SPORTSTER® MODELS

2021 HARLEY-DAVIDSON® SERVICE MANUAL

94000835

IMPORTANT NOTICE

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

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

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

Harley-Davidson Motor Company

SPORTSER® MODELS

2021 HARLEY-DAVIDSON® SERVICE MANUAL

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NOTES

FOREWORD

GENERAL

A WARNING

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

This service manual has been prepared with the following purposes in mind:

- To acquaint the user with the construction of the Harley-Davidson product and assist in the performance of basic maintenance and repair.
- To introduce the professional Harley-Davidson technician to the latest field-tested and factory-approved major repair methods.

We sincerely believe that this service manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR MANUAL

Use the TABLE OF CONTENTS (which follows this FOREWORD) Refer to the table below for the content layout of this manual.

NUMBER	CHAPTER
1	Maintenance
2	Chassis
3	Engine
4	Fuel System
5	Drive and Transmission
6	Electrical
A	Wiring
B	Reference

and the INDEX (at the back of this manual) to quickly locate subjects. Chapters and topics in this manual are sequentially numbered for easy navigation.

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

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

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

PREPARATION,FOR SERVICE

A WARNING

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

Good preparation is *very* important for efficient service work. Start each job with a clean work area. This will allow the repair to proceed as smoothly as possible. It will also reduce the incidence of misplaced tools and parts.

Clean a motorcycle that is excessively dirty before work starts. Cleaning will occasionally uncover sources of trouble. Gather any tools, instruments and any parts needed for the job before work begins. Interrupting a job to locate tools or parts is a distraction and causes needless delay.

NOTE

- *To avoid unnecessary disassembly, carefully, read all related service information before repair work begins.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly,*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), first disarm the system. Keep the fob close to the vehicle or use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to disable the system. Activate the system after service is completed.*

SERVICE BULLETINS

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

USE_GENUINE_REPLACEMENT_PARTS

A WARNING

Harley-Davidson parts and accessories are designed for Harley-Davidson motorcycles. Using non-Harley-Davidson parts or accessories can adversely affect performance, stability or handling, which could result in death or serious injury. (00001 b)

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

WARNINGS AND CAUTIONS

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

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

A WARNING

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

A CAUTION

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

NOTICE

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

NOTE

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

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

A WARNING

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

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

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

PRODUCT R_EFERENCES

A WARNING

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

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

Special Tools

All tools mentioned in this manual with a part number beginning with "HD", "J" or "B" must be ordered through your local Harley-Davidson dealer. Special tools may only be purchased, serviced or warrantied through a Harley-Davidson dealer.

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

LOCTITE Sealing and Threadlocking Products

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

PRODUCT REGISTERED MARKS

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

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

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

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Air filter element screw	40-60 in-lbs	4.5-6.8 N-m	1.6 AIR CLEANER AND EXHAUST SYSTEM, Air Cleaner LOCTITE 243 MEDIUM STRENGTH THREAD-LOCKER AND SEALANT (BLUE) (99642-97)
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	1.13 DRIVE BELT AND SPROCKETS, Adjustment
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	1.21 WHEEL ALIGNMENT, Wheel Alignment
Battery strap fastener	72-96 in-lbs	8.1-10.8 N-m	1.20 BATTERY MAINTENANCE, Installation and Connection
Battery terminal screw	60-70 in-lbs	6.8-7.9 N-m	1.20 BATTERY MAINTENANCE, Installation and Connection
Battery terminal screw	60-70 in-lbs	6.8-7.9 N-m	1.20 BATTERY MAINTENANCE, Installation and Connection
Brake caliper, front, mounting bolt	28-38 ft-lbs	38-51.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Front
Brake caliper, front, pad pin	131-173 in-lbs	14.8-19.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Front
Brake caliper, rear, mounting bolt	28-38 ft-lbs	38-51.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake caliper, rear, pad pin	131-173 in-lbs	14.8-19.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake hose clamp to rear fork screw	30-40 in-lbs	3.4-4.5 N-m	1.13 DRIVE BELT AND SPROCKETS, Adjustment
Brake line, front, manifold bolt	36-48 in-lbs	4.1-5.4 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake master cylinder, front, reservoir cover screws	9-18 in-lbs	1-2 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Front
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Clutch cable adjuster jamnut	120 in-lbs	13.6 N-m	1.10 CLUTCH, Adjustment
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Clutch inspection cover screws	84-108 in-lbs	9.5-12.2 N-m	1.9 TRANSMISSION LUBRICANT, Transmission Lubrication
Clutch inspection cover screws	84-108 in-lbs	9.5-12.2 N-m	1.10 CLUTCH, Adjustment
Fork stem pinch bolt, upper	30-35 ft-lbs	40.7-47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Fork stem pinch bolt, upper	30-35 ft-lbs	40.7-47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away Does not include XL1200X
Headlamp clamp nut: Iron 1200 (XL1200NS)	120-240 in-lbs	13.6-27.1 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp clamp nut: Iron 883 (XL883N)	120-240 in-lbs	13.6-27.1 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp horizontal adjustment: Forty-Eight (XL1200X)	30-35 ft-lbs	40.7-47.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment

FASTENER	TORQUE VALUE		NOTES
Headlamp screw	40 in-lbs	4.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp vertical adjustment: Forty-Eight (XL1200X)	30-35 ft-lbs	40.7-47.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Lower pinch screw in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 Nm	1.17 STEERING HEAD BEARINGS, Fall-Away
Lower pinch screw in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 Nm	1.17 STEERING HEAD BEARINGS, Fall-Away
Lower pinch screw in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Oil drain hose clamp	6-10 in-lbs	0.7-1.1 N-m	1.5 ENGINE OIL AND FILTER, Changing Oil and Filter
Primary chain adjuster locknut	20-25 ft-lbs	27.1-33.9 Nm	1.8 PRIMARY CHAIN, Free Play Adjustment
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 N-m	1.9 TRANSMISSION LUBRICANT, Transmission Lubrication Apply LOCTITE 565 THREAD SEALANT
Primary chain inspection cover	100-120 in-lbs	11.3-13.6 Nm	1.8 PRIMARY CHAIN, Free Play Adjustment
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.16 SPARK PLUGS, Installation
Switch housing screw	35-45 in-lbs	4-5.1 N-m	1.14 THROTTLE CONTROL, Cable Inspection and Lubrication
Upper pinch screw in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 Nm	1.17 STEERING HEAD BEARINGS, Fall-Away
Upper pinch screw in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Upper pinch screw in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 Nm	1.17 STEERING HEAD BEARINGS, Fall-Away
Visor screws	40 in-lbs	4.5 Nm	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment

SERVICING A NEW MOTORCYCLE

A WARNING

Perform the service and maintenance operations as indicated in the regular service interval table. Lack of regular maintenance at the recommended intervals can affect the safe operation of your motorcycle, which could result in death or serious injury. (0001 0a)

Perform necessary set-up tasks before customer delivery. See applicable model year predelivery and set-up instructions.

The performance of new motorcycle initial service is required to keep warranty in force and to verify proper emissions systems operation. See MAINTENANCE SCHEDULE (Page 1-9).

SAFE OPERATING MAINTENANCE

NOTE

- *Do not attempt to tighten engine head bolts or engine damage may result.*
- *During the initial break-in period, use only GENUINE HARLEY-DAVIDSON H-D 360 MOTORCYCLE OIL 20W50. Failure to use the recommended oil results in improper break-in of the engine cylinders and piston rings.*

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

Check:

1. Tires for correct pressure, excessive wear or any signs of tire damage.
2. Drive belt tension and condition.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks.
5. Check brake pads and discs for wear.
6. Cables for fraying, crimping and free operation.
7. Engine oil and transmission fluid levels.
8. Headlamp, auxiliary/fog lamp, tail lamp, stop lamp, horn and turn signal operation.

SHOP PRACTICES

Repair Notes

General maintenance practices are given in this section.

NOTE

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

All special tools and torque values are noted at the point of use.
All required parts or materials can be found in the parts catalog.

Safety

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

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

Do not just do the job, do the job safely.

Removing Parts

Always consider the weight of a part when lifting. Use a hoist whenever necessary. Do not lift heavy parts by hand. If a hoist and adjustable lifting beam or sling are needed to remove some parts, verify that:

- The lengths of multiple chains or cables from the hoist to the part are equal and parallel.
- Slings, chains and cables are positioned directly over the center of the part.
- No obstructions interfere with the lifting operation.
- Parts are not left suspended.

A WARNING

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

Always use blocking or proper stands to support the part that has been hoisted. If a part cannot be removed, verify that all bolts and attaching hardware have been removed. Verify that no parts are in the way of the part being removed.

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

Cleaning

Always clean around lines or covers before they are removed. Plug, tape or cap holes and openings to keep out dirt, dust and debris. Clean and inspect all parts as they are removed. Verify that all holes and passages are clean and open. After cleaning, cover all parts with clean lint-free cloth, paper or other material. Verify that the part is clean when installed.

Thoroughly clean all parts to be reused before assembly. Clean parts promote better component operation and longer life. Seals, filters and covers used in this vehicle keep out extraneous dirt and dust. Keep these items in good condition to guarantee satisfactory operation.

Cleaning Fastener Threads

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

NOTE

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

- Clean all threadlocking material from fastener threads and threaded holes.
- Use a wire brush or thread-chasing die to clean fastener threads.
- Use a thread chaser to clean threaded holes.
- Use PJ1 cleaner or equivalent to remove all traces of oil and contaminants from threads.
- Clear all threaded holes with low-pressure compressed air.

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

Disassembly and Assembly

Always assemble or disassemble one part at a time. Do not work on two assemblies simultaneously. Make all necessary adjustments. Inspect your work when finished to verify that everything is done. Do not exceed specified torque values while tightening hardware and threaded parts.

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

Checking Torques on Fasteners

Check torque using a torque wrench set to the minimum specification for that fastener. If the fastener does not rotate, the fastener torque has been maintained. If the fastener rotates, remove it to determine if it has a threadlocking agent.

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

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

Magnetic Parts Trays

Magnetic parts trays are common in the service facility. They are convenient and can keep parts from becoming lost during a repair procedure. However, hardened steel parts can become magnetized when held in magnetic parts trays.

Metal fragments from normal wear are usually trapped in the oil filter or by the magnetic drain plug. Magnetized parts in the engine can retain these fragments, potentially causing accelerated engine wear and damage.

Never place parts from inside the vehicle's powertrain on a magnetic parts tray.

DISPOSAL AND RECYCLING

Help protect our environment! Many communities maintain facilities for recycling used fluids, plastics and metals. Dispose of or recycle used oil, lubricants, fuel, coolant, brake fluid and batteries in accordance with local regulations. Many Harley-Davidson parts and accessories are made of plastics and metals which can also be recycled.

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. Do not exceed specified torque values while tightening fasteners during assembly.

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

Replace all damaged or missing lubrication fittings.

Use LOCTITE 565 THREAD SEALANT on pipe fitting threads.

Threadlocking Agents

Always follow specific service manual procedures when working with fasteners containing preapplied threadlocking agents when fastener replacement is recommended. When reusing fasteners containing threadlocking agents, thoroughly clean all fasteners and threaded holes. Always use the recommended threadlocking agent for the specific procedure.

Wiring, Hoses and Lines

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

Instruments and Gauges

Replace damaged or defective instruments and gauges.

Bearings

Always use the proper tools and fixtures when servicing bearings.

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

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

Only remove bearings if necessary. Removal usually damages bearings requiring replacement with **new** parts.

Bushings

Do not remove a bushing unless damaged, excessively worn or loose in its bore. Press out bushings requiring replacement.

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

Verify that all oil holes are properly aligned during installation.

Gaskets

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

Lip-Type Seals

Lip seals are used to seal oil or grease and are usually installed

with the sealing lip facing the contained lubricant. Seal orientation, however, may vary under different applications.

Do not remove seals unless necessary. Only remove seals to gain access to other parts or if seal damage or wear dictates replacement.

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

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

O-Rings

Always discard O-rings after removal. Since many O-rings are similar in size and appearance, always use **new** O-rings, keeping them packaged until use to avoid confusion. To prevent leaks, lubricate the O-rings before installation with the same type of lubricant as that being sealed. Verify that all gasket, O-ring and seal mating surfaces are thoroughly clean before installation.

Gears

Always check gears for damaged or worn teeth.

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

Lubricate mating surfaces before pressing gears on shafts.

Shafts

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

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

Clean all rust from the machined surfaces of **new** parts.

Part Replacement

A WARNING

Harley-Davidson parts and accessories are designed for Harley-Davidson motorcycles. Using non-Harley-Davidson parts or accessories can adversely affect performance, stability or handling, which could result in death or serious injury. (00001 b)

Always install **new** genuine Harley-Davidson parts and accessories. This provides best service life and maintain compliance with noise and emissions regulations.

Installing non-Harley-Davidson, off-road or competition parts can void warranty or result in an unsafe vehicle.

CLEANING

Protecting Rubber Parts

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.

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

Rust or Corrosion Removal

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

Bearings

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

A WARNING

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

Cover bearings with a 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.
- Placed bits 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 yourself and bystanders with approved eye protection.

Wrenches

- Never use an extension on a wrench handle.
- If possible, always pull on a wrench handle and adjust your stance to prevent a fall if something suddenly releases.
- Always keep the wrench squarely installed on the fastener.
- Never use a hammer on any wrench other than a STRIKING FACE wrench.
- Discard any wrench with damaged or battered points.
- Never use a pipe wrench to bend, raise or lift a pipe.

Pliers/Cutters/Pry Bars

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

Hammers

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

Screwdrivers

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

Ratchets and Handles

- Periodically clean and lubricate ratchet mechanisms with a light grade oil. Do not replace parts individually. Rebuild ratchets 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. 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 make sure that the ratchet's gear wheel is engaged with the pawl.

Sockets

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

Storage Units

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

FUEL

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

A 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)

A WARNING

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

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

Table 1-1. Octane Rating

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

GASOLINE BLENDS

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

NOTICE

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

- Gasoline/METHYL TERTIARY BUTYL ETHER (MTBE) blends are a mixture of gasoline and as much as 15 percent MTBE. Gasoline/MTBE blends use in your motorcycle is approved.
- ETHANOL fuel is a mixture of ethanol (grain alcohol) and unleaded gasoline and can have an impact on fuel mileage. Fuels with an ethanol content of up to 10 percent may be used in your motorcycle without affecting vehicle performance. U.S. EPA regulations currently indicate that fuels with 15 percent ethanol (E15) are restricted from use in motorcycles at the time of this publication. Some motorcycles are calibrated to operate with higher ethanol concentrations to meet the fuel standards in certain countries.
- REFORMULATED OR OXYGENATED GASOLINES (RFG) describes gasoline blends that are specifically designed to burn cleaner than other types of gasoline. This results in fewer tailpipe emissions. They are also formulated to evaporate less when filling the tank. Reformulated gasolines use additives to oxygenate the gas. Your motorcycle will run normally using this type of fuel. Harley-Davidson recommends using it whenever possible as an aid to cleaner air in our environment.
- Do not use racing fuel or fuel containing methanol. Use of these fuels will damage the fuel system.
- Using fuel additives other than those approved for use by Harley-Davidson may damage the engine, fuel system and other components.

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

ENGINE LUBRICATION

A CAUTION

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

A CAUTION

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

NOTICE

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

Engine oil is a major factor in the performance and service life of the engine. Use the proper grade of oil for the lowest temperature expected before the next oil change. Refer to Table 1-2.

This motorcycle was originally equipped with GENUINE HARLEY-DAVIDSON H-D 360 MOTORCYCLE OIL 20W50. If operation under extreme cold or heat are expected, refer to Table 1-2 for alternative choices.

If H-D 360 or SYN3 is not available, add oil certified for diesel engines. Acceptable designations include: CH-4, CI-4 and CJ-4. The preferred viscosities, in descending order are: 20W50, 15W40 and 10W40.

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

Table 1-2. Recommended Engine Oils

TYPE	VISCOSITY	LOWEST AMBIENT TEMPERATURE	COLD-WEATHER STARTS BELOW 50 °F (10 °C)
Screamin' Eagle SYN3 Full Synthetic Motorcycle Lubricant	SAE 20W50	Above 30.2 °F (-1 °C)	Excellent
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 20W50	Above 39.2 °F (4 °C)	Good
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 50	Above 60.8 °F (16 °C)	Poor
Genuine Harley-Davidson H-D 360 Motorcycle Oil	SAE 60	Above 80.6 °F (27 °C)	Poor

LOW TEMPERATURE LUBRICATION

Change engine oil often in colder climates. If motorcycle is frequently ridden less than 15 mi (24 km), in ambient temperatures below 60 °F (16 °C), reduce oil change intervals to 1500 mi (2,400 km).

NOTE

Lower ambient temperatures require more frequent oil changes.

Water vapor is a normal by-product of combustion . During cold-weather operation, some water vapor condenses to liquid form on the cool surfaces inside the engine. In freezing weather, this water becomes slush or ice. If the engine is not warmed to operating temperature, accumulated slush or ice blocks the oil lines and causes engine damage. Over time, water will accumulate, mix with the engine oil and form a sludge that is harmful to the engine.

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

GENERAL

Regular Service Intervals

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

NOTE

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

Some countries, such as Brazil, may require all regular maintenance to be performed by an authorized Harley-Davidson dealer for your limited warranty to remain in effect. Check with your authorized Harley-Davidson dealer.

Some countries, such as Brazil, may require additional annual (or semi-annual) regular maintenance steps to be performed to keep your limited warranty in effect and/or comply with vehicle regulations. Check with your authorized Harley-Davidson dealer as well as the motorcycle regulations in your country

After completing the final service interval, repeat the service schedule starting at the 8000 km (5000 mi) interval.

Whenever a vehicle is in for maintenance, always check for and complete recalls and open product programs.

Whenever a vehicle is in for maintenance, always verify that the latest calibration is installed.

Table 1-3. Regular Service Intervals: Harley-Davidson Sportster Models

COMPONENT	ACTION	1600 KM 1000 MI	8000 KM 5000 MI	16000 KM 10000 MI	24000 KM 15000 MI	32000 KM 20000 MI	40000 KM 25000 MI	48000 KM 30000 MI	56000 KM 35000 MI	64000 KM 40000 MI	72000 KM 45000 MI	80000 KM 50000 MI	NOTES
Service Intervals													
Electrical equipment and switches	Inspect	x	x	x	x	x	x	x	x	x	x	x	
Front tire pressure and tread	Check	x	x	x	x	x	x	x	x	x	x	x	1
Front wheel spoke torque (if equipped)	Tighten	x	x			x			x			x	2, 5, 3
Front brake fluid level	Inspect	x	x	x	x	x	x	x	x	x	x	x	
DOT4 front brake fluid moisture content	Check	x	x	x	x	x	x	x	x	x	x	x	1,2
Steering head bearings	Adjust	x		x		x		x		x		x	2
Steering head bearings	Lubricate							x					2
Throttle controls	Lubricate	x	x	x	x	x	x	x	x	x	x	x	2
Hand control switch housing screw torque	Tighten	x		x		x		x		x		x	1, 2, 4
Air cleaner filter	Inspect		x	x	x	x	x	x	x	x	x	x	3
Engine oil and filter	Replace	x	x	x	x	x	x	x	x	x	x	x	1, 3
Primary chain	Adjust	x	x	x	x	x	x	x	x	x	x	x	
Transmission lubricant	Replace	x		x		x		x		x		x	3
Oil and brake lines	Inspect	x	x	x	x	x	x	x	x	x	x	x	1,2, 6
Fuel lines and fittings	Inspect	x	x	x	x	x	x	x	x	x	x	x	1,2,6
Upper front stabilizer link to engine bracket mounting screw	Tighten	x		x		x		x		x		x	1,2, 4
Front isolator mounting bolt and nut	Tighten	x		x		x		x		x		x	1,2, 4
Rear brake fluid level	Inspect	x	x	x	x	x	x	x	x	x	x	x	
DOT4 rear brake fluid moisture content	Check	x	x	x	x	x	x	x	x	x	x	x	1, 2
Brake system	Replace	Flush brake system and replace DOT 4 hydraulic brake fluid every two years or sooner if moisture content is 3% or greater.											2
Brake pads and discs	Inspect	x	x	x	x	x	x	x	x	x	x	x	
Front axle nut	Tighten	x		x		x		x		x		x	1, 2, 4
Brake banjo bolt	Tighten	x		x		x		x		x		x	1, 2, 4
Jiffy stand	Lubricate	x	x	x	x	x	x	x	x	x	x	x	2, 3

NOTES

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

Table 1-3. Regular Service Intervals: Harley-Davidson Sportster Models

COMPONENT	ACTION	1600 KM 1000 MI	8000 KM 5000 MI	16000 KM 10000 MI	24000 KM 15000 MI	32000 KM 20000 MI	40000 KM 25000 MI	48000 KM 30000 MI	56000 KM 35000 MI	64000 KM 40000 MI	72000 KM 45000 MI	80000 KM 50000 MI	NOTES
Clutch	Adjust	x	x	x	x	x	x	x	x	x	x	x	2, 3
Brake and clutch controls	Lubricate	x	x	x	x	x	x	x	x	x	x	x	
Rear wheel spoke torque (if equipped)	Tighten	x	x			x			x			x	2, 5, 3
Rear tire pressure and tread	Check	x	x	x	x	x	x	x	x	x	x	x	1
Drive belt and sprockets	Inspect	x	x	x	x	x	x	x	x	x	x	x	2
Drive belt	Check	x	x	x	x	x	x	x	x	x	x	x	2
Rear axle nut	Tighten	x		x		x		x		x		x	1,2, 4
Exhaust system, fasteners and shields	Inspect	x	x	x	x	x	x	x	x	x	x	x	1, 3
12 volt battery	Check	Check battery, terminal torque and clean connections annually. Lubricate terminals with ELECTRICAL CONTACT LUBRICANT.											1
Spark plugs	Replace	___ Replace spark plugs every two years or every 30,000 mi (48,000 km), whichever comes first.											
Front forks	Rebuild									x			2
Fuel filter	Replace	Replace fuel filter element every 100000 (161,000 km.											2, 3
Component and system functions	Road Test	x x	x	x	x	x	x	x	x x	x		x	

NOTES

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

Lubricants, Greases, and Sealants

The below table lists common lubricants, greases, and sealants along with a corresponding part number and package size. Refer to Table 1-4.

Table 1-4. Lubricants, Greases, Sealants

ITEM	PART NUMBER	PACKAGE
3M 847 Adhesive	021200-19718 *	5 oz tube
3M General Purpose Adhesive Remover		15 oz aerosol
Anti-Seize Lubricant	98960-97	1 oz squeeze tube
CCI #20 Brake Grease	42830-05	squeeze packet
DOT 4 Brake Fluid	99953-99A	12 oz bottle
Dow Corning Moly 44 Grease	94674-99	2 cc packet
Electrical Contact Lubricant	11300004	1 oz squeeze tube
Formula+ Transmission and Primary Chaincase Lubricant	99851-05	1 qt bottle
G40M Brake Grease	42820-04	squeeze packet
Genuine Harley-Davidson Extended Life Antifreeze and Coolant	99822-02	1 gal container
Genuine Harley-Davidson H-D 360 20W50 Motorcycle Oil	99816-2050/00QT	1 qt bottle
Harley-Davidson Adhesive (Griplock)	99839-95	10 g tube
Harley-Davidson High Performance Sealant - Gray	99650-02	1.9 oz squeeze tube
Harley-Davidson Leather Dressing	98261-91V	6 oz can
Harley-Davidson Seal Grease	11300005	1 oz tube
Harley Lube	94968-09	1/4 oz needle dispenser
Hylomar Gasket and Thread Sealant	99653-85	3.0 oz tube
Loctite 222 Low Strength Threadlocker and Sealant (purple)	99811-97	6 mL tube
Loctite 243 Medium Strength Threadlocker and Sealant (blue)	99642-97	6 mL tube
	11100005	50 mL bottle
Loctite 246 Medium Strength/High Temperature Threadlocker (blue)		
Loctite 262 High Strength Threadlocker and Sealant (red)	94759-99	6 mL tube

Table 1-4. Lubricants, Greases, Sealants

ITEM	PART NUMBER	PACKAGE
Loctite 271 High Strength Threadlocker and Sealant (red)		6 mL tube
	11100006	50 mL bottle
Loctite 411 Prism Instant Adhesive		
Loctite 420 Super Bonder Adhesive		
Loctite 565 Thread Sealant	99818-97	6 mL tube
Loctite 770 Prism Primer		
Loctite 7649 Cleaner/Primer	98968-99	1.75 oz bottle
PJ1 Super Cleaner99878-87TA	98968-99	13 oz aerosol can
Screamin' Eagle Assembly Lube	11300002	4 oz tube
Screamin' Eagle SYN3 Full Synthetic Motorcycle Lubricant 20W50	99824-03/00QT	1 qt bottle
Special Purpose Grease	99857-97A	14 oz cartridge
Type "E" Hydraulic Fork Oil	62600026	16 oz bottle
Wheel Bearing Grease	99855-89	1 lb can
	99856-92	14 oz cartridge
* Not a Harley-Davidson part number		

CHECKING AND ADDING OIL

Removing and Replacing Oil Filler Cap

1. Park motorcycle on a level surface on jiffy stand.
2. See Figure 1-1. Remove the filler cap from the oil tank.
   a. Press straight down on the filler cap and release. The cap will pop up.
   b. Pull up on the filler cap while turning counterclockwise one-quarter turn as if removing the filler cap.
3. Wipe dipstick clean.

NOTE

See Figure 1-2. Align tabs on oil tank filler neck to slots (1, 2) on dipstick.

4. Install the dipstick into the tank.
   a. Turn the filler cap clockwise one-quarter turn as if screwing the filler cap into tank. When the filler cap stops turning, it is seated.
   b. Press down on the filler cap until it snaps in place, flush with the top of the oil tank cover.

Figure 1-1. Filler Cap Location

1. **Wide slot**
2. **Narrow slot**

Figure 1-2. Filler Cap Slots

Oil Level Cold Check

NOTE

- *Check engine oil level at each complete fuel refill.*
- *An accurate engine oil check can only be made with the engine at operating temperature (Hot Check).*

1. Park motorcycle on a level surface on jiffy stand.
2. Remove the filler cap and wipe the dipstick clean. Install the oil filler cap in tank.
3. Remove oil filler cap again and visually check for oil in the tank.

4. If oil is not visible in the tank, install the filler cap.

NOTE

If the oil pressure lamp stays lit after starting engine, immediately shut off the engine.

5. Start and idle the engine for 30 seconds. Stop the engine.
6. Remove oil filler cap and visually check for oil in the tank.

NOTICE

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

NOTE

Use only recommended oil. Recommended viscosity depends upon ambient temperature. Refer to Table 1-2.

7. If there is no oil visible in the tank, add oil until it is present on the bottom of the dipstick.
8. When oil is present on the bottom of the dipstick, perform a hot check.

Oil Level Hot Check

1. Run the engine until the engine oil is at operating temperature.
2. Idle the motorcycle on the jiffy stand for one to two minutes. Turn off engine.
3. Park motorcycle on a level surface on jiffy stand.
4. Remove the filler cap. Wipe dipstick clean. Install the filler cap in the tank.

NOTICE

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

NOTICE

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

NOTE

- *Use only recommended oil. Recommended viscosity depends upon ambient temperature. Refer to Table 1-2.*
- *The oil tank has a built-in pressure relief valve. If the oil tank is overfilled, excessive pressure is created in the oil tank. The pressure relief valve opens to relieve the pressure and prevent damage to the oil tank. Excessive oil due to overfilling is forced out the pressure relief valve when it opens.*

5. See Figure 1-3. Remove the filler cap. Check engine oil level.
   a. **Below the lower mark:** Add only enough oil until the level reads between the upper and lower marks.
   b. **Between the upper and lower marks:** It is safe to operate the motorcycle.
   c. **Above the upper mark:** Drain the oil until the level reads between the upper and lower marks.
6. Install the filler cap.
7. If oil was added, remove the filler cap to verify the engine oil level in the oil tank. Do not fill oil tank to a level above upper mark on the dipstick. Install the filler cap.

Figure 1-3. Dipstick

CHANGING OIL AND FILTER

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

FASTENER	TORQUE VALUE	
Oil drain hose clamp	6-10 **in-lbs**	0.7-1.1 N-m

Draining Oil Tank

A WARNING

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

NOTICE

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

Completely drain oil tank of used oil at scheduled service intervals. Refill with fresh oil. Refer to General (Page 1-9).

NOTE

- *Change oil at specified intervals in normal service at warm or moderate temperatures.*
- *Change engine oil at shorter intervals in cold weather or in severe operating conditions. See Low Temperature Lubrication (Page 1-8).*
- *Change engine oil at shorter intervals if ridden extremely hard, used in competition or driven on dusty roads.*
- *Always change oil filter when changing engine oil.*

1. Run motorcycle until engine is at normal operating temperature.
2. Remove dipstick from oil tank.

NOTE

The drain pan must hold approximately 3.0 qt (2.8 L).

3. Place a drain pan directly under the oil tank.
4. See Figure 1-4. Pull clip (1) from frame tube.
5. Direct drain hose (2) in front of bracket (3) into drain pan.
6. Loosen clamp (4). Remove plug (5) from end of hose.

NOTE

Completely drain engine oil from oil tank.

7. Allow oil to drain.
8. Install plug into hose.
9. Tighten clamp.
   Torque: 6-10 **in-lbs** (0.7-1.1 N-m) *Oil drain hose clamp*
10. Route drain hose along frame tube.

11. Clip hose to frame.

Figure 1-4. Drain Hose

Removing Oil Filter

1. Place a drain pan under the oil filter.

NOTE

See Figure 1-5. Turn filter (1) counterclockwise to remove from mount (2).

NOTICE

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

2. Remove oil filter with wrench.

   Special Tool: OIL FILTER WRENCH (HD-42311)
   Special Tool: OIL FILTER WRENCH (HD-44067-A)

3. Drain engine oil. Discard oil filter.

4. Clean any oil spills off crankcase and frame.

Figure 1-5. Oil Filter

Installing Oil Filter

NOTE

To build oil pressure on engine startup, partially fill oil filter.

1. Pour about 4 fl oz (120 ml) of fresh, clean engine oil into **new** oil filter.
2. Allow time for oil to soak into filter element.
3. See Figure 1-6. Wipe oil filter mount contact surface (1) with a clean cloth. Surface must be smooth and free of debris or old gasket material.
4. Apply a thin film of oil to contact surface of the oil filter mount and filter gasket (2) of **new** oil filter.

NOTE

*Do not use oil filter wrench to install **new** oil filter.*

5. Install **new** oil filter.
   a. Screw filter onto adapter (3) until gasket contacts the gasket contact surface.
   b. Hand-tighten one-half to three-quarters turn to secure the oil filter.

Figure 1-6. Installing Oil Filter

Refilling Oil Tank

NOTICE j

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

NOTE

Use the proper grade of oil for the lowest temperature expected before the next oil change. Refer to Table 1-2.

1. Pour 2 qt (1.9 L) of oil into engine oil tank.
2. Install dipstick in oil tank. Seat cap.
3. See Figure 1-7. Verify oil pressure.
   a. Start engine.
   b. Verify that the oil pressure indicator turns off at 1000 rpm or above.
   c. Turn off engine.
4. Perform engine oil level hot check.
5. Start engine and carefully check for oil leaks around drain plug and oil filter.

Figure 1-7. Oil Pressure Indicator

AIR CLEANER

FASTENER	TORQUE VALUE	
Air cleaner cover screw	36-60 in-lbs	4.1-6.8 N-m
Air filter element screw	40-60 in-lbs	4.5-6.8 N-m

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

Removal

1. See Figure 1-8. Remove cover screw (7) from the cover (6).
2. Remove air cleaner cover. Remove seal (5) from the cover.
3. Remove element screws (4). Remove the filter element (3) and gasket (2) from backplate. Discard gasket.
4. Remove O-rings (1). Discard O-rings.
5. Inspect the cover seal. Replace if necessary.
6. Clean the air cleaner backplate.
7. Clean the inside of air cleaner cover.

NOTICE

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

Installation

1. See Figure 1-8. Apply a thin coat of engine oil to the new O-rings (1). Install O-rings to breather tubes.
2. Position a new gasket (2) on the air filter element (3). Line up the gasket holes with the backplate holes.

NOTE

Install the filter element with THIS SIDE OUT on top.

3. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to each element screw (4). Install the filter element onto the backplate. Tighten.

   Torque: 40-60 in-lbs (4.5-6.8 N-m) *Air filter element screw*
4. Fit seal (5) onto cover (6). Verify alignment around cover edge.
5. Install cover onto backplate. Do not pinch or distort seal.
6. Install screw (7).

   Torque: 36-60 in-lbs (4.1-6.8 N-m) *Air cleaner cover screw*

Figure 1-8.

CLEANING FILTER ELEMENT

A WARNING

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

NOTE

Do not tap the filter on a hard surface.

1. Wash the filter in warm soapy water.
2. To remove soot, soak the filter in warm soapy water for 30 minutes.

NOTE

The filter is clean if light is visible through filter.

3. Hold the filter up to light.

A WARNING

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

4. Dry the filter from the inside with low-pressure compressed air.

CHECK EXHAUST SYSTEM LEAKAGE

Check exhaust system for leaks at every scheduled service interval.

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

Exhaust System Leakage

If an exhaust system leak is evident at a muffler or header pipe connection, disassemble and clean all mating surfaces. See EXHAUST SYSTEM (Page 4-38).

- Replace any damaged components.
- If leak continues, disassemble and apply Permatex Ultra Copper, LOCTITE 5920 FLANGE SEALANT or equivalent.
- Assemble components. Wipe off any excess sealant.
- Follow sealant product instructions. Allow adequate curing time before operating vehicle.

AIR PRESSURE

A WARNING

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

Always maintain proper tire pressure as specified in Table 1-5. Do not load tires beyond GAWR specified in Table 2-4. Underinflated, over-inflated or overloaded tires can fail.

Tire pressure varies with changes in ambient and tire temperature. Check tire pressure when the tires are cold. Refer to Table 1-5. Increase tire pressure by 1 °F (5 °C) for every 10 °F (5 °C) change in ambient temperature above this point.

NOTE

Harley-Davidson does not perform any testing with only nitrogen in tires. Harley-Davidson neither recommends nor discourages the use of pure nitrogen to inflate tires.

Table 1-5. Specified Tires

MODEL	MOUNT	DIAMETER	SPECIFIED TIRE	PRESSURE (cold 68 °F (20 °C))	
		in		psi	kPa
Iron 883™ (XL883N)	Front	19	Michelin Scorcher "31" 100/90B19 M/C 57H	30	207
	Rear	16	Michelin Scorcher "31" 150/80B16 M/C 77H	40	276
Iron 1200™ (XL1200NS)	Front	19	Michelin Scorcher "31" 100/90B19 M/C 57H	30	207
	Rear	16	Michelin Scorcher "31" 150/80B16 M/C 77H	40	276
Forty-Eight™ (XL1200X)	Front	16	Michelin Scorcher "31" 130/90B16 M/C 73H	36	248
	Rear	16	Michelin Scorcher "31" 150/80B16 M/C 77H	40	276

TIRE REPLACEMENT

Tread Wear

A WARNING

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

Harley-Davidson tires are equipped with wear bars that run horizontally across the tread. When a tire is worn to the point that the wear bars are visible, or 1/32 in (0.8 mm) tread depth remains, the tire can:

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

Replace the tires with **new** tires before the tread wear bars appear:

- See Figure 1-9. Indicators (1) on the tire sidewalls point to tread wear bars (2) in the tread.
- Tread wear bars appear in the tread pattern when 1/32 in (0.8 mm) or less of tread remains.

Figure 1-9. Tread Pattern: Michelin Tires

Tire Damage

Replace tires with **new** tires when:

- Tire cords or fabric are visible through cracked sidewalls, snags or deep cuts.
- A bump, bulge or split is found anywhere on the tire.
- A puncture, cut or other damage cannot be repaired.

SPECIFIED TIRES

A WARNING

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

A WARNING

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

- Store **new** tires on a horizontal tire rack. Do not stack tires in a vertical stack.
- Mount only Harley-Davidson specified tires. Refer to Table 1-5.

WHEEL BEARINGS

NOTE

Replace bearings in sets only See SEALED WHEEL BEARINGS (Page 2-19).

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. Listen for abnormal noise.
   c. Verify smooth bearing rotation.
3. Check wheel bearings and axle spacers for wear and corrosion. Excessive play or roughness indicates worn bearings.

FREE PLAY ADJUSTMENT

FASTENER	TORQUE VALUE	
Primary chain adjuster locknut	20-25 ft-lbs	27.1-33.9 N-m
Primary chain inspection cover	100-120 in-lbs	11.3-13.6 N-m

A WARNING

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

1. Remove main fuse.
2. See Figure 1-10. Remove inspection cover (1).

NOTE

Rotate the engine to measure free play at several chain positions.

3. See Figure 1-11. Through the inspection opening, measure chain free play at the tightest position.

NOTE

Factory setting: *Initial cold engine free play is %-% in (6.35-9.53 mm). With the engine cold, measure free play on a primary chain that has never been adjusted:*

- *Less than % in (6.35 mm): Adjust to specification.*
- *Between % in (6.35 mm) and % in (9.53 mm): Do NOT adjust.*

Do not adjust the primary chain tighter than specified.

Running chain too tight will result in excessive wear.

NOTICE

(00202a)

4. If the measurement is not in specification, adjust the primary chain. Refer to Table 1-6.
   a. See Figure 1-10. Loosen the locknut (2).
   b. With a hex key, turn the adjuster screw (3) clockwise to reduce free play or counterclockwise to increase free play.
   c. When free play is within specification, hold the adjuster screw with a hex key. Tighten the locknut to 20-25 ft-lbs (27.1-33.9 N-m). "
5. If the primary chain cannot be adjusted to specification, replace the chain. See PRIMARY DRIVE AND CLUTCH (Page 5-7).
6. Install a new gasket and the primary chain inspection cover. Tighten to 100-120 in-lbs (11.3-13.6 N-m).
7. Install main fuse.

Figure 1-10. Primary Chain Inspection Cover and Adjuster

Figure 1-11. Primary Chain Free Play

Table 1-6. Primary Chain Free Play Specifications

ENGINE	in	mm
Cold	3/8-1/2	9.5-12.7
Hot	1/4-3/8	6.3-9.5

TRANSMISSION LUBRICATION

FASTENER	TORQUE VALUE	
Clutch inspection cover screws	84-108 in-lbs	9.5-12.2 N-m
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 N-m

Check Lubricant Level

1. Run motorcycle until engine is at normal operating temperature.
2. Turn off ignition switch and STOP/RUN switch.

NOTE

Stand motorcycle upright to equalize lubricant level in the transmission and clutch compartments.

3. Stand motorcycle upright (not leaning on jiffy stand) on a level surface.

A WARNING

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

4. Mid-mount controls: Remove left side rider footrest and mounting bracket assembly. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).
5. See Figure 1-12. Remove screws and washers. Remove clutch inspection cover (1).
6. See Figure 1-13. Verify that lubricant level is even with bottom of clutch diaphragm spring (1).

NOTICE

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

NOTICE

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

7. If the level is low, add FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT through clutch inspection cover opening. Verify that lubricant level is even with bottom of clutch diaphragm spring.
8. Install the clutch inspection cover:
   a. Install new quad ring. Verify that the quad ring is fully seated in groove of primary cover.
   b. See Figure 1-14. Install cover and tighten screws in sequence to 84-108 in-lbs (9.5-12.2 N-m).
9. Mid-mount controls: Install left side rider footrest and mounting bracket assembly. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).
10. Run engine. Check for leaks.

Figure 1-12. Primary Cover

Figure 1-13. Chaincase Lubricant Level

Change Lubricant

A WARNING

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

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

2. Park motorcycle on a level surface on jiffy stand. The chaincase lubricant can drain out of transmission.

A WARNING

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

3. Turn off ignition switch and STOP/RUN switch.

4. See Figure 1-12. Position a suitable container under drain plug (2).

5. Remove drain plug. Drain lubricant.

6. Position the motorcycle straight up and level to allow extra fluid to drain from clutch compartment.

Do not over-tighten filler or drain plug. Doing so could

NOTICE

result in a lubricant leak. (00200b)

7. Clean magnetic drain plug. Replace drain plug O-ring if damaged.

8. Apply LOCTITE 565 THREAD SEALANT. Install drain plug. Tighten to 14-30 ft-lbs (19-40.7 N-m).

9. Remove the clutch inspection cover.

10. See Figure 1-13. Add 1.00 qt (0.95 L) of FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT through clutch inspection cover opening. Verify that level is even with bottom of clutch diaphragm spring (1).

11. Install the clutch inspection cover:

    a. Install new quad ring. Verify that the quad ring is fully seated in groove of the primary cover.

    b. See Figure 1-14. Install cover and tighten screws in sequence to 84-108 in-lbs (9.5-12.2 N-m).

12. Run engine. Check for lubricant leaks.

Figure 1-14. Clutch Inspection Cover Torque Sequence

ADJUSTMENT

FASTENER	TORQUE VALUE	
Clutch cable adjuster jamnut	120 **in-lbs**	13.6 N-m
Clutch inspection cover screws	84-108 **in-lbs**	9.5-12.2 N-m

Release Clutch Cable Tension

AWARNING

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

1. Remove main fuse.
2. See Figure 1-15. Remove cable retaining clips.
3. See Figure 1-16. Pull rubber boot (1) away from cable adjuster (2).
4. Loosen jamnut (3).
5. Turn adjuster to loosen clutch cable at hand lever.

Figure 1-15. Cable Retaining Clips

Clutch Adjustment

1. **Mid-mount controls:** Remove clutch side rider footrest and mounting bracket assembly to access clutch inspection cover. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).
2. Remove clutch inspection cover. Discard quad ring.
3. See Figure 1-17. Remove hex lockplate and spring (1) from adjusting screw (2).
4. Turn adjusting screw counterclockwise until resistance is felt.

Figure 1-16. Clutch Cable Adjuster

Turn adjusting screw clockwise 1/4 turn.

5. Install hex lockplate and spring. Turn adjusting screw clockwise to fit lockplate onto flats of adjusting screw.
6. Install clutch inspection cover.
   a. Install **new** quad ring in primary cover.
   b. Install inspection cover.
   c. Install screws and tighten in a cross-wise pattern to 84-108 **in-lbs** (9.5-12.2 N-m).
7. **Mid-mount controls:** Install footrest and mounting bracket. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

Figure 1-17. Clutch Adjustment Screw

Lever Free Play

1. See Figure 1-16. Turn cable adjuster (2) away from jamnut (3) until there is no slack in cable at clutch lever.

2. See Figure 1-18. Pull clutch cable ferrule (1) away from clutch lever bracket (2) and measure free play (3).

3. Adjust to specification. Refer to Table 1-7.

4. See Figure 1-16. Tighten jamnut (3) to 120 **in-lbs** (13.6 N-m).

5. Install rubber boot (1) over cable adjuster (2).

6. See Figure 1-15. Install cable retaining clips.

7. Install main fuse.

1. Clutch cable ferrule
2. Clutch lever bracket
3. Free play

Table 1-7. Clutch Lever Free Play Specifications

FREE PLAY	in	mm
Measurement	1/16-1/8	1.6-3.2

Figure 1-18. Clutch Free Play Adjustment

GENERAL

The front and rear brakes are fully hydraulic disc brake systems that require little maintenance.

A WARNING

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

A WARNING

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)

A WARNING

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

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

(00240e)

NOTICE

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

NOTE

- *If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.*
- *Cover handlebar switches with a shop towel before adding brake fluid to front master cylinder reservoir. Spilling brake fluid on handlebar switches can render them inoperative.*

INSPECT BRAKE LINES

Inspect brake lines for leaks, contact or abrasion. Refer to Table 1-8.

Table 1-8. Brake Line Inspection

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

FLUID LEVEL

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

FASTENER	TORQUE VALUE	
Brake master cylinder, reservoir cover screws	9-18 in-lbs	1-2 N-m

e. Install diaphragm, plate and cover.

f. Tighten to:

Torque: 9-18 **in-lbs** (1-2 N-m) *Brake master cylinder, reservoir cover screws*

5. Test front brake lever and rear brake pedal for firm feel. Bleed brakes as necessary. See Bleeding Brakes (Page 2-54).

Figure 1-19. Front Master Cylinder Reservoir Low Level Mark

Figure 1-20. Rear Master Cylinder Reservoir Low Level Mark

TROUBLESHOOTING

Use the following troubleshooting guide to help in determining probable causes of poor brake operation. Refer to Table 1-9.

NOTE

- *At every service, check moisture content of fluid using DOT 4 BRAKE FLUID MOISTURE TESTER (PART NUMBER: HD-48497-A). Follow the instructions included with tool.*
- *Flush brake system and replace DOT 4 fluid every two years or sooner if brake fluid test shows moisture content is 3% or greater.*
- *Fluid should never need to be added or removed from the system during normal wear, except for fluid replacement as specified in the maintenance schedule.*
- *Fluid level in reservoir will decrease with brake wear-. Reservoir volume is adequate to provide fluid to the wear limits of the pads and rotors.*

1. **Front brake:** Check fluid level.
   a. Set motorcycle upright and turn handlebar to level reservoir.
   b. See Figure 1-19. Check low-level mark on reservoir sight glass.
2. **Rear brake:** Check fluid level.
   a. Stand motorcycle upright (not leaning on jiffy stand) on a level surface.
   b. See Figure 1-20. Check low-level mark on reservoir sight glass.
3. If fluid is low:
   a. Check brake pad installation or for wear beyond specification. Replace or repair as necessary. See BRAKE PADS AND DISCS (Page 1-28).
   b. Check brake components for leaks. Repair as necessary.
4. If fluid is still low, add DOT 4 BRAKE FLUID as necessary.
   a. Clean cover.
   b. Remove cover screws and cover.
   c. Remove diaphragm plate and diaphragm.
   d. Add DOT 4 BRAKE FLUID to full level ridge around top of reservoir.

Table 1-9. Troubleshooting Brakes

CONDITION	CHECK FOR	REMEDY
Low reservoir fluid level	Leaks in brake system	Repair as necessary. Bleed brake system.
	Worn pads and discs	Replace pads and discs.
Excessive lever or pedal travel or spongy feel	Air in system	Bleed brake system.
	Low reservoir fluid level	Repair leaks as necessary. Bleed brake system.
		Replace pads and discs.
Chattering sound when brake is applied	Worn brake pads	Replace brake pads.
	Loose mounting bolts	Tighten bolts.
	Warped brake disc	Replace brake disc.
Ineffective brake lever or pedal - travels to limit	Low fluid level	Repair leaks as necessary. Bleed brake system.
		Replace pads and discs.
	Piston cup not functioning	Rebuild master cylinder.
Ineffective brake lever or pedal - travel normal	Distorted or glazed brake disc	Replace brake disc.
	Distorted, glazed or contaminated brake pads	Replace brake pads.
Brake pads drag on disc - does not retract.	Cup in master cylinder blocking relief port	Inspect master cylinder.
	Master cylinder overfilled	Correct fluid level.

INSPECTION

Brake Pads

A WARNING

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

A WARNING

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

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

(00240e)

NOTICE

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

See Figure 1-21. Replace brake pads if pads on either front or rear are worn to 0.04 in (1.02 mm) or less above backplate. Always replace both pads as a set. See BRAKE PADS AND DISCS (Page 1-28).

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

Figure 1-21. Brake Pad Thickness

Brake Disc Thickness, Lateral Runout and Warpage

Minimum acceptable thickness is stamped on side of disc. Replace disc if warped, badly scored or worn beyond service limit.

Maximum brake disc lateral runout and warpage is 0.008 in (0.2 mm) when measured near outside diameter.

- **To replace front brake discs, see FRONT WHEEL (Page 2-15).**
- **To replace rear brake disc, see REAR WHEEL (Page 2-17).**

BRAKE PAD REPLACEMENT: FRONT

FASTENER	TORQUE VALUE	
Brake caliper, front, mounting bolt	28-38 ft-lbs	38-51.5 N-m
Brake caliper, front, pad pin	131-173in-lbs	14.8-19.5 N-m
Brake master cylinder, front, reservoir cover	9-18 in-lbs	1—2 N-m

Removal

NOTICE

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

NOTE

- *Cover handlebar switches with a shop towel before adding brake fluid to reservoir.*
- *If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.*

1. **Position motorcycle to level front master cylinder reservoir.**
2. **Wrap a shop towel around master cylinder reservoir to contain any brake fluid spills.**

3. See Figure 1-22. Remove screws (5), reservoir cover (4), diaphragm plate (3) and diaphragm (2) from master cylinder reservoir (1).

NOTE

As pistons are pressed into their bores, fluid level can rise above max fill level. Remove fluid as necessary.

Figure 1-22. Front Brake Master Cylinder Cover

4. Remove caliper bracket and caliper.
   a. Loosen, but do not remove, brake pad pin.
   b. Remove caliper bracket mounting bolts.
   c. **ABS models:** Remove WSS wire lead clips from the brake line.
   d. Remove caliper bracket and caliper.

5. Remove old pads.
   a. Support caliper assembly.
   b. To press the pistons back into their bores, press pads apart.
   c. Pull pad pin part way until wheel-side pad is free.
   d. Continue to pull out pad pin until piston-side pad is free.
   e. Remove pads.

6. Inspect pad pin for grooving and wear.
   a. Measure pad pin diameter in an unworn area.
   b. Measure pad pin diameter in an area of grooving or wear.
   c. If wear exceeds 0.011 in (0.28 mm), replace pin.

Installation

NOTE

See Figure 1-23. Verify that pad spring is installed before installing ***new*** *pads.*

1. Install piston-side brake pad.
   a. Slide pad mounting tab to rear.
   b. Press pad against pistons.
   c. See Figure 1-24. Align pad spring feet against pad spring.

2. Install wheel-side brake pad.
   a. Fit mounting tab under retaining clip.
   b. Press pad against mounting bracket.

3. Install pad pin.
   a. Press piston-side pad against pad spring.
   b. Start pad pin.
   c. Press wheel-side pad against pad spring.
   d. Complete pad pin installation.

Figure 1-23. Caliper Pad Spring

Figure 1-24. Pad Spring Feet

4. Install caliper and bracket.
   a. **ABS models:** Fit WSS wire lead bracket, clip and wire to caliper mounting boss.
   b. Install mounting bolts.
   c. Tighten to 28-38 ft-lbs (38-51.5 N-m).
   d. Tighten pad pin to 131-173 **in-lbs** (14.8-19.5 N-m).

A WARNING

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

5. Squeeze brake lever to push pistons against outside brake pad.

NOTE

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

A WARNING

Contact with DOT 4 brake fluid can have serious health effects. Failure to wear proper skin and eye protection could result in death or serious injury. [1]

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1 If inhaled: Keep calm, remove to fresh air, seek medical attention.

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

(00240e)

NOTICE

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

6. Check fluid level in brake reservoir. Add enough DOT 4 BRAKE FLUID to reservoir to bring fluid level to max fill level.

7. Install diaphragm and plate. Install reservoir cover with screws. Tighten to .
   Torque: 9-18 **in-lbs** (1-2 N-m) *Brake master cylinder, front, reservoir cover screws NOTE*

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

A WARNING

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

8. Test brakes.
   a. Turn ignition on. Check operation of rear lamps.
   b. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy. See Bleeding Brakes (Page 2-54).

BRAKE PAD REPLACEMENT: REAR

FASTENER	TORQUE VALUE	
Brake caliper, rear, mounting bolt	28-38 ft-lbs	38-51.5 N-m
Brake caliper, rear, pad pin	131-173in-lbs	14.8-19.5 N-m
Brake line P-clamp, rear, screw	30-40 **in-lbs**	3.4-4.5 N-m
Brake master cylinder, rear, reservoir cover screws	9-18 **in-lbs**	1-2 N-m

Removal

NOTE

- *If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.*
- As *piston is pushed back into caliper, fluid level can rise higher than max fill level. If necessary, remove fluid.*

1. Prepare motorcycle:
   a. Raise the motorcycle.
   b. Remove left side lower shock bolt. Rotate shock away from caliper. See Shock Absorbers (Page 2-79).
2. Position motorcycle to level master cylinder reservoir.
3. Place container under reservoir to catch fluid overflow.
4. Remove reservoir cover.

5. Remove caliper.
   a. Remove brake line P-clamp from rear fork.
   b. Loosen, but do not remove, pad pin.
   c. Remove caliper mounting bolts.
   d. Remove caliper from bracket.

6. Remove old pads.
   a. Support caliper.
   b. To press pistons into their bores, press pads apart.
   c. Pull pad pin part way until wheel side pad is free.
   d. Pull pin until outside pad is free.
   e. Remove pads and pad spring.

7. Inspect pin for grooving and wear.
   a. Measure pin diameter in an unworn area.
   b. Measure pin in area of any grooving or wear.
   c. If wear exceeds 0.011 in (0.28 mm), replace pin.

Installation

NOTE

*Verify that pad spring is installed before installing **new** pads.*

1. See Figure 1-25. Install **new** pads.
   a. Hold pad spring (1).
   b. Hold pads (2) in position.
   c. Press pad pin (3) through outside caliper, outside pad and spring.
   d. While compressing pads and spring, press pad pin over center of pad spring through wheel-side pad.
   e. While pressing down on spring center, align pin with wheel side caliper.
   f. Partially install pad pin.

2. Install caliper.
   a. Fit caliper over brake disc.
   b. Install mounting bolts. Tighten to 28-38 ft-lbs (38-51.5 N-m).
   c. Tighten pad pin to 131-173 **in-lbs** (14.8-19.5 N-m).
   d. Install brake line P-clamp. Tighten to 30-40 **in-lbs** (3.4-4.5 N-m).

3. Check fluid level in brake reservoir. Level must be between low-level mark and max fill level.

A WARNING

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

4. Install master cylinder reservoir cover and screws. Tighten.
   Torque: 9-18 **in-lbs** (1-2 N-m) *Brake master cylinder reservoir cover screws*

5. Return to operation.
   a. Install shock absorber. See Shock Absorbers (Page 2-79).
   b. Lower the motorcycle.

NOTE

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

6. Test brakes.
   a. Turn ignition switch **ON.** Check operation of rear lamps.
   b. Test ride motorcycle at low speed. Bleed the brake fluid if brakes feel spongy. See Bleeding Brakes (Page 2-54).

1. Pad spring
2. Pads
3. Pad pin

Figure 1-25. Rear Brake Pads

GENERAL

A WARNING

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

In the case of stone damage to belt, inspect the sprockets for damage and replace as required. If replacing belt, always replace both transmission and rear sprockets.

CLEANING

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

INSPECTION

Sprockets

NOTE

Chrome chips or large rear sprocket gouges leave a pattern on belt face.

1. See Figure 1-26. Inspect each tooth (1) of rear sprocket for:

a. Tooth damage.

b. Large chrome chips with sharp edges.

c. Gouges caused by hard objects.

d. Excessive loss of chrome plating.

2. To check if chrome is worn, drag with medium pressure a scribe across bottom of a groove (2).

a. If scribe slides across groove without digging in or leaving a visible mark, chrome is still good.

b. If scribe or knife points digs in and leaves a visible mark, it is cutting bare aluminum. A knife point does not penetrate chrome.

3. Replace rear sprocket if major tooth damage or loss of chrome exists.

Figure 1-26. Rear Sprocket

Drive Belt

NOTE

Belt teeth are coated with polyethylene lubricant. Coating will wear off over time. Worn coating is not an indicator of belt wear.

See Figure 1-27. Inspect drive belt for:

- Cuts or unusual wear patterns.
- Outboard edge bevel wear (8). Some bevel wear is common, but it indicates that sprockets are misaligned.
- Stone damage (7) on outside ribbed surface. If cracks/damage exists near edge of belt, replace belt immediately. Damage to center of belt requires belt replacement. When cracks extend to edge of belt, failure is imminent.
- Inside (toothed portion) of belt for exposed tensile cords (normally covered by nylon layer and polyethylene layer). This condition causes belt failure. It indicates worn transmission sprocket teeth. Replace belt and transmission sprocket.
- Signs of puncture or cracking at base of belt teeth. Replace belt if either condition exists.
- If conditions 2, 3, 6 or 7 (on edge of belt) exist, replace belt.

NOTE

Condition 1 may develop into 2 or 3 over time. Condition 1 is not grounds for replacing belt. Watch condition 1 closely before condition 2 develops which requires belt replacement.

Table 1-10. Drive Belt Wear Analysis

NO.*	CONDITION	REQUIRED ACTION
1	Internal tooth cracks (hairline)	OK to run, but monitor condition.
2	External tooth cracks	Replace belt.
3	Missing teeth	Replace belt.
4	Chipping (not serious)	OK to run, but monitor condition.
5	Fuzzy edge cord	OK to run, but monitor condition.
6	Hook wear	Replace belt and sprocket.
7	Stone damage	Replace belt if damage is on the edge.

Table 1-10. Drive Belt Wear Analysis

NO.*	CONDITION	REQUIRED ACTION
8	Bevel wear (outboard edge only)	OK to run, but monitor condition.
* See Figure 1-27		

Figure 1-27. Drive Belt Wear Patterns

CHECK DRIVE BELT DEFLECTION

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

NOTE

Always use BELT TENSION GAUGE (PART NUMBER: HD-35381-A) to measure belt defection. Failure to use tension gauge may cause under-tensioned belts. Loose belts can fail due to "ratcheting" flumping a tooth) which causes tensile cord crimping and breakage.

Check deflection:

- With transmission in neutral.
- With motorcycle at ambient temperature.
- With motorcycle upright or on jiffy stand with rear wheel on the ground.
- With the vehicle unladen: no rider, no luggage and empty saddlebags.

A WARNING

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

1. Disarm security system. Remove main fuse. See Replacement (Page 6-5).
2. Shift transmission to neutral.

NOTE

*When adjusting a **new** belt, rotate rear wheel a few revolutions prior to setting the tension.*

3. See Figure 1-28. Measure belt deflection using BELT TENSION GAUGE (PART NUMBER: HD-35381-A):
   a. Slide O-ring (4) to zero mark (3).
   b. **Models equipped with belt deflection window:** Fit belt cradle (2) against bottom of drive belt in line with belt deflection window.
   c. **All other models:** Fit belt cradle (2) against bottom of drive belt halftway between drive pulleys.
   d. Press upward on knob (6) until O-ring slides down to 10 lb (4.54 kg) mark (5) and hold steady.
4. Measure belt deflection:
   a. **Models equipped with belt deflection window:** See Figure 1-30. Measure belt deflection as viewed through belt deflection viewing window while holding gauge steady. Each deflection graduation is approximately 1/16 in (1.6 mm).
   b. **All other models:** See Figure 1-29. Measure amount of deflection (4) while holding gauge steady.

NOTE

Set to the lower (tightest) specification if the belt has less than 1000 mi (1,600 km).

5. Compare with specifications. Refer to Table 1-11. If not within specifications, see a Harley-Davidson dealer.
6. Install main fuse.

Table 1-11. Belt Deflection Specifications*

MODELS	in	mm
All models	1/4-5/16	6.4-7.9
* Deflection measured at 10 lb (4. 5 kg) tension.		

Figure 1-28. Belt Tension Gauge

1. Drive belt
2. Deflection graduations (Approx: 1.5 mm (1/16-in)

Figure 1-29. Belt Deflection Window

Figure 1-30. Checking Belt Deflection

ADJUSTMENT

FASTENER	TORQUE VALUE	
Axle, rear, nut	95-105 ft-lbs	129-142 N-m
Brake hose clamp to rear fork screw	30-40 in-lbs	3.4-4.5 N-m

NOTE

Rear brake line is clamped tightly to rear fork to avoid chafing of brake line in clamp. A small amount of slack must be maintained in rear brake line between clamp and rear caliper.

1. **See Figure 1-31. Remove screw (1) from clamp (2) on rear brake line (3).**
2. **See Figure 1-32. Remove and discard E-clip (1) and loosen axle nut (4).**

NOTE

Turn both adjuster nuts same number of turns in order to maintain approximate alignment of rear wheel.

3. **Turn axle adjuster nuts (2) clockwise to decrease belt deflection (increase tension), or counterclockwise to increase belt deflection (decrease tension).**
4. **Check rear wheel alignment. See Wheel Alignment (Page 1-52).**

A WARNING

Do not exceed specified torque when tightening axle nut. Exceeding torque can cause wheel bearings to seize during vehicle operation, which could result in death or serious injury. (00408e)

5. **Tighten axle nut (4) to 95-105 ft-lbs (129-142 N-m). Install new E-clip (1).**
6. **See Figure 1-31. Position clamp (2) on rear brake line (3). Secure clamp to rear fork with screw (1). Tighten to 30-40 in-lbs (3.4-4.5 N-m).**

Figure 1-31. Rear Brake Line

E-clip
Axle adjuster nut (2)
Axle adjuster (2) Axle
nut Washer
Protective cap (2)

Figure 1-32. Drive Belt Adjustment

CABLE INSPECTION AND LUBRICATION

FASTENER	TORQUE VALUE	
Switch housing screw	35--45 in-lbs	4-5.1 N-m

1. Release throttle cable tension. See Cable Adjustment (Page 1-36).
2. See Figure 1-33. Remove screws (1) to separate upper switch housing from the lower housing.
3. Unhook ferrules and cables from throttle grip. Remove throttle sleeve.
4. Inspect each cable. Replace cable assembly if cable is frayed or kinked.
5. Inspect cable outer sheath from throttle grip to induction module. Replace as necessary.
6. Apply a light coating of graphite to handlebar and inside surface of housings. Replace throttle grip.
7. Pour two drops of HARLEY LUBE into cable housings.
8. Install switch housing. Tighten to 35-45 in-lbs (4-5.1 N-m).
9. Adjust throttle cables.

CABLE ADJUSTMENT

Operation

A 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)

A 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. (00031 b)

1. See Figure 1-33. Loosen friction screw (3).
2. Roll on and release throttle grip. If throttle does not return to closed (idle), inspect and adjust throttle cables.
3. With engine idling, turn handlebar stop to stop. If engine speed changes, adjust throttle cables.

Adjustment

1. See Figure 1-33. Loosen friction screw (3).
2. Remove rubber boots from cable adjusters (6).
3. Loosen jamnuts (7).
4. Verify throttle cables are seated in cable guide. Turn cable adjusters to shorten cable housings to minimum length.
5. Point front wheel straight ahead. With engine OFF, roll throttle grip (2) fully open. Hold in position.
6. Gently turn cable adjuster on throttle cable (4) counterclockwise until throttle cam (8) touches throttle cam stop (10). Release throttle grip. Tighten jamnut on throttle cable adjuster.
7. Turn handlebar full right lock. Turn cable adjuster on idle cable (5) to lengthen sleeve until end of cable housing touches spring (9) within cable guide (11).

NOTE

The throttle control must operate freely when front wheel is turned to right and left fork stops.

8. Check adjustment. Twist and release throttle grip two or three times. If throttle does not return to idle, turn idle adjuster to shorten sleeve until correct. Tighten jamnuts.
9. Slide rubber boots over cable adjusters.

1. Screw (2)
2. Throttle grip
3. Friction screw
4. Throttle cable
5. Idle cable
6. Cable adjuster (2)
7. Jamnut (2)
8. Throttle cam
9. Spring
10. Throttle cam stop
11. Cable guide

Figure 1-33. Throttle Cable Adjustment

GENERAL

Inspect and lubricate the following items according to MAINTENANCE SCHEDULE (Page 1-9).

- Front brake hand lever
- Clutch hand lever
- Throttle control cables
- Throttle control grip sleeve
- Clutch cable
- Steering head bearings
- Jiffy stand

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

CABLES AND HAND LEVERS

For throttle cables, see THROTTLE CABLES (Page 2-87).

Use HARLEY® LUBE for clutch lever and cable.

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

JIFFY STAND

Clean and lubricate the jiffy stand. For more information, see Jiffy Stand (Page 2-124).

STEERING HEAD BEARINGS

Lubricate the steering head bearings with SPECIAL PURPOSE GREASE. See STEERING HEAD BEARINGS (Page 1-41).

REMOVE

PART NUMBER	TOOL NAME
HD-52006	ADJUSTABLE SPARK PLUG WIRE PULLER

.. WARNING

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

NOTE

- *Never remove spark plugs until heads have cooled.*
- *Use ADJUSTABLE SPARK PLUG WIRE PULLER (PART NUMBER: HD-52006) to remove stubborn spark plug boots.*

1. Disconnect spark plug cables.
2. Remove spark plugs.

INSPECT

NOTE

Discard plugs with eroded electrodes, heavy deposits or a cracked insulator.

See Figure 1-34. Compare plug deposits to Table 1-12.

Figure 1-34. Spark Plug Deposits

Table 1-12. Spark Plug Deposit Analysis

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

CLEAN

A WARNING

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

If the plugs require cleaning between tune-ups:

1. Clean electrodes and insulator with electrical contact cleaner. Dry plug with compressed air.
2. Use a thin file to flatten electrodes.

NOTE

Electrodes with sharp edges require 25-40 percent less voltage than ones with rounded edges.

3. Check condition of threads in cylinder head. Use a penetrating oil and clean out with a thread chaser. Verify that plug threads are clean.
4. If necessary, replace with **new** spark plugs.

INSTALLATION

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

1. Verify proper gap before installing **new** or cleaned spark plugs.

   a. Select a wire-type feeler gauge within specification. Refer to Table 1-13.

   b. Pass the wire gauge between the center and the outer electrodes.

c. If necessary, use the proper tool to bend the outer electrode to bring the gap to within specification.

2. Apply ANTI-SEIZE LUBRICANT to the spark plug threads. Tighten to 12-18 fl-lbs (16.3-24.4 N-m).

3. See Figure 1-35. Connect spark plug cables. Check connections at coil, spark plugs and anchor clips or harness caddies.

Table 1-13. Spark Plug Gap

MODEL	in	mm
XL	0.038-0.043	0.97-1.09

Figure 1-35. Spark Plug Cable Routing: All Models

INSPECT SPARK PLUG CABLES

1. Inspect spark plug cables. Replace if necessary.
   a. Check for cracks or loose terminals.
   b. Check for loose fit on ignition coil and spark plugs.

2. Check cable boots and caps for cracks or tears. Replace cable if boots or caps are worn or damaged.

3. See Figure 1-36. Check spark plug cable resistance with an ohmmeter. Replace cables not meeting resistance specifications. Refer to Table 1-14.

Table 1-14. Spark Plug Cable Resistance

CABLE	RESISTANCE (OHMS)
Front	1,750-4,836
Rear	4,843-15,420

Figure 1-36. Testing Resistance

FALL-AWAY

FASTENER	TORQUE VALUE	
Brake line, front, manifold bolt	36-48 **in-lbs**	4.1-5.4 N-m
Fork stem pinch bolt, upper	30-35 ft-lbs	40.7-47.5 N-m
Lower pinch screw in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m
Upper pinch screw in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m

Measurement

NOTICE

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

1. Lift motorcycle until both tires are off the ground. Verify that the lower frame rails front to back and left to right are level.
2. Remove any accessory that interferes with front fork swing.
3. Disconnect the clutch cable.
4. **XL1200NS:** Remove the throttle cable retainer clip.
5. **ABS models:** Remove:
   a. Fastener securing the brake line manifold to the lower fork bracket.
   b. Upper clamp securing brake lines to the left frame tube.
6. Cover the front fender tip with a strip of masking tape.
7. Install a pointer mounted to a floor stand. With the front wheel pointed straight ahead, position the pointer at the center of the fender.
8. Tap the fender on one side until the front fork begins to pivot (fall-away) without being tapped. Mark that point. Repeat in the opposite direction.
9. Measure the distance between the two fall-away marks.
10. If fall-away is not within specification, adjust the fall-away. Refer to Table 1-15.

Table 1-15. Fall-Away Specifications

MODEL	MINIMUM		MAXIMUM	
	in	mm	in	mm
XL883N	5.0	127	6.0	152
XL1200NS	5.0	127	6.0	152
XL1200X	6.0	152	8.0	203

Adjustment

1. See Figure 1-37. Loosen the lower bracket pinch screws (2) and the fork stem pinch screw (1).
2. Adjust fall-away:
   a. If fall-away is more than the maximum, loosen the fork stem bolt (3).
   b. If fall-away is less than the minimum, tighten the fork stem bolt.
3. Tighten the fork stem pinch screw.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Fork stem pinch bolt, upper*
4. **All but XL1200X:** Tighten the lower bracket pinch screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Fork stem pinch bolt, upper*
5. **XL1200X:** See Figure 1-38. Tighten lower bracket pinch screws. Sequence is UPPER HOLES, LOWER HOLES, UPPER HOLES, LOWER HOLES, UPPER HOLES, LOWER HOLES on both sides.

   a. Tighten upper screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Upper pinch screw in lower fork bracket: XL 1200X (initial)*

   b. Tighten lower screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Lower pinch screw in lower fork bracket: XL 1200X*

   c. Tighten upper screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Upper pinch screw in lower fork bracket: XL 1200X (initial)*

   d. Tighten lower screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Lower pinch screw in lower fork bracket: XL 1200X*

   e. Tighten upper screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Upper pinch screw in lower fork bracket: XL 1200X (initial)*

   f. Tighten lower screws.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Lower pinch screw in lower fork bracket: XL 1200X*
6. Verify fall-away.
7. If removed, attach brake line manifold to lower fork bracket. Tighten.

   Torque: 36-48 **in-lbs** (4.1-5.4 N-m) *Brake line, front, manifold bolt*
8. Install clamp securing brake lines to left frame tube.

9. **ABS models:**
   a. Install fastener securing the brake line manifold to the lower fork bracket.

   b. Install upper clamp securing brake lines to the left frame tube.

10. Install the clutch cable. Adjust clutch cable free play.

11. **XL1200NS:** Install throttle cable retainer clip.

12. Install any accessories that were removed before checking fall-away.

1. Fork stem pinch screw
2. Bracket pinch screws
3. Fork stem bolt

Figure 1-37. Steering Head Assembly (typical)

1. Lower bracket
2. Upper screw hole
3. Lower screw hole

Figure 1-38. XL1200X Lower Bracket

LUBRICATION

Disassemble the steering head assembly and lubricate the tapered roller bearings with SPECIAL PURPOSE GREASE. See FORK STEM AND BRACKET ASSEMBLY (Page 2-72).

SHOCK ABSORBER PRELOAD: ALL MODELS

Identify Shock

Sportster models have low, medium or tall shock absorbers depending on the market in which it is sold.

1. Park your motorcycle on the jiffy stand without any luggage or load.
2. Identify the shock.
   a. See Figure 1-39. Measure from the center of the lower shock mounting bolt to the center of the upper mounting bolt. Compare the measurement to the identification table to determine if your motorcycle has low, medium or tall shock absorbers. Refer to Table 1-16.

Figure 1-39. Shock Absorber Length

Figure 1-40. Preload Adjustment Arrow

Identify the Preload Dot

NOTE

The total of rider weight and passenger plus cargo and accessories cannot exceed the maximum added weight allowed.

Table 1-16. Shock Absorber Length

MEASUREMENT*		SHOCK
in	mm	
11.220	285.0	Low. Refer to Table 1-18.
11.712	297.5	Medium. Refer to Table 1-19.
13.366	339.5	Tall. Refer to Table 1-20.
* Measure unladen on jiffy stand.		

Refer to Table 1-17.

1. Add the weight of the rider and riding gear to get the rider weight.
2. Separately, add the weight of the passenger, their riding gear, intended cargo and any accessories.
3. Identify the table that corresponds to the model and shock absorber configuration of your motorcycle.
   a. **Low Travel:** Refer to Table 1-18.
   b. **Medium Travel:** Refer to Table 1-19.

Table 1-17. Maximum Added Weight Allowed

MODEL	SPECIFICATIONS	
	lb	kg
Iron 883™ (XL883N)	436	198
Iron 1200™ (XL1200NS)	438	199
Forty-Eight™ (XL1200X)	444	202

   c. **Tall Travel:** Refer to Table 1-20.

4. In the table, locate the preload dot number corresponding to the rider, passenger, cargo and accessories calculations.
   a. Under RIDER WEIGHT, identify the row that includes the total weight of the rider
   b. In the row of PASSENGER, CARGO AND ACCESSORIES, identify the total weight column for any passenger, cargo and accessories.
   c. The number at the intersection of the RIDER WEIGHT row and the PASSENGER, CARGO AND ACCESSORIES column is the recommended preload dot.

Table 1-18. Low Travel Shocks Preload

		ADDITIONAL WEIGHT OF PASSENGER, CARGO AND ACCESSORIES												
lb		0	20	40	60	80	100	120	140	160	180	200	220	240
kg		0	9	18	27	36	45	54	64	73	82	91	100	109
RIDER WEIGHT		PRELOAD DOT												
lb	kg													
100-129	45-59	1	2	3	4	5	6	6	7	8	9	9	10	10
130-159	59-72	2	3	4	5	6	7	7	8	9	9	10	10	11
160-189	73-86	3	4	5	6	7	7	8	9	9	10	10	11	12
190-219	86-99	4	5	6	7	7	8	9	9	10	11	11	12	-

Table 1-19. Medium Travel Shocks Preload

		WEIGHT OF PASSENGER, CARGO AND ACCESSORIES															
lb		0	16	32	48	64	80	96	112	128	144	160	176	192	208	224	240
kg		0	7	15	22	29	36	44	51	58	65	73	80	87	94	102	109
RIDER WEIGHT		PRELOAD DOT															
lb	kg																
100-123	45-56	1	2	3	4	5	6	7	7	8	9	9	10	11	11	12	13
124-147	56-67	2	3	4	5	6	7	7	8	9	9	10	11	11	12	13	13
148-171	67-78	3	4	5	6	7	8	8	9	9	10	11	11	12	13	13	-
172-195	78-89	4	5	6	7	8	8	9	10	10	11	12	12	13	13		-
196-219	89-99	5	6	7	8	8	9	10	10	11	12	12	13	13			-

Table 1-20. Tall Travel Shocks Preload

		WEIGHT OF PASSENGER, CARGO AND ACCESSORIES													
lb		0	18	36	54	72	90	108	126	144	162	180	198	216	234
kg		0	8	16	25	33	41	49	57	65	73	82	90	98	106
RIDER WEIGHT		PRELOAD DOT													
lb	kg														
116-141	53-64	1	2	3	4	5	6	7	8	9	10	11	11	12	13
142-167	64-76	2	3	4	5	6	7	8	9	10	11	11	12	13	-
168-193	76-88	3	4	5	6	7	8	9	10	11	11	12	13		-
194-219	88-99	4	5	6	7	8	9	10	11	11	12	13			-

Shock Adjustment

A WARNING

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

NOTE

To prevent damage to the adjustment and locking rings, do not use any other wrench than the one supplied with your motorcycle.

1. Remove seat. See SEAT (Page 2-100).
2. See Figure 1-41. Lift the latch (2) and slide the spanner wrench (1) from the retention pocket.

Figure 1-41. Spanner Wrench Retention Pocket

NOTICE

Avoid shock damage. Make sure shock threads are clean and free of debris before loosening or tightening shock adjusting nuts. (00646b)

3. If necessary, clean the threads on the shock absorber.
4. See Figure 1-42. Use the spanner wrench to turn the upper locking ring counterclockwise (1) to unlock the ring.

NOTE

See Figure 1-40. Rotate the lower adjustment ring clockwise (3) to increase preload. Rotate the lower adjustment ring counterclockwise to decrease preload.

5. *See* Figure 1-42. Use the spanner wrench to turn (2) the lower adjustment ring below the recommended dot.

NOTE

See Figure 1-40. Count down from the top dot (1) on the shock dot scale to identify the recommended preload dot.

6. See Figure 1-42. Rotate the upper locking ring to align with the recommended preload dot (3).
7. Cover one-half the recommended preload dot (4) with the upper locking ring.
8. Use the wrench to hand tighten the lower adjustment ring against the upper locking ring (5).
9. Adjust the opposite shock absorber to the same preload dot.
10. Return the spanner wrench to the retention pocket under the seat.
11. Install seat. See SEAT (Page 2-100).

1. **Loosen upper locking ring**
2. **Turn lower adjustment ring below recommended dot**
3. **Rotate upper locking ring to dot**
4. **Align upper locking ring to dot**
5. **Tighten lower adjustment ring**

Figure 1-42. Preload Adjustment

INSPECTION

Check engine mounts and stabilizer links:

1. **See Figure 1-43. Check for cracks or tears on rubber of front and rear mount isolators (17, 18):**
2. **Check for lateral movement at each end of the three stabilizer links (8). Any lateral move ment indicates the need to replace the stabilizer link: Ro.atlonal movement does not indicate excess wear**
3. **Check that all engine mount bolts and stabilizer link screws are tight . See STABILIZER LINKS (age 2-80), FRONT ENGINE MOUNT AND ISOLATOR (Page 2-82) or REAR ENGINE MOUNT AND ISOLATOR (Page 2-84) fortorque specifications.**

4 Checkthatthe mounts are supporting the weight of the motor.

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Figure 1-43 . Engine Mounting Assembles: All Models

1. **Screw (3)**
2. **Screw (2)**
3. **Screw (3)**
4. **Screw (11)**
5. **Washer (4)**
6. **Spacer**
7. **Lockwasher (2)**
8. **Stabilizer link (3)**
9. **Front isolator mount**
10. **Rear isolator mount**
11. **Nut**
12. **Bolt**
13. **Rear fork pivot shaft**
14. **Rear pivot iockplate**
15. **Stabilizer link bracket (2)**
16. **Engine bracket**
17. **Front mount isolator (2)**
18. **Rear mount isolator (2)**
19. **Groundi ng strap**

GENERAL

A 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)

A WARNING

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

A WARNING

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

NOTICE

Keep battery clean and lightly coat terminals with petroleum jelly to prevent corrosion. Failure to do so could result in damage to battery terminals. (00217a)

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

NOTE

For charging information, see Charging Battery (Page 1-49). See the electrical diagnostic manual for information about testing and troubleshooting this part.

Figure 1-44. Battery

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 1-45. Battery Warning Label

Table 1-21. 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
Eyes	Flush with water. Get immediate medical attention.

DISCONNECTION AND REMOVAL

A 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 seat.
2. Remove left side cover.
3. Keyless models with sirens: Verify that fob is present. Switch OFF/RUN switch to RUN before removing main fuse or disconnecting battery.
4. See Figure 1-46. Pull fuse block (1) aside.
5. Remove main fuse.
6. Disconnect negative battery cable at negative terminal (2).
7. Remove positive terminal boot (3) from positive battery terminal. Disconnect positive battery cable.
8. See Figure 1-47. Remove strap fastener (1).
9. Unhook battery strap from mount (2) on top of battery.
10. Remove battery.

Figure 1-46. Battery Compartment

NOTE

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

1. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water).
2. When the solution stops bubbling, rinse off the battery with clean water.
3. Clean cable connectors and battery terminals using a wire brush or sandpaper. Remove any oxidation.
4. Inspect the battery screws, and cables for breakage, loose connections and corrosion.
5. Check the battery terminals for melting or damage caused by over-tightening.
6. Inspect the battery for discoloration, raised top or a warped or distorted case. This might indicate that the battery has been frozen, overheated or overcharged.
7. Inspect the battery case for cracks or leaks.

Figure 1-47. Battery Strap

CLEANING AND INSPECTION

VOLTAGE TEST

A 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)

A WARNING

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

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

1. If the open circuit (disconnected) voltage reading is below 12.6 V:
   a. Charge the battery.
   b. Check the voltage after the battery has set for at least one hour.
2. If the voltage reading is 12.7 V or above:
   a. Perform a battery diagnostic test. See the electrical diagnostic manual for the load test procedure.
   b. Refer to Table 1-22.

Table 1-22. Voltage Test For Battery Charge Conditions

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

CHARGING BATTERY

Safety Precautions

An automatic, constant monitoring battery charger/tender with a charging rate of 5 amps maximum at no more than 14.6 volts is recommended. The use of constant current chargers (including trickle chargers) to charge sealed AGM batteries is not recommended.

Any overcharge causes dry-out and premature battery failure. Always review charger instructions before charging a battery. In addition to the manufacturer's instructions, follow these general safety precautions:

- Always wear eye, face and hand protection.
- Always charge batteries in a well-ventilated area.
- Turn off the charger before connecting or disconnecting the leads to the battery to avoid dangerous sparks.
- Never try to charge a visibly damaged or frozen battery.
- Connect the charger leads to the battery. Red positive lead to the positive terminal. Black negative lead to the negative terminal. If the battery is still in the vehicle, connect the negative lead to the chassis ground. Verify that the ignition and all electrical accessories are turned off.
- Verify that charger leads to battery are not separated, frayed or loose.
- If the battery temperature exceeds 110 °F (43 °C) during charging, discontinue charger. Allow the battery to cool.

Using a Battery Charger

Charge the battery if:

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

A WARNING

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

NOTICE

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

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

A WARNING

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

NOTICE [2 3]

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

NOTE

- *Most constant monitoring battery chargers are completely automatic. They can be left connected to both AC power and to the battery that is being charged. When leaving this type of charger connected for extended periods of time, periodically check the battery to check if it is unusually warm. This is an indication that the battery has a weak cell or internal short. Read the manufacturer's instructions for the charger.*

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

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 battery charger to the battery tender connector. Verify that the ignition and all electrical accessories are turned off.

3. Step away from the battery and turn on the charger.

A WARNING

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

4. After the battery is fully charged, turn the charger OFF. Disconnect the black battery charger lead from the negative terminal of the battery.

5. Disconnect the red battery charger lead from the positive terminal of the battery.

6. Mark the charging date on the battery.

7. Perform a battery diagnostic test to determine the condition of the battery. See the electrical diagnostic manual.

8. If charging a battery because voltmeter test reading was below 12.6 V, perform voltmeter test. See the electrical diagnostic manual.

FASTENER	TORQUE VALUE	
Battery strap fastener	72-96 in-lbs	8.1-10.8 N-m
Battery terminal screw	60-70 in-lbs	6.8-7.9 N-m

NOTICE

INSTALLATION AND CONNECTION

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

1. Apply a light coat of petroleum jelly or corrosion retardant to negative and positive terminals.

2. Install battery.

3. See Figure 1-47. Install top of battery strap to mount (2). Install strap fastener (1). Tighten to 72-96 in-lbs (8.1-10.8 N-m).

A 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)

4. See Figure 1-48. Install positive terminal screw through main fuse cable (1) then positive cable (2). Tighten to 60-70 in-lbs (6.8-7.9 N-m).

5. Install rubber boot over terminal.

NOTE

See Figure 1-49. Route negative battery cable under fuse block wire harness.

6. Install screw through negative battery cable and into negative battery terminal. Tighten to 60-70 in-lbs (6.8-7.9 N-m).

7. Install main fuse.

8. Install fuse block to oil tank.

9. Install left side cover.

10. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

Figure 1-48. Positive Terminal

Figure 1-49. Negative Battery Cable under Fuse Block Wire Harness

STORAGE

A WARNING

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

If the motorcycle is stored with the security system armed, connect an automatic, constant monitoring battery charger/tender to maintain battery charge. Refer to the Harley-Davidson Parts and Accessories catalog.

If the motorcycle is stored with the battery installed, without a Harley-Davidson constant monitoring battery charger/tender, and with the security system not armed, remove main fuse.

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

See Figure 1-50. A battery that is removed from the vehicle is affected by self-discharge. A battery that is stored in the vehicle is affected by self-discharge and, more significantly, by parasitic loads. A parasitic load is caused by things like diode leakage or maintaining computer memory with the vehicle turned off.

Batteries self-discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool, dry place.

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

NOTE

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

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

Figure 1-50. Effective Rate of Temperature on Battery Self-discharging Rate

WHEEL ALIGNMENT

PART NUMBER	TOOL NAME
HD-48856-A	AXLE ALIGNMENT PLUGS

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

Checking Wheel Alignment

A 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)

NOTE
Some models require muffler removal.

1. See Figure 1-51. Insert alignment plugs (1, 2) from AXLE ALIGNMENT PLUGS (PART NUMBER: HD-48856-A) into right and left ends of rear axle. Turn handle until plug is firmly held in axle.

2. See Figure 1-52. Fabricate an alignment tool using a piece of % in (3.175 mm) diameter aluminum welding rad 6 in (153 mm) long.

   a. Grind one end down to a blunt point (1).

   b. Bend rad at a 90 degree angle, 2.25 in (57 mm) (3) from blunt point.

   c. Place a snug-fitting rubber grommet (2) on rod to act as a slide measurement indicator.

3. Gauge distance between rear fork pivot bolt and rear axle alignment plug center.

   a. See Figure 1-53. Insert blunt point of wheel alignment tool (1) in alignment dimple (4).

   b. Slide rubber grommet (2) along tool shaft until it aligns with hole in renter of axle alignment plug (3).

   c. Without moving grommet, position alignment tool on left side of rear fork.

4. Verify measurements match on both sides of axle. Adjust if necessary.

Figure 1-51. Axle Alignment Plugs

Figure 1-52. Wheel Alignment Tool

Figure 1-53. Checking Wheel Alignment

Adjusting Wheel Alignment

1. Remove and discard E-clip.
2. Loosen rear axle nut.
3. Locate side with longer alignment dimple to axle center distance. Turn nut on axle adjuster counterclockwise to shorten distance. Adjust axle until left and right side alignment measurements are equal.

NOTE

- *Keep axle adjuster mechanisms firmly seated (under tension) on each side of rear fork during wheel alignment. Do so by applying moderate upward force on lower span of drive belt. This force tensions drive belt, which holds rear axle forward against both adjuster mechanisms.*
- *Do not tighten rear axle nut or install **new** E-clip until after checking drive belt tension.*

4. Adjust drive belt deflection. See Check Drive Belt Deflection (Page 1-33).

NOTE

Ifrear axle has been moved, verify slack in rear brake line between clamp and rear caliper. If necessary, reposition brake line. See Check Drive Belt Deflection (Page 1-33).

A WARNING

Do not exceed specified torque when tightening axle nut. Exceeding torque can cause wheel bearings to seize during vehicle operation, which could result in death or serious injury. (00408e)

5. Tighten axle nut to 95-105 ft-lbs (129-142 N-m).
6. Install **new** E-clip.
7. Install muffler if removed.

FASTENER	TORQUE VALUE	
Headlamp horizontal adjustment: Forty-Eight (XL1200X)	30-35 ft-lbs	40.7-47.5 N-m
Headlamp screw	40 in-lbs	4.5 N-m
Headlamp vertical adjustment: Forty-Eight	30-35 ft-lbs	40.7-47.5 N-m
Visor screws	40 in-lbs	4.5 N-m

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HEADLAMP ALIGNMENT

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

NOTE

Choose a wall in minimum light.

4. **See Figure 1-54. Park the motorcycle on a perpendicular line (1) with the front axle 25 ft (7.6 m) (3) from a wall.**
5. **Draw a vertical line (2) on the wall.**

FASTENER	TORQUE VALUE	
Headlamp clamp nut: Iron 1200(XL1200NS)	120--240 in-lbs	13.6-27.1 N-m
Headlamp clamp nut: Iron 883 (XL883N)	120--240 in-lbs	13.6-27.1 N-m

NOTE

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

6. **With the motorcycle loaded, point the front wheel straight forward at wall. Measure the distance (4) from the floor to the center of the high beam bulb.**
7. **Draw a horizontal line (5) through the vertical line on the wall. Place line 2.1 in (53.3 mm) lower than the measured bulb centerline.**

NOTE

The headlamp is aligned when the light beam hot spot is located over the intersection of the lines.

8. **With the high beam activated, verify headlamp alignment. Adjust as necessary.**

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

Figure 1-54. Headlamp Alignment: Sportster Models

HEADLAMP ADJUSTMENT

Forty-Eight (XL1200X)

1. Set horizontal adjustment:
   a. See Figure 1-55. Loosen horizontal adjustment screw (3).
   b. Turn headlamp right or left as necessary to direct light beam straight ahead.
   c. Tighten horizontal adjustment screw to:

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Headlamp horizontal adjustment: Forty-Eight (XL 1200X)*

2. Set vertical adjustment:
   a. Loosen locknut (1) for vertical adjustment bolt.
   b. Tilt headlamp up or down to aim it at horizontal line on wall.
   c. Tighten headlamp locknut.
      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Headlamp vertical adjustment: Forty-Eight (XL1200X)*

1. Locknut
2. Vertical adjustment bolt
3. Horizontal adjustment screw

Figure 1-55. Headlamp Adjustment: Forty-Eight (XL1200X)

Iron 883 (XL883N)

1. See Figure 1-56. Remove snap plug (1) on top of headlamp bracket (2).

2. Loosen headlamp clamp nut (3).

3. Tilt headlamp up or down to aim it at horizontal line. At same time, turn it right or left to aim beam straight ahead.

4. After lamp is properly positioned tighten headlamp clamp nut.

   Torque: 120-240 **in-lbs** (13.6-27.1 N-m) *Headlamp clamp nut: Iron 883 (XL883N)*

5. Install snap plug.

Figure 1-56. Headlamp Adjustment: Iron 883 (XL883N), Iron 1200 (XL1200NS)

1. See Figure 1-57. Remove visor screws (7) and washers (6).

2. Remove headlamp visor (1) from headlamp visor bracket (2).

3. Remove screw (3) and washer (4).

4. Loosen headlamp clamp nut (5).
5. Tilt headlamp up or down to aim at horizontal line. At same time, turn it right or left to aim beam straight ahead.

6. After lamp is properly positioned tighten headlamp clamp nut.

   Torque: 120-240 **in-lbs** (13.6-27.1 N-m) *Headlamp clamp nut: Iron 1200 (XL 1200NS)*

7. Install washer (4) and screw (3). Tighten.

   Torque: 40 **in-lbs** (4.5 N-m) *Headlamp screw*

8. Install headlamp visor.

   a. Align visor on bracket.

   b. Install washers (6) and screws (7). Tighten.

Torque: 40 **in-lbs** (4.5 N-m) *Visor screws*

Figure 1-57. Headlamp Adjustment: Iron 1200 (XL1200NS)

PLACING IN STORAGE

A WARNING

Do not store motorcycle with gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00003a)

1. **Change the engine oil. See Changing Oil and Filter (Page 1-13).**
2. **Check the transmission lubricant level. See Transmission Lubrication (Page 1-21).**

A 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)

A WARNING

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

3. **Fill fuel tank. Add fuel stabilizer following manufacturer's instructions.**
4. **Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Replace the spark plugs.**
5. **Inspect drive belt deflection. See WHEEL ALIGNMENT (Page 1-52).**
6. **Inspect drive belt and sprockets. See DRIVE BELT AND SPROCKETS (Page 1-32).**
7. **Inspect air cleaner filter. See Air Cleaner (Page 1-16).**
8. **Lubricate controls. See CABLE AND CHASSIS LUBRICATION (Page 1-38).**
9. **Inspect operation of all electrical equipment and switches.**
10. **Check tire inflation and inspect tires for wear and/or damage. See TIRES AND WHEELS (Page 1-18). 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.**

A 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)

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

A 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)

A 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)

12. **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 BATTERY MAINTENANCE (Page 1-47).**

A 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)

13. **If the motorcycle is to be covered, use a material that will breathe, such as a Harley-Davidson storage cover or light canvas. Plastic materials that do not breathe promote the formation of condensation, which leads to corrosion.**

REMOVAL FROM STORAGE

A WARNING

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

1. **Charge and install battery. If main fuse was removed, plug it in.**
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

A WARNING

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

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

NOTE

See the electrical diagnostic manual for additional information.

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Engine run switch in OFF position.
2. Ignition switch not in IGNITION 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. Bank angle sensor (BAS) tripped and ignition switch not cycled OFF then back to IGNITION position.
7. Security system activated.
8. Motorcycle in gear and clutch not pulled in.
9. Main fuse not in place.
10. Jiffy stand down and transmission in gear (HDI models).

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fuel filter clogged.
3. Plugged fuel injectors.
4. Discharged battery, loose or damaged battery terminal connections.
5. Fouled spark plugs.
6. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
7. Ignition timing incorrect due to faulty coil, ECM or sensors (TMAP, CKP).
8. BAS tripped and ignition/light key switch not cycled OFF then back to IGNITION.
9. Damaged wire or loose wire connection at ignition coil, battery or ECM connector.
10. Sticking or damaged valve(s) or wrong length pushrod(s).
11. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

Starts Hard

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

NOTE

For cold weather starts, always disengage clutch.

Starts But Runs Irregularly or Misses

1. Spark plugs in bad condition or partially fouled.
2. Spark plug cables in bad condition and shorting or leaking.
3. Spark plug gap too close or too wide.
4. Faulty ignition coil, ECM or sensor (TMAP, CKP, ET or HO2S).
5. Battery nearly discharged.
6. Damaged wire or loose wire connection at ignition coil, battery 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. Partially plugged fuel injectors.
12. Damaged intake or exhaust valve(s).
13. Weak or damaged valve springs.
14. Incorrect valve timing.

Spark Plug Fouls Repeatedly

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

Pre-Ignition or Detonation (Knocks or Pings)

1. Excessive carbon deposit on piston head or in combustion chamber.
2. Incorrect heat range spark plug.
3. Faulty spark plug(s).
4. Ignition timing advanced. ECM or sensors (CKP,ET or TMAP) defective.
5. Fuel octane rating too low.
6. Intake manifold vacuum leak.

Check Engine Light Illuminates During Operation

Fault detected. See the electrical diagnostic manual for this motorcycle.

Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow over engine.
3. Leaking valve(s).
4. Heavy carbon deposits.
5. Ignition timing retarded. ECM or sensor (CKP, TMAP) defective.

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 pushrod(s).
4. Incorrect pushrod length.
5. Cam(s), cam gear(s), or cam bushing(s) worn.
6. Rocker arm binding on shaft.
7. Valve sticking in guide.

Excessive Vibration

1. Stabilizer links worn or loose, or stabilizer link brackets loose or damaged.
2. Isolators worn or isolator bolts loose or damaged.
3. Isolator mounting brackets (left side of vehicle) loose or damaged.
4. Rubber mounts loose or worn.
5. Rear fork pivot shaft fasteners loose.
6. Front engine mounting bolts loose.
7. Exhaust system binding or hitting frame.
8. Engine/transmission and rear wheel not aligned properly.
9. Damaged frame.
10. Ignition timing advanced due to faulty sensor inputs (CKP, TMAP) or poorly tuned engine.
11. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
12. Wheels not aligned, rims bent, or tires worn or damaged.
13. Internal engine problem.

LUBRICATION SYSTEM

PART NUMBER	TOOL NAME
HD-35457	BLACK LIGHT LEAK DETECTOR

Oil Does Not Return To Oil Tank

1. Oil tank empty.
2. Oil pump gerotors damaged. The oil pump is not functioning.
3. Restricted oil hoses or fittings.
4. Restricted oil filter.

Engine Uses Too Much Oil Or Smokes Excessively

1. Piston rings badly worn or damaged.
2. Valve guide(s) or seal(s) worn or damaged.
3. Restricted oil filter.
4. Oil tank overfilled.
5. Restricted oil return hose to tank.
6. Restricted breather operation.
7. Plugged crankcase scavenge port.
8. Oil diluted with gasoline.

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

1. Loose parts.
2. Imperfect seal at gaskets, pushrod cover, washers, etc.

NOTE

To aid locating leaks, use BLACK LIGHT LEAK DETECTOR (PART NUMBER: HD-35457).

3. Restricted oil return hose to tank.
4. Restricted breather passage(s) to air cleaner.
5. Restricted oil filter.
6. Oil tank overfilled.
7. Porosity.

Low Oil Pressure

1. Oil tank underfilled.
2. Faulty low oil pressure switch.
3. Worn oil pump gerotor(s).
4. Worn pinion shaft drive gear.
5. Restricted feed hose from oil tank.
6. Restricted high-pressure feed hose to oil filter housing.
7. Oil diluted with gasoline.
8. Oil bypass plunger stuck open.

High Oil Pressure

1. Oil tank overfilled.
2. Restricted oil tank return hose.
3. Oil bypass plunger stuck closed.

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. Clutch dragging slightly.
2. Transmission lubricant level too high.
3. Transmission lubricant too heavy (winter operation).
4. Shifter return spring (inside primary chaincase) bent or broken.
5. Bent shifter rod.
6. Shifter forks sprung or damaged.
7. Corners worn off gear dogs and shifter dog rings.

Jumps Out Of Gear

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

Clutch Slips

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

Clutch Drags Or Does Not Release

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

Clutch Chatters

Friction plates or steel plates worn, warped or dragging.

HANDLING

1. Tires improperly inflated. Do not overinflate.
2. Loose wheel axle nuts. Tighten to torque specification.
3. Improper vehicle alignment: rear wheel out of alignment with frame and front wheel.
4. Rims and tires out-of-true sideways.
5. Rims and tires out-of-round or eccentric with hub.
6. Loose spokes (models with laced wheels).
7. Irregular or peaked front tire tread wear.
8. Damaged tires or improper front-rear tire combination.
9. Tire and wheel unbalanced.
10. Steering head bearings improperly adjusted or pitted or worn bearings and races.
11. Shock absorbers damaged/worn - not functioning normally.
12. Heavy front end loading. Non-standard equipment on the front end (such as heavy radio receivers, extra lighting equipment, or luggage) tends to cause unstable handling.
13. Engine mounts/stabilizer links loose, worn or damaged.
14. Rear fork pivot assembly: improperly tightened or assembled, or loose, pitted or damaged pivot bearings.
15. Incorrect, non-specified tire(s) mounted on front or rear wheel.

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

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

FASTENER	TORQUE VALUE		NOTES
Axle, front, nut	60-65 ft-lbs	81-88 N-m	2.5 WHEELS, General
Axle, front, nut	60-65 ft-lbs	81-88 N-m	2.5 WHEELS, FRONT WHEEL
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	2.5 WHEELS, General
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	2.5 WHEELS, REAR WHEEL
Belt guard screw	120-180 in-lbs	13.6-20.3 N-m	2.18 BELT GUARD AND DEBRIS DEFLECTOR, Belt Guard
Brake caliper, front, mounting bolt	28-38 ft-lbs	38-51.6 N-m	2.8 FRONT BRAKE CALIPERS, Installation
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m	2.8 FRONT BRAKE CALIPERS, Assembly
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m	2.10 REAR BRAKE CALIPER, Assembly
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m	2.11 Brake Lines, Rear Brake Line (Non-ABS)
Brake caliper bleeder valve	35-61 in-lbs	3.9-6.9 N-m	2.12 Bleeding Brakes, Procedure
Brake disc, front, screw	16-24 ft-lbs	21.7-32.6 N-m	2.5 WHEELS, FRONT WHEEL Cast front wheel
Brake disc, rear, screw	30-45 ft-lbs	40.7-61.1 N-m	2.5 WHEELS, REAR WHEEL
Brake lever pivot pin	5-13 in-lbs	0.5-1.5 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Front Brake Lever
Brake lever pivot pin nut	44-61 in-lbs	4.9-6.9 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Front Brake Lever
Brake line, front, manifold bolt	36-48 in-lbs	4.1-5.4 N-m	2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS)
Brake line, front, manifold bolt	36-48 in-lbs	4.1-5.4 N-m	2.11 Brake Lines, Front Manifold to EHCU (ABS)
Brake line, rear, bracket fasteners	120-180 in-lbs	13.6-20.3 N-m	2.19 REAR FORK, Installation
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.8 FRONT BRAKE CALIPERS, Installation
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.10 REAR BRAKE CALIPER, Installation
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Rear Brake Line (Non-ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Rear Brake Line (Non-ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Front Manifold to EHCU (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Rear Master Cylinder to EHCU (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Rear Master Cylinder to EHCU (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Rear EHCU to Caliper (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.11 Brake Lines, Rear EHCU to Caliper (ABS)
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.14 Electro Hydraulic Control Unit (EHCU), Installation

FASTENER	TORQUE VALUE		NOTES
Brake line bracket clamp fastener	20-30 in-lbs	2.3-3.4 N-m	2.11 Brake Lines, Front Manifold to EHCU (ABS)
Brake line clamp screw, fork bracket	45-65 in-lbs	5.1-7.4 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)
Brake line clamp screw, fork bracket	45-65 in-lbs	5.1-7.4 N-m	2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS)
Brake line clamp screw, steering stem	120-168 in-lbs	13.6-19 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m	2.11 Brake Lines, Rear Brake Line (Non-ABS)
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m	2.11 Brake Lines, Rear EHCU to Caliper (ABS)
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m	2.14 Electro Hydraulic Control Unit (EHCU), Installation
Brake line tube nuts	128-173 in-lbs	14.5-19.5 N-m	2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS)
Brake line tube nuts	128-173 in-lbs	14.5-19.5 N-m	2.11 Brake Lines, Front Manifold to EHCU (ABS)
Brake master cylinder, front, reservoir cover screws	9-17 in-lbs	1-2 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Front Master Cylinder Reservoir Cover
Brake master cylinder, front, reservoir cover screws	9-17 in-lbs	1-2 N-m	2.12 Bleeding Brakes, Procedure
Brake master cylinder, rear, mounting bracket screw	45-50 ft-lbs	61-68 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Master Cylinder Mounting Bracket
Brake master cylinder, rear, mounting screw	18-22 ft-lbs	24.4-29.9 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake master cylinder, rear, pushrod collar	130-173 in-lbs	14.7-19.6 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Master Cylinder Rebuild Kit
Brake master cylinder, rear, reservoir cover screws	9-17 in-lbs	1-2 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Cover
Brake master cylinder, rear, reservoir cover screws	9-17 in-lbs	1-2 N-m	2.12 Bleeding Brakes, Procedure
Brake master cylinder clamp, front, screw	108-132 in-lbs	12.2-14.9 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake pad pin	131-173 in-lbs	14.8-19.5 N-m	2.8 FRONT BRAKE CALIPERS, Assembly
Brake pad pin	131-173 in-lbs	14.8-19.5 N-m	2.10 REAR BRAKE CALIPER, Assembly
Brake pedal clevis screw	13-17 ft-lbs	17.6-23 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Brake pedal clevis screw	13-17 ft-lbs	17.6-23 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Right Footrest and Rear Brake Pedal Assembly
Brake rod ball stud	120-180 in-lbs	13.6-20.4 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Brake rod ball stud	120-180 in-lbs	13.6-20.4 N-m	2.36RIDER FOOT CONTROLS: FORWARD, Right Footrest and Rear Brake Pedal Assembly
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	2.24 THROTTLE CABLES, Installation
Caliper to mounting bracket, rear	28-38 ft-lbs	38-51.5 N-m	2.10 REAR BRAKE CALIPER, Installation
Clutch cable fitting	36-108 in-lbs	4.1-12.2 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Clutch cable wireform screw	9-11 in-lbs	1.1-1.2 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Clutch inspection cover screws	84-108 in-lbs	9.5-12.2 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Clutch lever anti-rattle spring screw	8-13 in-lbs	0.9-1.5 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Damper cartridge screw (All but XL1200X)	11-18 ft-lbs	15-25 N-m	2.16 FRONT FORK, Assembly: Left Side
Damper cartridge screw (XL 1200X)	22-30 ft-lbs	30-40 N-m	2.16 FRONT FORK, Assembly: Left Side

FASTENER	TORQUE VALUE		NOTES
Debris deflector screw	36-60 in-lbs	4.1-6.8 N-m	2.18 BELT GUARD AND DEBRIS DEFLECTOR, Debris Deflector
EHCU mounting bracket fasteners	15-18 ft-lbs	20.3-24.4 N-m	2.14 Electro Hydraulic Control Unit (EHCU), Installation
EHCU to mounting bracket fastener	50-70 in-lbs	5.8-7.8 N-m	2.14 Electro Hydraulic Control Unit (EHCU), Installation
Engine mount, front, bolt	95-105 ft-lbs	129-142 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Fender, rear, mounting fastener	120-168 in-lbs	13.6-19 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Installation
Fender, rear, mounting fastener	120-168 in-lbs	13.6-19 N-m	2.32 REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS, Assembly and Installation
Fender brace, rear, screw	20-25 in-lbs	2.3-2.8 N-m	2.32 REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS, Assembly and Installation
Fender to fork brace, front: XL1200X	30-42 in-lbs	3.4--4.7 N-m	2.29 Front Fender, All Models Tighten in cross pattern.
Fender to forks, front: All models except XL1200X	96-156 in-lbs	10.9-17.6 N-m	2.29 Front Fender, All Models
Footrest support bracket	45-50 ft-lbs	61-68 N-m	2.19 REAR FORK, Installation
Footrest support bracket	45-50 ft-lbs	61-68 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Footrest support bracket	45-50 ft-lbs	61-68 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Footrest support bracket	45-50 ft-lbs	61-68 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Left Footrest and Shift Lever Assembly
Footrest support bracket	45-50 ft-lbs	61-68 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Right Footrest and Rear Brake Pedal Assembly
Footrest support bracket	45-50 ft-lbs	61-68 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Left Footrest and Shift Lever Assembly
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Right Footrest and Rear Brake Pedal Assembly
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Fork, front, pinch bolt	21-27 ft-lbs	28.5-36.6 N-m	2.5 WHEELS, FRONT WHEEL
Fork, front, stem bolt, final torque	72-96 in-lbs	8.1-10.9 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork, front, stem bolt, first torque	23-27 ft-lbs	31.2-36.6 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork, front, upper bracket pinch screw	30-35 ft-lbs	40.7--47.5 N-m	2.16 FRONT FORK, Installation
Fork, rear, pivot bolt nut	120-130 ft-lbs	162.7-176.3 N-m	2.19 REAR FORK, Installation
Fork, rear, pivot bolt nut	120-130 ft-lbs	162.7-176.3 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Fork brace to forks: XL1200X	18-22 ft-lbs	24.4-29.8 N-m	2.29 Front Fender, All Models
Fork slider tube fastener (All but XL1200X)	132-216 in-lbs	14.9-24.4 N-m	2.16 FRONT FORK, Assembly: Right Side
Fork slider tube fastener (XL1200X)	37--44 ft-lbs	50-60 N-m	2.16 FRONT FORK, Assembly: Right Side

FASTENER	TORQUE VALUE		NOTES
Fork stem pinch bolt	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork stem pinch bolt: All but XL1200X	30-35 ft-lbs	40.7-47.5 Nm	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork tube plug	22-59 ft-lbs	30-80 N-m	2.16 FRONT FORK, Assembly: Left Side
Front fork lower bracket pinch screw: All butXL1200X	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Gear shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Left Footrest and Shift Lever Assembly
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	2.26 HANDLEBAR, Installation
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	12.26 HANDLEBAR, Installation
Handlebar control lever clamp screw	108-132 **in-lbs**	12.2-14.9 Nm	2.25 CLUTCH CONTROL, Assembly and Installation
Handlebar control lever clamp screw	108-132 **in-lbs**	12.2-14.9 N-m	2.26 HANDLEBAR, Installation
Handlebar riser bolt, lower	30-40 ft-lbs	40.7-54.3 Nm	2.26 HANDLEBAR, Installation
Headlamp visor bracket to headlamp bracket button screw	3.0-3.7 ft-lbs	4-5 Nm	2.28 HEADLAMP VISOR, Disassemble and Assemble
Headlamp visor bracket to headlight bracket socket head screw	10-16 ft-lbs	14-22 Nm	2.28 HEADLAMP VISOR, Disassemble and Assemble
Headlamp visor screw	35-45 **in-lbs**	4-5.1 N-m	2.28 HEADLAMP VISOR, Removal and Installation
Isolator, front, mounting bracket screw	25-35 ft-lbs	33.9-47.5 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
Isolator, front, mounting bracket screw	25-35 ft-lbs	33.9-47.5 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
License plate clamp nut: top mount bracket	20-25 **in-lbs**	2.3-2.8 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Top Mount License Plate Bracket
License plate screw (India)	35-45 **in-lbs**	4-5.1 N-m	2.34 REAR LICENSE PLATE: INDIA MODELS, Rear License Plate: India
License plate support bracket screws: top mount bracket	20-25 **in-lbs**	2.3-2.8 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Top Mount License Plate Bracket
Locknut, fork tube plug	13-16.6 ft-lbs	17.5-22.5 N-m	2.16 FRONT FORK, Assembly: Left Side
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 Nm	2.16 FRONT FORK, Installation
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 Nm	2.16 FRONT FORK, Installation
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 Nm	2.16 FRONT FORK, Installation
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 Nm	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Mirror stem locknut	96-144 **in-lbs**	10.9-16.3 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Mirror stem locknut	96-144 **in-lbs**	10.9-16.3 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Parking brake nut	44-62 **in-lbs**	5-7 Nm	2.13 PARKING BRAKE ASSEMBLY, Install
Parking brake pivot pin	44-62 **in-lbs**	5-7 N-m	2.13 PARKING BRAKE ASSEMBLY, Install
Seat bracket screw	40-60 **in-lbs**	4.5-6.8 N-m	2.27 SEAT, Installation
Seat mounting screw	15-30 **in-lbs**	1.7-3.4 N-m	2.27 SEAT, Installation
Seat post bolt	120-168 **in-lbs**	13.6-19 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Installation

FASTENER	TORQUE VALUE		NOTES
Seat post bolt	120-168 in-lbs	13.6-19 N-m	2.32 REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS, Assembly and Installation
Shifter peg screw	96-144 in-lbs	10.9-16.3 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Left Footrest and Shift Lever Assembly
Shifter peg screw	96-144 in-lbs	10.9-16.3 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shifter rod to shift lever screw	120-180 in-lbs	13.6-20.4 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shifter rod to shift lever screw	120-180 in-lbs	13.6-20.4 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shift pedal clevis screw	13-17 ft-lbs	17.6-23 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shift rod jamnuts	84-132 in-lbs	9.5-14.9 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Adjusting Shift Pedal
Shift rod screw	120-180 in-lbs	13.6-20.4 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Adjusting Shift Pedal
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m	2.5 WHEELS, REAR WHEEL
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m	2.18 BELT GUARD AND DEBRIS DEFLECTOR, Belt Guard
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m	2.20 Shock Absorbers, Installation Apply 2-3 drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads.
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m	2.20 Shock Absorbers, Installation
Slider tube cap	22-59 ft-lbs	30-80 N-m	2.16 FRONT FORK, Assembly: Right Side
Sprocket cover, forward and lower screw	80-120 in-lbs	9-13.6 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Sprocket mounting screw, 1st torque	60 ft-lbs	81.3 N-m	2.5 WHEELS, REAR WHEEL
Sprocket mounting screw, final torque	80 ft-lbs	108 N-m	2.5 WHEELS, REAR WHEEL
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Lower Front Stabilizer Link
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Stabilizer link, upper front, engine bracket mounting screw	55-65 ft-lbs	74.6-88.2 N-m	2.21 STABILIZER LINKS, Upper Front Stabilizer Link
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Upper Front Stabilizer Link
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Upper Front Stabilizer Link
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Lower Front Stabilizer Link
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Lower Front Stabilizer Link
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Rear Stabilizer Link

FASTENER	TORQUE VALUE		NOTES
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Stop lamp switch, rear	12-15 in-lbs	1.4-1.6 N-m	2.11 Brake Lines, Rear Master Cylinder to EHCU (ABS)
Strut cover fastener, front	120-168 in-lbs	13.6-19 N-m	2.33 SAREE GUARD: INDIA MODELS, Saree Guard
Strut cover fastener, rear	120-168 in-lbs	13.6-19 N-m	2.33 SAREE GUARD: INDIA MODELS, Saree Guard
Switch housing screw	35-45 in-lbs	4-5.1 N-m	2.24 THROTTLE CABLES, Installation
Switch housing screw	35-45 in-lbs	4-5.1 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Switch housing screw	35-45 in-lbs	4-5.1 N-m	2.26 HANDLEBAR, Installation
Switch housing screw	35-45 in-lbs	4-5.1 N-m	2.26 HANDLEBAR, Installation
Turn signal, front, set screw	96-120 in-lbs	10.9-13.6 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Turn signal, front, set screw	96-120 in-lbs	10.9-13.6 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Turn signal stalk locknut	120-168 in-lbs	13.6-19 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Installation
Turn signal stalk locknut	120-168 in-lbs	13.6-19 N-m	2.32 REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS, Assembly and Installation
Turn signal stalk locknut	96-156 in-lbs	10.9-17.6 N-m	2.33 SAREE GUARD: INDIA MODELS, Saree Guard
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Valve stem nut	12-15 in-lbs	1.4-1.7 N-m	2.4 Tires, Installation

TABLES

Chassis

Table 2-1. Dimensions: Iron 883 (XL883N) Model

ITEM	Iron 883 (XL883N)	
	in	mm
Length	86	2185
Overall width	32.1	815
Overall height	44.9	1140
Wheel base	59.6	1515
Ground clearance	5.5	140
Seat height"[1]	25.7	653
(1) With 81.7 kg (180 lb) rider on seat.		

Table 2-2. Dimensions: Forty-Eight (XL1200X), Iron 1200 (XL1200NS) Models

ITEM	Iron 1200™ (XL1200NS)		Forty-Eight™ (XL1200X)	
	in	mm	in	mm
Length	86.6	2200	85.2	2165
Overall width	36.0	915	32.9	835
Overall height	48.8	1240	43.3	1100
Wheelbase	59.6	1515	58.9	1495
Ground clearance	4.3	110	4.3	110
Seat height [111]	25.7	653	26.2	665
(1) With Weight: 180 lb (82 kg) rider on seat.				

A WARNING

Do not exceed the motorcycle's Gross Vehicle Weight Rating (GVWR) or Gross Axle Weight Rating (GAWR). Exceeding these weight ratings can lead to component failure and adversely affect stability, handling and performance, which could result in death or serious injury. (00016f) [4]

- The GVWR and GAWR are shown on information plate, on frame down tube.

NOTE

- *The maximum additional weight allowed on motorcycle equals* Gross *Vehicle Weight Rating (GVWR) minus running weight. For example, a motorcycle with GVWR of 1,200 lb (544 kg) having a running weight of 800 lb (363 kg), would allow a maximum of an additional 400 lb (181 kg) combined weight of rider, passenger', riding gear, cargo and installed* accessories.
- *For important information regarding tire data and tire inflation,* see *TIRES AND WHEELS (Page 1-18).*

4 GVWR is sum of weight of motorcycle, accessories and maximum weight of rider, passenger and cargo that can be safely carried.

- GAWR is maximum amount of weight that can be safely carried on each axle.

Table 2-3. Weights: Iron 883 (XL883N) Model

ITEM	Iron 883™ (XL883N)	
	lb	kg
Running weight [1,1]	564	256
Maximum added weight allowed [121]	436	198
GVWR	1000	454
GAWR front	335	152
GAWR rear	665	302

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

Table 2-4. Weights:Forty-Eight (XL1200X), Iron 1200 (XL1200NS) Models

ITEM	Iron 1200™ (XL1200NS)		Forty-Eight™ (XL1200X)	
	lb	kg	lb	kg
Running weight"[1]	564	256	556	252
Maximum added weight allowed[121]	436	198	444	201

Table 2-4. Weights:Forty-Eight (XL 1200X), Iron 1200 (XL1200NS) Models

ITEM	Iron 1200™ (XL1200NS)		Forty-Eight ™ (XL1200X)	
	lb	kg	lb	kg
GVWR	1000	454	1000	454
GAWR, front	335	152	335	152
GAWR, rear	665	302	665	302

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

Table 2-5. Capacities: Iron 883 (XL883N) Model

ITEM	Iron 883™ (XL883N)	
	U.S.	L
Fuel tank (total)	3.3 gal	12.5
Oil tank with filter	2.8 qt	2.6
Transmission (approximate)	1.0 qt	0.95
Low fuel warning light	0.8 gal	3.0

Table 2-6. Capacities: Forty-Eight (XL1200X), Iron 1200 (XL1200NS) Models

ITEM	Iron 1200™ (XL1200NS)		Forty-Eight™ (XL1200X)	
	U.S.	L	U.S.	L
Fuel tank (total)	3.3 gal	12.5	2.1 gal	7.9
Oil tank with filter	2.8 qt	2.6	2.8 qt	2.6
Transmission (approximate)	1.0 qt	0.95	1.0 qt	0.95
Low fuel warning light	0.8 gal	3.0	0.65 gal	2.5

Table 2-7. Brake Disc Specifications

SPECIFICATION	FRONT		REAR	
	in	mm	in	mm
Diameter	11.811	300	10.236	260
Min thickness	0.177	4.5	0.256	6.5
Max runout	0.008	0.20	0.008	0.20

Wheels and Tires

A WARNING

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

Table 2-8. Specified Tires

MODEL	MOUNT	DIAMETER	SPECIFIED TIRE	PRESSURE (cold 68 °F (20 °C))	
		in		psi	kPa
Iron 883™ (XL883N)	Front	19	Michelin Scorcher "31" 100/90B19 M/C 57H	30	207
	Rear	16	Michelin Scorcher "31" 150/80B16 M/C 77H	40	276
Iron 1200™ (XL1200NS)	Front	19	Michelin Scorcher "31" 100/90B19 M/C 57H	30	207
	Rear	16	Michelin Scorcher "31" 150/80B16 M/C 77H	40	276
Forty-Eight™ (XL1200X)	Front	16	Michelin Scorcher "31" 130/90B16 M/C 73H	36	248
	Rear	16	Michelin Scorcher "31" 150/80B16 M/C 77H	40	276

VEHICLE IDENTIFICATION NUMBER (VIN)

General

See Figure 2-2. A unique 17-digit serial or Vehicle Identification Number (VIN) is assigned to each motorcycle. Refer to Table 2-9.

Location

See Figure 2-1. The full 17-digit VIN is stamped on the right side of the frame near the steering head. In some destinations, a printed VIN label is also attached on the front downtube.

Abbreviated VIN

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

NOTE

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

Figure 2-1. VIN Locations

Figure 2-2. Typical Harley-Davidson VIN: 2021 Sportster Models

Table 2-9. Harley-Davidson VIN Breakdown: 2021 Sportster Models

POSITION	DESCRIPTION	POSSIBLE VALUES
1	World manufacturer identifier	1HD=Originally manufactured in the United States 5HD=Originally manufactured in the United States for sale outside of the United States 932=Originally manufactured in Brazil MEG=Originally manufactured in India MLY=Originally manufactured in Thailand
2	Motorcycle type	1=Heavyweight motorcycle (901 cm or larger) 4=Middleweight motorcycle (351 cm^3 to 900 cm^3)
3	Model	See **VIN** model table
4	Engine type	2=Evolution 883 cm air-cooled, fuel-injected 3=Evolution 1202 cm air-cooled, fuel-injected

Table 2-9. Harley-Davidson VIN Breakdown: 2021 Sportster Models

POSITION	DESCRIPTION	POSSIBLE VALUES
5	Configuration/calibration, introduction	1 =Domestic (DOM) 2=California (CAL) 3=Canada (CAN) 4=ENG, ENG2, HDI, HD2, HD4 5=Japan (JPN) 6=Australia (AUS) 7=Brazil (BRZ) 8=Asia Pacific (APC) 9=India (IND, IND2) 0=ASEAN(AZN) A=China (CHN) G= HD3
6	VIN check digit	Can be 0-9 or X
7	Model year	M=2021
8	Assembly plant	B=York, PA U.S.A. D=H-D Brazil-Manaus, Brazil (CKD) N=Haryana India (Bawal District Rewari) S=Tasit, Pluagdang, Rayong, Thailand
9	Sequential number	Varies

Table 2-10. VIN Model Codes: Sportster Models

CODE	MODEL	CODE	MODEL
LC	XL1200X Forty-Eight®	LP	XL1200NS Iron 1200™
LE	XL883N Iron 883™		

REMOVE

NOTE

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

1. **Remove wheel. See FRONT WHEEL (Page 2-15) or REAR WHEEL (Page 2-17).**
2. **Deflate tire.**

NOTE

Replace tube only: *Do not completely remove tire from rim to replace tube. Remove one side to access tube and inspect tire.*

3. **Loosen both tire beads from rim flange.**
4. **Remove tire.**

CLEAN, INSPECT AND REPAIR

1. **Clean.**
   a. **Clean the inside of tire and outer surface of tube.**
   b. **Clean rim bead area with a stiff wire brush.**
2. **Inspect.**
   a. **Verify that wheel is true. See CHECKING AND TRUING WHEELS (Page 2-22).**
   b. **Check tire tread depth.**
   c. **Inspect tire for punctures or tears. Small punctures can be repaired.**

A WARNING

Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the removed tire by a Harley-Davidson dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (129 km/h). Failure to follow this warning could lead to tire failure and result in death or serious injury. (00015b)

3. **Repair.**
   a. **Patch inner tubes only as an emergency measure. Replace a damaged or patched tube as soon as possible.**
   b. **Repair tread on tubeless tires if puncture is % in (6.4 mm) or smaller.**
   c. **Make repairs from inside the tire.**
   d. **Always combine a patch and plug when repairing tire.**

INSTALLATION

FASTENER	TORQUE VALUE	
Valve stem nut	12-15 in-lbs	1.4-1.7 N-m

Mounting

A WARNING

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

A WARNING

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

A WARNING

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

Mount tires with arrows molded into the tire sidewall with the arrow pointing in the direction of forward rotation.

If a tire has a colored balance dot on the sidewall, locate the balance dot next to the valve stem.

For tire pressures, see Air Pressure (Page 1-18).

Tube Type Tires

A WARNING

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

NOTE

- *Replace the tube whenever the tire is replaced.*
- *Only patch inner tubes as an emergency measure. Replace a patched tube as soon as possible.*
- *For correct tire and tube types, see Specified Tires (Page 1-19).*

1. **Install tube and tire.**
2. **Install valve stem nut. Tighten.**

   Torque: 12-15 in-lbs (1.4-1.7 N-m) *Valve stem nut*

Tubeless Tires

A WARNING

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

1. See Figure 2-3. Replace damaged or leaking valve stems.
2. Press the snap-in valve stem (2) into the rim hole.
3. Install tire.

Figure 2-3. Tubeless Tire Valve Stem

CHECK TIRE RUNOUT

Lateral Runout

NOTE

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

1. Check tire pressure.
2. See Figure 2-4. Spin the wheel and measure lateral runout from a fixed point to a smooth area on the tire sidewall.
3. If lateral runout exceeds 0.090 in (2.29 mm), remove tire from rim and check rim lateral runout. See CHECKING AND TRUING WHEELS (Page 2-22).
   a. If rim runout is within specification, replace faulty tire.
   b. If rim runout is not within specification, replace cast wheel. See CHECKING AND TRUING WHEELS (Page 2-22).

Figure 2-4. Tire Lateral Runout

Radial Runout

1. Check tire pressure.
2. See Figure 2-5. Spin the wheel on the axle and measure radial runout at the tread centerline.
3. If tire runout exceeds 0.090 in (2.29 mm), remove tire from rim and check rim radial runout. See CHECKING AND TRUING WHEELS (Page 2-22).
   a. If rim runout is within specification, replace faulty tire.
   b. If rim runout is not within specification, replace cast wheel. See CHECKING AND TRUING WHEELS (Page 2-22).

Figure 2-5. Tire Radial Runout

BALANCE WHEEL

Static vs Dynamic

Wheel balancing is recommended to improve handling. Balanced wheels reduce vibration especially at high speeds.

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

Weights

NOTE

- *If more than 3.5 oz (99.2 g) of weight is required to balance wheel, rotate the tire 180 degrees on the rim and again balance the assembly Balance wheels to within 0.5 oz (14 g).*
- *All wheel weights currently supplied by Harley-Davidson are made from zinc which is lighter than lead. The weight of each zinc segment is 0.18 oz (5 g) as compared to 0. 25 oz (7 g) for lead. Weights are stamped for easy identification.*
- *If adding more than 1.5 oz (43 g) of weight at one location, divide the amount to apply half to each side of rim.*
- *On cast wheels without a flat area near the bead, place the weights cross-wise through the opening.*

1. See Figure 2-7. Place weights on a smooth surface of the wheel rim such that centrifugal force keeps them in place. Make sure that the area of application is clean, dry and free of oil and grease.

NOTE

See Figure 2-6. When installing wheel weights, consider cosmetics. Snaking (1) is not to exceed 0.040 in (1.02 mm) (2) of straight. The angle alignment of individual segments is not to exceed three degrees (3).

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

Figure 2-6. Weight Segment Alignment

Figure 2-7. Wheel Weight Placement

GENERAL

FASTENER	TORQUE VALUE	
Axle, front, nut	60-65 ft-lbs	81-88 N-m
Axle, rear, nut	95-105 ft-lbs	129-142 N-m

Good handling and maximum tire mileage are directly related to the care of wheels and tires. Regularly inspect wheels and tires for damage and wear. If handling problems occur, see TROUBLESHOOTING (Page 1-57) or refer to Table 2-11 for a list of probable causes.

Keep tires inflated to the recommended air pressure. Always balance the wheel after replacing a tube or tire.

Table 2-11. Wheel Service Chart

CHECK FOR	REMEDY
Loose axle nuts.	Tighten front axle nut to 60-65 ft-lbs (81-88 N-m).
	Tighten rear axle nut to 95-105 ft-lbs (129-142 N-m).
Excessive side-play or radial (up-and-down) play in wheel hubs.	Replace wheel hub bearings. See SEALED WHEEL BEARINGS (Page 2-19).
Alignment of rear wheel in frame or with front wheel.	Check rear wheel alignment as described in this section or repair rear fork as described in REAR FORK (Page 2-76).
Rims and tires lateral runout more than 1/32 in (0.79 mm).	True wheels or replace rims. See CHECKING AND TRUING WHEELS (Page 2-22).
Rims and tires radial runout more than 1/32 in (0.79 mm).	
Irregular or peaked front tire wear.	Replace as described in WHEELS (Page 2-14) and Tires (Page 2-11).
Correct tire inflation.	Inflate tires to correct pressure. See TIRES AND WHEELS (Page 1-18).
Correct tire and wheel balance.	Static balance can be satisfactory if dynamic balancing facilities are not available. However, dynamic balancing is recommended.
Steering head bearings.	Replace pitted or worn bearings. Check steering head bearing fall-away. See FORK STEM AND BRACKET ASSEMBLY (Page 2-72).
Damper tubes.	Check for leaks. See FRONT FORK (Page 2-61).
Shock absorbers.	Check damping action and mounting stud bushings. See Shock Absorbers (Page 2-79).
Rear fork bearings.	Check for looseness. See REAR FORK (Page 2-76).

WHEEL_BEARING_END_PLAY

1. Raise the wheel off the ground.

NOTE

ABS models: *See Figure 2-8. Mount magnetic base (1) far from* WSS *(2) and ABS encoded bearing (3).*

2. Mount a magnetic base dial indicator on the brake disc.
3. Set the indicator contact point (4) on the end of the axle.

NOTE

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

4. Move the wheel all the way back. Hold the wheel in position. Zero the dial indicator (5).
5. Move the wheel all the way forward. Note the reading of the dial indicator. Verify the reading.
6. If end play exceeds specifications, replace both wheel bearings. Refer to Table 2-12.

Figure 2-8. Measuring Wheel Bearing End Play

Table 2-12. Wheel Bearing End Play

DIRECTION	in	mm
Lateral	0.002	0.05

FASTENER	TORQUE VALUE	
Axle, front, nut	60-65 ft-lbs	81-88 N-m
Brake disc, front, screw	16-24 ft-lbs	21.7-32.6 N-m
Fork, front, pinch bolt	21-27 ft-lbs	28.5-36.6 N-m

Removal

1. Raise front end.

NOTE

Do not operate brakes with the caliper removed or the caliper pistons may be forced out. Seating piston requires caliper disassembly

2. **Dual disc models:** Remove both calipers.
3. See Figure 2-9. Remove brake caliper mounting screws (1). Slide caliper off brake disc. Support caliper out of way.
4. **XL1200X:** Remove front fender. See Front Fender (Page 2-104).
5. Remove axle nut (2) and flat washer (3) from axle on left side.
6. See Figure 2-10. On right side, loosen pinch screw.
   a. On right side, loosen nut (4) on pinch screw (1).

NOTE

- ***ABS models:*** *Do not pull wheel speed sensor cable taut or use to retain wheel, axle or other components.*
- ***ABS models:*** *Keep wheel speed sensor and ABS encoder bearing away from magnetic fields. Items such as magnetic parts trays, magnetic base dial indicators, alternator rotors can damage sensors.*

7. Pull axle out of hub while supporting wheel.

8. Remove spacer and front wheel assembly.

Figure 2-9. Left Side Front Caliper Mounting

Figure 2-10. Right Side Front Wheel Mounting (typical)

Disassembly: Cast Front Wheel

1. If necessary, remove tire. See Tires (Page 2-11).
2. Remove five screws and left side brake disc.
3. If necessary, remove roller bearings and hub spacer. See SEALED WHEEL BEARINGS (Page 2-19).
4. If necessary, remove five screws and right side brake disc on dual disc models.

Assembly: Cast Front Wheel

A WARNING

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

1. See Figure 2-11. Install hub spacer (4) and **new** bearings (3) . See SEALED WHEEL BEARINGS (Page 2-19).

NOTE

Dual disc models: *Groove on hub is the primary brake side (left side).*

2. Install brake disc(s). Secure with **new** screws and tighten in an alternating pattern.

   Torque: 16-24 ft-lbs (21.7-32.6 N-m) *Brake disc, front, screw*

sm07574f

1. **Axle**
2. **Washer**
3. **Bearings (2)**
4. **Hub spacer**
5. **Wheel**
6. **Brake disc**
7. **Fastener (5)**
8. **Wide spacer (non-ABS)**
9. **Narrow spacer**
10. **Nut**
11. **WSS (ABS)**

Figure 2-11. Disc Wheels (typical)

Installation

1. See Figure 2-11. Apply a light coat of ANTI-SEIZE LUBRICANT to axle (1), bearing (3) bores and hub spacer (4) bore.

2. Position wheel (5) between forks. Verify that bearing spacers, on right and left side of wheel bearings (3), and the WSS (ABS models) (11) are in position.

3. See Figure 2-10. With pinch screw (1) loose, insert threaded end of axle (5) through right side fork. Push axle through fork and wheel hub until it begins to emerge from left side of hub.

4. Push axle through left fork, until axle shoulder contacts external bearing spacer on right fork side.

NOTE

ABS models: *Rotate front* WSS *counterclockwise until index pin contacts shoulder on left fork slider.*

5. See Figure 2-9. Install flat washer (3) and axle nut (2) over threaded end of axle. Insert screwdriver or steel rod through hole in axle on right side of vehicle. While holding axle stationary, tighten axle nut.

   Torque: 60-65 ft-lbs (81-88 N-m) *Axle, front, nut*

6. Tighten pinch bolt.

   a. Tighten pinch bolt to 21-27 ft-lbs (28.5-36.6 N-m).

7. **XL1200X:** Install front fender. See Front Fender (Page 2-104).

NOTE

ABS models: *Install* WSS *cable bracket when installing brake caliper. Secure* WSS *cable to clip bracket with cable clip.*

8. Install brake caliper. See FRONT BRAKE CALIPERS (Page 2-29).

NOTE

ABS models: *Make sure that* WSS *cable is secured with three retainer clips and cable strap.*

A WARNING

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

A WARNING

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

9. Pump brakes to move pistons out until brake pads contact rotor. Verify piston location against pad.

REAR WHEEI

NOTICE

FASTENER	TORQUE VALUE	
Axle, rear, nut	95-105 ft-lbs	129-142 N-m
Brake disc, rear, screw	30-45 ft-lbs	40.7-61.1 N-m
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m
Sprocket mounting screw, 1st torque	60 ft-lbs	81.3 N-m
Sprocket mounting screw, final torque	80 ft-lbs	108 N-m

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 cross-members, oil pan, mounting brackets, components or housings. Failure to comply can cause serious damage resulting in the need to perform major repair work. (00586d)

Removal

1. Raise the motorcycle.
2. Remove rear muffler if necessary to access rear axle. See EXHAUST SYSTEM (Page 4-38).
3. Remove right lower shock absorber nut. To avoid damage to sprocket when rear wheel is removed, pull screw out slightly.
4. See Figure 2-12. Remove E-clip (2), axle nut (1) and washer (3).
5. Loosen adjuster screws several turns to relieve belt tension.
6. Gently tap end of axle (4) with a soft hammer to loosen. Pull axle free of rear fork assembly.
7. Slide wheel forward and slip belt off sprocket.

NOTE

- *Do not disassemble rear brake caliper in order to remove rear wheel.*
- *ABS models: Do not pull wheel speed sensor cable taut or use to retain wheel, axle or other components.*
- *ABS models: Keep wheel speed sensor and ABS encoder bearing away from magnetic fields. Items such as magnetic parts trays, magnetic base dial indicators, alternator rotors can damage sensors.*

8. Remove spacers and roll rear wheel assembly back out of fork.
9. Remove rear wheel assembly.

NOTE

Do not operate rear brake pedal with rear wheel removed or caliper piston is forced out of piston bore. Seating piston requires caliper disassembly

Figure 2-12. Rear Wheel Mounting

Disassembly

1. If necessary, remove tire. See Tires (Page 2-11).
2. See Figure 2-13. If necessary, remove screws to detach rear brake disc from left side of wheel.
3. If necessary, remove screws and washers to detach rear sprocket from right side of wheel.
4. If necessary, remove wheel bearings and hub spacer. See SEALED WHEEL BEARINGS (Page 2-19).

Cleaning and Inspection

1. Inspect parts for wear or damage.

A WARNING

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

2. Inspect brake pads and disc. See BRAKE PADS AND DISCS (Page 1-28).
3. Inspect drive belt and sprocket. See DRIVE BELT AND SPROCKETS (Page 1-32).

Assembly

1. Install hub spacer and **new** wheel bearings, if removed. See SEALED WHEEL BEARINGS (Page 2-19).

   a. **Cast or disc wheel:** See Figure 2-13.

2. If brake disc was removed, install brake disc on valve stem side of wheel. Secure with **new** screws. Tighten.

   Torque: 30-45 ft-lbs (40.7-61.1 N-m) *Brake disc, rear, screw*

3. If rear sprocket was removed, install sprocket on side of wheel opposite valve stem.

   a. Secure with **new** screws and washers. Tighten.

      Torque: 60 ft-lbs (81.3 N-m) *Sprocket mounting screw, 1st torque*

   b. Loosen each screw 180 degrees. Tighten.

      Torque: 80 ft-lbs (108 N-m) *Sprocket mounting screw, final torque*

4. Verify that wheel assembly is true. See CHECKING AND TRUING WHEELS (Page 2-22).

5. Install tire. See Tires (Page 2-11).

emn7^77fl

1.	**Axle**	**9.**	**Brake disc**
2.	**Screw (5)**	**10.**	**Screw (5)**
3.	**Spacer, wide**	**11.**	**Spacer, narrow (non-ABS)**
4.	**Washer (5)**	**12.**	**Axle nut**
5.	**Roller bearing (2)**	**13.**	**E-clip**
6.	**Sprocket**	**14.**	**Washer**
7.	**Hub spacer**	**15.**	**WSS (ABS)**
8.	**Wheel**		

Figure 2-13. Cast Rear Wheel (typical)

Installation

1. See Figure 2-13. Apply a light coat of ANTI-SEIZE LUBRICANT to axle, bearing bores and hub spacer bore.

2. Place wheel centrally in rear fork assembly. Engage brake disc in caliper.

3. Slide wheel forward. Pull drive belt over sprockets.

4. Position sprocket side spacer between wheel and rear fork.

5. Insert axle through right side of rear fork and axle adjuster, sprocket side spacer, wheel assembly, disc side spacer, rear caliper bracket, WSS and left side of rear fork and axle adjuster.

6. Install washer and axle nut on left end of axle. Leave fasteners loose.

7. Apply 2-3 drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of lower shock absorber screw.

8. Slide right lower shock absorber screw back in place. Install nut. Tighten.

   Torque: 45-50 ft-lbs (61-68 N-m) *Shock absorber mounting bolt*

NOTE

If rear brake caliper was disassembled or removed, see *REAR BRAKE CALIPER (Page 2-40).*

9. Adjust drive belt deflection. See Adjustment (Page 1-34).

NOTE

ABS models: *Rotate* WSS *counterclockwise until index pin contacts caliper bracket.*

10. Tighten axle nut. Install E-clip.

    Torque: 95-105 ft-lbs (129-142 N-m) *Axle, rear, nut NOTE*

ABS models: *Secure* WSS *wire harness to rear brake line with clips.*

A WARNING

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

11. Check wheel bearing end play. See Wheel Bearing End Play (Page 2-14).

12. If necessary, install rear muffler. See EXHAUST SYSTEM (Page 4-38).

A 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)

13. Pump brake pedal to move out piston until it contacts outside brake pad. Verify piston location against pad.

SEALED WHEEL BEARINGS

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

Inspection

1. Rotate the inner bearing race and check for abnormal noise. Bearing must rotate smoothly.

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

Removal

1. Remove wheel. See WHEELS (Page 2-14).

NOTE

See Figure 2-14. Some wheel hubs do not provide adequate support for the puller bridge. Place a used brake disc over the hub to support the puller bridge.

Figure 2-14. Brake Disk as Puller Aid

2. See Figure 2-15. Obtain WHEEL BEARING INSTALLER AND REMOVER (PART NUMBER: HD-44060-C) and assemble.
   a. Sparingly apply graphite lubricant to forcing screw (1) for prolonged service life and 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 collet (6). Fasten collet and ball bearing to forcing screw.

3. Hold end of forcing screw and turn collet to expand edges of collet.

4. See Figure 2-16. When expanded collet has gripped bearing edges, hold end of forcing screw (1) and turn the nut (2) to remove bearing from wheel.

5. Remove spacer from inside wheel hub.

NOTE

On some wheels, the second bearing must be driven out with a punch from the opposite side.

6. Repeat procedure for opposite side bearing. Discard both bearings upon removal.

Figure 2-15. Wheel Bearing Removal Tool

Figure 2-16. Removing Bearing

Installation

NOTE

- *When installing wheel bearings, use WHEEL BEARING INSTALLER AND REMOVER (PART NUMBER: HD-44060-C).*
- *Install bearing on primary (left) side first.*
- ***ABS models:** The encoder bearing (red in color) is installed on the primary (left) brake disc side. One or two grooves in the disc mounting surface identify the primary (left) side.*

1. Obtain WHEEL BEARING INSTALLER AND REMOVER (PART NUMBER: HD-44060-C) and assemble.
2. Lightly apply graphite lubricant to threaded rod.
3. See Figure 2-17. Place threaded rod (1) through support plate (2). Insert assembly through wheel.

NOTE

Bearing orientation is important.

4. See Figure 2-18. Place the bearing on the rod.
   a. **Standard bearing** with the lettered side against installer (5).
   b. **ABS bearing** with red side against wheel.
5. Assemble installer (5), bearing (4), washer (3) and nut (2) over rod.

NOTE

Bearing is fully seated when nut can no longer be turned.

6. Holding hex end of threaded rod, turn nut to install wheel bearing. Remove tool.
7. Install spacer inside wheel hub.
8. Reverse tool to install opposite side wheel bearing.

Figure 2-17. Assembling Installation Tool

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

Figure 2-18. Installing Bearing

CAST WHEEL RUNOUT

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

Wheel Stand

1. Check the wheel bearings before measuring runout. See SEALED WHEEL BEARINGS (Page 2-19).
2. Install the truing arbor in the wheel hub. Mount the wheel in a WHEEL TRUING STAND (PART NUMBER: HD-99500-80).
3. Tighten the arbor nuts so that the hub will turn on its bearings.
4. Mount a gauge rod or a dial indicator to the base of the truing stand.

Lateral Runout

1. See Figure 2-19. Point the gauge rod or indicator at the rim bead flange.
2. Rotate the wheel and measure the lateral distance at several locations around the rim. Replace the wheel if lateral runout exceeds specification. Refer to Table 2-13.

Radial Runout

1. See Figure 2-20. Point the gauge rod or indicator at the rim tire bead safety hump.
2. Rotate the wheel and measure radial distance at several locations. Replace the wheel if radial runout exceeds specification. Refer to Table 2-13.

Table 2-13. Wheel Rim Runout

RUNOUT	in	mm
Lateral	0.030	0.76
Radial	0.030	0.76

Figure 2-19. Lateral Runout

Figure 2-20. Radial Runout

INSPECTION

1. Check fluid level in brake reservoir. If it is low, check for worn pads/disc(s) or leaks in brake system. See Inspection (Page 1-28).
2. Check brake pads and discs for excessive wear or damage. Replace or repair as necessary.
   a. **Brake pads:** See Brake Pad Replacement: Front (Page 1-28).
   b. **Brake discs:** See FRONT WHEEL (Page 2-15).
3. Check for leaks in brake lines, banjo fittings, front caliper pistons or bleeder screw. Repair as necessary.
   a. **Brake line:** See Brake Lines (Page 2-44).
   b. **Brake caliper:** See FRONT BRAKE CALIPERS (Page 2-29).
4. Repeat the bleeding procedure if brakes feel spongy. See Bleeding Brakes (Page 2-54).
5. If brake still does not operate properly, the master cylinder is defective. Replace or repair as necessary.

REMOVAL

1. **All models except XL1200X:** See Figure 2-21. Remove turn signal.
   a. Loosen turn signal clamp screw (1).
   b. Remove and support turn signal (2) and wire harness.
2. Remove locknut (3), washer (4) and mirror (5).

A WARNING

Contact with DOT 4 brake fluid can have serious health effects. Failure to wear proper skin and eye protection could result in death or serious injury. [5]

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5 If inhaled: Keep calm, remove to fresh air, seek medical attention.

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

(00240e)

3. Drain brake fluid.
   a. Remove bleeder cap from caliper bleeder screw.
   b. Install a length *of%* in (7.9 mm) ID clear plastic tubing over bleeder screw. Place free end in a suitable container.
   c. Open bleeder screw one-half turn.
   d. Remove reservoir cover.
   e. Pump brake hand lever several times to drain brake fluid.
   f. Close bleeder screw.
4. Remove banjo bolt (6) and two sealing washers (7). Discard sealing washers.
5. See Figure 2-22. Remove the screws (1) and washers (2) securing the clamp (3) to the master cylinder housing.
6. Capture the locking washers (4).

Figure 2-21. Front Brake Master Cylinder

Figure 2-22. Master Cylinder Handlebar Clamp

FRONT BRAKE LEVER

FASTENER	TORQUE VALUE	
Brake lever pivot pin	5-13in-lbs	0.5-1.5Nm
Brake lever pivot pin nut	44-61 in-lbs	4.9-6.9 Nm

Removal

1. See Figure 2-23. Remove the nut (1) and pivot pin (2).
2. Remove the brake lever (3).

Installation

1. Lubricate the brake lever pivot pin hole and bushing with G40 BRAKE GREASE.
2. See Figure 2-23. Install the brake lever (3).

Figure 2-23. Front Brake Lever

FRONT MASTER CYLINDER RESERVOIR COVER

FASTENER	TORQUE VALUE	
Brake master cylinder, front, reservoir cover screws	9-17 in-lbs	1-2 N m

Removal

1. Clean cover to prevent dirt from entering reservoir.
2. See Figure 2-24. Remove screws (1) and cover (2).
3. Remove diaphragm plate (3) and diaphragm (4).

Installation

3. Install the pivot pin (2). Tighten to 5-13 in-lbs (0.5-1.5 N-m).
4. Install the nut (1). Tighten to 44-61 in-lbs (4.9-6.9 N-m).

1. See Figure 2-24. Install diaphragm (4) and diaphragm plate (3).

2. Install cover (2).

3. Install cover screws (1). Tighten to 9-17 in-lbs (1-2 N-m).

Figure 2-24. Front Brake Master Cylinder/Reservoir Cover

FRONT MASTER CYLINDER

Disassembly

A 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

To prevent damage, install soft jaw covers on vise.

1. **See Figure 2-25. Clamp master cylinder in a vise by mirror mounting boss with banjo fitting hole facing down.**
2. **Remove and discard dust boot.**
3. **See Figure 2-26. Press down on end of piston. Remove and discard retaining ring.**
4. **Remove and discard piston assembly and spring.**

Figure 2-25. Clamping Front Master Cylinder

Figure 2-26. Piston Retaining Ring

Cleaning and Inspection

A WARNING

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

A WARNING

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

NOTE

- *Do not use a wire or similar tool to clean drilled passages in bottom of reservoir.*
- *Do not contaminate with mineral oil or other solvents.*

1. Clean master cylinder/reservoir.
   a. Clean components with denatured alcohol.
   b. Blow out drilled passages and piston bore with low-pressure compressed air from a clean air supply.
   c. Wipe parts dry with a clean, lint-free cloth.

2. Inspect parts. Replace or repair as necessary.
   a. Inspect piston bore for scoring, pitting or corrosion.
   b. Inspect outlet port that mates with banjo fitting. This surface is a critical sealing surface.
   c. Inspect diaphragm for damage.

Assembly

NOTE

- *There are three master cylinder bore sizes: 12.7 mm, 14 mm and 15.87* mm. *Install master cylinder with* ***new*** *parts from the correct service repair kit.*
- *Use only CCI #20 BRAKE GREASE to lubricate master cylinder bores, pistons, primary cups and secondary cups.*
- *Use only G40M BRAKE GREASE on end of piston that contacts brake lever.*
- *To prevent damage, install soft jaw covers on vise.*

1. See Figure 2-25. Clamp master cylinder in a vise with banjo fitting hole pointing straight down.

NOTE

If necessary, assemble secondary cup to piston. The wide end of secondary cup faces master cylinder'.

2. See Figure 2-27. Coat piston bore of master cylinder housing, piston assembly (3, 5) and primary cup (4) with CCI #20 BRAKE GREASE.

3. Install large end of spring (6) into master cylinder bore. Seat spring against counter-bore at bottom of cylinder.

4. ABS single disc and all dual disc: Install piston.
   a. Install primary cup over spring.
   b. Install piston assembly into cylinder.

5. Non-ABS single disc: Install piston assembly (5) into cylinder.

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

A 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. Press down on piston. Install retaining ring (2). Verify that retaining ring is seated in groove.

NOTE

Large lip fits inside cylinder. Install small lip of boot into groove in piston.

7. Install dust boot (1).

8. Apply approximately 0.1 g G40M BRAKE GREASE to end of piston.

Figure 2-27. Master Cylinder Rebuild Kits

INSTALLATION

2. Position brake lever and master cylinder assembly inboard of

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Brake master cylinder clamp, front, screw	108-132 in-lbs	12.2-14.9 N-m
Mirror stem locknut	96-144 in-lbs	10.9-16.3 N-m
Turn signal, front, set screw	96-120 in-lbs	10.9-13.6 N-m

1. Install brake lever.

switch housing assembly.

3. See Figure 2-28. Engage tab of stop lamp switch (1) on lower switch housing in bracket slot (2) at top of brake lever bracket.

4. Align holes in handlebar clamp with master cylinder housing. Install two screws and washers.

5. Beginning with top screw, tighten both screws to.

Torque: 108-132 in-lbs (12.2-14.9 N-m) *Brake master cylinder clamp, front, screw*

NOTICE

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

6. See Figure 2-29. Install brake line banjo fitting.

a. Support a **new** sealing washer on each side of brake line banjo fitting.

b. Insert banjo bolt through sealing washers and fitting.

c. Thread bolt into master cylinder housing.

d. Tighten to.
Torque: 14-18 ft-lbs (19-24.4 N-m) *Brake line banjo bolt*

7. Fill and bleed brakes. See Bleeding Brakes (Page 2-54).

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

8. **ABS models:** Verify that system is bled. Perform "ABS Service" procedure in "Tool Box" menu.

Special Tool: DIGITAL TECHNICIAN II (HD-48650) *NOTE XL 1200X: Install mirrors below handlebar controls.*

9. See Figure 2-30. Install mirror.

a. Install locknut (4) and lockwasher (3).

b. Adjust mirrors (1) as necessary.

c. Lay a protective cover over fuel tank.

d. **XL1200X:** Slowly turn handlebar lock-to-lock. Verify that mirror does not strike fuel tank.

e. Tighten locknut to 96-144 **in-lbs** (10.9-16.3 N-m).

10. **All Models except XL1200X:** See Figure 2-31. Install turn signal.

a. Install turn signal (2).

b. Install set screw (1) to capture turn signal.

c. Point lens forward.

d. Lay a protective cover over fuel tank.

e. Slowly turn handlebar lock-to-lock. Verify that turn signal does not strike fuel tank.

f. Tighten set screw to 96-120 **in-lbs** (10.9-13.6 N-m).

11. Check operation of rear lamps.

A WARNING

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

12. Test brakes.

Figure 2-28. Brake Lever Bracket to Switch Housings

Figure 2-29. Banjo Fitting Configuration

Figure 2-30. Mirror

Figure 2-31. Turn Signal: XL Models except XL1200X

REMOVAL

A WARNING

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

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

(00240e)

NOTICE

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

NOTE

- *To replace brake pads, do not remove front brake calipers from caliper mounting brackets. See BRAKE PADS AND DISCS (Page 1-28).*
- *Carefully remove brake line components to prevent damage to banjo bolt seating* **surfaces.**
- *If DOT 4 brake fluid contacts painted* **surfaces,** *IMMEDIATELY flush area with clear water.*

1. **Drain brake fluid.**
   a. **See Figure 2-32. Remove cap (1) from bleeder screw (2).**
   b. **Install end of a length of 5/16 in (7.9 mm) ID clear plastic tubing over bleeder screw. Place free end in a suitable container.**
   c. **Open bleeder screw one-half turn.**
   d. **Pump brake hand lever repeatedly to drain brake fluid.**
   e. **Close bleeder screw.**
2. **Remove banjo bolt (3) and sealing washers to detach front brake line from caliper. Discard sealing washers.**
3. **Loosen, but do not remove, pad pin (4).**
4. **Remove mounting bolts (5).**
5. **To disengage from brake disc, pull caliper and mounting bracket rearward.**

1. **Cap**
2. **Bleeder screw**
3. **Banjo bolt**
4. **Pad pin**
5. **Mounting bolt (2)**

Figure 2-32. Front Brake Caliper

DISASSEMBLY

1. **See Figure 2-33. Remove pad pin (11), brake pads (15), insulators (14) and pad retainers (13).**
2. **Remove caliper from bracket (2).**
3. **Remove pad spring (12). Do not remove bleeder screw (10).**
4. **Install a discarded brake pad with friction material against back of the caliper and backplate facing pistons.**
5. **To hold brake pad in place, loosely install pad pin.**

NOTE

Do not damage banjo bolt sealing **surface** *or threads.* **Use** *an air nozzle with a rubber tip.*

A WARNING

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

A 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)

6. **Apply low-pressure compressed air through banjo bolt hole to force pistons (7) from bores.**
7. **Remove pad pin and brake pad.**

NOTE
If necessary, gently wiggle pistons.

8. Remove pistons (7) by hand.

NOTE
Damaged piston bores leak. Do not use metal objects to remove or install objects from piston bores. Use only a wooden toothpick to prevent damage to pistons, seals and bores.

9. Use a wooden toothpick to remove dust seals (5) and piston seals (4). Discard seals.

10. If necessary, remove bleeder screw.

1. **Retainer clip**
2. **Bracket**
3. **Pin boot**
4. **Piston seal (2)**
5. **Dust seal (2)**
6. **Bolt pin**
7. **Piston (2)**
8. **Bushing boot**
9. **Bleeder screw cap**
10. **Bleeder screw**
11. **Pad pin**
12. **Pad spring**
13. **Pad retainer (2)**
14. **Insulator (2)**
15. **Brake pad (2)**

Figure 2-33. Front Brake Caliper

CLEANING AND INSPECTION

1. Inspect each brake pad and disc. See Inspection (Page 1-28).

a. If necessary, replace brake pads. See Brake Pad Replacement: Front (Page 1-28).

b. If necessary, replace brake disc. See FRONT WHEEL (Page 2-15).

2. Wipe old lubrication from inside of caliper pin boot and caliper bushing boot with a soft, clean cloth.

3. Clean all rubber parts with DOT 4 brake fluid.

A WARNING

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

4. Clean all metal parts with denatured alcohol.

5. Wipe parts dry with a clean, lint-free cloth.

NOTE
Do not use a wire or similar instrument to clean drilled passages.

A WARNING

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

6. **Blow out drilled passages and piston bore with low-pressure compressed air from a clean air supply.**

7. **Inspect all components. Replace if necessary.**

   a. **Check pistons for pitting, scratching or corrosion on outside surfaces.**

NOTE

Do not hone bores.

   b. **Inspect caliper piston bores for pitting or corrosion.**

   c. **Inspect caliper bolt pin. If damaged or worn, replace entire brake caliper assembly.**

   d. **Inspect caliper bushing boot and caliper pin boot.**

   e. **Replace all seals after disassembly.**

8. **Measure pad pin wear.**

   a. **Measure pad pin diameter (A) across an unworn section.**

   b. **Measure pad pin diameter (B) across visible grooves or wear.**

   c. **Subtract B from A. If wear is out of specification, replace pad pin. Refer to Table 2-14.**

Table 2-14. Pad Pin Wear: Specifications

PAD PIN	in	mm
Wear (maximum)	0.011	0.28

FASTENER	TORQUE VALUE	
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m
Brake pad pin	131-173 in-lbs	14.8-19.5 N-m

ASSEMBLY

Pistons

NOTE

Use ONLY KS62F assembly grease for lubrication.

1. **Lubricate following parts with a light coat of KS62F silicone grease from service parts kit. All other surfaces must be dry.**

only a wooden toothpick to prevent damage to pistons, **seals** *and bores.*

2. **Install a new piston seal and a new dust seal into each piston bore.**

3. **By hand, carefully insert pistons, nose radius first, into caliper bores. If resistance is felt, remove pistons. Check if seals are fully seated in grooves.**

4. **If removed, install bleeder screw. Tighten bleeder screw to 35-61 in-lbs (3.9-6.9 N-m).**

5. **See Figure 2-34. Install pad spring in channel. Press firmly into place.**

Figure 2-34. Caliper Pad Spring

Brake Caliper to Mounting Bracket

1. **See Figure 2-33. Verify that the retainer clip (1) is installed on bracket (2).**
2. **Apply approximately 0.4 g of G40M BRAKE GREASE inside bushing boot (8) and pin boot (3).**
3. **See Figure 2-35. Apply G40M BRAKE GREASE inside boot lip to prevent sticking between boots and bolt pins.**
4. **Assemble brake caliper and mounting bracket, carefully installing bolt pins into boots.**
5. **See Figure 2-36. Install brake caliper onto mounting bracket until boot lips (1) fit over pin shoulders (2).**

a. Nose radius of pistons.

b. All surfaces of piston seals and dust seals.

NOTE

Damaged piston bores leak. Do not **use** *metal objects to remove or install objects from piston bores. Use*

1. **Caliper bushing boot**
2. **Bracket bolt pin**
3. **Caliper pin boot**
4. **Caliper bolt pin**

Figure 2-35. Caliper Pins and Boots

Figure 2-36. Pins Shoulder and Boot Lips

Brake Pads

1. Install piston side brake pad.

   a. Slide pad mounting tab to rear.

   b. Press pad against pistons.

   c. See Figure 2-37. Align pad spring feet against pad spring.

   d. Press down to allow pad pin to pass though pad pin hole.

2. Install opposite brake pad.

   a. Fit mounting tab under retainer clip.

   b.

   c. Press against pad spring to align with pad pin.

   d. Install pad pin.

3. Tighten pad pin to 131-173 **in-lbs** (14.8-19.5 N-m). *NOTE*
If pad pin does not fit, check following:

- *The pads must be a set. Do not use two identical pads.*
- *Pad spring must be correctly oriented.*
- *Pad mounting tabs must be fully seated in mounting bracket slot.*

- *Before pad pin is installed, pads must be pushed tight up against pad spring.*

Figure 2-37. Pad Spring Feet

INSTALLATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake caliper, front, mounting bolt	28-38 ft-lbs	38-51.6 N-m
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m

Press pad against mounting bracket.

A WARNING

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

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

(00240e)

NOTICE

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

NOTE

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

1. See Figure 2-38. Install brake caliper (1) and mounting bracket (2) over brake disc with bleeder screw (3) facing upwards.

NOTE

ABS models: *Position* WSS *wire clip bracket over mounting holes.*

2. Install mounting bolts (4) into mounting holes on fork leg. Tighten to 28-38 ft-lbs (38-51.6 N-m).

NOTICE

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

3. Install banjo fitting (5).
   a. Position a **new** sealing washer on each side of brake line banjo fitting.
   b. Install banjo bolt through sealing washers and fitting.
   c. Install banjo bolt into master cylinder housing.
   d. Rotate banjo fitting clockwise until it contacts positive stop.
   e. Tighten to 14-18 ft-lbs (19-24.4 N-m).

NOTE

- *Do not use sight glass to determine maximum fluid level. Only read fluid level in sight glass as an indicator that fluid level is low.*
- *Cover handlebar switches with a shop towel before adding brake fluid to reservoir. Spilling brake fluid on handlebarswitches can render them inoperative.*
- *Use only DOT 4 BRAKE FLUID from a sealed container.*
- *Do not overfill reservoir.*
- *Do not reuse old brake fluid.*

4. Check operation of rear lamps.
5. Bleed brake system. See Bleeding Brakes (Page 2-54).
6. Fill brake fluid reservoir with DOT 4 BRAKE FLUID to full level ridge around the top of the reservoir.

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

7. **ABS models:** Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to verify operation of brakes. Perform "ABS Service" procedure in "Tool Box" menu.

NOTE

Avoid making hard stops for first 100 mi (160 km). Allow ***new*** *pads to become conditioned to brake discs.*

A WARNING

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

8. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy.

1. Brafcecaliper
2. Mounting bracket
3. Bleeder screw Mounting bolt (2) ... Banjbtting

Figure 2-388 Franttdiper Assembly

INSPECTION

1. If the fluid level in brake reservoir is low, check for worn pads/disc(s) or leaks in brake system.
2. Check rear brake pads and disc for excessive wear or damage. See Inspection (Page 1-28).
   a. **Brake pads:** See Brake Pad Replacement: Rear (Page 1-30).
   b. **Brake discs:** See REAR WHEEL (Page 2-17).
3. Check for leaks in brake lines, around banjo fittings or brake caliper pistons or bleeder screw. Repair as necessary.
   a. **Non-ABS brake line:** See Rear Brake Line (Non-ABS) (Page 2-46).
   b. **ABS brake line:** See Rear Master Cylinder to EHCU (ABS) (Page 2-51) and Rear EHCU to Caliper (ABS) (Page 2-52).
   c. **Brake caliper:** See REAR BRAKE CALIPER (Page 2-40).
4. Check mechanical brake linkage from brake pedal to master cylinder for damage. Replace or repair as necessary.
   a. **Mid-mount controls:** See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).
   b. **Forward controls:** See RIDER FOOT CONTROLS: FORWARD (Page 2-120).
5. Repeat the bleeding procedure if brakes feel spongy. See Bleeding Brakes (Page 2-54).
6. If brake still does not operate properly, brake master cylinder is defective. Replace or repair as necessary.

REMOVAL

A WARNING

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

- **If inhaled: Keep calm, remove to fresh air, seek medical attention.**
- **If on skin: Remove contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, seek medical attention.**
- **If in eyes: Wash affected eyes for at least 15 minutes under running water with eye lids held open. If irritation develops, seek medical attention.**
- **If swallowed: Rinse mouth and then drink plenty of water. Do not induce vomiting. Contact Poison Control. Immediate medical attention required.** [6]

NOTICE

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

NOTE

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

1. Drain brake fluid.
   a. Remove cap from caliper bleeder screw.
   b. Install a length of 5/16 in (7.9 mm) ID clear plastic tubing over bleeder screw. Place free end in a suitable container.
   c. Open bleeder screw one-half turn.
   d. Pump brake several times to drain brake fluid.
   e. Close bleeder screw.
2. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).
3. Remove the rider control assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-117) or Right Footrest and Rear Brake Pedal Assembly (Page 2-120).

A 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 2-39. Remove retaining ring (1) and brake rod pin (2).
5. Remove banjo bolt (3) and sealing washers. Discard sealing washers.

NOTE

Models without passenger footrests have a master cylinder mounting bracket in place of a footrest mounting bracket.

6. Remove two screws (4) and two washers securing master cylinder to passenger footrest mounting bracket.

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6 See Safety Data Sheet (SDS) for more details available at sds.harley-davidson.com

(00240e)

Figure 2-39. Rear Brake Master Cylinder

COVER

FASTENER	TORQUE VALUE	
Brake master cylinder, rear, reservoir cover	9-17 in-lbs	1-2 N-m

Removal

1. See Figure 2-40. Clean cover.
2. Remove cover screws (1).
3. Remove cover (2), diaphragm plate (3) and gasket (4).

Installation

1. Install gasket.
2. Install diaphragm plate.
3. Install cover.
4. Install cover screws. Tighten to 9-17 in-lbs (1-2 N-m).

Figure 2-40. Cover

MASTER CYLINDER REBUILD KIT

FASTENER	TORQUE VALUE	
Brake master cylinder, rear, pushrod collar	130-173in-lbs	14.7-19.6 N-m

Disassembly

NOTE

- *Do not disassemble rear master cylinder unless necessary.*
- *Install a **new** rebuild kit when unit is reassembled.*

1. See Figure 2-41. Hold hex nut (1). Remove pushrod collar (2).
2. Remove hex nut.
3. Remove spring retainer (4), external boot (3), pushrod (7) and return spring (5).

At. 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. Remove retaining ring (8).
5. Remove pushrod, piston (10) with secondary (9) and primary cup (11) and spring (12).

NOTE

1.	Hexnut	7.	Pushrod assembly
2.	Pushrod collar	8.	Retaining ring
3.	Return spring boot	9.	Secondary cup
4.	Spring retainer	10.	Piston
5.	Return spring	11.	Primary cup
6.	Boot	12.	Spring

Figure 2-41. Master Cylinder

Cleaning and Inspection

A WARNING

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

A WARNING

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

NOTE

Do not use wire or similar tool to clean drilled passages.

1. **Blow out drilled passages and piston bore in master cylinder body with low pressure compressed air from a clean air supply.**
2. **Inspect parts for wear or damage.**
   a. **Inspect piston bore for damage. Replace or repair as necessary.**
   b. **Inspect outlet port critical sealing surface that mates with brake line banjo fitting. Replace or repair as necessary.**
3. **Verify that vent holes in master cylinder air separator are open and free of dirt or debris.**

Assembly

*When assembling rear brake master cylinder, always use **new** parts from the service parts kit. See parts catalog.*

1. **Lubricate cylinder bore, piston and cups with CCI #20 BRAKE GREASE.**
2. **If necessary, install cups on piston.**
3. **Install spring. Seat spring against counter bore at bottom of cylinder.**
4. **Install piston assembly.**
5. **Apply approximately 0.1 g of G40M BRAKE GREASE to ball end of pushrod. Insert ball end of pushrod into cupped end of piston.**
6. **Temporarily thread hex nut onto pushrod several turns to protect pushrod threads.**
7. **Compress piston with pushrod.**

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

A 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)

8. Install retaining ring. Verify that retaining ring is completely seated in groove.

9. Remove hex nut from pushrod.

10. Apply approximately 0.1 g of G40M BRAKE GREASE around groove in wide washer foot of pushrod.

11. Carefully slide boot over pushrod and into end of master cylinder bore. Press lip of inner boot down around groove in boot collar nut.

12. Fit boot into grooves inside master cylinder bore.

13. Install external return spring.

14. Install retainer and hex nut.

15. See Figure 2-42. Tighten hex nut to 1.92 in (48.8 mm) from face of master cylinder to end of hex nut.

16. Install pushrod collar.

    a. Thread collar onto pushrod until it contacts hex nut.

    b. Hold hex nut. Tighten collar to 130-173 **in-lbs** (14.7-19.6 N-m).

17. Install external boot.

    a. Fit lip of external boot to master cylinder groove.

    b. Position tabs at 3 o'clock and 9 o'clock position when master cylinder body is held upright.

sm07934

Figure 2-42. 1.92 in (48.8 mm)

MASTER CYLINDER MOUNTING BRACKET

NOTE

FASTENER	TORQUE VALUE	
Brake master cylinder, rear, mounting bracket screw	45-50 ft-lbs	61-68 N-m

If the model does not include passenger footrests, the master cylinder mounts to a separate bracket.

Removal

1. Remove the master cylinder.

2. Remove the two screws (1) and the bracket (2).

Installation

1. See Figure 2-43. Install the bracket.

2. Install the two screws. Tighten to 45-50 ft-lbs (61-68 N-m).

3. Install the master cylinder.

Figure 2-43. Master Cylinder Mounting Bracket

INSTALLATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Brake master cylinder, rear, mounting screw	18-22 ft-lbs	24.4-29.9 N-m

A 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 2-44. Install rear master cylinder/reservoir and screws (1) on mounting bracket (3) or passenger footrest bracket (2).

2. Tighten to 18-22 ft-lbs (24.4-29.9 N-m).

NOTE

When tightening banjo bolt into master cylinder, rotate banjo fitting clockwise until it contacts positive stop.

3. Install brake line banjo fitting.

a. Support a **new** sealing washer on each side of hydraulic brake line banjo fitting.

b. Insert banjo bolt through washers and fitting.

c. Thread bolt into master cylinder housing.

d. Tighten to 14-18 ft-lbs (19-24.4 N-m).

A WARNING

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

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

(00240e)

NOTICE

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

4. **Install brake control rod.**

5. **Insert rod pin. Secure with retaining ring.**

6. **Install rider footrest assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-117) or Right Footrest and Rear Brake Pedal Assembly (Page 2-120).**

7. **Install exhaust system. See EXHAUST SYSTEM (Page 4-38).**

8. **Stand motorcycle upright (not leaning on jiffy stand) on a level surface.**

NOTE

- *If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.*
- *Rear brake master cylinder reservoir must be level to fill. Check fluid level.*
- *Use only DOT4 BRAKE FLUID from a sealed container*
- *Do not overfill reservoir.*
- *Do not reuse old brake fluid.*

9. **Remove reservoir cap.**

10. **Fill reservoir with DOT 4 BRAKE FLUID until fluid level reaches max fill level.**

11. **Bleed brake system. See Bleeding Brakes (Page 2-54).**

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

12. **ABS models: Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to verify that system is bled. Perform "ABS Service" procedure in "Tool Box" menu.**

A WARNING

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

13. **Check operation of rear lamps.**

A WARNING

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

A WARNING

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

14. Test ride motorcycle at low speed.

Figure 2-44. Rear Brake Master Cylinder Mounting

REAR BRAKE CALIPER

REMOVAL

A WARNING

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

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

(00240e)

NOTICE

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

NOTE

- *Damaged banjo bolt surfaces will leak. Do not damage banjo fitting seating surfaces.*
- *If DOT 4 brake fluid contacts painted surfaces, IMMEDIATELY flush area with clear water.*
- *Do not reuse brake fluid.*

1. Stand motorcycle upright (not leaning on jiffy stand) on a level surface.
2. Raise the rear of the motorcycle.
   a. Remove left side lower shock bolt.
   b. Rotate shock away from the caliper. See Shock Absorbers (Page 2-79).
3. Place suitable container under rear caliper brake line banjo fitting to catch brake fluid.
4. See Figure 2-45. Remove banjo bolt (1) and sealing washers (2). Discard sealing washers.
5. Remove brake caliper mounting bolts (3) and caliper.

Figure 2-45. Rear Brake Caliper

DISASSEMBLY

1. See Figure 2-46. Remove pad pin (1).
2. Remove pad spring (2).
3. Remove brake pads (3).

NOTE

Do not damage banjo bolt sealing surface or threads of banjo bolt hole. Use an air nozzle with a rubber tip.

A WARNING

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

A 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)

4. Remove brake pad from caliper.
5. Remove and discard pistons.
   a. Install a discarded brake pad.
   b. Apply low-pressure compressed air to banjo bolt hole to force a piston (4) partially out of caliper bore.
   c. Remove discarded pad and piston.
   d. Repeat for opposite piston.

NOTE

Do not use metal objects to remove or install seals in piston bore.

6. Use a wooden toothpick and remove dust seals (5) and piston seals (6) from caliper bores. Discard seals.
7. If necessary, remove bleeder screw (7).

Figure 2-46. Rear Brake Caliper Assembly

CLEANING AND INSPECTION

1. Inspect brake pads and brake disc. See Inspection (Page 1-28).

a. If necessary, replace brake pads. See Brake Pad Replacement: Rear (Page 1-30).

b. If necessary, replace brake disc. See REAR WHEEL (Page 2-17).

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

A WARNING

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

2. Clean caliper halves with denatured alcohol.

3. Wipe parts dry with a clean, lint-free cloth.

NOTE

Do not use a wire or similar instrument to clean drilled passages.

A WARNING

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

4. Clean drilled passages and piston bore with low pressure compressed air from a clean air supply.

NOTE

Do not hone bores.

5. Inspect caliper piston bores. If bores show pitting or corrosion, replace caliper.

6. Measure pad pin wear.

a. Measure pad pin diameter (A) across an unworn section.

b. Measure pad pin diameter (B) across visible grooves or wear.

c. Subtract B from A. If wear is out of specification, replace pad pin. Refer to Table 2-15.

Table 2-15. Pad Pin Wear: Specifications

PAD PIN	in	mm
Wear (maximum)	0.011	0.28

INSTALLATION

FASTENER	TORQUE VALUE	
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Caliper to mounting bracket, rear	28-38 ft-lbs	38-51.5 N-m

1. See Figure 2-47. Install rear caliper over brake disc onto mounting bracket.

2. **Install mounting bolts (3). Tighten.**

   Torque: 28-38 ft-lbs (38-51.5 N-m) *Caliper to mounting bracket, rear*

NOTE

Rotate banjo fitting clockwise until it contacts positive stop on caliper housing.

3. **Insert banjo bolt (1) through new sealing washers (2) and fitting.**

4. **Install banjo bolt into caliper housing. Tighten.**

   Torque: 14-18 ft-lbs (19-24.4 N-m) *Brake line banjo bolt*

5. **Return to operation.**

   a. **Install the shock absorber. See Shock Absorbers (Page 2-79).**

   b. **Lower the motorcycle.**

A WARNING

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

A WARNING

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

- **If inhaled: Keep calm, remove to fresh air, seek medical attention.**
- **If on skin: Remove contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, seek medical attention.** [7]

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7 If in eyes: Wash affected eyes for at least 15 minutes under running water with eye lids held open. If irritation develops, seek medical attention.

- **If swallowed: Rinse mouth and then drink plenty of water. Do not induce vomiting. Contact Poison Control. Immediate medical attention required.**
- **See Safety Data Sheet (SDS) for more details available at sds.harley-davidson.com**

(00240e)

NOTICE

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

6. **Bleed brake system. See Bleeding Brakes (Page 2-54).**

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

7. **ABS models: Use Digital Technician to verify that system is bled.**

   Special Tool: DIGITAL TECHNICIAN II (HD-48650)

NOTE

To condition new pads to brake discs, avoid making hard stops for first 100 mi (160 km).

A WARNING

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

8. **Test brakes.**

   a. **Check operation of rear lamps.**

   b. **Test ride motorcycle at low speed. Repeat the bleeding procedure if brakes feel spongy. See Bleeding Brakes (Page 2-54).**

Figure 2-47. Rear Brake Caliper

ASSEMBLY

FASTENER	TORQUE VALUE	
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m
Brake pad pin	131-173 in-lbs	14.8-19.5 N-m

1. Lubricate following with a light coat of KS62F ASSEMBLY GREASE from service parts kit. All other surfaces must be dry.

   a. Piston seal

   b. Dust seal

NOTE

Do not use metal tools to install seals in piston bore.
To prevent damage, only use a wooden toothpick.

2. Install **new** piston seals into groove in piston bores.

3. Install **new** dust seals into groove in piston bores.

NOTE

If piston meets resistance, check if seals are seated in grooves.

4. Carefully insert **new** piston into caliper bore. Repeat for opposite piston.

5. If removed, install bleeder screw and cap. Tighten to 35-61 **in-lbs** (3.9-6.9 N-m).

6. Install brake pads.

   a. See Figure 2-48. Install and hold pad spring.

   b. Install a **new** set of pads. Hold pads in position.

   c. Press pad pin through outside caliper, outside pad and spring.

   d. While compressing pads and spring, press pad pin over center of pad spring through wheel side pad.

   e. While pressing down on spring center, align pin with wheel side caliper.

   f. Install pad pin. Tighten to 131-173 **in-lbs** (14.8-19.5 N-m).

Figure 2-48. Rear Caliper Pad Spring

FASTENER	TORQUE VALUE	
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Brake line clamp screw, fork bracket	45-65 in-lbs	5.1-7.4 N-m
Brake line clamp screw, steering stem	120--168 in-lbs	13.6-19 N-m

FRONT BRAKE LINE (NON-ABS)

Removal

A WARNING

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

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

(00240e)

NOTICE

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

1. Drain brake fluid.
   a. Remove cap from bleeder screw.
   b. Install end of a length of A in (7.9 mm) ID clear plastic tubing over bleeder screw. Place free end in a suitable container..
   c. Open bleeder screw one-half turn.
   d. Pump brake hand lever repeatedly to drain brake fluid.
   e. Close bleeder screw. Tighten to 35-61 **in-lbs** (3.9-6.9 N-m).
2. Remove brake line clamp screw from fork bracket.
3. Remove brake line clamp at steering stem under lower fork bracket.
   a. **Single disc models:** Remove screw with captive washer and clamp.
   b. **Dual disc model:** Remove screw with captive washer and clamp to remove brake line manifold.

NOTE

Carefully remove brake line components to prevent damage to banjo bolt sealing surfaces.

4. **XL1200NS:** Remove cable strap.
5. Remove banjo bolt and sealing washers from master cylinder. Discard sealing washers.
6. Remove banjo bolt and sealing washers from front brake calipers. Discard sealing washers.
7. Inspect brake line. Replace or repair as necessary.

Installation

1. Route brake line. See Front Brake Line Routing (Non-ABS) (Page 2-46).

NOTE

See Figure 2-49. Banjo fittings are configured to fit matching size master cylinder.

2. See Figure 2-50 or Figure 2-51. Loosely install master cylinder banjo bolt (1) and fitting with **new** washers (2).

3. Loosely install upper clamp (3) and screw (4).

4. Loosely install lower clamp:
   a. **Single disc models:** To lower fork bracket stem with screw.
   b. **Dual disc model:** See Figure 2-51. Install screw through brake line manifold into steering head stem.

5. Loosely install banjo bolt and banjo fitting with **new** sealing washers to brake calipers.

6. Tighten fasteners to specification:
   a. Master cylinder banjo bolt to 14-18 ft-lbs (19-24.4 N-m).
   b. Fork bracket clamp screw to 45-65 **in-lbs** (5.1-7.4 N-m).
   c. Steering stem clamp screw to 120-168 **in-lbs** (13.6-19 N-m).
   d. Brake caliper banjo bolt to 14-18 ft-lbs (19-24.4 N-m).

7. XL1200NS: Install cable strap.

8. Fill and bleed brakes with new DOT 4 BRAKE FLUID. See Procedure (Page 2-54).

WARNING

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

9. Check operation of rear lamps and test ride motorcycle.

Figure 2-49. Banjo Fitting Configuration

Figure 2-50. Brake Lines: Non-ABS

Figure 2-51. Non-ABS Brake Line: Dual Disc Model

FRONT BRAKE LINE ROUTING (NON-ABS)

A WARNING

Do not bend metal brake line. Bending brake line could cause metal fatigue and brake failure, which could result in death or serious injury. (00543b)

1. **See Figure 2-52. Fit upper clamp (2) and lower clamp (3) to grommets.**

NOTE

XL 1200NS does not have a grommet on upper clamp.

2. **Route brake line down in front of handlebar and inward behind the fork brackets.**

3. **Route brake line down and across to left side under front fork lower bracket to brake caliper.**

4. **XL1200NS: attach cable strap (1) as shown.**

Figure 2-52. Brake Line Routing: XL883N, XL1200NS, XL1200X

REAR BRAKE LINE (NON-ABS) [8 9]

FASTENER	TORQUE VALUE	
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m

A WARNING

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

- **If inhaled: Keep calm, remove to fresh air, seek medical attention.**
- **If on skin: Remove contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, seek medical attention.**
- **If in eyes: Wash affected eyes for at least 15 minutes under running water with eye lids held open. If irritation develops, seek medical attention.**

9 **If swallowed: Rinse mouth and then drink plenty of water. Do not induce vomiting. Contact Poison Control. Immediate medical attention required.**

- **See Safety Data Sheet (SDS) for more details available at sds.harley-davidson.com**

(00240e)

NOTICE

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

NOTE

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

Removal

1. Drain rear brake fluid:
   a. Remove bleeder screw cap from bleeder screw on rear brake caliper.
   b. Install end of a length of 5/16 in (7.9 mm) ID clear plastic tubing over caliper bleeder screw. Place free end in a suitable container.
   c. Open bleeder screw one-half turn.
   d. Pump brake pedal to drain brake fluid.
   e. Close bleeder screw. Tighten to 35-61 **in-lbs** (3.9-6.9 N-m).
2. Remove debris deflector. See Belt Guard (Page 2-75).
3. Separate stop lamp switch connector [121] housings.
4. Remove banjo bolt and sealing washers. Discard washers.

NOTE

If necessary, replace extrusion plug and J-clamp.

5. See Figure 2-53. Remove brake line from J-clamp.
6. See Figure 2-54. Open plastic clamps in brake line bracket.
7. Remove screw to detach P-clamp from rear fork.
8. Remove banjo bolt and sealing washers from caliper. Discard washers.
9. If necessary, replace stop lamp switch. See Rear Stop Lamp Switch (Page 6-41).

Installation

1. Loosely route brake line from master cylinder to rear caliper.
   a. See Figure 2-53. Install banjo bolt and **new** sealing washers to master cylinder.
   b. Install brake line in J-clamp on frame cross-member.
   c. See Figure 2-54. Route brake line through plastic clamps in brake line bracket.
   d. Install P-clamp around brake line to rear fork.
   e. Install banjo bolt and **new** sealing washers to caliper.

NOTE

- *Adjust brake hose length between rear caliper and clamp so there is no extra length and does not make contact with the rear fork.*
- *Do not twist or stretch brake hose.*
- *Rotate banjo fitting clockwise until it contacts positive stop.*

2. Tighten fasteners:
   a. Master cylinder banjo bolt to 14-18 ft-lbs (19-24.4 N-m).
   b. P-clamp screw to 30-40 **in-lbs** (3.4-4.5 N-m).
   c. Caliper banjo bolt to 14-18 ft-lbs (19-24.4 N-m).
3. Connect stop lamp connector [121] housings.
4. Install debris deflector. See Belt Guard (Page 2-75).

A WARNING

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

5. Bleed brake system. See Bleeding Brakes (Page 2-54).

A WARNING

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

6. Check operation of rear lamps.
7. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy.

Figure 2-53. Rear Brake Line J-clamp

Figure 2-54. Rear Brake Line to Caliper

FRONT MASTER CYLINDER TO MANIFOLD TO CALIPER (ABS)

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUEVALUE	
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Brake line clamp screw, fork bracket	45-65 in-lbs	5.1-7.4 N-m
Brake line tube nuts	128-173 in-lbs	14.5-19.5 N-m
Brake line, front, manifold bolt	36-48 in-lbs	4.1-5.4 N-m

Removal

1. Cover front fender and surface finishes.
2. Drain brake fluid. See Bleeding Brakes (Page 2-54).
3. See Figure 2-55. Remove banjo bolt (1) and sealing washers (2) from master cylinder. Discard sealing washers.
4. Remove P-clamp (3) from upper fork bracket.
5. XL1200NS: Remove cable strap (10).
6. Remove both manifold to EHCU brake line tube nuts from the rear of the manifold.
7. Remove clips to WSS wire harness.

NOTE

Dual disc model: *Remove caliper banjo bolts at both calipers.*

8. Remove banjo bolt (6) and sealing washers (7) from caliper. Discard sealing washers.
9. Remove manifold bolt (8).
10. Dual disc model: Remove upper brake line tube nut (4) from manifold (5).

1. Banjo bolt
2. Sealing washer (2)
3. P-clamp
4. Tube nut
5. Manifold
6. Banjo bolt
7. Sealing washer (2)
8. Manifold bolt
9. Grommet
10. Cable strap (XL1200NS)

Figure 2-55. Brake Line Master Cylinder to Manifold to Caliper

Installation

1. Dual disc model: Finger-tighten tube nut from upper brake line to manifold.
2. See Figure 2-56. Route brake line behind fork bracket.
3. See Figure 2-55. Install banjo bolt (1) and new sealing washers (2). Tighten to.
   Torque: 14-18 ft-lbs (19-24.4 N-m) *Brake line banjo bolt*
4. Install clamp (3) to fork bracket. Tighten to.

   Torque: 45-65 in-lbs (5.1-7.4 N-m) *Brake line clamp screw, fork bracket*

NOTE

XL 1200NS: *do not have a grommet on upper clamp.*

5. **XL1200NS:** Install cable strap (10).

6. Loosely install both manifold to EHCU brake line tube nuts to the rear of the manifold.

7. Install manifold bolt. Tighten to.

   Torque: 36-48 **in-lbs** (4.1-5.4 N-m) *Brake line, front, manifold bolt*

8. Tighten tube nuts to.

   Torque: 128-173 **in-lbs** (14.5-19.5 N-m) *Brake line tube nuts*

9. Route brake line to caliper.

NOTE

Dual disc model: *Install banjo bolts to both calipers.*

10. Install banjo bolt with **new** sealing washers. Rotate fitting against caliper. Tighten to.

    Torque: 14-18 ft-lbs (19-24.4 N-m) *Brake line banjo bolt*

11. Install clips on brake line and WSS wire lead at wire lead flags.

NOTE

Dual calipers: *Bleed both calipers.*

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

12. Fill and bleed brakes. See Bleeding Brakes (Page 2-54).

13. Verify system is bled.

    Special Tool: DIGITAL TECHNICIAN II (HD-48650)

A WARNING

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

14. Test brakes.

    a. Check operation of rear lamps.

    b. Test ride motorcycle.

Figure 2-56. Front Brake Line (ABS) Routing

FRONT MANIFOLD TO EHCU (ABS)

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Brake line bracket clamp fastener	20-30 **in-lbs**	2.3-3.4 N-m

FASTENER	TORQUE VALUE	
Brake line tube nuts	128—173 in-lbs	14.5-19.5 N-m
Brake line, front, manifold bolt	36-48 in-lbs	4.1-5.4 N-m

Removal

1. Drain brake fluid. See Bleeding Brakes (Page 2-54).
2. Forward controls: Remove rider right side control assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-120).
3. Remove brake rod C-clip and pin. Pull rod out of master cylinder.
4. See Figure 2-57. Remove tube nuts (1) from manifold.
5. Remove frame clips (2) on downtube.
6. Remove clamp (9) fasteners (3) at bracket (4).
7. Remove frame clips along right lower frame tube.
8. EVAP models: Remove canister and bracket. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).
9. Remove EHCU. See Removal (Page 2-57).
10. Remove front brake line banjo bolts (5) and sealing washers (6) on EHCU ports. Discard sealing washers.
11. Remove rear clip (7).

NOTE

The lines are glued to grommets (8) at factory. Leave grommets attached unless replacing a single line. Install new grommets if both lines are replaced.

12. If necessary, separate brake lines from grommets.

1. Tube nuts (2)
2. Frame clips (4)
3. Clamp fasteners (2)
4. Bracket
5. Banjo bolt (2)
6. Sealing washers (4)
7. Clip
8. Grommets (6)
9. Clamps (2)

Figure 2-57. Manifold to EHCU Brake Lines

Installation

1. Loosely install line clamps over brake lines and to bracket (4).

NOTE

All banjo eyelets must fit anti-rotation features.

2. Loosely install banjo fittings with new sealing washers and bolts to EHCU ports.
3. Install the clip (7) over brake lines.
4. See Figure 2-58. Route brake lines around rear of frame and along the lower right frame toward the front.
5. Route the brake lines across both downtubes and up the left frame tube to the manifold.
6. Install two frame clamps around line grommets on lower right frame tube.
7. Install two frame clamps around line grommets on left front downtube.

NOTE

Level each metal brake line to other at manifold.

8. Loosely install lines to manifold.

   a. Remove manifold fastener.

   b. Loosely install tube nuts on manifold.

   c. Loosely install manifold fastener.

9. Install brake rod into pushrod collar. Install C-clip and pin.

10. Forward controls: Install rider right side footrest assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-120).

11. Tighten fasteners:

   a. Manifold fastener to 36-48 in-lbs (4.1-5.4 N-m).

   b. Tube nuts to 128-173 in-lbs (14.5-19.5 N-m).

   c. Brake line clamp fasteners to 20-30 in-lbs (2.3-3.4 N-m).

   d. Banjo bolts to 14-18 ft-lbs (19-24.4 N-m).

12. Install EHCU bracket. See Installation (Page 2-58).

13. EVAP models: Install EVAP bracket and canister. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

14. Fill and bleed brake fluid. See Bleeding Brakes (Page 2-54).

15. Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to verify that system is bled.

A WARNING

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

16. Test brakes.

   a. Check operation of rear lamps.

   b. Test ride motorcycle.

Figure 2-58. Manifold to EHCU Front Brake Line Routing

REAR MASTER CYLINDER TO EHCU (ABS)

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
Stop lamp switch, rear	12-15 in-lbs	1.4-1.6 N-m

Removal

1. Remove debris deflector. See Belt Guard (Page 2-75).
2. Drain brake system. See Procedure (Page 2-54).
3. EVAP models: Remove EVAP canister and bracket. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).
4. Separate rear stop lamp switch connectors [121-1] [121-2].
5. Remove EHCU. See Removal (Page 2-57).
6. Remove banjo bolt from master cylinder. Discard sealing washers.
7. See Figure 2-59. Remove the EHCU MC2 banjo bolt. Discard sealing washers.
8. If necessary, remove stop lamp switch.

Figure 2-59. EHCU Rear Master Cylinder MC2

Installation

1. If removed, install stop lamp switch. Tighten to 12-15 **in-lbs** (1.4-1.6 N-m).

2. Route brake line from master cylinder to EHCU.

NOTE

All banjo eyelets must fit anti-rotation features.

3. See Figure 2-60. Loosely install banjo bolts with **new** sealing washers to:

   a. Rear master cylinder

   b. EHCU MC2 port

4. Tighten banjo bolts:

   a. Rear master cylinder 14-18 ft-lbs (19-24.4 N-m)
   b. EHCU port MC2 14-18 ft-lbs (19-24.4 N-m)

5. Install EHCU and bracket. See Installation (Page 2-58).

6. Install debris deflector. See Belt Guard (Page 2-75).

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

7. Bleed brake system. See Procedure (Page 2-54).

8. Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to verify that system is bled.

A WARNING

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

9. Test brakes.

   a. Check operation of rear lamps.

b. Test ride motorcycle.

Figure 2-60. Master Cylinder to EHCU Brake Line Routing

REAR EHCU TO CALIPER (ABS)

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake line P-clamp, rear, screw	30-40 **in-lbs**	3.4-4.5 N-m
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m

Removal

1. Drain brake system. See Procedure (Page 2-54).
2. RemoveEVAP canister and bracket. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).
3. Lower EHCU. See Removal (Page 2-57).
4. Remove rear caliper banjo bolt. Discard sealing washers.
5. Remove P-clamp fastener on rear fork.
6. Remove WSS line clips from brake line bracket.
7. Open plastic clamps in brake line bracket.
8. Remove EHCU banjo bolt from R port. Discard sealing washers.

Installation

1. See Figure 2-61. Route brake line from EHCU to caliper.

NOTE

All banjo eyelets must fit anti-rotation features.

2. Install EHCU banjo bolt with **new** sealing washers. Tighten to 14-18 ft-lbs (19-24.4 N-m).

3. Route brake fine p'lastk im Hilile bracket da^mps.

4. Install rearbrake^^CT^baajo bolt. Tighten to 14-18 friths (19-24.4 N-m).

NOTE

- *Do not* twist *or* stretch *brake* ^hooe..
- *Adjust brake h^& t^^th tear damp* so *there* is *no ^extra ^^th am8 contact wth the rear fork.*
- *Rotate banjo fitting until stop.*

5. Install rear fork P-damp. Tighten to (3.4-4.5 N-m).

6. Install clips over WSS wire lead and reair brake lime.

7. Install bracket and EHCU. See Installation (Page 2-58).

8. Install EVAP canister and bracket. See EVAPORA^TIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bl^eeding procedure to verify all air is removed from the sys^tem. Failure to properly bleed the brake system could adve^ety affect braking, which could result in death or serious injury. (00585c)

9. Fill and bleed brake fluid. See Procedure (Page 2-54).

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A WARWING

After repairing the brakesystem, testbrakesattowspeed. W brakes are notoperating properly, resting dt high speeds can cause loss of control, which could result ;in death or serious injury. (00289a)

11. Test brakes.

Figure 2-61. EHCU to Caliper Rear Brake Line Routing

GENERAL

A WARNING

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

A WARNING

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

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

(00240e)

| NOTICE [10] [11]

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

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

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

NOTICE

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

Verify front brake hand lever and rear brake foot pedal have a firm feel when applied. Bleed system as necessary.

PROCEDURE

PART NUMBER	TOOLNAME
BB200A	BASIC VACUUM BRAKE BLEEDER

FASTENER	TORQUE VALUE	
Brake caliper bleeder valve	35-61 in-lbs	3.9-6.9 N-m
Brake master cylinder, front, reservoir cover	9-17 in-lbs	1-2 N-m
Brake master cylinder, rear, reservoir cover	9-17 in-lbs	1-2 N-m

NOTE

If the brake system was drained, use the BASIC VACUUM BRAKE BLEEDER (PART NUMBER: BB200A). Refer to the instructions provided with the tool. If a vacuum brake bleeder is not available, use the following procedure.

1. **Remove bleeder screw cap. Install end of clear plastic tubing over bleeder screw and place free end in a clean container.**

2. **Position vehicle or handlebar so master cylinder reservoir is level.**

NOTE

Protect paint from brake fluid spills. Wrap a clean shop cloth around the outside of the master cylinder reservoir.

3. **Remove cover from master cylinder reservoir.**

NOTE

Pay careful attention to the fluid level in the master cylinder reservoir. Add fluid before it empties to avoid drawing air into the brake lines.

A WARNING

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

4. **Add brake fluid as necessary. Verify proper operation of the master cylinder relief port by actuating the brake pedal or lever. A slight spurt of fluid breaks the fluid surface in the reservoir if internal components are working properly. Refer to Table 2-16.**

5. **Operate the brake lever or pedal to build hydraulic pressure.**

6. **While holding pressure with the brake lever or pedal:**

   a. **Open bleeder screw about three-quarters of a turn.**

   b. **Close bleeder screw as soon as the lever or pedal has moved full range of travel.**

   c. **Allow brake lever or pedal to return slowly to its released position.**

7. Repeat steps until all air bubbles are purged and a solid column of fluid is observed in the bleeder tube.

8. Tighten bleeder screw to specification. Install bleeder screw cap.

NOTE

Bleed both calipers.

9. Fill reservoir to specified level.

NOTE

Check master cylinder cover gasket bellows. Verify that the master cylinder cover gasket bellows is not extended or brake fluid is ejected from the reservoir.

10. Verify that gasket and sealing surfaces are free of debris. Install master cylinder reservoir cover. Refer to Table 2-17.

    a. **Front master cylinder reservoir:** Install the cover with the vent holes facing the rear. Install cover screws. Tighten to specification.

    b. **Rear master cylinder reservoir:** Install cover screws. Tighten to specification.

11. Check operation of rear lamps.

A WARNING

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

12. Test ride motorcycle. Repeat the bleeding procedure if brakes feel spongy.

Table 2-16. Fluid Level

ITEM	SPECIFICATION
Front reservoir	Boss or ridge
Rear reservoir	Ledge or range window

Table 2-17. Torque Specifications

COMPONENT	TORQUE
Bleeder	35-131 **in-lbs** (3.9-13.9 N-m)
Front cover	9-17 **in-lbs** (1-2 N-m)
Rear cover	9-17 **in-lbs** (1-2 N-m)

REMOVE

INDONESIA ONLY

NOTE

Make sure parking brake is disengaged.

1. See Figure 2-62. Remove mirror. See CLUTCH CONTROL (Page 2-91).

   a. Mounted Above: Mirror assembly components (1, 7, 6).

   b. Mounted Below: Mirror assembly components (5, 8, 9).

2. Remove nut (4).

3. Remove pivot pin (2).

4. Remove parking brake assembly (3).

INSTALL

INDONESIA ONLY

NOTE

FASTENER	TORQUE VALUE	
Parking brake nut	44-62 in-lbs	5-7 N-m
Parking brake pivot pin	44-62 in-lbs	5-7 N-m

PART NUMBER	CONSUMABLE
42820-04	G40M BRAKE GREASE

System uses unique brake pivot hardware - reuse or replace as needed with correct parts designated for parking brake application.

1. See Figure 2-62. Install parking brake assembly.

   a. Install parking brake assembly (3) below the master cylinder bracket.

   b. Align holes of parking brake assembly, master cylinder bracket and brake lever.

   c. Lubricate and install pivot pin (2).

   G40M BRAKE GREASE (42820-04)

   NOTE

   Do not apply grease to threads.

2. Install mirror. See CLUTCH CONTROL (Page 2-91).

   a. Mounted Above: Align holes in parking brake assembly and master cylinder bracket. Install mirror assembly components (1, 7, 6).

   b. Mounted Below: Align holes in parking brake assembly and master cylinder bracket. Install mirror assembly components (5, 8, 9).

3. Tighten pivot pin (2).

   Torque: 44-62 in-lbs (5-7 N-m) *Parking brake pivot pin*

4. Install nut (4). Tighten.

   Torque: 44-62 in-lbs (5-7 N-m) *Parking bake nut*

1. Mirror (Mounted above)
2. Pivot pin
3. Parking brake assembly
4. Flange nut
5. Mirror (Mounted below)
6. Lock nut
7. Lock washer
8. Lock washer
9. Bullet nut

Figure 2-62. Parking Brake (Indonesia)

REMOVAL

PART NUMBER	TOOLNAME
BB200A	BASIC VACUUM BRAKE BLEEDER

A WARNING

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

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

(00240e)

NOTICE

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

NOTICE

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

1. Remove left side cover.

2. Remove main fuse.

NOTE

- *For best results, use a BASIC VACUUM BRAKE BLEEDER (PART NUMBER: BB200A) to drain brakes.*
- *Dispose of used brake fluid in accordance with local regulations.*

3. Drain both front and rear brakes.

   a. Remove bleeder screw caps.

   b. Install a length of 5/16 in (7.9 mm) ID plastic tubing over bleeder screws. Place free in catch container.

   c. Open bleeder screw one-half turn.

   d. Pump brake several times to drain brake fluid.

   e. Close bleeder screw.

4. See Figure 2-63. Remove frame clamps (1).

5. Remove P-clamp on rear brake line to rear fork.

6. Open plastic clamps in brake line bracket. Pull brake line away from bracket

NOTE

EVAP models: *The two fasteners securing EVAP bracket also secure ABS module bracket.*

7. **EVAP models:** Remove EVAP canister. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

8. Remove two fasteners (2) to EHCU bracket.

NOTE

Do not bend the metal brake lines when lowering or removing the EHCU.

9. Lower EHCU to access connector and banjo bolts.

10. Disconnect EHCU connector [166] (3).

NOTE

Wrap banjo fittings with a lint-free cloth to absorb brake fluid.

11. Remove four brake line banjo bolts (4). Discard sealing washers.

NOTICE

This device is sensitive to electrostatic discharge (ESD). To prevent damage to the device, always touch the motorcycle frame or a grounded surface before handling. (00588c)

12. Remove fasteners (5) securing EHCU to bracket.

1. Frame clamps (2)
2. Bracket to frame fasteners (2)
3. Connector [166]
4. Banjo bolts (4)
5. EHCU fastener (2)

Figure 2-63. EHCU and Bracket

INSTALLATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m
EHCU mounting bracket fasteners	15-18 ft-lbs	20.3-24.4 N-m
EHCU to mounting bracket fastener	50-70 in-lbs	5.8-7.8 N-m

1. Inspect rubber frame grommets. Replace or repair as necessary.

2. Attach EHCU to mounting bracket.

   a. Start both EHCU fasteners to capture EHCU against both sides of bracket.

   b. Tighten to 50-70 in-lbs (5.8-7.8 N-m).

NOTE
EHCU marks identify brake line connections.

3. See Figure 2-64. Install brake line banjo fittings.

   a. Loosely install banjo fittings to EHCU with new sealing washers.

   b. See Figure 2-65. Install clip over MC2 and MC1 brake lines.

   c. Tighten banjo bolts to 14-18 ft-lbs (19-24.4 N-m).

4. Connect EHCU connector [166].

5. Mount EHCU bracket to frame.

   a. EVAP models: Install EVAP cannister bracket. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

   b. Loosely install fasteners.

   c. Tighten to 15-18 ft-lbs (20.3-24.4 N-m).

6. Install brake line through plastic clamps in brake line bracket.

7. Install rear brake line P-clamp. Tighten to 30-40 in-lbs (3.4-4.5 N-m).

8. Install frame clamps over brake line grommets.

9. For a new unit, calibrate EHCU with DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

10. Bleed brake system. See Bleeding Brakes (Page 2-54).

11. Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to verify that system is bled.

A WARNING

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

12. Test brakes.

    a. Check operation of rear lamps.

    b. Test ride. Test for soft or spongy brakes. Bleed brakes as necessary.

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1. Front brake master cylinder (MC1) in
2. Front (F) caliper out Rear brake master
3. cylinder (MC2) in Rear (R) caliper out
4. Figure 2-64. Brake Fluid Line Connections

Figure 2-65. Brake Line Clip

OPENING AND CLOSING

Open

1. Cover passenger footpeg and rear brake fluid line.

2. Grasp top corners of side cover.

NOTE

- *Disengage rear dip first.*
- *See Figure 2-66. Cover hangs from hook (3) on battery tray.*

3. Gently pull cover with barrel clips (1) away from plastic socket clips (2) on frame.

NOTICE

Leaning or placing tools on side cover could cause damage to cover and/or mounting tab on battery tray. (00523b)

4. Rest cover on passenger footpeg.

Close

1. Raise the cover.

NOTE

Align the front clip first.

2. Align the barrel clips with the socket clips.
3. Press the top of cover to snap the clips in place.

Figure 2-66. Left Side Cover

REPLACEMENT

Remove

1. Lift side cover up.

2. Tilt cover to the rear.

3. See Figure 2-67. With a back and forth rocking motion, pull up and out to disengage cover (1) from mounting hook (2) on battery tray (3).

Barrel Clip

See Figure 2-68. Install barrel clip (1) with fastener (2) .Hand tighten.

Install

1. Position cover over battery tray. Align slot in cover to mounting hook.
2. Install cover over mounting hook.
3. Close the cover.

Figure 2-67. Bottom Mount

Figure 2-68. Barrel Clip

CHECK FOR OIL LEAK

Fork Oil Seals

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

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

Check Oil Leak

1. Observe oil ring.
2. Wipe fork clean.
3. Ride motorcycle over bumpy road or complete six braking events.
4. See Figure 2-69. Check fork slider tube for oil.
   a. If a normal oil/dust film (1,2) is present, there is no leak.
   b. If an oil run or drip (3) is present, perform procedure two or three more times to confirm oil leak.

Figure 2-69. Front Forks

1. **Normal oil/dust film**
2. **Normal oil/dust film**
3. **Drip**

REMOVAL

1. Remove front brake caliper. See FRONT BRAKE CALIPERS (Page 2-29).
2. Remove front wheel assembly. See WHEELS (Page 2-14).
3. Remove fender. See Front Fender (Page 2-104).
4. **XL1200NS:** Remove throttle cable clip.
5. See Figure 2-70. Loosen the upper pinch bolts (2).
6. Loosen slider tube caps (1).
7. Loosen lower pinch bolts (3). Remove fork assemblies from fork brackets.

Figure 2-70. Fork Tube Bracket

DISASSEMBLY: RIGHT SIDE

NOTICE

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

Drain Fork Oil

1. See Figure 2-71. Remove tube cap (7) from slider tube (9). Remove O-ring (6) from tube cap.

2. Place a pan under fork.

3. Turn fork upside over pan. Pump slider to drain fork oil.

Fork Disassembly

1. See Figure 2-71. Remove spring (5) from slider tube.
2. Remove spring collar (19) and spring washer (20) from slider tube.
3. **All except XL883N, XL1200NS:** Remove cover (11).

NOTE

See See Figure 2-84.. The XL883N, XL 1200NS has fork gaiters (2) instead of metal covers. The lower lip (3) of the gaiter fits into groove at upper end of slider (1). The upper end of gaiter fits tightly around slider tube, just below lower bracket (4).

4. **XL883N, XL1200NS:** See See Figure 2-84.. Peel back lower lip (3) of fork gaiter (2) from slider groove and slide fork gaiter up and off end of slider tube.
5. See Figure 2-71. Remove dust seal (12). Compress internal circle clip (13). Remove clip from groove in top of slider bore.
6. Remove screw (18) and washer (17) from bottom of slider.

NOTE

Since there is little resistance to damper tube (3) rotation within slider tube (9) when removing screw (18), use an air impact wrench for best results.

7. Remove slider tube (9) from slider until lower bushing (10) on slider tube contacts upper bushing (1) in slider.
8. Remove oil seal (14), spacer (2) and upper bushing using lower bushing on slider.
9. Remove sleeve (15). Sleeve is within slider or on bottom end of damper tube (3).
10. Insert a small diameter rod through opening in bottom of slider tube to remove damper tube assembly.
11. Remove rebound spring (8) from damper tube.
12. Remove damper tube ring (4) from damper tube.
13. Remove lower bushing from damper tube only if replacement is necessary.

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1. Upper bushing
2. Spacer
3. Damper tube
4. Damper tube ring
5. Spring
6. O-ring
7. Tube cap
8. Rebound spring
9. Slider tube
10. Lower bushing
11. Cover (all except XL883N, XL1200NS)
12. Dust seal
13. Oil seal retaining ring
14. Oil seal
15. Sleeve
16. Pinch bolt
17. Washer
18. Screw
19. Spring collar
20. Spring washer
21. Fork gaiter (XL883N, XL1200NS)
22. • Washer
23. Lockwasher
24. Nut
25. Slider (RH XL883N, XL1200NS)
26. Slider (RH XL1200X)

Figure 2-71. Front Forks: Right Side

DISASSEMBLY:_LEFTSIDE

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

NOTICE

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

1. Clamp fork tube in fork tube holder and mount in vise with fork vertical.

Special Tool: FORK TUBE HOLDER (HD-41177)

A 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)

2. See Figure 2-76. Remove fork tube cap (1, 2) from fork tube.

3. Pull up on fork slider (21,23) to compress fork assembly. This causes the cartridge damper (20) rod to protrude from top of fork tube (18, 19).

4. Holding locknut (4), remove fork tube plug from threaded end of the damper rod. Remove O-ring (3) from fork tube plug. Discard O-ring.

5. Drain fork oil into a suitable container.

6. See Figure 2-72. Install front fork compressor:

   Special Tool: FRONT FORK COMPRESSOR (HD-45966)

   a. Clamp tool in vise in a vertical position with length adjuster screw topside.

   b. Pull up on fork slider to compress fork assembly.

   c. Place hole at bottom of fork slider over post (5) at bottom end of tool.

   d. With the smaller OD topside, place fork spring compressing tool collar over locknut, spring seat and flat washer of fork assembly.

   Special Tool: FORK SPRING COMPRESSING TOOL COLLAR (HD-45966-2)

NOTE

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

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

   f. Turn retaining pins as necessary to lock position of spring compressor collar (4).

   g. Tighten length adjuster screw to compress spring.

7. See Figure 2-73. Remove locknut from end of damper rod.

Figure 2-72. Fork Spring Compressing Tool

Figure 2-73. Compress Fork Spring

8. Loosen length adjuster screw to release tension on fork spring. Loosen retaining pins and remove spring compressor collar. Remove spring seat and flat washer.

9. Remove fork assembly from tool. Remove fork spring from fork tube.

10. See Figure 2-74. Thread rod extension tool (part of FRONT FORK COMPRESSOR (PART NUMBER: HD-45966)) onto end of damper rod.

11. See Figure 2-75. Turn fork assembly upside down over drain pan and slowly pump damper rod at least 20 times until rod moves freely.

NOTE

If only performing a fork oil change, see Filling and Final Assembly in Assembly: Left Side (Page 2-68). If overhauling the fork assembly, continue with procedure.

12. Remove extension tool from damper rod. Install fork spring back into fork tube.

13. See Figure 2-76. Place fork assembly upside down on a clean shop rag on the floor. While compressing spring (14, 16) to prevent rotation of damper cartridge, remove screw (25). Use an air impact wrench for best results. Discard screw and copper washer (24).

14. Remove spring and cartridge damper from fork tube.

Figure 2-74. Damper Rod Extension Tool

Figure 2-75. Pump Damper Rod Extension Tool 15. **All except XL883N, XL1200NS:** Remove cover (8).

NOTE

XLBB3N, XL 1200NS: See See Figure 2-84.. Peel back lower lip (3) of fork gaiter (2) from slider groove and slide fork gaiter up and off end of slider tube.

16. See Figure 2-76. Remove dust seal (9). Compress oil seal retaining ring (10, 11). Remove ring from groove in top of slider bore.

NOTE

Do not bend or stretch oil seal retaining ring during removal.

17. See Figure 2-76. Remove oil seal retaining ring.
18. Expand fork slider and tube against each other repeatedly (in slide-hammer effect) to remove fork tube including seal (12), slider spacer (13), fork tube bushing (17) and slider bushing (15).
19. Slide seal, slider spacer and slider bushing off end of fork tube. Discard oil seal.
20. Gently pry at split line to expand fork tube bushing. Remove bushing from groove at end of fork tube.

NOTE

The left side lower stop is different than the right side lower stop. Set aside or mark as needed.

21. Remove lower stop (22) from fork slider, or end of cartridge damper if still installed.

1. Fork tube cap (all but XL1200X)
2. Fork tube cap (XL1200X)
3. O-ring
4. Locknut
5. Spring Seat
6. Fork gaiter (XL883N, XL1200NS)
7. Spring washer
8. Cover (all except XL883N, XL1200NS)
9. Dust seal
10. Oil seal retaining ring (XL1200X)
11. Oil seal retaining ring (all except XL1200X)
12. Seal
13. Slider spacer
14. Spring (XL1200X)
15. Slider bushing
16. Spring (all except XL1200X)
17. Fork tube bushing
18. Fork tube(all except XL1200X)
19. Fork tube(XL1200X)
20. Cartridge damper
21. Fork slider (all except XL1200X)
22. Lower stop
23. Fork slider (XL1200X)
24. Copper washer
25. Screw, 10 mm

Figure 2-76. Front Fork: Left Side

CLEAN AND INSPECT

1. Clean all parts.
2. Inspect parts for wear or damage. Replace parts if necessary.
3. Inspect OD of slider bushing and ID of fork tube bushing.
   a. If coating is worn through (metallic substrata showing), replace bushing.
   b. Inspect for distortion.
   c. If deep scratches or scoring are found, replace bushing. Also inspect mating components for similar wear. Replace or repair as necessary.

4. Check fork tube and slider for scoring, scratches and abnormal wear.

5. Inspect fork tube for nicks from stones and road debris, especially in area where seal contacts it. Replace if necessary.

6. See Figure 2-77. Check runout with a dial indicator.

   a. Set fork tube on V-blocks.

   b. Replace fork if runout exceeds 0.008 in (0.2 mm).

Figure 2-77. Measure Fork Tube Runout

ASSEMBLY: RIGHT SIDE

PART NUMBER	TOOLNAME
HD-36583	FORK SEAL AND BUSHING INSTALLATION TOOL
HD-45305	FORK SEAL DRIVER
HD-59000-B	HARLEY-DAVIDSON PRO-LEVEL OIL GAUGE

FASTENER	TORQUE VALUE	
Fork slider tube fastener (All butXL1200X)	132-216 in-lbs	14.9-24.4 N-m
Fork slider tube fastener (XL1200X)	37-44 fl-lbs	50-60 N-m
Slider tube cap	22-59 ft-lbs	30-80 N-m

NOTICE

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

1. See Figure 2-71. If lower bushing (10) was removed, install new lower bushing in groove of slider tube (9). Expand bushing only enough to fit over tube.

2. Install damper tube ring (4) into grooves of damper tube (3).

3. Place rebound spring (8) over damper tube. Insert damper tube into slider tube.

4. Insert spring into slider tube with tapered end down.

5. Install damper tube through opening at bottom of slider tube using spring. Place sleeve (15) over end of damper tube.

6. Install spring washer (20) and spring collar (19) into slider tube.

7. Install slider tube assembly.

   a. Install slider tube assembly into slider.

   b. Install screw (18) with washer (17) at bottom of slider.

   c. Exercise slider tube through its full range of travel within slider several times to verify proper component alignment.

   d. Apply a downward force on spring. All but XL1200X: tighten screw to 132-216 in-lbs (14.9-24.4 N-m). XL1200X: tighten screw to 37-44 fl-lbs (50--60 N-m).

NOTE

- *See Figure 2-78. Coat lips (3) and inner diameter of oil seal with HARLEY-DAVIDSON SEAL GREASE.*
- *Apply HARLEY-DAVIDSON SEAL GREASE to mating surfaces of dust cover.*

8. See Figure 2-71. Place upper bushing (1), spacer (2) (concave side down) and oil seal (14) (lettering side up) over slider tube.

9. For XL1200X place fork seal driver over slider tube, all other models use fork seal and bushing installation tool. tap components downward with installation tool.

   Special Tool: FORK SEAL DRIVER (HD-45305)
   Special Tool: FORK SEAL AND BUSHING INSTALLATION TOOL (HD-36583)

10. Install oil seal retaining ring (13) into groove in top of slider bore.

11. Install dust seal (12) at top of slider.

12. All except XL883N, XL1200NS: Install cover (11).

13. XL883N, XL1200NS: See Figure 2-84. Slide a fork gaiter (2) down each slider tube. Peel back lower lip (3) and slip over end of fork slider (1). Fit lower lip down over groove in upper end of fork slider. Slide upper end of fork gaiter down as far as possible.

1. **Top (lettering side)**
2. **Bottom**
3. **Lip (2)**

Figure 2-78. Fork Seal

Filling and Final Assembly

NOTE

Remove the spring, spring washer and spring collar before adding oil.

1. Position fork tube assembly upright. Compress assembly fully.

2. Pour TYPE "E" HYDRAULIC FORK OIL into fork.

   a. **All but XL1200X:** .
   Volume: 14 fl oz (414 ml)

   b. **XL1200X:** .
   Volume: 26 fl oz (769 ml)

3. Pump slider tube 8-10 times to expel air and compress assembly fully.

4. See Figure 2-79. Set fork level oil.

   Special Tool: HARLEY-DAVIDSON PRO-LEVEL OIL GAUGE (HD-59000-B)

   a. Adjust length of draw off tube to specification (1). Refer to Table 2-18.

   b. Lock tube (2) to collar (3) with thumb lock (4).

   c. Fit collar to fork tube.

   d. Draw off excess oil.

5. Install spring and other components.

NOTE

Apply HARLEY-DAVIDSON SEAL GREASE to O-ring.

6. Install slider tube cap with O-ring. Screw tube cap all the way into slider tube. Tighten to.

   Torque: 22-59 ft-lbs (30-80 N-m) *Slider tube cap*

Table 2-18. Fork Oil Level Specifications: Right Side

MODEL	in	mm
XL883N	4.72	120
XL1200NS	4.72	120
XL1200X	6.34	161

Figure 2-79. Oil Level Gauge

ASSEMBLY: LEFT SIDE

PART NUMBER	TOOL NAME
HD-34634	FORK OIL SEAL INSTALLER
HD-41177	FORK TUBE HOLDER
HD-45305	FORK SEAL DRIVER
HD-45966	FRONT FORK COMPRESSOR
HD-59000B	FORK OIL LEVEL GAUGE

FASTENER	TORQUE VALUE	
Damper cartridge screw (All butXL1200X)	11-18 ft-lbs	15-25 N-m
Damper cartridge screw (XL1200X)	22-30 ft-lbs	30-40 N-m
Fork tube plug	22-59 ft-lbs	30-80 N-m
Locknut, fork tube plug	13-16.6 ft-lbs	17.5-22.5 N-m

NOTICE

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

NOTE

Lubricate all seal lips, quad rings and O-rings with HARLEY-DAVIDSON SEAL GREASE during assembly.

1. See Figure 2-71. Coat **new** fork tube bushing (17) ID with clean fork oil. Expand fork tube bushing only as far as required to slip over end and into groove of fork tube.

2. Slide cartridge damper (20) into fork tube (18, 19) so that cartridge end drops through hole at bottom of fork tube.

3. Install lower stop (22) at end of damper cartridge.
4. Install fork tube into fork slider (21,23).
5. Install new screw (25) with new copper washer (24) into end of cartridge damper.
6. Coat **new** slider bushing (15) ID and OD with clean fork oil. Slide slider bushing down fork tube.
7. Slide slider spacer (13) down fork tube until it contacts slider bushing.
8. Slide FORK OIL SEAL INSTALLER (PART NUMBER: HD-34634) for all but XL1200X or FORK SEAL DRIVER (PART NUMBER: HD-45305) for XL1200X down fork tube. Using tool as a slide hammer, drive slider bushing into counterbore of fork slider. Remove tool.

NOTE

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

9. Coat lips of new fork oil seal (12) with HARLEY-DAVIDSON SEAL GREASE. Place the lettered side of the seal facing upward. Slide seal down fork tube until it contacts slider spacer.
10. Remove masking tape from edge of fork tube.
11. Clamp fork slider into a soft-jawed vise.
12. See Figure 2-80. Using FORK OIL SEAL INSTALLER (PART NUMBER: HD-34634) for all but XL1200X or FORK SEAL DRIVER (PART NUMBER: HD-45305) for XL1200X like a slide hammer, drive fork oil seal down until retaining clip groove is visible. Remove tool.

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Figure 2-80. Install Fork Oil Seal

NOTE

See Figure 2-76. Do not bend or stretch oil seal retaining ring (10, 11) when installing.

13. Install oil seal retaining ring in fork slider groove.
14. Install dust seal (9) at top of slider.
15. All except XL883N, XL1200NS: Install cover (8).
16. XL883N, XL1200NS: See Figure 2-84. Slide a fork gaiter (6) down each slider tube. Peel back lower lip (3) and slip over end of fork slider (1). Fit lower lip down over groove in upper end of fork slider. Slide upper end of fork gaiter down as far as possible.
17. Tighten damper cartridge screw:
    a. All but XL1200X:

       Torque: 11-18 ft-lbs (15-25 N m) *Damper cartridge screw (All but XL 1200X)*

    b. XL1200X:

       Torque: 22-30 ft-lbs (30-40 N-m) *Damper cartridge screw (XL 1200X)*

Filling and Final Assembly

1. Clamp fork slider upright.

   Special Tool: FORK TUBE HOLDER (HD-41177)

2. Fill fork tube:
    a. See Figure 2-81. Thread extension rod onto end of damper rod.
    b. With fork tube compressed, pour TYPE "E" HYDRAULIC FORK OIL into the fork tube almost to the top.
    c. Pump fork tube ten times to remove air from system.
    d. Slowly pump the damper rod until resistance is felt.
    e. Place the damper rod in the fully bottomed position.
    f. Remove the extension tool from the end of the damper rod.

A WARNING

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

3. See Figure 2-82. Adjust collar of fork oil level gauge to specification (1) Refer to Table 2-19.

   Special Tool: FORK OIL LEVEL GAUGE (HD-59000B)

4. With the fork tube bottomed in the fork slider, insert tube of gauge until collar rests flat on top of fork tube.
5. Draw excess oil from fork with plunger. If no oil is drawn out, add a small amount to the fork tube and repeat.

Figure 2-81. Pump Damper Rod Extension Tool

Figure 2-82. Oil Level Gauge

Table 2-19. Fork Oil Level Specifications: Left Side

MODEL	in	mm
XL883N	5.94	151
XL1200NS	5.94	151
XL1200X	4.84	123

6. Install fork spring into fork tube with closer spaced coils toward bottom.

7. Pull up on fork slider to compress fork assembly causing damper rod and spring to protrude from top of fork tube.

8. Install damper rod extension tool onto end of damper rod.

9. Remove fork assembly from fork tube holder.

   Special Tool: FORK TUBE HOLDER (HD-41177)

A 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)

10. See Figure 2-72. Clamp front fork compressor in vise in a vertical position with length adjuster screw (2) topside.

    Special Tool: FRONT FORK COMPRESSOR (HD-45966)

11. Pull up on fork slider to compress fork assembly.

12. Place hole at bottom of fork slider over post (5) at bottom end of tool.

13. Place flat washer rounded side up over damper rod extension tool (1) and on top of spring. Place spring seat concave side up on top of flat washer. With smaller OD topside, place spring compressor over spring seat and flat washer.

NOTE

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

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

A 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)

15. See Figure 2-73. Turn retaining pins as necessary to lock position of spring compressor.

16. Tighten length adjuster screw to compress spring.

17. After several turns, pull up on extension tool to raise damper rod. Repeat until threaded portion of rod can be pulled out of spring. Remove extension tool. Do not release damper rod.

18. Align locknut with the non-threaded end over the damper rod and thread locknut until it contacts shoulder.

19. Loosen length adjuster screw to release tension on fork spring. Loosen retaining pins and remove spring compressor. Remove fork assembly from tool.

20. Clamp fork tube holder in vise. Clamp fork tube into tool.

    Special Tool: FORK TUBE HOLDER (HD-41177)

21. See Figure 2-76. Install **new** O-ring (3) onto fork tube cap (1,2). Install fork tube cap onto threaded end of rod until it bottoms. Turn locknut (4) in until it contacts fork tube cap. Tighten to.

    Torque: 13-16.6 ft-lbs (17.5-22.5 N-m) *Locknut, fork tube plug*

22. Tighten fork tube plug to.

    Torque: 22-59 ft-lbs (30-80 N-m) *Fork tube plug*

23. Install fork and assemble motorcycle. See Installation (Page 2-71).

INSTALLATION

FASTENER	TORQUE VALUE	
Fork, front, upper bracket pinch screw	30-35 ft-lbs	40.7-47.5 N-m
Front fork lower bracket pinch screw: All but XL1200X	30-35 ft-lbs	40.7-47.5 N-m
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m

1. See Figure 2-83. Insert each fork assembly through front fork lower and upper brackets above top surface of front fork upper bracket.

   0. 42-0.5 in (10.7-12.7 mm)

2. Position slider tubes to extend fork tube caps above top surface of front fork upper bracket (1).

   a. All models:

      0. 42-0.5 in (10.7-12.7 mm)

3. Tighten upper pinch screws (2) to.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Fork, front, upper bracket pinch screw*

4. All but XL1200X: Tighten lower pinch screws (4) to.

   Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Front fork lower bracket pinch screw: All but XL 1200X*

5. XL1200X: Tighten lower fork bracket pinch bolts:

   a. Tighten upper bolts to:.

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Upper pinch bolt in lower fork bracket: XL 1200X (initial)*

   b. Tighten lower bolts to:

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Lower pinch bolt in lower fork bracket: XL 1200X*

   c. Tighten upper bolts to:

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Upper pinch bolt in lower fork bracket: XL 1200X (initial)*

   d. Tighten lower bolts to:

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Lower pinch bolt in lower fork bracket: XL 1200X*

   e. Tighten upper bolts to:

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Upper pinch bolt in lower fork bracket: XL 1200X (initial)*

   f. Tighten lower bolts to:

      Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Lower pinch bolt in lower fork bracket: XL 1200X*

6. XL883N, XL1200NS: See Figure 2-84. Slide upper end of each fork gaiter (2) up until it contacts underside of front fork lower bracket (4).

7. XL1200NS:

   a. Install turn signal assemblies.

   b. Install throttle cable clip.

8. Install front fender. See Front Fender (Page 2-104).
9. Install front wheel and caliper. See WHEELS (Page 2-14).

Figure 2-83. Tube Cap Extension

Figure 2-84. Fork Gaiter: XL883N, XL1200NS

REMOVAL _AND_DISASSEMBLY

1. Cover the fuel tank.
2. Remove the fork tube assemblies. See FRONT FORK (Page 2-61).
3. **XL1200X:** Remove turn signal assemblies. See Front Turn Signals (Page 6-35).
4. See Figure 2-85. Loosen fork stem pinch screw (7). Remove fork stem bolt (9) and washer (8).

NOTE

Use caution to avoid damaging control cables, wiring harnesses, clutch cable or brake lines.

5. Remove P-clamps securing brake lines to fork brackets. See Brake Lines (Page 2-44).
6. Lift handlebar assembly from steering head with fork upper bracket (6) attached. Carefully position assembly out of the way.

NOTE

Only disconnect handlebar connections if removing as an assembly

7. Remove upper seal (5) and upper bearing cone (3). Slide fork stem and lower bracket (1) from frame.
8. **XL1200X:** Remove the clutch cable wireform from the upper bracket.

1. **Fork stem and lower bracket**
2. **Lower seal**
3. **Bearing cone (2)**
4. **Bearing cup (2)**
5. **Upper seal**
6. **Fork upper bracket**
7. **Fork stem pinch screw**
8. **Washer**
9. **Fork stem bolt**
10. **Upper pinch screw (2)**
11. **Lower pinch screw (2)**
12. **Steering head (part of frame)**

Figure 2-85. Fork Stem and Bracket Assembly: Typical

CLEANING, INSPECTION AND REPAIR

PART NUMBER	TOOLNAME
HD-33416	UNIVERSAL DRIVER HANDLE
HD-39301-A	STEERING HEAD BEARING RACE REMOVER

1. See Figure 2-85. Clean the seals (2, 5), bearing cones (3), fork stem and lower bracket (1) and steering head (12) with solvent.
2. Inspect fork stem and lower bracket (1). Replace as necessary.

NOTE

Replace bearings and bearing cups as a set.

3. Inspect bearings. Replace as necessary.

   a. Pitting

   b. Wear

   c. Scoring

4. Turn the bearings in the races to check for roughness. Replace as necessary.

NOTE

The lower bearing cone is a slip-fit on the fork stem. If necessary, gently pry bearing cone off fork stem with a pair of flat blade screwdrivers.

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

5. Replace bearings and bearing cups:

   a. Slide lower bearing cone up and off fork stem.

   b. Remove lower seal (2).

   c. Drive bearing cups from steering head using STEERING HEAD BEARING RACE REMOVER (PART NUMBER: HD-39301-A) and UNIVERSAL DRIVER HANDLE (PART NUMBER: HD-33416). **Discard bearing cups.**

ASSEMBLY AND INSTALLATION

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

FASTENER	TORQUE VALUE	
Clutch cable wireform screw	9-11 in-lbs	1.1-1.2 N-m
Fork stem pinch bolt	30-35 ft-lbs	40.7-47.5 N-m
Fork stem pinch bolt: All but XL1200X	30-35 ft-lbs	40.7-47.5 N-m
Fork, front, stem bolt, final torque	72-96 in-lbs	8.1-10.9 N-m
Fork, front, stem bolt, first torque	23-27 ft-lbs	31.2-36.6 N-m
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7-47.5 N-m

1. See Figure 2-86. If bearing cups (4) were removed, obtain **new** bearings and bearing cups. Install **new** bearing cups into frame steering head.

   Special Tool: STEERING HEAD BEARING RACE INSTALLER (HD-39302)

A WARNING

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

2. Liberally coat the bearing cones (3) with SPECIAL PURPOSE GREASE. Work the grease thoroughly into the bearing rollers.

3. Place lower bearing seal (2) over fork stem. Install lower bearing cone (3) onto fork stem and bracket (1).

4. Insert fork stem and bracket (1) through the steering head. Install bearing cone (3) and seal (5) onto the stem.

5. Install the upper bracket (6) including the handlebar assembly and loosely install fork stem bolt (9) with washer (8).

6. Install fork slider and tube assemblies. See FRONT FORK (Page 2-61). Leave both lower fork bracket pinch screws (11)loose.

7. Install P-clamps securing brake lines to fork brackets. See Brake Lines (Page 2-44).

8. Tighten fork stem bolt (9) to.

   Torque: 23-27 ft-lbs (31.2-36.6 N-m) *Fork, front, stem bolt, first torque*

9. Loosen fork stem bolt. Tighten to.

   Torque: 72-96 **in-lbs** (8.1-10.9 N-m) *Fork, front, stem bolt, final torque*

10. **All but XL1200X:** Tighten lower fork bracket pinch bolt to.

    Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Fork stem pinch bolt: All but XL 1200X*

11. **XL1200X:** Tighten lower fork bracket pinch bolts:

    a. Tighten upper bolts to: 30-35 ft-lbs (40.7-47.5 N-m).

    b. Tighten lower bolts to: 30-35 ft-lbs (40.7-47.5 N-m).

    c. Tighten upper bolts to: 30-35 ft-lbs (40.7-47.5 N-m).

    d. Tighten lower bolts to: 30-35 ft-lbs (40.7-47.5 N-m).

    e. Tighten upper bolts to: 30-35 ft-lbs (40.7-47.5 N-m).

    f. Tighten lower bolts to: 30-35 ft-lbs (40.7-47.5 N-m).

12. Tighten fork stem pinch screw (7).

    Torque: 30-35 ft-lbs (40.7-47.5 N-m) *Fork stem pinch bolt*

13. **XL1200X:** Install turn signal assemblies. See Front Turn Signals (Page 6-35).

14. **XL1200X:** See Figure 2-86. Install the wireform (2), washer (3) and fastener (4) to the upper fork bracket (1). Tighten.

    Torque: 9-11 **in-lbs** (1.1-1.2 N-m) *Clutch cable wireform screw*

15. Check steering head bearing fall-away. See Fall-Away (Page 1-41).

Figure 2-86. Clutch Cable Wireform (typical)

BELT GUARD

FASTENER	TORQUE VALUE	
Belt guard screw	120-180 in-lbs	13.6-20.3 N-m
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m

Removal

1. See Figure 2-87. Remove right side lower shock absorber mount nut (1) and washer (11).
2. Pull shock absorber mounting bolt (2) out slightly until it clears mounting hole in belt guard (4).
3. Remove screw (5), washer (6) and nut (7) securing front of belt guard to rear fork.

Installation

1. See Figure 2-87. Slide belt guard (4) into place. Tab on front of belt guard mounts outboard of mounting bracket on rear fork.
2. Secure front of belt guard to rear fork with screw (5), washer (6) and nut (7). Tighten.

   Torque: 120-180 in-lbs (13.6-20.3 N-m) *Belt guard screw*
3. Apply 2-3 drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of the lower shock absorber bolt.
4. Push lower shock absorber bolt (2) through belt guard mounting hole. Install washer (11) and thread nut (1) on screw. Tighten.

   Torque: 45-50 ft-lbs (61-68 N-m) *Shock absorber mounting bolt*

DEBRIS DEFLECTOR

FASTENER	TORQUE VALUE	
Debris deflector screw	36-60 in-lbs	4.1-6.8 N-m

Removal

1. See Figure 2-87. Loosen, but do not remove, three screws and captive washers (9) securing debris deflector (8) to underside of rear fork.
2. Slide debris deflector forward until keyway slots in deflector clear screw heads.

Installation

1. See Figure 2-87. Position debris deflector (8) in place on underside of rear fork.
2. Fit large end of keyway slots in deflector over screw heads and captive washers (9). Slide deflector rearward to lock screws in slots.
3. Tighten to 36-60 in-lbs (4.1-6.8 N-m).

1. Nut
2. Mounting bolt
3. Washer
4. Belt guard
5. Screw
6. Washer
7. Nut
8. Debris deflector
9. Screw with captive washer (3)
10. Rear Fork
11. Washer

Figure 2-87. Belt Guard and Debris Deflector

REMOVAL

NOTICE

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

1. Raise the motorcycle.
2. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).
3. Remove rear wheel. See REAR WHEEL (Page 2-17).
4. Remove the rider footrest bracket.
   a. Remove the brake pushrod E-clip and pin.
   b. Remove the rider support bracket fasteners.

NOTE

The rear brake components can be removed without draining the brake fluid. Support the components to prevent strain on the brake lines.

5. Remove rear brake master cylinder reservoir. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).
6. Remove screw securing brake line clamp to rear fork. See REAR BRAKE CALIPER (Page 2-40).
7. Remove both shock absorber screws, washers and nuts from rear fork. See Shock Absorbers (Page 2-79).
8. Remove rear brake caliper from rear fork mounting bracket.
9. Remove the caliper mounting bracket.
10. Support the brake line harness bracket.
11. **Models with saree guard:** Remove saree guard. See SAREE GUARD: INDIA MODELS (Page 2-114).
12. Remove belt guard and debris deflector. See BELT GUARD AND DEBRIS DEFLECTOR (Page 2-75).
13. See Figure 2-88. Remove rear fork.
    a. Support rear fork (1).
    b. Remove the retaining clip (2).
    c. Remove the flange nut (3).
    d. Pull the pivot bolt from the rear fork and the pivot sleeve.

Figure 2-88. Rear Fork Assembly

PIVOT BEARINGS

PART NUMBER	TOOLNAME
HD-46281	BEARING REMOVER/INSTALLER TOOL

Removal

NOTE

Remove pivot bearings only if replacement is required.

1. See Figure 2-89. With recessed end of cup facing up, place receiver cup from BEARING REMOVER/INSTALLER TOOL (PART NUMBER: HD-46281) on press bed.
2. Place rear fork pivot bearing boss (2) over cup.
3. Slide pilot (5) through bearing and into receiver cup.
4. Insert handle (4) through other rear fork pivot bearing boss and bearing, down into pilot.
5. Engage press ram on end of handle.
6. Press bearing out.

(00061a)

2. Dry parts with low-pressure, compressed air.

3. Carefully inspect bearings for wear and/or corrosion. Replace or repair as necessary.

4. Verify that the bearing retaining rings are not bent or damaged. Replace or repair as necessary.

5. Check that rear fork is not bent, twisted or cracked. Replace or repair as necessary.

Installation

1. Assemble the bearings and retaining rings.
2. See Figure 2-90. With recessed end of cup facing up, place receiver cup (7) from BEARING REMOVER/INSTALLER TOOL (PART NUMBER: HD-46281) on press bed.
3. Place rear fork pivot bearing boss (2) over cup.
4. Place new pivot bearing (6) over pivot bearing boss, with retaining ring side of bearing up.
5. Slide pilot (5) through new pivot bearing, through pivot bearing boss, and into receiver cup.
6. Insert handle (4) down into pilot.
7. Engage press ram on end of handle.
8. Press bearing down until retaining ring bottoms out in rear fork pivot bearing boss.

1. Rear fork
2. Pivot bearing boss
3. Press
4. Handle
5. Pilot
6. Bearing
7. Receiver cup

Figure 2-90. Installing Rear Fork Pivot Bearings

INSTALLATION

FASTENER	TORQUE VALUE	
Brake line, rear, bracket fasteners	120-180 in-lbs	13.6-20.3 N-m
Footrest support bracket	45-50 ft-lbs	61-68 N-m
Fork, rear, pivot bolt nut	120-130 ft-lbs	162.7-176.3 N-

1. Install rear fork.
   a. Slide pivot bolt through fork and pivot sleeve.
   b. Install flange nut.
   c. Tighten to 120-130 ft-lbs (162.7-176.3 N-m).
   d. Install retaining ring.
2. Install belt guard and debris deflector. See BELT GUARD AND DEBRIS DEFLECTOR (Page 2-75).
3. Install caliper mounting bracket.

4. Capture brake line harness bracket in left passenger footrest.

5. **Models with saree guard:** Install saree guard. See SAREE GUARD: INDIA MODELS (Page 2-114).

6. **Non-passenger footrest models:** Install brake line harness bracket and fasteners. Tighten.

   Torque: 120-180 **in-lbs** (13.6-20.3 N-m) *Brake line, rear, bracket fasteners*

7. Install rear brake master cylinder/reservoir. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).

8. Install right rider footrest bracket.

   a. Install brake rod into master cylinder/reservoir pushrod.

   b. Install pushrod pin. Secure with E-clip.

   c. Mount support bracket with two fasteners. Tighten to 45-50 ft-lbs (61-68 N-m).

9. Install rear brake caliper.

10. Install rear brake hose clamp.

11. Install both shock absorber screws, washers and nuts. See Shock Absorbers (Page 2-79).

12. Install rear wheel. See WHEELS (Page 2-14).

13. Adjust drive belt deflection. See Adjustment (Page 1-34).

14. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

AXLE ADJUSTERS

Removal

1. Remove rear wheel. See REAR WHEEL (Page 2-17).
2. Remove caliper bracket.
3. See Figure 2-91. Remove caps (1), locknuts (2) and adjusters (3).

Installation

1. Install axle adjusters, locknuts and caps.
2. Install caliper bracket.
3. Install rear wheel. See REAR WHEEL (Page 2-17).

Figure 2-91. Axle Adjusters

REMOVAL

NOTE

If a lift is not available, service one shock absorber at a time.

1. Models with saree guard: Remove saree guard. See SAREE GUARD: INDIA MODELS (Page 2-114).
2. Note preload setting.

NOTE

See Figure 2-92. Washer (7) is used for right shock absorber only

3. Remove mounting fastener (6), washers (5, 7) and nut (4) from bottom end of shock absorber.
4. Remove mounting fastener (1) and washer (2) from top end of shock absorber.
5. Remove shock absorber.

CLEANING.ANDJNSPECTION

1. Clean all parts.
2. Inspect parts for wear or damage.
3. Check rubber bushings for wear, cracking and stiffness.
4. Examine shock absorber for signs of leakage.

INSTALLATION

FASTENER	TORQUE VALUE
Shock absorber mounting bolt	45-50 ft-lbs 1 61-68 N-m

NOTE

Offset in the large rubber bushing must face toward the vehicle.

1. See Figure 2-92. Assemble mounting fastener (1), washer (2).
2. Models with saree guard: If removed, install saree guards. See .
3. Install assembled hardware through shock absorber (3).
4. Apply 2-3 drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads of the upper and lower mounting bolts.
5. Position bottom end of shock absorber against outboard side of rear fork mount. Insert mounting fastener (6) and washer (5) through shock absorber and rear fork mount.
6. *NOTE*

Washer (7) is used on right shock absorber only.

Install washer (7) and nut (4).

7. Install upper mounting bolt into frame boss. Tighten.

Torque: 45-50 ft-lbs (61-68 N-m) *Shock absorber mounting bolt*

8. Tighten nut.

Torque: 45-50 ft-lbs (61-68 N-m) *Shock absorber mounting bolt*

9. Adjust shock absorber preload to original settings.

Figure 2-92. Rear Shock Absorbers

STABILIZER LINKS

GENERAL

The stabilizer link system allows the engine to move on its rubber engine mounts while maintaining engine-to-frame alignment. The stabilizer links provide a fixed alignment, and no adjustment is necessary or possible.

The spherical ball end of the stabilizer may rotate loosely, but should not have lateral movement. Replace the link if lateral movement exists.

UPPER FRONT STABILIZER LINK

FASTENER	TORQUE VALUE	
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link, upper front, engine bracket mounting screw	55-65 ft-lbs	74.6-88.2 N-m
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m

Removal

NOTE

See Figure 2-93. Models with a side-mounted horn do not include a horn bracket (9).

1. Remove screws (5), washers (8), horn bracket (9) and upper frame bracket (3) from frame.
2. Remove screws (6), lockwashers (7) and engine bracket (1) from front cylinder head.

Disassembly

1. See Figure 2-93. Remove screw (4) from engine bracket (1) and stabilizer link (2).
2. Remove screw (4) from upper frame bracket (3) and stabilizer link (2).

Assembly

1. See Figure 2-93. Install screw (4) through stabilizer link (2) to engine bracket (1).
2. Install screw (4) through stabilizer link to upper frame bracket (3).
3. Tighten stabilizer link screws to 25-35 ft-lbs (33.9-47.5 N-m).

Installation

1. See Figure 2-93. Install screws (6), lockwashers (7) and engine bracket (1) to front cylinder head. Tighten to 55-65 ft-lbs (74.6-88.2 N-m).

NOTE

Models with a side-mounted horn do not include a horn bracket (9).

2. Install upper frame bracket (3), horn bracket (9), screws (5) and washers (8). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

1. **Engine bracket**
2. **Upper stabilizer link**
3. **Upper frame bracket**
4. **Screw**
5. **Screw (2)**
6. **Screw (2)**
7. **Lockwasher (2)**
8. **Washer (2)**
9. **Horn bracket (front mount models)**

Figure 2-93. Upper Front Stabilizer Link Assembly

LOWER FRONT STABILIZER LINK

FASTENER	TORQUE VALUE	
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m

Removal

1. Position motorcycle upright.
2. See Figure 2-94. Remove screw (3) securing stabilizer link (1) to engine case.
3. Remove screws (4), washers (5) and lower frame bracket (2) from frame.

Disassembly

1. See Figure 2-94. Remove screw (3) from lower frame bracket (2).
2. Remove stabilizer link (1) from lower frame bracket.

Assembly

1. See Figure 2-94. Install stabilizer link (1) into lower frame bracket (2).
2. Install screw (3) through stabilizer link (1) to lower frame bracket (2)
3. Tighten stabilizer link screw to 25-35 ft-lbs (33.9-47.5 N-m).

Installation

1. See Figure 2-94. Install screws (4), washers (5) and lower frame bracket (2) to frame. Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

2. Install stabilizer link to engine case (1). Secure with screw (3). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

Figure 2-94. Lower Front Stabilizer Link Assembly

REAR STABILIZER LINK

FASTENER	TORQUE VALUE	
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m

Removal

1. **EVAP models:** Remove EVAP canister and mounting bracket. See Charcoal Canister (Page 4-42).

2. See Figure 2-95. Remove short screw (3), long screw (4), ground strap (2), stabilizer link (1) and spacer (5).

Installation

1. See Figure 2-95. Install short screw (3) through ground strap (2) and stabilizer link (1). Install screw into frame on right side of motorcycle. Leave fasteners loose.

2. Install long screw (4) through ground strap, stabilizer link and spacer (5) into engine case.

NOTE

Align ground strap so *it does not come into contact with EVAP canister mounting hardware.*

3. Tighten both screws to 25-35 ft-lbs (33.9-47.5 N-m).

4. **EVAP models:** Install EVAP canister and mounting bracket. See Charcoal Canister (Page 4-42).

Figure 2-95. Rear Stabilizer Link Assembly

FRONT ENGINE MOUNT AND ISOLATOR

REMOVAL

1. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).

PART NUMBER	TOOL NAME
HD-45968	FAT JACK

2. Loose rear axle and drive belt. See Drive Belt (Page 5-13).
3. **Forward mount controls:** Remove both forward control assemblies. See RIDER FOOT CONTROLS: FORWARD (Page 2-120).
4. Support front of engine with FAT JACK (PART NUMBER: HD-45968) and suitable blocks.
5. See Figure 2-93. Remove screw (4) securing upper front stabilizer link (2) to stabilizer link bracket (3).
6. See Figure 2-94. Remove screw (3) securing lower front stabilizer link (1) to stabilizer link bracket (2).
7. See Figure 2-95. Remove screw (4) from left end of rear stabilizer link (1) and ground strap (2). Remove spacer (5).

NOTE

See Figure 2-96. Jack engine up or down to remove bolt (3).

8. Remove nut (4) and bolt (3) from front engine mounUisolator assembly.
9. Remove screws (5) from front isolator mount (2) on left side of motorcycle. Remove isolator mount and left front isolator (1).
10. Without damaging wire harness caddy, raise front of engine.
11. Without damaging frame downtube, carefully pry front end of engine to left approximately 1.0 in (25.4 mm).
12. Remove right front isolator (1) from crankcase.

Figure 2-96. Front Engine Mount and Isolator

INSTALLATION

PART NUMBER	TOOL NAME
HD-45968	FAT JACK

FASTENER	TORQUE VALUE	
Engine mount, front, bolt	95-105 ft-lbs	129-142 N-m
Isolator, front, mounting bracket screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m

1. See Figure 2-96. Install both front isolators (1) in engine mounting boss on front of crankcase. Each isolator has a half-moon tab and fits into engine mounting boss in only one way. Push engine to right until right isolator contacts frame boss.
2. Install front isolator mount (2) over left front isolator.
3. Install screws (5) through front isolator mount and thread into frame. Tighten to 25-35 ft-lbs (33.9-47.5 N-m).
4. Insert bolt (3) through front isolator/engine mount assembly from left side. Thread nut (4) onto bolt. Tighten to 95-105 ft-lbs (129-142 N-m).
5. See Figure 2-94. Attach lower front stabilizer link (1) to bracket (2) with screw (3). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).
6. See Figure 2-93. Attach upper front stabilizer link (2) to bracket (3) with screw (4). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

7. See Figure 2-95. Install screw (4) through free end of ground strap (2), rear stabilizer link (1), spacer (5), and into engine crankcase. Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

8. Remove FAT JACK (PART NUMBER: HD-45968) and blocks from under engine.
9. **Forward mount controls:** Install both forward control assemblies. See RIDER FOOT CONTROLS: FORWARD (Page 2-120).

10. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

11. Adjust drive belt. See DRIVE BELT AND SPROCKETS (Page 1-32).

REMOVAL

PART NUMBER	TOOLNAME
HD-45968	FAT JACK

1. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).

NOTICE

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

2. Use FAT JACK (with aid of suitable blocks) to support engine.

   Special Tool: FAT JACK (HD-45968)

3. Remove sprocket cover.

   a. See Figure 2-97. Remove screw (6), washer (5) and exhaust pipe clamp bracket (4).

   b. Remove two screws (2, 3).

   c. Remove sprocket cover (1).

4. Remove rear drive belt. See Drive Belt (Page 5-13).

5. Remove rear brake master cylinder remote reservoir. Do not disconnect hose from reservoir. Secure reservoir to vehicle in an upright position, out of way. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).

6. Support rear fork.

7. See Figure 2-98. Remove retaining ring (9), nut (8) and rear fork pivot bolt (1).

8. Pull rear fork back far enough to clear rear engine mounts and isolators.

9. **EVAP models:** Remove EVAP canister and mounting bracket. See Charcoal Canister (Page 4-42).

10. See Figure 2-95. Remove screws (3, 4) securing rear stabilizer link (1). Remove stabilizer link, ground strap (2), and spacer (5).

11. See Figure 2-93. Remove screw (4) securing upper front stabilizer link (2) to stabilizer link bracket (3).

12. See Figure 2-94. Remove screw (3) securing lower front stabilizer link (1) to stabilizer link bracket (2).

13. Support rear of engine.

14. See Figure 2-98. Remove two screws (7) securing rear isolator mount (2) to left side of frame. Remove isolator mount and left isolator (3).

15. Remove three screws (6) securing rear pivot lockplate (5) to rear of engine case. Remove lockplate and rear fork pivot shaft (4).

NOTE

Move engine up or down slightly to remove pivot shaft.

16. Carefully pry rear end of engine to the left. 1

    in (25.4 mm)

17. Remove right rear isolator (3) from frame.

Figure 2-97. Sprocket Cover

1. Pivot bolt
2. Rear isolator mount
3. Isolator (2)
4. Rear fork pivot shaft
5. Rear pivot lockplate
6. Screw (3)
7. Screw (2)
8. Nut
9. Retaining ring

Figure 2-98. Rear Engine Mount/Isolator

INSTALLATION

1. See Figure 2-98. Install new right rear isolator (3) into frame,

PART NUMBER	TOOL NAME
HD45968	FAT JACK

FASTENER	TORQUE VALUE	
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m
Fork, rear, pivot bolt nut	120-130 ft-lbs	162.7-176.3N-
Isolator, front, mounting bracket screw	25-35 ft-lbs	33.9-47.5 N-m
Sprocket cover, forward and lower screw	80-120 in-lbs	9-13.6 N-m
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m

lining up tabs on isolator with slots in frame. Slide rear end of engine to right until engine mounting boss on rear of crankcase contacts right isolator.

2. Slide rear fork pivot shaft (4) through engine mounting boss.

NOTE

Move engine slightly in one direction or another to align pivot shaft with isolator.

3. Install rear pivot lockplate (5) over pivot shaft with ridges on lockplate engaging flats on pivot shaft flange. Secure to crankcase with three screws (6). Tighten.

   Torque: 80-120 in-lbs (9-13.6 N-m) *Sprocket cover, forward and lower screw*

4. Install new left rear isolator (3) on rear fork pivot shaft.

5. Place rear isolator mount (2) over left rear isolator, lining up tabs on isolator with slots in isolator mount. Install screws (7). Tighten..

   Torque: 25-35 ft-lbs (33.9-47.5 N-m) *Isolator, front, mounting bracket screw*

6. Remove FAT JACK and support blocks.

   Special Tool: FAT JACK (HD-45968)

7. See Figure 2-93. Attach upper front stabilizer link (2) to bracket (3) with screw (4). Tighten.

   Torque: 25-35 ft-lbs (33.9-47.5 N-m) *Stabilizerlink, upper front, frame bracket mounting screw*

8. See Figure 2-94. Attach lower front stabilizer link (1) to bracket (2) with screw (3). Tighten.

   Torque: 25-35 ft-lbs (33.9-47.5 N-m) *Stabilizer link, lower front, frame bracket mounting screw*

9. See Figure 2-95. Install ground strap (2) and rear stabilizer link (1) to right side frame using short screw (3). Install free end of ground strap, stabilizer link and spacer (5) into engine case using long screw (4). Tighten screws.

   Torque: 25-35 ft-lbs (33.9-47.5 N-m) *Stabilizer link screw*

10. EVAP models: Install EVAP canister and mounting bracket. See Charcoal Canister (Page 4-42).

11. See Figure 2-98. Install rear fork pivot bolt (1).

    a. Slide rear fork forward into position.

    b. Install pivot bolt.

    c. Install pivot bolt nut (8).

    d. Tighten to 120-130 ft-lbs (162.7-176.3 N-m).

    e. Install retaining ring (9).

12. Lower rear fork.

13. Install rear brake master cylinder remote reservoir. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).

14. Install rear drive belt. See Drive Belt (Page 5-13).

15. Install sprocket cover.

    a. See Figure 2-97. Install sprocket cover (1). Secure with two screws (2, 3). Long screw goes in top hole, short screw in bottom hole. Leave fasteners loose.

b. Install exhaust pipe clamp bracket (4), washer (5) and screw (6). Tighten to 30-33 ft-lbs (40.7-44.7 N-m). Now tighten screws (2, 3) to 80-120 **in-lbs** (9-13.6 N-m).

16. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A WARNING

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

2. Remove main fuse.
3. Remove seat.
4. **XL1200NS:** See Figure 2-99. Remove clip from around throttle cables and fork slider tube.
5. Remove fuel tank. See Removing Fuel Tank (Page 4-10).
6. See Figure 2-100. Remove left wire harness caddy fastener.
7. See Figure 2-101. Cut and discard cable straps (1,2).
8. Remove coil bracket (3) from frame. Remove throttle cables.
9. Shorten cable housings:
   a. See Figure 2-102. Slide rubber boots off cable adjusters.
   b. Loosen jamnuts (1) on each adjuster (2).
   c. Turn adjusters to shorten cable housings.
10. Remove upper and lower switch housing screws. Remove upper switch housing.
11. See Figure 2-103. Disconnect ferrules and cables from throttle control grip.
12. Remove friction spring.

NOTE
Place a drop of light oil on retaining rings.

13. With a rocking motion, pull crimped inserts and cables from lower housing.
14. Remove air cleaner assembly. See All Models (Page 4-8).
15. See Figure 2-104. Disconnect cables from throttle cam:
    a. Remove throttle cable from guide and cam.
    b. Remove idle cable and spring from guide and cam.

Figure 2-99. Throttle Cable Clip: XL1200NS

Figure 2-100. Caddy Fastener

Figure 2-101. Cable Straps around Throttle Cables

Figure 2-102. Throttle Cable Adjusters

Figure 2-103. Throttle Cable Ferrules

Figure 2-104. Induction Module Throttle Cam

THROTTLE ADJUSTING SCREW

Removal

1. See Figure 2-105. Thread throttle adjusting screw (1) all way out.
2. Remove friction shoe (2) from switch housing.
3. Remove retaining ring (4) from screw. Remove spring (3).

Installation

1. Thread adjusting screw and spring into switch housing.
2. Snap retaining ring into place.
3. Coat bottom of friction shoe with SPECIAL PURPOSE GREASE.
4. Thread adjusting screw into friction shoe.

Figure 2-105. Throttle Adjusting Screw

CLEANING. ANDJNSPECTION

A WARNING

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

- Clean parts in a non-volatile cleaning solution.
- Dry parts with low-pressure, compressed air.
- Replace cables if necessary.

INSTALLATION

1. Lightly coat graphite to handlebar and inside surfaces of

FASTENER	TORQUE VALUE	
Caddy fastener, front	15-25in-lbs	1.7-2.8Nm
Switch housing screw	35--45 in-lbs	4-5.1 Nm

switch housings.

NOTE

• Always replace retaining rings if damaged or distorted.

• *Place a drop of light oil on retaining rings of crimped inserts.*

2. See Figure 2-106. Attach cables to lower housing with retaining rings.

   a. Silver throttle control cable insert, Diameter: 0.25 in (6.3 mm) in front hole.

   b. Gold idle control cable insert, Diameter: 0.31 in (7.9 mm) in rear hole.

3. See Figure 2-107. Connect cables:

   a. Ferrule grip notches at top, slide throttle control grip (1) over end of right side handlebar until it bottoms against closed end. Pull grip back about Length:
      0. 13 in (3.2 mm) to prevent binding.

   b. Install friction shoe (2) in lower housing.

   c. Engage housing (3) into throttle control grip.

   d. Fit ferrules (4) over cable ball ends (5).

   e. Seat ferrules in opposite grip notches.

4. Install upper switch housing (6) over handlebar and lower housing:

   a. Install upper (7) and lower housing screws (8).

   b. Tighten.

      Torque: 35-45 **in-lbs** (4-5.1 N-m) *Switch housing screw*

5. Route the cables:

   a. Point cables forward from throttle control grip and front fork upper bracket.

   b. Turn downward between right slider tube and headlamp.

   c. **XL1200NS:** Install clip around throttle cables and slider tube.

   d. Route rearward along right side of frame steering head and frame backbone.

   e. Turn over ignition switch housing.

   f. Pass between coil bracket and frame.

   g. Route downward to induction module.

6. Install cables into throttle cam:

   a. Install throttle control cable housing into inboard (idle) cable guide and cam grip notch.

   b. Install idle control cable housing and spring into outboard (throttle) cable guide and cam grip notch.

7. Secure throttle cables into right side wire harness caddy:

   a. Secure instrument connector [20] with forward cable strap.

   b. Secure wiring harnesses inside caddy with rear cable strap.

A WARNING

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

NOTE

Do not pinch cables between frame and/or forks.

8. Secure left side harness caddy to right side wire harness caddy with screw. Tighten to .

   Torque: 15-25 **in-lbs** (1.7-2.8 N-m) *Caddy fastener, front*

9. Turn handlebar lock-to-lock. Verify that cables do not pull tight.

10. Adjust control cables. See Cable Adjustment (Page 1-36).

11. Install air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).

12. Install fuel tank. See Installing Fuel Tank (Page 4-11).

13. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

14. Install main fuse.

1. Idle cable insert (gold insert, rear hole)
2. Throttle cable insert (silver insert, front hole)

Figure 2-106. Throttle Cable Inserts

1. **Throttle control grip**
2. **Friction shoe**
3. **Lower switch housing**
4. **Ferrule (2)**
5. **Cable ball end**
6. **Upper switch housing**
7. **Upper housing screw**
8. **Lower housing screw**
9. **Retaining ring (2)**

Figure 2-107. Throttle Control

REMOVAL AND DISASSEMBLY

Clutch Cable: Lower

A WARNING

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

1. Remove main fuse.
2. **Mid-mount controls:** Remove left side rider footrest and mounting bracket assembly. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).
3. Remove clips securing clutch cable to frame downtube.
4. See Figure 2-108. Slide rubber boot (1) on clutch cable adjuster (2) upward. Loosen jamnut (3) from adjuster.
5. Turn adjuster to shorten cable housing until there is a large amount of free play at clutch hand lever. See CLUTCH (Page 1-23).
6. Remove screws (1) and clutch inspection cover (2).
7. Slide hex lockplate and attached spring (3) from flats of clutch adjusting screw assembly (8).
8. Turn clutch adjusting screw assembly clockwise to release ramp assembly (5) and coupling (6). Remove nut (4) from end of adjusting screw.
9. Remove hook of ramp from cable coupling. Remove clutch cable end (11) from slot in coupling. Remove coupling and ramp assembly.
10. Remove cable end fitting (12) and clutch cable (13) lower section from primary cover. Remove O-ring (10) from cable end fitting. Discard O-ring.
11. Clean parts in a non-volatile cleaning solution.

Figure 2-108. Clutch Cable Adjuster Mechanism

sm0l830

1.	**Screw (6)**	**10.**	**O-ring**
2.	**Clutch inspection cover**	**11.**	**Clutch cable end**
3.	**Hex lockplate and spring**	**12.**	**Cable end fitting**
4.	**Nut**	**13.**	**Clutch cable**
5.	**Ramp assembly (see items 14-17)**	**14.**	**Outer ramp**
6.	**Coupling**	**15.**	**Ball (3)**
7.	**Quad ring**	**16.**	**Inner ramp**
8.	**Clutch adjusting screw assembly**	**17.**	**Retaining ring**
9.	**Primary cover**		

Figure 2-109. Clutch Release Mechanism

Clutch Lever and Cable: Upper

1. See Figure 2-110. Remove retaining ring (8) and pivot pin (7). Discard retaining ring.
2. Remove lever (2) from clutch lever bracket.
3. Remove clutch cable pin (5). Disconnect clutch cable (6) upper section from lever.

NOTE

Remove bushing from top of lever.

4. Remove bushing (1) from clutch lever.
5. Remove screw (4) and anti-rattle spring (3).

1. Bushing
2. Lever
3. Anti-rattle spring
4. Screw
5. Clutch cable pin
6. Clutch cable
7. Pivot pin
8. Retaining ring

Figure 2-110. Clutch Lever and Cable

Clutch Hand Control

NOTE

XL 1200X: Leave turn signals and brackets installed.

1. All models except XL1200X: See Figure 2-111. Loosen set screw (9). Remove turn signal assembly from clutch lever bracket. See Front Turn Signal Wire Harness (Page 6-36).
2. Remove locknut (1), washer (2), and mirror (3).

NOTE

Loosen left handlebar switch housing screws to remove clutch control clamp and clutch lever bracket.

3. See Figure 2-111. Loosen fasteners (4) to remove clamp (7).
4. Remove bracket (8).

1. Locknut
2. Washer
3. Mirror
4. Fastener (2)
5. Washer (2)
6. Nylon retainer (2)
7. Clamp
8. Bracket
9. Set screw

Figure 2-111. Clutch Hand Control Clamp and Bracket: All Models except XL1200X

ASSEMBLY AND INSTALLATION

FASTENER	TORQUE VALUE	
Clutch cable fitting	36-108 in-lbs	4.1-12.2 Nm
Clutch inspection cover screws	84-108 in-lbs	9.5-12.2 N-m
Clutch lever anti-rattle spring screw	8-13 in-lbs	0.9-1.5 N-m
Footrest support bracket	45-50 ft-lbs	61-68 N-m
Handlebar control lever clamp screw	108-132 in-lbs	12.2-14.9 N-m
Mirror stem locknut	96-144 in-lbs	10.9-16.3 N-m
Switch housing screw	35-45 in-lbs	4-5,1 N-m
Turn signal, front, set screw	96-120 in-lbs	10.9-13.6 N-m

Clutch Hand Control

1. See . Position clamp (7) and bracket (8) on handlebar. Hold clamp and bracket assembly firmly against left handlebar switch housing.

2. Secure components to left handlebar using fasteners (4), washers (5) and retainers (6). Starting with top screw, tighten.

   Torque: 108-132 **in-lbs** (12.2-14.9 Nm) *Handlebar control lever clamp screw*

NOTE

- *Adjust mirrors so you can see a small portion of your shoulders in each mirror.*
- *Do not allow mirrors or turn signals to strike fuel tank on lock-to-lock handlebar turns.*

3. Install mirror, washer and locknut. Tighten.

   Torque: 96-144 **in-lbs** (10.9-16.3 N-m) *Mirror stem locknut*

4. Install turn signal.

   a. Secure with set screw. See Front Turn Signals (Page 6-35).

   b. Position so turn signal lens faces directly forward. Verify there is no contact or binding.

   c. Tighten.

      Torque: 96-120 **in-lbs** (10.9-13.6 N-m) *Turn signal, front, set screw*

5. If two screws of left handlebar switch housing were loosened during clutch hand control removal, tighten.

   Torque: 35-45 **in-lbs** (4-5.1 N-m) *Switch housing screw*

Clutch Lever and Clutch Cable: Upper

1. See Figure 2-110. Install anti-rattle spring (3) and screw (4) onto lever (2). Tighten.

   Torque: 8-13 **in-lbs** (0.9-1.5 N-m) *Clutch lever anti-rattle spring screw*

NOTE

Bushing (1) has a collar on one end. Install bushing from top of lever.

2. Install bushing in lever.

3. Connect upper end of clutch cable (6) to lever using clutch cable pin (5).

4. Install lever.

   a. Position lever within clutch lever bracket.

   b. Install pivot pin (7).

   c. Secure with **new** retaining ring (8).

Clutch Cable: Lower

1. See Figure 2-112. Route clutch cable (3):

   a. Forward from clutch lever (1).

   b. **XL1200NS, XL1200X:** Through clutch cable guide.

   c. Down to left front fork slider tube. Refer to Table 2-20.

   d. Through two clips (6) on left front frame downtube.

   e. Rearward to primary cover (4).

NOTE

Check that cable is not pinched between lower steering head bracket and frame and left and right fork stops.

2. **Non-ABS Models:** See Figure 2-113. Rotate the clutch cable clip back and up as far as it goes.

Table 2-20. Clutch Cable Lower Routing Around Left Fork Slider

MODEL	ROUTE	NOTES
XL883N	Outboard	-
XL1200NS	Inboard	Through the clutch cable guide
XL1200X	Inboard	Through the clutch cable guide

Figure 2-112. Clutch Cable

Figure 2-113. Non-ABS Clutch Cable Clip Orientation

3. See Figure 2-109. Install **new** O-ring (10) over clutch cable end fitting (12) of clutch cable (13) lower section.

4. Screw fitting into primary cover (9). Tighten.

   Torque: 36-108 **in-lbs** (4.1-12.2 N-m) *Clutch cable fitting*

5. Install coupling (6):

   a. Install coupling (6) over cable end (11) with rounded side inboard and ramp connector button outboard.

   b. With retaining ring side of ramp assembly (5) facing inward, place hook of ramp around coupling button.

   c. Rotate assembly counterclockwise until tang on inner ramp (16) fits in slot of primary cover.

6. Install nut (4) on clutch adjusting screw assembly (8) until slot of screw is accessible with a screwdriver. Fit nut hex into recess of outer ramp (14).

7. Turn adjusting screw counterclockwise until resistance is felt. Back off adjusting screw 1/4 turn.

NOTE

Slightly turn adjusting screw clockwise to slide /ockplate onto flats within recess of outer ramp.

8. Install hex lockplate and spring (3) onto flats of clutch adjusting screw assembly (8).

9. Install clutch inspection cover (2).

   a. Install **new** quad ring (7).

   b. Secure cover with screws (1).

   c. In a cross-wise pattern, tighten.

      Torque: 84-108 **in-lbs** (9.5-12.2 N-m) *Clutch inspection cover* screws

10. **Mid-mount controls:** Install left side rider footrest and mounting bracket assembly. Tighten. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

    Torque: 45-50 ft-lbs (61-68 N-m) *Footrest support bracket*

11. Adjust clutch lever free play. See Adjustment (Page 1-23)

12. Install main fuse.

REMOVAL

^WARNING

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

1. Remove main fuse.
2. Remove two screws securing clutch control assembly to left side of handlebar. See CLUTCH CONTROL (Page 2-91).
3. Remove two screws securing left handlebar switch assembly to handlebar. See LEFT HANDLEBAR CONTROL MODULE (Page 6-62). Let wires carefully support switch assembly.
4. Remove left handlebar grip. See Left Hand Grip (Page 2-99).
5. Remove front brake master cylinder assembly from right handlebar. See FRONT BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-23).
6. See Figure 2-114 or Figure 2-115. Remove wiring harness retainers (1). Do not cut into wiring harnesses. Discard retainers.
7. Loosen two control housing screws. Do not remove.
8. If removing lower handlebar clamps, loosen, but do not remove, two bolts (2) securing lower handlebar clamps (6) to upper fork bracket.
9. Remove screws (4) and instrument bracket (5).
10. Detach handlebar from lower handlebar clamps.
11. Slide right-hand control housing and throttle assembly off detached handlebar.
12. If removing lower handlebar clamps, remove bolts, washers (3) and lower handlebar clamps from upper fork bracket.

Figure 2-114. Handlebar:XL883N, XL1200NS (Typical)

Figure 2-115. Handlebar: XL1200X

INSTALLATION

FASTENER	TORQUE VALUE	
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m
Handlebar control lever clamp screw	108-132 in-lbs	12.2-14.9 N-m
Handlebar riser bolt, lower	30-40 ft-lbs	40.7-54.3 N-m
Switch housing screw	35-45 in-lbs	4-5.1 N-m

All Models

1. If lower handlebar clamps were removed, secure clamps to upper fork bracket with bolts and washers. Finger tighten bolts. Route wiring harnesses between lower handlebar clamps.

2. Slide right side handlebar control housing and throttle assembly onto right end of handlebar. Position handlebar on lower handlebar clamps.

3. Place upper handlebar clamp/instrument bracket in position. Install four screws.

4. Adjust handlebar to desired position on all models except.

NOTE

In applicable regions, handlebar may be rotated forward to an alternate position. It is the responsibility of the dealer to confirm that it is lawful in their region for the handlebar to be rotated to alternate position.

Loosen handlebar before adjustment to avoid cosmetic damage to paint.

XL 1200X: *Tighten front clamp screws first. Then tighten rear clamp screws.*

   a. See Figure 2-118. XL1200NS: adjust to 11° or end of grip to the ground is.

      Length/Dimension/Distance: 40.1 in (1,019 mm)

5. Tighten clamp screws:

   a. Rear clamp screws, first, to 12-18 ft-lbs (16.3-24.4 N-m).

   b. Front clamp screws, second, to 12-18 ft-lbs (16.3-24.4 N-m).

6. Tighten lower handlebar riser bolts.

   Torque: 30-40 ft-lbs (40.7-54.3 N-m) *Handlebar riser bolt, lower*

Figure 2-116. Alignment Marks

Figure 2-117. Handlebar Riser: All Models

Figure 2-118. Handlebar Mounting Angle

1. Install front brake master cylinder assembly. See FRONT BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-23).

2. Install a **new** left side grip. See Left Hand Grip (Page 2-99).

3. Position left side control and loosely install hand control clamp screws. See LEFT HANDLEBAR CONTROL MODULE (Page 6-62).

4. Attach clutch control assembly to left side of handlebar.

5. Tighten:

   a. Clutch lever handlebar clamp screw to 108-132 **in-lbs** (12.2-14.9 N-m). See CLUTCH CONTROL (Page 2-91).

   b. Left side control clamp screws to 35-45 **in-lbs** (4-5.1 N-m).

   c. Right side control clamp screws to 35-45 **in-lbs** (4-5.1 N-m).

6. Install **new** wiring harness retainers around handlebar wiring harnesses. Push retainers into holes in handlebar.

7. Install main fuse.

A WARNING

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

8. Verify following:

   a. Clutch cable adjustment/operation.

   b. Throttle cable operation.

   c. All electrical switch functions.

d. Brake operation and stop lamp function.

LEFT HAND GRIP

Removal

Slice hand grip open with a sharp knife. Peel hand grip open to remove.

Installation

1. Rough left grip end of handlebar with emery cloth.
2. Clean grip end with acetone.
3. Apply LOCTITE 770 PRISM PRIMER to inside of a **new** hand grip. Remove any excess primer with a clean cloth. Wait two minutes for the primer to set.
4. Apply LOCTITE 411 PRISM INSTANT ADHESIVE to inside of **new** hand grip.

NOTE

LOCTITE 411 PRISM INSTANT ADHESIVE sets in four minutes and cures in 24 hours.

5. Install **new** hand grip with a twisting motion.

REMOVAL

1. Remove screw to detach seat from rear fender.
2. Slide seat forward.
3. See Figure 2-119. Lift slightly to detach keyhole (2) bracket from seat post.
4. See Figure 2-120. Slide seat rearward to detach seat tongue (1) from rear fuel tank bracket.
5. Verify that tongue and mounting bracket (3) are tightly secured to the seat bottom.

Figure 2-119. Seat Post

Figure 2-120. Seat: Solo

INSTALLATION

NOTE

See Figure 2-121. If removed, tighten seat bracket screw to 40-60 ***in-lbs*** *(4.5-6.8 N-m).*

FASTENER	TORQUE VALUE	
Seat bracket screw	40-60 in-lbs	4.5-6.8 N m
Seat mounting screw	15-30in-lbs	1.7-3.4Nm

1. Position seat on frame with mounting bracket at rear.
2. Slide seat forward until the tongue fits snugly under rear fuel tank bracket.
3. Push seat forward to engage keyhole onto seat post. Pull seat back slightly.

NOTE

Solo seat bracket uses forward hole in rear fender.

4. See Figure 2-121. Install seat mounting screw to fasten seat mounting bracket to top of rear fender.
5. Pull up on seat to verify that it is locked in place.
6. Tighten seat mounting screw.

   Torque: 15-30 in-lbs (1.7-3.4 Nm) *Seat mounting screw*

7. Pull up on the seat to be sure it is secure.

1. **Solo seat**
2. **Seat mounting screw**
3. **Clip**
4. **Seat nut**
5. **Mounting bracket (XL1200X)**
6. **Mounting bracket (XL883N, XL1200NS)**
7. **Seat bracket screw**

Figure 2-121. Seat Assembly

REMOVAL AND INSTALLATION

FASTENER	TORQUE VALUE	
Headlamp visor screw	35-45 in-lbs	4-5.1 N-m

Removal

1. See Figure 2-122. Remove screws (11) and washers (10).
2. Remove headlamp visor (8).

Installation

1. Place headlamp visor (8) in position.
2. Install washers (10) and screws (11).
3. Align headlamp visor to headlight. Tighten screws.

   Torque: 35-45 in-lbs (4-5.1 N-m) *Headlamp visor screw*

DISASSEMBLE AND ASSEMBLE

FASTENER	TORQUE VALUE	
Headlamp visor bracket to headlamp bracket button screw	3.0-3.7 ft-lbs	4-5 N-m
Headlamp visor bracket to headlight bracket socket head screw	10-16 ft-lbs	14-22 N-m

Disassemble

1. See Figure 2-122. Remove screw (3), washer (4) and cable guide (5).
2. Remove screw (1) and washer (2).
3. Remove screws (13), washers (12), bracket (6) and spacers (9).
4. Lower headlamp mount assembly.
5. Remove seal (7).

Assemble

1. See Figure 2-122. Position headlamp assembly on headlamp visor bracket.
2. Install Washer (2) and screw (1) to headlamp assembly. Tighten.

   Torque: 3.0-3.7 ft-lbs (4-5 N-m) *Headlamp visor bracket to headlamp bracket button screw*
3. Place bracket (6) on upper clamp fork.
4. Install spacers (9), washers (12) and screws (13). Tighten.

   Torque: 10-16 ft-lbs (14-22 N-m) *Headlamp visor bracket to headlight bracket socket head screw*
5. Install seal (7).
6. Align headlamp. See HEADLAMP ALIGNMENT (Page 1-54)
7. Insta headl

1. Screw
2. Washer
3. Screw
4. Washer
5. Cable guide
6. Headlamp visor bracket
7. Gasket
8. Headlamp visor
9. Spacer (2)
10. Washer (3)
11. Screw (3)
12. Washer (2)
13. Screw (2)

Figure 2-122. Headlamp Visor

ALL MODELS

FASTENER	TORQUE VALUE	
Fender to fork brace, front: XL1200X	30--42 in-lbs	3.4--4.7 N-m
Fender to forks, front: All models except XL1200X	96-156 in-lbs	10.9-17.6 N-m
Fork brace to forks: XL1200X	18-22 ft-lbs	24.4-29.8 N-m

See Figure 2-123. Tighten in a crosswise pattern to specification. Refer to Table 2-21.

Figure 2-123. Front Fenders

Table 2-21. Front Fender Fastener Torque Values

MODEL	CALLOUT	FASTENER	TORQUE
All models except XL1200X	1	Fender to forks, front (fasteners with locknuts)	96-156 in-lbs (10.9-17.6 N-m)
XL1200X	2	Fender to fork brace, front: XL1200X (tighten in cross pattern)	30--42 in-lbs (3.4--4.7 N-m)
	3	Fork brace to forks, front: XL1200X	18-22 ft-lbs (24.4-29.8 N-m)

FRONT LICENSE PLATE: INDIA

XL883N, XL1200NS

1. See Figure 2-124. Install P-clamps (5) on fork tubes.
2. Install license plate to P-clamps. Install fasteners (3), washers (2) and nuts (4).
3. Tighten to torque specified in Table 1-11Table 1-17Table 2-10Table 2-19Table 3-4Table 4-3Table 6-4.

Figure 2-124. Front License Plate Mount: XL883N, XL1200NS

1. See Figure 2-125. Install P-clamps (5) on fork tubes.
2. Install license plate to P-clamps. Install fasteners (3), washers (2) and nuts (4).
3. Tighten to torque specified in Table 1-11Table 1-17Table 2-10Table 2-19Table 3-4Table 4-3Table 6-4.

Figure 2-125. Front License Plate Mount: XL1200X

REAR FENDER: TOP MOUNT LICENSE PLATE

FRONT LICENSE PLATE: INDIA

REMOVAL

1. Remove seat.

A 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 2-126. Disconnect rear lighting connectors.

   a. Right turn signal [18] (3)
   b. Tail lamp [40] (2)

   c. Left turn signal [19] (1)

4. Remove rear wheel to access fender hardware. See REAR WHEEL (Page 2-17).

5. Remove tail lamp assembly.

   a. Remove tail lamp lens and bulb. See REAR FENDER: TOP MOUNT LICENSE PLATE (Page 2-106).

   b. See Figure 2-127. Unplug left [19] (1) and right [18] (2) turn signal connectors from rear lighting circuit board.

   c. Pull turn signal wiring harnesses through holes in tail lamp base and rear fender.

   d. Disengage turn signal wiring harnesses from wire retention brackets.

6. See Figure 2-128. Remove rear turn signal stalk locknuts (1) from inside rear fender on both sides.

   a. See Figure 2-129. Support fender. Remove front strut cover fastener (4), washer (3) and locknut (1), and rear strut cover fastener (2), washer (3) and clip nut (5). Repeat on opposite side.

   b. Remove rear fender strut covers and attached turn signal assemblies.

   c. Remove bolt (11), seat post (7) and washer (8) to detach top of fender from frame cross member tab.

   d. Carefully remove rear fender and attached license plate bracket, tail lamp base and wire harness.

1. Left turn signal [19]
2. Tail lamp [40]
3. Right turn signal [18]

Figure 2-126. Rear Lighting Connectors

1. Left turn signal connector [19]
2. Right turn signal connector [18]
3. Rear lighting power connector [94]
4. Tail lamp connector [93]
5. Screw and washer

Figure 2-127. Tail Lamp Housing

1. Rear turn signal stalk nut (2)
2. Forward fender support screw and washer (2)
3. Rear fender support screw and washer (2)
4. Forward fender support nut (2)
5. Rear fender support nut plate (2)
6. Wire retention bracket
7. Rear lighting wiring harness and conduit

Figure 2-128. Rear Fender, Strut Cover and Turn Signal Lamp Assembly

1. Locknut (4)
2. Rear strut cover fastener (2)
3. Washer (4)
4. Front strut cover fastener (2)
5. Clip nut (2)
6. Inner fender brace
7. Seat post
8. Washer
9. Tee spacer
10. Grommet
11. Bolt

Figure 2-129. Rear Fender Assembly: Top Mount License Plate

INSTALLATION

FASTENER	TORQUE VALUE	
Fender, rear, mounting fastener	120-168 in-lbs	13.6-19 N-m
Seat post bolt	120-168 in-lbs	13.6-19 N-m
Turn signal stalk locknut	120-168in-lbs	13.6-19 N-m

1. Carefully install rear fender onto motorcycle.
2. See Figure 2-129. Temporarily install rear and front strut cover fasteners (2, 4) to hold fender in place.
3. Route rear lighting connectors between frame cross-member and top of oil tank.
   a. Right turn signal [18]
   b. Tail lamp [40]
   c. Left turn signal [19]
4. Connect housings.
5. Secure front of fender with bolt (11), washer (8) and seat post (7). Tighten finger-tight.
6. Remove fasteners (4, 2). Install fender strut cover with attached turn signal assembly to fender strut.
7. Push turn signal wiring harness through openings in strut and fender.
8. Install locknut (1) onto turn signal stalk from inside fender. Finger-tighten.
9. Secure fender to strut with fasteners (4), washer (3) and locknut (1) in forward mounting hole.
10. Install fastener (2), washer (3) and clip nut (5) in aft mounting hole. Finger-tighten.
11. In sequence, tighten all fender mounting hardware:
    a. Bolt and seat post to 120-168 in-lbs (13.6-19 N-m).
    b. Turn signal stalk locknuts to 120-168 in-lbs (13.6-19 N-m).
    c. Fender mounting fasteners to 120-168 in-lbs (13.6-19 N-m).
12. Install tail lamp assembly.
    a. Route turn signal wiring harnesses through wire retention brackets.
    b. Pull turn signal wiring harnesses through holes in rear fender and tail lamp base.
    c. See Figure 2-126. Connect tail lamp connector [94] (3) and left [19] and right [18] (1, 2) turn signal connectors.
    d. Install tail lamp lens and bulb. See Electrical (Page 6-1).
13. Install rear wheel. See Chassis (Page 2-1).
14. Install main fuse.
15. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

A WARNING

Be sure headlamp, tail and stop lamp and turn signals are operating properly before riding. Poor visibility of rider to other motorists can result in death or serious injury. (00478b)

16. Check operation of all lamps.

FENDER PREPARATION

Seat Nut

Replace C-clip and seat nut with a new seat nut kit.

Fender Extension

1. See Figure 2-130. Drill out rivets (1) securing rear fender extension (2) to fender with a 1/4 in drill bit.
2. Rivet fender extension to fender backed by a washer (3).

Wire Harness and Conduit

If necessary, replace the wire harness. See TAIL LAMP: MODELS WITH BOTTOM-MOUNT LICENSE PLATE (Page 6-29).

Figure 2-130. Fender Extension

TOP MOUNT LICENSE PLATE BRACKET

FASTENER	TORQUE VALUE	
License plate clamp nut: top mount bracket	20-25 in-lbs	2.3-2.8 N-m
License plate support bracket screws: top mount bracket	20-25 in-lbs	2.3-2.8 N-m

Removal

1. See Figure 2-131. Loosen nut (6). Remove license plate.
2. Remove nut, washer (5) and fastener (7) to remove clamp (3) and license plate bracket (2).
3. Holding support bracket (4), remove screws (8).

Installation

1. See Figure 2-131. Position support bracket (4) on fender and install outer screws (8).
2. Install middle screw through support bracket, fender and fender brace.
3. Install nuts (9).

   Torque: 20-25 in-lbs (2.3-2.8 N-m) *License plate support bracket screws: top mount bracket*
4. Install license plate bracket (2) and clamp (3) to support bracket with bolt (7), washer (5) and nut (6).

   Torque: 20-25 in-lbs (2.3-2.8 N-m) *License plate clamp nut: top mount bracket*

Figure 2-131. Top Mount License Plate Bracket

GENERAL

Some models have rear turn signal housings that serve as stop lamp, tail lamp and turn signals. These models have either a side-mount or center mount license plate bracket.

REMOVAL AND DISASSEMBLY

A WARNING

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

1. Remove seat.
2. Remove main fuse.
3. Remove rear wheel. See REAR WHEEL (Page 2-17).
4. See Figure 2-132. Separate lighting connector housings.
   a. Right turn signal connector (1) [18]
   b. License plate lamp connector (2) [40]
   c. Left turn signal connector (3) [19]
5. Remove socket terminals from left and right turn signal connectors [18B], [19B]. Remove socket terminals from license plate lamp connector [40].

Figure 2-132. Rear Lighting Harness Connectors: Models With Integrated Turn Signal, Tail and Stop Lamps

6. See Figure 2-133. Carefully pull both rear lighting harnesses (2, 3) and license plate lamp harness (6) through feed-through holes (4, 5) in rear fender.
7. Remove both rear lighting harnesses and license plate lamp harness from fender harness clips (1).
8. See Figure 2-134. Remove left rear lighting harness (5) from harness clips (2) on lower side of bracket on left side of fender. Repeat steps for the opposite side.
9. See Figure 2-135. Remove rear turn signal stalk nuts (6) from inside rear fender on both sides. Remove turn signals.
10. Remove fender hardware.
    a. See Figure 2-135. Remove forward fender support screw with washer (2) and nut (4) and aft fender support screw with washer (3) and nut plate (5). Repeat steps for the opposite side.
    b. Remove screw with washer (9) and rear fender brace (7).
    c. Remove screw with washer (1) and rear fender brace (6).
11. **Center-mount models:** Remove license plate lamp module harness from upper harness clips on bracket inside fender (left side).
12. See Figure 2-135. Remove rear fender strut covers (1) and attached turn signal assemblies from rear fender struts. Carefully pull turn signal wiring harnesses through holes in rear fender and strut.

Figure 2-133. Wire Harness Routing and Harness Brackets

Figure 2-134. License Plate Lamp Module (side-mount, typical)

1. **Rear fender strut cover**
2. **Forward fender support screw with washer (2)**
3. **Aft fender support screw with washer (2)**
4. **Forward fender support nut (2)**
5. **Aft fender support nut plate (2)**
6. **Rear turn signal stalk nut (2)**
7. **Rear fender brace**
8. **Fender seat nut kit (2)**
9. **Screw with washer**

Figure 2-135. Rear Fender, Strut Cover and Turn Signal Lamp Assembly (side-mount license plate)

13. Place a clean shop towel between each fender strut and fender to protect paint.

14. Have an assistant hold rear fender in place. See Figure 2-136. Remove seat post (1), washer (2) and screw (5). Remove rear fender. Do not damage paint. Lay rear fender on a soft, clean surface.

15. **Side-mount models:** Remove convertible side mount license plate bracket from rear fender.

    a. See Figure 2-134. Remove license plate lamp module harness from upper harness clips (1) and harness channel (3) in license plate bracket. Remove two screws (6) and license plate lamp module (7).

    b. See Figure 2-137. Carefully drill out two pop rivets (3) securing license plate bracket assembly (2) to left side of fender.

16. If replacing rear fender:

    a. Remove fender seat nut kit.

    b. Carefully drill out pop rivets securing rear fender extension to old fender with a 1/4 drill bit.

    c. Set nut kit and fender extension aside.

Figure 2-136. Seat Post and Rear Fender Mount Hardware

1. Rear fender
2. License plate bracket assembly
3. Pop rivet (2)

Figure 2-137. License Plate Bracket Assembly (side-mount, typical)

ASSEMBLY AND INSTALLATION

FASTENER	TORQUE VALUE	
Fender brace, rear, screw	20-25 in-lbs	2.3-2.8 N-m
Fender, rear, mounting fastener	120-168 in-lbs	13.6-19 N-m
Seat post bolt	120--168 in-lbs	13.6-19 N-m
Turn signal stalk locknut	120-168 in-lbs	13.6-19 N-m

1. Prepare the fender:
   a. Install fender seat nut kit.
   b. Rivet rear fender extension to fender.

2. Side-mount: Install convertible side mount license plate bracket on fender.
   a. See Figure 2-137. Position license plate bracket assembly (2) against inside of rear fender (1). Line up holes in bracket with holes in fender. Secure bracket to fender with two new pop rivets (3).
   b. See Figure 2-134. Install license plate lamp module (7) on to license plate bracket. Secure with two screws (6). Feed license plate lamp harness (4) up through harness channel (3). Insert harness into upper license plate bracket harness clips (1).

3. Place clean shop towels over fender struts. With aid of an assistant, carefully install rear fender onto vehicle.
4. See Figure 2-136. With assistant holding rear fender in place, install screw (5) through fender and frame tab. Install washer (2) on screw. Thread seat post (1) onto screw. Finger-tighten seat post.
5. Remove shop towels from fender struts.
6. Install turn signal lamp assemblies. Carefully feed each turn signal harness through appropriate hole in fender strut and fender as you install each strut cover.
7. Install fender hardware. See Figure 2-135. Thread nut (6) onto each rear turn signal stalk finger-tight. Install two forward fender support screws and washers (2). Thread nut (4) onto each screw finger-tight.
8. Center-mount: Hook tab of license plate bracket into slot in rear fender brace.
9. Place rear fender brace in position under fender and secure with screw and washer finger-tight.
   a. Center-mount: Thread each mounting screw through rear fender brace, into threaded inserts in license plate bracket. Install finger-tight. Make sure threaded inserts in license plate bracket fit into holes in rear fender brace. Install two aft fender support screws with washers (3).
   b. Side-mount: See Figure 2-138. Install nut plate (2) on each mounting screw (5) finger-tight. Install two aft fender support screws with washers (3).

NOTE

Side-mount: see *Figure 2-138. Make* sure *that tab (3) on each nut plate (2) fits into slot (4) in fender brace (1).*

10. Tighten all fender mounting hardware in the following order:
    a. See Figure 2-136. Tighten screw (5) and seat post (1) to 120-168 in-lbs (13.6-19 N-m).
    b. Tighten rear fender brace screw (9) to 20-25 in-lbs (2.3-2.8 N-m).
    c. See Figure 2-135. Tighten left and right turn signal stalk nuts (6) to 120-168 in-lbs (13.6-19 N-m).
    d. Tighten forward and aft fender support screws (2, 3) on both sides of fender to 120-168 in-lbs (13.6-19 N-m).
11. See Figure 2-133. Install left rear lighting harness (3) and license plate lamp harness (6) into fender harness clip (1) on left side of fender. Install right rear lighting harness (2) into fender harness clip on right side of fender.
12. Carefully feed both rear lighting harnesses and license plate lamp harness through feed-through holes (4, 5) in rear fender.
13. Install socket terminals to left and right turn signal connectors [18B], [19B]. Install socket terminals to license plate lamp connector [40].
14. Plug in license plate lamp connector [40].

15. Plug in left rear lighting harness connector [18].

16. Plug in right rear lighting harness connector [19].

17. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

18. Install rear wheel. See REAR WHEEL (Page 2-17).

19. Install main fuse.

A WARNING

Be sure headlamp, tail and stop lamp and turn signals are operating properly before riding. Poor visibility of rider to other motorists can result in death or serious injury. (00478b)

20. Check operation of all lamps.

Figure 2-138. Rear Fender Nut Plate: Models With Integrated Turn Signal, Tail and Stop Lamps

SAREE GUARD

FASTENER	TORQUE VALUE	
Strut cover fastener, front	120-168 in-lbs	13.6-19 N-m
Strut cover fastener, rear	120-168 in-lbs	13.6-19 N-m
Turn signal stalk locknut	96-156 in-lbs	10.9-17.6 N-m

Right and Left-Rear

1. Remove rear strut cover.

2. See Figure 2-139. Remove saree guard (1).

3. Install saree guard.

   a. Fit saree guard to fender strut.
   b. Thread turn signal connector and wire harness through notch in saree guard and hole in fender.

   c. Install strut cover.

   d. Verify installation of rear fastener clip nut (6).

   e. Install front and rear strut cover fasteners (2) and washers (3).

   f. Install front fastener locknut (4) and turn signal stalk locknut (5).

4. Tighten fasteners:

   a. Front strut cover fastener to 120-168 in-lbs (13.6-19 N-m).

   b. Turn signal stalk locknut to 96-156 in-lbs (10.9-17.6 N-m).

   c. Rear strut cover fastener to 120-168 in-lbs (13.6-19 N-m).

5. Complete strut cover installation. See Assembly and Installation (Page 2-112).

Figure 2-139. Right and Left-Rear Saree Guard

Left-Front

1. Remove left upper rear shock absorber fastener and washer. See Removal (Page 2-79).

2. See Figure 2-140. Remove screw (2), two washers (3) and flange nut (4) to remove saree guard (1).

NOTE

Apply 2-3 drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to shock absorber fastener.

3. Install saree guard.

   a. Fit saree guard to footrest bracket and shock mount.

   b. Install screw, washers and flange nut.

   c. Install shock absorber fastener and washer.

1. Left-front saree guard
2. Screw
3. Washer
4. Flange nut

Figure 2-140. Left-Front Saree Guard

REAR LICENSE PLATE: INDIA

FASTENER	TORQUE VALUE
License plate screw (India)	35-45 in-lbs 1 4-5.1 N-m

1. See Figure 2-141. Assemble screws (1), washers (2), license plate and nuts (3) to the license plate bracket.

2. Tighten.

   Torque: 35-45 in-lbs (4-5.1 N-m) *License plate screw (India)*

Figure 2-141. License Plate Bracket

RIGHT FOOTREST AND REAR BRAKE PEDAL ASSEMBLY

FASTENER	TORQUE VALUE	
Brake pedal clevis screw	13-17 ft-lbs	17.6-23 N-m
Brake rod ball stud	120-180in-lbs	13.6-20.4 N-m
Footrest support bracket	45-50 ft-lbs	61-68 N-m
Footrest wear peg	72-108 **in-lbs**	8.1-12.2 N-m

Removal

1. Remove mufflers. See EXHAUST SYSTEM (Page 4-38).

2. See Figure 2-142. Remove brake rod (7).
   a. Remove retaining ring (1) and clevis pin (2) from master cylinder pushrod collar.
   b. Remove brake rod (7) from brake pedal (8).

3. Remove footrest.
   a. Remove retaining ring (3), clevis pin (4). Discard retaining ring.
   b. Remove retaining ring (9), screw (10) and clevis (11). Discard retaining ring.
   c. Remove footrest (5) and spring washer (6).

4. Remove two fasteners (12) and right rider footrest/brake pedal support bracket (13) from frame.

Installation

1. Mount support bracket with two fasteners. Tighten to 45-50 ft-lbs (61-68 N-m).

2. Install brake pedal.
   a. Slide brake pedal onto clevis.
   b. Fit clevis to support bracket.
   c. Line up hole in clevis with hole in support bracket. Secure with screw.
   d. Tighten to 13-17 ft-lbs (17.6-23 N-m).
   e. Install retaining ring.

NOTE

Position spring washer inside clevis with square edge toward the inside.

3. Install footrest.
   a. Install footrest and spring washer on clevis.
   b. Align holes.
   c. Push clevis pin from top down through hole in clevis.
   d. Install retaining ring.

4. If removed, install wear peg. Tighten to 72-108 **in-lbs** (8.1-12.2 N-m).

5. Install brake rod.
   a. Insert brake rod into master cylinder collar. Secure with clevis and retaining ring.
   b. Apply two drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the ball stud.
   c. Thread ball stud into brake pedal. Tighten to 120-180 **in-lbs** (13.6-20.4 N-m).

6. Install mufflers. See EXHAUST SYSTEM (Page 4-38).

1. Retaining ring
2. Clevis pin
3. Retaining ring
4. Clevis pin
5. Footrest
6. Spring washer
7. Brake rod
8. Brake pedal
9. Retaining ring
10. Screw
11. Clevis
12. Screw (2)
13. Bracket
14. Wear peg

Figure 2-142. Brake Side Mid-Mount Controls

LEFT FOOTREST AND SHIFT LEVER

FASTENER	TORQUE VALUE	
Footrest support bracket	45-50 ft-lbs	61-68 N-m
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m
Gear shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m
Shifter peg screw	96-144 in-lbs	10.9-16.3 N-m

Removal

1. See Figure 2-143. Remove retaining ring (1), clevis pin (2), footrest (3) and spring washer (4). Discard retaining ring.
2. Remove two screws (5) and left rider footrest support bracket (6) from frame.
3. Remove screw (7) and shifter peg (8).
4. Remove pinch screw (9) and washer (10). Remove shift lever (12) and rubber washer (11).

Installation

1. Install rubber washer and shift lever on transmission shift lever shaft. Secure with washer and pinch screw. Tighten to 16-20 ft-lbs(21.7-27.1 N-m).

NOTE

*A **new** shifter peg screw comes with a lock patch.*

2. Install shifter peg.

ASSEMBLY

a. Clean screw threads of shifter peg screw. Apply one or two drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue).

b. Install shifter peg and screw.

c. Tighten to 96-144 in-lbs (10.9-16.3 N-m).

3. Attach rider footrest support bracket to frame with two screws. Tighten to 45-50 ft-lbs (61-68 N-m).

NOTE

Position spring washer inside support bracket mounting boss with square edge toward inside.

4. Install footrest.

a. Install footrest with spring washer on footrest support bracket.

b. Align holes.

c. Push clevis pin from top down through hole in support bracket.

d. Install new retaining ring.

5. If removed, install wear peg. Tighten to 72-108 in-lbs (8.1-12.2 N-m).

1. Retaining ring
2. Clevis pin
3. Footrest
4. Spring washer
5. Fastener
6. Support bracket
7. Screw
8. Shifter peg
9. Pinch screw
10. Washer
11. Rubber washer
12. Shift lever
13. Wear peg

Figure 2-143. Left Footrest and Shift Lever

RIGHT FOOTREST AND REAR BRAKE PEDAL ASSEMBLY

FASTENER	TORQUE VALUE	
Brake pedal clevis screw	13-17 ft-lbs	17.6-23 N-m
Brake rod ball stud	120-180 in-lbs	13.6-20.4 N-m
Footrest support bracket	45-50 ft-lbs	61-68 N-m
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m

Removal

1. See Figure 2-144. Remove brake rod (7).

a. Remove retaining ring (1) and clevis pin (2) from master cylinder collar.

b. Remove brake rod ball stud from brake pedal (8).

2. Remove footrest.

a. Remove retaining ring (3) and clevis pin (4).

b. Remove footrest (5) and spring washer (6). Discard retaining ring.

3. Remove brake pedal.

a. Remove retaining ring (9). Discard retaining ring.

b. Remove screw (10) and clevis (11).

c. Slide brake pedal off clevis.

4. Remove footrest/brake pedal support bracket.

a. **Non-ABS models:** Remove two screws (12), footrest/brake pedal support bracket (13) and J-clip (14).

b. **ABS models:** Remove two screws (12), footrest/brake pedal support bracket (13) and ABS brake line bracket.

Installation

1. See Figure 2-144. Install footrest/brake pedal support bracket.

a. **Non-ABS models:** Position J-clip against frame.

b. **ABS models:** Position ABS brake line bracket against frame

c. Mount footrest/brake pedal support bracket and J-clip/ABS brake line bracket to frame with screws.

d. Tighten to 45-50 ft-lbs (61-68 N-m).

2. Install brake pedal.

a. Slide brake pedal onto clevis.

b. Mount clevis on footrest/brake pedal support bracket.

c. Align hole in clevis with hole in support bracket. Secure with screw (10).

d. Tighten to 13-17 ft-lbs (17.6-23 N-m).

e. Install **new** retaining ring on end of clevis.

3. Install footrest.

a. Install footrest and spring washer on clevis.

b. Align holes.

c. Push clevis pin from top down through hole in clevis.

d. Install **new** retaining ring.

4. If removed, install wear peg. Tighten to 72-108 **in-lbs** (8.1-12.2 N-m).

5. Install brake rod.

a. Insert brake rod into master cylinder collar. Secure with clevis and retaining ring.

b. Apply two drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to ball stud.

c. Thread ball stud into brake pedal. Tighten to 120-180 **in-lbs** (13.6-20.4 N-m).

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1. Retaining ring
2. Clevis pin
3. Retaining ring
4. Clevis pin
5. Footrest
6. Spring washer
7. Brake rod
8. Brake pedal
9. Retaining ring
10. Screw
11. Clevis
12. Screw (2)
13. Footrest/brake pedal support bracket
14. J-clip
15. Wear peg

Figure 2-144. Brake Side Forward Controls

LEFT FOOTREST AND SHIFT LEVER ASSEMBLY

FASTENER	TORQUE VALUE	
Footrest support bracket	45-50 ft-lbs	61-68 N-m
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m
Shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m
Shift pedal clevis screw	13-17 ft-lbs	17.6-23 N-m
Shifter peg screw	96-144 in-lbs	10.9-16.3 N-m
Shifter rod to shift lever screw	120-180 in-lbs	13.6-20.4 N-m

Removal

1. See Figure 2-145. Remove retaining ring (1), clevis pin (2), footrest (3) and spring washer (4). Discard retaining ring.
2. Remove screw (5) and shifter peg (6).
3. Remove shifter rod screws (7) and shifter rod (8) from shifter lever assembly (9) and shift lever (10).
4. Remove retaining ring (11), screw (12) and clevis (13). Slide shifter lever assembly off clevis. Discard retaining ring.
5. Remove two screws (14), footrest/shifter lever support bracket (15) and J-clip (16) from frame.
6. Remove pinch screw (17), washer (18), shift lever (10) and rubber washer (19) from transmission shift shaft.

Installation

1. See Figure 2-145. Install rubber washer (19) and shift lever (10) onto transmission shifter shaft, with shift lever arm pointing straight down. Secure with pinch screw (17) and washer (18). Tighten pinch screw to 16-20 ft-lbs (21.7-27.1 N-m).
2. Mount J-clip (16) and footrest/shift lever support bracket (15) to frame with two screws (14). Tighten to 45-50 ft-lbs (61-68 N-m).
3. Install shift lever clevis:
   a. Slide shifter lever assembly (9) onto clevis (13).
   b. Mount clevis on footrest/shifter lever support bracket.

c. **Line up hole in clevis with hole in support bracket.**

d. Secure with screw (12). Tighten to 13-17 ft-lbs (17.6-23 N-m).

e. Install retaining ring (11) on end of clevis.

4. Mount footrest (3) on clevis with spring washer (4):

a. Position spring washer inside clevis with square edge toward inside.

b. Align holes.

c. Push clevis pin (2) from top down through hole in clevis.

d. Secure with new retaining ring (1).

5. If removed, install wear peg. Tighten to 72-108 in-lbs (8.1-12.2 N-m).

6. Thread screw (7) in one end of shifter rod (8) into shift lever (10). Tighten to 120-180 in-lbs (13.6-20.4 N-m).

7. Thread screw (7) in other end of shifter rod into shift lever assembly (9). Tighten to 120-180 in-lbs (13.6-20.4 N-m).

NOTE

A new shifter peg screw has lock patch.

8. If reusing shifter peg screw, clean screw threads. Apply one or two drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to threads.

9. Install shifter peg (6). Secure with screw (5). Tighten to 96-144 in-lbs (10.9-16.3 N-m).

1. Retaining ring
2. Clevis pin
3. F ootrest
4. Spring washer
5. Screw
6. Shifter peg
7. Screw (2)
8. Shifter rod assembly
9. Shifter lever assembly
10. Shift lever
11. Retaining ring
12. Screw
13. Clevis
14. Screw (2)
15. F ootrest/shifteliever support bracket
16. J-clip
17. Pinch screw
18. Washer
19. Rubber washer
20. Wear peg

Side F orwarControls

F igur2-145. Shifter

ADJUSTING SHIFT PEDAL

F ASENER	TORQUE VALUE	
Shift rod jamnuts	84-132 in-lbs	9.5-14.9 N-m

F 8TENER	TORQUE VALUE	
Shift rod screw	96-144 in-lbs	10.9-16.3 N-m

1. See Figure 2-146. Loosen locknuts (1) on shift rod (2).

2. Remove ball joint screw (3).

NOTE

Adjust for an equal number of threads (4) visible on both ends of shift red.

3. Turn ball joint or shift rod to adjust rod length.

4. Temporarily attach ball joint to shift lever.

5. Measure shift lever angle (5). Remove and adjust as necessary until angle is 45 degrees.

6. Tighten to 120-180 **in-lbs** (13.6-20.4 N-m).

7. Hold shifter rod. Tighten locknuts to 84-132 **in-lbs** (9.5-14.9 N-m).

Figure 2-146. Shifter Linkage: Models with Forward Controls

1. **Locknut**
2. **Shift rod**
3. **Ball joint screw**
4. **Threads**
5. **45 degrees**

REMOVAL

A 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)

1. Position motorcycle upright on a suitable lift.

NOTE
Remove stop to release spring tension.

2. See Figure 2-147. Remove stop (1).

3. Retract leg (2).

4. Remove pretzel clip (3). Discard pretzel clip.

A WARNING

Wear safety glasses or goggles when removing or installing spring. Spring tension can cause spring, attached components and/or hand tools to fly out which could result in death or serious injury. (00477c)

5. Hold leg in retracted position. Withdraw clevis pin (4) until it disengages from upper pivot hole of yoke.

6. Use pliers to detach spring (5) from the frame-mounted anchor pin. Unhook end of spring from leg.

7. Remove clevis pin from lower pivot hole of yoke.

8. Remove upper and lower bushings (6).

9. Remove bumper (7) if required.

10. Remove JSS if equipped. See JIFFY STAND SENSOR (JSS): INTERNATIONAL MODELS (Page 6-70).

Figure 2-147. Jiffy Stand

CLEANING AND LUBRICATION

1. Clean the jiffy stand components, the frame-mounted yoke and the anchor pin.

2. See Figure 2-148. Apply ANTI-SEIZE LUBRICANT to the leg pivot holes in the yoke (1), the groove of the anchor pin (2) and the OD of the clevis pin.

3. Coat the ramp (3) of the yoke with ANTI-SEIZE LUBRICANT.

Figure 2-148. Lubrication Points

INSTALLATION

A WARNING

Wear safety glasses or goggles when removing or installing spring. Spring tension can cause spring, attached components and/or hand tools to fly out which could result in death or serious injury. (00477c)

1. If necessary, install the JSS. See JIFFY STAND SENSOR (JSS): INTERNATIONAL MODELS (Page 6-70).

2. Press in a **new** rubber bumper.

NOTE

Face open ends of spring hooks toward centerline of vehicle.

3. See Figure 2-149. Install spring.

   a. Hook spring into spring mounting hole (2) on leg.

   b. Hook spring over frame-mounted anchor pin (1).

4. Install bushing onto clevis pin with shoulder of bushing facing head of clevis pin.

5. Hold leg in its retracted position. Insert clevis pin halfway up through yoke and pivot hole of leg.

NOTE

Verify that shank of lower bushing fits inside lower pivot hole in yoke.

6. Push clevis pin through slotted upper hole in yoke.

7. Install upper bushing with shoulder facing up against upper surface of yoke.

8. Insert **new** pretzel clip through hole in end of clevis pin.

NOTE

See Figure 2-150. Snap the loop of the pretzel clip over the end of the clevis pin.

9. Press the stop onto the motorcycle frame.

NOTE

When retracted, the leg is seated against the stop.

10. Extend and retract jiffy stand leg several times to check operation.

A WARNING

Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)

A WARNING

Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted, it can contact the road surface causing a loss of vehicle control, which could result in death or serious injury. (00007a)

11. Rest motorcycle on jiffy stand.

Anchor pin
Leg spring mounting hole

Figure 2-149. Jiffy Stand (typical)

Figure 2-150. Pretzel Clip

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A 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 fuel tank. See FUEL TANK (Page 4-10).

4. Turn front forks full left lock.

NOTE

Carefully orient drill bit to center of lock pin.

5. See Figure 2-151. Using a 5/64 drill bit, carefully drill a hole in center of lock pin.

6. See Figure 2-152. Remove lock pin.

   a. Insert a screw extractor into drilled hole.

   b. Hold body of screw extractor with a pliers or tap handle.

   c. With a small hammer, gently "tap" on pliers or tap handle.

7. Remove lock assembly.

Figure 2-151. Drilling Lock Pin

Figure 2-152. Removing Lock Pin

INSTALLATION

1. Insert **new** lock assembly in frame lock housing.
2. Align lock pin hole in **new** lock assembly with hole in frame lock housing.
3. Drive **new** lock pin in position (flush with frame lock housing).
4. Install fuel tank. See FUEL TANK (Page 4-10).
5. Verify proper operation of fork lock.
   a. Turn front forks fully to left.
   b. Insert key into fork lock. Turn key 90 degrees clockwise.
   c. Verify that front forks are locked and cannot be turned.
   d. Turn key 90 degrees counterclockwise. Remove from fork lock.
   e. Verify that front forks are now free to turn right and left.

PART NUMBER	CONSUMABLE
	3M GENERAL PURPOSE ADHESIVE REMOVER

1. Mark location of emblem with masking tape.

REMOVAL

2. Remove emblem using fishing line or waxed dental floss.

NOTE

Wear protective gloves.

3. Remove remaining foam backing tape and adhesive from mounting surface.

   Consumable: 3M GENERAL PURPOSE ADHESIVE REMOVER()

NOTE

- *Do not clean with denatured alcohol, mineral spirits or other solvents. Damage to components may occur.*
- *For maximum bond, surface must be clean and dry.*

4. Clean with a mixture of 50 percent isopropyl alcohol and 50 percent distilled water.

INSTALLATION

NOTE

- *Apply in ambient temperatures between 70-100 °F (21-38 °C).*
- *Parts cannot be repositioned after initial installation. Do not remove protective film from adhesive until ready to apply*
- *Do not bend emblem to fit contour of mounting surface.*
- *Allow at least 24 hours after application before exposing the area to vigorous washing, strong water spray or extreme weather.*
- *The adhesive bond will increase to maximum strength after about 72 hours at normal room temperature.*

1. Test fit medallion.
   a. Check medallion against curve of mounting surface.
   b. Match left and right sides of fuel tank or top cover, as applicable.
2. Remove protective film from back of medallion.

NOTE

- *Protect adhesive from grease, oil, dust, dirt and fingerprints.*
- *Once applied, do not shift medallion.*

3. Apply even pressure across entire surface. Hold in place for 15 seconds.
4. Wait 20 minutes before touching medallion.

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

FASTENER	TORQUE VALUE		NOTES
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Brake line fastener	120-180 in-lbs	13.6-20.3 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Breather screw	35-55 in-lbs	4-6.2 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Crankcase fastener	15-19 ft-lbs	20.3-25.8 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Cylinder screws, 1st torque	96-120 in-lbs	11-14 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, CYLINDER HEAD See procedure
Cylinder screws, 1st torque	96-120 in-lbs	11-14 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, CYLINDER HEAD See procedure
Cylinder screws, final torque	13-15 ft-lbs	18-20 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, CYLINDER HEAD Plus 90 degrees. See procedure
Cylinder screws, final torque	13-15 ft-lbs	18-20 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, CYLINDER HEAD Plus 90 degrees. See procedure
Cylinder stud	120-240 in-lbs	13.6-27.1 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Engine mount, front, bolt	95-105 ft-lbs	129-142 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Assembling Motorcycle After Top End Repair
Gearcase cover fasteners	120-140 in-lbs	13.6-15.8 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Cam Gears and Gearcase Cover
Isolator mount, front, screw	25-35 ft-lbs	33.9-47.5 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Isolator mount, rear, screw	25-35 ft-lbs	33.9-47.5 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Oil filter adapter	18-22 ft-lbs	24.4-29.8 N-m	3.19 OIL FILTER MOUNT, Assembly
Oil pressure switch	60-90 in-lbs	6.8-10.2 N-m	3.4 Oil Pressure, Checking Oil Pressure
Oil pump cover screws	70-80 in-lbs	7.9-9 N-m	3.18 Oil Pump, Assembly
Oil pump feed fitting	100-120 in-lbs	11.3-13.6 N-m	3.18 Oil Pump, Installation
Oil pump high-pressure feed hose fitting nut	85-105 in-lbs	9.6-11.8 N-m	3.18 Oil Pump, Installation
Oil pump high-pressure feed hose to crankcase fitting	60-90 in-lbs	6.8-10.2 N-m	3.18 Oil Pump, Installation
Oil pump to crankcase screw	125-150 in-lbs	14.1-16.9 N-m	3.18 Oil Pump, Installation
Oil tank bracket fastener	72-96 in-lbs	8.1-10.8 N-m	3.22 OIL TANK, Oil Tank Bracket
Oil tank mounting screws	72-96 in-lbs	8.1-10.8 N-m	3.22 OIL TANK, Installation
Pinion shaft locking nut	19-21 ft-lbs	26-29 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Cam Gears and Gearcase Cover plus 15-19 degrees of rotation

FASTENER	TORQUE VALUE		NOTES
Piston oil jet screw	25-35 in-lbs	2.8-3.9 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Rocker cover, inner, large bolt	18-22 ft-lbs	24.4-29.8 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Rocker cover, inner, screw	135-155 in-lbs	15.3-17.5 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Rocker cover, inner, small bolt	135-155 in-lbs	15.3-17.5 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Rocker cover, outer, screw	120-168 in-lbs	13.6-19 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Assembling Motorcycle After Top End Repair
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Assembling Motorcycle After Top End Repair
Tappet cover, anti-rotation mounting screw	100-120 in-lbs	11.3-13.6 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Tappets
Tappet cover fastener	90-120 in-lbs	10.2-13.6 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Tappet Covers, Pushrod Covers and Pushrods
Wire harness ground wire	55-75 in-lbs	6.2-8.5 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure

SPECIFICATIONS: SPORTSTER MODELS

Table 3-1. Engine

ITEM	XL883 MODELS		XL1200 MODELS	
Number of cylinders	2			
Type	4-cycle, 45 degree, V-twin, air cooled			
Compression ratio	9:1		10:1	
Bore	3.000 in	76.2 mm	3.500 in	88.9 mm
Stroke	3.811 in	96.8 mm	3.811 in	96.8 mm
Displacement	53.9 in^3	883 cm^3	73.4 in^3	1202 cm^3

Table 3-2. Cylinder Heads: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Valve guide in head (tight)	0.0033-0.0020	0.084-0.051	-	-
Valve seat in head	0.0035-0.0010	0.089-0.025	-	-
Head gasket surface (flatness)	0.006	0.152	Replace if more than 0.006	Replace if more than 0.152

Table 3-3. Rocker Arms and Shafts: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Shaft in bushing (loose)	0.0005-0.0020	0.013-0.051	0.0035	0.0889
End clearance	0.003-0.013	0.08-0.33	0.025	0.635
Bushing fit in rocker arm	0.004-0.002	0.10-0.05	-	-
Shaft fit in rocker cover	0.0007-0.0022	0.018-0.056	0.0035	0.0889

Table 3-4. Valves: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Fit in guide (intake/exhaust)	0.001-0.003	0.0254-0.0762	0.0038	0.0965
Seat width	0.040-0.062	1.02-1.57	0.090	2.286
Stem protrusion from cylinder valve pocket	2.028-2.064	51.511-52.426	2.082	52.883

Table 3-5. Valve Springs (Intake/Exhaust): All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
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	2.325 in (min)	59.1 mm (min)

Table 3-6. Tappets: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Fit in guide	0.0008-0.0023	0.020-0.058	0.003	0.0762
Roller fit	0.0006-0.0013	0.015-0.033	-	-
Roller end clearance	0.008-0.022	0.203-0.559	0.026	0.660

Table 3-7. Cylinder Bore: XL883 Models

BORE DIAMETER	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Standard +/-0.0002 in (0.0051 mm)	3.0005	76.213	3.0035	76.289
0.005 in OS +/-0.0002 in (0.0051 mm)	3.0048	76.323	3.0078	76.389
0.010 in OS +/-0.0002 in (0.0051 mm)	3.0098	76.449	3.0128	76.525
Taper	-	-	0.002	0.0508
Out of round	-	-	0.003	0.0762

Table 3-7. Cylinder Bore: XL883 Models

BORE DIAMETER	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Top gasket surface warpage	-	-	0.006	0.152
Base gasket surface warpage	-	-	0.008	0.203

Table 3-8. Cylinder Bore: XL1200 Models

BORE DIAMETER	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Standard +/-0.0002 in (0.0051 mm)	3.4978	88.844	3.5008	88.920
0.005 in OS +/-0.0002 in (0.0051 mm)	3.502	88.95	3.505	89.027
0.010 in OS +/-0.0002 in (0.0051 mm)	3.507	89.08	3.510	89.154
Taper	-	-	0.002	0.0508
Out of round	-	-	0.003	0.0762
Top gasket surface warpage		-	0.006	0.152
Base gasket surface warpage	-	-	0.008	0.203

Table 3-9. Pistons: XL883 Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Compression ring gap (top and 2nd)	0.010-0.023	0.25-0.58	0.032	0.813
Oil control ring rail gap	0.010-0.053	0.25-1.35	0.065	1.651
Top compression ring side clearance	0.0020-0.0045	0.051-0.114	0.0065	0.165
2nd compression ring side clearance	0.0020-0.0045	0.051-0.114	0.0065	0.165
Oil control ring side clearance	0.0014-0.0074	0.036-0.188	0.0094	0.239
Piston pin fit (loose, room temperature)	0.00005-0.00045	0.0013-0.0114	-	
Piston fit in cylinder (loose, room temperature)	0.0015-0.0026	0.038-0.066	0.0030	0.076

Table 3-10. Pistons: XL1200 Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Compression ring gap (top and 2nd)	0.007-0.020	0.18-0.51	0.032	0.813
Oil control ring rail gap	0.009-0.052	0.23-1.32	0.065	1.651
Top compression ring side clearance	0.0020-0.0045	0.051-0.114	0.0065	0.165
2nd compression ring side clearance	0.0016-0.0041	0.041-0.104	0.0065	0.165
Oil control ring side clearance	0.0016-0.0076	0.041-0.193	0.0094	0.239
Piston pin fit (loose at room temperature)	0.00005-0.00045	0.0013-0.0114	-	-
Piston fit in cylinder (loose at room temperature)	0.0015-0.0026	0.038-0.066	0.0030	0.076

Table 3-11. Connecting Rods: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Piston pin fit (loose)	0.00125-0.00175	0.0318-0.0445	0.00200	0.0508
Side play between fly-wheels	0.005-0.025	0.013-0.64	0.030	0.762
Fit on crankpin	0.0004-0.0017	0.010-0.043	0.0027	0.0686

Table 3-12. Flywheels: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Runout (flywheels at rim)	0.000-0.010	0.00-0.254	0.010	0.254
Runout {shaft at flywheel end)	0.000-0.002	0.00-0.0508	0.002	0.0508
End play	0.003-0.013	0.076-0.330	0.013	0.330

Table 3-13. Pinion Shaft Bearing: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Pinion shaft journal dia-meter	1.2500-1.2496	31.750-31.740	1.2494	31.735
Outer race diameter in right crankcase	1.5646-1.5652	39.741-39.756	1.5656	39.776
Bearing running clearance	0.00012-0.00088	0.0030-0.0224	-	-
Fit in cover bushing {loose)	0.0023-0.0043	0.058-0.109	0.0050	0.127

Table 3-14. Gearcase: All Models

ITEM	NEW COMPONENTS		SERVICE WEAR LIMIT	
	in	mm	in	mm
Cam gear shaft in bushing (loose)	0.0007-0.0022	0.018-0.056	0.003	0.0762
Cam gear shaft endplay (except rear intake)	0.005-0.024	0.13-0.61	0.025	0.635
Rear intake cam gear shaft end play	0.006-0.024	0.15-0.61	0.040	1.016

Table 3-15. Sprocket Shaft Bearing: All Models

ITEM	SPECIFICATION (INTERFERENCE FIT)	
	in	mm
Outer race fit in crankcase (tight)	0.006	0.152
Inner race fit on shaft (tight)	0.006	0.152

Table 3-16. Oil Pressure: At Operating Temperature

rpm	ALL XL MODELS*	
	psi	kPa
1000	7-12	43.3-82.7
2500	10-17	68.9-117
* Pressure reading taken at oil pressure switch fitting.		

Table 3-17. Electrical

COMPONENT	SPECIFICATION	
Ignition timing	Not adjustable	
Battery	12 V, 225 CCA, 12 Ah, sealed and maintenance free	
Charging system	Single-phase, 30 A system (375 W@ 13.5 V, 2000 rpm, 405 W max power @ 13.5 V)	
Spark plug size	12 mm	
Spark plug gap	0.038-0.043 in	0.97-1.09 mm
Spark plug torque	12-18 ft-lbs	16.3-24.4 Nm

Table 3-18. Oil Pump

ITEM	NEW COMPONENTS		SERVICE WEAR LIMITS	
	in	mm	in	mm
Feed/scavenger inner/outer gerotor clearance	0.003	0.08	0.004	0.102
Shaft to pump clearance	0.0025	0.064	-	-

OPERATION

See Figure 3-1. On the piston downstroke, a mixture of crankcase air and oil mist is vented up the pushrod covers (1) through a breather valve (2) in each inner rocker box section.

The oil mist separates from the crankcase air, collects and passes through a small drain hole adjacent to the exhaust valve in the head where it eventually returns to the crankcase.

The crankcase air is routed through a passage in each cylinder head. The crankcase air then travels through each air cleaner backing plate mounting bolt (3) into the filtered side of the air cleaner.

Figure 3-1. Crankcase Breathing System

OPERATION

All Models

When an engine is cold, the engine oil is more viscous (thicker). During start-up, oil pressure is higher than normal and oil circulation is restricted. As the engine warms to normal operating temperature, the engine oil warms up and becomes less viscous. The oil pressure decreases.

- Increased engine speed increases oil pressure. The faster the oil pump rotors spin, the greater the volume of circulated oil.
- Decreased engine speed lowers the volume of oil pumped and the measured oil pressure.

NOTE

The oil pump is non-regulatory and delivers its entire volume of oil under pressure to the oil filter mount.

Oil Pressure Indicator Lamp

See Figure 3-2. The oil pressure indicator lamp turns on to indicate improper circulation of the engine oil.

Refer to Table 3-19. The oil pressure indicator lamp turns on when:

- Ignition switch is turned on before starting engine.
- Oil is not circulating through the running engine.
- Oil pressure is abnormally low on the running engine.
- Engine is idling far below 1000 rpm.

The oil pressure indicator lamp turns off when oil is circulating with adequate pressure through the engine running at 1000 rpm or greater.

Figure 3-2. Oil Pressure Indicator Lamp

NOTICE

If the oil pressure indicator lamp remains lit, always check the oil supply first. If the oil supply is normal and the lamp is still lit, stop the engine at once and do not ride further until the trouble is located and the necessary repairs are made. Failure to do so may result in engine damage. (00157a)

NOTE

Residual oil pressure in the filter housing may prevent the lamp from turning on. This may occur when cycling the ignition key to on after stopping the engine.

Table 3-19. Oil Pressure Indicator Lamp Troubleshooting

OIL PRESSURE INDICATOR LAMP	PROBABLE CAUSES
Stays on at speeds above idle.	Empty oil tank.
	Clogged feed line (ice and sludge, freezing temperatures).
	Air-bound oil line.
	Grounded oil pressure switch wire.
	Malfunctioning oil pressure switch.
	Diluted oil.
	Malfunctioning check valve. See OIL FILTER MOUNT (Page 3-74).
	Malfunctioning or improperly installed pressure relief valve.
Flickers at idle.	Incorrect idle speed. Malfunctioning or improperly installed check valve. See OIL FILTER MOUNT (Page 3-74).
	Malfunctioning or improperly installed pressure relief valve.
Does not glow when ignition is turned on (before operating engine).	Malfunctioning signal switch.
	Malfunction in wiring.
	Malfunction in LED.
	Dead battery.
	See NOTE before this table.

CHECKING_OIL_PRESSURE

PART NUMBER	TOOL NAME
HD-96921-52D	OIL PRESSURE TEST GAUGE KIT
HD-96925-58	OIL PRESSURE GAUGE ADAPTER

FASTENER	TORQUE VALUE	
Oil pressure switch	60-90 **in-lbs**	6.8-10.2 N-m

Preparation

1. Check engine oil. See ENGINE OIL AND FILTER (Page 1-12).
2. Slide a catch pan under the motorcycle.
3. Obtain OIL PRESSURE TEST GAUGE KIT (PART NUMBER: HD-96921-52D).

Connecting Gauge

1. See Figure 3-3. Detach wiring from oil pressure indicator lamp switch (2).
2. Remove oil pressure switch.
3. See Figure 3-4. Install OIL PRESSURE GAUGE ADAPTER (PART NUMBER: HD-96925-58) (2) in oil pressure indicator lamp switch mounting hole. Tighten adapter snugly. Do not over-tighten.

Testing Pressure

1. See Figure 3-5. Assemble banjo bolt (2), washer (3), OIL PRESSURE GAUGE banjo fitting (1) and second washer onto adapter and tighten snugly.

NOTE

For an accurate reading, test when engine oil is at normal operating temperature: 230 °F (110 °C).

2. Temporarily secure oil pressure gauge and hose to motorcycle frame with cable straps. Verify gauge and hose assembly do not interfere with normal operation.
3. Ride motorcycle until engine reaches normal operating temperature.
4. Check and record the pressure readings at normal idle (approximately 1000 rpm) and again at 2500 rpm. Refer to Table 3-16.

Removing Gauge

1. Stop engine.
2. Remove OIL PRESSURE GAUGE assembly from oil pressure indicator lamp switch mounting hole in crankcase. Cut cable straps securing gauge and hose. Remove banjo bolt, gauge assembly, washers and adapter.
3. See Figure 3-3. Coat threads of oil pressure switch (2) with LOCTITE 565 THREAD SEALANT.

NOTE

Do not over-tighten the oil pressure switch.

4. Replace the oil pressure switch. Tighten to 60-90 **in-lbs** (6.8-10.2 N-m).
5. Connect [120] (3) by pushing elbow connector straight up onto stud on oil pressure switch. Position the wire so it does not contact the crankcase or surrounding components.

Finalize Test

NOTE

If an appreciable amount of oil leaked out when oil pressure switch was removed, replace with fresh oil.

1. Check engine oil level. See ENGINE OIL AND FILTER (Page 1-12).
2. Start engine. Test oil pressure switch for proper operation. Check for oil leaks.

1. Oil filter
2. Indicator switch
3. Switch connector [120]

Figure 3-3. Oil Pressure Indicator Switch

1. **Gauge**
2. **Adapter, pressure switch hole**
3. **Banjo bolt**
4. **Washers (2)**

Figure 3-4. Oil Pressure Test Gauge Set

1. **Oil pressure gauge banjo fitting**
2. **Banjo bolt**
3. **Washer (2)**
4. **Adapter**
5. **Oil pressure gauge hose**

Figure 3-5. Oil Pressure Test Connections

OIL PUMP OPERATION

The oil pump consists of two gerotor gear sets housed in one pump body. One is feed and the other scavenge (return). Each gerotor gear set has an inner and an outer gerotor. The inner gerotor has one less lobe than the outer gerotor. Both gerotors have fixed centers which are offset to each other. The inlet and outlet sides of the pump are sealed by the tips and lobes of the gerotor set. This prevents oil on the outlet side (high pressure) from being transferred to the inlet side.

The feed pump distributes oil to the engine and has fewer lobes than the scavenge pump, allowing for greater pressure development. The scavenge pump returns oil to the tank and has more lobes than the feed pump allowing for greater oil flow.

See Figure 3-6. Both rotor sets (3, 4) are driven off a common shaft (2) that is coupled by gears to the crankshaft.

Figure 3-6. Oil Pump

See Figure 3-7. As the crankshaft rotates, the cavity volume increases between the gerotors on the inlet side of the pump. This creates a vacuum causing oil to be drawn in. The volume continues to increase until it is equivalent to that of the missing lobe on the inner gerotor.

See Figure 3-8. Continuous rotation moves the pocket of oil to the outlet side of the pump. As the oil moves to the outlet side of the pump, the cavity decreases in volume. This forces pressurized oil out the discharge port. In operation, the gerotors provide a continuous flow of oil.

Figure 3-7. Inlet Side Oil Flow

1. **Seal**
2. **Oil out**
3. **Continuous flow**

Figure 3-8. Outlet Side Oil Flow

OIL.FLOW

NOTE

See Figure 3-8. The paragraph numbers correspond with the callouts.

1. Oil is gravity-fed from the oil tank to the gerotor-style oil pump through a **feed hose.** Oil enters the **feed section** and fills a cavity located under the feed pump. See Oil Pump (Page 3-71).
2. The feed pump transfers oil from the inlet cavity through the **feed hose** to the oil filter mount.
3. Oil flows through the **filter mount cavity** to the oil filter.
4. Oil enters the peripheral cavity of the **oil filter,** passes through the filtering medium into the central cavity of the oil filter, and flows into the filter adapter (fitting which connects filter to filter mount).
5. Adequate oil pressure in the filter mount cavity activates the **oil pressure indicator lamp switch** and shuts off the oil pressure indicator lamp.
6. Oil flowing from the filter adapter opens the **check ball.** The check ball opens at 10-13 psi (69-90 kPa) oil pressure.
7. With the check ball open, oil flows into the **crankcase feed galley.**
8. Oil flows through the feed galley in the crankcase to the tappet blocks and hydraulic lifters. **Cross-drilled passages** intersect the main feed galley and carry oil to each hydraulic lifter. From this cavity, oil is also fed to the piston jets.
9. Oil also enters an **intersecting passage** in the gearcase cover. Oil flow is then routed to the crankshaft area.
10. Oil enters a hole in the end of the **pinion gear shaft** and travels to the right flywheel where it is routed through the flywheel to the **crank pin.** Oil is forced through the crank pin to lubricate the rod bearing assembly.
11. Oil flows up passages in the **pushrods** to the rocker arm shafts and bushings.
12. The valve stems are lubricated by oil supplied through drilled oil holes in the **rocker arms.**
13. Collected in the cylinder heads, oil flows down the **pushrod covers** and into the **tappet blocks.** From the tappet block drain holes, oil flows into the gearcase. After lubricating the gearcase, the oil flows to the return side of the oil pump.
14. Feed oil to the rocker area is returned to the gearcase through a **passage** in the head, cylinder and crankcase.
15. Oil collected in the **sump** is splash-fed to the pistons, cylinder walls and flywheel components.
16. Oil in the sump returns to the scavenge pump through an internal **passage** located in the rear of the sump housing. The downward stroke of the pistons and the scavenge pump feed oil to the oil pump.
17. Return oil fills a **cavity** above the pumps return gears. The return gears pump oil back to the oil tank.
18. A small amount of oil flows from the feed galley in the right crankcase through a **restricted orifice.** The orifice sprays the oil onto the rear intake cam gear in the gearcase. Oil is transferred to the teeth of all the cam gears through the gear meshing action.

NOTES

sm04243

Figure 3-9. Lubrication Diagram (Red=Feed Oil, Blue=Return Oil)

NOTES

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. Repair or replace parts as necessary.
2. If oil is not reaching the hydraulic lifters, remove and inspect. Clean lifter bore of all foreign material. Replace parts as necessary. See Tappets (Page 3-44).
3. Examine pushrod, lifter and lifter bore for proper fit and any signs of unusual wear. Replace parts as necessary.
4. Visually inspect camshaft lobes for abnormal wear.
5. Remove camshafts and pinion gear, clean and inspect for wear and fit. Replace parts as necessary.
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. Face valves and valve seats.

COMPRESSION TEST

PART NUMBER	TOOL NAME
HD-33223-1	CYLINDER COMPRESSION GAUGE

Combustion chamber leakage may cause performance issues. A compression test can help determine the source of cylinder leakage.

Test engine at normal operating temperature.

1. Disconnect spark plug wires.
2. Clean around spark plug base. Remove spark plugs.
3. Connect CYLINDER COMPRESSION GAUGE (PART NUMBER: HD-33223-1) to front cylinder.
4. Verify transmission is in NEUTRAL. With throttle plate in wide open position, crank engine continuously through 5-7 full compression strokes.
5. Note gauge readings at the end of the first and last compression strokes. Record test results.
6. Connect the gauge to the rear cylinder and repeat test.
   a. Compression is normal if final readings are within specification and do not indicate more than a 10 psi (0.689 bar) variance between cylinders. Refer to Table 3-20.
   b. If compression is below specification, refer to Table 3-21.
7. Inject approximately 0.5 fl oz (15 ml) SAE 30 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.

NOTE

Verify that throttle plate is in the closed position after testing.

Table 3-20. Normal Compression Ranges

ENGINE	COMPRESSION	
	psi	bar
XL883 models	165-180	11.4-12.4
XL1200 models	200-225	13.8-15.5

Table 3-21. Compression Test Results

TEST RESULTS	CAUSE
Compression low on first stroke, builds up on the following strokes, but does not reach normal. Improves when oil is added to cylinder.	Ring trouble
Compression low on first stroke, does not build up on following strokes. Does not improve with the addition of oil.	Valve trouble
	Head gasket leak
	Incorrect pushrod length

PART NUMBER	TOOL NAME
HD-35667-A	CYLINDER LEAKDOWN TESTER

CYLINDER LEAKAGE TEST

The cylinder leakage test pinpoints engine problems including leaking valves, worn, damaged or stuck piston rings and blown head gaskets.

Use CYLINDER LEAKDOWN TESTER (PART NUMBER: HD-35667-A). Follow the specific instructions supplied with the tester.

1. Run engine until it reaches normal operating temperature.
2. Clean around spark plug base. Remove spark plugs.
3. Remove the air cleaner and set the throttle in the wide open position.
4. Rotate the piston to TDC of the compression stroke (both valves closed).
5. To keep the crankshaft from turning when air pressure is applied to the cylinder, engage transmission in fifth gear and lock the rear brake.

NOTE

Before performing the cylinder leakage test, verify that the tester itself is free from leakage. Apply a soap solution around the tester fittings. Connect the cylinder leakdown tester to the compressed air source. Look for any bubbles that would indicate leakage from the tester.

6. Following the manufacturer's instructions, perform a cylinder leakage test. Make a note of the percent of leakage. Leakage greater than 12 percent indicates internal engine problems.
7. Listen for air leaks at induction module intake, exhaust pipe and head gasket.
   a. Air escaping through the induction module indicates a leaking intake valve.
   b. Air escaping through the exhaust pipe indicates a leaking exhaust valve.

NOTE

- *If air is escaping through valves, check pushrod length.*
- *Complete the cylinder leakage test(s). Install the spark plugs. Verify that the throttle plate is in the closed position before starting the engine.*

DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION

Before removing the cylinder heads, check for compression and cylinder leakage. See Compression Test (Page 3-15) or Cylinder Leakage Test (Page 3-15).

Check Prior to Cylinder Head Removal

1. Oil tank overfilled.
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.

ADJUSTMENT AND TESTING

General

Often only cylinder head and cylinder repair is needed (valves, rings, piston, etc.). Service these components with the engine in the frame. See Stripping Motorcycle for Top End Repair (Page 3-19).

After disassembling the top end only, it may be found that crankcase repair is necessary. Crankcase repair requires removal of engine crankcase from chassis. See REMOVING ENGINE FROM CHASSIS (Page 3-46).

Symptoms indicating a need for engine repair are often misleading. If more than one symptom is present, possible causes can be narrowed down to make a partial diagnosis. An above-normal consumption of oil, for example, could be caused by several mechanical faults. However, when accompanied by blue-gray exhaust smoke and low engine compression, it indicates worn piston rings. Low compression by itself however, may indicate leaking valves, in addition to worn piston rings. See TROUBLESHOOTING (Page 1-57).

Piston slap is a condition where piston and/or cylinder are worn out-of-round and are loose fitting, allowing the piston to slap from front to rear of the cylinder as it moves up and down.

Frequently, valves, rings, pins, bushings and bearings need attention at the same time. If any one of the above components is worn, inspect all of these components. Repair or replace as necessary.

TOP END REPAIR

NOTE

During top end disassembly, the engine can be left in the chassis for service.

Two options are available depending upon engine status.

- Engine in Chassis (Page 3-18).
- Engine Removed from Chassis (Page 3-18).

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.

- The cam compartment can be serviced with the engine in the chassis. See Engine in Chassis (Page 3-32).
- To service components in the flywheel compartment, the engine must be removed and the crankcase halves split. See Engine Removed from Chassis (Page 3-32).

TYPICAL SYMPTOMS

Always use all available symptoms to begin a diagnosis. Symptoms indicating a need for engine repair are often misleading. If more than one symptom is present, possible causes can be narrowed down to make a partial diagnosis. An above normal consumption of oil, for example, could be caused by several mechanical faults. However, when accompanied by blue-gray exhaust smoke and low engine compression, it indicates worn piston rings. Low compression by itself however, may indicate leaking valves, in addition to worn piston rings. See TROUBLESHOOTING (Page 1-57).

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.

Frequently, valves, rings, pins, bushings and bearings need attention at the same time. If any one of the above components is worn, inspect all of these components. Repair or replace as necessary.

ENGINE IN CHASSIS

Table 3-22. Engine in Chassis

SERVICE PROCEDURE	COMPONENT REPAIR PROCEDURES
Remove parts necessary to gain access to all components above cylinder deck. See Stripping Motorcycle for Top End Repair (Page 3-19). Continue with TOP END OVERHAUL: DISASSEMBLY (Page 3-19). Remove/repair subassembly components only if necessary.	
Remove rocker arm outer covers. Remove crankcase breathers. See CYLINDER HEADS (Page 3-19).	*Inspect and repair as necessary. See Operation (Page 3-6).
Remove cylinder heads. See CYLINDER HEADS (Page 3-19).	*Inspect and repair as necessary. See CYLINDER HEAD (Page 3-53).
Remove pushrods, pushrod covers and tappet covers. See CYLINDER HEADS (Page 3-19). Remove tappets. See Tappets (Page 3-34).	*Inspect and repair as necessary. See Tappets (Page 3-44).
Remove cylinders and pistons. See CYLINDER AND PISTON (Page 3-22).	*Inspect and repair as necessary. See CYLINDER AND PISTON (Page 3-64). Inspect upper connecting rod and repair as necessary. See Connecting Rod Bushings (Page 3-68).
Complete all appropriate steps under TOP END OVERHAUL: ASSEMBLY (Page 3-25). Complete motorcycle assembly. See Assembling Motorcycle After Top End Repair	

* When this step is completed during top end service, advance to TOP END OVERHAUL: ASSEMBLY (Page 3-25) if no other work is to be done.

ENGINE_REMOVED_FROM_CHASSIS _____

Table 3-23. Engine Removed from Chassis

SERVICE PROCEDURE	COMPONENT REPAIR PROCEDURES
Remove engine from chassis. See REMOVING ENGINE FROM CHASSIS (Page 3-46). Start TOP END OVERHAUL: DISASSEMBLY (Page 3-19). Remove and repair sub-assembly components as necessary.	
Remove rocker arm outer covers. Remove crankcase breathers. See CYLINDER HEADS (Page 3-19).	*Inspect and repair as necessary. See Operation (Page 3-6).
Remove cylinder heads. See CYLINDER HEADS (Page 3-19).	*Inspect and repair as necessary. See CYLINDER HEAD (Page 3-53).
Remove pushrods, pushrod covers and tappet covers. See CYLINDER HEADS (Page 3-19). Remove tappets. See Tappets (Page 3-34).	*Inspect and repair as necessary. See Tappets (Page 3-44).
Remove cylinders and pistons. See CYLINDER AND PISTON (Page 3-22).	*Inspect and repair as necessary. See CYLINDER AND PISTON (Page 3-64). Inspect upper connecting rod and repair as necessary. See Connecting Rod Bushings (Page 3-68).
Complete all appropriate steps under TOP END OVERHAUL: ASSEMBLY (Page 3-25). Install engine in motorcycle. Complete all appropriate steps under INSTALLING ENGINE IN CHASSIS (Page 3-49). Complete motorcycle assembly. See Assembling Motorcycle After Top End Repair (Page 3-30).	

* When this step is completed during top end service, advance to TOP END OVERHAUL: ASSEMBLY (Page 3-25) if no other work is to be done.

GENERAL

This section describes disassembling the top end of the engine, from the cylinder deck up. To perform a complete top end overhaul, follow all steps listed in this section.

Then follow all steps listed in the following sections, including inspection and repair procedures: See CYLINDER HEAD (Page 3-53) and CYLINDER AND PISTON (Page 3-64).

NOTE

Clean engine before disassembly. Abrasive particles can damage machined surfaces or plug oil passageways. Remove all dirt and particles before disassembly to prevent component damage.

STRIPPING MOTORCYCLE FOR TOP END REPAIR

A WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

1. Purge the fuel supply hose of high pressure gasoline. Disconnect fuel supply hose from fuel pump module. See FUEL TANK (Page 4-10).

2. Remove seat.

A WARNING

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

3. Remove main fuse.

4. Remove exhaust pipes and mufflers. See EXHAUST SYSTEM (Page 4-38).

5. Disconnect spark plug cables from spark plugs.

6. Drain and remove fuel tank. See FUEL TANK (Page 4-10).

7. Remove horn. See Front Mount (Page 6-51).

8. Remove air cleaner assembly:
   a. Remove cover, air filter and air cleaner backing plate. See All Models (Page 4-8).
   b. **EVAP models:** Remove EVAP purge hose from induction module. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

9. Remove induction module. See INDUCTION MODULE (Page 4-14).
10. Secure induction module assembly and throttle cables out of the way.
11. See Figure 3-10. Remove upper front stabilizer link and frame bracket:
    a. Remove screw (4) securing stabilizer link (2) to engine bracket (1).
    b. Remove screws (5) and washers (8). Remove horn bracket (9) and frame bracket (3) with stabilizer link.

1. Engine bracket
2. Upper stabilizer link
3. Upper frame bracket
4. Screw
5. Screw (2)
6. Screw (2)
7. Lockwasher (2)
8. Washer (2)
9. Horn bracket

Figure 3-10. Upper Front Stabilizer Link Assembly

CYLINDER HEADS

Disassembling Rocker Covers

NOTICE

Prevent engine damage. Washers and fasteners used in the engine are hardened parts. Do not use unhardened parts. (00544b)

1. Remove spark plugs.
2. See Figure 3-13. Remove four screws (1) and sealing washers (2). Discard sealing washers.
3. Remove outer rocker cover (3).
4. Remove and discard gaskets (4, 5).
5. Rotate crankshaft until both valves are closed on head being removed.

6. See Figure 3-11. Remove hardware securing inner rocker cover to cylinder head in the following order.
   a. Remove screws and washers (1).
   b. Remove bolts and washers (2).
   c. Loosen rocker arm bolts (3) in 1/4-1/2 turn increments using a cross pattern. This relieves valve spring pressure evenly on inner rocker cover.

7. See Figure 3-13. Remove inner rocker cover (8). Remove and discard gasket (16).

8. Remove screw (6), breather assembly (7) and breather seal (17). Discard seal.

NOTE

Mark rocker arm shafts for reassembly in their original positions. Install valve train components in their original positions or increased engine wear may result.

9. See Figure 3-12. Remove rocker arm shafts by tapping them out using a hammer and a soft metal punch.

10. See Figure 3-13. Remove rocker arms (11, 12). Mark the rocker arms for reassembly in their original locations.

Figure 3-11. Inner Rocker Cover Fasteners

Figure 3-12. Removing Rocker Arm Shafts (typical)

1. **Screw (4)**
2. **Sealing washer (4)**
3. **Outer rocker cover**
4. **Gasket**
5. **Gasket**
6. **Screw**
7. **Breather assembly**
8. **Inner rocker cover**
9. **Rocker arm shaft (2)**
10. **Rocker arm bushing (4)**
11. **Rocker arm**
12. **Rocker arm**
13. **Bolt(4)**
14. **Screw (2)**
15. **Bolt (3)**
16. **Gasket**
17. **Breather seal**
18. **Breather location: Front Cylinder**
19. **Breather location: Rear Cylinder**

Figure 3-13. Rocker Cover Assembly

Removing Cylinder Head

NOTE

See Figure 3-14 or Figure 3-15. Follow sequence ofincremental removal as described below to prevent component damage.

1. See Figure 3-14 and Figure 3-15. Loosen each screw 1/8-turn following the sequence shown.
2. Continue loosening in 1/8-turn increments until screws are loose. Remove head screws.
3. Remove cylinder head and head gasket. Discard head gasket.

Figure 3-14. Front Cylinder Screw Torque Sequence

Figure 3-15. Rear Cylinder Screw Torque Sequence

Disassembling Pushrods and Covers

1. See Figure 3-16. Remove pushrod covers (2), O-rings (1, 3) and push rods (4). Discard O-rings.
2. Mark the location and orientation (top and bottom) of each pushrod.
3. Remove socket screws (5) and washers (6).
4. Remove tappet cover (7) and gasket (8). Discard gasket.

1. **O-ring (4)**
2. **Pushrod cover (4)**
3. **O-ring (4)**
4. **Pushrod (4)**
5. **Screw (8)**
6. **Washer (8)**
7. **Tappet cover (2)**
8. **Gasket (2)**
9. **Screw (2)**
10. **Anti-rotation device (2)**
11. **Tappet(4)**
12. **Right crankcase**

Figure 3-16. Middle Valve Train Components

CYLINDER AND PISTON

PART NUMBER	TOOLNAME
HD-34623-C	PISTON PIN RETAINING RING INSTALLER
HD-42320-A	PISTON PIN EXTRACTOR

PART NUMBER	TOOLNAME
HD-42322	PISTON SUPPORT PLATE

1. See Figure 3-17. Rotate crankshaft until piston (6) of cylinder being removed is at bottom of its stroke.

1. **Piston pin bushing**
2. **Connecting rod**
3. **Lock ring (2)**
4. **Piston pin**
5. **Piston ring set**
6. **Piston**
7. **Cylinder**
8. **Cylinder stud (4)**
9. **Cylinder base gasket**
10. **Dowel (2)**
11. **Head gasket**

Figure 3-17. Cylinder and Piston

2. Carefully raise cylinder just enough to permit placing clean towel under piston to prevent any foreign matter from falling into crankcase.

NOTE

- *If cylinder does not come loose, tap lightly with rawhide or plastic hammer perpendicular to cylinder fins. Never try to pry cylinder up.*
- *To avoid damage to piston assembly and/or cylinder studs, do not allow piston to fall against studs.*

3. Carefully lift cylinder over piston and cylinder studs (8). Do not allow piston to fall against cylinder studs.

4. Discard cylinder base gasket (9).

NOTE

With cylinder removed, be careful not to bend the cylinder studs. The slightest bend could cause a stress riser and could lead to stud failure.

5. Install a 6.0 in (150 mm) length of% in (12.7 mm) ID plastic or rubber hose over each cylinder stud. This will protect the studs and the pistons.

NOTE

- *It is not necessary to remove both piston pin lock rings during piston removal. Leave second lock ring in piston pin bore.*
- *Do not reuse piston pin lock rings. Removal may weaken lock rings and they may break or dislodge if reused, resulting in engine damage.*

A 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)

NOTICE

Handle piston with extreme care. The alloy used in these pistons is very hard. Any scratches, gouges or other marks in the pistons could score the cylinder during engine operation and cause engine damage. (00546b)

6. See Figure 3-18. Remove piston pin lock ring as follows:

   a. Insert PISTON PIN RETAINING RING INSTALLER (PART NUMBER: HD-34623-C) into piston pin bore until claw on tool is positioned in slot of piston (directly under lock ring).

   b. Squeeze handles of tool together and pull from bore. Hold a shop towel over bore during removal in the event that the lock ring should fly out. Remove lock ring from claw and discard.

Figure 3-18. Removing Piston Pin Lock Ring

NOTE

To avoid damage to piston or cylinder base studs, use PISTON SUPPORT PLATE (PART NUMBER: HD-42322) to secure piston in place while removing piston pin.

7. Remove piston pin. Since pin is a loose fit in piston, pin should easily slide out. If pin is difficult to remove, use PISTON PIN EXTRACTOR (PART NUMBER: HD-42320-A), as follows:
   a. See Figure 3-19. Remove acorn nut and spacer (1) from rod end of tool.
   b. Slide rod end through piston pin. Install spacer and acorn nut on end of rod.
   c. Position rubber coated tips (2) of tool on flat on each side of piston pin bore.
   d. Hold tool body (3) and turn handle (4) clockwise until piston pin is pulled free of bore.
8. Remove piston from connecting rod. Be sure to hold connecting rod shank upright to prevent it from striking crankcase.
9. Place a 3.0 in (76.2 mm) length of 1.0 in (25.4 mm) ID foam-type water pipe insulation around each connecting rod to prevent damage.
10. Mark each pin boss with either an "F" or an "R" to indicate front or rear cylinder, respectively.
11. Spread piston rings outward until they clear grooves in piston and lift off.

Figure 3-19. Removing Piston Pin with HD-42320-A Piston Pin Remover

GENERAL

This section describes assembling the top end of the engine, from the cylinder deck up. If the engine crankcase has been disassembled for repair, it must be assembled before assembling the top end of the engine. See BOTTOM END OVERHAUL: ASSEMBLY (Page 3-37).

PISTON AND CYLINDER

PART NUMBER	TOOL NAME
HD-34623-C	PISTON PIN RETAINING RING INSTALLER
HD-42322	PISTON SUPPORT PLATE
HD-96333-51 E	PISTON RING COMPRESSOR

1. Slide approximately 6 in (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud to protect cylinder studs and piston from damage.

NOTE

See Figure 3-20. Install pistons with the arrow on the top and the side of the piston point toward the front.

2. Install piston assembly over connecting rod.
3. Install piston pin.

NOTE

Place a clean shop towels over cylinder and lifter bores prior to the next step, to prevent the piston pin lock ring from falling into the crankcase.

4. See Figure 3-21. Install **new** piston pin lock rings with the PISTON PIN RETAINING RING INSTALLER (PART NUMBER: HD-34623-C). Make sure the ring groove is clean and that the ring is fully seated in the groove with the gap away from the slot at the bottom.

NOTE

- *Always use **new** lock ring.*
- *Clean lock ring groove and seat lock ring firmly in groove.*
- *If the lock ring does not seat firmly in groove, discard the lock ring.*
- *Do not install a used lock ring or a **new** one that has been installed and removed. A loosely installed ring will come out of the piston groove and damage cylinder and piston beyond repair.*

Figure 3-20. Directional Arrows

Figure 3-21. Installing Piston Lock Rings

5. See Figure 3-22. Make sure the piston ring end gaps are properly positioned as shown.
6. Lubricate cylinder wall, piston, pin and rod bushing with engine oil.
7. Remove cylinder stud sleeves. Install a **new** cylinder base gasket. Make sure the piston does not bump the studs or crankcase.

Figure 3-22. Position Ring End Gaps at Arrows

8. See Figure 3-23. Install PISTON SUPPORT PLATE (PART NUMBER: HD-42322) as shown. Rotate crankshaft to rest piston on support plate.
9. See Figure 3-24. Compress the piston rings using PISTON RING COMPRESSOR (PART NUMBER: HD-96333-51 E).
10. Gently slide cylinder over cylinder base studs and piston crown, resting it on the top of the ring compressor band as shown.
11. Push the cylinder down with a firm, quick motion until the bottom of the cylinder bore slides below the piston ring area.
12. Remove the piston ring compressor and piston support plate, and push the cylinder all the way down onto the crankcase cylinder deck.
13. Repeat for other piston and cylinder.

Figure 3-23. Piston Support Plate

Figure 3-24. Installing Cylinder Over Piston

TAPPET COVERS, PUSHROD COVERS AND PUSHRODS

FASTENER	TORQUE VALUE	
Tappet cover fastener	90-120 **in-lbs**	10.2-13.6 N-m

1. See Figure 3-26. If anti-rotation devices (10) and tappets (11) have been removed, install the tappets. See Tappets (Page 3-44).
2. See Figure 3-25. Orient tabs of the front (1) and rear (2) tappet covers to the front and rear cylinders.
3. See Figure 3-26. Install tappet covers (7) and **new** gaskets (8). Secure with screws (5) and washers (6). Tighten to 90-120 **in-lbs** (10.2-13.6 N-m).

4. Install new O-rings (3) in recesses in tappet covers. Press pushrod covers (2) into O-rings.

5. Identify pushrod location by its color and length. Refer to Table 3-24.

6. Slide intake and exhaust pushrods (4) down inside pushrod covers until they rest on seat at top of tappet (11).

Table 3-24. Pushrod Specifications

POSITION	COLOR BAND	LENGTH	
		in	cm
Intake	Orange	10.746	27.295
Exhaust	Purple	10.800	27.432

Figure 3-25. Tappet Cover Orientation

1. O-ring (4)
2. Pushrod cover (4)
3. O-ring (4)
4. Pushrod (4)
5. Screw (8)
6. Washer (8)
7. Tappet cover (2)
8. Gasket (2)
9. Screw (2)
10. Anti-rotation device(2)
11. Tappet(4)
12. Right crankcase

Figure 3-26. Middle Valve Train Components

CYLINDER HEAD

FASTENER	TORQUE VALUE	
Cylinder screws, 1st torque	96-120 in-lbs	11-14 N-m
Cylinder screws, final torque	13-15 ft-lbs	18-20 N-m

NOTE

- *Install the pushrod covers and lower cover retainers before installing cylinder heads. See Tappet Covers, Pushrod Covers and Pushrods (Page 3-26).*
- *Thoroughly clean and lubricate threads of cylinder head screws before installation. Friction caused by dirt and grime will result in a false torque indication.*

1. Coat mating surfaces of cylinder base studs and screws with parts cleaning solution.
2. Scrape old oil and any carbon deposits from threads by using a back-and-forth motion, threading each head screw onto its mating cylinder stud.
3. Remove screws from studs. Wipe or blow dry thread surfaces.
4. Thoroughly clean and dry gasket surfaces of cylinder and cylinder head.
5. See Figure 3-27. Install a **new** head gasket to cylinder.
6. Carefully lower cylinder head over studs and position on dowels. Use great care so as not to disturb head gasket.

NOTE

Only oil film must remain on the cylinder head screw surfaces. Too much oil will pool in the head screw sleeve preventing full thread engagement.

7. Lightly coat threads, underside of flange and bottom face of cylinder screws in clean Harley-Davidson 20W50 engine oil. Wipe off excess oil.
8. Start cylinder screws onto cylinder studs, tovo short screws on left side of engine, tovo long screws on right. Tighten all screws only finger-tight at this time.

NOTE

The procedure for tightening the head screws is critical to proper distribution of pressure over gasket area. It prevents gasket leaks, stud failure and head and cylinder distortion.

9. See Figure 3-28 and Figure 3-29. In sequence, tighten screws in the following steps:
   a. Tighten each screw to 96-120 **in-lbs** (11-14 N-m).
   b. Tighten each screw to 13-15 ft-lbs (18-20 N-m).
   c. **Loosen all screws.**
10. After screws are loosened from initial torque, tighten screws in three stages. Tighten in sequence:
   a. Tighten each screw to 96-120 **in-lbs** (11-14 N-m).
   b. Tighten each screw to 13-15 ft-lbs (18-20 N-m).
   c. See Figure 3-30. Mark cylinder head and screw shoulder with a line (1).
   d. Tighten each screw an additional 85-95 degrees (2).

1. **Cylinder head**
2. **Gasket**

Figure 3-27. Cylinder Head Installation

1. **Short**
2. **Short**
3. **Long**
4. **Long**

Figure 3-28. Front Cylinder Screw Torque Sequence

Figure 3-29. Rear Cylinder Screw Torque Sequence

sm03408

1. Mark

2. 85-95 degrees

Figure 3-30. Tighten Screws

ROCKER COVERS

FASTENER	TORQUE VALUE	
Breather screw	35-55 in-lbs	4-6.2 N-m
Rocker cover, inner, large bolt	18-22 ft-lbs	24.4-29.8 N-m
Rocker cover, inner, screw	135-155 in-lbs	15.3-17.5 N-m
Rocker cover, inner, small bolt	135--155 in-lbs	15.3-17.5 N-m
Rocker cover, outer, screw	120--168 in-lbs	13.6-19 N-m

Inner Cover

1. Rotate crankshaft to position the lifters on the base circle of the cams.

2. See Figure 3-33. Install new gasket (1) with FRONT HEAD facing up on the front head and REAR HEAD facing up on the rear head.

3. Install the inner rocker cover assembly (2) (with rocker arms and shafts). Fit the ends of the pushrods in the rocker arm sockets.

NOTE

To avoid damage to pushrods or rocker arms, do not rotate crankshaft until both pushrods can be turned with fingers.

4. Install all fasteners (3, 5, 4) finger-tight one turn at a time.

5. See Figure 3-31. Tighten the fasteners in sequence:

   a. Tighten the four large bolts (1, 2, 3, 4). Re-tighten the first fastener (5).

      Torque: 18-22 ft-lbs (24.4-29.8 N-m) *Rocker cover, inner, large bolt*

   b. Tighten the three small bolts (6, 7, 8).

      Torque: 135-155 in-lbs (15.3-17.5 N-m) *Rocker cover, inner, small bolt*

   c. Tighten the two small bolts (9, 10).

      Torque: 135-155 in-lbs (15.3-17.5 N-m) *Rocker cover, inner, screw*

Figure 3-31. Inner Rocker Cover Torque Sequence **Breather**

1. Identify breather location for front and rear cylinders.

2. See Figure 3-33. Install breather (7) with new breather seal (6).

3. Install screw (8). Tighten.

   Torque: 35-55 in-lbs (4-6.2 N-m) *Breather screw*

Outer Cover

1. See Figure 3-33. Install new gaskets (9, 10) on the inner rocker cover.

2. Install outer rocker cover (11) on inner rocker cover. Install fasteners (13) and new sealing washers (12).

3. See Figure 3-32. Tighten fasteners (1, 2, 3, 4) in sequence and then re-tighten the first fastener (1).

   Torque: 120-168 in-lbs (13.6-19 N-m) *Rocker cover, outer-, screw*

sm07288

Figure 3-32. Outer Cover Torque Sequence

sm07278

1. **Gasket**
2. **Inner rocker cover**
3. **Large bolts (4)**
4. **Small bolts (3)**
5. **Screws (2)**
6. **Breather seal**
7. **Breather**
8. **Screw**
9. **Gasket**
10. **Cover gasket**
11. **Outer rocker cover**
12. **Sealing washer (4)**
13. **Fastener (4)**

Figure 3-33. Rocker Cover

ASSEMBLING MOTORCYCLE AFTER TOP END REPAIR

FASTENER	TORQUE VALUE	
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9--47.5 N-m

1. See Figure 3-34. Install upper front stabilizer link and frame bracket:

   a. Install upper frame bracket (3) with upper stabilizer link (2), horn bracket (9), screws (5) and washers (8). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

   b. Install screw (4) securing stabilizer link to engine bracket (1). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).

2. Install induction module. See INDUCTION MODULE (Page 4-14).

3. Install induction module connectors:

   a. TPS [88].

   b. IAC [87].

   c. TMAP sensor [80].

   d. Fuel injector connectors [84], [85].

4. Install air cleaner assembly. See All Models (Page 4-8).

5. **EVAP models:** Install EVAP purge hose on induction module. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

6. Install horn. See Front Mount (Page 6-51).

A WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

7. Install fuel tank.

   a. Install front and rear screws, washers and locknuts. Tighten to 15-20 ft-lbs (20.3-27.1 N-m).

   b. Install fastener protective caps.

   c. Attach quick-connect fitting on fuel line to fuel tank fitting.

   d. Gently tug on quick-connect fitting to verify that it is securely locked in place. See FUEL TANK (Page 4-10).

8. Install exhaust pipes and mufflers. Plug in rear HO2S connector [137] and front HO2S connector [138]. See EXHAUST SYSTEM (Page 4-38).

9. Connect spark plug cables to spark plugs.

10. Install main fuse.

11. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

1. Engine bracket
2. Upper stabilizer link
3. Upper frame bracket
4. Screw
5. Screw (2)
6. Screw (2)
7. Lockwasher (2)
8. Washer (2)
9. Horn bracket (models with front mounted horn)

Figure 3-34. Upper Front Stabilizer Link Assembly

ENGINE IN CHASSIS

Table 3-25. Engine in Chassis: Cam Compartment Service

SERVICE PROCEDURE	COMPONENT REPAIR PROCEDURES
Remove parts necessary to gain access to all components above cylinder deck. See Stripping Motorcycle for Top End Repair (Page 3-19).	
Continue with TOP END OVERHAUL: DISASSEMBLY (Page 3-19). Remove/repair subassembly components only if necessary.	
Remove rocker arm outer covers. Remove crankcase breathers. See CYLINDER HEADS (Page 3-19).	Inspect and repair as necessary. See Operation (Page 3-6).
Remove pushrods, pushrod covers and tappet covers. See CYLINDER HEADS (Page 3-19). Remove tappets. See Tappets (Page 3-34).	Inspect and repair as necessary. See Tappets (Page 3-44).
Continue with BOTTOM END OVERHAUL: DISASSEMBLY (Page 3-34).	
Remove gear case cover and cam gears. See GEARCASE COVER AND CAM GEARS (Page 3-36).	*Inspect and repair as necessary. See GEARCASE COVER AND CAM GEARS (Page 3-36).
Remove oil pump components. See Oil Pump (Page 3-71).	Inspect and repair as necessary. See Oil Pump (Page 3-71).
Complete all appropriate steps under BOTTOM END OVERHAUL: ASSEMBLY (Page 3-37).	
Complete motorcycle assembly. See Assembling Motorcycle After Top End Repair (Page 3-30).	
* When this step is completed during bottom end service, advance to BOTTOM END OVERHAUL: ASSEMBLY (Page 3-37) if no other work is to be done.	

ENGINE REMOVED FROM CHASSIS

Table 3-26. Engine Removed from Chassis: Flywheel Compartment Service or Complete Engine Overhaul

SERVICE PROCEDURE	COMPONENT REPAIR PROCEDURES
Remove engine from chassis. See REMOVING ENGINE FROM CHASSIS (Page 3-46).	
Start TOP END OVERHAUL: DISASSEMBLY (Page 3-19). Remove and repair subassembly components as necessary.	
Remove rocker arm outer covers. Remove crankcase breathers. See CYLINDER HEADS (Page 3-19).	Inspect and repair as necessary. See Operation (Page 3-6).
Remove cylinder heads. See CYLINDER HEADS (Page 3-19).	Inspect and repair as necessary. See CYLINDER HEAD (Page 3-53).
Remove pushrods and pushrod covers. See CYLINDER HEADS (Page 3-19). Remove tappet covers and tappets. See Tappets (Page 3-44).	Inspect and repair as necessary. See Tappet Covers, Pushrod Covers and Pushrods (Page 3-26).
Remove cylinders and pistons. See CYLINDER AND PISTON (Page 3-22).	Inspect and repair as necessary. See CYLINDER AND PISTON (Page 3-64). Inspect upper connecting rod and repair as necessary. See Connecting Rod Bushings (Page 3-68).
Continue with BOTTOM END OVERHAUL: DISASSEMBLY (Page 3-34). Remove and repair subassembly components as necessary.	
Remove gearcase cover and cam gears. See GEARCASE COVER AND CAM GEARS (Page 3-36).	Inspect and repair as necessary. See GEARCASE COVER AND CAM GEARS (Page 3-36).
Remove oil pump. See Oil Pump (Page 3-71) or Oil Pump (Page 3-71).	Inspect and repair as necessary. See Oil Pump (Page 3-71).
Complete all appropriate steps under Crankcase (Page 3-34) to split crankcases and remove flywheel assembly, piston jets, etc.	Inspect and repair as necessary. See Crankcase (Page 3-79). Inspect and repair transmission assembly as necessary. See TRANSMISSION REMOVAL AND DISASSEMBLY (Page 5-19), TRANSMISSION ASSEMBLY (Page 5-23), TRANSMISSION INSTALLATION (Page 5-36) and related subjects.

Table 3-26. Engine Removed from Chassis: Flywheel Compartment Service or Complete Engine Overhaul

SERVICE PROCEDURE	COMPONENT REPAIR PROCEDURES
Complete all appropriate steps under BOTTOM END OVERHAUL: ASSEMBLY (Page 3-37).	
Complete all appropriate steps under TOP END OVERHAUL: ASSEMBLY (Page 3-25).	
Install engine in motorcycle. Complete all appropriate steps under INSTALLING ENGINE IN CHASSIS (Page 3-49).	
Complete motorcycle assembly. See Assembling Motorcycle After Top End Repair (Page 3-30).	

GENERAL

This section describes disassembling the bottom end of the engine. If engine overhaul requires disassembly of crankcases, remove engine from vehicle. See REMOVING ENGINE FROM CHASSIS (Page 3-46).

Then disassemble top end of engine. See CYLINDER HEADS (Page 3-19) and CYLINDER AND PISTON (Page 3-22).

Thoroughly clean area around gearcase cover and tappets. Blow loose dirt from crankcase with low pressure compressed air.

OIL PUMP

1. Remove oil pump feed and return hoses. Mark hoses for later installation. Discard hose clamps.
2. See Figure 3-35. Carefully remove two screws (2) that secure pump to crankcase. Pump will drop with screws removed. Discard mounting gasket.
3. If oil pump requires repair, see Oil Pump (Page 3-71).

Figure 3-35. Oil Pump

TAPPETS

1. See Figure 3-36. Remove screw (1).
2. Remove anti-rotation device (2). Mark anti-rotation device for location (fronUrear cylinder) as it is removed.
3. Remove tappet (3). Mark tappet for location (fronUrear cylinder) and function (intake/exhaust) as it is removed. This will simplify installation.
4. Repeat previous steps for other cylinder.
5. Place tappets in clean plastic bags to keep out dust, dirt and debris.

Figure 3-36. Tappet Components

CAM GEAR END PLAY

NOTE

Gauge cam gear end play with the tappets removed.

1. Rotate the crankshaft until the lobe of the cam gear is pointing toward the tappet guide bore.
2. With a flat blade screwdriver, gently pry the cam gear toward the gearcase cover.
3. Gauge the gap between the case bushing and the cam gear shaft thrust face.
4. Compare the gauge size to the cam gear end play specifications. Refer to Table 3-14.

CRANKCASE

Split Crankcase

1. Remove clutch and primary drive components. See PRIMARY DRIVE AND CLUTCH (Page 5-7).
2. Remove starter. See STARTER (Page 6-20).

A CAUTION

Do not rotate crankcase half in engine stand when flywheel is installed. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552c)

3. Mount crankcase assembly in engine stand. Position crankcase tilted at a 45 degree angle, right side down.

4. Remove 11 long fasteners (1, 2) and four short fasteners (3) from left side of crankcase assembly.

5. Remove two fasteners (4) from right side of crankcase assembly.

Figure 3-37. Crankcase Fasteners

6. See Figure 3-38. Tap crankcase gently with rawhide mallet to loosen and separate the halves. Remove left crankcase assembly with transmission.

NOTE

Flywheel assembly slides off left main bearing by hand. No tools are required for this operation.

7. See Figure 3-39. Remove the flywheel assembly from right crankcase.

8. Remove transmission assembly from left crankcase. See TRANSMISSION REMOVAL AND DISASSEMBLY (Page 5-19).

Figure 3-38. Separating Crankcase Halves

Figure 3-39. Removing Flywheels from Right Crankcase

Piston Oil Jets

1. See Figure 3-40. Remove screws (3) from each piston oil jet assembly (2) to free piston oil jets from right crankcase (1).

2. Remove piston oil jets and gaskets (4) from right crankcase. Discard gaskets.

Figure 3-40. Piston Oil Jet Assemblies

Removing Cylinder Base Studs

If cylinder base studs require replacement, proceed.

1. Install a 3/8-16 nut onto cylinder base stud.
2. Install a second nut onto stud until it contacts the first nut.
3. Tighten nuts against each other.
4. Placing wrench on first (lower) nut installed, remove stud from cylinder deck.
5. Remove nuts from cylinder base stud.

GEARCASE COVER AND_CAM_GEARS _____

1. Remove any parts that interfere with gearcase disassembly.
2. Remove inner rocker cover to remove valve spring pressure from the camshafts. See Cam Gears and Gearcase Cover (Page 3-41).
3. Measure cam gear end play and record measurements. See Cam Gear End Play (Page 3-34).
4. Place a pan under gearcase to collect oil.

NOTE

Never pry cover off. Tap lightly with a rawhide hammer.

5. See Figure 3-41. Remove cover screws (1) and cover (2). Discard gasket (3).
6. Remove cam gears (4, 5, 6 and 7). Mark each component for installation.

NOTE

Nut is secured by LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) on the nut threads.

7. Remove nut (8). Slide pinion gear (9) and oil pump drive gear (10) off pinion shaft.

1. **Fastener**
2. **Cover**
3. **Gasket**
4. **Rear exhaust cam**
5. **Rear intake cam**
6. **Front intake cam**
7. **Front exhaust cam**
8. **Nut**
9. **Pinion gear**
10. **Oil pump drive gear**
11. **Shaft key**

Figure 3-41. Gearcase Cover and Cam Gears

CRANKCASE

PART NUMBER	TOOL NAME
B-45520	GEAR DETENT ASSEMBLY AID
B-45655	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER
B-45676-A	SPROCKET SHAFT SEAL INSTALLER
HD-42326-B	CRANKSHAFT GUIDE
HD-42579-A	SPROCKET SHAFT BEARING/SEAL INSTALLATION TOOL
HD-42720-2	CRANKCASE BEARING REMOVER/INSTALLER BASE
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

FASTENER	TORQUE VALUE	
Crankcase fastener	15-19 ft-lbs	20.3-25.8 N-m
Cylinder stud	120--240 in-lbs	13.6-27.1 N-m
Piston oil jet screw	25-35 in-lbs	2.8-3.9 N-m

Installing Piston Oil Jets

NOTE

- *Damaged gaskets cause oil leakage and/or low oil pressure.*
- *See Figure 3-42. Gasket (4) is part of piston oil jet (2) assembly. It is not sold separately.*

1. See Figure 3-42. With oil jet pointed upward, install new piston oil jet assemblies (2) with gaskets (4) in right crankcase.

2. Apply LOCTITE 222 LOW STRENGTH THREADLOCKER AND SEALANT (purple) to screws (3).

3. Install screws to secure piston oil jet assembly to crankcase. Tighten to 25-35 in-lbs (2.8-3.9 N-m).

Figure 3-42. Piston Oil Jet Assemblies

Installing Pinion Shaft Bearings

1. See Figure 3-43. Lubricate pinion shaft and pinion shaft bearing (2) with SCREAMIN' EAGLE ASSEMBLY LUBE.

2. Slip bearing on pinion shaft.

3. See Figure 3-44. Using TRANSMISSION SHAFT RETAINING RING PLIERS (PART NUMBER: J-5586-A), install new retaining ring in groove of pinion shaft bearing inner race. Make sure that retaining ring is fully seated in groove.

Figure 3-43. Pinion Shaft and Left Main Bearings

Figure 3-44. Installing Pinion Shaft Bearing and Retaining Ring

Installing Left Main Bearing

NOTE

When installing the left main bearing, press the bearing from the inside of the left crankcase toward the outside. A shoulder is incorporated into the left crankcase. The bearing can be installed in one direction only.

1. See Figure 3-45. Using CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER (PART NUMBER: B-45655) and CRANKCASE BEARING REMOVER/INSTALLER BASE (PART NUMBER: HD-42720-2), press left main bearing into the left crankcase.

   a. Place support tube (1) on press bed with recessed cup end facing up.

   b. With the inboard side of the left crankcase (2) facing upward, position crankshaft bearing bore (3) over support tube.

   c. Place left main bearing (4) over bearing bore. Insert piloUdriver (5) through left main bearing, through crankshaft bearing bore and into support tube.

   d. Apply pressure with press ram (6) until left main bearing bottoms out in bearing bore.

2. See Figure 3-46. Install **new** retaining ring from the inside of the left crankcase.

Figure 3-45. Installing Left Main Bearing in Crankcase

Figure 3-46. installing Left Main Bearing Retaining Ring

Assembling Crankcase Halves

1. Install transmission assembly In left crankcase. See TRANSMISSION INSTALLATION (Page 5-36).

NOTE

See Figure 3-4 7. The gear detent assembly aid is used to move the gear detent lever clear of the shifter drum for assembly.

2. Retract detent assembly in right case half. Install GEAR DETENT ASSEMBLY AID (PART NUMBER: B-45520) until it bottoms in right case half.

3. Shift transmission to first gear.

4. Lubricate left main bearing with SCREAMIN' EAGLE ASSEMBLY LUBE.

5. Assemble crankcase halves together.

   a. See Figure 3-48. Install flywheel assembly In right crankcase. Slide pinion shaft through outer race In right crankcase.

   b. Slide CRANKSHAFT GUIDE (PART NUMBER: HD-42326-B) onto flywheel sprocket shaft.

   c. Apply a thin coat of HARLEY-DAVIDSON HIGH-PERFORMANCE SEALANT - GRAY to crankcase joint faces.

   d. See Figure 3-49. Carefully fit crankcases together.

   e. Apply a drop of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to last few threads of each crankcase fastener (13 long and four short).

   f. See Figure 3-50. Install four short fasteners In right case bottom locations (1,2, 3, 4).

   g. Install 11 long fasteners In left case locations (5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15).

h. Install 2 long fasteners In right case locations (16, 17).

I. Tighten fasteners to 15-19 ft-lbs (20.3-25.8 N-m) in sequence shown.

6. Remove transmission gear detent assembly aid.

Figure 3-47. Using Gear Detent Assembly Aid (Part No. B-45520)

Figure 3-48. Installing Flywheels in Right Crankcase

Figure 3-49. Assembling Crankcases with Crankshaft Guide Tool (Part No. HD-42326-B)

Figure 3-50. Crankcase Fastener Torque Sequence

7. See Figure 3-51 and Figure 3-52. Install spacer in ID of **new** seal. With the open (lipped) side of seal facing outward, center seal/spacer assembly over bearing bore.

NOTE

If the spacer is removed after installation, repeat the seal procedure.

8. See Figure 3-53. Install bearing seal and spacer.
   a. Center seal/spacer driver (2) over seal, so that the sleeve (smaller O.D.) seats between seal wall and garter spring.
   b. Assemble SPROCKET SHAFT BEARING/SEAL INSTALLATION TOOL (PART NUMBER: HD-42579-A) (1) and SPROCKET SHAFT SEAL INSTALLER (PART NUMBER: B-45676-A) onto sprocket shaft.
   c. Rotate handle clockwise until the spacer contacts the bearing. Remove tool from sprocket shaft.

9. Install retaining ring into groove in sprocket shaft bearing bore.

Figure 3-51. Open Side of Seal Faces Out

Figure 3-52. Install Spacer and Seal

Figure 3-53. Install Bearing Seal and Spacer

Installing Cylinder Base Studs

See Figure 3-54. If cylinder studs were removed:

1. Pack clean towels into crankcase opening.

2. Place a steel ball into a head screw (1).

3. The cylinder studs (2) have a shoulder (3) at the lower end. Place the end of the studs without the shoulder into the head screw.

4. Install the studs in the crankcase with the shoulder end down. Use an air gun (4) to drive the stud until the shoulder reaches the crankcase.

5. Remove air gun. Use a torque wrench to tighten studs to 120-240 in-lbs (13.6-27.1 N-m).

Figure 3-54. Cylinder Studs

CAM AND PINION GEAR IDENTIFICATION

NOTE

Prior to changing any cam gears, check gear shaft fit within corresponding bushings. Worn bushings can cause excessive backlash.

See Figure 3-55. Cam lobes are stamped with a number (1, 2, 3, or 4) followed by a letter. The number identifies the cam location/function. The letter identifies the cam lobe profile. Refer to Table 3-27.

sm03406

Figure 3-55. Cam Identification (typical)

Table 3-27. Cam Identification

CAM	LOCATION
Rear exhaust	1W
Rear intake	2W
Front intake	3W
Front exhaust	4W

CAM GEARS AND GEARCASE COVER

1. See Figure 3-56. Make sure shaft key (11) is installed on flywheel pinion shaft. Install oil pump drive gear (10) and pinion gear (9) on pinion shaft.

PART NUMBER	TOOL NAME
HD-43984	CRANKSHAFT LOCKING TOOL

FASTENER	TORQUE VALUE	
Gearcase cover fasteners	120--140 in-lbs	13.6-15.8 N-m
Pinion shaft locking nut	19-21 ft-lbs	26-29 N-m

NOTE

See Figure 3-57. Timing mark on pinion gear tooth is aligned with keyway in ID of pinion gear. The timing mark will allow you to easily position pinion gear over shaft key and against oil pump drive gear on pinion shaft.

2. See Figure 3-56. Clean threads on pinion shaft and nut (8). Apply several drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red).

NOTE

When using CRANKSHAFT LOCKING TOOL, do NOT use impact wrench to drive nut onto pinion shaft.

1. Fastener
2. Cover
3. Gasket
4. Rear exhaust cam
5. Rear intake cam
6. Front intake cam
7. Front exhaust cam
8. Nut
9. Pinion gear
10. Oil pump drive gear
11. Shaft key

Figure 3-56. Gearcase Cover and Cam Gears

Figure 3-57. Pinion Gear Timing Mark and Keyway

3. See Figure 3-59. Install pinion shaft nut.

   a. Install CRANKSHAFT LOCKING TOOL (PART NUMBER: HD-43984) over pinion shaft.

   b. Install nut on pinion shaft.

   c. Tighten to 19-21 ft-lbs (26-29 N-m).

   d. Tighten another 15-19 degrees of rotation.

   e. Remove CRANKSHAFT LOCKING TOOL (PART NUMBER: HD-43984).

NOTE

See Figure 3-60. Install rear exhaust and front intake cam gears before rear intake cam gear. This sequence prevents an alignment problem with the pinion gear.

Figure 3-58. Oil Pump Drive Gear and Pinion Gear Installed on Pinion Shaft

4. Lubricate all cams and all cam bushings in right crankcase with SCREAM IN' EAGLE ASSEMBLY LUBE.

5. See Figure 3-60. Rotate crankshaft until timing mark on pinion gear points exactly at centerline of rear intake cam bushing.

Figure 3-59. Crankshaft Locking Tool (Part No. HD-43984)

until timing mark (a slot) points exactly at centerline of rear intake cam bushing.

7. Install front intake cam (6). Rotate cam until slotted timing mark points exactly at centerline of rear intake cam bushing.

NOTE

See Figure 3-60. "V" marks on rear intake cam are not used for timing of Sportster model engines.

8. See Figure 3-56. Install rear intake cam (5). Rotate the cam to align the threetiming marks (dots) with timing marks on the pinion gear, rear exhaust cam and front intake cam.
9. Install front exhaust cam (7). Rotate the cam to line up the timing mark with the timing mark of the front intake cam.
10. See Figure 3-60. Verify timing marks. If necessary, remove a cam, rotate it slightly and install. If timing marks are off even one tooth, engine cannot run correctly.
11. See Figure 3-56. Install a **new** dry gasket (3) on gearcase cover (2).

Figure 3-60. Cam, Pinion Gear and Timing Mark Indexing (cam #2 "V" marks are not used for timing)

12. Lubricate all cam bushings in gearcase cover with SCREAMIN' EAGLE ASSEMBLY LUBE.

13. See Figure 3-61. Install gearcase cover. Tighten in sequence to 120-140 **in-lbs** (13.6-15.8 N-m).

14. Measure cam gear end play. See Cam Gear End Play (Page 3-34).

6. See Figure 3-56. Install rear exhaust cam (4). Rotate cam

Figure 3-61. Gearcase Cover Mounting Screw Torque Sequence

TAPPETS

FASTENER	TORQUE VALUE	
Tappet cover, anti-rotation mounting screw	100-120in-lbs	11.3-13.6 N-m

General

See Figure 3-62. The tappet and roller (4), under compression force from valve spring, follow the surface of the revolving cam. The up-and-down motion is transmitted to the valve by the pushrod and rocker arm. The tappet contains a piston (2) and cylinder. The check valve (3) allows the unit to fill with engine oil (1) reducing clearance in the valve train. The unit automatically compensates for heat expansion to maintain minimal clearances between the cam and the pushrod.

It is normal for tappets to click when engine is started after standing for some time. Tappets have a definite leakdown rate which permits the oil in the tappets to escape. This design allows units to compensate for various expansion conditions of parts and still maintain minimal clearances. Tappets are functioning properly if they become quiet after a few minutes of engine operation.

Figure 3-62. Tappet Assembly

Cleaning and Inspection

A WARNING

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

1. Clean all parts, except roller/tappet assembly, in solvent. Blow dry with compressed air.
2. Measure valve tappet OD and crankcase bore ID to calculate clearance. If guide clearance exceeds specification, replace the tappets and/or crankcases. Refer to Table 3-28.
3. Measure tappet roller free play. Recommended service practice is tappet replacement.
4. Measure tappet roller end clearance.
5. Soak tappets in clean engine oil and kept covered until assembly.
6. Apply SCREAMIN' EAGLE ASSEMBLY LUBE to rollers and OD of tappet before installation.

Installation

1. See Figure 3-63. Rotate engine so that both tappets (3) from the cylinder being serviced are installed on the base circle (lowest position) of the cam.
2. Apply a liberal amount of engine oil to tappet assembly (especially roller needles) for smooth initial operation.

Table 3-28. Valve Tappet Specifications

ITEM	SERVICE WEAR LIMIT	
	in	mm
Tappet clearance in guide	0.0030	0.076
Tappet roller free play (clearance on pin)	0.0015	0.038
Tappet roller end clearance	0.026	0.660

NOTE

Face the flats of the tappets front and rear when installed in the engine and with the oil feed hole toward the gear cover.

3. Insert the intake and exhaust tappets into the anti-rotation blocks (2).
4. Install anti-rotation blocks with tappets into bore in right crankcase (4). Secure with screw (1). Tighten to 100-120 in-lbs (11.3-13.6 N-m).

NOTE

The front tappet cover has a tab on the front or right side.

The rear tappet cover has a tab on the rear or left side.

5. Install the tappet covers, pushrod covers, and pushrods. See Tappet Covers, Pushrod Covers and Pushrods (Page 3-26).

1. Screw (2)
2. Anti-rotation device (2)
3. Tappet (4)
4. Right crankcase

Figure 3-63. Tappet Components

PART NUMBER	TOOLNAME
HD-45968	FAT JACK
HD-46284	ENGINE HOOK

1. Raise the motorcycle.

PROCEDURE

a. Secure front wheel.

b. Place jack under frame to support rear of motorcycle.

Special Tool: FAT JACK (HD-45968)

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

3. Remove seat.

4. Remove left side cover. See Left Side Cover (Page 2-60).

A WARNING

Prevent accidental vehicle start-up, which could cause death or serious injury. First disconnect negative (■) battery cable at engine and then positive (+) **cable from battery. (00280b)**

5. Disconnect battery. See BATTERY MAINTENANCE (Page 1-47).

6. Drain transmission. See TRANSMISSION LUBRICANT (Page 1-21).

7. Drain engine oil. See ENGINE OIL AND FILTER (Page 1-12). Do not install drain plug back in end of drain hose now.

8. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).

9. Remove right front footrest assembly and rear brake linkage.

   a. **Mid-mount controls:** See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

   b. **Forward controls:** See RIDER FOOT CONTROLS: FORWARD (Page 2-120).

10. Remove sprocket cover. See TRANSMISSION SPROCKET (Page 5-41).

11. Remove exhaust mounting bracket. See Mounting Bracket (Page 4-40).

12. Loosen rear axle nut and move rear axle all the way forward. Tighten axle nut enough to hold the axle and wheel in position in the rear fork. Remove drive belt from transmission sprocket. See Drive Belt (Page 5-13).

13. Disconnect oil tank feed, vent and return hoses from oil tank. See OIL TANK (Page 3-85).

14. Remove fuel tank. See FUEL TANK (Page 4-10).

15. Remove air cleaner assembly.

    a. See All Models (Page 4-8).

    b. **EVAP models:** Remove EVAP purge hose from induction module. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

16. Unplug the following connectors from the induction module:

    a. Fuel injector connectors [84], [85].

    b. TMAP sensor [80].

    c. IAC [87].

    d. TPS [88].

17. Remove push-in fastener securing induction module wire harness to wire caddy.

18. Disconnect throttle and idle cables from induction module. See Removal (Page 2-87).

NOTE

Record cable strap positions. Remove cable straps from stator harness.

19. Unplug the following electrical connectors from the engine:

    a. Main wire harness ground wire at powertrain ground stud on crankcase.

    b. Spark plug wires.

    c. Oil pressure switch [120]. See Oil Pressure Switch (Page 6-46).

    d. CKP sensor [79]. See Crank Position Sensor (CKP) (Page 6-43).

    e. Sidestand switch connector on frame.

    f. Alternator AC connector [46] and DC connector [47]. Remove three cable straps securing stator harness and neutral lead to frame. See Figure 3-66. See VOLTAGE REGULATOR (Page 6-47).

    g. Neutral indicator switch connector [136]. Remove barbed cable strap. See Neutral Indicator Switch (Page 6-45).

h. VSS [65]. See Vehicle Speed Sensor (VSS) (Page 6-44).

i. Starter relay wire at starter motor. See STARTER (Page 6-20).

j. ET sensor [90]. Cut the barbed cable strap securing sensor harness to oil tank mounting bracket. Remove cable strap. See ENGINE TEMPERATURE (ET) SENSOR (Page 4-28).

20. Remove battery positive cable from starter and battery negative cable from ground. See BATTERY CABLES (Page 6-13).

21. Disconnect clutch cable. Remove from clutch lever on left handlebar. Remove cable clips securing clutch cable to frame left front downtube. See CLUTCH CONTROL (Page 2-91).

22. Remove push-in fasteners securing right wire harness caddy to coil bracket. Discard push-in fasteners. Remove screw securing ignition switch to coil bracket, if equipped. Unplug spark plug wires from coil. Unplug ignition coil harness connector [83) from coil. Remove coil and bracket from frame. See IGNITION COIL (Page 6-18).

23. Remove screw securing left wire harness caddy to right wire harness caddy. Separate caddies. See Removal (Page 6-52).

24. Unplug the following harness connectors located in the wire harness caddies:

    a. Instruments connector [20).

    b. Headlamp connector [38].

    c. Right side control connectors [22-1,22-2].

    d. Leftside control connector [24].

    e. Front turn signal connector [31].

    f. Front wheel speed sensor [167], if equipped.

25. Remove wire harness caddy latch clip from frame backbone.

26. Slide left wire harness caddy between frame and engine, toward right side of vehicle. Move wire harness caddies and wiring harnesses out of the way.

27. EVAP models: Remove EVAP canister and EVAP canister clip, leaving hoses connected. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

28. ABS models: Remove EHCU assembly from frame and unplug connector. Pull EHCU harness out from between engine and frame to prevent damage during engine removal. See Removal (Page 2-57).

29. Remove stabilizers. See STABILIZER LINKS (Page 2-80).

    a. Remove rear stabilizer link assembly.

    b. Remove upper front stabilizer link assembly.

    c. Remove lower front stabilizer link assembly.

30. Remove rider left footrest and mounting bracket assembly and shift lever.

    a. **Mid-mount controls:** See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

    b. **Models with forward controls:** See RIDER FOOT CONTROLS: FORWARD (Page 2-120).

NOTE

Keep master cylinder upright. Ifthe reservoir is inverted, bleed the rear brake.

31. **Models without passenger footrests:**

    a. Remove brake line bracket (left side). See Brake Lines (Page 2-44).

    b. Remove bolts securing rear master cylinder. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).

    c. Remove two bolts and master cylinder mounting bracket.

32. **Mid-mount controls:**

    a. **Non-ABS models:** See Figure 3-64. Remove fasteners (13) and J-clip (14) from each side of frame.

    b. **ABS models:** Remove fasteners (13) and J-clip (14) from left side of frame. Remove fasteners (13) securing ABS brake line bracket (17) to right side of frame.

33. Loosen, but do not remove, two front isolator mounting bracket screws (11) on left side of engine.

34. Loosen, but do not remove, two rear isolator mounting bracket screws (3) on left side of engine.

35. Attach ENGINE HOOK (PART NUMBER: HD-46284) and engine hoist. Carefully raise engine enough to relieve pressure from mounting bolts.

36. Remove front engine mount bolt (10) and nut (12).

37. Remove two screws (11) and front isolator mount (9).

38. Remove retaining ring (16), nut (15) and rear fork pivot bolt (1). Pull rear fork back until fork pivot bosses clear the frame. See REAR FORK (Page 2-76).

39. Remove two screws (3) and rear isolator mounting bracket (2) from frame.

40. Remove left side isolators from mounts.

41. Lift engine as necessary and swing assembly out from chassis toward the left side. Swing rear of engine out first. Then remove engine from chassis.

1. Bolt (2)
2. Rear isolator mount
3. Screw (2)
4. Rear fork pivot shaft
5. Rear pivot lockplate
6. Screw (3)
7. Rear isolator (2)
8. Front isolator (2)
9. Front isolator mount
10. Front mount bolt
11. Screw (2)
12. Nut
13. Screw (4)
14. J-clip (2)
15. Nut
16. Retaining ring
17. Brake line bracket (ABS only)

Figure 3-64. Engine Mount and Isolator Components (typical)

PART NUMBER	TOOLNAME
HD-46284	ENGINE HOOK

FASTENER	TORQUE VALUE	
Axle, rear, nut	95-105 ft-lbs	129-142 N-m
Brake line fastener	120-180 in-lbs	13.6-20.3 N-m
Engine mount, front, bolt	95-105 ft-lbs	129-142 N-m
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m
Isolator mount, front, screw	25-35 ft-lbs	33.9-47.5 N-m
Isolator mount, rear, screw	25-35 ft-lbs	33.9-47.5 N-m
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m
Wire harness ground wire	55-75 in-lbs	6.2-8.5 N-m

PROCEDURE

1. See Figure 3-64. Make sure pivot shaft (4) and rear pivot lockplate (5) are mounted on engine mounting boss at rear of engine. Position right rear isolator (7) on pivot shaft on rear of engine. Do not Install left rear isolator now.

2. Position right front isolator (8) on front of engine. Do not Install left front isolator now.

3. Attach engine hook and engine hoist to engine.

   Special Tool: ENGINE HOOK (HD-46284)

NOTE

Make sure rear isolator locator tabs line up with slots in frame.

4. Lift engine and swing assembly into chassis from left side. Swing front of engine in first.

5. Install left rear isolator (7) over pivot shaft (4). Install rear isolator mount (2) over left rear isolator and attach to frame with two screws (3). Leave fasteners loose.

6. Raise or lower engine until right front isolator lines up with mounting hole in frame.

7. Install left front isolator (8) and front isolator mount (9) to left side of frame with two screws (11). Leave fasteners loose.

8. Insert front engine mount bolt (10) from left side, through isolators and crankcase boss. Place nut (12) on bolt but do not tighten now.

9. Tighten two screws (11) securing front isolator mount (9).

   Torque: 25-35 ft-lbs (33.9-47.5 N-m) *Isolator mount, front, screw*

10. Tighten two screws (3) securing rear isolator mount (2).

    Torque: 25-35 ft-lbs (33.9-47.5 N-m) *Isolator mount, rear, screw*

11. Install rear fork. See REAR FORK (Page 2-76).

12. Tighten front engine mount bolt (10) and nut (12).

    Torque: 95-105 ft-lbs (129-142 N-m) *Engine mount, front, bolt*

13. Remove engine hook .

    Special Tool: ENGINE HOOK (HD-46284)

NOTE

Check each end of the stabilizer links for excessive wear before installation. The spherical ball end may rotate loosely, but should not have any lateral movement. Replace the link if lateral movement exists.

14. Install stabilizers. See STABILIZER LINKS (Page 2-80).

    a. Install lower front stabilizer link assembly.

    b. Install upper front stabilizer link assembly.

    c. Install rear stabilizer link assembly.

15. Models without passenger footrests:

    a. Install rear brake master cylinder bracket. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).

    b. Install brake line bracket. Tighten fasteners to 120-180 in-lbs (13.6-20.3 N-m).

16. Place belt into position over sprockets.

17. Install rear master cylinder to bracket. See REAR BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-35).

18. Install shift lever and rider left footrest and mounting bracket assembly:

    a. Mid-mount controls: See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

    b. Forward controls: See RIDER FOOT CONTROLS: FORWARD (Page 2-120).

19. ABS models: Install EHCU bracket. See Installation (Page 2-58).

NOTE

Verify that the EVAP canister mounting hardware does not contact the rear stabilizer ground strap.

20. EVAP models: Install EVAP mounting bracket, canister and hoses. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

NOTE

Route rear spark plug wire through wire harness caddy

21. Position left and right wire harness caddies on either side of frame backbone. Plug in the following connectors, located in the caddies:

    a. Instruments connector [20].

    b. Headlamp connector [38].

    c. Right hand control connectors [22-1,22-2].

    d. Left hand control connector [24].

    e. Front turn signal connector [31].

    f. Front wheel speed sensor [167] (if equipped).

22. See Figure 3-65. Position the wiring harnesses, the right wire harness caddy and the throttle cables between the coil bracket uprights. Install **new** cable straps (1,2).

23. Mount caddies together. Verify tabs on caddies engage each other and frame backbone bracket. Secure with screw. See MAIN WIRING HARNESS AND ELECTRICAL CADDIES (Page 6-52).

24. Position ignition coil and bracket on frame behind steering head.

Figure 3-65. Ignition Coil

25. Install ignition coil. Plug ignition coil harness connector into coil. See IGNITION COIL (Page 6-18). Secure right wire harness caddy to coil bracket with **new** push-in fasteners.

26. Plug spark plug cables into coil. Connect spark plug wires to spark plugs.

27. Connect clutch cable to clutch lever on handlebar. Adjust clutch. See CLUTCH CONTROL (Page 2-91).

28. Plug the following electrical connectors into the engine:

    a. Engine Temperature (ET) sensor connector. See ENGINE TEMPERATURE (ET) SENSOR (Page 4-28).

    b. Vehicle Speed Sensor (VSS) connector [65]. See Vehicle Speed Sensor (VSS) (Page 6-44).

NOTE

Route starter relay wire behind VSS wiring to avoid contact with belt.

    c. Starter relay wire at starter motor. See STARTER (Page 6-20).

    d. Install battery positive cable to starter post and battery negative cable to crankcase stud. See BATTERY CABLES (Page 6-13).

    e. Install main harness ground cable to powertrain ground stud on crankcase. Tighten fastener to 55-75 **in-lbs** (6.2-8.5 N-m).

    f. Neutral indicator switch connector [136]. See Neutral Indicator Switch (Page 6-45).

    g. Alternator AC connector [46] and DC connector [47]. See VOLTAGE REGULATOR (Page 6-47).

    h. Crank position (CKP) sensor connector [79]. See Crank Position Sensor (CKP) (Page 6-43).

    i. Jiffy Stand Sensor (JSS) connector. Install into J-clip. On models not equipped with JSS, connector from harness is installed with a plug.

    j. Oil pressure switch connector [120]. See Oil Pressure Switch (Page 6-46).

    k. See Figure 3-66. Install lower right frame tube cable straps.

29. Install throttle and idle cables to induction module. See Installation (Page 2-88).

30. Connect the following connectors to the induction module. See INDUCTION MODULE (Page 4-14).

    a. Throttle position sensor (TPS) connector [88].

    b. Idle Air Control (IAC) connector [87].

    c. Temperature Manifold Absolute Pressure (TMAP) sensor connector [80].

    d. Fuel injector connectors [84], [85].

31. Install horn. See HORN (Page 6-51).

32. Install air cleaner assembly. See All Models (Page 4-8).

33. **EVAP models:** Install EVAP purge hose on induction module. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

34. Using **new** hose clamps, install oil tank feed, vent and return hoses onto oil tank. Install drain plug in the end of the drain hose. Secure with worm drive clamp. Tighten securely. Install drain hose to frame with clip. See OIL TANK (Page 3-85).

35. Install exhaust pipe bracket to crankcase. See Exhaust Pipe Bracket (Page 4-40).

36. Install sprocket cover. See TRANSMISSION SPROCKET (Page 5-41).

37. Install exhaust pipe clamp bracket, washer and screw to sprocket cover. Tighten.

    Torque: 30-33 ft-lbs (40.7-44.7 N-m) *Exhaust pipe clamp bracket screw*

38. Tighten other two sprocket cover screws.

    Torque: 80-120 **in-lbs** (9-13.6 N-m) *Sprocket cover, forward and lower screws*

39. Install right front footrest assembly and rear brake linkage.

    a. **Mid-mount controls:** See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

    b. **Forward controls:** See RIDER FOOT CONTROLS: FORWARD (Page 2-120).

40. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

NOTE

H02S is installed in lower clip only.

41. See Figure 3-67. Attach clutch cable (along with wiring harness and front HO2S harness) to frame front left downtube with cable clips.

Figure 3-66. Lower Right Frame Tube Cable Straps

Figure 3-67. Frame Retaining Clips

42. Adjust belt tension and rear wheel alignment. Tighten rear axle nut.

    Torque: 95-105 ft-lbs (129-142 N-m) *Axle, rear, nut*

43. Install **new** E-clip. See WHEEL ALIGNMENT (Page 1-52).

J.WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

44. Install fuel tank See FUEL TANK (Page 4-10).

45. Add engine oil. See Changing Oil and Filter (Page 1-13).

46. Fill primary chaincase/transmission with FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT. See TRANSMISSION LUBRICANT (Page 1-21).

^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)

47. Connect battery. See BATTERY MAINTENANCE (Page 1-47).

48. Install left side cover. See Left Side Cover (Page 2-60).

49. Install seat. After installing seat, pull up on the seat to make sure that it is secure.
50. Perform engine oil level hot check. See Checking and Adding Oil (Page 1-12).

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR

1. See Figure 3-68. Clamp VALVE SPRING COMPRESSOR (PART NUMBER: HD-34736-B) in vise. Compress valve spring.
2. See Figure 3-69. Remove valve collar retainers (7), upper valve spring collar (6) and valve spring (5). Mark valve collar retainers for reassembly in original positions.
3. Use a fine tooth file to remove any burrs on the valve stem at the retainer groove. Mark valve to match with cylinder head.
4. Remove valve (1), valve seal and lower valve spring collar (4) by hand. No special tools are required to remove valve seal and lower valve spring collar assembly.

Figure 3-68. Valve Spring Compressor

Figure 3-69. Cylinder Head

CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
B-45525	VALVE GUIDE HONE
HD-34751	CLEANING BRUSH
HD-96796-47	VALVE SPRING TESTER

Cylinder Heads

A WARNING

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

1. Bead blast or scrape carbon from head and valve ports. Be careful to avoid scratching or nicking cylinder head-to-cylinder joint faces. Blow off loosened carbon or dirt with compressed air.
2. Soak cylinder head in an aluminum-compatible cleaner/solvent to loosen carbon deposits.

3. Wash all parts in non-flammable solvent, followed by a thorough washing with hot, soapy water.

A WARNING

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

4. Blow out oil passages in head. Be sure they are free of sludge and carbon particles.

5. Remove loosened carbon from valve head and valve stem using a wire wheel. Never use a file or other hardened tool which could scratch or nick valve.

6. Polish valve stem with very fine emery cloth or steel wool.

7. See Figure 3-70. Check head gasket surface on head for flatness. Machine or replace any head which exceeds SERVICE WEAR LIMIT of 0.006 in (0.152 mm).

Figure 3-70. Gasket Surface: Flat Within 0.006 in (0.152 mm)

Rocker Arm Assemblies

1. Check each rocker arm at pad end and pushrod end for uneven wear or pitting. Replace rocker arm if either condition exists.

NOTE

Most of the wear in rocker arm shafts *and bores results from the up and down movement of the pushrods and valves. Therefore, the following measurements should be taken top-to-bottom on rocker arm* shafts *and bores.*

2. See Figure 3-71. Measure and record rocker arm shaft diameter at the positions where rocker arm bushings ride and where shaft fits in inner rocker cover.

Figure 3-71. Measuring Rocker Arm Shaft Diameter at Bushing Position (top) and Cover Position (bottom)

3. Measure and record rocker arm shaft bore diameters.
   a. See Figure 3-72. Measure rocker arm shaft bore in inner rocker cover.
   b. See Figure 3-73. Measure rocker arm bushing inner diameter.

4. Check clearances and measurements obtained in step 3 against specifications in Specifications (Page 3-3). Repair or replace parts exceeding Service Wear Limits. If rocker arm bushings require replacement, see Replacing Rocker Arm Bushings (Page 3-56).

5. See Figure 3-74. Assemble rocker arms and rocker arm shafts into inner rocker cover.

6. Check end play of rocker arm with feeler gauge. Replace rocker arm or inner rocker cover or both if end play exceeds 0.025 in (0.635 mm).

Figure 3-72. Measuring Rocker Arm Shaft Bore Diameter in Inner Rocker Cover

Figure 3-73. Measuring Rocker Arm Bushing Inner Diamet

Valves

er

Figure 3-74. Assembling Inner Rocker Cover (typical)

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 necessary.
3. Inspect for burrs around the valve stem retainer groove. Remove burrs with a fine tooth file if found.
4. Inspect valves. Replace as necessary.
   a. Verify a seating surface width of 0.040-0.062 in (1.02-1.57 mm).
   b. Check for pit marks and burn spots.
   c. Verify color of carbon on exhaust valves as black or dark brown.
   d. Check for white or light buff carbon indicating excessive heat and burning.

Valve Seats

NOTE

Valve seats are subject to wear, pitting, and burning. Resurface valve seats after finishing valves.

1. Inspect valve seats for cracking, chipping or burning. Replace valve seats if necessary.

Figure 3-75. Measuring Valve Stem Protrusion

2. See Figure 3-75. Check valve seats for recession by measuring valve stem protrusion.
   a. Wipe valve seats and valve faces clean. Insert valve into valve guide.
   b. Measure valve stem protrusion from end of valve stem to machined surface of head upon which the lower valve collar sits, as shown. If valve stem protrudes more than 2.082 in (52.883 mm), replace valve seat or cylinder head.

NOTE

If the valve seat is loose or is not fully seated in the head, seat movement will prevent the proper transfer of heat from the valve. The valve seat surface must be flush with (or below) the head surface. See Specifications (Page 3-3) for valve seat-to-cylinder head fit.

Valve Guides

1. Clean valve guides by lightly honing with VALVE GUIDE HONE (PART NUMBER: B-45525).
2. Scrub valve guides with CLEANING BRUSH (PART NUMBER: HD-34751) and hot soapy water.
3. Measure valve stem outer diameter and valve guide inner diameter. Replace if the guides do not match specifications. See Specifications (Page 3-3).

Valve Springs

1. Inspect valve springs for damaged or discolored coils.
2. See Figure 3-76. Measure free length of each spring. Refer to Table 3-29.

3. Test compression force of spring using VALVE SPRING TESTER (PART NUMBER: HD-96796-47). Refer to Table 3-

4. Replace as necessary.

Figure 3-76. Checking Spring Free Length

Table 3-29. Valve Spring Specifications

SPRING	U.S.	METRIC
Length (min)	2.325 in	59.1 mm
Compression (min)	297 lb @ 1.300 in	1321 **N** @33.02 mm
Compression (max)	327 lb@ 1.300 in	1455 N @ 33.02 mm

29.

Spark Plug Threads

Inspect spark plug threads for damage. If threads in cylinder head are damaged, a special plug type insert can be installed using a 12 mm spark plug repair kit.

Pushrods

Examine pushrods, particularly the ball ends. Replace any rods that are bent, worn, discolored or damaged.

PART NUMBER	TOOL NAME
HD-94804-57	ROCKER ARM BUSHING REAMER

REPLACING ROCKER ARM BUSHINGS

1. See Figure 3-77. To replace worn bushings, press or drive them from the rocker arm. If bushing is difficult to remove, turn a 9/16-18 tap into bushing. From opposite side of rocker arm, press out bushing and tap using a discarded rocker arm shaft.
2. Press replacement bushing into rocker arm, flush with rocker arm end, and split portion of bushing towards top of rocker arm.
3. Using remaining old bushing as a pilot, line ream **new** bushing with ROCKER ARM BUSHING REAMER (PART NUMBER: HD-94804-57).
4. Repeat for other end of rocker arm.

Figure 3-77. Replacing Rocker Arm Bushings

REFACING VALVE SEATS

PART NUMBER	TOOLNAME
B-35758-52A	7.02MM PILOT
HD-34751	CLEANING BRUSH
HD-35758-D	NEWAY VALVE SEAT CUTTER SET

PART NUMBER	TOOL NAME
HD-39786	I CYLINDER HEAD HOLDING FIXTURE

NOTE

- *Check that valve stem to valve guide clearance is correct before refacing. Refer to Table 3-30. If **new** valve guides must be installed, see Replacing Valve Guides (Page 3-58) and 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 degree valve face and the 46 degree valve seat.*
- *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 preignition.*

1. Secure cylinder head for servicing.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (PART NUMBER: HD-39786) into cylinder head spark plug hole.
   b. Clamp fixture in vise. Tighten cylinder head onto the fixture to prevent any movement during operation.
   c. Place cylinder head at a 45 degree angle or one that offers a comfortable working position.
2. To determine the correct location of the 46 degree valve seat in the head, measure the width of the valve. Subtract 0. 080 in (2.032 mm) from that number.
3. Set your dial caliper to the lesser measurement. Lock the caliper for reference. This is the location of your valve seat.
4. Use a permanent magic marker to highlight the valve seat area to be cut. Highlight all three angles. Allow marker to dry.

NOTE

- *Clean the cutter blades and cutter pilot. The correct cleaning brush is supplied with the Neway tool set.*
- *Clean the inside of the valve guide with the VALVE GUIDE BRUSH.*

Figure 3-78. Neway Valve Seat Cutter Set (Part No. HD-35758-C)

5. See Figure 3-78. Obtain the NEWAY VALVE SEAT CUTTER SET (PART NUMBER: HD-35758-D). Select the correct 7.02MM PILOT (PART NUMBER: B-35758-52A). Securely seat the pilot by pushing down and turning using the installation tool supplied in the tool set.
6. Choose the proper 46 degree cutter (intake or exhaust) and gently slide the cutter onto the pilot. Do not drop the cutter onto the valve seat.

NOTE

Do not remove any more metal than is necessary.

7. Apply constant pressure. Cut the seat to a uniform finish and to remove pitting.

NOTE

- *If the width of the clean-up angle is greater on one side of the valve seat than the other, replace the valve guide.*
- *After making the 46 degree cut, a groove cut completely around the valve seat indicates worn cutter blades. This condition can be corrected by staggering the blades. Loosen all blades. Move each blade slightly 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 degree will help in determining where new angles are.*

8. Lock a dial caliper to the predetermined setting. Measure the 46 degree cut at the outermost edge at the widest point of the circle to determine the next cut.
   a. If the 46 degree cut is too high (towards the combustion chamber), use the 31 degree cutter to lower the valve seat closer to the port.
   b. If the 46 degree cut is too low, use the 60 degree cutter to raise the valve seat or move it away from the port.

NOTE

- *Because you are using the top measurement of the valve seat as a reference point, it will usually be necessaiy to use the 31 degree cutter following the initial 46 degree cut.*
- *Always highlight the valve seat with the permanent magic marker in order to verify the location of the 46 degree valve seat.*

9. If the location of the valve seat is not correct, repeat previous two steps.
10. When you accomplish a complete clean-up of the 46 degree angle and the width is at least 0.062 in (1.575 mm), proceed to the next step.
11. Select the proper 60 degree cutter and gently slide the cutter down the cutter pilot to the valve seat.
12. Remove just enough material to provide an even valve seat width of 0.040-0.062 in (1.016-1.575 mm).
13. Remove cutter and cutter pilot.
14. Repeat the process on any valve seat that needs service.

15. Insert valve in the valve guide and bottom on the valve seat. Position the cylinder head port upwards with slight thumb pressure against the valve. Fill the port with solvent to seal the valve to the seat.

NOTE

Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve seat for irregularities or defects and if necessary repeat the above cutting process.

16. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water.

17. Scrub valve guide bores with CLEANING BRUSH (PART NUMBER: HD-34751) and hot, soapy water.

A WARNING

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

18. Blow parts dry with low pressure compressed air.

Figure 3-79. Intake and Exhaust Valve and Seat Dimensions

Replacing Valve Seats

Replacing a valve seat is a complex operation requiring special equipment. If the valve seat is loose or not fully seated, transfer of heat from the valve will be impaired. The valve seat surface must be flush with or below the head surface. See Specifications (Page 3-3).

PART NUMBER	TOOL NAME
B-45524-A	VALVE GUIDE REMOVER/INSTALLER
B-45525	VALVE GUIDE HONE
HD-34751	CLEANING BRUSH
HD-39782-A	CYLINDER HEAD SUPPORT STAND
HD-39786	CYLINDER HEAD HOLDING FIXTURE
HD-39847	REAMER T-HANDLE
HD-39964	VALVE GUIDE REAMER

REPLACING VALVE GUIDES

Replace valve guides before grinding valve seats. The valve stem bore in valve guide determines valve seat grinding location. If valve stems and/or valve guides are worn beyond service wear limits, install **new** parts. Refer to Table 3-30.

Removal

NOTE

Always use cylinder head support stand. Misalignment during valve guide replacement can damage cylinder head valve guide bore.

1. See Figure 3-80. Prepare cylinder head for valve guide replacement.
   a. Insert sleeve of intake (4 or 6) or exhaust (5 or 7) seat adapter into tube at top of CYLINDER HEAD SUPPORT STAND (PART NUMBER: HD-39782-A) (3).
   b. Center valve seat on seat adapter.

NOTE

Do not press out the valve guide from the bottom of the cylinder head. Excessive carbon buildup prevents a proper interference fit for valve guides.

2. See Figure 3-81. At top of the cylinder head, insert VALVE GUIDE REMOVER/INSTALLER (PART NUMBER: B-45524-A) (1) into valve guide bore until tool shoulder contacts end of valve guide.

NOTE

See Figure 3-80. Installer sleeve (2) is not used for valve guide removal.

3. Center VALVE GUIDE REMOVER/INSTALLER under press ram (3). Apply pressure until valve guide drops free of cylinder head. Discard valve guide.

Table 3-30. Valve Stem Clearance and Service Wear Limits

VALVE	CLEARANCE		SERVICE WEAR LIMIT	
	in	mm	in	mm
Intake	0.001-0.003	0.0254-0.0762	0.0035	0.0965
Exhaust	0.001-0.003	0.0254-0.0762	0.0035	0.0965

Table 3-31. Valve Guide Remover and Installer Components

PART NO	ITEM
B-45524-A	Valve guide remover/installer with installer sleeve
HD-39782-A	Cylinder head support stand
HD-39782-2	Intake seat adapter, 883
HD-39782-3	Exhaust seat adapter, 883
HD-39782-6	Intake seat adapter, 1200
HD-39782-7	Exhaust seat adapter, 1200

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Figure 3-80. Valve Guide Replacement Tools

Valve guide remover/installer Installer sleeve Cylinder head support stand Intake seat adapter, 883 Exhaust seat adapter, 883 Intake seat adapter, 1200 Exhaust seat adapter, 1200

Figure 3-81. Removing Shoulderless Valve Guide

Installation

1. Check valve guide to valve guide bore clearance.

   a. Measure outer diameter of a **new** standard valve guide.

   b. Measure the cylinder head valve guide bore. The valve guide diameter should be 0.0020-0.0033 in (0.0508-0.0838 mm) larger than cylinder head valve guide bore.

   c. If interference fit is within specification, use a replacement valve guide. If interference fit is not within specification, replace the cylinder head.

2. Measure cylinder head bore and outside diameter of replacement valve guide to verify correct interference fit.

NOTE

Always use cylinder head support stand. Misalignment during valve guide replacement can damage cylinder head valve guide bore.

3. Prepare cylinder head for valve guide replacement.

   a. See Figure 3-80. Insert sleeve of intake (4 or 6) or exhaust (5 or 7) seat adapter into tube at top of cylinder head support stand (3). Position cylinder head so that valve seat is centered on seat adapter.

   b. Apply petroleum jelly to lightly lubricate external surfaces of valve guide. Spread lubricant so that thin film covers entire surface area.

   c. Start valve guide into bore at top of cylinder head.

   d. Place installer sleeve (2) over valve guide. Insert VALVE GUIDE REMOVER/INSTALLER (1) into installer sleeve.

   e. See Figure 3-82. Center VALVE GUIDE REMOVER/INSTALLER (1) under press ram. Apply pressure until valve guide is started in bore. Back off ram slightly to allow valve guide to center itself.

NOTE

Always back off ram to allow the valve guide to find center Pressing valve guide into cylinder head in one stroke can damage remover/installer, valve guide and/or cylinder head.

   f. Verify that cylinder head support stand (3) and VALVE GUIDE REMOVER/INSTALLER are square. Center VALVE GUIDE REMOVER/INSTALLER under ram and press valve guide further into bore, then back off ram again to allow valve guide to find center.

   g. Repeat previous step and then apply pressure to VALVE GUIDE REMOVER/INSTALLER until installer sleeve (2) contacts machined area of cylinder head surrounding valve guide.

Figure 3-82. Installing Shoulderless Valve Guide

4. Secure cylinder head for service.

   a. See Figure 3-83. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (PART NUMBER: HD-39786) (3) 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.

Figure 3-83. Reaming Valve Guide Bore

NOTE

- *Avoid damage to valve guide bore. Never back reamer out of valve guide.*
- *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.*

5. Obtain the B-45523-A (VALVE GUIDE REAMER) (2) and REAMER T-HANDLE (PART NUMBER: HD-39847) (1).

   a. Install T-handle on reamer.

   b. Start bit of reamer into bore at top of cylinder head.

   c. Placing thumb on drive socket of REAMER T-HANDLE, apply slight pressure rotating clockwise.

   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. Carefully pulling on bit, remove reamer shaft through combustion chamber side of valve guide.

NOTE

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

AWARNING

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 low pressure compressed air into the valve guide bore to remove any metal shavings or debris.

7. See Figure 3-84. Clean valve guide bore with CLEANING BRUSH (PART NUMBER: HD-34751) (1).

8. See Figure 3-85. Obtain VALVE GUIDE HONE (PART NUMBER: 8-45525) and VALVE GUIDE REAMER (PART NUMBER: 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. Complete ten to twelve strokes using entire length of finishing stone arrangement and drill. Work for a crosshatch pattern of approximately 60 degrees.

NOTE

The hone is not intended for the removal of material.

Figure 3-84. Scrubbing Valve Guide Bore

Figure 3-85. Honing Valve Guide Bore

A WARNING

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

NOTE

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

9. Direct low pressure compressed air into the valve guide bore to remove any debris.

10. See Figure 3-84. Clean bore with the VALVE GUIDE CLEANING BRUSH (1).

NOTE

Always verify valve stem to valve guide clearance after honing, since a worn reamer may cut the bore undersize.

11. 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. If valve stem to valve guide clearance is not within specification, the valve stem may be excessively worn or the valve guide bore undercut. Refer to Table 3-30.

12. 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. 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.

A WARNING

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

13. Dry parts with low-pressure, compressed air.

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR

1. Apply a liberal amount of SCREAMIN' EAGLE ASSEMBLY LUBE to the valve stem.

2. See Figure 3-90. Insert valve (1) into valve guide (3) and bottom valve on valve seat (2).

3. See Figure 3-86. Place a protective sleeve over the valve stem keeper groove. Coat the protective sleeve with SCREAMIN' EAGLE ASSEMBLY LUBE.

NOTE

- *Always use a protective sleeve on the valve stem keeper groove when installing valve stem seal. Installation without the protective sleeve will damage the seal. This will cause leaking around the valve stem, excessive oil consumption and valve sticking.*
- *See Figure 3-87. The valve seal is incorporated into the lower valve collar and is installed by hand. NO SPECIAL TOOLS ARE REQUIRED.*
- *The valve seal is completely installed when the lower valve collar contacts the machined surface of the head.*

4. See Figure 3-88. Place a **new** seal and lower valve collar assembly over valve stem and onto valve guide.

NOTE

- *Do not remove valve after seal is installed. Otherwise, sharp edges on keeper groove will damage seal.*
- *A single valve spring is used for each valve.*

Figure 3-86. Valve Guide Seal Protector Sleeve

sm01534d

Figure 3-87. Valve Seal and Lower Valve Collar Assembly (seal and lower collar replaced as assembly only)

Figure 3-88. Valve Seal and Lower Valve Collar Assembly Installation

5. See Figure 3-90. Install valve spring (5) and upper collar (6).
6. See Figure 3-89. Compress valve spring with VALVE SPRING COMPRESSOR (PART NUMBER: HD-34736-B).
7. See Figure 3-90. Insert valve collar retainers (7) into upper collar, making sure they engage groove in valve stem. The retainer gaps should be equal.
8. Release and remove VALVE SPRING COMPRESSOR.
9. Repeat previous steps for remaining valve(s).

Figure 3-89. Valve Spring Compressor

1. Valve
2. Valve seat
3. Valve guide
4. Valve seal and lower spring collar
5. Spring
6. Upper valve spring collar
7. Collar retainer

Figure 3-90. Cylinder Head

CLEANING, INSPECTION AND REPAIR

PART NUMBER	TOOL NAME
HD-33446-86	XL EVOLUTION TORQUE PLATE BOLTS
HD-33446-B	CYLINDER TORQUEPLATES

1. Soak cylinder and piston in an aluminum-compatible cleaner/solvent until deposits are soft. Clean with a brush. Blow off loosened carbon and dirt particles. Wash in solvent.

A WARNING

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

2. Clean oil passage in cylinder with low pressure compressed air.

3. Clean piston ring grooves with a piece of compression ring ground to a chisel shape.

4. Inspect piston pin to see that it is not pitted or scored.

5. Check piston pin bushing to see that it is not loose in connecting rod, grooved, pitted or scored.

   a. A piston pin properly fitted to upper connecting rod bushing has a 0.00125-0.00175 in (0.0317-0.0444 mm) clearance in bushing.

   b. If piston pin-to-bushing clearance exceeds 0.002 in (0.0508 mm), replace worn parts. See Connecting Rod Bushings (Page 3-68).

6. Clean piston pin lock ring grooves.

7. Inspect piston and cylinder for cracks, burnt spots, grooves and gouges.

NOTE

Check connecting rod for up and down play in lower bearings. When up and down play is detected, replace flywheel and connecting rod assembly

Checking Gasket Surface

NOTE

Replace the cylinder and piston if either cylinder gasket surface does not meet specification.

1. See Figure 3-91. Check that cylinder top (head) gasket surface is flat within 0.006 in (0.15 mm).

   a. Lay a straight edge across the surface.

   b. Insert a feeler gauge between the straightedge and the gasket surface.

2. Check that the cylinder base gasket surface is flat within 0. 008 in (0.2 mm).

   a. Lay a straightedge across the surface.

   b. Insert a feeler gauge between the straightedge and the gasket surface.

Figure 3-91. Checking Gasket Surfaces

Measuring Cylinder Bore

1. See Figure 3-92. Remove any burrs from the cylinder gasket surfaces.

2. Install a head and base gasket and CYLINDER TORQUEPLATES (PART NUMBER: HD-33446-B) and XL EVOLUTION TORQUE PLATE BOLTS (PART NUMBER: HD-33446-86). Tighten in the cylinder head torque sequence. See CYLINDER HEAD (Page 3-27).

NOTE

Torque plates simulate operating conditions. Without torque plates, measurements vary as much as 0.001 in (0.025 mm).

3. Take cylinder bore measurement in ring path, starting about A in (13 mm) from top of cylinder, measuring from front to rear, and then side to side. Record readings.

4. Measure at top, center and bottom of the ring path. Record readings. Determine if the cylinder is out-of-round, tapered or bulged. Refer to Table 3-32.

Table 3-32. Cylinder Bore Service Wear Limits

BORE SIZE	XL883 MODELS		XL1200 MODELS	
	in	mm	in	mm
Standard bore	3.0035	76.289	3.5008	88.920
0.005 in (0.13 mm) Oversize	3.0078	76.398	3.5050	89.027
0.010 in (0.25 mm) OS bore	3.0128	76.525	3.5100	89.154

NOTE

If piston clearance exceeds service limit, cylinders should be bored and honed to next standard oversize. Fit the cylinder with the oversized piston and rings. Do not fit piston tighter than 0.0007 in (0.018 mm). See Specifications (Page 3-3).

Figure 3-92. Measuring Cylinder Bore

Measuring Piston to Cylinder Fit

NOTE

- *This measurement is heat sensitive. Both piston and cylinder must be at room temperature. Holding the piston in your hand for too long can cause measurements to vary by as much as 0.002 in (0.051 mm).*
- *See Figure 3-93. The measurement is taken on bare aluminum to avoid measuring errors. An oval-shaped opening in the coating is present on each side of the piston for placement of the micrometer.*
- *See Figure 3-94. The oval openings are too small for a standard fat anvil micrometer. Use a 3-4 inch blade or ball anvil style micrometer, or a 4-5 inch micrometer with spherical ball anvil adapters.*

1. Measure the piston skirt at the oval openings. Transfer that measurement to a dial bore gauge.

NOTE

Install the torque plates on the cylinder.

2. Mark the top, middle and bottom of the piston ring travel zone with a marker. Measure at markings in cylinder parallel and perpendicular to crankshaft.
3. Replace piston and/or cylinder if running clearance exceeds 0.003 in (0.076 mm).

Figure 3-93. Measurement Area

1. **4-5 inch micrometer**
2. **Spherical ball anvil adapter (2)**

Figure 3-94. Micrometer with Anvil Adapters

Boring and Honing Cylinder

1. The cylinder must be bored with gaskets and torque plates attached. Bore the cylinder to 0.003 in (0.08 mm) under the desired finished size.

NOTE

With the torque plates installed, hone the cylinder from the crankcase end of the cylinder.

2. Use a 280 grit rigid hone followed by a 240 grit flexible ball hone to hone the cylinder. Work for a 60 degree crosshatch pattern.

   Final cylinder bore sizes are measured after honing. Refer to Table 3-33.

[NOTICE [12] [13]

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537c)

NOTE

- *When cylinder requires boring over 0.010 in (0.25 mm), replace the cylinder.*
- *Replace the cylinder if it is scuffed or grooved.*

13 Use the original piston if cylinder bore was not changed, Replace the rings. Hone the cylinder walls with a No. 240 grit

3. 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 remaining dirt or debris.

A WARNING

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

4. Hot rinse the cylinder. Dry with moisture free low pressure compressed air.

5. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder.

NOTE

*After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a **new** lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.*

6. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run.

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flexible ball hone.

Table 3-33. Cylinder Final Bore Sizes

BORE SIZE	XL 883		XL 1200	
	in	mm	in	mm
Standard bore*	3.0005	76.213	3.4978	88.844
0.005 in (0.13 mm) OS bore	3.0048	76.323	3.502	88.95
0.010 in (0.25 mm) OS bore	3.0098	76.449	3.507	89.08

*All bore sizes + 0.0002 in (0.00508 mm)

Fitting Piston Rings

See Figure 3-95. Piston rings are of two types: compression and oil control. The two compression rings are positioned in the two upper piston ring grooves. The dot on the second compression ring must face upward. Ring sets are available to fit standard and oversize pistons.

1. See Figure 3-96. Place piston in cylinder about % in (13 mm) from top. Set ring to be checked inside cylinder, squarely against piston. Remove piston and check ring end gap with thickness gauge. See Specifications (Page 3-3).

NOTE

- *Always deglaze or hone the cylinder before installing **new** rings.*
- *Always use **new** piston rings. Piston rings take a set and must not be reused.*
- *Replace a ring if the end gap exceeds specification. See Specifications (Page 3-3).*
- *If end gap is under specification, file the ring gap. Insufficient ring gap can cause ring breakage, cylinder scuffing or piston seizure.*
- *Ring end gap specifications are applicable to rings for oversized pistons.*

Figure 3-95. Piston Rings

Figure 3-96. Measuring Ring End Gap

A WARNING

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

2. Blow debris from piston oil drain holes and ring grooves with low pressure compressed air. Apply clean engine oil to piston ring grooves.
3. See Figure 3-97. Install oil control ring expander spring. Make sure ends of spring point upward. Spiral bottom oil control ring into space in ring groove below expander spring. Position oil control ring gap 90 degrees from gap in expander spring. Spiral top oil control ring into space in ring groove above expander spring. Position oil control ring gap 180 degrees from gap in bottom oil control ring.

Figure 3-97. Installing Oil Control Ring Expander Spring (typical)

4. See Figure 3-98. Use a piston ring expander tool to slip compression rings over piston into their respective grooves. Install second compression ring first, then top compression ring. Be extremely careful not to over expand or twist rings, or damage piston surface when installing rings.

NOTE

Install second compression ring with dot towards top of piston.

Figure 3-98. Installing Piston Rings

5. See Figure 3-99. Position rings so end gaps of adjacent rings are a minimum of 90 degrees apart. Ring gaps are not to be within 10 degrees of the thrust face centerline.
6. See Figure 3-100. Check for proper side clearance with thickness gauge, as shown. See Specifications (Page 3-3).

NOTE

If the ring grooves are clean and the side play is still not correct, replace the rings, the piston or both.

Figure 3-99. Position Ring End Gaps at Arrows

Figure 3-100. Measuring Ring Clearance in Groove

PART NUMBER	TOOLNAME
HD-35102	WRIST PIN BUSHING HONE
HD-39964	VALVE GUIDE REAMER
HD-94800-26A	REAMER
HD-95952-33C	CONNECTING ROD CLAMPING TOOL
HD-95970-32D	PISTON PIN BUSHING TOOL

CONNECTING ROD BUSHINGS

1. See Figure 3-101. Obtain the CONNECTING ROD CLAMPING TOOL and install as follows:
   a. Slide clamp (2) over connecting rod so that slots engage cylinder head studs. Exercise caution to avoid scratching or bending studs.
   b. With the knurled side up, screw threaded cylinders (1) onto studs to secure position of clamp.
   c. Alternately turn each clamp thumbscrew (3) a few turns to gradually fix position of connecting rod. Turning only one thumbscrew will move rod off-center, while tightening second thumbscrew can cause rod to flex or bend.
2. Install rubber hoses over remaining two cylinder studs.
3. See Figure 3-102. Obtain the PISTON PIN BUSHING TOOL (PART NUMBER: HD-95970-32D).
   a. Sparingly apply graphite lubricant to threads of bolt (6) to prolong service life and provide smooth operation.
   b. Slide receiver cup (5) onto bolt with the closed side facing bolt head.
   c. Insert bolt through upper connecting rod bushing.

1. **Threaded cylinder (2)**
2. **Clamp**
3. **Thumb screw (2)**

Figure 3-101. Connecting Rod Clamping Tool (Part No. HD-95952-33C)

Removing Upper Connecting Rod Bushings

NOTE

- *Replace the upper connecting rod bushing if the piston pin to rod bushing clearance exceeds 0.002 in (0.051 mm).*
- *Place clean shop towels in and around the crankcase bore. This prevents chips and shavings from falling into the crankcase.*
- *If CONNECTING ROD CLAMPING TOOL (PART NUMBER: HD-95952-33C) holes are too small, enlarge the holes in the tool.*

Figure 3-102. Connecting Rod Bushing Remover/Installer (Part No. HD-95970-32D)

4. Remove bushing as follows:
   a. See Figure 3-103. Slide remover side of remover/installer onto bolt. The driver is stamped to verify proper orientation.
   b. See Figure 3-102. Slide bearing (3) and flat washer (2) onto bolt (6) until they contact remover/installer (4).
   c. Thread nut (1) onto bolt until assembly is snug.
   d. Using two box end wrenches, tighten nut on bolt until bushing is free.
   e. Remove nut from bolt. Remove flat washer, bearing and remover/installer. Remove bolt from bushing bore.
   f. Remove bushing from receiver cup and discard.

NOTE

Leave CONNECTING ROD CLAMPING TOOL installed during bushing installation procedure which follows.

Figure 3-103. Remover Stackup. Use Remover Side Of Remover/Installer

Installing Upper Connecting Rod Bushings

1. See Figure 3-102. Obtain the PISTON PIN BUSHING TOOL (PART NUMBER: HD-95970-32D).
   a. Sparingly apply graphite lubricant to threads of bolt (6) to prolong service life and provide smooth operation.
   b. Slide receiver cup (5) onto bolt with the closed side facing bolt head.
   c. Insert bolt through upper connecting rod bushing bore.
   d. See Figure 3-104. Slide **new** bushing onto bolt. Start bushing into bore. Be sure that bushing is square in bore and not cocked.
   e. Slide installer side of remover/installer onto bolt until shoulder contacts bushing. The remover/installer is stamped to verify proper orientation.
   f. Slide bearing and flat washer onto bolt until they contact remover/installer.
   g. Thread nut onto bolt until assembly is snug.
   h. See Figure 3-105. Using two box end wrenches, tighten nut on bolt until collar on remover/installer bottoms against connecting rod.
2. Remove nut from bolt and remove flat washer, bearing and remover/installer. Remove bolt from bushing bore. Do not scratch or gouge bushing.

NOTE

Leave CONNECTING ROD CLAMPING TOOL installed during bushing reaming procedure which follows.

Figure 3-104. Installer Stackup

Figure 3-105. Installing New Piston Pin Bushing

Reaming Upper Connecting Rod Bushings

NOTE

Sizing bushing with less than 0.00125 in (0.0317 mm) clearance can result in a bushing loosening and/or seized pin in rod.

1. Clean up and size bushing to 0.0010-0.0005 in (0.025-0.013 mm) undersize using the REAMER (PART NUMBER: HD-94800-26A).
   a. Carefully insert bit of reamer into upper connecting rod bushing. Do not apply lubricant to reamer or bushing. Ream the bushing dry or cut will not be accurate.
   b. Install a 11/16 12-pt socket and T-handle on reamer lug.
   c. Placing thumb on drive socket, apply slight pressure on reamer while rotating handle/drive socket clockwise.

NOTE

For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bushing bore will be tapered if pressure is not centrally applied.

   d. Continue rotating handle/drive socket until entire bit has passed through bushing and shank of reamer rotates freely in the bore.

NOTE

Never back reamer out of connecting rod or bushing will be damaged.

2. Remove T-handle and socket, and carefully pulling on bit, draw shaft of reamer out of connecting rod bushing.

NOTE

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

3. Using contact cleaner or cleaning solvent, thoroughly wipe upper connecting rod and bushing of any metal shavings or debris.

NOTE

Leave CONNECTING ROD CLAMPING TOOL installed during bushing honing procedure which follows.

Honing Upper Connecting Rod Bushings

1. Obtain the WRIST PIN BUSHING HONE (PART NUMBER: HD-35102) and VALVE GUIDE REAMER (PART NUMBER: HD-39964) to hone bushing to final size. Use a liberal amount of honing oil to prevent damage to hone or bushing. Use care to prevent foreign material from falling into the crankcase.
   a. Install hone in a high speed electric drill.
   b. Apply reamer lubricant to finishing stones of hone and inside of upper connecting rod bushing.
   c. Start finishing stones of hone into bushing.
   d. Complete 10 to 12 complete strokes using entire length of finishing stone arrangement and drill. Work for a crosshatch pattern of approximately 60 degrees.

NOTE

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

2. Using contact cleaner or cleaning solvent, thoroughly wipe upper connecting rod and bushing of any metal shavings or debris. Continue wiping until a clean cloth shows no evidence of dirt or debris.
3. Lightly oil a good piston pin and insert it into the upper connecting rod bushing bore to feel for the proper interference fit. The pin should slide in and out of the bushing without binding, but also without pivoting or rocking.
4. Remove the connecting rod clamping tool.
5. Remove shop towels exercising caution that shavings, chips and other debris do not fall into crankcase.

Repair

If connecting rod is bent, do not attempt to straighten. Replace flywheel and connecting rod assembly. Straightening connecting rods by bending will damage the bearing on the crank pin and the piston pin bushing.

GENERAL

The oil pump seldom needs servicing. Check for all possible malfunctions related to oil pressure before disassembling oil pump. See ENGINE LUBRICATION SYSTEM (Page 3-10), OIL TANK (Page 3-85) and Oil Pressure Switch (Page 6-46).

1. Make sure that all oil line connections are tight and lines are not pinched or damaged.
2. Check level and condition of oil in tank. Diluted oil impacts pressure readings. In freezing weather, proper circulation of oil can be affected if the oil feed line becomes clogged with ice or sludge.
3. If oil pressure indicator fails to go out with engine running, check for a grounded oil pressure switch wire [120] or faulty switch.

1. **Oil pump cover**
2. **Screw with washer (2)**
3. **Torx screw (2)**
4. **Connector**
5. **Hose fitting**
6. **Feed gerotor set**
7. **Gerotor separator plate**
8. **Scavenge gerotor set**
9. **Retaining ring**
10. **Thrust washer**
11. **O-ring**
12. **Oil pump body**
13. **Elbow fitting**
14. **Gear shaft**
15. **Gasket**

Figure 3-106. Oil Pump

REMOVAL

NOTE

The oil pump can be removed with engine in frame and without removing gearcase cover.

1. Drain oil from oil tank.

NOTE

See Figure 3-107. Do not remove oil pump feed fitting (2) from the pump (1). Hold oil pump feed fitting and loosen large high-pressure hose fitting nut (3). Then remove high-pressure hose (4) from oil pump feed fitting.

2. See Figure 3-107. Remove high-pressure feed hose (4) from oil pump (1).

Figure 3-107. Oil Pump Feed Hose

NOTE

See Figure 3-106. The oil pump is designed to be removed as a complete assembly by removing the two long screws (2) at opposite corners of the pump. The other two screws (3) hold the pump together so that it may be removed and installed as a unit.

3. See Figure 3-106. Carefully remove two screws (2) that secure oil pump to crankcase. Pump drops with screws removed. Discard mounting gasket (15).
4. Disconnect and mark the two remaining oil hoses from the pump.

CLEANING AND INSPECTION

A WARNING

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

1. Clean all parts in cleaning solvent.
2. Blow out holes and oil passages with compressed air.
3. See Figure 3-108. Inspect both gerotor sets for wear.
   a. Mesh pieces of each set together as shown.
   b. Gauge clearance.
   c. If clearance exceeds 0.004 in (0.102 mm), replace gerotors.
   d. Measure thickness of feed gerotors with a micrometer. Replace gerotors as a set if they are not the same thickness.

Figure 3-108. Gerotor Wear Limit

DISASSEMBLY

1. See Figure 3-106. Remove screws (3). Lift cover (1) off body (12). Remove and discard O-ring (11).
2. Slide both pieces of feed gerotor set (6), separator plate (7) and both pieces of scavenge gerotor set (8) off gear shaft (14).
3. Remove and discard retaining ring (9). Remove thrust washer (10) and gear shaft.

INSTALLATION

1. See Figure 3-106. Place new mounting gasket (15) in position.

FASTENER	TORQUE VALUE	
Oil pump feed fitting	100-120 in-lbs	11.3-13.6 Nm
Oil pump high-pressure feed hose fitting nut	85-105 in-lbs	9.6-11.8 Nm
Oil pump high-pressure feed hose to crankcase fitting	60-90 in-lbs	6.8-10.2 Nm
Oil pump to crankcase screw	125-150 in-lbs	14.1-16.9N-m

2. Secure pump to crankcase with screws (2). Tighten to 125-150 in-lbs (14.1-16.9 Nm).

NOTE

*Use **new** hose clamps to secure oil tank feed hose and vent hose to oil pump fittings. If fittings were removed, use TEFLON PIPE SEALANT or HYLOMAR on fitting threads.*

3. Install hoses on oil pump. Attach oil tank feed hose to hose fitting (5) with new clamp. Attach oil tank vent hose to elbow fitting (13) with new clamp.
4. See Figure 3-107. If oil pump feed fitting (2) was removed for any reason, install fitting in oil pump (1) cover. Tighten to 100-120 in-lbs (11.3-13.6 Nm).
5. If high-pressure feed hose (4), was removed completely, install end opposite high-pressure fitting nut (3) in crankcase. Tighten to 60-90 in-lbs (6.8-10.2 N m).

6. Install high-pressure feed hose fitting nut (3) onto feed fitting on front of oil pump. Hold oil pump feed fitting with a wrench and tighten high-pressure hose fitting nut to 85-105 **in-lbs** (9.6-11.8 N-m).

7. Add engine oil. See ENGINE OIL AND FILTER (Page 1-12).

ASSEMBLY

FASTENER	TORQUE VALUE	
Oil pump cover screws	70-80 **in-lbs**	7.9-9 N-m

NOTE

Liberally coat all moving parts with clean engine oil to lubricate at start-up.

1. See Figure 3-106. Install gear shaft (14) through oil pump body (12). Position thrust washer (10) over end of shaft. Install **new** retaining ring (9) into groove in shaft.

2. Insert inner gerotor of the scavenge gerotor set (8) over gear shaft.

3. Place outer gerotor over inner to complete scavenge set.

4. Install separator plate (7) into case.

5. Place feed gerotor set (6) over gear shaft.

6. Install a **new** O-ring (11) into groove in oil pump cover (1). Place cover onto pump body. Install cover screws (3). Tighten to 70-80 **in-lbs** (7.9-9 N-m).

GENERAL

Oil is pressure-fed from the oil pump to the oil filter mount via a hose connection. Oil travels through the filter mount into the filter via outer filter holes.

Adequate oil pressure activates the oil pressure indicator lamp switch in the filter mount, which turns off the oil pressure indicator lamp.

The check ball in the filter adapter opens at 10-13 psi (68.9-89.6 kPa) oil pressure.

Filtered oil leaves the filter, flowing past the check ball.

DISASSEMBLY

1. Remove oil filter. See ENGINE OIL AND FILTER (Page 1-12).
2. See Figure 3-109. Remove oil filter adapter (1) from oil filter mount (2).
3. Remove check ball (3) and spring (4).

CLEANING AND INSPECTION

A WARNING

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

Thoroughly clean all parts in cleaning solvent. Blow out holes and passages using compressed air.

ASSEMBLY

FASTENER	TORQUE VALUE	
Oil filter adapter	18-22 ft-lbs	24.4-29.8 N-m

NOTE

Use TEFLON PIPE SEALANT or HYLOMAR GASKET AND THREAD SEALANT on all fittings installed to oil filter mount.

1. See Figure 3-109. Place spring (4) and check ball (3) into threaded hole at center of mount (2). Push oil filter adapter against ball to compress spring.
2. Install threaded end with LOCTITE 242 MEDIUM STRENGTH THREADLOCKER into threaded hole. Tighten to 18-22 ft-lbs (24.4-29.8 N-m).
3. Install **new** oil filter and add engine oil. See Changing Oil and Filter (Page 1-13).

Figure 3-109. Oil Filter Mount

BUSHING INSPECTION AND REMOVAL

PART NUMBER	TOOL NAME
HD-95760-69A	BUSHING AND BEARING PULLER

NOTE

The camshaft and pinion gear shafts are supported by bushings in both the cover and the crankcase.

1. See Figure 3-110. Measure each bushing and its corresponding cam gear shaft or pinion gear shaft. Replace bushings that exceed service wear limits. Refer to Table 3-34. ”
2. See Figure 3-111. Use BUSHING AND BEARING PULLER (PART NUMBER: HD-95760-69A) to remove bushings from gearcase cover and crankcase.

Figure 3-110. Cam and Pinion Bushings

Table 3-34. Cam and Pinion Shaft Specifications

SHAFT	CORRECT CLEARANCE		SERVICE WEAR LIMIT	
	in	mm	in	mm
Cam	0.0007-0.0022	0.018-0.056	0.003	0.08
Pinion	0.0023-0.0043	0.058-0.109	0.005	0.13

Figure 3-111. Removing Cam Bushing from Gearcase Cover

BUSHING INSTALLATION

NOTE

Installing and reaming crankcase and gearcase cover bushings can alter the center distances between mating gears. Incorrect spacing can damage gears and increase gear noise.

Cam Gear Bushings in Right Crankcase

See Figure 3-112. Position cam gear bushings in crankcase with oiling slot at exact top of bore (12 o’clock position).

1. Press each bushing in crankcase bore until bushing shoulder contacts crankcase boss.
2. Ream the **new** bushing to size after installation. See Bushing Reaming (Page 3-76).

Figure 3-112. Cam Gear Bushing Installed in Crankcase

Cam Gear Bushings (Except Rear Intake Bushing) in Gearcase Cover

1. Press each bushing in its gearcase cover bore until the bushing shoulder contacts cover boss. These bushings require no specific orientation.
2. Line-ream the **new** bushing to correct size after installation. See Bushing Reaming (Page 3-76).

Rear Intake Cam Gear Bushing in Gearcase Cover

Press the rear intake cam gear bushing into its gearcase cover bore with an arbor press. The bushing must be oriented in a specific position of rotation within the cover bore.

1. See Figure 3-113. Position bushing (1) over bore of gearcase cover (2) with chamfered edge downward and slot upward. Align slot in bushing with slot in gearcase cover boss. Press bushing into cover bore until bushing is flush with cover boss.
2. Line-ream the **new** bushing to correct size after installation. See Bushing Reaming (Page 3-76).

Pinion Shaft Bushing in Gearcase Cover

1. Using an arbor press, install pinion shaft bushing in gearcase cover flush with cover boss. This bushing requires no specific orientation.
2. See Figure 3-114. The replacement bushing must be secured from rotation by installation of a dowel pin. Drill a No. 31 hole, 0.281 in (7.14 mm) deep, at top side of boss (side toward top of gearcase cover). Center drill bit so hole is drilled half in bushing and half in cover.
3. Drive a **new** dowel pin no more than 0.020 in (0.51 mm) below the bushing face. Carefully peen edges of hole to lock the pin in place.
4. Line-ream the **new** bushing to correct size after installation. See Bushing Reaming (Page 3-76).

Figure 3-113. Rear Intake Cam Gear Bushing Installed in Gearcase Cover

BUSHING REAMING

NOTE

- *Installing and reaming crankcase and gearcase cover bushings can alter the center distances between mating gears. Incorrect spacing can damage gears and increase gear noise.*

Figure 3-114. Drilling Pinion Bushing Dowel Pin Hole in Gearcase Cover

- *Bushings in right crankcase serve as pilots for reaming gearcase cover bushings and must, therefore, be reamed to size first.*

PART NUMBER	TOOL NAME
HD-38871	CAMSHAFT BUSHING REAMER PILOT
HD-94803-67	REAR INTAKE CAM GEAR BUSHING REAMER
HD-94812-1	PINION SHAFT BUSHING REAMER
HD-94812-87	PINION SHAFT BUSHING REAMER PILOT

- *After reaming any bushing, check shaft fit in the bushing. It may be necessary to make a second pass with reamer to attain proper fit.*

Cam Gear Bushings in Right Crankcase

1. Separate two halves of crankcase, unless already done. Place right crankcase on flat surface with gearcase side up.
2. See Figure 3-115. Position CAMSHAFT BUSHING REAMER PILOT (PART NUMBER: HD-38871) onto gearcase side of crankcase. The upper right and lower left indexing holes in pilot must be placed over dowels in crankcase.
3. Insert two bolts (supplied with pilot) through two remaining holes in pilot, and into threaded holes of crankcase. Tighten bolts securely.

4. Insert a standard 11/16 reamer through pilot hole and into bushing while turning reamer clockwise. Continue turning reamer clockwise through bushing until smooth shank of reamer passes through hole in pilot.

5. Detach reamer from handle. Pull reamer out opposite side of crankcase.

A WARNING

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

6. Thoroughly clean right crankcase, removing all metal chips/shavings. Blow out all bushing bores and oil passages using low pressure compressed air.

Figure 3-115. Reaming Cam Gear Bushing in Right Crankcase

Cam Gear Bushings (Except Rear Intake Bushing) in Gearcase Cover

NOTE

Line-ream newly installed cam gear bushings to establish correct clearance and to produce perfect alignment. Use *the right crankcase* as *a pilot for the reamer. If crankcase halves are not separated,* use *a spare right crankcase to perform the following line-reaming procedures.*

2. Insert a standard 11/16 reamer through the previously

1. Bushings to be reamed must be installed in gearcase cover as described in Bushing Installation (Page 3-75). Attach gearcase cover to right crankcase, which has been disassembled from left crankcase, securing with at least three mounting screws.
5. Separate gearcase cover from right crankcase. Inspect bushing for proper cam gear shaft fit. Repeat line reaming

reamed cam gear bushing in right crankcase in line with one of the bushings to be reamed in gearcase cover.

3. Turn reamer clockwise through bushing in cover until reamer bottoms. Then give reamer one complete clockwise turn to size the bushing. Continue turning reamer clockwise while extracting reamer from bushing.

4. Repeat two previous steps for remaining two cam gear bushings (except rear intake bushing) in gearcase cover, if required.

5. Separate gearcase cover from right crankcase. Inspect bushings for proper cam gear shaft fit. Repeat line reaming operation if necessary.

A WARNING

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

6. Thoroughly clean gearcase cover, removing all metal chips/shavings. Blow out all bushing bores and oil passages using low pressure compressed air.

Rear Intake Cam Gear Bushing in Gearcase Cover

NOTE

Line-ream newly installed cam gear bushings to establish correct clearance and to produce perfect alignment. Use *the right crankcase* as *a pilot for the reamer. If crankcase halves are not separated,* use *a spare right crankcase to perform the following line reaming procedures.*

1. Install rear intake cam gear bushing in gearcase cover. See Bushing Installation (Page 3-75).

2. Identify the previously reamed rear intake cam gear bushing in right crankcase, which has been disassembled from left crankcase. Insert the shank end of REAR INTAKE CAM GEAR BUSHING REAMER (PART NUMBER: HD-94803-67) through gearcase side of this bushing.

3. With reamer inserted into bushing in right crankcase, attach gearcase cover to right crankcase, securing with at least three mounting screws.

4. Turn reamer clockwise through bushing in gearcase cover until reamer bottoms. Then give reamer one complete clockwise turn to size the bushing. Continue turning reamer clockwise while extracting reamer from bushing.

operation if necessary.

A WARNING

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

6. Thoroughly clean gearcase cover, removing all metal chips/shavings. Blow out all bushing bores and oil passages using low pressure compressed air.

Pinion Shaft Bushing in Gearcase Cover

NOTE

*Ream a **new** pinion shaft bushing in the gearcase cover with the right crankcase and the PINION SHAFT BUSHING REAMER PILOT (PARTNUMBER: HD-94812-87) as pilots for the reamer. If the crankcase halves are not separated, use a spare right crankcase to line-ream the bushing.*

1. Install pinion shaft bushing in gearcase cover. See Bushing Installation (Page 3-75).

2. Attach gearcase cover to right crankcase with a minimum of three mounting screws.

3. See Figure 3-116. Install a PINION SHAFT BUSHING REAMER PILOT (PART NUMBER: HD-94812-87) into right crankcase roller race. Insert PINION SHAFT BUSHING REAMER (PART NUMBER: HD-94812-1) through the pilot.

4. Turn reamer clockwise through bushing in gearcase cover until reamer bottoms. Then give reamer one complete clockwise turn to size the bushing. Continue turning reamer clockwise while extracting reamer from bushing.
5. Separate gearcase cover from right crankcase. Inspect bushing for proper pinion shaft fit. Repeat line reaming operation if necessary.

A WARNING

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

6. Remove pilot from right crankcase roller race. Thoroughly clean gearcase cover, removing all metal chips/shavings. Blow out all bushing bores and oil passages using low pressure compressed air.

Figure 3-116. Line Reaming Pinion Shaft Bushing

GENERAL

When replacing the connecting rod and flywheel assembly, the pinion shaft bearing, or the sprocket shaft bearing, inspect and make repairs to the cylinder heads, the cylinders, the gear case and the transmission. Perform a complete engine overhaul.

NOTE

When engine is removed from chassis, do not lay engine on primary side. Laying engine on primaiy side will damage the clutch cable end fitting. If fitting is damaged, clutch cable must be replaced.

DISASSEMBLY

1. Disassemble crankcase. See Crankcase (Page 3-34).

NOTE

PART NUMBER	TOOLNAME
B-45655	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER
CJ114	SNAP-ON BODY DENT PULLER
HD-42720-2	CRANKCASE BEARING REMOVER/INSTALLER BASE
HD-46663	CRANKCASE BEARING REMOVER ADAPTER
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

Remove either the pinion shaft bearing or the left main bearing with this procedure.

2. See Figure 3-117. The pinion shaft bearing assembly (3) remains on pinion shaft (2) when flywheel assembly (1) is removed from right crankcase. Using TRANSMISSION SHAFT RETAINING RING PLIERS (PART NUMBER: J-5586-A), remove retaining ring (4) and slip bearing off pinion shaft.

Figure 3-117. Removing Pinion Shaft Bearing Retaining Ring

NOTE

The sprocket shaft inner race is not replaceable. Replace crankshaft if race is worn or damaged.

3. See Figure 3-118. Remove outer left main bearing retaining ring.
4. Remove left main oil seal from left crankcase with SNAP-ON BODY DENT PULLER (PART NUMBER: CJ114).
5. Remove thrust washer next to left main bearing.

Figure 3-118. Removing Left Main Oil Seal Retaining Ring

6. See Figure 3-119. Remove left main bearing retaining ring from the inside of the left crankcase.

NOTE

Press the left main bearing from the outside of the left crankcase toward the inside. A shoulder in the left crankcase prevents the bearing from being pressed towards the outside.

7. See Figure 3-120. Assemble the CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER (PART NUMBER: B-45655) with a CRANKCASE BEARING REMOVER/INSTALLER BASE (PART NUMBER: HD-42720-2) and a CRANKCASE BEARING REMOVER ADAPTER (PART NUMBER: HD-46663). Press left main bearing out of the left crankcase.
   a. Place support tube (1) on press bed with recessed cup end facing up.
   b. With the outboard side of the left crankcase (2) facing upward, position crankshaft bearing bore (3) over support tube.
   c. Place adapter (4) over left main bearing. Insert piloUdriver (5) through adapter, through left main bearing and into support tube.
   d. Carefully apply pressure with press ram (6) until left main bearing drops free.

Figure 3-119. Removing Left Main Bearing Retaining Ring

Figure 3-120. Removing Left Main Bearing from Crankcase

FITTING PINION BEARINGS

PART NUMBER	TOOL NAME
CJ950	BEARING SEPARATOR
HD-34902-7	END CAP
J-21686-12	FORCING SCREW
J-7830-5	BRIDGE

Outer and Inner Races

The outer race is a pressed-in bushing in the right crankcase. The inner race is pressed on the pinion shaft.

See Figure 3-121. To remove pinion shaft inner race, use BEARING SEPARATOR (PART NUMBER: CJ950), three items from END CAP (PART NUMBER: HD-34902-7), BRIDGE (PART NUMBER: J-7830-5) and FORCING SCREW (PART NUMBER: J-21686-12), and two bolts. Apply heat to race to aid removal.

Figure 3-121. Pulling Pinion Shaft Inner Bearing

Pinion bearing selection is based on the largest measured outside diameter (OD) of the inner race and the smallest measured inside diameter (ID) of the outer race (crankcase bushing).

A running clearance of 0.0002-0.0008 in (0.005-0.02 mm) is established during crankcase set or flywheel assembly replacement and engine rebuild.

See Figure 3-122. Installed inner races are identified at the factory as shown.

See Figure 3-124. Outer races are identified at the factory as shown.

NOTE

The different sizes of crankcase sets and flywheel assemblies do not have separate part numbers. Replacement crankcase sets can have a class 1, 2 or 3 pinion outer race. Replacement flywheel assemblies can have either a class A or B inner race.

Figure 3-122. Factory Inner Race Sizes

Table 3-35. Inner Race Specifications

RACE OD		CLASS	IDENTIFICATION*
in	mm		
1.2498-1.2500	31.745-31.750	**A**	White
1.2496-1.2498	31.740-31.745	B	Green
* Paint dot on end of spline.			

Bearing Selection

See Figure 3-123. Pinion bearing roller OD cannot be measured to required accuracy with a micrometer. Select bearings using the identification information given for inner and outer races and bearings. Refer to Table 3-38.

NOTE

If either inner or outer race show wear, measure both races to confirm correct bearing fit of 0.0002-0.0008 in (0.005-0.02 mm). The service wear limit of the outer race ID is 1.5656 in (39.776 mm).

Figure 3-123. Bearing Roller OD (A)

Table 3-36. Roller Specifications

ROLLER OD (A)	IDENTIFICATION (PACKAGE COLOR)
Largest	Red
	Blue
	White (gray)
Smallest	Green

Table 3-37. Outer Race Specifications

RACE ID		CLASS NO.	STAMPED IDENTIFICATION*
in	mm		
1.5646-1.5648	39.741-39-746	1	1
1.5648-1.5650	39.746-39.751	2	2
1.5650-1.5652	39.751-39.756	3	3
* Stamped number inside crankcase near race.			

NOTE

Removal and installation of the inner and outer bearing races require the use of shop-made tools. See Figure 3-126, Figure 3-127, and Figure 3-128.

1. Measure ID of outer race at four places with a dial bore gauge. Take measurement on ID where bearing rollers ride. Record the four measurements.

2. If the largest measurement is larger than 1.5656 in (39.776 mm) or the required lapping to remove wear marks would enlarge bore beyond 1.5656 in (39.776 mm), continue at Step 8. Refer to Table 3-39.

3. If the largest measurement is 1.5656 in (39.776 mm) or less, cover the cam bearings with masking tape to prevent debris from entering bearings. Assemble crankcase halves.

NOTE

The next step requires lapping the outer race. To keep sprocket shaft and pinion shaft bearings aligned, support the lap by an adaptor or pilot in the left crankcase.

Table 3-39. Used Pinion Bearing Outer Race Specifications

ITEM	in	mm
Largest ID allowed	1.5656	39.776
Roundness of ID (within)	0.0002	0.005
Taper (within)	0.0002	0.005

Figure 3-124. Factory Outer Race Sizes

Table 3-38. Pinion Shaft Bearing Selection

FACTORY STAMPED NUMBER	OUTER RACE ID		BEARING SIZE AS IDENTIFIED BY COLOR CODING		
	in	mm			
	1.5654-1.5656	39.761-39.766			Red
	1.5652-1.5654	39.756-39.761		Red	Blue
3	1.5650-1.5652	39.751-39.756	**Red**	**Blue**	White-gray
2	1.5648-1.5650	39.746-39.751	**Blue**	**White-gray**	Green
1	1.5646-1.5648	39.741-39.746	**White-gray**	**Green**	
Inner Race OD (in)			**1.2496-1.2498**	**1.2498-1.2500**	1.2500-1.2502
Inner Race OD (mm)			31.740-31.745	31.745-31.750	31.750-31.755
Factory Color Code			**Green**	**White**	

4. Lap the outer race. The race must be lapped until all wear marks are removed. See Lapping Pinion Bearing Outer Race (Page 3-84).

5. After lapping race, again measure ID of race at four places and record the measurements.

6. Check measurements against the specifications listed in Table 3-39.

7. If lapping increased bore ID to larger than 1.5656 in (39.776 mm), go to next step. If roundness or taper do not meet specifications, continue lapping until specifications are met. If all specifications are met, continue at Step 10 to remove and size inner race.

NOTE

Always use the smallest outer race ID measurement and the largest OD inner race measurement when selecting bearings.

8. Press the outer race from the right crankcase. Press **new** outer race into crankcase flush with inside edge of cast-in insert.

9. The **new** outer race must be lapped slightly to true and align with left case bearing to specifications. Refer to Table 3-40. See Lapping Pinion Bearing Outer Race (Page 3-84).

Table 3-40. New Pinion Bearing Outer Race Fit and Finish

ITEM	SPECIFICATION	
	in	mm
ID	1.5646-1.5652	39.741-39.756
Roundness within:	0.0002	0.005

Table 3-40. New Pinion Bearing Outer Race Fit and Finish

ITEM	SPECIFICATION	
	in	mm
Taper within:	0.0002	0.005
Surface finish	16 RMS	

10. See Figure 3-121. Pull inner race from pinion shaft using BEARING SEPARATOR (PART NUMBER: CJ950), three items from END CAP (PART NUMBER: HD-34902-7), BRIDGE (PART NUMBER: J-7830-5) and FORCING SCREW (PART NUMBER: J-21686-12), and two bolts. Apply heat to race to aid removal.

11. See Figure 3-125. Press **new** inner race on pinion shaft using shop-made tool. When the tool bottoms against the flywheel, the correct inner race location is automatically established. The **new** inner race must be machined to dimension based on the finished lapped ID of the outer race.

Table 3-41. Inner Race Fit and Finish

ITEM	SPECIFICATION	
	in	mm
Roundness within:	0.0002	0.005
Taper within:	0.0002	0.005
Surface finish	16 RMS	

Refer to Table 3-38.

1. **Pinion shaft inner race**
2. **Flywheel (gear side)**
3. **1.135-1.145 in (28.83-29.08 mm)**

Figure 3-125. Inner Race Location

Inner Bearing Finish Example

The following example illustrates how to determine the required inner race OD:

1. If smallest measured ID of outer race is 1.5651 in (39.754 mm), an inner race OD range of 1.2496-1.2504 in (31.74-31.76 mm) is required. Refer to Table 3-38.

NOTE

Have machinist precision grind outer race to center or middle of required OD range. This will prevent grinding outer race undersize and gives a more easily achieved tolerance range.

2. Precision grind inner race OD to the middle of the desired range. Refer to Table 3-38.

3. Measure OD at four places. Verify that OD is to specification. Refer to Table 3-41.

4. For example purposes:

   a. The largest measured OD of inner race after grinding is 1.2499 in (31.747 mm) OD.

   b. With a 1.5651 in (39.754 mm) ID outer race and a 1.2499 in (31.747 mm) OD inner race, a blue bearing is required. Refer to Table 3-38.

Figure 3-126. Pinion Shaft Outer Race Installation Tool

Figure 3-127. Pinion Shaft Outer Race Removal Tool

sm03437

1. **1.50 in (38.1 mm)**
2. **1.00 in (25.4 mm)**
3. **5.50 in (139.7 mm)**
4. **1.135-1.145 in (28.83-29.08 mm)**
5. **1.262-1.272 in (32.05-32.31 mm)**

Figure 3-128. Pinion Shaft Inner Race Installation Tool

LAPPING PINION BEARING OUTER RACE

PART NUMBER	TOOL NAME
HD-46287	LAPPING TOOL ADAPTER
HD-96710-40C	CRANKCASE MAIN BEARINGLAPPING TOOL
HD-96712-87A	CRANKCASE MAIN BEARING LAP

1. See Figure 3-129. Obtain CRANKCASE MAIN BEARING LAPPING TOOL (PART NUMBER: HD-96710-40C). Assemble CRANKCASE MAIN BEARING LAP (PART NUMBER: HD-96712-87A) to lapping handle.

NOTE

Left main roller bearing must be installed in left crankcase to use LAPPING TOOL ADAPTER (PART NUMBER: HD-46287). See Crankcase (Page 3-37).

2. Assemble LAPPING TOOL ADAPTER (PART NUMBER: HD-46287) to left main bearing.

3. Secure right and left crankcase halves with three crankcase stud bolts (top center and bottom left and right).

4. Insert lap shaft with arbor assembled through pinion bearing bushing and into lapping tool adapter.

NOTE

Do not adjust arbor snug in bushing or bushing will bell. Belling is a condition where hole is larger at ends than it is in the center.

5. Tighten arbor expansion collars using a length of 0.156 in (3.96 mm) rod as spanner until arbor begins to drag.

NOTE

Do not apply a heavy coat.

6. Withdraw arbor far enough to coat lightly with 220 grit lapping compound. Reposition lap in bushing.

7. Turn handle at moderate hand speed. To avoid grooving and tapering, work lap back and forth in bushing as it is revolved.

NOTE

Lapping is completed when entire bushing surface has a dull, satin finish rather than a glossy, smooth appearance.

8. At frequent intervals, remove lap from crankcase, wash and inspect bushing.

A WARNING

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

9. When finished, flush off lap tool using cleaning solvent and dry using compressed air. Apply fresh, light coat of fine lapping compound.

Figure 3-129. Lapping Pinion Bearing Outer Race

PRESSURE RELIEF VALVE

See Figure 3-132. The oil tank has a pressure relief valve (7) in top of tank. If vent line is pinched, restricted or if tank is overfilled, excessive pressure is created. The valve opens if pressure in tank exceeds 10 psi (68.9 kPa).

OIL LINE ROUTING

See Figure 3-130. An oil line (4) routes oil at front lower right corner of oil tank to a fitting on oil pump (1).

From feed section of oil pump, another feed line (2) directs flow up to the oil filter mount. Eventually, oil drains to sump where it collects in scavenge section of oil pump. The return line (3) routes oil back to tank where cycle is repeated.

Figure 3-130. Engine Hose Routing

CRIMP CLAMPS

Removal

PART NUMBER	TOOL NAME
HD-41137	HOSE CLAMP PLIERS

NOTE

Pry overlap to release crimp clamps. If clamps must be cut, use a sharp high-quality wire cutter. To prevent breaking plastic fittings, do not twist clamp while cutting.

1. See Figure 3-131. Push the tip of a small screwdriver under end of tang (2).

NOTE

Plastic fittings are fragile. Use care when removing clamp.

2. Pry until tang is free of tab (1).

3. Remove clamp.

Figure 3-131. Removing Crimp Clamp

Installation

1. Install **new** clamp.
2. Tighten clamp using HOSE CLAMP PLIERS (PART NUMBER: HD-41137).

REMOVAL

1. Remove seat.
2. Remove left side covers.
3. Remove main fuse.
4. Drain engine oil. See Changing Oil and Filter (Page 1-13).
5. Remove battery. See Disconnection and Removal (Page 1-48).
6. Remove battery tray. See Removal (Page 6-12).
7. Remove right side cover.
8. Remove drive belt guard. See BELT GUARD AND DEBRIS DEFLECTOR (Page 2-75).

NOTE

For ease of assembly, mark oil tank lines: drain, feed, vent and return.

9. See Figure 3-132. Remove clamps and oil lines:
   a. Oil drain (3)
   b. Feed (4)
   c. Vent (5)
   d. Return (6)

NOTE

Remove oil tank from right side.

10. Remove oil tank fasteners (1).

INSTALLATION

FASTENER	TORQUE VALUE
Oil tank mounting screws	72-96 **in-lbs** | 8.1-10.8 N-m

1. Slide oil tank into position from right side.

2. See Figure 3-132. Loosely install oil tank mounting screws (1).

3. Install oil lines with **new** clamps:

   a. Oil drain line (3)

   b. Feed line (4)

   c. Vent line (5)

   d. Return line (6)

4. Crimp oil line clamps.

5. Tighten oil tank mounting screws to 72-96 **in-lbs** (8.1-10.8 N-m).

6. Install belt guard. See BELT GUARD AND DEBRIS DEFLECTOR (Page 2-75).

7. Install right side cover.

8. Install battery tray. See Installation (Page 6-12).

A WARNING

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

9. Install main fuse.

10. Install left side cover.

11. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

12. Add engine oil. See Checking and Adding Oil (Page 1-12).

Figure 3-132. Engine Oil Tank

OIL TANK BRACKET

FASTENER	TORQUE VALUE	
Oil tank bracket fastener	72-96 **in-lbs**	8.1-10.8 N-m

Removal

1. Remove oil tank.
2. See Figure 3-133. Remove bracket fasteners (1).
3. Remove bracket (2).

Installation

1. Fit bracket to frame.

2. Install fasteners. Tighten to 72-96 **in-lbs** (8.1-10.8 N-m).

3. Install oil tank.

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1. **Fastener (2)**
2. **Bracket**

Figure 3-133. Oil Tank Bracket

NOTES

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

FASTENER	TORQUE VALUE		NOTES
Air cleaner breather screw	84-120 **in-lbs**	9.5-13.6 N-m	4.15 AIR CLEANER ASSEMBLY, All Models Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) if reusing existing screws
Electrical caddy fasteners	30-40 **in-lbs**	34-4.5 N-m	4.7 FUEL TANK, Installing Fuel Tank
Electrical caddy fasteners	30-40 **in-lbs**	34-4.5 N-m	4.15 FUEL PUMP, Installation
ET sensor	120-168 **in-lbs**	13.6-19 N-m	4.13 ENGINE TEMPERATURE (ET) SENSOR, Installation
EVAP canister mounting bracket screw	15-18 ft-lbs	20.3-24.4 N-m	4.17 EVAPORATIVE (EVAP) EMISSIONS CON-TROL, Charcoal Canister
Exhaust mounting bracket fastener	30-33 ft-lbs	40.7—44.7 N-m	4.16 EXHAUST SYSTEM, Mounting Bracket
Exhaust pipe bracket acorn nut	20-30 ft-lbs	27.1—40.7 N-m	4.16 EXHAUST SYSTEM, Exhaust Pipes
Exhaust pipe clamp bracket fastener	30-33 ft-lbs	40.7-44.7 N-m	4.16 EXHAUST SYSTEM, Exhaust Pipe Bracket
Exhaust pipe flange nut	96-120 **in-lbs**	10.8-13.6 N-m	4.16 EXHAUST SYSTEM, Exhaust Pipes
Exhaust shield worm drive clamps	20-40 **in-lbs**	2.3-4.5 N-m	4.16 EXHAUST SYSTEM, Exhaust Shields
Exhaust shield worm drive clamps	20-—.0 **in-lbs**	2.3-4.5 N-m	4.16 EXHAUST SYSTEM, Muffler Shields
Fuel hose retaining bracket screw	60 **in-lbs**	6.8 N-m	4.14 Fuel Injectors, Installation
Fuel pump bracket mounting screw	19-36 **in-lbs**	2.1—4.1 N-m	4.15 FUEL PUMP, Assembly
Fuel pump module mounting screw	40-45 **in-lbs**	4.5-5.1 N-m	4.(3 FUEL FILTER ELEMENT, Installation
Fuel pump module mounting screw	40-45 **in-lbs**	4.5-5.1 N-m	4.15 FUEL PUMP, Installation
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m	4.7 FUEL TANK, Installing Fuel Tank
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m	4.(3 INDUCTION MODULE, Installation
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m	4.14 Fuel Injectors, Installation
HO2S	12.2-14.2 ft-lbs	16.5-19.3 N-m	4.12 HEATED OXYGEN SENSOR (HO2S), Install-ation
IAC mounting screw	60 **in-lbs**	6.8 N-m	4.(3 INDUCTION MODULE, Assembly
IAC mounting screw	60 **in-lbs**	6.8 N-m	4.(9 Idle Air Control (IAC), Installation
Induction module cable bracket screw	60 **in-lbs**	6.8 N-m	4.(3 INDUCTION MODULE, Assembly
Induction module mounting bracket screw	120-144 **in-lbs**	13.6-16.3 N-m	4.8 INDUCTION MODULE, Installation
Induction module screw	35 **in-lbs**	*4* N-m	4.(3 INDUCTION MODULE, Assembly
Induction module screw	35 **in-lbs**	*4* N-m	4.11 TEMPERATURE MANIFOLD ABSOLUTE PRESSURE (TMAP) SENSOR, Installation
Intake manifold mounting screw	100-120 **in-lbs**	11.3-13.6 N-m	4.(3 INDUCTION MODULE, Installation
Muffler clamp	38-43 ft-lbs	51.5-58.3 N-m	4.16EXHAUST SYSTEM,Mufflers
Muffler mounting bracket fastener	17-20 ft-lbs	23-27.1 N-m	4.16EXHAUST SYSTEM,Mufflers
Muffler to bracket screw	17-20 ft-lbs	23-27.1 N-m	4.16EXHAUST SYSTEM,Mufflers
Sprocket cover screws	80-120 **in-lbs**	9-13.6 N-m	4.16 EXHAUST SYSTEM, Mounting Bracket
TPS screw	35 **in-lbs**	4 N-m	4.10 Throttle Position Sensor (TPS), Installation

SPECIFICATIONS

Table 4-1. Capacities: Iron 883 (XL883N) Model

ITEM	Iron 883™ (XL883N)	
	U.S.	L
Fuel tank (total)	3.3 gal	12.5
Oil tank with filter	2.8 qt	2.6
Transmission (approximate)	1.0 qt	0.95
Low fuel warning light	0.8 gal	3.0

Table 4-2. Capacities: Forty-Eight (XL1200X), Iron 1200 (XL1200NS) Models

ITEM	Iron 1200™ (XL1200NS)		Forty-Eight™ (XL1200X)	
	U.S.	L	U.S.	L
Fuel tank (total)	3.3 gal	12.5	2.1 gal	7.9
Oil tank with filter	2.8 qt	2.6	2.8 qt	2.6
Transmission (approximate)	1.0 qt	0.95	1.0 qt	0.95
Low fuel warning light	0.8 gal	3.0	0.65 gal	2.5

GENERAL

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

A 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 pump delivers fuel to the fuel hose, a cavity in the induction module that supplies the fuel injectors, and to the pressure regulator. Excess fuel pressure is bypassed to the fuel tank through the pressure regulator.

The fuel pump can be turned on with DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but does not run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

TESTING

Connect Fuel Pressure Gauge

1. See FUEL TANK (Page 4-10). Purge fuel supply line and

PART NUMBER	TOOLNAME
HD-41182	FUEL PRESSURE GAUGE
HD-44061	FUEL PRESSURE GAUGE ADAPTER

disconnect fuel supply line from fuel pump module.

2. Connect fuel pump connector [141].

NOTE

Do not kink fuel hose when installing or removing fuel pressure gauge and adapter.

3. See Figure 4-1. Attach pressure gauge adapter:

   Special Tool: FUEL PRESSURE GAUGE ADAPTER (HD-44061)

   a. See Figure 4-2. Pull up on sleeve of fuel tank quick-connect fitting (2) and insert neck of fuel pressure gauge adapter (3) into quick-connect fitting.

   b. Push up on bottom of adapter. Pull down on sleeve until it clicks. Tug on adapter to verify that it is locked in place.

   c. In same manner, connect fuel supply line fitting (1) to quick-connect fitting (4) on adapter.

A 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)

4. Verify that fuel valve (6) and air bleed petcock on fuel pressure gauge are closed.

5. See Figure 4-3. Remove protective cap from free end of fuel pressure gauge adapter.

6. Connect pressure gauge to Schroeder valve.

   Special Tool: FUEL PRESSURE GAUGE (HD-41182)

Perform Test

1. Start and idle engine to pressurize fuel system. Open fuel valve to allow flow of fuel down hose of pressure gauge.
2. Purge air from gauge and hose:
   a. Position clear air bleed tube in a suitable container.
   b. Open and close air-bleed petcock to purge gauge and hose of air.
   c. Repeat this step several times until only solid fuel (without bubbles) flows from air bleed tube.
   d. Close petcock.
3. Open and close throttle to change engine speed. Note reading of the pressure gauge.
4. Turn engine OFF and service as necessary. Refer to Table 4-3.

Figure 4-1. Fuel Pressure Gauge Adapter (Part No. HD-44061)

Figure 4-2. Assembling Adapter, Gauge and Fuel Supply Line to Fuel Tank

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Fuel supply line fitting
Fuel tank quick-connect fitting
Fuel pressure gauge adapter

Figure 4-3. Fuel Pressure Gauge Installed

Adapter quick-connect fitting
Pressure adapter/Schroeder valve fitting
Fuel valve (closed position)

Table 4-3. Fuel Pressure Test

RESULTS	CAUSE	SOLUTION
Less than: 55 psi (380 kPa)	Restricted fuel filter	Replace
	Restricted pump inlet screen	Clean
	Restricted fuel line or hose to gauge	Clear
	Faulty fuel pump	Replace
	Restricted check valve fitting	Clear
	Leak inside tank (hose or coupling)	Replace or repair as necessary
	Faulty pressure regulator	Replace
Steady at: 55-62 psi (380-425 kPa)	Correct operating fuel pressure	
More than: 62 psi (425 kPa)	Check valve fitting and fuel tank	Replace or repair as necessary
	Fuel pressure regulator	Replace

A WARNING

Return to Service

1. Position air bleed tube in a suitable container. Open air-bleed petcock to relieve fuel system pressure and purge pressure gauge of gasoline.

A 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)

2. Remove fuel pressure gauge from adapter. Install protective cap over Schroeder valve.

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)

3. Remove adapter:

   a. Pull up on knurled sleeve of fuel pressure gauge adapter quick-connect fitting.

   b. Remove fuel supply line from adapter.

   c. Release adapter from fuel tank.

A WARNING

To prevent spray of fuel, be sure quick-connect fittings are

4. Install fuel hose:

a. Push fuel hose fitting into quick connect fitting.

properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

4. Install fuel hose:

a. Push up on release sleeve of fuel pump quick-connect fitting.

b. Push fuel hose fitting into quick-connect fitting.

c. Pull down on release sleeve to lock.

d. Tug on fuel hose fitting to verify that it is locked.

GENERAL

A WARNING

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

A WARNING

Read and follow warnings and directions on propane bottle. Failure to follow warnings and directions can result in death or serious injury. (00471b)

NOTE

- *To prevent false readings, keep air cleaner cover installed when performing test.*
- *Do not direct propane into air cleaner. It causes false readings.*
- ***Screamin' Eagle air cleaner assemblies:*** *This type of air cleaner has an open backplate. Even with air cleaner cover on, directing nozzle too close to backplate can give false readings.*

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

- 14 oz propane cylinder.
- PROPANE ENRICHMENT KIT (PART NUMBER: HD-41417).

Assemble Tester

1. See Figure 4-4. Make sure valve knob (6) is closed (fully clockwise).
2. Install valve assembly (5) onto propane bottle (1).

Adjust Tester

1. See Figure 4-4. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises 5-10 SCFH on gauge.
3. Release trigger button.

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

Figure 4-4. Leak Tester

PROCEDURE

1. Run motorcycle until engine is at normal operating temperature.
2. See Figure 4-5. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.
3. Press and release trigger button (2) to dispense propane. The tone of the engine changes when propane enters source of leak. Repeat as necessary to detect leak.
4. When test is finished, close valve knob (turn knob fully clockwise).

1. **Propane bottle**
2. **Trigger button**
3. **Nozzle**

Figure 4-5. Checking for Leaks: All Models

ALL MODELS

FASTENER	TORQUE VALUE	
Air cleaner breather screw	84-120 in-lbs	9.5-13.6 N-m

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

Removal

1. Remove air filter element. See AIR CLEANER AND EXHAUST SYSTEM (Page 1-16).
2. See Figure 4-6. Remove breather screws (3) from backplate (4).
3. Remove air cleaner backplate and gasket (5). Discard gasket.

Installation

NOTICE

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

1. See Figure 4-6. Position new gasket (5) and backplate (4) at induction module air inlet.
2. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to existing screws or use new breather screws (3). Install air cleaner backplate to engine heads. Tighten.

   Torque: 84-120 in-lbs (9.5-13.6 N-m) *Air cleaner breather screw*
3. Install air filter element. See AIR CLEANER AND EXHAUST SYSTEM (Page 1-16).

   Consumable: LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) (99642-97)

Figure 4-6. Air Cleaner Assembly

GENERAL

A WARNING

Do not use solvents or other products that contain chlorine on plastic fuel system components. Chlorine can degrade plastic fuel system components, which can cause a loss of fuel system pressure or engine stalling and could result in death or serious injury. (00621 b)

The fuel filter element is located in the fuel pump assembly inside the fuel tank.

Check fuel system hose and fittings for leaks.

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

2. Remove seat.

A WARNING

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

3. Remove main fuse.

4. Drain and remove fuel tank. See FUEL TANK (Page 4-10).

5. Remove fuel pump assembly from fuel tank. See FUEL PUMP (Page 4-33).

6. See Figure 4-7. Remove and discard cover plate seal (6).

7. Remove retaining clip (4).

8. Lift filter housing (5) off fuel pump assembly (1).
9. Remove and discard filter element (3) and O-ring (2).

INSTALLATION

FASTENER	TORQUE VALUE	
Fuel pump module mounting screw	40-45 **in-lbs**	4.5-5.1 N-m

1. See Figure 4-7. Install a **new** O-ring (2).

2. Install **new** filter element (3) into filter housing (5).

3. Install filter housing onto base of fuel pump assembly (1). Secure with retaining clip (4), making sure that clip is oriented right side up, exactly as shown in the figure.

4. Install **new** cover plate seal (6) into groove in cover plate (7).

5. Install fuel pump assembly into fuel tank. Tighten mounting screws in a crosswise pattern to 40-45 **in-lbs** (4.5-5.1 N-m). See FUEL PUMP (Page 4-33).

6. Install fuel tank and reconnect fuel hose. See FUEL TANK (Page 4-10). Fill fuel tank. Check for leaks.

7. Install main fuse.

8. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

9. Turn ignition switch ON. Verify fuel pump operation.

Figure 4-7. Replacing Fuel Filter Element

PURGING AND DISCONNECTING FUEL SUPPLY LINE

A WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge fuel supply line:
   a. Remove the electrical caddy cover.
   b. See Figure 4-8. Separate fuel pump connector [141] housings.
   c. Start engine.
   d. Operate starter an additional 3 seconds after engine stalls to remove remaining fuel from fuel supply line.

NOTE

Immediately clean up any fuel spills.

2. See Figure 4-9. Disconnect fuel supply line (3) from fuel pump module (4):
   a. Push up and hold quick-connect release sleeve (1).
   b. Pull down on fuel supply line fitting (2).

Figure 4-8. Fuel Pump Connector [141]

Figure 4-9. Fuel Tank Quick-Connect Fitting

REMOVING FUEL TANK

A WARNING

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

1. Remove main fuse.
2. Remove seat.
3. Purge and disconnect fuel supply line. See Purging and Disconnecting Fuel Supply Line (Page 4-10).

NOTE

- *If fuel tank is removed to access other components, do not drain fuel from tank.*
- *Drain fuel if tank is disassembled.*
- *Drain fuel into an approved container.*
- *Immediately wipe up any spilled fuel.*

4. Drain fuel tank:
   a. Obtain a transfer pump with a long, flexible nozzle.
   b. Position vehicle upright.
   c. Remove fuel tank filler cap.

NOTE

Aim nozzle toward right side of fuel tank to avoid contacting and damaging fuel pump assembly

   d. Insert fuel transfer pump nozzle into fuel tank filler spout.
   e. Direct pumped fuel into an approved container.
   f. Pump fuel until fuel tank is empty.

5. See Figure 4-10. Remove vent line (1) from fuel tank vent nipple.
6. Remove protective caps, locknuts, screws and washers from

front and rear of fuel tank.

7. Protect top fork clamp and paint with a clean, soft cloth over front of fuel tank.

8. Lift rear of fuel tank.

9. Remove fuel pump harness from trough on electrical caddy.

10. Remove fuel pump harness from caddy clip around frame backbone.

11. Lift fuel tank off motorcycle.

12. Remove fuel pump assembly. See FUEL PUMP (Page 4-33).

13. See Figure 4-11. Remove fuel tank vapor vent (9).

Figure 4-10. Fuel Tank Vent Line

CLEANING AND INSPECTION

A WARNING

When servicing the fuel system, do not smoke or allow open flame or sparks in the vicinity. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00330a)

1. Clean inside of fuel tank:
   a. Flush with a commercial cleaning solvent or a soap and water solution.
   b. Shake fuel tank to agitate cleaning agent
   c. Thoroughly flush fuel tank after cleaning.
   d. Allow to dry completely.

2. Carefully inspect fuel line and vent line for damage, cuts, cracks, holes, wear or general deterioration. Replace or repair as necessary.

3. Inspect the fuel tank for leaks or other damage. Replace as necessary.

FASTENER	TORQUE VALUE	
Electrical caddy fasteners	30-40 in-lbs	3.4-4.5 N-m
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m

6. Lift rear of fuel tank.

INSTALLING FUEL TANK

NOTE

Verify that wiring harnesses are not pinched between fuel tank and frame during tank installation.

1. Install fuel pump into fuel tank using new gasket. See FUEL PUMP (Page 4-33).

2. See Figure 4-11. Install new fuel tank vapor vent (9). Push fuel tank vapor vent until it bottoms.

NOTE

See Figure 4-11. Verify that front fuel tank brackets are located outboard of ignition coil bracket (8).

3. Position fuel tank on motorcycle.

4. Install front fastener.
   a. Place washer (4) on long screw (2).
   b. From right to left, push screw through front fuel tank bracket, ignition coil bracket and frame.
   c. Place second washer over screw.
   d. Hand-start locknut (5).

Figure 4-11. Fuel Tank Mounting (typical)

5. Place a clean, soft cloth over front of fuel tank to keep tank from contacting top fork clamp and damaging paint.

7. See Figure 4-12. Route fuel pump wire harness.
   a. Route harness through retainer on caddy latch clip.

b. Route harness behind vent line (3).

c. Route harness down through electrical caddy trough (4).

d. Route harness to front of electrical caddy.

NOTE

Do not pinch harness between fuel tank and frame backbone tube.

8. Install fuel tank.

a. Lower rear of fuel tank into position.

b. See Figure 4-11. Place washer (4) on short screw (3).

c. From right to left, push screw through rear fuel tank bracket and frame.

d. Place second washer over screw

e. Hand-start locknut (5).

f. Tighten both front and rear fuel tank mounting fasteners to 15-20 ft-lbs (20.3-27.1 N-m).

g. Install protective caps (6) on screw ends.

9. See Figure 4-10. Install vent line onto fuel tank vent nipple.

10. Connect fuel pump connector [141] housings.

11. Install electrical caddy cover. Tighten.

Torque: 30-40 **in-lbs** (3.4-4.5 N-m) *Electrical caddy fasteners*

~ sm0657l b [1]

1. Fuel pump
2. Wire harness
3. Vent line
4. Electrical caddy trough

Figure 4-12. Fuel Pump Wire Harness Routing

CONNECTING FUEL HOSE AND FILLING FUEL TANK

A 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)

1. See Figure 4-9. Connect fuel hose.

a. Push up on release sleeve (1).

b. Push fuelsupply line fitting (2) into fuel pump module fuel pump quick-connect fitting.

c. To lock quick-connect fitting, pull down on release sleeve.

d. Tug on fuel hose fitting to make sure that it is securely locked in place.

2. See Figure 4-10. Install vent hose onto vent nipple on fuel tank.

A WARNING

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

A 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)

3. Fill fuel tank. Carefully inspect for leaks around fuel pump module.

4. Install main fuse.

5. Turn ignition on to verify that fuel pump is activated.

6. Carefully inspect for leaks at quick-connect fitting.

7. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

VAPOR VALVE

General

The fuel tank is vented through a standpipe (vent tube) within the fuel tank. The vent hose allows hydrocarbon vapors (pressure) to escape when motorcycle is upright. The vent hose connects to the vapor valve. The valve prevents fuel tank from draining during a tip over.

Non-EVAP models: The lower vent hose is vented to the atmosphere.

EVAP models: The lower vent hose is routed to a charcoal EVAP canister. See EVAPORATIVE (EVAP) EMISSIONS CONTROL (Page 4-42).

Removal

1. See Figure 4-13. Pull the rubber elbow hose (1) from the tank vent tube.
2. Carefully remove the vapor valve (4) from the caddy clip (6).
3. Pull the exhaust hose (5) out from between the frame tubes.

Installation

A WARNING

Excessive pressure can build in the fuel tank if vapor valve is not mounted vertically with long fitting to top. Leaks due to excessive pressure can cause a fire or explosion, which could result in death or serious injury. (00265a)

NOTE

Mount vapor valve upright with longer end at top.

1. See Figure 4-13. Assemble vent hose elbow (1), line (2), vapor valve (4), hose (3) and exhaust hose (5).
2. Press elbow over fitting on bottom of fuel tank.

NOTE

To avoid breaking caddy clip (6), do NOT force valve into clip.

3. Snap valve into clip on ECM caddy.
4. Route vent hose alongside electrical caddy and between frame tubes.

1. **Hose elbow**
2. **Vent line**
3. **Hose**
4. **Vapor valve**
5. **Exhaust hose**
6. **Vapor valve clip**

Figure 4-13. Vent Hose and Vapor Valve

REMOVAL

A 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)

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

A 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)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A WARNING

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

2. Remove main fuse.

3. Remove air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).

4. Remove seat.

5. Lift rear of fuel tank up to access induction module.

   a. Loosen (but do not remove) front fuel tank mounting screw.

   b. Remove rear fuel tank mounting screw, washers and nut.

   c. Carefully pivot rear of fuel tank upward and prop in position.

6. See Figure 4-14. Remove screw (2) and mounting bracket (1).

1. Mounting bracket
2. Screw
Figure 4-14. Induction Module Mounting Bracket

7. See Figure 4-15. Unplug the following connectors:

   a. Front fuel injector (4) connector [84],

   b. Rear fuel injector (5) connector [85],

   c. TMAP sensor (6) connector [80],

   d. IAC (7) connector [87],

   e. TPS (8) connector [88].

8. **EVAP models:** Remove purge hose from fitting (9) on induction module (1).

1. **Induction module**
2. **Intake manifold**
3. **Throttle cable bracket**
4. **Front fuel injector [84A]**
5. **Rear fuel injector [85A]**
6. **TMAP sensor [80A]**
7. **IAC [87A]**
8. **TPS [88A]**
9. **Purge hose fitting (EVAP controlled models)**
10. **Fuel supply line**
11. **Throttle wheel**
12. **Fuel rail**

Figure 4-15. Induction Module Assembly

9. See Figure 4-16. Loosen but do not remove screws (2) securing intake manifold to heads on left side.
10. See Figure 4-17. Remove screws (3) securing intake manifold to heads on right side of vehicle.
11. Pull mounting flanges (4) away from heads as much as possible. Pull induction module and intake manifold assembly toward the right side.
12. Remove throttle cables from induction module.
13. Remove induction module and intake manifold from vehicle.

Figure 4-16. Intake Manifold Mounting Screws: Left Side

Figure 4-17. Intake Manifold Mounting Screws: Right Side

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN

A 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)

1. Remove fuel supply line, fuel rail and fuel injectors. See Fuel Injectors (Page 4-30).

NOTE

Heat mounting screws to soften the thread sealant with ROB/NAIR HEAT GUN (PART NUMBER: HD-25070). Do not use an open flame.

2. See Figure 4-18. Remove screws (1,2) and cable bracket (3) from induction module (4).
3. Remove the following assemblies:
   a. TPS. See Throttle Position Sensor (TPS) (Page 4-22).
   b. TMAP sensor. See TEMPERATURE MANIFOLD ABSOLUTE PRESSURE (TMAP) SENSOR (Page 4-24).
   c. IAC. See Idle Air Control (IAC) (Page 4-20).
4. See Figure 4-19. Remove two screws (3) to separate induction module (1) from intake manifold (2). Discard O-ring (4).

NOTE

At this level of disassembly, induction module contains no more serviceable parts. Replace module if defective.

Figure 4-18. Removing/Installing Cable Bracket

Figure 4-19. Induction Module Assembly

INSTALLATION

FASTENER	TORQUE VALUE	
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m
Induction module mounting bracket screw	120-144in-lbs	13.6-16.3 N-m

FASTENER	TORQUE VALUE	
Intake manifold mounting screw	100-120 **in-lbs**	11.3-13.6 N-m

1. See Figure 4-16. Make sure two mounting screws (2) are screwed into heads two or three turns.

2. See Figure 4-20. Install mounting flanges (1) on intake manifold (5) with counterbore (2) facing away from manifold and open slotted ends of flanges facing away from induction module (6).

3. Place a **new** seal (3) into each mounting flange with the beveled edge (4) facing the mounting flange counterbore.

NOTE

When induction module is positioned on manifold mounting screws, verify that the flanges are correctly installed on the manifold. Verify that the rubber seals are in place.

4. Place induction module assembly in position between engine heads. Slide open slotted ends of mounting flanges under heads of two mounting screws on left side of engine.

5. See Figure 4-17. Holding induction module/intake manifold assembly in place, install two mounting screws (3) into remaining mounting flange holes. Tighten all four screws finger-tight.

6. See Figure 4-14. Install mounting bracket (1) and screw (2). Tighten screw finger-tight.

7. Temporarily install two breather screws through mounting bracket. Screw breather screws finger-tight into cylinder heads to line up the induction module.

8. Tighten mounting bracket screws to 120-144 **in-lbs** (13.6-16.3 N-m).

9. Tighten all four intake manifold mounting screws to 100-120 **in-lbs** (11.3-13.6 N-m).

10. Install throttle cables to induction module.

11. Adjust throttle cables. See THROTTLE CONTROL (Page 1-36).

Figure 4-20. Installing Mounting Flange and Seal

12. **EVAP controlled models:** See Figure 4-21. Install purge hose onto fitting (2) on induction module (1).

13. See Figure 4-22. Plug in the following connectors:

    a. Front fuel injector (1) connector [84],

    b. Rear fuel injector (2) connector [85],

    c. TMAP sensor (3) connector [80],

    d. IAC (4) connector [87],

    e. TPS (5) connector [88].

14. Remove prop from under rear of fuel tank. Lower rear of fuel tank into position. Install fastener, washer and nut in fuel tank rear mounting holes. Tighten to 15-20 ft-lbs (20.3-27.1 N-m). Install protective caps on screw ends. See FUEL TANK (Page 4-10).

15. Install air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).

A 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)

16. Connect fuel supply line to fuel pump module. Fill fuel tank. Carefully check for leaks around fuel pump module. See FUEL **TANK** (Page 4-10).
17. Install main fuse.
18. Close left side cover.
19. Turn ignition switch to ON and OFF to reset IAC to park position.
20. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

Figure 4-21. Purge Hose Fitting: EVAP Controlled Models

Figure 4-22. Induction Module Electrical Connectors

ASSEMBLY

FASTENER	TORQUEVALUE	
IAC mounting screw	60 **in-lbs**	6.8 N-m
Induction module cable bracket screw	60 **in-lbs**	6.8 N-m
Induction module screw	35 **in-lbs**	4 N-m

1. See Figure 4-19. Place **new** O-ring (4) into groove (5) in induction module (1) mating surface.

2. Align induction module to intake manifold (2). Secure with two screws (3). Tighten screws to 35 **in-lbs** (4 N-m).

3. Install the following assemblies:

   a. TPS. See Throttle Position Sensor (TPS) (Page 4-22).

   b. TMAP sensor. See TEMPERATURE MANIFOLD ABSOLUTE PRESSURE (TMAP) SENSOR (Page 4-24).

   c. IAC. See Idle Air Control (IAC) (Page 4-20).

NOTE

Do not install /AC mounting screw on throttle wheel side of induction module until cable bracket is installed. Install other IAC mounting screw but do not tighten.

4. See Figure 4-18. Install cable bracket (3) onto induction module (4):

   a. Use **new** screws (1, 2) or apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to existing screws.

   b. Install both screws finger-tight.
   c. Tighten both IAC mounting screws to 60 **in-lbs** (6.8 N-m). Tighten side screw (1) to 60 **in-lbs** (6.8 N-m).

5. Install fuel injectors, fuel rail and fuel supply line. See Fuel Injectors (Page 4-30).

GENERAL

A WARNING

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

See Figure 4-23. The ECM uses the IAC to control engine idle speed. See the electrical diagnostic manual for troubleshooting.

Figure 4-23. IAC

REMOVAL

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN

A WARNING

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

1. Remove main fuse.
2. Remove air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).
3. See Figure 4-24. Unplug harness connector [87B] from IAC connector [87A] (1).

NOTE

Use ROBINAIR HEAT GUN (PART NUMBER: HD-25070) to heat screws (2) to soften the thread sealant and avoid breakage during removal. Do not use an open flame.

4. Using a six-point socket (not a Torx wrench), remove two screws (2) in the following order:
   a. Heat fastener nearest to throttle bracket for two minutes using ROBINAIR HEAT GUN (PART NUMBER: HD-25070). Remove screw.
   b. Heat remaining screw for one minute. Remove screw.
5. See Figure 4-25. Grasp IAC. Rotate clockwise until IAC mounting tab (1) clears throttle cable bracket (2).
6. With a gentle twisting motion, pull IAC straight out of induction module body.

Figure 4-24. IAC Removal

Figure 4-25. IAC Rotation

INSTALLATION

FASTENER	TORQUE VALUE	
IAC mounting screw	60 **in-lbs**	6.8 N-m

1. See Figure 4-26. If reusing IAC (1), inspect O-ring (2) for damage. Replace if necessary.

A WARNING

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

2. Clean all locking agent from the threads of the attachment screws and holes. Blow debris from screw holes using low-pressure compressed air.

3. Apply a thin coat of **clean** engine oil to O-ring.

4. See Figure 4-25. Rotate IAC approximately 45 degrees clockwise so IAC mounting tab clears throttle cable bracket (2) when IAC is installed.

5. With a gentle twisting motion, insert IAC into induction module.

6. Rotate IAC to face harness connector to intake manifold and position mounting tab underneath tab on throttle cable bracket.

7. Install IAC.

   a. See Figure 4-24. Apply a drop of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to the threads of each screw.

   b. Install screws (2).
   c. Use a six-point socket (not a Torx wrench). Tighten to 60 **in-lbs** (6.8 N-m).

8. Plug harness connector [87B] into IAC connector [87A] (1).

9. Install air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).

10. Install main fuse.

Figure 4-26. IAC and O-ring

GENERAL

A WARNING

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

See Figure 4-27. The TPS is on the side of the induction module. The TPS monitors the physical position of the throttle shaft. See the electrical diagnostic manual for troubleshooting.

Figure 4-27. Throttle Position Sensor (TPS) Location

REMOVAL

A WARNING

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

1. Remove main fuse.
2. Remove air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).
3. See Figure 4-28. Unplug TPS harness connector [88B] from connector socket [88A] (4).
4. Remove two screws (5). Detach TPS (3) from induction module (1).

Figure 4-28. TPS Removal

INSTALLATION

FASTENER	TORQUE VALUE	
TPS screw	35 **in-lbs**	4 N-m

NOTE

- *Close throttle to install TPS.*
- *See Figure 4-28. Note orientation of TPS (3) relative to induction module (1) body. The connector socket (4) is at approximately 7 o'clock position, facing toward intake manifold (2).*

1. See Figure 4-29. Fit pocket (3) of TPS (2) over throttle shaft (4). Align TPS correctly and line up mounting holes in sensor with holes in body of induction module (1).

NOTE

Mount TPS body flush against mounting boss on induction module.

2. Install two screws (5) to fasten sensor to induction module. Tighten to 35 **in-lbs** (4 N-m).
3. Open and close throttle plates to check operation. Verify that mechanism operates without binding or sticking.
4. Connect TPS harness socket connector [88B] to sensor pin connector [88A].
5. Install air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).
6. Install main fuse.
7. Verify throttle control operation.

1. **Induction module**
2. **TPS**
3. **Pocket**
4. **Throttle shaft**
5. **Screw (2)**

Figure 4-29. TPS Installation

GENERAL

SENSOR

A WARNING

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

See Figure 4-30. The temperature manifold absolute pressure (TMAP) sensor performs the dual functions of monitoring air temperature and air pressure in the intake manifold. See the electrical diagnostic manual for troubleshooting.

Figure 4-30. TMAP Sensor Location

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

A 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)

1. Remove main fuse.
2. Remove air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).
3. Remove fuel rail and fuel injectors to access two screws that secure induction module to intake manifold. See Fuel Injectors (Page 4-30).
4. Remove screws. Separate induction module from intake manifold. See INDUCTION MODULE (Page 4-14).
5. See Figure 4-31. Pull induction module away from intake manifold far enough to allow the TMAP sensor retaining bracket (1) to clear the TMAP sensor body (2).
6. Unplug harness connector [80B] from TMAP connector [80A] (3).
7. Grasp TMAP sensor. With a gentle twisting motion, pull sensor straight up out of intake manifold body.

Figure 4-31. TMAP Sensor Removal/Installation

INSTALLATION

FASTENER	TORQUE VALUE	
Induction module screw	35 in-lbs	4 N-m

1. See Figure 4-32. If reusing TMAP sensor (1), inspect O-ring (2) in groove of sensor for damage. Replace or repair as necessary.
2. Apply a thin coat of clean engine oil to TMAP sensor O-ring.
3. See Figure 4-31. With a gentle twisting motion, insert sensor (2) into intake manifold with connector [80A] (3) facing rear cylinder head.
4. Plug harness connector [80B] into TMAP sensor.
5. Inspect O-ring (4) between induction module and intake manifold for damage. Install new O-ring if necessary. Make sure that O-ring is fully seated in its grove in induction module body.
6. Mate induction module to intake manifold. Secure with two screws. Tighten.

   Torque: 35 in-lbs (4 N-m) *Induction module screw*
7. Install fuel injectors and fuel rail. See Fuel Injectors (Page 4-30).
8. Install air cleaner assembly. See AIR CLEANER ASSEMBLY (Page 4-8).

A 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)

A WARNING

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

A 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)

9. Connect fuel hose to fuel pump module.

10. Install main fuse.

Figure 4-32. TMAP Sensor

PART NUMBER	TOOL NAME
HD-50017	OXYGEN SENSOR WRENCH

REMOVAL

NOTE

For HO2S troubleshooting, see the electrical diagnostic manual.

1. See Figure 4-33. Disconnect the front HO2S.
   a. Separate the front HO2S connector [138] (1) housings
   b. Remove the frame clip (2).
2. See Figure 4-34. Disconnect the rear HO2S (1).
   a. Open the left side cover.
   b. Separate the rear HO2S connector [137] housings (3).
   c. Remove the wire harness from the caddy cover clip.

NOTE

- *Mark each HO2S FRONT or REAR.*
- *Do not damage the HO2S wire harness.*

Figure 4-33. Front HO2S and Connector

1. HO2S
2. Cover clip
3. HO2S connector

Figure 4-34. Rear HO2S and Connector [137]

INSTALLATION

PART NUMBER	TOOL NAME
HD-50017	OXYGEN SENSOR WRENCH

FASTENER	TORQUE VALUE	
HO2S	12.2-14.2ft-lbs	16.5-19.3 N-m

NOTE

- *Do not drop or strike HO2Ss. Do not install dropped HO2Ss.*
- *New HO2S threads are coated with ANTI-SEIZE LUBRICANT*
- *Ifa HO2S is being reused, apply a thin coat of ANTI-SEIZE LUBRICANT to the threads. Install new seal rings.*
- *Do not use any other compound on threads.*

1. Install the front and rear HO2S with the OXYGEN SENSOR WRENCH (PART NUMBER: HD-50017).
2. Tighten to 12.2-14.2 ft-lbs (16.5-19.3 N-m).

NOTE

Clean any dielectric grease off the connector housings.

3. Connect the front HO2S.
   a. Route the wire harness.
   b. Connect the pin and socket connector [138] housings.
   c. Install the frame clip over the sensor harness, clutch cable and wiring harness.
4. Connect the rear HO2S.
   a. Route the rear HO2S wire harness over the caddy and under the EVAP hose.

3. Remove the front and rear HO2S with the OXYGEN

SENSOR WRENCH (PART NUMBER: HD-50017).

b. **Fit the wire harness to the hook on the caddy cover.**
c. **Connect the pin and socket connector [137] housings.**

GENERAL

See Figure 4-35. The ET sensor is located in the top of the rear cylinder head. See the electrical diagnostic manual for troubleshooting.

Figure 4-35. ET Sensor Location

REMOVAL

To prevent spray of fuel, purge system of high-pressure fuel

PART NUMBER	TOOLNAME
HD-48116-A	TEMPERATURE SENSOR SOCKET

A WARNING

before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

A 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)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A 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 fuel tank. See FUEL TANK (Page 4-10).

4. See Figure 4-36. Disconnect the ET sensor connector [90] (3) on right side of ECM caddy.

5. Cut barbed cable strap (2) to free sensor harness from the oil tank mounting bracket.

6. Remove ET sensor:

   a. Attach a universal joint, a 6 in extension and a ratchet to the TEMPERATURE SENSOR SOCKET (PART NUMBER: HD-48116-A).

   b. Fit ET sensor harness into slot in temperature sensor socket.

   c. Slide socket down harness, through square hole in center of rear rocker cover assembly and fit onto ET sensor.

   d. See Figure 4-37. Once you have installed the temperature sensor socket (1) onto the sensor (4), secure the sensor harness to the socket extension (3) with tape (6) to allow removal of the sensor.

e. Remove ET sensor from rear cylinder head.

Figure 4-36. ET Sensor Harness

Figure 4-37. Tape ET Sensor Harness to Extension

INSTALLATION

FASTENER	TORQUE VALUE	
ET sensor	120-168in-lbs	13.6-19 N-m

1. See Figure 4-37. Fit ET sensor (4) into temperature sensor socket (1).

NOTE

The sensor harness MUST turn with socket and extension. Otherwise, the harness can be damaged when sensor is installed.

2. Holding ET sensor in place in socket, wrap a piece of tape (6) around sensor harness (5) and socket extension (3).

3. Slide assembly down into top of rear head. Carefully thread sensor into head. Do not cross-thread. Tighten to 120-168 **in-lbs** (13.6-19 N-m).

NOTE

Make sure that there is a loop in sensor harness when securing harness. If harness is pulled tight or contacts rear rocker cover, it could be damaged during vehicle operation.

4. See Figure 4-36. Use a **new** barbed cable strap (2) to secure sensor harness to oil tank bracket. Position cable strap so harness forms a loop (1) between sensor and cable strap.

5. Connect sensor connector [90] (3). Secure to ECM caddy.

6. Install fuel tank and connect fuel supply line. See FUEL TANK (Page 4-10).

7. Install main fuse.

8. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

A WARNING

Do not use solvents or other products that contain chlorine on plastic fuel system components. Chlorine can degrade plastic fuel system components, which can cause a loss of fuel system pressure or engine stalling and could result in death or serious injury. (00621b)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A 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. XL models with 4.5 USgal (17 L) fuel tank: Raise fuel tank to access fuel injectors and fuel rail.

   a. Remove seat.

   b. Loosen (but do not remove) front fuel tank mounting screw. Remove rear fuel tank mounting screw, washers and nut. See FUEL TANK (Page 4-10).

   c. Place a clean shop cloth between front of fuel tank and front fork upper bracket to protect fuel tank finish. Carefully pivot rear of fuel tank upward and prop in position with a block of soft wood or other suitable device.

4. See Figure 4-39. Unplug engine sub-harness connectors from fuel injector connectors [84A], [85A] (7, 8).

5. Remove screw (5) and retaining bracket (2).

6. If replacing either fuel supply line (1) or fuel rail (6), remove the fuel supply line:

   a. Hold fuel rail in place.

   b. With a twisting motion, pull fuel supply line straight up out of fuel rail.

7. Hold fuel injectors (9, 10) in place by pressing down on harness connectors (7, 8). Pull off fuel rail injectors with a rocking motion.

8. With a gentle twisting motion, pull fuel injectors out of intake manifold.

9. Remove and discard O-rings (11).

1. Fuel supply line
2. Retaining bracket
3. Fuel rail
4. Front fuel injector and connector
5. Rear fuel injector and connector

Figure 4-38. Fuel Injector Assembly Location

sm06576b

1.	**Fuel supply line**	7.	**Front injector [84A]**
2.	**Retaining bracket**	8.	**Rear injector [85A]**
3.	**Sealing washer**	9.	**Front fuel injector**
4.	**O-ring**	10.	**Rear fuel injector**
5.	**Screw**	11.	**O-ring(4)**
6.	**Fuel rail**	12.	**Intake manifold**

Figure 4-39. Fuel Injector Assembly

INSTALLATION

FASTENER	TORQUE VALUE	
Fuel hose retaining bracket screw	60 **in-lbs**	6.8 N-m
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m

1. See Figure 4-39. Apply a thin coat of clean engine oil to **new** fuel injector O-rings (11). Install O-rings onto fuel injectors (9, 10).

2. With harness connectors (7, 8) facing up, push fuel injectors into intake manifold.

3. See Figure 4-38. Rotate fuel injectors to position harness connectors as shown.

4. Gently press fuel rail onto free end of fuel injectors. Press fuel rail down until hole in fuel rail molded-in bracket lines up with mounting hole in intake manifold (12).

5. If fuel supply line and fuel rail were separated in disassembly procedure, reassemble:

   a. See Figure 4-39. Inspect sealing washer (3) and O-ring (4) for damage. If either require replacement, install a **new** fuel line kit.

   b. Lightly coat O-ring with clean engine oil. Push fuel supply line into fuel rail bore until collar on hose is flush with top of fuel rail.

6. See Figure 4-39. Install retaining bracket (2) and fastener (5):

   a. See Figure 4-40. Align fuel supply line with locating flange (2) positioned as shown.

   b. Install retaining bracket (3). Fit U-shaped opening in bracket around fuel supply line and locating flange.

   c. See Figure 4-39. Secure retaining bracket (2) with screw (5). Tighten to 60 **in-lbs** (6.8 N-m).

NOTE

See Figure 4-38. The fuel injector harness leads are mounted between bracket and induction module.

7. Connect engine sub-harness connectors to fuel injectors.

8. **Models with** 4.5 USgal (17 L) **fuel tank:** If fuel tank was raised up to gain access to the fuel injectors, install fuel tank and seat:

   a. Remove prop from under rear of fuel tank.

   b. Lower rear of fuel tank into position.

   c. Install fastener, washer and nut in fuel tank rear mounting holes.

   d. Tighten front and rear fasteners to 15-20 ft-lbs (20.3-27.1 N-m).

e. Install protective caps on screw ends. See FUEL TANK (Page 4-10).

9. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

10. Connect fuel hose to fuel pump module.

11. Fill fuel tank.

12. Check for leaks around fuel pump module. See FUEL TANK (Page 4-10).

13. Install main fuse.

14. Close left side cover.

Figure 4-40. Mounting Fuel Hose and Fuel Rail

GENERAL

A 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)

A 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)

A WARNING

Do not use solvents or other products that contain chlorine on plastic fuel system components. Chlorine can degrade plastic fuel system components, which can cause a loss of fuel system pressure or engine stalling and could result in death or serious injury. (00621b)

Carefully inspect fuel line for cuts, tears, holes or other damage. Replace line if any damage is found. Even a small hole can cause a reduction in fuel pressure.

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. **Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).**

A 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. **Drain fuel from fuel tank. Remove fuel tank. See FUEL TANK (Page 4-10).**

4. **Lay fuel tank upside-down on a soft cloth.**

5. **See Figure 4-42. Remove screws (3).**

6. **See Figure 4-43. Carefully lift fuel pump module out of fuel tank. Tilt module when it is almost free of fuel tank.**

7. **Remove and discard cover plate seal.**

Figure 4-41. Fuel Pump Connector [141]

1. Fuel tank
2. Fuel pump module
3. Screw (5)
4. Fuel pump harness
5. Quick-connect fitting

Figure 4-42. Fuel Pump Module

Figure 4-43. Removing and Installing Fuel Pump Module: All Models

DISASSEMBLY

The disassembly procedure consists of following groups:

- Pressure regulator and filter housing.
- Fuel pump assembly and pump bracket.
- Low fuel level sensor assembly.
- Fuel pump.

NOTE

See Figure 4-44. Note positions of wiring harness cable straps (1) and pump assembly clamp (2).

Pressure Regulator and Filter Housing

1. See Figure 4-44. Remove cable strap (1) securing wiring harness to the filter housing hose (4).
2. See Figure 4-45. Remove ground clip (12) from top of filter housing (23).
3. Remove and discard clamp (1). Remove filter housing hose (11) from top of fuel pump (2).
4. Remove retaining clip (24) from top of filter housing. Remove pressure regulator (22).
5. Remove second retaining clip (24) from bottom of filter housing. Remove filter housing. Remove fuel filter element (25) from housing.
6. Remove O-ring (26) from filter housing mount (19).

Fuel Pump Assembly and Pump Bracket

1. See Figure 4-44. Record location of any cable straps securing wiring harness to fuel pump bracket (3). Remove cable straps.
2. See Figure 4-45. Unplug fuel pump harness connector [86] (13).
3. Unplug low fuel level sensor connector from fuel pump/sender harness (14).
4. Remove and discard clamp (1). Remove filter housing hose (11) from top of fuel pump (2).
5. Remove and discard pump assembly clamp (7). Remove pump assembly with pump insulator (3) from pump bracket (5).
6. Remove push nut (16) and low fuel level sensor assembly (17) from pump bracket.
7. Remove screws and lockwashers (6). Remove pump bracket from cover plate (9).

Low Fuel Level Sensor Assembly

1. See Figure 4-44. Record location of cable strap (1) securing low fuel level sensor connector to filter housing hose (4). Remove cable strap.
2. See Figure 4-45. Unplug fuel pump/sender harness connector (15) from the low fuel level sensor (17).
3. Remove push nut (16) and low fuel level sensor assembly

Figure 4-44. Fuel Pump Cable Straps and Pump Clamp

(17) from pump bracket (5).

FASTENER	TORQUE VALUE	
Fuel pump bracket mounting screw	19-36 in-lbs	2.1-4.1 N-m

The assembly procedure consists of the following groups:

ASSEMBLY

- Low fuel level sensor assembly.
- Fuel pump assembly and pump bracket.
- Pressure regulator and filter housing.

Low Fuel Level Sensor Assembly

NOTE

The low fuel lamp turns off when there is sufficient fuel in tank, the ignition switch has been cycled and motorcycle is moving.

1. See Figure 4-45. Install low fuel level sensor assembly (17) onto pump bracket (5). Secure with push nut (16).

2. Plug fuel pump/sender harness connector (15) into low fuel level sensor (17).

3. See Figure 4-44. Secure low fuel level sensor connector and fuel pump/sender harness to filter housing hose (4) with cable strap (1).

Fuel Pump Assembly and Pump Bracket

1. See Figure 4-45. Install pump bracket (5) onto cover plate (9). Secure with three screws w/lockwashers (6). Tighten to 19-36 **in-lbs** (2.1-4.1 N-m).

2. Install low fuel level sensor assembly (17) onto pump bracket. Secure with push nut (16).

3. Install fuel pump assembly (2) and pump insulator (3) onto pump bracket.

4. Secure with pump assembly clamp (7).
5. Install filter housing hose (11) on top of fuel pump. Secure with clamp (1).

6. Plug in fuel pump harness connector [86] (13).

7. See Figure 4-44. Secure fuel pump/sender harness to fuel pump bracket (3) with **new** cable straps (1).

Pressure Regulator and Filter Housing

1. See Figure 4-45. Install **new** O-ring onto filter housing mount (19).
2. Install fuel filter element (25) into filter housing (23). Install filter housing onto filter housing mount.
3. Orient filter and secure fuel filter element with retaining clip (24) at bottom of housing.
4. Install pressure regulator (22) on top of filter housing.
5. Orient and secure pressure regulator with second retaining clip (24) as shown.
6. Install filter housing hose (11) on top of fuel pump (2). Secure with **new** clamp (1).
7. Install ground clip (12) on top of filter housing.
8. See Figure 4-44. Secure fuel pump/sender harness to filter housing hose (4) with **new** cable strap (1).

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1. Clamp
2. Fuel pump
3. Pump insulator
4. Cover plate seal
5. Pump bracket
6. Screw w/lockwasher (3)
7. Pump assembly clamp
8. Inlet sock
9. Cover plate
10. Fuel pump and sender harness connector [141]
11. Filter housing hose
12. Ground clip
13. Fuel pump harness connector [86]
14. Fuel pump/sender harness
15. Low fuel level sensor connector
16. Push nut
17. Low fuel level sensor
18. Retaining ring
19. Filter housing mount
20. Screw (5)
21. Fuel outlet quick-connect fitting
22. Pressure regulator
23. Filter housing
24. Retaining clip (2)
25. Fuel filter element
26. O-ring
27. Cable strap

Figure 4-45. Fuel Pump and Sender Assembly

INSTALLATION

FASTENER	TORQUE VALUE	
Electrical caddy fasteners	30-40 in-lbs	3.4-4.5 N-m
Fuel pump module mounting screw	40-45 in-lbs	4.5-5.1 N-m

1. See Figure 4-45. Install new cover plate seal (4) into groove in cover plate (9).

2. See Figure 4-43. Carefully install fuel pump module into fuel tank.

   a. Tilt module.

   b. Lower it into fuel tank.

   c. Straighten module to complete installation.

_____ 3. See Figure 4-46. Install screws. Tighten in sequence.

Torque: 40-45 in-lbs (4.5-5.1 N-m) *Fuel pump module mounting screw*

4. Install fuel tank. See FUEL TANK (Page 4-10).

   a. Verify that fuel pump harness fits in wire harness caddy latch clip with loop in harness between latch clip and fuel pump module.

   b. Plug in fuel pump harness connector [141].

   c. Install electrical caddy cover. Tighten.

   Torque: 30-40 in-lbs (3.4-4.5 N-m) *Electrical caddy fasteners*

   d. Connect vent hose to fuel tank vent nipple.

5. Connect fuel hose to fuel tank. Fill fuel tank. Check for leaks around fuel pump module. See FUEL TANK (Page 4-10).

6. Install main fuse.

7. Close left side cover.

8. Check for leaks:

   a. Turn ignition on.
   b. Verify that fuel pump is activated.

   c. Check for leaks at quick-connect.

   d. Turn ignition off.

Figure 4-46. Fuel Pump Module Torque Sequence

UNIT REMOVAL

1. Remove mufflers. See Mufflers (Page 4-38).
2. Remove exhaust pipes. See Exhaust Pipes (Page 4-40).

Remove exhaust system in two steps.

1. Worm drive clamp (6)
2. Exhaust shield (2)
3. Upper rear shield: Mid-mount controls
4. Worm drive clamp (4)
5. Muffler shield (2)
6. Muffler clamps (2)
7. Screws (4)
8. Washers (4)
9. Rear muffler
10. Fasteners (2)
11. Washers (2)
12. Muffler mounting bracket
13. Front muffler
14. Front HO2S connector [138]
15. Rear HO2S connector [137]
16. Nuts (4)
17. Acorn nut
18. Fastener
19. Clamps (2)
20. Retaining ring (2)
21. Exhaust flange(2)
22. Gasket (2)
23. Exhaust mounting bracket
24. Fasteners (3)
25. Washers (3)
26. Muffler gasket (2, HDI, England, Japan)

Figure 4-47. Exhaust System

MUFFLERS

Removal

FASTENER	TORQUE VALUE	
Muffler clamp	38-43 ft-lbs	51.5-58.3 N-m
Muffler mounting bracket fastener	17-20 ft-lbs	23-27.1 N-m
Muffler to bracket screw	17-20 ft-lbs	23-27.1 N-m

1. Remove exhaust shields.
2. Remove muffler shields.
3. See Figure 4-47. Loosen muffler clamps (6).

4. Remove rear muffler screws (7) and washers (8). Remove rear muffler (9).
5. HDI, England, Japan: Remove muffler gaskets (26). Discard muffler gaskets.
6. Remove fasteners (10) and washers (11) securing muffler mounting bracket to exhaust mounting bracket.
7. Remove front muffler (13) and mounting bracket (12).
8. Remove front muffler screws and washers.
9. Remove and discard muffler clamps.

Installation

NOTE

HD/, England, Japan: *See Figure 4-47. Use a pipe expander (such as Snap-on Part No. PH300) on mufflers (9, 13) to aid installation of gaskets (26), if necessary.*

1. HDI, England, Japan: See Figure 4-47. Install new muffler gaskets into mufflers.
2. Install new muffler clamps over end of mufflers.
3. Install front muffler on muffler mounting bracket. Finger tighten fasteners.
4. See Figure 4-48. Thread front mounting bracket fastener 1/2 way into bracket.

NOTE

Rotate front muffler and mounting bracket to clear exhaust bracket.

5. Slide muffler onto exhaust pipe.
6. Rotate muffler and mounting bracket to slide front fastener into exhaust bracket slot.
7. Install rear washer and fastener.
8. Install rear muffler to mounting bracket.

NOTE

- *Orient front muffler clamp down and out.*
- *Orient up rear muffler clamp.*

9. Install washers and bracket fasteners. Finger tighten.
10. Tighten fasteners in sequence:
    a. Muffler mounting bracket to exhaust mounting bracket 17-20 ft-lbs (23-27.1 N-m).
    b. Muffler to bracket screw 17-20 ft-lbs (23-27.1 N-m).
    c. Muffler clamps 38--43 ft-lbs (51.5-58.3 N-m).
11. Install exhaust shields.
12. Install muffler shields.

Figure 4-48. Bolt Half-Way Installed

EXHAUST SHIELDS

FASTENER	TORQUE VALUE	
Exhaust shield worm drive clamps	20--40 in-lbs	2.3--4.5 N-m

Removal

1. See Figure 4-47. Open worm drive clamps (1).
2. Remove exhaust shields (2) and clamps.
3. Mid-mount controls: Remove the upper rear shield (3).

Installation

1. Install worm drive clamps with exhaust shields.
2. Orient clamp screws for access.
3. Tighten to 20-40 in-lbs (2.3-4.5 N-m).

MUFFLER SHIELDS

FASTENER	TORQUE VALUE	
Exhaust shield worm drive clamps	20--40 in-lbs	2.3--4.5 N-m

Removal

1. See Figure 4-47. Open worm drive clamps (4).
2. Remove muffler shields (5) and clamps.

Installation

1. Install worm drive clamps and muffler shields.
2. See Figure 4-49. For each muffler shield, install the front worm drive clamp and rotate toward the muffler mounting bracket. Install the rear worm drive clamp screw as shown.
3. Tighten to 20-40 in-lbs (2.3-4.5 N-m).

Figure 4-49. Muffler Shield Clamp Screw Orientation

EXHAUST PIPES

PART NUMBER	TOOL NAME
PFSX916	SNAP-ON WRENCH

FASTENER	TORQUE VALUE	
Exhaust pipe bracket acorn nut	20-30 ft-lbs	27.1-40.7 N-m
Exhaust pipe flange nut	96-120 in-lbs	10.8-13.6 N-m

Removal

1. Remove mufflers. See Mufflers (Page 4-38).
2. See Figure 4-47. Separate front HO2S connector [138] (14).
3. Separate rear HO2S connector [137] (15).
4. Remove nuts (16) from front and rear cylinder head studs.

NOTE

Support exhaust pipes.

5. Remove acorn nut (17), fastener (18) and clamps (19) from sprocket cover exhaust pipe bracket.
6. Remove exhaust pipes.
7. Remove retaining ring (20), exhaust flange (21) and gasket (22) as necessary.

Installation

NOTE

Orient flange counterbore to exhaust port.

1. Fit exhaust flange over end of each exhaust pipe.
2. Install new retaining ring.
3. Fit exhaust pipe flanges to cylinder head mounting studs.
4. Install flange nuts finger-tight.
5. Install and finger tighten the clamps (19), fastener (18) and acorn nut (17).

NOTE

Use SNAP-ON WRENCH (PARTNUMBER: PFSX916) to reach exhaust pipe flange nuts.

6. Tighten:
   a. Exhaust pipe flange nuts to 96-120 in-lbs (10.8-13.6 N-m).
   b. Sprocket cover bracket acorn nut to 20-30 ft-lbs (27.1-40.7 N-m).
7. Connect HO2S [138] connector housings.
8. Connect HO2S [137] connector housings.
9. Install mufflers.
10. Install exhaust shields.
11. Install muffler shields.

EXHAUST PIPE BRACKET

FASTENER	TORQUE VALUE	
Exhaust pipe clamp bracket fastener	30-33 ft-lbs	40.7-44.7 N-m

1. See Figure 4-50. Remove fastener (1), washer (2) and exhaust pipe bracket (3) as necessary.

2. Install bracket, washer and fastener.

MOUNTING BRACKET

3. Tighten to 30-33 ft-lbs (40.7-44.7 N-m).

Figure 4-50. Exhaust Pipe Bracket

FASTENER	TORQUE VALUE	
Exhaust mounting bracket fastener	30-33 ft-lbs	40.7-44.7 N-m
Sprocket cover screws	80-120 in-lbs	9-13.6 N-m

Removal

1. Remove exhaust system.
2. Remove rider foot controls as an assembly.
   a. **Mid-mount controls:** See Right Footrest and Rear Brake Pedal Assembly (Page 2-117).
   b. **Forward controls:** See Right Footrest and Rear Brake Pedal Assembly (Page 2-120).
3. Remove C-clip and pin from brake rod at master cylinder.
4. Remove sprocket cover.
5. See Figure 4-51. Remove fasteners (1), washers (2) and mounting bracket (3).

Installation

1. Install mounting bracket with washers and fasteners.
2. Tighten to 30-33 ft-lbs (40.7-44.7 N-m).
3. Install sprocket cover and fasteners. Tighten to 80-120 **in-lbs** (9-13.6 N-m).
4. Install brake rod with C-clip and pin at master cylinder.
5. Install rider foot controls as an assembly.
   a. **Mid-mount controls:** See Right Footrest and Rear Brake Pedal Assembly (Page 2-117).
   b. **Forward controls:** See Right Footrest and Rear Brake Pedal Assembly (Page 2-120).
6. Install exhaust system.

Figure 4-51. Exhaust Mounting Bracket

GENERAL

See Figure 4-52. Motorcycles sold in some markets have an evaporative (EVAP) emissions control system.

- **Vent:** Hydrocarbon vapors in fuel tank (2) are vented through a vapor valve (5). The vapors are stored in the charcoal canister (7). When tipped, the valve closes. Gasoline cannot leak into charcoal canister from the vent hoses (4, 6).
- **Purge:** Under certain engine conditions, the ECM (working with the EFI system relay) opens the purge solenoid (9). Negative pressure (vacuum) draws the fuel vapors in the charcoal canister through the purge tube to the induction module. They are then burned as part of the normal combustion process.

.. WARNING

Keep evaporative emissions vent lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00266a)

NOTE

Check all connections and routings. Make sure that the hoses am not pinched, kinked, cracked or torn. Improper connections can teak charcoal from canister.

1. **Induction module**
2. **Fuel tank**
3. **Vapor vent**
4. **Fuel tank-to-vapor valve hose**
5. **Vapor valve**
6. **Vapor valve-to-canister hose**
7. **Charcoal canister**
8. **Caninster-to-purge solenoid hose**
9. **Purge solenoid**
10. **Canister-to-induction module purge hose**

Figure 4-52. Evaporative (EVAP) Emissions Control

CHARCOAL CANISTER

FASTENER	TORQUE VALUE	
EVAP canister mounting bracket screw	15-18 ft-lbs	20.3-24.4 N-m

Removal

NOTE

See Figure 4-53. Mark purge hose and fitting (1) as SOLENiOD. Mark vent hose and fitting (2) as TANK.

1. Mark hoses connected to charcoal canister (3).
2. Disconnect hoses from canister.

NOTE

Locking tabs (4) can be permanently deformed if overloaded during removal.

3. **Press locking tabs (4) at left end of canister clip. Slide canister towards left side to disengage from canister clip.**
4. **Remove two screws (5) to detach canister mounting bracket (6).**

Figure 4-53. Canister Mounting

Installation

1. **Install mounting bracket with screws. Tighten to 15-18 ft-lbs (20.3-24.4 N-m).**

NOTE

Bend locking tabs outward somewhat if canister is not held securely.

2. **Press canister against tabs. Slide charcoal canister into clip until tabs lock canister in place.**
3. **See Figure 4-53. Connect hoses as mark in removal.**

FUEL VAPOR VENT HOSE

Removal

1. **See Figure 4-55. Remove fuel vapor vent hose (4) from vapor valve fitting on fuel tank.**
2. **See Figure 4-54. Disconnect vent hose from fitting on canister (1).**
3. **Remove vapor vent hose.**

Installation

1. **See Figure 4-55. Connect fuel vapor vent hose (4) onto vapor valve fitting of fuel tank.**
2. **See Figure 4-54. Connect vent hose to fitting on charcoal canister (1).**

CANISTER-TO-SOLENOID HOSE

Removal

1. **Remove electrical caddy cover.**
2. **See Figure 4-54. Remove purge hose (2) from fittings of canister.**
3. **See Figure 4-55. Remove purge hose (5) from fitting of purge solenoid.**

Installation

1. **See Figure 4-54. Install end of purge hose with curved end (2) onto lower fitting of canister (3).**
2. **See Figure 4-55. Install opposite end onto purge solenoid lower fitting (5).**

Figure 4-54. EVAP Canister Connections

SOLENOID-TO-INDUCTION MODULE HOSE

Removal

1. **See Figure 4-55. Remove purge hose (2) from purge solenoid.**
2. **Disconnect hose from fitting on induction module.**
3. **Remove purge hose.**

Installation

1. **See Figure 4-55. Connect hose (2) to fitting on induction module.**
2. **Install on upper fitting of purge solenoid.**
3. **Secure purge hose to frame backbone with new cable strap (1).**

Figure 4-55. EVAP Hose Routing

PURGE.SOLENOID

Removal

1. See Figure 4-55. Remove electrical caddy cover.
2. Disconnect purge solenoid connector.
3. Press locking tab in caddy. Remove purge solenoid (6).
4. Remove purge hoses (2, 5) from purge solenoid.
5. Remove purge solenoid.

Installation

1. See Figure 4-55. Install purge solenoid (6)
2. Install purge hose to induction module (2) onto fitting of purge solenoid closest to the connector cavity.
3. Install purge hose from charcoal canister (5) onto purge solenoid.
4. Install purge solenoid connector.
5. Check all routing to verify that hoses are not pinched or kinked and that there is no contact with hot exhaust or engine parts.
6. Install electrical caddy cover.

SUBJECT	PAGE NO.
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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

FASTENER	TORQUE VALUE		NOTES
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	5.5 Drive Belt, Drive Belt
Clutch cable fitting	36-108 in-lbs	4.1-12.2 N-m	5.3 PRIMARY COVER, Installation
Clutch inspection cover screws	84-108 in-lbs	9.5-12.6 N-m	5.3 PRIMARY COVER, Installation
Countershaft retaining screw	33-37 ft-lbs	44.8-50.2 N-m	5.13 TRANSMISSION INSTALLATION, Shifter Shaft Installation
Crankcase fastener	15-19 ft-lbs	20.3-25.8 N-m	5.13 TRANSMISSION INSTALLATION, Assembling Crankcases
Engine sprocket nut	240-260 ft-lbs	326-353 N-m	5.4 PRIMARY DRIVE AND CLUTCH, Installation
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m	5.5 Drive Belt, Drive Belt
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.8 N-m	5.14 TRANSMISSION SPROCKET, Installation
Gear detent assembly screw	90-110 in-lbs	10.2-12.4 N-m	5.13 TRANSMISSION INSTALLATION, Installation
Gear shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m	5.3 PRIMARY COVER, Installation
Muffler mounting bracket screw	30-33 ft-lbs	40.7-44.7 N-m	5.14 TRANSMISSION SPROCKET, Installation
Neutral indicator switch	120-180 in-lbs	13.6-20.3 N-m	5.13 TRANSMISSION INSTALLATION, Assembling Crankcases
Primary chain adjuster locknut	20-25 ft-lbs	27.1-33.9 N-m	5.3 PRIMARY COVER, Installation
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 N-m	5.3 PRIMARY COVER, Installation
Primary chain cover screws	120-140 in-lbs	13.6-15.8 N-m	5.3 PRIMARY COVER, Installation
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m	5.5 Drive Belt, Drive Belt
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m	5.14 TRANSMISSION SPROCKET, Installation
Transmission mainshaft nut	50-60 ft-lbs	67.8-81.3 N-m	5.4 PRIMARY DRIVE AND CLUTCH, Installation
Transmission sprocket lockplate screw	90-120 in-lbs	10.3-13.6 N-m	5.14 TRANSMISSION SPROCKET, Installation
Transmission sprocket nut	50 ft-lbs	67.8 N-m	5.14 TRANSMISSION SPROCKET, Installation Initial torque plus 30-40 degrees.

SPORTSTER SPECIFICATIONS

Table 5-1. Sprocket Teeth

DRIVE	ITEM	XL883 MODELS		XL1200 MODELS	
		U.S., CANADA, ASIA PACIFIC, BRAZIL	REST OF WORLD	U.S.	WORLD
Primary	Engine	34	38	38	38
	Clutch	57	57	57	57
Final	Transmission	29	29	29	30
	Rear wheel	68	68	68	68

Table 5-2. Overall Drive Ratios

GEAR	XL883 MODELS		XL1200 MODELS	
	U.S., CANADA, ASIA PACIFIC, BRAZIL	REST OF WORLD	U.S.	WORLD
First	10.407	9.315	9.315	9.004
Second	7.436	6.653	6.653	6.432
Third	5.530	4.948	4.948	4.783
Fourth	4.583	4.102	4.102	3.965
Fifth	3.931	3.517	3.517	3.400

NOTE

Service wear limits are given as a guideline for measuring components that are not new. For measurement specifications not given under SERVICE WEAR LIMITS, see NEW

Table 5-3. Clutch Pack Plate Specifications

ITEM	NEW COMPONENTS		SERVICE WEAR LIMIT	
	in	mm	in	mm
CLUTCH PLATE THICKNESS				
Friction plate (fiber)	0.0866 ± 0.0031	2.2000 ± 0.0800	0.0795	2.0200
Steel plate	0.0629	1.6000	N/A	N/A
MAXIMUM ALLOWABLE WARPAGE				
Friction plate (fiber)	N/A	N/A	0.0059	0.1500
Steel plate	N/A	N/A	0.0059	0.1500

REMOVAL

A WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect battery cables (negative (-) cable first) before proceeding. (00307a)

1. Disconnect battery cables. See Disconnection and Removal (Page 1-48).
2. Remove left side rider footrest and mounting bracket assembly.
   a. **Mid-mount controls:** See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).
   b. **Forward controls:** See RIDER FOOT CONTROLS: FORWARD (Page 2-120).
3. See Figure 5-1. Place a drain pan under motorcycle. Remove drain plug (1) and drain lubricant from primary drive housing.
4. Loosen locknut (2). Turn chain adjuster screw (3) counterclockwise to relax primary chain tension.
5. Remove gear shift lever (4) and rubber washer from transmission shifter shaft.
6. Loosen clutch cable tension at clutch cable adjuster.
7. Remove clutch inspection cover (5).
8. See Figure 5-2. Remove quad ring (1) from groove in primary cover. Discard quad ring.
9. Remove hex lockplate (2) and attached spring from flats of adjusting screw.
10. Turn adjusting screw clockwise to release ramp assembly (3) and coupling mechanism. As adjusting screw is turned, ramp assembly moves forward. Remove nut from end of adjusting screw.
11. Remove hook (4) of ramp (3) from cable coupling (5). Remove clutch cable end from slot in coupling. Remove coupling and ramp assembly.
12. See Figure 5-4. Turn cable end fitting counterclockwise to remove clutch cable lower section from primary cover. Remove and discard O-ring from cable end fitting.
13. Remove screws and captive washers to remove cover. Discard gasket.
14. See Figure 5-5. Remove and discard shifter shaft oil seal.

1. Primary drain plug
2. Locknut
3. Adjuster screw
4. Shift lever
5. Clutch inspection cover

Figure 5-1. Primary Cover (mid-mount controls)

1. Quad ring
2. Hex lockplate
3. Ramp assembly
4. Hook
5. Cable coupling

Figure 5-2. Clutch Release Ramp

Screw

Inspection Cover
Quad ring Screw
Gasket

Figure 5-3. Primary Cover

Figure 5-4. Clutch Cable Fitting

Figure 5-5. Shifter Shaft Oil Seal

CLUTCH RELEASE RAMP

Clean all parts with denatured alcohol. Wipe parts dry with a clean, lint-free cloth.

2. See Figure 5-6. Inspect three balls (1) and ball socket surfaces of inner (2) and outer (3) ramp. Replace or repair as necessary.

3. Check hub fit of inner and outer ramps. Replace ramps if excessively worn.

4. Assemble inner and outer ramps.
   a. Apply a light coat of multi-purpose grease to balls and ramps.
   b. Insert balls in sockets of outer ramp.
   c. Install inner ramp on hub of outer ramp with tang on inner ramp 180 degrees from hook of outer ramp.
   d. Install **new** retaining ring (4) in groove of outer ramp hub.

Install clutch release ramp.

a. Fit adapter (5) over clutch cable end with rounded side inboard, the ramp connector button outboard.

b. With retaining ring side of ramp assembly facing inward, place hook of ramp around coupling button.

c. Rotate assembly counterclockwise until tang on inner ramp fits in slot of primary cover.

Figure 5-6. Clutch Release Ramp

PRIMARY CHAINADJUSTER

1. See Figure 5-7. Remove locknut (1) from adjuster screw (4). Turn adjuster screw out of threaded boss in primary cover (3).
2. Inspect adjuster shoe (5). Replace or repair as necessary.
3. Position adjuster inside primary cover (3) with closed side of shoe against cover. Thread adjuster screw (4) all the way into threaded boss at bottom of cover.

NOTE

Hold adjuster screw in place with a hex key while threading locknut on.

4. Thread locknut (1) onto adjuster screw with nylon sealing surface (2) toward cover.

1. Locknut
2. Nylon sealing surface
3. Primary cover

FASTENER	TORQUE VALUE	
Clutch cable fitting	36-108 in-lbs	4.1-12.2 N-m
Clutch inspection *cover* screws	84-108 in-lbs	9.5-12.6 N-m
Gear shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m
Primary chain adjuster locknut	20-25 ft-lbs	27.1-33.9 N-m
Primary chain cover screws	120-140 in-lbs	13.6-15.8 N-m
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 N-m

1. Install a new shifter shaft oil seal.

2. Install a new gasket on primary cover.

3. Apply 2-3 drops of LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) to primary cover screws.

4. Adjuster screw
5. Shoe

Figure 5-7. Primary Chain Adjuster Assembly

INSTALLATION

4. See Figure 5-8. Install primary *cover* and gasket using 16 screws with captive washers. Tighten in sequence.

   Torque: 120-140 **in-lbs** (13.6-15.8 N-m) *Primary chain cover screws*

5. Install drain plug:

   a. Clean magnetic drain plug.

   b. Inspect O-ring and replace if necessary.

   c. Apply LOCTITE 565 PIPE SEALANT WITH TEFLON to drain plug.

   d. Install plug. Tighten to 14-30 ft-lbs (19-40.7 N-m).

6. Install **new** O-ring *over* cable end fitting of clutch cable lower section. Turn fitting clockwise to install into primary cover. Tighten fitting.

   Torque: 36-108 **in-lbs** (4.1-12.2 N-m) *Clutch cable fitting*

7. Fit coupling *over* cable end with rounded side of coupling inboard and ramp connector button outboard. With retaining ring side of ramp assembly facing inward, place hook of ramp around coupling button. Rotate assembly counterclockwise until tang on inner ramp fits in slot of primary cover.

8. Thread nut on adjusting screw assembly until slot of screw is accessible with a screwdriver. Fit nut hex into recess of outer ramp and turn adjusting screw counterclockwise until resistance is felt. Back off adjusting screw 1/4 turn.

9. Slide lockplate and spring onto flats of adjusting screw. If necessary, turn adjusting screw clockwise slightly until lockplate slides onto flats. Fit the lockplate within recess of outer ramp.

10. Fill transmission to specification.

11. Install **new** quad ring. Verify that quad ring is fully seated in groove.

12. Install screws to secure clutch inspection *cover* to primary cover. Tighten in sequence shown.

    Torque: 84-108 **in-lbs** (9.5-12.6 N-m) *Clutch inspection cover screws*

13. Adjust clutch and clutch lever free play. See CLUTCH (Page 1-23).

14. Install left side rider footrest and mounting bracket assembly.

    a. **Mid-mount controls:** See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

    b. **Forward controls:** See RIDER FOOT CONTROLS: FORWARD (Page 2-120).

15. Adjust primary chain free play. When tension is set, tighten locknut. See PRIMARY CHAIN (Page 1-20).

    Torque: 20-25 ft-lbs (27.1-33.9 N-m) *Primary chain adjuster locknut*

16. Install rubber washer and gear shift lever on shifter shaft. Secure with pinch screw and washer. Tighten.

    Torque: 16-20 ft-lbs (21.7-27.1 N-m) *Gear shift lever pinch screw*

A WARNING

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

17. Install battery cables.

Figure 5-8. Outer Primary Cover Torque Sequence

TROUBLESHOOTING

Refer to Table 5-4.

Table 5-4. Clutch Troubleshooting

SYMPTOM	CHECK ORDER	CAUSE	REMEDY
Clutch slips	1	Incorrect clutch release adjustment	Check and adjust clutch release mechanism.
	2	Worn clutch plates	Check service wear limits. Replace plates.
Clutch drags	1	Incorrect clutch release adjustment	Check and adjust clutch release mechanism.
	2	Worn clutch release ramps or balls	Replace release ramps and/or balls.
	3	Warped clutch steel plates	Replace clutch steel plates.
	4	Worn or damaged clutch gear splines	Replace clutch gear or hub as required.
	5	Overfilled primary	Drain lubricant to correct level.

REMOVAL

PART NUMBER	TOOL NAME
HD-38362	SPROCKET LOCKING LINK
HD-46283	SPROCKET LOCKING LINK

A WARNING

To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect battery cables (negative (-) cable first) before proceeding. (00307a)

NOTE

See Figure 5-10. If replacement of clutch pack (28) is only service work required, perform REMOVAL steps 1 and 2 only. Do not remove clutch assembly, primary chain and engine sprocket as an assembly. Proceed to DISASSEMBLY

1. Disconnect both battery cables, negative battery cable first. See Disconnection and Removal (Page 1-48).

2. Remove primary cover. Discard primary cover gasket. See PRIMARY COVER (Page 5-3).

NOTE

See Figure 5-9. Do not position sprocket locking link too close to shifter shaft (2). If sprocket locking link contacts shifter shaft sprocket, locking link can damage shifter shaft and/or engine crankcase.

3. Install a locking link:

   a. **XL883 models with 34/57 gear ratio:** Use SPROCKET LOCKING LINK (PART NUMBER: HD-38362).

   b. **XL883, XL1200 models with 38/57 gear ratio:** Use SPROCKET LOCKING LINK (PART NUMBER: HD-46283).

4. Remove engine sprocket nut. Do not remove engine sprocket.

5. See Figure 5-10. Remove large retaining ring (16). Remove adjusting screw assembly (12, 13, 14 and 15) from pressure plate (11).

NOTE

Turn left-hand thread mainshaft nut (7) clockwise to remove.

6. Remove mainshaft nut (7) and spring washer (6).

7. Remove clutch assembly, primary chain and engine sprocket as an assembly from vehicle.

8. Inspect primary chain. Replace or repair as necessary.

9. Inspect stator and rotor. Replace or repair as necessary. See ALTERNATOR (Page 6-48).

Figure 5-9. Using Sprocket Locking Link (Part No. HD-46283 or HD-38362) to Loosen Engine Sprocket Nut

sm01352

1. Retaining ring
2. Clutch shell and sprocket
3. Ball bearing
4. Retaining ring
5. Clutch hub
6. Spring washer
7. Mainshaft nut
8. Spring plate
9. Steel plate (6)
10. Friction plate, fiber (8)
11. Pressure plate
12. Adjusting screw
13. Bearing
14. Retaining ring
15. Release plate
16. Retaining ring
17. Diaphragm spring
18. Spring seat
19. Retaining ring
20. Retaining ring
21. Inner ramp
22. Outer ramp
23. Nut
24. Locking plate
25. Clutch adjustment spring
26. Ball (3)
27. Clutch cable coupling
28. Clutch pack (consists of items 8, 9,10)

Figure 5-10. Clutch Assembly

DISASSEMBLY

_ *NOTE*

PART NUMBER	TOOL NAME
HD-38515-91	CLUTCH SPRING FORCING SCREW
HD-38515-A	SPRING COMPRESSING TOOL

■ *See Figure 510. If replacement of dutch pack (28)* **I's** *the only service wor^k required, perform DISASSEM^BLY Steps 2-5 and* **7** *only, and then proceed to the NOTE under INSPECTION AND REPAIR.*

- ***Observe all WARNING and CAUTION statements which apply to the steps specified.***

1. See Figure 5-10. With clutch assembly removed from primary chaincase, install the adjusting screw assembly (12, 13, 14 and 15) into the pressure plate (11):

   a. Match the two tabs on release plate (15) to the notches in the pressure plate.

   b. Install the retaining ring (16).

A WARNING

Disassemble clutch using a spring compressing tool. The diaphragm spring is compressed and, if removed without proper tools can fly out, which could result in death or serious injury. (00292a)

2. See Figure 5-11. Compress clutch diagram spring.

   a. Thread the CLUTCH SPRING FORCING SCREW (PART NUMBER: HD-38515-91) onto the clutch adjusting screw.

   b. Place the bridge of the SPRING COMPRESSING TOOL (PART NUMBER: HD-38515-A) against diaphragm spring.

   c. Thread the tool handle onto end of forcing screw.

NOTE

See Figure 5-10. Turn compressing tool handle only enough to remove retaining ring (19) and spring seat (18). Excessive compression of diaphragm spring could damage clutch pressure plate.

3. See Figure 5-10. With a wrench onthe clutch spring forcing screw flats to prevent the forcing screw from turning, turn handle clockwise until tool relieves pressure on retaining ring (19) and spring seat (18).

4. Remove and discard retaining ring. Remove spring seat from the groove in clutch hub (5) prongs. Remove the assembly of diaphragm spring (17), pressure plate (11), adjusting screw components (12, 13, 14 and 15) and compressing tool.

5. Turn the compressing tool handle counterclockwise until the clutch spring forcing screw disconnects from the clutch adjusting screw. Remove spring seat and diaphragm spring from pressure plate assembly.

6. Remove retaining ring (16) and adjusting screw assembly from pressure plate. If necessary, disassemble adjusting screw assembly by removing retaining ring (14), and then separating the remaining adjusting screw components (12, 13, and 15).

7. Remove the clutch pack (28) from the clutch hub. The clutch pack consists of one spring plate (8), six steel plates (9), and eight friction (fiber) plates (10).

NOTE

See Figure 5-10. Bearing (3) will be damaged by disassembly ofclutch hub (5) and shell (2). Always replace bearing (3) if hub and shell are disassembled. If the assembly is pressed apart, the bearing must be replaced.

8. If necessary, disassemble clutch shell and clutch hub as follows:

   a. Remove retaining ring (1) from inboard end of clutch hub (5).

   b. Using an arbor press, separate clutch hub from assembly of clutch shell (2), bearing (3), and retaining ring (4).

   c. Remove retaining ring (4) from groove in clutch shell.

   d. Press on the inboard side of bearing (3) outer race to remove bearing from clutch shell.

1. **Forcing screw**
2. **Bridge, spring compressing tool**
3. **Handle**
4. **Open-end wrench**

Figure 5-11. Compressing Clutch Diaphragm Spring

INSPECTION AND REPAIR

A WARNING

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

NOTE

See Figure 5-10. If replacement of clutch pack (28) is only service required, perform all INSPECTION AND REPAIR steps. Proceed to NOTES under ASSEMBLY

1. See Figure 5-10. Wash all parts, except friction plates (10), spring plate (8) and bearings (3 and 13), in a non-volatile cleaning solution or solvent. Dry parts with low-pressure, compressed air.

2. Examine clutch components:
   a. Inspect all clutch plates for wear and discoloration.
   b. Inspect all friction plates (10) and the spring plate (8) for worn lining surfaces or checked or chipped linings.
   c. Inspect each steel plate (9) for grooves.
   d. Place each steel plate on a flat surface. Using a feeler gauge, check for flatness in several places. If any one of plates are damaged, or warped more than 0.006 in (0.15 mm), replace entire clutch pack.
   e. Wipe lubricant from seven wide friction plates.
   f. See Figure 5-12. Measure thickness of each friction plate. If any one of plates is less than 0.0795 in (2.02 mm), replace entire clutch pack.
   g. See Figure 5-10. Inspect clutch shell ball bearing (3) for smoothness by rotating clutch shell while holding clutch hub. Replace a bearing that is rough or binds.
   h. See Figure 5-13. Check primary chain sprocket (3) and starter ring gear (4) on the clutch shell (1). If either sprocket or ring gear is badly worn or damaged, replace clutch shell.
   i. Check slots (5, 6) that mate with clutch plates on both clutch shell and clutch hub (2). If slots are worn or damaged, replace shell and/or hub.
   j. See Figure 5-10. Check diaphragm spring (17) for cracks or bent tabs. Install a **new** spring if either condition exists.

Figure 5-12. Friction Plate Thickness

1. Clutch shell

PART NUMBER	TOOLNAME
HD-38515-91	CLUTCH SPRING FORCING SCREW
HD-38515-A	SPRING COMPRESSING TOOL

2. Clutch hub
3. Primary chain sprocket
4. Starter ring gear
5. Clutch hub slots
6. Clutch shell slots

Figure 5-13. Checking Clutch Hub and Clutch Shell

ASSEMBLY

NOTE

- *See Figure 5-10. If replacement of clutch pack (28) is the only service work required, perform all ASSEMBLY Steps except 2, 5 and 6. Then proceed to the NOTE under INSTALLATION.*
- *Replace the clutch pack, steel plates, friction plates and spring plate, as a set.*

1. Submerge and soak all friction and steel plates in GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT for at least five minutes.
2. See Figure 5-14. Assemble the clutch hub (1) and clutch shell (4):
   a. Press a **new** ball bearing (3) into clutch shell.
   b. Secure the bearing with a **new** retaining ring (2).
   c. Press inboard end of clutch hub into clutch shell bearing.
   d. Secure with a **new** retaining ring (5) on end of hub.

1. **Clutch hub**
2. **Retaining ring**
3. **Ball bearing**
4. **Clutch shell**
5. **Retaining ring**

Figure 5-14. Clutch Hub and Shell Assembly

NOTE

See Figure 5-10. The clutch pack (28) consists of one spring plate (8), six steel plates (9) and eight friction (fiber) plates (10).

3. Install clutch pack into clutch shell in order: **F - St - F - St - F - St - F - Sp - F - St - F - St - F - St - F (F** = Friction plate, **St =** Steel plate, **Sp =** Spring plate)
4. Place pressure plate (11) and adjusting screw onto clutch pack (28).
5. Assemble bearing (13) and adjusting screw (12) in release plate (15). Secure with **new** retaining ring (14).
6. Align the two tabs on perimeter of release plate (15) with the corresponding recesses in pressure plate. Install adjusting screw assembly (12, 13, 14, 15) into pressure plate (11). Secure adjusting screw assembly with **new** retaining ring (16).
7. Install diaphragm spring (17) with its concave side facing inboard (toward pressure plate), onto pressure plate assembly. Align square openings of pressure plate and diaphragm spring (17) .
8. Position spring seat (18) with its flat, larger outer diameter side facing inboard (toward diaphragm spring).
9. Install a **new** retaining ring (19) onto convex (outboard) side of diaphragm spring.
10. Thread the CLUTCH SPRING FORCING SCREW (PART NUMBER: HD-38515-91) onto the clutch adjusting screw. Place the bridge of the SPRING COMPRESSING TOOL (PART NUMBER: HD-38515-A) against diaphragm spring. Thread the tool handle onto end of forcing screw. Do not tighten compressing tool against diaphragm spring at this time.
11. See Figure 5-11. Place an open-end wrench (4) on the clutch spring forcing screw (1) flats to prevent the forcing screw from turning.

NOTE

Turn compressing tool handle only enough to install spring seat and retaining ring. Excessive compression of diaphragm spring could damage clutch pressure plate.

12. See Figure 5-10. Turn compressing tool handle clockwise to compress diaphragm spring (17). Compresses just enough to install spring seat (18) and retaining ring (19) into the groove in clutch hub (5) prongs.
13. Verify retaining ring is positioned against flange face (outboard side) of spring seat and fully seated in groove of clutch hub. Carefully loosen and remove compressing tool.

NOTE

As *the compressing tool is removed, the diaphragm spring will move outward This movement will force the spring seat up into the inside of the retaining ring. The spring seat provides an operating surface for the diaphragm spring. Additionally, it prevents the retaining ring from coming out during operation.*

INSTALLATION

NOTE

PART NUMBER	TOOL NAME
HD-38362	SPROCKET LOCKING LINK
HD-46283	SPROCKET LOCKING LINK

FASTENER	TORQUE VALUE	
Engine sprocket nut	240-260 ft-lbs	326-353 N-m
Transmission mainshaft nut	50-60 ft-lbs	67.8-81.3 N-m

See Figure 5-10. If replacement of clutch pack (28) is the only service work required, perform INSTALLATION last step only.

1. See Figure 5-10. Remove retaining ring (16). Remove adjusting screw assembly (12, 13, 14, 15) from pressure plate (11). This step allows installation of the transmission mainshaft nut and washer.
2. Clean the oil off the threads of the engine sprocket shaft, the engine sprocket nut, the transmission mainshaft and the mainshaft nut.
3. Install the engine sprocket, primary chain and clutch assembly as a unit.

NOTE

See Figure 5-15. Do not position the sprocket locking link too close to the shifter shaft (2). If the sprocket locking link contacts the shifter shaft while tightening the engine sprocket nut, the shifter shaft and/or the engine crankcase can be damaged.

4. See Figure 5-15. Install the sprocket locking link.
   a. **XL883 models with 34/57 gear ratio:** Use Special Tool: SPROCKET LOCKING LINK (HD-38362)
   b. **XL883, XL1200 models with 38/57 gear ratio:** Use Special Tool: SPROCKET LOCKING LINK (HD-46283)

5. Apply two or three drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) onto threads of engine sprocket shaft.

6. Install engine sprocket nut. Tighten to.

   Torque: 240-260 ft-lbs (326-353 N-m) *Engine sprocket nut*

NOTE

See Figure 5-16. Spring washer (2) must be installed with the word "out" facing the transmission mainshaft nut (1). Incorrect assembly can result in clutch and/or transmission failure.

7. See Figure 5-16. Apply two or three drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) onto threads of transmission mainshaft. Install spring washer (2) and mainshaft nut (1) (left-hand threads) on transmission mainshaft. Tighten nut to .
   Torque: 50-60 ft-lbs (67.8-81.3 **N-m)** *Transmission mainshaft nut*

8. Remove the sprocket locking link.

9. See Figure 5-17. Install adjusting screw assembly (1) in pressure plate, noting that two tabs on perimeter of release plate must be inserted into corresponding recesses in pressure plate. Secure assembly with a **new** retaining ring (2).

10. Install primary cover using **new** gasket. See PRIMARY COVER (Page 5-3).

11. Adjust primary chain and clutch. See PRIMARY CHAIN (Page 1-20) and CLUTCH (Page 1-23).

12. Fill transmission with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT. See TRANSMISSION LUBRICANT (Page 1-21).

13. Connect battery and close left side cover. See BATTERY MAINTENANCE (Page 1-47).

Figure 5-15. Tighten Engine Sprocket Fastener (typical)

Figure 5-16. Mainshaft Nut and Washer

Figure 5-17. Clutch Adjusting Screw Assembly and Retaining Ring

DRIVE BELT HANDLING

See Figure 5-18.

- Do not exceed 5 in (127 mm) forward bend (1).
- Do not exceed 10 in (254 mm) reverse bend (2).
- Do not twist (3).
- Do not crimp, pinch or kink (4).
- Do not pry (5).

Figure 5-18. Drive Belt Handling

FASTENER	TORQUE VALUE	
Axle, rear, nut	95-105 ft-lbs	129-142 N-m
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m

DRIVE BELT

Removal

1. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).

2. Mid-mount controls: Remove right side rider footresUbrake pedal and mounting bracket assembly. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

3. See Figure 5-19. Remove screw (1), washer (2) and exhaust pipe clamp bracket (3).

4. Remove screws (4, 5) and cover (6).

5. See Figure 5-20. Remove E-clip (1). Discard E-clip.

6. Loosen rear axle nut (4).
7. Turn axle adjuster nut (2) on each side of rear fork an equal number of turns counterclockwise to decrease belt tension.

Figure 5-19. Sprocket Cover

Figure 5-20. Drive Belt Adjustment

8. Remove right lower shock absorber screw, washers and nut. See Removal (Page 2-79).

9. Remove belt guard and debris deflector. See Belt Guard (Page 2-75).

A WARNING

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

10. Remove belt.

1. Screw
2. Washer
3. Exhaust pipe clamp bracket
4. Screw
5. Screw
6. Sprocket cover

Installation

1. Install belt onto sprockets.

2. Install front of belt guard. See Belt Guard (Page 2-75).

3. Install debris deflector. See Debris Deflector (Page 2-75).
4. Install right lower shock absorber bolt, washers and nut. See Installation (Page 2-79).

NOTE

See Figure 5-19. Short screw ***(5) goes in bottom hole. Long*** screw ***(4) goes in top hole. Do not tighten*** screws.

5. Install sprocket cover (6). Secure with two screws.

6. Install exhaust pipe clamp bracket (3), washer (2) and screw (1).

7. Tighten:

   a. Exhaust pipe clamp bracket fastener.

      Torque: 30-33 ft-lbs (40.7-44.7 N-m) ***Exhaust pipe clamp bracket*** screw

   b. Sprocket ***cover*** fasteners.

      Torque: 80-120 **in-lbs** (9-13.6 N-m) ***Sprocket cover, forward and lower*** screws

8. **Mid-mount controls:** Install right side rider footrest/brake pedal and mounting bracket assembly. See RIDER FOOT CONTROLS: MID-MOUNT (Page 2-117).

9. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

10. Check wheel alignment. See Wheel Alignment (Page 1-52).

11. Adjust drive belt deflection. See Check Drive Belt Deflection (Page 1-33).

12. See Figure 5-20. Tighten rear axle nut (4).

    Torque: 95-105 ft-lbs (129-142 N-m) ***Axle, rear, nut***

13. Install **new** E-clip (1).

GENERAL

See Figure 5-21. The transmission is a five-speed constant-mesh type housed in an extension of the crankcase. The transmission permits the rider to vary the ratio of engine speed-to-rear driving wheel speed in order to meet the varying conditions of operation.

The transmission is foot-operated by the gear shifter lever, which transmits the force through a gear shifter shaft. The shifter shaft actuates a pawl and a shifter fork drum. The shifter fork drum moves shifter forks. The shifter forks slide a series of shifter dogs into and out of mesh with the other gears.

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1. **Mainshaft**
2. **Countershaft**
3. **Countershaft gears**
4. **Sliding member**
5. **Power flow**
6. **Moves in**
7. **Moves out**

Figure 5-21. Transmission Power Flow

CASE DISASSEMBLY FOR TRANSMISSION REMOVAL

GENERAL

The rear compartment of the left and right crankcase halves form the transmission case. Servicing of transmission components requires removing the engine and disassembling (splitting) the crankcase.

ENGINE REMOVAL AND DISASSEMBLY

1. Remove engine from chassis. See REMOVING ENGINE FROM CHASSIS (Page 3-46).

PART NUMBER	TOOL NAME
HD-42310-45	ENGINE CRADLE

2. Support engine using ENGINE CRADLE (PART NUMBER: HD-42310-45).
3. Disassemble top end. See TOP END OVERHAUL: DISASSEMBLY (Page 3-19).
4. Remove primary cover, clutch assembly, primary chain and engine sprocket. See PRIMARY DRIVE AND CLUTCH (Page 5-7).
5. Disassemble gearcase. See BOTTOM END OVERHAUL: DISASSEMBLY (Page 3-34).
6. Remove transmission sprocket.
7. See Figure 5-22. Shift transmission into first gear. Remove countershaft retaining screw (1).
8. Shift transmission to NEUTRAL. See Figure 5-23. Unplug neutral switch connector [131] (2) by pulling connector straight off neutral switch (1). Remove neutral switch and flat washer.
9. See Figure 5-24. Verify that shifter drum detent is visible in neutral switch hole indicating that transmission is in neutral.

Figure 5-22. Countershaft Retaining Screw

10. See Figure 5-25 and Figure 5-26. Compress ratchet arms in order to clear shifter drum. Remove shifter shaft assembly from left crankcase half.

Figure 5-23. Neutral Switch and Connector

Figure 5-24. Shifter Drum Neutral Detent

11. Remove starter. See STARTER (Page 6-20).
12. See Figure 5-27. With transmission still in neutral, scribe a line on end of shifter drum at 12 o'clock position for later reference.

Figure 5-25. Shifter Shaft Assembly

Figure 5-26. Removing Shifter Shaft Assembly

NOTE

Figure 5-27. Scribed Line on Shifter Drum at 12 o'clock

Figure 5-28. Crankcase Fasteners

- ***Crankcase assembly has 17 fasteners: 15 inserted from left side and two inserted from right side. Verify that all fasteners have been removed before attempting to separate crankcase halves.***
- ***Angle crankcase assembly in engine stand to prevent components falling when crankcase halves are separated.***

13. See Figure 5-28. Remove crankcase fasteners (1, 2) (11 long and four short) from left side of crankcase assembly. Remove fasteners (3) from right side of crankcase assembly.
14. Tap crankcase gently with rawhide mallet to loosen and separate halves. See Figure 5-29. Remove left crankcase assembly with transmission.

NOTE

Flywheel assembly slides off left main bearing by hand. No tools are required for this operation.

15. See Figure 5-30. Remove flywheel assembly from right crankcase half.
16. See Figure 5-31. Remove screw (1), gear detent assembly (2) and detent spring (3) from inside transmission cavity of right crankcase.

Figure 5-29. Separating Crankcase Halves

Figure 5-30. Removing Flywheel Assembly From Right Crankcase Half

1. Screw
2. Gear detent assembly
3. Detent spring

Figure 5-31. Gear Detent Assembly

TRANSMISSION REMOVAL FROM LEFT CRANKCASE

PART NUMBER	TOOLNAME
B-43985-1	TRANSMISSION REMOVER
HD-46285	TRANSMISSION ASSEMBLY FIXTURE

NOTE

See Figure 5-32. Shifter design allows for one common part number for both countershaft shifter forks (4, 5). As the transmission runs, each shifter fork develops a certain wear pattern with its mating parts. Install shifter forks in original locations.

Figure 5-32. Shifter Forks, Drum and Shafts

1. See Figure 5-33. Remove shifter fork shafts by inserting a small flat punch in the slots and tapping on the end of each shaft until it falls free.

NOTE

Carefully tap on alternate sides of the shaft using the provided slots.

2. See Figure 5-34. Remove shifter drum (1) and shifter forks (2). Mark each shifter fork as it is removed, so it can be reinstalled in the same location.

Figure 5-33. Slots For Removing Shifter Fork Shafts

Figure 5-34. Transmission Assembly

Figure 5-35. Pressing Transmission From Left Crankcase

A WARNING

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

NOTE

Use the TRANSMISSION ASSEMBLY FIXTURE (PART NUMBER: HD-46285) to remove the transmission.

3. See Figure 5-35. Remove left crankcase half (3) and transmission assembly (4) from engine stand.
   a. Place crankcase half and transmission assembly (4) on arbor press (1) and support transmission assembly on parallel supports (5).
   b. Press transmission assembly using TRANSMISSION REMOVER (PART NUMBER: B-43985-1) (2) to remove transmission from crankcase half.
   c. Remove crankcase from press.

CLEANING AND INSPECTION

A WARNING

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

1. Clean all parts in cleaning solvent. Blow dry with compressed air.
2. Check gear teeth for damage. Replace parts if necessary.
3. Inspect the engaging dogs on the gears. Replace parts if necessary.

MAINSHAFT DISASSEMBLY

PART NUMBER	TOOL NAME
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

A 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

- ***Transmission operation creates a specific wear pattern on the parts. Mark parts for installation in their original location and orientation.***
- ***Mainshaft 2nd and 3rd gears are integral to the shaft.***
- ***Mainshaft first gear*** is ***directional. Mark gear when removed for correct installation.***
- Press ***transmission assembly out of left crankcase half to service mainshaft and countershaft.***
- ***All thrust washers are one common part number This transmission requires no shimming.***
- ***Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.***

1. See Figure 5-36. Remove first gear (1).
2. Use TRANSMISSION SHAFT RETAINING RING PLIERS (PART NUMBER: J-5586-A) to expand retaining ring. Remove retaining ring (2). Discard retaining ring.
3. Slide thrust washer (3) off end of mainshaft.
4. Remove fourth gear (4) and split bearing (5). Discard bearing.

sm03375

1. **Mainshaft 1st gear**
2. **Retaining ring**
3. **Thrust washer**
4. **Mainshaft 4th gear**
5. **Split bearing**
6. **Mainshaft**
7. **Mainshaft 3rd gear (integral to shaft)**
8. **Mainshaft 2nd gear (integral to shaft)**

Figure 5-36. Transmission Mainshaft Assembly

COUNTERSHAFT DISASSEMBLY

PART NUMBER	TOOLNAME
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

A 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

- ***Transmission operation creates a specific wear pattern on the parts. Mark parts for installation in their original location and orientation.***
- ***Countershaft fifth gear is integral to the shaft.***
- ***Once the transmission assembly has been pressed out of the left crankcase half, the mainshaft and countershaft assemblies are serviced separately***
- ***All thrust washers are one common part number. This transmission requires no shimming.***
- ***Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.***

1. See Figure 5-37. Remove spacer (19) and second gear (18) from the end of the countershaft (2). Remove and discard split bearing (17).
2. Remove spacer (16).

NOTE

When removing the dog ring (15), it is important to mark the direction of the ring on the shaft as parts establish wear patterns.

3. Remove dog ring (15).
4. Using TRANSMISSION SHAFT RETAINING RING PLIERS (PART NUMBER: J-5586-A), expand and remove retaining ring (14). Discard retaining ring.
5. Remove thrust washer (13), third gear (12), and split bearing (11). Discard bearing.
6. Remove thrust washer (10).
7. Expand, remove and discard retaining ring (9).
8. Remove fourth gear (8) and dog ring (7).
9. Expand, remove and discard retaining ring (6).
10. Remove thrust washer (5), first gear (4) and split bearing (3). Discard bearing.

sm03376

1. Countershaft 5th gear (integral to shaft)
2. Countershaft
3. Split bearing
4. Countershaft 1st gear
5. Thrust washer
6. Retaining ring
7. Dog ring
8. Countershaft 4th gear
9. Retaining ring
10. Thrust washer
11. Split bearing
12. Countershaft 3rd gear
13. Thrust washer
14. Retaining ring
15. Dog ring
16. Spacer
17. Split bearing
18. Countershaft 2nd gear
19. Spacer

Figure 5-37. Transmission Countershaft Assembly

MAINSHAFT ASSEMBLY

Wear safety glasses or goggles when removing or installing

PART NUMBER	TOOL NAME
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

A WARNING

injury. (00312a)

NOTE

- ***Always install parts in their original locations and orientations.***
- ***Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.***
- ***Lubricate spit bearings and internal bores of gears with SCREAMIN' EAGLE ASSEMBLY LUBE before assembly.***

Figure 5-38. Transmission Mainshaft Assembly

COUNTERSHAFT ASSEMBLY

PART NUMBER	TOOLNAME
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS

A WARNING

retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

NOTE

Always install parts in their original locations and orientations.

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

1. See Figure 5-39. Install **new** split bearing (3) in first gear position on mainshaft.

- ***Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.***
- ***Lubricate spit bearings and internal bores of gears with SCREAMIN' EAGLE ASSEMBLY LUBE before assembly.***

1. See Figure 5-38. Install **new** split bearing (5) in fourth gear position on mainshaft.
2. Install fourth gear (4) and thrust washer (3).
3. Using TRANSMISSION SHAFT RETAINING RING PLIERS (PART NUMBER: J-5586-A), expand and install **new** retaining ring (2).
4. Install first gear (1).
2. Install first gear (4) and thrust washer (5).
3. Using TRANSMISSION SHAFT RETAINING RING PLIERS (PART NUMBER: J-5586-A), expand and install **new** retaining ring (6).
4. Install dog ring (7) onto fourth gear (8). Now install dog ring and gear assembly onto countershaft.
5. Expand and install **new** retaining ring (9).
6. Install thrust washer (10).
7. Install **new** split bearing (11) in third gear position on mainshaft.
8. Install third gear (12) and thrust washer (13).
9. Expand and install **new** retaining ring (14).
10. Install dog ring (15). Make sure to install with dog ring facing same direction as when it was removed.
11. Install spacer (16).

12. Install **new** split bearing (17) in second gear position on shaft.
13. Install second gear (18) and spacer (19).

NOTE

At this point both mainshaft and countershaft sub-assemblies can be pressed into the left crankcase half.

sm03376

1. **Countershaft 5th gear (integral to shaft)**
2. **Countershaft**
3. **Split bearing**
4. **Countershaft 1st gear**
5. **Thrust washer**
6. **Retaining ring**
7. **Dog ring**
8. **Countershaft 4th gear**
9. **Retaining ring**
10. **Thrust washer**
11. **Split bearing**
12. **Countershaft 3rd gear**
13. **Thrust washer**
14. **Retaining ring**
15. **Dog ring**
16. **Spacer**
17. **Split bearing**
18. **Countershaft 2nd gear**
19. **Spacer**

Figure 5-39. Transmission Countershaft Assembly

GENERAL

NOTE

PART NUMBER	TOOLNAME
B-45847	CROSS PLATE
HD-35316-11	RECEIVER CUP
HD-35316-4A	8 IN. BOLT
HD-35316-7	WASHER
HD-35316-9	BEARING DRIVER
HD-35316-D	MAIN DRIVE GEAR REMOVER AND INSTALLER SET

cement of main drive gear bearing (7). Gear removal procedure

Figure 5-40. Main Drive Gear and Bearing Assembly

REMOVAL

3. Obtain MAIN DRIVE GEAR REMOVER AND INSTALLER SET (PART NUMBER: HD-35316-D). See Figure 5-42. Position CROSS PLATE (PART NUMBER: B-45847) (1) on right crankcase as shown. Position so roll pins (2) fit into crankcase mating screw holes and center bolt hole (3) over main drive gear (4).

Main Drive Gear

1. Split crankcases. See CASE DISASSEMBLY FOR TRANSMISSION REMOVAL (Page 5-16).
2. See Figure 5-41. From inside right crankcase, tap out seal (3) at end of main drive gear (1). Discard seal.

Figure 5-41. Main Drive Gear Assembly (typical)

4. See Figure 5-43. Insert 8 IN. BOLT (PART NUMBER: HD-35316-4A) (2) through cross plate (1) and main drive gear (3).
5. At outside of case, place WASHER (PART NUMBER: HD-35316-7) (4), bearing (5), washer (6) and nut (7) over end of bolt. Tighten nut until main drive gear is free.

Figure 5-42. Positioning Cross Plate

Figure 5-43. Removing Main Drive Gear

Main Drive Gear Ball Bearing

A WARNING

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

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

1. See Figure 5-40. Remove and discard oil seal (10). Remove and discard main drive gear bearing retaining ring (9).
2. See Figure 5-44. From inside crankcase, position BEARING DRIVER (PART NUMBER: HD-35316-9) (2) over main drive gear bearing.
3. Insert 8 IN. BOLT (PART NUMBER: HD-35316-4A) (1) through bearing driver and bearing.
4. At outside of case, slide RECEIVER CUP (PART NUMBER: HD-35316-11) (3) onto bolt and over bearing. Install bearing (4), flat washer (5) and nut (6) over end of bolt.

NOTE
Support bearing remover assembly

5. Tighten nut until main drive gear ball bearing is free.
6. Discard main drive gear ball bearing.

Figure 5-44. Removing Main Drive Gear Bearing

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-95637-46B	WEDGE ATTACHMENT

1. See Figure 5-40. Remove retaining ring (11) from inboard end of main drive gear (2). Discard retaining ring.
2. See Figure 5-41. Drive out needle bearings (2) from inside bore of main drive gear (1). Discard needle bearings. Do not reuse bearings after removal from drive gear bore.
3. Remove and discard O-ring (4).

NOTE

When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. Remove this inner race before installing main drive gear.

4. See Figure 5-45. Attach WEDGE ATTACHMENT (PART NUMBER: HD-95637-46B) (3) to inner race (2) on main drive gear (1).
5. Place main drive gear with bearing race puller assembly onto press bed as shown in the photo.

NOTE

Provide a soft surface to catch the main drive gear when it falls free in the next step.

6. Press main drive gear out of inner bearing race. Discard inner bearing race.

Figure 5-45. Removing Inner Bearing Race from Main Drive Gear

ASSEMBLY

PART NUMBER	TOOLNAME
HD-47855	INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL

NOTE

When the installation tool bottoms on the gear, the installed bearing depth is correct.

1. See Figure 5-46. Place main drive gear (4) on press bed with gear end facing up.
2. Place needle bearing (3) squarely into end of drive gear with lettered side of bearing facing up. Always press on lettered side of bearing to install. Insert the INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL (PART NUMBER: HD-47855) (2) with end stamped "INNER" facing needle bearing.
3. Press in the inner bearing until the installation tool bottoms on the main drive gear.

1. Press ram
2. Needle bearing installation tool
3. Needle bearing
4. Main drive gear

Figure 5-46. Pressing Inner Needle Bearing Assembly into Main Drive Gear

4. See Figure 5-47. Place main drive gear (4) on press bed with gear end facing down.
5. Place needle bearing (3) squarely into end of drive gear with lettered side of bearing facing up. Always press on lettered side of bearing to install. Insert installation tool (2) with end stamped "OUTER" facing needle bearing.
6. Press i n the outer needle bearing until the installation tool bottoms on the main drive gear.
7. See Figure 5-40. Install new retaining ring (11) in inboard end of main drive gear (2).

Figure 5-47. Pressing Outer Needle Bearing Assembly into Main Drive Gear

INSTALLATION

PART NUMBER	TOOLNAME
B-45847	CROSS PLATE
HD-35316-12	INSTALLER CUP
HD-35316-4A	8 IN. BOLT
HD-35316-7	WASHER
HD-35316-8	BEARING DRIVER
HD-35316-C	5-SPEED & 6-SPEED MAIN DRIVE GEAR REMOVER AND INSTALLER
HD-47856	MAIN DRIVE GEAR SEAL INSTALLER KIT
HD-47856-1	INSTALLER
HD-47856-2	PILOT
HD-47856-4	ADAPTER
HD-47856-5	NUT

Main Drive Gear Bearing

1. See Figure 5-48. Place CROSS PLATE (PART NUMBER: B-45847) (1) on right crankcase as shown. Position cross plate so that roll pins (2) fit into crankcase mating screw holes and bolt hole (3) in cross plate is centered over crankcase bearing bore (4).
2. See Figure 5-49. Insert 8 IN. BOLT (PART NUMBER: HD-35316-4A) (2) through cross plate (1) and main drive gear bearing bore.
3. Place main drive gear bearing (3), BEARING DRIVER (PART NUMBER: HD-35316-8) (4), BEARING (5), FLAT WASHER (6) and NUT (7) over end of bolt.

NOTE

Do not continue to tighten nut after bearing bottoms against lip in crankcase bearing bore. Tightening nut too much can break lip in bearing bore casting.

4. Tighten nut until main drive gear bearing bottoms against lip cast into crankcase bearing bore.
5. Remove main drive gear bearing installer tool.

NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

A 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 5-51. At outside of case install new beveled retaining ring (9) in groove inside bearing bore with beveled side facing outside of case.
7. Lubricate main drive gear bearing with SCREAMIN' EAGLE ASSEMBLY LUBE.

1. Cross plate
2. Roll pin (2)
3. Bolt hole
4. Crankcase bearing bore

Figure 5-48. Positioning Cross Plate

Figure 5-49. Installing Main Drive Gear Bearing

Figure 5-50. Lubricating Main Drive Gear Needle Bearing

Main Drive Gear

1. See Figure 5-50. Lubricate both main drive gear needle bearing assemblies with SPECIAL PURPOSE GREASE.

2. See Figure 5-51. Install **new** O-ring (3) into groove in main drive gear (2). Lubricate O-ring with SCREAMIN' EAGLE ASSEMBLY LUBE.

1. Needle bearing (2)
2. Main drive gear
3. O-ring
4. Oil seal
5. Shifter drum bushing
6. Right crankcase
7. Main drive gear bearing
8. Countershaft bearing (closed end)
9. Retaining ring
10. Oil seal
11. Retaining ring

Figure 5-51. Main Drive Gear and Bearing Assembly

3. See Figure 5-52. Insert 8 IN. BOLT (PART NUMBER: HD-35316-4A) (1) through WASHER (PART NUMBER: HD-35316-7) (2) and main drive gear (3). From inside of case insert bolt with washer and main drive gear through inner race of main drive gear bearing.
4. At outside of case, place INSTALLER CUP (PART NUMBER: HD-35316-12) (4), BEARING (5), FLAT WASHER (6) and NUT (7) over end of bolt. Tighten nut until main drive gear bottoms against main drive gear bearing.
5. Remove 5-SPEED & 6-SPEED MAIN DRIVE GEAR REMOVER AND INSTALLER (PART NUMBER: HD-35316-C) set.
6. See Figure 5-51. Tap in new oil seal (4) at threaded end of main drive gear to a depth of 0.060-0.03 in (1.524-0.762 mm).

1. 8 inch bolt
2. Washer
3. Main drive gear
4. Installer cup
5. Bearing Flat
3. washer Nut
7.

Figure 5-52. Installing Main Drive Gear (typical) Main Drive

Gear Seal

1. Obtain MAIN DRIVE GEAR SEAL INSTALLER KIT (PART NUMBER: HD-47856).
2. See Figure 5-53. From outside of crankcase, install PILOT (PART NUMBER: HD-47856-2) over end of main drive gear bearing inner race.
3. Coat lips of new main drive gear seal with SCREAMIN' EAGLE ASSEMBLY LUBE.
4. See Figure 5-54. Place seal over pilot and position seal squarely in end of crankcase bore.

NOTE

ADAPTER (PART NUMBER: HD-47856-4) and main drive gear have left-hand threads.

5. See Figure 5-55. Thread ADAPTER (PART NUMBER: HD-47856-4) onto end of main drive gear several turns. Do NOT tighten on drive gear. Doing so could make it difficult to remove adapter after seal has been installed.

Figure 5-53. Install Pilot

Figure 5-54. Install Main Drive Gear Seal

Figure 5-55. Install Adapter

Figure 5-56. Place Installer over Adapter

6. See Figure 5-56. Slide INSTALLER (PART NUMBER: HD-47856-1) over adapter until cupped end of installer is flat against seal.
7. See Figure 5-57. Thread NUT (PART NUMBER: HD-47856-5) onto end of adapter, until it tightens against installer.
8. See Figure 5-58. Place crow's foot wrench (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.
9. Holding adjustable wrench, tighten large nut with crow's foot wrench until outer face of seal is flush with outer edge of crankcase bore.

NOTE

It is acceptable to recess seal to about 0.030 in (0.762 mm) below outer edge of bore. Seal will be controlled by tool.

10. Remove nut, installer, adapter and pilot.

Figure 5-57. Install Nut

Figure 5-58. Press Seal Into Crankcase

REMOVAL

PART NUMBER	TOOLNAME
HD-95760-69A	BUSHING AND BEARING PULLER
HD-95765-69A	1/2 COLLET

Split crankcases. See CASE DISASSEMBLY FOR TRANSMISSION REMOVAL (Page 5-16).

Countershaft Needle Bearing

See Figure 5-59. From inside transmission case use a bearing driver to remove countershaft bearing (1) from crankcase bore.

Shifter Drum Bushing

1. See Figure 5-59. The shifter drum bushing (2) is a press fit in the right crankcase half. Inspect the bushing against the corresponding end of the shifter drum for proper fit and wear.
2. If bushing is to be replaced, use BUSHING AND BEARING PULLER (PART NUMBER: HD-95760-69A) with 1/2 COLLET (PART NUMBER: HD-95765-69A) to remove bushing from crankcase bore.

INSTALLATION

PART NUMBER	TOOLNAME
A157-8	SNAP-ON BUSHING DRIVER 1/2-INCH ADAPTER

Countershaft Needle Bearing

1. Find a 1-1/4 in bearing driver.
2. See Figure 5-59. Position the open end of the countershaft bearing (1) toward the bore in the outside of the case.
3. Square the driver against the closed end of the bearing.
4. Drive the bearing flush or no more than 0.030 in (0.762 mm) below the outside surface.
5. Lubricate with SCREAMIN' EAGLE ASSEMBLY LUBE.

Shifter Drum Bushing

1. See Figure 5-59. Using A157C (SNAP-ON BUSHING DRIVER SET) and the SNAP-ON BUSHING DRIVER 1/2-INCH ADAPTER (PART NUMBER: A157-8), install a new shifter drum bushing (2).
2. Lubricate with SCREAMIN' EAGLE ASSEMBLY LUBE.

Figure 5-59. Transmission Right Case Bearings

REMOVAL

PART NUMBER	TOOL NAME
PR-36	SNAP RING PLIERS

Mainshaft and Countershaft Bearings

1. Split crankcases. See CASE DISASSEMBLY FOR TRANSMISSION REMOVAL (Page 5-16).
2. Disassemble transmission. See TRANSMISSION REMOVAL AND DISASSEMBLY (Page 5-19).
3. Inspect the mainshaft and countershaft ball bearings for damage.
4. See Figure 5-61. If bearing replacement is required, remove retaining rings (1, 2) using SNAP RING PLIERS (PART NUMBER: PR-36).
5. Press out bearings (3, 4) from the inside of foe crankcase.

Shifter Drum Bushing

1. Inspect the shifter drum bushing for damage.
2. If bushing requires replacement, press bushing out of crankcase from primary side toward inside of case.

INSTALLATION

Mainshaft and Countershaft Bearings

1. Place crankcase on press with inside surface of crankcase downward.
2. Lay bearing squarely over bore with printed side of bearing upward.
3. Place a driver (slightly smaller than outside diameter of tearing) against outer rare.
4. Press bearing into bore until bearing bottoms against shoulder.
5. Install **new** retaining ring with beveled side facing away from bearing.

Shift Drum Bushing

1. Place crankcase on press with outside surface of crankcase downward.
2. See Figure 5-60. Lay bushing squarely over bore. Using a pressing tool larger than OD of bushing, press bushing into bore until tool contacts crankcase.

1. Press bushing to contact shoulder in crankcase half.
2. Shifter drum bushing.
3. Outside crankcase

Figure 5-60. Shifter Drum Bushing Assembly

Figure 5-61. Ball Bearing Assembly

GENERAL

Before reinstalling transmission and reassembling crankcase halves, perform any necessary engine overhaul procedures. See BOTTOM END SERVICE (Page 3-32) and TOP END SERVICE (Page 3-18).

INSTALLATION

PART NUMBER	TOOL NAME
B-43985	TRANSMISSION REMOVAL AND INSTALLATION TOOL
B-43985-3	TRANSMISSION INSTALLER
B-43985-4	GUIDE
HD-46285-2	CASE HOLDING FIXTURE

FASTENER	TORQUE VALUE
Gear detent assembly screw	90-110 **in-lbs 1**0.2-12.4 N-m

1. See Figure 5-62. Assemble detent spring (3) onto gear detent assembly (2).

2. Install detent assembly with spring into place in transmission cavity of right crankcase.

3. Secure with screw (1). Tighten to 90-110 **in-lbs** (10.2-12.4 N-m).

NOTE

Use the TRANSMISSION REMOVAL AND INSTALLATION TOOL (PART NUMBER: 8-43985) to install the countershaft.

4. See Figure 5-63. Place transmission assembly (2) onto CASE HOLDING FIXTURE (PART NUMBER: HD-46285-2) (3) on press bed. Use support block(s) (4) if necessary.

5. Screw the GUIDE (PART NUMBER: B-43985-4) (1) into end of countershaft.

Figure 5-62. Gear Detent Assembly

Figure 5-63. Transmission on Fixture

6. See Figure 5-64. Install left crankcase (3) over transmission assembly (4).

7. Place the TRANSMISSION INSTALLER (PART NUMBER: B-43985-3) (2) over mainshaft and countershaft bearings in crankcase.

8. Position crankcase and transmission assemblies on press with installer under press ram (1).

Figure 5-64. Pressing Transmission into Left Crankcase

NOTE

Verify that the crankcase does not tilt when pressed onto transmission assembly. Place press ram on the installer closer to mainshaft to keep the crankcase level.

9. Press crankcase onto transmission assembly until shafts bottom out on bearings.
10. Remove left crankcase with transmission assembly from press.

NOTE

When removing assembly from fixture, prevent 1st gear from falling off shaft. Gear can be damaged if it strikes a hard surface.

SHIFTER.FORKS_AND.DRUM.ASSEMBLY.

NOTE

- *See Figure 5-65. Each shifter fork develops a wear pattern with its mating parts. Install each shifter fork in its original location.*
- *Lubricate the shaft bore in each shifter fork with SCREAMIN' EAGLE ASSEMBLY LUBE before assembly.*

1. Place 2nd/3rd gear Shifter fork onto dog ring between countershaft 2nd and 3rd gears.
2. Install shifter drum into left case half with scribed line at 12 o'clock. This will place shifter drum in neutral position.

NOTE

See Figure 5-66. Install shifter fork shafts in the left case half by lightly tapping on the end of the shaft with a brass or hard plastic hammer until shaft is seated in bore.

3. Place 1st gear shifter fork onto dog ring between countershaft 1st and 4th gear gears. Install shifter fork shaft through two installed shifter forks and into left crankcase half.
4. Install 4th/5th gear shifter fork onto sliding gear with dogs located on mainshaft. Install remaining shifter fork shaft through last installed shifter fork and into left crankcase half.

NOTE

Seat shifter fork shafts in left crankcase half bore using light taps with a brass hammer.

Figure 5-65. Shifter Forks, Drum and Shafts

Figure 5-66. Installing Shifter Fork Shafts

ASSEMBLING CRANKCASES

PART NUMBER	TOOL NAME
B-45520	GEAR DETENT ASSEMBLY AID
HD-42326-B	CRANKSHAFT GUIDE

FASTENER	TORQUE VALUE	
Crankcase fastener	15-19 ft-lbs	20.3-25.8 N-m
Neutral indicator switch	120--180 in-lbs	13.6-20.3 N-m

1. See Figure 5-67. Retract detent assembly in right case half and thread GEAR DETENT ASSEMBLY AID (PART NUMBER: B-45520) into neutral switch hole until it has bottomed in right case half.

2. See Figure 5-68. Install flywheel assembly into right crankcase half.

.4.CAUTION

Do not rotate crankcase half in engine stand when flywheel is installed. The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552c)

NOTE

Always place transmission in first gear when assembling crankcases. Other gear selections could cause damage.

3. Place transmission in first gear.

4. See Figure 5-69. Assemble crankcase halves together.

   a. Slide CRANKSHAFT GUIDE (PART NUMBER: HD-42326-B) onto flywheel sprocket shaft.

   b. Apply a thin coat of HARLEY-DAVIDSON GRAY HIGH-PERFORMANCE SEALANT - GRAY to crankcase joint faces.

   c. Lubricate main drive gear inner bearings with SCREAMIN' EAGLE ASSEMBLY LUBE.

   d. Carefully fit crankcases together.

   e. Apply several drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to last few threads of crankcase fasteners.

   f. Install 11 long and four short from the left side and two long from the right side.

   g. See Figure 5-70. In sequence, tighten to 15-19 ft-lbs (20.3-25.8 N-m).

5. Remove GEAR DETENT ASSEMBLY AID. Install neutral indicator switch and flat washer. Tighten to 120-180 **in-lbs** (13.6-20.3 N-m).

Figure 5-67. Using Gear Detent Assembly Aid (Part No. B-45520)

Figure 5-68. Installing Flywheel Assembly In Right Crankcase

Figure 5-69. Assembling Crankcases withCrankshaft Guide Tool (Part No. HD-42326-B)

Figure 5-70. Crankcase Fastener Torque Sequence

SHIFTER SHAFT INSTALLATION

FASTENER	TORQUE VALUE
Countershaft retaining screw	33-37 ft-lbs 144.8-50.2 N-m

1. See Figure 5-71. Correctly install shifter return spring onto the reverse side of the shifter shaft assembly before placing shaft in left crankcase half.

NOTE

See Figure 5-73. Verify shifter shaft return spring assembly and installation. Incorrect spring installation could cause problems with shifting.

2. See Figure 5-73. Press the ratchet arms and insert shaft assembly into the bushing in the left case half and release. Ratchet arms should now be inside the end plate of the shifter drum contacting the shifter drum pins.

3. See Figure 5-74. Apply several drops of LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to last few threads of countershaft retaining screw. Thread screw into end of shaft.

4. Place transmission in gear. Tighten screw to 33-37 ft-lbs (44.8-50.2 N-m).

5. Install transmission sprocket. See TRANSMISSION SPROCKET (Page 5-41).

6. Continue assembling engine. See BOTTOM END OVERHAUL: ASSEMBLY (Page 3-37) and TOP END OVERHAUL: ASSEMBLY (Page 3-25).

7. Install primary chain and engine sprocket, clutch assembly, and primary cover. See PRIMARY DRIVE AND CLUTCH (Page 5-7).

8. Install engine in chassis. See INSTALLING ENGINE IN CHASSIS (Page 3-49).

Figure 5-71. Correctly Installed Shifter Shaft Return Spring

Figure 5-72. Incorrectly Installed Shifter Shaft Return Spring

Figure 5-73. Installing Shifter Shaft Assembly

Figure 5-74. Countershaft Retaining Screw

REMOVAL

PART NUMBER	TOOL NAME
HD-46282-1A	SPROCKET HOLDING TOOL ADAPTER
HD-46282-A	TRANSMISSION SPROCKET HOLDING TOOL SET
HD-46288	MAINSHAFT LOCKNUT WRENCH

A WARNING

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

1. Remove main fuse.
2. Shift transmission to neutral.
3. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).
4. Remove retaining ring and clevis pin from master cylinder pushrod collar.
5. Remove right footrest and rear brake pedal assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-117) or Right Footrest and Rear Brake Pedal Assembly (Page 2-120).
6. See Figure 5-75. Remove screw (1), washer (2) and exhaust pipe clamp bracket (3).
7. Remove two screws (4, 5). Remove sprocket cover (6).
8. Remove rear drive belt from transmission sprocket. See Drive Belt (Page 5-13).
9. See Figure 5-76. Remove screw and washer from exhaust mounting bracket.
10. Remove two screws (5) and sprocket lockplate (4).

NOTE

Install SPROCKET HOLDING TOOL ADAPTER (PART NUMBER: HD-46282-1A) through exhaust mounting bracket into threaded boss in crankcase.

11. See Figure 5-77. Install TRANSMISSION SPROCKET HOLDING TOOL SET (PART NUMBER: HD-46282-A) (2). Place handle of tool underneath reaction adapter.
12. Use a breaker bar (4) with MAINSHAFT LOCKNUT WRENCH (PART NUMBER: HD-46288) (3). Turn nut **clockwise** to remove.

sm01469

1. **Screw**
2. **Washer**
3. **Exhaust pipe clamp bracket**
4. **Screw**
5. **Screw**
6. **Sprocket cover**

Figure 5-75. Sprocket Cover

1. **Main drive gear shaft**
2. **Transmission sprocket**
3. **Transmission sprocket nut**
4. **Lockplate**
5. **Screw (2)**
6. **Reaction adapter: removal**
7. **Reaction adapter: installation**

Figure 5-76. Transmission Sprocket Assembly

Figure 5-77. Removing Transmission Locknut

INSTALLATION

PART NUMBER	TOOL NAME
HD-46282-1A	SPROCKET HOLDING TOOL ADAPTER
HD-46282-A	TRANSMISSION SPROCKET HOLDING TOOL SET
HD-46288	MAINSHAFT LOCKNUT WRENCH

FASTENER	TORQUE VALUE	
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.8 N-m
Muffler mounting bracket screw	30-33 ft-lbs	40.7-44.7 N-m
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m
Transmission sprocket lock-plate screw	90-120 in-lbs	10.3-13.6 N-m
Transmission sprocket nut	50 ft-lbs	67.8 N-m

1. See Figure 5-76. Install transmission sprocket (2) onto main drive gear shaft (1).

NOTE

Screw SPROCKET HOLDING TOOL ADAPTER (PART NUMBER: HD-46282-1A) into threaded hole in crankcase (7).

2. Shift transmission to neutral.

3. Apply threadlocker and assembly lube.

   a. Apply LOCTITE 262 HIGH STRENGTH THREADLOCKER AND SEALANT (red) to the LH threads of transmission sprocket nut (3).

   b. Apply a thin film of SCREAMIN' EAGLE ASSEMBLY LUBE to back face of the sprocket nut.

NOTE

Turn left-hand thread sprocket nut ***counterclockwise*** *to install.*

4. See Figure 5-78. Install sprocket nut.

   a. Install TRANSMISSION SPROCKET HOLDING TOOL SET (PART NUMBER: HD-46282-A) (2). Place handle of tool on top of reaction adapter.

   b. Use a torque wrench (4) with MAINSHAFT LOCKNUT WRENCH (PART NUMBER: HD-46288) (3).

5. See Figure 5-79. Tighten transmission sprocket nut to specification.

   a. Tighten to 50 ft-lbs (67.8 N-m) initial torque.

   b. Scribe a line on transmission sprocket nut and continue line on transmission sprocket as shown.

   c. Tighten transmission sprocket nut 30-40 degrees more.

NOTE

The lockplate can be turned to either side to align screw holes. If screw holes cannot be properly aligned, tighten nut slightly until holes align. Do not exceed 45 degrees. Never LOOSEN nut to align screw holes.

6. See Figure 5-76. Install lockplate.

   a. Install lockplate (4) over nut (3). Align two diagonally opposed holes with two tapped holes of sprocket (2).

NOTE

Always install both screws to secure lockplate.

   b. Install screws (5) through two holes in lockplate into two tapped holes in sprocket. Tighten to 90-120 in-lbs (10.3-13.6 N-m).

7. Remove SPROCKET HOLDING TOOL ADAPTER (PART NUMBER: HD-46282-1A).

8. See Figure 5-76. Install screw and washer to secure exhaust mounting bracket to engine crankcase. Tighten to 30-33 ft-lbs (40.7-44.7 N-m).

9. Install rear drive belt onto transmission sprocket. See Drive Belt (Page 5-13).

10. Adjust drive belt deflection. See DRIVE BELT AND SPROCKETS (Page 1-32).

11. See Figure 5-75. Install sprocket cover (6). Thread long screw (4) in top hole and short screw (5) in bottom hole, finger-tight.

12. Install exhaust pipe clamp bracket (3), washer (2) and screw (1). Tighten to 30-33 ft-lbs (40.7-44.8 N-m). Now tighten screws (2, 3) to 80-120 in-lbs (9-13.6 N-m).

13. Install clevis pin and retaining ring through brake pushrod into master cylinder pushrod collar.

14. Install right footrest and rear brake pedal assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-117) or Right Footrest and Rear Brake Pedal Assembly (Page 2-120).

15. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

16. Install main fuse.

1. Holding tool reaction adapter
2. Sprocket holding tool
3. Mainshaft locknut wrench
4. Torque wrench

Figure 5-78. Installing Transmission Sprocket

1. Transmission sprocket
2. Sprocket nut
3. Line scribed on nut and sprocket

Figure 5-79. Transmission Sprocket Nut Final Tightening Procedure

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NOTES

FASTENER TORQUE VALUES IN THIS CHAPTER

FASTENER	TORQUE VALUE		NOTES
Alternator rotor to sprocket screw	120-140 in-lbs	13.6-15.8 N-m	6.26 ALTERNATOR, Assembly and Installation
Alternator stator mounting screw	30-40 in-lbs	3.4-4.5 N-m	6.26 ALTERNATOR, Assembly and Installation
Battery negative cable to crankcase stud	55-75 in-lbs	6.2-8.5 N-m	6.9 BATTERY CABLES, Negative Battery Cable
Battery terminal screw	60-70 in-lbs	6.8-7.9 N-m	6.9 BATTERY CABLES, Negative Battery Cable
Battery tray fastener	96-156 in-lbs	10.8-17.6 N-m	6.8 Battery Tray, Installation
Battery tray fastener	96-156 in-lbs	10.8-17.6 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m	6.20 Rear Stop Lamp Switch, Removal
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	6.15 INDICATOR LAMP MODULE, Assembly
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Backbone Electrical Caddies
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	6.29 RIGHT HANDLEBAR CONTROL MODULE, Installation
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	6.30 LEFT HANDLEBAR CONTROL MODULE, Installation
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	6.31 WHEEL SPEED SENSOR (WSS), Front WSS
CKP screw	100-120 in-lbs	11.3-13.6 N-m	6.21 Crank Position Sensor (CKP), Installation
Coil mounting bracket screw	35-45 in-lbs	4-5.1 N-m	6.12 IGNITION COIL, Installation
Coil mounting screw	24-72 in-lbs	2.7-8.1 N-m	6.12 IGNITION COIL, Installation
ECM caddy fastener	72-96 in-lbs	8.1-10.8 N-m	6.8 Battery Tray, Installation
ECM fastener	19-24 in-lbs	2.1-2.7 N-m	6.5 ELECTRONIC CONTROL MODULE (ECM), Installation
Electrical caddy cover	30-40 in-lbs	3.4-4.5 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Electrical caddy fastener	30-40 in-lbs	3.4-4.5 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Fender, rear, mounting fastener	120-168 in-lbs	13.6-19 N-m	6.19 REAR TURN SIGNALS, Removal and Install-ation
Fender brace, rear, screw	20-25 in-lbs	2.3-2.8 N-m	6.17 LICENSE PLATE LAMP MODULE, Installa- tion: Center-Mount License Plate
Fender support, rear, screw	132-216 in-lbs	14.9-24.4 N-m	6.17 LICENSE PLATE LAMP MODULE, Installa- tion: Center-Mount License Plate
Fork bracket screw: XL1200X	10-13 ft-lbs	13.6-17.6 N-m	6.18 Front Turn Signals, Removal and Installation
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	6.15 INDICATOR LAMP MODULE, Replacement Tighten rear first, front second: XL883N, XL1200NS
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	6.15 INDICATOR LAMP MODULE, Replacement Tighten rear first, front second: XL883N
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	6.15 INDICATOR LAMP MODULE, Replacement Front screws first: XL1200X
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	6.15 INDICATOR LAMP MODULE, Replacement Front screws first: XL1200X
Headlamp mount: XL1200X	30-35 ft-lbs	41-47 N-m	6.14 HEADLAMP, Headlamp Mounts
Headlamp upper bracket fasteners: XL883N	120-192 in-lbs	14-22 N-m	6.14 HEADLAMP, Headlamp Mounts

FASTENER	TORQUE VALUE		NOTES
Headlamp visor bracket screw: XL1200NS	10-16 ft-lbs	14-22 N-m	6.14 HEADLAMP, Headlamp Mounts
Horn fastener: front mount	36-48 in-lbs	4.1-5.4 N-m	6.27 HORN, Front Mount
Ignition switch face nut	72-96 in-lbs	8.1-10.8 N-m	6.10 Ignition Switch, Installation
Ignition switch mounting screw	35-45 in-lbs	4-5.1 N-m	6.10 Ignition Switch, Installation
J-clip fastener	45-50 ft-lbs	61-67.8 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, J-Clips: Mid-Mount Models
JSS screw	96-120 in-lbs	10.9-13.6 N-m	6.34 JIFFY STAND SENSOR (JSS): INTERNA-TIONAL MODELS, Installation
License plate lamp housing screw	14-16 in-lbs	1.6-1.8 N-m	6.17 LICENSE PLATE LAMP MODULE, Installa- tion: Center-Mount License Plate
License plate reflector bracket nut	35-44 in-lbs	4-5 N-m	6.17 LICENSE PLATE LAMP MODULE, Reflector Brackets
Main harness ground wire	55-75 in-lbs	6.2-8.5 N-m	6.9 BATTERY CABLES, Positive Battery Cable
Main harness ground wire	55-75 in-lbs	6.2-8.5 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Neutral indicator switch	120-180 in-lbs	13.6-20.3 N-m	6.23 Neutral Indicator Switch, Replacement
Oil pressure switch	60-90 in-lbs	6.8-10.2 N-m	6.24 Oil Pressure Switch, Installation
Oil tank mounting screws	72-96 in-lbs	8.1-10.8 N-m	6.9 BATTERY CABLES, Positive Battery Cable
Oil tank mounting screws	72-96 in-lbs	8.1-10.8 N-m	6.9 BATTERY CABLES, Positive Battery Cable
Oil tank mounting screws	72-96 in-lbs	8.1-10.8 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Solenoid contact post jamnut	65-80 in-lbs	7.3-9 N-m	6.13 STARTER, Solenoid
Speedometer screws	12-17 in-lbs	1.4-1.9 N-m	6.4 SPEEDOMETER, Installation
Speedometer screws	12-17 in-lbs	1.4-1.9 N-m	6.4 SPEEDOMETER, Installation
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	6.27 HORN, Front Mount
Starter motor oil line clamp fastener	16-21 in-lbs	1.8-2.4 N-m	6.13 STARTER, Installation
Starter mounting bolt	13-20 ft-lbs	17.6-27.1 N-m	6.13 STARTER, Installation
Starter positive ring terminal	60-80 in-lbs	6.8-9 N-m	6.13 STARTER, Installation
Starter ring terminal hex nut	60-80 in-lbs	6.8-9 N-m	6.9 BATTERY CABLES, Positive Battery Cable
Starter ring terminal hex nut	60-80 in-lbs	6.8-9 N-m	6.13 STARTER, Solenoid
Stator harness retainer screw	56 in-lbs	6.3 N-m	6.26 ALTERNATOR, Assembly and Installation Screw must be flush with plate. Do not exceed torque specification.
Stop lamp switch, rear	12-15 in-lbs	1.4-1.6 N-m	6.20 Rear Stop Lamp Switch, Installation
Switch assembly retainer screws	8-10 in-lbs	0.9-1.1 N-m	6.29 RIGHT HANDLEBAR CONTROL MODULE, Installation
Switch assembly retainer screws	8-10 in-lbs	0.9-1.1 N-m	6.30 LEFT HANDLEBAR CONTROL MODULE, Clutch Switch Replacement
Switch assembly retainer screws	8-10 in-lbs	0.9-1.1 N-m	6.30 LEFT HANDLEBAR CONTROL MODULE, Installation
Switch housing fastener	35-45 in-lbs	4-5.1 N-m	6.29 RIGHT HANDLEBAR CONTROL MODULE, Installation
Switch housing fastener	35-45 in-lbs	4-5.1 N-m	6.30 LEFT HANDLEBAR CONTROL MODULE, Installation
Tail lamp housing screw	10-20 in-lbs	1.1-2.3 N-m	6.17 LICENSE PLATE LAMP MODULE, Installa- tion: Center-Mount License Plate
Turn signal, front, ball head studs: XL883N, XL1200NS	96-144 in-lbs	10.8-16.3 N-m	6.18 Front Turn Signals, Removal and Installation
Turn signal, front, ball stud set screw: XL883N, XL1200NS	96-120 in-lbs	10.8-13.6 N-m	6.18 Front Turn Signals, Removal and Installation

FASTENER	TORQUE VALUE		NOTES
Turn signal housing to mount, rear, fastener	96-156 in-lbs	10.9-17.6 N-m	6.19 REAR TURN SIGNALS, Removal and Installation
Turn signal mount screw, front: XL1200X	12-16 ft-lbs	16.3-21.7 N-m	6.18 Front Turn Signals, Removal and Installation
Turn signal stalk locknut	120-168 in-lbs	13.6-19 N-m	6.19 REAR TURN SIGNALS, Removal and Installation
Voltage regulator mounting screw	30-60 in-lbs	3.4-6.8 N-m	6.25 VOLTAGE REGULATOR, Installation
VSS screw	100-120 in-lbs	11.3-13.6 N-m	6.22 Vehicle Speed Sensor (VSS), Installation

SPECIFICATIONS

Table 6-1. Electrical

COMPONENT	SPECIFICATION	
Ignition timing	Not adjustable	
Battery	12 V, 225 CCA, 12 Ah, sealed and maintenance free	
Charging system	Single-phase, 30 A system (375 W@ 13.5 V, 2000 rpm, 405 W max power @ 13.5 V)	
Spark plug size	12 mm	
Spark plug gap	0.038-0.043 in	0.97-1.09 mm
Spark plug torque	12-18 ft-lbs	16.3-24.4 Nm

Table 6-2. Ignition Coil Resistance

RESISTANCE	PRIMARY	SECONDARY
All Models	0.3-0.7 Ohm	1500-2400 Ohm

Table 6-3. Alternator

ITEM	SPECIFICATION
AC voltage output	20-28 VAC per 1000 engine rpm
Stator coil resistance	0.1-0.3 Ohm

Table 6-4. Voltage Regulator

ITEM	SPECIFICATION
Voltage output @ 75 °F (23.9 °C)	14.3-14.7 VDC
Current @ 3600 rpm	32 A

Table 6-5. Fuses

ITEM	AMP RATING
Main fuse	40
Battery	10
P&A	15

Table 6-6. Starter Specifications

STARTER DATA	
Free current	90 A (max) @ 11.5 V
Cranking current	250 A (max) @ 68 °F (20 °C)

Table 6-7. 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

REPLACEMENT

Removal

1. Open left side cover.
2. See Figure 6-1. Pull fuse block.
3. See Figure 6-2. Lift side latches to remove the cap.
4. Models with sirens: With fob present, turn OFF/RUN to RUN (keyless) or turn ignition switch to ON.
5. See Figure 6-3. Remove the suspect fuse:
   a. Main (1)
   b. P&A (2)
   c. Battery (3)
6. Inspect fuse. Discard damaged fuse.

Installation

1. Turn OFF/RUN to OFF (keyless) or turn ignition switch to OFF.
2. See Figure 6-3.Install new fuse as necessary.
3. See Figure 6-2. Install cap.
4. See Figure 6-1. Install fuse block.
5. Close side cover.

Figure 6-1. Fuse Block

Figure 6-2. Cap Side Latch

1. Main
2. P&A
3. Battery

Figure 6-3. Fuses

REMOVAL

A WARNING

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

NOTE

- *The speedometer has backlight LEDs. Replace the entire assembly if an LED fails.*
- *Both the ECM and the speedometer retain the odometer value. If the speedometer is replaced, the new speedometer will display the odometer value stored in the ECM. The new speedometer will lock to the mileage stored in the ECM after 31.1 mi (50 km) have been accumulated. The trip B odometer will display the countdown mileage.*
- *If the speedometer is installed on another vehicle after it has locked to the ECM, the odometer will display "VIN ERR" on the new vehicle. If the speedometer is removed from the vehicle before the countdown reaches zero, it will reset the mileage countdown to 31.1 mi (50 km). This mileage countdown allows for a road test to verify that speedometer replacement was the proper repair.*

XL883N and XL1200NS

1. **XL1200NS: Remove bolt-on instrument bracket/clamp. See HANDLEBAR (Page 2-96).**
2. **See Figure 6-4. Remove screws (6) from backplate (5).**
3. **Separate speedometer connector [39] (7).**
4. **Push speedometer (1) and front and back gaskets (2, 4) out of instrument housing (3).**
5. **Inspect gaskets, speedometer connector [39] and wiring. Repair or replace as required.**

XL1200X

1. **See Figure 6-5. Remove screws (5) from backplate (4).**
2. **Separate speedometer connector [39] (6).**
3. **Push speedometer (1) and gasket (2) out of instrument housing (3).**
4. **Inspect gaskets, speedometer connector [39] and wiring. Repair or replace as required.**

INSTALLATION

FASTENER	TORQUE VALUE	
Speedometer screws	12-17 in-lbs	1.4-1.9 N-m

XL883N and XL1200NS

NOTE

Lubricate parts with glass cleaner or isopropyl alcohol.

1. **See Figure 6-4. Install front gasket (2) on speedometer.**
2. **Install speedometer connector [39] (7) through instrument housing (3).**
3. **Connect speedometer connector [39] into back of speedometer.**

NOTE

Align speedometer locator features with tabs in instrument housing.

4. **Install speedometer into instrument housing.**

NOTE

Align gasket tabs with tabs in instrument housing.

5. **Install back gasket (4).**

NOTE

Position vent hole at bottom.

6. **Install backplate (5).**
7. **Install screws (6). Tighten.**

   Torque: 12-17 in-lbs (1.4-1.9 N-m) *Speedometer screws*

8. **XL1200NS: Install bolt-on instrument brackeUclamp. See HANDLEBAR (Page 2-96)**
9. **Install main fuse.**

Figure 6-4. Speedometer: XL883N and XL1200NS

XL1200X

1. See Figure 6-5. Install gasket (2) on speedometer (1).

2. Install speedometer connector [39B] (6) through instrument housing (3).

NOTE

Lubricate parts with glass cleaner or isopropyl alcohol.

3. Connect speedometer connector [39B] into back of speedometer.

4. Install speedometer into instrument housing/clamp.

5. Align the backplate (4) slot over harness.

6. Install screws (5). Tighten.
   Torque: 12-17 in-lbs (1.4—1.9 N-m) *Speedometer screws*

7. Install main fuse.

1. Speedometer
2. Gasket
3. Instrument housing
4. Backplate
5. Screw (2)
6. Speedometer connector [39B]
7. Indicator lamp module

Figure 6-5. Speedometer: XL1200X

REMOVAL

NOTE

- *For diagnostic information see the electrical diagnostic manual.*
- *This part is not serviceable. Replace assembly upon failure.*

1. **Models with security systems:** Disarm security system.
2. Remove left side cover.

AWARNING

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

3. Remove main fuse.
4. See Figure 6-6. Remove fastener (1).
5. Remove ECM.
6. Disconnect connector [78B-1] (2).
7. Disconnect connector [78B-2] (3).

INSTALLATION

PART NUMBER	TOOL NAME
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE
ECM fastener	19-24 **in-lbs**] 2.1-2.7 N-m

1. See Figure 6-6. Connect connector [78B-1] (2)to ECM.
2. Connect connector [78B-2] (2) to ECM.
3. Install ECM into caddy.
4. Install fastener (1). Tighten to 19-24 **in-lbs** (2.1-2.7 N-m).
5. Install main fuse.
6. Install side cover.
7. Calibrate with DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

Figure 6-6. Electronic Control Module (ECM)

REMOVAL

NOTE

- *For diagnostic information see the electrical diagnostic manual.*
- *This part is not serviceable. Replace assembly upon failure.* 1

. Remove side cover.

A WARNING

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

2. Remove main fuse.
3. See Figure 6-7. Press release to disconnect battery power connector [259B].
4. Remove BCM from electrical caddy.
5. See Figure 6-8. Press the central release on BCM connector [242B]. Rotate locking bar. Disconnect the connector.

Figure 6-7. Battery Power Connector [259] Release

Figure 6-8. BCM Connector [242] Release

INSTALLATION

NOTE

- *Replacement BCMs are configured for keyless ignition.*
- *If ignition is cycled ON when BCM is not secured in electrical caddy, the lights cycle on for 2 seconds and word "tip" displays in the odometer.*
- ***Keyed ignition:*** *If RUN/STOP switch is in RUN position when BCM is replaced, BCM enables all ignition functions. However, ignition switch does not function. To restore functionality, turn ignition and RUN/STOP switches OFF then turn ignition ON.*

PART NUMBER	TOOLNAME
HD-48650	DIGITAL TECHNICIAN II

1. Verify that ignition and/or OFF/RUN switch are off.
2. See Figure 6-8. Connect BCM connector [242B] connector housing.
3. Partially install BCM into caddy.
4. See Figure 6-7. Connect battery power connector [259B].

NOTE

See Figure 6-9. Route the BCM harness under connector [242B].

5. Install BCM in caddy.
6. Install main fuse.
7. **Keyed ignition:** Turn ignition switch to ON to configure BCM.
8. **Keyless ignition:** Turn RUN/STOP switch to RUN.

A WARNING

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

9. Configure BCM and password learn with DIGITAL TECHNICIAN II (PART NUMBER: HD-48650).

10. Install side cover.

A WARNING

Be sure headlamp, tail and stop lamp and turn signals are operating properly before riding. Poor visibility of rider to other motorists can result in death or serious injury. (00478b)

11. Test all switches and lights for proper operation.

Figure 6-9. BCM Harness Bundle

ACTIVATION

Activation consists of assigning two fobs to the system and entering an initial PIN.

NOTE

If the fob is lost or inoperable, the PIN allows the owner to disarm the system. See Changing the PIN (Page 6-69).

1. Configure the security system by assigning both fobs to the vehicle.
2. Configure the security system by entering a PIN picked by the owner.

Record the PIN in the owner's manual. Instruct the customer to carry a copy (use the wallet card found in the owner's manual). See Personal Identification Number (PIN) (Page 6-69).

Once the system has been activated, it "arms" within 5 seconds of switching the IGN switch to OFF and no motorcycle motion.

ANTENNA

See Figure 6-10. The antenna module connects directly to the antenna connector [209].

Figure 6-10. Security Antenna

FOB BATTERY

Battery Replacement Schedule

Replace the fob battery every year.

Battery Replacement

1. Open the fob case.
   a. See Figure 6-11. Place a thin blade in the thumbnail slot (1) between the two halves of the case.
   b. Slowly twist the blade.

NOTE

Use a CR2032 or equivalent battery.

2. Install a new battery with the positive side down.
3. Close the case.
   a. See Figure 6-11. With O-ring (3) in place, align case halves.
   b. Snap case halves together.

Figure 6-11. Open Fob

REMOVAL

A WARNING

Prevent accidental vehicle start-up, which could cause death or serious injury. First disconnect negative (-) battery cable at engine and then positive (+) cable from battery. (00280b)

1. Remove seat.
2. Remove left side cover.
3. Remove main fuse.
4. Remove battery. See Disconnection and Removal (Page 1-48).
5. Remove ECM. See Removal (Page 6-8).
6. Remove BCM. See Removal (Page 6-9).
7. Remove cable strap securing fuse block wire harness to battery tray.
8. Remove connectors from battery tray:
   a. Rear HO2S connector [137]
   b. Rear WSS [65]
   c. Data link [91]
9. Remove negative battery cable from tray bottom.
10. See Figure 6-12. Remove ECM caddy fastener (1), battery tray fasteners (2) and battery tray.
11. Unhook WSS wire lead from battery tray clips.

Figure 6-12. Battery Tray Fasteners

INSTALLATION

FASTENER	TORQUE VALUE	
Battery tray fastener	96-156 in-lbs	10.8-17.6 N-m
ECM caddy fastener	72-96 in-lbs	8.1-10.8 N-m

1. Set the battery tray in place.
2. Route the WSS connector [137] through the clips on the back side of the tray. Install the cable strap.
3. See Figure 6-13. Install the battery tray fasteners (1). Tighten to 96-156 in-lbs (10.8-17.6 N-m).
4. Install the ECM caddy fastener (2) securing the tray to the ECM caddy. Tighten to 72-96 in-lbs (8.1-10.8 N-m).
5. Fit the negative battery cable to the bottom of the tray.
6. Install connectors on the tray:
   a. Data link [91]
   b. WSS [65]
   c. HO2S [137
7. Clip the fuse block wire harness extension into the tray.
8. Install the ECM. See Installation (Page 6-8).
9. Install the BCM. See Installation (Page 6-9).
10. Install battery. See Installation and Connection (Page 1-50).
11. Install main fuse.
12. Install left side cover.
13. Install seat.

Figure 6-13. Battery Tray

FASTENER	TORQUE VALUE	
Battery negative cable to crankcase stud	55-75 **in-lbs**	6.2-8.5 N-m
Battery terminal screw	60-70 **in-lbs**	6.8-7.9 N-m

Removal

1. Remove left side cover.
2. Remove main fuse.
3. Remove negative cable from battery. See Disconnection and Removal (Page 1-48).
4. See Figure 6-14. Remove nut and ring terminal from negative battery ground stud.

NOTE

Note routing of negative battery cable across crankcase and under battery tray

5. Pull cable from notch in bottom of battery tray.
6. Pull negative battery cable from under battery tray.

Figure 6-14. Negative Battery Cable Ring Terminal and Ground Stud

Installation

A 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)

1. Route negative battery cable under battery tray, positive battery cable and main wire harness ground to crankcase ground stud.
2. See Figure 6-14. Install negative battery cable ring terminal and nut. Tighten to 55-75 **in-lbs** (6.2-8.5 N-m).
3. Fit negative cable to hook in bottom of battery tray.

NEGATIVE BATTERY CABLE

NOTE

Apply a light coat of petroleum jelly or corrosion retardant material to battery terminals.

4. Install negative battery cable to battery. Tighten to 60-70 **in-lbs** (6.8-7.9 N-m).
5. Install main fuse.
6. Install left side cover.

POSITIVE BATTERY CABLE

FASTENER	TORQUE VALUE	
Main harness ground wire	55-75 **in-lbs**	6.2-8.5 N-m
Oil tank mounting screws	72-96 **in-lbs**	8.1-10.8 N-m
Starter ring terminal hex nut	60-80 **in-lbs**	6.8-9 N-m

Removal

A 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 seat.
2. Remove side covers.
3. Remove ECM caddy cover.
4. Remove battery. See Disconnection and Removal (Page 1-48).
5. Remove ECM. See ELECTRONIC CONTROL MODULE (ECM) (Page 6-8).
6. Remove BCM. See BODY CONTROL MODULE (BCM) (Page 6-9).
7. Remove battery tray. See Battery Tray (Page 6-12).
8. Remove oil tank fasteners.
9. Remove fastener securing electrical caddy to oil tank bracket.
10. Remove main wire harness ground from crankcase.
11. Pull back rubber cap, remove nut and captive lockwasher and positive battery cable from starter post.
12. Remove boot from battery end of cable.
13. See Figure 6-15. Remove cable strap securing positive battery cable to main wire harness.
14. Pull battery cable up and out.

Figure 6-15. Cable Strap around Positive Battery Cable and Wire Harness

Installation

NOTICE

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

1. Install cable ring terminal over starter post. Install battery cable to left and back under ECM electrical caddy.
   b. Tighten to 60-80 **in-lbs** (6.8-9 N-m).

2. Secure positive battery cable to starter post.

   a. Install nut.

   c. Install rubber boot over starter post

3. Route positive cable up right side of frame.

NOTE

Position positive battery cable to locate the cable strap on the yellow tape area.

4. See Figure 6-15. Secure positive battery cable to main wiring harness with **new** cable strap.

5. Install oil tank mounting screws. Tighten to 72-96 **in-lbs** (8.1-10.8 N-m).

6. Install battery tray. See Battery Tray (Page 6-12).

7. Install fastener securing electrical caddy to oil tank bracket. Tighten to 72-96 **in-lbs** (8.1-10.8 N-m).

8. Install wire harness ground wire to crankcase. Tighten to 55-75 **in-lbs** (6.2-8.5 N-m).

9. Install ECM. See ELECTRONIC CONTROL MODULE (ECM) (Page 6-8).

10. Install BCM. See BODY CONTROL MODULE (BCM) (Page 6-9).

11. Install boot on positive battery cable.

12. Install battery in battery tray. See Installation and Connection (Page 1-50).

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. **Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).**

A 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 seat.**
4. **Remove fuel tank. See FUEL TANK (Page 4-10).**
5. **See Figure 6-16. Remove face nut (5).**
6. **Remove mounting screw (6).**
7. **Remove switch cover (3).**
8. **Disconnect connector (1) from ignition switch (2).**
9. **Remove ignition switch.**

INSTALLATION

1. **See Figure 6-16. Connect connector (1) to ignition switch (2).**

FASTENER	TORQUE VALUE	
Ignition switch face nut	72-96 in-lbs	8.1-10.8 N-m
Ignition switch mounting screw	35-45 in-lbs	4-5.1 N-m

2. **Install ignition switch into the switch cover (3) with the word TOP stamped on the switch body facing upward.**
3. **Loosely install face nut (5).**
4. **Install mounting screw (6). Tighten to 35-45 in-lbs (4-5.1 N-m).**
5. **Tighten face nut to 72-96 in-lbs (8.1-10.8 N-m).**
6. **Install fuel tank. See FUEL TANK (Page 4-10).**
7. **Install seat. After installing seat, pull up on the seat to make sure that it is secure.**
8. **Install main fuse.**

A WARNING

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

9. **Test all switches and lights for proper operation.**

Figure 6-16. Ignition Switch

SPARK PLUG CABLES

GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core (instead of solid wire) for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A 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 seat.

4. Remove fuel tank. See FUEL TANK (Page 4-10).
5. See Figure 6-17. Remove screw (1) securing left wire harness caddy (2) to right wire harness caddy.

6. Carefully disengage left wire harness caddy. Remove caddy from frame backbone.

NOTE

Always grasp rubber boot as close as possible to the spark plug terminal when removing spark plug cables. Do not pull on the cable portion itself. Pulling on the cable damages the carbon core.

7. Remove front spark plug boot and cable from left side ignition coil tower.

8. Remove rear spark plug boot and cable from right side ignition coil tower.

9. Remove spark plug boot and cable assemblies from front and rear spark plugs.

10. Remove rear spark plug cable from notch in right wire harness caddy. Remove the cable.

11. See Figure 6-18. Remove rear spark plug cable (2) from curved trough on right wire harness caddy (1).

c. Remove cable strap from mounting boss on caddy latch clip (5).

Figure 6-17. Ignition Coil and Left Wire Harness Caddy

Figure 6-18. Rear Spark Plug Cable Routing

a. Cut cable strap (4).

b. Remove spark plug cable from between frame and engine.

INSTALLATION

1. Install rear spark plug cable boot to right side ignition coil tower.
2. Install cable between wire harness caddies, and down through notch in right caddy, toward right side of engine.
3. See Figure 6-18. Install rear spark plug cable (2):
   a. In trough in right wire harness caddy (1).
   b. Over top of engine sub-harness (3).
   c. Back toward left side of engine.
4. See Figure 6-19. Install new barbed cable strap (3) on rear spark plug cable (1), 7.0-7.25 in (178-184 mm) from tip of spark plug boot (2).
   a. Install cable strap to position spark plug cable above mounting boss on caddy latch clip.
   b. Press cable strap barbed prong firmly into hole in caddy latch clip mounting boss.

NOTE

Verify that the rear spark plug cable is routed properly. The cable cannot chafe against frame, fuel tank or rear cylinder head.

5. Install rear spark plug cable and boot to rear spark plug until it clicks.
6. Install front spark plug cable and boot to left side ignition coil tower. Install other end of cable onto front spark plug until it clicks.
7. See Figure 6-17. Install left wire harness caddy (2) to right wire harness caddy. Secure with screw (1). See MAIN IRING HARNESS AND ELECTRICAL CADDIES (Page 6-52).
8. Install fuel tank. See FUEL TANK (Page 4-10).
9. Install seat. After installing seat, pull up on the seat to make sure that it is secure.
10. Install main fuse.
11. Start engine to verify ignition.

Figure 6-19. Rear Spark Plug Cable and Cable Strap

IGNITION COIL

GENERAL

The ignition coil is attached to a mounting bracket secured by the front fuel tank mounting bolt. The unit is divided into separate front and rear coils that fire the spark plugs one cylinder at a time.

The ignition coil is mounted on the left half of a two-piece bracket assembly. The right half of the bracket assembly secures the ignition switch and right wire harness caddy to the vehicle. The two bracket halves are secured together with a screw.

NOTE
This part cannot be repaired. Replace upon failure.

See the electrical diagnostic manual for troubleshooting.

REMOVAL

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A 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 seat.

4. Remove fuel tank. See FUEL TANK (Page 4-10).

5. See Figure 6-20. Remove screw (1) securing left wire harness caddy (2) to right wire harness caddy. Carefully disengage left wire harness caddy. Remove caddy from frame backbone.

NOTE
Always grasp rubber boot as close as possible to spark plug terminal when removing spark plug cables. Do not pull on cable portion itself. Pulling on cable damages carbon core.

Figure 6-20. Ignition Coil and Left Wire Harness Caddy

6. See Figure 6-21. Disconnect coil harness connector [83B] (2) from ignition coil (1).

7. **Keyed ignition:** Disconnect ignition switch connector [83B].

8. Remove front spark plug boot and cable (3) from left ignition coil tower.

9. Remove rear spark plug boot and cable (4) from right ignition coil tower.

10. Remove screw (5) securing mounting bracket (6). Remove coil and bracket from vehicle.

11. See Figure 6-22. Remove screws (4) to remove ignition coil (1) from mounting bracket (2) and plate (3).

Figure 6-21. Ignition Coil Mounting and Connections

Figure 6-22. Ignition Coil Mounting

1. See Figure 6-22. Position new ignition coil (1) on underside of mounting bracket (2).

2. Install ignition coil to mounting bracket with screws (4) and plate (3). Tighten to 24-72 in-lbs (2.7-8.1 N-m).

INSTALLATION

FASTENER	TORQUE VALUE	
Coil mounting bracket screw	35-45 in-lbs	4-5.1 N-m
Coil mounting screw	24-72 in-lbs	2.7-8.1 N-m

3. See Figure 6-21. Install coil:

   a. Install ignition coil (1) and mounting bracket (6).

   b. Make sure all wiring harnesses from front or motorcycle are positioned between coil bracket upright and vehicle frame.

   c. Install screw (5). Tighten to 35-45 in-lbs (4-5.1 N-m).

   d. Connect ignition coil connector [33B].

4. Keyed ignition: Connect ignition switch connector [83B].

5. Install front spark plug boot and cable (3) to left side of coil.

6. Install rear spark plug boot and cable (4) to right side of coil.

7. See Figure 6-20. Install left wire harness caddy (2) to right wire harness caddy. Secure with screw (1).

8. Install fuel tank. See FUEL TANK (Page 4-10).

9. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

10. Install main fuse.

REMOVAL

A WARNING

Prevent accidental vehicle start-up, which could cause death or serious injury. First disconnect negative (■) battery cable at engine and then positive (+) cable from battery. (00280b)

1. Disconnect battery. See BATTERY MAINTENANCE (Page 1-47).
2. Drain transmission. Remove primary cover. See PRIMARY COVER (Page 5-3).
3. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).
4. Remove starter solenoid connector [128].
5. Remove positive battery lead from starter.
6. Remove fastener securing oil line retaining clamp to starter.

NOTE

Use a ball hex driver to remove the starter mounting bolts.

7. See Figure 6-23. Remove two starter mounting bolts and washers.
8. Remove starter and gasket from right side of motorcycle.

Figure 6-23. Starter Mounting Bolts

TOUCH-UP PAINT

Touch-up damaged paint before installation. Follow directions provided with paint. Paint flaking does not require starter replacement.

INSTALLATION

FASTENER	TORQUE VALUE	
Starter motor oil line clamp fastener	16-21 **in-lbs**	1.8-2.4 N-m
Starter mounting bolt	13-20 ft-lbs	17.6-27.1 Nm
Starter positive ring terminal	60-80 **in-lbs**	6.8-9 N-m

1. See Figure 6-23. Install starter and starter gasket from right side of motorcycle.
2. Install two starter mounting bolts and washers. Tighten.

   Torque: 13-20 ft-lbs (17.6-27.1 N-m) *Starter mounting bolt*
3. Install oil line clamp to starter motor. Tighten.

   Torque: 16-21 **in-lbs** (1.8-2.4 N-m) *Starter motor oil line clamp fastener*
4. Connect starter solenoid connector [128].
5. Install positive battery cable. Tighten. Place rubber boot securely over terminal.

   Torque: 60-80 **in-lbs** (6.8-9 N-m) *Starter positive ring terminal*
6. Install primary cover. See PRIMARY COVER (Page 5-3).
7. Fill primary chaincase. See TRANSMISSION LUBRICANT (Page 1-21).
8. Install exhaust system. See EXHAUST SYSTEM (Page 4-38).

A WARNING

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

9. Connect battery. See BATTERY MAINTENANCE (Page 1-47).

SOLENOID

FASTENER	TORQUE VALUE	
Solenoid contact post jamnut	65-80 **in-lbs**	7.3-9 N-m
Starter ring terminal hex nut	60-80 **in-lbs**	6.8-9 N-m

Remove Cover and Plunger

1. See Figure 6-24. Remove fasteners (1), cover (2) and gasket (3).
2. Remove the plunger (4) with spring (5).

Figure 6-24. Solenoid Plunger

Short Post Contact: Starter

1. Disassemble the short post contact:
   a. Remove the hex nut and the ring terminal from the post.
   b. See Figure 6-25. Remove jamnut (8), wave washer (7), O-ring (6) and round bushing (5).
   c. Remove the post bolt (1).
   d. Remove the hold-in terminal (2) from the post bolt.
   e. Remove the contact plate (3) and the square bushing (4).
2. Assemble the short post contact:
   a. Insert the square bushing into the housing.
   b. Install the contact plate with the 90 degree part of the contact plate against the solenoid winding.
   c. Install the post bolt through the hold-in terminal, the contact plate and the square bushing.
   d. Install the round bushing, O-ring, wave washer and jamnut.

Figure 6-25. Short Post Contact (starter)

Long Post Contact: Battery Positive

1. See Figure 6-26. Remove the long post contact:
   a. Remove hex nut (9).
   b. Remove jamnut (8), wave washer (7), O-ring (6) and the round bushing (5).
   c. Remove post bolt (4), contact plate (3), square bushing (2) and paper insulator (1).
2. Install the long post contact:
   a. Insert the square bushing through the paper insulator into the housing.
   b. Install the contact plate with the foot against the solenoid winding.
   c. Install the post bolt.

NOTE

Check that the index pin on the round bushing fits the blind hole in the housing.

   d. Install the round bushing, O-ring, wave washer and jamnut.

Figure 6-26. Long Post Contact (battery)

Install Plunger and Cover

1. Apply LUBRIPLATE 110 to the plunger shaft. Install the spring.
2. Install the plunger and spring in the housing.
3. While compressing the plunger, alternately tighten the contact postjamnuts to 65-80 **in-lbs** (7.3-9 N-m).
4. Check that the contact plates are aligned to the solenoid winding.
5. Install the cover:
   a. Install a **new** gasket on the cover.
   b. Install the cover.
   c. Install the fasteners until snug.
6. Install the starter positive ring terminal.
7. Install the hex nut. Tighten to 60-80 **in-lbs** (6.8-9 N-m).

CLUTCH SHAFT ASSEMBLY

Removal

1. See Figure 6-27. Loosen the two starter support bolts (1).
2. Remove the two fasteners (2) and separate the clutch assembly housing (4) from the starter/solenoid housing (3).
3. Save the spring (5) from the solenoid plunger shaft.

NOTE

Remove the old assembly lube to release the steel ball (8).

4. Remove and save the steel ball from the bearing end of the clutch shaft assembly (6) bore.
5. Tap on the end of the shaft to remove the clutch shaft assembly from the housing.
6. Remove the idler gear (7) from the bearing cage.
7. Remove bearing cage and the five steel cylinders.

1. **Starter support bolts**
2. **Fasteners**
3. **Starter and solenoid housing**
4. **Clutch assembly housing**
5. **Spring**
6. **Clutch shaft assembly**
7. **Idler gear**
8. **Steel ball**

Figure 6-27. Starter Drive Housing and Clutch Shaft

Inspection

1. Inspect the O-rings in the clutch assembly housing bore.
2. Inspect the spring for kinks or elongation.
3. Inspect the steel ball.
4. Inspect the idler gear and the cage.
5. Inspect the clutch shaft assembly pinion gear for missing or damaged teeth.
6. Check that the roller bearings and the clutch gear on the clutch shaft rotate freely.

Installation

1. Lubricate components with LUBRIPLATE 110.
2. See Figure 6-28. Install the bearing cage (1) and the five steel cylinders (2).
3. Install the idler gear (3) over the bearing cage.
4. Align the gear teeth to the idler gear. Install the clutch shaft assembly (4) in the housing. Seat the bearing in the counterbore.
5. Install the steel ball (5) in the bore of the shaft.
6. Apply a light film of LUBRIPLATE 110 to solenoid plunger shaft. Install spring (6) on solenoid plunger shaft.
7. Apply a thin layer of HARLEY-DAVIDSON HIGH PERFORMANCE SEALANT - GRAY to the face of the clutch assembly housing.

8. See Figure 6-27. Install the completed clutch assembly housing (4) to the starter and solenoid housing (3).
9. Install the fasteners. Tighten alternately until snug.

1. **Bearing cage**
2. **Steel cylinders**
3. **Idler gear**
4. **Clutch shaft assembly**
5. **Steel ball**
6. **Spring**

Figure 6-28. Starter Clutch Assembly

BULB.REPLACEMENT

Hi/Low Beam

NOTE

Replace the bulb with the specified H4 halogen bulb.

1. **XL1200NS:** See HEADLAMP VISOR (Page 2-102). Remove headlamp visor.
2. Remove the trim ring. Remove the screw (1) and the trim ring (2).
3. Hold the lens and compress the release tabs of the connector (11) to disconnect from spade terminals.
4. Remove the rubber boot (9) from back of the lens.
5. Compress the ends of the retaining clip (8) to release from the retaining tabs and pivot retaining clip back.
6. Remove and replace the bulb (7).

NOTE

The tab opposite bulb center spade connector fits top notch in the reflector which points to top of lens.

7. Install the retaining clip over the bulb. Press the ends into the retaining tabs.
8. Install the rubber boot with the word TOP over the top notch. Press the center ring down flush with base of the bulb.
9. Connect the bulb connector to the bulb.
10. Install the lens. Fit the adapter ring and the lens to the headlamp shell.
11. Install the trim ring, screw and nut as necessary.
12. **XL1200NS:** See HEADLAMP VISOR (Page 2-102). Install headlamp visor.

Position Lamp: HDI

1. Disconnect the spade connectors from the position lamp bulb holder.
2. Remove the bulb holder from the lens.
3. Push and rotate **new** bulb clockwise into socket.
4. Install the bulb holder and connect the connectors.

1. **Screw**
2. **Nut**
3. **Trim ring**
4. **Lens**
5. **Bulb shield**
6. **Position lamp (HDI)**
7. **Bulb**
8. **Retaining clip**
9. **Rubber boot**
10. **Adapter ring**
11. **Connector**
12. **XL883N, XL1200NS**
13. **XL1200X**

Figure 6-29. Headlamp Assembly: XL883N, XL1200NS and XL1200X

HEADLAMP MOUNTS

FASTENER	TORQUE VALUE	
Headlamp mount: XL1200X	30-35 ft-lbs	41-47 N-m
Headlamp upper bracket fasteners: XL883N	120-192in-lbs	14-22 N-m
Headlamp visor bracket screw: XL1200NS	10-16 ft-lbs	14-22 N-m

Mount: XL883N

A WARNING

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

1. Remove main fuse.

2. See Figure 6-30. Mount upper bracket (1) to upper fork clamp with washer (2) and fastener (3). Tighten.

   Torque: 120-192 in-lbs (14-22 N'm) *Headlamp upper bracket fasteners: XL883N*

3. Install washer (4), lockwasher (5) and nut (6) to headlamp. Tighten hand-tight.

4. Install main fuse.

5. Align headlamp. See HEADLAMP ALIGNMENT (Page 1-54).

1. Upper bracket
2. Washer (2)
3. Fastener (2)
4. Washer
5. Lockwasher
6. Nut
7. Plug

Figure 6-30. Headlamp Mount: XL883N

Mount: XL1200NS

1. Remove main fuse.

2. Position headlamp (8) into headlamp bracket (9).

3. Position washer (10), lockwasher (7), clamp nut (11) and mount (6) on headlamp visor bracket (3).

4. Install washer (1) and screw (2). Hand tighten.

5. Place headlamp visor bracket assembly on upperclamp fork.
6. Install spacers (5), washers (12) and screws (13). Tighten.

   Torque: 10-16 ft-lbs (14-22 N'm) *Headlamp visor bracket screw: XL 1200NS*

7. Align headlamp. See HEADLAMP ALIGNMENT (Page 1-54).

8. Install headlamp visor (4). See HEADLAMP VISOR (Page 2-102).

9. Install main fuse.

1. **Washer**
2. **Screw**
3. **Headlamp visor bracket**
4. **Headlamp visor**
5. **Spacer (2)**
6. **Mount**
7. **Lockwasher**
8. **Headlamp**
9. **Headlamp bracket**
10. **Washer**
11. **Headlamp clamp nut**
12. **Washer (2)**
13. **Screw (2)**

Figure 6-31. Headlamp Mount XL1200NS

Mount: XL1200X

1. Remove main fuse.

2. See Figure 6-32. Install fastener (1), washer (2) and mounting post (3). Tighten.

   Torque: 30-35 ft-lbs (41-47 N-m) *Headlamp mount: XL1200X*

3. Install headlamp, fastener (4) and washer (5). Secure with washer, lockwasher (6) and nut (7). Hand tighten.

4. Install main fuse.

5. Align headlamp. See HEADLAMP ALIGNMENT (Page 1-54).

1. **Fastener**
2. **Washer**
3. **Mounting post**
4. **Mount fastener**
5. **Washer (2)**
6. **Lockwasher**
7. **Nut**

Figure 6-32. Headlamp Assembly Mount: XL1200X

PRELIMINARY DISASSEMBLY

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Position vehicle upright.
2. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).
3. Disconnect fuel supply line from fuel pump module.

A WARNING

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

4. Remove main fuse.
5. Remove seat.
6. Remove fuel tank. See FUEL TANK (Page 4-10).
7. Disconnect instrument connector [20].
   a. Remove screw securing left wire harness caddy to right wire harness caddy.
   b. See Figure 6-33. Locate instrument connector [20] on right wire harness caddy.
   c. Disconnect connector [20] housings.
8. Record cable strap locations before removal.
9. Remove cable straps.

Figure 6-33. Instrument Connector [20]

REPLACEMENT

FASTENER	TORQUE VALUE	
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m

1. Cover headlamp bracket with a protective cloth.
2. Holding instrument housing (2), remove screws securing housing/clamp assembly to handlebar risers.
3. See Figure 6-34 or Figure 6-35. Remove screws (5) to remove indicator lamp module (3) from instrument housing and indicator lamp bezel.
4. Remove speedometer. See Removal (Page 6-6).
5. Remove instrument harness.
6. Place new instrument harness in position.
7. Install speedometer. See Installation (Page 6-6).
8. See Figure 6-34 or Figure 6-35. Install new indicator lamp bezel (1) and indicator lamp module (3) to instrument housing (2). Install screws (5).
9. Install instrument housing onto handlebar risers.
10. XL883N, XL1200NS: Tighten rear screws first then front screws:
    a. Rear screws first to 12-18 ft-lbs (16.3-24.4 N-m).
    b. Front screws to 12-18 ft-lbs (16.3-24.4 N-m).
11. XL1200X: Tighten front screws first then rear screws.
    a. Front screws first to 12-18 ft-lbs (16.3-24.4 N-m).
    b. Rear screws to 12-18 ft-lbs (16.3-24.4 N-m).

Indicator lamp bezel Instrument housing Indicator lamp module Instrument harness connector Screw (2)

[20A]

Figure 6-34. XL883N and XL1200NS

1. Indicator lamp bezel
2. Instrument housing
3. Indicator lamp module
4. Instrument harness connector [20A]
5. Screw (2)

Figure 6-35. XL1200X

ASSEMBLY

FASTENER	TORQUE VALUE	
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m

1. See MAIN WIRING HARNESS AND ELECTRICAL CADDIES (Page 6-52).
   a. Feed instrument harness between coil bracket uprights, back to right wire harness caddy.
   b. Plug instrument harness pin connector [20A] into socket connector [20B] in right wire harness caddy.
   c. Mate right and left wire harness caddies.
   d. Install screw. Tighten to 15-25 in-lbs (1.7-2.8 N-m).
2. Secure instrument harness with cable straps.
3. Install fuel tank. See FUEL TANK (Page 4-10).
4. Install main fuse.
5. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

GENERAI

Tail Lamp Bulb: Not replaceable. See housing.

Tail Lamp Housing: Use procedure for Center-Mount License Plate Lamp. See LICENSE PLATE LAMP MODULE (Page 6-30).

GENERAL

Some markets use a convertible side-mount license plate. This assembly requires a separate license plate lamp module.

NOTE

- *This part is not serviceable. Replace assembly upon failure.*
- *This feature may not be available in all markets.*

REMOVAL: SIDE-MOUNT LICENSE PLATE

A WARNING

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

1. **Remove main fuse.**

NOTICE

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

2. **Remove rear wheel. See REAR WHEEL (Page 2-17).**

3. **Remove seat.**

4. **See Figure 6-36. Disconnect license plate lamp connector [40]. '**

5. **See Figure 6-37. Carefully remove license plate lamp harness (6) through left feed-through hole (5) on left side of fender.**

6. **Remove license plate lamp harness from bracket (1) on left side of fender.**

7. **Remove parts.**

   a. **See Figure 6-38. Remove license plate lamp harness (3) from upper license plate bracket harness clips (1) and harness channel (2).**

   b. **Remove screws (4) and license plate lamp module**

Figure 6-36. License Plate Lamp Connector [40]

Figure 6-37. Wire Harness Routing and Harness Brackets

(5) from license plate bracket.

Figure 6-38. License Plate Lamp Module

INSTALLATION: SIDE-MOUNT LICENSE PLATE

1. Attach parts.

   a. See Figure 6-38. Install **new** license plate lamp module (5) into convertible side mount license plate bracket. Install screws (4).

   b. Install license plate lamp harness (3) up through harness channel (2). Install harness into upper license plate bracket harness clips (1).

2. See Figure 6-37. Install license plate lamp harness (6) into bracket (1) on left side of fender.

3. Install harness through feed-through hole (5) on left side of rear fender.

4. Connect license plate lamp connector [40] housings.

5. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

6. Install rear wheel. See REAR WHEEL (Page 2-17).

7. Install main fuse.

. A WARNING

Be sure headlamp, tail and stop lamp and turn signals are operating properly before riding. Poor visibility of rider to other motorists can result in death or serious injury. (00478 b)

8. Check operation of all lamps.

REMOVAL: CENTER-MOUNT LICENSE PLATE

NOTE

• See Figure 6-39. Vehicles in some *markets have a center-mounted license plate holder and lamp assembly.*

• Some destinations use an LED tail lamp/license plate lamp. Replace the entire assembly if an LED fails.

Figure 6-39. License Plate Holder and Lamp Assembly: XL883N, XL1200NS and XL1200X

1. Remove main fuse.

2. Remove seat.

NOTICE

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

3. Remove rear wheel. See REAR WHEEL (Page 2-17).

4. Disconnect the license plate lamp harness connector [40] housings.

5. Remove parts.

   a. See Figure 6-40. Remove license plate lamp harness (3) from harness bracket (1) and harness clips (2). Remove harness and connector through hole in rear fender.

   b. See Figure 6-41. Remove fender support screws and washers (4). Remove screw and washer (5) securing rear fender to rear fender brace (2). Remove fender brace and license plate holder assembly (1).

Figure 6-40. License Plate Holder and Lamp Harness Mounting

Figure 6-41. License Plate Holder (typical)

6. See Figure 6-42. Remove screws and washers (2) securing license plate lamp housing to license plate holder (1).
7. See Figure 6-43. Remove lamp housing (3) and gasket (2) from license plate holder (1).

Figure 6-42. License Plate Holder and Lamp Mounting Screws (typical)

1. **License plate holder**
2. **Screw and washer (2)**

Figure 6-43. Lamp Housing Separated from License Plate Holder (typical)

8. See Figure 6-44. Insert the tip of a small flat bladed screwdriver (3) into each slot (2) in lamp housing. Gently tilt screwdriver handle outward (away from lamp housing) enough to disengage housing from cover. Remove housing from cover. Remove housing from tabs (4) in cover.
9. See Figure 6-45. If replacing a light bulb (2), gently pull bulb

straight out of socket assembly (3). Push **new** light bulb into socket.

Figure 6-44. Removing License Plate Lamp Housing Cover

Figure 6-45. Replacing License Plate Light Bulbs

INSTALLATION: CENTER-MOUNT LICENSE PLATE

FASTENER	TORQUE VALUE	
Fender brace, rear, screw	20-25 in-lbs	2.3-2.8 N-m
Fender support, rear, screw	132-216 in-lbs	14.9-24.4 N-m
License plate lamp housing screw	14-16 in-lbs	1.6-1.8 N-m
Tail lamp housing screw	10-20 in-lbs	1.1-2.3 N-m

NOTE

- *Some markets are equipped with a combination tail lamp/license plate lamp. This procedure covers both types.*
- *License plate lamp bulb is replaceable.*
- *Tail lamp/license plate bulb is not replaceable. Replace the entire lamp housing.*

1. See Figure 6-44. Carefully install housing cover onto lamp housing (1), sliding tabs (4) on cover into slots (2) in housing. Verify that harness wires fit into feed slots (5) in housing.

2. Gently install cover onto housing Do not pinch wires.

3. Install gasket onto lamp housing.

4. Install lamp housing onto license plate holder with lamp housing cover facing upward.

5. Secure lamp housing with two screws. Tighten.

   Torque: 14-16 in-lbs (1.6-1.8 N-m) *License plate lamp housing screw*
   Torque: 10-20 in-lbs (1.1-2.3 N-m) *Tail lamp housing screw*

6. Install parts.

   a. Install tab on license plate holder into slot in rear fender brace. Install assembly onto vehicle. Install screw and washer through fender and into fender brace. Tighten finger-tight.

   b. Install screws and washers through fender struts, fender, fender brace and into threaded inserts in license plate holder.

   c. See Figure 6-46. Verify that license plate holder threaded inserts (3) fit into holes (4) in rear fender brace (2).

   d. Tighten Fender support screw.

      Torque: 132-216 in-lbs (14.9-24.4 N-m) *Fender support, real, screw*

   e. Tighten Fender brace rear screw.

      Torque: 20-25 in-lbs (2.3-2.8 N-m) *Fender brace, rear, screw*

7. Install license plate lamp harness into three clips in fender bracket. Feed harness and connector through feedthrough hole in fender. Press harness into harness bracket.

8. Connect license plate lamp harness connector [40B] housings.

9. Install rear wheel. See REAR WHEEL (Page 2-17).

10. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

11. Install main fuse.

A WARNING

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

12. Check operation of all lamps.

Figure 6-46. License Plate Holder and Rear Fender Brace

REFLECTOR BRACKETS

Removal

FASTENER	TORQUE VALUE	
License plate reflector bracket nut	35-44 **in-lbs**	4-5 N-m

1. See Figure 6-47. Remove the nuts (1), washers (2) and bolts (3). Remove the reflector brackets (4).

Installation

1. See Figure 6-47. Install the reflector brackets (4) to the license plate assembly with the bolts (3), washers (2) and nuts (1). Tighten.

   Torque: 35-44 **in-lbs** (4-5 N-m) *License plate reflector bracket nut*

Figure 6-47. License Plate and Reflector Brackets

BULB REPLACEMENT

1. Insert coin in notch. Carefully twist coin until lens cap pops out of turn signal housing.
2. Replace bulb.
   a. Push bulb and turn counterclockwise.
   b. While pushing bulb in, rotate counterclockwise to remove.
   c. Coat base of new bulb with ELECTRICAL CONTACT LUBRICANT.
   d. Push and rotate new bulb clockwise into socket.
3. Snap lens cap back into housing.

REMOVAL AND INSTALLATION

APPLICABILITY	
0	• 2021 IRON 883 (XL883N) • 2021 IRON 1200 (XL1200NS)

FASTENER	TORQUE VALUE	
Turn signal, front, ball head studs:XL883N,XL1200NS	96-144 in-lbs	10.8-16.3 N-m
Turn signal, front, ball stud set screw: XL883N, XL1200NS	96-120 in-lbs	10.8-13.6 N-m

Removal

1. Remove wire harness. See Front Turn Signal Wire Harness (Page 6-36).
2. See Figure 6-48. Loosen set screw to remove turn signal assembly.

Installation

1. See Figure 6-49. Inspect ball end stud (1). Replace or repair as necessary.
2. If replaced, tighten new ball head studs .

   Torque: 96-144 in-lbs (10.8-16.3 N-m) *Turn signal, front, ball head studs: XL883N, XL 1200NS*
3. See Figure 6-48. Install ball end stud into lever bracket. Loosely install set screw.
4. Adjust turn signal so lens is aimed directly forward. Tighten set screw.

   Torque: 96-120 in-lbs (10.8-13.6 N-m) *Turn signal, front, ball stud set screw: XL883N, XL 1200NS*
5. Check for clearance.
   a. Lay protective cover over fuel tank.
   b. Slowly turn handlebar to full left lock and full right lock.
   c. If either turn signal contacts fuel tank, loosen set screw. Reposition turn signal outward away from fuel tank. Make sure that lens is aimed forward.
6. Install wire harness. See Front Turn Signal Wire Harness (Page 6-36).
   d. Tighten set screw to specification.

Figure 6-48. Ball Stud Set Screw

Figure 6-49. Turn Signals: All Except XL1200X

APPLICABILITY	
0	• 2021 FORTY-EIGHT (XL1200X)

FASTENER	TORQUE VALUE	
Fork bracket screw: XL1200X	10-13 ft-lbs	13.6-17.6 N-m
Turn signal mount screw, front: XL1200X	12-16 ft-lbs	16.3-21.7 N-m

Removal

1. Remove wire harness. See Front Turn Signal Wire Harness (Page 6-36).
2. See Figure 6-50. Fork bracket screw (1).
3. Remove turn signal assembly (7) and mount (5).
4. Remove screw (2).
5. Pull turn signal and wire harness through mount.

Installation

1. Install wire harness through mount. See FrontTurn Signal Wire Harness (Page 6-36).
2. See Figure 6-50. Install turn signal assembly (7) to mount (5) with screw (2). Tighten to .

   Torque: 12-16 ft-lbs (16.3-21.7 N-m) *Turn signal mount screw, front: XL 1200X*
3. Install mount to fork bracket with fork bracket screw (1). Tighten to .

   Torque: 10-13 ft-lbs (13.6-17.6 N-m) *Fork bracket screw: XL 1200X*
4. Install wire harness. See Front Turn Signal Wire Harness (Page 6-36).

Figure 6-50. Turn Signals: XL1200X

FRONT TURN SIGNAL WIRE HARNESS

Removal

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge and disconnect fuel supply line. See FUEL TANK (Page 4-10).

A 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 fuel tank. See FUEL TANK (Page 4-10).
4. Separate left and right wire harness caddies. See MAIN WIRING HARNESS AND ELECTRICAL CADDIES (Page 6-52).
5. See Figure 6-51. Locate turn signal connector [31] mounted on right wire harness caddy. Press latch. Disconnect turn signal connector.
6. Remove corresponding socket terminals from connector [31B],
7. Remove turn signals.
8. Remove wire conduit through coil bracket and bundled wire harness.

Installation

1. Lay old turn signal housing and wires next to new. Cut new wires to length.
2. Trim sheath back approximately.

   Length/Dimension/Distance: *2A* in (63.5 mm)
3. Install new socket terminals onto wires.
4. Route wire conduit through fork clamp, handlebar clips (all except XL1200X), coil bracket, and wire harness into electrical caddy.
5. Install turn signals.
6. Match wire lead colors. Install socket terminals into connector [31B] housing.
7. See Figure 6-51. Connect turn signal connector.

8. Install left and right wire harness shields. See MAIN WIRING HARNESS AND ELECTRICAL CADDIES (Page 6-52).

9. Install fuel tank. See FUEL TANK (Page 4-10).

10. Install main fuse.

JA 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. Check operation of all lamps.

Figure 6-51. Turn Signal Connector [31]

GENERAL

Bulb Replacement

See Bulb Replacement (Page 6-35).

Tail and Stop Lamps

The rear turn signals are the tail and stop lamps. This feature may not be available in all markets.

NOTE

Models in certain markets have LED rear turn signal, stop lamp, tail lamp assemblies. Replace the entire assembly if an LED fails.

REMOVAL AND INSTALLATION

FASTENER	TORQUE VALUE	
Fender, rear, mounting fastener	120--168 in-lbs	13.6-19 N-m
Turn signal housing to mount, rear, fastener	96-156 in-lbs	10.9-17.6 N-m
Turn signal stalk locknut	120--168 in-lbs	13.6-19 N-m

Removal

A WARNING

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

1. Remove main fuse.
2. Remove seat.
3. Remove rear wheel. See REAR WHEEL (Page 2-17).
4. See Figure 6-52. Disconnect turn, stop and tail lamp [18], [19] (3, 1) harness connectors.
5. See Figure 6-53. Remove left rear lighting harness (3) from bracket (1).
6. Remove lighting harness from lower bracket harness clips (2).
7. See Figure 6-54. Remove both turn signal wire harnesses (2, 3) through right and left feed-through holes (4, 5) in rear fender.
8. See Figure 6-55. Remove screws (3, 4), washers (5), locknut (7) and nut plate (8). Remove assembled rear fender strut covers (1) and rear turn signal assemblies (2) from rear fender struts. Carefully remove turn signal harnesses through holes in fender and fender struts.
9. Remove socket terminals from left and right turn signal connectors [18B], [19B].
10. Remove turn signal stalk (6) and rear fender strut cover (1) from each rear turn signal assembly (2). Separate mount from turn signal housing.

Figure 6-52. Rear Lighting Harness Connectors

Figure 6-53. Rear Lighting Harness Removal/Installation

1. **Bracket (2)**
2. **Right turn signal wire harness**
3. **Left turn signal wire harness**
4. **Right feed-through hole**
5. **Left feed-through hole**
6. **License plate lamp harness**

Figure 6-54. Wire Harness Routing and Harness Brackets

1. **Rear fender strut cover (2)**
2. **Rear turn signal assembly (2)**
3. **Screw (2)**
4. **Screw (2)**
5. **Washer (4)**
6. **Turn signal stalk (2)**
7. **Locknut (4)**
8. **Nut plate (2)**
9. **Rear fender**
10. **Frame**

Figure 6-55. Rear Fender Mounting Components (typical)

Installation

1. Lay old turn signal housing and wires next tc **new** wires. Cut **new** wires to length. Trim sheath back approximately

   Length/Dimension/Distance: $2^1/4$ in (63.5 mm)

2. Crimp **new** terminals onto wires.

3. See Figure 6-56. Install each turn rear signal housing (3) and mount (4) to rear fender strut cover and turn signal stalk. Tighten to.

   Torque: 96-156 **in-lbs** (10.9-17.6 N-m) *Turn signal housing to mount, rear, fastener*

4. Install wiring harness terminal sockets into left and right connector housings [19B], [18B].

5. Install rear fender strut covers over fender struts. Install turn signal wiring harness through hole in strut and fender.

6. Install nut onto turn signal stalk from inside fender. Tighten finger-tight.

7. See Figure 6-55. Secure fender to each fender strut (1) with screw (3), washer (5) and nut (7) in forward mounting hole. Install screw (4), washer (5) and nut plate (8) in rear mounting hole. Tighten finger-tight.

REAR STOP LAMP SWITCH

NOTE

See Figure 6-57. Verify that tab (3) on nut plate (2) fits into slot (4) in rear fender brace (1) when securing nut plate with rear fender mounting screw (5).

8. Tighten fasteners in following sequence:

   a. Tighten turn signal stalk nuts to. 120-168 **in-lbs** (13.6-19 N-m).

   b. Tighten strut cover screws to.

   Torque: 120-168 **in-lbs** (13.6-19 N-m) *Fender, rear, mounting fastener*

9. Install rear wheel. See REAR WHEEL (Page 2-17).

10. Connect left turn/stop/tail lamp [19] and right turn/stop/tail lamp [18] connector housings.

11. Install main fuse.

12. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

A WARNING

Be sure headlamp, tail and stop lamp and turn signals are operating properly before riding. Poor visibility of rider to other motorists can result in death or serious injury. (00478b)

13. Check operation of all lamps.

1. **Lens**
2. **Bulb (element)**
3. **Rear turn signal housing**
4. **Mount**
5. **Turn signal stalk**
6. **Rear turn signal housing (sealed unit: XL883N, XL1200NS,XL1200X)**

Figure 6-56. Rear Turn Signal Components

1. Rear fender brace
2. Nut plate (2)
3. Tab
4. Slot
5. Mounting screw (2)

Figure 6-57. Rear Fender Nut Plate: Models With Integrated Turn Signal, Tail and Stop Lamps

REMOVAL

FASTENER	TORQUE VALUE
Brake caliper bleeder screw	35-61 **in-lbs** I 3.9-6.9 N-m

Stop Lamp Switch

1. Remove left side cover.
2. Remove main fuse.
3. Remove mufflers. See Mufflers (Page 4-38).
4. Drain brake fluid:
   a. Remove cap from caliper bleeder screw.
   b. Install a length of 5/16 in (7.9 mm) ID clear plastic tubing over bleeder screw. Place free end in a suitable container.
   c. Open bleeder screw 1/2 turn.
   d. Remove reservoir cover.
   e. Pump brake pedal several times to drain brake fluid.
   f. Close bleeder screw. Tighten to 35-61 **in-lbs** (3.9-6.9 N-m).

NOTE

Do not cut conduit routing wire leads to the stop lamp switch connector [121].

5. Cut shrink tubing covering stop lamp switch and harness.
6. Separate spade connectors [121B-1] and [121B-2] from stop lamp switch.
7. Remove stop lamp switch.

Wire Harness

1. Separate stop lamp connector [121] housings.
2. Remove all terminals from housing.
3. Pull terminals through routing conduit one lead at a time.
4. Remove master cylinder banjo bolt and sealing washers. Discard sealing washers.

INSTALLATION

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT
HD-48650	DIGITAL TECHNICIAN II

FASTENER	TORQUE VALUE	
Stop lamp switch, rear	**12-15 in-lbs**	**1.4-1.6 N-m**

Wire Harness

1. Thread terminals and wire leads through routing conduit in front of the connector [121].
2. See Figure 6-58. Route wire harness:
   a. Along brake line.
   b. Under master cylinder.
   c. Along brake line to stop lamp switch.
3. Push terminals into connector housing until they click in place.
4. Connect stop lamp switch connector [121] housings.

Figure 6-58. Switch Wire Routing Conduit

Stop Lamp Switch

1. Install stop lamp switch. Tighten to 12-15 **in-lbs** (1.4—1.6 N-m).
2. See Figure 6-59. Install spade connectors [121B-1] and [121B-2.
3. Fit wire leads along stop lamp switch and to brake line.
4. Install heat shrink tubing over switch and harness.

A 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.

5. Use an ULTRA TORCH UT-100 (PART NUMBER: HD-39969) or ROBINAIR HEAT GUN (PART NUMBER: HD-25070) with HEAT SHIELD ATTACHMENT (PART NUMBER: HD-41183) to shrink tubing.

6. Install mufflers. See Mufflers (Page 4-38).

A WARNING

When any hydraulic brake component, line or connection is loosened or replaced on an ABS motorcycle, Digital Technician II must be used during the brake bleeding procedure to verify all air is removed from the system. Failure to properly bleed the brake system could adversely affect braking, which could result in death or serious injury. (00585c)

7. Bleed brake system. See Bleeding Brakes (Page 2-54).

8. **ABS models:** Use DIGITAL TECHNICIAN II (PART NUMBER: HD-48650) to verify that system is bled.

9. Install main fuse.

10. Install side cover.

A WARNING

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

11. Test operation of rear brake.

A WARNING

Be sure headlamp, tail and stop lamp and turn signals are operating properly before riding. Poor visibility of rider to other motorists can result in death or serious injury. (00478b)

12. Check operation of all lamps.

Figure 6-59. Stop Lamp Switch Spade Connectors [121-1] [121-2]

GENERAL

The CKP sensor is a variable reluctance (VR) sensor. It generates an AC signal by sensing the passing of 30 teeth cast into the left side flywheel. Two consecutive teeth are missing in the flywheel to establish a reference point. The CKP sensor sends a signal to the ECM. This signal is used to reference engine position (TDC) and engine speed. The CKP sensor is located near the lower front left corner of the engine crankcase.

NOTE
This part cannot be repaired. Replace upon failure.

REMOVAL

A WARNING

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

1. Remove main fuse.
2. See Figure 6-60. Disconnect CKP sensor harness connector [79A] from wiring harness connector [79B] (4), located along left frame downtube.
3. Remove CKP wire harness from j-clip (3).
4. Remove screw (2). Carefully remove CKP sensor (1) and O-ring from engine crankcase.

1. CKP sensor
2. Screw
3. J-clip
4. CKP sensor harness connector [79]

Figure 6-60. CKP Sensor

INSTALLATION

FASTENER	TORQUE VALUE	
CKP screw	100-120 in-lbs	11.3-13.6 N-m

NOTE
The CKP sensor O-ring has a blue Teflon coating that provides lubrication during installation. No other lubrication is needed.

1. See Figure 6-60. Carefully install CKP sensor (1) and O-ring into engine crankcase with screw (2). Tighten to 100-120 in-lbs (11.3-13.6 N-m).
2. Route CKP sensor harness through J-clip (3).
3. Connect CKP sensor harness connector [79A] to wiring harness connector [79B] (4).
4. Install main fuse.
5. Start engine to verify operation.

REMOVAL

A WARNING

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

1. Remove main fuse.
2. See Figure 6-61. Disconnect VSS harness connector [65A] (1) from VSS (3).
3. Remove screw (2). Carefully remove VSS and O-ring.

INSTALLATION

NOTE

FASTENER	TORQUE VALUE	
VSS screw	100-120 in-lbs	11.3-13.6 N-m

*The **new** VSS O-ring has a Teflon coating that provides lubrication during installation. No other lubrication is needed.*

1. See Figure 6-61. Carefully install VSS (3) and new O-ring into engine crankcase with screw (2). Tighten to 100-120 in-lbs (11.3-13.6 N-m).
2. Attach VSS harness connector [65A] (1) to VSS.
3. Install main fuse.
4. Test ride motorcycle.

Figure 6-61. Vehicle Speed Sensor (VSS)

GENERAL

See Figure 6-62. The neutral indicator switch (1) is threaded into the right crankcase half immediately forward of the main drive gear. A short jumper wire connects the switch to the harness connector [136] (2) under the engine crankcase.

A pin on the shifter drum contacts the neutral indicator switch plunger, completing the neutral indicator circuit.

A motorcycle whose neutral indicator lamp does not light can be tested to determine the problem:

- In a burned out indicator lamp, the wire harness to the instruments or in the main wire harness.
- In the neutral indicator switch and its jumper wire.

NOTE

Replace assembly upon failure.

Figure 6-62. Neutral Indicator Switch

REPLACEMENT

To prevent accidental vehicle start-up, which could cause

FASTENER	TORQUE VALUE	
Neutral indicator switch	120-180 in-lbs	13.6-20.3 N-m

A WARNING

death or serious injury, remove main fuse before proceeding. (00251b)

1. Remove main fuse.
2. Remove exhaust system. See EXHAUST SYSTEM (Page 4-38).
3. Remove rider control assembly. See Right Footrest and Rear Brake Pedal Assembly (Page 2-120) or Right Footrest and Rear Brake Pedal Assembly (Page 2-117).
   a. Remove brake rod C-clip and pin.
   b. Remove rod from master cylinder.
4. Remove sprocket cover and rear drive belt from transmission sprocket. See Drive Belt (Page 5-13).
5. Remove transmission sprocket. See TRANSMISSION SPROCKET (Page 5-41).
6. Disconnect jumper wire connector from neutral indicator switch.
7. Remove switch and washer from right crankcase half.
8. Note routing of neutral switch jumper wire down between crankcase and rear of gearcase cover.
9. Cut cable strap securing switch harness to bottom right frame tube to remove neutral switch jumper wire from neutral switch harness connector [136]
10. Install **new** neutral indicator switch and washer. Tighten to 120-180 **in-lbs** (13.6-20.3 N-m).
11. Plug **new** neutral switch jumper wire into neutral indicator switch [131].
12. Connect jumper wire connector [136A] to harness socket connector [136B].
13. Secure neutral switch harness and stator harness with cable strap to bottom right frame tube under oil pump.
14. Install transmission sprocket. See TRANSMISSION SPROCKET (Page 5-41).
15. Install secondary drive belt and sprocket cover. See Drive Belt (Page 5-13).
16. Adjust drive belt deflection. See DRIVE BELT AND SPROCKETS (Page 1-32).
17. See EXHAUST SYSTEM (Page 4-38). Install rear muffler and exhaust pipe.
18. Install main fuse.
19. Check operation of neutral indicator lamp.

GENERAL

The oil pressure signal lamp switch is a pressure-actuated diaphragm-type switch. When oil pressure is low, spring tension holds the switch contacts closed completing the signal lamp circuit. The complete circuit causes the indicator lamp to illuminate.

See Figure 6-63. The oil pressure switch is located under the oil filter mount at the front of the engine crankcase.

NOTE

Replace assembly upon failure.

Figure 6-63. Oil Pressure Indicator Lamp Switch

REMOVAL

A WARNING

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

T

1. Remove main fuse.
2. See Figure 6-63. Disconnect oil pressure switch [120] (3) by pulling elbow connector straight down from stud on oil pressure switch (2).
3. Place a drain pan under motorcycle.
4. Remove oil pressure switch.

INSTALLATION

FASTENER	TORQUE VALUE	
Oil pressure switch	60-90 **in-lbs**	6.8-10.2 N-m

NOTE

New switches have a sealant contact patch on the mounting threads.

1. If installing original sensor, coat threads of oil pressure switch with LOCTITE 565 HIGH PERFORMANCE THREAD SEALANT.
2. See Figure 6-63. Install oil pressure switch (2). Tighten to 60-90 **in-lbs** (6.8-10.2 N-m).

NOTE

Position connector elbow away from engine.

3. Connect [120] to oil pressure switch (3). Position the wire so than it does not contact crankcase or surrounding components.
4. Install main fuse.
5. Check engine oil level. Add oil if necessary. See ENGINE OIL AND FILTER (Page 1-12).
6. Start engine. Test oil pressure switch for proper operation. Check oil pressure switch for leaks.

REMOVAL

A WARNING

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

NOTE
This part is not serviceable. Replace assembly upon failure.

1. Remove side cover.
2. Remove main fuse.

NOTE
Do not pull on wiring when removing stator connector [47].

3. See Figure 6-64. Cut cable strap (1) around frame and stator connector [47] (2) wire harness.
4. Lift external latch on stator connector [47] pin housing. Separate the socket housing.
5. Lift external latch on DC output connector [77] (3) pin housing. Separate the socket housing.
6. Remove screws (4) from voltage regulator.
7. Remove regulator.

1. Cable strap
2. Stator connector [47]
3. DC output connector [77]
4. Screws (2)

Figure 6-64. Voltage Regulator

INSTALLATION

FASTENER	TORQUE VALUE	
Voltage regulator mounting screw	30-60 **in-lbs**	3.4-6.8 N-m

1. Install voltage regulator on downtube mounting bracket with mounting screws. Tighten to 30-60 **in-lbs** (3.4-6.8 N-m).
2. See Figure 6-65. Plug socket connector [47] into regulator pin connector (1). Lock in place with external locking latch.
3. Plug socket connector into regulator DC output connector (2). Lock in place with external locking latch.
4. Verify latch connection to prevent connector separation.
5. Install cable strap around frame and stator connector wire lead.
6. Install main fuse.
7. Close side cover.
8. Test charging system. See the electrical diagnostic manual.

1. Stator voltage connector [47]
2. DC output connector [77]

Figure 6-65. Regulator Connectors

REMOVAL AND DISASSEMBLY

A WARNING

Prevent accidental vehicle start-up, which could cause death or serious injury. First disconnect negative (-) battery cable at engine and then positive (+) **cable from battery. (00280b)**

1. Disconnect battery. See BATTERY MAINTENANCE (Page 1-47).
2. Remove primary cover. See PRIMARY COVER (Page 5-3).
3. Remove clutch assembly, primary chain and engine sprocket and rotor assembly as a unit. See PRIMARY DRIVE AND CLUTCH (Page 5-7).

Stator

1. Open external latch and disconnect stator harness connector [47] from voltage regulator. See VOLTAGE REGULATOR (Page 6-47).

NOTE

Note cable strap locations.

2. See Figure 6-66. Remove cable straps (1) from stator harness.
3. Remove stator harness from opening between right crankcase half and gearcase cover.
4. Remove and discard screws (2) securing stator (3) to left crankcase half.
5. Remove two screws (4) and retainer plate (5).
6. Remove grommet (6) from left crankcase half.
7. Remove stator harness from grommet hole in left crankcase half. Remove stator.

Rotor

1. See Figure 6-66. Remove bolts (7) securing alternator rotor (8) to sprocket (9).
2. See Figure 6-67. Position blocks (2) under rotor (1). Press sprocket (3) free of rotor.

NOTE

Resistance to sprocket/rotor disassembly is due in part to magnetic force of permanent rotor magnets.

1. **Cable strap (3)**
2. **Screw (4)**
3. **Stator**
4. **Screw (2)**
5. **Retainer plate**
6. **Grommet**
7. **Bolts (8)**
8. **Rotor**
9. **Sprocket**

Figure 6-66. Alternator Components

Figure 6-67. Removing Rotor from Sprocket

CLEANING AND INSPECTION

1. Remove debris from rotor magnets. Clean rotor by wiping thoroughly with a clean cloth.

2. Check rotor for:
   a. Loose or cracked magnets.
   b. Stator bolt contact with rotor.
   c. Spline damage to rotor center mounting bolt hole.

3. Clean stator, stator leads and grommet thoroughly with a clean cloth.

4. Check stator for:
   a. Contact with rotor.
   b. Damaged or cracked insulation.
   c. Electrical failures. See the electrical diagnostic manual.

ASSEMBLY AND INSTALLATION

FASTENER	TORQUE VALUE	
Alternator rotor to sprocket screw	120-140 in-lbs	13.6-15.8 N-m
Alternator stator mounting screw	30-40 in-lbs	3.4-4.5 N-m
Stator harness retainer screw	56 in-lbs	6.3 N-m

Stator

1. See Figure 6-66. Install stator wiring harness and attached grommet (6) into open grommet hole in left crankcase half.

2. Apply a light coating of clean engine oil to grommet. Install grommet into hole in left crankcase half.

3. Position stator (3) on left crankcase half. Install new screws (2). Tighten to 30-40 in-lbs (3.4-4.5 N-m).

NOTE

Do not exceed maximum torque.

4. See Figure 6-68. Install stator harness retainer (1).
   a. Position stator harness retainer over harness and onto engine crankcase with relief (3) facing shifter shaft assembly (4).
   b. Install screws (2).
   c. Verify that harness is not pinched.
   d. Tighten to 56 in-lbs (6.3 N-m).
   e. Verify that the screws are flush with plate.

5. Route stator wire harness:
   a. Across top of crankcase halves to right side of engine.
   b. Downward through opening between right crankcase half and gearcase cover.
   c. Forward and upward along inboard side of right frame downtube.

6. Connect stator harness to voltage regulator harness at connector [46]. Lock external latch in place. See VOLTAGE REGULATOR (Page 6-47).

7. See Figure 6-69. Secure stator harness and neutral switch wire lead with cable straps.

Figure 6-68. Stator Harness Retainer

Figure 6-69. Cable Strap Locations

Rotor

1. See Figure 6-70. Position rotor (1) on sprocket (2). Align holes in sprocket with holes in rotor.

2. Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue). Insert mounting bolts through rotor. Start bolts into tapped holes in sprocket.

3. Position pipe section (3) with an inside diameter larger than the sprocket mounting hub over center of rotor.

4. Press rotor onto sprocket. Tighten to 120-140 in-lbs (13.6-15.8 N-m).

HORN

Final Assembly

1. Install clutch assembly, primary chain and engine sprocket/rotor assembly as a unit. See PRIMARY DRIVE AND CLUTCH (Page 5-7).
2. Install primary cover, left footrest assembly and gear shift lever. See PRIMARY COVER (Page 5-3).
3. Connect battery. See BATTERY MAINTENANCE (Page 1-47).
4. Test charging system. See electrical diagnostic manual.

Figure 6-70. Pressing Rotor onto Sprocket

FRONT MOUNT

FASTENER	TORQUE VALUE	
Horn fastener: front mount	36-48 **in-lbs**	4.1-5.4 N-m
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m

Removal

1. See Figure 6-71. Remove spade connectors from the right and left terminals (1, 2).
2. Remove fasteners (3) from horn bracket.
3. Remove horn (4).

NOTE

The horn bracket is the upper front stabilizer link bracket.

4. If necessary, remove fasteners (5), washers (6) and bracket (7).

Installation

1. See Figure 6-71. Install bracket (7), washers (6) and fasteners (5). Tighten to 25-35 ft-lbs (33.9-47.5 N-m).
2. Install horn (4) and fasteners (3). Tighten to 36-48 **in-lbs** (4.1-5.4 N-m).
3. Connect the red wire to the left terminal (2).
4. Connect the black wire to the right terminal (1).

1. Right terminal
2. Left terminal
3. Fastener (3)
4. Horn
5. Fastener (2)
6. Washer (2)
7. Horn bracket

Figure 6-71. Front Mount Horn

REMOVAL

1. Remove seat.

2. Remove left and right side covers.

3. Remove caddy cover.

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

4. Purge the fuel supply line. See Purging and Disconnecting Fuel Supply Line (Page 4-10).

5. Remove main fuse.

A WARNING

Prevent accidental vehicle start-up, which could cause death or serious injury. First disconnect negative (-) battery cable at engine and then positive (+) cable from battery. (00280b)

6. Remove battery. See Disconnection and Removal (Page 1-48).

7. Remove fuel tank. See FUEL TANK (Page 4-10).

8. Remove harness at the left front:

   a. Remove clips securing harness and clutch cable to frame downtube.

   b. Disconnect oil pressure switch [120] connector.

   c. Disconnect neutral switch [136] connector.

   d. Disconnect voltage DC [47] regulator connector.

   e. Remove CKP sensor[79].

   f. Disconnect JSS [133] connector.

   g. Disconnect front HO2 sensor [138].

9. Disconnect horn connectors [122].

10. Remove the harness on the right side:

    a. Remove spark plug wires from ignition coil.
    b. Remove cable strap securing ET sensor lead to oil tank bracket.

    c. Disconnect ET sensor [90].

    d. Remove wire harness clip securing EVAP hose and engine harness to caddy.

11. Remove BCM. See BODY CONTROL MODULE (BCM) (Page 6-9).

12. Remove ECM. See ELECTRONIC CONTROL MODULE (ECM) (Page 6-8).

13. Remove negative battery cable from notch at bottom of electrical caddy.

14. **ABS models:** Remove EHCU bracket bolts and lower the EHCU. See Removal (Page 2-57).

    a. Disconnect ABS connector [166].

    b. Remove harness from retainer clip.

15. Disconnect rear stop lamp switch [121] housings.

16. Disconnect wire harness connectors from engine:

    a. VSS [65].
    b. Solenoid connector [128].

    c. Main harness ground [GND1].

17. Remove data link. Disconnect rear WSS connector [168]. Remove cable strap securing connector to battery tray.

18. Remove battery tray. See Battery Tray (Page 6-12).

19. Remove engine harness.

    a. Loosen latch clip.
    b. Remove retainer.

    c. Disconnect connector [145] housings.

20. Remove rear spark plug wire from engine.

21. Remove EVAP lines from purge solenoid.

22. Remove EVAP line from caddy retainer clip.

23. Remove vapor valve from caddy.

24. Disconnect turn signal [18], [19] and tail lamp [45] connectors.

25. Separate front caddy housings:

    a. Remove two push clips securing coil bracket to caddy.

    b. Cut cable straps securing throttle cables.

    c. Remove caddy housing fastener.

26. Disconnect coil connector [83].

27. Disconnect front connectors:

    a. Headlamp connector [38]

    b. LH controls [24]

    c. RH controls [22-1] [22-2]

    d. Turn signal [31]

    e. Speedometer [20]

28. **ABS models:** Disconnect front WSS [167].

29. **Keyed ignition:** Disconnect ignition switch connector [33].

30. Remove oil tank fasteners.

31. Remove fastener securing caddy to oil tank bracket.

    a. Pull harness away from rear frame downtube.

    b. Cut cable strap securing positive battery cable to caddy.

    c. Move wire harness caddy from right to left between rear cylinder and frame.

Figure 6-72. Main Wire Harness

4. Separate backbone electrical caddy housings:

BACKBONE ELECTRICAL CADDIES

FASTENER	TORQUE VALUE	
Caddy fastener, front	15-25 **in-lbs**	1.7-2.8 N-m

Preparation

1. Remove seat.

A WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge and disconnect fuel supply line. See Purging and Disconnecting Fuel Supply Line (Page 4-10).

3. Remove fuel tank. See FUEL TANK (Page 4-10).

    a. Remove two push clips securing coil bracket to caddy.

    b. Cut cable straps securing throttle cables.

    c. Remove caddy housing fastener.

Small Backbone Electrical Caddy

1. See Figure 6-73. Cut, remove and discard all cable straps securing wiring harness bundles to small backbone electrical caddy.
2. Separate caddy from wiring harness.
3. Position wiring harness bundles on small backbone electrical caddy as shown in figure.
4. Install cable straps as shown.

Large Backbone Electrical Caddy

1. See Figure 6-74. Remove all cable straps securing wiring harness bundles to large backbone electrical caddy.
2. Separate caddy from wiring harness and connector sockets.
3. Position wiring harness bundles and connector sockets on large backbone electrical caddy as shown in figure.
4. Install cable straps as shown.

Reassembly

1. Position throttle cables against caddy. Secure with cable straps.
2. Fit caddy halves together. Fasten with single screw. Tighten to 15-25 **in-lbs** (1.7-2.8 N-m).
3. Install push clips securing coil bracket to caddy.
4. Install fuel tank. See FUEL TANK (Page 4-10).
5. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

Figure 6-73. Small Backbone Electrical Caddy Cable Straps

Figure 6-74. Large Backbone Electrical Caddy Cable Straps

REPLACING ECM ELECTRICAL CADDY

Removal

1. Remove main wiring harness. See Removal (Page 6-52).
2. See Figure 6-75. Remove all cable straps securing wiring harness bundles to ECM electrical caddy.
3. Separate caddy from wiring harness.

Installation

1. See Figure 6-75. Position wiring harness bundles and connector sockets on ECM electrical caddy.
2. Install cable straps as shown.
3. Install wiring harness onto motorcycle. See Installation (Page 6-55).

Figure 6-75. ECM Electrical Caddy Cable Straps

INSTALLATION

FASTENER	TORQUE VALUE	
Battery tray fastener	96-156 in-lbs	10.8-17.6 N-m
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m
Electrical caddy cover	30-40 in-lbs	3.4-4.5 N-m
Electrical caddy fastener	30-40 in-lbs	3.4-4.5 N-m
Main harness ground wire	55-75 in-lbs	6.2-8.5 N-m
Oil tank mounting screws	72-96 in-lbs	8.1-10.8 N-m

1. Prepare harness for installation and routing:
   a. Install new cable strap in caddy for positive battery cable.
   b. Security models without siren: Connect siren connector [142] to empty housing in electrical caddy.
   c. Position connectors and wire leads before routing.
2. Route harness left to right between rear cylinder and frame downtube.
   a. Route harness underneath right side EVAP house.
   b. Route ET sensor down and to rear.
   c. Route tail lamp and turn signals connectors around right side of downtube.
   d. Route stop lamp switch connectors around right side of downtube and down toward switch.
   e. Route starter solenoid connector and VSS connector toward front.
   f. Route EHCU connector through frame and around in front of brake line bracket.
3. Install front caddy on left side of throttle cables.
4. Route horn wire to horn.
5. See Figure 6-76. Secure positive battery cable to electrical caddy with new cable strap.

Figure 6-76. Cable Strap around Positive Battery Cable

6. Install cable straps through front caddy around throttle cables. Cut off ends.
7. See Figure 6-77. Install latch clip.
   a. Position plug wire on latch clip to coil and spark plug.
   b. Install engine harness.

Figure 6-77. Right Wire Harness Caddy Latch Clip

8. Connect upper front connectors:
   a. Speedometer connector [20]
   b. Right side hand controls [22-1] [22-2]

c. Left side hand controls [24]

d. Turn signals [31]

e. Headlamp [38]

9. **ABS models:** Connect front WSS [167].

10. **Keyed ignition:** Connect ignition switch [33]. See Ignition Switch (Page 6-15).

11. Route rear spark plug wire to coil inside caddy.

12. Connect front and rear spark plug wires to coil. Connect coil [83].

13. Install coil bracket to frame and front caddy.

14. Install caddy halves together. Fasten with single screw. Tighten.

    Torque: 15-25 **in-lbs** (1.7-2.8 N-m) *Caddy fastener, front*

15. Install push clips securing coil bracket to caddy.

16. Secure front wire bundle with **new** cable strap.

17. Route front wire bundles down left side of downtube.

NOTE

Non-ABS models: *See Figure 6-78. Secure neutral lead with J-clip.*

18. Route neutral switch along lower frame rail. Secure front wire bundle with **new** cable strap.
19. Connect oil pressure switch connector [120].
20. Secure neutral and oil pressure switch leads to back bar with **new** cable strap.
21. Connect regulator connector [47].

Figure 6-78. Lower Right Frame Tube Cable Straps

1. Neutral switch and stator leads
2. Non-ABS J-clip
3. Neutral switch and stator leads
4. Neutral switch and stator leads

22. See Figure 6-79. Connect lower front connectors:

    a. JSS [133]

    b. CKP [79]

    c. Front HO2S [138]

23. Clip harness, front HO2S [138] and clutch cable to frame downtube.

24. Connect horn connector [122].

Figure 6-79. Left Downtube Wire Routing

25. Loosely install oil tank fasteners.

26. Install electrical caddy and fastener. Tighten.

    Torque: 30=40 **in-lbs** (3.4-4.5 N-m) *Electrical caddy fastener*

27. Fit rear WSS lead to hooks on battery tray.

28. Loosely install the tray.

29. Install battery tray mounting screws, Tighten.

    Torque: 96-156 **in-lbs** (10.8-17.6 N-m) *Battery tray fastener*

30. Tighten oil tank fasteners.

    Torque: 72-96 **in-lbs** (8.1-10.8 N-m) *Oil tank mounting screws*

31. Install battery ground through hook in battery tray.

32. Connect rear lighting connectors:

    a. Left turn signal [19]
    b. Stop lamp [45]

    c. Right turn signal [18]

NOTE

See Figure 6-80. Route starter solenoid connector [128] (1) wire harness (2) behind V$S connector [128] (3) to prevent damage by drive belt.

33. Connect right rear connectors:

    a. VSS [65]

    b. Starter solenoid [128]
    c. ET sensor [90] and retainer

Figure 6-80. VSS [65] and Starter Solenoid [128] Wire Leads

34. Route engine harness down through trough to connector on front of electrical caddy. Connect engine harness connector [145].

35. Install EVAP lines on purge solenoid.
36. Install EVAP line to caddy retainer clip.

37. Install vapor valve to caddy.

38. Attach EVAP hose to electrical caddy with harness retainer clip.

39. Install ECM. See ELECTRONIC CONTROL MODULE (ECM) (Page 6-8).

40. Install main harness ground. Tighten.

    Torque: 55-75 **in-lbs** (6.2-8.5 N-m) *Main harness ground wire*

41. Install BCM. See BODY CONTROL MODULE (BCM) (Page 6-9).

42. See Figure 6-81. Fit rear HO2S connector [137] clip to top of battery tray.

43. Snap vapor valve into place.

44. Fit data link to battery tray.

45. Route rear HO2S wire lead over and through caddy clip. Connect HO2S [137] housings.
46. Connect rear WSS [168].

Figure 6-81. Under Seat Routing

47. **ABS models:** Connect harness to EHCU. Remove EHCU bracket bolts and lower EHCU.

    a. Route EHCU harness through retainer clip.

    b. Connect ABS connector [166] to EHCU.

    c. Position EHCU. Install bracket. See Installation (Page 2-58).

48. Connect rear stop lamp switch connector [121].

A 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)

49. Install battery. See Installation and Connection (Page 1-50).

50. Install fuel tank. See Installing Fuel Tank (Page 4-11).

    a. Clip pump harness to caddy latch clip.

    b. Connect fuel pump connector [141].

51. Install caddy cover. Tighten.

    Torque: 30-40 **in-lbs** (3.4-4.5 N-m) *Electrical caddy cover*

52. Install main fuse.

53. Install side covers.

54. Install seat. After installing seat, pull up on the seat to make sure that it is secure.

A WARNING

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

55. Test all switches and lights for proper operation.

J-CLIPS: MID-MOUNT MODELS

FASTENER	TORQUE VALUE	
J-clip fastener	45-50 ft-lbs	61-67.8 N-m

Remove and install J-clips from frame as necessary. Tighten to 45-50 ft-lbs (61-67.8 N-m).

REMOVAL

A WARNING

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

1. Remove main fuse.
2. Remove fuel tank. See FUEL TANK (Page 4-10).
3. See Figure 6-82. Remove caddy fastener.
4. See Figure 6-83. Disconnect right hand control module connector [22B-1] (1) and engine OFF/RUN switch connector [22B-2] (2).
5. Remove front master cylinder assembly. See FRONT BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-23).
6. See Figure 6-84. Remove upper and lower fasteners (1, 2).
7. Remove upper housing (3).
8. Remove throttle and idle cables, if necessary. See THROTTLE CONTROL (Page 1-36).
9. See Figure 6-84. Remove screws (5) and retainer (6).

NOTE

- *Record wire routing and cable strap locations before removal.*
- *Disconnect connectors as necessary*

10. Carefully remove control module (7) from lower housing (4)
11. Remove cable straps. Remove wire leads through cable anchors.

Figure 6-82. Caddy Fastener

Figure 6-83. RH Switch Connectors [22-1] [22-2]

Figure 6-84. Right Hand Switch Assembly

START/Hazard and Turn Signal

See Figure 6-85. Replace the START/hazard key cap (1) and turn signal key cap (2).

OFF/RUN

1. Remove OFF/RUN key cap (3).
2. Remove pins (4) and springs (5).
3. Install springs.
4. Install pins.
5. Install OFF/RUN key cap.

Figure 6-85. Key Caps

INSTALLATION

FASTENER	TORQUE VALUE	
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m
Switch assembly retainer screws	8-10 in-lbs	0.9-1.1 N-m
Switch housing fastener	35--45 in-lbs	4-5.1 N-m

1. See Figure 6-84. Install control module (7) in lower housing (4).
2. Position stop lamp switch.
3. Install retainer (6) and screws (5). Tighten to 8-10 in-lbs (0.9-1.1 N-m).
4. Position lower housing on handlebar.
5. Install throttle and idle cables, if removed. See Installation (Page 2-88).
6. See Figure 6-84. Install upper housing (3).
8. See Figure 6-86. Position brake master cylinder assembly inboard of module housing assembly. Engage tab (2) on lower module housing in the groove (3) at top of brake lever bracket.
9. Install front master cylinder. See FRONT BRAKE MASTER CYLINDER AND RESERVOIR (Page 2-23).

NOTE

Tighten lower housing fastener first. Any gap between upper and lower housings is at front of housing.

10. See Figure 6-84. Tighten lower and upper fasteners (2, 1) to 35--45 in-lbs (4-5.1 N-m).
11. Adjust throttle cables. See THROTTLE CABLES (Page 2-87).
12. See Figure 6-83. Connect right hand control module connector [22B-1] (1) and engine OFF/RUN switch connector [22B-2] (2).
13. Secure harness with clamps and cable strap as noted during removal.
14. See Figure 6-82. Install caddy fastener. Tighten to 15-25 in-lbs (1.7-2.8 N-m).
15. Install fuel tank. See FUEL TANK (Page 4-10).
16. Install main fuse. See Fuses (Page 6-5).

A WARNING

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

17. Test switches.

Figure 6-86. Module Housing Alignment

FRONT STOP LAMP SWITCH REPLACEMENT

1. See Figure 6-87. Cut wires flush at inoperative stop lamp switch.
2. If **new** clutch switch wires have terminals installed, cut wires at terminal end.
3. Remove 0.25-0.31 in (6.4-7.9 mm) of insulation from each wire end.
4. Cut two pieces of dual wall heat shrink tubing to a length of 0.5 in (12.7 mm).
5. Place heat shrink over each wire on terminal end.
6. Solder each matched pair of wires.

A 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.

Figure 6-87. Front Stop Lamp Switch

RIGHT HANDLEBAR CONTROL KEY CAPS

7. Install, but do not tighten upper and lower fasteners (1,2).

REMOVAL

A WARNING

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

1. Remove main fuse.
2. Remove fuel tank. See FUEL TANK (Page 4-10).
3. See Figure 6-88. Remove caddy fastener.
4. See Figure 6-90. Disconnect left hand control module connector [24].
5. Remove clutch hand control. See CLUTCH CONTROL (Page 2-91).
6. See Figure 6-89. Remove upper and lower fasteners (1, 2).
7. Remove upper housing (3).
8. Remove screws (5) and retainer (6).

NOTE

- *Record wire routing and cable strap locations before removal.*
- *Disconnect connectors as necessary.*

9. Carefully remove control module (7) from lower housing (4)
10. Remove cable straps. Remove wire leads through cable anchors.

Figure 6-88. Caddy Fastener

Figure 6-89. Left Hand Switch Assembly

Figure 6-90. LH Control Module Connector [24]

LEFT_HANDLEBAR_CONTROL_KEY_CAPS_

TRIP/HORN and Turn Signal

See Figure 6-91. Replace TRIP/HORN key cap (1) and turn signal key cap (2).

LIGHTS

1. Remove LIGHTS key cap (3).
2. Remove pins (4) and springs (5).

3. Install springs.
4. Install pins.
5. Install LIGHTS key cap.

Figure 6-91. Key Caps

CLUTCH SWITCH REPLACEMENT

FASTENER	TORQUE VALUE	
Switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 N-m

1. Cut wires flush at inoperative clutch switch.
2. If **new** clutch switch wires have terminals installed, cut wires at terminal end.
3. Remove 0.25-0.31 in (6.4-7.9 mm) of insulation from each wire end.
4. Cut two pieces of dual wall heat shrink tubing to a length of 0.5 in (12.7 mm).
5. Place heat shrink over each wire on terminal end.
6. Solder each matched pair of wires.

A 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. Apply heat to heat shrink tubing.
8. Install clutch switch into housing. Install retainer and screws.
9. Tighten screws to 8-10 **in-lbs** (0.9-1.1 N-m).

Figure 6-92. LH Clutch Switch and Retainer

INSTALLATION

FASTENER	TORQUE VALUE	
Caddy fastener, front	15-25 **in-lbs**	1.7-2.8 N-m
Switch assembly retainer screws	8-10 **in-lbs**	0.9-1.1 N-m
Switch housing fastener	35-45 **in-lbs**	4-5.1 N-m

NOTE
Verify placement of rubber grommet on wire harness.

1. See Figure 6-89. Install control module (7) in lower housing (4).
2. Position clutch switch.
3. Install retainer (6) and screws (5). Tighten to 8-10 **in-lbs** (0.9-1.1 N-m).
4. Position lower housing on handlebar.
5. See Figure 6-89. Install upper housing (3).
6. Install, but do not tighten upper and lower fasteners (1,2).
7. See Figure 6-93. Position clutch hand lever assembly inboard of switch assembly. Engage tab (3) on lower module housing in groove (2) at the bottom of clutch lever bracket.
8. Install clutch hand control. See CLUTCH CONTROL (Page 2-91).

NOTE
Tighten lower housing fastener first. Any gap between upper and lower housings is at front of housing.

9. See Figure 6-89. Tighten lower and upper fasteners (2, 1) to 35-45 **in-lbs** (4-5.1 N-m).

10. Secure harness with cable anchors and cable strap as noted.

11. See Figure 6-93. Connect left hand control module connector [24].

12. See Figure 6-82. Install caddy fastener. Tighten to 15-25 **in-lbs** (1.7-2.8 N-m).

13. Install fuel tank. See FUEL TANK (Page 4-10).

14. Install main fuse. See Fuses (Page 6-5).

A WARNING

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

15. Test switch operation.

Figure 6-93. Clutch Lever Bracket

FASTENER	TORQUE VALUE	
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m

FRONTWSS

Removal

1. Remove fuel tank. See Removing Fuel Tank (Page 4-10).

NOTICE

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

2. Raise motorcycle to permit wheel removal.

3. Remove fastener to open caddy halves.

4. See Figure 6-94. Remove WSS wire harness.

   a. Separate WSS connector [168] (1) housings.
   b. Cut cable strap (2).

   c. Remove lead clips (3) around brake line.

   d. Remove WSS mounting clip (4).

5. Retract axle to free WSS. See FRONT WHEEL (Page 2-15).

6. Remove WSS.

1. Connector [168]
2. Cable strap
3. Clips (3)
4. Bracket clip

Figure 6-94. WSS Wire Harness

Installation

NOTE

- *Keep* WSS *away from magnetic fields (magnetic parts trays, magnetic base dial indicators, alternator rotors, and* so *on).*
- *Do not pull on* WSS *lead.*

1. See Figure 6-95. Position WSS with index pin to outboard side.

2. Push axle through WSS into fork.

3. Rotate WSS index pin to fit notch in front fork.

4. Install front wheel. See FRONT WHEEL (Page 2-15).

5. Install WSS clip mounting bracket with caliper.

6. Install WSS wire lead.

   a. Install WSS clip and wire lead.

   b. Route wire lead through coil bracket.

   c. Connect WSS connector [167] housings.

   d. Install cable strap

   e. Secure wire lead to brake line at flagged locations.

7. Connect caddy halves. Install fastener. Tighten to 15-25 in-lbs (1.7-2.8 N-m).

8. Install fuel tank. See Removing Fuel Tank (Page 4-10).

9. Verify that the WSS wire lead does not get pinched between lower fork bracket and frame when turning handlebar from full left to full right lock.

Figure 6-95. WSS Index Pin

REARWSS

NOTICE

Removal

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 cross-members, oil pan, mounting brackets, components or housings. Failure to comply can cause serious damage resulting in the need to perform major repair work. (00586d)

1. Raise motorcycle to permit wheel removal.
2. Remove side cover.
3. Remove main fuse.
4. See Figure 6-96. Remove wire harness.
   a. Remove cable straps (3).
   b. Remove wire clip (1) from brake line.
   c. Remove extension strap (2) from rear brake caliper.
   d. Disconnect rear WSS [167] (4).

NOTE

The WSS *works with ABS encoder bearing installed in wheel hub. See SEALED WHEEL BEARINGS (Page 2-19).*

5. Remove axle to free WSS. See REAR WHEEL (Page 2-17).
6. Remove WSS.

Installation

NOTE

- *Keep* WSS *away from magnetic fields (magnetic parts trays, magnetic base dial indicators, alternator rotors, etc.).*
- *Do not pull* WSS *lead.*
- *Orient* WSS *index pin outboard and below caliper bracket.*

1. Install axle through **new** WSS and caliper bracket.
2. Install rear wheel. See REAR WHEEL (Page 2-17).
3. Route wire harness.
   a. Rotate up WSS index pin against caliper bracket.
   b. Install extension strap into rear brake caliper bracket.
   c. Clip wire clip to brake line at flagged locations.
   d. Install cable straps.
   e. Connect[167].
4. Install main fuse.
5. Install side cover.

Figure 6-96. Rear WSS

REPLACEMENT

Removal

1. Disarm security system.
2. Remove rear fender.
   a. **XL883N (Canada), XL1200NS, XL1200X:** See REAR FENDER: TOP MOUNT LICENSE PLATE (Page 2-106).
   b. **XL883N, XL1200NS, XL1200X:** See REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS (Page 2-110).
3. See Figure 6-97. Disconnect connector [142B] (2) from siren.
4. Remove siren.

Installation

1. See Figure 6-97. Install siren into battery tray with sounder disc facing down. Make sure siren locking tabs (1) lock siren in place.
2. Connect connector [142B] (2) to siren.
3. Install rear fender.
   a. **XL883N (Canada), XL1200NS, XL1200X:** See REAR FENDER: TOP MOUNT LICENSE PLATE (Page 2-106).
   b. **XL883N, XL1200NS, XL1200X:** See REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS (Page 2-110).

NOTE

Two chirps after an arming command indicate a working siren.

4. Verify siren operation.

Figure 6-97. Smart Siren

BATTERY

Replacement Schedule

NOTE

- *The 9 V battery is rechargeable. Battery life is approximately three to six years.*
- *If the motorcycle battery is less than 12.5 the internal siren battery cannot charge.*

Replacement

1. Disarm security system.
2. Remove siren. See Replacement (Page 6-67).
3. See Figure 6-98. Push the catches (1) in through the two slots (2) in the end of the siren with a small pick to release the cover (3).

NOTE

- *Do not wipe away the existing grease. Reapply the grease to terminals on new battery*
- *Only install a 9 V nickel metal hydride battery*

4. Remove 9 V battery (4) from polarized battery clip.

5. Recharge and/or install a **new** 9 V battery.
6. Install battery cover (3).
   a. 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.
7. Install siren. See Replacement (Page 6-67).

NOTE

Two chirps after an arming command indicate a working siren.

8. Verify operation.

Figure 6-98. Siren Battery Compartment

GENERAL

The PIN consists of five digits. Each digit can be any number from 1 through 9. There can be no zeros (0) in the PIN. Use the PIN to disarm the security system in case the fob becomes unavailable.

CHANGING THE PIN

The rider can change the PIN at any time. Refer to Table 6-8.

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 6-8. Changing the PIN

STEP	ACTION	WAIT FOR CONFIRMATION	NOTES
1	Select a 5-digit (1 thru 9) PIN.		
2	With an assigned fob present, turn the OFF/RUN switch to **RUN.**		
3	Cycle the OFF/RUN switch twice: **OFF -RUN - OFF - RUN.**		
4	Press **left** turn signal switch **2 times.**	ENTER PIN will scroll through the odometer window.	
5	Press **right** turn signal switch **1 time** and release.	Turn signals will flash 3 times. Current PIN will appear in odometer. The first digit will be flashing.	
6	Enter first digit of new PIN by pressing and releasing the **left** turn signal switch until the selected digit appears.		
7	Press **right** turn signal switch **1 time** and release.	The new digit will replace the current in odometer window.	
8	Enter second digit of selected PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
9	Press **right** turn signal switch **1 time** and release.	The new digit will replace the current in odometer window.	
10	Enter third digit of the selected PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
11	Press **right** turn switch **1 time** and release.	The new digit will replace the current in odometer window.	
12	Enter fourth digit of new PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
13	Press **right** turn switch **1 time** and release.	The new digit will replace the current in odometer window.	
14	Enter fifth digit of the new PIN by pressing and releasing the **left** turn signal switch until the selected digit is present.		
15	Press **right** turn switch **1 time** and release.	The new digit will replace the current in odometer window.	
16	Push the OFF/RUN switch to the **OFF** position.		Pushing the OFF/RUN switch to **OFF** stores the new PIN in the module.
17	Record on the wallet card from the owner's manual.		

REMOVAL

1. Stand motorcycle upright (not leaning on jiffy stand) on a level surface.
2. See Figure 6-99. Disconnect JSS connector [133] (1).
3. Cut cable strap securing JSS harness to frame.
4. See Figure 6-100. Remove screw (1). Remove JSS (2) and harness.

Figure 6-99. JSS Connector

Figure 6-100. JSS

INSTALLATION

FASTENER	TORQUE VALUE	
JSS screw	96-120 in-lbs	10.9-13.6 N-m

1. See Figure 6-100. Install JSS (2).

2. Install screw (1). Tighten finger-tight.

NOTE
See Figure 6-101. Align JSS (1) with mounting tab (2) on yoke (3). Improper alignment will damage sensor or tab.

3. See Figure 6-102. With JSS (1) aligned with mounting tab on jiffy stand bracket, tighten screw (2) to 96-120 in-lbs (10.9-13.6 N-m).

NOTE
Do not route JSS harness through J-clip. Harness can chafe against J-clip.

4. Route JSS harness forward along frame under left side of engine.
5. Secure harness to outboard side of frame with new cable strap (3).
6. If necessary, replace plug (4).
7. Connect JSS harness connector housing [133A] to main harness connector housing [133B].

A 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)

A WARNING

Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)

A WARNING

Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted, it can contact the road surface causing a loss of vehicle control, which could result in death or serious injury. (00007a)

8. Test JSS with jiffy stand down and up:
   a. Turn ignition on.
   b. Shift transmission into gear.
   c. Switch OFF/RUN switch to RUN.
   d. Disengage clutch.
   e. Jiffy stand down: Press the START button. Engine does not start. "SidE StAnd" scrolls across the odometer display.
   f. Jiffy stand up: Press the START button. Engine can start and run. "SidE StAnd" clears from the odometer display.

Figure 6-101. JSS Mounting (top view)

Figure 6-102. JSS Harness Routing

OPERATION

Jiffy Stand Down: Engine Non-Start

See Figure 6-103. The engine does not start if the rider presses the starter button with the transmission in gear and the jiffy stand down. The message "SidE StAnd" (1) scrolls across the odometer display.

Raising the jiffy stand (or putting the transmission in neutral) permits the engine to run and clear the message.

Jiffy Stand Down: Engine Starts and Stalls

With the jiffy stand down, if the ECM receives a signal indicating the transmission is in neutral or indicating the clutch is engaged, the engine starts and runs. The engine will continue to run after disengaging the clutch and shifting into gear. However with the jiffy stand still down, the engine stalls as the clutch is engaged.

Jiffy Stand Drops

If the jiffy stand drops out of the retracted position at speeds greater than 10 mph (15 km/h):

- The engine continues to run.
- The warning indicator flashes twice.
- "SidE StAnd" scrolls across the odometer display.
- The message remains until the jiffy stand is retracted.

Press the trip switch (2) once while the engine is running to clear the "SidE StAnd" message.

Figure 6-103. SidE StAnd Display

NOTES

SUBJECT PAGE NO.
A.1 WIRING DIAGRAMS A-1

NOTES

GENERAL

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table A-1.

For Solid Color Wires: See Figure A-1. The alpha code identifies wire color.

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code. For example, a trace labeled GN/Y is a green wire with a yellow stripe.

Wiring Diagram Symbols

See Figure A-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets [ ]. The letter inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A and the pin symbol after a connector number identifies the pin side of the terminal connectors.

B=Socket: The letter B and the socket symbol after a connector number identifies the socket side of the terminal connectors. Other symbols found on the wiring diagrams include the following:

Diode: The diode allows current flow in one direction only in a circuit.

Wire break: The wire breaks are used to show option variances or page breaks.

No Connection: Two wires crossing over each other in a wiring diagram that are shown with no splice indicating they are not connected together.

Circuit to/from: This symbol indicates a more complete circuit diagram on another page. The symbol is also identifying the direction of current flow.

Splice: Splices are where two or more wires are connected together along a wiring diagram. The indication of a splice only indicates that wires are spliced to that circuit. It is not the true location of the splice in the wiring harness.

Ground: Grounds can be classified as either clean or dirty grounds. Clean grounds are identified by a (BK/GN) wire and are normally used for sensors or modules.

NOTE

Clean grounds usually do not have electric motors, coils or anything that may cause electrical interference on the ground circuit.

Dirty grounds are identified by a (BK) wire and are used for components that are not as sensitive to electrical interference.

Twisted pair: This symbol indicates the two wires are twisted together in the harness. This minimizes the circuit's electromagnetic interference from external sources. If repairs are necessary to these wires they should remain as twisted wires.

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1. Connector number
2. Terminal code (A=pin, B=socket)
3. Solid wire color
4. Striped wire color
5. Socket symbol
6. Pin symbol
7. Diode
8. Wire break
9. No connection
10. Circuit to/from
11. Splice
12. Ground
13. Twisted pair

Figure A-1. Connector/Wiring Diagram Symbols

1. Battery
2. P&A
3. Main
4. Fuse block [64]

Figure A-2. Fuse Block and Socket Terminals

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Table A-1. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Gray
LBE	Light Blue
LGN	Light Green
0	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

WIRING DIAGRAMS

Refer to the table below for wiring diagram information.

WIRING DIAGRAM LIST

FIGURE	NUMBER
Battery Power Distribution	Figure A-3.
Ignition and Accessory Power Distribution	Figure A-4.
Sensor Grounds	Figure A-5.
Ground Circuit: 1 of 2	Figure A-6.
Ground Circuit: 2 of 2	Figure A-7.
Front Lighting and Hand Controls: 2021 Sportster	Figure A-8.
Main Harness 1 of 2: 2021 Sportster	Figure A-9.
Main Harness 2 of 2: 2021 Sportster	Figure A-10.
Rear Lighting: 2021 Sportster	Figure A-11.

Figure A-3. Battery Power Distribution

Figure A-4. Ignition and Accessory Power Distribution

Figure A-5. Sensor Grounds

Figure A-6. Ground Circuit: 1 of 2

Figure A-7. Ground Circuit: 2 of 2

NOTES

Figure A-8. Front Lighting and Hand Controls: 2021 Sportster

Figure A-9. Main Harness 2 of 2: 2021 Sportster

Figure A-10. Main Harness 2 of 2: 2021 Sportster

1483999

Single LED Stop Lamp(Canada)

Right Turn

BK
V
BE

Stop/ Tail Lamp

BE
R/Y
BK

Left Turn

BE
V
BK

[18B]

BKI 1
V 12
BE I 3

[40B]

I BE I 1
R/Y : 2
BK I 3

See Main ► Harness (2 of 2)

[19B]

BE 3
I V 2
DK 1

Dual Stop Lamp Bulb w/LED LP Lamp

STT

BK
V
BE

[18B]

BK 1
V 2
BE 3

[40B]

LP LLmp

See Main ► Harness (2 of 2)

[40B]

LP Lamp

BK
BK

BK 1
BK 3

See Main * Harness

[19B]
-<

BE n
V !
BK

STT

BE
V
DK

LED

[18B]

STT

R
W
GN
BK

W .
GN
I BK I 1

(2 of 2)

--- 7"
[19B]

STT Q cQ

*
W
W

1
2
3
4

Figure A-11. Rear Lighting: 2021 Sportster

SUBJECT	PAGE NO.

8.1 GLOSSARY 8-1
8.2 METRIC CONVERSION 8-4
8.3 FLUID CONVERSION 8-5
8.4 TORQUE CONVERSION 8-6

NOTES

ACRONYMS AND ABBREVIATIONS

Refer to the table below for a list of common acronyms and abbreviations.

Table B-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AAT	Ambient air temperature
ABS	Anti-lock braking system
AC	Alternating current
ACC	Accessory position on ignition switch
ACR	Automatic compression release
AGM	Absorbed glass mat (battery)
Ah	Ampere-hour
AIS	Active intake solenoid
AWG	American wire gauge
B+	Battery voltage
bar	Bar
BAS	Bank angle sensor
BCM	Body control module
BMU	Battery Management Unit
BOB	Breakout box
BTDC	Before top dead center
°C	Celsius (Centigrade)
CA	California
CAL	Calibration
CAN	Controller area network
CBTx	CB send transmission
CB Rx	CB receive transmission
cc	Cubic centimeters
CCA	Cold cranking amps
CCW	Counterclockwise
CKP	Crankshaft position
cm	Centimeters
cm^3	Cubic centimeters
CW	Clockwise
DC	Direct current
DLC	Data link connector
DOM	Domestic
DOT	Department of Transportation
DTC	Diagnostic trouble code
DVOM	Digital volt ohm meter
ECM	Electronic control module
ECT	Engine coolant temperature
ECU	Electronic control unit
EEPROM	Electrically erasable programmable read only memory
EFI	Electronic fuel injection
EHCU	Electro hydraulic control unit
EPTC	Electronic Powertrain Controller
ET	Engine temperature
ETC	Electronic throttle control
EVAP	Evaporative emissions control system
EVPT	Electric Vehicle Powertrain
°F	Fahrenheit
fl oz	Fluid ounce
FPS	Fuel pressure sensor
ft	Feet
ft-lbs	Foot pounds
FTP	Flash to pass
g	Gram
gal	Gallon

Table B-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
GAWR	Gross axle weight rating
GND	Ground (electrical)
GPS	Global positioning system
GVWR	Gross vehicle weight rating
HCU	Hydraulic control unit
HDI	Harley-Davidson International
HD-Link	Networking system
H-DSSS	Harley-Davidson smart security system
HFM	Hands-free mode
HFSM	Hands-free security module
Hg	Mercury
H02S	Heated oxygen sensor
hp	Horsepower
hr	Hour
IAC	Idle air control
IAT	Intake air temperature
IC	Instrument cluster
ID	Inside diameter
IGN	Ignition light/key switch position
IM	Instrument module
IMU	Inertial Measurement Unit
in	inch
in^3	Cubic inch
INJ PW	Injector pulse width
INTCM	Intercom
in-lbs	Inch pounds
JSS	Jiffy stand sensor
kg	Kilogram
km	Kilometer
km/h	Kilometers per hour
kPa	Kilopascal
kW	Kilowatt
KS	Knock sensor
L	Liter
lb	Pounds
LCD	Liquid crystal display
LED	Light emitting diode
LH	Left hand
ILHCM	Left hand control module
LP	License plate
LT	Left
mA	Milliampere
MAP	Manifold absolute pressure
max	Maximum
MCM	Motor Control Module
mi	Mile
min	Minimum
mL	Milliliter
mm	Millimeter
mph	Miles per hour
ms	Millisecond
Nm	Newton-meter
NIM	Navigation interface module
NiMH	Nickel metal hydride
N/A	Not applicable
Q2	Oxygen
OBC	Onboard Charger
OD	Outside diameter
OEM	Original equipment manufacturer
oz	Ounce
P&A	Parts and Accessories
Part No.	Part number
PIN	Personal identification number

Table B-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
PND	Personal navigation device
psi	Pounds per square inch
PWM signal	Pulse width modulated signal
qt	Quart
RAD	Radio
RCM	Reverse control module
RDS	Radio data system
RES	Reserve mark on fuel supply valve
RESS	Rechargeable Energy Storage System
RH	Right hand
RHCM	Right hand control module
rpm	Revolutions per minute
RT	Right
s	Seconds
SCFH	Cubic feet per hour at standard conditions
SDARS	Satellite digital audio radio service
SPDO	Speedometer
SPKR	Speaker
STT	Stop/tail/turn
TA	Traffic announcement
TCA	Throttle control actuator
TCU	Telemetry Control Unit
TDC	Top dead center
TGS	Twist grip sensor
TPMS	Tire pressure monitoring system
TPS	Throttle position sensor
TSM	Turn signal module
TSSM	Turn signal/security module
TT	Telltale
USB	Universal serial bus
V	Volt
VAC	Volts of alternating current
VDC	Volts of direct current
VIN	Vehicle identification number
VR	Voice recognition
vsc	Vehicle Security Advisory Controller
vss	Vehicle speed sensor
w	Watt
WA	Weather alert
WHIM	Wireless headset interface module
wss	Wheel speed sensor

Table B-2. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN)								INCHES to MILLIMETERS (IN x 25.40 = MM)							
mm	in	mm	in	mm	In	mm	in	In	mm	in	mm	in	mm	in	mm
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

UNITED_STATES_SYSTEM

Unless otherwise specified, all fluid volume measurements in this manual are expressed in United States (U.S.) units-of-measure. See below:

•. 1 pint (U.S.) = 16 fluid ounces (U.S.)

- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.)= 4 quarts (U.S.)= 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). To convert between U.S. units-of-measure and metric units-of-measure, refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

Fluid volume measurements in this manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

BRITISH IMPERIAL SYSTEM

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. To convert between U.S. units and British Imperial units, refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201= pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds **(in-lbs)**
- inch pounds **(in-lbs)** X 0.08333 = foot pounds (ft-lbs)

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs)
- Newton meters (Nm) X 8.85085 = inch pounds **(in-lbs)**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm)
- inch pounds **(in-lbs)** X 0.112985 = Newton meters (Nm)

TOOLS

Part Number	TOOL NAME	NOTES
A157-8	SNAP-ON BUSHING DRIVER 1/2-INCH ADAPTER	5.11 TRANSMISSION RIGHT CASE BEARINGS, Installation
B-35758-52A	7.02MM PILOT	3.16 CYLINDER HEAD, Refacing Valve Seats
B-43985	TRANSMISSION REMOVAL AND INSTALLATION TOOL	5.13 TRANSMISSION INSTALLATION, Installation
B-43985-1	TRANSMISSION REMOVER	5.8 TRANSMISSION REMOVAL AND DISASSEMBLY, Transmission Removal From Left Crankcase
B-43985-3	TRANSMISSION INSTALLER	5.13 TRANSMISSION INSTALLATION, Installation
B-43985-4	GUIDE	5.13 TRANSMISSION INSTALLATION, Installation
B-45520	GEAR DETENT ASSEMBLY AID	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase 5.13 TRANSMISSION INSTALLATION, Assembling Crankcases
B-45524-A	VALVE GUIDE REMOVER/INSTALLER	3.16 CYLINDER HEAD, Replacing Valve Guides
B-45525	VALVE GUIDE HONE	3.16 CYLINDER HEAD, Cleaning and Inspection 3.16 CYLINDER HEAD, Replacing Valve Guides
B-45655	CRANKCASE BEARING REMOVER/INSTALLER WITH ADAPTER	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase 3.21 Crankcase, Disassembly
B-45676-A	SPROCKET SHAFT SEAL INSTALLER	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
B-45847	CROSS PLATE	5.10 MAIN DRIVE GEAR AND BEARING, Removal 5.10 MAIN DRIVE GEAR AND BEARING, Installation
BB200A	BASIC VACUUM BRAKE BLEEDER	2.12 Bleeding Brakes, Procedure 2.14 Electro Hydraulic Control Unit (EHCU), Removal
CJ114	SNAP-ON BODY DENT PULLER	3.21 Crankcase, Disassembly
CJ950	BEARING SEPARATOR	3.21 Crankcase, Fitting Pinion Bearings
HD-25070	ROBINAIR HEAT GUN	4.8 INDUCTION MODULE, Disassembly 4.9 Idle Air Control (IAC), Removal 6.20 Rear Stop Lamp Switch, Installation
HD-33223-1	CYLINDER COMPRESSION GAUGE	3.6 Troubleshooting, Compression Test
HD-33416	UNIVERSAL DRIVER HANDLE	2.17 FORK STEM AND BRACKET ASSEMBLY, Cleaning, Inspection and Repair
HD-33446-86	XL EVOLUTION TORQUE PLATE BOLTS	3.17 CYLINDER AND PISTON, Cleaning, Inspection and Repair
HD-33446-B	CYLINDER TORQUEPLATES	3.17 CYLINDER AND PISTON, Cleaning, Inspection and Repair
HD-34623-C	PISTON PIN RETAINING RING INSTALLER	3.9 TOP END OVERHAUL: DISASSEMBLY, CYLINDER AND PISTON 3.10 TOP END OVERHAUL: ASSEMBLY, Piston and Cylinder
HD-34634	FORK OIL SEAL INSTALLER	2.16 FRONT FORK, Assembly: Left Side
HD-34736-B	VALVE SPRING COMPRESSOR	3.16 CYLINDER HEAD, Disassembly 3.16 CYLINDER HEAD, Assembly
HD-34751	CLEANING BRUSH	3.16 CYLINDER HEAD, Cleaning and Inspection 3.16 CYLINDER HEAD, Refacing Valve Seats 3.16 CYLINDER HEAD, Replacing Valve Guides
HD-34902-7	END CAP	3.21 Crankcase, Fitting Pinion Bearings
HD-35102	WRIST PIN BUSHING HONE	3.17 CYLINDER AND PISTON, Connecting Rod Bushings
HD-35316-11	RECEIVER CUP	5.10 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-12	INSTALLER CUP	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	5.10 MAIN DRIVE GEAR AND BEARING, Removal

TOOLS

Part Number	TOOL NAME	NOTES
		5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-7	WASHER	5.10 MAIN DRIVE GEAR AND BEARING, Removal 5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-8	BEARING DRIVER	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-9	BEARING DRIVER	5.10 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-C	5-SPEED & 6-SPEED MAIN DRIVE GEAR REMOVER AND INSTALLER	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-D	MAIN DRIVE GEAR REMOVER AND INSTALLER SET	5.10 MAIN DRIVE GEAR AND BEARING, Removal
HD-35381-A	BELT TENSION GAUGE	1.13 DRIVE BELT AND SPROCKETS, Check Drive Belt Deflection
HD-35457	BLACK LIGHT LEAK DETECTOR	1.24 TROUBLESHOOTING, Lubrication System
HD-35667-A	CYLINDER LEAKDOWN TESTER	3.6 Troubleshooting, Cylinder Leakage Test
HD-35758-D	NEWAY VALVE SEAT CUTTER SET	3.16 CYLINDER HEAD, Refacing Valve Seats
HD-36583	FORK SEAL AND BUSHING INSTALLATION TOOL	2.16 FRONT FORK, Assembly: Right Side
HD-38362	SPROCKET LOCKING LINK	5.4 PRIMARY DRIVE AND CLUTCH, Removal 5.4 PRIMARY DRIVE AND CLUTCH, Installation
HD-38515-91	CLUTCH SPRING FORCING SCREW	5.4 PRIMARY DRIVE AND CLUTCH, Disassembly 5.4 PRIMARY DRIVE AND CLUTCH, Assembly
HD-38515-A	SPRING COMPRESSING TOOL	5.4 PRIMARY DRIVE AND CLUTCH, Disassembly 5.4 PRIMARY DRIVE AND CLUTCH, Assembly
HD-38871	CAMSHAFT BUSHING REAMER PILOT	3.20 GEARCASE, Bushing Reaming
HD-39301-A	STEERING HEAD BEARING RACE REMOVER	2.17 FORK STEM AND BRACKET ASSEMBLY, Cleaning, Inspection and Repair
HD-39302	STEERING HEAD BEARING RACE INSTALLER	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
HD-39782-A	CYLINDER HEAD SUPPORT STAND	3.16 CYLINDER HEAD, Replacing Valve Guides
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.16 CYLINDER HEAD, Refacing Valve Seats 3.16 CYLINDER HEAD, Replacing Valve Guides
HD-39847	REAMER T-HANDLE	3.16 CYLINDER HEAD, Replacing Valve Guides
HD-39964	VALVE GUIDE REAMER	3.16 CYLINDER HEAD, Replacing Valve Guides 3.17 CYLINDER AND PISTON, Connecting Rod Bushings
HD-39969	ULTRA TORCH UT-100	6.20 Rear Stop Lamp Switch, Installation
HD-41137	HOSE CLAMP PLIERS	3.22 OIL TANK, Crimp Clamps
HD-41177	FORK TUBE HOLDER	2.16 FRONT FORK, Disassembly: Left Side 2.16 FRONT FORK, Assembly: Left Side
HD-41182	FUEL PRESSURE GAUGE	4.3 Fuel Pressure Test, Testing
HD-41183	HEAT SHIELD ATTACHMENT	6.20 Rear Stop Lamp Switch, Installation
HD-41417	PROPANE ENRICHMENT KIT	4.4 Intake Leak Test, Leak Tester
HD-42310-45	ENGINE CRADLE	5.7 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL, Engine Removal and Disassembly
HD-42311	OIL FILTER WRENCH	1.5 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-42320-A	PISTON PIN EXTRACTOR	3.9 TOP END OVERHAUL: DISASSEMBLY, CYLINDER AND PISTON
HD-42322	PISTON SUPPORT PLATE	3.9 TOP END OVERHAUL: DISASSEMBLY', CYLINDER AND PISTON 3.10 TOP END OVERHAUL: ASSEMBLY, Piston and Cylinder

TOOLS

Part Number	TOOL NAME	NOTES
HD-42326-B	CRANKSHAFT GUIDE	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase 5.13 TRANSMISSION INSTALLATION, Assembling Crankcases
HD-42579-A	SPROCKET SHAFT BEARING/SEAL INSTALLATION TOOL	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-42720-2	CRANKCASE BEARING REMOVER/INSTALLER BASE	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase 3.21 Crankcase, Disassembly
HD-43984	CRANKSHAFT LOCKING TOOL	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Cam Gears and Gearcase Cover
HD-44060-C	WHEEL BEARING INSTALLER AND REMOVER	2.5 WHEELS, SEALED WHEEL BEARINGS
HD-44061	FUEL PRESSURE GAUGE ADAPTER	4.3 Fuel Pressure Test, Testing
HD-44067-A	OIL FILTER WRENCH	1.5 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-45305	FORK SEAL DRIVER	2.16 FRONT FORK, Assembly: Right Side 2.16 FRONT FORK, Assembly: Left Side
HD-45966	FRONT FORK COMPRESSOR	2.16 FRONT FORK, Disassembly: Left Side 2.16 FRONT FORK, Assembly: Left Side
HD-45966-2	FORK SPRING COMPRESSING TOOL COLLAR	2.16 FRONT FORK, Disassembly: Left Side
HD-45968	FAT JACK	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Removal 2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation 2.23 REAR ENGINE MOUNT AND ISOLATOR, Removal 2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation 3.14 REMOVING ENGINE FROM CHASSIS, Procedure
HD-46281	BEARING REMOVER/INSTALLER TOOL	2.19 REAR FORK, Pivot Bearings
HD-46282-1A	SPROCKET HOLDING TOOL ADAPTER	5.14 TRANSMISSION SPROCKET, Removal 5.14 TRANSMISSION SPROCKET, Installation
HD-46282-A	TRANSMISSION SPROCKET HOLDING TOOL SET	5.14 TRANSMISSION SPROCKET, Removal 5.14 TRANSMISSION SPROCKET, Installation
HD-46283	SPROCKET LOCKING LINK	5.4 PRIMARY DRIVE AND CLUTCH, Removal 5.4 PRIMARY DRIVE AND CLUTCH, Installation
HD-46284	ENGINE HOOK	3.14 REMOVING ENGINE FROM CHASSIS, Procedure 3.15 INSTALLING ENGINE IN CHASSIS, Procedure
HD-46285	TRANSMISSION ASSEMBLY FIXTURE	5.8 TRANSMISSION REMOVAL AND DISASSEMBLY, Transmission Removal From Left Crankcase
HD-46285-2	CASE HOLDING FIXTURE	5.13 TRANSMISSION INSTALLATION, Installation
HD-46287	LAPPING TOOL ADAPTER	3.21 Crankcase, Lapping Pinion Bearing Outer Race
HD-46288	MAINSHAFT LOCKNUT WRENCH	5.14 TRANSMISSION SPROCKET, Removal 5.14 TRANSMISSION SPROCKET, Installation
HD-46663	CRANKCASE BEARING REMOVER ADAPTER	3.21 Crankcase, Disassembly
HD-47855	INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL	5.10 MAIN DRIVE GEAR AND BEARING, Assembly
HD-47856	MAIN DRIVE GEAR SEAL INSTALLER KIT	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-1	INSTALLER	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-2	PILOT	5.10 MAIN DRIVE GEAR AND BEARING, Installation

TOOLS

Part Number	TOOLNAME	NOTES
HD-47856-4	ADAPTER	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-5	NUT	5.10 MAIN DRIVE GEAR AND BEARING, Installation
HD-48116-A	TEMPERATURE SENSOR SOCKET	4.13 ENGINE TEMPERATURE (ET) SENSOR, Removal
HD-48497-A	DOT 4 BRAKE FLUID MOISTURE TESTER	1.11 BRAKES, Fluid Level
HD-48650	DIGITAL TECHNICIAN II	, Preparation For Service 2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation 2.8 FRONT BRAKE CALIPERS, Installation 2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Installation 2.10 REAR BRAKE CALIPER, Installation 2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS) 2.11 Brake Lines, Front Manifold to EHCU (ABS) 2.11 Brake Lines, Rear Master Cylinder to EHCU (ABS) 2.11 Brake Lines, Rear EHCU to Caliper (ABS) 2.14 Electro Hydraulic Control Unit (EHCU), Installation 4.3 Fuel Pressure Test, General 6.5 ELECTRONIC CONTROL MODULE (ECM), Installation 6.6 BODY CONTROL MODULE (BCM), Installation 6.20 Rear Stop Lamp Switch, Installation
HD-48856-A	AXLE ALIGNMENT PLUGS	1.21 WHEEL ALIGNMENT, Wheel Alignment
HD-50017	OXYGEN SENSOR WRENCH	4.12 HEATED OXYGEN SENSOR (HO2S), Removal 4.12 HEATED OXYGEN SENSOR (HO2S), Installation
HD-52006	ADJUSTABLE SPARK PLUG WIRE PULLER	1.16 SPARK PLUGS, Remove
HD-59000-B	HARLEY-DAVIDSON PRO-LEVEL OIL GAUGE	2.16 FRONT FORK, Assembly: Right Side
HD-59000B	FORK OIL LEVEL GAUGE	2.16 FRONT FORK, Assembly: Left Side
HD-94800-26A	REAMER	3.17 CYLINDER AND PISTON, Connecting Rod Bushings
HD-94803-67	REAR INTAKE CAM GEAR BUSHING REAMER	3.20 GEARCASE, Bushing Reaming
HD-94804-57	ROCKER ARM BUSHING REAMER	3.16 CYLINDER HEAD, Replacing Rocker Arm Bushings
HD-94812-1	PINION SHAFT BUSHING REAMER	3.20 GEARCASE, Bushing Reaming
HD-94812-87	PINION SHAFT BUSHING REAMER PILOT	3.20 GEARCASE, Bushing Reaming
HD-95637-46B	WEDGE ATTACHMENT	5.10 MAIN DRIVE GEAR AND BEARING, Disassembly
HD-95760-69A	BUSHING AND BEARING PULLER	3.20 GEARCASE, Bushing Inspection and Removal 5.11 TRANSMISSION RIGHT CASE BEARINGS, Removal
HD-95765-69A	1/2 COLLET	5.11 TRANSMISSION RIGHT CASE BEARINGS, Removal
HD-95952-33C	CONNECTING ROD CLAMPING TOOL	3.17 CYLINDER AND PISTON, Connecting Rod Bushings
HD-95970-32D	PISTON PIN BUSHING TOOL	3.17 CYLINDER AND PISTON, Connecting Rod Bushings
HD-96333-51 E	PISTON RING COMPRESSOR	3.10 TOP END OVERHAUL: ASSEMBLY, Piston and Cylinder
HD-96710-40C	CRANKCASE MAIN BEARING LAPPING TOOL	3.21 Crankcase, Lapping Pinion Bearing Outer Race

TOOLS

Part Number	TOOLNAME	NOTES
HD-96712-87A	CRANKCASE MAIN BEARING LAP	3.21 Crankcase, Lapping Pinion Bearing Outer Race
HD-96796-47	VALVE SPRING TESTER	3.16 CYLINDER HEAD, Cleaning and Inspection
HD-96921-52D	OIL PRESSURE TEST GAUGE KIT	3.4 Oil Pressure, Checking Oil Pressure
HD-96925-58	OIL PRESSURE GAUGE ADAPTER	3.4 Oil Pressure, Checking Oil Pressure
HD-99500-80	WHEEL TRUING STAND	2.6 CHECKING AND TRUING WHEELS, Cast Wheel Runout
J-21686-12	FORCING SCREW	3.21 Crankcase, Fitting Pinion Bearings
J-5586-A	TRANSMISSION SHAFT RETAINING RING PLIERS	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase 3.21 Crankcase, Disassembly 5.8 TRANSMISSION REMOVAL AND DISASSEMBLY, Mainshaft Disassembly 5.8 TRANSMISSION REMOVAL AND DISASSEMBLY, Countershaft Disassembly 5.9 TRANSMISSION ASSEMBLY, Mainshaft Assembly 5.9 TRANSMISSION ASSEMBLY, Countershaft Assembly
J-7830-5	BRIDGE	3.21 Crankcase, Fitting Pinion Bearings
PFSX916	SNAP-ON WRENCH	4.16 EXHAUST SYSTEM, Exhaust Pipes
PR-36	SNAP RING PLIERS	5.12 TRANSMISSION LEFT CASE BEARINGS, Removal

NOTES

Torque Values

FASTENER	TORQUE VALUE		NOTES
Air cleaner breather screw	84-120 in-lbs	9.5-13.6 N-m	4.5 AIR CLEANER ASSEMBLY, All Models Apply LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (blue) if reusing existing screws
Air cleaner cover screw	36-60 in-lbs	4.1-6.8 N-m	1.6 AIR CLEANER AND EXHAUST SYSTEM, Air Cleaner
Air filter element screw	40-60 in-lbs	4.5-6.8 N-m	1.6 AIR CLEANER AND EXHAUST SYSTEM, Air Cleaner LOCTITE 243 MEDIUM STRENGTH THREADLOCKER AND SEALANT (BLUE) (99642-97)
Alternator rotor to sprocket screw	120-140 in-lbs	13.6-15.8 N-m	6.26 ALTERNATOR, Assembly and Installation
Alternator stator mounting screw	30-40 in-lbs	3.4-4.5 N-m	6.26 ALTERNATOR, Assembly and Installation
Axle, front, nut	60-65 ft-lbs	81-88 N-m	2.5 WHEELS, General
Axle, rear, nut	95-105 ft-lbs	129-142 N-m	1.13 DRIVE BELT AND SPROCKETS, Adjustment
Battery negative cable to crankcase stud	55-75 in-lbs	6.2-8.5 N-m	6.9 BATTERY CABLES, Negative Battery Cable
Battery strap fastener	72-96 in-lbs	8.1-10.8 N-m	1.20 BATTERY MAINTENANCE, installation and Connection
Battery terminal screw	60-70 in-lbs	6.8-7.9 N-m	1.20 BATTERY MAINTENANCE, Installation and Connection
Battery tray fastener	96-156 in-lbs	10.8-17.6 N-m	6.8 Battery Tray, Installation
Belt guard screw	120-180 in-lbs	13.6-20.3 N-m	2.18 BELT GUARD AND DEBRIS DEFLECTOR, Belt Guard
Brake caliper bleeder screw	35-61 in-lbs	3.9-6.9 N-m	2.8 FRONT BRAKE CALIPERS, Assembly
Brake caliper bleeder valve	35-61 in-lbs	3.9-6.9 N-m	2.12 Bleeding Brakes, Procedure
Brake caliper, front, mounting bolt	28-38 ft-lbs	38-51.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Front
Brake caliper, front, pad pin	131-173 in-lbs	14.8-19.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Front
Brake caliper, rear, mounting bolt	28-38 ft-lbs	38-51.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake caliper, rear, pad pin	131-173 in-lbs	14.8-19.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake disc, front, screw	16-24 ft-lbs	21.7-32.6 N-m	2.5 WHEELS, FRONT WHEEL Cast front wheel
Brake disc, rear, screw	30-45 ft-lbs	40.7-61.1 N-m	2.5 WHEELS, REAR WHEEL
Brake hose clamp to rear fork screw	30-40 in-lbs	3.4-4.5 N-m	1.13 DRIVE BELT AND SPROCKETS, Adjustment
Brake lever pivot pin	5-13 in-lbs	0.5-1.5 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Front Brake Lever
Brake lever pivot pin nut	44-61 in-lbs	4.9-6.9 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Front Brake Lever
Brake line P-clamp, rear, screw	30-40 in-lbs	3.4-4.5 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake line banjo bolt	14-18 ft-lbs	19-24.4 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake line bracket clamp fastener	20-30 in-lbs	2.3-3.4 N-m	2.11 Brake Lines, Front Manifold to EHCU (ABS)
Brake line clamp screw, fork bracket	45-65 in-lbs	5.1-7.4 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)
Brake line clamp screw, steering stem	120-168 in-lbs	13.6-19 N-m	2.11 Brake Lines, Front Brake Line (Non-ABS)

Torque Values

FASTENER	TORQUE VALUE		NOTES
Brake line fastener	120-180 in-lbs	13.6-20.3 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Brake line tube nuts	128-173 in-lbs	14.5-19.5 N-m	2.11 Brake Lines, Front Master Cylinder to Manifold to Caliper (ABS)
Brake line, front, manifold bolt	36-48 in-lbs	4.1-5.4 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Brake line, rear, bracket fasteners	120-180 in-lbs	13.6-20.3 N-m	2.19 REAR FORK, Installation
Brake master cylinder clamp, front, screw	108-132 in-lbs	12.2-14.9 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake master cylinder, front, reservoir cover screws	9-17 in-lbs	1-2 N-m	2.12 Bleeding Brakes, Procedure
Brake master cylinder, front, reservoir cover screws	9-18 in-lbs	1-2 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Front
Brake master cylinder, rear, mounting bracket screw	45-50 ft-lbs	61-68 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Master Cylinder Mounting Bracket
Brake master cylinder, rear, mounting screw	18-22 ft-lbs	24.4-29.9 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Brake master cylinder, rear, pushrod collar	130-173 in-lbs	14.7-19.6 N-m	2.9 REAR BRAKE MASTER CYLINDER AND RESERVOIR, Master Cylinder Rebuild Kit
Brake master cylinder, rear, reservoir cover screws	9-18 in-lbs	1-2 N-m	1.12 BRAKE PADS AND DISCS, Brake Pad Replacement: Rear
Brake master cylinder, reservoir cover screws	9-18 in-lbs	1-2 N-m	1.11 BRAKES, Fluid Level
Brake pad pin	131-173 in-lbs	14.8-19.5 N-m	2.8 FRONT BRAKE CALIPERS, Assembly
Brake pedal clevis screw	13-17 ft-lbs	17.6-23 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Brake rod ball stud	120-180 in-lbs	13.6-20.4 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Breather screw	35-55 in-lbs	4-6.2 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
CKP screw	100-120 in-lbs	11.3-13.6 N-m	6.21 Crank Position Sensor (CKP), Install-ation
Caddy fastener, front	15-25 in-lbs	1.7-2.8 N-m	2.24 THROTTLE CABLES, Installation
Caliper to mounting bracket, rear	28-38 ft-lbs	38-51.5 N-m	2.10 REAR BRAKE CALIPER, Installation
Clutch cable adjuster jamnut	120 in-lbs	13.6 N-m	1.10 CLUTCH, Adjustment
Clutch cable fitting	36-108 in-lbs	4.1-12.2 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Clutch cable wireform screw	9-11 in-lbs	1.1-1.2 N-m	2.17 FORK STEM AND BRACKET AS-SEMBLY, Assembly and Installation
Clutch inspection cover screws	84-108 in-lbs	9.5-12.2 N-m	1.9 TRANSMISSION LUBRICANT, Transmission Lubrication
Clutch lever anti-rattle spring screw	8-13 in-lbs	0.9-1.5 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Coil mounting bracket screw	35-45 in-lbs	4-5.1 N-m	6.12 IGNITION COIL, Installation
Coil mounting screw	24-72 in-lbs	2.7-8.1 N-m	6.12 IGNITION COIL, Installation
Countershaft retaining screw	33-37 ft-lbs	44.8-50.2 N-m	5.13 TRANSMISSION INSTALLATION, Shifter Shaft Installation
Crankcase fastener	15-19 ft-lbs	20.3-25.8 N-m	3.13 BOTTOM END OVERHAUL: AS-SEMBLY, Crankcase
Cylinder screws, 1st torque	96-120 in-lbs	11-14 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, CYLINDER HEAD See procedure

Torque Values

FASTENER	TORQUE VALUE		NOTES
Cylinder screws, final torque	13-15 ft-lbs	18-20 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, CYLINDER HEAD Plus 90 degrees. See procedure
Cylinder stud	120-240 in-lbs	13.6-27.1 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Damper cartridge screw (All but XL1200X)	11-18 ft-lbs	15-25 N-m	2.16 FRONT FORK, Assembly: Left Side
Damper cartridge screw (XL1200X)	22-30 ft-lbs	30-40 N-m	2.16 FRONT FORK, Assembly: Left Side
Debris deflector screw	36-60 in-lbs	4.1-6.8 N-m	2.18 BELT GUARD AND DEBRIS DEFLECTOR, Debris Deflector
ECM caddy fastener	72-96 in-lbs	8.1-10.8 N-m	6.8 Battery Tray, Installation
ECM fastener	19-24 in-lbs	2.1-2.7 N-m	6.5 ELECTRONIC CONTROL MODULE (ECM), Installation
EHCU mounting bracket fasteners	15-18 ft-lbs	20.3-24.4 N-m	2.14 Electro Hydraulic Control Unit (EHCU), Installation
EHCU to mounting bracket fastener	50-70 in-lbs	5.8-7.8 N-m	2.14 Electro Hydraulic Control Unit (EHCU), Installation
ET sensor	120-168 in-lbs	13,6-19 N-m	4.13 ENGINE TEMPERATURE (ET) SENSOR, Installation
EVAP canister mounting bracket screw	15-18 ft-lbs	20.3-24.4 N-m	4.17 EVAPORATIVE (EVAP) EMISSIONS CONTROL, Charcoal Canister
Electrical caddy cover	30-40 in-lbs	3.4-4.5 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Electrical caddy fastener	30-40 in-lbs	3.4-4.5 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, Installation
Electrical caddy fasteners	30-40 in-lbs	3.4-4.5 N-m	4.7 FUEL TANK, Installing Fuel Tank
Engine mount, front, bolt	95-105 ft-lbs	129-142 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
Engine sprocket nut	240-260 ft-lbs	326-353 N-m	5.4 PRIMARY DRIVE AND CLUTCH, Installation
Exhaust mounting bracket fastener	30-33 ft-lbs	40.7-44.7 N-m	4.16 EXHAUST SYSTEM, Mounting Bracket
Exhaust pipe bracket acorn nut	20-30 ft-lbs	27.1-40.7 N-m	4.16 EXHAUST SYSTEM, Exhaust Pipes
Exhaust pipe clamp bracket fastener	30-33 ft-lbs	40.7-44.7 N-m	4.16 EXHAUST SYSTEM, Exhaust Pipe Bracket
Exhaust pipe clamp bracket screw	30-33 ft-lbs	40.7-44.7 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Exhaust pipe flange nut	96-120 in-lbs	10.8-13.6 N-m	4.16 EXHAUST SYSTEM, Exhaust Pipes
Exhaust shield worm drive clamps	20-40 in-lbs	2.3-4.5 N-m	4.16 EXHAUST SYSTEM, Exhaust Shields
Fender brace, rear, screw	20-25 in-lbs	2.3-2.8 N-m	2.32 REAR FENDER: MODELS WITH INTEGRATED TURN SIGNAL, TAIL AND STOP LAMPS, Assembly and Installation
Fender support, rear, screw	132-216 in-lbs	14.9-24.4 N-m	6.17 LICENSE PLATE LAMP MODULE, Installation: Center-Mount License Plate
Fender to fork brace, front: XL1200X	30-42 in-lbs	3.4-4.7 N-m	2.29 Front Fender, All Models Tighten in cross pattern.
Fender to forks, front: All models except XL1200X	96-156 in-lbs	10.9-17.6 N-m	2.29 Front Fender, All Models
Fender, rear, mounting fastener	120-168 in-lbs	13.6-19 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Installation
Footrest support bracket	46-50 ft-lbs	61-68 N-m	2.19 REAR FORK, Installation
Footrest wear peg	72-108 in-lbs	8.1-12.2 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Right Footrest and Rear Brake Pedal Assembly
Fork brace to forks: XL12OOX	18-22 ft-lbs	24.4-29.8 N-m	2.29 Front Fender, All Models
Fork bracket screw; XL1200X	10-13 ft-lbs	13.6-17.6 N-m	6.18 Front Turn Signals, Removal and Installation

Torque Values

FASTENER	TORQUE VALUE		NOTES
Fork slider tube fastener (All but XL1200X)	132-216 in-lbs	14.9-24.4 N-m	2.16 FRONT FORK, Assembly: Right Side
Fork slider tube fastener (XL1200X)	37-44 ft-lbs	50-60 N-m	2.16 FRONT FORK, Assembly: Right Side
Fork stem pinch bolt	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork stem pinch bolt, upper	30-35 ft-lbs	40.7-47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Fork stem pinch bolt: All but XL1200X	30-35 ft-lbs	40.7-47.5 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork tube plug	22-59 ft-lbs	30-80 N-m	2.16 FRONT FORK, Assembly: Left Side
Fork, front, pinch bolt	21-27 ft-lbs	28.5-36.6 N-m	2.5 WHEELS, FRONT WHEEL
Fork, front, stem bolt, final torque	72-96 in-lbs	8.1-10.9 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork, front, stem bolt, first torque	23-27 ft-lbs	31.2-36.6 N-m	2.17 FORK STEM AND BRACKET ASSEMBLY, Assembly and Installation
Fork, front, upper bracket pinch screw	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Fork, rear, pivot bolt nut	120-130 ft-lbs	162.7-176.3 N-m	2.19 REAR FORK, Installation
Front fork lower bracket pinch screw: All butXL1200X	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Fuel hose retaining bracket screw	60 in-lbs	6.8 N-m	4.14 Fuel Injectors, Installation
Fuel pump bracket mounting screw	19-36 in-lbs	2.1-4.1 N-m	4.15 FUEL PUMP, Assembly
Fuel pump module mounting screw	40-45 in-lbs	4.5-5.1 N-m	4.6 FUEL FILTER ELEMENT, Installation
Fuel tank fasteners	15-20 ft-lbs	20.3-27.1 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Assembling Motorcycle After Top End Repair
Gear detent assembly screw	90-110 in-lbs	10.2-12.4 N-m	5.13 TRANSMISSION INSTALLATION, Installation
Gear shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Left Footrest and Shift Lever Assembly
Gearcase cover fasteners	120-140 in-lbs	13.6-15.8 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Cam Gears and Gearcase Cover
HO2S	12.2-14.2 ft-lbs	16.5-19.3 N-m	4.12 HEATED OXYGEN SENSOR (HO2S), Installation
Handlebar clamp screw	12-18 ft-lbs	16.3-24.4 N-m	2.26 HANDLEBAR, Installation
Handlebar control lever clamp screw	108-132 in-lbs	12.2-14.9 N-m	2.25 CLUTCH CONTROL, Assembly and Installation
Handlebar riser bolt, lower	30-40 ft-lbs	40.7-54.3 N-m	2.26 HANDLEBAR, Installation
Headlamp clamp nut: Iron 1200 (XL1200NS)	120-240 in-lbs	13.6-27.1 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp clamp nut: Iron 883 (XL883N)	120-240 in-lbs	13.6-27.1 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp horizontal adjustment: Forty-Eight (XL1200X)	30-35 ft-lbs	40.7-47.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp mount: XL1200X	30-35 ft-lbs	41-47 N-m	6.14 HEADLAMP, Headlamp Mounts
Headlamp screw	40 in-lbs	4.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp upper bracket fasteners: XL883N	120-192 in-lbs	14-22 N-m	6.14 HEADLAMP, Headlamp Mounts
Headlamp vertical adjustment: Forty-Eight (XL1200X)	30-35 ft-lbs	40.7-47.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Headlamp visor bracket screw: XL1200NS	10-16 ft-lbs	14-22 N-m	6.14 HEADLAMP, Headlamp Mounts
Headlamp visor bracket to headlamp bracket button screw	3.0-3.7 ft-lbs	4-5 N-m	2.28 HEADLAMP VISOR, Disassemble and Assemble

Torque Values

FASTENER	TORQUE VALUE		NOTES
Headlamp visor bracket to headlight bracket socket head screw	10-16 ft-lbs	14-22 N-m	2.28 HEADLAMP VISOR, Disassemble and Assemble
Headlamp visor screw	35-45 in-lbs	4-5.1 N-m	2.28 HEADLAMP VISOR, Removal and Installation
Horn fastener: front mount	36-48 in-lbs	4.1-5.4 N-m	6.27 HORN, Front Mount
IAC mounting screw	60 in-lbs	6.8 N-m	4.8 INDUCTION MODULE, Assembly
Ignition switch face nut	72-96 in-lbs	8.1-10.8 N-m	6.10 Ignition Switch, Installation
Ignition switch mounting screw	35-45 in-lbs	4-5.1 N-m	6.10 Ignition Switch, Installation
Induction module cable bracket screw	60 in-lbs	6.8 N-m	4.8 INDUCTION MODULE, Assembly
Induction module mounting bracket screw	120-144 in-lbs	13.6-16.3 N-m	4.8 INDUCTION MODULE, Installation
Induction module screw	35 in-lbs	4 N-m	4.8 INDUCTION MODULE, Assembly
Intake manifold mounting screw	100-120 in-lbs	11.3-13.6 N-m	4.8 INDUCTION MODULE, Installation
Isolator mount, front, screw	25-35 ft-lbs	33.9-47.5 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Isolator mount, rear, screw	25-35 ft-lbs	33.9-47.5 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure
Isolator, front, mounting bracket screw	25-35 ft-lbs	33.9-47.5 N-m	2.22 FRONT ENGINE MOUNT AND ISOLATOR, Installation
J-clip fastener	45-50 ft-lbs	61-67.8 N-m	6.28 MAIN WIRING HARNESS AND ELECTRICAL CADDIES, J-Clips: MidMount Models
JSS screw	96-120 in-lbs	10.9-13.6 N-m	6.34 JIFFY STAND SENSOR (JSS): INTERNATIONAL MODELS, Installation
License plate clamp nut: top mount bracket	20-25 in-lbs	2.3-2.8 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Top Mount License Plate Bracket
License plate lamp housing screw	14-16 in-lbs	1.6-1.8 N-m	6.17 LICENSE PLATE LAMP MODULE, Installation: Center-Mount License Plate
License plate reflector bracket nut	35-44 in-lbs	4-5 N-m	6.17 LICENSE PLATE LAMP MODULE, Reflector Brackets
License plate screw (India)	35-45 in-lbs	4-5.1 N-m	2.34 REAR LICENSE PLATE: INDIA MODELS, Rear License Plate: India
License plate support bracket screws: top mount bracket	20-25 in-lbs	2.3-2.8 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Top Mount License Plate Bracket
Locknut, fork tube plug	13-16.6 ft-lbs	17.5-22.5 N-m	2.16 FRONT FORK, Assembly: Left Side
Lower pinch bolt in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m	2.16 FRONT FORK, Installation
Lower pinch screw in lower fork bracket: XL1200X	30-35 ft-lbs	40.7-47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
Main harness ground wire	55-75 in-lbs	6.2-8.5 N-m	6.9 BATTERY CABLES, Positive Battery Cable
Mirror stem locknut	96-144 in-lbs	10.9-16.3 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Muffler clamp	38-43 ft-lbs	51.5-58.3 N-m	4.16 EXHAUST SYSTEM, Mufflers
Muffler mounting bracket fastener	17-20 ft-lbs	23-27.1 N-m	4.16 EXHAUST SYSTEM,Mufflers
Muffler mounting bracket screw	30-33 ft-lbs	40.7-44.7 N-m	5.14 TRANSMISSION SPROCKET, Installation
Muffler to bracket screw	17-20 ft-lbs	23-27.1 N-m	4.16 EXHAUST SYSTEM, Mufflers
Neutral indicator switch	120-180 in-lbs	13.6-20.3 N-m	5.13 TRANSMISSION INSTALLATION, Assembling Crankcases
Oil drain hose clamp	6-10 in-lbs	0.7-1.1 N-m	1.5 ENGINE OIL AND FILTER, Changing Oil and Filter
Oil filter adapter	18-22 ft-lbs	24.4-29.8 N-m	3.19 OIL FILTER MOUNT, Assembly
Oil pressure switch	60-90 in-lbs	6.8-10.2 N-m	3.4 Oil Pressure, Checking Oil Pressure
Oil pump cover screws	70-80 in-lbs	7.9-9 N-m	3.18 Oil Pump, Assembly

Torque Values

FASTENER	TORQUE VALUE		NOTES
Oil pump feed fitting	100-120 in-lbs	11.3-13.6 N-m	3.18 Oil Pump, Installation
Oil pump high-pressure feed hose fitting nut	85-105 in-lbs	9.6-11.8 N-m	3.18 Oil Pump, Installation
Oil pump high-pressure feed hose to crankcase fitting	60-90 in-lbs	6.8-10.2 N-m	3.18 Oil Pump, Installation
Oil pump to crankcase screw	125-150 in-lbs	14.1-16.9 N-m	3.18 Oil Pump, Installation
Oil tank bracket fastener	72-96 in-lbs	8.1-10.8 N-m	3.22 OIL TANK, Oil Tank Bracket
Oil tank mounting screws	72-96 in-lbs	8.1-10.8 N-m	3.22 OIL TANK, Installation
Parking brake nut	44-62 in-lbs	5-7 N-m	2.13 PARKING BRAKE ASSEMBLY, Install
Parking brake pivot pin	44-62 in-lbs	5-7 N-m	2.13 PARKING BRAKE ASSEMBLY, Install
Pinion shaft locking nut	19-21 ft-lbs	26-29 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Cam Gears and Gearcase Cover plus 15-19 degrees of rotation
Piston oil jet screw	25-35 in-lbs	2.8-3.9 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Primary chain adjuster locknut	20-25 ft-lbs	27.1-33.9 N-m	1.8 PRIMARY CHAIN, Free Play Adjustment
Primary chain cover screws	120-140 in-lbs	13.6-15.8 N-m	5.3 PRIMARY COVER, Installation
Primary chain inspection cover	100-120 in-lbs	11.3-13.6 N-m	1.8 PRIMARY CHAIN, Free Play Adjustment
Primary chaincase drain plug	14-30 ft-lbs	19-40.7 N-m	1.9 TRANSMISSION LUBRICANT, Transmission Lubrication Apply LOCTITE 565 THREAD SEALANT
Rocker cover, inner, large bolt	18-22 ft-lbs	24.4-29.8 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Rocker cover, inner, screw	135-155 in-lbs	15.3-17.5 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Rocker cover, inner, small bolt	135-155 in-lbs	15.3-17.5 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Rocker cover, outer, screw	120-168 in-lbs	13.6-19 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Rocker Covers
Seat bracket screw	40-60 in-lbs	4.5-6.8 N-m	2.27 SEAT, Installation
Seat mounting screw	15-30 in-lbs	1.7-3.4 N-m	2.27 SEAT, Installation
Seat post bolt	120-168 in-lbs	13.6-19 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Installation
Shift lever pinch screw	16-20 ft-lbs	21.7-27.1 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shift pedal clevis screw	13-17 ft-lbs	17.6-23 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shift rod jamnuts	84-132 in-lbs	9.5-14.9 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Adjusting Shift Pedal
Shift rod screw	120-180 in-lbs	13.6-20.4 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Adjusting Shift Pedal
Shifter peg screw	96-144 in-lbs	10.9-16.3 N-m	2.35 RIDER FOOT CONTROLS: MID-MOUNT, Left Footrest and Shift Lever Assembly
Shifter rod to shift lever screw	120-180 in-lbs	13.6-20.4 N-m	2.36 RIDER FOOT CONTROLS: FORWARD, Left Footrest and Shift Lever Assembly
Shock absorber mounting bolt	45-50 ft-lbs	61-68 N-m	2.5 WHEELS, REAR WHEEL
Slider tube cap	22-59 ft-lbs	30-80 N-m	2.16 FRONT FORK, Assembly: Right Side

Torque Values

FASTENER	TORQUE VALUE		NOTES
Solenoid contact post jamnut	65-80 in-lbs	7.3-9 N-m	6.13 STARTER, Solenoid
Spark plug	12-18 ft-lbs	16.3-24.4 N-m	1.16 SPARK PLUGS, Installation
Speedometer screws	12-17 in-lbs	1.4-1.9 N-m	6.4 SPEEDOMETER, 1 nstallation
Sprocket cover screws	80-120 in-lbs	9-13.6 N-m	4.16 EXHAUST SYSTEM,Mounting Bracket
Sprocket cover, forward and lower screw	80-120 in-lbs	9-13.6 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Sprocket cover, forward and lower screws	80-120 in-lbs	9-13.6 N-m	2.23 REAR ENGINE MOUNT AND ISOLATOR, Installation
Sprocket mounting screw, 1st torque	60 ft-lbs	81.3 N-m	2.5 WHEELS, REAR WHEEL
Sprocket mounting screw, final torque	80 ft-lbs	108 N-m	2.5 WHEELS, REAR WHEEL
Stabilizer link screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Upper Front Stabilizer Link
Stabilizer link, lower front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Lower Front Stabilizer Link
Stabilizer link, upper front, engine bracket mounting screw	55-65 ft-lbs	74.6-88.2 N-m	2.21 STABILIZER LINKS, Upper Front Stabilizer Link
Stabilizer link, upper front, frame bracket mounting screw	25-35 ft-lbs	33.9-47.5 N-m	2.21 STABILIZER LINKS, Upper Front Stabilizer Link
Starter motor oil line clamp fastener	16-21 in-lbs	1.8-2.4 N-m	6.13 STARTER, Installation
Starter mounting bolt	13-20 ft-lbs	17.6-27.1 N-m	6.13 STARTER, Installation
Starter positive ring terminal	60-80 in-lbs	6.8-9 N-m	6.13 STARTER, Installation
Starter ring terminal hex nut	60-80 in-lbs	6.8-9 N-m	6.9 BATTERY CABLES, Positive Battery Cable
Stator harness retainer screw	56 in-lbs	6.3 N-m	6.26 ALTERNATOR, Assembly and Installation Screw must be flush with plate. Do not exceed torque specification.
Stop lamp switch, rear	12-15 in-lbs	1.4—1.6 N-m	2.11 Brake Lines, Rear Master Cylinder to EHCU (ABS)
Strut cover fastener, front	120-168 in-lbs	13.6-19 N-m	2.33 SAREE GUARD: INDIA MODELS, Saree Guard
Strut cover fastener, rear	120-168 in-lbs	13.6-19 N-m	2.33 SAREE GUARD: INDIA MODELS, Saree Guard
Switch assembly retainer screws	8-10 in-lbs	0.9-1.1 N-m	6.29 RIGHT HANDLEBAR CONTROL MODULE, Installation
Switch housing fastener	35-45 in-lbs	4-5.1 N-m	6.29 RIGHT HANDLEBAR CONTROL MODULE, Installation
Switch housing screw	35-45 in-lbs	4-5.1 N-m	1.14 THROTTLE CONTROL, Cable Inspection and Lubrication
TPS screw	35 in-lbs	4 N-m	4.10 Throttle Position Sensor (TPS), Installation
Tail lamp housing screw	10-20 in-lbs	1.1-2.3 N-m	6.17 LICENSE PLATE LAMP MODULE, Installation: Center-Mount License Plate
Tappet cover fastener	90-120 in-lbs	10.2-13.6 N-m	3.10 TOP END OVERHAUL: ASSEMBLY, Tappet Covers, Pushrod Covers and Pushrods
Tappet cover, anti-rotation mounting screw	100-120 in-lbs	11.3-13.6 N-m	3.13 BOTTOM END OVERHAUL: ASSEMBLY, Tappets
Transmission mainshaft nut	50-60 ft-lbs	67.8-81.3 N-m	5.4 PRIMARY DRIVE AND CLUTCH, Installation
Transmission sprocket lockplate screw	90-120 in-lbs	10.3-13.6 N-m	5.14 TRANSMISSION SPROCKET, Installation
Transmission sprocket nut	50 ft-lbs	67.8 N-m	5.14 TRANSMISSION SPROCKET, Installation Initial torque plus 30-40 degrees.

Torque Values

FASTENER	TORQUE VALUE		NOTES
Turn signal housing to mount, rear, fastener	96-156 in-lbs	10.9-17.6 N-m	6.19 REAR TURN SIGNALS, Removal and Installation
Turn signal mount screw, front: XL1200X	12-16 ft-lbs	16.3-21.7 N-m	6.18 Front Turn Signals, Removal and Installation
Turn signal stalk locknut	120-168 in-lbs	13.6-19 N-m	2.31 REAR FENDER: TOP MOUNT LICENSE PLATE, Installation
Turn signal, front, ball head studs: XL883N, XL1200NS	96-144 in-lbs	10.8-16.3 N-m	6.18 Front Turn Signals, Removal and Installation
Turn signal, front, ball stud set screw: XL883N, XL1200NS	96-120 in-lbs	10.8-13.6 N-m	6.18 Front Turn Signals, Removal and Installation
Turn signal, front, set screw	96-120 in-lbs	10.9-13.6 N-m	2.7 FRONT BRAKE MASTER CYLINDER AND RESERVOIR, Installation
Upper pinch bolt in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7--47.5 N-m	2.16 FRONT FORK, Installation
Upper pinch screw in lower fork bracket: XL1200X (initial)	30-35 ft-lbs	40.7--47.5 N-m	1.17 STEERING HEAD BEARINGS, Fall-Away
VSS screw	100-120 in-lbs	11.3-13.6 N-m	6.22 Vehicle Speed Sensor (VSS), Installation
Valve stem nut	12-15 in-lbs	1.4—1.7 N-m	2.4 Tires, Installation
Visor screws	40 in-lbs	4.5 N-m	1.22 HEADLAMP ALIGNMENT, Headlamp Adjustment
Voltage regulator mounting screw	30-60 in-lbs	3.4-6.8 N-m	6.25 VOLTAGE REGULATOR, Installation
Wire harness ground wire	55-75 in-lbs	6.2-8.5 N-m	3.15 INSTALLING ENGINE IN CHASSIS, Procedure

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