.

Table 7-9. Rear Fender Lighting Connector Pin Location (Domestic)

PIN	COLOR	FUNCTION
1	W	Right running
2	R	Right stop
3	GN	Right turn
4	BK	Right ground
5	-	Not used
6	BK	Tail lamp ground
7	W	Left running
8	R	Left stop
9	GN	Left turn
10	BK	Left ground
11	-	Not used
12	R	License plate lamp

Table 7-10. Rear Fender Lighting Connector Pin Location (HDI)

PIN	COLOR	FUNCTION
1	-	Not used
2	-	Not used
3	R	Right turn
4	BK	Right ground
5	-	Not used
6	BK	Tail lamp ground
7	-	Not used
8	-	Not used
9	R	Left turn
10	BK	Left ground
11	R	Stop
12	W	Tail lamp

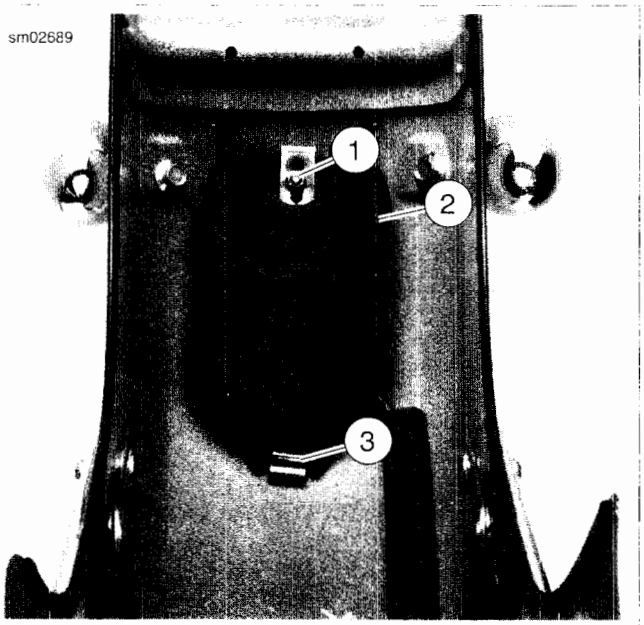


1. **License plate bracket (with tail lamp for HDI)**
2. **Retainer clip (2)**
3. **Retainer clip (2)**
4. **Right turn/running/stop lamp**
5. **12-pin connector**
6. **wiring harness channel**
7. **Left turn/running/stop lamp**

Figure 7-52. Rear Fender Lighting: FXCWC

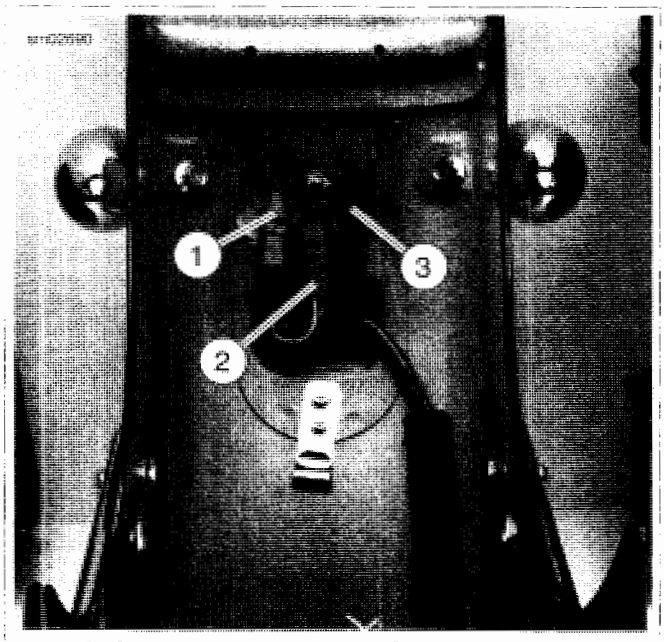
Rear Turn Signals: FLSTN

1. Remove rear fender. See 2.36 REAR FENDER: FLSTN.
2. See Figure 7-53. Remove fastener (1). Disengage tail lamp connector cover (2) from clip (3).
3. See Figure 7-54. Disconnect left [19] (1) and right [18] (3) turn signal connectors.
4. Remove wire terminals from turn signal connectors. See A.5 DEUTSCH ELECTRICAL CONNECTORS for connector disassembly.
5. See Figure 7-55. Remove screws (1) to release turn signal bar (2) from fender.
6. Install new turn signal bar. Tighten screws (1) to 15-19 ft-lbs (20.4-25.8 Nm).
7. Install wire terminals into turn signal connectors. See A.5 DEUTSCH ELECTRICAL CONNECTORS for connector assembly.
8. See Figure 7-54. Connect left [19] (1) and right [18] (3) turn signal connectors.
9. See Figure 7-53. Slide tail lamp connector cover (2) into clip (3). Install fastener (1) and tighten to 8-30 **in-lbs** (0.9-3.4 Nm).



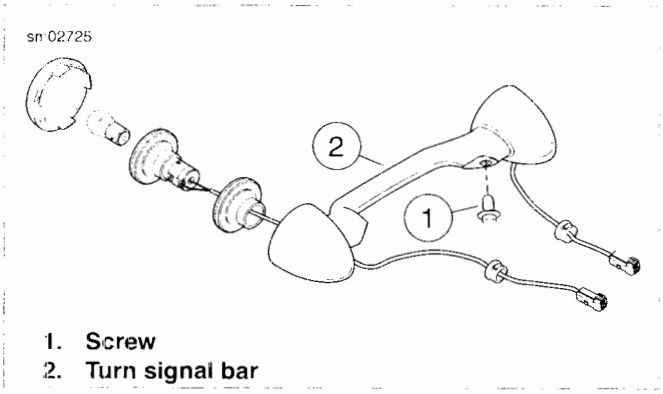
1. Fastener
2. Tail lamp connector cover
3. Clip

Figure 7-53. Tail Lamp Connector Cover



1. Left turn signal connector [19]
2. Tail lamp connector [93]
3. Right turn signal connector [18]

Figure 7-54. Turn Signal Connectors



1. Screw
2. Turn signal bar

Figure 7-55. Rear Turn Signals: FLSTN

GENERAL

The crank position sensor is a variable reluctance (VR) sensor that generates an AC signal by sensing the passing of the 30 teeth machined in the left side flywheel. Two consecutive teeth are missing in the flywheel to establish a reference point. The crank position sensor sends a signal to the electronic control module which is used to reference engine position (TDC) and engine speed.

NOTE

CKP sensor connector is not serviceable. If connector or sensor fails, the entire assembly must be replaced.

REMOVAL

1. Remove seat.

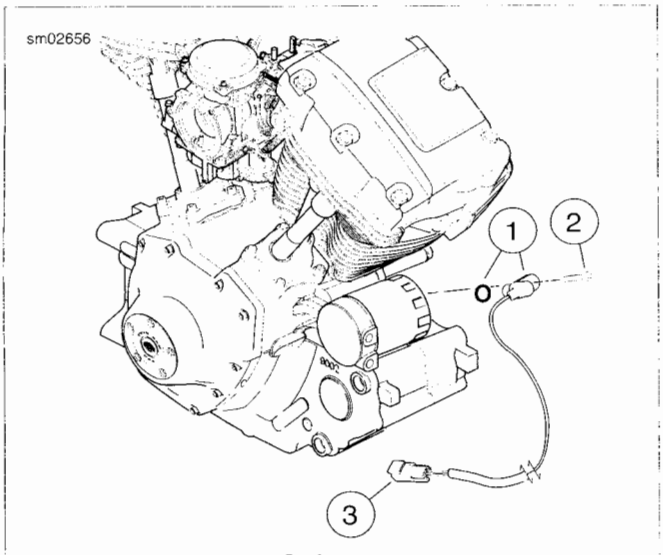
⚠WARNING

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

2. Remove main fuse.
3. Detach wiring behind regulator bracket.
   a. Disengage connector from bracket.
   b. See Figure 7-56. Disconnect the 2-place Mini-Deutsch CKP connector [79A] (3).
4. Remove screw and captive washer (2) to detach CKP sensor and o-ring (1) from crankcase. Carefully remove crank position sensor.

NOTE

Before removing wiring, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.



1. **CKP sensor and O-ring**
2. **Screw and captive washer**
3. **CKP connector [79A]**

Figure 7-56. CKP Sensor Assembly

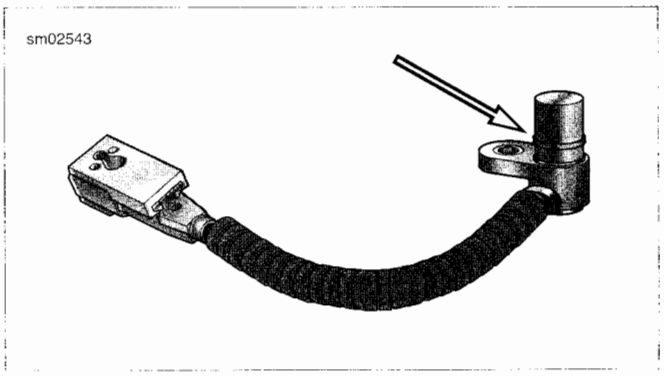


Figure 7-57. CKP Sensor O-Ring

INSTALLATION

1. See Figure 7-56. Lubricate CKP sensor o-ring (1) with clean engine oil.
2. See Figure 7-58. Install new CKP sensor with screw and captive washer. Tighten screw to 90-120 **in-lbs** (10.2-13.6 Nm).
3. Route wiring to connector behind regulator bracket.
4. Attach wiring.
   a. Mate connector [79].
   b. Attach connector to bracket.
5. Install main fuse.

⚠WARNING

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

6. Install seat.

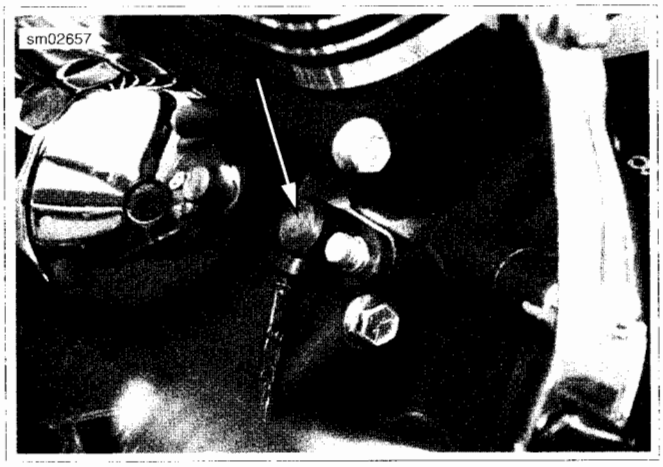


Figure 7-58. Installed CKP Sensor

REMOVAL

All Except FXCWC

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. See Figure 7-59. Remove spark plug cables from coil.
4. Remove screw (4) to detach cover (5) from coil (1).
5. Remove two mounting screws (2) to detach coil from seat post.
6. Detach connector [83] from backside of coil.

FXCWC Only

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. See Figure 7-60. Remove spark plug cables from coil.
4. Remove screw (4).
5. Remove nut (3) and washer (2).
6. Detach connector [83] from backside of coil.

INSTALLATION

All Except FXCWC

1. See Figure 7-59. Attach connector [83] to backside of coil.
2. Position coil on seat post. Install two screws (2) and tighten to 120-180 **in-lbs** (13.6-20.3 Nm).
3. Fasten cover (5) to coil with screw (4). Tighten to 30-40 **in-lbs** (3.4-4.5 Nm).
4. Attach spark plug cables to coil. Rear cylinder spark plug cable attaches to upper coil tower.
5. Install main fuse.

⚠WARNING

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

6. Install seat.

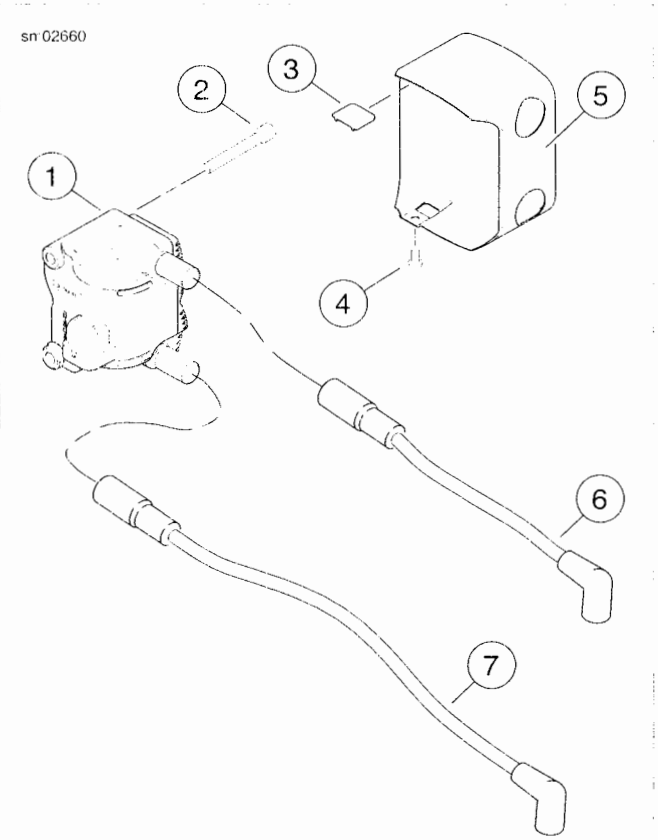
FXCWC Only

1. See Figure 7-60. Attach connector [83] to backside of coil.
2. Position coil on bracket and install screw (4).
3. Make sure ignition/light switch is fully seated. Install washer (2) and nut (3). Tighten nut to 115-135 **in-lbs** (13.0-15.3 Nm).
4. Attach spark plug cables to coil.
5. Install main fuse.

⚠WARNING

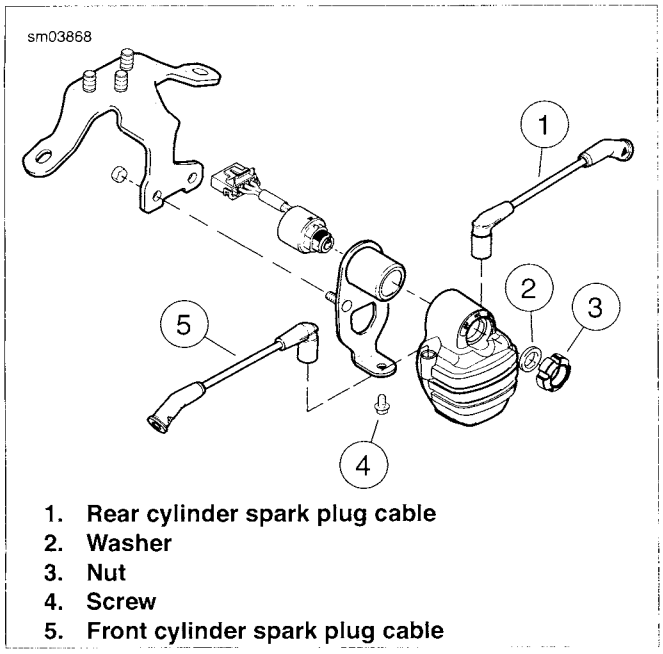
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

6. Install seat.



1. **Coil**
2. **Screw**
3. **Pad (2)**
4. **Screw with washer**
5. **Coil cover**
6. **Rear cylinder spark plug cable**
7. **Front cylinder spark plug cable**

Figure 7-59. Coil (All Except FXCWC)



1. Rear cylinder spark plug cable
2. Washer
3. Nut
4. Screw
5. Front cylinder spark plug cable

Figure 7-60. Coil (FXCWC Only)

GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

NOTE

See 1.18 SPARK PLUGS for spark plug information.

REMOVAL

⚠WARNING

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

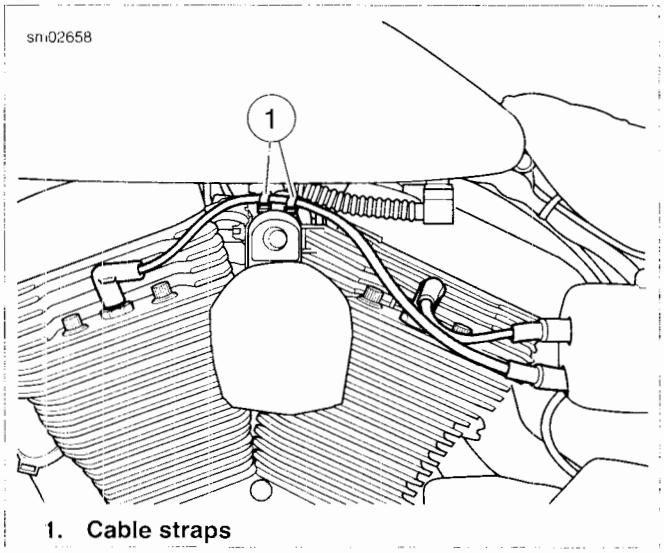
NOTE

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. Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.
2. **All but FXCWC:** see Figure 7-61. Remove cable straps on horn bracket for front spark plug cable.

INSTALLATION

1. See Figure 7-61 (all but FXCWC) or Figure 7-62 (FXCWC). Connect spark plug cables to ignition coil and spark plugs. Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.
   a. **All but FXCWC:** rear cylinder plug cable connects to top coil terminal.
   b. **FXCWC:** front cylinder plug cable connects to front coil terminal.
2. **All but FXCWC:** secure front spark plug cable to horn bracket with **new** cable straps.



1. **Cable straps**

Figure 7-61. Spark Plug Cable Routing (All Except FXCWC)

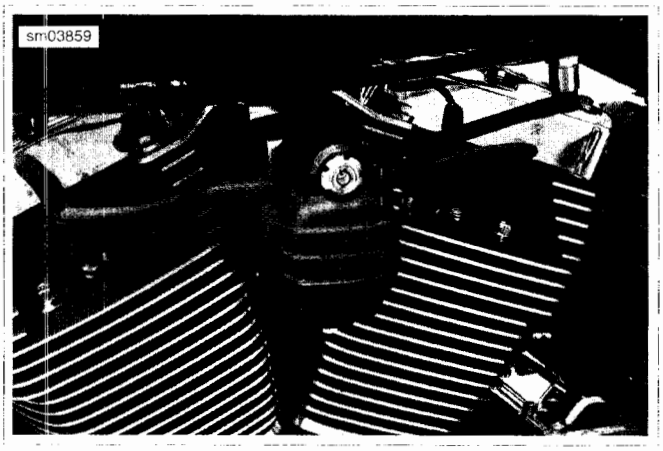


Figure 7-62. Spark Plug Cable Routing (FXCWC)

REMOVAL

⚠WARNING

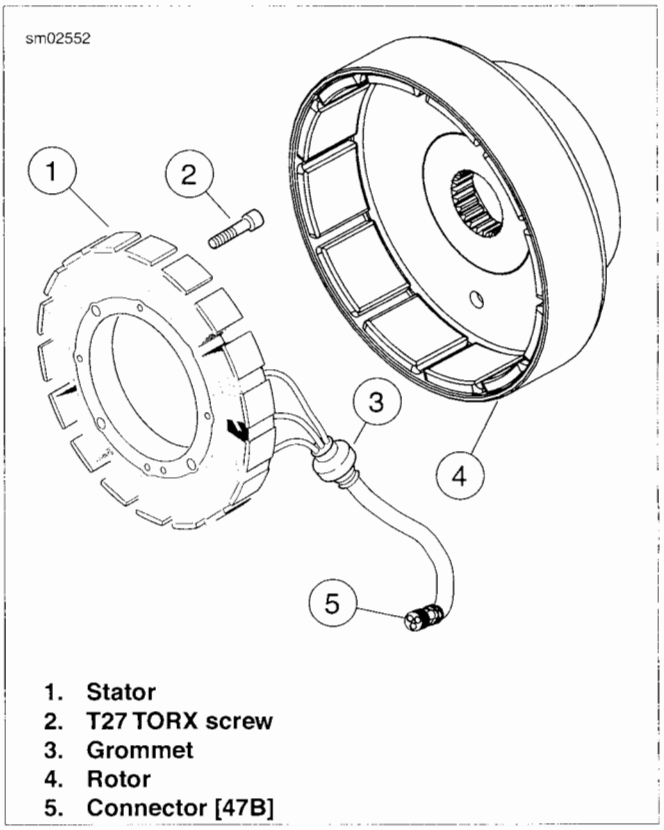
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Remove primary cover, primary drive and clutch. See 5.4 DRIVE COMPONENTS.
3. Remove primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.
4. Disconnect stator connector from voltage regulator. See 7.6 VOLTAGE REGULATOR.
5. See Figure 7-63. Remove alternator rotor (4). Two bolts can be inserted through the holes in the rotor face to aid during removal.

NOTE

See Figure 7-63. Contact cleaner, alcohol or glass cleaner sprayed on rubber grommet (3) will provide lubrication when pulling it through crankcase hole.

6. Move grommet (3) to one side and spray lubricant into gap to lubricate grommet and ease removal. Repeat for other side.
7. Remove T27 TORX screws (2).
8. Remove stator (1) while pulling rubber grommet (3) and wires through crankcase hole.



1. **Stator**
2. **T27 TORX screw**
3. **Grommet**
4. **Rotor**
5. **Connector [47B]**

Figure 7-63. Rotor and Stator

CLEANING AND INSPECTION

The rotor and stator can be replaced individually if either is damaged.

- Remove all foreign particles from the rotor magnets.
- Clean the rotor and stator using clean, soapy water.

INSTALLATION

NOTE

Stator Torx fasteners are not re-usable. They must be replaced.

1. Insert wires through crankcase hole.
2. See Figure 7-63. Push rubber grommet (3) with wires through crankcase hole. If necessary, apply the same lubricant used during removal.
3. Install the stator (1) on the crankcase and fasten in place using **new** TORX screws. Tighten to 55-75 **in-lbs** (6.2-8.4 Nm).
4. Mate connector [47] (5) onto voltage regulator and engage latch to secure. See 7.6 VOLTAGE REGULATOR.
5. Install rotor (4) on the sprocket shaft.
6. Install primary chaincase housing. See 5.5 PRIMARY CHAINCASE HOUSING.
7. Install clutch, primary drive and primary cover. See 5.4 DRIVE COMPONENTS.

8. Connect negative battery cable.

GENERAL

- See Figure 7-64. The fuel gauge is mounted in the left fuel tank cap. Remove by gently pulling upward. Do not twist.
- Three wires attach to the bottom of the gauge (1).
- The fuel gauge sending unit is under the console in the middle of the tank.

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.

NOTE

The gauge wires are routed through a tube in the tank and are secured at the bottom of the tank.

⚠WARNING

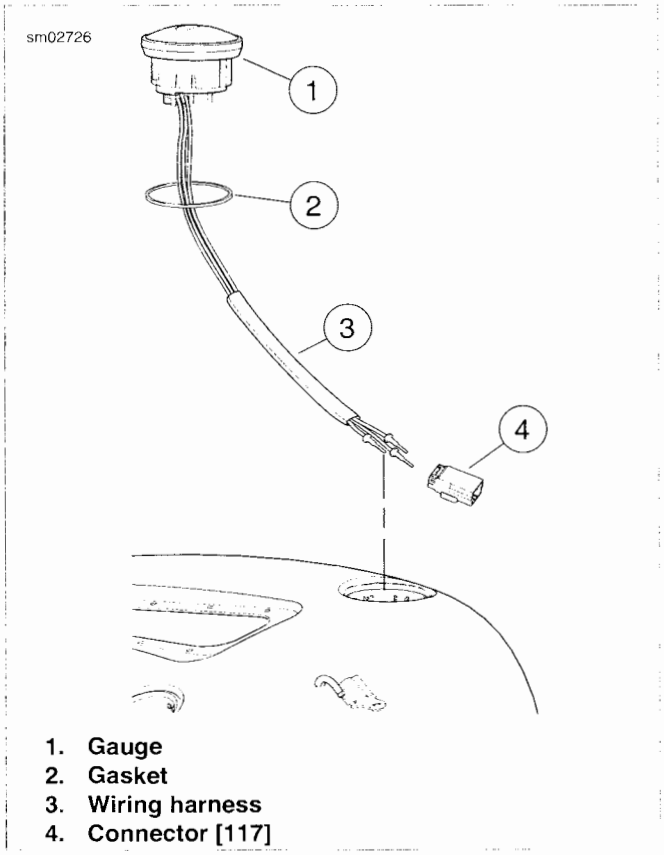
Stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near gasoline. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00002a)

3. Remove fuel tank fasteners and slide tank back to reveal fuel gauge connector [117]. See 4.6 FUEL TANK.
4. See Figure 7-65. Disconnect connector [117] and remove terminals. See B.1 CONNECTORS.
5. Remove fuel gauge wiring from clamp at bottom of fuel tank.

NOTE

Do not twist gauge and wiring during removal.

6. See Figure 7-64. Pull up on gauge (1). Remove gauge, gasket (2) and wiring from fuel tank. Discard gasket.



1. **Gauge**
2. **Gasket**
3. **Wiring harness**
4. **Connector [117]**

Figure 7-64. Fuel Gauge

INSTALLATION

1. See Figure 7-64. Install wiring harness (3) through **new** gasket (2).
2. Push wiring harness through tube in fuel tank.
3. While gently pulling on wiring harness, install gauge (1) and gasket by carefully moving gauge back and forth while pushing down at the same time.
4. See Figure 7-65. Install wiring into connector [117]. Mate connector halves.
5. Slide fuel tank into position and install fasteners. See 4.6 FUEL TANK.
6. Secure wire at bottom of fuel tank.
7. Install main fuse.

⚠WARNING

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

8. Install seat.

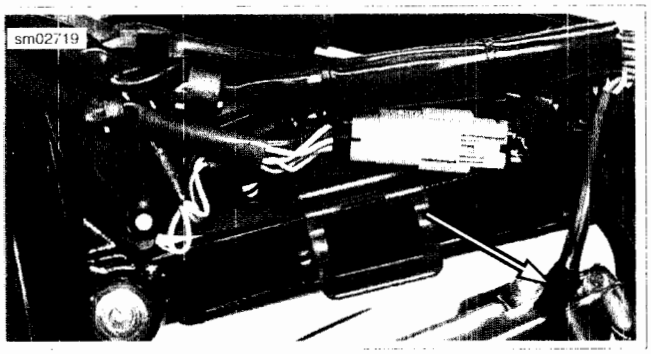


Figure 7-65. Fuel Gauge Connector [117] Location

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. See Figure 7-66. Remove screw from front of instrument console.
4. See Figure 7-67. Remove acorn nut from rear of instrument console.
5. Place a clean shop rag on the fuel tank. Turn instrument console over and place on top of shop cloth.
6. See Figure 7-68. Disconnect electrical connector and remove instrument console.

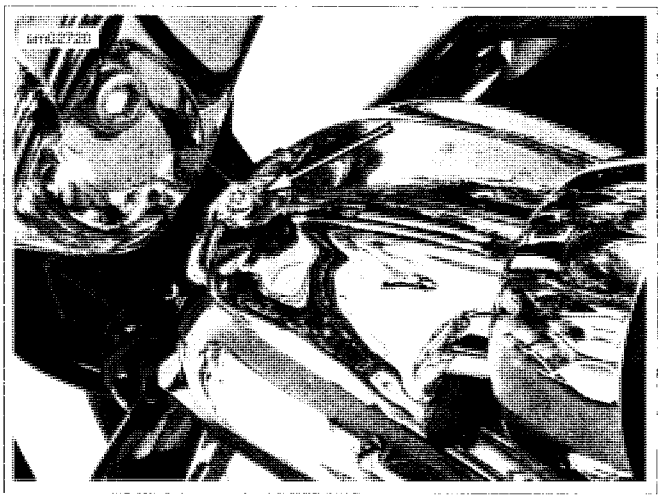


Figure 7-66. Front Console Screw

INSTALLATION

NOTE

When installing console, do not pinch wires. Improper installation may cause electrical component malfunction.

1. See Figure 7-68. Connect connector if necessary. Lay console over center of tank.
2. Install mounting hardware.
   a. See Figure 7-67. Loosely install acorn nut on rear console mount.
   b. See Figure 7-66. Loosely install screw with washer in front console mount.
   c. Tighten rear acorn nut before tightening front screw. Tighten to 30-40 **in-lbs** (3.4-4.5 Nm).
   d. Tighten front screw to 30-40 **in-lbs** (3.4-4.5 Nm).
3. If speedometer housing cup was removed from instrument console, install housing cup and tighten screws to 50-60 **in-lbs** (5.7-6.8 Nm)
4. Install main fuse.
5. Check indicator light functions.

⚠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.

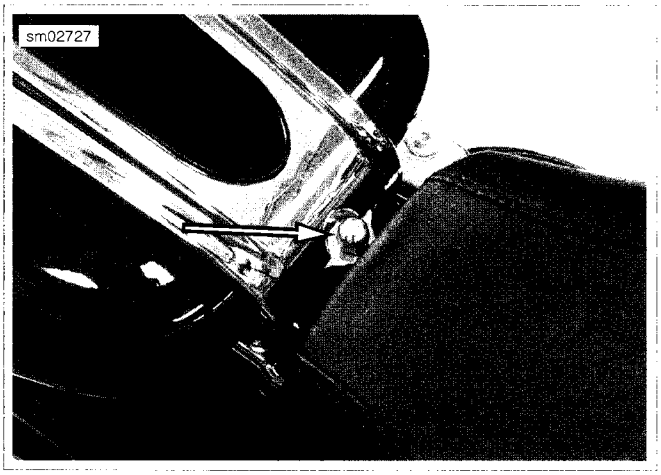


Figure 7-67. Rear Console Mount

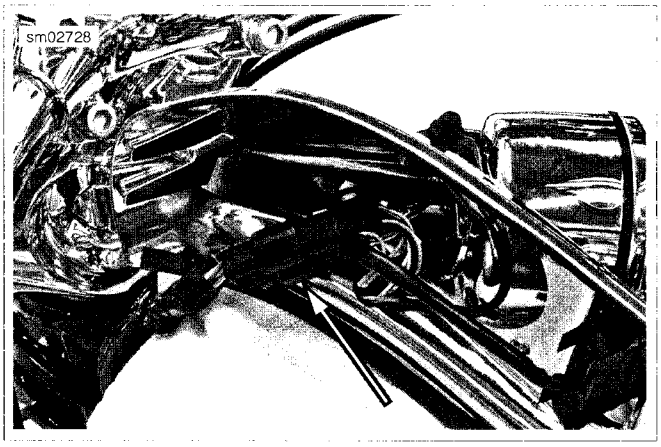


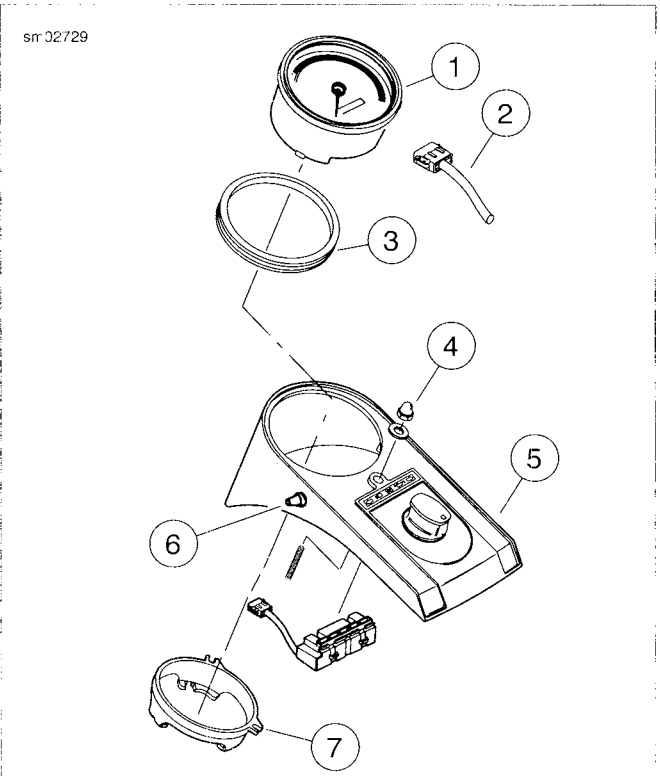
Figure 7-68. Console Wiring

REMOVAL

1. See Figure 7-69. Remove nut and washer (4) and lift console (5) from fuel tank.
2. Position clean shop rags on fuel tank and flip console over to expose underside.
3. Depress connector tab and disconnect 12-place harness connector [39] (2) from speedometer under console.
4. Unscrew the rubber boot from the odometer reset switch (6) on the left side of the console.
5. Remove the odometer reset switch from hole in console.
6. See Figure 7-70. Pry between three tabs and speedometer with a screwdriver to raise and release back clamp from speedometer. Remove back clamp from speedometer.
7. See Figure 7-69. Remove speedometer from console.
8. Remove gasket (3) from speedometer.

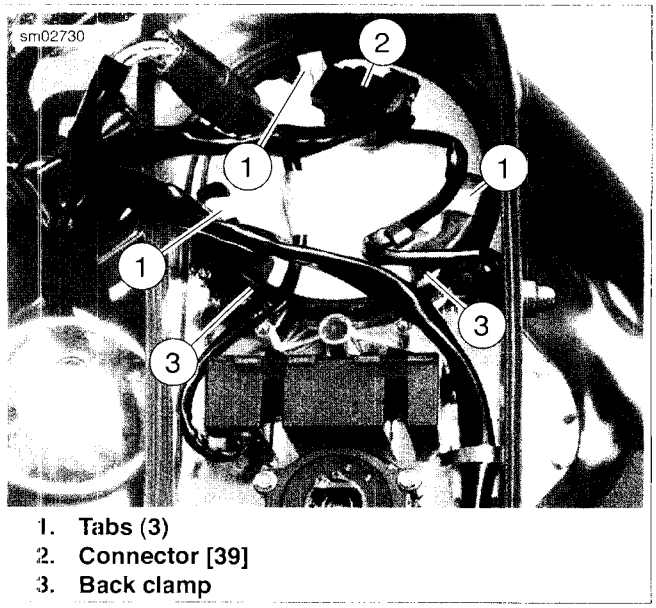
INSTALLATION

1. See Figure 7-69. Install gasket (3) to speedometer.
2. Position speedometer in console (5).
3. See Figure 7-70. Press on back clamp (3) until three tabs engage on back of speedometer.
4. See Figure 7-69. Insert odometer reset switch (6) through hole in console and install rubber boot.
5. Connect 12-place connector [39] (2) to speedometer under console.
6. Remove shop rags. Attach console to fuel tank with nut and washer (4). Tighten to 7-11 ft-lbs (9.5-14.9 Nm).
7. Test speedometer for proper operation.



1. **Speedometer**
2. **Connector [39]**
3. **Gasket**
4. **Nut and washer**
5. **Console**
6. **Reset switch**
7. **Back clamp**

Figure 7-69. Speedometer: All But FXCWC (Typical)



1. **Tabs (3)**
2. **Connector [39]**
3. **Back clamp**

Figure 7-70. Connector [39] (Typical)

REMOVAL

1. Remove seat.
2. Remove instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.
3. See Figure 7-71. Detach connector body from speedometer mount.
4. See Figure 7-72. Push in tabs (1) and carefully pull speedometer away from instrument console. Make sure wiring and connectors do not get damaged.
5. Remove connector (2) from speedometer.

INSTALLATION

1. See Figure 7-72. Attach connector (2) to speedometer.

NOTE

When installing speedometer, make sure wiring and connectors do not get damaged.

2. Install speedometer into instrument console. Make sure tabs (1) fully engage against instrument console.
3. See Figure 7-71. Attach connector body to speedometer mount.
4. Install instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.

⚠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.

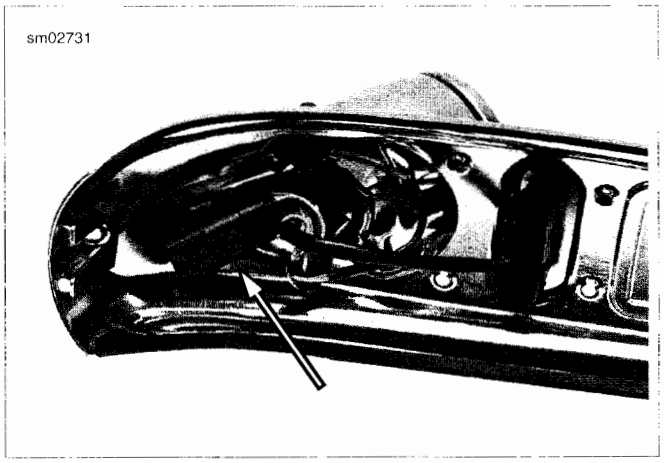
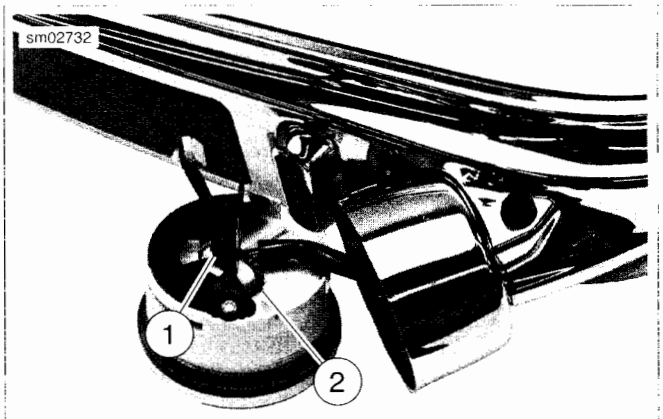


Figure 7-71. Speedometer Electrical Connector: FXCWC



1. **Tab (2)**
2. **Connector**

Figure 7-72. Speedometer Removal

GENERAL

The vehicle speed sensor is powered and monitored by the ECM. The ECM processes the vehicle speed signal and transmits this signal to the TSM/TSSM/HFSM and speedometer through serial data.

The vehicle speed sensor is located on the transmission just behind the transmission top cover.

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Remove main fuse.
3. Remove rear electrical panel. See 7.3 ELECTRICAL PANEL.
4. See Figure 7-73. Disconnect 3-place vehicle speed sensor connector [65].
5. Remove sensor mounting bolt and lift sensor from transmission case.

INSTALLATION

1. See Figure 7-73. Install sensor into transmission case using mounting bolt. Tighten bolt to 84-108 **in-lbs** (9.5-12.2 Nm).
2. Mate 3-place vehicle speed sensor connector [65].
3. Install electrical panel. See 7.3 ELECTRICAL PANEL.
4. Install main fuse.

⚠WARNING

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

5. Install seat.

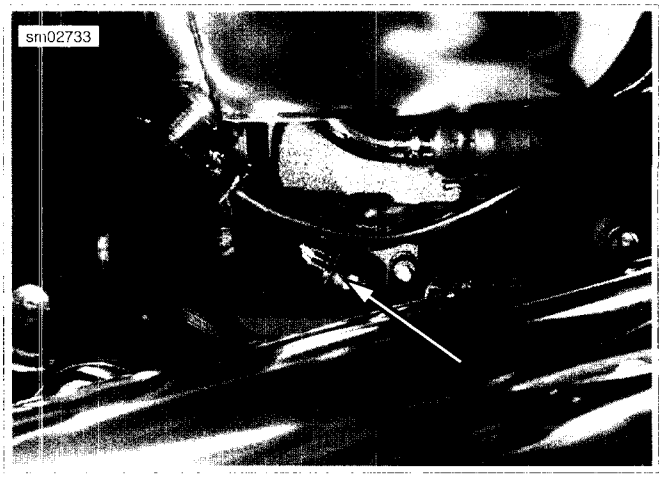


Figure 7-73. Vehicle Speed Sensor

GENERAL

The indicator lamp assembly is equipped with Light Emitting Diode (LED) indicators. The indicator lamp assembly is not serviceable. If one LED is bad, the entire assembly must be replaced.

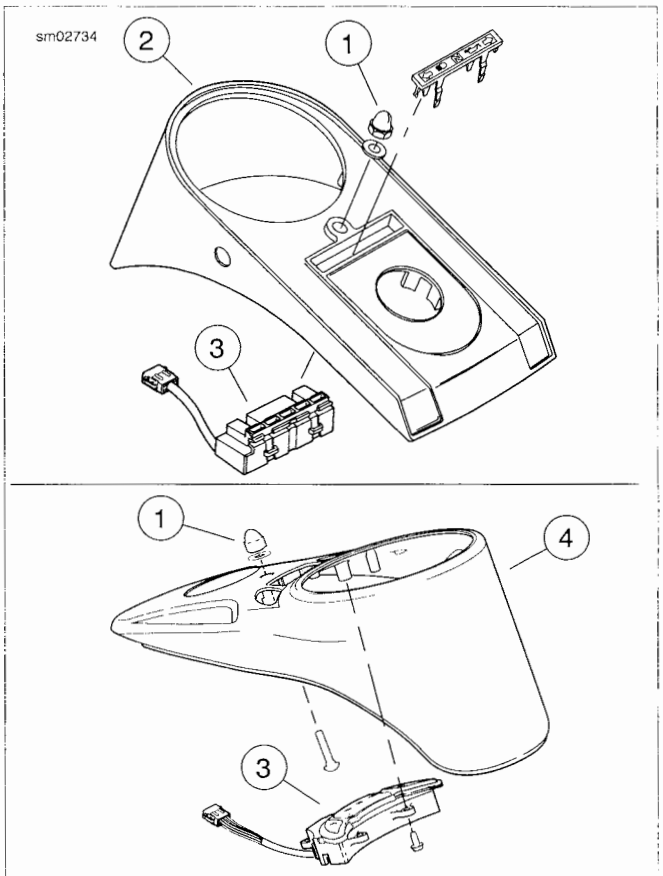
See the ELECTRICAL DIAGNOSTIC MANUAL for troubleshooting procedures.

REMOVAL

1. See Figure 7-74. Remove nut and washer (1). Raise console (2 or 4) from fuel tank. Place shop rags on tank and flip console over to expose underside.
2. **All except FLSTSB and FLSTC:** See Figure 7-75. Squeeze clips together (2) and gently pry indicator lamp assembly (1) out of console from the side with a screwdriver.
3. **FLSTSB and FLSTC:** See Figure 7-76. Remove screws (2) and gently pull indicator lamp assembly (1) out of console.
4. Disconnect 8-place connector [21] (3) from indicator lamp assembly.

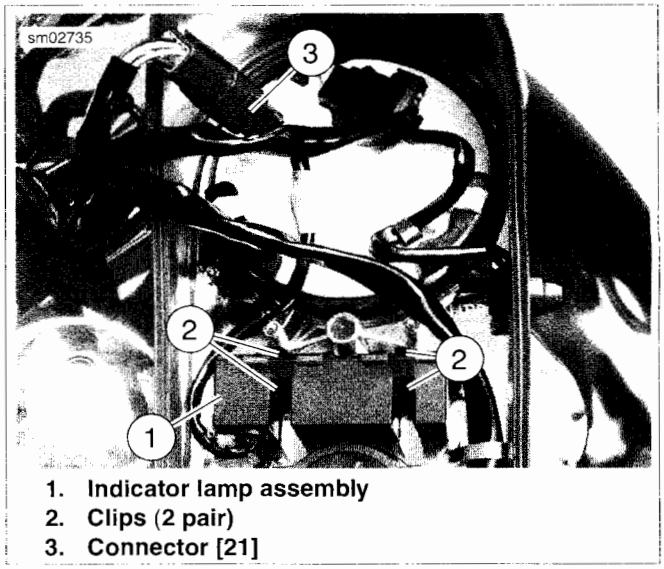
INSTALLATION

1. **All except FLSTSB AND FLSTC:**. See Figure 7-75. Install indicator lamp assembly (1) into console. Make sure clips (2) engage to secure assembly in place.
2. **FLSTSB and FLSTC:**. See Figure 7-76. Install indicator lamp assembly (1) into console with screws (2).
3. Connect connector [21] (3) to main wiring harness.
4. See Figure 7-74. Place console (2 or 4) in position. Install nut and washer (1). Tighten to 7-11 ft-lbs (9.5-14.9 Nm).



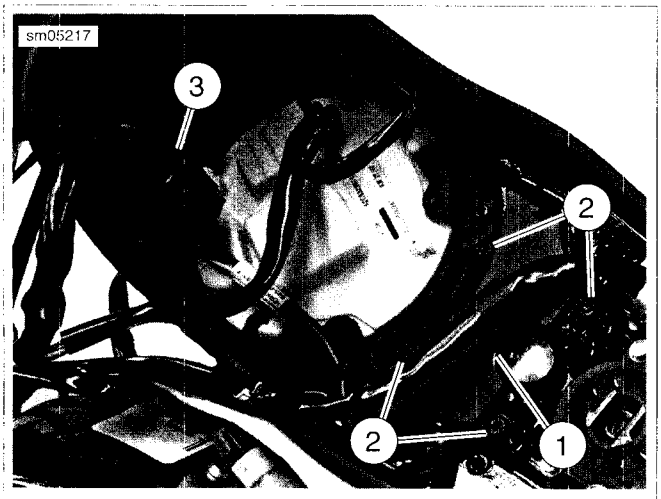
1. **Nut and washer**
2. **Console: all but FLSTSB and FLSTC**
3. **Indicator lamp assembly**
4. **Console: FLSTSB and FLSTC**

Figure 7-74. Indicator Lamp Assembly: All but FXCWC



1. **Indicator lamp assembly**
2. **Clips (2 pair)**
3. **Connector [21]**

Figure 7-75. Connector [21]



1. Indicator lamp assembly
2. Screws (4)
3. Connector [21]

Figure 7-76. Connector [21]: FLSTSB

REMOVAL

NOTE

Indicator light assembly and harness connecting to main harness, speedometer, and odometer reset switch are sold as a single unit.

1. Remove instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.
2. Remove speedometer. See 7.27 SPEEDOMETER: FXCWC.
3. Remove odometer reset switch from instrument console.
4. Figure 7-77 Spread tabs apart and remove indicator lamp assembly with harness.

INSTALLATION

1. See Figure 7-77. Install indicator lamp assembly into console. Make sure clips are fully engaged to secure assembly in place.
2. Install odometer reset switch into side of instrument console.
3. Install speedometer into instrument console. See 7.27 SPEEDOMETER: FXCWC.
4. Install instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.

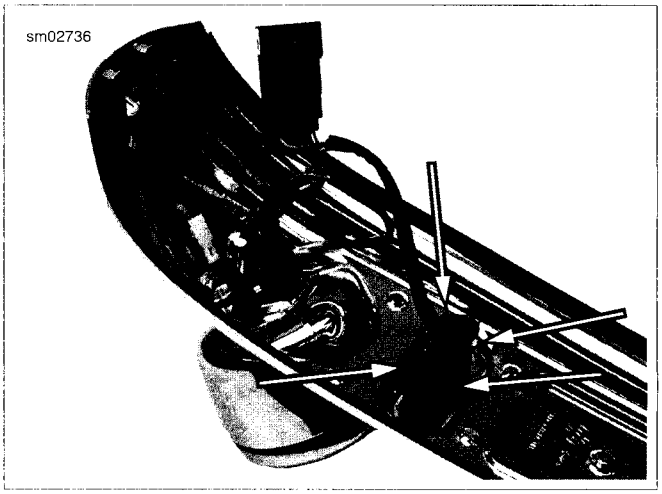


Figure 7-77. Indicator Lamp Assembly: FXCWC

GENERAL

See Figure 7-78. The neutral switch is located on the transmission top cover. The two terminal switch is normally closed. When the transmission shifter is in neutral and the ignition switch is in the IGNITION position, the switch causes the NEUTRAL indicator light to illuminate.

REMOVAL

1. Remove battery and battery caddy. See 1.25 BATTERY MAINTENANCE, Disconnection and Removal.
2. Make sure transmission shifter is in NEUTRAL.
3. See Figure 7-79. Remove connectors from switch studs.
4. Remove neutral switch and o-ring from transmission top cover.

NOTE

To replace connectors, use heat-sealed butt splice connectors. See A.16 SEALED SPLICE CONNECTORS.

INSTALLATION

NOTE

The transmission shifter must be in the NEUTRAL position when installing the switch to allow the bottom ball on the switch to engage the ramp on the shifter cam.

1. See Figure 7-79. Lubricate o-ring with transmission oil.
2. Install switch with o-ring to transmission top cover. Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).

NOTE

The neutral switch is not polarity sensitive, so either connector can be attached to either stud.

3. Install connectors to switch studs.
4. Install battery caddy and battery. See 1.25 BATTERY MAINTENANCE, Installation and Connection.

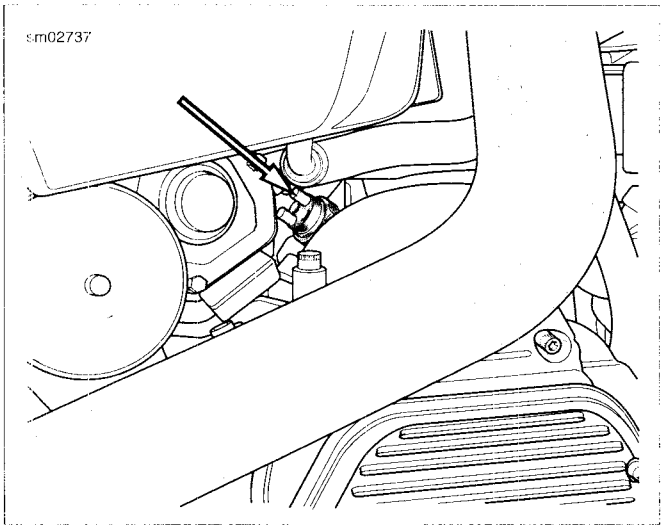
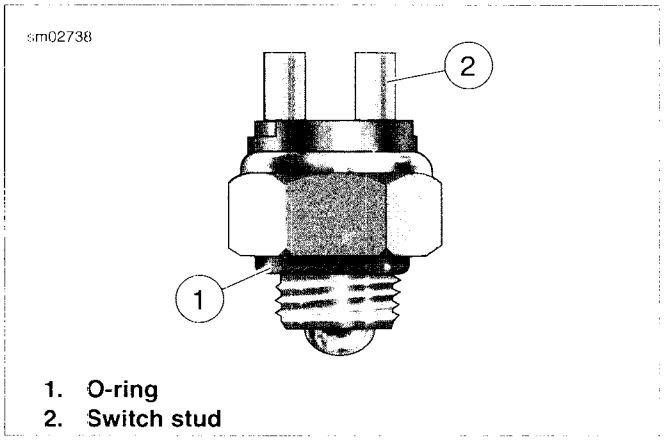


Figure 7-78. Neutral Switch Location



1. **O-ring**
2. **Switch stud**

Figure 7-79. Neutral Switch

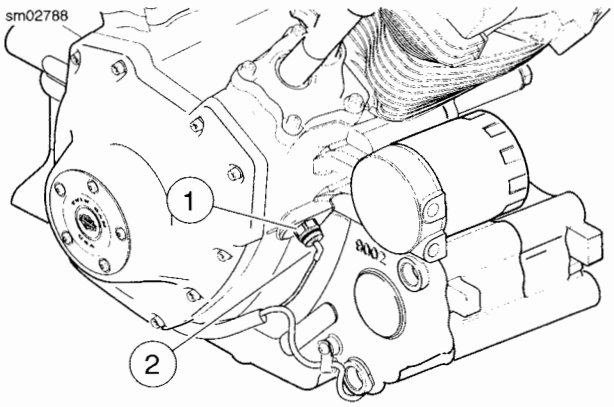
5. Test neutral switch for proper operation.
   a. Turn ignition switch to IGNITION position.
   b. Verify that transmission shifter is in NEUTRAL.
   c. Check to see that NEUTRAL indicator light illuminates.

GENERAL

See Figure 7-80. The oil pressure switch monitors oil pressure in the crankcase. If the oil pressure drops below 3 psi (20.6 kPa), the oil pressure switch is tripped and illuminates the low oil pressure indicator light. The oil pressure switch is located on the right side of the crankcase.

REMOVAL

1. See Figure 7-80. Remove connector (2) from oil pressure switch (1).
2. Using a 15/16 in. open end wrench, remove switch from crankcase.



1. **Oil pressure switch**
2. **Connector jumper**

Figure 7-80. Oil Pressure Switch

INSTALLATION

NOTE

Perform step 1 only if original switch is being re-installed. New switches have a sealant contact patch on the threads. If new switch is being installed, begin at step 2.

1. Coat threads of oil pressure switch with LOCTITE PIPE SEALANT WITH TEFLON (PST).
2. See Figure 7-80. Install oil pressure switch (1) to crankcase. Tighten switch to 96-144 **in-lbs** (10.8-16.3 Nm).
3. Attach connector (2) to oil pressure switch.
4. Test oil pressure switch for proper operation.

NOTE

If connector (2) requires replacement, see A.16 SEALED SPLICE CONNECTORS.

GENERAL

See Figure 7-81. The rear stoplight switch monitors brake fluid pressure in the rear brake line. When pressure in the line reaches a preset level, the rear stoplight switch is tripped and illuminates the tail light/stoplight.

REMOVAL

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. See Figure 7-81. Remove both connectors (2) from rear stoplight switch (1).
2. Place a clean container under the rear stoplight switch and brake line to catch escaping fluid.
3. Remove rear stoplight switch.

INSTALLATION

1. Coat threads of stoplight switch with LOCTITE 565 (thread sealant) perpendicular to the threads. Do not allow thread sealant to make contact with end of switch.
2. See Figure 7-81. Install rear stoplight switch (1). Tighten switch to 12-15 ft-lbs (16.3-20.3 Nm).
3. Install both switch connectors (2).

⚠WARNING

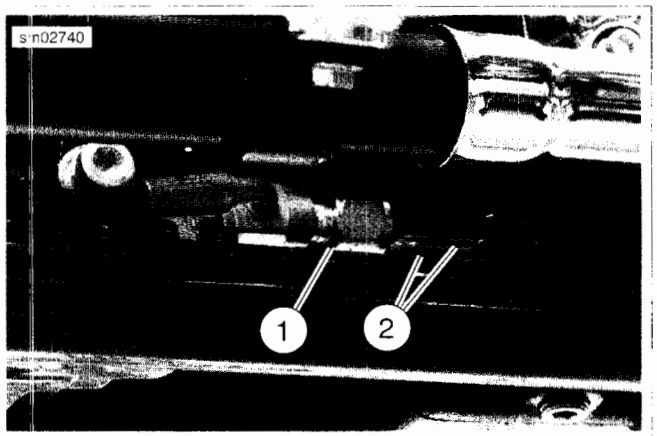
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

4. Bleed brake system. See 1.16 BLEEDING BRAKES.

⚠WARNING

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

5. Check stoplight for proper operation.



1. **Stoplight switch**
2. **Connectors**

Figure 7-81. Rear Stoplight Switch

INSPECTION

If the horn fails to sound or does not sound satisfactorily, check for loose, frayed or damaged wires leading to horn terminal, discharged battery or corroded ground.

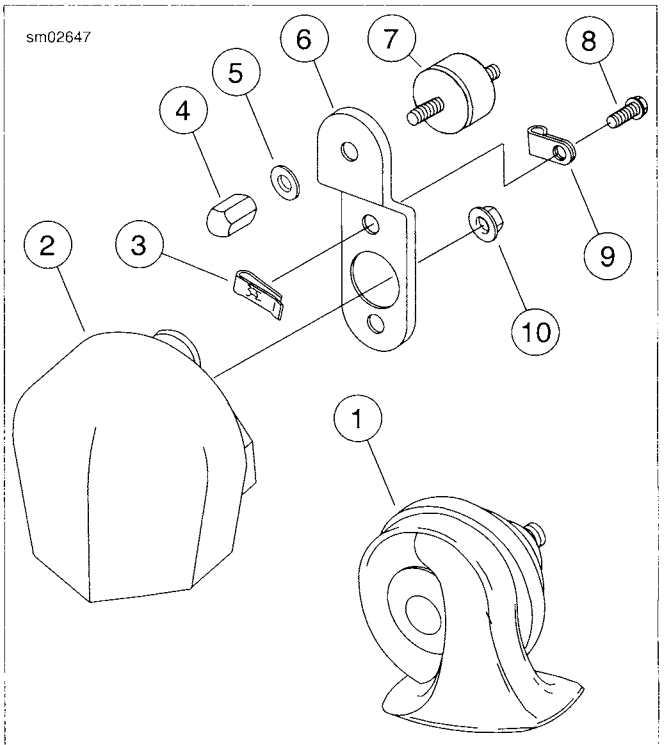
The horn is permanently sealed and non-repairable. Only the mounting hardware is replaceable.

NOTE

No tonal adjustments may be made to this horn.

REMOVAL AND INSTALLATION: ALL BUT FXCWC

1. See Figure 7-82. Remove acorn nut (4) and washer (5) to detach horn bracket (6) from vehicle.
2. Disconnect wires from posts on back side of horn.
3. Remove screws (8) and nut (10) to detach horn from bracket. Free wires from clamp (9).
4. Install **new** horn on bracket.
   a. Secure with screws (8), and push nuts (3). Tighten screws to 35-55 **in-lbs** (4.0-6.2 Nm).
   b. Install nut (10) and tighten to 80-100 **in-lbs** (9.0-11.3 Nm). Fold wires under clamp (9).
5. Attach wiring.
6. Attach horn bracket to vehicle using washer (5) and acorn nut (4). Tighten nut to 80-100 **in-lbs** (9.0-11.3 Nm). When tightening fasteners, be sure the horn does not contact the horn cover or other parts.

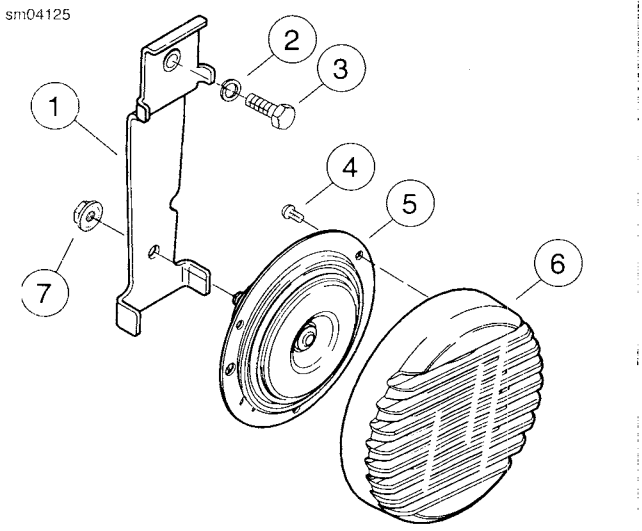


1. **Horn**
2. **Cover**
3. **Push nut (2)**
4. **Acorn nut**
5. **Washer**
6. **Bracket**
7. **Rubber mount**
8. **Screw (2)**
9. **Clamp**
10. **Nut**

Figure 7-82. Horn

REMOVAL AND INSTALLATION: FXCWC

1. See Figure 7-83. Remove bolt (3) and washer (2) to detach horn bracket (1) from vehicle.
2. Disconnect wires from posts on back side of horn.
3. Remove locknut (7) to detach horn from bracket.
4. Remove screws (4) to detach cover (6) from horn (5).
5. Replace horn.
6. Install **new** horn to bracket.
   a. Attach cover to horn with screws (4). Tighten to 40-50 **in-lbs** (4.52-5.65 Nm).
   b. Attach horn to bracket with locknut (7).
7. Attach wiring.
8. Attach horn bracket to vehicle using washer (2) and bolt (3). Tighten to 13-15 ft-lbs (17.64-20.36 Nm).



1. **Bracket**
2. **Washer**
3. **Bolt**
4. **Screw (3)**
5. **Horn**
6. **Cover**
7. **Locknut**

Figure 7-83. Horn: FXCWC

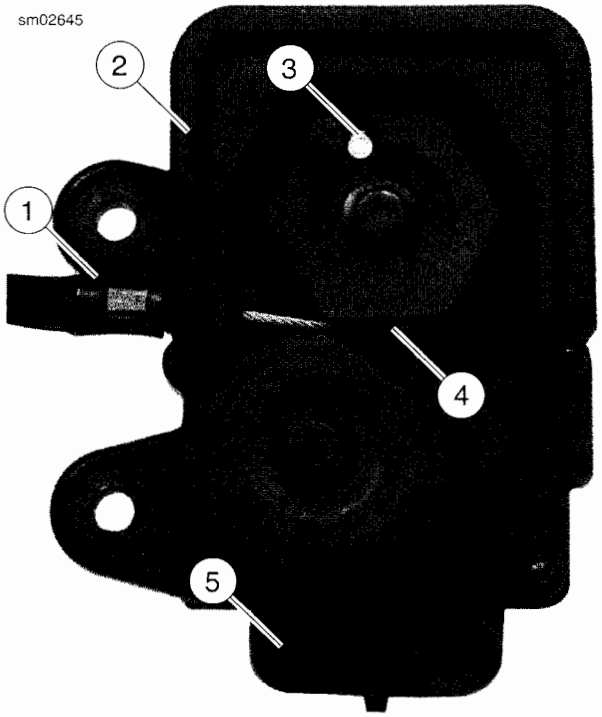
GENERAL

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

The active exhaust module is located on the exhaust bracket. The attached cable is routed to a bellcrank located on the rear exhaust pipe.

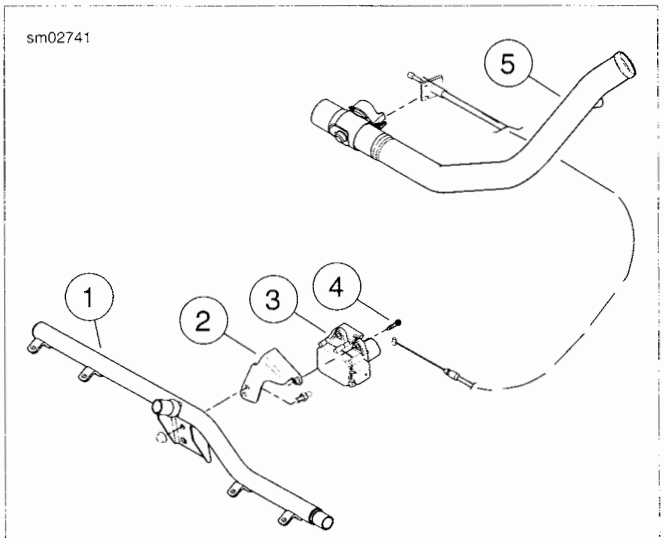
REMOVAL

1. Remove exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.
2. See Figure 7-84. Disconnect active exhaust module connector [179] (5).
3. Remove active exhaust cable housing (1) from notch in shroud (2). Remove ferrule (3) from active exhaust module to free cable (4).
4. See Figure 7-85. Remove module fasteners (4) from active exhaust module bracket (2).



1. **Active exhaust cable housing**
2. **Shroud**
3. **Ferrule**
4. **Active exhaust cable**
5. **Active exhaust module connector [179]**

Figure 7-84. Active Exhaust Module



1. **Interconnect tube assembly**
2. **Active exhaust module bracket**
3. **Active exhaust module**
4. **Fastener**
5. **Rear exhaust pipe**

Figure 7-85. Active Exhaust Module Mounting

REPAIR

NOTE

See Figure 7-84. Active exhaust module shroud (2) can be replaced. Replace shroud if active exhaust cable housing (1) is a loose fit in shroud.

1. Remove fasteners securing shroud.
2. Replace shroud. Replace fasteners and tighten securely.

INSTALLATION

1. See Figure 7-85. install active exhaust module (3) to bracket (2) using fasteners (4). Tighten fasteners to 32-40 **in-lbs** (3.6-4.5 Nm).
2. See Figure 7-84. Install ferrule (3) into slot shown. Wrap cable around active exhaust module shroud as shown.
3. Clip active exhaust cable housing (1) into shroud (2).
4. Connect active exhaust module connector [179] (5).
5. Install exhaust system. See 4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB or 4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB.

REMOVAL

NOTES

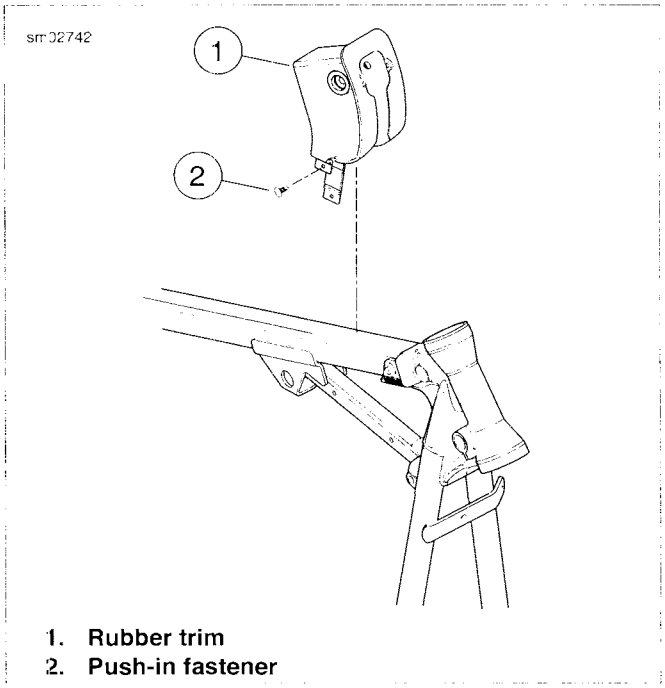
- *See Appendix B for the main wiring harness schematic and a description of all connector locations.*
- *Disarm TSSM/HFSM before removal.*

1. Remove seat.

⚠WARNING

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

2. Disconnect battery cables, negative cable first. Remove battery. See 7.12 BATTERY CABLES.
3. Disconnect harness grounds.
4. Remove rear splash guard to access electrical panel.
5. **All but FXCWC:** Remove instrument panel. Disconnect connectors:
   a. Speedometer connector.
   b. Indicator lamp connector.
   c. Ignition key switch.
6. **FXCWC:** Remove instrument panel. Disconnect connectors:
   a. 12-pin connector attaching main harness to indicator lamp harness.
   b. Ignition key switch.
7. Remove voltage regulator and connectors located in front electrical caddy. See 7.7 FRONT ELECTRICAL CADDY.
   a. Voltage regulator [77].
   b. Stator [47].
   c. Front oxygen sensor connector [138].
   d. Crank position sensor [79].
   e. Jiffy stand interlock connector [133].
8. Remove fuel tank. See 4.6 FUEL TANK. This includes detaching fuel gauge connector [117] and fuel pump and sender [141].
9. On vehicles with active exhaust, remove active exhaust connector [179] from active exhaust module.
10. On vehicles with active intake, remove air cleaner and disconnect active intake solenoid connector [179]. See 4.5 AIR CLEANER ASSEMBLY.



1. **Rubber trim**
2. **Push-in fastener**

Figure 7-86. Rubber Trim

11. See Figure 7-86. On all but FXCWC, remove push-in fastener (2) from rubber trim (1) on frame. Disconnect connectors:
    a. MAP sensor connector [80].
    b. Right handlebar controls [22].
    c. Left handlebar controls [24].
    d. Front turn signals [31].
    e. Front fender tip lamp [32] (FLST and FLSTC only).
    f. Headlamp [38].
    g. Spotlamp switch (if present).
    h. Horn wires [122].
    i. IAT sensor connector [89].
    j. ET sensor connector [90].
    k. IAC connector [87].
    l. TP sensor connector [88].
    m. Front [84] and rear [85] fuel injector connectors.
12. Disconnect rear oxygen sensor connector [137] located under oil tank on right side of vehicle.
13. Remove starter. See 7.13 STARTER.
14. Remove vehicle speed sensor connector [65] located on transmission case.
15. Open clamps around harness along frame tubes. Cut cable strap from harness as necessary.

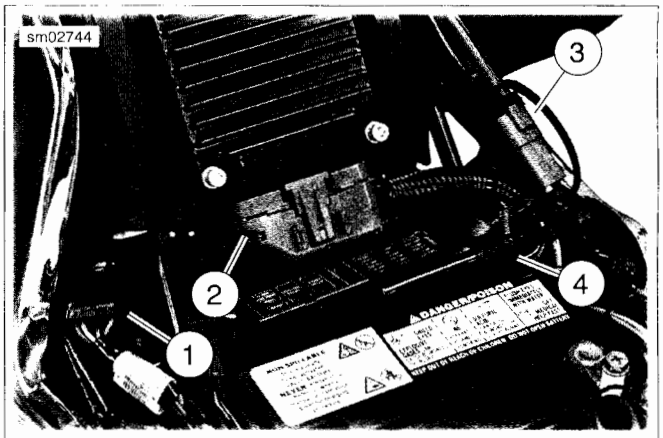
16. Disconnect connectors:
    a. Electronic control module [78].
    b. Stoplight switch.
    c. Oil pressure switch [121].
    d. Starter solenoid [128].
    e. Tail lamp [7].
    f. TSM/HFSM/TSSM connector [30].
    g. Security siren connector [142].
    h. Neutral switch wiring [131].
17. Detach data link connector [91A] from fuse block bracket.
18. Detach fuse block wiring.
    a. Remove fuse block bracket from frame.
    b. Depress tab located on fuse block bracket and slide the fuse block out of the mounting slots. Repeat for other block.
19. Disconnect coil connector [83].
20. Remove harness clips and any remaining cable straps. Disconnect all ground wires.
21. Slowly remove harness from frame taking note of wire routings.

INSTALLATION

NOTE

Be sure to securely attach ground terminals to their proper frame locations and replace all cable straps.

1. Place harness wires into their original positions.
2. Attach the following connectors:
    a. Stoplight switch [121].
    b. Oil pressure switch [120].
    c. Turn signal/turn signal security module [30].
    d. Security siren connector [142].
    e. Vehicle speed sensor connector [65].
    f. Neutral indicator switch [131].
    g. Starter solenoid [128].
    h. Ignition coil [83].
3. Install starter. See 7.13 STARTER.
4. Install fuse and relay blocks on bracket.
5. See Figure 7-87. Attach connectors under seat.
    a. Tail lamp [7].
    b. Electronic control module [78].
    c. Secure data link connector [91A] to frame.
6. Attach connectors under fuel tank trim.
    a. MAP sensor connector [80].
    b. Right handlebar controls [22].
    c. Left handlebar controls [24].
    d. Front turn signals [31].
    e. Front fender tip lamp [32] (FLST and FLSTC only).
    f. Headlamp [38].
    g. Spotlamp switch (if present).
    h. Horn wires.
    i. IAT sensor connector [89].
    j. ET sensor connector [90].
    k. IAC connector [87].
    l. TP sensor connector [88].
    m. Front [84] and rear [85] fuel injector connectors.



1. **Tail lamp connector**
2. **Electronic control module connector [10]**
3. **Data link connector [91A]**
4. **Main fuse connector**

Figure 7-87. Connectors Under Seat

7. See Figure 7-88. Attach ground wires to frame in front of battery. Negative battery cable attaches to right side post (2). See 7.12 BATTERY CABLES.
8. See Figure 7-86. On all but FXCWC, insert push-in fastener (2) into rubber trim (1) on frame.
9. Install splash guard over electrical panel. See 7.3 ELECTRICAL PANEL.
10. Install fuel tank. See 4.6 FUEL TANK.
11. **All but FXCWC:** Connect connectors and install instrument console. See 7.26 SPEEDOMETER: ALL BUT FXCWC.
    a. Speedometer connector.
    b. Indicator lamp connector.
    c. Ignition key switch.

12. **FXCWC:** Connect connectors and install instrument console. See 7.25 INSTRUMENT CONSOLE: FXCWC.
    a. 12-pin connector attaching main harness to indicator lamp harness.
    b. Ignition key switch.
13. Install voltage regulator and connectors located in front electrical caddy. See 7.7 FRONT ELECTRICAL CADDY.
    a. Voltage regulator [77].
    b. Stator [47].
    c. Front oxygen sensor connector [138].
    d. Crank position sensor [79].
    e. Jiffy stand interlock connector [133].
14. On vehicles with active exhaust, connect active exhaust connector [179] to active exhaust module
15. On vehicles with active intake, connect active intake solenoid connector [178] and install air cleaner. See 4.5 AIR CLEANER ASSEMBLY.

⚠WARNING

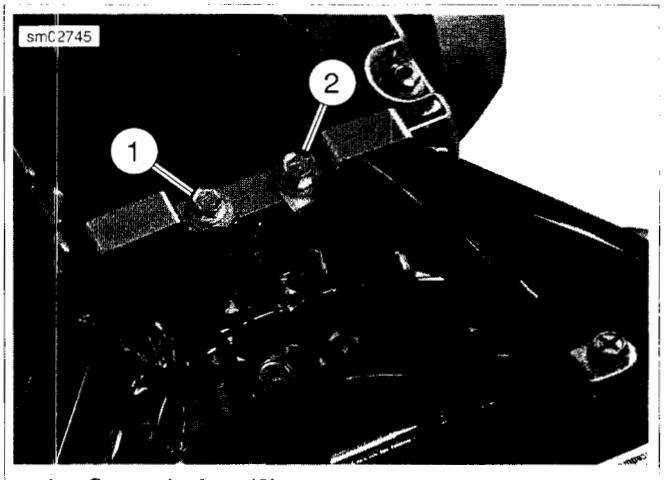
Connect positive (+) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00068a)

16. Install battery and connect battery cables, positive cable first.

⚠WARNING

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

17. Install seat.
18. Turn ignition ON. Test switches for correct operation.
    a. Left and right turn signals, front and rear.
    b. Four-way hazard warning flashers.
    c. Rear brake lamp.
    d. Headlamp.
    e. Horn.
    f. Indicator lamps.
    g. Starter.
    h. Speedometer.



1. **Ground wires (2)**
2. **Ground wire and negative battery cable**

Figure 7-88. Ground Wires and Negative Battery Cable

GENERAL

The switches are of rugged construction and feature a superior seal to protect electrical contacts and components from dirt and moisture in harsh environments.

The left handlebar switches include the headlamp HI - LO switch, horn and left turn signal switch. The right handlebar switches include the engine start and RUN - OFF switch and right turn signal switch. The individual switches are non-repairable and must be replaced if they malfunction.

NOTES

- *On certain models, the turn signal wiring is routed through the lower switch housings and handlebars.*
- *To replace or repair individual switches in either the right or left handlebar switch assemblies, see 7.38 RIGHT HANDLEBAR SWITCH or 7.39 LEFT HANDLEBAR SWITCH.*

REPAIR PROCEDURES

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

See 7.38 RIGHT HANDLEBAR SWITCH and 7.39 LEFT HANDLEBAR SWITCH. The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

The information below is useful when repairing handlebar switch assemblies.

1. To better access wires and avoid damaging conduit with radiant heating device, push conduit back and secure with extra 7.0 in. (177.8 mm) cable strap in kit.
2. Strip 0.5 in (12.7 mm) of insulation off switch wires. Twist stripped ends of switch wires until all strands are tightly coiled.
3. Cut dual wall heat-shrink tubing, supplied in repair kit into 1.0 in. (25.4 mm) segments. Slide tubing over each wire of **new** switch assembly.
4. Splice existing and **new** switch wires, matching wire colors. Solder the spliced connections. For best results, do one wire at a time.
5. Center the heat-shrink tubing over the soldered splices.

⚠WARNING

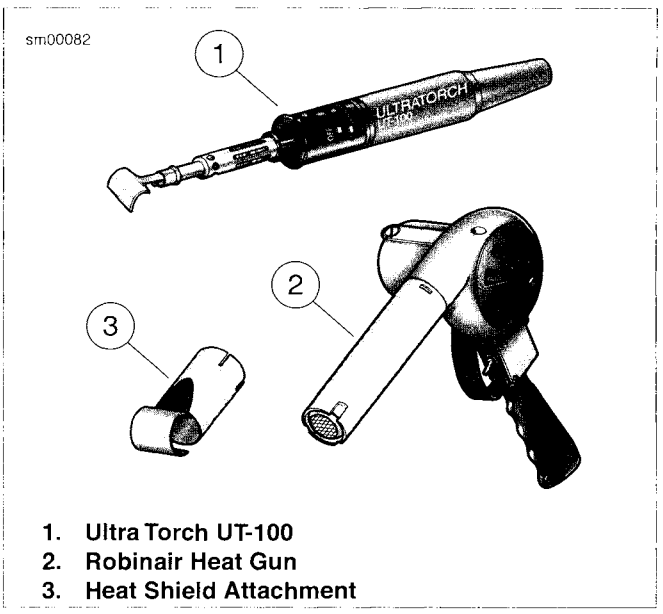
Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

6. See Figure 7-89. Using the ULTRA TORCH UT-100 (Part No. HD-39969) or ROBINAIR HEAT GUN (Part No. HD-25070) with HEAT SHIELD ATTACHMENT (Part No. HD-41183) or other suitable radiant heating device, uniformly heat the heat-shrink tubing to insulate and seal the soldered connections. Apply heat just until the meltable sealant exudes out both ends of tubing and it assumes a smooth cylindrical appearance.
7. Inspect the melted sealant for solder beads. Excess solder or heat may force some solder out with the melted sealant. Use a small needle nose pliers to remove any solder found. Briefly heat the connection to reseal the tubing if solder beads were removed. Use less solder or reduce heating time or intensity when doing subsequent splices.

⚠WARNING

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



1. **Ultra Torch UT-100**
2. **Robinair Heat Gun**
3. **Heat Shield Attachment**

Figure 7-89. Radiant Heating Devices

REMOVAL

NOTE

The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)

1. Remove main fuse.
2. See Figure 7-90. Place the 5/32 in. (4 mm) thickness cardboard insert between the brake lever and lever bracket.
3. Using a T25 TORX drive head, loosen but do not remove the upper and lower switch housing screws.
4. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the master cylinder housing. Remove the brake lever/master cylinder assembly and clamp from the handlebar.
5. Remove the upper and lower switch housing screws.
6. Remove the friction shoe from the end of the tension adjuster screw.

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.

7. Loosen cable adjusters. See 1.13 THROTTLE CABLES
8. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.
9. Remove the throttle control grip from the end of the handlebar.
10. Pull the crimped inserts at the end of the throttle and idle control cable housings from the lower switch housing. For best results, use a rocking motion while pulling. Place a drop of light oil on the retaining rings, if necessary. Remove the cables from the switch housing.

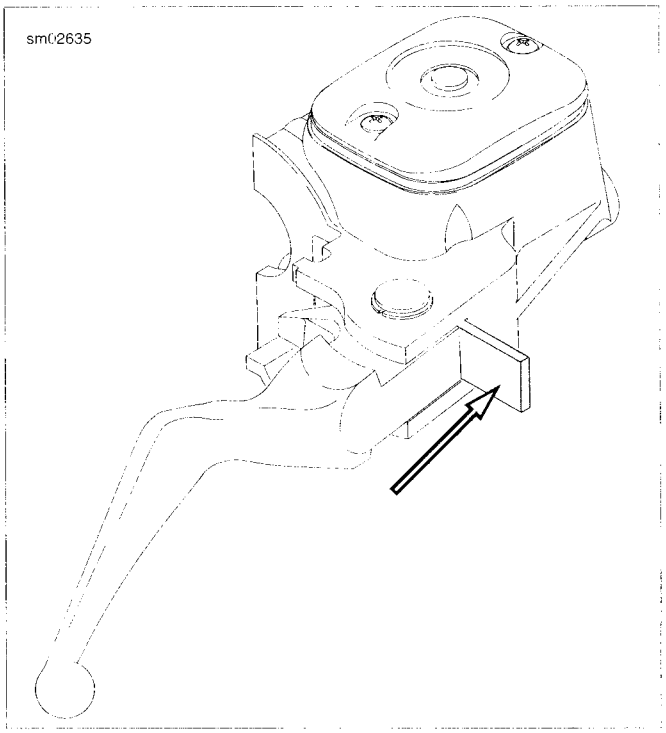


Figure 7-90. Install 5/32 in. (4 mm) Thickness Cardboard Insert

INSTALLATION

1. See Figure 7-91. Push the throttle and idle control cables into the lower switch housing until they snap in place. Note the different diameter inserts crimped into the end of the throttle and idle cable housings.
   a. Push the silver insert (2) of throttle cable housing into the hole in front of tension adjuster screw (3).
   b. Push the gold insert (1) of idle cable housing into the hole at the rear of tension adjuster screw (3).

NOTE

To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.

2. See Figure 7-92. Route the cable (2) to the upper switch housing as shown.
3. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 in. (3.2 mm).
4. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw.

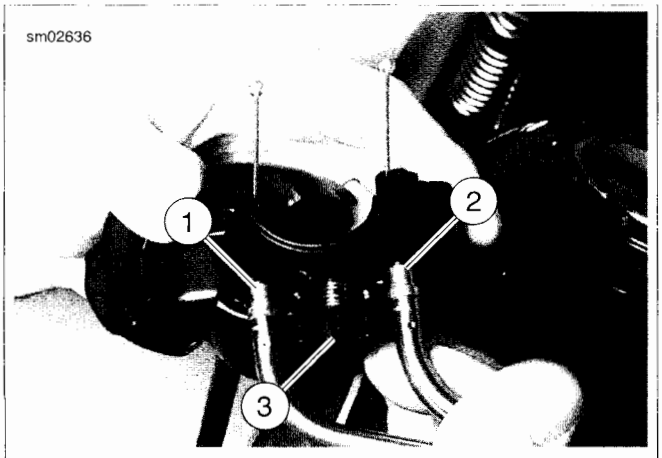
NOTE

The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.

5. See Figure 7-93. Position lower switch housing beneath the throttle control grip. Install the brass ferrules (4) onto the cable so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches (3) on the throttle control grip. Verify that the cables are captured in the grooves (2) molded into the grip.
6. Position the upper switch housing over the handlebar and lower switch housing.
7. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.
8. Start the upper and lower switch housing screws, but do not tighten.

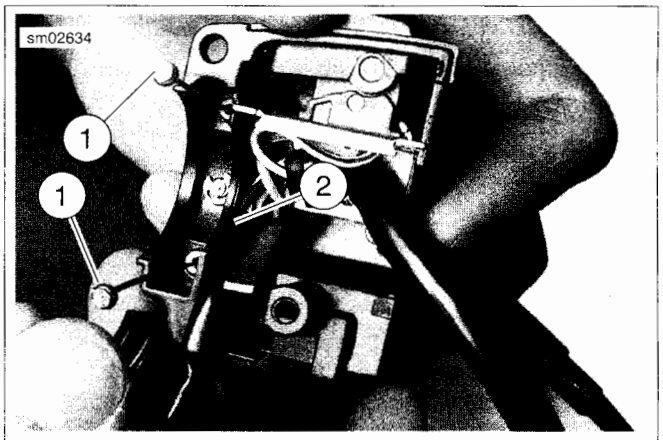
CAUTION

Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight switch. (00324a)



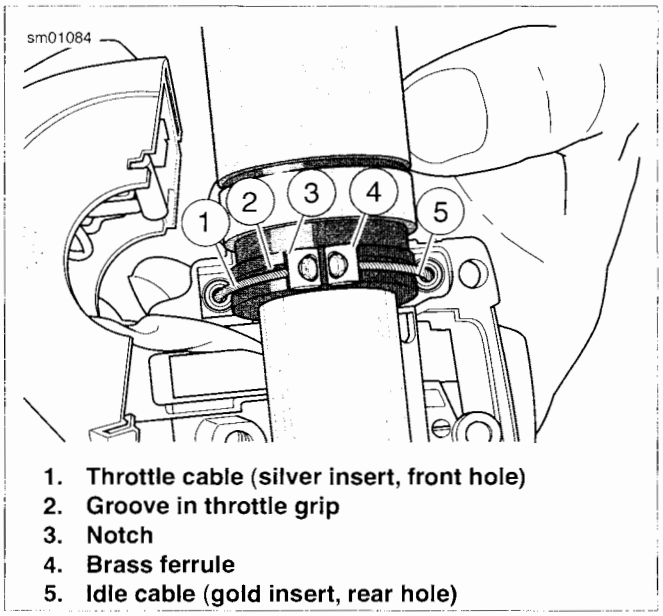
1. **Idle cable insert (gold insert, rear hole)**
2. **Throttle cable insert (silver insert, front hole)**
3. **Tension adjuster screw**

Figure 7-91. Right Lower Switch Housing



1. **End fittings**
2. **Upper switch housing cable**

Figure 7-92. Route Cable to Upper Switch Housing



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

Figure 7-93. Throttle Cable Attachment

9. See Figure 7-94. Position the brake lever/master cylinder assembly inboard of the switch housing assembly, engaging the tab (2) on the lower switch housing in the groove (3) at the top of the brake lever bracket.
10. Align the holes in the handlebar switch clamp with those in the master cylinder housing and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten to specification using a T27 TORX drive head. Refer to Table 7-11.
11. Using a T25 TORX drive head, tighten lower and upper switch housing screws to specification. Refer to Table 7-11.

NOTE

Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.

Table 7-11. Handlebar Switch Assembly Fasteners

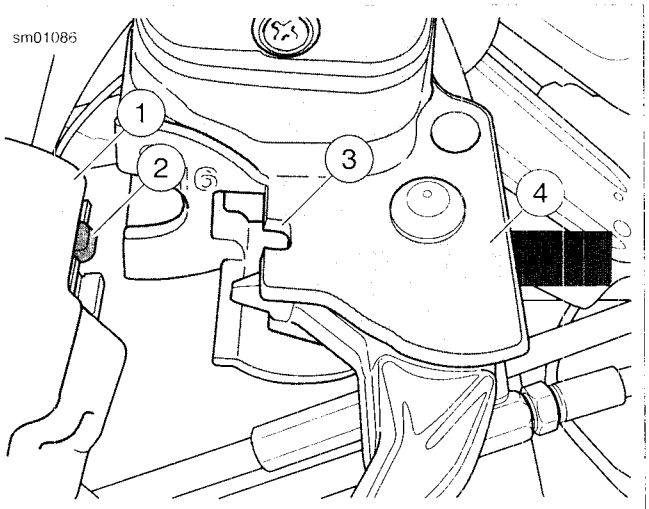
FASTENER	TORQUE
Handlebar switch clamp screws	60-80 **in-lbs** (6.8-9.0 Nm)
Switch housing screws	35-45 **in-lbs** (4.0-5.1 Nm)

12. Remove the cardboard insert between the brake lever and lever bracket.
13. Adjust throttle cables. See 1.13 THROTTLE CABLES
14. Install main fuse. See 7.8 FUSES.

⚠WARNING

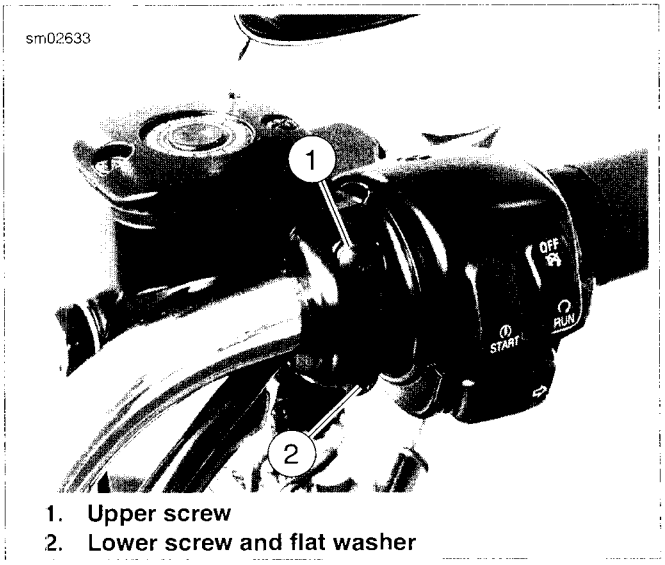
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

15. Test the switches for proper operation.
16. Secure wire harness to handlebar as necessary.



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

Figure 7-94. Switch Housing Alignment (typical)



1. **Upper screw**
2. **Lower screw and flat washer**

Figure 7-95. Handlebar Switch Clamp Screws

SWITCH REPAIR/REPLACEMENT

Switch and Lead Replacement

After cutting off the connector terminals, the leads of faulty switches can be pulled through the conduit. Replacement switch leads can be routed through the conduit and terminated at the connector. If necessary, only the switches can be replaced.

Switch Only Replacement: Upper Housing

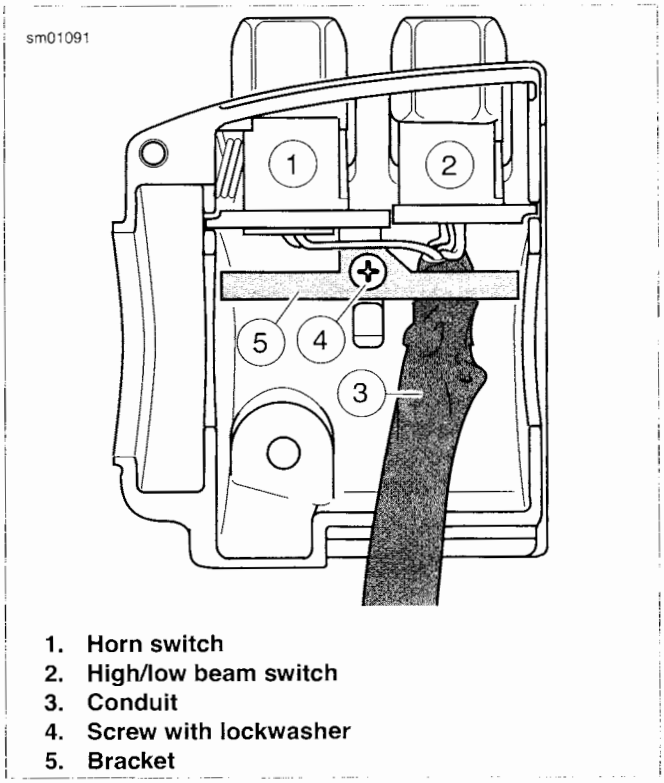
NOTE

Replace the engine stop and engine start switches as a single assembly even if only one switch is determined to be faulty.

1. See Figure 7-96. From inside the switch housing, remove the screw with lockwasher (4) to release the bracket (5). Remove the bracket and switch assembly from the housing.
2. Move cable conduit (3) from beneath wing of bracket. Cut wires 0.25 in. (6.4 mm) from old switches (1, 2). Discard old switch and bracket assembly.
3. Slide conduit forward over cut ends of switch wires and cut off 0.5 in. (12.7 mm) of conduit (3) material. Push conduit back to access switch wires.
4. See Figure 7-97. Separate **new** engine stop switch (2) and engine start switch (1) wires into two bundles.
5. See 7.37 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 7-97. Route wires downstream of splices beneath wing on engine stop switch side of bracket as shown in Figure 7-96.
7. See Figure 7-97. Install a **new** 7.0 in. (177.8 mm) cable strap (5) beneath wing on engine start switch side (1) of bracket and capture wire splices (4).
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at the edge of the boss captures

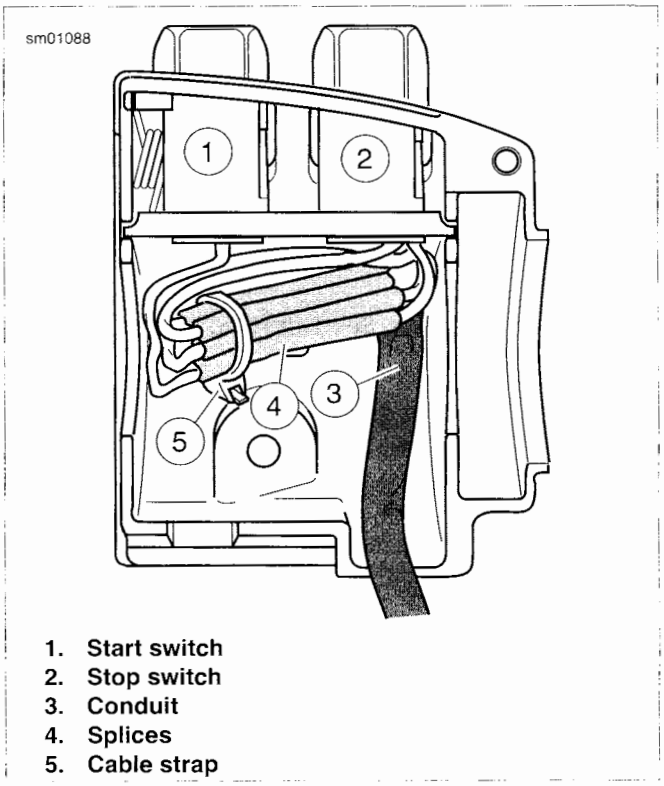
the bottom edge of the bracket, while tabs on each side of the bracket fit in slots cast into the housing.

9. See Figure 7-96. Install screw and lockwasher (4) to secure bracket (5) inside housing. Verify that wing on engine stop switch (2) side of bracket captures edge of conduit (3) as shown.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. Continue with 7.38 RIGHT HANDLEBAR SWITCH, Assembly.



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Screw with lockwasher**
5. **Bracket**

Figure 7-96. Upper Housing Without Splices



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 7-97. Upper Housing With Splices

Switch Only Replacement: Lower Housing

1. From inside the switch housing, carefully cut cable strap to free conduit from the turn signal switch bracket.
2. Remove the screw with lockwasher to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.
3. Continue with TURN-RIGHT SIGNAL SWITCH or FRONT STOPLIGHT SWITCH procedures which follow.

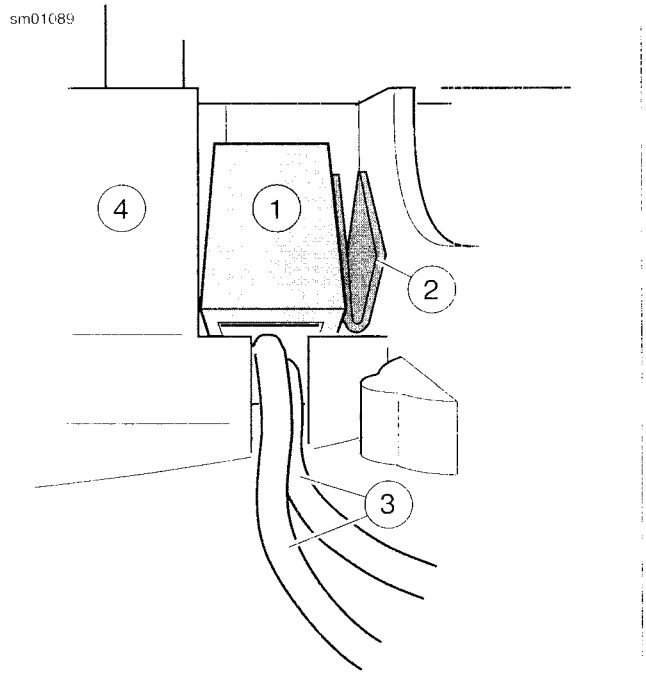
Turn-Right Signal Switch Only

1. Perform steps in LOWER HOUSING REPAIR.
2. Cut wire 1.5 in. (38.1 mm) from old switch. Discard old switch assembly.
3. See 7.37 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
4. Continue with 7.38 RIGHT HANDLEBAR SWITCH, Assembly.

Front Stoplight Switch Only

1. Perform steps in LOWER HOUSING REPAIR.
2. Carefully remove the wedge between the switch and switch housing, if present. To remove the switch from the housing, press the plunger and slowly rotate switch upward while rocking slightly.
3. Cut wires 1.0 in. (25.4 mm) from old switch. Discard old switch.
4. See 7.37 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.

5. Carefully press plunger against inside wall of switch housing. With thumb over plunger bore, move switch into the installed position in the switch housing cavity. When plunger is positioned against thumb, slowly rotate switch downward while rocking slightly. Release the plunger only after switch is properly positioned in the cavity.
6. Verify that the plunger is square in the bore and that the boot is not compressed, collapsed or torn. If necessary, gently work the plunger in and out until boot is fully extended.
7. See Figure 7-98. Push down on switch (1) so that it bottoms against housing and wires (3) run in groove at base of cavity. With the concave side facing outward, insert wedge (2) between switch and outboard side of switch housing.
8. Push wedge down until it also bottoms against housing. Verify that the plunger is still square in the bore and then place a drop of RTV Silicone Sealant on upper corner of wedge.
9. Continue with 7.38 RIGHT HANDLEBAR SWITCH, Assembly.



1. **Stoplight switch**
2. **Wedge**
3. **Switch wires**
4. **Lower switch housing**

Figure 7-98. Install Stoplight Switch

ASSEMBLY

1. See Figure 7-99. Insert tapered end of **new** 7.0 in. (177.8 mm) cable strap (1) into round hole in turn signal switch bracket (2) and then feed back through using the adjacent hole. Reserve the oblong hole for the bracket screw.

NOTE

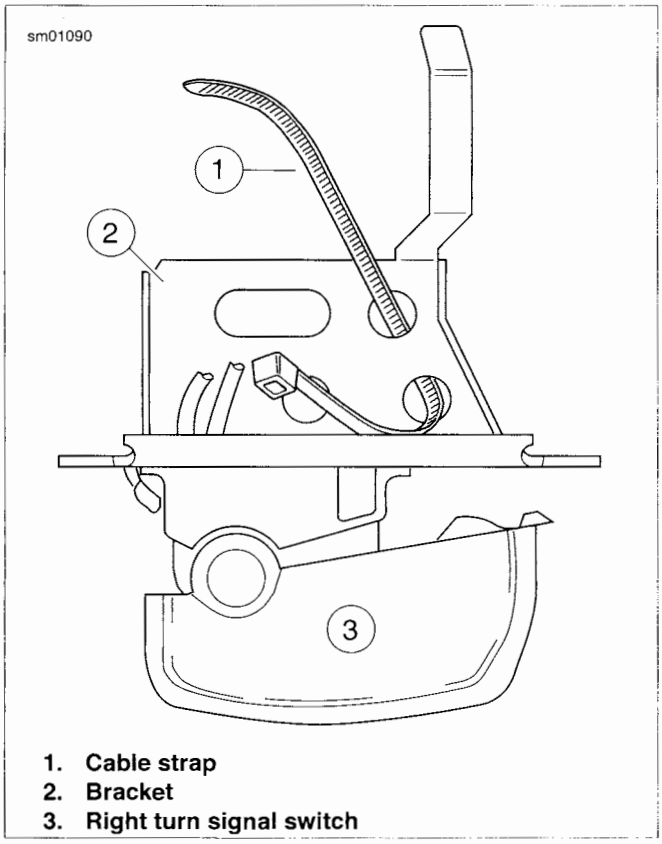
Be sure that all splices are positioned above the turn signal switch bracket.

2. Place the turn signal switch assembly into the housing, aligning the oblong hole in the bracket with the threaded hole in the boss. Be sure that the bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start screw with lockwasher to secure bracket inside housing.

CAUTION

If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)

4. Loop switch wires so that spliced lengths are positioned across bracket.
5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Install second 7.0 in. (177.8 mm) cable strap capturing conduit and wire splices. Securely tighten cable strap to draw splices to conduit. Remove any excess cable strap material.
7. Tighten screw to secure bracket inside housing.
8. Route wire bundle to upper switch housing by gently pressing conduit into channel next to angular arm of bracket. Secure bundle to arm using third cable strap. Cut any excess cable strap material. If necessary, bend angular arm of bracket downward to firmly secure front stoplight switch in position.
9. See 7.38 RIGHT HANDLEBAR SWITCH, Installation.
   a. If lower housing switches were replaced, perform the entire procedure.
   b. If upper housing switches were replaced, begin with step 11.



1. Cable strap
2. Bracket
3. Right turn signal switch

Figure 7-99. Insert Cable Strap in Switch Bracket

REMOVAL

NOTE

The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

⚠WARNING

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

1. Remove main fuse. See 7.8 FUSES.
2. Using a T25 TORX drive head, loosen but do not remove the upper and lower switch housing screws.
3. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the clutch lever bracket. Remove the clutch hand lever assembly and clamp from the handlebar.
4. Remove the upper and lower switch housing screws.
5. Remove the grip sleeve from the end of the handlebar if damaged.

INSTALLATION

1. If the grip sleeve was removed, thoroughly clean handlebar to remove all adhesive residue. Pour adhesive into new grip. Roll grip to evenly distribute adhesive on inside surfaces. Install grip on handlebar with a twisting motion.
2. See Figure 7-100. Install upper and lower switch housings on handlebar. Be sure that ribs (2) on outboard side of switch housings fit in grooves (3) molded into grip.
3. Verify that the wire harness conduit runs in the groove at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.
4. Start the upper and lower switch housing screws, but do not tighten.
5. See Figure 7-101. Position the clutch hand lever assembly inboard of the switch housing assembly, engaging the tab (3) on the lower switch housing in the groove (2) at the bottom of the clutch lever bracket.
6. Align the holes in the handlebar switch clamp with those in the clutch lever bracket and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten screws to specification with a T27 TORX drive head. Refer to Table 7-12.
7. Using a T25 TORX drive head, tighten lower and upper switch housing screws to specification. Refer to Table 7-12.

NOTE

Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.

Table 7-12. Handlebar Switch Assembly Fasteners

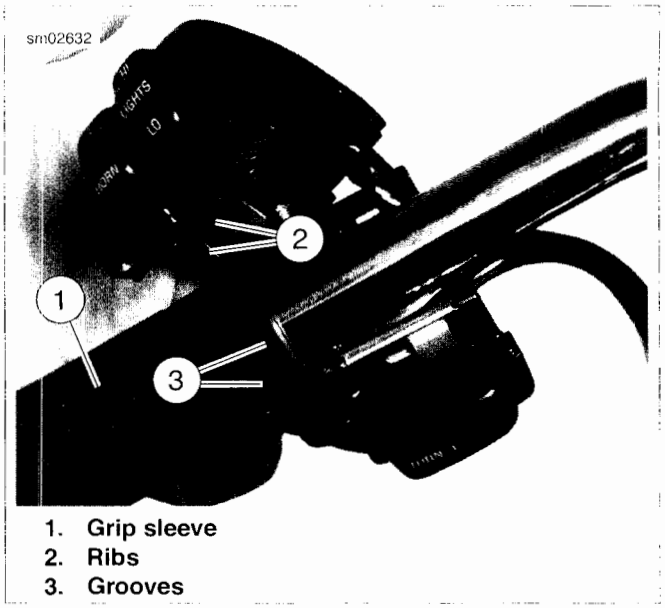
FASTENER	TORQUE
Handlebar switch clamp screws	60-80 **in-lbs** (6.8-9.0 Nm)
Switch housing screws	35-45 **in-lbs** (4.0-5.1 Nm)

8. Install main fuse. See 7.8 FUSES.

⚠WARNING

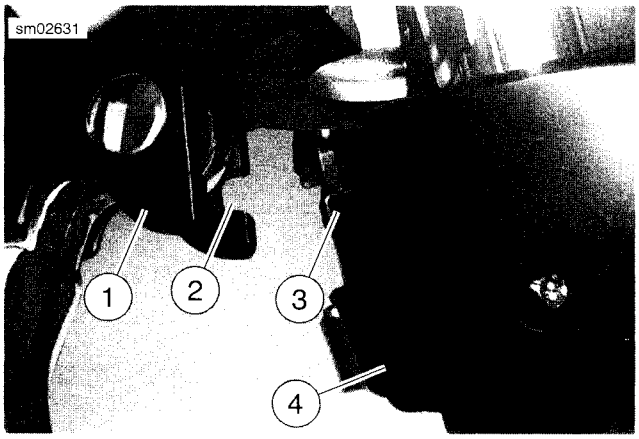
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

9. Test the switches for proper operation.
10. Secure wire harness to handlebar as necessary.



1. **Grip sleeve**
2. **Ribs**
3. **Grooves**

Figure 7-100. Left Handlebar Switch Housings



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

Figure 7-101. Clutch Lever Bracket

SWITCH REPAIR/REPLACEMENT

Switch and Lead Replacement

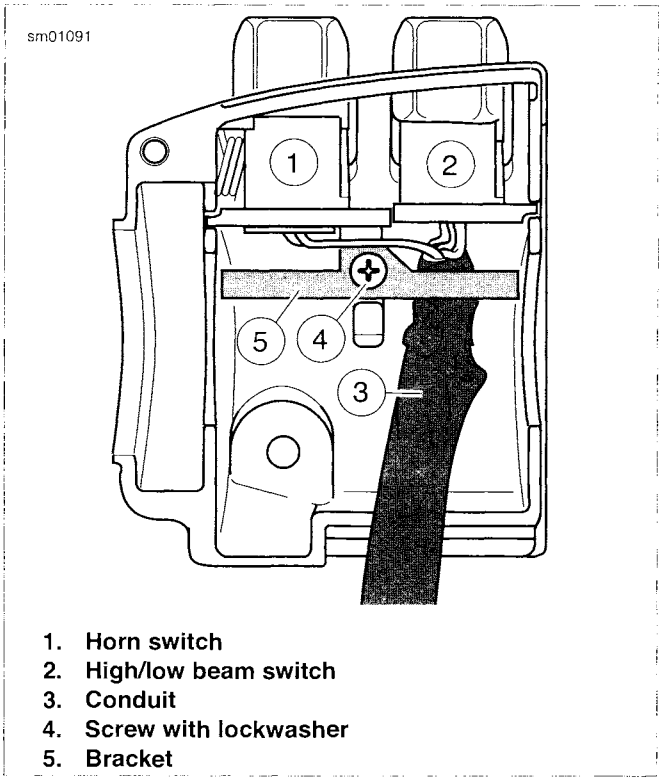
After cutting off the connector terminals, the leads of faulty switches can be pulled through the conduit. Replacement switch leads can be routed through the conduit and terminated at the connector. If necessary, only the switches can be replaced.

Switch Only Replacement: Upper Housing

NOTES

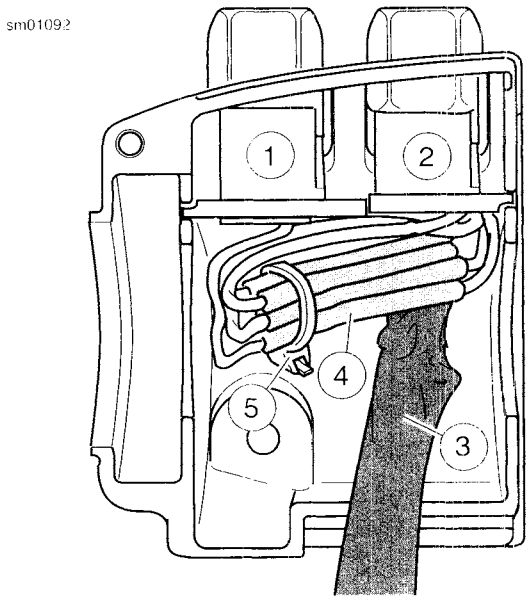
Replace the horn switch and high/low beam switch as a single assembly even if only one switch is determined to be faulty.

1. See Figure 7-102. From inside the switch housing, remove the screw with lockwasher (4) to release the bracket (5). Remove bracket and switch assembly from the housing.
2. Move cable conduit (3) from beneath wing of bracket. Cut wires 0.25 in. (6.4 mm) from old switches (1, 2). Discard old switch and bracket assembly.
3. Slide conduit forward over cut ends of switch wires and cut off 0.5 in. (12.7 mm) of conduit (3) material. Push conduit back to access switch wires.
4. Separate the **new** horn switch (1) and high/low beam switch (2) wires into two bundles.
5. See 7.37 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 7-103. Route wires downstream of splices beneath wing on high/low beam switch side of bracket as shown in Figure 7-102.
7. See Figure 7-103. Install a **new** 7.0 in. (177.8 mm) cable strap (5) beneath wing on horn switch side (1) of bracket and capture wire splices (4).
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at the edge of the boss captures the bottom edge of the bracket, while tabs on each side of the bracket fit in slots cast into the housing.
9. See Figure 7-102. Install screw and lockwasher (4) to secure bracket (5) inside housing. Verify that wing on high/low switch (2) side of bracket captures edge of conduit (3) as shown.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. Continue with 7.39 LEFT HANDLEBAR SWITCH, Assembly.



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Screw with lockwasher**
5. **Bracket**

Figure 7-102. Upper Housing Without Splices



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 7-103. Upper Housing With Splices

Switch Only Replacement: Lower Housing

1. From inside the switch housing, carefully cut cable strap to free conduit from the turn signal switch bracket.
2. Remove screw with lockwasher to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.
3. Continue with TURN-LEFT SIGNAL SWITCH or CLUTCH INTERLOCK SWITCH procedures.

Turn-Left Signal Switch Only

1. Perform steps in LOWER HOUSING REPAIR.
2. Cut wires 1.5 in. (38.1 mm) from old turn signal switch. Discard switch assembly.
3. See 7.37 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
4. Continue with 7.39 LEFT HANDLEBAR SWITCH, Assembly.

Clutch Interlock Switch Only

1. Perform steps in LOWER HOUSING REPAIR.
2. See Figure 7-104. Cut wires 0.25 in. (6.4 mm) from old switch. Discard switch assembly.
3. See 7.37 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
4. Continue with 7.39 LEFT HANDLEBAR SWITCH, Assembly.

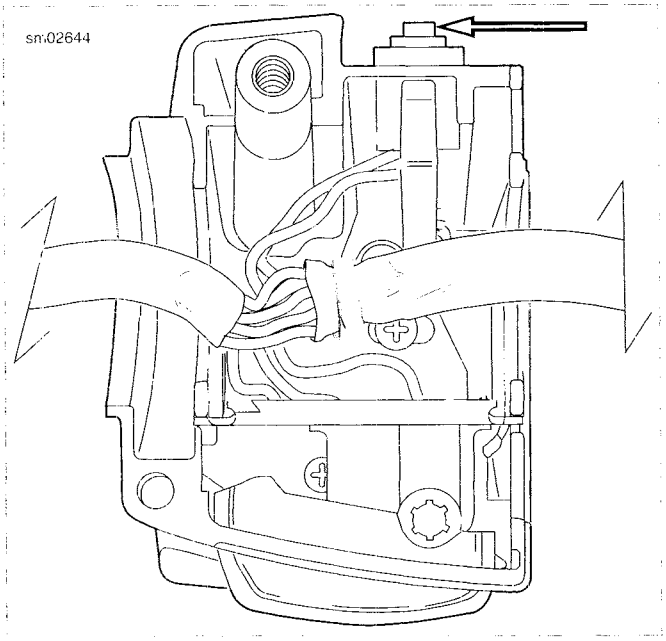


Figure 7-104. Clutch Interlock Switch

ASSEMBLY

1. See Figure 7-105. Insert tapered end of **new** 7.0 in. (177.8 mm) cable strap (1) into round hole in turn signal switch bracket (2) and then feed back through using the adjacent hole. Reserve the oblong hole for the bracket screw.

NOTE

Be sure that all splices are positioned above the turn signal switch bracket.

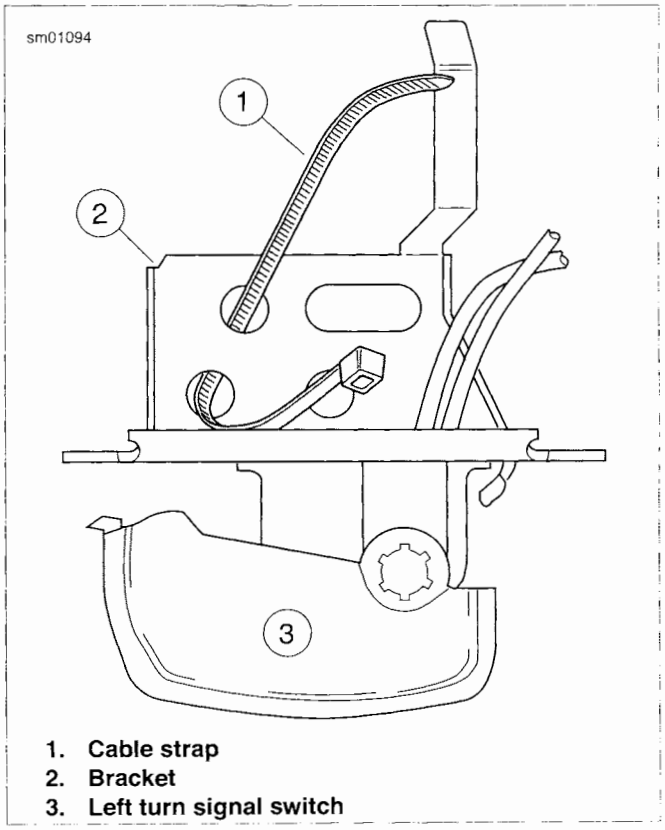
2. Place the turn signal switch assembly (3) into the housing, aligning the oblong hole in the bracket with the threaded hole in the boss. Be sure that the bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start screw with lockwasher to secure bracket inside housing.

CAUTION

If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)

4. Loop switch wires so that spliced lengths are positioned across bracket.
5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Tighten screw to secure bracket inside housing.
7. Route wire bundle to upper switch housing below and then forward of the main wire harness, positioning conduit in channel next to angular arm of bracket. Secure bundle to arm using **new** cable strap. Cut any excess cable strap material.

8. See 7.39 LEFT HANDLEBAR SWITCH, Installation.
   a. If lower housing switches were replaced, perform the whole procedure.
   b. If upper housing switches were replaced, begin with step 7.
9. Verify the operation of the clutch interlock switch. See the electrical diagnostics manual.



1. **Cable strap**
2. **Bracket**
3. **Left turn signal switch**

Figure 7-105. Insert Cable Strap in Switch Bracket

GENERAL

The TSSM and HFSM use batteries in the fob and siren. These are the only parts requiring periodic maintenance.

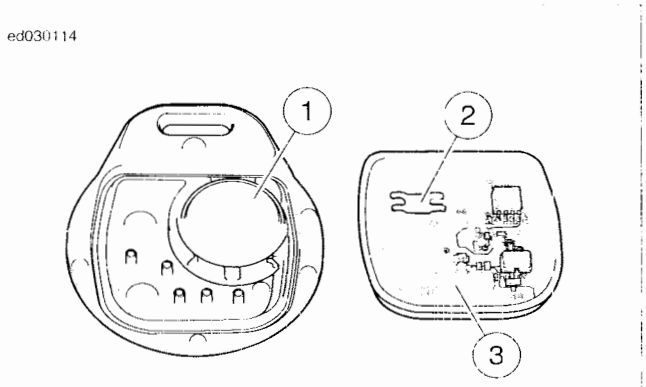
FOB BATTERY

Schedule

Replace the fob battery every two years.

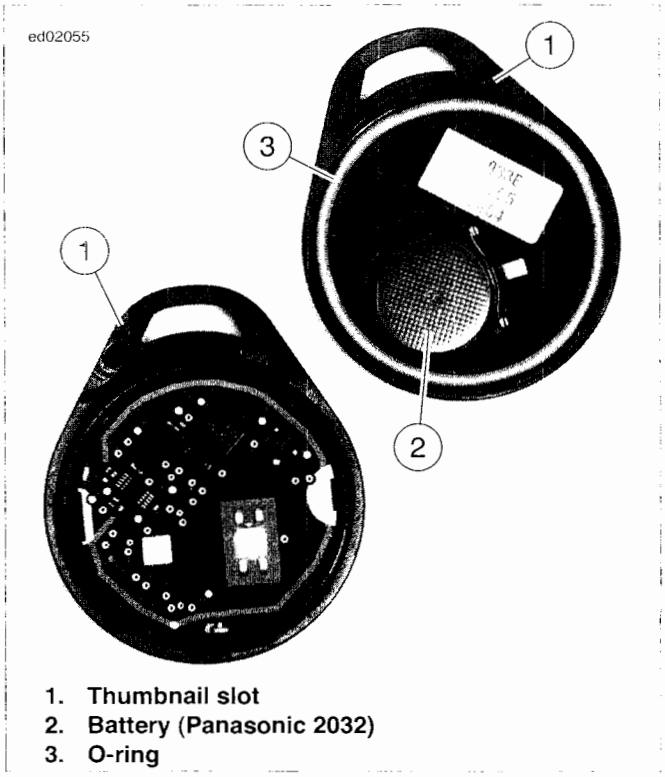
Battery Replacement

1. Open the fob case.
   a. **TSSM:** See Figure 7-106. Place a thin blade between the two halves of the case.
   b. **HFSM:** See Figure 7-107. Place a thin blade in the thumbnail slot (1) between the two halves of the case.
   c. Slowly twist the blade.
2. Replace the battery.
   a. Remove the original battery.
   b. Install a **new** battery with the positive (+) side down. Use a Panasonic® 2032 or equivalent.
3. Close the case.
   a. **TSSM:** See Figure 7-106. Align case and circuit board (3) as shown.
   b. **HFSM:** See Figure 7-107. With O-ring (3) in place, align case halves.
   c. Snap case halves together.
4. **TSSM:** While standing next to the motorcycle, press and hold the fob button for 10-15 seconds until the security system responds with two turn signal flashes/siren chirps.



1. **Battery**
2. **Battery contact**
3. **Circuit board**

Figure 7-106. Open Fob: TSSM



1. **Thumbnail slot**
2. **Battery (Panasonic 2032)**
3. **O-ring**

Figure 7-107. Open Fob: HFSM

SMART SIREN (IF INSTALLED)

Schedule

The siren's internal 9 volt battery is rechargeable and does not need to be replaced on a regular basis. Battery life under normal conditions is approximately three to six years.

NOTES

- *See Figure 7-108 and Figure 7-109. Early style siren works with both TSSM and HFSM. Late style siren only works with HFSM.*
- *The internal siren battery may not charge if the motorcycle's battery is less than 12.5 Volts.*

Battery Replacement: Early Style Siren

1. Disarm system and remove siren.
2. See Figure 7-108. Remove battery cover.
   a. Place the siren module on a flat, sturdy table with the potted section (area with epoxy covering circuit board) facing up and towards you.
   b. Position a knife blade at a 45 degree angle to the long side of the siren case. Insert the knife blade between the siren case and battery cover at one of the two accessible corners of the battery cover. Keep the blade slightly higher towards the battery cover as this helps keep the blade away from the battery seal.
   c. Slowly twist the blade towards the battery cover and the cover will pop off.

NOTES

- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on **new** battery.*
- *Only a 9 Volt nickel metal hydride battery should be used in the siren.*

3. Replace battery by removing old battery from polarized battery clip. Install a **new** 9 Volt nickel metal hydride battery.
4. Install battery cover.
   a. Carefully replace the rubber seal.
   b. Align battery cover with case placing round corners on cover away from connector [142A]. Snap cover into place.
5. Install siren and check operation. If siren is working properly, it responds with two chirps after receiving the arm command.

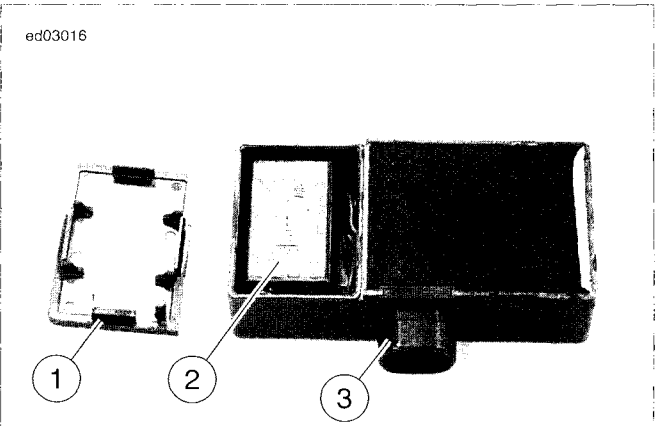
Battery Replacement: Late Style Siren

1. Disarm system and remove siren.
2. See Figure 7-109. With a small screwdriver or pick, push the catches (1) in through the two slots (2) in the end of the siren to release the battery cover (3).

NOTES

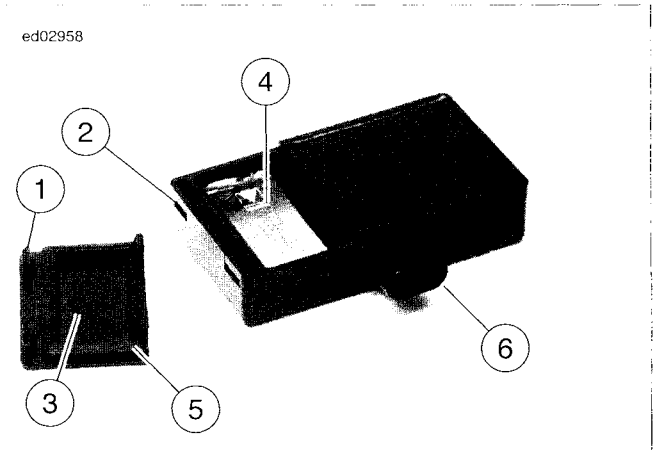
- *For protection against corrosion, battery terminals and battery clip are covered with a special grease. Do not wipe away this substance. Apply all available existing grease to terminals on **new** battery.*
- *Only a 9 Volt nickel metal hydride battery should be used in the siren.*

3. Replace battery (4) by removing old battery from polarized battery clip.
4. Recharge and install or install a **new** 9 Volt nickel metal hydride battery.
5. Install battery cover (3).
   a. Carefully replace the rubber seal (5) on the cover.
   b. Align battery cover with case placing round corners on cover away from connector [142A] (6).
   c. Snap cover into place.
6. Install siren and check operation. If siren is working properly, it responds with two chirps after receiving the arm command.



1. **Cover**
2. **Battery**
3. **Connector [142A]**

Figure 7-108. Battery Compartment (Early Style Siren)



1. **Catch (2)**
2. **Slot (2)**
3. **Cover**
4. **9 Volt battery**
5. **Rubber seal**
6. **Connector [142A]**

Figure 7-109. Battery Compartment (Late Style Siren)

GENERAL

The PIN consists of five digits. Each digit can be any number from 1 through 9. There can be no zeros (0) in the PIN. Use the PIN to disarm the security system in case the fob becomes unavailable.

INITIAL PIN ENTRY

To enter a PIN on a motorcycle with no PIN previously installed during HFSM actuation, refer to Table 7-13.

Table 7-13. Entering an Initial PIN: HFSM, TSSM

STEP	ACTION	CONFIRMATION
1	Select a five-digit (1 through 9) initial PIN and record in the Owner's Manual and on the wallet card.	
2	With an assigned fob present, set engine stop switch to **OFF.**	
3	Cycle ignition switch **IGNITION**-OFF-**IGNITION**-OFF-**IGNITION.**	
4	Press **left** turn signal button twice.	Turn signals flash three times.
5	Press **right** turn signal button once.	Five dashes appear in the odometer window. The first dash flashes.
6	Enter first digit (a) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
7	Press **right** turn signal button once.	The digit (a) replaces the dash in the odometer. The second dash flashes.
8	Enter second digit (b) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
9	Press **right** turn signal button once.	The digit (b) replaces the dash in the odometer. The third dash flashes.
10	Enter third digit (c) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
11	Press **right** turn signal button once.	The digit (c) replaces the dash in the odometer. The fourth dash flashes.
12	Enter fourth digit (d) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
13	Press **right** turn signal button once.	The digit (d) replaces the dash in the odometer. The fifth dash flashes.
14	Enter fifth digit (e) of initial PIN by pressing **left** turn signal button until desired digit is displayed in odometer.	
15	Press **right** turn signal button once.	The digit (e) replaces the dash in the odometer. The first digit flashes.
16	Turn the ignition switch to **OFF.**	

CHANGING THE PIN

To change a PIN, refer to Table 7-14. The rider can change the PIN at any time.

Modifying an Existing Pin

If a PIN was previously entered, the odometer will display the equivalent digit. Each additional press of the left turn switch will increment the digit.

Examples:

- To advance from 5 to 6, press and release the left turn switch 1 time.
- To advance from 8 to 2, press and release the left turn switch 3 times (9-1-2).

Table 7-14. Changing the PIN: HFSM

STEP	ACTION	CONFIRMATION	NOTES
1	Select a five-digit (1 through 9) PIN and record in the Owner's Manual and on the wallet card.		
2	With fobs present, cycle ignition switch IGNITION-OFF-IGNITION-OFF-IGNITION.		
3	Press **left** turn signal button twice.	Turn signals flash 3 times.	
4	Press **right** turn signal button once.	Current PIN will appear in odometer. The first digit will flash.	
5	Enter first digit (a) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
6	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The second digit flashes.	
7	Enter second digit (b) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
8	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The third digit flashes.	
9	Enter third digit (c) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
10	Press **right** turn signal button once.	The new digit replaces the dash in the odometer. The fourth digit flashes.	
11	Enter fourth digit (d) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
12	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The fifth digit flashes.	
13	Enter fifth digit (e) of new PIN by pressing **left** turn signal button until desired digit is displayed in odometer.		
14	Press **right** turn signal button once.	The new digit replaces the current in the odometer. The first digit flashes.	
15	Turn the ignition switch to **OFF.**		Turning ignition switch to OFF stores PIN.

GENERAL

Setting up a vehicle TSM/HFSM depends on whether the vehicle has a TSM or the optional HFSM security system installed.

SIDECAR CONFIGURATION

⚠WARNING

Only Touring Harley-Davidson Motorcycles are suitable for sidecar use. Consult a Harley-Davidson dealer. Use of motorcycles other than Touring models with sidecars could result in death or serious injury. (00040a)

All motorcycles ship with the H-DSSS set for use **without** a sidecar installed. If a motorcycle is equipped with a TSM, no further actuation is required.

ACTUATION

Actuation consists of assigning two fobs to the system, and entering an initial PIN. The PIN can be changed by the rider at any time.

1. Configure HFSM motorcycles by assigning **both** fobs to the vehicle.
2. Configure HFSM motorcycles by entering a PIN picked by the owner. The personal code allows the owner to operate the system if the fob is lost or inoperable. Record the PIN in the Owner's Manual and instruct the customer to carry a copy (use the wallet card found in the Owner's Manual). See 7.41 PERSONAL IDENTIFICATION NUMBER (PIN).

Once the system has been activated, it will always "arm" within 5 seconds of turning the ignition switch to **OFF** and no motorcycle motion.

FOB ASSIGNMENT

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

Use DIGITAL TECHNICIAN II (Part No. HD-48650) to assign both fobs to the H-DSSS. Follow the menu prompts in the DIGITAL TECHNICIAN II (Part No. HD-48650) display and scan the fob serial number with the bar code reader, or key-in the number from the keyboard. See a Harley-Davidson dealer.

NOTE

Each fob has a unique serial number. The label should be removed from the fob and attached to a blank NOTES page in the Owner's Manual for reference.

POWER DISRUPTION AND CONFIGURING

PART NUMBER	TOOL NAME
HD-42682	BREAKOUT BOX

The HFSM will not enter PIN entry mode on the first attempt after battery voltage has been removed from terminal 1. This will occur after any of the following:

- Battery disconnect or power drain.
- Battery fuse removal.
- Connecting BREAKOUT BOX (Part No. HD-42682) to HFSM connector.

Therefore, after all battery reconnects, the configuration sequence must be modified as follows:

1. Set Engine Stop Switch to **OFF**, cycle ignition switch **IGNITION-OFF-IGNITION-OFF-IGNITION** and press left turn signal switch **twice**.
2. Repeat steps listed above.
3. Continue with PIN entry sequence listed.

GENERAL

If the ECM or TSM/HFSM is faulty, replace the unit. See 7.4 ELECTRONIC CONTROL MODULE (ECM) or 7.5 TURN SIGNAL AND SECURITY MODULE (TSM/TSSM/HFSM). Then, to determine if password learn is necessary, refer to Table 7-15.

Table 7-15. Password Learn

DEVICE REPLACED	IS PASSWORD LEARN NECESSARY?
ECM	Yes
TSM	No *
TSM/HFSM	Yes
* If a TSM has been replaced by a HFSM, or a HFSM has been replaced by a TSM, password learn is necessary.	

PASSWORD LEARNING

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

To perform password learning procedure, refer to Table 7-16. When finished, continue with all instructions under 7.42 H-DSSS ACTUATION.

TSM/HFSM: Always perform all appropriate instructions under 7.42 H-DSSS ACTUATION after TSM/HFSM replacement or removal.

TSM/TSSM (Japan/Korea markets): Always perform all appropriate instructions under VEHICLE DELIVERY in the electrical diagnostic manual after TSM/TSSM replacement or removal.

NOTES

- ***HFSM:*** *Fob assignment must be performed at an authorized Harley-Davidson dealer using DIGITAL TECHNICIAN II (Part No. HD-48650).*
- ***TSSM:*** *Do not forget to enter a Personal Identification Number (PIN) for TSSM vehicles. If a code is not assigned and the key fob is lost or damaged while the vehicle is armed, the TSSM must be replaced.*

Table 7-16. Setting TSM/TSSM/HFSM and ECM Password

NO.	ACTION	CONFIRMATION	NOTES
	Ignition must be turned off for at least 15 seconds.	With Ignition Switch turned off, Check Engine lamp and Security lamp will be off.	
1	Install **new** TSM/TSSM/HFSM or ECM.		
2	Set Engine Stop Switch to **RUN.**		
3	Turn Ignition Switch **ON.**	Verify Check Engine lamp and Security lamp illuminate and then turn off.	TSM/HFSM enables start relay.
4	Attempt normal start one time.	Engine starts and stalls. Check Engine lamp illuminates and stays on.	Password has not been learned. ECM sets DTC P1009.
5	Wait ten seconds. Security lamp will illuminate and stay on.	Security lamp illuminates.	ECM enters Password Learning mode for ten minutes. Do not cycle Ignition Switch or interrupt vehicle power or Password Learn will be unsuccessful.
6	Wait until Security lamp turns off.		This takes ten minutes.
7	Quickly (within two seconds) turn Ignition Switch OFF-**ON.**		ECM must not be allowed to shutdown.
8	Wait until Security lamp turns off.		This takes ten minutes.
9	Quickly (within two seconds) turn Ignition Switch OFF-**ON.**		ECM must not be allowed to shutdown.
10	Wait until Security lamp turns off.		This takes ten minutes.
11	Quickly (within two seconds) turn Ignition Switch OFF-**ON.**		ECM must not be allowed to shutdown.

Table 7-16. Setting TSM/TSSM/HFSM and ECM Password

NO.	ACTION	CONFIRMATION	NOTES
12	Turn Ignition Switch **OFF**. Wait 15 seconds before turning Ignition Switch on. Turn Ignition Switch **ON** and start engine to confirm successful Password Learn procedure. Clear DTCs.		
13	**TSM/HFSM:** Perform all steps under 7.42 H-DSSS ACTUATION. **TSM/TSSM (Japan/Korea markets):** Perform all steps under VEHICLE DELIVERY in electrical diagnostic manual.		

NOTES

AMP MULTILOCK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTILOCK CRIMPER
SNAP-ON TT600-3	SNAP-ON PICK

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

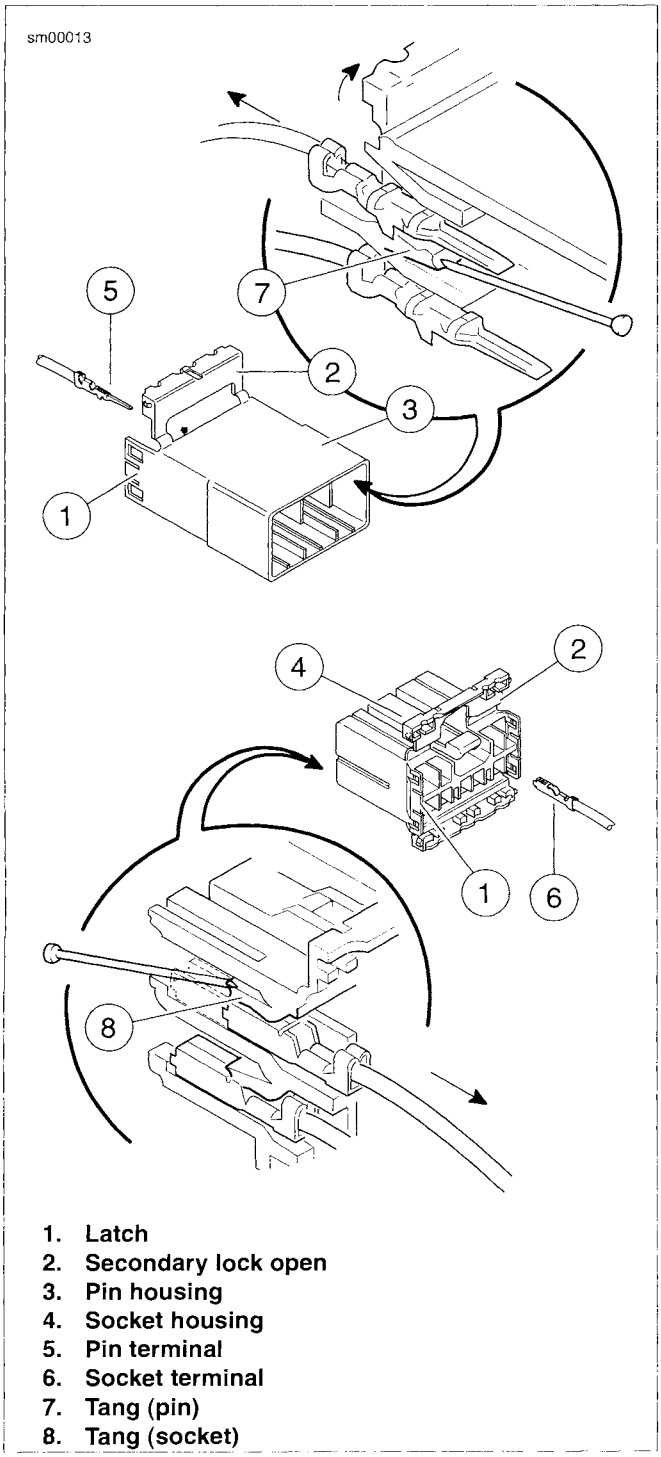
If socket/pin terminal tool is not available, a push pin/safety pin or a SNAP-ON PICK (Part No. SNAP-ON TT600-3) may be used.

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.



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

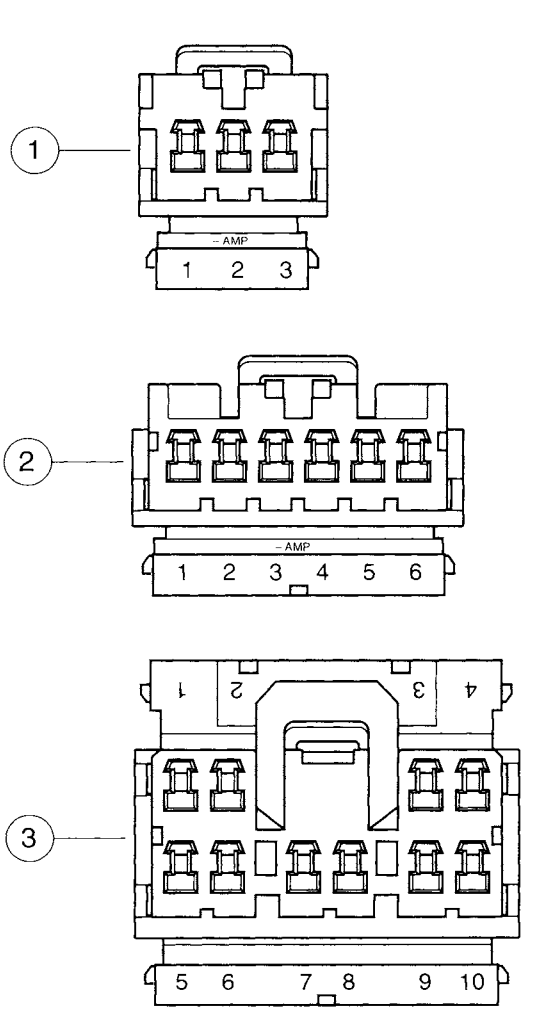
See Figure A-3. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

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

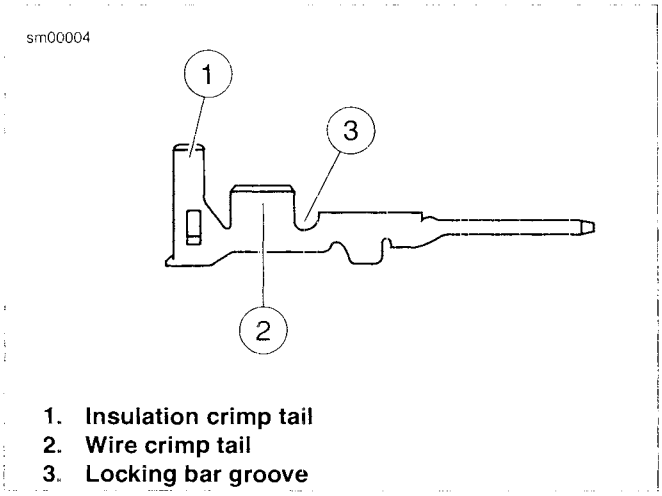
1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

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.

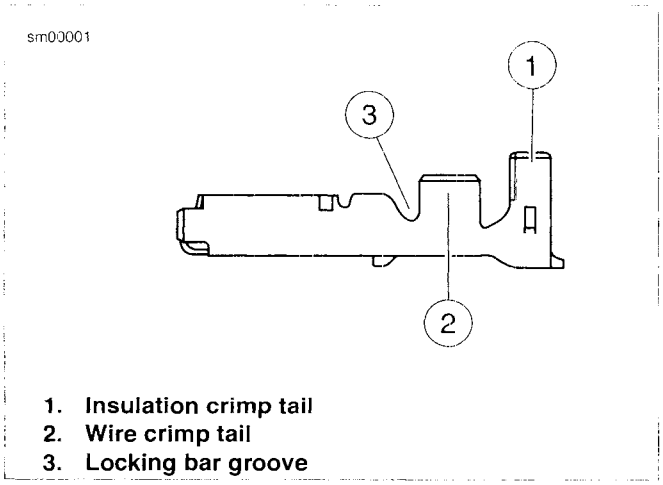
Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

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.

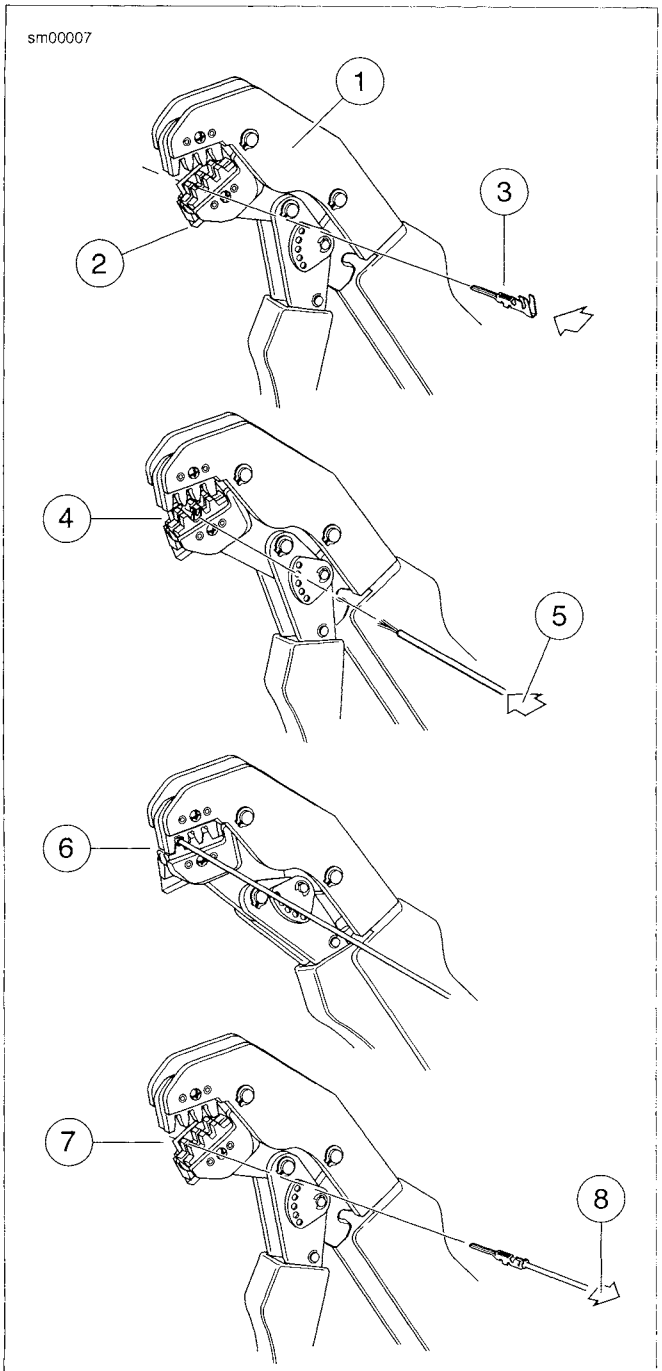
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.

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.

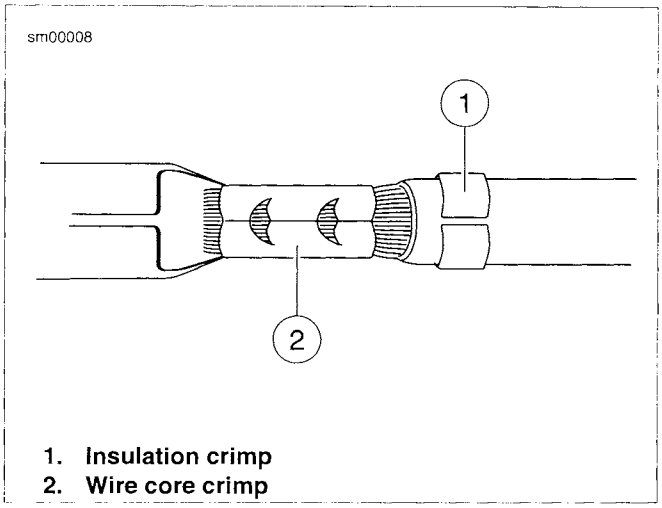


1. Open position
2. Locking bar flange
3. Insert contact
4. Release locking bar
5. Insert lead
6. Squeeze
7. Raise locking bar
8. Remove crimped terminal

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

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.

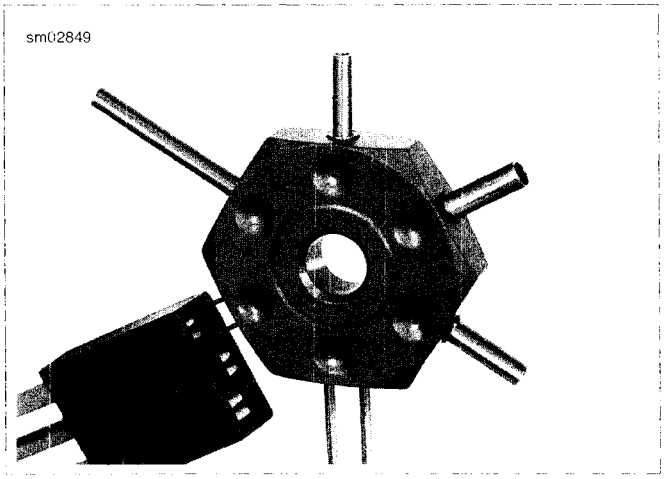


Figure A-8. Removing Autofuse Terminal from Ignition Switch

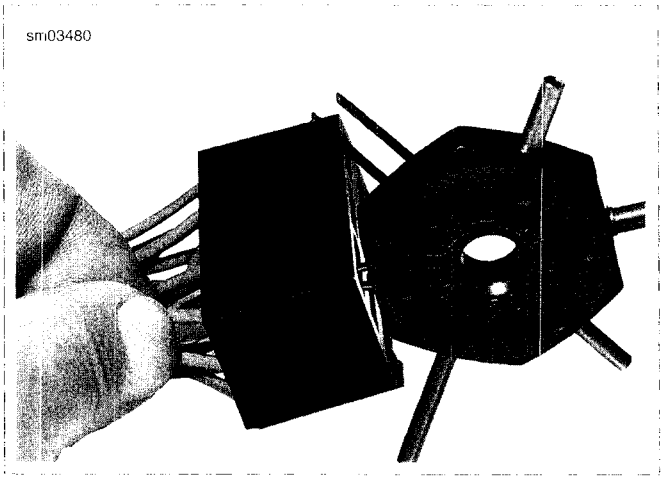


Figure A-9. Removing Autofuse Terminal from Fuse Block

DELPHI 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.

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.

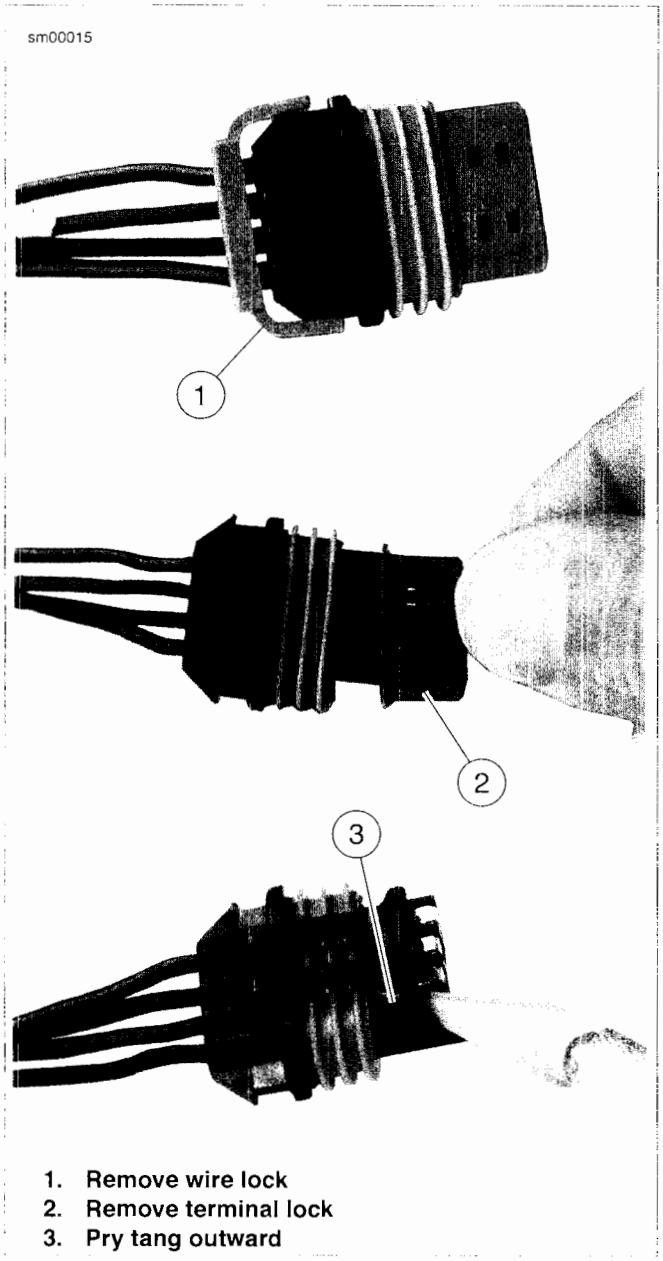
Installing Socket Terminals

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



1. Remove wire lock
2. Remove terminal lock
3. Pry tang outward

Figure A-11. Delphi Connector: Removing Socket Terminals

DELPHI MAIN FUSE HOUSING REPAIR

General

A Delphi Main fuse connector completes the circuit through the main fuse.

Removing Main Fuse

1. See Figure A-12. Depress latches on main fuse cover (1) and then slide cover off of connector (2).
2. Holding the connector (fuse holder), pull the main fuse out of the connector.

Installing Main Fuse

1. Insert the blade terminals of the main fuse into the sockets of the connector and press the main fuse into the connector.
2. Slide the cover over the fuse until the cover clicks into place.

NOTE

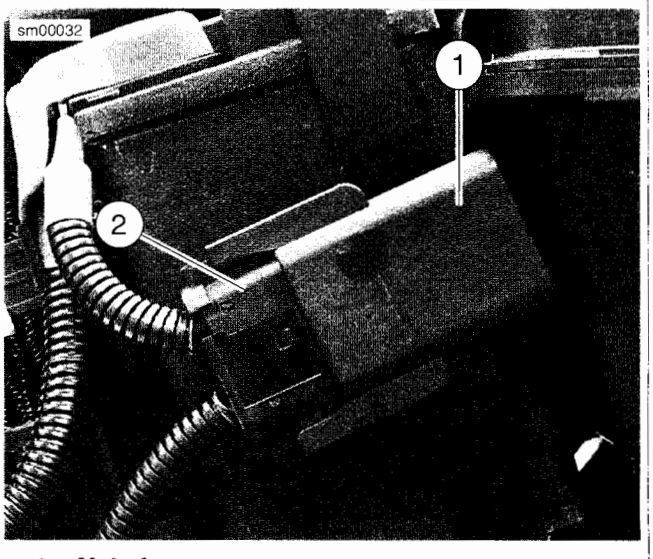
If removed from an OE attachment such as a grooved fuse block cover, engage cover and slide into place.

Removing Socket Terminals

1. Disconnect battery. See 1.25 BATTERY MAINTENANCE.
2. See Figure A-13. Disengage slots (1) on secondary lock (2) from tabs (3) and remove secondary lock.
3. Insert flat blade of pick or small screwdriver into opening (4) until it stops.
4. Tug on cable to pull socket from connector housing. Pivot the pick toward the terminal body to release the latch if necessary.
5. Repeat to remove remaining socket terminal.

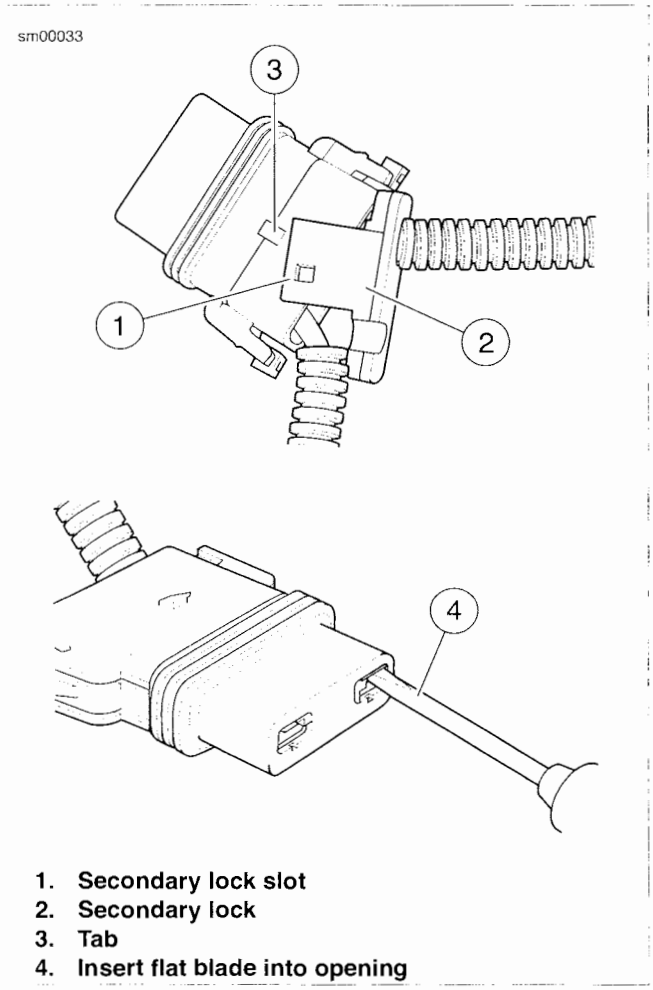
Installing Socket Terminals

1. See Figure A-14. Carefully bend tang outward away from the terminal body.
2. Properly orient terminal to the cavity in the housing and push terminal into connector housing until it clicks in place. Verify that socket will not back out of chamber.
3. Push rubber seal into connector housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto connector housing. be sure slots engage tabs on sides of connector housing.
6. Connect battery cables. See 1.25 BATTERY MAINTENANCE.



1. **Main fuse cover**
2. **Delphi main fuse housing**

Figure A-12. Delphi Connector Housing: Main Fuse



1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

Figure A-13. Delphi Main Fuse Housing: Remove Socket Terminals

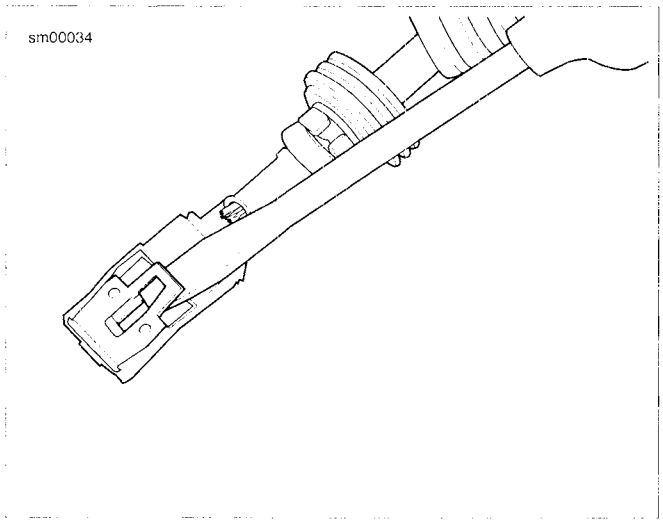


Figure A-14. Delphi Main Fuse Housing: Bend Tang

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

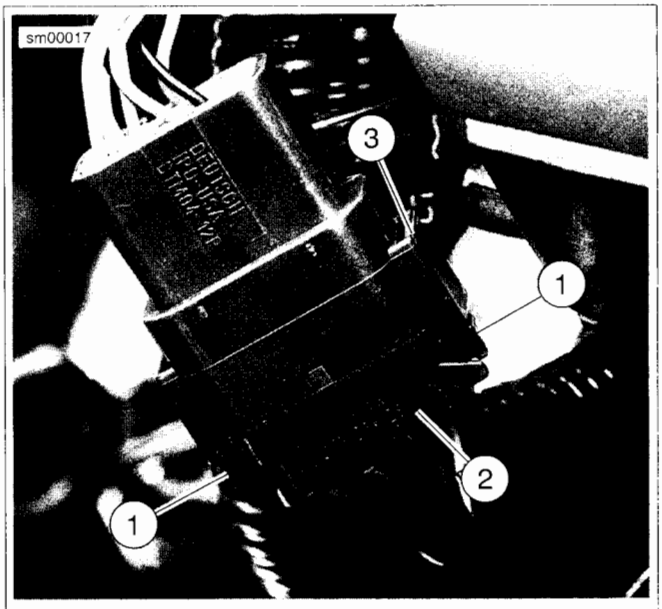
See Figure A-15. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

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-15. Deutsch Connector

Removing Socket Terminals

1. See Figure A-16. 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-19. 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-18. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

NOTE

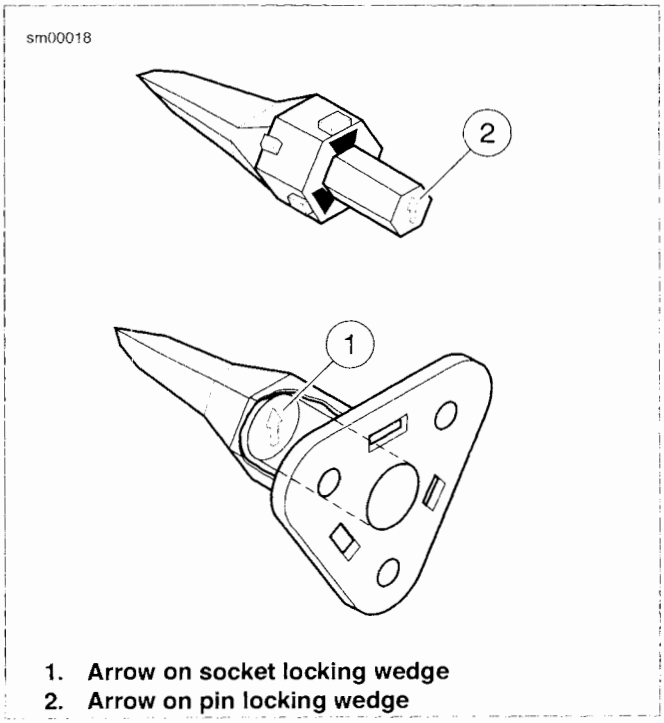
Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.

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

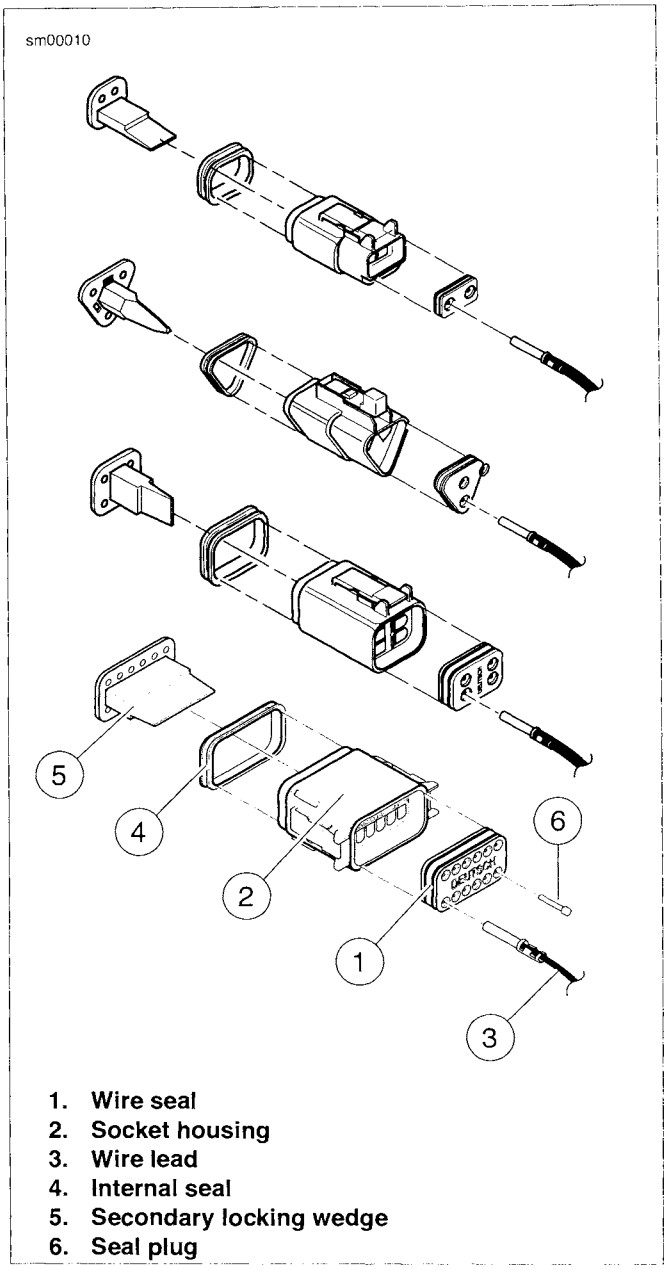
- *See Figure A-17. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, 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-16. Deutsch Connector: Remove Secondary Locking Wedge



1. **Arrow on socket locking wedge**
2. **Arrow on pin locking wedge**

Figure A-17. Deutsch Connector: 3-Place Locking Wedges



1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-18. 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.*

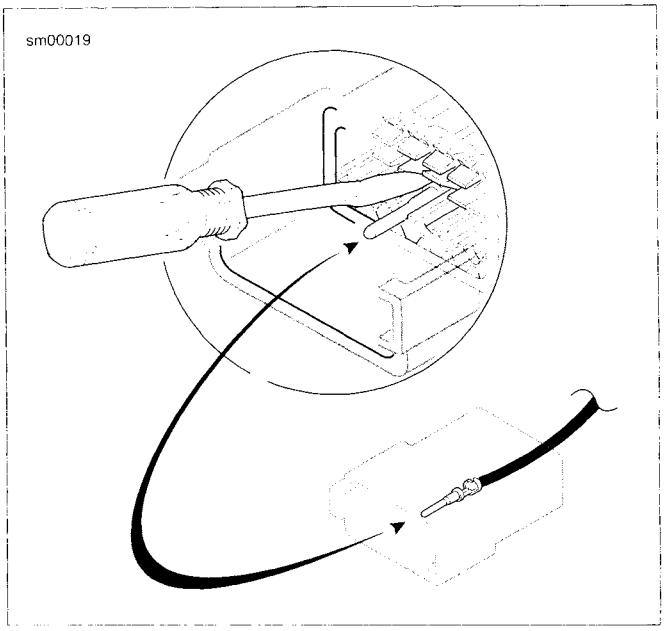


Figure A-19. Deutsch Connector: Depress Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-20. 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.

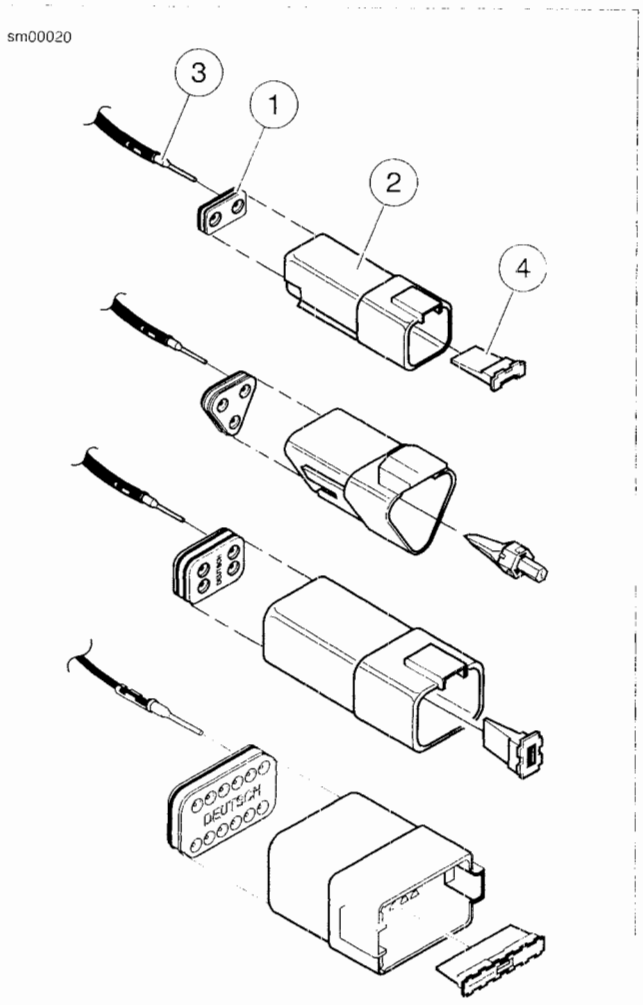
NOTE

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-17. 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-20. 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.6 DEUTSCH STANDARD TERMINAL REPAIR
Mini Terminal (solid barrel)	A.7 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR
Mini Terminal (with crimp tails)	A.8 DEUTSCH MINI TERMINAL REPAIR

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-21. 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.

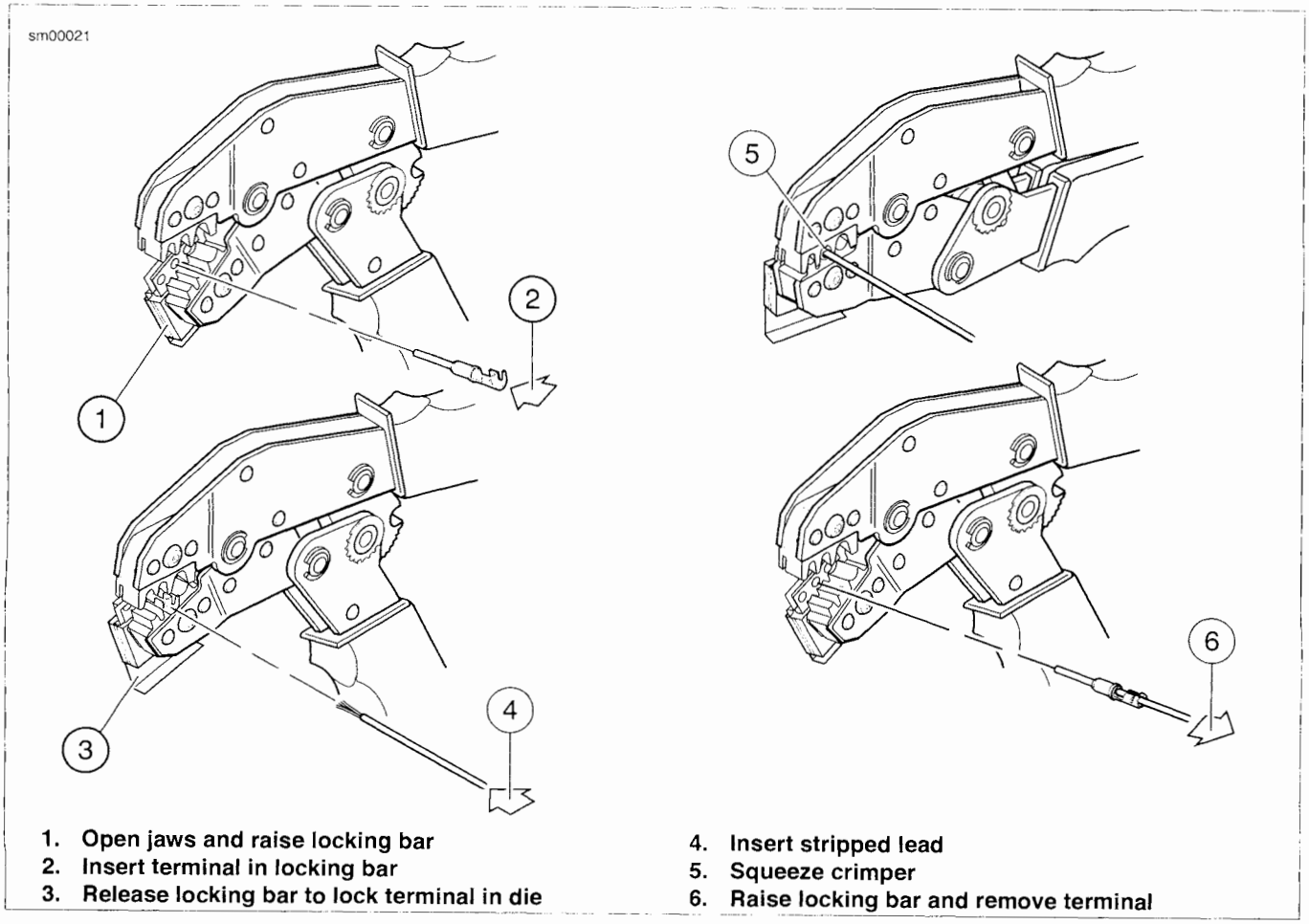
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens 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-21. Crimping a Deutsch Standard Terminal

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-22. 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-23. 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.

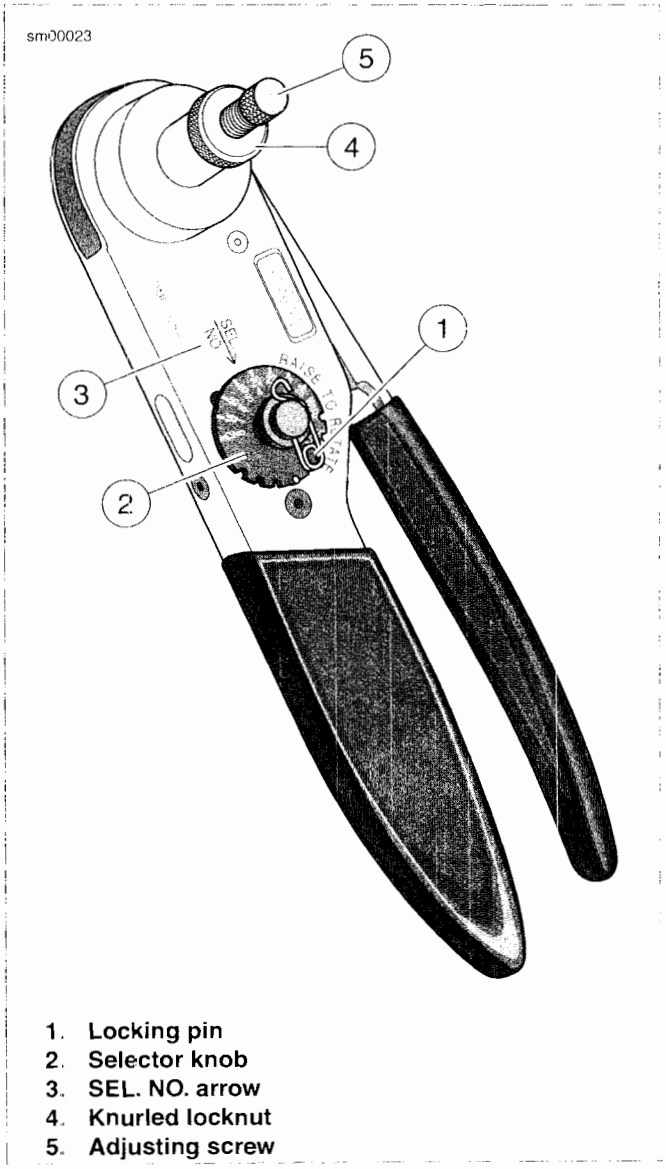
NOTE

Tool must be readjusted when changing contact size/type.

6. Install pin to lock selector knob.

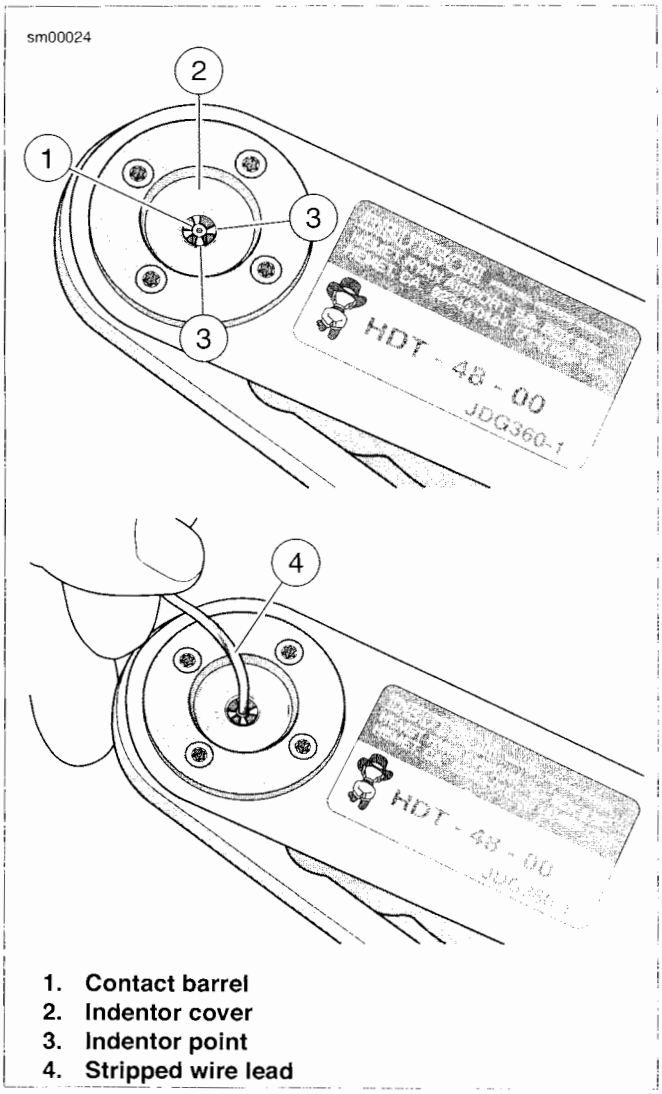
Inspecting Crimps

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-22. Electrical Crimper Tool (HD-42879)



1. Contact barrel
2. Indentor cover
3. Indentor point
4. Stripped wire lead

Figure A-23. Deutsch Solid Barrel

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-24. 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.

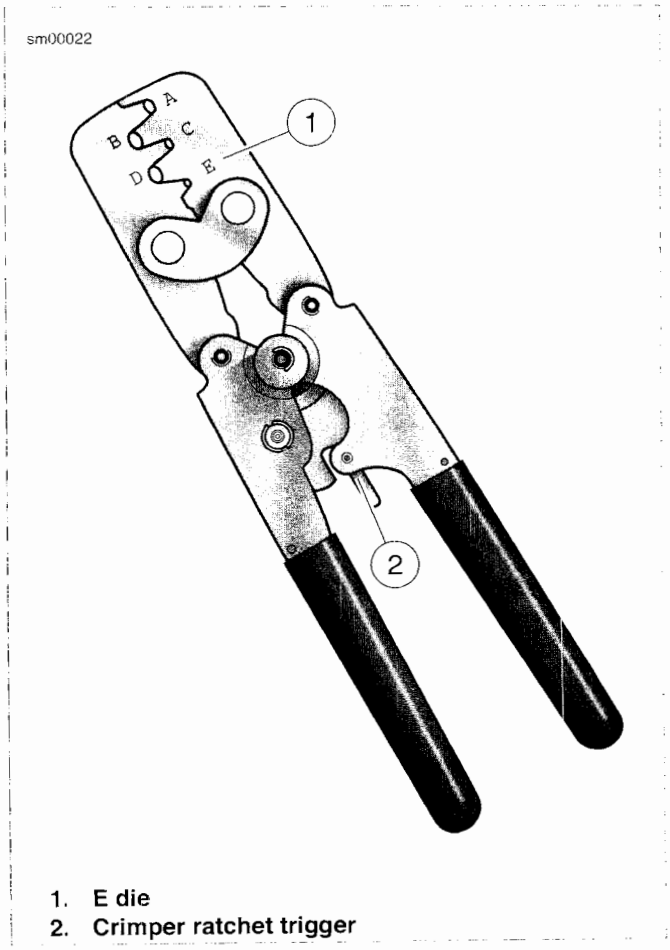
NOTE

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-24. Packard Terminal Crimper (HD-38125-7)

MOLEX CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-25. 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-26. 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-27. 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-28. 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-29. 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.

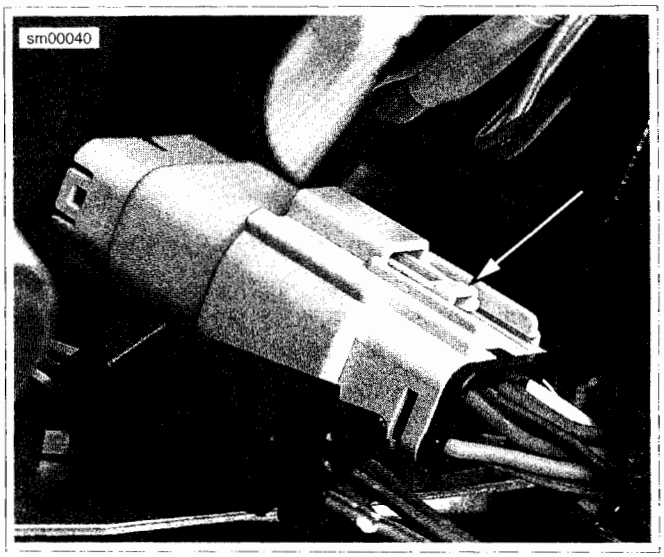


Figure A-25. Molex Connector: Latch

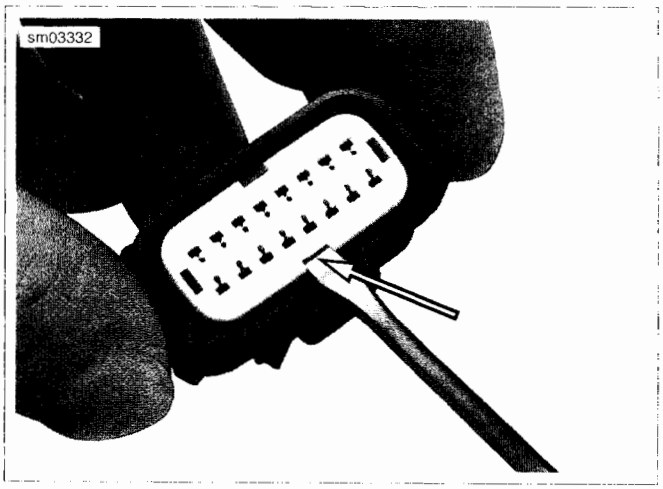


Figure A-26. Secondary Lock Pry Slot (Socket Housing)

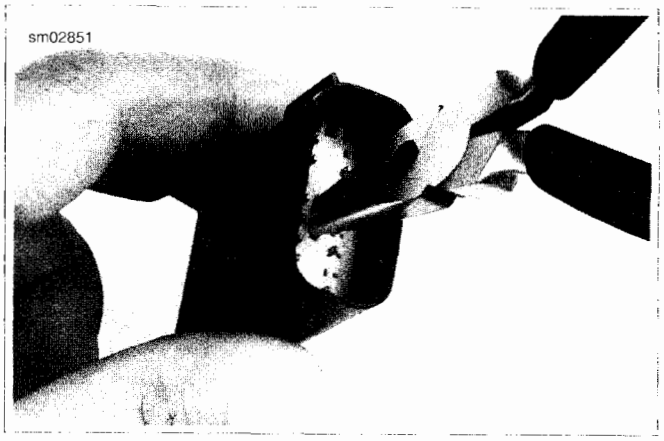


Figure A-27. Pull Up Secondary Lock (Pin Housing)

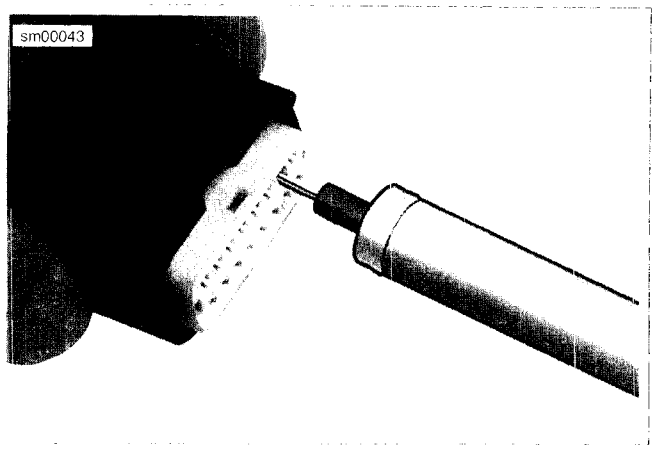
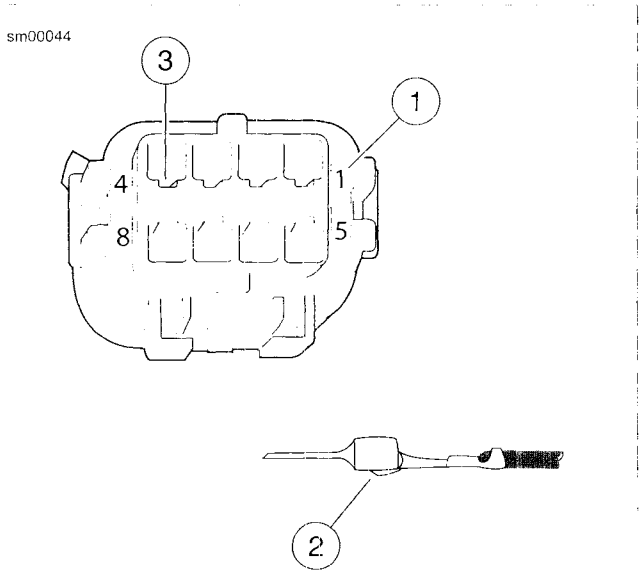


Figure A-28. Molex Connector: Terminal Remover (HD-48114)



1. **Cavity number**
2. **Tang**
3. **Cavity slot**

Figure A-29. 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-30. 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.

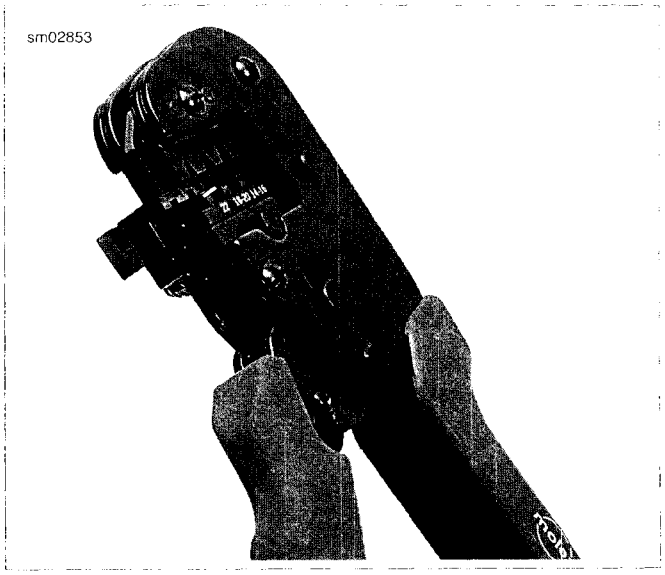
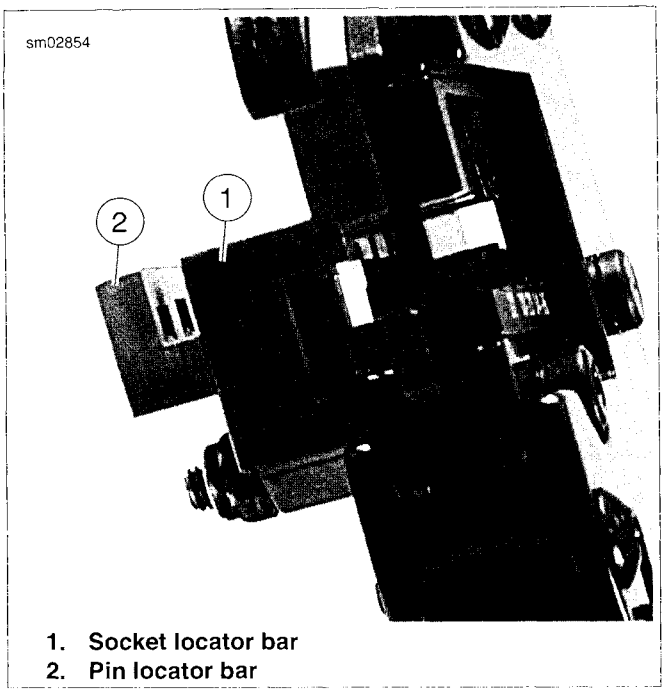


Figure A-30. Open Electrical Crimp Tool (HD-48119) at 45 Degrees



1. **Socket locator bar**
2. **Pin locator bar**

Figure A-31. Terminal Locator Bars

Position Terminal in the Punch/Die

1. See Figure A-32. 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-31. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-33. 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-34. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

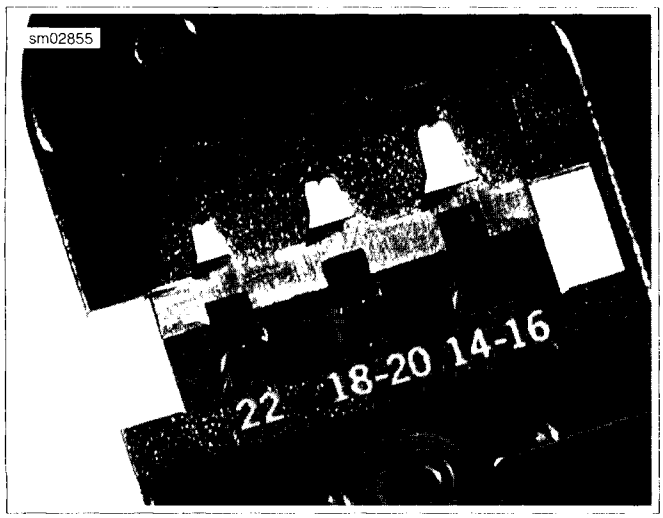


Figure A-32. Square Openings in Socket Locator Bar

Insert Stripped Lead

See Figure A-35. 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.*

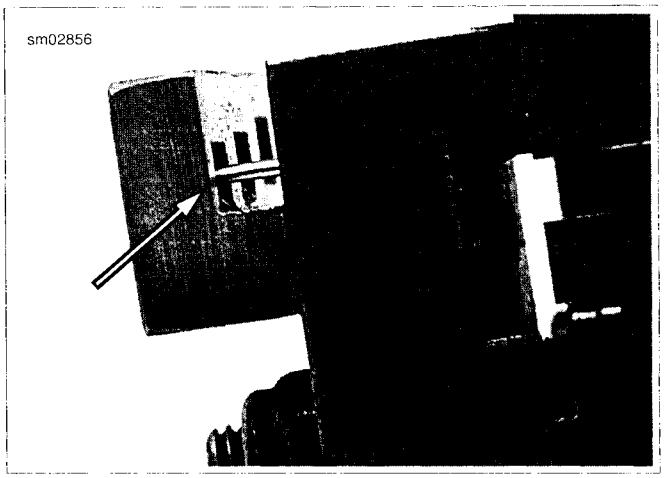


Figure A-33. Pin Terminal against Pin Locator Bar

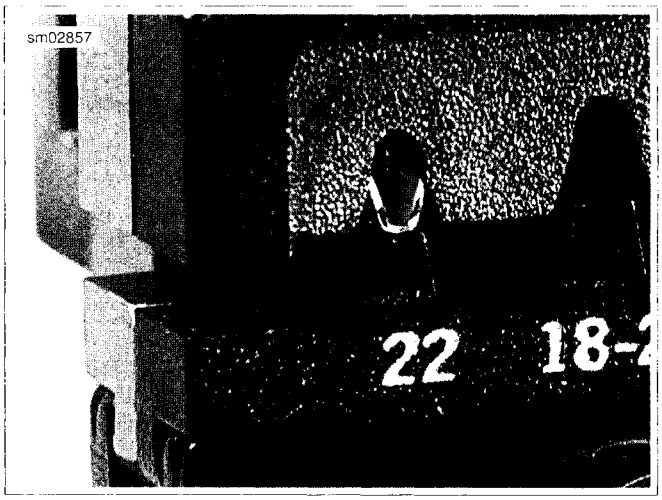


Figure A-34. Crimp Tails in Vertical Alignment between Punch and Die

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.*

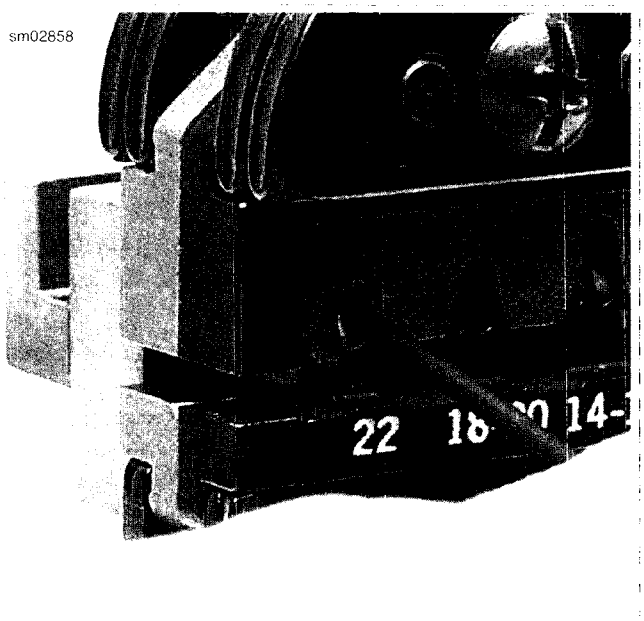
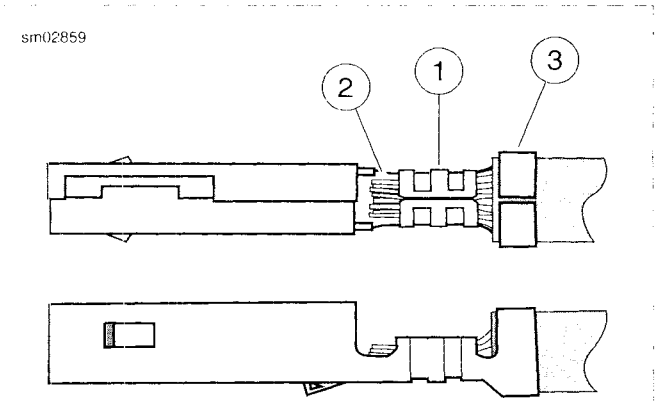


Figure A-35. Stripped Lead at Up Angle

Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
   a. See Figure A-36. 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-36. Terminal Crimp

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-37 for pull-to-seat connector or Figure A-38 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

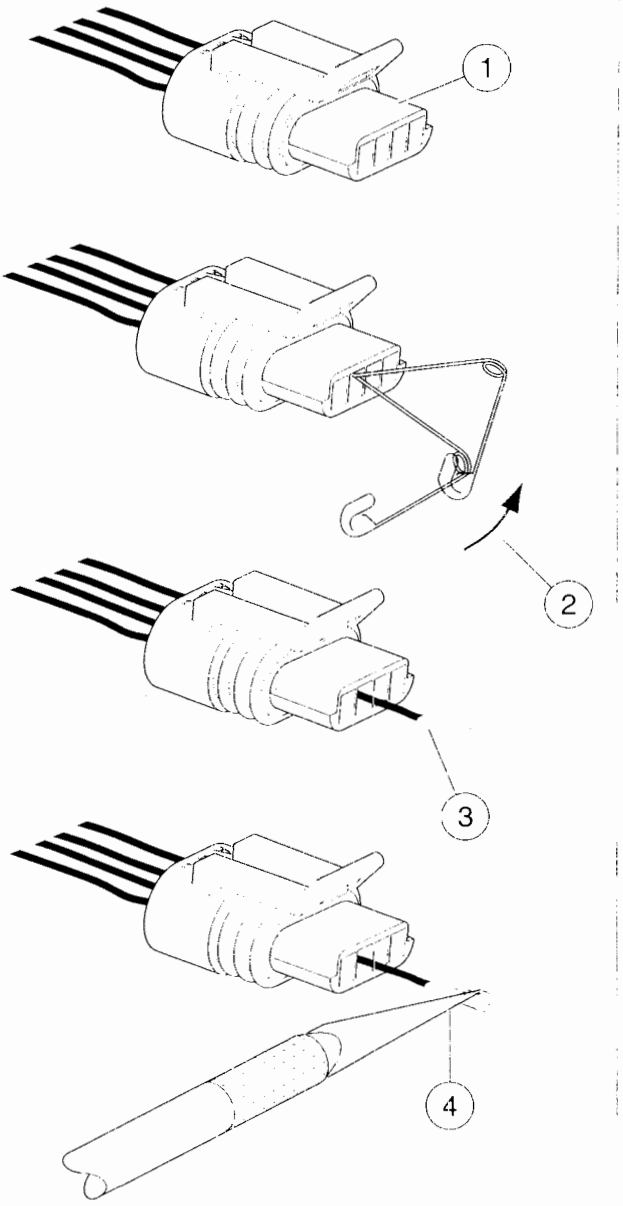
NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. See Figure A-37 for pull-to-seat connector or Figure A-38 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-38. 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.

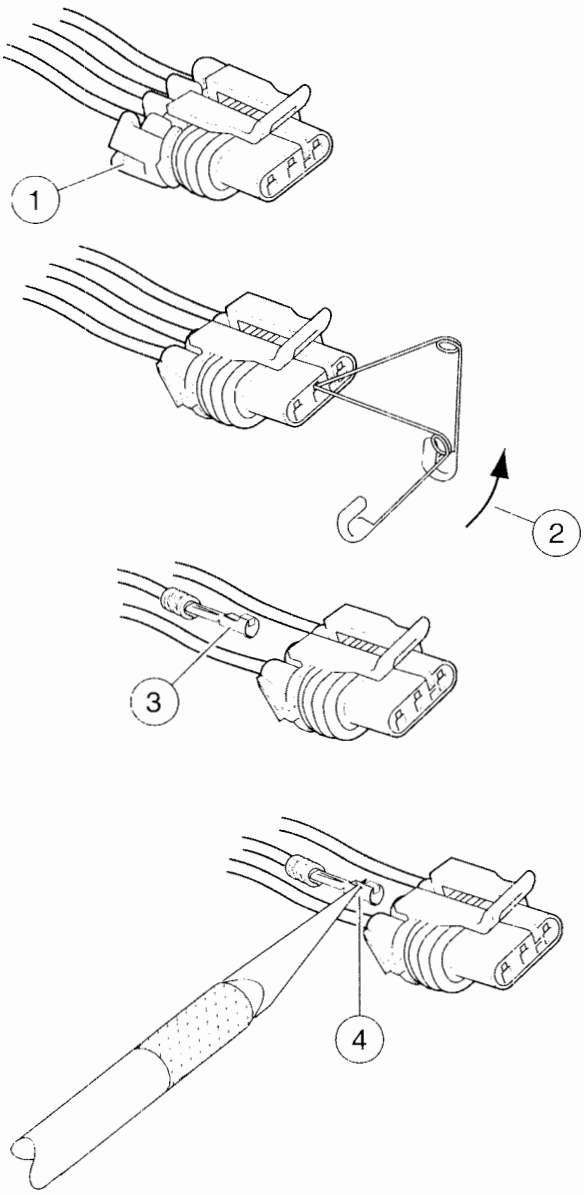
sm00027



1. Locate tang in chamber
2. Pivot pin to depress tang
3. Push to remove
4. Raise tang to install

Figure A-37. 150 Metri-Pack Connector: Pull-to-Seat

sm00028



1. Remove wire lock
2. Pivot pin to depress tang
3. Pull to remove
4. Raise tang to install

Figure A-38. 150 Metri-Pack Connector: Push-to-Seat

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-39. 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-39. 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

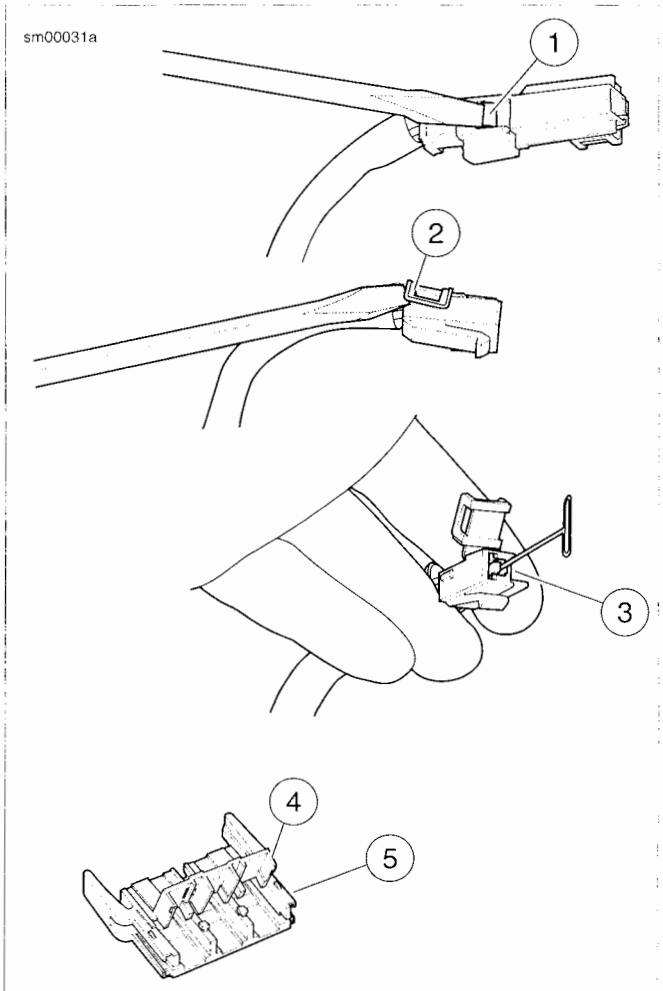
1. See Figure A-39. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped 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-39. 480 Metri-Pack Connector: Remove Socket Terminal

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.

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-40. 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

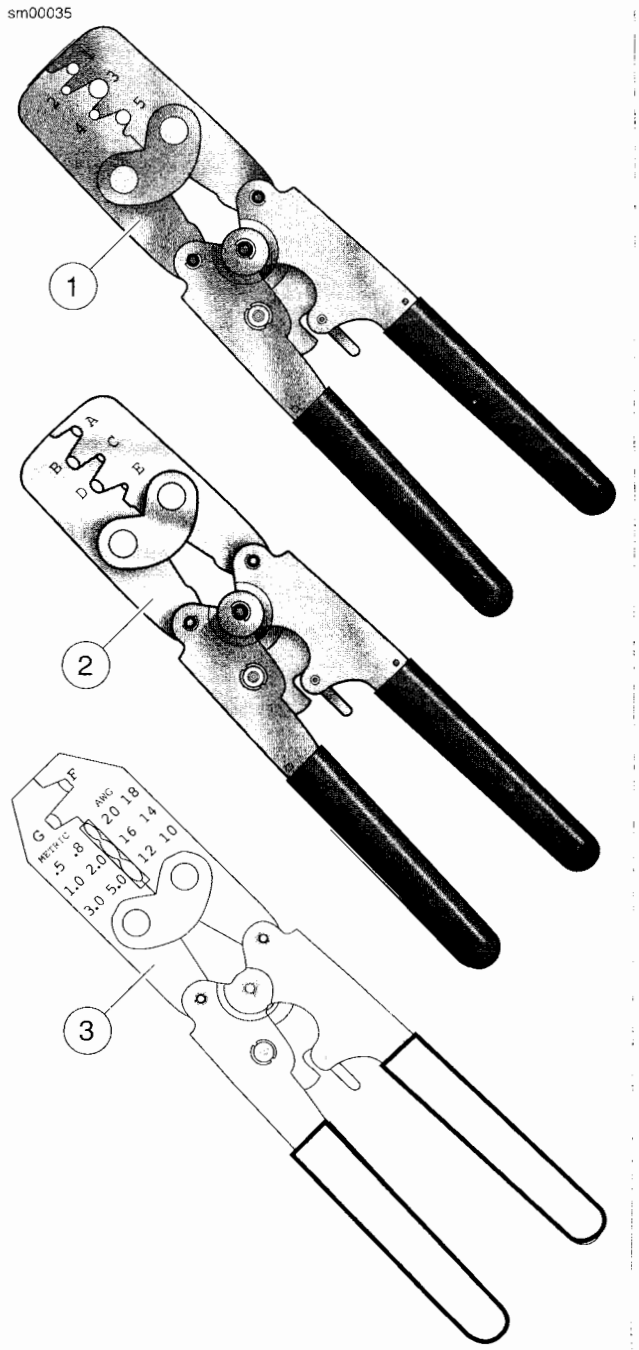
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

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-40. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

NOTE

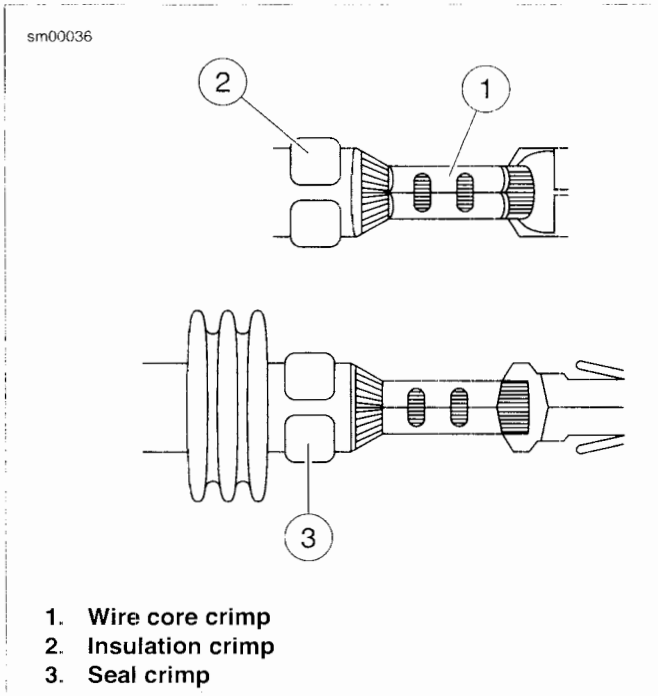
*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-41. 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-41. 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-41. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

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-42. 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

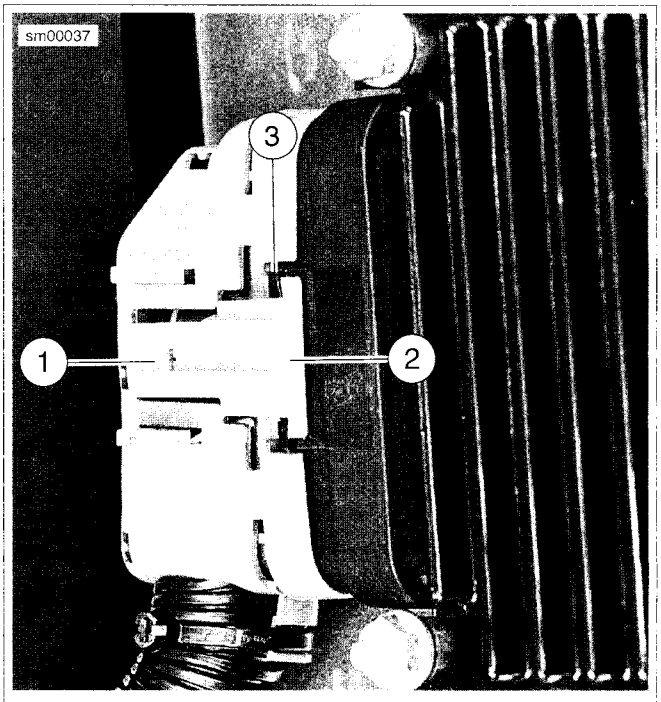
1. See Figure A-43. Gently press latch (1) on each side of the clear plastic secondary lock (2) and remove. For best results, release one side at a time.
2. Carefully cut cable strap (3) to free strain relief collar (4) from conduit (5).
3. See Figure A-44. Using a thin blade, gently pry at seam at back 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

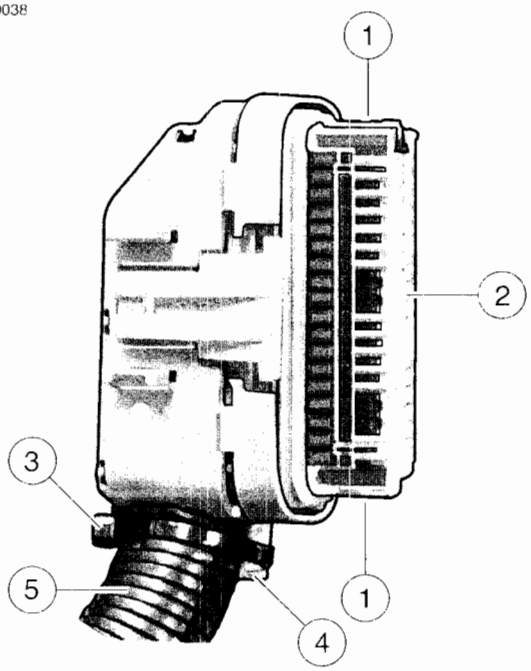
If necessary, crimp new terminals on wire leads. See A.13 PACKARD METRI-PACK TERMINALS.



1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

Figure A-42. Packard 100W to ECM (Typical)

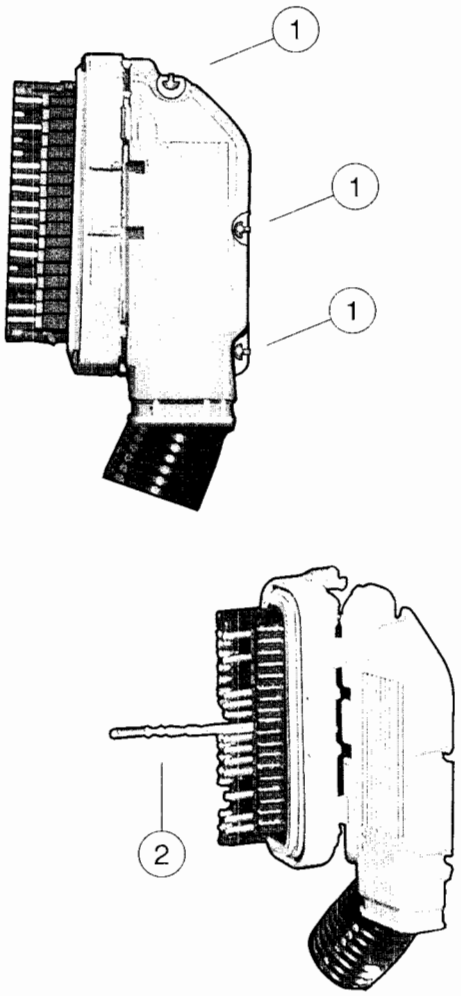
sm00038



1. Latch
2. Secondary lock
3. Cable strap
4. Strain relief collar
5. Conduit

Figure A-43. Packard 100W Connector

sm00039



1. Pins
2. Socket terminal

Figure A-44. Packard 100W Connector: Separate Halves of Socket Housing

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.10 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-47. 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-48. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-46. 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.

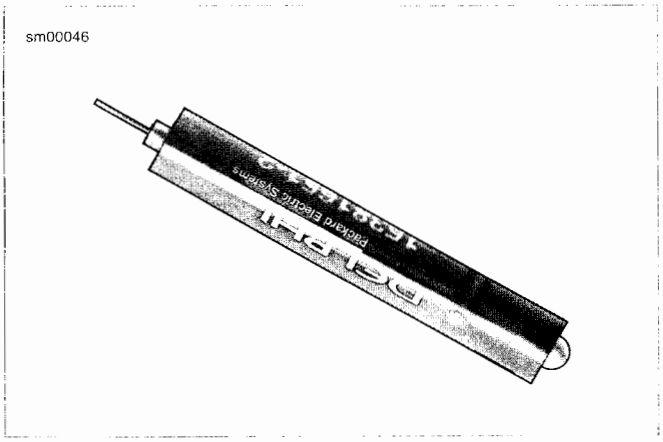


Figure A-45. Packard Micro 64 Terminal Remover (HD-45928)

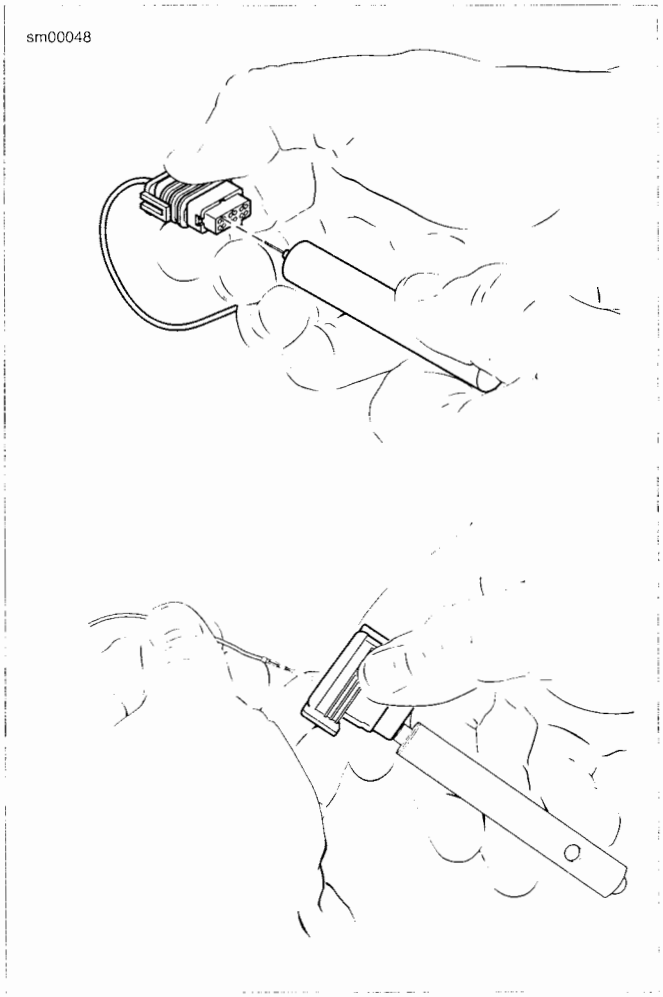


Figure A-46. Packard Micro 64 Connector: Insert Tool and Remove Terminal

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-47. 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 installed. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

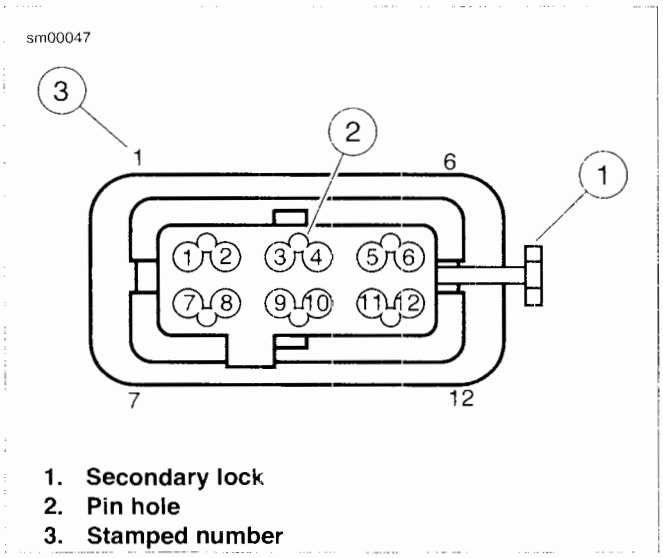
Strip lead removing 1/8 in. (3.0 mm) of insulation.

Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.
2. See Figure A-49. 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-47. Packard Micro 64 Connector: Housing

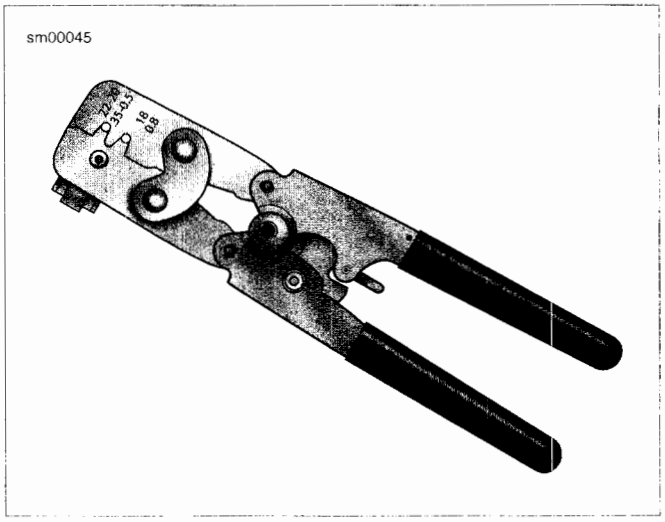
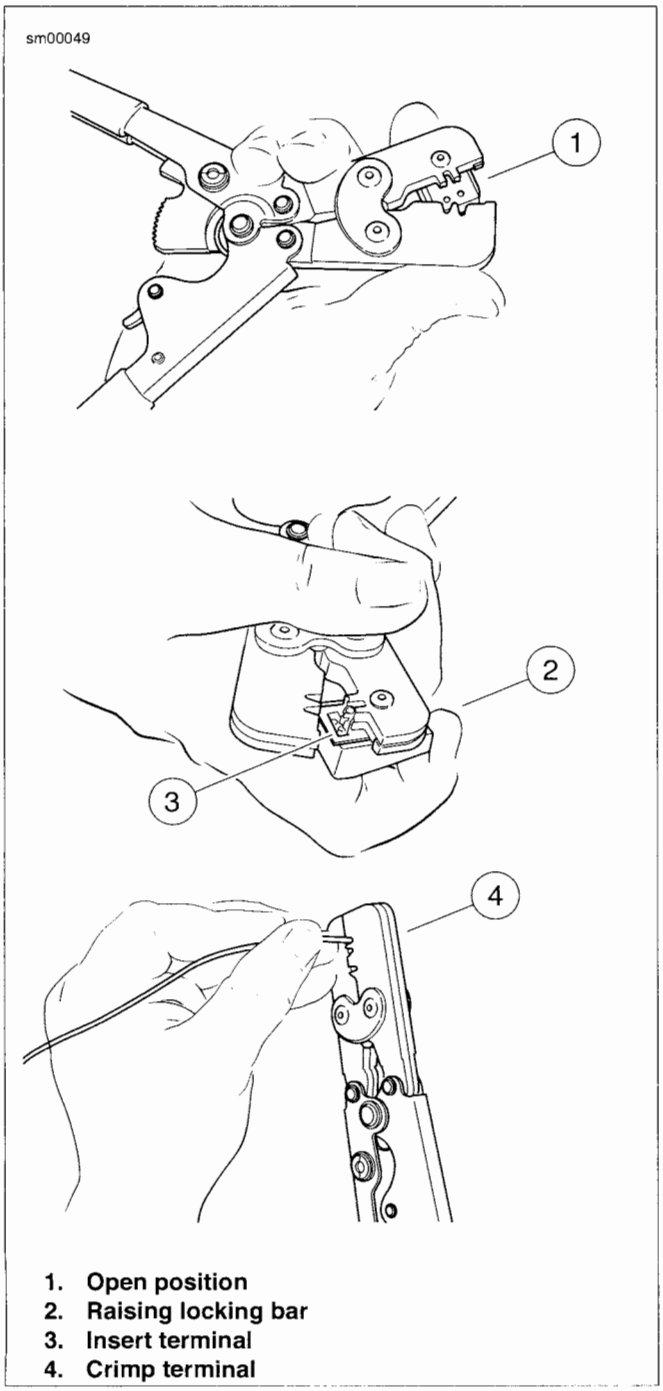


Figure A-48. Packard Micro 64 Terminal Crimper (HD-45929)



1. Open position
2. Raising locking bar
3. Insert terminal
4. Crimp terminal

Figure A-49. Packard Micro 64 Connector: Terminal in Crimper

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-51. The connector is crimped twice - one side and then the other.

1. See Figure A-50. 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-51. 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.

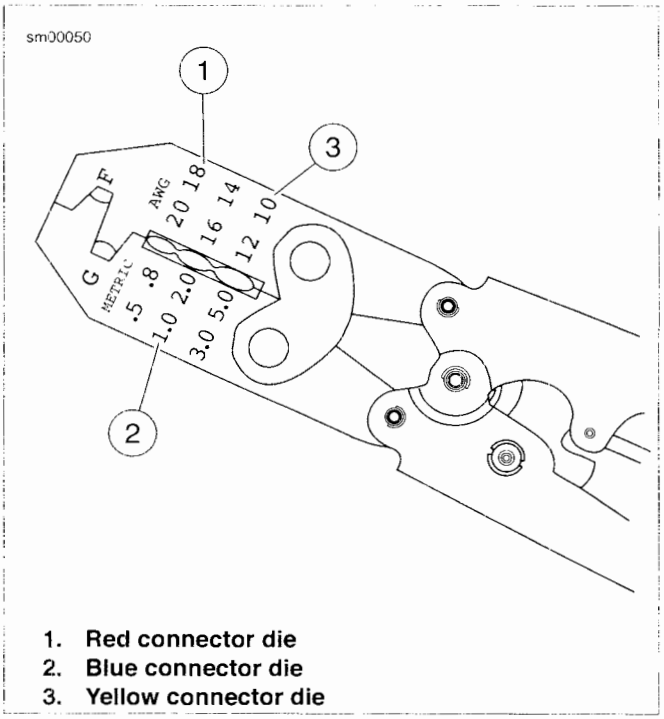
7. Use an ULTRA TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

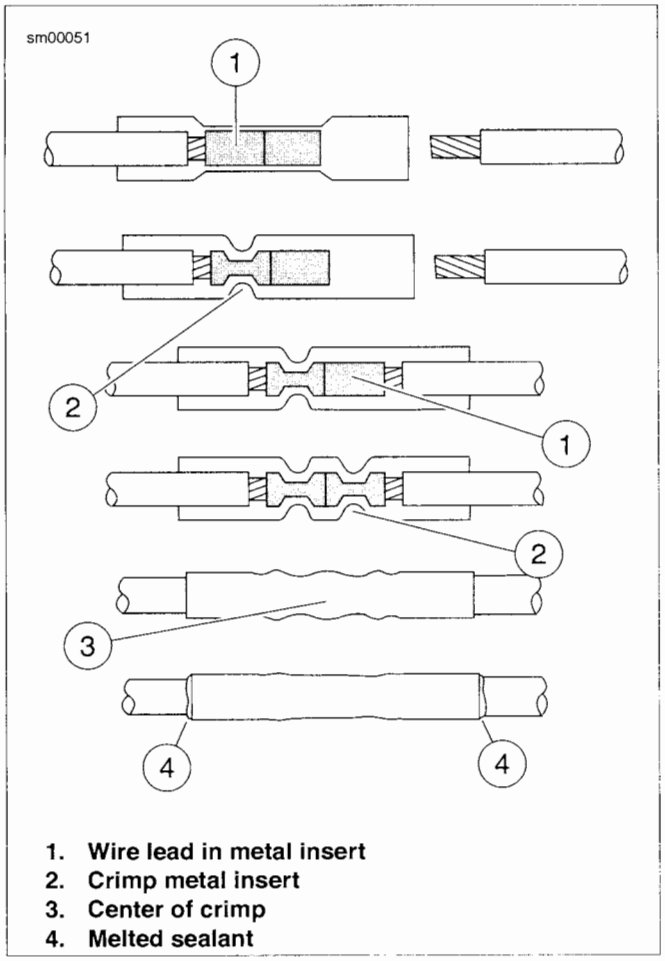
Inspecting Seals

See Figure A-51. 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-50. 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-51. Sealed Splice Connector

CONNECTOR LOCATIONS

Function/Location

On the vehicle, 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. Softail Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[5]	MAXIFUSE	Spade terminals	Under seat
[7]	Tail lamp harness to main harness	8-place Multilock 12-place Molex (FXCWC)	Under seat
[18]	Right rear turn signal	2-place Multilock	Inside tail lamp lens
[19]	Left rear turn signal	2-place Multilock	Inside tail lamp lens
[20]	Console harness	12-place Molex	Under console
[21]	Indicator lamps (except FXCWC)	8-place Mini-Deutsch	Under fuel tank console
[22]	Right hand controls	6-place Molex	Under fuel tank, right side
[24]	Left hand controls and horn	8-place Molex	Under fuel tank, left side
[30]	TSM/TSSM/HFSM	12-place Deutsch	Electrical panel behind fender extension
[31]	Front turn signals	6-place Multilock	Inside top frame tube
[32]	Front fender tip lamp	2-place Multilock	Under fuel tank, left side
[33]	Ignition switch	3-place Packard 4-place Packard (FXCWC)	Under fuel tank console
[38]	Headlamp	4-place Multilock	Under fuel tank, left side
[39]	Speedometer	12-place Packard	Back of speedometer
[40]	Tail lamp power in	6-place Multilock	Inside tail lamp lens
[45]	Rear fender tip lamp	3-place Multilock	Inside tail lamp lens
[47]	Voltage regulator to stator	3-place Packard	Back of voltage regulator
[62]	Fuse block (start relay, system relay)	Spade terminals	Under seat
[64]	Fuse block	Spade terminals	Under seat
[65]	Vehicle Speed Sensor (VSS)	3-place Delphi	Top of transmission case
[73]	Passing lamps	2-place Multilock	Behind headlamp
[77]	Voltage regulator	2-place Deutsch	Back of voltage regulator
[78]	Electronic Control Module (ECM)	36-place Packard	Under seat (all except FXCWC) In front of rear fender (FXCWC)
[79]	Crankshaft Position (CKP) sensor	2-place Mini-Deutsch	Back of voltage regulator bracket
[80]	Manifold Absolute Pressure (MAP) sensor	3-place Packard	Top of manifold
[83]	Ignition coil	4-place Delphi	Back of coil
[84]	Front injector	2-place Delphi	Beneath fuel tank
[85]	Rear injector	2-place Delphi	Beneath fuel tank
[87]	Idle Air Control (IAC)	4-place Delphi	Beneath fuel tank
[88]	Throttle Position (TP) sensor	3-place Delphi	Behind air cleaner backing plate
[89]	Intake Air Temperature (IAT) sensor	2-place Delphi	Behind air cleaner backing plate
[90]	Engine Temperature (ET) sensor	2-place Delphi	Back of front cylinder, left side
[91]	Data link connector	4-place Deutsch	Under seat

Table B-1. Softail Connector Locations

NO.	DESCRIPTION	TYPE	LOCATION
[93]	Tail lamp	4-place Multilock	Inside tail lamp lens
[109]	Passing lamp switch	Spade terminals	Behind headlamp
[117]	Fuel gauge	4-place Multilock	Left front side of fuel tank
[121]	Rear stop lamp switch	Spade terminals	Behind transmission
[122]	Horn	Spade terminals	Between cylinders, left side
[128]	Starter solenoid	Spade terminals	Top of starter
[131]	Neutral switch	Post terminals	Top of transmission
[133]	Jiffy stand sensor	3-place Molex	Back of voltage regulator bracket
[137]	Rear oxygen sensor	2-place Amp	Under oil tank
[138]	Front oxygen sensor	2-place Amp	Behind voltage regulator
[139]	Oil pressure switch	Post terminals	Front right crankcase
[141]	Fuel pump and sender	4-place Packard	Top of fuel tank
[142]	Security siren (optional)	3-place Delphi	Electrical panel behind fender extension
[143]	Front fender tip lamp	2-place Multilock	Under front fender tip lamp bracket
[154]	Trip odometer reset switch	-	Under fuel tank console
[157]	Indicator lamps (FXCWC)	8-place Mini-Deutsch	Under fuel tank console
[160]	B+ connector	1-place Packard	Under seat
[178]	Active intake solenoid	2-place Amp	Air cleaner backing plate
[179]	Active exhaust	5-place Amp	Exhaust bracket
[208]	Hands-Free Security Module (HFSM) antenna harness	4-place Deutsch	Electrical panel behind fender extension
[209]	Hands-Free Security Module (HFSM) antenna	2-place Molex	Under seat
[GND1] [GND2]	Harness grounds (2)	Ring terminals	Under seat

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-2.

For Solid Color Wires: See Figure B-1. The alpha code identifies wire color.

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code. For example, a trace labeled GN/Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

See Figure B-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets. The letter inside the brackets identifies whether the housing is a socket or pin housing.

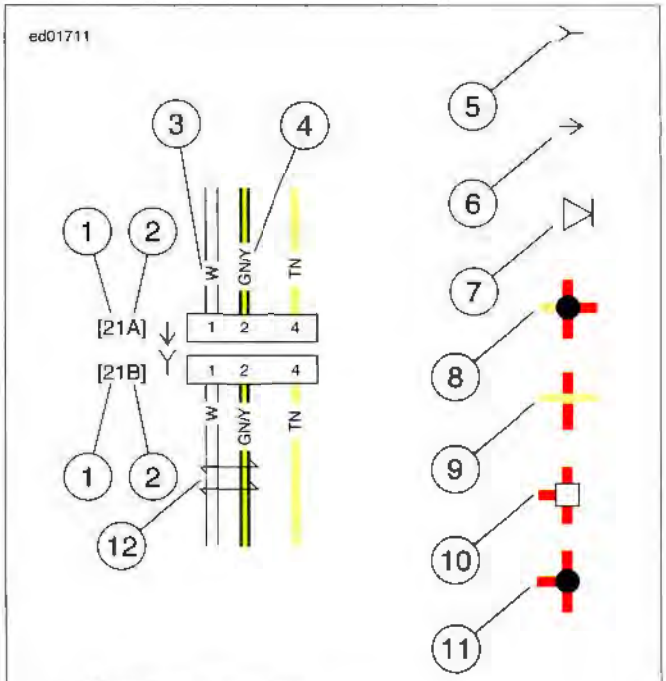
A=Pin: The letter A after a connector number and the pin symbol identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode, a symbol for a wire-to-wire connection, a symbol verifying that no connection between two wire traces exists, symbols for actual and virtual splices, and a symbol identifying two wires that are twisted together.

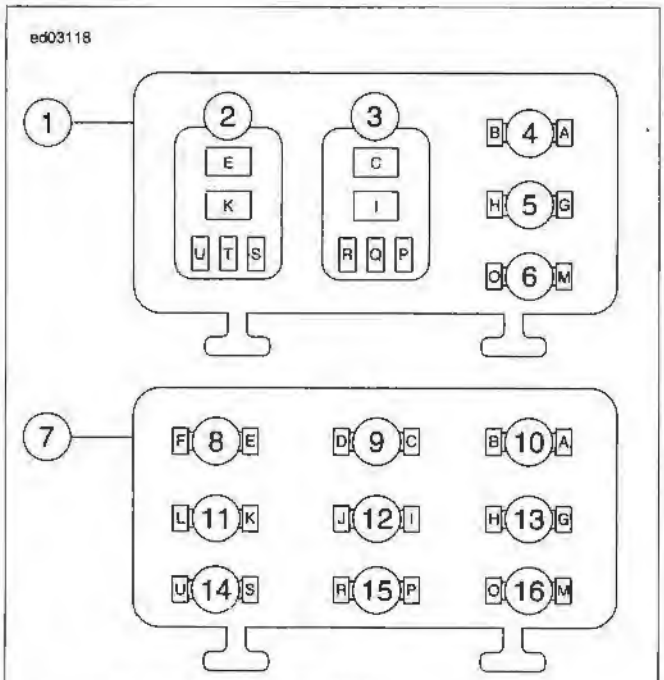
Actual splices are splices where two wires are connected together at a specific location along a wire. Virtual splices are splices shown connected anywhere along a wire, usually used in a wiring or schematic diagram for clarity.

Grounds are classified as either clean or dirty grounds. Clean grounds are normally used for sensors or modules. These grounds usually do not have electric motors or coils or anything that may cause electrical interference on the ground circuit. The dirty grounds are used for components that are not as sensitive to electrical interference.



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. **Actual splice**
11. **Virtual splice**
12. **Twisted pair**

Figure B-1. Connector/Wiring Diagram Symbols



1. Fuse and relay block [62]
2. Start relay
3. System relay
4. Spare
5. Spare
6. Fuel pump
7. Fuse block [64]
8. ECM power
9. P&A
10. Instruments
11. Engine control
12. Battery
13. Ignition
14. Headlamp
15. Accessories
16. Lights

Figure B-2. Fuse Block and Socket Terminals

Table B-2. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Gray
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

Refer to the table below for wiring diagram information.

Wiring Diagram List

DIAGRAM	LOCATION
Battery Power Distribution	Figure B-3
Accessory Power Distribution: FXCWC	Figure B-4
Accessory Power Distribution: Except FXCWC	Figure B-5
Ignition Power Distribution: FXCWC	Figure B-6
Ignition Power Distribution: Except FXCWC	Figure B-7
Sensor 5 Volt Reference Voltage Distribution	Figure B-8
Sensor Ground Circuit	Figure B-9
Sensor Ground Circuit: Except FXCWC	Figure B-10
Sensor Ground Circuit: FXCWC	Figure B-11
Power Ground Circuit	Figure B-12
Main Harness: 2010 Softail (Except FXCWC)	Figure B-13
Main Harness: 2010 Softail (Including FXCWC)	Figure B-14
Handlebar Switches, Indicators, and Lighting: 2010 Softail (Except FXCWC)	Figure B-15
Ignition Circuit: 2010 Softail (Except FXCWC)	Figure B-16
Lighting Circuit: 2010 Softail (Except FXCWC)	Figure B-17
Horn & Instruments: 2010 Softail (Except FXCWC)	Figure B-18
Starting and Charging Circuits: 2010 Softail (Except FXCWC)	Figure B-19
Security Circuit: 2010 Softail (Except FXCWC)	Figure B-20
Main Harness: 2010 Softail (FXCWC Only)	Figure B-21
Handlebar Switches, Indicators, and Lighting: 2010 Softail (FXCWC Only)	Figure B-22
Ignition Circuit: 2010 Softail (FXCWC Only)	Figure B-23
Lighting Circuit: 2010 Softail (FXCWC Only)	Figure B-24
Horn & Instruments: 2010 Softail (FXCWC Only)	Figure B-25
Starting and Charging Circuits: 2010 Softail (FXCWC Only)	Figure B-26
Security Circuit: 2010 Softail (FXCWC Only)	Figure B-27

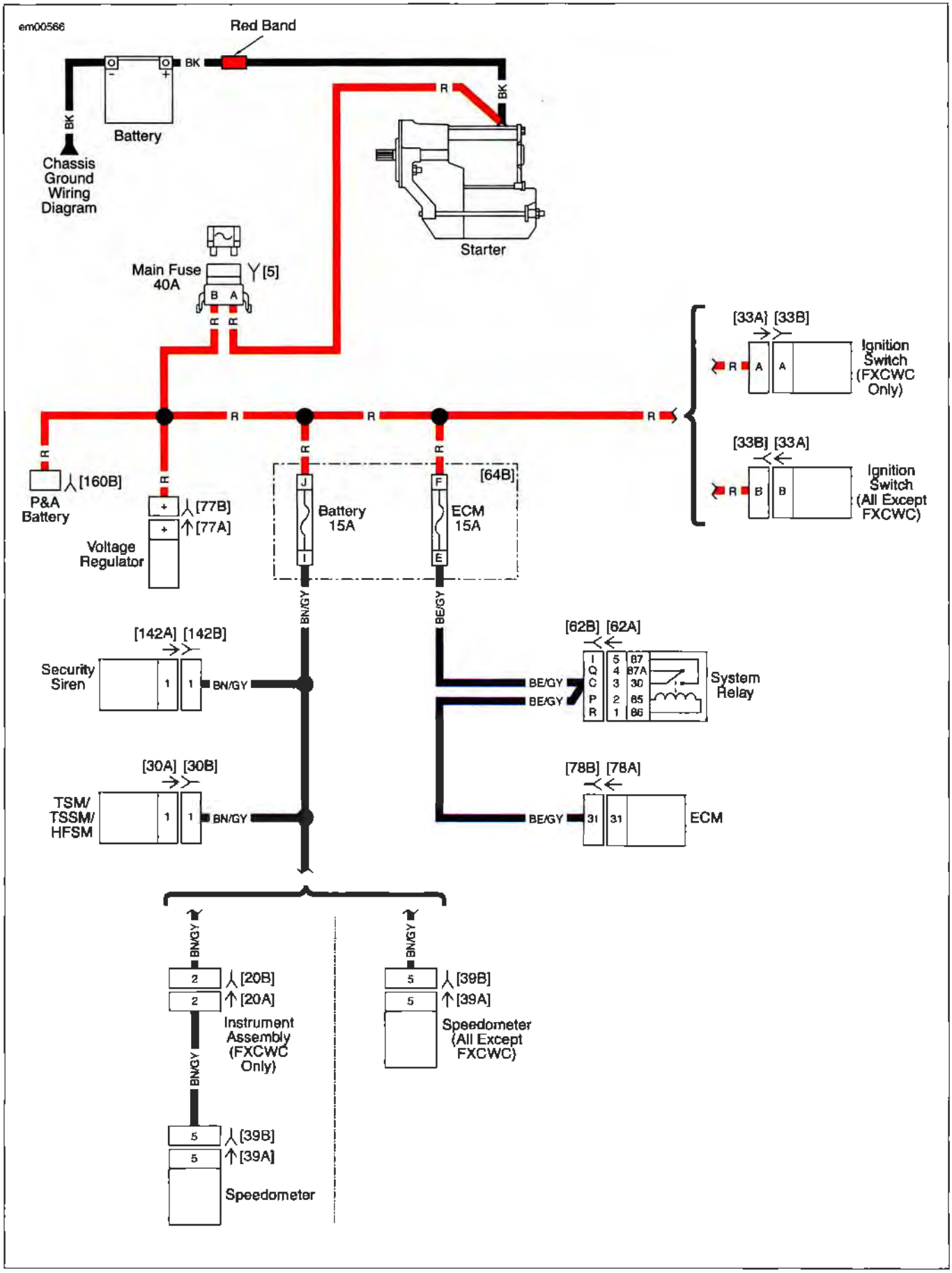


Figure B-3. Battery Power Distribution

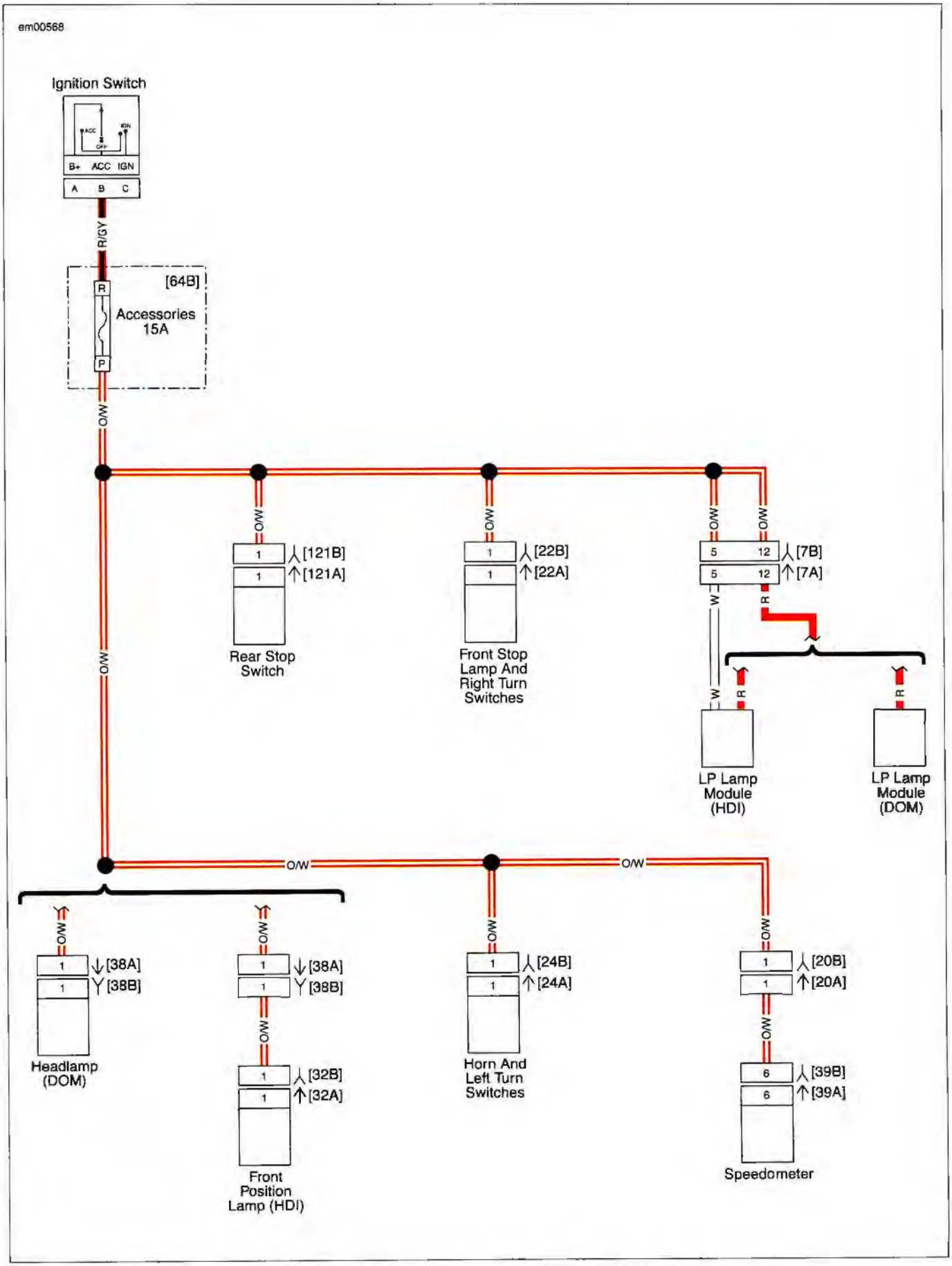


Figure B-4. Accessory Power Distribution: FXCWC

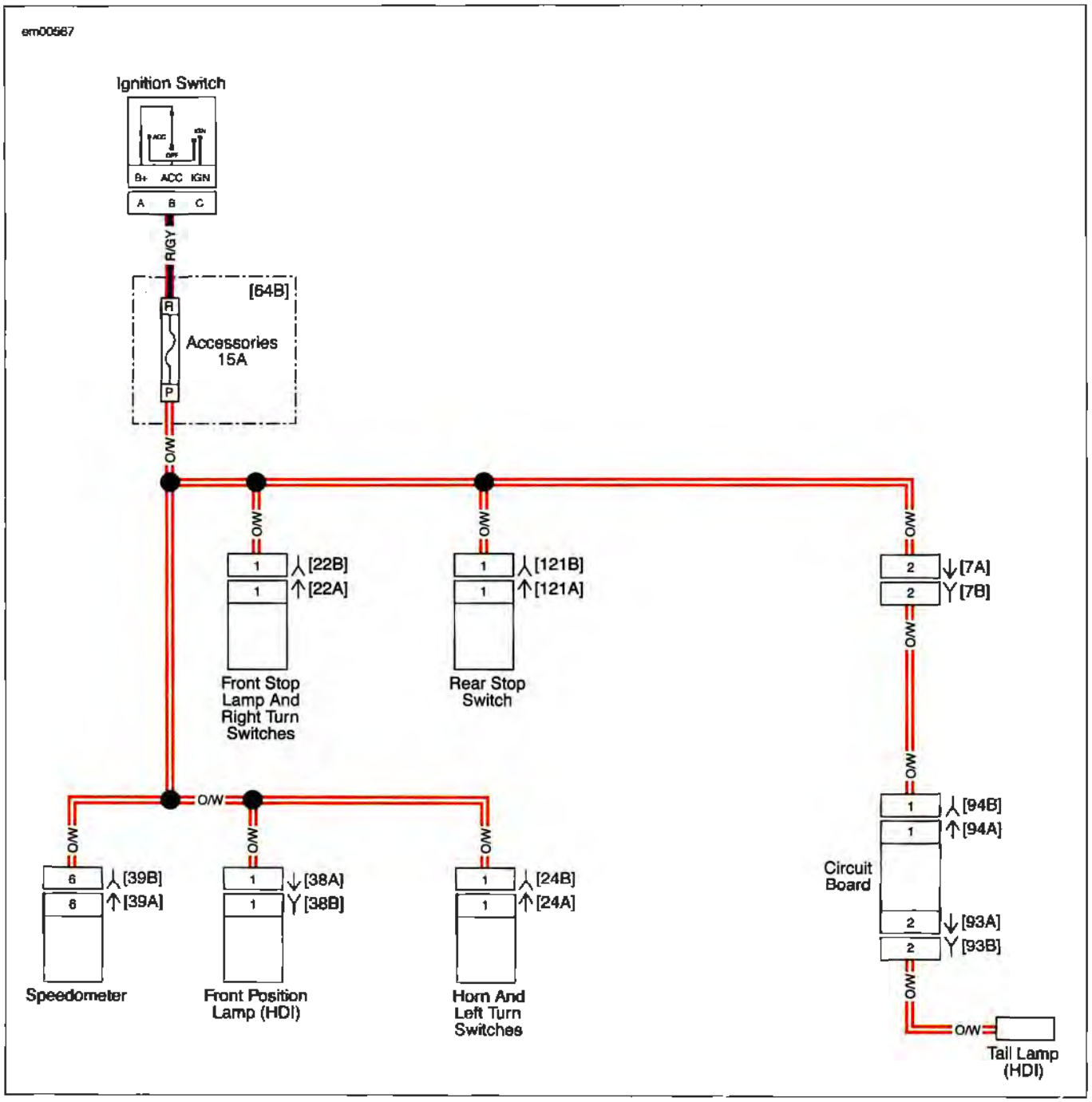


Figure B-5. Accessory Power Distribution: Except FXCWC

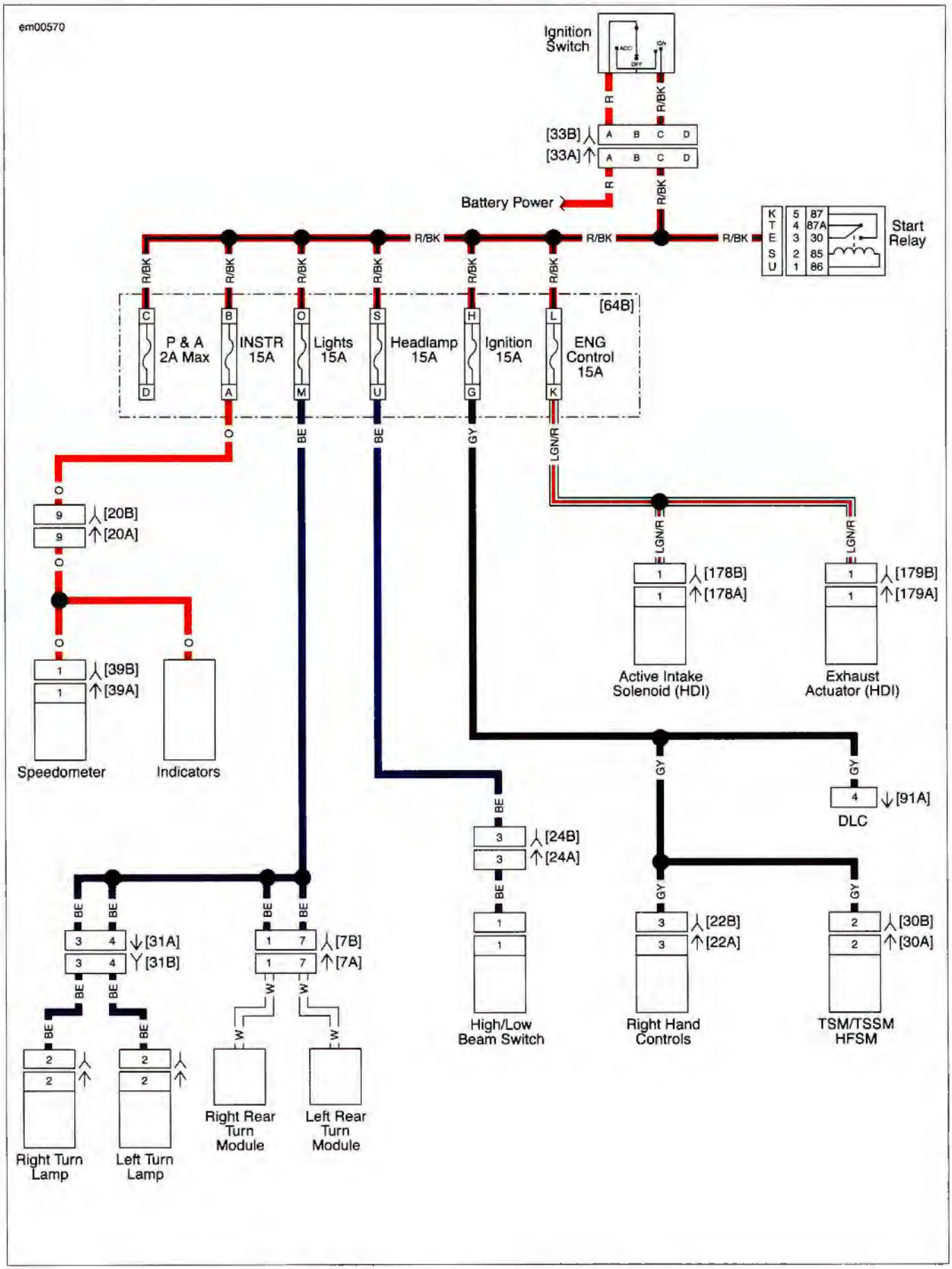


Figure B-6. Ignition Power Distribution: FXCWC

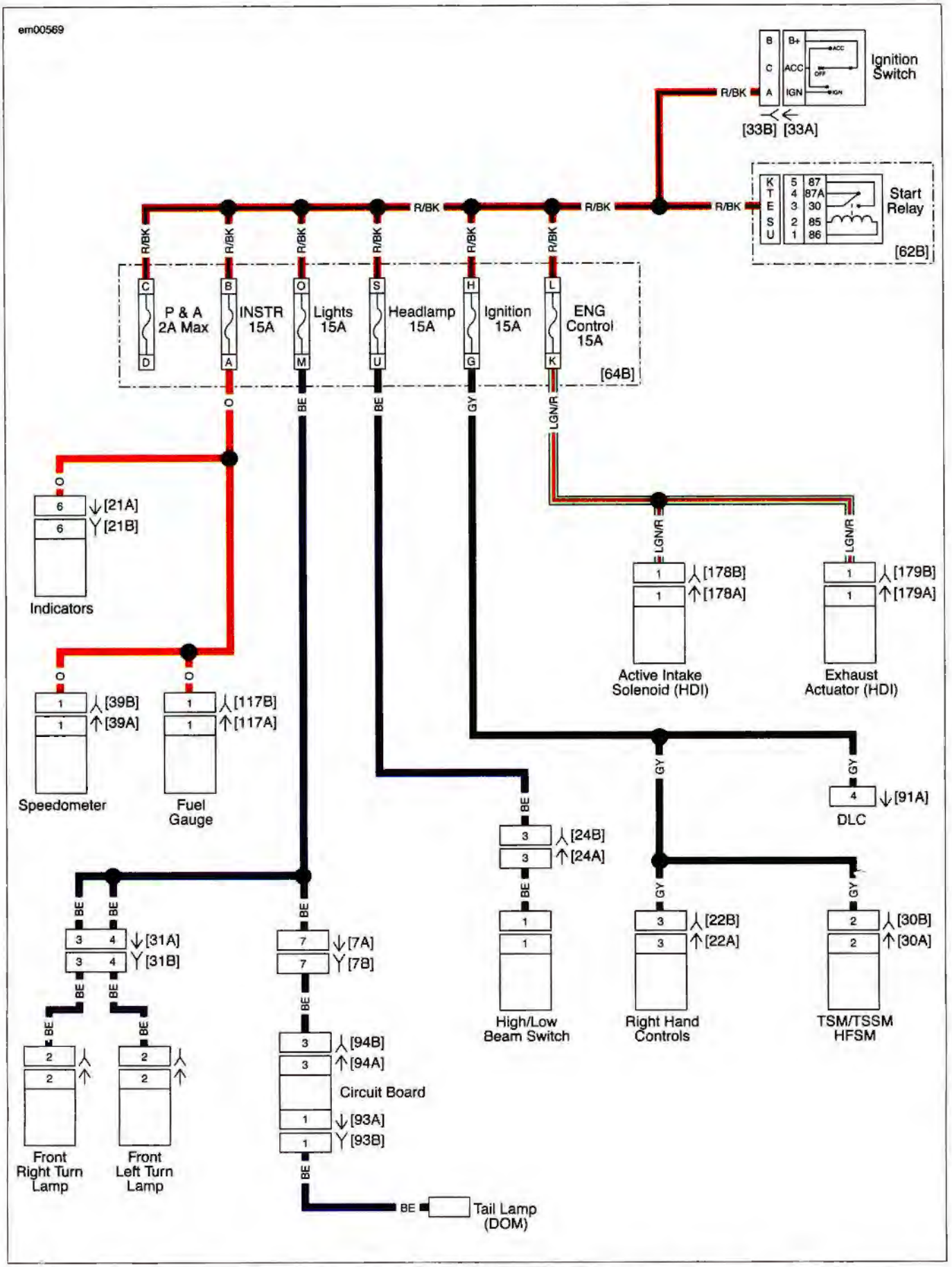


Figure B-7. Ignition Power Distribution: Except FXCWC

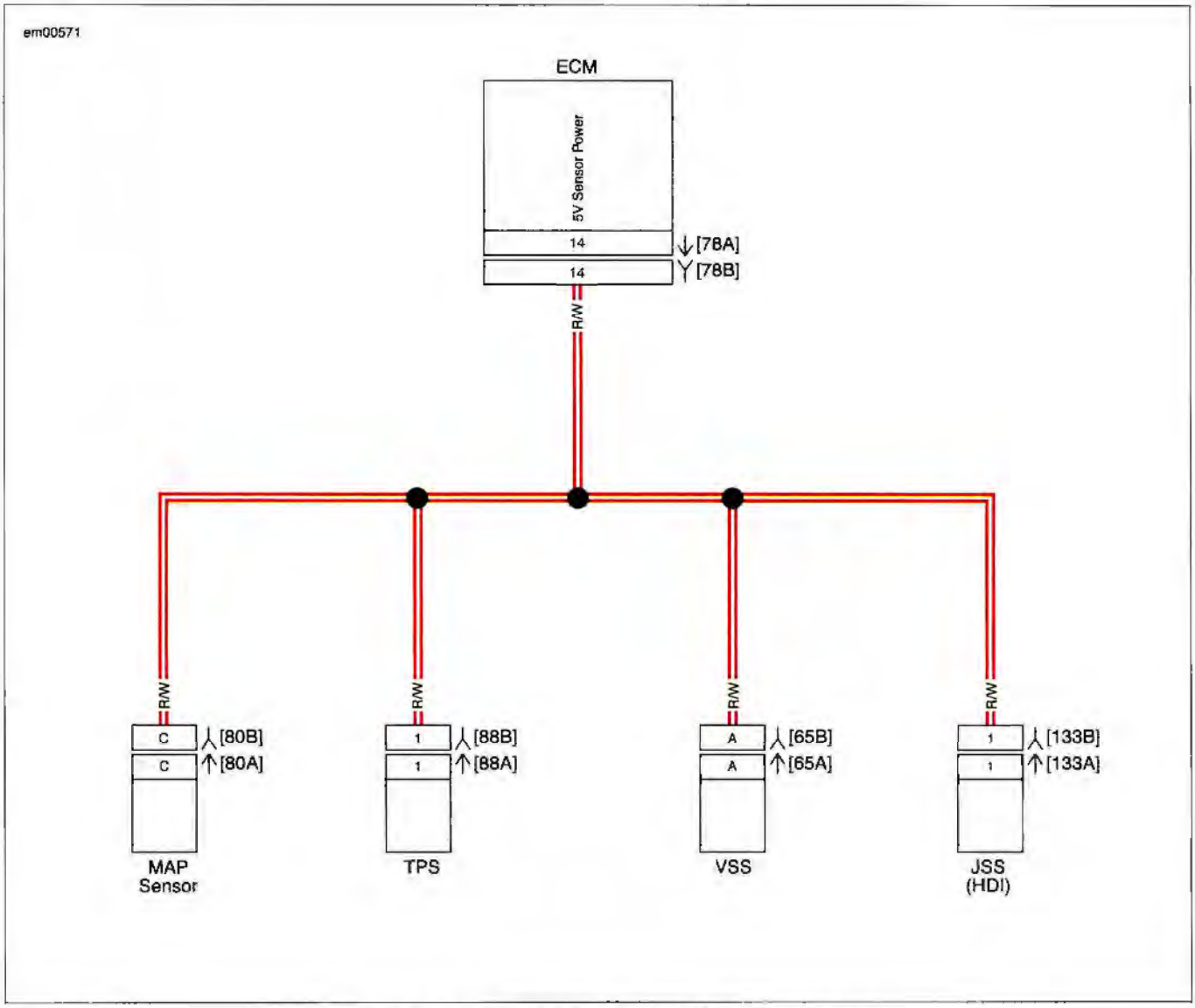


Figure B-8. Sensor 5 Volt Reference Voltage Distribution

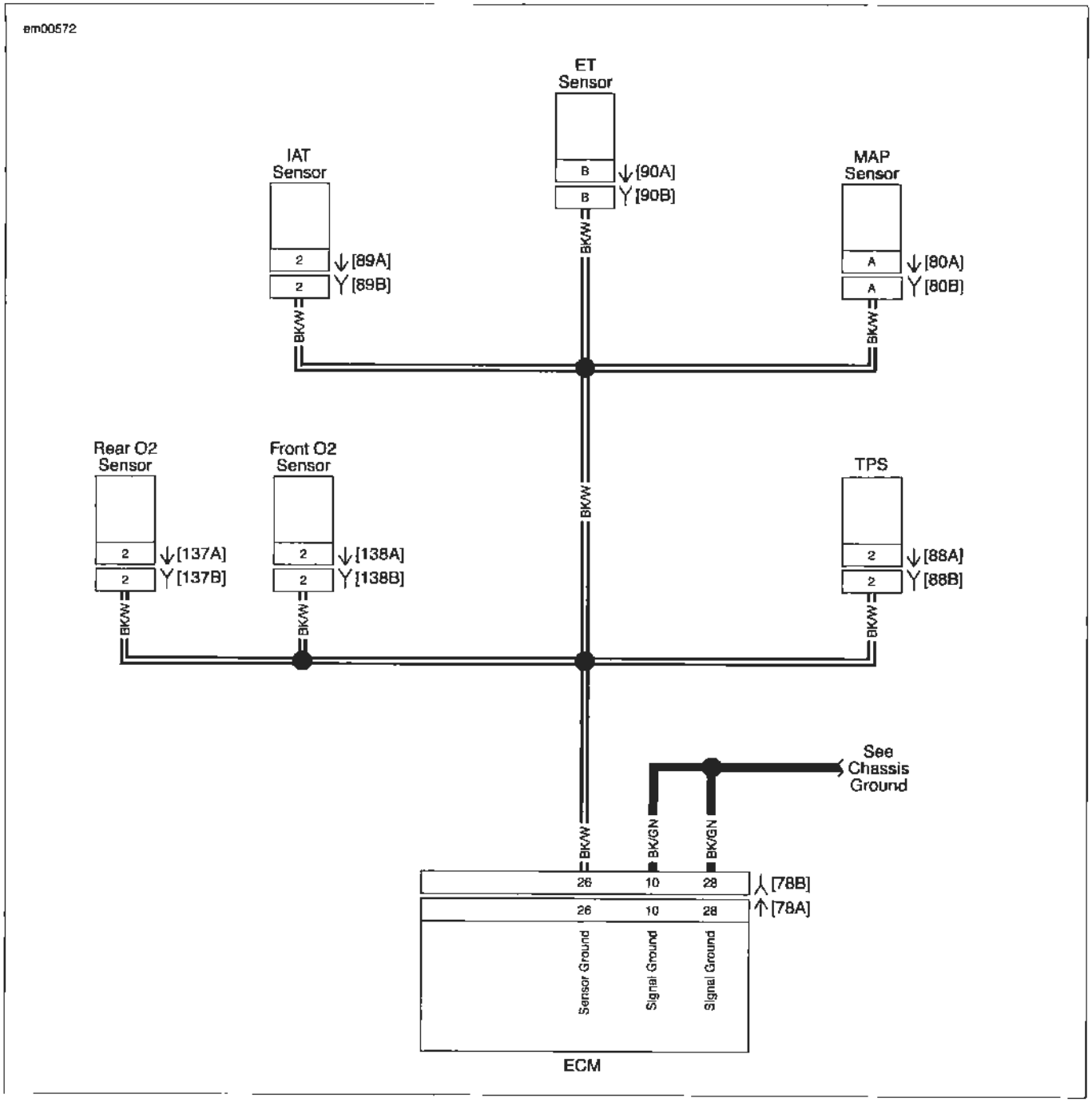


Figure B-9. Sensor Ground Circuit

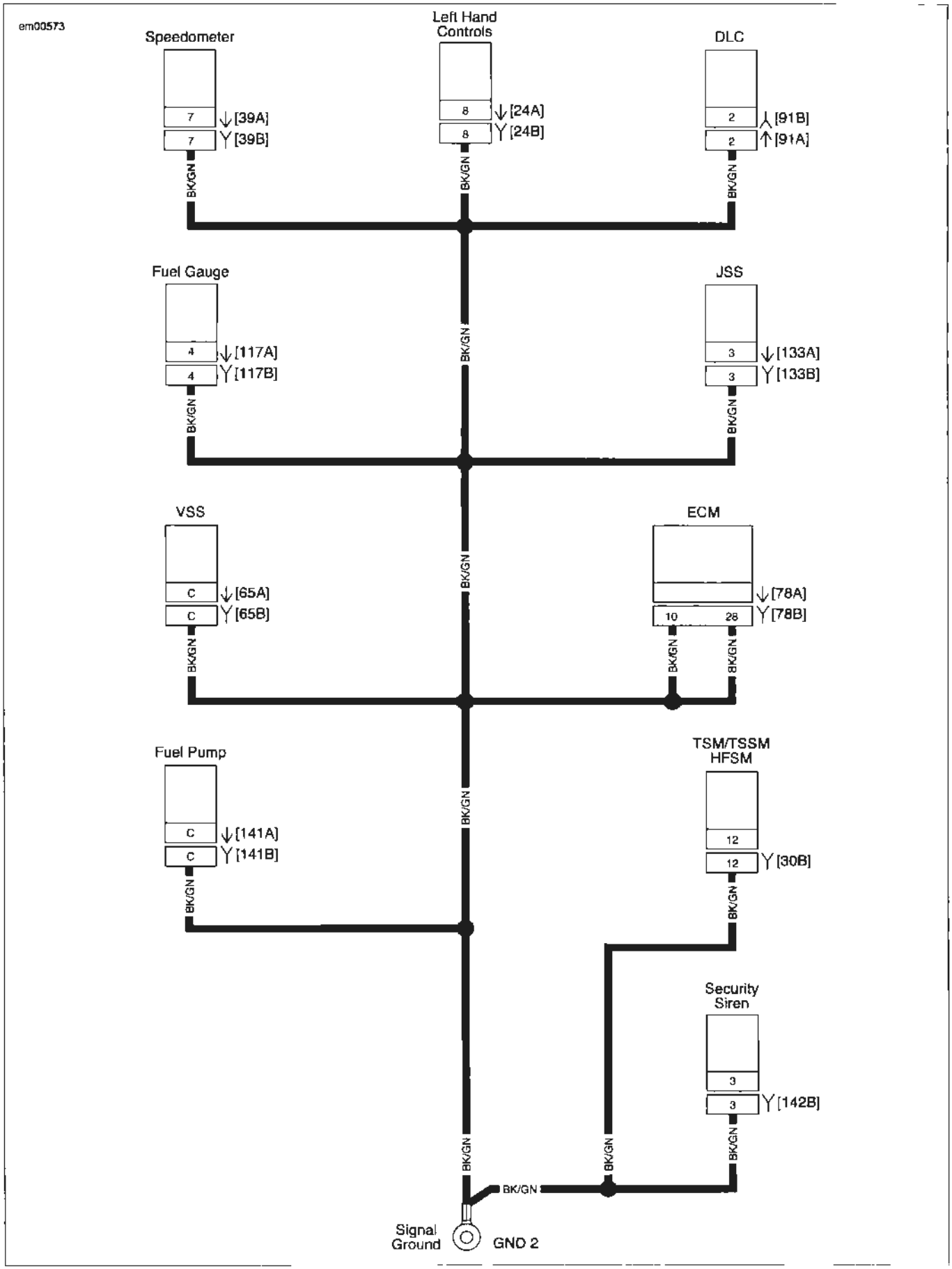


Figure B-10. Sensor Ground Circuit: Except FXCWC

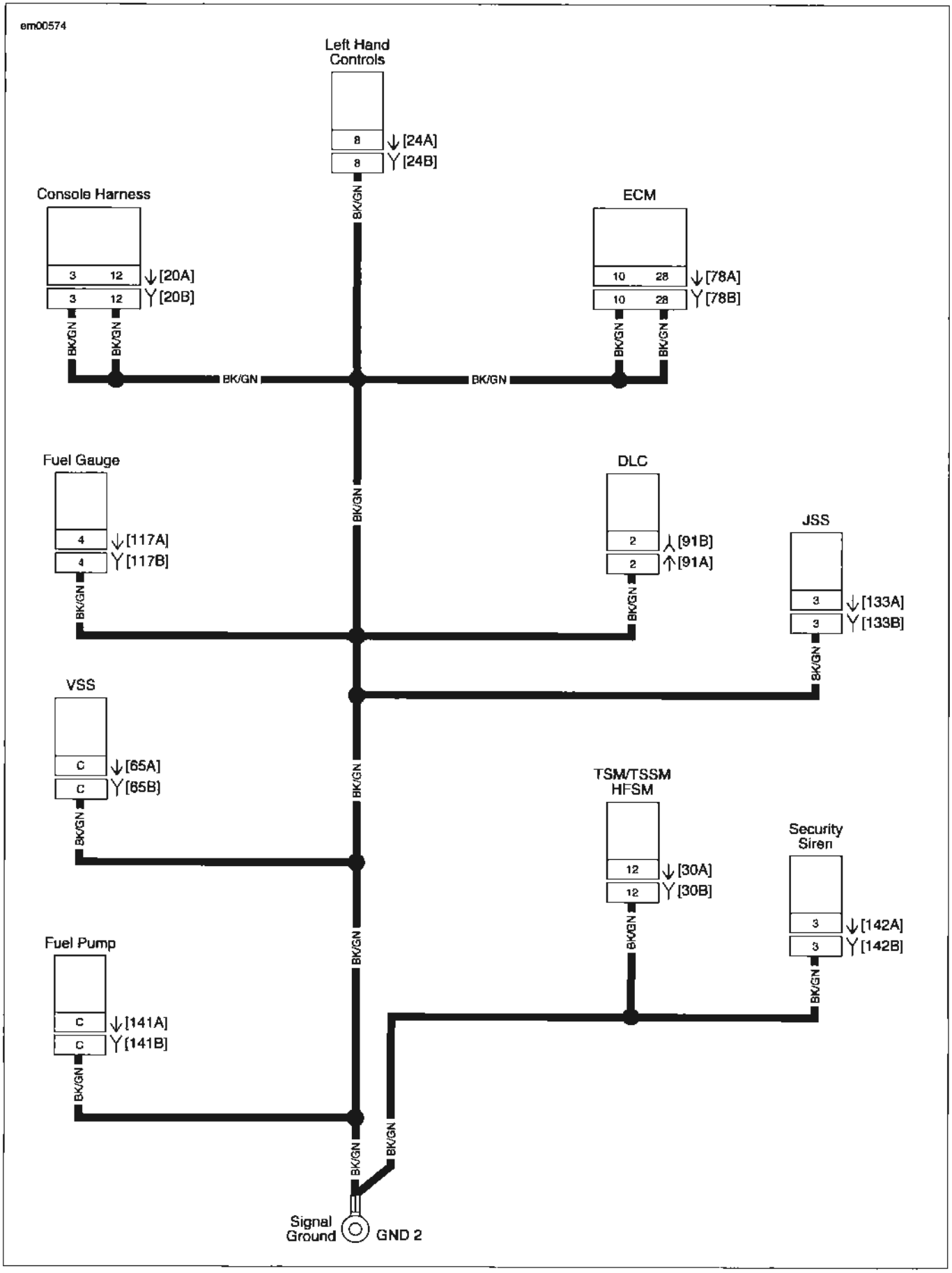


Figure B-11. Sensor Ground Circuit: FXCWC

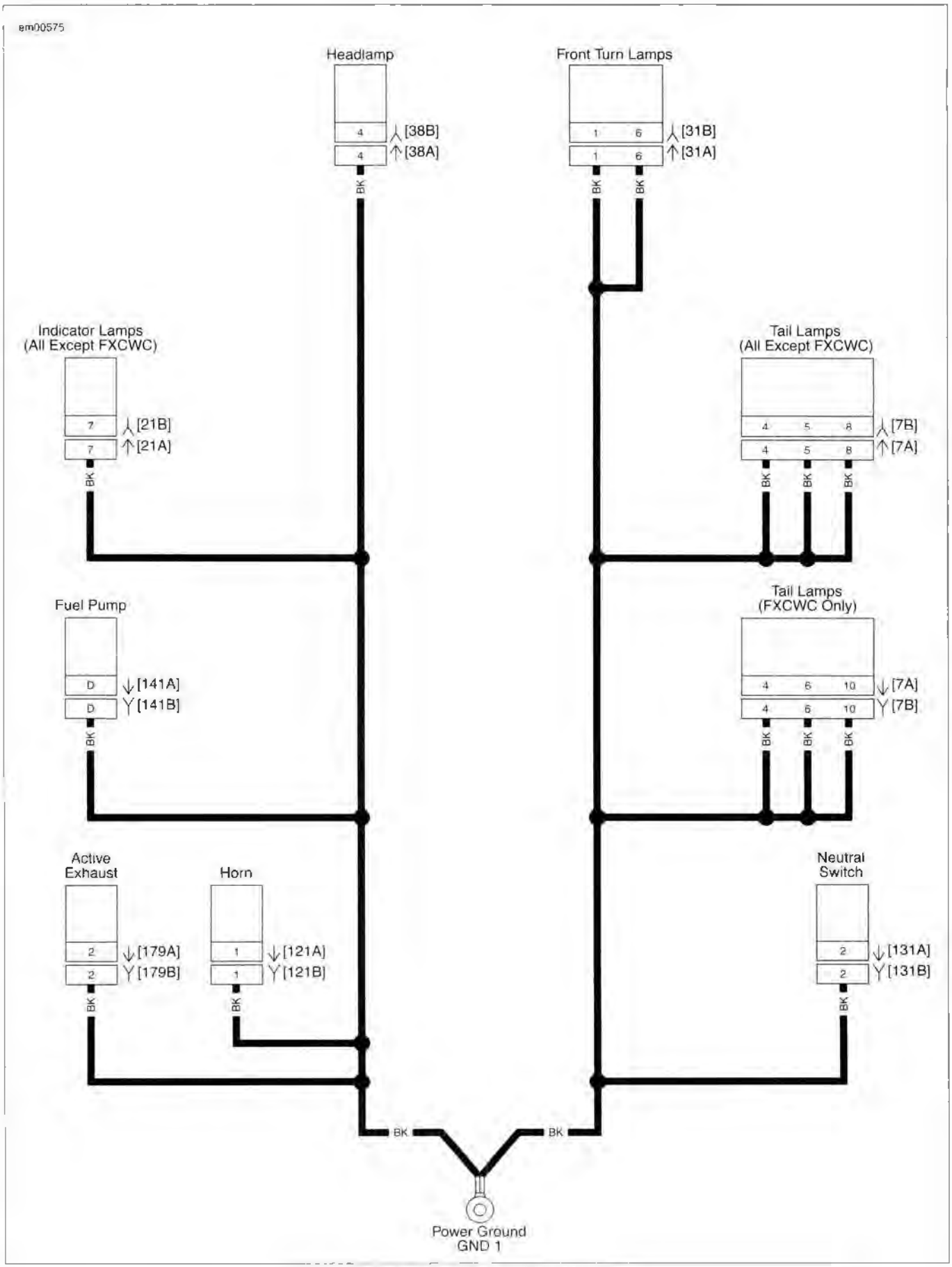
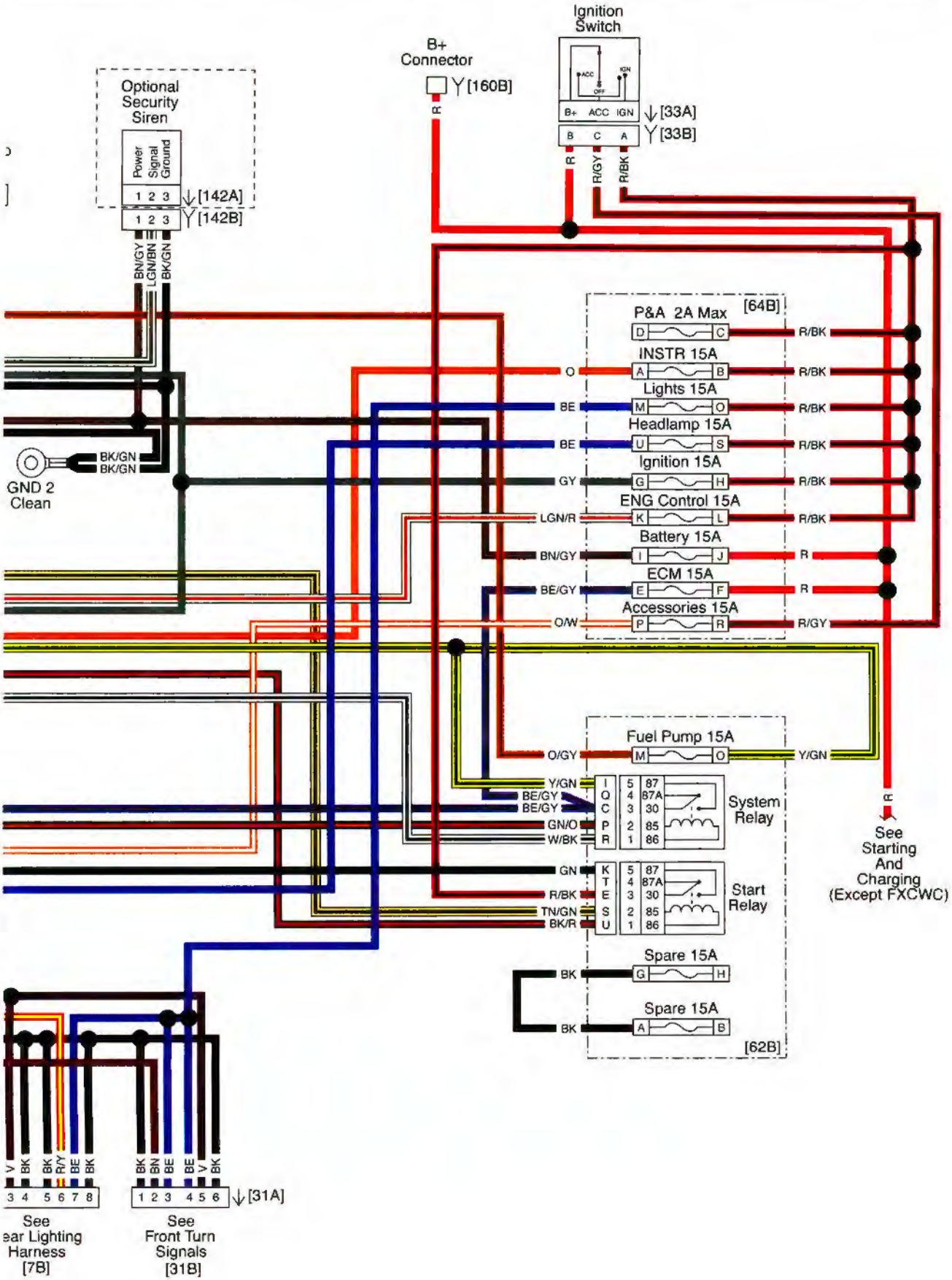


Figure B-12. Power Ground Circuit

Figure B-13.
Main Harness: 2010 Softail (Except FXCWC)



s: 2010 Softail (Except FXCWC)

et00249

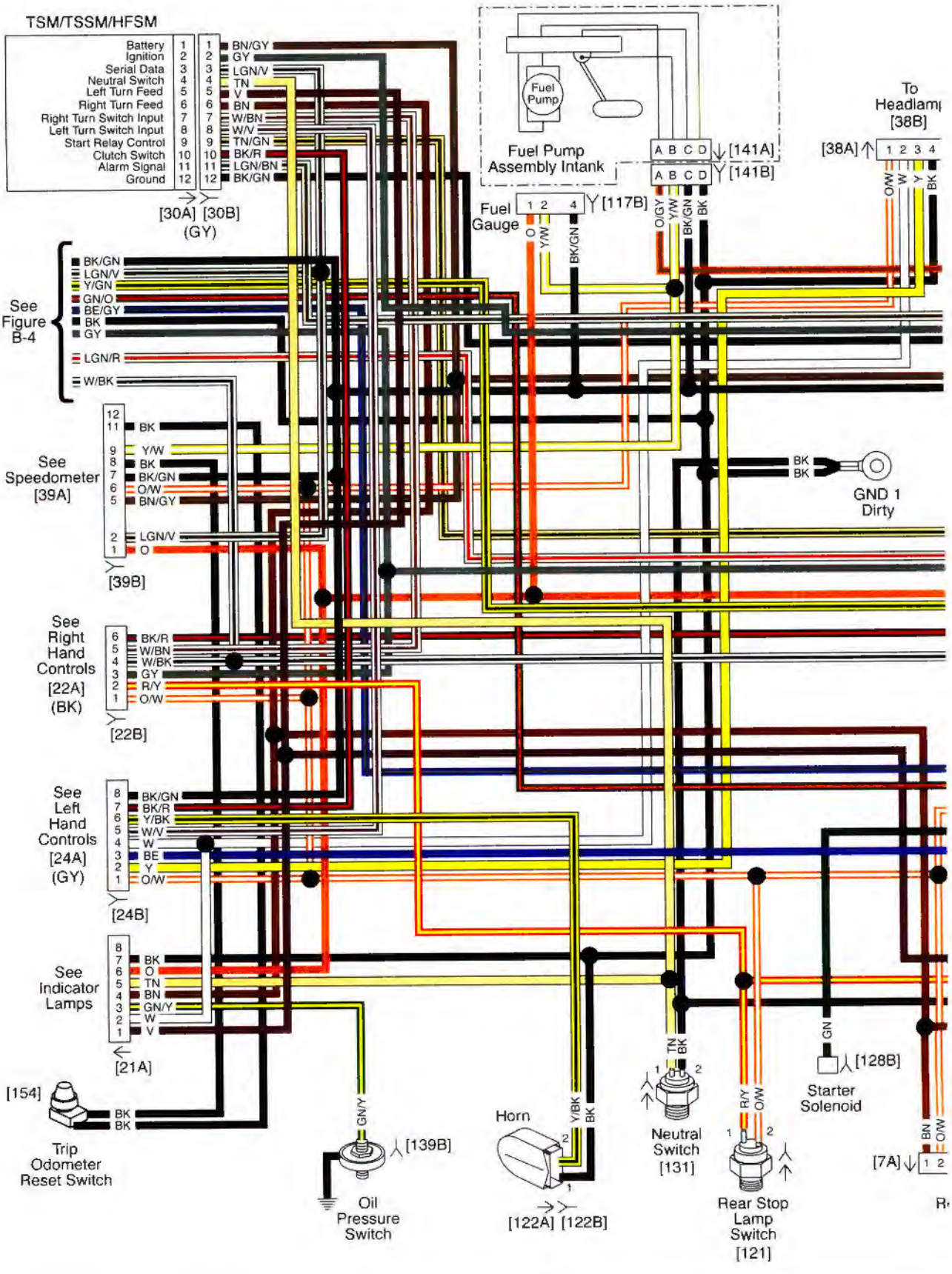
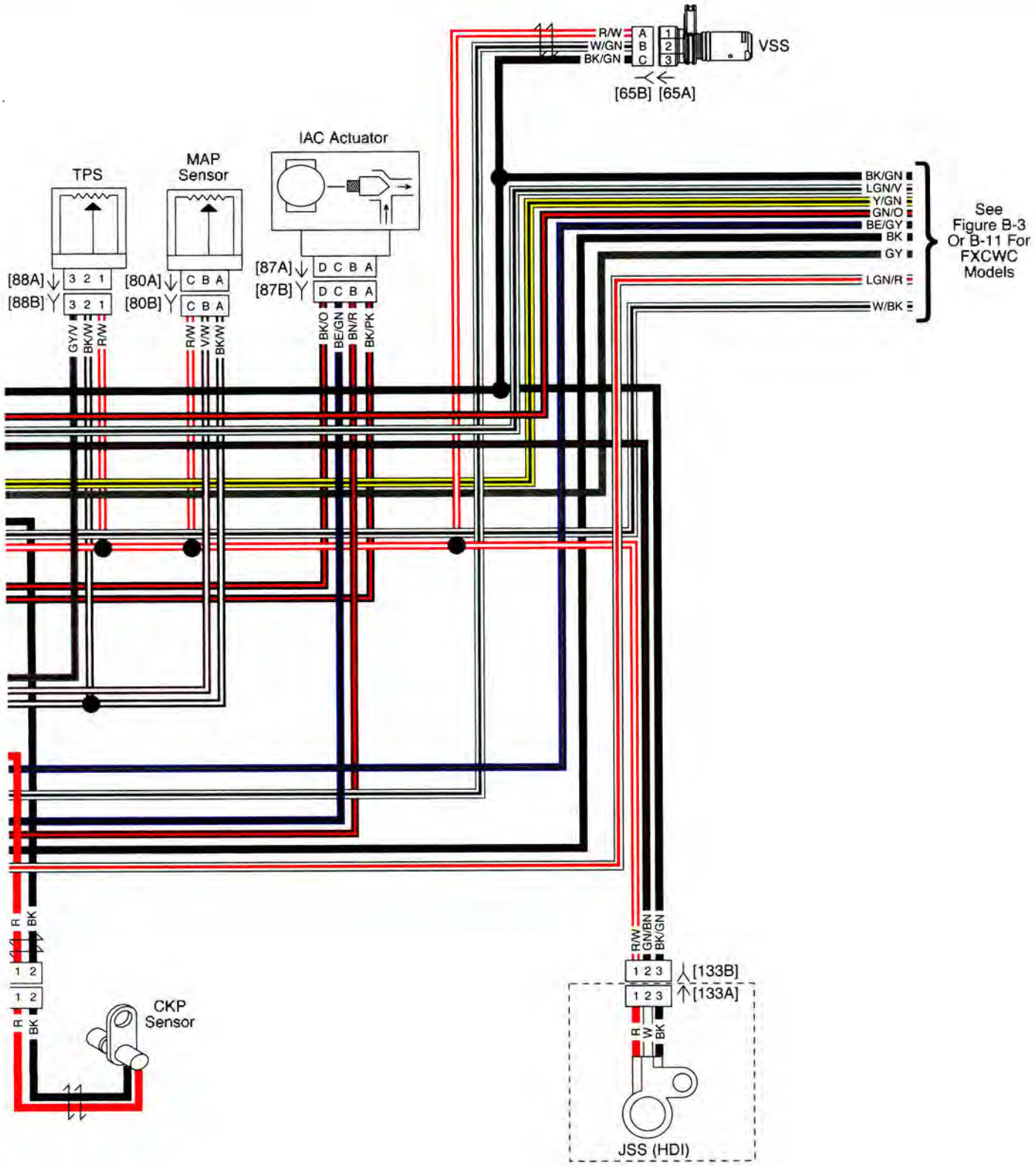


Figure B-13. Main Harnes

Figure B-13.
Main Harness: 2010 Softail (Except FXCWC)

Figure B-14.
Main Harness: 2010 Softail (Including FXCWC)


R/W
W/GN
BK/GN
A
B
C
1
2
3
VSS
[65B] [65A]
IAC Actuator
TPS
MAP Sensor
[88A]
[88B]
3 2 1
[80A]
[80B]
C B A
[87A]
[87B]
D C B A
GY/V
BK/W
R/W
R/W
V/W
BK/W
BK/O
BE/GN
BN/R
BK/PK
BK/GN
LGN/V
Y/GN
GN/O
BE/GY
BK
GY
LGN/R
W/BK
See Figure B-3 Or B-11 For FXCWC Models
R
BK
1 2
CKP Sensor
R/W
GN/BN
BK/GN
1 2 3
[133B]
[133A]
R
W
BK
JSS (HDI)

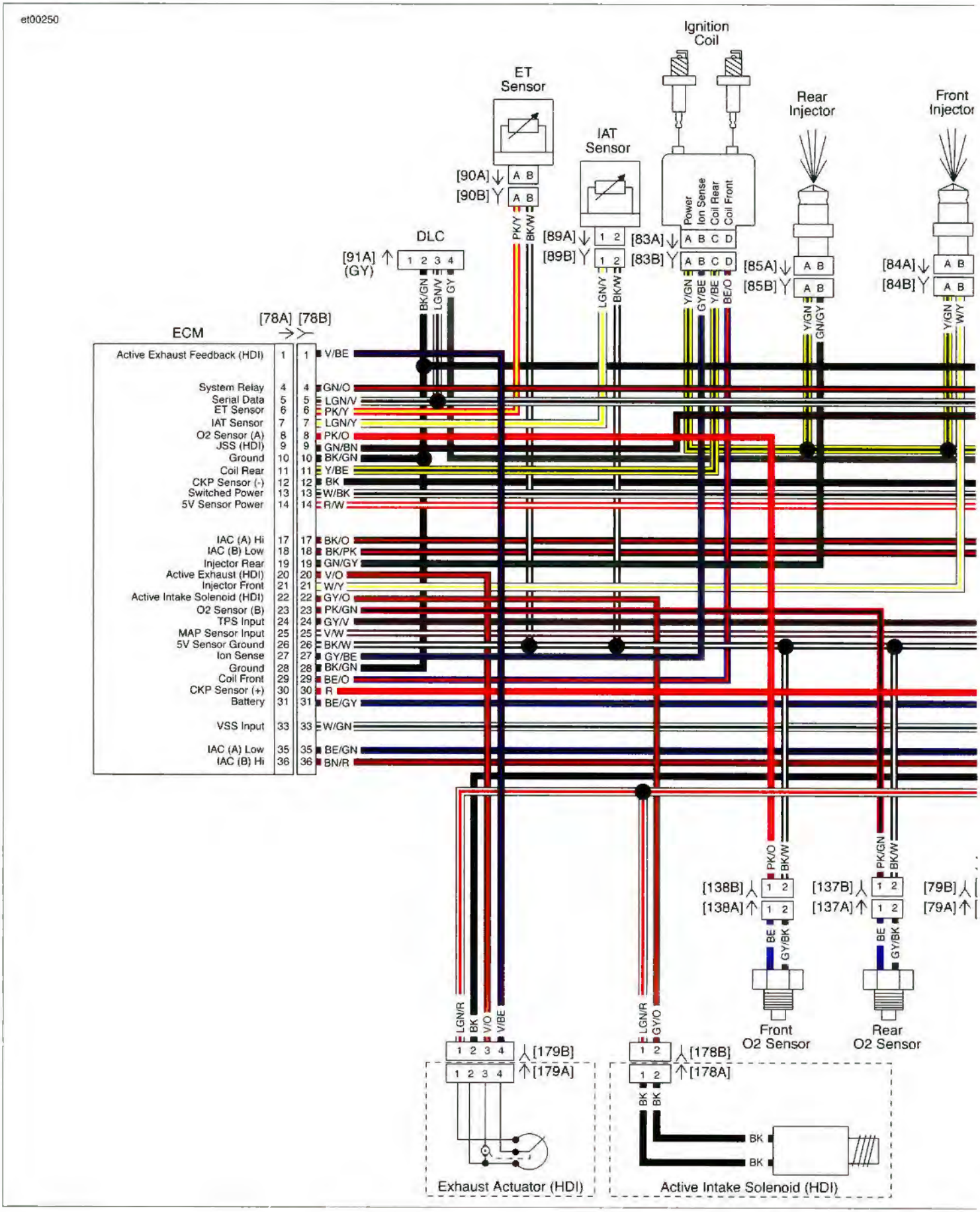
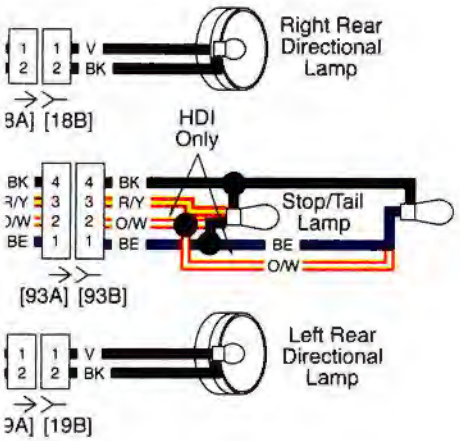
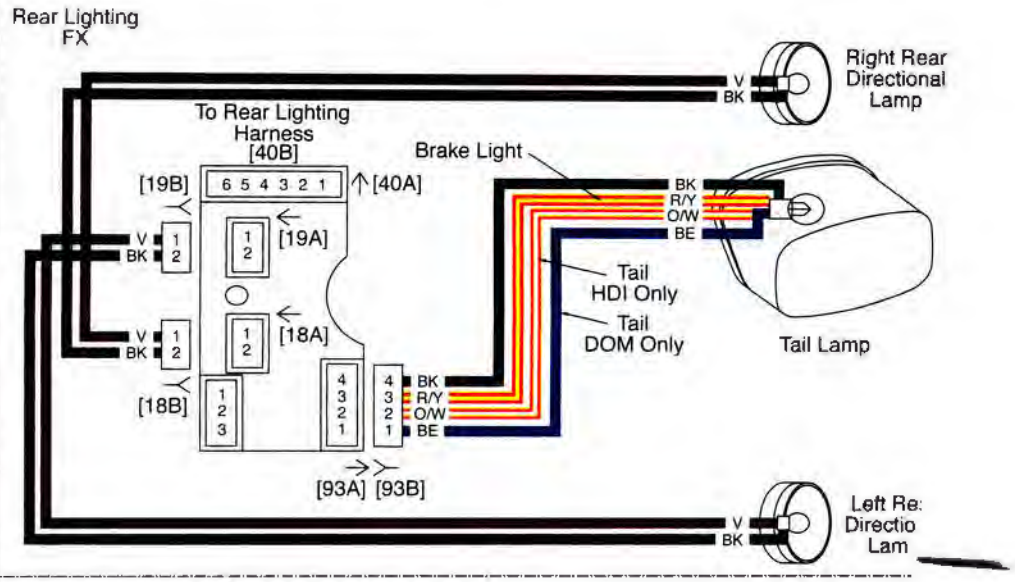


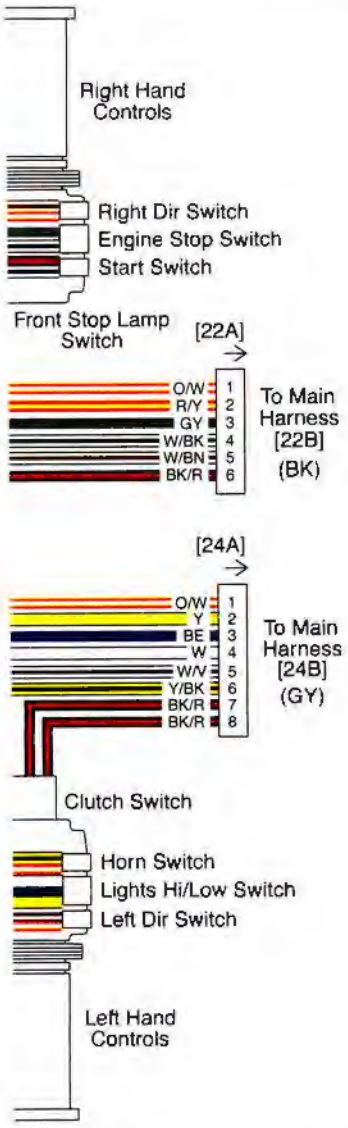
Figure B-14. Main Harness:

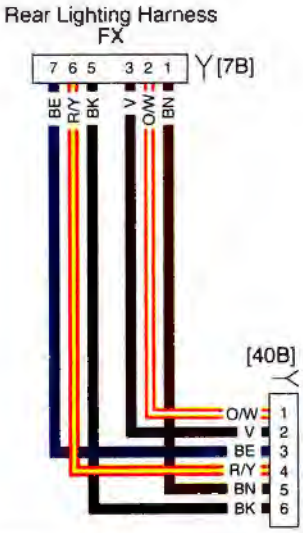
Figure B-14.
Main Harness: 2010 Softail (Including FXCWC)

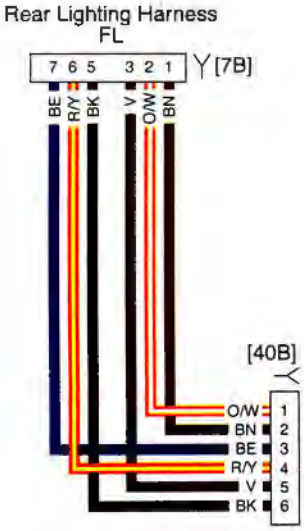
Figure B-15.
Handlebar Switches, Indicators, and Lighting: 2010 Softail
(Except FXCWC)

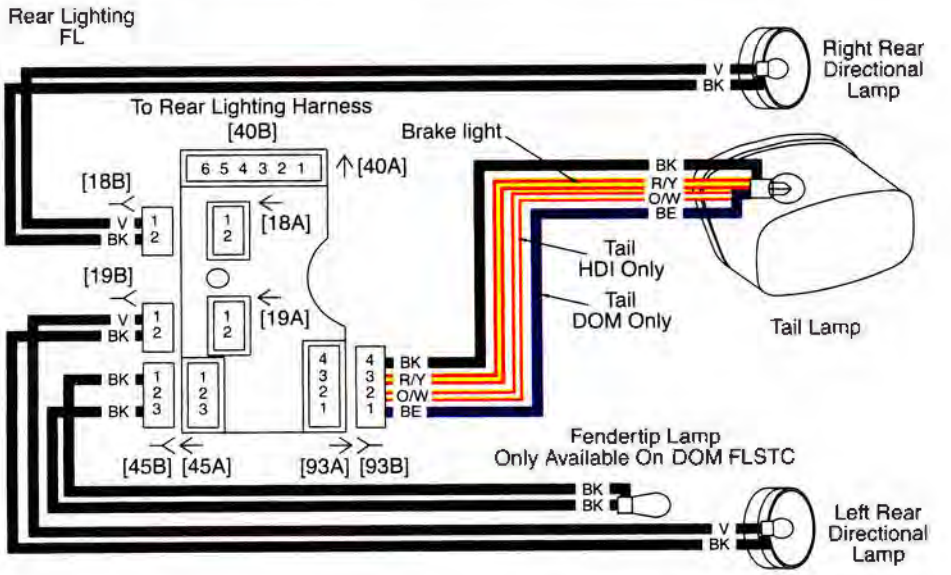

Right Rear Directional Lamp
HDI Only
Stop/Tail Lamp
Left Rear Directional Lamp
[18B]
[93A]
[93B]
[19B]


Rear Lighting FX
Right Rear Directional Lamp
To Rear Lighting Harness [40B]
Brake Light
Tail HDI Only
Tail DOM Only
Tail Lamp
[19B]
[40A]
[19A]
[18A]
[18B]
[93A]
[93B]


Right Hand Controls
Right Dir Switch
Engine Stop Switch
Start Switch
Front Stop Lamp Switch
[22A]
To Main Harness [22B] (BK)
[24A]
To Main Harness [24B] (GY)
Clutch Switch
Horn Switch
Lights Hi/Low Switch
Left Dir Switch
Left Hand Controls


Rear Lighting Harness FX
[7B]
[40B]


Rear Lighting Harness FL
[7B]
[40B]


Rear Lighting FL
Right Rear Directional Lamp
To Rear Lighting Harness [40B]
Brake light
Tail HDI Only
Tail DOM Only
Tail Lamp
[18B]
[40A]
[18A]
[19B]
[19A]
[45B]
[45A]
[93A]
[93B]
Fendertip Lamp Only Available On DOM FLSTC
Left Rear Directional Lamp

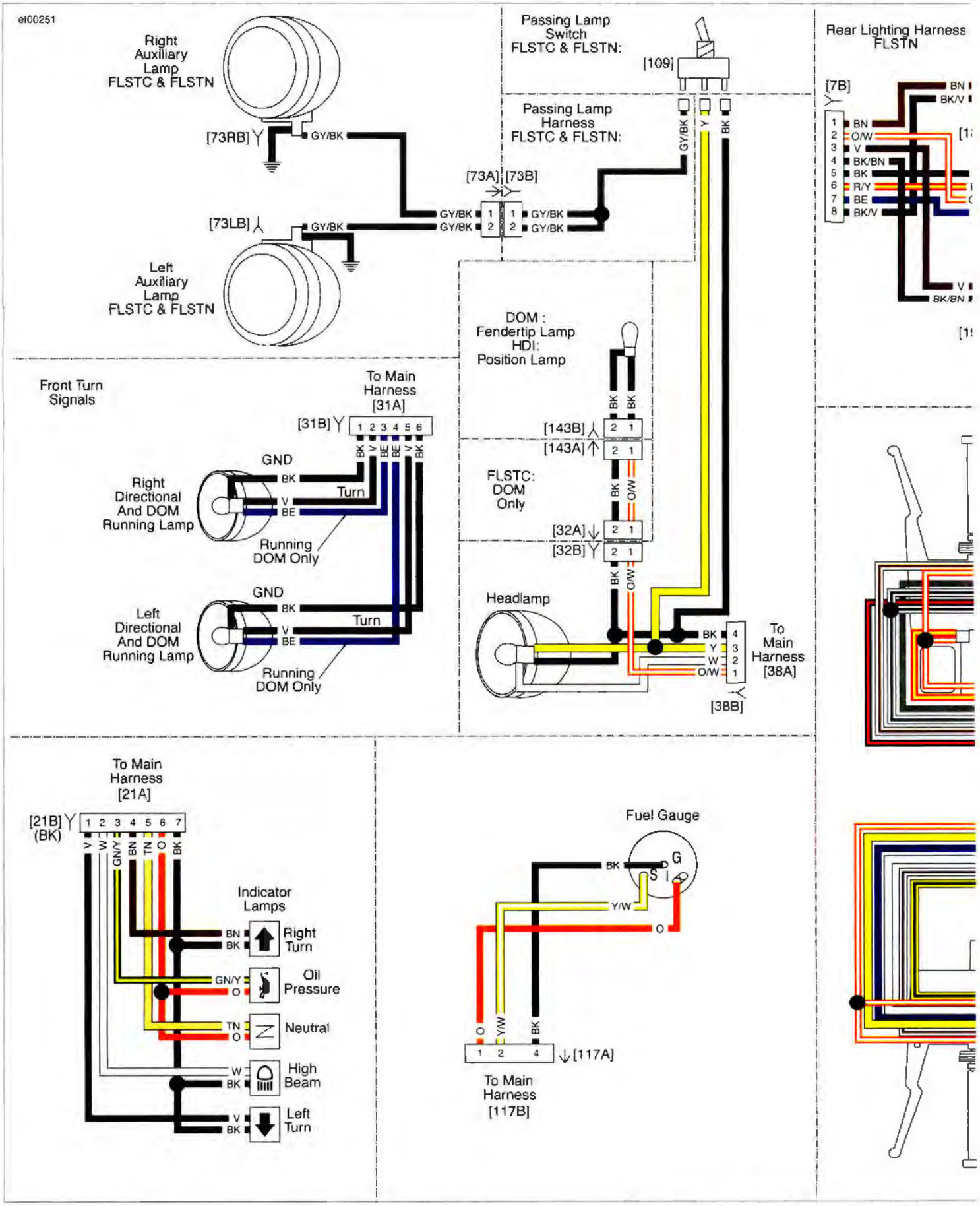
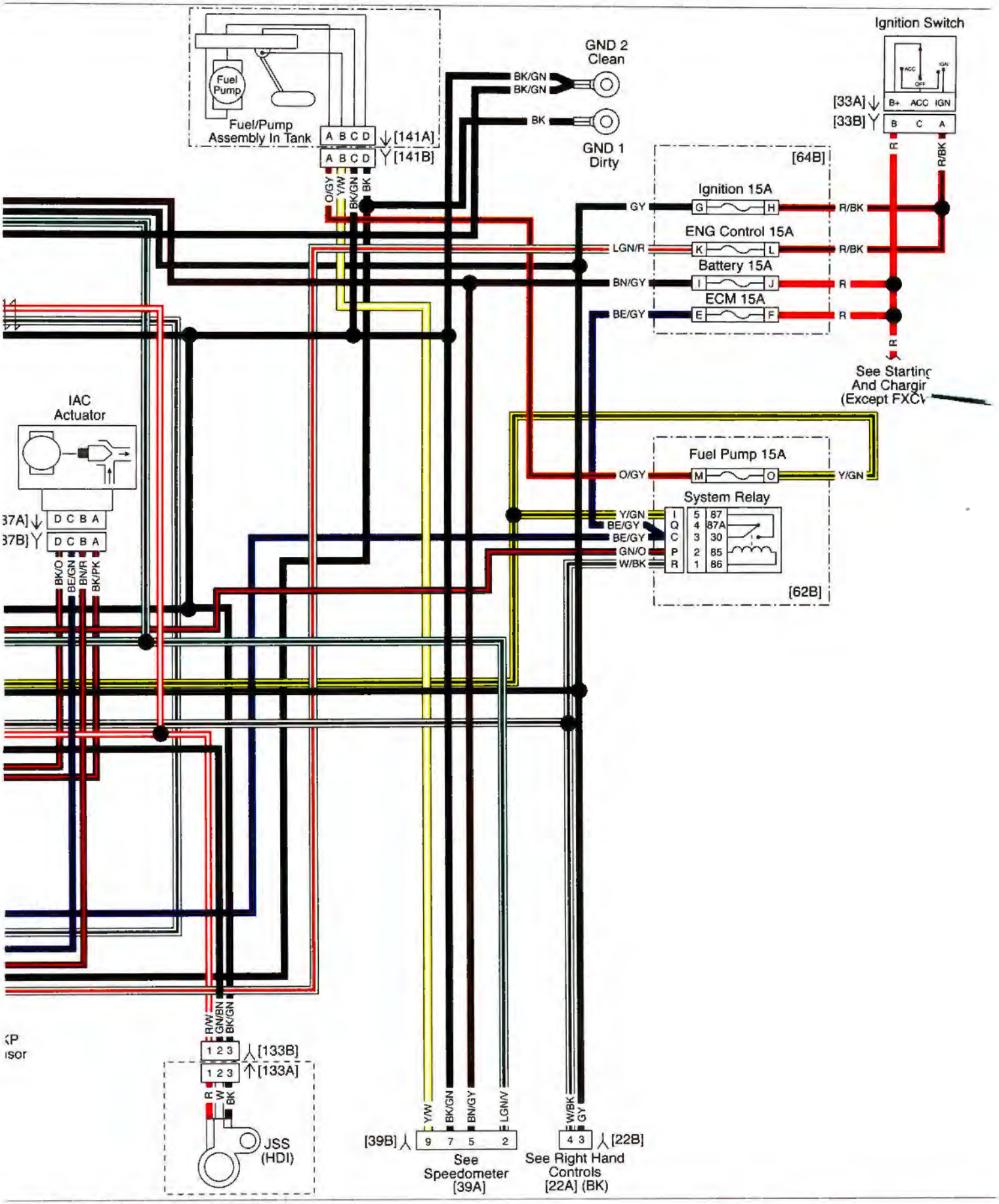


Figure B-15. Handlebar Switches, Indicato

Figure B-15.
Handlebar Switches, Indicators, and Lighting: 2010 Softail
(Except FXCWC)

Figure B-16.
Ignition Circuit: 2010 Softail (Except FXCWC)



t: 2010 Softail (Except FXCWC)

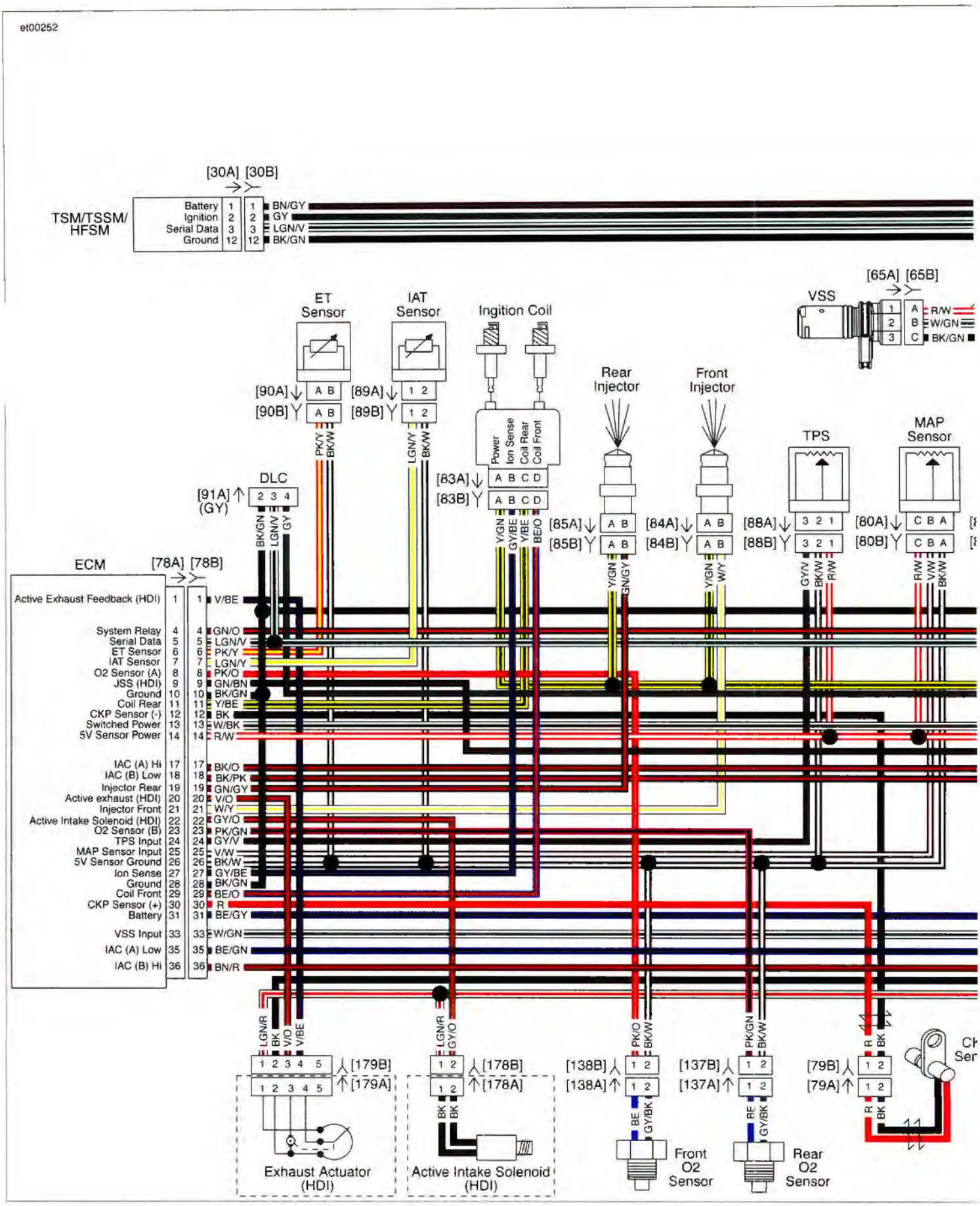
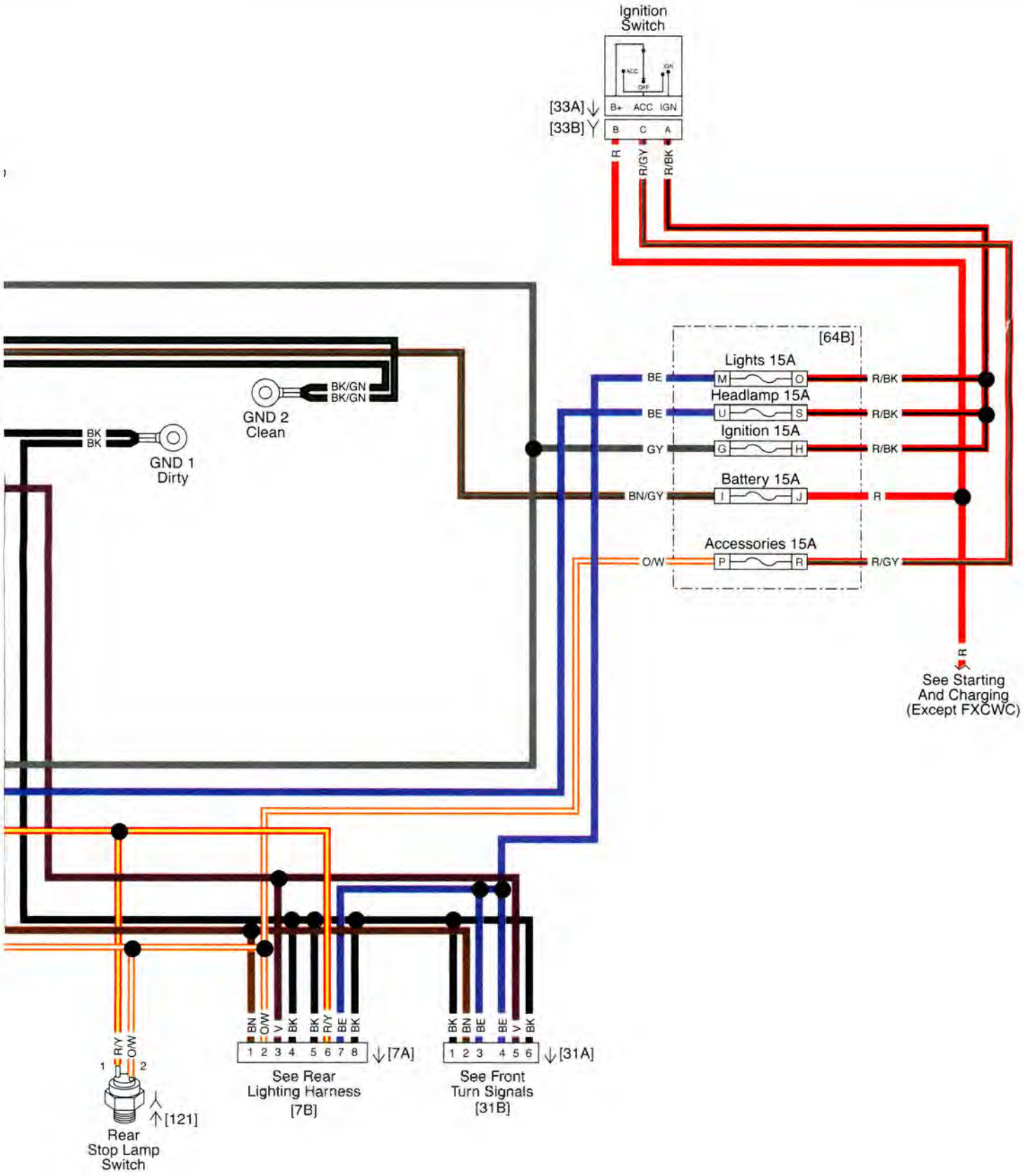


Figure B-16. Ignition Circui

Figure B-16.
Ignition Circuit: 2010 Softail (Except FXCWC)

Figure B-17.
Lighting Circuit: 2010 Softail (Except FXCWC)



ıit: 2010 Softail (Except FXCWC)

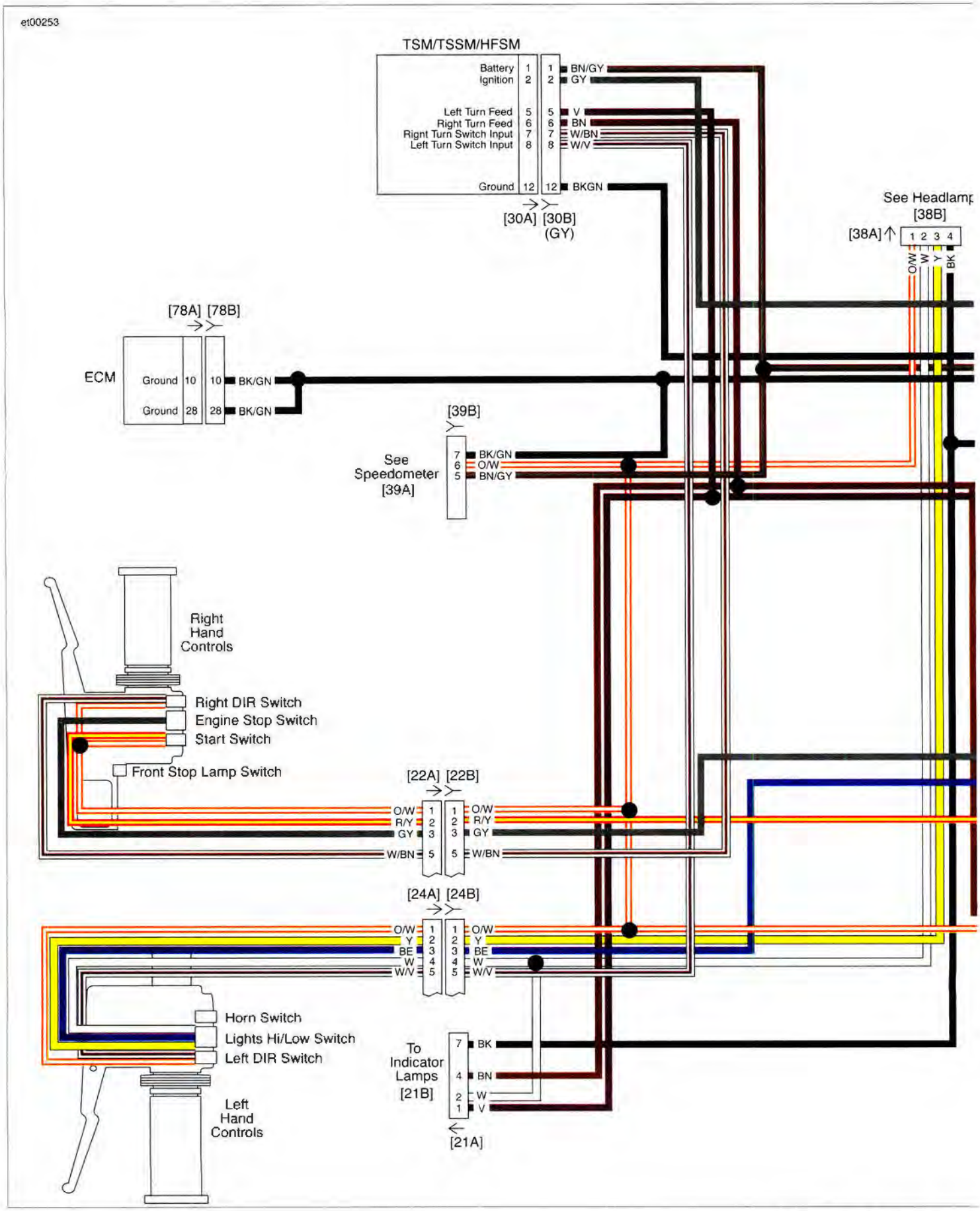
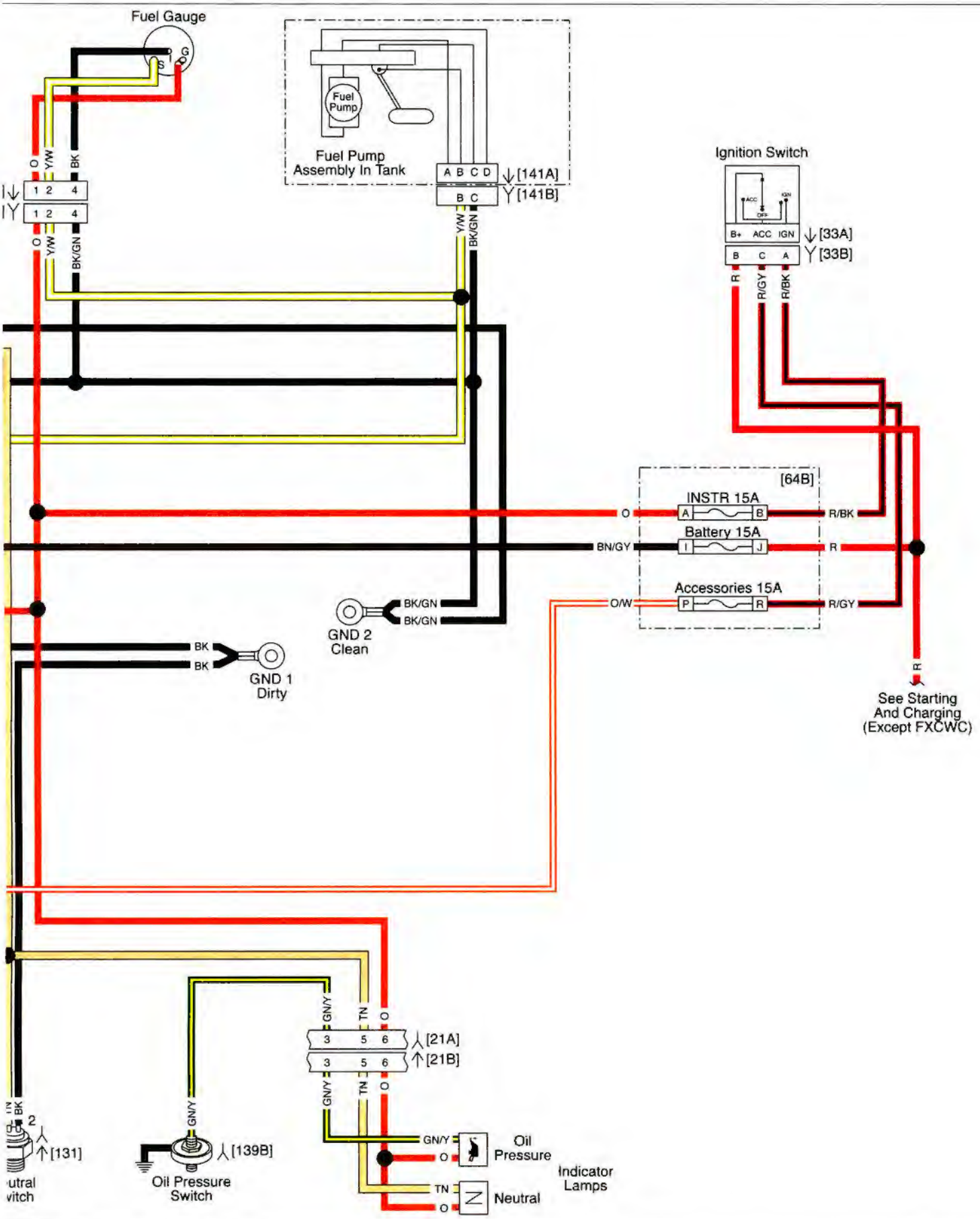


Figure B-17. Lighting Circu

Figure B-18.
Horn & Instruments: 2010 Softail (Except FXCWC)



nts: 2010 Softail (Except FXCWC)

et00254

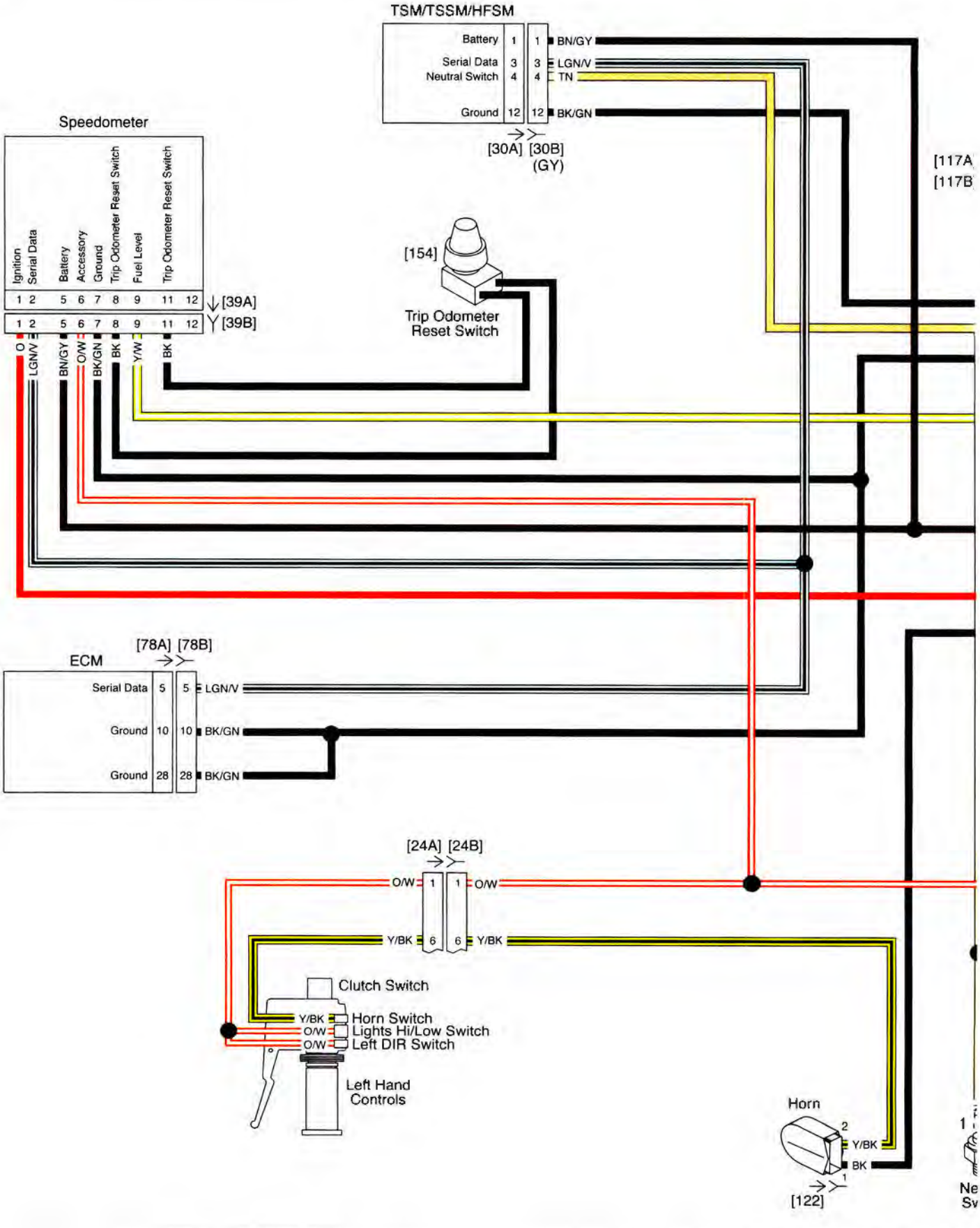


Figure B-18. Horn & Instrume

Figure B-18.
Horn & Instruments: 2010 Softail (Except FXCWC)

Figure B-19.
Starting and Charging Circuits: 2010 Softail (Except FXCWC)

et00255

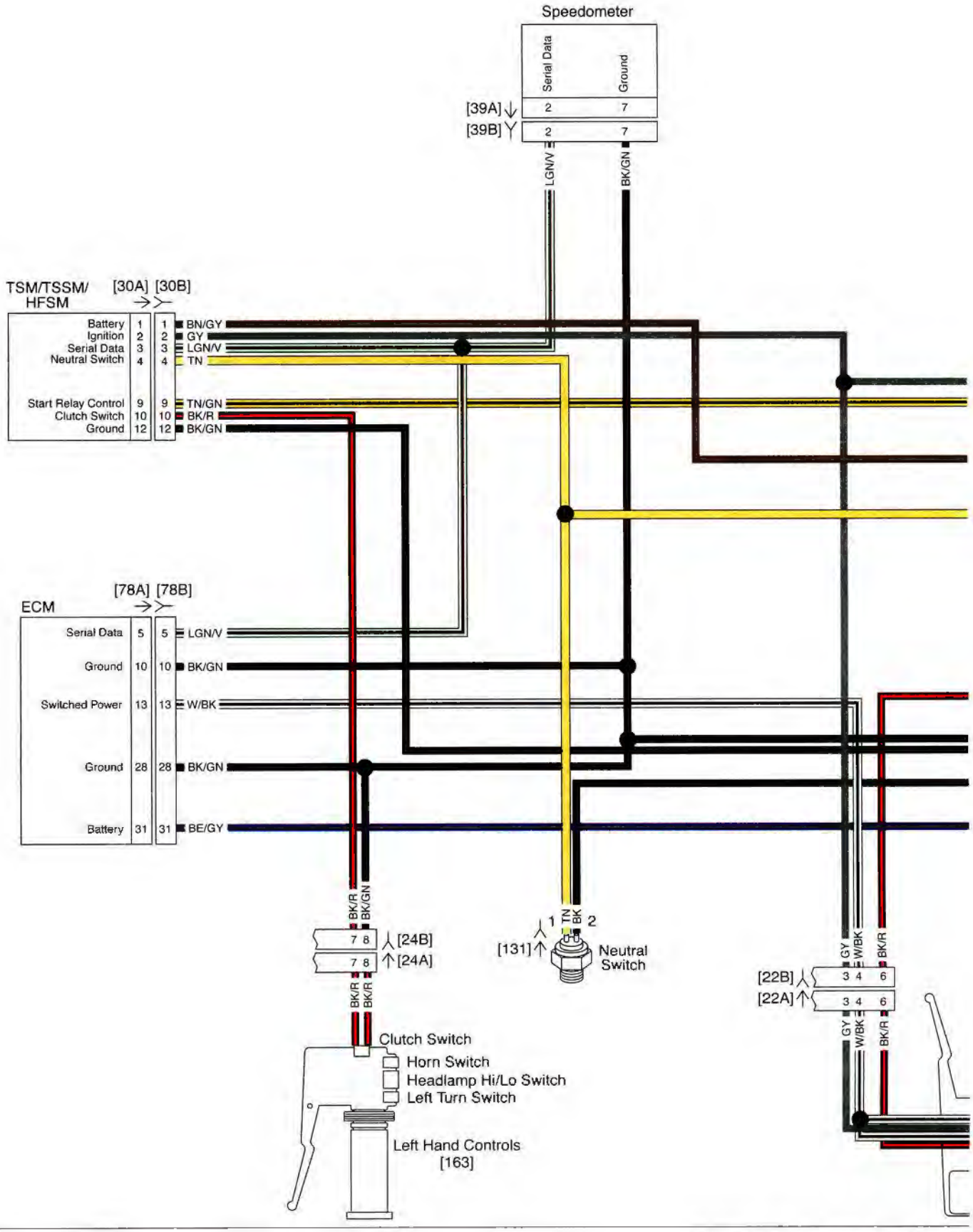
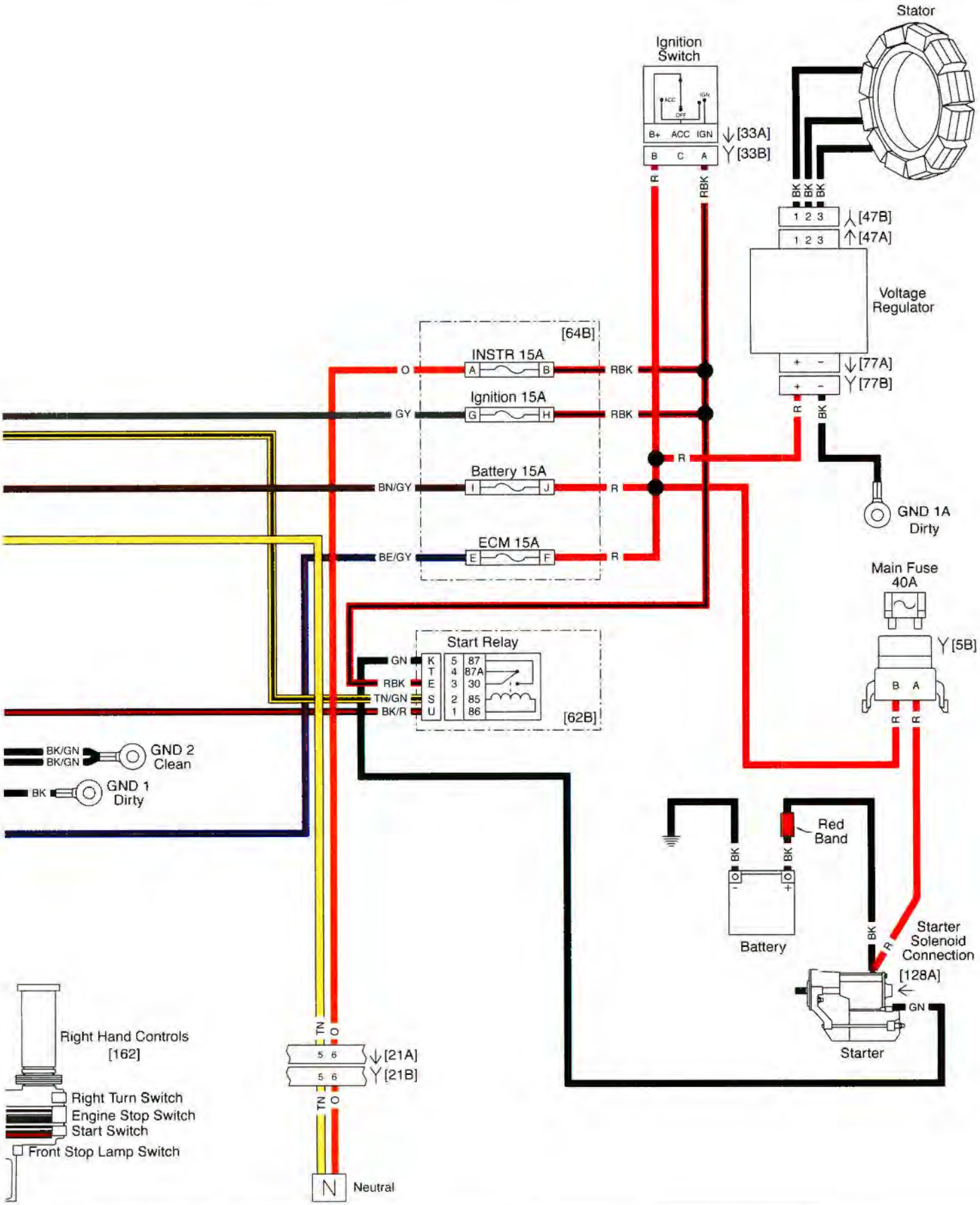


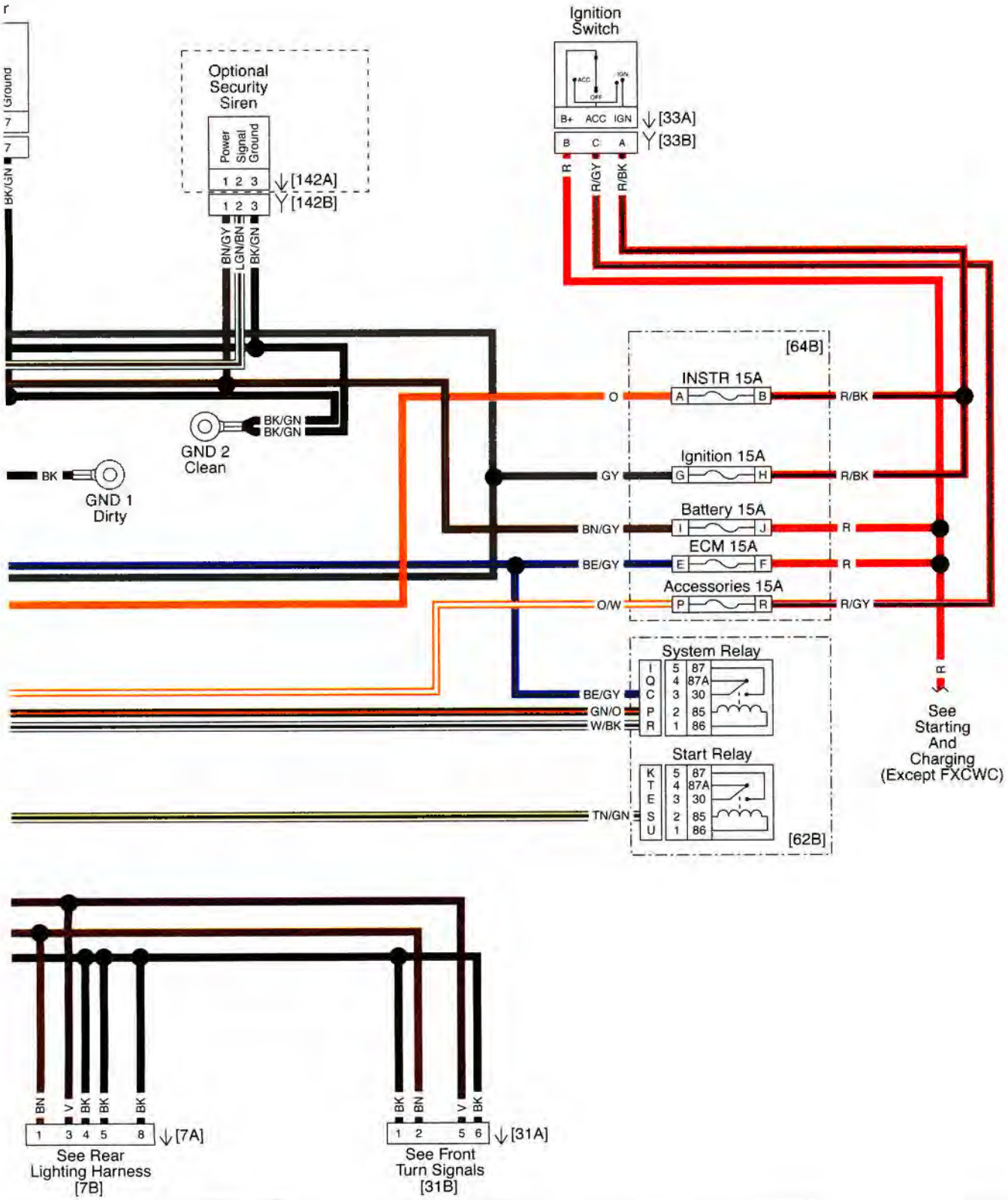
Figure B-19. Starting and Chargin



g Circuits: 2010 Softail (Except FXCWC)

Figure B-19.
Starting and Charging Circuits: 2010 Softail (Except FXCWC)

Figure B-20.
Security Circuit: 2010 Softail (Except FXCWC)


Ignition Switch
B+ ACC IGN
B C A
[33A]
[33B]
Optional Security Siren
Power
Signal
Ground
1 2 3
[142A]
[142B]
BN/GY
LGN/BN
BK/GN
BK/GN
BK/GN
GND 2 Clean
BK
GND 1 Dirty
[64B]
INSTR 15A
O
R/BK
Ignition 15A
GY
R/BK
Battery 15A
BN/GY
R
ECM 15A
BE/GY
R
Accessories 15A
O/W
R/GY
System Relay
BE/GY
GN/O
W/BK
Start Relay
TN/GN
[62B]
See Starting And Charging (Except FXCWC)
BN
V
BK
BK
BK
1 3 4 5 8
[7A]
See Rear Lighting Harness [7B]
BK
BN
V
BK
1 2 5 6
[31A]
See Front Turn Signals [31B]

et00256

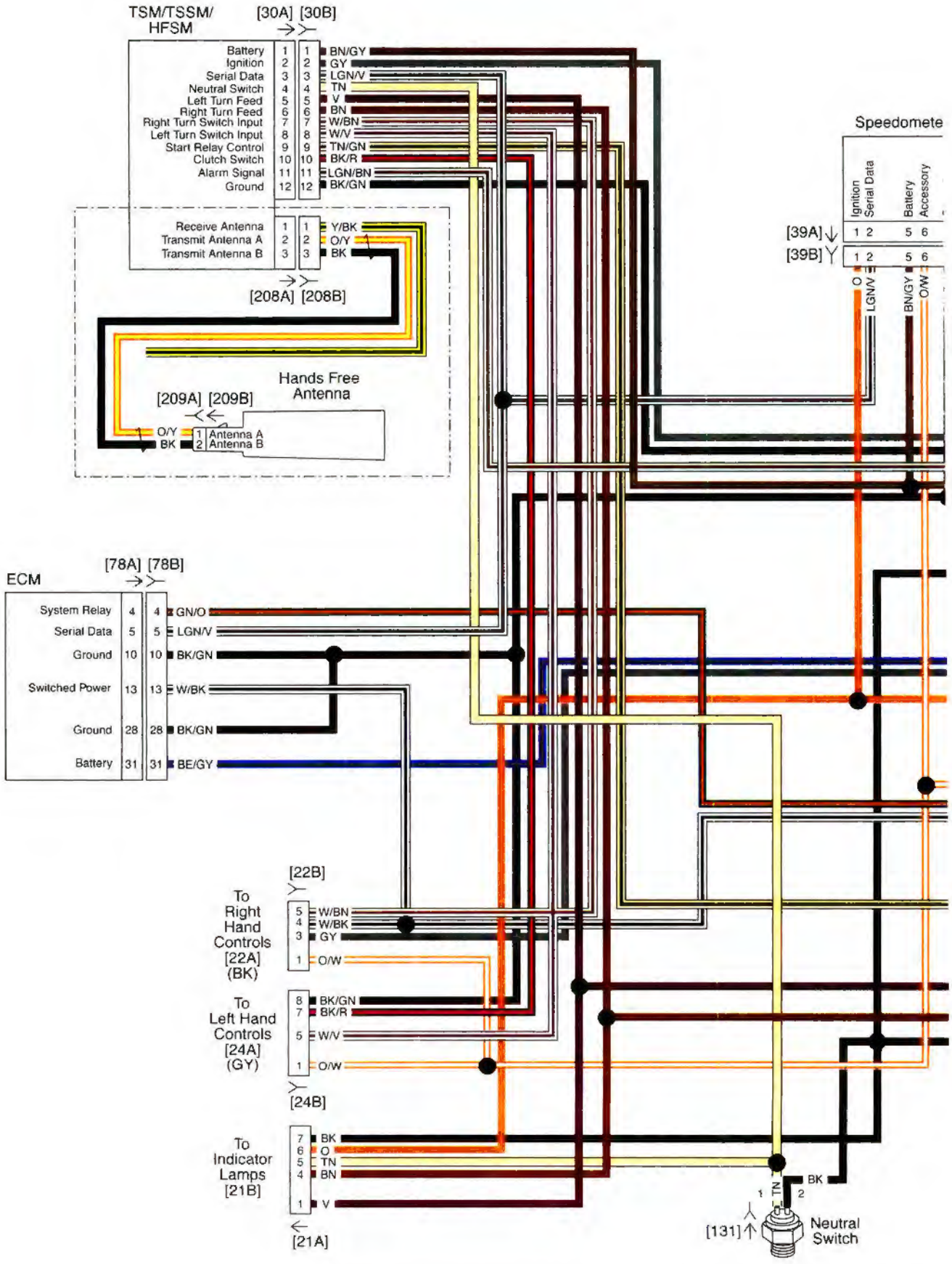
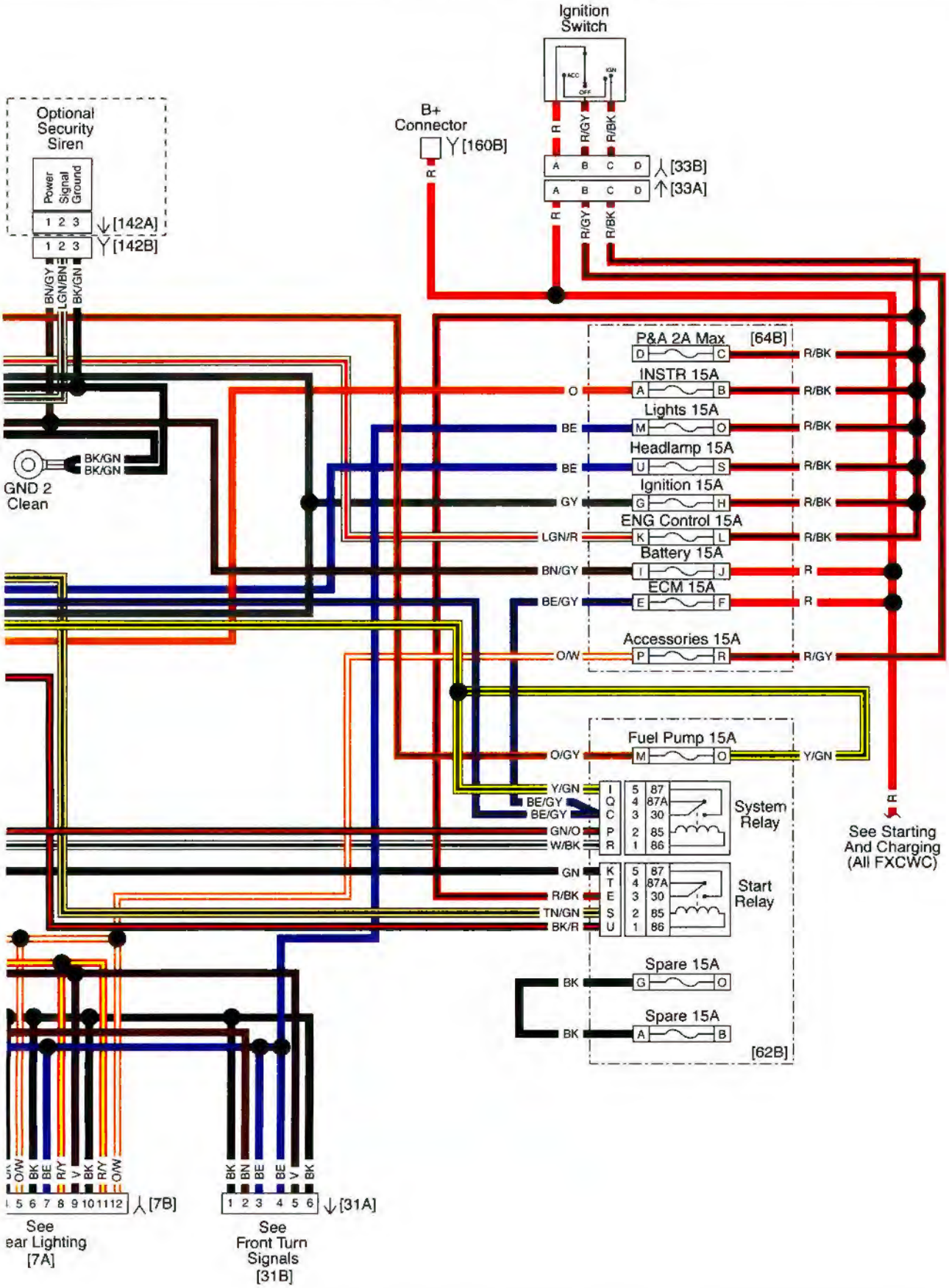


Figure B-20. Security Circu

Figure B-20.
Security Circuit: 2010 Softail (Except FXCWC)

Figure B-21.
Main Harness: 2010 Softail (FXCWC Only)



ss: 2010 Softail (FXCWC Only)

et00257

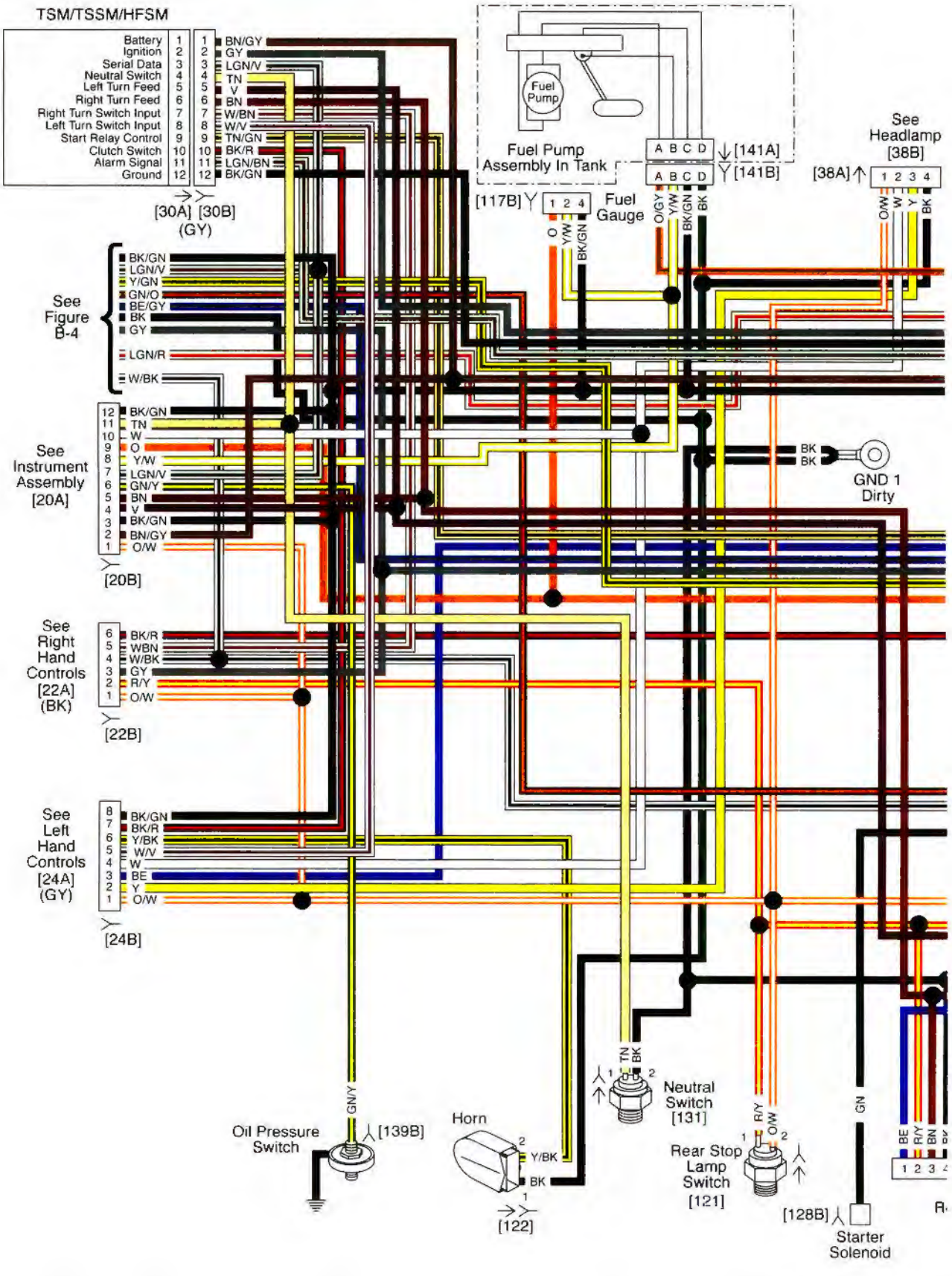
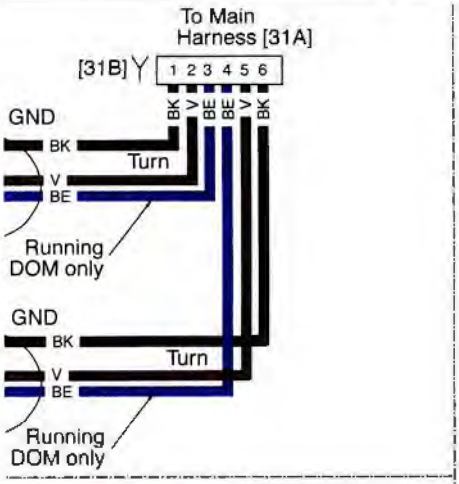


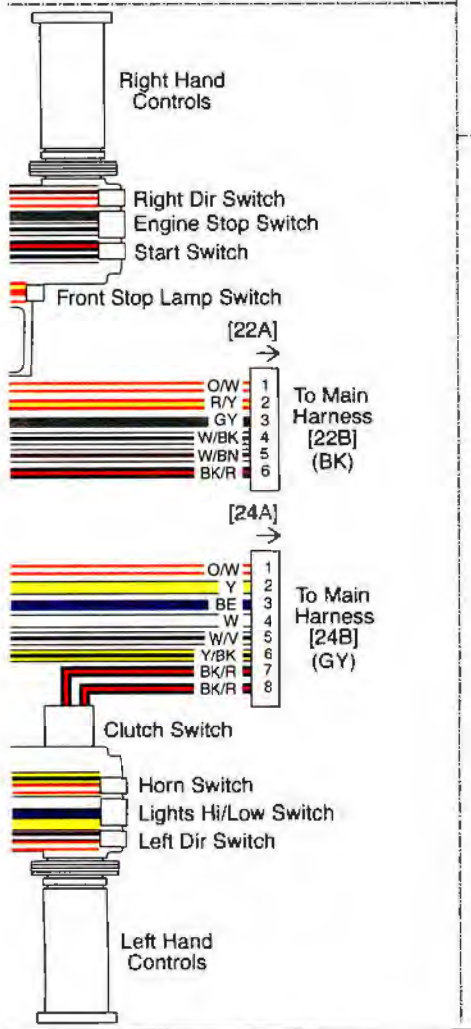
Figure B-21. Main Harne

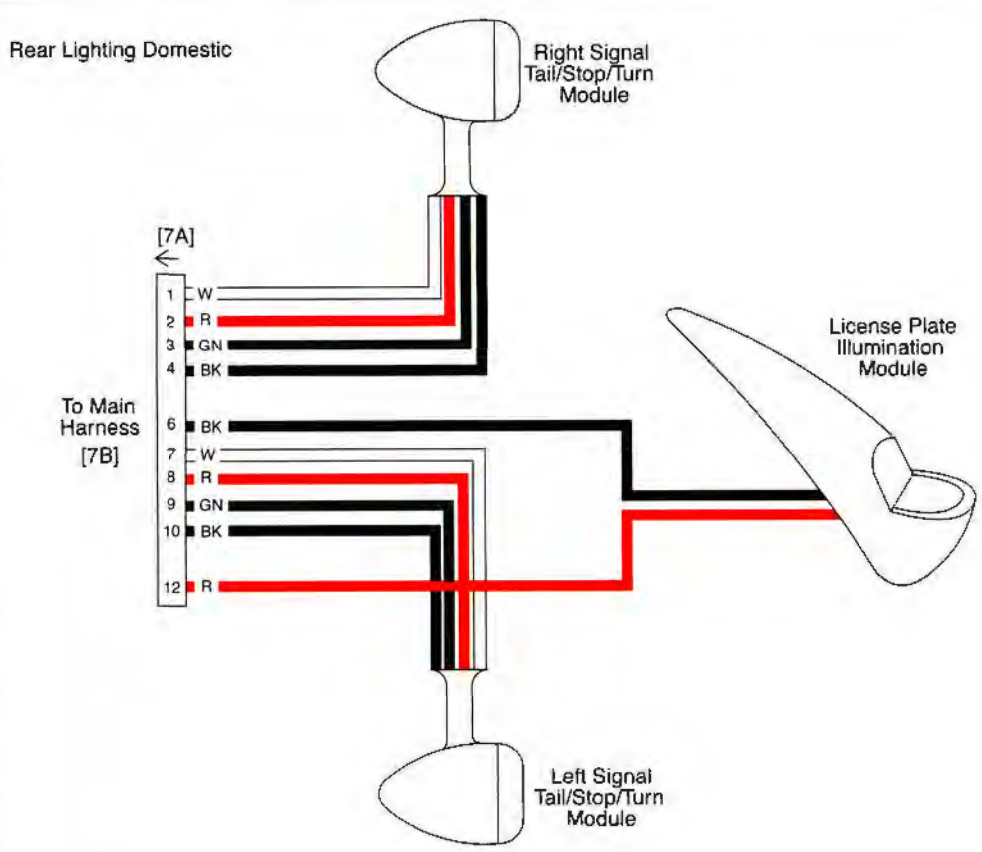
Figure B-21.
Main Harness: 2010 Softail (FXCWC Only)

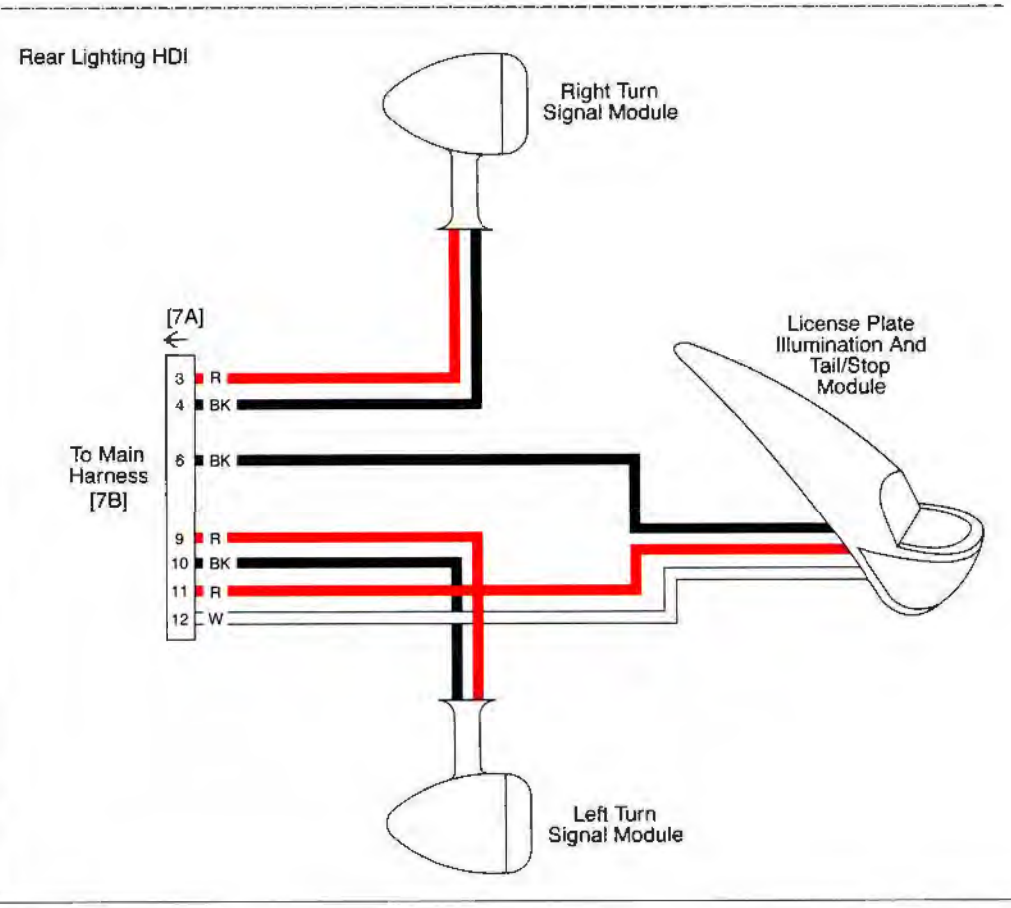
Figure B-22.
Handlebar Switches, Indicators, and Lighting: 2010 Softail
(FXCWC Only)


To Main Harness [31A]
[31B]
1 2 3 4 5 6
BK V BE BE V BK
GND
BK
Turn
V
BE
Running DOM only
GND
BK
Turn
V
BE
Running DOM only


O/W
W
Y
BK
1 2 3 4
To Main Harness [38A]
[38B]


Right Hand Controls
Right Dir Switch
Engine Stop Switch
Start Switch
Front Stop Lamp Switch
[22A]
O/W
R/Y
GY
W/BK
W/BN
BK/R
1 2 3 4 5 6
To Main Harness [22B] (BK)
[24A]
O/W
Y
BE
W
W/V
Y/BK
BK/R
BK/R
1 2 3 4 5 6 7 8
To Main Harness [24B] (GY)
Clutch Switch
Horn Switch
Lights Hi/Low Switch
Left Dir Switch
Left Hand Controls


Rear Lighting Domestic
Right Signal Tail/Stop/Turn Module
[7A]
1 W
2 R
3 GN
4 BK
To Main Harness [7B]
6 BK
7 W
8 R
9 GN
10 BK
12 R
License Plate Illumination Module
Left Signal Tail/Stop/Turn Module


Rear Lighting HDI
Right Turn Signal Module
[7A]
3 R
4 BK
To Main Harness [7B]
6 BK
9 R
10 BK
11 R
12 W
License Plate Illumination And Tail/Stop Module
Left Turn Signal Module

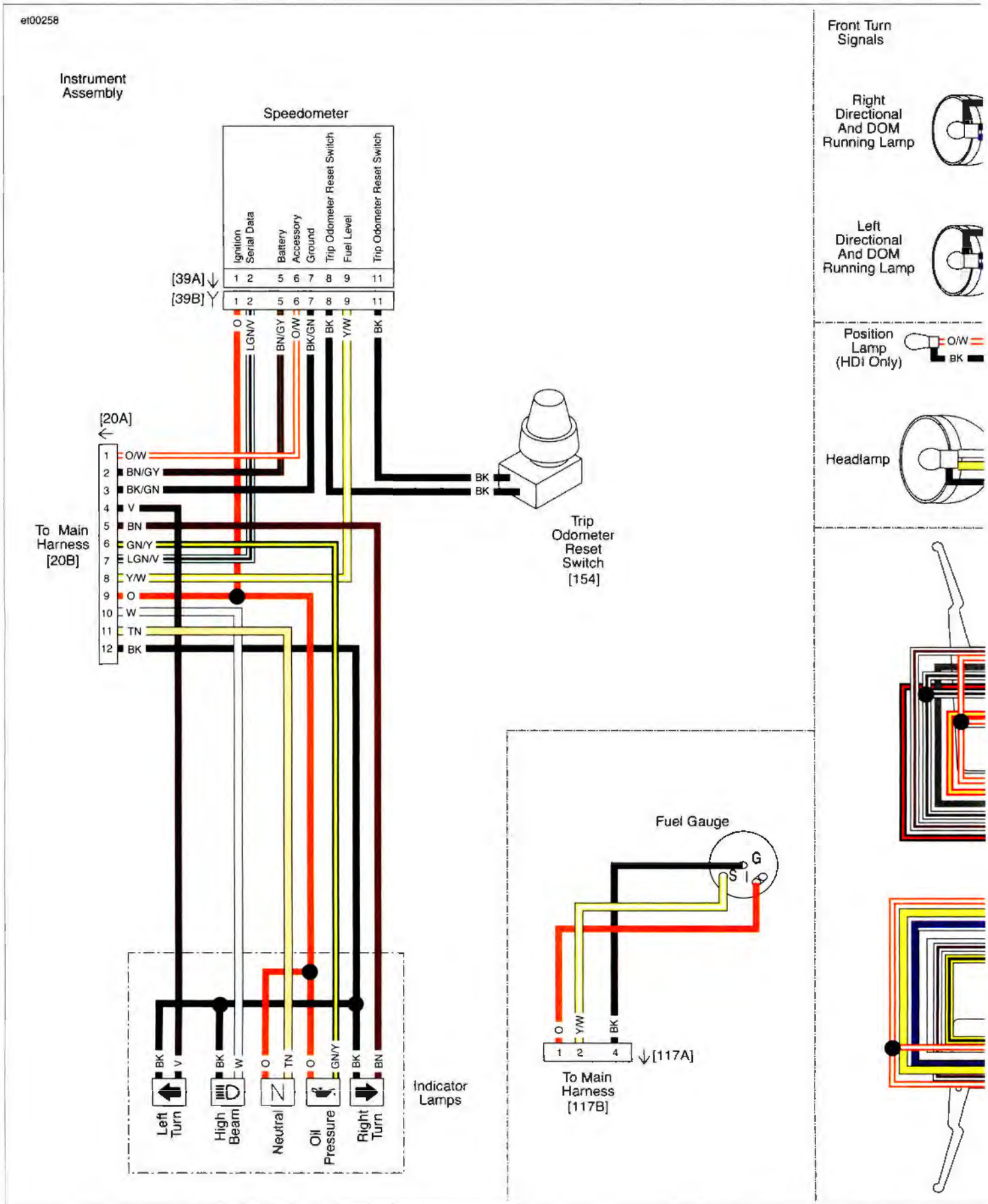
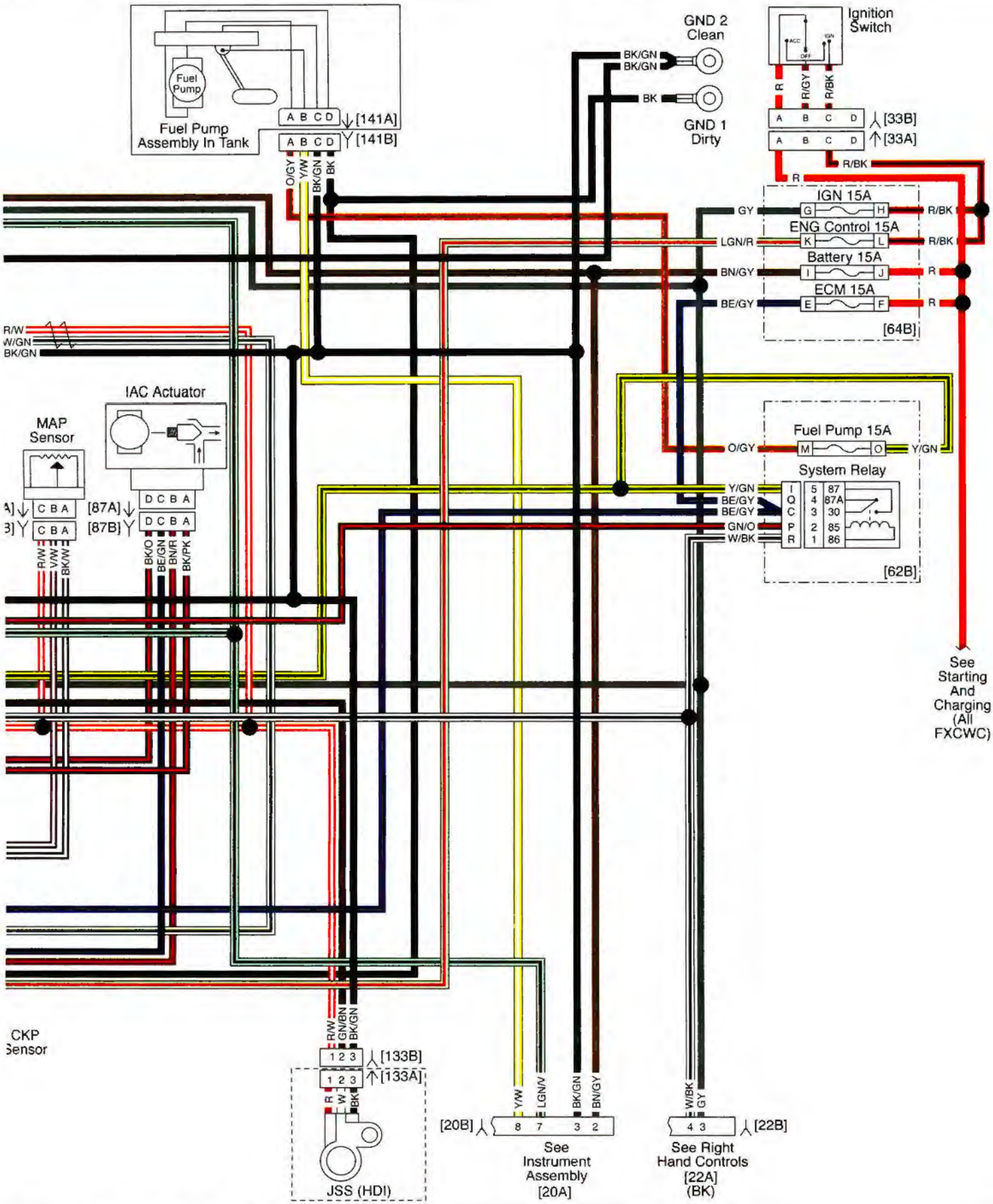


Figure B-22. Handlebar Switches, Indicat

Figure B-22.
Handlebar Switches, Indicators, and Lighting: 2010 Softail
(FXCWC Only)

Figure B-23.
Ignition Circuit: 2010 Softail (FXCWC Only)



:uit: 2010 Softail (FXCWC Only)

et00259

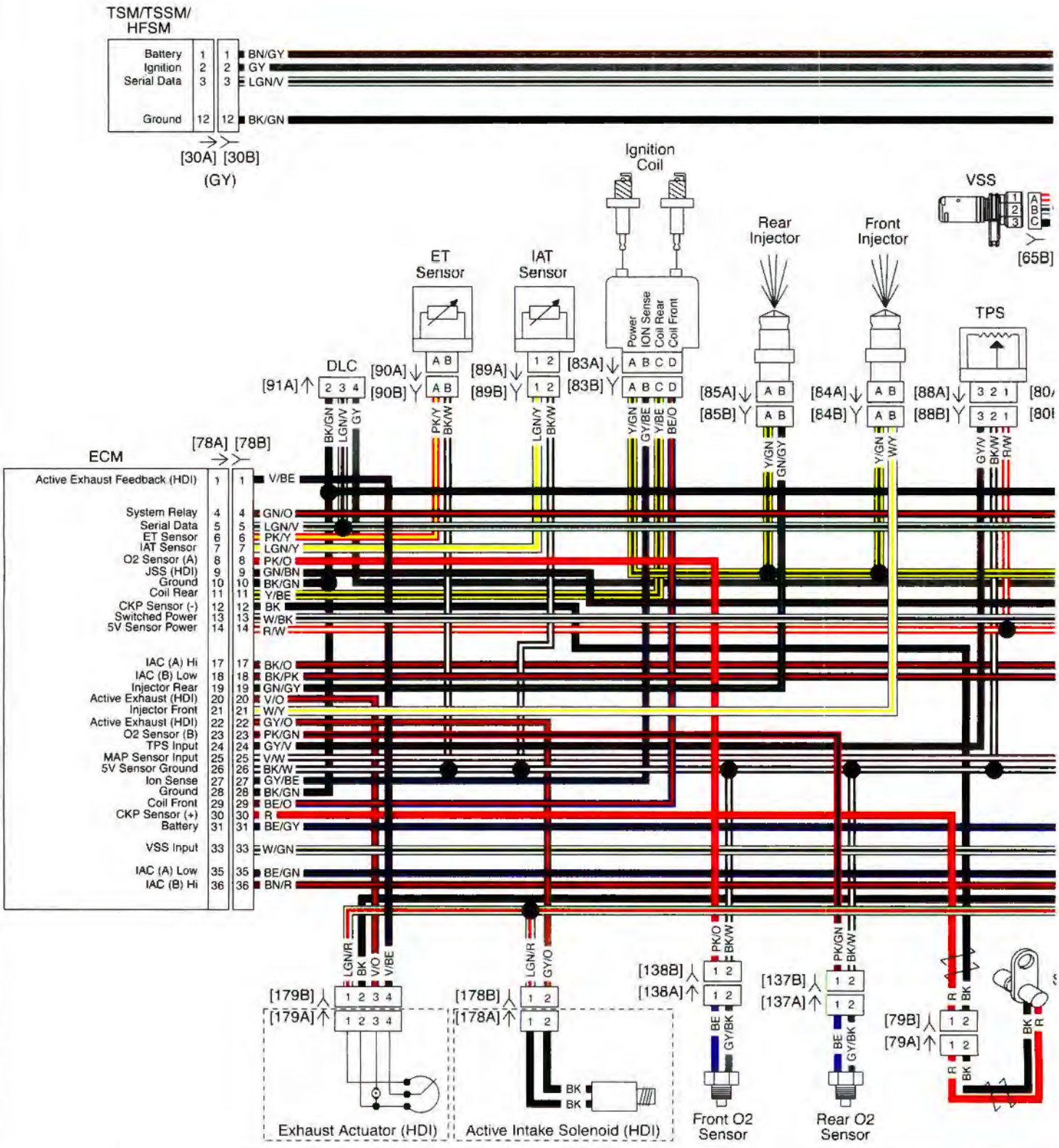
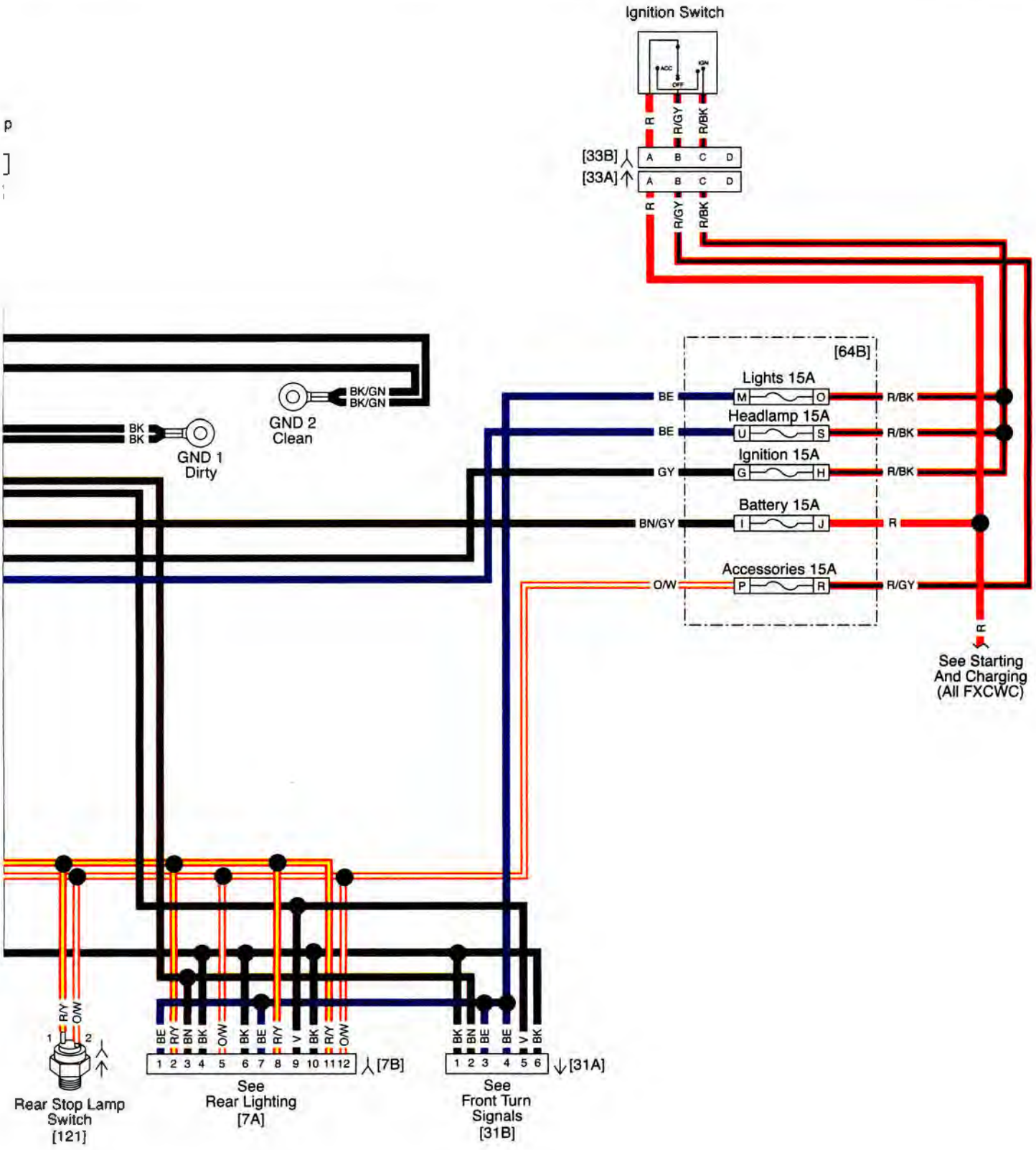


Figure B-23. Ignition Circ

Figure B-23.
Ignition Circuit: 2010 Softail (FXCWC Only)

Figure B-24.
Lighting Circuit: 2010 Softail (FXCWC Only)


Ignition Switch
ACC
IGN
OFF
R
R/GY
R/BK
[33B]
[33A]
A B C D
[64B]
Lights 15A
Headlamp 15A
Ignition 15A
Battery 15A
Accessories 15A
BE
GY
BN/GY
O/W
M O
U S
G H
I J
P R
R/BK
R
R/GY
See Starting And Charging (All FXCWC)
BK/GN
BK/GN
GND 2
Clean
BK
BK
GND 1
Dirty
R/Y
O/W
1 2
Rear Stop Lamp Switch [121]
BE R/Y BN BK O/W BK BE R/Y V BK R/Y O/W
1 2 3 4 5 6 7 8 9 10 11 12
[7B]
See Rear Lighting [7A]
BK BN BE BE V BK
1 2 3 4 5 6
[31A]
See Front Turn Signals [31B]

et00260

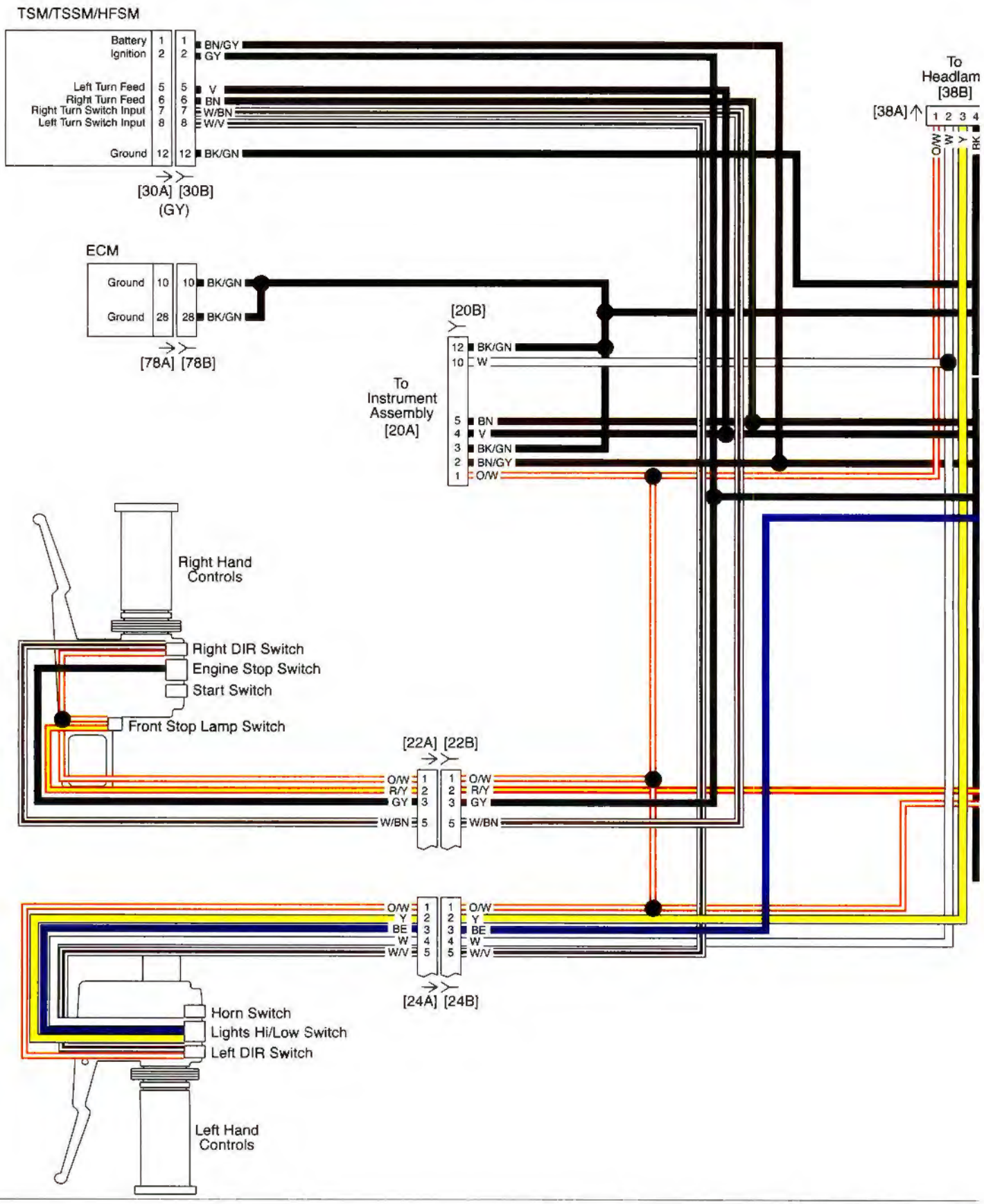
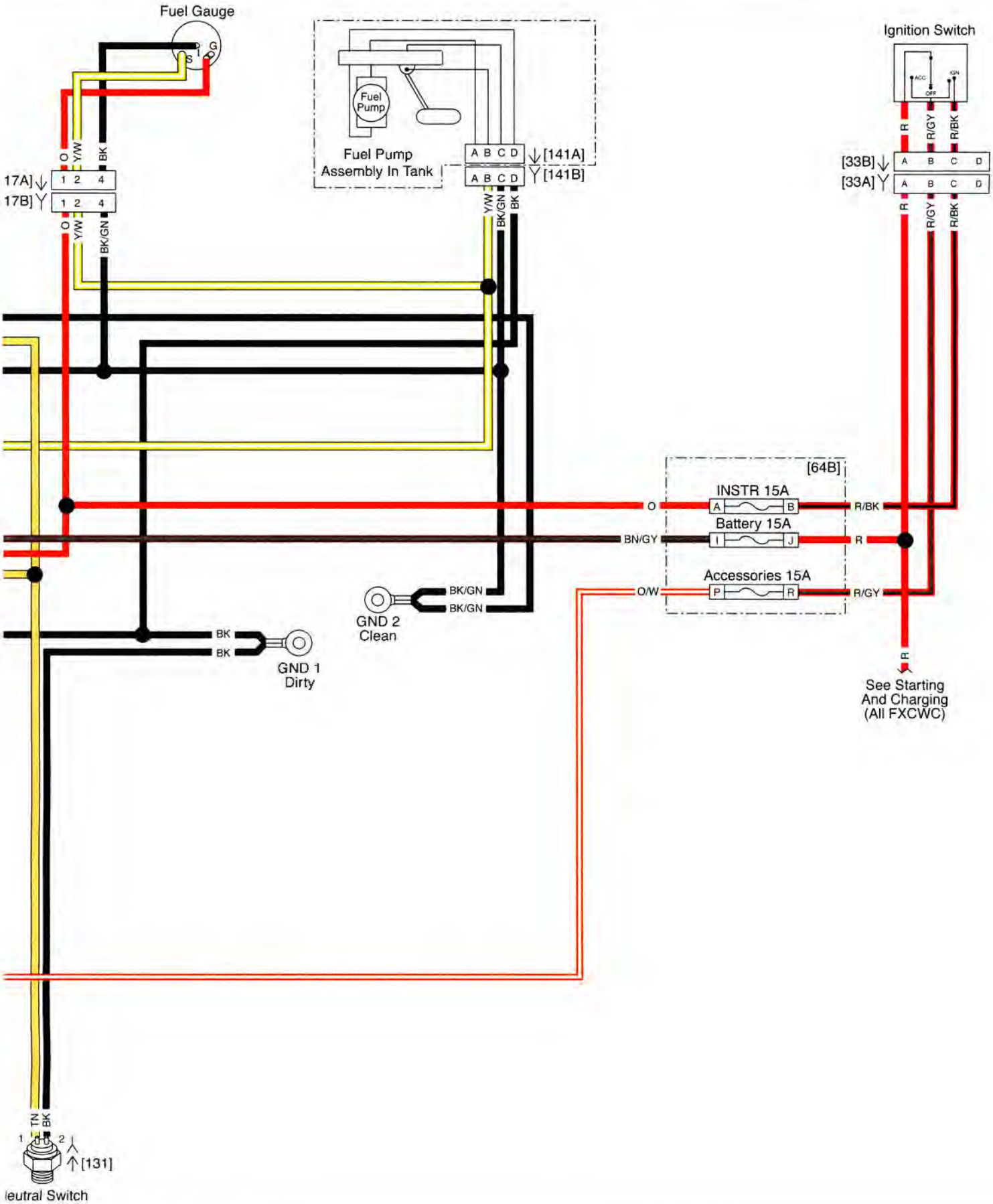


Figure B-24. Lighting Circ

Figure B-24.
Lighting Circuit: 2010 Softail (FXCWC Only)

Figure B-25.
Horn & Instruments: 2010 Softail (FXCWC Only)



nents: 2010 Softail (FXCWC Only)

et00261

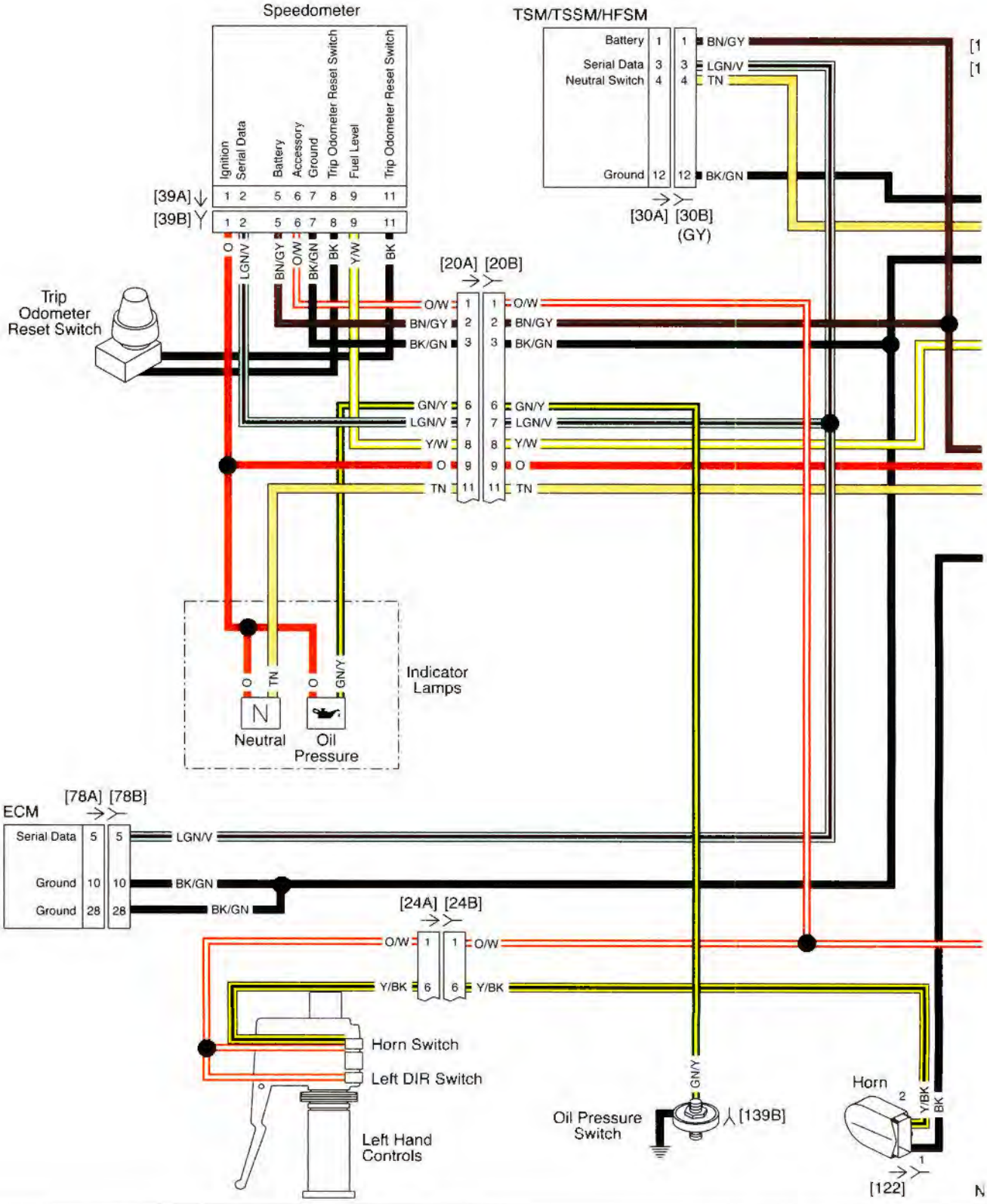
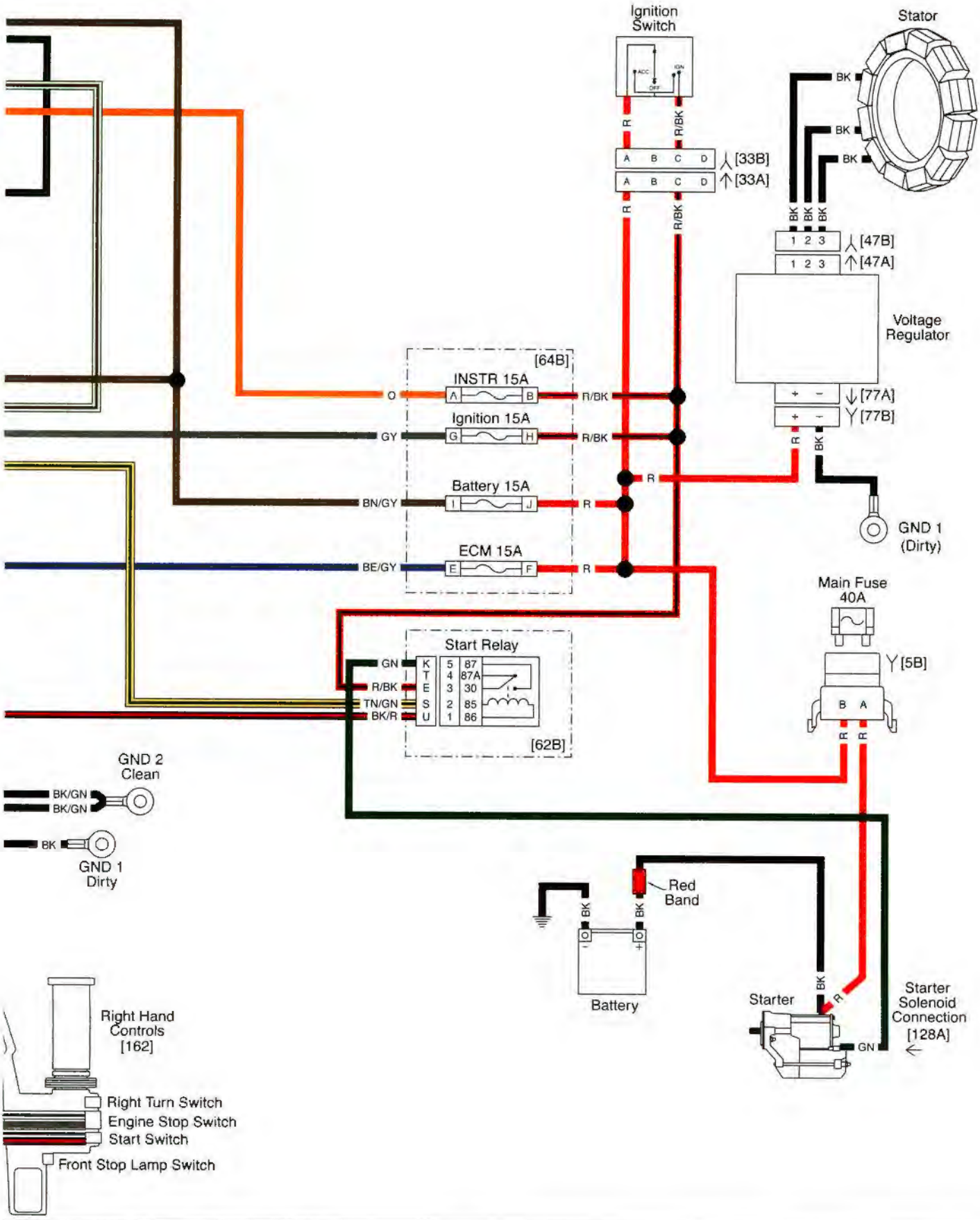


Figure B-25. Horn & Instrun

Figure B-25.
Horn & Instruments: 2010 Softail (FXCWC Only)

Figure B-26.
Starting and Charging Circuits: 2010 Softail (FXCWC Only)



Circuits: 2010 Softail (FXCWC Only)

et00262

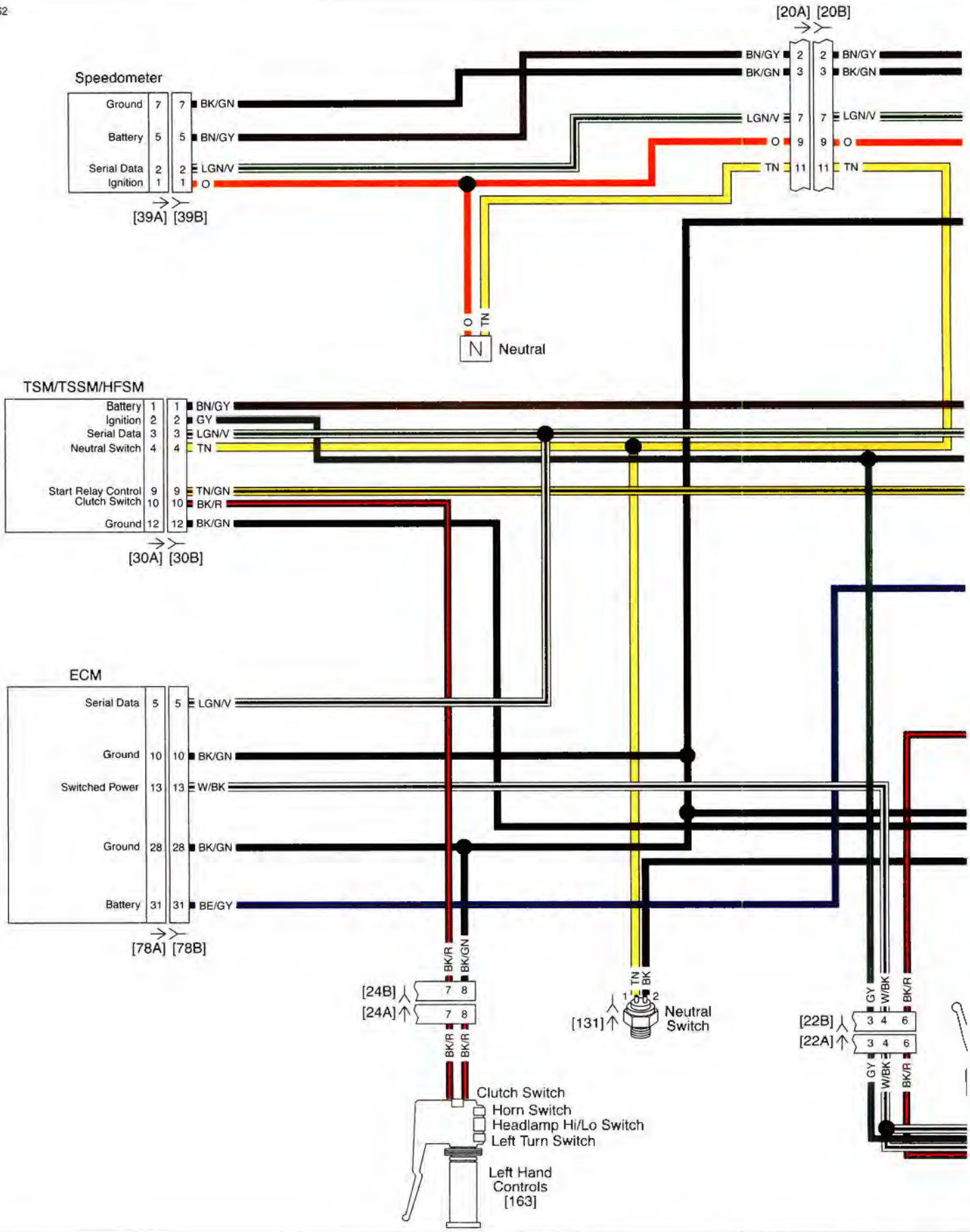
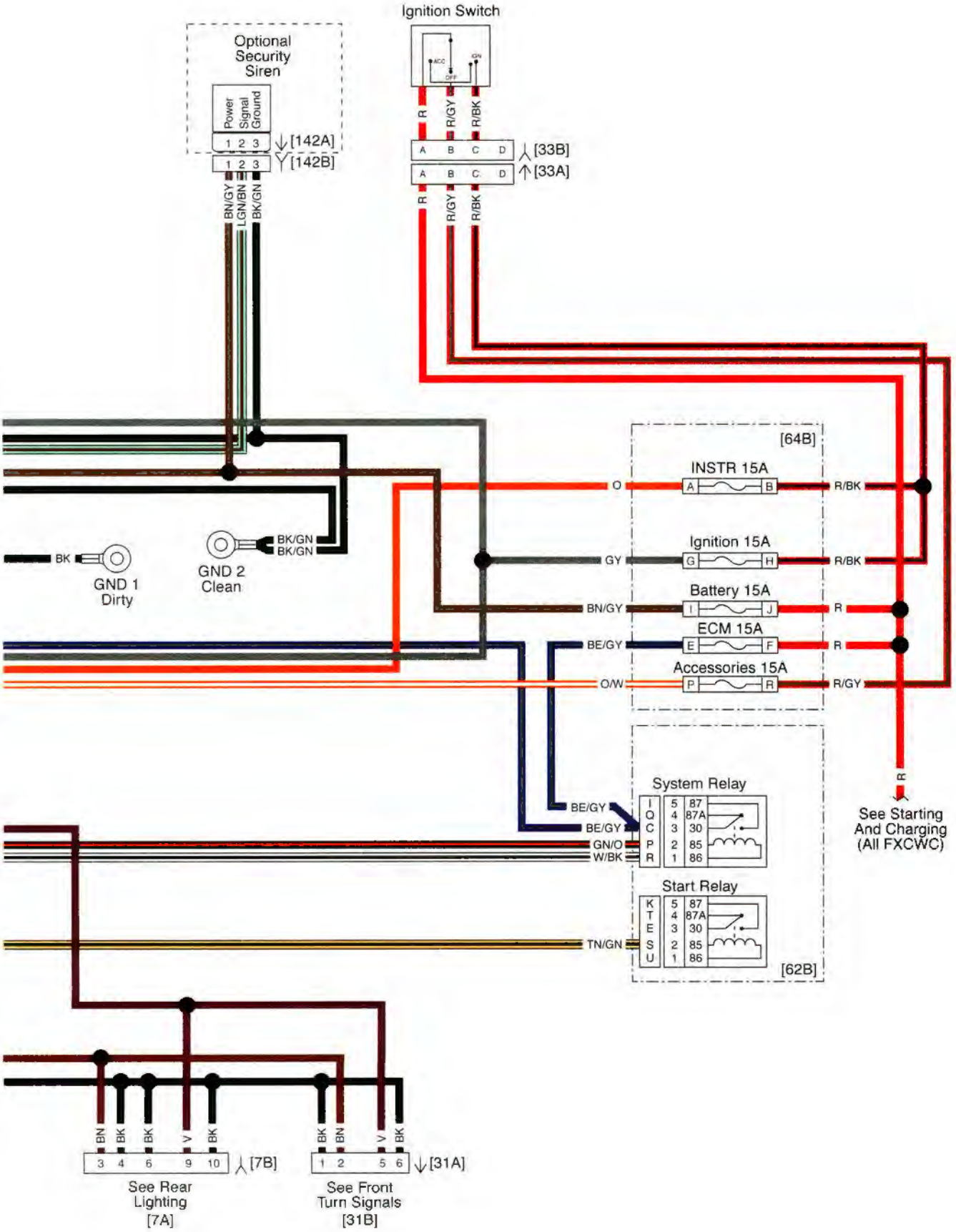


Figure B-26. Starting and Charging

Figure B-26.
Starting and Charging Circuits: 2010 Softail (FXCWC Only)

Figure B-27.
Security Circuit: 2010 Softail (FXCWC Only)



uit: 2010 Softail (FXCWC Only)

et00263

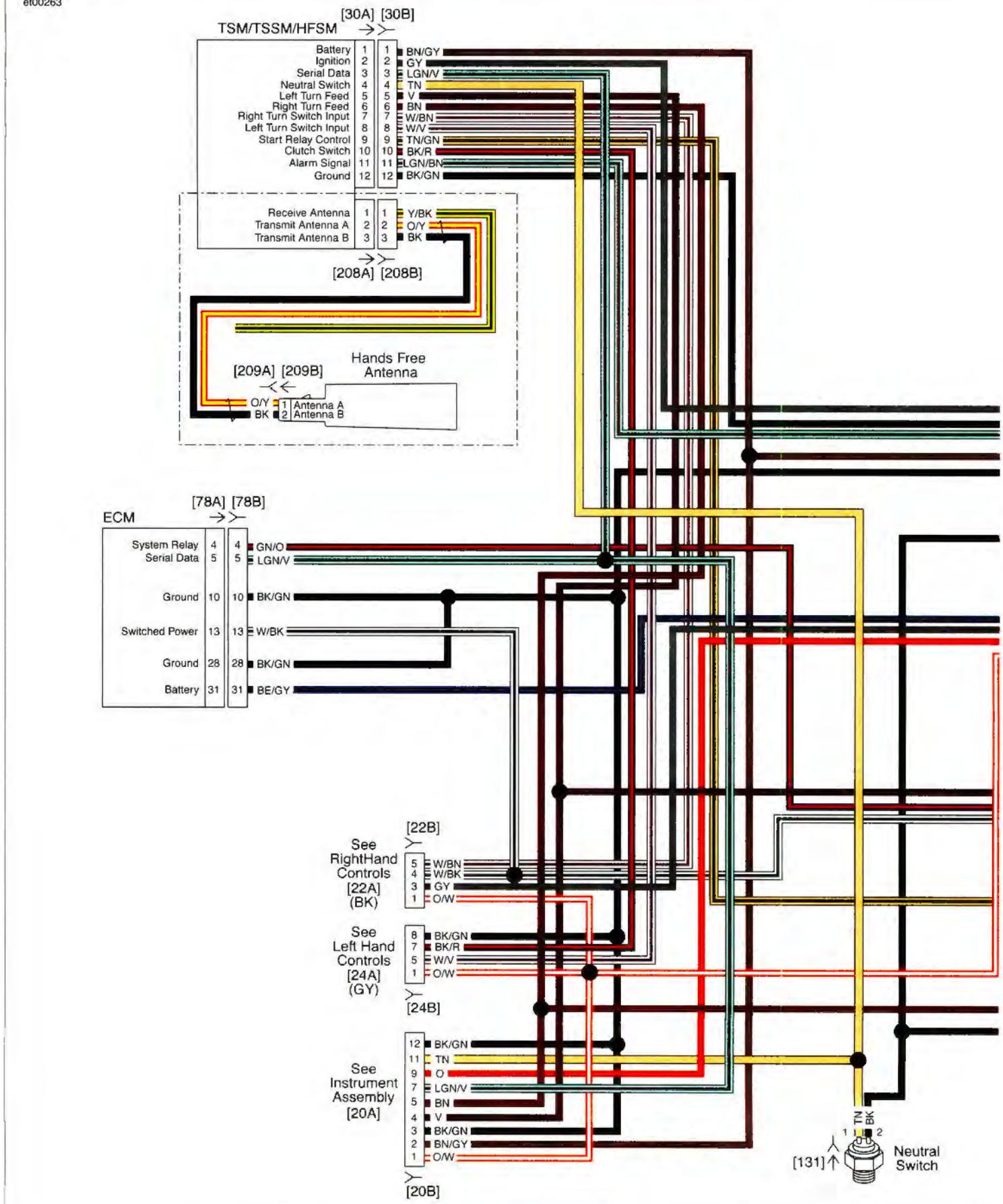


Figure B-27. Security Circ

Figure B-27.
Security Circuit: 2010 Softail (FXCWC Only)

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

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.)

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).

NOTES

APPENDIX D GLOSSARY

ACRONYMS AND ABBREVIATIONS

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
ABS	Anti-lock braking system
Ah	Ampere-hour
AC	Alternating current
ACC	Accessory position on ignition switch
ACR	Automatic compression release
AIS	Active Intake Solenoid
AGM	Absorbed glass mat (battery)
AWG	American wire gauge
B+	Battery voltage
bar	Bar
BAS	Bank angle sensor
BTDC	Before top dead center
°C	Celsius (Centigrade)
CA	California
CAL	Calibration
CAN	Controller area network
cc	Cubic centimeters
cm	Centimeters
cm^3	Cubic centimeters
CCA	Cold cranking amps
CKP	Crankshaft position
cm	Centimeter
CCW	Counterclockwise
CW	Clockwise
DC	Direct current
DLC	Data link connector
DOM	Domestic
DTC	Diagnostic trouble code
DOT	Department of Transportation
DVOM	Digital volt ohm meter
ECM	Electronic control module
ECT	Engine coolant temperature
ECU	electronic control unit
EEPROM	Electrically erasable programmable read only memory
EFI	Electronic fuel injection
ET	Engine temperature
EVAP	Evaporative emissions control system
°F	Fahrenheit
FPS	Fuel pressure sensor
ft	Foot

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
ft-lbs	Foot pounds
fl oz	Fluid ounce
g	Gram
gal	Gallon
GAWR	Gross axle weight rating
GPS	Global positioning system
GND	Ground (electrical)
GVWR	Gross vehicle weight rating
HCU	Hydraulic control unit
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson smart security system
HFSM	Hands-free security module
Hg	Mercury
H02S	Heated oxygen sensor
hp	Horsepower
hr	Hour
IAC	Idle air control
IAT	Intake air temperature
IC	Instrument cluster
ID	Inside diameter
IGN	Ignition light/key switch position
in	Inch
in^3	Cubic inch
INJ PW	Injector pulse width
in-lbs	Inch pounds
JSS	Jiffy stand sensor
kg	Kilogram
km	Kilometer
kPa	Kilopascal
km/h	Kilometers per hour
kW	Kilowatt
L	Liter
lb	Pounds
LCD	Liquid crystal display
LED	Light emitting diode
mA	Milliampere
MAP	Manifold absolute pressure
max	Maximum
mi	Mile
min	Minimum
mL	Milliliter
mm	Millimeter
mph	Miles per hour
ms	millisecond

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
Nm	Newton-meter
NiMH	Nickel metal hydride
N/A	Not applicable
O2	Oxygen
OD	Outside diameter
OEM	Original equipment manufacturer
oz	Ounce
P&A	Parts and Accessories
Part No.	Part number
PIN	Personal identification number
psi	Pounds per square inch
PWM signal	Pulse width modulated signal
qt	Quart
RCM	Reverse control module
RES	Reserve mark on fuel supply valve
RPM	Revolutions per minute
s	seconds
SCFH	Cubic feet per hour at standard conditions
TCA	Throttle control actuator
TDC	Top dead center
TGS	Twist grip sensor
TMAP	Intake air temperature/manifold absolute pressure
TPS	Throttle position sensor
TSM	Turn signal module
TSSM	Turn signal/security module
V	Volt
VAC	Volts of alternating current
VDC	Volts of direct current
VIN	Vehicle identification number
VSS	Vehicle speed sensor
W	Watt
WSS	Wheel speed sensor

NOTES

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
94455-89	SPANNER WRENCH	1.19 SUSPENSION ADJUSTMENTS, Shock Absorbers
94681-80	SPOKE NIPPLE WRENCH	2.9 TRUING LACED WHEELS, Truing Wheels
98716-87A	STORAGE COVER	1.27 STORAGE, Placing in Storage
99863-01A	GLOBAL BATTERY CHARGER	1.25 BATTERY MAINTENANCE, Storage
B-45523	VALVE GUIDE REAMER	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45524-1	VALVE GUIDE DRIVER	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45524-2A	VALVE GUIDE INSTALLER SLEEVE	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45525	VALVE GUIDE HONE	3.23 CYLINDER HEAD, Inspection
B-45525	VALVE GUIDE HONE	3.23 CYLINDER HEAD, Valve Guide Replacement
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.28 CRANKCASE, Left Crankcase Half
B-45655	CRANKCASE BEARING REMOVER/INSTALLER	3.28 CRANKCASE, Left Crankcase Half
GA500A	SNAP-ON TERMINAL PICK	A.2 AUTOFUSE ELECTRICAL CONNECTORS, Autofuse Connector Repair
HD-25070	ROBINAIR HEAT GUN	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	7.37 HANDLEBAR SWITCH ASSEMBLIES, Repair Procedures
HD-25070	ROBINAIR HEAT GUN	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-33223-1	CYLINDER COMPRESSION GAUGE	3.8 TROUBLESHOOTING, Compression Test
HD-33416	UNIVERSAL DRIVER HANDLE	2.20 STEERING HEAD, Disassembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.23 CYLINDER HEAD, Disassembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.23 CYLINDER HEAD, Assembly
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Inspection
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Valve and Seat Refacing
HD-34751	VALVE GUIDE CLEANING BRUSH	3.23 CYLINDER HEAD, Assembly
HD-34902-B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-34902-C	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER	5.5 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race
HD-35316-10	PILOT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-11	RECEIVER CUP	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-12	INSTALLER CUP	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-3A	CROSS PLATE	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-3A	CROSS PLATE	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-4A	8 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-5	12 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-5	12 IN. BOLT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-7	WASHER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-7	WASHER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-8	BEARING DRIVER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-9	BEARING DRIVER	6.7 MAIN DRIVE GEAR AND BEARING, Removal

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-35381-A	BELT TENSION GAUGE	1.12 DRIVE BELT AND SPROCKETS, Checking Belt Deflection
HD-35667-A	CYLINDER LEAKDOWN TESTER	3.8 TROUBLESHOOTING, Cylinder Leakdown Test
HD-35667-A	CYLINDER LEAKDOWN TESTER	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-35758-C	NEWAY VALVE SEAT CUTTER SET	3.23 CYLINDER HEAD, Valve and Seat Refacing
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.13 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.8 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-39301A	STEERING HEAD BEARING RACE REMOVER	2.20 STEERING HEAD, Disassembly
HD-39302	STEERING HEAD BEARING RACE INSTALLER	2.20 STEERING HEAD, Assembly
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-39782-1	CYLINDER HEAD SUPPORT STAND	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39782-3	INTAKE SEAT ADAPTER	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39782-4	EXHAUST SEAT ADAPTER	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39782-B	CYLINDER HEAD SUPPORT STAND KIT	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Disassembly
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Valve and Seat Refacing
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.23 CYLINDER HEAD, Assembly
HD-39847	REAMER T-HANDLE	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39964	REAMER LUBRICANT	3.23 CYLINDER HEAD, Valve Guide Replacement
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.6 DEUTSCH STANDARD TERMINAL REPAIR, Deutsch Standard Terminal Crimps
HD-39969	ULTRA TORCH UT-100	7.37 HANDLEBAR SWITCH ASSEMBLIES, Repair Procedures
HD-39969	ULTRA TORCH UT-100	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41182	FUEL PRESSURE GAUGE	4.16 FUEL PRESSURE TEST, Testing
HD-41183	HEAT SHIELD ATTACHMENT	7.37 HANDLEBAR SWITCH ASSEMBLIES, Repair Procedures
HD-41183	HEAT SHIELD ATTACHMENT	A.16 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41417	PROPANE ENRICHMENT KIT	4.19 INTAKE LEAK TEST, Leak Tester

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41475	DEUTSCH CONNECTOR SERVICE KIT	A.5 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41475-100	TERMINAL PICK TOOL	7.16 TAIL LAMP: ALL BUT FLSTN, Base Replacement
HD-41475-100	FLAT BLADE L-HOOK	A.5 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-41609	AMP MULTILOCK CRIMPER	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-42310-25A	SOFTAIL ENGINE CRADLE	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Crankcase
HD-42311	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.16 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.17 TOP END OVERHAUL: ASSEMBLY, Piston
HD-42320-B	PISTON PIN REMOVER	3.16 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42322	PISTON SUPPORT PLATE	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-42324-A	CYLINDER TORQUE PLATES	3.16 TOP END OVERHAUL: DISASSEMBLY, Cylinder Head
HD-42324-A	CYLINDER TORQUE PLATES	3.23 CYLINDER HEAD, Inspection
HD-42324-A	CYLINDER TORQUE PLATES	3.24 CYLINDER, Inspection
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER	3.26 CAM SUPPORT PLATE AND COVER, Cam Needle Bearings
HD-42326-B	CRANKSHAFT GUIDE	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-42682	BREAKOUT BOX	7.42 H-DSSS ACTUATION, Power Disruption and Configuring
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.28 CRANKCASE, Left Crankcase Half
HD-42720-5	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.28 CRANKCASE, Left Crankcase Half
HD-42879	ELECTRICAL CRIMPER TOOL	A.7 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR, Deutsch Solid Barrel Terminal Crimps
HD-44060-10	25 MM COLLET	2.7 SEALED WHEEL BEARINGS, Removal
HD-44060A	WHEEL BEARING INSTALLER/REMOVER	2.7 SEALED WHEEL BEARINGS, Removal
HD-44060A	WHEEL BEARING INSTALLER/REMOVER	2.7 SEALED WHEEL BEARINGS, Installation
HD-44061	FUEL PRESSURE GAUGE ADAPTER	4.16 FUEL PRESSURE TEST, Testing
HD-44062	BALANCE SHAFT RETENTION PINS	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Counterbalancer Assembly
HD-44062	BALANCE SHAFT RETENTION PINS	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Counterbalancer Assembly
HD-44062	BALANCE SHAFT RETENTION PIN	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
HD-44063	HYDRAULIC TENSIONER COMPRESSOR	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Counterbalancer Assembly

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-44063	HYDRAULIC TENSIONER COMPRESSOR	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
HD-44065-1	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER	3.28 CRANKCASE, Right Crankcase Half
HD-44065-1	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER	3.28 CRANKCASE, Right Crankcase Half
HD-44065-4	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE	3.28 CRANKCASE, Right Crankcase Half
HD-44065-4	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE	3.28 CRANKCASE, Right Crankcase Half
HD-44067	OIL FILTER WRENCH	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-44358	FLYWHEEL SUPPORT FIXTURE	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-44408	HYDRAULIC TENSIONER RETAINERS	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Counterbalancer Assembly
HD-44408	HYDRAULIC TENSIONER RETAINERS	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
HD-44455	OIL LINE REMOVING TOOL	3.31 OIL TANK: ALL BUT FXCWC, Removal and Disassembly
HD-44455	OIL LINE REMOVING TOOL	3.32 OIL TANK: FXCWC, Removal and Disassembly
HD-44750	DIGITAL TECHNICIAN	4.4 IDLE SPEED, General
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-46282	FINAL DRIVE SPROCKET LOCKING TOOL	5.7 TRANSMISSION SPROCKET, Removal
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL	5.7 TRANSMISSION SPROCKET, Installation
HD-47190	SEAT MOUNTING SCREW TOOL	2.41 SEAT: FXST, Removal and Installation
HD-47255	SPRINGER STEERING HEAD BEARING TOOL	1.21 STEERING HEAD BEARINGS: FLSTSB, Adjustment: FLSTSB
HD-47856-1	INSTALLER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-2	PILOT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-3	ADAPTER	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-6	NUT	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-7	CROW'S FOOT WRENCH	6.7 MAIN DRIVE GEAR AND BEARING, Installation
HD-47910	MAINSHAFT LOCKNUT WRENCH	5.7 TRANSMISSION SPROCKET, Removal
HD-47910	MAINSHAFT LOCKNUT WRENCH	5.7 TRANSMISSION SPROCKET, Installation
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL	6.7 MAIN DRIVE GEAR AND BEARING, Cleaning and Inspection
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.18 BOTTOM END OVERHAUL: DISASSEMBLY, Cam Support Plate and Cover
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
HD-47956	CAMSHAFT ASSEMBLY TOOL	3.26 CAM SUPPORT PLATE AND COVER, Camshafts
HD-47977	PRIMARY DRIVE LOCKING TOOL	5.4 DRIVE COMPONENTS, Removal
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER	A.9 MOLEX CONNECTORS, Molex Connector Repair

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-48119	ELECTRICAL CRIMP TOOL	A.9 MOLEX CONNECTORS, Crimp Terminal to Lead
HD-48262	OXYGEN SENSOR SOCKET	4.13 OXYGEN SENSOR, Removal
HD-48283	CRANKSHAFT ROTATING WRENCH	3.16 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate
HD-48309	BALANCER SHAFT INSTALLER	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair
HD-48457	BALANCER SHAFT REMOVER	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair
HD-48474	BALANCE SHAFT SUPPORT BEARING REMOVER/INSTALLER	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair
HD-48498-A	ACR SOLENOID SOCKET	3.23 CYLINDER HEAD, Installation Overview
HD-48615	BALANCE SHAFT SPROCKET ALIGNMENT TOOL	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
HD-48648	BRAKE CALIPER PISTON REMOVER	2.16 REAR BRAKE CALIPER, Disassembly
HD-48649	FRONT BRAKE CALIPER PISTON REMOVER	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Disassembly
HD-48650	DIGITAL TECHNICIAN II	7.42 H-DSSS ACTUATION, Fob Assignment
HD-48650	DIGITAL TECHNICIAN II	7.43 TSM/HFSM: PASSWORD LEARN, Password Learning
HD-48985	SPOKE TORQUE WRENCH	1.8 TIRES AND WHEELS, Wheel Spokes
HD-48985	SPOKE TORQUE WRENCH	2.9 TRUING LACED WHEELS, Truing Wheels
HD-94660-2	PILOT	5.7 TRANSMISSION SPROCKET, Removal
HD-94660-2	PILOT	5.7 TRANSMISSION SPROCKET, Installation
HD-94681-80	SPOKE NIPPLE WRENCH	1.8 TIRES AND WHEELS, Wheel Spokes
HD-94681-80	SPOKE NIPPLE WRENCH	1.8 TIRES AND WHEELS, Wheel Spokes
HD-94681-80	SPOKE WRENCH	2.9 TRUING LACED WHEELS, Setting Rim Offset
HD-94804-57	ROCKER ARM BUSHING REAMER	3.21 ROCKER ARM SUPPORT PLATE, Cleaning and Inspection
HD-95635-46	ALL-PURPOSE CLAW PULLER	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair
HD-95637-10	LONG BOLTS	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-95637-46B	WEDGE ATTACHMENT	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	6.7 MAIN DRIVE GEAR AND BEARING, Removal
HD-95937-46B	WEDGE ATTACHMENT	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair
HD-95952-1	THREADED CYLINDERS	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-95952-33C	CONNECTING ROD CLAMPING TOOL	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96333-51F	PISTON RING COMPRESSOR	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96796-47	VALVE SPRING TESTER	3.23 CYLINDER HEAD, Inspection
HD-96921-52D	OIL PRESSURE GAUGE SET	3.7 OIL PRESSURE, Checking Oil Pressure
HD-97087-65B	HOSE CLAMP PLIERS	3.31 OIL TANK: ALL BUT FXCWC, Installation
HD-97087-65B	HOSE CLAMP PLIERS	3.32 OIL TANK: FXCWC, Installation
HD-97225-55C	SPROCKET SHAFT BEARING TOOL	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-97225-55C	SPROCKET SHAFT BEARING INSTALLER	3.28 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-99500-80	WHEEL TRUING STAND	2.9 TRUING LACED WHEELS, Setting Rim Offset
HD-99500-80	WHEEL TRUING STAND	2.9 TRUING LACED WHEELS, Truing Wheels
HD-99500-80	WHEEL TRUING STAND	2.9 TRUING LACED WHEELS, Truing Wheels
HD-99500-80	WHEEL TRUING STAND	2.17 TIRES, Wheel Balancing
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS	6.6 TRANSMISSION ASSEMBLY, Disassembly
PART NO. HD-34634	FORK SEAL INSTALLER	2.18 FRONT FORK: TELESCOPIC, Assembly
PART NO. HD-45305	FORK SEAL DRIVER	2.18 FRONT FORK: TELESCOPIC, Assembly
RS-25100-200	BEARING	6.7 MAIN DRIVE GEAR AND BEARING, Removal
RS-25100-200	BEARING	6.7 MAIN DRIVE GEAR AND BEARING, Removal
SNAP-ON TT600-3	SNAP-ON PICK	A.1 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
SNAP-ON TT600-3	SNAP-ON PICK	A.12 PACKARD 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair
SRES24	SNAP-ON-ADAPTER	2.22 REAR SHOCK ABSORBERS, Removal
SS-306G	SNAP-ON TORQUE COMPUTER	2.22 REAR SHOCK ABSORBERS, Installation
TA360	SNAP-ON TORQUE ANGLE GAUGE	3.24 CYLINDER, Inspection

FASTENER	TORQUE VALUE		NOTES
Active exhaust module fasteners	32-40 **in-lbs**	3.6-4.5 Nm	7.35 ACTIVE EXHAUST, Installation
Adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.11 CLUTCH, Adjustment
Air cleaner bracket screws	40-60 **in-lbs**	4.5-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.5 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.5 AIR CLEANER ASSEMBLY, Installation
Air cleaner filter element screw	40-60 **in-lbs**	4.5-6.8 Nm	4.5 AIR CLEANER ASSEMBLY, Installation
Automatic compression release (ACR)	11-15 ft-lbs	14.9-20.3 Nm	3.23 CYLINDER HEAD, Installation Overview/Apply three equally spaced dots of LOCTITE 246 THREADLOCKER MEDIUM STRENGTH/HIGH TEMPERATURE around lower third of threads
Auxiliary lamp bracket	72-120 **in-lbs**	8.1-13.6 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, FLST and FLSTC Models
Auxiliary lamp bracket hardware	72-120 **in-lbs**	8.1-13.6 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, FLSTN Models
Auxiliary lamp nut	15-18 ft-lbs	20.3-24.4 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Balance shaft bolts	42-47 ft-lbs	56.9-63.7 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
Balance shaft housing screws	18-22 ft-lbs	24.4-29.8 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Counterbalancer Assembly
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	1.25 BATTERY MAINTENANCE, Installation and Connection
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	1.25 BATTERY MAINTENANCE, Installation and Connection
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	7.12 BATTERY CABLES, Routing Procedure
Battery cable to battery fasteners	60-72 **in-lbs**	6.8-8.1 Nm	7.12 BATTERY CABLES, Routing Procedure
Battery terminal fastener	60-72 **in-lbs**	6.8-8.1 Nm	1.5 MAINTENANCE SCHEDULE, General
Bearing retainer	25-35 **in-lbs**	2.8-4.0 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Bearing retainer	25-35 **in-lbs**	2.8-4.0 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Bearing retainer	25-35 **in-lbs**	2.8-4.0 Nm	2.19 FRONT FORK: SPRINGER, Fork Rockers/LOCTITE ANTI-SEIZE
Bearing retainer jam nut	95-105 ft-lbs	128.8-142.4 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Bearing retainer jam nut	95-105 ft-lbs	128.8-142.4 Nm	2.19 FRONT FORK: SPRINGER, Fork Rockers
Belt sprocket screws-final torque	77-83 ft-lbs	104.5-112.6 Nm	2.6 REAR WHEEL, Assembly
Belt sprocket screws-initial torque	60 ft-lbs	81.4 Nm	2.6 REAR WHEEL, Assembly/After initial torque, loosen screws 1/2 turn (180 degrees)
Bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	1.16 BLEEDING BRAKES, Procedure
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Assembly
Brake caliper/master cylinder banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.16 REAR BRAKE CALIPER, Assembly

FASTENER	TORQUE VALUE		NOTES
Brake caliper bridge bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Assembly
Brake caliper mounting bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Installation
Brake caliper mounting bolt, rear	10-14 ft-lbs	13.6-18.9 Nm	2.16 REAR BRAKE CALIPER, Installation
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.5 FRONT WHEEL: FLSTSB, Assembly
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm	2.6 REAR WHEEL, Assembly
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	2.16 REAR BRAKE CALIPER, Assembly
Brake reaction link-to-fork leg bracket acorn nut	35-40 ft-lbs	47.5-54.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Breather assembly bolts	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Cable adjuster jam nut	120 **in-lbs**	13.6 Nm	1.11 CLUTCH, Adjustment
Cam chain tensioner fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam cover screws	125-155 **in-lbs**	14.1-17.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Chain tensioner fasteners	15-19 ft-lbs	20.3-25.8 Nm	5.4 DRIVE COMPONENTS, Installation
Chrome aluminum laced wheel spoke nipple	55 **in-lbs**	6.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch adjustment screw locknut	72-120 **in-lbs**	8-14 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch cable fitting	90-120 **in-lbs**	10.18-13.57 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Clutch cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.11 CLUTCH, Adjustment
Clutch diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm	5.6 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	5.4 DRIVE COMPONENTS, Installation
Clutch inspection cover fastener torque	84-108 **in-lbs**	10-12 Nm	1.5 MAINTENANCE SCHEDULE, General
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant
Clutch release cover screws	84-108 **in-lbs**	9.5-12.2 Nm	6.5 CLUTCH RELEASE COVER, Assembly and Installation
Coil cover screw: all but FXCWC	30-40 **in-lbs**	3.4-4.5 Nm	7.21 IGNITION COIL, Installation
Compensating sprocket bolt: All but FXCWC-final torque	140 ft-lbs	190.0 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-final torque	140 ft-lbs	190.0 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-initial torque	100 ft-lbs	135.7 Nm	5.4 DRIVE COMPONENTS, Installation
Compensating sprocket bolt: All but FXCWC-initial torque	100 ft-lbs	135.7 Nm	5.4 DRIVE COMPONENTS, Installation
Counterbalance assembly bearing	40-70 **in-lbs**	4.5-7.9 Nm	3.30 COUNTERBALANCER ASSEMBLY, Cleaning, Inspection, and Repair

FASTENER	TORQUE VALUE		NOTES
Crankcase bolt (final torque)	15-19 ft-lbs	20.3-25.8 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase bolt (initial torque)	120 **in-lbs**	13.6 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase oil fittings	120-168 **in-lbs**	13.6-19.0 Nm	3.28 CRANKCASE, Pipe Plugs and Oil Fittings
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.28 CRANKCASE, Pipe Plugs and Oil Fittings
Crank Position Sensor (CKP)	90-120 **in-lbs**	10.2-13.6 Nm	7.20 CRANK POSITION SENSOR (CKP), Installation
Crank sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.1 Nm	3.24 CYLINDER, Inspection
Cylinder head bolts, initial	120-144 **in-lbs**	13.5-16.2 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head/See special method to tighten
Cylinder head bolts, initial	120-144 **in-lbs**	13.6-16.3 Nm	3.24 CYLINDER, Inspection
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Cylinder head breather bolts	22-24 ft-lbs	29.9-32.6 Nm	4.5 AIR CLEANER ASSEMBLY, Installation
Cylinder stud	10-20 ft-lbs	3.6-27.1 Nm	3.28 CRANKCASE, Cylinder Studs
Diaphragm spring retainer bolts	70-100 **in-lbs**	7.9-11.3 Nm	5.6 CLUTCH, Clutch Pack and Bearing
Drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.6 ENGINE OIL AND FILTER, Changing Oil and Filter
ECM fasteners: FXCWC	45-55 **in-lbs**	5.1-6.2 Nm	7.3 ELECTRICAL PANEL, Installation: FXCWC
ECM mounting screws: FLST/FLSTC/FLSTN	45-55 **in-lbs**	5.1-6.2 Nm	7.4 ELECTRONIC CONTROL MODULE (ECM), Installation: All But FXCWC
ECM mounting screws: FXST/FXSTC/FLSTF/FLSTFB	30-35 **in-lbs**	3.4-4.0 Nm	7.4 ELECTRONIC CONTROL MODULE (ECM), Installation: All But FXCWC
Electrical panel fastener	36-60 **in-lbs**	4.1-6.8 Nm	3.32 OIL TANK: FXCWC, Installation
Electrical panel fasteners	36-60 **in-lbs**	4.1-6.8 Nm	3.31 OIL TANK: ALL BUT FXCWC, Installation
Electrical panel fasteners	36-60 **in-lbs**	4.1-6.8 Nm	7.3 ELECTRICAL PANEL, Installation: All But FXCWC
Electrical panel fasteners: FXCWC	36-60 **in-lbs**	4.1-6.8 Nm	7.3 ELECTRICAL PANEL, Installation: FXCWC
Engine/transmission bracket bolts	30-35 ft-lbs	40.7-47.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Engine mounting bolts, front	70-80 ft-lbs	94.9-108.5 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Engine oil drain plug	14-21 ft-lbs	19-28 Nm	1.5 MAINTENANCE SCHEDULE, General
Engine Temperature (ET) sensor	10-15 ft-lbs	13.6-20.3 Nm	4.9 ENGINE TEMPERATURE SENSOR (ET), Installation
Exhaust carriage bolt flange locknut	20-25 ft-lbs	27.1-33.9 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust interconnect clamp	15-19 ft-lbs	20.4-27.1 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System

FASTENER	TORQUE VALUE		NOTES
Exhaust manifold clamp lower nut final torque	100-120 **in-lbs**	11.3-13.6 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut final torque	100-120 **in-lbs**	11.3-13.6 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut initial torque	9-18 **in-lbs**	1.0-2.0 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp lower nut initial torque	9-18 **in-lbs**	1.0-2.0 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp upper nut	100-120 **in-lbs**	11.3-13.6 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust manifold clamp upper nut	100-120 **in-lbs**	11.3-13.6 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, System
Exhaust pipe clamp locknut	20-25 ft-lbs	27.1-33.9 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Exhaust system interconnect tube fasteners	20-25 ft-lbs	27.14-33.93 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, System
Fender Support Studs: FLSTC	21-27 ft-lbs	28.5-36.6 Nm	2.47 SADDLEBAGS: FLSTC, Installation
Flare nut socket locknut	18 ft-lbs	24.4 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
FLSTSB handlebar riser locknut	25-35 ft-lbs	33.9-47.5 Nm	2.28 HANDLEBARS: FLSTSB, Installation
Fork drain screw, all models but FXCWC	52-78 **in-lbs**	5.9-8.9 Nm	2.18 FRONT FORK:TELESCOPIC, Replacing Fork Oil
Fork drain screw, FXCWC	12-18 **in-lbs**	1.4-2.0 Nm	2.18 FRONT FORK:TELESCOPIC, Replacing Fork Oil
Fork stem acorn nut	30-35 **in-lbs**	3.4-4.0 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Fork stem nut: FXCWC	70-80 ft-lbs	94.9-108.4 Nm	2.20 STEERING HEAD, Installation
Fork stem nut: FXST, FXSTC	70-80 ft-lbs	94.9-108.4 Nm	2.20 STEERING HEAD, Installation
Fork stem upper bracket pinch bolt: FLST, FLSTC, FLSTF/B, FLSTN	25-30 ft-lbs	33.9-40.7 Nm	2.20 STEERING HEAD, Installation
Fork tube cap	60-70 ft-lbs	81.3-94.9 Nm	2.18 FRONT FORK:TELESCOPIC, Replacing Fork Oil
Fork tube plug	60-70 ft-lbs	81.4-95.0 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Fork tube plug	60-70 ft-lbs	81.4-95.0 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Front axle nut	60-65 ft-lbs	81.3-88.1 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Installation
Front axle nut	60-65 ft-lbs	81.3-88.1 Nm	2.5 FRONT WHEEL: FLSTSB, Installation/Discard upon removal
Front axle slider cap nuts	11-15 ft-lbs	14.9-20.3 Nm	2.4 FRONT WHEEL: ALL BUT FLSTSB, Installation
Front brake caliper banjo bolt	17-22 ft-lbs	23.0-29.8 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation

FASTENER	TORQUE VALUE		NOTES
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Front brake hose bracket bolt	96-120 **in-lbs**	10.8-13.6 Nm	2.20 STEERING HEAD, Installation
Front brake hose bracket bolt	96-120 **in-lbs**	10.8-13.6 Nm	2.20 STEERING HEAD, Installation
Front brake hose bracket bolt	96-120 **in-lbs**	10.8-13.6 Nm	2.20 STEERING HEAD, Installation
Front brake lower caliper screw/guide pin	25-30 ft-lbs	33.9-40.7 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front brake upper caliper mounting bolt	25-30 ft-lbs	33.9-40.7 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Front caliper self-tapping retainer screw	40-50 **in-lbs**	4.5-5.6 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Assembly
Front engine mounting nuts	70-80 ft-lbs	94.9-108.5 Nm	1.26 ENGINE MOUNTS, Inspection
Front fender acorn stud assembly	35-40 ft-lbs	47.5-54.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front fender acorn stud assembly	35-40 ft-lbs	47.5-54.3 Nm	2.31 FRONT FENDER: FLSTSB, Installation
Front fender fasteners	15-21 ft-lbs	20.3-28.5 Nm	2.30 FRONT FENDER: ALL BUT FLSTSB, Installation
Front fender locknut	25-30 ft-lbs	33.9-40.7 Nm	2.31 FRONT FENDER: FLSTSB, Installation
Front fender screw	18-22 ft-lbs	24.4-29.9 Nm	2.31 FRONT FENDER: FLSTSB, Installation
Front fork damper tube screw	29.5-36.8 ft-lbs	40-50 Nm	2.18 FRONT FORK: TELESCOPIC, Assembly
Front fork damper tube screw	10.8-18 ft-lbs	14.7-24.5 Nm	2.18 FRONT FORK: TELESCOPIC, Assembly
Front fork leg bracket screws	35-40 ft-lbs	47.5-54.3 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Front instrument panel screw	30-40 **in-lbs**	3.4-4.5 Nm	7.25 INSTRUMENT CONSOLE: FXCWC, Installation
Front shock absorber acorn nuts	45-50 ft-lbs	61.0-67.8 Nm	2.19 FRONT FORK: SPRINGER, Front Shock Absorber/LOCTITE THREADLOCKER 243 (blue)
Fuel Pump/Fuel Gauge Sending Unit T20 TORX screws	18-24 **in-lbs**	2.0-2.7 Nm	4.15 FUEL PUMP AND FUEL GAUGE SENDING UNIT, Installation
Fuel supply tube fastener	90-110 **in-lbs**	10.2-12.4 Nm	4.14 FUEL INJECTORS, Installation
Fuel tank front screw	28-32 ft-lbs	38.0-43.4 Nm	4.6 FUEL TANK, Installation/all but FXCWC
Fuel tank mount acorn nut	28-32 ft-lbs	38.0-43.4 Nm	4.6 FUEL TANK, Installation/FXCWC
Fuel tank rear mount nut	14-18 ft-lbs	19.0-24.4 Nm	4.6 FUEL TANK, Installation/FXCWC
Fuel tank T40 TORX screw	18-22 ft-lbs	24.4-29.8 Nm	4.6 FUEL TANK, Installation/all but FXCWC
Handlebar clamp front fasteners	12-15 ft-lbs	16.3-20.3 Nm	2.26 HANDLEBARS: ALL BUT FLSTF/FLSTFB/FLSTSB/FXCWC, Installation
Handlebar clamp rear fasteners	12-15 ft-lbs	16.3-20.3 Nm	2.26 HANDLEBARS: ALL BUT FLSTF/FLSTFB/FLSTSB/FXCWC, Installation
Handlebar clamp screws: FLSTSB	15-18 ft-lbs	20.3-24.4 Nm	2.28 HANDLEBARS: FLSTSB, Installation
Handlebar clamp screw torque	12-15 ft-lbs	16.3-20.3 Nm	1.5 MAINTENANCE SCHEDULE, General

FASTENER	TORQUE VALUE		NOTES
Handlebar lower clamp fastener; FLSTF/B	30-40 ft-lbs	40.7-54.2 Nm	2.27 HANDLEBARS: FLSTF/B, Installation
Handlebar lower clamp fastener; FXCWC	30-40 ft-lbs	40.7-54.2 Nm	2.29 HANDLEBARS: FXCWC, Installation
Handlebar switch clamp screw	60-80 **in-lbs**	6.8-9.0 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Handlebar switch clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.38 RIGHT HANDLEBAR SWITCH, Installation
Handlebar switch clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	7.39 LEFT HANDLEBAR SWITCH, Installation
Handlebar switch housing screw	35-45 **in-lbs**	4-5 Nm	1.5 MAINTENANCE SCHEDULE, General
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	1.13 THROTTLE CABLES, Cable Inspection, Lubrication and Adjustment
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.38 RIGHT HANDLEBAR SWITCH, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	7.39 LEFT HANDLEBAR SWITCH, Installation
Handlebar upper clamp fasteners; FLSTF/B	12-18 ft-lbs	16.3-24.4 Nm	2.27 HANDLEBARS: FLSTF/B, Installation
Handlebar upper clamp screw; FXCWC	12-15 ft-lbs	16.3-20.3 Nm	2.29 HANDLEBARS: FXCWC, Installation/Follow torque sequence
Headlamp circuit board/pin housing screw	40-48 **in-lbs**	4.5-5.4 Nm	7.16 TAIL LAMP: ALL BUT FLSTN, Base Replacement
Headlamp horizontal adjustment fastener	30-35 ft-lbs	40.7-47.5 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp lens base screws	20-24 **in-lbs**	2.3-2.7 Nm	7.16 TAIL LAMP: ALL BUT FLSTN, Base Replacement
Headlamp vertical adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment/FXSTC, FXCWC
Headlamp vertical adjusting bolt	25-35 ft-lbs	33.9-47.5 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment/FLSTSB
Headlamp vertical adjusting bolt	35-45 ft-lbs	47.5-61.0 Nm	1.23 HEADLAMP ALIGNMENT, Headlamp Adjustment/All but FLSTSB, FXSTC, FXCWC
Horn bracket clamp	80-100 **in-lbs**	9.0-11.3 Nm	7.34 HORN, Removal and Installation: All But FXCWC
Horn bracket mounting bolt: FXCWC	13-15 ft-lbs	17.64-20.36 Nm	7.34 HORN, Removal and Installation: FXCWC
Horn bracket nut	80-100 **in-lbs**	9.0-11.3 Nm	7.34 HORN, Removal and Installation: All But FXCWC
Horn bracket screws	35-55 **in-lbs**	4.0-6.2 Nm	7.34 HORN, Removal and Installation: All But FXCWC
Horn cover screws: FXCWC	40-50 **in-lbs**	4.52-5.65 Nm	7.34 HORN, Removal and Installation: FXCWC
Ignition/light switch bracket locknuts	12-15 ft-lbs	16.3-20.4 Nm	7.11 IGNITION AND LIGHT SWITCH, Removal and Installation: FXCWC
Ignition/light switch nut	115-135 **in-lbs**	13.0-15.3 Nm	7.11 IGNITION AND LIGHT SWITCH, Removal and Installation: FXCWC
Ignition coil nut (FXCWC only)	115-135 **in-lbs**	13.0-15.3 Nm	7.21 IGNITION COIL, Installation
Ignition coil screws (all except FXCWC)	120-180 **in-lbs**	13.6-20.3 Nm	7.21 IGNITION COIL, Installation
Indicator lamp console nut	7-11 ft-lbs	9.5-14.9 Nm	7.29 INDICATOR LAMPS: ALL BUT FXCWC, Installation

FASTENER	TORQUE VALUE		NOTES
Instrument console acorn nut	7-11 ft-lbs	9.5-14.9 Nm	4.6 FUEL TANK, Installation/all but FXCWC
Instrument panel acorn nut	7-11 ft-lbs	9.5-14.9 Nm	7.11 IGNITION AND LIGHT SWITCH, Removal and Installation: All But FXCWC
Intake air temperature sensor (IAT) fastener	15-20 **in-lbs**	1.7-2.3 Nm	4.8 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Jiffy stand bracket assembly screws	25-30 ft-lbs	33.9-40.7 Nm	2.38 JIFFY STAND, Installation
Jiffy stand sensor screw	96-144 **in-lbs**	10.8-16.3 Nm	2.38 JIFFY STAND, Sensor (HDI Models)
Jounce bumper bolts	84-108 **in-lbs**	9.5-12.2 Nm	2.23 REAR FORK, Installation
License plate bracket (tail lamp for HDI) fasteners: FXCWC	57-63 **in-lbs**	6.45-7.12 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
License plate bracket fasteners	30-50 **in-lbs**	3.4-5.6 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
License plate support fasteners	60-90 **in-lbs**	6.8-10.2 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	7.14 STARTER SOLENOID, Solenoid Contacts
Lower fork stem pinch bolts	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Lower fork stem pinch bolts: all but FXCWC	55-60 ft-lbs	74.6-81.4 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Lower fork stem pinch bolts: FLST, FLSTC, FLSTF/B, FLSTN	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Lower fork stem pinch bolts: FXCWC	35-40 ft-lbs	47.5-54.3 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Lower handlebar clamp fasteners	30-40 ft-lbs	40.7-54.3 Nm	2.26 HANDLEBARS: ALL BUT FLSTF/FLSTFB/FLSTSB/FXCWC, Installation
Lower rear fender mounting bolts	28-32 ft-lbs	38.0-43.4 Nm	2.35 REAR FENDER: FXCWC, Installation
Lower triple tree pinch bolt	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Lower triple tree pinch bolt	35-40 ft-lbs	47.5-54.3 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Lower triple tree pinch bolt: FXCWC	35-40 ft-lbs	47.5-54.3 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Lower triple tree pinch bolt: FXST, FXSTC	55-60 ft-lbs	74.6-81.4 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FXST, FXSTC, FXCWC
Luggage Rack Front Fasteners: FLSTN	96-120 **in-lbs**	10.8-13.6 Nm	2.46 LUGGAGE RACK: FLSTN, Removal and Installation
Luggage Rack Rear Fasteners: FLSTN	12-14 ft-lbs	16.3-19.0 Nm	2.46 LUGGAGE RACK: FLSTN, Removal and Installation
Mainshaft/countershaft nuts	85-95 ft-lbs	115.3-128.8 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Manifold mounting screws	96-144 **in-lbs**	10.8-16.3 Nm	4.10 INDUCTION MODULE, Installation
Master cylinder cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.14 FRONT BRAKE CALIPER: FLSTSB, Installation
Master cylinder cover screw torque: front	12-15 **in-lbs**	1.4-1.7 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder cover screw torque: rear	6-8 **in-lbs**	0.7-0.9 Nm	1.5 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover screw: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.15 BRAKES, Fluid Inspection

FASTENER	TORQUE VALUE		NOTES
Master cylinder reservoir cover screw: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.16 BLEEDING BRAKES, Procedure
Master cylinder reservoir cover screw: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.15 BRAKES, Fluid Inspection
Master cylinder reservoir cover screw: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.16 BLEEDING BRAKES, Procedure
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Master cylinder reservoir cover screws: front cover	12-15 **in-lbs**	1.4-1.7 Nm	2.13 FRONT BRAKE CALIPER: ALL BUT FLSTSB, Installation
Master cylinder reservoir cover screws: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir cover screws: rear cover	6-8 **in-lbs**	0.7-0.9 Nm	2.15 REAR BRAKE MASTER CYLINDER, Installation
Mounting bolt and slider pin, rear caliper	10-14 ft-lbs	13.6-18.9 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Muffler clamp	38-43 ft-lbs	51.6-58.4 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Muffler clamps: all but FLSTF/FLSTFB/FLSTN	38-43 ft-lbs	51.6-58.4 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Muffler fasteners: all but FLSTF/FLSTFB/FLSTN	96-120 **in-lbs**	10.86-13.57 Nm	4.17 EXHAUST SYSTEM: ALL BUT FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Muffler support fastener	96-120 **in-lbs**	10.8-13.6 Nm	4.18 EXHAUST SYSTEM: FLSTF/FLSTFB/FLSTN/FLSTSB, Mufflers
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	7.31 NEUTRAL SWITCH, Installation
Oil pressure switch	96-144 **in-lbs**	10.8-16.3 Nm	7.32 OIL PRESSURE SWITCH, Installation
Oil pump screws, initial torque	40-45 **in-lbs**	4.5-5.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Oxygen sensor	29-44 ft-lbs	39.3-59.7 Nm	4.13 OXYGEN SENSOR, Installation
Pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	1.17 BRAKE PADS AND DISCS, Brake Pad Replacement
Piston jet screw	25-35 **in-lbs**	2.8-3.9 Nm	3.28 CRANKCASE, Right Crankcase Half
Pivot shaft nut	90-110 ft-lbs	122-149.1 Nm	2.23 REAR FORK, Installation
Pivot shaft nut	90-110 ft-lbs	122-149.1 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Pivot stud (thin head) acorn nut	45-50 ft-lbs	61.0-67.8 Nm	2.19 FRONT FORK: SPRINGER, Fork Rockers/LOCTITE THREADLOCKER 243 (blue)
Primary cam sprocket flange bolts, final torque	34 ft-lbs	46.1 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.19 BOTTOM END OVERHAUL: ASSEMBLY, Cam Support Plate and Cover
Primary chaincase drain plug	14-21 ft-lbs	19-28 Nm	1.5 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.9 PRIMARY CHAINCASE LUBRICANT, Changing Primary Chaincase Lubricant

FASTENER	TORQUE VALUE		NOTES
Primary cover fasteners	108-120 **in-lbs**	12.2-13.6 Nm	5.3 PRIMARY CHAINCASE COVER, Installation
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm	1.12 DRIVE BELT AND SPROCKETS, Adjusting Belt Deflection
Rear axle nut	95-105 ft-lbs	128.8-142.5 Nm	2.6 REAR WHEEL, Installation
Rear caliper banjo bolt	17-22 ft-lbs	23.1-29.9 Nm	2.16 REAR BRAKE CALIPER, Installation
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.32 REAR FENDER: FLST/FLSTC, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.32 REAR FENDER: FLST/FLSTC, Installation/Final torque
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.33 REAR FENDER: FLSTF/B, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.33 REAR FENDER: FLSTF/B, Installation/Final torque
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.34 REAR FENDER: FXST/FXSTC/FLSTSB, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.34 REAR FENDER: FXST/FXSTC/FLSTSB, Installation/Final torque
Rear fender support fasteners, lower-front	30-35 ft-lbs	40.7-47.5 Nm	2.36 REAR FENDER: FLSTN, Installation/Initial torque
Rear fender support fasteners, lower-front	38-42 ft-lbs	51.5-56.9 Nm	2.36 REAR FENDER: FLSTN, Installation/Final torque
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.32 REAR FENDER: FLST/FLSTC, Installation
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.33 REAR FENDER: FLSTF/B, Installation
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.34 REAR FENDER: FXST/FXSTC/FLSTSB, Installation
Rear fender support fasteners, upper	21-27 ft-lbs	28.5-36.6 Nm	2.36 REAR FENDER: FLSTN, Installation
Rear fork pivot nut	90-110 ft-lbs	122.0-149.1 Nm	1.26 ENGINE MOUNTS, Inspection
Rear instrument panel acorn nut	30-40 **in-lbs**	3.4-4.5 Nm	7.25 INSTRUMENT CONSOLE: FXCWC, Installation
Rear master cylinder banjo bolt	17-22 ft-lbs	23-30 Nm	2.15 REAR BRAKE MASTER CYLINDER, Installation
Rear master cylinder nut	30-40 ft-lbs	40.7-54.2 Nm	2.15 REAR BRAKE MASTER CYLINDER, Installation
Rear shock bolt	121-136 ft-lbs	164.0-184.4 Nm	2.22 REAR SHOCK ABSORBERS, Installation
Rear shock locknut	32-39 ft-lbs	43.4-52.9 Nm	2.22 REAR SHOCK ABSORBERS, Installation
Rear stoplight switch	12-15 ft-lbs	16.3-20.3 Nm	7.33 REAR STOPLIGHT SWITCH, Installation
Rigid fork leg stud	60-65 ft-lbs	81.3-88.1 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Rigid fork pivot stud	25-35 **in-lbs**	2.8-4.0 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover bolts	15-18 ft-lbs	20.3-24.4 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.17 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Rocker pivot stud acorn nut	45-50 ft-lbs	61.0-67.8 Nm	1.22 ROCKER BEARINGS: FLSTSB, Inspection
Rocker pivot stud acorn nut	45-50 ft-lbs	61.0-67.8 Nm	2.19 FRONT FORK: SPRINGER, Spring Fork
Saddlebag Flange Nuts: FLSTC	120-144 **in-lbs**	13.6-16.3 Nm	2.47 SADDLEBAGS: FLSTC, Installation

FASTENER	TORQUE VALUE		NOTES
Saddlebag Lower Bracket Acorn Nut: FLSTC	120-144 **in-lbs**	13.6-16.3 Nm	2.47 SADDLEBAGS: FLSTC, Installation
Sealing fasteners	26-28 ft-lbs	35.3-38.0 Nm	5.5 PRIMARY CHAINCASE HOUSING, Installation
Seat Fasteners: FXSTC	60-80 **in-lbs**	6.8-9.0 Nm	2.42 SEAT: FXSTC, Removal and Installation
Seat hinge nut	20-25 ft-lbs	27.1-33.9 Nm	2.45 SEAT: FLSTSB, Seat: FLSTSB
Seat hinge screw	90-110 **in-lbs**	10.2-12.4 Nm	2.43 SEAT: FXCWC, Removal and Installation
Seat hinge screw	14-16 ft-lbs	19.0-21.7 Nm	2.45 SEAT: FLSTSB, Seat: FLSTSB
Seat pillion support fastener	30-35 ft-lbs	40.7-47.5 Nm	2.43 SEAT: FXCWC, Removal and Installation/Initial torque
Seat pillion support fastener	38-42 ft-lbs	51.5-56.9 Nm	2.43 SEAT: FXCWC, Removal and Installation/Final torque
Seat spring support bracket bolts	15-20 ft-lbs	20.3-27.1 Nm	2.45 SEAT: FLSTSB, Seat: FLSTSB
Secondary cam chain tensioner fastener	100-120 **in-lbs**	11.3-13.6 Nm	3.26 CAM SUPPORT PLATE AND COVER, Camshafts
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	6.6 TRANSMISSION ASSEMBLY, Assembly
Shifter rod lever screw	18-22 ft-lbs	24.4-29.8 Nm	6.8 TRANSMISSION CASE, Assembly
Shifter rod locknut	80-120 **in-lbs**	9.0-13.6 Nm	6.4 SHIFTER LINKAGE, Shifter Rod
Signal lamp mounting bracket screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Signal lamp mounting bracket screws	36-60 **in-lbs**	4.1-6.8 Nm	7.18 AUXILIARY LAMPS: FLST/FLSTC/FLSTN, Adjustment: FLST/FLSTC/FLSTN Models
Slider Tube Cap	60-70 ft-lbs	81.3-95.0 Nm	2.18 FRONT FORK: TELESCOPIC, Installation
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	7.13 STARTER, Field Coil Assembly
Spark plug	12-18 ft-lbs	16-24 Nm	1.5 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.18 SPARK PLUGS, Inspection
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	3.8 TROUBLESHOOTING, Compression Test
Speedometer console nut	7-11 ft-lbs	9.5-14.9 Nm	7.26 SPEEDOMETER: ALL BUT FXCWC, Installation
Speedometer housing cup	50-60 **in-lbs**	5.7-6.8 Nm	7.25 INSTRUMENT CONSOLE: FXCWC, Installation
Splash guard fastener (all but FXCWC)	36-48 **in-lbs**	4.1-5.4 Nm	4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister
Splash guard fastener (All But FXCWC)	36-48 **in-lbs**	4.1-5.4 Nm	3.31 OIL TANK: ALL BUT FXCWC, Installation
Splash guard fasteners: FXCWC	36-60 **in-lbs**	4.1-6.8 Nm	3.32 OIL TANK: FXCWC, Installation
Splash guard fasteners: FXCWC	36-60 **in-lbs**	4.1-6.8 Nm	7.3 ELECTRICAL PANEL, Installation: FXCWC
Splash guard fasteners (FXCWC)	36-60 **in-lbs**	4.1-6.8 Nm	4.20 EVAPORATIVE EMISSIONS CONTROL (CA MODELS), Charcoal Canister
Splash guard screw: all but FXCWC	36-48 **in-lbs**	4.1-5.4 Nm	7.3 ELECTRICAL PANEL, Installation: All But FXCWC
Spoke nipple	55 **in-lbs**	6.2 Nm	1.8 TIRES AND WHEELS, Wheel Spokes
Spoke nipple	55 **in-lbs**	6.2 Nm	2.9 TRUING LACED WHEELS, Truing Wheels
Spring bridge acorn nut	30-35 ft-lbs	40.7-47.5 Nm	2.19 FRONT FORK: SPRINGER, Spring Fork
Spring rod acorn nut (spring fork)	20-25 ft-lbs	27.1-33.9 Nm	2.19 FRONT FORK: SPRINGER, Spring Fork

FASTENER	TORQUE VALUE		NOTES
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	7.13 STARTER, Field Coil Assembly
Starter mounting bolts	25-27 ft-lbs	33.9-36.6 Nm	7.13 STARTER, Installation
Starter nut	70-90 **in-lbs**	7.9-10.2 Nm	1.25 BATTERY MAINTENANCE, Installation and Connection
Starter nut	70-90 **in-lbs**	7.9-10.2 Nm	7.12 BATTERY CABLES, Routing Procedure
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	7.13 STARTER, Field Coil Assembly
Stator screws	55-75 **in-lbs**	6.2-8.4 Nm	7.23 ALTERNATOR, Installation/T27 TORX, use only once
Steel laced wheel spoke nipple	55 **in-lbs**	6.2 Nm	1.5 MAINTENANCE SCHEDULE, General
Steering head bearing retainer final torque	120-144 **in-lbs**	13.6-16.3 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Steering head bearing retainer initial torque	20-25 ft-lbs	27.1-33.9 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Tail lamp connector cover fastener	8-30 **in-lbs**	0.9-3.4 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
Tail lamp fastener: FLSTN	8-30 **in-lbs**	0.9-3.4 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
Tail lamp fasteners	60-90 **in-lbs**	6.8-10.2 Nm	7.17 TAIL LAMP: FLSTN, Tail Lamp Replacement
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm	7.16 TAIL LAMP: ALL BUT FLSTN, Bulb Replacement
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.11 IDLE AIR CONTROL (IAC), Installation
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.12 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), Installation/Use new screws
Throttle control housing screws	35-45 **in-lbs**	4.0-5.1 Nm	2.24 THROTTLE CONTROL, Assembly/Installation
Throttle position sensor fasteners	18 **in-lbs**	2.0 Nm	4.7 THROTTLE POSITION SENSOR (TPS), Installation
Top engine mount bolt	45-50 ft-lbs	61.0-67.8 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission drain plug	14-21 ft-lbs	19-28 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	6.8 TRANSMISSION CASE, Installation
Transmission filler plug	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission filler plug torque	25-75 **in-lbs**	3-9 Nm	1.5 MAINTENANCE SCHEDULE, General
Transmission lockplate screws	84-108 **in-lbs**	9.5-12.2 Nm	5.7 TRANSMISSION SPROCKET, Installation/LOCTITE patch, use 3-5 times
Transmission mounting bolts (final torque)	34-39 ft-lbs	46.1-52.9 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts (initial torque)	15 ft-lbs	20.3 Nm	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts-final torque	34-39 ft-lbs	46.1-52.9 Nm	6.8 TRANSMISSION CASE, Installation
Transmission mounting bolts-initial torque	15 ft-lbs	20.3 Nm	6.8 TRANSMISSION CASE, Installation
Transmission side door screw	13-18 ft-lbs	17.6-24.4 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Transmission sprocket nut: final torque	35 ft-lbs + 35-40 degrees	47.5 Nm + 35-40 degrees	5.7 TRANSMISSION SPROCKET, Installation

FASTENER	TORQUE VALUE		NOTES
Transmission sprocket nut: initial torque	35 ft-lbs	47.5 Nm	5.7 TRANSMISSION SPROCKET, Installation/Right hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 271 (red) to last few threads.
Transmission top cover	84-132 **in-lbs**	9.5-14.9 Nm	6.6 TRANSMISSION ASSEMBLY, Installation
Turn/running/stop lamp fastener: FXCWC	10-12 ft-lbs	13.57-16.28 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
Turn signal bar screws: FLSTN	15-19 ft-lbs	20.4-25.8 Nm	7.19 TURN SIGNALS AND RUNNING LIGHTS, Lamp Replacement
Upper engine mounting bolt	45-50 ft-lbs	61.0-67.8 Nm	3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Upper engine mounting to cylinder head bolts	35-40 ft-lbs	47.5-54.3 Nm	1.26 ENGINE MOUNTS, Inspection
Upper engine to frame mounting bolt	45-50 ft-lbs	61.0-67.8 Nm	1.26 ENGINE MOUNTS, Inspection
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.20 STEERING HEAD BEARINGS: ALL BUT FLSTSB, Adjustment: FLST, FLSTC, FLSTF/B, FLSTN
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.21 STEERING HEAD BEARINGS: FLSTSB, Adjustment: FLSTSB
Upper fork stem pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	1.21 STEERING HEAD BEARINGS: FLSTSB, Adjustment: FLSTSB
Upper rear fender mounting bolts-final torque	48-52 ft-lbs	65.1-70.6 Nm	2.35 REAR FENDER: FXCWC, Installation
Upper rear fender mounting bolts-initial torque	30-35 ft-lbs	40.7-47.5 Nm	2.35 REAR FENDER: FXCWC, Installation
Upper triple clamp pinch bolt	25-30 ft-lbs	33.9-40.7 Nm	2.19 FRONT FORK: SPRINGER, Rigid Fork
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.17 TIRES, Installation
Vehicle speed sensor mounting bolt	84-108 **in-lbs**	9.5-12.2 Nm	7.28 VEHICLE SPEED SENSOR (VSS), Installation
Voltage regulator	50-80 **in-lbs**	5.7-9.0 Nm	7.7 FRONT ELECTRICAL CADDY, Assembly
Voltage regulator bracket to crankcase fasteners	70-100 **in-lbs**	7.9-11.3 Nm	7.7 FRONT ELECTRICAL CADDY, Assembly

D

E

F

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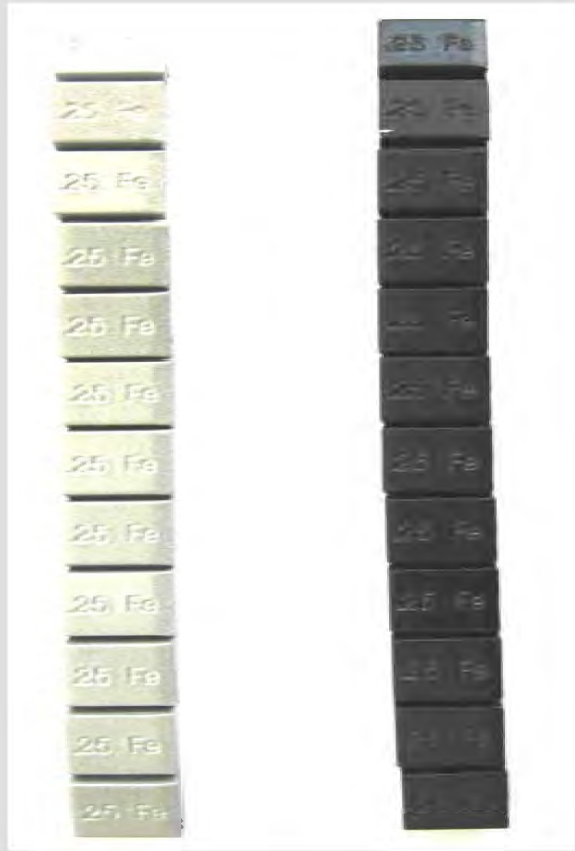
W

2010 Harley-Davidson® New Model and Technical Information

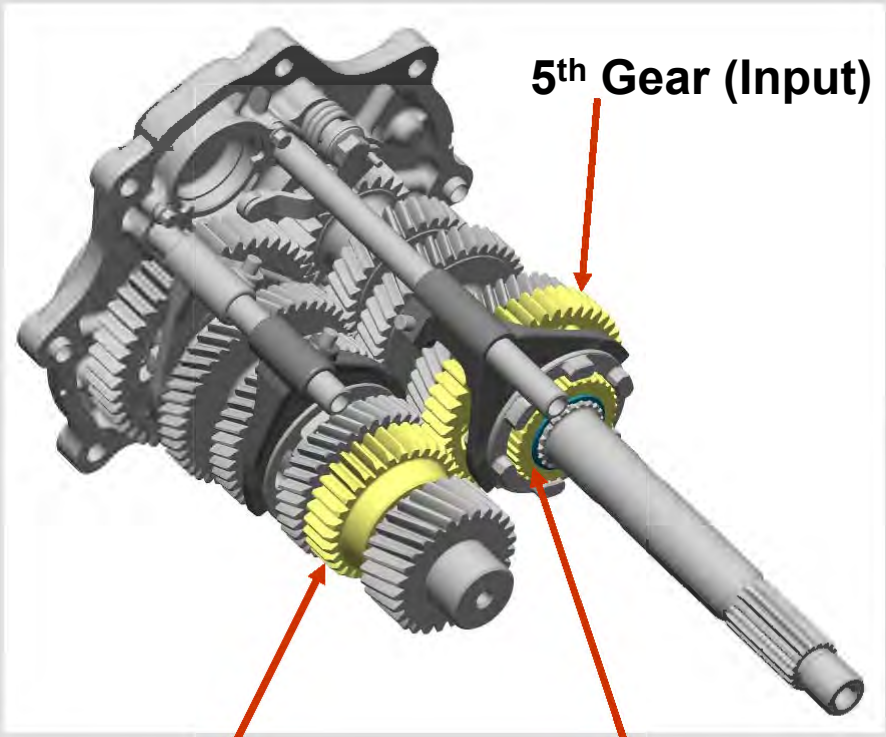
All Big Twin Models

- Tire pressures commonized across models
- Lead free wheel weights
  - this is a running change
  - the segments will be a different weight
    - they were 0.25 oz (7 gm)
    - they now are 0.18 oz (5 gm)

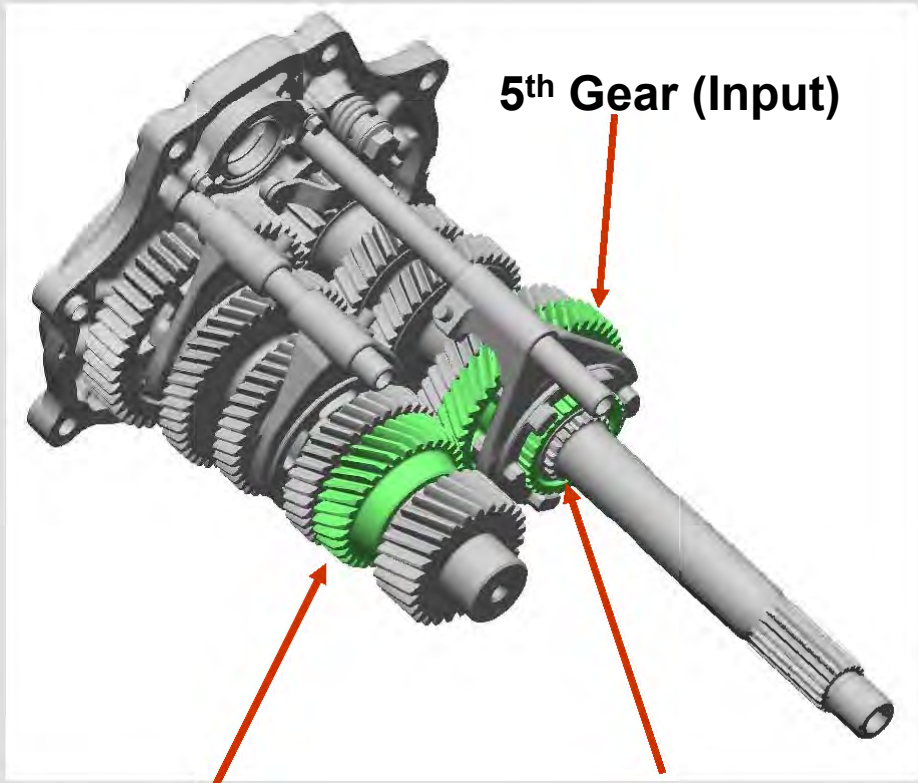


2010 Big Twin Transmission Changes

2009 - Earlier



2010 Model Year



2010 Big Twin Transmission Changes

What changed and why?

- Helical 5th gear – Has greater thrust loads.
- Snap ring groove moved inboard by about 0.90” to add material behind the snap ring.
- Moving the groove resulted in a change to the guide hub, adding the counterbore.
- The new mainshaft will be used for all replacement parts and transmissions.

2010 Big Twin Transmission Changes

- The mainshaft is retrofitable as a kit that contains the mainshaft, guide hub, snap ring and needle bearing.
  - Will require the new mainshaft inner primary bearing race.

- All replacement transmissions will come with the new mainshaft assembly (with the new gear hub).

- Upgrading to helical 5th is **Not Retrofitable**
  - Results of upgrading to the helical 5th gear
    - Vehicle Speed slower than indicated by speedometer
    - The 6th gear light may not function correctly
    - No plan for new calibration

2010 VIN Changes

2009 VIN Scheme

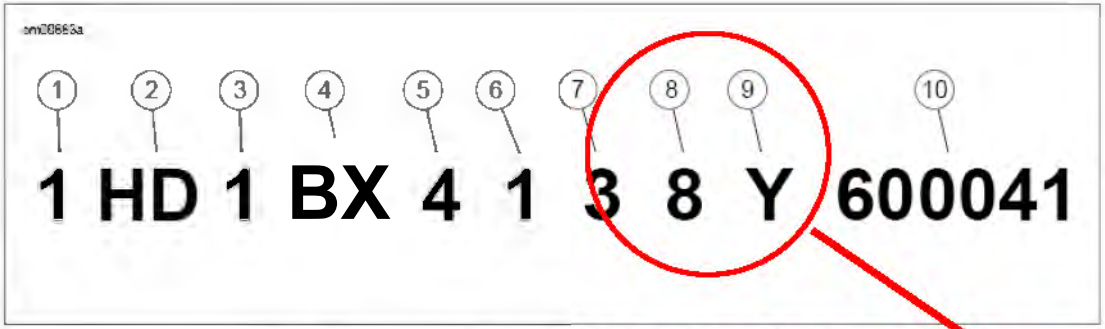


Figure 1. Typical Harley-Davidson V.I.N.: 2008 Touring Models

2010 VIN Scheme

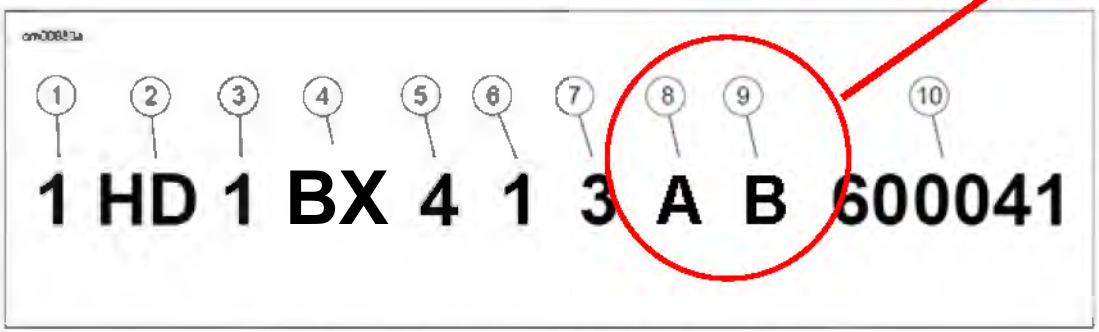


Figure 1. Typical Harley-Davidson V.I.N.: 2010 Touring Models

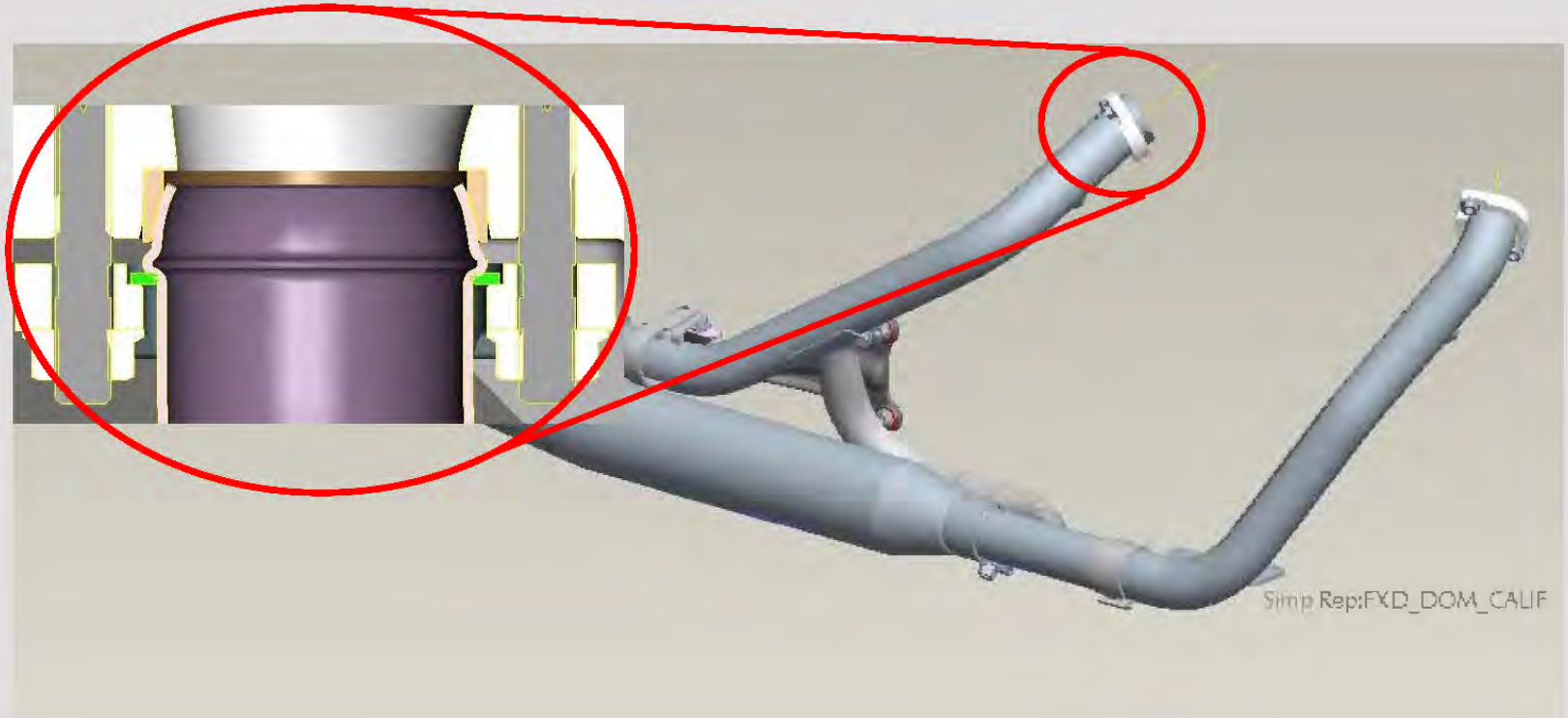
Changes in the 8th and 9th character

2010 VIN Changes

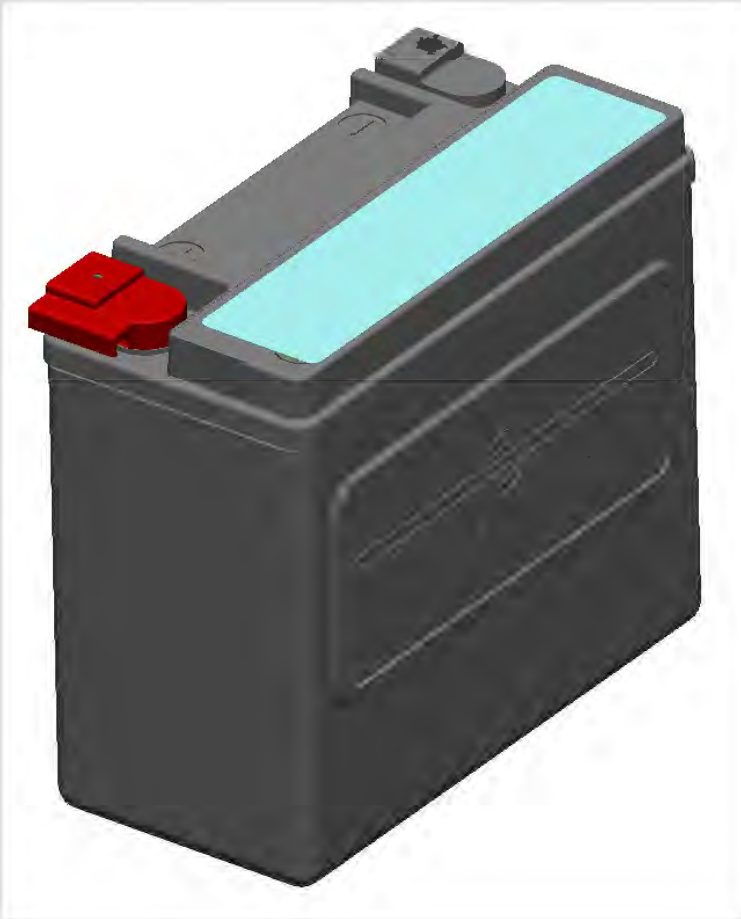
POSITION	DESCRIPTION	POSSIBLE VALUES	
1	Market designation	1=Originally manufactured for sale within the United States 5=Originally manufactured for sale outside of the United States	
2	Manufacturer	HD=Harley-Davidson	
3	Motorcycle type	1=Heavyweight motorcycle (901 cc or larger)	
4	Model	See V.I.N. model table	
5	Engine type	4=Twin Cam 96™, 1584 cc air cooled, fuel injected	
6	Introduction date/ calibration	1 = Regular introduction date/ 49 State calibration 2 = Mid-year introduction date/ 49 State calibration 3 = Regular introduction date/ California calibration 4 = Cosmetic changes and/or special introductory date/ California calibration 5 = cosmetic changes and/or special introductory date/ California calibration 6 = California/mid-year/ California calibration **A** = Regular introduction date CAN Calibration **B** = Mid-year introduction date/ CAN Calibration **C** = Regular introduction date HDI Calibration **D** = Mid-year introduction date/ HDI Calibration **E** = Regular introduction date JPN Calibration **F** = Mid-year introduction date/ JPN Calibration **G** = Regular introduction date AUS Calibration **H** = Mid-year introduction date/ AUS Calibration **J** = Regular introduction date BRZ Calibration **K** = Mid-year introduction date/ BRZ Calibration	
7	V.I.N. check digit	Can be 0-9 or X	
8	Model year	**5 = 2005** **6 = 2006** **7 = 2007** **8 = 2008** **9 = 2009**	**A = 2010** **B = 2011** **C = 2012** **D = 2013** **E = 2014**
9	Assembly plant	**1981 T0 2009** **T = Tomahawk, WI** **Y = York, PA** **K = Kansas City, MO** **M = Manaus, Brazil** **3 = Buell East Troy**	**2010 TO 2039** **A = Tomahawk, WI** **B = York, PA** **C = Kansas City, MO** **D = Manaus, Brazil** **E = Buell East Troy**
10	Sequential number	Varies	

All Big Twin Models

New spherical exhaust port pipe endform offers improved seal and fitment.



New Battery



Same external geometry and cable interface with a new internal design.

2010 Dyna® Models

2010 Dyna® Models
(Returning Models)

FXD

FXDB

FXDC

FXDF

FXDL
(Japan only)

2010 Dyna® Suspension Changes

- No changes to front forks except for torques and fork oil level
- No changes to FXDF or FXDL
- All Dyna® models now use the FXDB belt tension specification
- The chart to the right explains which rear shocks were used on 2009 models and which shocks will be used on 2010 models.

2009 vs. 2010 Dyna® Shocks		
	2009 Rear Shocks	2010 Rear Shocks
FXD	54517-06	54615-01
FXDB	54615-01	54615-01
FXDC	54512-90A	54615-01
FXDL	54534-09	54615-01
FXDF	54537-08A	54537-08A
FXDWG	54615-01	54615-01

2010 Dyna® Models

- Wider tunnels on all fuel tanks
- New Guide for Assembly to Protect Paint

2010 Dyna® Models

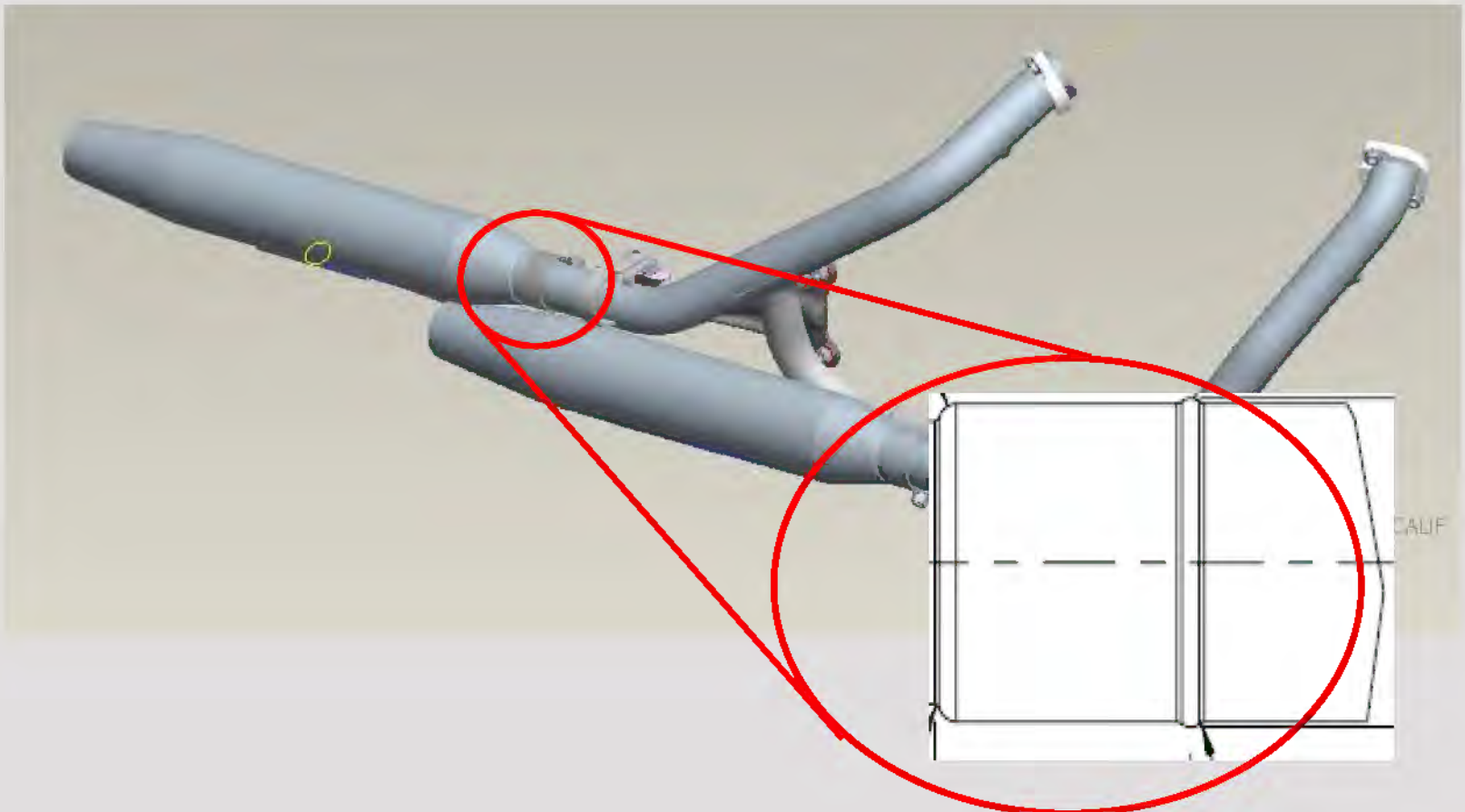
- 7-pin design floating rotors on all models with laced wheels

2010 Dyna® Models Exhaust System Updates

- Meet MY2010 EPA Emissions regulations for all Harley-Davidson® vehicles sold in 50 state and Canadian markets
- Reduce oxygen intrusion into the exhaust system
  - Promotes catalyst health and efficiency

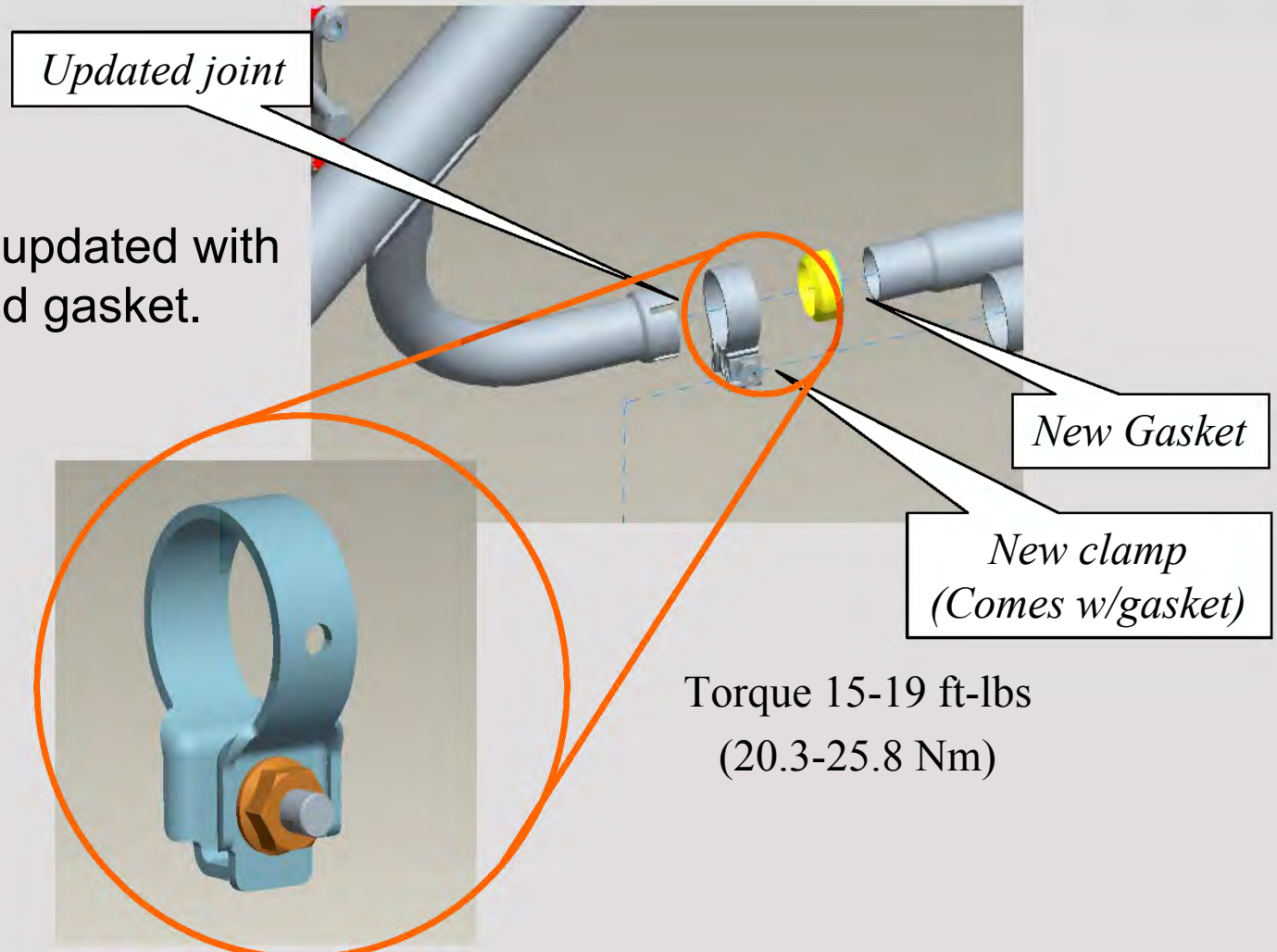
2010 Dyna® Models

New rib/curl pipe end feature offers positive muffler stop and improved pipe consistency.



2010 Dyna® Models

Crossover joints updated with new clamp and gasket.



New 2010 FXDWG
Wide Glide®

New 2010 FXDWG Wide Glide®

*All Dyna® Models

New 2010 FXDWG Wide Glide®

Domestic tail lights

Side mount license plate Domestic only

Canada & all International tail lights

Taillight (HDI/Canada)

New 2010 FXDWG Wide Glide®

- Internally wired handlebar
- 34 degree frame with tank mount boss raised by ¾” & rear forgings moved out 2mm each side from FXDF
- Flame tank replacement part is VIN restricted
- Two new rear fenders (Domestic & HDI/Canada)

2010 Softail® Models

2010 Softail® Models
(Returning Models)

Heritage® Custom
(Brazil only)

Softail® Deluxe

Softail® Cross Bones®

Softail® Custom

Heritage Softail® Classic

Softail® Standard
(Australia & Japan only)

Softail® Rocker™ C

Fat Boy®

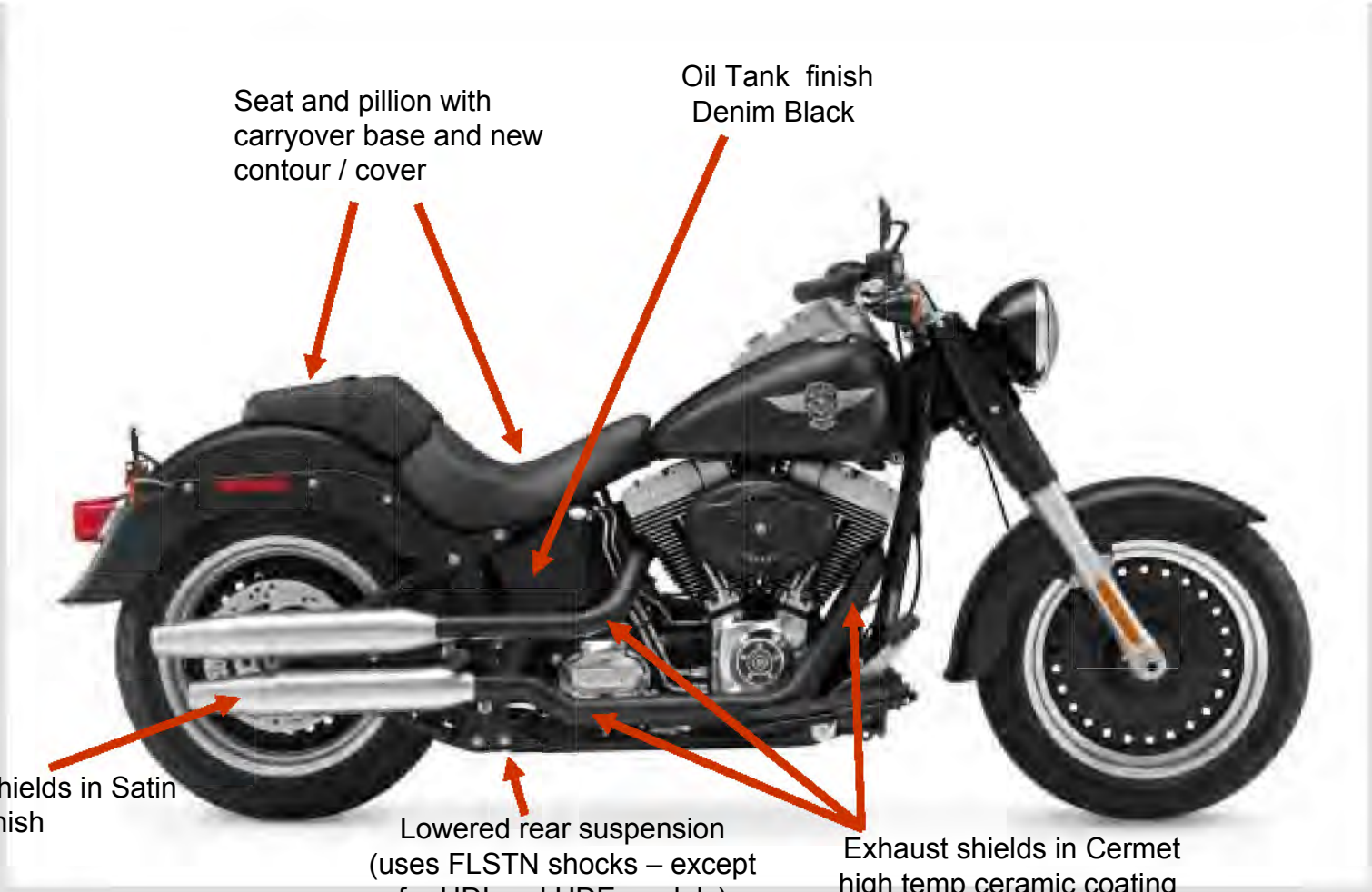
2010 Softail® Models

2 Softail® models have
been dropped for 2010

Night Train®

Rocker®

NEW 2010 FLSTFB
Fat Boy® Lo
(Fat Boy® Special in HDI and HDE markets)



2010 Softail® Models

Rear Fender Electrical Routing
- Rocker rear fender – change rivets to push pins
- Add grommet to rear lighting harness on all Bobtails

Rocker Main Harness
- Changes to facilitate commonizing gnd. location with the rest of the Softail family

New Master Cylinder Cap/Gasket
- Changes to the master cylinder cap and gasket to improve sealing

Mufflers
- New internals – better sealing at the catalyst
- New pipe to muffler seal
- California & 49-state mufflers commonized

Rocker crossover tube
- Mounting wedges removed
- New interconnect gasket
- Adding clamps at interconnect joints

Exhaust Pipes
- New end forms at head & muffler joints
- New pipe to muffler clamp & gasket

Transmission
- Helical 5th gear in transmission

2010 FLSTC Softail® Models

Fuel Tank Panel

Change holes

Adding ABS Back and UV Protection to Leather

2010 Softail® Models

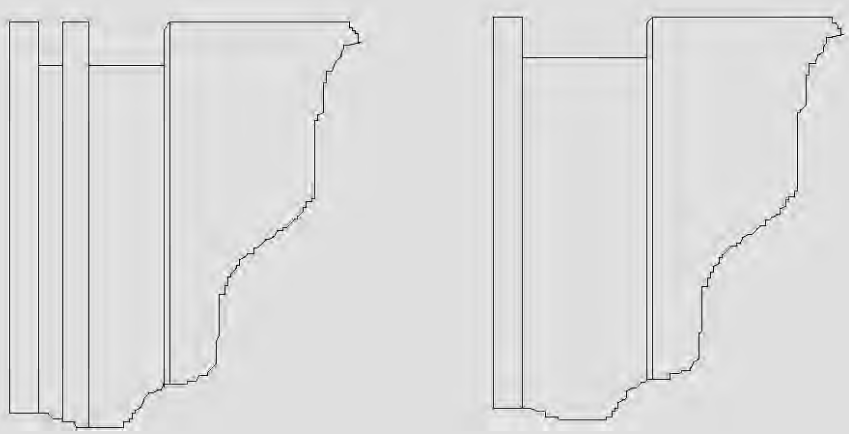
- Change to zinc plated finish for better clamp load retention

Softail® Engine Bracket

2010 Softail® Models

FLSTF New Grip

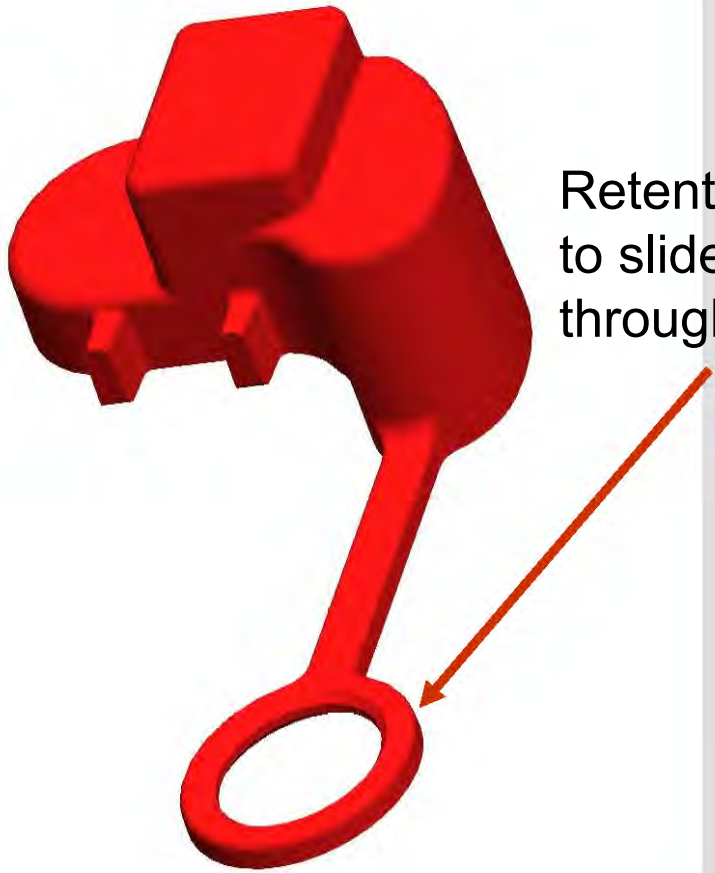
Removed rib to allow for more compliance with the switch housing location.



2010 Softail® Models

- Used on all Softail® Models
- No tie-wrap needed

Positive Battery Cable Boot



2010 Softail® Models

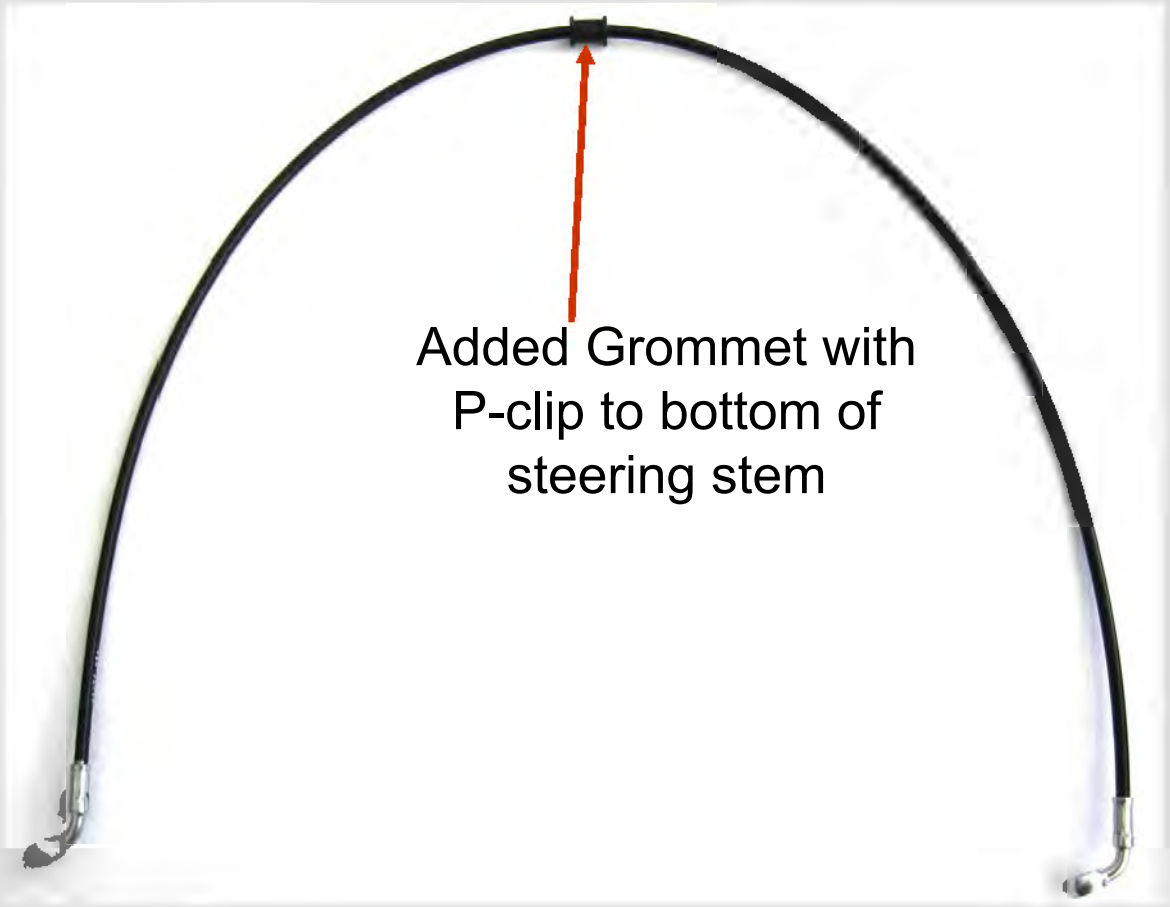
46953-08A
FXCWC

FXCWC left hand slider change

Changes in radii

2010 Softail® Models

FXCWC Front Brake line



2010 Softail® Models

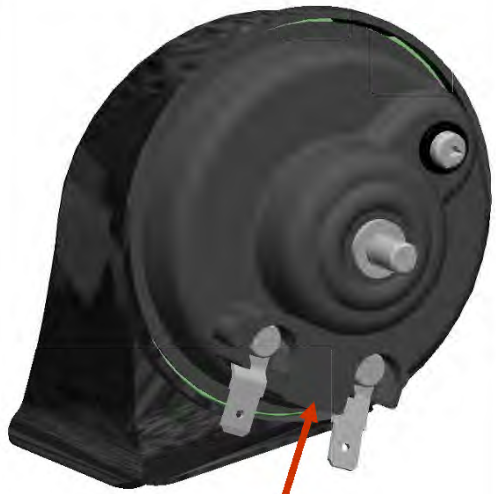
New Horn
Isolator Design

Two-Piece insert (current)

One-Piece insert

2010 Softail® Models

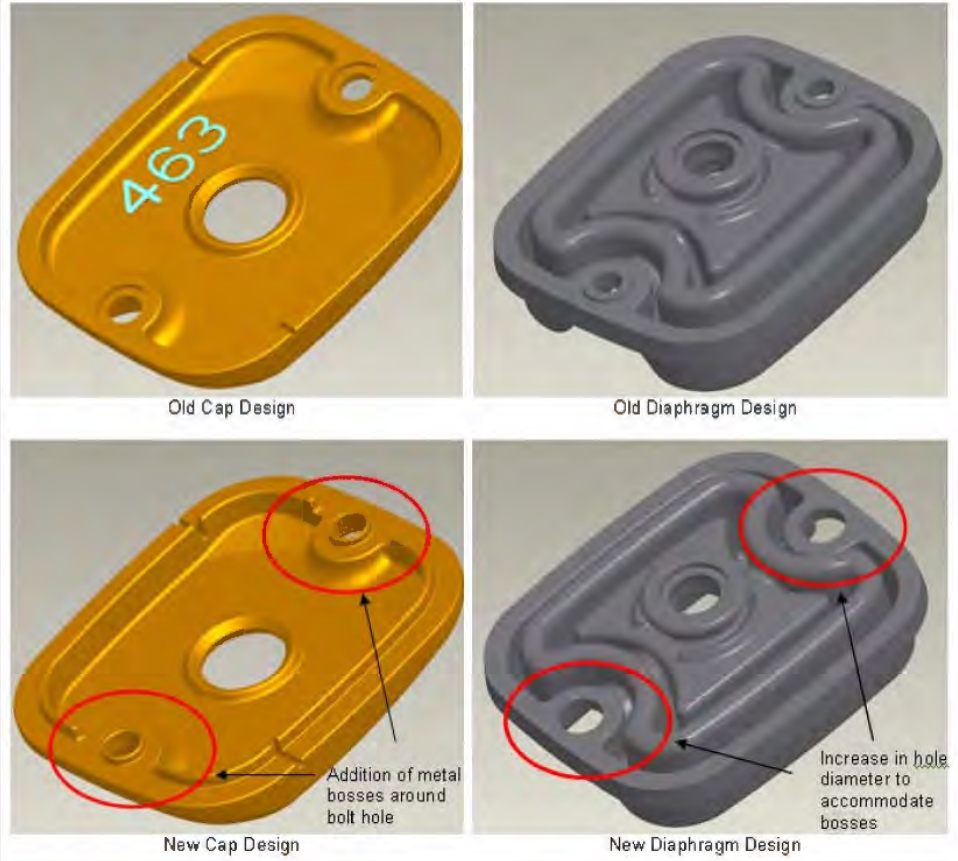
New Horn



Breather hole re-located from diaphragm to bottom side of connector.

2010 Softail® Models

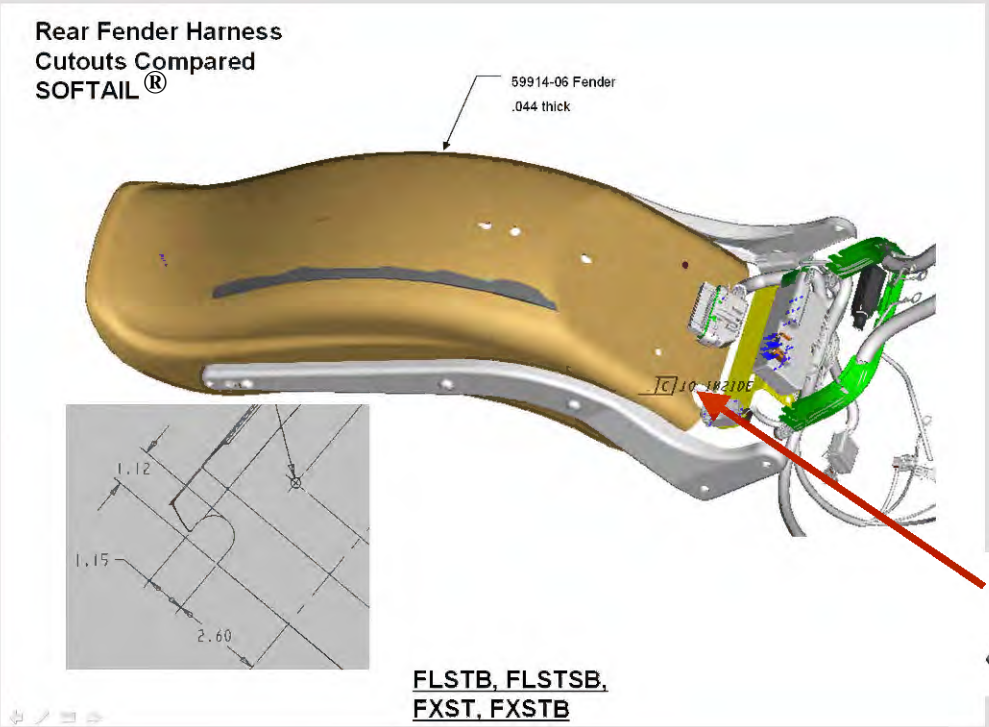
New Master Cylinder Cap and Gasket



2010 Softail® Models

Rear Fender Lighting Harness Grommet

- Improvement to address possible wire chafing
- Only on Bobtail rear lighting harnesses



2010 Sportster® Models

2010 Sportster® Models

883 Models (Domestic / HDI)

XL 883L

XL 883N

XL 883R (HDI only)

2010 Sportster® Models

1200 Models (Domestic / HDI)

XL 1200C

XL 1200L

XL 1200N

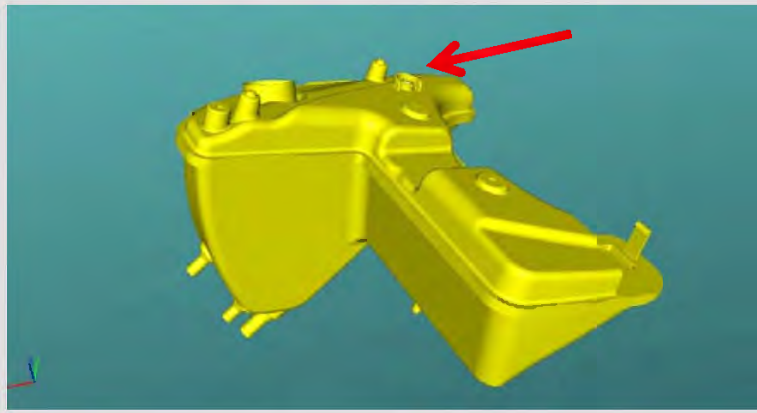
XR1200™

2010 XL Sportster® Content

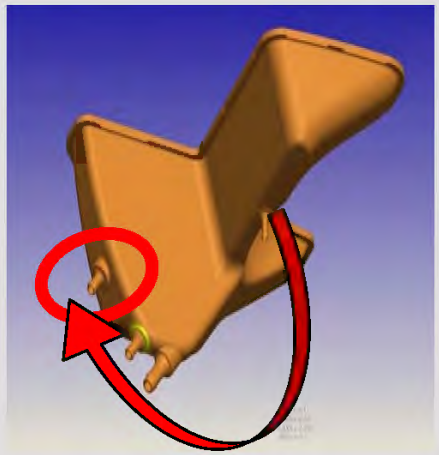
- ECM relocation to down tube behind rear cylinder
  - Design allows for XL harness to be installed in the same assembly location as XR harness
- Consolidation and reorientation of fuse block
  - Addresses current warranty concern (water intrusion/corrosion) by positioning the fuse block in a downward sloping orientation and adding a protective cover
  - Consolidation of wire harness circuits has reduced the amount of fuses within the fuse block
- New oil tank
- New oil tank bracket
  - Dual purpose mounting of oil tank and ECM Caddy

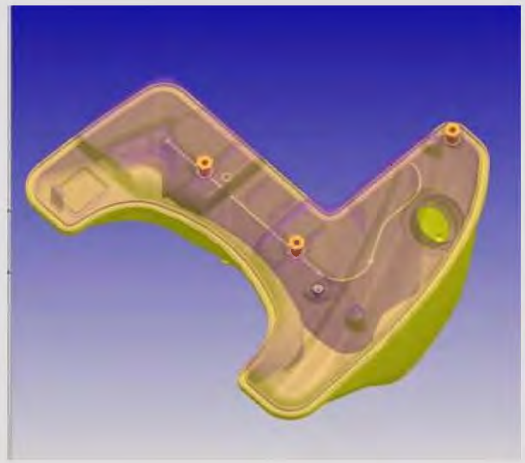
2010 Sportster® Oil Tank

1. Added 10 psi. Pressure Relief Valve Assembly:
   - The oil tank has a pressure relief valve in the top of the tank
   - If the vent line is pinched, restricted or if the tank is overfilled, excessive pressure is created in the oil tank
   - The valve opens if the pressure in the tank exceeds 10 psi. to prevent damage to the oil tank



2. New XL Oil Return Line location, moved to right hand side of XL models due to the ECM relocation.





New 2010 XR1200X™ (International)

New 2010 XR1200X™ (International)

- **Project Description** – Higher specification XR variant that complements the base XR1200™ model and provides key chassis performance features.

- **Key Features:**
  - Blacked out theme; engine, exhaust, paint, graphics
  - Fully adjustable high performance suspension
  - Highlighted wheels
  - Floating front rotors
  - New graphics and denim paint

New 2010 XR1200X™ (International)

- New Big Piston Forks
  - High performance light weight front fork
  - Adjustable rebound and compression on top of the fork
  - Spring pre-load adjuster on the bottom of the fork
  - Requires the use of Harley-Davidson® BPF Performance Fork Oil (99885-10)

- New Rear Shock Absorbers
  - Fully adjustable (adjustable compression damping, rebound damping and spring preload), with attached reservoir.

- Consolidation and reorientation of fuse block
  - Addresses current warranty concern (water intrusion/corrosion) by positioning the fuse block in a downward sloping orientation and adding a protective cover.
  - Consolidation of wire harness circuits has reduced the amount of fuses within the fuse block.

- New oil tank

- New oil tank bracket
  - Dual purpose mounting of oil tank and the H-Clip.

XL/XR 2010 Exhaust Content

- **Carryover XL Interconnect/Support Bar**
  - Move to a common interconnect/support bar for all models
  - 65339-04 will go across all models

- **New XR Header Pipes**
  - Updated Catalyst
  - Catalyst is still located in header pipe assembly (same as 2009)

2010 Touring Models

2010 Touring Models
(Returning Models)

FLHTCU

FLHTC

FLHX

FLHRC

FLHR

FLHT
(England, HDI, Japan)

NEW 2010 FLTRX
Road Glide® Custom

- Shared content with the FLHX
  - Cruise Optional
  - 2 into 1 exhaust
  - Stop-tail-turn rear light bar and new fender harness

Road Glide®
Headlamp Changes

- Bubble replaced with shroud (similar to the P&A 2009 design)
- Headlamp mounting bracket modified to service bulbs without removing fairing. Allows replacement from the front.
- It is not recommended to retrofit the shroud on earlier model year vehicles since the head lamps also changed to tolerate exposure.

Road Glide®
Fairing Mount Changes

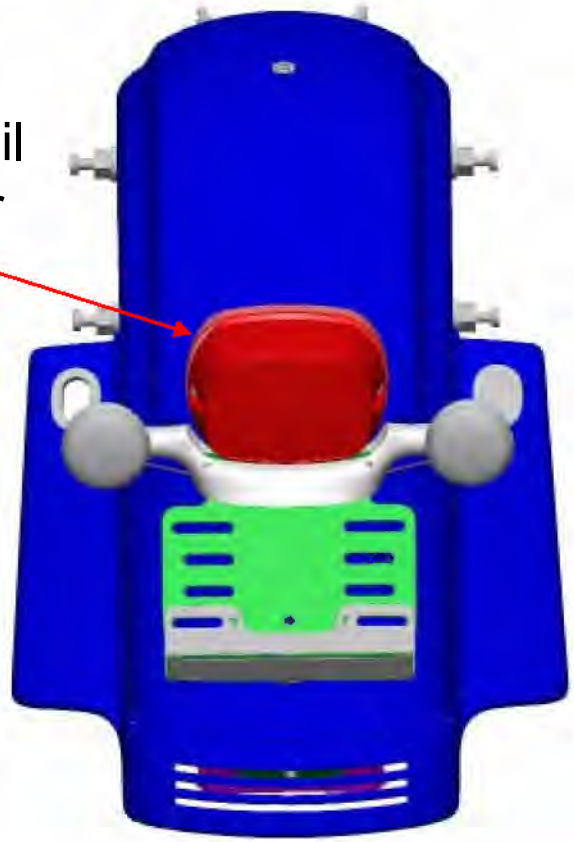
The outer/inner fairing is lifted up 0.800” and tipped 2 degrees forward.

Inner Fairing to Frame Stamped Mount
-Studs are moved 7/8” higher
-Clearance made to bottom front edge of mount

1.5” Angled Fairing Brackets
Two parts
- Left Side
- Right Side

Canadian Rear Lighting
(FLHX/FLTRX)

Conventional tail light with amber directionals.



HDI Rear Lighting
(FLHX/FLTRX)

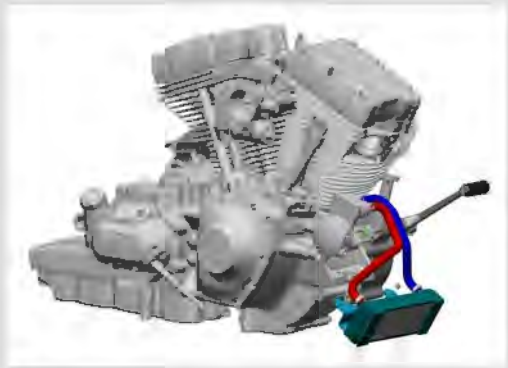
- Directional is LED, amber circle inset for turn signal
- Red LED panel for stop/running light

2010 FLHTK
Electra Glide® Ultra Limited

- FLHTK - Electra Glide® Ultra Limited
  - The upgrade for the average Ultra Classic® Electra Glide® customer
  - Top of the line in touring and rider comfort
  - Unique Two – Tone paint

2010 FLHTK
Electra Glide® Ultra Limited

- Twin Cam 103™ Engine (1690cc)
  - with Oil Cooler (no Cover)
  - with chrome accents
- Heated Hand Grips
- Cruise Control
- ABS
- Security System
- Tour-Pak® assembly with luggage rack and 12V power supply



Other Touring Changes for the 2010 Model Year

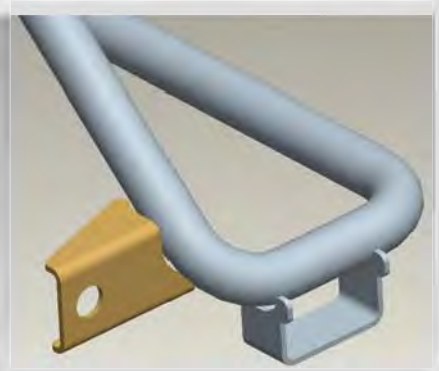
- Brembo® Front Plastic Master Cylinder Piston
  - Plastic Master Cylinder pistons are an industry standard

- Brembo® Plastic Rear Master Cylinder Cap (Running Change for 2010)

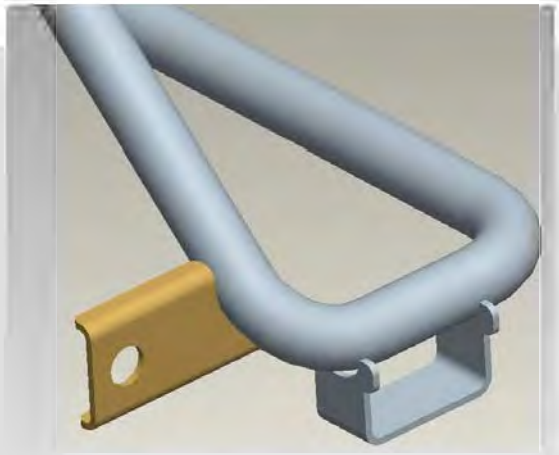
Saddlebag Bracket Improvement

Bracket change to accommodate the new 2 into 1 exhaust on FLHX and FLTRX

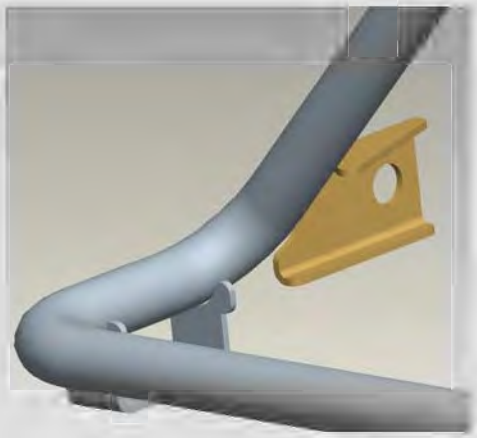
NEW



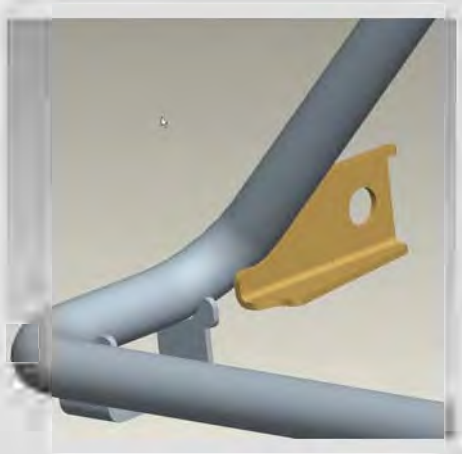
OLD



NEW

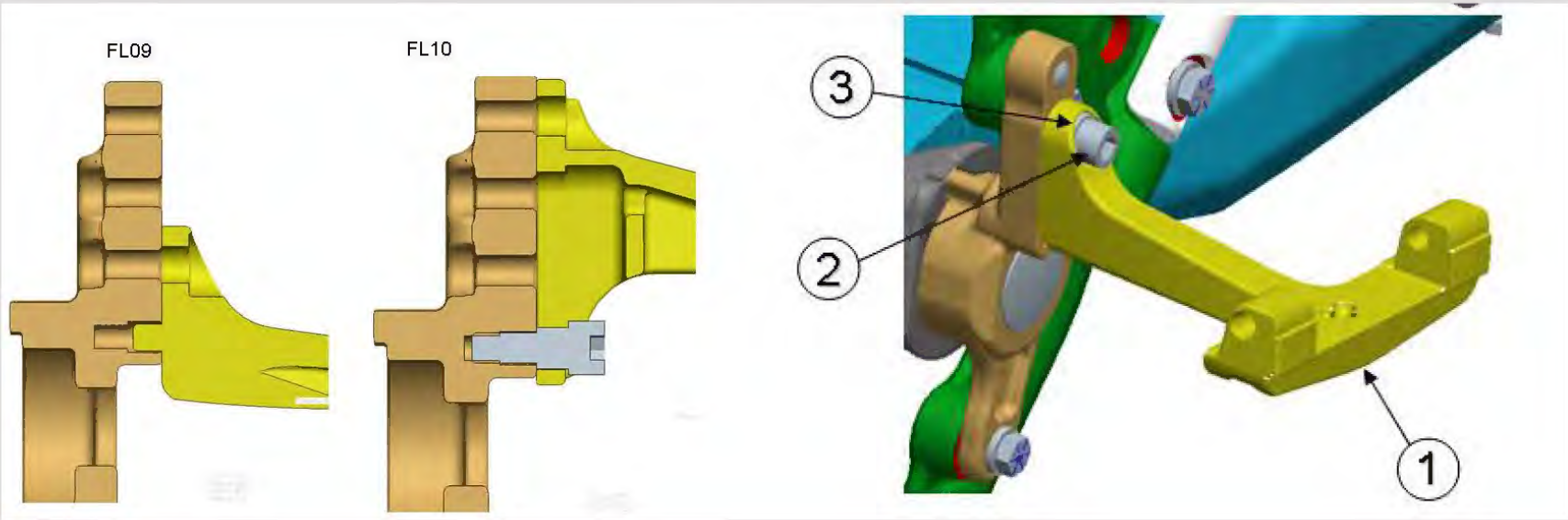


OLD



2010 Touring Passenger Foot Board Bracket Update

- Passenger Foot Board Bracket change
  - Adding bolt to bottom of bracket
  - Upper bolt can be removed to adjust bracket, lower bolt is a shoulder bolt and remains in place during bracket adjustment



New Heated Oxygen Sensor for 2010 Touring Models Only

- New smaller heated oxygen sensors will be integrated into the front pipe casting.
- New sensor is a 4 wire narrow band sensor.
- New service tool (HD-50017) is needed to torque the new heated O2 sensors.

2010 Trike Models

2010 Trike Models

FLHTCUTG

FLHXXX

2010 Trike Models

- **Powertrain:** Twin Cam 103™ Engine (1690cc); unique reinforced trans case, Trike specific Engine Mounts, unique snubber nuts, and pivot shaft torque
- **Driveline:** 70T sprocket, 1 1/8” belt, rear axle/diff assembly, rear drive compensation, reverse
- **Suspension:** Tuned rear shocks, Extended front forks – Unique sliders, Fork Tubes, Springs
- **Exhaust:** Header pipes – modified 2010 Touring
- **Wheels:** Matching front and rear cast alum wheels. Center rear hub cap.
- **Triple clamp:** Unique triple clamp with reduced trail for optimized steer effort, reduced steer angle

2010 Trike Models

- **Triple clamp integration:** Unique inner fairing, and fairing skirt, CVO™ Passing lamp/ turn signal bar for Tri Glide™, FLHX front turn signals for Street Glide® Trike
- **Steer Damper:** Ohlins® damper
- **Tires:** Automotive type Dunlop® Rears 205/65R15, front tire is a 16” 43022-91A
- **Brakes:** Brembo® dual front, Hayes® Rear disc brakes, Parking brake
- **Speedo:** Unique Calibration
- **Front fender**: Bumper removed FLHTCUTG and FLHX front fender on FLHXXX

2010 Trike® Models

- New Main Wiring Harnesses (reverse integrated rather than overlay)
- New Interconnect Harness (includes heated grip connectors)
- New Tail Light Harness
- Common Lower Fairing Caps with Touring models
- Improved Trunk Door Seal
  - Will retro-fit
- Updated Reverse Switch Housing with Revised Switch Graphics
  - Will retro-fit

2010 Trike® Models

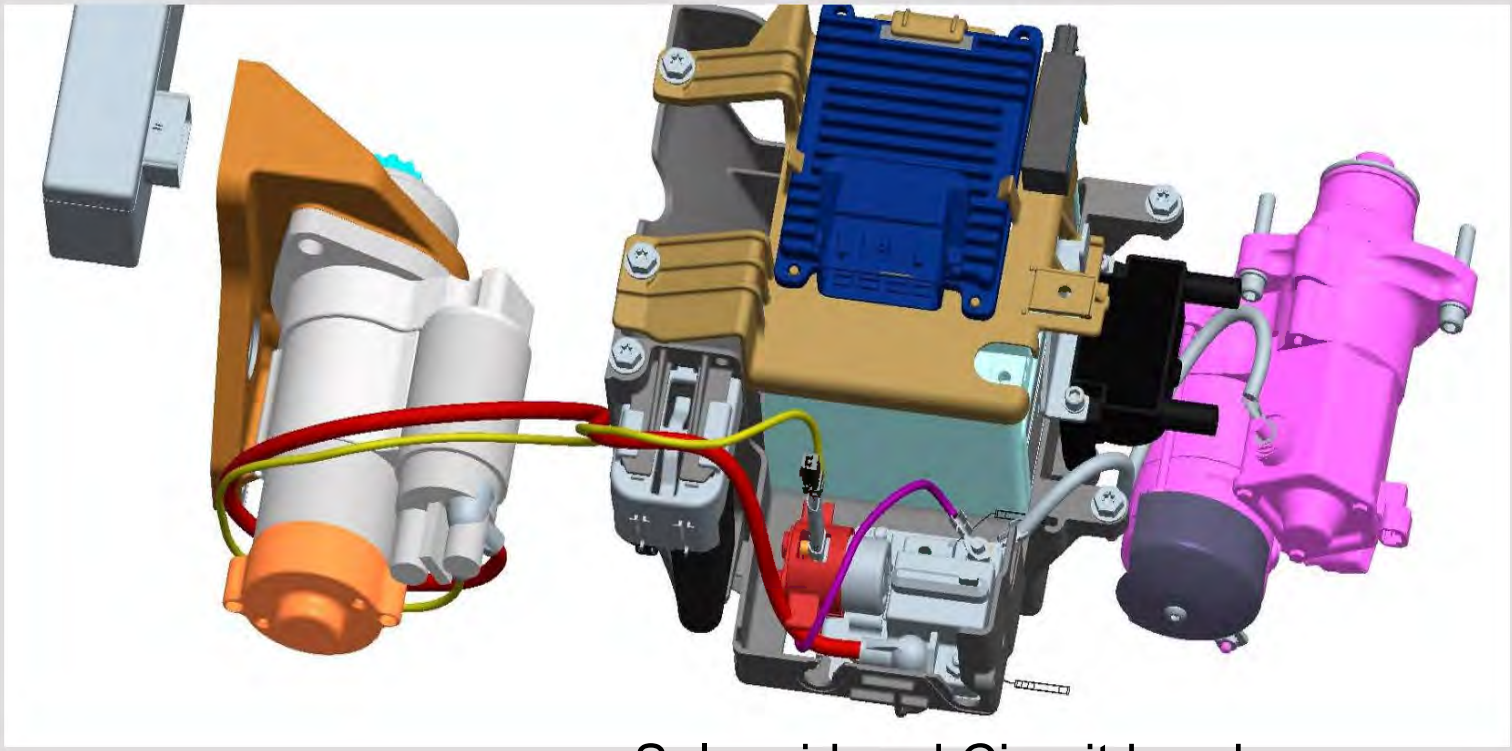
- Relocated Reverse Circuit Breaker and Solenoid
- Reduced Rear Brake Effort
  (New Master Cylinder and Calipers – will retro-fit)
- Steer Damper (improved temperature range-will retro-fit)

2010 Trike® Models

- Heated O2 Sensors
- Exhaust Catalyst / New right side exhaust for North America
- Helical 5th Gear
- Passenger Floorboard Support

2010 Trike® Models

Reverse Circuit Breaker Relocation
(New for 2010)



Solenoid and Circuit breaker under right side cover.

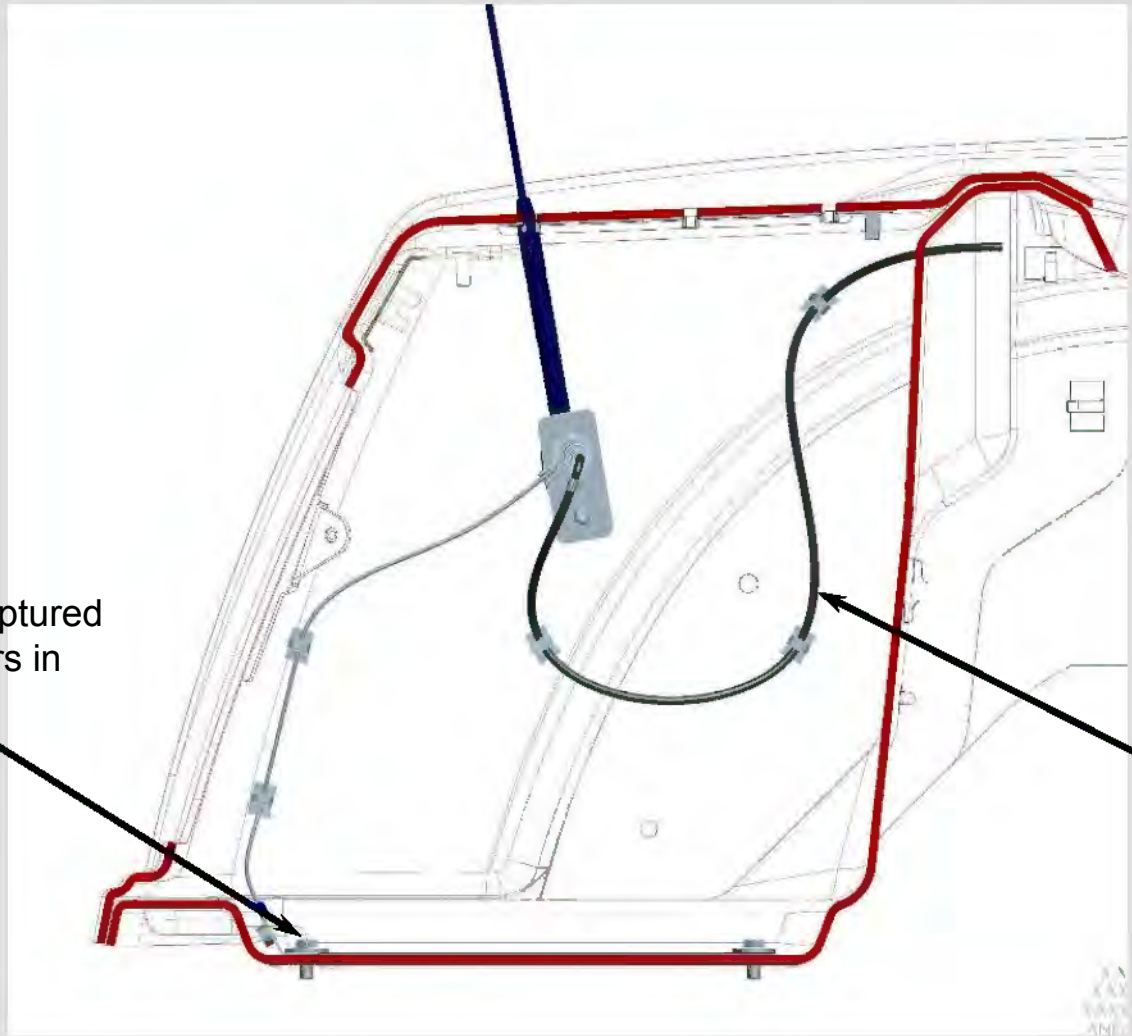
2010 FLHXXX Street Glide® Trike

- Unique steer damper bracket on the frame due to no engine guard.
- Unique body for antenna and no Tour-Pak® assembly.

2010 FLHXXX Street Glide® Trike

Antenna Location

2010 FLHXXX Street Glide® Trike

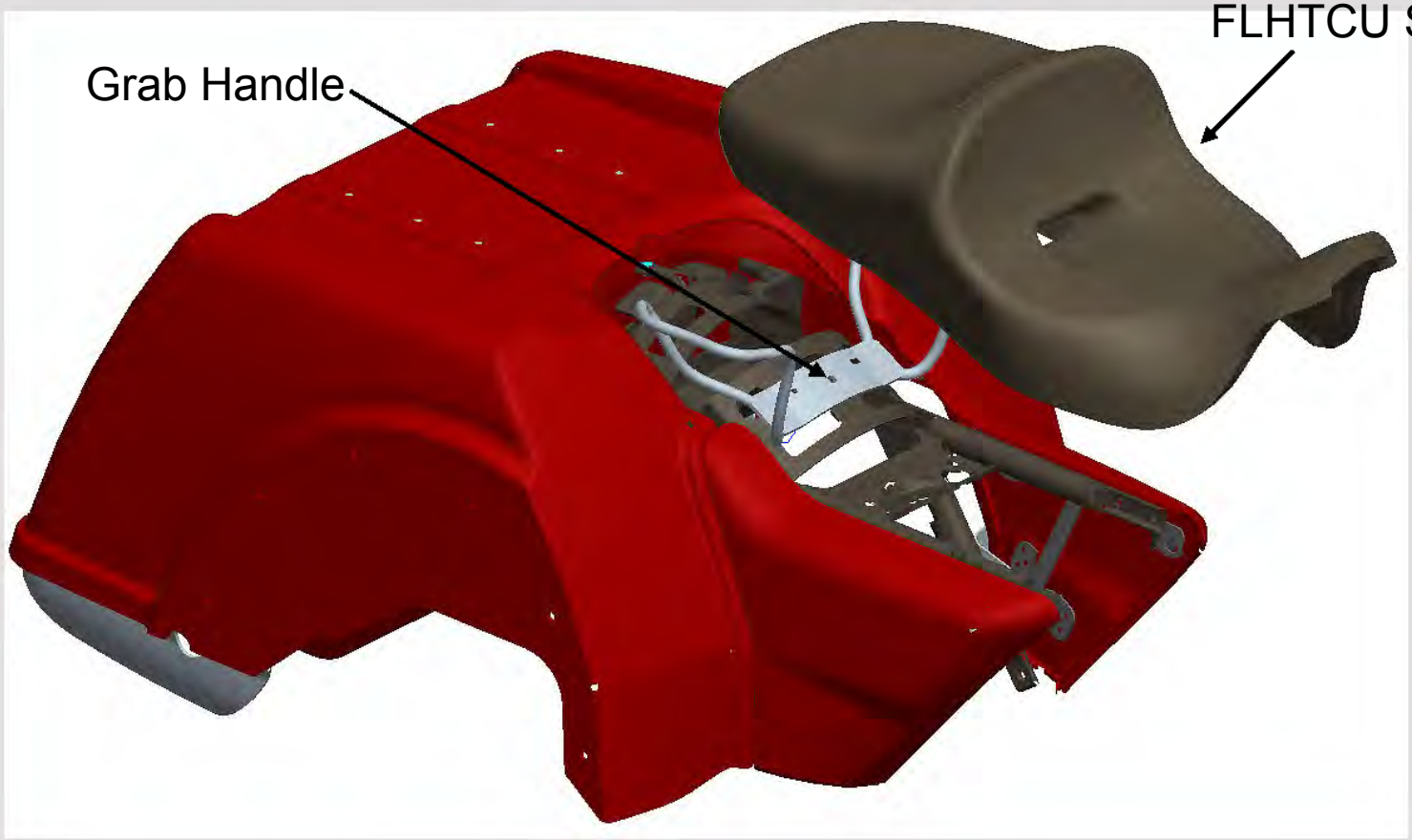


Ground Plate captured by body fasteners in 4 places

Antenna wire from main harness.

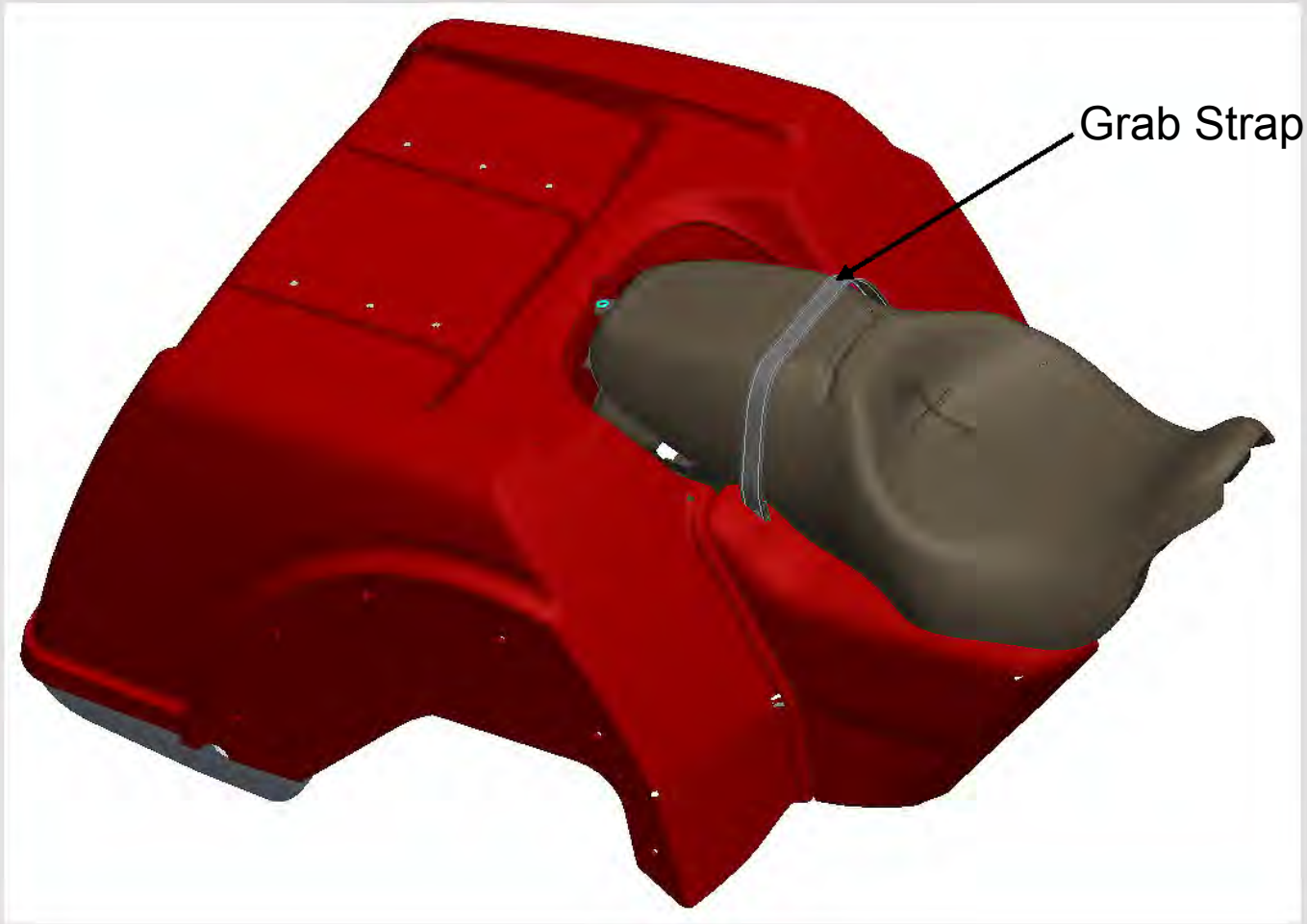
2010 FLHTCUTG Tri Glide™ Ultra Classic® Models

2010 FLHTCUTG GRAB HANDLE MOUNT



2010 FLHXXX Street Glide® Trike Models

2010 FLHXXX GRAB STRAP MOUNT



2010 Trike Models
P&A Options

- FLHXXX unique Tour-Pak® kit – to keep antenna on body
- Passenger Backrest and Rack for FLHXXX
- Shown below - FLHTCUTG with Chrome Rear Guard and H-D® V-Logo Mud Flaps

2010 VRSC™ Models

2010 VRSC™ Models

VRSCAW

VRSCDX

VRSCF

2010 VRSC™ Models

- No major changes
- New wheel assemblies for lead free wheel weights – running change
- New battery part number suffix
- New Brembo® front brake master cylinder and plastic piston
- No changes for V-Rod® exhaust systems between 2009 & 2010 model year
- Japan Muffler e-mark

2010 CVO™ Models

2010 FXDFSE2 CVO™ Fat Bob®

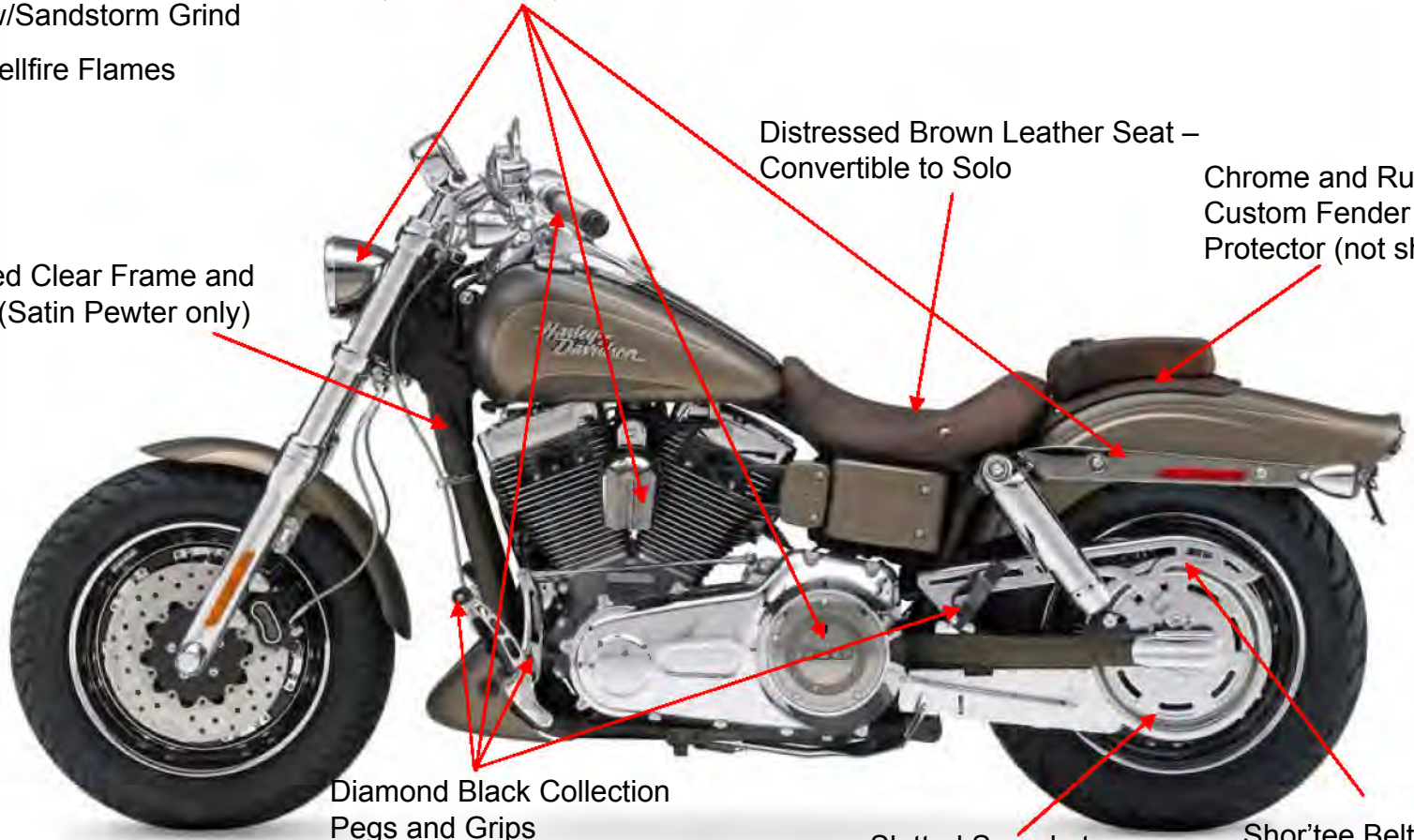
2010 FXDFSE2 CVO™ Fat Bob®

Paint colors:

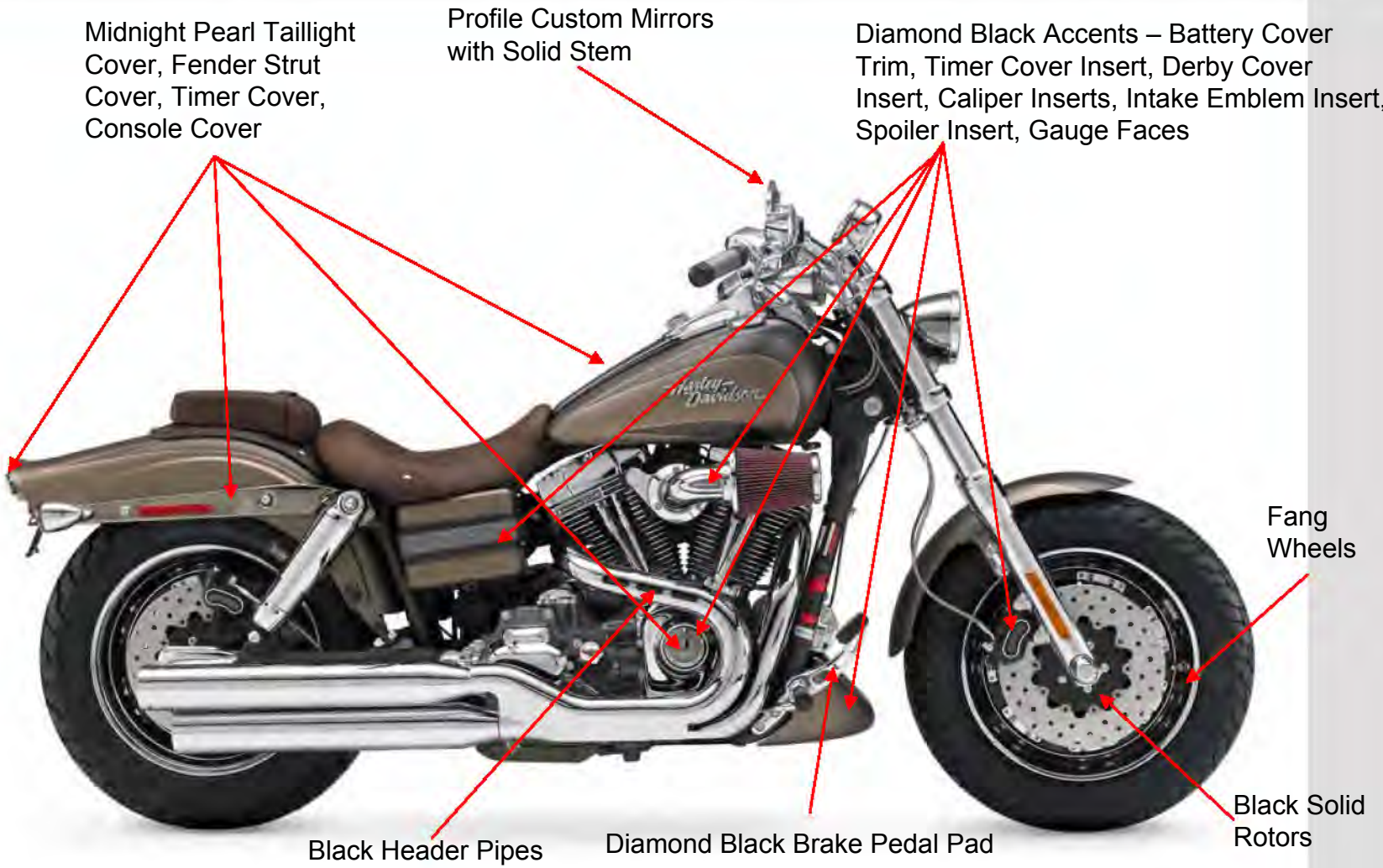
Cryptic Black w/Hellfire Flames

Satin Pewter w/Sandstorm Grind

Opal Blue w/Hellfire Flames



2010 FXDFSE2 CVO™ Fat Bob®



2010 FLHTCUSE5 CVO™ Ultra Classic® Electra Glide®

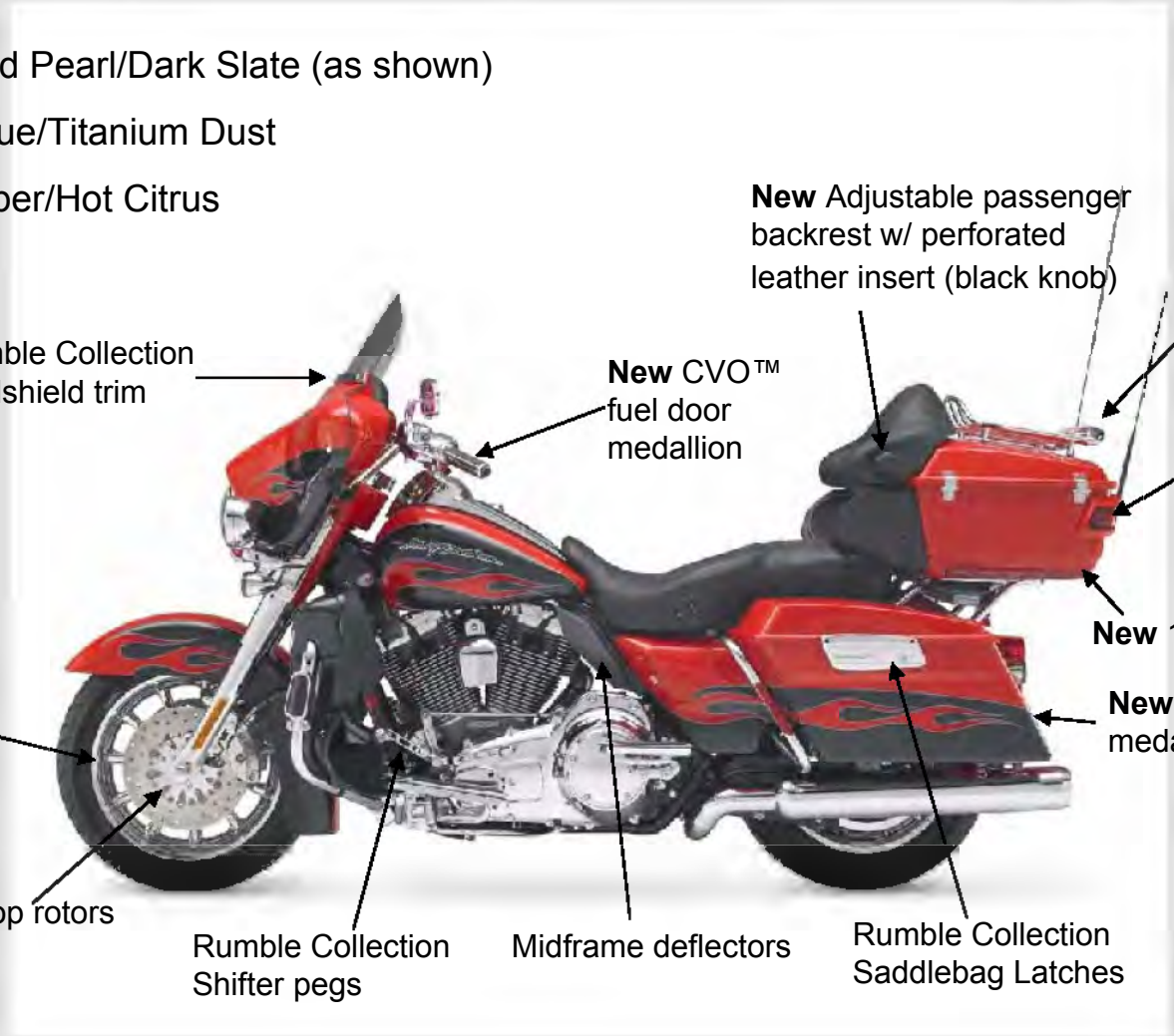
2010 FLHTCUSE5 CVO™ Ultra Classic® Electra Glide®

Paint colors:

Color 1:Scarlet Red Pearl/Dark Slate (as shown)

Color 2: Riptide Blue/Titanium Dust

Color 3: Burnt Amber/Hot Citrus



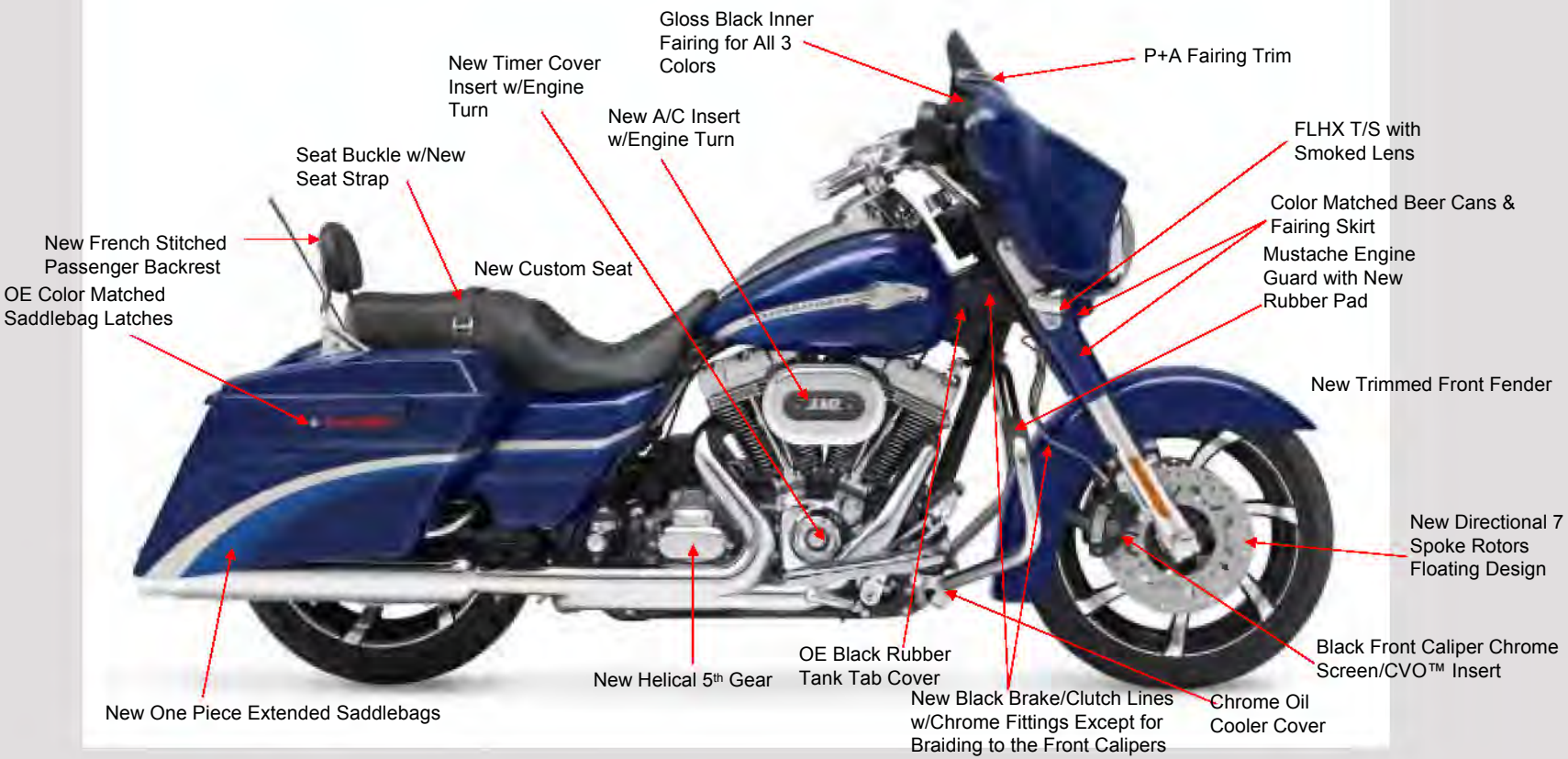
2010 FLHTCUSE5 CVO™ Ultra Classic® Electra Glide®

2010 FLHXSE CVO™ Street Glide®

2010 FLHXSE CVO™ Street Glide®

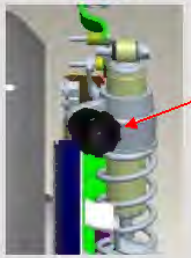
Three Color Selections:
Color 1: Spiced Rum with Gold Leaf Graphics
Color 2: Candy Concord with Pale Gold Leaf Graphics
Color 3: Tequila Sunrise with Pale Gold Leaf Graphics

New 18" Contrast Chrome
7 Spoke Cast Wheels
D407 180/55 B18 Rear Tire
D407 130/70 B18 Front Tire



2010 FLHXSE CVO™ Street Glide®

Standard FLHX Windscreen (2 versions- DOM/HDI)



New Hand Adjustable Rear Suspension (adjustment on left side)

New ACR Bracket to hold wires

Spun Aluminum Metal Faced Gages

Standard FLHX Mirrors

Handlebars With Chrome Controls

Chrome Gas Cap Cover

Color Matched Frame Covers

Color Matched Rear Fascia

Full Extended Saddlebags

LED Stop Tail Turn Signals

Color Matched LP Light Cover

Mufflers and End Caps

2010 FLSTSE CVO™ Softail® Convertible

2010 FLSTSE CVO™ Softail® Convertible

Paint Colors

Inferno Orange w/ Vivid Black

Abyss Blue w/ Sapphire

Crimson Red Sunglo w/ Autumn Haze

New Handlebar w/ Rumble Collection Grips and Mirrors

New 2 Piece Console w/ Painted Accents

New Seat w/ Genuine Buffalo Insert

New Detachable Passenger Pillion w/ Genuine Buffalo Insert

New Detachable Passenger Backrest & Upright

New Clean Front Fender

New Skirted Wide Rear Fender

New Waved Brake Rotors

New 18" Stinger Wheels

Rumble Collection Floorboards & Shifter Peg

New 200mm Rear Tire with 18" x 6" Stinger Wheel

2010 FLSTSE CVO™ Softail® Convertible

2010 FLSTSE CVO™ Softail® Convertible