

2008 Dyna Models Service Manual

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ABOUT THIS MANUAL

GENERAL

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

HOW TO USE YOUR SERVICE MANUAL

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

NO.	CHAPTER
1	Maintenance
2	Chassis
3	Engine
4	Fuel System
5	Starter
6	Drive
7	Transmission
8	Electrical
A	Appendix A Connector Repair
B	Appendix B Wiring
C	Appendix C Conversions
D	Appendix D Glossary

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

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

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

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

PREPARATION FOR SERVICE

⚠WARNING

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

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

NOTES

- *To avoid unnecessary disassembly, carefully read all relative service information before repair work is started.*
- *In figure legends, the number which follows the name of a part indicates the quantity necessary for one complete assembly.*
- *When servicing a vehicle equipped with the Harley-Davidson Smart Security System (H-DSSS), you must first disarm the security system. Either keep the fob in close proximity to the vehicle, or use Digital Technician to disable the security system while the vehicle is being serviced and re-enable the system after service is completed.*

SERVICE BULLETINS

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

USE GENUINE REPLACEMENT PARTS

⚠WARNING

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

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

WARNINGS AND CAUTIONS

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

⚠WARNING

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

⚠CAUTION

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

CAUTION

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

NOTE

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

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

⚠WARNING

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

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

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

PRODUCT REFERENCES

⚠WARNING

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

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

Kent-Moore Products

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

Loctite Sealing and Threadlocking Products

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

PRODUCT REGISTERED MARKS

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

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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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NOTES

SERVICING A NEW MOTORCYCLE

⚠WARNING

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

Service operations to be performed before customer delivery are specified in the applicable model year PREDELIVERY AND SET-UP MANUAL.

The performance of new motorcycle initial service is required to keep warranty in force and to ensure proper emissions systems operation. See 1.2 MAINTENANCE SCHEDULE.

SAFE OPERATING MAINTENANCE

NOTES

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

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

Check:

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

SHOP PRACTICES

Repair Notes

General maintenance practices are given in this section.

NOTES

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

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

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

Safety

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

Removing Parts

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

⚠WARNING

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

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

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

Cleaning

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

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

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

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

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

Disassembly and Assembly

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

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

Checking Torques on Fasteners with Lock Patches

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

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

Magnetic Parts Trays

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

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

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

REPAIR AND REPLACEMENT PROCEDURES

Hardware and Threaded Parts

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

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

Replace all damaged or missing lubrication fittings.

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

Threadlocking Agents

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

Wiring, Hoses and Lines

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

Instruments and Gauges

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

Bearings

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

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

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

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

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

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

Bushings

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

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

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

Gaskets

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

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

Lip Type Seals

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

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

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

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

O-Rings (Preformed Packings)

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

Gears

Always check gears for damaged or worn teeth.

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

Lubricate mating surfaces before pressing gears on shafts.

Shafts

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

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

Clean all rust from the machined surfaces of new parts.

Part Replacement

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

Exhaust System Leakage

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

CLEANING

Part Protection

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

Cleaning Process

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

Rust or Corrosion Removal

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

Bearings

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

⚠WARNING

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

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

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

TOOL SAFETY

Air Tools

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

Wrenches

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

Pliers/Cutters/Pry bars

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

Hammers

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

Punches/Chisels

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

Screwdrivers

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

Ratchets and Handles

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

Sockets

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

Storage Units

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

GENERAL

The table below lists the periodic maintenance requirements for Dyna model motorcycles. If you are familiar with the procedures, just refer to the table for the recommended service interval. If necessary, see the quick reference table (Table 1-2) for the required specifications.

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

Also, throughout this manual, you will be instructed to use various lubricants, greases and sealants. Refer to Table 1-3. for the correct part numbers of these items.

Table 1-1. Regular Service Intervals: 2008 Dyna Models

ITEM SERVICED	PROCEDURE	1000 MI. 1600 KM	5000 MI. 8000 KM	10,000 MI. 16,000 KM	15,000 MI. 24,000 KM	20,000 MI. 32,000 KM	25,000 MI. 40,000 KM	NOTES
Engine oil and filter	Replace	X	X	X	X	X	X	
Air cleaner	Inspect, service as required	X	X	X	X	X	X	
Tires	Check pressure, inspect tread	X	X	X	X	X	X	
Wheel spokes	Check tightness	X	X			X		1, 4
Primary chaincase lubricant	Replace	X		X		X		
Transmission lubricant	Replace	X				X		
Clutch	Check adjustment	X	X	X	X	X	X	1
Rear belt and sprockets	Inspect, adjust belt	X	X	X	X	X	X	1
Throttle, brake and clutch controls	Check, adjust and lubricate	X	X	X	X	X	X	1
Jiffy stand	Inspect and lubricate	X		X		X		1
Fuel, lines and fittings	Inspect for leaks	X	X	X	X	X	X	1
Fuel pump filter	Replace						X	1
Brake fluid	Check levels and condition	X	X	X	X	X	X	5
Brake pads and discs	Inspect for wear	X	X	X	X	X	X	
Spark plugs	Inspect	X	X	X	X	X	X	
	Replace					X		
Electrical equipment and switches	Check operation	X	X	X	X	X	X	
Front fork oil	Replace							1, 6
Steering head bearings	Adjust	X		X		X		1, 2
Rear fork bearings		Inspect every 30,000 miles (48,000 kilometers)						1
Critical fasteners	Check tightness	X		X		X		1
Engine mounts and stabilizer links	Inspect			X		X		1
Battery	Check battery and clean connections							3
Exhaust system	Inspect for leaks, cracks, and loose or missing fasteners or heat shields	X	X	X	X	X	X	3
Road test	Verify component and system functions	X	X	X	X	X	X	

NOTES:

1. Should be performed by an authorized Harley-Davidson dealer, unless you have the proper tools, service data and are mechanically qualified.
2. Disassemble, lubricate and inspect every 30,000 miles (48,000 kilometers).
3. Perform annually.
4. Not all vehicles are equipped with spoke wheels. Consult appropriate topic in service manual.
5. Replace D.O.T. 4 HYDRAULIC BRAKE FLUID and flush system every two (2) years.
6. Disassemble, lubricate and inspect every 50,000 miles (80,000 kilometers).

Table 1-2. Quick Reference Maintenance Chart

ITEM SERVICED	SPECIFICATION	DATA
Engine oil and filter	Drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
	Oil capacity	3 qt. (2.4 L)
	Filter	Hand tighten 1/2-3/4 turn after gasket contact
	Chrome filter part number	63798-99A
	Black filter part number	63731-99A
Primary chain lubricant	Lubricant capacity	32 oz. (0.95 liters)
	Primary chaincase drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
Clutch adjustment	Free play at adjuster screw	1/2-1 turn
	Adjuster screw locknut torque	72-120 **in-lbs** (8.1-13.6 Nm)
	Free play at hand lever	1/16-1/8 in. (1.6-3.2 mm)
	Clutch inspection cover torque	84-108 **in-lbs** (9.5-12.2 Nm)
Transmission lubricant	Lubricant level	Check with motorcycle at normal operating temperature and parked on jiffy stand. Remove and wipe off dipstick. Place dipstick in filler hole with filler plug resting on threads and remove. Lubricant level should be between upper and lower ends of the oil level indicator marks on the dipstick.
	Lubricant capacity	32 oz (0.95 liters)
	Transmission drain plug torque	14-21 ft-lbs (19.0-28.5 Nm)
	Filler/check plug torque	25-75 **in-lbs** (2.8-8.5 Nm)
Tire condition and pressure	Pressure for solo rider All except FXDF	Front: 30 psi (207 kPa) Rear: 36 psi (248 kPa)
	Pressure for rider and passenger All except FXDF	Front: 30 psi (207 kPa) Rear: 40 psi (276 kPa)
	Pressure for solo rider FXDF	Front: 36 psi (248 kPa) Rear: 36 psi (248 kPa)
	Pressure for rider and passenger FXDF	Front: 36 psi (248 kPa) Rear: 40 psi (276 kPa)
	Wear	Replace tire if 1/32 in. (0.8 mm) or less of tread pattern remains
Wheel spokes	Spoke nipple torque	55-65 **in-lbs** (6.5-7.3 Nm)
Brake fluid reservoir level	D.O.T. 4 hydraulic brake fluid part numbers	99953-99A (12 oz.)
	Proper fluid level	1/8-1/4 in. (3.2-6.4 mm) below gasket surface
	Master cylinder reservoir cover torque	6-8 **in-lbs** (0.7-0.9 Nm)
Brake pad linings and discs	Minimum brake pad thickness	0.04 in. (1.02 mm)
	Minimum brake disc thickness	See stamp on side of disc
Drive belt	Upward measurement force applied at midpoint of bottom of belt strand	10 lb. (4.5 kg)
	With motorcycle On jiffy stand without rider or luggage	FXD, FXDWG, FXDF- 5/16-3/8 in. (7.9-9.5 mm) FXDB, FXDC, FXDL- 1/4-5/16 in. (6.4-7.9 mm)
	Vehicle upright with rear wheel in air	FXD, FXDWG, FXDF- 1/2-9/16 in. (12.7-14.3 mm) FXDB, FXDC, FXDL- 5/16-3/8 in. (7.9-9.5 mm)
Air cleaner	Air cleaner cover bracket screw torque	40-60 **in-lbs** (4.5-6.8 Nm)
	Air cleaner cover screw torque	36-60 **in-lbs** (4.1-6.8 Nm)
	Adhesive for air cleaner cover screw	LOCTITE THREADLOCKER 243 Part No. 99642-97 (6 ml)
Clutch and throttle cables	Lubricant	SUPER OIL Part No. 94968-85TV (1/4 fl. oz.)
	Handlebar switch housing screw torque	35-45 **in-lbs** (4.0-5.1 Nm)

Table 1-2. Quick Reference Maintenance Chart

ITEM SERVICED	SPECIFICATION	DATA
Spark plugs	Type	HD-6R12
	Gap	0.038-0.043 in. (0.97-1.09 mm)
	Torque	12-18 ft-lbs (16.3-24.4 Nm)
Engine idle speed	Idle speed	950-1050 RPM
Front fork oil	Amount	See 2.17 FRONT FORK.
	Type	HYDRAULIC FORK OIL (TYPE E) Part No. 99884-80 (16 oz.)
Battery	Battery terminal torque	60-96 **in-lbs** (6.8-10.9 Nm)

Table 1-3. Lubricants, Greases, Sealants

ITEM	PART NUMBER	PACKAGE
Anti-Seize Lubricant	98960-97	1 oz squeeze tube
CCI #20 Brake Grease	42830-05 (included in master cylinder rebuild kit)	squeeze packet
D.O.T. 4 Brake Fluid	99953-99A	12 oz. bottle
Electrical Contact Lubricant	99861-02	1 oz squeeze tube
Genuine Harley-Davidson Formula+ Transmission and Primary Chaincase Lubricant	99851-05	1 qt bottle
G40M Brake Grease	42820-04	squeeze packet
Gray High Performance Sealant	99650-02	1.9 oz squeeze tube
HYLOMAR Gasket and Thread Sealant	99653-85	3.5 oz tube
Loctite Pipe Sealant With Teflon 565	99818-97	6 ml squeeze tube
Loctite Prism Primer (770)		
Loctite Prism Superbonder (411)		
Loctite Superbonder 420 Adhesive		
Loctite Threadlocker 243 (blue)	99642-97	6 ml squeeze tube
Loctite Threadlocker 262 (red)	94759-99	6 ml squeeze tube
Loctite Threadlocker 272	98618-03	10 ml bottle
Special Purpose Grease	99857-97	14 oz. cartridge
Super Oil	94968-85TV	1/4 fl. oz
Type "E" Hydraulic Fork Oil	99884-80	16 oz bottle

FUEL

Refer to Table 1-4. Always use a good quality unleaded gasoline. Octane ratings are usually found on the pump.

⚠WARNING

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

⚠WARNING

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

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

Table 1-4. Octane Ratings

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

GASOLINE BLENDS

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

CAUTION

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

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

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

ENGINE LUBRICATION

CAUTION

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

Engine oil is a major factor in the performance and service life of the engine. Always use the proper grade of oil for the lowest temperature expected before the next scheduled oil change. Refer to Table 1-5. Your authorized dealer has the proper oil to suit your requirements.

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

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

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

Table 1-5. Recommended Engine Oils

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

WINTER LUBRICATION

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

NOTE

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

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

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

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

CHECKING AND ADDING OIL

CAUTION

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

Check engine oil level:

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

Type of Oil

Refer to Table 1-5. Use the proper grade of oil for the lowest temperature expected before the next oil change. For information regarding winter needs, see 1.3 FUEL AND OIL.

If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include CF-4, CG-4, CH-4 and CI-4. The preferred viscosities for the diesel engine oils, in descending order, are 20W50, 15W40 and 10W40. At the first opportunity, see a Harley-Davidson dealer to change back to 100 percent Harley-Davidson oil.

Checking with Cold Engine

1. See Figure 1-1. Unscrew and remove engine oil filler cap with attached dipstick. Wipe dipstick clean.
2. Reinstall filler cap. Turn filler cap clockwise until it stops.
3. See Figure 1-2. Again, unscrew and remove filler cap and check oil level on dipstick. If oil level in pan is below lower mark on dipstick, add enough Harley-Davidson oil to bring level up between lower mark (1) and cold check level (2) on dipstick.

NOTE

Be sure to clean oil from dipstick threads. If oil is present on dipstick threads, it can weep past dipstick o-ring. This condition may be incorrectly diagnosed as an oil leak.

4. Replace filler cap and screw in securely.

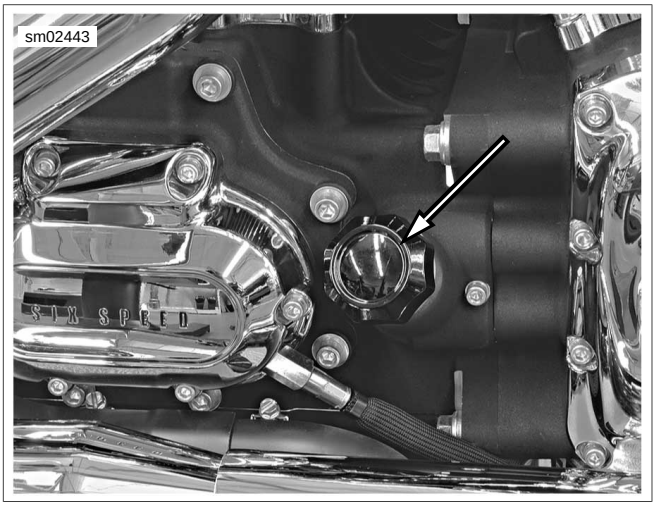
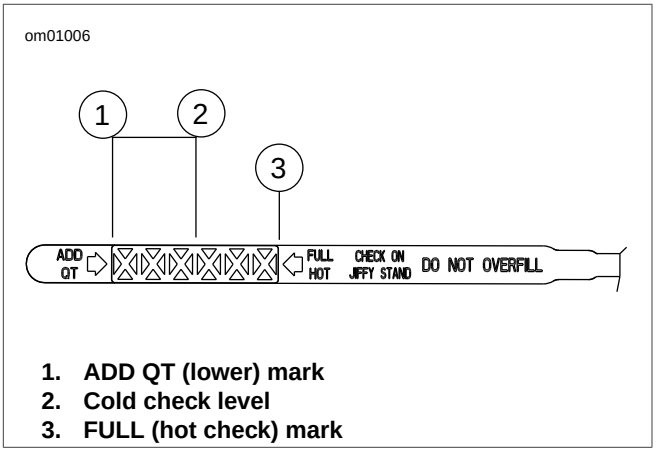


Figure 1-1. Checking Engine Oil Level



1. **ADD QT (lower) mark**
2. **Cold check level**
3. **FULL (hot check) mark**

Figure 1-2. Engine Oil Dipstick

Checking with Warm Engine

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

1. Idle motorcycle on jiffy stand for 1-2 minutes.
2. Shut motorcycle off and with motorcycle leaning on jiffy stand on level ground, unscrew and remove engine oil filler cap with attached dipstick. Wipe dipstick clean.
3. Reinstall filler cap. Turn filler cap clockwise until it stops.
4. See Figure 1-2. Again, unscrew and remove filler cap and check oil level on dipstick. If oil level in pan is below lower mark on dipstick, add enough Harley-Davidson oil to bring level up between lower mark (1) and cold check level (2) on dipstick.

NOTE

Be sure to clean oil from dipstick threads. If oil is present on dipstick threads, it can weep past dipstick o-ring. This condition may be incorrectly diagnosed as an oil leak.

5. Replace filler cap and screw in securely.

6. Add oil, if required, to FULL mark (3). Do not overfill.

CHANGING OIL AND FILTER

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

NOTES

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

1. Ride motorcycle until engine is warmed up to normal operating temperature.
2. Unscrew and remove engine oil filler cap with attached dipstick.
3. See Figure 1-3. Remove the engine oil drain plug with o-ring. Allow oil to drain into a suitable container.

CAUTION

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

4. See Figure 1-4. Remove the oil filter using the OIL FILTER WRENCH (Part No. HD-42311) or OIL FILTER WRENCH (Part No. HD-44067) . Clean the oil filter mount flange of any old gasket material.

NOTE

On vehicles equipped with forward controls, shift linkage may have to be removed to provide enough clearance to remove and install oil filter.

5. See Figure 1-5. Lube the gasket on **new** oil filter with engine oil and install **new** filter. Hand tighten oil filter 1/2 to 3/4 turn after gasket contacts filter mounting surface. Do NOT use oil filter wrench for oil filter installation.
6. See Figure 1-3. Install oil pan drain plug (1).
   a. Inspect o-ring for tears or damage. Replace if required. Wipe any foreign material from plug.
   b. Install o-ring and drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
7. Fill oil pan with the correct amount of oil. Use the proper grade of oil for the lowest temperature expected before next oil change. Refer to Table 1-5.
   a. Use 2.5 quarts (2.4 liters) of engine oil for a wet capacity refill.
   b. Use 3.0 quarts (2.7 liters) for a dry capacity refill.

   NOTE

   Use wet capacity for engines that have just had the oil drained. Use dry capacity for engines that have been disassembled, cleaned in solvent and dried.
8. Check engine oil level using cold check procedure.
9. Start engine and carefully check for oil leaks around drain plug and oil filter.
10. Check engine oil level using hot check procedure.

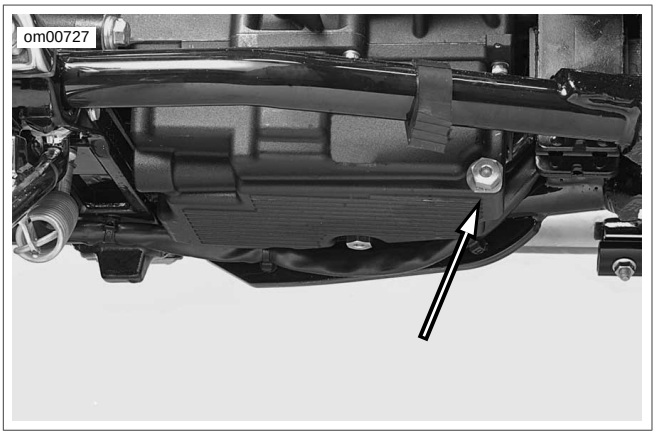


Figure 1-3. Engine Oil Drain Plug (oil pan under transmission, view from left side of vehicle)

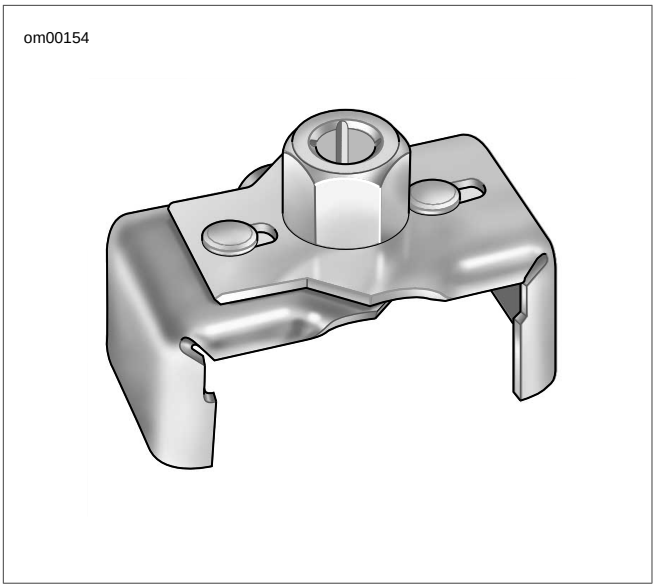


Figure 1-4. Oil Filter Wrench (Part No. HD-42311)

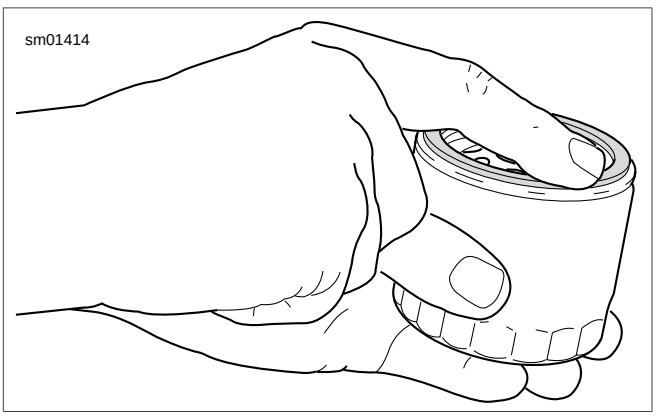


Figure 1-5. Lubricating New Oil Filter Gasket

BULB REQUIREMENTS 1.5

GENERAL

Use the table to identify the bulb location and part number. Refer to Table 1-6.

NOTE

The speedometer, tachometer, odometer and indicator lamps are illuminated with LEDs. LEDs are non-repairable. The entire assembly must be replaced if an LED fails.

Table 1-6. Bulb Chart: 2008 Dyna Models

LAMP	DESCRIPTION	BULBS REQUIRED	CURRENT DRAW (AMPERAGE)	H-D PART NUMBER
Headlamp	High beam/low beam (FXDF)	2	5.0/4.58	69838-08
	High beam/low beam (all other models)	1	5.0/4.58	68329-03
	Position lamp international	1	0.32	53438-92
Tail and stop lamp	Tail lamp	1	0.59	68167-04
	Stop lamp	1	2.10	68167-04
	Tail lamp international	1	0.59	68167-04
	Stop lamp international	1	2.10	68167-04
Turn signal lamp	Front/running	2	2.25/0.59	68168-89
	Front international	2	1.75	68163-84
	Rear	2	2.25	68572-64B
	Rear international	2	1.75	68163-84
Instrument panel indicators	High beam indicator	Illuminated with LEDs. Replace entire assembly upon failure.		
	Oil pressure indicator			
	Neutral indicator			
	Turn signal indicators			
Fuel Gauges: All models use an LED built into the gauge.				

FLUID INSPECTION

CAUTION

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

CAUTION

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

1. See Figure 1-6. Check level in rear brake master cylinder reservoir. Level should be 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface.

CAUTION

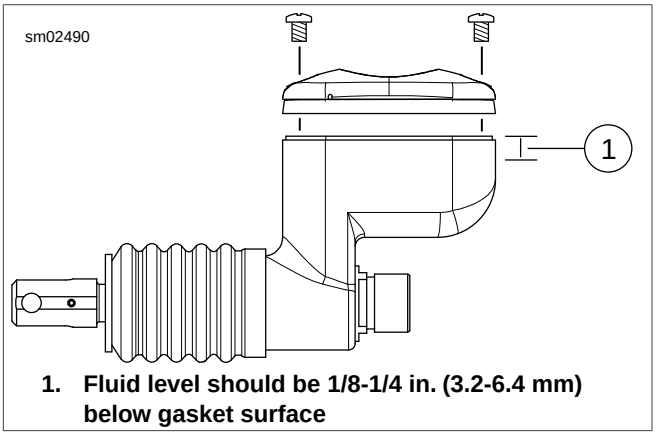
Do not allow dirt or debris to enter the master cylinder reservoir. Dirt or debris in the reservoir can cause improper operation and equipment damage. (00205c)

2. See Figure 1-7. Check level in front brake master cylinder reservoir. Level should be 1/4 ± 1/8 in. (6.35 ± 3.18 mm) below the gasket surface.
3. Install gaskets and covers. Tighten reservoir cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).

WARNING

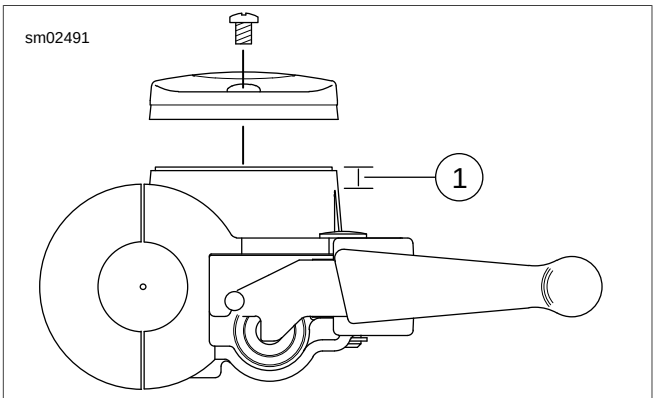
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

4. Front brake hand lever and rear brake foot pedal must have a firm feel when applied. If not, bleed system using only D.O.T. 4 BRAKE FLUID. See 1.15 BLEEDING BRAKES.



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

Figure 1-6. Rear Brake Master Cylinder Reservoir



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

Figure 1-7. Front Brake Master Cylinder Reservoir

REAR PEDAL HEIGHT

The rear brake pedal should not require adjustment. If minor pedal height adjustment is desired:

1. See Figure 1-8. Brake rod (5) is threaded into push rod (3) in rear brake master cylinder (1), and locked in place with jam nut (4). Loosen jam nut.

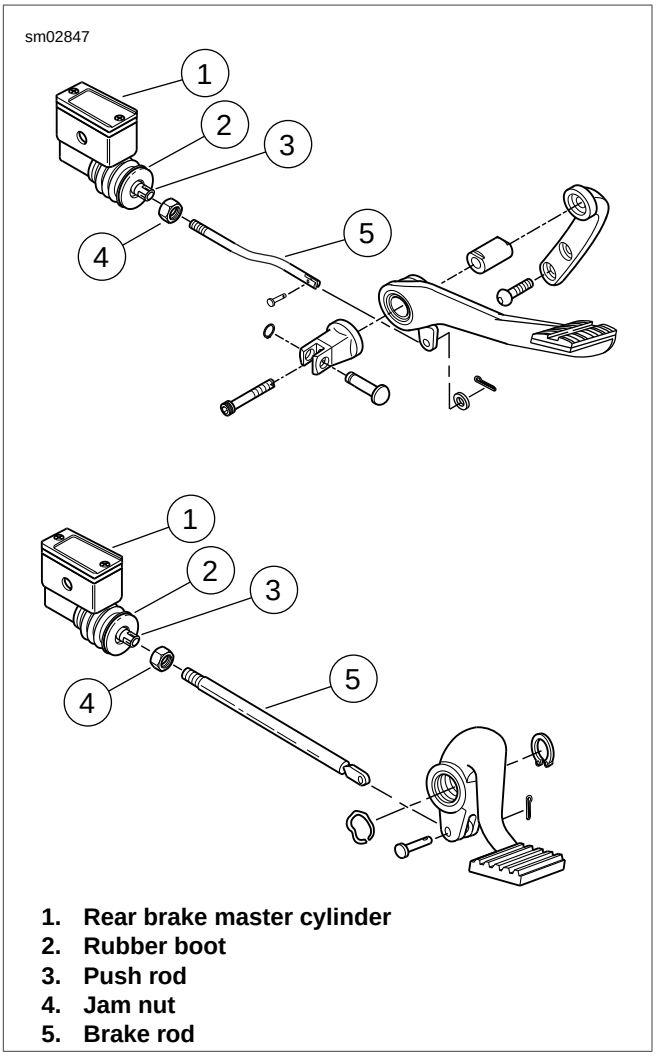
WARNING

When adjusting brake control rod, never allow more than nine threads to be exposed between control rod and jam nut. If more than nine threads are exposed, brake rod can come apart resulting in loss of rear brake, which could cause death or serious injury. (00306c)

2. Using an open-end wrench on the push rod flats, turn the push rod in the direction which will correct pedal height. When correct pedal height is obtained, tighten jam nut.
3. Verify that water drain hole in rubber boot (2), which covers rear brake push rod, is positioned to bottom.

NOTE

Brake pedal freeplay is built into master cylinder and no adjustment is required. When pedal is pushed down with hand, a small amount of freeplay must be felt.



1. **Rear brake master cylinder**
2. **Rubber boot**
3. **Push rod**
4. **Jam nut**
5. **Brake rod**

Figure 1-8. Rear Brake Pedal Height (Top: FXDWG models, Bottom: All models but FXDWG)

REMOVAL

1. See Figure 1-9. Remove screw (1) and air cleaner cover (2).
2. See Figure 1-10. Gently pull both rubber breather tubes (1) from the element.
3. Slide clip-nut (2) to the left to allow access to third screw. Remove three screws (3), bracket (4) and filter element (5).
4. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

⚠WARNING

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

5. Gently pull the breather tubes from the breather bolts on the backplate.

⚠WARNING

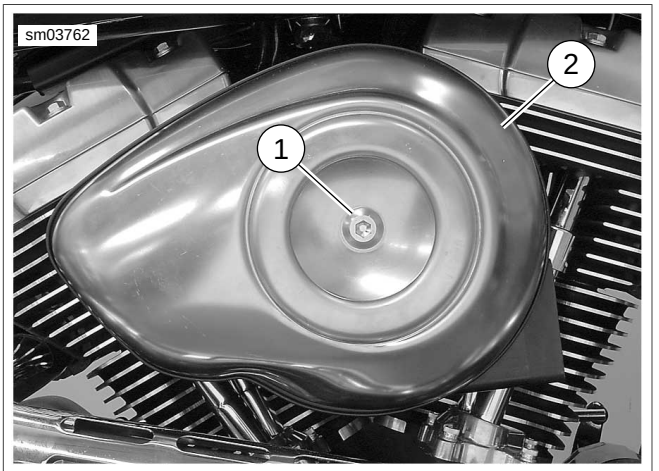
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

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

NOTE

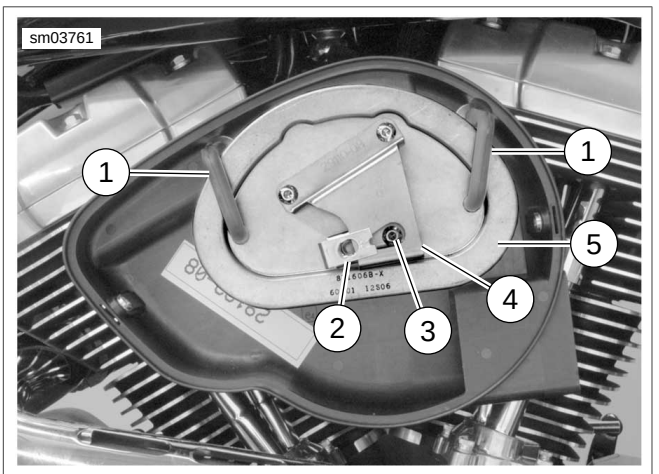
The breather tubes allow crankcase vapors to be directed into the air filter element. By providing effective recirculation of crankcase vapor, the tubes serve to eliminate the pollutants normally discharged from the crankcase. Air cleaner mounting without installation of the breather tubes, or with breather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

9. Wipe inside of air cleaner cover and backplate with damp cloth to remove dust.
10. On California models only, make sure trap door swings freely.



1. **Cover screw**
2. **Air cleaner cover**

Figure 1-9. Air Cleaner Cover



1. **Breather tubes**
2. **Clip-nut**
3. **Screw (3)**
4. **Bracket**
5. **Filter element**

Figure 1-10. Air Cleaner Element

INSTALLATION

1. See Figure 1-11. Position **new** gasket on filter element. Make sure gasket holes are aligned with screw holes.
2. See Figure 1-10. Attach breather tubes (1) to breather screws on backplate.
3. Install air filter element (5) and bracket (4) using three screws (3). Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). Slide clip-nut (2) to the right and into place.
4. Insert breather tubes (1) into holes in filter element.

5. See Figure 1-9. Install air filter cover (2).
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of air cleaner cover screw (1).
   b. Install air cleaner cover and tighten screw to 36-60 **in-lbs** (4.1-6.8 Nm).

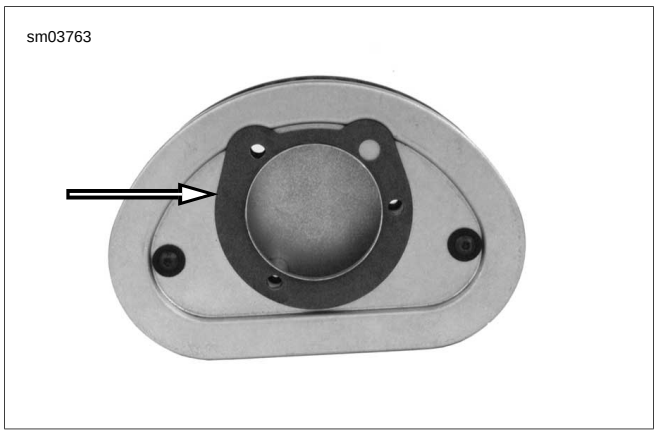


Figure 1-11. Element Gasket

EXHAUST SYSTEM LEAK CHECK

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

1. Check entire exhaust system for loose or missing fasteners, broken pipe clamps or brackets, and obvious signs of leakage (carbon tracks at pipe joints, etc.).
2. Check for loose or broken heat shields. Repair or replace as necessary.
3. Start engine, cover muffler ends with clean, dry shop towels and listen for audible signs of exhaust leakage.
4. Correct any leaks detected. See 4.16 EXHAUST SYSTEM for exhaust system removal and installation procedures.

TIRES

WARNING

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

WARNING

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

WARNING

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

NOTES

- *Inner tubes must not be used in radial tires and radial tires must not be used on laced (wire spoked) wheels.*
- *Tubeless tires are used on all Harley-Davidson cast and disc wheels.*
- *Tire sizes are molded on the tire sidewall. Inner tube sizes are printed on the tube.*
- *New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.*

Check tire pressure and tread:

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

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

NOTE

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

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

Table 1-7. Tire Pressures: 2008 Dyna Models

MODEL	LOAD	TIRE PRESSURE (COLD)			
		FRONT		REAR	
		PSI	kPa	PSI	kPa
All models except FXDF	Solo rider	30	206	36	248
	Rider and passenger	30	206	40	275
FXDF	Solo rider	36	248	36	248
	Rider and passenger	36	248	40	275

TIRE REPLACEMENT

See Figure 1-12. Arrows on tire sidewalls pinpoint location of wear bar indicators.

See Figure 1-13. Tread wear indicator bars appear on tire tread surfaces when 1/32 in. (0.8 mm) or less tire tread remains. Always remove tires from service before they reach the tread wear indicator bars, indicating 1/32 in. (0.8 mm) tread pattern depth remaining.

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

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

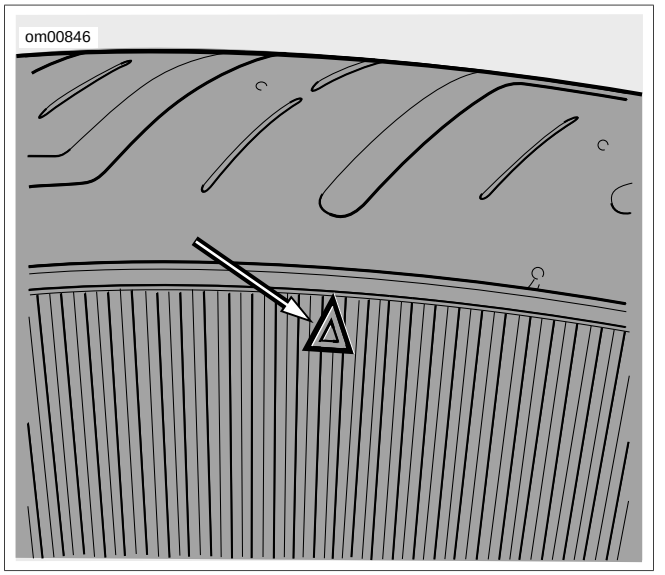


Figure 1-12. Tire Sidewall Wear Bar Locator

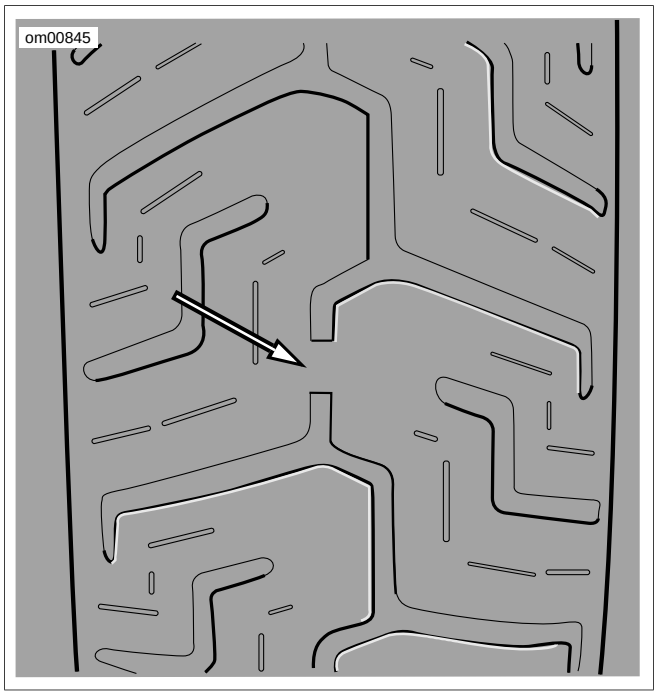


Figure 1-13. Wear Bar Appearance

WHEEL BEARINGS

1. Replace when bearings exceed end play service wear limit of 0.002 in. (0.051 mm).
2. Inspect any time the wheels are removed.
   a. Inspect the play of the wheel bearings by finger while they are in the wheel.
   b. Rotate the inner bearing race and check for abnormal noise.
   c. Make sure bearing rotates smoothly.
3. Check wheel bearings and axle spacers for wear and corrosion. Excessive play or roughness indicates worn bearings. Replace bearings in sets only. See 2.5 SEALED WHEEL BEARINGS, Inspection.

WHEEL SPOKES

WARNING

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

CAUTION

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

Inspect vehicles with wire spokes as follows:

1. Raise motorcycle wheel off the ground.
2. Lightly tap each spoke with a spoke wrench. Loose spokes sound dull and must be tightened.
3. Tighten spoke nipples to torque specified in Table 1-8.
4. If more than a few spokes are loose, true the entire wheel following procedure under 2.9 TRUING LACED WHEELS.

Table 1-8. Spoke Nipple Torque Specification

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

GENERAL

All models have an automatic chain tensioner. For primary chain service procedures, see 6.3 DRIVE COMPONENTS.

CHANGING PRIMARY CHAINCASE LUBRICANT

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

CAUTION

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

WARNING

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

2. See Figure 1-14. Remove magnetic drain plug at bottom of primary chaincase. Drain lubricant into suitable container.

NOTE

Dispose of lubricant in accordance with local regulations.

3. Clean drain plug. If plug has accumulated a lot of debris, inspect the condition of chaincase components.
4. Install **new** o-ring on drain plug.
5. Install drain plug back into primary chaincase cover. Tighten plug to 14-21 ft-lbs (19.0-28.5 Nm).
6. See Figure 1-15. Remove five TORX screws with captive washers (3) to detach clutch inspection cover (2) from primary chaincase cover.
7. Remove the seal (1). Wipe oil from groove in chaincase cover and mounting surface.

CAUTION

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

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

Table 1-9. Primary Chaincase Lubricant Refill Capacity

ITEM	CAPACITY (WET)
Primary chaincase lubricant	32 ounces (0.95 liter)

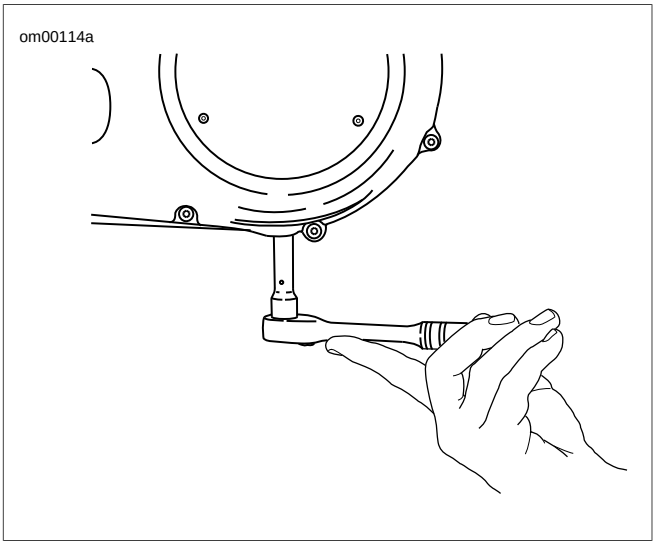
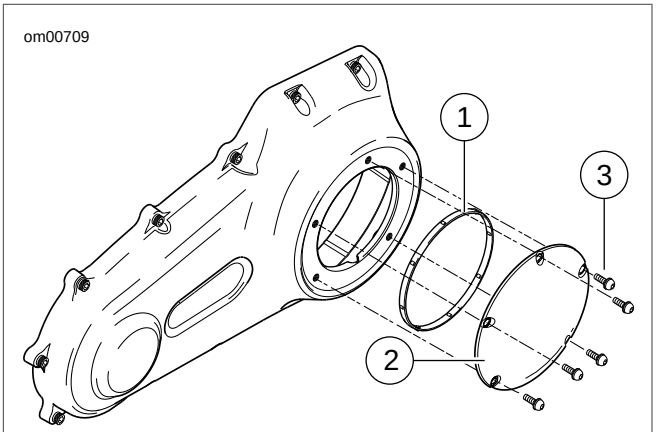


Figure 1-14. Removal/Installation of Chaincase Drain Plug



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

Figure 1-15. Clutch Cover

9. Install clutch inspection cover and **new** seal as follows:
   a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase.
   b. See Figure 1-15. Position **new** seal (1) in groove in primary chaincase cover and press each of the nubs on seal into the groove. The nubs will retain seal in position.
   c. See Figure 1-16. Insert screw (with captive washer) through clutch inspection cover and carefully thread it into the top cover screw hole.
   d. Start the remaining four screws (with captive washers).
   e. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) following torque sequence shown in Figure 1-16.

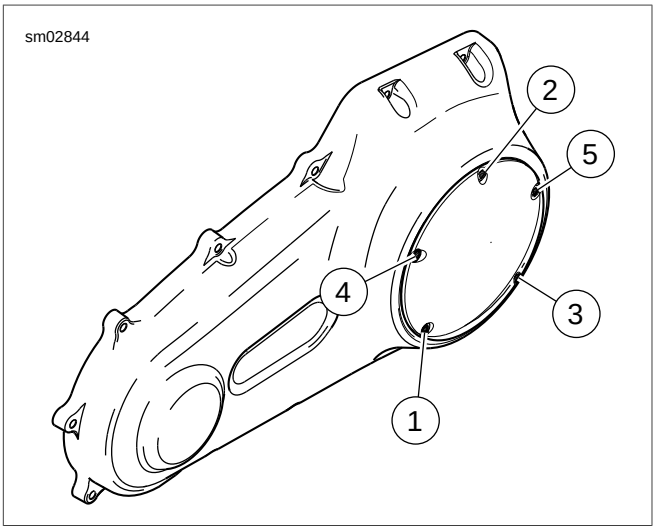


Figure 1-16. Clutch Cover Torque Sequence

CHANGING TRANSMISSION LUBRICANT

1. See Figure 1-17. Remove transmission filler plug.

CAUTION

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

WARNING

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

2. See Figure 1-19. Remove transmission drain plug and drain lubricant into a suitable container.

NOTE

Dispose of transmission lubricant in accordance with local regulations.

3. Inspect O-ring on drain plug for tears or damage. Replace as required. Wipe any foreign material from plug.

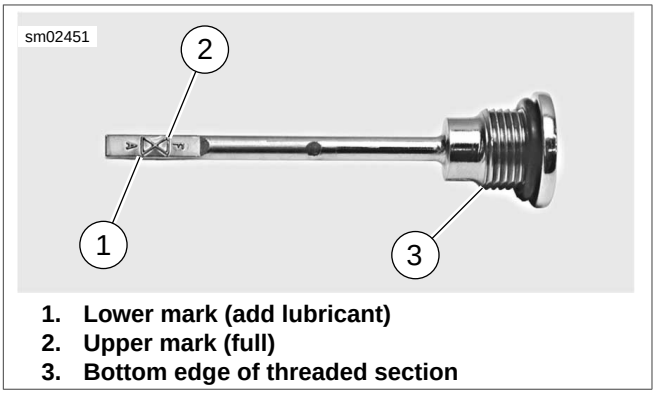
CAUTION

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

4. Install O-ring and drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Do not over-tighten.
5. Fill the transmission with 32 oz. (0.95 liter) of GENUINE Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05) (quart).
6. With motorcycle on a level surface and resting on jiffy stand, check lubricant level.
   a. Insert filler plug/dipstick into transmission fill hole but do not thread in.
   b. See Figure 1-18. Remove filler plug/dipstick and check lubricant level on dipstick. Lubricant level should be between upper mark (2) and lower mark (1). If necessary, add lubricant until level is correct.
7. Install filler plug/dipstick and tighten to 25-75 **in-lbs** (2.8-8.5 Nm).

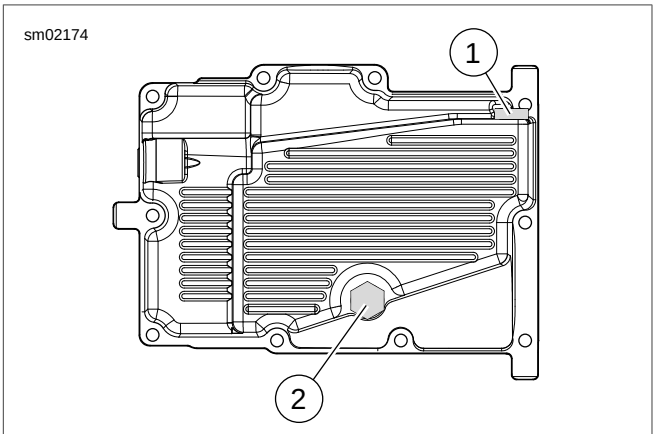


Figure 1-17. Transmission Filler Plug/Dipstick Location



1. **Lower mark (add lubricant)**
2. **Upper mark (full)**
3. **Bottom edge of threaded section**

Figure 1-18. Filler Plug/Dipstick



1. **Engine oil drain plug and O-ring**
2. **Transmission drain plug**

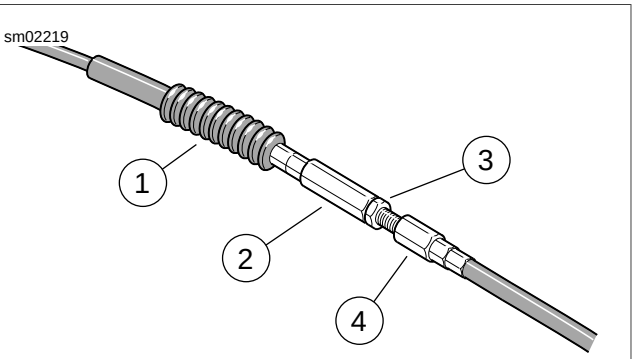
Figure 1-19. Oil Pan

ADJUSTMENT

NOTE

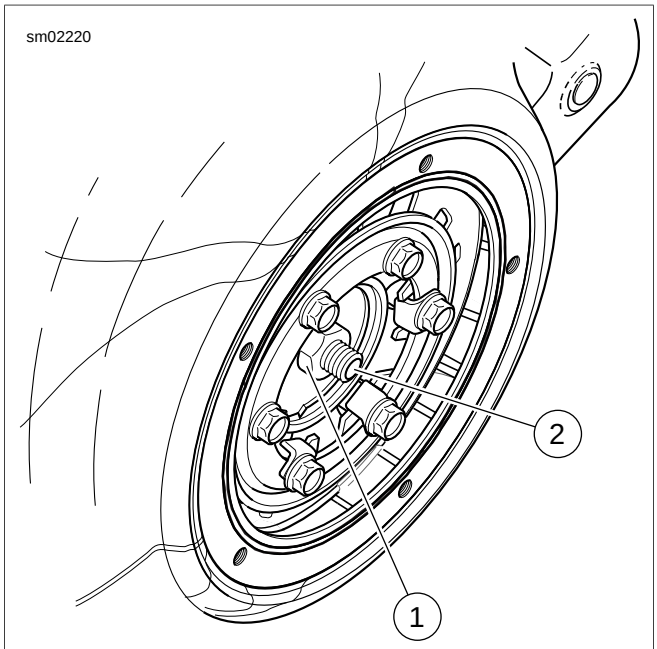
Perform the clutch adjustment with the motorcycle at room temperature. The clearance at the adjuster screw will increase as the powertrain temperature increases. If adjuster screw is adjusted with powertrain hot, clearance at push rod bearing could be insufficient with powertrain cold and clutch slippage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

1. Stand motorcycle upright and level.
2. Remove five TORX screws with captive washers to detach clutch inspection cover from primary chaincase cover.
3. Remove and discard clutch inspection cover seal.
4. See Figure 1-20. Add freeplay to cable.
   a. Slide rubber boot (1) off cable adjuster.
   b. Holding cable adjuster (2) with 1/2 in. wrench, loosen jam nut (3) using a 9/16 in. wrench.
   c. Turn cable adjuster (2) until there is a large amount of freeplay at clutch hand lever.
5. See Figure 1-21. Loosen jam nut (1) on clutch adjuster screw (2). To take up all freeplay, turn screw inward (clockwise) until lightly seated. Activate the clutch lever to verify the balls are seated in the ramps.
6. Back out adjusting screw (counterclockwise) 1/2 to 1 full turn. Tighten jam nut to 72-120 **in-lbs** (8.1-13.6 Nm), while holding adjusting screw with an Allen wrench.
7. Squeeze clutch lever to maximum limit three times, to set ball and ramp release mechanism.
8. Check freeplay.
   a. Turn cable adjuster away from jam nut until slack is eliminated at hand lever.
   b. See Figure 1-22. Pull clutch cable ferrule (2) away from clutch lever bracket (3) to check freeplay. Turn cable adjuster as necessary to obtain 1/16-1/8 in. (1.6-3.2 mm) freeplay between end of cable ferrule and clutch lever bracket.
9. Hold adjuster with 1/2 in. wrench. Using 9/16 in. wrench, tighten jam nut against cable adjuster. Cover cable adjuster mechanism with rubber boot.
10. Install clutch inspection cover and seal. Install seal as follows:
    a. Thoroughly wipe all lubricant from cover mounting surface and groove in chaincase.
    b. See Figure 1-15. Position seal (1) in groove in primary chaincase cover and press each of the nubs on seal into the groove. The nubs will retain seal in position.
    c. See Figure 1-16. Insert screw (with captive washer) through clutch inspection cover and carefully thread it into the top cover screw hole.
    d. Start the remaining four screws (with captive washers).
    e. Alternately tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm) following torque sequence shown in Figure 1-16.



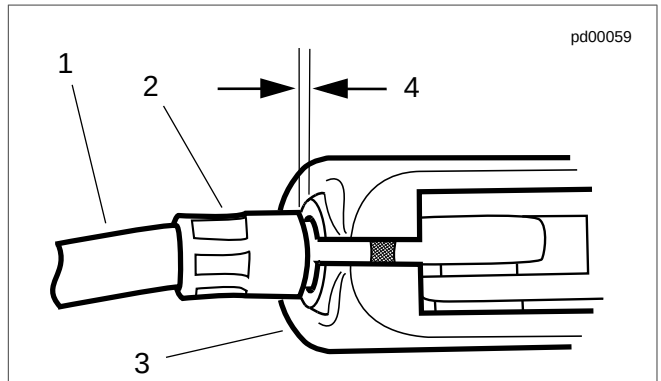
1. **Rubber boot**
2. **Cable adjuster**
3. **Jam nut**
4. **Cable end**

Figure 1-20. Clutch Cable Adjuster



1. Jam nut
2. Clutch adjuster screw

Figure 1-21. Clutch Adjuster Screw



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

Figure 1-22. Clutch Hand Lever

GENERAL

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

⚠WARNING

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

CLEANING

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

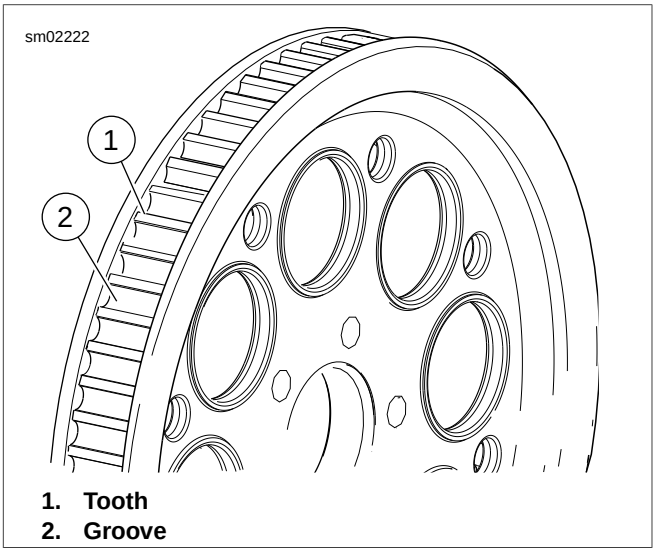
INSPECTION

Sprockets

NOTE

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

1. See Figure 1-23. Inspect each tooth (1) of rear sprocket for:
   a. Major tooth damage.
   b. Large chrome chips with sharp edges.
   c. Gouges caused by hard objects.
   d. Excessive loss of chrome plating (see next step).
2. To check if chrome plating has worn off, drag a scribe or sharp knife point across the bottom of a groove (2) (between two teeth) with medium pressure.
   a. If scribe or knife point slides across groove without digging in or leaving a visible mark, chrome plating is still good.
   b. If scribe or knife points digs in and leaves a visible mark, it is cutting the bare aluminum. A knife point will not penetrate the chrome plating.
3. Replace rear sprocket if major tooth damage or loss of chrome exists.



1. Tooth
2. Groove

Figure 1-23. Rear Sprocket

Rear Belt

See Figure 1-24. Inspect drive belt for:

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

NOTE

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

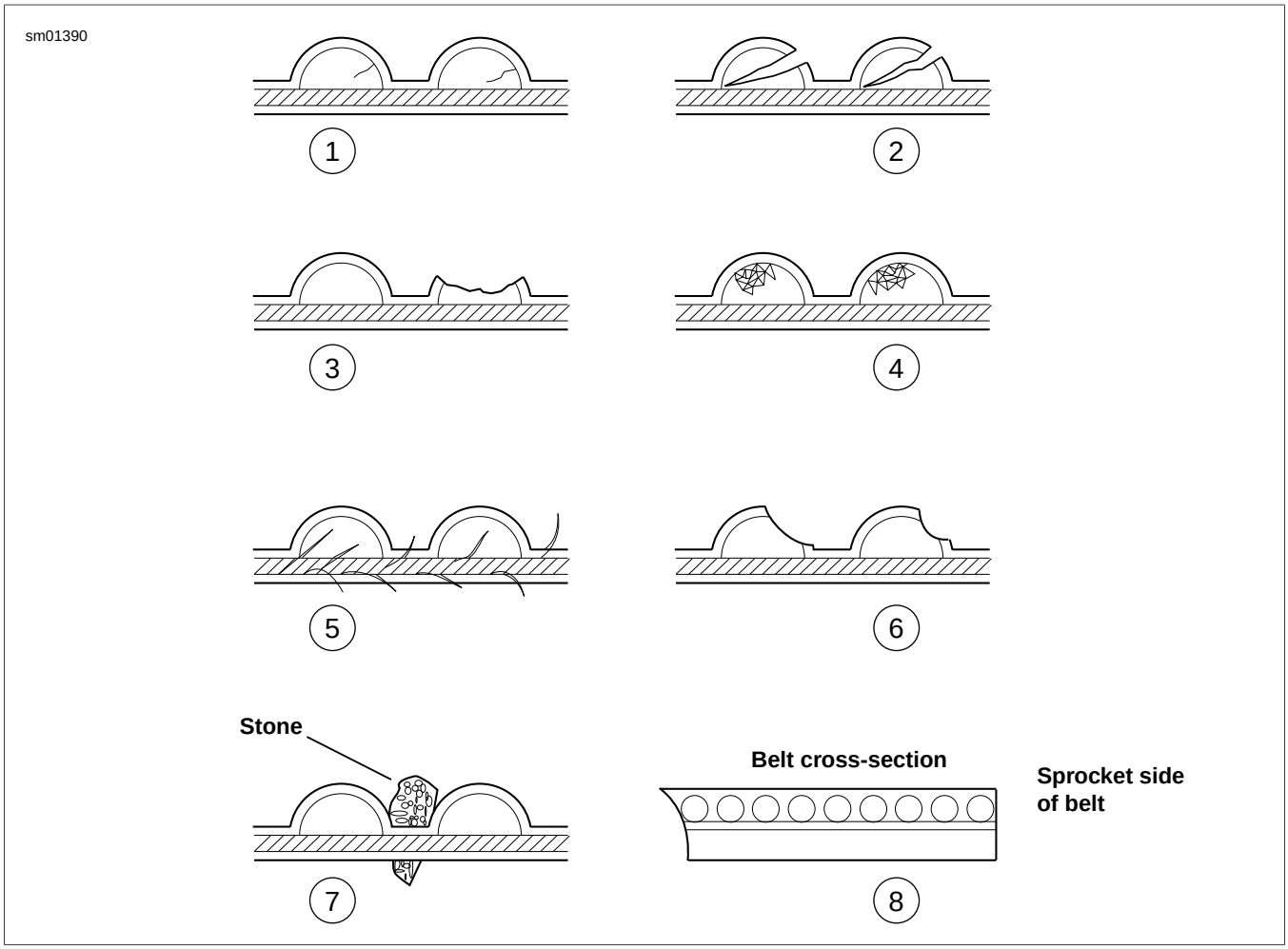


Figure 1-24. Drive Belt Wear Patterns

Table 1-10. Drive Belt Wear Analysis

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

INSPECTION

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

Check rear belt deflection:

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

When checking belt deflection:

- Set belt tension at tightest point in belt.
- Measure belt deflection with motorcycle cold and the approximate weight of the owner on motorcycle.

1. See Figure 1-25. Obtain H-D BELT TENSION GAUGE (Part No. HD-35381-A).

NOTE

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

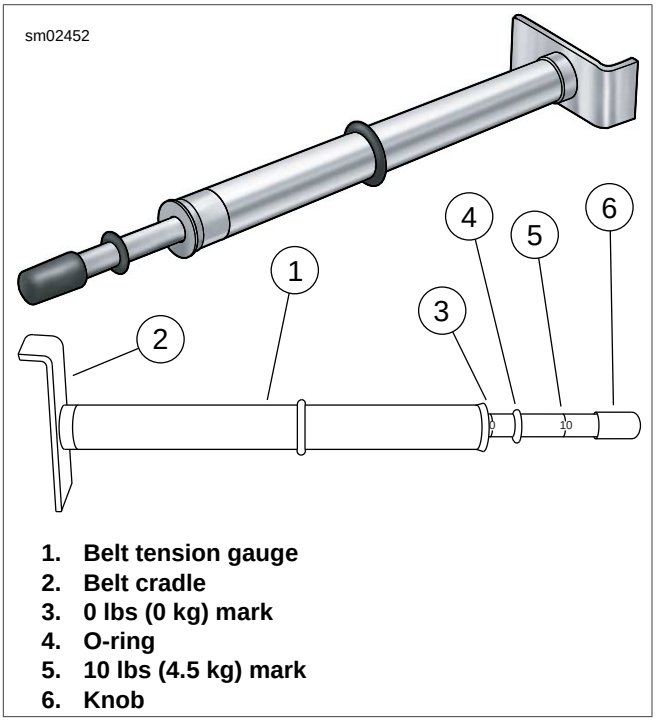
2. To use the belt tension gauge:
   a. Slide O-ring (4) toward 0 lbs (0 kg) mark (3).
   b. Fit belt cradle (2) against bottom of drive belt half-way between drive pulleys (point 3 in Figure 1-26.)
   c. Press upward on knob (6) until O-ring slides down to 10 lbs (4.5 kg) mark (5).
   d. See Figure 1-27. Measure belt deflection as viewed through deflection viewing window (2) while holding gauge steady. Deflection graduations (3) are 1/8 in. (3.2 mm) apart.
3. See Figure 1-26. Check drive belt deflection. Apply 10 lbs (4.5 kg) of force upward at point 3.
4. Measure belt deflection several times, each time with belt moved (by rotating rear wheel) to a different position on sprockets.
5. Refer to Table 1-11. Compare drive belt deflection with specifications listed in the table.

NOTE

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

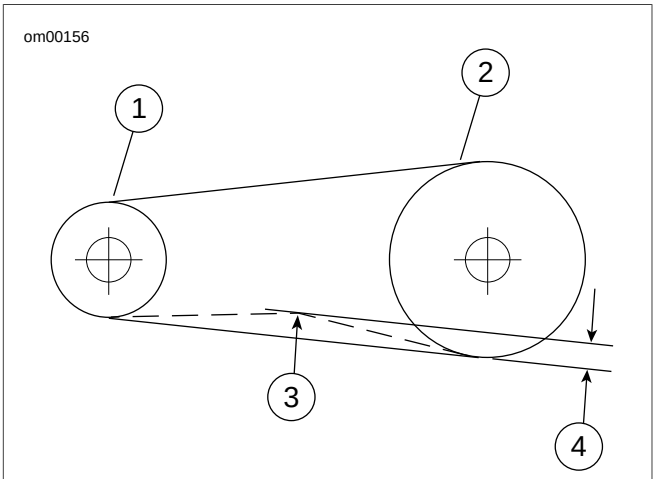
Table 1-11. Rear Belt Deflection

	FXDWG/FXD/FXDF		FXDB/FXDC/FXDL	
	IN.	MM	IN.	MM
With motorcycle on jiffy stand without rider or luggage	5/16-3/8	7.9-9.5	1/4-5/16	6.4-7.9
Vehicle upright with rear wheel in air	1/2-9/16	12.7-14.3	5/16-3/8	7.9-9.5



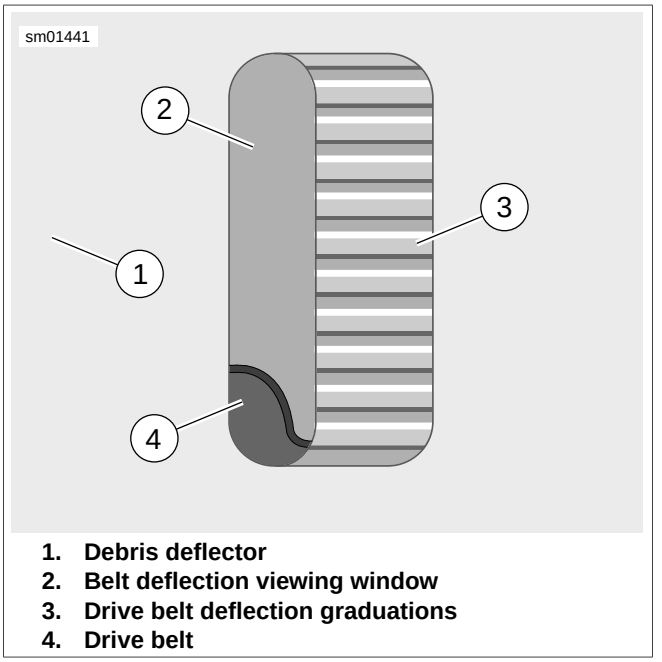
1. **Belt tension gauge**
2. **Belt cradle**
3. **0 lbs (0 kg) mark**
4. **O-ring**
5. **10 lbs (4.5 kg) mark**
6. **Knob**

Figure 1-25. Belt Tension Gauge (Part No. HD-35381-A)



1. **Transmission sprocket**
2. **Rear wheel sprocket**
3. **Force**
4. **Deflection of belt**

Figure 1-26. Check Belt Deflection



1. **Debris deflector**
2. **Belt deflection viewing window**
3. **Drive belt deflection graduations**
4. **Drive belt**

Figure 1-27. Belt Deflection Window

ADJUSTMENT

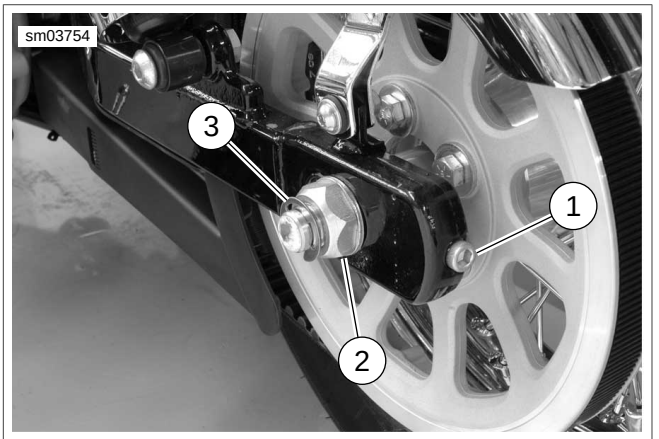
If belt adjustment is necessary, perform the following procedure:

1. See Figure 1-28. Remove retaining ring (3) and loosen axle nut (2).
2. Adjust belt tension by turning the axle adjusters (1) an equal number of turns to keep the wheel aligned until the specification in Table 1-11 is achieved.
3. Tighten axle nut (2) to 95-105 ft-lbs (128.8-142.4 Nm).
4. Install retaining ring (3).
5. Tighten adjuster screws to 96-120 **in-lbs** (10.8-13.6 Nm).
6. Verify rear wheel alignment. See 2.11 VEHICLE ALIGNMENT.

⚠WARNING

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

7. Check wheel bearing end play. See 2.5 SEALED WHEEL BEARINGS, Inspection



1. **Axle adjuster**
2. **Axle nut**
3. **Retaining ring**

Figure 1-28. Axle Adjusters (Left Side Shown)

CABLE INSPECTION, LUBRICATION AND ADJUSTMENT

Inspection and Lubrication

1. See Figure 1-29. Remove two screws (1) to separate the upper handlebar housing from the lower housing.
2. Unhook each ferrule and cable from the throttle grip and remove the throttle sleeve.
3. Apply a light coat of graphite to the handlebar and replace throttle grip.
4. Put one or two drops of SUPER OIL (Part No. HD-94968-85TV) into the housing of each cable.
5. When assembling the handlebar housing, tighten both screws (1) to 35-45 **in-lbs** (4.0-5.1 Nm).

Adjustment

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

⚠WARNING

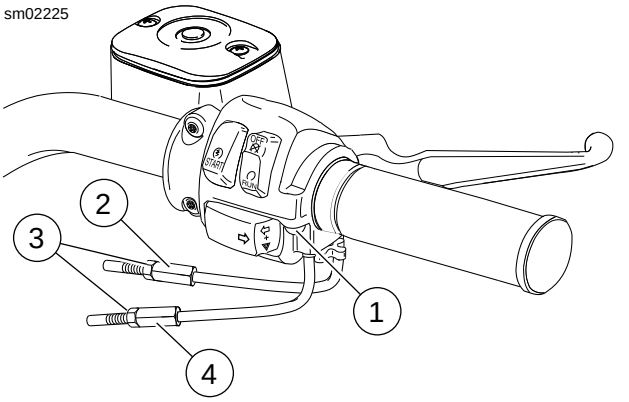
Before starting engine, be sure throttle control will snap back to idle position when released. A throttle control that prevents engine from automatically returning to idle can lead to loss of control, which could result in death or serious injury. (00390a)

⚠WARNING

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

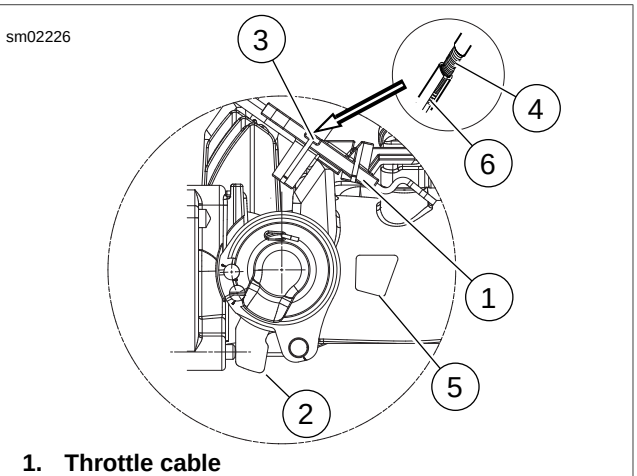
Adjust throttle cables:

1. See Figure 1-29. Slide rubber boot off throttle cable adjuster mechanism (2).
2. Holding cable adjuster with a 3/8 inch wrench, loosen jam nut turning in a clockwise direction.
3. Back jam nut (3) away from cable adjuster until it stops. Turn cable adjuster clockwise until it contacts jam nut. Repeat procedure on idle cable adjuster.
4. See Figure 1-30. Point the front wheel straight ahead. Gently turn the throttle grip so that the throttle is wide open (fully counterclockwise) and then hold in position. Now turn the throttle cable adjuster counterclockwise until the throttle cam (2) just touches the cam stop (5) on the induction module.
5. Release the throttle grip, turn throttle cable adjuster counterclockwise an additional 1/2-1 full turn, and then tighten the jam nut against the cable adjuster. Cover cable adjuster mechanism with rubber boot.
6. Turn the front wheel full right. Turn the idle cable adjuster counterclockwise until the cable housing (4) just touches the spring (6) in the cable guide (as seen through slot).
7. Work the throttle grip to verify that the throttle cable returns to the idle position when released. If the cable does not return to idle, turn the cable adjuster clockwise slightly until the correct response is achieved.
8. Tighten jam nut against the cable adjuster and cover cable adjuster mechanism with rubber boot.



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

Figure 1-29. Throttle Cable Adjusters



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

Figure 1-30. Induction Module Cable Connection

GENERAL

⚠WARNING

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

⚠CAUTION

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

CAUTION

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

CAUTION

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

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

PROCEDURE

NOTE

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

1. Remove bleeder valve cap. Install end of a length of clear plastic tubing over caliper bleeder valve; place other end in a clean container. Stand motorcycle upright.
   a. Front brake bleeder valve-see Figure 1-31.
   b. Rear brake bleeder valve-see Figure 1-32.
2. Add D.O.T. 4 BRAKE FLUID to master cylinder reservoir. Fluid level should be 1/8-1/4 in. (3.2-6.4 mm) below the gasket surface. Depress and hold brake lever/pedal to build up hydraulic pressure.
3. Open bleeder valve slowly about 1/2-turn counterclockwise; brake fluid will flow from bleeder valve and through tubing. When brake lever/pedal has moved its full range of travel, close bleeder valve (clockwise). Allow brake lever/pedal to return slowly to its released position.
4. Repeat Steps 2-3 until all air bubbles are purged.
5. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm). Install bleeder valve cap.
6. Verify master cylinder fluid level as described in Step 2.

⚠WARNING

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

7. Attach covers to master cylinder reservoirs. Tighten screws on covers to 6-8 **in-lbs** (0.7-0.9 Nm).



Figure 1-31. Front Brake Bleeder Valve

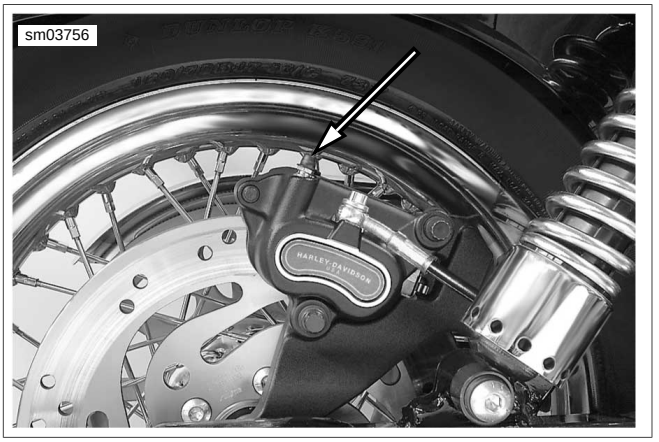


Figure 1-32. Rear Brake Bleeder Valve

INSPECTION

Check brake pads and discs:

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

Brake Pads

CAUTION

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

CAUTION

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

WARNING

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

See Figure 1-33. Replace brake pads (3) if brake pad friction material on either the front or rear caliper is worn to 0.04 in. (1.02 mm) or less above the backing plate (4). Always replace both pads in a caliper as a set. See 1.16 BRAKE PADS AND DISCS, Brake Pad Replacement.

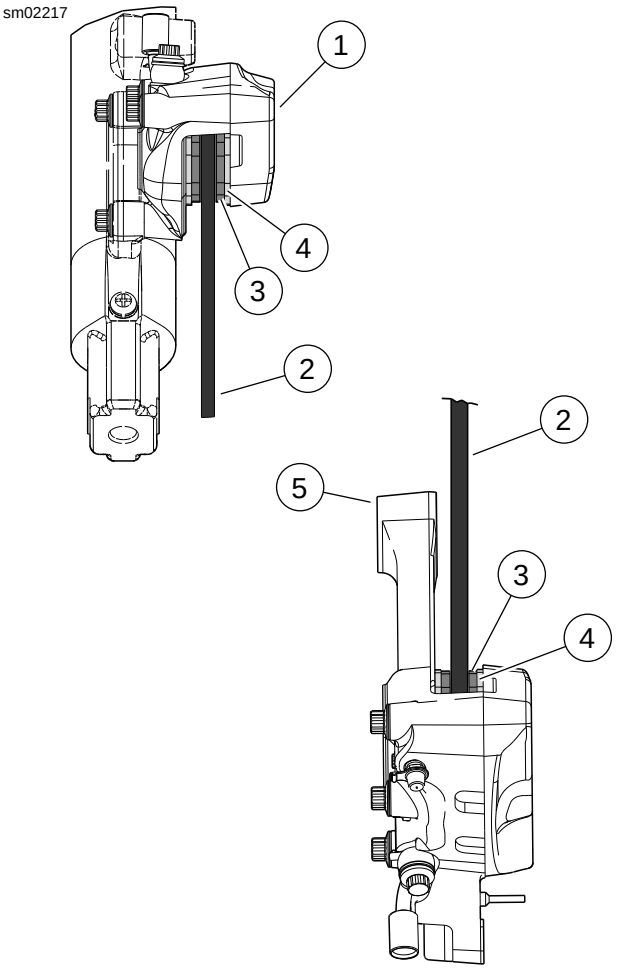
When checking the brake pads and discs, inspect the brake hoses for correct routing and any signs of damage.

Brake Disc Thickness

The minimum brake disc (2) thickness is stamped on the side of the disc. Replace disc if badly scored.

Brake Disc Lateral Runout and Warpage

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



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

Figure 1-33. Brake Pad Inspection

BRAKE PAD REPLACEMENT

Rear Brake Caliper

1. If present, remove right saddlebag.
2. Remove the rear master cylinder reservoir cap. As the pistons are pushed back into the caliper, fluid level may rise above the recommended 1/8 in. (3.2 mm) below the gasket surface. You may have to remove fluid to allow for this.
3. See Figure 1-34. Loosen, but do not remove, pad pin (1) (metric).
4. Pry the outside pad back until the pistons are completely retracted. Use steady pressure to prevent scoring the brake disc. Pry between the pad and the brake disc in order to push the caliper pistons back into their bores.

5. Once the pistons have been fully retracted into their bores, pull pad pin part way until the inside pad drops free. Note the pad's original orientation for replacement purposes.
6. Continue to remove the pin until the outer pad drops free.

⚠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)

7. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace pin.
8. Install **new** outer brake pad using the same orientation as the pad previously removed. Curved portion of pad must face up and tab must engage slot (2) in caliper housing.
9. Partially install pad pin until it retains the outer pad.
10. Install the inner pad and ensure tab engages slot in caliper housing. Finish installing pad pin and tighten to 80-120 **in-lbs** (9.0-13.6 Nm).

⚠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)

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

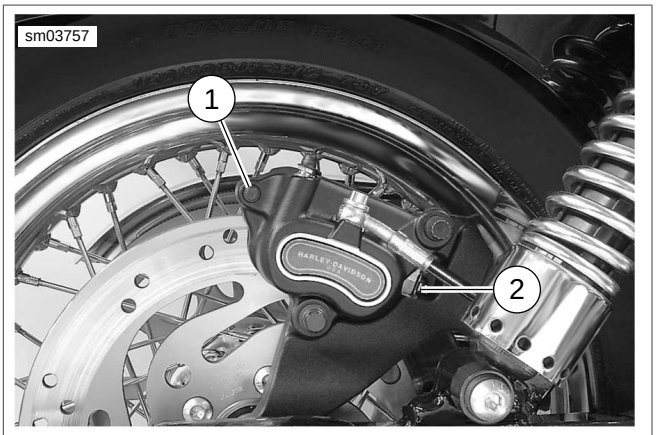
⚠WARNING

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

14. Test brake system.
    a. Turn ignition switch ON. Pump brake pedal to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See 1.15 BLEEDING BRAKES.

NOTE

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



1. **Pad pin**
2. **Tab slot**

Figure 1-34. Pad Retaining Pin (Rear Caliper Shown)

Front Brake Caliper

1. Remove the front master cylinder reservoir cap. As the pistons are pushed back into the caliper, fluid level may rise above the recommended 1/8 in. (3.2 mm) below the gasket surface. Fluid may need to be removed to allow for this.
2. See Figure 1-35. Loosen, but do not remove bridge bolt/pad pin (3) (metric).
3. Remove both caliper mounting bolts (1, 2) (metric). Detach caliper from front forks and brake disc.
4. Pry the pads back to force all four caliper pistons into their bores.

NOTE

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

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

⚠WARNING

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

NOTES

- *See Figure 1-36. Ensure the pad spring tabs (1) on brake pad engage the pad springs in the pistons.*
- *If the directional tab (2) does not face down when caliper is installed, brake noise may develop.*

7. Install **new** pads into caliper. The directional tab (2) must face down when caliper is installed.
8. Loosely install the center bridge bolt/pad pin.

9. Attach caliper to front fork.
   a. See Figure 1-35. Place caliper over brake disc with bleeder valve facing upward.
   b. Loosely install long mounting bolt (1) (metric) into upper hole on fork leg.
   c. Install short mounting bolt (2) (metric) into lower hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   e. Final tighten center bridge bolt/pad pin (3) to 15-16 ft-lbs (20.3-22.6 Nm).
10. Pump brake hand lever to move pistons out until they contact both brake pads. Verify piston location against pads. If the front wheel is off the ground, rotate wheel to check for excessive brake pad drag.
11. Check brake fluid level in master cylinder. Fill to proper level if necessary using D.O.T. 4 BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 6-8 **in-lbs** (0.7-0.9 Nm).

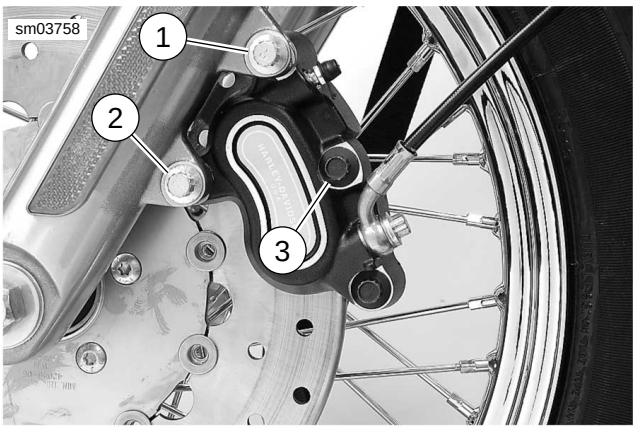
⚠WARNING

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

12. Test brake system.
   a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See 1.15 BLEEDING BRAKES.

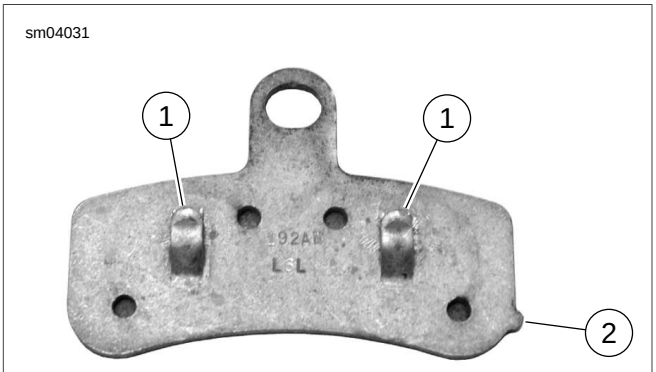
NOTE

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



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

Figure 1-35. Front Brake Caliper (Left Side Shown)



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

Figure 1-36. Front Brake Pad

GENERAL

⚠WARNING

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

⚠WARNING

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

⚠WARNING

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

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

NOTE

For charging information, see 1.17 BATTERY MAINTENANCE, Charging Battery. For testing information, see ELECTRICAL DIAGNOSTIC MANUAL.

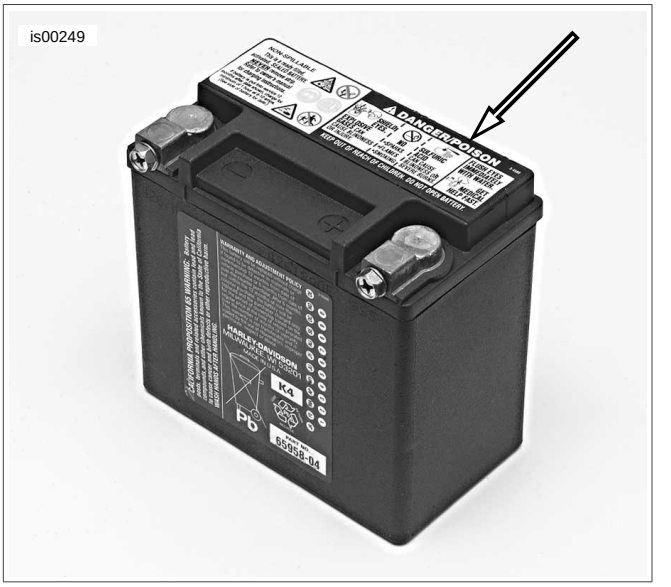


Figure 1-37. AGM Battery with Warning Label



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

Figure 1-38. Battery Warning label

Table 1-12. Antidotes for Battery Acid

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

CLEANING AND INSPECTION

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

VOLTMETER TEST

⚠WARNING

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

⚠WARNING

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

Voltmeter Test

Refer to Table 1-13. The voltmeter test provides a general indicator of battery condition. Check the voltage of the battery to verify that it is in a 100% fully charged condition. If the open circuit (disconnected) voltage reading is below 12.6V, charge the battery and then recheck the voltage after the battery has set for one to two hours. If the voltage reading is 12.7V or above, perform a load test. See the Electrical Diagnostic Manual for the load test procedure.

Table 1-13. Voltmeter Test For Battery Charge Conditions

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

CHARGING BATTERY

Safety Precautions

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

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

Using a Battery Charger

Charge the battery if any of the following conditions exist:

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

⚠WARNING

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

CAUTION

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

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

NOTE

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

Table 1-14. Battery Charging Rates/Times (Approximate)

BATTERY AMP HOUR	STATE OF CHARGE		3 AMP CHARGER	6 AMP CHARGER	10 AMP CHARGER	20 AMP CHARGER
	VOLTAGE	% OF CHARGE				
19	12.7	100%	-	-	-	-
	12.6	75%	1.75 hours	50 minutes	30 minutes	15 minutes
	12.3	50%	3.5 hours	1.75 hours	1 hour	30 minutes
	12.0	25%	5 hours	2.5 hours	1.5 hours	45 minutes
	11.8	0%	6 hours, 40 minutes	3 hours, 20 minutes	2 hours	1 hour

NOTE

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

WARNING

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

CAUTION

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

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

NOTE

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

4. Step away from the battery and turn on the charger. See the charging instructions in Table 1-14.

WARNING

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

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

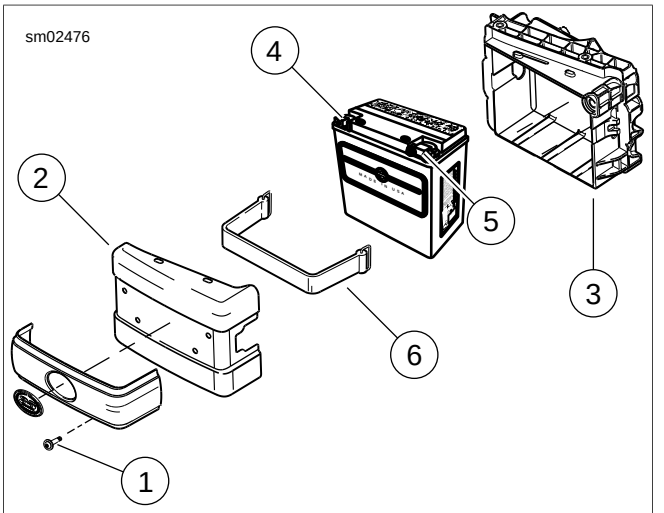
DISCONNECTION AND REMOVAL

1. Remove seat.

WARNING

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

2. See Figure 1-39. Remove lower fastener (1).
3. Pivot cover (2) outward and lift to disengage slots on cover from projections on battery tray (3).
4. Unthread and remove battery negative cable from negative battery terminal (4).
5. Unbolt and remove battery positive cable from positive (+) battery terminal (5).
6. Remove battery strap (6).
7. Remove battery from tray.



1. **Screw**
2. **Cover**
3. **Battery tray**
4. **Negative battery terminal**
5. **Positive battery terminal**
6. **Battery strap**

Figure 1-39. Battery Assembly

STORAGE

PART NUMBER	TOOL NAME
99863-01A	GLOBAL BATTERY CHARGER

⚠WARNING

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

CAUTION

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

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

If the motorcycle is to be stored with the battery installed, a GLOBAL BATTERY CHARGER unavailable, and with the security system **not** armed, unplug the maxi-fuse.

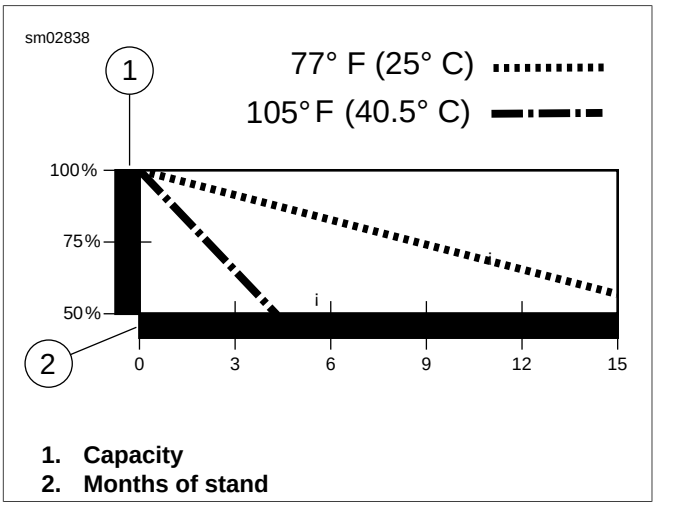
If the motorcycle will not be operated for several months, such as during the winter season, remove the battery from the motorcycle and fully charge.

See Figure 1-40. Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place.

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

NOTES

- *The GLOBAL BATTERY CHARGER (Part No. 99863-01A) may be used to maintain battery charge for extended periods of time without risk of overcharging or boiling.*
- *When returning a battery to service after storage, see ELECTRICAL DIAGNOSTIC MANUAL.*



1. **Capacity**
2. **Months of stand**

Figure 1-40. Battery Self-Discharge Rate

INSTALLATION AND CONNECTION

CAUTION

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

⚠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)

NOTE

Check that battery is fully charged before installation.

1. See Figure 1-39. With battery terminals facing outward, place battery in battery tray and install battery strap.
2. Insert fastener through battery positive cable terminal and into threaded hole of battery positive (+) terminal (5). Tighten fastener to 60-96 **in-lbs** (6.8-10.9 Nm). Place battery terminal cover over positive battery terminal.
3. Insert fastener through battery negative cable terminal into threaded hole of battery negative (-) terminal (4). Tighten fastener to 60-96 **in-lbs** (6.8-10.9 Nm).
4. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.

5. Place slots on battery cover (2) on projections on battery tray (3). Install screw (1) to secure cover.

⚠WARNING

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

6. Install seat.

REAR SHOCK PRELOAD ADJUSTMENT

PART NUMBER	TOOL NAME
HD-94700-52C	SPANNER WRENCH

⚠WARNING

Be sure both shock absorbers are adjusted to same preload position. Improper adjustment can adversely affect stability and handling, which could result in death or serious injury. (00036a)

The rear shock absorber springs can be adjusted to five positions to compensate for various loads.

- For heavy loads, the springs should be compressed.
- For lighter loads the springs should be extended.

See Figure 1-41. To adjust the rear shock absorber, turn spring adjusting cam to desired position with a SPANNER WRENCH (Part No. HD-94700-52C). Both spring adjusting cams must be adjusted to the same position. When returning to off-cam position, cams should be backed off in opposite direction.

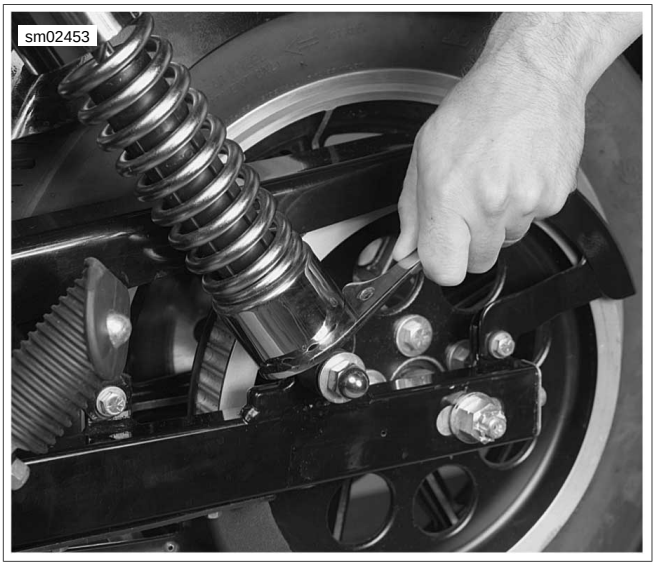


Figure 1-41. Rear Shock Absorber Spring Adjustment (Typical)

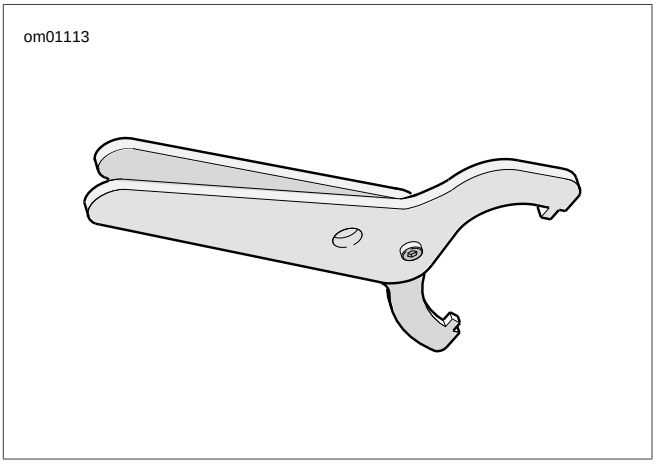


Figure 1-42. Spanner Wrench (HD-94700-52C)

INSPECTION

WARNING

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

1. After the engine has cooled to room temperature, disconnect cables from both spark plugs.
2. Remove spark plugs. If a plug has eroded electrodes, heavy deposits or a cracked insulator, discard it.
3. See Figure 1-43. Compare your observations of the plug deposits with the descriptions provided below.
   a. A wet, black and shiny deposit on plug base, electrodes and ceramic insulator tip indicates an oil fouled plug. The condition may be caused by one or more of the following: worn pistons, worn piston rings, worn valves, worn valve guides, worn valve seals, a weak battery or a faulty ignition system.
   b. A dry, fluffy or sooty black deposit indicates an air-fuel mixture that is too rich.
   c. A light brown, glassy deposit indicates an overheated plug. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes and is caused by an air-fuel mixture that is too lean, a hot-running engine, valves not seating or improper ignition timing. The glassy deposit on the spark plug is a conductor when hot and may cause high-speed misfiring. A plug with eroded electrodes, heavy deposits or a cracked insulator must be replaced.
   d. A plug with a white, yellow, tan or rusty brown powdery deposit indicates balanced combustion. Clean off spark plug deposits at regular intervals.

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. If the plugs require cleaning between tune-ups, proceed as follows:
   a. Degrease firing end of spark plug using ELECTRICAL CONTACT CLEANER. Dry plug with compressed air.
   b. Use a thin file to flatten spark plug electrodes. A spark plug with sharp edges on its electrodes requires 25-40% less firing voltage than one with rounded edges.
   c. If the plugs cannot be cleaned, replace with **new** spark plugs.
5. Check electrode gap with a wire-type feeler gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Proper gap measurement is 0.038-0.043 in. (0.97-1.09 mm).
6. Check condition of threads on cylinder head and plug. If necessary to remove deposits, apply penetrating oil and clean out with a thread chaser.
7. Apply LOCTITE ANTI-SEIZE to the spark plug threads. Install and tighten to 12-18 ft-lbs (16.3-24.4 Nm).
8. Connect spark plug cables. Rear cylinder plug cable attaches to top coil terminal. Verify that cables are securely connected to coil and spark plugs.

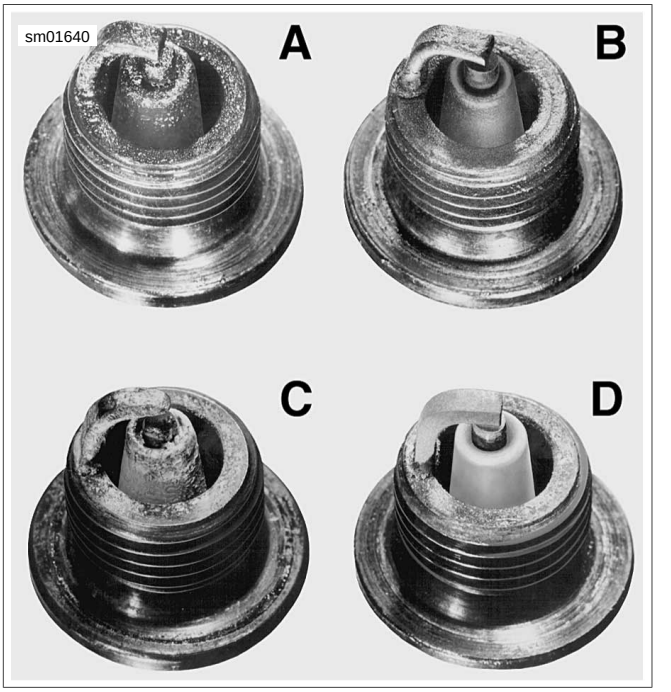


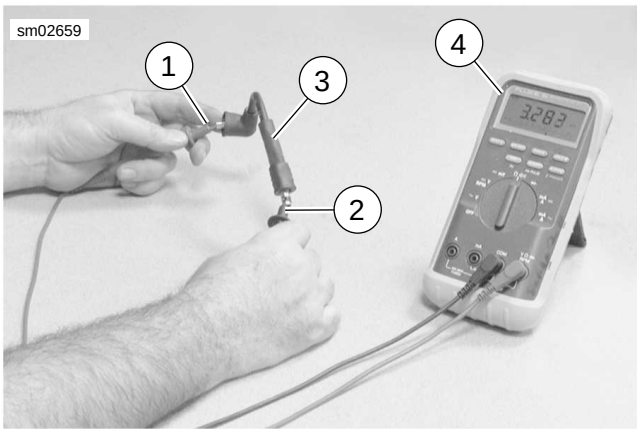
Figure 1-43. Typical Spark Plug Deposits

SPARK PLUG CABLE INSPECTION

1. Inspect spark plug cables. Replace cables that are worn or damaged.
   a. Check for cracks or loose terminals.
   b. Check for loose fit on ignition coil and spark plugs.
2. Check cable boots/caps for cracks or tears. Replace boots/caps that are worn or damaged.
3. See Figure 1-44. Check spark plug cable resistance with an ohmmeter. Compare values from test with Table 1-15. Replace cables not meeting resistance specifications.

Table 1-15. Spark Plug Cable Resistance Values: Dyna

DESCRIPTION	LENGTH		RESISTANCE VALUE (OHMS)
	In.	mm	
Front cable	19.00	483	4750-12,675
Rear cable	7.25	184	1813-4833



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

Figure 1-44. Testing Resistance

ADJUSTMENT

PART NUMBER	TOOL NAME
HD-41494	HUBCAP REMOVER AND INSTALLER

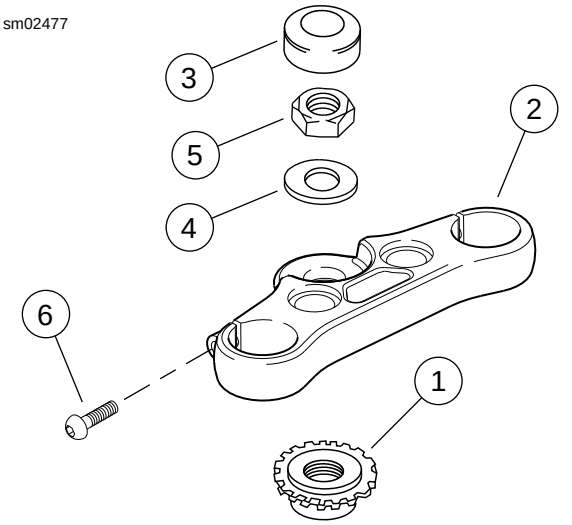
Bearing Adjustment (Fall Away)

1. Support motorcycle in an upright position so the front end is completely suspended and the vehicle is level.
2. Remove all accessory weight, such as a windshield, that may influence the way the front end swings. If clutch cable is routed so it pulls the front end one way or the other, disconnect it.
3. Place a suitable marking material, such as masking tape, over the fender tip.
4. Install a pointer so the base is stationary on the floor and the pointer indicates the center of the fender. The front end should be straight ahead, however the balance point may be slightly off center.
5. Check steering head bearing tension.
   a. Tap the fender on one side until the front end begins to "fall-away" by itself. Label this point on the marking material.
   b. Repeat the previous step in the other direction.
   c. Measure distance between marks.
6. The distance between the "fall-away" marks must be 2.0-4.0 in (50.8-101.6 mm).

NOTES

- *If distance measured is 2.0-4.0 in. (50.8-101.6 mm) no bearing adjustment is needed.*
- *If distance measured is outside the range given, bearing adjustment is needed.*

7. See Figure 1-45. With HUBCAP REMOVER AND INSTALLER (Part No. HD-41494) unscrew and remove stem cap (3).
8. Loosen fork stem nut (5).
9. Loosen lower triple clamp pinch bolts.



1. **Star nut**
2. **Upper triple clamp**
3. **Stem cap**
4. **Hardened flat washer**
5. **Stem nut**
6. **Pinch bolt (2)**

Figure 1-45. Steering Head Components

10. Tighten or loosen the star nut (1) until the measurement is within limits.
    a. If the distance is more than 4.0 in. (101.6 mm), turn the adjuster nut counter clockwise to loosen.
    b. If the distance is less than 2.0 in. (50.8 mm), turn the adjuster nut clockwise to tighten.
11. Remove the stem nut and lightly lubricate the threads with anti-seize lubricant.
12. Install stem nut and tighten to 70-80 ft-lbs (95-108.5 Nm).
13. Check fall-away. If it is 2.0-4.0 in. (50.8-101.6 mm), tighten lower triple clamp pinch bolts to 30-35 ft-lbs (40.7-47.5 Nm).
14. Repeat the "fall-away" procedure to be sure the adjustment is correct.
15. Install and adjust clutch cable.
16. Test ride motorcycle.

LUBRICATION

Use SPECIAL PURPOSE GREASE (Part No. 99857-97) every 30,000 mile (48,280 km) service interval. For steering head bearing lubrication, see 2.18 STEERING HEAD.

REPLACING FORK OIL

Fork assemblies must be removed to drain fork oil. See 2.17 FRONT FORK.

CABLE AND CHASSIS LUBRICATION 1.22

GENERAL

Inspect and lubricate the following at scheduled service intervals as specified in 1.2 MAINTENANCE SCHEDULE.

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

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

CABLES AND HAND LEVERS

For throttle cables, see 1.14 THROTTLE CABLES.

Use SUPER OIL (Part No. HD-94968-85TV) for hand levers and cables.

JIFFY STAND

Clean and lubricate the jiffy stand. For more information, see 2.30 JIFFY STAND.

INSPECTION

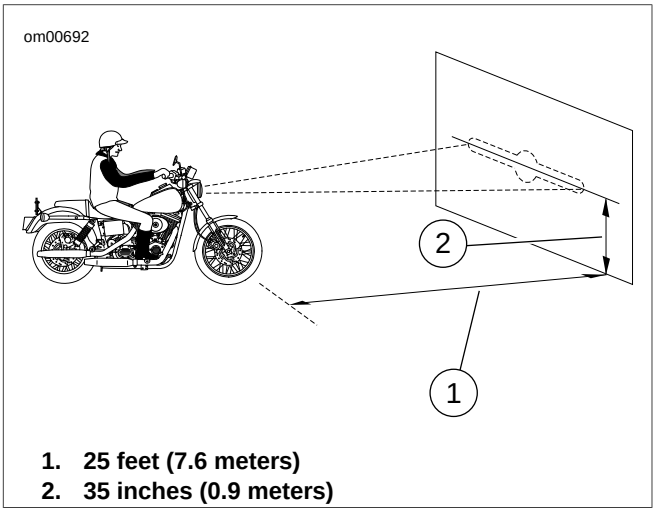
⚠WARNING

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

Check headlamp for proper height and lateral alignment:

- When the new owner takes delivery of the motorcycle.
- When there is a change in load (adding luggage, etc.)

1. Verify correct front and rear tire pressure. See 1.8 TIRES AND WHEELS.
2. Place motorcycle on level floor (or pavement) in an area with minimum light.
3. See Figure 1-46. Position motorcycle 25 ft (7.6 m) away from a screen or wall. Measure the distance from directly below the front axle to the base of the screen/wall.
4. Draw a horizontal line 35 in. (0.9 m) above floor on screen/wall.
5. Load vehicle with rider, passenger (if normally present) and any cargo. Weight will compress vehicle suspension slightly.
6. Stand motorcycle upright with both tires resting on floor and with front wheel held in straight alignment (directly forward).
7. See Figure 1-47. Turn ignition switch ON. Set handlebar headlamp switch to HIGH beam position.
8. Check light beam for alignment.
   a. The main beam, which is a broad, flat pattern of light, should be centered equally above and below the horizontal line.
   b. The main beam of light should also be directed straight ahead. Properly adjusted headlamps project an equal area of light to right and left of center.
   c. Adjust headlamp alignment if necessary.



1. 25 feet (7.6 meters)
2. 35 inches (0.9 meters)

Figure 1-46. Checking Headlamp Alignment: Dyna Models

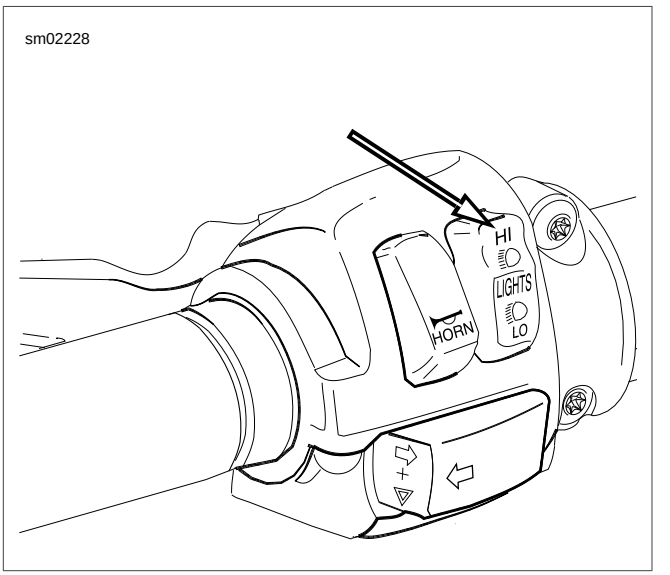
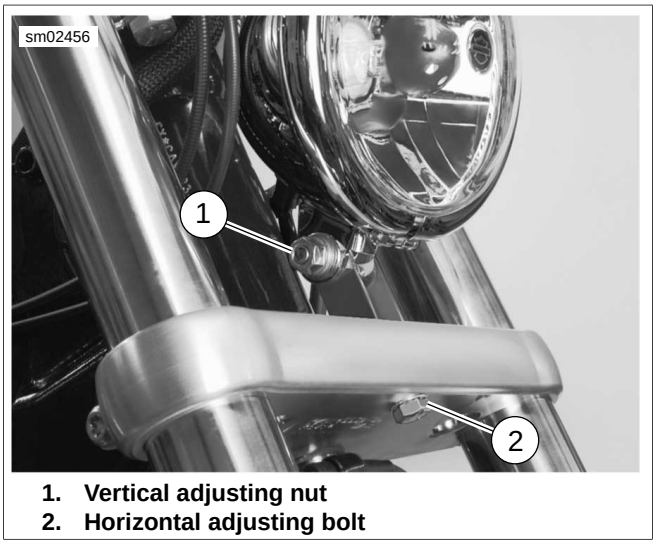


Figure 1-47. Headlamp Switch High Beam Setting

ADJUSTMENT

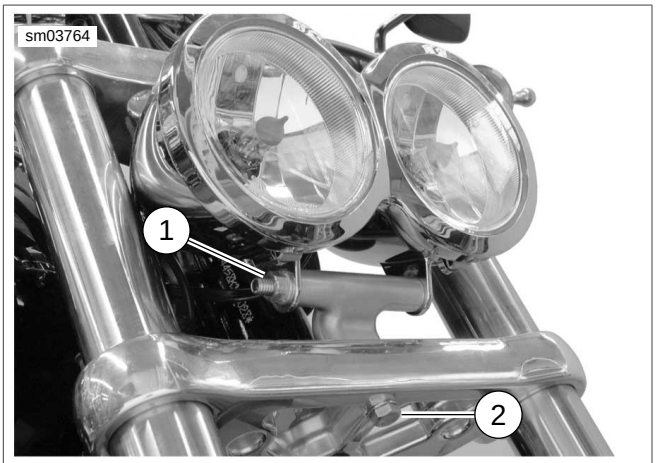
All Models

1. See Figure 1-48 or Figure 1-49. Loosen horizontal adjusting bolt (2) to adjust headlamp beam side to side. Tighten bolt to 25-30 ft-lbs (33.9-40.7 Nm).
2. Loosen nut on vertical adjusting nut (1) to adjust headlamp beam up or down. Tighten nut to 25-30 ft-lbs (33.9-40.7 Nm).



1. Vertical adjusting nut
2. Horizontal adjusting bolt

Figure 1-48. Headlamp Adjustments: Single Bulb



1. Vertical adjusting nut
2. Horizontal adjusting bolt

Figure 1-49. Headlamp Adjustments: Dual Bulb

INSPECTION

Inspect critical fasteners, except head bolts at the scheduled service intervals.

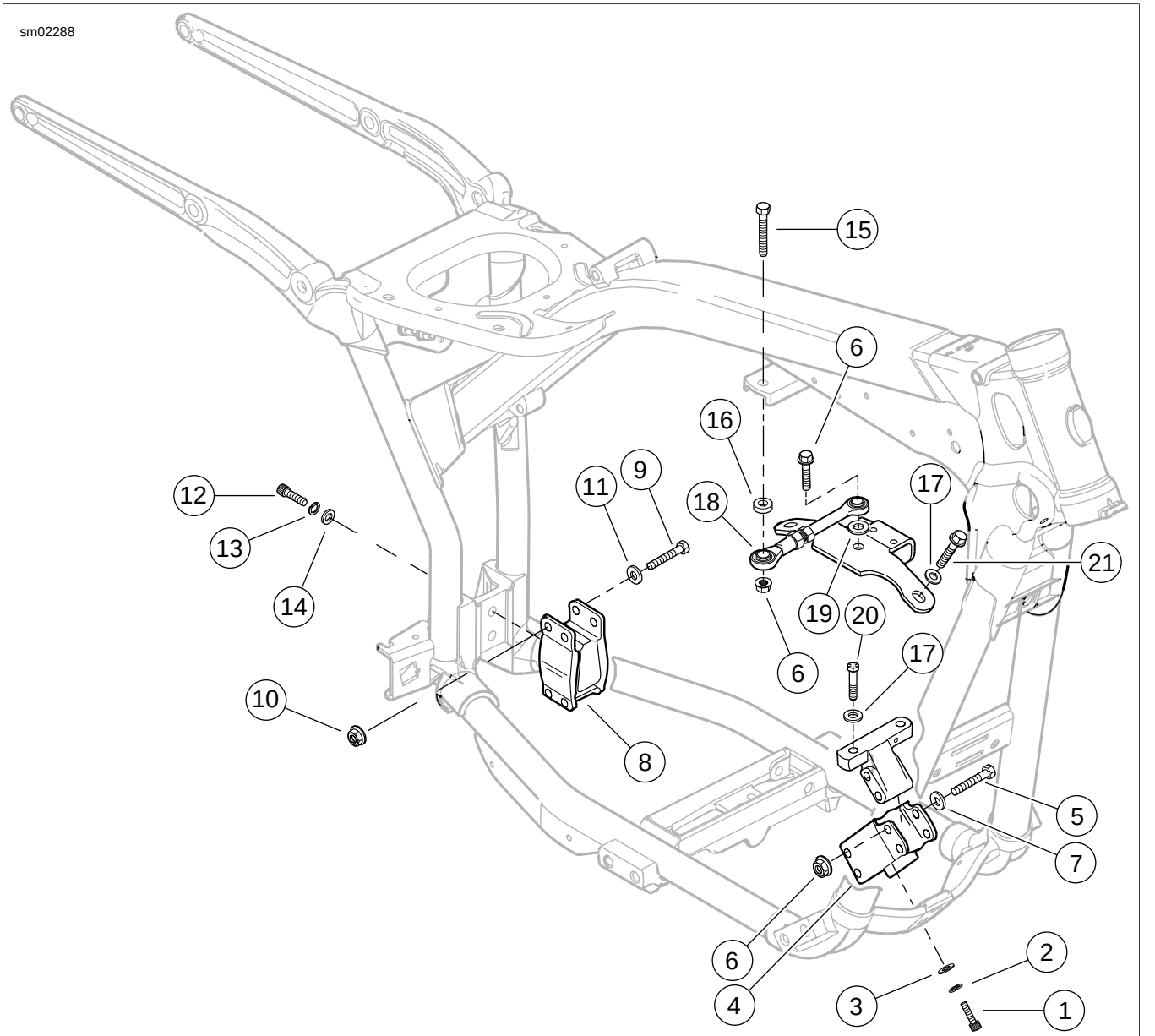
Refer to Table 1-16. Tighten all critical fasteners, except head bolts, to service manual specifications. Replace any damaged or missing hardware.

Table 1-16. Critical Fasteners: Dyna

SYSTEM	FASTENER	TORQUE	
Hand controls	Upper and lower switch housing screws	35-45 **in-lbs**	3.9-5.1 Nm
	Clutch lever handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
	Master cylinder handlebar clamp screws	60-80 **in-lbs**	6.8-9.0 Nm
Brakes	Banjo bolts	21-25 ft-lbs	28.5-33.9 Nm
	Front brake caliper mounting bolts	28-38 ft-lbs	38.0-51.5 Nm
	Front brake pad pin/bridge bolt	15-16 ft-lbs	20.3-22.6 Nm
	Rear brake caliper mounting bolts	10-14 ft-lbs	13.6-18.9 Nm
	Rear brake pad pin	80-120 **in-lbs**	9.0-13.6 Nm
	Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm
	Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm
	Reservoir cover screws	6-8 **in-lbs**	0.7-0.9 Nm
	Rear master cylinder mounting nut	30-40 ft-lbs	40.7-54.2 Nm
Axle nuts	Front axle	62-67 ft-lbs	84.1-90.1 Nm
	Rear axle	95-105 ft-lbs	128.1-142.4 Nm
Front fork	Lower fork pinch bolts	30-35 ft-lbs	40.7-47.5 Nm
	Axle cap fasteners	10-14 ft-lbs	13.6-19.0 Nm
	Upper bracket pinch bolts	30-35 ft-lbs	40.7-47.5 Nm
	Handlebar clamp mounting screw	12-16 ft-lbs	16.3-21.7 Nm

INSPECTION

1. See Figure 1-50. Check for cracks or tears in the isolator rubber.
2. Check stabilizer links for wear.
3. Check that all engine mount bolts are tight.
4. Check that all engine mount rivets are not sheared.
5. Check that the mounts are supporting the weight of the motor.



1. **Bolt**
2. **Lockwasher**
3. **Washer**
4. **Front isolator**
5. **Bolt**
6. **Flange nut**
7. **Washer**
8. **Rear isolator**
9. **Bolt**
10. **Flange nut**
11. **Washer**
12. **Bolt**
13. **Lockwasher**
14. **Washer**
15. **Bolt**
16. **Spacer**
17. **Washer (3)**
18. **Stabilizer link**
19. **Washer**
20. **Bolt**
21. **Bolt**

Figure 1-50. Engine Mounts

GENERAL

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

This work should be performed by your local Harley-Davidson dealer or other qualified technician following Service Manual procedures.

PLACING IN STORAGE

PART NUMBER	TOOL NAME
98716-87A	STORAGE COVER

⚠WARNING

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

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

⚠WARNING

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

⚠WARNING

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

2. Prepare your fuel system by filling fuel tank and adding a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions.
3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine 5-6 revolutions. Reinstall spark plugs.
4. Inspect rear belt deflection. See 1.13 REAR BELT DEFLECTION.
5. Inspect rear belt and sprockets. See 1.12 REAR BELT AND SPROCKETS.
6. Inspect air cleaner filter. See 1.7 AIR CLEANER AND EXHAUST SYSTEM.
7. Lubricate controls. See 1.22 CABLE AND CHASSIS LUBRICATION.
8. Inspect operation of all electrical equipment and switches.
9. Check tire inflation and inspect tires for wear and/or damage. See 1.8 TIRES AND WHEELS. If the motorcycle will be stored for an extended period of time, securely support the motorcycle under the frame so that all weight is off the tires.

⚠WARNING

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

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

⚠WARNING

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

⚠WARNING

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

11. Remove battery from vehicle. Charge battery until the correct voltage is obtained. Charge the battery every other month if it is stored at temperatures below 60° F (16° C). Charge battery once a month if it is stored at temperatures above 60° F (16° C). See 1.17 BATTERY MAINTENANCE.

⚠WARNING

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

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

REMOVAL FROM STORAGE

⚠WARNING

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

1. Charge and install the battery.

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

GENERAL

⚠WARNING

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

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

NOTE

For further troubleshooting information, see the Electrical Diagnostics Manual.

ENGINE

Starter Motor Does Not Operate or Does Not Turn Engine Over

1. Ignition switch not in ON position.
2. Engine run switch in OFF position.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay, or solenoid faulty.
5. Electric starter shaft pinion gear not engaging or overrunning clutch slipping.
6. TSM/TSSM/HFSM Bank Angle Sensor tripped and ignition switch not cycled OFF then ON.

Engine Turns Over But Does Not Start

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

NOTE

For cold weather starts, always disengage clutch.

5. Spark plug cables in bad condition and shorting, cable connections loose or cables connected to incorrect cylinders.
6. Loose wire connection at coil, battery or ECM connector.
7. Ignition timing incorrect due to faulty coil, ECM or sensors (MAP, CKP and/or TSM/TSSM/HFSM).

Starts Hard

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

NOTE

For cold weather starts, always disengage clutch.

9. Ignition not functioning properly (possible sensor failure).
10. Faulty ignition coil.
11. Valves sticking.

Starts But Runs Irregularly or Misses

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

Spark Plug Fouls Repeatedly

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

Pre-Ignition or Detonation (Knocks or Pings)

1. Fuel octane rating too low.
2. Faulty spark plugs.
3. Incorrect spark plug for the kind of service.
4. Excessive carbon deposit on piston head or in combustion chamber.
5. Ignition timing advanced due to faulty sensors (MAP and/or CKP).

Overheating

1. Insufficient oil supply or oil not circulating.
2. Insufficient air flow over engine.
3. Heavy carbon deposit.
4. Ignition timing retarded due to faulty sensor(s): Manifold Absolute Pressure (MAP) and/or Crank Position (CKP).
5. Leaking valve.

Valve Train Noise

1. Low oil pressure caused by oil feed pump not functioning properly or oil passages obstructed.
2. Faulty hydraulic lifters.
3. Bent push rod(s).
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Chain tensioner or shoe worn.

Excessive Vibration

1. Wheels and/or tires worn or damaged.
2. Engine/transmission/rear wheel not aligned properly.
3. Primary chain badly worn or links tight as a result of insufficient lubrication or misalignment.
4. Engine to transmission mounting bolts loose.
5. Upper engine mounting bracket loose.
6. Ignition timing advanced due to faulty sensor inputs (MAP and/or CKP)/poorly tuned engine.
7. Internal engine problem.
8. Broken frame.

Check Engine Light Illuminates During Operation

Fault detected. For diagnostic information see the Electrical Diagnostic Manual.

LUBRICATION SYSTEM

Oil Does Not Return To Oil Pan

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

Engine Uses Too Much Oil Or Smokes Excessively

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

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

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

Low Oil Pressure

1. Oil pan underfilled.
2. Faulty low oil pressure switch.
3. Oil pump O-ring damaged or missing.
4. Bypass valve stuck in open position.
5. Ball missing or leaking in cam support plate.

High Oil Pressure

1. Oil pan overfilled.
2. Bypass valve stuck in closed position.

ELECTRICAL SYSTEM

NOTE

For diagnostic information see the ELECTRICAL DIAGNOSTIC MANUAL.

Alternator Does Not Charge

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

Alternator Charge Rate Is Below Normal

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

Speedometer Operates Erratically

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

TRANSMISSION

Shifts Hard

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

Jumps Out Of Gear

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

Clutch Slips

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

Clutch Drags Or Does Not Release

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

Clutch Chatters

Friction discs or steel discs worn or warped.

HANDLING

Irregularities

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

BRAKES

Brake Does Not Hold Normally

1. Master cylinder reservoir low on fluid.
2. Brake system contains air bubbles.
3. Master cylinder or 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; brake pedal and master cylinder piston not returning completely.
8. Brake fades due to heat build up - brake pads dragging or excessive braking.
9. Brake fluid leak when under pressure.

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NOTES

SPECIFICATIONS

Table 2-1. Dimensions: 2008 Dyna Models

ITEM	FXD		FXDC		FXDL		FXDWG		FXDB		FXDF	
	IN.	MM	IN.	MM	IN.	MM	IN.	MM	IN.	MM	IN.	MM
Wheel base	64.2	1630	64.2	1630	64.6	1641	68.3	1735	64.2	1630	63.8	1620
Overall length	92.8	2357	92.9	2359	93.1	2364	97.5	2477	92.8	2358	91.7	2330
Overall width	36.7	931	38.9	988	36.3	921	36	915	37.5	953	35.0	890
Road clearance	6.0	153	6.0	153	5.6	142	6.2	158	5.6	142	4.92	125
Overall height	46.8	1189	47.7	1212	47.0	1194	49.3	1251	50.4	1279	44.6	1132
Saddle height*	27.6	700	26.8	680	26.8	680	28.5	723	26.8	680	26.1	663
*With 180 lb. (81.6 kg) rider on seat.												

Table 2-2. Capacities: 2008 Dyna Models

ITEM	FXDC/FXDWG		FXD		FXDL		FXDB		FXDF	
	U.S.	LITERS	U.S.	LITERS	U.S.	LITERS	U.S.	LITERS	U.S.	LITERS
Fuel tank (total)	5.1 gal	19.3	4.8 gal	18.2	4.8 gal	18.2	4.8 gal	18.2	5.1 gal	19.3
Oil tank with filter	3.0 qt	2.8	3.0 qt	2.8	3.0 qt	2.8	3.0 qt	2.8	3.0 qt	2.8
Transmission (approximate)	32 oz.	0.95	32 oz.	0.95	32 oz.	0.95	32 oz.	0.95	32 oz.	0.95
Primary chaincase (approximate)	32 oz.	0.95	32 oz.	0.95	32 oz.	0.95	32 oz.	0.95	32 oz.	0.95
Low fuel warning light on	0.9 gal	3.4	0.9 gal	3.4	0.9 gal	3.4	0.9 gal	3.4	0.9 gal	3.4

Table 2-3. Weights: 2008 Dyna Models

ITEM	FXD		FXDC		FXDL		FXDWG		FXDB		FXDF	
	LB.	KG	LB.	KG	LB.	KG	LB.	KG	LB.	KG	LB.	KG
Weight (as shipped from factory)	632	287	645	293	641	291	650	295	634	288	670	304
GVWR	1085	492	1085	492	1085	492	1085	492	1085	492	1085	492
GAWR front	390	177	390	177	390	177	390	177	390	177	390	177
GAWR rear	695	316	695	316	695	316	695	316	695	316	695	316

NOTES

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

TIRES

WARNING

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

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

Example: T19 x 2.15 MT DOT. "T" indicates that the rim conforms to Tire and Rim Association standards. The "19" is the normal diameter of the rim in inches, measured at the bead seat diameter. The "2.15" is the width of the bead seat measured in inches. "MT" designates the rim contour. "DOT" means that the rim meets Department of Transportation Federal Motor Vehicle Safety Standards.

Table 2-4. Tire Fitment - Tubeless Cast Wheels

Wheel Size & Position	Rim Size & Contour	Rim Valve Hole Dia.	Tire Size
16 in. - Front	E16 x 3.00 MT	0.327 in.	Dunlop D427F 130/90B16 73H
19 in. - Front	T19 x 2.5 MT	0.327 in.	Dunlop D401F 100/90-19 57H
16 in. - Rear	T16 x 5.0 MT	0.333 in.	Dunlop D427 180/70B16 77H
17 in. - Rear	T17 x 4.5 MT	0.327 in.	Dunlop K591 160/70B17 73V

Table 2-5. Tire Fitment - Tube Type Steel Laced Wheels

Wheel Size & Position	Rim Size & Contour	Tube Size Center Valve Tube	Tire Size
19 in. - Front	19M/C x MT2.5 T	MJ/MM90-19 100/90-19	Dunlop D401F 100/90-19 57H
21 in. - Front	21 M/C x MT2.15 T	MH90x21	Dunlop D402F MH90-21 54H
17 in. - Rear	17M/C x MT4.5 T	150-160/70-17	Dunlop K591 160/70B17 73V

Table 2-6. Tire Fitment - Tube Type Chrome Aluminum Profile Laced Wheels

Wheel Size & Position	Rim Size & Contour	Tube Size Center Valve Tube	Tire Size
19 in. - Front	T19 x 2.50 TLA	MJ/MM90-19 100/90-19	Dunlop D401F 100/90-19 57H
21 in. - Front	T21 x 2.15 TLA	MH90x21	Dunlop D402F MH90-21 54H
17 in. - Rear	17M/C x MT4.5 T	150-160/70-17	Dunlop K591 160/70B17 73V

Table 2-7. Tire Pressures: 2008 Dyna Models

MODEL	LOAD	TIRE PRESSURE (COLD)			
		FRONT		REAR	
		PSI	kPa	PSI	kPa
All models except FXDF	Solo rider	30	206	36	248
	Rider and passenger	30	206	40	275
FXDF	Solo rider	36	248	36	248
	Rider and passenger	36	248	40	275

GENERAL

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

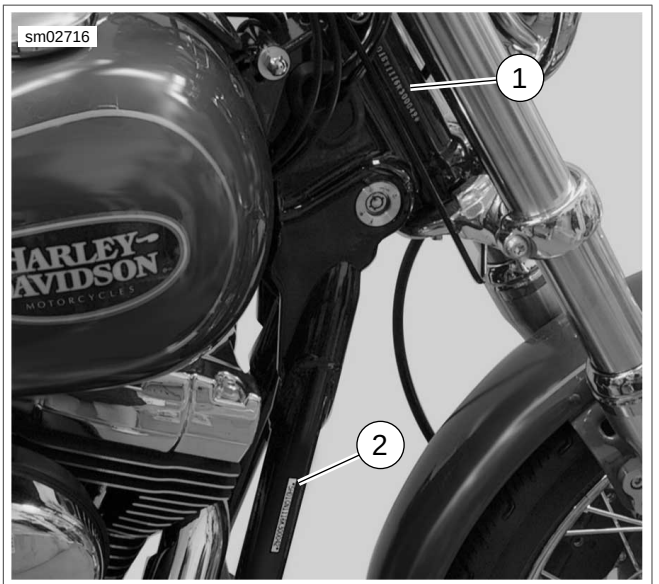
An abbreviated V.I.N. is stamped on the left side crankcase at the base between the cylinders.

Sample V.I.N. as it appears on the steering head - **1HD1GN4178K111000**

Sample abbreviated V.I.N. as it appears on the left crankcase **GP48300000**

NOTE

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



1. **Stamping**
2. **Label**

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

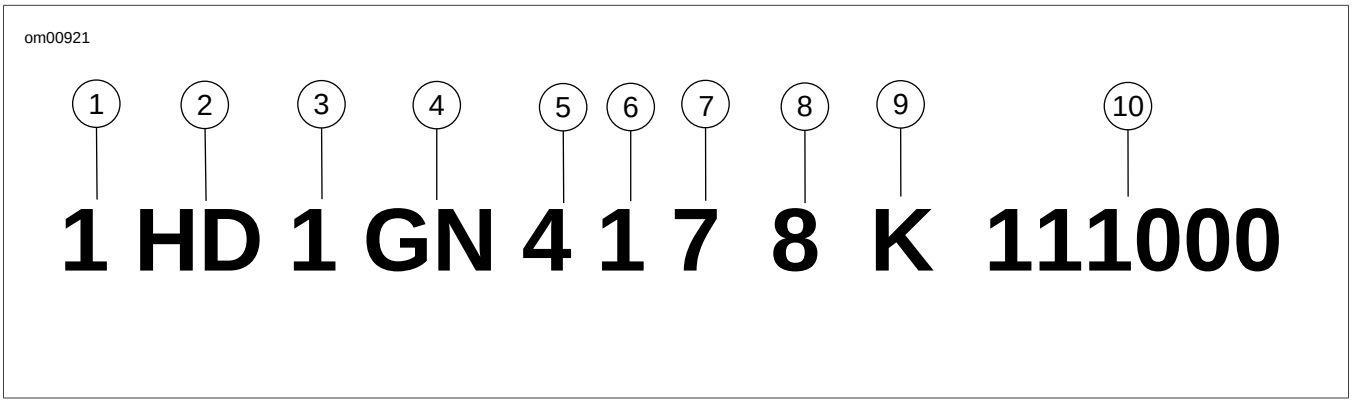


Figure 2-2. Typical Harley-Davidson V.I.N.: 2008 Dyna Models

Table 2-8. Harley-Davidson 2008 Dyna Model V.I.N. Description

ITEM	DESCRIPTION	POSSIBLE VALUES
1	Market designation	1=Originally manufactured for sale **within** the United States 5=Originally manufactured for sale **outside** of the United States
2	Manufacturer and make	HD=Harley-Davidson
3	Motorcycle type	1=Heavyweight motorcycle 901 cc and larger
4	Model	See model V.I.N. table
5	Engine type	4=Twin cam 96, 1584cc air cooled, fuel injected
6	Introduction date	1=Regular 2=Mid-year 3=California/regular 4=Cosmetic changes and/or special introductory date 5=California/cosmetic changes and/or special introductory date 6=California/mid-year
7	V.I.N. check digit	Can be 0-9 or X

Table 2-8. Harley-Davidson 2008 Dyna Model V.I.N. Description

ITEM	DESCRIPTION	POSSIBLE VALUES
8	Model year	8=2008
9	Plant of manufacture	K=Kansas City, MO., U.S.A.
10	Sequential number (last 6 digits)	varies

Table 2-9. V.I.N. Model Codes: 2008 Dyna Models

CODE	MODEL	CODE	MODEL
GM	FXD Dyna Super Glide®	GP	FXDWG Wide Glide® 105th Anniversary
GV	FXDC Dyna Super Glide Custom®	GX	FXDB Street Bob™
GN	FXDL Dyna Low Rider®	GY	FXDF Fat Bob™

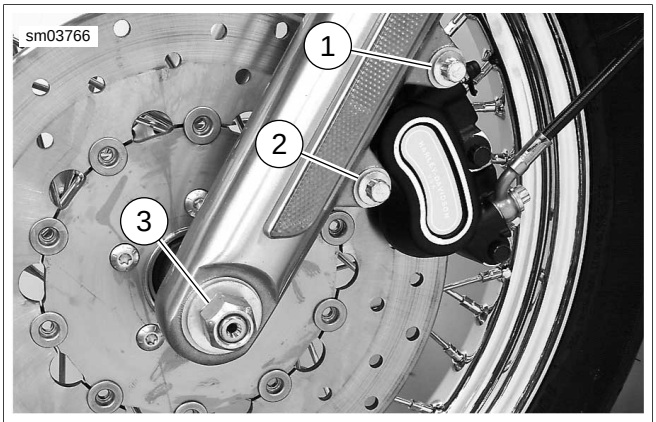
REMOVAL

1. Block motorcycle underneath frame so front wheel is raised off the ground.
2. Inspect wheel bearing end play and service bearings if necessary. See 2.5 SEALED WHEEL BEARINGS.
3. See Figure 2-3. Remove mounting bolts (1, 2) and remove brake caliper. Support caliper using a rubber bungee cord.

NOTE

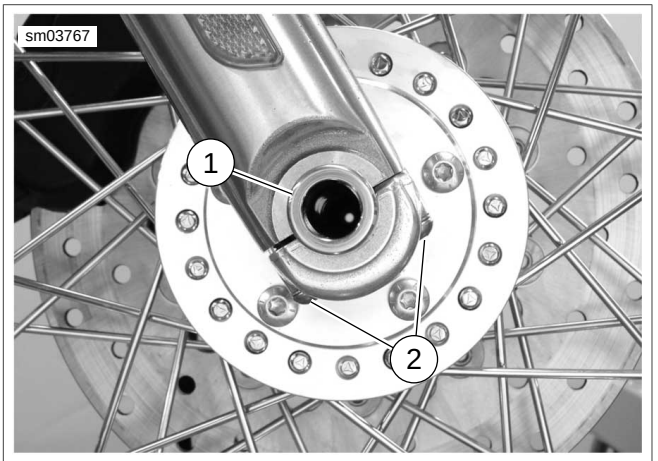
Do not operate front brake lever with the front wheel removed or the caliper piston may be forced out of piston bore. Reseating the piston requires disassembly of the caliper.

4. Remove axle nut and washer (3).
5. See Figure 2-4. Loosen the slider cap screws (2) and pull the axle (1) free.
6. Remove wheel from forks.



1. Long mounting bolt
2. Short mounting bolt
3. Axle nut and washer

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



1. Axle
2. Slider cap screws and washers

Figure 2-4. Front Wheel Mounting (Right Side)

DISASSEMBLY

NOTE

To service tire or valve stem assembly, see 2.16 TIRES.

Cast Wheel

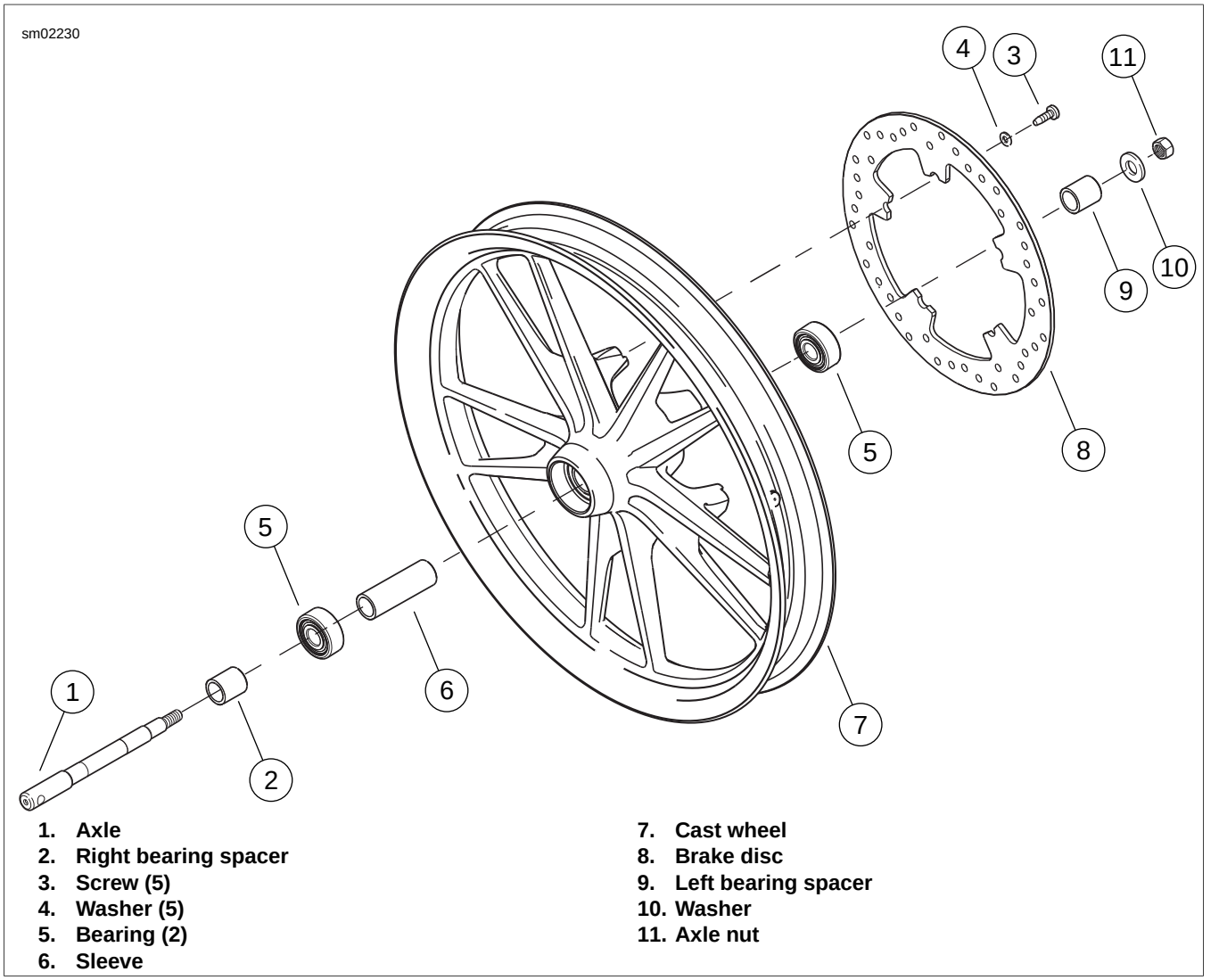
1. See Figure 2-5. Remove spacers (2, 9) from left and right sides.
2. If necessary, remove brake disc (8). On left side of wheel, remove five screws (3) and washers (4) to detach brake disc (8). Discard screws.

Cast Wheel, Dual Brakes

1. See Figure 2-6. Remove spacers (2, 9) from left and right sides.
2. If necessary, remove brake discs (8). Remove five screws (3) to detach each brake disc (8). Discard screws.

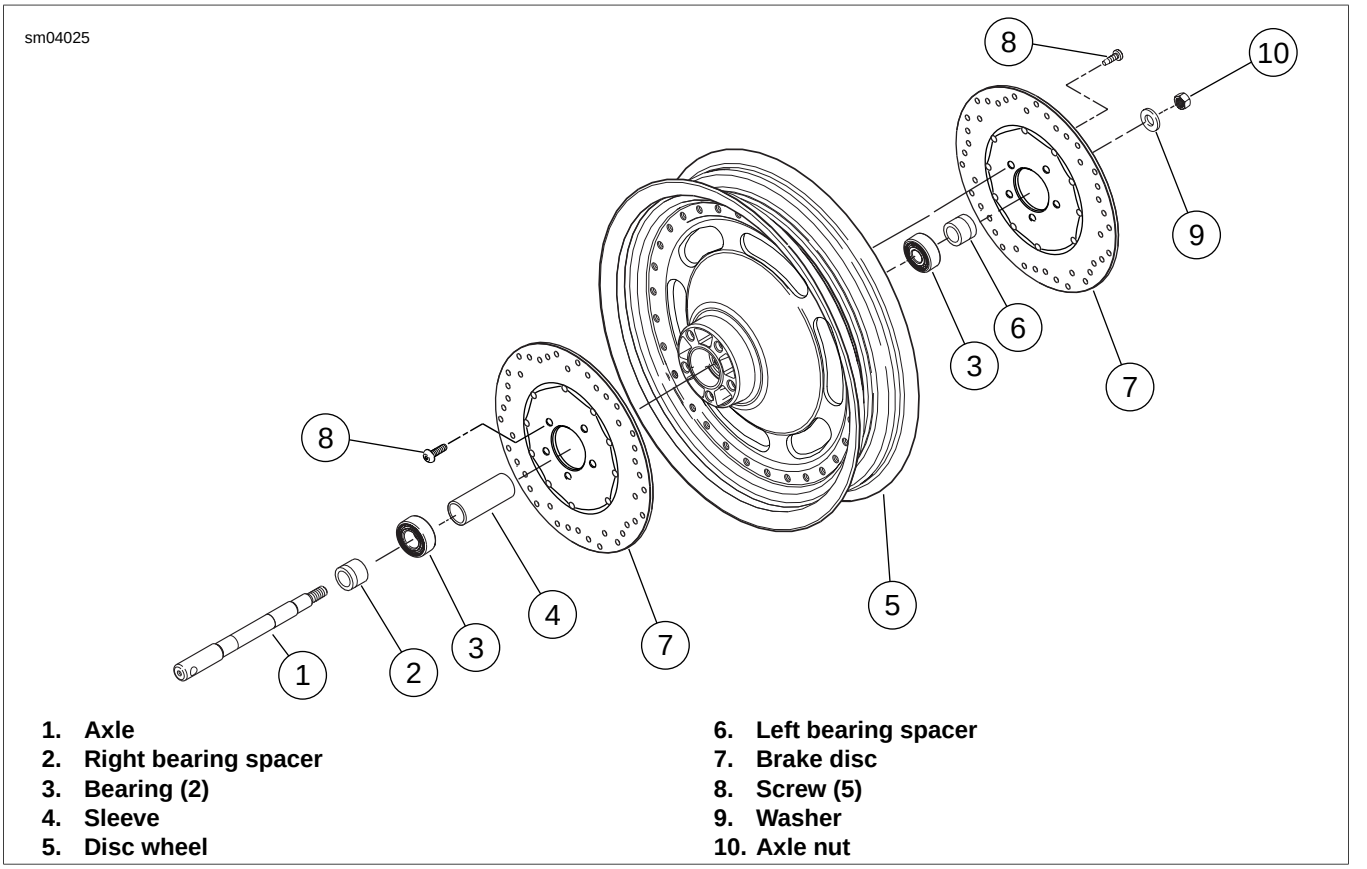
Laced Wheel

1. See Figure 2-7. Remove spacers (2, 9) from left and right sides.
2. If necessary, remove brake disc(s) (8). On left side of wheel, remove five screws (3) to detach brake disc (8). Discard screws.



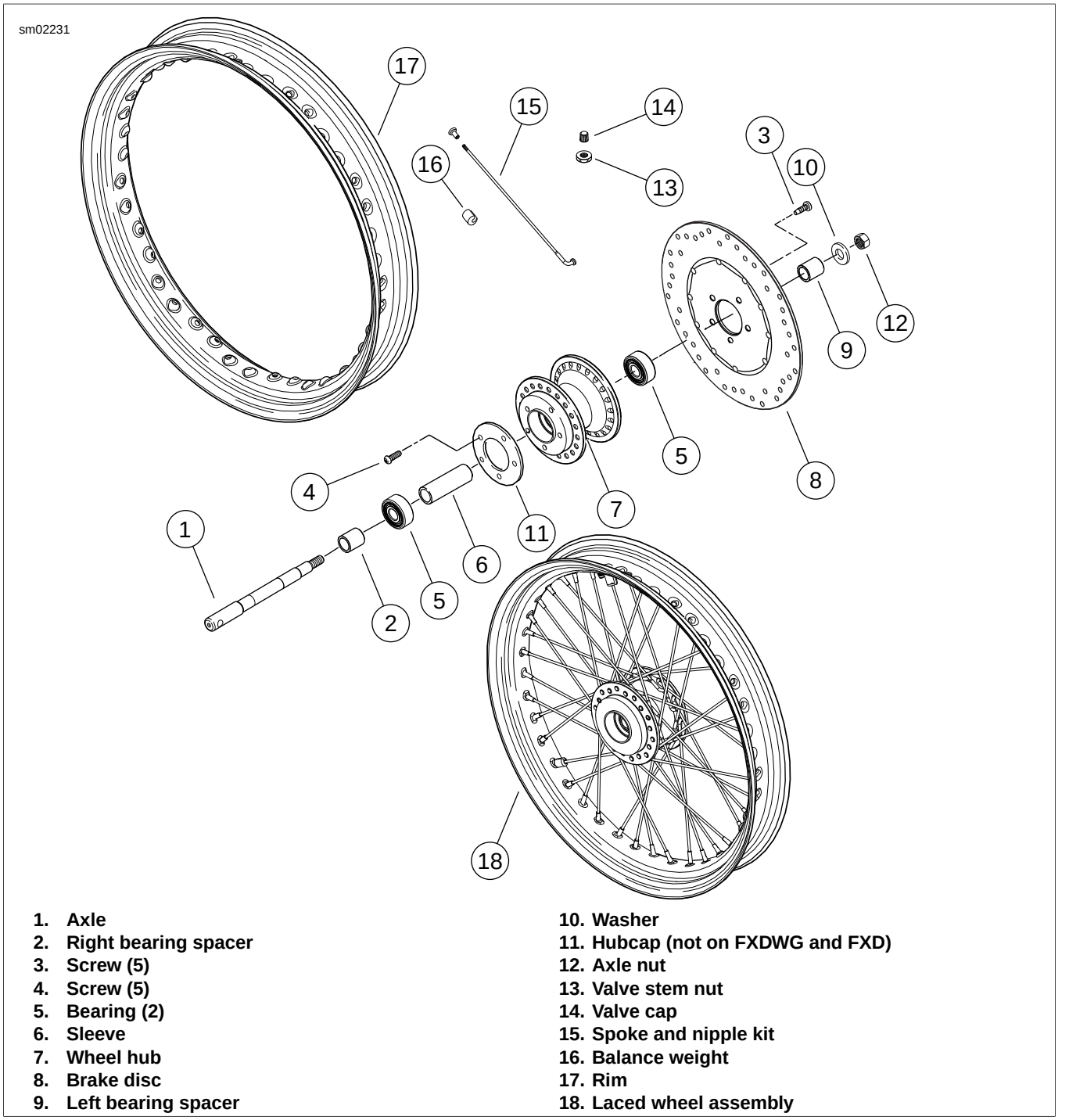
1. **Axle**
2. **Right bearing spacer**
3. **Screw (5)**
4. **Washer (5)**
5. **Bearing (2)**
6. **Sleeve**
7. **Cast wheel**
8. **Brake disc**
9. **Left bearing spacer**
10. **Washer**
11. **Axle nut**

Figure 2-5. Cast Front Wheel



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

Figure 2-6. Cast Front Wheel Components (FXDF)



1. **Axle**
2. **Right bearing spacer**
3. **Screw (5)**
4. **Screw (5)**
5. **Bearing (2)**
6. **Sleeve**
7. **Wheel hub**
8. **Brake disc**
9. **Left bearing spacer**
10. **Washer**
11. **Hubcap (not on FXDWG and FXD)**
12. **Axle nut**
13. **Valve stem nut**
14. **Valve cap**
15. **Spoke and nipple kit**
16. **Balance weight**
17. **Rim**
18. **Laced wheel assembly**

Figure 2-7. Laced Front Wheel

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear.
2. Inspect brake rotor and pads. See 1.16 BRAKE PADS AND DISCS.

ASSEMBLY

⚠WARNING

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

CAUTION

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

Cast Wheel

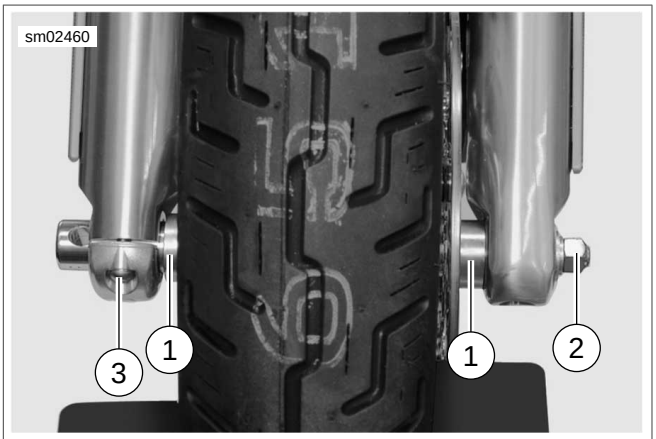
1. See Figure 2-5. If necessary, install brake disc (8). Verify that brake disc is clean.
2. On left side of wheel, install five **new** screws (3) and washers (4) to attach brake disc (8). Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
3. FXDF: Install second disc on right side of wheel. Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
4. Install spacers (2, 9) with largest chamfered end facing away from wheel.
5. Verify that wheel and tire are true. See 2.10 CHECKING CAST WHEEL RUNOUT.

Laced Wheel

1. If hub and rim were disassembled, see 2.7 WHEEL LACING: 19 INCH RIM or 2.8 WHEEL LACING: 21 INCH RIM.
2. See Figure 2-7. If necessary, install brake disc (8). Verify that brake disc is clean.
3. On left side of wheel, install five **new** screws (3) and washers (4) to attach brake disc (8). Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
4. Install spacers (2, 9) with largest chamfered end facing away from wheel.
5. Verify that wheel and tire are true. See 2.9 TRUING LACED WHEELS.

INSTALLATION

1. Apply a light coat of LOCTITE ANTI-SEIZE LUBRICANT to the axle, bearing bores, and the bore of the inner sleeve.
2. See Figure 2-8. Place wheel into front fork and install axle. Verify that axle spacers (1) on right and left side are properly installed.
3. See Figure 2-9. Install slider cap with cast-in spacer (1) toward the rear of the vehicle. Do not tighten fasteners at this time.
4. Install the washer, lockwasher, and axle nut. Tighten axle nut to 60-65 ft-lbs (81.3-88.1 Nm). Hold axle stationary with a steel rod or screwdriver inserted through hole on right end of axle while tightening.
5. Tighten rear axle cap fastener (2) to 10-14 ft-lbs (13.6-19.0 Nm), then tighten front axle cap fastener (3) to 10-14 ft-lbs (13.6-19.0 Nm).



1. **Spacer (2)**
2. **Axle nut, lockwasher and washer**
3. **Slider cap fasteners**

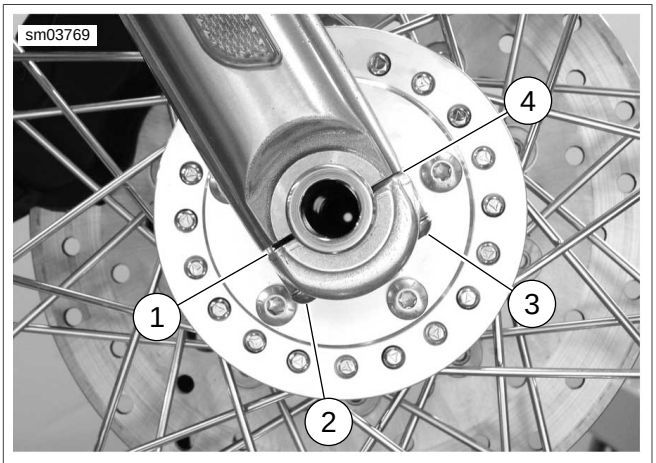
Figure 2-8. Front Axle Assembly

6. See Figure 2-3. Install the brake caliper to the fork legs.
   a. Loosely install long mounting bolt (1) (metric) into top hole on fork leg.
   b. Install short mounting bolt (2) (metric) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   c. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).

WARNING

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

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



1. **Cast in spacer**
2. **Rear axle cap fastener**
3. **Front axle cap fastener**
4. **Gap**

Figure 2-9. Axle Cap Installation

REMOVAL

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
2. Remove three screws to detach the debris deflector from rear fork. See 2.20 DEBRIS DEFLECTOR.
3. Inspect wheel bearing end play and service bearings if necessary. See 2.5 SEALED WHEEL BEARINGS.
4. See Figure 2-10. Remove retaining ring (3), axle nut (2), and washer from left side of axle.
5. Loosen adjuster on each side several turns to remove belt tension.
6. See Figure 2-11. Loosen, but do not remove, left and right **upper** mounting nuts (1).
7. Remove left and right **lower** shock mounting screws (2).
8. Allow rear fork and wheel to lower.
9. Remove belt guard. See 2.19 BELT GUARD.
10. Pry brake pads away from rotor and remove retaining pin and brake pads. See 1.16 BRAKE PADS AND DISCS.

NOTE

Caliper to rear wheel clearance is minimal. To prevent damage to surfaces, be careful when removing caliper from rear fork.

11. Remove caliper assembly from caliper mount. Support caliper with an elastic cord. See 2.15 REAR BRAKE CALIPER.

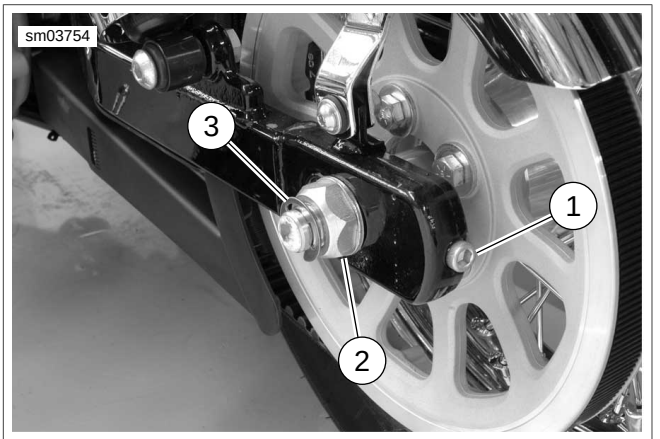
NOTE

Spacer and caliper mount may fall out when axle is removed.

12. Remove axle from wheel.
13. Move wheel forward and slip belt off sprocket.
14. Pull wheel and belt sprocket from rear fork.

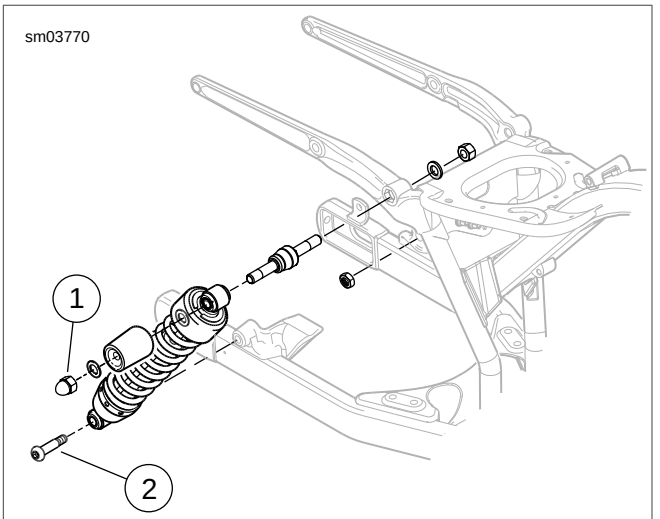
NOTE

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



1. **Axle adjuster**
2. **Axle nut**
3. **Retaining ring**

Figure 2-10. Axle Adjusters (Left Side Shown)



1. **Upper mounting nut (2)**
2. **Lower mounting screw (2)**

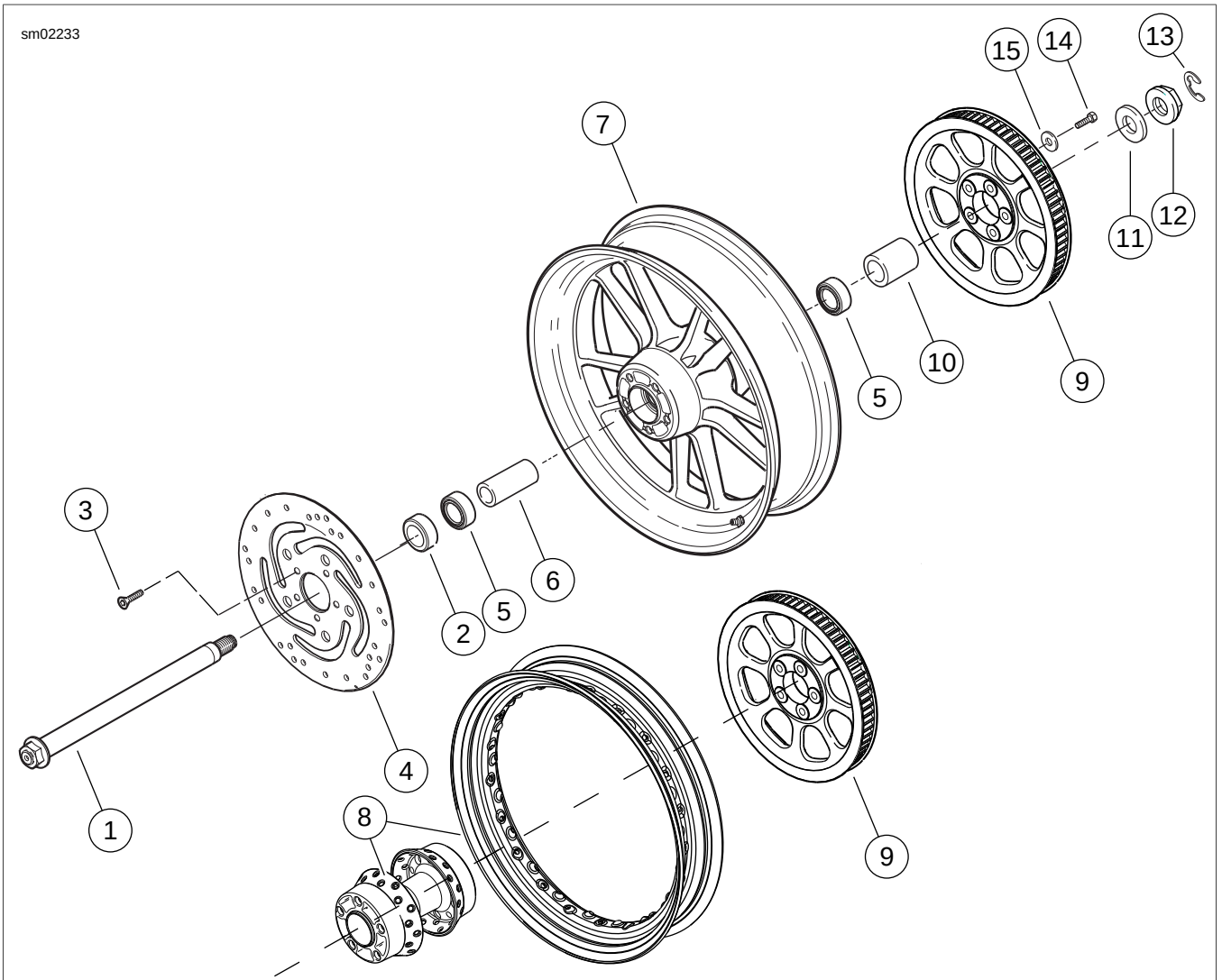
Figure 2-11. Rear Shock Mount

DISASSEMBLY

NOTE

With the exception of the sprocket cover, component parts for cast and laced rear wheels are identical.

1. See Figure 2-12. Remove spacers (2, 10) from left and right sides.
2. If necessary, remove brake disc and/or rear sprocket.
   a. On left side of wheel, remove five screws (14) and washers (15) to detach rear sprocket (9). Discard screws.
   b. On right side of wheel, remove five screws (3) to remove rear brake disc (4).Discard screws.



1. **Axle**
2. **Right bearing spacer**
3. **Screw (5)**
4. **Rear brake disc**
5. **Bearing (2)**
6. **Sleeve**
7. **Cast wheel**
8. **Laced wheel hub and rim**
9. **Rear sprocket**
10. **Left bearing spacer**
11. **Washer**
12. **Axle nut**
13. **Retaining ring**
14. **Screw (5)**
15. **Washer (5)**

Figure 2-12. Rear Wheel/Hub

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear.
2. Inspect brake rotor and pads. See 1.16 BRAKE PADS AND DISCS.
3. Inspect rear belt and sprocket. See 1.12 REAR BELT AND SPROCKETS.

ASSEMBLY

CAUTION

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

1. If hub and rim were disassembled, see 2.6 WHEEL LACING: 17 INCH RIM.
2. See Figure 2-12. Using **new** screws (3), install brake disc (4) on valve stem side of wheel if removed.
3. Tighten screws to 30-45 ft-lbs (40.7-61.0 Nm).
4. Using **new** screws (14), install belt sprocket (9) if removed.
5. Tighten screws to 55-65 ft-lbs (74.6-88.1 Nm).
6. Install spacers (2, 10) into hub with largest chamfered end facing away from wheel.

7. Verify that wheel and tire are true.
   a. For laced wheels, see 2.9 TRUING LACED WHEELS.
   b. For cast wheels, see 2.10 CHECKING CAST WHEEL RUNOUT.

INSTALLATION

1. Apply a light coat of LOCTITE ANTI-SEIZE LUBRICANT to the axle, bearing bores, and the bore of the inner sleeve.
2. Roll wheel into rear fork and position brake caliper mount between wheel and fork. Ensure notch in caliper mount is engaged with tab on fork.
3. Slide drive belt over drive sprocket. Make sure brake disc is centered between brake pads.
4. Install axle:
   a. From right side, carefully insert axle through right rear fork and rear caliper bracket.
   b. Continue sliding axle through wheel hub sleeve, sprocket, left side spacer and left rear fork.

NOTE

Caliper to rear wheel clearance is minimal. To prevent damage to surfaces, be careful when installing caliper.

5. Install caliper assembly to rear fork. See 2.15 REAR BRAKE CALIPER.
6. Install brake pads and retaining pin. See 1.16 BRAKE PADS AND DISCS.
7. See Figure 2-11. Attach rear shocks.
   a. Apply two or three drops of LOCTITE THREADLOCKER 243 (blue) to threads of lower shock mounting screws (2).
   b. Lift rear fork and install both shock absorbers with lower shock mounting screws (2).
   c. Tighten upper shock nuts to 30-40 ft-lbs (40.7-54.2 Nm).
   d. Tighten lower shock fasteners to 30-40 ft-lbs (40.7-54.2 Nm).

⚠WARNING

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

⚠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)

8. See Figure 2-10. Install washer and axle nut (2) on left side of axle.
   a. Tighten axle nut to 95-105 ft-lbs (128.8-142.4 Nm).
   b. Install retaining ring (1).
9. Install debris deflector using three screws. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). See 2.20 DEBRIS DEFLECTOR.
10. Install belt guard. See 2.19 BELT GUARD.

⚠WARNING

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

11. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
12. Verify correct axle alignment. See 2.11 VEHICLE ALIGNMENT.
13. Check belt deflection. See 1.13 REAR BELT DEFLECTION.

INSPECTION

1. Block motorcycle underneath frame so wheel is raised off the ground.
2. Turn the wheel through several rotations.
3. See Figure 2-13. Mount a magnetic base dial indicator to the brake disc with the dial's contact point on the end of the axle.
4. Move the wheel side to side to check bearing end play.
   a. If the end play is less than the service wear limit of 0.002 in. (0.051 mm), bearing passes inspection.
   b. If end play exceeds service wear limit or feels rough, remove wheel and replace both wheel bearings.

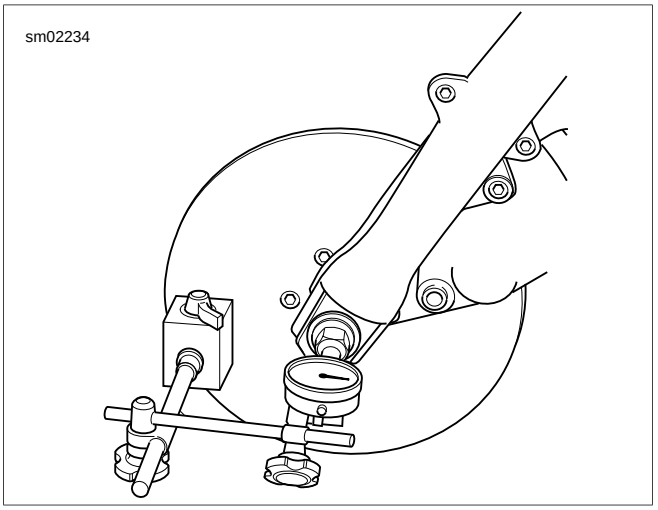


Figure 2-13. Wheel Bearing Inspection (Front Wheel Shown)

REMOVAL

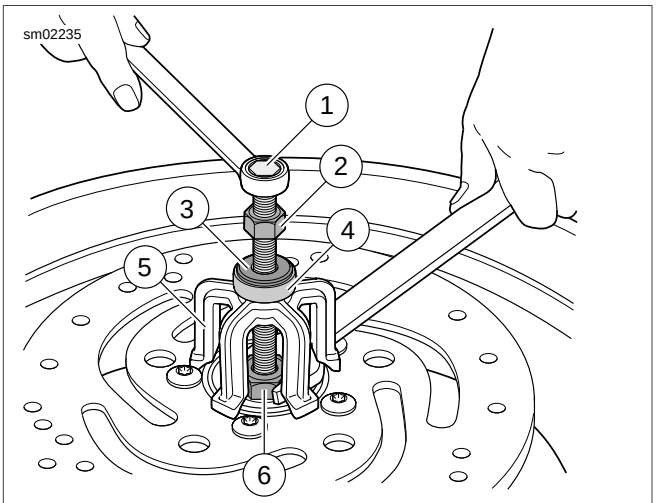
PART NUMBER	TOOL NAME
HD-44060-10	25 MM COLLET
HD-44060A	WHEEL BEARING INSTALLER/REMOVER

1. Remove wheel from motorcycle. See 2.3 FRONT WHEEL.
2. If present, remove hub plate from wheel on opposite side of front brake disc.

NOTE

See Figure 2-15. Some wheel hubs may not provide adequate support for the puller bridge. In these cases center a used brake disc over the hub to support the puller bridge while removing the bearings.

3. See Figure 2-14. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060A) and assemble using 25 MM COLLET (Part No. HD-44060-10) (10).
   a. Sparingly apply graphite lubricant to threads of forcing screw (1) to prolong service life and ensure smooth operation.
   b. Install nut (2), washer (3) and Nice bearing (4) on screw. Insert assembly through hole in bridge (5).
   c. Drop ball bearing inside 25 mm collet (6). Fasten collet and ball bearing to forcing screw.
4. Hold end of forcing screw and turn collet to expand edges of collet.
5. See Figure 2-16. When expanded collet has gripped bearing edges, hold end of forcing screw and turn the nut to remove bearing from wheel.
6. Remove spacer from inside wheel hub.
7. Repeat procedure for opposite side bearing. Discard all bearings upon removal.



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

Figure 2-14. Removal Tool

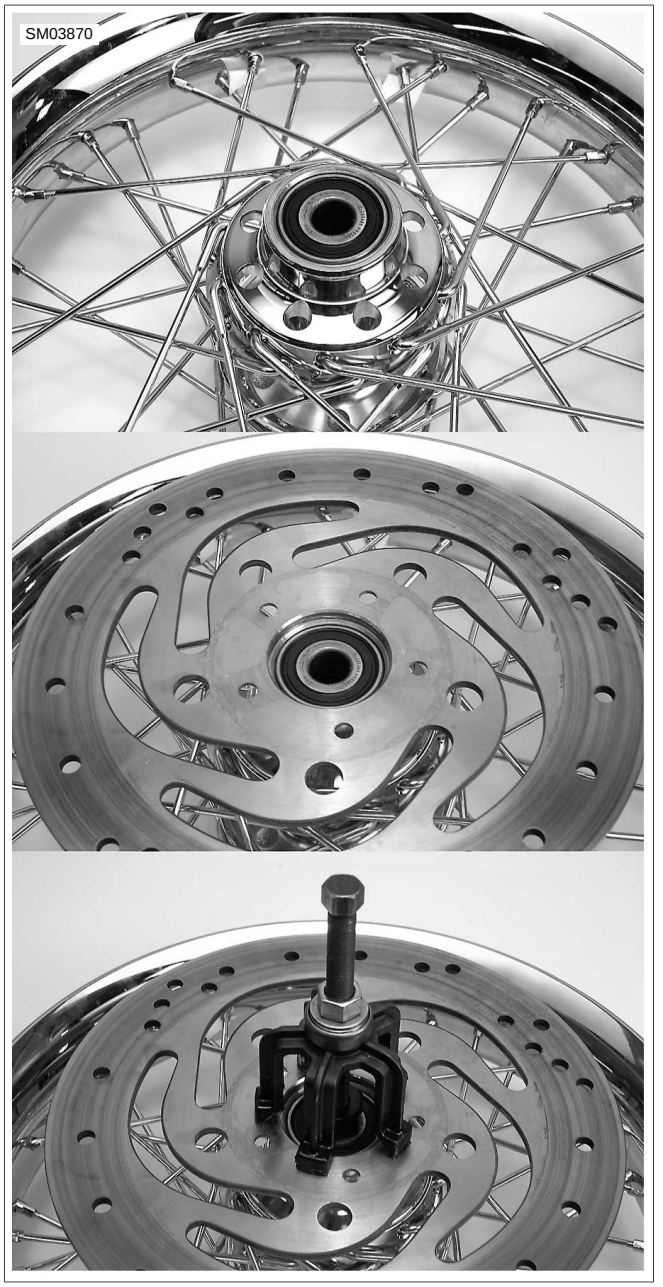
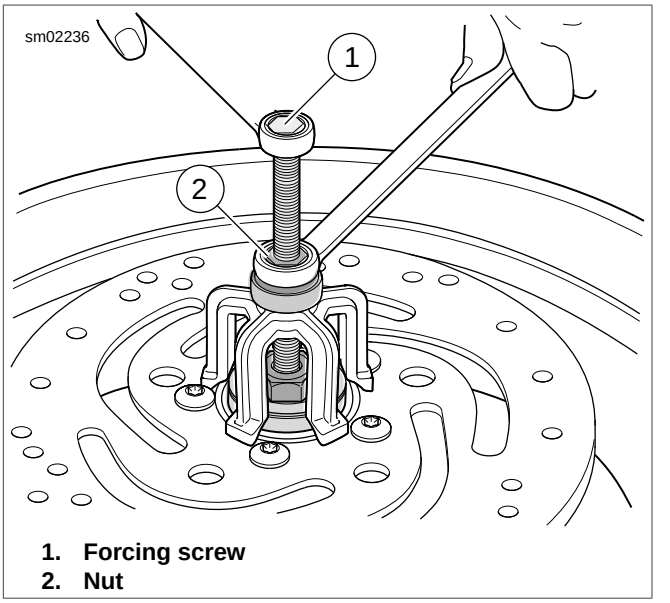


Figure 2-15. Brake Disk as Puller Aid



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

Figure 2-16. Remove Bearing

INSTALLATION

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

NOTE

Always install first bearing on primary brake disc side. If front wheel has two brake discs, install bearing on the left side first.

1. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060) and assemble.
   a. Sparingly apply graphite lubricant to threads of threaded rod to prolong service life and ensure smooth operation.
   b. See Figure 2-17. Place threaded rod through support plate. Insert assembly through wheel.
   c. See Figure 2-18. Place the **new** bearing (6) on rod (1) with lettered side facing away from wheel centerline.
   d. Install pilot (5), Nice bearing (4), washer (3) and nut (2) over rod.
2. Hold hex end of threaded rod (1) and turn nut (2) to install bearing (6). Bearing will be fully seated when nut can no longer be turned. Remove tool.
3. Install spacer inside wheel hub.
4. Reverse tool and install opposite side bearing.

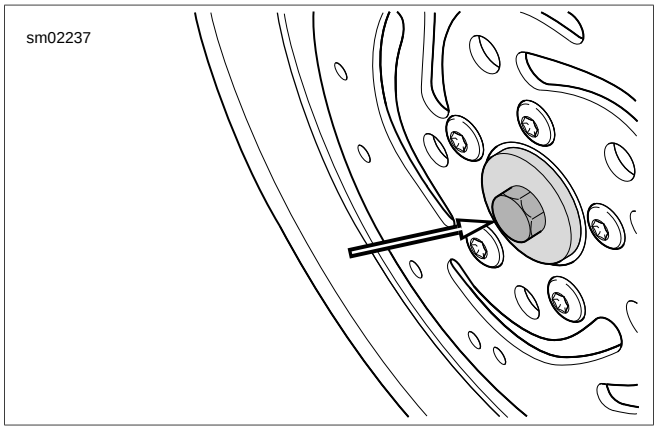
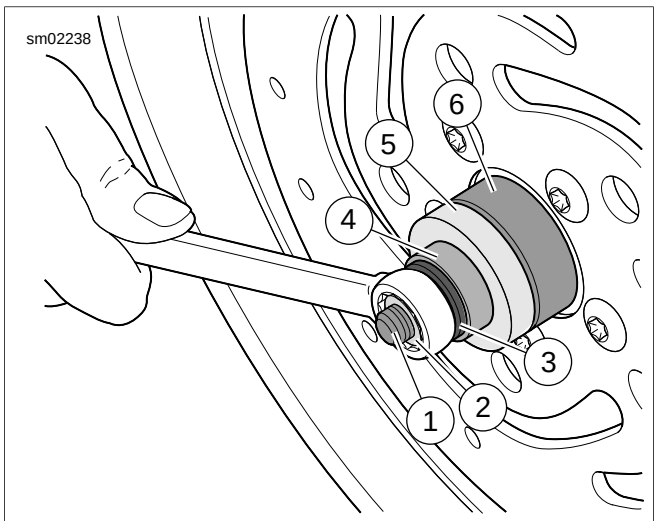
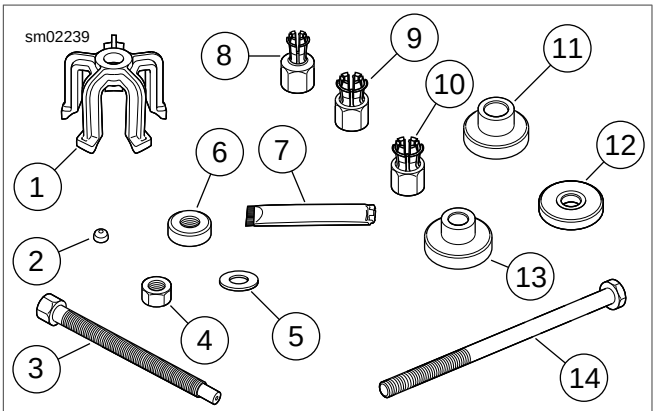


Figure 2-17. Installation Tool Support Plate



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

Figure 2-18. Installing Bearing



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

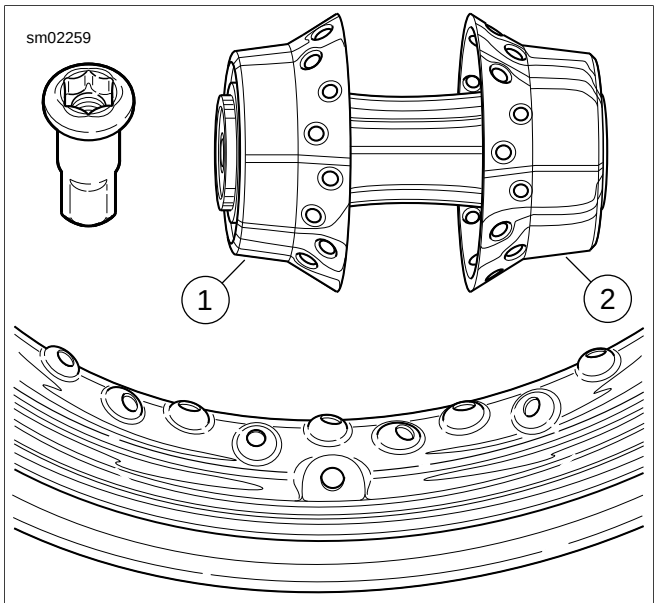
Figure 2-19. Wheel Bearing Installer/Remover Components

NOTES

- *Parts 1-7 are common to removal and installation.*
- *Parts 8-9 are used for removal only.*
- *Parts 10-13 are used for installation only.*

GENERAL

If only rim is to be replaced, tape spokes together to hold position on hub and remove spokes from rim. Install taped hub/spoke assembly to new rim and tighten spokes. Then remove tape and true wheels.



1. **Narrow flange (brake side)**
2. **Wide flange (sprocket side)**

Figure 2-20. Rim, Hub and Spoke Nipple

PROCEDURE

Hub: Brake Disc Flange Up

1. See Figure 2-21. Place the hub on table with brake disc side (narrow flange) up. Insert a spoke in each hole of the **lower** row. Angle spokes clockwise.
2. Center the rim over the hub assembly with the valve stem hole facing upward.
3. See Figure 2-22. Using any **lower** row spoke, place the first spoke into the rim hole to the left of the valve stem hole on the upper half of the rim centerline.
4. See Figure 2-23. Install the rest of lower row spokes in every fourth hole.
5. See Figure 2-24. Place the first **upper** row spoke into the hub as shown below. Angle the spoke counterclockwise crossing four lower row spokes. The spoke must enter the hole to the left of the valve stem hole.
6. See Figure 2-25. Install the remaining nine upper row spokes into every fourth remaining hole above the rim centerline.

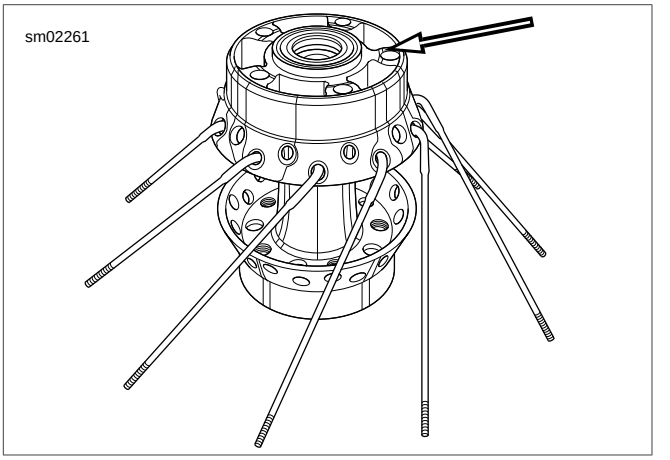


Figure 2-21. Hub: Brake Side (Narrow Flange) Up

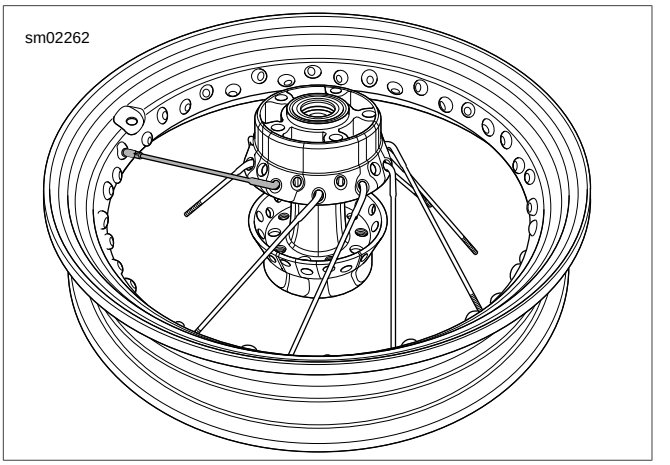


Figure 2-22. Brake Side Up: Start First Spoke of Bottom Row

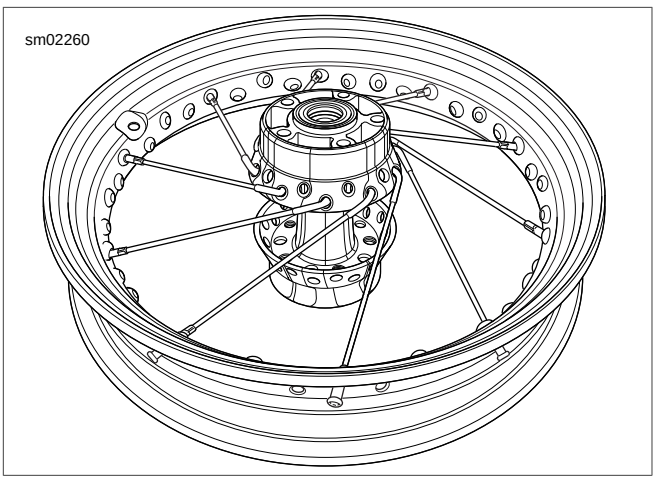


Figure 2-23. Brake Side Up: Bottom Row of Spokes Laced

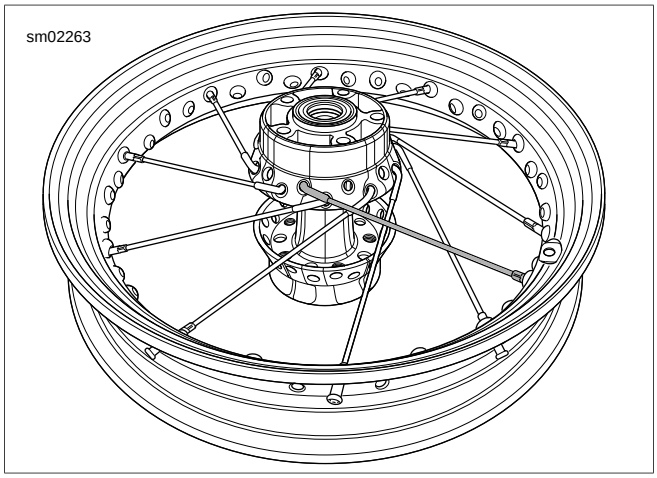


Figure 2-24. Brake Side Up: Start First Spoke of Top Row

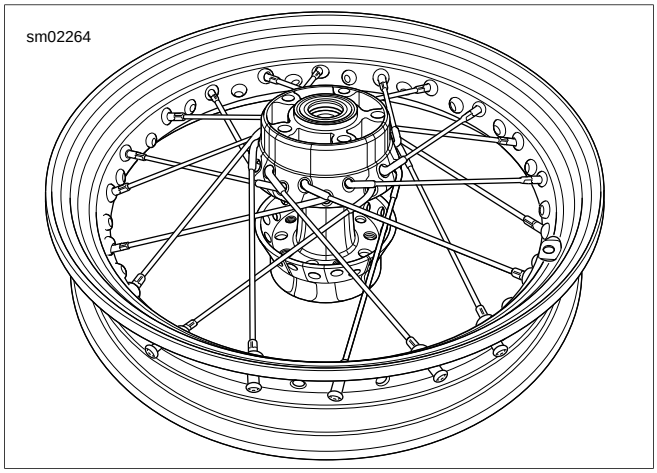


Figure 2-25. Brake Side Up: Top Row of Spokes Laced

Hub: Sprocket Side Up

1. See Figure 2-26. Turn hub and rim over so the sprocket side (wide flange) faces up. Place any **lower** row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.
2. See Figure 2-27. Place the remaining nine lower row spokes, angled clockwise, into hub and rim.
3. See Figure 2-28. Insert any **upper** row spoke into hub and angle spoke counterclockwise. Place spoke into appropriate rim hole.
4. See Figure 2-29. Install remaining nine upper row spokes.
5. Tighten spoke nipples to specification listed in Table 2-10.
6. True wheel. See 2.9 TRUING LACED WHEELS.

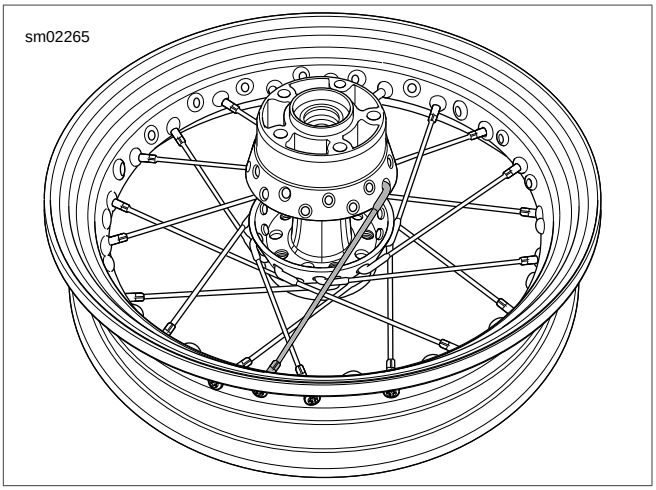


Figure 2-26. Sprocket Side Up: Start First Spoke of Bottom Row

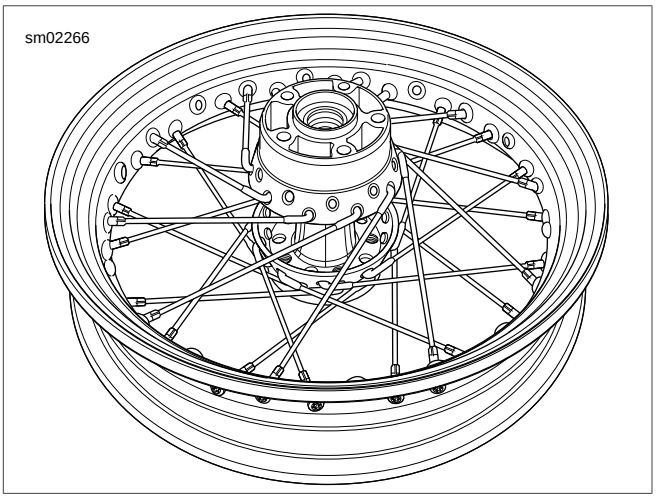


Figure 2-27. Sprocket Side Up: Bottom Row of Spokes Laced

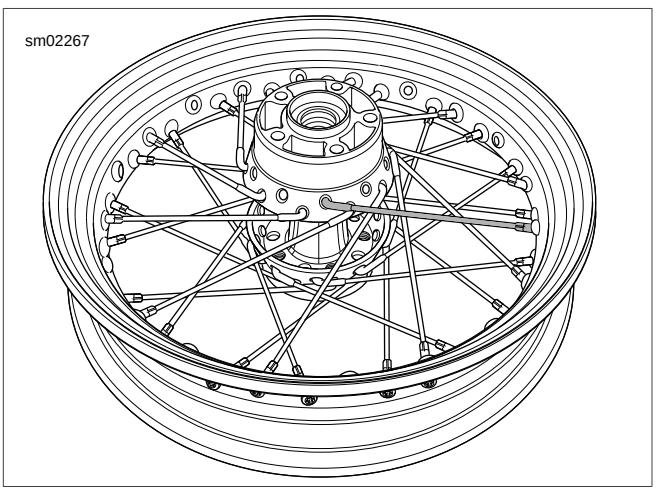


Figure 2-28. Sprocket Side Up: Start First Spoke of Top Row

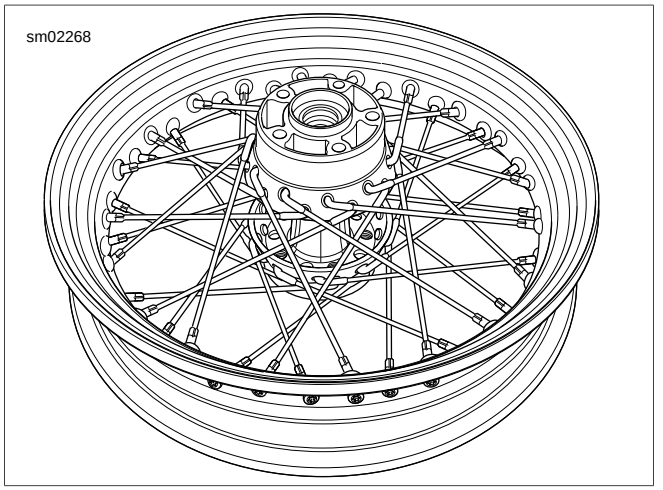


Figure 2-29. Wheel Completely Laced

Table 2-10. Spoke Nipple Torque Specification

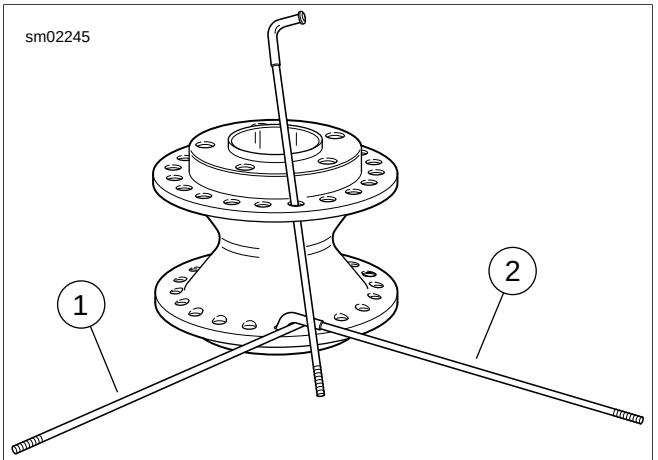
RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

PROCEDURE

NOTE

If only rim is to be replaced, tape spokes together to hold position on hub and remove spokes from rim. Install taped hub/spoke assembly to new rim and tighten spokes. Then remove tape and true wheels.

1. Divide spokes into two groups.
   a. Inner spokes have long heads.
   b. Outer spokes have short heads.
2. Lubricate spoke threads and nipple shoulders with tire mounting lubricant.
3. See Figure 2-30. Place hub on bench with the brake disc side up. On dual-disc wheel hubs, this is the side with the cast recesses between the brake disc bolt holes. Insert one outer spoke (short head) into any bottom flange hole and swing it clockwise. Insert an inner spoke (long head) in the next hole to the left of the outer spoke. Swing the inner spoke counterclockwise over the outer spoke.
4. Find the hole in the upper flange directly above the two spokes just inserted. This hole uses a long head inner spoke. Insert inner spoke into the hole on the upper flange that directly bisects the two spokes in the bottom flange. Insert all remaining spokes in upper flange alternating the inner and outer spokes.
5. After one flange side is completed flip wheel hub upside down and repeat to finish other flange.
6. See Figure 2-31. With all forty spokes inserted in hub, group all spokes on top flange into two bundles. Secure each group with throttle grips to keep the spokes together.



1. Outer spoke (short head)
2. Inner spoke (long head)

Figure 2-30. Lacing 19 Inch Wheel Hub

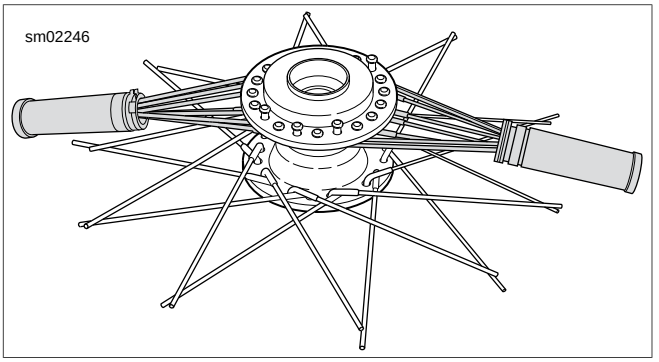


Figure 2-31. Bundling Top Spokes

7. Swing all bottom flange outer spokes (short head) clockwise.
8. Swing the inner spokes (long head) counterclockwise, crossing over the outer spokes (short head).
9. Angle all spokes as far as they will go without overlapping the next LIKE spoke. For instance, swing an inner spoke (long head) counter clockwise across four spokes as far as it will go before crossing another inner spoke (laced in a cross-four pattern).

NOTES

- *All inside spokes lay over all outside spokes.*
- *See Figure 2-32. The valve stem hole is centered of the rim; you do not have to worry about choosing the correct relationship between the rim and the hub.*

10. Center the rim over the hub assembly.

NOTE

It is recommended that you lace the first spoke next to the valve stem hole. When lacing your first spoke, place spoke nipples through several rim holes to determine the correct lacing direction. Only one spoke will fit into the spoke nipple correctly. When connecting the spoke to the spoke nipple, finger tighten two to three threads.

11. Straighten any spokes that were accidentally bumped or moved on the bottom flange.
12. Work with the bottom flange of outer spokes (short head) first.
13. See Figure 2-33. Using the spoke alignment method discussed previously, Locate a hole pointing downward and outward toward the bottom flange of outer spokes (short head).
    a. Verify outer spoke (short head) reaches the spoke nipple and secure spoke loosely by hand. Skip three rim holes and repeat lacing. Follow pattern to complete bottom flange outer spokes (short head).
    b. See Figure 2-34. Once you have completed lacing the bottom row of outer spokes (short head) double check for three empty holes in between each spoke.

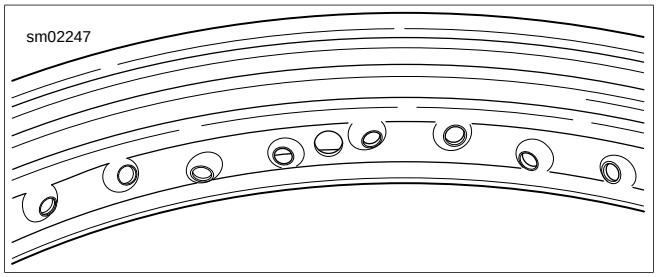


Figure 2-32. Valve Stem Hole Location

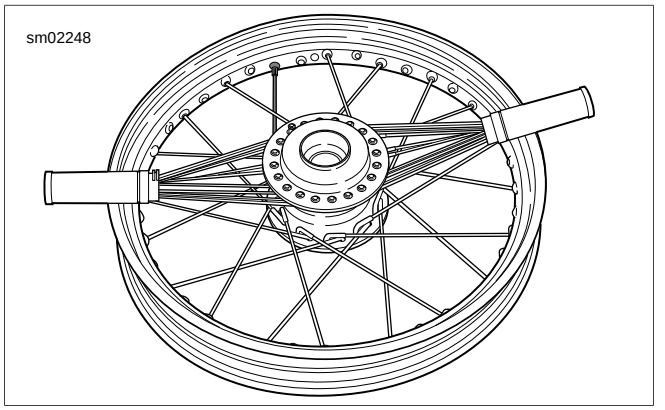


Figure 2-33. Beginning Spoke: Bottom Flange Outer

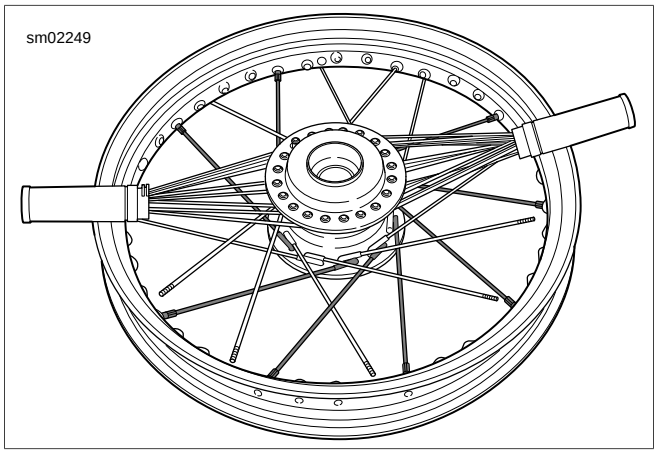


Figure 2-34. Completed Spokes: Bottom Flange Outer

14. Work with bottom flange inner spokes (long head) next. Choose a beginning spoke closest to the valve stem hole.
    a. See Figure 2-35. Each inner spoke (long head) crosses four outer spokes (short head).
    b. See Figure 2-36. Verify inner spoke reaches spoke nipple and secure spoke loosely by hand. Skip every other hole and repeat lacing. Follow pattern to complete bottom row inner spokes (long head).
15. See Figure 2-37. Undo each top bundle and fan the spokes out (in a starburst pattern) around the top rim edge.

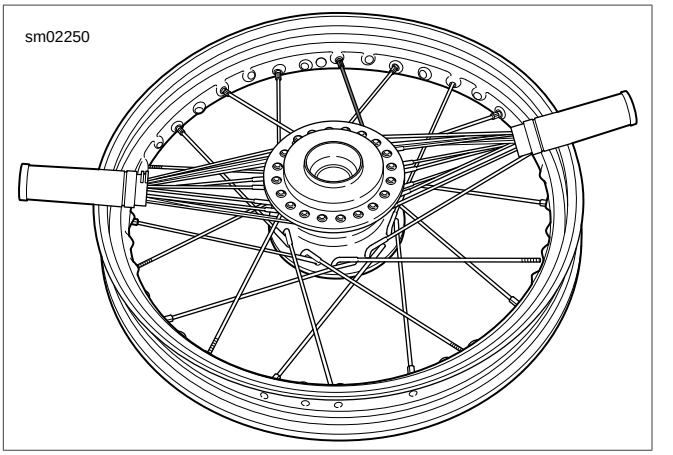


Figure 2-35. Beginning Spoke: Bottom Flange Inner

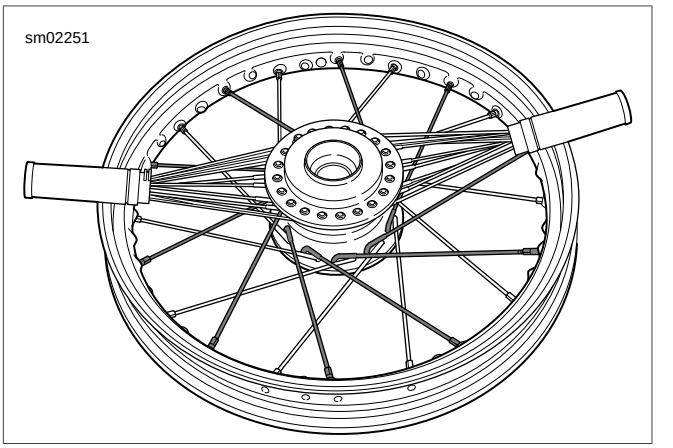


Figure 2-36. Completed Spokes: Bottom Flange Inner

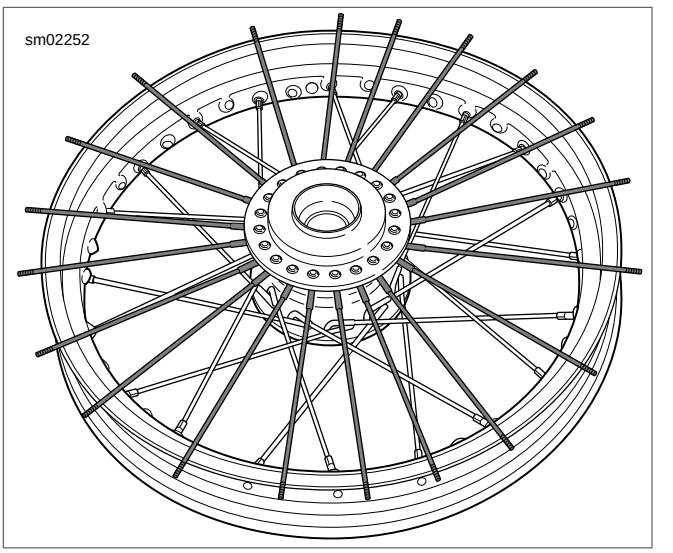


Figure 2-37. Fanning Top Flange Spokes

16. See Figure 2-38. Point all the top flange inner spokes (long head) clockwise one at a time leaving the outer spokes (short head) resting on the rim.

NOTE

Do not knock outer spokes (short head) under inner spokes (long head) or they will be trapped underneath the inner row of spokes.

17. Using the spoke alignment method discussed previously, choose a beginning spoke closest to the valve stem hole. Start with top flange inner spokes (long head) first.
    a. See Figure 2-39. Verify spoke reaches spoke nipple and secure spoke by hand. Follow pattern to complete top flange inner spokes (long head).
    b. See Figure 2-40. Once you have completed the top flange of inner spokes (long head) double check for one empty hole after every third spoke.

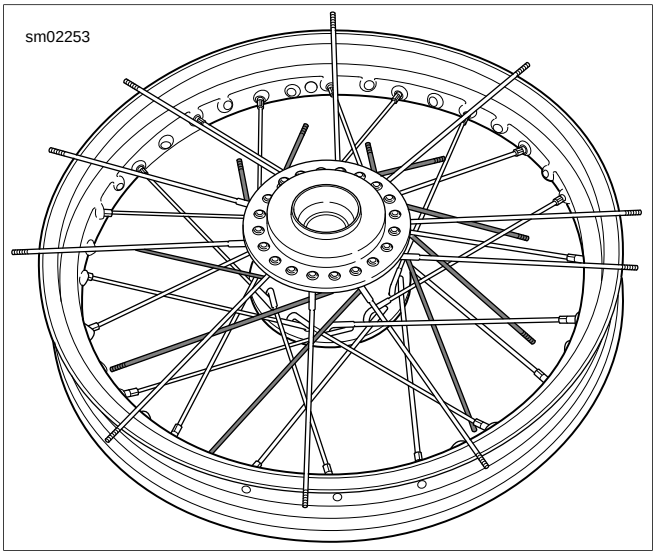


Figure 2-38. Setting Top Flange Inner Spokes

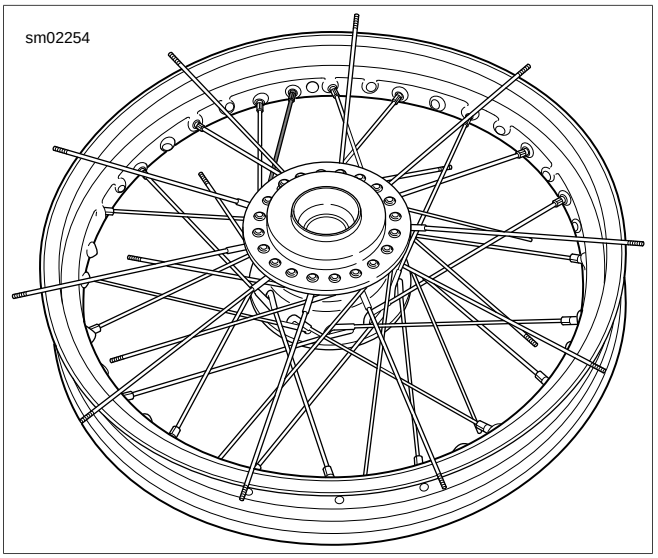


Figure 2-39. Beginning Spoke: Top Flange Inner

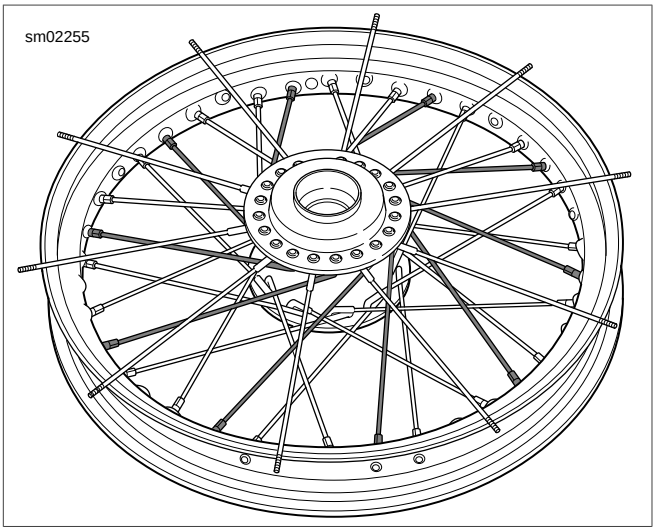


Figure 2-40. Completed Spokes: Top Flange Inner

18. See Figure 2-41. Finish with top flange outer spokes (short head). Point the top flange outer spokes (short head) counterclockwise and make sure each one crosses four inner spokes before securing it to the rim.
19. See Figure 2-42. Verify spoke reaches spoke nipple and secure spoke by hand. Follow pattern to complete top flange outer spokes (short head).
20. Tighten spoke nipples to specification listed in Table 2-11.
21. True the wheel. See 2.9 TRUING LACED WHEELS.

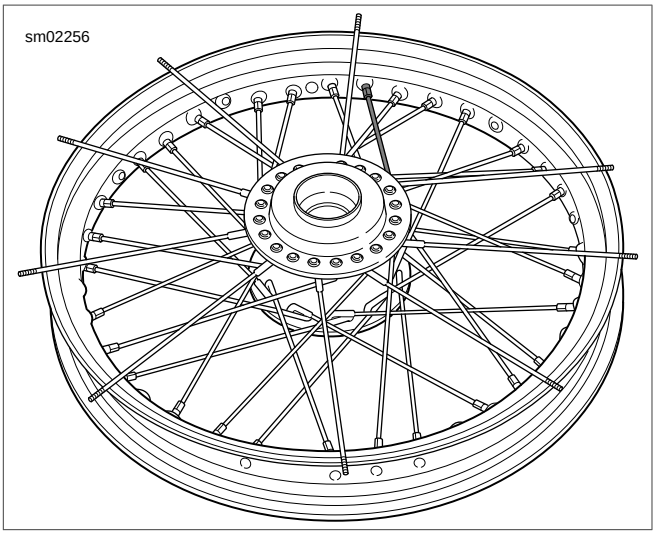


Figure 2-41. Beginning Spoke: Top Flange Outer

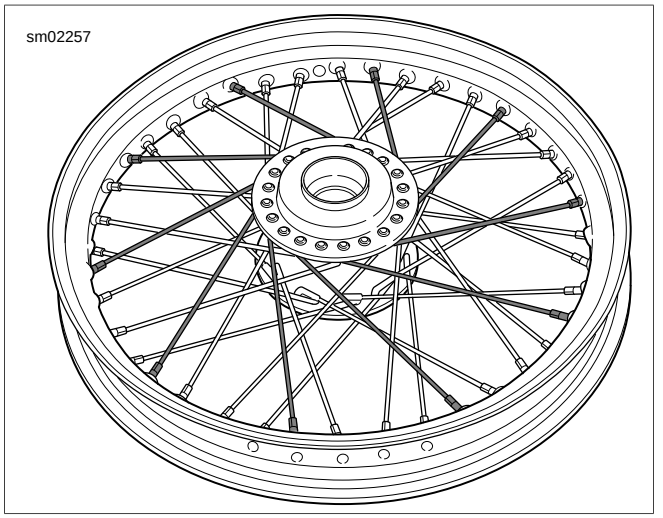


Figure 2-42. Completed Spokes: Top Flange Outer

Table 2-11. Spoke Nipple Torque Specification

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

GENERAL

If only rim is to be replaced, tape spokes together to hold position on hub and remove spokes from rim. Install taped hub/spoke assembly to new rim and tighten spokes. Then remove tape and true wheels.

NOTES

- *Do not install incorrect spokes or spoke nipples on rim. Steel laced rims use zinc plated spokes and spoke nipples. Chrome aluminum profile laced rims use chrome plated spokes and spoke nipples. Using incorrect spokes can result in improper thread engagement which could result in damage to rim, tubes or tire.*
- *Steel laced rims use zinc plated spokes. Chrome aluminum profile laced rims use chrome plated spokes.*

See Figure 2-43. Measure distance "A" to determine spoke length. Refer to Table 2-12 to determine correct spoke length for type of rim used.

Table 2-12. 21 Inch Rim Spoke Length

RIM	SPOKE	IN.	MM
Steel laced	Long head	9.36-9.40	237.7-238.8
	Short head	9.04-9.44	238.8-239.8
Chrome aluminum profile laced	Long head	9.48-9.52	240.8-241.8
	Short head	9.48-9.52	240.8-241.8

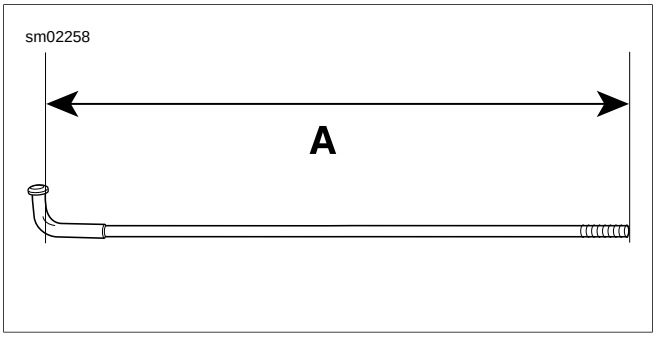


Figure 2-43. Measuring Spoke Length

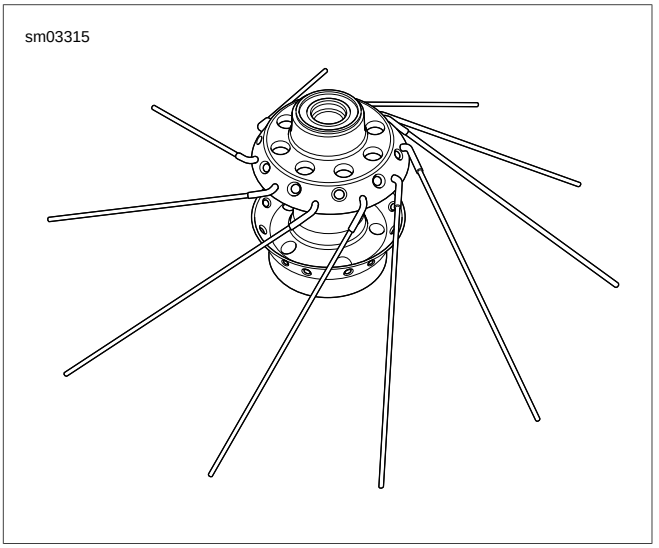


Figure 2-44. Spokes in Lower Row

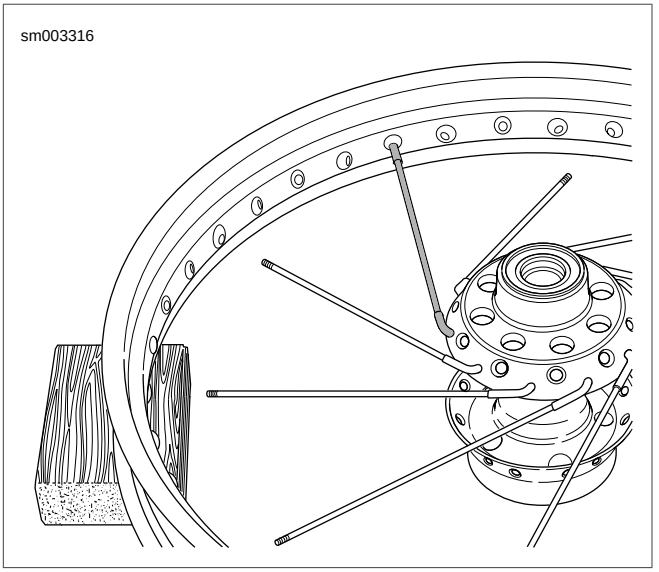


Figure 2-45. Lower Row into Rim

PROCEDURE

1. See Figure 2-44. Place the hub on table with brake disc side (wide flange) down. Insert a spoke in each hole of the **lower** row. Angle spokes clockwise.
2. Center the rim over the hub assembly with the valve stem hole facing upward.
3. See Figure 2-45. Using any **lower** row spoke, place the first spoke into the rim hole, angled to correctly accept the spoke, on the upper half of the rim centerline.
4. See Figure 2-46. Install the rest of lower row spokes in every fourth hole.
5. See Figure 2-47. Place the first **upper** row spoke into the hub as shown below. Angle the spoke counterclockwise crossing four lower row spokes. The spoke must enter the hole to the right of the valve stem hole.

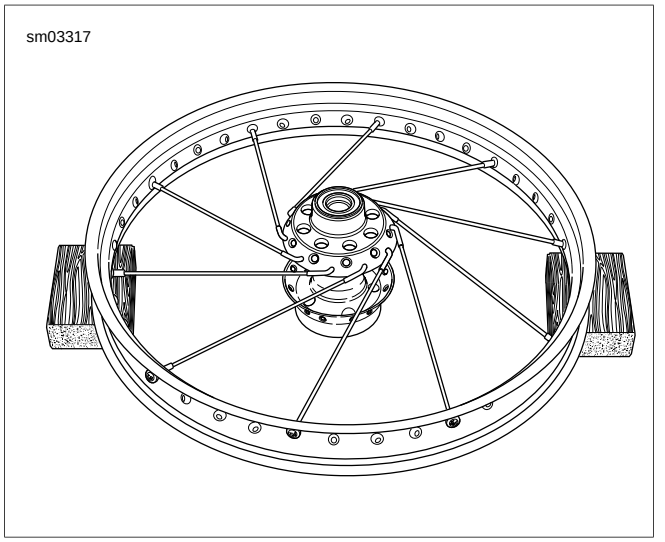


Figure 2-46. Lower Row Spokes Spaced to Every 4th Hole

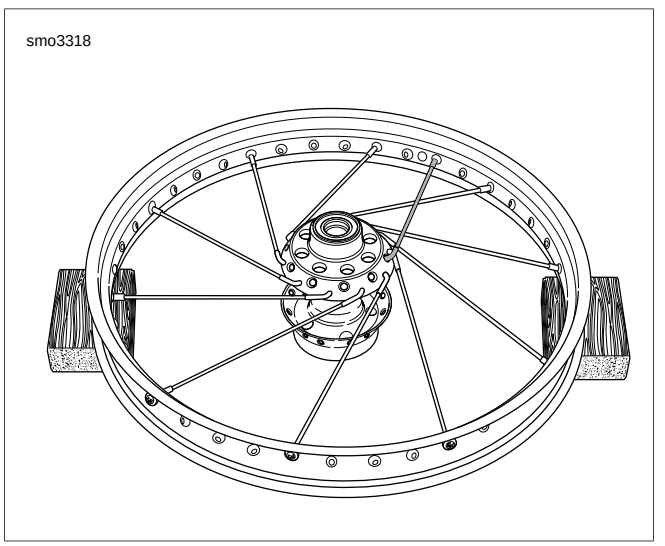


Figure 2-47. Spokes into Hub Upper Row

6. See Figure 2-48. Install the remaining nine upper row spokes into every fourth remaining hole above the rim centerline. This completes spoke installation on this side.

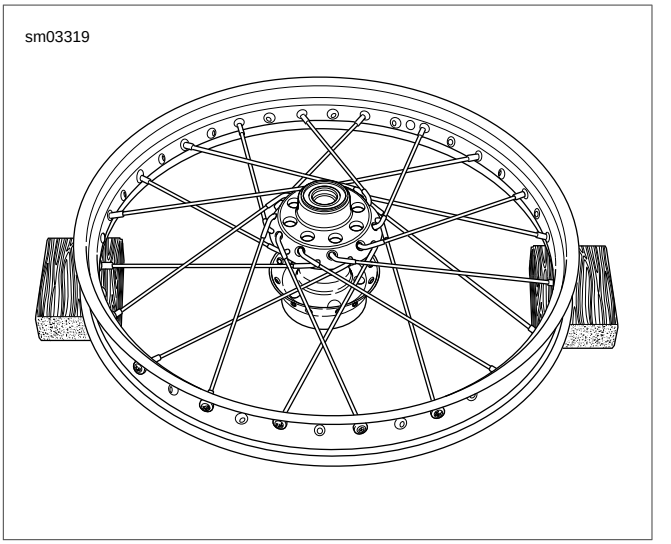


Figure 2-48. Upper Row Spokes Completed

7. See Figure 2-49. Turn rim over, brake disc side up. Place any **lower** row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.

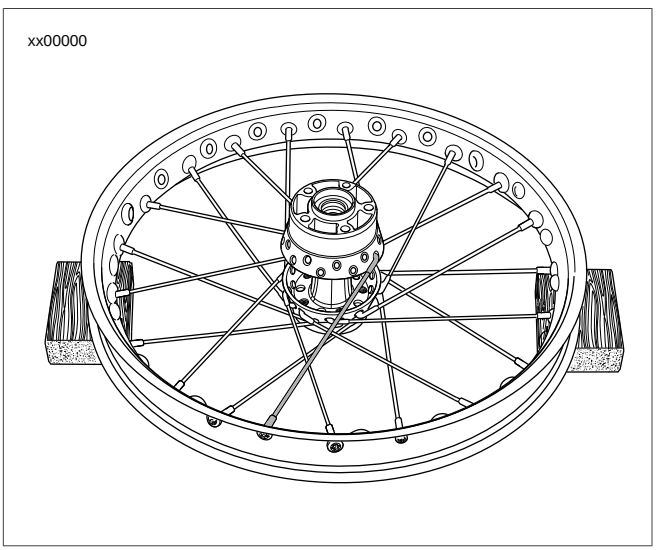


Figure 2-49. Install Lower Spokes into Hub

8. See Figure 2-50. Place the remaining nine lower row spokes, angled clockwise, into hub and rim.

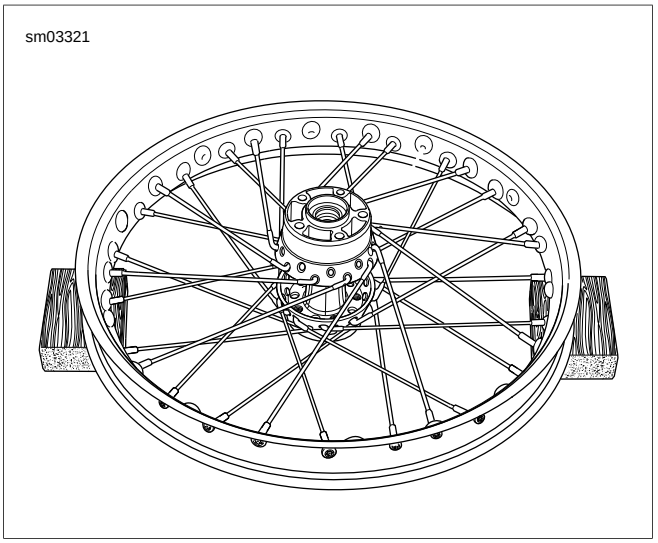


Figure 2-50. Lower Row Spokes Completed

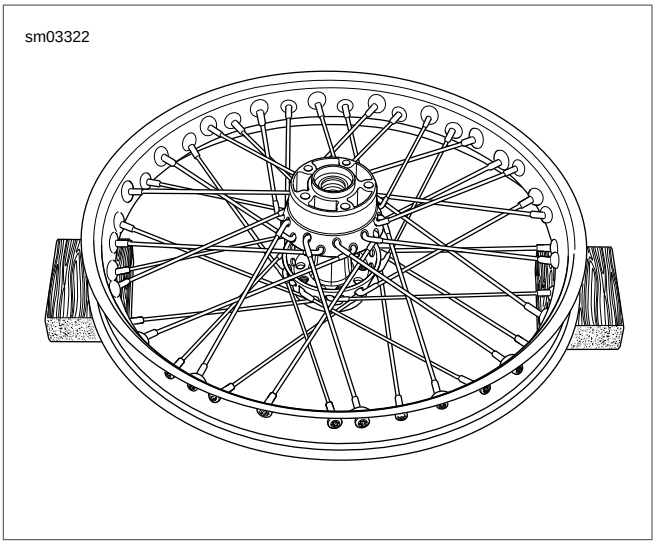


Figure 2-51. Upper Spoke Row Completed

9. See Figure 2-51. Insert any **upper** row spoke into hub and angle spoke counterclockwise into appropriate rim hole. Install remaining upper row spokes.
10. Tighten spoke nipples to the torque specification listed in Table 2-13.
11. True wheel. See 2.9 TRUING LACED WHEELS.

Table 2-13. Spoke Nipple Torque Specification

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

GENERAL

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

LATERAL TRUING

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

1. Divide the wheel spokes into ten groups of four and mark the center of each group with a piece of tape. The groups should be directly across from one another and approximately 90 degrees apart. Tighten the spokes in these four groups finger tight, leaving all others loose.
2. See Figure 2-52. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND (Part No. HD-99500-80). Tighten arbor nuts so hub will turn on its bearings.
3. See Figure 2-53 and Table 2-14 Lay a straightedge across hub brake disc flange and one of the marked spoke groups. Measure distance "A" from the straightedge to the location as shown.
4. If the dimension is not correct, tighten the four spokes accordingly. Use SPOKE WRENCH (Part No. HD-94681-80). For example, If the measurement on the **right** rim edge side is **less** than it should be, **loosen** the two spokes attached to the hub **right** side and **tighten** the two spokes attached to the hub **left** side. Turn all four spokes an equal number of turns until offset dimension is correct.

NOTE

Always loosen the appropriate spokes before tightening the other two. Reversing this procedure will cause the rim to become out-of-round.

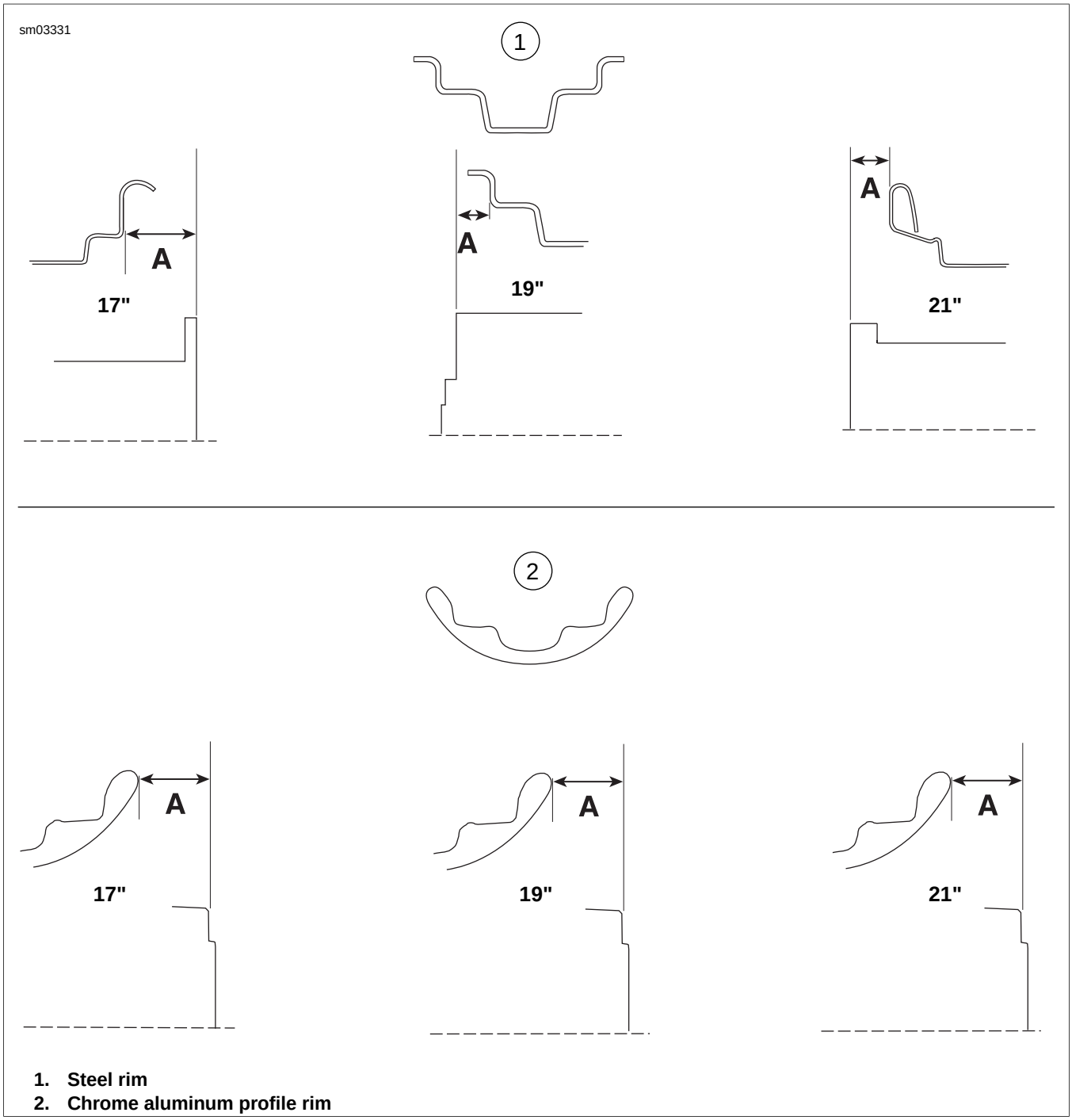
5. Repeat the previous step for all four groups on the wheel.



Figure 2-52. Front Wheel Hub Offset Dimension

Table 2-14. Laced Wheel Hub Offset Dimensions

LACED WHEEL TYPE	WHEEL SIZE	OFFSET (A)	
		IN.	MM
Steel (1)	17"	0.615-0.645	15.62-16.38
	19"	1.135-1.165	28.83-29.59
	21"	1.525-1.555	38.74-39.50
Chrome aluminum profile (2)	17"	0.385-0.415	9.78-10.54
	19"	0.885-0.915	22.48-23.24
	21"	1.555-1.585	39.48-40.26



1. **Steel rim**
2. **Chrome aluminum profile rim**

Figure 2-53. Laced Wheel Hub Offset Dimensions

RADIAL TRUING

1. See Figure 2-54. Adjust truing stand gauge to the rim's tire bead seat as shown. The rim should be trued within 0.030 in. (0.76 mm).
2. Spin the rim slowly.
   a. If the rim contacts the gauge on or near a marked group of spokes, loosen the spokes in the marked group on the opposite side of the rim. Now tighten the spokes in the group where the rim makes contact. Loosen and tighten spokes an equal number of turns.
   b. If the rim contacts the gauge between two marked groups, loosen the spokes in both opposite groups and tighten the spoke groups on the side of the rim that makes contact.

3. When the wheel is centered and trued, start at the valve hole and tighten the rest of the spoke nipples one turn at a time until they are snug.
4. Seat each spoke head in the hub flange using a flat nose punch and mallet. Then check wheel trueness again and tighten the nipples accordingly.

⚠WARNING

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

5. Verify spokes are tightened to specification listed in Table 2-15.
6. File or grind off ends of spokes protruding through nipples to prevent puncturing tube when tire is mounted.

NOTE

After installation of front wheel, visually check the relationship of the front wheel to the fork fender bosses. The front wheel should be approximately centered between the bosses.

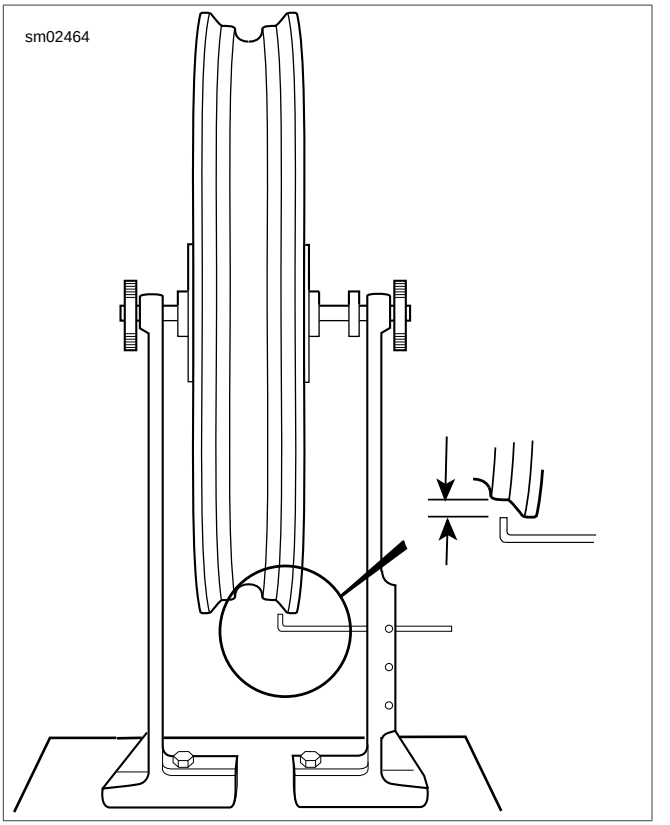


Figure 2-54. Truing Rim Radially

Table 2-15. Spoke Nipple Torque Specification

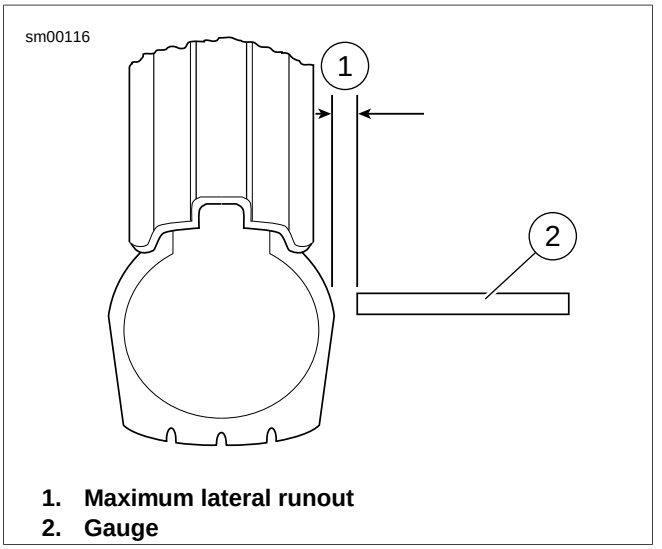
RIM TYPE	MINIMUM TORQUE
All	55 **in-lbs** (6.2 Nm)

GENERAL

The die-cast wheels should be checked for lateral and radial runout before installing a new tire or tube.

LATERAL RUNOUT

See Figure 2-55. Install arbor in the wheel hub and place wheel in the truing stand. To check rim lateral runout, place a gauge rod or dial indicator near the rim bead. If lateral runout exceeds 0.030 in. (0.76 mm), replace the wheel.



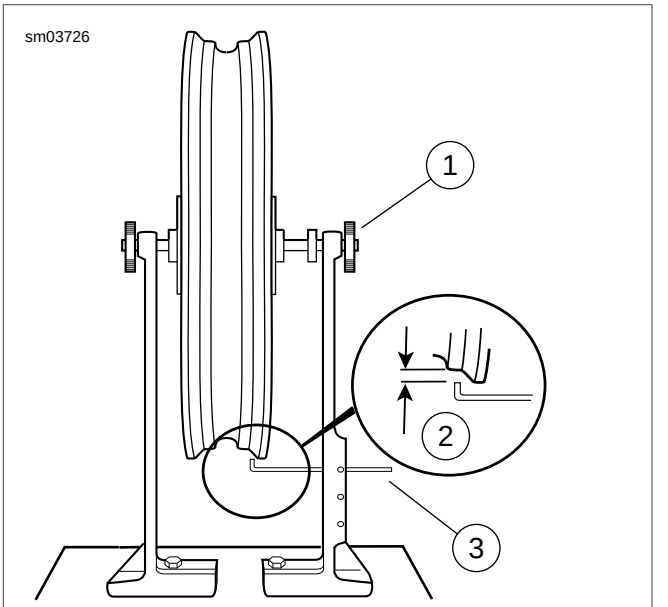
1. **Maximum lateral runout**
2. **Gauge**

Figure 2-55. Checking Tire Lateral Runout

RADIAL RUNOUT

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

See Figure 2-56. Using WHEEL TRUING AND BALANCING STAND (Part No. HD-99500-80), check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in. (0.76 mm).



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

Figure 2-56. Checking Cast Rim Radial Runout

INSPECTION

PART NUMBER	TOOL NAME
HD-48856	AXLE ALIGNMENT PLUG SET

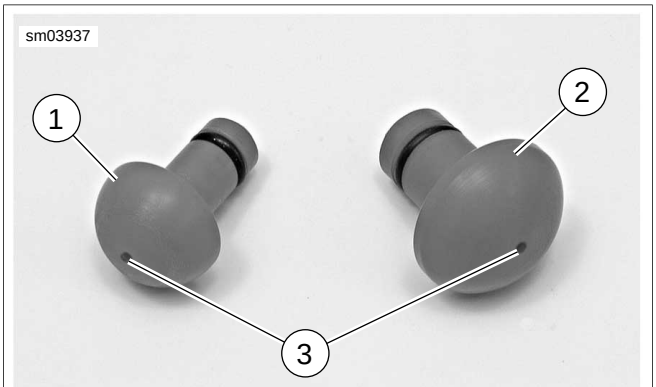
WARNING

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

WARNING

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

1. Verify wheels are true to specifications. See 2.9 TRUING LACED WHEELS or 2.10 CHECKING CAST WHEEL RUNOUT
2. Check steering head bearing adjustment and adjust if necessary. See 2.18 STEERING HEAD.
3. See Figure 2-59. To ensure accurate measurements, obtain a piece of 1/8 in. (3.2 mm) aluminum welding rod 12.25 in. (311 mm) long. Grind one end down to a blunt point. With a pliers, bend the rod 90° as shown. Place a snug fitting O-ring or cable strap on the rod to act as a slide measurement indicator.
4. Obtain AXLE ALIGNMENT PLUG SET (Part No. HD-48856). See Figure 2-57. Insert axle alignment plugs (1, 2) into left and right ends of rear axle.
5. See Figure 2-58. With the blunt point of the alignment tool inserted in the rear fork pilot hole, slide the O-ring along the tool until it is aligned with the center of the alignment plug as shown. Measure and record distance from end of tool to O-ring. Repeat for the other side of the motorcycle.



1. **Alignment plug (left side)**
2. **Alignment plug (right side)**
3. **Alignment hole**

Figure 2-57. Axle Alignment Plugs

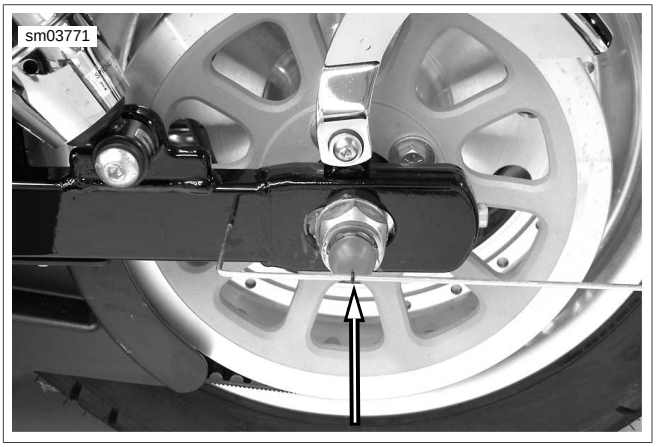
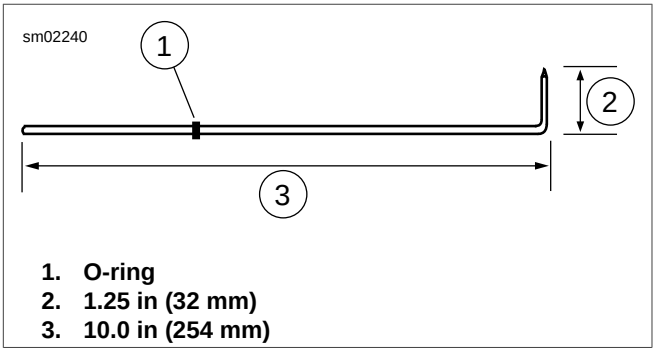


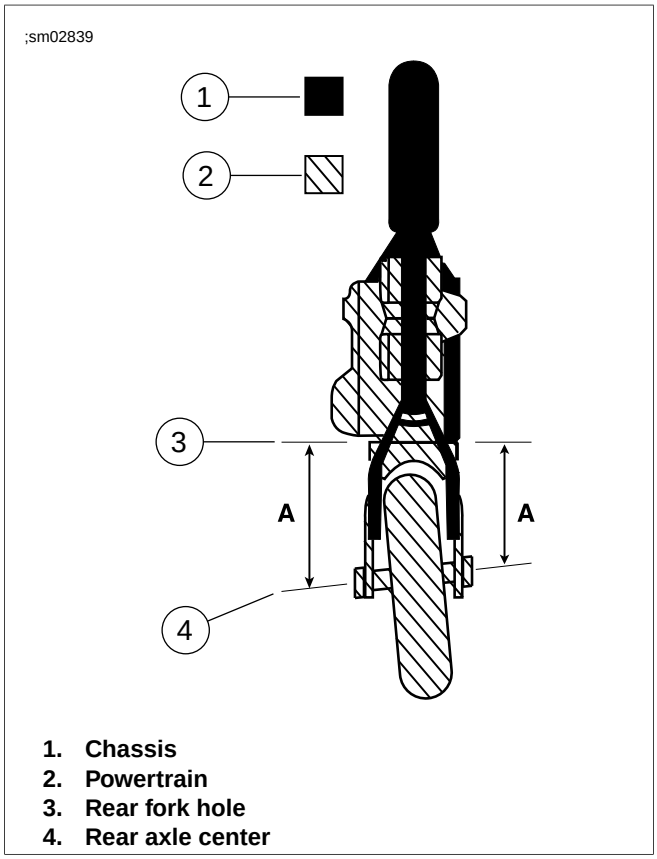
Figure 2-58. Measuring Alignment



1. **O-ring**
2. **1.25 in (32 mm)**
3. **10.0 in (254 mm)**

Figure 2-59. Alignment Tool

6. See Figure 2-60. The measurement between the center of the rear axle and the rear fork hole must be equal to within 1/32 in. (0.8 mm) on both sides of the motorcycle. If it is not, adjust the rear wheel with the axle adjusters to accomplish the equal measurement. It is extremely important that this adjustment be made as accurately as possible in order to make the remaining adjustments accurate.
7. Raise the rear of the motorcycle so that the rear wheel spins freely. Do this by placing a center stand or blocking under the frame.
8. See Figure 2-61. Remove the bolt (2) which attaches the top stabilizer link (1) to the engine mounting bracket.
9. Position front wheel so brake disc is vertical using an inclinometer. If possible, use a digital inclinometer for the best accuracy.



1. **Chassis**
2. **Powertrain**
3. **Rear fork hole**
4. **Rear axle center**

Figure 2-60. Adjust Axle Adjusters until A = A

NOTES

- *The exhaust system must be in place while performing the following steps.*
- *Motorcycle must be upright and level before performing this procedure.*
- *Stabilizer link should only be loosened/adjusted on end with threads showing. Adjusting or loosening other end will tear the isolator.*
- *There should be 0.25 in. (6.4 mm) minimum clearance between the fuel tank tunnel and the head of the left stabilizer link mounting bolt.*

10. Loosen jam nut (3) on stabilizer link. Adjust the stabilizer so that the bolt removed in previous step can be reinstalled without pushing the engine to the right or left. Tighten jam nut.
11. Check the rear brake disc with the inclinometer to ensure that it is parallel to the front brake disc.
12. If the rear brake disc is not parallel to the front brake disc, adjust the top stabilizer link until the rear brake is parallel to within 1 degree of the front brake disc's position.
13. If you cannot adjust the front and rear brake discs to within 1°, inspect the frame, front fork and/or rear fork for damage.

⚠WARNING

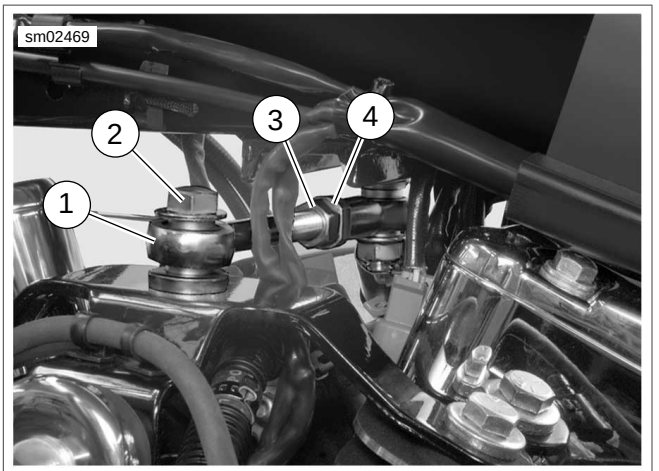
To prevent damage to fuel tank and possible fire or explosion, which could cause death or serious injury, maintain clearance specified in service manual between fuel tank and head of left stabilizing link mounting bolt. (00262a)

14. If you have to adjust the top stabilizer link more than five full turns to bring the brake discs to specification, again inspect the frame, front fork and/or rear fork for damage.
15. Tighten the stabilizer jam nut (3).

NOTE

If the stabilizer link has been adjusted more than five full turns, the vehicle's vibration will very likely have reached an unacceptable level. Adjust the vehicle's vibration level as follows:

16. Be sure the transmission is in neutral.
17. Loosen, but do not remove, ALL the mounting bolts on the engine isolators and start the engine. Let the engine run for approximately 5 seconds. This will center the mounts on the frame and power train assembly.
18. Tighten isolator mounting bolts to 25 ft-lbs (33.9 Nm).



1. **Top stabilizer link**
2. **Bolt**
3. **Jam nut**
4. **Adjusting stud (nut)**

Figure 2-61. Top Stabilizer

GENERAL

WARNING

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

CAUTION

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

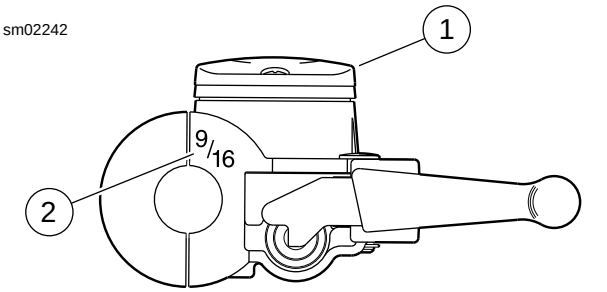
CAUTION

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

CAUTION

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

See Figure 2-62. Master cylinders designed for single disc (one caliper) operation have a 9/16 in. (14.3 mm) bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket.



1. **Single disc master cylinder**
2. **Bore stamp size**

Figure 2-62. Bore Size

REMOVAL AND DISASSEMBLY

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

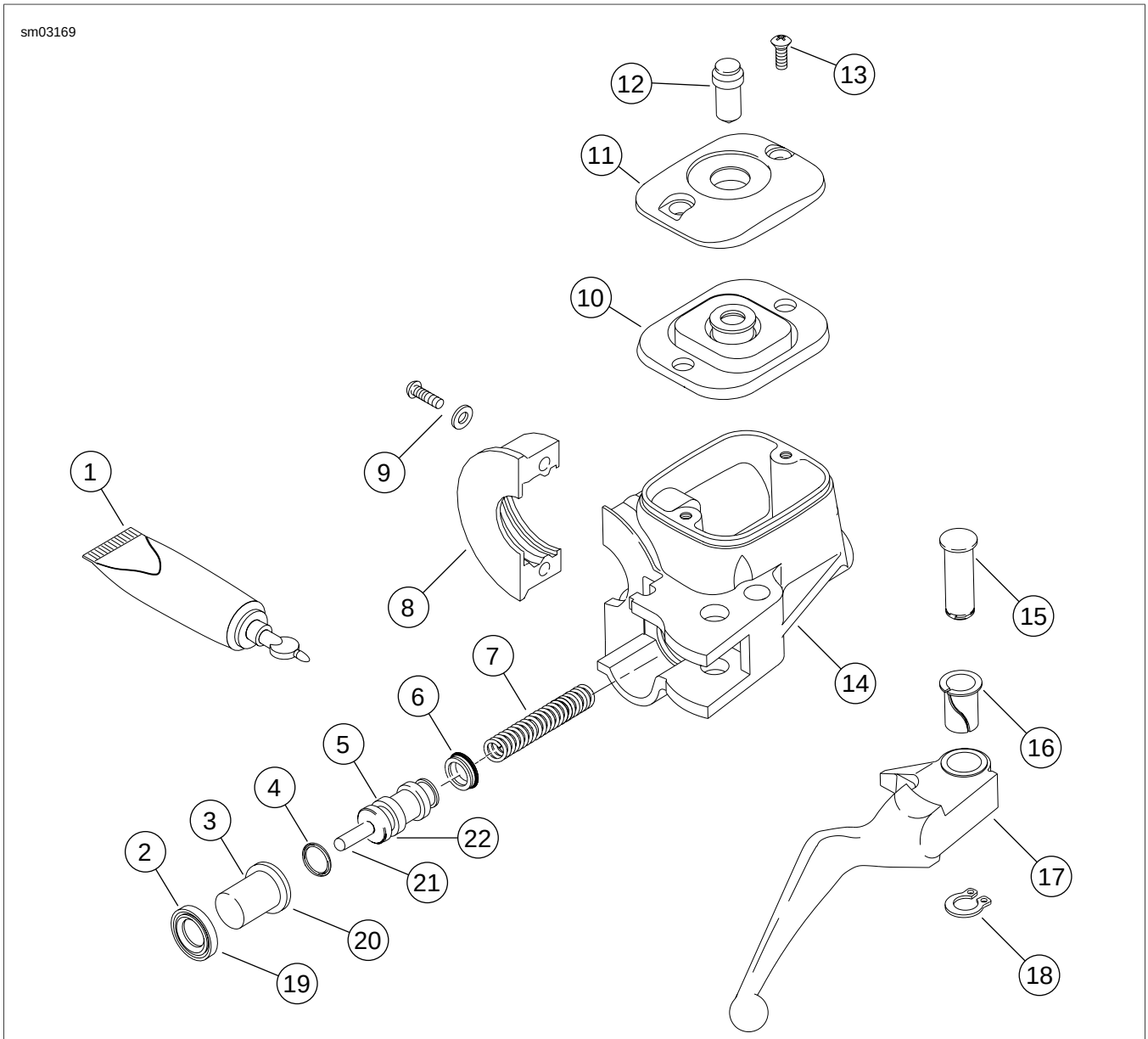
CAUTION

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

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

CAUTION

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

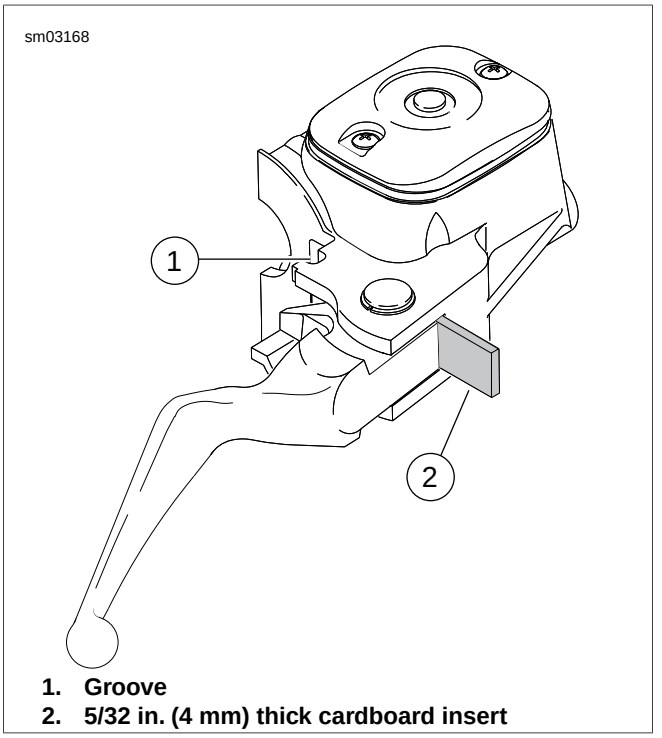


1. **Lubricant**
2. **Wiper**
3. **Piston cap**
4. **O-ring**
5. **Piston**
6. **Primary cup**
7. **Spring**
8. **Handlebar clamp**
9. **T27 TORX screw and washer (2)**
10. **Gasket**
11. **Cover**
12. **Site glass**
13. **Screw (2)**
14. **Master cylinder reservoir**
15. **Pivot pin**
16. **Bushing**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

Figure 2-63. Front Brake Master Cylinder

3. See Figure 2-64. Place the cardboard insert between the brake lever and lever bracket.
4. See Figure 2-63. Remove the two T27 TORX screws with flat washers (9) to detach the handlebar clamp (8) from the master cylinder reservoir (14).
5. Remove retaining ring (18) from pivot pin groove at bottom of master cylinder bracket.
6. Remove pivot pin (15) and brake hand lever (17).
7. Carefully remove wiper (2) with pick or similar tool.
8. Remove piston cap (3).

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



1. Groove
2. 5/32 in. (4 mm) thick cardboard insert

Figure 2-64. Cardboard Insert

CLEANING AND INSPECTION

1.

WARNING

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

WARNING

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

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

ASSEMBLY AND INSTALLATION

NOTE

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

1. See Figure 2-63. Fit O-ring (4) into groove on outboard side of piston (5) (pin side).
2. Fit primary cup (6) over lip on inboard side of piston, so that closed side (smaller OD) contacts shoulder.
3. Coat piston bore of master cylinder reservoir with special lubricant (1) supplied in the service parts kit. Also apply the lubricant to OD of installed O-ring (4) and primary cup (6).
4. Insert spring (7) into piston bore, so that it seats against counterbore (recess) at bottom.
5. Slide piston over spring.
6. Fit wiper (2) over piston cap (3) so that flat side of wiper contacts cap shoulder.
7. Fit piston cap over piston pin (5).
8. Press down on wiper until it contacts the counterbore. Larger OD of wiper must be completely seated in groove on outlet side of piston bore.
9. Install the master cylinder reservoir cover (11). Secure with two screws, but do not tighten at this time.
10. Align hole in brake hand lever (17) with hole in master cylinder bracket. From the top of the assembly, slide pivot pin (15) through bracket and hand lever.

WARNING

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

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

CAUTION

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

12. See Figure 2-65. Position the brake lever/master cylinder assembly inboard of the switch housing assembly engaging the tab (2) on the lower switch housing (1) in the groove (3) at the top of the brake lever bracket (4).
13. Align the holes in the handlebar clamp with those in the master cylinder housing and start the two T27 TORX screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten the screws to 60-80 **in-lbs** (6.8-9.0 Nm).

CAUTION

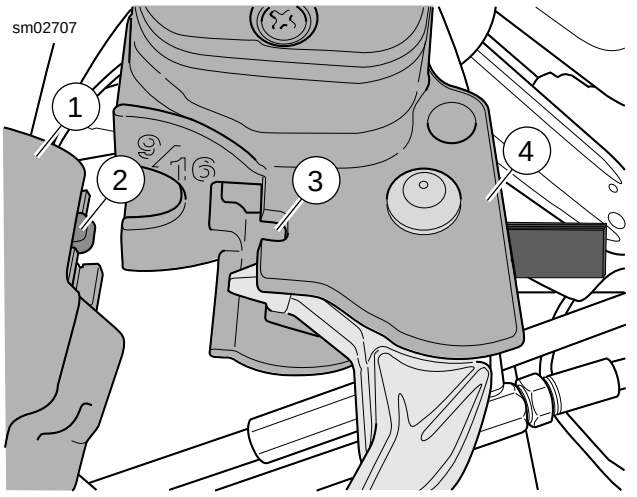
Avoid leakage. Be sure gaskets, banjo bolt(s), brake line and caliper bore are clean and undamaged before assembly. (00321a)

To avoid leakage, verify that the steel/rubber washers, banjo bolt, brake line fitting and master cylinder bore are completely clean.

14. Start banjo bolt (with **new** steel/rubber washers) to secure brake line fitting to master cylinder reservoir. Tighten banjo bolt to 21-25 ft-lbs (28.5-33.9 Nm).

WARNING

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



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

Figure 2-65. Attach Master Cylinder to Right Handlebar Switches

NOTE

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

15. Remove the master cylinder reservoir cover. Stand motorcycle up so master cylinder is level. Add brake fluid to master cylinder reservoir until fluid level is about 1/4 inch (6.4 mm) from the top.

NOTE

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

WARNING

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

16. Bleed front brake system. See 1.15 BLEEDING BRAKES.
17. Verify proper operation of the master cylinder relief port. Actuate the brake hand lever. A slight spurt of fluid will break the fluid surface in the reservoir compartment if all internal components are working properly.
18. Add brake fluid to the master cylinder reservoir until the fluid level is about 1/4 inch (6.4 mm) from the top.
19. Install the master cylinder reservoir coverand gasket. Tighten to 6-8 **in-lbs** (0.7-0.9 Nm).
20. With the Ignition/Light Key Switch turned to IGNITION, actuate the front brake hand lever to verify operation of the brake lamp.

WARNING

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

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

NOTE

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

REMOVAL

NOTE

If only replacing brake pads, see 1.16 BRAKE PADS AND DISCS.

⚠CAUTION

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

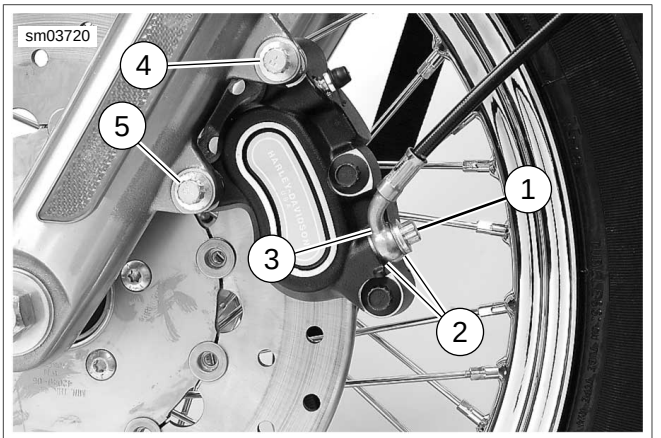
CAUTION

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

CAUTION

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

1. See Figure 2-66. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach front brake line (3) from caliper. Discard washers.
2. Remove the upper (4) and lower (5) mounting bolts (metric). Lift caliper upward to remove from brake disc.



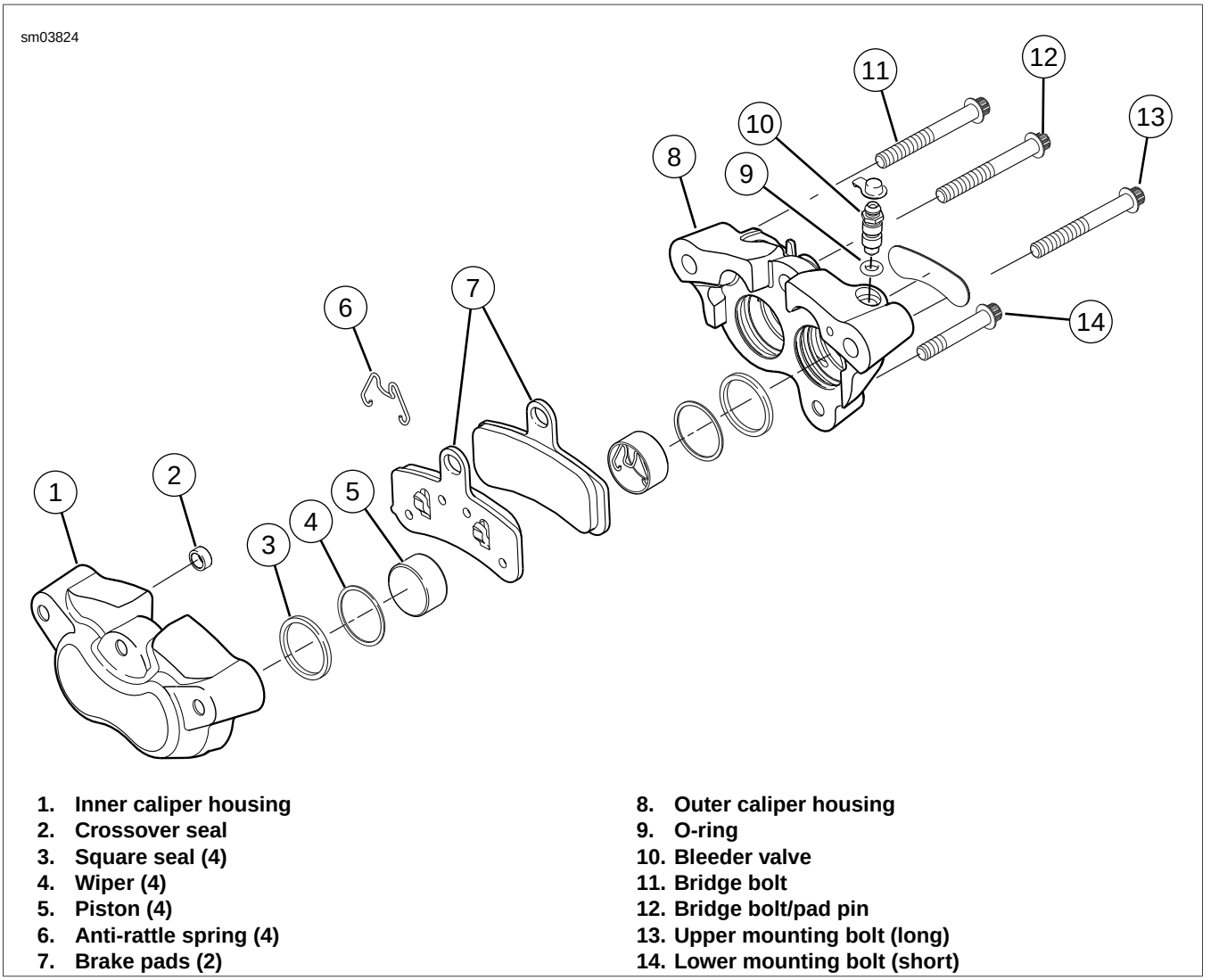
1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Brake line**
4. **Upper mounting bolt (long)**
5. **Lower mounting bolt (short)**

Figure 2-66. Front Caliper

DISASSEMBLY

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

1. See Figure 2-67. Remove bridge bolt/pad pin (12) (metric), brake pads (7) and bridge bolt (11) (metric) to separate caliper housings (1, 8).



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

Figure 2-67. Front Brake Caliper

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

⚠WARNING

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

3. See Figure 2-68 and Figure 2-69. Remove pistons.
   a. Place FRONT BRAKE CALIPER PISTON REMOVER (Part No. HD-48649) (3) between caliper housings.

   NOTE

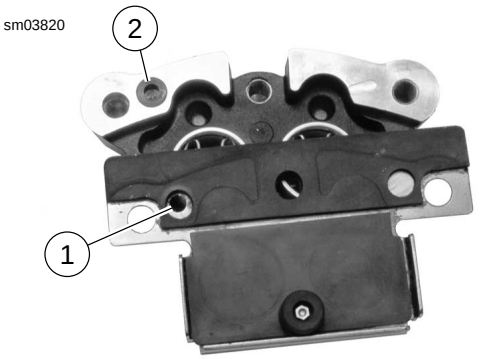
   Ensure the hole in the tool (1) aligns with the crossover holes (2) in the caliper housings.

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

CAUTION

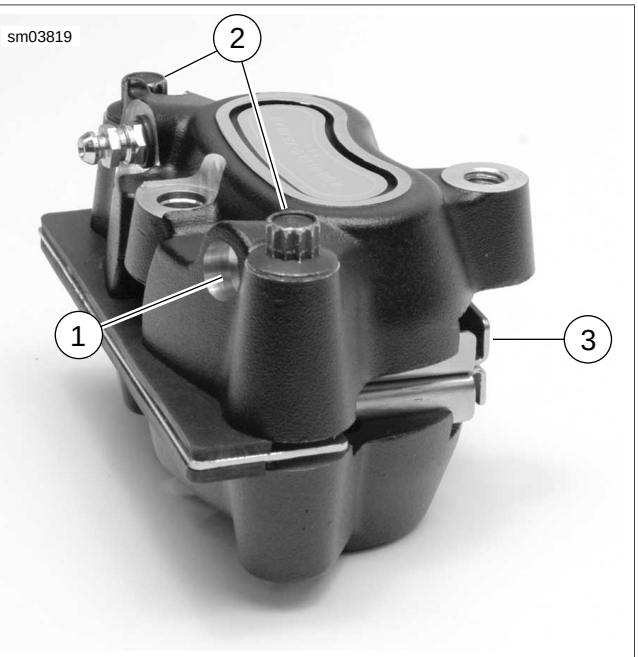
Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (00529d)

6. See Figure 2-70. Remove and discard crossover seal (1) from inside caliper housing.
7. Using a wooden toothpick (2), remove a wiper (3) and square seal (4) from each caliper bore. Discard all removed parts.



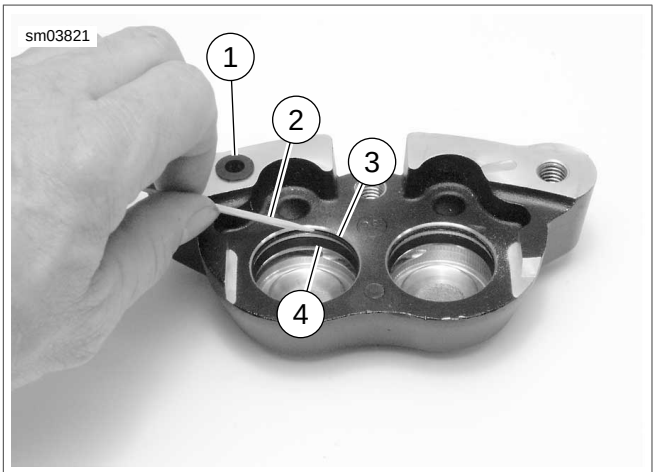
1. **Hole in tool**
2. **Crossover hole in caliper housing**

Figure 2-68. Installing Tool



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

Figure 2-69. Removing Pistons



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

Figure 2-70. Wipers and Seals

CLEANING, INSPECTION AND REPAIR

⚠WARNING

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

⚠WARNING

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

1. Clean all parts with denatured alcohol or D.O.T. 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe parts dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.
2. Carefully inspect all components. Replace any parts that appear damaged or worn.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect caliper piston bore. Do not hone bore. If bore should show pitting or corrosion, replace caliper.
   c. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace both pins.
   d. Always replace wipers, square seals and crossover seal after disassembly.

3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.
4. Inspect brake pads and brake disc. See 1.16 BRAKE PADS AND DISCS.

ASSEMBLY

NOTE

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

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

CAUTION

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

2. See Figure 2-67. Install a **new** square seal (3) and a **new** wiper (4) into each piston bore. Use a wooden toothpick (2) to aid installation if needed.
3. See Figure 2-71. Install pad spring (2) in each piston. Ensure spring is securely installed in the groove in the piston.
4. Turn the piston so the pad spring (2) is oriented as shown. Carefully insert pistons, by hand, into bores of both caliper housings. Press pistons squarely into place until they bottom in the bores. If installation shows resistance, remove piston and check that seals and wipers are properly installed.
5. Place a **new** crossover seal (1) on inside caliper housing.
6. Assemble caliper housings.
   a. Install bleeder valve and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
   b. Verify that **new** crossover seal is installed on inside caliper housing.
   c. See Figure 2-67. Mate inside and outside caliper housings using bridge bolt (11) and upper mounting bolt (long) (13) (metric).
   d. Tighten bridge bolt to 28-38 ft-lbs (38.0-51.5 Nm).

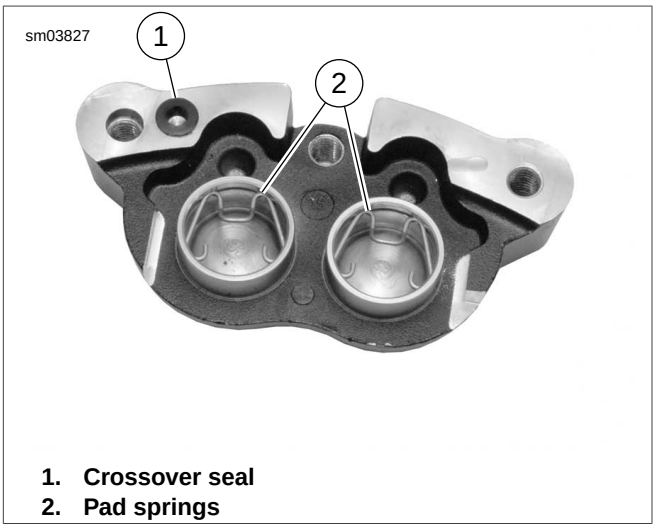
WARNING

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

NOTES

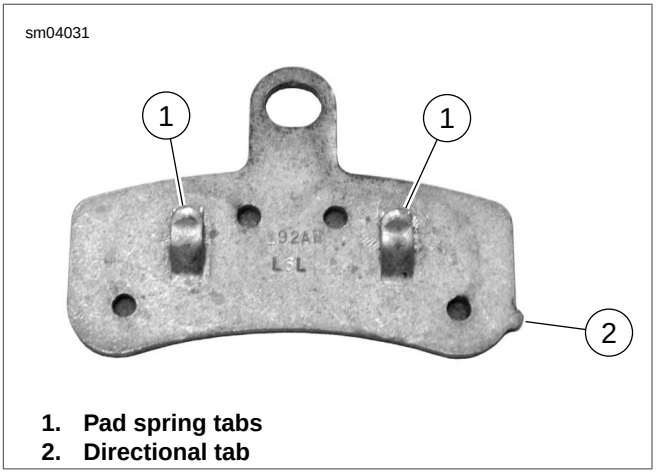
- *See Figure 2-72. Ensure the pad spring tabs (1) on brake pad engage the pad springs in the pistons.*
- *If the directional tab (2) does not face down when caliper is installed, brake noise may develop.*

7. Install **new** pads into caliper. The directional tab (2) must face down when caliper is installed.
8. See Figure 2-67. Install pad pin/bridge bolt (12) (metric). Tighten to 15-16 ft-lbs (20.3-22.6 Nm).



1. Crossover seal
2. Pad springs

Figure 2-71. Front Caliper Pad Springs



1. Pad spring tabs
2. Directional tab

Figure 2-72. Front Brake Pad

INSTALLATION

1. See Figure 2-73. Attach caliper to fork leg.
   a. Place caliper over brake disc with bleeder valve facing upwards.
   b. Loosely install long mounting bolt (4) (metric) into top hole on fork leg.
   c. Install short mounting bolt (5) (metric) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).
   d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.0-51.5 Nm).

CAUTION

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

2. Lubricate **new** steel/rubber washers with D.O.T. 4 BRAKE FLUID. Connect the brake line (3) to caliper using two **new** steel/rubber washers (2) and banjo bolt (1). Tighten to 21-25 ft-lbs (28.5-33.9 Nm).

⚠CAUTION

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

3. Remove cover from front brake master cylinder. Fill master cylinder with D.O.T. 4 BRAKE FLUID. Verify that fluid level is 1/8-1/4 in. (3.2-6.4 mm) below top of reservoir with master cylinder in a level position.

⚠WARNING

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

4. Bleed brake system. See 1.15 BLEEDING BRAKES.

⚠WARNING

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

5. Verify proper operation of the master cylinder relief port. Actuate the brake lever with the cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.

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

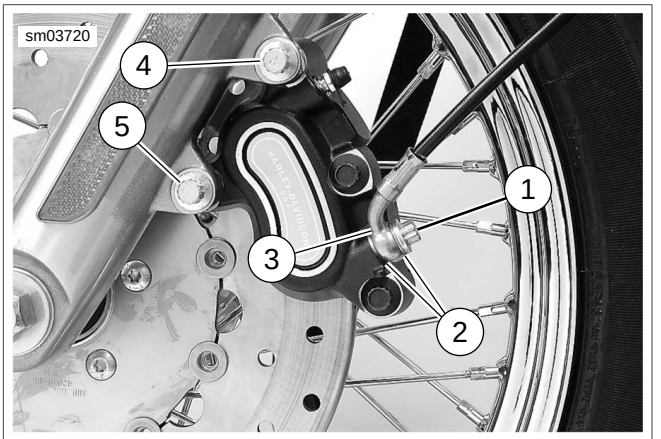
⚠WARNING

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

7. Test brake system.
   a. Turn ignition switch ON. Pump brake hand lever to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 1.15 BLEEDING BRAKES.

NOTE

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



1. **Banjo bolt**
2. **Steel/rubber washer (2)**
3. **Brake line**
4. **Upper mounting bolt (long)**
5. **Lower mounting bolt (short)**

Figure 2-73. Front Caliper

GENERAL

WARNING

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

CAUTION

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

CAUTION

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

CAUTION

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

REMOVAL

CAUTION

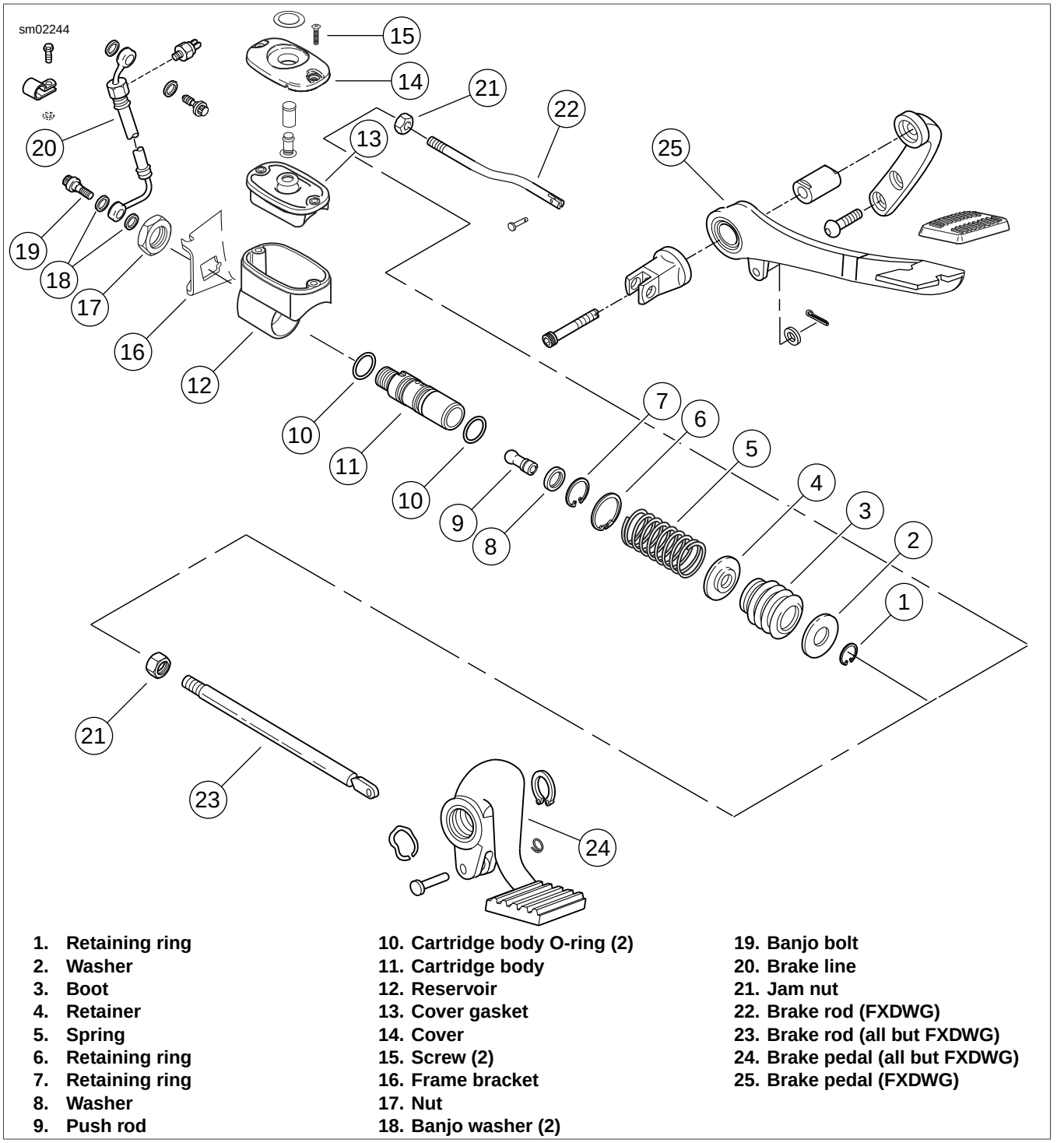
Do not remove or install the master cylinder assembly without first positioning a 5/32-inch (4 mm) thick insert between the brake lever and lever bracket. Removing or installing the master cylinder assembly without the insert in place may result in damage to the rubber boot and plunger on the front stoplight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

1. See Figure 2-74. Remove banjo bolt (19) and banjo washers (18). Discard washers.
2. Remove master cylinder mounting nut (17).
3. Loosen jam nut (21) on threaded brake rod (22/23).
4. Unscrew push rod (9) from brake rod.

NOTE

Wrench flats on push rod allow a wrench to be used if needed.

5. Raise pedal to move master cylinder/reservoir (12) forward and out of frame bracket (16).



1. **Retaining ring**
2. **Washer**
3. **Boot**
4. **Retainer**
5. **Spring**
6. **Retaining ring**
7. **Retaining ring**
8. **Washer**
9. **Push rod**
10. **Cartridge body O-ring (2)**
11. **Cartridge body**
12. **Reservoir**
13. **Cover gasket**
14. **Cover**
15. **Screw (2)**
16. **Frame bracket**
17. **Nut**
18. **Banjo washer (2)**
19. **Banjo bolt**
20. **Brake line**
21. **Jam nut**
22. **Brake rod (FXDWG)**
23. **Brake rod (all but FXDWG)**
24. **Brake pedal (all but FXDWG)**
25. **Brake pedal (FXDWG)**

Figure 2-74. Rear Brake Master Cylinder

DISASSEMBLY

1. Clean exterior of master cylinder/reservoir with a clean, nonflammable solvent. Lubricate all internal parts with lubricant provided in kit.
2. See Figure 2-74. Thread banjo bolt (19) into the cartridge body (11).
3. Remove boot (3) from groove in master cylinder/reservoir (12). Set master cylinder/reservoir upright with banjo bolt resting on bench and push master cylinder/reservoir down and off the cartridge body.
4. Protect cartridge body from dirt or grease.
5. Press down on large washer (2) to compress spring (5), keep spring compressed and remove retaining ring (1) from groove in push rod (9).
6. Carefully release spring and remove washer, boot, spring retainer (4) (inside boot) and spring.

7. Remove and discard retaining ring (7) from bore of cartridge body and remove push rod and washer (8).

NOTE

Do not disassemble cartridge body (11). The cartridge body contains the piston and associated components. These parts are not sold; therefore, replace the cartridge body if piston seal leakage is evident.

CLEANING AND INSPECTION

WARNING

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

WARNING

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

1. Clean exterior of master cylinder/reservoir with a clean, nonflammable solvent. Lubricate all internal parts with lubricant provided in kit.
2. See Figure 2-74. Inspect reservoir bore (12) for scratches. Replace if scratches are present.
3. Check boot (3) for tears and replace if any exist.
4. Inspect threads on cartridge body (11), push rod (9) and banjo bolt (19). Replace any part with damaged threads. Inspect spring for cracks or broken coils - replace if any exist.
5. Carefully remove large O-rings (10) from cartridge body. Do not scratch O-ring grooves. Clean grooves with soft cotton cloth moistened with alcohol. Inspect grooves for scratches and dirt. Remove dirt or replace cartridge body if grooves are scratched.

ASSEMBLY

CAUTION

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

1. See Figure 2-74. Lubricate O-rings (10) with D.O.T. 4 brake fluid and install in O-ring grooves on cartridge body (11).
2. Lubricate bore of master cylinder/reservoir (12) with D.O.T. 4 brake fluid.
3. Insert cartridge body into reservoir. Using hand-pressure only, press cartridge body into adapter making sure notch on cartridge body engages lug inside bore of the adapter.
4. Thread banjo bolt (19) into cartridge body and stand master cylinder upright with banjo bolt resting on bench.
5. Place washer (8) on push rod (9).
6. Place a **new** retaining ring (7) on push rod. Insert ball-end of push rod into piston. Push piston downward with push rod until washer is properly seated in the cartridge bore.
7. Install the **new** retaining ring in groove inside cartridge bore. Make certain retaining ring is fully seated in groove.
8. Release downward pressure on push rod and check that push rod rotates freely.
9. Install retaining ring (6) in groove on cartridge body.
10. Install on push rod, spring (5), spring retaining washer (4) (large cupped side toward spring), boot (3) with drain hole down, and washer (2).
11. Press down on washer and install retaining ring (1) in push rod groove.
12. Seat sealing lip of boot into groove on master cylinder/reservoir adapter.

INSTALLATION

CAUTION

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

1. See Figure 2-74. Guide threaded end of master cylinder/reservoir (12) through hole in bracket (16). Make sure the square body of the master cylinder/reservoir is engaged in the square hole of the mounting bracket.
2. Install nut (17) and tighten to 30-40 ft-lbs (40.7-54.2 Nm).
3. Thread push rod (9) fully onto brake rod (22/23). Do not tighten jam nut (21) at this time.
4. Lubricate new steel/rubber washers (18) with D.O.T. 4 BRAKE FLUID. Install brake line (20) using banjo bolt (19) and new steel/rubber washers (18). Position brake line and tighten banjo bolt to 21-25 ft-lbs (28.5-33.9 Nm).

WARNING

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

WARNING

When adjusting brake control rod, never allow more than nine threads to be exposed between control rod and jam nut. If more than nine threads are exposed, brake rod can come apart resulting in loss of rear brake, which could cause death or serious injury. (00306c)

5. Unscrew push rod from brake rod just enough to adjust pedal height. When correct pedal height is obtained, tighten jam nut. Make certain that no more than nine threads are visible on brake rod.

6. Verify that water drain hole in rubber boot (3), which covers rear brake push rod, is positioned to bottom.

NOTE

Brake pedal freeplay is built into master cylinder and no adjustment is required. When pedal is pushed down with hand, a small amount of freeplay must be felt.

7. Bleed brake system and tighten bleeder valve as directed. See 1.15 BLEEDING BRAKES.

8. Install gasket (13) and cover (14) on master cylinder/reservoir. Tighten cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).

⚠WARNING

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

9. Test brake system.
   a. Turn ignition switch ON. Pump brake pedal to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 1.15 BLEEDING BRAKES.

NOTE

A sight glass in cover (14) enables the rider to visually check the brake fluid level without removing the master cylinder cover. When the reservoir is full, the sight glass appears dark. As the fluid level drops, the glass appears lighter to indicate this condition to the rider.

REMOVAL

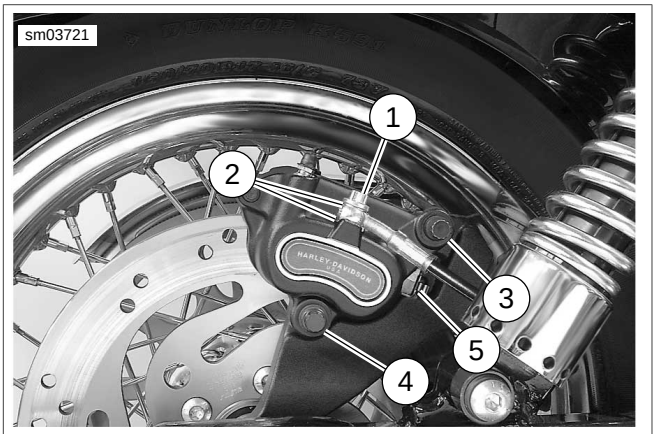
NOTE

If only replacing brake pads, do not remove rear brake caliper. Should pad replacement be necessary, see 1.16 BRAKE PADS AND DISCS.

CAUTION

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

1. Remove right saddlebag, if equipped.
2. See Figure 2-75. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach rear brake line from caliper. Discard washers.
3. Remove both the slider pin (3) and mounting bolt (4) (metric). Remove caliper assembly from brake disc.
4. To remove rear caliper mount:
   a. Remove axle from rear wheel. See 2.4 REAR WHEEL.
   b. Lift rear caliper mount away from axle and rear fork. Notch in caliper mount must clear tab on rear fork.



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

Figure 2-75. Rear Caliper

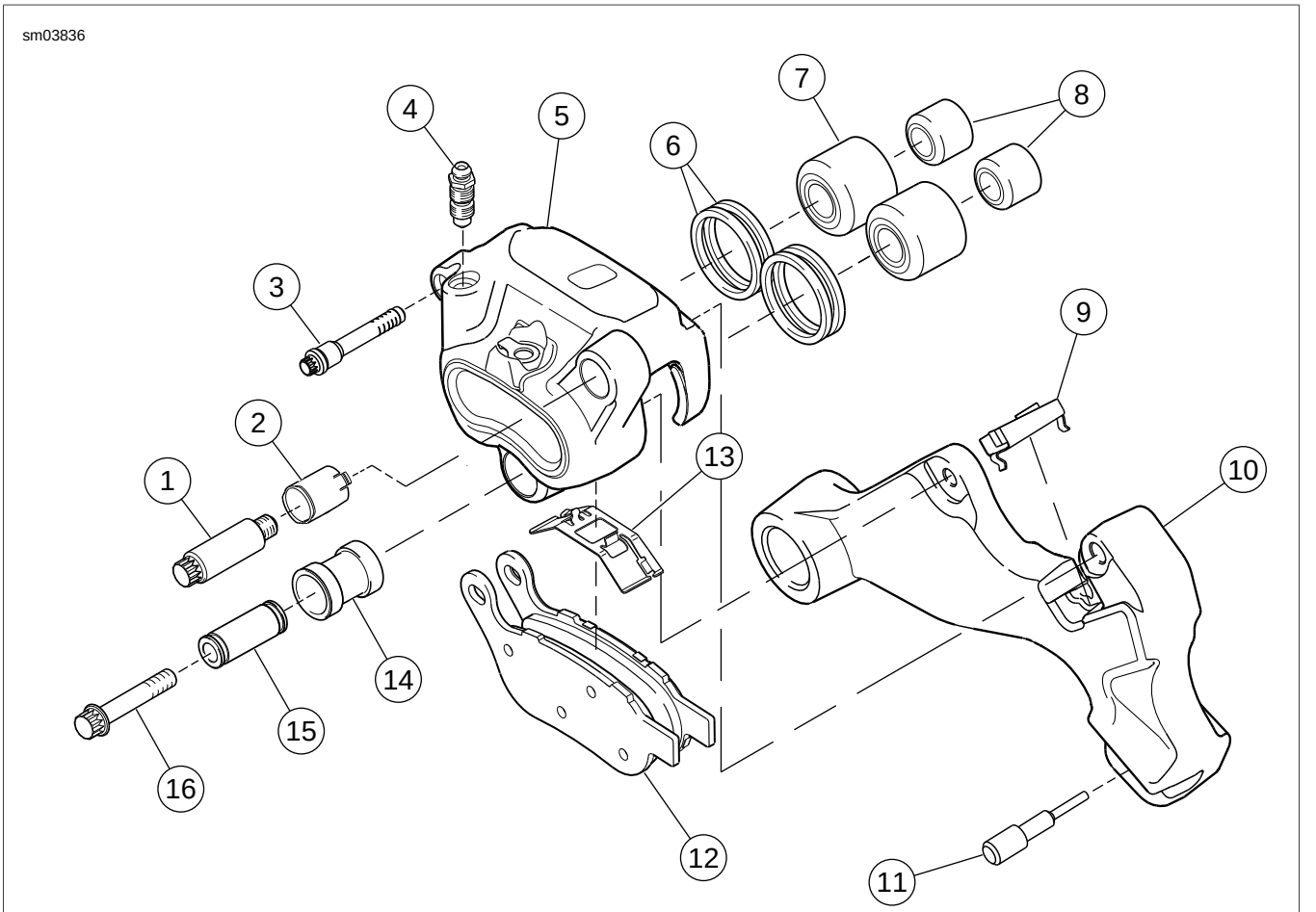
DISASSEMBLY

PART NUMBER	TOOL NAME
HD-48648	BRAKE CALIPER PISTON REMOVER

1. See Figure 2-76. Remove pad pin (3) and brake pads (12).
2. If necessary, remove bleeder valve (4).

NOTE

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



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

Figure 2-76. Rear Brake Caliper

⚠WARNING

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

⚠CAUTION

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

NOTE

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

3. See Figure 2-77. Remove pistons.
   a. Place BRAKE CALIPER PISTON REMOVER (Part No. HD-48648) (3) into caliper housing. Install bolt (2) only enough to hold tool in place.

   NOTE

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

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

CAUTION

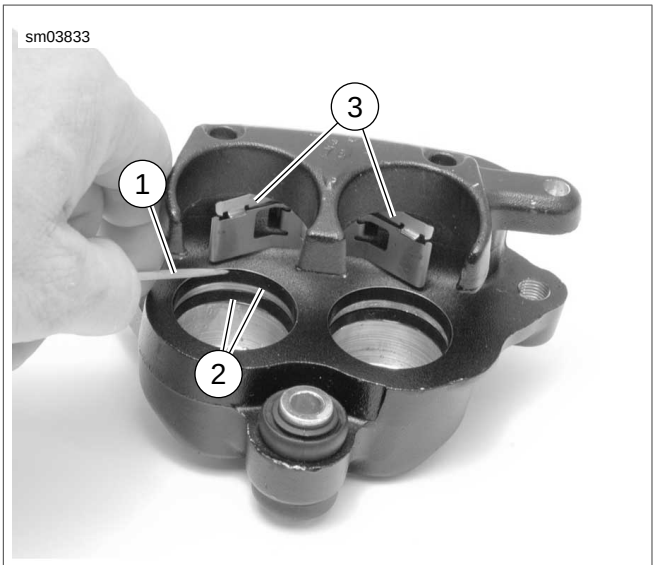
Avoid leakage. Prevent damage to piston or piston bore. Use non-metallic tools when servicing components. (00529d)

5. See Figure 2-78. Using a wooden toothpick (1), remove two square seals (2) from each caliper bore. Discard all removed parts.
6. Pull anti-rattle spring (3) straight out to remove.



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

Figure 2-77. Removing Pistons



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

Figure 2-78. Seals and Spring

CLEANING, INSPECTION AND REPAIR

WARNING

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

WARNING

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

1. Clean all parts with denatured alcohol or D.O.T. 4 BRAKE FLUID. Do not contaminate with mineral oil or other solvents. Wipe parts dry with a clean, lint free cloth. Blow out drilled passages and bore with a clean air supply. Do not use a wire or similar instrument to clean drilled passages.

2. Carefully inspect all components. Replace any parts that appear damaged or worn.
   a. Check pistons for pitting, scratches or corrosion on face and also on ground surfaces.
   b. Inspect phenolic insulators for damage.
   c. Inspect caliper piston bore. Do not hone bore. If bore should show pitting or corrosion, replace caliper.
   d. Inspect pad pin for grooving and wear. Measure the pad pin diameter in an unworn area, and then in the area of any grooving or wear. If wear is more than 0.015 in. (0.38 mm), replace both pins.
   e. See Figure 2-76. Inspect dust boot (13) for cracks and damage. Inspect bushing (14) for free movement. Inspect bushing (2) for free movement or damage.
   f. Always replace square seals after disassembly.
3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.
4. Inspect brake pads and brake disc. See 1.16 BRAKE PADS AND DISCS.

ASSEMBLY

NOTE

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

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

CAUTION

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

2. See Figure 2-78. Install two **new** square seals (2) into each piston bore. Use a wooden toothpick (1) to aid installation if needed.
3. Install anti-rattle spring (3). Ensure it is oriented correctly.
4. Carefully insert pistons, by hand, into bores of caliper housing. Press pistons squarely into place until they bottom in the bores. If installation shows resistance, remove piston and check that seals are properly installed.
5. See Figure 2-76. Install bleeder valve (4) (with o-ring) in caliper housing, if removed, and tighten to 80-100 **in-lbs** (9.0-11.3 Nm).

NOTE

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

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

NOTE

If pad pins do not fit, check the following:

- *You are using a set of pads, not two identical pads.*
- *Anti-rattle spring orientation matches Figure 2-76.*

INSTALLATION

1. Install rear axle and caliper mount if removed. Ensure notch in mount engages tab on rear fork. See 2.4 REAR WHEEL.
2. See Figure 2-76. Ensure torque clip (9) is in place in caliper mount.
3. See Figure 2-75. Install caliper with pads on caliper mount. Tighten slider pin (3) and mounting bolt (4) (metric) to 10-14 ft-lbs (13.6-18.9 Nm). Ensure tabs on brake pads engage slot (5) in caliper mount.

CAUTION

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

4. Lubricate **new** steel/rubber washers with D.O.T. 4 BRAKE FLUID. Connect the brake line to caliper using two **new** washers (2) and banjo bolt (1). Tighten to 21-25 ft-lbs (28.5-33.9 Nm).

⚠CAUTION

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

5. Remove cover from rear brake master cylinder. Fill master cylinder with D.O.T. 4 BRAKE FLUID. Verify that fluid level is 1/8 in. (3.2 mm) below top of reservoir with master cylinder in a level position.

⚠WARNING

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

6. Bleed brake system. See 1.15 BLEEDING BRAKES.

⚠WARNING

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

7. Test brake system.
   a. Turn ignition switch ON. Pump brake foot pedal to verify operation of the brake lamp.
   b. Test ride the motorcycle. If the brakes feel spongy, bleed the system again. See 1.15 BLEEDING BRAKES.

NOTE

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

GENERAL

WARNING

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

WARNING

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

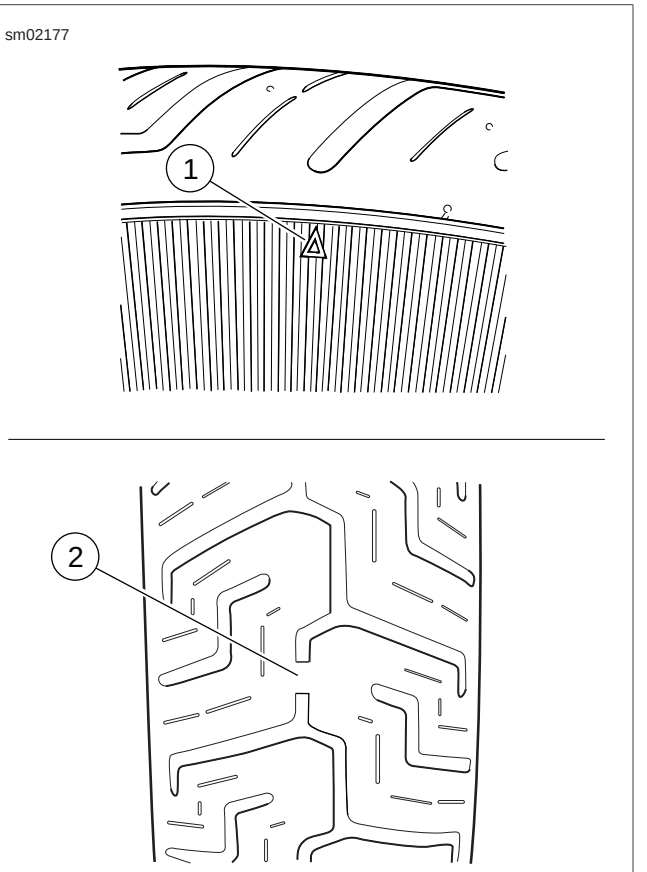
New tires should be stored on a horizontal tire rack. Avoid stacking new tires in a vertical stack. The weight of the stack compresses the tires and closes down the beads.

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

See Figure 2-79. The tread wear indicator bars will appear on tire tread surfaces when 1/32 in. (0.8 mm) or less of tread remains. Always remove tires from service before they reach the tread wear indicator bars.

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

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



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

Figure 2-79. Tread Wear Indicators

REMOVAL

NOTE

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

1. Remove wheel from motorcycle:
   a. If removing front wheel, see 2.3 FRONT WHEEL, Removal.
   b. If removing rear wheel, see 2.4 REAR WHEEL, Removal.
2. Deflate tire.

NOTE

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

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

CLEANING, INSPECTION AND REPAIR

1. Clean the inside of tire and outer surface of tube.
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Check wheels for lateral and radial runout before installing a new tire.
   a. On models with laced wheels, see 2.9 TRUING LACED WHEELS.
   b. On models with cast wheels, see 2.10 CHECKING CAST WHEEL RUNOUT.
4. Inspect the tire and tube for wear and damage. Inspect tread depth. Replace worn tires. Replace damaged tubes.

WARNING

Replace punctured or damaged tires. In some cases, small punctures in the tread area may be repaired from within the demounted tire by a Harley-Davidson dealer. Speed should NOT exceed 50 mph (80 km/h) for the first 24 hours after repair, and the repaired tire should NEVER be used over 80 mph (130 km/h). Failure to follow this warning could result in death or serious injury. (00015a)

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

INSTALLATION

WARNING

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

WARNING

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

WARNING

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

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

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

Tube Type Tires

WARNING

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

WARNING

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

NOTES

- *For correct tire and tube types, see 2.1 SPECIFICATIONS.*
- *Whenever a tube type tire is replaced, the tube should also be replaced. Inner tubes should be patched only as an emergency measure. Replace a damaged or patched tube as soon as possible. Rim bands must be used on all laced wheels.*

1. See Figure 2-80. On laced wheels, install a rim strip into the rim well. Make sure no spokes protrude through nipples, and be sure to align the valve stem hole in rim strip with valve stem hole in rim.
2. Install tube and tire.



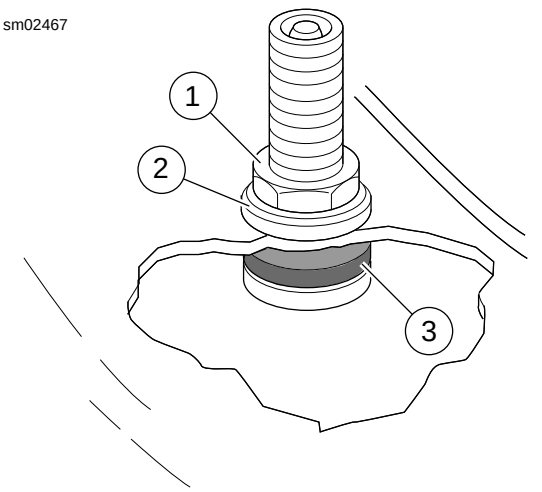
Figure 2-80. Installing Rim Strip

Tubeless Tires

⚠WARNING

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

1. See Figure 2-81. On tubeless wheels, damaged or leaking valve stems must be replaced. Install rubber grommet (3) on valve stem.
2. Insert valve stem into rim hole.
3. Install metal washer (2).
4. Install nut and tighten to 12-15 **in-lbs** (1.4-1.7 Nm).
5. Install tire.



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

Figure 2-81. Tubeless Tire Valve Stem

REMOVAL

1. Support motorcycle so front end is off floor and forks are fully extended. Remove brake caliper and front wheel. See 2.3 FRONT WHEEL.
2. Remove front fender. See 2.27 FRONT FENDER.
3. Loosen screws. Do not remove tube caps. Slide fork sides downward clear of fork brackets.
4. Repeat procedure for opposite fork tube and slider assembly.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-41177	FORK HOLDING TOOL

1. See Figure 2-82. Clamp fork tube and slider assembly in FORK HOLDING TOOL (Part No. HD-41177) and mount in vise.

NOTE

In next step, use a 12mm allen wrench to loosen seat pipe screw.

2. See Figure 2-84. While internal components are still under tension and less prone to rotate, break loose but do not completely unthread seat pipe screw.

NOTE

On right fork tube and slider assembly, remove axle holder to access seat pipe screw.

⚠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)

3. See Figure 2-85. Remove fork tube cap (7) and O-ring (6).
4. Remove the long spring collar (8).
5. Remove from fork holding tool and invert fork over a suitable container. Allow fork to drain. Extend and retract slider several times to push oil out of internal components. The washer (5), and spring (4) will fall out of fork tube.
6. Clamp fork tube in holder. Mount fork holding tool horizontally in vise.
7. See Figure 2-83. Remove slider cover from slider by inserting brass drift into notch in slider and lightly tapping cover.
8. See Figure 2-85. Compress oil seal retaining ring (11) and remove retaining ring from groove in top of slider bore.
9. Remove seat pipe screw (20) and washer (19) from bottom of slider (16, 17). Retain the seat pipe screw and washer.
10. Withdraw slider from fork tube (1) until bushing guide (14) contacts bushing (24) on fork tube. Bushing guide is a slight interference fit in slider.
11. Using the slider as a slide hammer, hit the bushing with the bushing guide with a quick continuous stroke until slider is pulled free of the fork tube.
12. Drain the slider and allow the stop oil lock piece (15) to fall free.

NOTE

If replacing the slider only, the components remaining in the fork tube can be left assembled and the fork re-assembled. See 2.17 FRONT FORK, Assembly.

13. If still attached to seat pipe, remove stop oil lock piece from the lower end of seat pipe.
14. Remove seat pipe (3) piston and ring assembly.
15. Remove rebound spring (2).
16. Remove oil seal (12), seal spacer (13), and bushing guide (14).
17. Repeat procedure for opposite fork tube and slider assembly.

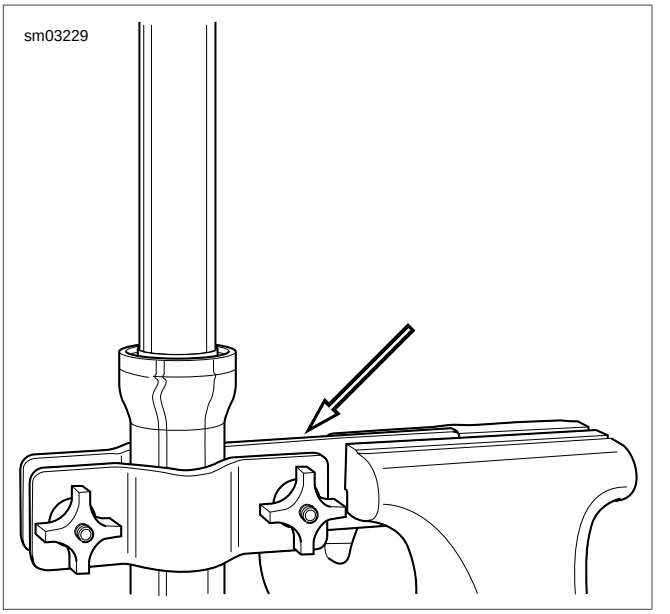


Figure 2-82. Fork Holding Tool (HD-41177) (mounted vertically to slider)

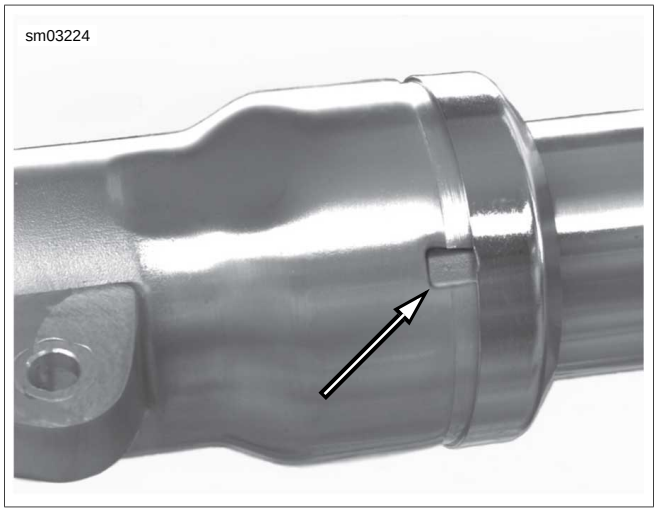
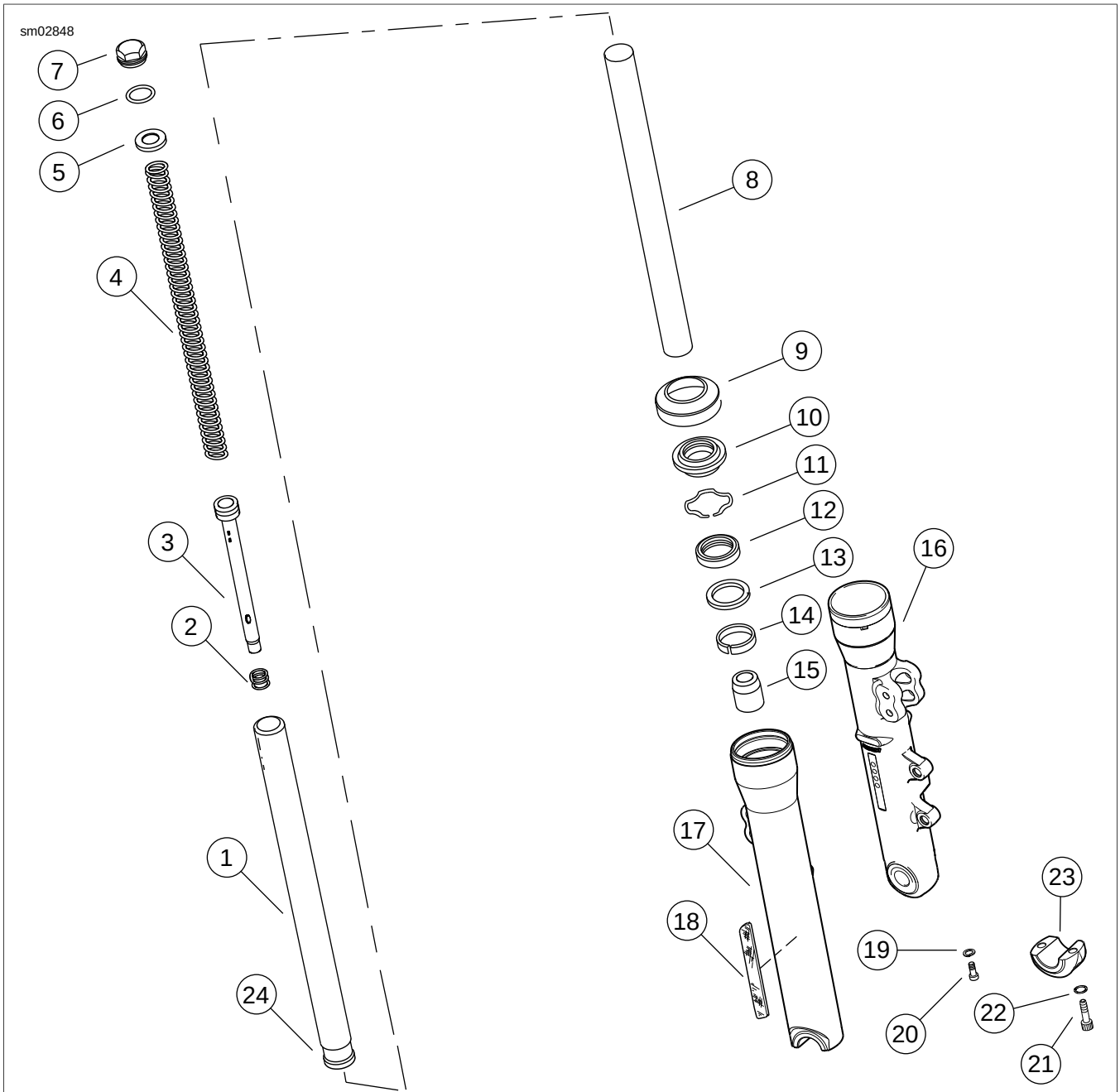


Figure 2-83. Notch in Slider



Figure 2-84. Seat Pipe Screw (right fork assembly)



1. Fork tube
2. Spring
3. Seat pipe
4. Spring
5. Washer
6. O-ring
7. Fork tube cap
8. Spring collar
9. Slider cover
10. Dust seal
11. Oil seal retaining ring
12. Oil seal
13. Oil seal spacer
14. Bushing guide
15. Lower stop
16. Slider assembly (left)
17. Slider assembly (right)
18. Reflector
19. Washer
20. Seat pipe screw
21. Axle cap fastener
22. Lockwasher
23. Axle cap
24. Bushing

Figure 2-85. Front Fork

CLEANING AND INSPECTION

1. Thoroughly clean and inspect each part. If inspection shows that any parts are bent, broken or damaged, those parts should be repaired or replaced.
2. See Figure 2-85. Inspect fork tube bushing (24) and bushing guide (14) and replace as required.
3. Always replace oil seals (12) and o-rings (6).
4. Check dust cover (9) where it rubs on fork tube. The dust cover should present a good continuous seal and not show excessive wear.
5. Check the slider tube (1) where it rubs on dust cover. The tube should show a bright, shining surface, free of scoring or abrasions.
6. If springs (4) are broken, replace springs.
7. If a fork tube or slider (16, 17) is bent or damaged, replace it.
8. Replace all other worn or damaged components as necessary.

ASSEMBLY

PART NUMBER	TOOL NAME
B-45305	FORK SEAL DRIVER
HD-59000A	PRO-LEVEL OIL GAUGE
HD-99884-80	TYPE E FORK OIL

1. See Figure 2-85. Insert seat pipe assembly (3) with the spring (2) into slider tube (1).
2. Slide bushing guide (14) down to bushing (24) on fork tube (1). Follow with spacer (13), oil seal (12), retaining ring (11), dust shield (10) and slider cover (9).
3. Install fork tube into FORK HOLDING TOOL (Part No. HD-41177) mounted horizontally in a vise.
4. Fit lower stop (15) onto seat pipe.
5. See Figure 2-86. Side seat pipe back into fork tube until seat pipe is centered in tube.
6. See Figure 2-85. Gently install slider assembly (16, 17) onto slider tube and bushing (24).
7. Thread seat pipe screw (20) and washer (19) into seat pipe through bottom of slider assembly. Draw fastener into seat pipe but do not tighten.
8. Verify action of fork by sliding slider up and down fork tube.
9. Assemble the FORK SEAL DRIVER (Part No. B-45305) over fork tube in front of oil seal.

NOTE

Chamfered lips on oil seal MUST face towards oil in fork.

10. See Figure 2-87. Holding fork seal driver (4) together, tap oil seal (3), spacer (2) and bushing guide (1) into slider bore.
11. See Figure 2-85. Install oil seal retaining ring (11) into groove in top of oil seal.
12. Push dust seal (10) against oil seal and stopper ring.
13. Rotate slider cover (9) to match any removal burrs to notch in slider and snap slider cover into place.
14. Move slider through its full range of travel several times to verify alignment. Then, pulling down on slide to apply downward force on rebound spring, tighten seat pipe screw to 106-159 **in-lbs** (12-18 Nm).
15. Re-position fork tube vertically in fork holding tool. With slider tube compressed, fill the fork with Harley-Davidson TYPE E FORK OIL (Part No. HD-99884-80) until it is approximately the applicable following distance from top of fork tube:
    a. FXDWG- 4.4 in. (112 mm), approximately 29.6 oz (875 cc).
    b. All other Dyna models- 4.3 in. (110 mm), approximately 26.6 oz (787 cc).
16. Slowly pump slider 8 to 10 times to exhaust air from assembly. Fully compress slider to determine oil level.

NOTE

Fork oil level is measured from top of fork tube, with spacer and spring removed and fork fully compressed.

17. Using the PRO-LEVEL OIL GAUGE (Part No. HD-59000A), adjust the oil level to specification.
18. Pull out the slider and install the spring (4) in the fork tube with the tightly wound end at the bottom.
19. Install the washer (5) and spring collar (8).

⚠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)

20. With a **new** O-ring, install and tighten fork tube caps to 16-43 ft-lbs (22-58 Nm).

NOTE

To prevent cross threading fork tube caps, use caution when threading in the caps with the spring compressed.

21. Repeat for opposite fork tube and slider assembly.

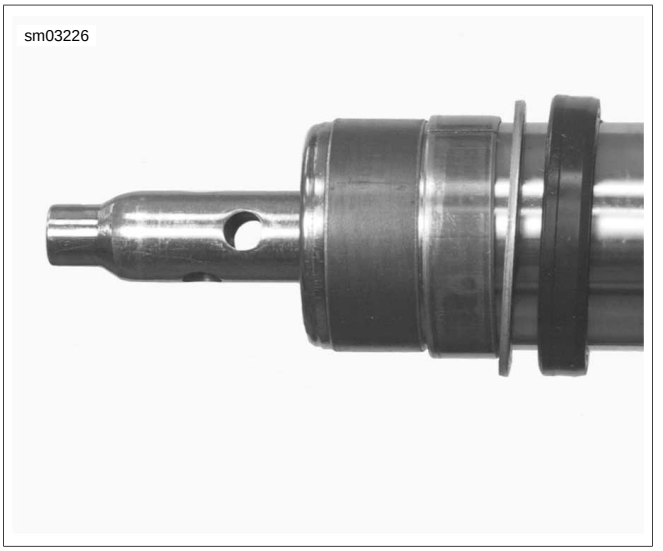
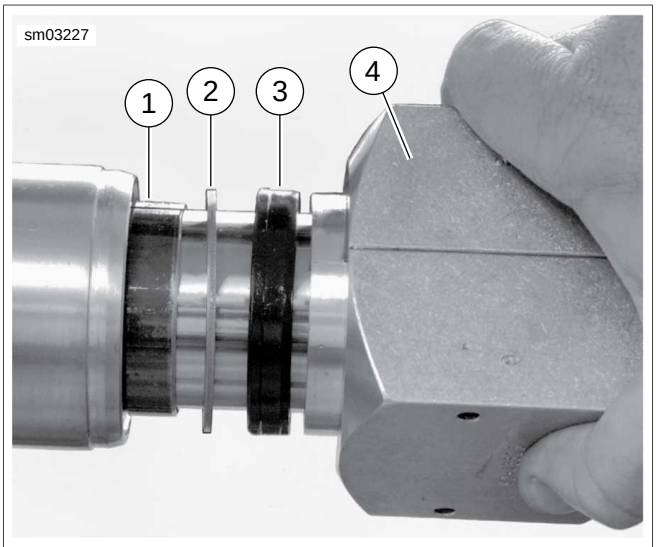


Figure 2-86. Seat Pipe Centered in Fork Tube



1. **Bushing guide**
2. **Spacer**
3. **Oil seal (chamfered lips must face oil)**
4. **Fork seal driver**

Figure 2-87. Assembled Fork Seal Driver

INSTALLATION

1. See Figure 2-88. Insert fork tube and slider assemblies through lower triple clamp and upper triple clamp. Fork tubes should protrude above upper triple clamp 0.450-0.500 in. (11.4-12.7 mm). Measurement must be taken at midpoint of fork tube between top surface of triple clamp to top of fork cap. Tighten pinch bolts to 30-35 ft-lbs (41-48 Nm).
2. Install front fender and bracket. See 2.27 FRONT FENDER.
3. Install front brake caliper hydraulic lines and install front brake calipers. See 2.3 FRONT WHEEL. Install front wheel and align the wheel to the forks.

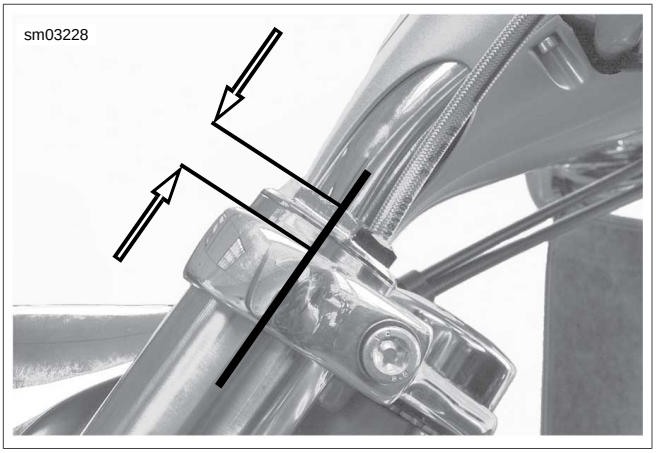
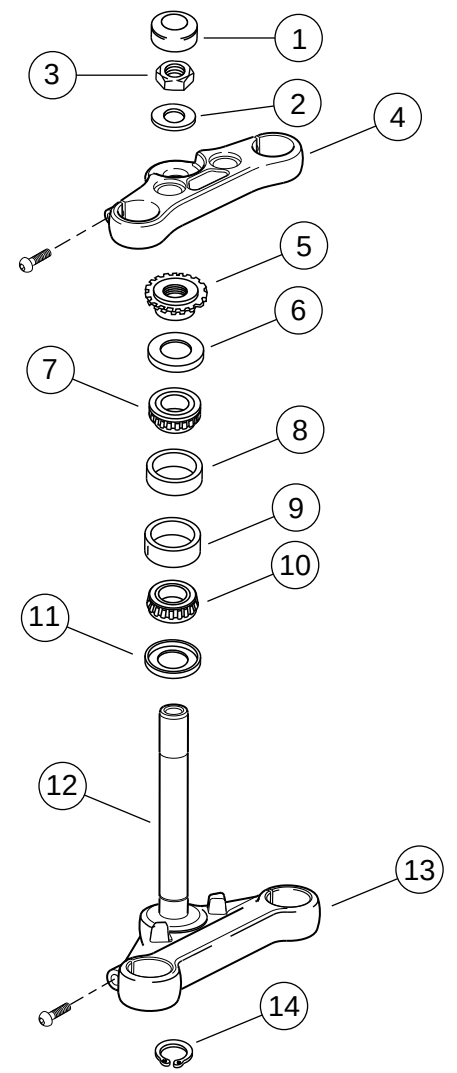


Figure 2-88. Fork Tube Protrusion: Typical

REMOVAL

1. Remove fork sides. See 2.17 FRONT FORK.
2. Remove the headlamp from lower fork bracket. See 8.9 HEADLAMP.
3. See Figure 2-89. Remove the fork stem cap (1). Remove the fork stem nut and the handlebar with upper bracket (4). Be careful not to pinch or kink control cables.
4. Remove the adjusting nut (5) and pull the fork stem and bracket (12) out of the steering head. Remove the upper dust shield (6) and bearing cone (7). Slide fork stem (12) and bracket (13) from frame.



1. **Fork stem cap**
2. **Hardened flat washer**
3. **Fork stem nut**
4. **Upper fork bracket**
5. **Adjusting nut**
6. **Upper dust shield**
7. **Bearing cone**
8. **Bearing cup**
9. **Bearing cup**
10. **Bearing cone**
11. **Lower dust shield**
12. **Fork stem**
13. **Lower fork bracket**
14. **Retaining ring**

Figure 2-89. Steering Head

INSPECTION

1. Check upper and lower bearing races in steering head. If they are pitted or grooved, replace the bearings and races in sets.

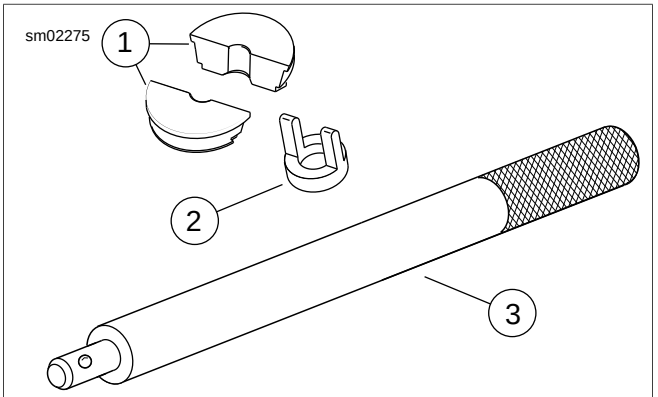
CAUTION

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

2. Check the roughness of the bearings by turning them in the race. Replace bearings if they do not turn freely and smoothly.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-33416	UNIVERSAL DRIVER
HD-39301-A	STEERING HEAD BEARING RACE REMOVER



1. **Remover (2 pieces)**
2. **Collet**
3. **Driver**

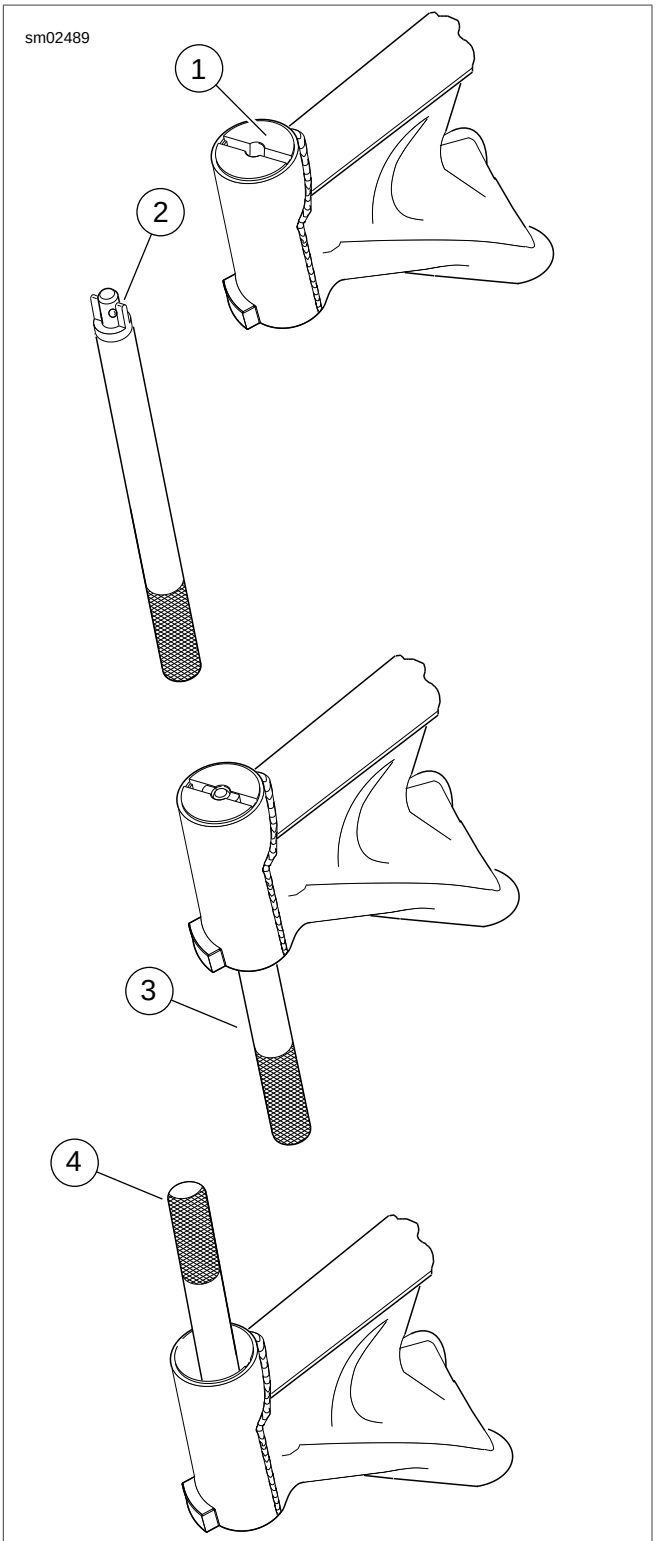
Figure 2-90. Race Remover Tools

Steering Head Bearing Race Removal

1. See Figure 2-91. With the tapered side down, seat the two-piece STEERING HEAD BEARING RACE REMOVER (Part No. HD-39301-A) (1) on the upper bearing race leaving a gap in the middle.
2. Install the collet (2) on the UNIVERSAL DRIVER (Part No. HD-33416).
3. Insert the driver at the bottom of the steering head tube, and while holding the remover tool on the race, center the collet in the gap (3). Tap the driver to remove the upper race.
4. Reverse the tool and repeat the procedure (4) to remove the lower bearing race.

NOTE

If bearing cups are removed, the bearings cannot be reused. They must be replaced. The lower bearing cone is not pressed on fork stem and may be slipped off fork stem along with lower dust shield.



1. **Install remover on upper race**
2. **Install collet on driver**
3. **Install driver in remover and remove upper race**
4. **Remove lower race**

Figure 2-91. Remove Races

ASSEMBLY

PART NUMBER	TOOL NAME
HD-39302	STEERING HEAD BEARING RACE INSTALLER
HD-99857-97	SPECIAL PURPOSE GREASE

1. Pack the new bearings with SPECIAL PURPOSE GREASE (Part No. HD-99857-97).

NOTE

Press only on inner bearing race or damage to bearing will occur.

2. See Figure 2-89. Install the lower dust shield (11) and new bearing (10) on the fork stem (12).

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)

3. Lubricate the races with engine oil. Install the **new** races using STEERING HEAD BEARING RACE INSTALLER (Part No. HD-39302).

INSTALLATION

WARNING

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

1. See Figure 2-89. Insert the stem and bracket assembly into the frame steering head and install the upper bearing (7) and dust shield (6). Secure with the adjusting nut (5). Tighten the adjusting nut until there is no noticeable shake or freeplay between bearings and races. Fork stem must turn freely from side to side.

NOTE

The washer under the fork stem nut is a special hardened material. Never replace this washer with a common flat washer. Doing so may allow the fork stem nut torque to loosen resulting in loss of steering control.

2. Install upper bracket (4), hardened flat washer (2).

NOTE

- *Original equipment fork stem nut has a blue coating. If a new nut is being installed, the replacement nut will not have a coating.*
- *Whenever the stem nut is loosened or removed, the threads must be lubricated with anti-seize lubricant prior to assembly and tightening.*

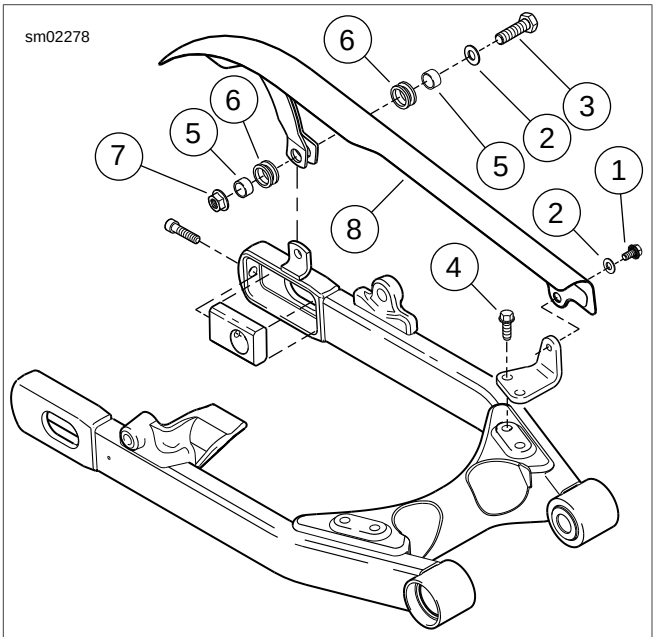
3. Lubricate threads of fork stem nut (3) with a light coating of anti-seize lubricant. Install stem nut and tighten securely.
4. Install the headlamp assembly. See 8.9 HEADLAMP.
5. Install fork sides. See 2.17 FRONT FORK.
6. Adjust steering head bearings. See 1.20 STEERING HEAD BEARINGS.
7. Tighten fork stem nut to 70-80 ft-lbs (94.9-108.4 Nm).
8. Install the fork stem cap.
9. Align headlamp. See 1.23 HEADLAMP ALIGNMENT.

REMOVAL

1. See Figure 2-92. Remove front fastener (1) and washer (2).
2. Remove rear fastener (3) and washer (2) from nut (7).
3. Lift belt guard (8) away from rear fork.
4. Disassemble belt guard by removing grommets (6) and spacers (5).

INSTALLATION

1. See Figure 2-92. If removed, install grommets (6) and spacers (5) on belt guard.
2. Place assembled belt guard over front and rear tabs on rear fork.
3. Loosely install front fastener (1) and washer (2).
4. Loosely install rear fastener (3) and washer (2) with nut (7).
5. Tighten front fastener (1) to 10-15 ft-lbs (13.6-20.3 Nm).
6. Tighten rear fastener (3) and nut (7) to 10-15 ft-lbs (13.6-20.3 Nm).
7. Verify that belt guard does not contact belt during rear fork travel.



1. **Front fastener**
2. **Washer (2)**
3. **Rear fastener**
4. **Screw, belt guard bracket (2)**
5. **Spacer (2)**
6. **Grommet (2)**
7. **Nut**
8. **Belt guard**

Figure 2-92. Belt Guard

REMOVAL

See Figure 2-93. Remove three screws to detach debris deflector from rear fork.

INSTALLATION

See Figure 2-93. Attach debris deflector to rear fork using three screws. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm).

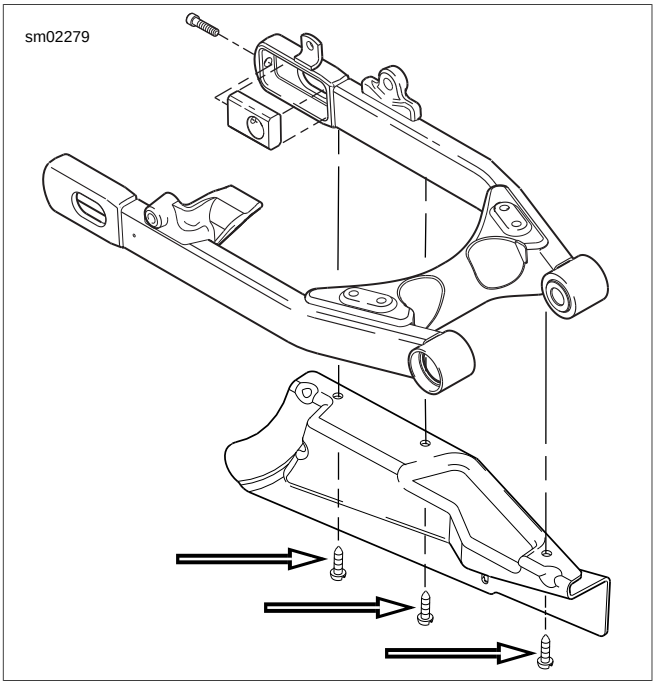
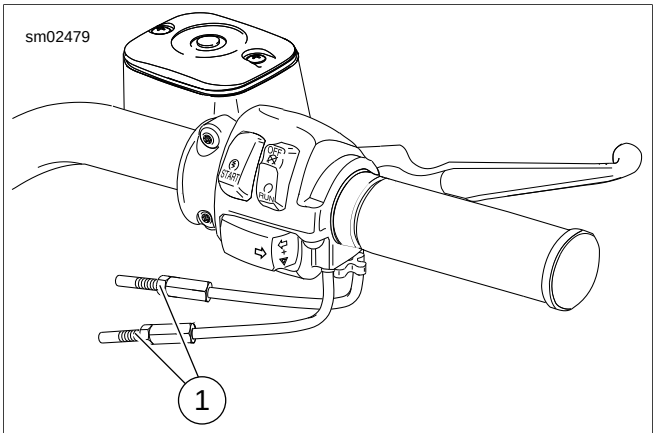


Figure 2-93. Debris Deflector Screws

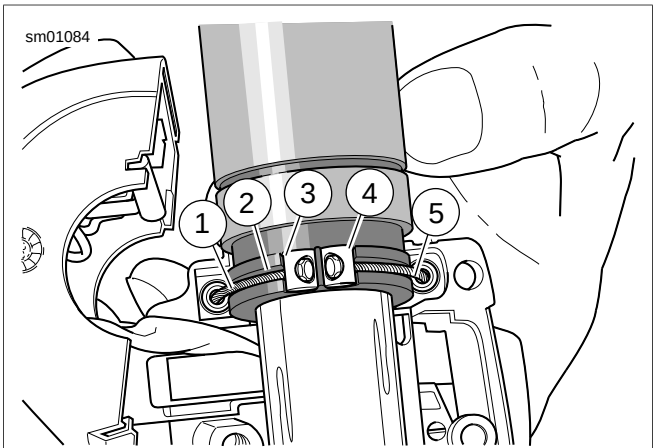
REMOVAL/DISASSEMBLY

1. See Figure 2-94. Loosen cable adjuster jam nuts. Screw throttle cable adjuster until it is a short as possible. Remove the two screws that hold the handlebar housing together to separate the upper and lower housings.
2. Unhook the ferrules and cables from the throttle grip and lower housing.
3. Remove air cleaner assembly and disconnect throttle cables from induction module. See 4.4 AIR CLEANER ASSEMBLY, Removal.
4. See Figure 2-95. Pull the cables from the housing by placing a drop of oil on the retaining ring that holds the cable in the housing, then firmly pull the bent tubing portion of the cable out of the housing using a rocking motion.



1. **Adjuster jam nut (2)**

Figure 2-94. Handlebar Throttle Control



1. **Throttle cable (silver insert, front hole)**
2. **Groove in throttle grip**
3. **Notch**
4. **Brass ferrule**
5. **Idle cable (gold insert, rear hole)**

Figure 2-95. Throttle Cable Attachment

CLEANING AND INSPECTION

WARNING

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

1. Wash all components in non-flammable cleaning solvent. Blow parts dry with low pressure compressed air.
2. Replace the control cables if frayed, kinked or bent.
3. Put one or two drops of oil into the housing of each control cable.

ASSEMBLY/INSTALLATION

1. Apply a light coating of graphite to the handlebar and inside surface of the housings.
2. See Figure 2-94. Attach the control cable assemblies to the lower housing.
   a. Push the silver insert of the throttle cable housing into the hole in front of the tension adjuster screw.
   b. Push the gold insert of the idle cable housing into the hole at the rear of the tension adjuster screw.
   c. Install adjusting screw, spring and friction pad in the lower housing if they were removed.
3. Position the throttle grip on the handlebar. Place the lower housing on the throttle. Position the ferrules and retaining rings over the cable balls and seat them in the throttle notches.

WARNING

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

4. Fasten upper housing to lower housing using two screws. Tighten to 35-45 **in-lbs** (4.0-5.1 Nm).
5. Check throttle cable routing.
6. Install throttle cables and adjust.
7. Install air cleaner.

THROTTLE CABLE ROUTING

WARNING

Pinched throttle cables can restrict throttle response, which could result in loss of control and death or serious injury. (00423b)

NOTE

- *Control cables must not pull tight when handlebars are turned to left and right fork stops. Also, be sure control cables and wires are clear of fork stops at steering head*

so they will not be pinched when fork is turned against stop.

- *Install cable ties securing throttle cables to frame so that tail of cable faces top of vehicle. Using this method will ensure proper placement of cables.*

See Figure 2-96. Throttle cables are routed behind front fork upper bracket, then under right side of tank to induction module.



Figure 2-96. Throttle Cable Routing: FXDWG, FXDF (Typical)

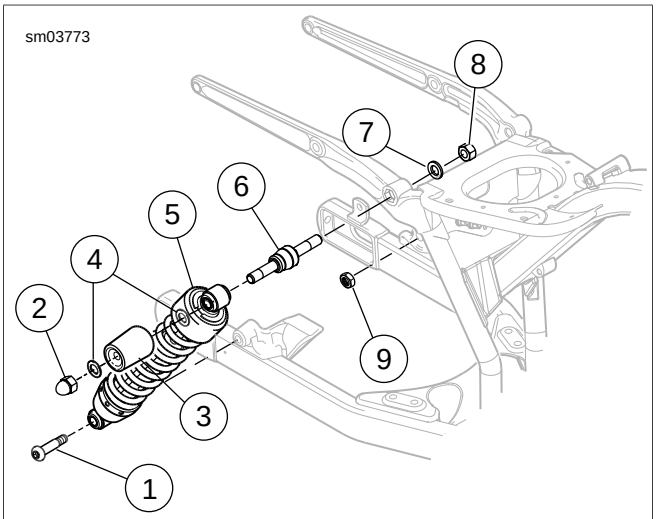
GENERAL

When removing the shocks for repair or replacement, remove and install one shock first, then the other. This will eliminate the need for raising the rear end of the motorcycle. If it is necessary to remove both shocks at once, place the motorcycle on a center stand with the rear wheel raised off the ground.

For information on preload adjustment and suspension settings, see 1.18 SUSPENSION ADJUSTMENTS.

REMOVAL

1. Block motorcycle underneath frame so rear wheel is raised off the ground.
2. See Figure 2-97. Remove lower shock mount screw (1). Nut (9) is only used on left side.
3. Remove upper shock mount nut (2), outer washer (4), chrome cover (3), inner washer (4), and shock absorber (5).
4. Repeat for other shock absorber.
5. If stud (6) is to be removed, remove nut (8) and washer (7).



1. **Lower mounting screw (2)**
2. **Upper mounting nut (2)**
3. **Cover, chrome (FXDB, FXDC only) (2)**
4. **Washer (4)**
5. **Shock absorber (2)**
6. **Stud (2)**
7. **Hardened washer (2)**
8. **Nut (2)**
9. **Jam nut (lower-left side only)**

Figure 2-97. Rear Shock Absorber Mounting (Typical)

INSPECTION

NOTE

Shocks are non-repairable items, except for the rubber mounting bushings. If the shock is leaking or damaged, it must be replaced as an assembly.

1. Examine the rubber mounting bushings for cracks or wear. Examine the shock for leaks. The unit should not leak and should compress slightly easier than it extends. Compare the action of the shock with a new one to judge if it is worn. Replace the shock if necessary.
2. Clean and examine the shock mounting hardware. Replace parts that are worn or damaged.

INSTALLATION

1. See Figure 2-97. If removed, install stud (6), hardened washer (7) and nut (8). Tighten to 70-85 ft-lbs (101.7-115.2 Nm).
2. Fasten each shock to the frame and rear fork using the original hardware.
3. Attach lower shock mount to rear fork.
   a. Apply two to three drops of LOCTITE THREAD-LOCKER 243 (blue) to threads of bottom bolt (1).
   b. Install bolt and hand tighten.
4. Apply two to three drops of LOCTITE THREADLOCKER 243 (blue) to threads of shock mount nut (2).
   a. Install inside washer (4), shock (5), cover (3), (if applicable,) outside washer (4) and upper shock mount nut (2).
   b. Hand tighten nut (2).

NOTE

Before tightening, rotate shock cover (4) counterclockwise to provide for proper alignment when tightened.

5. Tighten upper and lower shock mount screws as follows:
   a. Lower mount: 30-40 ft-lbs (40.7-54.2 Nm)
   b. Upper mount: 30-40 ft-lbs (40.7-54.2 Nm)

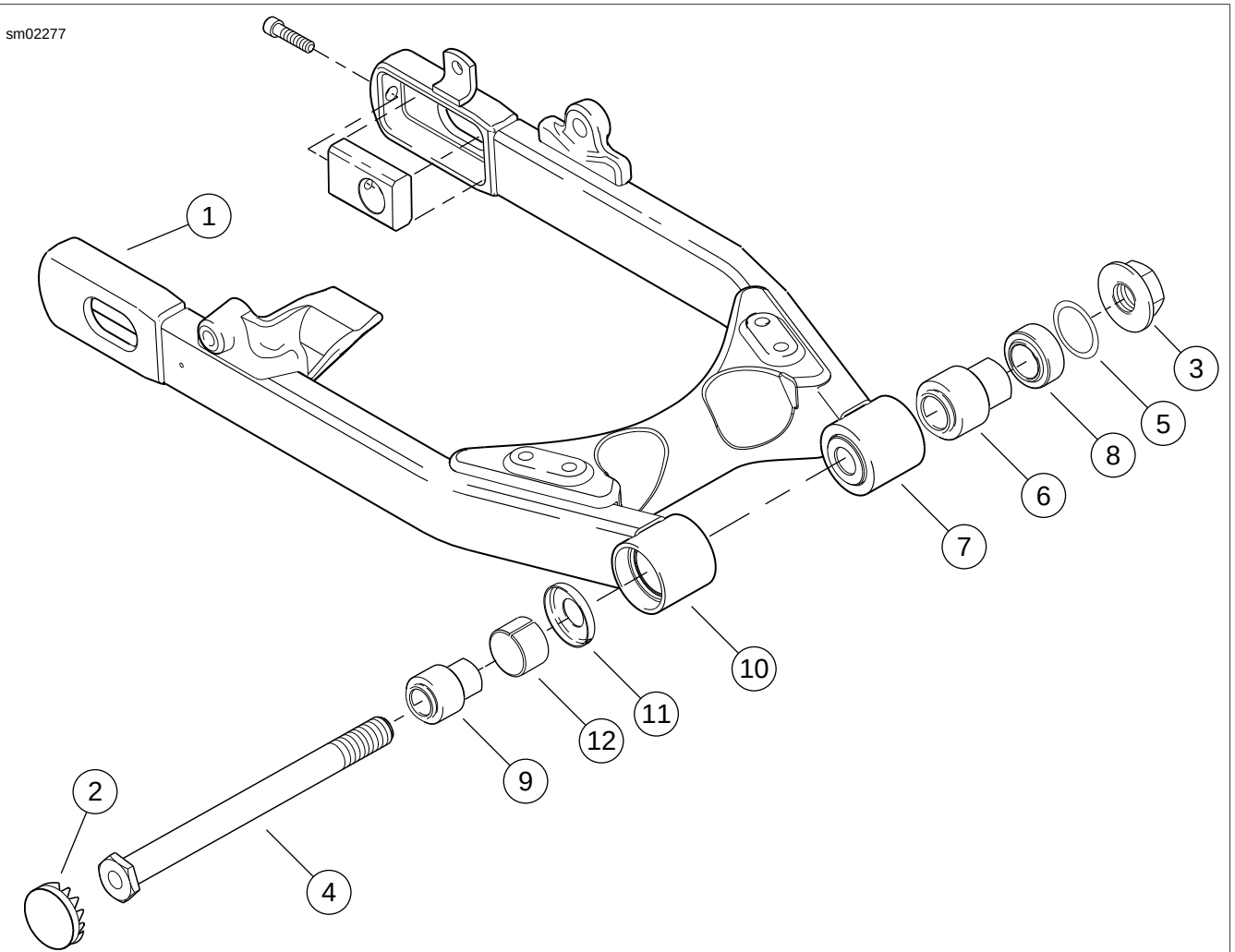
REMOVAL

1. Remove exhaust system. See 4.16 EXHAUST SYSTEM.
2. Remove rear brake caliper. See 2.15 REAR BRAKE CALIPER.
3. Remove rear wheel. See 2.4 REAR WHEEL.

NOTE

***Do not** remove sprocket or brake disc unless they are damaged and must be replaced.*

4. Remove lower shock absorber fasteners and swing shock absorbers away from swingarm. See 2.22 REAR SHOCK ABSORBERS.
5. Remove the belt and debris guards. See 2.19 BELT GUARD and 2.20 DEBRIS DEFLECTOR.
6. Remove rear brake line clamp from rear fork.
7. See Figure 2-98. Remove plug (2).
8. Remove nut (3).
9. Remove pivot shaft with attached nut (4). Support rear fork (1) and pull assembly from frame.



1. **Rear fork**
2. **Plug**
3. **Nut**
4. **Pivot shaft**
5. **Retaining ring**
6. **Left spacer**
7. **Left boss**
8. **Pivot bearing**
9. **Right spacer**
10. **Right boss**
11. **Dust shield**
12. **Bushing**

Figure 2-98. Rear Fork

DISASSEMBLY

Carefully mark all components as they are removed, so components may be easily returned to their original locations.

NOTE

The pivot bearing (8) is lifetime lubricated and will require no further attention other than cleaning. Only disassemble components from left boss of fork if they are damaged.

1. See Figure 2-98. Remove retaining ring (5), push or with a brass drift tap spacer (6) inboard to remove it from left fork boss (7).
2. From inboard side press or drive pivot bearing (8) from left fork boss.
3. Push or with a brass drift tap spacer (9) outboard to remove it from right fork boss (10).
4. Press pivot bushing (12) and dust shield (11) from fork assembly.

CLEANING AND INSPECTION

See Figure 2-98. The pivot bearing (8) is lifetime lubricated and will require no further attention other than cleaning. Clean the bearing bore with a clean shop towel, removing any dirt or grit adhering to the bearing surface.

1. Carefully inspect all bearing components for wear and/or corrosion. Replace any components that are damaged.
2. Check that rear fork is not bent or twisted. Replace if damaged.

ASSEMBLY

PART NUMBER	TOOL NAME
99855-89	WHEEL BEARING GREASE

1. See Figure 2-98. If necessary, install **new** pivot bearing (8) and press **new** bearing from outboard side until outer race is seated against shoulder in left fork boss (7).
2. Install retaining ring (5) and spacer (6). The spacer must be inserted from the inboard side.
3. If bushing (12) must be replaced, press the bushing and dust shield (11) into the fork bore so dust shield is flush to 0.060 in. (1.50 mm) above fork bore.
4. Coat right side pivot spacer (9) with WHEEL BEARING GREASE (Part No. 99855-89). Insert pivot spacer into pivot bushing (12) with chamfered end facing outward.

INSTALLATION

1. Coat pivot shaft with anti-seize lubricant.
2. Slide rear fork assembly into position on mounting boss of transmission case.
3. See Figure 2-98. Hold fork assembly in position and install the pivot shaft with attached nut (4) from right side. Thread nut (3) on threads of pivot shaft. Tighten nut to 71-75 ft-lbs (96.3-101.7 Nm).
4. Swing shock absorbers into position and install lower shock absorber fasteners. See 2.22 REAR SHOCK ABSORBERS.
5. Install rear brake caliper. See 2.15 REAR BRAKE CALIPER.
6. Install rear brake line clamp to rear fork.
7. Install rear wheel and adjust drive belt deflection. See 2.4 REAR WHEEL.
8. Install the belt and debris guards. See 2.19 BELT GUARD and 2.20 DEBRIS DEFLECTOR.
9. Install exhaust system. See 4.16 EXHAUST SYSTEM.

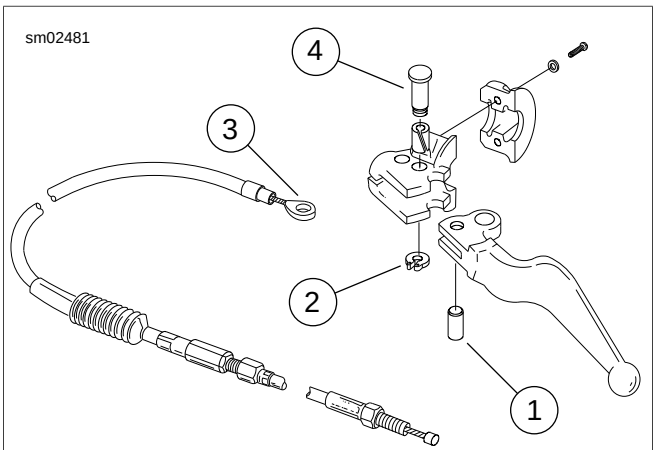
REMOVAL

1. Loosen clutch adjuster so clutch cable is fully slack. See 1.11 CLUTCH, Adjustment.

NOTE

Use the appropriate size retaining ring pliers and the appropriate tip to remove or install the retaining ring. Verify that the tip is in good condition.

2. See Figure 2-99. Remove the clutch cable anchor pin (1) from the hand lever. To remove anchor pin, it will be necessary to remove the retaining ring (2) and pivot pin (4).
3. Drain transmission lubricant and remove fill plug dipstick. Remove transmission side cover. See 7.4 CLUTCH RELEASE COVER.
4. See Figure 2-100. Note position of retaining ring opening. Retaining ring opening must be positioned in approximately the same location during assembly. Remove retaining ring (4).
5. Pull inner ramp and ramp coupling (3) out of side cover. Hold inner and outer ramps together to keep balls from falling free.
6. Rotate the inner ramp to a position which will allow the coupling to be disconnected from the inner ramp lever arm. Disconnect coupling from inner ramp. Disconnect cable end (2) from coupling.
7. Back out threaded cable fitting (1) from side cover.



1. **Anchor pin**
2. **Retaining ring**
3. **Clevis**
4. **Pivot pin**

Figure 2-99. Clutch Cable Installation

INSTALLATION

1. See Figure 2-100. Thread clutch cable fitting (1) (with o-ring) into side cover. Do not tighten at this time.
2. Connect cable end to ramp coupling (3). Rotate ramps for best access and install coupling on inner ramp. Place ramp assembly in position in side cover.

NOTE

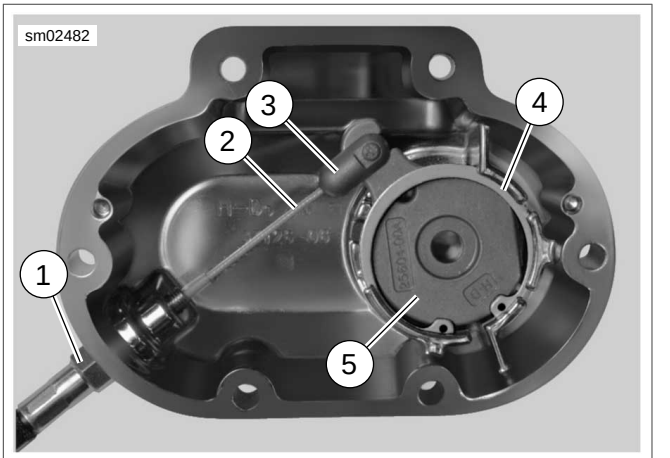
Use the appropriate size retaining ring pliers and the appropriate tip to remove or install the retaining ring. Verify that the tip is in good condition.

3. Install retaining ring (4). Position retaining ring opening to the right of the outer ramp tang (the stop that prevents rotation).
4. Place **new** gasket on side cover and install, fully tightening the clutch cable fitting. See 7.4 CLUTCH RELEASE COVER.
5. Place a few drops of oil inside cable housing.

NOTE

Anchor pin does not require lubrication.

6. Check that clutch cable is properly routed along left side of steering head, behind the triple trees, and through the clips on front frame crossmember.
7. See Figure 2-99. Insert anchor pin (1) through handle and clutch cable clevis end (3).
8. Place handle in bracket and install pivot pin (4) and retaining ring (2).
9. Adjust clutch cable. See 1.11 CLUTCH, Adjustment.



1. **Cable fitting**
2. **Clutch cable end**
3. **Ramp coupling**
4. **Retaining ring**
5. **Inner ramp**

Figure 2-100. Clutch Cable Connection

REMOVAL

All Models

WARNING

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

1. Disconnect negative battery cable.
2. Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.
3. Remove front master cylinder assembly. See 2.12 FRONT BRAKE MASTER CYLINDER.
4. Remove two screws securing clutch control assembly to left side of handlebar. See 2.24 CLUTCH CONTROL.
5. Remove right and left handlebar switch assemblies and throttle. See 8.29 RIGHT HANDLEBAR SWITCH or 8.30 LEFT HANDLEBAR SWITCH.

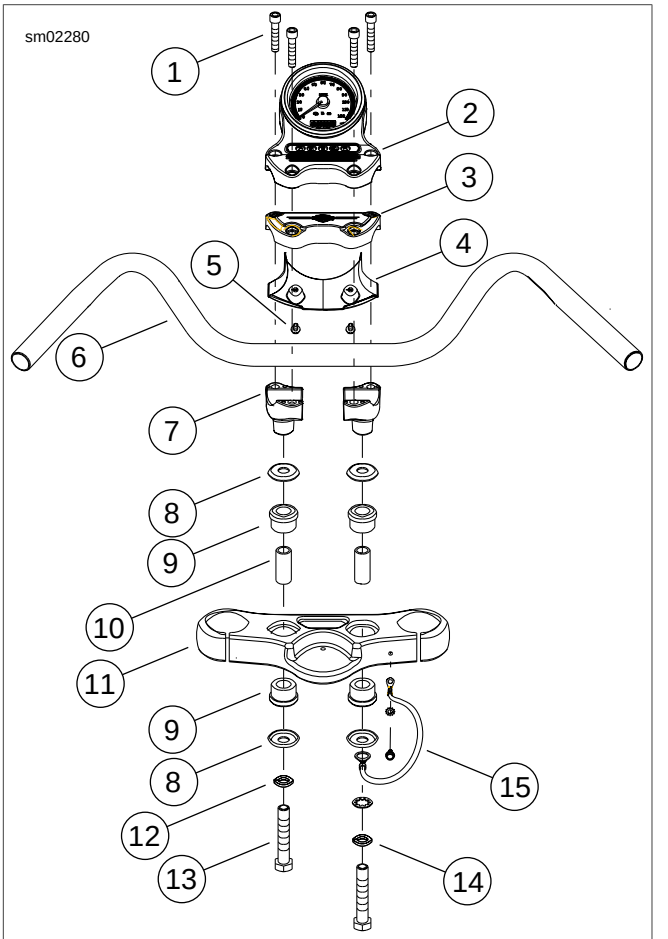
NOTE

Original equipment grip is glued in place and must be cut off to remove. Remove grip only if necessary.

6. Remove left handlebar grip.

FXD/FXDC Models

1. See Figure 2-101. Remove speedometer cover fasteners (5) and speedometer cover (4).
2. Remove upper handlebar clamp fasteners (1).
   a. For FXD models, remove upper handlebar clamp and speedometer assembly (2).
   b. For FXDC models, remove upper handlebar clamp (3).
3. Remove handlebar (6).
4. If removing lower handlebar clamps (7), remove two lower handlebar clamp fasteners (13), lockwashers (12), ground cable (15) and ground cable washer (14) and lower handlebar clamps from upper fork bracket (11). Replace bushings (9) if necessary.

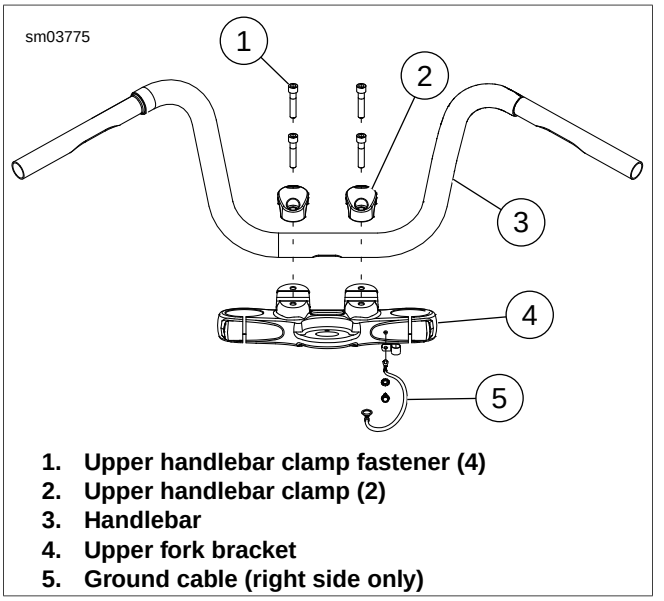


1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp and speedometer assembly (FXD)**
3. **Upper handlebar clamp (FXDC)**
4. **Speedometer cover (FXD)**
5. **Speedometer cover fastener (FXD, 2)**
6. **Handlebar**
7. **Lower handlebar clamp (2)**
8. **Cup washer (4)**
9. **Bushing (4)**
10. **Spacer (2)**
11. **Upper fork bracket**
12. **Lockwasher (2)**
13. **Lower handlebar clamp fastener (2)**
14. **Ground cable washer (right side only)**
15. **Ground cable (right side only)**

Figure 2-101. Handlebars: FXD, FXDC

FXDB

1. See Figure 2-102. Remove handlebar clamp fasteners (1).
2. Remove upper handlebar clamps (2).
3. Remove handlebar (3).

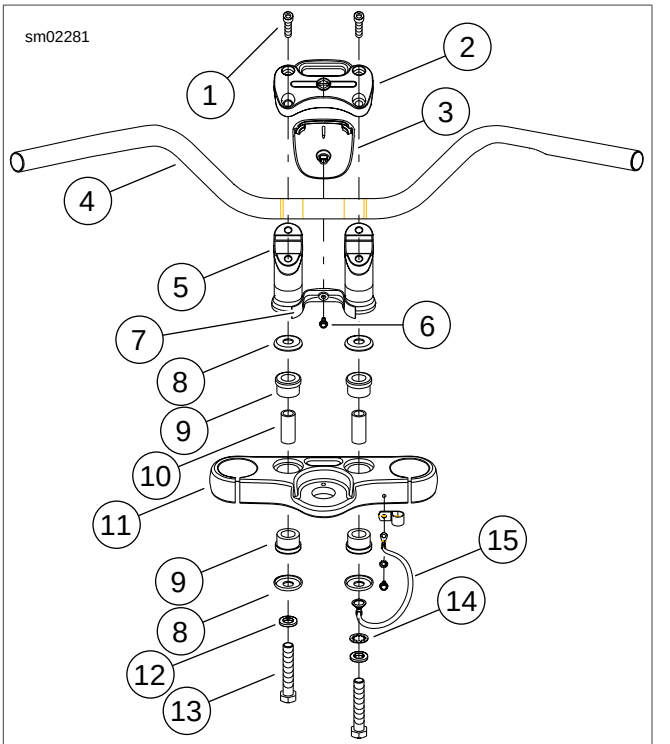


1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp (2)**
3. **Handlebar**
4. **Upper fork bracket**
5. **Ground cable (right side only)**

Figure 2-102. Handlebars: FXDB

FXDL Models

1. See Figure 2-103. Remove riser cover fastener (6) and riser cover (3).
2. Remove upper handlebar clamp fasteners (1).
3. Remove upper handlebar clamp (2).
4. Remove handlebar (4).
5. If removing risers (5), remove two riser fasteners (13), lockwashers (12), ground cable (15) and ground cable washer (14) and risers from upper fork bracket (11). Replace bushings (9) if necessary.



1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp**
3. **Riser cover**
4. **Handlebar**
5. **Riser (2)**
6. **Riser cover fastener**
7. **Riser cover retainer**
8. **Cup washer (4)**
9. **Bushing (4)**
10. **Spacer (2)**
11. **Upper fork bracket**
12. **Lockwasher (2)**
13. **Riser fastener (2)**
14. **Ground cable washer (right side only)**
15. **Ground cable (right side only)**

Figure 2-103. Handlebars: FXDL

INSTALLATION

FXD/FXDC Models

1. See Figure 2-101. If lower handlebar clamps (7) were removed, install lockwashers (12) on lower handlebar clamp fasteners (13). Install ground cable (15) and ground cable washer (14) on right-side fastener.

NOTE

In next step, make sure cup washers (8), bushings (9) and spacers (10) are in position in upper fork bracket (11).

2. Slide lower handlebar clamp fasteners through upper fork bracket.
3. Loosely install lower handlebar clamps to upper fork bracket using lower handlebar clamp fasteners.
4. Place handlebars (4) on lower handlebar clamps. Install upper handlebar clamp (2 or 3). Install but do not tighten clamp fasteners.

5. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

NOTE

On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp and will not be visible at all when handlebar is centered properly.

6. Raise handlebars to normal riding position and hold in position.
7. Secure handlebars in clamp:
   a. Tighten two rear fasteners (1) until cast-in spacers contact handlebar lower clamps (7).
   b. Tighten front fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Final tighten rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm). Slight gap between upper and lower clamps should exist at front.
8. Tighten lower handlebar clamp fasteners (13) to 30-40 ft-lbs (40.7-54.2 Nm).
9. Install speedometer cover (4) and speedometer cover fasteners (5). Tighten fasteners to 50-60 **in-lbs** (5.6-6.8 Nm).

FXDB Models

1. See Figure 2-102. Place handlebars (3) on risers. Install upper handlebar clamps (2). Install but do not tighten clamp fasteners.
2. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

NOTE

On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp and will not be visible at all when handlebar is centered properly.

3. Raise handlebars to normal riding position and hold in position.
4. Secure handlebars in clamp:
   a. Tighten two rear fasteners (1) until cast-in spacers contact risers.
   b. Tighten front fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Final tighten rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm). Slight gap between upper and lower clamps should exist at front.

FXDL Models

1. See Figure 2-103. If risers (5) were removed, install lockwashers (12) on riser fasteners (13). Install ground cable (15) and ground cable washer (14) on right-side fastener.

NOTE

In next step, make sure cup washers (8), bushings (9) and spacers (10) are in position in upper fork bracket (11).

2. Slide riser fasteners through upper fork bracket.
3. Loosely install risers to upper fork bracket using riser fasteners.
4. Place handlebars (4) on risers. Install upper handlebar clamp (2). Install but do not tighten clamp fasteners.
5. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

NOTE

On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp and will not be visible at all when handlebar is centered properly.

6. Raise handlebars to normal riding position and hold in position.
7. Secure handlebars in clamp:
   a. Tighten two rear fasteners (1) until cast-in spacers contact risers.
   b. Tighten front fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
   c. Final tighten rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm). Slight gap between upper and lower clamps should exist at front.
8. Tighten riser fasteners to 30-40 ft-lbs (40.7-54.2 Nm).
9. Install speedometer cover (4) and speedometer cover fasteners (5). Tighten fasteners to 50-60 **in-lbs** (5.6-6.8 Nm).
10. Install riser cover (3) riser cover fastener (6). Tighten fastener to 50-60 **in-lbs** (5.6-6.8 Nm).

All Models

1. Install left handlebar grip.
2. Install right and left handlebar switch assemblies. Do not tighten at this time. See 8.29 RIGHT HANDLEBAR SWITCH or 8.30 LEFT HANDLEBAR SWITCH.
3. Install clutch control assembly. See 2.24 CLUTCH CONTROL.
4. Install front brake master cylinder. See 2.12 FRONT BRAKE MASTER CYLINDER.
5. Connect battery negative cable. Tighten to 60-69 **in-lb** (6.8-10.9 Nm)

⚠WARNING

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

6. Test front brake lever for pressure and operation.
7. Test for correct operation. Adjust as required. See 1.14 THROTTLE CABLES.
8. Turn the Ignition/Light Key Switch to IGNITION and test switches for proper operation.
9. Operate brake lever to test stop light lamp.

REMOVAL

⚠WARNING

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

1. Disconnect negative battery cable.
2. Remove instrument panel. See 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
3. Unplug fuel gauge connector.
4. Remove fuel tank fasteners, vent, fuel supply fitting and slide fuel tank back. See 4.5 FUEL TANK.
5. Place blanket or protective cover over front of fuel tank to protect against scratches and other damage.
6. Disconnect all left and right side hand control connectors from connectors on main harness.

NOTE

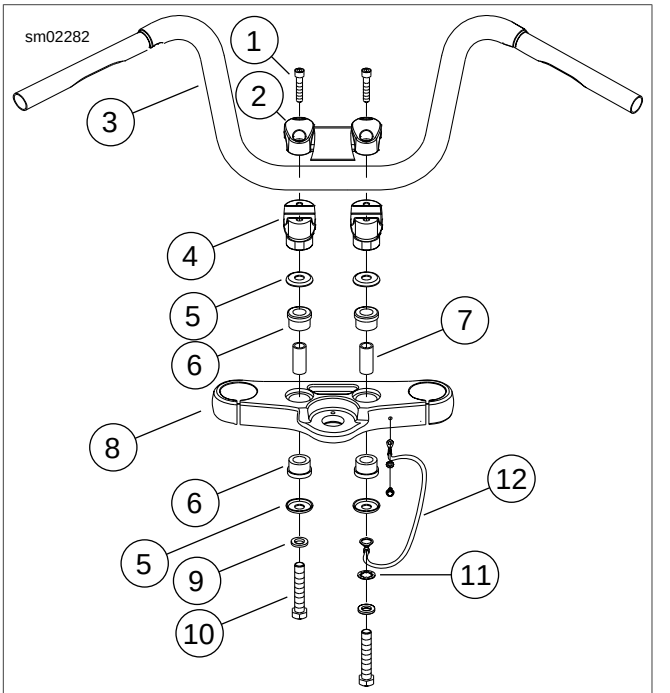
Make note of wire colors and locations in connector before removal. This will ensure proper wire location in connector during installation.

7. Identify wire leads and remove terminals from hand control connector housings (left hand control connector [24], right hand control connector [22]). See A.10 MOLEX CONNECTORS.
8. Remove terminals from turn signal multilock connector. See A.2 AMP MULTILOCK CONNECTORS
9. Remove front master cylinder assembly. See 2.12 FRONT BRAKE MASTER CYLINDER.
10. Remove clutch control assembly from handlebar. See 2.24 CLUTCH CONTROL.
11. Separate right handlebar switch assembly and remove throttle. See 8.29 RIGHT HANDLEBAR SWITCH.

NOTE

Original equipment grip is glued in place and must be cut off to remove. Remove grip only if necessary.

12. Remove left handlebar grip.
13. Remove switch housings, turn signals and wiring from handlebars.
14. See Figure 2-104. Remove upper handlebar clamp fasteners (1) and upper handlebar clamp (2). Remove handlebar.
15. If removing lower handlebar clamps (4), remove two lower handlebar clamp fasteners (10), lockwashers (9), ground cable (12) and ground cable washer (11) and lower handlebar clamps from upper fork bracket (8). Replace bushings (6) if necessary.



1. **Upper handlebar clamp fastener (4)**
2. **Upper handlebar clamp**
3. **Handlebar**
4. **Lower handlebar clamp (2)**
5. **Cup washer (4)**
6. **Bushing (4)**
7. **Spacer (2)**
8. **Upper fork bracket**
9. **Lockwasher (2)**
10. **Lower handlebar clamp fastener (2)**
11. **Ground cable washer (right side only)**
12. **Ground cable (right side only)**

Figure 2-104. Handlebars: FXDWG/FXDF (FXDWG shown)

INSTALLATION

NOTE

The turn signal wires enter the switch housings through a relief grommet in the housing. The turn signals must be supported throughout this procedure to prevent pulling the grommet or the turn sign wires out of the housing.

1. Repair or replace switches, turn signal switches, wires and grommets as necessary.

NOTE

For handlebar switch repair procedures, see 8.28 HANDLEBAR SWITCH ASSEMBLIES.

2. Wrap wire ends and open ends of conduit with electrical tape.
3. Cut a length of mechanics wire to use as a leader.
4. Lay mechanics wire along the wire harnesses so a few inches overlap and secure using electrical tape.

⚠WARNING

Grommets in each of the wiring holes in the handlebar must remain in position after routing the wiring through the handlebar. Operation without the grommets in place can damage wires, causing a short circuit which could result in death or serious injury. (00416d)

5. If necessary, replace grommets on handlebars wire openings.
6. Lubricate wire conduits with glass cleaner.
7. See Figure 2-105. Thread the wire leaders through the handlebar grommets and to the center hole.
8. Pull wire bundles through to the handlebar center hole.
9. Loosely install left and right switch housings.
10. Pull slack from wire harnesses and remove the tape and mechanics wire.

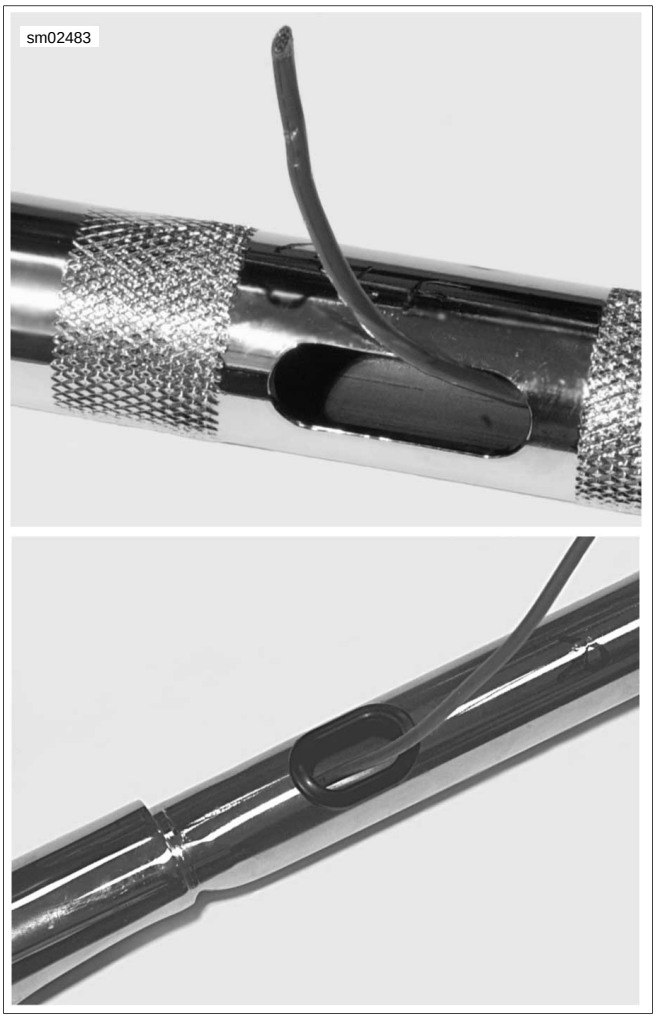


Figure 2-105. Wire Leader in Handlebars (Handlebars Removed from Motorcycle)

11. See Figure 2-104. If lower handlebar clamps (4) were removed, install lockwashers (9) on lower handlebar clamp fasteners (10). Install ground cable (12) and ground cable washer (11) on right-side fastener.
12. If removed, install cup washers (5), bushings (6) and spacers (7) in upper fork bracket (8).
13. Slide lower handlebar clamp fasteners (10) through upper fork bracket.
14. Loosely install lower handlebar clamps (4) to upper fork bracket using lower handlebar clamp fasteners.
15. Place handlebars (3) on lower handlebar clamps. Install upper handlebar clamps (2). Install but do not tighten clamp fasteners (1).
16. Insert wires into proper locations in wire connector housings. See B.2 WIRING DIAGRAMS, 2008 Dyna Wiring Diagrams.
17. Connect left and right hand control connectors [22, 24].
18. Connect turn signal connector [31].
19. Install clutch control and front master cylinder. Align housings and tighten fasteners. See 2.24 CLUTCH CONTROL or 2.12 FRONT BRAKE MASTER CYLINDER.
20. Slide fuel tank into position and install fuel tank fasteners. Connect vent hose and fuel supply fitting. See 4.5 FUEL TANK.
21. Connect fuel gauge connector [117].
22. Install instrument console. See 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
23. Using knurled areas of handlebar as a guide, center handlebars between lower handlebar clamps.

NOTE

On some models, knurled areas of handlebar will be completely hidden by upper handlebar clamp when handlebar is centered properly.

24. Raise handlebars to normal riding position and hold in position.

NOTE

Gap between upper and lower clamps should be equal front and rear.

25. Tighten front and rear fasteners to 12-16 ft-lbs (16.3-21.7 Nm).
26. See Figure 2-104. Remove one lower handlebar clamp fastener (10). Apply LOCTITE HIGH STRENGTH THREADLOCKER 271 (red) to fastener threads.
27. Install fastener and tighten to 30-40 ft-lbs (40.7-54.2 Nm). Repeat for other fastener.
28. Connect negative battery cable to battery.

⚠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)

29. Test front brake lever for pressure and operation.
30. Test throttle for correct operation. Adjust as required. See 1.14 THROTTLE CABLES.
31. Turn the Ignition/Light Key Switch to IGNITION and test switches for proper operation.

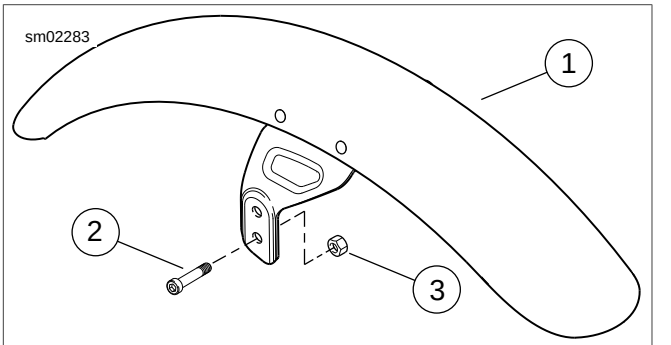
32. Operate brake lever to test stop light lamp.

REMOVAL

1. See Figure 2-106. Remove both fender mounting screws (2) and nuts (3) on each side.
2. Carefully remove fender being careful not to scratch the fender paint.

INSTALLATION

1. Carefully position fender and align mounting holes.
2. See Figure 2-106. Ensure the fender mounting brackets are resting against the machined bosses of the forks and install screws (2) through fender mounting holes in fork legs. Thread nuts (3) onto screws.
3. Tighten fender mounting nuts to 15-21 ft-lbs (20.3-28.5 Nm).



1. Front fender
2. Screw (2)
3. Nut (2)

Figure 2-106. Front Fender

GENERAL

This topic is split by vehicle type. However, the following steps are common to all models.

Removal

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Detach rear electrical harness.
   a. Follow the tail light and rear turn signal wire harness to the eight pin connector under the seat.
   b. Separate the eight pin connector.
   c. Remove the six wires and the attached socket terminals from the connector. See the electrical diagnostic manual and B.2 WIRING DIAGRAMS for more information.
4. Cut cable strap securing harness to frame. Pull harness through fender opening.
5. Continue with the steps for your specific vehicle.

Tail Lamp/Turn Signal Harness Routing

NOTE

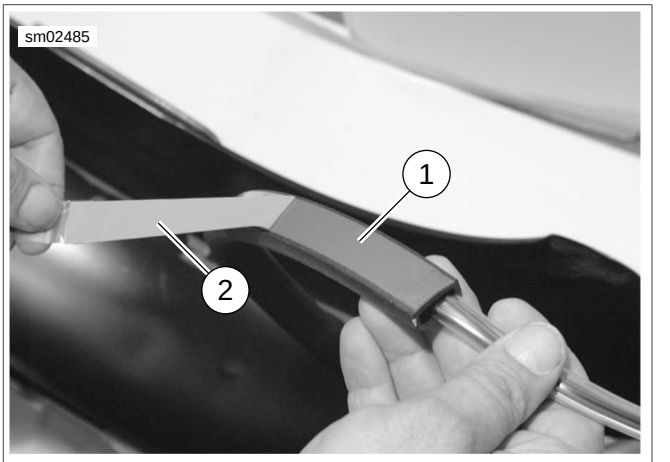
If you are replacing the existing conduit, it may be necessary to remove remaining adhesive. ***Do NOT use solvents or harsh chemicals to remove adhesive as damage to painted surfaces may occur.***

1. Thoroughly clean inside surface of fender with soap and water until it is free of dirt, oil, or other debris.

NOTE

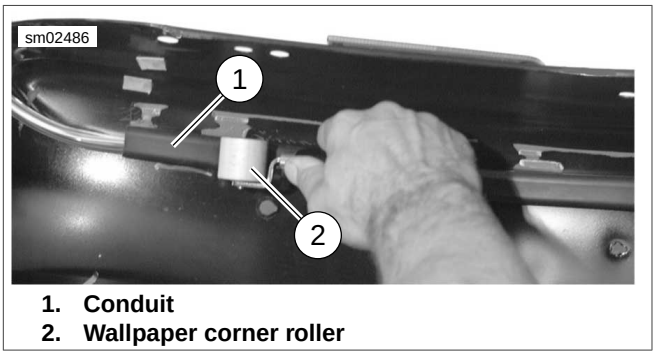
For typical wiring harness/conduit placement, see Figure 2-108.

2. Dry the surface, then wipe the area where conduit will be placed with Isopropyl Alcohol. Allow to dry completely.
3. Slide tail lamp wiring harness through conduit and plug connectors into appropriate sockets. See the electrical diagnostic manual and B.2 WIRING DIAGRAMS for more information.
4. Remove protective strip covering adhesive on conduit (see Figure 2-107.) and lightly position the conduit in place.



1. Conduit
2. Protective strip

Figure 2-107. Removing Protective Strip from Conduit



1. Conduit
2. Wallpaper corner roller

Figure 2-108. Purging Air Between Adhesive and Fender

5. Using a wallpaper corner roller (available at most home improvement stores), roll along conduit to purge the air from between the adhesive and the fender. See Figure 2-108.

NOTES

- *Do NOT rub the conduit to make it adhere to the fender. This will not do an adequate job of purging the air from between the adhesive and fender.*
- *Once the adhesive is in place, it requires 72 hours to fully cure. Do NOT pull or try to reposition the conduit during this period.*

6. Continue with the installation steps for your specific vehicle.

Installation

After attaching fender, perform the following steps on all models.

1. Route harness through opening in fender.
2. Install socket terminals back into connector. See the electrical diagnostic manual and B.2 WIRING DIAGRAMS for more information.

3. Connect negative battery cable.

WARNING

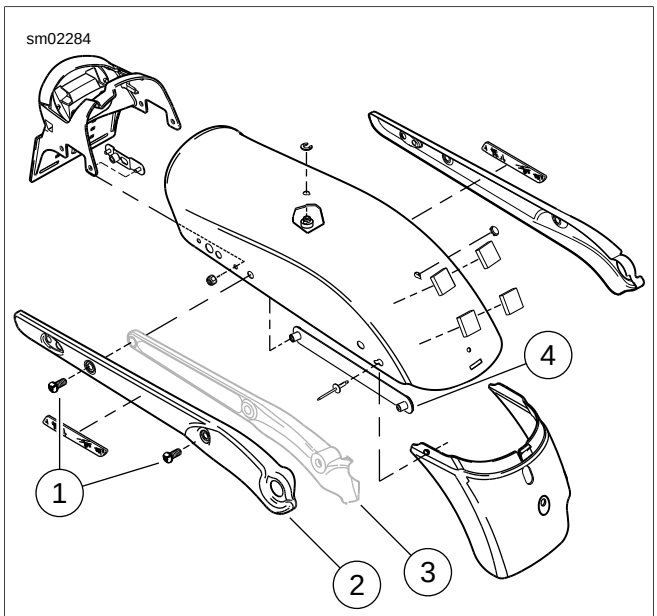
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

4. Install seat.

FXDWG/FXDF

Removal

1. Remove rear turn signal lamps. See 8.11 TURN SIGNALS AND RUNNING LIGHTS.
2. See Figure 2-109. Remove screws (1) from holes in cover (2), fender support (3) and mounting bracket (4).
3. Remove remaining screws (1) from left side of fender and carefully remove fender.



1. **Screw (4)**
2. **Cover, right**
3. **Fender support**
4. **Mounting bracket (inside fender)**

Figure 2-109. Rear Fender (FXDWG/FXDF)

Installation

1. Before installing fender, install tail lamp/turn signal harness and conduit to underside of fender.
2. See Figure 2-109. Apply LOCTITE THREADLOCKER 243 (blue) to the threads of screws (1). Place fender and covers (2) into position. Tighten screws (1) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 8.11 TURN SIGNALS AND RUNNING LIGHTS.
4. Finish with installation instructions under 2.28 REAR FENDER, General.

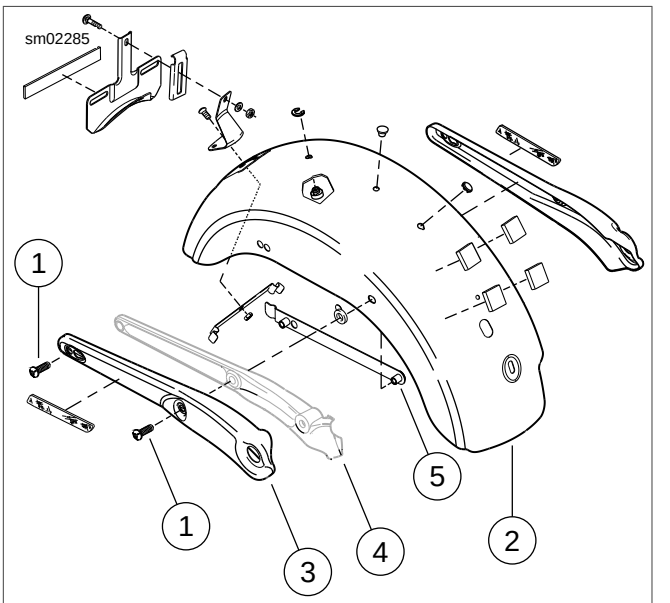
FXD, FXDC, FXDB AND FXDL MODELS

Removal

1. Remove rear turn signal lamps. See 8.11 TURN SIGNALS AND RUNNING LIGHTS, Rear Lamp Housing Replacement.
2. Remove screws (1) that hold fender in place and carefully remove fender and covers (3).

Installation

1. Before installing fender, install tail lamp/turn signal harness and conduit to underside of fender. See Tail Lamp/Turn Signal Harness Routing instructions under 2.28 REAR FENDER, General for procedure.
2. See Figure 2-110. Apply LOCTITE THREADLOCKER 243 (blue) to the threads of screws (1). Place fender and covers (3) into position. Tighten screws (1) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 8.11 TURN SIGNALS AND RUNNING LIGHTS, Rear Lamp Housing Replacement.
4. Finish with installation instructions under 2.28 REAR FENDER, General.



1. **Screw (4)**
2. **Fender**
3. **Covers (2)**
4. **Fender support**
5. **Mounting bracket (inside fender)**

Figure 2-110. Rear Fender (FXD, FXDC, FXDB, and FXDL)

REMOVAL

NOTE

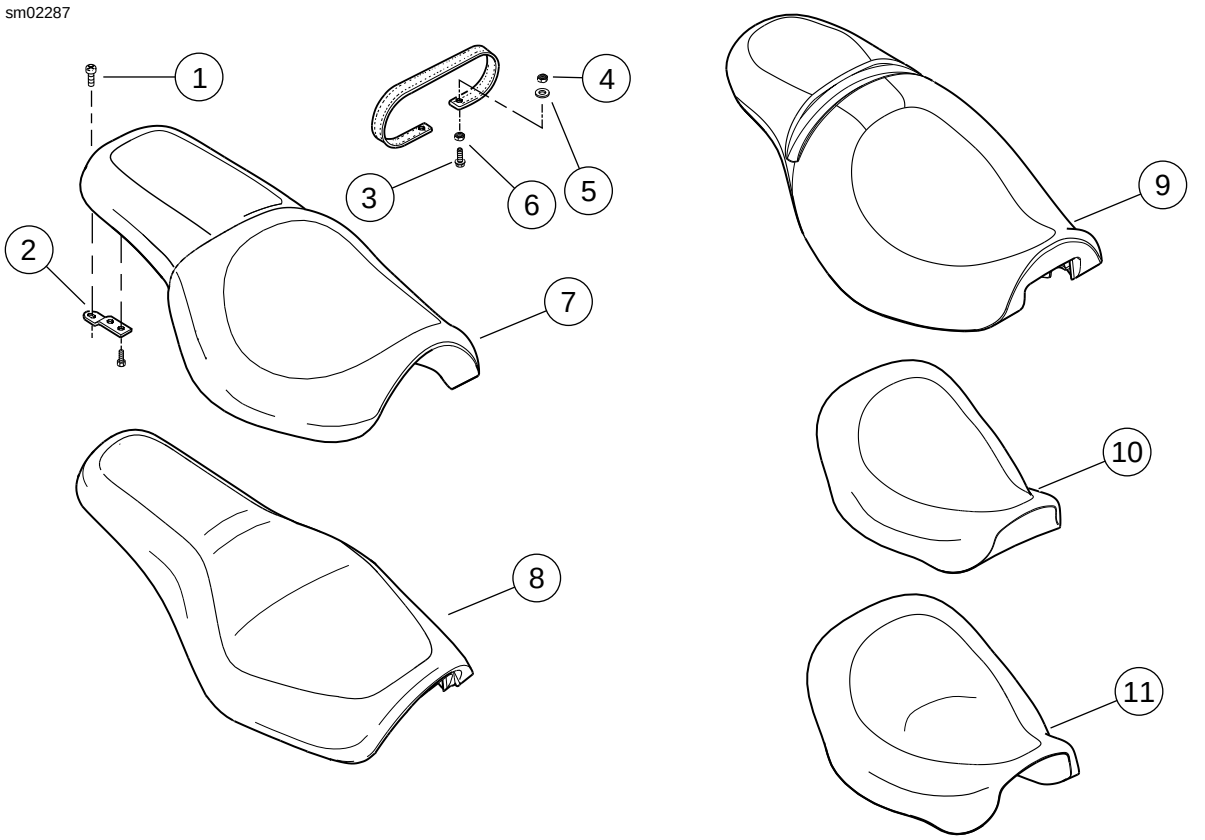
See Figure 2-111. There is a nylon retaining clip between the rear seat bracket and the fender. DO NOT lose this clip, substitute a clip of different material or install the seat without this clip. Any of the above actions will result in scratched fender paint. The nylon retaining clip secures the seat screw nut.

1. See Figure 2-111. Remove screw (1) from rear seat bracket (2). (Nylon clip remains with fender assembly.)

NOTE

- *There is a bracket at the front of the seat that slips under a u-shaped frame bracket.*
- *There is no need to remove the seat bracket and its fasteners from the seat pan.*
- *The strap is secured to the fender under the seat by a nut (4) and washer (5).*

2. Slide seat to the rear of the motorcycle and lift seat.
3. Remove nut (4) and washer (5).
4. Remove seat strap.



1. **Screw**
2. **Bracket**
3. **Seat strap**
4. **Nut**
5. **Washer**
6. **Plastic nut (retains strap screw)**
7. **Seat, FXDWG**
8. **Seat, FXDC, FXDF**
9. **Seat, FXDL**
10. **Solo seat, FXD**
11. **Solo seat, FXDB**

Figure 2-111. Seat

INSTALLATION

1. See Figure 2-111. Install seat strap.
   a. Fasten nut (4) and washer (5) above seat strap on frame.
   b. Tighten nut (4) to 60-90 **in-lbs** (6.78-10.17 Nm).
2. Slide back of seat through seat strap loop.
3. Slide bracket below front seat under the u-shaped frame bracket.

⚠WARNING

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

4. Install screw (1) and bracket (2) to fender. Verify nylon retaining clip is in position on fender.

CLEANING

WARNING

The jiffy stand locks when placed in the full forward (down) position with vehicle weight on it. If the jiffy stand is not in the full forward (down) position with vehicle weight on it, the vehicle can fall over which could result in death or serious injury. (00006a)

WARNING

Always park motorcycle on a level, firm surface. An unbalanced motorcycle can fall over, which could result in death or serious injury. (00039a)

WARNING

Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted, it can contact the road surface causing a loss of vehicle control, which could result in death or serious injury. (00007a)

1. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-114. Inspect top of catch (6). If covered with dirt, wipe dirt off with a shop towel and spray catch and mating surface with LOCTITE AEROSOL ANTI-SEIZE.
3. Move jiffy stand leg (3) forward and back to infuse anti-seize into mating parts.
4. If catch is covered with mud/grime, remove bolt (7) and catch (6).
5. Clean catch (6) and pivot block mating surface (5).
6. Spray LOCTITE AEROSOL ANTI-SEIZE on shaft of jiffy stand leg and pin (2) to lubricate the mating surface between pin and pivot block (5). Move leg back and forth and downward while spraying lubricant.
7. Assemble the catch so it engages the flats on the shaft of the jiffy stand leg and secure with bolt (7).
8. Tighten bolt (7) to 19 ft-lbs (25.8 Nm).
9. Check that jiffy stand operates correctly before using.

SENSOR (HDI MODELS)

1. See Figure 2-114. Make a note of harness routing for ease of assembly. Disconnect sensor connector located under the seat.
2. Remove cable anchors (2).
3. Remove screw (4) and remove sensor (3).
4. If necessary, remove screw (1) and remove sensor bracket (5).
5. Installation is in reverse of removal. Tighten screws (1, 4) to 96-144 **in-lbs** (10.8-16.3 Nm).

NOTE

See Figure 2-112. Ensure the sensor harness is routed to the inside of the left-lower frame and under the rear engine mount casting.

See Figure 2-113. Route the sensor harness in the same retainer cavity (3) as the vent tube (2).

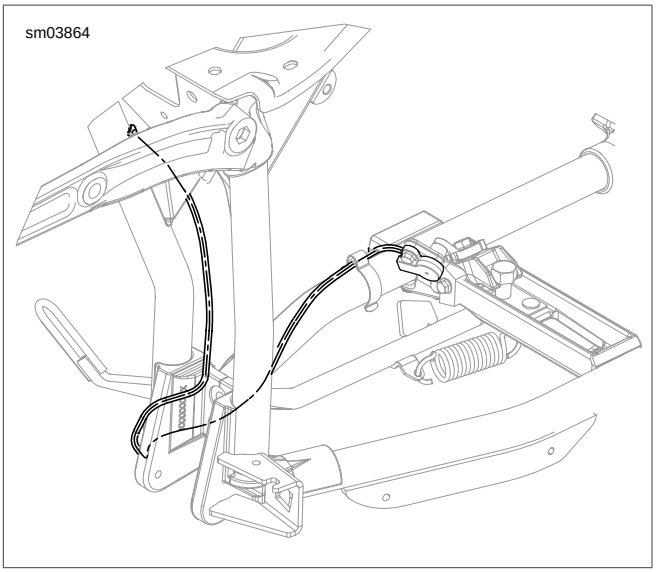
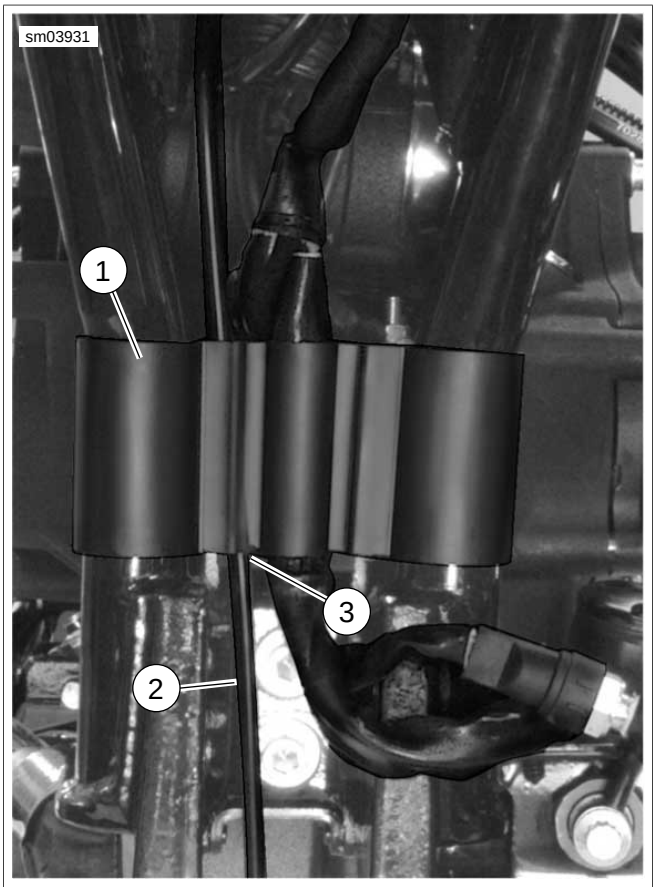


Figure 2-112. Jiffy Stand Sensor Harness Routing



1. **Wire harness retainer**
2. **Vent line**
3. **Retainer cavity**

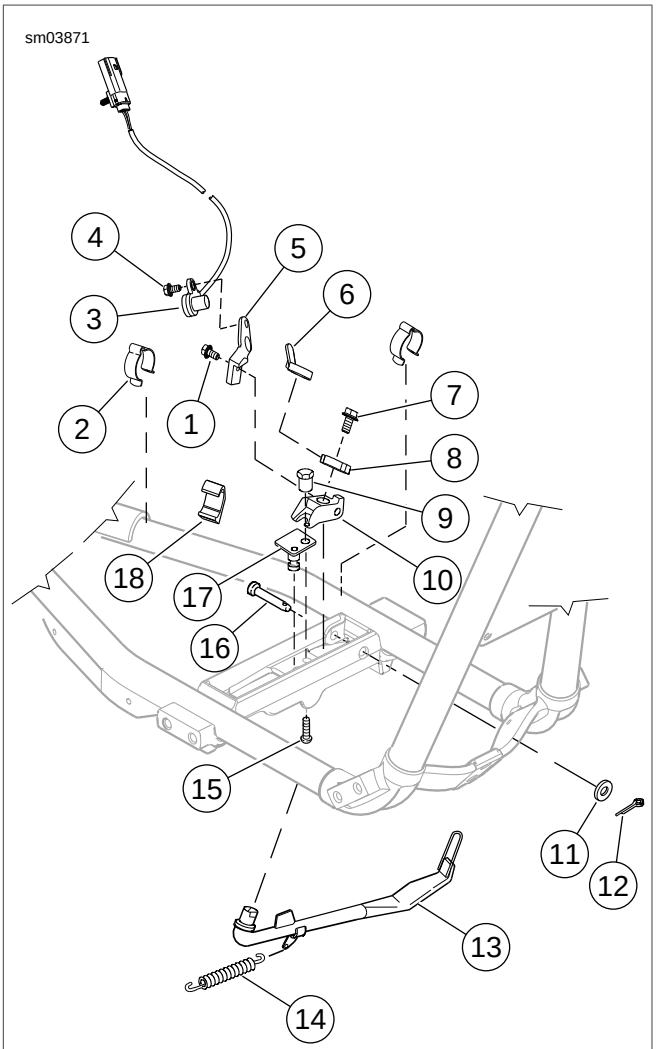
Figure 2-113. Harness Retainer

REMOVAL

WARNING

Block vehicle under frame such that vehicle will not fall when jiffy stand is removed. Failure to properly block vehicle could result in death or serious injury. (00462b)

1. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-114. Remove cotter pin and washer (10) from pin (2). Discard cotter pin.
3. Detach spring (8) from jiffy stand and anchor plate (9).
4. Pull pin (2) from between frame tubes. Jiffy stand and pivot block components will drop as an assembly.



1. **Sensor bracket screw (HDI)**
2. **Harness retainer (2) (HDI)**
3. **Sensor (HDI)**
4. **Sensor screw (HDI)**
5. **Sensor bracket (HDI)**
6. **Catch (replaces item 8 on HDI)**
7. **Bolt**
8. **Catch**
9. **Threaded spacer**
10. **Pivot block**
11. **Washer**
12. **Pretzel pin**
13. **Jiffy stand leg**
14. **Spring**
15. **Screw**
16. **Pin (secures pivot block)**
17. **Anchor plate**
18. **Bumper**

Figure 2-114. Jiffy Stand

INSTALLATION

WARNING

If leg stop is incorrectly installed, excessive wear can allow vehicle to fall when rested on jiffy stand, which could result in death or serious injury. (00479b)

1. See Figure 2-114. Place pivot block (5) and jiffy stand (3) assembly between frame tubes.
2. Insert the pin (2) from direction shown through frame tubes and pivot block (5). Secure with washer and a **new** cotter pin (10).
3. Attach spring (8) to anchor plate (9) and jiffy stand. When properly installed, hook on spring side connected to jiffy stand faces upward.
4. Check that jiffy stand operates correctly before using.

REMOVAL

Front Isolator

1. Support front of engine with jack.
2. See Figure 2-115. Remove bolts (1) lockwashers (2) and washers (3) securing front isolator (4) to frame.
3. Remove bolts (5), flange nuts (6) and washers (7). Remove front isolator (4).

NOTE

Motorcycle must be upright and level before performing this procedure.

Rear Isolator

1. Remove left side footpeg and debris deflector.
2. Use a jack on the oil tank to support rear of transmission.
3. Use a long extension, from right side of motorcycle and a wrench on the left side of rear isolator (8). Remove bolts (9), flange nuts (10) and washers (11).

NOTE

You will have to vary the load on the mount to slip the bolts out.

4. Remove bolts (12), lockwashers (13) and washers (14) securing rear isolator to frame. Remove rear isolator.

INSTALLATION

Front Isolator

1. Support front of engine with jack.
2. See Figure 2-115. Place front isolator (4) in position on frame and install bolts (1) lockwashers (2) and washers (3). Tighten bolts to 21-27 ft-lbs (28-36 Nm).
3. Install bolts (5), flange nuts (6) and washers (7). Tighten flange nuts to 21-27 ft-lbs (28-36 Nm).

NOTE

Be sure motorcycle is upright and level before performing this procedure.

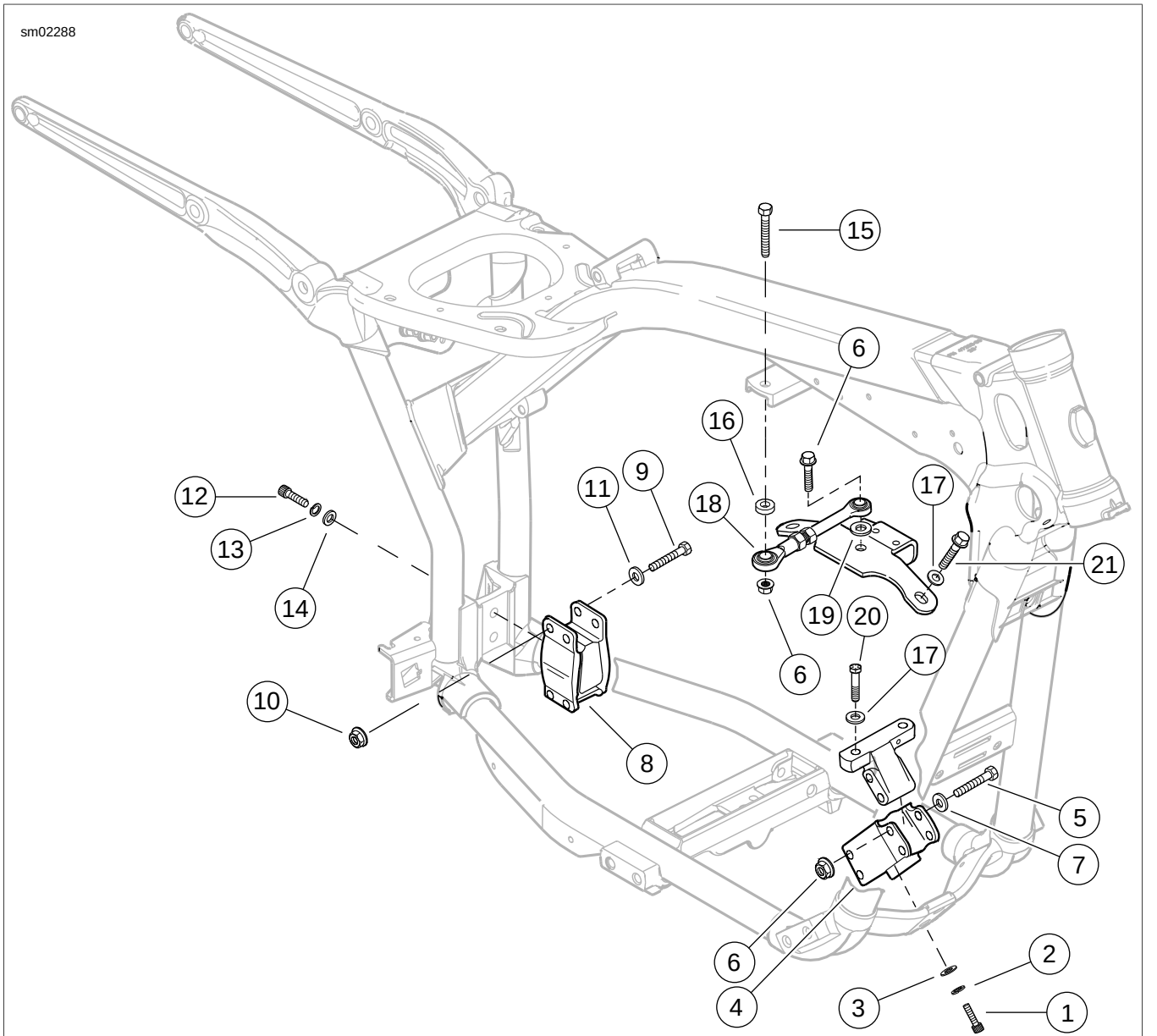
Rear Isolator

1. Use a jack on the oil tank to support rear of transmission.

NOTE

You will have to vary the load on the mount to slip the bolts in.

2. Place rear isolator (8) in position on frame and install bolts (12), lockwashers (13) and washers (14). Torque bolts to 21-27 ft-lbs (28-36 Nm).
3. Use a long extension, from right side of motorcycle and a wrench on the left side of rear isolator. Install bolts (9), flange nuts (10) and washers (11). Tighten flange nuts to 21-27 ft-lbs (28-36 Nm).
4. Install left side footpeg and debris deflector.



1. **Bolt**
2. **Lockwasher**
3. **Washer**
4. **Front isolator**
5. **Bolt**
6. **Flange nut**
7. **Washer**
8. **Rear isolator**
9. **Bolt**
10. **Flange nut**
11. **Washer**
12. **Bolt**
13. **Lockwasher**
14. **Washer**
15. **Bolt**
16. **Spacer**
17. **Washer (3)**
18. **Stabilizer link**
19. **Washer**
20. **Bolt**
21. **Bolt**

Figure 2-115. Engine Mounts

SUBJECT	PAGE NO.
3.1 SPECIFICATIONS	3-1
3.2 SERVICE WEAR LIMITS	3-3
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NOTES

SPECIFICATIONS

Table 3-1. General Specifications

GENERAL	DATA
Number of cylinders	2
Type	4-cycle, 45 degree, air-cooled V-twin
Torque (with shorty, dual exhaust)	91 ft-lbs @ 3000 RPM
	123 Nm @ 3000 RPM
Bore	3.75 in.
	95.25 mm
Stroke	4.375 in.
	111.13 mm
Piston displacement (approx.)	96 cubic in.
	1584 cc
Maximum sustained engine speed	5500 RPM
Idle speed	1000 RPM +/- 50

Table 3-2. Oil Pump Specifications

OIL PUMP	DATA
Type	Twin geroter, dual scavenge, crank mounted and driven, internal oil pump, dry sump
Pressure	30-38 PSI (207-262 kN/m^2) at 2000 RPM and normal operating temperature of 230° F (110° C)
Filtration	5 micron media, filtered between pump and engine

Table 3-3. Rocker Arms Specifications

ROCKER ARMS	IN.	MM
Shaft fit in bushing (loose)	0.0005-0.0020	0.013-0.051
End clearance	0.003-0.013	0.08-0.033
Bushing fit in rocker arm (tight)	0.002-0.004	0.051-0.102

Table 3-4. Rocker Arm Shaft Specifications

ROCKER ARM SHAFTS	IN.	MM
Shaft fit in rocker arm support plate (loose)	0.0007-0.0022	0.018-0.056

Table 3-5. Hydraulic Lifter Specifications

HYDRAULIC LIFTERS	IN.	MM
Fit in crankcase (loose)	0.0008-0.0020	0.02-0.05

Table 3-6. Cylinder Head Specifications

CYLINDER HEAD	IN.	MM
Valve guide in head (tight)	0.0022-0.0033	0.051-0.084
Valve seat in head (tight)	0.003-0.0045	0.076-0.114
Head gasket surface (flatness)	0-0.006	0-0.152

Table 3-7. Valve Specifications

VALVES	IN.	MM
Exhaust: fit in guide	0.001-0.003	0.0254-0.0762
Intake: fit in guide	0.001-0.003	0.0254-0.0762
Seat Width	0.040-0.062	1.02-1.58
Stem protrusion from cylinder head boss	2.012-2.032	51.10-51.61

Table 3-8. Valve Springs Specifications

VALVE SPRINGS	IN.	MM
Closed	135 lbs @ 1.850 in.	61.2 kg @ 47.0 mm
Open	312 lbs @ 1.300 in.	141.5 kg @ 33.0 mm
Free length	2.325 in.	59.1 mm

Table 3-9. Piston

PISTON		REPLACE IF WEAR EXCEEDS	
		IN.	MM
Fit in cylinder (loose)		0.0014-0.0025	0.036-0.064
Piston pin fit (loose)		0.0002-0.0005	0.00-0.013
Ring end gap	Top compression	0.010-0.020	0.254-0.508
	2nd compression	0.014-0.024	0.356-0.610
	Oil control ring	0.010-0.050	0.254-1.27
Ring side clearance	Top compression	0.0012-0.0037	0.030-0.094
	2nd compression	0.0012-0.0037	0.030-0.094
	Oil control rails	0.0031-0.0091	0.079-0.231

Table 3-10. Connecting Rod Specifications

CONNECTING ROD	IN.	MM
Piston pin fit (loose)	0.0007-0.0012	0.018-0.030
Side play between flywheels	0.005-0.015	0.13-0.38
Connecting rod to crankpin (loose)	0.0004-0.0017	0.0102-0.0432

Table 3-11. Flywheel Specifications

FLYWHEELS	IN.	MM
Runout (shaft measured in case)	0.000-0.010	0.0-0.254
Runout (measured in truing stand)	0.000-0.004	0.0-0.102
End play	0.003-0.010	0.076-0.254

Table 3-12. Crankshaft/Sprocket Shaft Bearing Specifications

CRANKSHAFT/SPROCKET SHAFT BEARINGS	IN.	MM
Roller bearing fit (loose)	0.0002-0.0015	0.005-0.038
Bearing fit in crankcase (tight)	0.0038-0.0054	0.097-0.137
Bearing inner race on crankshaft (tight)	0.0004-0.0014	0.010-0.036

GENERAL

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed values listed here.

Table 3-13. Rocker Arm/Rocker Arm Shaft

ROCKER ARM/ROCKER ARM SHAFT	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Shaft fit in bushing (loose)	0.0035	0.089
End clearance	0.025	0.635
Shaft fit in rocker arm support (loose)	0.0035	0.089

Table 3-14. Hydraulic Lifter

HYDRAULIC LIFTER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Fit in crankcase	0.003	0.076
Roller fit	0.0015	0.038
Roller end clearance	0.022	0.559

Table 3-15. Cam Support Plate

CAM SUPPORT PLATE	REPLACE IF	
	IN.	MM
Cam chain tensioner shoe	More than 0.090	More than 2.29
	1/2 thickness of shoe	
Crankshaft bushing maximum ID	More than 0.8545	More than 21.704

Table 3-16. Cylinder Head

CYLINDER HEAD	REPLACE IF	
	IN.	MM
Valve guide in head (tight)	Less than 0.002	Less than 0.051
Valve seat in head (tight)	Less than 0.002	Less than 0.051
Head warpage	More than 0.006	More than 0.152

Table 3-17. Cylinder

CYLINDER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Taper	0.002	0.051
Out of round	0.002	0.051
Warpage of gasket surfaces: top	0.006	0.152
Warpage of gasket or O-ring surfaces: base	0.004	0.102

Table 3-18. Cylinder Bore

CYLINDER BORE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Standard	3.752	95.301
0.005 in. oversize	3.757	95.428
0.010 in. oversize	3.762	95.555

Table 3-19. Piston

PISTON		REPLACE IF WEAR EXCEEDS	
		IN.	MM
Fit in cylinder (loose)		0.003	0.076
Piston pin fit (loose)		0.0008	0.020
Ring end gap	Top compression	0.030	0.762
	2nd compression	0.034	0.864
	Oil control rails	0.050	1.27
Ring side clearance	Top compression	0.0045	0.114
	2nd compression	0.0045	0.114
	Oil control rails	0.010	0.254

Table 3-20. Connecting Rod

CONNECTING ROD	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Piston pin fit (loose)	0.002	0.051
Side play between flywheels	0.020	0.508
Fit on crankpin (loose)	0.002	0.051

Table 3-21. Breather Assembly

BREATHER ASSEMBLY	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Breather cover warpage	0.005	0.13
Breather baffle warpage	0.005	0.13

Table 3-22. Valve Stem to Guide

VALVE STEM TO GUIDE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Table 3-23. Flywheel

FLYWHEEL	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Runout (shaft measured in case)	0.012	0.305
Runout (measured in truing stand)	0.005	0.127
End play	0.010	0.254

Table 3-24. Crankshaft Roller Bearing

CRANKSHAFT ROLLER BEARING	REPLACE IF	
	IN.	MM
Roller bearing fit (loose)	More than 0.0015	More than 0.038
Bearing fit in crankcase (tight)	Less than 0.0038	Less than 0.097
Inner race on crankshaft (tight)	Less than 0.0004	Less than 0.010

OIL FEED

NOTE

The oiling system is carefully designed for optimum efficiency. All oil holes and passageways are specially sized. Exercise caution to avoid enlarging oil holes during cleaning. Any modification of the oiling system will adversely affect oil pressure or cooling and lubrication efficiency.

See Figure 3-1. Oil flows from the oil pan (1) through a passageway at the front of the transmission housing (2).

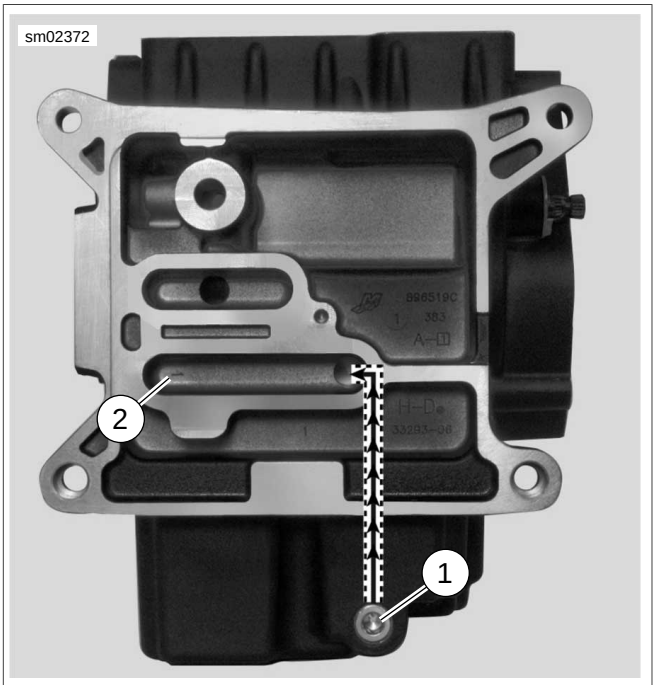
See Figure 3-2. Running through a passageway in the crankcase (1), oil exits a hole in the crankcase flange and enters a hole on the inboard side of the cam support plate (2). Passing through a channel in the cam support plate, the oil enters the feed side of the oil pump (3). See 3.4 OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate.

A passage (5) connects to a pressure relief valve (6) mounted in the bypass port of the cam support plate. When the oil pressure exceeds the setting of the valve spring (35 PSI), the orifice opens to bypass (7) excess oil back to the feed side of the pump (3).

See Figure 3-3. Oil not returned to the feed side exits a hole on the inboard side of the cam support plate and passes through a hole in the crankcase flange. Flowing through a passageway in the crankcase, where a reading is taken by the oil pressure sending unit (8), the oil exits the lower hole in the oil filter mount.

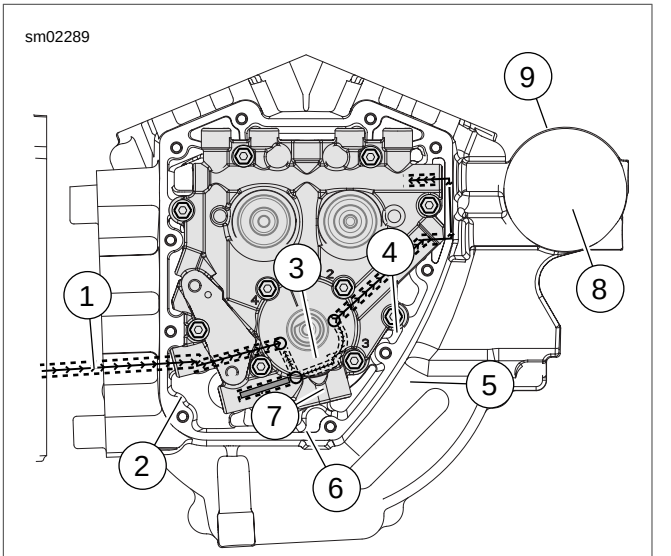
See Figure 3-2. After circulating through the oil filter, the flow of oil is directed back into the crankcase through the upper hole in the oil filter mount. Exiting a passageway in the crankcase through a hole in the crankcase flange, the flow of oil reenters the cam support plate (9).

Filtered oil is then routed to the top and bottom ends of the engine. See 3.3 ENGINE OIL FLOW, Top End and 3.3 ENGINE OIL FLOW, Bottom End which follow.



1. **Pickup from oil pan**
2. **Feed channel to engine**

Figure 3-1. Oil Flow from Pan



1. **Crankcase passage**
2. **Cam support plate/crankcase connection**
3. **Feed side of oil pump**
4. **Oil pump output**
5. **Overflow passage**
6. **Pressure relief valve**
7. **Bypass passage**
8. **Oil pressure sending unit**
9. **Return from oil filter into cam support plate**

Figure 3-2. Cam Support Plate Oil Flow

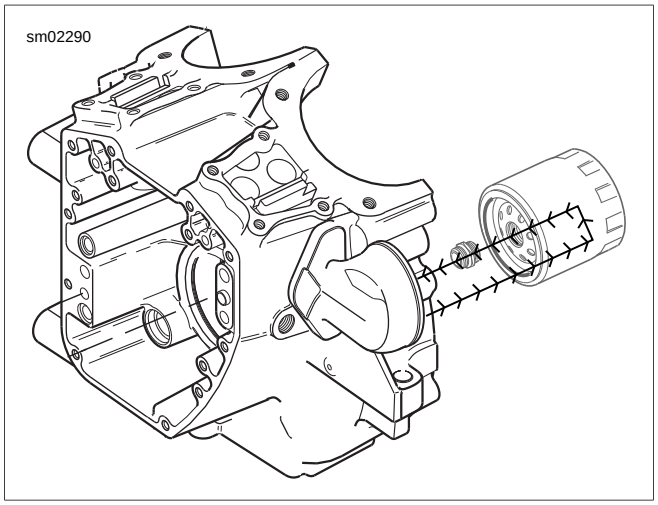


Figure 3-3. Oil Filter Flow

TOP END

Two illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-4.
- Top end oil flow is shown in Figure 3-5.

Oil passes through a channel in the cam support plate exiting the inboard side through two holes near the top (A11, A12). Entering two holes in the crankcase flange (B13, B14), one leading to the front cylinder and the other to the rear, the oil travels through passageways in the crankcase to the hydraulic lifter bores (D15).

Exiting a hole in each lifter bore (E16), the oil flows around the lifter and enters a hole at the side of the lifter body. As the chamber inside the lifter body is filled, the push rod socket rises to achieve the no-lash fit of the valve train components. The flow of oil then exits a hole centered in the lifter socket and runs up the hollow push rods.

NOTE

Note that there is one additional hole drilled into the inside lifter bores while the oblong hole circulates oil around the lifter body as described, the round hole (E17) feeds oil to the piston jets in the flywheel compartment.

Exiting holes at the top of the hollow push rods, oil enters a hole at the bottom of the intake and exhaust rocker arms. Lubricating the rocker arm bushings, oil flows down the rocker arm shafts and exits a pin hole in the outboard side of each rocker arm housing (F18) where it sprays the valve springs and the top of the valve stem.

Oil runs down to the low side of the rocker housing and enters the exhaust valve spring pocket where a drain hole (G19) leads to a passageway in the cylinder head casting.

Oil exits the bottom of the cylinder head and passes through a dowel pin (H20) on the "down side" of the cylinder flange. The oil runs through a vertical passageway in the cylinder, passes through a second dowel pin on the "down side" of the cylinder deck (I21) and enters the left crankcase half.

Flowing through a horizontal passageway in the left crankcase half (J22), oil runs through a third dowel pin (K23) to the right crankcase half where it travels through another passageway before emptying into the cam compartment (B23, B24).

Oil collecting in the cam compartment is picked up by one of two scavenge lobes on the oil pump (B25).

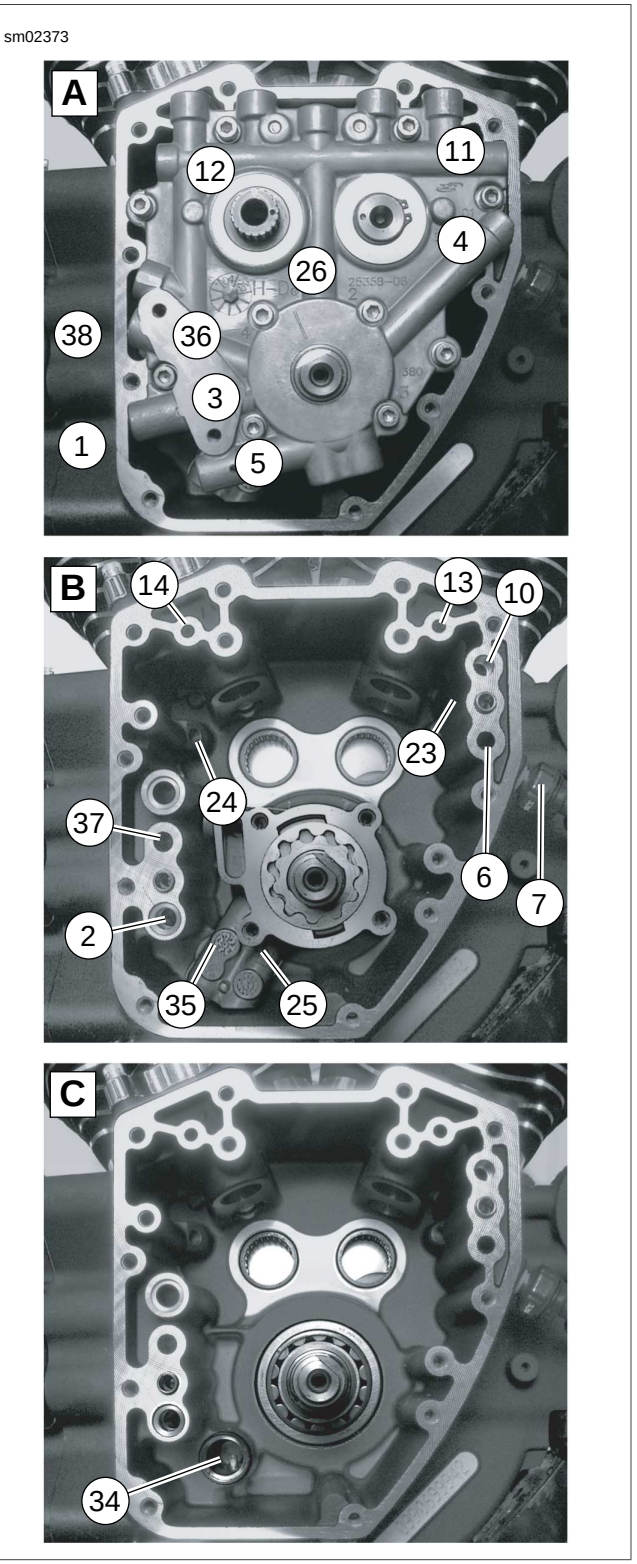


Figure 3-4. Engine Oil Flow - Cam Support Plate/Right Crankcase Half

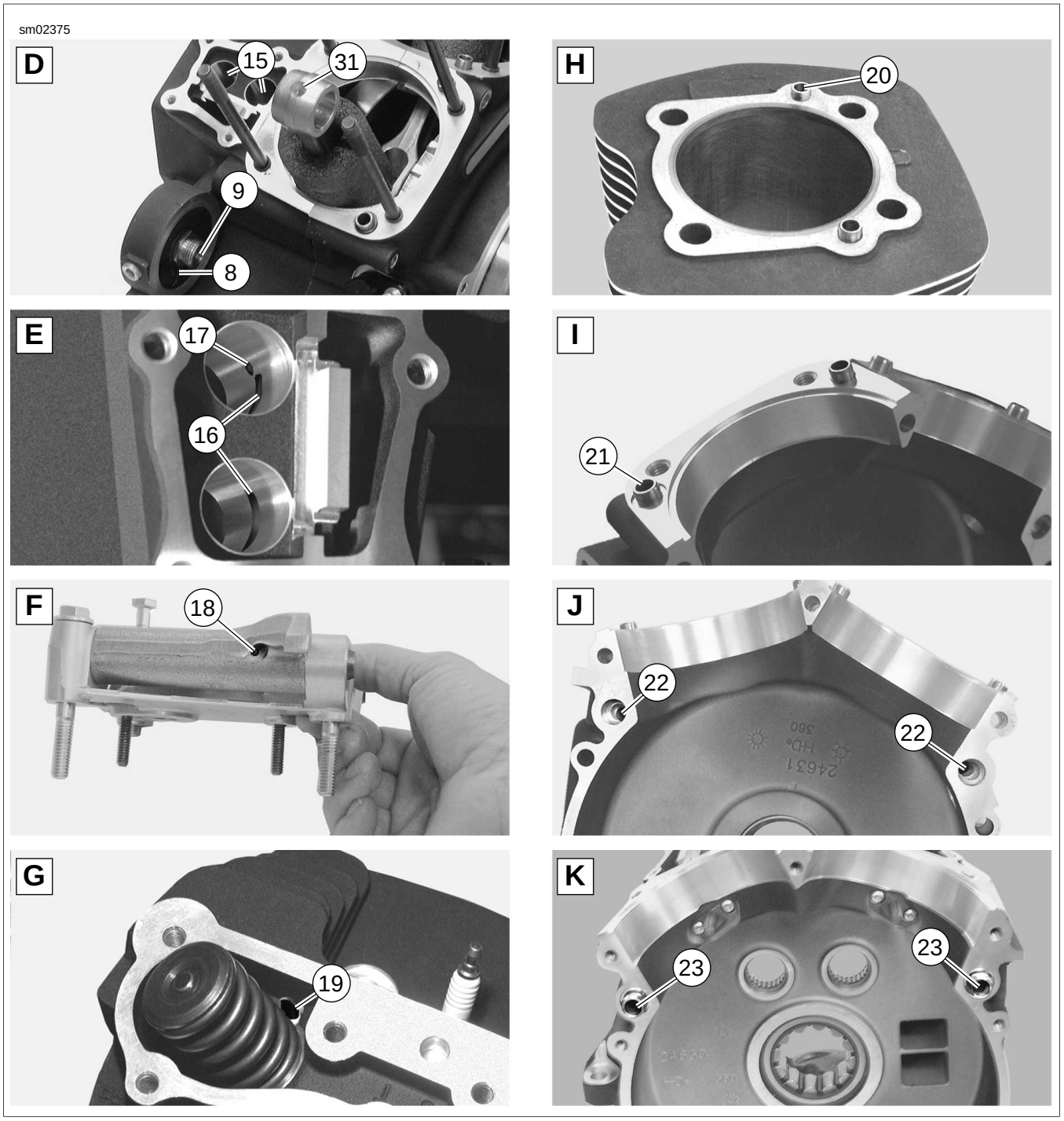


Figure 3-5. Engine Oil Flow - Top End

BOTTOM END

Three illustrations accompany this explanation.

- Cam support plate oil flow is shown in Figure 3-4.
- Top end oil flow is shown in Figure 3-5.
- Bottom end oil flow is shown in Figure 3-6.

Oil travels down the center passage of the cam support plate (A26) and sprays out through pin holes on each side of the casting to lubricate both the primary and secondary cam chains.

Oil also passes through a hole in the crankshaft bushing where the flow enters a drilling in the crankshaft (L27).

Oil runs down the center of the crankshaft and then up a cross drilling into the right side of the flywheel. The flow exits a drilling in the crank pin bore, enters the crank pin and then sprays out through three holes to lubricate the lower rod bearing set.

The oil splash and mist created by the action of the flywheel lubricates the crankshaft bearing and the camshaft needle bearings in the right crankcase half. This same action serves to lubricate the sprocket shaft bearing in the left crankcase half (M28).

Since the oil mist also lubricates the cylinder walls, three holes on each side of the piston (in the area of the third ring land) evacuates excess oil scraped from the walls on the piston downstroke.

The piston jets (N29), which receive a supply of oil from the intake lifter bores, spray the underside of the piston for cooling of the piston crown and skirt area. A check valve in each jet opens only when the oil pressure reaches 12-18 PSI (82.7-124.1 kPa), at which point the engine is operating above idle speed. At idle speeds (9-12 PSI (62.1-82.7 kPa)), the orifice remains closed to prevent over oiling and to ensure proper system operating pressure.

Oil spray from each piston jet also enters a hole at the bottom of each pin boss (O30) for lubrication of the piston pin. Another hole at the top of the connecting rod (D31) allows a portion of the oil to reach the upper rod bushing.

Surplus oil falls back to the bottom of the flywheel compartment where it collects in the sump area (P32). Oil in the sump is drawn to the cam compartment through an internal channel (P33, C34) that connects with the second scavenge lobe of the oil pump (B35).

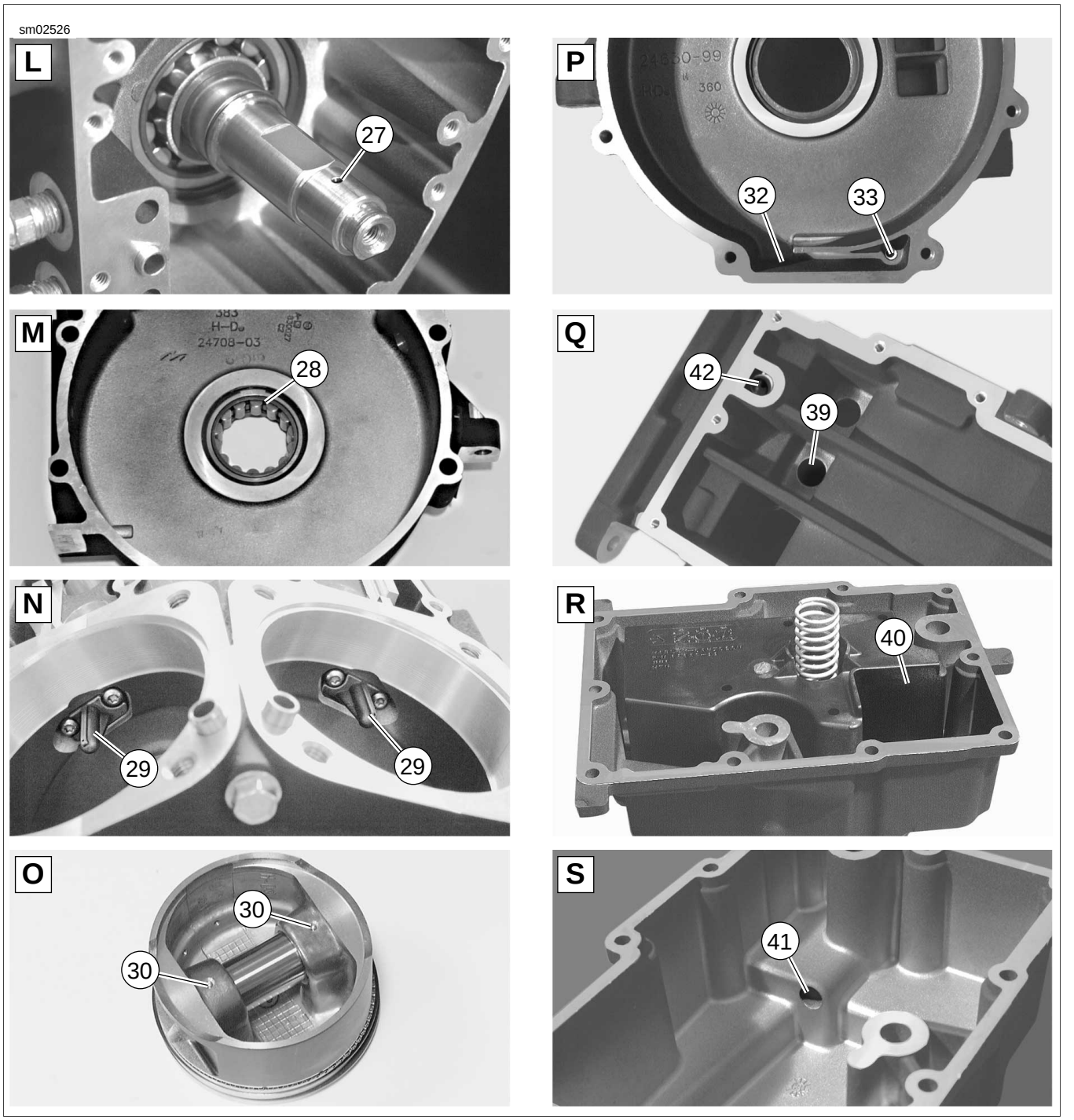


Figure 3-6. Engine Oil Flow - Bottom End

OIL RETURN

The "dual kidney" designation given to the oil pump refers to its two scavenging functions, whereby it simultaneously draws oil from both the cam and flywheel compartments.

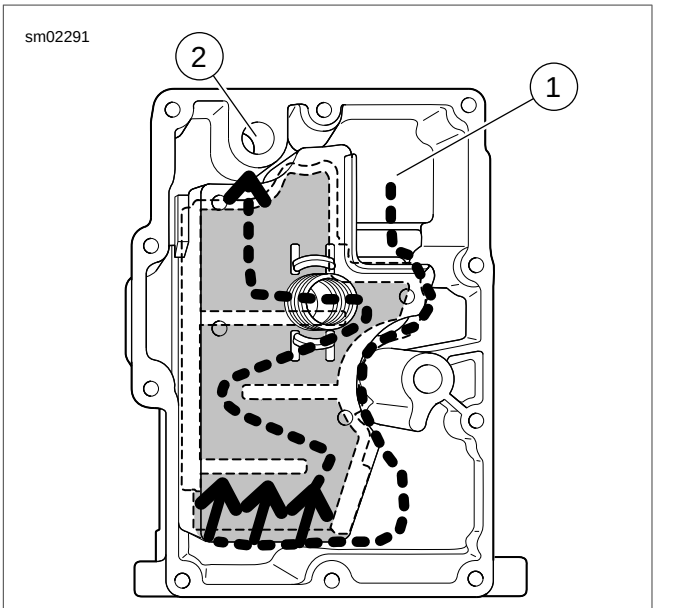
Oil sucked up by the scavenge lobes passes through the scavenge gerotors of the oil pump and is directed through a return channel in the cam support plate (A36). See 3.4 OIL PUMP OPERATION.

Exiting a hole on the inboard side of the cam support plate, the oil enters a hole in the crankcase flange (B37).

The oil flows through a passageway in the crankcase and exits the upper passage at the rear right side of the crankcase (A38). The flow of oil runs through a passageway at the front of the transmission housing (Q39) before emptying into the oil pan at the front of the baffle (R40).

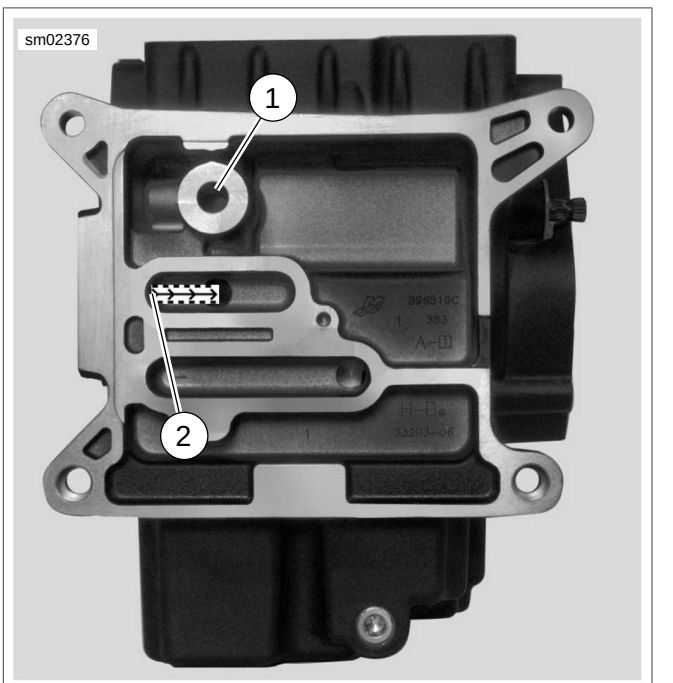
The oil flows to the rear of the oil pan along each side of the baffle. Spring tension holds the unit tight against the bottom of the pan to prevent oil from entering or escaping around the perimeter of the baffle. At the back of the oil pan, the oil enters the open side of the baffle where it is redirected forward. The baffle plates slow the circulation of the oil through the pan to enhance cooling.

Oil pickup occurs in the front compartment of the baffle where a passageway in the casting (S41) directs the flow upward. Passing through a second passageway in the transmission housing (Q42), the flow of oil enters the flexible hose connection (A1) to repeat the circuit.



1. **Oil returned to pan**
2. **Oil pickup to system**

Figure 3-7. Oil Pan Baffles



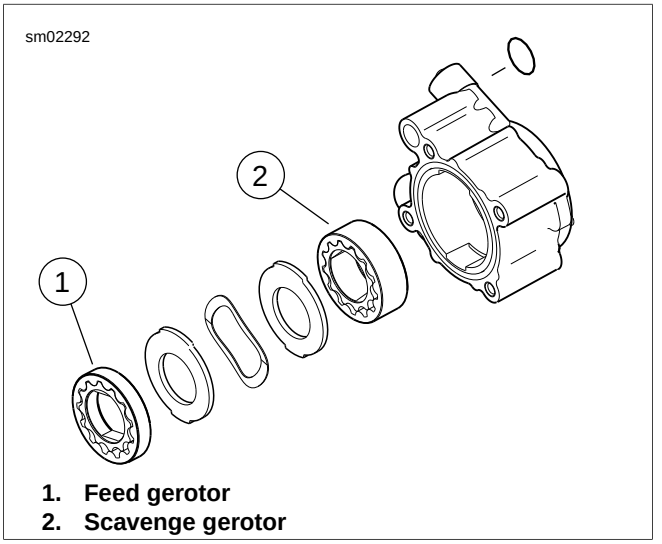
1. **Vent passage**
2. **Oil return passage**

Figure 3-8. Oil Return Passage

GENERAL

See Figure 3-9. The oil pump consists of a housing containing two gerotor gear sets, one feed and the other scavenge. Driven by the crankshaft, the feed gerotor set distributes oil to the engine, while the scavenge gerotor set draws oil from the cam and flywheel compartments and returns it to the oil pan.

Each gerotor gear set has two parts, an inner and outer gerotor. The inner and outer gerotors have fixed centers that are slightly offset to one another. Also, the inner gerotor has one less tooth.



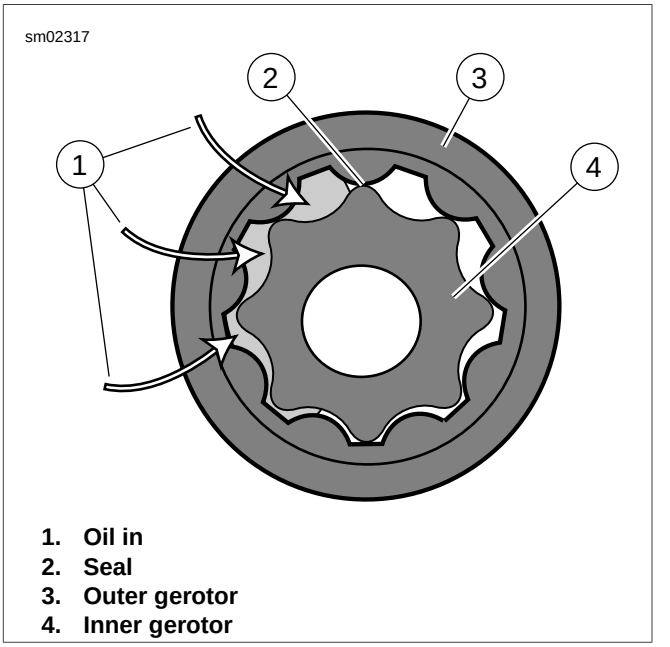
1. **Feed gerotor**
2. **Scavenge gerotor**

Figure 3-9. Oil Pump Gerotors

OPERATION

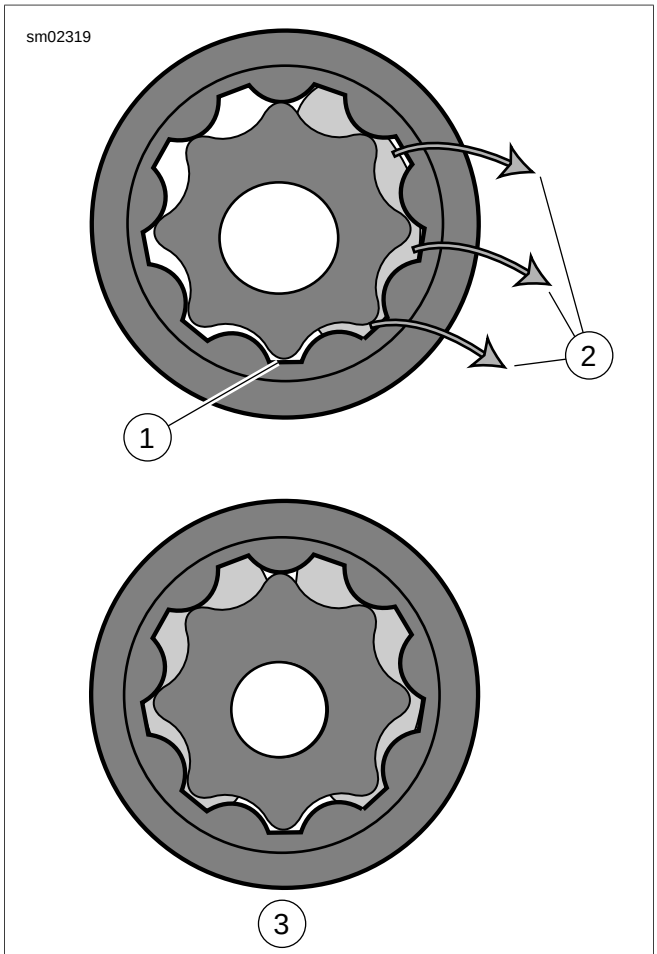
See Figure 3-10. As the crankshaft rotates, the cavity between the inner and outer gerotors on the inlet side of the pump increases in volume. This creates a vacuum causing oil to be drawn in. The cavity continues to increase until the volume is equivalent to that of the missing tooth on the inner gerotor. Note that the inlet and outlet sides of the pump are sealed by the tips and lobes of the inner and outer gerotors.

See Figure 3-11. Continued rotation moves the pocket of oil to the outlet side of the pump. In this area, the cavity decreases in volume as the gerotor teeth mesh causing the oil to be squeezed out the discharge port. As the cavity on the outlet side is emptied, a second seal formed by the tips and lobes of the inner and outer gerotors prevents oil on the outlet side (high pressure) from being transferred to the inlet side (low pressure). In operation, the gerotors provide a continuous flow of oil.



1. **Oil in**
2. **Seal**
3. **Outer gerotor**
4. **Inner gerotor**

Figure 3-10. Inlet Side Oil Flow



1. **Seal**
2. **Oil out**
3. **Continuous flow**

Figure 3-11. Outlet Side Oil Flow

GENERAL

The crankcase breather system relieves crankcase pressure produced by the downstroke of the pistons and allows crankcase vapors vacated from each cylinder to be directed into the air filter element. Through effective recirculation of crankcase vapors, the system serves to eliminate the pollutants normally discharged from the crankcase.

See Figure 3-12. As each piston pushes downward on its power and intake stroke, displaced air in the flywheel compartment is vented through the crankshaft roller bearing into the cam compartment and then up the push rod covers (1) into the rocker housing.

Air rushes under the rocker arm support plate, which is elevated slightly, and passes through an opening at the bottom of the plate to enter the breather baffle compartment (2).

In the baffle compartment, the flow of air passes upward through the oil filter gauze, where the oil is removed from the air. Two pin holes in the rocker arm support plate act as drain holes to rid the baffle compartment of the oil separated from the air.

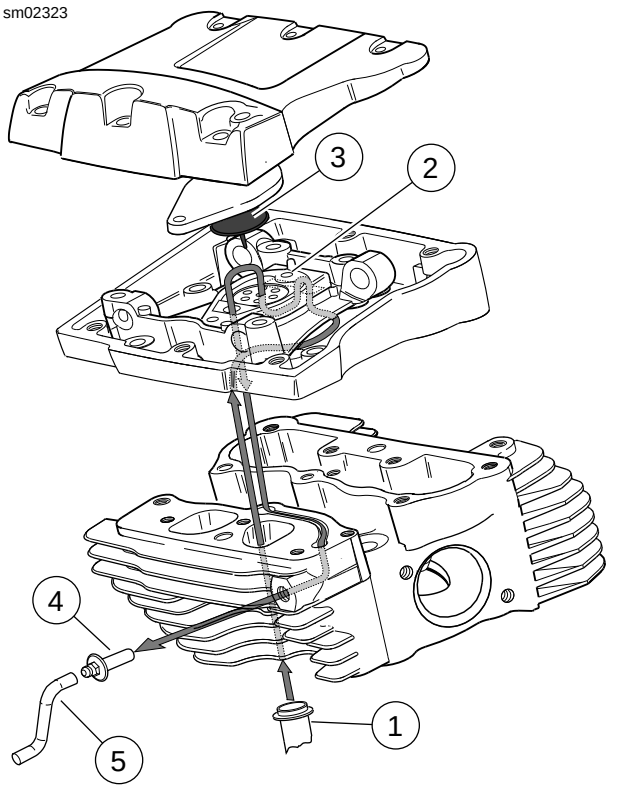
Passing through the oil filter gauze, the flow of air passes through the umbrella valve (3) into the breather compartment. The flaps of the umbrella valve only allow air to be vented one way, rising to allow the passage of air, but then falling back into place to seal the vent holes as the flow of air stops.

In the breather compartment, the flow of air reverses direction passing downward through holes aligned in the breather baffle, rocker arm support plate and rocker housing. Exiting the rocker housing, the air enters a passageway cast into the top of the cylinder head. Proper orientation of the rocker housing gasket is critical for effective sealing of this passageway.

Flowing through the cylinder head passageway, the air passes through a drilling in the air cleaner backplate bolt (4) and then through a breather tube (5) into the air filter element.

NOTE

Air cleaner mounting without installation of the breather tubes allows crankcase vapors to be vented into the atmosphere in violation of legal emissions standards.



1. **Push rod lever**
2. **Breather baffle**
3. **Umbrella valve**
4. **Air cleaner backplate bolt**
5. **Breather tube**

Figure 3-12. Breather Air Flow

OIL PRESSURE INDICATOR LAMP

See Figure 3-13. The red OIL PRESSURE indicator lamp illuminates to indicate improper circulation of the engine oil. The lamp illuminates when the ignition is first turned on (before the engine is started), but should be extinguished once the engine is running.

CAUTION

If the oil pressure indicator lamp remains lit, always check the oil supply first. If the oil supply is normal and the lamp is still lit, stop the engine at once and do not ride further until the trouble is located and the necessary repairs are made. Failure to do so may result in engine damage. (00157a)

If the indicator lamp is not extinguished, it may be the result of a low oil level or diluted oil supply. In freezing weather, the oil feed and return lines can clog with ice or sludge. A problem in the lamp wiring, faulty oil pressure sending unit, damaged oil pump, plugged oil filter element, incorrect oil viscosity, broken or weak spring in the oil pressure relief valve and/or damaged or incorrectly installed O-rings in the engine may also cause the indicator lamp to remain on.

To troubleshoot the problem, always check the engine oil level first. If the oil level is OK, determine if oil returns to the oil pan. If oil does not return, shut off the engine until the problem is located and corrected.

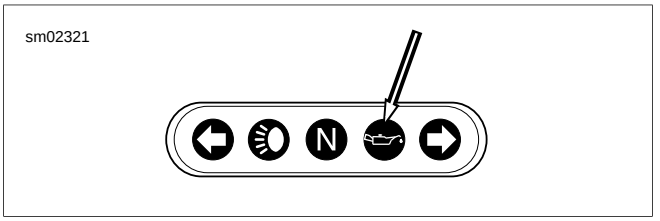


Figure 3-13. Oil Pressure Indicator Lamp

CHECKING OIL PRESSURE

PART NUMBER	TOOL NAME
HD-96921-52C	OIL PRESSURE GAUGE SET

Check operating oil pressure as follows:

1. Fill oil tank to proper level. See 1.4 ENGINE OIL AND FILTER.
2. See Figure 3-14. Remove oil pressure switch from crankcase. See 8.23 OIL PRESSURE SWITCH.
3. See Figure 3-15. Install OIL PRESSURE GAUGE SET (Part No. HD-96921-52C).
   a. Install adapter (2) in oil pressure switch mounting hole. Tighten adapter until snug.
   b. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten until snug.
4. Start engine and allow to reach operating temperature.

NOTE

Engine oil should be at normal operating temperature (230° F (110° C)) for an accurate reading.

5. Oil pressure should be 30-38 PSI (207-262 kPa) at 2000 RPM and normal operating temperature.
6. Stop engine. Remove oil pressure gauge assembly from oil pressure switch mounting hole in crankcase.
7. Install oil pressure switch. See 8.23 OIL PRESSURE SWITCH.

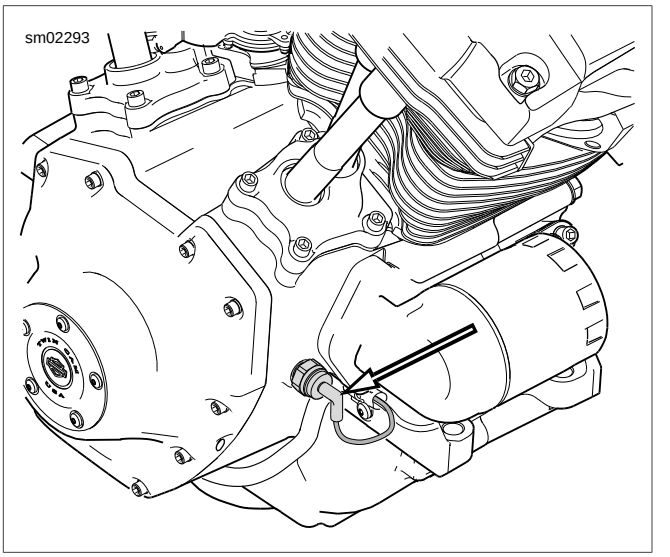
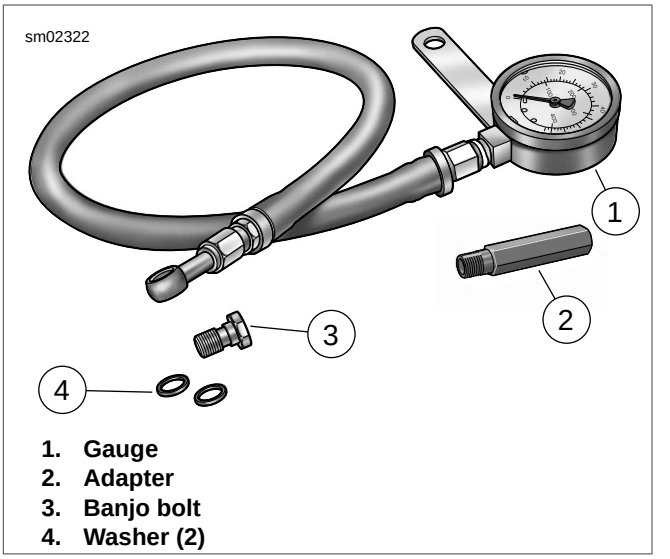


Figure 3-14. Oil Pressure Switch



1. **Gauge**
2. **Adapter**
3. **Banjo bolt**
4. **Washer (2)**

Figure 3-15. Oil Pressure Gauge Set

DIAGNOSING VALVE TRAIN NOISE

To diagnose and correct noisy hydraulic lifters and valve train components, use the following procedures:

1. With engine and oil at normal operating temperature, check oil pressure at 2000 RPM. If oil pressure is above 50 PSI (345 kPa) or below 5 PSI (34 kPa), inspect oil pump, crankcase passages, and oil hoses for restrictions or blockage. Repair or replace parts as necessary.
2. If oil is not reaching the hydraulic lifters, remove and inspect. See 3.21 PUSH RODS, LIFTERS AND COVERS, Lifter Inspection. Clean lifter bore of all foreign material. Replace hydraulic lifter if required.
3. Examine push rod, lifter and lifter block for proper fit and any signs of unusual wear. Replace parts as necessary.
4. Visually inspect camshaft lobes for abnormal wear.
5. Check cam chain tensioning shoe for wear.
6. Remove cylinder head and rocker box assemblies. Check rocker arm end play and check for binding. Inspect valve stems for scuffing and check stem to guide clearance. Check valve seats for signs of looseness or shifting.
7. Grind valves and valve seats.

COMPRESSION TEST

PART NUMBER	TOOL NAME
HD-33223-1	CYLINDER COMPRESSION GAUGE

Satisfactory engine performance depends upon a mechanically sound engine. In many cases, unsatisfactory performance is caused by combustion chamber leakage. A compression test can help determine the source of cylinder leakage. Use CYLINDER COMPRESSION GAUGE (Part No. HD-33223-1).

A proper compression test should be performed with the engine at normal operating temperature when possible.

1. Disconnect spark plug wires, clean around plug base and remove plugs.
2. Remove air cleaner. See 4.4 AIR CLEANER ASSEMBLY.
3. Connect compression tester to front cylinder per manufacturer's instructions.
4. Make sure transmission is in neutral. With throttle body butterfly plate in wide open position, crank engine continuously through 5 to 7 full compression strokes.
5. Note gauge readings at the end of the first and last compression strokes. Record test results.
6. Repeat steps 3 through 5 on rear cylinder.
7. If the final readings are 100 PSI (689 kPa) or more, and if the final readings do not indicate more than a 10% variance between cylinders, compression is considered normal. If compression does not meet specifications, refer to Table 3-25.
8. Inject approximately 1/2 oz. (15 ml) engine oil into each cylinder and repeat the compression tests on both cylinders. Readings that are considerably higher during the second test indicate worn piston rings.

NOTE

After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.

Table 3-25. Compression Test Results

DIAGNOSIS	TEST RESULTS
Ring trouble	Compression low on first stroke, tends to build up on the following strokes, but does not reach normal. Improves considerably when oil is added to cylinder.
Valve trouble	Compression low on first stroke, does not build up much on following strokes. Does not improve considerably with the addition of oil. Check for correct push rod length.
Head gasket leak	Same reaction as valve trouble.

CYLINDER LEAKDOWN TEST

PART NUMBER	TOOL NAME
HD-35667-A	CYLINDER LEAKDOWN TESTER

NOTE

This procedure should not be used on vehicles with an automatic compression release.

The cylinder leakage test will pinpoint engine problems including leaking valves, worn, broken or stuck piston rings and blown head gaskets. The cylinder leakage tester applies compressed air to the cylinder at a controlled pressure and volume and measures the percent of leakage from the cylinder.

Use the CYLINDER LEAKDOWN TESTER (Part No. HD-35667-A) and follow the specific instructions supplied with the tester.

The following are some general instructions that apply to Harley-Davidson V-twin engines:

1. Run engine until it reaches normal operating temperature.
2. Stop engine. Clean dirt from around spark plugs and remove the spark plugs.
3. Remove the air cleaner and set the throttle to the wide open position.
4. The piston in the cylinder being tested must be at top dead center of compression stroke (both valves closed) during the test.
5. To keep the engine from turning over when air pressure is applied to the cylinder, engage transmission in highest gear and lock the rear brake.

NOTE

Before performing the cylinder leakage test, verify that the tester itself is free from leakage to obtain the most accurate test results. With a soap solution (applied around all tester fittings), connect the cylinder leakdown tester to the compressed

air source and look for any bubbles that would indicate leakage from the tester.

6. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent of leakage. Leakage greater than 10% indicates internal engine problems.
7. Listen for air leaks at throttle body intake, exhaust pipe, and head gasket. Air escaping through the throttle body indicates a leaking intake valve. Air escaping through the exhaust pipe indicates a leaking exhaust valve.

NOTE

If air is escaping through valves, check for correct push rod length.

8. Repeat procedure on rear cylinder.

NOTE

After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.

DIAGNOSING SMOKING ENGINE OR HIGH OIL CONSUMPTION

Perform both a compression test and a cylinder leakage test. See 3.7 TROUBLESHOOTING, Compression Test and 3.7 TROUBLESHOOTING, Cylinder Leakdown Test. If further testing is needed, remove suspect head(s) and inspect for the following:

Check Prior To Cylinder Head Removal

1. Oil 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.

TOP END REPAIR

NOTE

During top end disassembly, the engine may be left in the chassis for service.

If servicing only cylinder head components, pistons, cylinders and/or upper rod bushings, two options are available depending upon engine status. See 3.13 REMOVING ENGINE FROM CHASSIS.

- 3.9 TOP END SERVICE, Engine in Chassis.
- 3.9 TOP END SERVICE, Engine Removed from Chassis.

BOTTOM END REPAIR

NOTE

Servicing components in the cam compartment requires only partial disassembly. This can be done with the engine left in the chassis.

After disassembling as far as the cylinder heads you may find that bottom end repair is necessary. Bottom end service may require either partial or complete disassembly of the engine.

- To service the cam compartment, see 3.10 BOTTOM END SERVICE, Engine in Chassis.
- To service components in the flywheel compartment, the engine must be removed and the crankcase halves split. See 3.10 BOTTOM END SERVICE, Engine Removed From Chassis.

TYPICAL SYMPTOMS

Symptoms indicating a need for engine repair are often misleading, but generally if more than one symptom is present, possible causes can be narrowed down to make at least a partial diagnosis. An above normal consumption of oil, for example, could be caused by several mechanical faults. But when accompanied by a blue-gray smoke from the exhaust, and when low compression is present, it indicates the rings need replacing. Low compression by itself, however, indicates improperly seated valves, not worn rings.

Certain "knocking" noises may be caused by loose bearings, others by piston slap, a condition where piston or cylinder or both out of tolerance, allowing the piston to slap from front to rear of the cylinder as it moves up and down.

Most frequently, valves, rings, pins, bushings, and bearings need attention at about the same time. If the symptoms can be narrowed down through the process of elimination to indicate that any one of the above components is worn, it is best to give attention to all of the cylinder head and cylinder parts.

ENGINE IN CHASSIS

Table 3-26. Engine In Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove parts to gain access to all components above cylinder deck. See 3.11 STRIPPING MOTORCYCLE FOR SERVICE.		
Disassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.19 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE*.
	PUSH RODS, LIFTERS AND COVERS	Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.22 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.23 CYLINDER*.
	PISTON	Inspect and repair. See 3.24 PISTON*.
Assemble top end. See 3.16 TOP END OVERHAUL: ASSEMBLY.		
Assemble motorcycle. See 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.16 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.		

ENGINE REMOVED FROM CHASSIS

Table 3-27. Engine Removed From Chassis

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURE
Remove engine from motorcycle. See 3.13 REMOVING ENGINE FROM CHASSIS.		
Disassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY	Inspect and repair. See 3.19 BREATHER ASSEMBLY*.
	ROCKER ARM SUPPORT	Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE*.
	PUSH RODS, LIFTERS AND COVERS	Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS*.
	CYLINDER HEAD	Inspect and repair. See 3.22 CYLINDER HEAD*.
	CYLINDER	Inspect and repair. See 3.23 CYLINDER*.
	PISTON	Inspect and repair. See 3.24 PISTON.
Assemble top end. See 3.16 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.14 INSTALLING ENGINE IN CHASSIS.		
Note: * If no other work is to be done, you may advance to 3.16 TOP END OVERHAUL: ASSEMBLY when this step is completed during top end service.		

ENGINE IN CHASSIS

Table 3-28. Engine In Chassis: Cam Compartment Service

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove parts to gain access to all components above cylinder deck. See 3.11 STRIPPING MOTORCYCLE FOR SERVICE.		
Dissassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.19 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE.
	PUSH RODS, LIFTERS AND COVERS.	Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS.
Disassemble bottom end. See 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.25 COVER AND CAM SUPPORT PLATE*.
	OIL PUMP	Inspect and repair. See 3.26 OIL PUMP.
Assemble bottom end. See 3.18 BOTTOM END OVERHAUL: ASSEMBLY.		
Assemble motorcycle. See 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE.		
Note: * If no other work is to be done, you may advance to 3.18 BOTTOM END OVERHAUL: ASSEMBLY when this step is completed during bottom end service.		

ENGINE REMOVED FROM CHASSIS

Table 3-29. Engine Removed: Flywheel Compartment Service or Complete Engine Overhaul

SERVICE PROCEDURE		COMPONENT REPAIR PROCEDURES
Remove engine from motorcycle. See 3.13 REMOVING ENGINE FROM CHASSIS.		
Dissassemble top end. See 3.15 TOP END OVERHAUL: DISASSEMBLY.		
	BREATHER ASSEMBLY.	Inspect and repair. See 3.19 BREATHER ASSEMBLY.
	ROCKER ARM SUPPORT PLATE.	Inspect and repair. See 3.20 ROCKER ARM SUPPORT PLATE.
	PUSH RODS, LIFTERS AND COVERS.	Inspect and repair. See 3.21 PUSH RODS, LIFTERS AND COVERS.
	CYLINDER HEAD	Inspect and repair. See 3.22 CYLINDER HEAD.
	CYLINDER	Inspect and repair. See 3.23 CYLINDER.
	PISTON	Inspect and repair. See 3.24 PISTON.
Disassemble bottom end. See 3.15 TOP END OVERHAUL: DISASSEMBLY.		
	COVER AND CAM SUPPORT PLATE	Inspect and repair. See 3.25 COVER AND CAM SUPPORT PLATE.
	CRANKCASE	Inspect crankcase and repair. See 3.27 CRANKCASE.
		Inspect and repair flywheel/connecting rod assembly. See 3.28 FLYWHEEL AND CONNECTING RODS.
Assemble bottom end. See 3.18 BOTTOM END OVERHAUL: ASSEMBLY.		
Assemble top end. See 3.16 TOP END OVERHAUL: ASSEMBLY.		
Install engine in motorcycle. See 3.14 INSTALLING ENGINE IN CHASSIS.		

PROCEDURE

NOTE

If performing top end service (or both cam compartment and top end), follow all the steps listed. If servicing cam compartment components only, perform steps 1 though 8.

1. Position motorcycle on a suitable lift.
2. Remove seat.

⚠WARNING

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

3. Disconnect battery cables, negative cable first.
4. Remove heat shields and exhaust. See 4.16 EXHAUST SYSTEM.
5. Remove two screws and rear brake pedal and right footpeg bracket. Disconnect assembly from master cylinder actuator lever.
6. Remove air cleaner cover and backplate. See 4.4 AIR CLEANER ASSEMBLY.

⚠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. Drain fuel from fuel tank into suitable container. See 4.5 FUEL TANK.
8. Unclip vapor valve, disconnect fuel gauge connector, remove one end of fuel tank crossover tube and remove fuel tank. See 4.5 FUEL TANK.
9. Loosen and remove throttle control cables from induction module. See 4.9 INDUCTION MODULE.
10. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
11. Remove right side stabilizer link nut, Allen bolt and spacer from frame tab. Remove two bolts from horn bracket and cylinder heads. Remove stabilizer link and horn bracket as an assembly.
12. Remove induction module connectors and induction module. See 4.9 INDUCTION MODULE.

PROCEDURE

NOTE

If top end service was performed (or both cam compartment and top end), follow all the steps listed. If only cam compartment components were serviced start with step 5.

1. Install induction module. Install induction module connectors. See 4.9 INDUCTION MODULE.

NOTE

If the stabilizer link bolt cannot be installed without pushing the engine to the right or left, perform the vehicle alignment procedure. See 2.11 VEHICLE ALIGNMENT.

2. Install horn bracket/stabilizer link assembly to frame tab and cylinder heads. Place spacer between frame tab and stabilizer link. Make sure horn ground wire is installed beneath bracket on front cylinder.
   a. Tighten the stabilizer link bolt to 18-22 ft-lbs (24.4-29.8 Nm).
   b. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
3. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.19 SPARK PLUGS.
4. Install throttle cables to induction module.
5. Install fuel tank, fuel gauge connector, fuel tank crossover tube and vapor valve. See 4.5 FUEL TANK.
6. Connect fuel hose to fuel tank.
7. Install backplate and air cleaner cover. See 4.4 AIR CLEANER ASSEMBLY.
8. Install master cylinder actuator lever. Install right footpeg bracket and rear brake pedal with two screws. Tighten to 25-35 ft-lbs (33.9-47.5 Nm).
9. Install heat shields and exhaust. See 4.16 EXHAUST SYSTEM.
10. Connect negative battery cable.

⚠WARNING

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

11. Install seat.
12. Remove motorcycle from lift.

PROCEDURE

NOTE

Removal begins on the RIGHT SIDE of the motorcycle.

1. Position motorcycle on a suitable lift.
2. Remove seat.

⚠WARNING

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

3. Disconnect battery cables, negative cable first.
4. Remove air cleaner cover and backplate. See 4.4 AIR CLEANER ASSEMBLY.

⚠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)

5. Cut hose clamp and remove fuel feed line (large O.D.) and vacuum line (small O.D.) from throttle body.
6. Drain fuel from fuel tank into suitable container. Remove fuel tank. See 4.5 FUEL TANK.
7. Loosen and remove throttle control cables from induction module. See 4.9 INDUCTION MODULE.
8. Remove heat shields and exhaust. See 4.16 EXHAUST SYSTEM.
9. Using a 5/16 in. Allen bit, remove two screws and rear brake pedal and right footpeg bracket. Remove cotter pin and clevis pin and disconnect assembly from master cylinder actuator lever.
10. Disconnect the following connectors.
    a. Crank position sensor connector [79].
    b. Stator/voltage regulator connector [46].
    c. Oil pressure sending unit connector [140].
11. Drain oil from primary chaincase. See 1.9 PRIMARY CHAIN.
12. Loosen pinch bolt and remove shifter foot lever from primary chaincase.
13. Using a 5/16 in. Allen bit, remove two screws and left side footpeg and bracket.
14. Remove primary chaincase cover and primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.
15. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
16. Remove right side stabilizer link nut, Allen bolt and spacer from frame tab. Remove two bolts from horn bracket and cylinder heads. Remove stabilizer link and horn bracket as an assembly.
17. Remove MAP sensor connector [80] from MAP sensor.
18. Note routing of clutch cable before removing. Disconnect clutch cable from clutch lever. Unclip cable at left side frame downtube and pull cable through chassis to right side of motorcycle. Leave cable installed on transmission. See 2.24 CLUTCH CONTROL.
19. Place wire loom or other protective material on both front downtubes to prevent damage.
20. Position jack under transmission. Place a block of wood between jack and oil pan to prevent damage to oil pan and raise jack just enough to support transmission.
21. Using a ratchet and ratchet strap, secure transmission to chassis (vertically) to prevent transmission from shifting position.
22. Remove four bolts and washers that connect engine to transmission.
23. Remove two bolts and washers that secure engine to front engine mount bracket.
24. Remove engine oil dipstick.
25. Using a suitable hoist, remove engine from chassis from the right side.

NOTE

The engine is positively located to the transmission with two dowels that fit in the lower mounting bolt holes and extend out approximately 0.5 in. (12.7 mm) from the transmission. The engine may have to be rotated counterclockwise slightly to disengage the locating dowels.

PROCEDURE

1. Using a suitable hoist, position engine in chassis and align four transmission mounting holes. A pry bar wrapped in a shop rag may be needed to position engine so two lower locating dowel pins engage holes in crankcase.
2. Install **new** engine to transmission case gasket.
3. Install four bolts and washers to mate transmission and engine. Tighten bolts finger tight.
4. Align two front engine mount bracket holes with engine and install bolts and washers. Tighten bolts finger tight.
5. See Figure 3-16. Tighten the four transmission mounting bolts in the sequence shown as follows:
   a. Tighten to 15 ft-lbs (20.3 Nm).
   b. Tighten to 30-35 ft-lbs (40.7-47.5 Nm).
6. Tighten two crankcase to front engine mounting bracket bolts to 25-30 ft-lbs (33.9-40.7 Nm).
7. Remove ratchet strap securing transmission to chassis.
8. Install engine oil dipstick.
9. Remove jack and block of wood from under transmission.
10. Remove wire loom or protective material from front downtubes.
11. Route clutch cable back to left side of motorcycle and install to clutch lever. See 2.24 CLUTCH CONTROL. Secure clutch cable to left downtube with clip.
12. Install MAP sensor connector [80] to MAP sensor.

NOTE

If the stabilizer link bolt cannot be installed without pushing the engine to the right or left, perform the vehicle alignment procedure. See 2.11 VEHICLE ALIGNMENT.

13. Install horn bracket/stabilizer link assembly to frame tab and cylinder heads. Place spacer between frame tab and stabilizer link. Make sure horn ground wire is installed beneath bracket on front cylinder.
    a. Tighten the stabilizer link bolt to 18-22 ft-lbs (24.4-29.8 Nm).
    b. Tighten two cylinder head bracket bolts to 35-40 ft-lbs (47.5-54.2 Nm).
14. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.19 SPARK PLUGS.
15. Install **new** gasket between engine and primary chaincase. Install primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.

NOTE

Make sure spring washer is in position on shifter shaft between engine and primary chaincase.

16. Adjust clutch. See 1.11 CLUTCH.

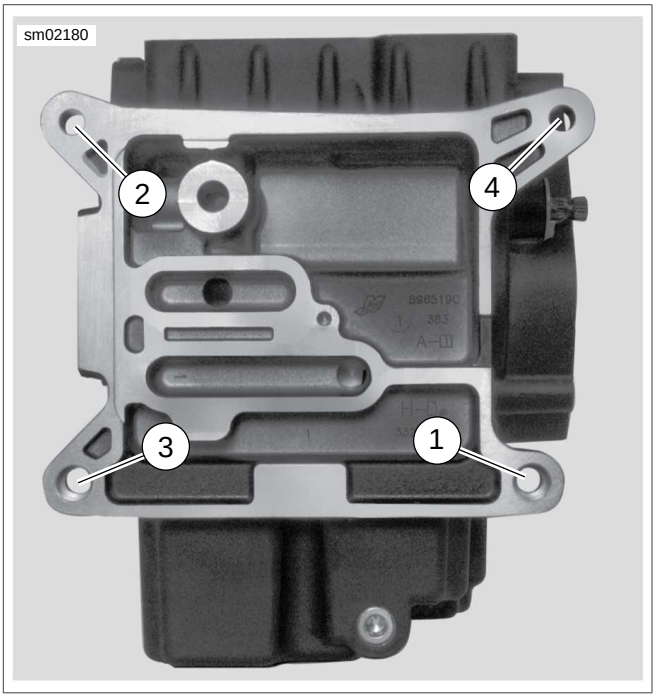


Figure 3-16. Transmission Housing to Crankcase Torque Sequence

17. Adjust primary chain. See 1.9 PRIMARY CHAIN.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

18. Install primary chaincase cover and magnetic drain plug. See 6.4 PRIMARY CHAINCASE HOUSING.
19. Fill primary chaincase with primary chaincase lubricant. See 1.9 PRIMARY CHAIN.
20. Install left side footpeg and bracket with two screws. Tighten to 25-35 ft-lbs (33.9-47.5 Nm).
21. Install shifter foot lever to primary chaincase. Tighten pinch bolt to 18-22 ft-lbs (24.4-29.8 Nm). Connect shifter linkage.
22. Move to right side of motorcycle. Connect the following connectors.
    a. Crank position sensor connector [79].
    b. Stator/voltage regulator connector [46].
    c. Oil pressure sending unit connector [140].
23. Install rear brake pedal and right footpeg bracket with two screws. Tighten to 25-35 ft-lbs (33.9-47.5 Nm). Install actuator lever to pedal with clevis pin and **new** cotter pin. See 2.14 REAR BRAKE MASTER CYLINDER.
24. Install exhaust and heat shields. See 4.16 EXHAUST SYSTEM.
25. Install throttle control cables to induction module. See 4.9 INDUCTION MODULE.

⚠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)

26. Install fuel tank and connect crossover tube, fuel gauge connector and clip vapor valve to downtube. See 4.5 FUEL TANK.
27. Install backplate and air cleaner cover. See 4.4 AIR CLEANER ASSEMBLY.

⚠WARNING

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

28. Connect battery cables, positive cable first.

⚠WARNING

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

29. Install seat.
30. Install **new** oil filter. Fill engine to either wet or dry capacity depending upon service status. See 1.4 ENGINE OIL AND FILTER.

NOTE

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

31. Remove motorcycle from lift.
32. Perform vehicle alignment. See 2.11 VEHICLE ALIGNMENT.
33. Check rear brakes, clutch and throttle for proper operation.
34. Check engine oil level with **both** cold check and hot check procedures. See 1.4 ENGINE OIL AND FILTER.

GENERAL

It is assumed that each step performed on one cylinder is automatically repeated on the other.

To perform a complete top end overhaul, follow all steps listed in this section including inspection and repair procedures.

BREATHER ASSEMBLY

PART NUMBER	TOOL NAME
HD-47248	LOWER ROCKER BOX WRENCH
HD-47258	UPPER ROCKER BOX WRENCH

NOTE

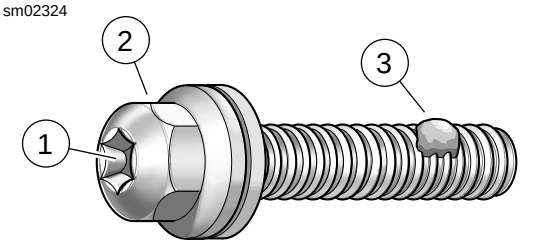
Dirt caked on cooling fins and other areas can fall into crankcase bore or stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways. Remove all dirt and particles before disassembly to prevent component damage.

1. Use low pressure spray to thoroughly clean exterior surfaces of engine prior to disassembly.

NOTES

- *See Figure 3-17. If the engine is left in the chassis for service, use the UPPER ROCKER BOX WRENCH (Part No. HD-47258) and LOWER ROCKER BOX WRENCH (Part No. HD-47248) to remove the rocker cover and rocker housing bolts, respectively. These tools are especially useful when removing the bolts on the left side of the engine (particularly the rear) where there is close proximity to the frame. With both an external and internal hex, the bolts also can be removed with either a 7/16 inch socket or open end/box wrench (open spaces), or a short 3/16 inch allen wrench (tight spaces).*
- *It is assumed that each step performed on one cylinder is automatically repeated on the other.*

2. See Figure 3-18. Following the sequence shown, alternately loosen the six rocker cover bolts. Remove the rocker cover bolts and their captive washers.
3. Remove the rocker cover and gasket. Discard gasket.
4. See Figure 3-20. Remove two bolts to release breather assembly and filter element from the rocker arm support plate. For inspection and repair information, see 3.19 BREATHER ASSEMBLY.



1. **Internal hex**
2. **External hex**
3. **Lock patch**

Figure 3-17. Rocker Cover Bolt (Rocker Housing Bolt Similar)

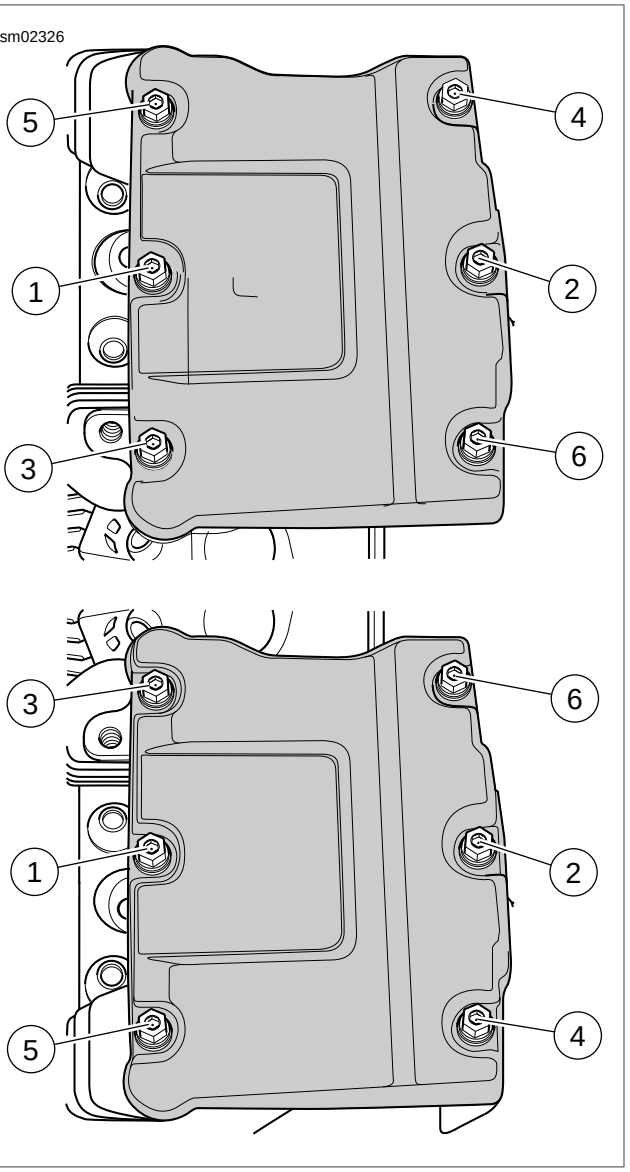


Figure 3-18. Rocker Cover Bolt Removal Sequence

ROCKER ARM SUPPORT PLATE

PART NUMBER	TOOL NAME
HD-48283	CRANKSHAFT ROTATING WRENCH

1. See Figure 3-19. Insert the blade of a small screwdriver into cast loop of spring cap retainer (at top of upper push rod cover). While pushing down on spring cap, rotate bottom of screwdriver toward outboard side to remove. Repeat step on second push rod cover.

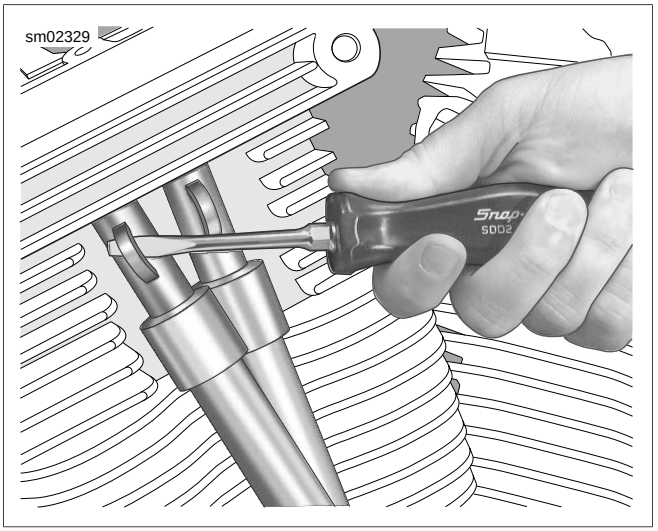


Figure 3-19. Removing Spring Cap Retainer

2. Collapse upper and lower push rod covers.
3. To remove the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (or lowest position) of the cam. To find the base circle, it is first necessary to rotate the engine. Based on the level of disassembly required, three methods of engine rotation are presented below.
   a. **With primary cover installed -** Remove spark plugs. With vehicle on center stand, place the transmission in 6th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. Continue with next numbered step.
   b. **With primary cover removed -** Remove spark plugs. Place the transmission in neutral. Fit a socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. Continue with step 4.

   NOTE

   Do not attempt to rotate engine by removing cam cover and placing socket on crank or primary cam sprocket flange bolt. Head of flange bolt can break off possibly resulting in damage to flywheel or camshaft.

   c. See Figure 3-21. **With engine mounted in engine stand -** Install CRANKSHAFT ROTATING WRENCH (Part No. HD-48283) on sprocket shaft and rotate in a counterclockwise direction until the base circle is found.

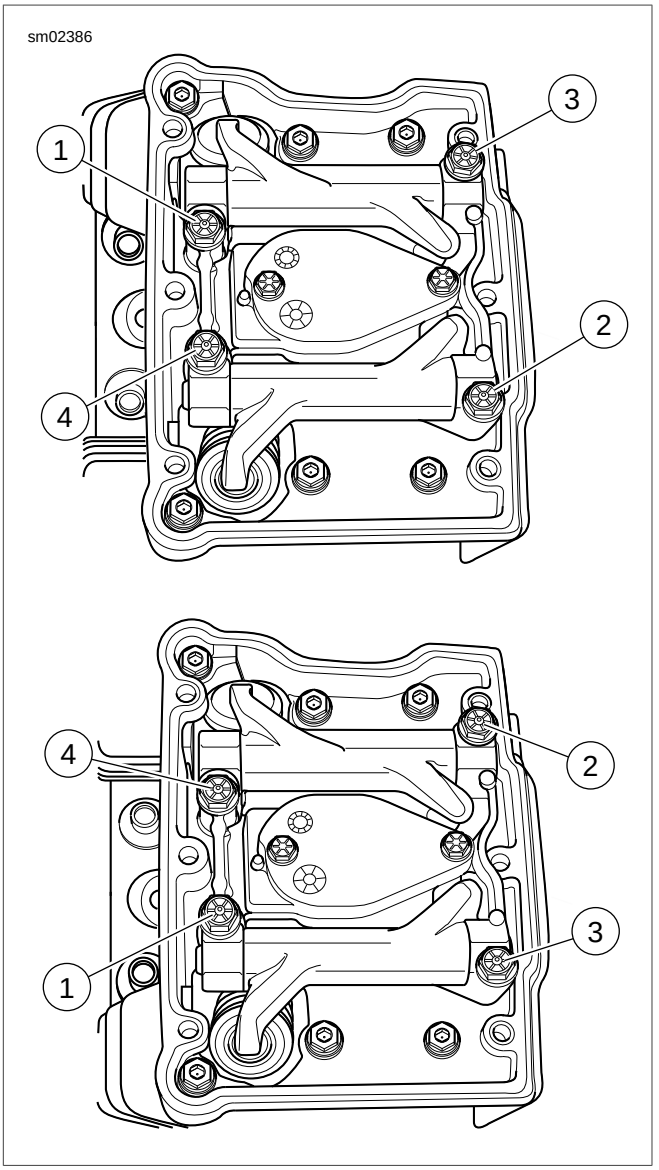


Figure 3-20. 1/4 Turn Rocker Arm Bolts in Sequence

4. Using one of the methods above, rotate engine until piston is at top dead center (TDC) of compression stroke.
   a. To accomplish this, first raise lower push rod cover to access intake lifter (inside hole of lifter cover).
   b. Place index finger on top of the intake lifter. While rotating engine, feel lifter rise (valve open) and fall (valve closed).
   c. Now place finger tightly over spark plug hole and rotate engine again. In the compression stroke, air will be forced out against your finger until the piston reaches the TDC position. Stop engine rotation when the flow of air through the spark plug hole stops.
   d. Direct the beam of a small flashlight into spark plug hole to verify piston is at TDC. Both intake and exhaust valves are now closed and the push rods are in the unloaded (loose) position.
5. See Figure 3-20. Alternately loosen each of the four rocker arm support plate bolts just 1/4 turn in the pattern shown the figure. Continue turning the bolts in these increments

until loose. Remove the rocker arm support plate bolts with flat washers.

6. Remove the rocker arm support plate assembly from the rocker housing. For inspection and repair information, see 3.20 ROCKER ARM SUPPORT PLATE.

NOTE

Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

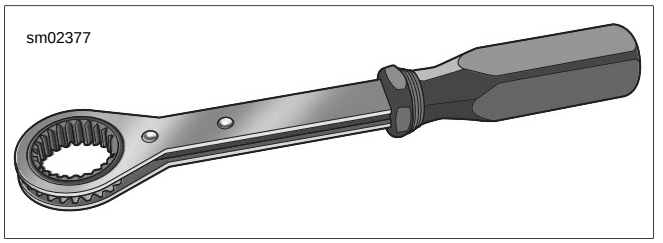
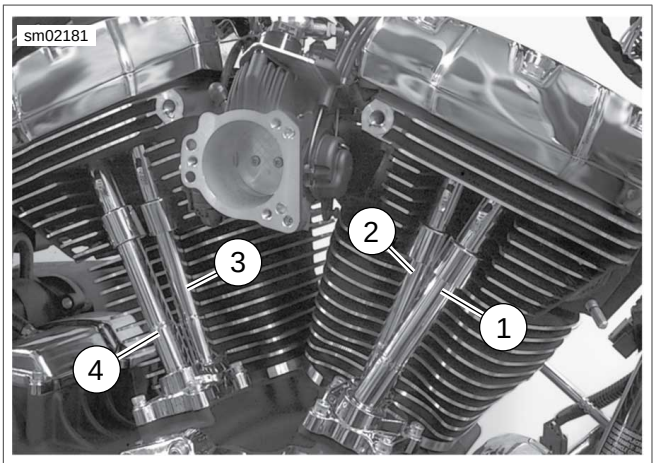


Figure 3-21. Crankshaft Rotating Wrench

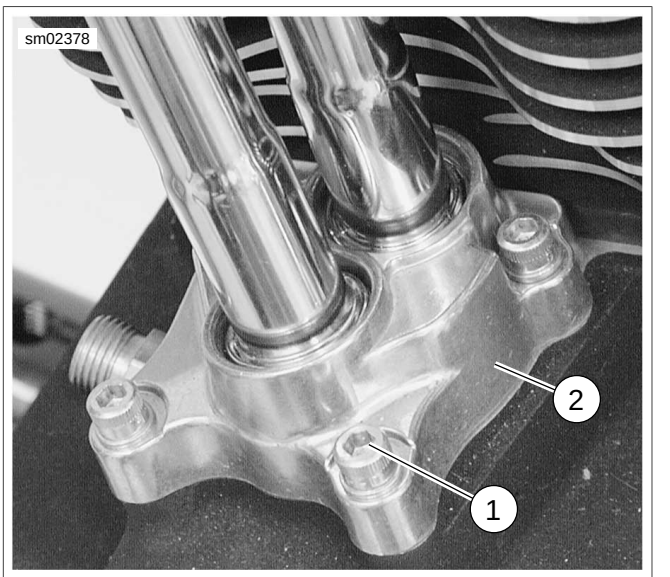


1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

Figure 3-22. Push Rod Locations

PUSH RODS, LIFTERS AND COVERS

1. See Figure 3-22. Remove the intake and exhaust push rods and push rod covers.
   a. Tag the push rods for location (front/rear cylinder), and orientation (top/bottom) as they are removed. This will simplify installation.
   b. Remove push rod covers from cylinder head and lifter cover bores.
   c. Remove three o-rings from push rod covers and discard. If o-ring is missing from upper push rod cover, be sure to dislodge it from the cylinder head bore.
2. See Figure 3-23. Remove lifter covers.
   a. Using a crosswise pattern, remove four screws with captive washers (1) to release the lifter cover (2).
   b. Remove the lifter cover and gasket. Discard gasket.
3. Remove lifters.
   a. Remove the anti-rotational pin to free the hydraulic lifters.
   b. Tag the lifters for location (front/rear cylinder) and function (intake/exhaust) as they are removed. This will simplify installation.
   c. Place the lifters in clean plastic bags to keep out dust, dirt and debris.
4. See Figure 3-24. Remove and discard o-ring from groove around breather baffle hole in rocker housing.
5. For inspection and repair information, see 3.21 PUSH RODS, LIFTERS AND COVERS.



1. **Screw with captive washer (4)**
2. **Lifter cover**

Figure 3-23. Lifter Cover

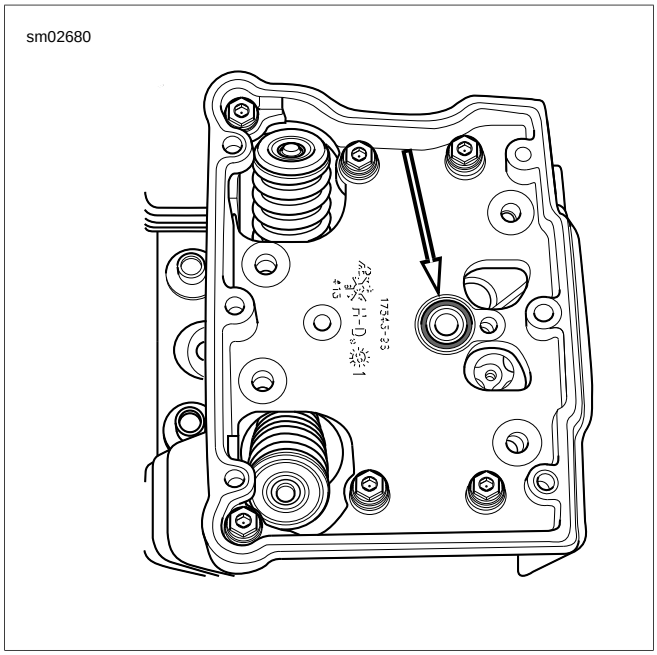


Figure 3-24. Breather Baffle Hole O-Ring

CYLINDER HEAD

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

1. See Figure 3-25. Following the sequence shown, alternately loosen the six rocker housing bolts. Remove rocker housing bolts and their captive washers.
2. Remove rocker housing and gasket. Discard gasket.

NOTE

To prevent distortion of the cylinder head, cylinder and cylinder studs, gradually loosen the cylinder head bolts in the specified sequence.

3. See Figure 3-26. Remove cylinder head bolts.
   a. Following the sequence shown, alternately loosen each of the four cylinder head bolts just 1/4 turn.
   b. Continue turning the bolts in these increments until loose.
   c. Remove the cylinder head bolts.
4. Remove cylinder head and head gasket.

NOTE

Save the cylinder head gasket (if salvageable) for use with the CYLINDER TORQUE PLATES (Part No. HD-42324-A) when measuring, boring or honing of the cylinder is required.

5. For inspection and repair information, see 3.22 CYLINDER HEAD.

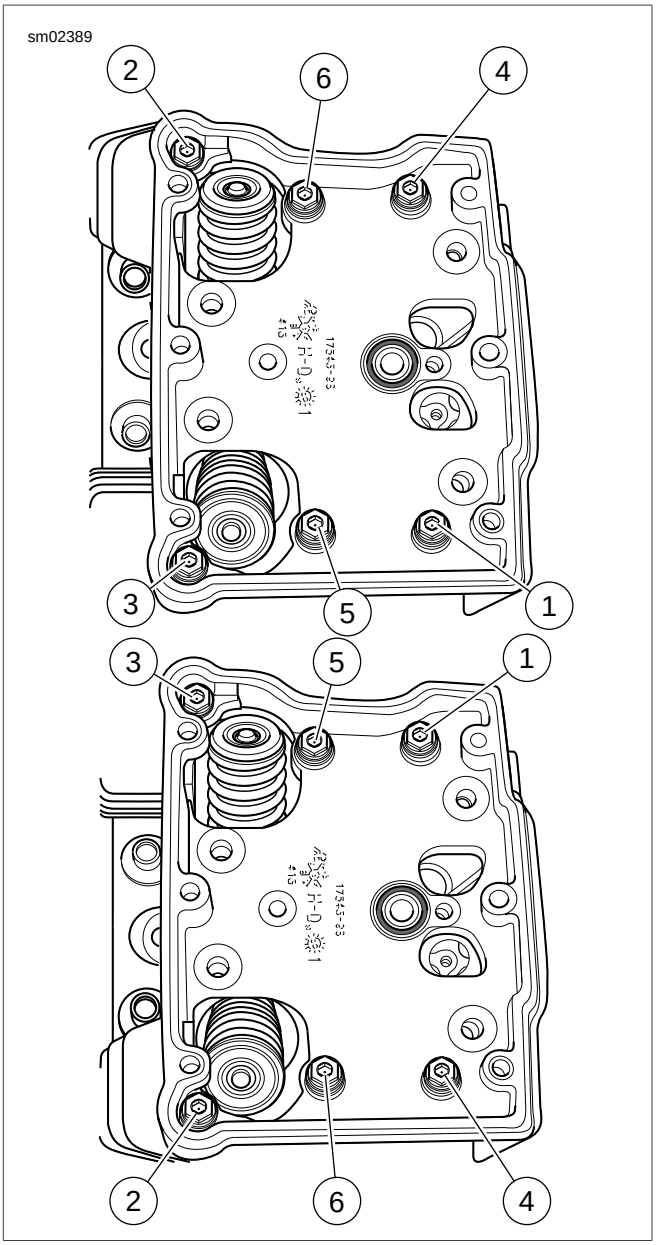


Figure 3-25. Rocker Housing Bolts Removal Sequence

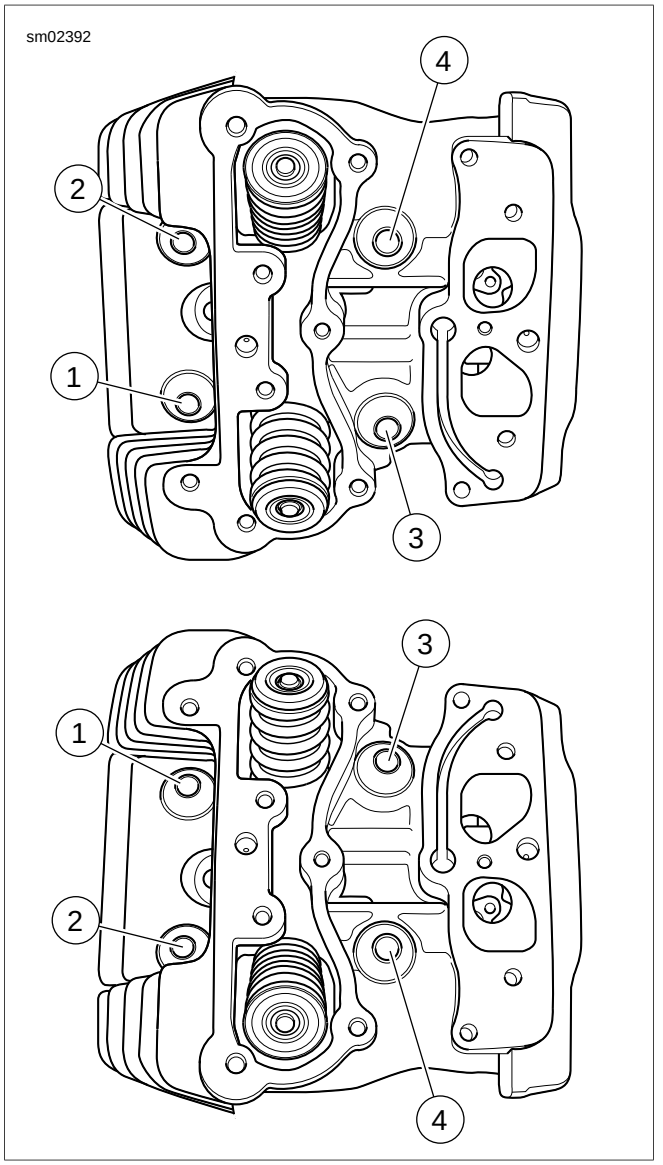


Figure 3-26. 1/4 Turn Head Bolts in Sequence

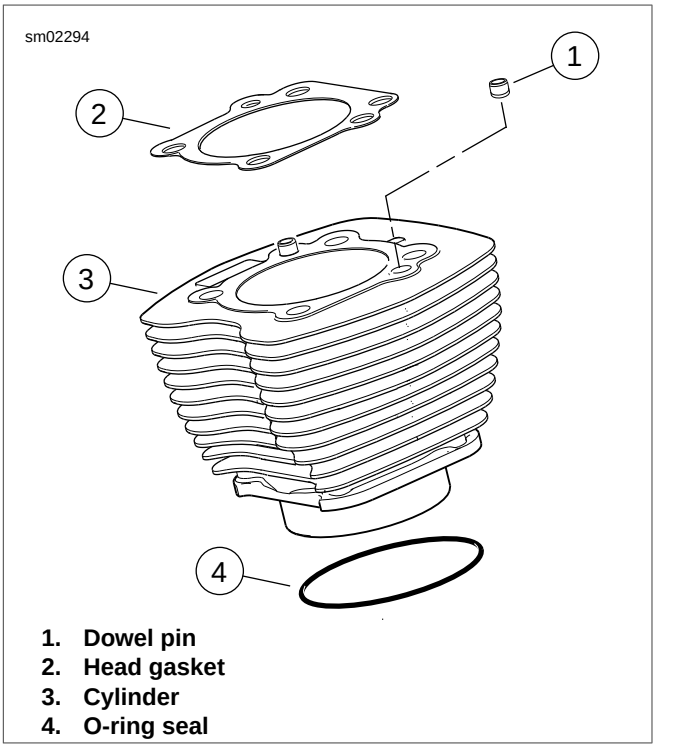
CYLINDER

1. Raise the cylinder just enough to place clean shop towels under the piston. This will prevent any dirt or debris, such as broken ring pieces, from falling into the crankcase bore.

NOTE

Exercise caution to avoid bending the cylinder studs. Even a slight bend or nick can cause a stress riser leading to stud failure.

2. Carefully remove the cylinder. Exercise caution to avoid bending the cylinder studs. As the piston becomes free of the cylinder, hold it upright to prevent it from striking the studs or dragging across the stud thread area.
3. Mark cylinder FRONT or REAR as appropriate.
4. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
5. See Figure 3-27. Remove o-ring seal (4) from the bottom of the cylinder liner. Discard o-ring seal.
6. See Figure 3-28. Remove o-ring from dowel pin (4) on base of cylinder deck. Discard o-ring.
7. For inspection and repair information, see 3.23 CYLINDER.



1. **Dowel pin**
2. **Head gasket**
3. **Cylinder**
4. **O-ring seal**

Figure 3-27. Cylinder Assembly

PISTON

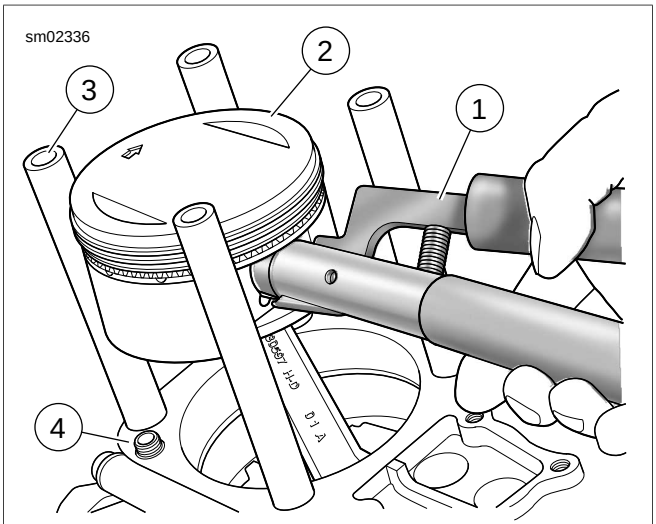
PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER
HD-42320-A	PISTON PIN REMOVER

1. Verify that clean shop towels are properly positioned over the crankcase bore to prevent the piston pin circlip from falling into the crankcase.

⚠WARNING

Wear safety glasses or goggles when removing or installing piston pin retaining rings. Piston pin retaining rings are compressed in the ring groove and can fly out when removed from the groove, which could result in serious eye injury. (00293a)

2. See Figure 3-28. Remove the piston pin circlip.
   a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A) (1) into the piston pin bore. Position claw on tool in slot of piston (2) (directly under circlip).
   b. Hold a shop towel over the piston pin bore in case a circlip should fly out during removal. Squeeze the handles of the tool together and pull from bore. Remove circlip from claw and discard.



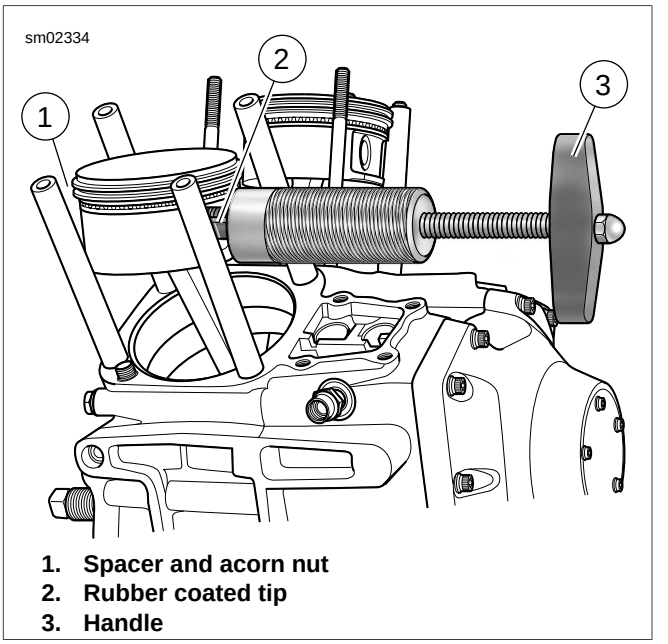
1. **Piston pin circlip remover/installer**
2. **Piston**
3. **Protective material over cylinder studs**
4. **Cylinder deck dowel (O-ring not shown)**

Figure 3-28. Piston Pin Circlip Removal (Part No. HD-42317)

NOTE

It is not necessary to remove both piston pin circlips during piston removal. Leave the second circlip in the pin bore.

3. See Figure 3-29. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-A).
   a. Remove acorn nut and spacer from rod end of tool.
   b. Slide rod end through piston pin. Install spacer and acorn nut (1) on end of rod.
   c. Position rubber-coated tips (2) of tool on flat each side of pin bore.
   d. Turn handle (3) in a clockwise direction until piston pin is pulled free of bore.
4. Remove the piston. Be sure to hold the connecting rod shank upright to prevent it from striking the crankcase. Place a 3.0 in. (76.2 mm) long piece of foam-type water pipe insulation around each connecting rod. Use material with an O.D. of 2.25 in. (57.1 mm) and an I.D. of 1.0 in. (25.4 mm) to prevent damage.
5. Turn the piston over. Mark the pin boss with the letters F(ront) or R(ear) to identify location.
6. Service as needed. For inspection and repair information, see 3.24 PISTON.
7. Complete engine work.
   a. If performing a top end overhaul only, see 3.16 TOP END OVERHAUL: ASSEMBLY.
   b. If performing a complete engine overhaul, see 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.



1. **Spacer and acorn nut**
2. **Rubber coated tip**
3. **Handle**

Figure 3-29. Piston Pin Remover (Part No. HD-42320-A)

GENERAL

NOTE

- *It is assumed that each step performed on one cylinder is automatically repeated on the other.*
- *Do not mix 2007 and later pistons with earlier style pistons. New style pistons have tapered wrist pin boss. The wrist pin portion of the connecting rod is also tapered.*

This section provides a sequential process for engine reassembly after a complete 3.15 TOP END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Piston installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Piston.
- Cylinder installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder.
- Cylinder head installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head.
- Push rods, lifters and covers installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers.
- Rocker arm support plate installation-see 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.
- Breather assembly installation-see 3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

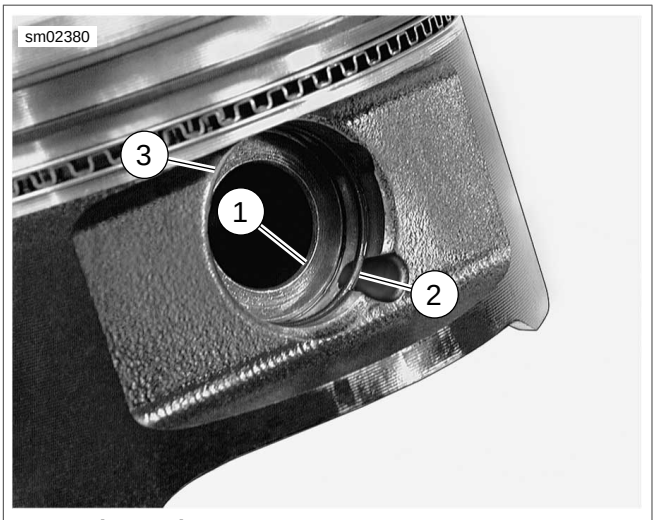
PISTON

PART NUMBER	TOOL NAME
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER

1. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
2. Apply clean H-D 20W50 engine oil to piston pin, piston bosses and upper connecting rod bushing.
3. Remove water pipe insulation from connecting rod shank.
4. See Figure 3-30. Place piston over rod end so that the arrow stamped at the top of the piston points toward the front of the engine.
5. See Figure 3-31. Insert piston pin (1) through pin bore and upper connecting rod bushing. Push pin until it contacts circlip installed in opposite pin boss. Verify that end gap (3) for circlip is 180 degrees from opening (2).
6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin circlip from falling into the crankcase. Verify that the circlip groove is clean and free of dirt and grime.



Figure 3-30. Piston Installation Arrow



1. **Piston pin**
2. **Circlip opening**
3. **End gap location**

Figure 3-31. Preinstalled Circlip

NOTE

Do not reuse piston pin circlips. The circlips could weaken during removal causing them to break or dislodge during engine operation, a condition that will result in engine damage.

7. Install **new** piston pin circlip with the PISTON PIN CIRCLIP REMOVER/INSTALLER (Part No. HD-42317-A).
   a. See Figure 3-32. Slide circlip down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture circlip in claw.
   b. Releasing pressure on handles, rotate circlip so that the end gap is centered at top of tool and then recapture in claw.
   c. Tilt the circlip forward until the end gap contacts nose of tool.
   d. See Figure 3-33. Insert the tool (1) into the piston pin bore until claw is aligned with slot (2) in piston.
   e. Firmly push the tool into the piston pin bore until it bottoms. Release handles and remove tool.
   f. Inspect the circlip to verify that it is fully seated in the groove.

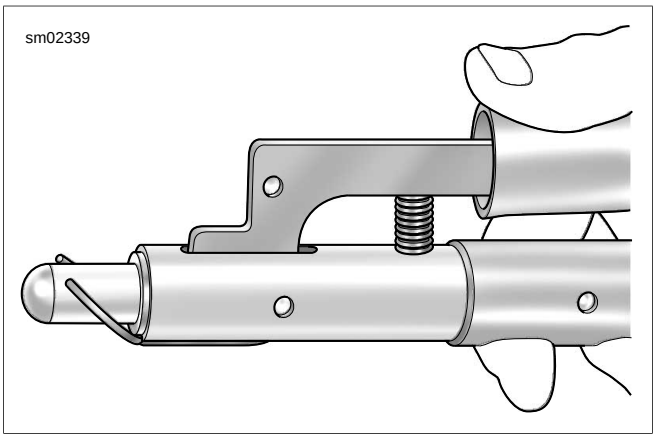
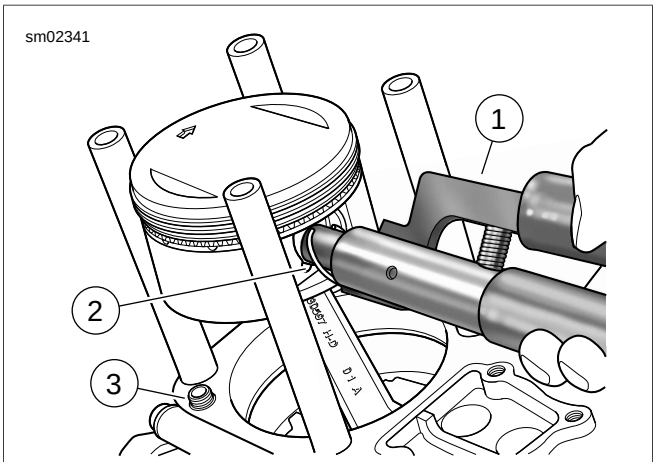


Figure 3-32. Aligning Circlip



1. **Piston pin circlip remover/installer**
2. **Slot**
3. **Cylinder deck dowel (O-ring not shown)**

Figure 3-33. Pin Circlip Remover/Installer (Part No. HD-42317)

CYLINDER

PART NUMBER	TOOL NAME
HD-42322	PISTON SUPPORT PLATE
HD-95952-1	THREADED CYLINDERS
HD-95952-33C	CONNECTING ROD CLAMPING TOOL
HD-96333-51E	PISTON RING COMPRESSOR

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings, keeping them packaged until use to avoid confusion.*

1. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-rings for both cylinder deck ring dowels. Install and verify that o-ring is properly seated in groove.
2. See Figure 3-34. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring seal for the bottom of the cylinder liner. Install **new** o-ring seal.

NOTE

Excessive lubrication of cylinder sleeve o-ring seal will result in oil weepage between cylinder and crankcase as engine is run. This condition may be incorrectly diagnosed as an oil leak.

3. See Figure 3-35. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.
4. Apply clean H-D 20W50 engine oil to piston, piston rings and cylinder bore.
5. Remove protective covers from cylinder studs. Rotate engine until piston is at top dead center. If necessary, see 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate for three methods of engine rotation.
6. See Figure 3-36. Install the PISTON SUPPORT PLATE (Part No. HD-42322).
   a. Slide both adjustable knobs (2) on support plate (1) down away from forked end. Tighten knobs when contact is made with flats at end of slots.
   b. With the forked end of the tool pointing towards the center of the engine and the adjustable knobs facing downward, capture shank of connecting rod in fork. Lay tool on cylinder deck so that adjustable knobs contact wall of cylinder bore.
   c. Rotate engine until piston skirt is centered and firmly seated on top of support plate.

7. See Figure 3-37. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96333-51E).
   a. Fit tabs on pliers (1) into slots of ring compressor band (2). The arrow stamped on the band indicates the side that faces up, so disregard the word "bottom". Place band around piston. Press the lever on the right side of the pliers to open the jaws for band expansion.
   b. Orient tool so that the top of the band is positioned between the top compression ring and the piston crown. Tightly squeeze handles of tool to compress piston rings. The ratcheting action of the tool allows release of the handles after the rings are compressed.
   c. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder over the cylinder studs and the piston crown resting it on the top of the ring compressor band.
   d. Place the palms of both hands at the top of the cylinder. Push down on the cylinder with a sharp, quick motion to pass the piston ring area.
   e. Rotate the engine slightly to raise piston off support plate. Remove pliers from band and then remove band from around shank of connecting rod. Remove piston support plate
8. Remove shop towels from around the crankcase bore exercising caution to keep out any dirt or debris.
9. Carefully set the cylinder over the two ring dowels in the cylinder deck. Push down on the cylinder until it is fully seated in the crankcase bore.

NOTE

See Figure 3-38. To hold the first cylinder in position while installing the second, install THREADED CYLINDERS (Part No. HD-95952-1) from CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C) onto cylinder studs with the knurled side down. This will prevent the piston rings from raising the cylinder as the engine is rotated to bring the other piston into position for installation of the second cylinder.

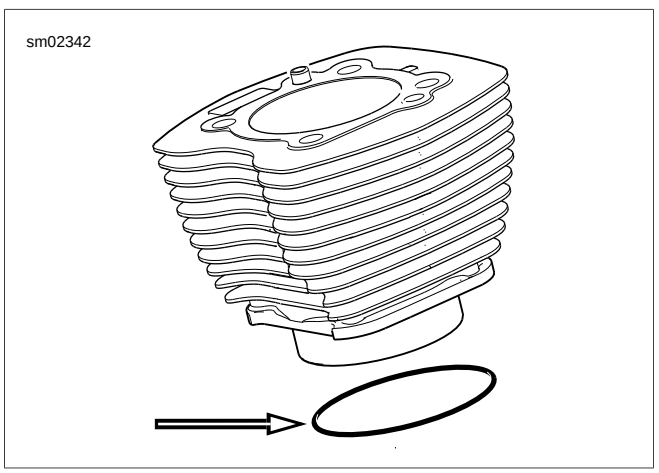
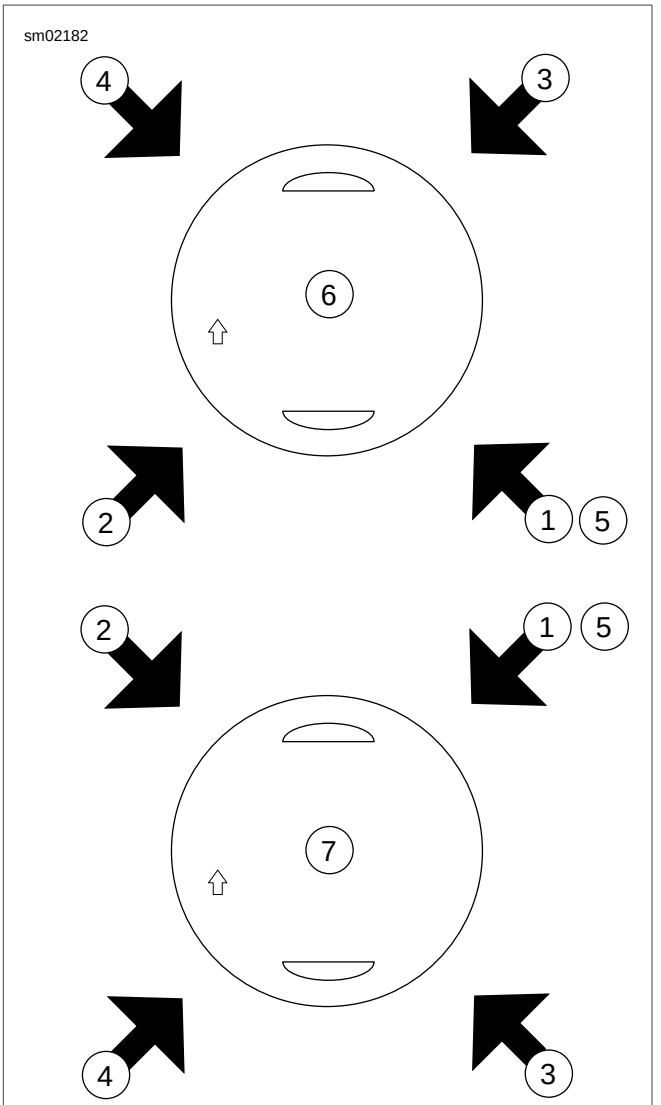
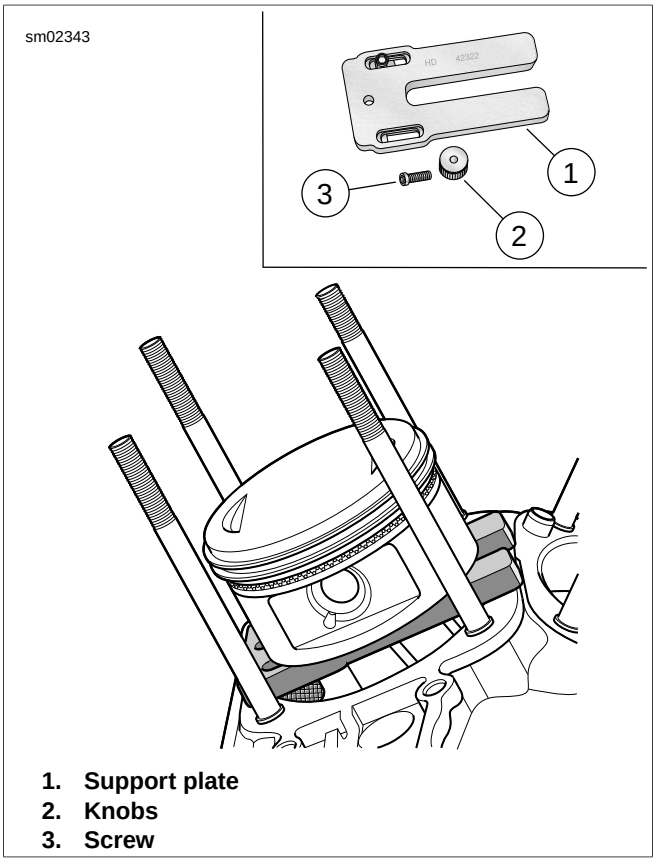


Figure 3-34. O-ring Seal For Cylinder



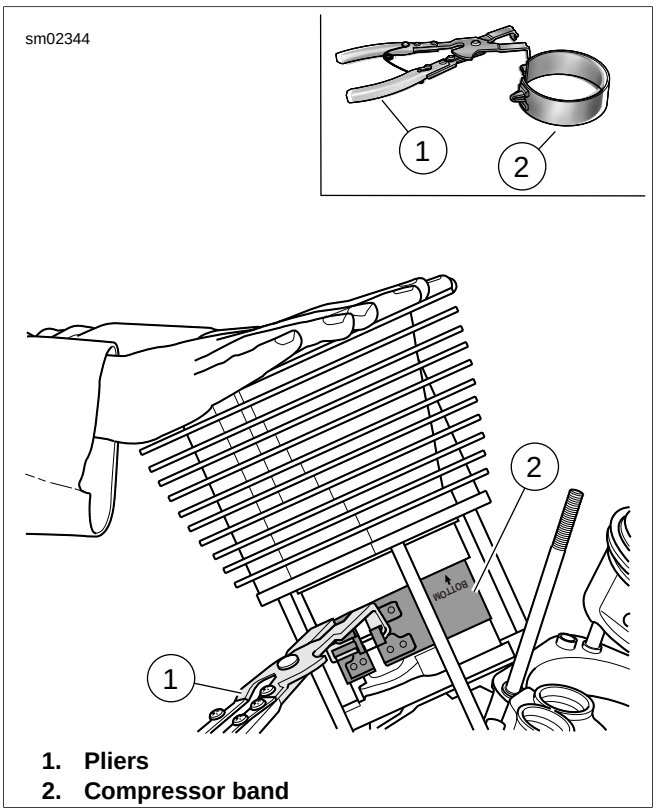
1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-35. Piston Ring Alignment



1. **Support plate**
2. **Knobs**
3. **Screw**

Figure 3-36. Piston Support Plate



1. **Pliers**
2. **Compressor band**

Figure 3-37. Piston Ring Compressor

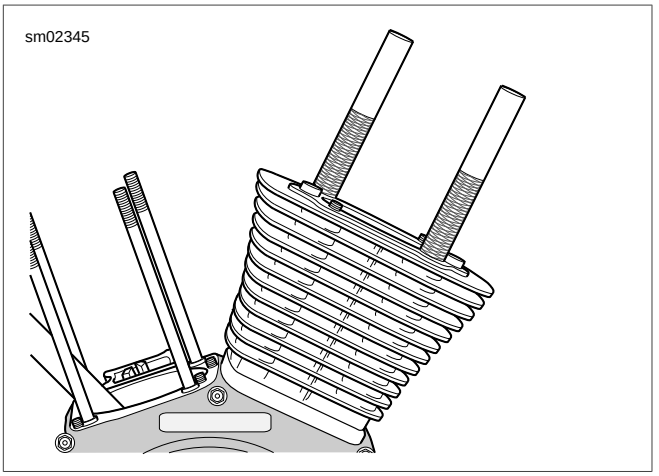


Figure 3-38. Install Threaded Cylinders to Studs

CYLINDER HEAD

NOTE

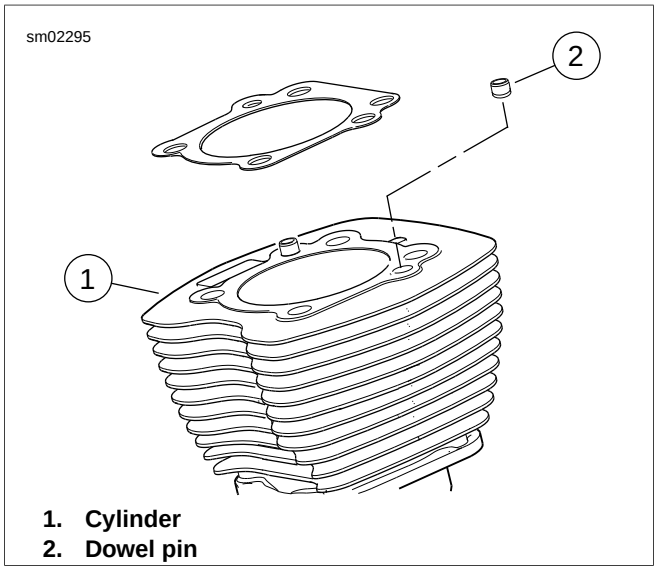
*To ensure proper head gasket alignment, install **new** o-rings over cylinder ring dowels before installing the head gasket. Improper head gasket alignment will cause leaks.*

1. See Figure 3-39. With the part number topside, place the head gasket over the two dowel pins in the upper flange of the cylinder.
2. Note that the word "Front" or "Rear" is cast into the top of the cylinder head to ensure proper installation. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder head over the two cylinder flange dowel pins. Lower the cylinder head at an angle that closely approximates the angle of the crankcase to avoid damage to machined surfaces or the dowel pins.

NOTE

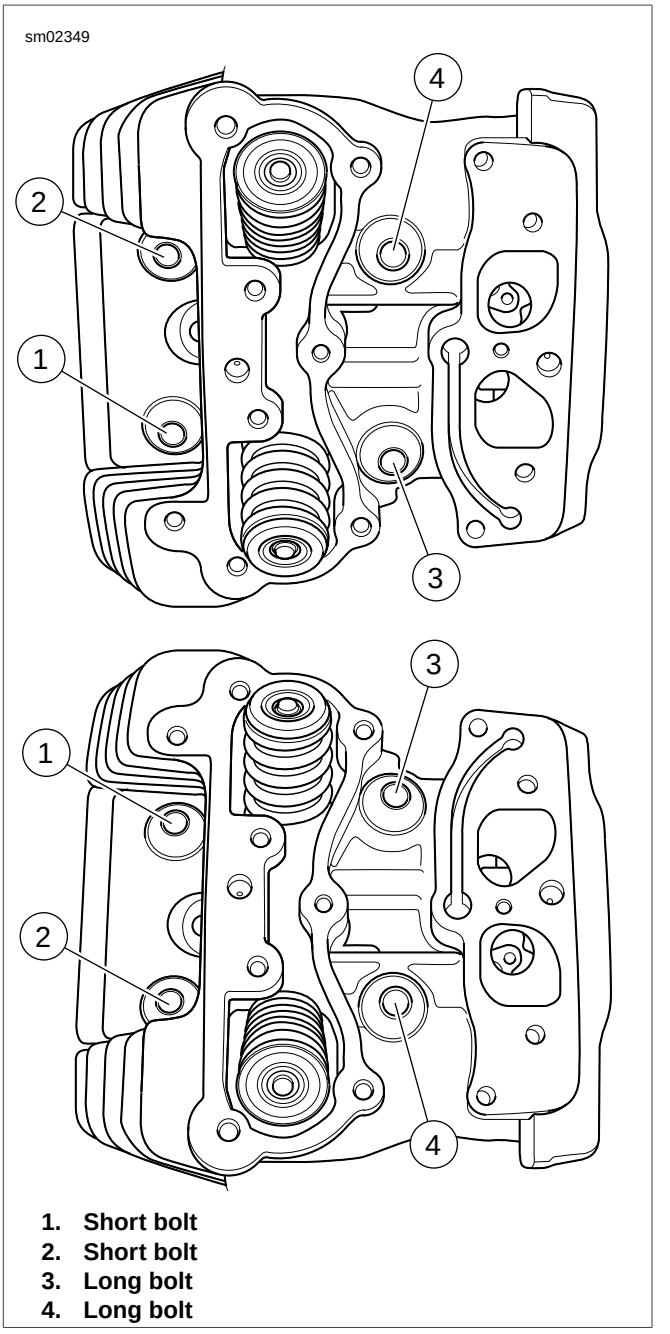
Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.

3. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.
4. See Figure 3-40. Loosely install the cylinder head bolts onto the cylinder studs. Place two short bolts on the left side of the engine and two long bolts on the right.



1. **Cylinder**
2. **Dowel pin**

Figure 3-39. Cylinder Dowel Pins



1. **Short bolt**
2. **Short bolt**
3. **Long bolt**
4. **Long bolt**

Figure 3-40. Cylinder Head Bolt Torque Sequence

NOTE

Improperly tightened cylinder head bolts may result in gasket leaks, stud failure and distortion of the cylinder and/or cylinder head.

5. Tighten the four cylinder head bolts.
   a. Following sequence shown, alternately turn each cylinder head bolt until finger tight.
   b. Following the same sequence, tighten the cylinder head bolts to 120-144 **in-lbs** (13.5-16.2 Nm).
   c. Continuing the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).
   d. See Figure 3-41. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.
   e. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. Be sure to tighten the cylinder head bolts in the sequence shown in Figure 3-40.

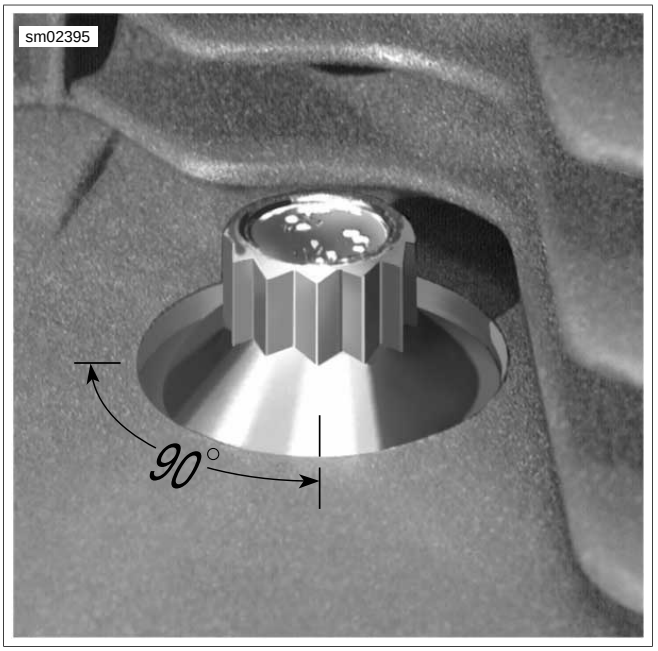
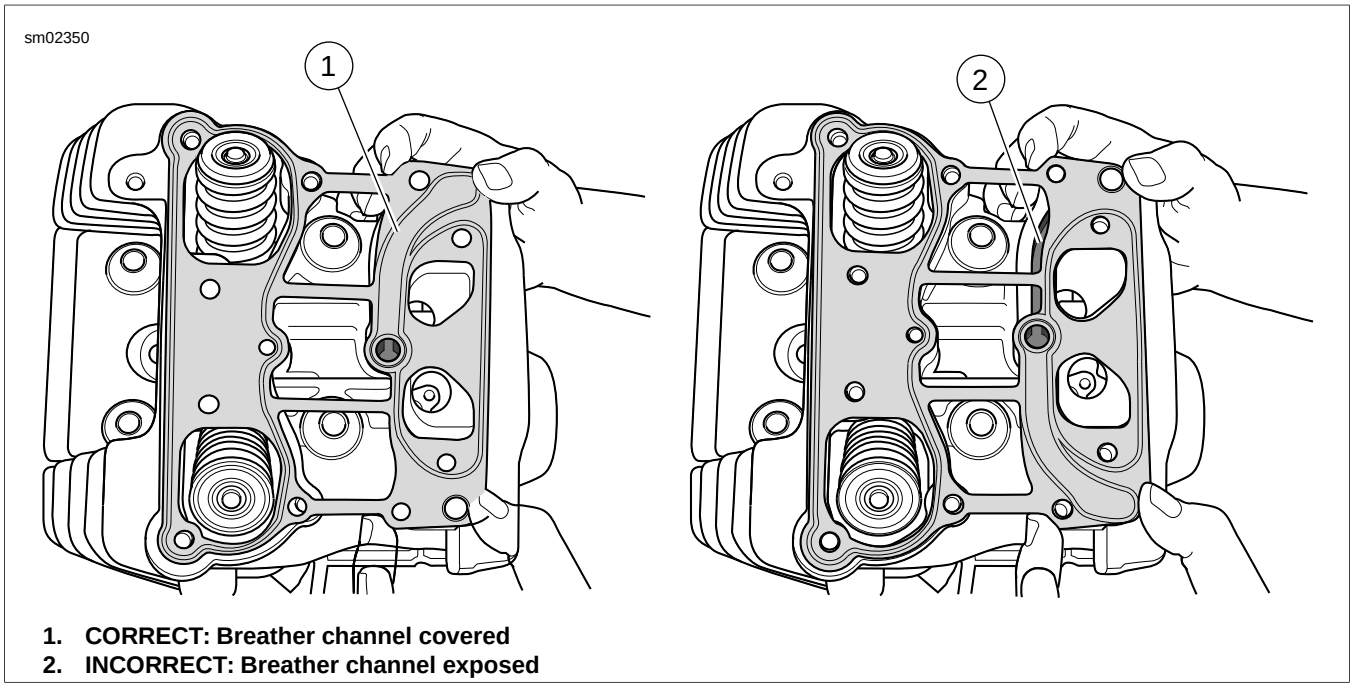


Figure 3-41. Final Tightening for Cylinder Head Bolts

NOTES

- *For best results, use SNAP-ON TORQUE ANGLE GAUGE TA360.*
- *Even though all bolt holes (rocker housing, rocker arm support plate and breather assembly) may appear to be in alignment, the rocker housing gasket may be installed upside down. An upside down gasket will result in an open breather channel causing a major oil leak when the vehicle is started, possibly resulting in engine and/or property damage.*
- *On front cylinder head, install side of gasket marked "front" facing up. On rear cylinder head, install side of gasket marked "rear" facing up.*

6. See Figure 3-42. Install a **new** rocker housing gasket on the cylinder head. Verify that the rocker housing gasket covers the breather channel.



1. **CORRECT: Breather channel covered**
2. **INCORRECT: Breather channel exposed**

Figure 3-42. Install Rocker Housing Gasket (Rear Cylinder Shown)

7. See Figure 3-44. With the indent (1) facing forward, place the rocker housing into position aligning the holes in the housing with those in the gasket.
8. See Figure 3-43. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker housing bolts. Loosely install the rocker housing bolts. Place two long bolts on the left side of the engine and four intermediate bolts in the interior. Alternately tighten the bolts to 120-168 **in-lbs** (13.6-19.0 Nm) in the sequence shown.

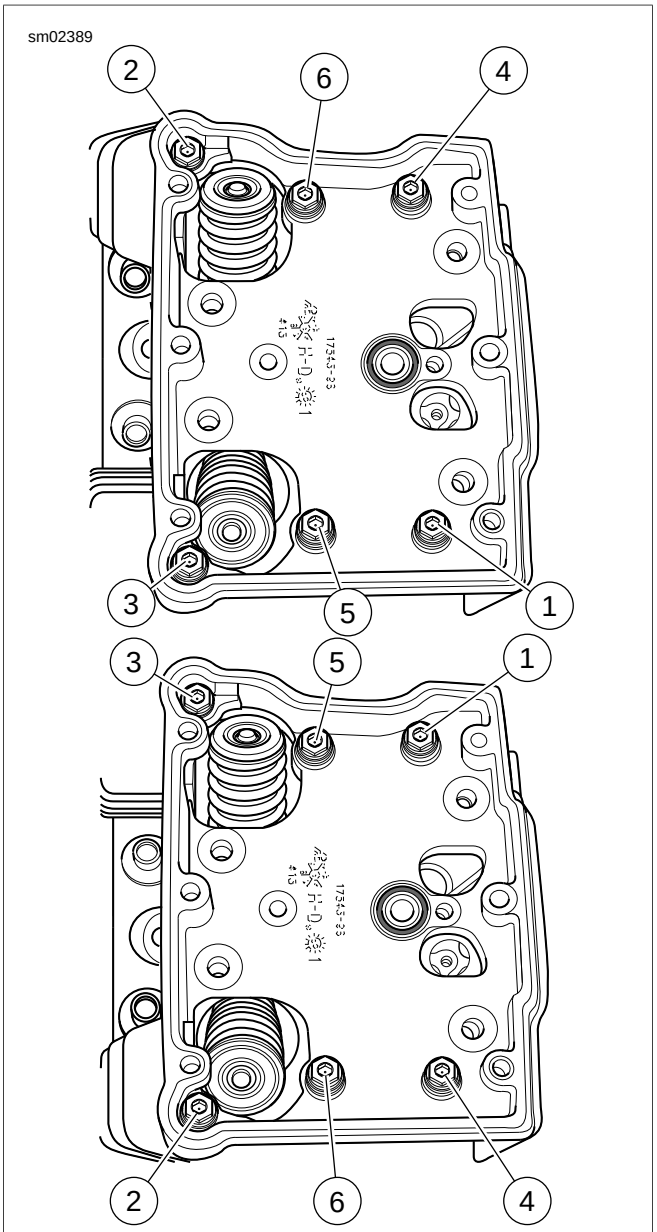
NOTES

- *If the engine was left in the chassis for service, final tighten the rear left rocker housing bolt (rear cylinder) using a torque wrench with a 1/4 in. drive.*
- *O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings, keeping them packaged until use to avoid confusion.*

9. See Figure 3-44. Apply a very thin film of clean H-D 20W50 engine oil to **new** baffle hole o-ring (2). Install **new** o-ring in groove around breather baffle hole in rocker housing.

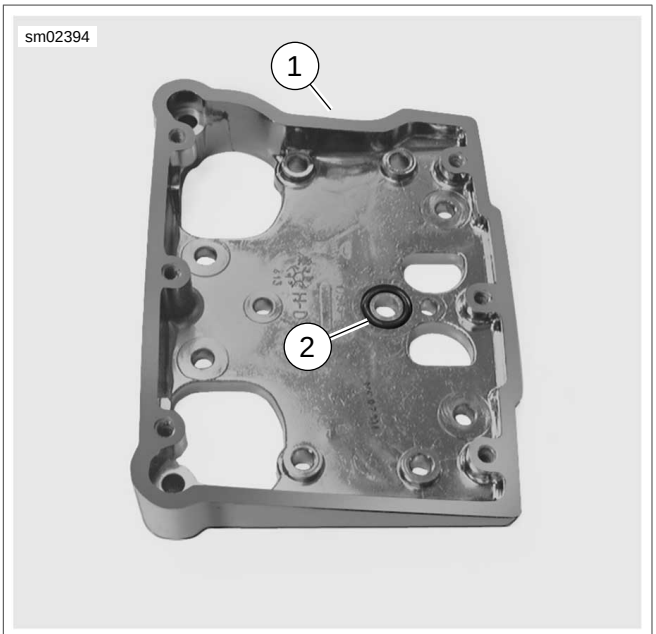
NOTE

Do not confuse breather baffle hole o-ring (Part No. 11270, large inner diameter) with the top push rod o-ring (Part No. 11293, small inner diameter).



1. **Short bolt, 1.25 in. (31.8 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Long bolt, 1.75 in. (44.5 mm)**
4. **Short bolt, 1.25 in. (31.8 mm)**
5. **Short bolt, 1.25 in. (31.8 mm)**
6. **Short bolt, 1.25 in. (31.8 mm)**

Figure 3-43. Rocker Housing Torque Sequence and Bolt Size



1. **Indent**
2. **Breather baffle hole O-ring**

Figure 3-44. Rocker Housing Alignment

PUSH RODS, LIFTERS AND COVERS

1. Remove any labels used on the hydraulic lifters. Install lifters in the crankcase bores with the oil hole on the inboard side and the flats on the lifters facing forward and rearward. To avoid damage, do not drop lifters onto cam lobes.
2. See Figure 3-45. Place the anti-rotational pin (4) on the machined flat between the blocks cast into the crankcase.
3. Install a **new** lifter cover gasket (2) aligning the holes in the gasket with those in the cover (1).

NOTE

Movement or loss of the pin can result in lifter rotation causing engine damage.

4. Install the lifter cover and start the four allen head socket screws (1/4 x 1.0 in). During installation, verify that the anti-rotational pin (4) is held in place by the ribs (3) cast into the inboard side of the lifter cover. Tighten the lifter cover screws to 90-120 **in-lbs** (10.2-13.6 Nm) in a cross-wise pattern.
5. Install push rod covers.
   a. Hand compress the push rod cover assembly and fit the o-ring end of the lower push rod cover into the lifter cover bore.
   b. Extending the assembly, fit the o-ring end of the upper push rod cover into the cylinder head bore.
   c. Do not install the spring cap retainers at this time.

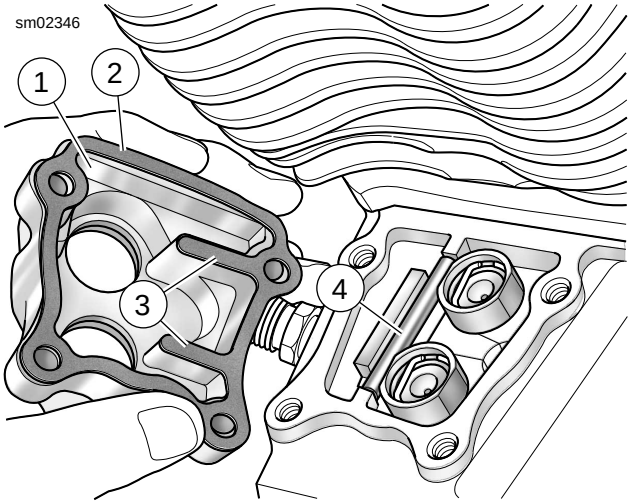
NOTE

To install spring cap retainers, see 3.16 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.

6. Refer to Table 3-30. Install the push rods in their original positions. Be sure to remove any tags that may have been used for identification.
   a. See Figure 3-46. For example, if reassembling the rear cylinder, slide the intake push rod (silver) through the front hole in the rocker housing engaging the lifter socket in the inside hole of the lifter cover.
   b. Slide the exhaust push rod (black) through the rear hole in the rocker housing engaging the lifter socket in the outside hole of the lifter cover.

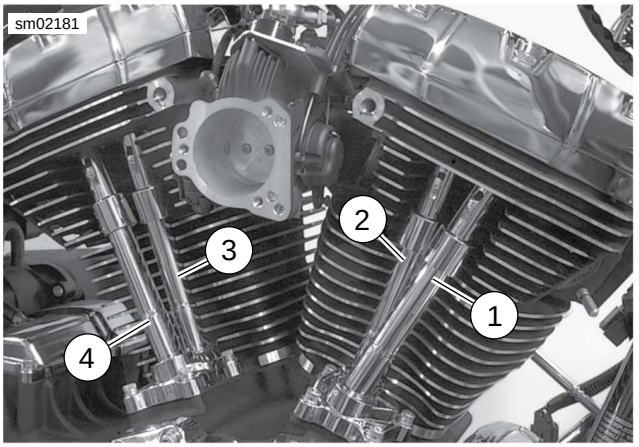
Table 3-30. Push Rod/Lifter Locations

CYL-INDER	COVER & PUSH ROD	LIFTER BORE COVER	CYLINDER HEAD/ROCKER HOUSING BORE
Front	Intake	Inside	Rear
	Exhaust	Outside	Front
Rear	Intake	Inside	Front
	Exhaust	Outside	Rear



1. **Cover**
2. **Gasket**
3. **Ribs on cover**
4. **Anti-rotational pin**

Figure 3-45. Installing Lifters



1. **Front cylinder exhaust push rod**
2. **Front cylinder intake push rod**
3. **Rear cylinder intake push rod**
4. **Rear cylinder exhaust push rod**

Figure 3-46. Push Rod Locations

ROCKER ARM SUPPORT PLATE

Installing the rocker arms and rotating the engine with the valve train loaded can result in bent push rods, damaged bushings or a warped support plate.

1. To install the rocker arm support plate, both lifters of the cylinder being serviced must be on the base circle (or lowest position) of the cam. To rotate engine, see 3.16 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate.
2. See Figure 3-47. Place the rocker arm support plate assembly into the rocker housing. Loosely install the four rocker arm support plate bolts with flat washers.

NOTE

If the engine was left in the chassis for service, final tighten the rocker arm support plate bolt on the rear left side of the rear cylinder using a 3/8 in. drive torque wrench with a 1/2 in. flank drive "dog bone" torque adapter (Snap-on FRDH161). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker housing.

3. Tighten rocker arm support plate bolts.
   a. Following the sequence shown, alternately tighten each of the four rocker arm support plate bolts just 1/4 turn. Continue turning the bolts in these increments until snug.
   b. Following the same sequence, tighten the bolts to 18-22 ft-lbs (24.4-29.8 Nm).
4. Lift up lower push rod covers and verify that both push rods spin freely.

NOTE

Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

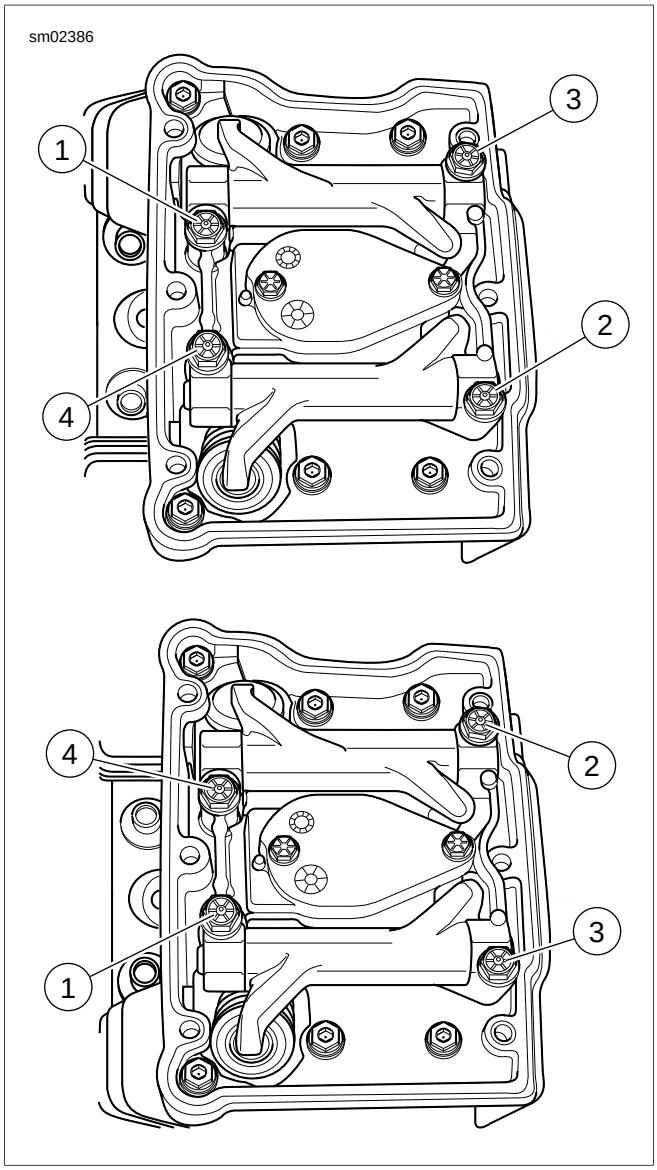


Figure 3-47. Rocker Arm Torque Sequence

5. Complete installation of the push rod covers.
   a. Verify that the o-ring ends of the upper and lower push rod covers fit snugly into the cylinder head and lifter cover bores.
   b. Insert the upper edge of spring cap retainer into the cylinder head bore leaving the bottom edge free.
   c. Insert blade of small screwdriver between bottom edge of spring cap retainer and top of spring cap.

NOTE

For best results, be sure that screwdriver, spring cap and spring cap retainer are free of grease and oil.

   d. See Figure 3-48. While simultaneously depressing spring cap with tip of screwdriver, use forefinger to slide bottom edge of spring cap retainer down shaft towards tip of screwdriver blade. As spring cap reaches its full length of travel, spring cap retainer should be in approximate position against upper push rod cover.
   e. Verify that spring cap retainer is seated tightly against upper push rod cover.



Figure 3-48. Install Spring Cap Retainers

BREATHER ASSEMBLY

NOTE

For breather assembly service procedures, see 3.19 BREATHER ASSEMBLY.

1. See Figure 3-50. Alternately tighten the two bolts to secure breather assembly to 90-120 **in-lbs** (10.2-13.6 Nm).
2. See Figure 3-49. Install a **new** rocker cover gasket with indent facing forward on the rocker housing flange. Place the rocker cover into position aligning the holes in the cover with those in the gasket.

NOTE

If the engine was left in the chassis for service, final tighten the three rocker cover bolts on the left side of the rear cylinder using a 3/8 in. drive torque wrench with a 7/16 in. flank drive "dog bone" torque adapter (Snap-on FRDH141). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker cover.

3. Figure 3-50. Install rocker cover bolts.
   a. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker cover bolts.
   b. Loosely install bolts in the rocker cover.
   c. Following the sequence shown, tighten bolts to 15-18 ft-lbs (20.3-24.4 Nm).
4. Complete motorcycle assembly.
   a. If engine was left in the chassis for service, see 3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE.
   b. If engine was removed for service, see 3.14 INSTALLING ENGINE IN CHASSIS.

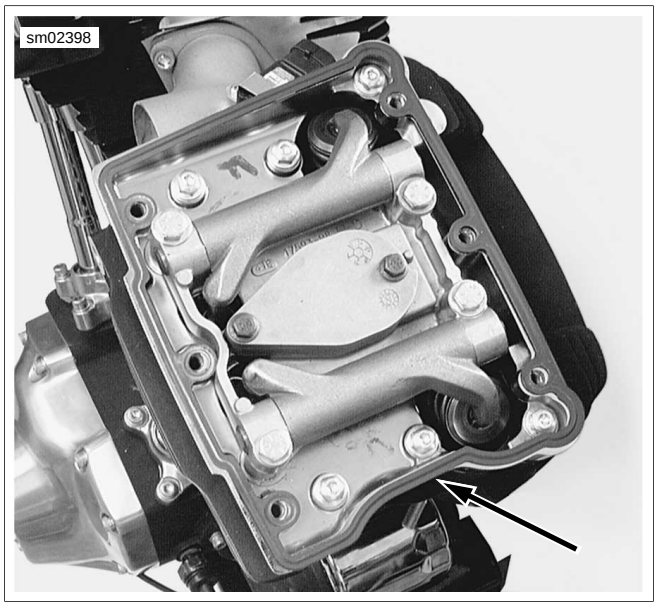
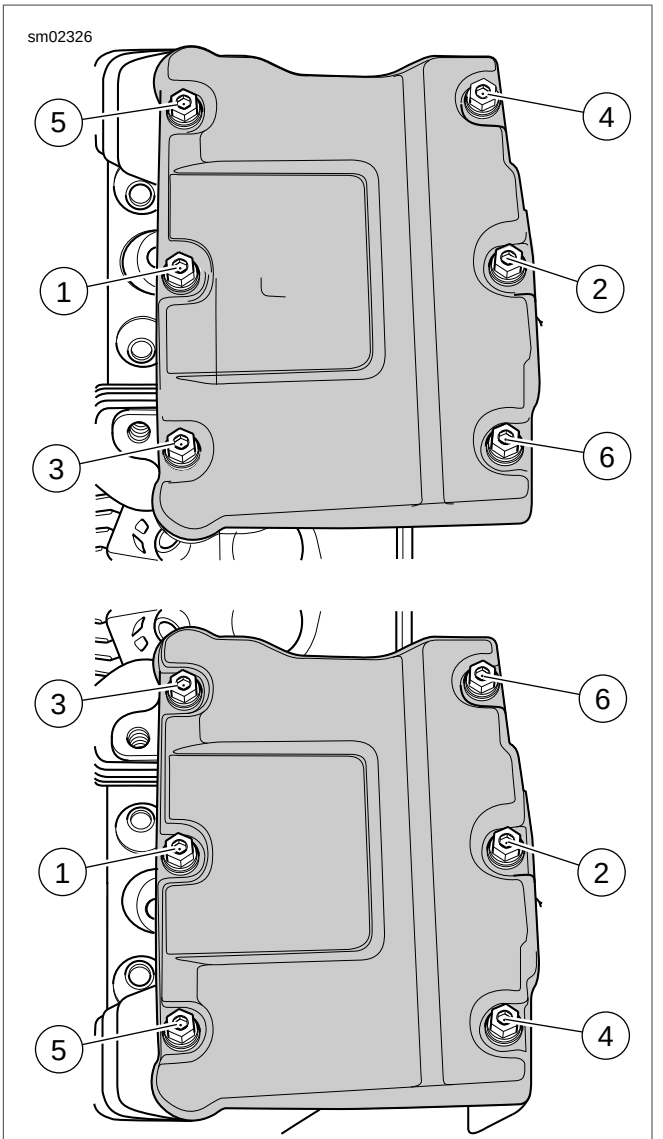


Figure 3-49. Rocker Cover Gasket Indent (Front Cylinder Shown)



1. **Short bolt, 1.0 in. (25.4 mm)**
2. **Long bolt, 1.75 in. (44.5 mm)**
3. **Short bolt, 1.0 in. (25.4 mm)**
4. **Long bolt, 1.75 in. (44.5 mm)**
5. **Short bolt, 1.0 in. (25.4 mm)**
6. **Long bolt, 1.75 in. (44.5 mm)**

Figure 3-50. Rocker Cover Bolts Torque Sequence

GENERAL

To perform a complete bottom end overhaul, follow all steps listed in this section including inspection and repair procedures.

COVER AND CAM SUPPORT PLATE

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

Prepare Engine

1. If performing a complete engine overhaul, perform all steps under 3.15 TOP END OVERHAUL: DISASSEMBLY.
2. If only servicing cam compartment components, partial top end disassembly is required. Remove breather assembly, rocker arm support plate, push rods and push rod covers. Do not remove lifters. See appropriate topics under 3.15 TOP END OVERHAUL: DISASSEMBLY.
3. Support lifters using improvised tool as described under 3.25 COVER AND CAM SUPPORT PLATE.
4. See Figure 3-51. Remove the ten allen head socket screws with captive washers to release the cam cover. Remove and discard the cam cover gasket.

NOTE

The cam support plate, lifter cover and crankshaft position sensor mount all use the same short allen head socket screw (1/4 x 1 in.). Only the cam cover uses the longer screw (1/4 x 1-1/4 in.). For ease of assembly, do not mix the short and long screws. Store the long screws inside the cam cover to avoid confusion. The short screws are interchangeable.

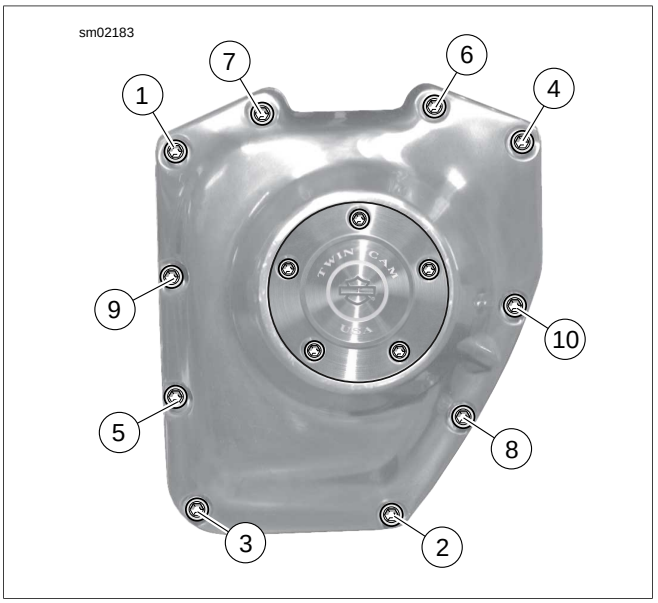


Figure 3-51. Cam Cover Screws

Cam Chain and Sprockets

1. See Figure 3-52. Using a colored marker, mark one of the links (1) of the primary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.

WARNING

Be sure to follow manufacturer's instructions when using propane torches. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00465c)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

NOTE

A piece of wire can be inserted into retention hole (6) to keep cam chain tensioner components assembled.

2. Remove primary cam chain tensioner fasteners (4) and primary cam chain tensioner (3).

NOTE

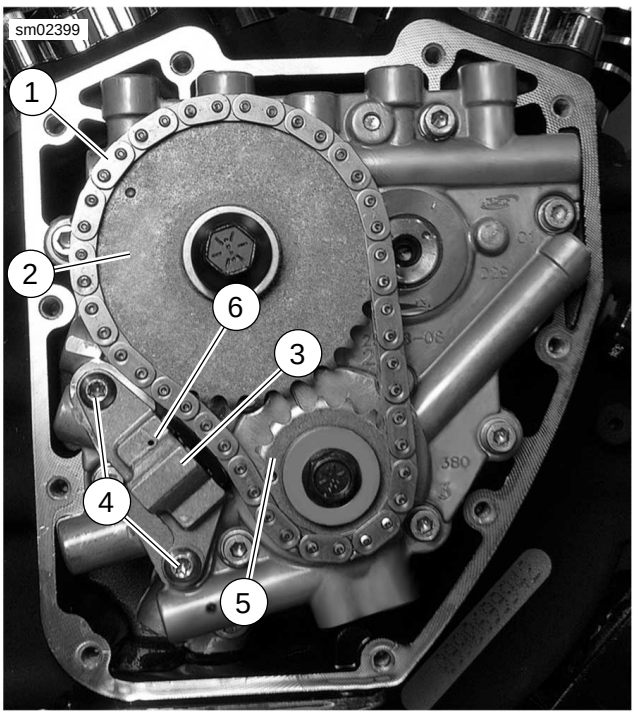
In next step, be sure side of tool labeled "crank side" faces crank sprocket.

3. See Figure 3-53. Install CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between cam sprocket (2) and crank sprocket (5).

NOTES

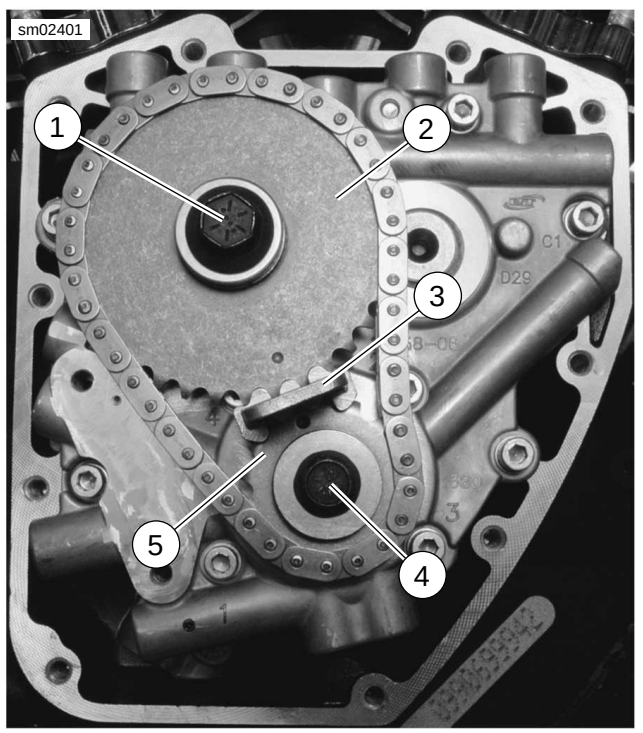
- *Only use approved methods for removing rear cam bolt. Other methods of removal, such as the use of a large breaker bar, may result in damage to chain drive and other components.*
- *If too much LOCTITE or perhaps the wrong LOCTITE was used to install the rear cam bolt, it may be very difficult to remove. In these cases, break down LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but not for so long as to turn bolt blue.*

4. Remove the rear cam sprocket bolt and flat washer (1) from the rear cam sprocket (2).
5. Remove the crank sprocket bolt and flat washer (4) from the crank sprocket (5).
6. Remove CAMSHAFT LOCKING TOOL.
7. Insert small pry bar (seal remover) between inboard side of rear cam sprocket and cam support plate. Working around its circumference, carefully ease off rear cam sprocket until loose on camshaft.
8. Ease off crank sprocket with a slightly smaller pry bar (seal remover). Remove the rear cam sprocket, primary cam chain and crank sprocket.



1. **Link**
2. **Rear cam sprocket**
3. **Primary cam chain tensioner**
4. **Primary cam chain tensioner fasteners**
5. **Crank sprocket**
6. **Retention hole**

Figure 3-52. Cam Support Plate Assembly



1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Camshaft locking tool (HD-47941)**
4. **Crank sprocket bolt (small) and flat washer**
5. **Crank sprocket**

Figure 3-53. Cam Support Plate Assembly

Cam Support Plate

1. See Figure 3-54. Following the sequence shown, alternately loosen and then remove the four allen head socket screws with captive washers to release the cam support plate from the oil pump flange.
2. See Figure 3-55. Following the sequence shown, alternately loosen and then remove the six allen head socket screws with captive washers to release the cam support plate from the crankcase flange.

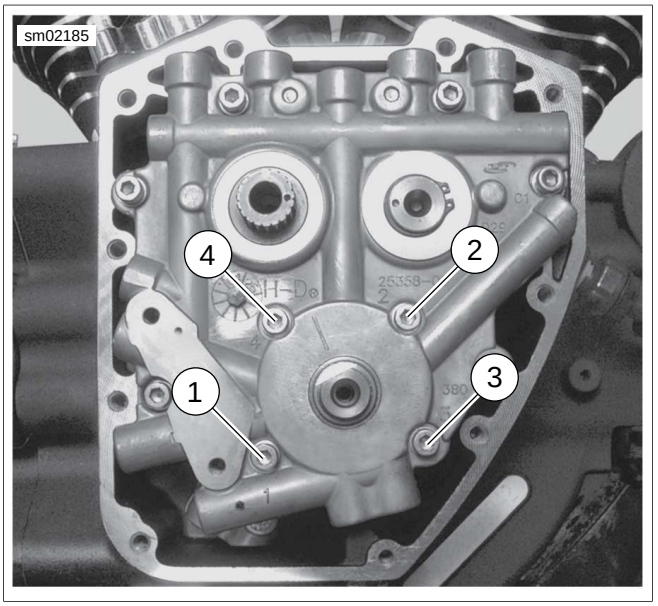


Figure 3-54. Oil Pump Torque Sequence

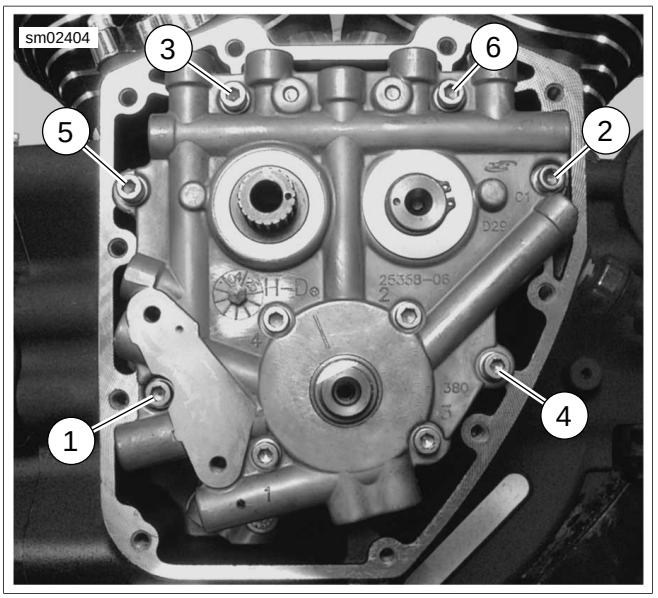
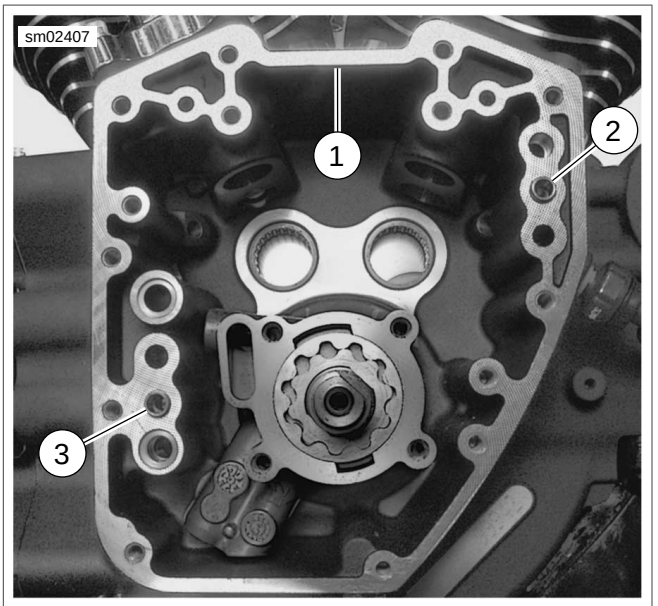


Figure 3-55. Cam Support Plate Torque Sequence

3. See Figure 3-56. Two ring dowels (2, 3) in crankcase flange locate cam support plate.
   a. Insert small pry bar (seal remover) between inboard side of cam support plate and crankcase flange in area adjacent to ring dowels.
   b. Alternately work each side free and then carefully ease cam support plate and camshafts from end of crankshaft.
4. See Figure 3-57. Remove o-ring (1) from groove around oil feed hole in crankcase flange. Discard o-ring.
5. Remove and discard o-ring (2) from crankcase post.
6. See 3.25 COVER AND CAM SUPPORT PLATE for inspection and repair information.



1. **Right crankcase half**
2. **Forward ring dowel**
3. **Rear ring dowel**

Figure 3-56. Ring Dowels

CRANKCASE

1. Carefully pull oil pump from crankshaft.
2. See Figure 3-57. Remove o-ring (2) from outboard side of oil pump housing. Remove o-ring from scavenge port stub. Discard o-rings. See 3.26 OIL PUMP for inspection and repair information.

NOTE

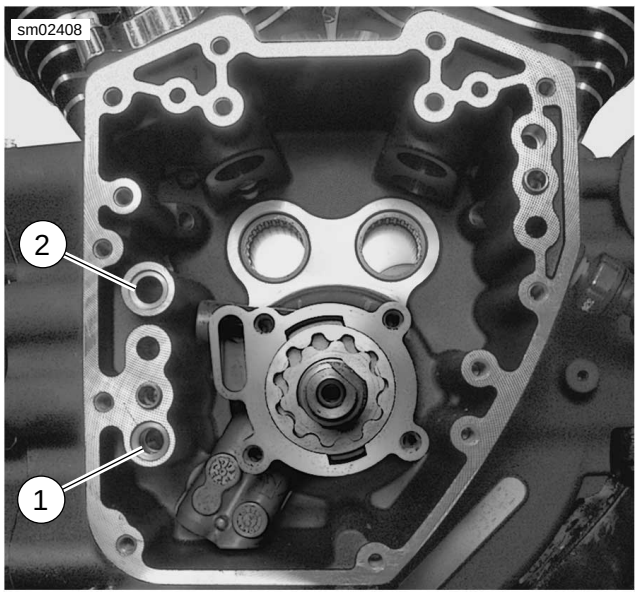
Do NOT rotate left crankcase half in the engine stand so the flywheel sprocket shaft is facing up. The flywheel assembly will fall out of the case.

3. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward.
4. See Figure 3-58. Remove the nine crankcase bolts in the sequence shown.

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped.

5. Using pry points, loosen case halves. Lift right crankcase half off end of crankshaft.
6. See Figure 3-59. Remove o-rings (1) from two dowel pins (2) in split line face of right case half. Discard o-rings.
7. For inspection and repair information, see 3.27 CRANKCASE.



1. **Oil feed hole O-ring**
2. **O-ring on crankcase post**

Figure 3-57. Oil Pump O-rings

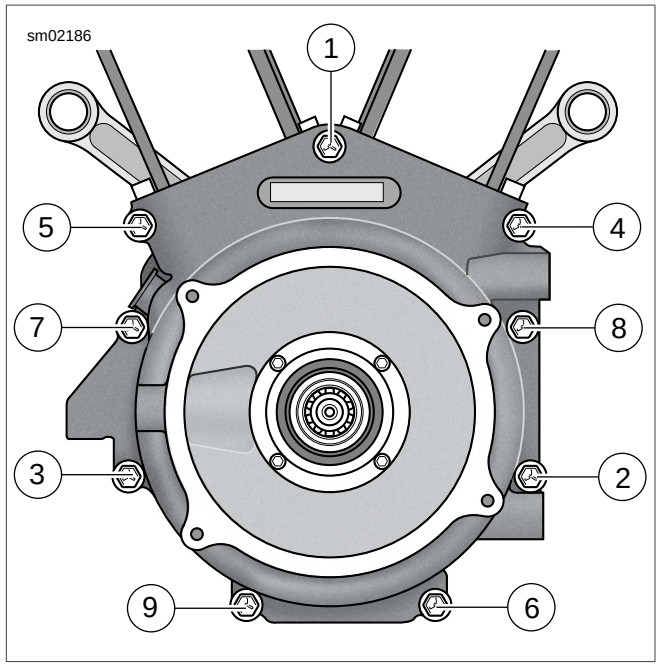
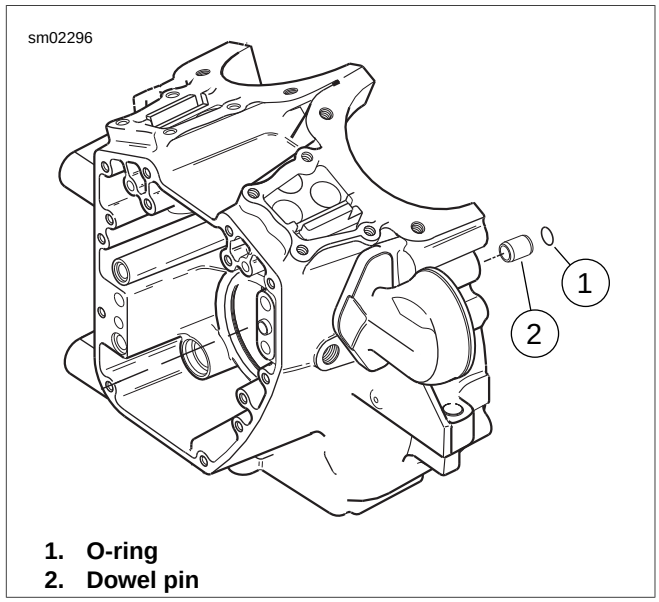


Figure 3-58. Crankcase Bolt Sequence



1. **O-ring**
2. **Dowel pin**

Figure 3-59. Right Crankcase Forward Dowel Pin (Rear Dowel Pin Not Shown)

GENERAL

This section lists a sequential process for engine reassembly after a complete bottom end disassembly and overhaul. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Crankcase installation: see 3.27 CRANKCASE.
- Cover and cam support plate installation: see 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate.

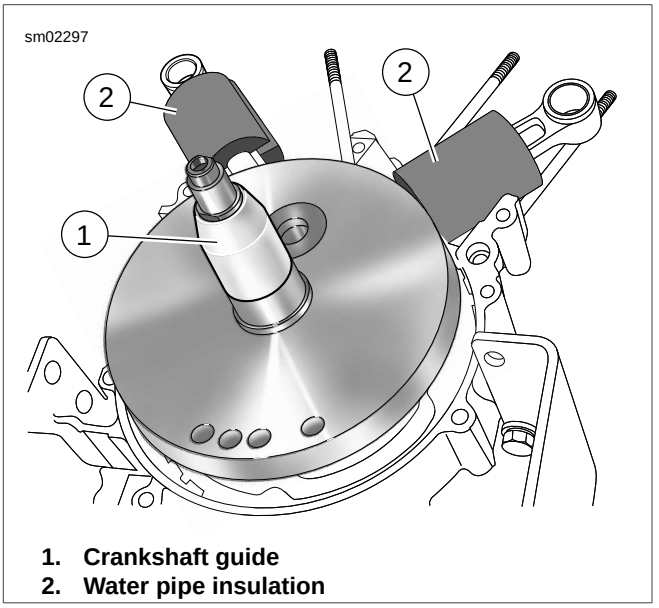
CRANKCASE

PART NUMBER	TOOL NAME
99650-02	HIGH-PERFORMANCE SEALANT, GRAY
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER
HD-42326-A	CRANKSHAFT GUIDE
HD-97225-55C	SPROCKET SHAFT BEARING TOOL

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. Bolt left crankcase half upright in engine stand.
2. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the left crankcase half, slide CRANKSHAFT GUIDE (Part No. HD-42326-A) onto flywheel sprocket shaft.
3. Slide flywheel assembly into left crankcase half. Remove CRANKSHAFT GUIDE tool.
4. Tip crankcase assembly in engine stand so that flywheel pinion shaft is pointing straight up.
5. Install **new** o-rings over two dowel pins in split line face of right case half. Apply a very thin film of clean H-D 20W50 engine oil to o-rings before installation.
6. With the right crankcase half resting on the cam cover flange, apply a bead of sealant approximately 0.056 in. (1.42 mm) wide to the split line face. For best results, use HIGH-PERFORMANCE SEALANT, GRAY (Part No. 99650-02).
7. See Figure 3-60. To facilitate assembly and prevent damage to the crankshaft (roller) bearing in the right crankcase half, place CRANKSHAFT GUIDE (1) (Part No. HD-42326-A) over end of crankshaft until it contacts shoulder on shaft.
8. Mate case halves sliding bearing roller in right crankcase half over end of crankshaft. Remove CRANKSHAFT GUIDE.



1. Crankshaft guide
2. Water pipe insulation

Figure 3-60. Crankshaft Guide (Part No. HD-42326-A)

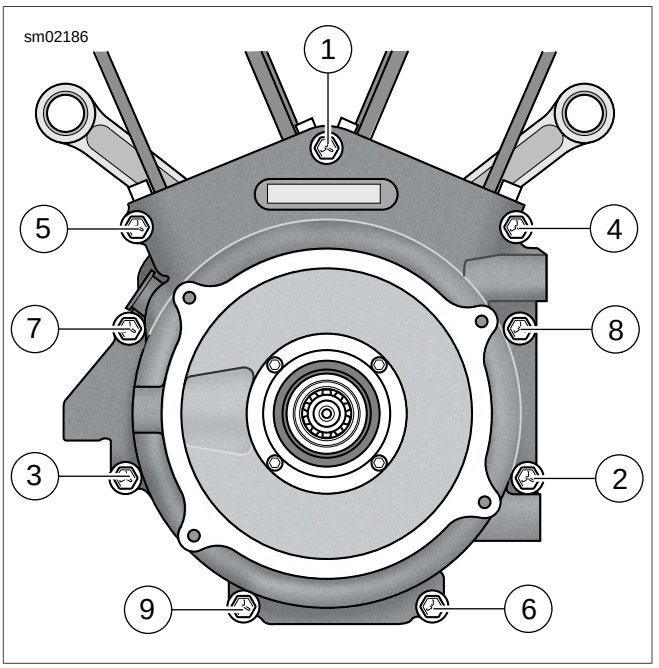


Figure 3-61. Tightening Crankcase Bolts

9. See Figure 3-61. Start the nine crankcase bolts and tighten in the following sequence.
   a. Alternately turn each crankcase bolt until finger tight.
   b. Tighten the crankcase bolts to 10 ft-lbs (13.6 Nm) in the order shown.
   c. Following the same sequence, tighten each bolt to to 15-19 ft-lbs (20.3-25.8 Nm).
10. Tip crankcase assembly so that sprocket shaft is pointing straight up.

11. Install thrust washer on sprocket shaft with "THIS SIDE OUT" facing out (and the chamfer inboard). If using OE part without markings, orient as required to preserve existing wear pattern.

12. See Figure 3-62. Install **new** oil seal into bearing bore. Obtain pilot adapter, pilot shaft, short collar, Nice bearing, large flat washer and handle from SPROCKET SHAFT BEARING TOOL (Part No. HD-97225-55C).
    a. Thread pilot adapter into sprocket shaft.
    b. Thread pilot shaft onto pilot adapter.
    c. Verify that lip garter spring is in place on both sides of oil seal.
    d. Install sprocket shaft spacer in oil seal bore.
    e. With the lettering on the oil seal facing outside, slide sprocket shaft spacer and oil seal over pilot shaft until it contacts bearing bore.
    f. Slide SPROCKET SHAFT OIL SEAL INSTALLER (Part No. HD-39361-B) over pilot shaft until it contacts oil seal.
    g. Slide short collar over pilot shaft until it contacts seal installer.
    h. Slide Nice bearing and large flat washer over pilot shaft.
    i. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and ensure smooth operation.
    j. Thread handle onto pilot shaft to complete assembly of tool.

13. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount.

14. Remove handle, flat washer, Nice bearing, short collar, seal installer, pilot shaft and pilot adapter from sprocket shaft.

15. Rotate crankcase in engine stand so that cam cover flange is facing upward.

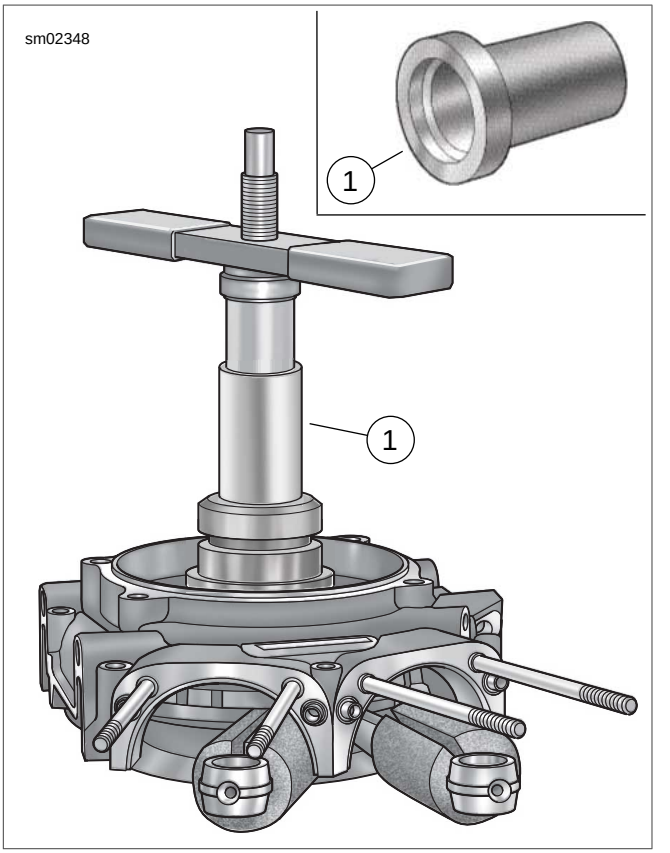


Figure 3-62. Sprocket Shaft Oil Seal Installer (Part No. HD-39361-B)

NOTE

O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use new o-rings keeping them packaged until use to avoid confusion.

16. See Figure 3-63. Assemble and install oil pump. Lubricate parts with clean H-D 20W50 engine oil during assembly.
    a. Apply a very thin film of clean H-D 20W50 engine oil to **new** scavenge port stub o-ring (6). Install **new** o-ring on scavenge port stub of oil pump housing.
    b. Slide oil pump housing (5) onto crankshaft fitting o-ring on scavenge port stub into crankcase bore at back of cam compartment. Firmly push on scavenge port stub with thumb to be sure that it is snug in bore. Inspect o-ring on stub to verify that it is not pinched or distorted.
    c. Separate the gerotor gears into two sets, one wide (4) (scavenge) and the other narrow (1) (feed).

NOTE

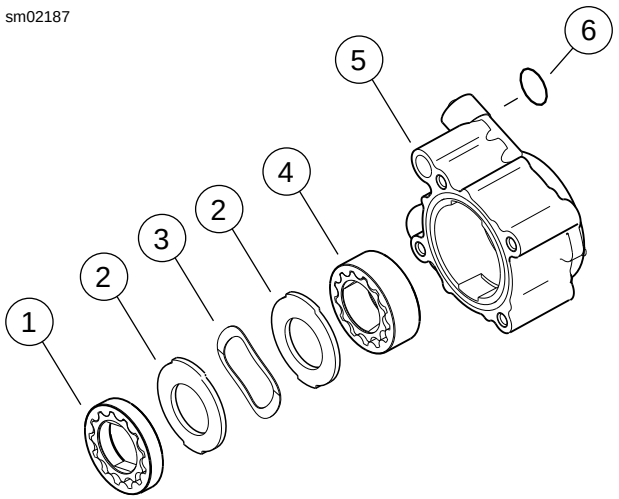
Lubricate oil pump parts with clean H-D 20W50 motor oil during assembly.

d. Fit the smaller of the wide gerotor gears into the larger. Slide the wide gerotor set (4) down the crankshaft until it bottoms in the oil pump housing.

e. Slide inside separator plate (2) down the crankshaft until it contacts the wide gerotor set (4). Install wave washer (3) and outside separator plate (2).

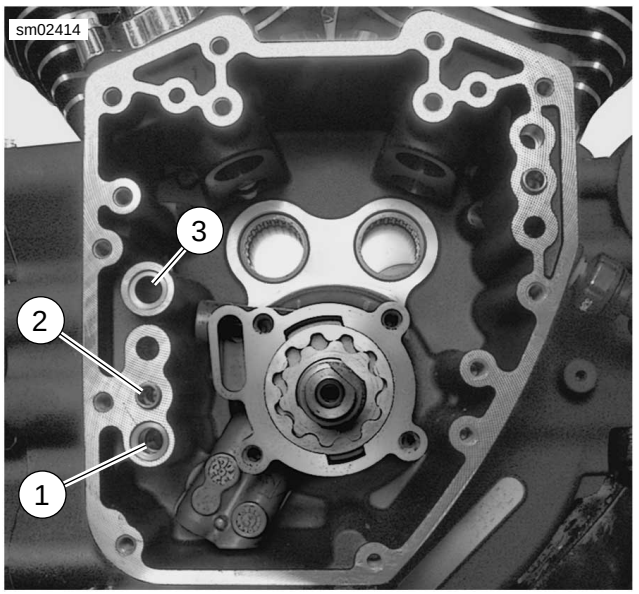
f. Fit the smaller of the narrow gerotor gears into the larger. Slide the narrow gerotor set (1) down the crankshaft until it contacts the outside separator plate (2).

g. See Figure 3-64. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for crankcase post. Install **new** o-ring in groove on crankcase post.



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-63. Assembling Oil Pump



1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on crankcase post**

Figure 3-64. Oil Feed Hole

COVER AND CAM SUPPORT PLATE

PART NUMBER	TOOL NAME
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL

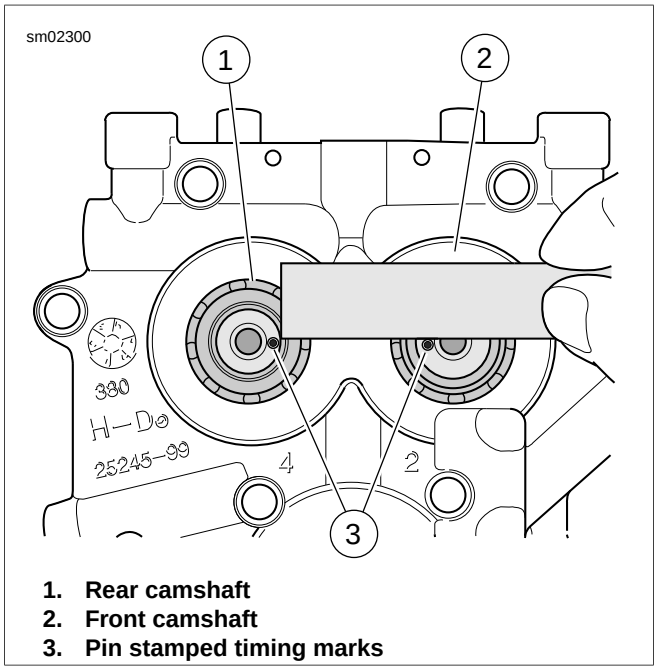
NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-64. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (1) for crankcase flange. Install **new** o-ring in groove around oil feed hole directly below rear ring dowel (2).

2. Lubricate cam needle bearings with clean H-D 20W50 engine oil.

3. See Figure 3-65. Using a straightedge, verify that the timing marks on the ends of the front and rear camshafts are in alignment. If necessary, rotate camshafts in order to make this observation.



1. **Rear camshaft**
2. **Front camshaft**
3. **Pin stamped timing marks**

Figure 3-65. Verify Alignment of Punch Marks

4. Aligning bushing in cam support plate with end of crankshaft, slide cam support plate over crankshaft onto two ring dowels in crankcase flange. Use a rubber mallet to fully seat cam support plate on ring dowels.
5. See Figure 3-66. Install cam support plate screws.
   a. Loosely install the six screws (1/4 x 1.0 in.) to secure the cam support plate to the crankcase flange.
   b. Tighten screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown.
6. See Figure 3-67. Install oil pump.
   a. Start four screws (1/4 x 1.0 in.) into oil pump screw holes 1, 2, 3 and 4.

   NOTE

   For methods of engine rotation, see 3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate.

   b. While rotating the engine, enabling the pump to find its natural center, alternately tighten the screws in holes 1 and 2 until snug.
   c. Tighten the screws in holes 3 and 4 until snug.
   d. Tighten all four screws to 40-45 **in-lbs** (4.5-5.1 Nm) in sequence shown.
   e. Final tighten all four screws to 90-120 **in-lbs** (10.2-13.6 Nm) in the sequence shown. Numbers cast adjacent to the bolt holes also indicate the oil pump torque sequence.
7. With the lettering facing inboard, install rear cam sprocket spacer onto the rear camshaft.

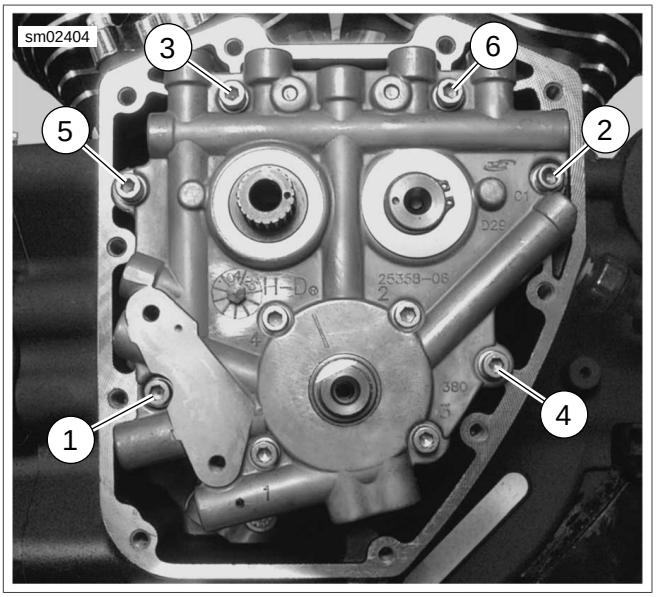


Figure 3-66. Cam Support Plate Torque Sequence

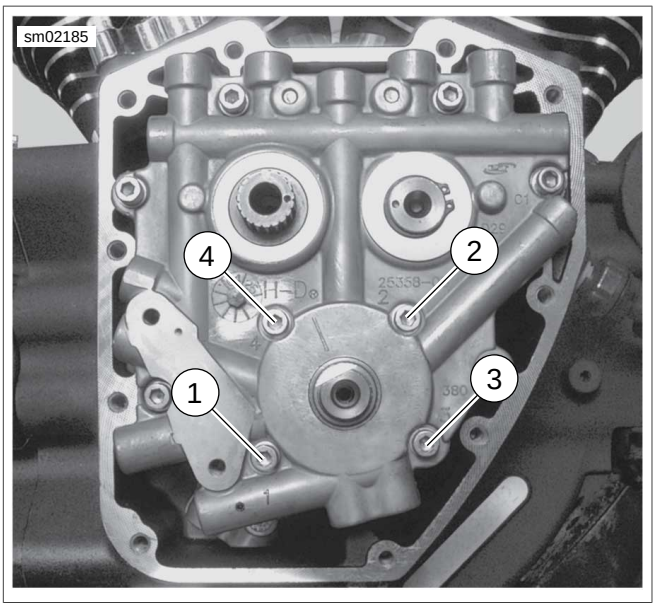


Figure 3-67. Oil Pump Torque Sequence

8. If using the original cam support plate, camshafts, primary cam sprocket, crank sprocket and flywheel assembly, then move to next step. However, if any of these parts have been replaced, then proceed as follows:
   a. Install primary cam sprocket onto splines of rear camshaft. Install long flange bolt with thicker flat washer to secure sprocket to end of camshaft.
   b. Install crank sprocket onto crankshaft. Install short flange bolt with smaller diameter flat washer (that is, washer from bulk inventory) to secure sprocket to end of crankshaft.

NOTE

Use of smaller diameter flat washer with crank sprocket flange bolt allows room on sprocket face for placement of straightedge under step 11(e).

c. See Figure 3-68. To prevent rotation, position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and primary cam sprockets. The handle of the tool is stamped "Crank" and "Cam" to ensure proper orientation. Tighten the crank and primary cam sprocket flange bolts to 15 ft-lbs (20.3 Nm). Remove the sprocket locking tool.

d. Remove crankshaft and rear camshaft end play.

NOTES

- *Crankshaft and rear camshaft endplay can be removed by performing one of the following steps:*

  a. Rotate engine stand so cam compartment is pointing upward. Push on crankshaft and rear camshaft to eliminate endplay.

  b. Install compensating sprocket assembly to pull the crankshaft to the left side of the engine. Push on crankshaft and rear camshaft to eliminate endplay.

- *Height differences between rear cam sprocket and crank sprocket can be addressed by changing the spacer behind the rear cam sprocket. See spacer sizes in Table 3-31.*

- *If the crank sprocket rises above the face of the rear cam sprocket more than 0.010 in. (0.254 mm), remove the flange bolt and rear cam sprocket. Note the part number stamped on the existing spacer behind rear cam sprocket. Replace spacer with the next larger size.*

- *If the rear cam sprocket rises above the face of the crank sprocket more than 0.010 in. (0.254 mm), replace the spacer with the next smaller size only.*

- *Repeat height inspection with the **new** spacer installed.*

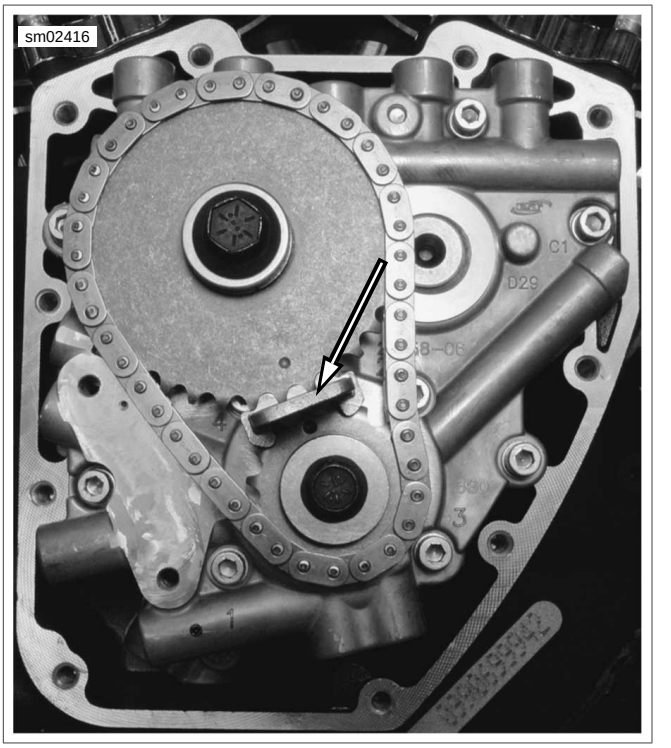


Figure 3-68. Camshaft Locking Tool

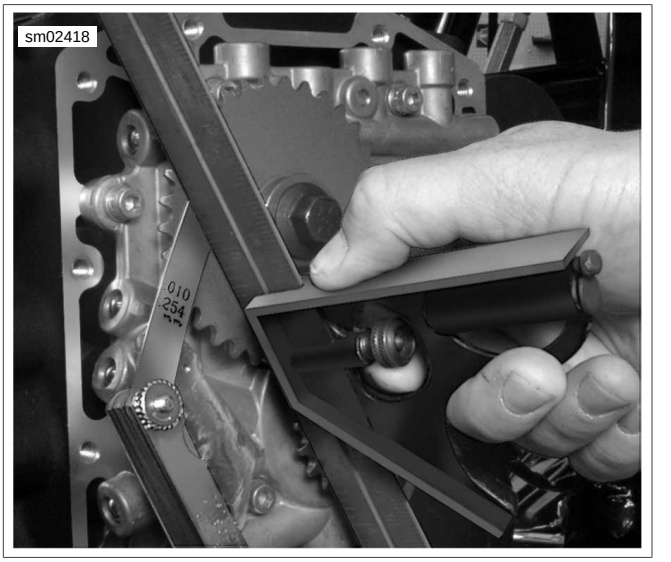


Figure 3-69. Check Alignment of Crank and Rear Cam Sprocket Faces

Table 3-31. Rear Cam Sprocket Spacers

PART NO.	IN.	MM.
25729-06	0.100	2.54
25731-06	0.110	2.79
25734-06	0.120	3.05
25736-06	0.130	3.30
25737-06	0.140	3.56
25738-06	0.150	3.81

9. See Figure 3-70. Apply a light amount of clean H-D 20W50 oil to splines on rear cam. Install the primary cam chain and sprocket assembly.
   a. Place the rear cam sprocket (3) in the cam chain. Hold the sprocket allowing the chain to hang loose. Rotate the sprocket so that the punch mark on the sprocket root faces straight downward.

NOTE

To maintain the original direction of rotation, verify that the colored mark placed on the chain link and crank sprocket is facing away from the cam support plate during installation.

   b. Place the crank sprocket (5) in the opposite end of the chain with the punch mark on the sprocket tooth facing straight upward.
   c. Maintaining the position of the sprockets on the chain with the punch marks in alignment, start the rear cam sprocket onto the end of the rear camshaft. Note that the sprocket has an integral key that must be aligned with the keyway in the camshaft.
   d. Maintaining the position of the crank sprocket on the chain, rotate the rear cam sprocket in a clockwise direction until the flat on the crank sprocket is aligned with the flat on the crankshaft. Install the crank sprocket.

10. See Figure 3-71. Rotate the rear cam sprocket in a clockwise direction until the punch mark on the root is aligned with the punch mark on the crank sprocket tooth. Locate alignment mark (5) on cam support plate to verify that the punch marks are in alignment.

NOTES

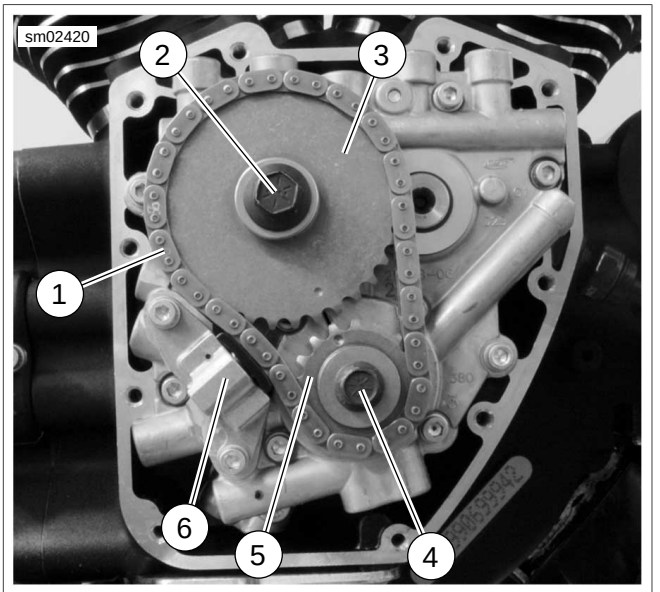
- *If the punch marks are not in alignment, then the sprockets must be removed and reinstalled. Misaligned sprockets will make the engine run erratically.*
- *Rear sprocket bolt and crank sprocket bolt must install freely by hand. Before installing bolts, remove any build-up of LOCTITE THREADLOCKER from the bolt holes with the proper sized thread chaser.*

11. Apply oil to bottom of **new** crank flange bolt head and washer (3). Loosely install bolt (small) with flat washer to secure crank sprocket (4) to end of crankshaft.
12. Apply oil to bottom of **new** rear sprocket bolt head and washer (1). Loosely install bolt (large) with flat washer to secure rear cam sprocket (2) to end of camshaft.

NOTE

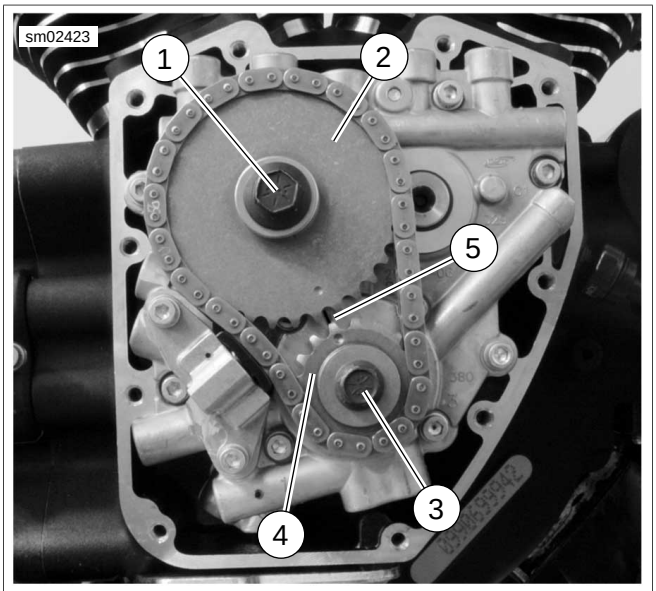
*Both crank and rear cam sprocket flange bolts are specially hardened while the flat washers are of a special diameter. Therefore, use only genuine Harley-Davidson parts when replacement is necessary. If **new** flange bolts are not available, thoroughly clean both internal and external threads and apply a **small** amount LOCTITE THREADLOCKER 262 (red) before installation. The crank and rear cam sprocket flange bolts and flat washers are **not** interchangeable.*

13. Position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-47941) between the crank and rear cam sprockets to prevent rotation. The handle of the tool is stamped "Crank" and "Cam" to ensure proper orientation.
   a. Tighten both bolts (1, 3) to 15 ft-lbs (20.3 Nm).
   b. Loosen both bolts one revolution (360 degrees).
   c. Final tighten the rear cam sprocket bolt (1) to 34 ft-lbs (46.1 Nm).
   d. Final tighten the crank sprocket bolt (3) to 24 ft-lbs (32.5 Nm).
   e. Remove the sprocket locking tool.
14. Install primary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).
15. Apply clean H-D 20W50 engine oil to crank and rear cam sprockets.
16. See Figure 3-72. Align holes in **new** cam cover gasket with those in the crankcase flange.



1. **Link**
2. **Rear cam sprocket bolt (large) and flat washer**
3. **Rear cam sprocket**
4. **Crank sprocket bolt (small) and flat washer**
5. **Crank sprocket**
6. **Primary cam chain tensioner**

Figure 3-70. Cam Support Plate Assembly



1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Crank sprocket bolt (small) and flat washer**
4. **Crank sprocket**
5. **Alignment mark**

Figure 3-71. Flange Bolts

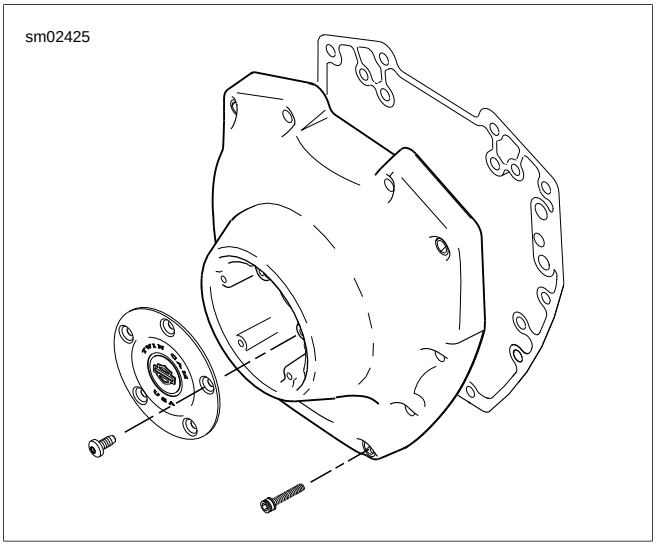


Figure 3-72. Cam Cover Gasket

NOTE

Before installing cam cover, verify cleanliness of blind holes in the crankcase flange. Tightening a screw with dirt, water or oil in the hole can cause the casting to crack or break. Damage to the casting requires replacement of the right crankcase half.

17. See Figure 3-71. Install the cam cover using ten allen head socket screws (1/4 x 1-1/4 in.). Following the sequence shown, alternately tighten the screws to 125-155 **in-lbs** (14.1-17.5 Nm). If cam cover assembly was completely removed continue as follows.
18. Complete motorcycle assembly.
    a. If engine was completely overhauled, see 3.16 TOP END OVERHAUL: ASSEMBLY. Perform all steps.
    b. If only cam compartment components were serviced, install push rod covers, push rods, rocker arm support plate and breather assembly. See appropriate topics under 3.16 TOP END OVERHAUL: ASSEMBLY.

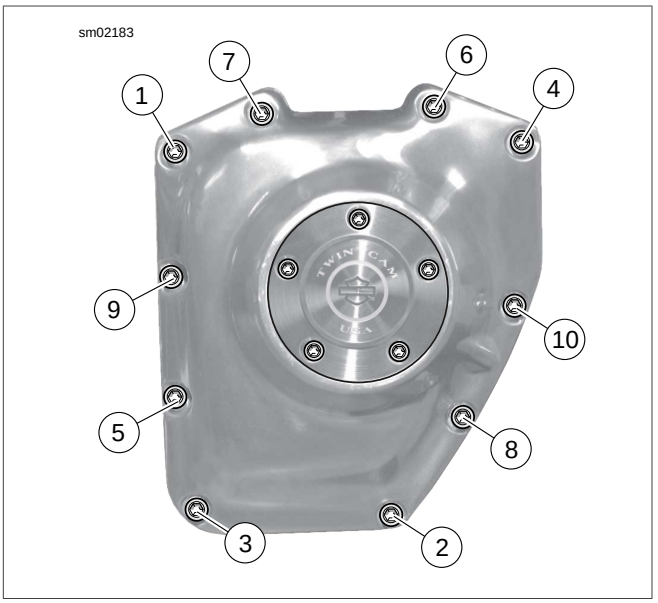


Figure 3-73. Cam Cover Screws

REMOVAL OVERVIEW

To remove breather assembly, see 3.15 TOP END OVERHAUL: DISASSEMBLY.

DISASSEMBLY

1. See Figure 3-74. Remove two fasteners (1) from the breather assembly cover (2) and remove breather assembly from rocker arm support plate (8).
2. Remove the breather cover and cover gasket (3). Discard gasket. Remove breather baffle (5) and breather baffle gasket (7). Discard gasket. Pull filter element (6) from bore on underside of breather baffle. Pull umbrella valve (4) from hole at top of breather baffle. Discard both filter element and umbrella valve.

CLEANING AND INSPECTION

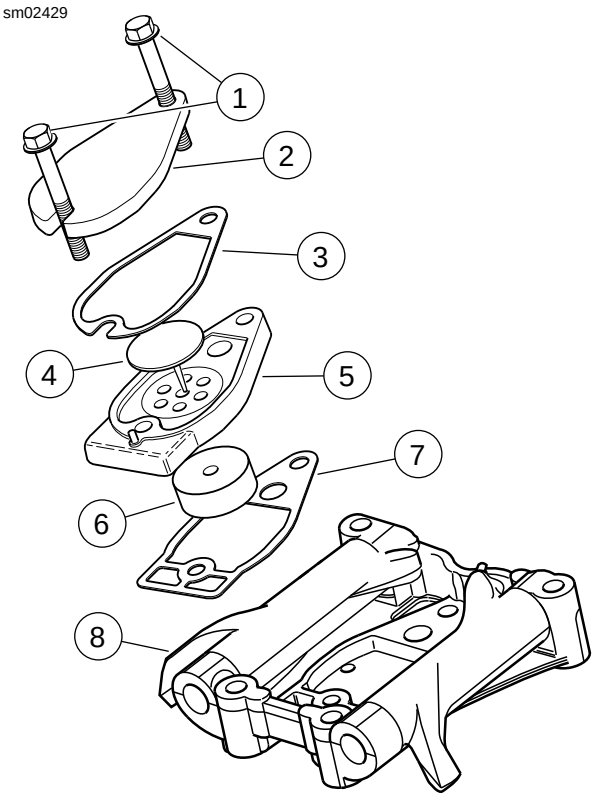
⚠WARNING

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

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-74. Set a straightedge diagonally across the length of the breather cover (2) intersecting the opposite corners of the gasket surface. Slide a feeler gauge beneath the straightedge to check the breather cover for warpage. Repeat the step checking the opposite diagonal. Discard the breather cover if any low spot exceeds 0.005 in. (0.13 mm).
3. Using method outlined in previous step, inspect the breather baffle (5) gasket surface for flatness. Discard the breather baffle if any low spot exceeds 0.005 in. (0.13 mm).

ASSEMBLY

1. See Figure 3-74. Insert stem of **new** umbrella valve (4) through center hole at top of breather baffle (5). Carefully pull rubber bead on stem through hole in baffle. Use denatured alcohol or glass cleaner to lubricate stem, if necessary. Verify that rubber bead is pulled completely through hole and resides on bottom side of baffle.
2. Press **new** filter element (6) into bore at bottom of baffle. Hole in filter element accommodates umbrella valve stem.
3. Place breather baffle gasket (7) on a clean flat surface.
   a. Aligning holes, place breather baffle (5), cover gasket (3) and breather cover (2) on top of breather baffle gasket.
   b. Slide two fasteners (1) through stackup to keep assembly together until time of installation.



1. **Fasteners (2)**
2. **Breather cover**
3. **Cover gasket**
4. **Umbrella valve**
5. **Breather baffle**
6. **Filter element**
7. **Breather baffle gasket**
8. **Rocker arm support plate**

Figure 3-74. Breather Assembly

INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly.

1. Install breather assembly.
2. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.

DISASSEMBLY

1. See Figure 3-75. Remove four bolts with flat washers (1) from the rocker arm support plate (5). The rocker arm shafts (4) on the push rod side (right) are notched to lock them in position.
2. Using a hammer and brass drift, tap left side of rocker arm shafts (4) so that the notched ends exit the rocker arm support plate (5) first. Mark the shafts so that they are installed in their original locations at time of assembly.
3. Remove the rocker arms from the rocker arm support plate. Mark the rocker arms to indicate location.

CLEANING AND INSPECTION

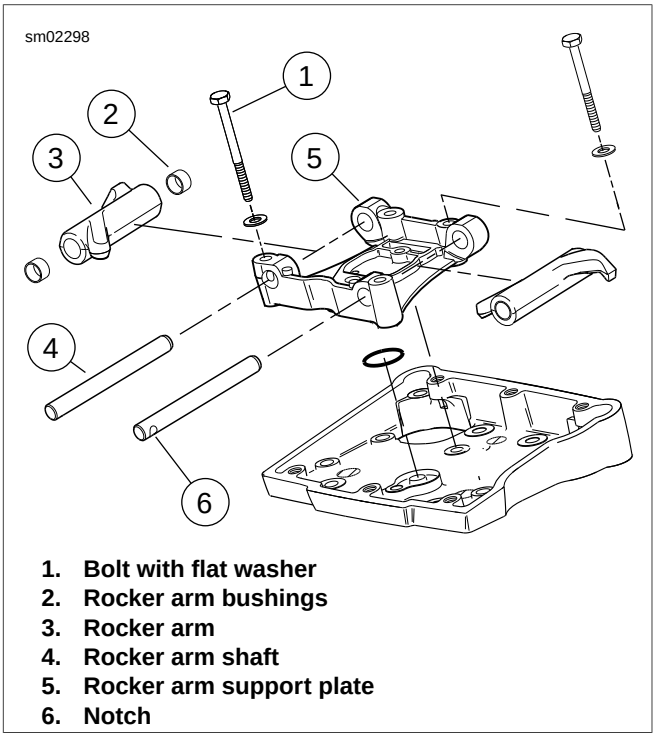
PART NUMBER	TOOL NAME
HD-94804-57	ROCKER ARM BUSHING REAMER

Inspection

WARNING

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

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-75. Check rocker arms (3) for uneven wear or pitting where contact is made with the valve stem tips. Check for concave wear where rocker arms contact the push rod ends. Replace rocker arm if excessive wear is found at either location.
3. Verify that oil holes in rocker arms and rocker arm support plate (5) are clean and open.
4. Inspect rocker arm shafts (4) for scratches, burrs, scoring or excessive wear. Replace as necessary.



1. **Bolt with flat washer**
2. **Rocker arm bushings**
3. **Rocker arm**
4. **Rocker arm shaft**
5. **Rocker arm support plate**
6. **Notch**

Figure 3-75. Rocker Arm Assembly

Rocker Shaft Fit

1. See Figure 3-76. Measure the inside diameter of the rocker arm support plate bore.
2. See Figure 3-77. Measure the outside diameter of the rocker arm shaft where it fits in the bore.
3. Repeat the measurement on opposite side of support plate and shaft. Replace shaft or support plate if any measurement equals or exceeds 0.0035 in. (0.089 mm).

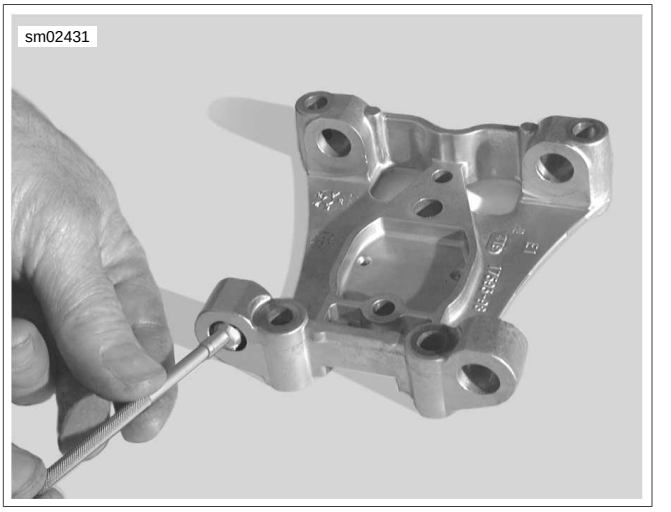


Figure 3-76. Checking Support Plate Bore



Figure 3-77. Checking Shaft to Support Plate Fit

Rocker Arm Shaft to Bushing

1. Check rocker arm shaft to bushing fit.
   a. See Figure 3-78. Measure the inside diameter of the rocker arm bushing.
   b. See Figure 3-79. Measure the outside diameter of the rocker arm shaft where it rides in the bushing.
2. Repeat measurement on opposite side of rocker arm and shaft. Replace shaft or bushings if any measurement equals or exceeds service wear limit of 0.0035 in. (0.089 mm).

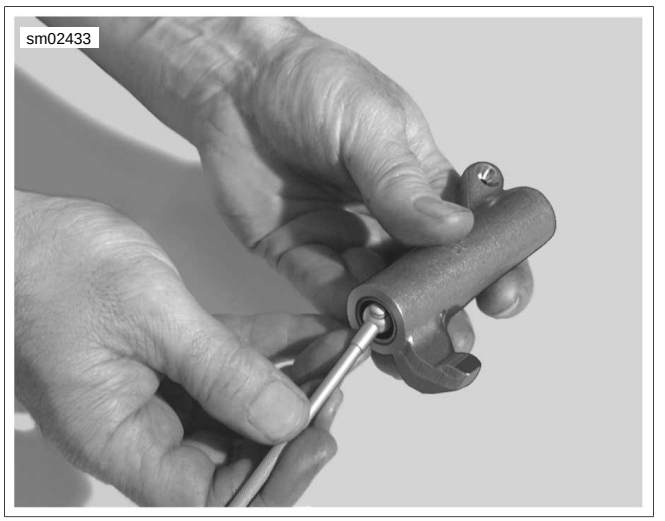


Figure 3-78. Checking Bushings



Figure 3-79. Checking Shaft to Bushing Fit

Replace Rocker Arm Bushings

1. Turn a 9/16"-18 tap into bushing until tight. Place rocker arm under ram of arbor press with tap at bottom. Slide a discarded rocker arm shaft through open end of rocker arm until contact is made with tap. Using shaft as driver (and untapped bushing as pilot), press against shaft until both tap and bushing are free. Repeat step to remove second bushing.
2. See Figure 3-80. Using a suitable driver, press **new** bushing into side of rocker arm until flush with casting. Be sure to orient bushing so that split line faces top of rocker arm. Repeat step to install second bushing.

NOTE

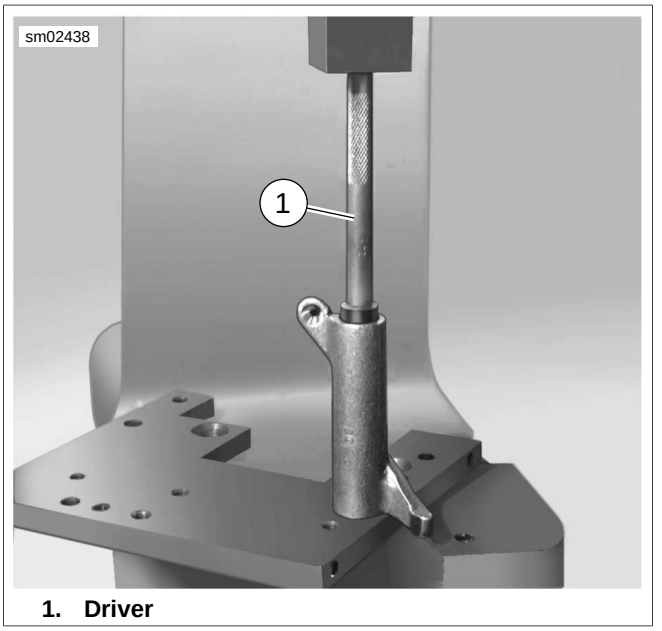
Never back reamer out of rocker arm or new bushing will be damaged.

3. See Figure 3-81. Lock rocker arm in a vise using brass jaw inserts or shop towels to prevent casting damage. Insert tapered end of ROCKER ARM BUSHING REAMER (Part No. HD-94804-57) into old bushing in rocker arm. Note that old bushing on drive side of reamer as pilot. Rotate reamer until the **new** bushing on the far side is reamed, and then continuing in the same direction, draw drive side of reamer from **new** bushing.

NOTE

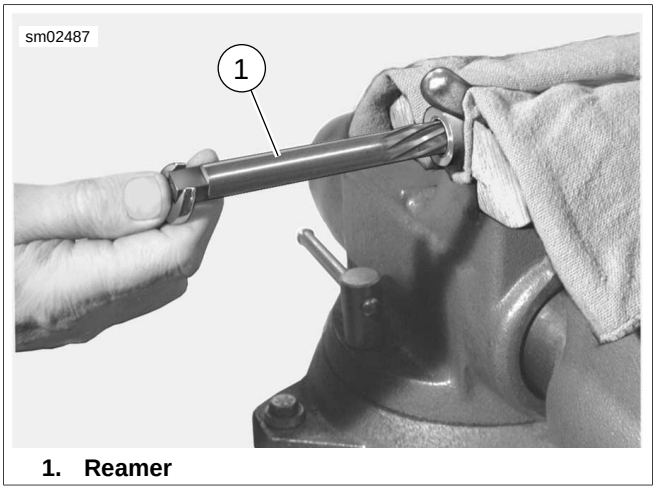
If short reamer is used, rotate tool while backing reamer out of first bushing. Inserting tool in opposite end of rocker arm, ream second bushing using reamed bushing as pilot.

4. Repeat steps to remove, install and ream second bushing.



1. **Driver**

Figure 3-80. Install Bushings



1. **Reamer**

Figure 3-81. Ream Bushings

ASSEMBLY

1. Place the rocker arms into position on the rocker arm support plate.
2. Push the un-notched ends of the rocker arm shafts into the right side of the support plate and then into the rocker arms. As they approach their fully installed positions, rotate the shafts so that the notches are aligned with the bolt holes in the support plate.
3. See Figure 3-82. Check for proper end play.
   a. Insert a feeler gauge between the rocker arm and support plate.
   b. Repeat measurement on other rocker arm.
   c. Replace the rocker arm, rocker arm support plate or both if end play exceeds 0.025 in. (0.635 mm).
4. Install the four bolts with flat washers in the rocker arm support plate. Remember that the two bolts on the push rod side (right) must engage the notches in the rocker arm shafts for proper assembly.



Figure 3-82. Check End Play

INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install rocker arm support plate.
2. Install breather assembly.
3. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods, lifters and covers.

DISASSEMBLY

See Figure 3-83. With the exception of the lifter covers, all parts should have been disassembled and marked during the removal procedure. Disassemble the lifter covers as follows:

1. Separate upper (2) and lower push rod covers (8).
2. Remove o-ring (9) from seat at bottom of lower push rod cover. Discard o-ring.
3. Remove o-ring (1) from seat at top of upper push rod cover. Slide o-ring (7), flat washer (6), spring (5) and spring cap (4) from body of upper push rod cover (2). Discard o-rings.

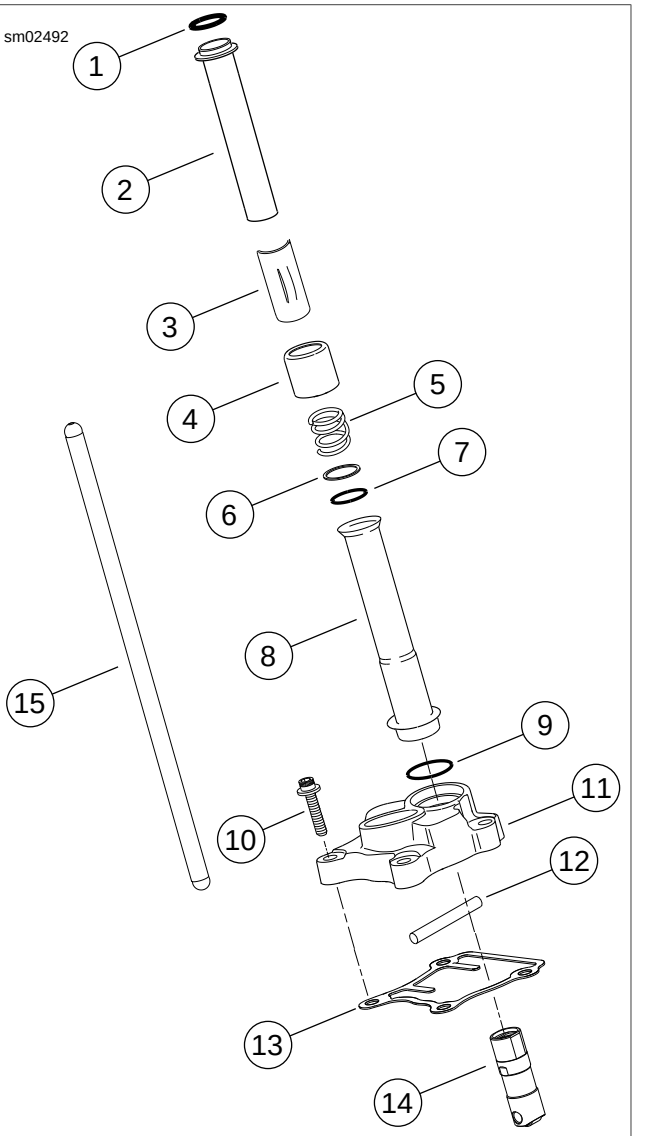
CLEANING AND INSPECTION

1. See Figure 3-83. Scrape old gasket material from the lifter cover (11) flange. Old gasket material left on mating surfaces will cause leaks.
2. With the exception of the hydraulic lifters (14), clean all parts in a non-volatile cleaning solution or solvent. Verify that the o-ring seats and contact surfaces of the push rod covers (2, 8) are completely clean.

⚠WARNING

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

3. Blow parts dry with low pressure compressed air. Verify that all oil holes are clean and open.
4. Verify that the hydraulic lifter rollers turn freely and are free of flat spots, scuff marks and pitting. If flat spots exist, examine the cam lobe on which the lifter operates.
5. Inspect the lifter socket for signs of wear. Verify that the plunger of the hydraulic lifter is fully extended up against the C-clip. Use index finger to pump plunger to verify lifter operation.
6. Examine the push rods (15). Replace any push rods that are bent, dented, broken or discolored. Replace the rod if the ball ends show signs of excessive wear or damage.
7. Cover all parts with a clean plastic sheet to protect them from dust and dirt.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Lifter cover screw**
11. **Lifter cover**
12. **Anti-rotational pin**
13. **Lifter cover gasket**
14. **Hydraulic lifter**
15. **Push rod**

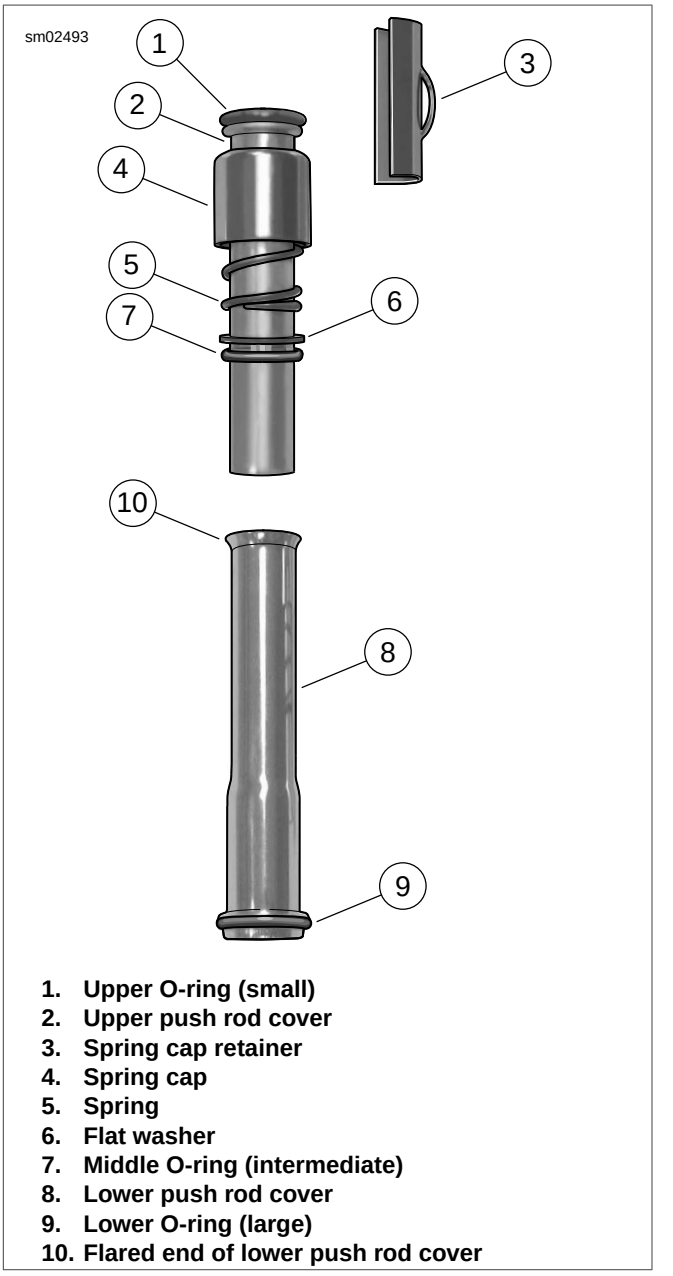
Figure 3-83. Push Rods, Lifters and Covers

LIFTER INSPECTION

NOTE

Inside and outside micrometers used for measuring lifters and lifter bores must be calibrated to ensure accurate readings.

1. Inspect lifters for excessive clearance in bores. Accurately measure tappet bore inner diameter with a gauge.
   a. Clearance should be within 0.0008-0.0020 in. (0.0203-0.0508 mm).
   b. Fit new lifters and/or replace crankcases if clearance exceeds SERVICE WEAR LIMIT of 0.0030 in (0.076 mm).
2. Check lifter radial play.
   a. Roller clearance on pin should be within 0.0006-0.0010 in (0.0152-0.0254 mm).
   b. Replace lifters if clearance exceeds SERVICE WEAR LIMIT of 0.0015 in. (0.0381 mm).
3. Check lifter roller end clearance.
   a. End clearance should be within 0.008-0.022 in. (0.203-0.559 mm).
   b. Replace lifters showing any sign of up or down movement on roller.
   c. Replace lifters if clearance exceeds SERVICE WEAR LIMIT of 0.022 in. (0.559 mm).
4. Soak lifters in clean engine oil. Keep covered until assembly.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**
10. **Flared end of lower push rod cover**

Figure 3-84. Assembled Push Rod Cover

ASSEMBLY

With the exception of the lifter covers, all parts will be assembled during the installation procedure. Assemble the lifter covers as follows:

NOTE

*O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-84. Obtain three **new** o-rings (1, 7 and 9). Apply a very thin film of clean H-D 20W50 engine oil to o-rings before installation.
2. Install **new** small o-ring (1) on seat at the top of the upper push rod cover (2).

3. Slide the spring cap (4), spring (5), flat washer (6) and **new** intermediate size o-ring (7) onto the body of the upper push rod cover. Move parts up body until spring cap (4) contacts upper o-ring seat.
4. Fit the straight end of the upper push rod cover into the flared end of the lower push rod cover (8).
5. Install **new** large o-ring (9) on seat at bottom of lower push rod cover.

INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install push rods, lifters and lifter covers.
2. Install rocker arm support plate.
3. Install breather assembly.
4. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

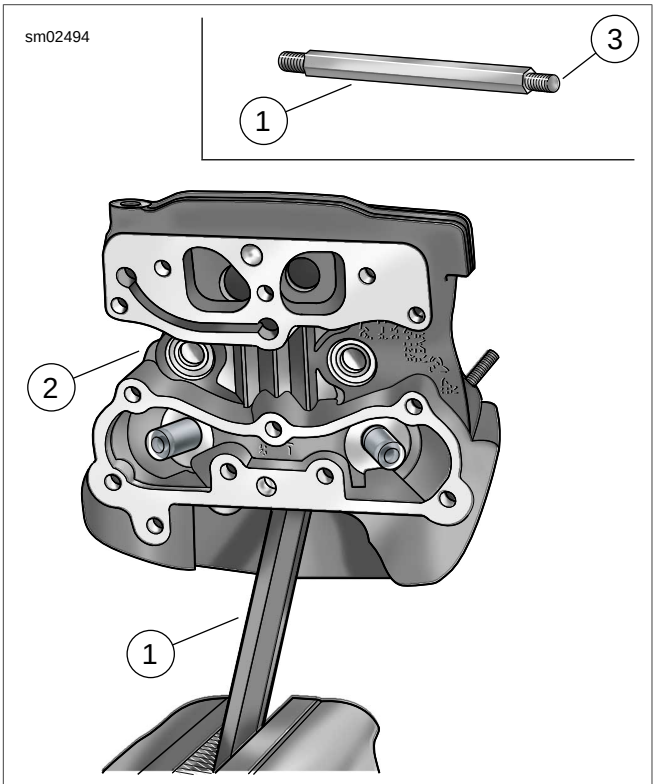
See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.

DISASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-39786	CYLINDER HEAD HOLDING FIXTURE

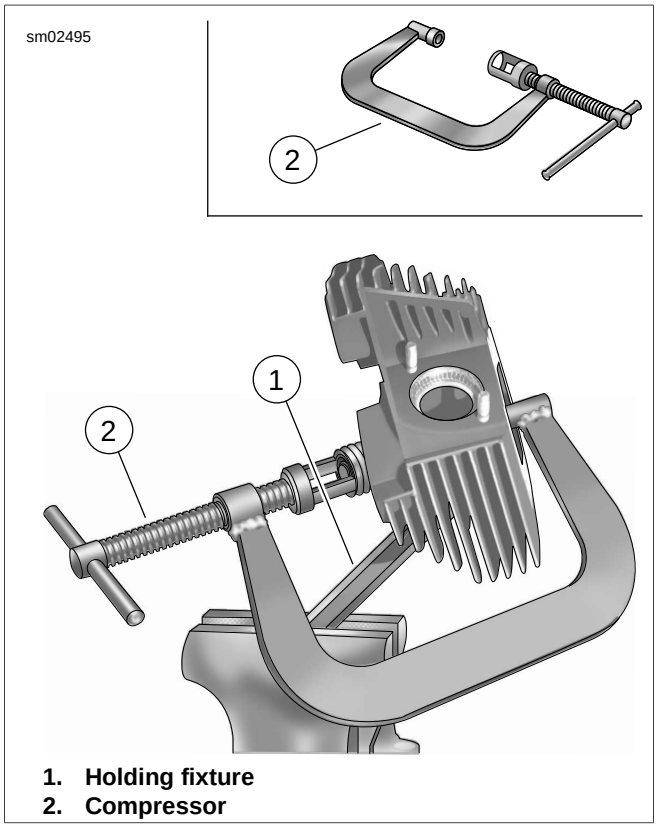
1. Before proceeding with the disassembly procedure, determine if cylinder head reconditioning is necessary.
   a. Raise valve ports of cylinder head to strong light source. If light is visible around edges of seats, then move to step 2 to recondition cylinder head.
   b. Fill ports at top of cylinder head with solvent. Wait ten full seconds and then check for leakage into combustion chamber. If solvent leakage into combustion chamber is evident, then move to step 2 to recondition cylinder head.
2. See Figure 3-85. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) (1) into cylinder head (2) spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.



1. Holding fixture
2. Cylinder head
3. 12 mm end of fixture

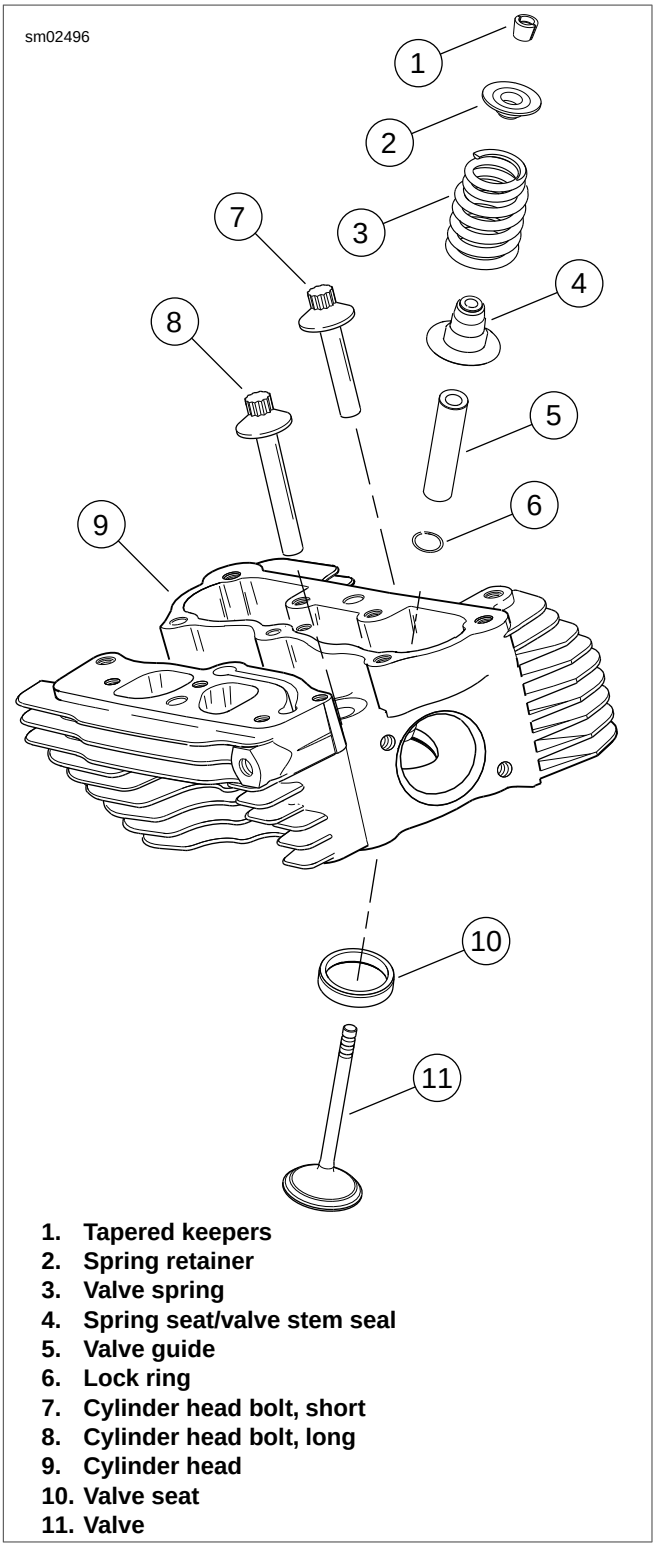
Figure 3-85. Cylinder Head Holding Fixture

3. See Figure 3-86. Release valve spring compression.
   a. Place VALVE SPRING COMPRESSOR (Part No. HD-34736-B) (2) over cylinder head. Center blunt end on the valve head. Seat adapter at end of forcing screw on the valve spring retainer.
   b. Rotate forcing screw to compress valve springs.
   c. See Figure 3-87. If spring retainer (2) has not broken free of tapered keepers (1), give head of tool a sharp tap with a soft mallet. Using magnetic rod or small screwdriver, remove the keepers (1) from the valve stem (11) groove.
   d. Rotate forcing screw to release the valve spring compression.
4. Remove the spring retainer (2) and valve spring (3).
5. Slide the valve (11) from the valve guide (5).
6. Remove valve seal assembly.
7. Mark the bottom of the valve F(ront) or R(ear) for identification. Also, separate and tag tapered keepers, valve spring and spring retainer so that they are installed on the same valve at time of assembly.
8. Repeat steps 3-7 to remove the other valve components.
9. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.



1. **Holding fixture**
2. **Compressor**

Figure 3-86. Valve Spring Compressor (Part No. HD-34736-B)



1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem seal**
5. **Valve guide**
6. **Lock ring**
7. **Cylinder head bolt, short**
8. **Cylinder head bolt, long**
9. **Cylinder head**
10. **Valve seat**
11. **Valve**

Figure 3-87. Cylinder Head Assembly

CLEANING

1. See Figure 3-87. Remove old gasket material from cylinder head (9). Gasket material left on sealing surfaces will cause leaks.

CAUTION

Do not use glass or sand to bead blast surfaces exposed to engine oil. Blasting materials can lodge in pores of the casting. Heat expansion releases this material which can contaminate oil resulting in engine damage. (00534b)

NOTE

Bead blasting materials could also enter threaded holes adversely affecting fastener engagement and torque indication. Cover all threaded holes before bead blasting.

2. Remove all carbon deposits from combustion chamber and machined surfaces of cylinder head. Exercise caution to avoid removing any metal material. For best results, use an air tool with a worn wire brush. Scraping may result in scratches or nicks.
3. To soften stubborn deposits, soak the cylinder head in a chemical solution, such as GUNK HYDRO-SEAL or other carbon and gum dissolving agent. Repeat step 2 as necessary.
4. Thoroughly clean the cylinder head, spring retainers, tapered keepers, valves and valve springs in a non-volatile cleaning solution or solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

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

5. Blow parts dry with low pressure compressed air.

INSPECTION

PART NUMBER	TOOL NAME
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-42324-A	CYLINDER TORQUE PLATES
HD-96796-47	VALVE SPRING TESTER

Cylinder Head

1. Check for scratches and nicks on all gasket sealing surfaces.
2. Check for warpage.
   a. With the combustion chamber side facing upward, set a straightedge diagonally across the length of the cylinder head intersecting the upper and lower corners of the gasket surface.
   b. Slide a feeler gauge beneath the straightedge to check the head for warpage.
   c. Checking the opposite diagonal, repeat the procedure to verify that the gasket surface is flat (especially if a head gasket was blown). Discard the head if any low spot is 0.006 in. (0.152 mm) or greater.

NOTE

For best results, use one of the CYLINDER TORQUE PLATES (Part No. HD-42324-A) in lieu of the straightedge. Lay the upper plate (without vise grip) flat on the machined surface of the head. As a preliminary check, see if the plate rocks from side to side. A head on which the plate rocks is immediately suspect. Insert a feeler gauge between the plate and head at various locations to see if warpage exceeds above specification.

3. Verify that oil passageways are open and clean.

Valve Guides

1. Inspect external surfaces, particularly the combustion chamber side, for cracks. Replace the guide if any cracks are found.
2. Prepare valve guides for inspection.
   a. Lightly hone bore using the VALVE GUIDE HONE (Part No. B-45525).
   b. Scrub with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) to remove any dust or debris.
   c. Polish the valve stem with fine emery cloth or steel wool to remove carbon buildup.
3. Check valve stem to guide clearance:
   a. Carefully measure the inside diameter of the valve guide using an inside ball micrometer.
   b. Measure the outside diameter of the valve stem with an outside micrometer.
   c. Refer to Table 3-32. If the clearance between stem and guide exceeds the limits shown, the valve stem and/or guide are excessively worn.
   d. Repeat measurements with a new valve to determine if the guide must be replaced.

Table 3-32. Valve Stem to Guide Clearance Service Wear Limits

VALVE	IN.	MM
Intake	0.0038	0.0965
Exhaust	0.0038	0.0965

Valves

1. Replace the valve if there is evidence of burning or cracking.
2. Inspect the end of the valve stem for pitting or uneven wear. Replace the valve if either of these conditions are found.
3. Inspect for burrs around the valve stem keeper groove. Remove burrs with a fine tooth file if found.
4. To determine if the valve stem is excessively worn, see valve guide inspection.

Valve Springs

1. Inspect springs for broken or discolored coils. Replace springs if either of these conditions are found.
2. Set the intake and exhaust valve springs on a level surface and use a straightedge to check for proper squareness

and height. Too much height corresponds to a reduction in spring pressure which results in sluggish valve action.

3. Check free length of springs using a dial vernier caliper or load test with the VALVE SPRING TESTER (Part No. HD-96796-47). Replace springs if free length or compression force do not meet specifications. See 3.1 SPECIFICATIONS.

Tapered Keepers

1. Inspect parts for damage or rust pits. Replace as necessary.
2. Inspect inboard side of tapered keepers for excessive wear. Upraised center must be pronounced and fit snugly in valve stem groove. Place keepers into groove and verify that they grip tightly without sliding.

Valve Seats

1. Inspect seats for cracking, chipping or burning. Replace seats if any evidence of these conditions are found.
2. Check seats for recession by measuring valve stem protrusion. See 3.22 CYLINDER HEAD, Valve and Seat Refacing.

VALVE GUIDE REPLACEMENT

PART NUMBER	TOOL NAME
B-45523	VALVE GUIDE REAMER
B-45525	VALVE GUIDE HONE
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39782-A	CYLINDER HEAD SUPPORT STAND
HD-39786	CYLINDER HEAD HOLDING FIXTURE
HD-39847	REAMER T-HANDLE
HD-39964	REAMER LUBRICANT
HD-39964	REAMER LUBRICANT

Removal

NOTES

- *If valve guide replacement is necessary, always install **new** guide before refacing valve seat.*
- *Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, the cylinder head valve guide bore will be damaged during the press procedure.*

1. See Figure 3-88. Prepare cylinder head for valve guide replacement.
   a. Obtain CYLINDER HEAD SUPPORT STAND (Part No. HD-39782-A).
   b. Insert sleeve of intake (3) or exhaust (4) seat adapter into tube at top support stand (2).
   c. Position cylinder head so that valve seat is centered on seat adapter.

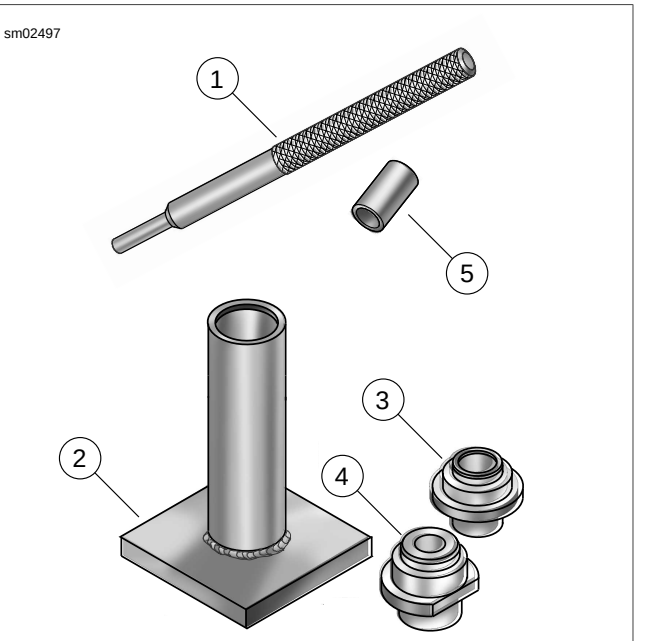
NOTE

Do not press out the valve guide from the bottom of the cylinder head. Carbon buildup on the combustion chamber side of the guide can deeply gouge the cylinder head bore diminishing the likelihood of achieving the proper interference fit and possibly requiring replacement of the cylinder head casting.

2. At top of the cylinder head, insert valve guide driver (1) into valve guide bore until stopped by shoulder.
3. See Figure 3-89. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.
4. Remove lock ring at top of cylinder head. Discard lock ring.

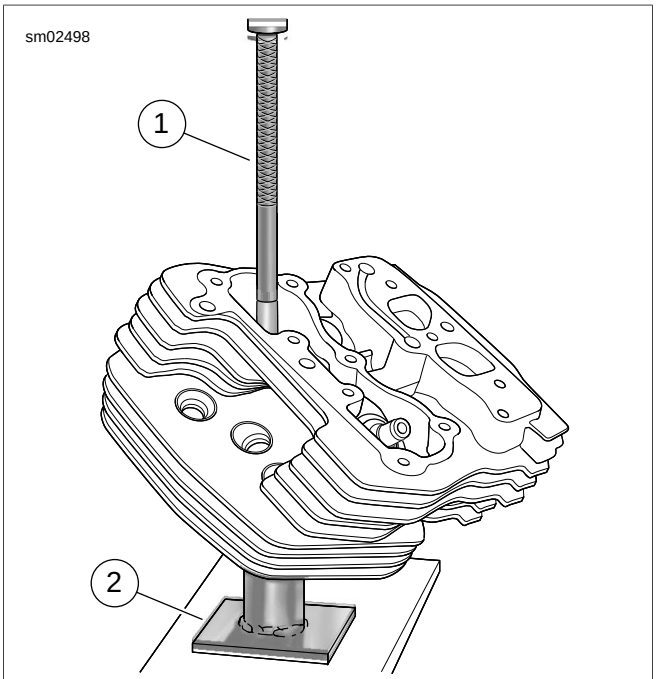
NOTE

Lock ring is not present on OEM intake valve guides.



1. **Valve guide driver**
2. **Cylinder head stand**
3. **Intake seat adapter**
4. **Exhaust seat adapter**
5. **Valve guide installer sleeve**

Figure 3-88. Valve Guide Replacement Tools



1. Valve guide driver
2. Cylinder head stand

Figure 3-89. Remove Valve Guide

Installation

1. Check valve guide to valve bore clearance.
   a. Measure the outside diameter of a new standard valve guide.
   b. Measure the cylinder head valve guide bore. The valve guide should be 0.0020-0.0033 in. (0.051-0.084 mm) larger than the bore.
   c. If clearance is not within specification, then select one of the following oversize guides: 0.001 in. (0.025 mm), 0.002 in. (0.05 mm) or 0.003 in. (0.08 mm).

NOTE

Since some material is typically removed when the guide is pressed out, it is normal to go to the next larger size for the proper interference fit.

2. Measure cylinder head bore and outside diameter of selected oversize guide to verify correct interference fit.

NOTE

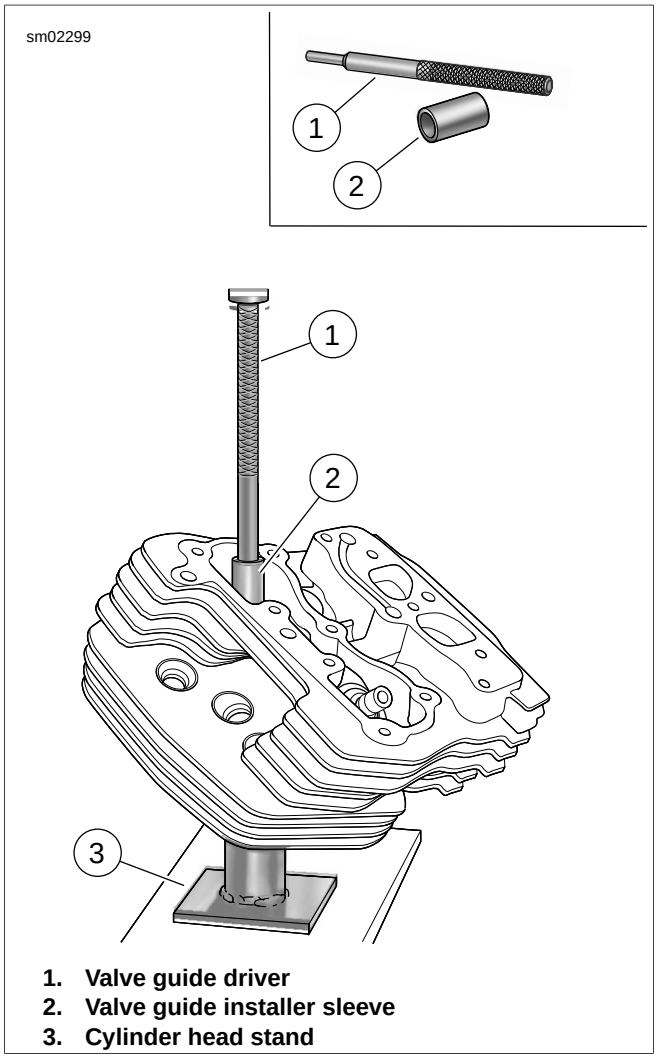
Support stand ensures that valve guide and seat are perpendicular. If perpendicularity is not achieved, cylinder head valve guide bore will be damaged during the press procedure.

3. Prepare cylinder head for valve guide replacement.
   a. See Figure 3-88. Insert sleeve of intake (3) or exhaust (4) seat adapter into tube at top of support stand (2). Position cylinder head so that valve seat is centered on seat adapter.
   b. Apply Vaseline to lightly lubricate external surfaces of valve guide. Spread lubricant so that thin film covers entire surface area.
   c. At top of cylinder head, start valve guide into bore.
   d. See Figure 3-90. Place installer sleeve (2) over valve guide and then insert tapered end of valve guide driver (1) into sleeve.
   e. Center valve guide driver under ram of arbor press and apply pressure only until valve guide is started in bore and then back off ram slightly to allow guide to center itself.

NOTE

Always back off ram to allow the valve guide to find center. Pressing guide into cylinder head in one stroke can bend driver, break guide, distort cylinder head casting and/or damage cylinder head valve guide bore.

   f. Verify that support stand (3) and driver (1) are square. Center driver under ram and press valve guide further into bore, but then back off ram again to allow valve guide to find center.
   g. Repeat previous step and then apply pressure to driver until installer sleeve contacts machined area of cylinder head.
   h. Install **new** lock ring into valve guide groove. Verify that lock ring is square and fully seated in the groove.



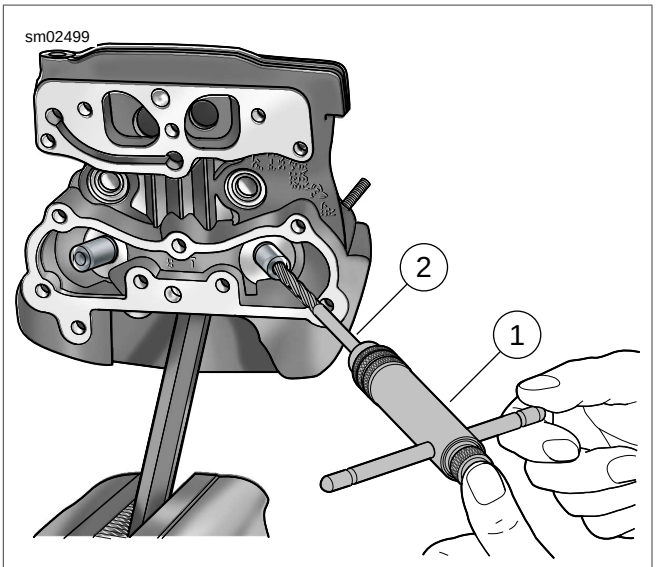
1. **Valve guide driver**
2. **Valve guide installer sleeve**
3. **Cylinder head stand**

Figure 3-90. Install Valve Guide

4. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

Valve guides must be reamed to within 0.0005-0.0001 in. (0.013-0.0025 mm) of finished size.



1. **T-handle**
2. **Valve guide reamer**

Figure 3-91. Reaming Valve Guide Bore

5. See Figure 3-91. Obtain the VALVE GUIDE REAMER (Part No. B-45523), REAMER T-HANDLE (Part No. HD-39847) and REAMER LUBRICANT (Part No. HD-39964).
   a. Install T-handle (1) on reamer (2).
   b. Apply a liberal amount of reamer lubricant to valve guide bore and bit of reamer. Start bit of reamer into bore at top of cylinder head.
   c. Placing thumb on drive socket of reamer T-handle, apply slight pressure on reamer while rotating in a clockwise direction. Squirt additional lubricant onto reamer and into guide as necessary.

NOTE

For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bore will be tapered if pressure is not centrally applied.

   d. Continue rotating reamer T-handle until entire bit has passed through valve guide bore and shank of reamer rotates freely.
   e. Remove T-handle from reamer, and carefully pulling on bit, draw shaft of reamer out combustion chamber side of valve guide.

⚠WARNING

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

6. Direct compressed air into the valve guide bore to remove any metal shavings or debris.
7. See Figure 3-92. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

8. See Figure 3-93. Obtain the VALVE GUIDE HONE (Part No. B-45525) and REAMER LUBRICANT (Part No. HD-39964).
   a. Install hone in a high speed electric drill.
   b. Apply reamer lubricant to finishing stones of hone and valve guide bore.
   c. Start finishing stones of hone into bore.
   d. Activating the drill, move the entire length of the finishing stone arrangement forward and backward through the bore for 10 to 12 complete strokes. Work for a crosshatch pattern of approximately 60°.
9. Direct compressed air into the valve guide bore to remove any debris. Clean with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).

NOTE

Always verify valve stem to valve guide clearance after honing, since a worn reamer may cut the bore undersize.

10. Check valve stem to valve guide clearance.
    a. Measure the inside diameter of the valve guide with an inside ball micrometer.
    b. Measure the outside diameter of the valve stem with an outside micrometer.
    c. Refer to Table 3-33. If the clearance between stem and guide is not within the limits shown, the low end being preferable, then the valve stem may be excessively worn or the valve guide bore undercut.

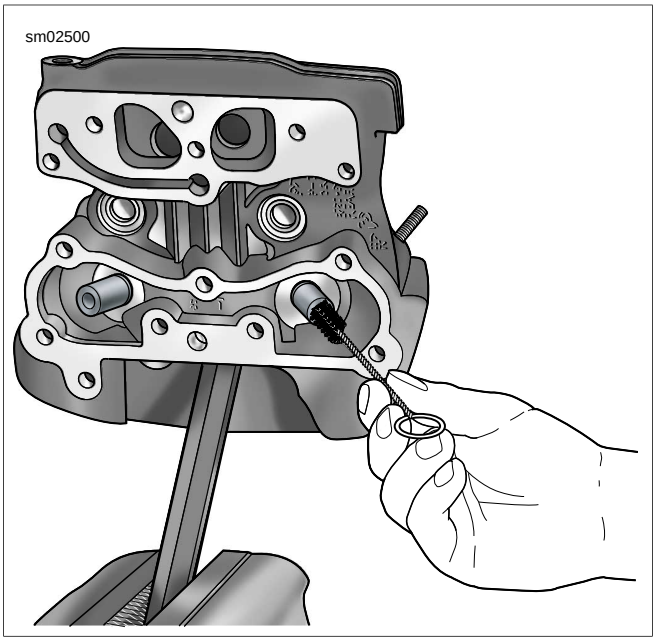


Figure 3-92. Scrubbing Valve Guide Bore

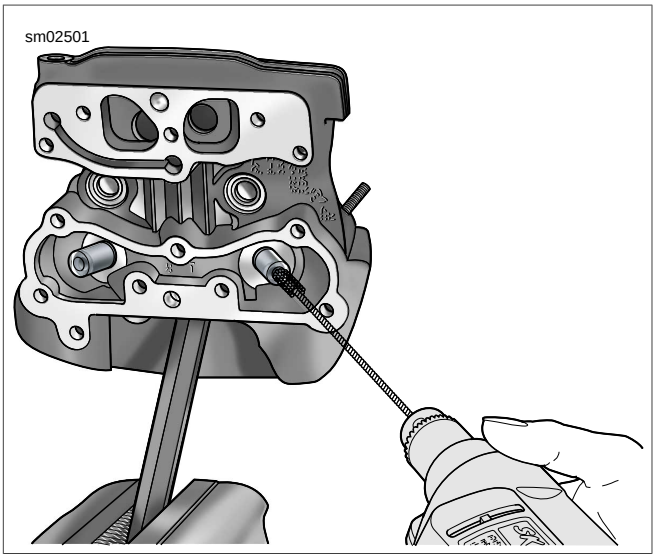


Figure 3-93. Honing Valve Guide Bore

11. Clean cylinder head assembly again.
    a. Using cleaning solvent, thoroughly clean cylinder head and valve guide bore.
    b. Scrub valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751). For best results, use a thin engine oil and clean valve guide bore with the type of swabs or patches found in gun cleaning kits.
    c. Continue to wipe bore until clean cloth shows no evidence of dirt or debris. Follow up with a thorough wash in hot soapy water.

⚠WARNING

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

12. Blow parts dry with low pressure compressed air.

Table 3-33. Valve Stem to Guide Clearance

VALVE	IN.	MM
Intake	0.001-0.003	0.0254-0.0762
Exhaust	0.001-0.003	0.0254-0.0762

VALVE AND SEAT REFACING

PART NUMBER	TOOL NAME
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-35758-C	NEWAY VALVE SEAT CUTTER SET
HD-39786	CYLINDER HEAD HOLDING FIXTURE

NOTES

- *Verify correct valve stem to valve guide clearance before refacing. Refer to Table 3-33. If **new** guides must be installed, complete that task before refacing valve seats.*
- *This procedure is not based on the lapping of valves. The end result is an interference fit between the 45° valve face and the valve seat which will be 46°.*

1. Hold the valve firmly against a wire wheel in a bench grinder. Remove all carbon deposits from the valve head, face and stem, but exercise caution to avoid removing any metal. Carbon left on the stem may affect alignment in the valve refacer. Polish the valve stem with steel wool or crocus cloth to remove any marks that might be left by the wire wheel.
2. Install valve (both intake and exhaust) in a valve refacer set to a 45° angle. The valve refacer is required equipment, since accuracy in matching the angle of the valve face with the angle of the valve seat is critical.

NOTES

- *Do not remove any more metal than is necessary to clean up and true the valve face. Removing metal reduces the service life of the valve. The amount of grinding needed to retrue the valve is a clear indication of its condition. Discard the valve if it cannot be quickly refaced while maintaining a good margin. See Figure 3-96. Valves that do not clean up quickly are either warped, excessively worn or too deeply pitted to be used.*
- *Obtain a **new** valve if grinding leaves the margin less than 0.0313 in (0.795 mm). A valve in this condition does not seat normally, burns easily and may crack or cause pre-ignition.*

3. Wipe valve seats and valve faces clean. From the bottom of the cylinder head, insert the valve stem into the valve guide. Push on head of valve until it contacts the valve seat.
4. See Figure 3-94. Measure valve stem protrusion. Seat wear causes the valve stem protrusion to change.
   a. Placing finger at bottom of valve to keep valve seated, use a dial vernier caliper to check the distance from the top of the valve stem to the machined area on the cylinder head.
   b. Seat wear and valve refacing causes the valve stem protrusion to change. If protrusion exceeds 2.032 in. (51.61 mm), then replace the valve, valve seat or cylinder head as necessary.

NOTE

Do not shorten the valve by grinding on the end of the stem. Grinding replaces the hardened case with mild steel which results in accelerated wear.

5. Secure cylinder head for servicing.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp fixture in vise and further tighten cylinder head onto the fixture to prevent any movement during operation.
   c. Place cylinder head at a 45° angle or one that offers a comfortable working position.
6. In order to determine the correct location of the 46° valve seat in the head, measure the width of the valve to be used and subtract 0.080 in. (2.032 mm) from that number.
7. Set your dial caliper to the lesser measurement and lock down for quick reference. This is the location of your valve seat.
8. Use a permanent magic marker to highlight the valve seat area that is going to be cut. Be sure to highlight all three angles. Allow marker to dry before proceeding.

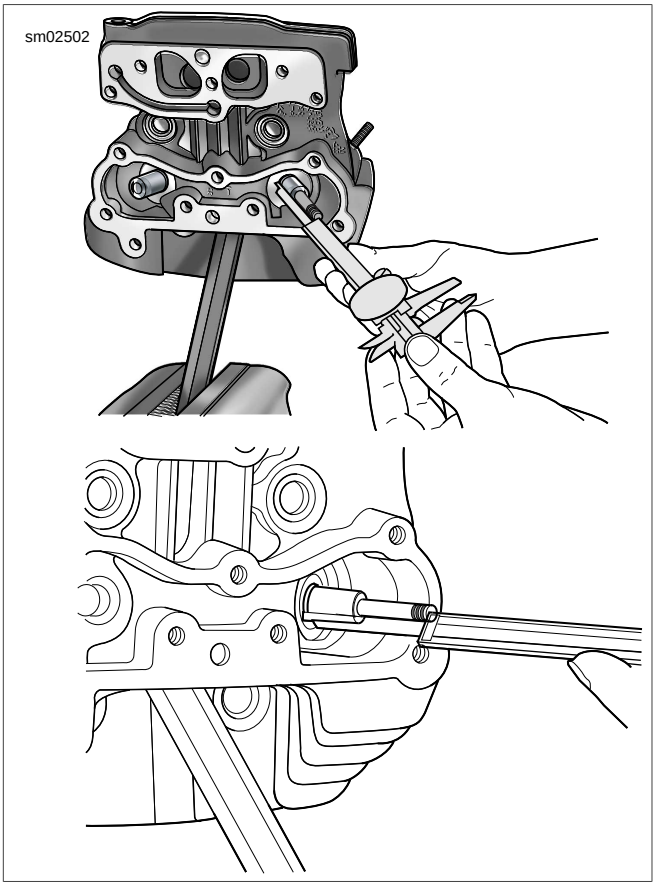


Figure 3-94. Checking Valve Stem Protrusion

NOTES

- *Always ensure cutter blades and cutter pilot are clean before beginning the cutting process. The correct cleaning brush is supplied with the Neway tool set.*
- *Always ensure the inside of the valve guide is clean by using VALVE GUIDE CLEANING BRUSH (Part No. HD-34751).*

9. See Figure 3-95. Obtain the NEWAY VALVE SEAT CUTTER SET (Part No. HD-35758-C). Choose the cutter pilot that fits properly into the valve guide hole. Securely seat the pilot by pushing down and turning using the installation tool supplied in the tool set.

10. Choose the proper 46° cutter (intake or exhaust) and gently slide the cutter onto the pilot. Be careful not to drop the cutter onto the seat.

11. While applying a constant and consistent pressure, remove just enough material to show a complete clean-up on the 46° angle. Do not remove any more metal than is necessary to clean up the seat (that is, to provide a uniform finish and remove pitting).

NOTES

- *If the width of the clean-up angle is greater on one side of the seat than the other, the guide may need to be replaced due to improper installation.*
- *After making the 46° cut, if you discover a groove cut completely around the seat, this means the blades of the cutter are in alignment and need to be staggered. This is accomplished by loosening all of the blades from the cutter body and moving each blade slightly in its cradle in opposite directions on the cutter. The tool needed to loosen the blades is supplied in the tool set. A permanent magic marker mark every 90° will help in determining where new angles are.*

12. Next, with your dial caliper locked to the predetermined setting, measure the 46° cut at the outermost edge at the widest point of the circle to determine what cut needs to be made next.
    a. If the 46° cut is too high (towards the combustion chamber), use the 31° cutter to lower the valve seat closer to the port.
    b. If the 46° cut is too low, use the 60° cutter to raise the valve seat or move it away from the port.

NOTES

- *Because you are using the top measurement of the valve seat as a reference point it will usually be necessary to use the 31° cutter following the initial 46° cut.*
- *Always highlight the valve seat with the permanent magic marker in order to ensure the location of the 46° valve seat.*

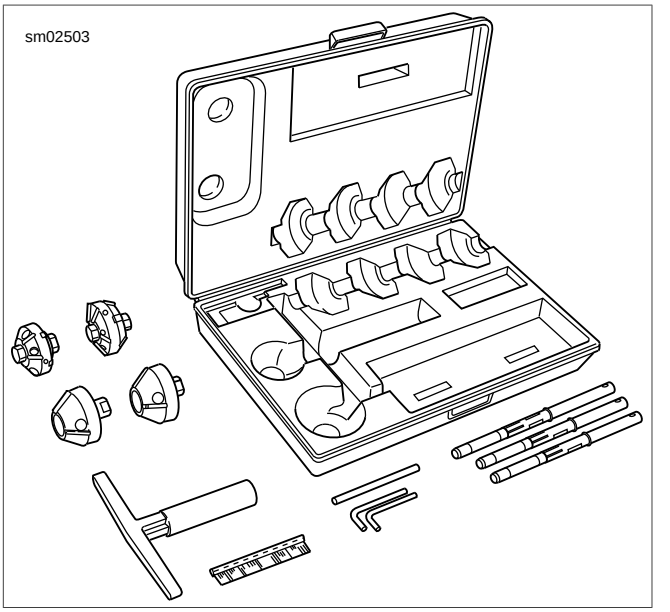


Figure 3-95. Neway Valve Seat Cutter Set

13. If the location of the valve seat is not correct, repeat steps 10 and 11.

14. When you accomplish a complete clean-up of the 46° angle and the width is at least 0.062 in. (1.575 mm), proceed to the next step.

15. Select the proper 60° cutter and gently slide the cutter down the cutter pilot to the valve seat.

16. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).

17. Remove cutter and cutter pilot.

18. Insert valve to be used in the valve guide and bottom on the valve seat. Positioning the cylinder head port upwards and with slight thumb pressure against the valve, completely fill the port with solvent to verify proper seal between the valve and the valve seat.

NOTE

Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve and valve seat for irregularities or defects and if necessary repeat the above valve grinding or valve seat cutting process.

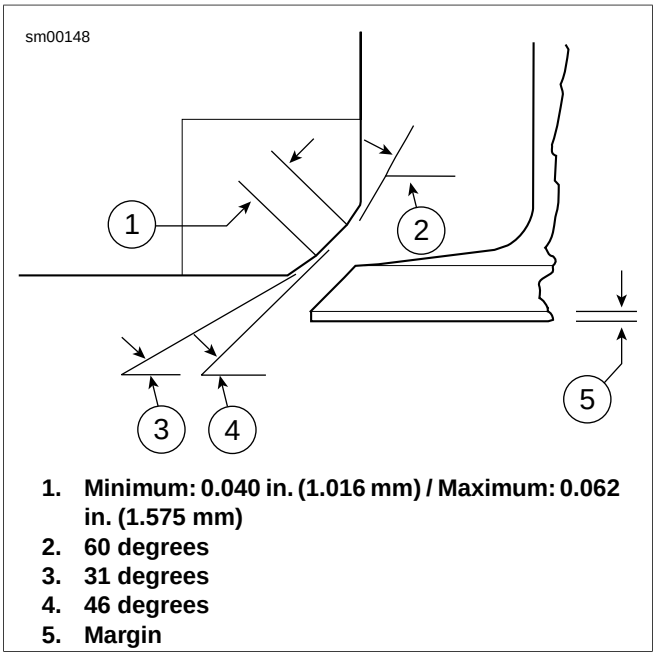
19. Repeat the process on any valve seat that needs service.

20. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

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

21. Blow parts dry with low pressure compressed air.



1. **Minimum: 0.040 in. (1.016 mm) / Maximum: 0.062 in. (1.575 mm)**
2. **60 degrees**
3. **31 degrees**
4. **46 degrees**
5. **Margin**

Figure 3-96. Valve and Seat Dimensions

ASSEMBLY

PART NUMBER	TOOL NAME
HD-34736-B	VALVE SPRING COMPRESSOR
HD-34751	VALVE GUIDE CLEANING BRUSH
HD-39786	CYLINDER HEAD HOLDING FIXTURE

1. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.

NOTE

At the time of disassembly, all parts should have been marked or tagged so that they are installed on the same valve (and in the same head).

2. Run the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751) through the valve guide bore to verify cleanliness.
3. Using TORCO MPZ or another suitable product, apply a liberal amount of engine assembly lube to valve stem.
4. From the bottom of the cylinder head, insert the valve stem into the valve guide.
5. To distribute the assembly lube evenly around the valve stem and guide, hand spin the valve as it is installed. Work the valve back and forth in the bore to verify that it slides smoothly and seats properly.
6. Remove the valve and apply a second coat of assembly lube to the valve stem. Install the valve in the valve guide.

CAUTION

Failure to install plastic capsule can cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage can cause leakage around the valve stem, excessive oil consumption and valve sticking. (00535b)

7. See Figure 3-97. Push on bottom of valve until it contacts the valve seat. Placing finger at bottom of valve to keep valve seated, slide plastic capsule over valve stem tip and keeper groove.
8. Apply a very thin film of clean H-D 20W50 engine oil to capsule.
9. See Figure 3-98. Obtain **new** valve stem seal.
10. Slide new valve stem seal/spring seat over capsule and down valve stem until contact is made with top of valve guide and machined area of cylinder head casting. Remove capsule from valve stem tip.

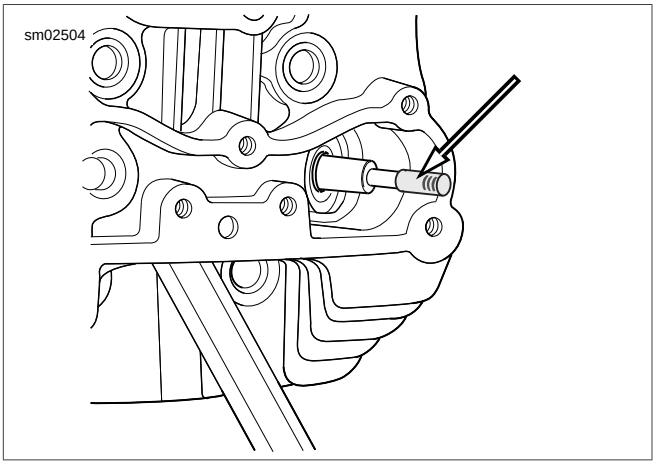


Figure 3-97. Plastic Capsule

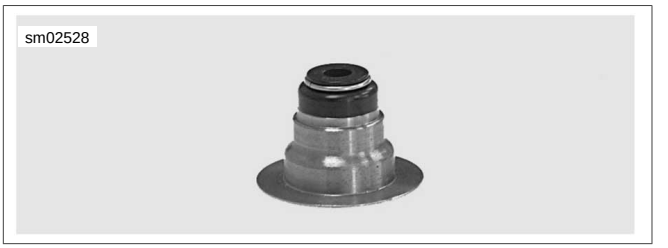
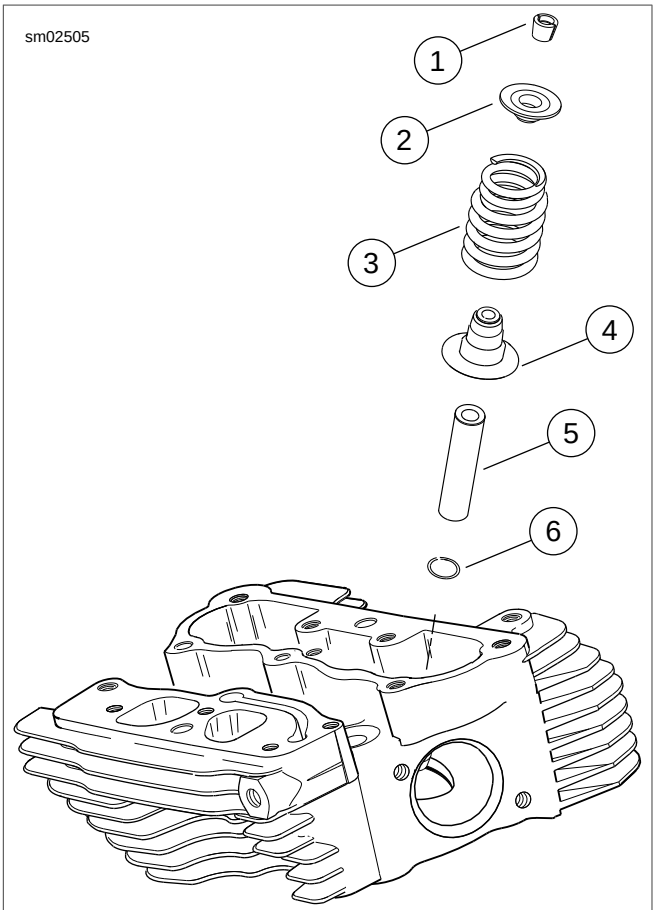


Figure 3-98. Valve Stem Seal/Spring Seat Assembly

11. See Figure 3-99. Apply a liberal amount of assembly lube to valve stem tip and keeper groove (1).
12. With the smaller diameter coils topside, install the valve spring (3) over the valve guide (5). Place the spring retainer (2) on top of the valve spring.

13. Obtain the VALVE SPRING COMPRESSOR (Part No. HD-34736-B) and proceed as follows:
    a. Place tool over cylinder head so that the blunt end is centered on the valve head and adapter at end of forcing screw is seated on the valve spring retainer.
    b. Rotate forcing screw to compress valve springs.
    c. With the tapered side down, fit the keepers into the valve stem groove. For best results, apply a dab of grease to the inboard side of the keepers before installation and use a magnetic rod for easy placement.
    d. Arranging tapered keepers so that the gaps are evenly spaced, turn forcing screw to release valve spring compression.
14. Tap the end of the valve stem once or twice with a soft mallet to ensure that tapered keepers are tightly seated in the valve stem groove.
15. Repeat previous steps to install the other valve components.
16. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.
17. Cover the cylinder head to protect it from dust and dirt until time of installation.



1. **Tapered keepers**
2. **Spring retainer**
3. **Valve spring**
4. **Spring seat/valve stem set seal**
5. **Valve guide**
6. **Lock ring**

Figure 3-99. Valve Assembly

INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder head.
2. Install push rod covers and push rods.
3. Install rocker arm support plate.
4. Install breather assembly.
5. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.

CLEANING

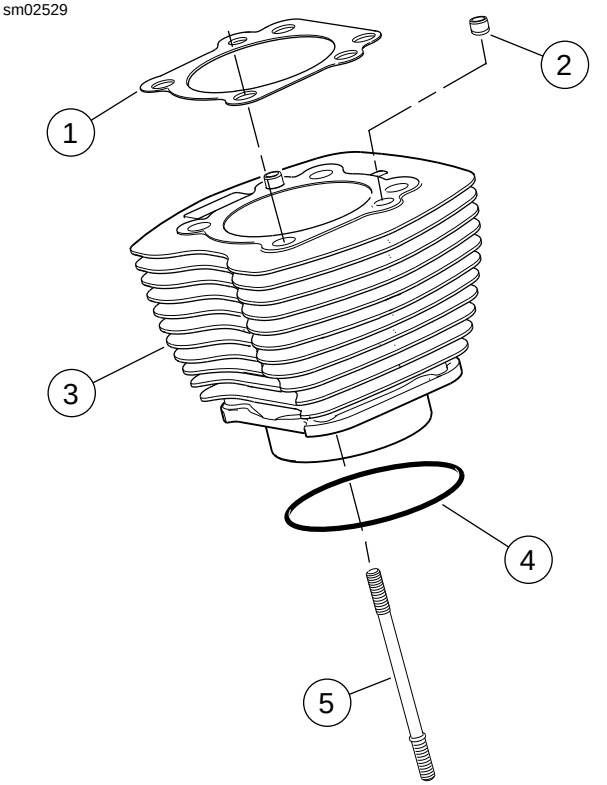
PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

1. See Figure 3-100. Scrape old gasket material from the machined surface at the top of the cylinder (3). Old gasket (1) material left on the mating surface will cause leaks.

WARNING

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

2. Clean cylinder in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air. Verify that oil passageways are clean and open.
3. Inspect the cylinder bore for defects or damage in the ring travel area. Replace cylinders that are severely scored, scuffed, scratched, burnt or gouged.
4. Using Magnaflux Dye Penetrant, inspect the cylinder for cracks. If no cracks are found, thoroughly wash cylinder to remove traces of dye.
5. Use a file to carefully remove any nicks or burrs from the machined surfaces of the cylinder.
6. See Figure 3-101. Check the machined surfaces for flatness using a feeler gauge and CYLINDER TORQUE PLATES (Part No. HD-42324-A) as follows:
   a. Lay gasket side of the upper torque plate (3) (without vise grip step) flat against the head gasket surface of the cylinder.
   b. As a preliminary check, see if the plate rocks from side to side. A cylinder on which the plate rocks is immediately suspect.
   c. Insert a feeler gauge between the plate and cylinder at various locations.
   d. The head gasket surface must be flat within 0.006 in. (0.15 mm).
   e. Now turn the cylinder upside down and lay the seal side of the lower torque plate (2) (with vise grip step) flat against the o-ring seal surface. Repeat steps 6b and 6c above.
   f. The o-ring seal surface must be flat within 0.004 in. (0.102 mm).
   g. Replace the cylinder (and piston) if either surface is not within specification.



1. **Cylinder head gasket**
2. **Dowel pin**
3. **Cylinder**
4. **O-ring seal**
5. **Cylinder stud**

Figure 3-100. Cylinder Assembly

INSPECTION

PART NUMBER	TOOL NAME
HD-42324-A	CYLINDER TORQUE PLATES

NOTE

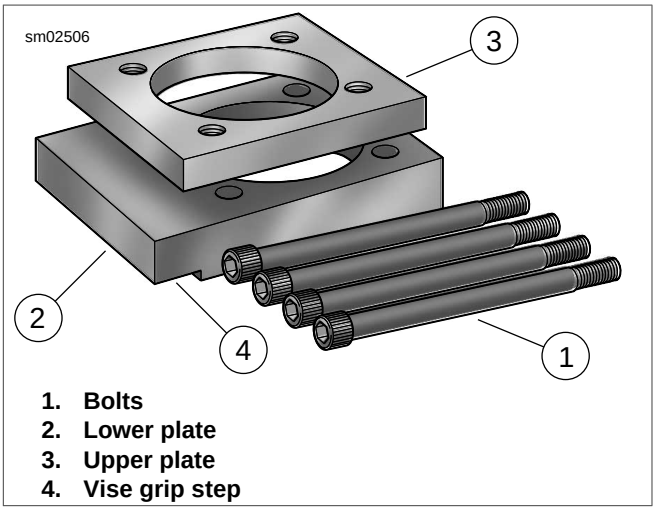
Failure to use cylinder torque plates can produce measurements that vary by as much as 0.001 in. (0.025 mm), possibly resulting in the use of parts that are not suitable for service.

1. See Figure 3-102. To simulate an assembled cylinder for accurately measuring cylinder taper and out-of-round conditions, as well as for boring, honing or deglazing, obtain the CYLINDER TORQUE PLATES (Part No. HD-42324-A). Install the torque plates as follows:
   a. Remove o-ring seal from cylinder sleeve, if installed.
   b. Place used head gasket over two dowel pins at top of cylinder.
   c. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp stepped side of lower plate in vise with the simulated split line (machined strip) facing away.
   d. Lightly oil threads and shoulders of four bolts (1) with clean H-D 20W50 engine oil. Slide four bolts all the way through holes of lower plate (2) until washers contact outboard side.
   e. Slide cylinder down bolts with the indent in the cooling fins facing upward.
   f. With the two dowel pins and head gasket in place, align holes in upper plate with ends of bolts. Blind holes in upper plate accommodate dowel pins in cylinder. Alternately tighten four bolts into upper plate in a crosswise pattern until finger tight.
   g. Tighten the bolts to 120-144 **in-lbs** (13.6-16.3 Nm) in the sequence shown.
   h. Following the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.1 Nm).
   i. Using a grease pencil, mark a straight line on one of the bolts continuing the line over onto the lower plate. Repeat step for remaining three bolts.
   j. Using the marks as a guide, turn each bolt 1/4 turn or 90°. Be sure to tighten the bolts in the sequence shown in Figure 3-103.

   NOTE

   For best results, obtain SNAP-ON TORQUE ANGLE GAUGE TA360.

   k. For purposes of inspection, remove the assembly from the vise and place on bench top.



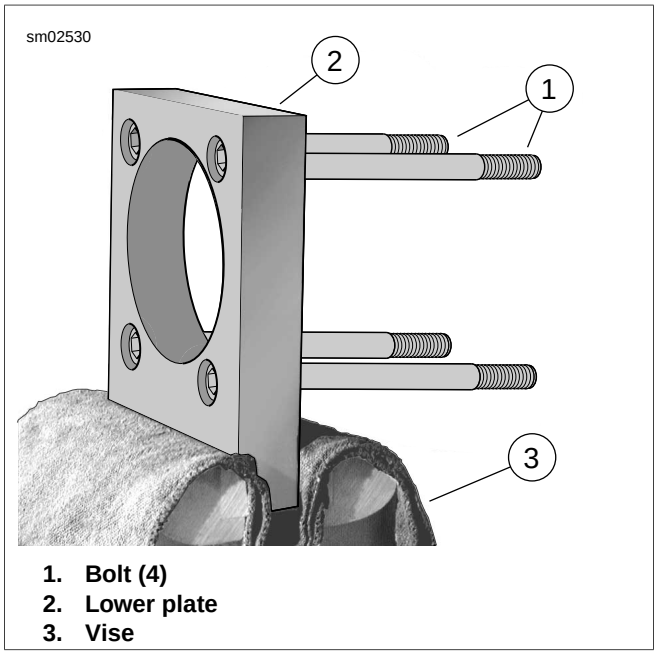
1. **Bolts**
2. **Lower plate**
3. **Upper plate**
4. **Vise grip step**

Figure 3-101. Cylinder Torque Plates (Part No. HD-42324-A)

NOTE

Maximum cylinder wear occurs at the very top of top ring travel. Minimum wear occurs below ring travel. Failure to measure the cylinder at these points may result in a faulty decision regarding the suitability of the cylinder for continued use.

2. See Figure 3-104. Using an inside micrometer or dial bore gauge, check cylinder bore for out-of round and taper. Proceed as follows:
   a. At the top of the piston ring travel zone, starting about 0.50 in. (12.70 mm) or from the top of the cylinder, measure the cylinder diameter at two locations; parallel and perpendicular to the crankshaft. Record the readings.
   b. Repeat the two measurements at the center of the piston ring travel zone.
   c. Repeat the measurements again at the bottom of the bore at a point below the piston ring travel zone.
   d. Rebore the cylinder if the parallel and perpendicular measurements at either the top, middle or bottom of the bore vary by more than 0.002 in. (0.051 mm). This indicates an out-of-round condition.
   e. Rebore the cylinder if the top, middle and bottom bore diameters either parallel or perpendicular to the crankshaft vary by more than 0.002 in. (0.051 mm). This indicates excessive taper.
3. Continue with cylinder service.
   a. If cylinders are not scuffed or scored and are not worn beyond the service limits, see 3.23 CYLINDER, Deglazing Cylinder.
   b. If cylinders are worn beyond the service limits, then they must be rebored and/or honed to accept the next standard oversize piston. See 3.23 CYLINDER, Boring and Honing Cylinder.



1. **Bolt (4)**
2. **Lower plate**
3. **Vise**

Figure 3-102. Attaching Cylinder Torque Plates

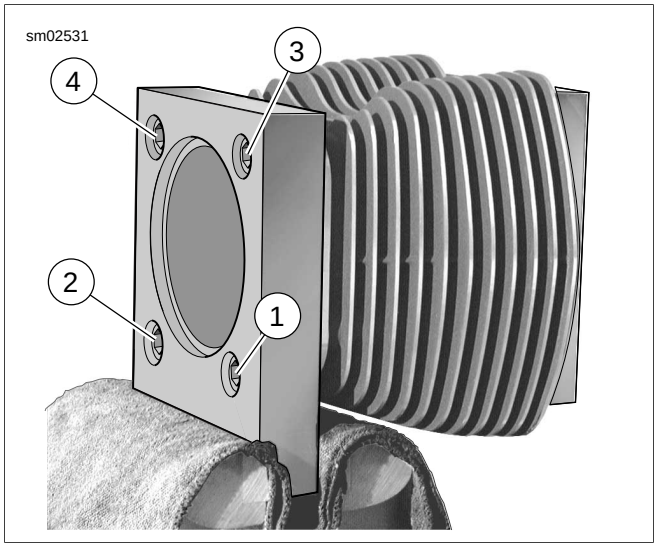


Figure 3-103. Cylinder Torque Plate Bolt Sequence

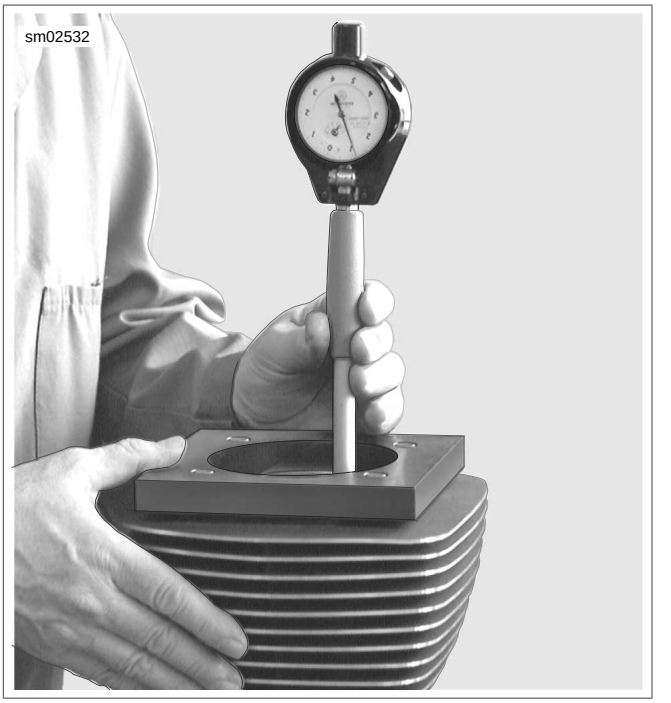


Figure 3-104. Measure for Out-of-Round and Taper

DEGLAZING CYLINDER

NOTE

Deglazing removes wear patterns, minor scuff marks and scratches without enlarging the bore diameter.

1. Lightly swab the cylinder bore with a cloth dipped in clean engine oil.
2. Obtain a 240 grit flexible ball-type deglazing tool with a bristle tip or finishing stone arrangement able to produce a 60° cross hatch pattern.
3. Install the deglazing tool in a slow-speed drill. The speed at which the tool rotates determines the speed at which it must be stroked up and down the bore to produce the desired cross hatch pattern.
4. Starting at the bottom of the cylinder, move the deglazing tool up and down the entire length of the cylinder bore for 10 to 12 complete strokes.
5. Stop to examine the cylinder bore and/or take measurements. A precise 60° cross hatch pattern in the piston travel area is the most important.

CAUTION

The angular cross hatch pattern ensures an even flow of oil onto the cylinder walls and promotes longer cylinder, piston and ring life. An incorrect cross hatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00536b)

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .

6. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence of dirt or debris.

7. Hot rinse the cylinder and dry with moisture free compressed air. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder. This prevents the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

8. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.23 CYLINDER, Inspection.

BORING AND HONING CYLINDER

1. Bore cylinder with gaskets and torque plates attached. Refer to Table 3-34. Bore the cylinder to 0.003 in. (0.08 mm) under the desired finished size.

CAUTION

An incorrect cross hatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption. (00538b)

2. Hone the cylinder to its finished size using a 280 grit rigid hone followed by a 240 grit flexible ball hone. Honing must be done with the torque plates attached. All honing must be done from the bottom (crankcase) end of the cylinder. Work for a 60° crosshatch pattern.

3. Stop frequently to examine the cylinder bore and/or take measurements. Remember, a precise 60° crosshatch pattern in the piston travel area is important.

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and engine failure. (00537b) .

4. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence of dirt or debris.

NOTE

Example: A 0.005 in. (0.13 mm) oversize piston will have the proper running clearance with a cylinder bore size of 3.7550-3.7555 in. (95.377-95.390 mm).

5. Hot rinse the cylinder and dry with moisture free compressed air.

6. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder. This prevents the cylinder bore from rusting.

NOTE

After wiping the cylinder with a clean, oiled paper towel, the towel will be dark with contamination. Repeat this process using a new lightly oiled paper towel each time until the towel remains white. The cylinder is now clean.

7. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See 3.24 PISTON, Inspection.

Table 3-34. Oversize Pistons/Cylinder Bores

PISTON			CYLINDER BORE FINISHED SIZE	
SIZE	IN.	MM	IN.	MM
Standard	N/A	N/A	3.7500-3.7505	95.250-95.263
Oversize	0.005	0.13	3.7550-3.7555	95.377-95.390
	0.010	0.25	3.7600-3.7605	95.504-95.517

INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder.
2. Install cylinder head.
3. Install push rod covers and push rods.
4. Install rocker arm support plate.
5. Install breather assembly.
6. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

NOTE

Do not mix 2007 and later pistons with earlier style pistons. New style pistons have tapered wrist pin boss. The wrist pin portion of the connecting rod is also tapered.

See 3.15 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.
6. Remove piston.

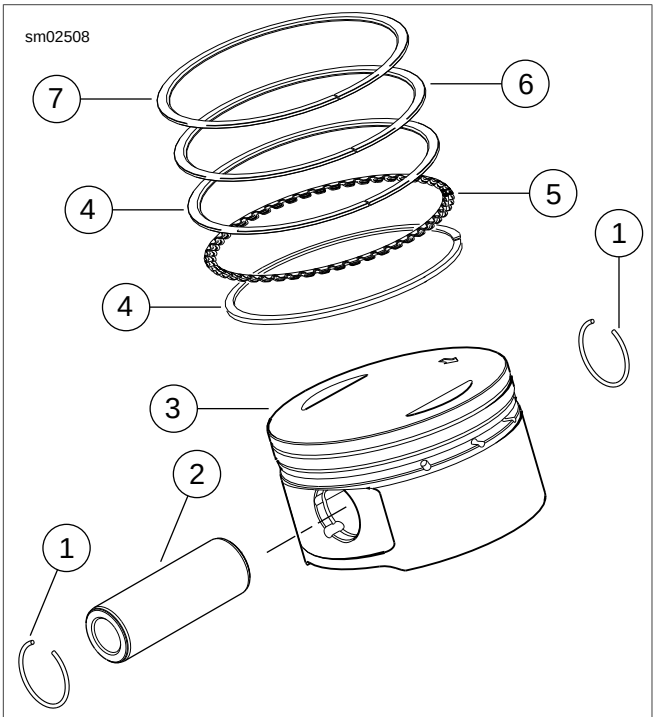
DISASSEMBLY

Piston Rings

WARNING

Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)

1. See Figure 3-105. Carefully remove top (7) and second (6) compression rings using the proper piston ring expander (Snap-on PRS8).
2. Using your fingers, remove the oil rail expansion ring (5) from the third ring groove. Remove top and bottom oil rails (4).
3. Discard the piston rings.



1. **Circlip**
2. **Piston pin**
3. **Piston**
4. **Oil rail**
5. **Expansion ring**
6. **Second compression ring**
7. **Top compression ring**

Figure 3-105. Piston Assembly

CLEANING

1. To remove all carbon and combustion deposits, soak the pistons in a special detergent that will not corrode aluminum. Maintain the temperature of the cleaning solution well below 212° F (100° C).

NOTE

Do not sand blast or glass bead blast pistons. Bead blasting rounds off ring lands and will result in oil contamination leading to accelerated wear.

WARNING

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

2. Thoroughly rinse the pistons. Blow parts dry with moisture free compressed air.
3. Clean the oil drain holes leading from the oil control ring groove to the underside of the piston crown. Run a small bristle brush through the passageways to ensure their cleanliness, but be careful not to damage or enlarge the holes. Do not use a wire brush.

4. Verify that all other oil holes are clean and open.

NOTE

Exercise care to avoid scratching the sides of the piston ring grooves.

5. Thoroughly clean the three piston ring grooves of all carbon deposits. A broken compression ring properly ground to a sharp chisel-like edge may be used for this purpose.

6. Using Magnaflux Dye Penetrant, inspect the piston for surface cracks. Pay special attention to the area around the pin bores, ring lands and oil drain holes beneath the piston crown. If no cracks are found, thoroughly wash piston to remove traces of dye.

INSPECTION

1. See Figure 3-106. Check piston pin.
   a. Lightly oil a good piston pin and insert it into the piston pin bore to feel for the proper interference fit. The pin should slide in and out without binding, but also without pivoting or rocking.
   b. Replace piston and/or pin if clearance exceeds 0.0008 in. (0.02 mm).

NOTE

Pistons with superficial wear marks, minor scratching or mild scoring may continue to be used.

2. Carefully inspect the pistons for damage or excessive wear.
   a. Discard pistons with cracked, broken or bent ring lands.
   b. Check the piston skirt for cracks, gouges, deep scratches or heavy scoring.
   c. Check the piston heads for evidence of burning, etching or melting.
   d. Look for marks or imprints caused by contact with valves.

3. Run your index finger around the edge of the piston crown to feel for dings, nicks or burrs. Lightly file the edge of the crown to remove any defects.

NOTE

Worn ring grooves result in high oil consumption and blow-by of exhaust gases. Blow-by of exhaust gases contaminates the engine oil supply with acids and leaves sludge in the crankcase. It also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.

4. See Figure 3-107. Measure piston ring side clearance.
   a. Insert the edge of a **new** ring into the piston ring groove. Insert a feeler gauge between the upper surface of the ring and the ring land.
   b. Since the grooves wear unevenly, repeat this check at several locations around the piston groove circumference.
   c. Discard the piston if the side clearance of either compression ring exceeds 0.0045 in. (0.11 mm).
   d. Discard the piston if the oil control ring side clearance exceeds 0.010 in. (0.25 mm).

NOTES

- *Check the piston clearance in the cylinder in which the piston will run. The torque plates must be installed on the cylinder and it must be deglazed and suitable for continued service.*
- *This inspection is very heat sensitive. Do not check piston running clearance immediately after honing or deglazing cylinder. Even holding the piston in your hand for too long can cause measurements to vary by as much as 0.0002 in. (0.0051 mm). Both piston and cylinder must be at room temperatures before proceeding.*
- *Piston measurement is taken on the bare aluminum to avoid measuring errors. An oval-shaped opening is present on each side of the piston for proper placement of the micrometer. See upper frame of Figure 3-108. The oval openings are too small for a standard flat anvil micrometer which would result in measuring errors. Use a 3-4 inch blade or ball anvil style micrometer, or a 4-5 inch micrometer with spherical ball anvil adapters. See lower frame of Figure 3-108.*

5. See Figure 3-108. Measure running clearance of pistons as follows:
   a. Holding outside micrometer, measure piston skirt diameter across the thrust faces (perpendicular to piston pin bore). Start below the bottom ring land and move micrometer towards bottom of skirt. Micrometer will be loose, then tight, about 0.5 in. (12.7 mm), from bottom and then loose again.
   b. Measure the piston skirt at the tightest spot and then transfer that measurement to dial bore gauge.
   c. Using a grease pencil, mark the top, middle and bottom of the piston ring travel zone in the cylinder bore. Measure at markings in cylinder parallel and perpendicular to crankshaft.
   d. Replace piston and/or cylinder if running clearance exceeds 0.003 in. (0.076 mm).



1. Pin must slide without binding or pivoting

Figure 3-106. Piston Pin Clearance

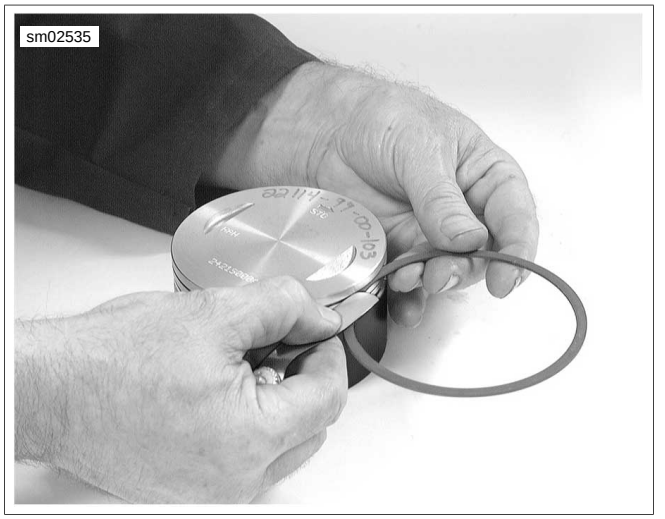
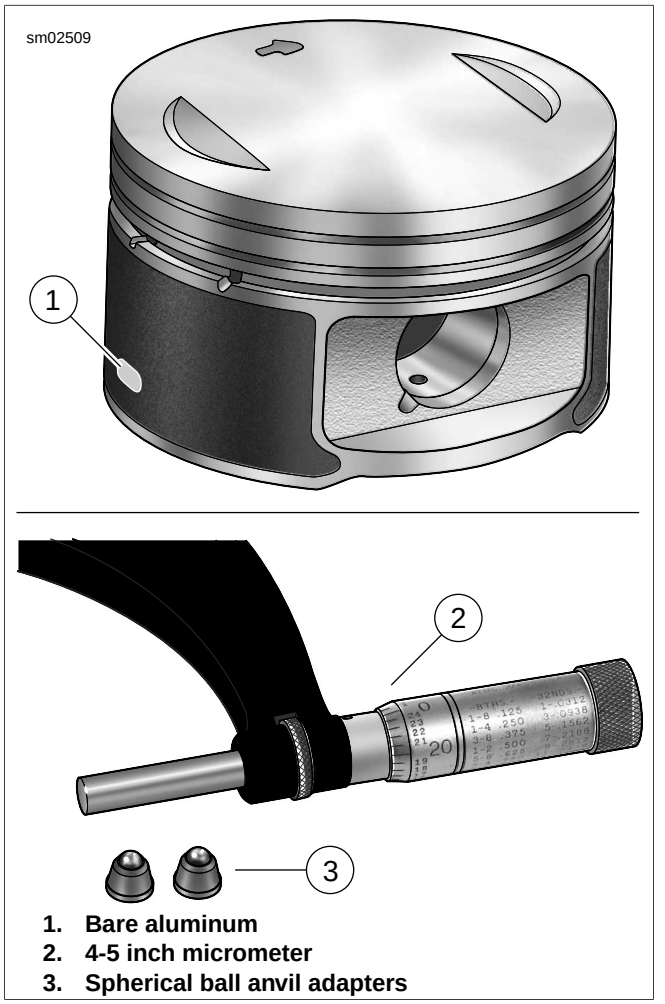


Figure 3-107. Measure Piston Ring Side Clearance



1. **Bare aluminum**
2. **4-5 inch micrometer**
3. **Spherical ball anvil adapters**

Figure 3-108. Measuring Running Clearance of Piston

ASSEMBLY

Checking Piston Ring Gap

NOTES

- *Always use **new** piston rings. Piston rings take a definite set and must not be reused if the engine has been operated. Always deglaze (or hone) the cylinder before installing **new** rings. Ring sets are available to fit oversize pistons.*
- *Insufficient ring gap may cause the ends to abut at engine operating temperatures, resulting in ring breakage, cylinder scuffing and/or piston seizure.*
- *Excessive ring gap results in high oil consumption and blow-by of exhaust gases. While blow-by contaminates the oil supply and leaves sludge in the crankcase, it also reduces engine efficiency by weakening the combustion seal necessary for efficient transfer of energy to the piston.*

1. See Figure 3-109. Check ring gap before placing each ring on the piston.
   a. Insert the **new** ring into the cylinder and square it in the bore using the top of the piston. Measure the ring gap with a feeler gauge.
   b. Top compression ring gap must be 0.010-0.020 in. (0.25-0.51 mm).
   c. Second compression ring gap must be 0.014-0.024 in. (0.36-0.61 mm).
   d. Oil control rail gap must be 0.010-0.050 in. (0.25-1.27 mm).

NOTE

Ring end gap dimensions also apply to oversize rings. Replace ring if end gap exceeds specification. If end gap is under specification, filing is permissible.

⚠WARNING

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

2. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.



Figure 3-109. Measuring Ring Gap

Installing Piston Rings

1. See Figure 3-110. Apply clean H-D 20W50 engine oil to three piston ring grooves.
2. Install expansion ring (4) into third ring groove.
3. Spiral bottom oil rail (5) into space below expansion ring (4). Position gap 90° from the gap in the expansion ring.
4. Spiral upper oil rail (3) into space above expansion ring (4). Position gap 180° from the gap in the bottom oil rail.

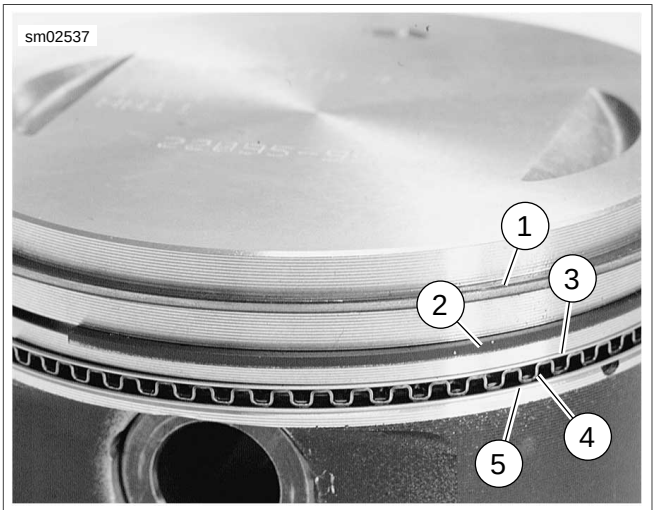
⚠WARNING

Wear safety glasses or goggles when removing or installing compression rings. Compression rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00469c)

NOTES

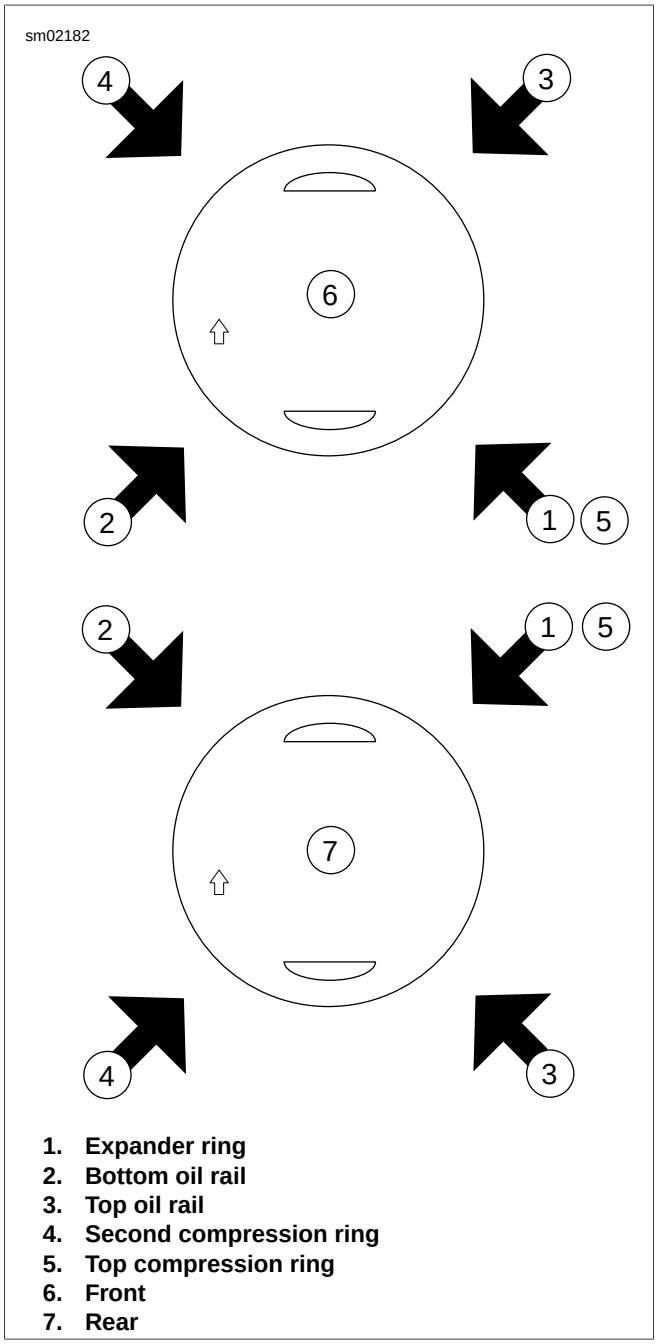
- *Use the proper piston ring spreader to prevent excessive ring twist and expansion. Over expansion may cause the ring to crack opposite the ring gap. Damaged or distorted rings result in blow-by of exhaust gases, increased oil consumption and lower service life on valves and other components.*
- *Installing the second compression ring upside down will cause oil to be scraped up into the combustion chamber resulting in excessive oil consumption and low service life on valves and other components.*

5. Using the proper piston ring expander (Snap-on PRS8), carefully install the second compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the expansion ring.
6. Using the proper piston ring expander (Snap-on PRS8), carefully install the top compression ring. Make sure the dot (punch mark) near the ring gap faces the piston crown. Rotate the ring so the gap is 180° from the gap in the second compression ring.
7. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.
8. See Figure 3-111. Verify the ring gaps are still properly staggered.



1. **Top compression ring**
2. **Second compression ring**
3. **Top oil rail**
4. **Expansion ring**
5. **Bottom oil rail**

Figure 3-110. Piston Rings



1. **Expander ring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**
6. **Front**
7. **Rear**

Figure 3-111. Piston Ring Gap Alignment

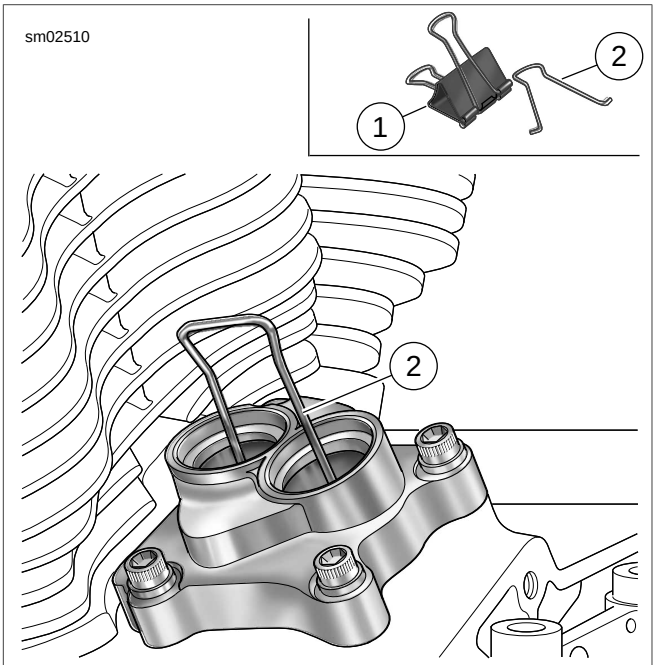
INSTALLATION OVERVIEW

See 3.16 TOP END OVERHAUL: ASSEMBLY.

1. Attach piston to connecting rod.
2. Install cylinder.
3. Install cylinder head.
4. Install push rod covers and push rods.
5. Install rocker arm support plate.
6. Install breather assembly.
7. Continue with vehicle assembly as directed.

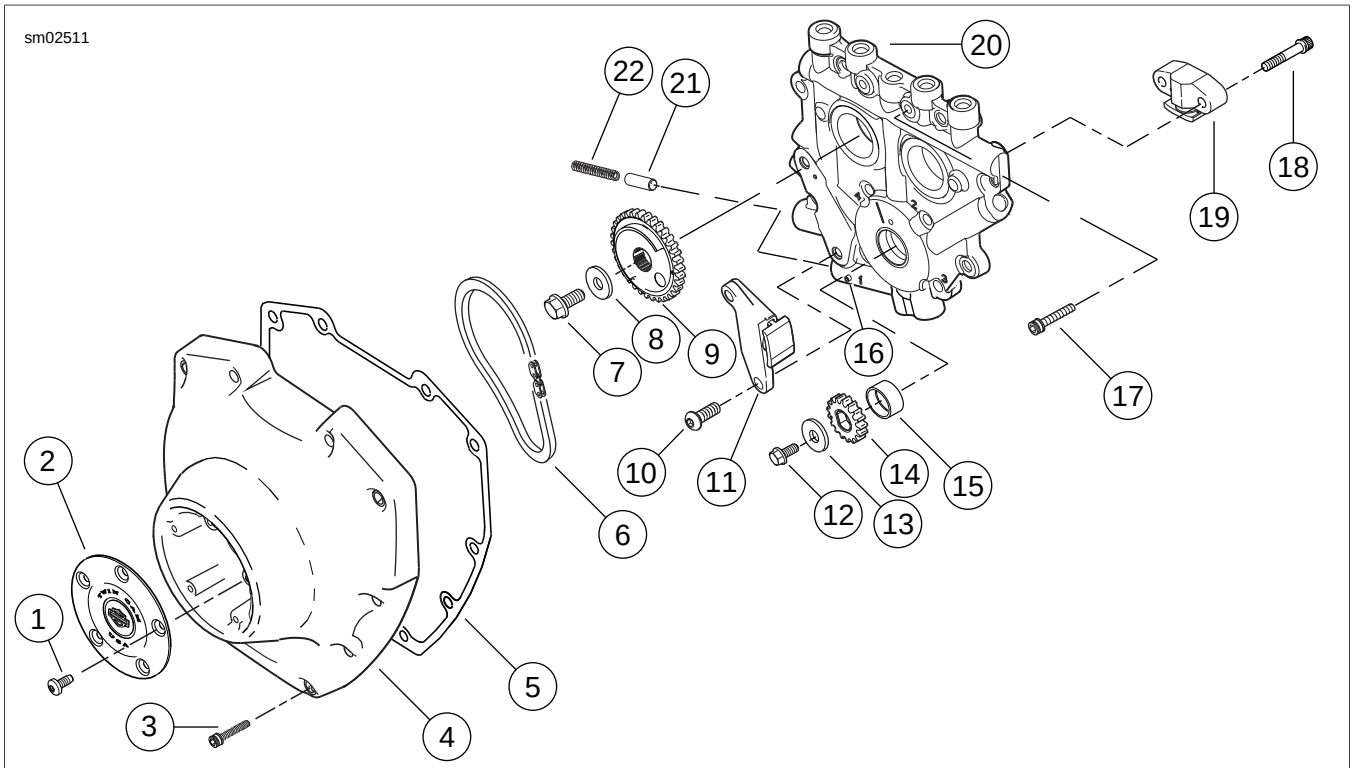
REMOVAL OVERVIEW

1. See 3.15 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. See Figure 3-112. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal.
   a. Obtain a large binder clip (1) which is available at any office supply store. Squeeze wireforms (2) to remove from binder clip.
   b. Compress wireform (2) slightly and insert free ends into outer and inner lifter cover bores so that legs engage walls of both hydraulic lifter sockets.
3. To remove cover and cam support plate, see 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.



1. **Binder clip**
2. **Wireform**

Figure 3-112. Hydraulic Lifter Holding Tool



1. **Ignition cover fastener**
2. **Ignition cover**
3. **Cam cover fastener**
4. **Cam cover**
5. **Cam cover gasket**
6. **Primary cam chain**
7. **Flange bolt, large**
8. **Flat washer**
9. **Rear cam sprocket**
10. **Fastener**
11. **Primary cam chain tensioner**
12. **Flange bolt, small**
13. **Flat washer**
14. **Crank sprocket**
15. **Crankshaft bushing**
16. **Roll pin**
17. **Cam support plate fastener (8)**
18. **Fastener**
19. **Secondary cam chain tensioner**
20. **Cam support plate**
21. **Oil pressure relief valve**
22. **Valve spring**

Figure 3-113. Cover and Cam Support Plate Assembly

CAMSHAFTS

PART NUMBER	TOOL NAME
HD-47956	CAMSHAFT ASSEMBLY TOOL

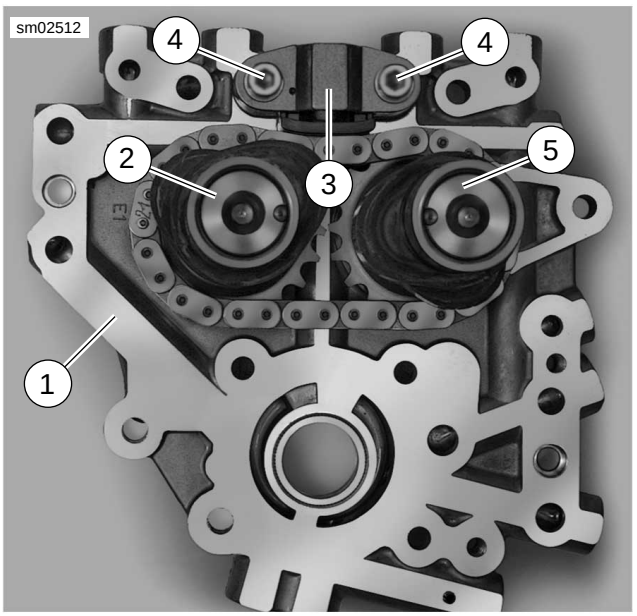
Removal

1. See Figure 3-114. Remove screws (4) and remove secondary cam chain tensioner (3).

⚠WARNING

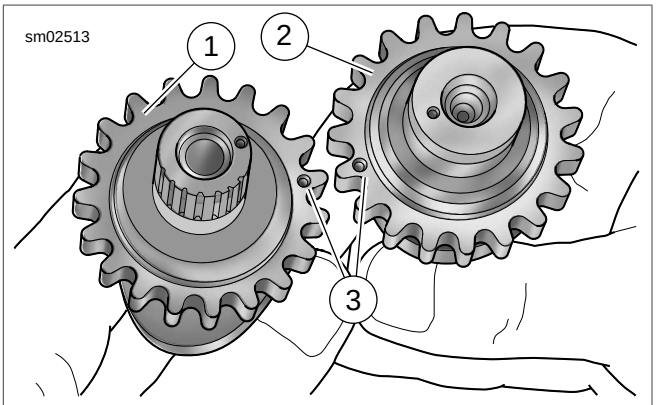
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

2. Remove retaining ring from groove at end of front camshaft. Discard retaining ring.
3. Do not mix front and rear camshaft spacers. Front spacer is 0.100 in. (2.54 mm) thick.
4. Using a colored marker, mark one of the links of the secondary cam chain. Maintaining the original direction of rotation during assembly may prolong service life.
5. Slide camshafts and secondary cam chain out of cam support plate.
6. Remove secondary cam chain from cam sprockets.



1. **Cam support plate**
2. **Front cam**
3. **Secondary cam chain tensioner**
4. **Secondary cam chain tensioner fasteners**
5. **Rear cam**

Figure 3-114. Camshafts



1. **Rear camshaft**
2. **Front camshaft**
3. **Timing marks**

Figure 3-115. Camshaft Timing Marks

Assembly

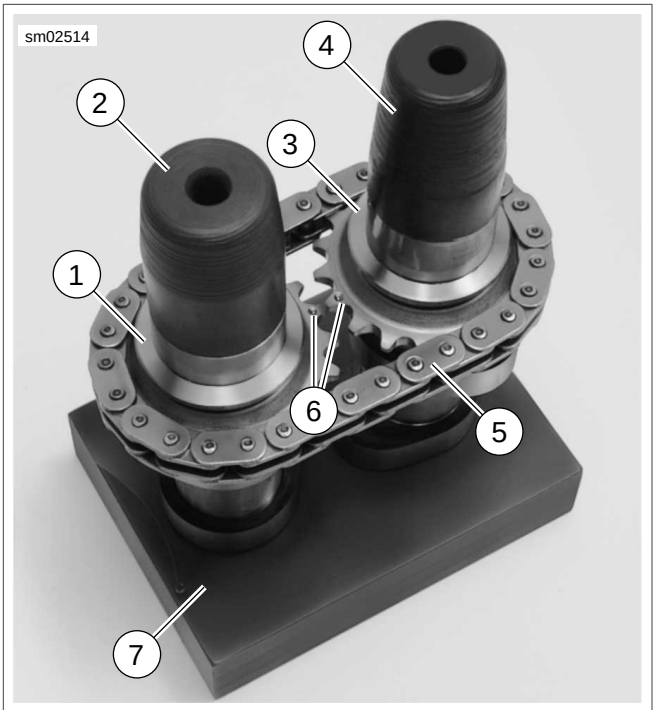
1. See Figure 3-115. Align timing marks on teeth of secondary cam sprockets (outboard faces).

NOTE

Do not mix camshafts during the installation procedure. The rear camshaft, which can be identified by the splined shaft, must go into the hole at the rear of the cam support plate.

2. Place the secondary cam chain around the sprockets of both the front and rear camshafts. To maintain the original direction of rotation, be sure that the colored mark placed on the chain link during disassembly is facing opposite the cam support plate during installation.

3. See Figure 3-116. Orient the camshafts so that they are positioned on opposite ends of the chain, and then verify that the alignment marks (6) are still in alignment.



1. **Rear camshaft**
2. **Small guide**
3. **Front camshaft**
4. **Large guide**
5. **Cam chain**
6. **Alignment marks**
7. **Base**

Figure 3-116. Camshaft Assembly Tool

4. Obtain CAMSHAFT ASSEMBLY TOOL (Part No. HD-47956). Place crankcase side of camshaft/cam chain assembly into base (7).

5. While maintaining cam timing mark alignment, place small guide (2) on rear camshaft (1). Place large guide (4) on front camshaft (3).

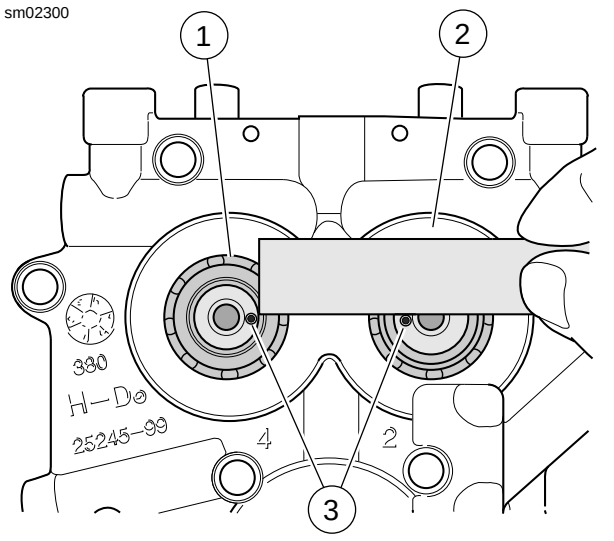
6. Lubricate support plate camshaft cavities with clean H-D 20W50 engine oil.

7. Install cam support plate over guides.
8. Remove guides and base.
9. See Figure 3-117. Using a straightedge, verify that the timing marks are in alignment. If they are not, then the camshafts must be removed, realigned and reinstalled.

⚠WARNING

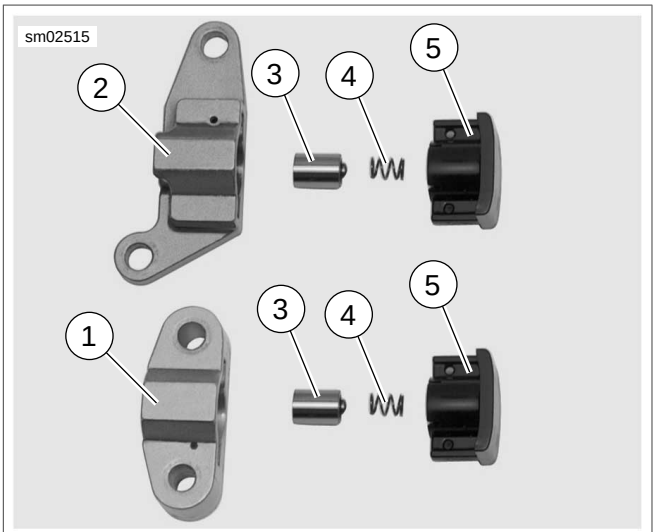
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

10. Install 0.100 in. (2.54 mm) thick front camshaft spacer over end of front camshaft.
11. With the sharp edge out, install **new** retaining ring in groove at end of front camshaft.
12. Inspect primary and secondary cam chain tensioners.
    a. Inspect tensioners for wear. Replace tensioners if damaged or if chain contact portion of shoe material is less than 0.060 in. (1.52 mm) thick.
    b. See Figure 3-118. Be sure primary and secondary cam chain tensioners are assembled as shown. If assembled incorrectly, tensioners will not function properly.
13. Install secondary cam chain tensioner. Tighten fasteners to 100-120 **in-lbs** (11.3-13.6 Nm).



1. **Rear camshaft**
2. **Front camshaft**
3. **Pin stamped timing marks**

Figure 3-117. Verify Alignment of Punch Marks



1. **Secondary cam chain tensioner**
2. **Primary cam chain tensioner**
3. **Piston**
4. **Spring**
5. **Shoe**

Figure 3-118. Cam Chain Tensioner Assemblies

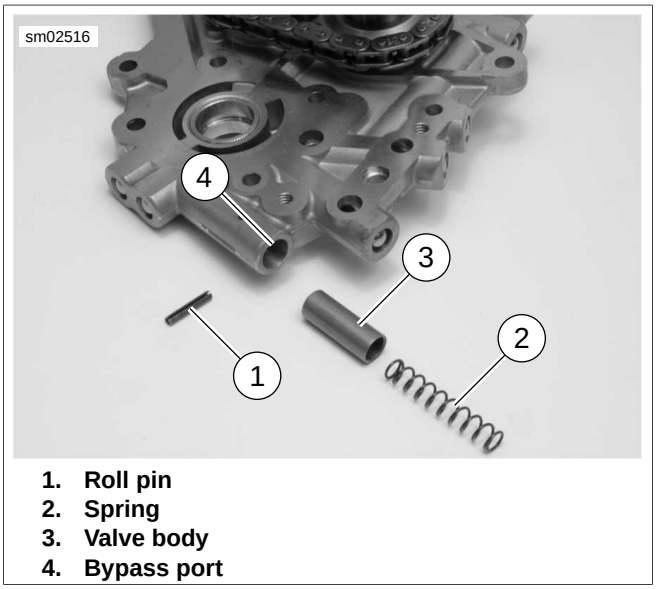
OIL PRESSURE RELIEF VALVE

Removal

1. Before removal, see 3.26 OIL PUMP, Cleaning and Inspection.
2. Secure the cam support plate in a vise with access to the roll pin. Be sure to install a pair of brass jaw inserts in the vise to avoid damage to the casting.
3. See Figure 3-119. Using a 1/8 in. punch with a small hammer, carefully tap roll pin (1) from pin hole in cam support plate. Discard roll pin.
4. Remove spring (2) and valve body (3) from bypass port.

Installation

1. Secure the cam support plate in a vise. Be sure to install a pair of brass jaw inserts to avoid damage to the casting.
2. See Figure 3-119. Lubricate valve body (3) with clean H-D 20W50 engine oil. Slide valve body into bypass port of cam support plate with the open side facing outward.
3. Slide spring (2) into bypass port until seated in open side of valve body.
4. Start **new** roll pin (1) into hole in cam support plate. Compress spring in port using the blade of a small screwdriver.
5. Holding spring compressed, tap roll pin into cam support plate until it approaches pin hole on opposite side.
6. Remove screwdriver to release spring. Verify that spring is straight and square in bore.
7. Using a 1/8 in. punch with a small hammer, carefully tap roll pin until flush with casting.



1. **Roll pin**
2. **Spring**
3. **Valve body**
4. **Bypass port**

Figure 3-119. Oil Pressure Relief Valve Assembly

Inspection

NOTE

If diagnosing low oil pressure, start with step 1. If diagnosing high oil pressure, then begin with step 2.

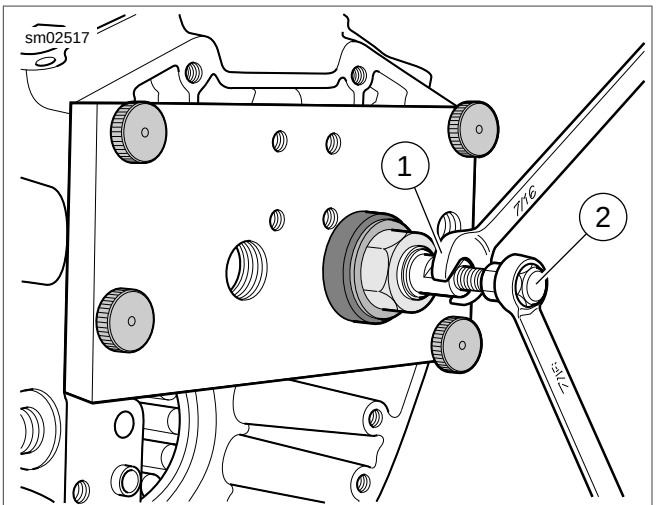
1. Insert straight stiff wire into unplugged hole outboard of roll pin until it bottoms. Mark wire and measure distance from edge of cam support plate to inboard side of piston. With piston fully seated in the bore, depth should be approximately 2.25 in. (57.15 mm). If it is not, continue with next step.
2. Remove oil pressure relief valve.
3. Inspect spring for stretching, kinking or distortion.
4. Inspect piston and bore for burrs, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.
5. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 in. (0.076 mm), install **new** piston and remeasure. Replace cam support plate if running clearance still exceeds specification.

CAM NEEDLE BEARINGS

PART NUMBER	TOOL NAME
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER

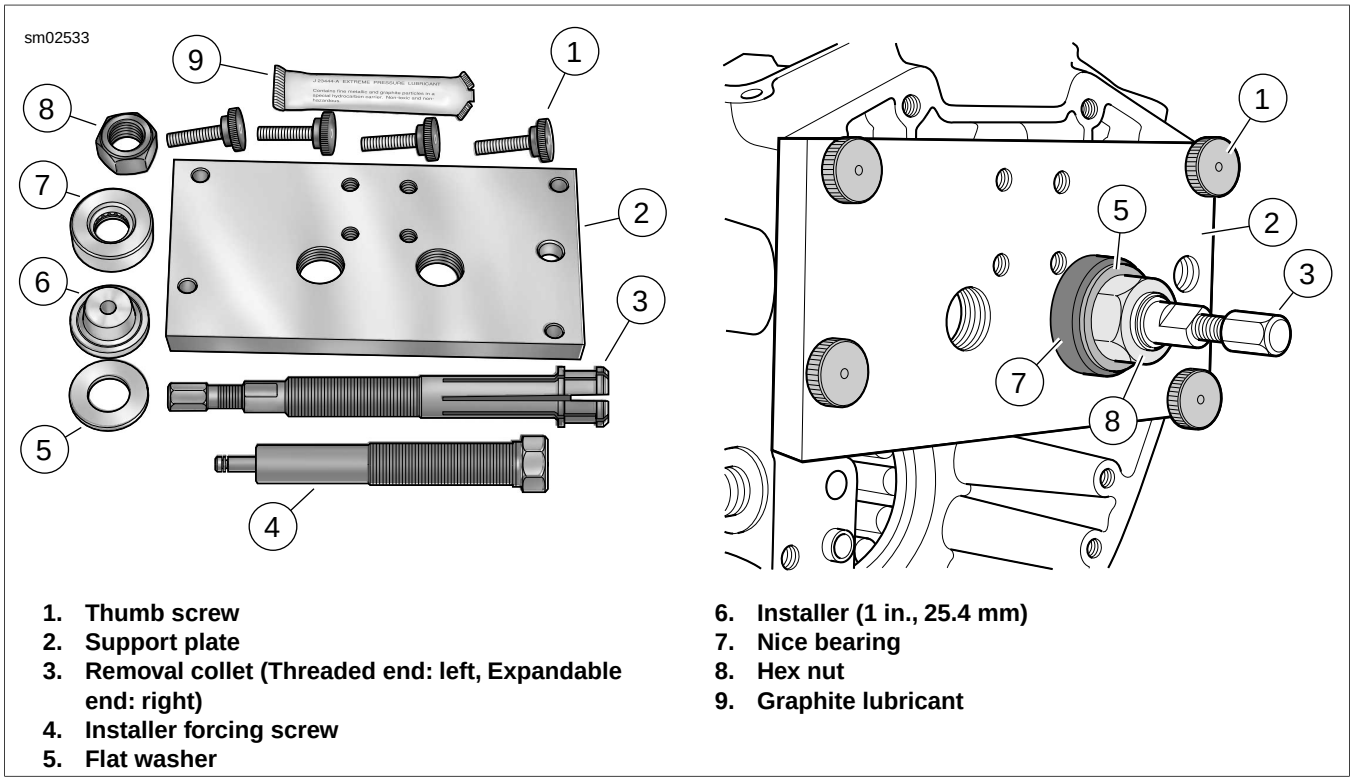
Removal

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).
2. See Figure 3-121. Remove four thumb screws (1) from threaded holes in support plate (2), if installed.
3. Sparingly apply graphite lubricant (9) to threads of collet (3) to prolong service life and ensure smooth operation.
4. Slide collet through support plate so that threaded end exits stamped side of plate.
5. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
6. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.
7. Center expandable end of collet in bearing bore and slide Nice bearing (7) and flat washer (5) on threaded end. Start hex nut (8) on threaded end.
8. Push expandable end of collet through bearing bore into flywheel compartment. Feel for inside edge of needle bearing using end of collet and then back off slightly.



1. **Flat**
2. **Hex**

Figure 3-120. Expanding Collet by Turning Hex Clockwise



1. **Thumb screw**
2. **Support plate**
3. **Removal collet (Threaded end: left, Expandable end: right)**
4. **Installer forcing screw**
5. **Flat washer**
6. **Installer (1 in., 25.4 mm)**
7. **Nice bearing**
8. **Hex nut**
9. **Graphite lubricant**

Figure 3-121. Camshaft Needle Bearing Remover/Installer (Part No. HD-42325-A)

9. Holding collet to prevent lateral movement, finger tighten hex nut until Nice bearing contacts support plate.
10. See Figure 3-120. Using a 7/16 in. open end wrench, hold flat on collet to prevent rotation. Using a second 7/16 in. open end wrench, expand collet by turning hex at end of shaft in a clockwise direction. Expandable end of collet makes contact with needle bearing ID.
11. See Figure 3-122. Using a 15/16 in. open end wrench, turn hex nut in a clockwise direction until bearing is free. If necessary, hold flat on collet to prevent rotation.
12. Remove four thumb screws and pull support plate from crankcase.
13. Holding flat on collet, turn hex at end of shaft in a counter-clockwise direction to close collet. Remove and discard needle bearing.
14. Remove hex nut, flat washer and Nice bearing from threaded end of collet. Pull collet from support plate.
15. Repeat this procedure to remove second needle bearing.

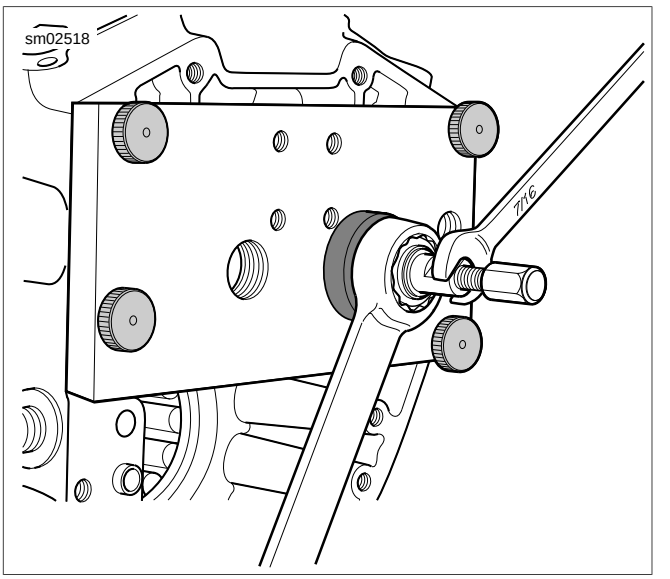


Figure 3-122. Bearing Removal

Installation

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325-A).

NOTE

To avoid engine damage, care must be taken to install needle bearings to the correct depth. The correct depth is achieved only when the edge of the needle bearing is 3.10 in. (78.7 mm) from the cam cover flange.

2. Since measuring from the top of the support plate is easier and produces the most accurate and consistent results, proceed as follows:
   a. See Figure 3-123. Using a dial caliper, measure thickness of support plate.
   b. To determine the required distance from the top of the support plate to the edge of the installed needle bearing, add measurement obtained in the previous step to 3.10 in. (78.7 mm).

NOTE

For example, if the support plate is 0.50 in. (12.7 mm) thick, then the measurement from the top of the support plate to the edge of the needle bearing should be 3.60 in. (91.4 mm).

3. See Figure 3-121. Sparingly apply graphite lubricant (9) to threads of installer forcing screw (4) to prolong service life and ensure smooth operation.
4. Thread installer forcing screw into stamped side of support plate (2) until threads begin to emerge from opposite side.
5. Place installer (6) at end of installer forcing screw.
6. Place **new** needle bearing on installer with lettered side facing shoulder.
7. See Figure 3-124. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
8. Align four holes at corners of support plate with threaded holes in crankcase flange. Install thumb screws in these holes to secure support plate to crankcase.

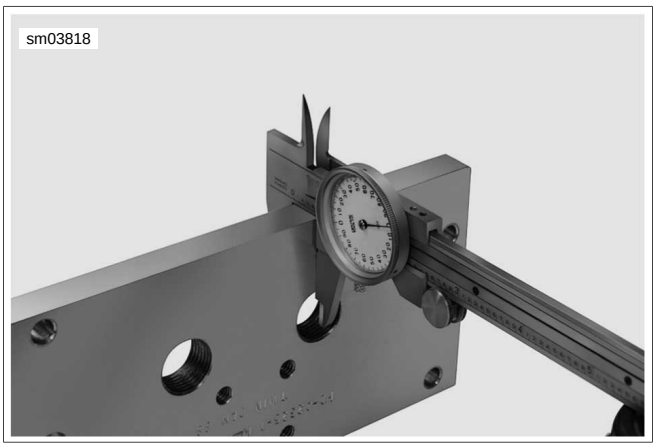


Figure 3-123. Measure Thickness of Support Plate

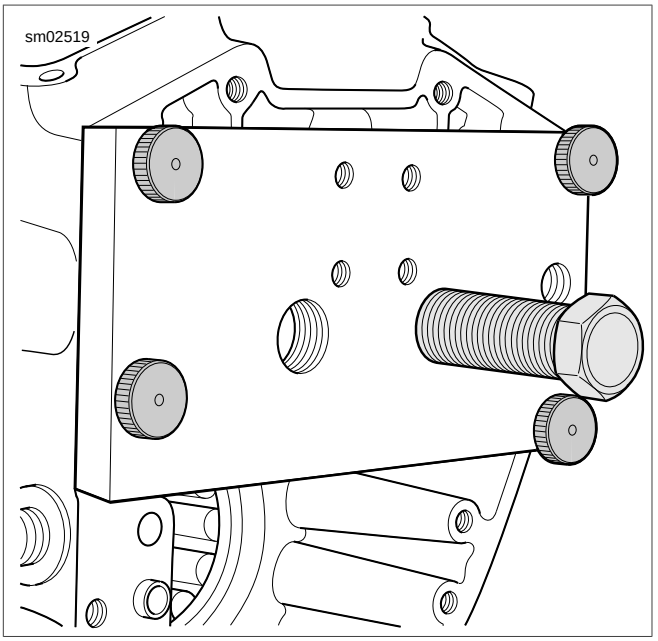


Figure 3-124. Installer Forcing Screw Installation

9. Install first needle bearing as follows:
   a. Obtain torque wrench and set to 25 ft-lbs (33.9 Nm).

NOTE

In next step, do not exceed 25 ft-lbs (33.9 Nm) to install bearing. If this specification is exceeded, bearing could push through case causing damage to case and bearing.

   b. See Figure 3-125. Using torque wrench, turn hex at end of installer forcing screw in a clockwise direction to press needle bearing into bore
   c. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.
   d. See Figure 3-126. Inserting dial caliper through forcing screw bore, measure distance from top of support plate to edge of needle bearing.
   e. Install forcing screw in support plate. Reaching into crankcase, place installer at end of forcing screw. Hand turn forcing screw until shoulder on installer makes contact with edge of needle bearing.
   f. Repeat the previous steps until needle bearing is installed to the correct depth (as calculated previously).

NOTE

In the next step, a measurement will be taken of the distance from the head of the installer forcing screw to the support plate. For an accurate measurement, be sure the shoulder on the installer is in contact with the edge of the needle bearing.

10. See Figure 3-127. Using a dial caliper, measure from head (top) of installer forcing screw to support plate. Record this measurement for use in installing second needle bearing.
11. Back out forcing screw. Reaching into crankcase, remove installer. Remove forcing screw from support plate.

12. Install forcing screw in support plate over second needle bearing bore. Reaching into crankcase, place installer at end of forcing screw. Place **new** needle bearing on installer with lettered side facing shoulder.

NOTE

In next step, do not exceed 25 ft-lbs (33.9 Nm) to install bearing. If this specification is exceeded, bearing could push through case causing damage to case and bearing.

13. Using torque wrench, turn hex on forcing screw in a clockwise direction until distance from head (top) of forcing screw to support plate equals measurement obtained previously.

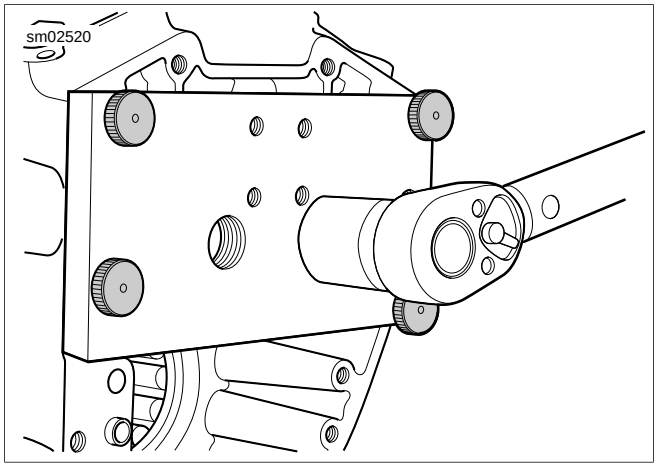


Figure 3-125. 1 Inch (25.4 mm) Bearing Installation

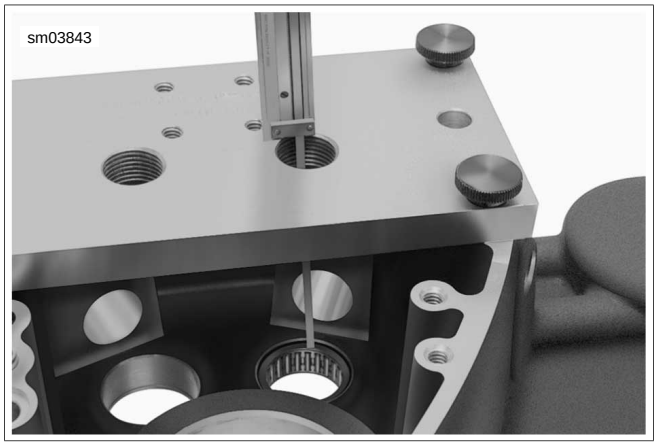


Figure 3-126. Measure from Top of Support Plate to Edge of Needle Bearing

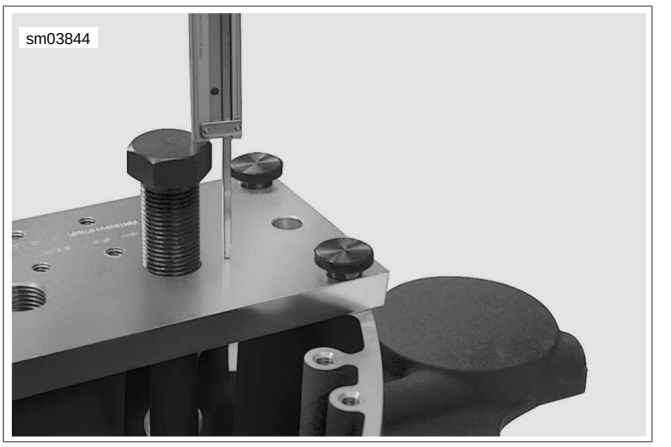


Figure 3-127. Measure from Top of Forcing Screw to Support Plate

CLEANING AND INSPECTION

Oil Pressure Valve

NOTE

If diagnosing low oil pressure, start with step 1. If diagnosing high oil pressure, then begin with step 2.

1. Insert straight stiff wire into unplugged hole outboard of roll pin until it bottoms. Mark wire and measure distance from edge of cam support plate to inboard side of piston. With piston fully seated in the bore, depth should be approximately 2.25 in. (57.15 mm). If it is not, continue with next step.
2. Remove oil pressure relief valve. See 3.25 COVER AND CAM SUPPORT PLATE, Oil Pressure Relief Valve.
3. Inspect spring for stretching, kinking or distortion.
4. Inspect piston and bore for burrs, scoring or other damage. Look for steel particles or aluminum chips. Replace cam support plate and piston if any of these conditions are found.
5. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 in. (0.076 mm), install **new** piston and remeasure. Replace cam support plate if running clearance still exceeds specification.

Cam Support Plate

Verify that all oil holes are clean and open.

NOTE

Exercise caution to avoid enlarging the oil holes or oil pressure will be adversely affected.

INSTALLATION OVERVIEW

1. Begin with 3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate.
2. Continue with 3.16 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. See 3.15 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal. See 3.25 COVER AND CAM SUPPORT PLATE.
3. To remove cover and cam support plate, see 3.17 BOTTOM END OVERHAUL: DISASSEMBLY. Remove oil pump after removing cam support plate.

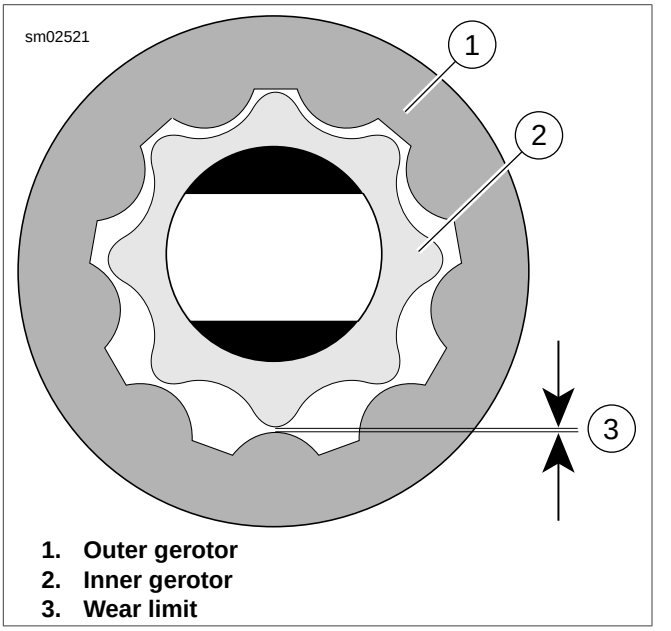
CLEANING AND INSPECTION

1. Clean all parts in a non-volatile cleaning solution or solvent.

WARNING

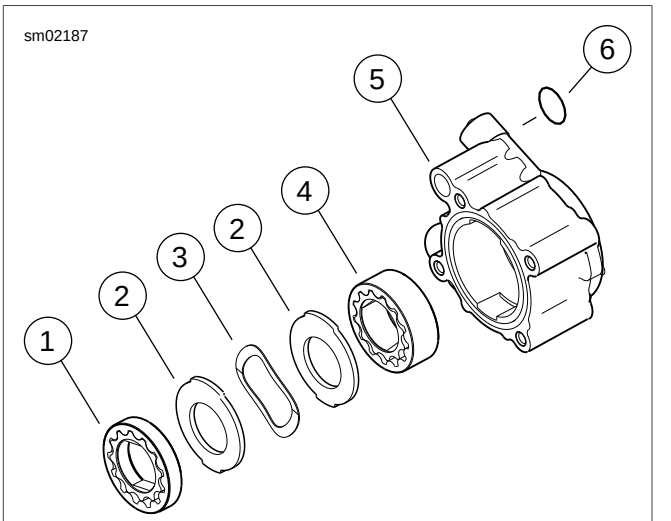
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

2. Blow parts dry with low pressure compressed air. Verify that all oil passages are clean and open.
3. Look for scoring, gouging or cracking caused by foreign material that may have passed through the oil pump.
4. Look for grooves or scratches on the cam support plate, which serves as the outboard side of the oil pump.
5. Check for excessive wear or damage on lobes of outer gerotor gears and between lobes on inner gerotor gears.
6. See Figure 3-128. Check gerotor wear.
   a. Mesh pieces of one gerotor set together.
   b. Use a feeler gauge to determine clearance between tips of lobes on inner and outer gerotors.
   c. Replace gerotors as a set if clearance exceeds 0.004 in. (0.10 mm). Inspect second gerotor set in the same manner.
7. Measure thickness of inner gerotor of one set with a micrometer. Measure the outer gerotor of the same set. Replace the gerotor set if the difference exceeds 0.001 in. (0.025 mm). Inspect second gerotor set in the same manner.
8. See Figure 3-129. Assemble the oil pump. Verify that feed gerotors stand proud of the oil pump surface 0.015-0.025 in. (0.381-0.635 mm). If measurement is less than 0.015 in. (0.381 mm), remove feed gerotor set and reassemble using new wave washer. Repeat measurement and replace oil pump body if still not within specification.



1. **Outer gerotor**
2. **Inner gerotor**
3. **Wear limit**

Figure 3-128. Measure Gerotor Sets for Wear



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Oil pump housing**
6. **Scavenge port O-ring**

Figure 3-129. Assembling Oil Pump

INSTALLATION OVERVIEW

1. See 3.25 COVER AND CAM SUPPORT PLATE, Installation Overview.
2. Continue with 3.16 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. Perform all steps under 3.15 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.

RIGHT CRANKCASE HALF

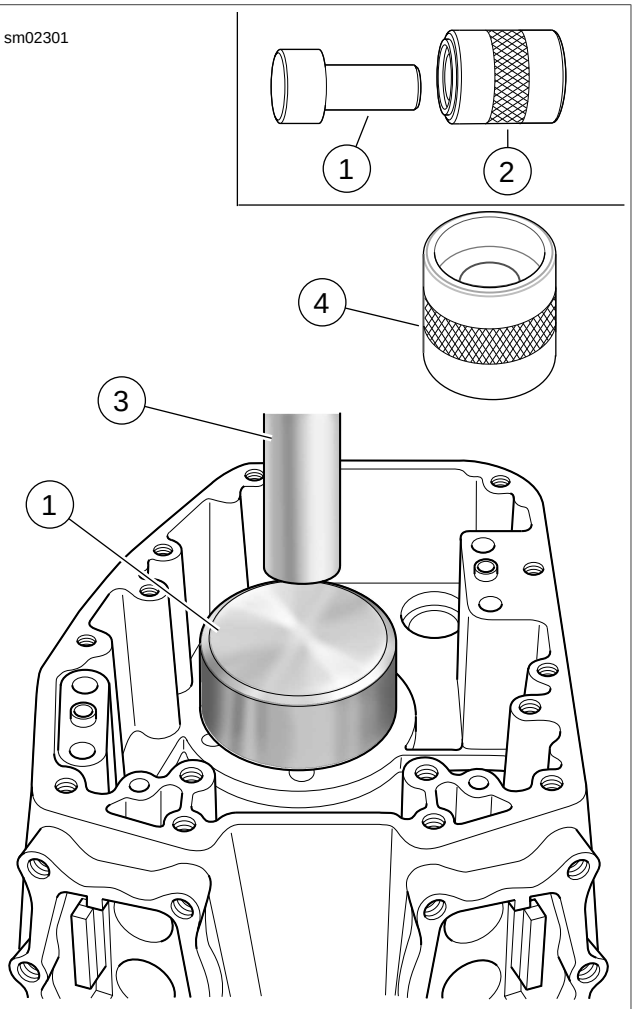
PART NUMBER	TOOL NAME
B-45655	CRANKSHAFT BEARING REMOVAL/INSTALL PILOT/DRIVER
B-45655	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER
HD-42720-5	CRANKSHAFT BEARING REMOVAL/INSTALL SUPPORT TUBE
HD-42720-5	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE

Crankshaft Bearing Removal

NOTE

Do not move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

1. See Figure 3-130. Obtain CRANKSHAFT BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. B-45655) and CRANKSHAFT BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-42720-5).
2. Place support tube (2) on hydraulic press table with the "A" end up. Note that the sides of the support tube are stamped to ensure proper orientation.
3. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube. During removal it is important that the curved edges on the pilot/driver (1) match the curved edges of the crankcase.
4. Slide pilot/driver (1) through bearing into support tube.
5. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until bearing is free.
6. Remove crankcase, pilot/driver and bearing from support tube. Discard bearing.



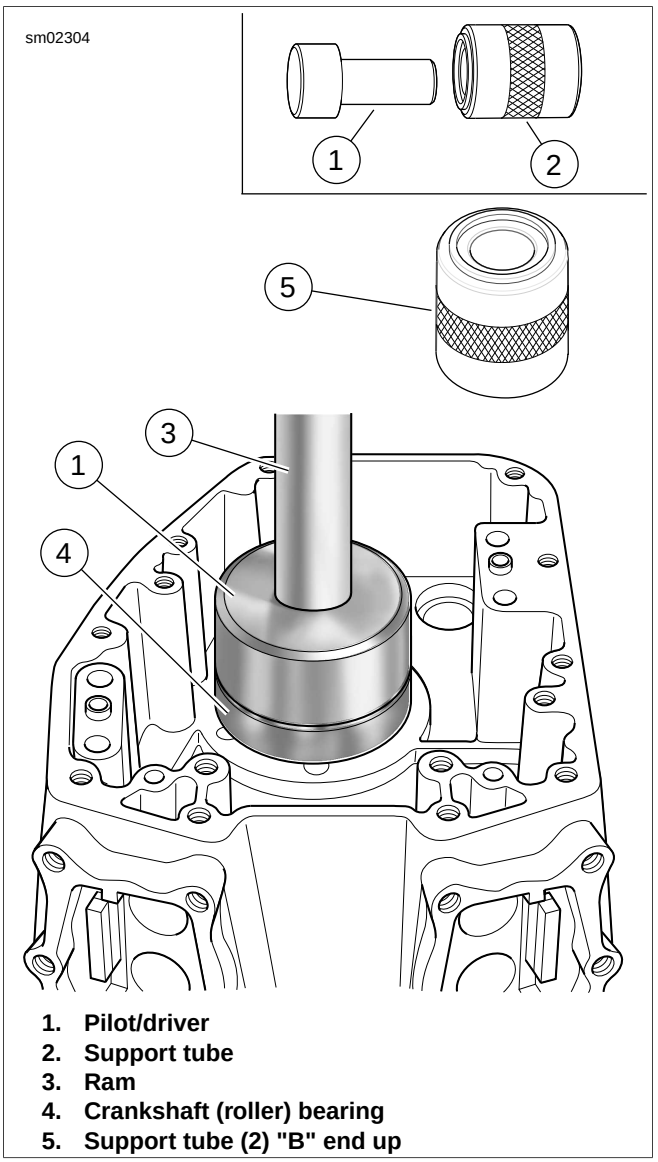
1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Support tube (2) "A" end up**

Figure 3-130. Crankshaft Bearing Removal

Crankshaft Bearing Installation

1. See Figure 3-131. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. B-45655) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-42720-5).
2. Obtain **new** crankshaft (roller) bearing (4). Spread a thin film of clean engine oil on O.D. of **new** bearing.
3. Turn support tube (2) over so that the "B" end is up. The sides of the support tube are stamped "A" and "B" to ensure proper orientation.
4. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube.
5. Lubricate leading edge (letter side) of **new** crankshaft (roller) bearing with clean engine oil. Start leading edge of bearing in bearing bore.

6. Slide pilot/driver (1) through bearing into support tube.
7. Center pilot/driver under ram (3) of press. Apply pressure to pilot/driver until resistance is felt and bearing is bottomed on the support tube.
8. Remove pilot/driver and crankcase half from support tube.

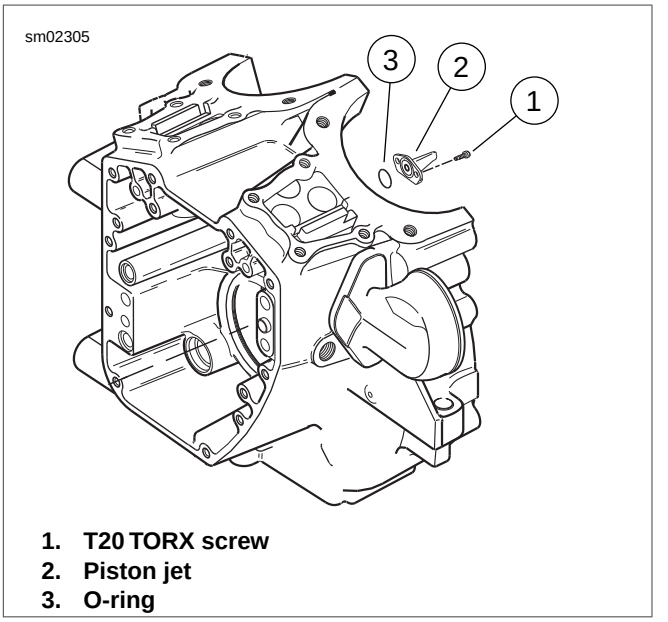


1. **Pilot/driver**
2. **Support tube**
3. **Ram**
4. **Crankshaft (roller) bearing**
5. **Support tube (2) "B" end up**

Figure 3-131. Crankshaft (Roller) Bearing Installation

Piston Jets Removal

1. See Figure 3-132. Remove two T20 TORX screws (1) to free piston jet (2) from crankcase.
2. Remove o-ring (3) from groove in mounting flange of jet. Discard o-ring.



1. **T20 TORX screw**
2. **Piston jet**
3. **O-ring**

Figure 3-132. Piston Jets

Piston Jets Installation

NOTES

- *If piston jet is being reused, apply LOCTITE THREADLOCKER 222 (purple) to threads of TORX screws before installation.*
- *O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong o-ring will have the same results. Since many o-rings are similar in size and appearance, always use **new** o-rings keeping them packaged until use to avoid confusion.*

1. See Figure 3-132. Apply a very thin film of clean H-D 20W50 engine oil to **new** o-ring (3) for piston jet. Install **new** o-ring in groove of jet mounting flange.
2. With jet pointed upward, start two T20 TORX screws (1) to secure piston jet (2) to crankcase. Tighten to 25-35 **in-lbs** (2.8-3.9 Nm).

LEFT CRANKCASE HALF

PART NUMBER	TOOL NAME
B-45655	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER
B-45655	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER
HD-42720-5	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE
HD-46663	CRANKCASE BEARING REMOVER ADAPTER

Crankshaft (Roller) Bearing Removal

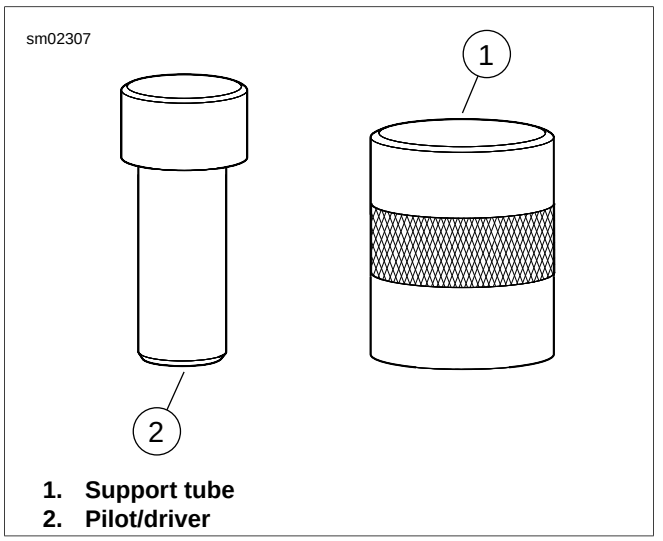
NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

⚠CAUTION

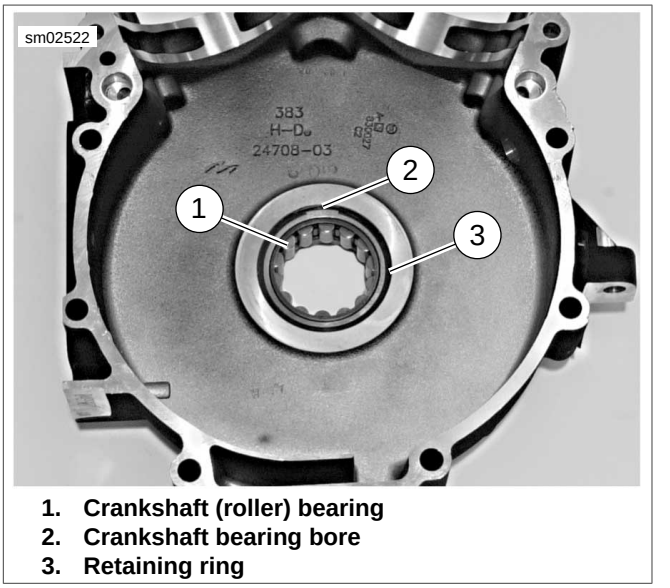
Do not rotate left crankcase half in engine stand such that flywheel sprocket shaft is facing up.The flywheel assembly can fall out, resulting in parts damage or moderate injury. (00552b)

1. While holding flywheel assembly so that it does not fall out of left crankcase half, rotate bottom end assembly in engine stand so assembly is upright and flywheel shafts are horizontal.
2. Carefully slide flywheel assembly out of left crankcase and place it in a clean safe place.
3. Unbolt left crankcase half from stand and move it to bench area. Remove thrust washer from outboard side of crankcase half by pulling it past oil seal. Set thrust washer aside for inspection or reuse.
4. See Figure 3-133. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-42720-5) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. B-45655).
5. Place support tube on work bench with "B" end up. Note that the sides of the support tube are stamped "A" and "B" to indicate proper orientation. With inboard side of left crankcase half facing upward, position crankshaft bearing bore over support tube.
6. Use a suitable drift punch to tap oil seal from crankcase bore. Discard oil seal.
7. See Figure 3-134. The left crankshaft (roller) bearing (1) is press-fit into the crankshaft bearing bore (2) in the left crankcase and secured with a retaining ring (3) on the inboard side. See Figure 3-135. Using the tip of a flat blade screwdriver, carefully lift the edge of the retaining ring up out of its groove in the crankcase. Slide the screwdriver tip around the edge of the bearing, lifting the retaining ring up and out of the groove. Be careful not to damage the lip of the groove in the crankcase.



1. **Support tube**
2. **Pilot/driver**

Figure 3-133. Left Crankshaft (Roller) Bearing Remover and Installer Tools



1. **Crankshaft (roller) bearing**
2. **Crankshaft bearing bore**
3. **Retaining ring**

Figure 3-134. Left Crankshaft (Roller) Bearing Assembly

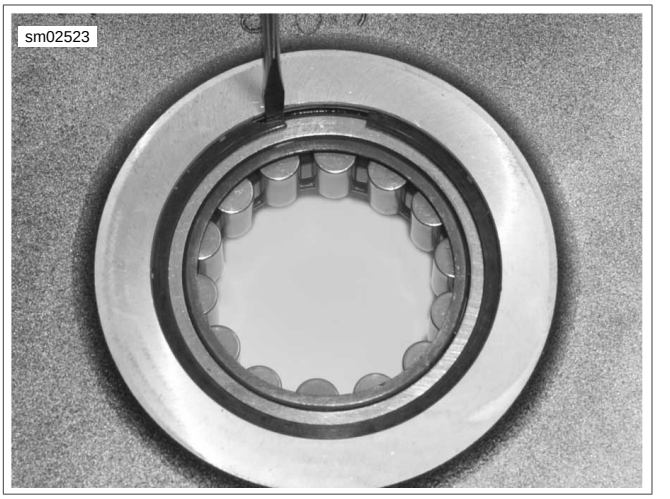
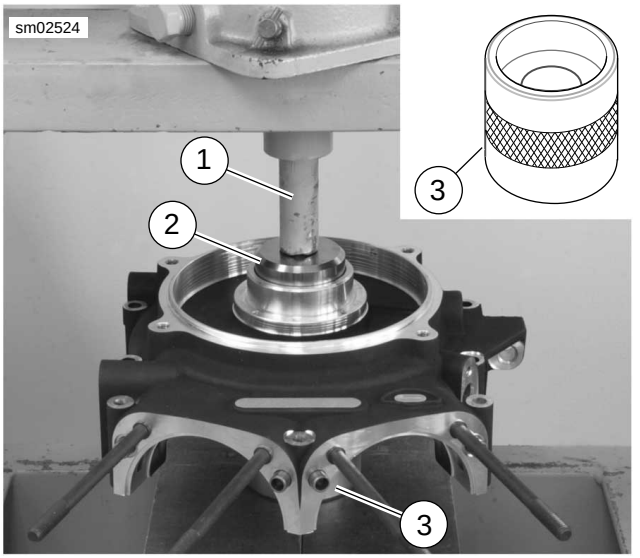
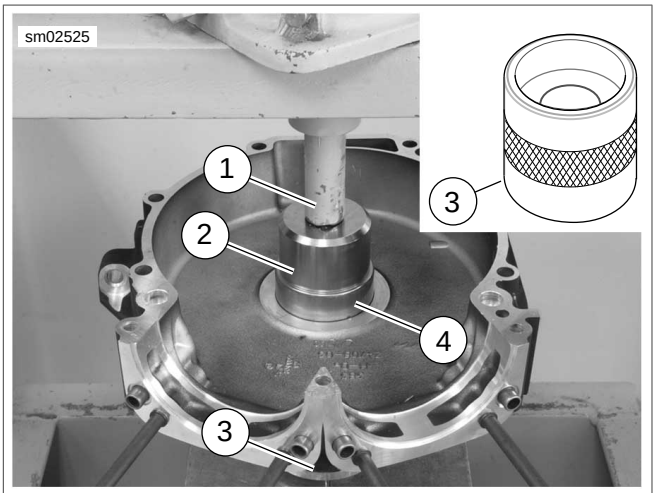


Figure 3-135. Removing Retaining Ring



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**

Figure 3-136. Left Crankshaft (Roller) Bearing Removal



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**
4. **Crankshaft (roller) bearing**

Figure 3-137. Left Crankshaft (Roller) Bearing Installation

8. See Figure 3-136. Place support tube (3) on hydraulic press table with the "A" end up. Note that the sides of the support tube are stamped "A" and "B" to ensure proper orientation.
9. With the outboard side of the left crankcase half facing upward, position crankshaft bearing bore over support tube.
10. Slide pilot/driver (2) through crankshaft (roller) bearing into support tube.
11. Center pilot/driver under ram (1) of press. Apply pressure to pilot/driver until bearing is free.
12. Remove crankcase half, pilot/driver and bearing from support tube. Discard bearing.

Crankshaft (Roller) Bearing Installation

NOTE

Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and could be dropped.

1. See Figure 3-133. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-42720-5), CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. B-45655) and CRANKCASE BEARING REMOVER ADAPTER (Part No. HD-46663).
2. See Figure 3-137. Obtain **new** crankshaft (roller) bearing (4). Place a thin film of clean engine oil on outer diameter of bearing.
3. Place support tube (3) on hydraulic press table with the "B" end up.
4. With the inboard side of the left crankcase half facing upward, position crankshaft bearing bore over support tube.
5. Lubricate leading edge of **new** crankshaft (roller) bearing before placement. Start **new** crankshaft (roller) bearing in bearing bore, letter side down.
6. Slide pilot/driver (2) and adapter through bearing into support tube.
7. Center pilot/driver (2) under ram (1) of press. Apply pressure to pilot/driver until bearing is lightly bottomed in crankshaft bearing bore.
8. Remove crankcase half and pilot/driver from support tube.
9. Obtain **new** retaining ring and install in bearing bore in inboard side of crankcase half. Work retaining ring into groove, being careful not to damage edges of groove. Make sure retaining ring is fully seated in groove.

NOTE

If retaining ring will not fit into groove in bearing bore, it is a sign that the bearing is not fully seated in the bore. Examine the bearing and bore. If necessary, remove bearing, clean bore and reinstall bearing. Then install retaining ring.

SPROCKET SHAFT BEARING INNER RACE

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-25070	ROBINAIR HEAT GUN
HD-34902B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER
HD-44358	FLYWHEEL SUPPORT FIXTURE
HD-95637-46B	WEDGE ATTACHMENT
HD-95637-46B	WEDGE ATTACHMENT
HD-95964-52	SPORTSTER 4-SPEED CLUTCH SPRING COMPRESSOR SCREW SEAT
HD-97225-55C	SPROCKET SHAFT BEARING TOOL

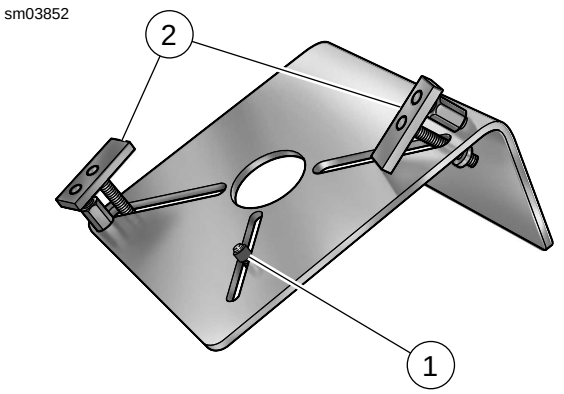
Removal

If reusing flywheel, remove bearing inner race and thrust washer as follows:

1. Obtain FLYWHEEL SUPPORT FIXTURE (Part No. HD-44358). See Figure 3-138. Install brass jaws or shop towels around teeth of vise to prevent damage to tool. Clamp tool in vise with the round hole topside.
2. Insert crankshaft end through hole resting flywheel assembly on fixture. Slide knurled locating pin down slot in tool to engage crank pin hole. Hand tighten locating pin.
3. Slide hold-down clamp down slot to engage inboard side of right flywheel half, and then hand tighten knurled nut at bottom to secure. Repeat step to secure hold-down clamp on opposite side of flywheel.

NOTE

For proper clamping force, hold-down clamp must not be tilted. Rotate hex on outboard stud until clamp is level.



1. **Locating pin**
2. **Hold-down clamp**

Figure 3-138. Flywheel Fixture (Part No. HD-44358)

4. Position WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of thrust washer and turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

5. Obtain two 3/8-16 inch bolts 7-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge and forcing screw from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (Part No. HD-34902B). Also obtain a suitable hardened washer or the SPORTSTER 4-SPEED CLUTCH SPRING COMPRESSOR SCREW SEAT (Part No. HD-95964-52).
6. Slide one bolt into channel on each side of bridge so that flat washer is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns.
7. Sparingly apply graphite lubricant to threads of forcing screw to prolong service life and ensure smooth operation. Start forcing screw into center hole of bridge.

NOTE

Failure to use hardened washer may result in damage to forcing screw and/or sprocket shaft.

8. Place hardened washer against end of sprocket shaft. Thread forcing screw into bridge until the steel ball at the end of the screw makes firm contact with hardened washer.
9. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

10. Turn forcing screw until thrust washer and bearing inner race move approximately 1/8 in. (3.2 mm).
11. Turn hex nuts an equal number of turns to separate halves of WEDGE ATTACHMENT (Part No. HD-95637-46B).
12. After bottoming thrust washer on shaft, reposition WEDGE ATTACHMENT (Part No. HD-95637-46B) on inboard side of bearing inner race. Turn hex nuts an equal number of turns to draw halves of wedge together.

CAUTION

Install wedge attachment only so far as necessary to ensure positive contact with bearing inner race. Installing tool with more contact than necessary will result in damage to the flywheel (00500b)

13. See Figure 3-139. Verify that the tool assembly is square, so that the bearing inner race is not cocked during removal.

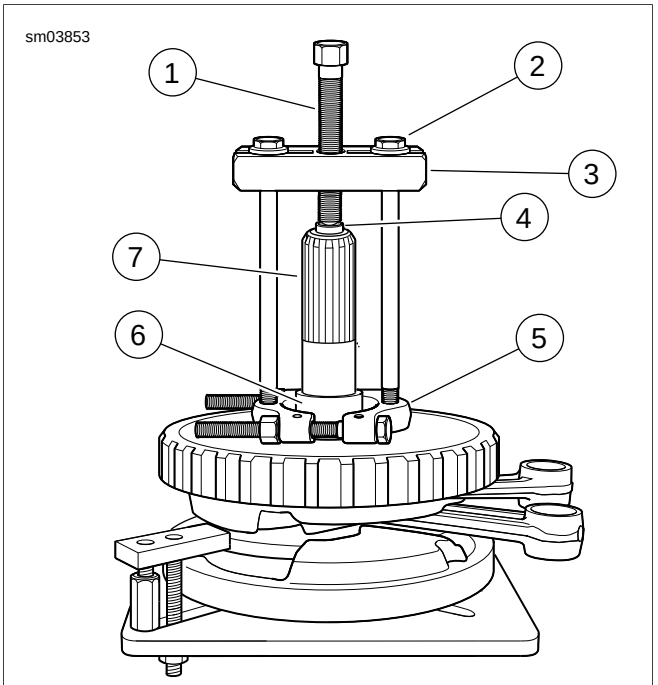
14. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat the bearing inner race for about 30 seconds using a circular motion.

NOTE

To facilitate removal without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

15. Turn forcing screw until bearing inner race is pulled free of sprocket shaft.

16. Remove thrust washer from sprocket shaft.



1. **Forcing screw**
2. **3/8-16 in. bolt with flat washer**
3. **Bridge**
4. **Hardened washer**
5. **Wedge attachment**
6. **Bearing inner race**
7. **Sprocket shaft**

Figure 3-139. Remove Inner Race from Sprocket Shaft

Installation

1. Place **new** thrust washer over sprocket shaft.

2. Place **new** bearing inner race on bench top. Using the ROBINAIR HEAT GUN (Part No. HD-25070), uniformly heat bearing inner race for about 60 seconds using a circular motion.

3. Wearing suitable gloves to protect hands from burns, place heated bearing inner race over sprocket shaft.

NOTE

To facilitate installation without heat, apply a light penetrating oil to shaft and leading edge of bearing inner race.

⚠WARNING

Do not use heating devices with penetrating oil. Penetrating oil is flammable which could result in death or serious injury. (00375a)

4. See Figure 3-140. Obtain the SPROCKET SHAFT BEARING TOOL (Part No. HD-97225-55C). Assemble tool as described below.
   a. See Figure 3-141. Thread pilot adapter into sprocket shaft.
   b. Thread pilot shaft onto pilot adapter.
   c. Slide long collar over pilot shaft until it contacts bearing inner race.
   d. Slide short collar over pilot shaft until it contacts long collar.
   e. Slide Nice bearing and large flat washer over pilot shaft.
   f. Sparingly apply graphite lubricant to threads of pilot shaft to prolong service life and ensure smooth operation.
   g. See Figure 3-142.Thread handle onto pilot shaft.

5. See Figure 3-143. Rotate handle of tool in a clockwise direction until bearing inner race makes firm contact with thrust washer. Verify that thrust washer cannot be rotated by hand.

6. Remove handle, flat washer, Nice bearing, short collar, long collar, pilot shaft and pilot adapter from sprocket shaft.

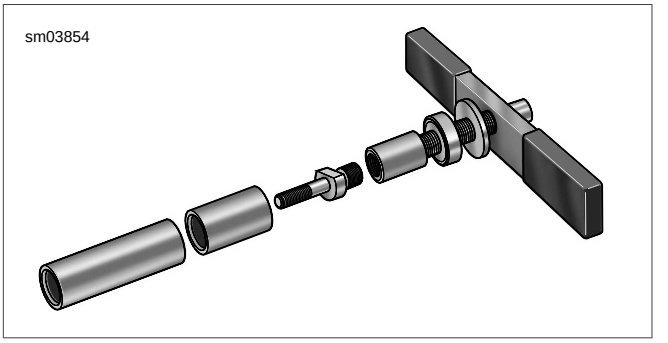


Figure 3-140. Sprocket Shaft Bearing Installer (Part No. HD-97225-55C)

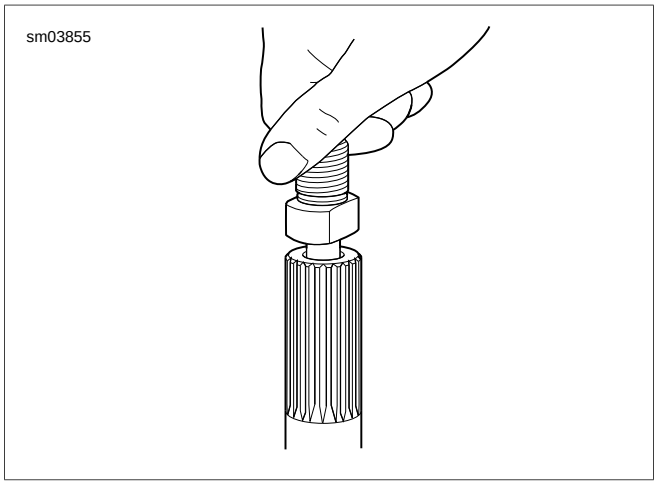
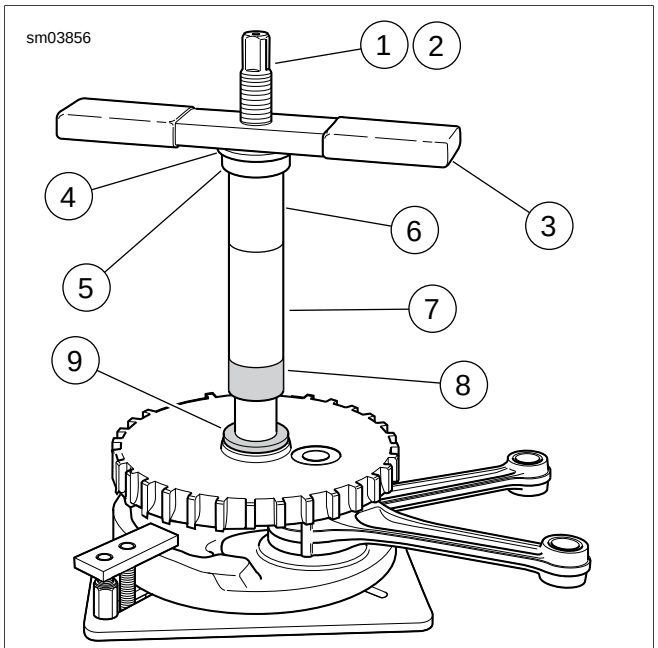


Figure 3-141. Thread Pilot Adapter into Sprocket Shaft



1. **Pilot adapter**
2. **Pilot shaft**
3. **Handle**
4. **Flat washer**
5. **Nice bearing**
6. **Short collar**
7. **Long collar**
8. **Inner race**
9. **Thrust washer**

Figure 3-142. Press Inner Race onto Sprocket Shaft: Setup

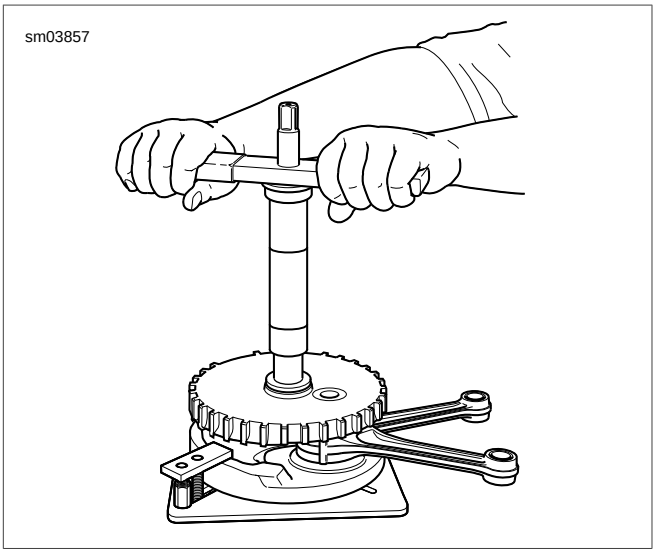


Figure 3-143. Press Inner Race onto Sprocket Shaft: Operation

CYLINDER STUDS

Removal

1. Thread a 3/8"-16 nut onto cylinder stud.
2. Thread a second nut onto stud until it contacts the first.
3. Placing wrench on first nut installed, remove stud.

Installation

1. Place a steel ball inside a head screw. Put the head screw on the end of the cylinder stud without the collar.
2. Start the stud in the cylinder deck with the collar side down. Tighten using air gun until collar reaches crankcase.
3. Hand tighten stud to 10-20 ft-lbs (3.6-27.1 Nm).

PIPE PLUG AND OIL FITTINGS

Removal

1. See Figure 3-144. Turn pipe plugs counterclockwise until free.

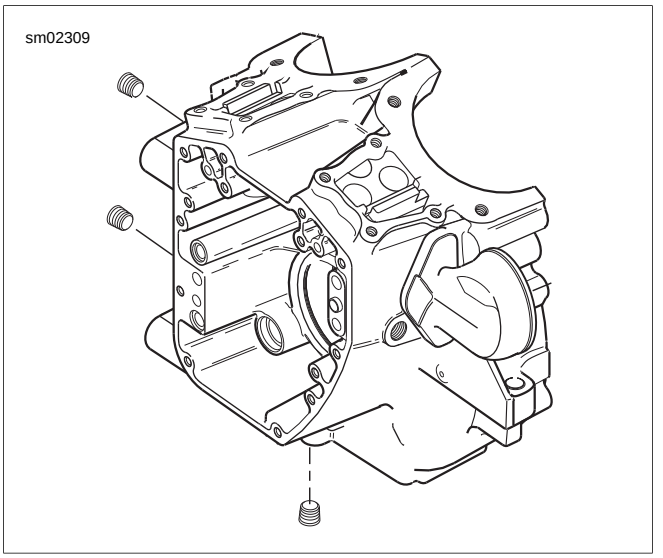


Figure 3-144. Pipe Plugs

Installation

1. Apply LOCTITE PIPE SEALANT 565 to threads.
2. Install pipe plugs. Tighten pipe plugs to 120-144 **in-lbs** (13.6-16.3 Nm).

CLEANING AND INSPECTION

1. Scrape old gasket material from the crankcase flanges. Old gasket material left on mating surfaces will cause leaks.
2. Clean all parts in a non-volatile cleaning solution or solvent.

WARNING

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

3. Blow parts dry with low pressure compressed air.
4. Verify that all oil holes and passageways are clean and open.
5. Check ring dowels for looseness, wear or damage. Replace as necessary.
6. Use a file to carefully remove any nicks or burrs from machined surfaces.
7. Clean out tapped holes and clean up damaged threads.
8. Check the top of the crankcase for flatness with a straightedge and feeler gauge. Replace if warped.
9. Spray all machined surfaces with clean engine oil.

INSTALLATION OVERVIEW

1. Perform all steps under 3.18 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.16 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. Perform all steps under 3.15 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.17 BOTTOM END OVERHAUL: DISASSEMBLY.
3. Remove sprocket shaft bearing. See 3.27 CRANKCASE.

INSPECTION

NOTE

Do not attempt to straighten connecting rods. Straightening rods will damage both the upper bushing and lower bearing.

1. Replace the flywheel/connecting rod assembly if any of the following conditions are noted:
   a. Connecting rods are bent or twisted.
   b. Connecting rods do not fall under their own weight or are in a bind.
   c. Sprocket teeth are worn in an irregular pattern or chipped.
   d. The crankshaft (roller) bearing inner races are brinelled, burnt, scored, blued or damaged.

NOTE

Bluing on connecting rods is part of the hardening process and is considered a normal condition.

2. Check connecting rod bearing clearance. Orient the assembly as shown in Figure 3-145.
   a. Holding the shank of each rod just above the bearing bore, pull up and down on the connecting rods.
   b. Any discernible up and down movement indicates excessive lower bearing clearance. Replace the flywheel/connecting rod assembly.
3. See Figure 3-146. Check connecting rod side play.
   a. Insert a feeler gauge between the thrust washer and the outboard side of the connecting rod.
   b. Replace the assembly if rod side play exceeds 0.020 in. (0.51 mm).

NOTE

If the flywheel, connecting rods or right side bearing inner race need to be replaced, then replace the entire flywheel assembly.

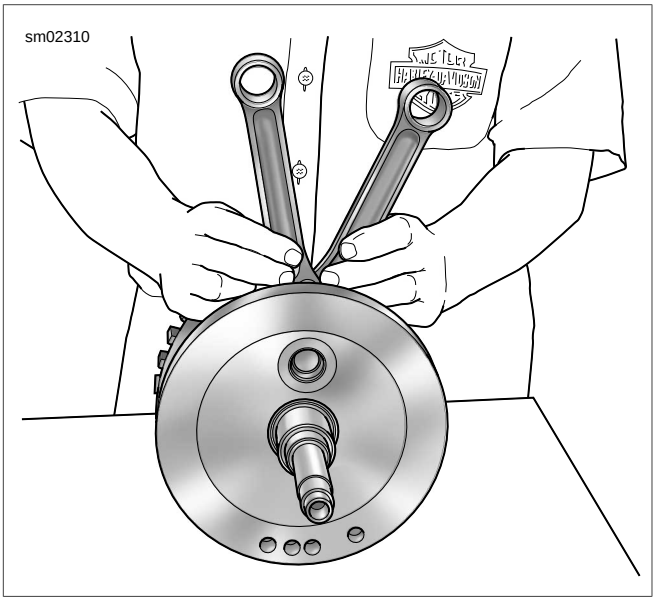


Figure 3-145. Connecting Rod Bearing Clearance

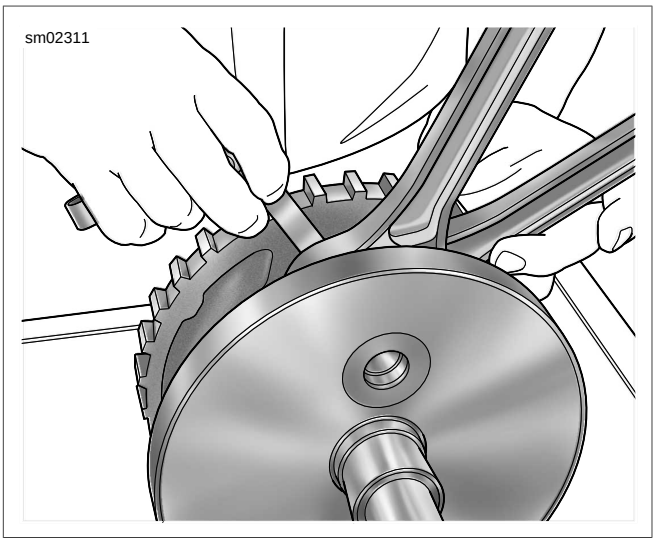


Figure 3-146. Connecting Rod Side Play

INSTALLATION OVERVIEW

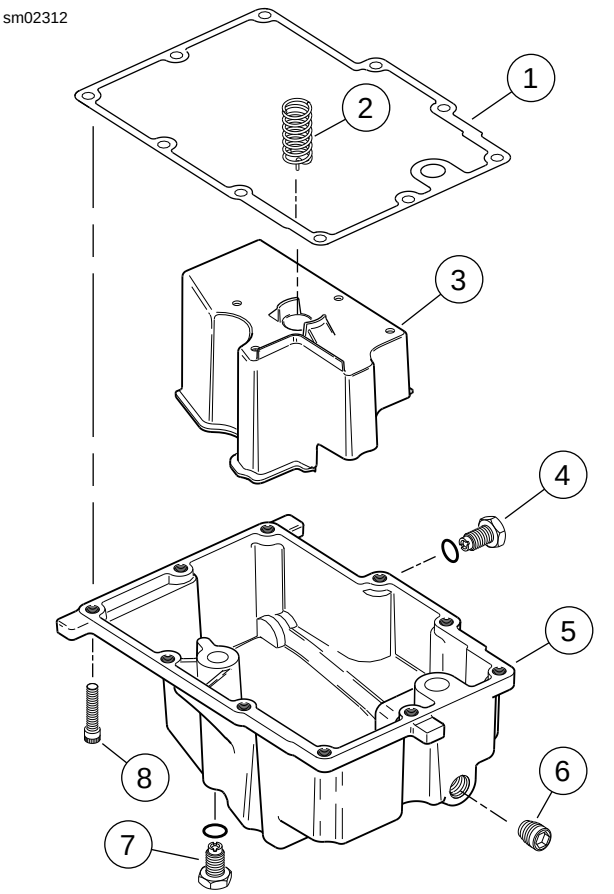
1. Perform all steps under 3.18 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.16 TOP END OVERHAUL: ASSEMBLY.

REMOVAL

NOTE

When jacking up motorcycle, do not apply pressure directly to the oil pan. Damage can occur unless measures are taken to distribute the pressure (such as a block of wood placed between the jack and the oil pan). A suitable lift which applies pressure at the tires is the only recommended method for raising the motorcycle.

1. Position motorcycle on a suitable lift.
2. See Figure 3-147. Drain fluids from oil pan.
   a. Remove engine oil drain plug (4), fill plug/dipstick and oil filter. Drain oil into suitable container. See 1.4 ENGINE OIL AND FILTER.
   b. Remove transmission drain plug (7). Drain transmission fluid into suitable container. See 1.10 TRANSMISSION LUBRICANT.
3. Remove ten screws (8) that secure the oil pan to the transmission housing.
4. Remove oil pan (5) and gasket (1). Discard gasket.
5. Remove baffle assembly (3) and spring (2) from oil pan.



1. **Gasket**
2. **Spring**
3. **Baffle assembly**
4. **Engine oil drain plug**
5. **Oil pan**
6. **Pipe plug**
7. **Transmission drain plug and O-ring**
8. **Screw (10)**

Figure 3-147. Oil Tank: Dyna Glide

INSTALLATION

1. Clean and examine all flange surfaces. Examine drain plug O-rings for tears or damage. Replace O-rings as required.
2. See Figure 3-147. Insert baffle assembly (3) and spring (2) in oil pan.
3. Place **new** gasket (1) on oil pan.

NOTE

Use a few drops of HYLOMAR to keep gasket in place and simplify installation.

4. Position gasket and oil pan on transmission housing and install with ten screws (8). Tighten to 84-108 **in-lbs** (9.5-12.2 Nm) following sequence shown in Figure 3-148.

5. Wipe any foreign material from engine and transmission drain plugs. Install plugs with O-rings. Tighten plugs to 14-21 ft-lbs (19.0-28.5 Nm).
6. Remove motorcycle from lift.
7. Replace fluids.
   a. Fill transmission with transmission fluid and check level. See 1.10 TRANSMISSION LUBRICANT.
   b. Install engine oil filter and fill oil pan. Check oil level with hot engine after inspecting for leaks. See 1.4 ENGINE OIL AND FILTER.

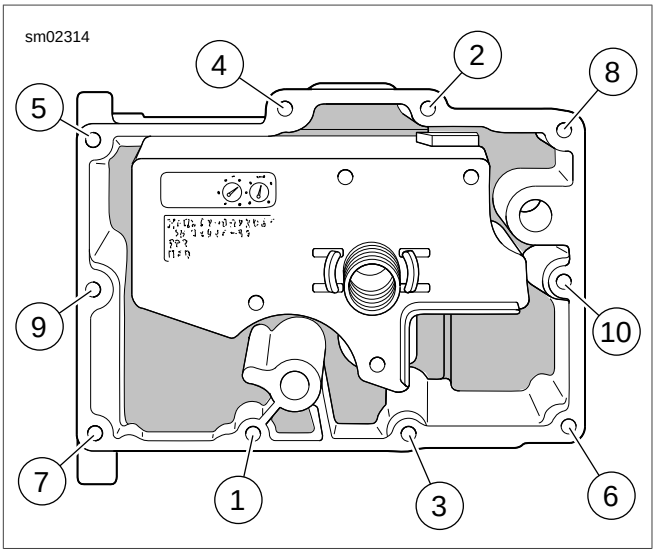


Figure 3-148. Oil Pan Torque Sequence

SUBJECT	PAGE NO.

4.1 SPECIFICATIONS: FUEL SYSTEM....4-1
4.2 ELECTRONIC FUEL INJECTION (EFI)....4-2
4.3 IDLE SPEED....4-3
4.4 AIR CLEANER ASSEMBLY....4-4
4.5 FUEL TANK....4-7
4.6 THROTTLE POSITION SENSOR (TPS)....4-10
4.7 INTAKE AIR TEMPERATURE SENSOR (IAT)....4-11
4.8 ENGINE TEMPERATURE SENSOR (ET)....4-12
4.9 INDUCTION MODULE....4-14
4.10 IDLE AIR CONTROL (IAC)....4-16
4.11 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP)....4-17
4.12 OXYGEN SENSOR....4-18
4.13 FUEL INJECTORS....4-19
4.14 FUEL PUMP....4-21
4.15 FUEL PRESSURE TEST....4-29
4.16 EXHAUST SYSTEM....4-31
4.17 INTAKE LEAK TEST....4-37
4.18 EVAPORATIVE EMISSIONS CONTROL (CA MODELS)....4-39

NOTES

SPECIFICATIONS

Table 4-1. Fuel Capacity

CAPACITY	FXD FXDL FXDB	FXDWG FXDC FXDF
Total (gallons)	4.8	5.1
Total (liters)	18.5	19.3

TROUBLESHOOTING

See the ELECTRICAL DIAGNOSTIC MANUAL for troubleshooting and diagnostic information.

GENERAL

PART NUMBER	TOOL NAME
HD-44750	DIGITAL TECHNICIAN

Idle speed can only be set using a computer based diagnostic package called DIGITAL TECHNICIAN (Part No. HD-44750), available only to Harley-Davidson dealers.

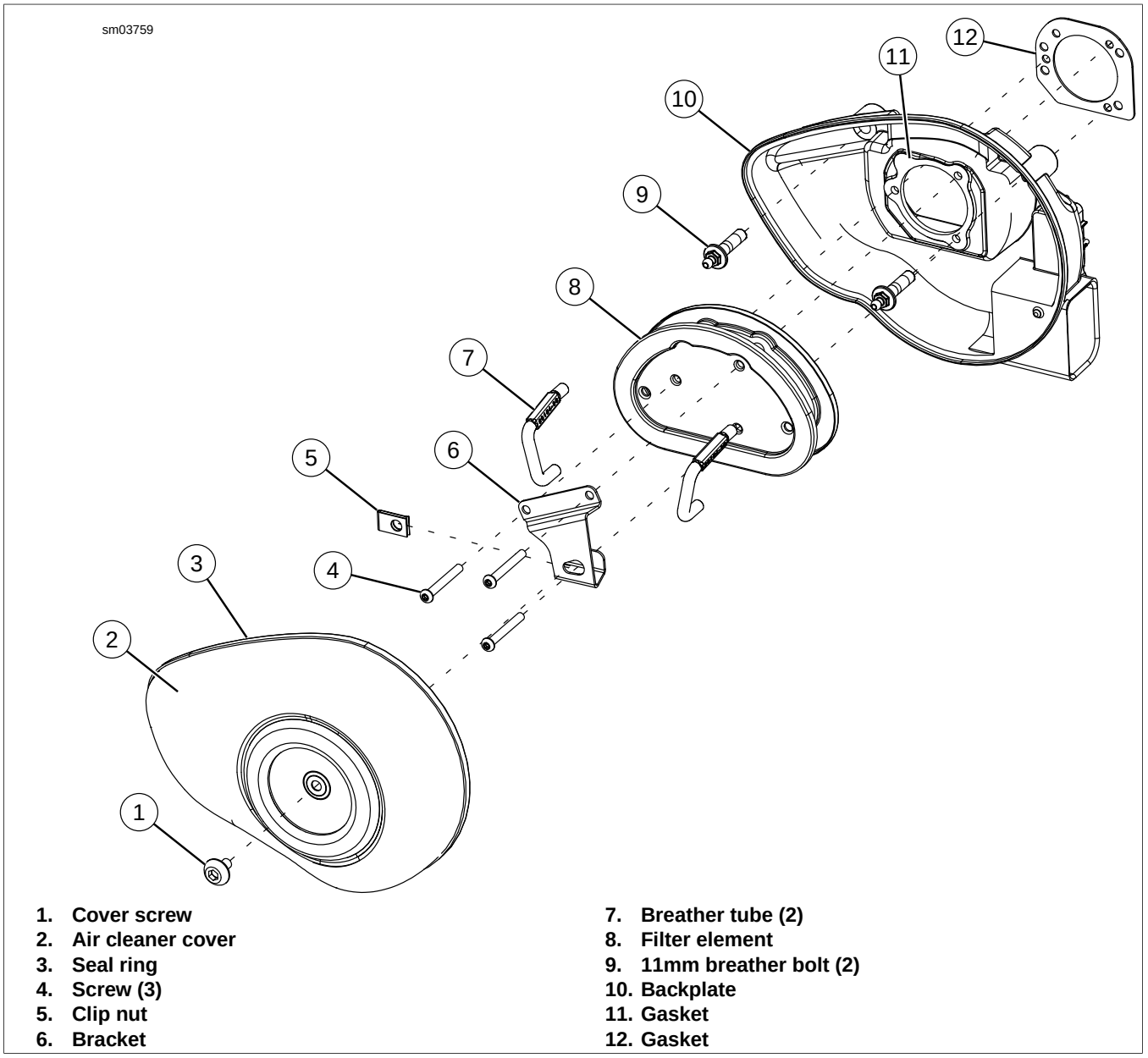
REMOVAL

1. See Figure 4-1. Remove screw (1) and air cleaner cover (2).
2. Gently pull both rubber breather tubes (7) from the element.
3. Slide clip-nut (5) to the left to allow access to third screw. Remove three screws (4), bracket (6) and filter element (8).
4. Gently pull the breather tubes from the breather bolts on the backplate.

⚠WARNING

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

5. Inspect filter element. See 1.7 AIR CLEANER AND EXHAUST SYSTEM. Replace the filter element if damaged or if filter media cannot be adequately cleaned.
6. Inspect seal ring (3) for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
7. Alternately back out both breather bolts (9) (metric) a few turns a time while pulling backplate (10) away from induction module.
8. Continue previous step until breather bolts are clear. Remove backplate (10), gasket (11) and gasket (12). Discard gaskets.
9. Wipe inside of air cleaner cover (2) and backplate (10) with damp cloth to remove dust.



1. **Cover screw**
2. **Air cleaner cover**
3. **Seal ring**
4. **Screw (3)**
5. **Clip nut**
6. **Bracket**
7. **Breather tube (2)**
8. **Filter element**
9. **11mm breather bolt (2)**
10. **Backplate**
11. **Gasket**
12. **Gasket**

Figure 4-1. Air Cleaner Assembly

INSTALLATION

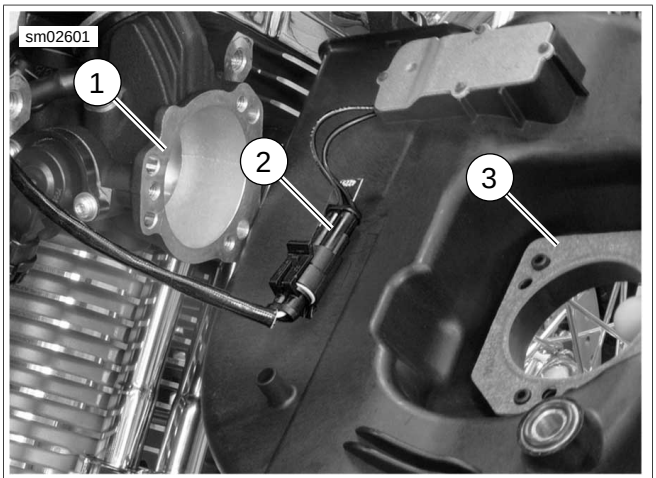
1. See Figure 4-1. Position **new** gasket (12) on backplate. Insert two breather bolts (9) (metric) into backplate. Thread bolts loosely into each cylinder head. Final tighten bolts to 22-24 ft-lbs (29.8-32.5 Nm).
2. Position **new** gasket (11) on filter element (8). Make sure gasket holes are aligned with screw holes.
3. Attach breather tubes (7) to breather screws on backplate.
4. Install air filter element (8) and bracket (6) using three screws (3). Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). Slide clip-nut (5) to the right and into place.
5. Insert breather tubes (7) into holes in filter element.
6. Install air filter cover (2).
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of air cleaner cover screw (1).
   b. Install air cleaner cover and tighten screw to 36-60 **in-lbs** (4.1-6.8 Nm).

BACKPLATE ASSEMBLY: HDI MODELS

See Figure 4-2. HDI models have unique backplates. These parts may be distinguished by:

- A different intake with a solenoid-operated trap door assembly at the mouth of the intake.
- An intake solenoid connector (2) on the backplate.

Perform the same routine maintenance on HDI models, but also check that the trap door in the backplate operates properly.



1. **Intake module**
2. **Intake solenoid connector [178]**
3. **Air cleaner backing plate**

Figure 4-2. Backplate: HDI Models

GENERAL

WARNING

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

The fuel tank is treated to resist rusting. However, when the motorcycle is not operated for a long period of time, see 1.26 STORAGE for specific information regarding fuel tank treatment.

For information on the tank-mounted fuel gauge, see the electrical diagnostic manual and 8.15 FUEL GAUGE.

REMOVAL

WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Remove electrical caddy cover.
2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-3. Remove the fuel pump fuse from the fuse block.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

WARNING

Do not twist fuel line fitting, as fuel line can crack causing a fuel leak. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00274a)

3. See Figure 4-4. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

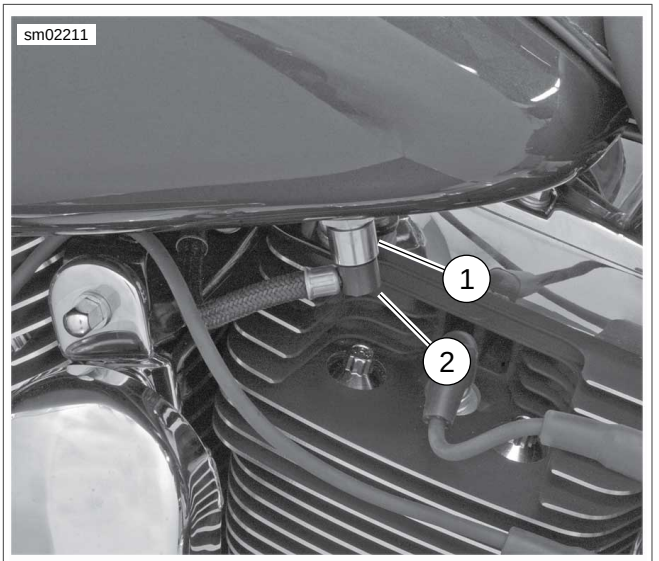
WARNING

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

4. Disconnect negative battery cable.
5. Remove instrument panel.
   a. For FXDWG/FXDC/FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
   c. For FXD models, see 8.15 FUEL GAUGE.



Figure 4-3. Fuel Pump Fuse



1. Quick connect fitting
2. Fuel supply line

Figure 4-4. Fuel Supply Line Fitting

6. See Figure 4-5. Unplug fuel pump module connector [141].

WARNING

Gasoline can drain from the crossover line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00259a)

7. Drain fuel tank.
   a. Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to ensure that end is securely plugged.
   b. See Figure 4-6. Cut clamp (2) from one end of crossover hose (3). Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.
8. See Figure 4-7. Disconnect crossover hose (1) and continuous venting vent line (9).
9. Remove the front mounting bolt (2), flat washers (3), and acorn nut (4).
10. Remove the rear mounting bolt (5), flat washers (6), and acorn nut (7).
11. See Figure 4-6. Disconnect fuel gauge connector [117] (1) located under left side of fuel tank.

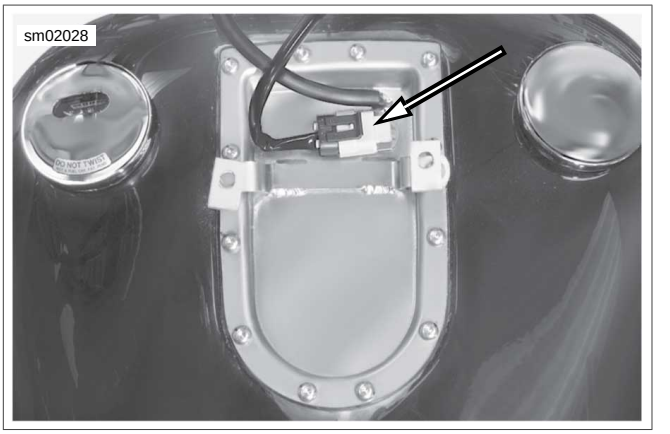
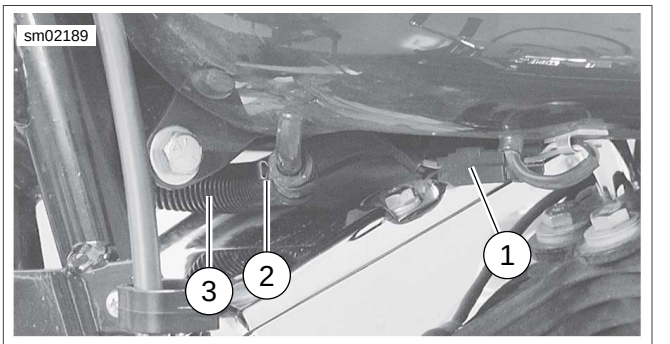
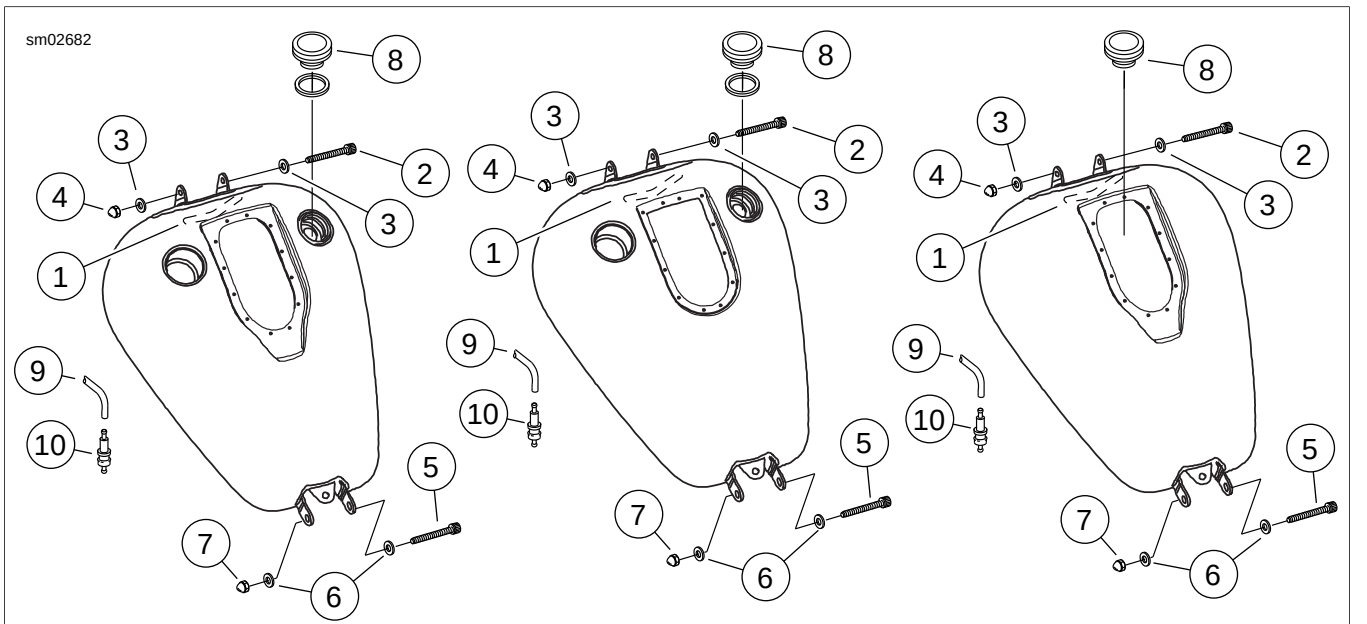


Figure 4-5. Fuel Pump Module Connector [141]



1. **Fuel gauge connector [117]**
2. **Clamp**
3. **Crossover hose**

Figure 4-6. Fuel Gauge Connector and Crossover Hose



1. **Crossover line**
2. **Front mounting fastener**
3. **Flat washer (2)**
4. **Acorn nut**
5. **Rear mounting fastener**
6. **Flat washer (2)**
7. **Acorn nut**
8. **Fuel cap**
9. **Continuous venting system vent line**
10. **Vapor valve**

Figure 4-7. Fuel Tank (Left: FXDL, FXDB, Center: FXDWG, FXDC, FXDF, Right: FXD)

CLEANING AND INSPECTION

1. Remove fuel pump. See 4.14 FUEL PUMP.
2. Remove fuel gauge sending unit. See 8.16 FUEL GAUGE SENDER.
3. Clean the tank interior with commercial cleaning solvent or a soap and water solution. Shake the tank to agitate the cleaning agent.
4. Flush the tank thoroughly after cleaning and allow it to air dry.
5. Inspect the interconnect lines, continuous venting system vent line (if applicable) and fuel line for cuts, cracks or holes. Replace lines as needed.
6. Inspect the tank for leaks and other damage. If a damaged tank cannot be successfully repaired, replace it.
7. Install fuel gauge sending unit. See 8.16 FUEL GAUGE SENDER.
8. Install fuel pump. See 4.14 FUEL PUMP.

INSTALLATION

PART NUMBER	TOOL NAME
HD-97087-65B	HOSE CLAMP PLIERS

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)

1. See Figure 4-8. Install continuous venting system vent line (9) to vapor valve (10).
2. Place a washer (3, 6) over each bolt (2, 5) and insert the bolts through the tank mounting lugs and frame bracket tubes.
3. Install acorn nuts (4, 7) and tighten to 15-20 ft-lbs (20.3-27.1 Nm).

NOTE

In next step, be sure crimped end of clamp faces toward front of vehicle.

4. Connect the crossover tube (1). Install **new** hose clamp using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
5. Connect the fuel feed line. Install **new** hose clamp using HOSE CLAMP PLIERS.
6. Connect the fuel gauge connector located under left side of fuel tank. See 8.15 FUEL GAUGE.
7. Install instrument panel.
   a. For FXDWG/FXDC/FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
   c. For FXD models, see 8.15 FUEL GAUGE.
8. Check for leaks.

Vapor Valve

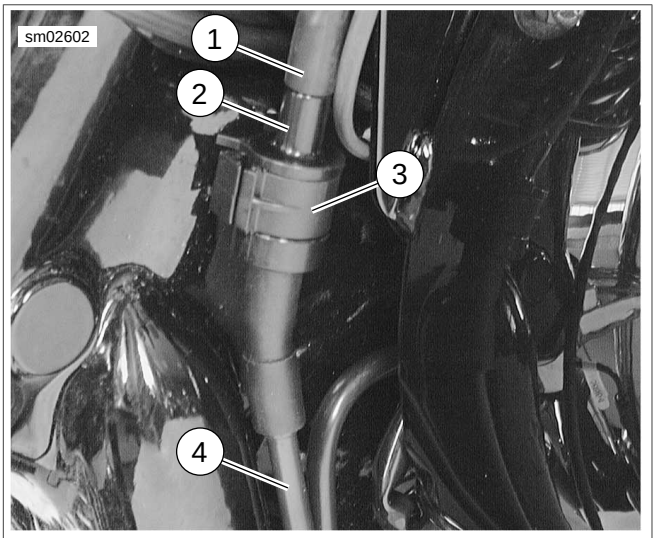
WARNING

Keep vent and vapor valve lines away from exhaust and engine. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00263a)

See Figure 4-8. The vapor valve (2) is clipped to the frame member just ahead of the fuel tank. Mark the two hoses (1, 4) connected to the upper and lower fittings of the vapor valve before removing it from its clip (3). When installing the vapor valve, place the valve back into the clip with the long necked end at the top.

NOTE

On California models, the hose from the vapor valve bottom fitting goes to the charcoal EVAP canister. On non-California models, the bottom fitting hose is vented to the atmosphere.



1. **Continuous venting system vent line**
2. **Vapor valve**
3. **Clip**
4. **Valve vent line**

Figure 4-8. Vapor Valve Installation (Typical)

GENERAL

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the throttle position sensor (TP sensor).

REMOVAL

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. Remove air cleaner backplate. See 4.4 AIR CLEANER ASSEMBLY.
4. See Figure 4-9. Unplug TP sensor connector [88].
5. Remove two fasteners to detach TP sensor from throttle body. Discard fasteners.

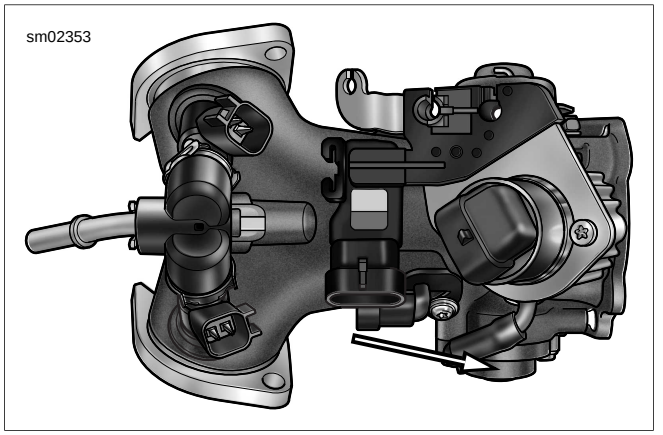


Figure 4-9. Throttle Position Sensor

INSTALLATION

NOTE

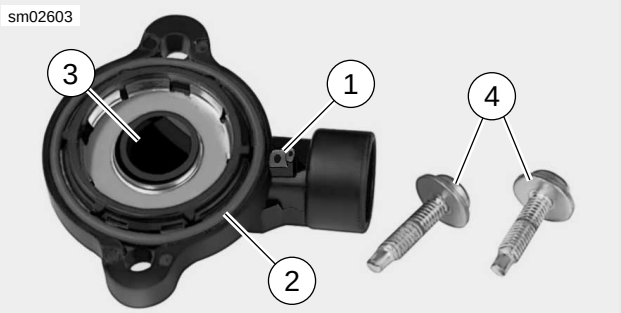
Throttle must be closed for proper installation of throttle position sensor.

1. See Figure 4-10. Inspect O-ring (2) in groove of throttle position sensor for cuts, tears or signs of deterioration. Install **new** O-ring if necessary.
2. Fit pocket (3) of throttle position sensor over throttle shaft while engaging index pin (1) with hole on machined flange of induction module.
3. Install two **new** fasteners (4) to fasten throttle position sensor to induction module. Tighten screws to 18 **in-lbs** (2.0 Nm).
4. Using the throttle lever mechanism, open and close the throttle plates to check for proper operation. Be sure that the mechanism operates smoothly without binding or sticking.
5. Connect TP sensor connector [88].
6. Install air cleaner assembly. See 4.4 AIR CLEANER ASSEMBLY.
7. Connect negative battery cable.

⚠WARNING

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

8. Install seat.



1. **Index pin**
2. **O-ring**
3. **Pocket**
4. **Fasteners**

Figure 4-10. Throttle Position Sensor Installation

GENERAL

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the intake air temperature sensor (IAT sensor).

REMOVAL

⚠WARNING

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

1. Disconnect negative battery cable.
2. Remove air cleaner backplate. See 4.4 AIR CLEANER ASSEMBLY.
3. See Figure 4-11. Unplug IAT sensor connector [89].
4. Remove fastener to detach IAT sensor. Discard fastener.

INSTALLATION

1. See Figure 4-12. Inspect O-ring (1) in groove of intake air temperature sensor for cuts, tears or signs of deterioration. Install **new** O-ring if necessary.
2. See Figure 4-11. Insert sensor into induction module with electrical connector facing toward the left side of the motorcycle.
3. See Figure 4-12. Install fastener (2) and tighten to 15-20 **in-lbs** (1.7-2.3 Nm).
4. Connect IAT sensor connector [89].
5. Install air cleaner assembly. See 4.4 AIR CLEANER ASSEMBLY.
6. Connect negative battery cable.

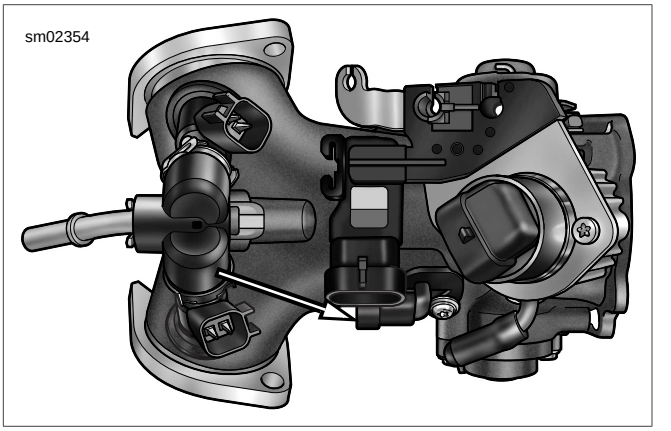
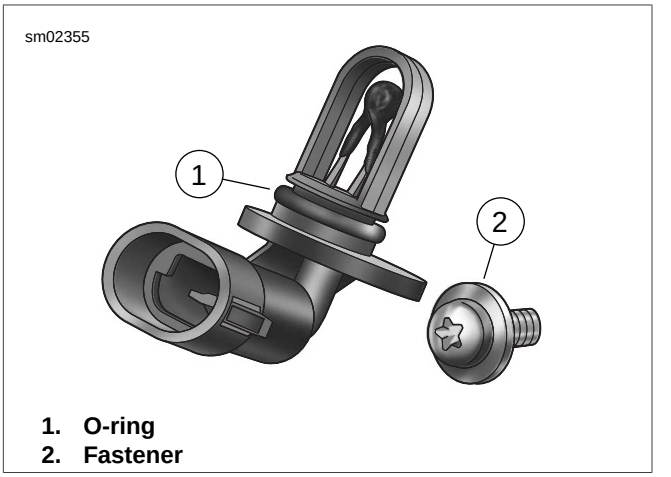


Figure 4-11. Intake Air Temperature Sensor Location



1. O-ring
2. Fastener

Figure 4-12. Intake Air Temperature Sensor

GENERAL

WARNING

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

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the engine temperature sensor (ET sensor).

REMOVAL

WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-13. Remove the fuel pump fuse from the fuse block.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

2. See Figure 4-14. Pull up on chrome sleeve of quick-connect fitting (1) and pull down on fuel supply line (2) to disconnect.

WARNING

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

3. Disconnect negative battery cable.
4. See Figure 4-15. Pull back boot to reveal ET sensor at back of front cylinder.
5. Unplug ET sensor connector [90] by pulling external latch outward and using rocking motion to remove.
6. See Figure 4-16. Loosen ET sensor using socket. When sensor starts to turn easily, finish removing by hand.

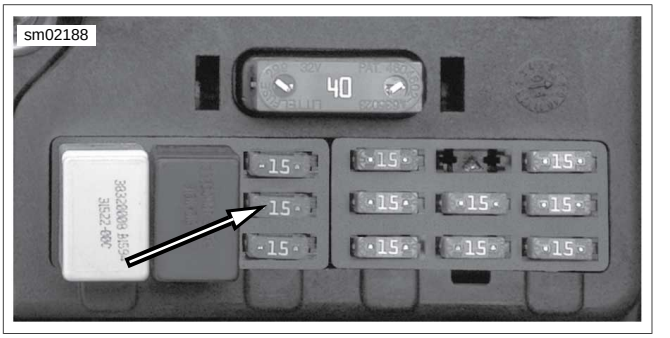
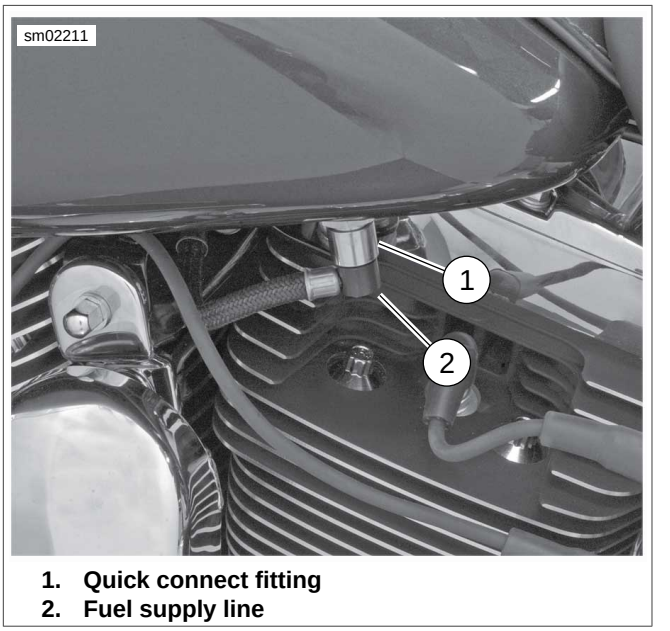


Figure 4-13. Fuel Pump Fuse



1. Quick connect fitting
2. Fuel supply line

Figure 4-14. Fuel Supply Line Fitting

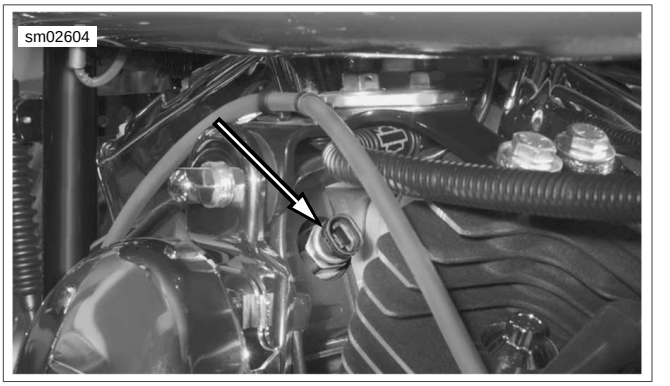


Figure 4-15. Engine Temperature Sensor



Figure 4-16. Engine Temperature Sensor Removal

INSTALLATION

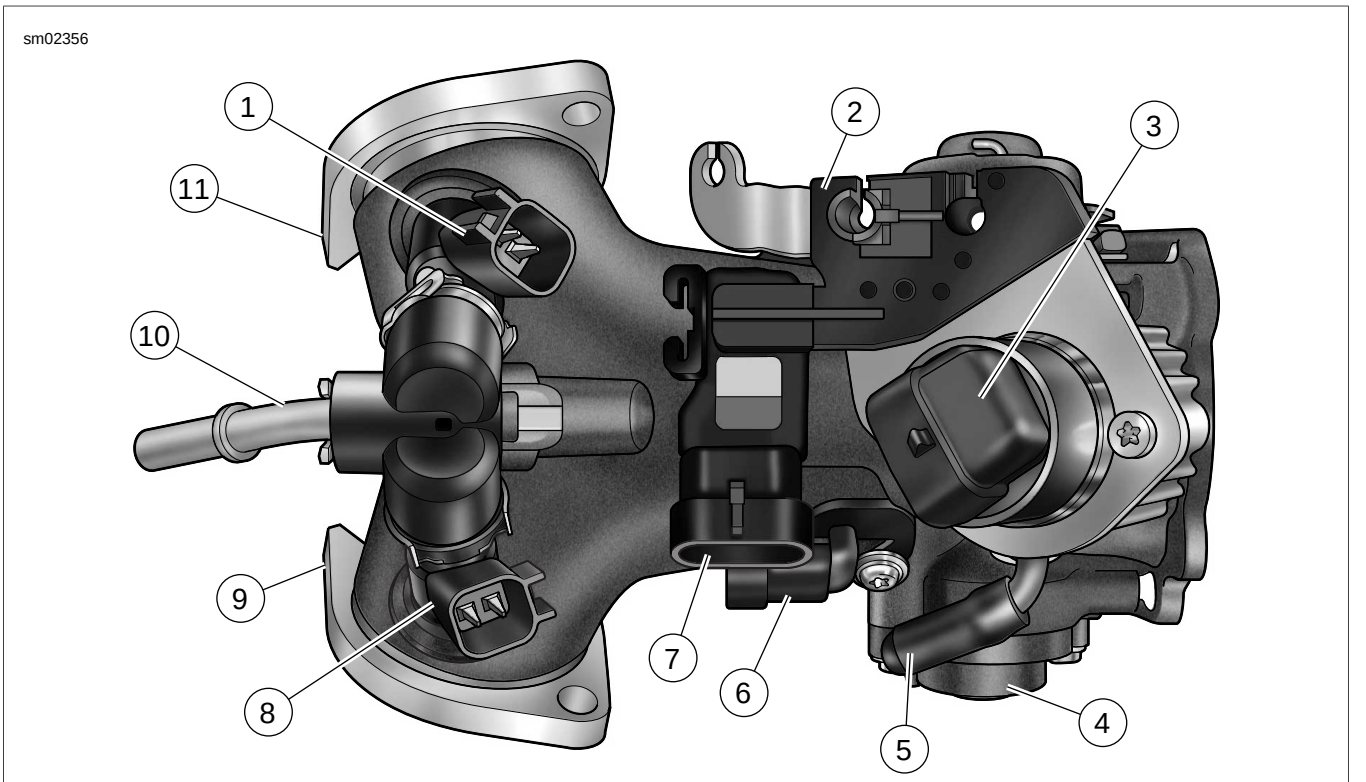
1. Hand start **new** ET sensor into cylinder head bore 2-3 turns.
2. Tighten sensor to 10-15 ft-lbs (13.6-20.3 Nm).
3. Connect ET sensor connector [90].
4. Pull boot over connector.
5. See Figure 4-14. Install fuel line fitting.
6. See Figure 4-13. Install fuel pump fuse.
7. Connect negative battery cable.

REMOVAL

⚠WARNING

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

1. Gain access to the induction module by removing fuel tank hardware and fuel line. Carefully pivot tank upward and prop in position. See 4.5 FUEL TANK.
2. Remove air cleaner backplate. See 4.4 AIR CLEANER ASSEMBLY.
3. See Figure 4-17. Pull purge hose from fitting (5) at top of induction module (California models only).
4. See Figure 4-18. Pull idle cable barrel (1) from upper hole in throttle wheel. Pull throttle cable barrel (2) from lower hole. Using slots, release idle and throttle cables from guides in throttle cable bracket.
5. See Figure 4-17. Remove idle air control connector (3) [87] and manifold absolute pressure sensor connector (7) [80].
6. Remove front fuel injector connector (1) [84] and rear fuel injector connector (8) [85].
7. Remove throttle position sensor connector (4) [88] and intake air temperature sensor connector (6) [89].



1. **Front fuel injector [84]**
2. **Throttle cable bracket**
3. **IAC connector [87]**
4. **TP sensor [88]**
5. **Purge hose fitting (used on California models only)**
6. **IAT sensor [89]**
7. **MAP sensor [80]**
8. **Rear fuel injector [85]**
9. **Rear mounting flange**
10. **Fuel supply tube**
11. **Front mounting flange**

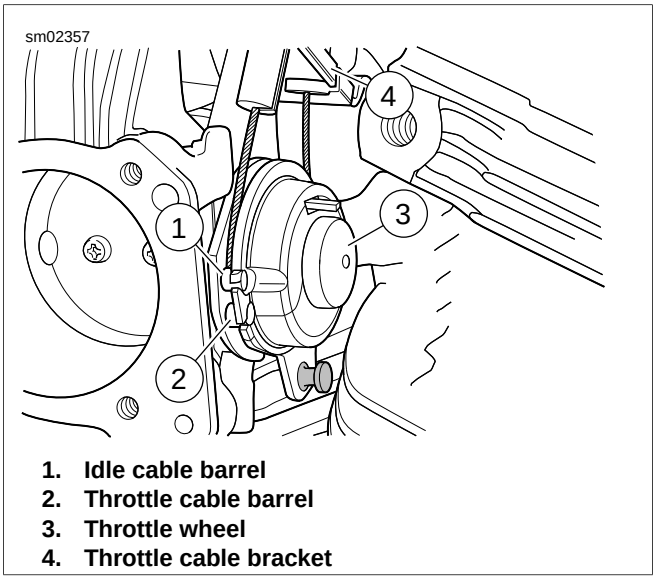
Figure 4-17. Induction Module

8. On left side of vehicle, loosen two hex screws holding front and rear mounting flanges (9, 11) to cylinder head.
9. On right side of vehicle, remove two Allen screws holding front and rear mounting flanges to cylinder head. Remove induction module from vehicle.

⚠WARNING

Gasoline can drain from the fuel line when disconnected from induction module. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00269a)

10. See Figure 4-20. If fuel supply line (2) is being replaced, depress tab (1) and pull to release from fuel supply tube (3).
11. Remove seals from flange adapters. Discard seals. Remove flange adapters from outlet ports of induction module.



1. **Idle cable barrel**
2. **Throttle cable barrel**
3. **Throttle wheel**
4. **Throttle cable bracket**

Figure 4-18. Throttle/Idle Cables

INSTALLATION

1. See Figure 4-17. Place a **new** seal in each mounting flange (9, 11) with the beveled side in against the counter-bore.

NOTE

When induction module is positioned on manifold mounting screws, be sure the flanges are installed correctly on the manifold. Be sure the rubber seals are in place.

2. Place intake manifold seal, flanges, and induction module in position. Install the manifold mounting screws finger tight.
3. See Figure 4-20. Slide fuel supply line (2) onto fuel supply tube (3).
4. See Figure 4-18. Install sleeve on throttle cable housing into cable guide at top of throttle cable bracket (4). Drawing throttle cable downward, fit barrel end (2) into lower hole in throttle wheel (3). Install sleeve and spring on idle cable housing into cable guide at bottom of throttle cable bracket inserting barrel end (1) into upper hole in throttle wheel.
5. See Figure 4-17. On California models, attach purge hose to fitting (5) on throttle body.
6. Connect front (1) and rear (8) fuel injector connectors, IAC (3) connector, MAP sensor (7) connector, TP sensor (4) connector and IAT (6) sensor connector.
7. Install air cleaner back plate. See 4.4 AIR CLEANER ASSEMBLY.
8. Tighten manifold mounting screws to 96-144 **in-lbs** (10.8-16.3 Nm).
9. Turn the Ignition/Light Key Switch to ON and then back to OFF to reset idle air control to park position.
10. Install air cleaner filter and cover.
11. Secure fuel tank. See 4.5 FUEL TANK.

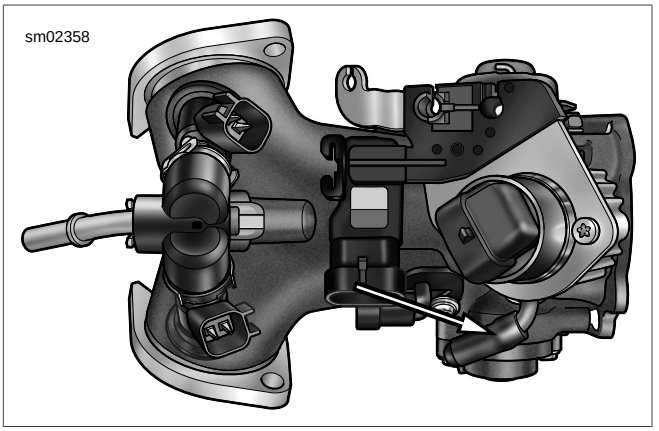
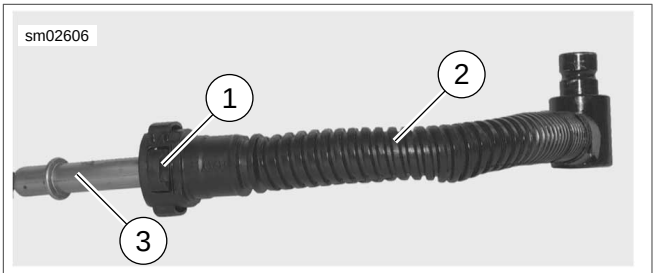


Figure 4-19. EVAP Hose Connection



1. **Tab**
2. **Fuel supply line**
3. **Fuel supply tube**

Figure 4-20. Fuel Supply Line

GENERAL

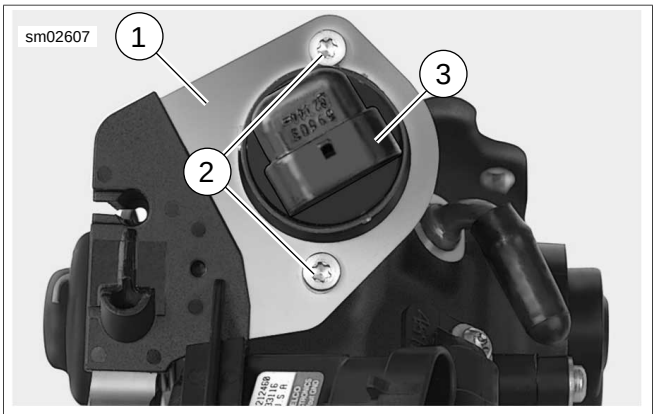
⚠WARNING

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

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the idle air control (IAC).

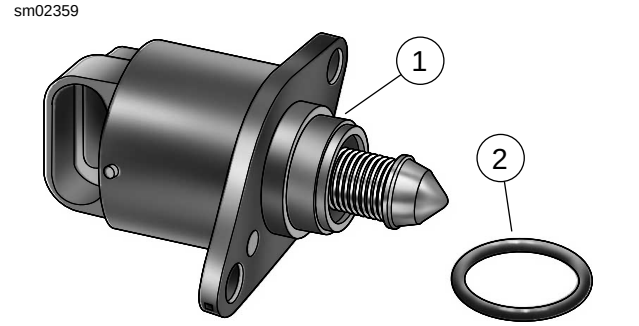
REMOVAL

1. Remove induction module. See 4.9 INDUCTION MODULE.
2. See Figure 4-21. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. See Figure 4-22. Pull IAC (1) and O-ring (2) from throttle body.



1. **Throttle cable bracket**
2. **Fasteners**
3. **Idle air control (IAC)**

Figure 4-21. Idle Air Control Location

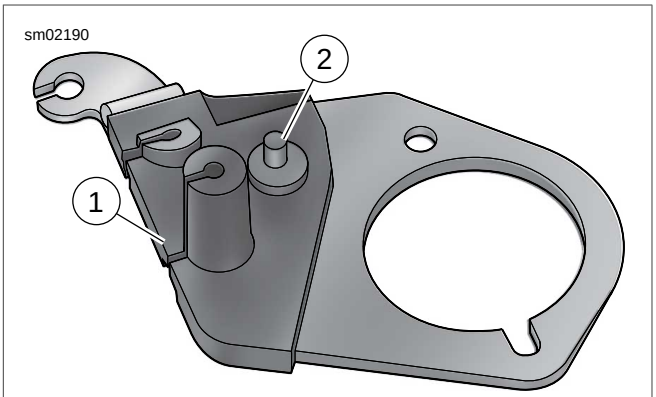


1. **Idle air control (IAC)**
2. **O-ring**

Figure 4-22. Idle Air Control

INSTALLATION

1. See Figure 4-22. Apply **clean** engine oil to IAC O-ring (2). Install O-ring in counterbore of induction module.
2. With the electrical connector facing the rear left side of the induction module, install idle air control into bore.
3. Place idle air control and o-ring into throttle body. Be sure o-ring is properly seated in throttle body groove.
4. See Figure 4-23. Insert index pin (2) at bottom of throttle cable bracket (1) into hole in boss at top of induction module.
5. See Figure 4-21. Install **new** throttle cable bracket fasteners (2). Tighten to 20-35 **in-lbs** (2.3-4.0 Nm).
6. Install induction module. See 4.9 INDUCTION MODULE.



1. **Throttle cable bracket**
2. **Index pin**

Figure 4-23. Throttle Cable Bracket

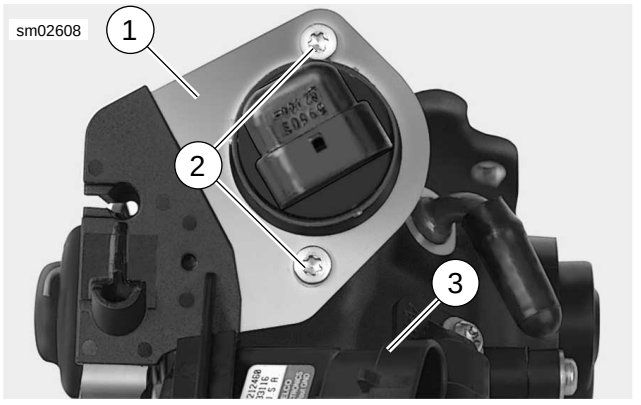
MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP) 4.11

GENERAL

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the temperature/manifold absolute pressure (T-MAP) sensor.

REMOVAL

1. Remove induction module. See 4.9 INDUCTION MODULE.
2. See Figure 4-24. Remove two fasteners (2) to release throttle cable bracket (1) from induction module. Discard fasteners.
3. Using appropriate tool, gently push up on MAP sensor and attached seal to remove from intake manifold.



1. **Throttle cable bracket**
2. **Fasteners**
3. **Manifold Absolute Pressure Sensor (MAP)**

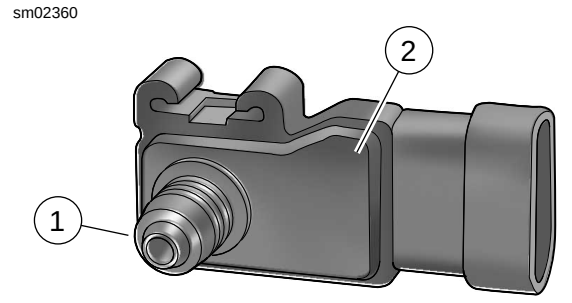
Figure 4-24. Throttle Cable Bracket Location

INSTALLATION

NOTE

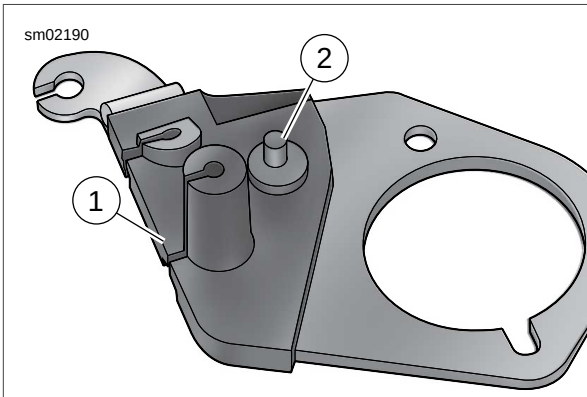
*See Figure 4-25. If the original sensor is re-installed, the seal (1) must be inspected. Seals not in good condition could cause vacuum leaks. Install **new** seal if necessary.*

1. Push MAP sensor and seal into intake manifold.
2. With the electrical connector facing toward the rear of the induction module (side opposite throttle wheel), insert MAP sensor into hole in induction module.
3. See Figure 4-26. Insert index pin (2) at bottom of throttle cable bracket into hole in boss at top of induction module.
4. See Figure 4-24. Install **new** throttle cable bracket fasteners (2). Tighten to 20-35 **in-lbs** (2.3-4.0 Nm).
5. Install induction module. See 4.9 INDUCTION MODULE.



1. **Seal**
2. **MAP sensor**

Figure 4-25. MAP Sensor



1. **Throttle cable bracket**
2. **Index pin**

Figure 4-26. Throttle Cable Bracket

GENERAL

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the oxygen sensor (O2).

REMOVAL

1. See Figure 4-27. The (O2) sensors are installed in threaded bosses on the inboard side of front and rear exhaust pipes.

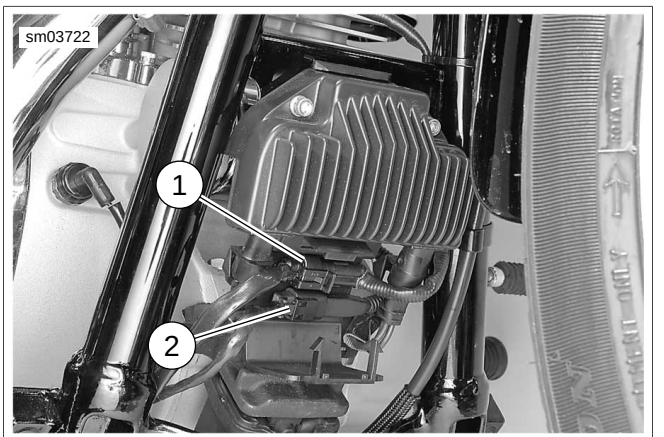
NOTE

See Figure 4-28. Front oxygen sensor connector is located in front electrical caddy. For more information on the disassembly and assembly of front electrical caddy see 8.5 VOLTAGE REGULATOR.

2. Open front electrical caddy and disconnect O2 sensor connector (1). Remove any cable straps securing harness before loosening and removing front O2 sensor.
3. See Figure 4-29. Remove seat. Disconnect sensor connector and remove any cable straps securing harness before loosening and removing rear O2 sensor.



Figure 4-27. Oxygen Sensors (Inboard Side of Exhaust Pipes)



1. **O2 sensor connector**
2. **CKP sensor connector**

Figure 4-28. Front Electrical Caddy and Connectors

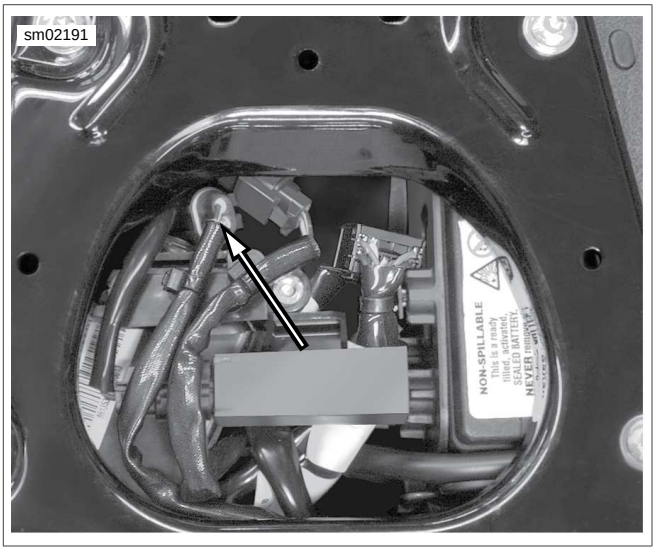


Figure 4-29. Rear O2 Connector and Harness

INSTALLATION

NOTES

- *Do not install sensors that have been dropped or impacted by other components. Damage to the sensing element may have occurred. Replacement sensor assemblies have threads coated with anti-seize lubricant and new seal rings.*
- *Apply a thin coat of ANTI-SEIZE LUBRICANT (Part No. 98960-97) to threads of each oxygen sensor prior to installing in header. Do not use any other grease or sealant product.*

1. If sensor is being reinstalled, replace seal ring and coat threads on sensor with LOCTITE ANTI-SEIZE.
2. Thread sensor into threaded boss on exhaust pipe and tighten to 29-44 ft-lbs (39.3-59.7 Nm).

NOTE

Ensure both connector halves are clean and free of any dielectric grease. Never use dielectric grease on sealed connectors.

3. Route sensor harness to mating connector and connect. Install cable straps that were removed during removal.
4. Repeat above for other sensor.

GENERAL

⚠WARNING

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

Refer to the ELECTRICAL DIAGNOSTIC MANUAL for information on the function and testing of the fuel injectors.

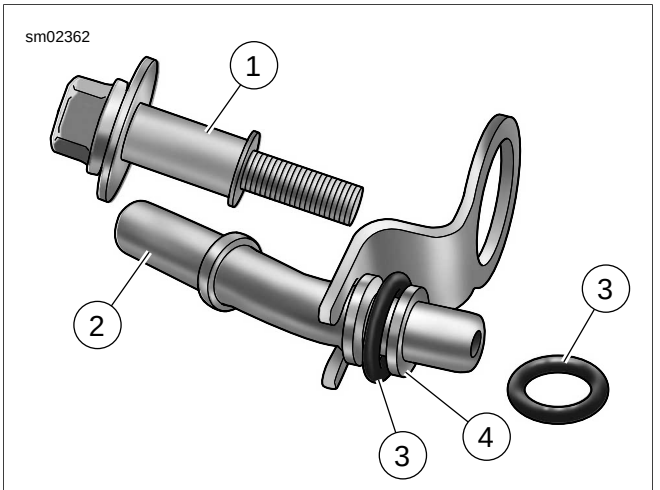
REMOVAL

1. Remove induction module. See 4.9 INDUCTION MODULE.

NOTE

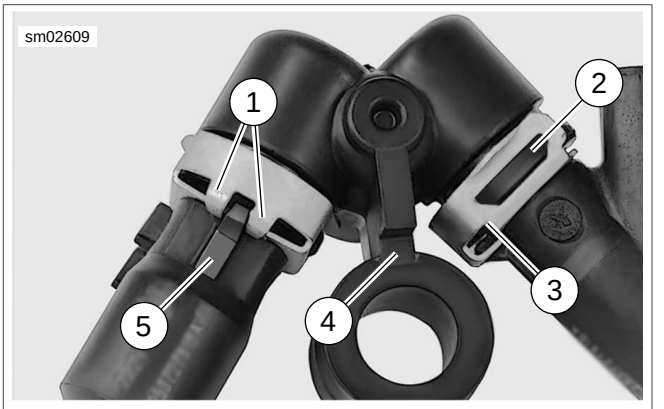
If not replacing fuel supply tube or o-rings, do not remove.

2. See Figure 4-30. Remove fastener (1) retaining fuel supply tube (2).
3. Pull fuel supply tube from fuel rail. Remove sealing washer (4) and O-ring (3) from fuel supply tube. Remove second o-ring from fuel rail bore. Discard sealing washer and O-rings.
4. See Figure 4-31. Pull fuel injectors with attached fuel rail from induction module. To overcome the resistance of the bottom O-ring on both fuel injectors, gently rock assembly back and forth while pulling.
5. See Figure 4-32. Remove spring clips (2) from fuel injectors. Pull fuel injectors from fuel rail. To overcome the resistance of the top O-ring, gently rock each fuel injector while pulling.
6. Remove o-rings (1) from fuel injectors. Discard O-rings.



1. **Fastener**
2. **Fuel supply tube**
3. **O-ring (2)**
4. **Sealing washer**

Figure 4-30. Fuel Supply Tube

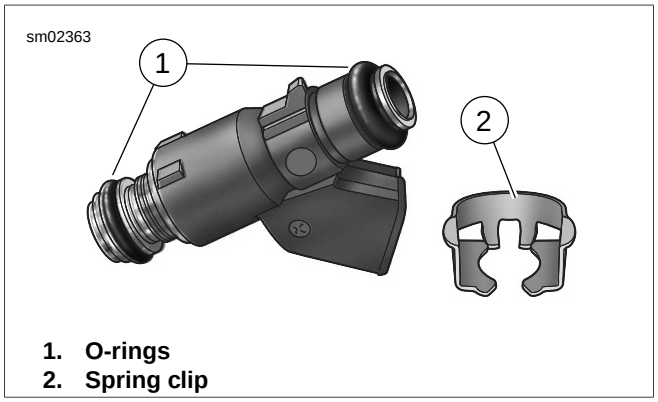


1. **Fork**
2. **Lip**
3. **Opening**
4. **Rail tab**
5. **Injector tab**

Figure 4-31. Fuel Rail

INSTALLATION

1. See Figure 4-32. Apply a thin coat of clean engine oil to **new** fuel injector o-rings (1). Install on fuel injectors.
2. See Figure 4-31. Push electrical connector side of fuel injectors into fuel rail.
3. With the concave side toward the fuel rail, install spring clip into slot on fuel injector. In the installed position, openings (3) in sides of clip engage lip (2) on fuel rail, while fork (1) at back of clip captures rail tab (4) on fuel injector.
4. Rotate fuel injectors, so that the electrical connectors are on the outboard side. Push fuel injectors into induction module bores until tab on fuel rail engages machined slot at top of induction module.
5. See Figure 4-30. Slide **new** o-ring (3) down shorter neck of the fuel supply tube until it contacts the collar. Slide **new** sealing washer (4) down tube until it contacts O-ring. Install second o-ring (3) in fuel rail bore.
6. Push fuel supply tube (2) into fuel rail bore until clamp is seated on round step of fuel rail. Install fastener (1) and tighten to 90-110 **in-lbs** (10.2-12.4 Nm).
7. Install induction module. 4.9 INDUCTION MODULE.



1. **O-rings**
2. **Spring clip**

Figure 4-32. Fuel Injector

GENERAL

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)

Carefully inspect hose for cuts, tears, holes or other damage. Replace hose if any damage is found. Even a small hole can cause a reduction in fuel pressure.

Refer to the electrical diagnostic manual for information on the function and testing of the fuel pump.

REMOVAL

WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

1. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 4-33. Remove the fuel pump fuse from fuse block.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.



Figure 4-33. Fuel Pump Fuse

WARNING

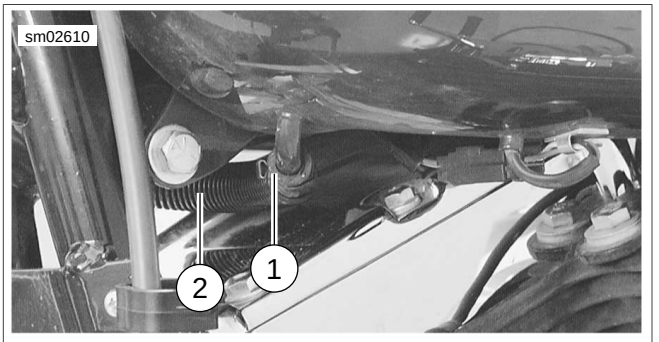
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. Remove instrument console.
   a. For FXDWG/FXDC/FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
   c. For FXD models, see 8.15 FUEL GAUGE.
4. Disconnect console wiring.

WARNING

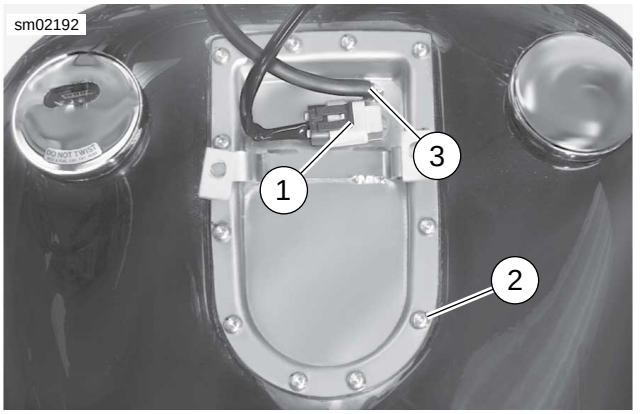
Gasoline can drain from the crossover line when disconnected from fuel tank. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00259a)

5. Drain fuel tank.
   a. Obtain a short section of hose (5/16 inch I.D.). Insert bolt in one end of hose and install hose clamp to ensure that end is securely plugged.
   b. See Figure 4-34. Cut clamp (1) from one end of crossover hose (2). Quickly replace crossover hose on fuel tank fitting with open end of short hose while directing flow of gasoline from free end of crossover hose into suitable container.
6. See Figure 4-35. Unplug fuel pump and sender connector (1) [141].
7. Remove vent hose (3).
8. Remove top plate screws (2) and discard.
9. See Figure 4-36. On FXDL, FXDB, FXDWG, FXDF and FXDC models, rotate top plate (3) until vent tube (1) clears fuel tank.



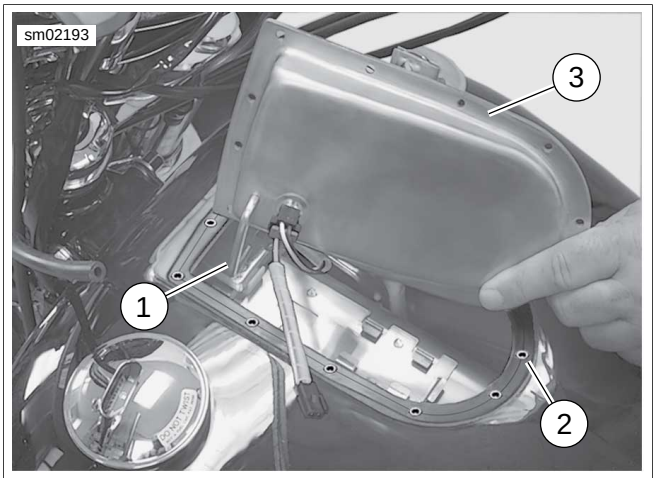
1. Clamp
2. Crossover hose

Figure 4-34. Fuel Crossover Hose



1. **Fuel pump and sender connector [141]**
2. **Screws (12)**
3. **Vent hose**

Figure 4-35. Top Plate Screws: FXDC/FXDWG/FXDF



1. **Vent tube**
2. **Gasket**
3. **Top plate**

Figure 4-36. Fuel Line Clamp

10. See Figure 4-37. Depress tab and remove fuel pump/sender wiring from top plate. Remove top plate.
11. See Figure 4-38. Depress tabs (1) and remove fuel line (4) from fuel pump assembly (2).
12. Remove fuel gauge wiring harness (5) from clip (6).
13. Disconnect fuel pump connector (3).
14. See Figure 4-39. Lift fuel pump assembly tab. Push assembly towards front of vehicle to disengage from fuel tank.
15. Rotate fuel pump assembly clockwise and upward to remove fuel pump assembly from fuel tank.

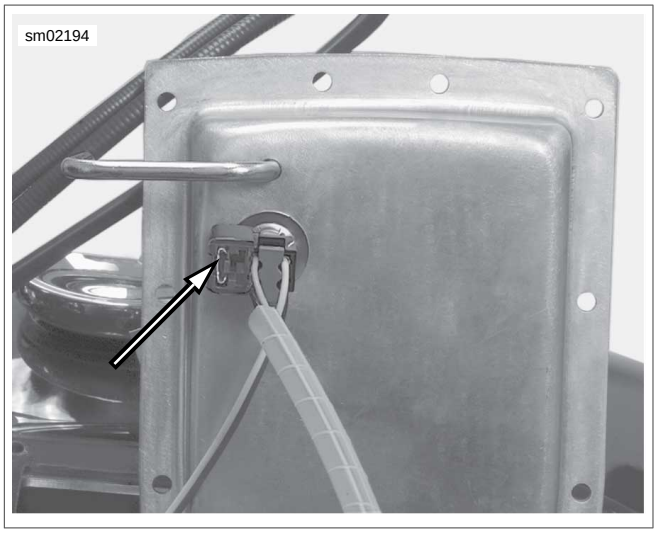
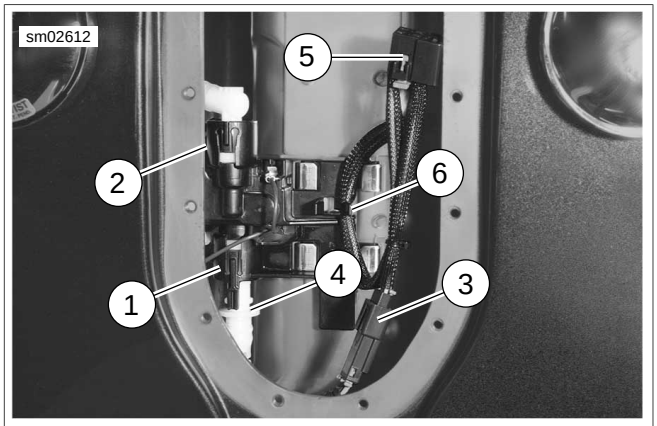


Figure 4-37. Connector Tab



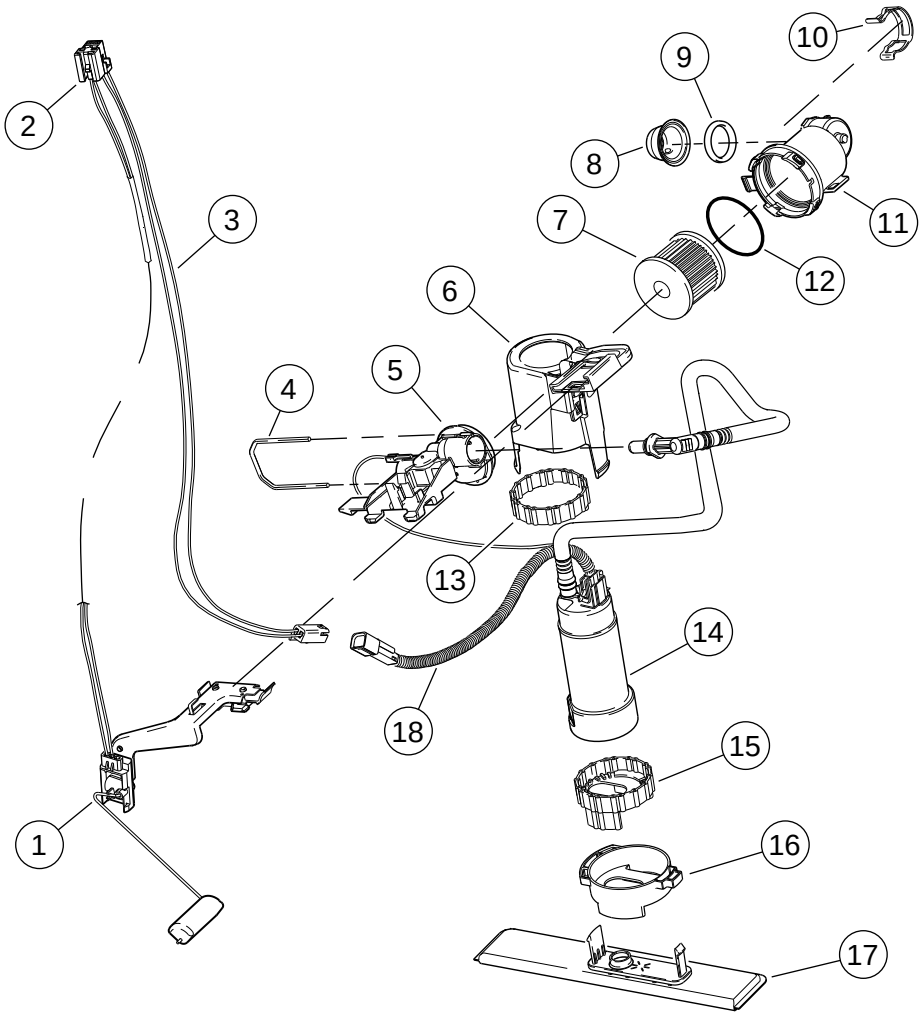
1. **Tabs (2)**
2. **Fuel pump assembly**
3. **Fuel pump connector**
4. **Fuel line**
5. **Fuel gauge wiring harness**
6. **Clip**

Figure 4-38. Fuel Pump



Figure 4-39. Fuel Pump Removal

sm02364



1. **Sender**
2. **Top plate connector**
3. **Fuel pump/sender wiring**
4. **Clip**
5. **End cap**
6. **Upper retainer**
7. **Filter**
8. **Regulator**
9. **O-ring**
10. **Regulator clip**
11. **Filter housing**
12. **O-ring**
13. **Upper isolator**
14. **Fuel pump**
15. **Lower isolator**
16. **Lower retainer**
17. **Inlet sock**
18. **Electrical harness**

Figure 4-40. Fuel Pump/Fuel Gauge Sending Unit

DISASSEMBLY/ASSEMBLY

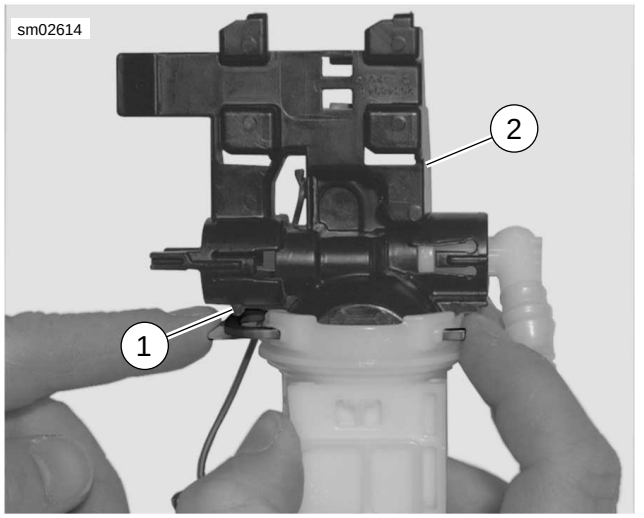
Fuel Filter

1. See Figure 4-41. Depress tab and remove filter retainer clip (1).
2. Separate fuel pump body from end cap (2).
3. See Figure 4-42. Remove O-ring (2).
4. Remove fuel filter (1).
5. Install **new** fuel filter.
6. Install **new** o-ring.
7. See Figure 4-41. Place end cap (2) on fuel pump body.
8. Install fuel filter retainer clip (1).

Regulator

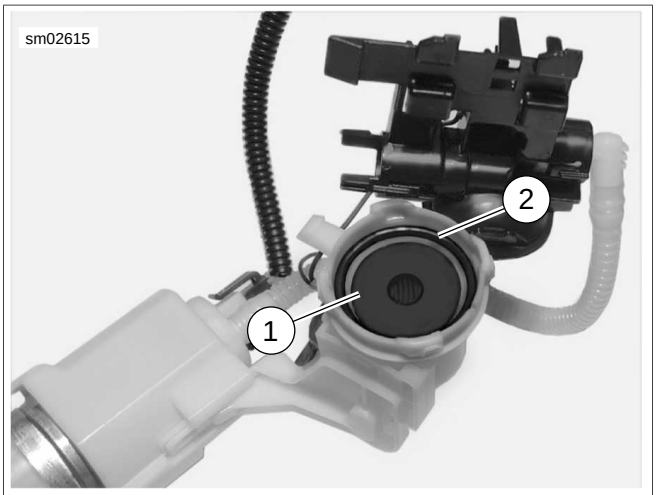
1. See Figure 4-43. Remove wire terminal (3).
2. Disengage clip (2) from regulator.
3. Remove regulator from pump assembly.
4. Install **new** O-ring on **new** regulator.
5. Install regulator into pump assembly.
6. Install clip over regulator.

7. Replace wire terminal.



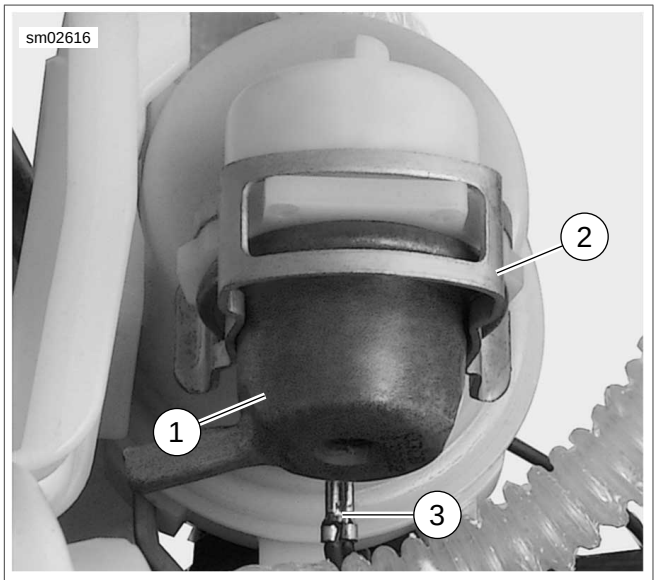
1. **Fuel filter retainer clip**
2. **End cap**

Figure 4-41. Filter Retainer Clip



1. **Fuel pump filter**
2. **O-ring**

Figure 4-42. Bail Bracket



1. **Regulator**
2. **Clip**
3. **Wire terminal**

Figure 4-43. Regulator

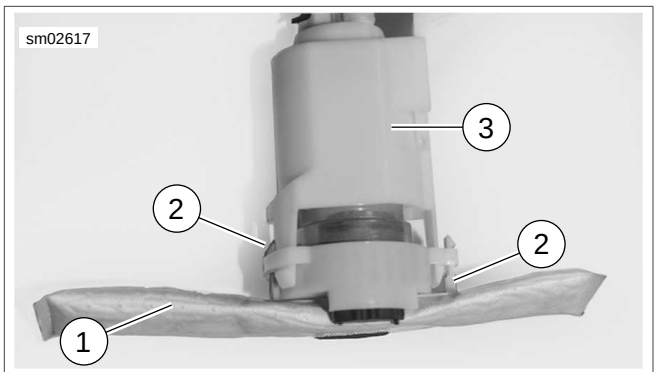
Inlet Sock

1. See Figure 4-44. Depress tabs (2) securing inlet sock (1) to upper retainer (3).
2. Remove inlet sock from upper retainer.

NOTE

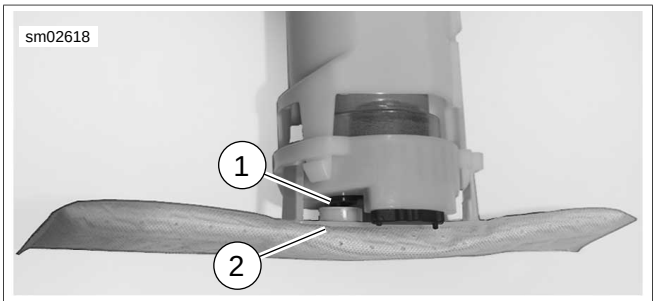
See Figure 4-45. In next step, be sure inlet sock engages fuel pump inlet.

3. See Figure 4-44. Install inlet sock (1) on upper retainer (3). Be sure tabs (2) engage slots in body.



1. **Inlet sock**
2. **Tab (2)**
3. **Upper retainer**

Figure 4-44. Fuel Sock



1. **Fuel pump inlet**
2. **Inlet sock**

Figure 4-45. Fuel Sock Installation

Fuel Pump

1. See Figure 4-46. Using screwdriver, break tabs securing fuel pump hose to end cap.
2. Remove inlet sock. See 4.14 FUEL PUMP.
3. See Figure 4-47. Disconnect fuel pump connector (1).
4. See Figure 4-48. Depress tabs (1) and remove lower retainer (2) from upper retainer.
5. Remove fuel pump from fuel pump body.
6. See Figure 4-40. Install lower isolator in lower retainer.
7. Install upper isolator into upper retainer.
8. Install fuel pump into upper retainer.
9. See Figure 4-48. Install lower retainer.
10. See Figure 4-46. Install fuel pump hose into **new** end cap.
11. See Figure 4-47. Install fuel pump connector (1). Inspect fuel pump wiring, (2) replace if damaged.
12. Install inlet sock. See 4.14 FUEL PUMP.

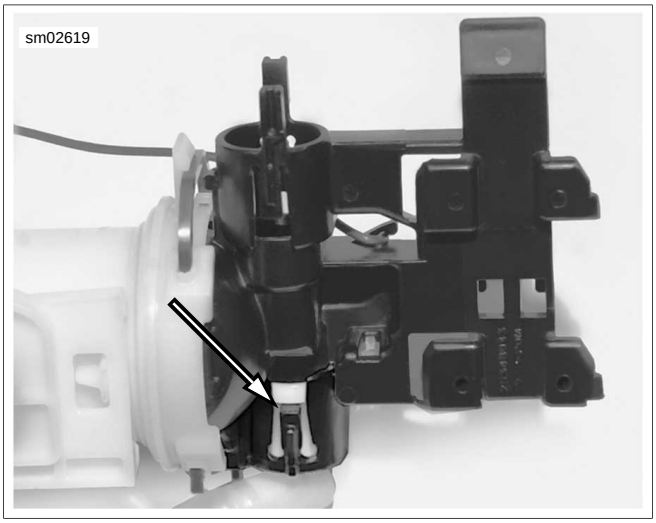
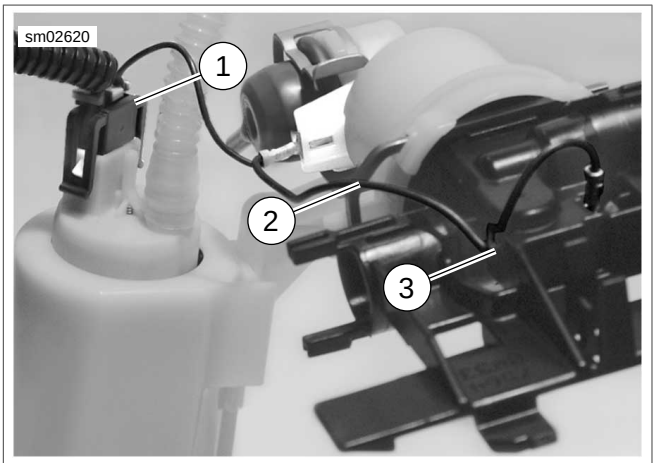
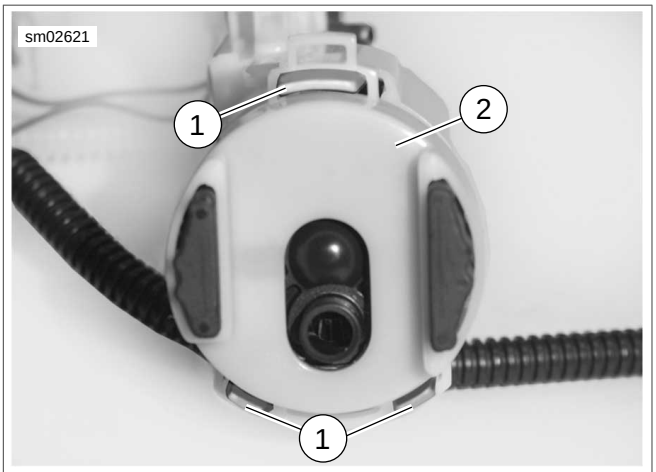


Figure 4-46. Fuel Pump Hose Retaining Clip (2)



1. **Fuel pump connector**
2. **Wire harness**
3. **Wire clip**

Figure 4-47. Fuel Pump Connector



1. **Tab (3)**
2. **Fuel pump lower retainer**

Figure 4-48. Filter Retainer Clip

INSTALLATION

NOTE

Fuel pump sits in left side of fuel tank.

1. See Figure 4-49. Install fuel pump into left side of fuel tank as shown.
2. Rotate pump counterclockwise and downward into position.
3. See Figure 4-50. Install fuel pump so end cap (8) engages mounting tabs (4).
4. Connect fuel pump connector (7).
5. Place fuel gauge wiring harness (5) into clip (6).
6. Install **new** O-ring on fuel line (1). Install fuel line.
7. Install **new** top plate gasket on fuel tank. Do not apply any type of sealant to gasket.

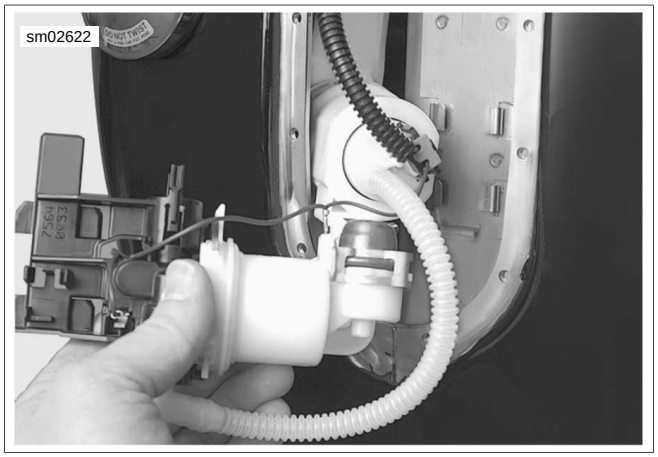
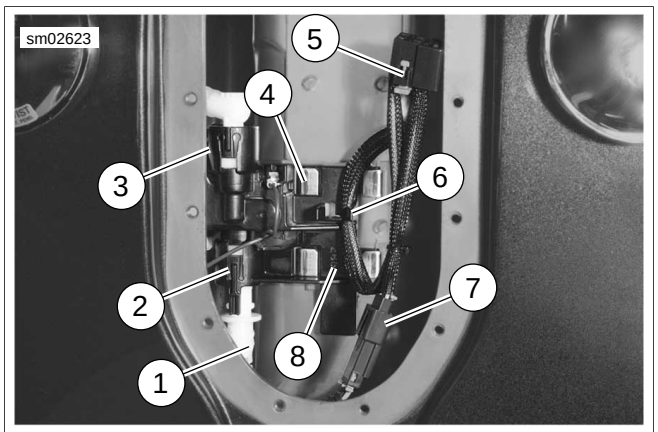


Figure 4-49. Fuel Pump Installation



1. **Fuel line**
2. **Tabs (2)**
3. **Fuel pump assembly**
4. **Mounting tabs (4)**
5. **Fuel gauge wiring harness**
6. **Clip**
7. **Fuel pump connector**
8. **End cap**

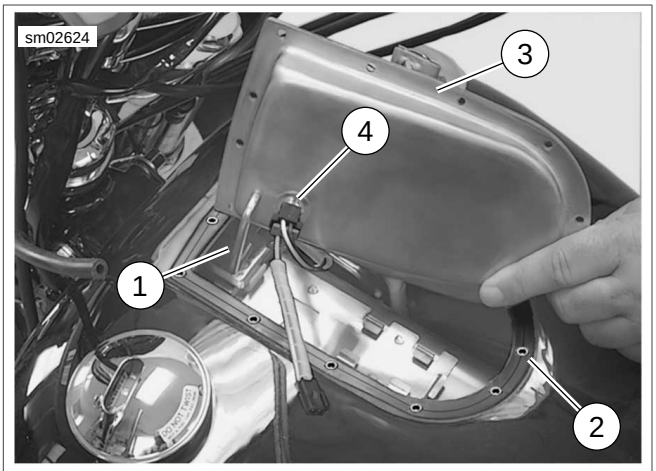
Figure 4-50. Fuel Pump

8. See Figure 4-51. Install fuel pump/sender wire connector (4) on top plate (3).
9. Install top plate.
   a. On FXDL, FXDWG and FXDF models, hold top plate at 90° angle.
   b. See Figure 4-52. On all models, install sender wiring into clip (3).
   c. See Figure 4-51. On FXDL, FXDB, FXDWG, FXDC and FXDF models, making sure that vent tube is installed inside of tank, rotate top plate into position.
10. Loosely install **new** sealing screws in top plate.
11. On FXDWG, FXDC and FXDF models, see Figure 4-54. Tighten sealing fasteners using pattern shown to 20 **in-lbs** (2.3 Nm).
12. On FXD/FXDB/FXDL models, see Figure 4-55. Tighten sealing fasteners using pattern shown to 20 **in-lbs** (2.3 Nm).
13. See Figure 4-53. Connect fuel pump/sending unit connector [141].
14. Install instrument console.
    a. For FXDWG/FXDC/FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
    b. For FXDL/FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
    c. For FXD models, see 8.15 FUEL GAUGE.

NOTE

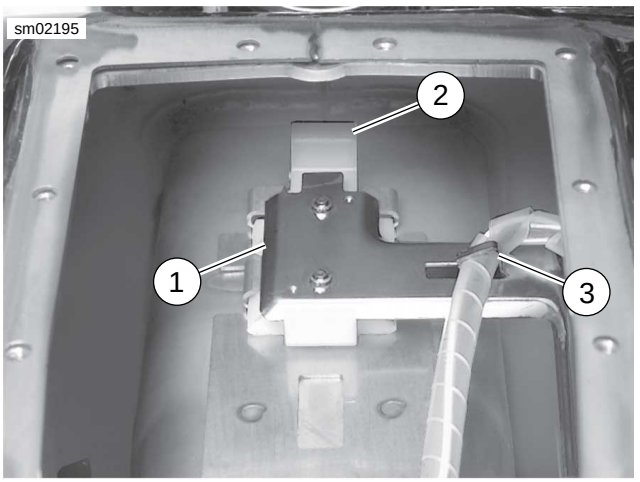
In next step, be sure crimped end of clamp faces toward front of vehicle.

15. Connect crossover hose with **new** clamps.
16. Connect the fuel pump fuse to the main wiring harness.
17. Connect negative battery cable.
18. Fill tank with gasoline and check for leaks.
19. Check fuel system pressure. See 4.15 FUEL PRESSURE TEST.



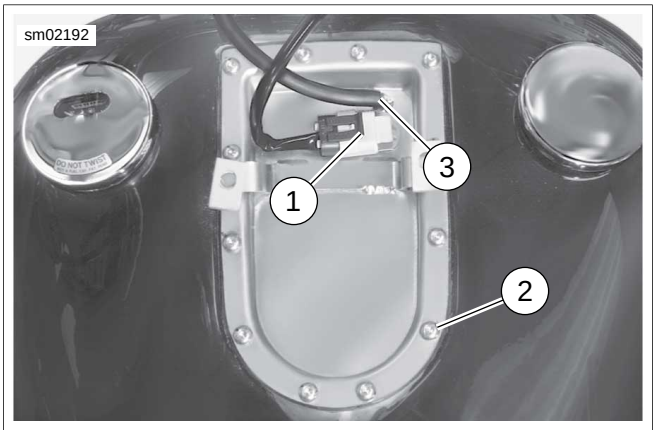
1. **Vent tube**
2. **Gasket**
3. **Top plate**
4. **Fuel pump/sender wire connector**

Figure 4-51. Top Plate



1. Fuel gauge sender
2. Removal tab
3. Wiring clip

Figure 4-52. Fuel Gauge Sender



1. Fuel pump and sender connector [141]
2. Screws (12)
3. Vent hose

Figure 4-53. Top Plate: FXDWG/FXDF

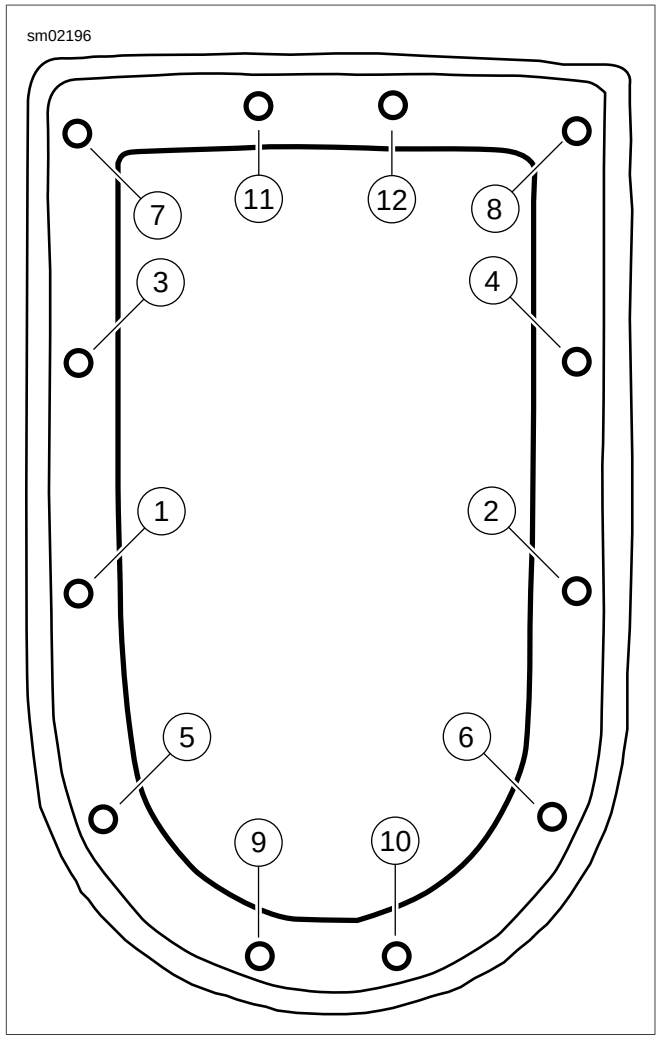


Figure 4-54. Top Plate Torque Sequence: FXDWG/FXDC/FXDF

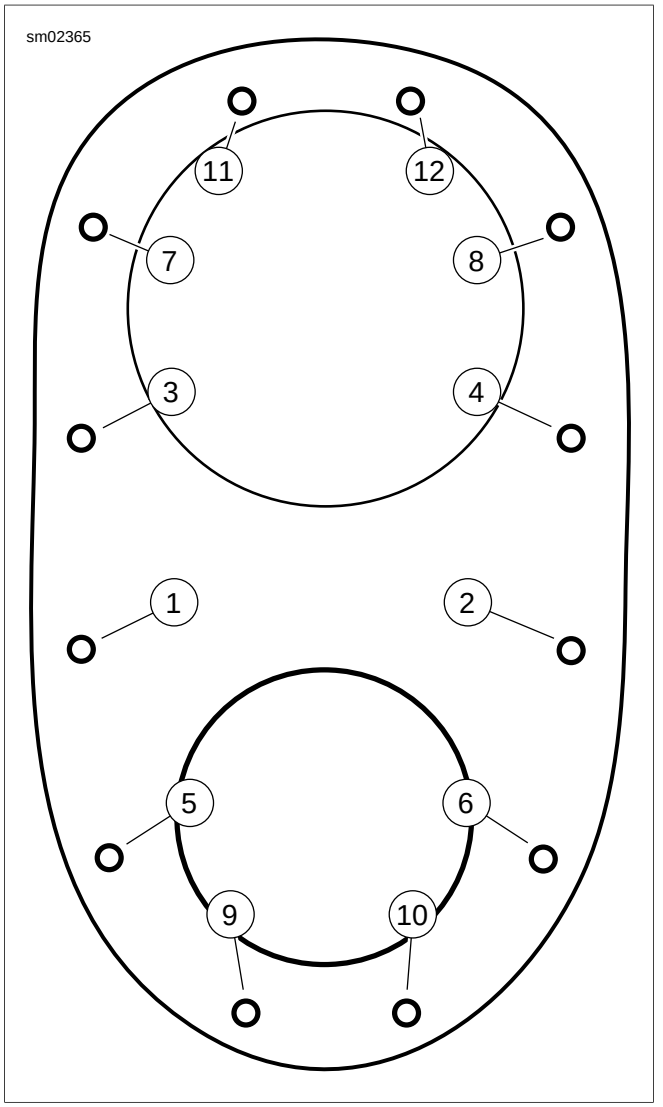


Figure 4-55. Top Plate Torque Sequence: FXD/FXDB/FXDL

GENERAL

The fuel pump delivers fuel to the fuel line, to a cavity in the induction module that supplies the fuel injectors and to the pressure regulator, where the system pressure is controlled. Excess fuel pressure is bypassed to the fuel tank through the pressure regulator.

See Figure 4-56. The fuel pump fuse is located under the seat. The fuel pump can be turned on with Digital Technician or by applying battery voltage to the fuel pump fuse.

Improper fuel system pressure may contribute to one of the following conditions:

- Cranks, but won't run.
- Cuts out (may feel like ignition problem).
- Hesitation, loss of power or poor fuel economy.

NOTE

Refer to the electrical diagnostic manual for further information on the function and testing of the fuel system.

TESTING

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

The fuel pressure gauge (0-100 PSI) allows for fuel injector and fuel system pressure diagnosis. A special adapter allows the gauge to be attached to the external fuel supply line.

Avoid crimping the fuel line when installing/removing fuel pressure gauge and adapter.

1. Remove electrical caddy cover.

⚠WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge the fuel supply line of high pressure gas.
   a. See Figure 4-56. Remove the fuel pump fuse from fuse block.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

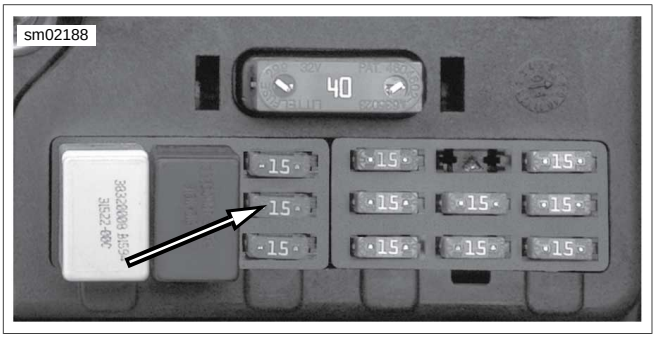


Figure 4-56. Fuel Pump Fuse

⚠WARNING

Gasoline can drain from quick-connect fitting when removing fuel line. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00267a)

3. Pull up on chrome sleeve of quick-connect fitting (fitting on left side of fuel tank) and pull down on fuel supply line to disconnect.

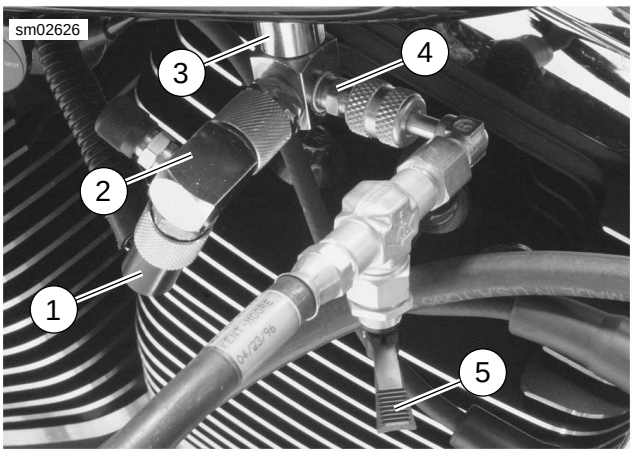
NOTE

The next step requires two fuel pressure gauge adapters. Failure to use two adapters will cause the fuel line to twist. This may result in a broken fuel line or fuel line fitting.

4. Attach fuel line to gauge assembly.
   a. See Figure 4-57. Install a second adapter in series with the first.
   b. See Figure 4-58. Pull up on chrome sleeve of quick-connect fitting and insert neck of FUEL PRESSURE GAUGE ADAPTER (Part No. HD-44061) into fuel supply line.
   c. While pushing up on bottom of adapter, pull down on chrome sleeve until it "clicks" into the locked position. Tug on adapter to be sure that it will not come free.
   d. In the same manner, install neck of second fuel supply line fitting into quick-connect fitting on fuel tank. Tug on fuel supply line to be sure that it will not come free.



Figure 4-57. Fuel Pressure Gauge Adapters



1. **Fuel supply line**
2. **Adapter to fuel line**
3. **Adapter to fuel tank**
4. **Pressure adapter Schroeder valve union**
5. **Fuel valve (closed position)**

Figure 4-58. Fuel Line

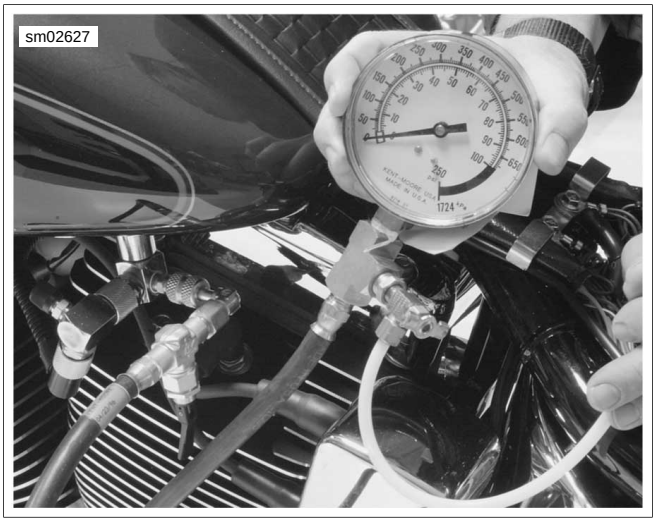


Figure 4-59. Fuel Pressure Gauge Installed (Typical)

WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

5. Verify that the fuel valve and air bleed petcock on the FUEL PRESSURE GAUGE (Part No. HD-41182) are closed.
6. See Figure 4-57. Remove protective cap from free end of fuel pressure gauge adapter. Connect fuel pressure gauge to Schroeder valve.
7. See Figure 4-56. Install fuel pump fuse.
8. Start and idle engine to pressurize the fuel system. Open the fuel valve to allow the flow of fuel down the hose of the pressure gauge.
9. Position the clear air bleed tube in a suitable container and open and close the air bleed petcock to purge the gauge and hose of air. Repeat this step several times until only solid fuel (without bubbles) flows from the air bleed tube. Close the petcock.
10. Open and close throttle to change engine speed. Note the reading of the pressure gauge. Fuel pressure should remain steady at 55-62 psi (380-425 kPa).

NOTE

If fuel pressure gauge reading is not within specifications, see electrical diagnostic manual for further diagnosis.

11. Turn the engine off. Position the air bleed tube in a suitable container. Open the air bleed petcock to relieve the fuel system pressure and purge the pressure gauge of gasoline.

WARNING

Gasoline can drain from the adapter when gauge is removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00254a)

12. Remove fuel pressure gauge from the adapter. Install protective cap over Schroeder valve.

WARNING

Gasoline can drain from the fuel line and adapter when removed. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. Wipe up spilled fuel immediately and dispose of rags in a suitable manner. (00255a)

13. Pull up on sleeve of quick-connect fitting and remove fuel supply line from fuel pressure gauge adapter. Release adapter from fuel tank in the same manner.

WARNING

To prevent spray of fuel, be sure quick-connect fittings are properly mated. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00268a)

14. Pull up on chrome sleeve of quick-connect fitting (forward fitting on left side of tank) and insert neck of fuel supply line fitting. While pushing up on bottom of fuel supply line fitting, pull down on chrome sleeve until it "clicks" into the locked position. Tug on fuel supply line to be sure that it will not come free.
15. Install electrical caddy cover.

REMOVAL: ALL BUT FXDF

NOTE

If removing exhaust as an assembly and not removing mufflers, skip muffler removal steps.

1. Remove seat.
2. See Figure 4-60. Disconnect rear O2 sensor connector [137]. Note wire routing for proper installation.
3. See Figure 4-61. Open front electrical caddy cover and disconnect front O2 sensor connector [138] (1). Remove connector housing from caddy.
4. See Figure 4-62. On models with an active exhaust module, remove active exhaust cable (1):
   a. Remove cable (1) and retainer (2) from exhaust pipe.
   b. Remove ferrule (3) from bellcrank (4).
5. See Figure 4-63. Remove muffler support bracket nuts (29) from bolts (30). Remove muffler support bracket (28).
6. Loosen locknuts (17) on muffler clamps (19) to exhaust pipes. Remove mufflers (16, 27).
7. Loosen or remove heat shields (1, 8) by opening worm drive clamps (2).
8. Remove flange nuts (35) from front and rear cylinder head exhaust studs.
9. Remove locknut (3) and bolt (41) attaching front exhaust pipe clamp (4) to front exhaust bracket (40).
10. Remove bolt (13), acorn nut (15) and washer (14) attaching rear exhaust pipe clamp (10) to rear exhaust bracket (23). Remove bracket (44) if equipped.
11. Remove exhaust system as an assembly.

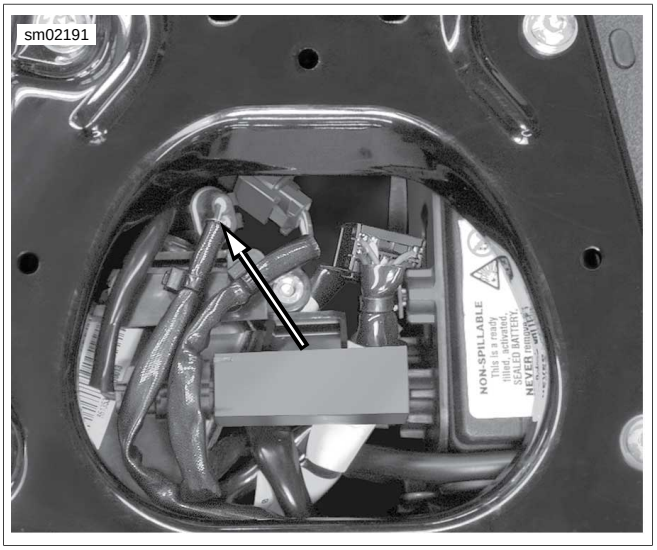
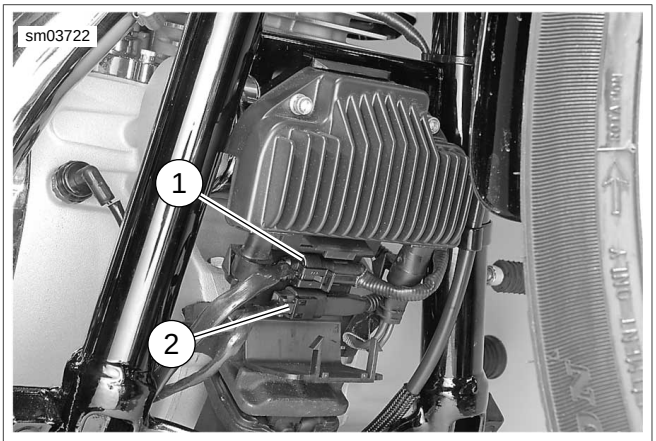
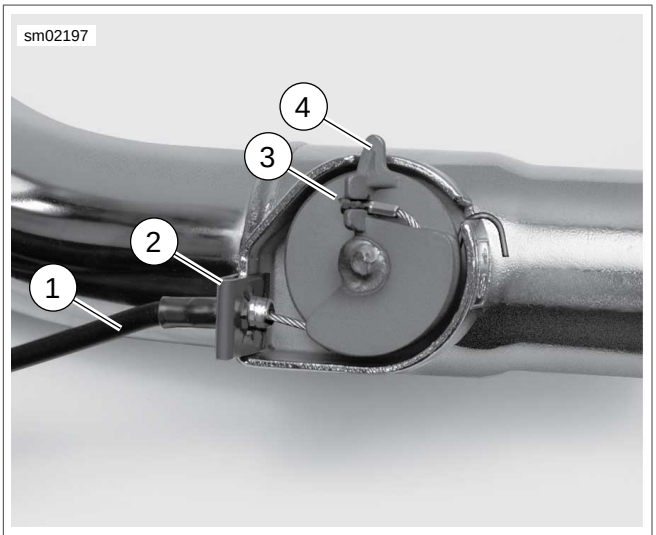


Figure 4-60. Rear O2 Connector and Harness



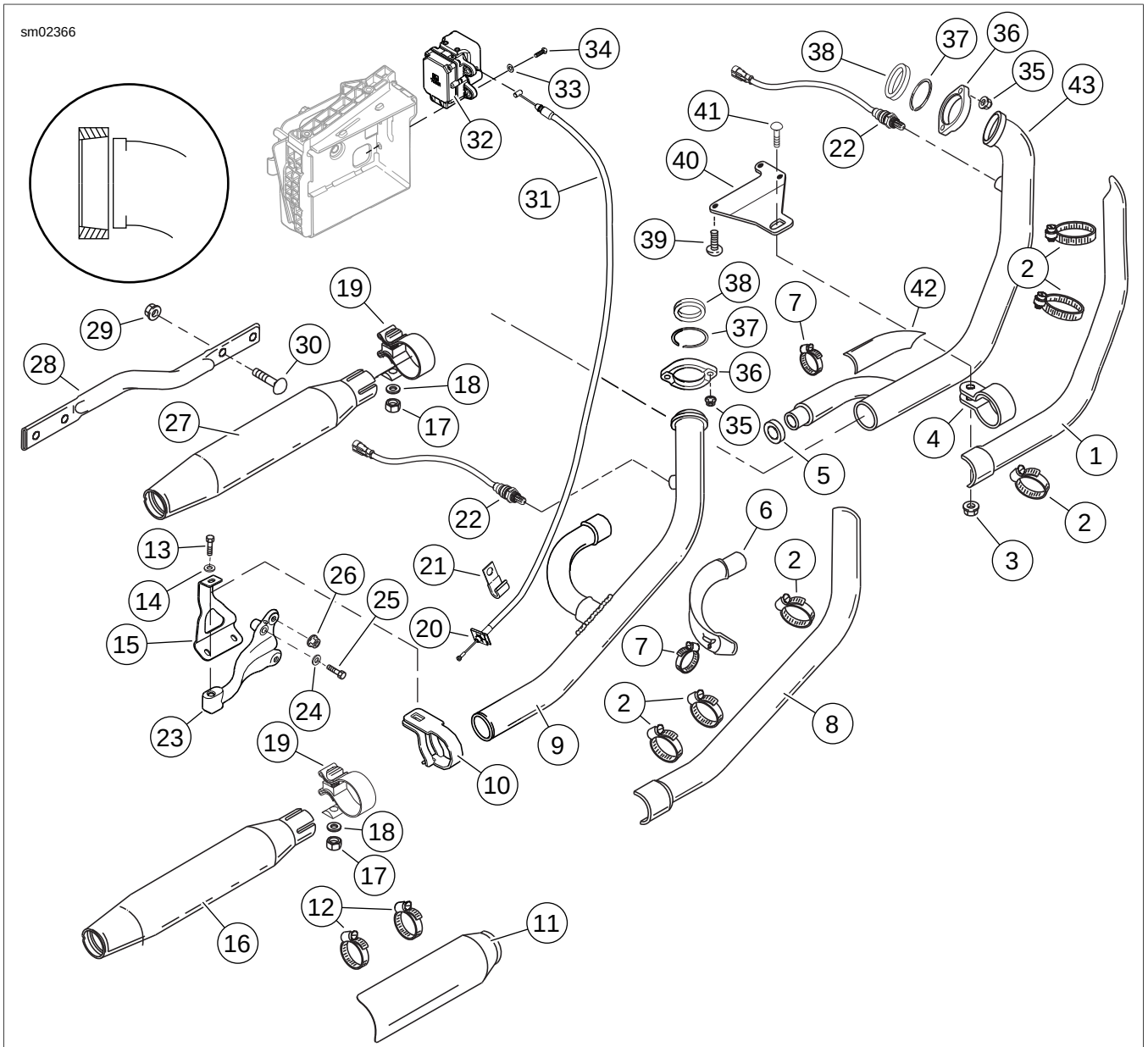
1. **O2 sensor connector**
2. **CKP sensor connector**

Figure 4-61. Front Electrical Caddy and Connectors



1. **Active exhaust cable**
2. **Cable retainer**
3. **Ferrule**
4. **Bellcrank**

Figure 4-62. Bellcrank



1. Front heat shield
2. Worm drive clamp (6)
3. Locknut
4. Exhaust pipe front clamp
5. Interconnect gasket
6. Rear crossover pipe heat shield
7. Worm drive clamp (4)
8. Rear heat shield
9. Rear exhaust pipe
10. Rear exhaust pipe clamp
11. Muffler heat shield (2)
12. Worm drive clamp (4)
13. Bolt
14. Washer
15. Acorn nut
16. Rear muffler
17. Locknut (2)
18. Washer
19. Muffler clamp (2)
20. Cable retainer
21. Active exhaust cable clip
22. Oxygen sensor (2, DOM only)
23. Rear exhaust bracket
24. Washer
25. Rear exhaust bracket fastener
26. Nut (2)
27. Front muffler
28. Muffler support bracket
29. Nut
30. Bolt
31. Active exhaust cable
32. Active exhaust module
33. Washer
34. Active exhaust module fastener
35. Flange nut (4)
36. Exhaust manifold flange (2)
37. Retaining ring (2)
38. Exhaust gasket (2)
39. Screw (3)
40. Front exhaust bracket
41. Bolt
42. Front crossover pipe heat shield
43. Front exhaust pipe
44. Bracket (active exhaust equipped models only)

Figure 4-63. Exhaust System: All But FXDF

DISASSEMBLY: ALL BUT FXDF

1. See Figure 4-63. Free front exhaust pipe (43) from rear exhaust pipe (9) by twisting and separating at crossover pipe.
2. Examine exhaust gaskets (38) and retaining rings (37) in cylinder head exhaust ports. Replace if necessary.
3. Replace the front (42) and rear (6) crossover pipe heat shields, if necessary.
4. Remove interconnect gasket (5) from crossover pipe bell on rear exhaust pipe.

ASSEMBLY: ALL BUT FXDF

1. See Figure 4-63. If front (42) and rear (6) crossover pipes heat shield were removed, install now.
2. Insert **new** interconnect gasket (5) into crossover pipe bell on rear exhaust pipe (9). Connect rear exhaust pipe to front exhaust pipe (43) at crossover pipe.

INSTALLATION: ALL BUT FXDF

NOTES

- *See inset in Figure 4-63. Replacement exhaust gaskets (38) are tapered internally. Be sure the thin end goes over the exhaust pipe. Also check condition of retaining ring (37) before installation.*
- *If mufflers were not removed, skip muffler installation steps.*

1. Position ends of exhaust pipes into front and rear cylinder head exhaust ports with holes in exhaust manifold flanges (36) over cylinder head exhaust studs. Loosely thread on flange nuts (35).
2. Position front exhaust pipe clamp (4) on front exhaust bracket (40). Install bolt (41) and locknut (3). Do not tighten nut and bolt at this time.
3. Position rear exhaust pipe clamp (10) and bracket (44) (if equipped) on rear exhaust bracket (23). Install bolt (13), washer (14) and acorn nut (15). Do not tighten nut and bolt at this time.

NOTE

TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. To ensure sealing integrity of muffler clamps, and prevent the possibility of leakage, Harley-Davidson recommends that the muffler clamp assemblies be discarded and replaced each time they are removed.

4. Install front and rear mufflers (27, 16) on front and rear exhaust pipes. Install muffler clamps (19) using nuts (17). Do not tighten nuts at this time.
5. Install muffler support bracket (28) and bracket (44) (if equipped) using nuts (29) and bolts (30). Do not tighten nuts at this time. Install exhaust system.
6. Align exhaust system and tighten all nuts and bolts; beginning at cylinder head exhaust ports and working backwards.
7. Tighten flange nuts (35), at front cylinder studs as follows:
   a. Install lower nut and tighten finger tight.
   b. Install upper nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
8. Tighten flange nuts at rear cylinder studs as follows:
   a. Install upper nut and tighten finger tight.
   b. Install lower nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
9. Open the worm drive clamps (2) and install heat shields (1, 8).
10. Tighten nuts (29) to 15-19 ft-lbs (20.3-25.8 Nm).
11. Align mufflers. Tighten muffler clamp nuts (17) to 45-50 ft-lbs (61.0-67.8 Nm).
12. See Figure 4-62. On models with an active exhaust module, install active exhaust cable (1) to bellcrank (4):
    a. Install ferrule (3) in bellcrank.
    b. Wrap cable around bellcrank.
    c. Install cable retainer (2) on exhaust pipe.
    d. See Figure 4-64. Ensure cable is properly routed and secured.
13. See Figure 4-60. Connect rear O2 sensor connector [137].

NOTE

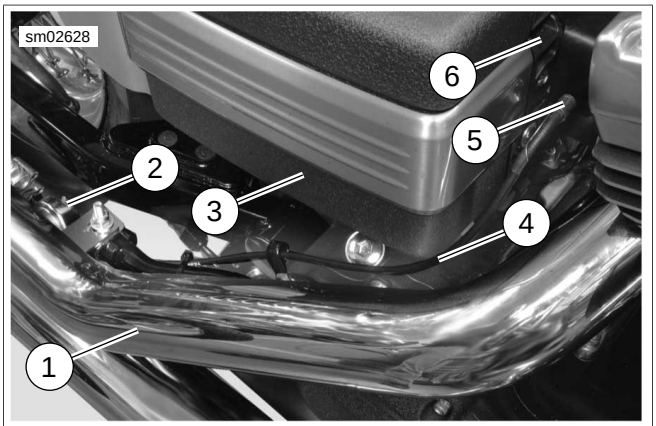
Connector halves must be clean and dry. Do not apply dielectric grease to sealed connectors or terminals.

14. See Figure 4-61. Connect front O2 sensor connector [138]. Close front electrical caddy cover.

WARNING

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

15. Install seat.



1. **Rear exhaust pipe**
2. **Bellcrank**
3. **Battery cover**
4. **Active exhaust cable**
5. **Cable end**
6. **Active exhaust module**

Figure 4-64. Active Exhaust Bellcrank Location

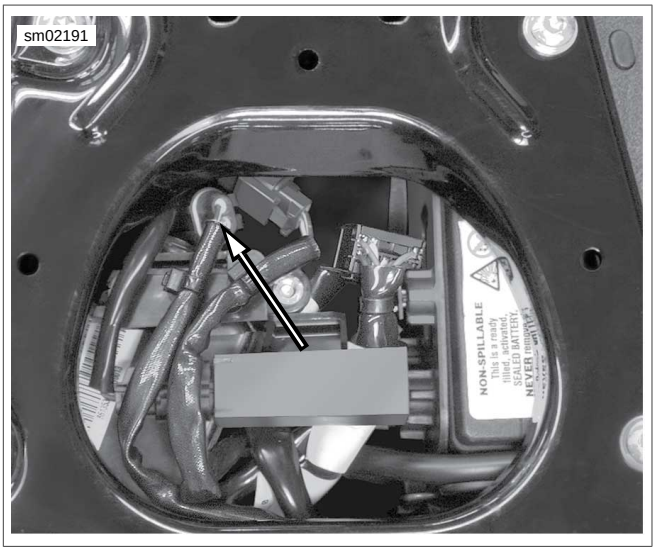


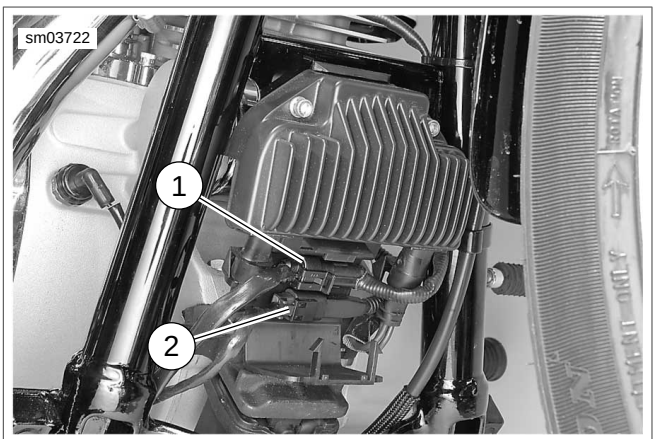
Figure 4-65. Rear O2 Connector and Harness

REMOVAL: FXDF

NOTE

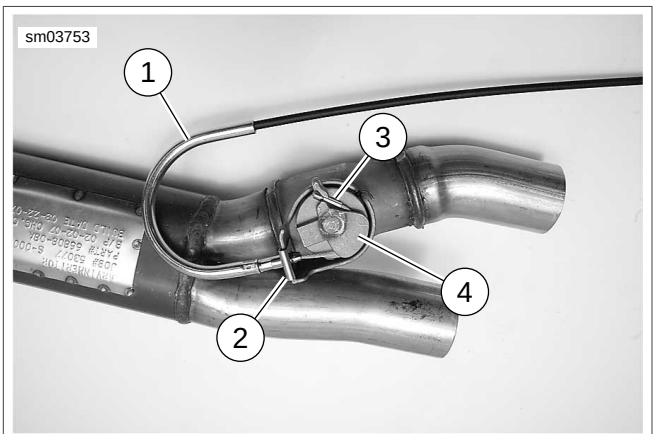
If removing exhaust as an assembly and not removing mufflers, skip muffler removal steps.

1. Remove seat.
2. See Figure 4-65. Disconnect rear O2 sensor connector [137]. Note wire routing for proper installation.
3. See Figure 4-66. Open front electrical caddy cover and disconnect front O2 sensor connector [138] (1). Remove connector housing from caddy.
4. See Figure 4-67. On models with an active exhaust module, remove active exhaust cable (1):
   a. Remove cable and retainer (2) from exhaust pipe.
   b. Remove ferrule (3) from bellcrank (4).
5. See Figure 4-68. Remove bolt (1) and washer (2) attaching mufflers together.
6. Remove muffler support bracket bolt (4) and washer (3) attaching mufflers (22, 23) to rear exhaust bracket (5).
7. Loosen locknuts on muffler clamps (21). Remove mufflers.
8. Loosen or remove heat shields (16, 17, 18) by opening worm drive clamps (15, 19).
9. Remove flange nuts (12) from front and rear cylinder head exhaust studs.
10. Remove head pipe assembly (14).
11. If necessary, remove flange locknuts (7) and bolt (8) to remove muffler bracket (5).



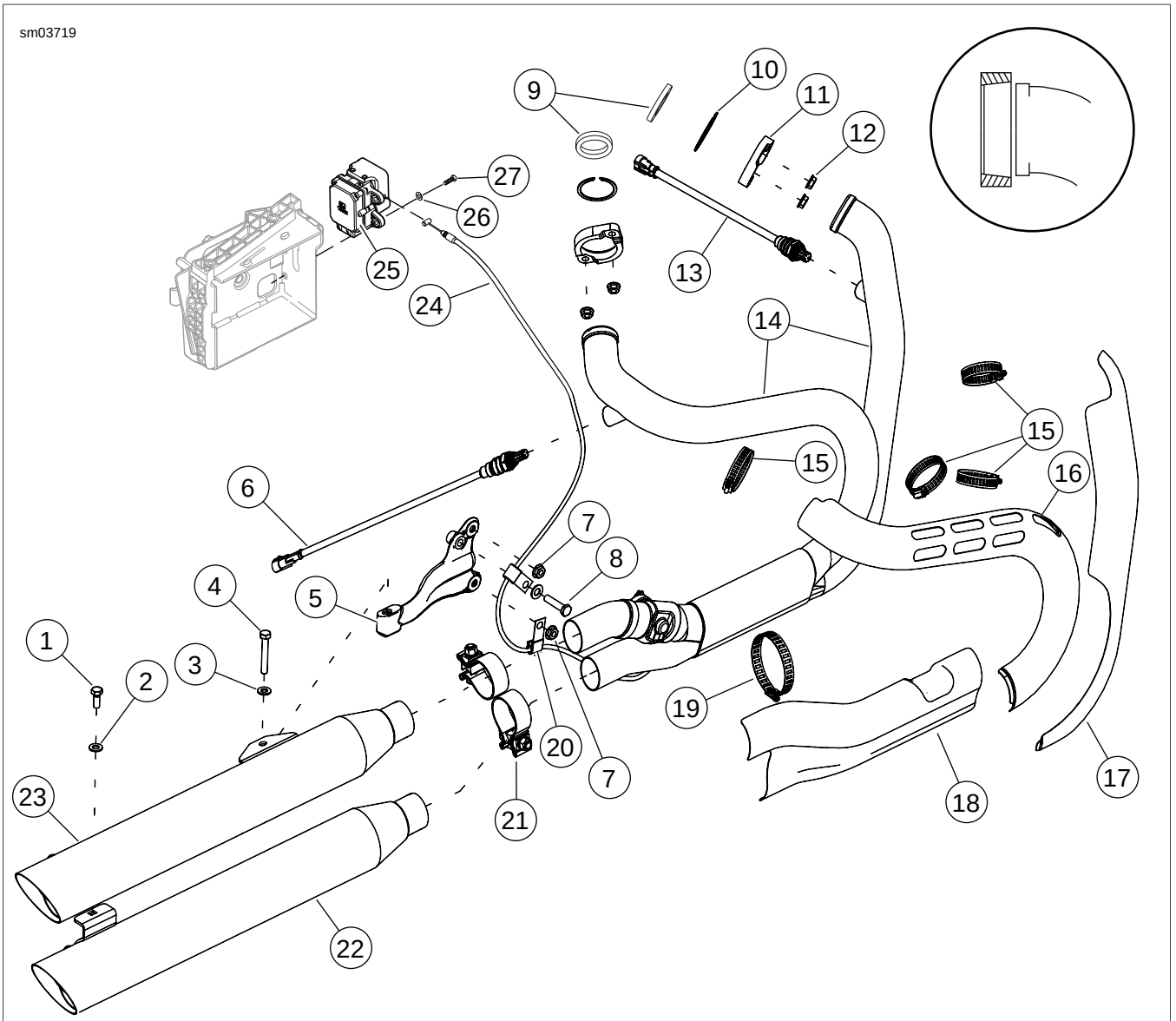
1. **O2 sensor connector**
2. **CKP sensor connector**

Figure 4-66. Front Electrical Caddy and Connectors



1. **Active exhaust cable**
2. **Cable retainer**
3. **Ferrule**
4. **Bellcrank**

Figure 4-67. Bellcrank: FXDF



1. **Bolt, muffler-to-muffler**
2. **Washer**
3. **Washer**
4. **Bolt, muffler mounting**
5. **Muffler bracket**
6. **Rear oxygen sensor**
7. **Flange locknut (2)**
8. **Bolt**
9. **Exhaust gasket (2)**
10. **Retaining ring (2)**
11. **Exhaust pipe flange**
12. **Flange nut (4)**
13. **Front oxygen sensor**
14. **Head pipe assembly**
15. **Worm drive clamp, small (4)**
16. **Rear heat shield**
17. **Front heat shield**
18. **Collector heat shield**
19. **Worm drive clamp, large (3)**
20. **Cable clamp (2)**
21. **Muffler clamp (2)**
22. **Front (lower) muffler**
23. **Rear (upper) muffler**
24. **Active exhaust cable assembly**
25. **Active exhaust module**
26. **Washer**
27. **Active exhaust module fastener**

Figure 4-68. Exhaust System: FXDF

INSTALLATION: FXDF

NOTES

- *See inset in Figure 4-68. Replacement exhaust gaskets (9) are tapered internally. Be sure the thin end goes over the exhaust pipe. Also check condition of retaining ring (10) before installation.*
- *If mufflers were not removed, skip muffler installation steps.*

1. See Figure 4-68. If removed, install muffler bracket. Tighten flange locknuts (7) to 15-19 ft-lbs (20.3-25.8 Nm). Tighten bolt (8) to 15-19 ft-lbs (20.3-25.8 Nm).

2. Position ends of head pipe assembly (14) into front and rear cylinder head exhaust ports with holes in exhaust manifold flanges (11) over cylinder head exhaust studs. Loosely install flange nuts (12).

3. Slide muffler clamps (21) onto exhaust pipes.

NOTE

TORCA muffler clamps have eliminated the need for silicone or graphite tape during assembly. To ensure sealing integrity of muffler clamps, and prevent the possibility of leakage, Harley-Davidson recommends that the muffler clamp assemblies be discarded and replaced each time they are removed.

4. Install front and rear mufflers (22, 23) on exhaust pipes. Install muffler clamps (21). Do not tighten nuts at this time.

5. Install muffler-to-muffler bolt (1) and washer (2). Do not tighten at this time.

6. Install muffler mounting bolt (4) and washer (3). Do not tighten at this time.

NOTE

Align exhaust system and tighten all nuts and bolts, beginning at cylinder head exhaust ports and working backwards.

7. Tighten flange nuts (12), at front cylinder studs as follows:
   a. Install lower nut and tighten finger tight.
   b. Install upper nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).

8. Tighten flange nuts at rear cylinder studs as follows:
   a. Install upper nut and tighten finger tight.
   b. Install lower nut and tighten to 9-18 **in-lbs** (1-2 Nm).
   c. Tighten upper nut to 100-120 **in-lbs** (11.3-13.6 Nm).
   d. Tighten lower nut to 100-120 **in-lbs** (11.3-13.6 Nm).

9. Open the worm drive clamps (15, 19) and install heat shields (16, 17, 18).

10. Tighten muffler mounting bolt (43) to 15-19 ft-lbs (20.3-25.8 Nm). Tighten muffler attaching bolt (1) securely.

11. Align mufflers. Tighten muffler clamp nuts to 45-50 ft-lbs (61.0-67.8 Nm).

12. See Figure 4-67. On models with an active exhaust module, install active exhaust cable (1):
   a. Install ferrule (3) in bellcrank (4).
   b. Wrap cable around bellcrank.
   c. Install cable and retainer (2) on exhaust pipe.
   d. See Figure 4-69. Ensure cable routing is correct and secure with two camps (3).

NOTE

Connector halves must be clean and dry. Do not apply dielectric grease to sealed connectors or terminals.

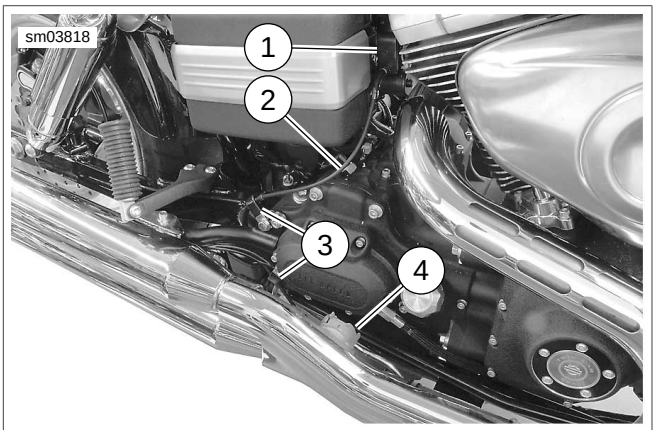
13. See Figure 4-65. Connect rear O2 sensor connector [137].

14. See Figure 4-61. Connect front O2 sensor connector [138]. Close front electrical caddy cover.

⚠WARNING

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

15. Install seat.



1. **Active exhaust module**
2. **Active exhaust cable**
3. **Clamp (2)**
4. **Bellcrank**

Figure 4-69. Active Exhaust Cable: FXDF

GENERAL

WARNING

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

WARNING

Read and follow warnings and directions on propane bottle. Failure to follow warnings and directions can result in death or serious injury. (00471b)

NOTES

- *To prevent false readings, keep air cleaner cover installed when performing test.*
- *Do not direct propane into air cleaner; false readings will result.*
- *Be careful when testing vehicle with Screamin' Eagle air cleaner assembly. This type of air cleaner has an open backing plate. Even with air cleaner cover on, directing nozzle too close to backing plate can give false readings.*

LEAK TESTER

PART NUMBER	TOOL NAME
HD-41417	PROPANE ENRICHMENT KIT

Parts List

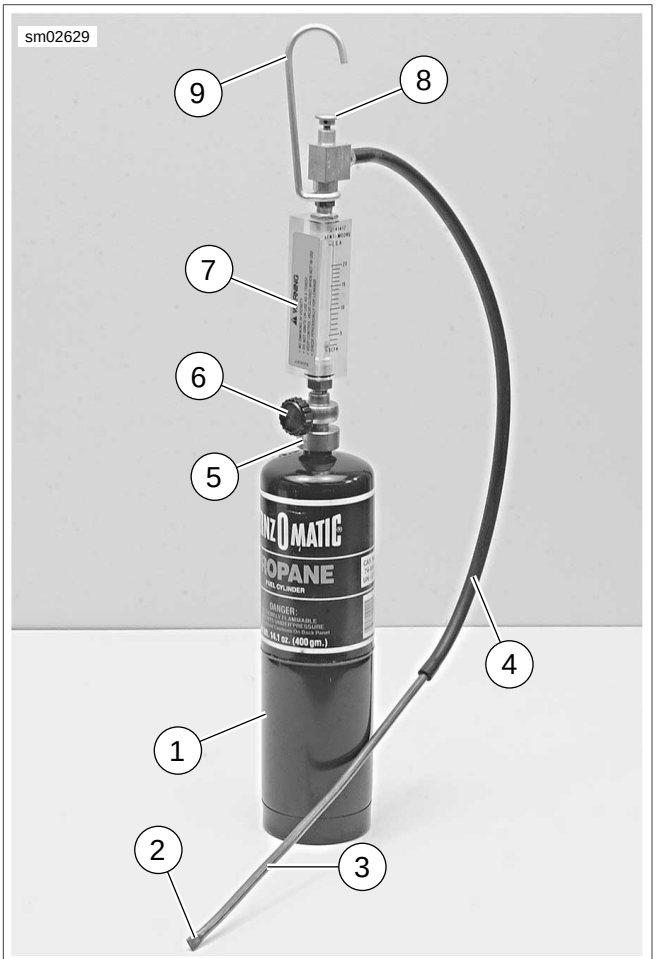
- Standard 14 oz. propane cylinder.
- PROPANE ENRICHMENT KIT (Part No. HD-41417).

Tester Assembly

1. See Figure 4-70. Make sure valve knob (6) is closed (fully clockwise).
2. Screw valve assembly (5) onto propane bottle (1).

Tester Adjustment

1. See Figure 4-70. Press and hold trigger button (8).
2. Slowly open valve knob (6) until pellet in flow gauge (7) rises to between 5 and 10 SCFH on gauge.
3. Release trigger button.



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

Figure 4-70. Leak Tester

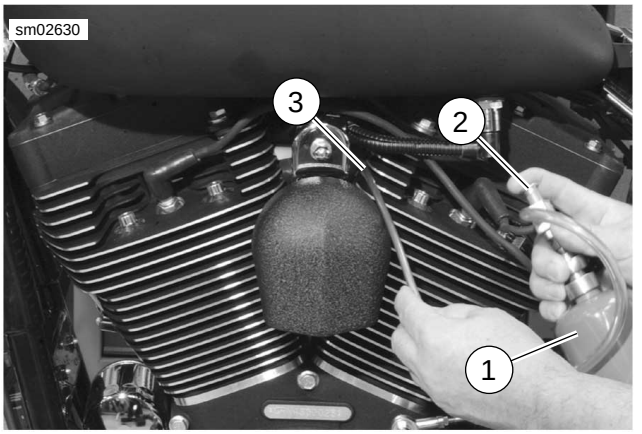
PROCEDURE

1. Start engine.
2. Warm up engine to operating temperature.

NOTE

Do not direct propane stream toward air cleaner. If propane enters air cleaner, a false reading will be obtained.

3. See Figure 4-71. Aim nozzle (3) toward possible sources of leak such as intake manifold mating surfaces.
4. Press and release trigger button (2) to dispense propane. Tone of engine will change when propane enters source of leak. Repeat as necessary to detect leak.
5. When test is finished, close valve knob (turn knob fully clockwise).



1. **Propane bottle**
2. **Trigger button**
3. **Nozzle**

Figure 4-71. Checking for Leaks

EVAPORATIVE EMISSIONS CONTROL (CA MODELS) 4.18

GENERAL

Harley-Davidson motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system to conform with California Air Resource Board (CARB) regulations. See Figure 4-72. The EVAP system functions as follows:

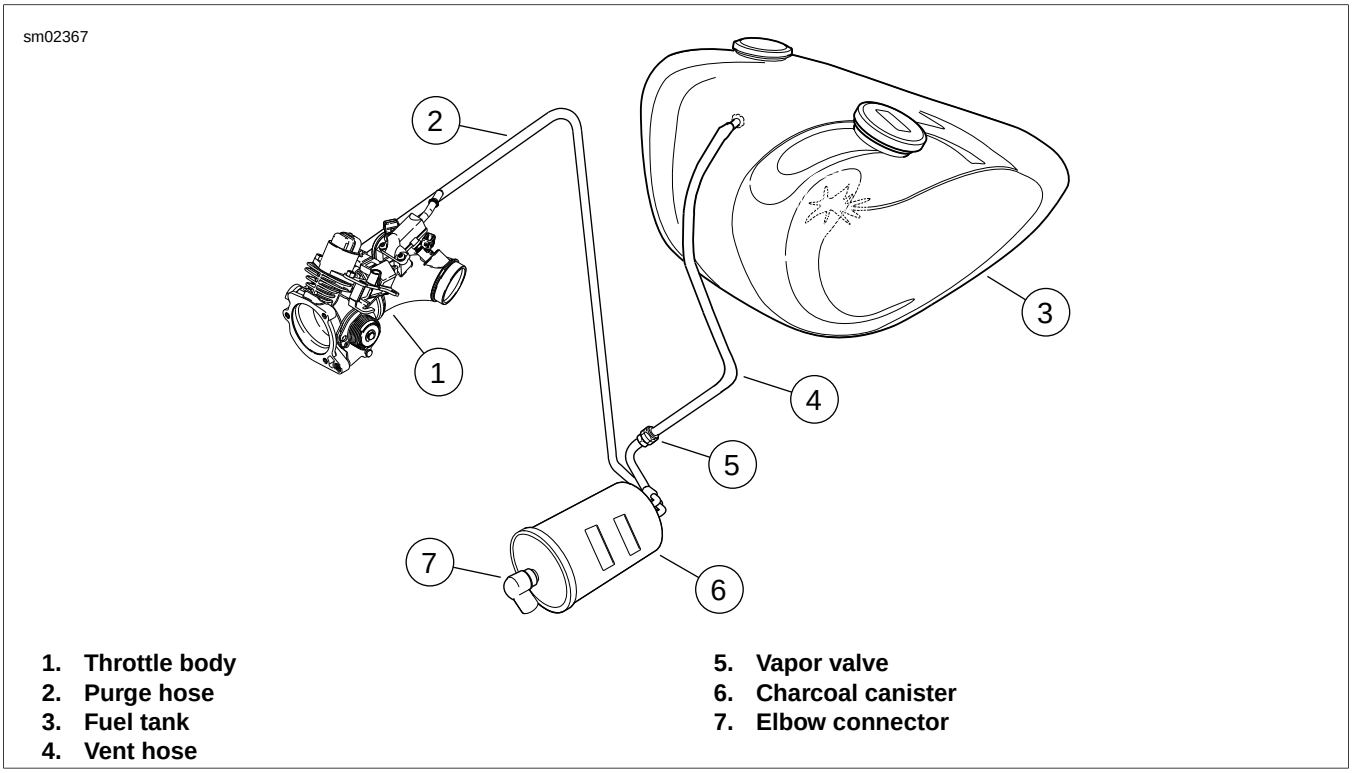
- The fuel vapor vent tube connected to the vapor valve on the fuel tank top plate allows fuel vapors in the fuel tank to be vented to the charcoal canister. If the motorcycle is tipped, the vapor valve also prevents the loss of gasoline through the vent tube.
- Under certain engine conditions, the ECM (working in conjunction with the EFI system relay) opens the purge solenoid. Negative pressure (vacuum) draws the fuel vapors stored in the charcoal canister through the purge tube to the induction module, where they are 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

The EVAP system has been designed to operate with a minimum of maintenance. Check that all tubes are correctly routed and properly connected. Also, verify that the tubes are not pinched or kinked, and that there is no contact with the drive belt and hot exhaust or engine parts.



1. **Throttle body**
2. **Purge hose**
3. **Fuel tank**
4. **Vent hose**
5. **Vapor valve**
6. **Charcoal canister**
7. **Elbow connector**

Figure 4-72. Schematic-CA Evaporative Emissions Control System

CHARCOAL CANISTER

Removal

⚠WARNING

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

See Figure 4-73. The EVAP charcoal canister is mounted between the forward frame downtubes.

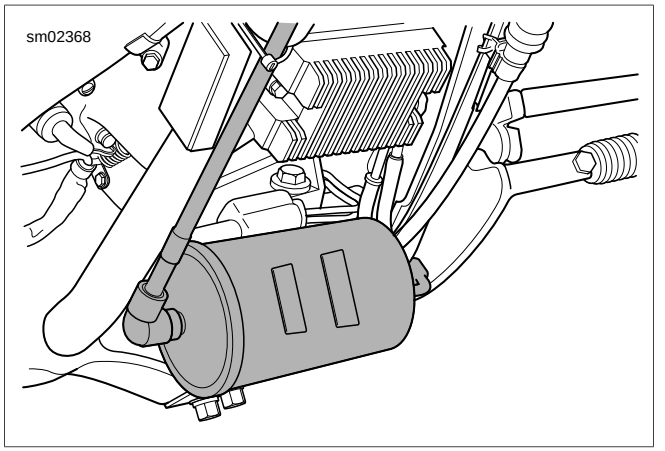
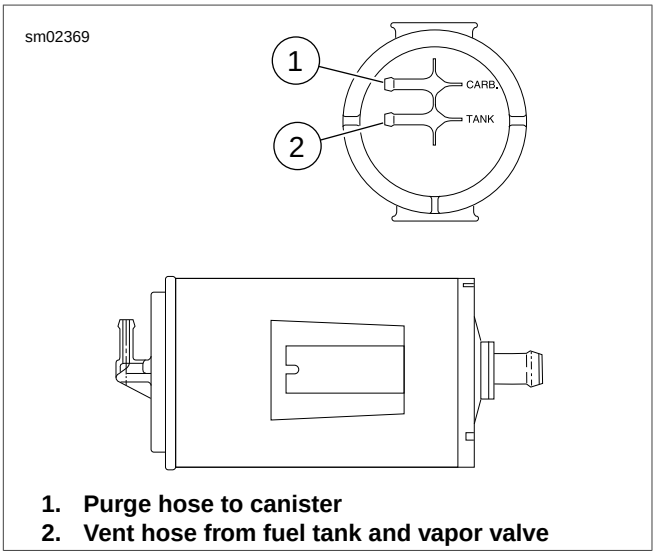


Figure 4-73. Charcoal Canister Location

1. Remove maxi-fuse. See 8.6 FUSES AND RELAYS.
2. Pull clean air hose (connection from air cleaner backplate) off nipple on right side of charcoal canister.
3. With a screwdriver, lift up the tang on the canister bracket and slide the canister sideways until it drops free from the bracket.
4. See Figure 4-74. Note the two hose connections on the left side of the canister. To ensure correct assembly, label each hose to match the stamps on the canister before disconnecting.
5. Remove canister.

Installation

1. See Figure 4-73. Slide canister into mounting bracket until canister clicks in place.
2. See Figure 4-74. Attach hoses to canister nipples as marked.



1. Purge hose to canister
2. Vent hose from fuel tank and vapor valve

Figure 4-74. Charcoal Canister Connections

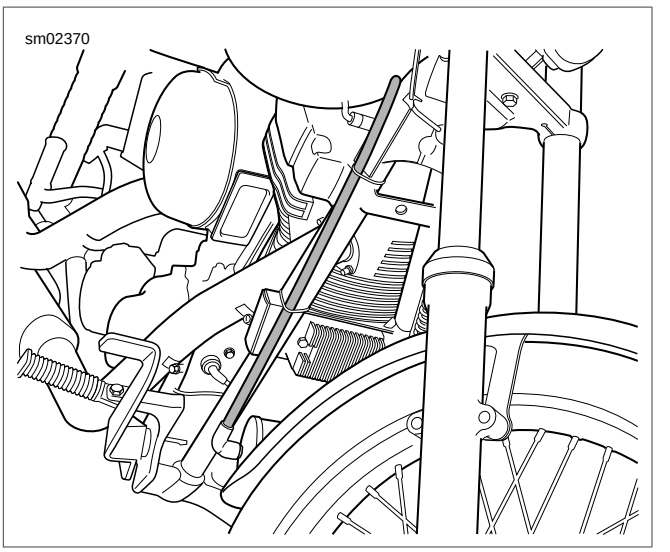


Figure 4-75. Hose Routing-Clean Air Inlet Hose

SUBJECT **PAGE NO.**
5.1 SPECIFICATIONS: STARTER....5-1
5.2 STARTER....5-2
5.3 STARTER SOLENOID....5-8

NOTES

SPECIFICATIONS

Table 5-1. Starter Specifications

STARTER DATA	
Free speed	3000 RPM (min.) @ 11.5 V
Free current	90 amp (max.) @ 11.5 V
Cranking current	200 amp (max.) @ 68°F
Stall torque	8.0 ft-lbs (10.8 Nm) @ 2.4 V

Table 5-2. Service Wear Limits Specifications

SERVICE WEAR LIMITS	IN.	MM
Brush length minimum	0.433	11.0
Commutator diameter minimum	1.141	28.981

GENERAL

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idler gear and drive housing.

NOTE

For troubleshooting and diagnostic information, see the electrical diagnostic manual for this motorcycle.

Starter Relay

The starter relay is not repairable. Replace the unit if it fails.

Wiring Diagrams

The starting circuit wiring diagram contains information about wiring configuration. For additional information, see the electrical diagnostic manual for this motorcycle.

REMOVAL

WARNING

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

1. Remove battery. See 1.17 BATTERY MAINTENANCE.
2. Remove battery tray. See 8.8 BATTERY TRAY AND BATTERY CABLES.
3. See Figure 5-1. Remove starter cover fastener (1) and starter cover (2) from starter.
4. Disconnect starter wiring:
   a. Remove protective boot (4).
   b. Remove nut with washer (metric).
   c. Remove positive battery cable ring terminal.
   d. Detach solenoid wire (5).
5. Remove both starter mounting bolts and washers (3).
6. Remove starter from right side of motorcycle.
7. Discard starter housing O-ring.
8. Before disassembling the starter, perform diagnostics.

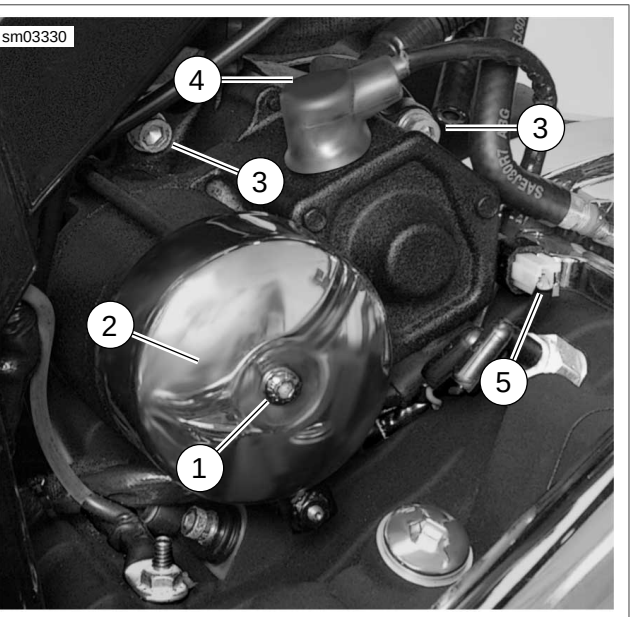
INSTALLATION

1. Examine two split ring dowel bushings in inner primary housing where starter motor assembly mounts. If dowel bushings are loose, remove bushings and pry open slightly to provide an interference fit in primary housing. Reinstall bushings into primary housing.
2. Install **new** starter housing O-ring.
3. Install starter from right side of motorcycle.
4. See Figure 5-1. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of starter mounting bolts (3).
5. Install the two starter mounting bolts (3) and washers. Tighten to 25-27 ft-lbs (33.9-36.6 Nm).

WARNING

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

6. See Figure 5-1. Attach positive battery cable, and solenoid wire (5). Tighten nut (metric) to 65-85 **in-lbs** (7.3-9.6 Nm). Place protective boot (4) securely over terminal.
7. Attach starter cover (2) using fastener (1).
8. Install battery tray. See 8.8 BATTERY TRAY AND BATTERY CABLES.
9. Install battery. See 1.17 BATTERY MAINTENANCE.



1. **Starter cover fastener***
2. **Starter cover***
3. **Starter mounting fasteners**
4. **Protective boot**
5. **Solenoid wire**

Figure 5-1. Starter

NOTE

Items marked with an asterisk (*) not used on all models.

TESTING

Armature

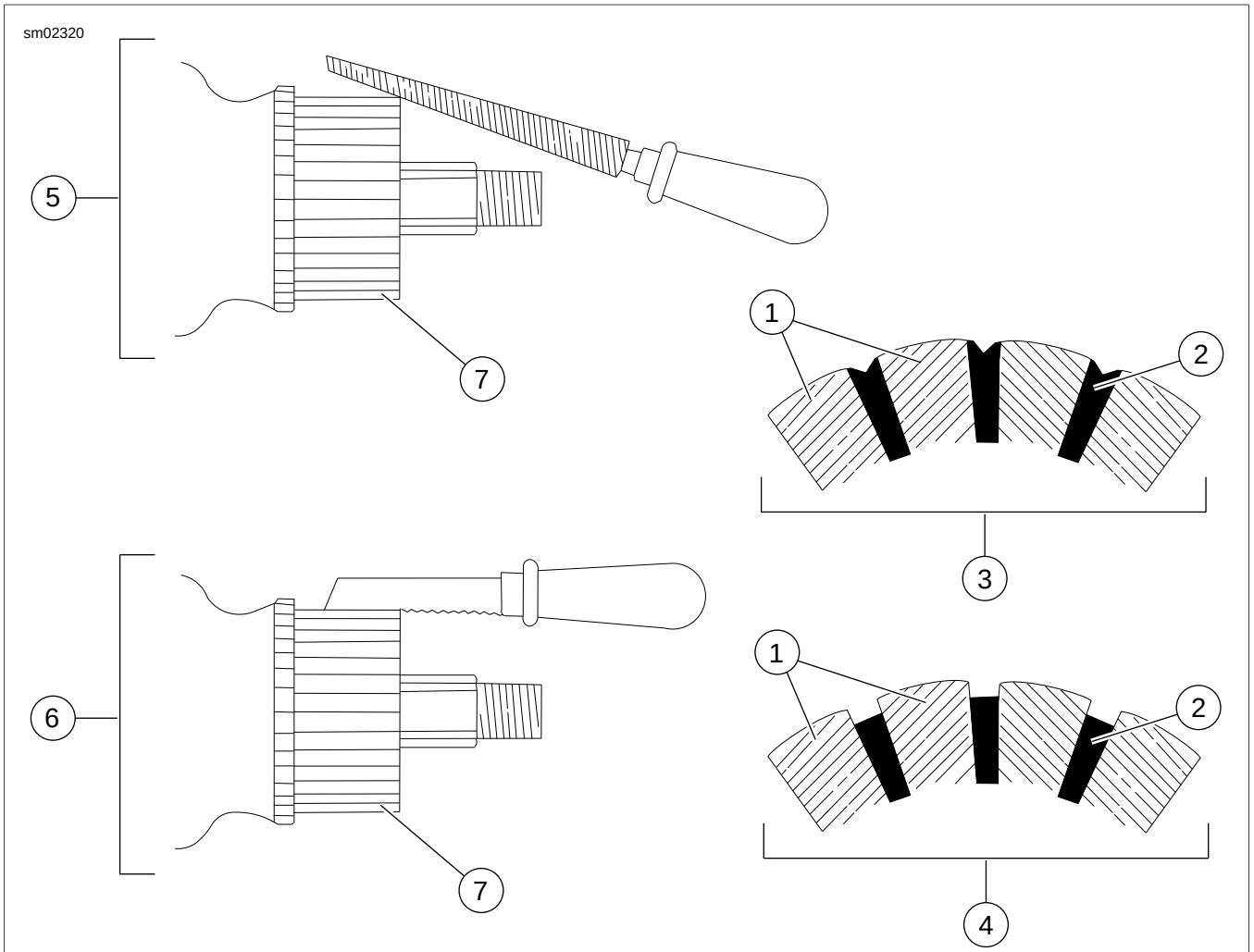
1. Remove armature and brush holder from field coil. See 5.2 STARTER, Field Coil Assembly.
2. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in. (29.98 mm).

3. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.20 mm), use an undercutting machine to undercut the mica to 1/32 in. (0.79 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

NOTES

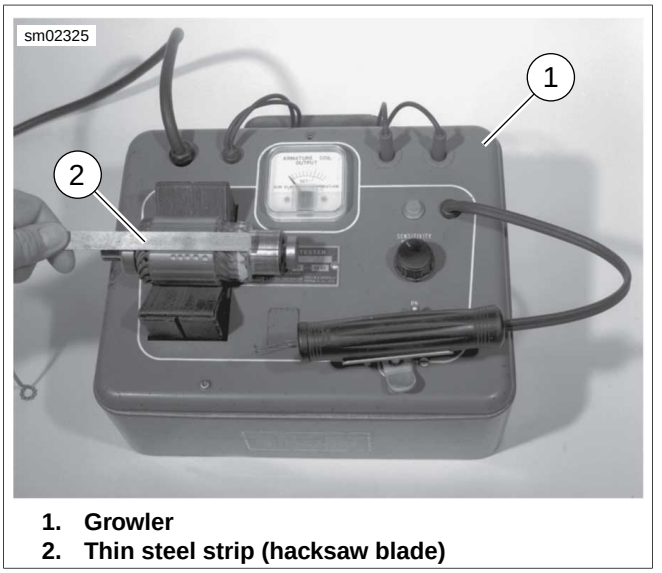
- *See Figure 5-2. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the armature with crocus cloth to remove any burrs.*
- *Do not use sandpaper or emery cloth on commutator. The abrasive grit may remain on commutator segments and could cause excessive brush wear.*

4. See Figure 5-3. Check for a SHORTED ARMATURE.
   a. Place armature on growler (1).
   b. Hold a thin steel strip (2) (hacksaw blade), against the armature core and slowly turn armature.
   c. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Replace the armature if shorted.
5. See Figure 5-4. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester.
   a. Touch one probe to any commutator segment.
   b. Touch the other probe to the armature core.
   c. There should be no continuity (infinite ohms). If there is continuity, the armature is grounded. Replace a grounded armature.
6. See Figure 5-5. Check for an OPEN ARMATURE with an ohmmeter or continuity tester.
   a. Check for continuity between all commutator segments.
   b. There should be continuity (0 ohms) at all test points. If there is no continuity at any test point, then the armature is open. Replace an open armature.



1. **Segments**
2. **Mica**
3. **Incorrect (Mica must not be left with a thin edge next to segments)**
4. **Correct (Mica must be cut away clean between segments)**
5. **Starting groove in mica with 3 cornered file**
6. **Undercutting mica with piece of hacksaw blade**
7. **Commutator**

Figure 5-2. Undercutting Mica Separators



1. **Growler**
2. **Thin steel strip (hacksaw blade)**

Figure 5-3. Shorted Armature Test Using Growler

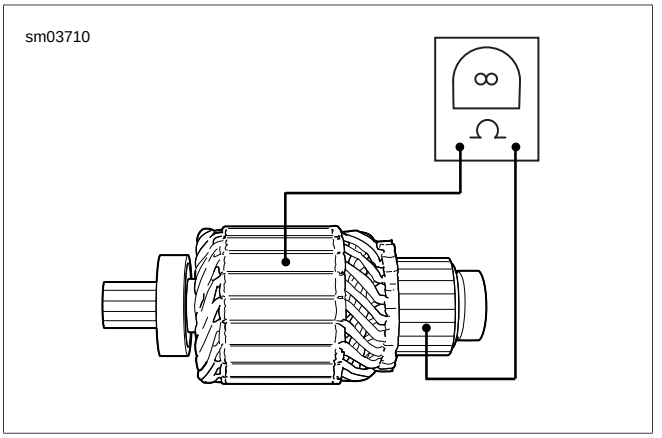


Figure 5-4. Grounded Armature Test

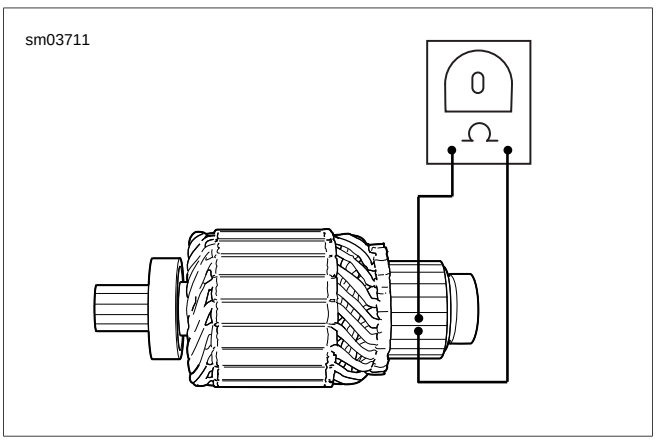


Figure 5-5. Armature Open Test

Brushes and Brush Holder

1. Remove armature and brush holder from field coil. See 5.2 STARTER, Field Coil Assembly.
2. Measure the brush length. If any one of four brushes is less than 0.433 in. (11 mm), replace the field coil and brush holder assembly. No further testing is necessary.
3. See Figure 5-6. Check for a GROUNDED FIELD COIL WINDING with an ohmmeter or continuity tester.
   a. Touch one probe to the field coil housing (frame).
   b. Touch the other probe to each of two brushes attached to the field coil winding.
   c. There should be no continuity (infinite ohms). If there is continuity at either brush, then the field coil winding is grounded. Replace the field coil/brush holder assembly if grounded.
4. See Figure 5-7. Check for an OPEN FIELD COIL WINDING with an ohmmeter or continuity tester.
   a. Touch one probe to the field wire.
   b. Touch the other probe to each of the two brushes attached to the field coil winding(s).
   c. There should be continuity (0 ohms). If there is no continuity at either brush, then the field coil winding(s) are open. Replace the field coil/brush holder assembly if open.
5. See Figure 5-8. Test the BRUSH HOLDER INSULATION with an ohmmeter or continuity tester.
   a. Touch one probe to the holder plate.
   b. Touch the other probe to each of the positive (insulated) brush holders.
   c. There should be no continuity (infinite ohms). If there is continuity at either brush holder, replace the field coil/brush holder assembly.
   d. Touch one probe to the non-insulated brush holders and the other probe to the holder plate. If any resistance is measured, replace the field coil/brush holder assembly.

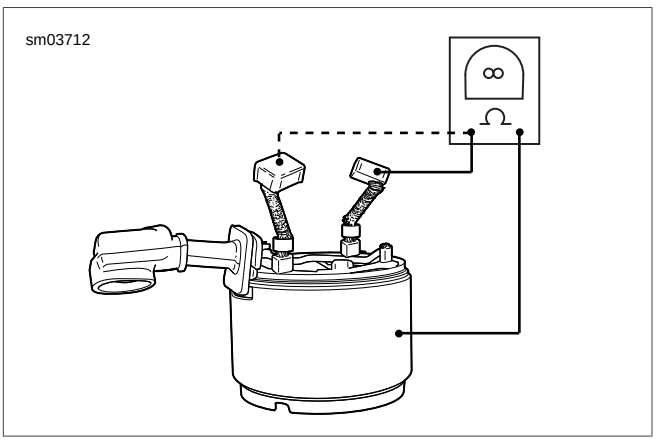


Figure 5-6. Grounded Field Test

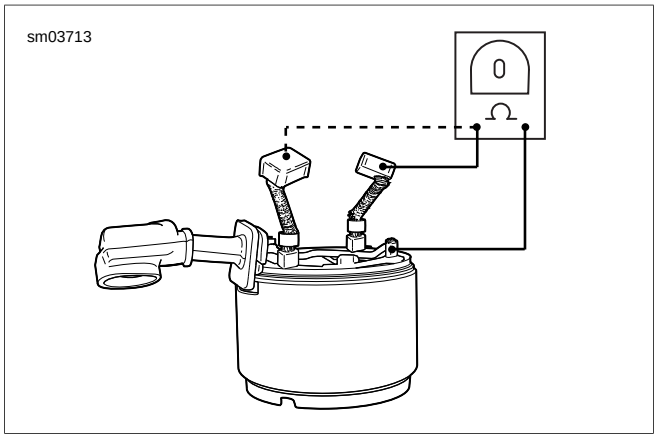


Figure 5-7. Open Field Test

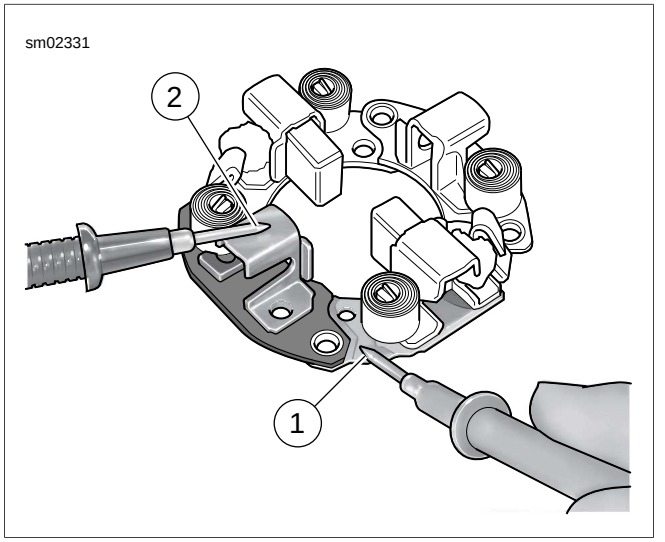


Figure 5-8. Brush Holder Insulation Test

FIELD COIL ASSEMBLY

Disassembly

1. Remove allen head screw to release chrome end cover, if equipped.
2. Remove two Keps nuts to release end cover bracket from thru bolts, if equipped.
3. Pull up rubber boot and remove hex nut with captive lockwasher to release field wire ring terminal from post on solenoid housing.
4. Using a 5/16 inch socket, loosen two thru bolts to release field coil from solenoid housing.
5. Pull field coil with end cap from solenoid housing.
6. Remove armature from field coil. Separating end cap and field coil flanges will facilitate removal.
7. Placing field coil on wooden block to prevent damage, use impact driver to remove two Phillips screws with captive washers from end cap. Discard screws.
8. Remove end cap from field coil.
9. Locate the two brushes attached to the field coil winding. Pushing on inboard side of one brush, grasp free end of brush spring on outboard side with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to free brush from brush holder. Repeat step to release second brush and then remove brush holder from field coil.

Inspection

1. For testing procedures, see 5.2 STARTER, Testing.
2. Inspect two o-rings in field coil bore for cuts, tears or signs of deterioration.
3. Inspect armature roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
4. Replace brush springs if bent or distorted.

Assembly

1. Attach brush holder to field coil. Locate the two brushes attached to the field coil winding. Catch free end of brush spring with the hooked end of a suitable pick. Raise end of brush spring only as far as necessary to install brush into brush holder. Repeat step to install second brush.
2. Retract all four brushes for armature installation. For good results, obtain four paper clips. Bend free end of each paper clip outward approximately 90°. Then, pushing on inboard side of brush, insert straight end of paper clip between outboard side of brush and inboard side of brush spring. Properly installed, the paper clip contacts the framework of the brush holder to keep spring pressure off the brush. Repeat step on remaining three brushes as shown in Figure 5-9.
3. Install armature in solenoid housing so that larger bearing on splined end seats in counterbore. Lubricate armature bearings with high temperature grease, such as LUBRI-PLATE 110, before installation.
4. Mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
5. Carefully place brush holder over armature. If additional clearance is needed, use a small flat blade screwdriver to gently push back the brushes slightly.
6. When the brush holder is centered over the armature, remove four paper clips to release brush springs. Verify that ends of brush springs make proper contact with brush sides.
7. Install end cap aligning holes in cap with those in brush holder. Start two **new** Phillips screws with captive washers. Alternately tighten Phillips screws until snug.
8. Install thru bolts to fasten field coil to solenoid housing. Using a 5/16 inch socket, alternately tighten thru bolts to 39-65 **in-lbs** (4.4-7.3 Nm).
9. Attach field wire ring terminal to short post on solenoid housing and install hex nut with captive lockwasher. Tighten hex nut to 70-90 **in-lbs** (7.9-10.2 Nm). Cover field wire ring terminal with rubber boot.

10. Install end cover bracket onto threaded end of thru bolts, if equipped. For proper orientation, be sure that the longest end of the bracket (before the bend) is on the field wire side. Install two Keps nuts and alternately tighten until snug.
11. Install allen head screw to fasten chrome end cover to end cover bracket, if equipped. Tighten screw to 90-110 **in-lbs** (10.2-12.4 Nm).

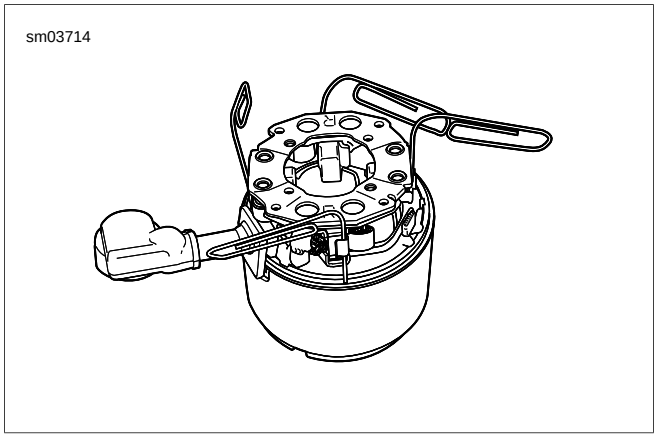


Figure 5-9. Install Paper Clips to Hold Brush Springs

DRIVE ASSEMBLY

Disassembly

1. Remove field coil. See 5.2 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release drive housing from solenoid housing.
4. Use a rubber mallet to separate drive and solenoid housings, if necessary.
5. Remove idler gear from bearing cage in drive housing. Remove bearing cage with five steel cylinders from shaft in drive housing.
6. Push on end of drive shaft to remove starter clutch assembly from drive housing.
7. Compressing internal springs, remove snap ring from groove at end of drive shaft.
8. Remove cup, pinion gear, short spring and spring seat from splined end of drive shaft.
9. Push on splined end of drive shaft to remove from starter clutch bore.
10. Remove long spring from drive shaft. Remove steel ball from drive shaft bore.
11. Remove return spring from solenoid plunger shaft.

Inspection

1. Inspect two o-rings in drive housing bore for cuts, tears or signs of deterioration.
2. Replace springs if kinked, elongated or distorted.
3. Inspect pinion gear and drive shaft gear. Replace if pitted, scored, rounded, cracked, chipped or worn.
4. Inspect roller bearings. Bearings must rotate freely without drag or sticking. Replace the bearings if pitted or grooved.
5. Inspect the steel ball for wear, pitting, surface breakdown or other damage.
6. Replace snap ring if bent or distorted.

Assembly

1. Install long spring onto drive shaft. Install steel ball in drive shaft bore. Insert splined end of drive shaft into starter clutch bore (gear side).
2. Insert a deepwell socket into starter clutch bore and stand assembly upright on work bench with the socket side down.
3. Push down on starter clutch, so that installed socket pushes against the drive shaft gear to compress the spring. Holding assembly with spring compressed, install spring seat, short spring, pinion gear and cup on splined end of drive shaft. Be sure that the collar on the pinion gear and the concave side of the cup both face the splined end of the drive shaft.
4. While pushing down to simultaneously compress both the long and short springs installed, install snap ring in groove at splined end of drive shaft. Verify that snap ring is fully seated in the groove and that it resides in concave portion of cup when spring tension is released.
5. Remove deepwell socket from starter clutch bore.
6. Install bearing cage with five steel cylinders onto shaft in drive housing. Be sure that all five steel cylinders are installed in grooves of bearing cage. Install idler gear over bearing cage. Lubricate parts with high temperature grease, such as LUBRIPLATE 110, during assembly.
7. Install starter clutch assembly in drive housing seating the larger bearing in the counterbore. Lubricate bearings with LUBRIPLATE 110 before installation.
8. Apply a light film of Lubriplate 110 to solenoid plunger shaft. Install return spring on solenoid plunger shaft.
9. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
10. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
11. Install field coil. See 5.2 STARTER, Field Coil Assembly.

SOLENOID ASSEMBLY

Disassembly

1. Remove field coil. See 5.2 STARTER, Field Coil Assembly.
2. Pull field coil with end cap from solenoid housing. Hold end cap to field coil to avoid pulling armature out of brush holder. If armature is pulled from brush holder, further disassembly is required.
3. Using a 9 mm socket, remove two hex screws with Phillips recess to release solenoid housing from drive housing.
4. Use a rubber mallet to separate solenoid and drive housings, if necessary.
5. Remove return spring from solenoid plunger shaft.

Assembly

1. Install return spring on solenoid plunger shaft.
2. Mate the solenoid and drive housings and install two hex screws using a 9 mm socket. Alternately tighten hex screws until snug.
3. Lubricate armature bearing with LUBRIPLATE 110. Seating armature bearing in counterbore, mate field coil and solenoid housings. For proper assembly, a nub on the field coil housing flange must engage the slot on solenoid housing flange closest to the short (field wire) post on the solenoid housing.
4. Install field coil. See 5.2 STARTER, Field Coil Assembly.

SOLENOID PLUNGER

Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.

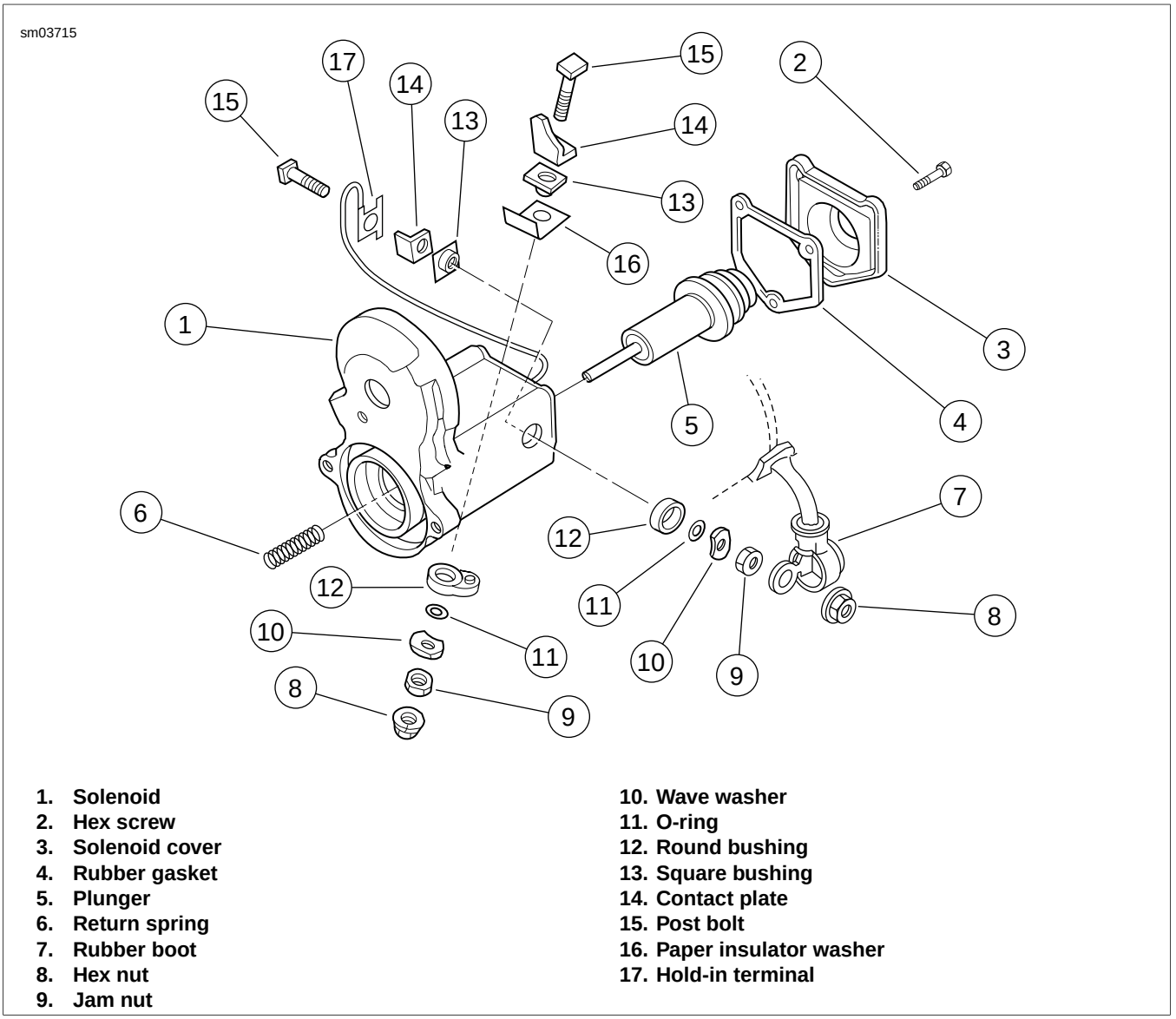
Assembly

1. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.
2. Install **new** rubber gasket on solenoid cover flange.
3. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

SOLENOID CONTACTS

Disassembly

1. Remove three hex screws to release solenoid cover.
2. Remove rubber gasket from solenoid cover flange.
3. Remove plunger and return spring.
4. Obtain Solenoid Contact Repair Kit.
5. Disassemble short post (field coil):
   a. See Figure 5-10. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
   b. On inside of solenoid housing, remove post bolt, hold-in terminal, contact plate and square bushing.
6. Disassemble long post (battery):
   a. Remove hex nut from post, if still installed. Remove jam nut, wave washer, round bushing and o-ring from post.
   b. On inside of solenoid housing, remove post bolt, contact plate, square bushing and paper insulator washer.



1. **Solenoid**
2. **Hex screw**
3. **Solenoid cover**
4. **Rubber gasket**
5. **Plunger**
6. **Return spring**
7. **Rubber boot**
8. **Hex nut**
9. **Jam nut**
10. **Wave washer**
11. **O-ring**
12. **Round bushing**
13. **Square bushing**
14. **Contact plate**
15. **Post bolt**
16. **Paper insulator washer**
17. **Hold-in terminal**

Figure 5-10. Solenoid Assembly

Assembly

1. Assemble short post (field coil):
   a. From inside solenoid housing, insert sleeve on square bushing into hole in solenoid housing.
   b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
   c. Slide short post bolt through holes in hold-in terminal, contact plate, square bushing and solenoid housing.
   d. At outside of solenoid housing, install round bushing, O-ring and wave washer onto end of post. Install jam nut, but do not tighten.
2. Assemble long post (battery):
   a. On inside of solenoid housing, align hole in paper insulator washer with hole in solenoid housing. Insert sleeve on square bushing into holes.
   b. With the foot inboard against solenoid winding, align hole in contact plate with hole in square bushing.
   c. Slide long post bolt through holes in contact plate, square bushing, paper insulator washer and solenoid housing.
   d. At outside of solenoid housing, install round bushing, o-ring and wave washer onto end of post. Verify that index pin on round bushing engages blind hole in solenoid housing. Install jam nut, but do not tighten.
3. Apply a light film of LUBRIPLATE 110 to plunger shaft and install return spring. Install plunger in solenoid.

4. While depressing plunger, alternately tighten jam nuts to 65-80 **in-lbs** (7.3-9.0 Nm). Verify that contact plates have not rotated out of alignment with plunger.
5. Install **new** rubber gasket on solenoid cover flange.
6. Install three hex screws to secure solenoid cover. Alternately tighten hex screws until snug.

SUBJECT **PAGE NO.**
6.1 SPECIFICATIONS: DRIVE....6-1
6.2 PRIMARY CHAINCASE COVER....6-2
6.3 DRIVE COMPONENTS....6-3
6.4 PRIMARY CHAINCASE HOUSING....6-8
6.5 CLUTCH....6-13
6.6 TRANSMISSION SPROCKET....6-18
6.7 DRIVE BELT....6-21

NOTES

SPECIFICATIONS

Table 6-1. Sprocket Specifications

SPROCKETS	NO. OF TEETH	
	DOM/HDI	Japan
Compensating	34	34
Clutch	46	46
Transmission	32	32
Rear Wheel	66	64

Table 6-2. Clutch Specifications

CLUTCH	DESCRIPTION
Type	Wet-multiple disc
Clutch lever freeplay (after internal adjustment)	1/16-1/8 in. (1.6-3.2 mm)

Table 6-3. Gear Specifications

GEAR	OVERALL GEAR RATIO	
	DOM/HDI	Japan
First (low)	9.312	9.030
Second	6.421	6.226
Third	4.774	4.630
Fourth	3.926	3.807
Fifth	3.279	3.179
Sixth (high)	2.790	2.706

NOTE

Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

GENERAL

The primary chaincase is a sealed housing containing the primary chain, chain tensioner, clutch, engine compensating sprocket and alternator.

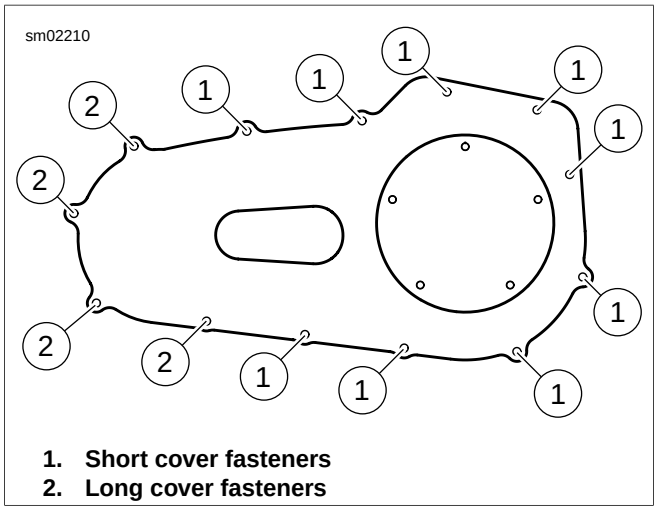
For information on primary chain lubrication, see 1.9 PRIMARY CHAIN.

REMOVAL

⚠ WARNING

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

1. Disconnect negative battery cable.
2. Drain the primary chaincase lubricant. See 1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant.
3. See Figure 6-1. When lubricant has drained, remove short (1) and long (2) cover fasteners and cover.



1. **Short cover fasteners**
2. **Long cover fasteners**

Figure 6-1. Primary Chaincase Cover

INSTALLATION

1. See Figure 6-2. On FXDWG and FXDF models, be sure sleeve (3) is installed in primary chaincase cover (2). Apply two drops of LOCTITE THREADLOCKER 262 (red) to sleeve threads and tighten sleeve to 15-19 ft-lbs (20.3-25.6 Nm).
2. See Figure 6-19. On all but FXDWG and FXDF models, replace tower gasket (9).

NOTE

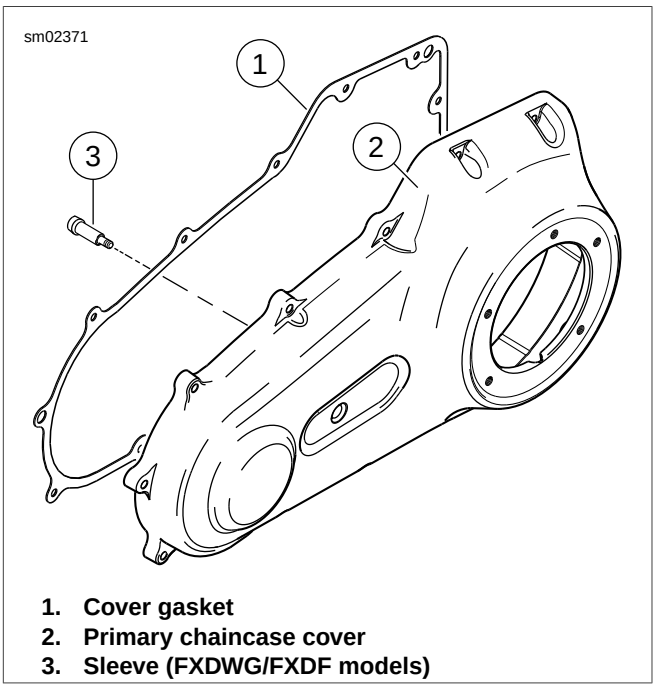
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

3. See Figure 6-2. Install **new** cover gasket (1).
4. See Figure 6-1. Install short (1) and long (2) primary cover fasteners in positions shown. Snug fasteners.
5. See Figure 6-3. Tighten primary cover fasteners (1-13) to 108-120 **in-lbs** (12.2-13.6 Nm) in the sequence shown.

CAUTION

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

6. Place motorcycle in an upright position and fill primary chaincase. See 1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant.
7. Connect negative battery cable.



1. **Cover gasket**
2. **Primary chaincase cover**
3. **Sleeve (FXDWG/FXDF models)**

Figure 6-2. Primary Chaincase Cover Gasket

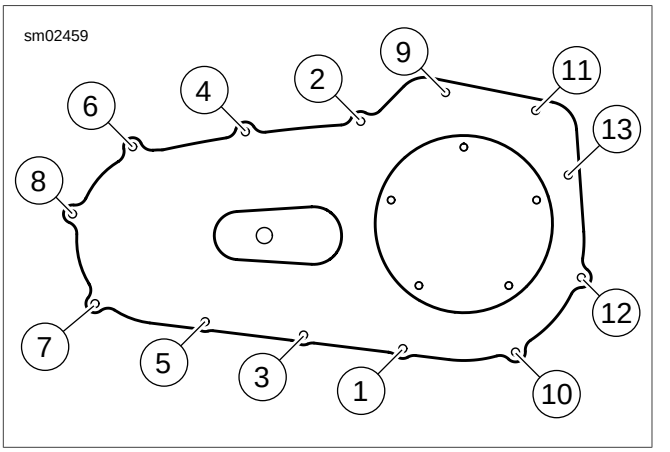


Figure 6-3. Primary Chaincase Cover Torque Sequence

REMOVAL

PART NUMBER	TOOL NAME
HD-47977	PRIMARY DRIVE LOCKING TOOL

NOTES

To remove the primary chain, remove compensating sprocket, clutch assembly and primary chain as an assembly:

1. Remove primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 6-4. Remove chain tensioner fasteners (2) then remove chain tensioner (1).
3. Using a colored marker, mark one of the links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.

WARNING

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

4. See Figure 6-5. Loosen locknut (3).
5. Remove retaining ring (1) and release plate (2).

WARNING

Do not apply heat to remove the clutch hub nut. Fuel vapor and possible fuel mixture in crankcase oil is extremely flammable and highly explosive, which could result in death or serious injury. (00440b)

NOTES

- *See Figure 6-7. When removing the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.*
- *The mainshaft nut has left handed threads, so turn clockwise to remove.*
- *Do not use PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) to remove or install components. Damage to components can occur if this tool is used. Use only PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) to remove and install components.*

6. Using a breaker bar, rotate clutch hub mainshaft nut in direction shown to remove.

NOTE

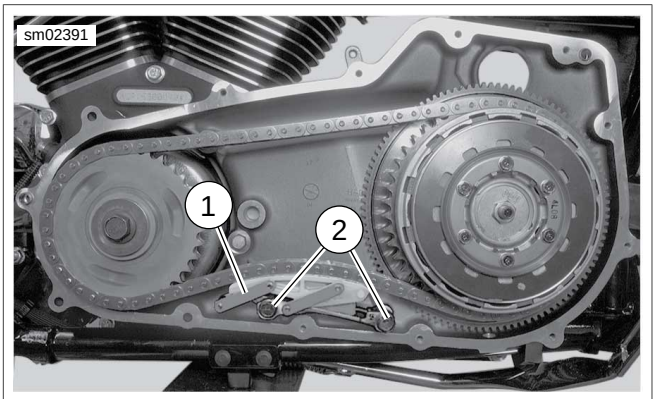
See Figure 6-8. When removing the compensating sprocket bolt, the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.

7. Using a breaker bar, rotate compensating sprocket bolt in direction shown to remove.
8. See Figure 6-9. Remove bolt (6) and washer (5).

NOTE

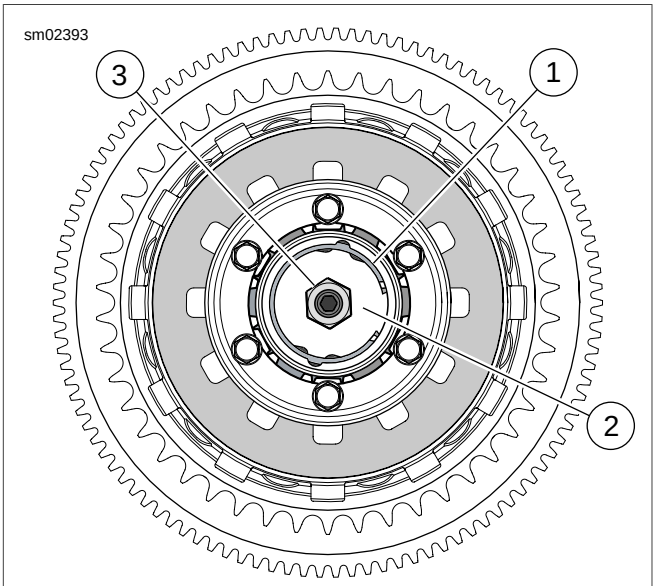
Using a colored marker or paint pen, mark one of the outboard links of the primary chain. Maintaining the original direction of rotation during assembly may prolong service life.

9. See Figure 6-6. Remove clutch assembly, primary chain and compensating sprocket assembly as a single assembly.



1. **Chain tensioner**
2. **Chain tensioner fasteners**

Figure 6-4. Chain Tensioner



1. **Retaining ring**
2. **Release plate**
3. **Locknut**

Figure 6-5. Clutch

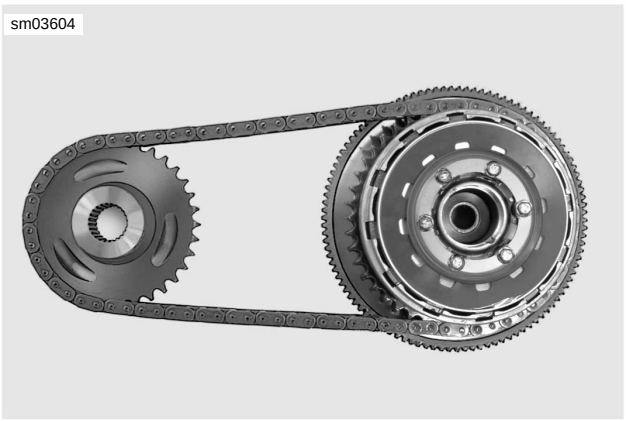
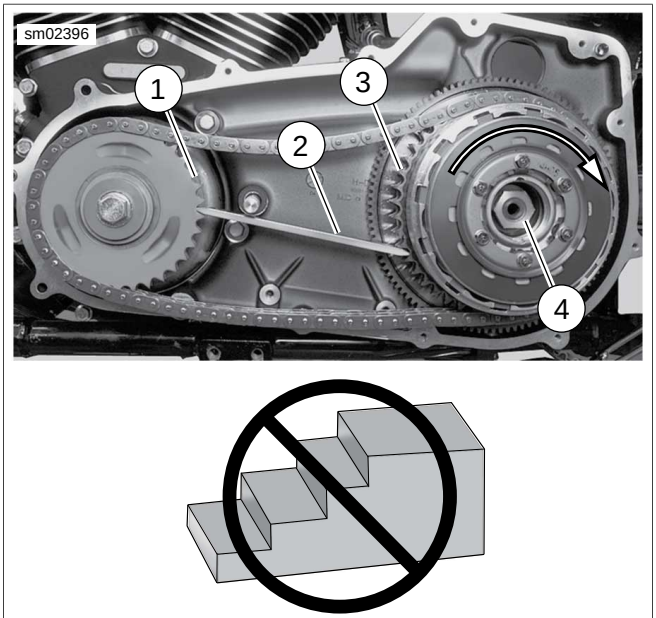
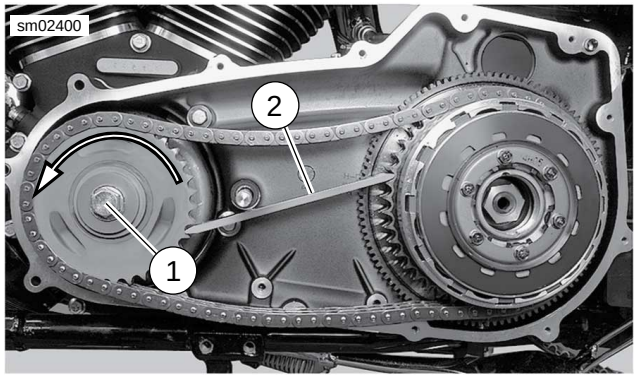


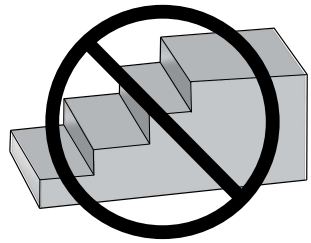
Figure 6-6. Remove Drive Components



1. **Engine sprocket**
2. **Primary drive locking tool**
3. **Clutch sprocket**
4. **Mainshaft nut**

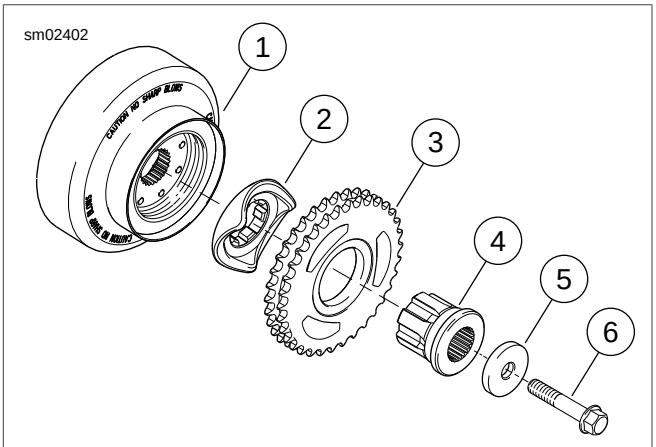
Figure 6-7. Removing Clutch Hub Mainshaft Nut





1. **Bolt**
2. **Primary drive locking tool**

Figure 6-8. Removing Compensating Sprocket Bolt



1. **Rotor**
2. **Sliding cam**
3. **Compensating sprocket**
4. **Shaft extension**
5. **Washer**
6. **Bolt**

Figure 6-9. Compensating Sprocket

INSTALLATION

PART NUMBER	TOOL NAME
HD-47977	PRIMARY DRIVE LOCKING TOOL

NOTE

The primary chain, compensating sprocket and clutch assembly must be installed as an assembly.

1. See Figure 6-10. Apply a thin layer of primary chaincase oil, to the inner diameter of the compensating sprocket

(3). and the splines of shaft extension (4). Assemble shaft extension, compensating sprocket and sliding cam (2). Place primary chain over compensating sprocket assembly.

2. Place drive components (primary chain, compensating sprocket assembly, and clutch assembly) into position. The clutch hub and shaft extension are splined, so a slight rotation of the chain drive will aid installation.

3. If reusing bolt (6), remove threadlocking material from bolt and engine sprocket shaft. Clean and prime threads of bolt and sprocket shaft. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads of bolt. Install bolt and washer (5) hand tight.

NOTE

Clutch hub mainshaft nut has left handed threads, so turn counterclockwise to install.

4. Clean and prime threads of nut. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads of the clutch hub mainshaft nut. Start nut onto mainshaft and tighten hand tight.

NOTE

See Figure 6-11. When tightening the compensating sprocket bolt, the PRIMARY DRIVE LOCKING TOOL (Part No. HD-47977) must be placed between the teeth of the engine and clutch sprockets.

5. Tighten compensating sprocket bolt to 155-165 ft-lbs (210.1-223.7 Nm). Remove primary drive locking tool.

NOTE

See Figure 6-12. When tightening the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL must be placed between the teeth of the engine and clutch sprockets.

6. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-108.5 Nm). Remove primary drive locking tool.

7. See Figure 6-13. Install release plate (5) with locknut (2) and adjuster screw (3) into clutch hub bore. The word "OUT" stamped on the release plate should face outward.

⚠WARNING

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

8. Inspect retaining ring (4) and replace if necessary. Install retaining ring in clutch hub bore to lock release plate in position. Verify that the retaining ring is completely seated in the groove.

9. Adjust clutch. See 1.11 CLUTCH, Adjustment.

NOTE

Primary chain tensioner is non-repairable. If tensioner is worn or damaged, assembly must be replaced.

10. See Figure 6-14. Although primary chain tensioner is sold as an assembly, tensioner parts can be disassembled. If primary chain tensioner becomes disassembled, assemble in order shown.

11. See Figure 6-15. Locate end of spring rod (2) on roll pin (3).

12. See Figure 6-16. Slide wedge (2) of primary chain tensioner in direction of arrow until all travel is removed.

13. Push shoe (1) down until it contacts wedge. Keep tension on shoe so wedge stays in place.

14. See Figure 6-17. Insert cable tie (2) as shown to hold wedge in place. Make sure end of cable tie is located below primary chain tensioner. If cable tie is installed this way, it will hang below primary cover gasket surface and serve as a reminder to remove cable tie before installing primary cover.

NOTE

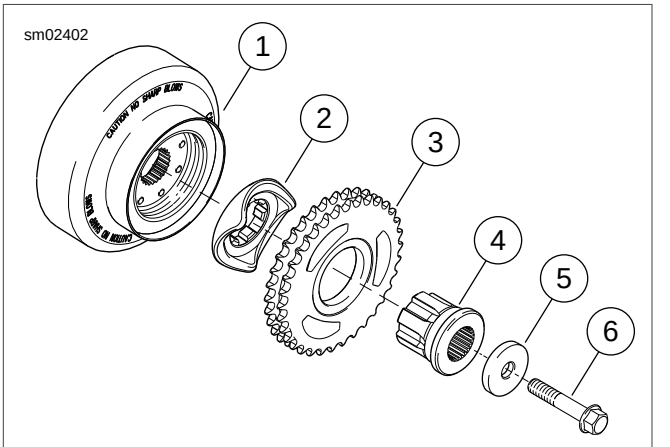
Primary chain tensioner will not complete chain adjustment until vehicle is ridden. Vehicle must be test ridden after tensioner removal/installation to ensure proper adjustment.

15. See Figure 6-18. Install primary chain tensioner (1) into place. Install chain tensioner fasteners (2) and tighten to 15-19 ft-lbs (20.3-25.8 Nm). Remove cable tie.

NOTE

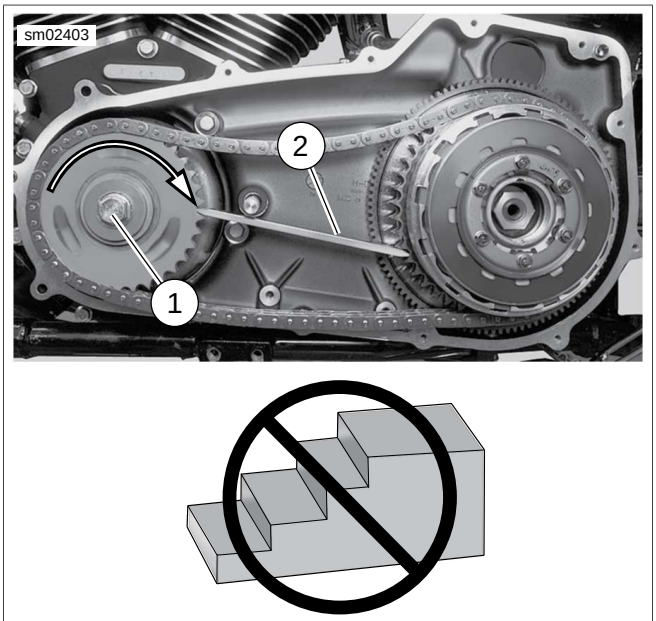
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

16. Install primary chaincase cover and fill with lubricant. See 6.2 PRIMARY CHAINCASE COVER, Installation.



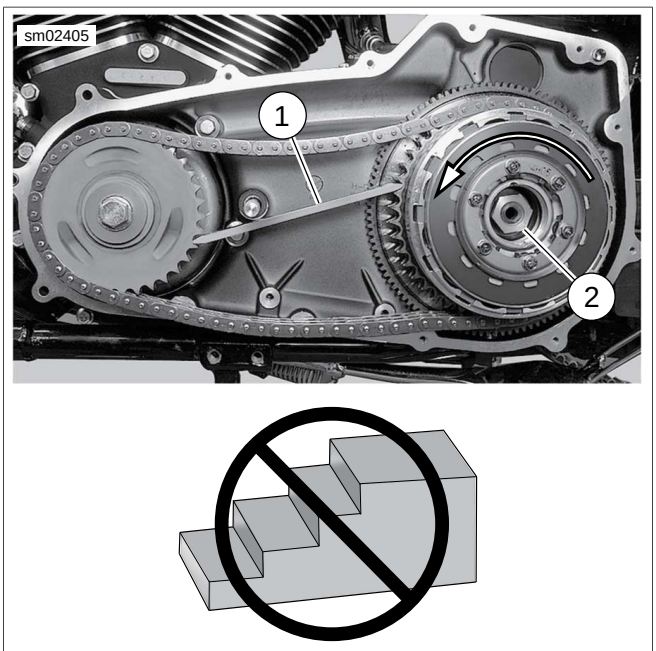
1. **Rotor**
2. **Sliding cam**
3. **Compensating sprocket**
4. **Shaft extension**
5. **Washer**
6. **Bolt**

Figure 6-10. Compensating Sprocket



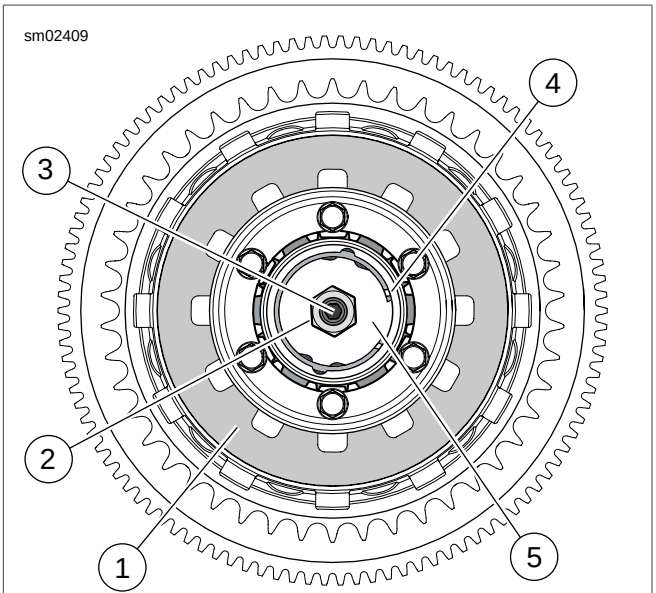
1. **Bolt**
2. **Primary drive locking tool**

Figure 6-11. Installing Compensating Sprocket Bolt



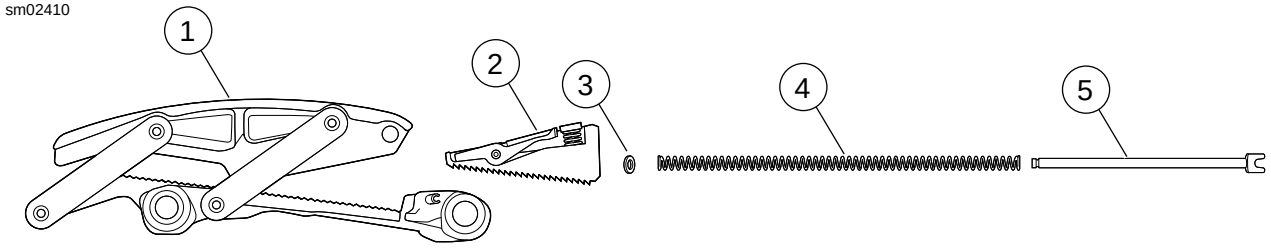
1. **Primary drive locking tool**
2. **Mainshaft nut**

Figure 6-12. Installing Clutch Hub Mainshaft Nut



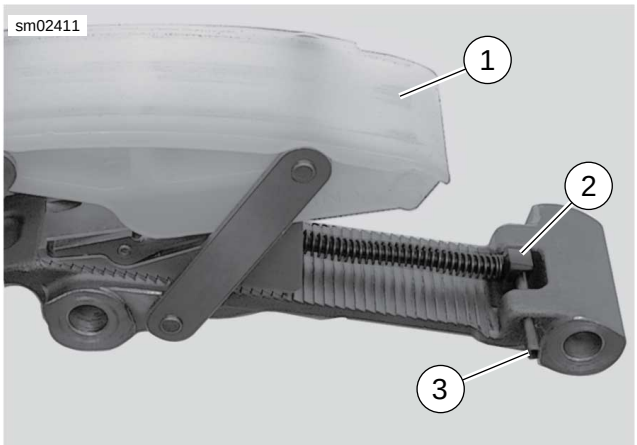
1. **Diaphragm spring**
2. **Locknut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Release plate**

Figure 6-13. Clutch



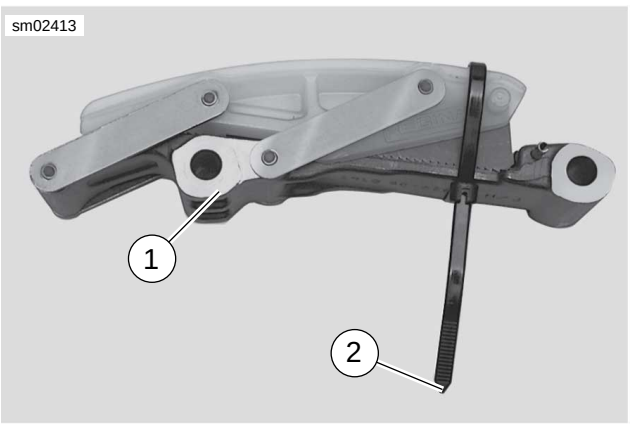
1. **Shoe assembly**
2. **Wedge**
3. **Washer**
4. **Spring**
5. **Spring rod**

Figure 6-14. Primary Chain Tensioner Assembly



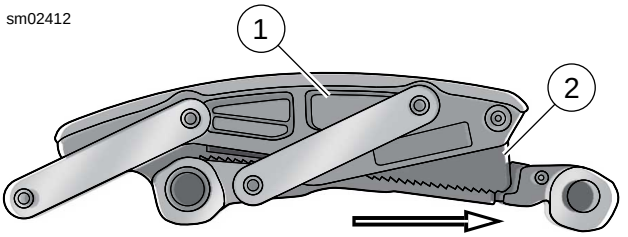
1. **Shoe**
2. **Spring rod**
3. **Roll pin**

Figure 6-15. Spring Rod Location



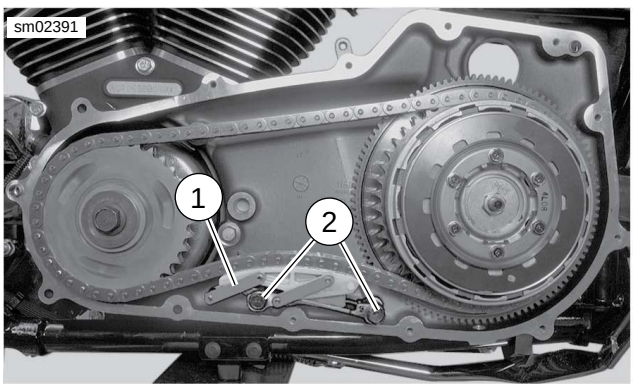
1. **Primary chain tensioner**
2. **Cable tie**

Figure 6-17. Securing Primary Chain Tensioner



1. **Shoe**
2. **Wedge**

Figure 6-16. Primary Chain Tensioner



1. **Chain tensioner**
2. **Chain tensioner fasteners**

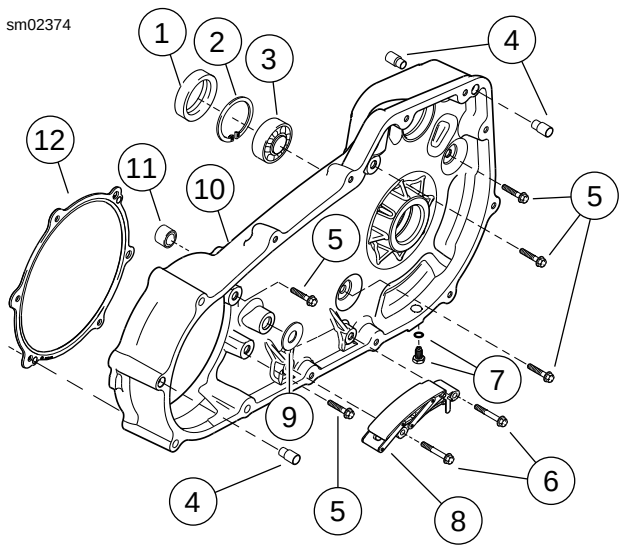
Figure 6-18. Chain Tensioner

REMOVAL

⚠WARNING

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

1. Disconnect battery cable, negative cable only.
2. Remove primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
3. Remove starter. See 5.2 STARTER, Removal.
4. Remove primary chain, clutch, and compensating sprocket. See 6.3 DRIVE COMPONENTS, Removal.
5. See Figure 6-19. Remove sealing fasteners (5) securing primary chaincase housing (10) to crankcase and transmission. Discard the crankcase gasket (12) and sealing fasteners.



1. **Seal**
2. **Lock ring**
3. **Bearing**
4. **Dowel pin**
5. **Sealing fastener**
6. **Chain tensioner fasteners**
7. **Drain plug and o-ring**
8. **Chain tensioner**
9. **Tower gasket**
10. **Primary chaincase housing**
11. **Shifter shaft bushing**
12. **Crankcase gasket**

Figure 6-19. Primary Chaincase Housing

INSPECTION

1. Inspect primary chaincase for cracks or damaged gasket surface.
2. Check the mainshaft bearing. Replace if bearing does not rotate freely. Replace the lip seal. See 6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing and Lip Seal.
3. On all but FXDWG and FXDF models, inspect shifter shaft bushing. Replace if worn or damaged. See 6.4 PRIMARY CHAINCASE HOUSING, Shifter Shaft Bushing.

MAINSHAFT BEARING AND LIP SEAL

Removal

⚠WARNING

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

1. Pull lip seal from bearing bore on transmission side of primary chaincase. Use a seal remover or rolling head pry bar for best results.
2. Remove retaining ring from groove on transmission side of bearing.
3. Support inner primary chaincase on transmission side of bearing.

NOTE

Support inner primary chain case area on transmission side while pressing bearing out of primary chaincase. The force needed to remove bearing may cause damage to primary chain case.

4. Place primary chaincase in arbor press. Press out bearing from clutch side applying pressure to the outer race.

Installation

1. Inspect the bearing bore to verify that it is clean and smooth. Install retaining ring in groove on pulley side of primary chaincase.
2. Place primary chaincase in arbor press with the transmission side up.
3. Support the bearing support area on the clutch side of the primary chaincase.

NOTE

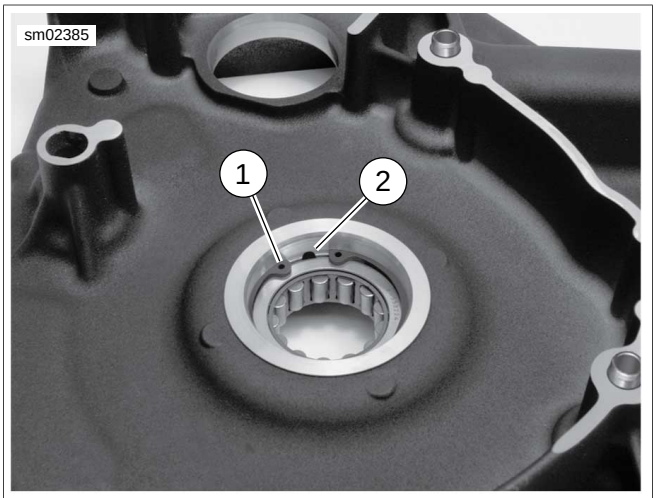
Support the bearing support area on clutch side while pressing bearing into bore. The force needed to press bearing into position may force and unsupported primary chain case to become damaged.

4. Apply a thin film of oil to outer diameter of bearing
5. Applying pressure to the outer race, press **new** bearing letter side up, into bore until it makes solid contact with the bearing support area.
6. See Figure 6-20. Retaining ring (1) must be oriented as shown to prevent blocking of oil passage (2). Install retaining ring to lock position of bearing in bore. Verify that the ring is fully seated in the groove and is in proper orientation.

NOTES

- *The lip garter spring side of the oil seal is also identified by the words "OIL SIDE".*
- *Install oil seal with a seal driver that will press only against outer rim of oil seal, NOT against the inner area.*
- *The minimum allowable depth of the seal is reached when the outer edge of the seal carrier is flush with the machined surface of the primary housing. The maximum allowable depth of the seal is reached when the seal carrier contacts the mainshaft bearing snap ring.*

7. Install mainshaft oil seal:
   a. Lubricate the O.D. of the new seal with clean engine oil.
   b. See Figure 6-21. With the lip garter spring side (stamped "oil side") facing toward the bearing, press squarely on the outer edge of a **new** oil seal until outer edge of seal is flush with machined surface of inner primary housing.
8. Lubricate the bearing and seal lip with multi-purpose grease or clean engine oil.



1. **Retaining ring**
2. **Oil passage**

Figure 6-20. Retaining Ring Orientation

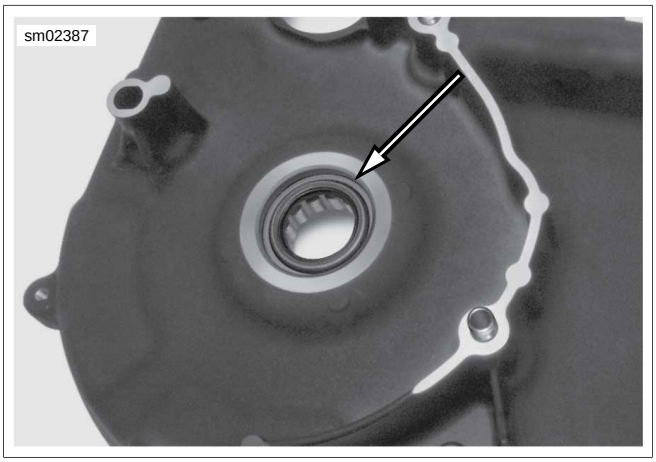


Figure 6-21. Oil Seal

MAINSHAFT BEARING INNER RACE

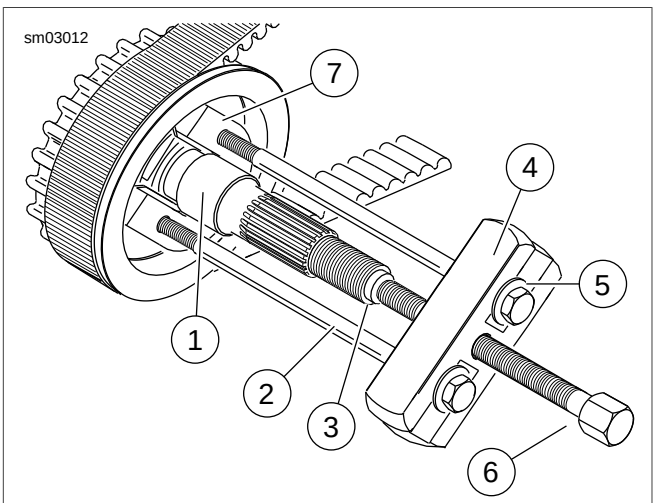
PART NUMBER	TOOL NAME
HD-34902-B	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER

Removal

NOTE

The bearing inner race must be positioned on the shaft a precise distance to properly align with the bearing outer race in the primary chaincase. To remove and install the bearing inner race, use the combination MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER (Part No. HD-34902-B).

1. See Figure 6-22. Install washers (5) on bolts (2). Slide one bolt into channel on each side of bridge (4) so that washer is between bridge and bolt head.
2. Thread bolts into stamped side of puller plate (7) an equal number of turns.
3. Apply graphite lubricant to threads of forcing screw (6). Thread forcing screw into bridge.
4. Position puller plate between inner race (1) and sprocket nut.
5. Install end cap into end of mainshaft. Thread forcing screw into bridge until the forcing screw seats in the end cap. Continue turning forcing screw until the bearing inner race is free of the mainshaft.



1. **Bearing inner race**
2. **Bolt (2)**
3. **End cap**
4. **Bridge**
5. **Washer (2)**
6. **Forcing screw**
7. **Puller plate**

Figure 6-22. Pulling Mainshaft Inner Bearing Race

Installation

1. See Figure 6-24. Slide bearing inner race (1), chamfer edge first, onto mainshaft.

NOTE

Extension shaft has left-hand threads.

2. Thread extension shaft (2) onto end of mainshaft .
3. Position installer sleeve (4) over extension shaft and against bearing inner race. Apply graphite lubricant to threads of extension shaft.
4. Place two washers (5) over threaded portion of extension shaft and install nut.
5. Tighten nut (6) while holding extension shaft stationary with wrench on flats (3) at end of screw threads. Press race onto shaft so inside edge is 0.100-0.125 in. (2.540-3.180 mm) from main drive gear.
6. Lubricate race with primary chaincase lubricant.

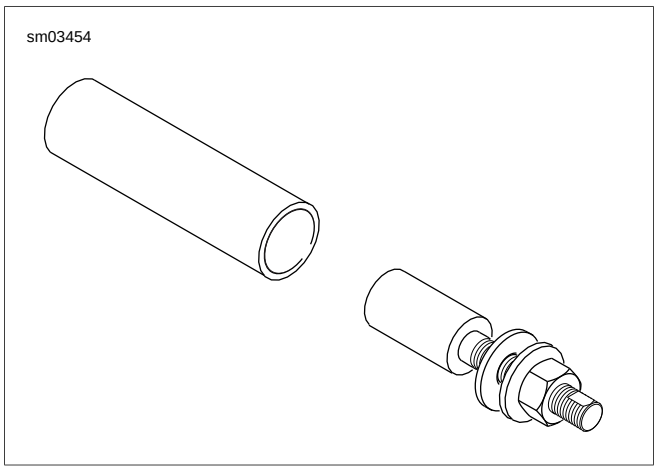
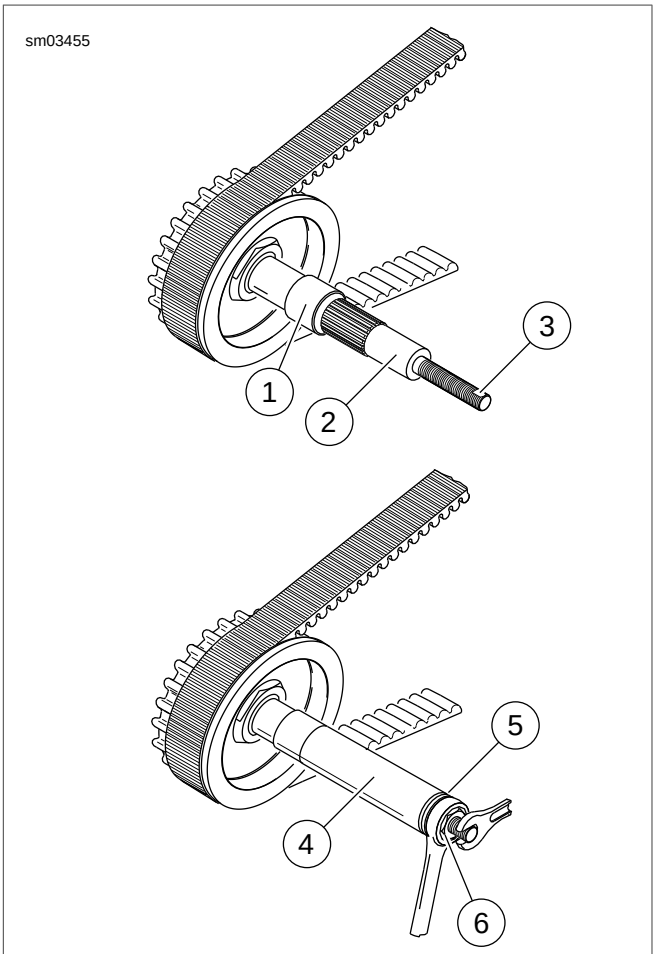


Figure 6-23. Mainshaft Bearing Inner Race Installer



1. **Bearing inner race**
2. **Extension shaft**
3. **Wrench flat**
4. **Installer sleeve**
5. **Washers**
6. **Nut**

Figure 6-24. Installing Bearing Race

SHIFTER SHAFT BUSHING

1. See Figure 6-25. Press out old bushing from clutch side of housing. Inspect the bushing bore to verify that it is clean and smooth.
2. Press new bushing into bore from transmission side of housing. Installed bushing must be flush to 0.020 in. (0.51 mm) below edge of bore.

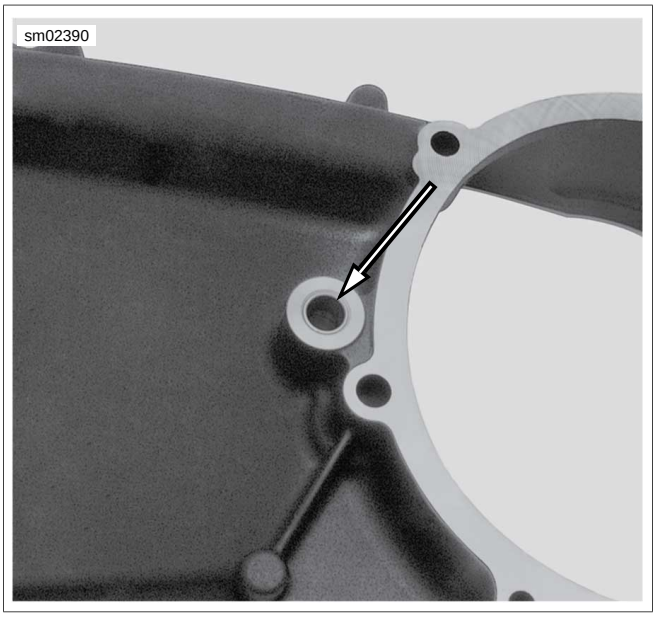


Figure 6-25. Shifter Shaft Bushing

INSTALLATION

NOTES

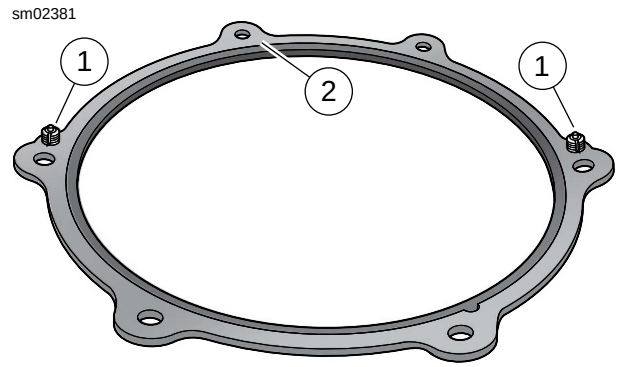
- *Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.*
- *See Figure 6-26. In next step, be sure dowels (1) in crankcase gasket (2) engage holes in crankcase.*

1. Verify pivot shaft torque. See 2.23 REAR FORK, Installation.
2. See Figure 6-27. Place crankcase gasket in place on gasket surface (2). Be sure dowels in gasket engage dowel holes (3).
3. Spread a thin film of oil on mainshaft oil seal lip and rubber portion of crankcase gasket. Be careful not to damage mainshaft seal when installing chaincase over the primary bearing inner race on the mainshaft.
4. See Figure 6-28. Insert **new** sealing fasteners.
5. See Figure 6-29. Tighten fasteners in sequence shown to 25-27 ft-lbs (33.9-36.6 Nm).
6. Install the primary chain, clutch, and compensating sprocket as an assembly. See 6.3 DRIVE COMPONENTS, Installation.
7. Install chain tensioner assembly.
8. Install starter. See 5.2 STARTER, Installation.

NOTE

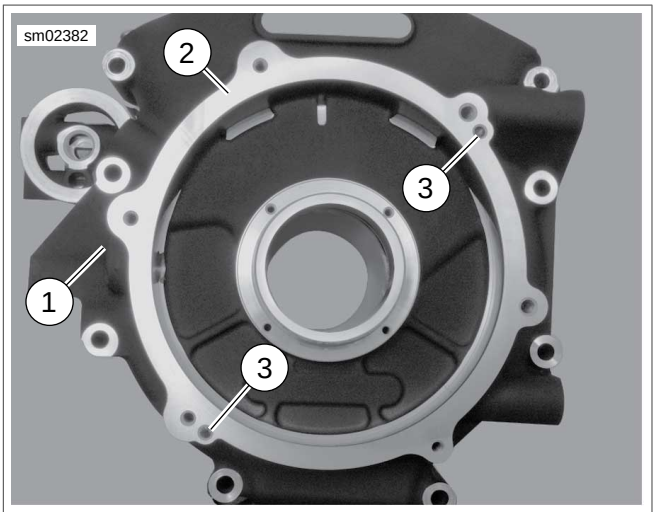
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks .

9. Install primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant.
11. Adjust rear belt tension.
12. Connect negative battery cable.



1. Dowel
2. Crankcase gasket

Figure 6-26. Crankcase Gasket



1. Crankcase
2. Gasket surface
3. Dowel holes

Figure 6-27. Crankcase

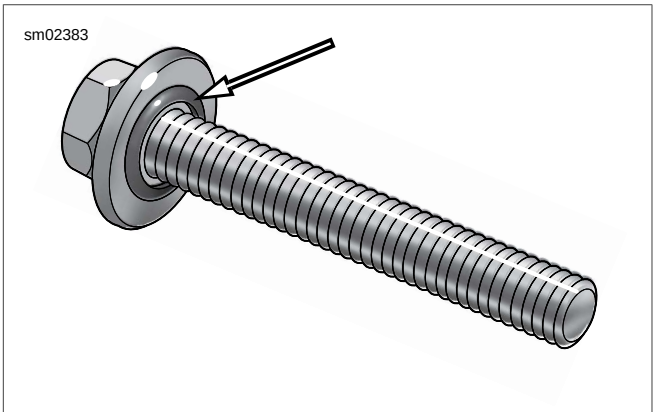


Figure 6-28. Sealing Fastener

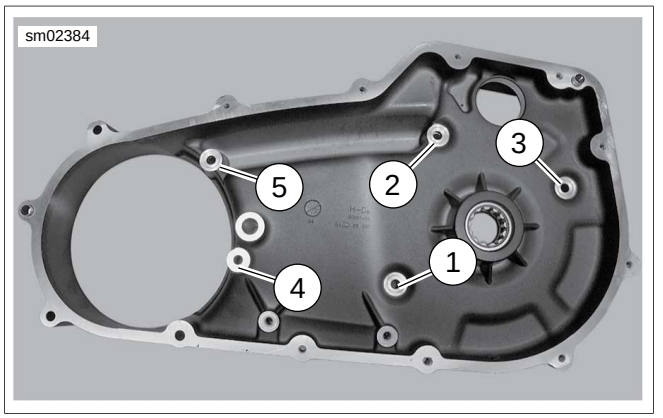


Figure 6-29. Sealing Fastener Torque Sequence

REMOVAL AND INSTALLATION

To remove the clutch without disassembly or for installation instructions, see 6.3 DRIVE COMPONENTS, Removal.

CLUTCH PACK ONLY

Partial Disassembly

This procedure can be performed on the motorcycle without removing the clutch shell or hub.

1. Remove primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
2. See Figure 6-30. Remove six bolts (1) (metric) to release diaphragm spring retainer (2) from clutch hub. Loosen each bolt gradually and in a star sequence around the hub.
3. Remove diaphragm spring retainer, diaphragm spring (3) and pressure plate (4) from clutch hub.
4. Remove friction plates (5, 7), steel plates (6), damper spring (8) and damper spring seat (9) from clutch hub (11). Continue with Cleaning And Inspection.

Cleaning And Inspection

⚠WARNING

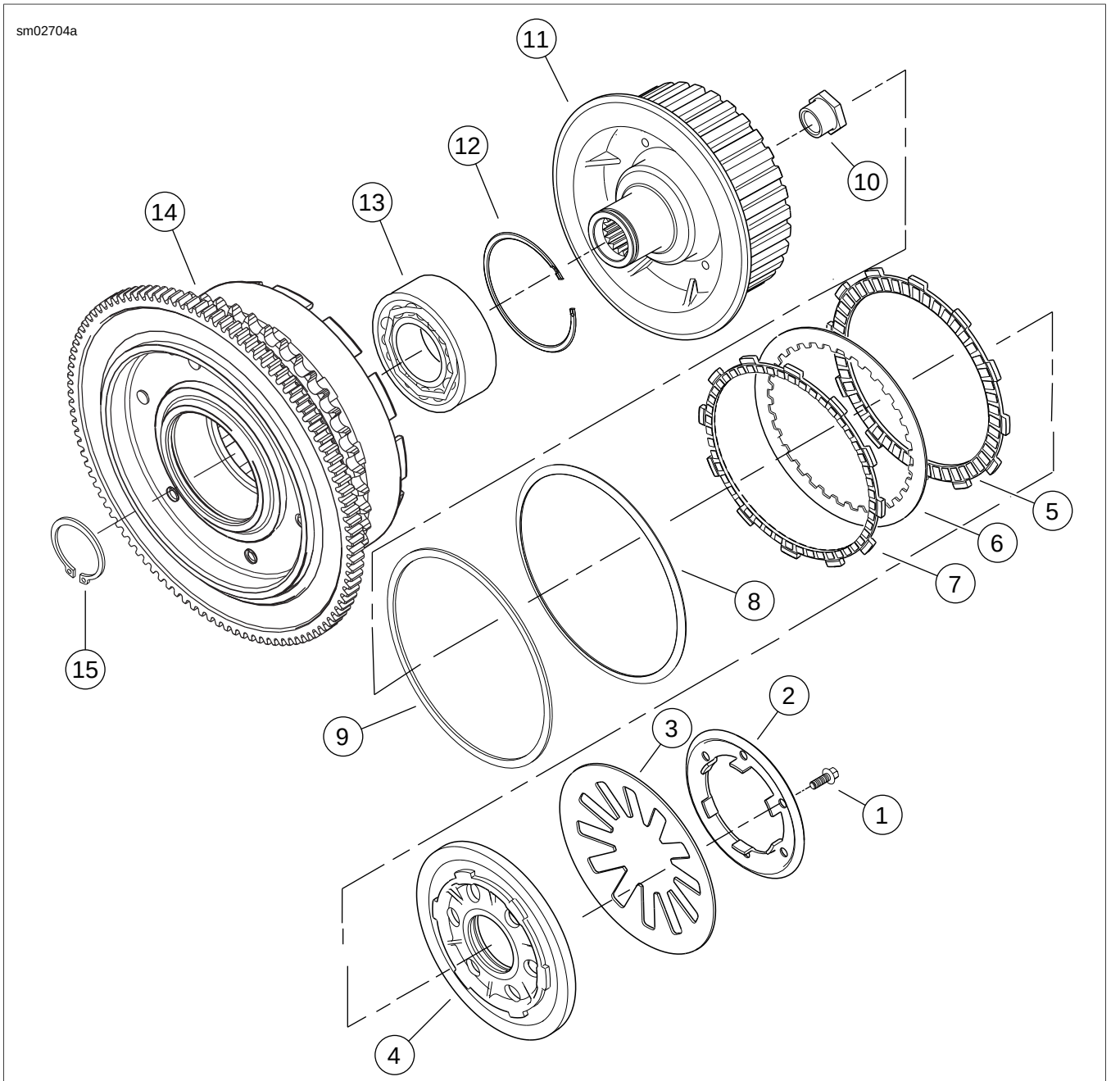
Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

1. Wash all parts in cleaning solvent, except for friction plates and bearing, if removed. Blow parts dry with low pressure compressed air.
2. Check **friction plates** as follows:
   a. Blow off all lubricant from the friction plates. Do not wipe off with a rag.
   b. Measure the thickness of each plate with a dial caliper or micrometer.
   c. If the thickness of any plate is less than 0.143 in. (3.62 mm), discard all friction plates and replace with an entirely **new** set.
   d. Look for worn or damaged fiber surface material (both sides).

NOTE

Replace all nine friction plates with an entirely new set if any individual plate shows evidence of wear or damage. Submerge and soak all friction plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.

3. Check the **steel plates** as follows:
   a. Discard any plate that is grooved or bluish in color. Blue plates are likely warped or distorted.
   b. Check each plate for distortion. Lay the plate on a precision flat surface. Insert a feeler gauge between the plate and the flat surface in several places. Replace any steel plate that is warped more than 0.006 in. (0.15 mm).
4. Holding the clutch hub, rotate the clutch shell to check bearing for smoothness. Replace the bearing if it runs rough, binds or has any end play.
5. Check the primary chain sprocket and the starter ring gear on the clutch shell. Replace the clutch shell if either sprocket or ring gear are badly worn or damaged.
6. Check the slots that mate with the clutch plates on both the clutch shell and hub. Replace shell or hub if slots are worn or damaged.
7. Check the diaphragm spring and diaphragm spring retainer for cracks or bent tabs. Obtain a **new** diaphragm spring or diaphragm spring retainer if either condition exists.



1. **Bolt (6) (metric)**
2. **Diaphragm spring retainer**
3. **Diaphragm spring**
4. **Pressure plate**
5. **Friction plate (9)**
6. **Steel plate (8)**
7. **Narrow friction plate**
8. **Damper spring**
9. **Damper spring seat**
10. **Mainshaft nut (metric)**
11. **Clutch hub**
12. **Retaining ring**
13. **Bearing**
14. **Clucth shell**
15. **Retaining ring**

Figure 6-30. Clutch Shell Assembly

Assembly

NOTE

Submerge and soak all friction plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.

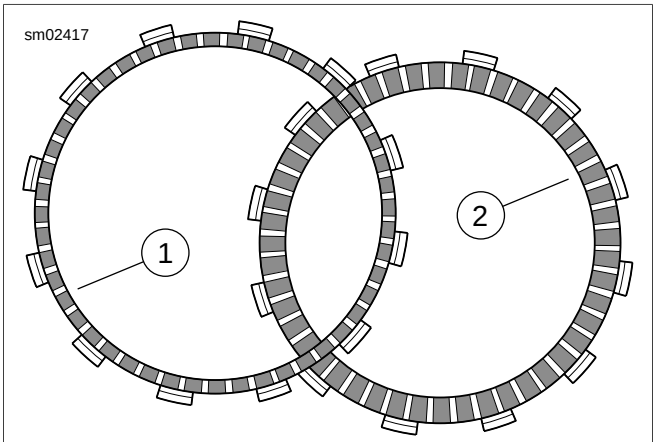
1. See Figure 6-31. Install the narrow friction plate on the clutch hub. Engage tabs on plate with slots in clutch shell.
2. See Figure 6-30. Install damper spring seat (9) on clutch hub (11). It must sit inboard of narrow friction plate (7).

3. Install damper spring (8) on clutch hub with the concave side out (facing away from damper spring seat).
4. Install a steel plate (6) with round edge outward and then a friction plate (5) on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.
5. Install pressure plate (4) on clutch hub aligning holes in plate with threaded bosses on hub.
6. Seat diaphragm spring (3) in recess of pressure plate with the concave side inward.
7. Align holes in diaphragm spring retainer (2) with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
8. Install six bolts (1) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten the bolts to 90-110 **in-lbs** (10.2-12.4 Nm).

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

9. Install primary chaincase cover and gasket. See 6.2 PRIMARY CHAINCASE COVER, Installation.
10. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant.



1. **Narrow plate**
2. **Regular plate**

Figure 6-31. Friction Plates

CLUTCH PACK AND BEARING

Complete Disassembly

1. Remove the primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Removal.
2. Remove clutch assembly. See 6.3 DRIVE COMPONENTS, Removal.
3. Follow all partial disassembly information under 6.5 CLUTCH, Clutch Pack Only.

NOTE

To avoid possible bearing damage, do not disassemble the clutch shell and hub assembly unless the bearing, hub or shell require replacement. Replace the bearing if disassembled.

WARNING

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

4. See Figure 6-32. With the transmission side up, remove retaining ring from clutch hub groove.
5. See Figure 6-33. Supporting clutch shell in same orientation, use arbor press and a suitable press plug to press hub from bearing in clutch shell.
6. See Figure 6-34. With the transmission side up, remove retaining ring from groove in clutch shell bore.
7. See Figure 6-35. Turn clutch shell over so that transmission side is down. Using arbor press and a suitable press plug, press on inner race to remove bearing from clutch shell bore.
8. Continue with Cleaning and Inspection found under 6.5 CLUTCH, Clutch Pack Only.



Figure 6-32. Clutch Hub Retaining Ring



Figure 6-33. Pressing Clutch Hub From Bearing

Assembly

1. Orient clutch shell in arbor press with transmission side up. Be sure to support clutch shell bore on sprocket side to avoid damage to ears on clutch basket. Using a suitable press plug, press against outer race until bearing contacts shoulder in clutch shell bore.

⚠WARNING

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

2. See Figure 6-34. Install retaining ring in groove of clutch shell bore so that flat side of ring is towards bearing the beveled side out.
3. Turn clutch shell over so sprocket side is up. Center hub in bearing. Be sure that bearing inner race is supported with sleeve on transmission side. Press hub into bearing until hub shoulder contacts bearing inner race.
4. See Figure 6-32. Turn assembly over so that the transmission side is up. Install retaining ring in groove of clutch hub.
5. Place clutch assembly on bench oriented with the transmission side down.
6. Soak all friction and steel plates in FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt.) for at least five minutes.
7. See Figure 6-36. Install the narrow friction plate on the clutch hub engaging tabs on plate with slots in clutch shell.
8. Install damper spring seat on clutch hub so that it seats inboard of narrow friction plate.
9. Install damper spring on clutch hub with the concave side up (facing opposite damper spring seat).
10. Install a steel plate and than a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and frictions plates.
11. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
12. See Figure 6-37. Seat diaphragm spring (1) in recess of pressure plate with the concave side down.
13. Align holes in diaphragm spring retainer with threaded bosses on clutch hub. Tabs on spring retainer contact flats on inboard side of bosses.
14. Install six bolts (5) (metric) to secure diaphragm spring retainer to clutch hub. Alternately tighten 90-110 **in-lbs** (10.2-12.4 Nm).
15. Install clutch. See 6.3 DRIVE COMPONENTS, Installation.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

16. Install primary chaincase cover and gasket. See 6.2 PRIMARY CHAINCASE COVER, Installation.
17. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant.



Figure 6-34. Install Clutch Shell Retaining Ring with Flat Side Against Bearing

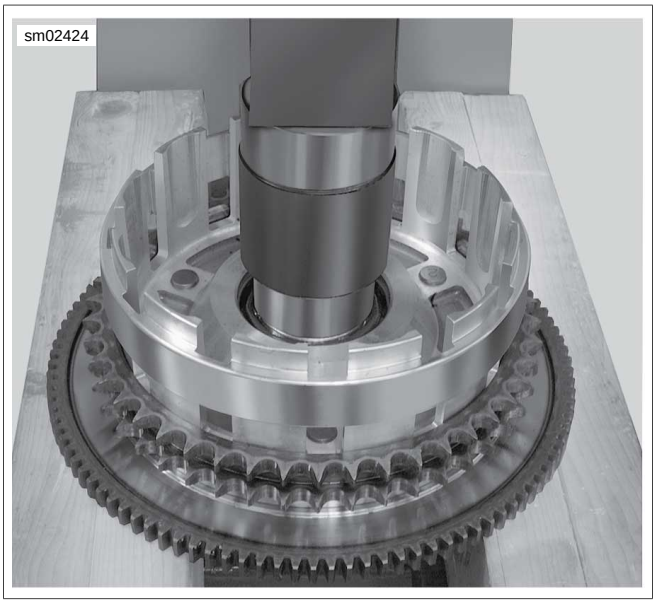
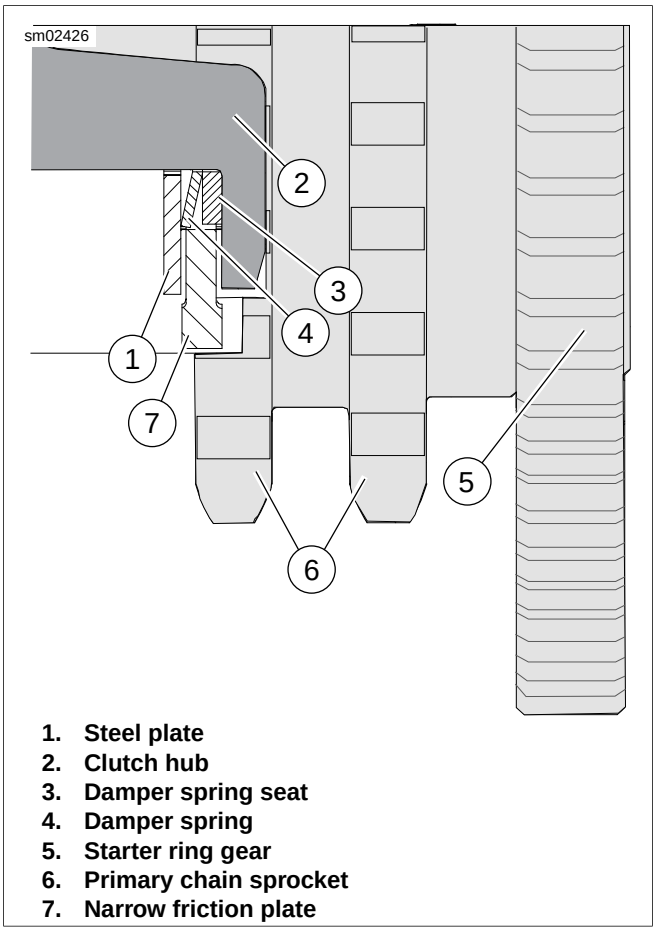
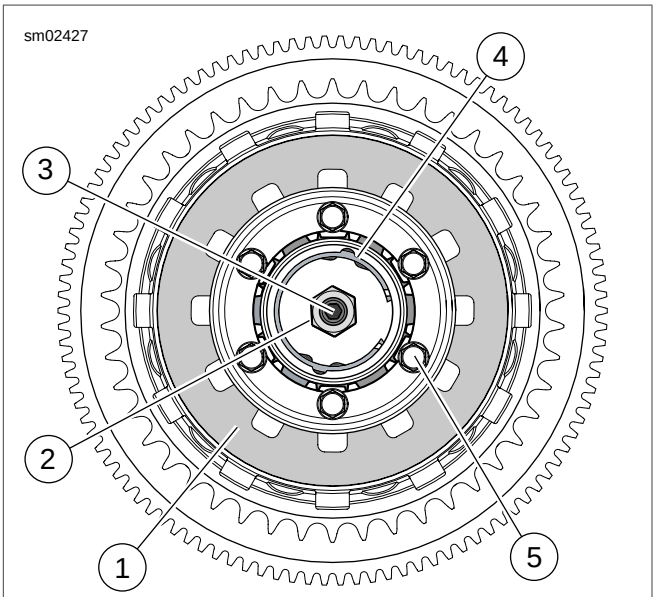


Figure 6-35. Pressing Bearing From Clutch Shell



1. **Steel plate**
2. **Clutch hub**
3. **Damper spring seat**
4. **Damper spring**
5. **Starter ring gear**
6. **Primary chain sprocket**
7. **Narrow friction plate**

Figure 6-36. Clutch Stackup



1. **Diaphragm spring**
2. **Jam nut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Bolt (6) (metric)**

Figure 6-37. Assembled Clutch

REMOVAL

PART NUMBER	TOOL NAME
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

1. Remove primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING, Removal.
2. Remove debris deflector. See 2.20 DEBRIS DEFLECTOR.

NOTE

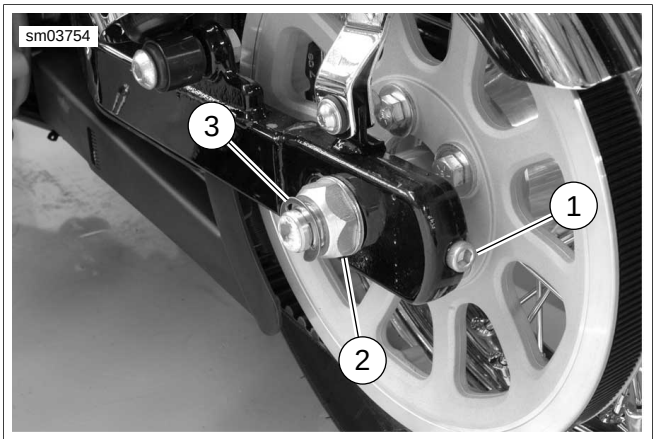
Loosen both axle adjusters an equal number of turns to maintain wheel alignment.

3. See Figure 6-38. Remove rear axle retaining ring (3). Loosen rear axle nut (2). Loosen both axle adjusters (1) to release tension on the drive belt.
4. Only remove sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.
5. Remove transmission sprocket.
   a. See Figure 6-39. Remove two screws (1) and lockplate (2).
   b. See Figure 6-40. Secure sprocket using FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282)(3). Final drive sprocket locking tool must rest against lower portion of rear fork pivot nut (2).

NOTE

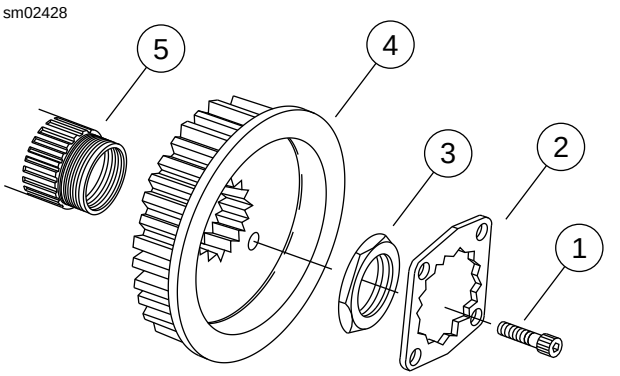
*Sprocket nut has a **right-hand** thread.*

   c. Install PILOT (Part No. HD-94660-2) on mainshaft.
   d. Remove the sprocket nut using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1).
6. Remove belt from sprocket as sprocket is removed.



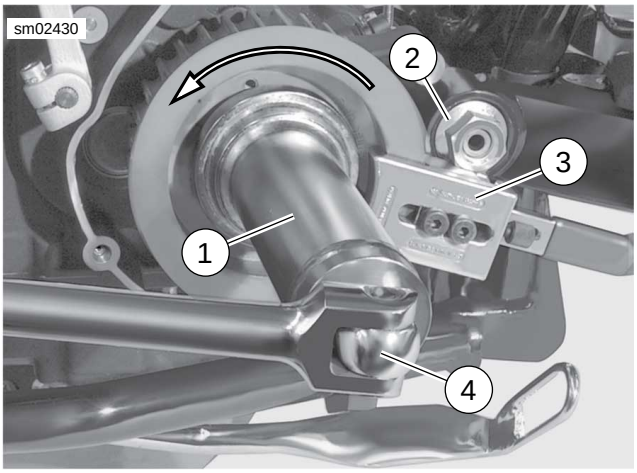
1. **Axle adjuster**
2. **Axle nut**
3. **Retaining ring**

Figure 6-38. Axle Adjusters (Left Side Shown)



1. **Screw (2)**
2. **Lockplate**
3. **Sprocket nut**
4. **Sprocket**
5. **Main drive gear**

Figure 6-39. Transmission Sprocket



1. **Mainshaft locknut wrench**
2. **Rear fork pivot nut**
3. **Final drive sprocket locking tool**
4. **3/4 inch breaker bar**

Figure 6-40. Sprocket Nut Removal (Typical)

CLEANING AND INSPECTION

1. Using a non-volatile cleaning solvent clean sprocket of all grease and dirt.
2. Inspect belt and sprocket. See 1.12 REAR BELT AND SPROCKETS, Inspection.
3. Inspect both main drive gear and mainshaft seals. Replace if damaged.

INSTALLATION

PART NUMBER	TOOL NAME
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL
HD-47910	MAINSHAFT LOCKNUT WRENCH
HD-94660-2	PILOT

NOTE

Only install sprocket nut while transmission is installed in frame. Failure to do so will result in damage to transmission and/or transmission stand.

1. Place transmission sprocket in position. Install the belt on the sprocket as the sprocket is installed on the main drive gear.

NOTES

- *Exercise caution to avoid getting oil on the threads of the sprocket nut or the integrity of the lock patch may be compromised.*
- *The transmission sprocket nut has **right-hand** threads. Turn the nut **clockwise** to install on the main drive gear.*

2. See Figure 6-39. Install the sprocket nut. The following procedure is based on whether a new or used nut is being used.
   a. **New sprocket nut:** spread a small quantity of clean engine oil on the inside face of the sprocket nut and the outside face of the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.
   b. **Used sprocket nut:** apply Loctite High Strength Threadlocker 271 (red) to the threads of the sprocket nut. Also spread a small quantity of clean engine oil on the inside face of the sprocket nut and the outside face of the sprocket. Limit the application to where the surfaces of the two parts contact each other. Install the sprocket nut until finger tight.
3. See Figure 6-41. Lock transmission sprocket with the FINAL DRIVE SPROCKET LOCKING TOOL (Part No. HD-46282) (2). Final drive sprocket locking tool must rest against upper portion of rear fork pivot nut (3).
4. Install PILOT (Part No. HD-94660-2) on mainshaft.
5. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-47910) (1), tighten sprocket nut to 35 ft-lbs (47.5 Nm) initial torque.
6. Loosen sprocket nut to remove initial torque.
7. Tighten sprocket nut to 35 ft-lbs (47.5 Nm).

CAUTION

Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)

8. See Figure 6-42. Scribe a line (3) on the transmission sprocket nut (1). Continue the line on the transmission sprocket (2) as shown.
9. Tighten the transmission sprocket nut an additional 35° to 45°.
10. Install lockplate over transmission sprocket nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes. To find the best fit, lockplate can be rotated to a number of positions and can be placed with either side facing sprocket.

NOTE

Maximum allowable tightening of sprocket nut is 45° of clockwise rotation after a torque of 35 ft-lbs (47.5 Nm). Do not loosen sprocket nut to align holes or nut will be under tightened.

11. If holes in lockplate do not align with those in sprocket, tighten sprocket nut as necessary (up to the 45° maximum) until sprocket and lockplate holes are in alignment.
12. See Figure 6-39. Install screws (1) through two of the four holes in lockplate (2), then into two corresponding tapped holes in sprocket (4).

NOTES

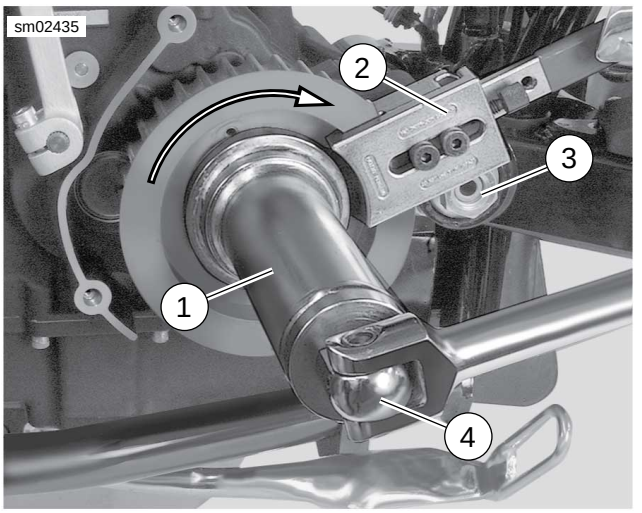
- *The screws have LOCTITE patches. With LOCTITE High Strength Threadlocker 271 (red) reapplied before installation, the screws can be re-used up to three times.*
- *To ensure the lockplate's security, you must use BOTH screws when you install the lockplate.*

13. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm).
14. Install primary chain assembly. See 6.3 DRIVE COMPONENTS.

NOTE

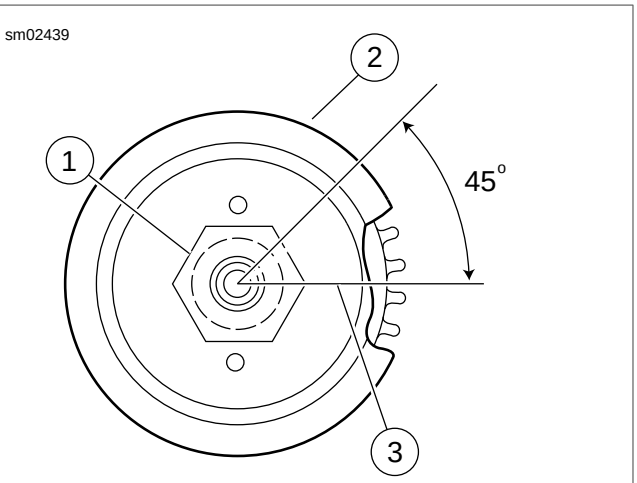
The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

15. Install primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER.
16. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN.
17. Verify pivot shaft torque. See 2.23 REAR FORK.
18. Adjust belt tension. See 1.13 REAR BELT DEFLECTION.
19. Verify vehicle alignment and tighten rear axle. See 2.11 VEHICLE ALIGNMENT.
20. Install debris deflector. See 2.19 BELT GUARD and 2.20 DEBRIS DEFLECTOR.



1. Mainshaft locknut wrench
2. Final drive sprocket locking tool
3. Rear fork pivot nut
4. 3/4 inch breaker bar

Figure 6-41. Sprocket Nut Installation (Typical)



1. Transmission sprocket nut
2. Transmission sprocket
3. Line scribed

Figure 6-42. Transmission Sprocket Nut Final Tightening

REMOVAL

1. Remove rear wheel. See 2.4 REAR WHEEL, Removal.
2. Remove primary chain, clutch, engine compensating sprocket, and chain adjuster as an assembly. See 6.3 DRIVE COMPONENTS.
3. Remove primary chaincase housing. See 6.4 PRIMARY CHAINCASE HOUSING, Removal.
4. Remove lower shock absorber fasteners, allow rear fork to rotate down. See 2.22 REAR SHOCK ABSORBERS.
5. Slip drive belt from transmission sprocket and rear fork.
6. Inspect belt and sprockets. See 1.12 REAR BELT AND SPROCKETS, General.

INSTALLATION

⚠WARNING

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

1. Install belt over transmission sprocket and rear fork.

NOTE

See Figure 6-43. Handling of belt during installation can effect belt durability.

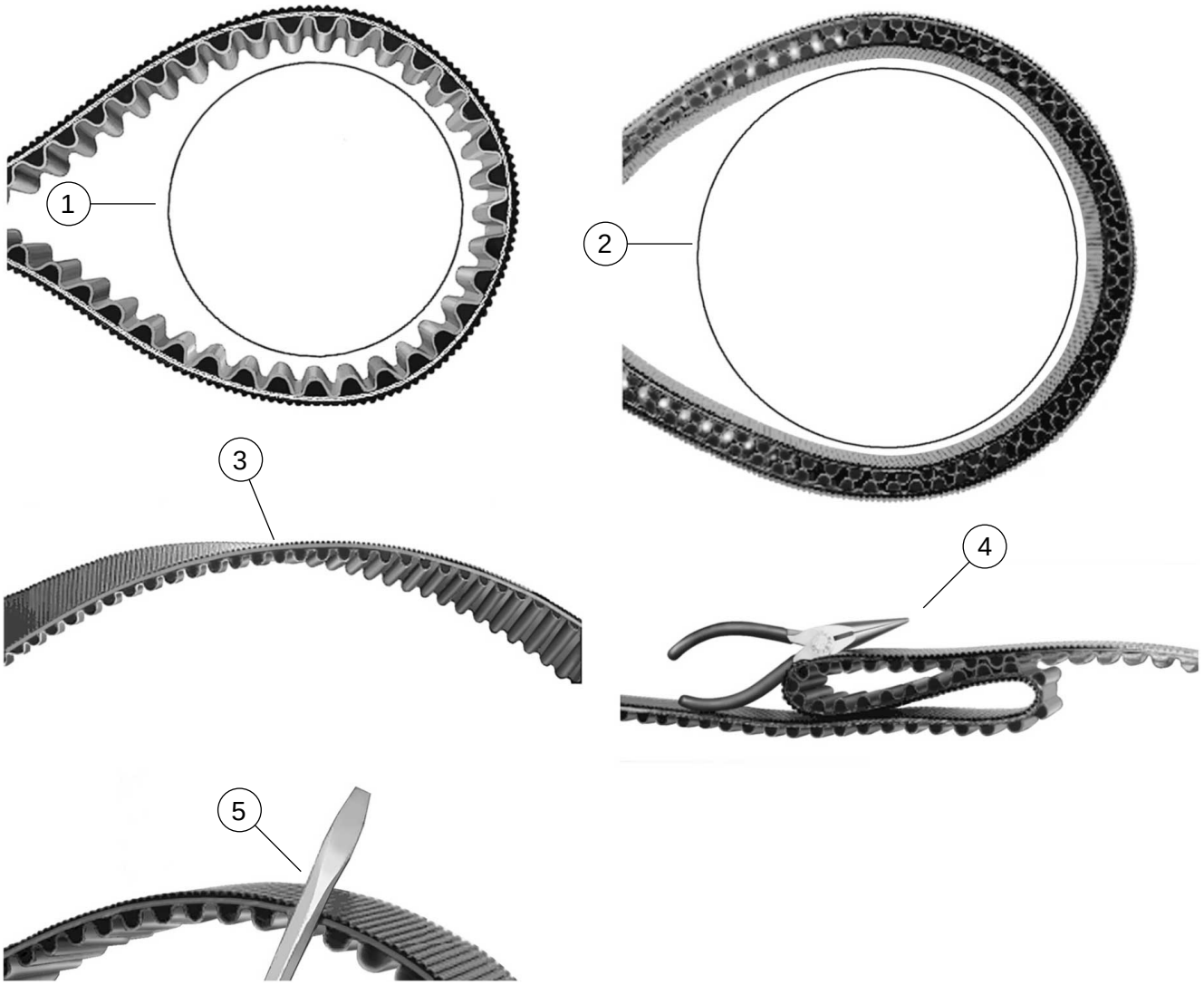
2. Rotate rear fork up and install lower shock absorber mounting fasteners. See 2.22 REAR SHOCK ABSORBERS, Installation.
3. Install the primary chaincase housing. See 6.4 PRIMARY CHAINCASE HOUSING, Installation.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

4. Install primary chain assembly. See 6.3 DRIVE COMPONENTS.
5. Install primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER.
6. Fill primary chaincase with lubricant. See 1.9 PRIMARY CHAIN.
7. Install rear wheel. See 2.4 REAR WHEEL, Installation.
8. Align vehicle. See 2.11 VEHICLE ALIGNMENT.
9. Adjust belt tension. See 1.13 REAR BELT DEFLECTION, Adjustment.

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1. **Forward bend: 5 in. (127 mm) minimum diameter**
2. **Reverse bend: 10 in. (254 mm) minimum diameter**
3. **Do not twist**
4. **Do not crimp, pinch or kink**
5. **Do not pry**

Figure 6-43. Proper Drive Belt Handling

SUBJECT **PAGE NO.**
7.1 SPECIFICATIONS: TRANSMISSION....7-1
7.2 TRANSMISSION....7-2
7.3 SHIFTER LINKAGE....7-4
7.4 CLUTCH RELEASE COVER....7-5
7.5 TRANSMISSION ASSEMBLY....7-7
7.6 MAIN DRIVE GEAR AND BEARING....7-19
7.7 TRANSMISSION CASE....7-26

NOTES

SPECIFICATIONS

Table 7-1. Transmission Specifications

TRANSMISSION	DATA
Type	6-speed forward constant mesh
FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT	Part No. 99851-05 (qt)
Capacity	32 oz.
	946.4 ml

Table 7-2. Gear Specifications

GEAR	OVERALL GEAR RATIO
First (low)	3.34
Second	2.31
Third	1.72
Fourth	1.39
Fifth	1.18
Sixth (high)	1.00

NOTE

Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.

SERVICE WEAR LIMITS

Table 7-3. Main Drive Gear Specifications

MAIN DRIVE GEAR (6th)	IN.	MM
Bearing fit in transmission case (loose)	0.0003-0.0017	0.0076-0.043
Fit in bearing (press-fit)	none	none
Fit on mainshaft	0.0009-0.0022	0.023-0.056
End play	none	none

Table 7-4. Mainshaft Tolerance Specifications

MAINSHAFT TOLERANCE	IN.	MM
Mainshaft runout	0.000-0.003	0.00-0.08
Mainshaft end play	none	none
5th gear end play	0.00-0.026	0.05-0.66
5th gear clearance	0.0004-0.0015	0.010-0.038

Table 7-5. Countershaft Tolerance Specifications

COUNTERSHAFT TOLERANCE	IN.	MM
Countershaft runout	0.000-0.003	0.00-0.08
Countershaft end play	none	none
1st gear end play	0.002-0.023	0.05-0.58
1st gear clearance	0.0004-0.0015	0.010-0.038
2nd gear end play	0.002-0.40	0.05-1.02
2nd gear clearance	0.0001-0.0012	0.003-0.030
3rd gear end play	0.002-0.042	0.05-1.07
3rd gear clearance	0.0004-0.0015	0.010-0.038
4th gear end play	0.001-0.028	0.03-0.71
4th gear clearance	0.0004-0.0015	0.010-0.038

Table 7-6. Shifter Dog Tolerance Specifications

SHIFTER DOG	IN.	MM
1st	0.015-0.112	0.381-2.845
2nd	0.021-0.136	0.533-3.454
3rd	0.014-0.118	0.356-2.997
4th	0.033-0.115	0.838-2.921
5th	0.016-0.115	0.406-2.921
6th	0.026-0.123	0.660-3.124

Table 7-7. Side Door Bearing Specifications

SIDE DOOR BEARING	IN.	MM
Fit in side door (tight)	0.0001-0.0014	0.0025-0.0356
Fit on countershaft (tight)	0.0007	0.018
Fit on countershaft (loose)	0.001	0.025
Fit on mainshaft (tight)	0.0007	0.018
Fit on mainshaft (loose)	0.001	0.025

Table 7-8. Shifter Fork Specifications

SHIFTER FORKS	IN.	MM
Shifter fork to cam groove end play	0.004-0.012	0.102-0.305
Shifter fork to gear groove end play	0.004-0.013	0.102-0.330
First and second gear shift fork wear limit	0.258	6.55
Third and fourth gear shift fork wear limit	0.198	5.03
Fifth and sixth gear shift fork wear limit	0.258	6.55

POWER FLOW

See Figure 7-1. The 6-speed transmission consists of two parallel shafts supporting six gears each. The longer, or mainshaft (7), also supports the clutch and serves as the input shaft. The shorter shaft is called the countershaft (8).

Each gear on the mainshaft is in constant mesh with a corresponding gear on the countershaft. Each of these six pairs of gears makes up a different speed in the transmission.

The transmission gears are divided into two types, gears that rotate with the shaft, and freewheeling gears that ride on bearings and spin freely on the shaft. A gear that rotates with the shaft always meshes with a freewheeling gear. Also, three dog rings are able to slide sideways on the shaft. These dog rings are used to change transmission speeds. The dogs, or projections, on the sides of the dog rings, engage dogs on adjacent freewheeling gears, transmitting power through the transmission.

Gear shifting is accomplished by three forks which fit into grooves machined into the dog rings that slide on the guide hubs. The position of the shifter forks is controlled by a drum-shaped shifter cam located in the transmission side door.

Neutral

Power is introduced to the transmission through the clutch. In neutral, with the clutch engaged, the mainshaft 1st, 2nd, 3rd and 4th gears are rotating, but no power is transferred to the countershaft since countershaft 1st, 2nd, 3rd and 4th gears are freewheeling gears.

1st Gear

When the transmission is shifted into first gear, the dog ring between countershaft 1st and 2nd, which rotates with the countershaft, engages countershaft 1st, which has been spinning freely on the countershaft driven by mainshaft 1st.

Now countershaft 1st is no longer freewheeling, but locked to the countershaft causing the countershaft and countershaft 6th to turn. Countershaft 6th transmits the power to the main drive gear and the sprocket as shown (1).

2nd Gear

Second gear is engaged when the dog ring between countershaft 1st and 2nd is shifted out of countershaft 1st and engages countershaft 2nd. This locks countershaft 2nd to the countershaft to complete the power flow as shown (2).

3rd Gear

Two shifter forks are used to make the shift from second to third. One fork moves the dog ring between countershaft 1st and 2nd to its neutral position, while another fork engages the dog ring between countershaft 3rd and 4th with countershaft 3rd. This locks countershaft 3rd to the countershaft to complete the power flow as shown (3).

4th Gear

Fourth gear is engaged when the dog ring between countershaft 3rd and 4th is shifted out of countershaft 3rd and engages countershaft 4th. This locks countershaft 4th to the countershaft to complete the power flow as shown (4).

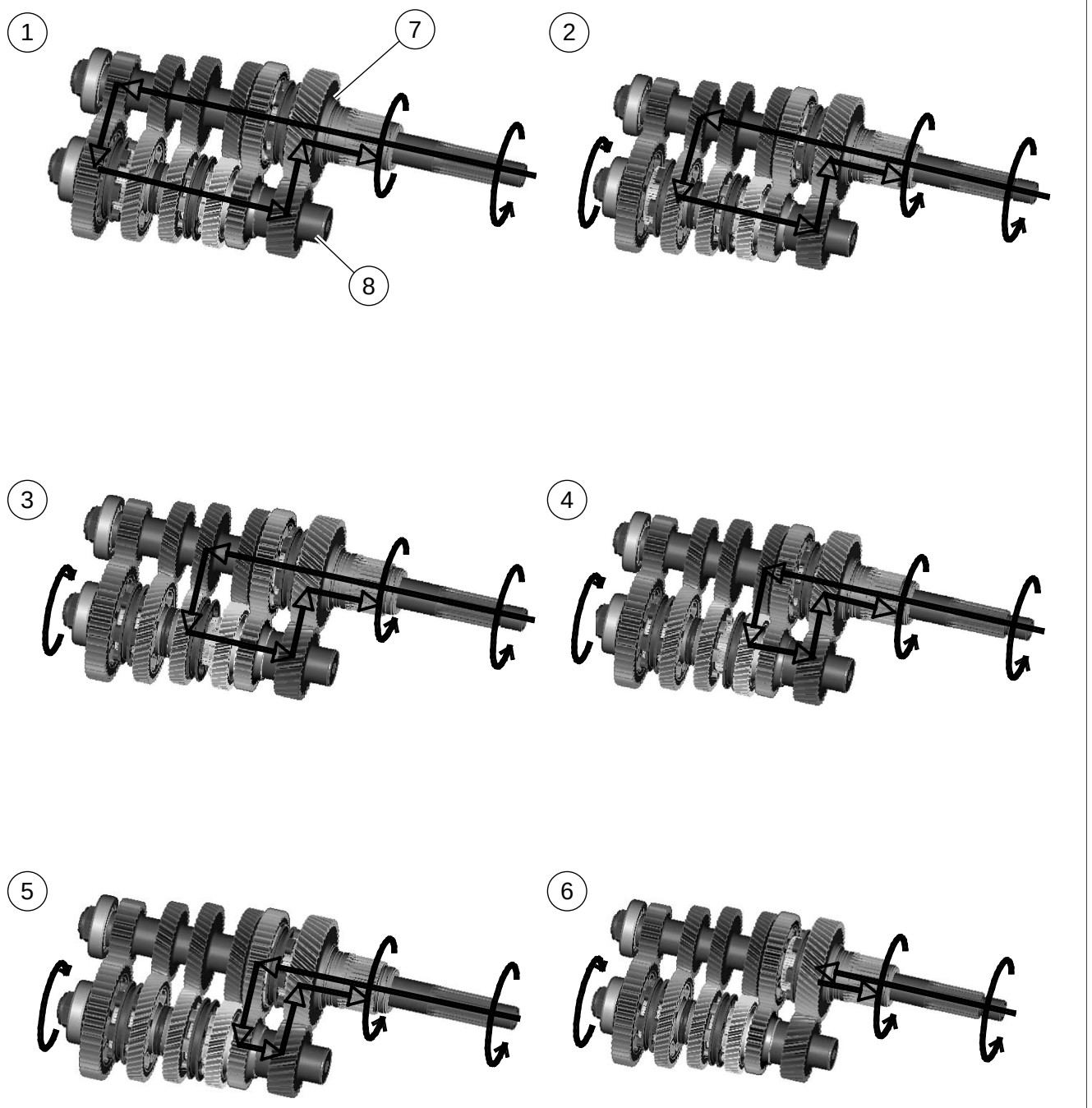
5th Gear

Two shifter forks are used to make the shift from fourth to fifth. One fork moves the dog ring between countershaft 3rd and 4th to its neutral position, while another fork engages the dog ring between mainshaft 5th and 6th with mainshaft 5th. This locks mainshaft 5th to the mainshaft to complete the power flow as shown (5).

6th Gear

The shift from fifth to sixth gear occurs when the dog ring between mainshaft 5th and 6th is shifted out of mainshaft 5th, and is shifted directly into the main drive gear (6th gear). The main drive gear is locked to the mainshaft resulting in a direct one-to-one drive ratio from the clutch to the sprocket as shown (6).

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1. First gear
2. Second gear
3. Third gear
4. Fourth gear
5. Fifth gear
6. Sixth gear
7. Mainshaft
8. Countershaft

Figure 7-1. Transmission Power Flow

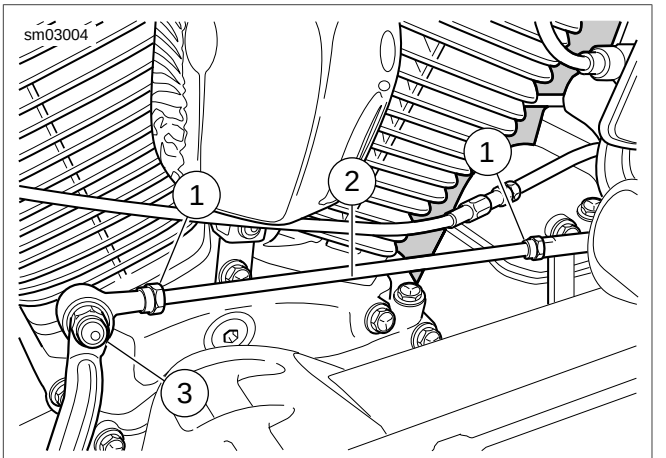
ADJUSTMENT

NOTE

Not all models are equipped with adjustable linkage.

The shift rod is set at the factory and should not need adjustment under normal circumstances. However, if full engagement or full lever travel is not achieved, adjust the shift rod.

1. See Figure 7-2. Remove locknut (3), lockwasher and flat washer to free front end of shift rod from inner shift arm.
2. Loosen jam nuts (1) and adjust rod (2) as necessary.
3. Install flat washer, lockwasher and locknut (3) to fasten front end of shift rod to inner shift arm.
4. Tighten locknut (3) to 96-144 **in-lbs** (10.8-16.3 Nm)
5. Tighten jam nuts to 80-120 **in-lbs** (9.0-13.6 Nm).



1. Jam nut (2)
2. Rod
3. Locknut

Figure 7-2. Shifter Rod

REMOVAL AND DISASSEMBLY

1. Remove maxi-fuse.
2. Remove exhaust system if needed. See 4.16 EXHAUST SYSTEM.
3. Drain transmission. See 1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant.

NOTE

Actuating the clutch hand lever after removing the six screws will help break the cover free.

4. See Figure 7-3. Remove the six screws that hold the clutch release cover in place. Remove the clutch release cover and discard the gasket.
5. Add freeplay to clutch cable. See 1.11 CLUTCH, Adjustment.

⚠WARNING

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

6. See Figure 7-4. Remove retaining ring (4). Lift inner ramp (5) and ramp coupling (3) out of clutch release cover. Disconnect clutch cable end (2) from the ball and ramp coupling.
7. See Figure 7-5. Remove balls (4) and outer ramp (2).
8. Unscrew clutch cable fitting from clutch release cover.

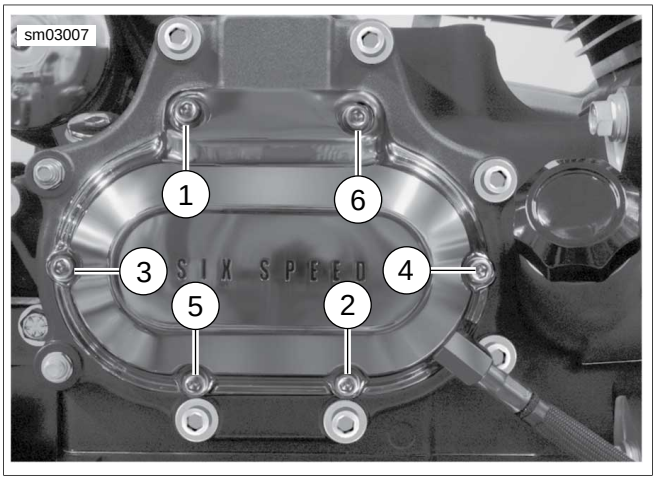
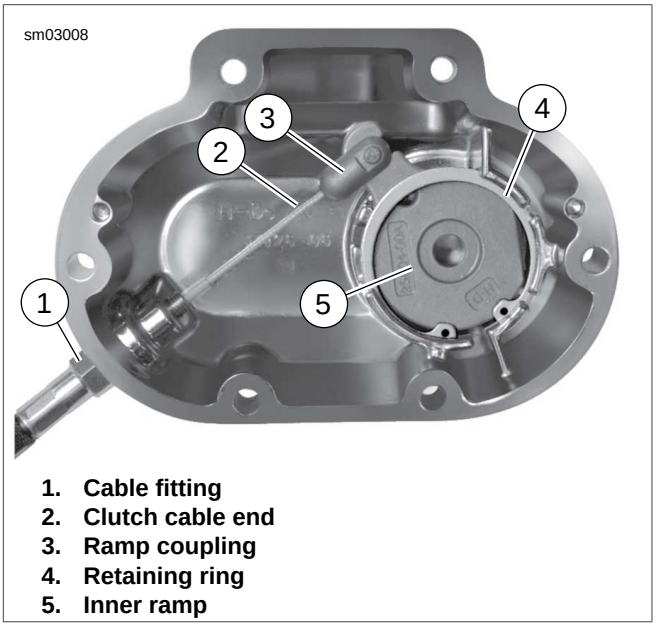
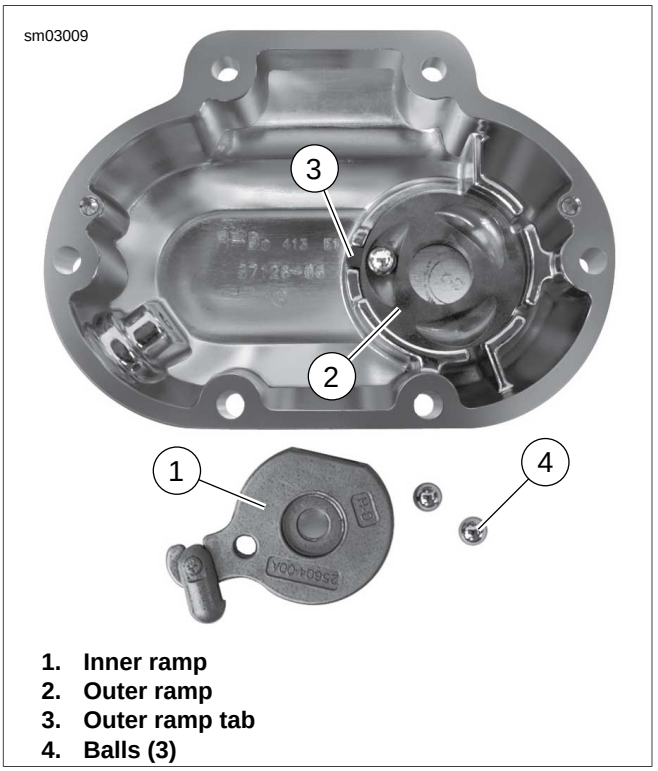


Figure 7-3. Cover Screws



1. **Cable fitting**
2. **Clutch cable end**
3. **Ramp coupling**
4. **Retaining ring**
5. **Inner ramp**

Figure 7-4. Clutch Cable Connection



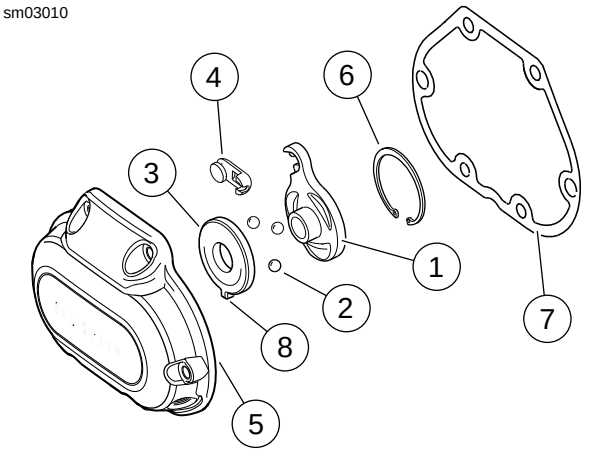
1. **Inner ramp**
2. **Outer ramp**
3. **Outer ramp tab**
4. **Balls (3)**

Figure 7-5. Coupling and Ramp Assembly

CLEANING AND INSPECTION

1. See Figure 7-6. Wash the ball and ramp mechanism components in cleaning solvent.

2. Inspect the three balls (2) and ball socket surfaces on ramps (1, 3) for wear, pitting, surface breakdown and other damage. Replace damaged parts.
3. Check fit of the ramp coupling (4) on inner ramp (1). Replace both parts if there is excessive wear.
4. Inspect the retaining ring (6) for damage or distortion.
5. Check clutch cable end for frayed or worn ends. Replace cable if damaged or worn. Check cable fitting o-ring for cuts, tears or signs of deterioration.
6. Check the bore in the cover (5) where the ramps (1, 3) are retained. There should be no wear.



1. **Inner ramp**
2. **Balls (3)**
3. **Outer ramp**
4. **Ramp coupling**
5. **Clutch release cover**
6. **Retaining ring**
7. **Gasket**
8. **Tab**

Figure 7-6. Release Mechanism Assembly

ASSEMBLY AND INSTALLATION

NOTE

Replace cable fitting o-ring if damaged or deformed.

1. See Figure 7-4. Screw clutch cable fitting (1) into clutch release cover. Do not tighten at this time.
2. See Figure 7-6. Place outer ramp (3) with ball socket side up in clutch release cover. Be sure tab (8) is in clutch release cover slot.
3. Apply a multi-purpose grease to the balls and outer ramp sockets. Place a ball in each of the outer ramp sockets.
4. Connect cable end to ramp coupling (4). Install coupling on inner ramp (1) and place inner ramp and coupling in position in clutch release cover (5).

⚠WARNING

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

NOTE

See Figure 7-4. Retaining ring opening must be centered above the break in the ribbing at bottom of the clutch release cover.

5. Install retaining ring (6).
6. See Figure 7-3. Verify that two dowel pins are in place on transmission side door flange. Place a **new** gasket on dowel pins.

NOTE

Clutch release cover screws in positions (1) and (6) are shorter than the others.

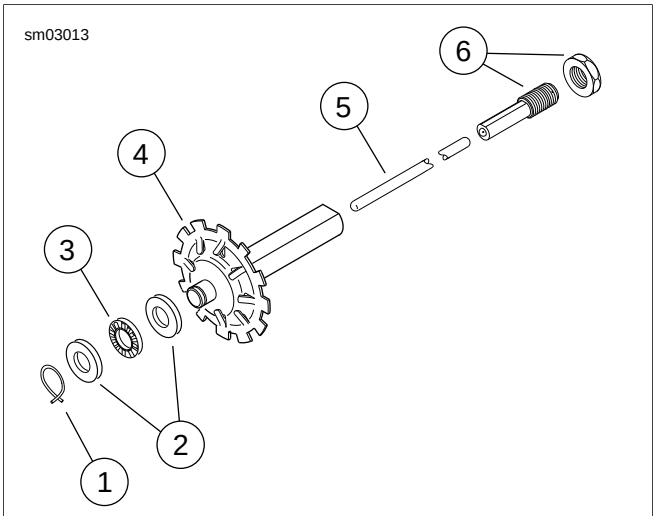
7. Install clutch release cover. Tighten all six screws to 84-108 **in-lbs** (9.5-12.2 Nm) in sequence shown.
8. Tighten clutch cable fitting to 90-120 **in-lbs** (10.2-13.6 Nm).
9. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant.
10. Adjust clutch cable. See 1.11 CLUTCH.
11. Install exhaust system if removed. See 4.16 EXHAUST SYSTEM.
12. Install maxi-fuse.

REMOVAL

NOTE

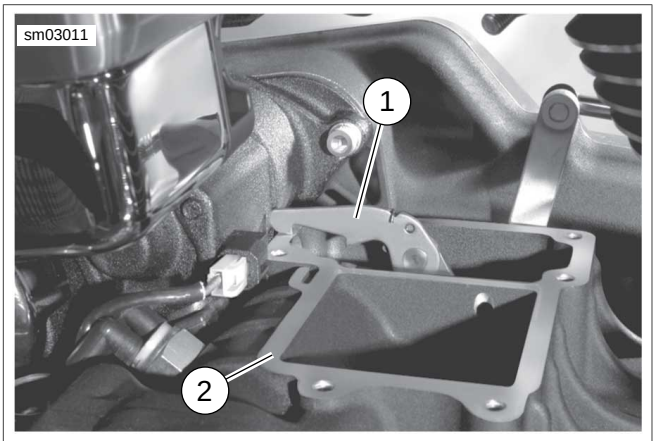
Leave the transmission case in the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed. For information on case removal see 7.7 TRANSMISSION CASE.

1. Remove exhaust system. See 4.16 EXHAUST SYSTEM.
2. Remove primary chaincase cover, clutch assembly, primary chain, compensating sprocket assembly and primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING, Removal.
3. Remove the bearing inner race from the transmission mainshaft. See 6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race.
4. Remove the clutch release cover from the transmission side door. See 7.4 CLUTCH RELEASE COVER, Removal and Disassembly.
5. See Figure 7-7. Remove oil slinger assembly from mainshaft. Remove push rod.
6. Remove transmission top cover, leaving the cover gasket in place.
7. See Figure 7-8. Place shifter cam pawl on top cover gasket.



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

Figure 7-7. Push Rod Assembly



1. **Shifter pawl**
2. **Top cover gasket surface**

Figure 7-8. Set Shifter Pawl on Gasket

NOTE

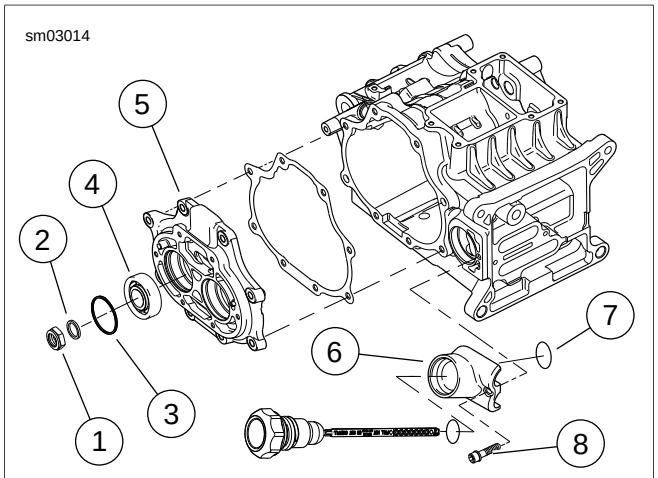
Only remove and install sprocket nut while transmission is in vehicle frame. Trying to remove and install sprocket nut with transmission in transmission stand may cause damage to transmission or stand.

8. If main drive gear is to be removed, see 7.6 MAIN DRIVE GEAR AND BEARING, Removal.
9. See Figure 7-9. Remove oil spout fastener (8), oil spout (6) and o-ring (7). Discard o-ring.

NOTES

- *The main drive gear bearing and retainer must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *See Figure 7-10. Do not attempt to remove shafts by tapping them out from opposite side. If you try to remove the shafts by tapping them with a hammer, you will damage the side door bearings. If the side door sticks or binds on the ring dowels, pry open using indents at each side of side door.*

10. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear bearings.
11. See Figure 7-11. Remove the transmission side door mounting hardware. Remove exhaust bracket, if equipped. Pry the side door loose and remove side door, mainshaft, countershaft and shifter cam from transmission case as an assembly. Discard gasket.



1. **Locknut (2)**
2. **Spacer**
3. **Retaining ring**
4. **Bearing**
5. **Side door**
6. **Oil spout**
7. **O-ring**
8. **Oil spout fastener**

Figure 7-9. Side Door Bearings

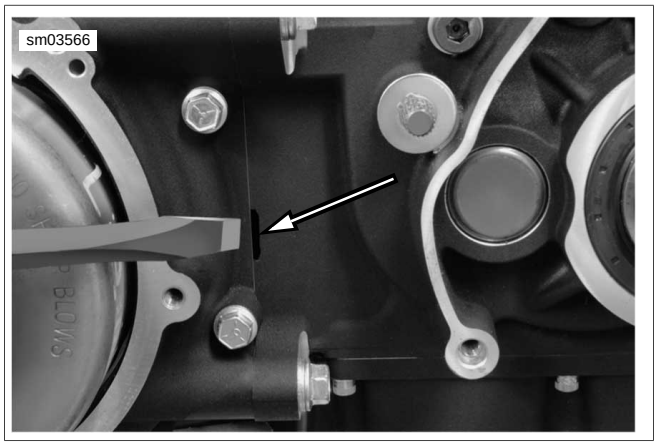
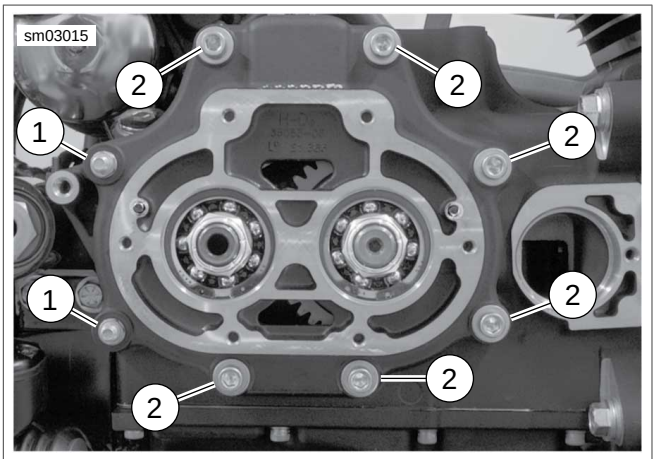


Figure 7-10. Transmission Case Pry Point



1. **Stud**
2. **Bolt**

Figure 7-11. Side Door Hardware

DISASSEMBLY

Shifter Cam/Shifter Forks

1. See Figure 7-12. and Figure 7-16. With access door on end (shafts pointing upward), remove shift fork shafts using easy-out twist extractor (non-flute design). Shafts have slight interference fit. Shafts can be reused, do not damage end of shaft. Mark end of shaft so same end can be reinserted during reassembly.

NOTE

Shifter shafts have a slight interference fit. Shifter shafts can be reused, so avoid damaging end of shaft. Mark shafts so they can be reinstalled in original position during assembly.

2. Remove shift forks from shafts.
3. See Figure 7-17. Remove lock plate fasteners (3) from lock plate (2). Discard fasteners.
4. See Figure 7-18. Insert screwdriver and gently pry back detent arm (4) to remove detent spring (3) tension from shift cam (5). Remove shift cam.
5. See Figure 7-14. If servicing detent assembly:
   a. Remove detent screw (1), detent arm (2), sleeve (3), and detent spring (4). Discard detent screw.
   b. Clean detent screw mounting hole in transmission side door.
   c. Assemble **new** detent screw, detent arm, sleeve and detent spring. Mount detent assembly in bearing housing as shown. Make certain to orient spring and detent arm as shown in the figure. Tighten screw to 120-150 **in-lbs** (13.6-17.0 Nm).

NOTE

Although many transmission parts can be installed in either direction, make sure parts are installed in same direction as removal.

6. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
7. Remove mainshaft and countershaft locknuts.
8. Remove transmission assembly from transmission case.

Mainshaft

1. See Figure 7-19. Remove retaining ring. Remove dog ring (3), guiding hub (2), mainshaft 5th gear (4) and bearing.

NOTE

If removing countershaft only, hold countershaft 3rd and 4th gear shift dog up while pressing countershaft out of side door bearings.

2. Place transmission assembly in arbor press and press mainshaft out of side door bearings.
3. Press countershaft out of side door bearings.
4. See 7.5 TRANSMISSION ASSEMBLY, Disassembly, Replacing Side Door Bearings for side door bearing replacement.

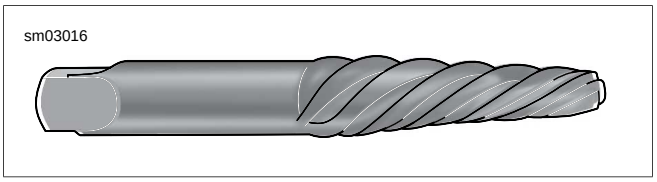
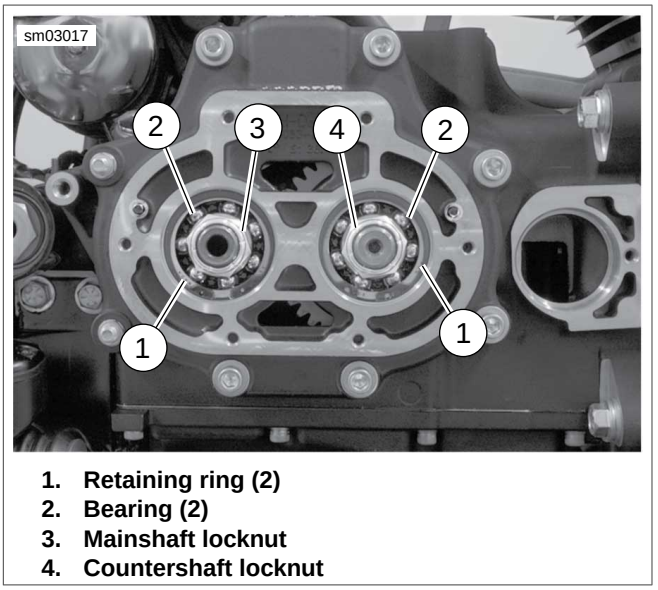
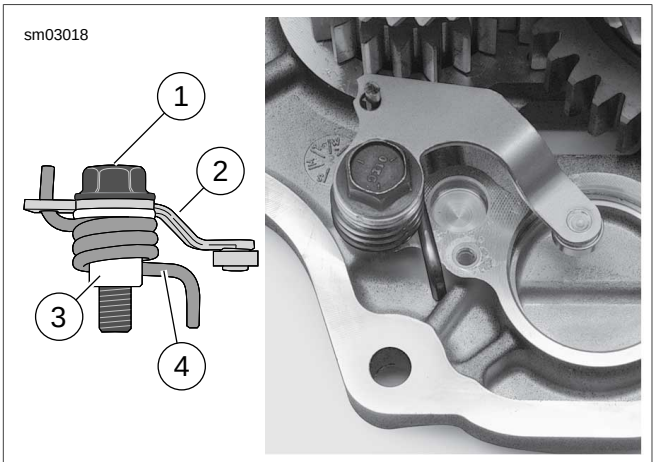


Figure 7-12. Screw Extractor



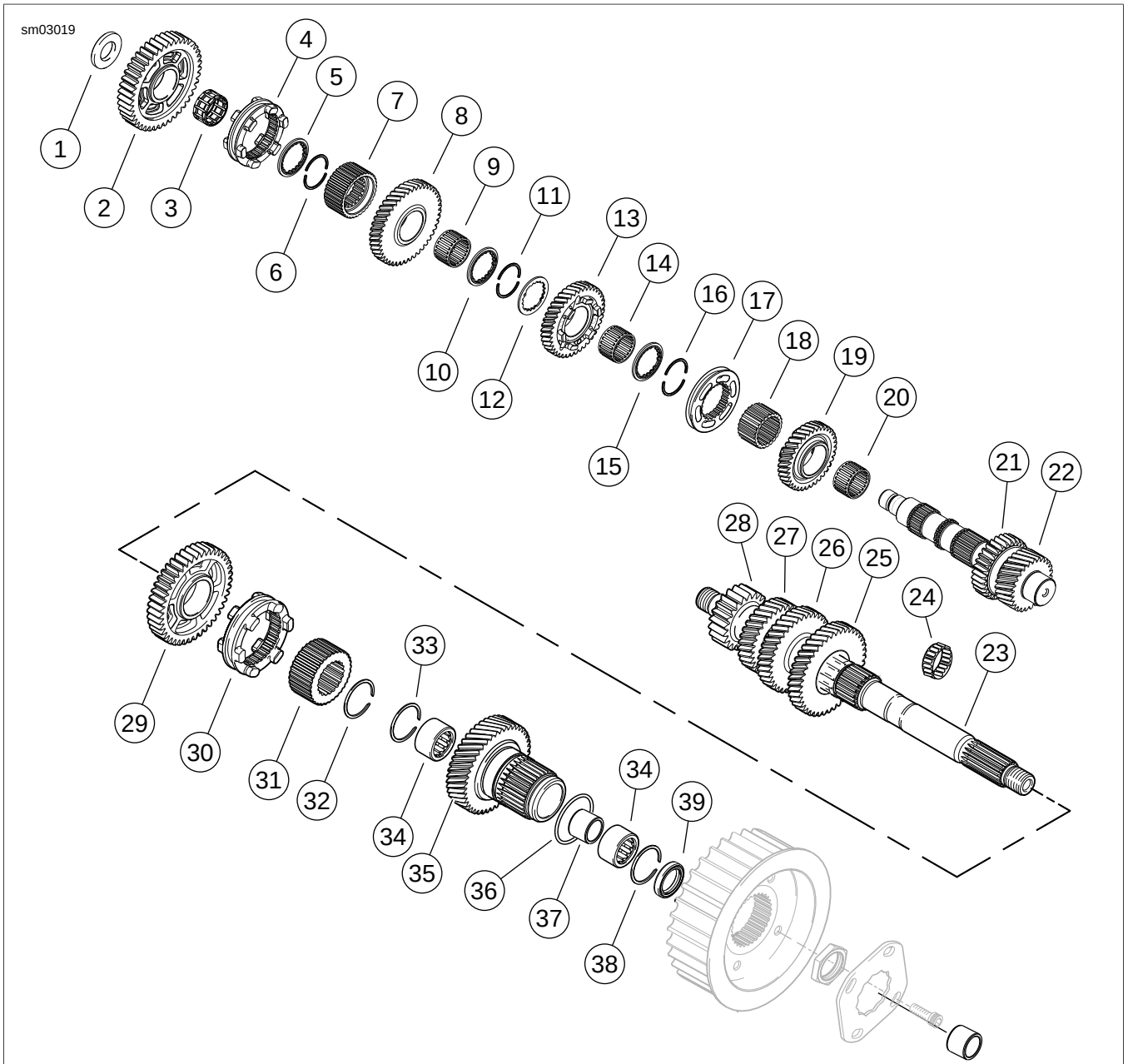
1. **Retaining ring (2)**
2. **Bearing (2)**
3. **Mainshaft locknut**
4. **Countershaft locknut**

Figure 7-13. Side Door Locknuts



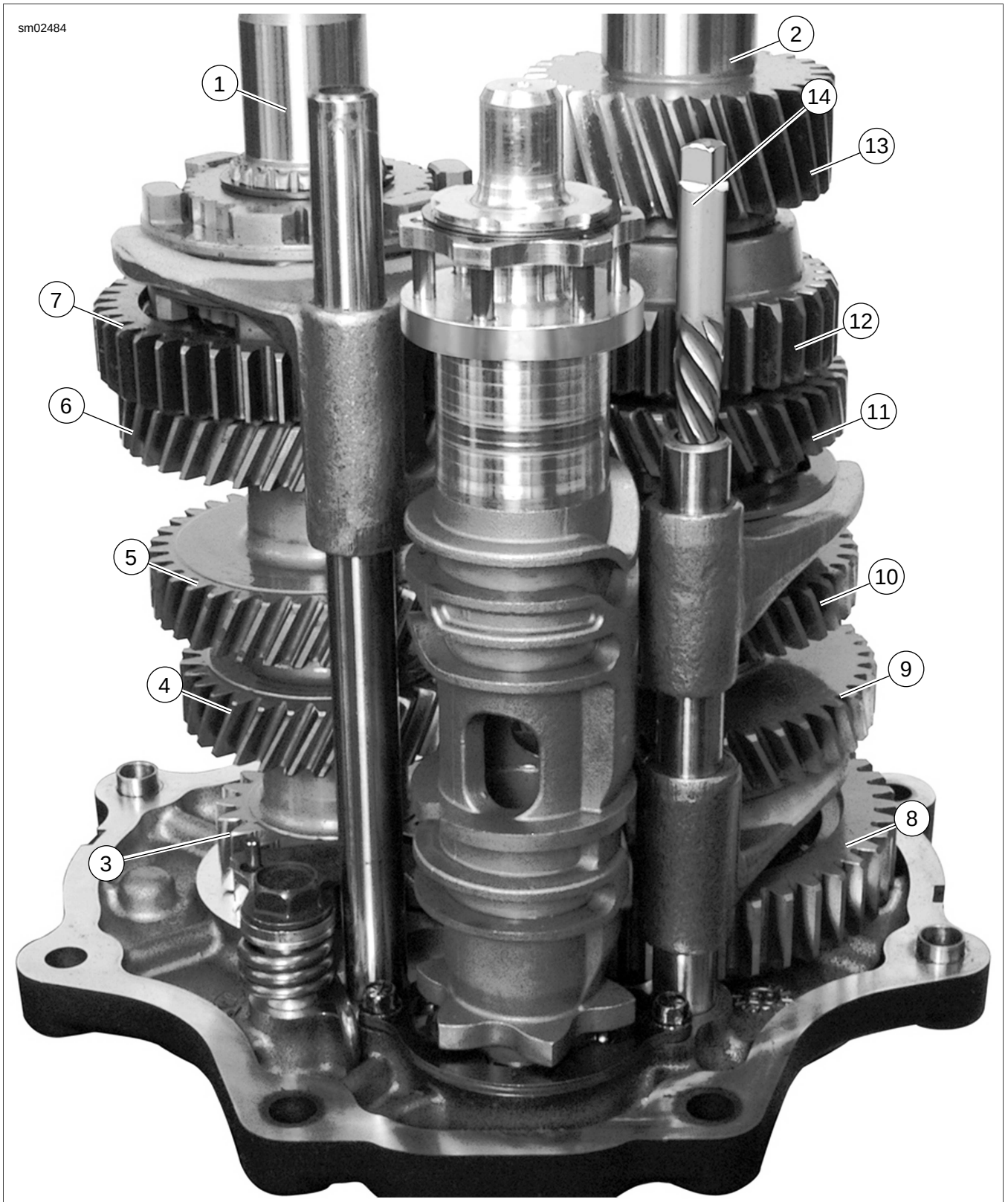
1. **Detent screw**
2. **Detent arm**
3. **Sleeve**
4. **Detent spring**

Figure 7-14. Detent Assembly



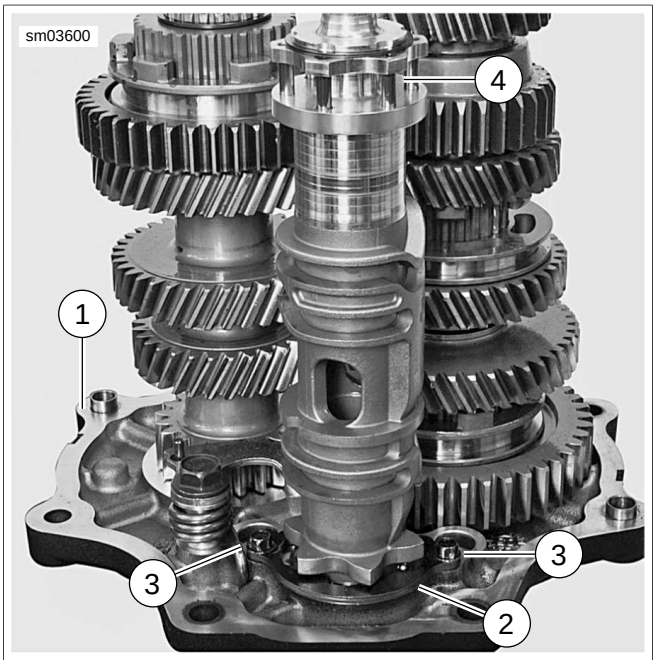
1. Spacer
2. Countershaft 1st gear
3. Bearing
4. Dog ring
5. Lock ring
6. Securing segment (2)
7. Guiding hub
8. Countershaft 2nd gear
9. Bearing
10. Lock ring
11. Securing segment (2)
12. Internal spline washer
13. Countershaft 3rd gear
14. Bearing
15. Lock ring
16. Securing segment (2)
17. Dog ring
18. Guiding hub
19. Countershaft 4th gear
20. Bearing
21. Countershaft 5th gear (part of countershaft)
22. Countershaft 6th gear (part of countershaft)
23. Mainshaft
24. Bearing
25. Mainshaft 4th gear
26. Mainshaft 3rd gear
27. Mainshaft 2nd gear
28. Mainshaft 1st gear
29. Mainshaft 5th gear
30. Dog ring
31. Guiding hub
32. Retaining ring
33. Retaining ring
34. Main drive gear bearing (2)
35. Main drive gear
36. O-ring
37. Bearing spacer
38. Retaining ring
39. Oil seal

Figure 7-15. Mainshaft and Countershaft Assembly



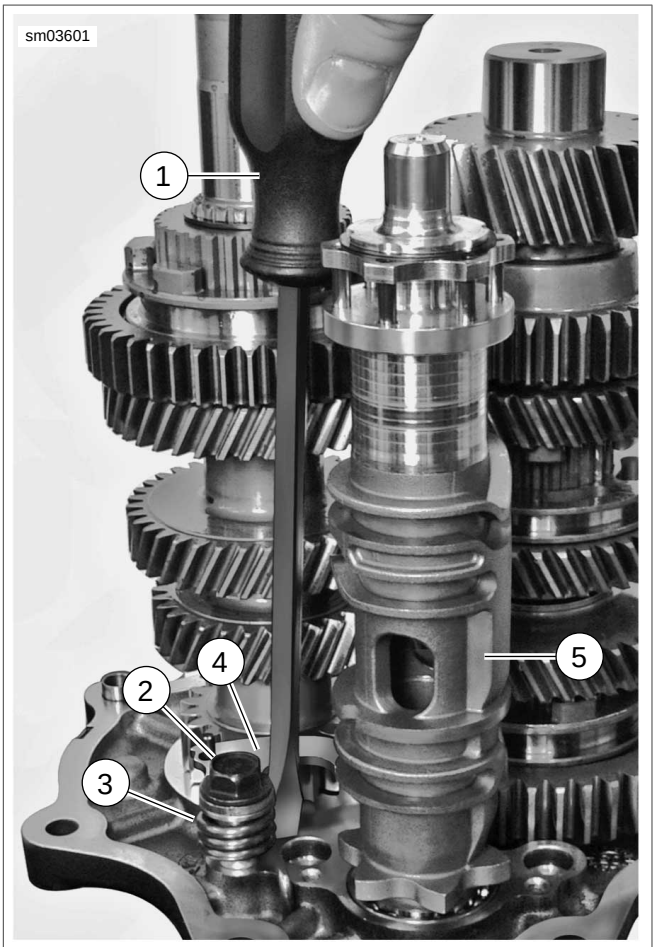
1. Mainshaft
2. Countershaft
3. Mainshaft 1st gear
4. Mainshaft 2nd gear
5. Mainshaft 3rd gear
6. Mainshaft 4th gear
7. Mainshaft 5th gear
8. Countershaft 1st gear
9. Countershaft 2nd gear
10. Countershaft 3rd gear
11. Countershaft 4th gear
12. Countershaft 5th gear
13. Countershaft 6th gear
14. Screw extractor

Figure 7-16. Gear Set



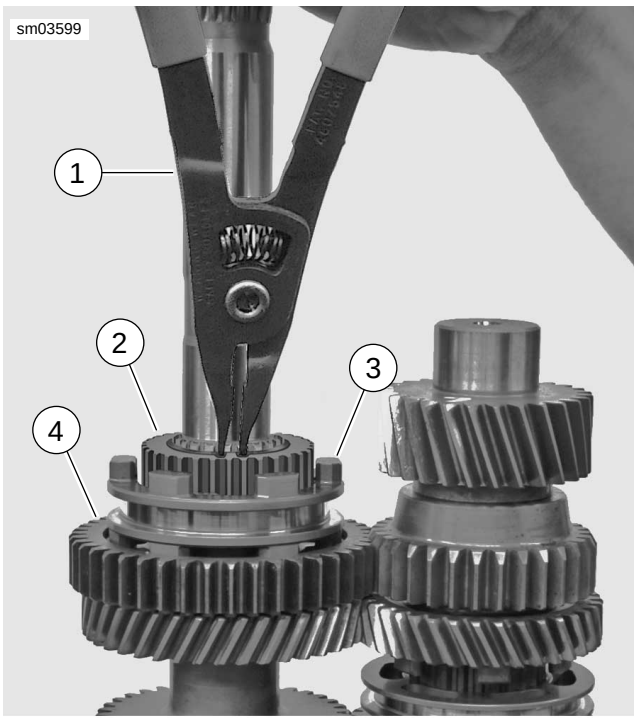
1. Side door
2. Lock plate
3. Lock plate fastener (2)
4. Shift cam

Figure 7-17. Shift Drum



1. Screwdriver
2. Detent fastener
3. Detent spring
4. Detent arm
5. Shift cam

Figure 7-18. Detent Assembly



1. **Retaining ring pliers**
2. **Guiding hub**
3. **Dog ring**
4. **Mainshaft 5th gear**

Figure 7-19. Mainshaft Retaining Ring

Countershaft

1. See Figure 7-20. Remove washer (1), countershaft 1st gear (2) and bearing.
2. See Figure 7-21. Remove countershaft 2nd gear lock ring.
3. See Figure 7-22. Remove securing segments (1). Remove dog ring (3), guiding hub (2), countershaft 2nd gear (4) and bearing.

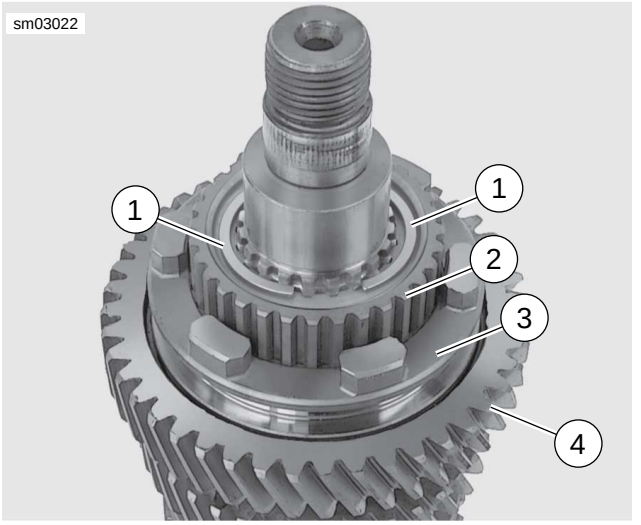


1. **Washer**
2. **Countershaft 1st gear**

Figure 7-20. Countershaft 1st Gear



Figure 7-21. Lock Ring



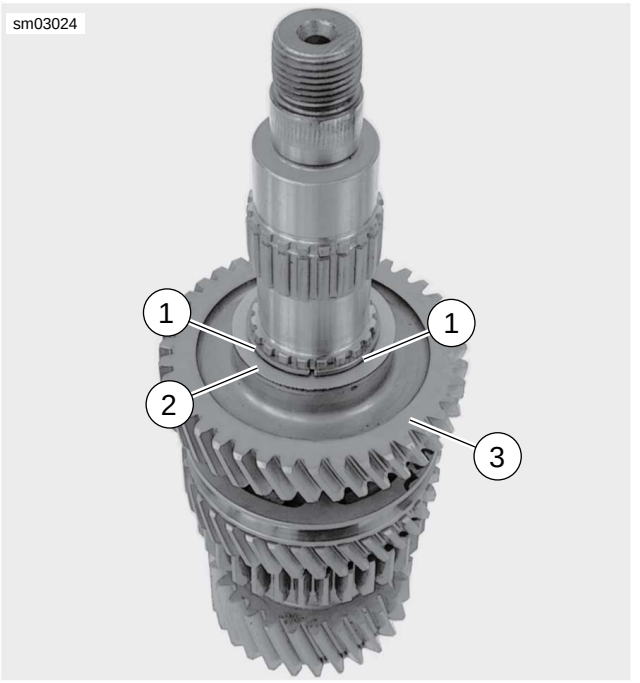
1. **Securing segment**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 2nd gear**

Figure 7-22. Securing Segment

4. See Figure 7-23. Remove countershaft 3rd gear lock ring.
5. See Figure 7-24. Remove securing segments (1), internal spline washer (2), countershaft 3rd gear (3) and bearing.
6. See Figure 7-25. Remove internal spline washer (1), guiding hub (2), dog ring (3), countershaft 4th gear (4) and bearing.

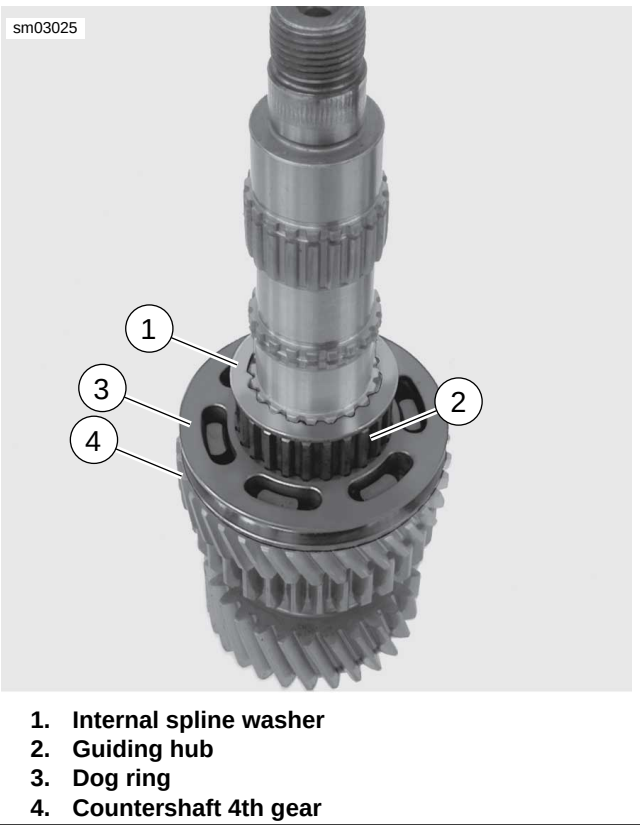


Figure 7-23. Third Gear Lock Ring



1. **Securing segment**
2. **Internal spline washer**
3. **Countershaft 3rd gear**

Figure 7-24. Countershaft Third Gear



1. **Internal spline washer**
2. **Guiding hub**
3. **Dog ring**
4. **Countershaft 4th gear**

Figure 7-25. Countershaft Assembly

Replacing Side Door Bearings

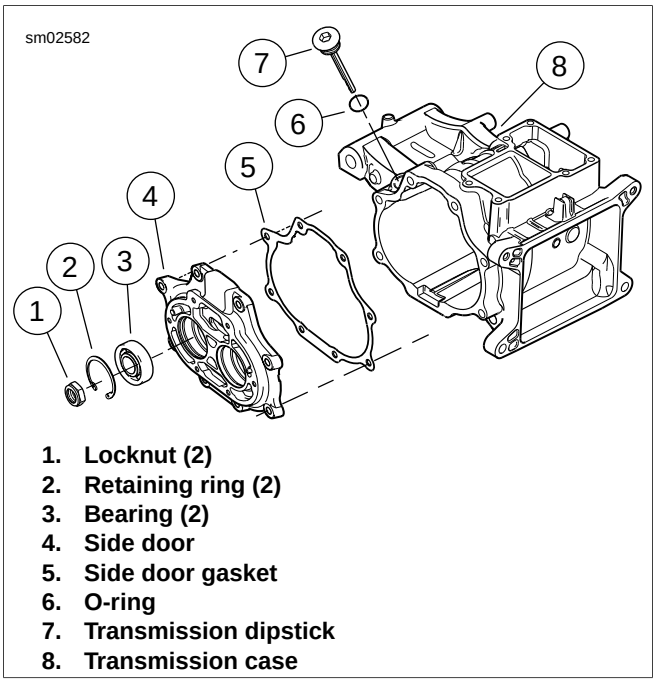
NOTE

Always replace side door bearing if the shaft is pressed out.

⚠WARNING

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

1. See Figure 7-26. Remove the retaining rings (2).
2. Press the bearings out of the side door.



1. **Locknut (2)**
2. **Retaining ring (2)**
3. **Bearing (2)**
4. **Side door**
5. **Side door gasket**
6. **O-ring**
7. **Transmission dipstick**
8. **Transmission case**

Figure 7-26. Side Door Bearings

CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all parts with solvent. Blow parts dry with low pressure compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs and pockets on the dog rings. Replace the dog rings if dogs and/or pockets are rounded, battered or chipped.
4. Inspect guiding hubs. Replace guiding hubs if splines are rounded, battered or chipped.
5. Inspect shift fork shafts. Replace if bent or damaged.
6. Inspect shift forks for wear or signs of overheating. Replace a shift fork if it is excessively worn or shows signs of overheating.
7. See Figure 7-27. Using a small carpenter's square, verify the shift forks are square. If shift fork does not rest directly on the square, then it is bent and must be replaced.
8. Inspect shift drum and bearing. Replace shift drum assembly if drum or bearing are damaged.
9. Clean shift cam lock plate mounting holes in transmission bearing housing.
10. Inspect side door bearings. Bearings must rotate freely without drag. Replace the bearings if pitted, grooved or if the shafts were removed.

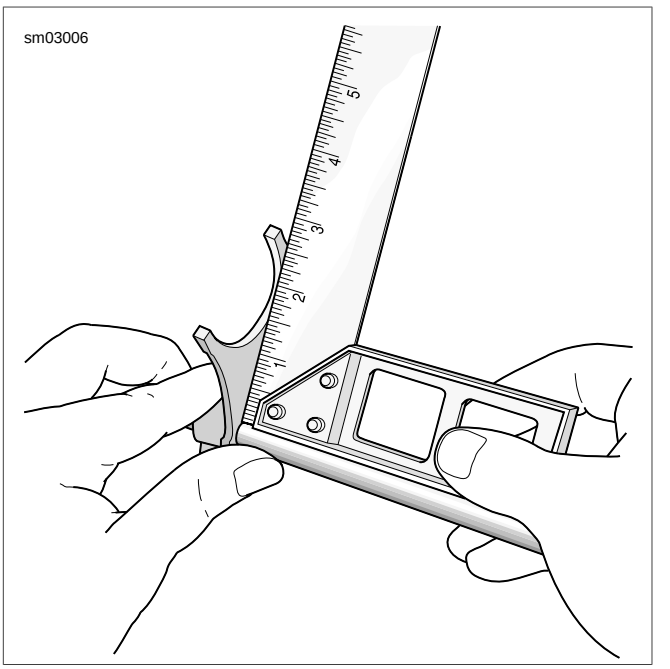


Figure 7-27. Checking Fork

ASSEMBLY

PART NUMBER	TOOL NAME
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS

Installing Side Door Bearings

NOTES

- *Always replace side door bearing if the shaft was pressed out.*
- *To perform the next step, you must use a plate for support or the bearing door will be damaged.*

1. When pressing **new** bearings into side door, press on the outside diameter of the bearing side with the numbers stamped on it. This side should face toward the outside of the door. Support the door from the opposite side at the bearing bores with a flat plate.

⚠WARNING

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

2. Install beveled retaining ring (2) with the flat side next to the bearing.

Countershaft

NOTES

- *Replace retaining ring and all gear roller bearings with **new** parts during assembly. Lubricate needle bearings and races with clean transmission lubricant before installation.*
- *Install securing segments so the side with the rounded edge is facing up and the side with the straight edge is down. Be sure segments fully engage grooves in countershaft.*
- *One side of the lock rings have a stepped face. The stepped face always faces the securing segments.*

1. See Figure 7-25. Install bearing, countershaft 4th gear (4), guiding hub (2), dog ring (3) securing segments and internal splined washer (1) on countershaft.
2. See Figure 7-24. Install bearing, countershaft 3rd gear (3), internal spline washer (2) and securing segments (1).
3. See Figure 7-23. Place countershaft 3rd gear lock ring over securing segments.

NOTES

- *In next step, the side of the guiding hub with the deeper counterbore, faces countershaft 2nd gear.*
- *Countershaft 2nd gear bearing is wider than other bearings on the countershaft*

4. See Figure 7-22. Install bearing, countershaft 2nd gear (4), guiding hub (2), dog ring (3) and securing segments (1) on countershaft.
5. See Figure 7-21. Place lock ring over securing segments.
6. See Figure 7-20. Install bearing, countershaft 1st gear (2) and washer (1).

NOTES

- *If installing countershaft only, hold countershaft 3rd and 4th gear shift dog up while pressing side door bearing on to countershaft.*
- *Failure to press on inner bearing races while pressing bearings on the shafts will damage the bearings.*

7. See Figure 7-28. Place countershaft in an arbor press supporting countershaft 6th gear. Using a suitable socket, press on inner bearing race until side door bearing contacts countershaft 1st gear washer. The mainshaft is installed to the left of the transmission top cover access cover hole when viewing the side door from the top.



Figure 7-28. Installing Countershaft

Mainshaft

NOTES

- *Failure to press on inner bearing race while pressing bearing on the shaft will damage the bearing.*
- *See Figure 7-29. Hold dog ring so that it is engaged with countershaft 3rd gear during the press procedure. If press is performed with dog ring engaged with countershaft 4th gear, contact with mainshaft 4th gear will push shafts out of alignment and result in possible bearing and gear damage.*

1. Place mainshaft in an arbor press, supporting mainshaft 4th gear.
2. Place rear side door bearing over mainshaft. Using a suitable socket, press on inner bearing race until side door bearing contacts mainshaft 1st gear.
3. See Figure 7-19. With side door on end (shafts pointing upward), install bearing and mainshaft 5th gear (4).
4. Be sure guiding hub counterbore is facing mainshaft 5th gear and install guiding hub (2) and dog ring (3).
5. Install **new** retaining ring using TRANSMISSION SHAFT RETAINING RING PLIERS (Part No. J-5586A) (1).

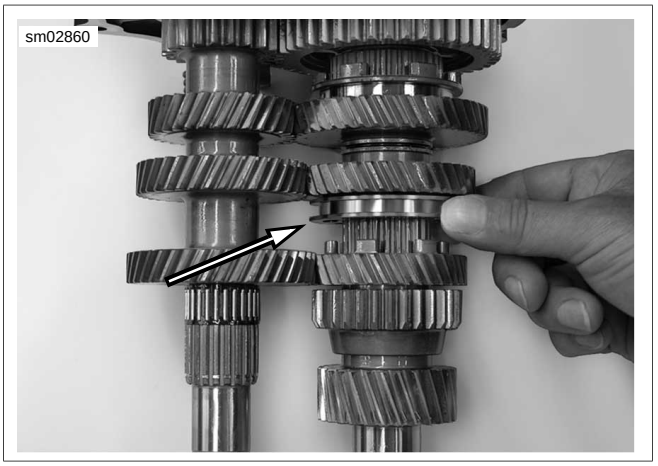


Figure 7-29. Raise and Hold Dog Ring

Shifter Cam/Shifter Forks

1. Using dog rings, lock two gears in place. Temporarily place transmission assembly into transmission case.
2. Install **new** nut on each shaft. Tighten nuts to 45-55 ft-lbs (61.0-74.6 Nm).
3. Remove transmission assembly from case.
4. See Figure 7-19. Place side door on end (shafts pointing upward).

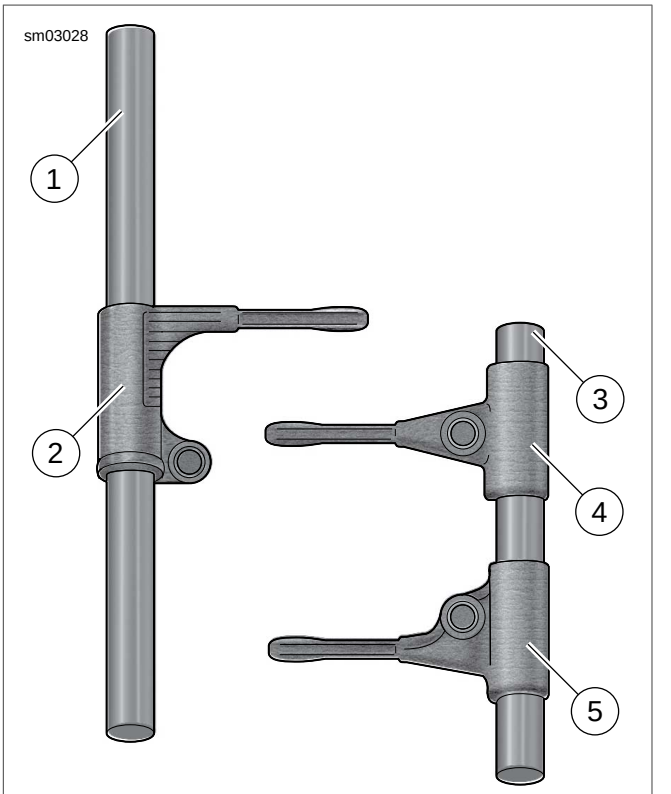
NOTE

If removed, install detent arm assembly. Tighten fastener to 120-150 ***in-lbs*** *(13.6-17.0 Nm).*

5. See Figure 7-14. Using screwdriver (1), pull detent arm back to allow installation of shift cam assembly.
6. Install shift cam assembly.
7. See Figure 7-17. Install lock plate (2) and **new** lock plate fasteners (3). Tighten fasteners to 57-63 **in-lbs** (6.4-7.1 Nm).
8. See Figure 7-30. The forks are different from each other and are identified as shown.
9. See Figure 7-31. Insert shifter fork (2) into the slot of the dog ring in between mainshaft 5th and 6th gear. Slide long shift shaft through 5th and 6th gear shifter fork and install shaft in hole in side door.
10. Insert shifter fork (6) into the slot of the dog ring in between countershaft 3rd and 4th gear. Insert shifter fork (9) into the slot of the dog ring in between countershaft 1st and 2nd gear. Slide short shift shaft through countershaft shifter forks and install shaft in hole in side door.

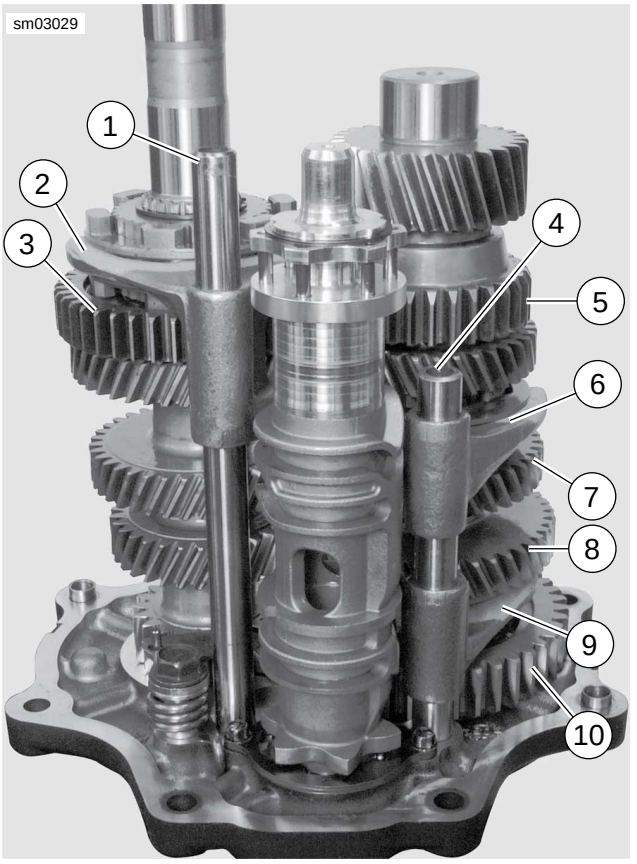
NOTE

If main drive gear was removed, install it now. See 7.6 MAIN DRIVE GEAR AND BEARING.



1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **Short shift shaft**
4. **3rd and 4th gear shifter fork**
5. **1st and 2nd gear shifter fork**

Figure 7-30. Shifter Forks and Shafts



1. **Long shift shaft**
2. **5th and 6th gear shifter fork**
3. **5th gear**
4. **Short shift shaft**
5. **4th gear**
6. **3rd and 4th gear shifter fork**
7. **3rd gear**
8. **2nd gear**
9. **1st and 2nd gear shifter fork**
10. **1st gear**

Figure 7-31. Transmission Gears and Shifter Forks

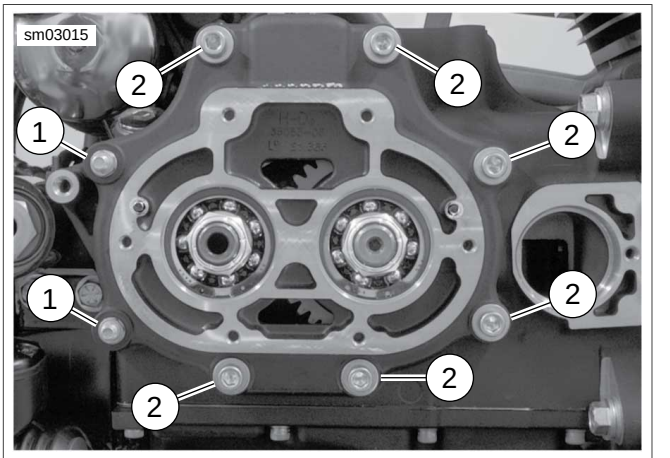
INSTALLATION

1. Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.
2. Verify that two ring dowels are in place on side door flange. place a **new** gasket on the ring dowels.
3. Apply clean transmission lubricant to the main drive gear bearings.

NOTE

Be sure the transmission filler plug/dipstick is removed before installing transmission assembly. Contact with the filler plug/dipstick will prevent installation of transmission assembly.

4. Install the transmission assembly in the transmission case.
5. If equipped, place exhaust bracket into position. Install side door fasteners.
6. See Figure 7-32. Using crosswise pattern, tighten all side door hardware (1, 2) to 13-18 ft-lbs (17.6-24.4 Nm).



1. **Stud**
2. **Bolt**

Figure 7-32. Side Door Hardware

7. Install mainshaft bearing inner race. See 6.6 TRANSMISSION SPROCKET.
8. See Figure 7-7. Install push rod assembly (items 2-5) in mainshaft hole. Secure with **new** retaining ring (1) if removed.

NOTE

The two top side cover fasteners are shorter in length than the others.

9. Install the clutch release cover, using a **new** gasket. See 7.4 CLUTCH RELEASE COVER.
10. Remove shifter cam pawl from top cover gasket surface and place on shift cam. Install **new** transmission top cover gasket. Install transmission top cover. Install top cover fasteners and tighten to 84-132 **in-lbs** (9.5-14.9 Nm).
11. Install vent hose to top cover fitting, if removed.
12. See Figure 7-26. Install **new** o-ring (7) on oil spout (6). Apply clean engine oil to o-ring. Push oil spout into transmission case. Install oil spout fastener (8). Tighten fastener to 84-132 **in-lbs** (9.5-14.9 Nm).
13. Install transmission sprocket nut. See 6.6 TRANSMISSION SPROCKET.
14. Install primary chaincase, clutch assembly and primary cover. See 6.2 PRIMARY CHAINCASE COVER, Installation.
15. Replace o-ring on plug. Clean and install transmission drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
16. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.
17. Install exhaust system. See 4.16 EXHAUST SYSTEM.

REMOVAL

PART NUMBER	TOOL NAME
HD-35316-10	PILOT
HD-35316-11	RECEIVER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-9	BEARING DRIVER
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER
RS-25100-200	NICE BEARING
RS-25100-200	NICE BEARING

CAUTION

Failure to use Main Drive Gear Remover and Installer can cause premature failure of bearing and related parts. (00540b)

NOTE

Main drive gear and bearing can be removed with the transmission case in the frame after removing door assembly. Use MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER (Part No. HD-35316-C).

1. Remove retaining ring.

NOTES

- *The main drive gear bearing and retaining ring must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.*
- *The CROSS PLATE (Part No. HD-35316-3A) is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up.*

2. See Figure 7-33. Place CROSS PLATE (Part No. HD-35316-3A) (1) on right side of transmission case as shown, and secure with two screws (2). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear (4).
3. Insert 12 IN. BOLT (Part No. HD-35316-5) (3) through cross plate and main drive gear.
4. At left side of transmission case, place WASHER (Part No. HD-35316-7), NICE BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt. Tighten nut until main drive gear is free.

NOTES

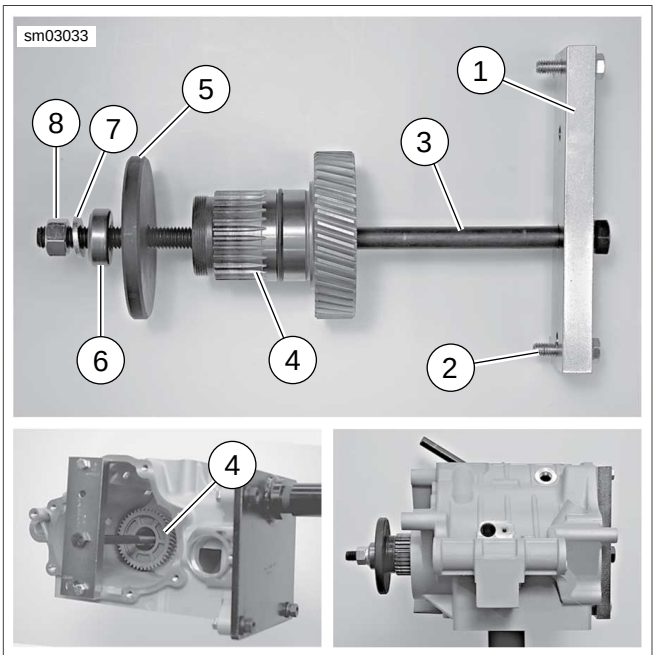
- *When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing must also be replaced.*
- *See Figure 7-34. When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. If the main drive gear is to be re-used, this inner race must be removed first.*
- *If not already done, remove large main drive gear oil seal and retaining ring.*

5. See Figure 7-35. Slide PILOT (Part No. HD-35316-10) (3) over small end of BEARING DRIVER (Part No. HD-35316-9) (2).
6. Insert 8 IN. BOLT (Part No. HD-35316-4A) (1) through bearing driver and pilot.
7. Insert bolt with bearing driver and pilot into right side of transmission case, through main drive gear bearing (4). Make sure bearing driver fits up against main drive gear bearing and pilot is centered in bearing bore.
8. At left side of case, slide RECEIVER CUP (Part No. HD-35316-11) (5) onto bolt and over main drive gear bearing. Install NICE BEARING (Part No. RS-25100-200) (6), flat washer (7) and nut (8) over end of bolt.

NOTE

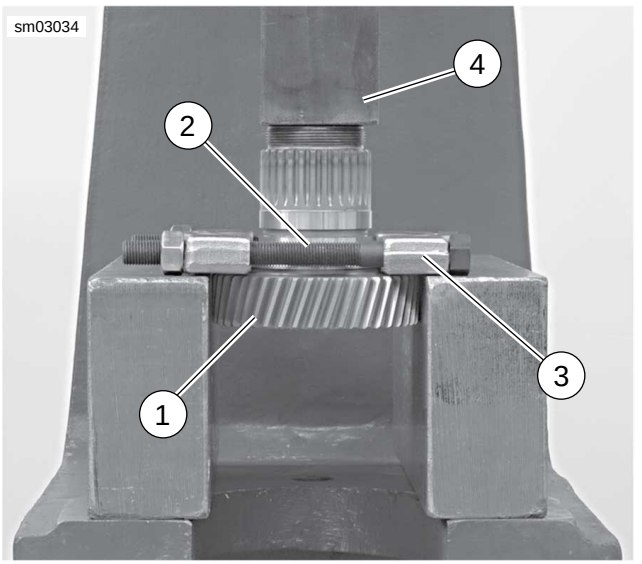
Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of transmission case when bearing comes free.

9. Tighten nut until main drive gear bearing is free.
10. Discard main drive gear bearing.



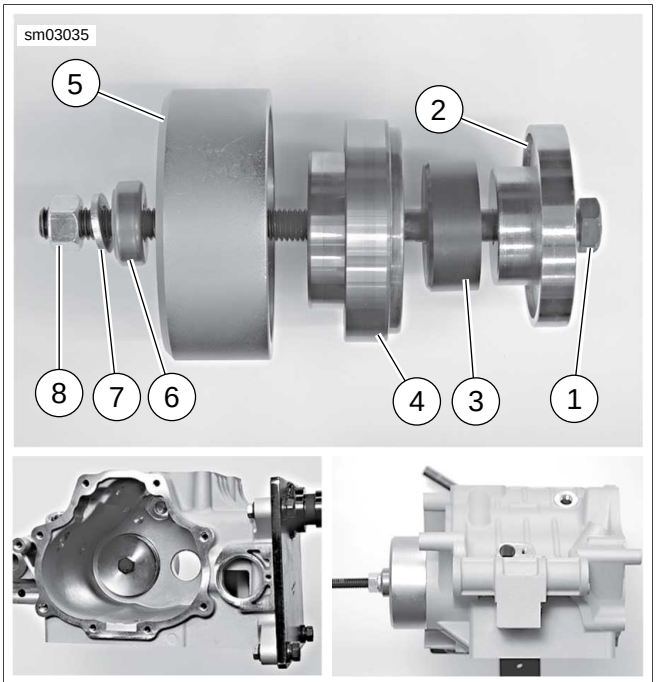
1. **Cross plate**
2. **Screw (2)**
3. **12 in. bolt**
4. **Main drive gear**
5. **Washer**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

Figure 7-33. Removing Main Drive Gear



1. **Main drive gear**
2. **Inner bearing race (not visible in this photo)**
3. **Bearing race puller**
4. **Press ram**

Figure 7-34. Removing Inner Bearing Race From Main Drive Gear



1. **8 in. Bolt**
2. **Bearing driver**
3. **Pilot**
4. **Main drive gear bearing**
5. **Receiver cup**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

Figure 7-35. Removing Main Drive Gear Bearing

CLEANING AND INSPECTION

PART NUMBER	TOOL NAME
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL
HD-47933	MAIN DRIVE GEAR SEAL INSTALLER

WARNING

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

1. Clean all parts in solvent except the transmission case and needle bearings. Blow dry with compressed air.

NOTE

Do not clean the transmission case and needle bearings. Normal cleaning methods will wash dirt and other contaminants into the bearing case and behind the needle bearings leading to bearing failure.

2. Inspect the main drive gear for pitting and wear. Replace if necessary.
3. Inspect the needle bearings inside the main drive gear. Replace the needle bearings if the mainshaft race is pitted or grooved.
4. Replace the sprocket if teeth are cracked or worn. See 6.6 TRANSMISSION SPROCKET for more information.
5. Inspect the needle bearings on the inside of the main drive gear. If mainshaft race surface appears pitted or grooved, replace these bearings.

NOTE

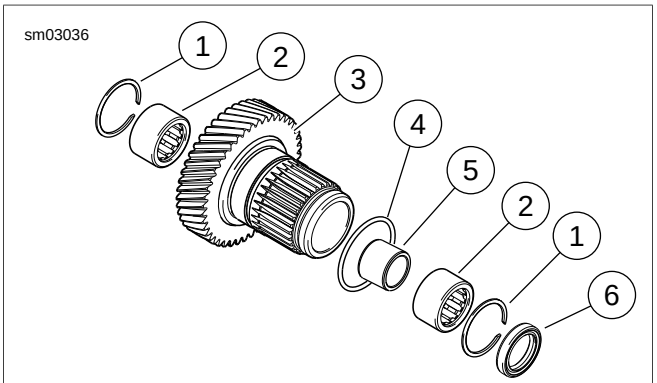
If the main drive gear needle bearings and/or seal need to be replaced, continue as follows. Otherwise, proceed to 7.7 TRANSMISSION CASE, Assembly.

Needle Bearing Replacement

WARNING

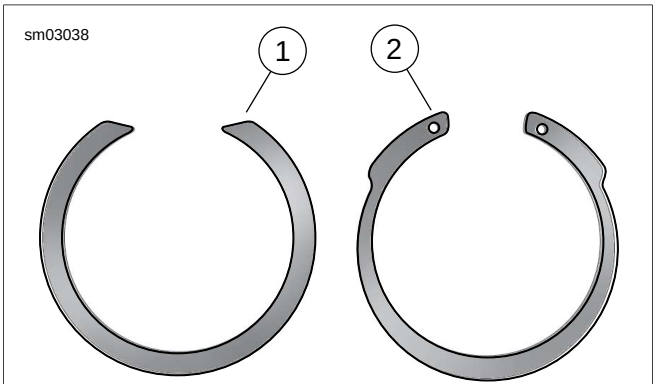
Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

1. See Figure 7-36. Remove mainshaft seal (6). Remove retaining rings (1), needle bearings (2) and spacer (5) from main drive gear (3). Discard retaining rings.



1. **Retaining ring (2)**
2. **Needle bearing (2)**
3. **Main drive gear**
4. **O-ring**
5. **Spacer**
6. **Mainshaft seal**

Figure 7-36. Main Drive Gear Assembly



1. **Original retaining ring**
2. **Replacement retaining ring**

Figure 7-37. Main Drive Gear Retaining Rings

NOTES

- *See Figure 7-37. When replacing needle bearings, discard original retaining rings (1) and install replacement retaining rings (2).*
- *To install the inner main drive gear needle bearings and mainshaft seal, use MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL (Part No. HD-47932).*

2. See Figure 7-38. Install clutch side needle bearing using an arbor press and the 0.400 in. step end of tool as shown. Press until tool is flush.

NOTES

- *An alternative method is provided which allows the mainshaft seal to be pressed into place after installation of the main drive gear. For detailed information, refer to steps that follow.*
- *If a serviceable mainshaft seal is already installed, then skip next step.*

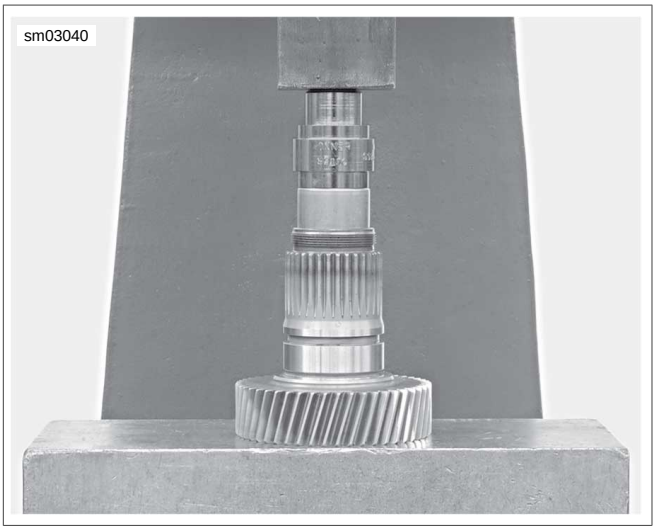


Figure 7-38. Installing Clutch Side Needle Bearing in Main Drive Gear

3. Install mainshaft seal:
   a. See Figure 7-39. Turn over tool and press in mainshaft seal using the 0.090 in. step.
   b. Install spacer.
   c. See Figure 7-36. Turn over the main drive gear in the arbor press. With the tool at the 0.188 in. step, press in inner bearing.
   d. Install **new** retaining rings.
   e. Install **new** o-ring into groove in main drive gear.
4. See Figure 7-41. If the mainshaft seal was not installed with the needle bearings (or if a faulty seal is discovered with the main drive gear installed in the transmission case), an alternative method is provided using the MAIN DRIVE GEAR SEAL INSTALLER (Part No. HD-47933).

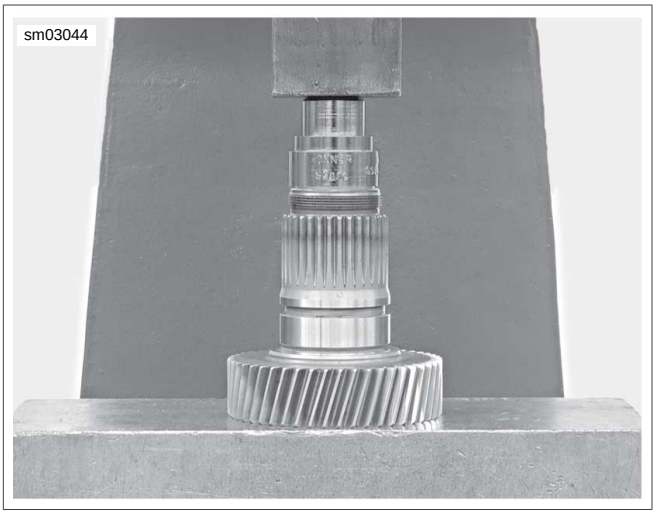


Figure 7-39. Pressing in Seal

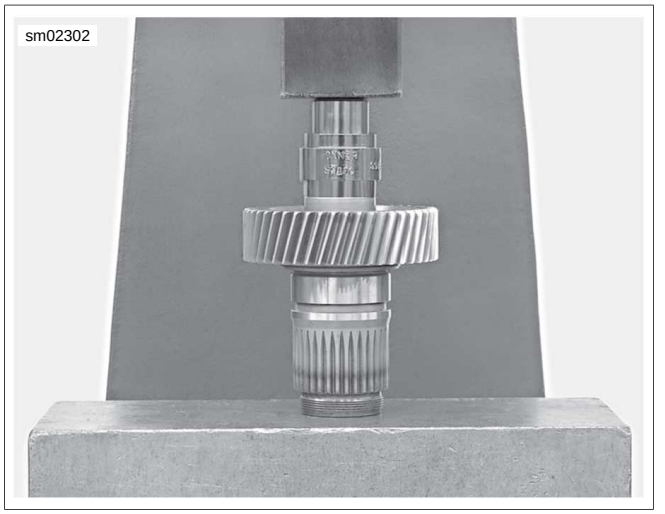
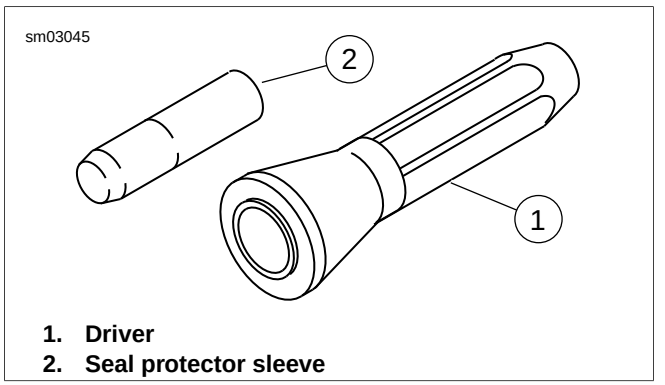


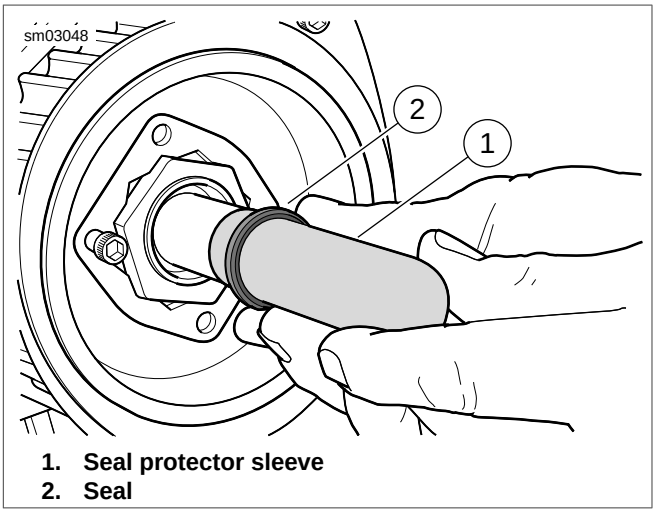
Figure 7-40. Installing Transmission Side Needle Bearing in Main Driver Gear



1. **Driver**
2. **Seal protector sleeve**

Figure 7-41. Main Drive Gear Seal Installer (Part No. HD-47933)

5. To install the mainshaft seal with the main drive gear in the transmission case, proceed as follows:
   a. Verify that the garter spring is in place on the lip of the oil seal.
   b. See Figure 7-42. Place the seal protector sleeve (1) over the end of the mainshaft. Lightly lubricate the protector sleeve and seal ID with clean transmission oil.
   c. Squarely seat the mainshaft seal (2) on the seal protector sleeve with the garter spring facing the transmission case.
   d. See Figure 7-43. Using seal driver, hand press seal onto mainshaft and into end of main drive gear. A rubber mallet may be used to lightly tap driver, if necessary. Seal is properly installed when seal driver bottoms out against end of main drive gear.



1. **Seal protector sleeve**
2. **Seal**

Figure 7-42. Seal Protector Sleeve

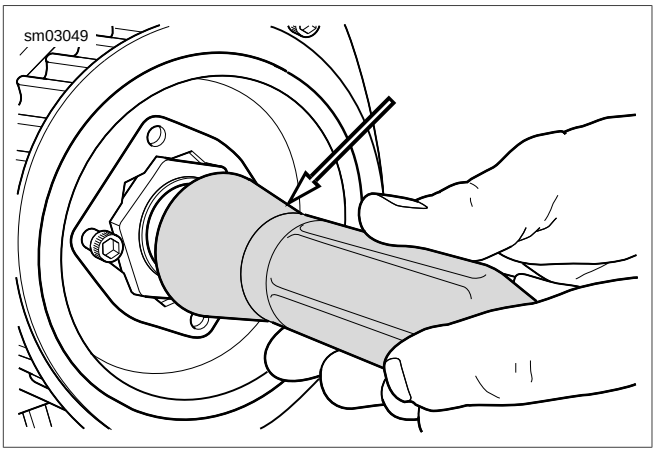


Figure 7-43. Seal Driver

INSTALLATION

PART NUMBER	TOOL NAME
HD-35316-12	INSTALLER CUP
HD-35316-3A	CROSS PLATE
HD-35316-4A	8 IN. BOLT
HD-35316-5	12 IN. BOLT
HD-35316-7	WASHER
HD-35316-8	BEARING DRIVER
HD-47856-1	INSTALLER
HD-47856-2	PILOT
HD-47856-3	ADAPTER
HD-47856-6	NUT
HD-47856-7	CROW'S FOOT WRENCH

CAUTION

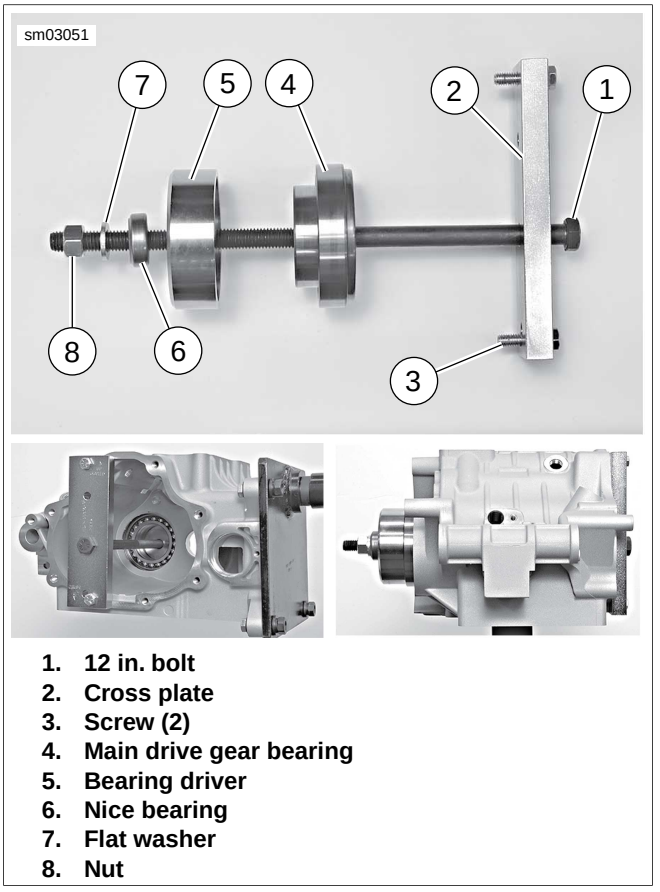
Improper tightening of sprocket nut can cause drive component damage. (00541b)

Installing Main Drive Gear Bearing

NOTE

CROSS PLATE (Part No. HD-35316-3A) will retrofit to earlier transmissions. Note that one end of cross plate is stamped, "UP 6 SPEED". Mount cross plate with this end pointing up for 6 speed transmissions.

1. See Figure 7-44. Place CROSS PLATE (Part No. HD-35316-3A) (2) on right side of transmission case as shown, and secure with two screws (3). Position cross plate so that large bolt hole in cross plate is lined up with center of main drive gear bearing bore in left side of transmission case.
2. Insert 12 IN. BOLT (Part No. HD-35316-5) (1) through cross plate and main drive gear bearing bore.
3. At outside of case, place main drive gear bearing (4), BEARING DRIVER (Part No. HD-35316-8) (5), BEARING (Part No. 217801) (6), FLAT WASHER (7) and NUT (8) over end of bolt.
4. Tighten nut until main drive gear bearing bottoms against lip cast into transmission case bearing bore.



1. **12 in. bolt**
2. **Cross plate**
3. **Screw (2)**
4. **Main drive gear bearing**
5. **Bearing driver**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

Figure 7-44. Installing Main Drive Gear Bearing (Typical)

Installing Main Drive Gear

NOTE

*See Figure 7-45. Make sure to install **new** o-ring (4) onto main drive gear (3) and lubricate o-ring with clean engine oil before installing drive gear into transmission case.*

1. See Figure 7-45. Insert 8 IN. BOLT (Part No. HD-35316-4A) (1) through WASHER (Part No. HD-35316-7) (2) and main drive gear (3). Insert assembly into transmission case, through main drive gear bearing.
2. At outside of case, place INSTALLER CUP (Part No. HD-35316-12) (5), BEARING (Part No. 217801) (6), FLAT WASHER (7) and NUT (8) over end of bolt. Tighten nut until main drive gear bottoms against main drive gear bearing.

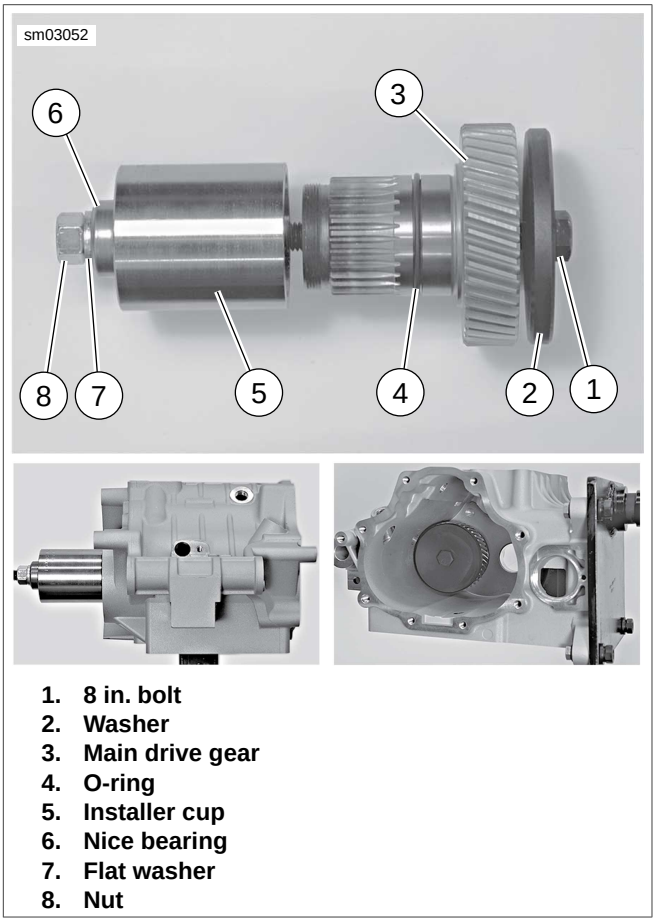
NOTE

See Figure 7-46. In next step, bearing retaining ring must be installed with the flat side facing the bearing and the opening in the ninety degree window as shown.

WARNING

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

3. See Figure 7-47. Install **new** retaining ring (2).



1. **8 in. bolt**
2. **Washer**
3. **Main drive gear**
4. **O-ring**
5. **Installer cup**
6. **Nice bearing**
7. **Flat washer**
8. **Nut**

Figure 7-45. Installing Main Drive Gear (Typical)

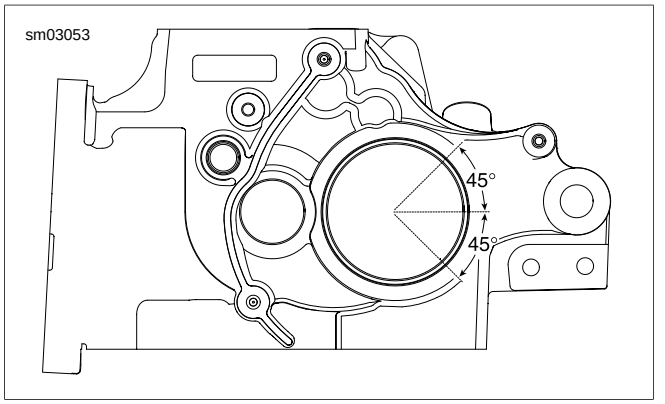


Figure 7-46. Retaining Ring Opening

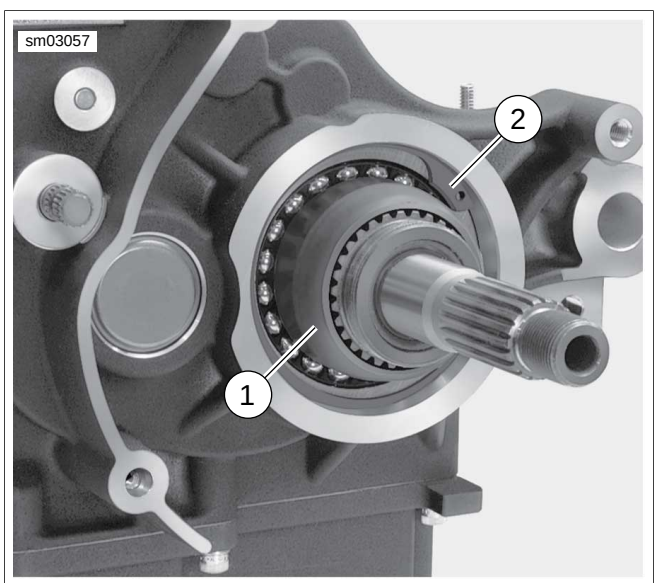
Installing Main Drive Gear Seal

1. See Figure 7-47. From outside of crankcase, install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.
2. Coat lips of **new** main drive gear seal with FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT (Part No. 99851-05, qt).
3. See Figure 7-48. Place seal over pilot and position seal squarely in end of crankcase bore.

NOTE

ADAPTER (Part No. HD-47856-3) and main drive gear have right-hand threads.

4. See Figure 7-49. Thread ADAPTER (Part No. HD-47856-3) onto end of main drive gear until it bottoms on main drive gear.



1. **Pilot**
2. **Retaining Ring**

Figure 7-47. Install Pilot (Part No. HD-47856-2)

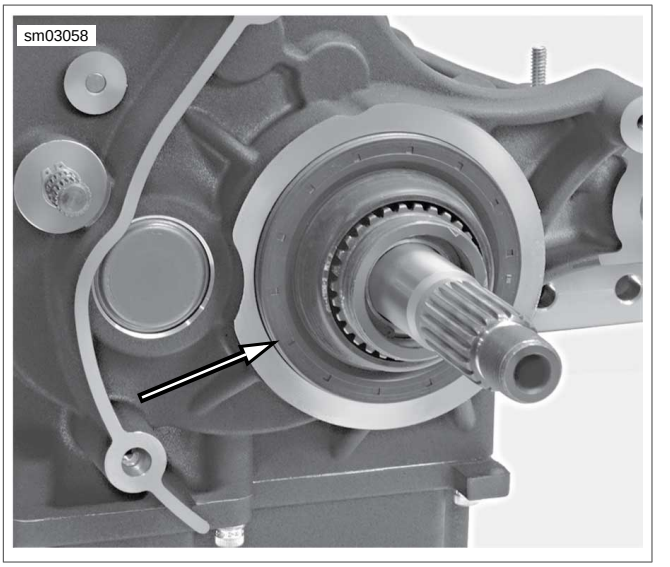


Figure 7-48. Place Main Drive Gear Seal Over Pilot

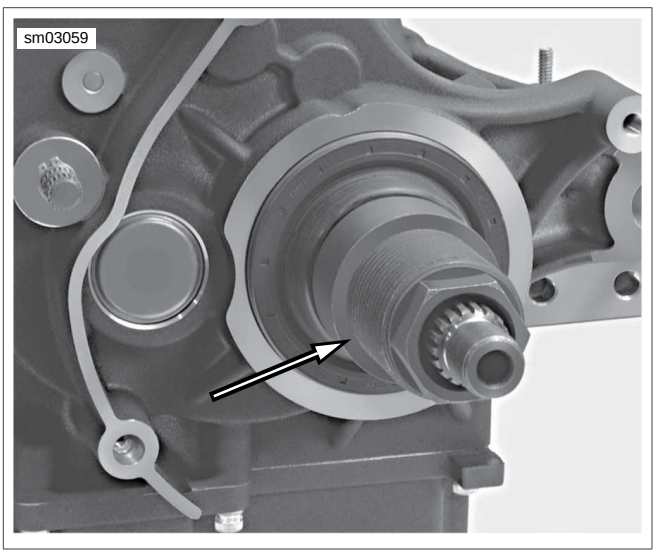


Figure 7-49. Install Adapter (Part No. HD-47856-3)

5. See Figure 7-50. Slide INSTALLER (Part No. HD-47856-1) over adapter until cupped end of installer is flat against seal.
6. See Figure 7-51. Thread NUT (Part No. HD-47856-6) onto end of adapter, until it tightens against installer.
7. See Figure 7-52. Place CROW'S FOOT WRENCH (Part No. HD-47856-7) (1) with 1/2 inch drive breaker bar (2) on large nut. Place an adjustable wrench (3) on flats of hex head cast into end of adapter.
8. Holding adjustable wrench, tighten large nut with crow's foot wrench until outer face of seal is flush with outer edge of transmission bore.

NOTE

It is acceptable to recess seal to about 0.030 in. (0.762 mm) below outer edge of bore. Seal depth will be controlled by tool.

9. Remove nut, installer, adapter and pilot.

10. Install main drive gear. See 6.6 TRANSMISSION SPROCKET.
11. Install the bearing inner race on the transmission mainshaft. See 7.5 TRANSMISSION ASSEMBLY, Assembly.
12. Install the starter. See 5.2 STARTER, Installation.
13. Install the primary chaincase housing. See 6.4 PRIMARY CHAINCASE HOUSING, Installation.
14. Install the clutch assembly, primary chain, chain tensioner assembly and compensating sprocket components See 6.3 DRIVE COMPONENTS, Installation.
15. Install the primary chaincase cover. See 6.2 PRIMARY CHAINCASE COVER, Installation.

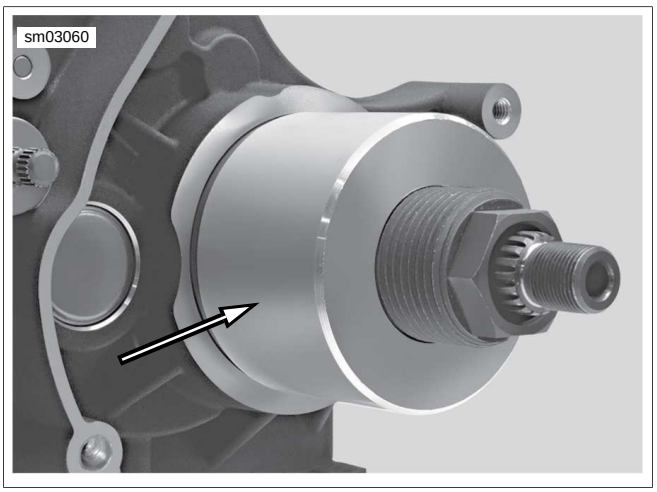


Figure 7-50. Place Installer (Part No. HD-47856-1) over Adapter

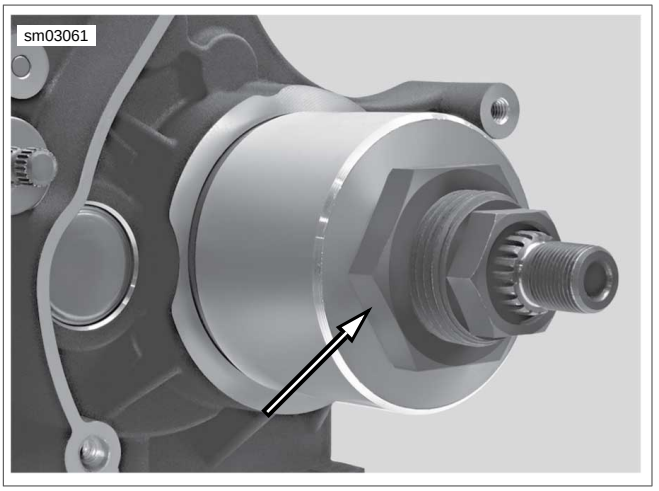
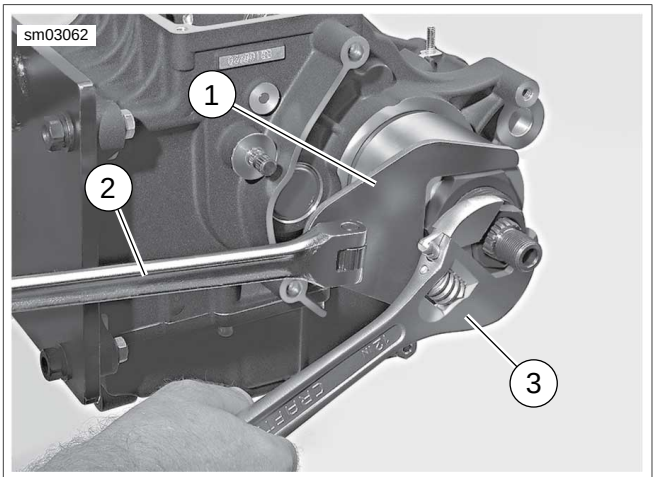


Figure 7-51. Install Nut (Part No. HD-47856-6)



1. **Crow's foot wrench**
2. **1/2 inch breaker bar**
3. **Adjustable wrench**

Figure 7-52. Press Seal Into Crankcase

REMOVAL

For information on pulling transmission case from frame, see 3.13 REMOVING ENGINE FROM CHASSIS.

⚠WARNING

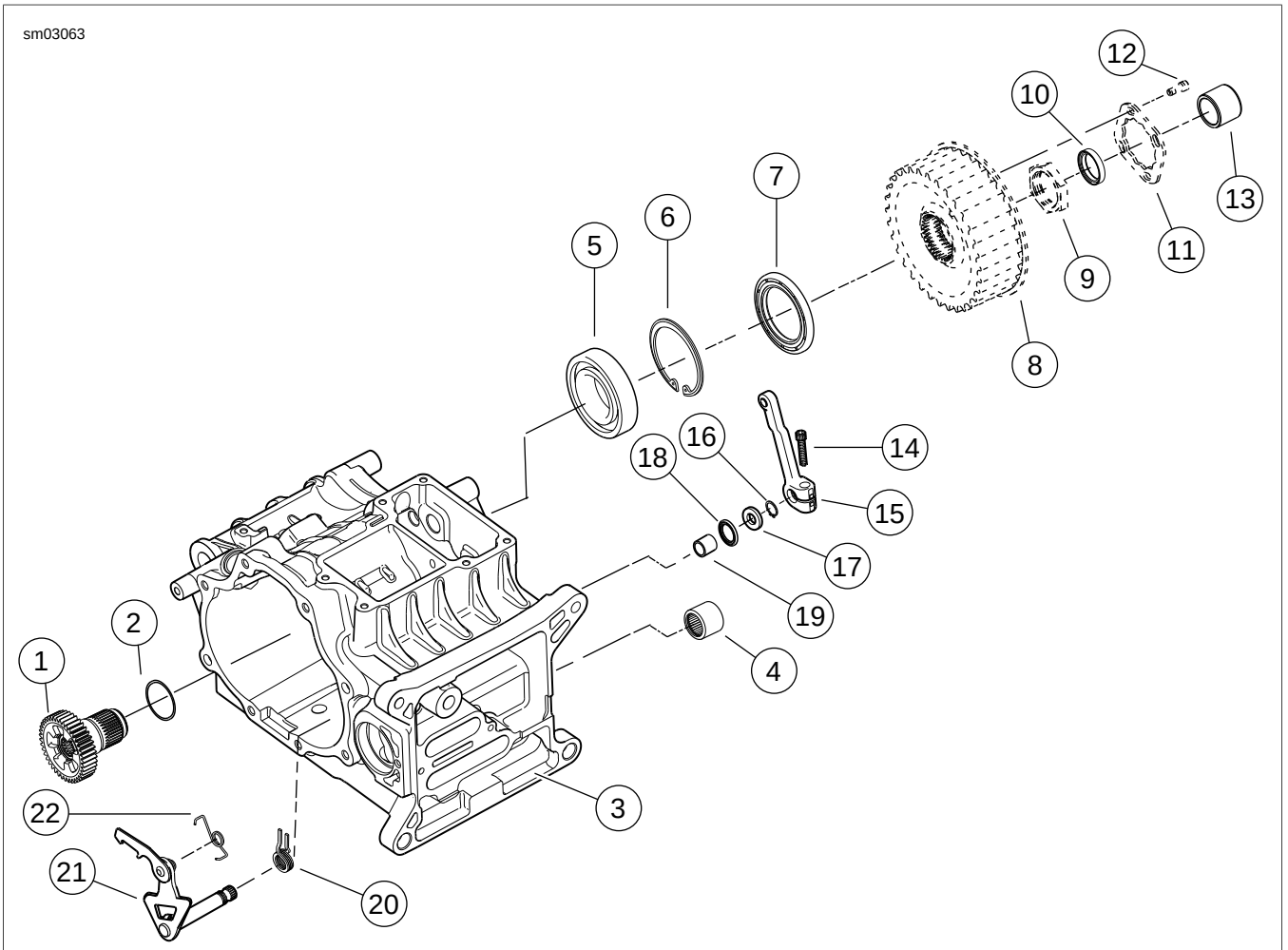
Disconnect negative (-) battery cable first. If positive (+) cable should contact ground with negative (-) cable connected, the resulting sparks can cause a battery explosion, which could result in death or serious injury. (00049a)

1. Disconnect battery, negative cable first.
2. Drain engine oil. See 1.4 ENGINE OIL AND FILTER, Changing Oil and Filter.
3. Drain transmission lubricant. See 1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant.
4. Remove starter. See 5.2 STARTER, Removal.
5. Remove transmission assembly. See 7.5 TRANSMISSION ASSEMBLY, Removal.
6. Position jack under lower frame crossmember to support rear of motorcycle. Slide wooden blocks beneath the crankcase to support the weight of the engine and transmission assembly.
7. Remove rear fork. See 2.23 REAR FORK, Removal.
8. Disconnect vehicle speed sensor (VSS). See 8.20 VEHICLE SPEED SENSOR (VSS), Removal.
9. Disconnect neutral switch. See 8.22 NEUTRAL SWITCH, Removal.
10. Remove fastener from ground post at top of transmission case and remove battery negative ring terminal.
11. Mark splines on shift arm and shift shaft to assist in assembly. Remove shift arm from shift shaft.
12. Remove four fasteners that connect transmission to engine.

NOTE

See Figure 7-10. Do not use a hammer to remove transmission. If the transmission sticks or binds on the ring dowels, gently pry away from crankcase using the indent.

13. Move transmission rearward until two ring dowels in lower flange are free of crankcase. Remove transmission case from left side of the motorcycle.



1. **Main drive gear**
2. **O-ring**
3. **Transmission case**
4. **Bearing**
5. **Bearing**
6. **Bevelled retaining ring**
7. **Oil seal**
8. **Sprocket**
9. **Sprocket nut**
10. **Oil seal, sixth gear**
11. **Lockplate**
12. **Allen screws**
13. **Bearing, inner race**
14. **Screw**
15. **Shifter rod lever**
16. **Retaining ring**
17. **Washer**
18. **Seal**
19. **Sleeve (inside transmission case)**
20. **Shifter lever centering spring**
21. **Shifter pawl lever assembly**
22. **Shifter shaft lever spring**

Figure 7-53. Transmission Case, Sprocket and Main Drive Gear

INSTALLATION

1. Install **new** ground post at top of transmission case. Tighten ground post until snug.

NOTE

*A **new** transmission case comes with the shifter shaft sleeve and seal, centering screw, countershaft needle bearing and main drive gear bearing and seal installed.*

2. Thoroughly wipe all engine oil from pockets in crankcase flange.
3. Install **new** engine-to-transmission gasket engaging two index pins in holes of transmission flange.
4. Verify that transmission dowels are seated. Place transmission case into position behind crankcase. Mate engine and transmission flanges.
5. Tighten fasteners.
   a. Using a crosswise pattern, **hand tighten** fasteners. Shorter bolts are installed at the top, longer fasteners are installed at the bottom.
   b. Alternately tighten bolts to 15 ft-lbs (20.3 Nm) in the same crosswise pattern.
   c. Final tighten bolts to 30-35 ft-lbs (40.7-47.5 Nm).
6. Install rear fork. See 2.23 REAR FORK, Installation.

7. Install shift shaft on shift arm.
8. Install transmission assembly and main drive gear. See 7.5 TRANSMISSION ASSEMBLY, Installation.
9. Adjust drive belt tension. 1.13 REAR BELT DEFLECTION.
10. Verify vehicle alignment. 2.11 VEHICLE ALIGNMENT.
11. Install primary chaincase. 6.4 PRIMARY CHAINCASE HOUSING.
12. Install drive components. See 6.3 DRIVE COMPONENTS.

NOTE

The gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

13. Install primary chaincase cover. 6.2 PRIMARY CHAINCASE COVER.
14. Install the exhaust system. 4.16 EXHAUST SYSTEM.
15. Clean transmission drain plug and install. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Place motorcycle in an upright position. Fill transmission to proper level with fresh transmission fluid. See 1.10 TRANSMISSION LUBRICANT.

CAUTION

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

16. Fill primary. 1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant.
17. Fill engine oil. 1.4 ENGINE OIL AND FILTER, Changing Oil and Filter.

⚠WARNING

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

18. Connect battery cables.

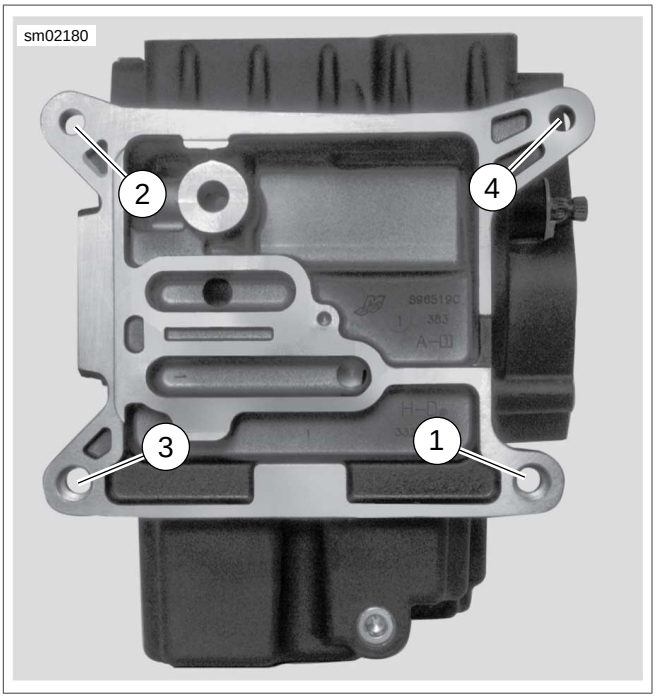


Figure 7-54. Transmission Housing to Crankcase Torque Sequence

DISASSEMBLY

Shifter Arm Assembly

1. See Figure 7-55. After removing door assembly, remove screw (8) and shifter rod lever (9) from the shifter pawl lever assembly (1).
2. Remove retaining ring (7), washer (6) and seal (5). Discard retaining ring and seal. Pull shifter pawl lever assembly out of the transmission case.
3. Inspect sleeve (2) inside transmission case.

CLEANING AND INSPECTION

⚠WARNING

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

1. Clean all parts in solvent except the case and main drive gear needle bearings. Blow parts dry with low pressure compressed air.

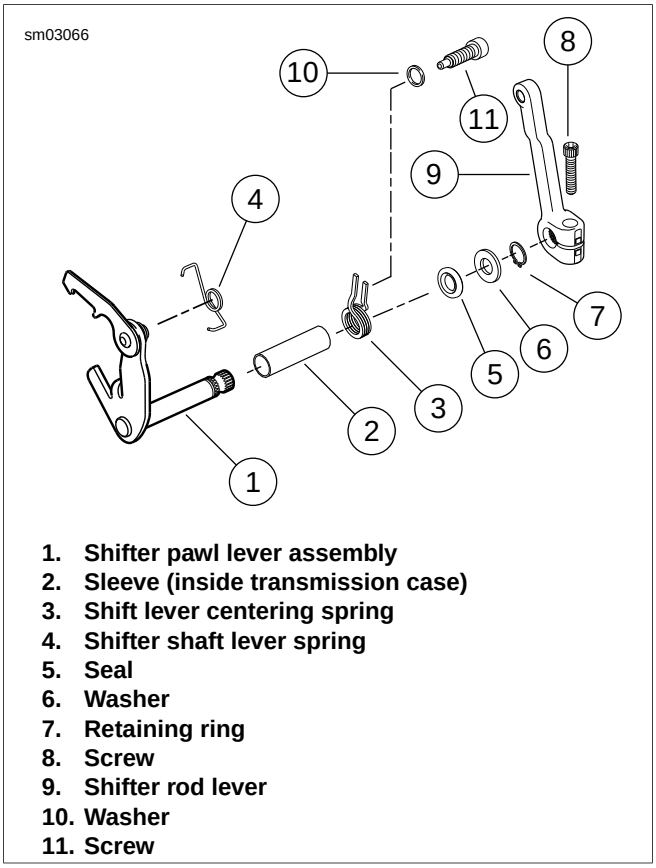
NOTE

The transmission case and needle bearings must not be cleaned. Normal cleaning methods will wash dirt or other contaminants into the bearing case (behind the needles) and leads to bearing failure.

2. See Figure 7-55. Inspect the shifter pawl lever assembly (1) for wear. Replace assembly if pawl ends are damaged. Replace centering spring (3) if elongated.
3. Inspect the shifter spring (4). Replace if the spring fails to hold the pawl on the cam pins.

4. Thoroughly clean the oil pan with solvent.

5. Inspect preformed transmission top cover vent hose for nicks, cuts or general deterioration. Replace as necessary. Use low-pressure compressed air to verify that hose and fitting are unobstructed.



1. **Shifter pawl lever assembly**
2. **Sleeve (inside transmission case)**
3. **Shift lever centering spring**
4. **Shifter shaft lever spring**
5. **Seal**
6. **Washer**
7. **Retaining ring**
8. **Screw**
9. **Shifter rod lever**
10. **Washer**
11. **Screw**

Figure 7-55. Shifter Arm Assembly

ASSEMBLY

Countershaft Needle Bearing Replacement

1. Find a suitable bearing driver 1.25 in. (31.75 mm) in diameter.

2. From the outside of the transmission case place the needle bearing open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven inward flush with the outside surface of the case or to a maximum depth of 0.030 in. (0.76 mm).

3. Lubricate the bearing with transmission lubricant.

Shifter Pawl Lever Assembly

1. See Figure 7-55. Verify that sleeve (2) is inside transmission case.

2. See Figure 7-56. Slide shifter lever centering spring (3) over shaft of shifter pawl lever assembly (2). Align opening on spring with tab on lever.

3. Place shifter shaft lever spring (4) on shifter pawl lever assembly.

NOTE

Do not bend shifter shaft lever spring more than necessary for assembly.

4. See Figure 7-57. Insert the assembly into the transmission case.

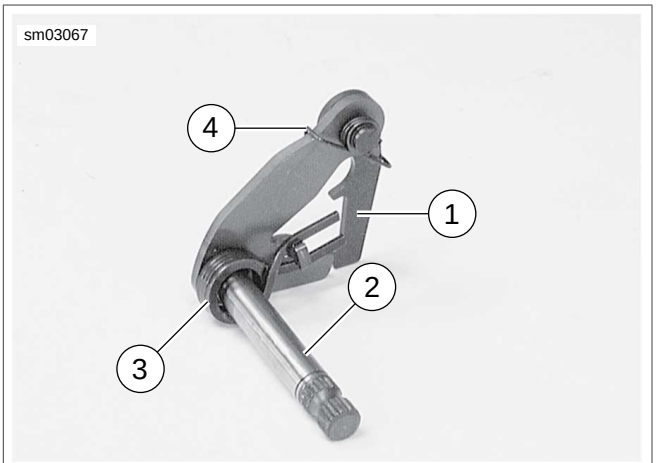
5. See Figure 7-58. Verify that pin sits inside shifter shaft lever spring.

6. See Figure 7-57. Install a **new** seal. Install washer (1) and a **new** retaining ring (2).

NOTE

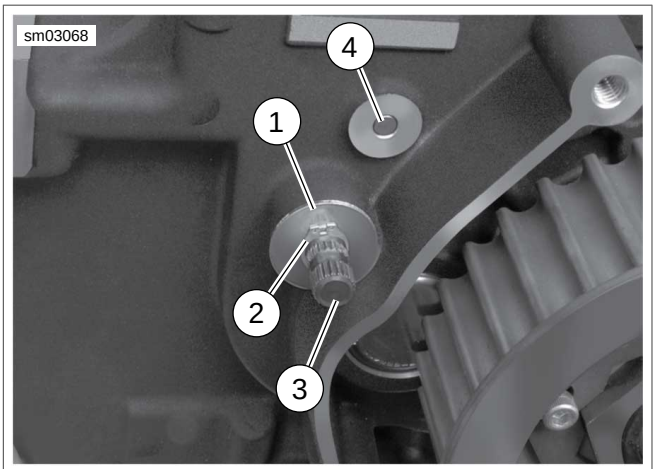
In next step, shifter rod lever must be installed so angle of lever is toward front of vehicle, one spline from vertical.

7. See Figure 7-55. Install shifter rod lever (9) on the shifter pawl lever assembly shaft end using screw (8). Tighten to 18-22 ft-lbs (24.4-29.8 Nm).



1. **Pawl (part of shifter pawl lever assembly)**
2. **Shifter pawl lever assembly**
3. **Shifter lever centering spring**
4. **Shifter shaft lever spring**

Figure 7-56. Shifter Pawl Lever Assembly



1. **Washer (with seal behind)**
2. **Retaining ring**
3. **Shifter shaft lever**
4. **Pin**

Figure 7-57. Shifter Shaft Lever, Exterior View

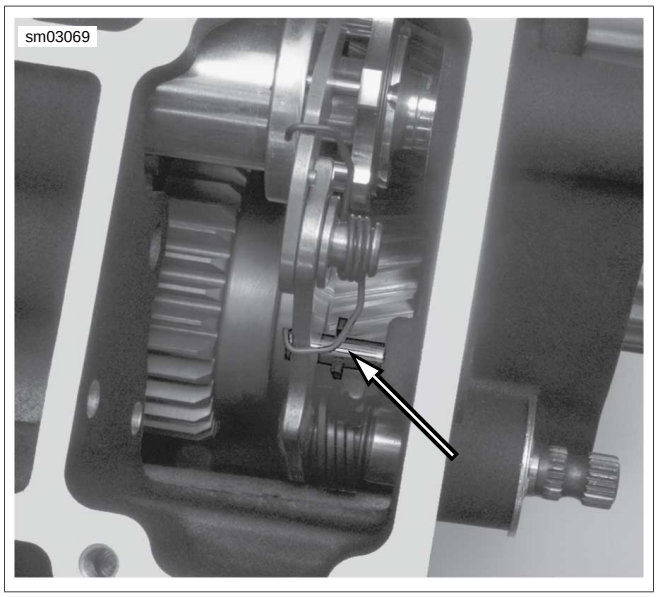


Figure 7-58. Shifter Shaft Lever Spring

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8.4 SPARK PLUG CABLES	8-5
8.5 VOLTAGE REGULATOR	8-6
8.6 FUSES AND RELAYS	8-7
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8.8 BATTERY TRAY AND BATTERY CABLES	8-12
8.9 HEADLAMP	8-14
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NOTES

SPECIFICATIONS

Table 8-1. Ignition

IGNITION	DATA
Idle speed	1000 ± 50 RPM
Spark plug size	12 mm
Spark plug gap	0.038-0.043 in.
	0.97-1.09 mm
Spark plug type	Harley-Davidson No. 6R12 (no substitute)
Ignition coil primary resistance	0.5-0.7 ohms
Ignition coil secondary resistance	5500-7500 ohms

Table 8-2. Circuit Breaker/Fuses

CIRCUIT BREAKERS/FUSES	AMPERES
Main fuse	40
Accessory fuse	15
Battery	
Customer accessory fuse	15
ECM fuse	15
Engine control	15
Fuel pump fuse	15
Ignition fuse	15
Instruments fuse	15
Lighting fuse	15

Table 8-3. Charging System

CHARGING SYSTEM	DATA
Battery	19 amp hour/270 CCA
Alternator AC voltage output	16-23 VAC per 1000 RPM
Alternator stator coil resistance	0.1-0.2 ohms
Regulator voltage output @ 3600 RPM	14.3-14.7 @ 75° F (24° C)
Regulator amperes @ 3000 RPM	35-50 amps

REMOVAL

NOTE

Security siren connector [142] is located under seat.

1. Remove seat.

⚠WARNING

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

2. Disconnect negative battery cable.
3. See Figure 8-1. Firmly grasp both sides of electrical caddy cover and pull outward to remove.
4. See Figure 8-2. Remove relay and fuse panels from electrical caddy.
   a. Insert small screwdriver into slot located under each relay/fuse panel.
   b. Using screwdriver, disengage relay/fuse panel from electrical caddy.
   c. Repeat for other relay/fuse panel.
5. See Figure 8-3. Disconnect main fuse connector from electrical caddy (1).
   a. Remove main fuse from connector.
   b. Insert small screwdrivers into slots (4) located on each side of main fuse.
   c. Using screwdrivers depress tabs of main fuse connector to disengage from electrical caddy.
6. Depress tab located on electrical caddy securing TSM/TSSM/HFSM. Pull TSM/TSSM/HFSM from electrical caddy. Disconnect TSM/TSSM/HFSM connector (2) [30].
7. Slide data link connector (3) [91] towards front of vehicle to disengage from electrical caddy.

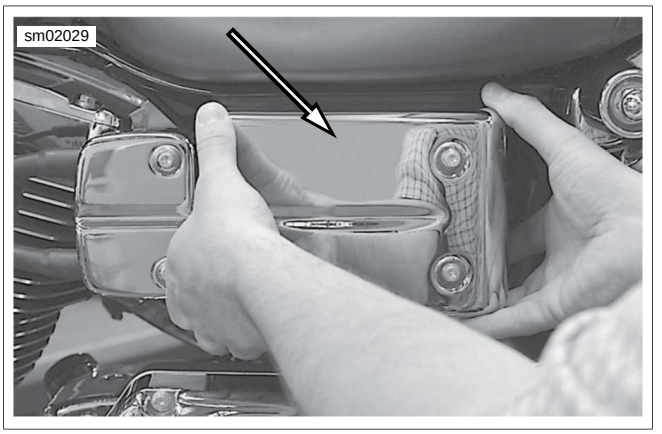
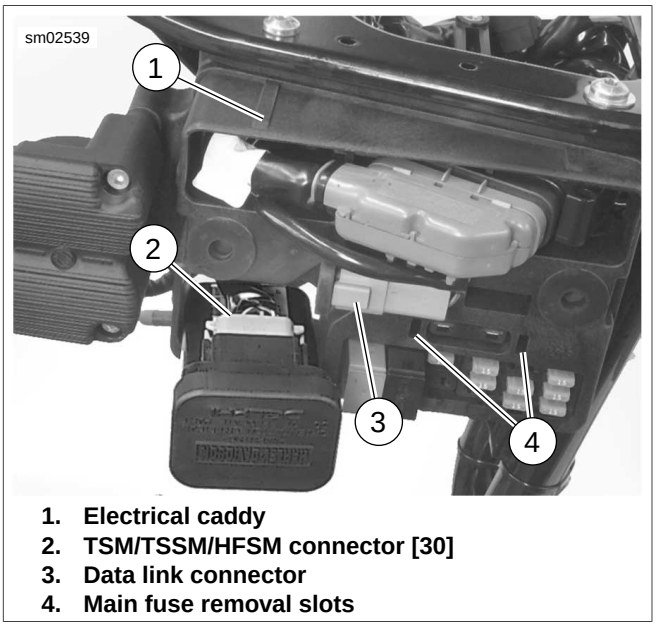


Figure 8-1. Electrical Caddy Cover



Figure 8-2. Removing Relay/Fuse Panels



1. **Electrical caddy**
2. **TSM/TSSM/HFSM connector [30]**
3. **Data link connector**
4. **Main fuse removal slots**

Figure 8-3. Electrical Caddy Removal

8. See Figure 8-4. Disconnect electronic control module (ECM) connector (2) [78].
9. Disconnect ignition coil connector [83].
10. Disconnect spark plug cables from coil.
11. Remove front electrical caddy fastener (4).
12. Remove top electrical caddy fasteners (3).
13. Remove wiring from electrical caddy.
14. Remove fasteners securing ECM and ground wire to electrical caddy.

INSTALLATION

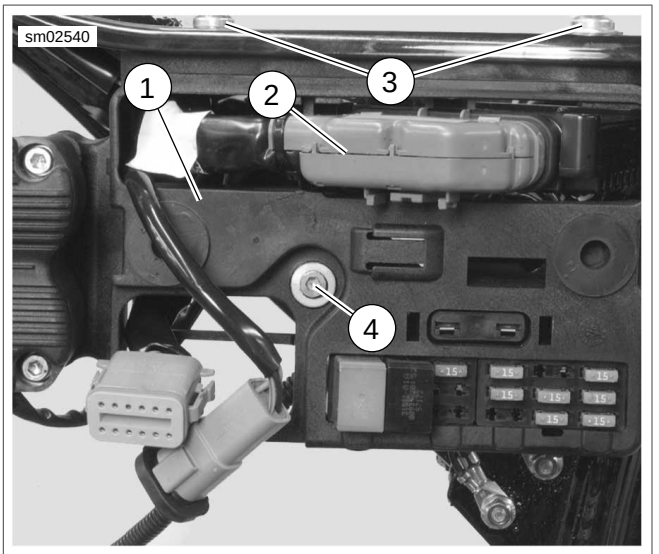
1. Attach ECM and ground wire to electrical caddy.
2. Install main fuse connector into rear of electrical caddy.
3. Install relay and fuse panels into rear of electrical caddy.
4. Route ECM and data link connector wiring through rear of electrical caddy past ECM.

5. See Figure 8-5. Route TSM/TSSM/HFSM wiring through rear of electrical caddy as shown.
6. See Figure 8-4. Install but do not tighten electrical caddy front fastener (4).
7. Install electrical caddy top fasteners (3). Tighten to 90-110 **in-lbs** (10.2-12.4 Nm).
8. Tighten electrical caddy front fastener to 40-60 **in-lbs** (4.5-6.8 Nm).
9. Connect electronic control module (ECM) connector [78].
10. See Figure 8-3. Connect TSM/TSSM/HFSM connector (2) [30] to TSM/TSSM/HFSM. Slide TSM/TSSM/HFSM into electrical caddy until tab of caddy engages TSM/TSSM/HFSM.
11. Install data link connector (3) to electrical caddy as shown.
12. Install main fuse.
13. Attach coil connector [83].
14. Attach spark plug cables. Rear cable is installed on upper coil tower.
15. Install electrical caddy cover.
16. Connect negative battery cable.

WARNING

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

17. Install seat.



1. **Electrical caddy**
2. **ECM connector [78]**
3. **Top electrical caddy fasteners (2)**
4. **Front electrical caddy fastener**

Figure 8-4. Electrical Caddy Fasteners

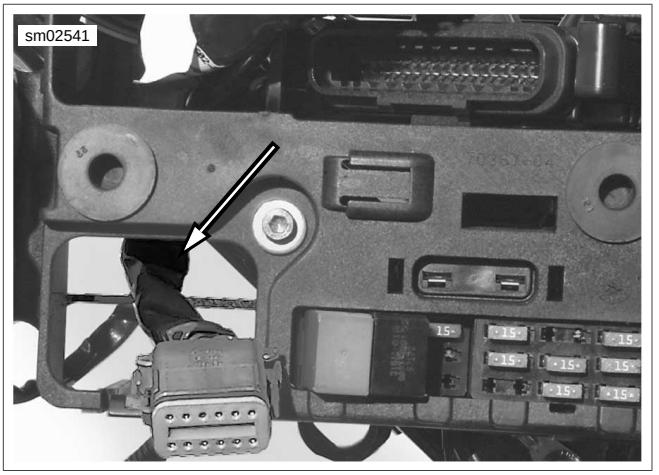


Figure 8-5. TSM/TSSM/HSFM Wiring

GENERAL

The electronic control module (ECM) is mounted in the electrical caddy. Refer to the Electrical Diagnostic Manual for information on the function and testing of the electronic control module.

NOTE

The electronic control module cannot be repaired. Replace the unit if it fails.

REPLACEMENT

1. Follow removal instructions under 8.2 ELECTRICAL CADDY to remove the electronic control module.

NOTE

After installing ECM, the password learning procedure must be performed. See the Electrical Diagnostic Manual for this model.

2. Follow installation instructions under 8.2 ELECTRICAL CADDY to install the electronic control module.



Figure 8-6. ECM Location

REMOVAL

⚠WARNING

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

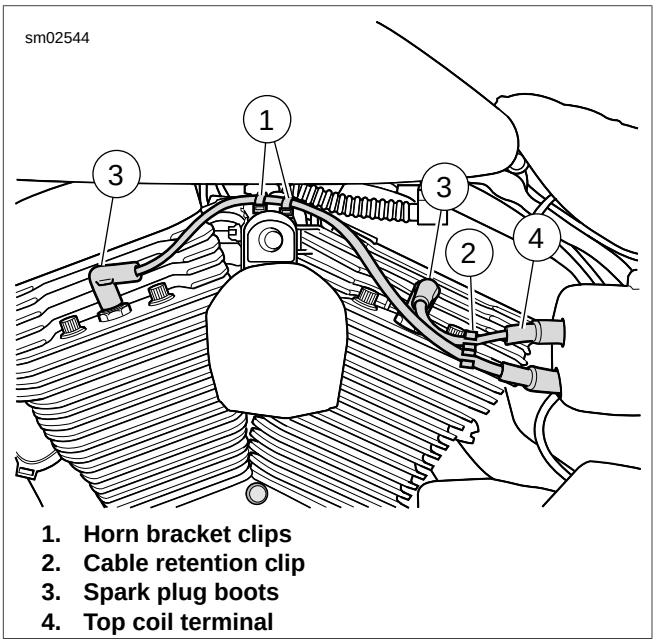
NOTE

When disconnecting spark plug cable, grasp and pull on the rubber boot at the end of the cable assembly. Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

1. Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.
2. See Figure 8-7. Remove clips (1) on horn bracket for front spark plug cable.

INSTALLATION

1. See Figure 8-7. Connect spark plug cables to ignition coil and spark plugs. Rear cylinder plug cable attaches to top coil terminal (4). Fasten boots/caps securely. Tight connections provide the necessary moisture-proof environment for the ignition coil and spark plug terminals.
2. Secure front spark plug cable to horn bracket with clips (1).
3. Install cable retention clip (2) over spark plug cables. Be sure clip is 1.5-2.0 in. (38.1-50.8 mm) from spark plug boots (3).



1. Horn bracket clips
2. Cable retention clip
3. Spark plug boots
4. Top coil terminal

Figure 8-7. Spark Plug Cable Routing

REMOVAL

NOTE

The voltage regulator cannot be repaired. Replace the unit if it fails.

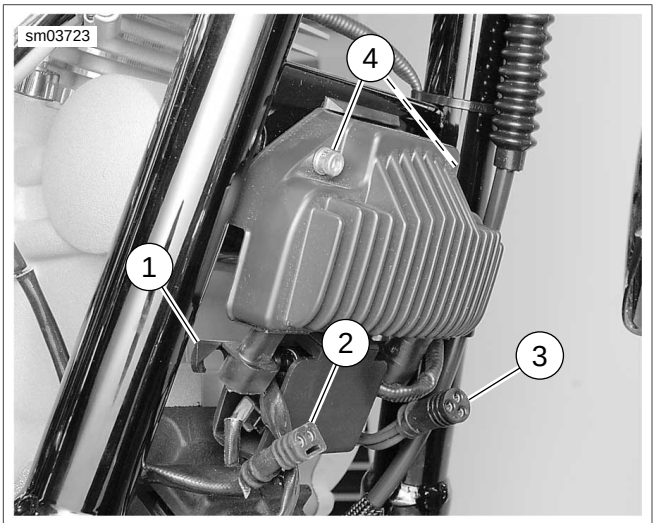
⚠WARNING

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

1. Disconnect negative battery cable.
2. See Figure 8-8. Release latches (1) from each connector.
3. Disconnect stator connector (3) and regulator output connector (2).
4. Remove voltage regulator fasteners (4).

NOTE

If removing wiring, carefully note wire routing.



1. **Connector latch**
2. **Regulator output connector**
3. **Stator connector**
4. **Regulator fastener (2)**

Figure 8-8. Voltage Regulator

INSTALLATION

1. See Figure 8-8. Install voltage regulator into position and install voltage regulator fasteners (4). Tighten fasteners to 60-80 **in-lbs** (6.8-9.0 Nm).
2. Connect voltage regulator output connector (2).
3. Connect stator connector (3).
4. Secure latches (1) on both connectors.
5. Connect negative battery cable.

GENERAL

The fuse block is under the electrical caddy cover. The block contains eight (nine on HDI models) 15 ampere replaceable fuses. All models utilize a 40 ampere main fuse as well as two spare 15 ampere fuses. The fuse block also contains the starter relay and system relay.

REMOVAL AND INSTALLATION

Relays

WARNING

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

1. Disconnect negative battery cable..
2. See Figure 8-9. Firmly grasp both sides of electrical caddy cover and pull outward to remove.
3. See Figure 8-10. Remove starter relay (1) or system relay (2) as needed: grasp body of relay and pull straight away from fuse block.
4. Plug in **new** relay.
5. Grasp caddy cover by both sides and push firmly into electrical caddy.
6. Connect negative battery cable.

Fuses

1. Make sure ignition switch is turned OFF.
2. See Figure 8-9. Firmly grasp both sides of electrical caddy cover and pull outward to remove.
3. Remove suspect fuse.
4. Plug in **new** fuse.
5. Grasp caddy cover by both sides and push firmly into electrical caddy.

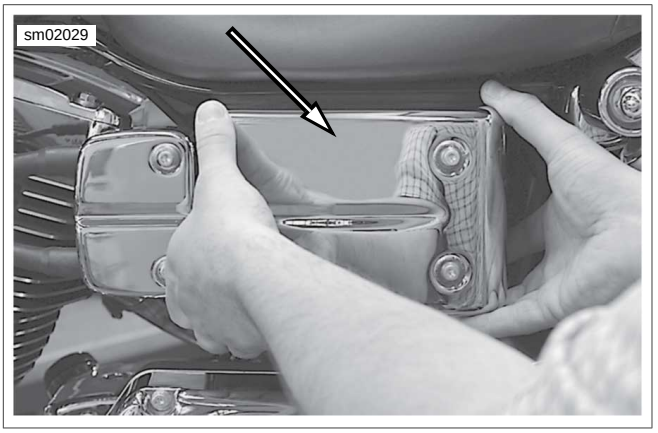
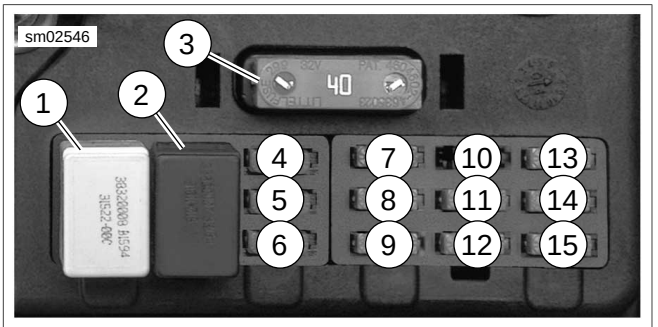


Figure 8-9. Electrical Caddy Cover



1. **Start relay**
2. **System relay**
3. **Main fuse (maxi-fuse) (40A)**
4. **ECM fuse (15A)**
5. **Fuel pump fuse (15A)**
6. **Engine control fuse (HDI models only) (15A)**
7. **Spare fuse (15A)**
8. **Spare fuse (15A)**
9. **Customer accessory fuse (15A)**
10. **P and A ignition fuse (15A)**
11. **Battery fuse (15A)**
12. **Accessories fuse (15A)**
13. **Instruments fuse (15A)**
14. **Ignition fuse (15A)**
15. **Lights fuse (15A)**

Figure 8-10. Fuses and Relays

GENERAL

WARNING

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

Dyna model ignition/light/key switches are non-repairable. If a switch is damaged, it must be replaced. Key switch functions and locations are listed in Table 8-4.

FXD, FXDL, FXDB

PART NUMBER	TOOL NAME
HD-47853	IGNITION SWITCH/FORK LOCK WRENCH

Removal

NOTE

FXD, FXDL and FXDB models have a combination ignition switch/ fork lock. To replace the fork lock on FXDWG, FXDF and FXDC models, follow this procedure. To replace the ignition switch on FXDWG, FXDF and FXDC models, see 8.7 IGNITION SWITCH/FORK LOCK, FXDWG, FXDC, FXDF Models (Ignition Switch Only).

1. Remove seat.

WARNING

To prevent spray of fuel, purge system of high-pressure fuel before supply line is disconnected. Gasoline is extremely flammable and highly explosive, which could result in death or serious injury. (00275a)

2. Purge the fuel supply line of high pressure gasoline.
   a. See Figure 8-11. Remove the fuel pump fuse located in the electrical caddy.
   b. Start the engine and allow the vehicle to run.
   c. When the engine stalls, operate the starter for 3 seconds to remove any remaining fuel from the fuel lines.

WARNING

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

3. Disconnect negative battery cable.
4. Remove instrument console.
   a. For FXDWG, FXDC, FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
   c. For FXD models, see 8.15 FUEL GAUGE.
5. Disconnect console wiring.
6. Gain access to the ignition switch fork/lock wiring by removing fuel tank hardware and fuel line. Carefully pivot tank upward and prop in position. See 4.5 FUEL TANK.
7. See Figure 8-12. Remove harness shield (1) by pushing both tabs of shield in at the same time.
8. While leaving harness connectors engaged, pull harness connectors from inside frame.
9. Remove decal (6).
10. See Figure 8-13. Place IGNITION SWITCH/FORK LOCK WRENCH (Part No. HD-47853) (1) on face nut (2). Turn ignition switch/fork lock wrench clockwise to loosen face nut. Turn face nut clockwise until it bottoms on ignition switch/fork lock.
11. See Figure 8-14. Rotate ignition switch/fork lock (2) clockwise to allow fork lock boss (3) to clear fork lock cavity (4). Remove ignition switch/fork lock from frame.
12. On FXD, FXDL, FXDB models, remove connector from ignition switch/fork lock.

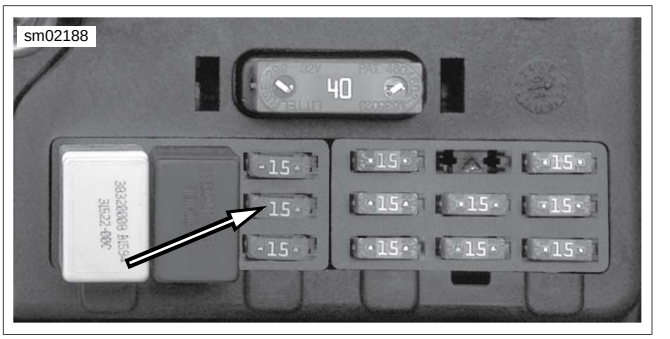
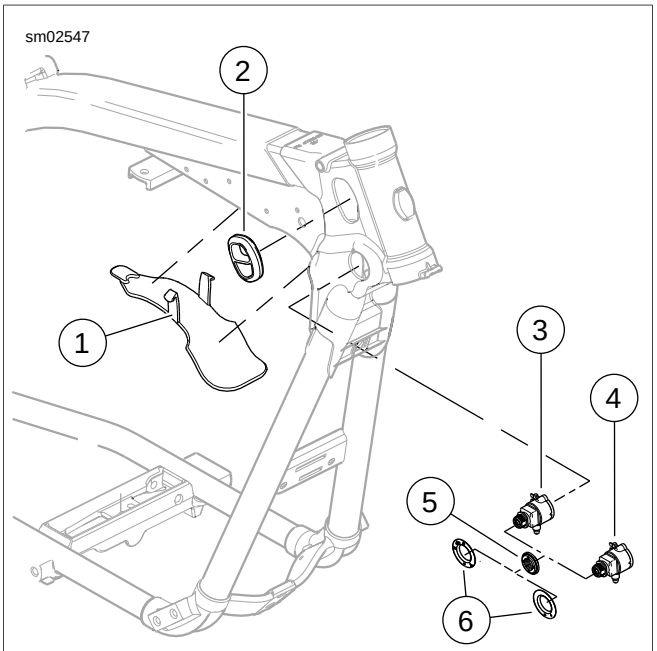
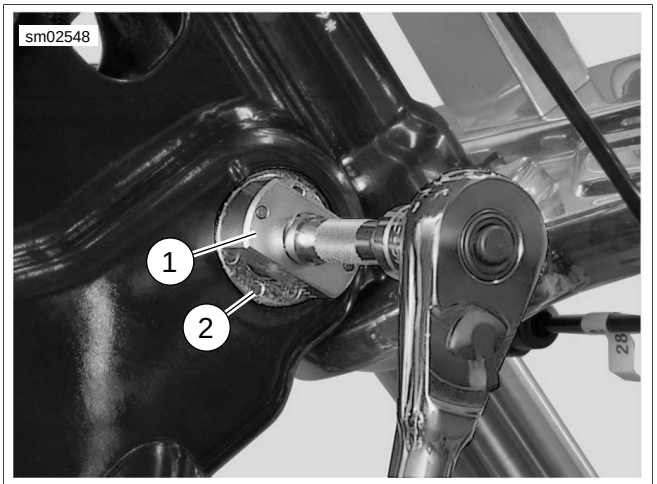


Figure 8-11. Fuel Pump Fuse



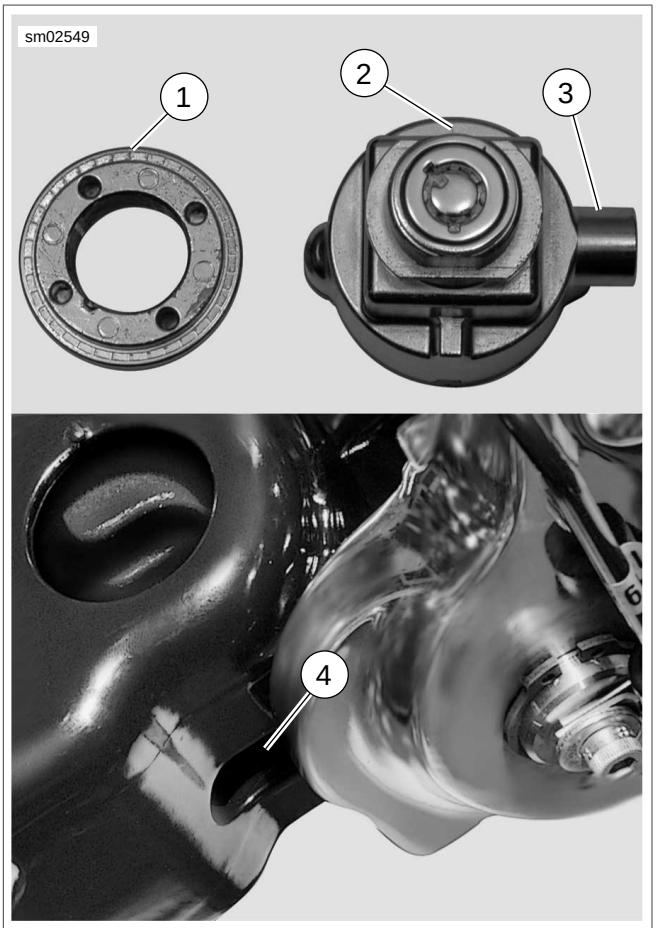
1. **Harness shield**
2. **Grommet (2)**
3. **Fork lock (FXD, FXDL, FXDB models)**
4. **Ignition switch/fork lock (FXDWG, FXDC models)**
5. **Face nut**
6. **Decal**

Figure 8-12. Harness Shield



1. **Ignition switch/fork lock wrench (HD-47853)**
2. **Face nut**

Figure 8-13. Fork Lock/Ignition Switch Wrench



1. **Face nut**
2. **Ignition switch/fork lock**
3. **Fork lock boss**
4. **Fork lock boss cavity**

Figure 8-14. Fork Lock/Ignition Switch

Installation

1. See Figure 8-14. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of face nut (1).
2. Install face nut on ignition switch/fork lock (2). Turn face nut clockwise until it bottoms on ignition switch/fork lock.
3. On FXD, FXDL, FXDB models, install connector on ignition switch/fork lock.
4. With fork lock boss (3) facing front of vehicle, install ignition switch/fork lock into frame.
5. See Figure 8-15. Align flats on ignition switch/fork lock with slots (2) in fork lock cavity (1).

NOTE

In next step, setting fork lock in the "locked" position may ease installation.

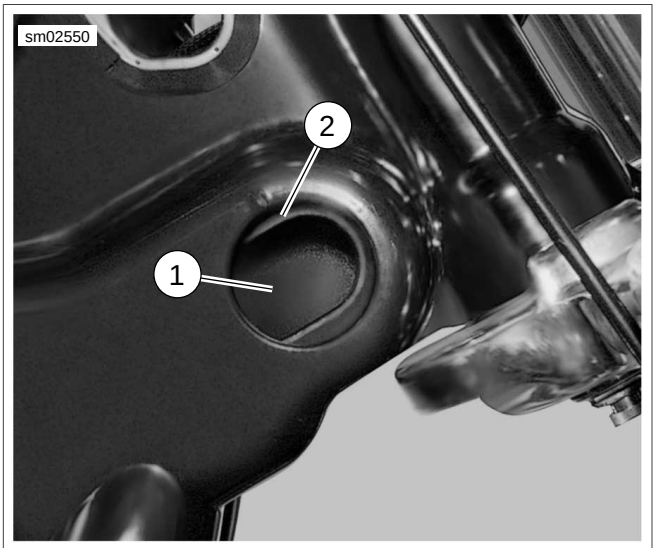
6. See Figure 8-14. Rotate ignition switch/fork lock until fork lock boss (3) engages fork lock boss cavity (4).
7. To ensure proper fork lock positioning, hold ignition switch/fork lock as far forward as possible in frame while tightening.

8. See Figure 8-13. Using IGNITION SWITCH/FORK LOCK WRENCH (Part No. HD-47853), turn face nut counter-clockwise until tight.
9. See Figure 8-12. Install decal (6).
10. Remove and save key code tag (on key ring with two keys). Key code is not marked on keys.
11. Push wiring harness into frame. Install harness shield by installing tab of shield into frame first then engaging tabs in holes in frame.
12. Place fuel tank into position and tighten hardware. Connect fuel line. See 4.5 FUEL TANK.
13. Install console wiring.
14. Install instrument console.
    a. For FXDWG, FXDC, FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
    b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
    c. For FXD models, see 8.15 FUEL GAUGE.
15. Connect negative battery cable.

⚠WARNING

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

16. Install seat.
17. Refer to Table 8-4. Test vehicle and fork lock operation.



1. **Fork lock cavity**
2. **Slot**

Figure 8-15. Fork Lock/Ignition Switch Cavity

Table 8-4. Key Switch Functions and Positions: 2008 Dyna Models

MODEL	LOCATION AND OPERATION	SWITCH POSITION	FUNCTION
FXD, FXDL, FXDB	On the right front of the motorcycle on the steering head. To unlock the switch and the front fork, push the key in and turn it counterclockwise. HDI: Press the lever/key (international) in and turn it clockwise to the OFF position. Be sure to push key in to move key to either position. **Fork Lock:** To lock the fork, move the fork to the full left position. Push down on key and turn it to the right, clockwise, to the closed lock icon. Remove the key.	OFF	Ignition, lamps and accessories are off.
		ACC*	Accessories and hazard warning flasher can be turned on. Instrument lamps are on. Brake lamp and horn can be activated. Key may be removed except on international models.
		IGNITION*	Ignition, lamps and accessories are on.
FXDWG, FXDC, FXDF	Switch is on fuel tank instrument panel. FXDWG/FXDF switch is locked or unlocked by lifting switch cover, inserting key and turning key counterclockwise to lock or clockwise to unlock. Key may be removed in any position. **Fork Lock:** The fork lock is on the right front of the motorcycle on the steering head. Insert key and press to turn the lock to the closed lock icon. Remove the key. To unlock the fork lock, insert key and press to turn the lock to the open lock icon. Remove the key.	OFF	Ignition, lamps and accessories are off.
		ACC*	Accessories are on. Hazard warning flashers can be operated. Instrument lamps are on. Brake lamp and horn can be activated.
		IGNITION*	Ignition, lamps and accessories are on.
*International models have an additional function - position lamp and tail lamp are also on.			

FXDWG, FXDC, FXDF MODELS (IGNITION SWITCH ONLY)

1. Remove seat.

⚠WARNING

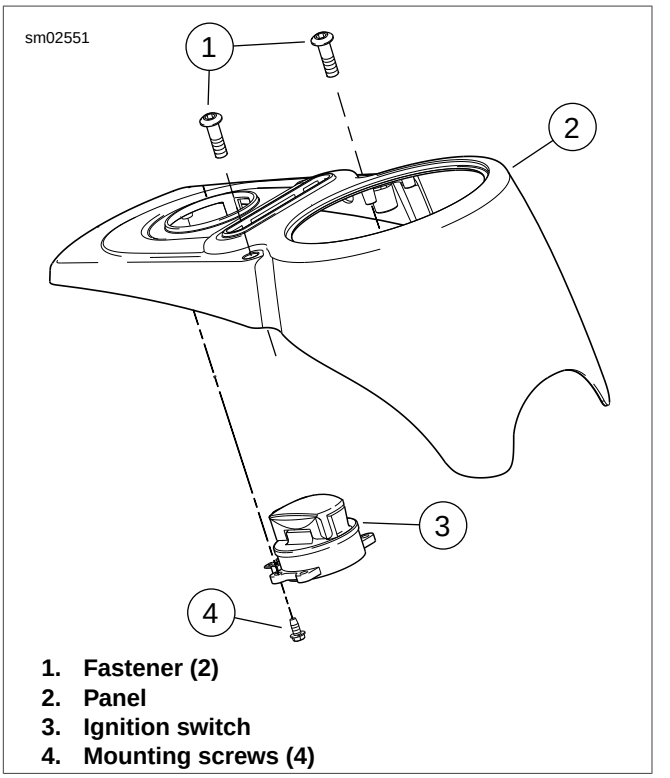
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

2. Disconnect negative battery cable.
3. See Figure 8-16. Remove fasteners (1) from instrument panel (2) and remove panel. Note position and color of the switch wire connectors. Disconnect wires.
4. Remove mounting screws (4). Replace switch (3).
5. Reconnect switch wire connectors in their original positions.
6. Install instrument panel with fasteners. Tighten acorn nut to 18-24 **in-lbs** (2.0-2.7 Nm).
7. Connect negative battery cable.

⚠WARNING

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

8. Install seat.
9. Refer to Table 8-4. Test vehicle operation.



1. **Fastener (2)**
2. **Panel**
3. **Ignition switch**
4. **Mounting screws (4)**

Figure 8-16. Ignition Switch: FXDWG, FXDC, FXDF

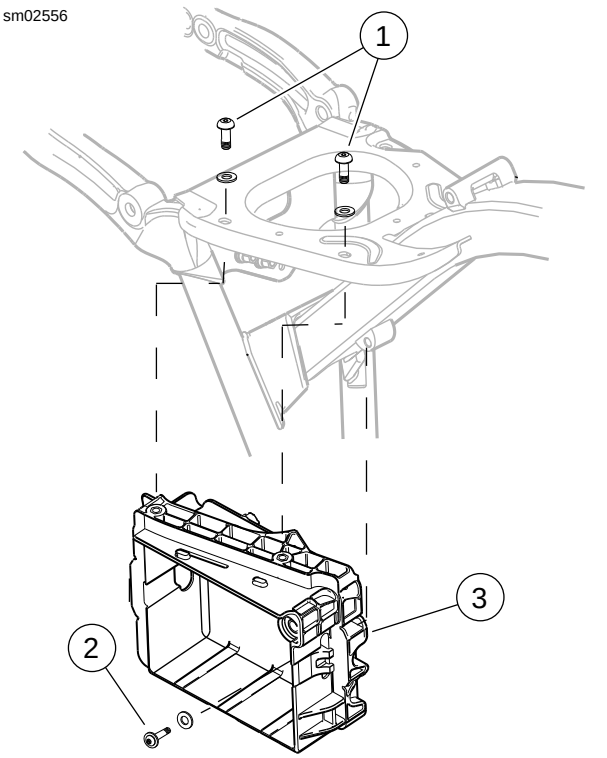
BATTERY TRAY

Removal

1. Remove battery.
2. See Figure 8-17. Remove two top screws and washers (1).
3. Remove screw and washer (2).
4. Guide battery cables out through holes in rear of battery tray (3) and remove tray.

Installation

1. Guide battery cables through holes in rear of battery tray (3) and place tray in position.
2. See Figure 8-18. Place battery cables in recesses at upper corners of battery tray.
3. See Figure 8-17. Install screws and washers (1, 2). Tighten screws to 96-120 **in-lbs** (10.8-13.6 Nm).



1. **Screws and washers (2)**
2. **Screw and washer**
3. **Battery tray**

Figure 8-17. Battery Tray

BATTERY CABLES

Routing

1. Install battery.

CAUTION

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

2. Route positive cable from battery positive terminal through upper front hole in battery tray. Continue to route positive battery cable to starter post on right side of chassis.

WARNING

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

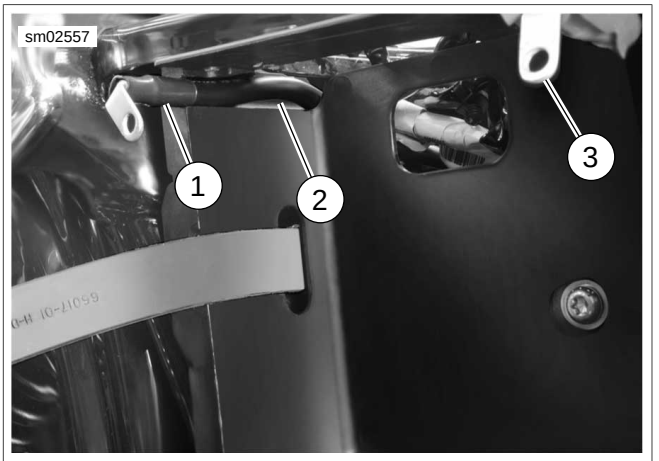
CAUTION

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

WARNING

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

3. Install positive cable to starter post with nut. Orient terminal so cable faces away (towards left side of motorcycle).
   a. Tighten nut to 65-85 **in-lbs** (7.3-9.6 Nm).
   b. Cover nut with protective rubber boot.
4. See Figure 8-18. Route negative battery cable toward left side of motorcycle and then down to transmission ground stud.
5. Install negative battery cable on transmission ground stud. Tighten to 13-20 ft-lbs (17.6-27.1 Nm).



1. Negative battery cable
2. Groove
3. Positive battery cable

Figure 8-18. Battery Cables

GENERAL

CAUTION

When replacement is required, use only the specified sealed beam unit or bulb, available from a Harley-Davidson dealer. An improper wattage sealed beam or bulb, can cause charging system problems. (00209a)

If either headlamp bulb filament burns out, the bulb must be discarded and a **new** bulb installed. Use only direct replacement bulbs as specified in the Parts Catalogs and 1.5 BULB REQUIREMENTS.

BULB REMOVAL

CAUTION

Never touch the quartz bulb. Fingerprints will etch the glass and decrease bulb life. Grab the bulb with paper or a clean, dry cloth. Failure to do so could result in bulb damage. (00210a)

Single Bulb Headlamp

1. See Figure 8-20. Loosen trim ring clamp screw (11) and nut (10). Remove trim ring (9).
2. Disconnect headlamp connector (2) from bulb (6) prongs.
3. Remove rubber boot (4) from back of headlamp lens (8).
4. See Figure 8-19. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.

WARNING

Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

5. Pivot wire retaining clip away from bulb. Remove bulb from headlamp assembly.

NOTE

*When installing **new** bulb, be sure connector contacts are clean to ensure good electrical contact.*

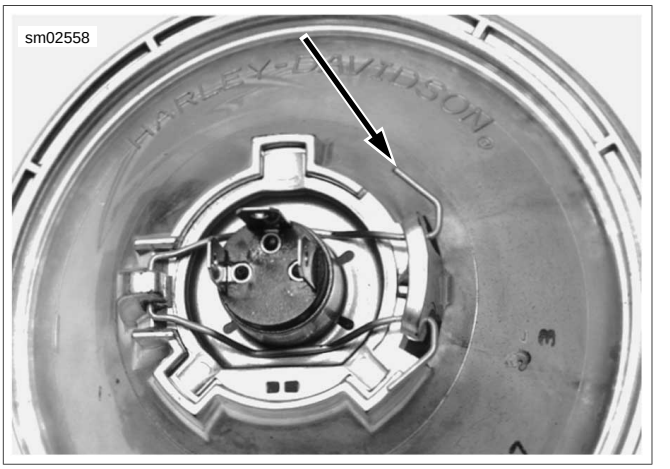
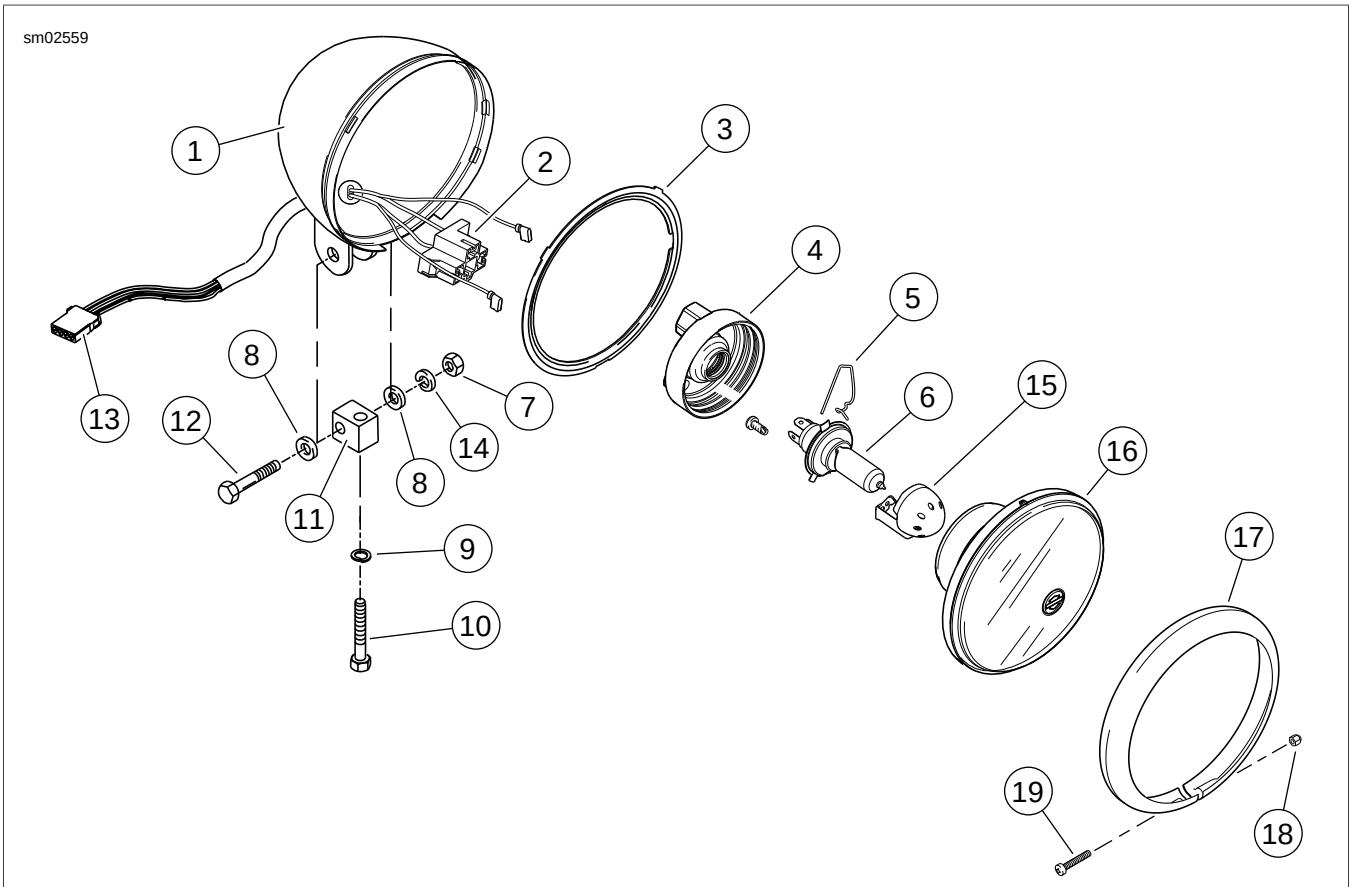


Figure 8-19. Wire Retaining Clip



1. **Headlamp housing**
2. **Headlamp connector**
3. **Adapter ring**
4. **Boot**
5. **Clip**
6. **Bulb**
7. **Vertical adjusting nut**
8. **Washer (2)**
9. **Lockwasher**
10. **Horizontal adjusting bolt**
11. **Mounting block**
12. **Vertical adjusting bolt**
13. **Headlamp housing connector**
14. **Lockwasher**
15. **Bulb shield**
16. **Headlamp lens**
17. **Trim ring**
18. **Nut**
19. **Screw**

Figure 8-20. Single Bulb Headlamp

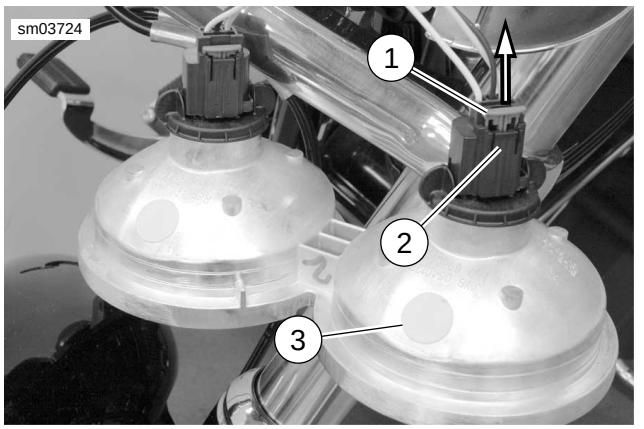
Dual Bulb Headlamp

1. See Figure 8-22. Remove two screws (1) and remove trim ring (5).
2. Pull reflector assembly (4) away from the headlight housing (2).
3. See Figure 8-21. Raise latch lock (1). Depress latch (2) and disconnect connector.

⚠WARNING

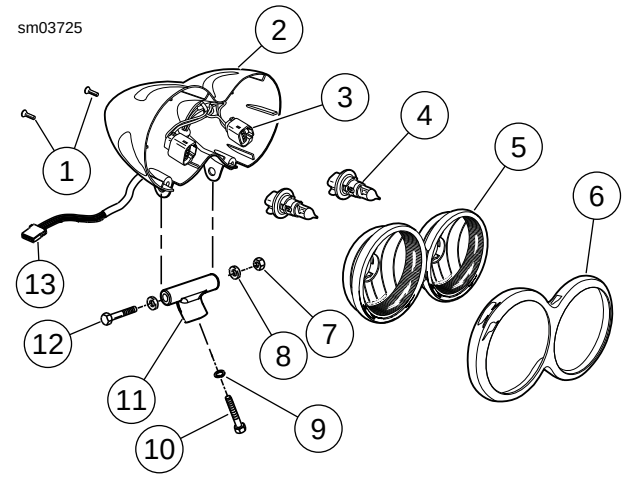
Handle bulb carefully and wear eye protection. Bulb contains gas under pressure, which, if not handled carefully, could cause serious eye injury. (00062b)

4. Rotate bulb assembly counterclockwise to remove from housing.



1. **Connector lock**
2. **Connector latch**
3. **Vent (yellow dot)**

Figure 8-21. Dual Headlamp Connector



1. **Screw (2)**
2. **Headlamp housing**
3. **Headlamp connector (2)**
4. **Bulb (2)**
5. **Reflector and lenz assembly**
6. **Trim ring**
7. **Vertical adjusting nut**
8. **Washer (2)**
9. **Lockwasher**
10. **Horizontal adjusting bolt**
11. **Mounting block**
12. **Vertical adjusting bolt**
13. **Headlamp housing connector**

Figure 8-22. Dual Bulb Headlamp

BULB INSTALLATION

Install **new** bulb and assemble headlamp components. To adjust light beam, see 1.23 HEADLAMP ALIGNMENT.

NOTES

- *Single Bulb Headlamp: When reassembling headlamp, make sure slots and tabs in headlamp, adapter ring and trim ring are aligned.*
- *Dual Bulb Headlamp: See Figure 8-21. Ensure vents (3) (yellow dots) are UP when installing reflector assembly in housing.*

HEADLAMP ASSEMBLY REMOVAL

1. Loosen fuel tank to gain access to the headlamp harness connector (13). See 4.5 FUEL TANK.
2. See Figure 8-20 or Figure 8-22. Separate connector (13) [38].
3. Remove bolt (12) nut (7) and washers (8, 14).
4. Remove headlamp assembly.
5. Disassemble and repair headlamp as necessary.

HEADLAMP ASSEMBLY INSTALLATION

1. See Figure 8-20 or Figure 8-22. Attach headlamp assembly to mount (11) using bolt (12) nut (7) and washers (8, 14).
2. Tighten bolt (10) to 25-30 ft-lbs (33.9-40.7 Nm).
3. Connect electrical harness connector and attach fuel tank. See 4.5 FUEL TANK.
4. Adjust headlamp alignment. See 1.23 HEADLAMP ALIGNMENT.

GENERAL

Dyna Glide models are equipped with a tail lamp that uses a mini harness and circuit board to simplify replacement.

The FXDWG and FXDF use a similar type assembly, but the lens and base are oriented 180 degrees different from the other models and there is no chrome taillamp bezel. The FXDWG and FXDF also use a different mini-harness than the other models.

TAIL LAMP BULB REPLACEMENT: STANDARD STYLE

1. See Figure 8-23. Make certain ignition switch is turned off.
2. Remove two screws and lens from base.

NOTE

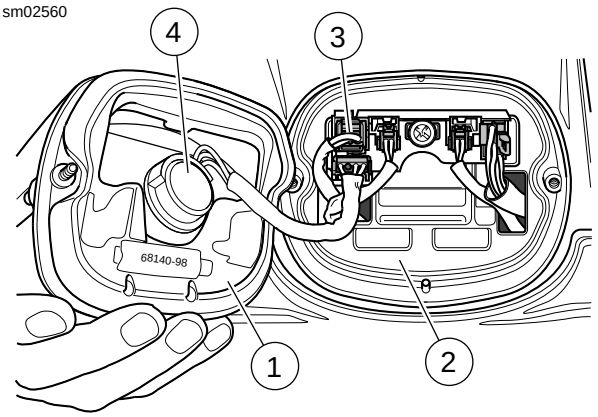
For ease of bulb removal, the 4-Pin multilock connector can be removed from circuit board.

3. Remove (pull) bulb assembly from lens. Remove bulb from socket.
4. Coat base of **new** bulb with ELECTRICAL CONTACT GREASE (Part No. 99861-90). Install **new** bulb in socket.
5. Install (push) bulb assembly to lens.
6. If removed connect 4-Pin multilock connector to circuit board.
7. Install lens to base with two screws. Tighten screws to 20-24 **in-lbs** (2.3-2.7 Nm).

⚠WARNING

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

8. Turn ignition on and test for proper tail lamp operation.



1. **Lens**
2. **Base**
3. **4-Pin multilock connector**
4. **Bulb assembly**

Figure 8-23. Tail Lamp: FXD, FXDC, FXDL

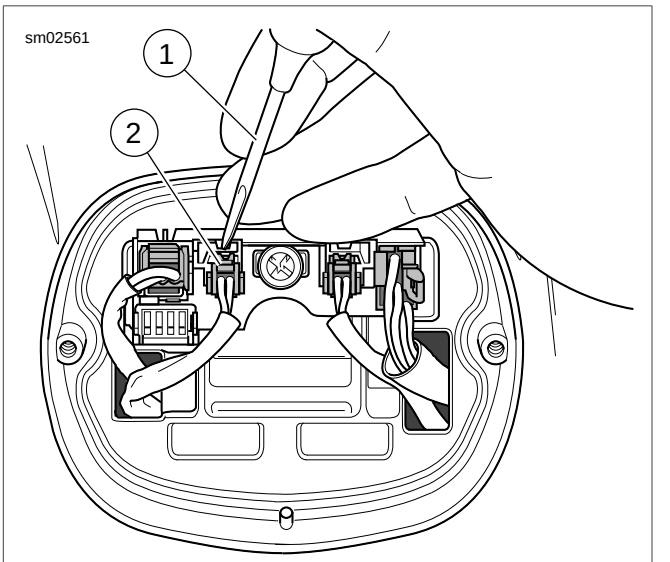
BASE REPLACEMENT

1. See Figure 8-23. Remove two screws and lens from base.
2. Depress locking tab and remove 4-Pin multilock connector from pin housing.
3. See Figure 8-24. Using a terminal pick or small screwdriver, depress locking tabs and remove two 2-Pin turn signal connectors and 6-Pin Power In connector from pin housing.
4. See Figure 8-25. Remove screw, pin housing and circuit board from base.

NOTE

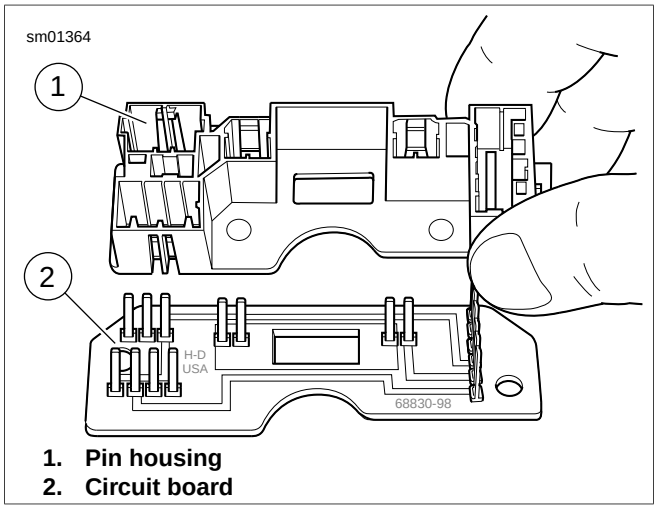
The circuit board is a press fit in the tail lamp housing of FXDWG and FXDF models and requires no screw to hold it in place.

5. Remove two nuts, screws and base from rear fender.
6. Install **new** base to rear fender with two screws and nuts. Tighten screws to 40-48 **in-lbs** (4.5-5.4 Nm).
7. Install circuit board/pin housing to base with screw. Circuit board snaps in on bottom.



1. **Terminal pick**
2. **2-Pin connector**

Figure 8-24. Removing 2-Pin Connectors



1. **Pin housing**
2. **Circuit board**

Figure 8-25. Pin Housing and Circuit Board

8. See Figure 8-26. Install connectors to pin housing.
9. Install lens to base with two screws. Tighten screws to 20-24 **in-lbs** (2.3-2.7 Nm).

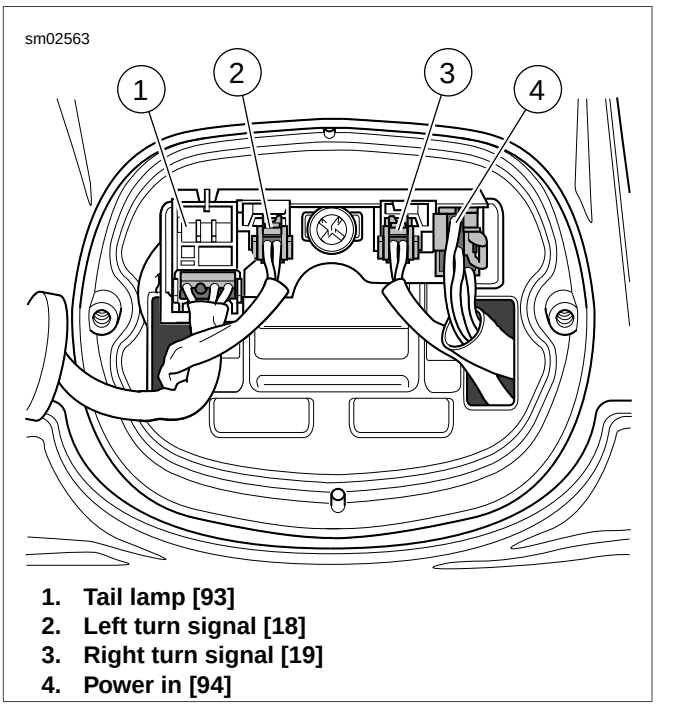
WARNING

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

10. Turn ignition on and test for proper tail lamp and turn signal operation.

NOTE

Refer to Table 8-5. Cavity numbers are on back side of secondary locks. All FXDWG/FXDF components are oriented 180 degrees from above and the turn signal connectors are reversed.



1. **Tail lamp [93]**
2. **Left turn signal [18]**
3. **Right turn signal [19]**
4. **Power in [94]**

Figure 8-26. Wire Location at Connectors

Table 8-5. Tail Lamp Wires

FUNCTION	NO.	TYPE	WIRE COLOR	CAVITY
Right turn signal	[19]	2-pin Multilock	V/BN	1
			BK	2
Left turn signal	[18]	2-pin Multilock	V/BN	1
			BK	2
Tail lamp	[93]	4-pin Multilock	BE	1
			HDI only-O/W or open on domestic models	2
			R/Y	3
			BK	4
Power in	[94]	6-pin Multilock	O/W	1
			BN (V on FXDWG)	2
			BE	3
			R/Y	4
			V (BN on FXDWG)	5
			BK	6

BULB REPLACEMENT: BULLET STYLE

1. Locate latch slot on circumference of turn signal lamp lens. Press in with small screw driver or coin to remove lens.
2. Push bulb in and rotate 1/4 turn counterclockwise to remove.
3. Inspect contacts in socket. If necessary, clean contacts with a small wire brush and electrical contact cleaner.
4. Evenly apply dielectric grease to the contacts and bottom of the **new** bulb.
5. Push and rotate **new** bulb into socket.
6. Snap-in and rotate lens to position latch slot on bottom.

NOTE

If after replacing a bulb, the turn signal or running lamp will not light, check the wiring, the ground at the socket and/or the switch.

FRONT LAMP HOUSING REPLACEMENT

NOTE

On FXDWG, FXDF and FXDB models, the turn signal wiring is routed through the lower switch housings. On FXDWG and FXDF models, the turn signal wires are routed through the handlebars. See 2.26 HANDLEBARS: FXDWG/FXDF or 8.28 HANDLEBAR SWITCH ASSEMBLIES for more information.

WARNING

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

1. Disconnect the negative battery cable.

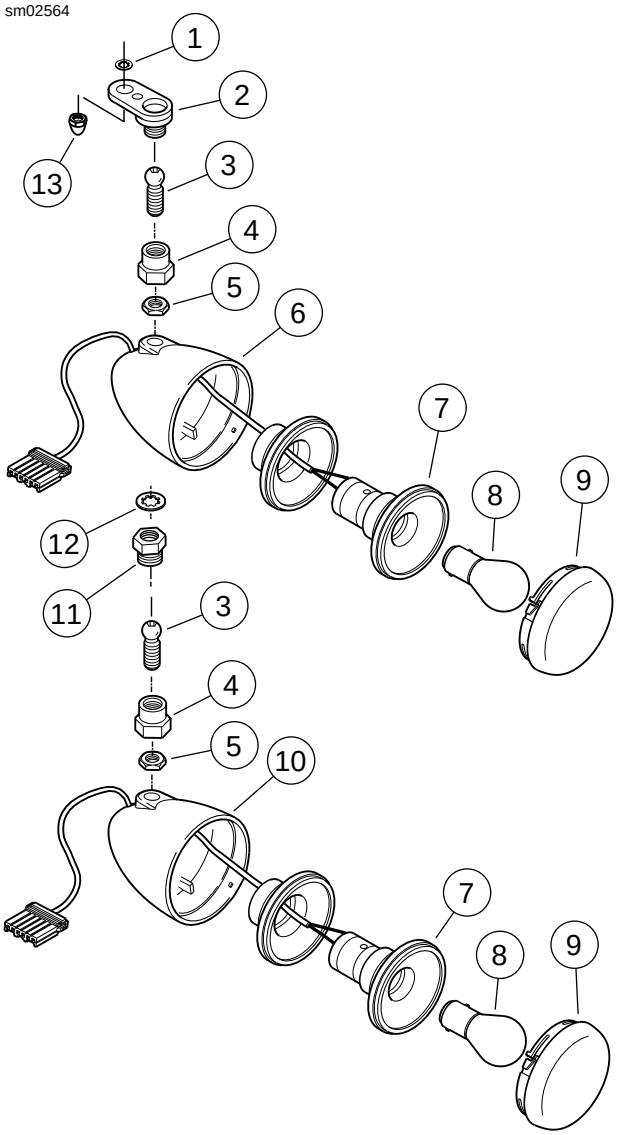
NOTE

Before removing turn signal wires, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

2. Remove fuel tank fasteners, vent, fuel supply fitting and slide fuel tank back. See 4.5 FUEL TANK.
3. Unplug fuel gauge connector [117].
4. Disconnect turn signal connector and cut cable straps around turn signal wire conduit.
5. Remove turn signal lamp wires from multilock connector. See A.2 AMP MULTILOCK CONNECTORS for connector information.

NOTE

To aid in installing new turn signal wires, attach thin wire to terminals on old turn signal wires before pulling old wires out of conduit or handlebars. This thin wire can then be used to guide new wires back through conduit or handlebars.



1. **Lockwasher**
2. **Ball receptacle**
3. **Ball stud**
4. **Ball stud clamp**
5. **Jam nut**
6. **Left lamp housing**
7. **Socket assembly**
8. **Bulb**
9. **Lens**
10. **Right lamp housing**
11. **Retainer**
12. **Lockwasher**
13. **Acorn nut**

Figure 8-27. Front Turn Signals

6. See Figure 8-27. Remove lamp housing:
   a. For left side housing, loosen ball stud clamp (4) until turn signal assembly is free from ball receptacle (2). Loosen jam nut (5) and remove ball stud (3) and ball stud clamp from lamp housing.
   b. For right side housing, loosen ball stud clamp (4) until turn signal assembly is free from retainer (11). Loosen jam nut (5) and remove ball stud (3) and ball stud clamp from lamp housing.
7. Pull turn signal wires from conduit or handlebars and remove turn signal lamp housing.
8. Lay old turn signal lamp housing next to new one and cut **new** wires to length. Crimp **new** terminals onto wires. See A.2 AMP MULTILOCK CONNECTORS for more information.
9. Install ball stud, ball stud clamp and jam nut in **new** lamp housing.
10. Install lamp housing:
    a. For left side housing, loosely install ball stud clamp to ball receptacle. Tighten jam nut.
    b. For right side housing, loosely install ball stud clamp to ball retainer. Tighten jam nut.
11. Using attached wire, pull turn signal wiring through conduit or handlebars. Route wiring to connector location under fuel tank.
12. Install turn signal lamp wires in proper locations in multilock connector.
13. Connect turn signal connector [31]. install connector in inside frame backbone.
14. Connect fuel gauge connector.
15. Install fuel tank.
16. Connect negative battery cable.
17. Adjust turn signals:
    a. For left side lamp, adjust position of directional lamp as necessary. While holding lamp in position, tighten ball stud clamp.
    b. For right side lamp, adjust position of directional lamp as necessary. Hold retainer with a wrench then use another wrench to tighten ball stud clamp on right directional lamp.
18. Lay a protective blanket over fuel tank. Slowly turn handlebars fully left and right. If either front directional lamp contacts fuel tank, loosen fasteners and reposition directional lamp outward away from fuel tank, making sure lens is still aimed forward.

⚠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)

19. Turn ignition ON and test for proper turn signal operation.

REAR LAMP HOUSING REPLACEMENT

⚠WARNING

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

1. Disconnect the negative battery cable.

NOTE

Before removing turn signal wires, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

2. Remove seat.
3. Disconnect turn signal wiring. See 8.10 TAIL LAMP.
4. Cut cable straps around turn signal wire conduit.
5. Remove turn signal lamp wires from multilock connector. See A.2 AMP MULTILOCK CONNECTORS for connector information.

NOTE

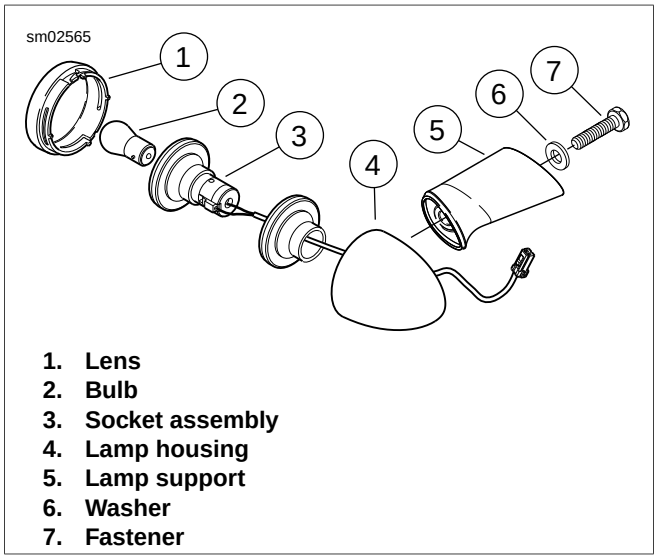
To aid in installing new turn signal wires, attach thin wire to terminals on old turn signal wires before pulling old wires out of conduit. This thin wire can then be used to guide new wires back through conduit.

6. See Figure 8-28. Remove the lamp support (5) by removing the fastener (7) and washer (6) inside the rear fender, then the lamp housing (4) can be removed from the lamp support (5).
7. Pull lamp housing wiring from conduit.
8. Lay old turn signal lamp housing next to new one and cut **new** wires to length. Crimp **new** terminals onto wires. See Appendix B for more information.
9. See Figure 8-29. Install **new** lamp housing and thread **new** wires back through conduit. Route conduit as shown. Insert terminals into connector and mate connector.
10. Rotate lamp assembly so lens points directly rearward.
11. While holding lamp assembly, tighten fastener to 12-16 ft-lbs (16.3-21.7 Nm).
12. Connect negative battery cable.

⚠WARNING

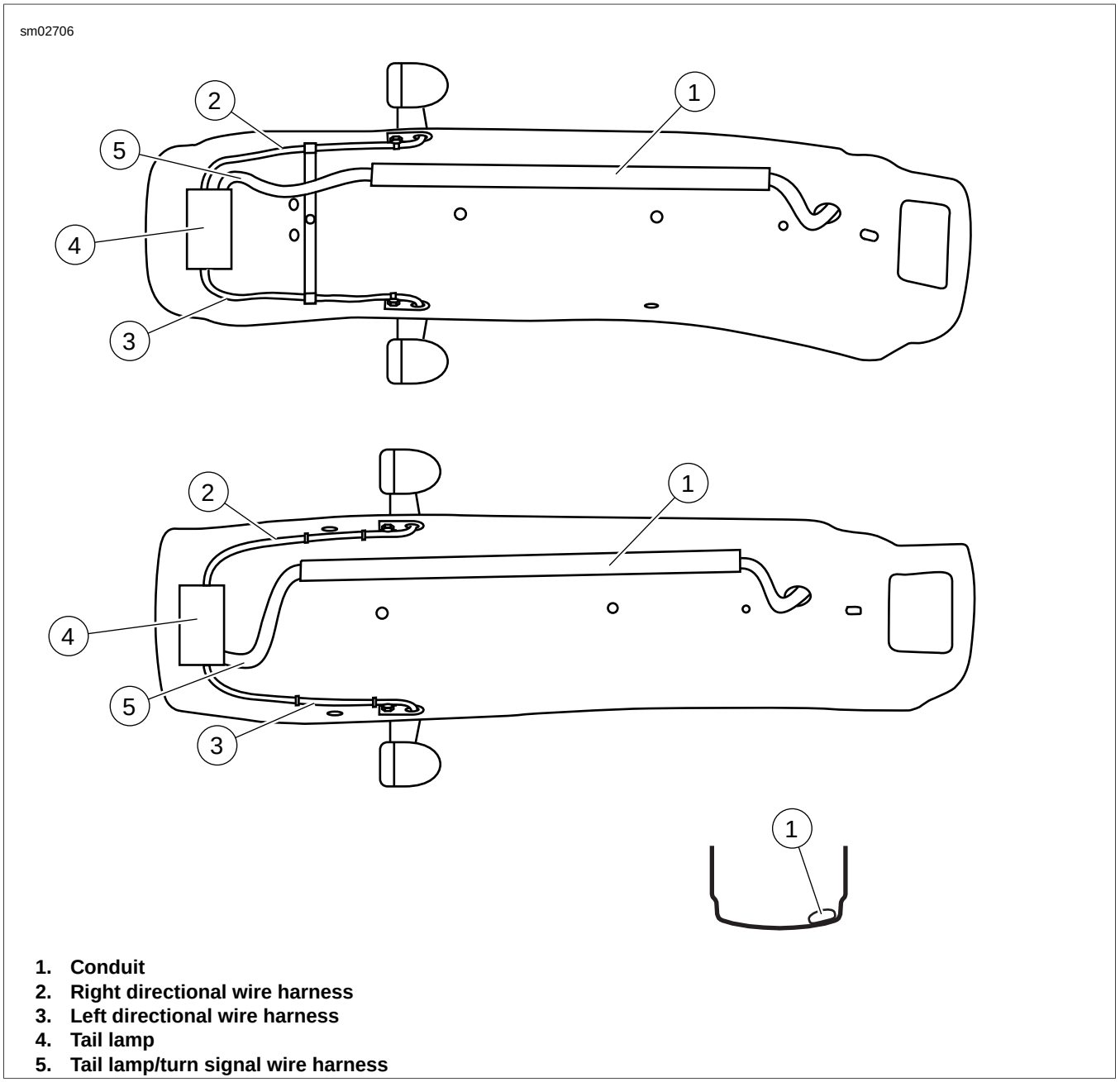
After installing seat, pull upward on seat to be sure it is locked in position. While riding, a loose seat can shift causing loss of control, which could result in death or serious injury. (00070b)

13. Install seat.
14. Turn ignition ON and test for proper turn signal operation.



1. **Lens**
2. **Bulb**
3. **Socket assembly**
4. **Lamp housing**
5. **Lamp support**
6. **Washer**
7. **Fastener**

Figure 8-28. Rear Turn Signals



1. **Conduit**
2. **Right directional wire harness**
3. **Left directional wire harness**
4. **Tail lamp**
5. **Tail lamp/turn signal wire harness**

Figure 8-29. Rear Fender Harness Routing-viewed from underneath (Top: FXD, FXDC, FXDL, FXDB; Bottom: FXDWG, FXDF)

TURN SIGNAL AND SECURITY MODULE (TSM/TSSM/HFSM) 8.12

REMOVAL

1. Verify security lamp is not blinking (vehicle is disarmed).

⚠WARNING

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

2. Disconnect negative battery cable.
3. See Figure 8-30. Remove electrical caddy cover.
4. See Figure 8-31. Depress tab (2). Pull TSM/TSSM/HFSM from electrical caddy.
5. See Figure 8-32. Unplug turn signal module connector.
6. See Figure 8-33. On models with HFSM, disconnect HFSM antenna connector.
7. Remove TSM/TSSM/HFSM from electrical caddy.

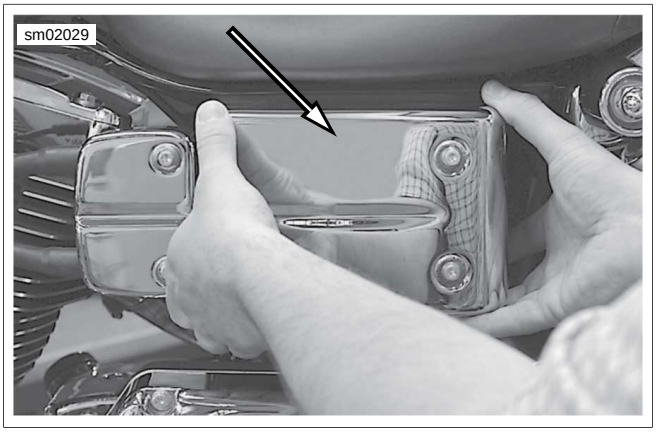
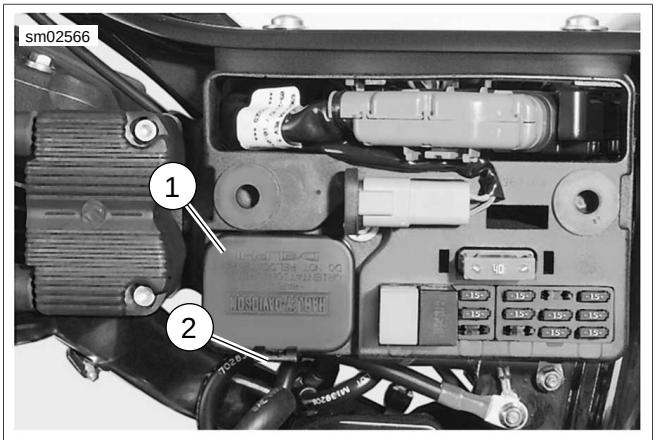


Figure 8-30. Electrical Caddy Cover



1. **TSM/TSSM/HSFM module**
2. **Tab**

Figure 8-31. TSM/TSSM (typical)

INSTALLATION

1. See Figure 8-32. Partially install TSM/TSSM/HFSM into electrical caddy.
2. Plug in TSM/TSSM/HFSM module connector.
3. See Figure 8-33. On models with an HFSM, connect HFSM antenna connector.
4. See Figure 8-32. Slide TSM/TSSM/HFSM into electrical caddy until tab engages TSM/TSSM/HFSM.
5. Connect negative battery cable.

⚠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. After installing TSM/TSSM/HFSM, the password learning procedure must be performed. See the Electrical Diagnostic Manual for this model.

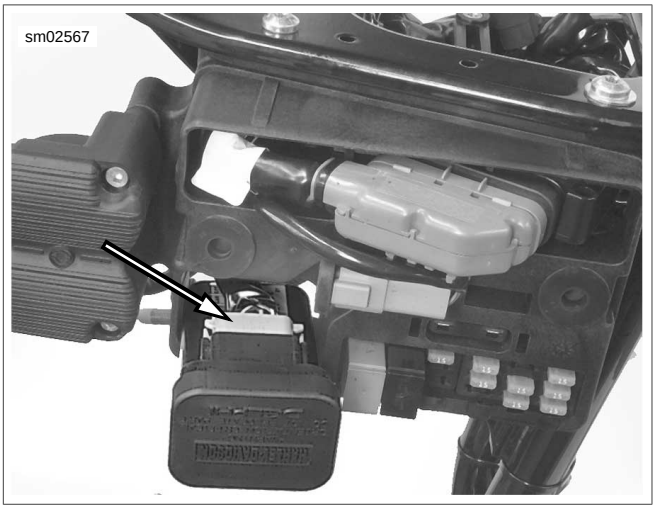


Figure 8-32. TSM/TSSM/HFSM Connector [30] (typical)

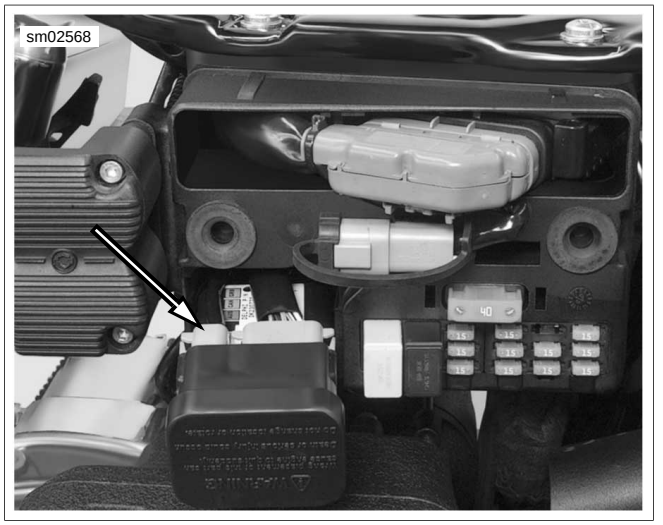


Figure 8-33. HFSM Antenna Connector [208]

GENERAL

The crank position sensor is a variable reluctance (VR) sensor that generates an AC signal by sensing the passing of the 30 teeth machined in the left side flywheel. Two consecutive teeth are missing in the flywheel to establish a reference point. The crank position sensor sends a signal to the ignition control module which is used to reference engine position (TDC) and engine speed.

NOTE

CKP sensor connector is not serviceable. If connector or sensor fails, the entire assembly must be replaced.

REMOVAL

WARNING

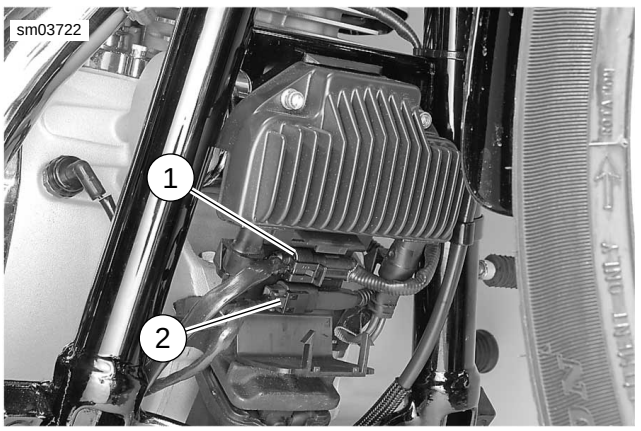
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.

NOTE

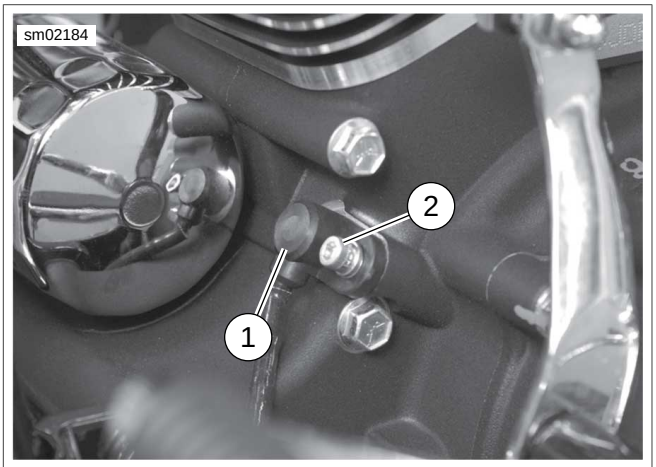
Before removing wiring, carefully note wire routing.

2. Depress upper front electrical caddy cover tabs to open cover.
3. See Figure 8-34. Remove CKP sensor connector (2) from front electrical caddy.
4. Disconnect CKP sensor connector.
5. See Figure 8-35. Remove screw and captive washer (2) to detach CKP sensor (1) and O-ring from crankcase. Carefully remove crank position sensor.



1. **O2 sensor connector**
2. **CKP sensor connector**

Figure 8-34. Front Electrical Caddy and Connectors

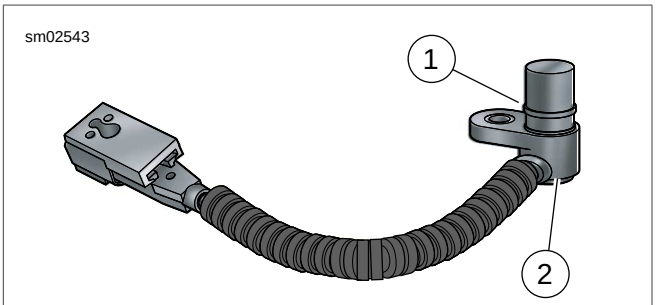


1. **CKP sensor**
2. **Screw and captive washer**

Figure 8-35. Crank Position Sensor

INSTALLATION

1. See Figure 8-36. Lubricate CKP sensor O-ring (1) with clean engine oil.
2. Install **new** CKP sensor with screw and captive washer. Tighten screw to 90-120 **in-lbs** (10.2-13.6 Nm).
3. Connect CKP sensor connector.
   a. Mate connector halves.
   b. Install connector on front electrical caddy.
4. Close and latch front electrical caddy cover.
5. Connect negative battery cable.



1. **O-ring**
2. **CKP sensor**

Figure 8-36. CKP Sensor

REMOVAL/DISASSEMBLY

⚠WARNING

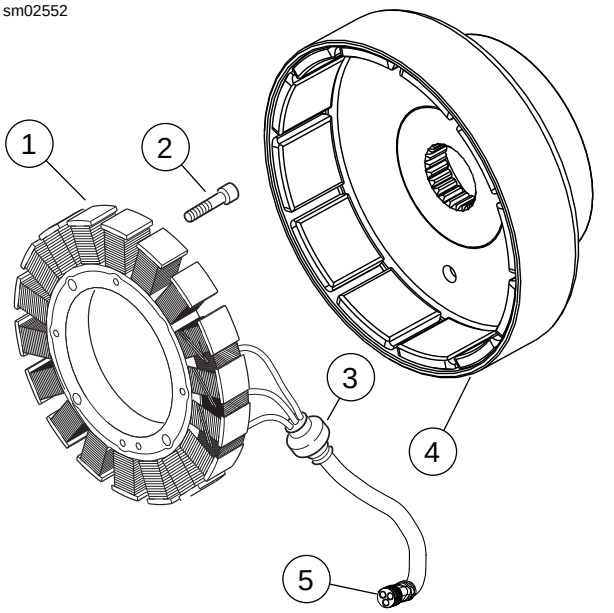
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Remove primary cover, primary drive and clutch. See 6.3 DRIVE COMPONENTS.
3. Remove primary chaincase. See 6.4 PRIMARY CHAIN-CASE HOUSING.
4. See Figure 8-37. Remove the alternator rotor (4) using two bolts inserted through the holes in the rotor face.
5. Remove the T27 TORX screws (2).
6. Remove the stator (1).

NOTE

Contact cleaner, alcohol or glass cleaner sprayed on rubber grommet will provide lubrication when pulling it through crankcase hole.

7. Move grommet (3) to one side and spray contact cleaner into gap to lubricate grommet and ease removal. Repeat for other side. Pull rubber grommet through crankcase hole.
8. See 8.5 VOLTAGE REGULATOR. Disconnect the stator lead from the voltage regulator and pull through crankcase hole.



1. **Stator**
2. **T27 TORX screw**
3. **Grommet**
4. **Rotor**
5. **Connector [46B]**

Figure 8-37. Rotor and Stator

ASSEMBLY/INSTALLATION

NOTE

Stator Torx fasteners are not re-usable. They must be replaced.

1. Insert wires through crankcase hole.
2. See Figure 8-37. Push rubber grommet (3) through crankcase hole. If necessary, apply the same lubricant used during removal.
3. Mate connector [46] (5) into voltage regulator and engage latch to secure. See 8.5 VOLTAGE REGULATOR.
4. Install the stator (1) on the crankcase and fasten in place using **new** TORX screws. Tighten to 55-75 **in-lbs** (6.2-8.4 Nm).
5. Install the rotor (4) on the sprocket shaft.
6. Apply LOCTITE THREADLOCKER 262 (red) to sprocket nut threads. Tighten sprocket nut to 150-165 ft-lbs (203.4-223.7 Nm).
7. Install primary chaincase. See 6.4 PRIMARY CHAINCASE HOUSING.
8. Install clutch, primary drive and primary cover. See 6.3 DRIVE COMPONENTS.
9. Connect negative battery cable.

GENERAL

- For FXDC, FXDL, FXDB, FXDWG and FXDF models, the fuel gauge is mounted in a simulated left fuel tank cap. Remove by gently pulling upward. Do not twist.
- For FXD models, the fuel gauge is in the center console. See FXD MODELS which follows for replacement instructions.
- If gauge is to be replaced, remove wires from back of gauge (FXDC, FXDL, FXDB, FXDWG and FXDF models).
- The fuel gauge sending unit is in the fuel tank under a console and top plate.

ALL BUT FXD MODELS

Removal

NOTE

The gauge wires are routed through a tube in the tank and are secured by a cable tie located in the top frame tube underneath the fuel tank.

WARNING

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

WARNING

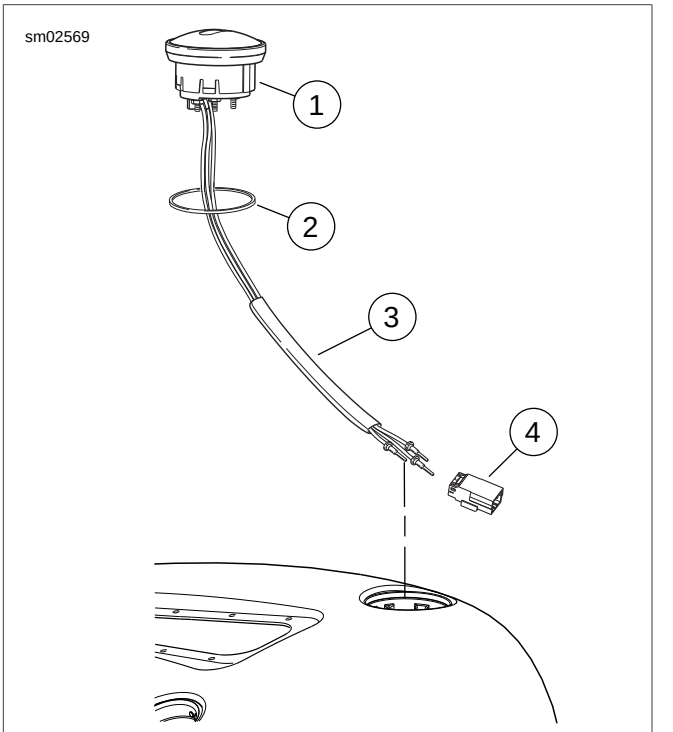
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Loosen fuel tank to gain access to the fuel gauge connector. See 4.5 FUEL TANK.
3. Disconnect fuel gauge connector [117] located under left side of fuel tank.
4. Detach terminals from connector (4).

NOTE

Do not twist gauge and wiring during removal.

5. See Figure 8-38. Pull up on gauge (1). Remove gauge, gasket (2) and wiring from fuel tank. Discard gasket.



1. **Gauge**
2. **Gasket**
3. **Wiring harness**
4. **Connector [117]**

Figure 8-38. Fuel Gauge: All but FXD

Installation

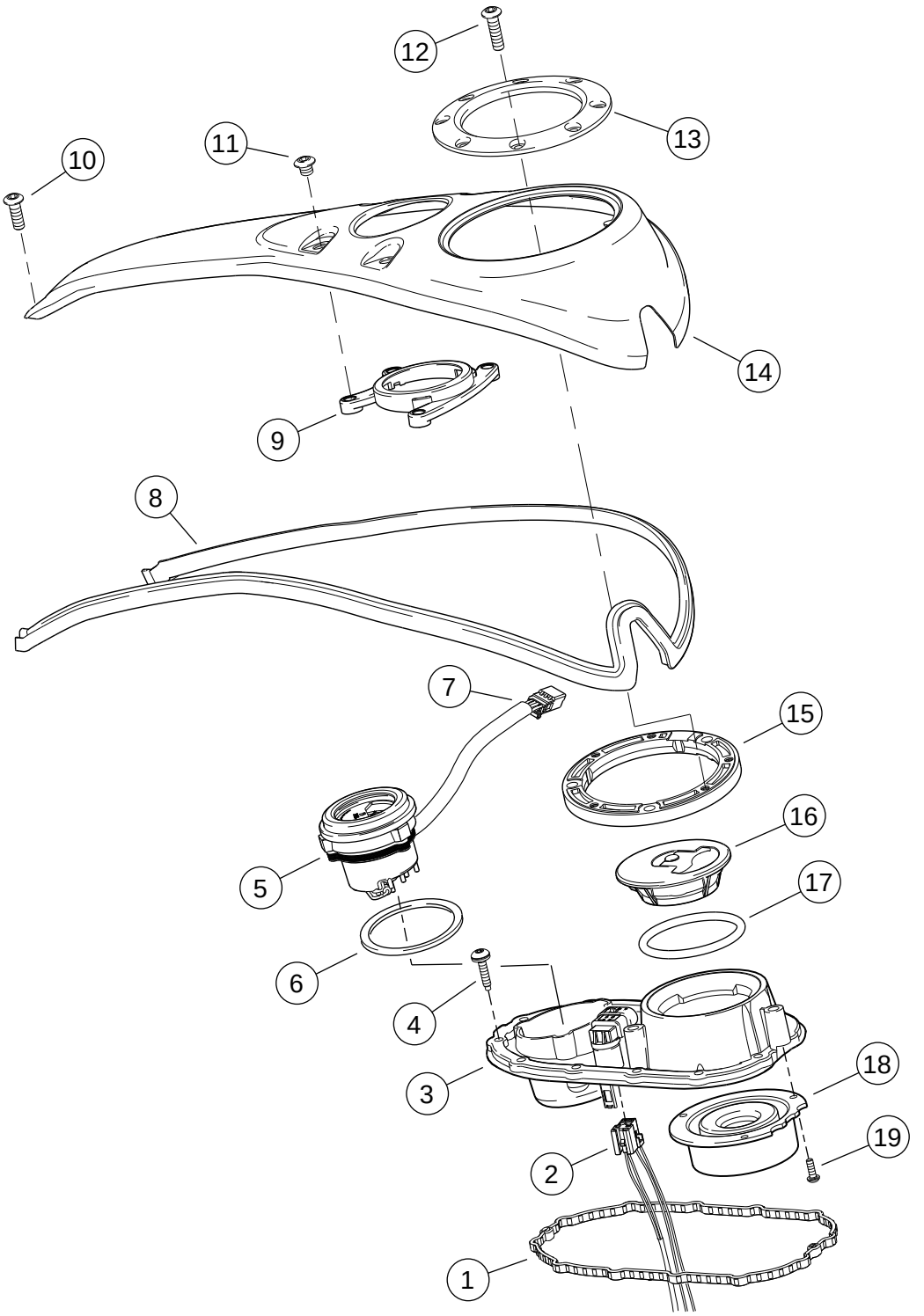
1. See Figure 8-38. Install wiring harness (3) through **new** gasket (2).
2. Push wiring harness through tube in fuel tank.
3. While gently pulling on wiring harness, install gauge (1) and gasket by carefully moving gauge back and forth while pushing down at the same time.
4. Install wiring into connector (4) [117]. Mate connector halves.
5. Secure wire under fuel tank with **new** cable tie.
6. Slide fuel tank into position and install fasteners. See 4.5 FUEL TANK.
7. Connect negative battery cable.

FXD MODELS

Console Removal

1. See Figure 8-39. Remove eight screws (12) that secure fuel cap trim ring (13) and top plate (3).
2. Remove screw (10) securing console (14) to fuel tank.

sm02570



1. Gasket
2. Fuel pump sending unit harness
3. Top plate
4. Screws (12)
5. Fuel gauge: FXD/FXDC
6. Gasket
7. Connector [117]
8. Trim
9. Mounting ring
10. Screw
11. Screw
12. Screws (8)
13. Fuel cap trim ring
14. Console
15. Trim ring
16. Filler cap
17. O-ring
18. Fuel restrictor
19. Screw

Figure 8-39. Fuel Gauge: FXD

Gauge Removal

WARNING

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

1. Disconnect negative battery cable.

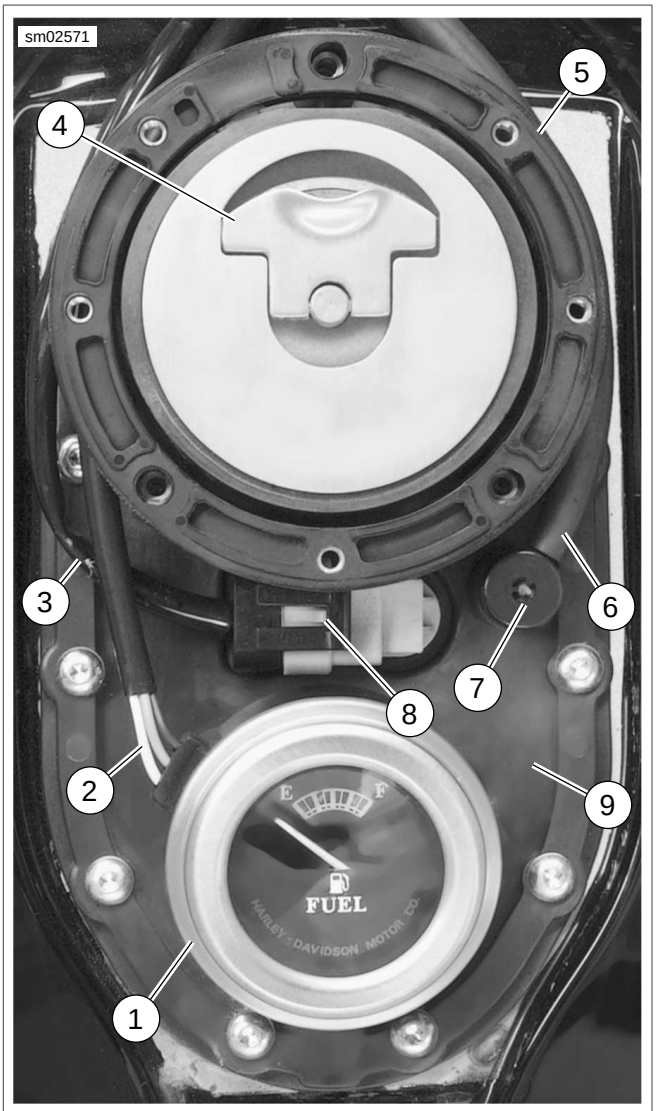
WARNING

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

2. Loosen fuel tank to gain access to the fuel gauge connector. See 4.5 FUEL TANK.
3. Disconnect fuel gauge connector [117] located under left side of fuel tank.
4. See Figure 8-40. Remove fuel gauge (1) from top plate (9).

Gauge Installation

1. See Figure 8-40. Install fuel gauge (1) into top plate (9).
2. Route fuel gauge wiring (2) as shown.
3. Connect fuel gauge connector [117] located under left side of fuel tank.

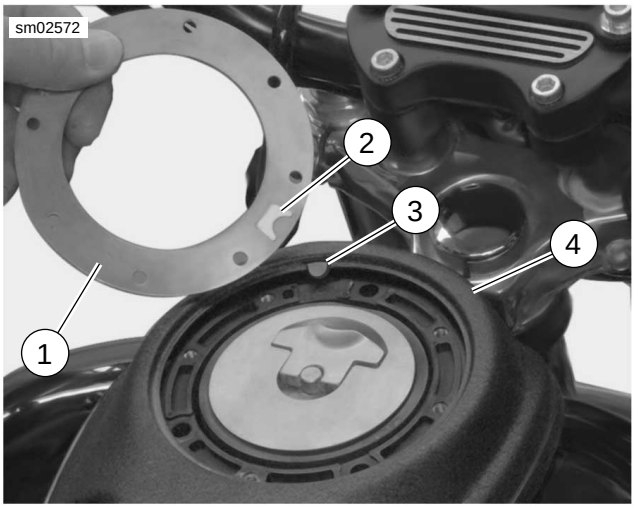


1. **Fuel gauge**
2. **Fuel gauge wiring**
3. **Fuel pump/sending unit wiring**
4. **Filler cap**
5. **Fuel cap trim ring**
6. **Vent hose**
7. **Vent**
8. **Fuel pump/sending unit connector [141]**
9. **Top plate**

Figure 8-40. Top Plate: FXD

Console Installation

1. See Figure 8-40. If removed, install trim ring (5) so holes in fuel cap trim ring align with threaded towers of top plate.
2. See Figure 8-39. Install console (14) over top plate (3).
3. See Figure 8-41. In next step, be sure slot (2) of fuel cap trim ring (1) is installed over tab (3) of console (4).
4. See Figure 8-39. Loosely install eight screws (12) that hold fuel cap trim ring (13) to top plate (3). Tighten screws to 18-22 **in-lbs** (2.03-2.49 Nm).
5. Install screw (10) securing console to fuel tank. Tighten screw to 18-24 **in-lbs** (2.0-2.7 Nm).



1. **Fuel cap trim ring**
2. **Slot**
3. **Tab**
4. **Console**

Figure 8-41. Fuel Cap Trim Ring: FXD

REMOVAL

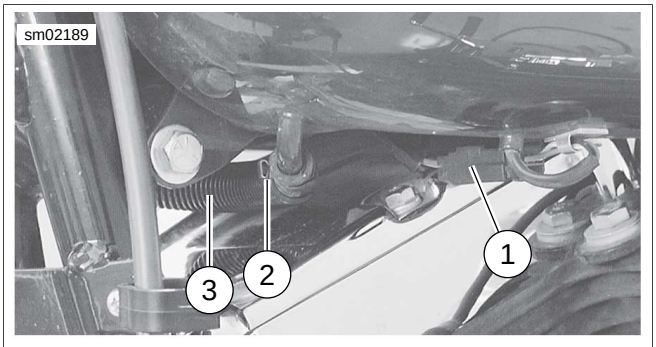
WARNING

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

WARNING

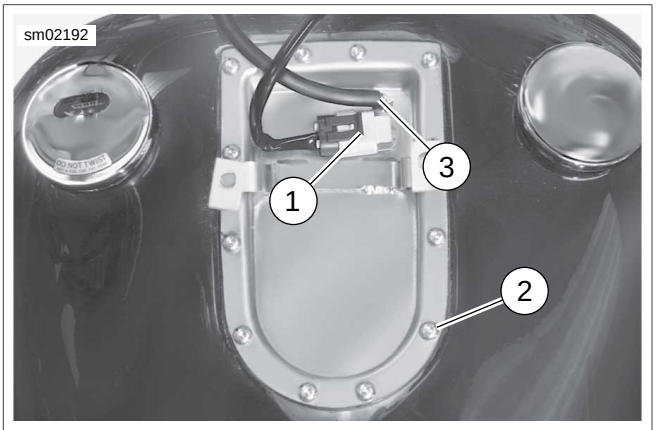
To prevent accidental vehicle start-up, which could cause death or serious injury, disconnect negative (-) battery cable before proceeding. (00048a)

1. Disconnect negative battery cable.
2. Drain fuel into adequately sized, approved gasoline container.
3. Remove instrument console.
   a. For FXDWG, FXDC, FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB
   c. For FXD models, see 8.15 FUEL GAUGE.
4. Disconnect console wiring.
5. See Figure 8-43. Unplug fuel pump and sender connector (1) [141].
6. Remove vent hose (3).
7. Remove top plate screws (2) and discard.



1. **Fuel gauge connector [117]**
2. **Clamp**
3. **Crossover hose**

Figure 8-42. Fuel Gauge Connector and Crossover Hose



1. **Fuel pump and sender connector [141]**
2. **Screws (12)**
3. **Vent hose**

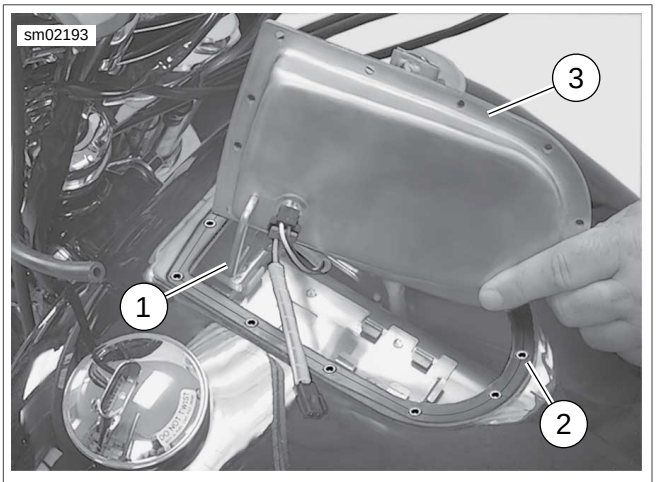
Figure 8-43. Top Plate Screws: FXDC/FXDWG/FXDF

8. See Figure 8-44. On FXDC, FXDL, FXDB, FXDWG and FXDF models, rotate top plate (3) until vent tube (1) clears fuel tank.
9. See Figure 8-45. Depress tab and remove fuel pump/sender wiring from top plate. Remove top plate.
10. Disconnect wire harness from fuel pump.
11. See Figure 8-46. Pull removal tab (2) towards rear of vehicle to disengage sender (1) from mounting tabs.

NOTE

Be careful not to bend float arm while removing. A bent float arm will give inaccurate readings.

12. Remove fuel gauge sender from fuel tank.



1. **Vent tube**
2. **Gasket**
3. **Top plate**

Figure 8-44. Fuel Line Clamp

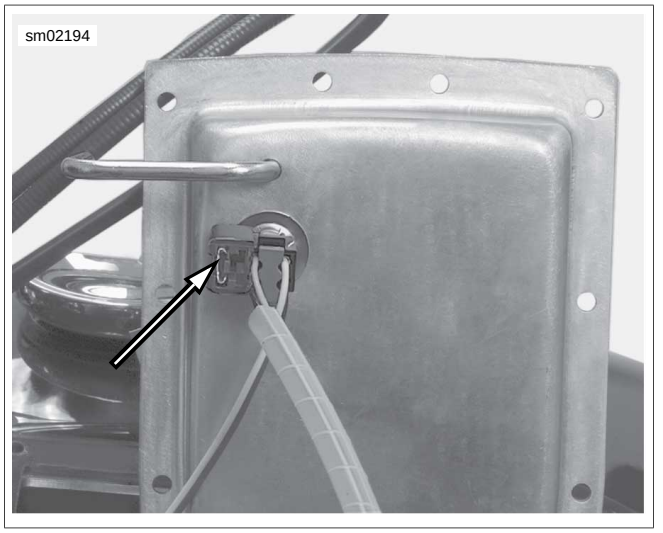
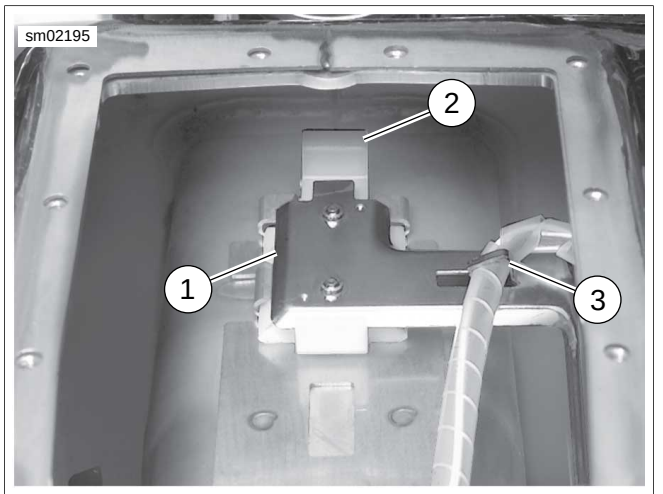


Figure 8-45. Connector Tab



1. **Fuel gauge sender**
2. **Removal tab**
3. **Wiring clip**

Figure 8-46. Fuel Gauge Sender

INSTALLATION

1. See Figure 8-47. Place **new** gasket (2) under top plate. Align gasket with screw holes.

NOTES

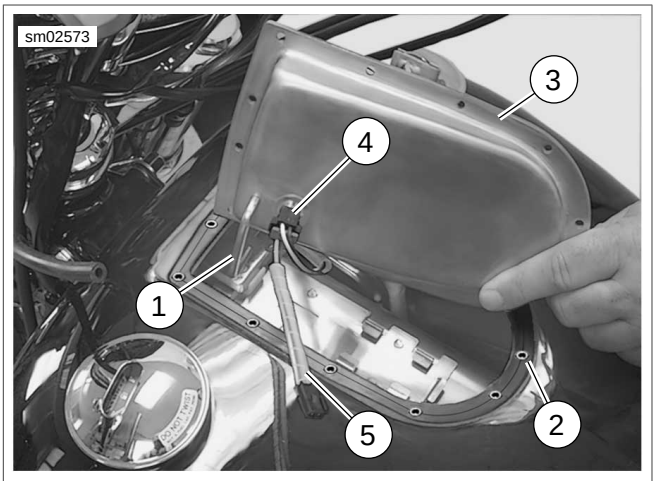
- *Do not apply any type of sealant to gasket.*
- *Fuel gauge sender sits in right side of fuel tank.*

2. Install fuel pump/sender wire connector (4) on top plate (3).
3. On FXDC, FXDL, FXDB, FXDWG and FXDF models, hold top plate at 90° angle. Making sure that vent tube is installed inside of tank, rotate top plate into position.
4. Loosely install **new** sealing screws in top plate.
5. For FXDWG/FXDC/FXDF models, see Figure 8-49. Tighten sealing fasteners using pattern shown to 20 **in-lbs** (2.26 Nm).
6. For FXD/FXDB/FXDL models, see Figure 8-50. Tighten sealing fasteners using pattern shown to 20 **in-lbs** (2.26 Nm).
7. See Figure 8-48. Connect fuel pump/sending unit connector [141].
8. Install instrument console.
   a. For FXDWG, FXDC, FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB
   c. For FXD models, see 8.15 FUEL GAUGE.

NOTE

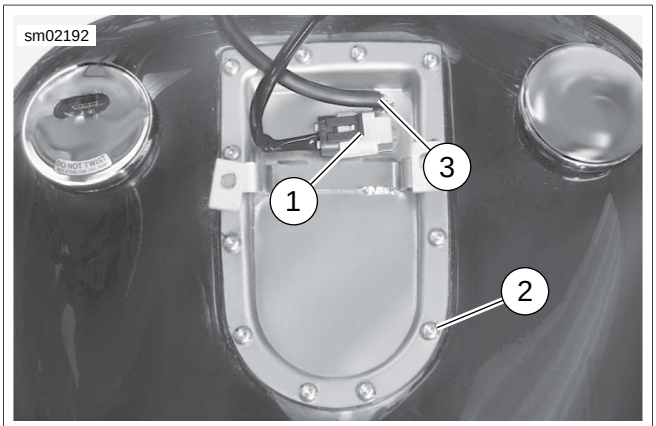
In next step, be sure crimped end of clamp faces toward front of vehicle.

9. Connect fuel tank crossover hose with **new** clamps.
10. Connect negative battery cable.
11. Fill tank with gasoline and check for leaks.



1. **Vent tube**
2. **Gasket**
3. **Top plate**
4. **Fuel pump/sender wire connector**
5. **Fuel pump harness**

Figure 8-47. Top Plate



1. **Fuel pump and sender connector [141]**
2. **Screws (12)**
3. **Vent hose**

Figure 8-48. Top Plate Screws: FXDC/FXDWG/FXDF

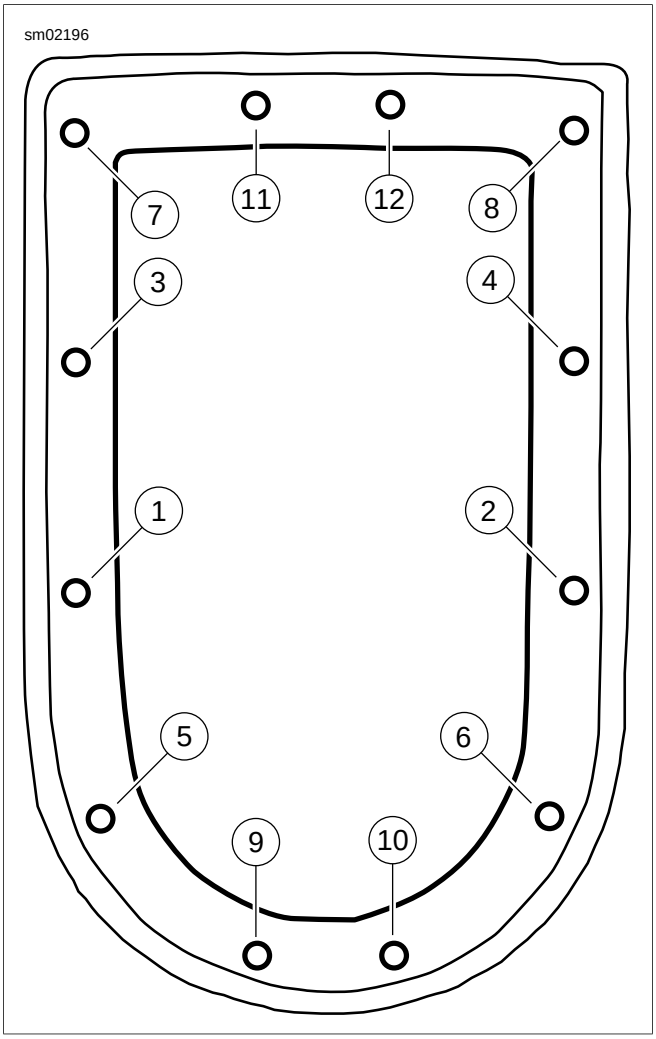


Figure 8-49. Top Plate Torque Sequence: FXDWG/FXDC/FXDF

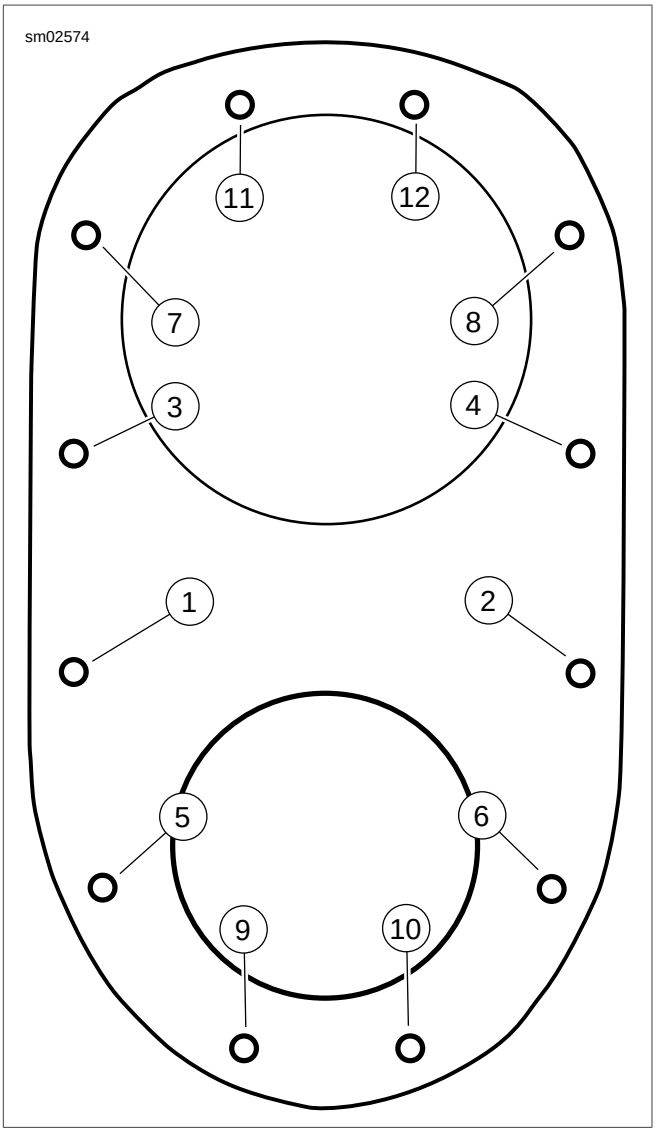


Figure 8-50. Top Plate Torque Sequence: FXD/FXDB/FXDL

REMOVAL

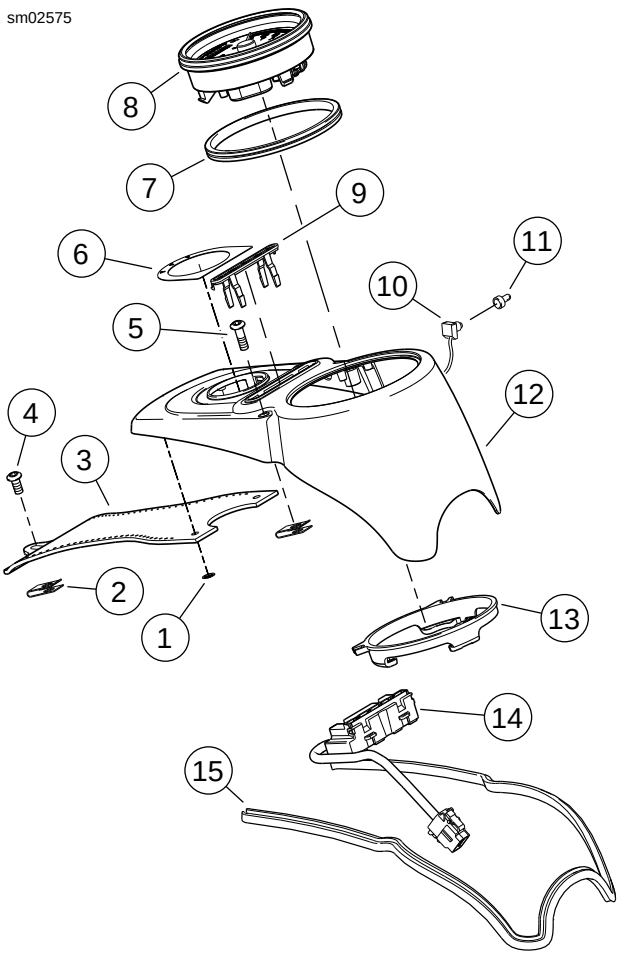
Speedometer

1. See Figure 8-51. Remove screw (4) securing trim to fuel tank. Remove screws (5) securing console to top plate.
2. Position clean towel on fuel tank and flip console over to expose underside.
3. Depress connector tab and disconnect 12-place harness connector [39] from speedometer (8) under console.
4. Unscrew the rubber boot (11) from the odometer reset switch (10) on the left side of the console.
5. Remove the odometer reset switch from hole in console.
6. Pry between three tabs and speedometer with a screwdriver to raise and release back clamp (13) from speedometer. Remove back clamp from speedometer.
7. Remove speedometer from console (12).
8. Remove gasket (7) from speedometer.

INSTALLATION

Speedometer

1. See Figure 8-51. Install gasket (7) to speedometer (8).
2. Position speedometer in console (12).
3. Press on back clamp (13) until three tabs engage on back of speedometer.
4. Insert odometer reset switch (10) through hole in console and install rubber boot (11).
5. Connect 12-place connector [39] to speedometer under console.
6. Install console to fuel tank with screws (5). Tighten to 18-24 **in-lbs** (2.0-2.7 Nm).
7. Install screw (4) securing fuel tank trim (3) to fuel tank. Tighten to 18-24 **in-lbs** (2.03-2.71 Nm).
8. Test speedometer for proper operation.



1. **Push nut**
2. **Speed nut**
3. **Trim**
4. **Screw**
5. **Screw**
6. **Name plate**
7. **Gasket**
8. **Speedometer**
9. **Bezel**
10. **Reset switch**
11. **Boot**
12. **Console**
13. **Back clamp**
14. **Lamp housing**
15. **Console trim**

Figure 8-51. Speedometer: FXDWG/FXDC/FXDF

REMOVAL

General

It is not necessary to cut any of the wiring harness cable ties to replace the speedometer and tachometer.

Speedometer

1. See Figure 8-52. Remove screws (5, 6) and lift console from fuel tank.
2. Position clean towel on fuel tank and flip console over to expose underside.
3. Remove four screws (1) and back clamp (2) from speedometer (10) and tachometer (9).
4. Depress connector tab and remove 12-place connector (11) [39] from back of speedometer.
5. Remove speedometer from console (13). Remove gasket from speedometer/console.

Tachometer

1. Complete steps 1-3 of speedometer removal.
2. Depress connector tab and remove 12-place connector (8) [108] from back of tachometer.
3. Remove tachometer from console (13). Remove gasket from tachometer/console.

INSTALLATION

General

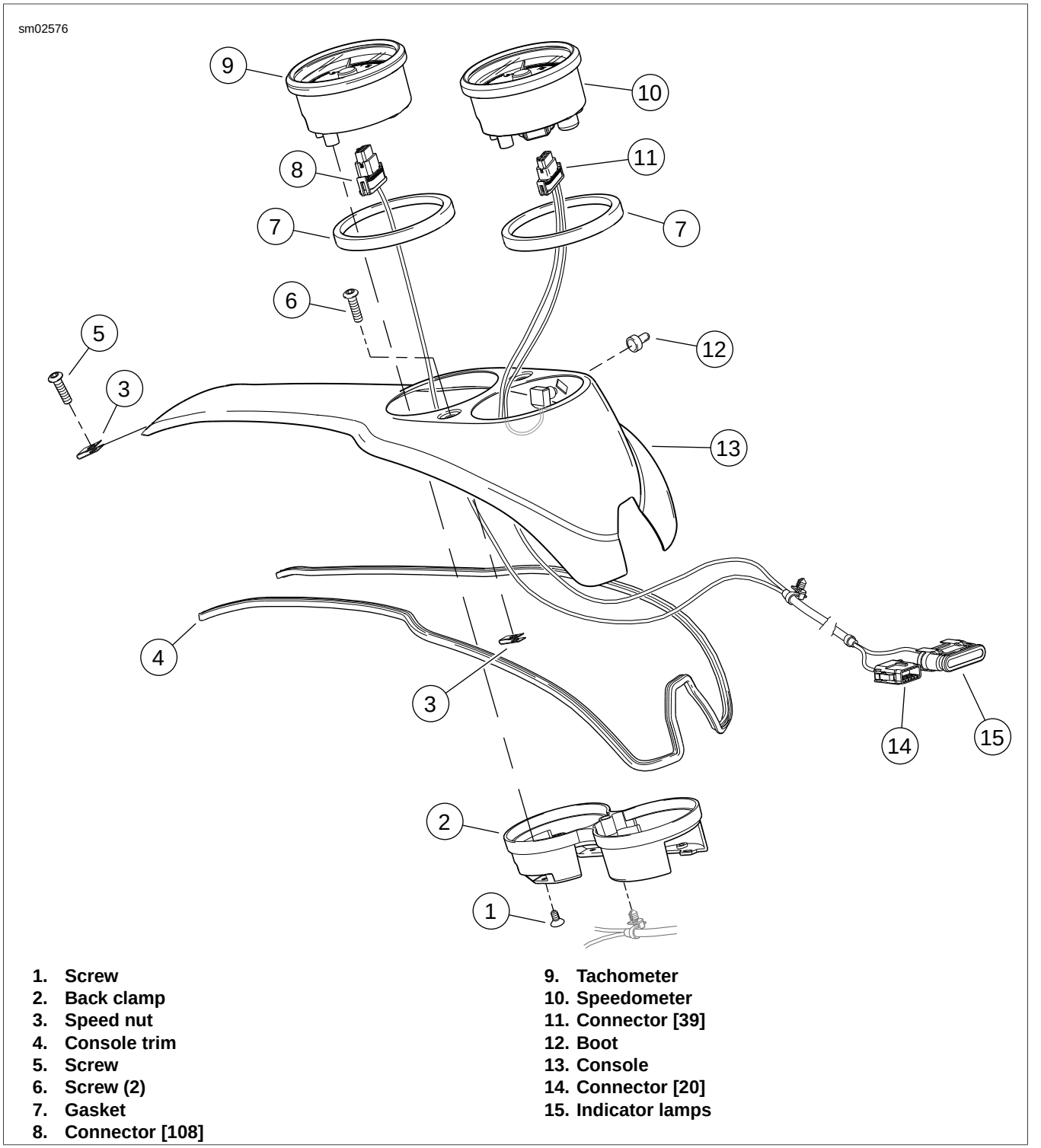
To ease installation, alcohol or glass cleaner may be applied to the gasket.

Speedometer

1. See Figure 8-52. Install gasket (7) to console (13).
2. Install speedometer (10) in console.
3. Install connector (11) [39] to back of speedometer.
4. Install back clamp (2) to speedometer/tachometer with four screws (1). Make sure there is no binding with the wiring harnesses and the bracket.
5. Install console to fuel tank with screws (5, 6). Tighten to 18-24 **in-lbs** (2.0-2.7 Nm).
6. Test speedometer for proper operation.

Tachometer

1. See Figure 8-52. Install gasket (7) to console (13).
2. Install tachometer (9) in console.
3. Install connector (8) [108] to tachometer under console.
4. Install back clamp (2) to speedometer/tachometer with screws (1). Make sure there is no binding with the wiring harnesses and the bracket.
5. Install console to fuel tank with screws (5, 6). Tighten to 18-24 **in-lbs** (2.0-2.7 Nm).
6. Test tachometer for proper operation.



1. **Screw**
2. **Back clamp**
3. **Speed nut**
4. **Console trim**
5. **Screw**
6. **Screw (2)**
7. **Gasket**
8. **Connector [108]**
9. **Tachometer**
10. **Speedometer**
11. **Connector [39]**
12. **Boot**
13. **Console**
14. **Connector [20]**
15. **Indicator lamps**

Figure 8-52. Instrumentation: FXDL, FXDB

REMOVAL

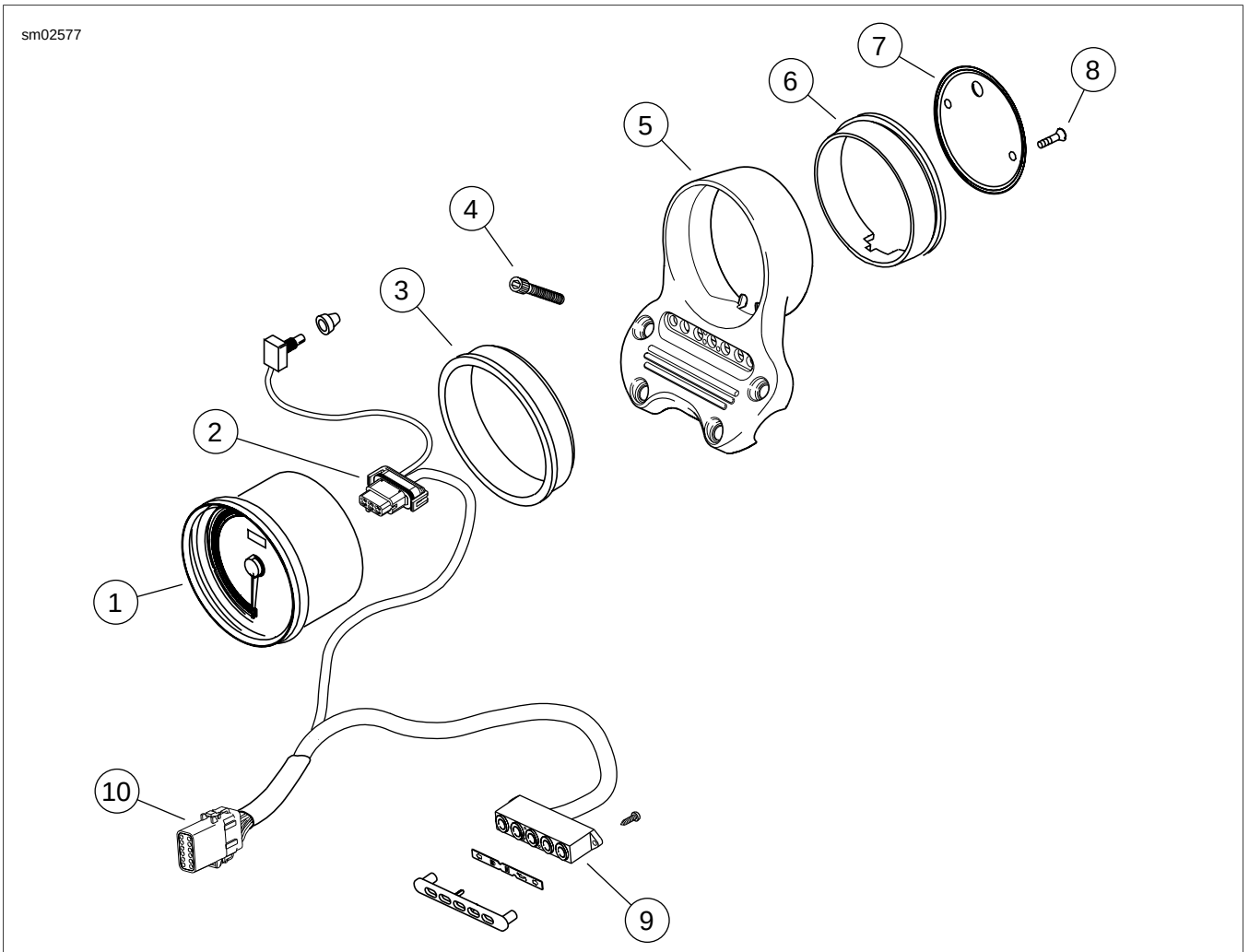
1. See Figure 8-53. Remove two screws (8) and backplate (7).
2. Depress tab and remove 12-pin connector (2) [39] from back of speedometer.
3. Push speedometer (1) through front of housing (5).
4. Remove front gasket (3) from speedometer.

INSTALLATION

NOTE

To ease installation, glass cleaner or alcohol may be applied to the inside surface of the gasket.

1. See Figure 8-53. Install front gasket (3) to speedometer and slide speedometer into housing. Press firmly until fully seated.
2. Connect 12-place connector (2) [39] to back of speedometer.
3. Route wires through slot in back of instrument housing. Install rear gasket (6) on back of housing. Install backplate (7) with two screws (8).



1. **Speedometer**
2. **Connector [39]**
3. **Front gasket**
4. **Bolt @ 12-18 ft-lbs (16.3-24.4 Nm)**
5. **Housing**
6. **Rear gasket**
7. **Backplate**
8. **Screw**
9. **LED assembly**
10. **Connector [20]**

Figure 8-53. Instrumentation: FXD

GENERAL

The vehicle speed sensor is a Hall Effect sensor that takes readings off 4th gear in the transmission.

The vehicle speed sensor is located on the transmission just behind the transmission top cover.

REMOVAL

1. Disconnect battery, negative cable first.
2. See Figure 8-54. Disconnect the vehicle speed sensor connector [65].
3. Remove sensor mounting bolt and lift sensor from transmission case.

NOTE

Before removing sensor wire, carefully note wire routing. It is a good idea to lay the new sensor wire next to the old wire and remove and replace the wires together, one cable strap at a time, to ensure proper routing.

INSTALLATION

1. See Figure 8-54. Install sensor into transmission case using mounting bolt. Tighten bolt to 84-108 **in-lbs** (9.5-12.2 Nm).
2. Install connector [65] to speed sensor.
3. Connect battery cables.

WARNING

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

4. Install seat.

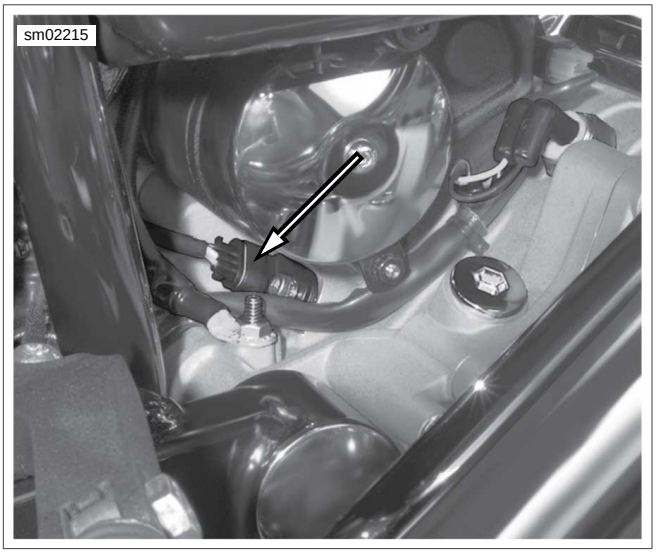


Figure 8-54. Vehicle Speed Sensor and Connector [65]

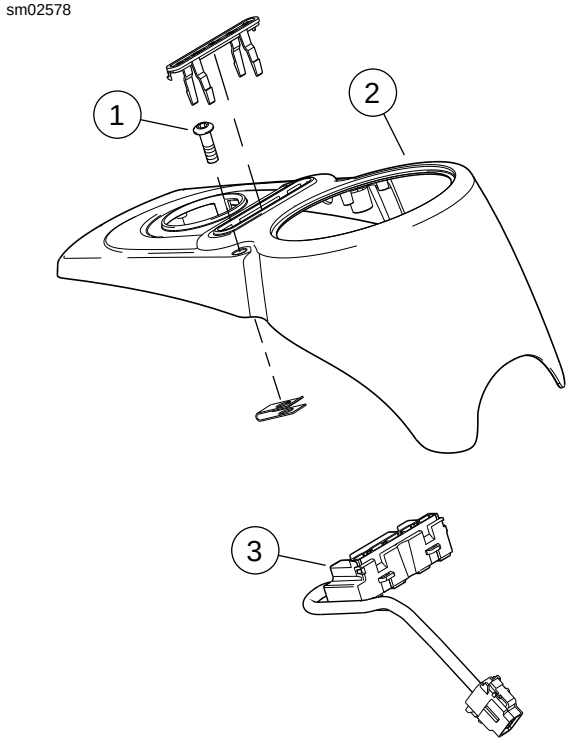
GENERAL

Dyna models are equipped with Light Emitting Diode (LED) indicators. The indicator LED assembly is not serviceable. If one LED is bad, the entire assembly must be replaced.

REMOVAL

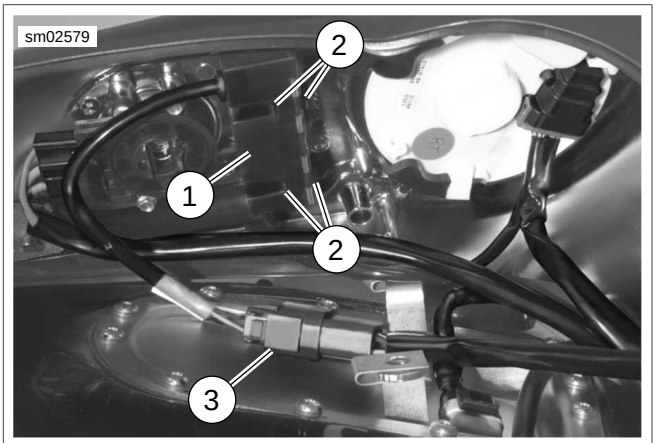
FXDWG/FXDC/FXDF Models

1. See Figure 8-55. Remove screws (1) and raise console (2) from fuel tank. Place shop rags on tank and flip console over to expose underside.
2. See Figure 8-56. Squeeze clips together (2) and gently pry LED assembly (1) out of console from the side with a screwdriver.
3. Disconnect 8-place connector (3) [21] from LED assembly.



1. Screw (2)
2. Console
3. LED assembly

Figure 8-55. Indicator Lamp Assembly: FXDWG, FXDC, FXDF

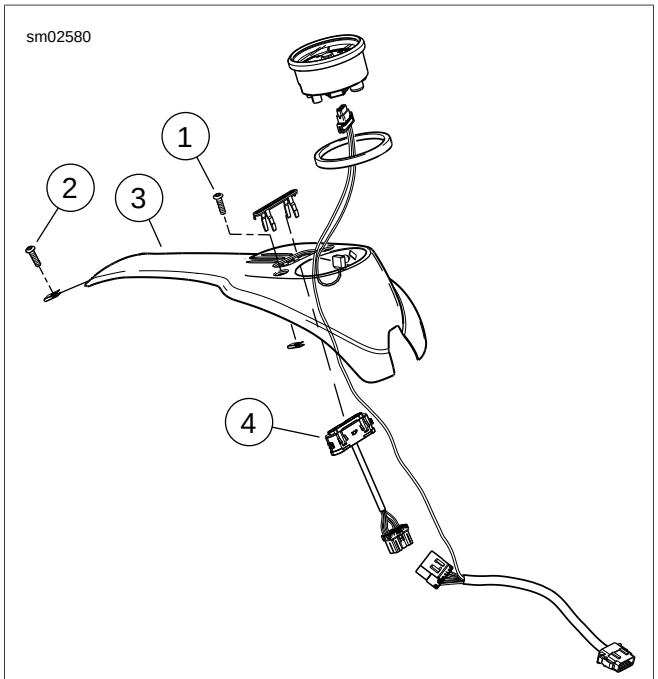


1. LED assembly
2. Clips (2 pair)
3. Connector [21]

Figure 8-56. FXDWG, FXDC, FXDF Conncector [21]

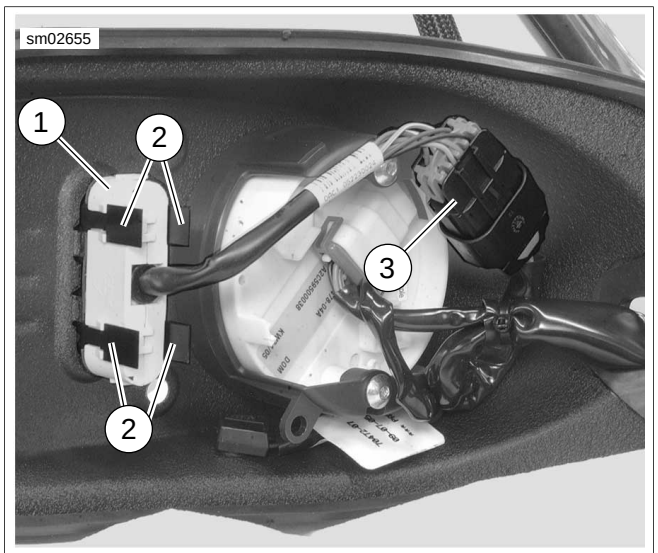
FXDB Models

1. See Figure 8-57. Remove long console fasteners (1) and short console fastener (2).
2. Raise console (3) from fuel tank. Place shop rags on tank and flip console over to expose underside.
3. See Figure 8-58. Release clips (2) to free LED housing (1) from console.
4. Disconnect connector (3) [21] from LED assembly.



1. **Console fastener, long (2)**
2. **Console fastener, short (1)**
3. **Console**
4. **LED assembly**

Figure 8-57. Indicator Lamps: FXDB



1. **LED assembly**
2. **Clips (2 pair)**
3. **Connector [21]**

Figure 8-58. FXDB Connector [21]

FXD Models

1. See Figure 8-59. Remove LED assembly fasteners (4) from LED assembly (3).
2. Pull LED assembly from speedometer bracket.

FXDL Models

1. Pull riser cover from between handlebar risers.
2. See Figure 8-60. Squeeze clips (2) together and gently pull LED assembly (1) from handlebar cover (3).

Table 8-6. FXDWG, FXDC, FXDF Connector [21] Pins

Pin On [21]	Wire Color	Function
1	Violet	left turn
2	White	high beam
3	Green/yellow	oil pressure
4	Brown	right turn
5	Tan	neutral
6	Orange	+12V
7	Black	ground
8	Not used	n/a

Table 8-7. FXDB Connector [21] Pins

Pin On [21]	Wire Color	Function
1	Brown	right turn
2	Green/yellow	oil pressure
3	White	high beam
4	Violet	left turn
5	Black	ground
6	Orange	+12V
7	Tan	neutral
8	Orange	+12V
9	Black	ground
10	Black	ground

Table 8-8. FXD, FXDL Connector [20] Pins

Pin On [20]	Wire Color
3	Brown
4	White
5	Violet
6	Orange
8	Tan
9	Green/yellow
12	Black

Table 8-9. LED Assembly Wiring

INDICATOR LAMP	CONNECTION
Oil pressure	Ground through switch
Neutral	Ground through switch
High beam	12V when active
Right/left turn	12V when active

INSTALLATION

FXDWG/ FXDC/FXDF Models

1. See Figure 8-56. Install LED assembly (1) into console. Make sure clips (2) engage to secure assembly in place.

2. Connect connector (3) [21] to main wiring harness.
3. See Figure 8-55. Place console (2) in position. Tighten screws (1) to 18-24 **in-lbs** (2.0-2.7 Nm).

FXDB Models

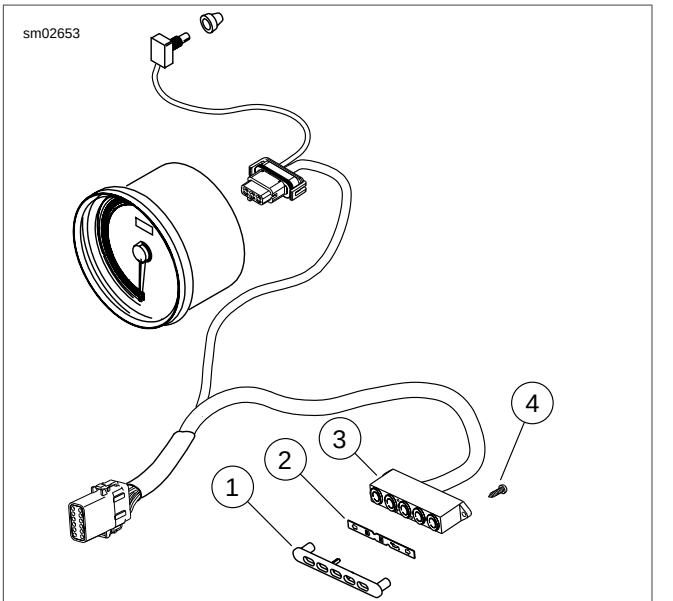
1. See Figure 8-58. Install LED assembly (1) into console.
2. Engage clips (2) into tabs on LED assembly.
3. Connect connector (3) [21] to main wiring harness.
4. See Figure 8-57. Place console (3) in position.
5. Install long console fasteners (1) and short console fastener (2). Tighten fasteners to 18-24 **in-lbs** (2.0-2.7 Nm).

FXD Models

1. See Figure 8-59. Install LED assembly (3) into speedometer bracket.
2. Install LED assembly fasteners (4) into LED assembly. Tighten fasteners (1) to 18-24 **in-lbs** (2.0-2.7 Nm).

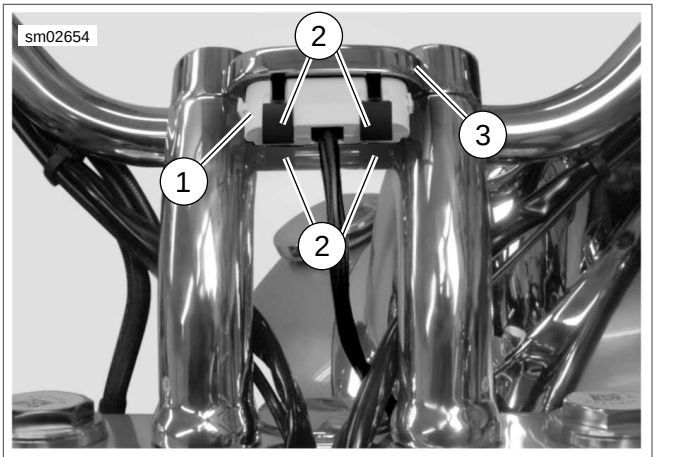
FXDL Models

1. See Figure 8-60. Install LED assembly (1) into handlebar cover.
2. Engage clips (2) into tabs on LED assembly.
3. Install riser cover between handlebar risers.



1. **Trim plate**
2. **Lens**
3. **LED assembly**
4. **LED assembly fasteners (2)**

Figure 8-59. Indicator Lamps: FXD

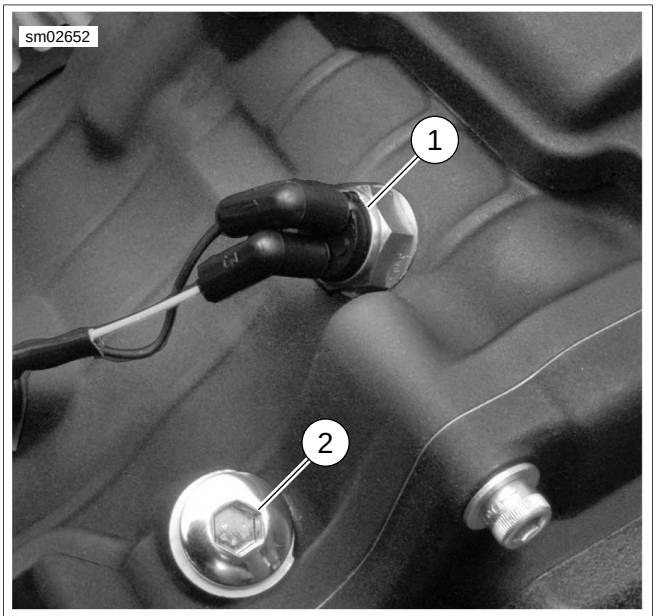


1. **LED assembly**
2. **Clips (2 pair)**
3. **Handlebar cover**

Figure 8-60. FXDL LED Assembly

GENERAL

See Figure 8-61. The neutral switch is located on the transmission case. The two terminal switch is normally closed. When the transmission shifter is in neutral and the ignition switch is in the IGNITION position, the switch causes the NEUTRAL indicator light to illuminate.



1. **Neutral switch**
2. **Transmission dipstick**

Figure 8-61. Neutral Switch Location

REMOVAL

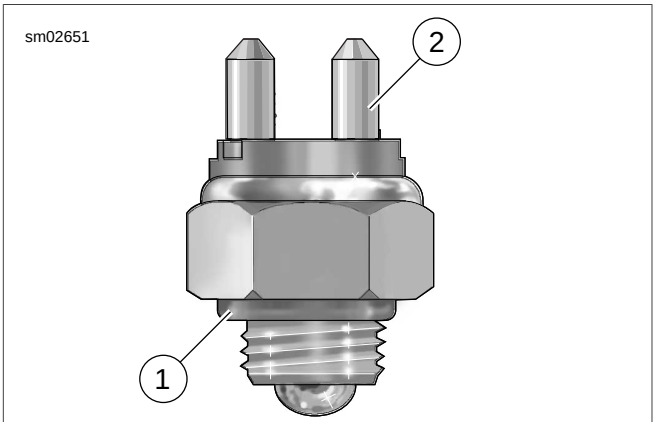
NOTE

Cover transmission top cover with masking tape while performing this task to prevent scratching chrome parts.

1. Make sure transmission shifter is in NEUTRAL.
2. See Figure 8-61. Using fingers, remove connectors from switch studs.
3. Remove neutral switch and O-ring from transmission case.

NOTE

To replace connectors, use heat-sealed wire connectors. See A.18 SEALED SPLICE CONNECTORS.



1. **O-ring**
2. **Switch stud**

Figure 8-62. Neutral Switch

INSTALLATION

NOTE

The transmission shifter must be in the NEUTRAL position when installing the switch to allow the bottom ball on the switch to engage the slot in the shifter cam.

1. See Figure 8-62. Lubricate O-ring with transmission oil.
2. Install switch with O-ring in transmission case.
3. Tighten to 120-180 **in-lbs** (13.6-20.3 Nm).

NOTE

The neutral switch is not polarity sensitive, so either connector can be attached to either stud.

4. Using fingers and a flat tip screwdriver, install connectors to switch studs.
5. Test neutral switch for proper operation.
   a. Turn ignition switch to IGNITION position.
   b. Verify that transmission shifter is in NEUTRAL.
   c. Check to see that NEUTRAL indicator light illuminates.

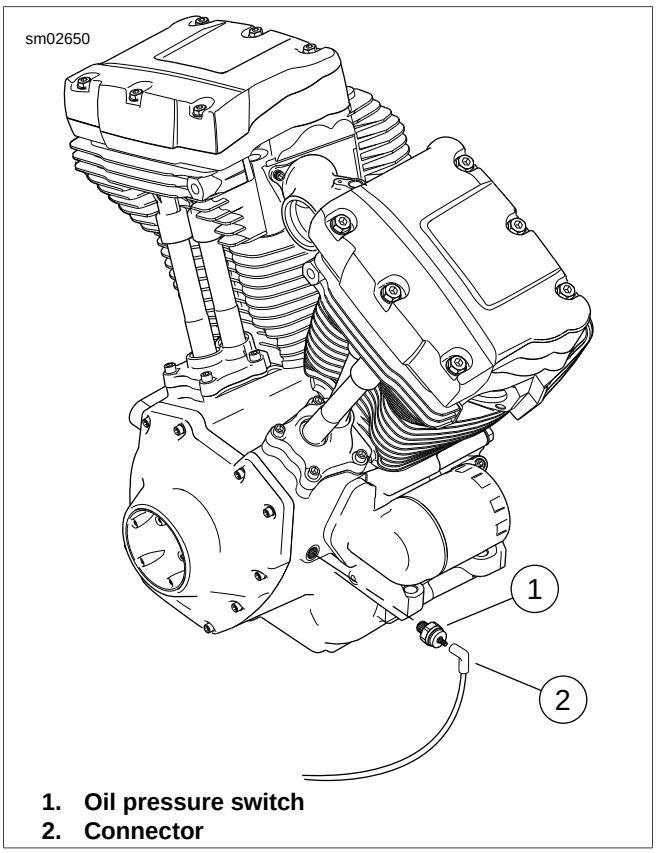
GENERAL

The oil pressure switch monitors oil pressure in the crankcase. If the oil pressure drops below 3 psi (20.6 kPa) the oil pressure switch is tripped and illuminates the low oil pressure indicator light.

See Figure 8-63. The oil pressure switch is located on the right side of the crankcase.

REMOVAL

1. See Figure 8-63. Remove connector (2) from oil pressure switch (1).
2. Using a 15/16 in. open end wrench, remove switch from crankcase.



1. **Oil pressure switch**
2. **Connector**

Figure 8-63. Oil Pressure Switch

INSTALLATION

NOTE

Perform step 1 only if original switch is being re-installed. New switches have a sealant contact patch on the threads. If new switch is being installed, begin at step 2.

1. Coat threads of oil pressure switch with LOCTITE PIPE SEALANT WITH TEFLON (PST).
2. See Figure 8-63. Install oil pressure switch (1) to crankcase.
3. Tighten switch to 96-144 **in-lbs** (10.8-16.3 Nm).
4. Attach connector (2) to oil pressure switch.
5. Test oil pressure switch for proper operation.

NOTE

If connector (2) requires replacement, see A.18 SEALED SPLICE CONNECTORS in the appendix.

GENERAL

See Figure 8-64. The rear stoplight switch monitors brake fluid pressure in the rear brake line. When pressure in the line reaches a preset level, the rear stoplight switch is tripped and illuminates the tail light/stoplight.

REMOVAL

CAUTION

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

1. See Figure 8-64. Remove both connectors (2) from rear stoplight switch (1).
2. Place a clean container under the rear stoplight switch and brake line to catch escaping fluid.
3. Remove rear stoplight switch.

INSTALLATION

1. Coat threads of stop light switch with LOCTITE 565 (thread sealant) perpendicular to the threads. Do not allow thread sealant to make contact with end of switch.
2. See Figure 8-64. Install rear stoplight switch (1). Tighten switch to 12-15 ft-lbs (16.3-20.3 Nm).
3. Install switch connectors (2).

WARNING

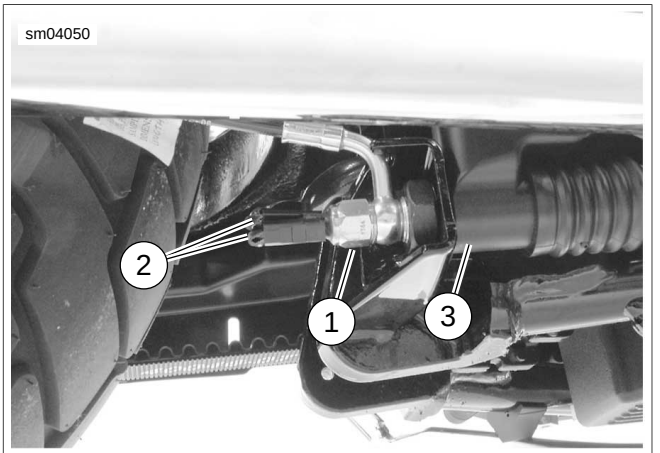
After repairing the brake system, test brakes at low speed. If brakes are not operating properly, testing at high speeds can cause loss of control, which could result in death or serious injury. (00289a)

4. Bleed brake system. See 1.15 BLEEDING BRAKES.

WARNING

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

5. Check stop light for proper operation.



1. **Stoplight switch**
2. **Connectors**
3. **Master cylinder**

Figure 8-64. Rear Stoplight Switch

INSPECTION

If the horn fails to sound or does not sound satisfactorily, check for loose, frayed or damaged wires leading to horn terminal, discharged battery or corroded ground.

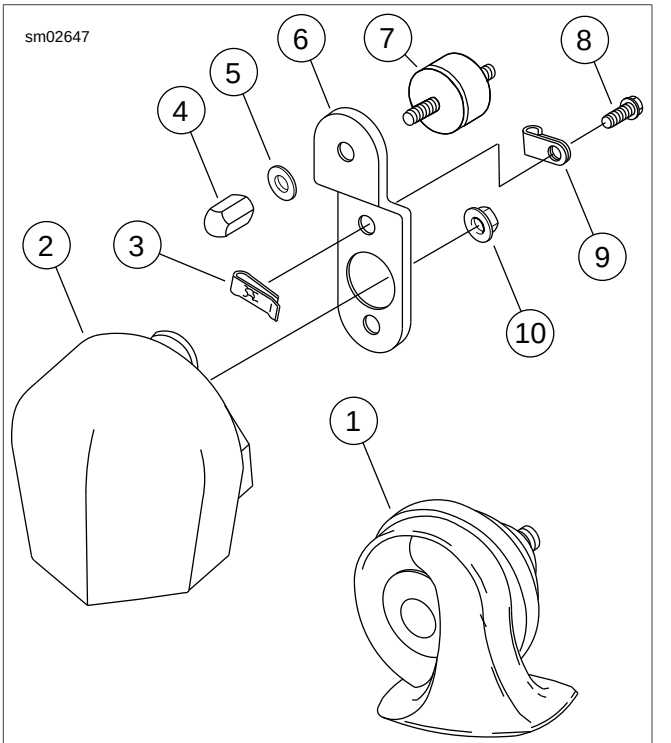
The horn is permanently sealed and non-repairable. Only the mounting hardware is replaceable.

NOTE

No tonal adjustments may be made to this horn.

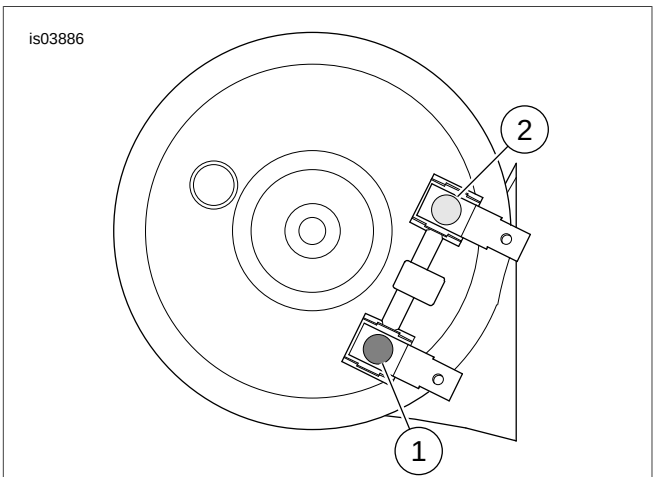
REPLACEMENT

1. See Figure 8-65. Remove nut (4) and washer (5) to detach horn bracket (6) from vehicle.
2. See Figure 8-66. Disconnect wires from posts (1, 2) on back side of horn.
3. See Figure 8-65. Remove screws (8) and nut (10) to detach horn from bracket. Free wires from clamp (9).
4. Install **new** horn on bracket. Secure with screws (8), push nuts (3) and nut (10). Fold wires under clamp (9).
5. See Figure 8-66. Attach wiring.
   a. Connect Y/BK wire to gold post (1).
   b. Connect BK wire to silver post (2).
6. See Figure 8-65. Attach horn to vehicle using washer (5) and nut (4). Tighten nut to 10-15 ft-lbs (13.6-20.3 Nm). When tightening fasteners, be sure the horn does not contact the horn cover or other parts.



1. **Horn**
2. **Cover**
3. **Push nut (2)**
4. **Acorn nut**
5. **Washer**
6. **Bracket**
7. **Rubber mount**
8. **Screw (2)**
9. **Clamp**
10. **Nut**

Figure 8-65. Horn



1. **Gold post and Y/BK wire**
2. **Silver post and BK wire**

Figure 8-66. Horn Wiring

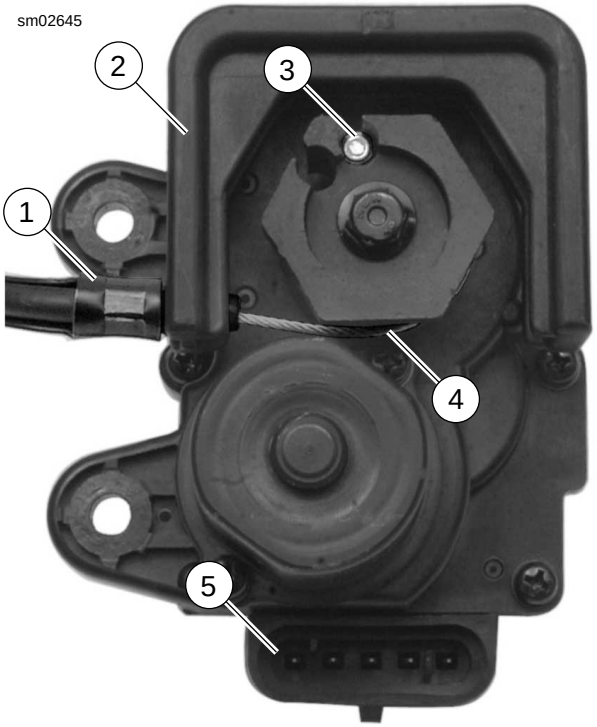
GENERAL

The active exhaust system utilizes an actuator valve located in the rear exhaust pipe which is connected to a servo motor via a cable. The valve position automatically adjusts to enhance engine performance.

The active exhaust module is located in front of the battery box. The attached cable is routed to a bellcrank located on the rear exhaust pipe.

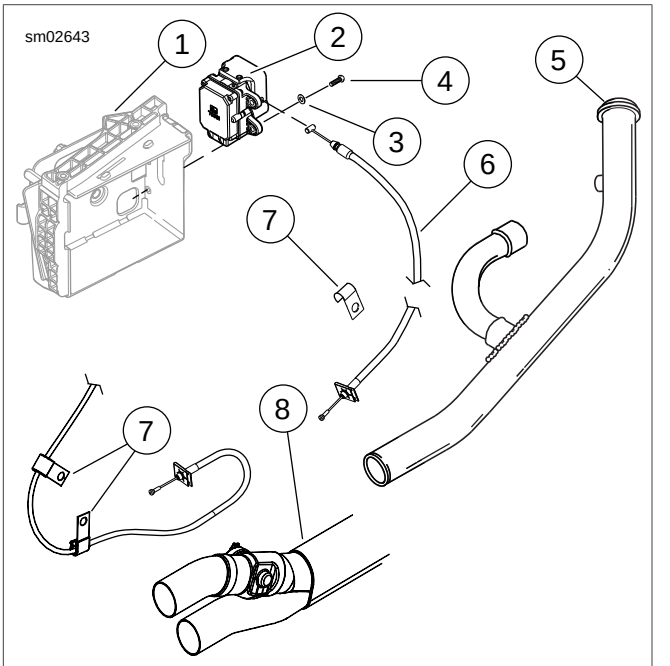
REMOVAL

1. See Figure 8-67. Remove active exhaust cable housing (1) from notch in shroud (2). Remove ferrule (3) from active exhaust module to free cable (4).
2. See Figure 8-68. Remove module fasteners (4) and washers (3) from battery box (1).



1. **Active exhaust cable housing**
2. **Shroud**
3. **Ferrule**
4. **Active exhaust cable**
5. **Active exhaust module connector [179]**

Figure 8-67. Active Exhaust Module



1. **Battery box**
2. **Active exhaust module**
3. **Washer (2)**
4. **Module fastener (2)**
5. **Rear exhaust pipe, all but FXDF**
6. **Cable**
7. **Clip**
8. **Head pipe, FXDF**

Figure 8-68. Active Exhaust

REPAIR

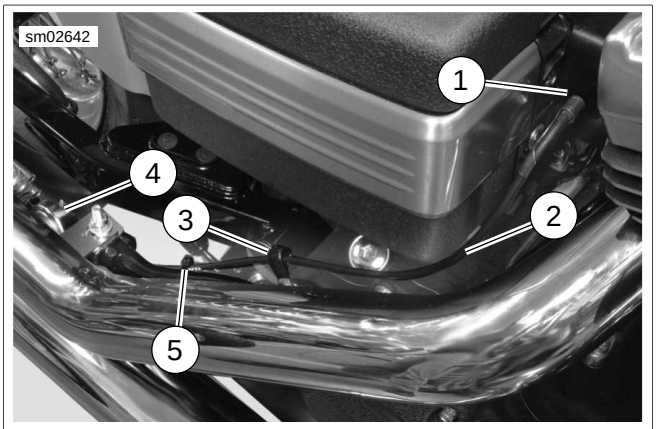
NOTE

See Figure 8-67. Active exhaust module shroud (2) can be replaced. Replace shroud if active exhaust cable housing (1) is a loose fit in shroud.

1. Remove fasteners securing shroud.
2. Replace shroud. Replace fasteners and tighten securely.

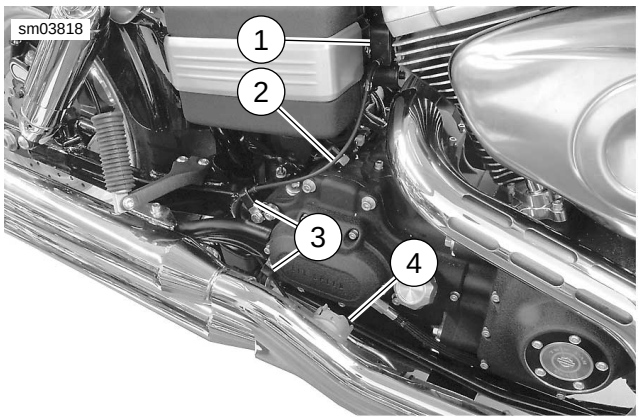
INSTALLATION

1. See Figure 8-67. Install ferrule (3) into slot shown. Wrap cable counterclockwise around active exhaust module shroud as shown.
2. Clip cable housing into active exhaust module housing (2).
3. Place active exhaust module into position in front of battery box.
4. Install fasteners (4) and washers (3). Tighten to 36-60 **in-lbs** (4.1-6.8 Nm).
5. See Figure 8-69 or Figure 8-70. After installation, be sure active exhaust cable is routed correctly and does not contact the exhaust pipe, battery cover or transmission case.



1. **Active exhaust module**
2. **Active exhaust cable**
3. **Clamp**
4. **Bellcrank**
5. **Cable tie**

Figure 8-69. Active Exhaust Cable: All but FXDF



1. **Active exhaust module**
2. **Active exhaust cable**
3. **Clamp (2)**
4. **Bellcrank**

Figure 8-70. Active Exhaust Cable: FXDF

GENERAL

The main wiring harness is routed through the frame backbone and has enough slack designed into it so that it can be pulled out of the front end of the backbone to access the connectors located inside the frame.

NOTE

See B.1 CONNECTORS, Connector Locations for a description of all connector locations.

REMOVAL

1. Remove seat.

⚠WARNING

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

NOTE

Disarm HFSM or TSSM before removal.

2. Disconnect battery cables, negative cable first.
3. Remove battery.
4. Remove battery tray. See 8.8 BATTERY TRAY AND BATTERY CABLES.
5. Remove instrument console.
   a. For FXDWG/FXDC/FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
   b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
   c. For FXD models, see 8.15 FUEL GAUGE.

NOTE

To ensure proper installation, make note of all wire routing and connector locations before removal. In particular, pay close attention to the locations of cable straps and anchors which must be replaced.

6. See Figure 8-71. Disconnect fuel pump/sender connector [141].
7. For FXDWG/FXDC/FXDF models, remove the remaining three main harness connectors. The three are:
   a. Key switch [33].
   b. Indicator lamps [21] (8-Place Mini-Deutsch).
   c. Speedometer [39] (NOTE: Reset boot and switch must be removed from console).
8. Remove fuel tank. See 4.5 FUEL TANK. This includes detaching fuel gauge connector [117].
9. Remove exhaust. See 4.16 EXHAUST SYSTEM.
10. Remove rear brake master cylinder. See 2.14 REAR BRAKE MASTER CYLINDER.
11. On HDI vehicles, remove active exhaust module connector [179] located in front of electrical caddy.
12. Remove electrical caddy and ignition coil. See 8.2 ELECTRICAL CADDY.



Figure 8-71. Fuel Pump Connector [141] (typical)

13. See Figure 8-72. Remove harness shield by pushing both tabs of shield in at the same time.
14. Pull harness connectors from inside frame.
15. Disconnect the following connectors:
   a. Right handlebar controls [22] (6-place Deutsch).
   b. Left handlebar controls [24] (6-Place Deutsch).
   c. Instruments [20].
   d. Turn signals [31].
   e. (FXDL/FXDB models) Instruments [21].
   f. Headlamp [38].

NOTE

In next step, note location of ground wires before removal to ensure proper installation.

16. See Figure 8-73. Remove ground wires from studs on frame.
17. Disconnect connectors located under seat:
   a. Accessory connector [4].
   b. Tail lamp harness connector [7].
   c. Rear oxygen sensor [137].
   d. Security siren connector [142] if security siren installed.
   e. B+ connector [160].
18. Disconnect starter solenoid [128].

19. Disconnect two neutral switch post terminals located on top of transmission.

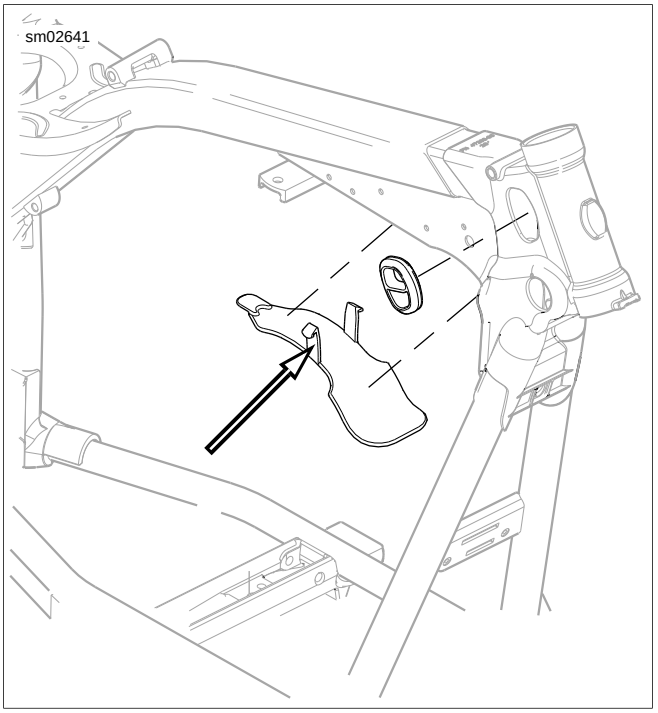


Figure 8-72. Harness Shield



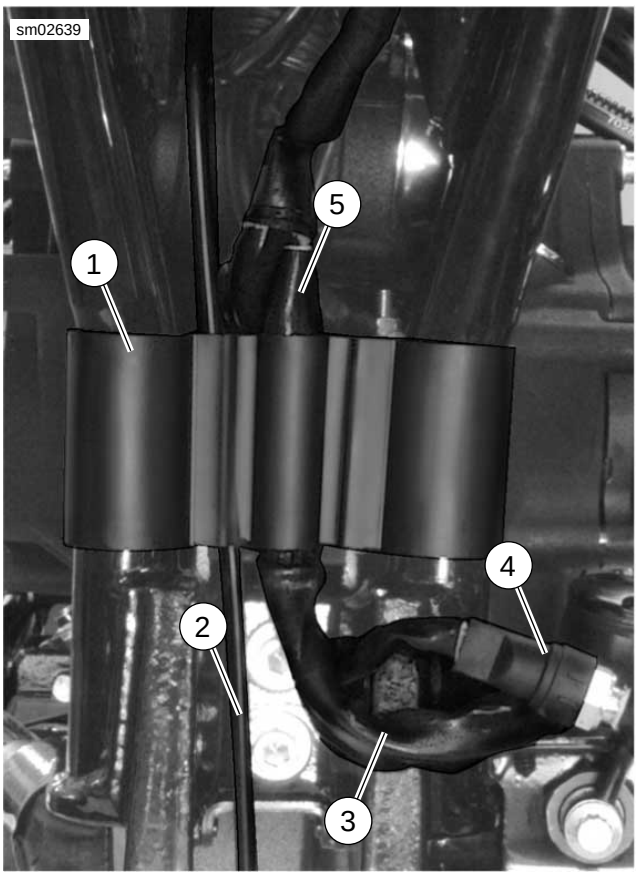
Figure 8-73. Vehicle Ground Studs

20. Remove rear stop light switch terminals. See 8.24 REAR STOPLIGHT SWITCH.
21. Remove starter post nut, positive battery cable and main wiring harness ring terminal from starter post.
22. Disconnect rear fender extension from fender.
23. See Figure 8-74. Slide wire harness retainer up frame tubes. Remove harness retainer from frame and harness.
24. Remove the following connectors located in fuel tank area:
    a. MAP sensor connector [80].
    b. Horn wires.
    c. IAT sensor connector [89].
    d. ET sensor connector [90].
    e. IAC connector [87].
    f. TP sensor connector [88].
    g. Front [84] and rear [85] fuel injector connectors.
25. Disconnect voltage regulator connector [77], crank position sensor connector [79], stator connector [46] and front oxygen sensor [138]. See 8.5 VOLTAGE REGULATOR.
26. Disconnect oil pressure switch connector [120].
27. On HDI vehicles, remove intake solenoid connector [178] from air cleaner backing plate.
28. Disassemble voltage regulator connector.

NOTE

The upper portion of the wiring harness is now free. Be careful to note routing before pulling harness out of position.

29. Attach a long thin wire to the top end of the wiring harness before pulling harness through frame backbone. This guide wire will aid in pulling the new harness back through the backbone.
30. Gently pull wiring harness out of rear of frame tube.



1. **Wire harness retainer**
2. **Vent line**
3. **To front of vehicle**
4. **Rear brake light switch**
5. **Front engine harness**

Figure 8-74. Main Wire Harness (Typical)

INSTALLATION

NOTES

- *Be sure to replace all cable straps and anchors.*
- *Do not remove factory installed wire harness tape securing connectors to harness unless necessary.*

1. Guide wiring harness back into frame backbone. Pull the front of the harness through using the guide wire while pushing the harness through the frame tube opening.
2. Connect the following connectors.
   a. Right handlebar controls [22] (6-place Deutsch).
   b. Left handlebar controls [24] (6-Place Deutsch).
   c. Instruments [20].
   d. Turn signals [31].
   e. (FXDL/FXDB models) Instruments [21].
   f. Headlamp [38].

NOTE

Be sure to leave enough slack in harness at front of vehicle so when front wheel is turned, harness does not bind.

3. Install connectors into frame. Install harness shield.
4. To ease installation, wrap voltage regulator terminals with electrical tape.
5. See Figure 8-74. Route engine harness (which contains voltage regulator connector [77], crank position sensor connector [79], stator connector [46] and front oxygen sensor [138] wiring to front of vehicle as shown. Install the oxygen sensor and crank position sensor connectors in front electrical caddy (see 8.13 CRANK POSITION SENSOR (CKP)). Connect the engine harness and stator connectors to the voltage regulator.
6. Route rear brake switch wiring (4) as shown and connect to rear brake switch.
7. Route neutral switch wiring and connect to neutral switch.
8. Route starter solenoid wiring and connect to starter solenoid.
9. Install rear brake master cylinder and rear brake control. See 2.14 REAR BRAKE MASTER CYLINDER.
10. Secure front engine harness with harness clamps.
11. Install wire harness retainer (1).
12. Connect rear fender extension to rear fender.

NOTES

- *See Figure 8-74. To prevent contact with rear fork, front engine harness (5) and rear brake switch wiring must be secured in wire harness retainer (1).*
- *If equipped with jiffy stand sensor (HDI models only), route the sensor harness up along the vent line (2) and secure in the same retainer cavity as the vent line.*

13. Connect oil pressure switch [120].
14. See Figure 8-75. Connect vehicle speed sensor connector [65].
15. See Figure 8-76. Secure harness grounds to studs.
16. Route top engine harness to fuel tank area.
17. Connect:
    a. MAP sensor connector [80].
    b. Horn wires.
    c. IAT sensor connector [89].
    d. ET sensor connector [90].
    e. IAC connector [87].
    f. TP sensor connector [88].
    g. Front [84] and rear [85] fuel injector connectors.
18. Install electrical caddy and wiring. See 8.2 ELECTRICAL CADDY.
19. See Figure 8-78. Mate connectors located under seat:
    a. Accessory connector [4].
    b. Tail lamp harness connector [7].
    c. Rear oxygen sensor [137].
    d. Security siren connector [142] if security siren installed.
    e. B+ connector [160].

20. On HDI vehicles, install active exhaust module connector [179] located in front of electrical caddy.
21. Install fuel tank. See 4.5 FUEL TANK. This includes connecting fuel gauge connector [117].
22. Install instrument console.
    a. For FXDWG/FXDC/FXDF models, see 8.17 INSTRUMENTS: FXDWG/FXDC/FXDF.
    b. For FXDL, FXDB models, see 8.18 INSTRUMENTS: FXDL/FXDB.
    c. For FXD models, see 8.15 FUEL GAUGE.
23. Install exhaust. See 4.16 EXHAUST SYSTEM.

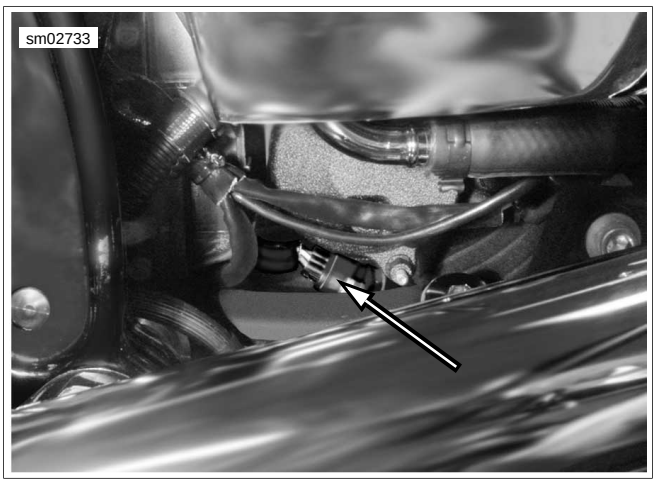
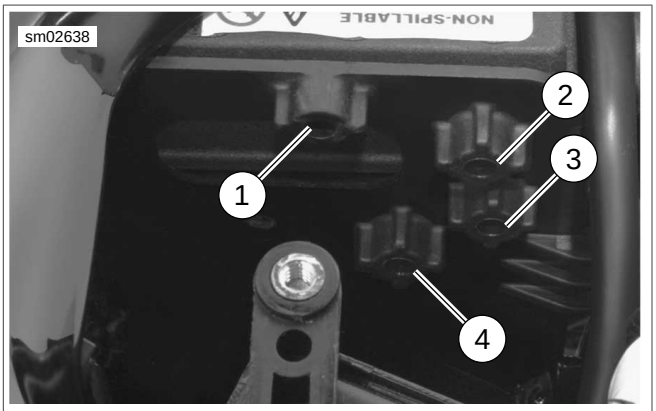


Figure 8-75. Vehicle Speed Sensor

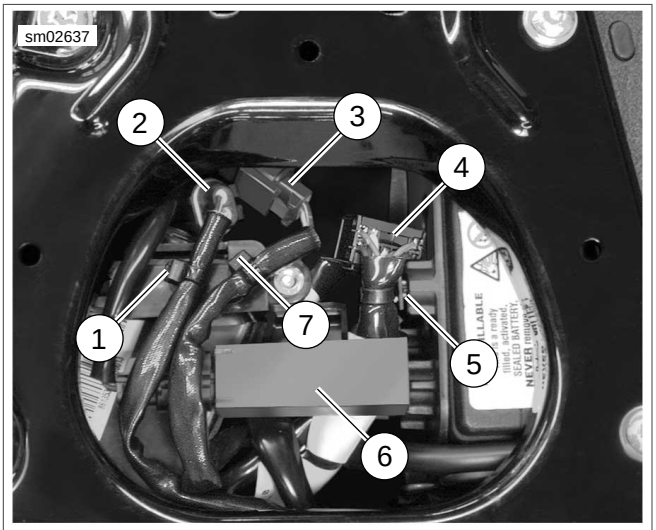


Figure 8-76. Vehicle Ground Studs



1. **Tail lamp connector location**
2. **B+ connector location**
3. **Accessory connector location**
4. **Unused**

Figure 8-77. Under Seat Connector Mounting Locations



1. **Cable strap anchor**
2. **Rear O2 sensor connector [137]**
3. **IAT sensor connector [89]**
4. **Tail lamp connector [7]**
5. **Cable strap anchor**
6. **HFSM antenna**
7. **Cable strap anchor**

Figure 8-78. Under Seat Wiring

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)

24. Install battery and battery tray.

⚠WARNING

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

25. Install seat.

⚠WARNING

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

26. Turn ignition ON. Test all electrical components for correct operation.

GENERAL

The switches are of rugged construction and feature a superior seal to protect electrical contacts and components from dirt and moisture in harsh environments.

The left handlebar switches include the headlamp HI - LO switch, horn and left turn signal switch. The right handlebar switches include the engine start and RUN - OFF switch and right turn signal switch. The individual switches are non-repairable and must be replaced if they malfunction.

NOTES

- *On certain models, the turn signal wiring is routed through the lower switch housings and handlebars.*
- *To replace or repair individual switches in either the right or left handlebar switch assemblies, see 8.29 RIGHT HANDLEBAR SWITCH or 8.30 LEFT HANDLEBAR SWITCH.*

REPAIR PROCEDURES

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-39969	ULTRA TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

See 8.29 RIGHT HANDLEBAR SWITCH and 8.30 LEFT HANDLEBAR SWITCH. The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

The information below is useful when repairing handlebar switch assemblies.

1. To better access wires and avoid damaging conduit with radiant heating device, push conduit back and secure with extra 7.0 in. (177.8 mm) cable strap in kit.
2. Strip 0.5 in (12.7 mm) of insulation off switch wires. Twist stripped ends of switch wires until all strands are tightly coiled.
3. Cut dual wall heat-shrink tubing, supplied in repair kit into 1.0 in. (25.4 mm) segments. Slide tubing over each wire of **new** switch assembly.
4. Splice existing and **new** switch wires, matching wire colors. Solder the spliced connections. For best results, do one wire at a time.
5. Center the heat-shrink tubing over the soldered splices.

⚠WARNING

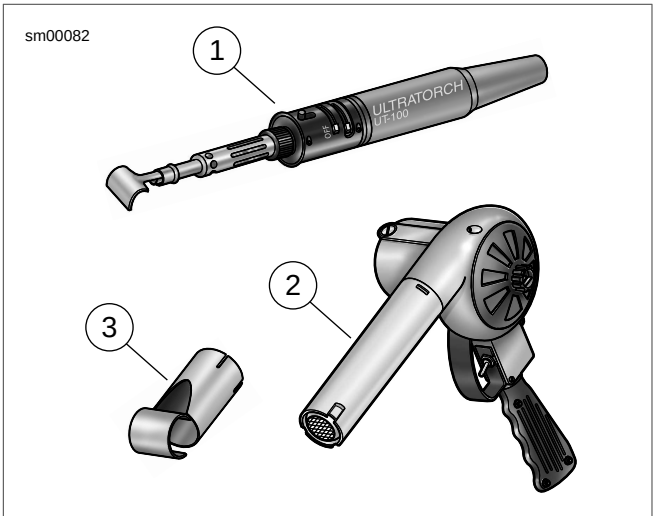
Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

6. See Figure 8-79. Using the ULTRA TORCH UT-100 (Part No. HD-39969) or ROBINAIR HEAT GUN (Part No. HD-25070) with HEAT SHIELD ATTACHMENT (Part No. HD-41183) or other suitable radiant heating device, uniformly heat the heat-shrink tubing to insulate and seal the soldered connections. Apply heat just until the meltable sealant exudes out both ends of tubing and it assumes a smooth cylindrical appearance.
7. Inspect the melted sealant for solder beads. Excess solder or heat may force some solder out with the melted sealant. Use a small needle nose pliers to remove any solder found. Briefly heat the connection to reseal the tubing if solder beads were removed. Use less solder or reduce heating time or intensity when doing subsequent splices.

⚠WARNING

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



1. **Ultra Torch UT-100**
2. **Robinair Heat Gun**
3. **Robinair Heat Gun Shrink Tool Attachment**

Figure 8-79. Radiant Heating Devices

REMOVAL

NOTE

The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

CAUTION

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

1. Remove maxi-fuse.
2. See Figure 8-80. Place the 5/32 in. (4 mm) thickness cardboard insert between the brake lever and lever bracket.
3. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the master cylinder housing. Remove the brake lever/master cylinder assembly and clamp from the handlebar.
4. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
5. Remove the friction shoe from the end of the tension adjuster screw.

NOTE

The friction screw is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.

6. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.
7. Remove the throttle control grip from the end of the handlebar.
8. Pull the crimped inserts at the end of the throttle and idle control cable housings from the lower switch housing. For best results, use a rocking motion while pulling. Place a drop of light oil on the retaining rings, if necessary. Remove the cables from the switch housing.

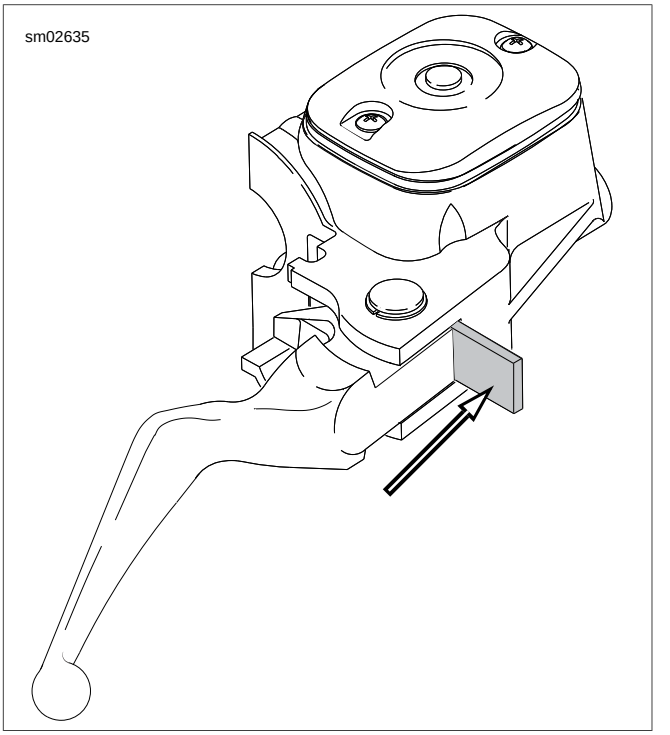


Figure 8-80. Install 5/32 in. (4 mm) Thickness Cardboard Insert

INSTALLATION

1. With the concave side facing upward, install the friction shoe so that the pin hole is over the point of the adjuster screw.

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.

2. See Figure 8-81. Push the throttle and idle control cables into the lower switch housing until they snap in place. Note the different diameter inserts crimped into the end of the throttle and idle cable housings.
   a. Push the silver insert (2) of throttle cable housing into the hole in front of tension adjuster screw (3).
   b. Push the gold insert (1) of idle cable housing into the hole at the rear of tension adjuster screw (3).

NOTE

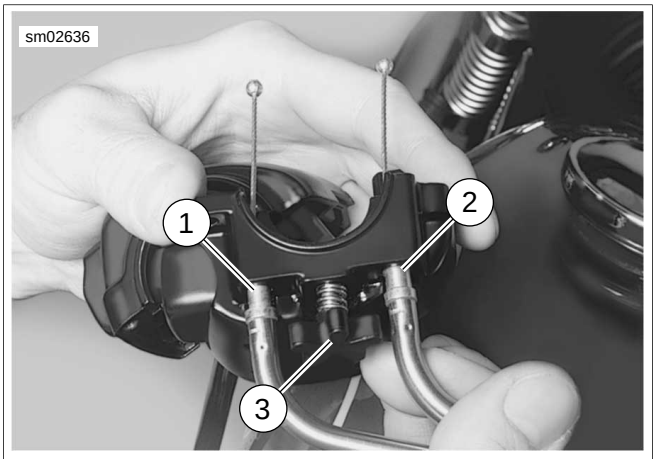
To aid assembly, place a drop of light oil on the retaining rings of the crimped inserts. Always replace the retaining rings if damaged or distorted.

3. See Figure 8-82. Route the cable (2) to the upper switch housing as shown.
4. Slide the throttle control grip over the end of the right handlebar until it bottoms against the closed end. Rotate the grip so that the ferrule notches are at the top. To prevent binding, pull the grip back about 1/8 in. (3.2 mm).

5. See Figure 8-83. Position lower switch housing beneath the throttle control grip. Install the brass ferrules (4) onto the cable so that the end fittings seat in the ferrule recess. Seat the ferrules in their respective notches (3) on the throttle control grip. Verify that the cables are captured in the grooves (2) molded into the grip.
6. Position the upper switch housing over the handlebar and lower switch housing.
7. Verify that the wire harness conduit runs in the depression at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.
8. Start the upper and lower switch housing screws, but do not tighten.

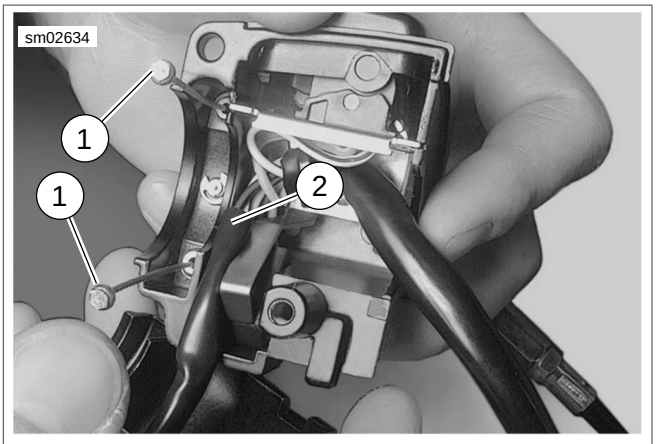
CAUTION

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



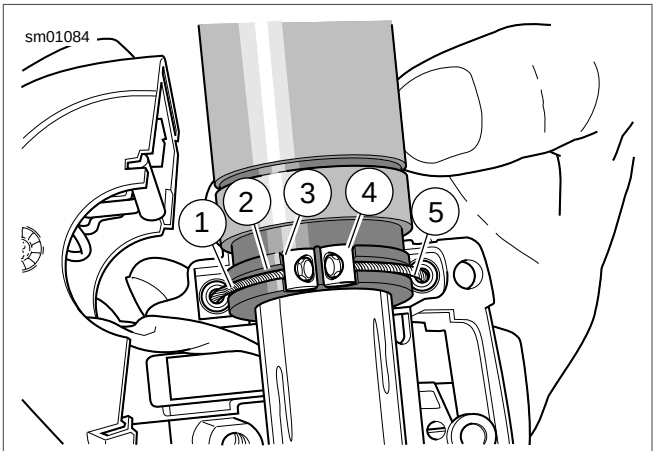
1. **Idle cable insert (gold insert, rear hole)**
2. **Throttle cable insert (silver insert, front hole)**
3. **Tension adjuster screw**

Figure 8-81. Right Lower Switch Housing



1. **End fittings**
2. **Upper switch housing cable**

Figure 8-82. Route Cable to Upper Switch Housing



1. **Throttle cable (silver insert, front hole)**
2. **Groove in throttle grip**
3. **Notch**
4. **Brass ferrule**
5. **Idle cable (gold insert, rear hole)**

Figure 8-83. Throttle Cable Attachment

9. See Figure 8-84. Position the brake lever/master cylinder assembly inboard of the switch housing assembly, engaging the tab (2) on the lower switch housing in the groove (3) at the top of the brake lever bracket.
10. Align the holes in the handlebar switch clamp with those in the master cylinder housing and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten to specification using a T27 TORX drive head. Refer to Table 8-10.
11. Using a T25 TORX drive head, tighten lower and upper switch housing screws to specification. Refer to Table 8-10.

NOTE

Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.

Table 8-10. Handlebar Switch Assembly Fasteners: Dyna Models

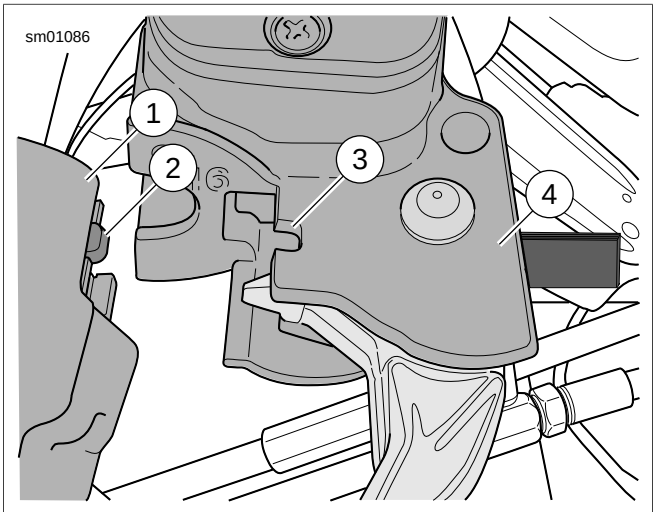
FASTENER	TORQUE
Handlebar switch clamp screws	60-80 **in-lbs** (6.8-9.0 Nm)
Switch housing screws	35-45 **in-lbs** (4.0-5.1 Nm)

12. Remove the cardboard insert between the brake lever and lever bracket.
13. Install maxi-fuse. See 8.6 FUSES AND RELAYS.

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)

14. Test the switches for proper operation.
15. If necessary, secure wire harness conduit to handlebar using **new** cable strap. Position cable strap approximately 4.0-5.0 in. (100-127 mm) from handlebar clamp. Cut any excess cable strap material.



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

Figure 8-84. Switch Housing Alignment (typical)



1. **Upper screw**
2. **Lower screw and flat washer**

Figure 8-85. Handlebar Switch Clamp Screws

DISASSEMBLY

CAUTION

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

1. Place the cardboard insert between the brake lever and lever bracket.
2. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
3. If replacing lower housing switches, perform steps 4 through 7 before continuing to repair section. If replacing upper housing switches, proceed directly to repair section.
4. See Figure 8-85. Using a T27 TORX drive head, loosen the upper screw (1) securing the handlebar switch clamp to the master cylinder housing. Remove the lower clamp screw with flat washer (2).
5. Remove the brass ferrules from the notches on the inboard side of the throttle control grip. Remove the ferrules from the cable end fittings.
6. Remove the friction shoe from the end of the tension adjuster screw.

NOTE

The friction shoe is a loose fit and may fall out or become dislodged if the lower switch housing is turned upside down or shaken.

7. Remove the throttle control grip from the end of the handlebar.

SWITCH REPAIR/REPLACEMENT

Upper Housing Repair

NOTE

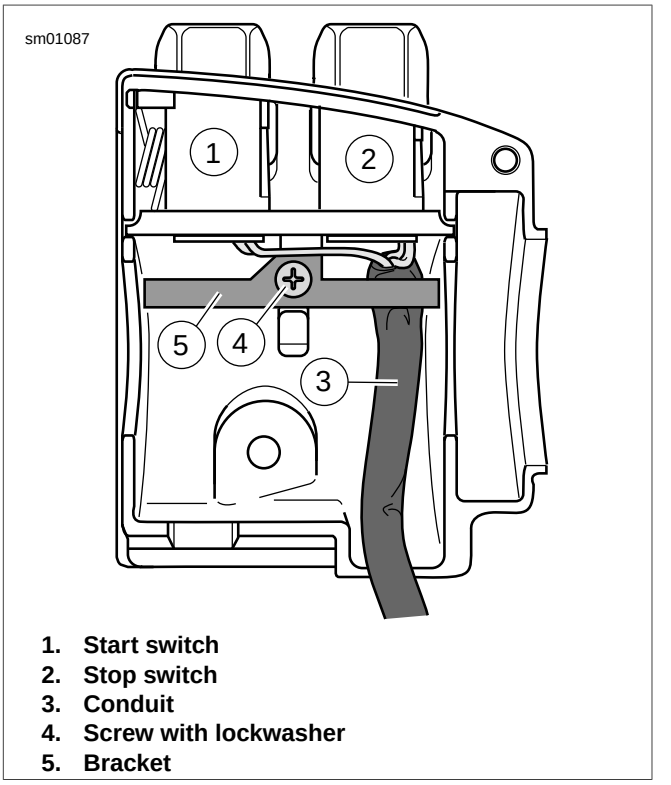
Replace the engine stop and engine start switches as a single assembly even if only one switch is determined to be faulty.

1. See Figure 8-86. From inside the switch housing, remove the screw with lockwasher (4) to release the bracket (5). Remove the bracket and switch assembly from the housing.
2. Move cable conduit (3) from beneath wing of bracket. Cut wires 0.25 in. (6.4 mm) from old switches (1, 2). Discard old switch and bracket assembly.
3. Slide conduit forward over cut ends of switch wires and cut off 0.5 in. (12.7 mm) of conduit (3) material. Push conduit back to access switch wires.
4. Separate new engine stop switch (2) and engine start switch (1) wires into two bundles.

NOTE

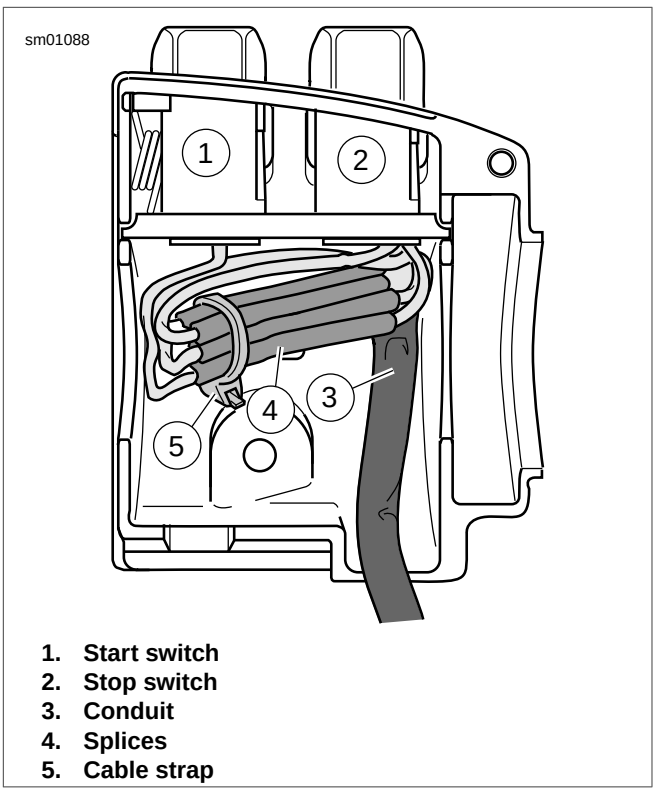
Replacement stop switch and start switch wires are cut to length; 2.5 in. (63.5 mm) and 2.0 in. (50.8 mm) respectively, and partially stripped.

5. See 8.28 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 8-87. Route wires downstream of splices beneath wing on engine stop switch side of bracket as shown in Figure 8-86.
7. See Figure 8-87. Install a **new** 7.0 in. (177.8 mm) cable strap (5) beneath wing on engine start switch side (1) of bracket and capture wire splices (4).
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at the edge of the boss captures the bottom edge of the bracket, while tabs on each side of the bracket fit in slots cast into the housing.
9. See Figure 8-86. Install screw and lockwasher (4) to secure bracket (5) inside housing. Verify that wing on engine stop switch (2) side of bracket captures edge of conduit (3) as shown.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. Continue with 8.29 RIGHT HANDLEBAR SWITCH, Assembly.



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Screw with lockwasher**
5. **Bracket**

Figure 8-86. Upper Housing Without Splices



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 8-87. Upper Housing With Splices

Lower Housing Repair

1. From inside the switch housing, carefully cut cable strap to free conduit from the turn signal switch bracket.

2. Remove the screw with lockwasher to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.

3. Continue with TURN-RIGHT SIGNAL SWITCH or FRONT STOPLIGHT SWITCH procedures which follow.

Turn-Right Signal Switch

1. Perform steps in LOWER HOUSING REPAIR.

2. Cut wire 1.5 in. (38.1 mm) from old switch. Discard old switch assembly.

NOTE

Replacement turn-right signal switch wires are cut to length of 1.5 in. (38.1 mm) and partially stripped.

3. See 8.28 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.

4. Continue with 8.29 RIGHT HANDLEBAR SWITCH, Assembly.

Front Stoplight Switch

1. Perform steps in LOWER HOUSING REPAIR.

2. Carefully remove the wedge between the switch and switch housing, if present. To remove the switch from the housing, depress the plunger and slowly rotate switch upward while rocking slightly.

3. Cut wires 1.0 in. (25.4 mm) from old switch. Discard old switch.

NOTE

Replacement stoplight switch wires are cut to length of 2.5 in. (63.5 mm) and partially stripped.

4. See 8.28 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.

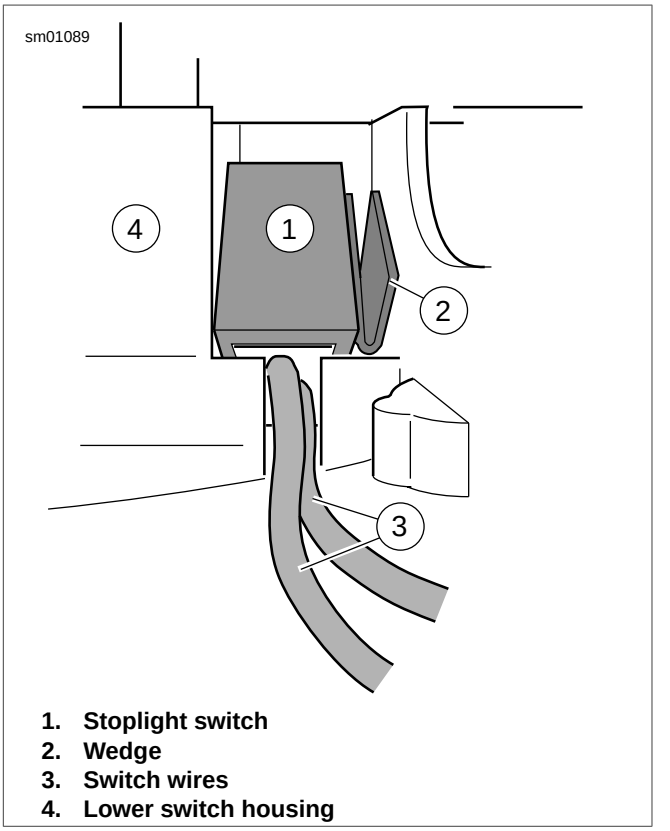
5. Carefully depress plunger against inside wall of switch housing. With thumb over plunger bore, move switch into the installed position in the switch housing cavity. When plunger is positioned against thumb, slowly rotate switch downward while rocking slightly. Release the plunger only after switch is properly positioned in the cavity.

6. Verify that the plunger is square in the bore and that the boot is not compressed, collapsed or torn. If necessary, gently work the plunger in and out until boot is fully extended.

7. See Figure 8-88. Push down on switch (1) so that it bottoms against housing and wires (3) run in groove at base of cavity. With the concave side facing outward, insert wedge (2) between switch and outboard side of switch housing.

8. Push wedge down until it also bottoms against housing. Verify that the plunger is still square in the bore and then place a drop of RTV Silicone Sealant on upper corner of wedge.

9. Continue with 8.29 RIGHT HANDLEBAR SWITCH, Assembly.



1. **Stoplight switch**
2. **Wedge**
3. **Switch wires**
4. **Lower switch housing**

Figure 8-88. Install Stoplight Switch

ASSEMBLY

1. See Figure 8-89. Insert tapered end of **new** 7.0 in. (177.8 mm) cable strap (1) into round hole in turn signal switch bracket (2) and then feed back through using the adjacent hole. Reserve the oblong hole for the bracket screw.

NOTE

Be sure that all splices are positioned above the turn signal switch bracket.

2. Place the turn signal switch assembly into the housing, aligning the oblong hole in the bracket with the threaded hole in the boss. Be sure that the bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.

3. Start screw with lockwasher to secure bracket inside housing.

CAUTION

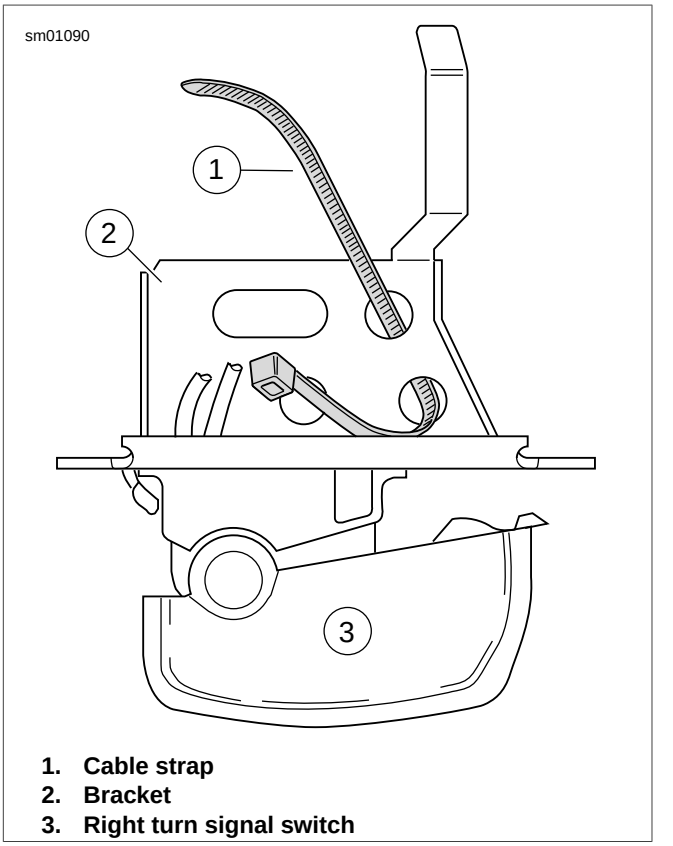
If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)

4. Loop switch wires so that spliced lengths are positioned across bracket.

5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.

6. Install second 7.0 in. (177.8 mm) cable strap capturing conduit and wire splices. Securely tighten cable strap to draw splices to conduit. Remove any excess cable strap material.

7. Tighten screw to secure bracket inside housing.
8. Route wire bundle to upper switch housing by gently pressing conduit into channel next to angular arm of bracket. Secure bundle to arm using third cable strap. Cut any excess cable strap material. If necessary, bend angular arm of bracket downward to firmly secure front stoplight switch in position.
9. See 8.29 RIGHT HANDLEBAR SWITCH, Installation.
   a. If lower housing switches were replaced, perform the entire procedure.
   b. If upper housing switches were replaced, begin with step 11.



1. **Cable strap**
2. **Bracket**
3. **Right turn signal switch**

Figure 8-89. Insert Cable Strap in Switch Bracket

REMOVAL

NOTE

The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

WARNING

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

1. Remove maxi-fuse. See 8.6 FUSES AND RELAYS.
2. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the clutch lever bracket. Remove the clutch hand lever assembly and clamp from the handlebar.
3. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
4. Remove the grip sleeve from the end of the handlebar if damaged.

INSTALLATION

1. If the grip sleeve was removed, thoroughly clean handlebar to remove all adhesive residue. Pour adhesive into new grip. Roll grip to evenly distribute adhesive on inside surfaces. Install grip on handlebar with a twisting motion.
2. See Figure 8-90. Install upper and lower switch housings on handlebar. Be sure that ribs (2) on outboard side of switch housings fit in grooves (3) molded into grip.
3. Verify that the wire harness conduit runs in the groove at the bottom of the handlebar. Be sure that the upper switch housing harness will not be pinched under the handlebar when the switch housing screws are tightened.
4. Start the upper and lower switch housing screws, but do not tighten.
5. See Figure 8-91. Position the clutch hand lever assembly inboard of the switch housing assembly, engaging the tab (3) on the lower switch housing in the groove (2) at the bottom of the clutch lever bracket.
6. Align the holes in the handlebar switch clamp with those in the clutch lever bracket and start the two screws (with flat washers). Position for rider comfort. Beginning with the top screw, tighten screws to specification with a T27 TORX drive head. Refer to Table 8-11.
7. Using a T25 TORX drive head, tighten lower and upper switch housing screws to specification. Refer to Table 8-11.

NOTE

Always tighten the lower switch housing screw first so that any gap between the upper and lower housings is at the front of the switch.

Table 8-11. Handlebar Switch Assembly Fasteners: Dyna Models

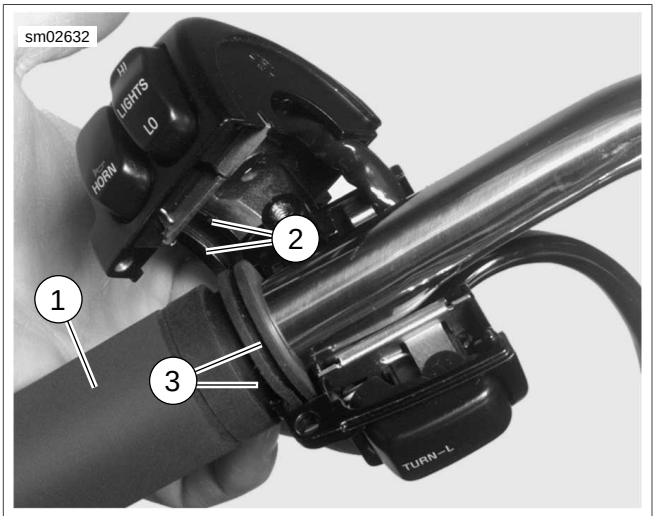
FASTENER	TORQUE
Handlebar switch clamp screws	60-80 **in-lbs** (6.8-9.0 Nm)
Switch housing screws	35-45 **in-lbs** (4.0-5.1 Nm)

8. Install maxi-fuse. See 8.6 FUSES AND RELAYS.

WARNING

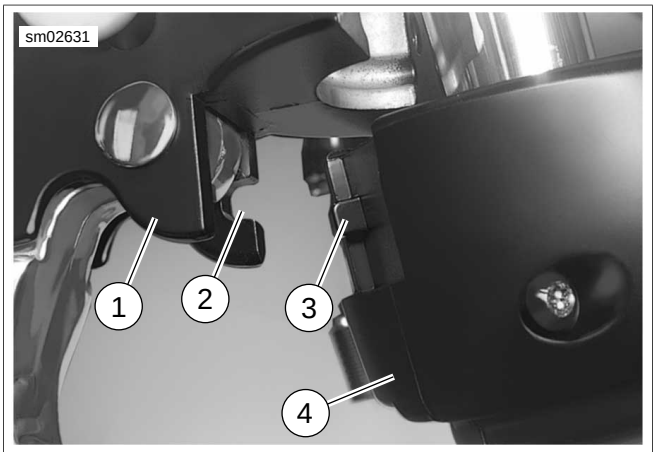
Be sure that all lights and switches operate properly before operating motorcycle. Low visibility of rider can result in death or serious injury. (00316a)

9. Test the switches for proper operation.
10. If necessary, secure wire harness conduit to handlebar using **new** cable strap. Position cable strap approximately 4-5 in. (100-127 mm) from handlebar clamp. Cut any excess cable strap material.



1. **Grip sleeve**
2. **Ribs**
3. **Grooves**

Figure 8-90. Left Handlebar Switch Housings



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

Figure 8-91. Clutch Lever Bracket

DISASSEMBLY

1. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
2. If replacing lower housing switches, perform next step before continuing to repair section. If replacing upper housing switches, proceed directly to repair section.
3. Using a T27 TORX drive head, loosen the upper screw securing the handlebar clamp to the clutch lever bracket. Remove the lower clamp screw with flat washer.

SWITCH REPAIR/REPLACEMENT

Upper Housing Repair

NOTE

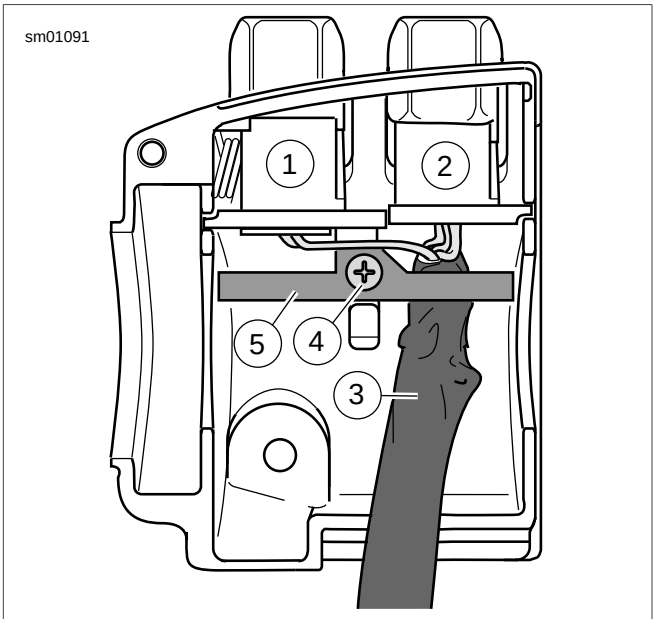
Replace the horn switch and high/low beam switch as a single assembly even if only one switch is determined to be faulty.

1. See Figure 8-92. From inside the switch housing, remove the screw with lockwasher (4) to release the bracket (5). Remove bracket and switch assembly from the housing.
2. Move cable conduit (3) from beneath wing of bracket. Cut wires 0.25 in. (6.4 mm) from old switches (1, 2). Discard old switch and bracket assembly.
3. Slide conduit forward over cut ends of switch wires and cut off 0.5 in. (12.7 mm) of conduit (3) material. Push conduit back to access switch wires.
4. Separate the new horn switch (1) and high/low beam switch (2) wires into two bundles.

NOTE

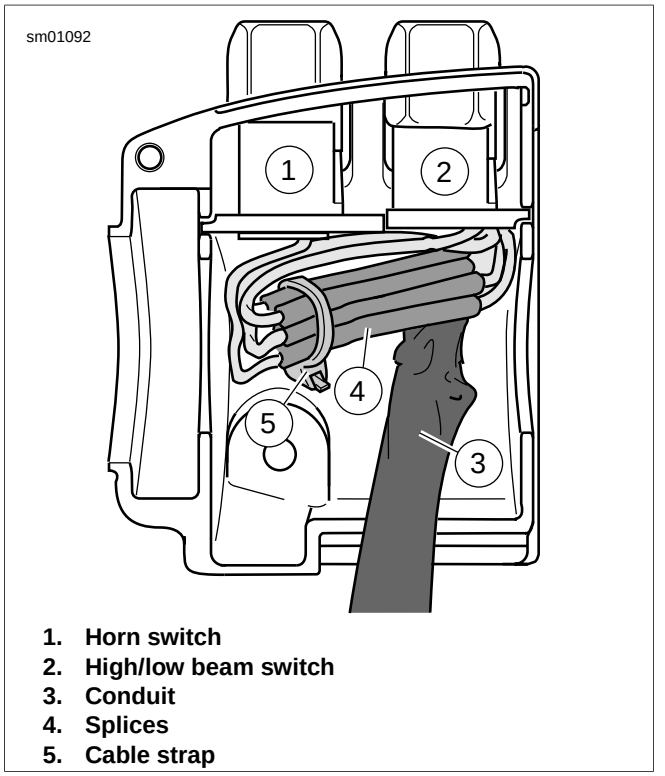
Replacement high/low beam switch and horn switch wires are cut to length of 2.5 in. (63.5 mm) and 2.0 in. (50.8 mm) respectively, and partially stripped.

5. See 8.28 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
6. Loop switch wires so that spliced lengths are positioned as shown in Figure 8-93. Route wires downstream of splices beneath wing on high/low beam switch side of bracket as shown in Figure 8-92.
7. See Figure 8-93. Install a **new** 7.0 in. (177.8 mm) cable strap (5) beneath wing on horn switch side (1) of bracket and capture wire splices (4).
8. Place switch assembly into upper housing aligning hole in bracket with threaded hole in boss. Be sure that bracket is fully seated. The step at the edge of the boss captures the bottom edge of the bracket, while tabs on each side of the bracket fit in slots cast into the housing.
9. See Figure 8-92. Install screw and lockwasher (4) to secure bracket (5) inside housing. Verify that wing on high/low switch (2) side of bracket captures edge of conduit (3) as shown.
10. Securely tighten cable strap to draw splices to bracket. Remove any excess cable strap material.
11. Continue with 8.30 LEFT HANDLEBAR SWITCH, Assembly.



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Screw with lockwasher**
5. **Bracket**

Figure 8-92. Upper Housing Without Splices



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 8-93. Upper Housing With Splices

Lower Housing Repair

1. From inside the switch housing, carefully cut cable strap to free conduit from the turn signal switch bracket.
2. Remove screw with lockwasher to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.
3. Continue with TURN-LEFT SIGNAL SWITCH or CLUTCH INTERLOCK SWITCH procedures.

Turn-Left Signal Switch

1. Perform steps in LOWER HOUSING REPAIR.
2. Cut wires 1.5 in. (38.1 mm) from old switch (Turn-L(eft) Signal Switch). Discard switch assembly.

NOTE

Replacement turn-right signal switch wires are cut to length of 1.5 in. (38.1 mm) and partially stripped.

3. See 8.28 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
4. Continue with 8.30 LEFT HANDLEBAR SWITCH, Assembly.

Clutch Interlock Switch

1. Perform steps in LOWER HOUSING REPAIR.
2. See Figure 8-94. Cut wires 0.25 in. (6.4 mm) from old switch. Discard switch assembly.

NOTE

Replacement turn-right signal switch wires are cut to length and partially stripped.

3. See 8.28 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
4. Continue with 8.30 LEFT HANDLEBAR SWITCH, Assembly.

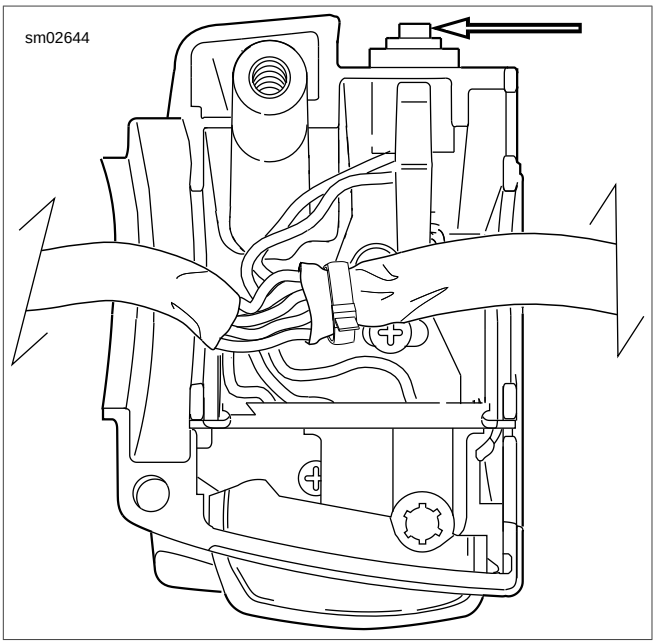


Figure 8-94. Clutch Interlock Switch

ASSEMBLY

1. See Figure 8-95. Insert tapered end of **new** 7.0 in. (177.8 mm) cable strap (1) into round hole in turn signal switch bracket (2) and then feed back through using the adjacent hole. Reserve the oblong hole for the bracket screw.

NOTE

Be sure that all splices are positioned above the turn signal switch bracket.

2. Place the turn signal switch assembly (3) into the housing, aligning the oblong hole in the bracket with the threaded hole in the boss. Be sure that the bracket is fully seated. Tabs on each side of bracket are captured in slots cast into switch housing.
3. Start screw with lockwasher to secure bracket inside housing.

CAUTION

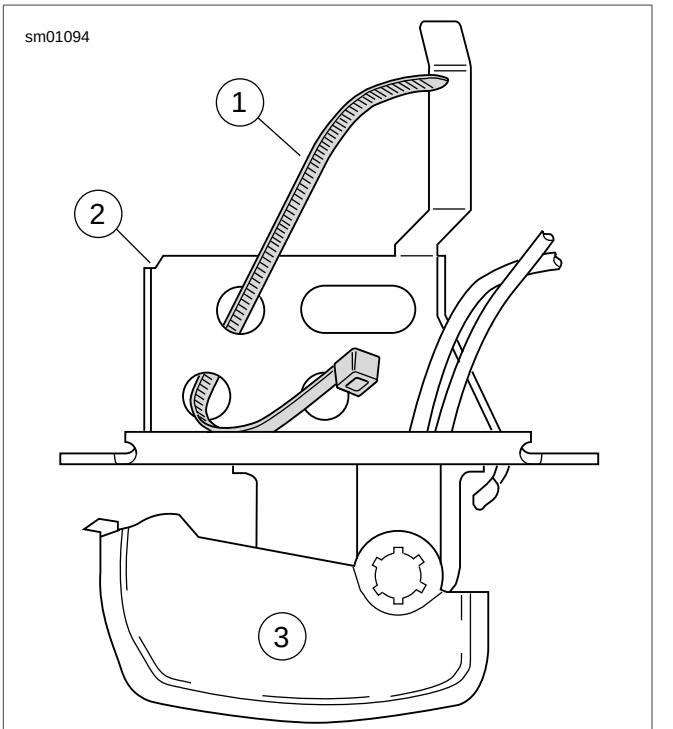
If routed incorrectly, wires can be pinched by casting or handlebar resulting in switch failure. (00542b)

4. Loop switch wires so that spliced lengths are positioned across bracket.
5. Capturing conduit about 0.25 in. (6.4 mm) from end, securely tighten cable strap to draw conduit to bracket. Remove any excess cable strap material.
6. Tighten screw to secure bracket inside housing.
7. Route wire bundle to upper switch housing below and then forward of the main wire harness, positioning conduit in channel next to angular arm of bracket. Secure bundle to

arm using new cable strap. Cut any excess cable strap material.

8. See 8.30 LEFT HANDLEBAR SWITCH, Installation.
   a. If lower housing switches were replaced, perform the whole procedure.
   b. If upper housing switches were replaced, begin with step 7.

9. Verify the operation of the clutch interlock switch. See the Electrical Diagnostic Manual.



1. **Cable strap**
2. **Bracket**
3. **Left turn signal switch**

Figure 8-95. Insert Cable Strap in Switch Bracket

NOTES

SUBJECT **PAGE NO.**

A.1 AMP 1-PLACE CONNECTORS....A-1
A.2 AMP MULTILOCK CONNECTORS....A-3
A.3 AUTOFUSE ELECTRICAL CONNECTORS....A-7
A.4 DELPHI CONNECTORS....A-8
A.5 DELPHI MAXI FUSE HOUSING....A-10
A.6 DEUTSCH ELECTRICAL CONNECTORS....A-12
A.7 DEUTSCH STANDARD TERMINAL REPAIR....A-16
A.8 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR....A-17
A.9 DEUTSCH MINI TERMINAL REPAIR....A-19
A.10 MOLEX CONNECTORS....A-20
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A.12 PACKARD 280 METRI-PACK RELAY AND FUSE BLOCK CONNECTORS....A-26
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NOTES

AMP 1-PLACE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-39621-27	SOCKET TERMINAL TOOL
HD-39621-28	PIN TERMINAL REMOVER

General

Obtain the necessary tools to repair the connector or terminals.

For terminal crimping, use the PACKARD TERMINAL CRIMPER (Part No. HD-38125-7).

Separating Pin and Socket Housings

Bend back the ears on the pin housing slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Push the pin and socket halves of the connector together until the latches click.

Removing Socket Terminals

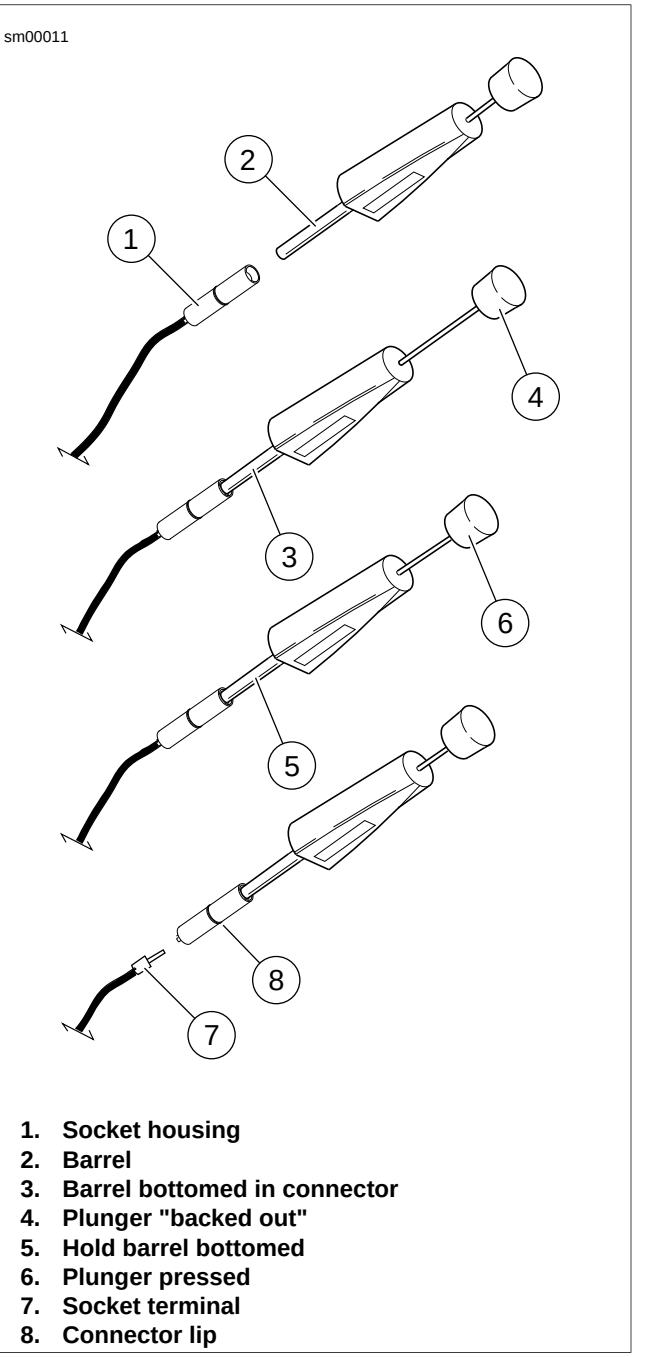
1. See Figure A-1. Grasp the lead on the wire end of the socket housing (1) and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.
2. Fit the barrel (2) of the SOCKET TERMINAL TOOL (Part No. HD-39621-27) over the socket.
3. While rotating the tool slightly, push until it bottoms (3) in the socket housing.
4. Allow the plunger (4) to "back out" of the handle.
5. Holding the socket housing while keeping the tool firmly bottomed (5), depress the plunger (6). The terminal (7) pops out the wire end of the connector.

NOTE

If the terminal is not released from the socket housing, then the terminal was not pushed forward far enough before placement of the tool or the tool was not bottomed in the connector housing.

Installing Socket Terminal

1. Note the lip at the middle of the socket housing. One side of the lip is flat while the other side is tapered. Insert the wire terminal into the socket housing on the flat (lip) side.
2. Push the lead into the socket housing until it stops. A click is heard when the terminal is properly seated.
3. Gently tug on the lead to verify that the terminal is locked in place.



1. **Socket housing**
2. **Barrel**
3. **Barrel bottomed in connector**
4. **Plunger "backed out"**
5. **Hold barrel bottomed**
6. **Plunger pressed**
7. **Socket terminal**
8. **Connector lip**

Figure A-1. Socket Terminal Tool (HD-39621-27)

Removing Pin Terminal

1. Grasp the lead on the wire end of the pin housing and push the terminal forward toward the mating end of the connector until it stops. This will disengage the locking tang from the groove in the connector.

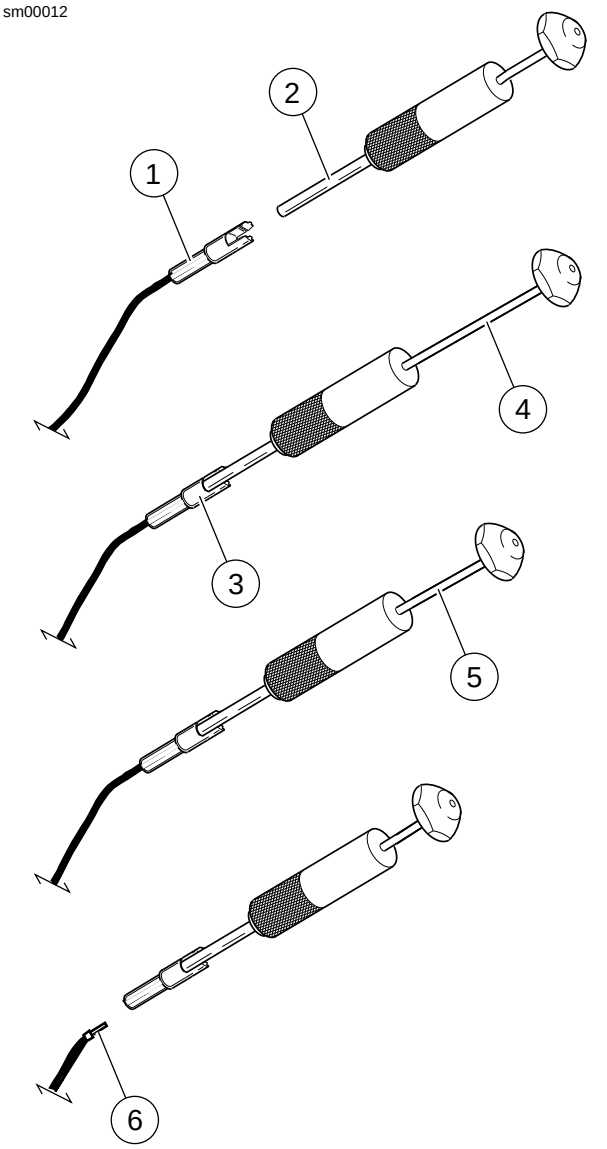
2. See Figure A-2.
   a. Fit the barrel of the PIN TERMINAL REMOVER (Part No. HD-39621-28) over the pin, and while rotating the tool slightly, push until it bottoms in the housing. Allow the plunger to "back out" of the handle.
   b. Holding the pin housing while keeping the tool firmly bottomed, depress the plunger. The terminal pops out the wire end of the connector.

NOTE

If the terminal is not released from the pin housing, then the terminal was not pushed forward far enough before placement of the tool or the tool was not bottomed in the connector housing.

Installing Pin Terminal

1. Push the lead into the pin housing until it stops. A click is heard when the terminal is properly seated.
2. Gently tug on the lead to verify that the terminal is locked in place.



1. **Pin housing**
2. **Barrel**
3. **Barrel bottomed in connector**
4. **Plunger backed out of the handle**
5. **Depressed plunger**
6. **Pin terminal**

Figure A-2. AMP Pin Terminal Remover (HD-39621-28)

AMP MULTILOCK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41609	AMP MULTILOCK CRIMPER

General

AMP Multilock connectors are found between wire harnesses and component wiring and may be either floating or anchored to the frame with attachment clips.

See Figure A-3. Attachment clips (1) on the pin housings are fitted to T-studs on the motorcycle frame. The T-studs identify OE connector locations. To maintain serviceability, always return connectors to OE locations after service.

Obtain the necessary tools to repair the connector and terminals.

NOTE

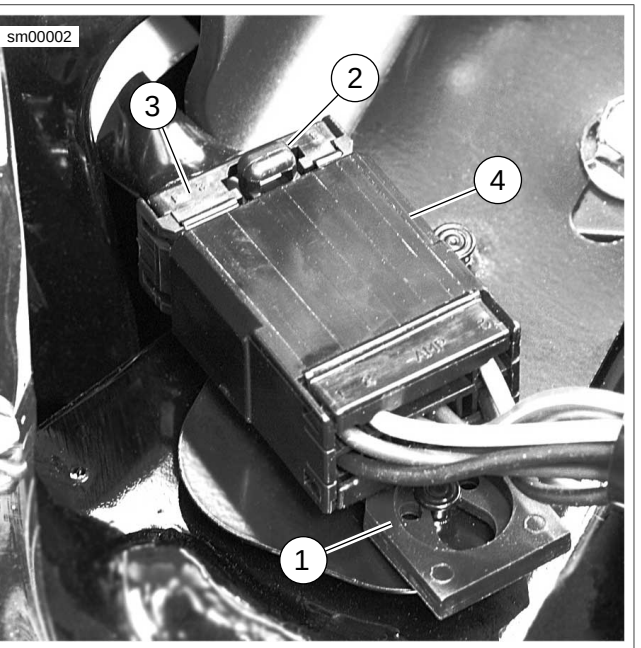
For terminal crimping use the AMP MULTILOCK CRIMPER (Part No. HD-41609).

Separating Pin and Socket Housings

1. If necessary, slide connector attachment clip T-stud to the large end of the opening.
2. See Figure A-3. Depress the release button (2) on the socket terminal side of the connector and pull the socket housing (3) out of the pin housing (4).

Mating Pin and Socket Housings

1. Hold the housings to match wire color to wire color.
2. Insert the socket housing into the pin housing until it snaps in place.
3. If OE location is a T-stud, fit large opening end of attachment clip over T-stud and slide connector to engage T-stud to small end of opening.



1. **Attachment clip**
2. **Release button**
3. **Socket housing**
4. **Pin housing**

Figure A-3. AMP Multilock Connector

Removing Terminals from Housing

1. See Figure A-4. Bend back the latch (1) to free one end of secondary lock (2) then repeat on the opposite end. Hinge the secondary lock outward.
2. Look in the terminal side of the connector (opposite the secondary lock) and note the cavity next to each terminal.
3. Insert a pick or pin into the terminal cavity until it stops.

NOTE

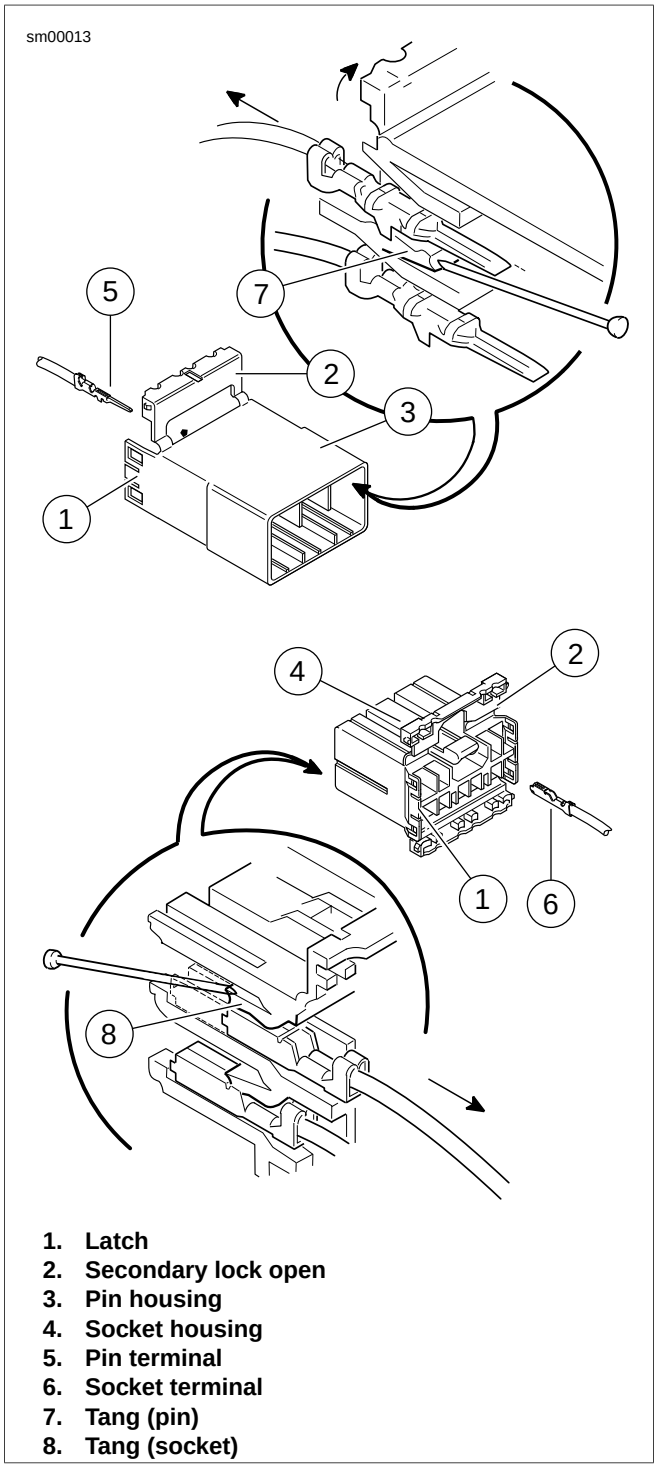
If socket/pin terminal tool is not available, a push pin/safety pin or a Snap-on pick (Part No. TT600-3) may be used.

4. Press the tang in the housing to release the terminal.
   a. **Socket:** Lift the socket tang (8) up.
   b. **Pin:** Press the pin tang (7) down.

NOTE

A "click" is heard if the tang is released.

5. Gently tug on wire to pull wire and terminal from cavity.



1. **Latch**
2. **Secondary lock open**
3. **Pin housing**
4. **Socket housing**
5. **Pin terminal**
6. **Socket terminal**
7. **Tang (pin)**
8. **Tang (socket)**

Figure A-4. AMP Multilock Connector: Socket and Pin Housings

Inserting Terminals into Housing

NOTE

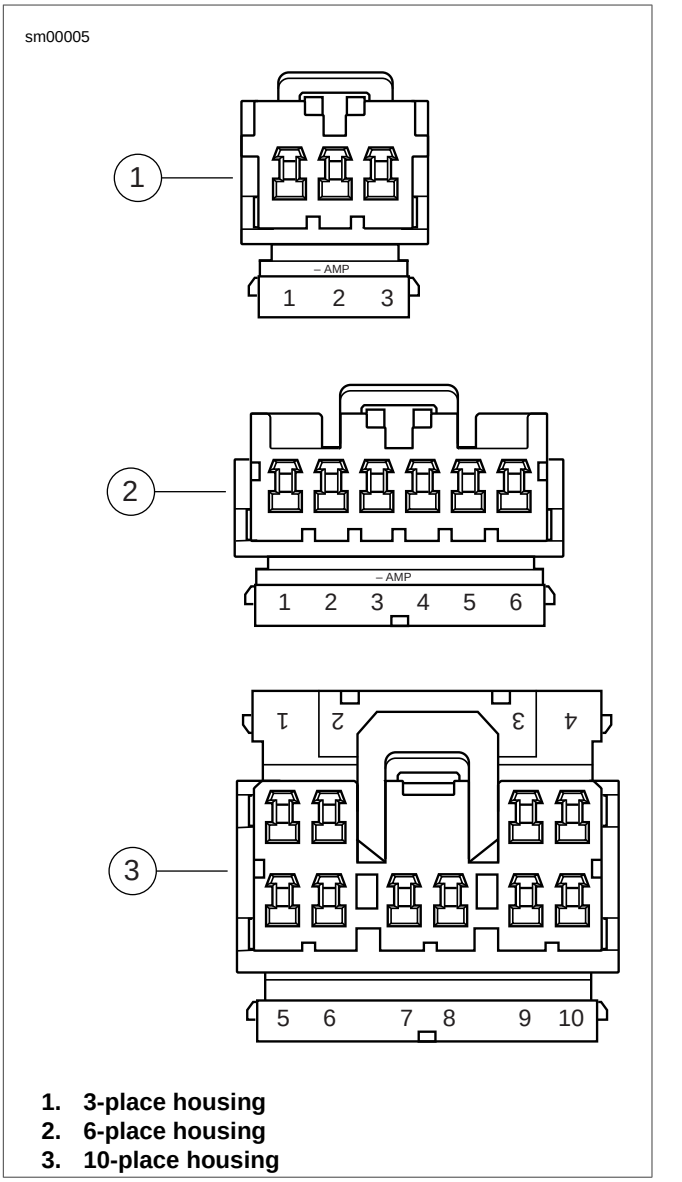
See Figure A-5. Cavity numbers are stamped into the secondary locks of both the socket and pin housings. Match the wire color to the cavity number found on the wiring diagram.

1. Hold the terminal so the catch faces the tang in the chamber. Insert the terminal into its numbered cavity until it snaps in place.

NOTES

- *Up and down can be determined by the position of the release button, the button is the top of the connector.*
- *On the pin side of the connector, tangs are positioned at the bottom of each cavity, so the slot in the pin terminal (on the side opposite the crimp tails) must face downward.*
- *On the socket side, tangs are at the top of each cavity, so the socket terminal slot (on the same side as the crimp tails) must face upward.*

2. Gently tug on wire end to verify that the terminal is locked in place.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.



1. **3-place housing**
2. **6-place housing**
3. **10-place housing**

Figure A-5. AMP Multilock Connector: Cavity Numbers on Secondary Locks (Socket Housings Shown)

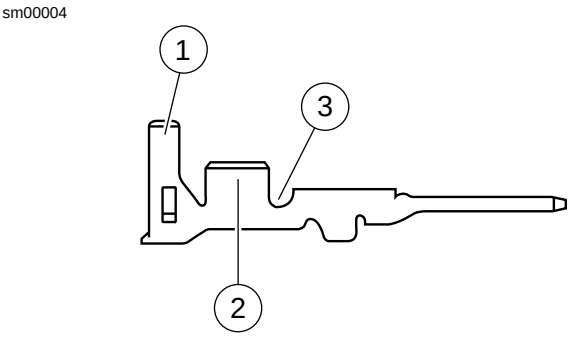
Preparing Wire Leads for Crimping

1. Strip 5/32 in. (4.0 mm) of insulation from the wire lead.

2. See Figure A-6 and Figure A-7. Select the pin/socket terminals from the parts catalog and identify the insulation crimp tails (1) and the wire crimp tails (2) and the groove for the crimp tool locking bar (3).
3. Identify the wire lead gauge and the corresponding crimper tool and nesting die. Refer to Table A-1.

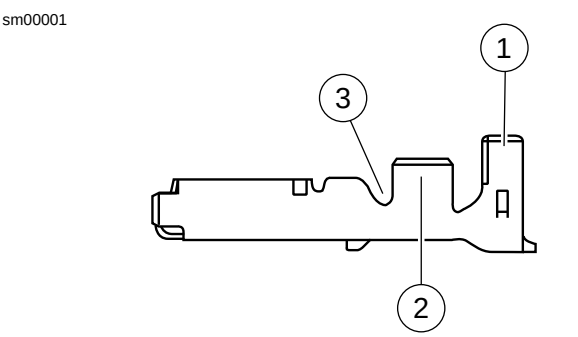
Table A-1. AMP Multilock Connector: Crimp Tool Wire Gauge/Nest

WIRE GAUGE	NEST
20	Front
16	Middle
18	Rear



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-6. AMP Multilock Connector: Pin Terminal



1. **Insulation crimp tail**
2. **Wire crimp tail**
3. **Locking bar groove**

Figure A-7. AMP Multilock Connector: Socket Terminal

Crimping Terminals to Leads

NOTE

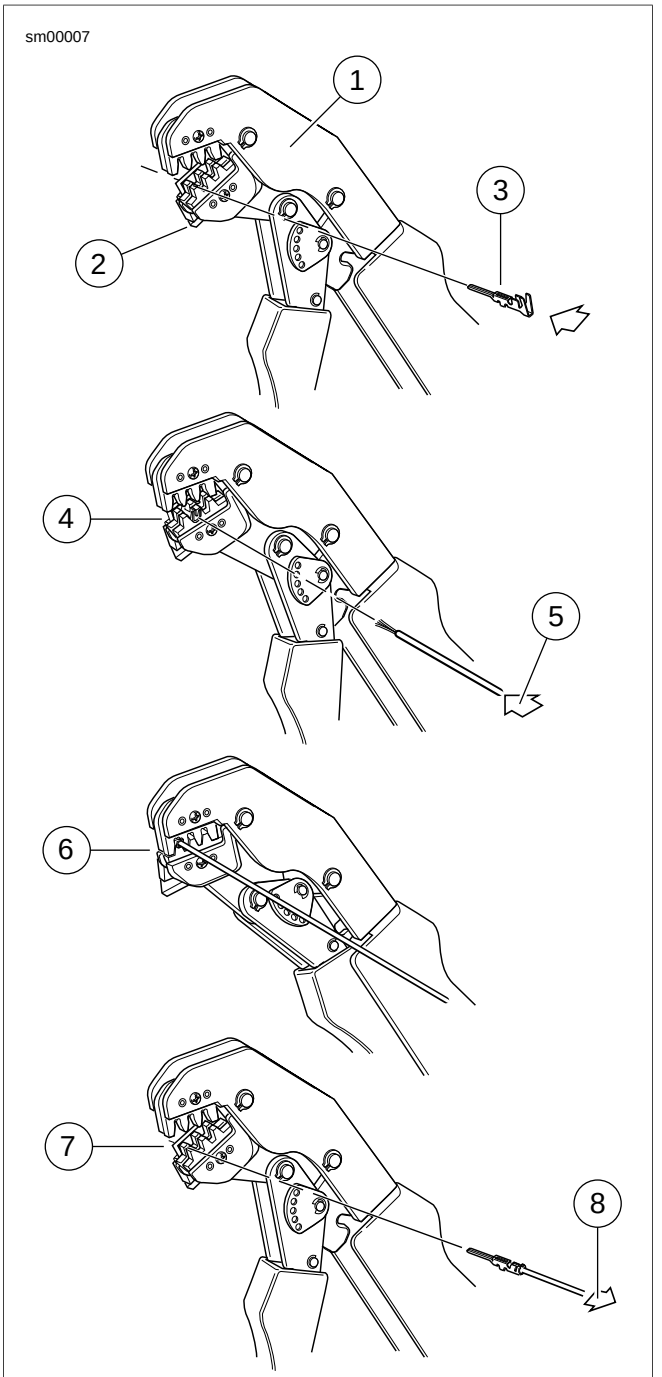
Crimping with an Amp Multilock tool is a one step operation. One squeeze crimps both the wire core and the insulation tails.

1. See Figure A-8. Squeeze the handles to cycle the AMP MULTILOCK CRIMPER (Part No. HD-41609) to the fully open position (1).
2. Raise locking bar by pushing up on bottom flange (2).

NOTE

See Figure A-6 and Figure A-7. Hold the terminal with the insulation crimp tail (1) facing up. The tool will hold the terminal by the locking bar groove (3) and crimp the wire crimp tail (2) around the bare wire of the stripped lead and the insulation crimp tail around the insulation.

3. See Figure A-8. With the insulation crimp tail facing upward, insert terminal (pin or socket) (3) through the locking bar, so that the closed side of the terminal rests on the nest of the crimp tool.
4. Release locking bar to lock position of contact (4). When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails.
5. Insert stripped end of lead (5) until ends make contact with locking bar.
6. Verify that wire is positioned so that wire crimp tails squeeze bare wire strands, while insulation crimp tails fold over the wire lead insulation.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. Raise up locking bar (8) and remove crimped terminal.

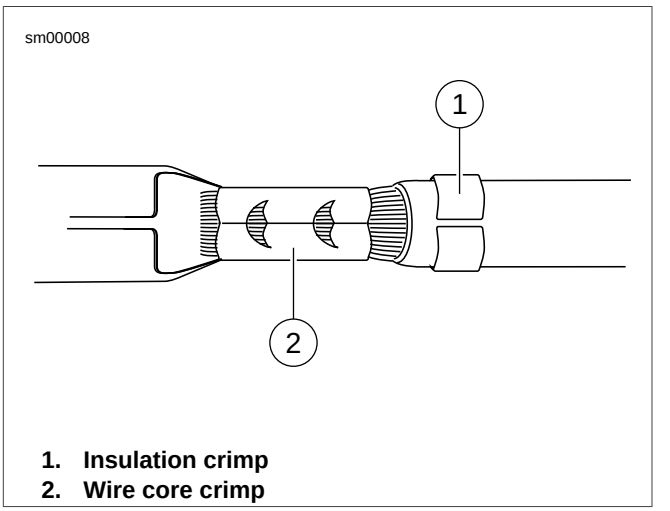


1. **Open position**
2. **Locking bar flange**
3. **Insert contact**
4. **Release locking bar**
5. **Insert lead**
6. **Squeeze**
7. **Raise locking bar**
8. **Remove crimped terminal**

Figure A-8. AMP Multilock Connector: Terminal Crimping Procedure

Inspecting Crimped Terminals

See Figure A-9. Inspect the wire core crimp (2) and insulation crimp (1). Distortion should be minimal.



1. **Insulation crimp**
2. **Wire core crimp**

Figure A-9. AMP Multilock Connector: Terminal Crimp

AUTOFUSE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
GA500A	SNAP-ON TERMINAL PICK

General

Autofuse electrical connector terminals are found in ignition switches and some fuse blocks.

Disassembly

1. Obtain SNAP-ON TERMINAL PICK (Part No. GA500A).
2. See Figure A-10 or Figure A-11. Insert smallest pair of pins into chamber on mating end of socket housing to depress tangs on each side of terminal simultaneously.
3. Gently pull on wire to remove terminal from wire end of socket housing.
4. If necessary, crimp new terminals on wires.

Assembly

1. Using a thin flat blade, like that on a hobby knife, carefully bend tang on each side of terminal outward away from terminal body.
2. With the open side of the terminal facing rib on wire end of socket housing, insert terminal into chamber until it locks in place.

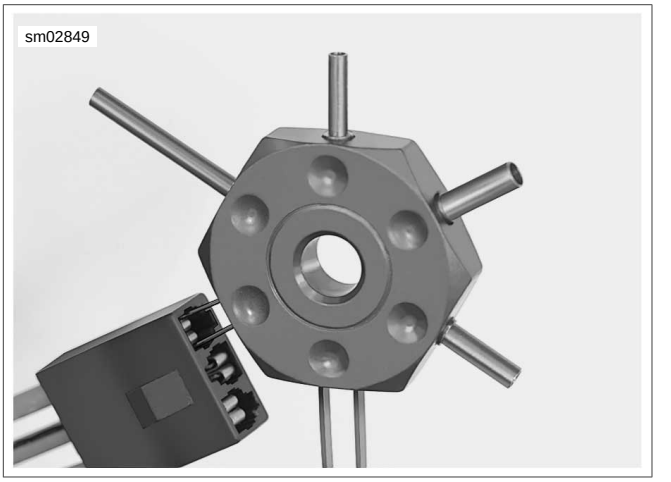


Figure A-10. Removing Autofuse Terminal from Ignition Switch

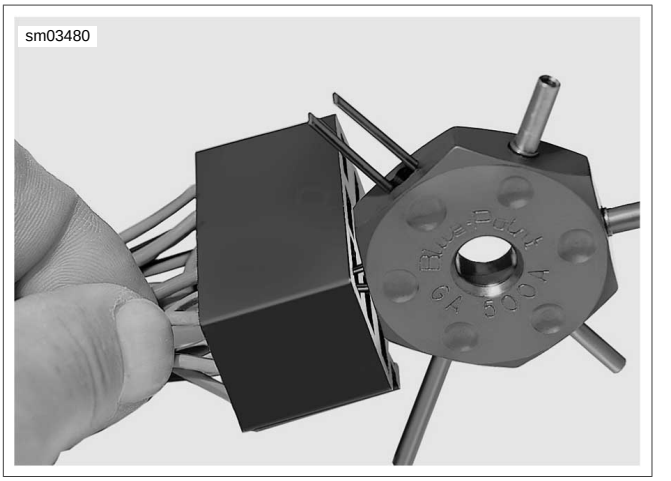


Figure A-11. Removing Autofuse Terminal from Fuse Block

DELPHI CONNECTOR REPAIR

General

Delphi connectors are embossed with the brand name, Delphi, on the housing latch.

Separating Pin and Socket Housings

See Figure A-12. Bend back the external latch(es) slightly and separate pin and socket halves of connector.

Mating Pin and Socket Housings

Push pin and socket halves of connector together until external latch(es) engage.

Removing Socket Terminals

NOTE

Although the parts of the different Delphi connectors vary in appearance, the instructions which follow will work for all. The only exception is the oil pressure sender connector [139B], the terminals of which are removed like the Packard push-to-seat connectors. Therefore, see A.11 PACKARD 150 METRI-PACK CONNECTORS to remove/install terminals in this connector.

1. See Figure A-13. If present, free one side of wire lock (1) from ear on wire end of socket housing, then release the other side. Release wires from channels in wire lock and remove from socket housing.
2. Use a fingernail to pry colored terminal lock (2) loose and then remove from mating end of socket housing.
3. Using a thin flat blade, like the unsharpened edge of a hobby knife, gently pry tang (3) outward away from terminal, and then tug on wire to back terminal out wire end of chamber. Do not pull on wire until tang is released or terminal will be difficult to remove.

Installing Socket Terminals

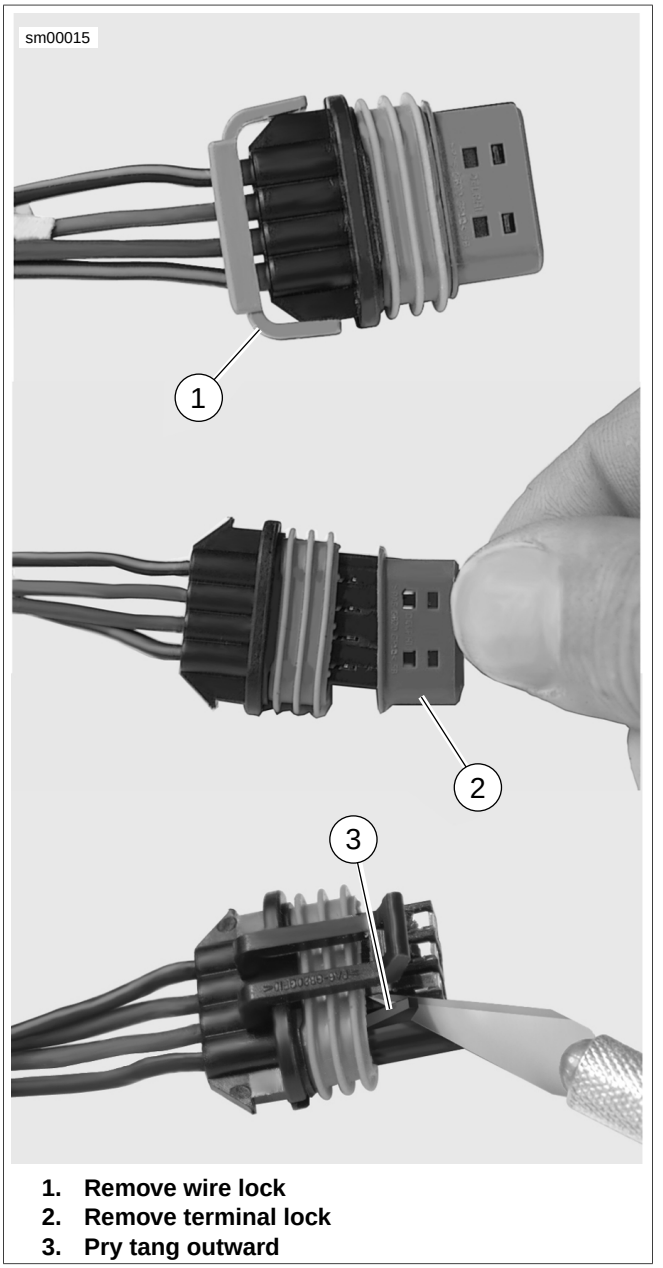
NOTE

For wire location purposes, alpha or numeric characters are stamped into the wire end of each socket housing.

1. Gently push tang on socket housing inward toward chamber. With the open side of the terminal facing the tang, push terminal into chamber at wire end of socket housing.
2. Gently tug on wire to verify that terminal is locked and will not back out of chamber. If necessary, use fingernail to push tang into engagement with terminal.
3. Install colored terminal lock onto mating end of socket housing.
4. If present, seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.



Figure A-12. Delphi Connector: Socket Housing Latch



1. **Remove wire lock**
2. **Remove terminal lock**
3. **Pry tang outward**

Figure A-13. Delphi Connector: Removing Socket Terminals

DELPHI MAXI-FUSE HOUSING REPAIR

General

A Delphi Maxi-fuse connector completes the circuit through the main fuse (Maxi-fuse).

Removing Maxi-Fuse

1. See Figure A-14. Depress latches on Maxi-fuse cover (1) and then slide cover off of connector (2).
2. Holding the connector (fuse holder), pull the Maxi-fuse out of the connector.

Installing Maxi-Fuse

1. Insert the blade terminals of the Maxi-fuse into the sockets of the connector and press the Maxi-fuse into the connector.
2. Slide the cover over the fuse until the cover clicks into place.

NOTE

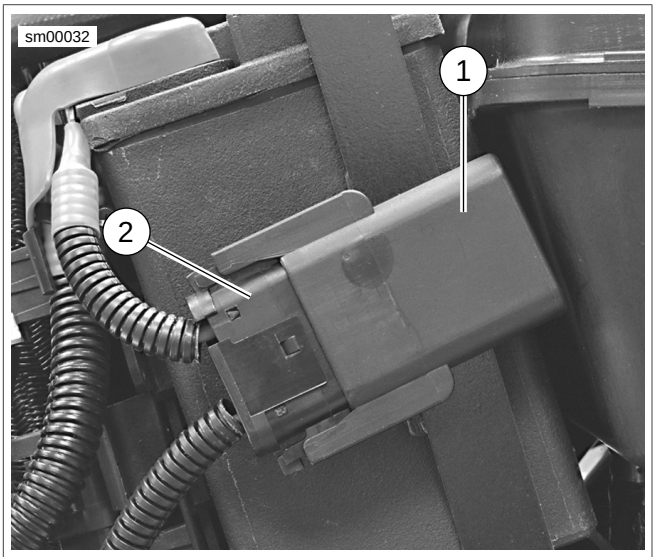
If removed from an OE attachment such as a grooved fuse block cover, engage cover and slide into place.

Removing Socket Terminals

1. See Figure A-15. Gently pull socket housing to disengage slots (1) on secondary lock (2) from tabs (3) on socket housing. Free secondary lock from cables and set aside.
2. Take note of the opening on one side of the socket terminal. Gently insert flat blade of pick (Snap-On TT600-5) or small screwdriver into opening (4) until it stops. Pivot the pick toward the terminal body and hold in position.
3. Tug on cable to pull socket from wire end of socket housing. A firm tug is necessary to overcome the resistance of the rubber seal.
4. Repeat to remove remaining socket terminal.

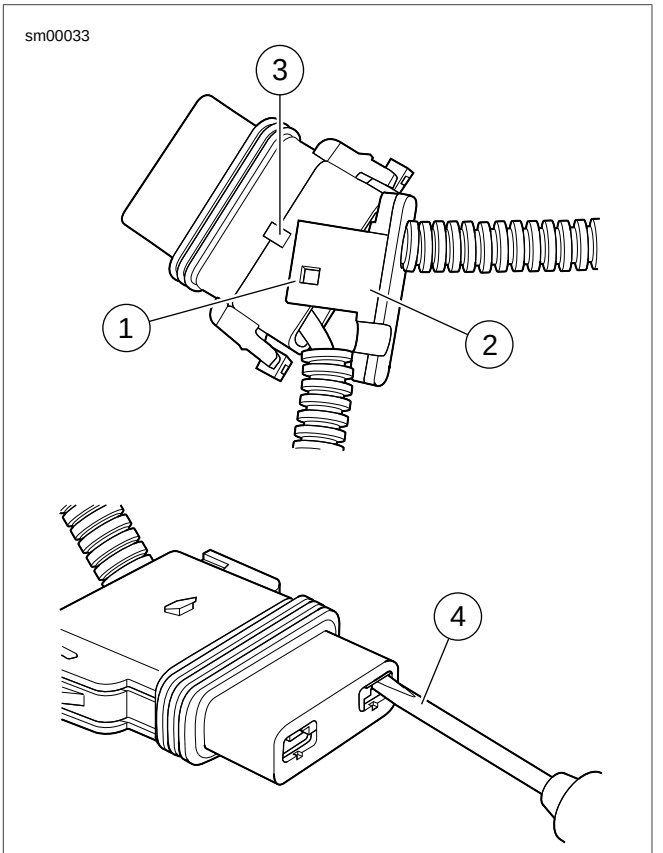
Installing Socket Terminals

1. See Figure A-16. Carefully bend tang outward away from the terminal body.
2. Feed socket into wire end of socket housing until it clicks in place. Verify that socket will not back out of chamber. A slight tug on the cable will confirm that it is locked.
3. Push rubber seal into wire end of socket housing.
4. Repeat to install remaining socket terminal.
5. Install secondary lock onto cables and then push onto wire end of socket housing until slots engage tabs on sides of socket housing.



1. **Maxi-fuse cover**
2. **Delphi Maxi-fuse housing**

Figure A-14. Delphi Connector Housing: Maxi-Fuse



1. **Secondary lock slot**
2. **Secondary lock**
3. **Tab**
4. **Insert flat blade into opening**

Figure A-15. Delphi Maxi-Fuse Housing: Remove Socket Terminals

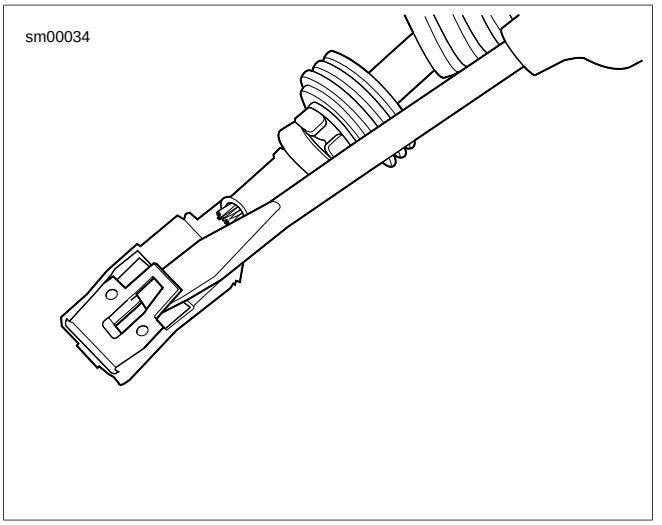


Figure A-16. Delphi Maxi-Fuse Housing: Bend Tang

DEUTSCH CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-41475	DEUTSCH CONNECTOR SERVICE KIT
HD-41475-100	FLAT BLADE L-HOOK

General

Deutsch connectors are colored coded for location purposes. Those connectors associated with **left** side accessories, such as the front and rear **left** turn signals, are **gray**. All other connectors, including those associated with right side accessories, are **black**.

NOTE

A DEUTSCH CONNECTOR SERVICE KIT (Part No. HD-41475) contains a selection of wire seals, internal seals, seal plugs, secondary locking wedges, attachment clips and socket/pin terminals. Also included is a compartmented storage box, carrying case and a FLAT BLADE L-HOOK (Part No. HD-41475-100) is used for the removal of all types of locking wedges.

Separating Pin and Socket Housings

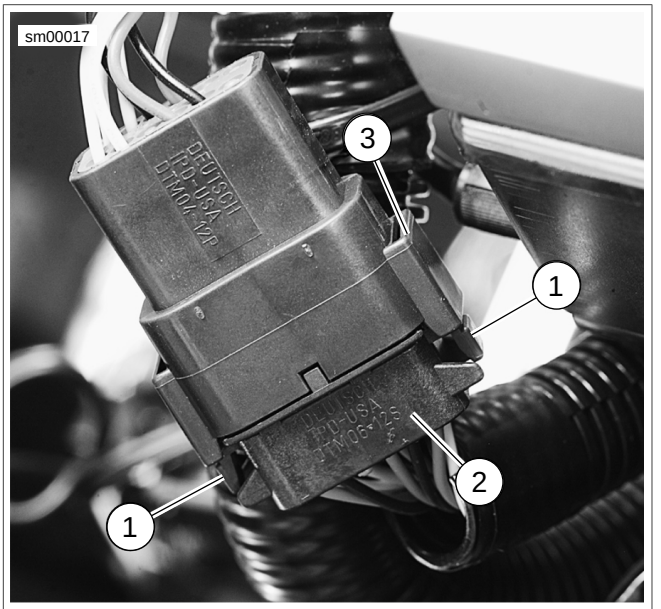
See Figure A-17. To separate the connector halves, depress the external latch(es) (1) on the socket housing (2) while rocking the pin (3) and socket housings.

NOTES

- *Generally, the socket housing is found on the accessory side, while the pin housing is plumbed to the wiring harness.*
- *Two-, three-, four- and six-place Deutsch connectors have one latch on the connector.*
- *Eight- and twelve-place connectors have a latch on each side. Simultaneously press both latches to separate the connector.*

Mating Pin and Socket Housings

1. Align the connectors to match the wire lead colors.
   a. **For One External Latch:** Two-, three-, four- and six-place Deutsch connectors have one external latch on the socket half of the connector. To fit the halves of the connector together, the latch on the socket side must be aligned with the latch cover on the pin side.
   b. **For Two External Latches:** (8-place and 12-place) Align the tabs on the socket housing with the grooves on the pin housing.
2. Insert socket housing into pin housing until it snaps or clicks into place.
   For Two External Latches: (8-place and 12-place) If latches do not click (latch), press on one side of the connector until that latch engages, then press on the opposite side to engage the other latch.
3. If necessary, fit the attachment clip to the pin housing.
4. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.



1. **External latch**
2. **Socket housing**
3. **Pin housing**

Figure A-17. Deutsch Connector

Removing Socket Terminals

1. See Figure A-18. Insert a small screwdriver between the socket housing and locking wedge in-line with the groove (in-line with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up and remove the secondary locking wedge.
2. See Figure A-21. Use a pick or small screwdriver to depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

NOTE

*If wire leads require **new** terminals, see the instructions for crimping terminals.*

Installing Socket Terminals

1. Match wire lead color to connector cavity.
2. See Figure A-20. Fit rear wire seal (1) into back of socket housing (2), if removed.
3. Grasp wire lead (3) approximately 1.0 in. (25.4 mm) behind the socket terminal. Gently push socket through hole in wire seal into its chambers until it "clicks" in place.
4. A tug on the wire will confirm that it is properly locked in place.

NOTE

Seal plugs (6) are installed through the wire seals of unused chambers. If removed, seal plugs must be replaced to seal the connector.

5. Install internal seal (4) on lip of socket housing, if removed.
6. Insert tapered end of secondary locking wedge (5) into socket housing and press down until it snaps in place. The wedge fits into the center groove within the socket housing and holds the terminal latches tightly closed.

NOTES

- *See Figure A-19. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (1) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the socket housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*

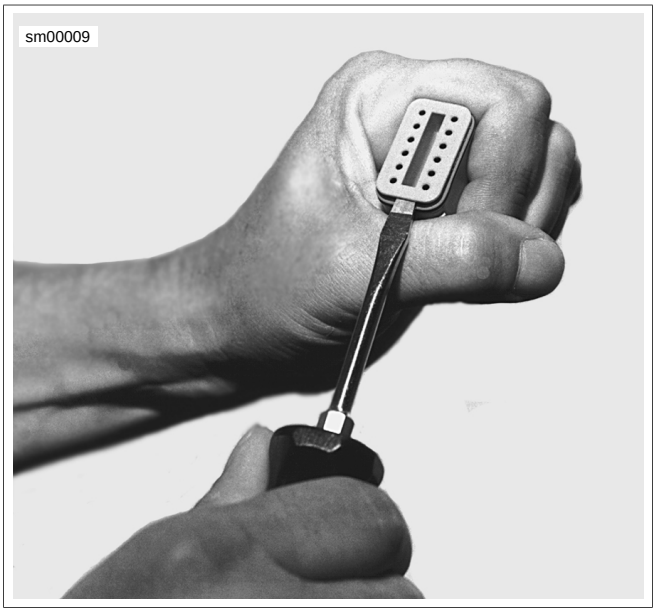
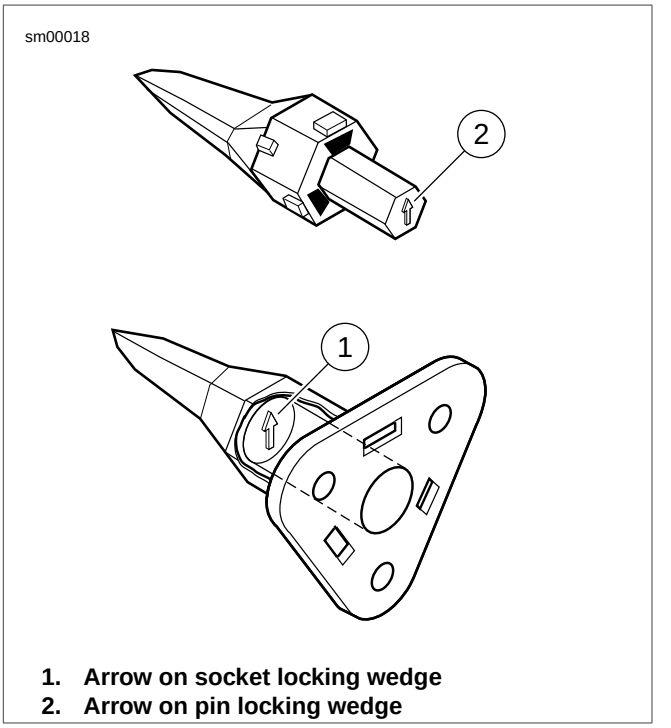
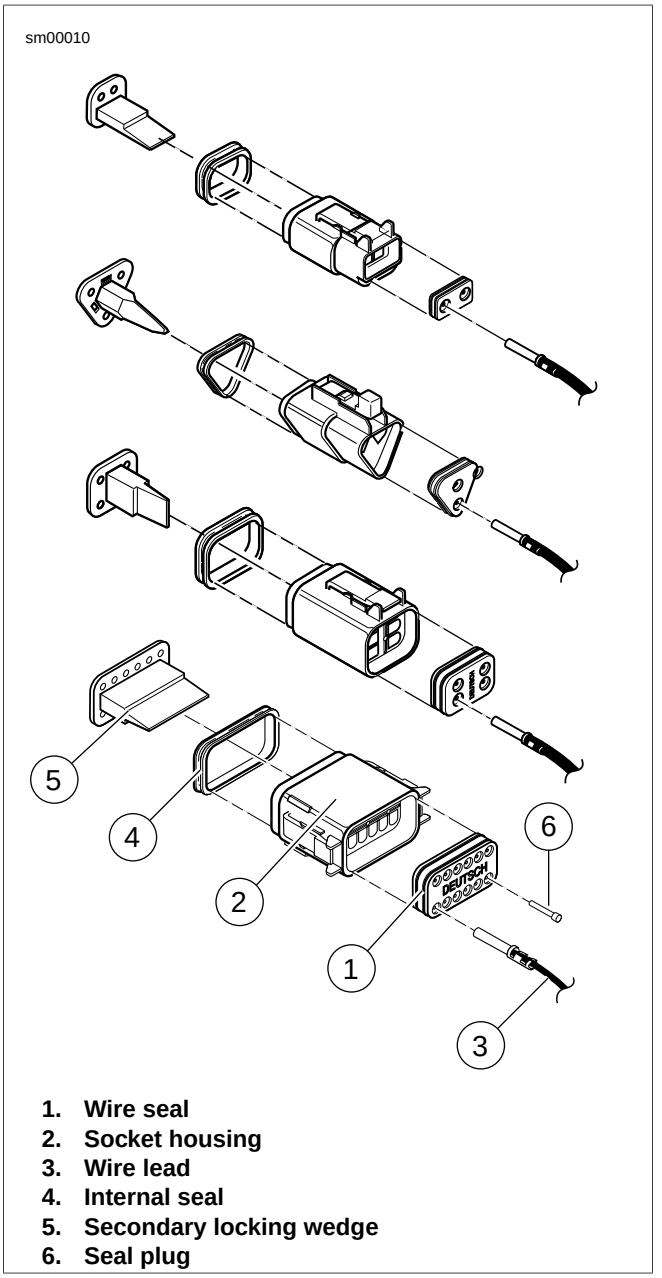


Figure A-18. Deutsch Connector: Remove Secondary Locking Wedge



1. Arrow on socket locking wedge
2. Arrow on pin locking wedge

Figure A-19. Deutsch Connector: 3-Place Locking Wedges



1. **Wire seal**
2. **Socket housing**
3. **Wire lead**
4. **Internal seal**
5. **Secondary locking wedge**
6. **Seal plug**

Figure A-20. Deutsch Connector: 2, 3, 4 and 12-Place Socket Housings

Removing Pin Terminals

1. Use the hooked end of a stiff piece of mechanics wire, a needle nose pliers or the FLAT BLADE L-HOOK (Part No. HD-41475-100) to remove the secondary locking wedge.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

NOTES

- *If wire leads require **new** terminals, see the instructions for crimping terminals.*
- *If it should become necessary to replace a pin or socket housing, please note that the 8-place and 12-place gray and black connectors are not interchangeable. Since location of the alignment tabs differ between the black and gray connectors, plugs or receptacles must be replaced by those of the same color.*
- *When replacing both socket and pin housings, then the black may be substituted for the gray, and vice versa. The socket and pin housings of all other connectors are interchangeable, that is, the black may be mated with the gray, since the alignment tabs are absent and the orientation of the external latch is the same.*

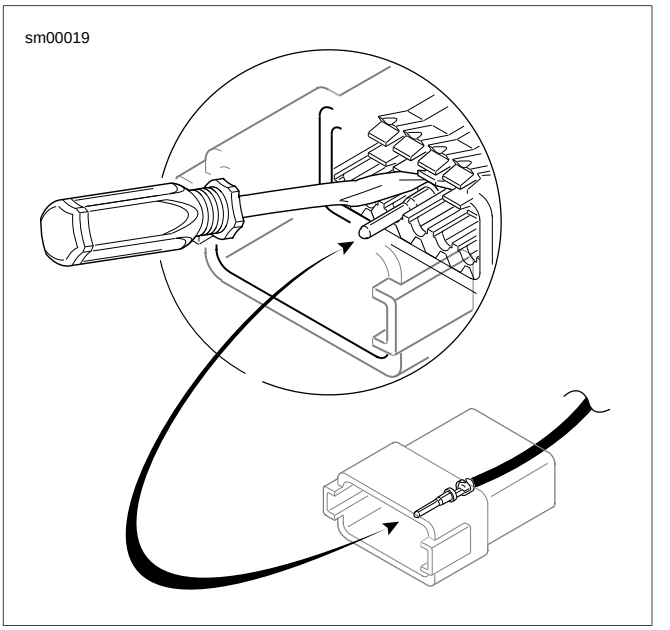


Figure A-21. Deutsch Connector: Depress Terminal Latch and Back Out Pin

Installing Pin Terminals

1. See Figure A-22. Fit wire seal (1) into back of pin housing (2).
2. Grasp wire lead approximately 1.0 in. (25.4 mm) behind the pin terminal (3). Gently push pin through holes in wire seal into its respective numbered chamber until it "clicks" in place.

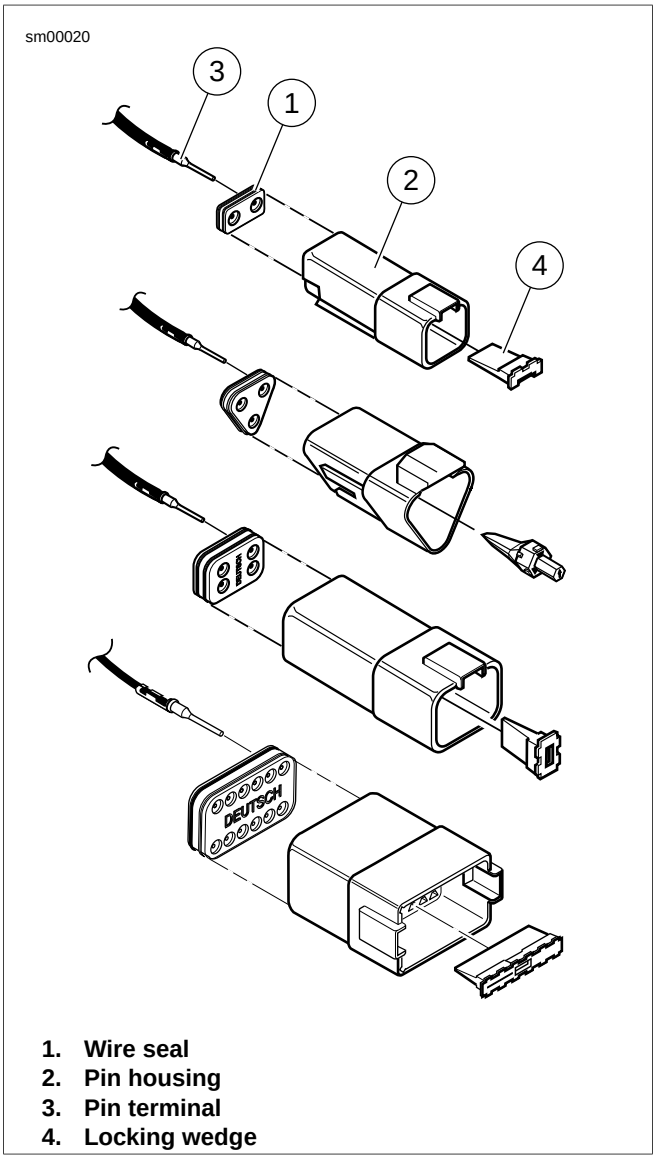
NOTE

A tug on the wire lead will confirm that a pin is locked in place.

3. Insert tapered end of secondary locking wedge (4) into pin housing and press down until it snaps in place.

NOTES

- *The wedge fits in the center groove of the pin housing and holds the terminal latches tightly closed.*
- *See Figure A-19. While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-place connector must be installed with the arrow (2) pointing toward the external latch.*
- *If the secondary locking wedge does not slide into the installed position easily, verify that all terminals are fully installed in the pin housing. The lock indicates when terminals are not properly installed by not entering its fully installed position.*



1. **Wire seal**
2. **Pin housing**
3. **Pin terminal**
4. **Locking wedge**

Figure A-22. Deutsch Connector: 2, 3, 4 and 12-Place Pin Housings

Crimping Terminals

Identify which of the types of Deutsch terminals are used with the connector and follow the corresponding crimping instructions. Refer to Table A-2.

Table A-2. Deutsch Connector: Terminal Crimping Instructions

TYPE	CRIMPING INSTRUCTIONS
Standard (with crimp tails)	A.7 DEUTSCH STANDARD TERMINAL REPAIR
Mini Terminal (solid barrel)	A.8 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR
Mini Terminal (with crimp tails)	A.9 DEUTSCH MINI TERMINAL REPAIR

DEUTSCH STANDARD TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL

Preparing Wire Leads for Crimping

1. Use a shop gauge to determine gauge of wire lead.
2. Strip lead removing 5/32 in. (4.0 mm) of insulation.

Crimping Terminal to Lead

1. See Figure A-23. Squeeze the handles of the DEUTSCH TERMINAL CRIMP TOOL (Part No. HD-39965-A) to open the jaws. Push the locking bar (1) up.
2. Insert (2) terminal (socket/pin) through hole of the locking bar, so that the rounded side of the contact barrel rests in the nest (concave split level area) with the crimp tails facing upward. To match the wire gauge to the crimp tool die, refer to Table A-3.
3. Release locking bar to lock terminal in die.

NOTE

If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the terminal so that the tails face straight upward. When positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.

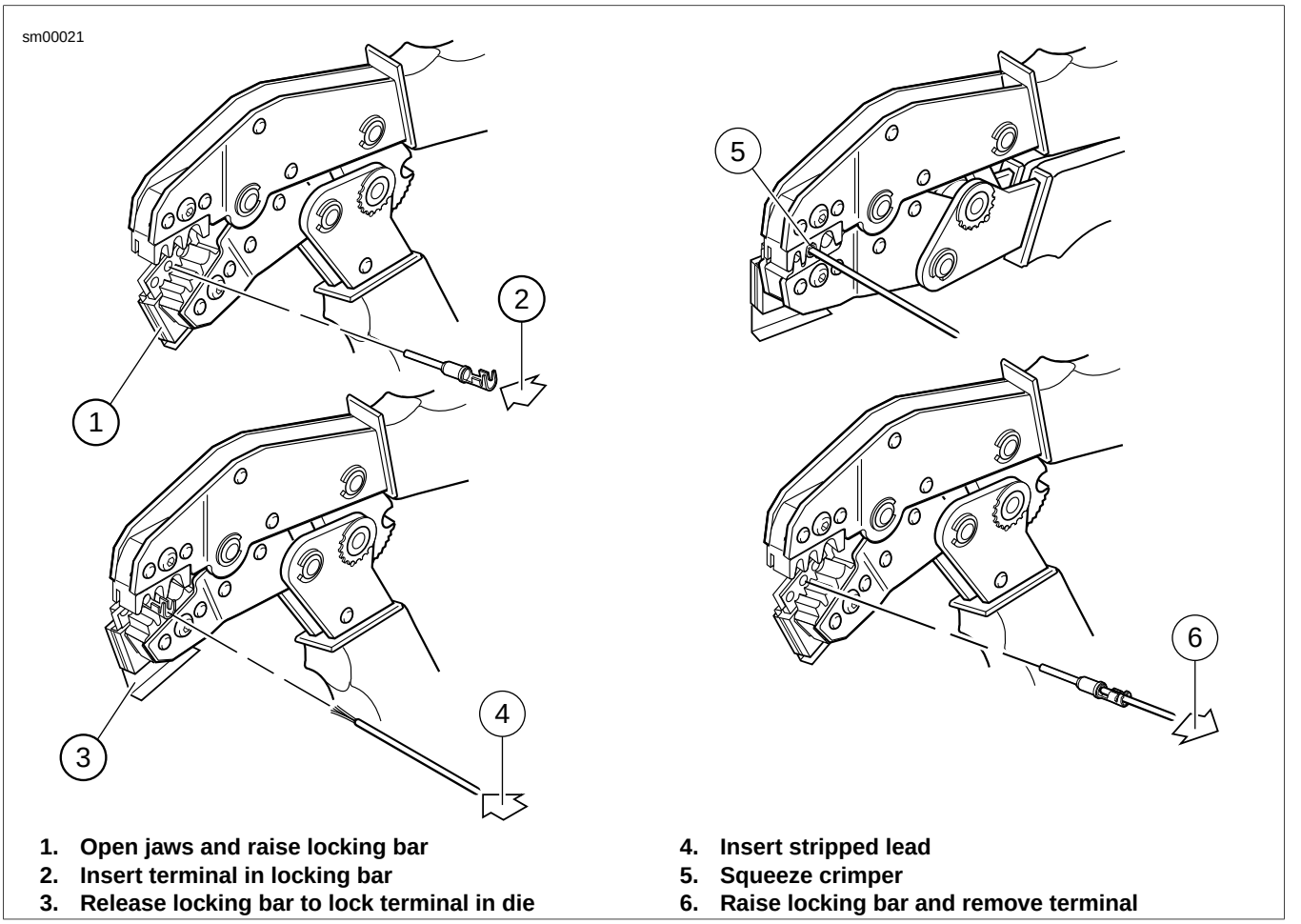
4. Insert stripped wire core between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over the insulation.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens after the terminal is crimped.
6. Raise locking bar up and remove wire lead and terminal.

Inspecting Crimps

Inspect the wire core and insulation crimps. Distortion should be minimal.

Table A-3. Deutsch Standard Terminal Crimp: Wire Gauge To Die

WIRE GAUGE (AWG)	CRIMP TOOL DIE
20	Front
16-18	Middle



1. **Open jaws and raise locking bar**
2. **Insert terminal in locking bar**
3. **Release locking bar to lock terminal in die**
4. **Insert stripped lead**
5. **Squeeze crimper**
6. **Raise locking bar and remove terminal**

Figure A-23. Crimping a Deutsch Standard Terminal

DEUTSCH SOLID BARREL TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-42879	ELECTRICAL CRIMPER TOOL

Preparing Wire Leads For Crimping

For size 20, 16 and 12 contacts, wire ranges 26-12 AWG.

Strip wire lead removing 1/4 in. (6.4 mm) of insulation.

Adjusting Crimper Tool

1. See Figure A-24. Squeeze the ELECTRICAL CRIMPER TOOL (Part No. HD-42879) handles to cycle the crimp tool to open.
2. Remove locking pin (1) from selector knob (2).
3. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow (3).
4. Loosen knurled locknut (4) and turn adjusting screw (5) clockwise (in) until it stops.

Crimping a Barrel Contact To Wire Lead

1. See Figure A-25. Turn tool over and drop contact barrel (1) into indentor cover (2) hole with the wire end out.
2. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
3. Slowly squeeze handles of crimp tool until contact is centered between the four indentor points (3).
4. Insert bare wire core strands of stripped wire lead (4) into contact barrel. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
5. Remove wire lead with crimped contact from indentor.

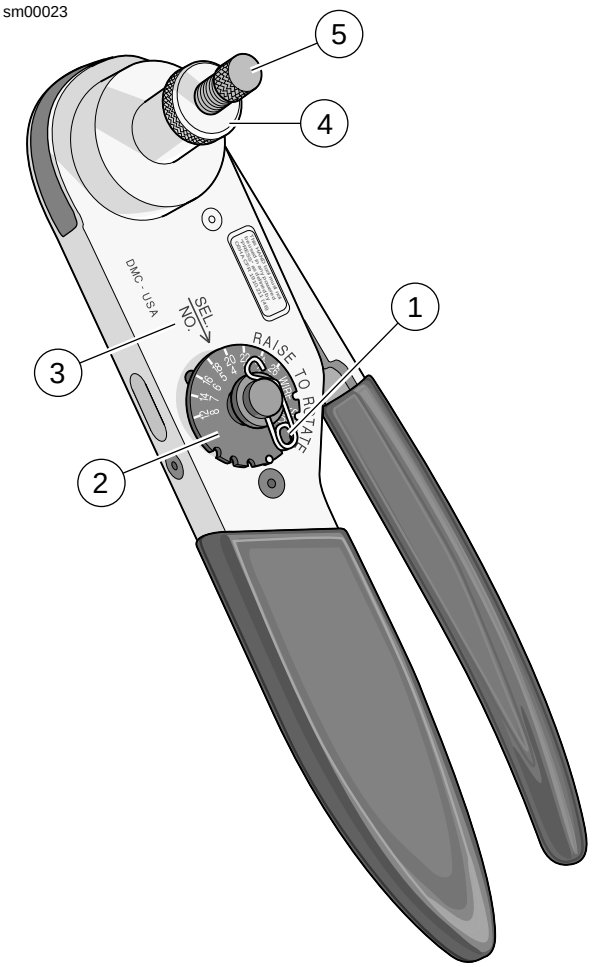
NOTE

Tool must be readjusted when changing contact size/type.

6. Install pin to lock selector knob.

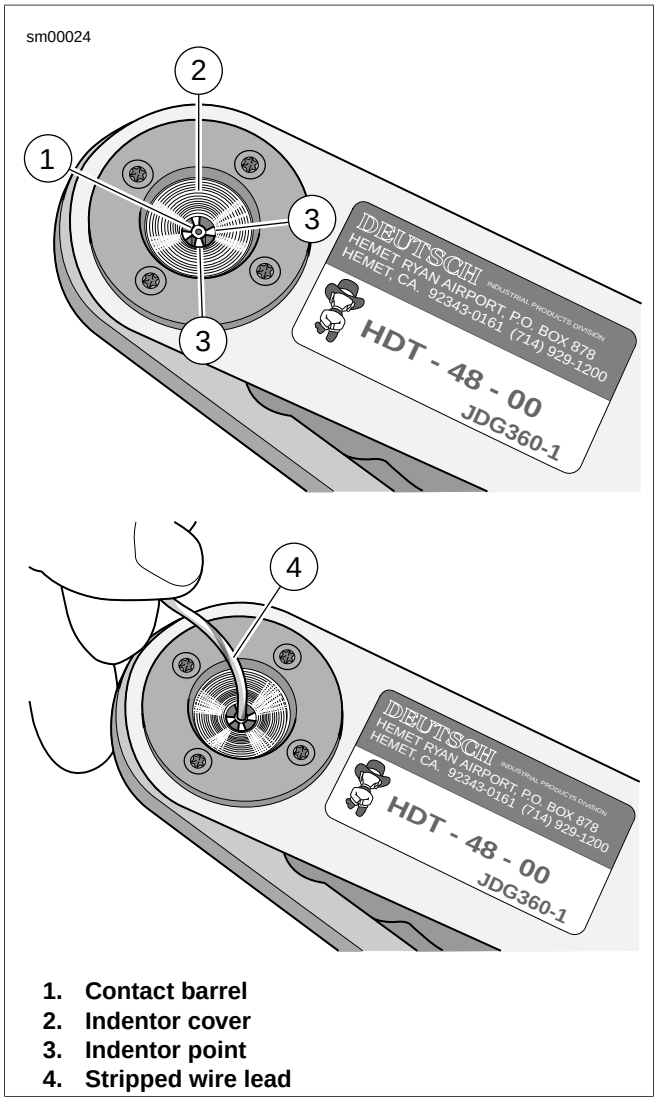
Inspecting Crimps

Inspect the crimp. All core wire strands are to be crimped in the barrel.



1. **Locking pin**
2. **Selector knob**
3. **SEL. NO. arrow**
4. **Knurled locknut**
5. **Adjusting screw**

Figure A-24. Electrical Crimper Tool (HD-42879)



1. **Contact barrel**
2. **Indentor cover**
3. **Indentor point**
4. **Stripped wire lead**

Figure A-25. Deutsch Solid Barrel

DEUTSCH MINI TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-7	PACKARD TERMINAL CRIMPER

Preparing Wire Leads for Crimping

Strip wire lead removing 5/32 in. (4.0 mm) of insulation.

Crimping a Mini Terminal to Wire Lead

1. See Figure A-26. Compress the handles of PACKARD TERMINAL CRIMPER (Part No. HD-38125-7) until the ratchet (2) automatically opens.

NOTE

Always perform core crimp before insulation crimp.

2. Position the core crimp on die E (1) of the crimper. Be sure the core crimp tails are facing the forming jaws.
3. Gently apply pressure to handles of tool until crimpers just secure the core crimp tails.
4. Insert stripped wire core stands between crimp tails. Position wire so that short pair of crimp tails squeeze bare wire strands, while long pair squeeze over the insulation.
5. Squeeze handle of crimper until tightly closed. Tool automatically opens when the crimping sequence is complete.

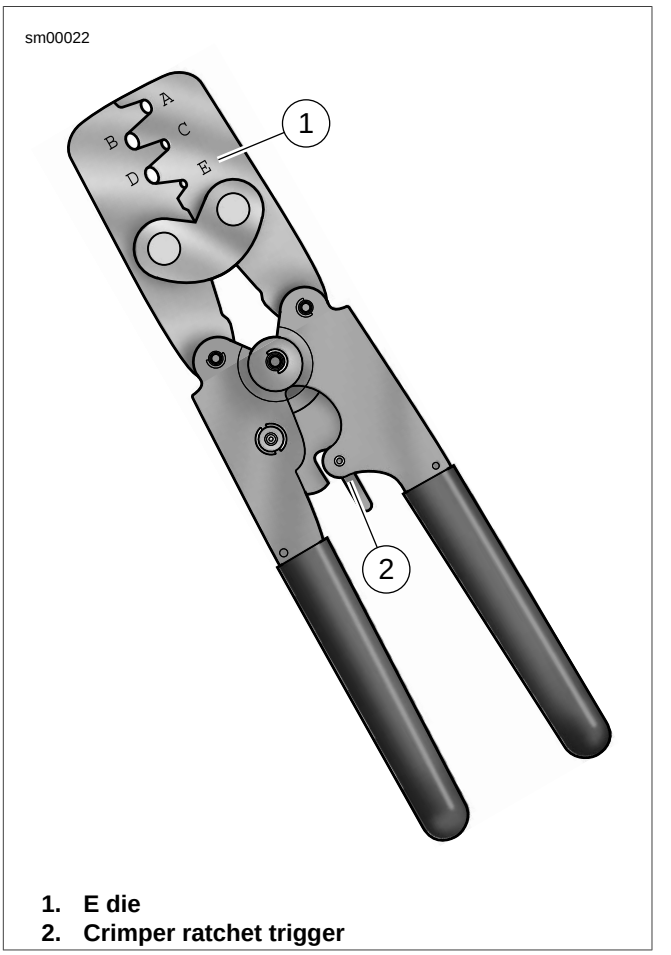
NOTE

If the crimper does not open, it can be opened by squeezing the ratchet trigger (2).

6. Position the insulation crimp on nest C of the crimper. Be sure the insulation crimp tails are facing the forming jaws.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.

Inspecting Crimps

Inspect the core and insulation crimps. Distortion should be minimal.



1. E die
2. Crimper ratchet trigger

Figure A-26. Packard Terminal Crimper (HD-38125-7)

MOLEX CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER

Separating Pin and Socket Housings

See Figure A-27. Depress the latch while pulling the pin and socket housings apart.

Mating Pin and Socket Housings

1. Orient the latch on the pin housing to the latch pocket on the socket housing so the rails on the outside of the pin housings lines up with the tunnels on the socket housing.
2. Press the housings together until the latch clicks.

Removing Terminals

1. Pull the secondary lock up, approximately 3/16 in. (4.8 mm), until it stops.
   a. **Socket Housing:** See Figure A-28. Use a small screwdriver in the pry slot. The slot next to the external latch provides a pivot point.
   b. **Pin Housing:** See Figure A-29. Use needle nose pliers to engage the D-holes in the center of the secondary lock.

NOTE

Do not remove the secondary lock from the connector housing.

2. See Figure A-30. Insert MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER (Part No. HD-48114) into the pin hole next to the terminal until the tool bottoms.
   a. **Socket Housing:** The pin holes are inside the terminal openings.
   b. **Pin Housing:** The pin holes are outside the pins.
3. Pressing the terminal remover to the bottom of the pin hole, gently pull on the wire to remove wire terminal from its cavity.

Installing Terminals

1. See Figure A-31. From the wiring diagram, match the wire color to its numbered terminal cavity.

NOTE

Cavity numbers (1) are stamped on the housing at the ends of the cavity rows. The cavity number can be determined by counting the cavities up or down along the row from each stamped number.

2. Orient the terminal so that the tang (2) opposite the open crimp engages the slot (3) in the cavity.
3. Push the terminal into the cavity.
4. Gently tug on wire to verify that the terminal is captured by the secondary lock.
5. With all terminals installed, push the secondary lock into the socket housing to lock the wire terminals into the housing.

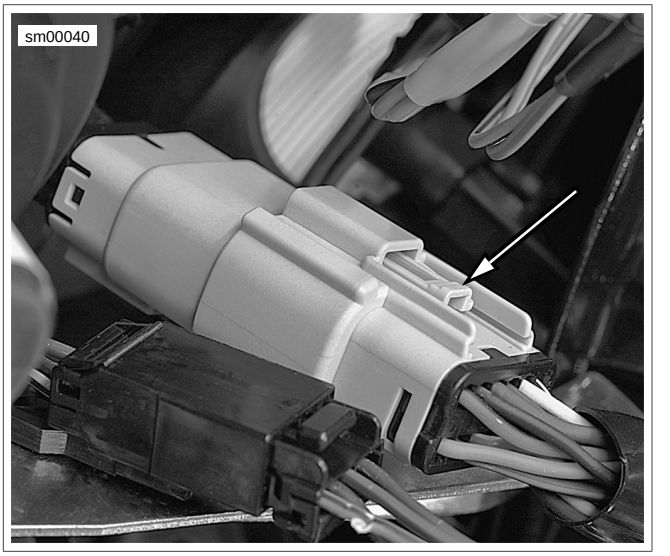


Figure A-27. Molex Connector: Latch



Figure A-28. Secondary Lock Pry Slot (Socket Housing)

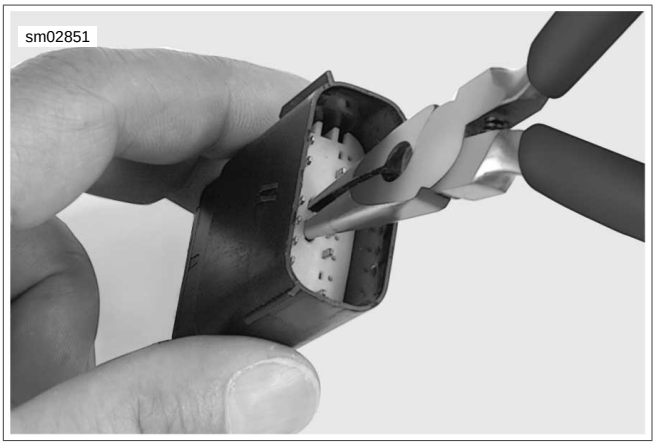


Figure A-29. Pull Up Secondary Lock (Pin Housing)

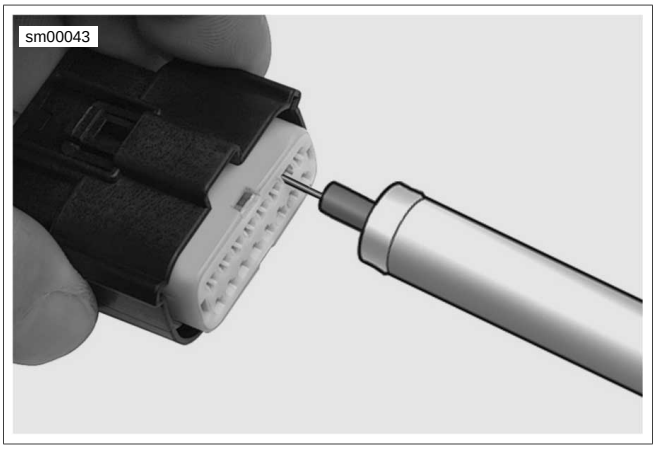
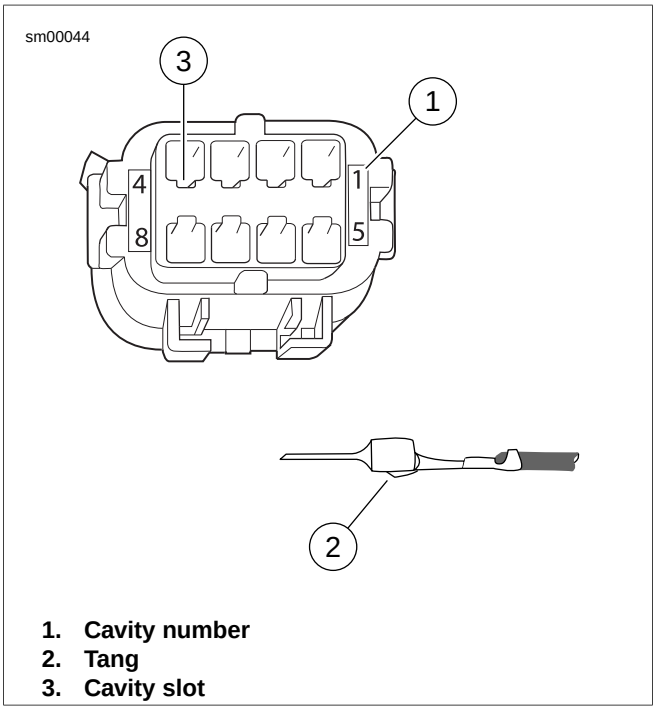


Figure A-30. Molex Connector: Terminal Remover (HD-48114)



1. **Cavity number**
2. **Tang**
3. **Cavity slot**

Figure A-31. Molex Connector: Pin Cavities and Wire Terminal

CRIMP TERMINAL TO LEAD

PART NUMBER	TOOL NAME
HD-48119	ELECTRICAL CRIMP TOOL

Prepare Lead

1. Cut the damaged terminal close to the back of the terminal to leave as much wire length as possible.
2. Strip approximately 3/16 in. (4.70-5.60 mm) of insulation from the end of the wire lead.

NOTE

The strip length is the same for both pin and socket terminals and for wire gauges from 22 to 14.

Prepare Tool

1. Identify the punch/die in the jaws of the ELECTRICAL CRIMP TOOL (Part No. HD-48119) for the wire gauge. Refer to Table A-4.
2. Squeeze and release the handles to open the tool.

NOTE

The crimp tool automatically opens when the handles are released.

3. See Figure A-32. Hold fully open tool at approximately 45 degrees.

NOTE

Do NOT tighten the locknut holding the locator bars. The bars must float to accommodate the different terminal gauges.

Table A-4. Crimp Tool Wire Gauge Punch/Die

AWG (WIRE GAUGE)	PUNCH/DIE
22	Left
18-20	Middle
14-16*	Right
* Crimp 16 AWG **pin** terminals in the 18-20 middle die.	

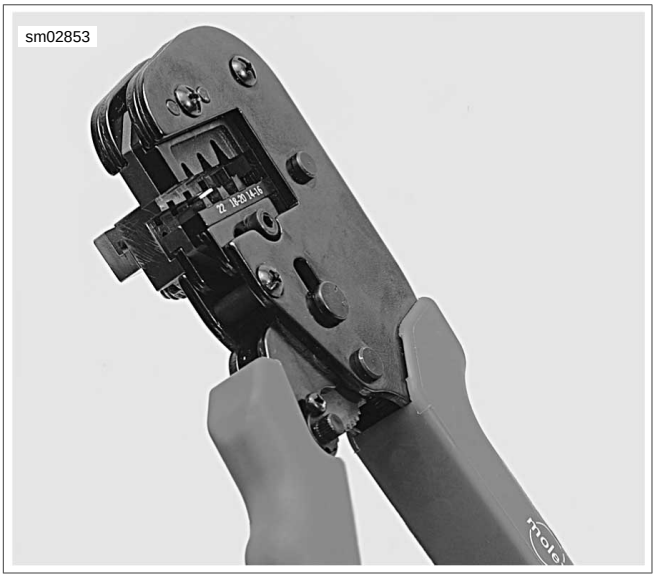
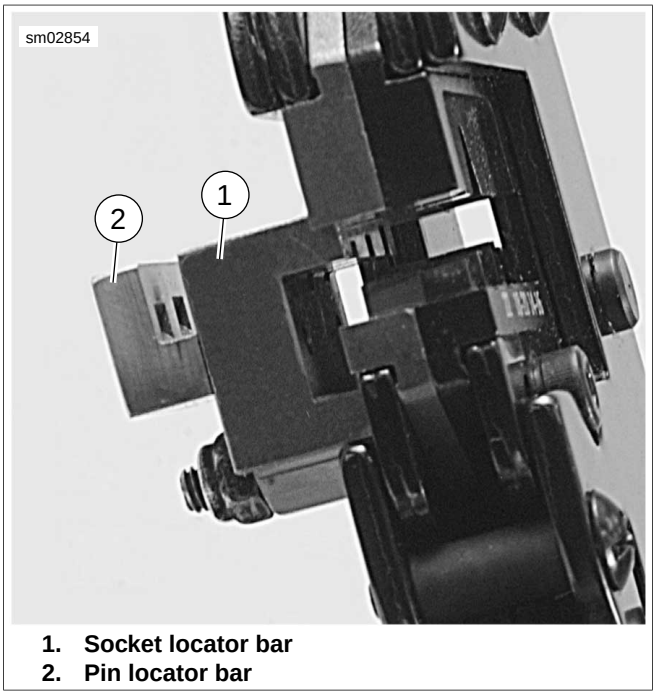


Figure A-32. Open Electrical Crimp Tool (HD-48119) at 45 Degrees



1. **Socket locator bar**
2. **Pin locator bar**

Figure A-33. Terminal Locator Bars

Position Terminal in the Punch/Die

1. See Figure A-34. With the crimp tails up, place the terminal through the punch/die into the square opening in the socket locator bar.
   a. **Socket Terminal:** See Figure A-33. A socket terminal stops against the back face of the socket locator bar (1).
   b. **Pin Terminal:** See Figure A-35. The tip of a pin terminal passes through the socket locator bar and stops in the notch in the face of the pin locator bar.
2. See Figure A-36. Ratchet the handles together until the crimp tails are held in vertical alignment between the punch and the die.

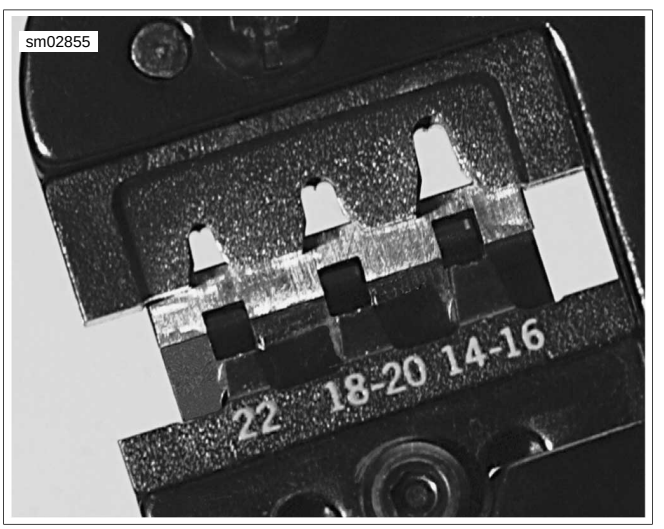


Figure A-34. Square Openings in Socket Locator Bar

Insert Stripped Lead

See Figure A-37. Insert the stripped end (wire core) between the crimp tails at an up angle until the wire core touches the face of the socket locator bar above the square opening.

NOTES

- *The insulation must extend through the insulation crimp tails.*
- *Insert the wire with little or no pressure. Pressing on the lead will bend the wire core.*

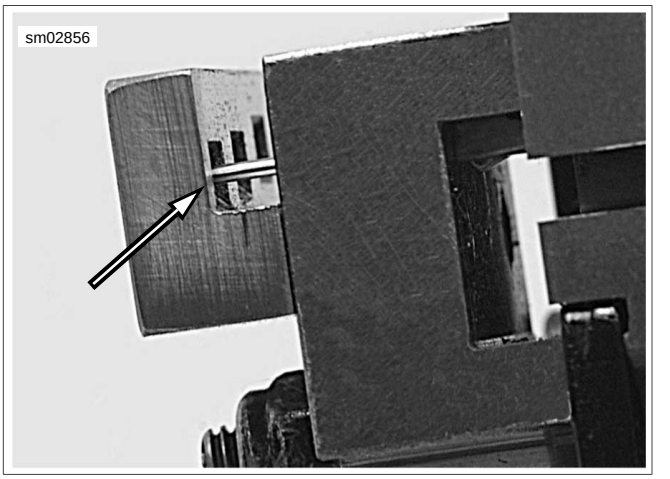


Figure A-35. Pin Terminal against Pin Locator Bar

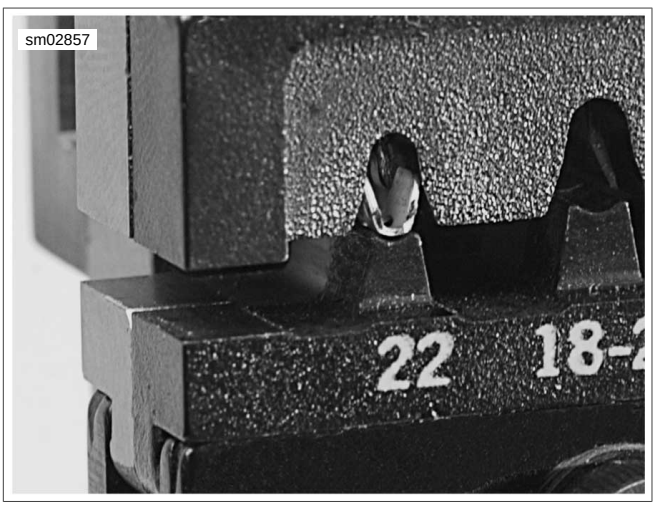


Figure A-36. Crimp Tails in Vertical Alignment between Punch and Die

Crimp Terminal to Lead

1. Holding the wire lead in position touching the locator face at an angle, quickly and smoothly squeeze the crimp tool closed.
2. Final squeeze the handles to open the tool and release the terminal.

NOTE

A stuck or jammed tool can be opened by pressing the ratchet release lever found between the handles. Do ***not*** *force the handles open or closed.*

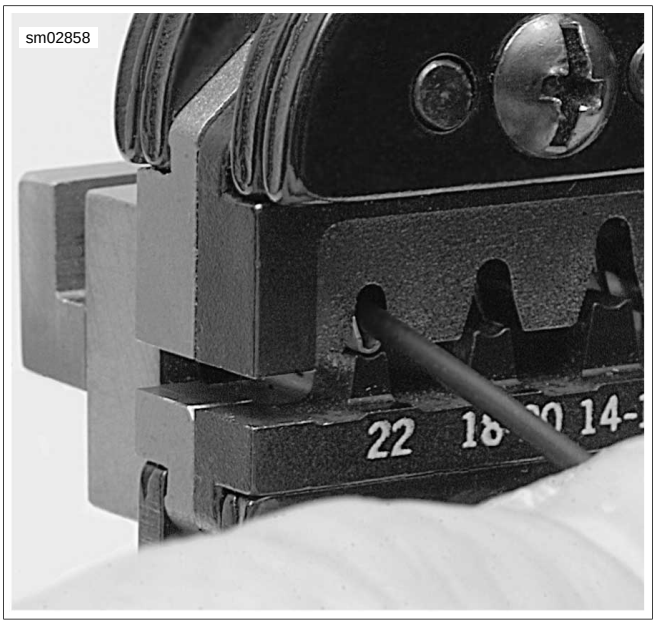
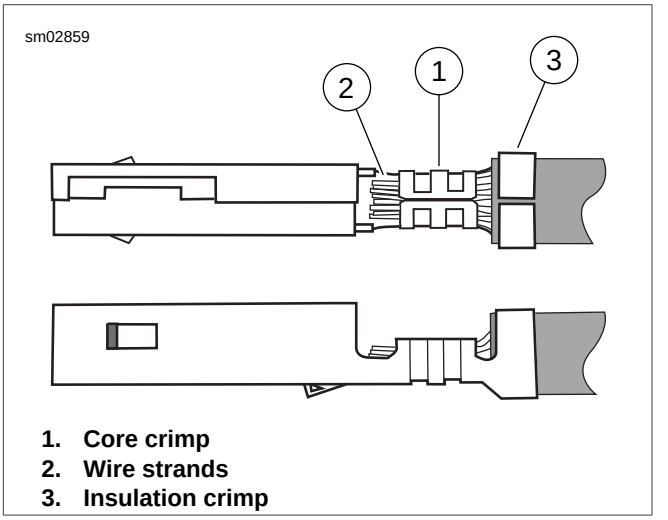


Figure A-37. Stripped Lead at Up Angle

Inspect Crimp

1. **Inspect Crimp:** Inspect the core and insulation crimp.
   a. See Figure A-38. The core tails should be creased into the wire strands at the core crimp (1).
   b. Strands (2) of wire should be visible beyond the core crimp but not forward into the terminal shell.
   c. The insulation tails should be folded into the insulation (3) without piercing or cutting the insulation.
   d. Distortion should be minimal.
2. **Test Crimp:** Hold the terminal and pull the lead.



1. **Core crimp**
2. **Wire strands**
3. **Insulation crimp**

Figure A-38. Terminal Crimp

150 METRI-PACK CONNECTOR REPAIR

General

Metri-Pack connectors are embossed with the initials (P.E.D.).

There are two types of connectors in this series:

- Pull-to-Seat
- Push-to-Seat

Separating Pin and Socket Housings

Bend back the external latch slightly and separate the pin and socket halves of the connector.

Mating Pin and Socket Housings

Align the wire colors and push the pin and socket halves of the connector together.

Removing Socket Terminal

1. See Figure A-39 for pull-to-seat connector or Figure A-40 for push to seat connector. Remove wire lock (1) from wire end of socket housing on push-to-seat type connectors.

NOTE

For best results, free one side of wire lock first and then release the other side.

2. Find the locking tang in the mating end of the connector.

NOTE

The tangs are always positioned in the middle of the chamber and are on the same side as the external latch.

3. Gently insert a safety pin into the chamber about 1/8 in. (3.2 mm).
   a. **For pull-to-seat:** Stay between the terminal and the chamber wall and pivot the end of the pin toward the terminal body.
   b. **For push-to-seat:** There is a small opening for the pin.
4. When a click is heard, remove the pin and repeat the procedure.

NOTE

The click is the sound of the tang returning to the locked position as it slips from the point of the pin.

5. Pick at the tang until the clicking stops and the pin seems to slide in deeper than it had previously. This is an indication that the tang has been depressed.

NOTE

On those terminals that have been extracted on multiple occasions, the click may not be heard, but pivot the pin as if the click was heard at least 3 times.

6. Remove the pin.
   a. **For pull-to-seat:** Push on the lead to extract the terminal from the mating end of the connector.
   b. **For push-to-seat:** Pull on the lead to draw the terminal out the wire end.

Inserting Socket Terminal

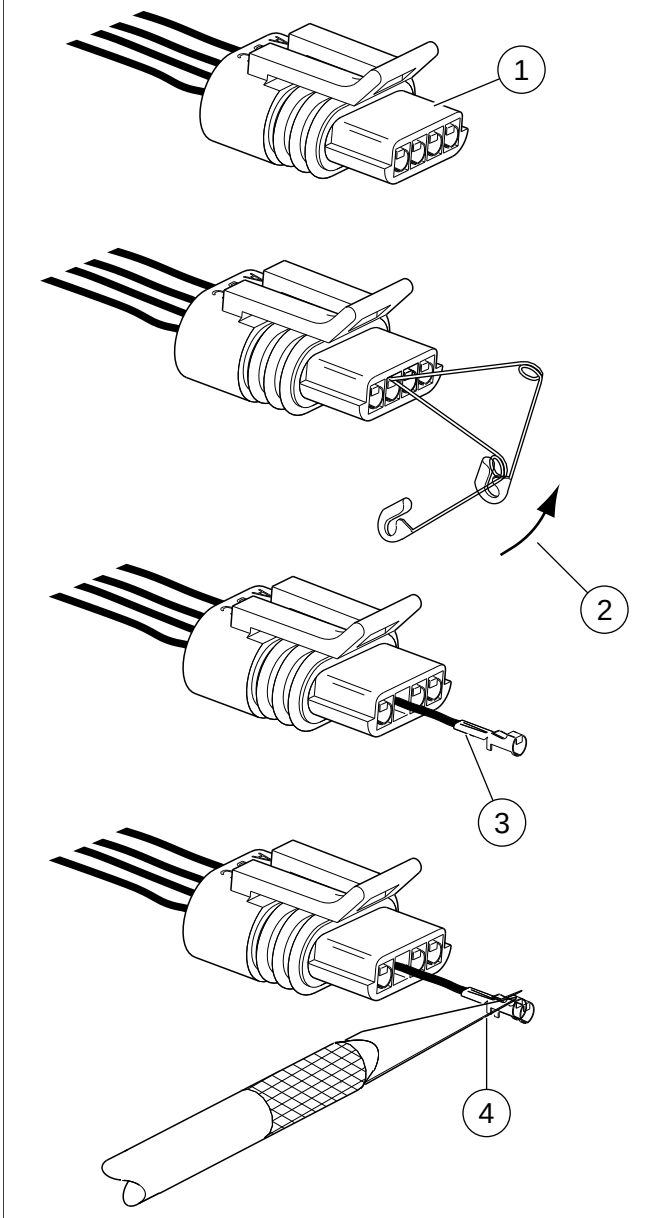
NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. See Figure A-39 for pull-to-seat connector or Figure A-40 for push to seat connector. Using a thin flat blade, like that on a hobby knife, carefully bend the tang outward away from the terminal body.
2. Gently pull or push on the lead to install the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Gently pull or push on the lead to verify that the terminal is locked in place.

   For push-to-seat: See Figure A-40. Seat wires in separate channels of wire lock and then push channels **inside** chambers at wire end of socket housing. Fully installed, slot on each side of wire lock engages ear on socket housing.

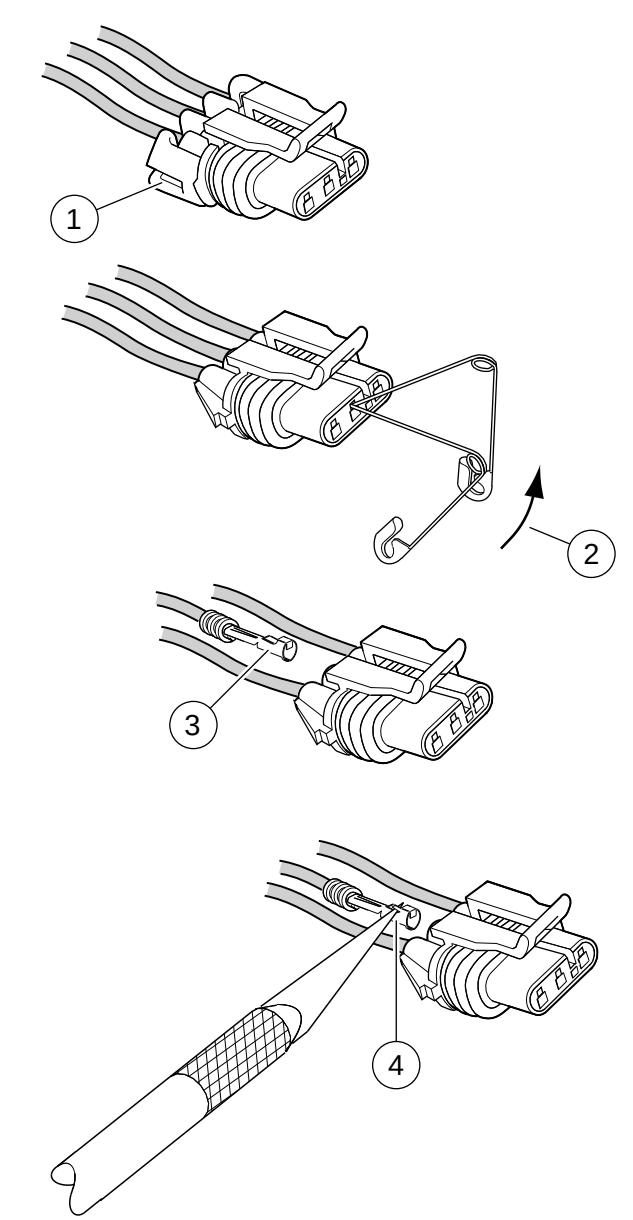
sm00027



1. **Locate tang in chamber**
2. **Pivot pin to depress tang**
3. **Push to remove**
4. **Raise tang to install**

Figure A-39. 150 Metri-Pack Connector: Pull-to-Seat

sm00028



1. **Remove wire lock**
2. **Pivot pin to depress tang**
3. **Pull to remove**
4. **Raise tang to install**

Figure A-40. 150 Metri-Pack Connector: Push-to-Seat

FUSE BLOCK REPAIR

Removing Socket Terminals

1. See Figure A-41. To remove secondary locks, insert end of small flat blade screwdriver (1) under lip of locking wedge (2) and gently pry up secondary lock.

NOTE

For best results, start with locking wedge on outboard side of secondary lock.

2. Looking into chamber at top of fuse block, note the tang next to each socket terminal.
3. Using a thin flat blade, like that on a hobby knife, gently push tang away from terminal, and then tug on wire to back terminal out.

Installing Socket Terminals

1. Match the wire lead color to the fuse block terminal cavity.

NOTES

- *Refer to the main harness wiring diagram for wire lead color codes.*
- *See Figure A-42. The main fuse block terminal cavity is identified as alpha (1) and numeric (2) coordinates. Refer to the main harness wiring diagram for fuse block terminal cavity coordinates.*

2. With the open side of the socket terminal facing the tang, push lead into chamber at the wire end of the fuse block. A click is heard when the terminal is properly engaged.
3. Gently tug on the wire to verify that the terminal is locked in place and will not back out of the chamber.
4. Install the secondary locks. With the locking wedges positioned above the tangs in each chamber, slide flat side of secondary lock into slot (between rows), and push down until it bottoms.

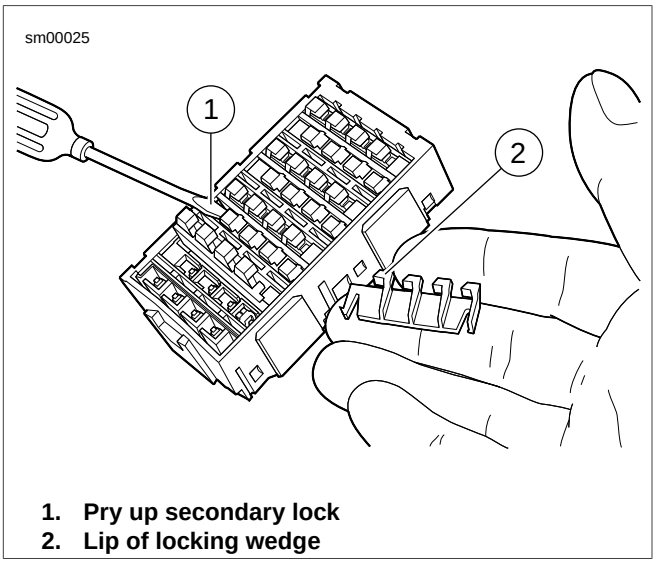
Crimping Terminals

Terminals are crimped twice; once over the wire core and a second time over the insulation/seal.

A correctly crimped terminal may require different crimping dies found on separate crimpers.

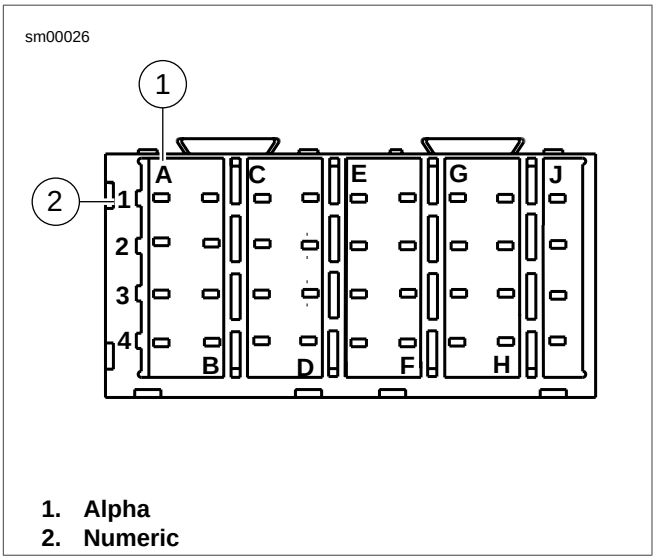
NOTE

The wiring diagram indicates when one socket terminal is be crimped to two wire leads.



1. Pry up secondary lock
2. Lip of locking wedge

Figure A-41. Fuse Block: Remove Secondary Locks



1. Alpha
2. Numeric

Figure A-42. Fuse Block: Coordinates (typical)

480 METRI-PACK CONNECTOR REPAIR

General

A 480 Metri-Pack (P.E.D.) connector is frequently used for the B+ (battery voltage) connector to power P&A accessories.

Referred to as Packard connectors, Metri-Pack connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

Cut any cable strap anchoring the wire conduits of the pin (accessory connector housing) and the socket (B+) housing.

See Figure A-43. Using small flat blade screwdriver, depress button (1) on pin housing (red wire) side of the connector and pull apart the pin and socket housings.

Mating Pin and Socket Housings

Orient the latch on the socket housing to the button catch on the pin housing and press the housings together.

Removing Socket Terminals

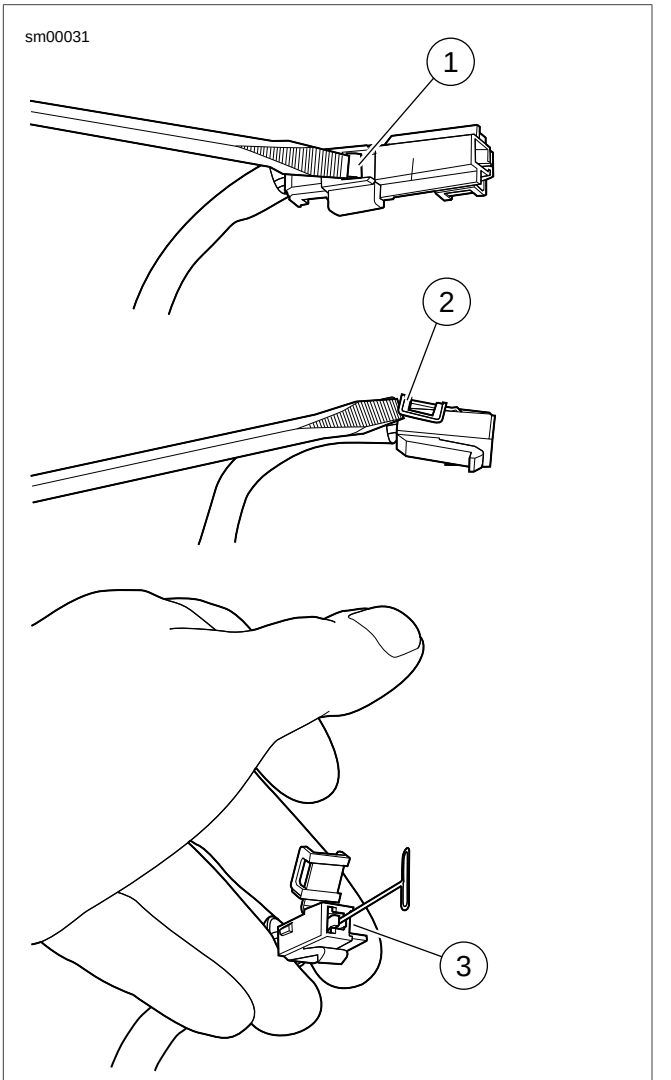
1. See Figure A-43. Bend back the latch (2) slightly and free one side of secondary lock, then repeat to release the opposite side. Rotate the secondary lock outward on hinge to access terminal in chamber of connector housing.
2. On the mating end of the connector, note the tang in the square shaped opening centered next to the terminal. Gently insert the point of a stick pin or large safety pin into the opening (3) between the tang and the chamber wall until it stops.
3. Pivot the end of the pin toward the terminal body to depress the tang.
4. Remove the pin and then pull terminal out of the wire end of connector housing.
5. If necessary, crimp **new** terminals on wires. See A.15 PACKARD METRI-PACK TERMINALS.

Installing Socket Terminals

1. Carefully bend the tang outward away from the terminal body.
2. With the tang on the same side as the square shaped opening in the mating end of the connector housing, feed terminal into wire end of connector housing until it "clicks" in place.
3. Verify that terminal will not back out of the chamber. A slight tug on the cable will confirm that it is locked.
4. Rotate the hinged secondary lock inward until latches fully engage tabs on both sides of connector housing.

NOTE

*If removed, install **new** anchored cable strap in O.E. location. Tighten cable strap to capture conduit of both accessory connector and B+ connector approximately 1.0 in. (25.4 mm) from housings.*



1. Button on pin housing
2. Secondary lock latch
3. Opening between tang and chamber wall

Figure A-43. 480 Metri-Pack Connector: Remove Socket Terminal

630 METRI-PACK CONNECTOR REPAIR

PART NUMBER	TOOL NAME
TT600-3	SNAP-ON PICK

General

Referred to as Packard connectors, Metri-Pack 630 series connectors are embossed with the initials P.E.D.

Separating Pin and Socket Housings

NOTE

If necessary, remove connector from barbed anchor or other retaining device.

Bend back the external latch slightly and separate pin and socket halves of the connector.

Mating Pin and Socket Housings

Orient the latch to the catch and push the pin and socket halves of the connector together until the latch "clicks".

NOTE

If removed, install connector on barbed anchor or other OE retaining device.

Removing Socket Terminal

1. Bend back the latch slightly and free one side of the secondary lock. Repeat the step to unlatch the other side.
2. Rotate the secondary lock outward on hinge to view the terminals in the chambers of the connector housing. The locking tang is on the side opposite the crimp tails and engages a rib in the chamber wall to lock the terminal in place.
3. Moving to the mating end of the connector, take note of the small opening on the chamber wall side of each terminal.
4. Insert SNAP-ON PICK (Part No. TT600-3) into opening until it stops. Pivot the end of the pick toward the terminal to depress the locking tang.
5. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat steps if the terminal is still locked in place.
6. If necessary, crimp **new** terminals on wires. Refer to A.15 PACKARD METRI-PACK TERMINALS.

Installing Socket Terminal

NOTE

Refer to the wiring diagrams to match wire lead colors to alpha characters molded into the secondary locks of each connector housing.

1. Using a thin flat blade, like that of a hobby knife, carefully bend the tang outward away from the terminal body.
2. With the tang facing the chamber wall, push the lead into the chamber at the wire end of the connector. A click is heard when the terminal is properly seated.
3. Gently tug on the wire end to verify that the terminal is locked in place and will not back out of the chamber.
4. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.

METRI-PACK TERMINAL CRIMPS

PART NUMBER	TOOL NAME
HD-38125-6	PACKARD TERMINAL CRIMP TOOL
HD-38125-7	PACKARD TERMINAL CRIMPER
HD-38125-8	PACKARD CRIMPING TOOL

Matching Terminal To Crimper

Metri-Pack connectors embossed with the initials P.E.D. require Packard crimp tools to crimp terminals to wire leads.

Terminals are crimped twice to a wire lead, once over the wire core and a second time over the insulation/seal.

See Figure A-44. A completed crimp may require two different crimping dies found on PACKARD TERMINAL CRIMP TOOL (Part No. HD-38125-6) and/or PACKARD TERMINAL CRIMPER (Part No. HD-38125-7). The terminal (pin or socket) and the wire lead gauge will determine the core crimp die and the insulator/seal die.

NOTE

The PACKARD CRIMPING TOOL (Part No. HD-38125-8) will also crimp sealed splice connectors in wire gauge sizes 18-20, 14-16 and 10-12.

Preparing Wire Lead

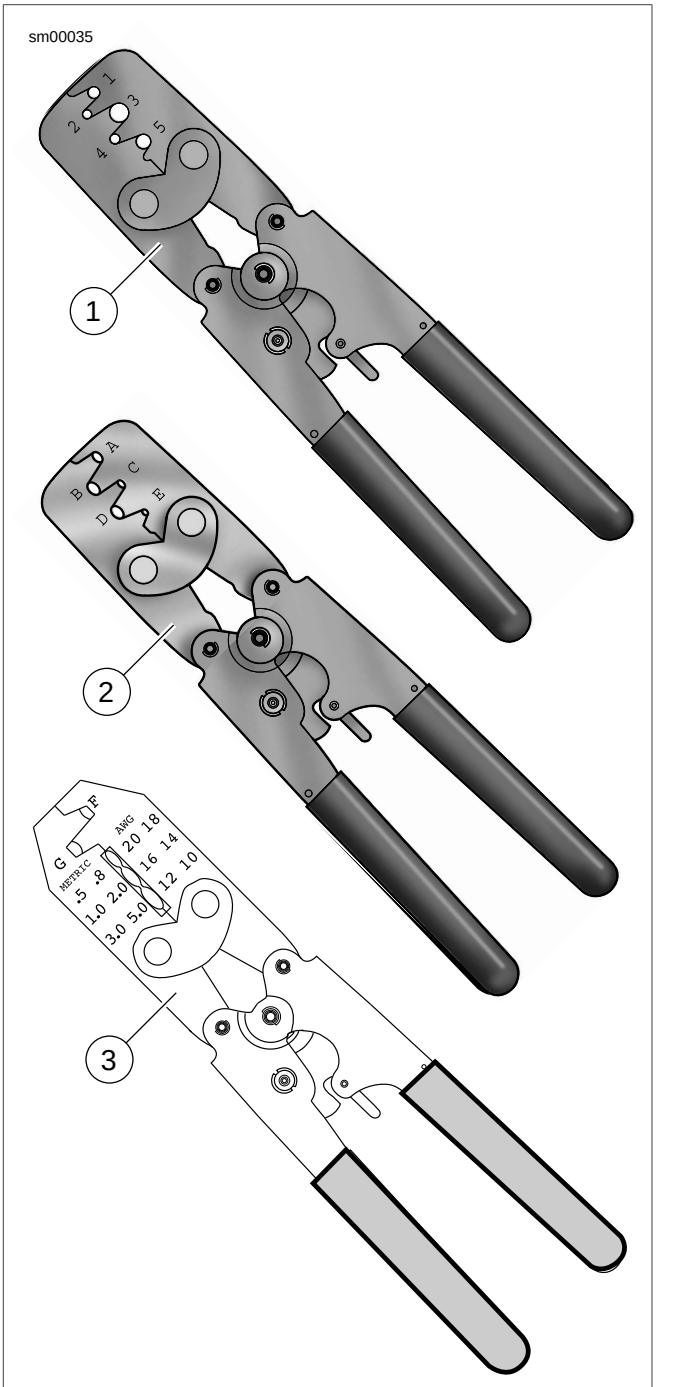
Use a wire striper to strip off the insulation and expose 5/32 in. (4.0 mm) of wire core.

Crimping Wire Core

NOTE

*Metri-Pack terminal crimps require two steps. Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. Squeeze and release handles until ratchet automatically opens.
2. Identify the corresponding sized nest for the core crimp.
3. Position the core crimp in the die. Be Sure the core crimp tails are facing the forming jaws.
4. Gently squeeze the handles until crimpers just secure the core crimp tails.
5. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze core wire strands, while long pair is positioned over the insulation or seal material.
6. Squeeze handles tightly closed. Release grip and the tool will automatically open.



1. **HD-38125-6 sealed terminals**
2. **HD-38125-7 non-sealed terminals**
3. **HD-38125-8 non-sealed terminals**

Figure A-44. Metri-Pack Terminal Crimp Tools

Crimping Insulation/Seal

NOTE

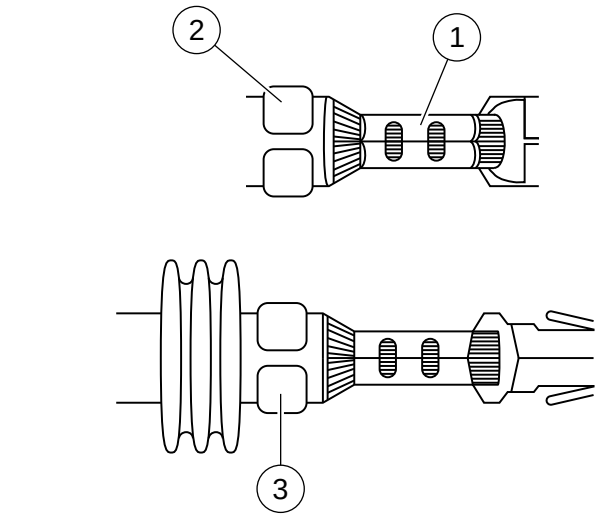
*Always perform **Crimping Wire Core** before **Crimping Insulation/Seal**.*

1. See Figure A-45. Identify the correct die for the insulation/seal crimp (2).

2. Position the insulation/seal crimp in the nest. Be sure the insulation/seal crimp tails are facing the forming jaws.
3. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimp is complete.

Inspecting Crimps

1. See Figure A-45. Inspect the wire core crimp (1). The tails should be folded in on the wire core without any distortion or excess wire strands.
2. Inspect the insulation (2) or seal (3) crimp. The tails of the terminal should be wrapped around the insulation without distortion.



1. **Wire core crimp**
2. **Insulation crimp**
3. **Seal crimp**

Figure A-45. Metri-Pack Connector: Inspect Core and Insulation/Seal Crimps

PACKARD 100W CONNECTOR REPAIR

General

A Packard 100W connector connects the the electronic control module (ECM) to the main harness.

NOTE

For vehicles with 73-pin connectors, see A.17 PACKARD MICRO-64 CONNECTORS and A.15 PACKARD METRI-PACK TERMINALS.

Separating Socket Housing From ECM

See Figure A-46. While pressing the connector into the ECM, press the thumb lever (1) against the connector until the latch (2) pops out of the catch (3) on the ECM.

Mating Socket Housing To ECM

Push the connector into the ECM until the latch is captured by the catch on the ECM.

Removing Socket Terminal

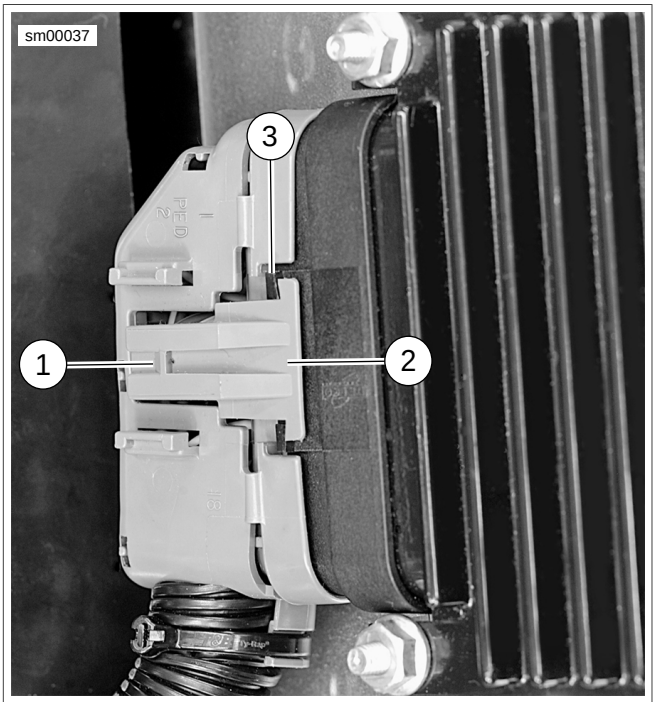
1. See Figure A-47. Gently depress latch (1) on each side of the clear plastic secondary lock (2) and remove. For best results, release one side at a time.
2. Carefully cut cable strap (3) to free strain relief collar (4) from conduit (5).
3. See Figure A-48. Using a thin blade, gently pry at seam at back of socket housing to release three plastic pins (1) from slots in housing. Separate and spread halves of socket housing.
4. Push on wire lead to free terminal from chamber.

Installing Socket Terminal

1. From inside socket housing, gently pull on wire to draw terminal into chamber.
2. Exercising caution to avoid pinching wires, press halves of socket housing together until three plastic pins fully engage slots in housing.
3. Install **new** cable strap in groove of strain relief collar capturing cable conduit.
4. With the two ribs on the secondary lock on the same side as the external latch, install over terminals until latches lock in place.

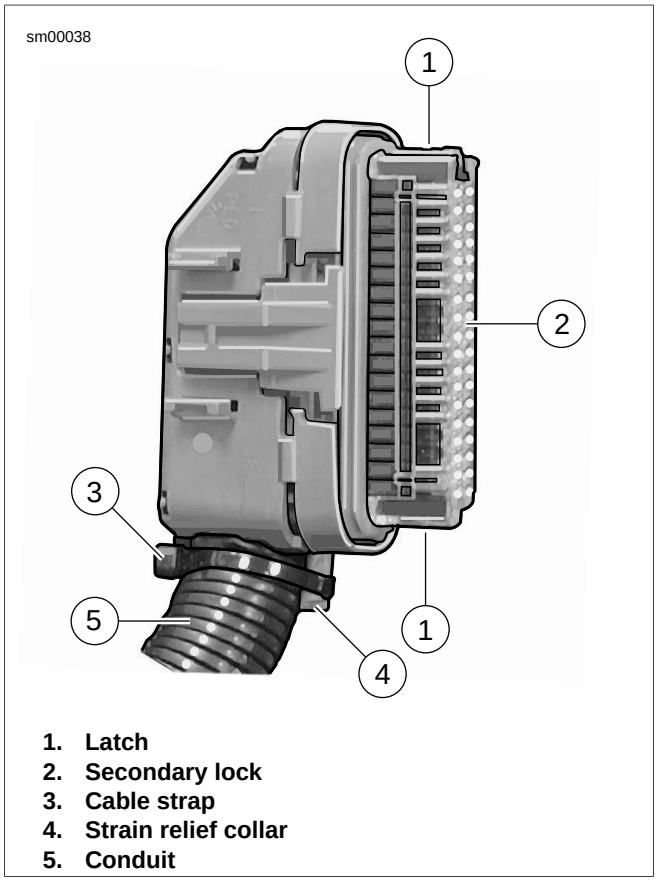
Crimping Terminals

If necessary, crimp new terminals on wire leads. See A.15 PACKARD METRI-PACK TERMINALS.



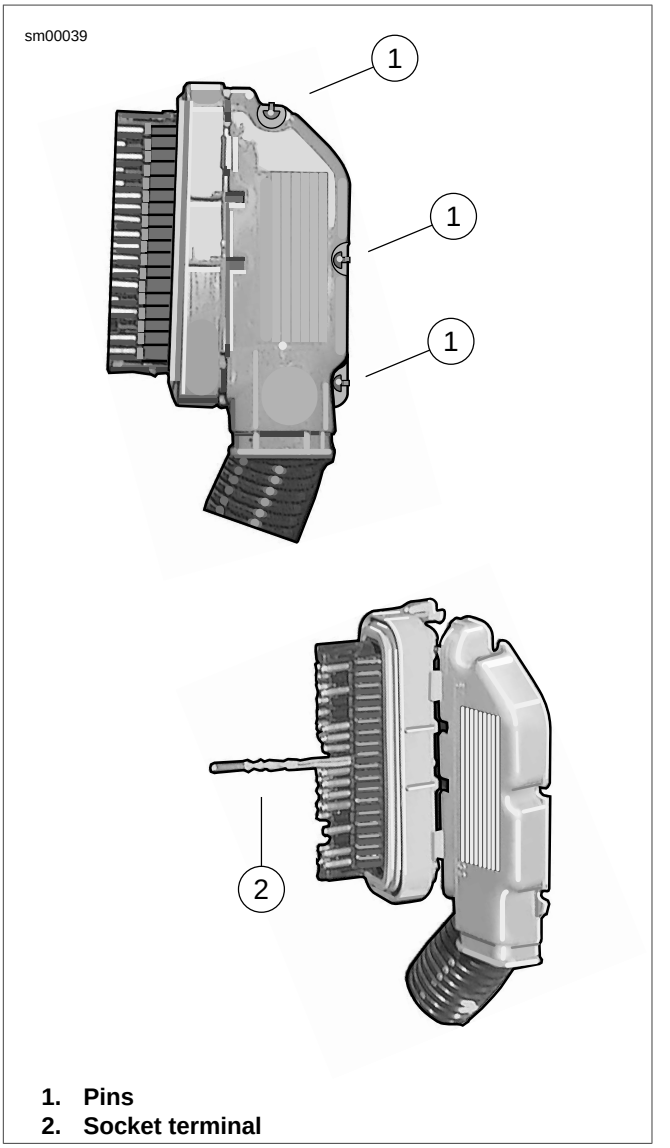
1. **Thumb lever**
2. **Latch**
3. **Catch (ECM)**

Figure A-46. Packard 100W to ECM (Typical)



1. Latch
2. Secondary lock
3. Cable strap
4. Strain relief collar
5. Conduit

Figure A-47. Packard 100W Connector



1. Pins
2. Socket terminal

Figure A-48. Packard 100W Connector: Separate Halves of Socket Housing

PACKARD MICRO-64 CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER

General

Packard Micro-64 connectors are frequently found on speedometers, tachometers and the ECM of Touring Models. For pin 73 of these ECMs, see A.11 PACKARD 150 METRI-PACK CONNECTORS.

Separating Pin and Socket Housings

Bend back the external latches slightly and separate the pin and socket housings.

Mating Pin and Socket Housings

Orient the wire lead colors and push the pin and socket housings of the connector together until the latches click.

Removing Terminal

1. See Figure A-51. Locate the head of the secondary lock (1) on one side of the connector housing.
2. Insert the blade of a small screwdriver between the center ear of the lock and the connector housing and gently pry out lock. When partially removed, pull lock from connector housing.
3. Locate pin hole (2) between terminals on mating end of connector.
4. See Figure A-52. Obtain the PACKARD MICRO-64 TERMINAL REMOVER (Part No. HD-45928).
5. See Figure A-50. Push the adjacent terminals all the way into the connector housing and then insert tool into hole until it bottoms.
6. Leaving the tool installed, gently tug on wires to pull either one or both terminals from wire end of connector. Remove tool.



Figure A-49. Packard Micro 64 Terminal Remover (HD-45928)

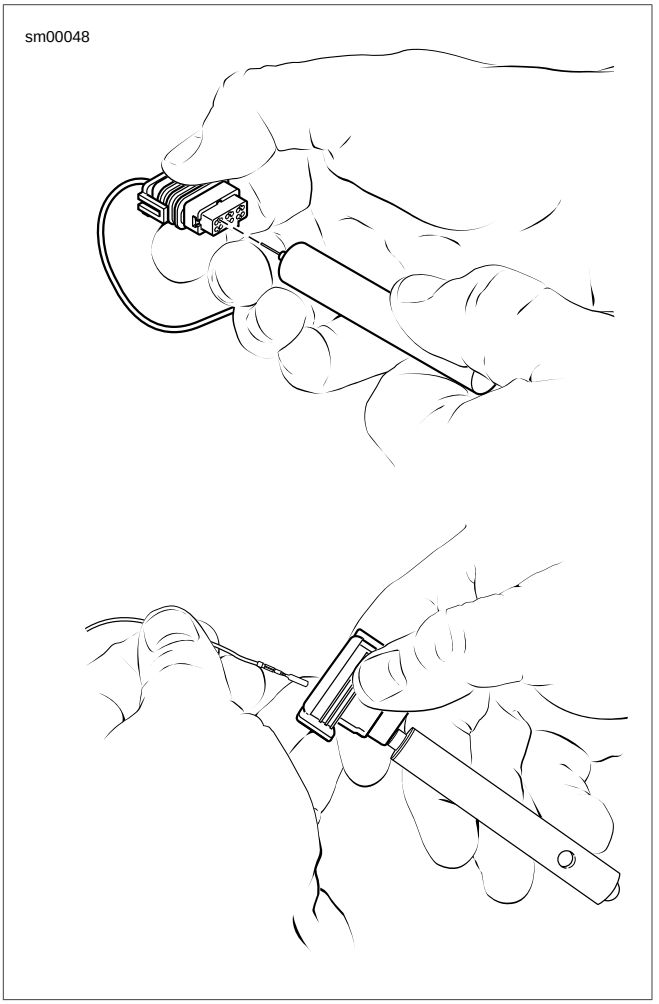


Figure A-50. Packard Micro 64 Connector: Insert Tool and Remove Terminal

Installing Terminal

1. Insert terminal into its respective numbered chamber on wire end of connector. No special orientation of the terminal is necessary.

NOTE

See Figure A-51. For wire location purposes, the corners of the socket housing are stamped (3) with the numbers 1, 6, 7 and 12, representing terminals 1-6 on one side, and 7-12 on the other.

2. Bottom the terminal in the chamber and then gently tug on the wire to verify that it is locked in place.

NOTE

Once the terminal is removed it may not lock in place when first reinstalled. Until the lock engages, move the terminal back and forth slightly while wiggling the lead.

3. Since the terminal remover tool releases two terminals simultaneously, repeat step 2 on the adjacent terminal even if it was not pulled from the connector housing.

4. With the center ear on the head of the secondary lockpin facing the mating end of the connector, push secondary lock in until head is flush with the connector housing.

Preparing Wire Leads for Crimping

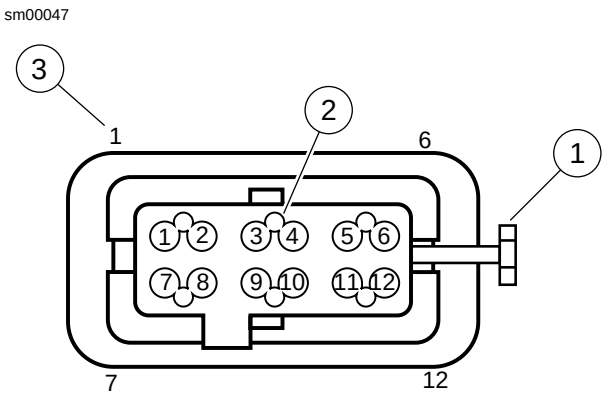
Strip lead removing 1/8 in. (3.0 mm) of insulation.

Crimping Terminals

1. Inspect **new** socket terminal for bent or deformed contact and crimp tails. Replace as necessary.
2. See Figure A-53. Squeeze the handles of the PACKARD MICRO-64 TERMINAL CRIMPER (Part No. HD-45929) to cycle the tool to the fully open position (1).
3. Raise locking bar and barrel holder by pushing up on bottom tab with index finger (2).
4. With the crimp tails facing upward, insert terminal through locking bar into front hole in barrel holder (20-22 gauge wire) (3).
5. Release locking bar to lock position of contact. When correctly positioned, the locking bar fits snugly in the space at the front of the core crimp tails and the closed side of the terminal rests on the outer nest of the crimp tool.
6. Insert wires between crimp tails until ends make contact with locking bar. Verify that wire is positioned so that wide pair of crimp tails squeeze bare wire strands, while the narrow pair folds over the insulation material.
7. Squeeze handle of crimp tool until tightly closed (4). Tool automatically opens when the crimping sequence is complete.
8. Raise locking bar and barrel holder to remove contact.

Inspecting Crimps

Inspect the quality of the core and insulation crimps. Distortion should be minimal.



1. **Secondary lock**
2. **Pin hole**
3. **Stamped number**

Figure A-51. Packard Micro 64 Connector: Housing

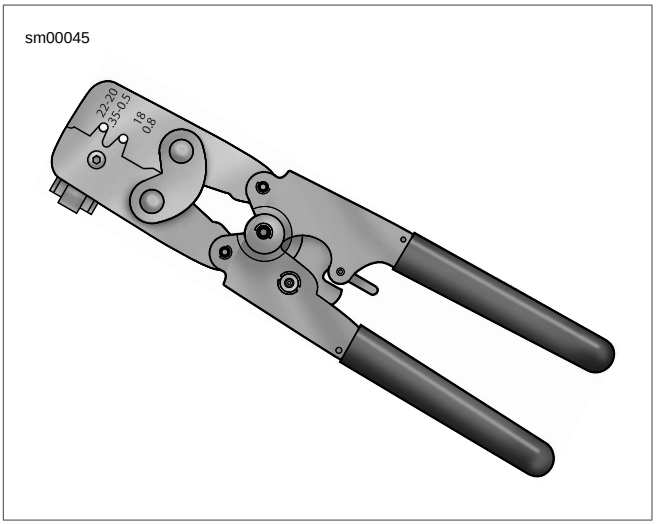
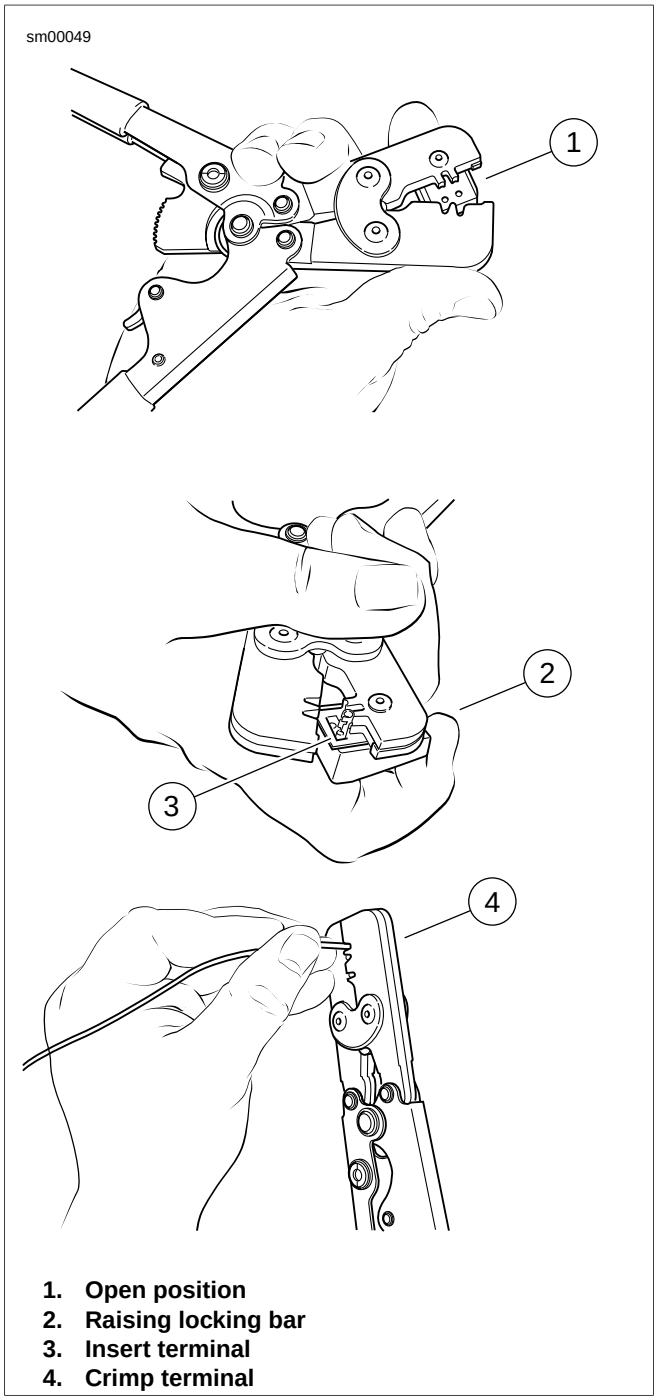


Figure A-52. Packard Micro 64 Terminal Crimper (HD-45929)



1. **Open position**
2. **Raising locking bar**
3. **Insert terminal**
4. **Crimp terminal**

Figure A-53. Packard Micro 64 Connector: Terminal in Crimper

SEALED SPLICE CONNECTOR REPAIR

PART NUMBER	TOOL NAME
HD-25070	ROBINAIR HEAT GUN
HD-38125-8	PACKARD CRIMPING TOOL
HD-39969	ULTRA-TORCH UT-100
HD-41183	HEAT SHIELD ATTACHMENT

General

Splice connectors and several OE ring terminal connectors use heat shrink covering to seal the connection.

Preparing Wire Leads

NOTE

If adjacent wires are to be spliced, stagger the splices so that the sealed splice connectors will not touch each other but are located at different positions along the length of the wires.

1. Using a shop gauge, identify the gauge of the wire.
2. Match the wire gauge to a sealed splice connector by color and part number. Refer to Table A-5.
3. Using a wire stripper, cut and strip a length of insulation off the wire ends. Refer to Table A-5 for the strip length.

Table A-5. Sealed Splice Connectors

WIRE GAUGE	CONNECTOR COLOR	CONNECTOR PART NO.	STRIP LENGTH
18-20 (0.5-0.8 mm)	Red	70585-93	3/8 in. (9.5 mm)
14-16 (1.0-2.0 mm)	Blue	70586-93	3/8 in. (9.5 mm)
10-12 (3.0-5.0 mm)	Yellow	70587-93	3/8 in. (9.5 mm)

NOTE

If any copper wire strands are cut off of the wire core, trim the end and strip the wire again in a larger gauge stripper.

Splicing Wire Leads

NOTE

See Figure A-55. The connector is crimped twice - one side and then the other.

1. See Figure A-54. Open the PACKARD CRIMPING TOOL (Part No. HD-38125-8) ratchet by squeezing the handles closed.
2. Match the connector color to the wire gauge crimp die in the jaws and insert one end of the sealed connector.
3. Gently squeeze the handles until the connector is held in the jaws.
4. See Figure A-55. Feed the stripped end of a wire into the connector until the wire stops inside the metal insert (1).
5. Squeeze the handles tightly closed to crimp the lead in the insert (2). The tool automatically opens when the crimping is complete.
6. Slide the connector to the other half of the metal insert. Insert the stripped wire lead (1) until it stops, and crimp the lead in the insert (2).

⚠WARNING

Be sure to follow manufacturer's instructions when using the UltraTorch UT-100 or any other radiant heating device. Failure to follow manufacturer's instructions can cause a fire, which could result in death or serious injury. (00335a)

- Avoid directing heat toward any fuel system component. Extreme heat can cause fuel ignition/explosion resulting in death or serious injury.
- Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed.
- Always keep hands away from tool tip area and heat shrink attachment.

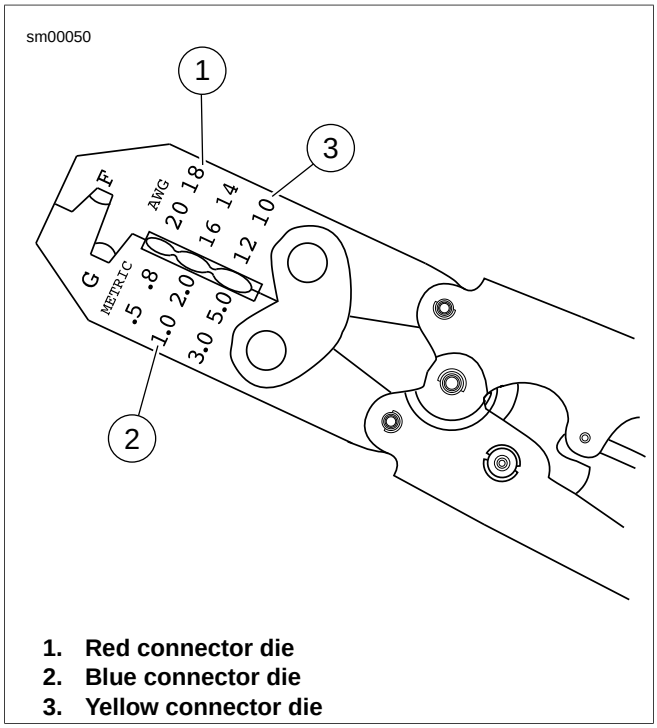
7. Use an ULTRA-TORCH UT-100 (Part No. HD-39969), or a ROBINAIR HEAT GUN (Part No. HD-25070) with a HEAT SHIELD ATTACHMENT (Part No. HD-41183), to heat the connector from the center of the crimp (3) out to each end.

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

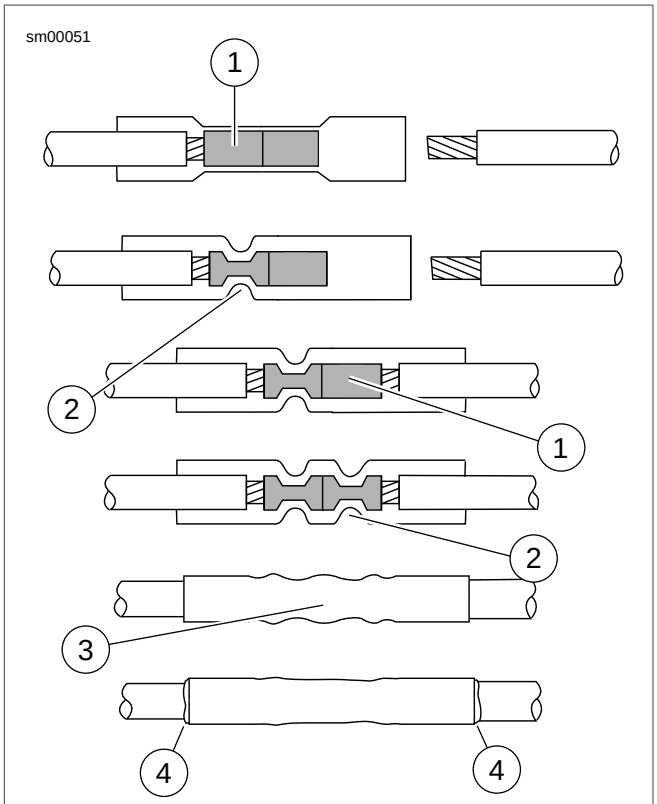
Inspecting Seals

See Figure A-55. Allow the splice to cool and inspect the seal. The insulation should appear smooth and cylindrical. Melted sealant will have extruded out the ends (4) of the insulation.



1. **Red connector die**
2. **Blue connector die**
3. **Yellow connector die**

Figure A-54. Packard Crimping Tool (HD-38125-8)



1. **Wire lead in metal insert**
2. **Crimp metal insert**
3. **Center of crimp**
4. **Melted sealant**

Figure A-55. Sealed Splice Connector

NOTES

SUBJECT **PAGE NO.**
B.1 CONNECTORS.....B-1
B.2 WIRING DIAGRAMS.....B-3

NOTES

CONNECTOR LOCATIONS

Function/Location

Refer to Table B-1. On the motorcycle, a connector can be identified by its function and location.

Place and Color

The place (number of wire cavities of a connector housing) and color of the connector can also aid identification.

Connector Number

On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets.

Repair Instructions

The repair instructions in this Service Manual are by connector type. Refer to Table B-1.

Table B-1. Connector Locations: Dyna Models

CONNECTOR NO.	DESCRIPTION	TYPE	LOCATION
[4]	accessory connector	4-place Deutsch	under seat
[5]	main fuse	spade terminals	under electrical caddie cover
[7]	tail lamp harness to main harness	8-place Multilock	under seat
[18]	left rear turn signal	2-place Multilock	inside tail lamp lens
[19]	right rear turn signal	2-place Multilock	inside tail lamp lens
[20]	console gauges/indicator lamps (all except FXDWG, FXDF, FXDC)	12-place Deutsch	inside top frame tube
[21]	indicator lamps	8-place Mini-Deutsch	FXDWG, FXDF, FXDC, FXDB: under fuel tank console
[22]	right hand controls	6-place Molex	inside top frame tube
[24]	left hand controls and horn	8-place Molex	inside top frame tube
[30]	TSM/TSSM/HFSM	12-place Deutsch	under electrical caddie cover
[31 L]	front turn signals (left)	3-place Multilock	inside top frame tube
[31 R]	right turn signals (left)	3-place Multilock	inside top frame tube
[33]	ignition key switch	3-place Packard	FXD, FXDL: inside top frame tube FXDWG, FXDF, FXDC: under fuel tank console
[38]	headlamp	4-place Multilock	inside top frame tube
[39]	speedometer	12-place Packard	back of speedometer
[46]	voltage regulator to stator	4-place Deutsch	inside front electrical caddie
[62]	starter relay	5-place Amp	under electrical caddie cover
[62]	system relay	5-place Amp	under electrical caddie cover
[65]	vehicle speed sensor (VSS)	3-place Delphi	rear of transmission case
[77]	voltage regulator	2-place Deutsch	inside front electrical caddie
[78]	electronic control module (ECM)	36-place Packard	under electrical caddie cover
[79]	crank position sensor (CKP)	2-place Mini-Deutsch	inside front electrical caddie
[80]	manifold air pressure sensor (MAP)	3-place Packard	top of induction module
[83]	ignition coil	4-place Delphi	back of coil
[84]	front injector	2-place Delphi	beneath fuel tank
[85]	rear injector	2-place Delphi	beneath fuel tank
[86]	fuel pump and sender	4-place Packard	top of fuel tank
[87]	idle air control (IAC)	4-place Delphi	beneath fuel tank
[88]	throttle position sensor (TP)	3-place Delphi	behind air cleaner backing plate
[89]	intake air temperature sensor (IAT)	2-place Delphi	behind air cleaner backing plate
[90]	engine temperature sensor (ET)	2-place Delphi	back of front cylinder, left side

Table B-1. Connector Locations: Dyna Models

CON-NECTOR NO.	DESCRIPTION	TYPE	LOCATION
[91]	data link connector	4-place Deutsch	under electrical caddie cover
[93]	tail lamp	4-place Multilock	inside tail lamp lens
[94]	tail lamp power in	6-place Multilock	inside tail lamp lens
[108]	tachometer	12-place Packard	back of tachometer
[117]	fuel gauge	4-place Multilock	under fuel tank
[120]	oil pressure switch	post terminal	on oil pressure switch, front of right crankcase
[122]	horn	spade terminals	between cylinders, left side
[128]	starter solenoid	spade terminal	top of starter
[137]	rear oxygen sensor	2-place Amp	under seat
[138]	front oxygen sensor	2-place Amp	inside front electrical caddie
[141]	fuel pump and sender	4-place Delphi	top of fuel tank
[142]	security siren (optional)	3-place Delphi	under seat
[154]	speedometer reset switch		FXD: back of speedometer FXDB, FXDL, FXDWG, FXDF, FXDC: on console
[160]	B+ connector	1-place Packard	under seat
[178]	active intake solenoid	2-place Amp	air cleaner backing plate
[179]	active exhaust	5-place Amp	behind rear cylinder head
[208]	hands free security module antenna harness	4-place Deutsch	under electrical caddie cover
[209]	hands free security module antenna	2-place Molex	under seat
-	fuse block	spade terminals	under electrical caddie cover
-	harness grounds (2)	ring terminals	under seat
-	neutral switch	post terminals	top of transmission
-	rear stoplight switch	spade terminals	behind rear brake master cylinder

WIRING DIAGRAM INFORMATION

Wire Color Codes

Wire traces on wiring diagrams are labeled with alpha codes. Refer to Table B-2.

For Solid Color Wires: See Figure B-1. The alpha code identifies wire color (3).

For Striped Wires: The code is written with a slash (/) between the solid color code and the stripe code (4). For example, a trace labeled GN / Y is a green wire with a yellow stripe.

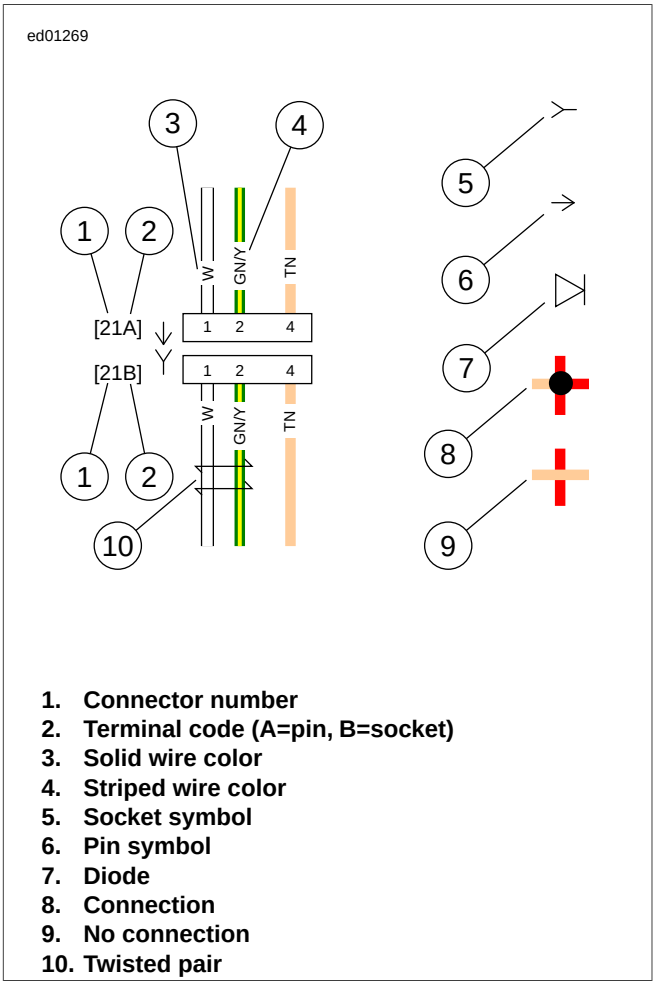
Wiring Diagram Symbols

See Figure B-1. On wiring diagrams and in service/repair instructions, connectors are identified by a number in brackets (1). The letter (2) inside the brackets identifies whether the housing is a socket or pin housing.

A=Pin: The letter A after a connector number and the pin symbol (6) identifies a pin housing.

B=Socket: The letter B after a connector number and the socket symbol (5) identifies a socket housing.

Other symbols found on the wiring diagrams include the symbol for a diode (7), a symbol for a wire-to-wire connection (8), a symbol that verifies that no connection (9) between two wire traces exists and a symbol identifying two wires that are twisted together (10).



1. **Connector number**
2. **Terminal code (A=pin, B=socket)**
3. **Solid wire color**
4. **Striped wire color**
5. **Socket symbol**
6. **Pin symbol**
7. **Diode**
8. **Connection**
9. **No connection**
10. **Twisted pair**

Figure B-1. Connector/Wiring Diagram Symbols (typical)

Table B-2. Wire Color Codes

ALPHA CODE	WIRE COLOR
BE	Blue
BK	Black
BN	Brown
GN	Green
GY	Grey
LGN	Light Green
O	Orange
PK	Pink
R	Red
TN	Tan
V	Violet
W	White
Y	Yellow

Refer to the table below for wiring diagram information.

Wiring Diagram List

DIAGRAM	LOCATION
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 1 OF 3	Figure B-2
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 2 OF 3	Figure B-3
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 3 of 3	Figure B-4
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), CHARGING CIRCUIT	Figure B-5
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), STARTING CIRCUIT	Figure B-6
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), IGNITION CIRCUIT	Figure B-7
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 1 OF 2	Figure B-8
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 2 OF 2	Figure B-9
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), HORN & INSTRUMENTS CIRCUIT	Figure B-10
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 1 OF 2	Figure B-11
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 2 OF 2	Figure B-12
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 1 OF 3	Figure B-13
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 2 OF 3	Figure B-14
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 3 OF 3	Figure B-15
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, CHARGING CIRCUIT	Figure B-16
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, STARTING CIRCUIT	Figure B-17
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, IGNITION CIRCUIT	Figure B-18
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 1 OF 2	Figure B-19
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 2 OF 2	Figure B-20
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, HORN & INSTRUMENTS CIRCUIT	Figure B-21
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 1 OF 2	Figure B-22
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 2 OF 2	Figure B-23

et01125

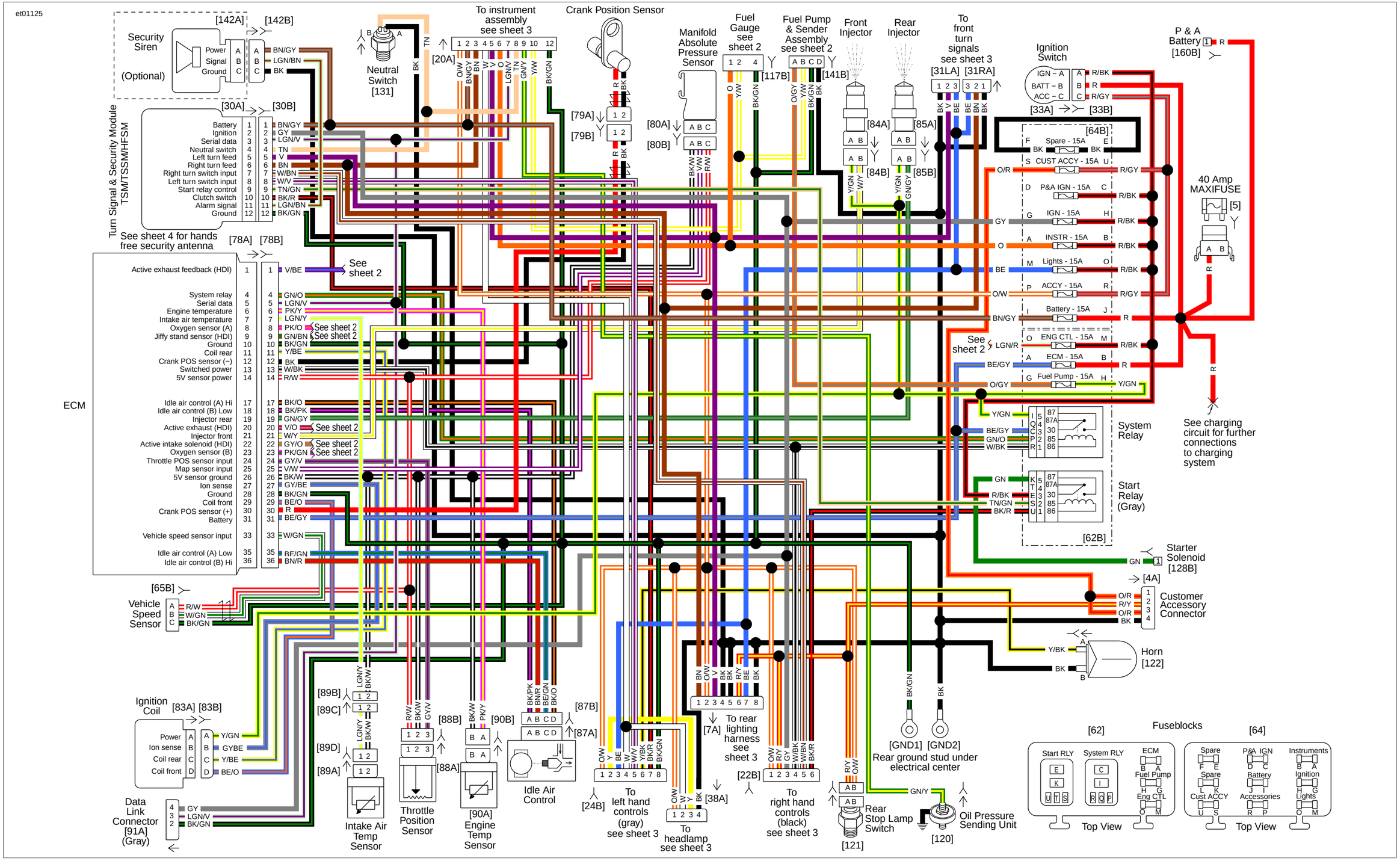


Figure B-2. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 1 OF 3

Figure B-2.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 1 OF 3

Figure B-2.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 1 OF 3

et01126

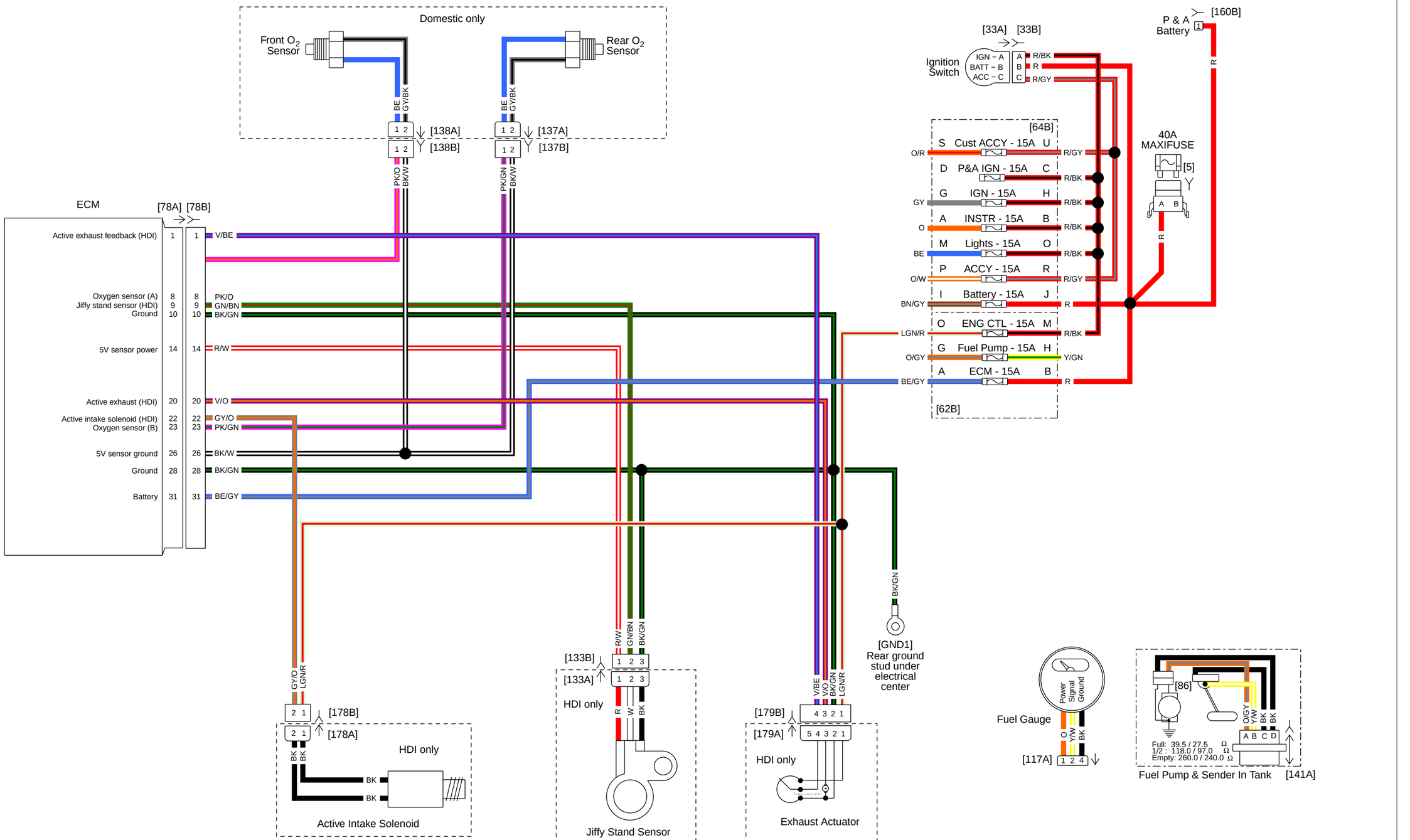
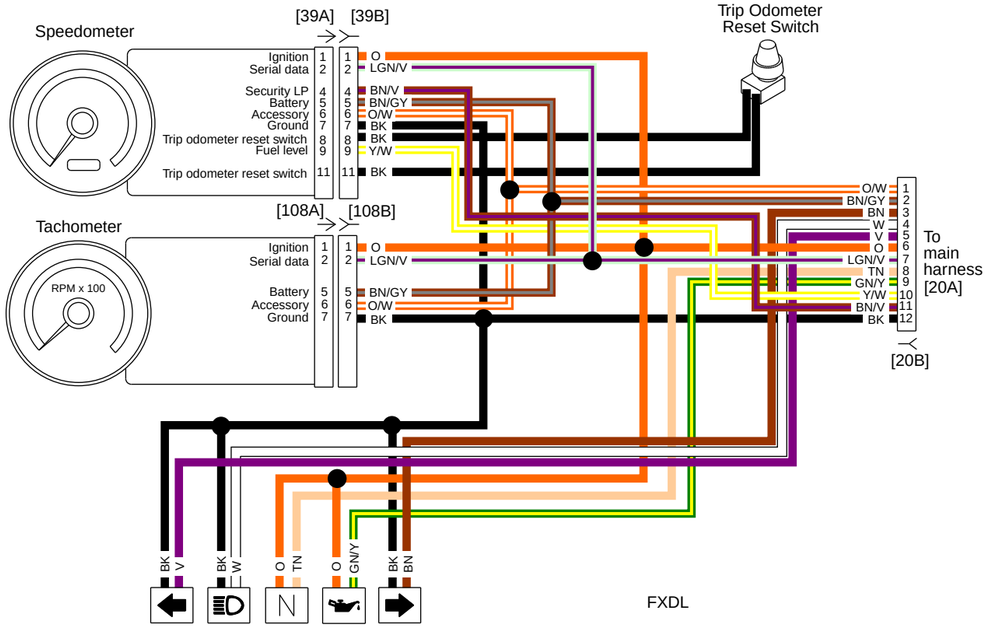


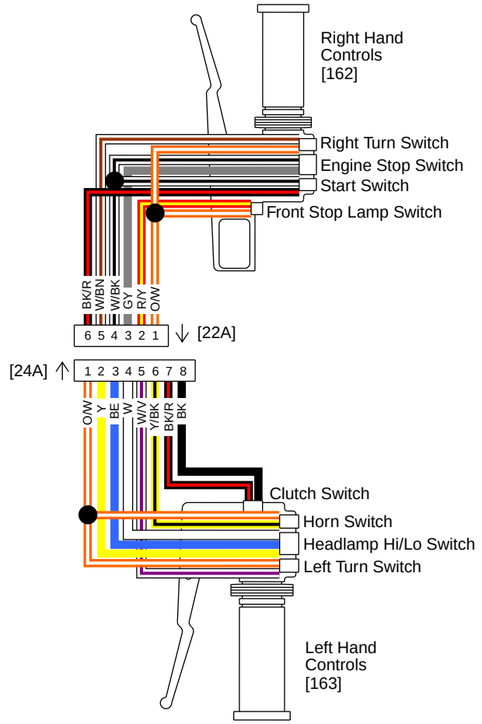
Figure B-3. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 2 OF 3

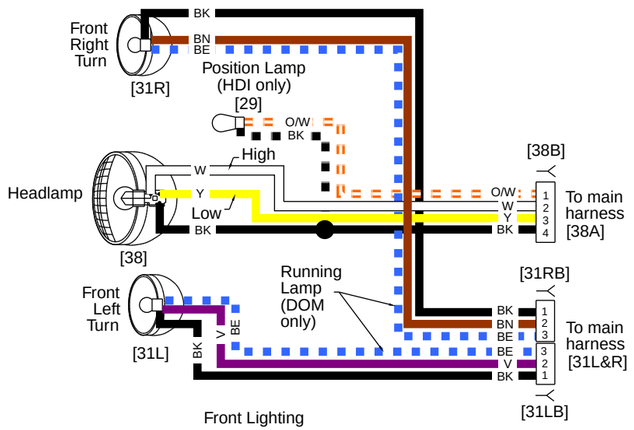
Figure B-3.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 2 OF 3

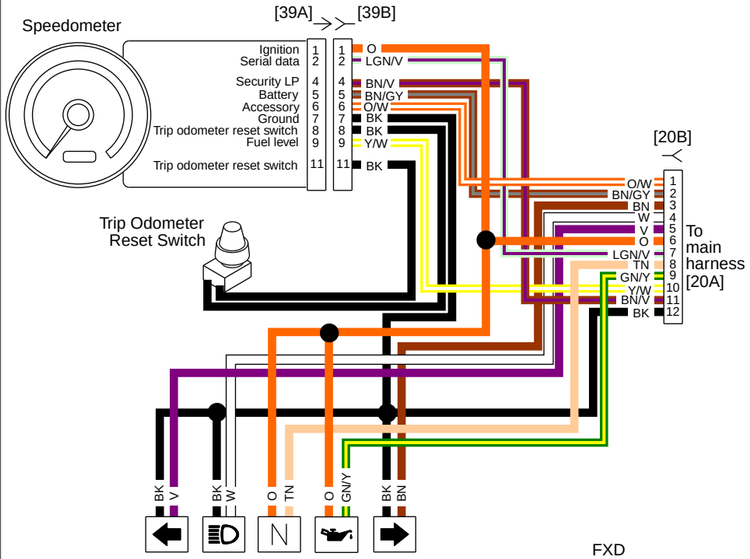
Figure B-3.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 2 OF 3

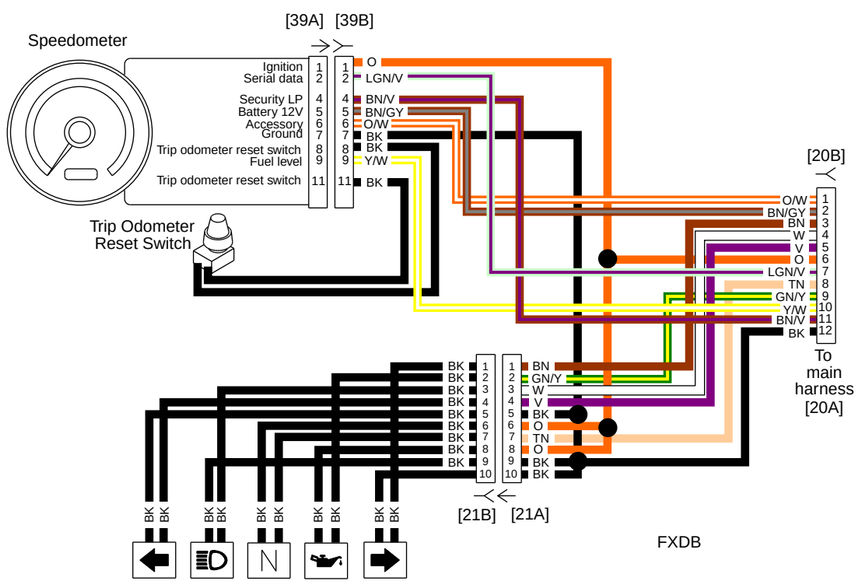
et01127











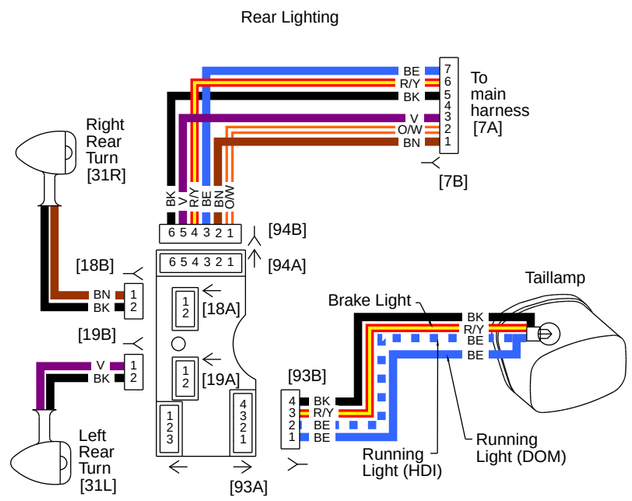


Figure B-4. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 3 of 3

Figure B-4.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 3 of 3

Figure B-4.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), MAIN HARNESS, SHEET 3 of 3

et01131

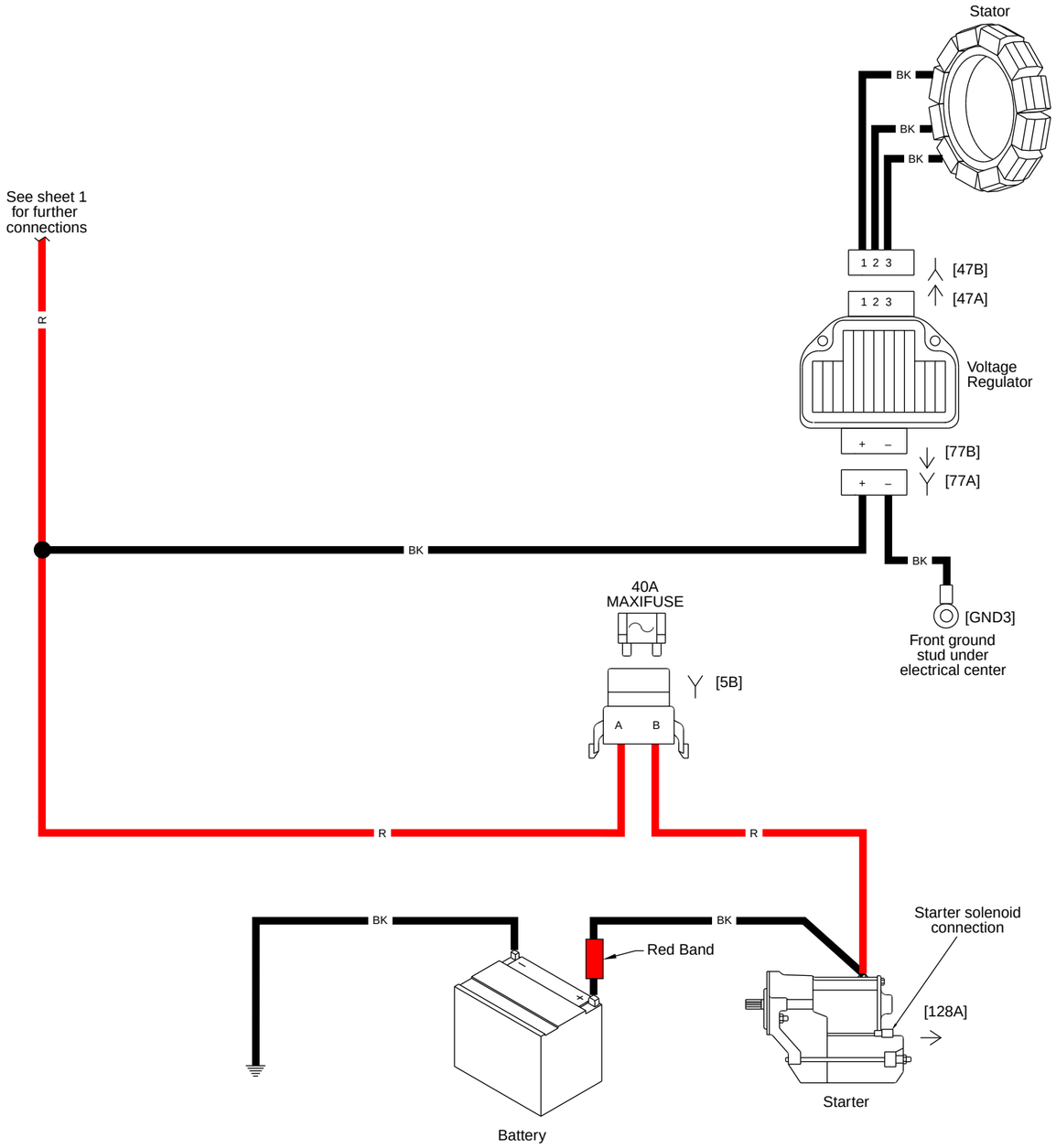


Figure B-5. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), CHARGING CIRCUIT

Figure B-5.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), CHARGING CIRCUIT

Figure B-5.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), CHARGING CIRCUIT

et01132

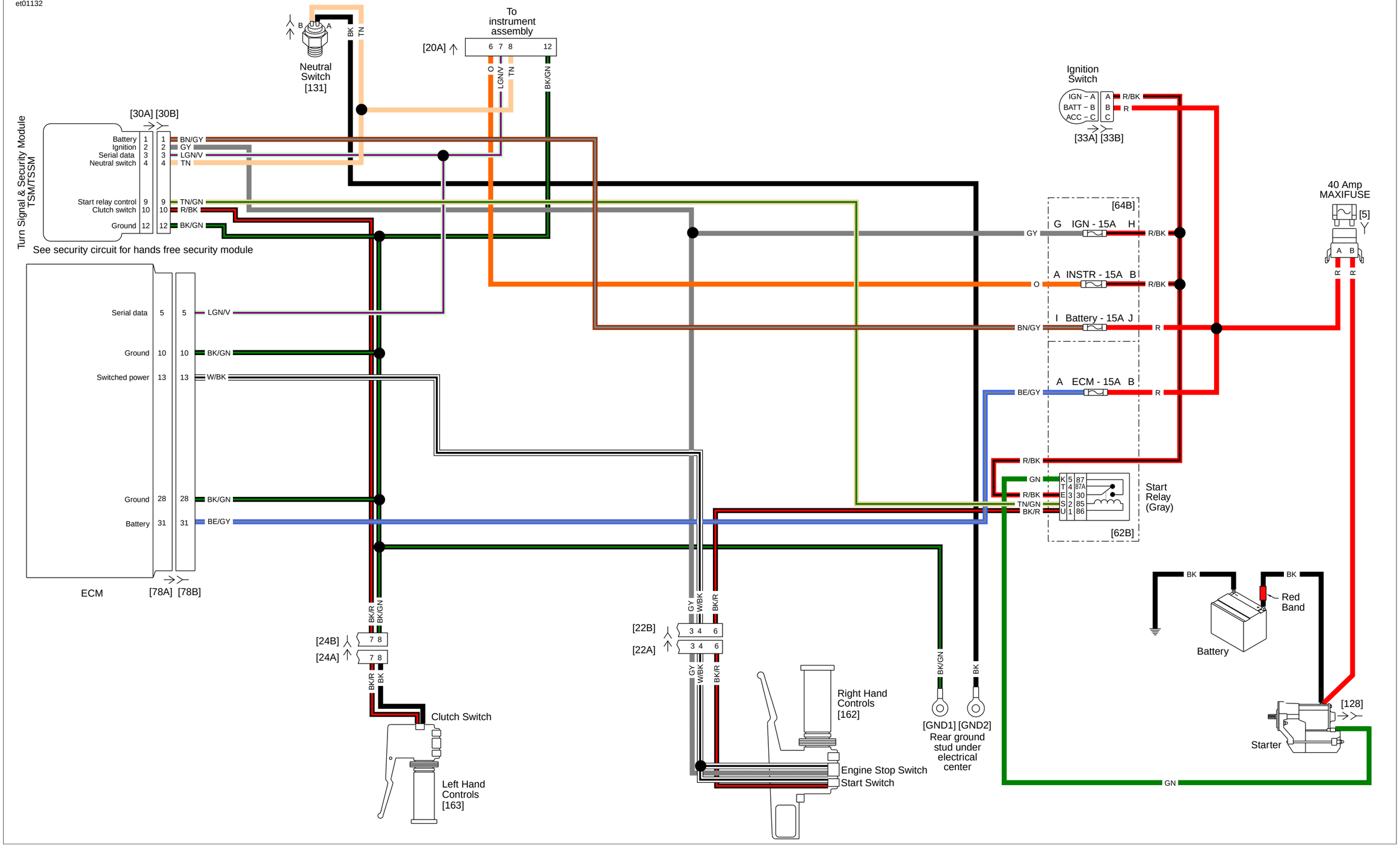


Figure B-6. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), STARTING CIRCUIT

Figure B-6.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), STARTING CIRCUIT

Figure B-6.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), STARTING CIRCUIT

et01133

Domestic only

To instrument assembly [20A]

Turn Signal & Security Module TSM/TSSM

ECM

Ignition Coil

Data Link Connector (Gray)

Front O_2 Sensor

Rear O_2 Sensor

Crank Position Sensor

Manifold Absolute Pressure Sensor

Fuel Pump & Sender Assy [141B]

Front Injector

Rear Injector

Ignition Switch

40 Amp MAXIFUSE

System Relay

Intake Air Temp Sensor

Throttle Position Sensor [88A]

Engine Temp Sensor [90A]

Idle Speed Control [87A]

Intake Actuator Solenoid

HDI only

Exhaust Actuator

[GND1] Rear ground stud under electrical center

To right hand controls [22B]

HDI only

Jiffy Stand Sensor

Figure B-7. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), IGNITION CIRCUIT

Figure B-7.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), IGNITION CIRCUIT

Figure B-7.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), IGNITION CIRCUIT

et01128

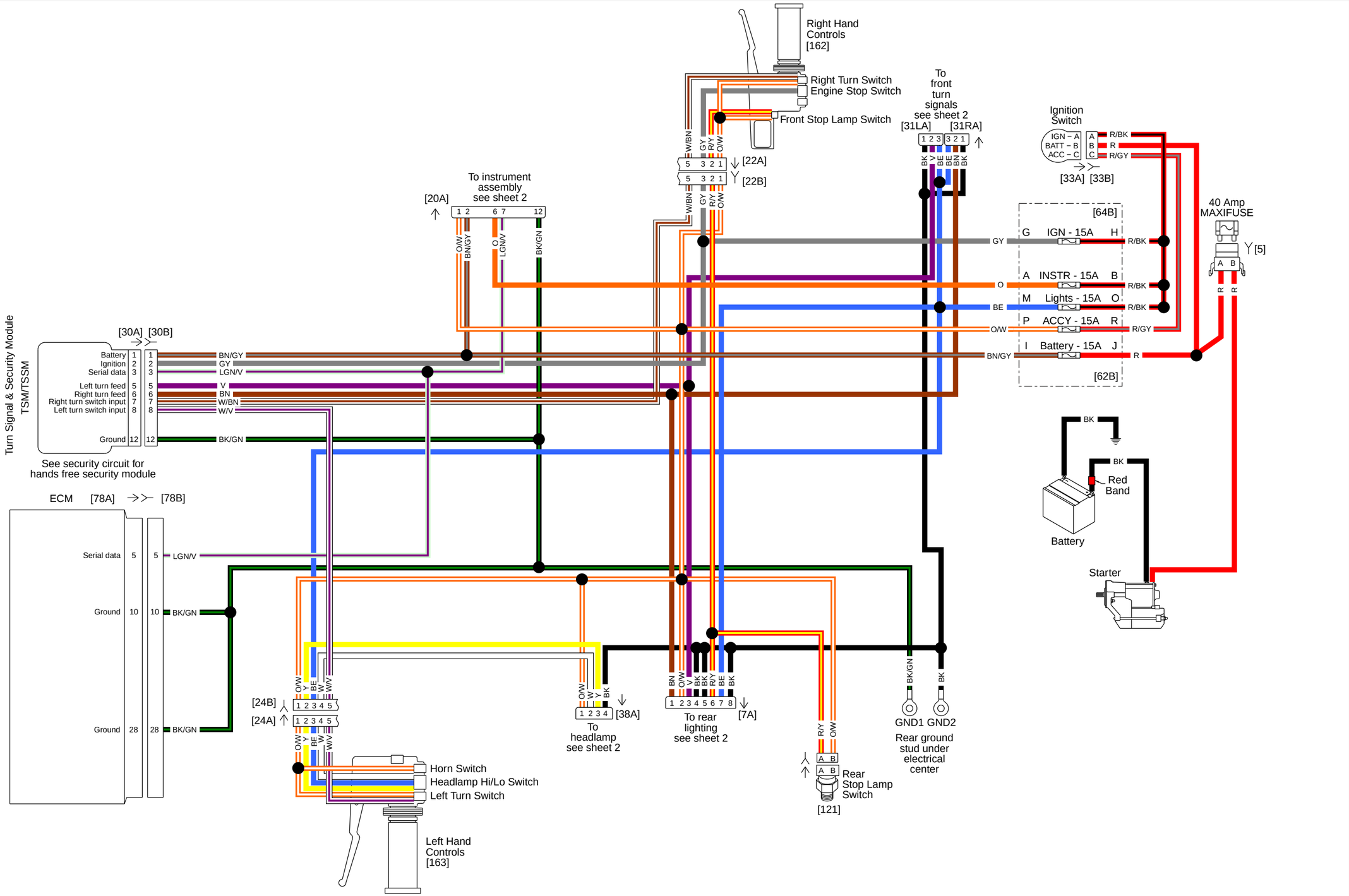
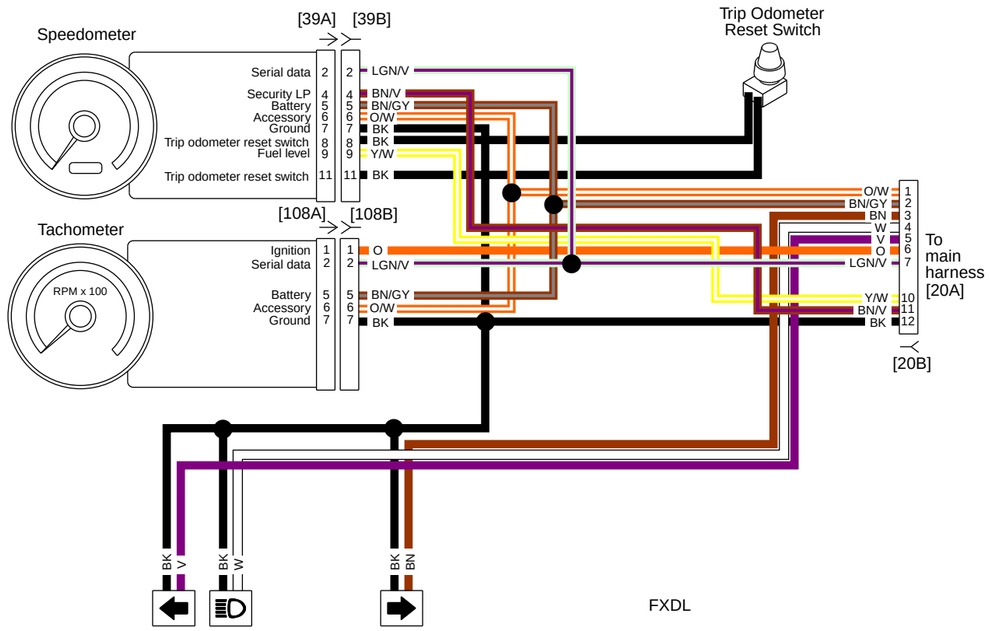


Figure B-8. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 1 OF 2

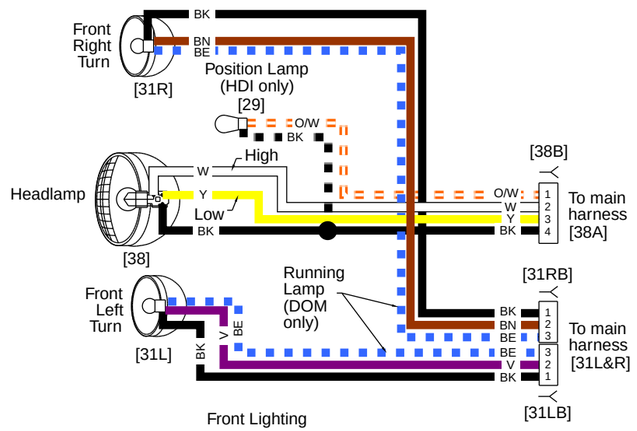
Figure B-8.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 1 OF 2

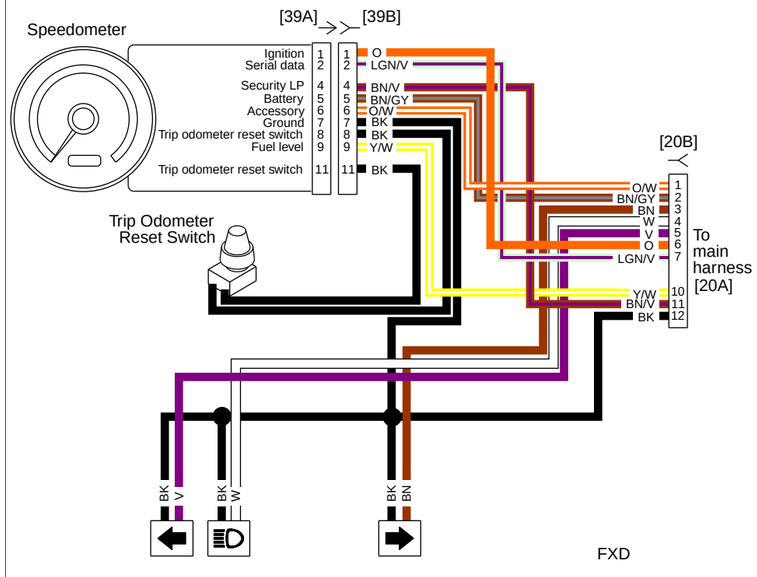
Figure B-8.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 1 OF 2

et01129

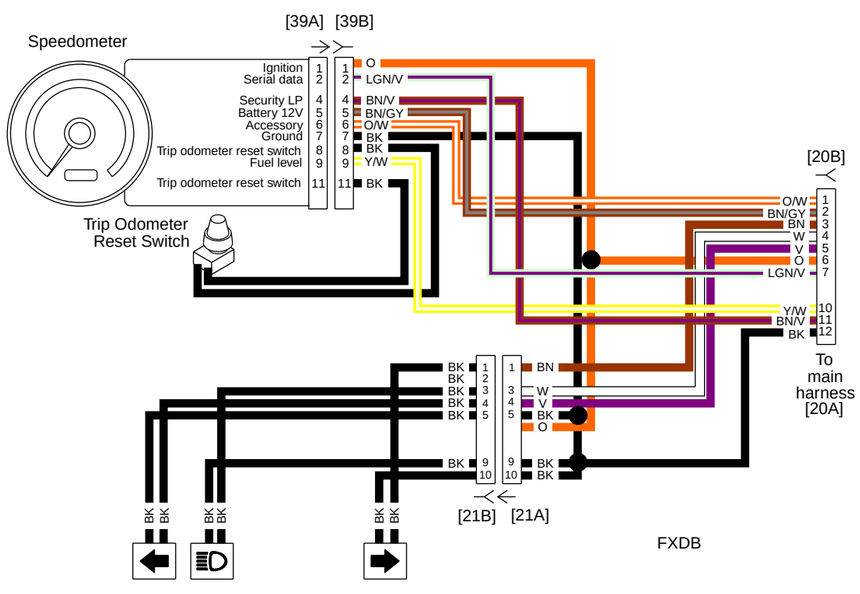


FXDL





FXD



FXDB

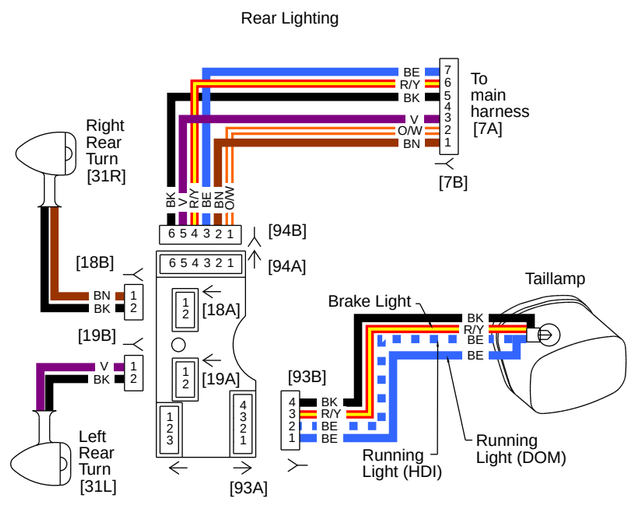
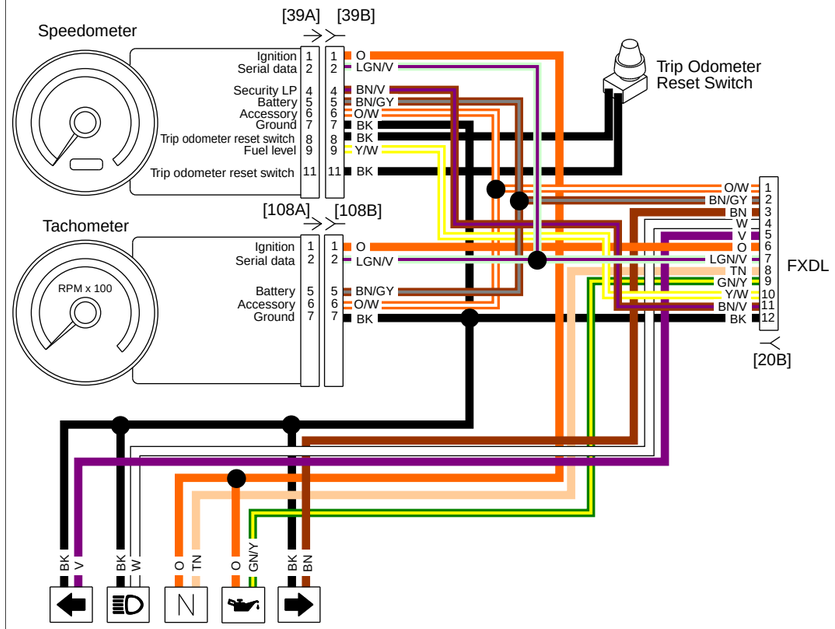


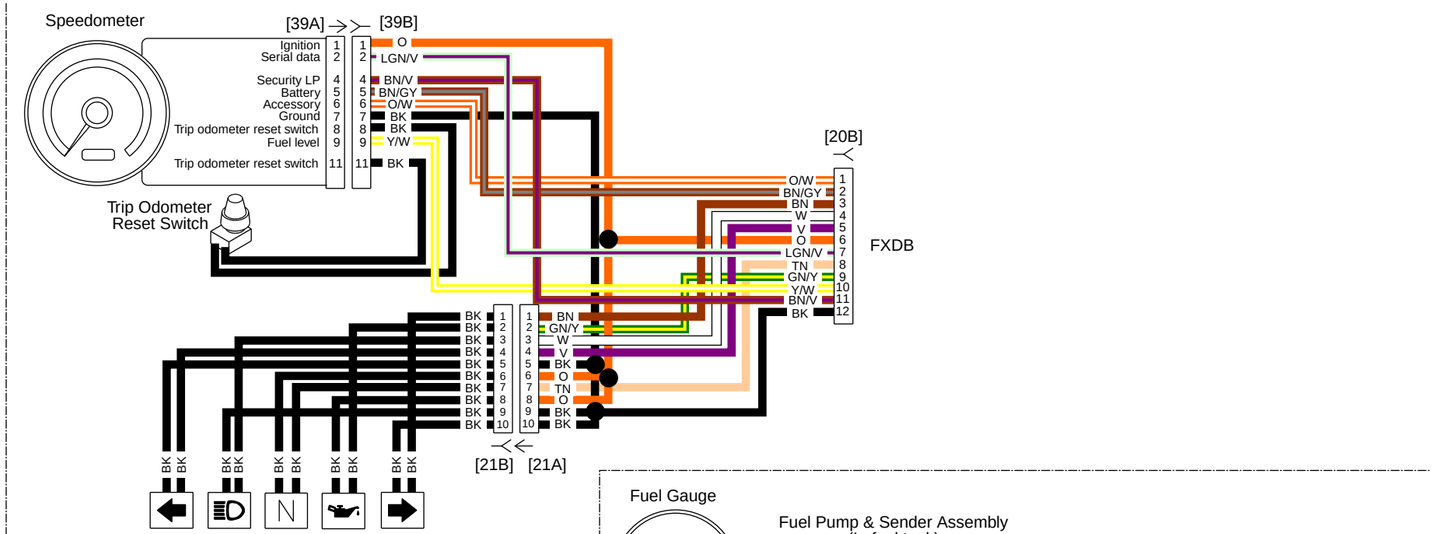
Figure B-9. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 2 OF 2

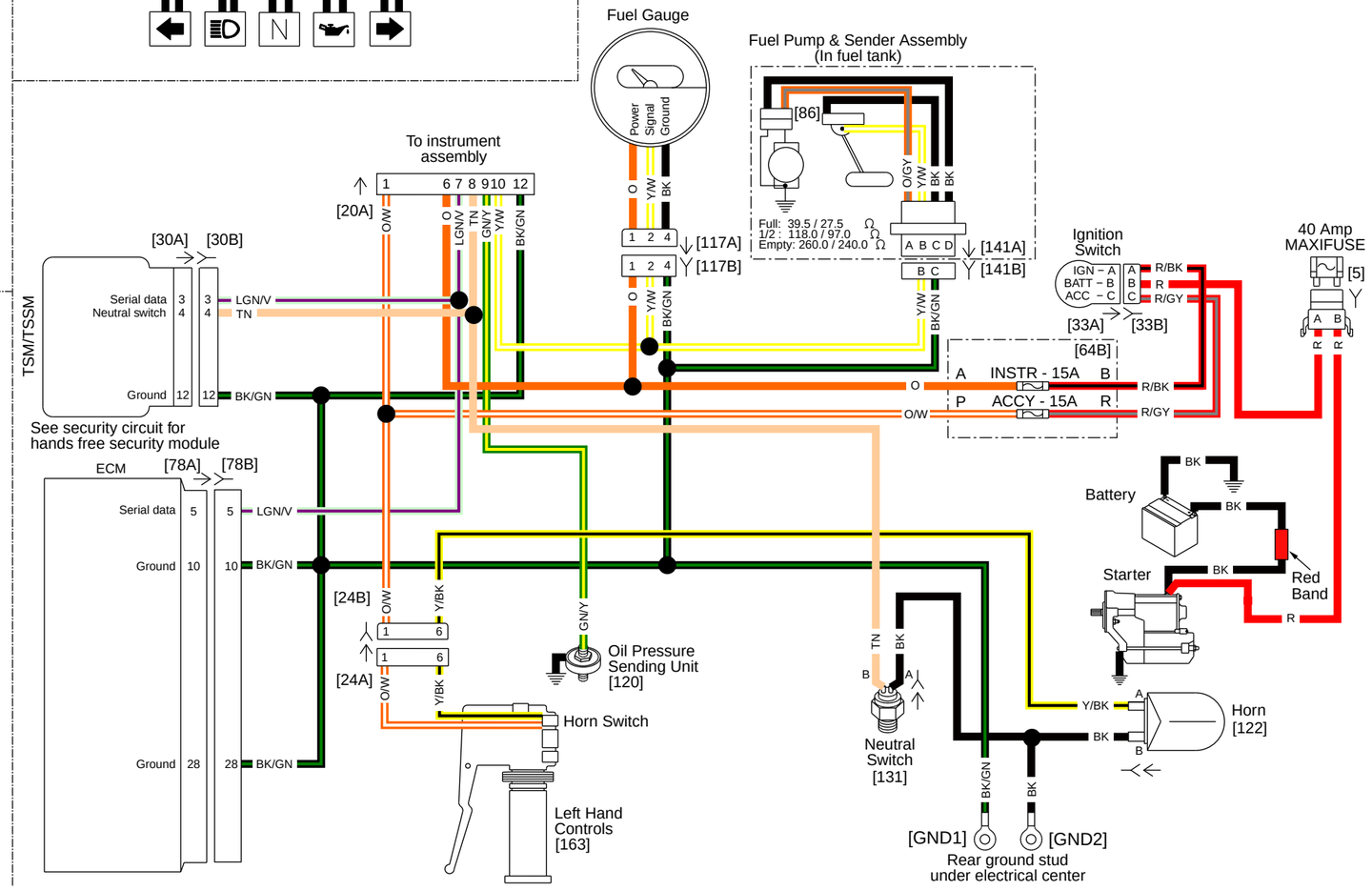
Figure B-9.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 2 OF 2

Figure B-9.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), LIGHTS, SHEET 2 OF 2

et01130







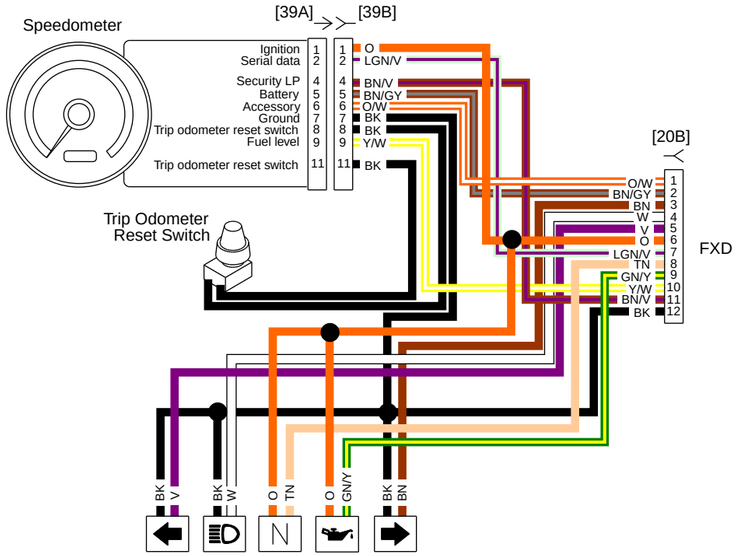


Figure B-10. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), HORN & INSTRUMENTS CIRCUIT

Figure B-10.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), HORN & INSTRUMENTS CIRCUIT

Figure B-10.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), HORN & INSTRUMENTS CIRCUIT

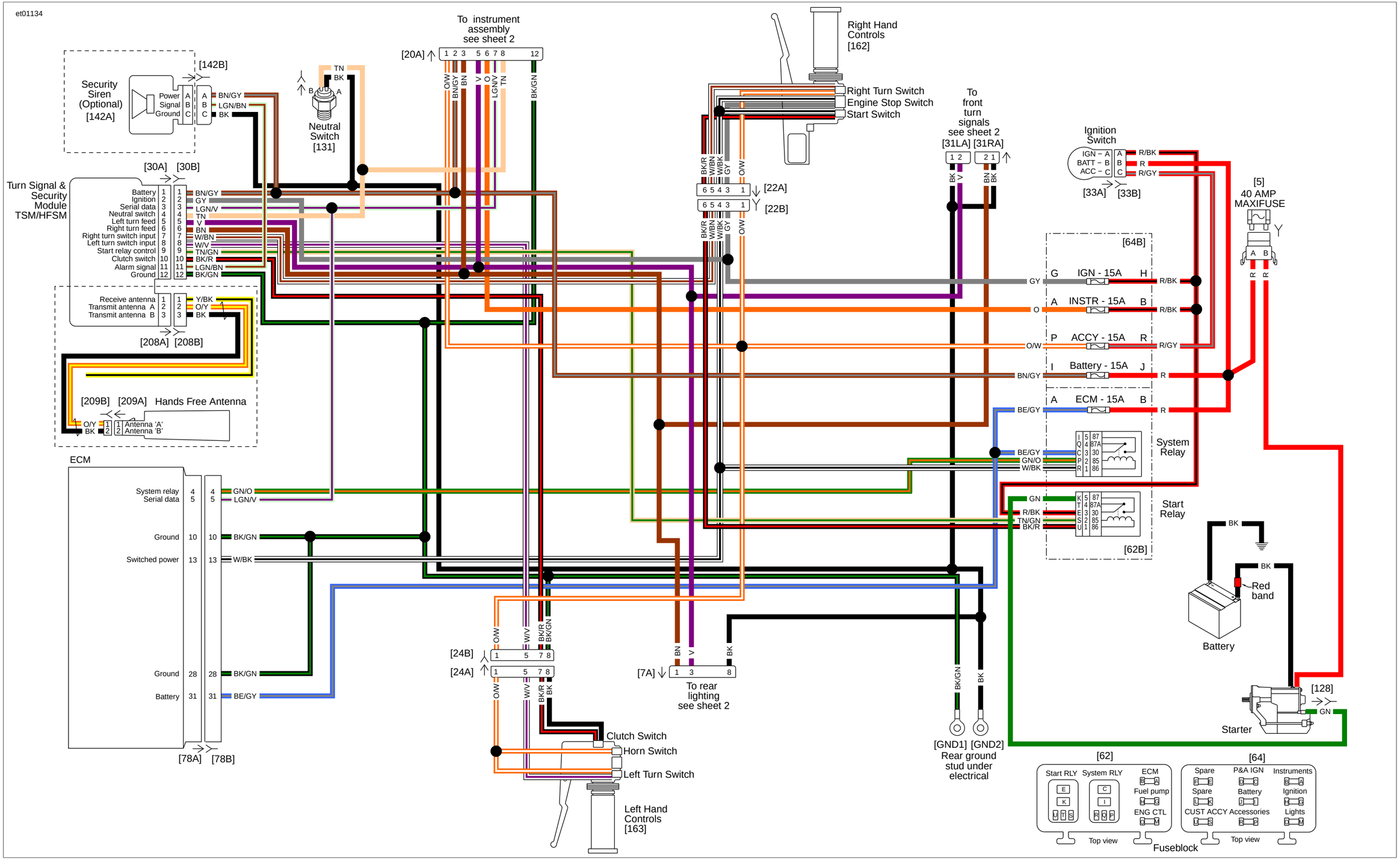
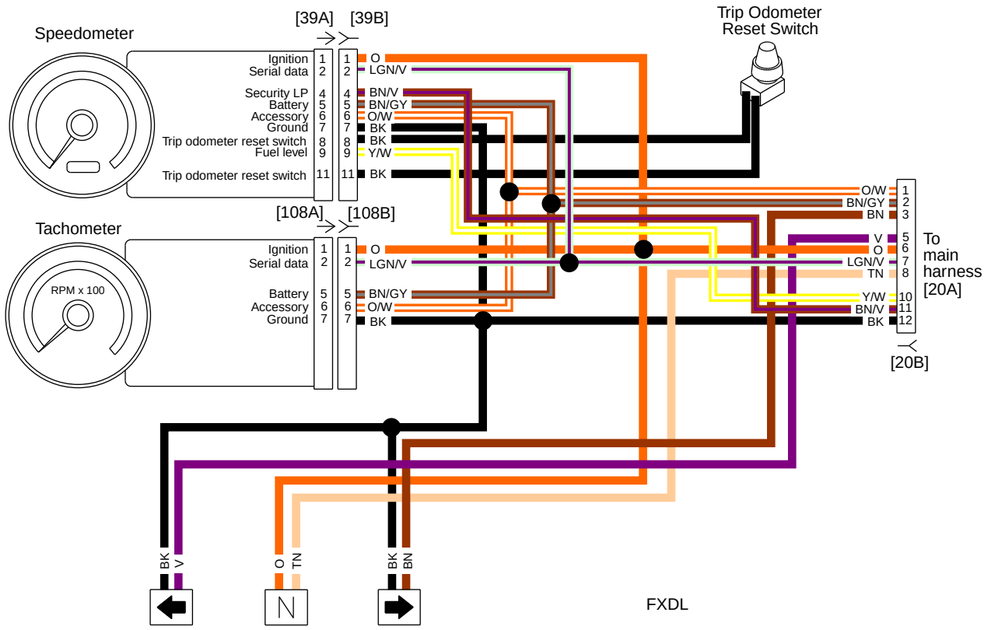


Figure B-11. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 1 OF 2

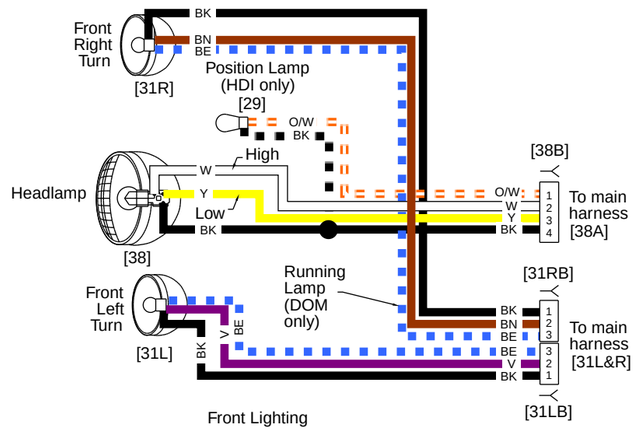
Figure B-11.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 1 OF 2

Figure B-11.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 1 OF 2

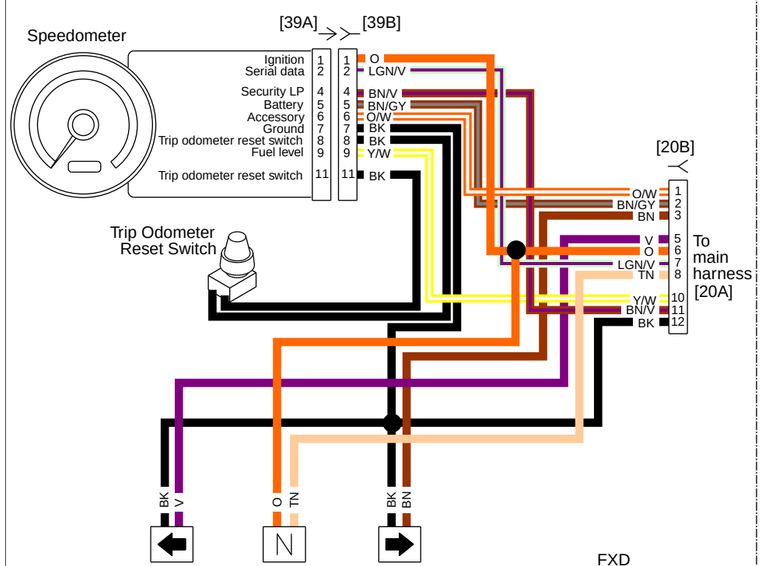
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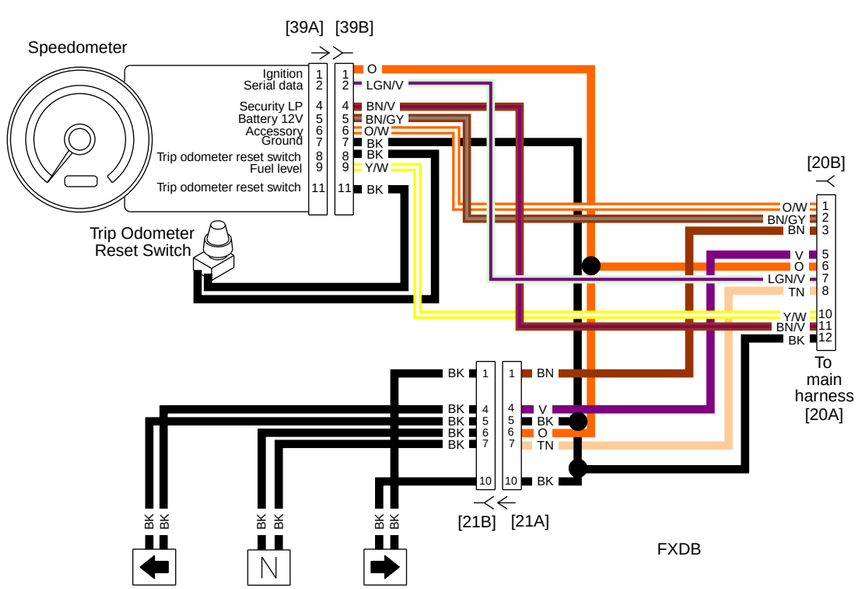
FXDL



Front Lighting



FXD



FXDB

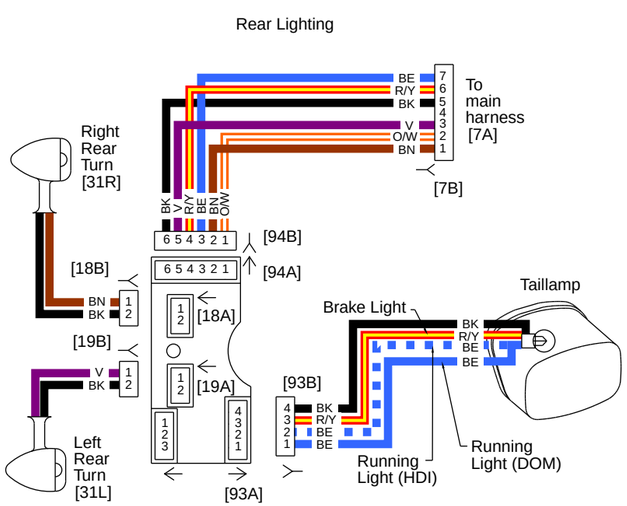


Figure B-12. 2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 2 OF 2

Figure B-12.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 2 OF 2

Figure B-12.
2008 ALL DYNA DOM. and INT. MODELS (Except FXDWG, FXDC, FXDF), SECURITY, SHEET 2 OF 2

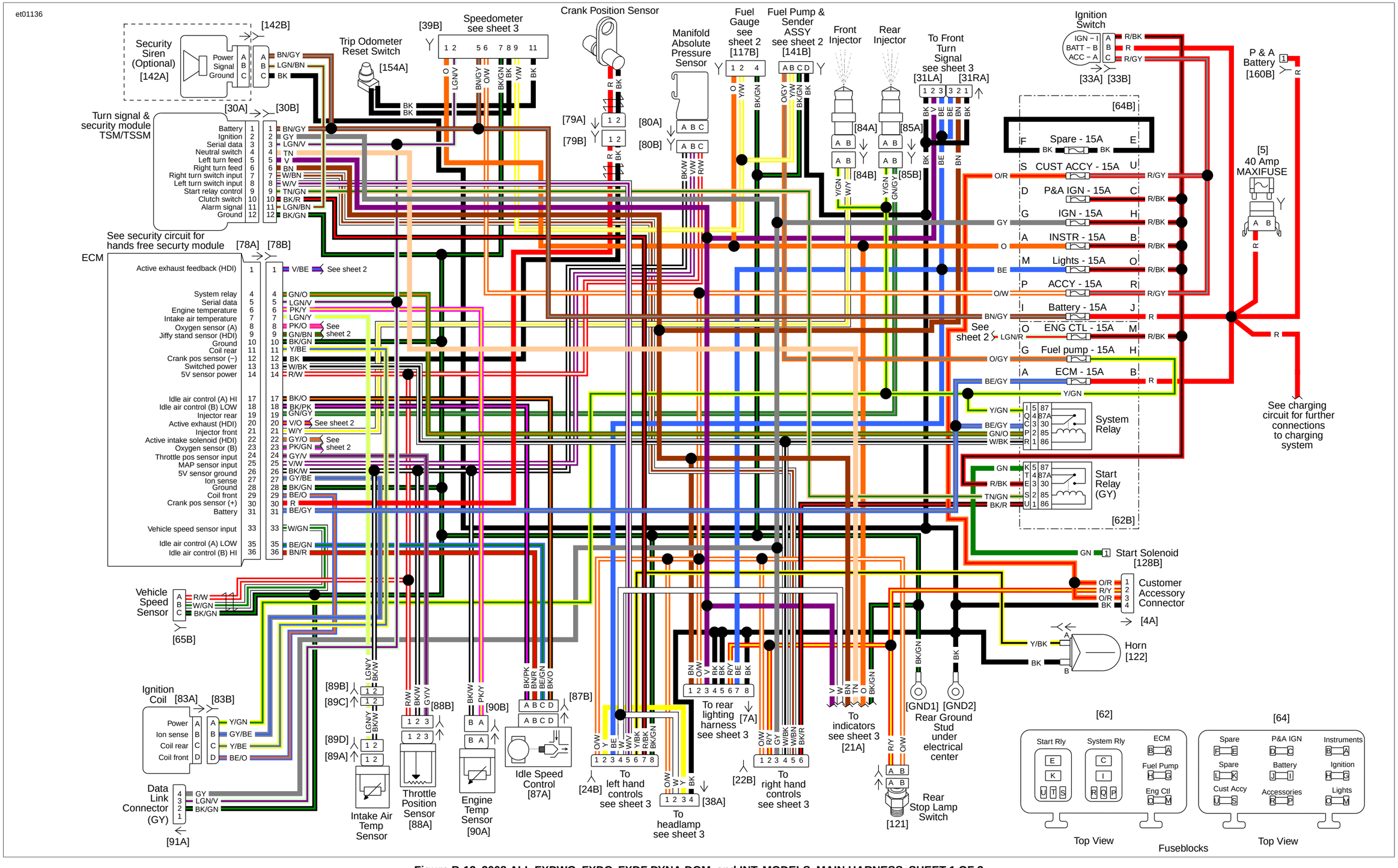


Figure B-13. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 1 OF 3

Figure B-13.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 1 OF 3

Figure B-13.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 1 OF 3

et01137

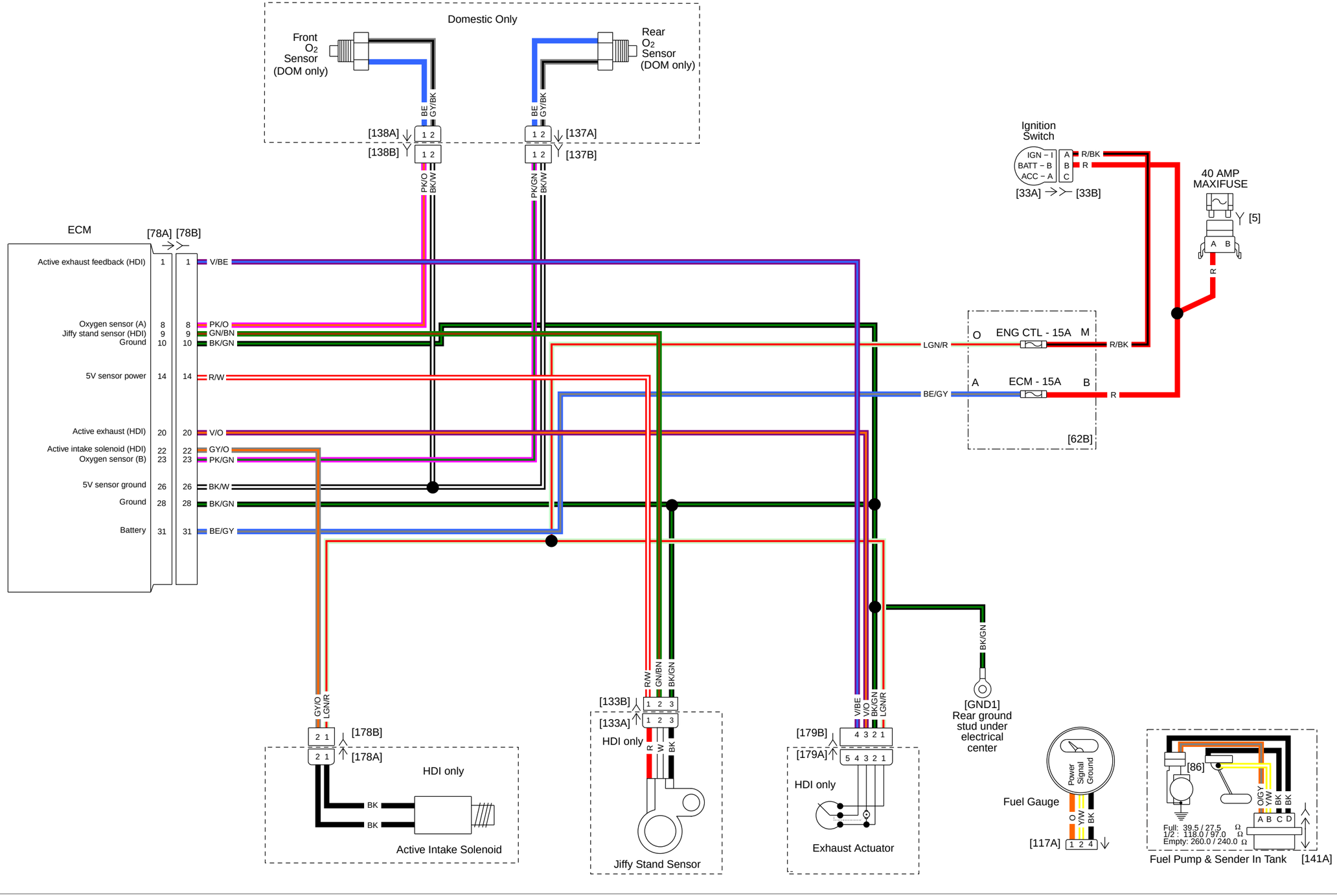
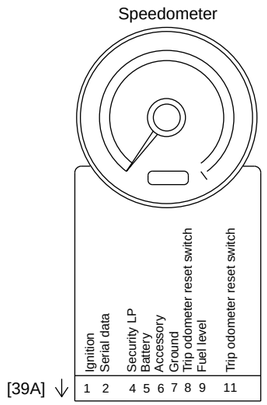


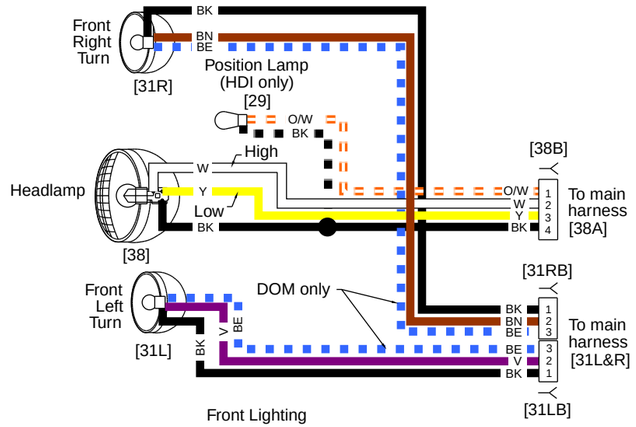
Figure B-14. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 2 OF 3

Figure B-14.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 2 OF 3

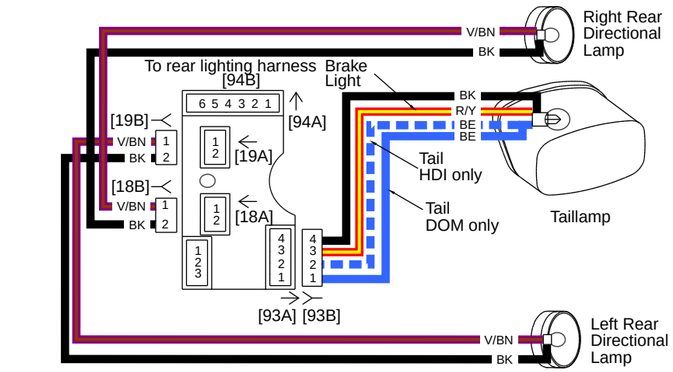
Figure B-14.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 2 OF 3

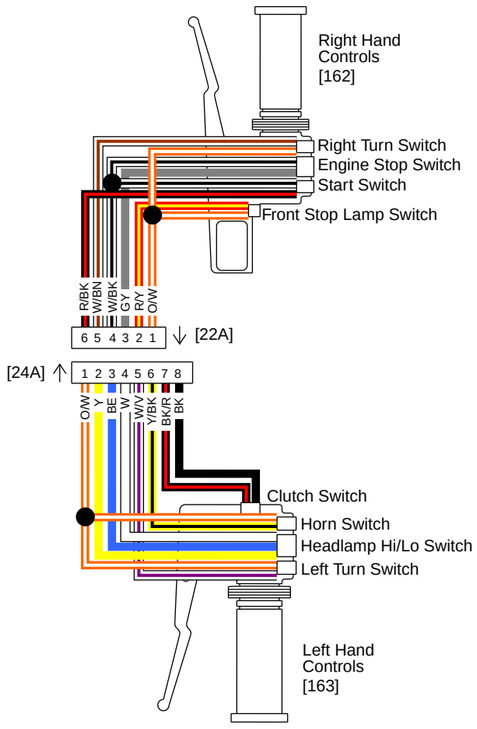
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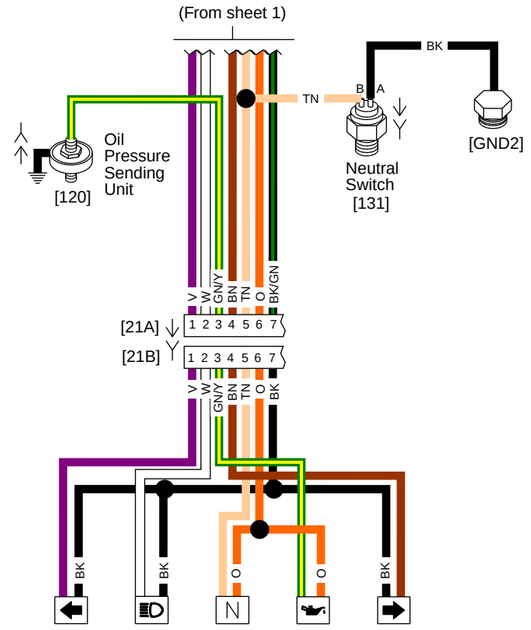


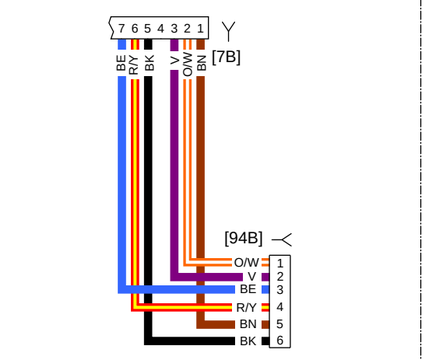


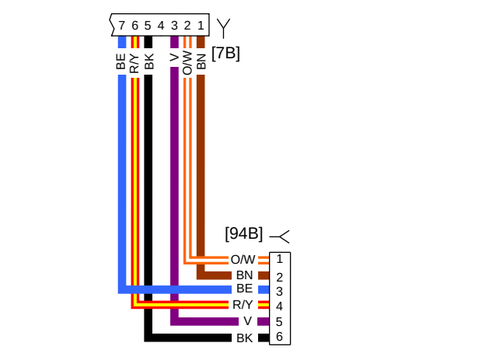
Front Lighting











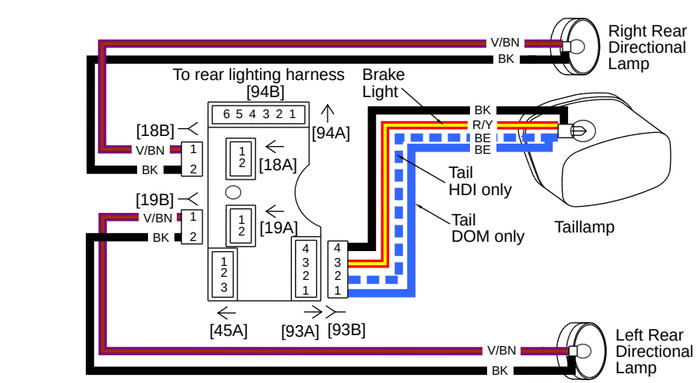


Figure B-15. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 3 OF 3

Figure B-15.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 3 OF 3

Figure B-15.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, MAIN HARNESS, SHEET 3 OF 3

et01131

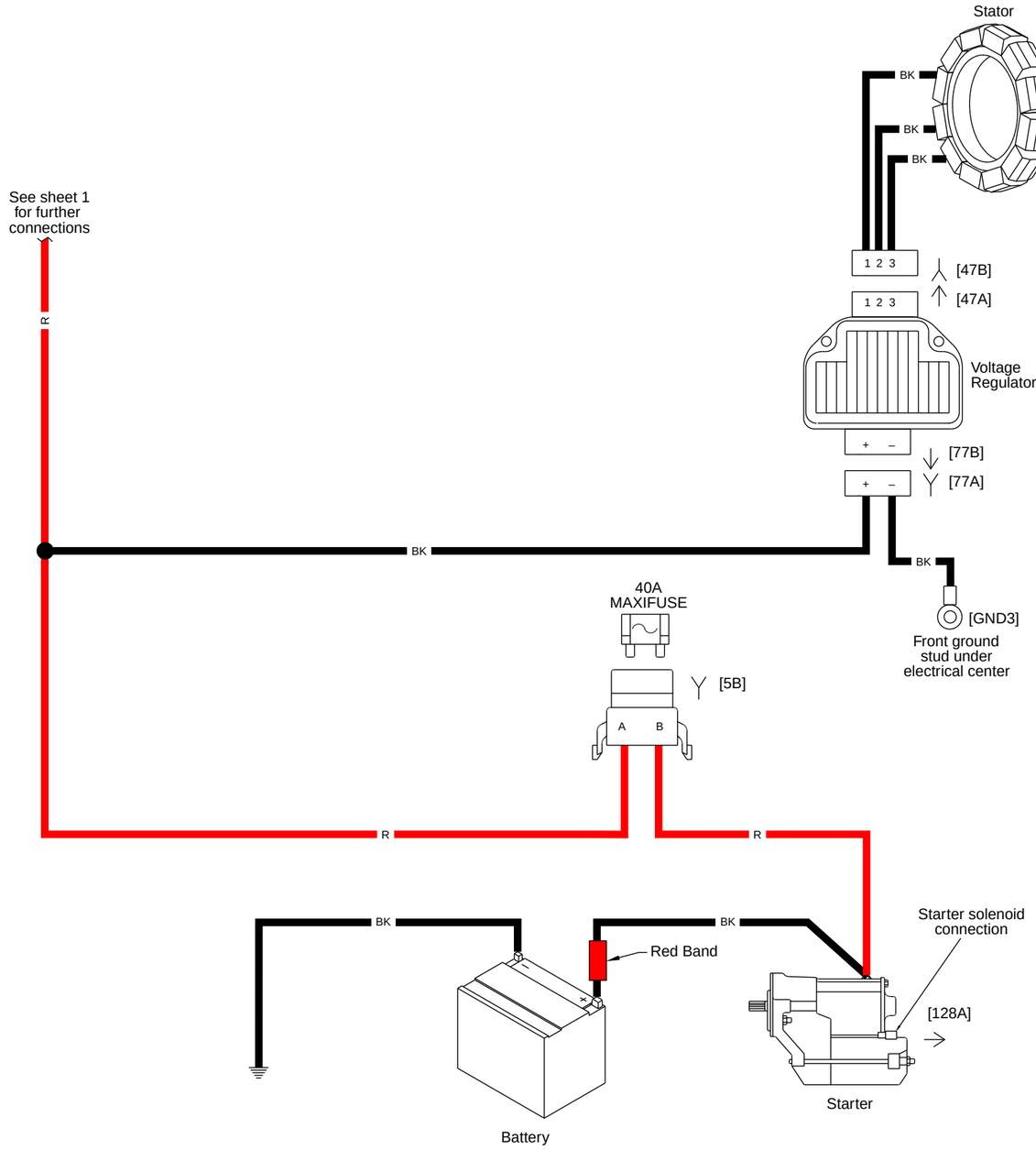


Figure B-16. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, CHARGING CIRCUIT

Figure B-16.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, CHARGING CIRCUIT

Figure B-16.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, CHARGING CIRCUIT

et01143

Speedometer
[39B] 2 7
LGN/V
BK/GN

[21A] 5 6
[21B] 5 6
TN
O

Neutral Switch [131]
B A
BK
TN

Ignition Switch
IGN – I
BATT – B
ACC – A
A B C
R/BK
O
[33A] [33B]

Turn Signal & Security Module TSM/TSSM
[30A] [30B]
Battery 1 1 BN/GY
Ignition 2 2 GY
Serial data 3 3 LGN/V
Neutral switch 4 4 TN
Start relay control 9 9 TN/GN
Clutch switch 10 10 BK/R
Ground 12 12 BK/GN

See security circuit for hands free security module

ECM
Serial data 5 5 LGN/V
Ground 10 10 BK/GN
Switched power 13 13 W/BK
Ground 28 28 BK/GN
Battery 31 31 BE/GY
[78A] [78B]

[64B]
G IGN - 15A H GY R/BK
A INSTR - 15A B O R/BK
I Battery - 15A J BN/GY R
A ECM - 15A B BE/GY R

40 Amp MAXIFUSE
[5]
A B
R R

GN K 5 87
T 4 87A
R/BK S 3 30
TN/GN S 2 85
R/BK U 1 86
Start Relay (Gray)
[62B]

BK BK
Red Band
Battery

[128A]
GN
Starter

[24B] 7 8
[24A] 1 2 3 4 5 6 7 8
R/BK BK/GN
O/W Y BE W/Y W/BK Y/BK R/BK BK
Clutch Switch
Horn Switch
Headlamp Hi/Lo Switch
Left Turn Switch
Left Hand Controls [163]

[22B] 3 4 6
[22A] 3 4 6
GY W/BK R/BK
Right Hand Controls [162]
Engine Stop Switch
Start Switch

BK/GN BK
[GND1] [GND2]
Rear ground stud under electrical center

Figure B-17. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, STARTING CIRCUIT

Figure B-17.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, STARTING CIRCUIT

Figure B-17.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, STARTING CIRCUIT

et01144

Domestic Only

Front O_2 Sensor

Rear O_2 Sensor

[39B] Speedometer

Crank Position Sensor

Manifold Absolute Pressure Sensor

Fuel Pump & Sender Assy [141B]

Front Injector

Rear Injector

Ignition Switch

[5] 40 Amp MAXIFUSE

Turn Signal & Security Module TSM/TSSM

[30A] [30B]

Battery 1 — BN/GY
Ignition 2 — GY
Serial data 3 — LGN/V
Ground 12 — BK/GN

ECM

Active exhaust feedback (HDI)	1	1	V/BE
System relay	4	4	GN/O
Serial data	5	5	LGN/V
Engine temperature	6	6	PK/Y
Intake air temperature	7	7	LGN/Y
Oxygen sensor (A)	8	8	PK/O
Jiffy stand sensor (HDI)	9	9	GN/BN
Ground	10	10	BK/GN
Coil rear	11	11	Y/BE
Crank pos sensor (−)	12	12	BK
Switched power	13	13	W/BK
5V sensor power	14	14	R/W
Idle air control (A) Hi	17	17	BK/O
Idle air control (B) Low	18	18	BK/PK
Injector rear	19	19	GN/GY
Active exhaust (HDI)	20	20	V/O
Injector front	21	21	W/Y
Active intake solenoid (HDI)	22	22	GY/O
Oxygen sensor (B)	23	23	PK/GN
Throttle pos sensor input	24	24	GY/V
Map sensor input	25	25	V/W
5V sensor ground	26	26	BK/W
Ion sense	27	27	GY/BE
Ground	28	28	BK/GN
Coil front output	29	29	BE/O
Crank pos sensor (+)	30	30	R
Battery	31	31	BE/GY
Idle air control (A) Low	35	35	BE/GN
Idle air control (B) Hi	36	36	BN/R

[78A] [78B]

[83A] [83B]

Power A — Y/GN
Ion sense B — GY/BE
Coil rear C — Y/BE
Coil front D — BE/O

Ignition Coil

Data Link Connector (Gray) [91A]
4 GY
3 LGN/V
2 BK/GN
1

[89B] [89C] [89D] [89A] Intake Air Temp Sensor

[88B] Throttle Position Sensor [88A]

[90B] Engine Temp Sensor [90A]

[87B] Idle Speed Control [87A]

[178B] [178A] Intake Actuator Solenoid — HDI Only

[179B] [179A] HDI Only — Exhaust Actuator

[22B] To right hand controls

GND1 Rear ground stud under electrical center

[64B]

G IGN 15A H — GY / R/BK
I Battery 15A J — BN/GY / R
O ENG CTL 15A M — LGN/R / R/BK
G Fuel Pump 15A H — O/GY / Y/GN
A ECM 15A B — BE/GY / R

System Relay

[62B]

[133B] [133A] HDI Only — Jiffy Stand Sensor

Figure B-18. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, IGNITION CIRCUIT

Figure B-18.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, IGNITION CIRCUIT

Figure B-18.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, IGNITION CIRCUIT

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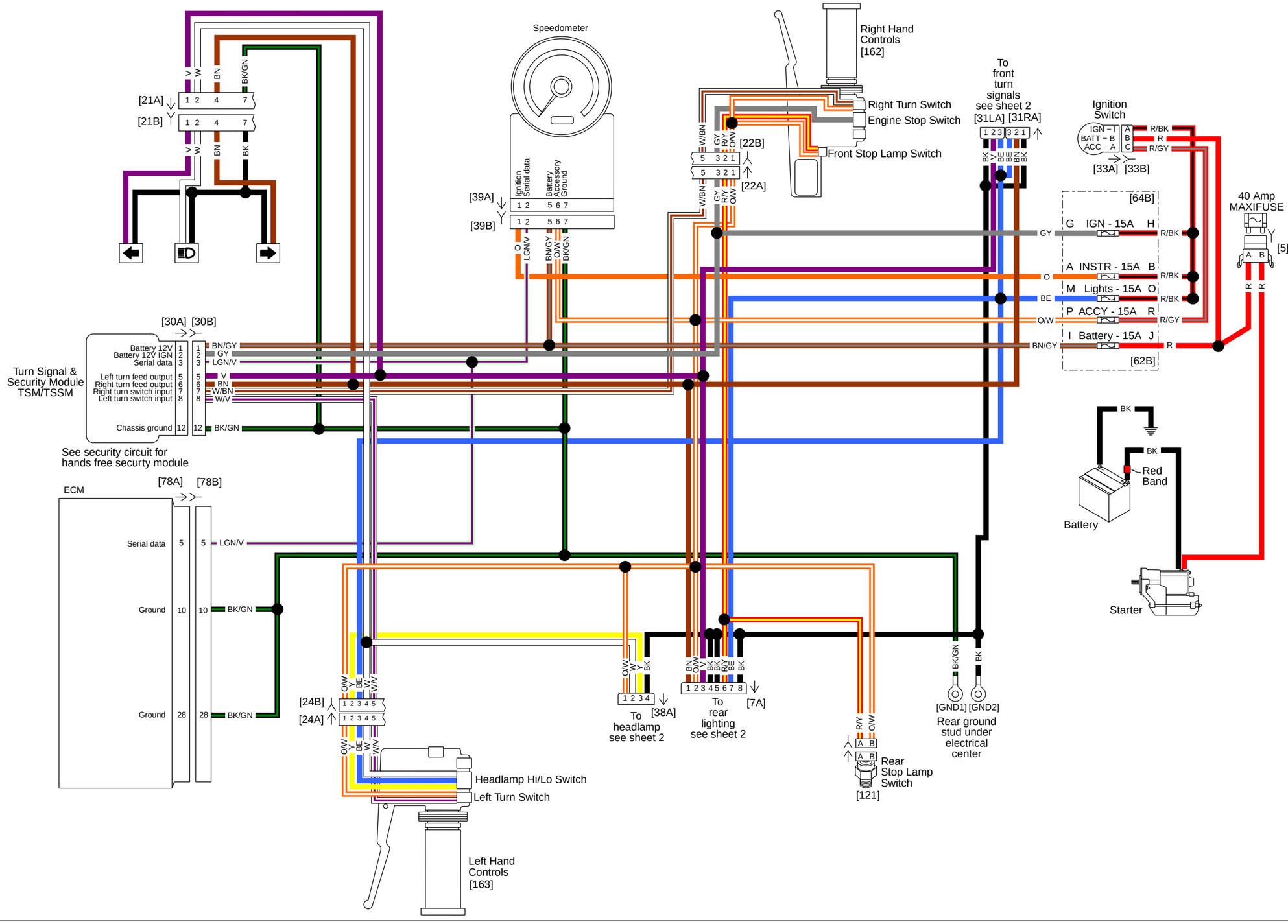
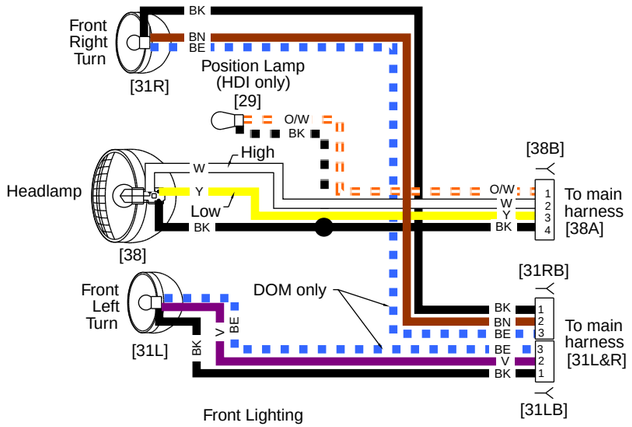


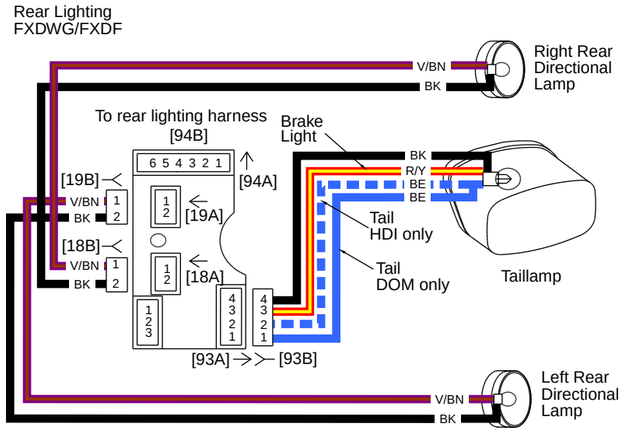
Figure B-19. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 1 OF 2

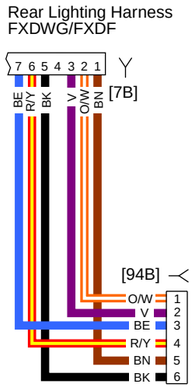
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2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 1 OF 2

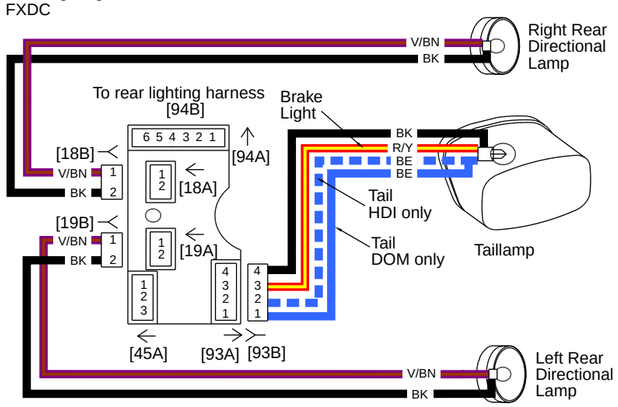
Figure B-19.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 1 OF 2

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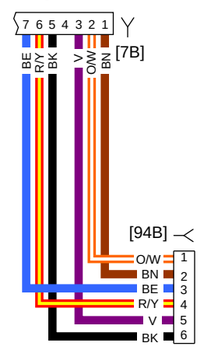


Figure B-20. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 2 OF 2

Figure B-20.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 2 OF 2

Figure B-20.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, LIGHTS, SHEET 2 OF 2

et01141

Speedometer

Ignition
Serial data
Accessory
Ground
Trip odometer Reset switch
Fuel level
Trip odometer Reset switch

[39A] 1 2 6 7 8 9 11
[39B] 1 2 6 7 8 9 11

Trip Odometer Reset Switch
[154]

O LGN/V O/W BK/GN BK Y/W BK

Fuel Gauge

Power
Signal
Ground

[117A] 1 2 4
[117B] 1 2 4

O Y/W BK
O Y/W BK/GN

Fuel Pump & Sender Assembly
(In fuel tank)

[86]

O/GY Y/W BK BK

Full: 39.5 / 27.5 Ω
1/2 : 118.0 / 97.0 Ω
Empty: 260.0 / 240.0 Ω

A B C D [141A]
A B C D [141B]

Y/W BK/GN

TSM/TSSM

[30A] [30B]

Serial data 3 3 LGN/V
Ground 12 12 BK/GN

See security circuit for hands free securty module

ECM

[78A] [78B]

Serial data 5 5 LGN/V
Ground 10 10 BK/GN
Ground 28 28 BK/GN

Ignition Switch

IGN – I A R/BK
BATT – B B R
ACC – A C R/GY

[33A] [33B]

40 Amp MAXIFUSE

[5]

R

[64B]

A INSTR - 15A B R/BK
P ACCY - 15A R R/GY

O
O/W

[24B] 1 6 O/W Y/BK
[24A] 1 6 O/W Y/BK

Horn Switch

Left Hand Controls
[163]

Oil Pressure Sending Unit
[120]

[21A] 3 5 6 GN/Y TN O
[21B] 3 5 6 GN/Y TN O

N

B A BK
Neutral Switch
[131]

Y/BK
BK

A
B
Horn
[122]

BK/GN BK

[GND1] [GND2]
Rear ground stud under electrical center

Figure B-21. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, HORN & INSTRUMENTS CIRCUIT

Figure B-21.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, HORN & INSTRUMENTS CIRCUIT

Figure B-21.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, HORN & INSTRUMENTS CIRCUIT

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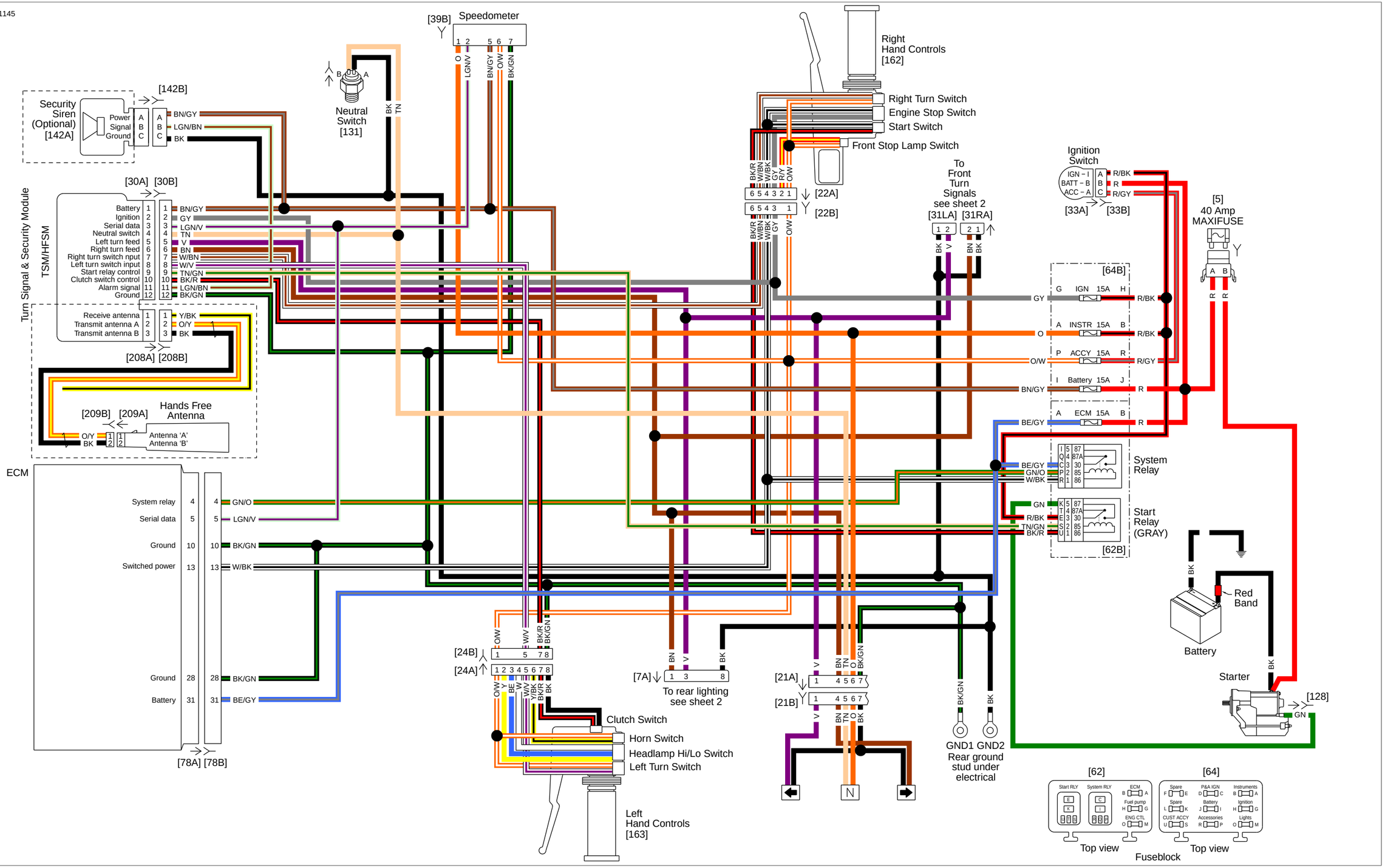
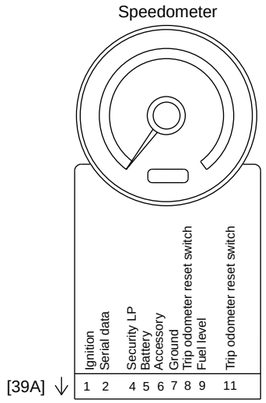


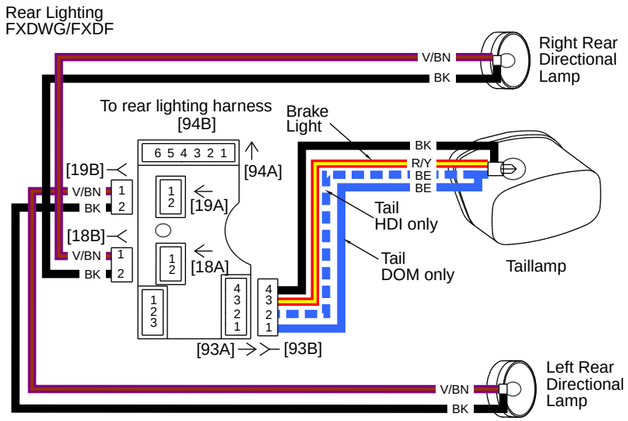
Figure B-22. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 1 OF 2

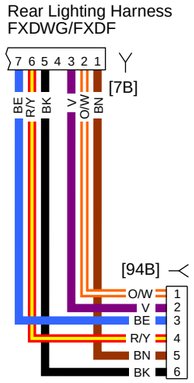
Figure B-22.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 1 OF 2

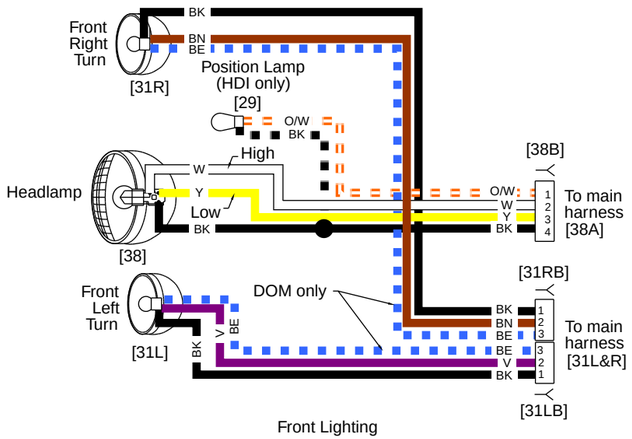
Figure B-22.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 1 OF 2

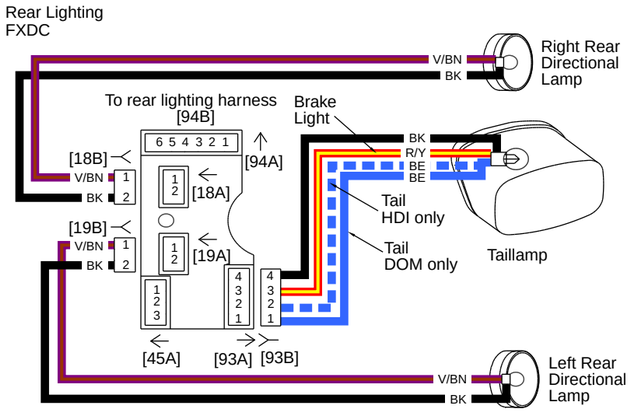
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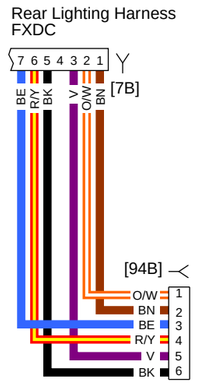


Figure B-23. 2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 2 OF 2

Figure B-23.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 2 OF 2

Figure B-23.
2008 ALL FXDWG, FXDC, FXDF DYNA DOM. and INT. MODELS, SECURITY CIRCUIT, SHEET 2 OF 2

SUBJECT **PAGE NO.**

C.1 LENGTH CONVERSION.....C-1
C.2 FLUID CONVERSION.....C-2
C.3 TORQUE CONVERSION.....C-3

NOTES

CONVERSION TABLE

Table C-1. Metric Conversions

MILLIMETERS to INCHES (MM x 0.03937 = IN.)								INCHES to MILLIMETERS (IN. x 25.40 = MM)							
MM	IN.	MM	IN.	MM	IN.	MM	IN..	IN.	MM	IN.	MM	IN.	MM	IN.	MM
.1	.0039	25	.9842	58	2.283	91	3.582	.001	.025	.6	15.240	1-15/16	49.21	3-5/16	84.14
.2	.0078	26	1.024	59	2.323	92	3.622	.002	.051	5/8	15.875	2	50.80	3-3/8	85.72
.3	.0118	27	1.063	60	2.362	93	3.661	.003	.076	11/16	17.462	2-1/16	52.39	3.4	86.36
.4	.0157	28	1.102	61	2.401	94	3.701	.004	.102	.7	17.780	2.1	53.34	3-7/16	87.31
.5	.0197	29	1.142	62	2.441	95	3.740	.005	.127	3/4	19.050	2-1/8	53.97	3-1/2	88.90
.6	.0236	30	1.181	63	2.480	96	3.779	.006	.152	.8	20.320	2-3/16	55.56	3-9/16	90.49
.7	.0275	31	1.220	64	2.519	97	3.819	.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.8	.0315	32	1.260	65	2.559	98	3.858	.008	.203	7/8	22.225	2-1/4	57.15	3-5/8	92.07
.9	.0354	33	1.299	66	2.598	99	3.897	.009	.229	.9	22.860	2.3	58.42	3-11/16	93.66
1	.0394	34	1.338	67	2.638	100	3.937	.010	.254	15/16	23.812	2-5/16	58.74	3.7	93.98
2	.0787	35	1.378	68	2.677	101	3.976	1/64	.397	1	25.40	2-3/8	60.32	3-3/4	95.25
3	.1181	36	1.417	69	2.716	102	4.016	.020	.508	1-1/16	26.99	2.4	60.96	3.8	96.52
4	.1575	37	1.456	70	2.756	103	4.055	.030	.762	1.1	27.94	2-7/16	61.91	3-13/16	96.84
5	.1968	38	1.496	71	2.795	104	4.094	1/32	.794	1-1/8	28.57	2-1/2	63.50	3-7/8	98.42
6	.2362	39	1.535	72	2.834	105	4.134	.040	1.016	1-3/16	30.16	2-9/16	65.09	3.9	99.06
7	.2756	40	1.575	73	2.874	106	4.173	.050	1.270	1.2	30.48	2.6	66.04	3-15/16	100.01
8	.3149	41	1.614	74	2.913	107	4.212	.060	1.524	1-1/4	31.75	2-5/8	66.67	4	101.6
9	.3543	42	1.653	75	2.953	108	4.252	1/16	1.588	1.3	33.02	2-11/16	68.26	4-1/16	102.19
10	.3937	43	1.693	76	2.992	109	4.291	.070	1.778	1-5/16	33.34	2.7	68.58	4.1	104.14
11	.4331	44	1.732	77	3.031	110	4.331	.080	2.032	1-3/8	34.92	2-3/4	69.85	4-1/8	104.77
12	.4724	45	1.772	78	3.071	111	4.370	.090	2.286	1.4	35.56	2.8	71.12	4-3/16	106.36
13	.5118	46	1.811	79	3.110	112	4.409	.1	2.540	1-7/16	36.51	2-13/16	71.44	4.2	106.68
14	.5512	47	1.850	80	3.149	113	4.449	1/8	3.175	1-1/2	38.10	2-7/8	73.02	4-1/4	107.95
15	.5905	48	1.890	81	3.189	114	4.488	3/16	4.762	1-9/16	39.69	2.9	73.66	4.3	109.22
16	.6299	49	1.929	82	3.228	115	4.527	.2	5.080	1.6	40.64	2-15/16	74.61	4-5/16	109.54
17	.6693	50	1.968	83	3.268	116	4.567	1/4	6.350	1-5/8	41.27	3	76.20	4-3/8	111.12
18	.7086	51	2.008	84	3.307	117	4.606	.3	7.620	1-11/16	42.86	3-1/16	77.79	4.4	111.76
19	.7480	52	2.047	85	3.346	118	4.645	5/16	7.938	1.7	43.18	3.1	78.74	4-7/16	112.71
20	.7874	53	2.086	86	3.386	119	4.685	3/8	9.525	1-3/4	44.45	3-1/8	79.37	4-1/2	114.30
21	.8268	54	2.126	87	3.425	120	4.724	.4	10.160	1.8	45.72	3-3/16	80.96	4-9/16	115.89
22	.8661	55	2.165	88	3.464	121	4.764	7/16	11.112	1-13/16	46.04	3.2	81.28	4.6	116.84
23	.9055	56	2.205	89	3.504	122	4.803	1/2	12.700	1-7/8	47.62	3-1/4	82.55	4-5/8	117.47
24	.9449	57	2.244	90	3.543	123	4.842	9/16	14.288	1.9	48.26	3.3	83.82	4-11/16	119.06

FLUID CONVERSION C.2

UNITED STATES SYSTEM

Unless otherwise specified, all fluid volume measurements in this Service Manual are expressed in United States (U.S.) units-of-measure. See below:

- 1 pint (U.S.) = 16 fluid ounces (U.S.)
- 1 quart (U.S.) = 2 pints (U.S.) = 32 fl. oz. (U.S.)
- 1 gallon (U.S.) = 4 quarts (U.S.) = 128 fl. oz. (U.S.)

METRIC SYSTEM

Fluid volume measurements in this Service Manual include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). Should you need to convert from U.S. units-of-measure to metric units-of-measure (or vice versa), refer to the following:

- fluid ounces (U.S.) x 29.574 = milliliters
- pints (U.S.) x 0.473 = liters
- quarts (U.S.) x 0.946 = liters
- gallons (U.S.) x 3.785 = liters
- milliliters x 0.0338 = fluid ounces (U.S.)
- liters x 2.114 = pints (U.S.)
- liters x 1.057 = quarts (U.S.)
- liters x 0.264 = gallons (U.S.)

BRITISH IMPERIAL SYSTEM

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The following conversions exist in the British Imperial system:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the same unit-of-measure terminology as the U.S. system is used in the British Imperial (Imp.) system, the actual volume of each British Imperial unit-of-measure differs from its U.S. counterpart. The U.S. fluid ounce is larger than the British Imperial fluid ounce. However, the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. Should you need to convert from U.S. units to British Imperial units (or vice versa), refer to the following:

- fluid ounces (U.S.) x 1.042 = fluid ounces (Imp.)
- pints (U.S.) x 0.833 = pints (Imp.)
- quarts (U.S.) x 0.833 = quarts (Imp.)
- gallons (U.S.) x 0.833 = gallons (Imp.)
- fluid ounces (Imp.) x 0.960 = fluid ounces (U.S.)
- pints (Imp.) x 1.201 = pints (U.S.)
- quarts (Imp.) x 1.201 = quarts (U.S.)
- gallons (Imp.) x 1.201 = gallons (U.S.)

UNITED STATES SYSTEM

The U.S. units of torque, foot pounds and inch pounds, are used in this service manual. To convert units, use the following equations:

- foot pounds (ft-lbs) X 12.00000 = inch pounds (**in-lbs**).
- inch pounds (**in-lbs**) X 0.08333 = foot pounds (ft-lbs).

METRIC SYSTEM

All metric torque specifications are written in Newton-meters (Nm). To convert metric to United States units and United States to metric, use the following equations:

- Newton meters (Nm) X 0.737563 = foot pounds (ft-lbs).
- Newton meters (Nm) X 8.85085 = inch pounds (**in-lbs).**
- foot pounds (ft-lbs) X 1.35582 = Newton meters (Nm).
- inch pounds (**in-lbs**) X 0.112985 = Newton meters (Nm).

NOTES

SUBJECT **PAGE NO.**

D.1 GLOSSARY.....D-1

NOTES

ACRONYMS AND ABBREVIATIONS

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
A	Amperes
AC	Alternating Current
ACC	Accessory
ACR	Automatic Compression Release
AGM	Absorbed Glass Mat (battery)
AMP	Ampere
AWG	American Wire Gauge
B+	Battery Voltage
BAS	Bank angle sensor
BTDC	Before Top Dead Center
C	Celsius (Centigrade)
CA	California
CAL	Calibration
CC	Cubic Centimeters
CCA	Cold Cranking Amps
CKP	Crankshaft Position
cm	Centimeter
DC	Direct Current
DLC	Data Link Connector
DOM	Domestic
DTC	Diagnostic Trouble Code
DVOM	Digital Volt Ohm Meter
ECM	Electronic Control Module
ECT	Engine Coolant Temperature
EEPROM	Electrically Erasable Programmable Read Only Memory
EFI	Electronic Fuel Injection
ET	Engine Temperature
EVAP	Evaporative Emissions Control System
F	Fahrenheit
ft-lbs	Foot-Pounds
fl oz.	Fluid Ounce
g	Gram
GAL	Gallon
GAWR	Gross Axle Weight Rating
GND	Ground (electrical)
GVWR	Gross Vehicle Weight Rating
HDI	Harley-Davidson International
H-DSSS	Harley-Davidson Smart Security System
HFSM	Hands Free Security Module
Hg	Mercury
IAC	Idle Air Control

Table D-1. Acronyms and Abbreviations

ACRONYM OR ABBREVIATION	DESCRIPTION
IAT	Intake Air Temperature
ID	Inside Diameter
IGN	Ignition Light/Key Switch
IM	Instrument Module
In.	Inch
INJ PW	Injector Pulse Width
in-lbs	Inch-Pounds
Kg	Kilogram
Km	Kilometer
kPa	Kilopascal
km/hr	Kilometers Per Hour
L	Liter
LCD	Liquid Crystal Display
LED	Light Emitting Diode
mA	Milliampere
MAP	Manifold Absolute Pressure
ml	milliliter
mm	millimeter
MPH	Miles Per Hour
ms	millisecond
Nm	Newton-Meter
N/A	Not Applicable
no.	Number
O2	Oxygen
OD	Outside Diameter
OEM	Original Equipment Manufacturer
oz	Ounce
P&A	Parts and Accessories
PN	Part Number
PSI	Pounds per Square Inch
RES	Reserve
RPM	Revolutions Per Minute
SCFH	Cubic Feet per Hour at Standard Conditions
TDC	Top Dead Center
TP	Throttle Position
TMAP	Intake Air Temperature/Manifold Absolute Pressure
TSM	Turn Signal Module
TSSM	Turn Signal/Security Module
V	Volt
VAC	Volts of Alternating Current
VDC	Volts of Direct Current
VIN	Vehicle Identification Number
VSS	Vehicle Speed Sensor

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
98716-87A	STORAGE COVER	1.26 STORAGE, Placing in Storage
99650-02	HIGH-PERFORMANCE SEALANT, GRAY	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
99855-89	WHEEL BEARING GREASE	2.23 REAR FORK, Assembly
99863-01A	GLOBAL BATTERY CHARGER	1.17 BATTERY MAINTENANCE, Storage
B-45305	FORK SEAL DRIVER	2.17 FRONT FORK, Assembly
B-45523	VALVE GUIDE REAMER	3.22 CYLINDER HEAD, Valve Guide Replacement
B-45525	VALVE GUIDE HONE	3.22 CYLINDER HEAD, Inspection
B-45525	VALVE GUIDE HONE	3.22 CYLINDER HEAD, Valve Guide Replacement
B-45655	CRANKSHAFT BEARING REMOVAL/INSTALL PILOT/DRIVER	3.27 CRANKCASE, Right Crankcase Half
B-45655	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER	3.27 CRANKCASE, Right Crankcase Half
B-45655	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER	3.27 CRANKCASE, Left Crankcase Half
B-45655	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER	3.27 CRANKCASE, Left Crankcase Half
GA500A	SNAP-ON TERMINAL PICK	A.3 AUTOFUSE ELECTRICAL CONNECTORS, Autofuse Connector Repair
HD-25070	ROBINAIR HEAT GUN	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-25070	ROBINAIR HEAT GUN	8.28 HANDLEBAR SWITCH ASSEMBLIES, Repair Procedures
HD-25070	ROBINAIR HEAT GUN	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-33223-1	CYLINDER COMPRESSION GAUGE	3.7 TROUBLESHOOTING, Compression Test
HD-33416	UNIVERSAL DRIVER	2.18 STEERING HEAD, Disassembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.22 CYLINDER HEAD, Disassembly
HD-34736-B	VALVE SPRING COMPRESSOR	3.22 CYLINDER HEAD, Assembly
HD-34751	VALVE GUIDE CLEANING BRUSH	3.22 CYLINDER HEAD, Inspection
HD-34751	VALVE GUIDE CLEANING BRUSH	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-34751	VALVE GUIDE CLEANING BRUSH	3.22 CYLINDER HEAD, Valve and Seat Refacing
HD-34751	VALVE GUIDE CLEANING BRUSH	3.22 CYLINDER HEAD, Assembly
HD-34902B	MAINSHAFT BEARING INNER RACE PULLER/INSTALLER	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-34902-B	MAINSHAFT BEARING INNER RACE REMOVER/INSTALLER	6.4 PRIMARY CHAINCASE HOUSING, Mainshaft Bearing Inner Race
HD-35316-10	PILOT	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-11	RECEIVER CUP	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-12	INSTALLER CUP	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-3A	CROSS PLATE	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-3A	CROSS PLATE	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-4A	8 IN. BOLT	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-4A	8 IN. BOLT	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-5	12 IN. BOLT	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-5	12 IN. BOLT	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-7	WASHER	7.6 MAIN DRIVE GEAR AND BEARING, Removal

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-35316-7	WASHER	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-8	BEARING DRIVER	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-35316-9	BEARING DRIVER	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35316-C	MAIN DRIVE GEAR/BEARING REMOVER AND INSTALLER	7.6 MAIN DRIVE GEAR AND BEARING, Removal
HD-35381-A	H-D BELT TENSION GAUGE	1.13 REAR BELT DEFLECTION, Inspection
HD-35667-A	CYLINDER LEAKDOWN TESTER	3.7 TROUBLESHOOTING, Cylinder Leakdown Test
HD-35758-C	NEWAY VALVE SEAT CUTTER SET	3.22 CYLINDER HEAD, Valve and Seat Refacing
HD-38125-6	PACKARD TERMINAL CRIMP TOOL	A.15 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair
HD-38125-7	PACKARD TERMINAL CRIMPER	A.9 DEUTSCH MINI TERMINAL REPAIR, Deutsch Mini Terminal Crimps
HD-38125-7	PACKARD TERMINAL CRIMPER	A.15 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.15 PACKARD METRI-PACK TERMINALS, Metri-Pack Terminal Crimps
HD-38125-8	PACKARD CRIMPING TOOL	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-39301-A	STEERING HEAD BEARING RACE REMOVER	2.18 STEERING HEAD, Disassembly
HD-39302	STEERING HEAD BEARING RACE INSTALLER	2.18 STEERING HEAD, Assembly
HD-39361-B	SPROCKET SHAFT OIL SEAL INSTALLER	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-39621-27	SOCKET TERMINAL TOOL	A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair
HD-39621-28	PIN TERMINAL REMOVER	A.1 AMP 1-PLACE CONNECTORS, AMP 1-Place Connector Repair
HD-39782-A	CYLINDER HEAD SUPPORT STAND	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.22 CYLINDER HEAD, Disassembly
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.22 CYLINDER HEAD, Valve and Seat Refacing
HD-39786	CYLINDER HEAD HOLDING FIXTURE	3.22 CYLINDER HEAD, Assembly
HD-39847	REAMER T-HANDLE	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-39964	REAMER LUBRICANT	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-39964	REAMER LUBRICANT	3.22 CYLINDER HEAD, Valve Guide Replacement
HD-39965-A	DEUTSCH TERMINAL CRIMP TOOL	A.7 DEUTSCH STANDARD TERMINAL REPAIR, Deutsch Standard Terminal Crimps
HD-39969	ULTRA TORCH UT-100	8.28 HANDLEBAR SWITCH ASSEMBLIES, Repair Procedures
HD-39969	ULTRA-TORCH UT-100	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41177	FORK HOLDING TOOL	2.17 FRONT FORK, Disassembly
HD-41182	FUEL PRESSURE GAUGE	4.15 FUEL PRESSURE TEST, Testing

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-41183	HEAT SHIELD ATTACHMENT	8.28 HANDLEBAR SWITCH ASSEMBLIES, Repair Procedures
HD-41183	HEAT SHIELD ATTACHMENT	A.18 SEALED SPLICE CONNECTORS, Sealed Splice Connector Repair
HD-41417	PROPANE ENRICHMENT KIT	4.17 INTAKE LEAK TEST, Leak Tester
HD-41475	DEUTSCH CONNECTOR SERVICE KIT	A.6 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41475-100	FLAT BLADE L-HOOK	A.6 DEUTSCH ELECTRICAL CONNECTORS, Deutsch Connector Repair
HD-41494	HUBCAP REMOVER AND INSTALLER	1.20 STEERING HEAD BEARINGS, Adjustment
HD-41609	AMP MULTILOCK CRIMPER	A.2 AMP MULTILOCK CONNECTORS, AMP Multilock Connector Repair
HD-42311	OIL FILTER WRENCH	1.4 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.15 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42317-A	PISTON PIN CIRCLIP REMOVER/INSTALLER	3.16 TOP END OVERHAUL: ASSEMBLY, Piston
HD-42320-A	PISTON PIN REMOVER	3.15 TOP END OVERHAUL: DISASSEMBLY, Piston
HD-42322	PISTON SUPPORT PLATE	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-42324-A	CYLINDER TORQUE PLATES	3.15 TOP END OVERHAUL: DISASSEMBLY, Cylinder Head
HD-42324-A	CYLINDER TORQUE PLATES	3.22 CYLINDER HEAD, Inspection
HD-42324-A	CYLINDER TORQUE PLATES	3.23 CYLINDER, Cleaning
HD-42325-A	CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER	3.25 COVER AND CAM SUPPORT PLATE, Cam Needle Bearings
HD-42326-A	CRANKSHAFT GUIDE	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-42720-5	CRANKSHAFT BEARING REMOVAL/INSTALL SUPPORT TUBE	3.27 CRANKCASE, Right Crankcase Half
HD-42720-5	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE	3.27 CRANKCASE, Right Crankcase Half
HD-42720-5	CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE	3.27 CRANKCASE, Left Crankcase Half
HD-42879	ELECTRICAL CRIMPER TOOL	A.8 DEUTSCH SOLID BARREL MINI TERMINAL REPAIR, Deutsch Solid Barrel Terminal Crimps
HD-44060	WHEEL BEARING INSTALLER/REMOVER	2.5 SEALED WHEEL BEARINGS, Installation
HD-44060-10	25 MM COLLET	2.5 SEALED WHEEL BEARINGS, Removal
HD-44060A	WHEEL BEARING INSTALLER/REMOVER	2.5 SEALED WHEEL BEARINGS, Removal
HD-44061	FUEL PRESSURE GAUGE ADAPTER	4.15 FUEL PRESSURE TEST, Testing
HD-44067	OIL FILTER WRENCH	1.4 ENGINE OIL AND FILTER, Changing Oil and Filter
HD-44358	FLYWHEEL SUPPORT FIXTURE	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-44750	DIGITAL TECHNICIAN	4.3 IDLE SPEED, General
HD-45928	PACKARD MICRO-64 TERMINAL REMOVER	A.17 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-45929	PACKARD MICRO-64 TERMINAL CRIMPER	A.17 PACKARD MICRO-64 CONNECTORS, Packard Micro-64 Connector Repair
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL	6.6 TRANSMISSION SPROCKET, Removal

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-46282	FINAL DRIVE SPROCKET LOCKING TOOL	6.6 TRANSMISSION SPROCKET, Installation
HD-46663	CRANKCASE BEARING REMOVER ADAPTER	3.27 CRANKCASE, Left Crankcase Half
HD-47248	LOWER ROCKER BOX WRENCH	3.15 TOP END OVERHAUL: DISASSEMBLY, Breather Assembly
HD-47258	UPPER ROCKER BOX WRENCH	3.15 TOP END OVERHAUL: DISASSEMBLY, Breather Assembly
HD-47853	IGNITION SWITCH/FORK LOCK WRENCH	8.7 IGNITION SWITCH/FORK LOCK, FXD, FXDL, FXDB
HD-47856-1	INSTALLER	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-2	PILOT	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-3	ADAPTER	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-6	NUT	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-47856-7	CROW'S FOOT WRENCH	7.6 MAIN DRIVE GEAR AND BEARING, Installation
HD-47910	MAINSHAFT LOCKNUT WRENCH	6.6 TRANSMISSION SPROCKET, Removal
HD-47910	MAINSHAFT LOCKNUT WRENCH	6.6 TRANSMISSION SPROCKET, Installation
HD-47932	MAIN DRIVE GEAR BEARING AND SEAL INSTALLATION TOOL	7.6 MAIN DRIVE GEAR AND BEARING, Cleaning and Inspection
HD-47933	MAIN DRIVE GEAR SEAL INSTALLER	7.6 MAIN DRIVE GEAR AND BEARING, Cleaning and Inspection
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.17 BOTTOM END OVERHAUL: DISASSEMBLY, Cover and Cam Support Plate
HD-47941	CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
HD-47956	CAMSHAFT ASSEMBLY TOOL	3.25 COVER AND CAM SUPPORT PLATE, Camshafts
HD-47977	PRIMARY DRIVE LOCKING TOOL	6.3 DRIVE COMPONENTS, Removal
HD-48114	MOLEX ELECTRICAL CONNECTOR TERMINAL REMOVER	A.10 MOLEX CONNECTORS, Molex Connector Repair
HD-48119	ELECTRICAL CRIMP TOOL	A.10 MOLEX CONNECTORS, Crimp Terminal to Lead
HD-48283	CRANKSHAFT ROTATING WRENCH	3.15 TOP END OVERHAUL: DISASSEMBLY, Rocker Arm Support Plate
HD-48648	BRAKE CALIPER PISTON REMOVER	2.15 REAR BRAKE CALIPER, Disassembly
HD-48649	FRONT BRAKE CALIPER PISTON REMOVER	2.13 FRONT BRAKE CALIPER, Disassembly
HD-48856	AXLE ALIGNMENT PLUG SET	2.11 VEHICLE ALIGNMENT, Inspection
HD-59000A	PRO-LEVEL OIL GAUGE	2.17 FRONT FORK, Assembly
HD-94660-2	PILOT	6.6 TRANSMISSION SPROCKET, Removal
HD-94660-2	PILOT	6.6 TRANSMISSION SPROCKET, Installation
HD-94681-80	SPOKE WRENCH	2.9 TRUING LACED WHEELS, Lateral Truing
HD-94700-52C	SPANNER WRENCH	1.18 SUSPENSION ADJUSTMENTS, Rear Shock Preload Adjustment
HD-94804-57	ROCKER ARM BUSHING REAMER	3.20 ROCKER ARM SUPPORT PLATE, Cleaning and Inspection
HD-95637-46B	WEDGE ATTACHMENT	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-95637-46B	WEDGE ATTACHMENT	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-95952-1	THREADED CYLINDERS	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder

Tools Used in This Manual

PART NUMBER	TOOL NAME	NOTES
HD-95952-33C	CONNECTING ROD CLAMPING TOOL	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-95964-52	SPORTSTER 4-SPEED CLUTCH SPRING COMPRESSOR SCREW SEAT	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-96333-51E	PISTON RING COMPRESSOR	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder
HD-96796-47	VALVE SPRING TESTER	3.22 CYLINDER HEAD, Inspection
HD-96921-52C	OIL PRESSURE GAUGE SET	3.6 OIL PRESSURE, Checking Oil Pressure
HD-97087-65B	HOSE CLAMP PLIERS	4.5 FUEL TANK, Installation
HD-97225-55C	SPROCKET SHAFT BEARING TOOL	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
HD-97225-55C	SPROCKET SHAFT BEARING TOOL	3.27 CRANKCASE, Sprocket Shaft Bearing Inner Race
HD-99500-80	WHEEL TRUING STAND	2.9 TRUING LACED WHEELS, Lateral Truing
HD-99500-80	WHEEL TRUING AND BALANCING STAND	2.10 CHECKING CAST WHEEL RUNOUT, Radial Runout
HD-99857-97	SPECIAL PURPOSE GREASE	2.18 STEERING HEAD, Assembly
HD-99884-80	TYPE E FORK OIL	2.17 FRONT FORK, Assembly
J-5586A	TRANSMISSION SHAFT RETAINING RING PLIERS	7.5 TRANSMISSION ASSEMBLY, Assembly
RS-25100-200	NICE BEARING	7.6 MAIN DRIVE GEAR AND BEARING, Removal
RS-25100-200	NICE BEARING	7.6 MAIN DRIVE GEAR AND BEARING, Removal
TT600-3	SNAP-ON PICK	A.14 PACKARD 630 METRI-PACK CONNECTORS, 630 Metri-Pack Connector Repair

NOTES

FASTENER	TORQUE VALUE		NOTES
Active exhaust module fasteners	36-60 **in-lbs**	4.1-6.8 Nm	8.26 ACTIVE EXHAUST, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.2 MAINTENANCE SCHEDULE, General
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover bracket screw	40-60 **in-lbs**	4.5-6.8 Nm	4.4 AIR CLEANER ASSEMBLY, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.2 MAINTENANCE SCHEDULE, General
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	1.7 AIR CLEANER AND EXHAUST SYSTEM, Installation
Air cleaner cover screw	36-60 **in-lbs**	4.1-6.8 Nm	4.4 AIR CLEANER ASSEMBLY, Installation
Axle cap fastener	10-14 ft-lbs	13.6-19.0 Nm	2.3 FRONT WHEEL, Installation
Axle cap fastener	10-14 ft-lbs	13.6-19.0 Nm	2.3 FRONT WHEEL, Installation
Battery terminal screw	60-96 **in-lbs**	6.8-10.9 Nm	1.2 MAINTENANCE SCHEDULE, General
Battery terminal screw	60-96 **in-lbs**	6.8-10.9 Nm	1.17 BATTERY MAINTENANCE, Installation and Connection
Battery terminal screw	60-96 **in-lbs**	6.8-10.9 Nm	1.17 BATTERY MAINTENANCE, Installation and Connection
Battery tray screws	96-120 **in-lbs**	10.8-13.6 Nm	8.8 BATTERY TRAY AND BATTERY CABLES, Battery Tray
Belt guard fastener	10-15 ft-lbs	13.6-20.3 Nm	2.19 BELT GUARD, Installation
Belt guard fastener	10-15 ft-lbs	13.6-20.3 Nm	2.19 BELT GUARD, Installation
Belt sprocket screws	55-65 ft-lbs	74.6-88.1 Nm	2.4 REAR WHEEL, Assembly
Bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	1.15 BLEEDING BRAKES, Procedure
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Brake bridge bolt/pad pin, front caliper	15-16 ft-lbs	20.3-22.6 Nm	2.13 FRONT BRAKE CALIPER, Assembly
Brake caliper/master cylinder banjo bolt	21-25 ft-lbs	28.5-33.9 Nm	2.12 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.13 FRONT BRAKE CALIPER, Assembly
Brake caliper bleeder valve	80-100 **in-lbs**	9.0-11.3 Nm	2.15 REAR BRAKE CALIPER, Assembly
Brake caliper bridge bolt, front	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.3 FRONT WHEEL, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.3 FRONT WHEEL, Assembly
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	2.3 FRONT WHEEL, Assembly
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm	2.4 REAR WHEEL, Assembly
Brake master cylinder reservoir cover screws	6-8 **in-lbs**	0.7-0.9 Nm	2.12 FRONT BRAKE MASTER CYL-INDER, Assembly and Installation
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Brake pad pin, rear caliper	80-120 **in-lbs**	9.0-13.6 Nm	2.15 REAR BRAKE CALIPER, Assembly
Brake reservoir cover screws, front	6-8 **in-lbs**	0.7-0.9 Nm	2.13 FRONT BRAKE CALIPER, Installation
Brake reservoir cover screws, rear	6-8 **in-lbs**	0.7-0.9 Nm	2.14 REAR BRAKE MASTER CYLINDER, Installation
Breather assembly bolts	90-120 **in-lbs**	10.2-13.6 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Breather bolts	22-24 ft-lbs	29.8-32.5 Nm	4.4 AIR CLEANER ASSEMBLY, Installation / metric
Cam chain tensioner fasteners	100-120 **in-lbs**	11.3-13.6 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate

FASTENER	TORQUE VALUE		NOTES
Cam cover screws	125-155 **in-lbs**	14.1-17.5 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Cam support plate screws	90-120 **in-lbs**	10.2-13.6 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Chain tensioner fasteners	15-19 ft-lbs	20.3-25.8 Nm	6.3 DRIVE COMPONENTS, Installation
CKP sensor screw	90-120 **in-lbs**	10.2-13.6 Nm	8.13 CRANK POSITION SENSOR (CKP), Installation
Clutch adjuster screw locknut	72-120 **in-lbs**	8.1-13.6 Nm	1.2 MAINTENANCE SCHEDULE, General
Clutch cable fitting	90-120 **in-lbs**	10.2-13.6 Nm	7.4 CLUTCH RELEASE COVER, Assembly and Installation
Clutch cover screws	84-108 **in-lbs**	9.5-12.2 Nm	1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant
Clutch diaphragm spring retainer bolts	90-110 **in-lbs**	10.2-12.4 Nm	6.5 CLUTCH, Clutch Pack Only
Clutch hub mainshaft nut	70-80 ft-lbs	94.9-108.5 Nm	6.3 DRIVE COMPONENTS, Installation
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.2 MAINTENANCE SCHEDULE, General
Clutch inspection cover screw	84-108 **in-lbs**	9.5-12.2 Nm	1.11 CLUTCH, Adjustment
Clutch jam nut	72-120 **in-lbs**	8.1-13.6 Nm	1.11 CLUTCH, Adjustment
Clutch release cover screws	84-108 **in-lbs**	9.5-12.2 Nm	7.4 CLUTCH RELEASE COVER, Assembly and Installation
Compensating sprocket bolt	155-165 ft-lbs	210.1-223.7 Nm	6.3 DRIVE COMPONENTS, Installation
Console mounting screws	18-24 **in-lbs**	2.0-2.7 Nm	8.15 FUEL GAUGE, FXD Models
Console mounting screws (FXDB)	18-24 **in-lbs**	2.0-2.7 Nm	8.21 INDICATOR LAMPS, Installation
Console mounting screws (FXDWG, FXDC, FXDF)	18-24 **in-lbs**	2.0-2.7 Nm	8.7 IGNITION SWITCH/FORK LOCK, FXDWG, FXDC, FXDF Models (Ignition Switch Only)
Console mounting screws (FXDWG/FXDC/FXDF)	18-24 **in-lbs**	2.0-2.7 Nm	8.17 INSTRUMENTS: FXDWG/FXDC/FXDF, Installation
Console mounting screws (FXDWG/FXDC/FXDF)	18-24 **in-lbs**	2.0-2.7 Nm	8.21 INDICATOR LAMPS, Installation
Console to fuel tank fasteners	18-24 **in-lbs**	2.0-2.7 Nm	8.18 INSTRUMENTS: FXDL/FXDB, Installation
Console to fuel tank fasteners	18-24 **in-lbs**	2.0-2.7 Nm	8.18 INSTRUMENTS: FXDL/FXDB, Installation
Cranckase bolts, final	15-19 ft-lbs	20.3-25.8 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase bolts, initial	10 ft-lbs	13.6 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Crankcase
Crankcase pipe plugs	120-144 **in-lbs**	13.6-16.3 Nm	3.27 CRANKCASE, Pipe Plug and Oil Fittings
Crank sprocket bolt, final torque	24 ft-lbs	32.5 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Cylinder head bolts, final	15-17 ft-lbs	20.3-23.0 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head / See special method to tighten
Cylinder head bolts, initial	120-144 **in-lbs**	13.5-16.2 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head / See special method to tighten
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Cylinder head bracket bolts	35-40 ft-lbs	47.5-54.2 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure

FASTENER	TORQUE VALUE		NOTES
Cylinder stud	10-20 ft-lbs	3.6-27.1 Nm	3.27 CRANKCASE, Cylinder Studs
Cylinder torque bolts, final	15-17 ft-lbs	20.3-23.1 Nm	3.23 CYLINDER, Inspection
Cylinder torque bolts, initial	120-144 **in-lbs**	13.6-16.3 Nm	3.23 CYLINDER, Inspection
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm	2.4 REAR WHEEL, Installation
Debris deflector screws	40-60 **in-lbs**	4.5-6.8 Nm	2.20 DEBRIS DEFLECTOR, Installation
Detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	7.5 TRANSMISSION ASSEMBLY, Assembly
Diaphragm spring retainer bolts	90-110 **in-lbs**	10.2-12.4 Nm	6.5 CLUTCH, Clutch Pack and Bearing
Drain plug	14-21 ft-lbs	19.0-28.5 Nm	3.29 OIL PAN, Installation / Clean plug before installation
Drain plug, engine	14-21 ft-lbs	19.0-28.5 Nm	1.4 ENGINE OIL AND FILTER, Changing Oil and Filter
Electrical caddy fasteners, front	40-60 **in-lbs**	4.5-6.8 Nm	8.2 ELECTRICAL CADDY, Installation
Electrical caddy fasteners, top	90-110 **in-lbs**	10.2-12.4 Nm	8.2 ELECTRICAL CADDY, Installation
Engine mount bolt	21-27 ft-lbs	28-36 Nm	2.31 ENGINE MOUNTS, Installation
Engine mount flange nut	21-27 ft-lbs	28-36 Nm	2.31 ENGINE MOUNTS, Installation
Engine mount flange nut	21-27 ft-lbs	28-36 Nm	2.31 ENGINE MOUNTS, Installation
Engine mount flange nut	21-27 ft-lbs	28-36 Nm	2.31 ENGINE MOUNTS, Installation
Engine temperature sensor	10-15 ft-lbs	13.6-20.3 Nm	4.8 ENGINE TEMPERATURE SENSOR (ET), Installation / Hand start 2-3 turns
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Exhaust flange nut (lower front cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Exhaust flange nut (lower rear cylinder)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Exhaust flange nut (upper front cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Exhaust flange nut (upper front cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Exhaust flange nut (upper rear cylinder, final torque)	100-120 **in-lbs**	11.3-13.6 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Exhaust flange nut (upper rear cylinder, initial torque)	9-18 **in-lbs**	1-2 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure
Footpeg bracket screws	25-35 ft-lbs	33.9-47.5 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure

FASTENER	TORQUE VALUE		NOTES
Fork stem nut	70-80 ft-lbs	94.9-108.4 Nm	2.18 STEERING HEAD, Installation / Anti-seize
Fork tube caps	16-43 ft-lbs	22-58 Nm	2.17 FRONT FORK, Assembly
Front axle nut	60-65 ft-lbs	81.3-88.1 Nm	2.3 FRONT WHEEL, Installation
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.3 FRONT WHEEL, Installation
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER, Installation
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.3 FRONT WHEEL, Installation
Front brake caliper upper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	2.13 FRONT BRAKE CALIPER, Installation
Front caliper banjo bolt	21-25 ft-lbs	28.5-33.9 Nm	2.13 FRONT BRAKE CALIPER, Installation
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Front caliper mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Front engine mounting bracket bolts	25-30 ft-lbs	33.9-40.7 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure
Front fender nuts	15-21 ft-lbs	20.3-28.5 Nm	2.27 FRONT FENDER, Installation
Front fork seat pipe screw	106-159 **in-lbs**	12-18 Nm	2.17 FRONT FORK, Assembly
Fuel gauge trim ring screws	18-22 **in-lbs**	2.03-2.49 Nm	8.15 FUEL GAUGE, FXD Models
Fuel supply tube fastener	90-110 **in-lbs**	10.2-12.4 Nm	4.13 FUEL INJECTORS, Installation
Fuel tank mounting fasteners	15-20 ft-lbs	20.3-27.1 Nm	4.5 FUEL TANK, Installation / Front and rear
Fuel tank trim screws	18-24 **in-lbs**	2.03-2.71 Nm	8.17 INSTRUMENTS: FXDWG/FXDC/FXDF, Installation
Handlebar switch clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	8.29 RIGHT HANDLEBAR SWITCH, Installation
Handlebar switch clamp screws	60-80 **in-lbs**	6.8-9.0 Nm	8.30 LEFT HANDLEBAR SWITCH, Installation
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	1.2 MAINTENANCE SCHEDULE, General
Handlebar switch housing screw	35-45 **in-lbs**	4.0-5.1 Nm	1.14 THROTTLE CABLES, Cable Inspection, Lubrication and Adjustment
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	8.29 RIGHT HANDLEBAR SWITCH, Installation
Handlebar switch housing screws	35-45 **in-lbs**	4.0-5.1 Nm	8.30 LEFT HANDLEBAR SWITCH, Installation
Headlight horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	8.9 HEADLAMP, Headlamp Assembly Installation
Horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	1.23 HEADLAMP ALIGNMENT, Adjustment
Horn mounting nut	10-15 ft-lbs	13.6-20.3 Nm	8.25 HORN, Replacement
Intake air temperature sensor fastener	15-20 **in-lbs**	1.7-2.3 Nm	4.7 INTAKE AIR TEMPERATURE SENSOR (IAT), Installation
Intake manifold mounting screws	96-144 **in-lbs**	10.8-16.3 Nm	4.9 INDUCTION MODULE, Installation
Isolator mounting bolts	25 ft-lbs	33.9 Nm	2.11 VEHICLE ALIGNMENT, Inspection
Jiffy stand bolt	19 ft-lbs	25.8 Nm	2.30 JIFFY STAND, Cleaning
Jiffy stand sensor screw	96-144 **in-lbs**	10.8-16.3 Nm	2.30 JIFFY STAND, Sensor (HDI Models)
LED assembly fasteners	18-24 **in-lbs**	2.0-2.7 Nm	8.21 INDICATOR LAMPS, Installation
Lifter cover screws	90-120 **in-lbs**	10.2-13.6 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Push Rods, Lifters and Covers
Long post jam nut	65-80 **in-lbs**	7.3-9.0 Nm	5.3 STARTER SOLENOID, Solenoid Contacts
Lower handlebar clamp fastener	30-40 ft-lbs	40.7-54.2 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Lower handlebar clamp fastener	30-40 ft-lbs	40.7-54.2 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation

FASTENER	TORQUE VALUE		NOTES
Lower handlebar clamp fastener	30-40 ft-lbs	40.7-54.2 Nm	2.26 HANDLEBARS: FXDWG/FXDF, Installation
Lower triple clamp pinch bolts	30-35 ft-lbs	40.7-47.5 Nm	1.20 STEERING HEAD BEARINGS, Adjustment
Mainshaft/countershaft nuts	45-55 ft-lbs	61.0-74.6 Nm	7.5 TRANSMISSION ASSEMBLY, Assembly
Master cylinder banjo bolt, rear	21-25 ft-lbs	28.5-33.9 Nm	2.14 REAR BRAKE MASTER CYLINDER, Installation
Master cylinder mounting nut, rear	30-40 ft-lbs	40.7-54.2 Nm	2.14 REAR BRAKE MASTER CYLINDER, Installation
Master cylinder reservoir cover	6-8 **in-lbs**	0.7-0.9 Nm	1.2 MAINTENANCE SCHEDULE, General
Master cylinder reservoir cover	6-8 **in-lbs**	0.7-0.9 Nm	1.15 BLEEDING BRAKES, Procedure
Master cylinder reservoir cover screw	6-8 **in-lbs**	0.7-0.9 Nm	1.6 BRAKES, Fluid Inspection
Master cylinder reservoir cover screw	6-8 **in-lbs**	0.7-0.9 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder reservoir cover screw	6-8 **in-lbs**	0.7-0.9 Nm	1.16 BRAKE PADS AND DISCS, Brake Pad Replacement
Master cylinder-to-handlebar switch screws	60-80 **in-lbs**	6.8-9.0 Nm	2.12 FRONT BRAKE MASTER CYLINDER, Assembly and Installation
Muffler bracket bolt	15-19 ft-lbs	20.3-25.8 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Muffler bracket flange nuts	15-19 ft-lbs	20.3-25.8 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Muffler clamp nuts	45-50 ft-lbs	61.0-67.8 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Muffler clamp nuts	45-50 ft-lbs	61.0-67.8 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Muffler mounting bolt	15-19 ft-lbs	20.3-25.8 Nm	4.16 EXHAUST SYSTEM, Installation: FXDF
Muffler support bracket nuts	15-19 ft-lbs	20.3-25.8 Nm	4.16 EXHAUST SYSTEM, Installation: All but FXDF
Neutral switch	120-180 **in-lbs**	13.6-20.3 Nm	8.22 NEUTRAL SWITCH, Installation
Oil pan screws	84-108 **in-lbs**	9.5-12.2 Nm	3.29 OIL PAN, Installation
Oil Pressure Switch	96-144 **in-lbs**	10.8-16.3 Nm	8.23 OIL PRESSURE SWITCH, Installation
Oil pump screws, initial torque	40-45 **in-lbs**	4.5-5.1 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Oil spout fastener	84-132 **in-lbs**	9.5-14.9 Nm	7.5 TRANSMISSION ASSEMBLY, Installation
Oxygen sensor	29-44 ft-lbs	39.3-59.7 Nm	4.12 OXYGEN SENSOR, Installation
Pinch bolts	30-35 ft-lbs	41-48 Nm	2.17 FRONT FORK, Installation
Piston jet screws	25-35 **in-lbs**	2.8-3.9 Nm	3.27 CRANKCASE, Right Crankcase Half
Pivot shaft nut	71-75 ft-lbs	96.3-101.7 Nm	2.23 REAR FORK, Installation
Primary cam sprocket flange bolts, final torque	34 ft-lbs	46.1 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Primary cam sprocket flange bolts, initial torque	15 ft-lbs	20.3 Nm	3.18 BOTTOM END OVERHAUL: ASSEMBLY, Cover and Cam Support Plate
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.2 MAINTENANCE SCHEDULE, General
Primary chaincase drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.9 PRIMARY CHAIN, Changing Primary Chaincase Lubricant
Primary cover fasteners	108-120 **in-lbs**	12.2-13.6 Nm	6.2 PRIMARY CHAINCASE COVER, Installation
Rear axle adjuster screw	96-120 **in-lbs**	10.8-13.6 Nm	1.13 REAR BELT DEFLECTION, Adjustment / Tighten after axle is tightened.

FASTENER	TORQUE VALUE		NOTES
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm	1.13 REAR BELT DEFLECTION, Adjustment
Rear axle nut	95-105 ft-lbs	128.8-142.4 Nm	2.4 REAR WHEEL, Installation
Rear caliper banjo bolt	21-25 ft-lbs	28.5-33.9 Nm	2.15 REAR BRAKE CALIPER, Installation
Rear caliper mounting bolt	10-14 ft-lbs	13.6-18.9 Nm	2.15 REAR BRAKE CALIPER, Installation
Rear fender cover screw	12-18 ft-lbs	16.3-24.4 Nm	2.28 REAR FENDER, FXDWG/FXDF
Rear fender screw	12-18 ft-lbs	16.3-24.4 Nm	2.28 REAR FENDER, FXD, FXDC, FXDB and FXDL Models
Rear stoplight switch	12-15 ft-lbs	16.3-20.3 Nm	8.24 REAR STOPLIGHT SWITCH, Installation
Rear turn signal lamp fastener	12-16 ft-lbs	16.3-21.7 Nm	8.11 TURN SIGNALS AND RUNNING LIGHTS, Rear Lamp Housing Replacement
Riser cover fastener	50-60 **in-lbs**	5.6-6.8 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Rocker Arm Support Plate
Rocker cover bolts	15-18 ft-lbs	20.3-24.4 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Breather Assembly
Rocker housing bolts	120-168 **in-lbs**	13.6-19.0 Nm	3.16 TOP END OVERHAUL: ASSEMBLY, Cylinder Head
Sealing fasteners	25-27 ft-lbs	33.9-36.6 Nm	6.4 PRIMARY CHAINCASE HOUSING, Installation
Seat strap nut	60-90 **in-lbs**	6.78-10.17 Nm	2.29 SEAT, Installation
Secondary cam chain tensioner fastener	100-120 **in-lbs**	11.3-13.6 Nm	3.25 COVER AND CAM SUPPORT PLATE, Camshafts
Shift drum detent arm fastener	120-150 **in-lbs**	13.6-17.0 Nm	7.5 TRANSMISSION ASSEMBLY, Disassembly
Shift drum lock plate fasteners	57-63 **in-lbs**	6.4-7.1 Nm	7.5 TRANSMISSION ASSEMBLY, Assembly
Shifter foot lever pinch bolt	18-22 ft-lbs	24.4-29.8 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure
Shifter linkage locknut	96-144 **in-lbs**	10.8-16.3 Nm	7.3 SHIFTER LINKAGE, Adjustment
Shifter rod lever screw	18-22 ft-lbs	24.4-29.8 Nm	7.7 TRANSMISSION CASE, Assembly
Shift rod jam nut	80-120 **in-lbs**	9.0-13.6 Nm	7.3 SHIFTER LINKAGE, Adjustment
Shock mounting fastener, lower	30-40 ft-lbs	40.7-54.2 Nm	2.4 REAR WHEEL, Installation
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm	2.4 REAR WHEEL, Installation
Shock mounting fastener, upper	30-40 ft-lbs	40.7-54.2 Nm	2.22 REAR SHOCK ABSORBERS, Installation / Loctite Threadlocker 343 (blue)
Shock mounting screw, lower	30-40 ft-lbs	40.7-54.2 Nm	2.22 REAR SHOCK ABSORBERS, Installation / Loctite Threadlocker 343 (blue)
Shock mounting stud nut, inner	70-85 ft-lbs	101.7-115.2 Nm	2.22 REAR SHOCK ABSORBERS, Installation
Sleeve	15-19 ft-lbs	20.3-25.6 Nm	6.2 PRIMARY CHAINCASE COVER, Installation
Solenoid ring terminal nut	70-90 **in-lbs**	7.9-10.2 Nm	5.2 STARTER, Field Coil Assembly
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.2 MAINTENANCE SCHEDULE, General
Spark plug	12-18 ft-lbs	16.3-24.4 Nm	1.19 SPARK PLUGS, Inspection
Speedometer cover fastener	50-60 **in-lbs**	5.6-6.8 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Speedometer cover fastener	50-60 **in-lbs**	5.6-6.8 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Speedometer sensor mounting bolt	84-108 **in-lbs**	9.5-12.2 Nm	8.20 VEHICLE SPEED SENSOR (VSS), Installation

FASTENER	TORQUE VALUE		NOTES
Spoke nipple	55-65 **in-lbs**	6.5-7.3 Nm	1.2 MAINTENANCE SCHEDULE, General
Spoke nipple	55 **in-lbs**	6.2 Nm	1.8 TIRES AND WHEELS, Wheel Spokes
Spoke nipple	55 **in-lbs**	6.2 Nm	2.6 WHEEL LACING: 17 INCH RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.7 WHEEL LACING: 19 INCH RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.8 WHEEL LACING: 21 INCH RIM, Procedure
Spoke nipple	55 **in-lbs**	6.2 Nm	2.9 TRUING LACED WHEELS, Radial Truing
Sprocket nut	150-165 ft-lbs	203.4-223.7 Nm	8.14 ALTERNATOR AND STATOR, Assembly/Installation
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	3.12 ASSEMBLING MOTORCYCLE AFTER SERVICE, Procedure
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure
Starter end cover screw	90-110 **in-lbs**	10.2-12.4 Nm	5.2 STARTER, Field Coil Assembly
Starter mounting bolts	25-27 ft-lbs	33.9-36.6 Nm	5.2 STARTER, Installation
Starter positive terminal nut	65-85 **in-lbs**	7.3-9.6 Nm	5.2 STARTER, Installation
Starter positive terminal nut	65-85 **in-lbs**	7.3-9.6 Nm	8.8 BATTERY TRAY AND BATTERY CABLES, Battery Cables / metric
Starter thru bolts	39-65 **in-lbs**	4.4-7.3 Nm	5.2 STARTER, Field Coil Assembly
Stator screws	55-75 **in-lbs**	6.2-8.4 Nm	8.14 ALTERNATOR AND STATOR, Assembly/Installation / T27 TORX, use only once
Steering head stem nut	70-80 ft-lbs	95-108.5 Nm	1.20 STEERING HEAD BEARINGS, Adjustment
Tail lamp base screws	40-48 **in-lbs**	4.5-5.4 Nm	8.10 TAIL LAMP, Base Replacement
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm	8.10 TAIL LAMP, Tail Lamp Bulb Replacement: Standard Style
Tail lamp lens screws	20-24 **in-lbs**	2.3-2.7 Nm	8.10 TAIL LAMP, Base Replacement
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.10 IDLE AIR CONTROL (IAC), Installation
Throttle cable bracket fasteners	20-35 **in-lbs**	2.3-4.0 Nm	4.11 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP), Installation / Use new screws
Throttle housing screws	35-45 **in-lbs**	4.0-5.1 Nm	2.21 THROTTLE CONTROL, Assembly/Installation
Throttle position sensor fasteners	18 **in-lbs**	2.0 Nm	4.6 THROTTLE POSITION SENSOR (TPS), Installation
Top plate fasteners	20 **in-lbs**	2.3 Nm	4.14 FUEL PUMP, Installation
Top plate fasteners	20 **in-lbs**	2.3 Nm	4.14 FUEL PUMP, Installation
Top plate fasteners (FXD/FXDB/FXDL)	20 **in-lbs**	2.26 Nm	8.16 FUEL GAUGE SENDER, Installation
Top plate fasteners (FXDWG/FXDC/FXDF)	20 **in-lbs**	2.26 Nm	8.16 FUEL GAUGE SENDER, Installation
Transmission case, 5/16 in. hardware	13-18 ft-lbs	17.6-24.4 Nm	7.5 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	1.2 MAINTENANCE SCHEDULE, General
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	7.5 TRANSMISSION ASSEMBLY, Installation
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	7.7 TRANSMISSION CASE, Installation
Transmission filler/check plug	25-75 **in-lbs**	2.8-8.5 Nm	1.2 MAINTENANCE SCHEDULE, General
Transmission filler plug/dipstick	14-21 ft-lbs	19.0-28.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant

FASTENER	TORQUE VALUE		NOTES
Transmission filler plug/dipstick	25-75 **in-lbs**	2.8-8.5 Nm	1.10 TRANSMISSION LUBRICANT, Changing Transmission Lubricant
Transmission ground stud nut	13-20 ft-lbs	17.6-27.1 Nm	8.8 BATTERY TRAY AND BATTERY CABLES, Battery Cables
Transmission lockplate screws	84-108 **in-lbs**	9.5-12.2 Nm	6.6 TRANSMISSION SPROCKET, Installation / LOCTITE patch, use 3-5 times
Transmission mounting bolts	15 ft-lbs	20.3 Nm	7.7 TRANSMISSION CASE, Installation
Transmission mounting bolts	30-35 ft-lbs	40.7-47.5 Nm	7.7 TRANSMISSION CASE, Installation
Transmission mounting bolts, final torque	30-35 ft-lbs	40.7-47.5 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission mounting bolts, initial torque	15 ft-lbs	20.3 Nm	3.14 INSTALLING ENGINE IN CHASSIS, Procedure
Transmission sprocket nut	35 ft-lbs	47.5 Nm	6.6 TRANSMISSION SPROCKET, Installation / Right hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 271 (red) to last few threads.
Transmission sprocket nut	35 ft-lbs	47.5 Nm	6.6 TRANSMISSION SPROCKET, Installation
Transmission top cover	84-132 **in-lbs**	9.5-14.9 Nm	7.5 TRANSMISSION ASSEMBLY, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.25 HANDLEBARS: ALL BUT FXDWG/FXDF, Installation
Upper handlebar clamp fastener	12-16 ft-lbs	16.3-21.7 Nm	2.26 HANDLEBARS: FXDWG/FXDF, Installation
Valve stem nut	12-15 **in-lbs**	1.4-1.7 Nm	2.16 TIRES, Installation
Vertical adjusting nut	25-30 ft-lbs	33.9-40.7 Nm	1.23 HEADLAMP ALIGNMENT, Adjustment
Voltage regulator fasteners	60-80 **in-lbs**	6.8-9.0 Nm	8.5 VOLTAGE REGULATOR, Installation

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OUTSIDE BACK COVER GOES HERE