

2003 Harley-Davidson®

DYNA
MODELS

SERVICE MANUAL

P/N 99481-03A

IMPORTANT NOTICE

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

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

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

Harley-Davidson Motor Company

2003 DYNA GLIDE MODELS

SERVICE MANUAL

The information in this Service Manual applies to 2003 Dyna Glide models.

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2003
Dyna Glide
Service Manual
Part No. 99481-03A

Clip out and mail to:
Service Communications Dept.
Harley-Davidson Motor Company
P.O. Box 653
Milwaukee, WI 53201

FOREWORD

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

Information is arranged as follows:

- Section 1–Maintenance
- Section 2–Chassis
- Section 3–Engine
- Section 4–Fuel System
- Section 5–Electric Starter
- Section 6–Drive
- Section 7–Transmission
- Section 8–Electrical
- Appendix A–Tools
- Appendix B–Wiring
- Appendix C–Metric Conversions

Use the TABLE OF CONTENTS following this FOREWORD or the INDEX at the back of the book to find the desired subject.

Note that each manual section contains sequentially numbered topics. The numbering system allows quick cross references throughout the document.

For example, the sixth topic (BRAKES) in section one (MAINTENANCE) could be referred to as:

1.6 BRAKES

This cross reference directs the reader to section **1** (MAINTENANCE) and topic **6** (BRAKES).

PREPARATION FOR SERVICE

⚠WARNING

Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near the work site. Inadequate safety precautions could result in death or serious injury.

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. See APPENDIX A-TOOLS for equipment required for special service work.

NOTE

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

SERVICE BULLETINS

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

USE GENUINE REPLACEMENT PARTS

⚠WARNING

When replacement parts are required, use only genuine Harley-Davidson parts or parts with equivalent characteristics (which include type, strength and material). Failure to do so may result in product malfunction. This could result in death or serious injury.

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 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.

⚠CAUTION

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

CAUTION

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

⚠WARNING

- **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. 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.**

- **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.**

- **Wear eye protection when using hammers, arbor or hydraulic presses, gear pullers, spring compressors, slide hammers and similar tools. Be especially cautious when using pulling, pressing or compressing equipment. The forces involved can cause parts to fly outward with considerable force, possibly resulting in personal injury.**

PRODUCT REFERENCES

⚠WARNING

Follow the directions listed on all products. Carefully read all labels, warnings and cautions before use. Inadequate safety precautions could result in death or serious injury.

When reference is made in this Service 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:

Kent-Moore
SPX Corporation
28635 Mound Road
Warren, Michigan 48092-3499
Telephone: 1-800-345-2233

Direct all product returns, warranty or otherwise, to the following address:

Kent-Moore
Attn: Returned Goods
655 Eisenhower Drive
Owatonna, Minnesota 55060-0995

Sealing and Threadlocking Products

LOCTITE PRODUCTS

Some procedures in this Service Manual call for the use of Loctite® products. If you have any questions regarding Loctite product usage or retailer/wholesaler locations, please call Loctite Corp. at 1-800-323-5106.

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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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SERVICING A NEW MOTORCYCLE

⚠WARNING

Always follow the listed service and maintenance recommendations, since they affect the safe operation of the motorcycle and the personal welfare of the rider. Failure to follow recommendations could result in death or serious injury.

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

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

After a new motorcycle has been driven its first 1000 miles (1600 km), and at every 2500 mile (4000 km) interval thereafter, have a Harley-Davidson dealer perform the service operations listed under 1.3 MAINTENANCE SCHEDULE.

SAFE OPERATING MAINTENANCE

CAUTION

- **Do not attempt to retighten engine head bolts. Retightening can cause engine damage.**
- **During the initial 1000 mile (1600 km) 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, passing lamp, tail lamp, brake lamp and turn signal operation.

SHOP PRACTICES

Repair Notes

NOTE

- *General maintenance practices are given in this section.*
- *Repair = Disassembly/Assembly.*
- *Replace = Removal/Installation.*

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

Always check the capacity rating and condition of hoists, slings, chains or cables before use. Failure to do so could lead to an accident which could result in death or serious injury.

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.

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.

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 on pipe fitting threads.

Wiring, Hoses and Lines

Replace 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.

Be sure that the chamfered side of the bearing always faces the shoulder (when bearings installed against shoulders). 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.

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. Unless otherwise instructed, never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part. But be aware that sections of a gasket may be used to seal passages.

Lip Type Seals

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

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

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

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

O-Rings (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.

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.

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 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

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 using 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/prybars

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

Hammers

- Never strike one 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

- Don't 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.
- Don't interchange POZIDRIV®, PHILLIPS® or REED AND PRINCE screwdrivers.
- Screwdriver handles are not intended to act as insulation; don't use on live electrical circuits.
- Don't 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

- Don't 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.
- Don't 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 work.

FUEL

⚠WARNING

Remove filler cap slowly and fill fuel tank slowly to prevent spillage; do not overfill or fill above the bottom of the filler neck insert. In addition, leave air space to allow for fuel expansion. Expansion can cause an overfilled tank to overflow gasoline through the filler cap onto surrounding areas. After refueling, be sure filler cap is securely tightened. Inadequate safety precautions may cause an explosion or fire which could result in death or serious injury.

Use a good quality leaded or unleaded gasoline (91 pump octane or higher). Pump octane is the octane number usually shown on the gas pump.

GASOLINE BLENDS

CAUTION

Using gasoline that has an alcohol additive, such as methanol, may cause fuel system rubber components' failure and/or engine damage.

Harley-Davidson motorcycles were designed to give the best performance using unleaded gasoline. Some fuel suppliers sell gasoline/alcohol blends as a fuel. The type and amount of alcohol added to the fuel is important.

- DO NOT USE GASOLINES CONTAINING METHANOL. Using gasoline/methanol blends will result in starting and driveability deterioration and damage to critical fuel system components.
- 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. Your motorcycle will run normally using this type of gas.

You may find that some gasoline blends adversely affect the starting, driveability or fuel efficiency of your bike. If you experience one or more of these problems, we recommend you try a different brand of gasoline or gasoline with a higher octane rating.

ENGINE OIL

Use the proper grade of oil for the lowest temperature expected before the next oil change.

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
- CF-4
- CG-4
- CH-4

The preferred viscosities for the diesel engine oils, in descending order, are:

- 20W-50
- 15W-40
- 10W-40

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

See 1.4 ENGINE OIL AND FILTER for all service information.

WINTER LUBRICATION

Combustion in an engine produces water vapor. During starting and warm-up in cold weather, especially in freezing temperatures, the vapor condenses to water before the crankcase is hot enough to exhaust it through the breather system. If the engine is run long enough for the crankcase to become thoroughly heated, the water returns to vapor and is then exhausted.

An engine used for only short trips, and seldom allowed to thoroughly warm up, accumulates increasing amounts of water in the oil pan. Water mixed with oil forms a sludge that causes accelerated engine wear. In freezing temperatures, the water becomes slush or ice, which may clog oil lines and result in engine failure.

Always change the engine oil more often in winter. If the engine is used for short runs, change the oil even more frequently. The farther below freezing the temperature drops the more often the oil should be changed.

MAINTENANCE TASK AND SERVICE DATA	PRE RIDE	10000 MI / 16000 KM	25000 MI / 40000 KM	50000 MI / 80000 KM	75000 MI / 120000 KM	100000 MI / 160000 KM	125000 MI / 200000 KM	150000 MI / 240000 KM	175000 MI / 280000 KM	200000 MI / 320000 KM	225000 MI / 360000 KM	250000 MI / 400000 KM	275000 MI / 440000 KM	300000 MI / 480000 KM	325000 MI / 520000 KM	350000 MI / 560000 KM	375000 MI / 600000 KM	400000 MI / 640000 KM	425000 MI / 680000 KM	450000 MI / 720000 KM	475000 MI / 760000 KM	500000 MI / 800000 KM
Engine oil (*) *Oil level:* Dipstick level depends on vehicle temperature. (1.4 ENGINE OIL AND FILTER)	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Engine oil filter (*) *Filter tightening:* Hand tighten oil filter 1/2 to 3/4 turn after gasket surface contacts filter mounting surface. (1.4 ENGINE OIL AND FILTER)		R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Battery (*) (1.5 BATTERY MAINTENANCE)		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Brake fluid level and condition *Brake fluid type:* D.O.T. 5 SILICONE BRAKE FLUID (1.6 BRAKES)		I		I		I		I		I		I		I		I		I		I		I
Brake pads and discs for wear *Minimum pad thickness:* 0.04 in. (1.02 mm) *Maximum brake disc lateral runout:* 0.008 in. (0.2 mm) (1.8 BRAKE PADS AND DISCS)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I

Table Code:

A - Adjust.
I - Inspect, and if necessary, correct, adjust, clean or replace.
L - Lubricate with specified lubricant.
R - Replace or change.
T - Tighten to proper torque.
X - Perform.
D - Disassemble, lubricate and inspect.
(*) - Also perform prior to storage or annually.

MAINTENANCE TASK AND SERVICE DATA	PRE RIDE	10000 MI 16000 KM	2500 MI 4000 KM	5000 MI 8000 KM	7500 MI 12000 KM	10000 MI 16000 KM	12500 MI 20000 KM	15000 MI 24000 KM	17500 MI 28000 KM	20000 MI 32000 KM	22500 MI 36000 KM	25000 MI 40000 KM	27500 MI 44000 KM	30000 MI 48000 KM	32500 MI 52000 KM	35000 MI 56000 KM	37500 MI 60000 KM	40000 MI 64000 KM	42500 MI 68000 KM	45000 MI 72000 KM	47500 MI 76000 KM	50000 MI 80000 KM
Tire pressure and inspect tire for wear/damage (*) (1.9 TIRES AND WHEELS)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Wheel spoke tightness *Wheel spoke nipple torque:* 40-50 **in-lbs** (4.5-5.6 Nm) (1.9 TIRES AND WHEELS)				I		I		I		I		I		I		I		I		I	
Primary chain adjustment (*) *Deflection:* Deflection depends upon vehicle temperature. (1.10 PRIMARY CHAIN)		I		I		I		I		I		I		I		I		I		I	
Primary chain lubricant *Lubricant level:* Visible between clutch and chaincase inner wall with vehicle upright, 26 oz (768.9 ml). *Lubricant type:* Part No. 99887-84 (quart) or 99886-84 (gallon) (1.11 PRIMARY CHAINCASE LUBRICANT)		R		R		R		R		R		R		R		R		R		R	
Clutch adjustment *Hand lever free play:* 1/16-1/8 in. (1.6-3.2 mm) (1.12 CLUTCH)		I		I		I		I		I		I		I		I		I		I	

Table Code:

A - Adjust.
I - Inspect, and if necessary, correct, adjust, clean or replace.
L - Lubricate with specified lubricant.
R - Replace or change.
T - Tighten to proper torque.
X - Perform.
D - Disassemble, lubricate and inspect.
(*) - Also perform prior to storage or annually.

MAINTENANCE TASK AND SERVICE DATA	PRE RIDE	1000 MI	2500 MI	5000 MI	7500 MI	10000 MI	12500 MI	15000 MI	17500 MI	20000 MI	22500 MI	25000 MI	27500 MI	30000 MI	32500 MI	35000 MI	37500 MI	40000 MI	42500 MI	45000 MI	47500 MI	50000 MI
		1600 KM	4000 KM	8000 KM	12000 KM	16000 KM	20000 KM	24000 KM	28000 KM	32000 KM	36000 KM	40000 KM	44000 KM	48000 KM	52000 KM	56000 KM	60000 KM	64000 KM	68000 KM	72000 KM	76000 KM	80000 KM
Transmission lubricant (*) *Lubricant level:* Bottom edge of FULL mark on dipstick with vehicle upright. *Lubricant type:* Part No. 99892-84 (quart), 99891-84 (gal), 98853-96 (case/qts) or 98852-96 (case/gals). *Drain plug:* 14-21 ft-lbs (19.0-28.5 Nm) (1.13 TRANSMISSION LUBRICANT)		R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Rear belt deflection inspection (*) *Deflection:* 5/16-3/8 in. (7.9-9.5 mm) *Specialty tool:* Part No. HD-35381 (1.14 REAR BELT DEFLECTION)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Rear belt and sprocket (*) (1.15 REAR BELT AND SPROCKETS)		I		I		I		I		I		I		I		I		I		I		I
Steering head bearing adjustment (1.17 STEERING HEAD BEARINGS)		A				A				A				D				A				A
Lubricate steering head bearings														L								
Front fork oil (1.18 FRONT FORK OIL)										X								X				

Table Code:

A - Adjust.
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T - Tighten to proper torque.
X - Perform.
D - Disassemble, lubricate and inspect.
(*) - Also perform prior to storage or annually.

MAINTENANCE TASK AND SERVICE DATA	PRERIDE	1000MI 1600KM	2500MI 4000KM	5000MI 8000KM	7500MI 12000KM	10000MI 16000KM	12500MI 20000KM	15000MI 24000KM	17500MI 28000KM	20000MI 32000KM	22500MI 36000KM	25000MI 40000KM	27500MI 44000KM	30000MI 48000KM	32500MI 52000KM	35000MI 56000KM	37500MI 60000KM	40000MI 64000KM	42500MI 68000KM	45000MI 72000KM	47500MI 76000KM	50000MI 80000KM
Spark plugs (*) *Plug type:* No. 6R12 *Plug gap:* 0.038-0.043 (0.97-1.09 mm) *Plug torque:* 11-18 ft-lbs (14.9-24.4 Nm) (1.19 SPARK PLUGS)		I		I		R		I		R		I		R		I		R		I		R
Air cleaner filter (*) *Cover screw torque:* 36-60 **in-lbs** (4.1-6.8 Nm) (1.20 AIR CLEANER FILTER)		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Lubricate controls (*) Front brake hand lever, clutch hand lever, throttle control cables, clutch control cable, rear brake pedal and jiffy stand (1.21 CABLE AND CHASSIS LUBRICATION)		L		L		L		L		L		L		L		L		L		L		L
Operation of throttle and enrichener controls (1.22 THROTTLE CABLES AND ENRICHENER)		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Engine idle speed *Idle speed:* 950-1050 RPM (1.23 IDLE SPEED AND IGNITION TIMING)		I		I		I		I		I		I		I		I		I		I		I

Table Code:

- **A** - Adjust.
- **I** - Inspect, and if necessary, correct, adjust, clean or replace.
- **L** - Lubricate with specified lubricant.
- **R** - Replace or change.
- **T** - Tighten to proper torque.
- **X** - Perform.
- **D** - Disassemble, lubricate and inspect.
- **(*)** - Also perform prior to storage or annually.

MAINTENANCE TASK AND SERVICE DATA	PRERIDE	1000MI 1600KM	2500MI 4000KM	5000MI 8000KM	7500MI 12000KM	10000MI 16000KM	12500MI 20000KM	15000MI 24000KM	17500MI 28000KM	20000MI 32000KM	22500MI 36000KM	25000MI 40000KM	27500MI 44000KM	30000MI 48000KM	32500MI 52000KM	35000MI 56000KM	37500MI 60000KM	40000MI 64000KM	42500MI 68000KM	45000MI 72000KM	47500MI 76000KM	50000MI 80000KM
Fuel supply valve filter screen *Filter hex fitting torque:* 15-20 ft-lbs (20.3-27.1 Nm) (1.24 FUEL SUPPLY VALVE FILTER)										X								X				
Fuel supply valve, hoses and fittings for leaks (*) (1.24 FUEL SUPPLY VALVE FILTER)		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Repack rear fork bearings (2.23 REAR FORK)										X								X				
Check oil and brake lines for leaks		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Engine mounts (1.25 ENGINE MOUNTS)						I				I				I				I				I
Operation of all electrical equipment and switches (*)		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
All critical fasteners except engine head bolts (1.27 CRITICAL FASTENERS)		T				T				T				T				T				T
Inspect windshield grommets						I				I				I				I				I
Road test		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table Code:

A - Adjust.
I - Inspect, and if necessary, correct, adjust, clean or replace.
L - Lubricate with specified lubricant.
R - Replace or change.
T - Tighten to proper torque.
X - Perform.
D - Disassemble, lubricate and inspect.
(*) - Also perform prior to storage or annually.

CHECKING AND ADDING OIL

See Figure 1-1. Check engine oil level:

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

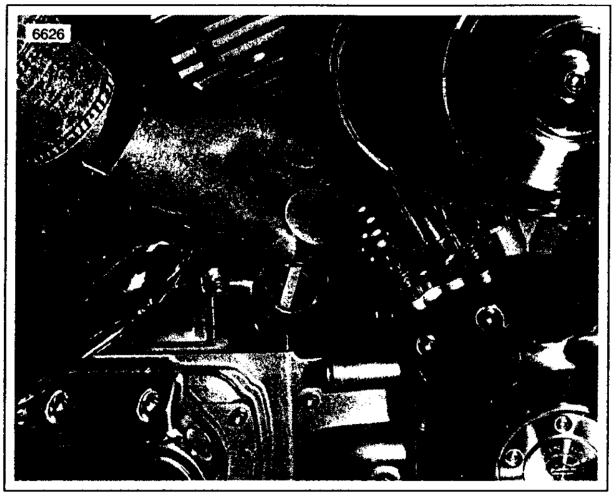


Figure 1-1. Checking Oil Level

Type of Oil

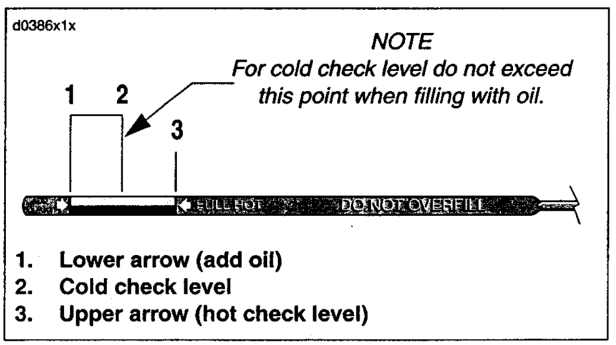
See Table 1-1. Use the proper grade of oil for the lowest temperature expected before the next oil change. See 1.2 FUEL AND OIL for specific information regarding winter needs.

If it is necessary to add oil and Harley-Davidson oil is not available, use an oil certified for diesel engines. Acceptable diesel engine oil designations include CF, CF-4, CG-4 and CH-4. The preferred viscosities for the diesel engine oils, in descending order, are 20W-50, 15W-40 and 10W-40. At the first opportunity, see a Harley-Davidson dealer to change back to 100 percent Harley-Davidson oil.

Checking With Cold Engine

See Figure 1-2. For preride inspection with motorcycle leaning on jiffy stand on level ground, oil should register on dipstick in the range between lower arrow (1) and midway point (2) when engine is cold.

If oil level is at or below lower arrow, add only enough oil to bring the level between the two arrows (2) on the dipstick. Do **NOT** add oil to FULL mark (3) on a cold engine.



1. **Lower arrow (add oil)**
2. **Cold check level**
3. **Upper arrow (hot check level)**

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, check oil level by inserting dipstick completely into oil pan filler neck.
3. Add oil, if required, to FULL mark (3). Do not overfill.

Table 1-1. Recommended Oil Grades

HARLEY-DAVIDSON TYPE	VISCOSITY	HARLEY-DAVIDSON RATING	LOWEST AMBIENT TEMP °F	COLD WEATHER STARTS BELOW 50°F
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

CHANGING OIL AND FILTER

PART NO.	SPECIALTY TOOL
HD-42311 or HD-44067	Oil filter wrench

Change engine oil and filter:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.
- When storing or removing the motorcycle for the season.

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 Glides are shipped from the factory with SAE 20W50 Harley-Davidson 360 Motor Oil.*
- *All Dyna Glides come equipped from the factory with a premium 10 micron synthetic media oil filter, Part No. 63798-99 (Chrome) or 63731-99 (Black). These are the only recommended replacement filters.*

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

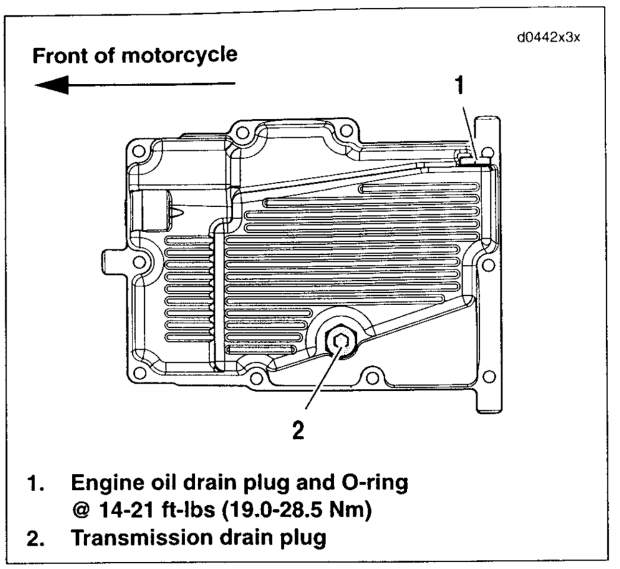
CAUTION

See Figure 1-4. Use OIL FILTER WRENCH (Part No. HD-42311 or HD-44067) for filter removal. This tool can prevent damage to crankshaft position sensor and/or sensor cable.

4. Remove the oil filter using the OIL FILTER WRENCH. Clean the oil filter mount flange of any old gasket material.
5. See Figure 1-5. Lube the gasket on **new** oil filter with engine oil and install **new** filter. Hand tighten oil filter 1/2 to 3/4 turn after gasket contacts filter mounting surface. Do NOT use oil filter wrench for oil filter installation.
6. See Figure 1-3. Install oil 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. See Figure 1-1. Fill oil pan with the correct amount of oil. Use the proper grade of oil for the lowest temperature expected before next oil change. See Table 1-1.
   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.



1. **Engine oil drain plug and O-ring @ 14-21 ft-lbs (19.0-28.5 Nm)**
2. **Transmission drain plug**

Figure 1-3. Oil Pan

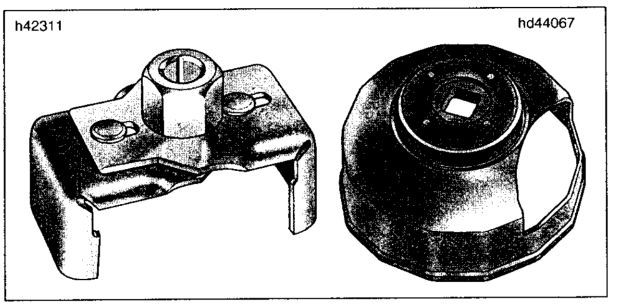


Figure 1-4. Oil Filter Wrench Part No. HD-42311 (left), HD-44067 (right)

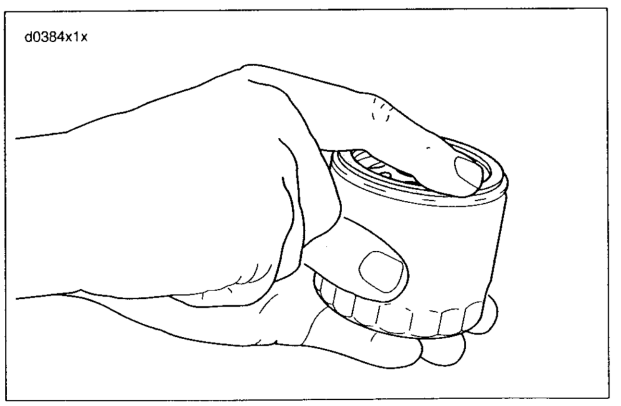


Figure 1-5. Lubing New Oil Filter

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.

GENERAL

⚠WARNING

See Figure 1-6. A warning label is attached to the top of the battery. Never remove warning label from battery. Failure to read and understand all precautions contained in warning label before performing any service on batteries could result in death or serious injury.

⚠WARNING

See Figure 1-7. All batteries contain electrolyte. Electrolyte is a sulfuric acid solution that is highly corrosive and can cause severe chemical burns. Avoid contact with skin, eyes, and clothing. Avoid spillage. Always wear protective face shield, rubberized gloves and protective clothing when working with batteries or electrolyte solution. KEEP BATTERIES AND ACID OUT OF REACH OF CHILDREN.

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.

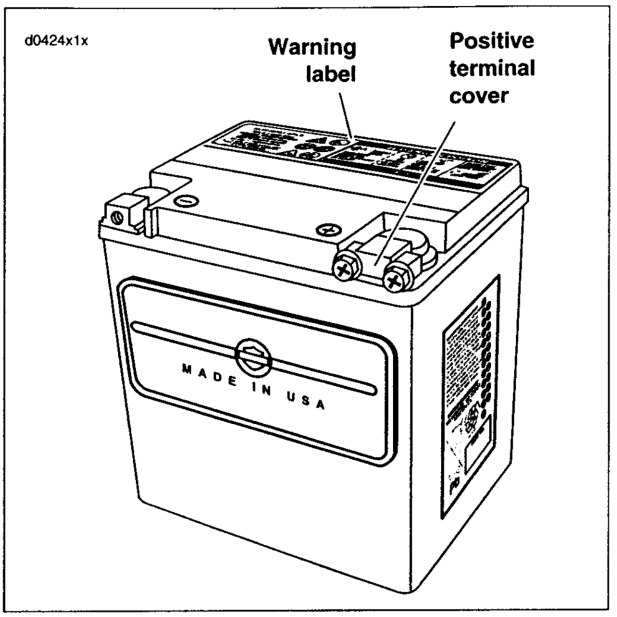


Figure 1-6. Battery

NOTE

See 8.15 BATTERY for charging and testing information.

Table 1-2. Battery Electrolyte Antidotes

CONTACT	SOLUTION
External	Flush with water.
Internal	Drink large quantities of milk or water, followed by milk of magnesia, vegetable oil or beaten eggs. Call doctor immediately.
Eyes	Flush with water, get immediate medical attention.



Figure 1-7. Battery Warning Label

DISCONNECTION AND REMOVAL

1. Remove seat.

⚠WARNING

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion that could result in death or serious injury.

2. See Figure 1-8. Remove nut (12) from ground stud (13) on frame (11).
3. Remove battery negative cable (black, 14) from ground stud (13).
4. Unbolt and remove battery positive cable (red, 10) from battery positive (+) terminal (7).
5. Remove lower rear bolt (6).
6. Remove upper rear bolt (5). Battery tray (4) will swing down allowing battery tray to be removed.
7. Remove top cover assembly (9).
8. Remove side cover (1) if present.
9. Lift battery from tray.
10. If battery is to be replaced, unbolt and remove battery negative cable (black, 14) from battery negative (–) terminal (3).

INSTALLATION AND CONNECTION

1. See Figure 1-8. If battery has been replaced, Insert bolt through battery negative cable (black, 14) into threaded hole of battery negative (–) terminal (3). Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
2. Place the fully charged battery into the battery tray (4), terminal side facing primary cover.

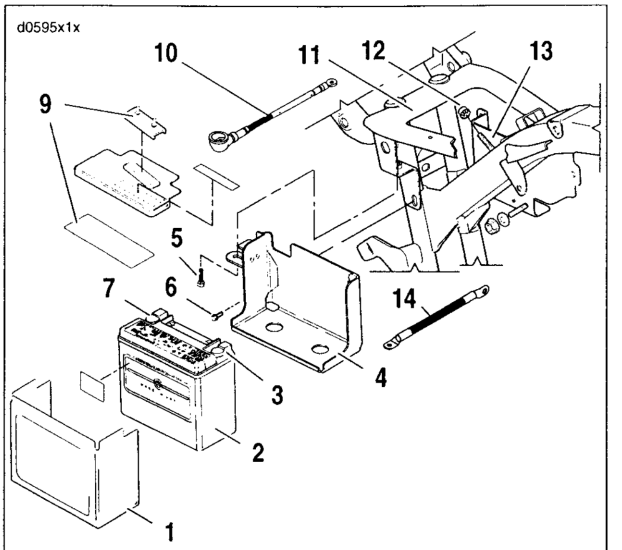
CAUTION

Attach the cables to the correct battery terminals using the proper torque. Overtightening bolts can damage battery terminals and incorrect connections may damage the motorcycle's electrical system.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion that could result in death or serious injury.

3. Insert bolt through battery positive cable (red,10) into threaded hole of battery positive (+) terminal (7). Tighten bolt to 60-96 **in-lbs** (6.8-10.9 Nm).
4. Place battery negative cable (black, 14) connection over ground stud (13) on frame (11).
5. Bolt nut (12) onto ground stud (13). Tighten nut (12) to 10-15 ft-lbs (13-20 Nm).
6. Apply a light coat of petroleum jelly or corrosion retardant material to both battery terminals.
7. Install battery side cover (1) if present. Make sure the bottom of the cover's outboard side is properly seated inboard of the retaining lip on the base of the battery tray.



1. **Side cover**
2. **Battery**
3. **Negative battery terminal**
4. **Battery tray**
5. **Mounting bolt**
6. **Mounting bolt**
7. **Positive battery terminal**
8. **Pad**
9. **Top cover assembly**
10. **Battery positive cable**
11. **Frame**
12. **Nut w/washer**
13. **Ground Stud**
14. **Battery negative cable**

Figure 1-8. Battery Assembly

8. Install top cover assembly (9) over side cover and battery.
9. Install upper rear bolt (5).
10. Install lower rear mounting bolt (6).

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

11. Install seat.

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.

STORAGE

⚠WARNING

Store the battery out of the reach of children. Inadequate safety precautions could result in death or serious injury.

CAUTION

The electrolyte in a discharged battery will freeze if exposed to freezing temperatures. Freezing may crack the battery case and buckle battery plates.

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 8.15 BATTERY.

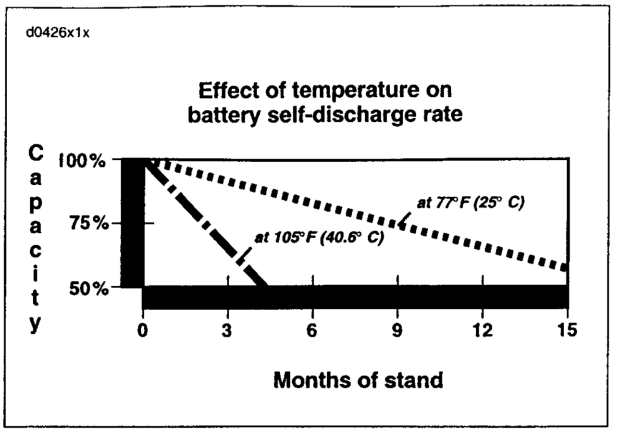


Figure 1-9. Battery Self-Discharge Rate

See Figure 1-9. Self-discharge is a normal condition and occurs continuously at a rate that depends on the ambient temperature and the battery's state of charge. Batteries discharge at a faster rate at higher ambient temperatures. To reduce the self-discharge rate, store battery in a cool (not freezing), dry place.

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

NOTE

The BATTERY TENDER PLUS AUTOMATIC BATTERY CHARGER (Part No. 99863-93TA) 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, refer to the instructions under 8.15 BATTERY.

FLUID INSPECTION

Check brake fluid reservoir level and condition:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.
- When storing or removing the motorcycle for the season.
- Also, check for fluid leaks at every service interval.

⚠CAUTION

Direct contact of D.O.T. 5 Silicone Brake Fluid may cause eye irritation, swelling and redness. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts may cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.

1. See Figure 1-10. Check level in rear brake master cylinder reservoir. Level should be 1/8 in. (3.2 mm) below the gasket surface.

CAUTION

To prevent dirt from entering the master cylinder reservoir, thoroughly clean the cover before removal.

2. See Figure 1-11. Check level in front brake master cylinder reservoir. Level should be 1/8 in. (3.2 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 completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

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. 5 SILICONE BRAKE FLUID. See 1.7 BLEEDING BRAKES.

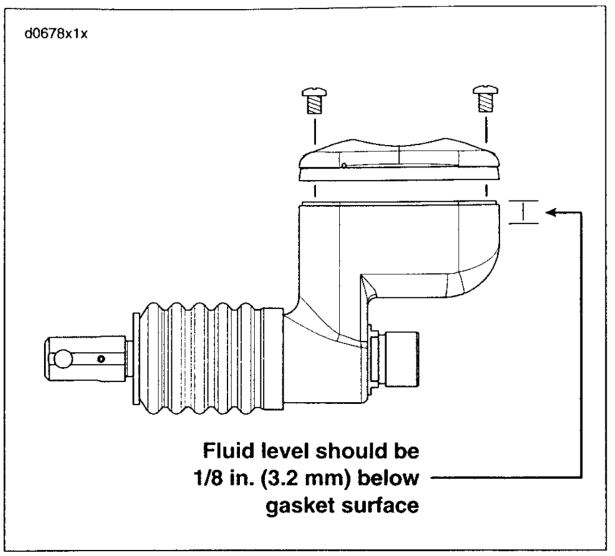


Figure 1-10. Rear Brake Master Cylinder Reservoir

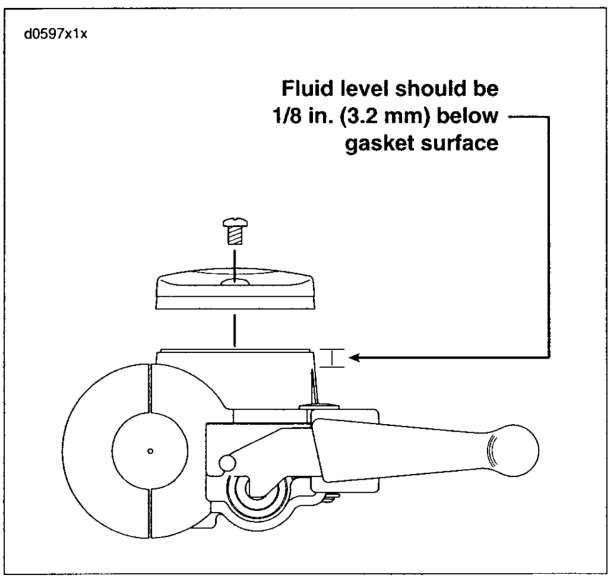


Figure 1-11. Front Brake Master Cylinder Reservoir

REAR PEDAL HEIGHT

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

1. See Figure 1-12. Brake rod (5) is threaded into pushrod (3) in rear brake master cylinder (1), and locked in place with jam nut (4). Loosen jam nut.

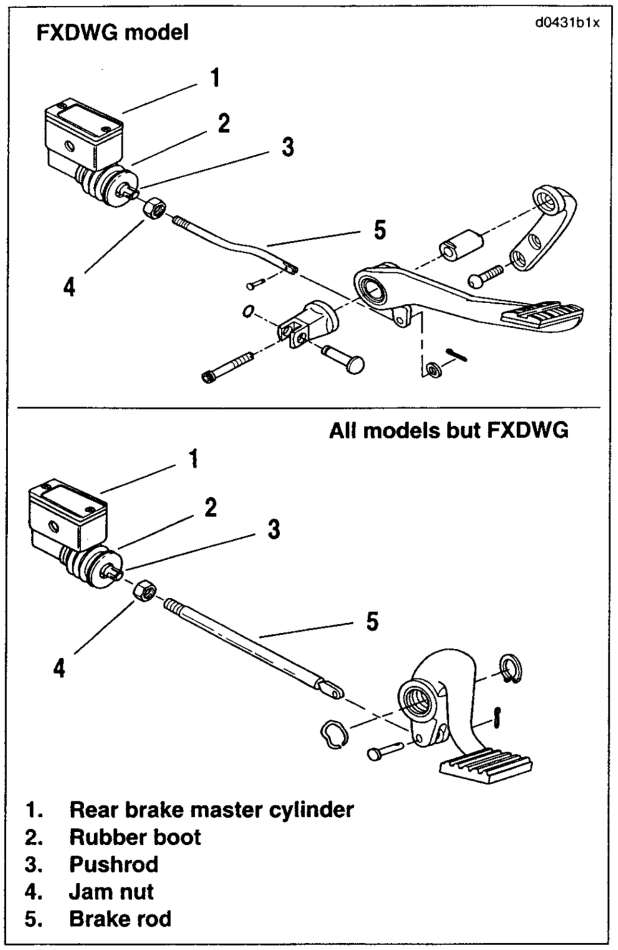
⚠WARNING

Do not lengthen linkage beyond point that exposes six threads outside of the jam nut or insufficient thread engagement between push rod and brake rod could cause linkage to come apart. This would result in a loss of the rear brake, which could lead to an accident resulting in death or serious injury.

2. Using an open-end wrench on the pushrod 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 free play is built into master cylinder and no adjustment is required. When pedal is pushed down with hand, a small amount of free play must be felt.



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

Figure 1-12. Rear Brake Pedal Height

BLEEDING BRAKES 1.7

GENERAL

⚠CAUTION

Direct contact of D.O.T. 5 Silicone Brake Fluid may cause eye irritation, swelling and redness. Avoid eye contact. In case of eye contact flush with large amounts of water and get medical attention. Swallowing large amounts may cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.

Check brake fluid level and condition:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.
- When storing or removing the motorcycle for the season.

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 1-13.
   b. Rear brake bleeder valve-see Figure 1-14.
2. Add D.O.T. 5 SILICONE BRAKE FLUID to master cylinder reservoir. Fluid level should be 1/8 in. (3.2 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.

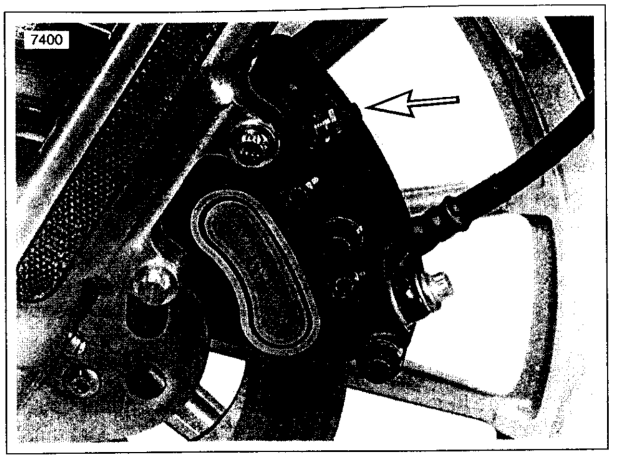


Figure 1-13. Front Brake Bleeder Valve

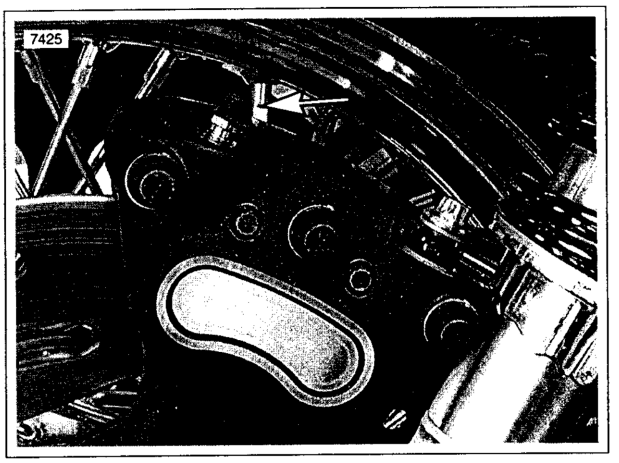


Figure 1-14. Rear Brake Bleeder Valve

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 completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

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

INSPECTION

Check brake pads and discs:

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

Brake Pads

⚠WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

See Figure 1-15. 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 BRAKE PAD REPLACEMENT below.

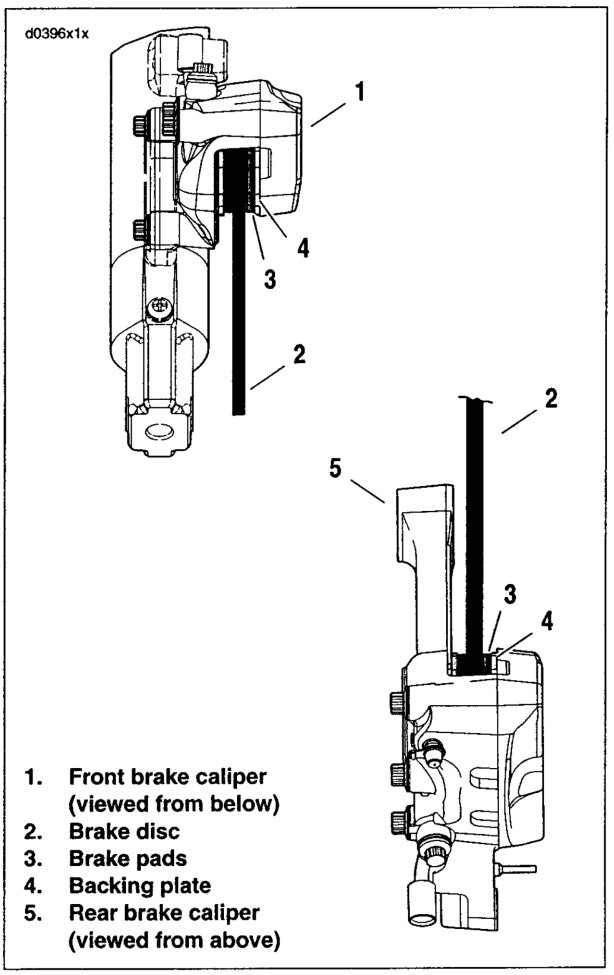
When checking the brake pads and discs, inspect the brake hoses for correct routing and any signs of damage.

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 1-15. 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 more than 1/8 in. (3.2 mm). You may have to remove fluid to allow for this.
3. See Figure 1-16. Loosen, but do not remove, both pad pins (12 pt/0.25 in.).
4. Pry the inside pad back. 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.

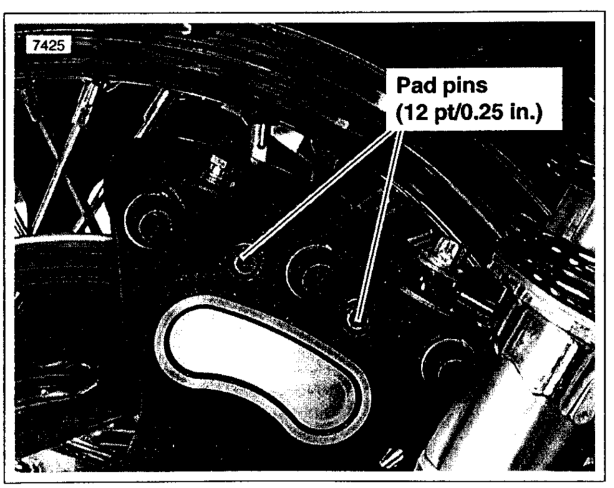


Figure 1-16. Pad Retaining Bolts (Rear Caliper Shown)

CAUTION

Do not completely pull pad pins from caliper during the next step. Completely removing pad pins at this time will cause difficulty during assembly.

5. Once the pistons have been fully retracted into their bores, pull pad pins part way until the inside pads drop free. Note the pad's original orientation for replacement purposes.

NOTE

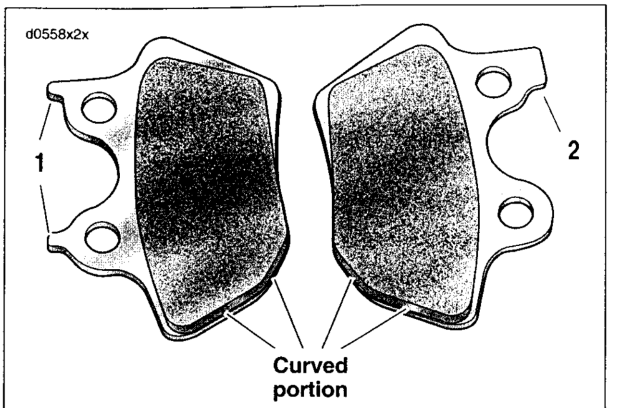
See Figure 1-17. The front left, front right (not present on all vehicles) and rear brake calipers use the same exact brake pad set. Install pad with two tabs (1) on the inboard side of the rear caliper.

6. Install **new** inside brake pad using the same orientation as the pad previously removed. Curved portion of pad must face rear of motorcycle.
7. Install pad pins until the pins snap into place with an audible click. Do not fully tighten at this time.
8. Pump brake pedal lever to move inside pistons out until they contact inside brake pads.
9. Pry the outside pad back. Pry between the pad and the brake disc in order to push the caliper pistons back into their bores.
10. Verify that inside pads are captured between brake disc and pistons. Completely remove pad pins to free outside brake pad. Note the pad's original orientation for replacement purposes.
11. Inspect pad pins 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.
12. Install **new** outside brake pad using the same orientation as the pad previously removed. If the inside pad moved during the previous step, reinstall. Curved portion of pad must face rear of motorcycle.
13. Install both pad pins through holes in inner and outer brake pads. Tighten to 180-200 **in-lbs** (20.3-22.6 Nm).

⚠WARNING

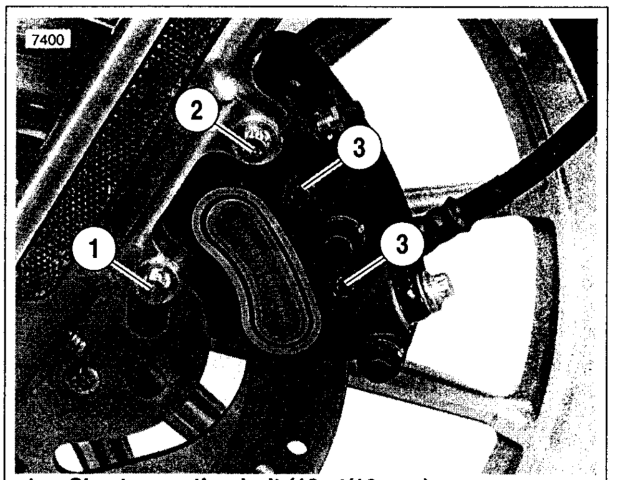
Whenever new pads are installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

14. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
15. Check brake fluid level in master cylinder. Fill to proper level if necessary using D.O.T. 5 SILICONE BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 6-8 **in-lbs** (0.7-0.9 Nm).
16. Install right saddlebag if necessary.



1. **Two tabs on backing plate**
2. **Single square tab on backing plate**

Figure 1-17. Brake Pad Orientation



1. **Short mounting bolt (12 pt/10 mm)**
2. **Long mounting bolt (12 pt/10 mm)**
3. **Pad pins (12 pt/0.25 in)**

Figure 1-18. Front Brake Caliper (Left Side Shown)

⚠WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

17. Test brake system.
    a. Turn ignition switch ON. Pump brake pedal to verify operation of the brake lamp.
    b. Test ride the motorcycle. If the brakes feel spongy, bleed the system. See 1.7 BLEEDING BRAKES.

NOTE

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

Front Brake Caliper

1. Remove the front master cylinder reservoir cap. As the pistons are pushed back into the caliper, fluid level may rise more than 1/8 in. (3.2 mm). You may have to remove fluid to allow for this.
2. See Figure 1-18. Loosen, but do not remove, both pad pins (3) (12 pt/0.25 in.).
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.
5. With the pistons retracted, remove the pad pins and brake pads.
6. Inspect pad pins 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.

NOTE

See Figure 1-17. The front left, front right (not present on all vehicles) and rear brake calipers use the same exact brake pad set.

- *On the right side of the vehicle, the pad with two tabs (1) installs on the inboard side of the caliper.*
- *On the left side of the vehicle, the pad with two tabs (1), installs on the outboard side of the caliper.*

7. Install **new** pads into caliper. Curved portion of pad must face rear of motorcycle.
8. Loosely install the pad pins until you hear an audible click.
9. Attach caliper to front fork.
   a. See Figure 1-19. On models with dual front calipers, check alignment of brake discs to calipers. Loosen axle pinch bolt nuts. Tighten axle nut to proper torque. Insert a 7/16 in. drill bit (1) through hole in front axle as far as it will go. Contact point (2) must have edge of drill bit touching the edge of fork leg. See 2.4 FRONT WHEEL.
   b. See Figure 1-18. Place caliper over brake disc with bleeder valve facing upwards.
   c. Loosely install long mounting bolt (2) (12 pt/10 mm) into top hole on fork leg.
   d. Install short mounting bolt (1) (12 pt/10 mm) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.51.5 Nm).
   e. Final tighten the top mounting bolt to 28-38 ft-lbs (38.51.5 Nm).
   f. Final tighten both pad pins to 180-200 **in-lbs** (20.3-22.6 Nm).
   g. On models with dual front calipers, tighten pinch bolt nuts while holding slider against 7/16 drill bit if necessary. See 2.4 FRONT WHEEL. Remove drill bit.

⚠WARNING

Whenever new pads are installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

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. 5 SILICONE BRAKE FLUID. Install master cylinder reservoir cap. Tighten reservoir cap screws to 6-8 **in-lbs** (0.7-0.9 Nm).

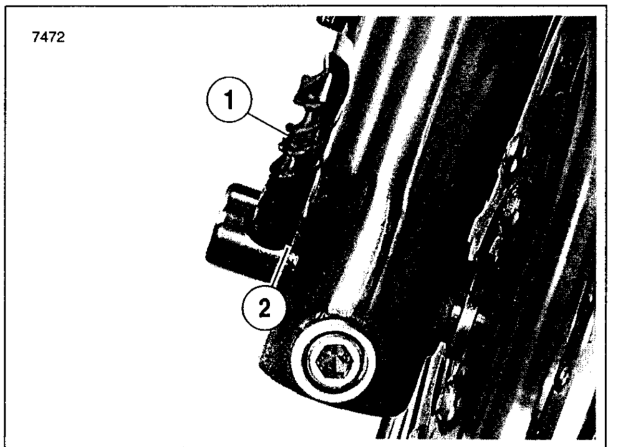
⚠WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

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 1.7 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. **7/16 Drill bit**
2. **Contact point**

Figure 1-19. Dual Caliper Alignment

TIRES

⚠WARNING

For your own personal safety, tires, rims and air valves must be correctly matched to wheel rims. See your Harley-Davidson dealer. Mismatching tires, tubes, rims and air valves may result in damage to the tire bead during mounting or may allow the tire to slip on the rim, possibly causing tire failure and resulting in death or serious injury.

- **In addition, using tires other than those specified may adversely affect motorcycle handling.**
- **Tubeless tires fitted with the correct size inner tubes may be used on all Harley-Davidson laced (wire spoked) wheels. Protective rubber rim strips must be used with tubeless tires (fitted with correct size inner tubes) when mounted on laced (wire spoked) wheels.**
- **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.**

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.

⚠WARNING

Do not exceed the maximum inflation pressure listed on tire sidewall. Overinflating could lead to tire failure which could result in death or serious injury.

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

Table 1-3. Tire Pressures

ALL MODELS DUNLOP TIRES ONLY	SOLO RIDER		RIDER & ONE PASSENGER	
	PSI	kPA	PSI	kPA
Front	30	207	30	207
Rear	36	248	40	276

TIRE REPLACEMENT

See Figure 1-20. Tire wear indicator bars appear on tire tread surfaces when 1/32 inch (0.8 mm) or less tire tread remains. Arrows on tire sidewalls pinpoint location of wear bar indicators. Always remove tires from service before they reach the tread wear indicator bars, indicating 1/32 inch (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.

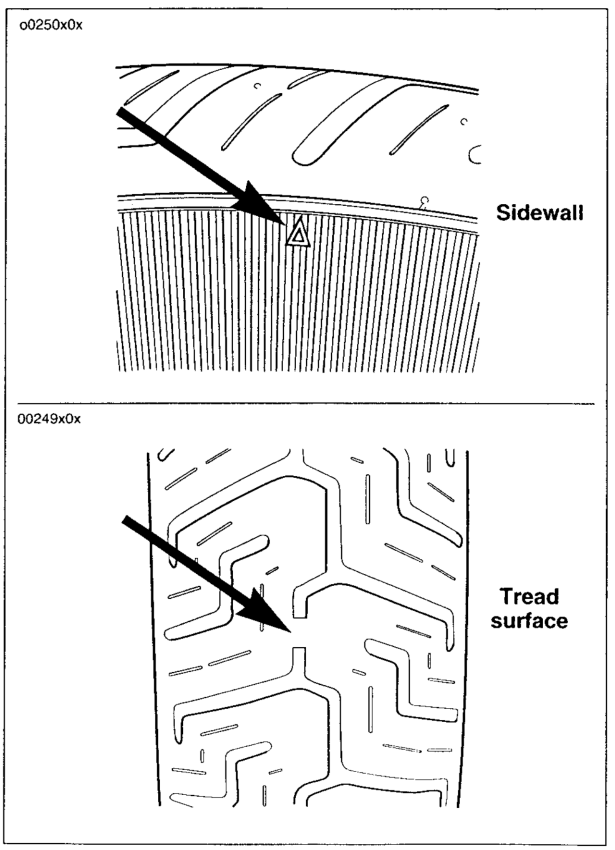


Figure 1-20. Tread Wear Indicators

WHEEL BEARINGS

Service wheel bearings:

- Inspect any time the wheels are removed.
- Replace when bearings exceed end play service wear limit of 0.002 in. (0.051 mm).

Check wheel bearings and axle spacers for wear and corrosion. Excessive play or roughness indicates worn bearings. Replace bearings in sets only. See 2.6 SEALED WHEEL BEARINGS.

WHEEL SPOKES

Inspect vehicles with wheel spokes:

- At the 5000 mile (8000 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

1. Raise motorcycle wheel off the ground.

CAUTION

If nipples require more than one full turn to tighten spoke, remove tire to check that spoke is not protruding far enough to damage tube.

2. Lightly tap each spoke with a spoke wrench. Loose spokes will sound dull and must be tightened. Tighten spokes to 40-50 **in-lbs** (4.5-5.6 Nm). If more than a few spokes are loose, true the entire wheel following procedure under 2.10 TRUING LACED WHEEL.

INSPECTION

Check primary chain tension:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

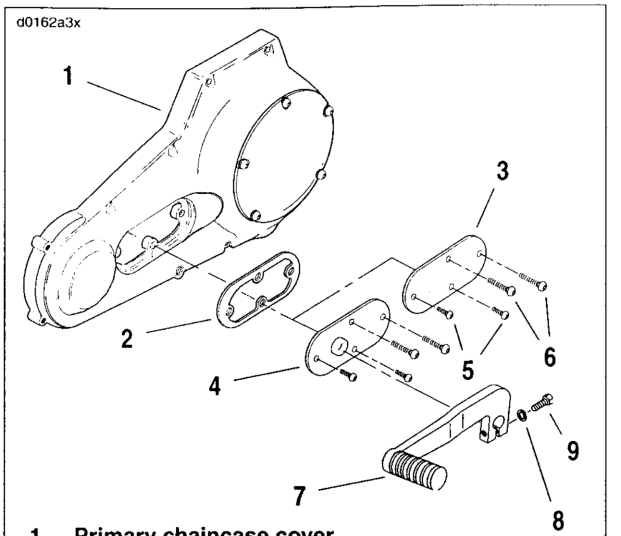
Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Set motorcycle upright and level.
2. See Figure 1-21. On all models except FXDWG, remove screw (9), washer (8) and foot shifter lever (7).
3. Remove two short screws (5), two long screws (6) and primary chain inspection cover (3 or 4).

CAUTION

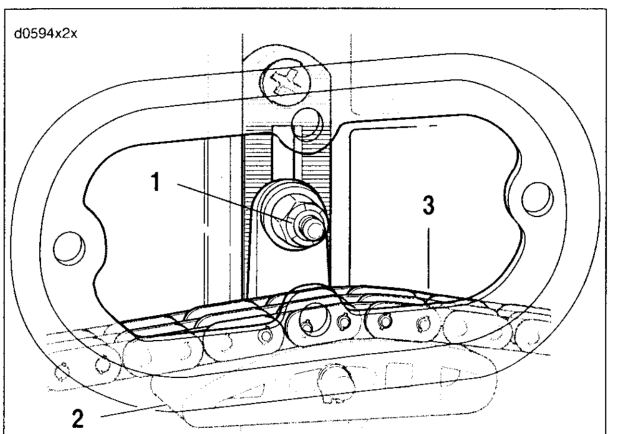
Adjust the primary chain at the tightest spot in the chain. Do not adjust chain tighter than specified play. Running chains too tight will result in excessive wear.

4. Check the primary chain tension. Push on the upper strand on the chain to verify that it has free movement midway between the engine compensating sprocket in the front and the clutch sprocket in the rear.
   a. With the engine cold, upward (not total) freeplay in upper strand should be 5/8-7/8 in. (15.9-22.3 mm).
   b. With the engine hot, upward (not total) freeplay in upper strand should be 3/8-5/8 in. (9.5-15.9 mm).
5. If freeplay adjustment is required, see Figure 1-22.
   a. Loosen, but do not remove, the center bolt nut (1).
   b. Move the shoe assembly (2) up or down to obtain the specified free play.
   c. Tighten center bolt nut to 21-29 ft-lbs (28.5-39.3 Nm). Replace the primary chain (3) if it is worn to the point where it cannot be properly adjusted.



1. **Primary chaincase cover**
2. **Gasket**
3. **Primary chain inspection cover (FXDWG)**
4. **Primary chain inspection cover (all except FXDWG)**
5. **Short screws (2)**
6. **Long screws (2)**
7. **Foot shifter lever (all except FXDWG)**
8. **Washer (all except FXDWG)**
9. **Screw (all except FXDWG)**

Figure 1-21. Inspection Cover



1. **Center bolt nut @ 21-29 ft-lbs (28.5-39.3 Nm)**
2. **Shoe assembly**
3. **Primary chain**

Figure 1-22. Primary Chain Adjustment

6. All models except FXDWG: see Figure 1-23. Inspect two o-rings (4) in grooves on end of shift lever sleeve (5). Replace if damaged or worn.
7. See Figure 1-21. Install inspection cover (3 or 4) and **new** gasket (2). Tighten both pairs of cover fasteners (5, 6) to 84-108 **in-lbs** (9.5-12.2 Nm).
8. On all models except FXDWG, install foot shifter lever (7), washer (8) and screw (9). Tighten screw to 96-120 **in-lbs** (10.8-13.5 Nm).

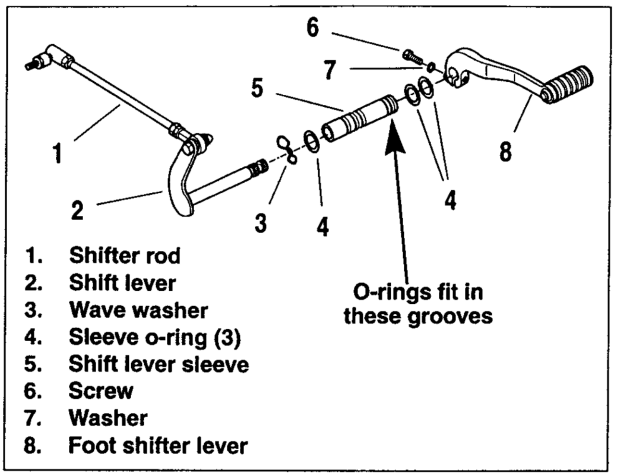


Figure 1-23. Shift Lever Assembly (All But FXDWG)

CHANGING LUBRICANT

Replace primary chaincase lubricant:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

1. See Figure 1-24. Remove drain plug at bottom of primary chaincase. Drain lubricant into suitable container.
2. Clean drain plug and reinstall. Tighten until plug projects 0.160-0.180 in. (4.1-4.6 mm) below chaincase. If a large amount of debris had accumulated on the drain plug, inspect the condition of chaincase components.
3. See Figure 1-25. Remove five TORX screws with captive washers (1) to detach clutch inspection cover (2) from primary chaincase cover.
4. Remove the quad ring (3) from the groove in the chaincase cover. Wipe oil from quad ring, groove in chaincase cover and mounting surface.

⚠WARNING

Exercise caution so that lubricant does not contact rear wheel, tire or brake components. Spilled lubricant could adversely affect traction which could result in death or serious injury.

CAUTION

Do not over-fill the primary chaincase with lubricant. Over-filling may cause rough clutch engagement, incomplete disengagement, clutch drag and/or difficulty in finding neutral at engine idle.

5. Pour 26 oz (768.9 ml) of primary chaincase lubricant in through the clutch inspection cover opening. See Figure 1-26. The primary chaincase lubricant level is acceptable when lubricant is visible in the bottom of the chaincase with the motorcycle standing upright (not resting on jiffy stand).

NOTE

Use only Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 (quart) or Part No. 99886-84 (gallon).

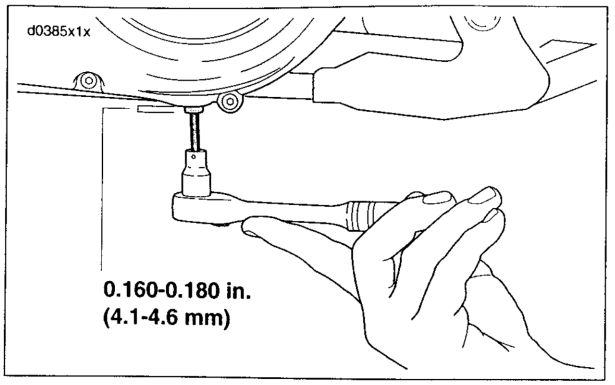
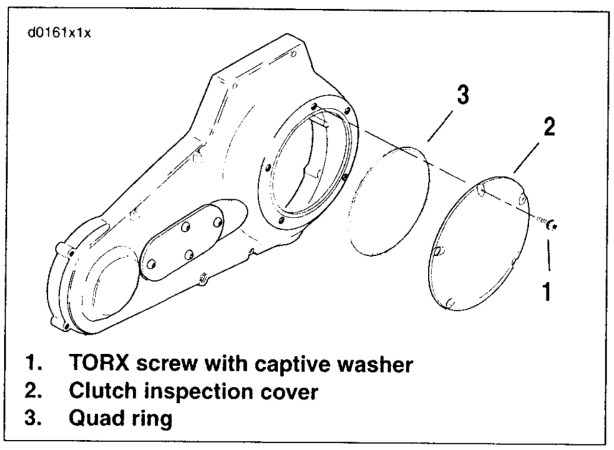


Figure 1-24. Removing Chaincase Drain Plug



1. TORX screw with captive washer
2. Clutch inspection cover
3. Quad ring

Figure 1-25. Clutch Cover

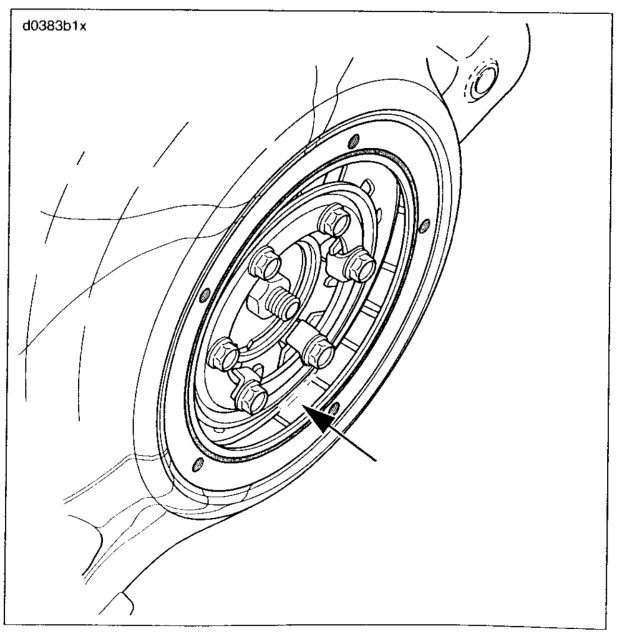


Figure 1-26. Chaincase Lubricant Level

CAUTION

Thoroughly wipe all lubricant from quad ring, cover mounting surface and groove in chaincase. Lubricant not removed prior to clutch inspection cover installation will be squeezed to the outboard side of the ring groove. This may result in some temporary weepage around the inspection cover.

6. Install clutch inspection cover.
   a. Inspect quad ring for tears or damage. Replace as required.
   b. Thoroughly wipe all lubricant from quad ring, cover mounting surface and groove in chaincase.
   c. Place quad ring in chaincase.
   d. Attach clutch inspection cover using five TORX screws with captive washers. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm). Follow torque sequence shown in Figure 1-27.

CAUTION

Do not move or shift cover while installing TORX fasteners. Movement will cause the quad ring to become displaced. This may result in leakage around the inspection cover.

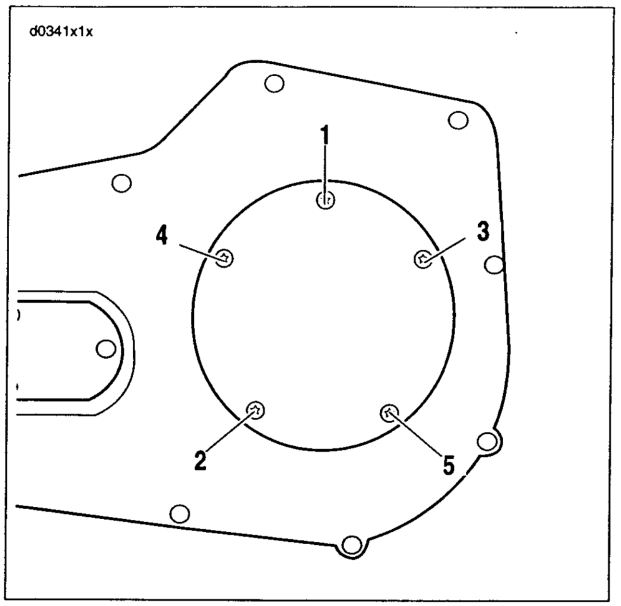


Figure 1-27. Clutch Cover Torque Sequence

ADJUSTMENT

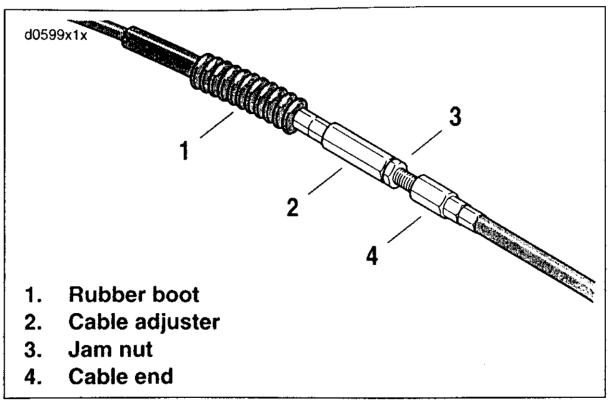
Check clutch adjustment:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

CAUTION

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. See Figure 1-28. 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 free play at clutch hand lever.
4. See Figure 1-29. Loosen locknut (1) on clutch adjuster screw (2). To take up all free play, turn screw inward (clockwise) until lightly seated. Activate the clutch lever to verify the balls are seated in the ramps.
5. Back out adjusting screw (counterclockwise) 1/2 to 1 full turn. Tighten jamnut to 72-120 **in-lbs** (8.1-13.6 Nm), while holding adjusting screw with an Allen wrench.
6. Squeeze clutch lever to maximum limit three times, to set ball and ramp release mechanism.
7. Check free play.
   a. Turn cable adjuster away from jam nut until slack is eliminated at hand lever.
   b. See Figure 1-30. Pull clutch cable ferrule (2) away from clutch lever bracket (3) to check free play. Turn cable adjuster as necessary to obtain 1/16-1/8 in. (1.6-3.2 mm) free play between end of cable ferrule and clutch lever bracket.
8. 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.



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

Figure 1-28. Clutch Cable Adjuster

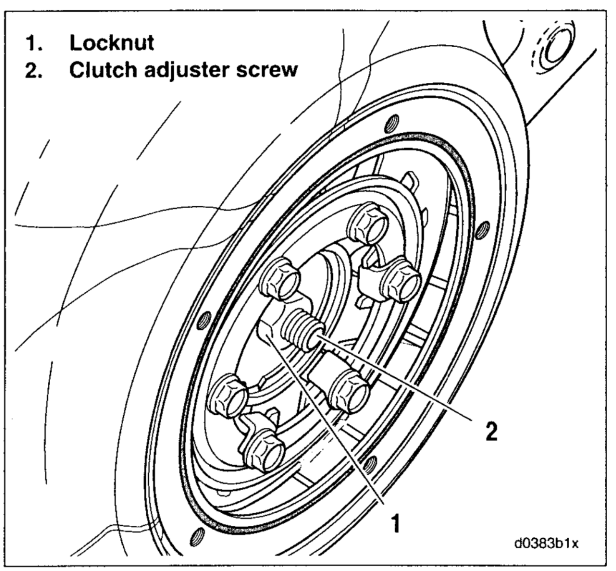
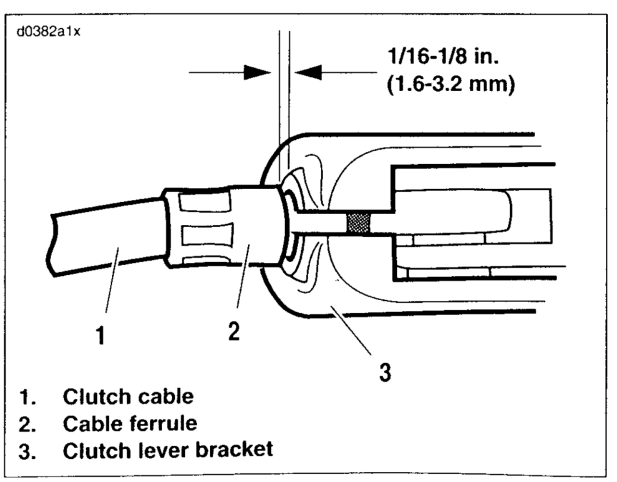


Figure 1-29. Clutch Adjuster Screw



1. Clutch cable
2. Cable ferrule
3. Clutch lever bracket

Figure 1-30. Clutch Hand Lever

CAUTION

Thoroughly wipe all lubricant from quad ring, cover mounting surface and groove in chaincase. Lubricant not removed prior to clutch inspection cover installation will be squeezed to the outboard side of the ring groove. This may result in some temporary weepage around the inspection cover.

9. Install clutch inspection cover.
   a. Remove quad ring from groove in chaincase cover.
   b. Inspect quad ring for tears or damage. Replace as required.
   c. Thoroughly wipe all lubricant from quad ring, cover mounting surface and groove in chaincase.
   d. Place quad ring in chaincase.
   e. Attach clutch inspection cover using five TORX screws with captive washers. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm). Follow torque sequence shown in Figure 1-31.

CAUTION

Do not move or shift cover while installing TORX fasteners. Movement will cause the quad ring to become displaced. This may result in leakage around the inspection cover.

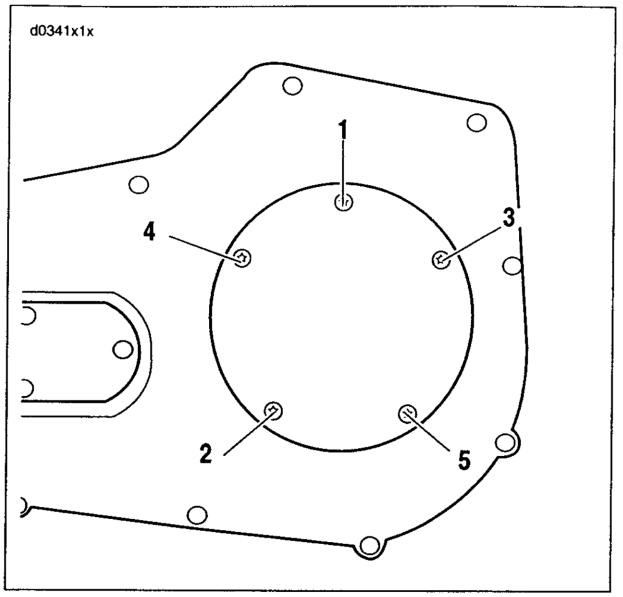


Figure 1-31. Clutch Cover Torque Sequence

CHANGING LUBRICANT

Replace transmission lubricant:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

1. See Figure 1-32. Remove transmission filler plug.
2. See Figure 1-33. Remove transmission drain plug (2) and drain lubricant into a suitable container.

CAUTION

Do not overtighten drain plug. When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter transmission drain case. These actions may result in damage to the motorcycle.

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

⚠WARNING

Exercise caution so that lubricant does not contact rear wheel, tire or brake components. Spilled lubricant could adversely affect traction which could result in death or serious injury.

4. Fill the transmission with 20-24 oz. (591.5-709.8 ml) of Harley-Davidson TRANSMISSION LUBRICANT, Part No. 99892-84 (qt) or 99891-84 (gal).
5. Check lubricant level.
   a. Place motorcycle in a level, upright position.
   b. Place dipstick inside fill hole and remove. Dipstick should rest on lip of filler. Do not screw in tight.
   c. See Figure 1-34. Lubricant level should be at the F(ULL) mark on dipstick when removed.
6. Install filler plug/dipstick.
   a. Check O-ring on dipstick for tears or damage. Replace as required. Wipe any foreign material from plug.
   b. Install filler plug/dipstick and tighten to 25-75 in-lbs (2.8-8.5 Nm).

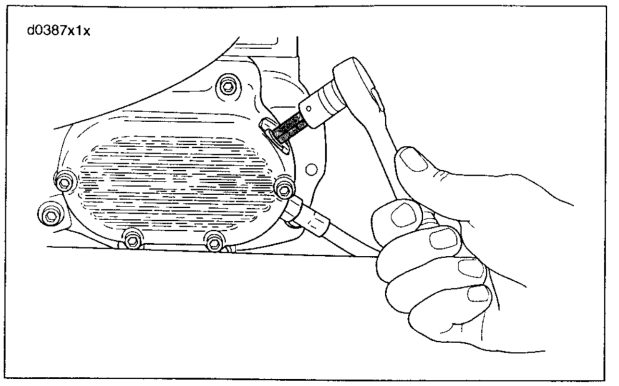
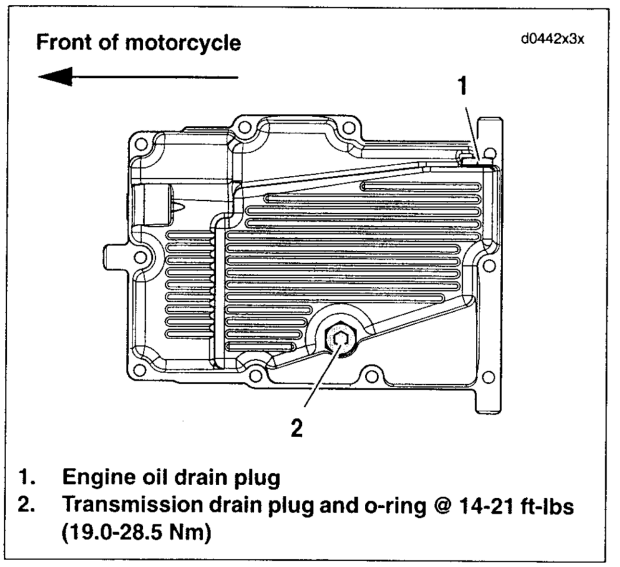


Figure 1-32. Transmission Lubricant Check/Fill



1. **Engine oil drain plug**
2. **Transmission drain plug and o-ring @ 14-21 ft-lbs (19.0-28.5 Nm)**

Figure 1-33. Oil Pan

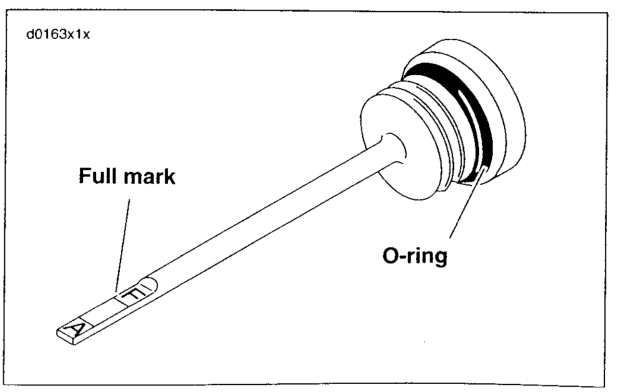


Figure 1-34. Filler Plug/Dipstick

INSPECTION

PART NO.	SPECIALTY TOOL
HD-35381	Belt tension gauge

Check rear belt deflection:

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

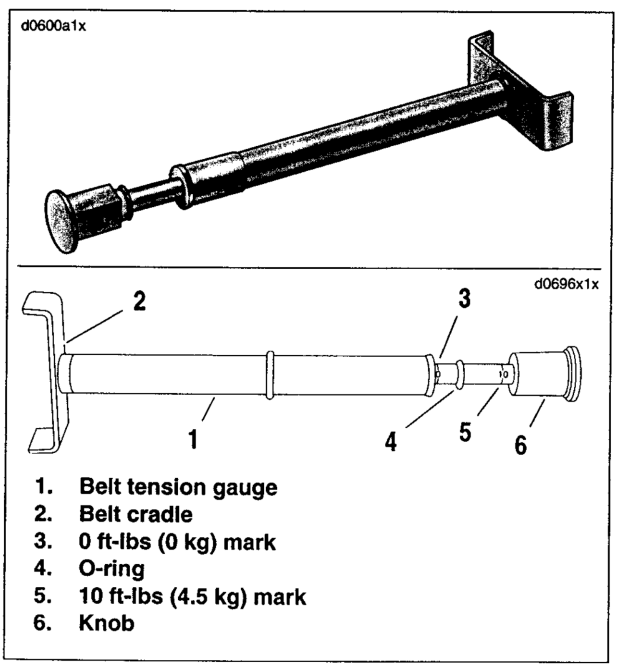
When checking belt deflection:

- 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 1-35. Obtain BELT TENSION GAUGE (HD-35381).

NOTE

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

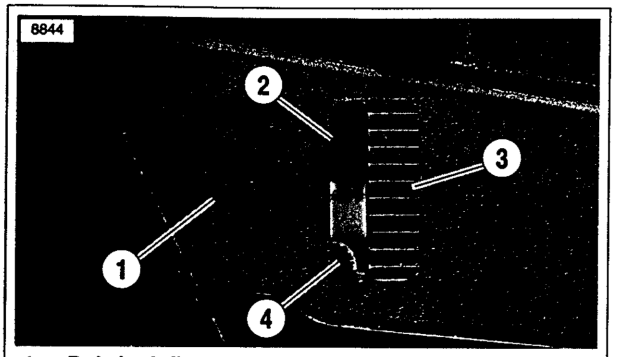


1. **Belt tension gauge**
2. **Belt cradle**
3. **0 ft-lbs (0 kg) mark**
4. **O-ring**
5. **10 ft-lbs (4.5 kg) mark**
6. **Knob**

Figure 1-35. Belt Tension Gauge (Part No. HD-35381)

2. To use the belt tension gauge:
   a. Slide O-ring (4) toward 0 ft-lbs (0 kg) mark (3).
   b. Fit belt cradle (2) against bottom of drive belt halfway between drive pulleys (point A in Figure 1-37.).
   c. Press upward on knob (6) until O-ring slides down to 10 ft-lbs (4.5 kg) mark (5).
   d. See Figure 1-36. 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 1-37. Check that the drive belt bottom strand deflects 5/16-3/8 in. (7.9-9.5 mm) while applying 10 lbs (4.5 kg) of force upward at point A.



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

Figure 1-36. Belt Deflection Window

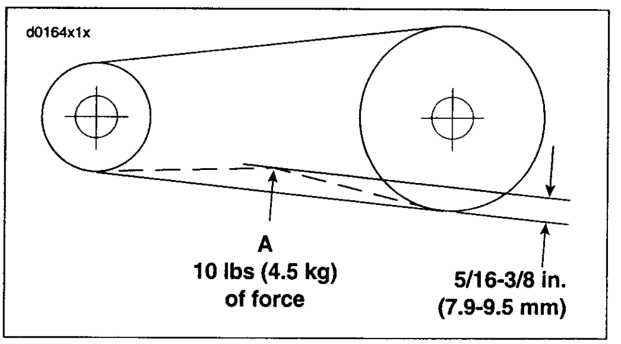


Figure 1-37. Checking Belt Deflection

4. Measure belt deflection several times, each time with belt moved (by rotating rear wheel) to a different position on sprockets.

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) 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.

ADJUSTMENT

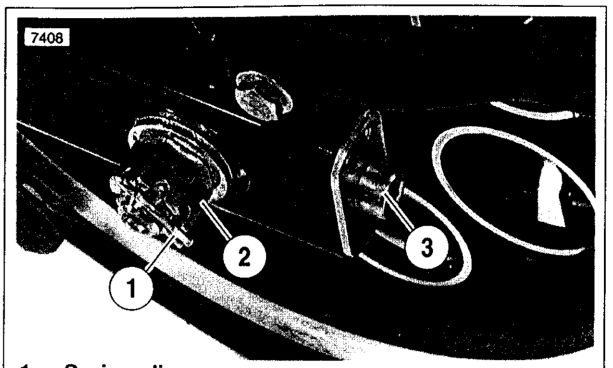
If belt adjustment is necessary, perform the following procedure:

1. See Figure 1-38. Remove spring clip (1) and loosen axle nut (2).
2. Adjust belt tension by turning the axle adjusters (3) an equal number of turns to keep the wheel aligned until the specification in step 3 under ADJUSTMENT above is achieved.
3. Verify rear wheel alignment. See 2.13 VEHICLE ALIGNMENT.

⚠WARNING

Do not exceed 65 ft-lbs (88.1 Nm) when tightening the axle nut. Exceeding 65 ft-lbs (88.1 Nm) may cause the wheel bearings to seize during operation, which could result in death or serious injury.

4. Tighten axle nut (2) to 60 ft-lbs (81.3 Nm).
5. Check to see if the spring clip (1) can be installed. If required, tighten nut just enough to align axle hole and nut slots, but do not exceed 65 ft-lbs (88.1 Nm).



1. **Spring clip**
2. **Axle nut**
3. **Axle adjuster**

Figure 1-38. Axle Adjusters

GENERAL

Inspect the drive belt and rear sprocket:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

NOTE

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.

CLEANING

Keep dirt, grease, oil, and debris off the belt and sprockets. Clean the belt with a rag which is slightly damp 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 1-39. 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 step 2).
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.

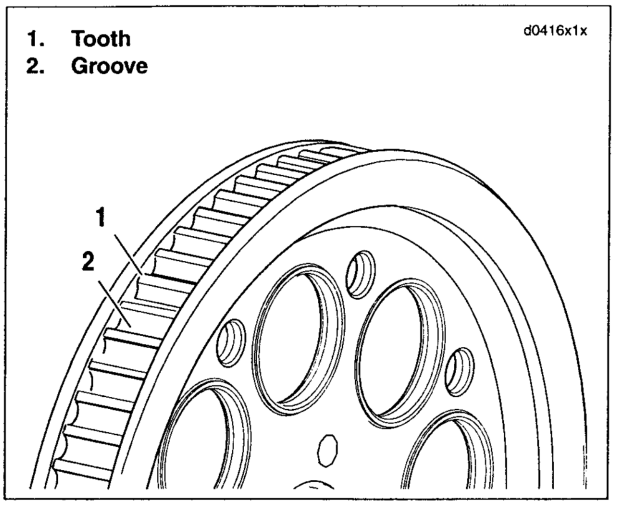


Figure 1-39. Rear Sprocket

Rear Belt

See Figure 1-40. 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.

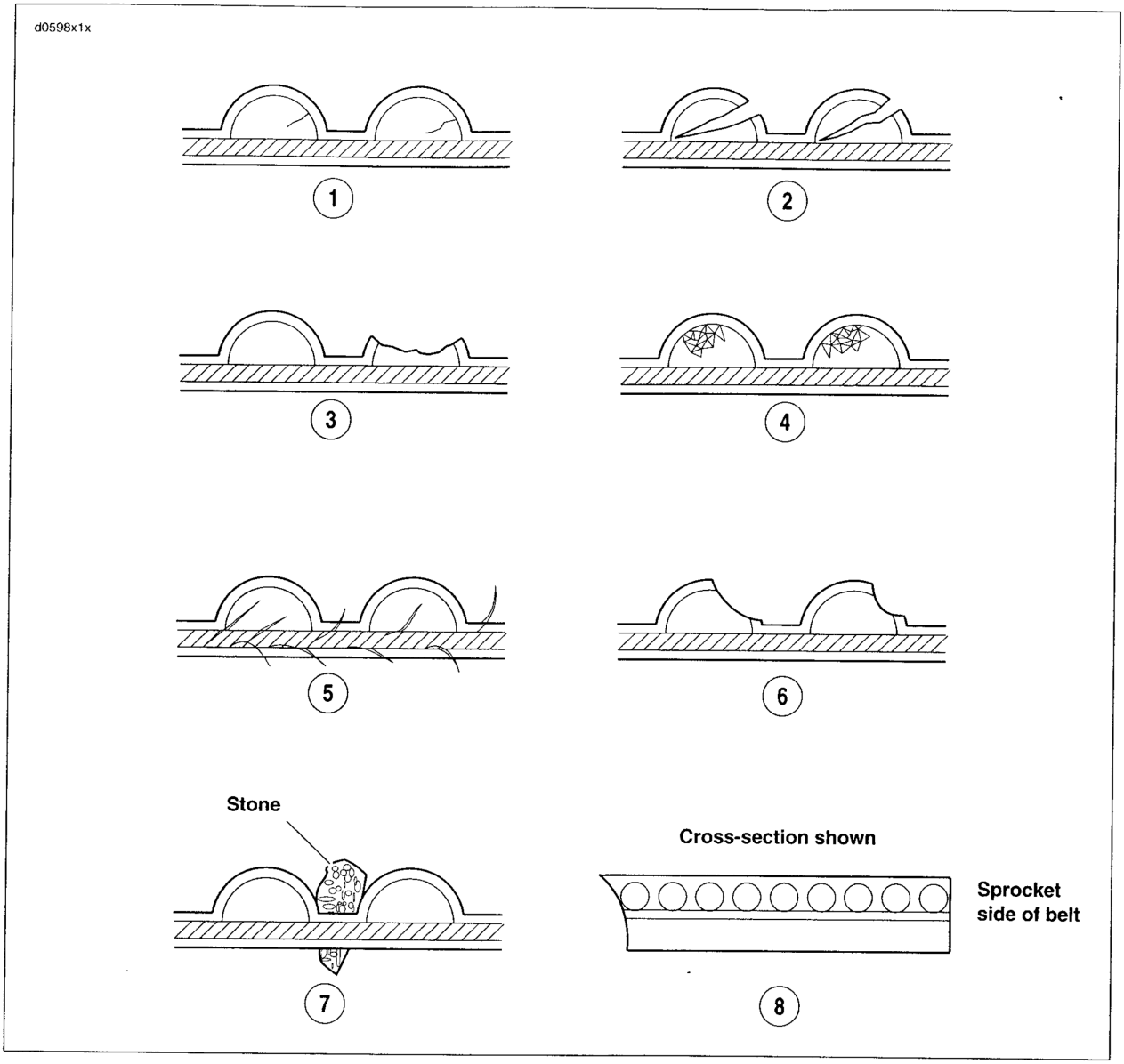


Figure 1-40. Drive Belt Wear Patterns

Table 1-4. 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

ALL MODELS BUT FXDX/FXDXT

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 spanner wrench. 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.

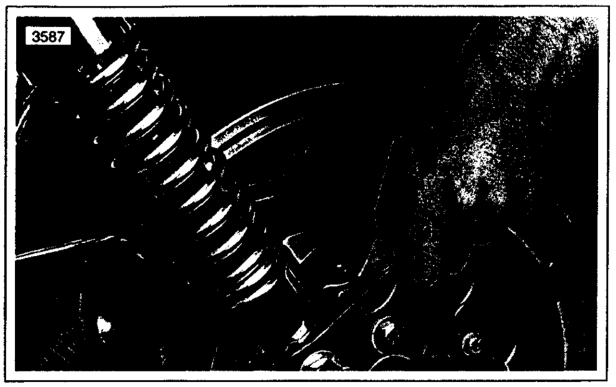


Figure 1-41. Rear Shock Absorber Spring Adjustment

FXDX/FXDXT MODELS

General

The FXDX & FXDXT motorcycle has a front suspension with cartridge valve 39 mm forks that adjust for compression and rebound damping and spring preload.

The rear suspension features shock absorbers that adjust for rebound damping as well as spring preload.

The front and rear suspension preload setting need to be adjusted for the rider's weight. This setting should be made before the motorcycle is ridden any distance.

If the preload adjustment is correct, and the rebound and compression damping are set at the factory recommended points, the motorcycle should ride properly. If the rider is unhappy with these settings they can be changed. Evaluating and changing the rebound and compression damping is a very subjective process with many variables and should be approached carefully.

Damping is set at the factory for the average rider under normal riding conditions. The rider may wish to adjust these settings to compensate for individual riding styles, weight variations, or when carrying a passenger.

- **Damping:** Resistance to movement. Damping affects how easily the suspension can move and limits oscillations of the system once movement has begun.
- **Compression:** Suspension is compressed when the wheel moves up.
- **Rebound:** The suspension is rebounding when it is moving back from being compressed.
- **Preload:** The spring is compressed somewhat during assembly. This initial compression provides a "loaded" condition in the spring. This initial compression is referred to as preload.

Preload Adjustment

⚠WARNING

Both shock absorber adjusting cams and front fork spring adjusting nuts must be adjusted to the same preload position. Not having the preload adjusted equally from side to side could adversely affect handling. This could lead to loss of control of the motorcycle which could result in death or serious injury.

NOTE

Changes in load will require changes in the preload setting. Carrying less weight than was used for setting up the suspension will require a reduction in the preload. Increasing the load will require an increase in the preload.

Front and rear suspension spring preload must be adjusted before any other adjustments can be attempted. This adjustment assures that the suspension has the proper amount of travel.

Spring preload is the most important suspension adjustment offered on your FXDX & FXDXT motorcycle. Correct setting of preload will result in a motorcycle that suits the rider's size and weight.

You will need two people to carry out this adjustment.

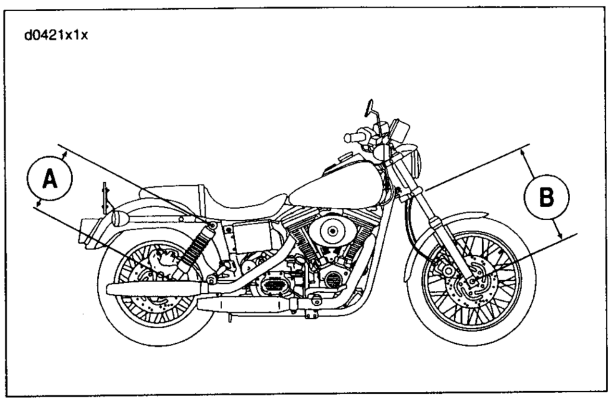
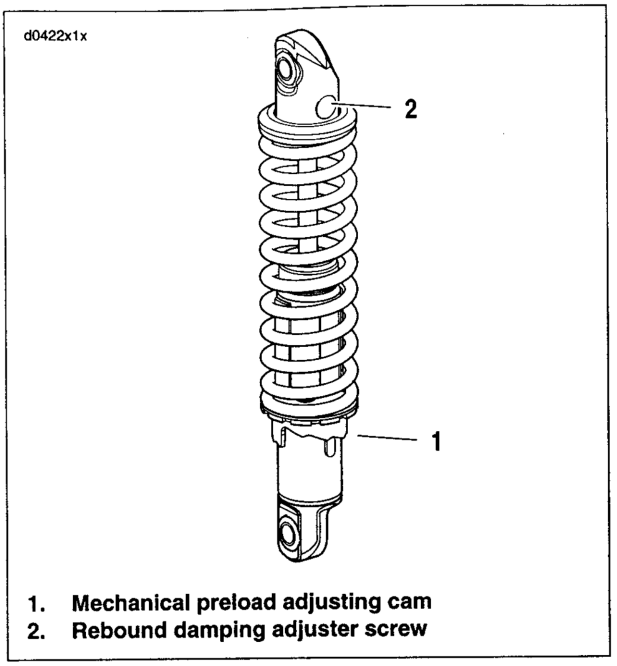


Figure 1-42. Preload Adjustment

1. Take the motorcycle off the jiffy stand and bounce the rear up and down a few times to be sure the suspension is free and not binding.
2. See Figure 1-42. With the motorcycle unloaded, take the following measurements.
   a. At the rear shock, measure the distance A, from the upper shock bolt center to lower shock bolt center.
   b. At the front fork, measure the distance B, from the front axle center to the bottom of the lower triple clamp.
3. With the help of an assistant take the same measurements with the rider in full gear on the motorcycle. The assistant should help balance the motorcycle so the rider can keep both feet on the footpegs. Bounce a few times on the seat to be sure the suspension is free and not binding.
4. Subtract the second measurement from the first. The difference, which is the squat, must be in the range of 0.5-1.0 in. (12.7-25.4 mm). If it is not, adjustment is necessary.
5. See Figure 1-43. To adjust the rear shock spring preload, turn spring adjusting cam (1) to the desired position using SPANNER WRENCH (Part No. HD-94700-52C). When returning to off-cam position, cams should be backed off in opposite direction.
6. See Figure 1-44. To adjust the front fork spring preload, turn spring adjusting nut (1) with a 7/8 in. wrench. Observe lines (2) on cylindrical portion of adjusting nuts to keep adjustments equal on both forks.
   a. Turning nut clockwise increases preload.
   b. Turning nut counterclockwise decreases preload.

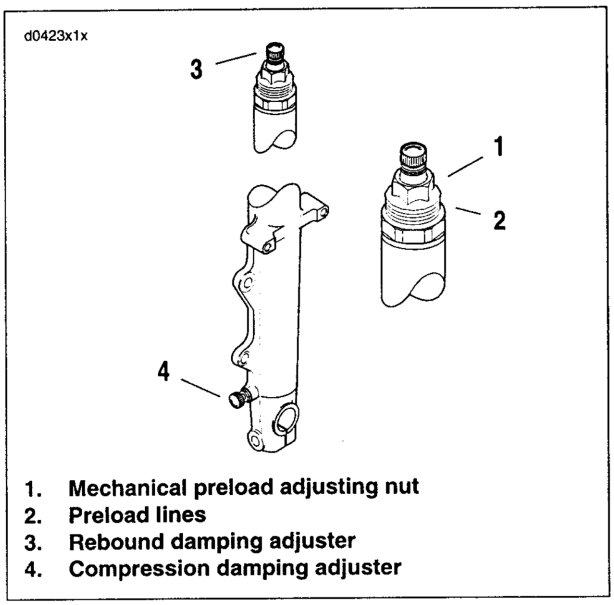
NOTE

The GVWR of the FXDX and FXDXT models is given in the Owner's specifications. Under no circumstances is it to be exceeded.



1. **Mechanical preload adjusting cam**
2. **Rebound damping adjuster screw**

Figure 1-43. Rear Shock Adjustments



1. **Mechanical preload adjusting nut**
2. **Preload lines**
3. **Rebound damping adjuster**
4. **Compression damping adjuster**

Figure 1-44. Front Fork Adjustments

Rear Suspension Adjustments

REBOUND ADJUSTMENT

See Figure 1-45. Adjust rebound damping by using the screw on the top of the shock. Rotate toward "H" (Clockwise) to increases rebound damping. Rotate toward "S" (Counter clockwise) to decrease rebound damping.

There are 10 click stops between hard (position 1) and soft (position 10) settings for rebound damping adjuster screws.

If the preload adjustment is correct and you have the rebound damping set at the factory recommended points the motorcycle should handle and ride properly.

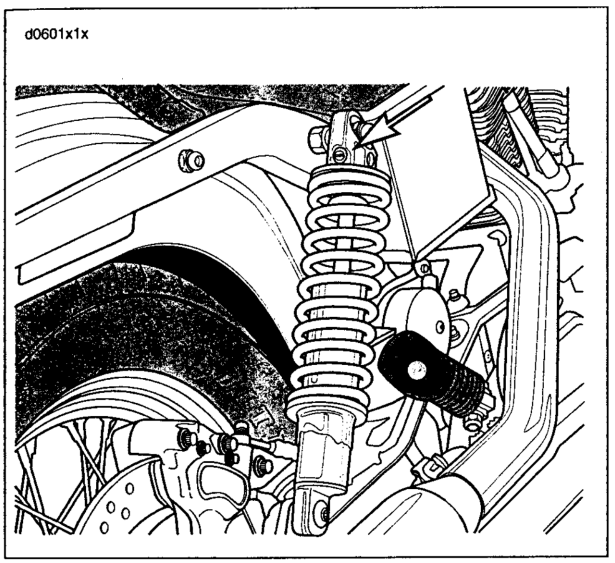


Figure 1-45. Rear Shock Rebound Adjuster

Front Suspension Adjustments

REBOUND ADJUSTMENT

See Figure 1-46. Located on top of each fork leg, the fork rebound adjuster knobs have 17 positions. Turning the adjuster knobs clockwise until they lock yields maximum rebound damping. Forks set in this position will have the slowest rebound. Adjusters turned fully counterclockwise will have the least amount of rebound damping. This adjustment will produce the fastest rebound. Make adjustments by counting the clicks while turning the adjuster knob(s).

COMPRESSION ADJUSTMENT

See Figure 1-47. The fork compression damping adjuster has 14 possible settings. Equal adjustments are made to the adjuster knobs at the base of each fork leg. Rotating the adjuster in the "H" direction (clockwise) gives a harder setting and rotating in the "S" direction (counterclockwise) yields softer damping.

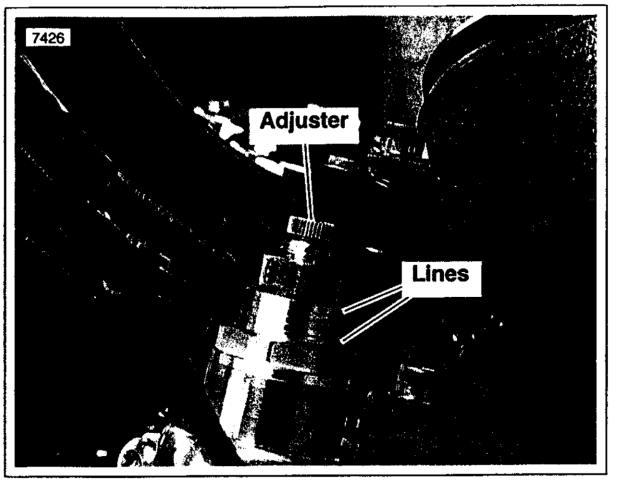


Figure 1-46. Front Fork Rebound Adjuster

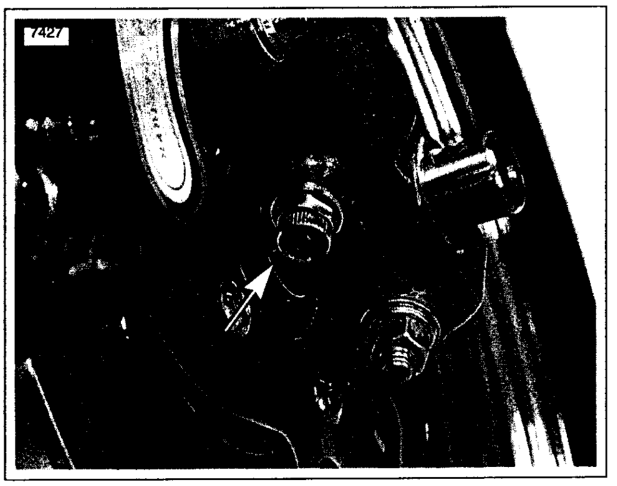


Figure 1-47. Front Fork Compression Adjuster

Table 1-5. FXDX/FXDXT Factory Suspension Settings

ADJUSTMENT	FROM FULL CLOCKWISE (MAXIMUM HARD)
Front fork rebound	Position 8
Front fork compression	Position 10
Rear shock rebound	Position 3
Rear shock preload	Third cam step

NOTE

See Figure 1-46. Factory setting for front fork preload has four lines visible and the fifth line flush with top of slider tube cap.

ADJUSTMENT

Check steering head:

- At the 1000 mile (1600 km) service interval. Adjust if necessary.
- At every 10,000 mile (16,000 km) service interval thereafter. Adjust if necessary.
- At every 30,000 mile (48,280 km) service interval, disassemble, lube and inspect the steering head bearings. Adjust if necessary. See 2.21 STEERING HEAD.

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. See Figure 1-48. Loosen lower triple clamp pinch bolts.
6. 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.
7. The distance between the "fall-away" marks must be 1.0-2.0 in. (25.4-50.8 mm). Tighten or loosen the fork adjuster nut/bolt until the measurement is within limits.
   a. If the distance is more than 2.0 in. (50.8 mm), loosen the adjuster nut.
   b. If it is less than 1.0 in. (25.4 mm), tighten the adjuster nut.

NOTE

On FXDWG models, the adjuster nut is tightened with a drift pin after loosening the top nut.

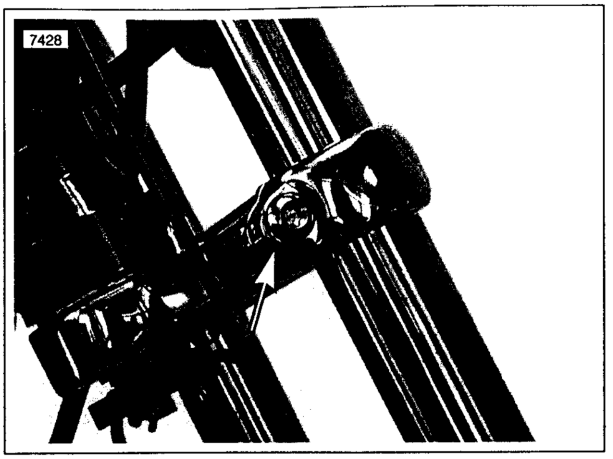


Figure 1-48. Lower Triple Clamp Pinch Bolt (Typical)

NOTE

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

8. Tighten lower triple clamp pinch bolts.
   a. FXDWG models: 30-35 ft-lbs (40.7-47.5 Nm).
   b. FXD, FXDL, FXDXT, FXDX models: 25-30 ft-lbs (33.9-40.7 Nm).
9. Repeat the "fall-away" procedure to be sure the adjustment is correct.

LUBRICATION

Use SPECIAL PURPOSE GREASE (Part No. 99857-97) every 30,000 mile (48,280 km) service interval.

REPLACING FORK OIL

Replace front fork oil:

- At every 20,000 mile (32,000 km) service interval.
- Prior to storage.

NOTE

For FXDX and FXDXT models only, see 2.20 FRONT FORK: FXDX AND FXDXT for fork oil replacement.

1. Support the motorcycle so the front end is off the floor and the forks are fully extended.
2. See Figure 1-49. Remove the fork tube caps.
3. See Figure 1-50. Remove the drain screws from the bottom of each fork and drain the fork oil.
4. Replace the drain screws and washers. Tighten screws to 13-17 **in-lbs** (1.5-2.0 Nm).
5. See Table 1-6. Fill the fork with Harley-Davidson TYPE E FORK OIL (Part No. HD-99884-80).
6. Install both fork tube caps. Tighten caps to 11-22 ft-lbs (14.9-29.8 Nm).

Table 1-6. Type E Fork Oil Amounts

MODEL	OZ	LITER	IN.	MM
FXDWG	12.0	0.36	7.28	184.9
FXD/FXDL	10.6	0.31	6.69	169.9

NOTE

See Table 1-6. Fork oil amounts can be measured two ways.

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

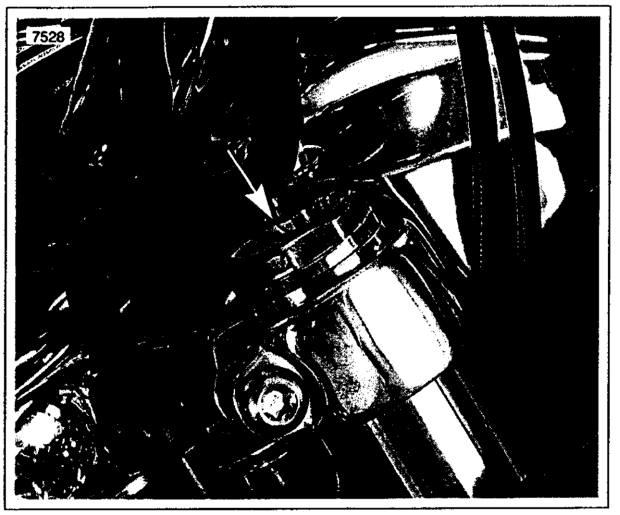


Figure 1-49. Fork Tube Cap (Typical Except For FXDX and FXDXT)

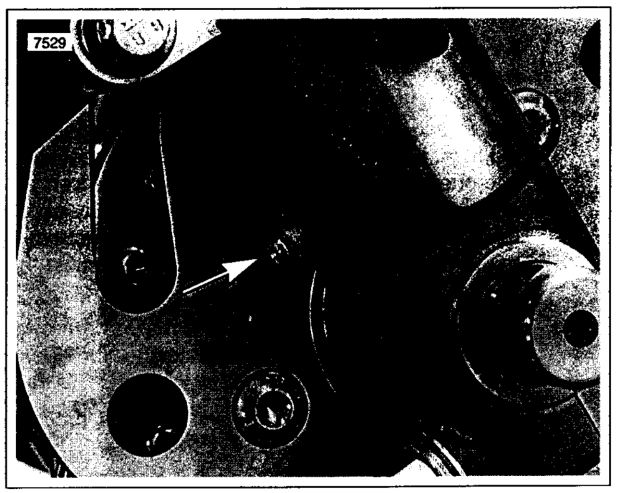


Figure 1-50. Fork Drain Screw (Typical Except For FXDX and FXDXT)

INSPECTION

Check spark plugs:

- Inspect at every 5000 mile (8000 km) service interval.
- Replace every 10,000 mile (16,000 km) service interval.

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 1-51. 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, engine idling for excessive periods of time and/or enrichener usage for excessive periods of time.
   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.
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 No. 6R12 spark plugs.

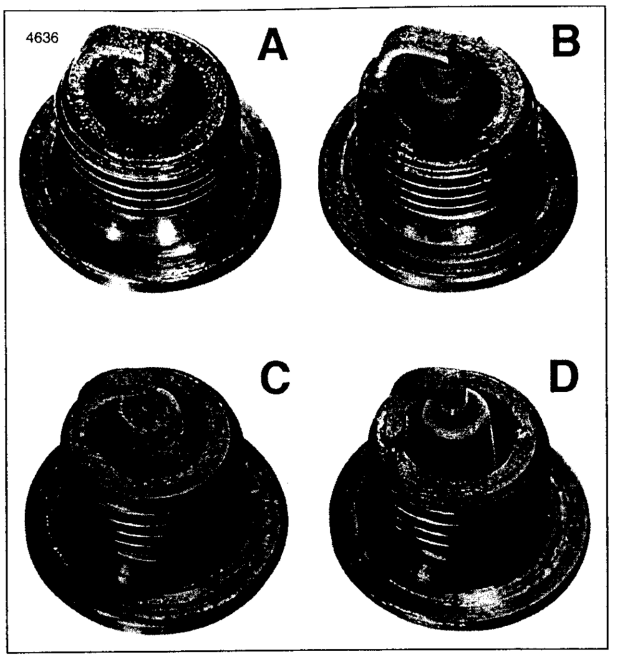


Figure 1-51. Typical Spark Plug Deposits

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 plugs. 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.

REMOVAL

Inspect and service air cleaner filter:

- At every scheduled service interval.

1. See Figure 1-52. Remove screw (1) and air cleaner cover (2).
2. Remove three TORX screws (3) and bracket (4) from filter element (5).
3. Gently pull both rubber breather tubes (8) from the back of the element. Remove filter element and gasket (6).
4. Replace the filter element if damaged or if filter media cannot be adequately cleaned.

⚠WARNING

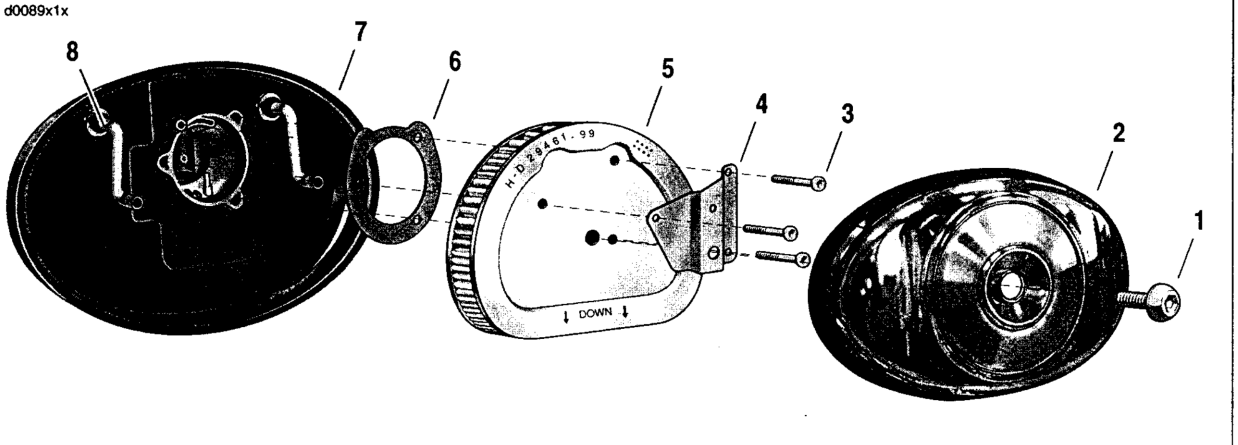
Do not use gasoline or solvents to clean the filter element. Volatile/flammable cleaning agents may cause an air intake system fire, which could result in death or serious injury.

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

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

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.



1. Screw @ 36-60 in-lbs (4.1-6.8 Nm)
2. Air cleaner cover
3. T27 TORX screw (3) @ 20-40 in-lbs (2.3-4.5 Nm)
4. Bracket
5. Filter element
6. Gasket
7. Backplate
8. Breather hose (2)

Figure 1-52. Air Cleaner Assembly

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.

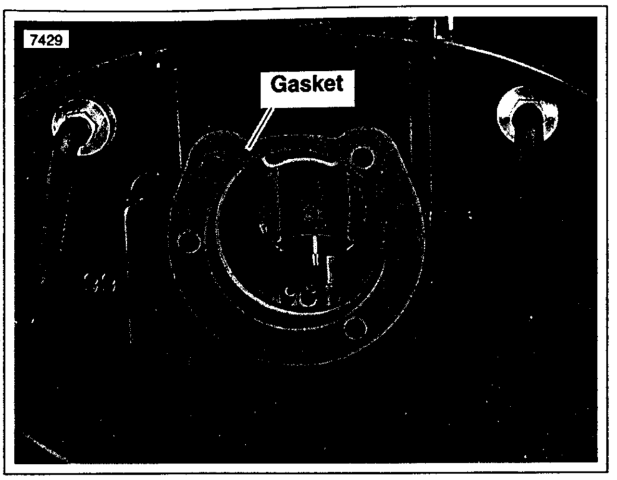


Figure 1-53. Gasket Installation

INSTALLATION

1. See Figure 1-53. Position **new** gasket on backplate.
2. See Figure 1-54. Insert two breather tubes into the holes in back of the filter element and place the element back into position. Attach breather tubes to breather screws on backplate.
3. See Figure 1-52. Install air filter element and bracket.
   a. Make sure gasket holes are aligned with backplate holes.
   b. Use three TORX screws (3) to secure bracket and filter element. Tighten to 20-40 **in-lbs** (2.3-4.5 Nm).
4. Install air filter cover (2).
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to threads of air cleaner cover screw (1).
   b. Install air cleaner cover using screw. Tighten to 36-60 **in-lbs** (4.1-6.8 Nm).

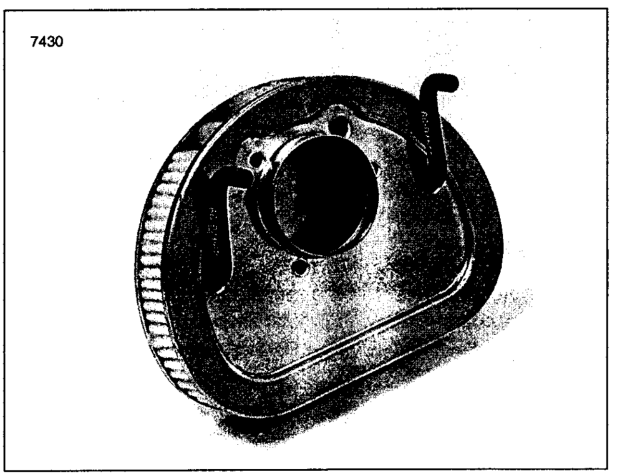


Figure 1-54. Breather Hose Holes on Backside of Filter

CABLE AND CHASSIS LUBRICATION 1.21

GENERAL

Inspect and lubricate the front brake lever, clutch hand lever, throttle control cables, clutch cable, foot shift lever, rear brake lever bearings and jiffy stand:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.
- If service is on muddy or dusty roads, clean and lubricate components at shorter intervals.

CABLES AND HAND LEVERS

CAUTION

Do not lubricate the enrichener cable or inside of enrichener cable conduit. The cable must have sliding resistance to work properly.

See 1.22 THROTTLE CABLES AND ENRICHENER for throttle cables.

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

FOOT SHIFT LEVER

Use WHEEL BEARING GREASE (Part No. 99855-89, can/ 99856-92, 14 oz. cartridge.

JIFFY STAND

Clean and lubricate the jiffy stand:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

If service is on muddy or dusty roads, clean and lubricate at shorter intervals. See 2.30 JIFFY STAND for more information.

CABLE INSPECTION, LUBRICATION AND ADJUSTMENT

Inspect the throttle and clutch cables:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) service interval thereafter.

Inspection and Lubrication

1. See Figure 1-55. 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. 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).

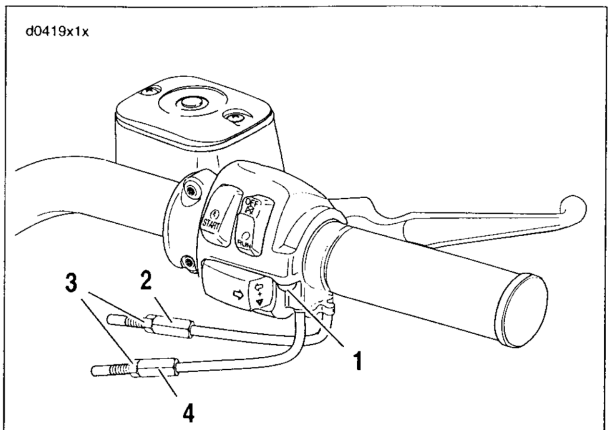
Adjustment

1. See Figure 1-55. Turn the cable adjusters (2, 4) and jamnuts (3) as short as they will go. Both cables should have zero adjustment at the start of this procedure.
2. Point the front wheel straight ahead.
   a. Turn the throttle grip wide open and hold it there.
   b. Turn the throttle cable adjuster (2), lengthening the sleeve, until the throttle cam just touches the cam stop. See Figure 1-56.
   c. Tighten the adjuster jamnut and release the throttle.
3. Turn the front wheel full right.
4. Turn the idle cable adjuster, lengthening the sleeve until the cable housing just touches the spring in the cable support sleeve.

⚠WARNING

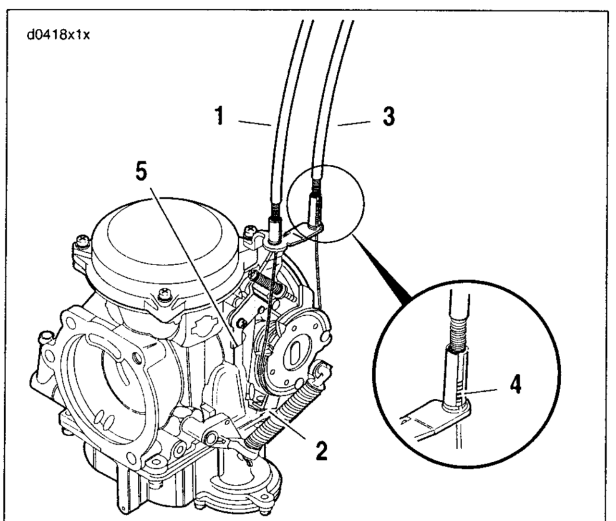
The throttle control must operate freely without binding. Irregular or sticking throttle response could cause a loss of control, leading to an accident which could result in death or serious injury.

5. Check adjustment.
   a. Work the throttle grip to be sure the cable returns to idle position when released.
   b. If the cable does not return to idle, turn idle adjuster, shortening the sleeve until correct adjustment is reached. Tighten the jamnut.



1. **Screws (2)**
2. **Throttle cable adjuster**
3. **Jamnuts (2)**
4. **Idle cable adjuster**

Figure 1-55. Throttle Cable Adjusters



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

Figure 1-56. Idle Cable Connection

ENRICHENER ADJUSTMENT

CAUTION

You must pay close attention to warm-up time. Either excessive or insufficient use of the enrichener may cause poor performance, erratic idle, poor fuel economy and spark plug fouling.

Inspect enrichener operation:

- At every scheduled service interval.

CAUTION

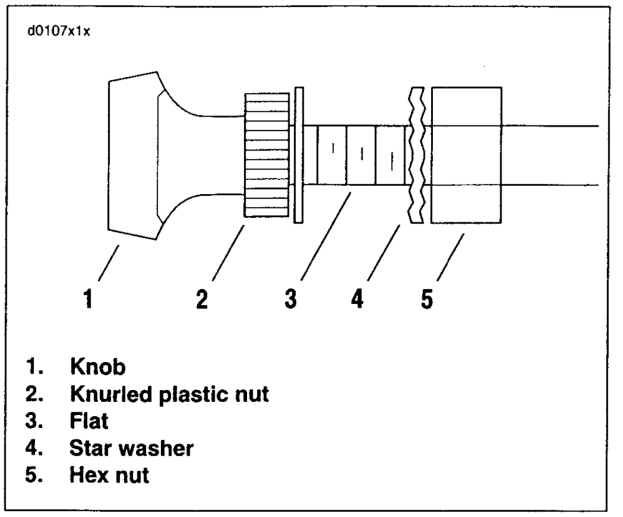
Do not lubricate the enrichener cable or inside of enrichener cable conduit. The cable must have sliding resistance to work properly.

See Figure 1-57. Check fuel enrichener operation. The fuel enrichener knob (1) should open, remain open and then close without binding. The knurled plastic nut (2) next to the enrichener knob controls the ease or difficulty with which the cable slides within the cable conduit.

1. Loosen hex nut (5) at backside of mounting bracket.
2. Move cable assembly free of slot in mounting bracket.
3. Hold cable assembly at flat (3) with an adjustable wrench. Turn knurled plastic nut (2) by hand to set sliding resistance.
   a. Turn counterclockwise to reduce resistance until knob slides inward unaided.
   b. Turn clockwise to increase resistance until knob remains fully out without holding and closes with relative ease.
4. Position cable assembly in slot in bracket. Tighten hex nut (5) at backside of bracket.

NOTE

The star washer (4) goes between the bracket and nut (5).



1. **Knob**
2. **Knurled plastic nut**
3. **Flat**
4. **Star washer**
5. **Hex nut**

Figure 1-57. Enrichener Control

IDLE SPEED INSPECTION

PART NO.	SPECIALTY TOOL
HD-33413-A	Carburetor idle adjuster
HD-33413-1A	Idle adjuster tip

Check engine idle speed:

- At the 1000 mile (1600 km) service interval.
- At every 5000 mile (8000 km) interval thereafter.

NOTE

- *The C.V. carburetor has an enrichener circuit that will cause the engine to idle above the normal idle range (950-1050 RPM) with the engine at normal operating temperature and the enrichener knob pulled fully out.*
- *The increase in idle speed is intended to alert the rider that the engine is warmed up to normal operating temperature and the enrichener knob should be pushed all the way in.*
- *Continuing to use the enrichener when the engine is at full operating temperature WILL CAUSE FOULED PLUGS.*
- *TECHNICIAN – Be sure the engine is warmed up to normal operating temperature and the enrichener knob is pushed all the way in BEFORE adjusting engine idle speed. Be aware that because there are variations in individual components, it is possible for a properly warmed up engine to idle above the normal idle range (950-1050 RPM) with the enrichener knob pulled PARTIALLY OUT.*

1. Start motorcycle engine and let vehicle reach normal operating temperature with enrichener knob pushed fully in (enrichener closed).
2. See Figure 1-58. Set idle speed to 950-1050 RPM using the CARBURETOR IDLE ADJUSTER (Part No. HD-33413-A) and TIP (Part No. HD-33413-1A).
   a. Turn clockwise to increase idle speed.
   b. Turn counterclockwise to decrease idle speed.

NOTE

Use a test tachometer connected to negative ignition coil terminal or the Scanalyzer's Data Monitor Mode to measure engine RPM on vehicles without tachometers.

IGNITION TIMING

See Figure 1-59. Ignition timing is controlled by the ignition module (1) based on input from:

- Manifold absolute pressure sensor.
- Crank position sensor.

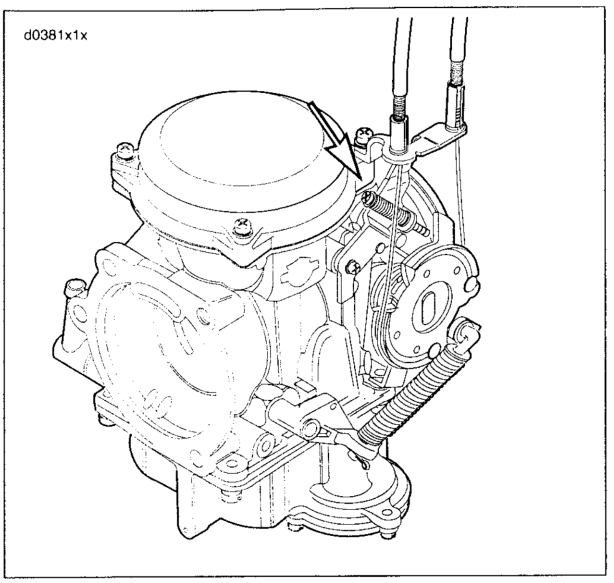
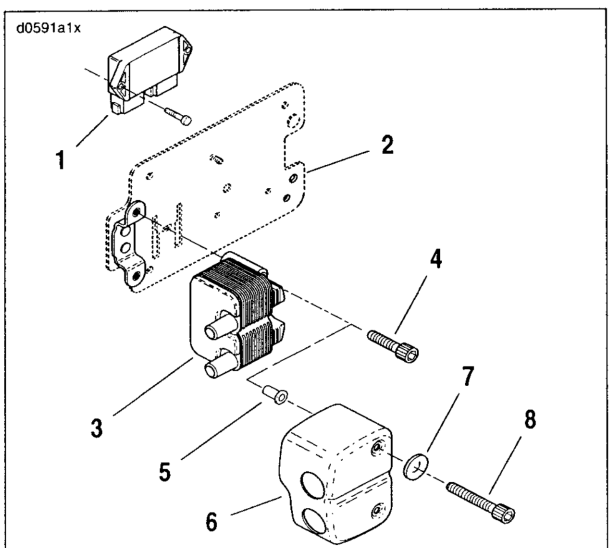


Figure 1-58. Idle Speed Adjustment Screw



1. **Ignition module**
2. **Electrical panel cover**
3. **Dual ignition coil**
4. **Screw (2) (all but FXDL/FXDWG/FXDXT)**
5. **Spacer (FXDL/FXDWG/FXDXT only)**
6. **Coil cover (FXDL/FXDWG/FXDXT only)**
7. **Washer (FXDL/FXDWG/FXDXT only)**
8. **Screw (2) (FXDL/FXDWG/FXDXT only)**

Figure 1-59. Ignition Module

There is no ignition timing adjustment required. Should a sensor fail, the resulting trouble code will identify the problem. See CHECKING FOR TROUBLE CODES in DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.

INSPECTION

PART NO.	SPECIALTY TOOL
HD-23738-A	Plastic Mity-Vac hand pump
HD-97087-65B	Hose clamp pliers

Check fuel tank filter:

- At every 20,000 mile (32,000 km) service interval.

NOTE

See 4.6 FUEL SUPPLY VALVE for more information.

1. See Figure 1-60. Turn ignition OFF. Turn fuel supply valve handle to OFF (horizontal) position.

⚠WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow open flame or sparks anywhere in the area when refueling or servicing the fuel system. Refuel only in a well ventilated area. Inadequate safety precautions could result in death or serious injury.

2. See Figure 1-61. Remove the fuel hose (7) from the outlet nipple (5). Remove the vacuum hose from the vacuum nipple (4).
3. Attach a piece of fuel hose to fuel outlet nipple and route hose into a proper, clean gasoline container.
4. Turn valve handle to RESERVE (handle up).
5. Using the appropriate hose adapter, connect the PLASTIC MITY-VAC® HAND PUMP (Part No. HD-23738-A) to vacuum nipple (4) on valve. See Figure 1-62.

CAUTION

Do not apply a vacuum greater than 25 in. of Hg to the valve at the vacuum nipple to avoid damaging the valve diaphragm.

6. Gently apply a vacuum of 1-10 in. of Mercury (Hg) or just enough vacuum to get a good flow of gasoline through the valve.
7. See Figure 1-61. After draining tank, turn the hex fitting (2) that attaches the valve to the fuel tank counterclockwise and remove the valve, gasket (3), and filter (1).
8. Clean or replace the fuel filter.
9. Coat valve threads with LOCTITE PIPE SEALANT WITH TEFLON.
10. Install **new** gasket on valve and install fuel filter.

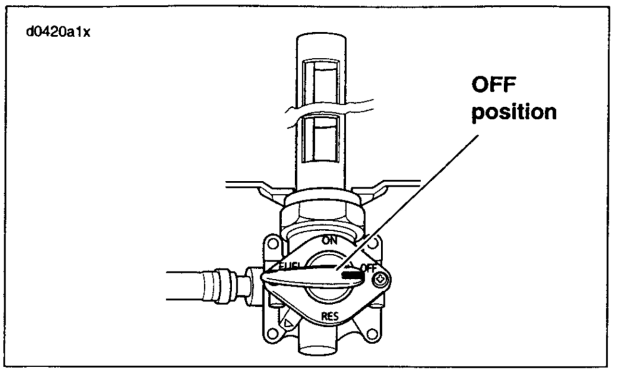


Figure 1-60. Fuel Supply Valve OFF

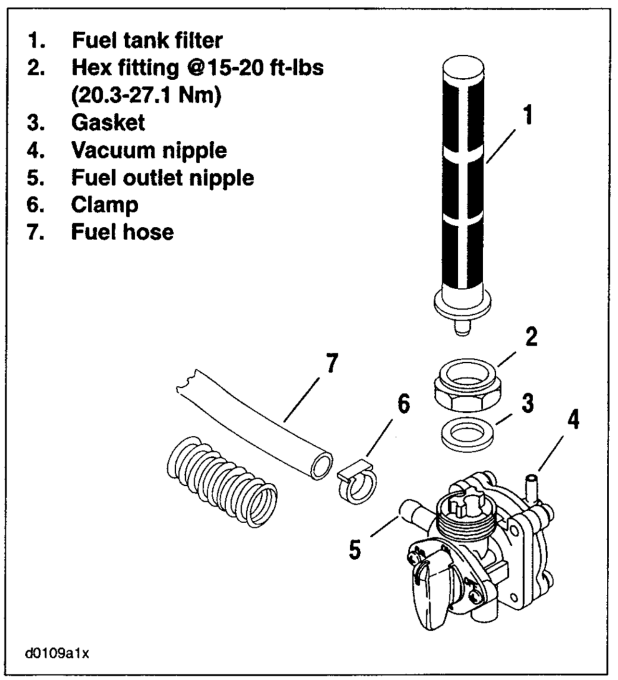


Figure 1-61. Fuel Supply Valve Assembly

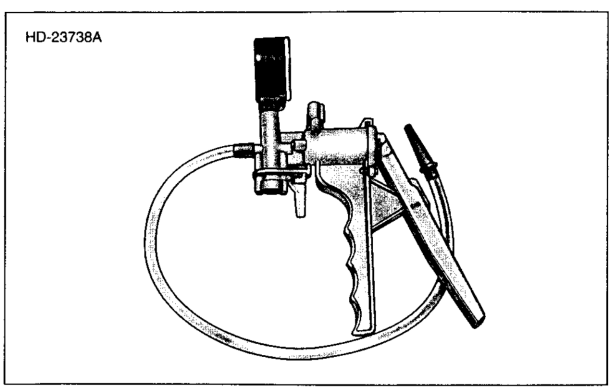


Figure 1-62. Mity-Vac Hand Pump, Part No. HD-23738-A

⚠WARNING

Do not thread fitting onto valve more than two turns to avoid "bottoming" fitting on valve. This could cause a gasoline leak and a fire hazard which could result in death or serious injury.

11. Attach fuel supply valve to tank.
    a. Thread fitting (2) on right hand threads of fuel tank two turns.
    b. Hold fitting (2) and thread body of fuel supply valve into left hand threads of fitting for two turns.
    c. Hold valve and tighten fitting (clockwise) to 15-20 ft-lbs (20.3-27.1 Nm).
12. See Figure 1-63. Connect the fuel hose to the valve using **new** clamp and HOSE CLAMP PLIERS (Part No. HD-97087-65B).
13. See Figure 1-64. Connect the fuel hose to the carburetor using **new** clamp and HOSE CLAMP PLIERS (Part No. HD-97087-65B).

CAUTION

Do not allow dirt or fluids to get into the vacuum hose assembly that connects the fuel valve to the carburetor. Contaminants could block the vacuum signal or inhibit free motion of moving parts which could cause the fuel valve to remain open.

14. Connect vacuum line to vacuum nipple and fill tank with gasoline. Check for leaks at fitting.
15. Turn valve handle to ON and start engine. No special procedures are required to start fuel flow. Carefully inspect for leaks. Turn valve OFF and shut off engine after inspection is complete.

FUEL SYSTEM LINES AND FITTINGS

Inspect the fuel system lines:

- At every scheduled service interval.
- After the fuel tank filter has been serviced.

Check fuel system lines and fittings for leaks.

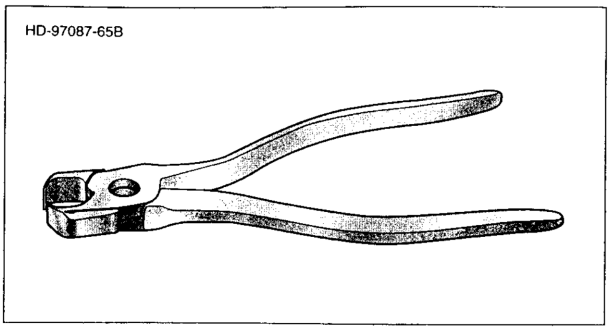


Figure 1-63. Hose Clamp Pliers, Part No. HD-97087-65B

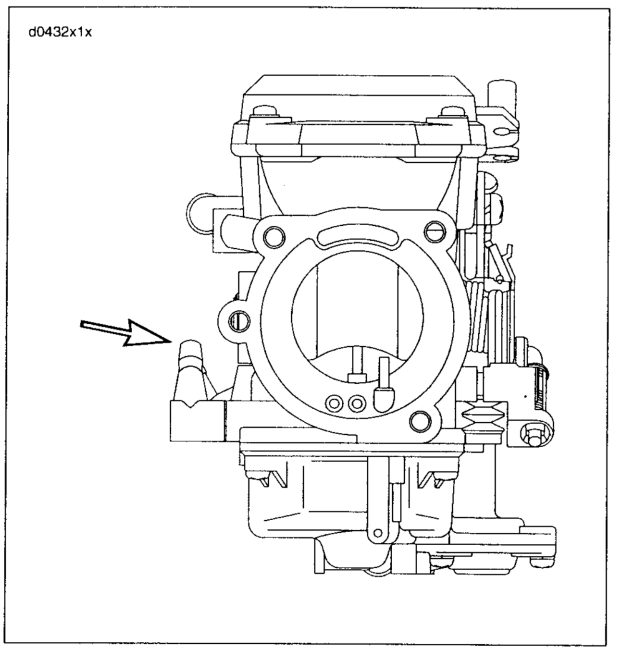


Figure 1-64. Carburetor Fuel Hose Connection

INSPECTION

Check engine mounts and stabilizer links:

- At every 10,000 mile (16,000 km) service interval.

1. See Figure 1-65. Check for cracks or tears in the mount 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.

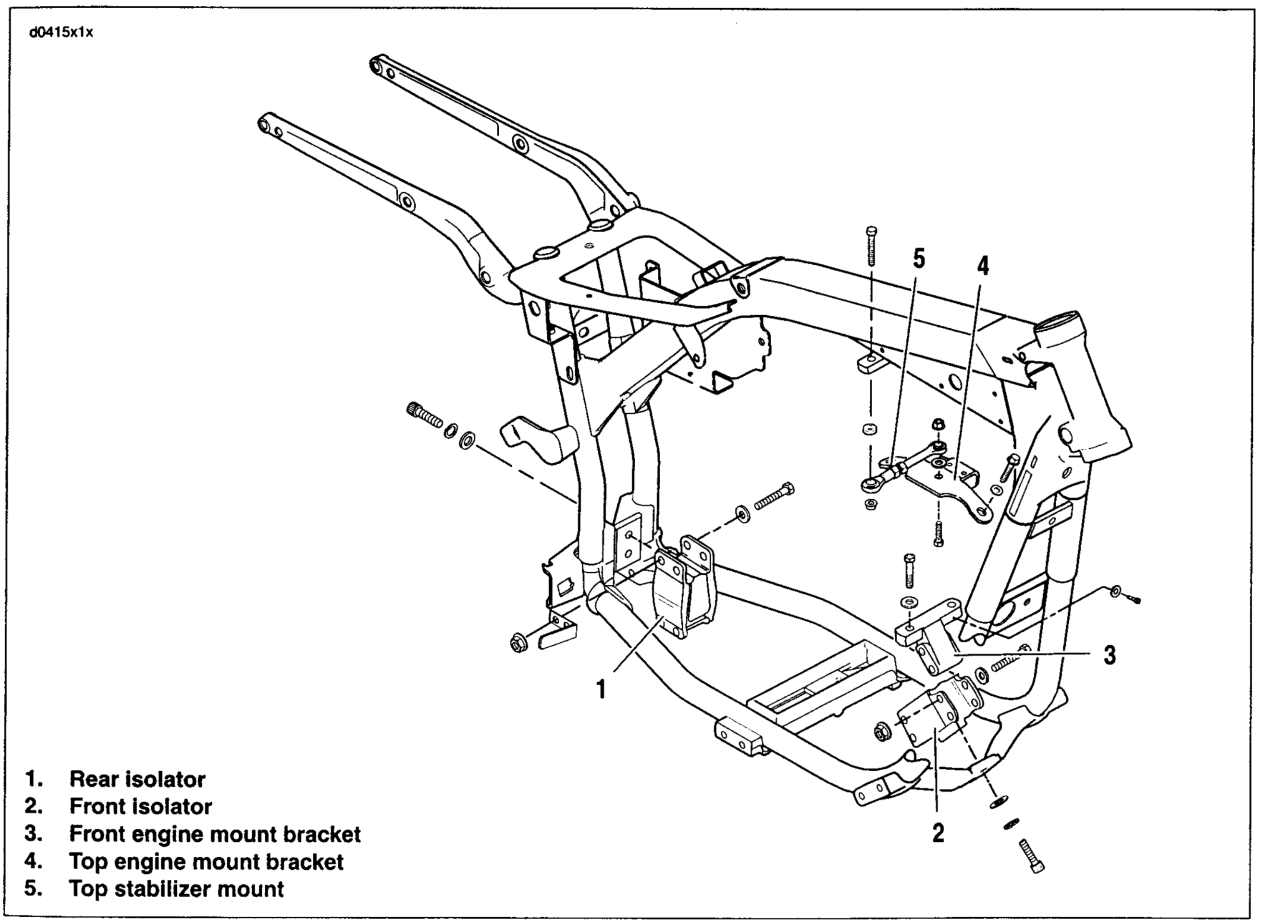


Figure 1-65. Engine Mounts

INSPECTION

⚠WARNING

Do not modify ignition/light switch wiring to circumvent the automatic-on headlight feature. High visibility is an important safety consideration for motorcycle riders. To reduce risk of vehicle damage and personal injury, ensure that headlight is on at all times. Failure to do so, could result in death or serious injury.

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 1.9 TIRES AND WHEELS.
2. Place motorcycle on level floor (or pavement) in an area with minimum light.
3. See Figure 1-66. 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 1-67. 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.

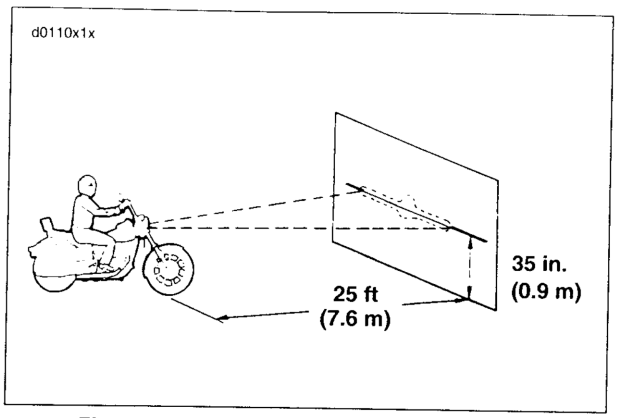


Figure 1-66. Checking Headlamp Alignment

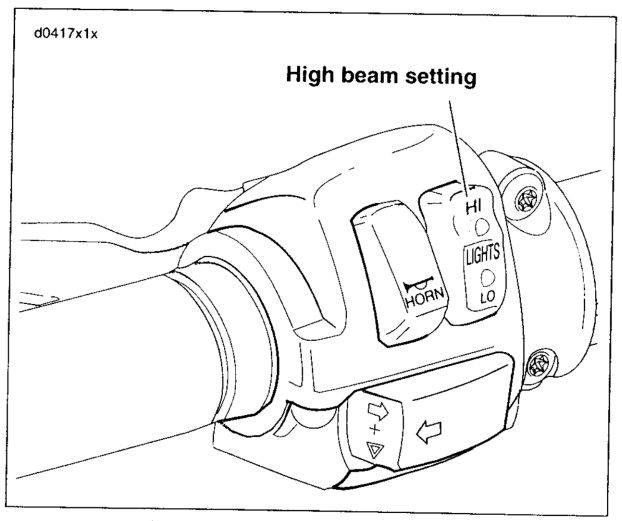


Figure 1-67. Headlamp Switch

ADJUSTMENT

All Models But FXDWG/FXDXT

1. See Figure 1-68. Remove snap plug on top of headlamp housing.



Figure 1-68. Snap Plug (Typical)

2. See Figure 1-69. Loosen adjusting nut on top of headlamp.

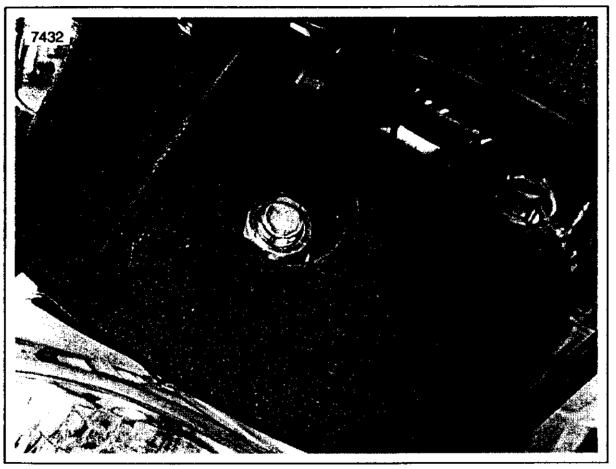
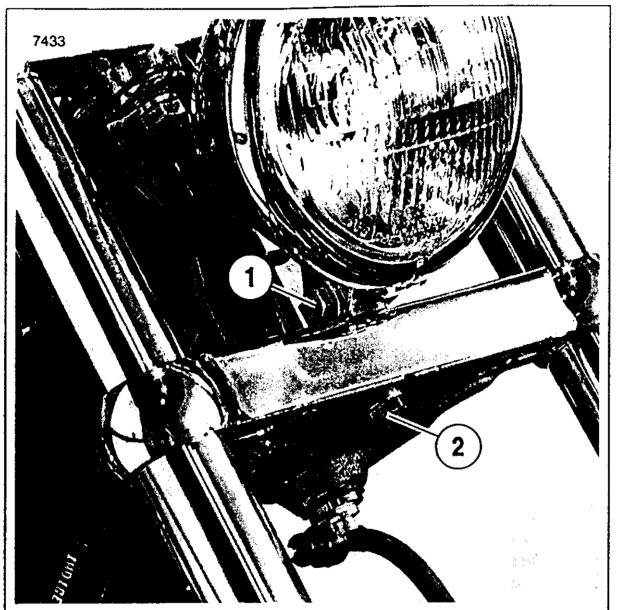


Figure 1-69. Adjusting Nut (Typical)

3. Tighten headlamp mounting nut to 120-180 **in-lbs** (13.6-20.3 Nm), being careful not to move the headlamp in the process. Check alignment and reinstall snap plug.



1. **Vertical adjusting bolt**
2. **Horizontal adjusting bolt**

Figure 1-70. FXDWG Adjustments

FXDWG Model

1. See Figure 1-70. 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 bolt (1) to adjust headlamp beam up or down. Tighten nut to 25-30 ft-lbs (33.9-40.7 Nm).

FXDXT Model

This model allows only vertical adjustment of the headlamp beam. Loosen nut on vertical adjusting screw underneath headlamp to adjust headlamp beam up or down. Tighten nut to 25-30 ft-lbs (33.9-40.7 Nm).

INSPECTION

Inspect critical fasteners, except head bolts:

- At the 1000 mile (1600 km) service interval.
- At every 10,000 mile (16,000 km) service interval thereafter.
- See Table 1-7. Torque all critical fasteners, except head bolts, to service manual specifications. Replace any damaged or missing hardware.

Table 1-7. Critical Fasteners

SYSTEM	FASTENER	TORQUE	
Hand controls	Upper and lower switch housings	35-45 **in-lbs**	4.0-5.1 Nm
	Clutch lever handlebar clamp	60-80 **in-lbs**	6.8-9.0 Nm
	Master cylinder handlebar clamp	60-80 **in-lbs**	6.8-9.0 Nm
Brakes	Banjo bolts	17-22 ft-lbs	23.0-29.8 Nm
	Lower brake caliper mounting pin	28-38 ft-lbs	38.0-51.5 Nm
	Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm
	Brake disc screws, rear	30-35 ft-lbs	40.7-47.5 Nm
	Brake disc screws, rear (allen)	23-27 ft-lbs	31.2-36.6 Nm
	Reservoir screws	6-8 **in-lbs**	0.7-0.9 Nm
	Rear master cylinder mounting nut	40-50 ft-lbs	54.2-67.8 Nm
Axle nuts	Front axle	50-55 ft-lbs	67.8-74.6 Nm
	Rear axle	60-65 ft-lbs	81.3-88.1 Nm
Front fork/handlebars	Lower fork pinch bolts, FXDWG	30-35 ft-lbs	40.7-47.5 Nm
	Lower fork pinch bolts, all but FXDWG	25-30 ft-lbs	33.9-40.7 Nm
	Slider bolts	108-156 **in-lbs**	12.2-17.6 Nm
	Upper bracket pinch bolts	21-27 ft-lbs	28.5-36.6 Nm
	Handlebar clamp mounting screw	70-80 **in-lbs**	7.9-9.0 Nm
	Riser clamp screws	144-180 **in-lbs**	16.3-20.3 Nm
	Riser lock nuts	30-40 ft-lbs	40.7-54.2 Nm

GENERAL

⚠WARNING

Gasoline is extremely flammable and highly explosive. Use care when handling gasoline. Do NOT store a motorcycle having gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present. Inadequate safety precautions could result in death or serious injury.

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 carburetor.

This work should be performed by a local Harley-Davidson dealer or other qualified technician following the procedures in this service manual.

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

Remove filler cap slowly and fill fuel tank slowly to prevent spillage; do not overfill or fill above the bottom of the filler neck insert. In addition, leave air space to allow for fuel expansion. Expansion can cause an overfilled tank to overflow gasoline through the filler cap onto surrounding areas. After refueling, be sure filler cap is securely tightened. Inadequate safety precautions may cause an explosion or fire which could result in death or serious injury.

2. Choose one of the following two methods for preparing your fuel system.
   a. Fill fuel tank and add a gasoline stabilizer. Use one of the commercially available gasoline stabilizers following the manufacturer's instructions. Turn fuel supply valve off. Start motorcycle and run vehicle until fuel in carburetor float bowl is gone and engine stops running.
   b. Drain all gasoline from the fuel tank. Spray the inside of the fuel tank with one of the commercially available rust preventatives. Follow 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. Adjust primary chain. See 1.10 PRIMARY CHAIN.
5. Inspect rear belt deflection. See 1.14 REAR BELT DEFLECTION.
6. Inspect rear belt and sprockets. See 1.15 REAR BELT AND SPROCKETS.
7. Inspect air cleaner filter. See 1.20 AIR CLEANER FILTER.
8. Lubricate controls. See 1.21 CABLE AND CHASSIS LUBRICATION.
9. Inspect operation of all electrical equipment and switches.
10. Check tire inflation and inspect tires for wear and/or damage. See 1.9 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

Do not apply any oil to brake discs or brake pads. Oil on disc pads degrades braking efficiency and can result in an accident which could result in death or serious injury.

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

⚠WARNING

- **Always unplug or turn off battery charger before connecting or disconnecting charger clamps at battery. Always disconnect the negative side first. Connecting or disconnecting clamps with charger on could cause a spark and a possible battery explosion. A battery explosion may rupture the battery case and spray sulfuric acid onto the surrounding area and personnel. This could result in death or serious injury.**
- **Batteries produce explosive hydrogen gas at all times, especially when being charged. Keep cigarettes, open flame and sparks away from the battery at all times. Ventilate area when charging battery. Battery contains sulfuric acid which can cause severe burns to eyes, skin and clothing. Always protect hands and protect eyes with shield or goggles when working near a battery or acid. KEEP BATTERIES AND ACID OUT OF THE REACH OF CHILDREN! Inadequate safety precautions could result in death or serious injury.**

12. Remove battery from vehicle. Charge battery until the correct voltage is obtained. Charge the battery every other month if it is stored at temperatures below 60° F (16° C). Charge battery once a month if it is stored at temperatures above 60° F (16° C). See 1.5 BATTERY MAINTENANCE.
13. If the motorcycle is to be covered, use a material that will breathe, such as light canvas or Part No. 98716-87. Plastic materials that do not breathe promote the formation of condensation, which leads to corrosion.

REMOVAL FROM STORAGE

⚠WARNING

After extended periods of storage and prior to starting vehicle, place transmission in gear, disengage clutch by pulling in clutch hand lever completely, and push vehicle back and forth a few times to ensure proper clutch disengagement. Improper clutch disengagement could result in death or serious injury.

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 intended solely as a guide to diagnosing problems. Carefully read the appropriate sections of this manual before performing any work. Observe all cautions and warnings. Failure to observe cautions and warnings could result in death or serious injury.

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.

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 Bank Angle Sensor tripped and ignition switch not cycled OFF then ON.

Engine Turns Over But Does Not Start

1. Fuel tank empty or fuel supply valve turned off.
2. Fouled spark plugs.
3. Engine flooded with gasoline as a result of over use of enrichener.
4. Vacuum hose to automatic fuel supply valve disconnected, leaking, or pinched.
5. Discharged battery, loose or broken battery terminal connections.
6. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

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

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 ignition module connector.
5. Carburetor controls not adjusted correctly.
6. Water or dirt in fuel system and carburetor.
7. Intake air leak.
8. Fuel tank vent hose and vapor valve plugged, or carburetor fuel line closed off, restricting fuel flow.
9. Enrichener valve inoperative.
10. Engine lubricant too heavy (winter operation).

NOTE

For cold weather starts, always disengage clutch.

11. Ignition not functioning properly (possible sensor failure).
12. Faulty ignition coil.
13. 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, module, or sensor.
5. Battery nearly discharged.
6. Damaged wire or loose connection at battery terminals, coil, or ignition module connector.
7. Intermittent short circuit due to damaged wire insulation.
8. Water or dirt in fuel system, carburetor or filter.
9. Fuel tank vent system plugged or carburetor vent line closed off.
10. Carburetor controls misadjusted.
11. Air leak at intake manifold or air cleaner.
12. Damaged carburetor.

13. Loose or dirty ignition module connector at crankcase.
14. Faulty Sensor(s): Manifold Absolute Pressure (MAP) and/or Crank Position (CKP).
15. Incorrect valve timing.
16. Weak or broken valve springs.
17. Damaged intake or exhaust valve.

A Spark Plug Fouls Repeatedly

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

Pre-Ignition or Detonation (Knocks or Pings)

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

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.
4. Incorrect push rod length.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.
7. Chain tensioning spring 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

1. Fault detected. See CHECKING FOR TROUBLE CODES in DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.

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 or clean-out plug missing or leaking in cam support plate.
6. O-ring missing from cam support plate.

High Oil Pressure

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

ELECTRICAL SYSTEM

Alternator Does Not Charge

1. Voltage regulator/rectifier module not grounded.
2. Engine ground wire loose or broken.
3. Faulty regulator-rectifier 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 regulator-rectifier module.
4. Faulty stator and/or rotor.

Speedometer Operates Erratically

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

CARBURETOR

Floods

1. Dirt or other foreign matter between valve and its seat.
2. Inlet valve sticking.
3. Inlet valve and/or valve seat worn or damaged.
4. Float misadjusted.
5. Leaky or damaged float.
6. Excessive "pumping" of hand throttle grip.
7. See 4.2 FUEL SYSTEM TROUBLESHOOTING.

TRANSMISSION

Shifts Hard

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

Jumps Out Of Gear

1. Shifter rod improperly adjusted.
2. Shifter drum (inside transmission) damaged.
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.
4. Clutch spring tension.
5. Clutch discs warped.

Clutch Chatters

1. Friction discs or steel discs worn or warped.

HANDLING

Irregularities

1. Improperly loaded motorcycle. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
2. Damaged tire(s) or improper front-rear tire combination.
3. Irregular or peaked front tire tread wear.
4. Incorrect tire pressure. See 1.9 TIRES AND WHEELS.
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. See 1.17 STEERING HEAD BEARINGS.
10. Tire and wheel unbalanced.
11. Rims and tires out-of-round or eccentric with hub.
12. Rims and tires out-of-true sideways.
13. Rear fork pivot.

BRAKES

Brake Does Not Hold Normally

1. Master cylinder reservoir low on fluid.
2. Brake system contains air bubbles.
3. Master or wheel cylinder piston worn or parts damaged.
4. Brake pads contaminated with grease or oil.
5. Brake pads badly worn.
6. Brake disc badly worn or warped.
7. Brake drags – insufficient brake pedal free play.
8. Brake fades due to heat build up – brake pads dragging or excessive braking.

CHASSIS 2

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SPECIFICATIONS 2.1

ITEM	FXD		FXDL		FXDX/T		FXDWG	
	in.	mm	in.	mm	in.	mm	in.	mm
Wheel base	62.5	1587.5	65.5	1663.7	63.9	1623.1	66.1	1678.9
Overall length	91.0	2311.4	94.0	2387.6	92.9	2359.7	94.5	2400.3
Overall width	28.5	723.9	28.5	723.9	33.0	838.2	33.5	850.9
Road clearance	5.4	137.2	4.6	116.8	5.9	149.7	5.4	137.2
Overall height	47.5	1206.5	47.5	1206.5	51.25	1301.8	47.5	1206.5
Saddle height	26.5	673.1	25.2	673.1	27.25/27.88	692.2/708.2	26.75	679.5

MODEL	FRONT FORK		FUEL TANK TOTAL		FUEL TANK RESERVE		OIL TANK W/FILTER		TRANSMISSION (APPROX.)		PRIMARY CHAINCASE	
	oz.	liter	gal.	liter	gal.	liter	qt.	liter	oz.	liter	oz.	liter
FXDWG	12.0	0.36	5.2	19.7	1.1	4.2	3.0	2.84	24.0	0.71	26.0	0.77
FXDL	10.6	0.31	4.9	18.5	0.9	3.4						
FXD												
FXDX	*	*										
FXDXT	*	*										

* See 2.20 FRONT FORK: FXDX AND FXDXT for procedure to check and fill front forks on FXDX and FXDXT model motorcycles.

ITEM	FXD		FXDL		FXDWG		FXDX		FXDXT	
	lb.	kg	lb.	kg	lb.	kg	lb.	kg	lb.	kg
Dry weight	612	277.6	614	278.5	612	277.6	619	281.1	642	291.2
GVWR	1085	492.1	1085	492.1	1085	492.1	1085	492.1	1085	492.1
GAWR front	390	176.9	390	176.9	390	176.9	390	176.9	390	176.9
GAWR rear	695	315.2	695	315.2	695	315.2	695	315.2	695	315.2

NOTE

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.

NOTE

See 1.9 TIRES AND WHEELS for important information regarding tire data and tire inflation.

TORQUE VALUES 2.2

ITEM	TORQUE		NOTES
Belt sprocket screws	45-55 ft-lbs	61.0-74.6 Nm	Laced wheels. Apply several drops of LOCTITE® thread locker 262 (red) to last few threads. Page 2-11
Belt sprocket screws	55-65 ft-lbs	74.6-88.1 Nm	Cast wheels. Apply several drops of LOCTITE® thread locker 262 (red) to last few threads. Page 2-11
Brake disc screws, front	16-24 ft-lbs	21.7-32.5 Nm	Page 2-7
Brake disc screws, rear	30-45 ft-lbs	40.7-61.0 Nm	Apply several drops of LOCTITE® thread locker 243 (blue) to last few threads. Page 2-10
Brake hose bracket bolt	132 in-lbs	14.9 Nm	Page 2-59
Debris deflector screws	40-60 in-lbs	4.5-6.8 Nm	Page 2-11, 2-65
Fork cap	22-29 ft-lbs	29.8-39.3 Nm	FXDX & FXDXT, page 2-55
Fork damper screw	22-29 ft-lbs	29.8-39.3 Nm	FXDX & FXDXT, page 2-55
Fork slider tube caps	11-22 ft-lbs	14.9-29.8 Nm	FXD & FXDL, page 2-48; FXDWG, PAGE 2-51
Fork stem bracket pinch bolt(s)	30-35 ft-lbs	40.7-47.5 Nm	FXDX & FXDXT, page 2-56
Front axle nut	50-55 ft-lbs	67.8-74.6 Nm	Page 2-8
Front axle pinch bolt nut	25-30 ft-lbs	3.9-40.7 Nm	FXD, FXDL, FXDX, FXDXT, page 2-8
Front axle slider cap nuts	60-132 in-lbs	6.8-14.9 Nm	FXDWG, page 2-8
Front brake caliper bleeder valve	80-100 in-lbs	9.0-11.3 Nm	Page 2-39
Front brake caliper bridge bolts	28-38 ft-lbs	38.0-51.5 Nm	Page 2-39
Front brake caliper lower mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	Short bolt, 12 pt/10 mm, page 2-11, page 2-40
Front brake caliper top mounting bolt	28-38 ft-lbs	38.0-51.5 Nm	Long bolt, 12 pt/10 mm, page 2-11, page 2-40
Front brake reservoir cover screws	6-8 in-lbs	0.7-0.9 Nm	Page 2-41
Front fender nuts	15-21 ft-lbs	20.3-28.5 Nm	Page 2-69
Front master cylinder banjo bolt	17-22 ft-lbs	23.0-29.8 Nm	Page 2-33
Gearbox mounting bracket screws	35-40 in-lbs	4.0-4.5 Nm	Page 2-80
Gearbox mounting screws	12-16 in-lbs	1.35-1.80 Nm	Page 2-80
Isolator mounting bolts	25 ft-lbs	33.9 Nm	Page 2-29
Jiffy stand bolt	19 ft-lbs	25.8 Nm	Page 2-73
Lower fork bracket pinch screws	25-30 ft-lbs	33.9-40.7 Nm	FXD, FXDL, FXDXT, page 2-48
Lower windshield mounting screws	9-11 in-lbs	1.01-1.24 Nm	FXDXT, page 2-81
Master cylinder clamp screw	70-80 in-lbs	7.9-9.0 Nm	T27 TORX, page 2-32
Rear axle nut	60-65 ft-lbs	81.3-88.1 Nm	Page 2-11

ITEM	TORQUE		NOTES
Rear brake caliper bleeder valve	80-100 in-lbs	9.0-11.3 Nm	Page 2-44
Rear brake caliper bridge bolts	28-38 ft-lbs	38.0-51.5 Nm	Page 2-44
Rear brake pad pins	15-16 ft-lbs	20.3-22.6 Nm	12 pt/0.25 in., page 2-40, 2-45
Rear brake reservoir cover screws	6-8 in-lbs	0.7-0.9 Nm	Page 2-36, 2-45
Rear fender sideplate nuts	12-18 ft-lbs	16.3-24.4 Nm	Apply several drops of LOCTITE® thread locker 243 (blue) to last few threads. FXDWG, page 2-71; FXD/FXDL, page 2-72
Rear fender sideplate/saddle-bag nuts	12-18 ft-lbs	16.3-24.4 Nm	FXDXT, Apply several drops of LOCTITE® thread locker 243 (blue) to last few threads. Page 2-72
Rear fork pivot screw	45-50 ft-lbs	61.0-67.8 Nm	Page 2-63
Rear master cylinder banjo bolt	17-22 ft-lbs	23.0-29.8 Nm	Page 2-36
Rear master cylinder mounting nut	40-50 ft-lbs	54.2-67.8 Nm	Page 2-36
Rear shock fasteners	25-40 ft-lbs	33.9-54.2 Nm	Apply several drops of LOCTITE® thread locker 243 (blue) to last few threads. Page 2-11
Seat strap nut	60-90 in-lbs	6.78-10.17 Nm	Page 2-75
Spoke nipples	40-50 in-lbs	4.5-5.6 Nm	16 in., page 2-15; 19 in., page 2-19; 21 in., page 2-21
Steering head pinch bolt	21-27 ft-lbs	28.5-36.6 Nm	All but FXDWG, page 2-59
Support bracket mounting screws	35-40 in-lbs	4.0-4.5 Nm	Page 2-81
Throttle housing screws	35-45 in-lbs	4.0-5.1 Nm	Page 2-66
Upper and lower bracket screws	12-16 in-lbs	1.35-1.80 Nm	Page 2-80
Upper and lower fastener bracket screws	12-15 in-lbs	1.35-1.70 Nm	Page 2-81
Upper and lower fastener bracket screws	12-16 in-lbs	1.35-1.80 Nm	Page 2-80
Upper and lower shock mounts	25-40 ft-lbs	35-54 Nm	Apply LOCTITE® thread locker 243 (blue) to last few threads. FXD/FXDL/FXDWG, page 2-60; FXDX/FXDXT, page 2-61
Upper bracket pinch screws	21-27 ft-lbs	28.5-36.6 Nm	FXDWG, page 2-59
Upper fork bracket pinch screws	25-30 ft-lbs	33.9-40.7 Nm	FXD, FXDL, FXDXT, page 2-48
Upper shock locknut	60-80 ft-lbs	81.3-108.5 Nm	FXD/FXDL/FXDWG, page 2-60; FXDX/FXDXT, page 2-61
Upper windshield extension link screws	12-16 in-lbs	1.35-1.80 Nm	Page 2-80
Upper windshield mounting screws	9-11 in-lbs	1.01-1.24 Nm	FXDXT, page 2-81
Valve stem nut	12-15 in-lbs	1.4-1.7 Nm	Page 2-26

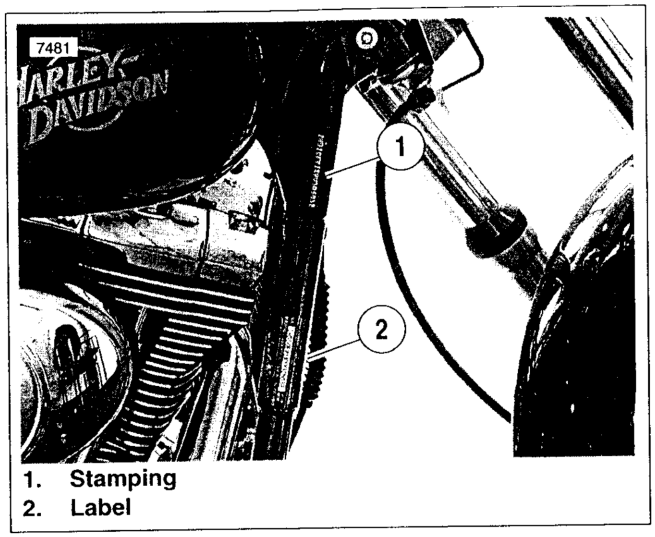
GENERAL

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

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

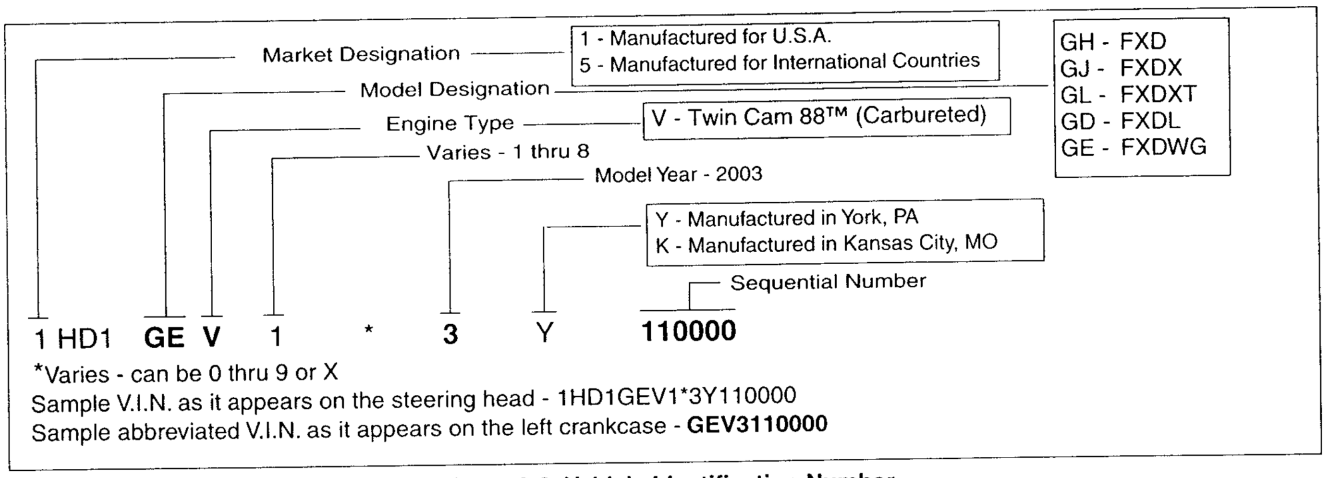
NOTE

See Figure 2-2. Always give the complete 17 digit V.I.N. when ordering parts or making inquiries about your motorcycle.



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

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



*Varies - can be 0 thru 9 or X
Sample V.I.N. as it appears on the steering head - 1HD1GEV1*3Y110000
Sample abbreviated V.I.N. as it appears on the left crankcase - **GEV3110000**

Figure 2-2. Vehicle Identification Number

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 2.6 SEALED WHEEL BEARINGS.

NOTE

The FXDX and FXDXT have dual front brake calipers; both calipers must be removed before removing the front wheel. All other models have a single front brake caliper.

3. See Figure 2-3. Remove brake caliper(s). Support caliper(s) using a rubber bungee cord.

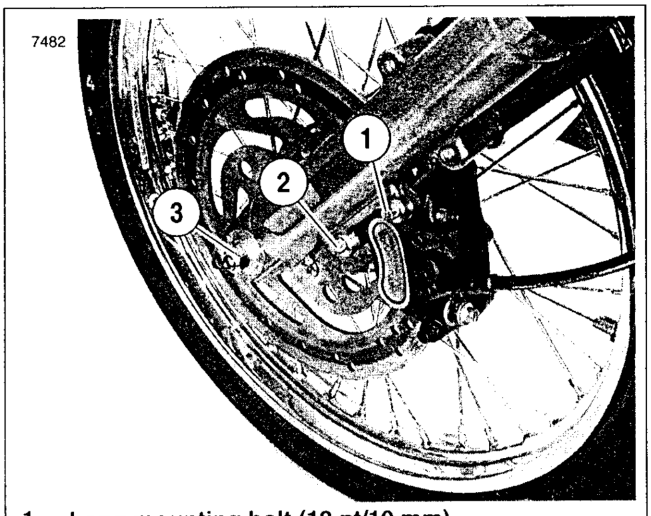
CAUTION

Be careful not to scratch the fender paint.

NOTE

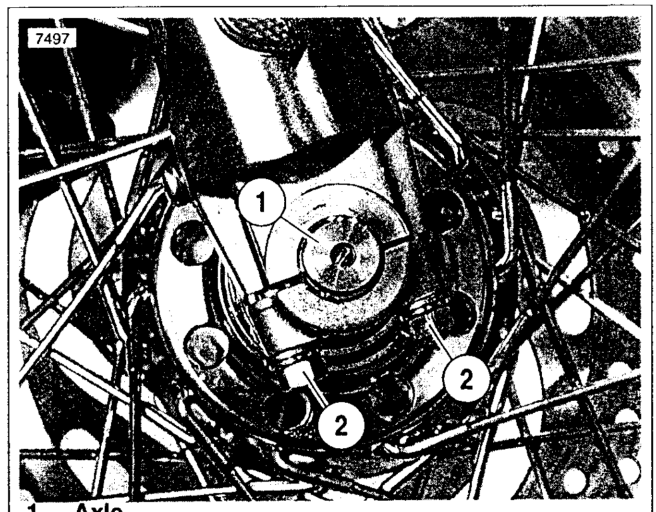
Do not operate front brake lever with the front wheel removed or the caliper piston may be forced out of piston bore. Reseating the piston requires disassembly of the caliper.

4. Remove axle nut, lockwasher and washer (3).
5. Remove wheel from forks.
   a. See Figure 2-4. For FXDWG models, loosen the slider cap nuts (2) and pull the axle (1) free.
   b. See Figure 2-5. For all other models, loosen pinch bolt nut (2) and pull the axle (1) free from the wheel.



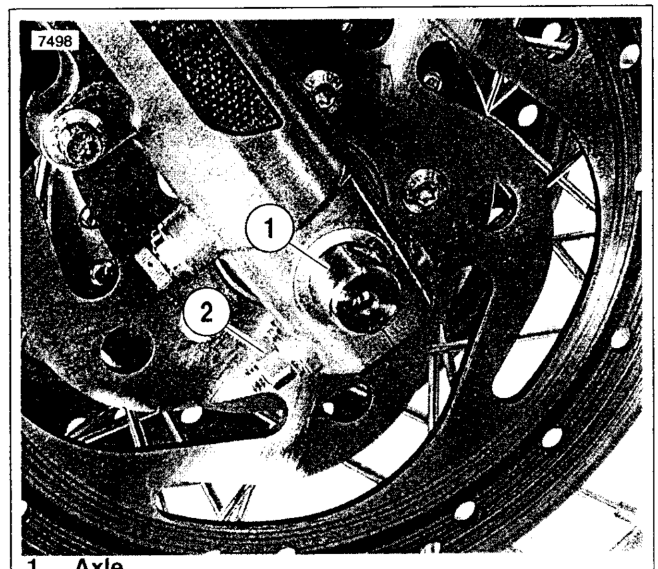
1. Long mounting bolt (12 pt/10 mm)
2. Short mounting bolt (12 pt/10 mm)
3. Axle nut, lockwasher and washer

Figure 2-3. Caliper Mounting Bolts (Left Side)



1. Axle
2. Slider cap nuts and washers

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



1. Axle
2. Pinch bolt nut

Figure 2-5. Front Wheel Mounting: All But FXDWG (Right Side)

1. Axle
2. Right bearing spacer
3. Screw (10)
4. Right brake disc (FXDX, FXDXT only)
5. Hub plate (FXD only)
6. Bearing (2)
7. Sleeve
8. Cast wheel
9. Left brake disc
10. Left bearing spacer
11. Washer
12. Lockwasher
13. Axle nut

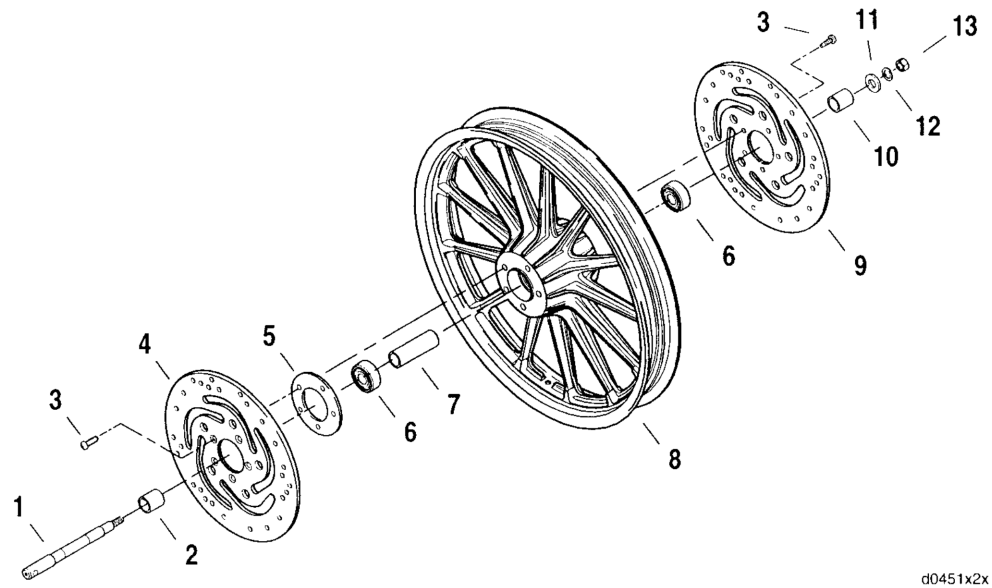


Figure 2-6. Cast Front Wheel

1. Axle
2. Right bearing spacer
3. Screw (5) (10 for FXDX)
4. Right brake disc (FXDX, FXDXT)
5. Bearing (2)
6. Sleeve
7. Wheel hub
8. Left brake disc
9. Left bearing spacer
10. Washer
11. Lockwasher
12. Axle nut
13. Valve stem nut
14. Valve cap
15. Spoke & nipple kit
16. Weight
17. 21" Rim
18. 21" Laced Wheel Assembly

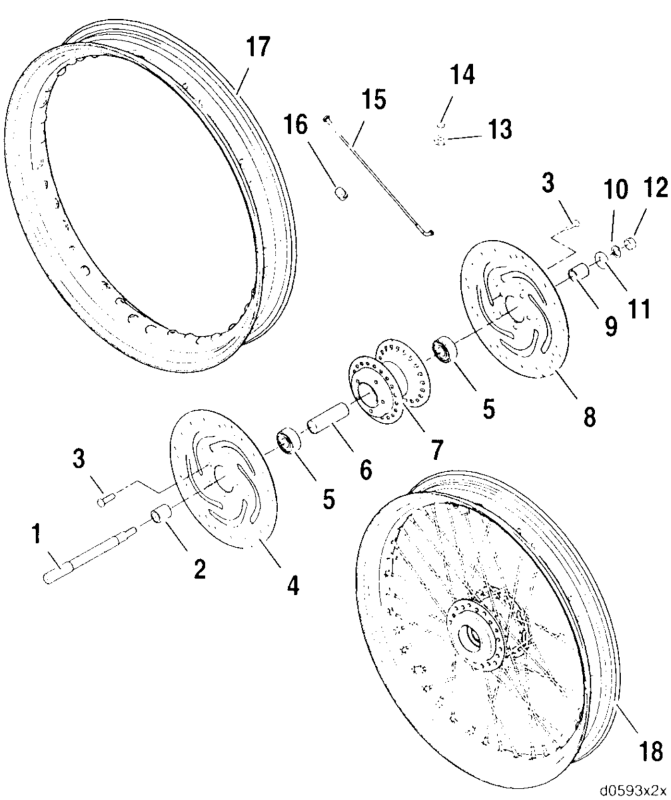


Figure 2-7. Laced Front Wheel

DISASSEMBLY

NOTE

See 2.12 TIRES to service tire or valve stem assembly.

Cast Wheel

1. See Figure 2-6. Remove spacers (2, 10) from left and right sides.
2. On wheels with dual brake discs, the left side of hub is marked for reference during assembly by two grooves cut in the hub face. If necessary, remove brake disc(s) (4, FXDX, FXDXT only, 9) and/or hub plate (5). Label all components so they may be installed in their original locations.
   a. On left side of wheel, remove five screws (3) to detach left brake disc (9).
   b. On right side of wheel, remove five screws (3) to remove right brake disc (4) or hub plate (5, FXD only).

Laced Wheel

1. See Figure 2-7. Remove spacers (2, 9) from left and right sides.
2. On wheels with dual brake discs, the left (primary disc) side of the hub is identified for reference during assembly by two grooves cut in the hub face. If necessary, remove brake disc(s) (4, 8). Label all components so they may be installed in their original locations.
   a. On left side of wheel, remove five screws (3) to detach left brake disc (8).
   b. On FXDX models, remove five screws (3) to remove right brake disc (4).

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear.

⚠WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

2. Inspect brake rotor and pads. See 1.8 BRAKE PADS AND DISCS.

ASSEMBLY

Cast Wheel

⚠WARNING

Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake rotor or reduced braking ability will occur which could result in death or serious injury.

1. See Figure 2-6. If necessary, install brake disc(s) (4, FXDX, FXDXT only, 9) and/or hub plate (5) in their original positions. Verify that brake disc(s) is clean. Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
   a. On left side of wheel, install five **new** screws (3) to attach left brake disc (9).
   b. On right side of wheel, install five **new** screws (3) to attach right brake disc (4, FXDX, FXDXT only) or hub plate (5, FXD only).
2. Install spacers (2, 10) with largest chamfered end facing away from wheel.
3. Verify that wheel and tire are true. See 2.11 CAST WHEEL RUNOUT.

Laced Wheel

1. If hub and rim were disassembled, see 2.7 WHEEL LACING: 16 IN. RIM, 2.8 WHEEL LACING: 19 IN. RIM, or 2.9 WHEEL LACING: 21 IN. RIM.

⚠WARNING

Do not allow brake fluid, bearing grease, lubricants, etc. to contact brake rotor or reduced braking ability will occur which could result in death or serious injury.

2. See Figure 2-7. If necessary, install brake disc(s) in their original positions. Verify that brake disc(s) is clean. Tighten fasteners to 16-24 ft-lbs (21.7-32.5 Nm).
   a. On left side of wheel, install five **new** screws (3) to attach left brake disc (8).
   b. On FXDX/FXDXT models, install five **new** screws (3) to attach right brake disc (4).
3. Install spacers (2, 9) with largest chamfered end facing away from wheel.
4. Verify that wheel and tire are true. See 2.10 TRUING LACED WHEEL.

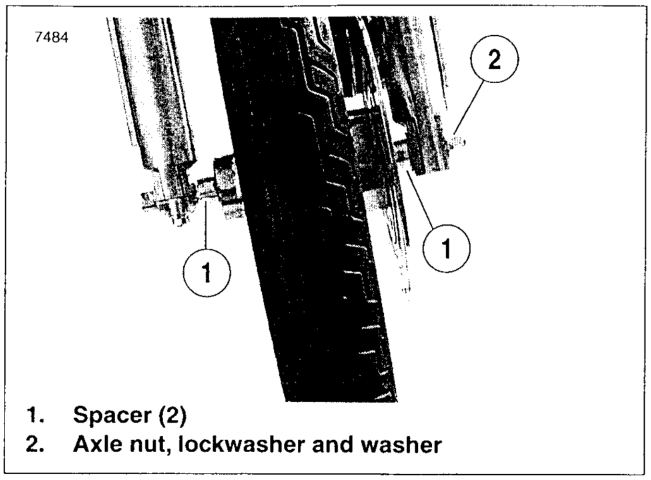
INSTALLATION

1. Apply a light coat of LOCTITE ANTI-SEIZE LUBRICANT to the axle.
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. Install the washer, lockwasher, and pinch bolt nuts. Tighten axle nut to 50-55 ft-lbs (67.8-74.6 Nm). Hold axle stationary while tightening.
4. If servicing a vehicle with a single front brake caliper, advance to the next step. On models with dual front brakes, align calipers to brake discs. See Figure 2-9.
   a. Loosen axle pinch bolt nuts.
   b. Insert 7/16 in. drill bit (2) as far as it will go into hole in axle (1).
   c. Position fork leg against edge of drill bit. Contact point (3) must the have edge of drill bit touching the edge of fork leg.
   d. Tighten the axle pinch bolt nuts to 25-30 ft-lbs (33.9-40.7 Nm).
   e. Withdraw drill bit and advance to step 6.
5. Tighten axle hardware on single caliper vehicles.
   a. See Figure 2-5. On FXD models, tighten the axle pinch bolt nut to 25-30 ft-lbs (33.9-40.7 Nm).
   b. See Figure 2-4. On FXDWG models, tighten the slider cap nuts to 60-132 **in-lbs** (6.8-14.9 Nm).
6. See Figure 2-3. Install the brake caliper to the fork legs.
   a. Loosely install long mounting bolt (1) (12 pt/10 mm) into top hole on fork leg.
   b. Install short mounting bolt (2) (12 pt/10 mm) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.51.5 Nm).
   c. Final tighten the top mounting bolt to 28-38 ft-lbs (38.51.5 Nm).

⚠WARNING

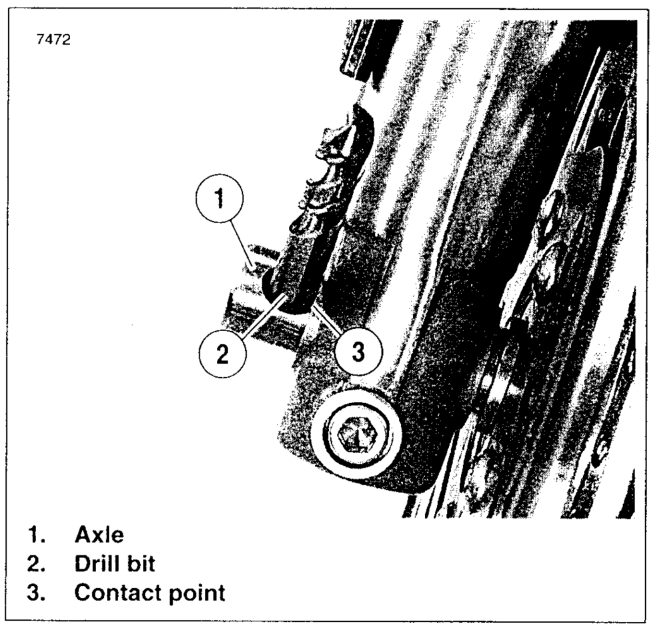
Whenever a wheel is installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

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



1. **Spacer (2)**
2. **Axle nut, lockwasher and washer**

Figure 2-8. Front Axle Assembly



1. **Axle**
2. **Drill bit**
3. **Contact point**

Figure 2-9. Dual Brake Disc Alignment

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 2.25 DEBRIS DEFLECTOR.
3. Inspect wheel bearing end play and service bearings if necessary. See 2.6 SEALED WHEEL BEARINGS.
4. See Figure 2-10. Remove spring clip (1), axle nut (2), and washer (3) from left side of axle.
5. See Figure 2-11. Loosen, but do not remove, left and right **upper** shock absorber nuts (1).
6. Remove left and right **lower** shock absorber nuts and washers (2).
7. Disconnect shock absorbers from lower shock mounting bolts. Allow rear fork and wheel to lower.
8. Remove belt guard (3). See 2.24 BELT GUARD.
9. Remove axle from wheel.
10. Move wheel forward and slip belt off sprocket.

NOTE

Tension may have to be relieved before belt will slip off. Spacer may fall out when tension is relieved.

11. Pull wheel and belt sprocket from rear fork.

NOTE

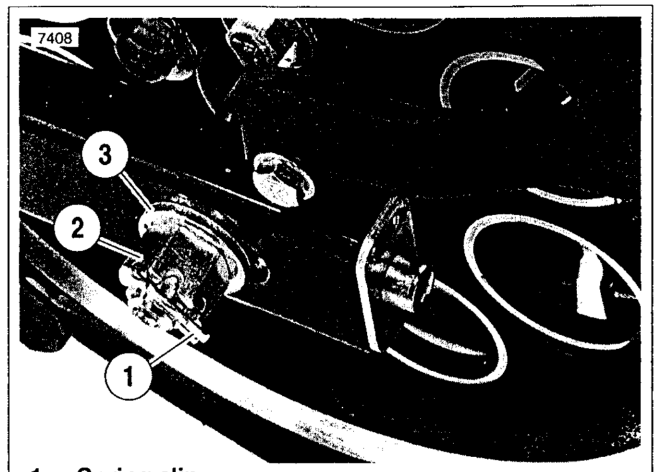
Do not operate rear brake pedal with the rear wheel removed or the caliper piston may be forced out of piston bores. Reseating the piston requires disassembly of the caliper.

DISASSEMBLY

NOTE

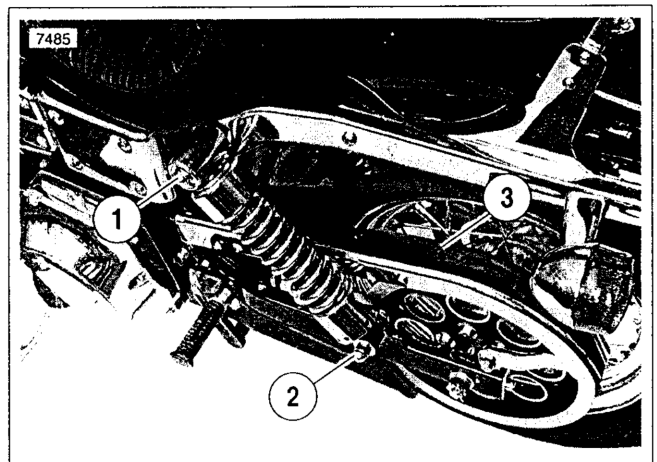
With the exception of the sprocket screw washer (16), component parts for cast and laced rear wheels are identical.

1. See Figure 2-12. Remove spacers (2, 10) from left and right sides.
2. If necessary, remove brake disc and/or rear sprocket. Label components so they may be installed in their original locations.
   a. On left side of wheel, remove five screws (15) and washers (16) to detach rear sprocket (9).
   b. On right side of wheel, remove five screws (3) to remove rear brake disc (4).



1. **Spring clip**
2. **Axle nut**
3. **Washer**

Figure 2-10. Rear Axle



1. **Upper mounting nuts**
2. **Lower mounting nuts and washers**
3. **Belt guard**

Figure 2-11. Rear Shock Mount

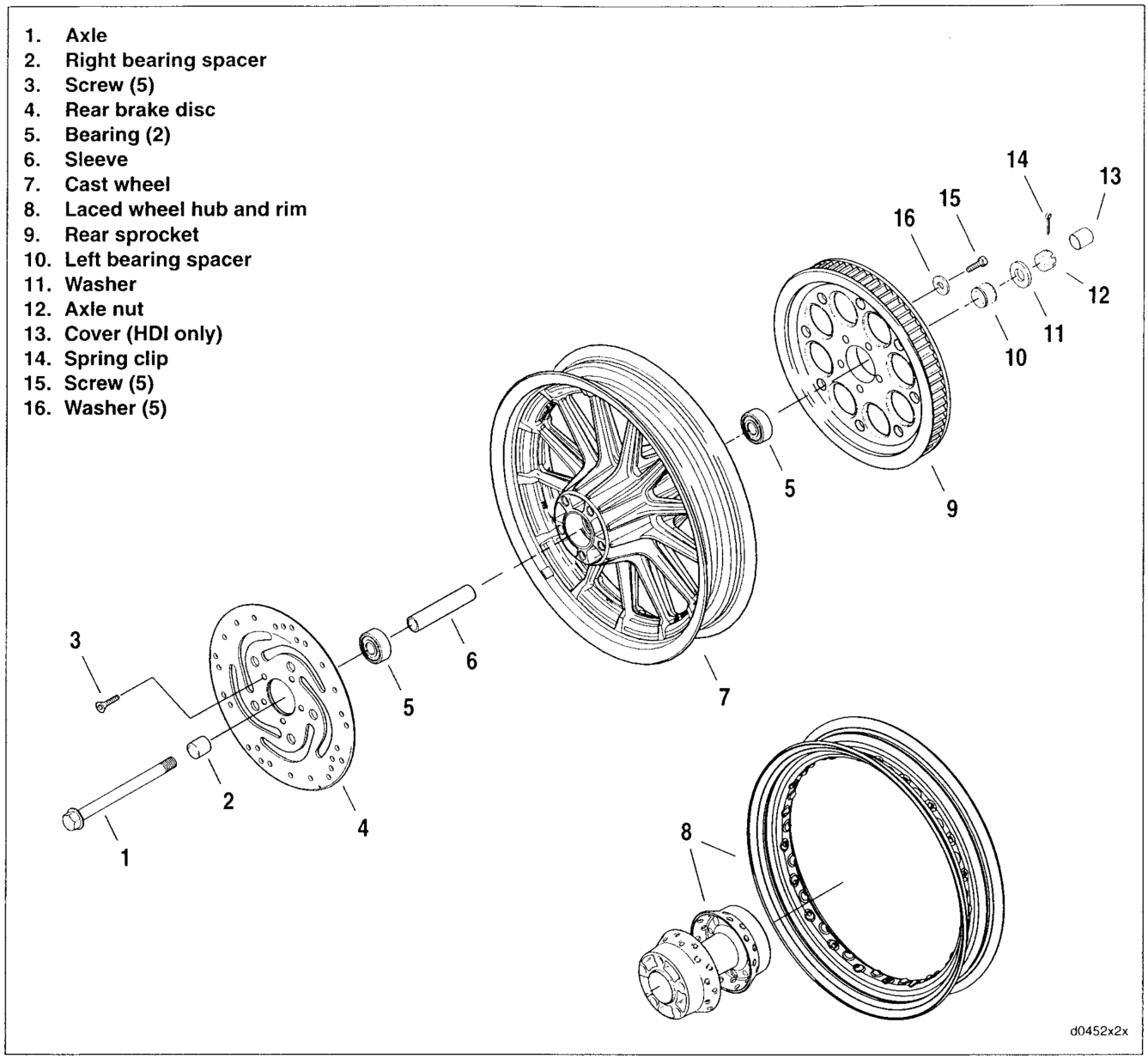


Figure 2-12. Rear Wheel/Hub

CLEANING AND INSPECTION

1. Inspect all parts for damage or excessive wear.

⚠WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

2. Inspect brake rotor and pads. See 1.8 BRAKE PADS AND DISCS.
3. Inspect rear belt and sprocket. 1.15 REAR BELT AND SPROCKETS.

ASSEMBLY

1. If hub and rim were disassembled, see 2.7 WHEEL LACING: 16 IN. RIM, 2.8 WHEEL LACING: 19 IN. RIM, or 2.9 WHEEL LACING: 21 IN. RIM.
2. See Figure 2-12. Install brake disc (4) on valve stem side of wheel if removed.
   a. Apply a drop of LOCTITE THREADLOCKER 243 (blue) to the five screws (3).
   b. Tighten to 30-45 ft-lbs (40.7-61.0 Nm).

3. Install belt sprocket (9) if removed.
   a. Apply two drops of LOCTITE THREADLOCKER 262 (red) to the five screws (15). Install sprocket using screws (15) and washers (16).
   b. On cast wheels, tighten screws to 55-65 ft-lbs (74.6-88.1 Nm).
   c. On laced wheels, tighten screws to 45-55 ft-lbs (61.0-74.6 Nm).
4. Install spacers (2, 10) into hub with largest chamfered end facing away from wheel.
5. Verify that wheel and tire are true.
   a. For laced wheels, see 2.10 TRUING LACED WHEEL.
   b. For cast wheels, see 2.11 CAST WHEEL RUNOUT.

INSTALLATION

1. Roll wheel into rear fork and position brake disc side spacer between wheel and fork.
2. Slide drive belt over drive sprocket. Make sure brake disc is centered between brake pads.
3. Coat axle with LOCTITE ANTI-SEIZE LUBRICANT and install.
   a. From right side, carefully insert axle through right rear fork, rear caliper bracket, right side spacer and brake disc.
   b. Continue sliding axle through wheel hub sleeve, sprocket, left side spacer and left rear fork.
4. See Figure 2-11. Attach rear shocks.
   a. Apply two or three drops of LOCTITE THREADLOCKER 243 (blue) to threads of upper and lower shock mounting bolts.
   b. Lift rear fork and install both shock absorbers with washers and mounting nuts (1, 2).
   c. Tighten all fasteners to 25-40 ft-lbs (33.9-54.2 Nm).

⚠WARNING

Do not exceed 65 ft-lbs (88.1 Nm) when tightening the axle nut. Exceeding 65 ft-lbs (88.1 Nm) may cause the wheel bearings to seize during vehicle operation, which could result in death or serious injury.

5. See Figure 2-10. Install washer (3) and axle nut (2) on left side of axle.
   a. Tighten axle nut to 60-65 ft-lbs (81.3-88.1 Nm).
   b. Check to see if the spring clip (2) can be installed. If required, tighten axle nut to no more than 65 ft-lbs (88.1 Nm) and align axle hole and nut slots. Install spring clip.
6. Install debris deflector using three screws. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm). See 2.25 DEBRIS DEFLECTOR.
7. Install belt guard. See 2.24 BELT GUARD.

⚠WARNING

Whenever a wheel is installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

8. Pump brake pedal to move pistons out until they contact both brake pads. Verify piston location against pads.
9. Verify correct axle alignment (2.13 VEHICLE ALIGNMENT) and then check belt deflection (1.14 REAR BELT DEFLECTION).

INSPECTION

1. Block motorcycle underneath frame so wheel is raised off the ground.
2. 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.
3. Turn the wheel through several rotations, then move the wheel side to side to check for 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.

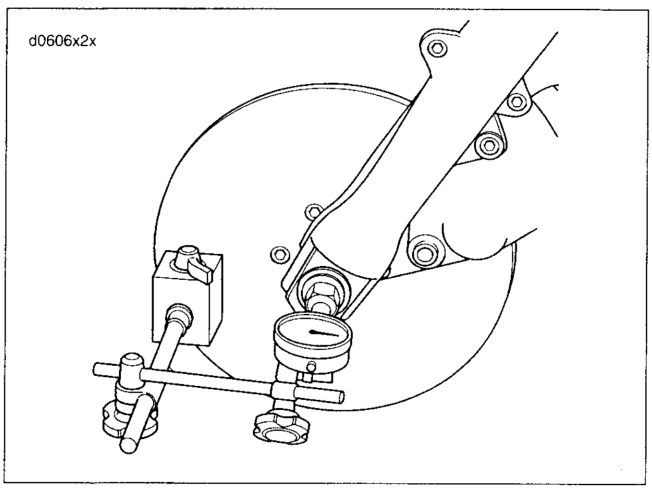
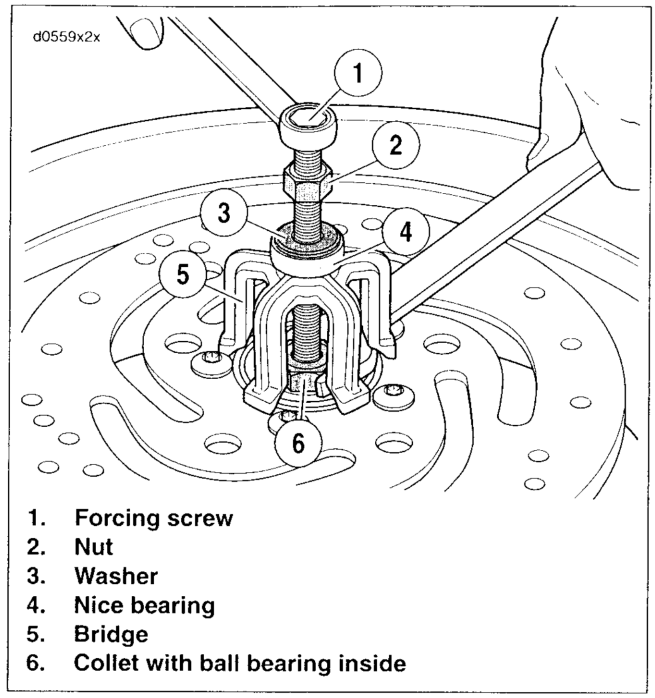


Figure 2-13. Wheel Bearing Inspection (Front Wheel Shown)

REMOVAL

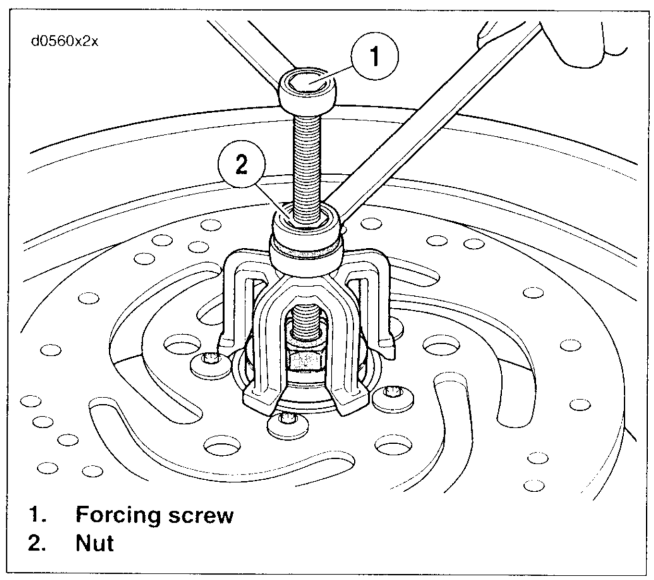
PART NO.	SPECIALTY TOOL
HD-44060	Wheel bearing installer/remover

1. Remove wheel from motorcycle. See 2.4 FRONT WHEEL or 2.5 REAR WHEEL as appropriate. On vehicles with a single front brake caliper, remove hub plate from wheel on opposite side of front brake disc.
2. See Figure 2-14. Obtain WHEEL BEARING INSTALLER/REMOVER (Part No. HD-44060) and assemble.
   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 collet (6). Fasten collet and ball bearing to forcing screw (1).



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

Figure 2-14. Removal Tool



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

Figure 2-15. Remove Bearing

3. Hold end of forcing screw (1) and turn collet (6) to expand edges of collet.
4. See Figure 2-15. When expanded collet has gripped bearing edges, hold end of forcing screw (1) and turn the nut (2) to remove bearing from wheel.
5. Remove spacer from inside wheel hub.
6. Repeat procedure for opposite side bearing. Discard all bearings upon removal.

INSTALLATION

PART NO.	SPECIALTY TOOL
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 2-16. Place threaded rod through support plate. Insert assembly through wheel.
   c. See Figure 2-17. 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.
5. On cast front wheels for single caliper vehicles, install hub plate opposite front brake disc.

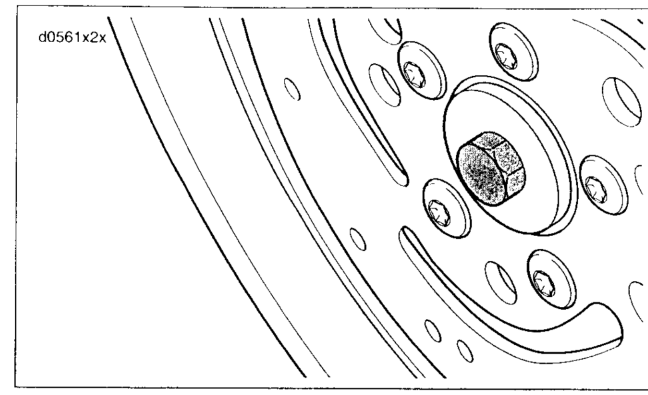
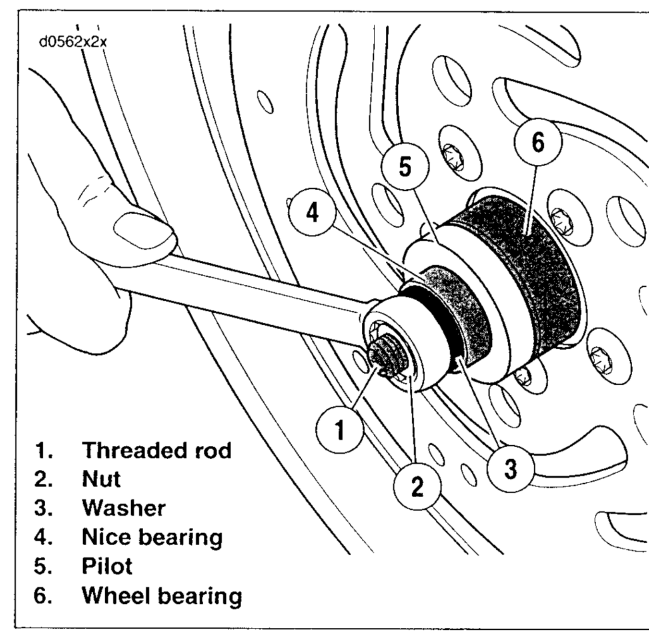
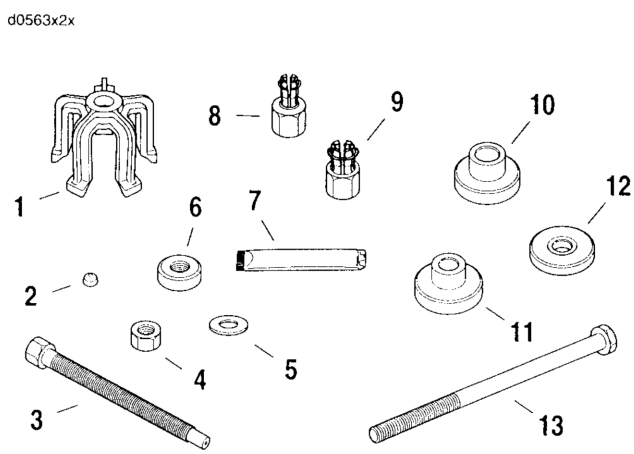


Figure 2-16. Installation Tool Support Plate



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

Figure 2-17. Installing Bearing



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

NO.	DESCRIPTION	PART NO.
1	Bridge	HD-44060-5
2	Steel ball	12547
3	Forcing screw	HD-44060-4
4	Nut	10210
5	Washer	12004
6	Nice bearing	RS25100-200
7	Lubricant	J-23444A
8	Collet, 3/4 in.	HD-44060-3
9	Collet, 1.0 in. (FLT front axle only)	HD-44060-7
10	Pilot, 1.0 in. (FLT front axle only)	HD-44060-8
11	Pilot, 3/4 in.	HD-44060-6
12	Support plate	HD-44060-1
13	Threaded rod	280856

Figure 2-18. Wheel Bearing Remover/Installer (Part No. HD-44060)

GENERAL

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.

⚠WARNING

Avoid using oils that attack or contribute to the deterioration of rubber materials. Use of unsuitable oils may lead to premature tire failure, which could result in death or serious injury.

Torx head spokes, the 16 in. laced wheel hub and the 16 in. wheel are shown below.

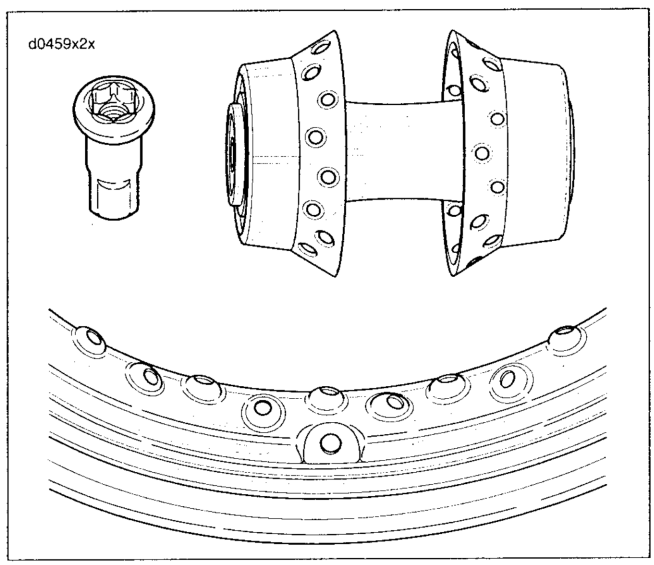


Figure 2-19.

PROCEDURE

1. Place the hub on table with brake disc side (narrow flange) up. Insert a spoke in each hole of the **lower** row as shown below. Angle spokes clockwise.

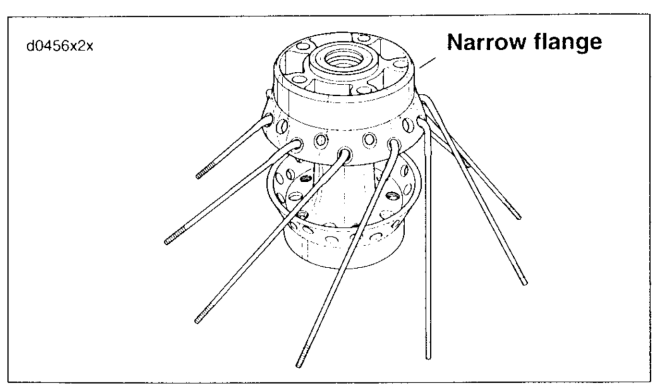


Figure 2-20.

2. Center the rim over the hub assembly with the valve stem hole facing upward.
3. 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.

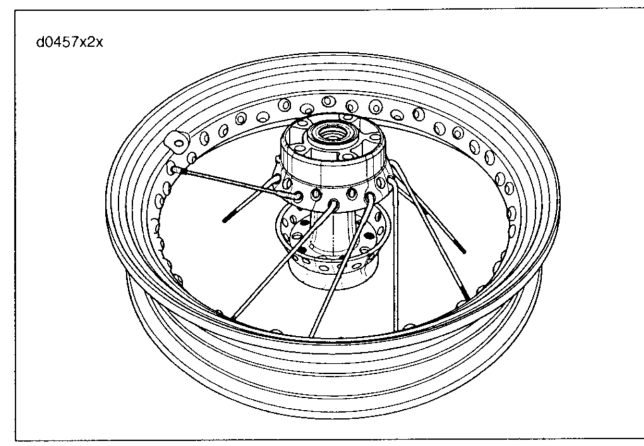


Figure 2-21.

4. Install the rest of lower row spokes in every fourth hole.

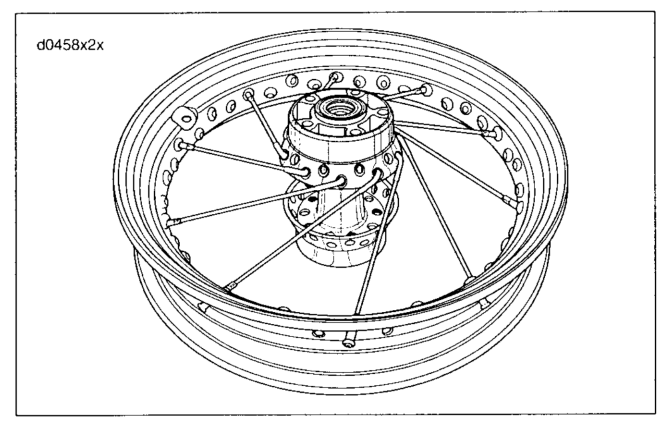


Figure 2-22.

5. 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.

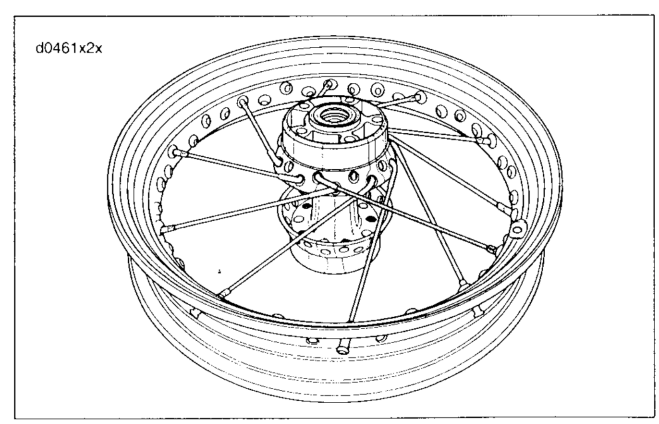


Figure 2-23.

6. Install the remaining nine upper row spokes into every fourth remaining hole above the rim centerline.

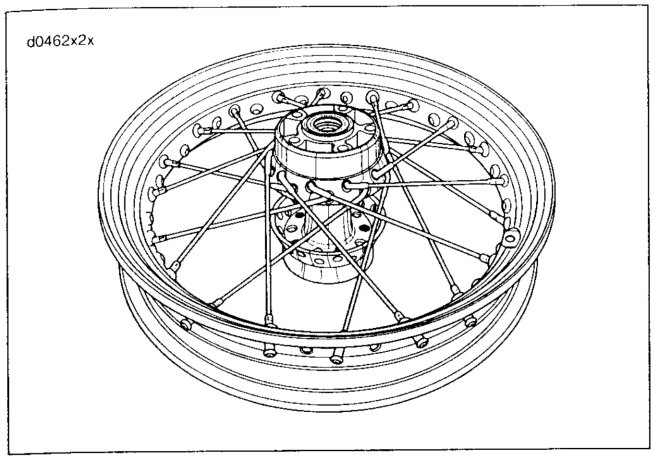


Figure 2-24.

7. Turn rim over so brake disc side (narrow flange) faces down. Place any **lower** row spoke into hub. Angle spoke clockwise and place into rim hole angled to accept it.

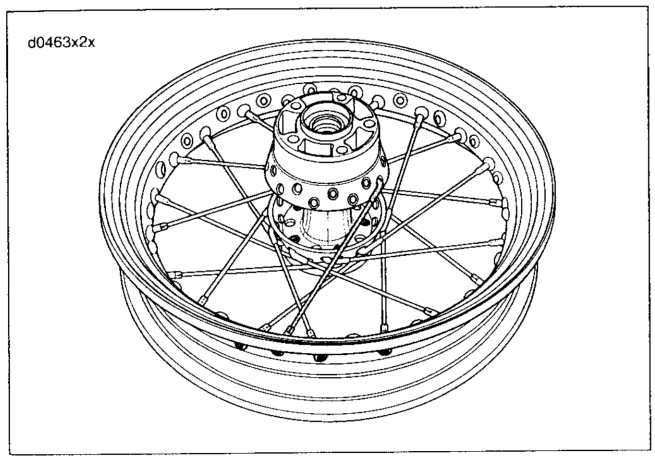


Figure 2-25.

8. Place the remaining nine lower row spokes, angled clockwise, into hub and rim.

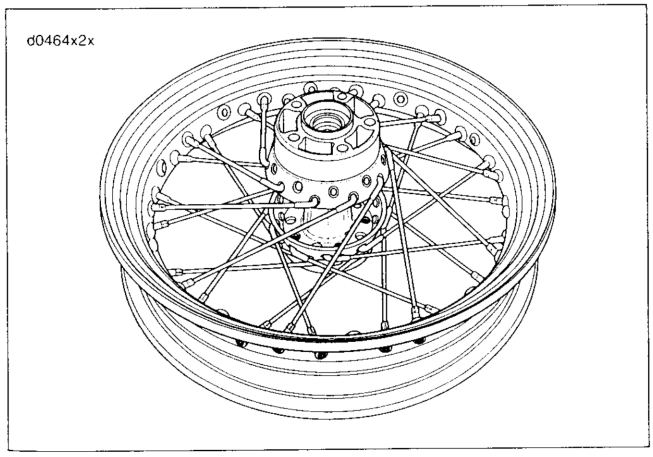


Figure 2-26.

9. Insert any **upper** row spoke into hub and angle spoke counterclockwise. Place spoke into appropriate rim hole.

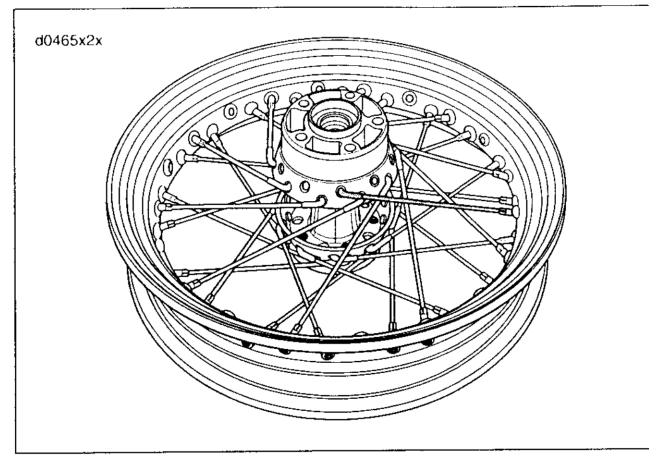


Figure 2-27.

10. Install remaining nine upper row spokes.

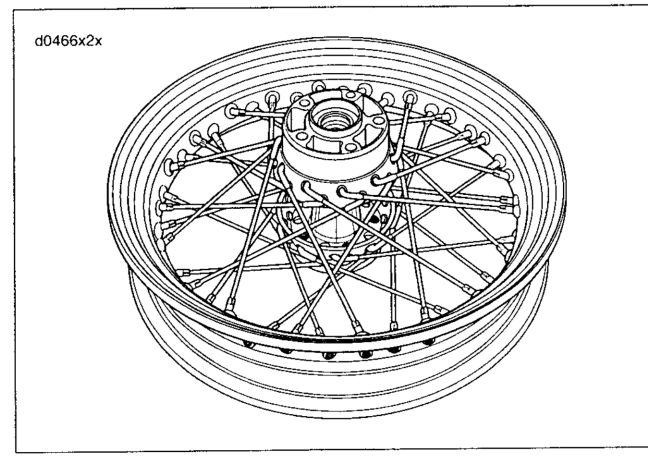


Figure 2-28.

11. Tighten spoke nipples to 40-50 **in-lbs** (4.5-5.6 Nm).
12. True wheel. See 2.10 TRUING LACED WHEEL.

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.
   - Inner spokes have long heads.
   - Outer spokes have short heads.

⚠WARNING

Avoid using oils that attack or contribute to the deterioration of rubber materials. Use of unsuitable oils may lead to premature tire failure, which could result in death or serious injury.

2. Lubricate spoke threads and nipple shoulders with tire mounting lubricant.
3. See Figure 2-29. 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 2-30. 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.
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).
   - 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 2-31. 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.*

9. Center the rim over the hub assembly.

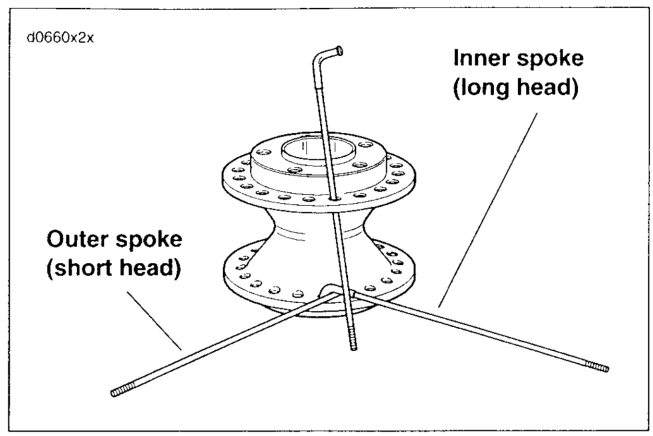


Figure 2-29. Lacing 19-in. Wheel Hub

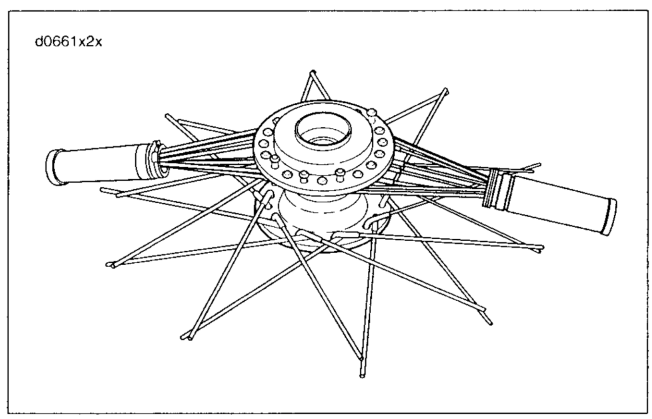


Figure 2-30. Bundling Top Spokes

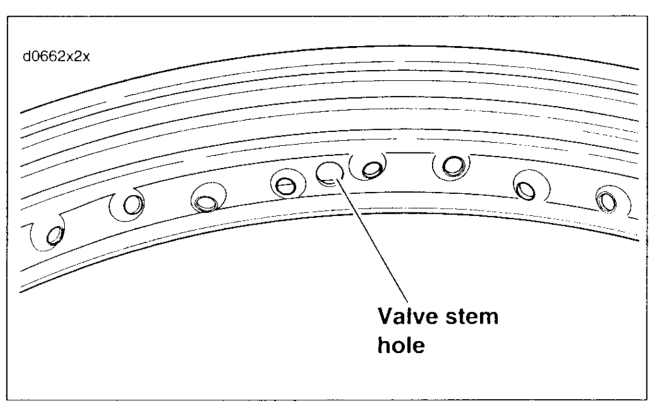


Figure 2-31. Valve Stem Location

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.

10. Straighten any spokes that were accidentally bumped or moved on the bottom flange.
11. Work with the bottom flange of outer spokes (short head) first.
12. See Figure 2-32. 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 2-33. Once you have completed lacing the bottom row of outer spokes (short head) double check for three empty holes in between each spoke.
13. Work with bottom flange inner spokes (long head) next. Choose a beginning spoke closest to the valve stem hole.
    a. See Figure 2-34. Each inner spoke (long head) crosses four outer spokes (short head).
    b. See Figure 2-35. 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).

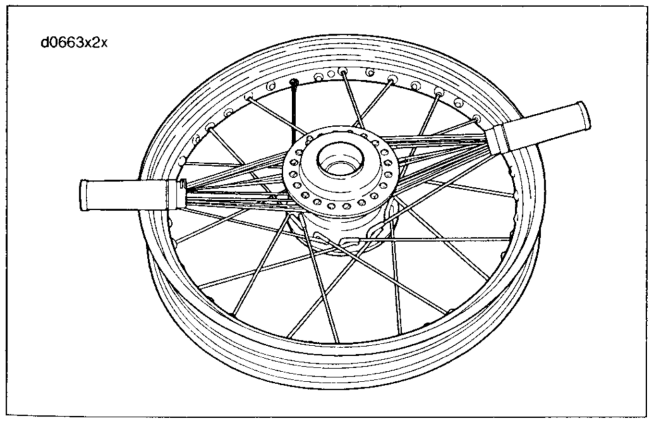


Figure 2-32. Beginning Spoke-Bottom Flange Outer

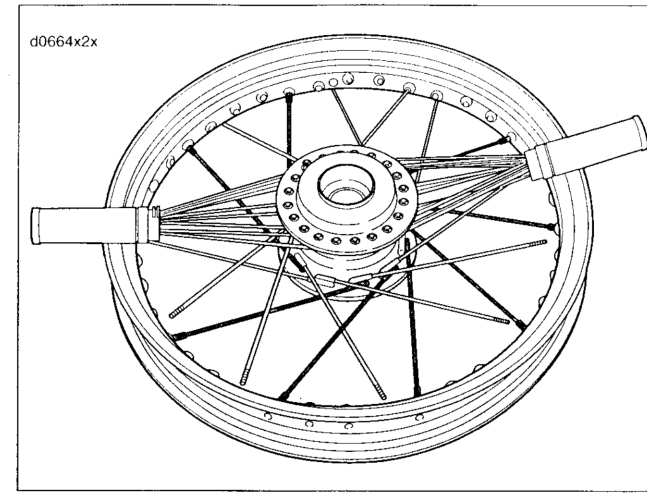


Figure 2-33. Completed Spokes-Bottom Flange Outer

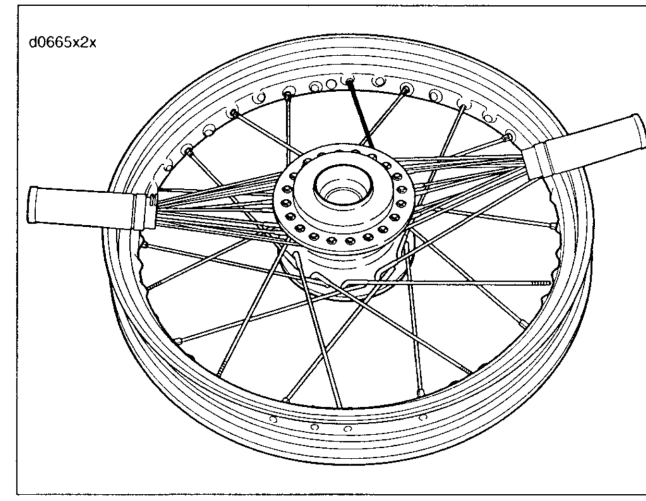


Figure 2-34. Beginning Spoke-Bottom Flange Inner

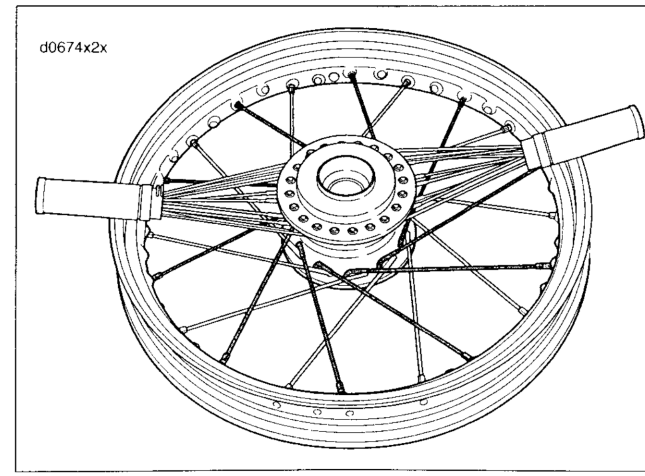


Figure 2-35. Completed Spokes-Bottom Flange Inner

14. See Figure 2-36. Undo each top bundle and fan the spokes out (in a starburst pattern) around the top rim edge.
15. See Figure 2-37. 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.

16. 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 2-38. Verify spoke reaches spoke nipple and secure spoke by hand. Follow pattern to complete top flange inner spokes (long head).
    b. See Figure 2-39. Once you have completed the top flange of inner spokes (long head) double check for one empty hole after every third spoke.

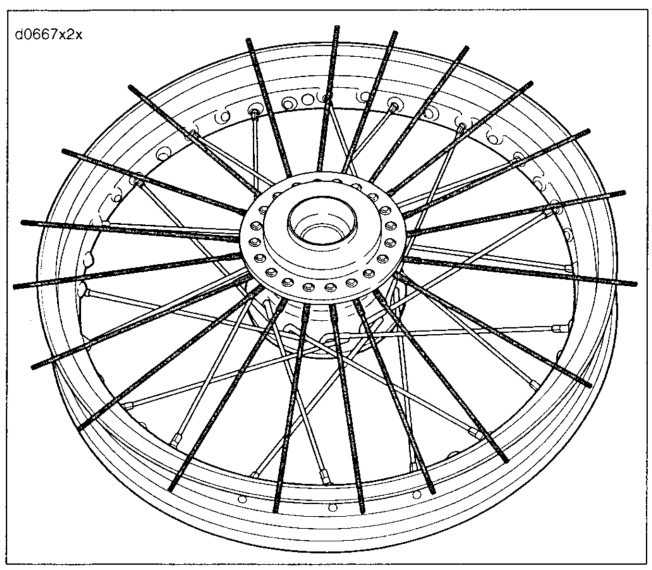


Figure 2-36. Fanning Top Flange Spokes

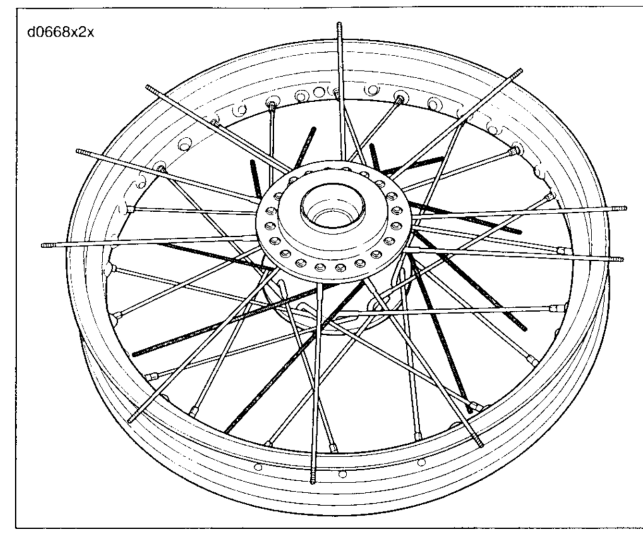


Figure 2-37. Setting Top Flange Inner Spokes

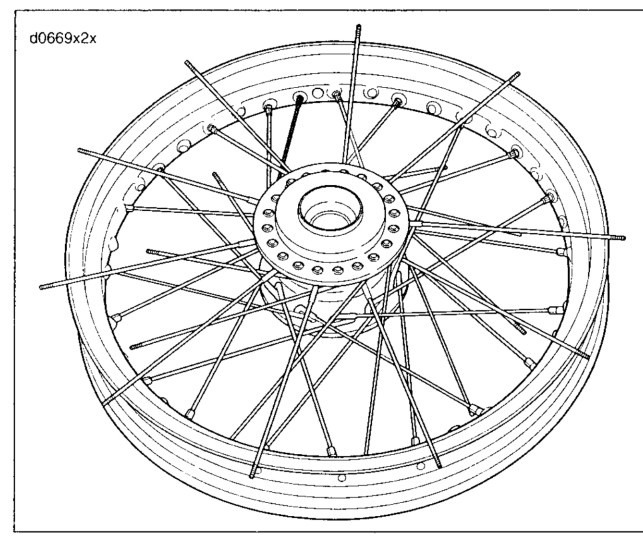


Figure 2-38. Beginning Spoke-Top Flange Inner

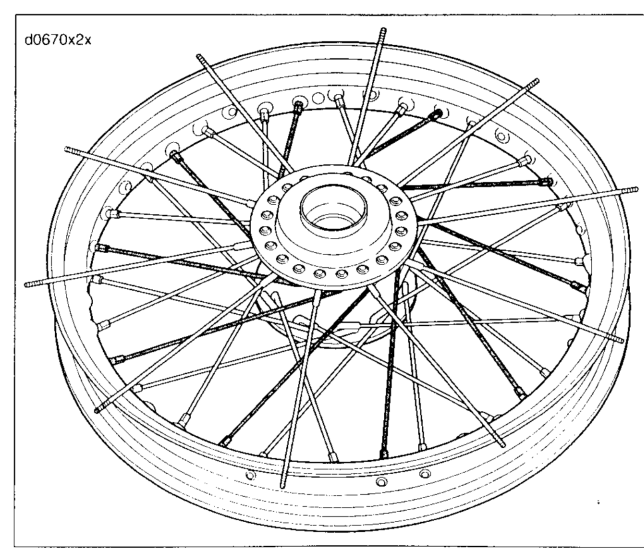


Figure 2-39. Completed Spokes-Top Flange Inner

17. See Figure 2-40. 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.
    - See Figure 2-41. Verify spoke reaches spoke nipple and secure spoke by hand. Follow pattern to complete top flange outer spokes (short head).
18. Tighten spoke nipples to 40-50 **in-lbs** (4.5-5.6 Nm).
19. True the wheel. See TRUING LACED WHEEL.

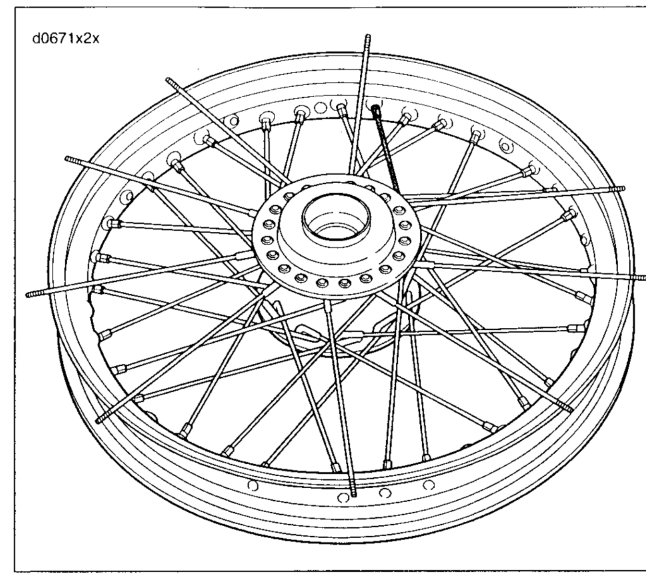


Figure 2-40. Beginning Spoke-Top Flange Outer

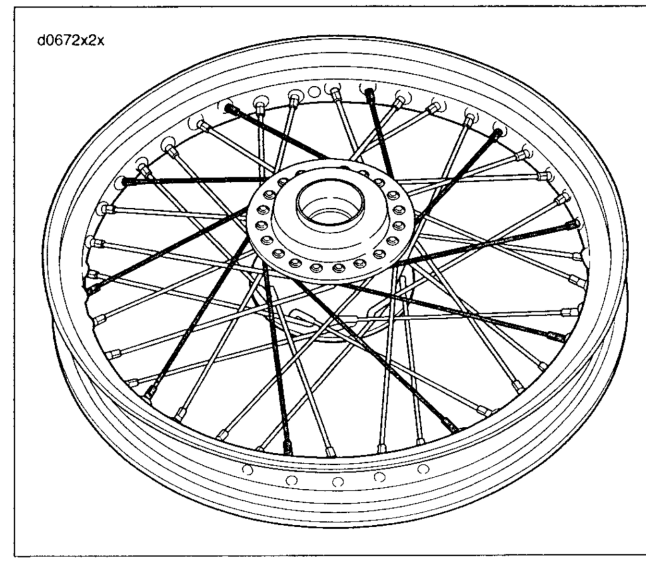


Figure 2-41. Completed Spokes-Top Flange Outer

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.

⚠WARNING

Avoid using oils that attack or contribute to the deterioration of rubber materials. Use of unsuitable oils may lead to premature tire failure, which could result in death or serious injury.

PROCEDURE

1. See Figure 2-42. Place the hub on table with brake disc side (wide flange) down. Insert a spoke in each hole of the **lower** row as shown below. Angle spokes clockwise.

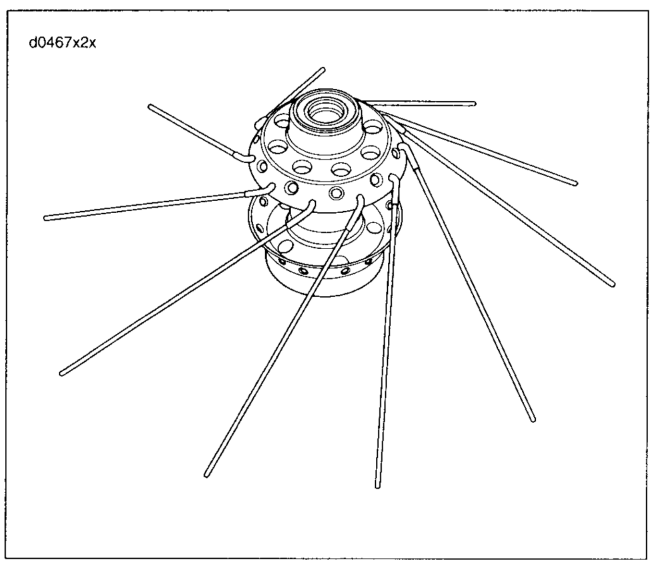


Figure 2-42.

2. Center the rim over the hub assembly with the valve stem hole facing upward.
3. See Figure 2-43. 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 2-44. Install the rest of lower row spokes in every fourth hole.
5. See Figure 2-45. 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.

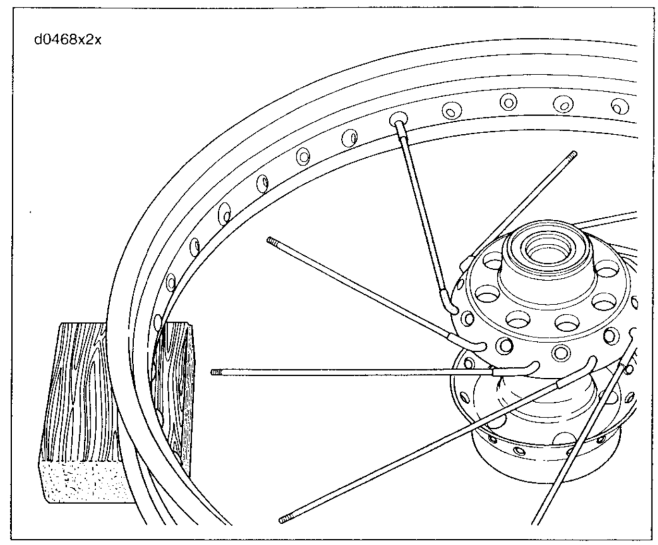


Figure 2-43.

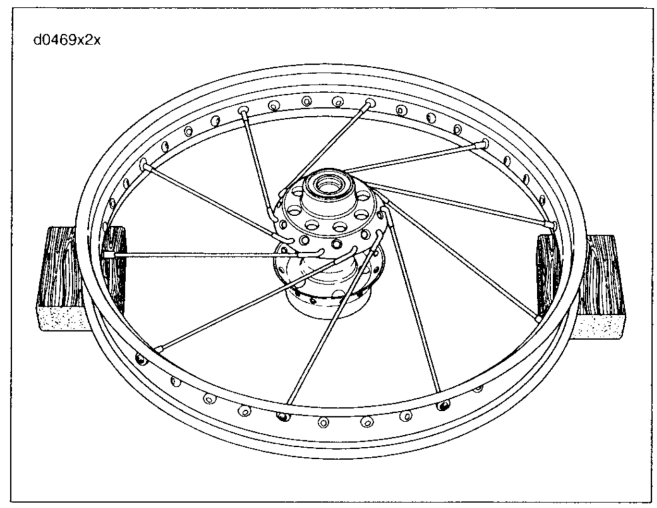


Figure 2-44.

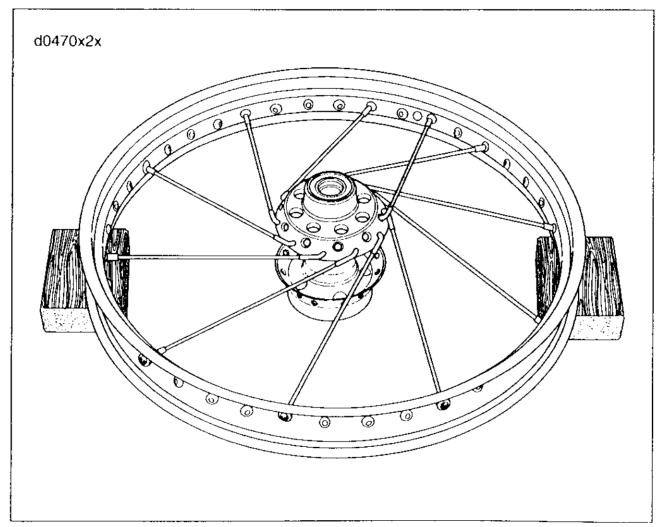


Figure 2-45.

6. See Figure 2-46. Install the remaining nine upper row spokes into every fourth remaining hole above the rim centerline. This completes spoke installation on this side.

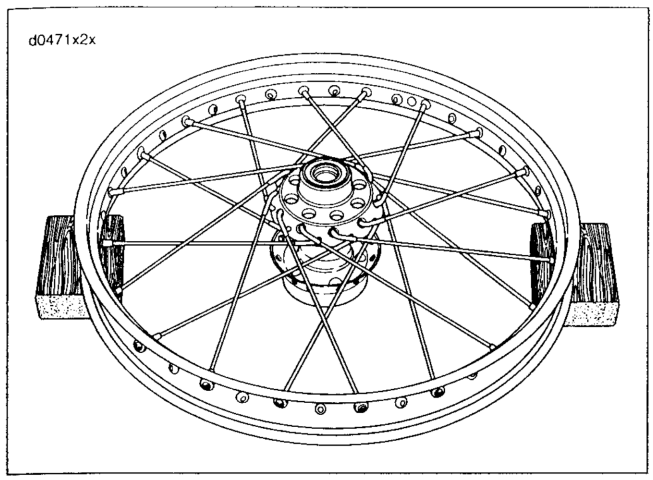


Figure 2-46.

7. See Figure 2-47. 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.

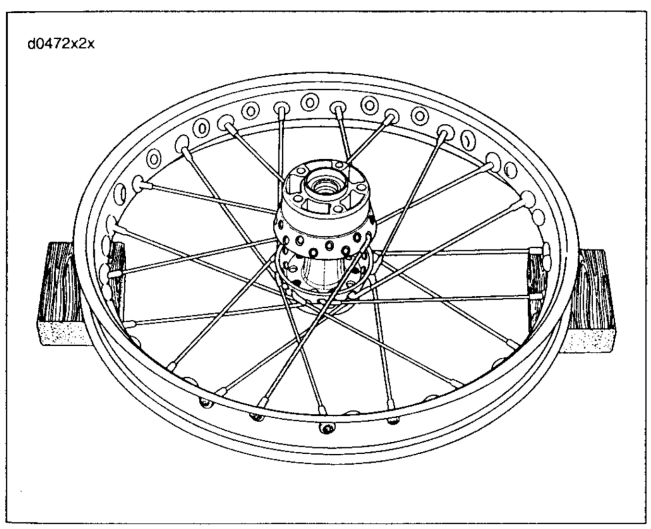


Figure 2-47.

8. See Figure 2-48. Place the remaining nine lower row spokes, angled clockwise, into hub and rim.

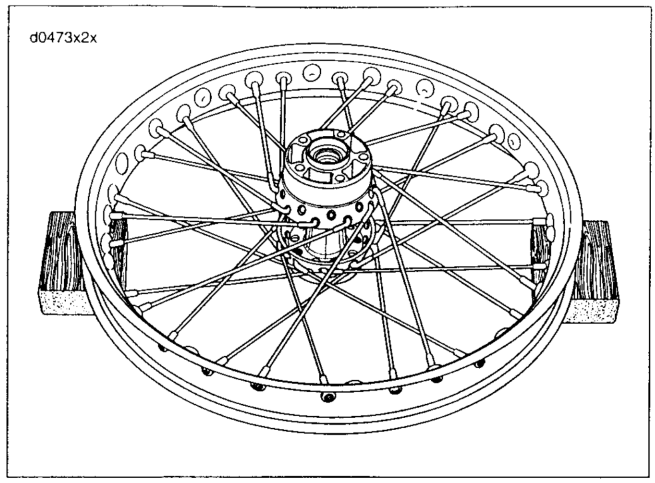


Figure 2-48.

9. See Figure 2-49. Insert any **upper** row spoke into hub and angle spoke counterclockwise into appropriate rim hole. Install remaining upper row spokes.

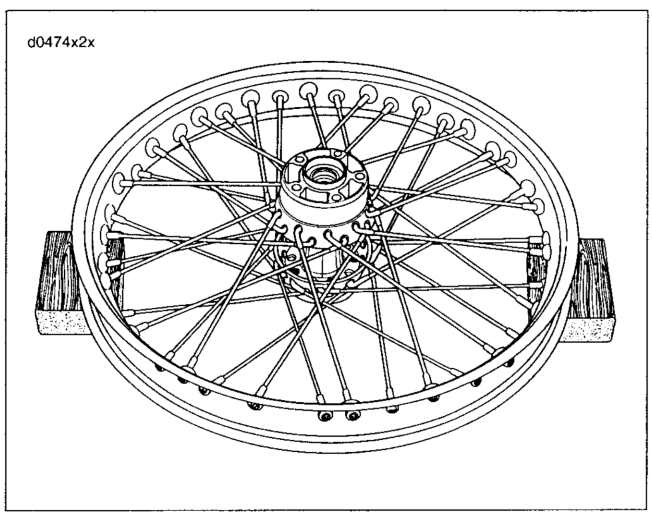


Figure 2-49.

10. Tighten spoke nipples to 40-50 **in-lbs** (4.5-5.6 Nm).
11. True wheel. See 2.10 TRUING LACED WHEEL.

GENERAL

PART NO.	SPECIALTY TOOL
HD-99500-80	Wheel truing stand
HD-94681-80	Spoke wrench

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

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 2-50. 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. Lay a straightedge across hub brake disc flange and one of the marked spoke groups. Measure distance "A" from the straightedge to the location shown in Figure 2-51.
   - The **FRONT WHEEL** offset dimension, distance "A", must be as listed in Table 2-1.

Table 2-1. Offset Dimensions

WHEEL	RIM SIZE	IN.	MM.
Front	21	1.640-1.660	41.656-42.164
	19	0.837-0.857	21.260-21.768
Rear	16	1.472-1.492	37.389-37.897

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.

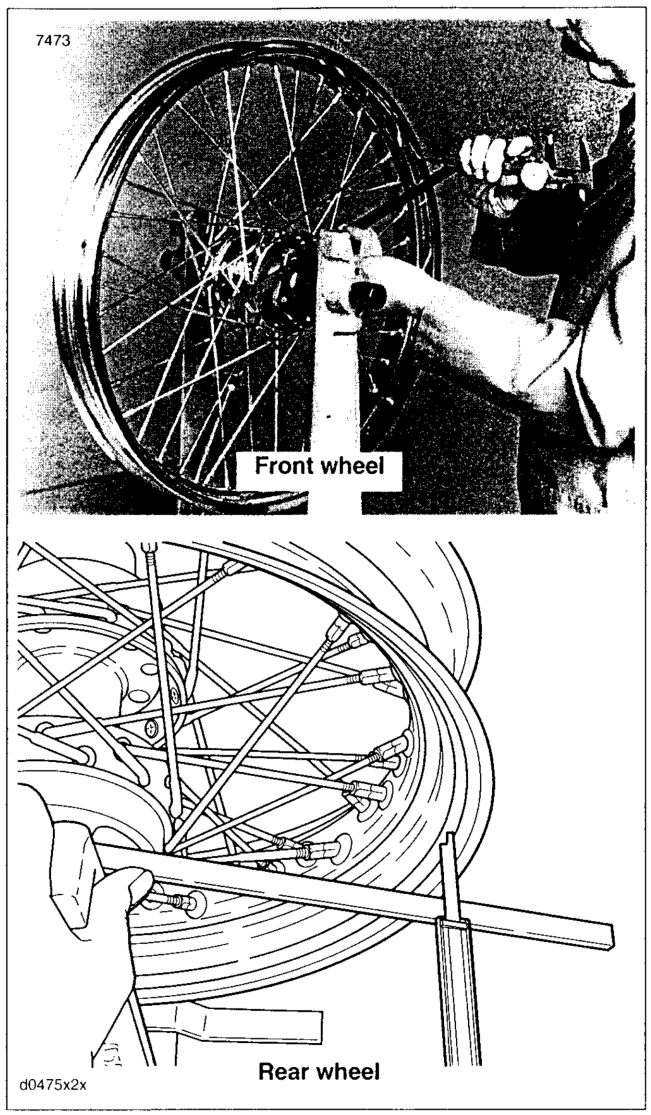


Figure 2-50. Check Laced Hub Offset Dimension

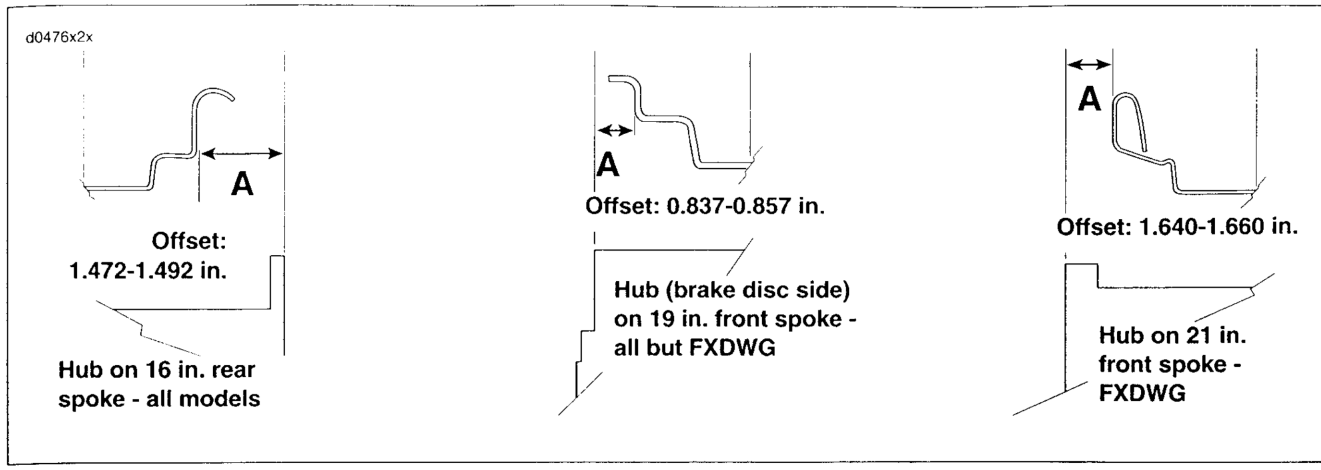


Figure 2-51. Laced Hub Offset Dimension

RADIAL TRUING

1. See Figure 2-52. Adjust truing stand gauge to the rim's tire bead seat as shown. The rim should be trued within 0.031 in. (0.79 mm).
2. Spin the rim slowly. 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.
3. 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.
4. 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.
5. 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.

CAUTION

Do not tighten spokes too tight, or nipples may be drawn through rim, or hub flanges may be distorted. Tighten spokes to 40-50 in-lbs (4.5-5.6 Nm). If spokes are left too loose, they will continue to loosen when wheel is put into service.

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.

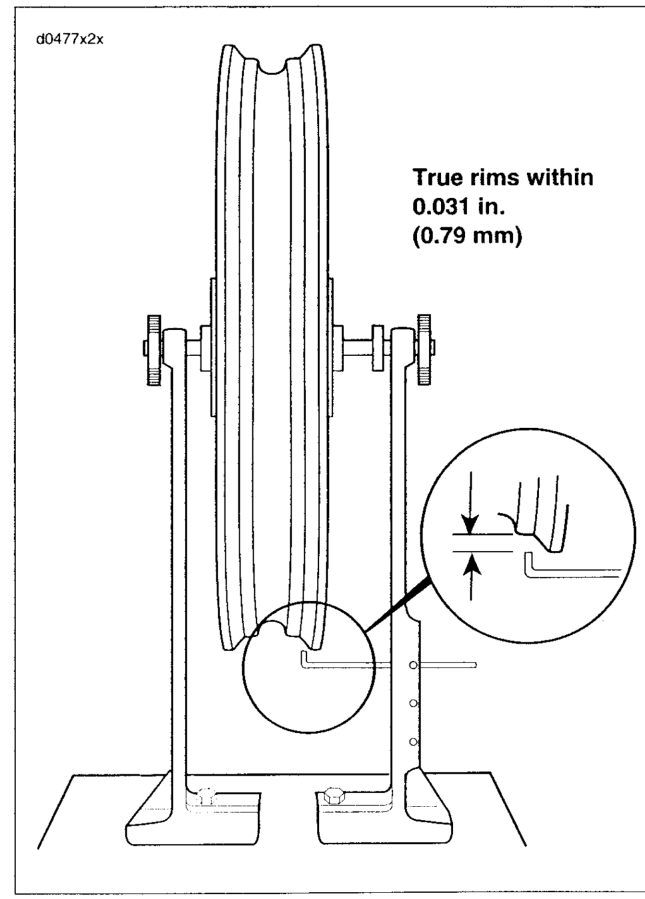


Figure 2-52. Truing Rim Radially

GENERAL

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

LATERAL RUNOUT

See Figure 2-53. 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 0.040 in. (1.02 mm), replace the wheel.

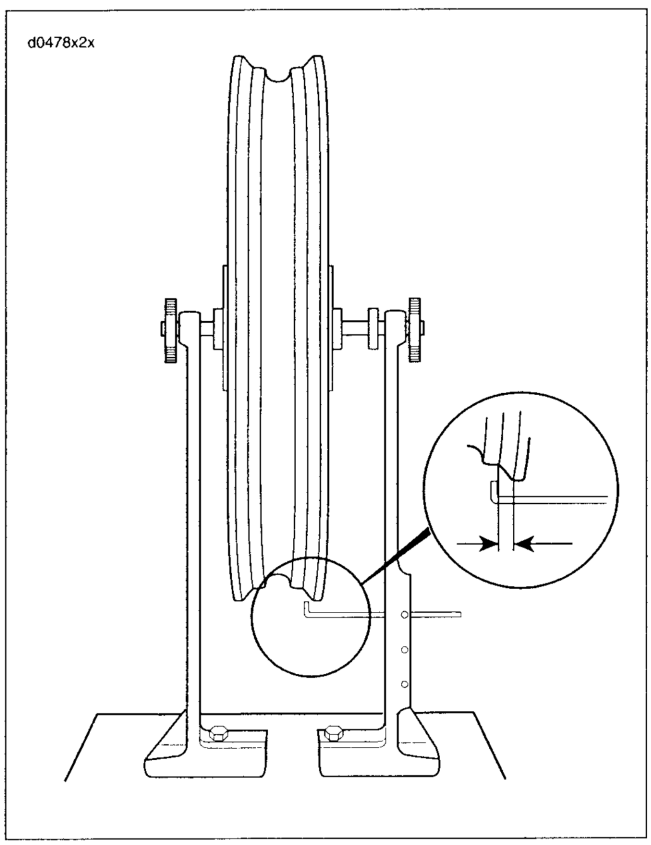


Figure 2-53. Checking Lateral Runout

RADIAL RUNOUT

See Figure 2-54. Check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in. (0.76 mm).

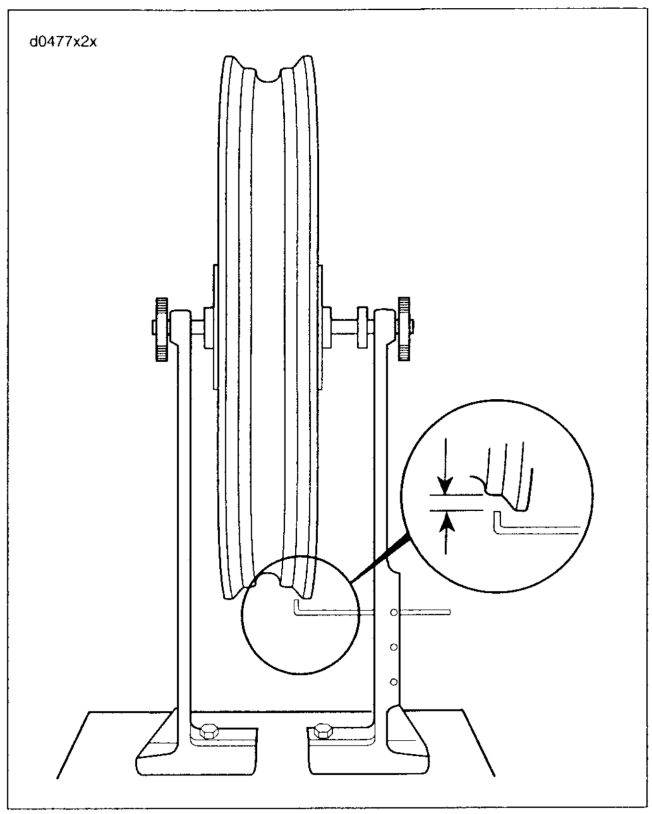


Figure 2-54. Checking Radial Runout

GENERAL

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

⚠WARNING

Harley-Davidson recommends replacement of any tire punctured or damaged. In some cases small punctures in the tread area may be repaired from within the demounted tire by your 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). In emergency situations, if a temporary repair is made, ride slowly with as light a load as possible until the tire is permanently repaired or replaced. Failure to heed this warning could result in death or serious injury.

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.

Acceptable repair methods include a patch and plug combination, chemical or hot vulcanizing patches or head-type plugs. When repairing tubeless tires, use TIRE SPREADER (Part No. HD-21000) to spread the tire sidewalls.

⚠WARNING

- **Never repair a tire with less than 1/16 in. (1.6 mm) tread depth. Inadequate tread depth can cause an accident which could result in death or serious injury.**
- **Always check both tire sidewalls for arrows indicating proper forward tire rotation. Some tires require different tire rotation depending on whether tire is used on front or rear wheel. Improper mounting can result in premature tire failure and handling problems, which could cause an accident resulting in death or serious injury.**

REMOVAL

1. Remove wheel from motorcycle.
2. Let the air out of the tire.
3. Loosen both tire beads from rim flange. In most cases, a bead breaker machine will be required to loosen the bead from the rim.
4. See Figure 2-55. Using tire tools (not sharp instruments), and RIM PROTECTORS (Part No. HD-01289) start upper bead over edge of rim at valve. Do not use excessive force when starting bead over rim. Bead wires may be damaged ruining the tire. Repeat all around rim until first bead is over rim.

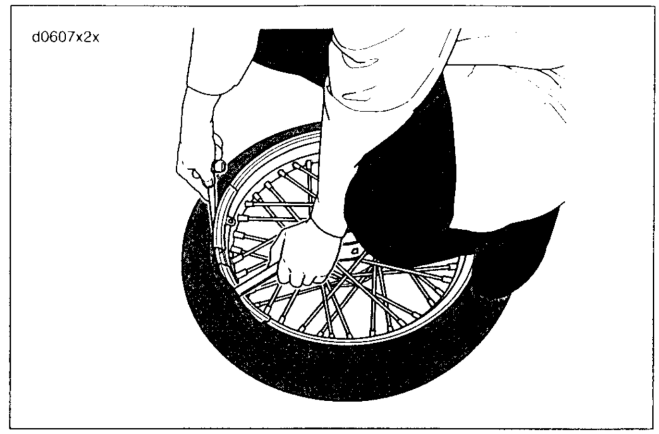


Figure 2-55. Starting Tire Off Rim

NOTE

It is not necessary to use tools to remove tubeless tires. Make sure beads are well lubricated before removing from rim.

CAUTION

If tire tools are used, take care not to damage the tire and rim sealing surfaces. Use RIM PROTECTORS (Part No. HD-01289) to protect rims.

5. Push lower bead into rim well on one side and insert tire tool underneath bead from opposite side. Pry bead over rim edge. Remove tire from rim.

NOTE

It is not always necessary to completely remove tire from rim. Removing one side allows the tire to be inspected.

CLEANING AND INSPECTION

1. Clean the inside of tire and rim.
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Inspect the tire for wear.

REPLACEMENT

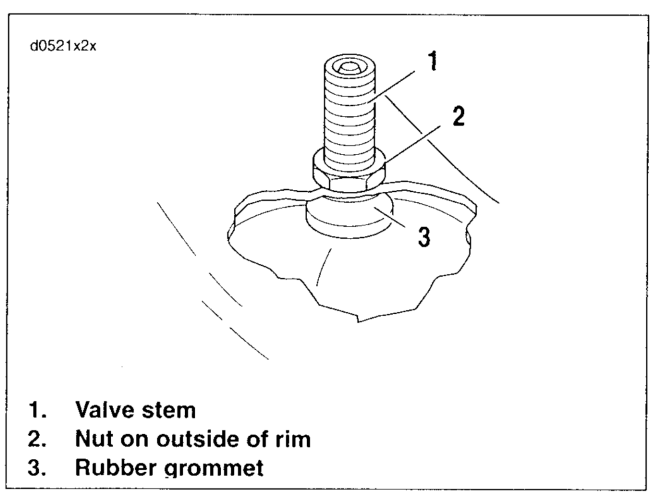
Always replace tires when 1/32 inch (0.8 mm) or less of tire tread remains, determined by the appearance of tire wear indicator bars. See TIRE REPLACEMENT under 1.9 TIRES AND WHEELS.

INSTALLATION

⚠WARNING

- **Use the correct tire. Your Harley-Davidson dealer has the latest information regarding appropriate replacement parts.**
- **Only install original equipment (stock) tire valves and valve caps. A valve or valve and cap combination that is too long may interfere with (strike) adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation could cause loss of control and could result in death or serious injury.**
- **Aftermarket valve caps that are heavier than the stock cap may have clearance at slow speeds; but, at high speed the valve/cap will be moved outward by centrifugal force. This outward movement could cause the valve/cap to strike the adjacent components, damage the valve and cause rapid tire deflation. Rapid tire deflation could cause loss of control and could result in death or serious injury.**
- **Damaged or leaking valves must be replaced.**

1. See Figure 2-56. Place rubber grommet (3) on valve stem (1) with shoulder in recess of the valve stem head.
   a. Insert valve stem center facing away from rim.
   b. Install nut (2). Tighten to 12-15 **in-lbs** (1.4-1.7 Nm).



1. **Valve stem**
2. **Nut on outside of rim**
3. **Rubber grommet**

Figure 2-56. Valve Stem

2. Thoroughly lubricate the rim flanges and both beads of the tire with tire lubricant. Install RIM PROTECTORS, (Part No. HD-01289) to prevent scarring rims.
3. See Figure 2-57. Starting at the valve stem, start the first bead into the rim well. Work the bead on as far as possible by hand. Use the tire tool to pry the remaining bead over the rim flange. If tire has colored dot on sidewall, it is a balance mark and should be located next to valve stem hole.
4. See Figure 2-58. Starting 180 degrees from the valve stem, start the second bead onto the rim. Work the bead onto the rim with tire tools, working toward valve in both directions. Remove the valve core from the rim hole before prying the remaining bead over the rim flange.

⚠WARNING

Do not inflate more than 40 psi (276 kPa) to seat the beads. Inflating the tire more than 40 psi (276 kPa) to seat the beads can cause the tire rim assembly to burst with force sufficient to cause death or serious injury. If the beads fail to seat at 40 psi (276 kPa), deflate and relubricate the bead and rim and reinflate to seat the beads but do not exceed 40 psi (276 kPa).

5. Inflate the tire to recommended pressure to seat the bead. See 1.9 TIRES AND WHEELS.
6. Use BEAD EXPANDER (Part No. HD-28700) to seat beads.

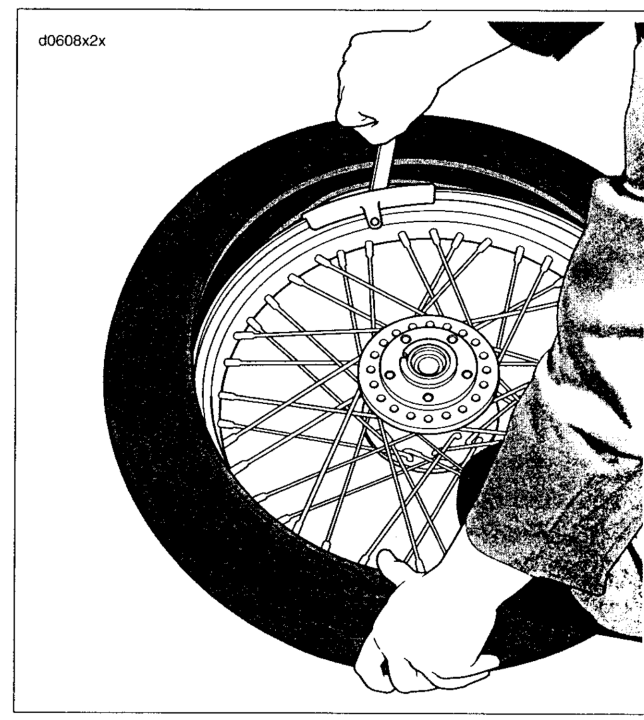


Figure 2-57. Starting Bead on Rim

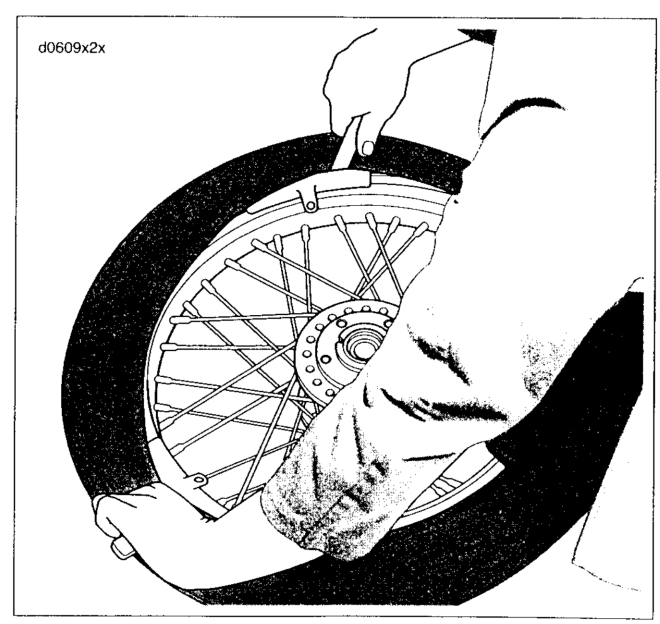


Figure 2-58. Starting Second Bead on Rim

CHECKING TIRE RUNOUT

Radial Runout

1. See Figure 2-59. Check runout by turning wheel on axle, measuring amount of radial displacement from a fixed point near the tire.
2. Maximum tire tread runout is 0.090 in. (2.29 mm). If tire tread runout exceeds 0.090 in. (2.29 mm), remove tire from rim and check rim runout to see if rim is at fault. See 2.10 TRUING LACED WHEEL or 2.11 CAST WHEEL RUNOUT.

NOTE

Make sure bead is properly seated on rim. Deflate and reseat tire if necessary.

3. If rim runout is less than 0.031 in. (0.79 mm), tire is at fault and should be replaced. If rim runout is more than 0.031 in. (0.79 mm), correct by replacing cast wheel or truing laced wheel.

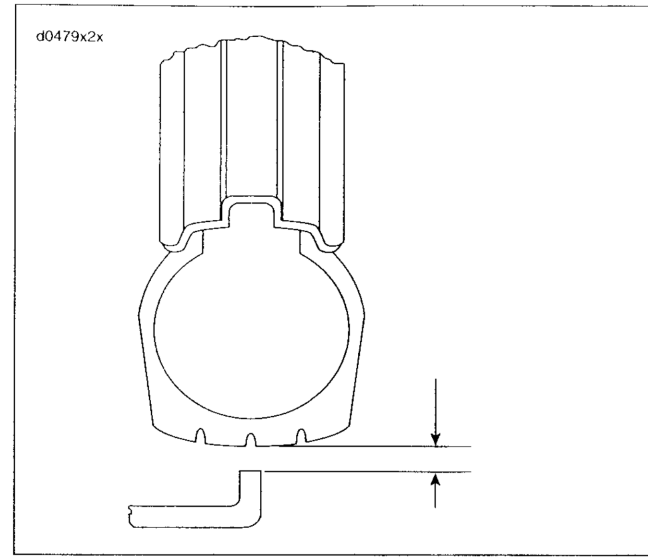


Figure 2-59. Radial Tire Runout

Lateral Runout

1. See Figure 2-60. Check runout by turning wheel on axle, measuring tread runout.
2. Maximum tire tread runout is 0.080 in. (2.03 mm). If tire tread runout exceeds 0.080 in. (2.03 mm), remove tire from rim and check rim bead runout to see if rim is at fault. See 2.10 TRUING LACED WHEEL or 2.11 CAST WHEEL RUNOUT.

NOTE

Be sure bead is properly seated on rim. Deflate and reseat tire if necessary.

3. If rim bead runout is less than 0.031 in. (0.79 mm), tire is at fault and should be replaced. If rim bead runout is more than 0.031 in. (0.79 mm), correct by replacing cast wheel or truing laced wheel.

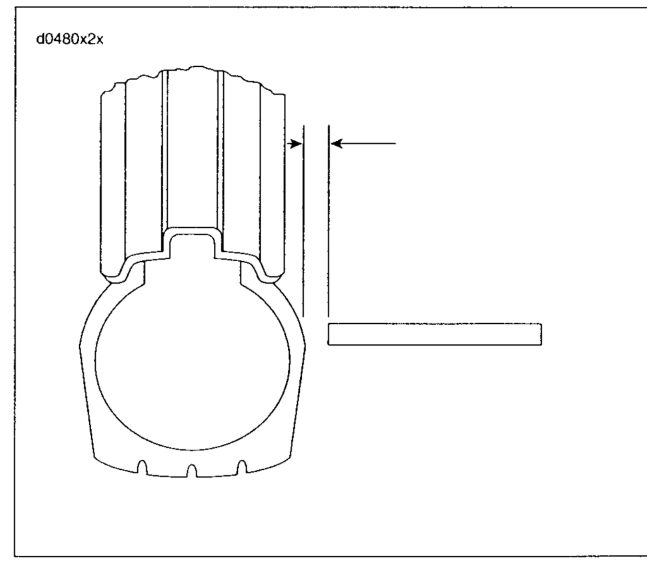


Figure 2-60. Lateral Tire Runout

WHEEL BALANCING

Wheels must be balanced to improve handling and reduce vibration, especially at high road speeds. Cast aluminum wheels require special self-adhesive weights. See Table 2-2.

Table 2-2. Wheel Weights and Colors

WEIGHT	1 oz. (28 g)	0.5 oz (14 g)	0.25 oz (7 g)
Gold	yes	yes	no
Silver	no	yes	yes
Black	no	no	yes

1. Self adhesive wheel weights should be applied to the flat surface of the rim. Be sure that application area is completely clean, dry and free of oil and grease.
2. Remove paper backing from weight and apply 3 drops of Loctite 420 (Superbonder) to the adhesive side of the weight. Place the weight on the rim, press firmly in place and hold for 10 seconds. Full adhesive cure takes 8 hours.

NOTE

If 1 oz. (28 g) or more weight must be added at one location, split the amount so that half is applied to each side of the rim. Wheel should not be used for 8 hours to allow adhesive to cure completely.

3. In most cases, static balancing using WHEEL TRUING STAND (Part No. HD-95500-80) will produce satisfactory results. However, dynamic balancing, utilizing a wheel spinner, should be used to produce finer tolerances for best high and low speed handling characteristics. Follow the instructions supplied with the balance machine you are using. Wheels should be balanced to within 0.5 oz. (14 g) at 60 MPH (97 km/h). The maximum permissible weight to accomplish balance is 3.5 oz. (99 g) total.

INSPECTION

⚠WARNING

Vehicle alignment is very important to assure proper handling and vibration control. Improper alignment could lead to an accident which could result in death or serious injury.

NOTE

Check the stabilizer for wear every 10,000 miles (16,000 km).

1. Verify wheels are true to specifications. See 2.10 TRUING LACED WHEEL or 2.11 CAST WHEEL RUNOUT.
2. Check steering head bearing adjustment and adjust if necessary. See 1.17 STEERING HEAD BEARINGS.
3. See Figure 2-62. To ensure accurate measurements, obtain a piece of 1/8 in. (3.2 mm) aluminum welding rod 11 in. (280 mm) long. Grind one end down to a blunt point. With a pliers, bend the rod 90 degrees as shown. Place a snug fitting grommet on the rod to act as a slide measurement indicator.
4. See Figure 2-61. With the blunt point of the alignment tool inserted in the rear fork pilot hole, slide the rubber grommet along the tool until it is aligned with the center of the axle as shown. Repeat for the other side of the motorcycle.
5. See Figure 2-63. The measurement between the center of the rear axle and the rear fork hole must be equal to within 1/32 in. 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.

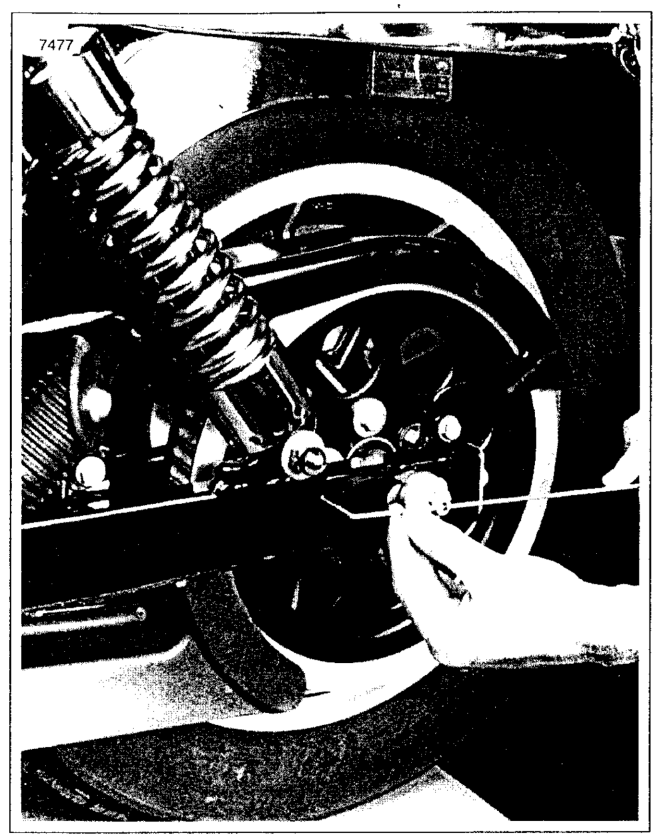


Figure 2-61. Measuring Alignment

6. 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.

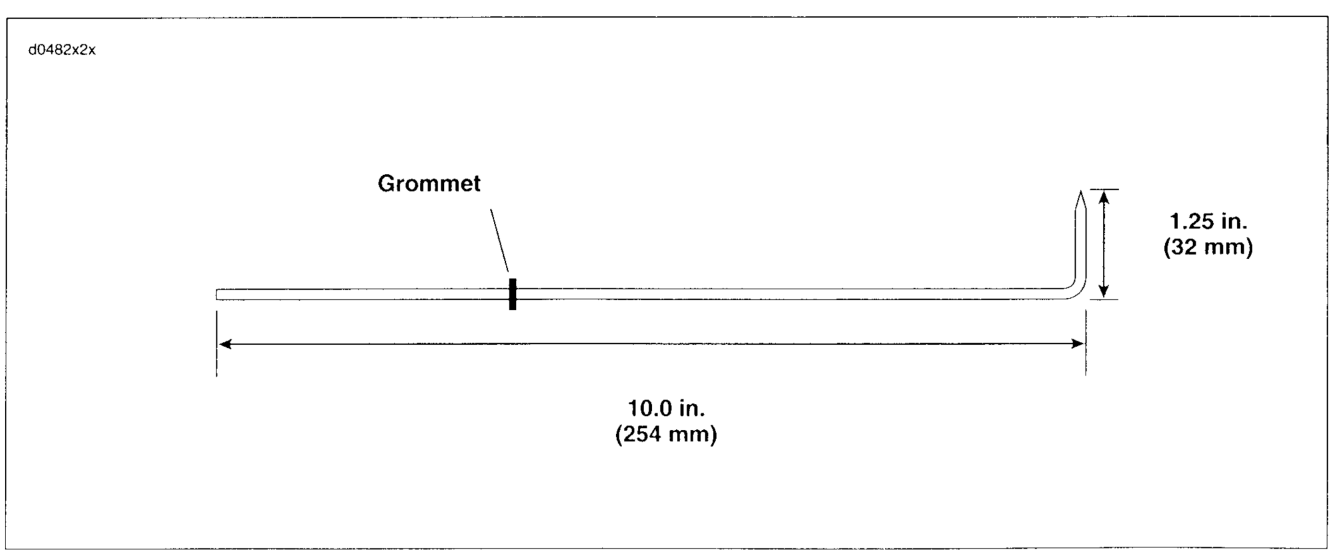


Figure 2-62. Alignment Tool

7. See Figure 2-64. Remove the bolt (2) which attaches the top stabilizer link (1) to the engine mounting bracket.
8. Position front wheel so brake disc is vertical using an inclinometer. If possible, use a digital inclinometer for the best accuracy.

NOTES

- *The exhaust system must be in place while performing the following steps.*
- *Motorcycle must be upright and level before performing this procedure.*

CAUTION

The Dyna Glide stabilizer link should only be loosened/adjusted on one end. There is one end that has threads showing. Adjust this end only. Do not loosen/adjust the other end or the isolator will tear.

9. Loosen jamnut (3) on stabilizer link. Adjust the stabilizer so that the bolt removed in step 7 can be reinstalled without pushing the engine to the right or left. Tighten jamnut.
10. Check the rear brake disc with the inclinometer to ensure that it is parallel to the front brake disc.

IF THE ABOVE STEPS DO NOT ALIGN VEHICLE:

11. 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.
12. If you cannot adjust the front and rear brake discs to within 1 degree, inspect the frame, front fork and/or rear fork for damage.

⚠WARNING

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. If there is not this minimum clearance, it is possible for the bolt head to damage the fuel tank, which could result in death or serious injury.

13. 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.
14. Tighten the stabilizer jamnut (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:

15. Be sure the transmission is in neutral.
16. 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.
17. Tighten isolator mounting bolts to 25 ft-lbs (33.9 Nm).

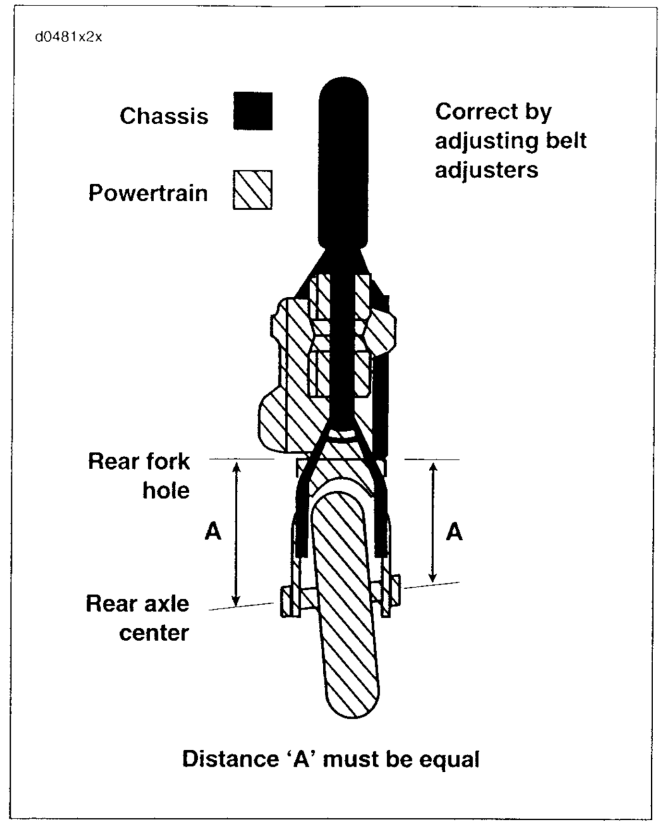
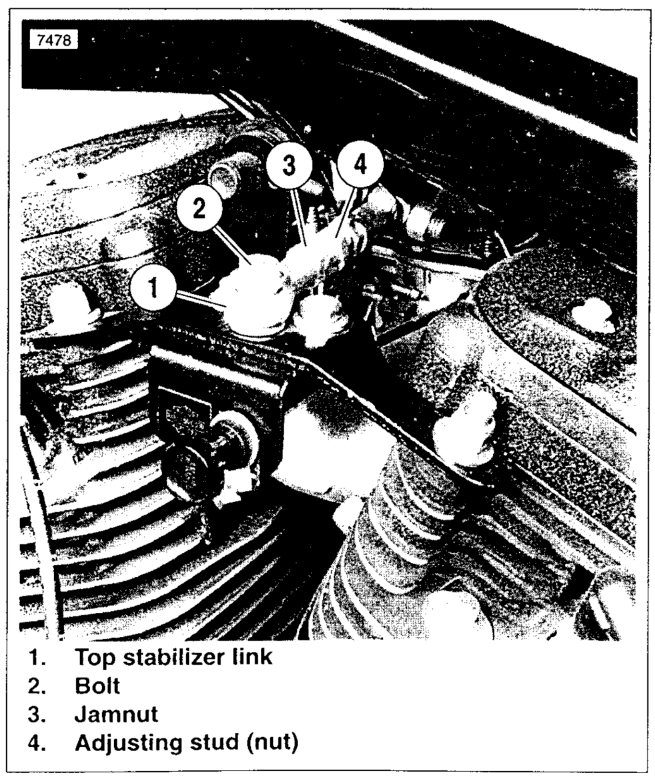


Figure 2-63. Rear Wheel Misaligned



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

Figure 2-64. Top Stabilizer

GENERAL

⚠WARNING

Do not use an 11/16 in. bore master cylinder assembly on single disc (one caliper) models. These master cylinder assemblies are not interchangeable. Using the wrong assembly can adversely affect braking efficiency or result in brake failure which could result in death or serious injury.

See Figure 2-65. Master cylinders designed for dual disc (two caliper) operation have an 11/16 inch (17.5 mm) bore, while those that are designed for single disc (one caliper) operation have a 9/16 inch (14.3 mm) bore. The bore size is stamped on the master cylinder assembly inboard of the handlebar clamp bracket.

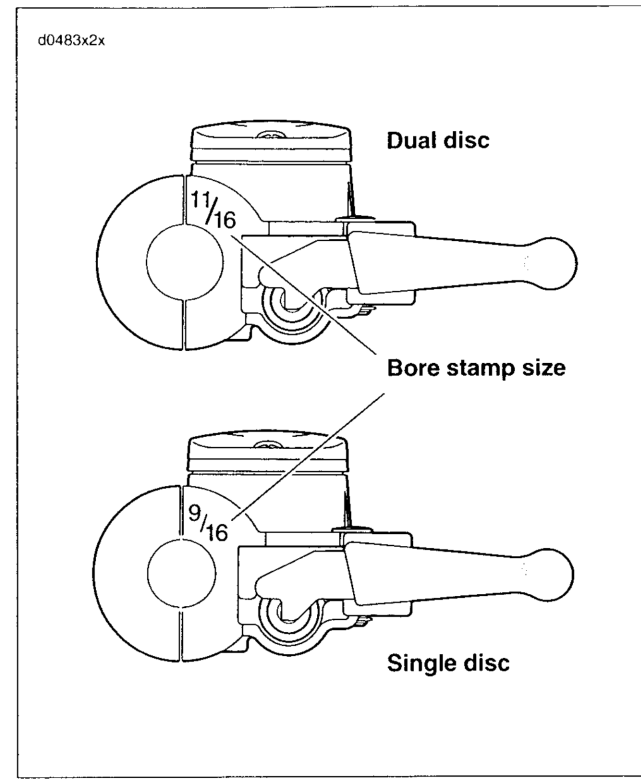


Figure 2-65. Bore Sizes

REMOVAL/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

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

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

CAUTION

Do not remove the master cylinder assembly without first placing a 5/32 inch (4 mm) thick cardboard insert between the brake lever and lever bracket. Removal without the insert may result in damage to the rubber boot and plunger of the front stoplight switch.

3. See Figure 2-66. Place the cardboard insert between the brake lever and lever bracket.
4. See Figure 2-67. Remove the two T27 TORX screws with flat washers (9) to detach the handlebar clamp (8) from the master cylinder reservoir (14).

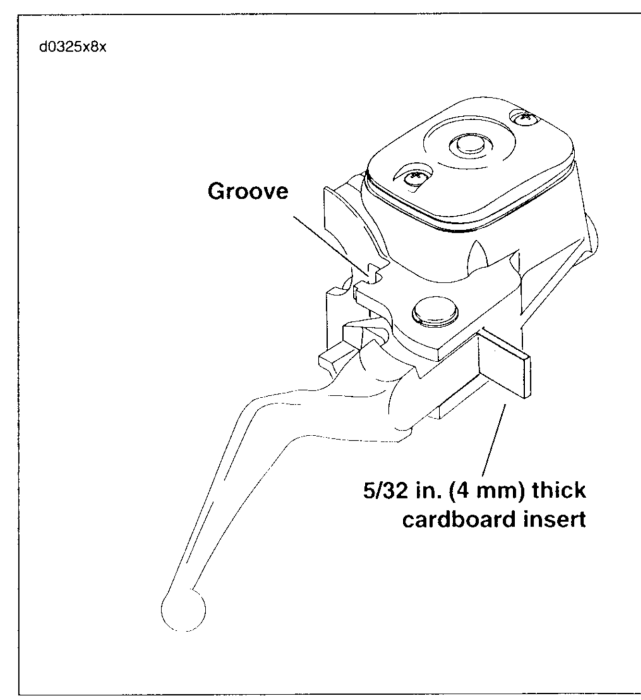


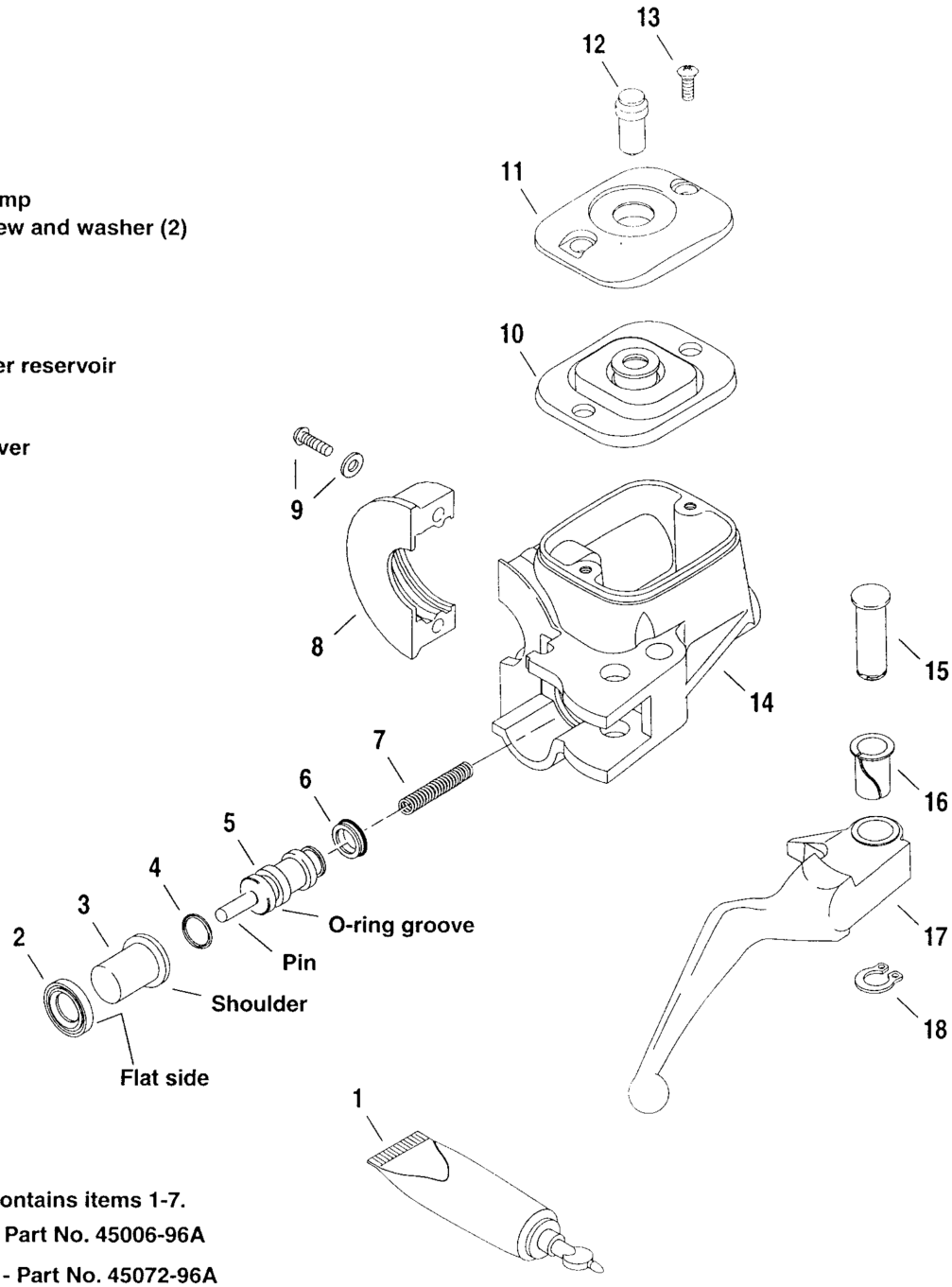
Figure 2-66. Cardboard Insert

⚠WARNING

Always wear proper eye protection when removing retaining rings. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

5. Remove retaining ring (18) from pivot pin groove at bottom of master cylinder bracket.

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



Service parts kit contains items 1-7.

- **9/16 in. bore - Part No. 45006-96A**
- **11/16 in. bore - Part No. 45072-96A**

Figure 2-67. Front Brake Master Cylinder

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).

CAUTION

To prevent dirt and other contaminants from entering the master cylinder reservoir, thoroughly clean the cover before removal.

11. Remove both screws (13), cover (11) and the cover gasket (10).

CLEANING AND INSPECTION

⚠WARNING

Do not use replacement parts from dual caliper repair kits (11/16 inch bore) on single caliper models. Parts are not interchangeable. Using the wrong replacement parts can adversely affect braking efficiency or result in brake failure which could result in death or serious injury.

1. Always reassemble the master cylinder using new parts from the correct repair kit (9/16 inch bore- HD Part No. 45006-96A; 11/16 inch bore- HD Part No. 45072-96A).

⚠WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This may result in improper brake operation which could result in death or serious injury.

2. Clean all parts with denatured alcohol or D.O.T. 5 SILICONE 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/INSTALLATION

1. See Figure 2-67. Fit O-ring (4) into groove at front of piston (5) (pin side).
2. Fit primary cup (6) over lip at back of piston so that closed side (smaller OD) contacts shoulder.
3. Coat piston bore of housing 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 master cylinder bore so that it seats against the recess at bottom.
5. Slide piston over spring.
6. Fit wiper (2) over piston cap (3) so that the 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 cover (11) with gasket (10) on the master cylinder reservoir. Install two screws (13) to fasten the cover to the reservoir, 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

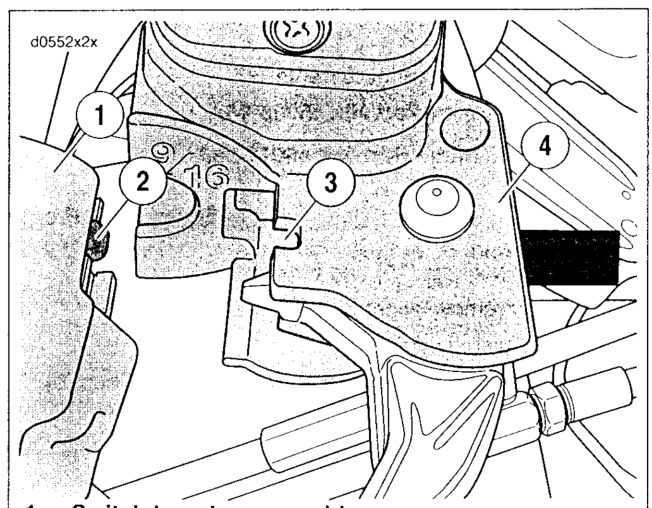
Always wear proper eye protection when installing retaining rings. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

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

CAUTION

See Figure 2-66. Do not install the master cylinder assembly without first placing the 5/32 in. thick cardboard insert (or cable strap eyelet) between the brake lever and lever bracket. Installation without the insert may result in damage to the rubber boot and plunger of the front stoplight switch.

12. See Figure 2-68. 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 both T27 TORX screws with flat washers. Position for rider comfort. Beginning with the top screw, tighten to 70-80 **in-lbs** (7.9-9.0 Nm).



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

Figure 2-68. Attach Master Cylinder To Right Handlebar Switches

CAUTION

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

14. Lubricate **new** steel/rubber washers with D.O.T. 5 SILICONE BRAKE FLUID. Position **new** steel/rubber washers on each side of hydraulic brake line fitting. Insert bolt through washers and fitting. Thread bolt into master cylinder housing and tighten to 17-22 ft-lbs (23.0-29.8 Nm).
15. Install length of clear plastic tubing over caliper bleeder valve, if removed. Place free end of tube in a clean container.
16. Remove the master cylinder cover. Stand the motorcycle upright so that the master cylinder is in a level position.

⚠CAUTION

Direct contact of D.O.T. 5 brake fluid with eyes may cause eye irritation, swelling and redness. 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. 5 brake fluid may cause digestive discomfort. If swallowed, obtain medical attention. Use in well ventilated area. KEEP OUT OF REACH OF CHILDREN.

17. Add D.O.T. 5 SILICONE BRAKE FLUID to the master cylinder reservoir until the fluid level is 1/8 inch (3.2 mm) from the top. Do not reuse old brake fluid. Use only D.O.T. 5 fluid from a sealed container.

⚠WARNING

Whenever the brake line is reconnected, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

18. Bleed brake system and tighten bleeder valve as directed. See 1.7 BLEEDING BRAKES.

⚠WARNING

Verify proper operation of the master cylinder relief port. A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and death or serious injury.

19. Verify proper operation of the master cylinder relief port. Actuate the brake hand lever with the cover removed. A slight spurt of fluid will break the surface if all internal components are working properly.
20. Install gasket and cover on master cylinder. Tighten cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).

⚠WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

21. 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 1.7 BLEEDING BRAKES.

NOTE

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

REMOVAL

CAUTION

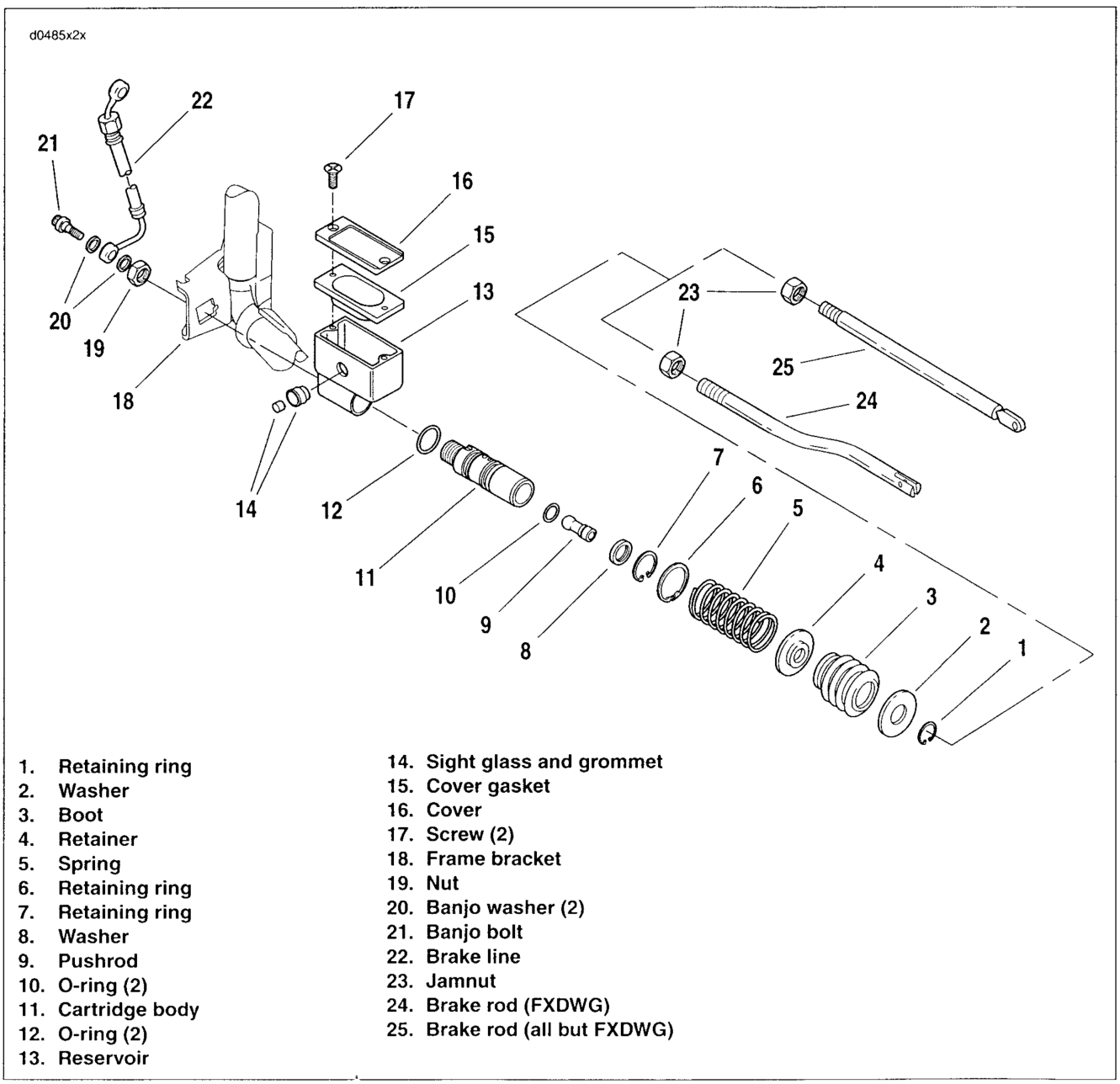
Damaged banjo bolt surfaces will leak when reassembled. Prevent damage to seating surfaces by carefully removing brake line components.

1. See Figure 2-69. Remove banjo bolt (21) and banjo washers (20). Discard washers.
2. Remove master cylinder mounting nut (19).
3. Loosen jamnut (23) on threaded brake rod (24/25).
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 (13) forward and out of frame bracket (18).



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

Figure 2-69. 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.

CAUTION

The banjo bolt will protect the sealing surface on the cartridge body from damage during the disassembly.

2. See Figure 2-69. Thread banjo bolt (21) into the cartridge body (11).
3. Remove boot (3) from groove in master cylinder/reservoir (13). 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

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This may result in improper brake operation which could result in death or serious injury.

1. Clean exterior of master cylinder/reservoir with a clean, nonflammable solvent. Lubricate all internal parts with lubricant provided in kit.
2. See Figure 2-69. Inspect reservoir bore (13) 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 (21). Replace any part with damaged threads. Inspect spring for cracks or broken coils – replace if any exist.
5. Carefully remove large O-rings (12) 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

1. See Figure 2-69. Lubricate O-rings (12) with D.O.T. 5 brake fluid and install in O-ring grooves on cartridge body (11).
2. Lubricate bore of master cylinder/reservoir (13) with D.O.T. 5 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 (21) 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

1. See Figure 2-69. Guide threaded end of master cylinder/reservoir (13) through hole in bracket (18). Make sure the square body of the master cylinder/reservoir is engaged in the square hole of the mounting bracket.
2. Install nut (19) and tighten to 40-50 ft-lbs (54.2-67.8 Nm).
3. Thread push rod (9) fully onto brake rod (24/25). Do not tighten jam nut (23).

CAUTION

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

4. Lubricate **new** steel/rubber washers (20) with D.O.T. 5 SILICONE BRAKE FLUID. Install brake line (22) using banjo bolt (21) and **new** steel/rubber washers (20). Position brake line and tighten banjo bolt to 17-22 ft-lbs (23.0-29.8 Nm).

⚠WARNING

Whenever the brake line is reconnected, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

⚠WARNING

Do not lengthen linkage beyond point that exposes six threads outside of the jam nut or insufficient thread engagement between push rod and brake rod could cause linkage to come apart. This would result in a loss of the rear brake, which could lead to an accident resulting in death or serious injury.

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

7. Bleed brake system and tighten bleeder valve as directed. See 1.7 BLEEDING BRAKES.
8. Install gasket (15) and cover (16) on master cylinder/reservoir. Tighten cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).

⚠WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

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 1.7 BLEEDING BRAKES.

NOTE

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

REMOVAL

NOTE

If only replacing brake pads, see 1.8 BRAKE PADS AND DISCS.

CAUTION

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

1. See Figure 2-70. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach front brake line (3) from caliper. Discard washers.
2. Remove both the upper (4) and lower (5) mounting bolts (12 pt/10 mm). Lift caliper upward to remove from brake disc.

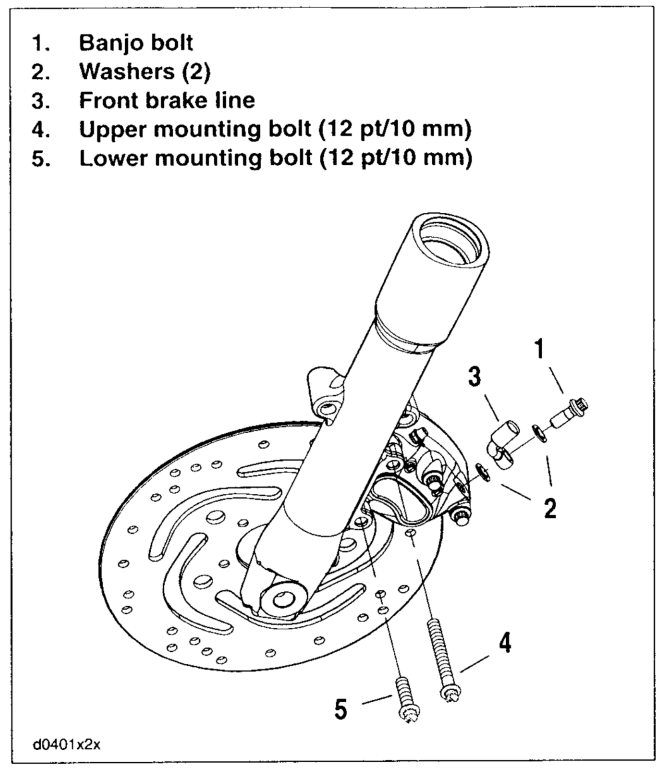


Figure 2-70. Front Caliper Mount

DISASSEMBLY

PART NO.	SPECIALTY TOOL
HD-43293-A	Brake caliper piston remover

1. See Figure 2-71. Remove pad pins (10) (12 pt/0.25 in.), brake pads (7) and bridge bolts (11) (12 pt/10 mm) to separate caliper housings (1, 8).
2. Remove anti-rattle spring (6). If necessary, remove bleeder valve (12).

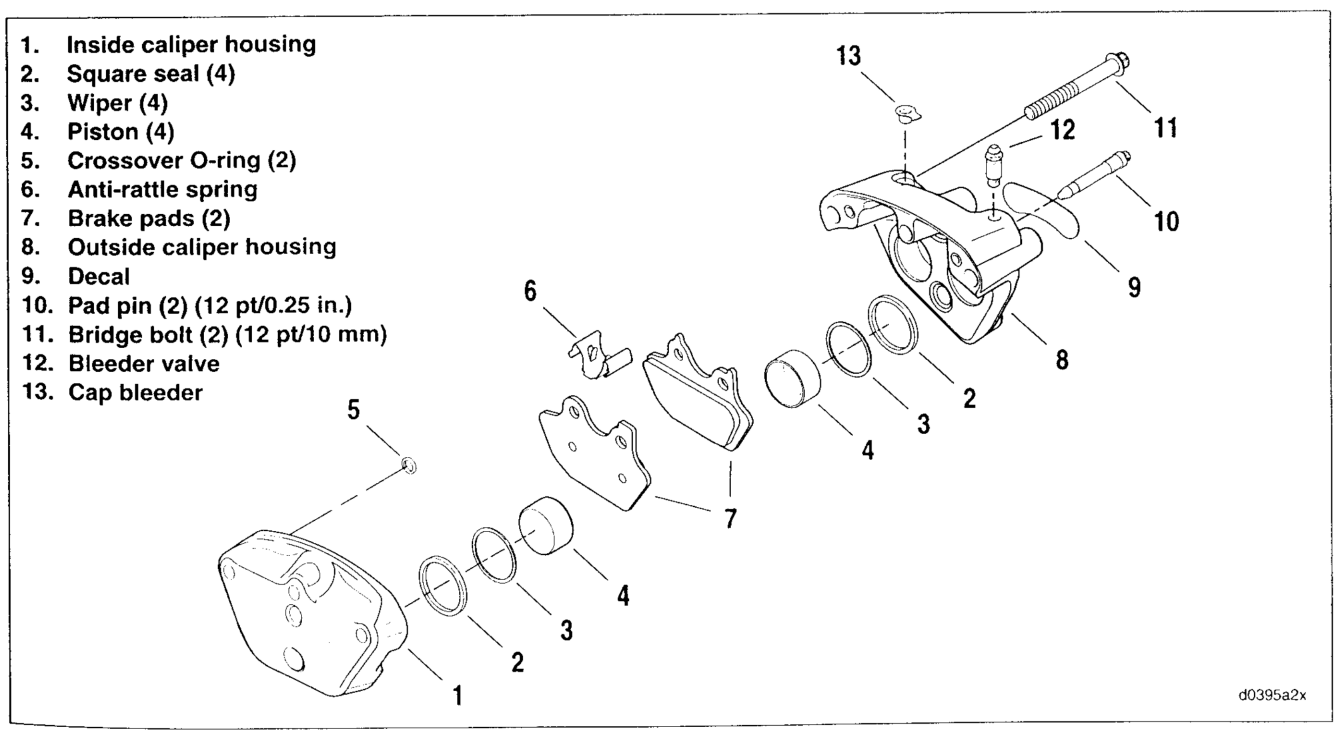
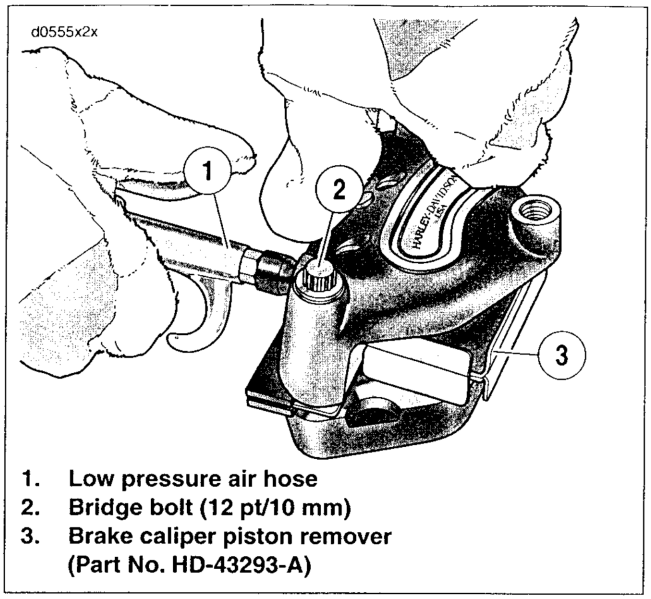
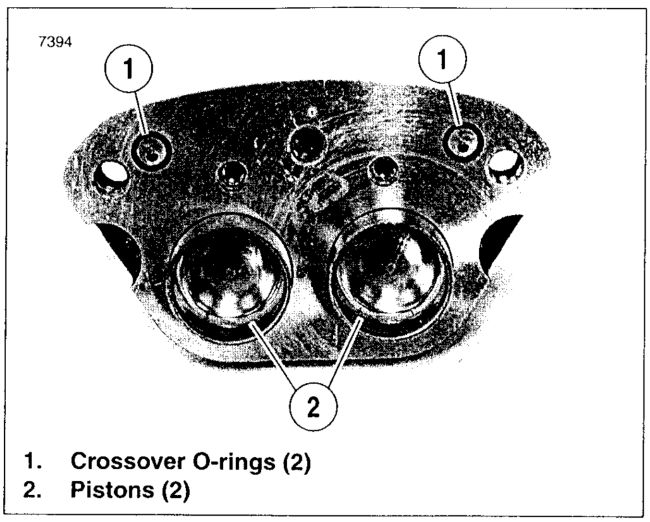


Figure 2-71. Front Brake Caliper



1. Low pressure air hose
2. Bridge bolt (12 pt/10 mm)
3. Brake caliper piston remover (Part No. HD-43293-A)

Figure 2-72. Removing Pistons



1. Crossover O-rings (2)
2. Pistons (2)

Figure 2-73. Crossover O-rings and Inside Housing

⚠WARNING

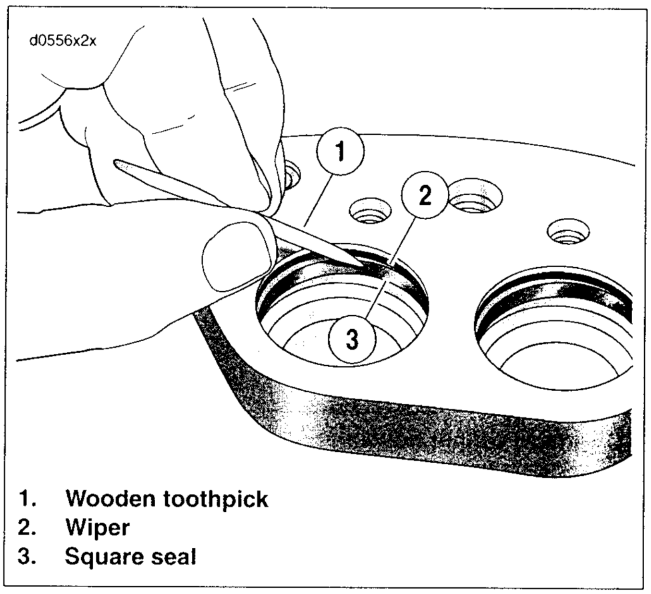
Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

3. See Figure 2-72. Remove pistons.
   a. Place BRAKE CALIPER PISTON REMOVER (3) (Part No. HD-43293-A) between caliper housings.
   b. Insert two bridge bolts (2) (12 pt/10 mm) and tighten securely.
   c. If the bleeder valve was removed, loosely reinstall or place a gloved finger over the bleeder valve hole on the outside caliper housing.
   d. Apply low pressure compressed air (1) to banjo bolt hole to remove pistons from caliper bores.
   e. Remove bridge bolts and remove tool.
4. See Figure 2-73. Remove and discard both crossover O-rings (1) from inside caliper housing.
5. If necessary, wiggle pistons (2) from caliper bores to completely remove.

CAUTION

Damaged pistons or piston bores will leak when reassembled. Do not use metal objects to remove or install objects from piston bores. Prevent damage to bores by only using a wooden toothpick when servicing calipers.

6. See Figure 2-74. Using a wooden toothpick (1), remove a wiper (2) and square seal (3) from each caliper bore. Discard all removed parts.



1. Wooden toothpick
2. Wiper
3. Square seal

Figure 2-74. Wipers and Square Seals

CLEANING, INSPECTION AND REPAIR

⚠WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This may result in improper brake operation which could result in death or serious injury.

1. Clean all parts with denatured alcohol or D.O.T. 5 SILICONE 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, scratching 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 pins 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 O-rings after disassembly.
3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.

⚠WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

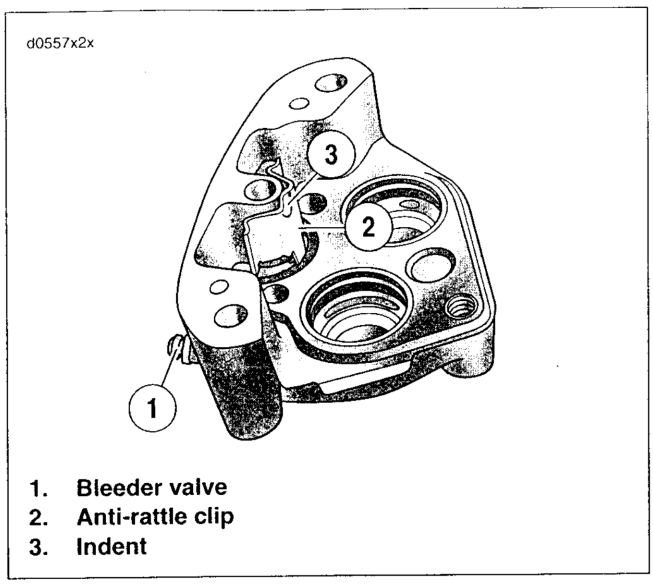
4. Inspect brake pads and brake disc. See 1.8 BRAKE PADS AND DISCS.

ASSEMBLY

CAUTION

Do not use D.O.T. 5 brake fluid for lubrication. Use of D.O.T. 5 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.



1. **Bleeder valve**
2. **Anti-rattle clip**
3. **Indent**

Figure 2-75. Front Caliper Anti-rattle Clip

CAUTION

Damaged piston bores will leak when reassembled. Do not use metal objects to remove or install objects from piston bores. Prevent damage to bores by only using a wooden toothpick when servicing calipers.

2. See Figure 2-74. Install a **new** square seal (3) and a **new** wiper (2) into each piston bore.
3. Carefully insert pistons by hand into bores of inside and outside caliper housings. If installation shows resistance, remove piston and check that seals and wipers are properly installed.
4. See Figure 2-73. Place two **new** crossover O-rings (1) on inside caliper housing.
5. Assemble caliper housings.
   a. See Figure 2-75. Install bleeder valve (1) on outside caliper housing if removed. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm).
   b. Place outside caliper housing on workbench with decal side down. Install anti-rattle clip (2) in channel with indent (3) facing upwards.
   c. Verify that **new** crossover O-rings are installed on inside caliper housing.
   d. Mate inside and outside caliper housings using bridge bolts (12 pt/10 mm). Place one bridge bolt in the middle hole and one next to the bleeder valve. Loosely install bridge bolts.
   e. Check that anti-rattle spring is still seated between caliper housings.
   f. Tighten bridge bolts to 28-38 ft-lbs (38.0-51.5 Nm).

NOTE

See Figure 2-76. The front left, front right (not present on all vehicles) and rear brake calipers use the same exact brake pad set.

- *On the right side of the vehicle, the pad with two tabs (1) installs on the inboard side of the caliper.*
- *On the left side of the vehicle, the pad with two tabs (1), installs on the outboard side of the caliper.*

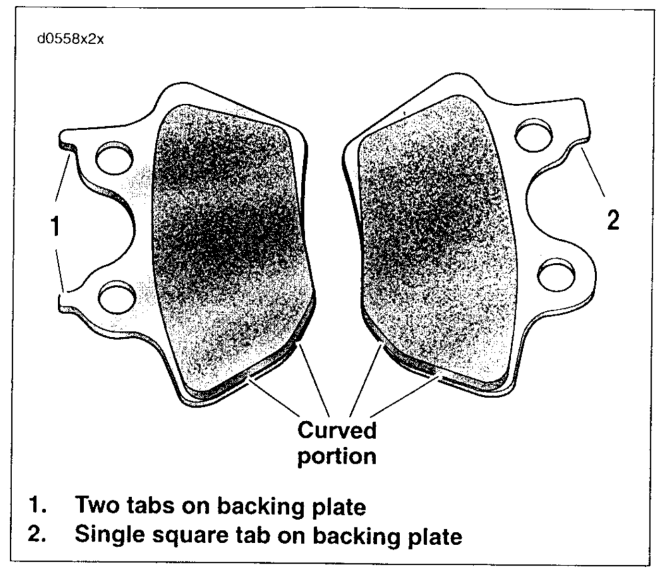
6. Insert one set of brake pads into caliper with friction material on pad facing opening for brake disc. Curved portion of pad must face rear of motorcycle when caliper is installed.
7. Install pad pins. Pad pins will give an audible click when inserted into inside housing. Tighten both pad pins to 15-16 ft-lbs (20.3-22.6 Nm).

NOTE

If pad pins do not fit, check the following:

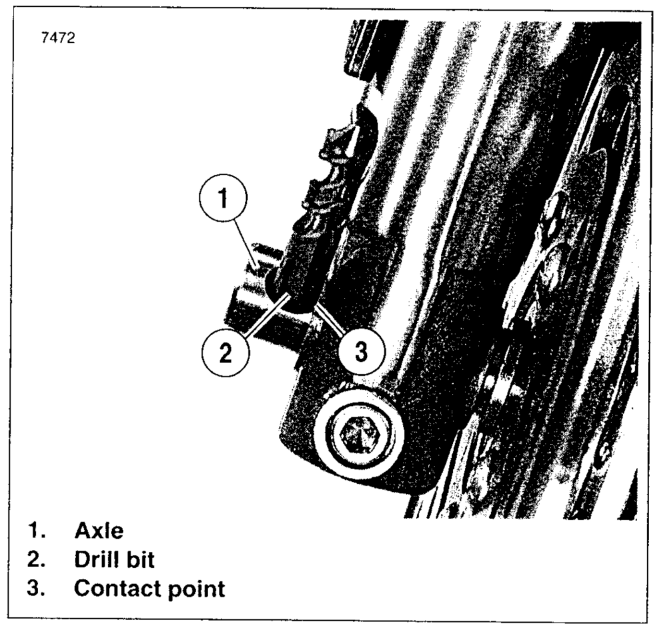
- *You are using a set of pads, not two identical pads.*
- *Anti-rattle clip orientation matches Figure 2-75.*

Pads must be pushed tight against the anti-rattle clip before the pad pins can be installed.



1. **Two tabs on backing plate**
2. **Single square tab on backing plate**

Figure 2-76. Brake Pad Alignment



1. **Axle**
2. **Drill bit**
3. **Contact point**

Figure 2-77. Dual Brake Disc Alignment

INSTALLATION

1. If servicing a vehicle with a single front brake caliper, advance to the next step. On models with dual front brakes, align calipers to brake discs. See Figure 2-77.
   a. Tighten axle nut to 50-55 ft-lbs (67.8-74.6 Nm).
   b. Loosen axle pinch bolt nuts.
   c. Insert 7/16 in. drill bit (2) into hole in axle (1) as far as it will go.
   d. Position fork leg against edge of drill bit. Contact point (3) must the have edge of drill bit touching the edge of fork leg.
   e. Tighten axle pinch bolt nuts to 25-30 ft-lbs (33.9-40.7 Nm) and withdraw drill bit.
2. See Figure 2-70. Attach caliper to fork leg.
   a. Place caliper over brake disc with bleeder valve facing upwards.
   b. Loosely install long mounting bolt (4) (12 pt/10 mm) into top hole on fork leg.
   c. Install short mounting bolt (5) (12 pt/10 mm) into bottom hole on fork leg. Tighten bottom mounting bolt to 28-38 ft-lbs (38.51.5 Nm).
   d. Final tighten the top mounting bolt to 28-38 ft-lbs (38.51.5 Nm).

CAUTION

To avoid leakage, verify that the washers, banjo bolt, brake line and caliper bore are completely clean.

3. Lubricate **new** steel/rubber washers with D.O.T. 5 SILICONE BRAKE FLUID. Connect the brake line (3) to caliper using two **new** steel/rubber washers (2) and banjo bolt (1). Tighten to 17-22 ft-lbs (23.0-29.8).
4. Remove cover from front brake master cylinder. Fill master cylinder with D.O.T. 5 SILICONE 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

Whenever brake calipers are installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

5. Bleed brake system. See 1.7 BLEEDING BRAKES.

⚠WARNING

Verify proper operation of the master cylinder relief port. A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and death or serious injury.

6. 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.
7. Install gasket and cover on master cylinder. Tighten cover screws to 6-8 **in-lbs** (0.7-0.9 Nm).
8. Tighten front axle and slider cap nuts if necessary. See 2.4 FRONT WHEEL.

⚠WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

9. 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 1.7 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.*

REMOVAL

NOTE

If only replacing brake pads, do not remove rear brake caliper. Should pad replacement be necessary, see 1.8 BRAKE PADS AND DISCS.

1. If present, remove right saddlebag.

CAUTION

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

2. See Figure 2-78. Remove the banjo bolt (1) and both steel/rubber washers (2) to detach rear brake line (3) from caliper. Discard washers.
3. Pull axle from rear wheel. See 2.5 REAR WHEEL.
4. Lift rear caliper away from axle and rear fork. Notch (4) in caliper mount must clear tab on rear fork.

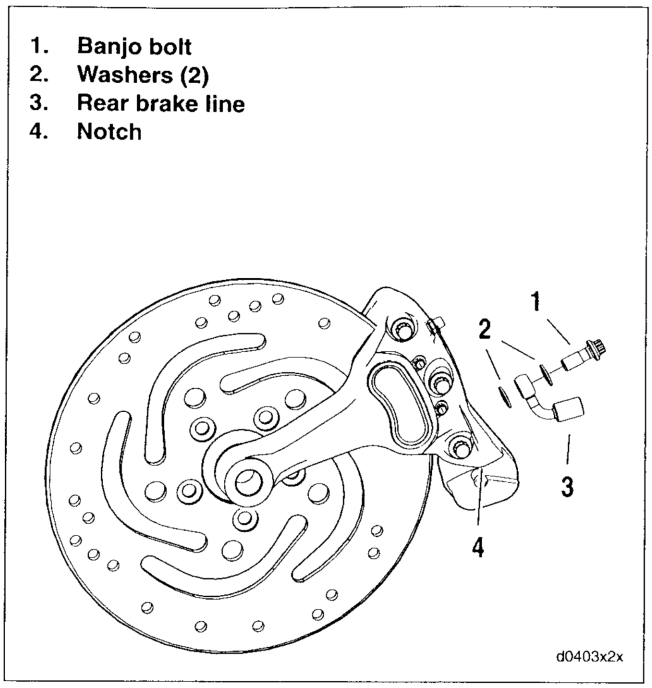


Figure 2-78. Rear Caliper Mount

DISASSEMBLY

PART NO.	SPECIALTY TOOL
HD-43293-A	Brake caliper piston remover

1. See Figure 2-79. Remove pad pins (10) (12 pt/0.25 in.), brake pads (7) and bridge bolts (11) (12 pt/10 mm) to separate caliper housings (1, 8).
2. Remove anti-rattle spring (6). If necessary, remove bleeder valve (12).
3. If necessary, cut rubber bumper (13) to remove.

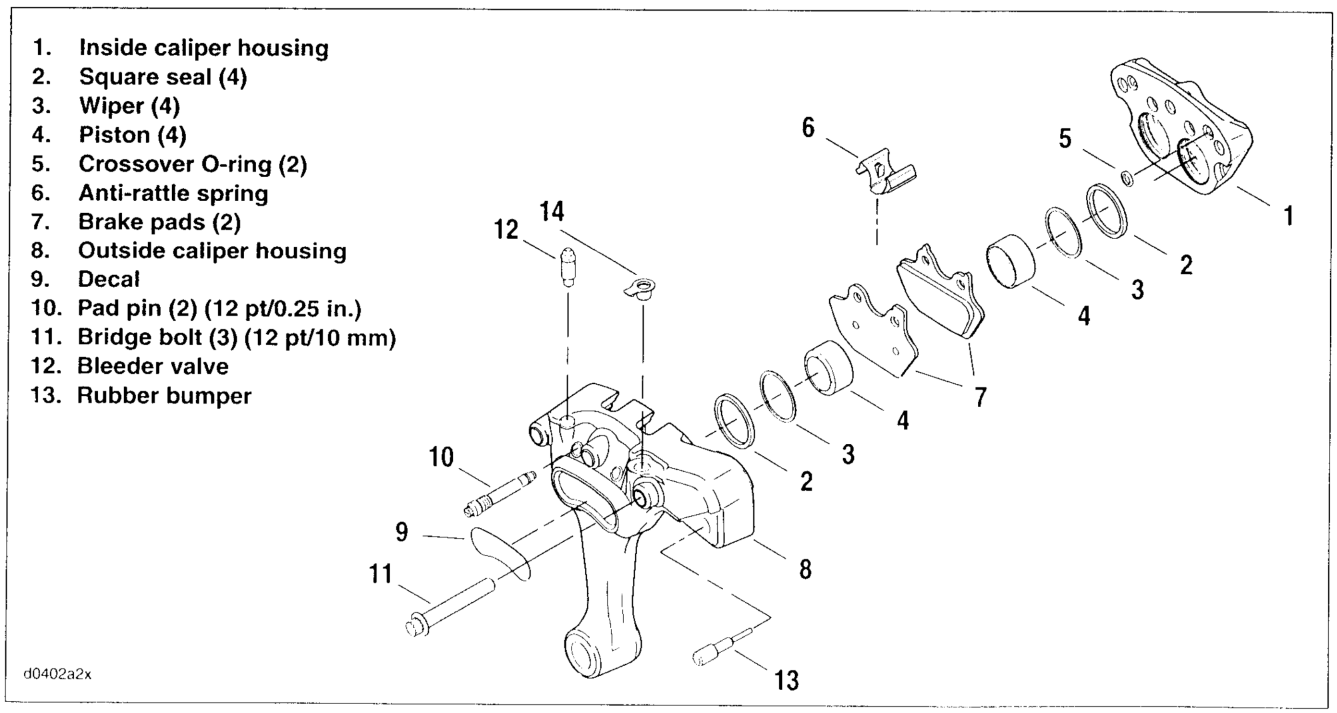
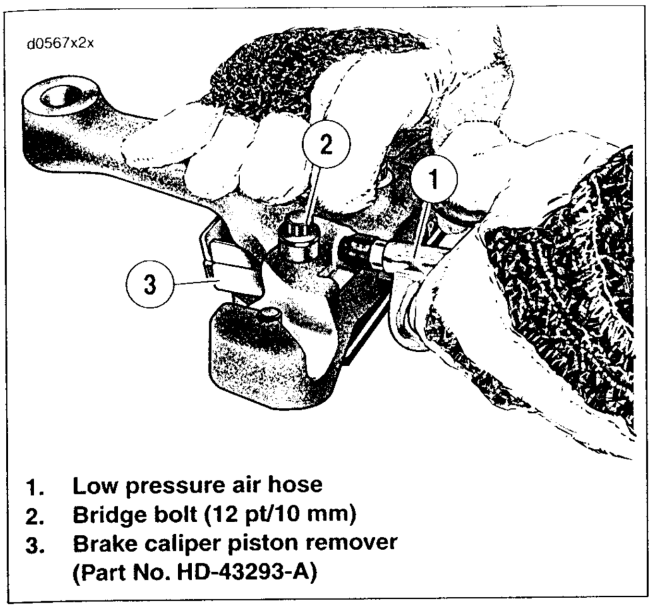
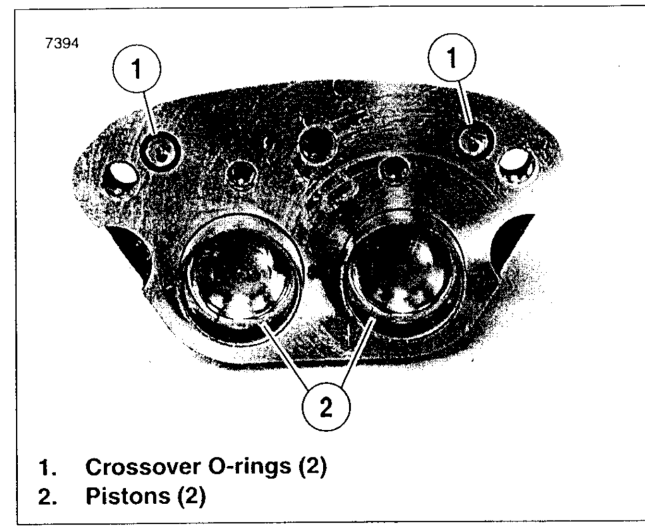


Figure 2-79. Rear Brake Caliper



1. Low pressure air hose
2. Bridge bolt (12 pt/10 mm)
3. Brake caliper piston remover (Part No. HD-43293-A)

Figure 2-80. Removing Pistons



1. Crossover O-rings (2)
2. Pistons (2)

Figure 2-81. Crossover O-rings and Inside Housing

⚠WARNING

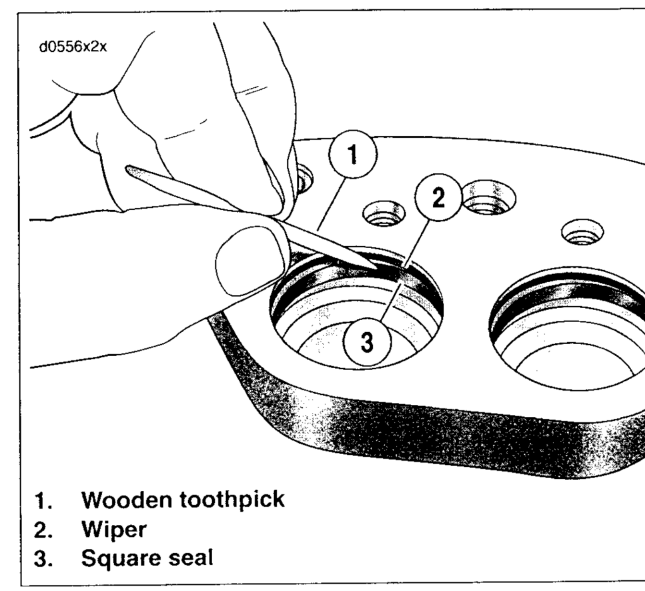
Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

4. See Figure 2-80. Remove pistons.
   a. Place BRAKE CALIPER PISTON REMOVER (3) (Part No. HD-43293-A) between caliper housings.
   b. Insert three bridge bolts (2) (12 pt/10 mm) and tighten securely.
   c. If the bleeder valve was removed, loosely reinstall or place a gloved finger over the bleeder valve hole on the outside caliper housing.
   d. Apply low pressure compressed air (1) to banjo bolt hole to remove pistons from caliper bores.
   e. Remove bridge bolts and remove tool.
5. See Figure 2-81. Remove and discard both crossover O-rings (1) from inside caliper housing.
6. If necessary, wiggle pistons (2) from caliper bores to completely remove.

CAUTION

Damaged pistons or piston bores will leak when reassembled. Do not use metal objects to remove or install objects from piston bores. Prevent damage to bores by only using a wooden toothpick when servicing calipers.

7. See Figure 2-82. Using a wooden toothpick (1), remove a wiper (2) and square seal (3) from each caliper bore. Discard all removed parts.



1. Wooden toothpick
2. Wiper
3. Square seal

Figure 2-82. Wipers and Square Seals

CLEANING, INSPECTION AND REPAIR

⚠WARNING

Clean brake system components using denatured alcohol. Do not use mineral-base cleaning solvents, such as gasoline or paint thinner. Use of mineral-base solvents causes deterioration of rubber parts that continues after assembly. This may result in improper brake operation which could result in death or serious injury.

1. Clean all parts with denatured alcohol or D.O.T. 5 SILICONE 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 pins 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 O-rings after disassembly.
3. If decal on outside housing is removed, scrape remaining adhesive from surface with a razor blade.

⚠WARNING

Always replace brake pads in complete sets for correct brake operation. Never replace just one brake pad. Failure to install brake pads as a set could result in death or serious injury.

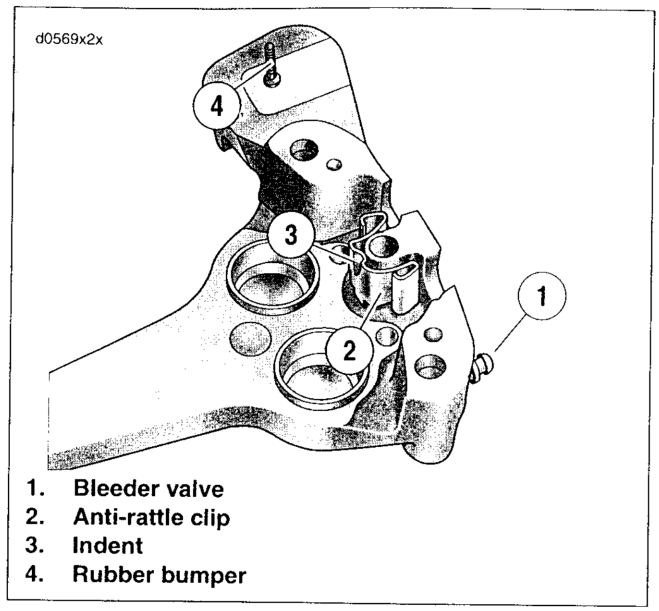
4. Inspect brake pads and brake disc. See 1.8 BRAKE PADS AND DISCS.

ASSEMBLY

CAUTION

Do not use D.O.T. 5 brake fluid for lubrication. Use of D.O.T. 5 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.



1. **Bleeder valve**
2. **Anti-rattle clip**
3. **Indent**
4. **Rubber bumper**

Figure 2-83. Anti-rattle Clip

CAUTION

Damaged piston bores will leak when reassembled. Do not use metal objects to remove or install objects from piston bores. Prevent damage to bores by only using a wooden toothpick when servicing calipers.

2. See Figure 2-82. Install a **new** square seal (3) and a **new** wiper (2) into each piston bore.
3. Carefully insert pistons by hand into bores of inside and outside caliper housings. If installation shows resistance, remove piston and check that seals and wipers are properly installed.
4. See Figure 2-81. Place two **new** crossover O-rings (1) on inside caliper housing.
5. Assemble caliper housings.
   a. See Figure 2-83. Install bleeder valve (1) on outside caliper housing if removed. Tighten bleeder valve to 80-100 **in-lbs** (9.0-11.3 Nm).
   b. Place outside caliper housing on workbench with decal side down. Install anti-rattle clip (2) in channel with indent (3) facing upwards.
   c. Verify that **new** crossover O-rings are installed on inside caliper housing.
   d. Mate inside and outside caliper housings using three bridge bolts (12 pt/10 mm). Loosely install bridge bolts.
   e. Check that anti-rattle spring is still seated between caliper housings.
   f. Tighten bridge bolts to 28-38 ft-lbs (38.0-51.5 Nm).
   g. If rubber bumper (4) on outside housing was removed, lubricate **new** part before installation.

NOTE

See Figure 2-84. The front left, front right (not present on all vehicles) and rear brake calipers use the same exact brake pad set. Install pad with two tabs (1) on the inboard side of the rear caliper.

6. Insert one set of brake pads into caliper with friction material on pad facing opening for brake disc. Curved portion of pad must face rear of motorcycle when caliper is installed.
7. Install pad pins. Pad pins will give an audible click when inserted into inside housing. Tighten both pad pins to 15-16 ft-lbs (20.3-22.6 Nm).

NOTE

If pad pins do not fit, check the following:

- *You are using a set of pads, not two identical pads.*
- *Anti-rattle clip orientation matches Figure 2-83.*

Pads must be pushed tight against the anti-rattle clip before the pad pins can be installed.

INSTALLATION

1. See Figure 2-78. Place caliper on rear axle with notch (4) inside rear fork tab. Verify that the rubber bumper is contacting the underside of the caliper mount for the full length of the bumper. Install rear axle and check drive belt tension. See 2.5 REAR WHEEL.

CAUTION

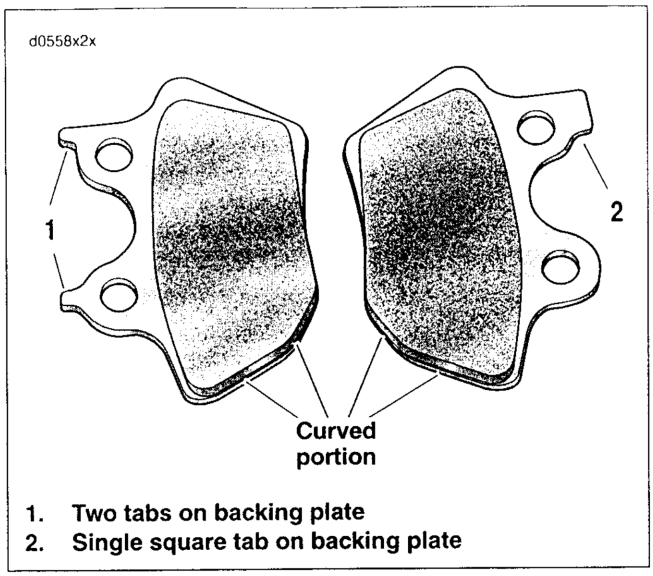
To avoid leakage, verify that the washers, banjo bolt, brake line and caliper bore are completely clean.

2. Lubricate **new** steel/rubber washers with D.O.T. 5 SILICONE BRAKE FLUID. Connect the brake line (3) to caliper using two **new** washers (2) and banjo bolt (1). Tighten to 17-22 ft-lbs (23.0-29.8).
3. Remove cover from rear brake master cylinder. Fill master cylinder with D.O.T. 5 SILICONE 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

Whenever brake calipers are installed, BEFORE moving motorcycle, you must pump brake fluid until the pistons push the pads against the brake disc. If you don't pump fluid pressure up again, the brakes will not be available to stop the motorcycle which could result in death or serious injury.

4. Bleed brake system. See 1.7 BLEEDING BRAKES.



1. **Two tabs on backing plate**
2. **Single square tab on backing plate**

Figure 2-84. Brake Pad Alignment

⚠WARNING

Verify proper operation of the master cylinder relief port. A plugged or covered relief port can cause brake drag or lockup, which may result in loss of vehicle control and death or serious injury.

5. Verify proper operation of the master cylinder relief port. Actuate the brake pedal 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).
7. Install right saddlebag if necessary.

⚠WARNING

After completing repairs or bleeding the system, always test motorcycle brakes at low speed. If brakes are not operating properly or braking efficiency is poor, testing at high speeds could result in death or serious injury.

8. 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 1.7 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.*

REMOVAL

1. Support the motorcycle so the front end is off floor and the forks are fully extended. Remove the brake caliper(s) and front wheel. See 2.4 FRONT WHEEL.
2. Remove front fender. See 2.28 FRONT FENDER.
3. Remove headlamp bracket. Attach headlamp to frame using rubber bungee strap. See 8.17 HEADLAMP.
4. See Figure 2-85. Loosen screws (2, 10). Do not remove tube caps (18). Slide fork sides downward clear of fork brackets (1, 9).

DISASSEMBLY

1. See Figure 2-85. Remove drain screw (35) from slider. Remove tube cap (18) and drain fork oil.
2. Remove O-ring (19) from inner groove in tube cap. Pull spring (20) out of fork tube (24).
3. Remove cover (26), dust seal (27), then compress internal retaining ring (28) and remove the ring from the internal groove at the top of slider (33).
4. Using an Allen wrench, remove screw (37) along with washer from the bottom end of fork slider. Damper (23) and tube (24) can now be removed from fork slider.

NOTE

Since there is little resistance to rotation when removing screw (37), use an air impact wrench for best results.

5. The upper bushing (31) has a slight interference fit in slider. The upper bushing, together with seal spacer (30) and oil seal (29), are removed by lightly hitting the upper bushing with the lower bushing as the fork tube is pulled free of the slider in a quick continuous stroke. Continue this slide hammer type action until the components are free.
6. Remove damper tube (23) by pushing it and spring assembly (21) free of fork tube by inserting a small diameter rod through the opening in the bottom of tube.
7. Remove stop (32) from the lower end of damper tube and slide off spring (20).
8. Rings (22) can now be removed from the grooves at the top of damper tube. Lower bushing (25) is not removed unless it is to be replaced.

CLEANING AND INSPECTION

1. Thoroughly clean and inspect each part. If inspection shows that any parts are bent, broken or damaged, replace those parts.
2. Inspect all seals for wear. If seals were removed, new seals must be installed.
3. See Figure 2-85. Inspect both rings (22) on damper tube and replace if worn excessively or damaged.
4. Check dust seal where it rubs on fork tube. The seal should present a good continuous seal and not show excessive wear. Check the fork tube where it is rubbed by the seal. The tube should show a bright, shining surface, free of scoring or abrasions.
5. Replace spring (20) if broken.
6. Inspect small hole in groove in lower end of fork tube and see that it is not obstructed.
7. Make sure tube cap O-ring (19) is in good condition, without irregularities, and that it provides proper sealing when in place.
8. Check drain screw washer and damper tube washer to see that they provide a good seal when used with their respective screws to prevent oil leakage.
9. Replace bent or damaged fork tube.

ASSEMBLY

PART NO.	SPECIALTY TOOL
HD-36583	Fork seal bushing tool

1. See Figure 2-85. If removed, install **new** lower bushing (25), expanding the bushing only enough to fit over slider tube (24). Slide the bushing into its groove with bushing opening oriented to the side.
2. Place spring (20) on damper tube (23), insert damper tube into fork tube.
3. Insert spring (21) into fork tube, tapered end down, and push damper tube through the opening at the bottom end of the fork tube. Place stop (32) over end of damper tube.

d0486c2x

1. Lower bracket and stem
2. Screw
3. Dust shield
4. Bearing cone
5. Bearing cup
6. Bearing cup
7. Bearing cone
8. Dust shield
9. Upper bracket
10. Screw
11. Screw
12. Washer
13. Screw
14. Fork stem cap (FXDL only)
15. Retaining ring
16. Screw
17. Lockwasher
18. Slider tube cap
19. O-ring
20. Spring
21. Spring
22. Damper tube ring
23. Damper tube
24. Slider tube
25. Slider tube bushing
26. Slider cover
27. Dust seal
28. Retaining ring, oil seal
29. Oil seal
30. Oil seal spacer
31. Upper bushing
32. Lower stop
33. Slider assembly (left)
34. Bushing
35. Drain screw with washer
36. Washer
37. Screw
38. Screw
39. Washer
40. Lockwasher
41. Nut

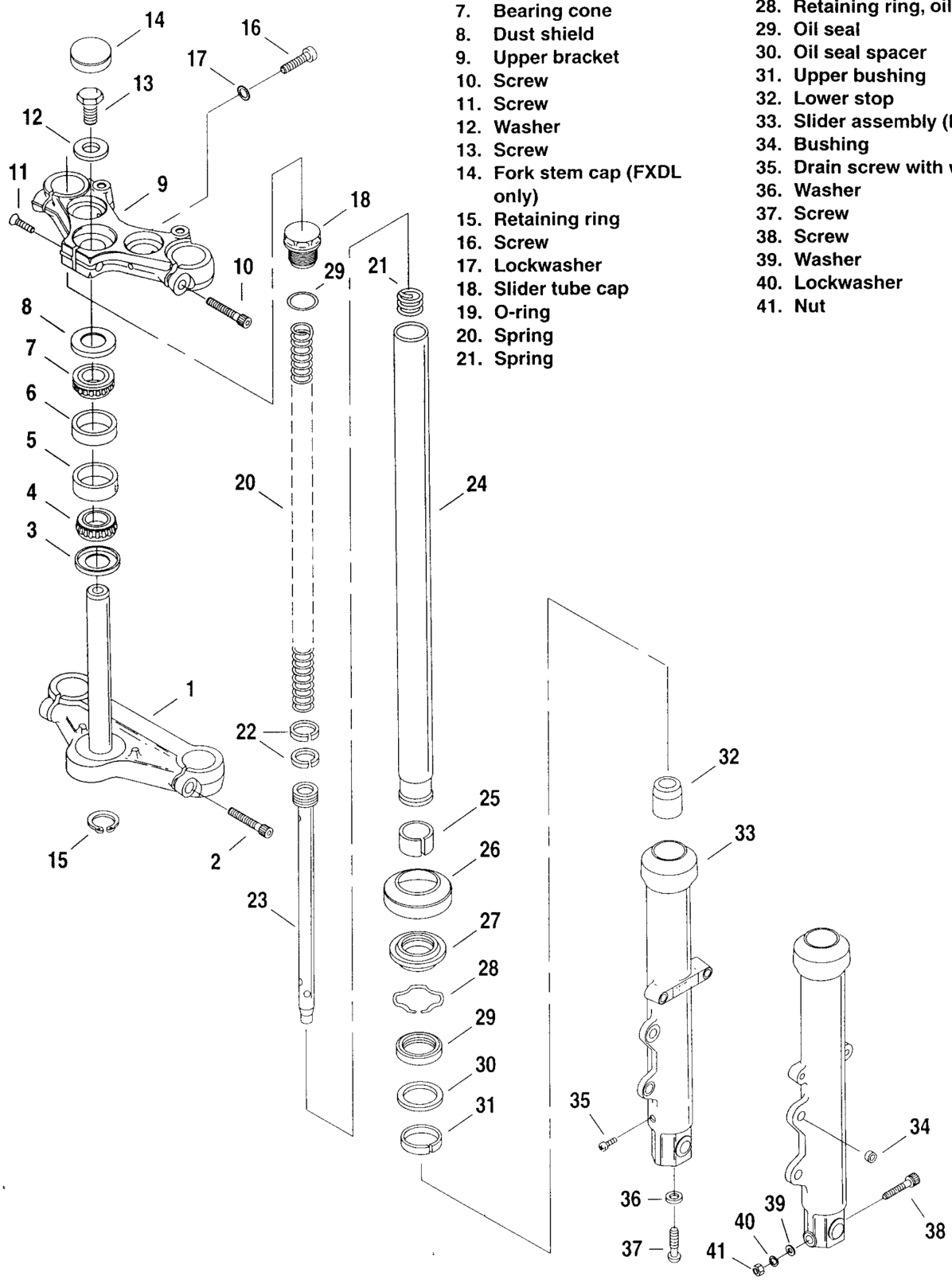


Figure 2-85. Front Fork: FXD and FXDL

4. Assemble fork tube into slider (33). Hold the assembly in place by exerting pressure on the spring and install socket bolt (37) with washer (36).
5. Place upper bushing (31), seal spacer (30) and oil seal (29), in that order, over fork tube. Be sure that the concave or dished surface of the seal spacer is downward and lettered side of the seal is facing upward. Place FORK SEAL AND BUSHING TOOL (Part No. HD-36583) over fork tube. Seat the upper bushing, seal spacer, and oil seal with the installation tool.
6. Install retaining ring (28) and dust seal (27).
7. Fill fork sides with Harley-Davidson TYPE E FORK OIL. See 1.18 FRONT FORK OIL for specifications.
8. Install slider tube caps. Tighten caps to 11-22 ft-lbs (14.9-29.8 Nm).

INSTALLATION

1. See Figure 2-85. Insert fork side through lower and upper brackets (1 and 9). Position slider tubes so that each fork tube extends 0.42-0.50 in. (10.7-12.7 mm) from the top surface of upper fork bracket (9) to the top surface of the tube cap (18). Be sure both sides are equal.
2. Position turn signal light brackets upright and tighten upper fork bracket pinch screws to 25-30 ft-lbs (33.9-40.7 Nm). Tighten lower fork bracket pinch screws (2) to 25-30 ft-lbs (33.9-40.7 Nm).
3. Install the headlamp bracket and adjust headlamp. See 8.17 HEADLAMP.
4. Install front fender. See 2.28 FRONT FENDER.
5. Install front wheel and brake caliper(s). See 2.4 FRONT WHEEL.

REMOVAL

1. Support the motorcycle so the front end is off floor and the forks are fully extended. Remove the front brake caliper and front wheel. See 2.4 FRONT WHEEL.
2. Remove front fender. See 2.28 FRONT FENDER.
3. See Figure 2-86. Remove the slider tube caps (1), spacers (2) and oil seals (3) from the top the fork sides.
4. Loosen the pinch bolts (4) and pull the fork sides from the brackets.

DISASSEMBLY

⚠WARNING

The FXDWG model has a pre-loaded fork spring. Disassemble the fork tube(s) carefully. The spring can force parts from the tube unexpectedly which could result in death or serious injury.

1. Support the motorcycle so the front end is off floor and the forks are fully extended.
2. See Figure 2-86. Remove slider tube cap (1). Loosen pinch bolts (4) if not already loose and slide tube down to lower bracket. Tighten lower bracket.
3. Remove the fork tube plug (5) and O-ring (6). Pull spring (7) out of slider tube (8). Remove drain screw (9) and washer (10), and drain the fork.
4. Remove dust cover (23). Compress retaining ring (11) and remove the clip from the internal groove at the top of fork slider (12).

NOTE

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

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

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 replaced.
2. See Figure 2-86. Inspect damper tube rings (22) on damper tube (15) and replace if worn excessively or damaged.
3. Replace either of the springs (7 or 20) if broken.
4. Inspect small hole in lower end of slider tube (8) and be sure it is not obstructed.
5. Be sure O-ring (6) is in good condition, without irregularities, and that it provides proper sealing when in place.
6. Check both washers (10 and 14) to see that they provide a good seal when used with their respective screws (9 and 13) to prevent oil leakage.
7. Replace bent or damaged fork tube (8).

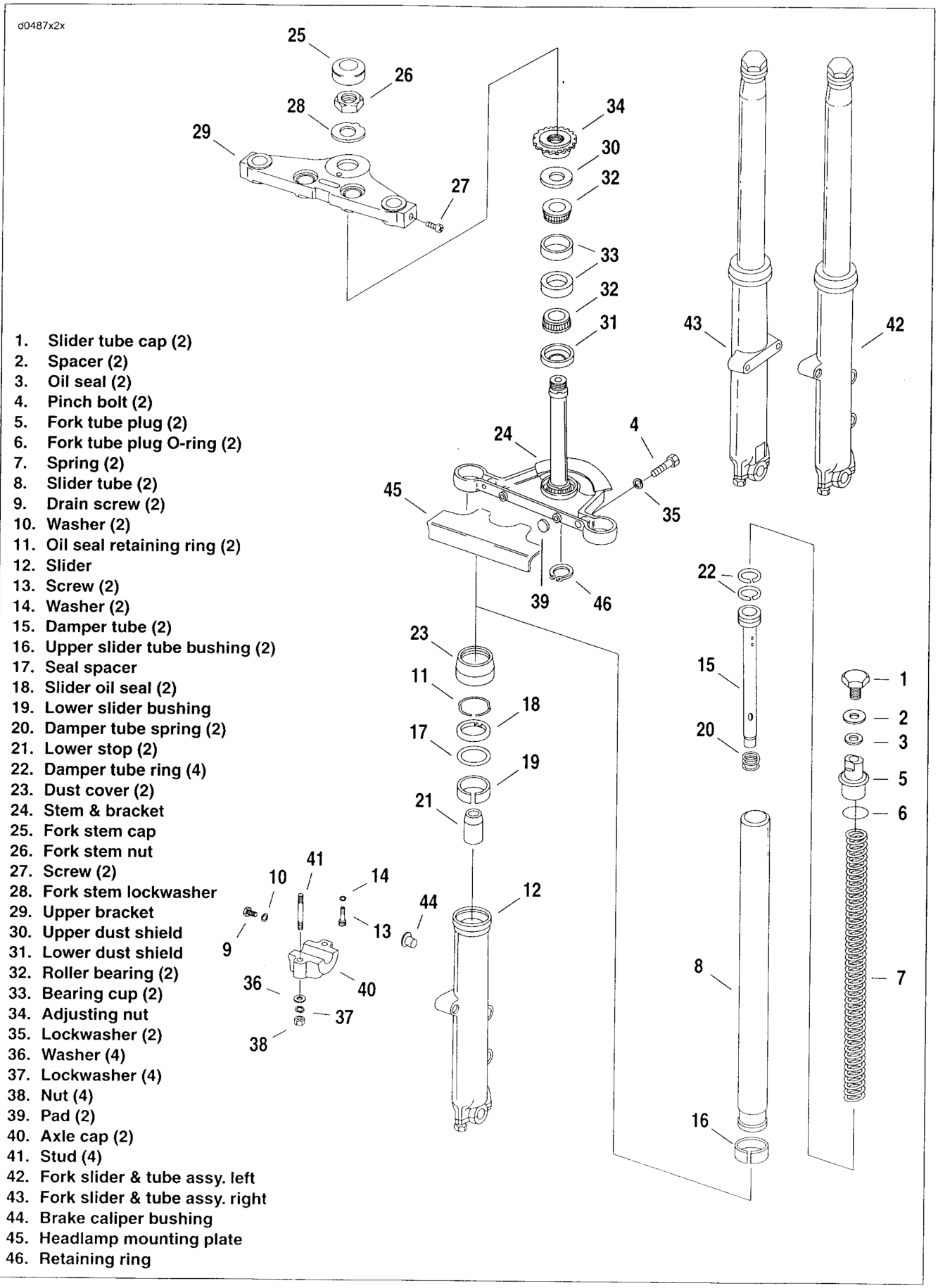


Figure 2-86. Front Fork: FXDWG

ASSEMBLY

PART NO.	SPECIALTY TOOL
HD-34634	Fork seal bushing tool

1. See Figure 2-86. Install damper tube rings (22). Place damper tube spring (20) on damper tube (15). Insert damper tube into fork tube (8).
2. Insert spring (7) into slider tube (8), tapered side toward damper tube, and push bottom of damper tube (15) through the opening at the bottom end of the fork tube. Place lower stop (21) over end of damper tube.
3. Position slider tube (8) and damper tube (15) in slider (12). Hold the assembly in place by exerting pressure on the spring and install socket screw (13) with washer (14).
4. Place upper bushing (16), seal spacer (17) and a new seal (18) (in that order) over fork slider (12). Slide the bushing into its groove with bushing opening oriented to the side. Be sure that the flanged surface of the seal spacer (17) is up and lettered side of the seal is facing upward. Place FORK SEAL BUSHING TOOL (Part No. HD-34634) over fork slider (12). Seat upper bushing, seal spacer, and seal with the installation tool. Install retaining ring (11). Install dust seal (23).
5. Fill fork sides with Harley-Davidson TYPE E FORK OIL. See 1.18 FRONT FORK OIL for specifications.

INSTALLATION

1. See Figure 2-86. Insert both fork side assemblies up through the fork stem and bracket (24) and upper bracket (29).

NOTE

Fork tube plug flats must face left and right not front and rear for screw (27) clearance.

2. Install a **new** oil seal (3), spacer (2) and fork tube plug (5). Tighten securely. Be sure one flat on each fork tube plug (5) faces toward the inside of the fork.
3. Install the slider tube caps(s) (1). Tighten to 11-22 ft-lbs (14.9-29.8 Nm).
4. Tighten fork stem bracket pinch bolt(s) (4) to 30-35 ft-lbs (40.7-47.5 Nm).
5. Install front fender. See 2.28 FRONT FENDER.
6. Install front wheel and brake caliper. See 2.4 FRONT WHEEL.

REMOVAL

1. Support the motorcycle so the front end is off floor and the forks are fully extended. Remove both front brake calipers and front wheel. See 2.4 FRONT WHEEL.
2. Remove front fender. See 2.28 FRONT FENDER.
3. Remove front fairing. See 2.35 WINDSHIELD: FXDXT
4. Remove headlamp bracket. Attach headlamp to frame using rubber bungee strap. See 8.17 HEADLAMP.
5. Loosen the upper and lower triple clamp pinch bolts and pull the fork sides from the brackets.

DISASSEMBLY

PART NO.	SPECIALTY TOOL
HD-41177	Fork tube holder
HD-41549-A	Fork spring compression tool
HD-41551	Spring plate tool

1. See Figure 2-87. Remove the stopper ring (1).
2. Remove the spring preload adjuster (3).

NOTE

DO NOT unthread rebound adjuster from damper rod. Incorrect assembly could result in reduced adjustment range.

3. Unthread the fork cap (5) from the fork tube and allow the fork leg to drop, exposing the spring.
4. See Figure 2-88. Set the FORK SPRING COMPRESSION TOOL (Part No. HD-41549-A) on the spring collar. Turn screws in to engage holes in collar. Compress the spring until the SPRING PLATE TOOL (Part No. HD-41551) can be positioned between the spacer and the spring collar.
5. See Figure 2-89. Hold the fork bolt and compression adjuster. Remove the fork bolt from the compression adjuster. Remove the spring adjuster plate from the fork bolt.
6. Remove spacer, spring collar and spring.
7. Pour out the fork oil by pumping the fork leg and rod 8-10 times or until rod moves freely.
8. See Figure 2-90. Position fork slider in vise using FORK TUBE HOLDER (Part No. HD-41177) to avoid damage.

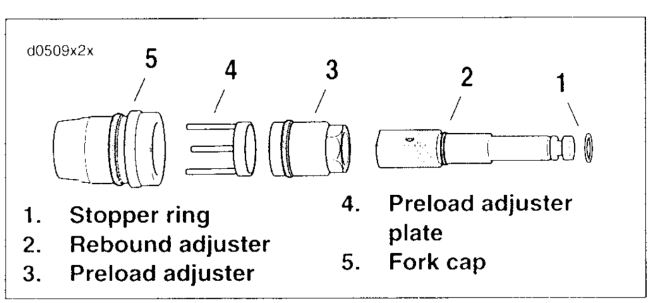


Figure 2-87. Fork Cap

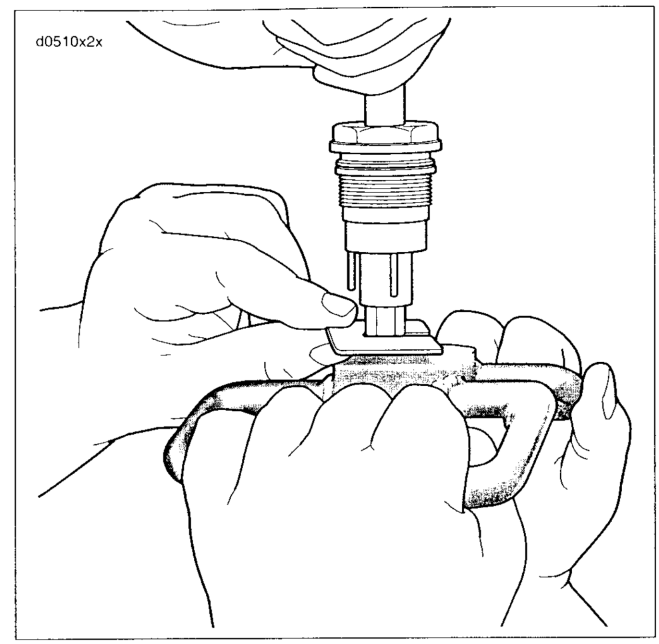


Figure 2-88. Compressing Fork Spring

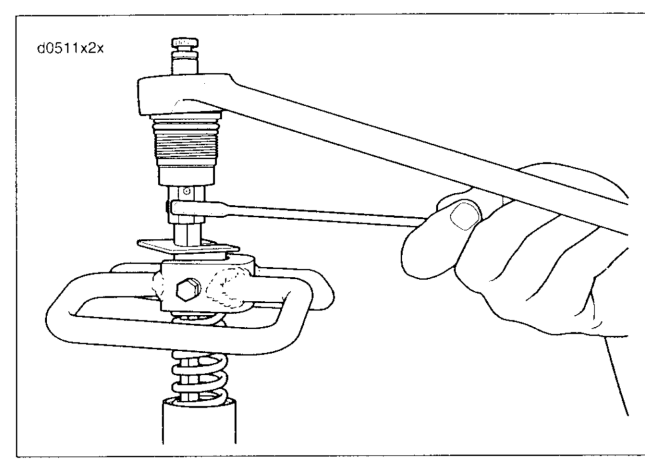


Figure 2-89. Removing Fork Bolt

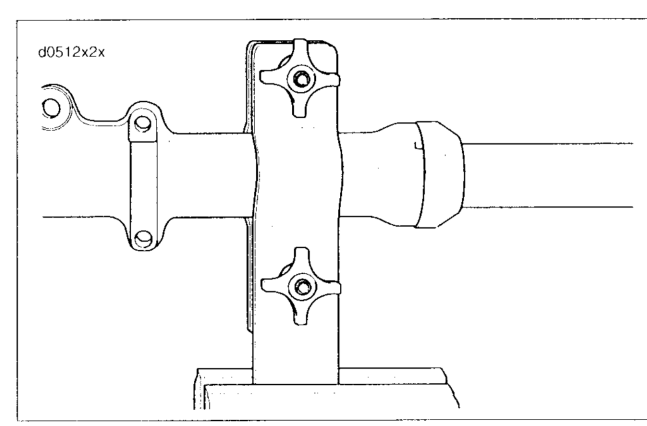
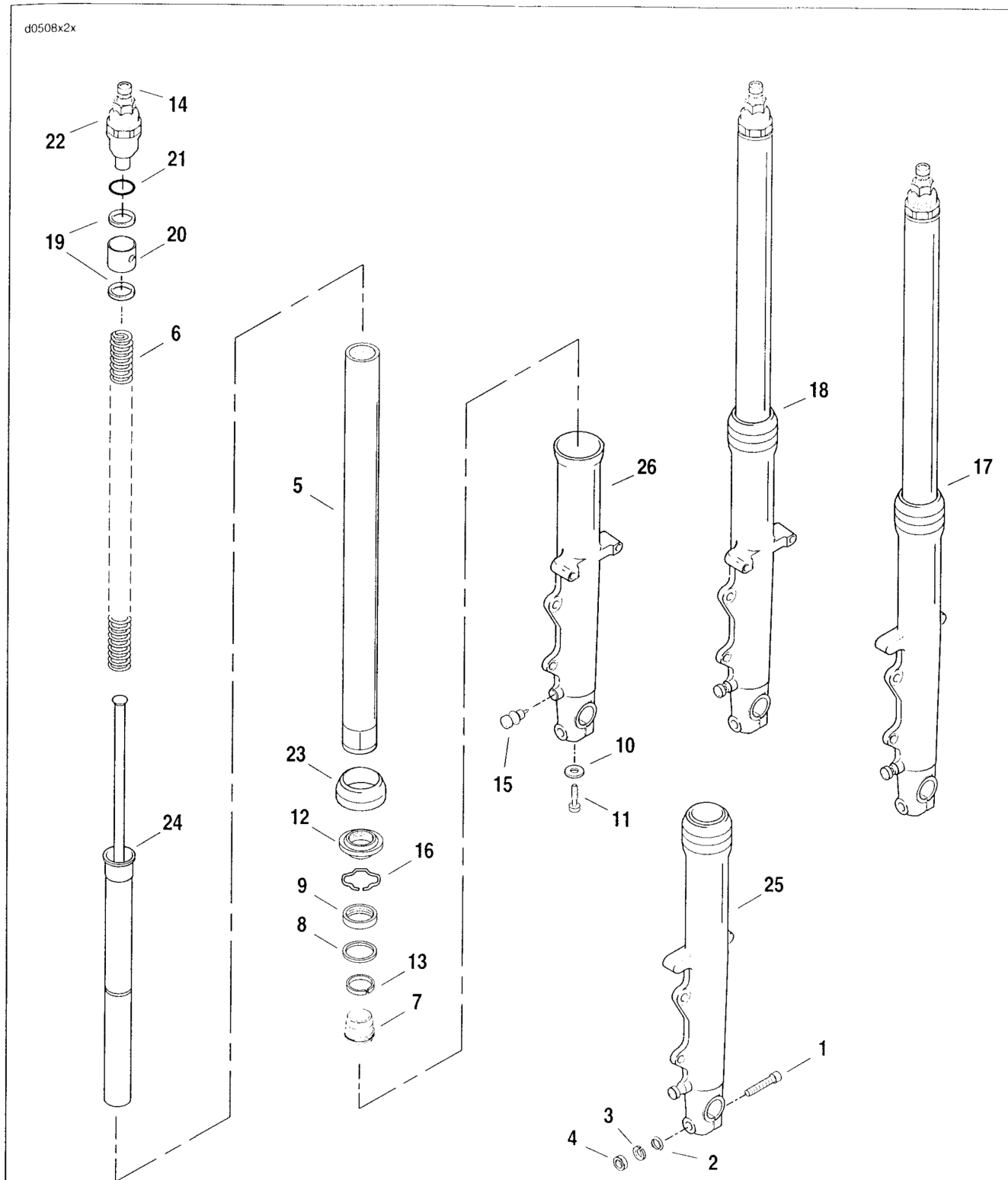


Figure 2-90. Fork Tube Holder



1. Screw
2. Washer
3. Lockwasher
4. Nut
5. Slider tube
6. Spring
7. Lower stop
8. Spacer
9. Oil seal
10. Washer
11. Screw
12. Seal
13. Bushing
14. Rebound adjuster
15. Compression adjuster
16. Retaining ring
17. Fork slider - right
18. Fork slider - left
19. Spacer
20. Spring collar
21. O ring
22. Cap
23. Cover
24. Damper
25. Slider - right
26. Slider - left

Figure 2-91. Front Fork: FXDX & FXDXT

9. See Figure 2-92. Remove the socket head bolt.

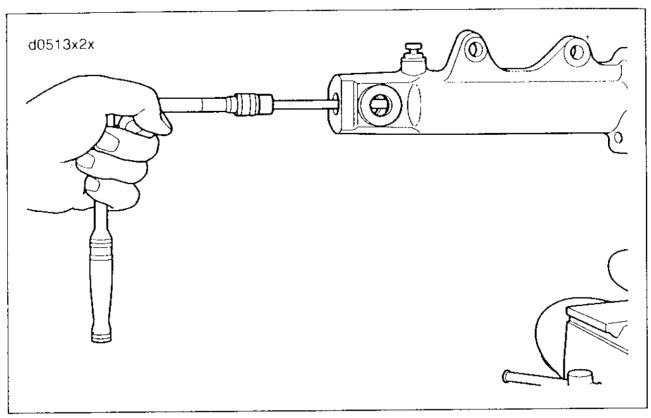


Figure 2-92. Socket Head Bolt

10. Remove damper from fork tube.
11. See Figure 2-93. Remove the cover from the slider. Remove seal and stopper ring.
12. Pull the fork tube out of the slider.
13. Remove the oil seal, spacer and guide bushing from the fork tube.

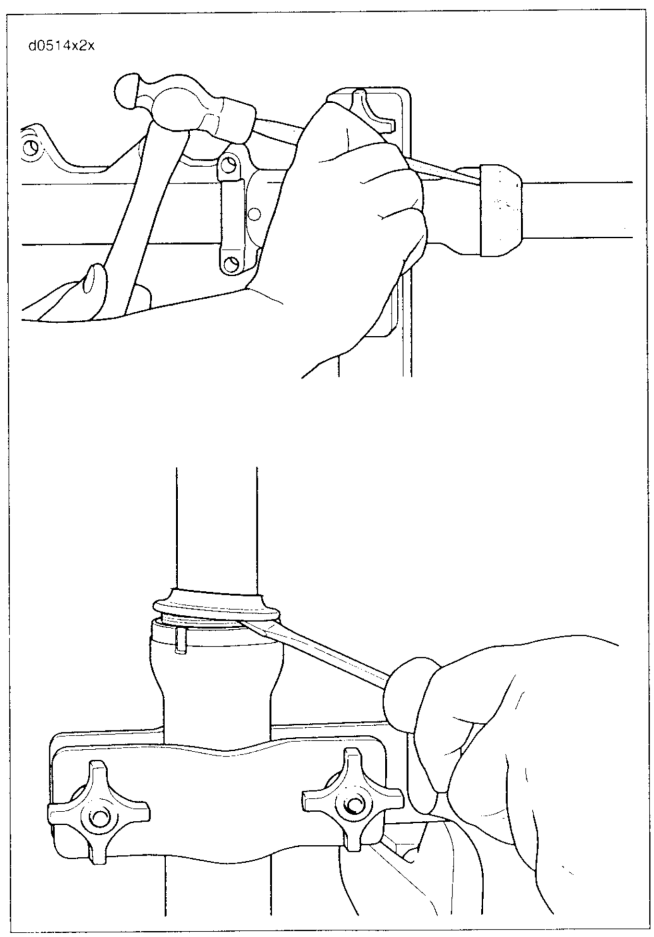


Figure 2-93. Fork Cover and Seal

CLEANING AND INSPECTION

1. Measure fork spring free length. Replace spring if it is shorter than 17.00 in. (431.8 mm).
2. Check the fork tube and slider for score marks, scratches or abnormal wear.
3. Check the slide and guide bushings for excessive wear or scratches.
4. Set the fork tube on V-blocks and measure runout. Runout should not exceed 0.008 in. (0.2 mm).

ASSEMBLY

PART NO.	SPECIALTY TOOL
HD-36583	Fork seal installer
HD-41177	Fork tube holder
HD-41549-A	Fork spring compression tool
HD-41551	Spring plate tool
HD-59000-A	Pro-level oil gauge

1. Coat oil seal with TYPE E FORK OIL.
2. Before installing slide bushing and guide bushing, lubricate with fork oil.
3. Install guide bushing and spacer seal.

NOTE

Guide bushing opening must be oriented to the side. DO NOT position to front or rear.

4. Slip the slider into the fork tube.
5. Place the slide bushing over the fork tube until it rests on the slider.
6. See Figure 2-94. Drive the guide bushing with the spacer seal into the slider.
7. Lubricate **new** oil seal with TYPE E FORK OIl.
8. Drive the oil seal into the slider using FORK SEAL INSTALLER (Part No. HD-36583).

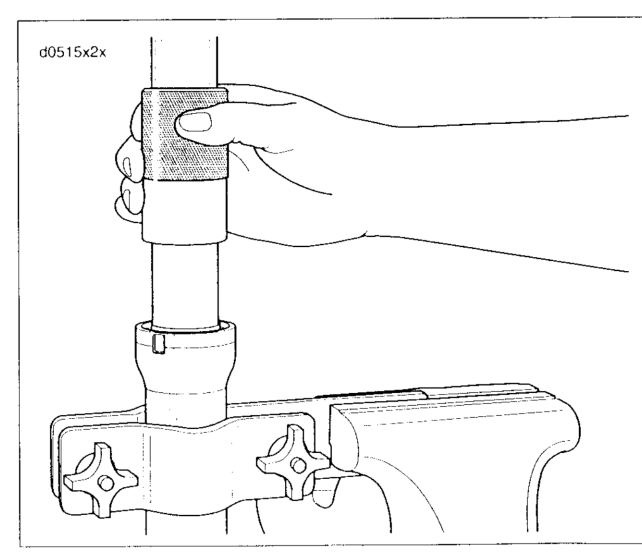


Figure 2-94. Fork Seal Installer

9. Install the stopper ring and dust seal.

10. If the rebound adjuster was removed from the damper rod follow the steps below, otherwise proceed to step 11.

    a. Bottom lock nut on threaded portion of damper rod.

    b. See Figure 2-95. Holding thumb on detent spring and ball, back out (turn counterclockwise) rebound adjuster to last "click." Turn down (clockwise) 17 "clicks".

    c. Thread rebound adjuster onto damper rod until adjuster stops at maximum thread engagement (Do not force).

    d. See Figure 2-96. Thread locknut on damper rod up to contact base of rebound adjuster and tighten in place.

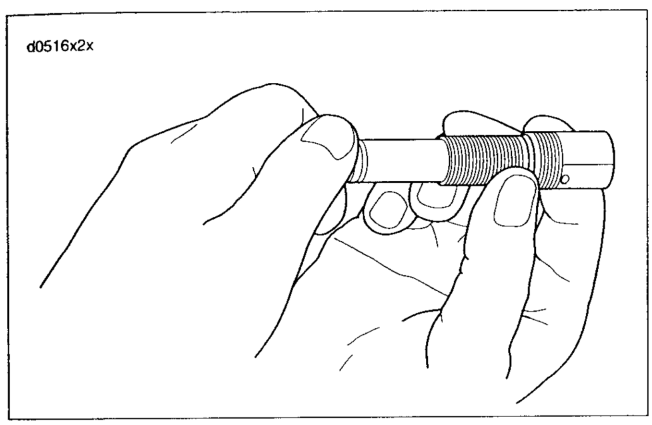


Figure 2-95.

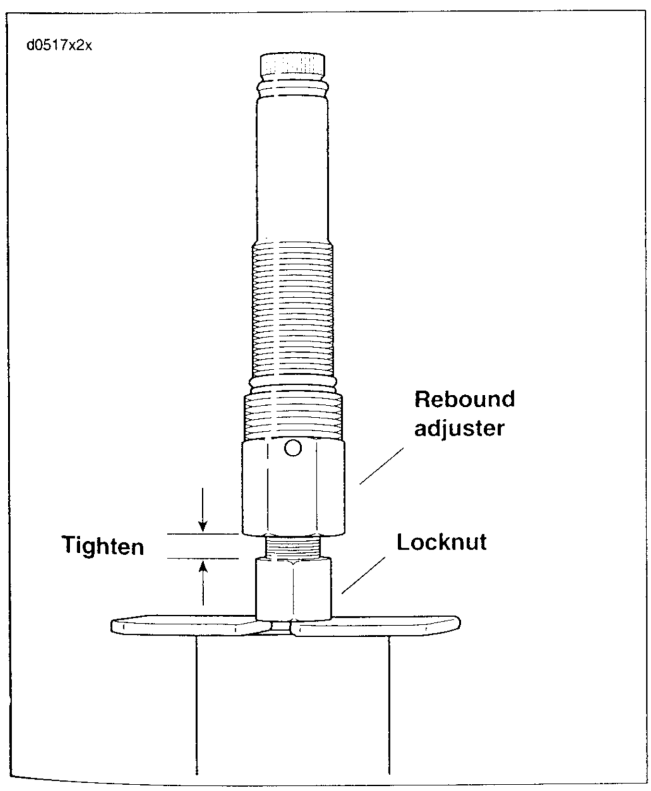


Figure 2-96.

11. See Figure 2-92. Hold slider in vise taking precautions to avoid damage. Install damper tube into the fork tube. Tighten socket screw and washer. Torque to 22-29 ft-lbs (29.8-39.3 Nm).

12. Pour half the TYPE E FORK OIL into fork tube.

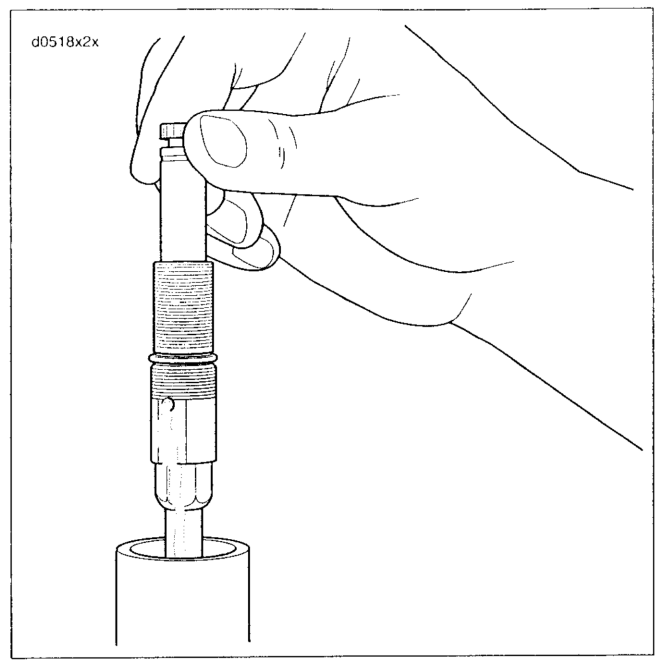


Figure 2-97. Pumping Damper Rod

13. See Figure 2-97. Slowly pump the damper rod 10 or more times.

14. Position the damper rod in the fully bottomed position.

15. Pour the remaining amount of TYPE E FORK OIL into the fork tube.

16. See Figure 2-98. Using the PRO-LEVEL OIL GAUGE (Part No. HD-59000-A) adjust the oil level to 5.04 in. (128 mm).

17. See Figure 2-91. Carefully clean and install spring (6), spring collar (20), and spacers (19).

NOTE

Spacers are stamped parts. Sharp edge created by stamping process must face collar.

18. See Figure 2-99. Using FORK SPRING COMPRESSION TOOL (Part No. HD-41549-A) push spring collar down and place SPRING PLATE (Part No. HD-41551) between spacer and spring collar.

19. Install fork cap and tighten against rebound adjuster. Tighten to 22-29 ft-lbs (29.8-39.3 Nm).

20. Tighten fork cap on fork tube. Torque to 11-22 ft-lbs (14.9-29.8 Nm).

21. Install the spring adjuster plate.

22. Replace O-rings on spring preload adjuster and lubricate with fork oil.

23. Install the spring preload adjuster.

24. Install the stopper ring.

25. Carefully drive slider cover into slider.

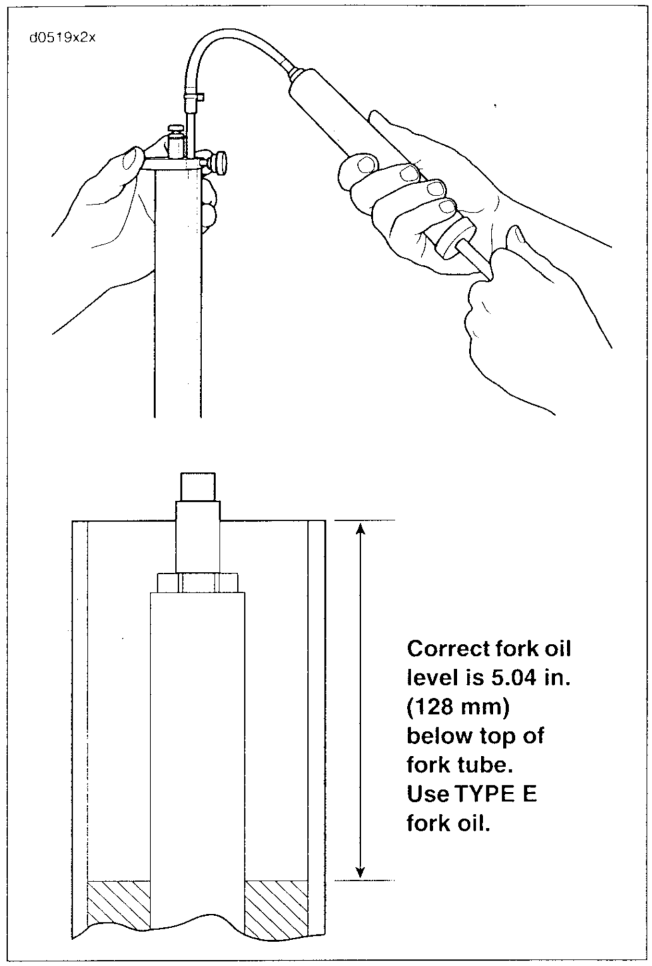


Figure 2-98. Checking Oil Height

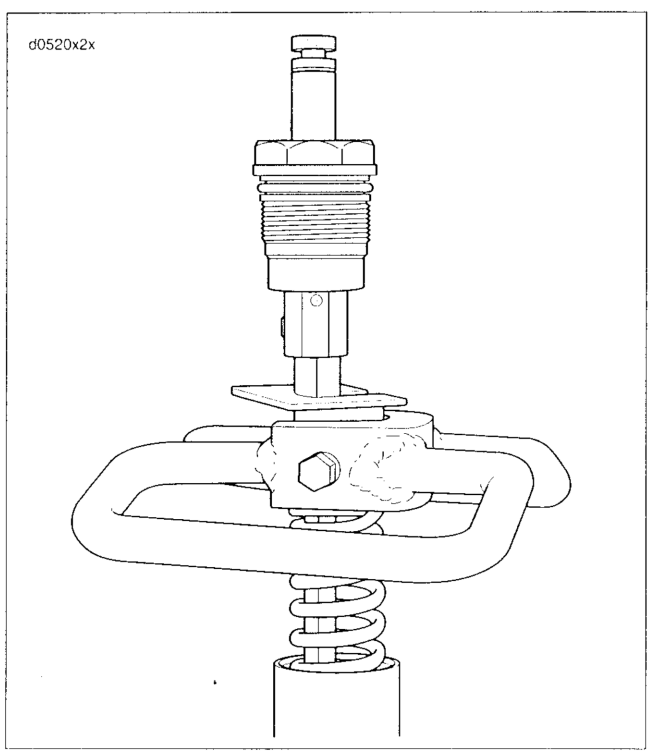
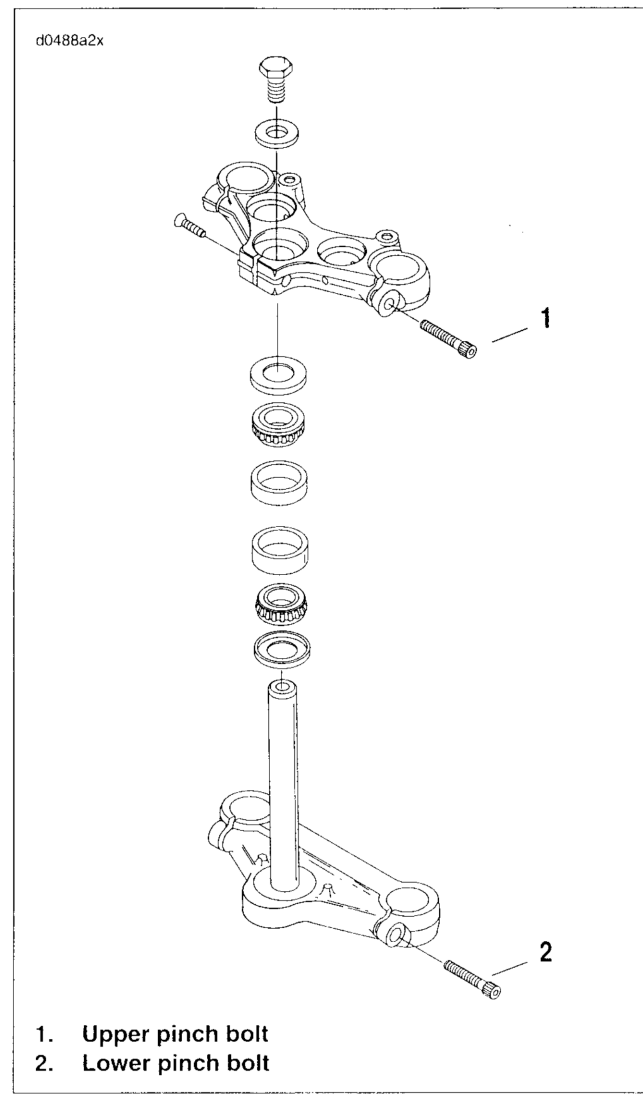


Figure 2-99. Spring Plate

INSTALLATION

1. See Figure 2-91. Insert both fork side assemblies up through the fork stem and bracket and upper bracket.
2. See Figure 2-100. Tighten fork stem bracket pinch bolt(s) to 30-35 ft-lbs (40.7-47.5 Nm).
3. Install the headlamp bracket and adjust headlamp. See 8.17 HEADLAMP.
4. Install front fender. See 2.28 FRONT FENDER.
5. Install front wheel and brake caliper. See 2.4 FRONT WHEEL.



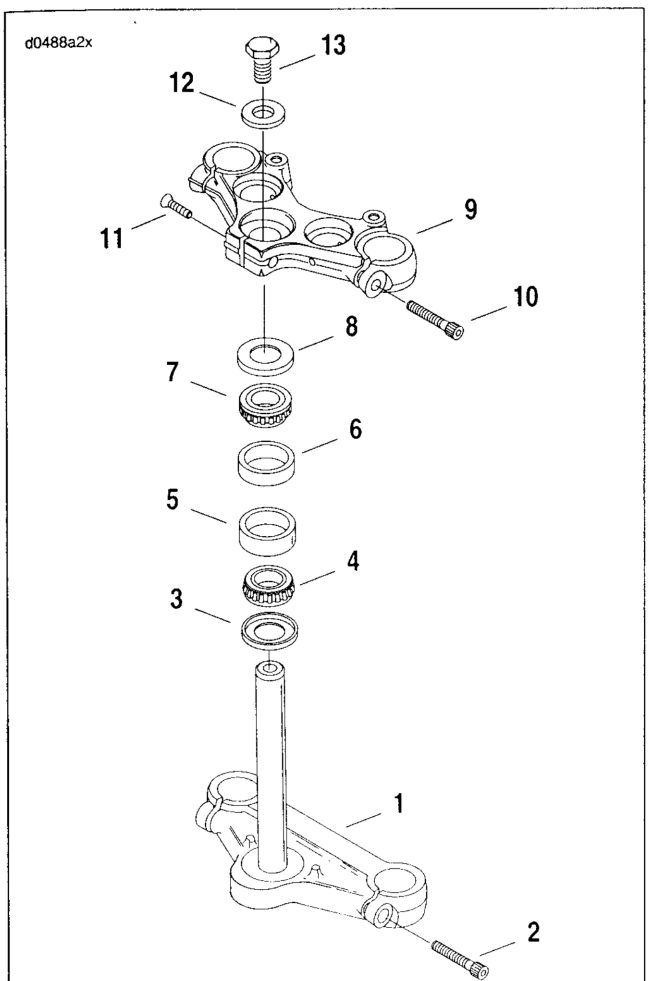
1. Upper pinch bolt
2. Lower pinch bolt

Figure 2-100. Fork Pinch Bolts

REMOVAL

All Models Except FXDWG

1. Remove fork sides. See 2.18 FRONT FORK: FXD AND FXDL or 2.20 FRONT FORK: FXDX AND FXDXT.
2. See Figure 2-101. Remove bolt (13), washer (12) and loosen socket head bolt (11). Lift handlebars from steering head with upper bracket (9) attached. Be careful not to pinch or kink control cables.
3. Remove dust cap (8) and bearing cone (7). Slide fork stem and bracket (1) from frame.

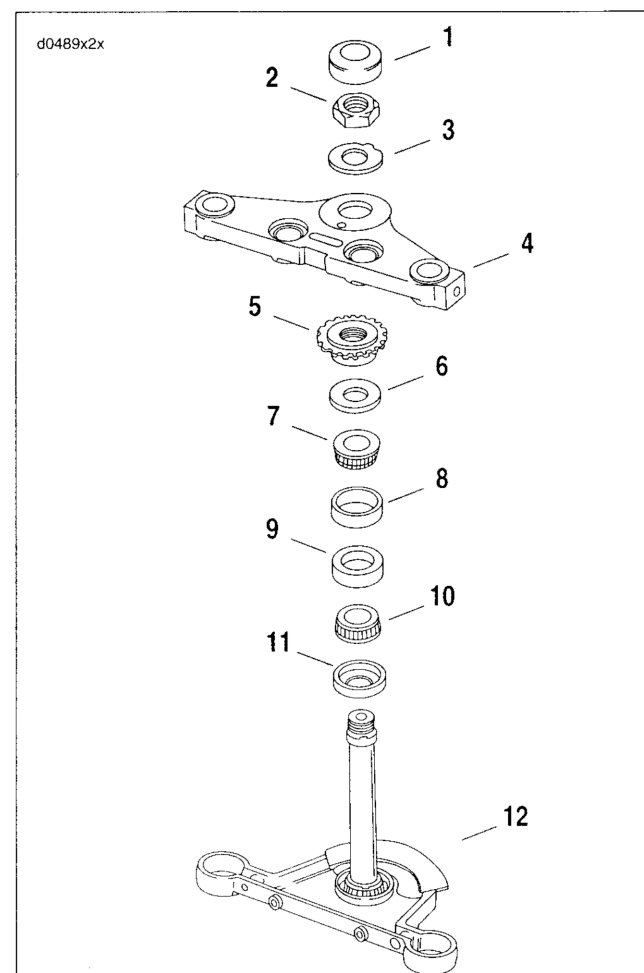


1. Fork stem and bracket
2. Socket head screw
3. Dust shield
4. Bearing cone
5. Bearing cup
6. Bearing cup
7. Bearing cone
8. Dust cap
9. Upper fork bracket
10. Socket head screw
11. Socket head bolt
12. Washer
13. Bolt

Figure 2-101. FXDL Style Steering Head

FXDWG Models

1. Remove fork sides. See 2.19 FRONT FORK: FXDWG.
2. Remove the headlamp and headlamp bracket. See 8.17 HEADLAMP.
3. Remove the brake hose bracket from the bottom of the fork stem and bracket.
4. See Figure 2-102. Remove the fork stem cap (1). Bend the lockwasher tab away from the fork stem nut (2) and remove the fork stem nut with the handlebar and upper bracket (4).
5. Remove the adjusting nut (5) and pull the fork stem and bracket (12) out of the steering head. Remove the upper dust shield (6).



1. Fork stem cap
2. Fork stem nut
3. Lockwasher
4. Upper 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 and bracket

Figure 2-102. FXDWG Steering Head

CLEANING AND 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

Always replace both races and bearings even if one race and bearing appear to be good. Mismatched bearing components may lead to excessive wear and the need for premature bearing replacement.

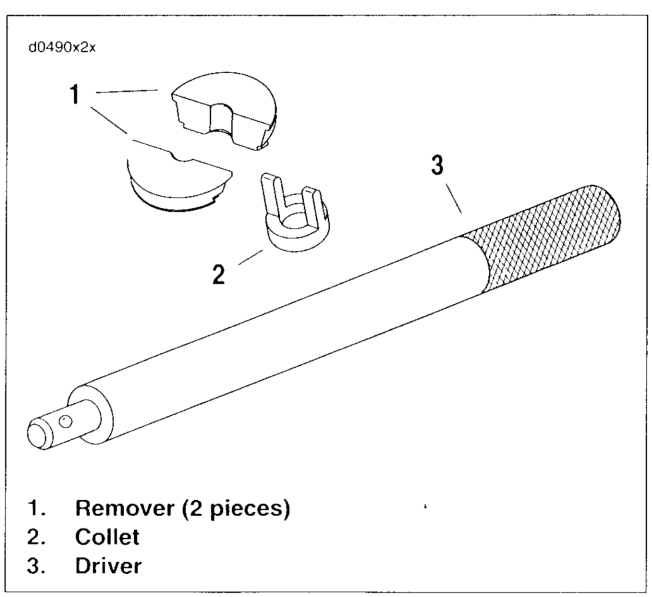
2. Check the roughness of the bearings by turning them in the race. Replace bearings if they do not turn freely and smoothly.

DISASSEMBLY

Steering Head Bearing Race Removal

PART NO.	SPECIALTY TOOL
HD-39301-A	Steering head bearing race remover
HD-33416	Universal driver

1. See Figure 2-104. With the tapered side down, seat the two-piece remover tool (1) on the upper bearing race leaving a gap in the middle.
2. Install the collet (2) on the driver.
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.



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

Figure 2-103. Race Remover Tools

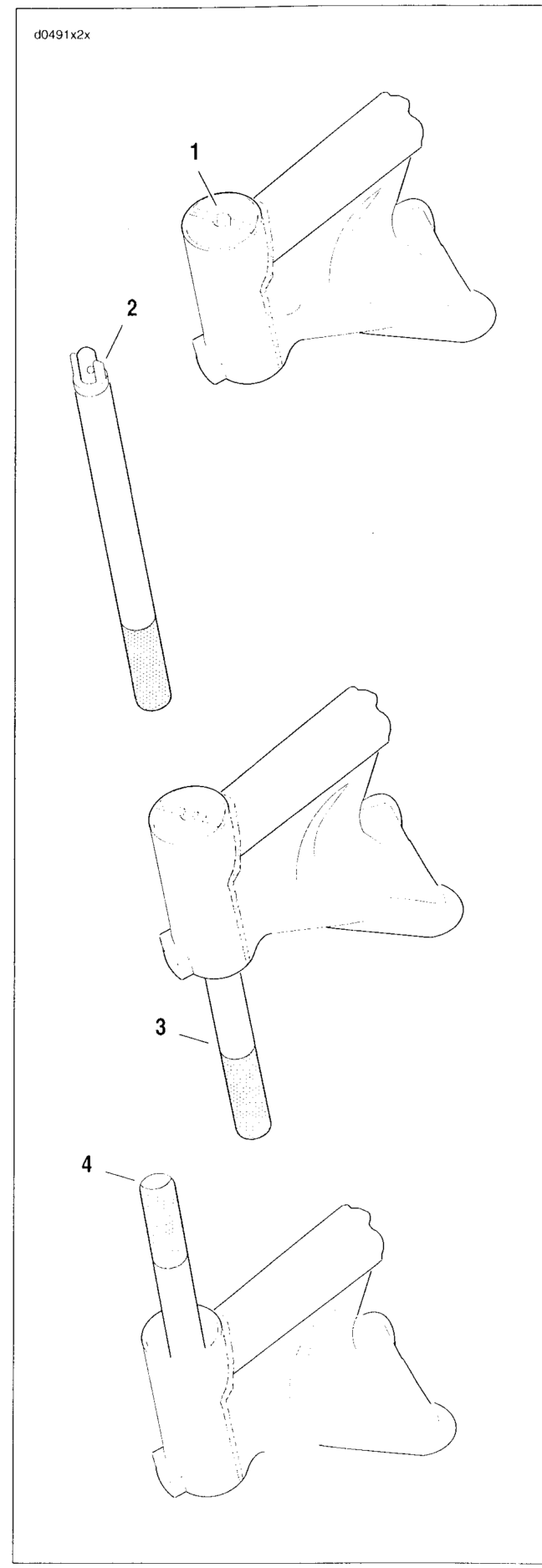


Figure 2-104. Remove Races

5. If necessary, remove bearing cups (FXDL style items 5, 6 in Figure 2-101./FXDWG items 8,9 in Figure 2-102.) using the same tools. **If bearing cups are removed, the bearings cannot be reused. They must be replaced.**
6. Chisel cage that retains rollers, off bearing on fork stem.
7. Turn the fork stem upside down while heating the bearing cone's inner race. The race will expand and fall free.

ASSEMBLY

PART NO.	SPECIALTY TOOL
HD-39302	Steering head bearing race installer

1. Pack the new bearings with SPECIAL PURPOSE GREASE (Part No. HD-99857-97).
2. Install the dust shield. Use a sleeve that will contact only the inner race of the new bearing then press the bearing into place.

⚠WARNING

The cup must be firmly seated against the shoulder in the bore. If it is not, the steering head adjustment will become loose and adversely affect the vehicle's handling which may lead to an accident which could result in death or serious injury.

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

INSTALLATION

All Models Except FXDWG

1. See Figure 2-101. Insert the fork stem and bracket (1) into steering head of frame. Install the bearing (7) and dust cap (8).

⚠WARNING

An improperly adjusted fork stem nut may adversely affect the vehicle's handling which may lead to an accident which could result in death or serious injury.

2. Install upper bracket (9) with handlebars, washer (12) and bolt (13).
3. Tighten bolt (13) so forks have no noticeable shake and turn left and right freely.
4. Tighten pinch bolt (11) to 21-27 ft-lbs (28.5-36.6 Nm).

CAUTION

Overtightening stem nut will cause the bearings to wear excessively leading to the need for premature bearing replacement.

5. Replace fork sides. See 2.18 FRONT FORK: FXD AND FXDL or 2.20 FRONT FORK: FXDX AND FXDXT.
6. Adjust steering head bearings. See 1.17 STEERING HEAD BEARINGS.

FXDWG Models

⚠WARNING

An improperly adjusted fork stem nut may adversely affect the vehicle's handling which may lead to an accident which could result in death or serious injury.

CAUTION

Overtightening adjusting nut will cause the bearings to wear excessively leading to the need for premature bearing replacement.

1. See Figure 2-102. Insert the stem and bracket assembly into the frame steering head and install the upper bearing and dust shield (6). Secure with the adjusting nut (5). Tighten the bearing seat until the bearings have no noticeable shake. Fork stem must turn freely from side to side.
2. Install upper bracket (4), a **new** lockwasher (3) and fork stem nut (2). Be sure pin on lockwasher registers in upper bracket hole. Tighten nut securely. Tighten upper bracket pinch screws to 21-27 ft-lbs (28.5-36.6 Nm).
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 132 **in-lbs** (14.9 Nm).
4. Install the headlamp assembly. See 8.17 HEADLAMP.
5. Install fork sides. See 2.19 FRONT FORK: FXDWG.
6. Adjust steering head bearings. See 1.17 STEERING HEAD BEARINGS.
7. Tighten fork stem nut to 35-40 ft-lbs (47-54 Nm). Bend the lockwasher tab against the nut (2) flat.
8. Install the fork stem cap.
9. Align headlamp. See 1.26 HEADLAMP ALIGNMENT.

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.

See 1.16 SUSPENSION ADJUSTMENTS for information on preload adjustment and suspension settings.

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.

FXD, FXDL, FXDWG MODELS

Removal

1. See Figure 2-105. Remove bottom shock mount from rear fork. Remove locknut (10), bolt (2), and spacer (11).
2. Remove upper shock mount from shock mount bolt (7).
   a. Remove acorn nut (3), and outside washer (12).
   b. Remove cover (5), inside washer (4) and shock (6).

Installation

1. Fasten each shock to the frame and rear fork using the original hardware.
2. See Figure 2-105. Attach bottom shock mount to rear fork.
   a. Apply two to three drops of LOCTITE THREADLOCKER 243 (blue) to threads of bottom bolt (2).
   b. Install bolt (2), spacer (11), and locknut (10).
   c. Hand tighten locknut.
3. Attach upper shock mount shock mount bolt (7).
   a. Apply two to three drops of LOCTITE THREADLOCKER 243 (blue) to threads of shock mount bolt (7).
   b. Install shock (6), inside washer (4), cover (5) and outside washer (12).
   c. Hand tighten acorn nut (3).
4. Tighten upper and lower shock mounts to 25-40 ft-lbs (34-54 Nm).

NOTE

If upper shock stud nut (9) is removed, tighten to 60-80 ft-lbs (81.3-108.5 Nm).

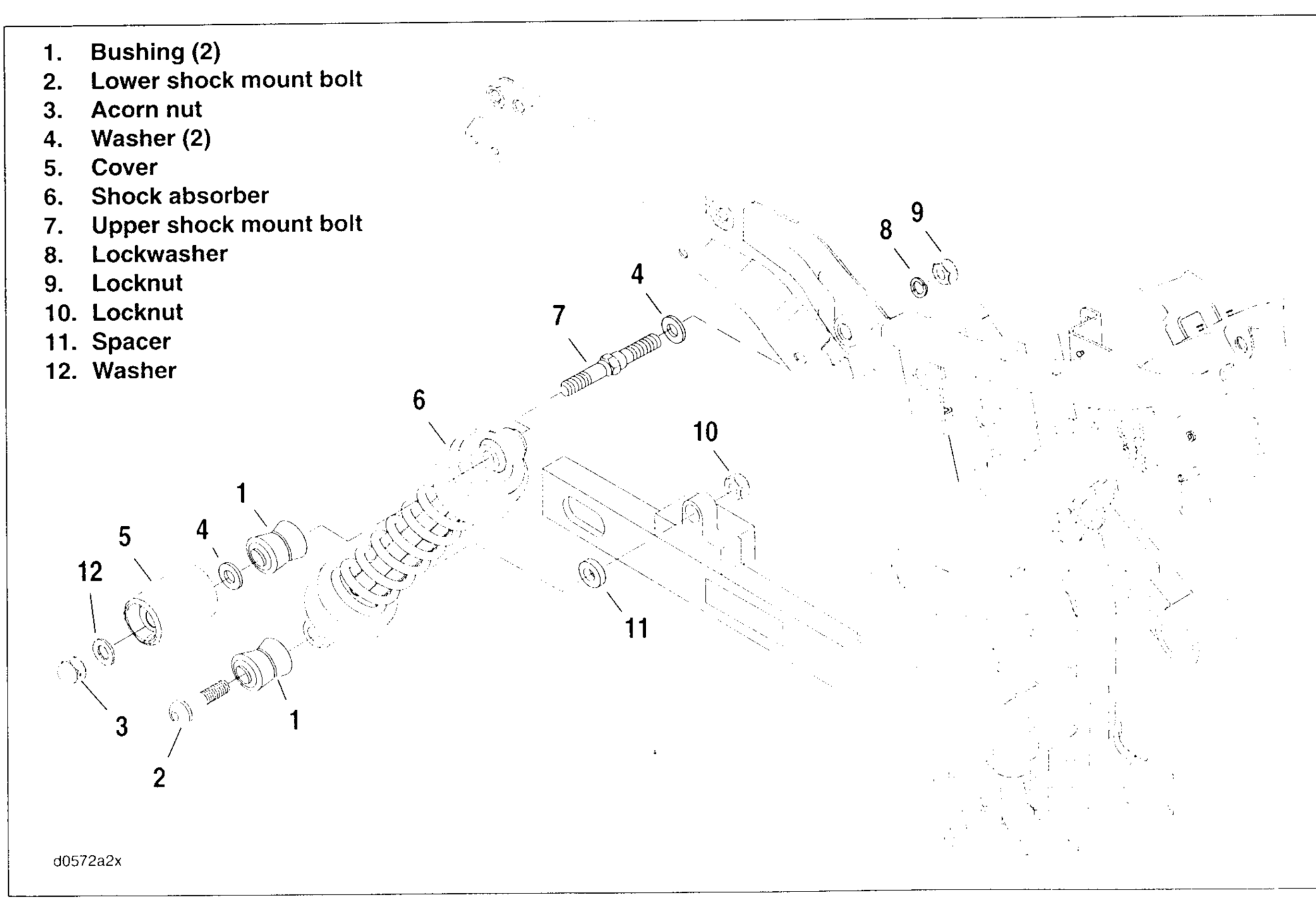


Figure 2-105. Rear Shock Absorber: FXD, FXDL FXDWG

FXDX, FXDXT MODELS

Removal

1. See Figure 2-106. Remove lower shock mount from rear fork.
   - Remove screw (1), washer (3) and locknut (9).
2. Remove upper shock mount from shock mount bolt (6).
   a. Remove acorn nut (2) and washers (3).
   b. Remove shock (4), and shock bolt sleeve (5).

Installation

1. Fasten each shock to the frame and rear fork using the original hardware.
2. See Figure 2-106. Attach lower shock mount to rear fork.
   a. Apply two to three drops of LOCTITE THREAD-LOCKER 243 (blue) to threads of bolt (1).
   b. Install bolt (1), spacer (10), and locknut (9).
   c. Hand tighten locknut.
3. Attach upper shock mount to shock mount bolt (6).
   a. Apply two to three drops of LOCTITE THREAD-LOCKER 243 (blue) to threads of shock mount bolt (6).
   b. Install shock bolt sleeve (5), shock (4), washers (3), and acorn nut (2).
4. Tighten upper and lower shock mounts to 25-40 ft-lbs (34-54 Nm).

NOTE

If upper shock locknut (8) is removed, tighten to 60-80 ft-lbs (81.3-108.5 Nm).

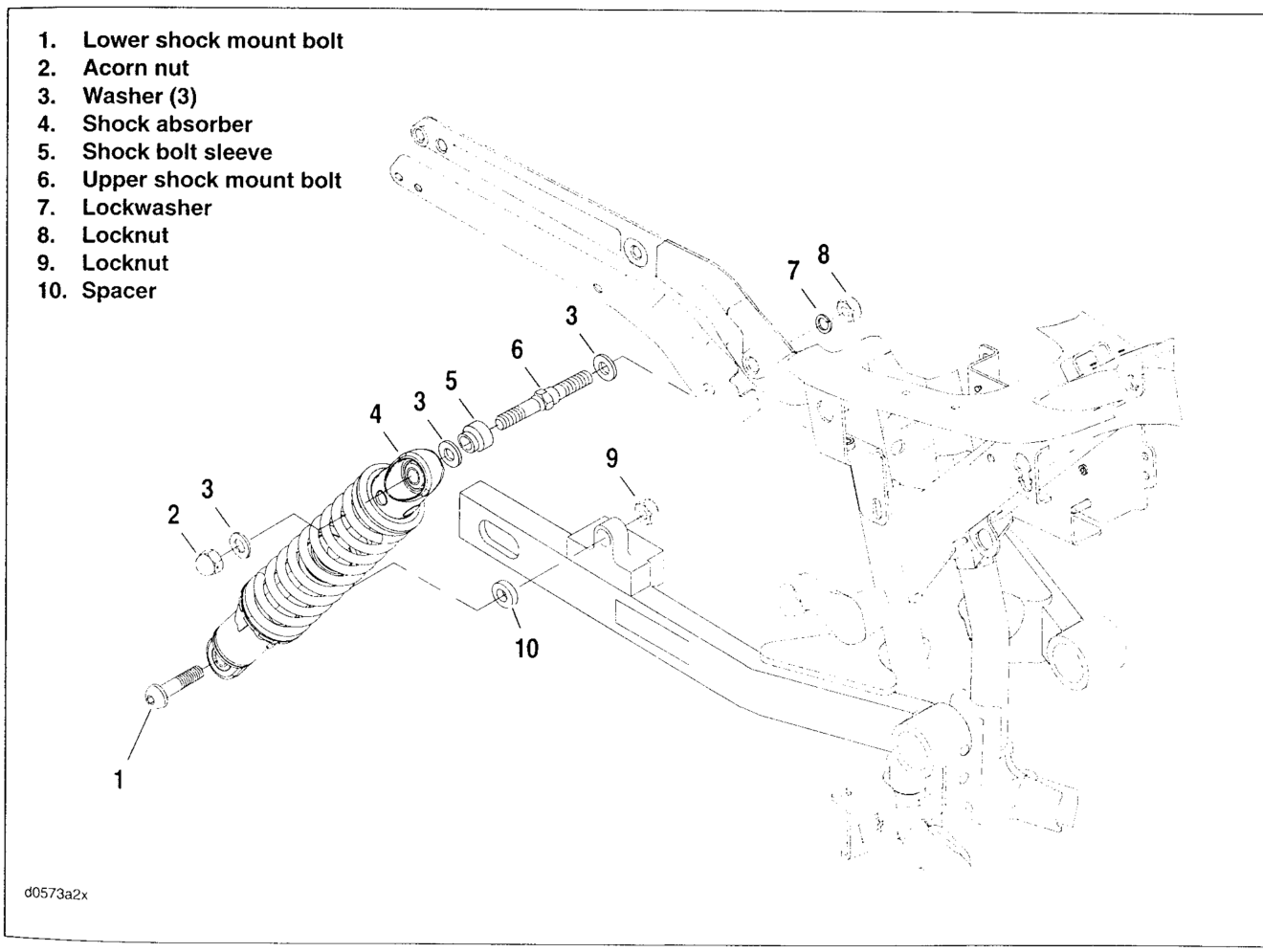


Figure 2-106. Rear Shock Absorber: FXDX, FXDXT

REMOVAL

1. Remove rear brake caliper. See 2.17 REAR BRAKE CALIPER.
2. Remove rear wheel. See 2.5 REAR WHEEL. DO NOT remove sprocket or brake disc unless they are damaged and must be replaced.
3. Remove rear shock absorbers. See 2.22 REAR SHOCK ABSORBERS.
4. Remove the belt and debris guards. See 2.24 BELT GUARD and 2.25 DEBRIS DEFLECTOR.
5. See Figure 2-107. Remove plug (2).
6. Remove screw (18) and lockwasher (17).
7. Remove pivot shaft with attached nut (3). Support rear fork (1) and pull assembly from frame.

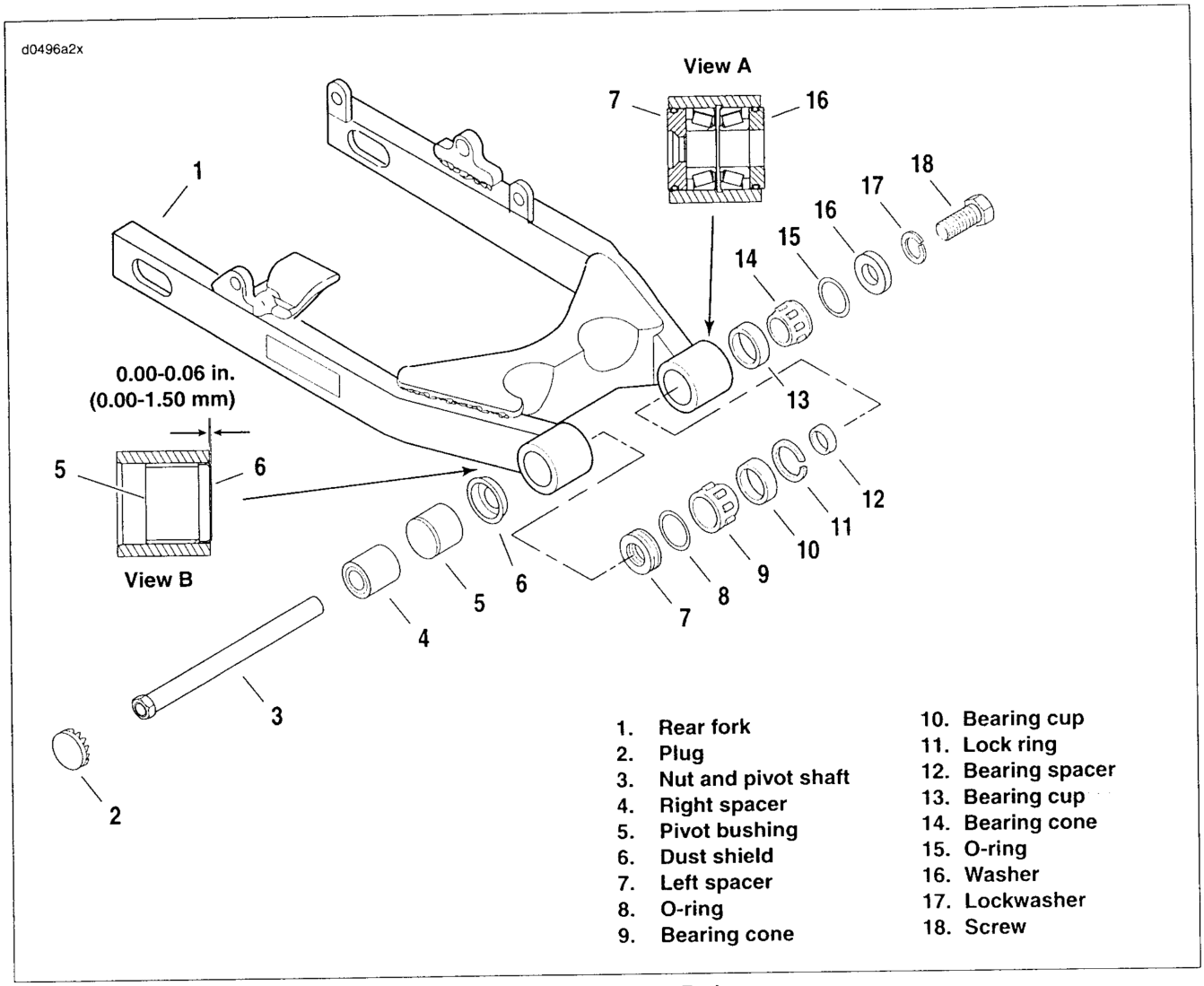


Figure 2-107. Rear Fork

DISASSEMBLY

Carefully mark all components as they are removed, so components may be easily returned to their original locations.

1. See Figure 2-107. Remove washer (16), spacers (7, 4), bearing cones (9, 14) and bearing spacer (12).

NOTE

Bearing cups (10, 13) or pivot bushing (5) should only be removed if replacement is required. The complete bearing assembly must be replaced, as a unit, if replacement is required. The bearing assembly consists of the two bearings and the lock ring. Bearing components must not be intermixed.

2. Drive bearing outer cups (10, 13) from fork with pin punch.

CAUTION

Make cuts as deep as possible in the next step, but use care not to damage bore.

3. Using a die grinder with a grinding burr, make two equally spaced cuts in lock ring (11) at 4:00 and 8:00 positions (with 12:00 being the opening).
4. Pry lock ring from groove and remove.
5. Press pivot bushing (5) and dust shield (6) from fork assembly.

CLEANING AND INSPECTION

1. Carefully inspect all bearing components for wear and/or corrosion. Replace complete bearing assembly if any component is damaged.
2. See Figure 2-107. Check condition of O-rings (8, 15) in washer (16) and spacer (7). Install **new** O-rings if required.

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection and a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

3. Wash all components in non-flammable cleaning solvent. Blow parts dry with low pressure compressed air.
4. Check that rear fork is not bent or twisted. Replace if damaged.

ASSEMBLY

1. See Figure 2-107. If necessary, install **new** lock ring (11) and press **new** bearing cups (10, 13) into position.

NOTE

Bearing assembly is shipped assembled as a unit with the lock ring. Do not intermix components. Mark all components so they may be correctly installed.

2. Pack bearing assembly with WHEEL BEARING GREASE (Part No. 99855-89) and assemble.

CAUTION

Bearing spacer (12) must be installed between bearings or bearing failure can result.

3. See section View A. Install washer (16) with small diameter hole facing away from bearing.
4. Install spacer (7) with thicker wall, adjacent to O-ring groove, facing away from bearing.
5. See section View B. If bushing (5) must be replaced, press the bushing and dust shield (6) into the fork bore so dust shield is flush to 0.060 in. (1.50 mm) above fork bore.
6. Coat right side pivot spacer (4) with WHEEL BEARING GREASE (Part No. 99855-89). Insert pivot spacer into pivot bushing (5) with chamfered end facing inward.

INSTALLATION

1. Slide rear fork assembly into position on mounting boss of transmission case.
2. See Figure 2-107. Hold fork assembly in position and install the pivot shaft with attached nut (3). Place lockwasher (17) over screw (18) and install next to washer (16). Tighten screw to 45-50 ft-lbs (61.0-67.8 Nm).
3. Install shock absorbers. See 2.22 REAR SHOCK ABSORBERS.
4. Install rear brake caliper. See 2.17 REAR BRAKE CALIPER.
5. Install rear wheel and adjust drive belt deflection. See 2.5 REAR WHEEL.
6. Install the belt and debris guards. See 2.24 BELT GUARD and 2.25 DEBRIS DEFLECTOR.

REMOVAL

1. See Figure 2-108. Remove front bolt and washer (6) from nut (1).
2. Remove rear bolt and washer (5) from nut (1).
3. Lift belt guard (4) away from rear fork.
4. Disassemble belt guard by removing grommets and washers (2, 3).

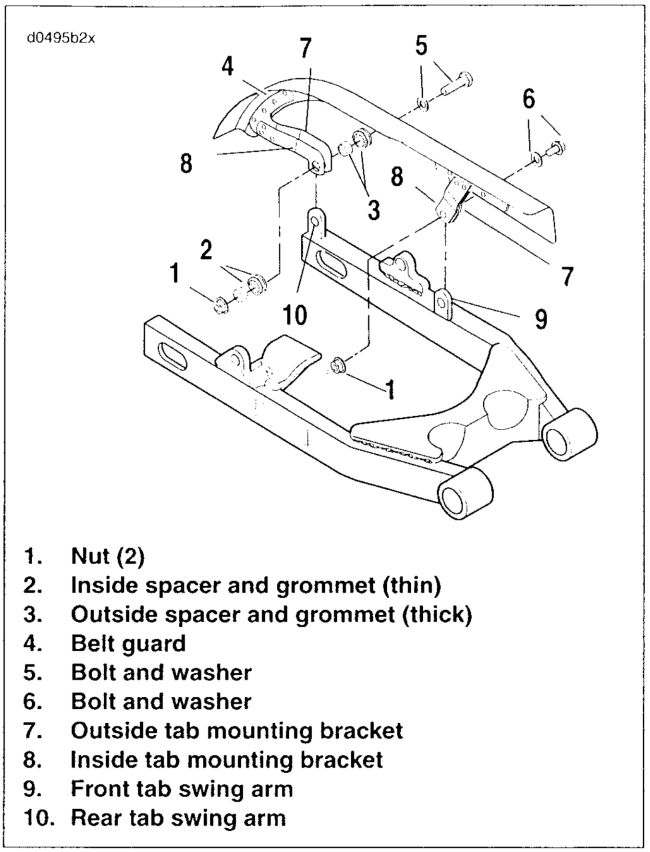
INSTALLATION

1. See Figure 2-108. If removed, install grommets and spacers on belt guard. Thicker grommet and spacer (3) fit around outside tab mounting bracket (7). Thinner grommet and spacer (2) fit around inside tab mounting bracket (8).

⚠WARNING

See Figure 2-108. Verify front and rear swingarm tabs (9, 10) are in between the belt guard's outside (7) and inside (8) mounting bracket. Failure to do so may cause equipment damage and could result in death or serious injury.

2. Place assembled belt guard over front (9) and rear (10) tabs on rear fork.
3. Loosely install front bolt and washer (6) with nut (1).
4. Loosely install rear bolt and washer (5) with nut (1).
5. Tighten hardware to 120-180 **in-lbs** (13.6-20.3 Nm).
6. Verify that belt guard does not contact belt during rear fork travel.



1. **Nut (2)**
2. **Inside spacer and grommet (thin)**
3. **Outside spacer and grommet (thick)**
4. **Belt guard**
5. **Bolt and washer**
6. **Bolt and washer**
7. **Outside tab mounting bracket**
8. **Inside tab mounting bracket**
9. **Front tab swing arm**
10. **Rear tab swing arm**

Figure 2-108. Belt Guard

REMOVAL

See Figure 2-109. Remove three screws to detach debris deflector from rear fork.

INSTALLATION

See Figure 2-109. Attach debris deflector to rear fork using three screws. Tighten to 40-60 **in-lbs** (4.5-6.8 Nm).

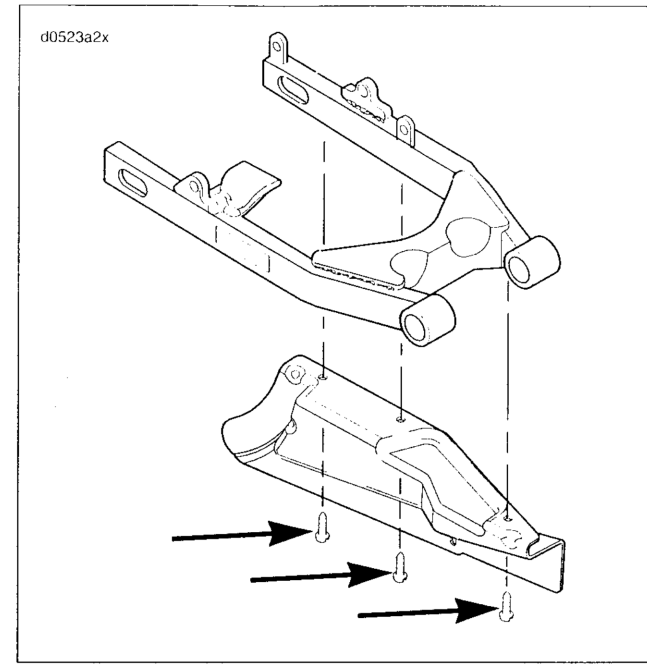


Figure 2-109. Debris Deflector Screws

REMOVAL/DISASSEMBLY

1. See Figure 2-110. 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 carburetor. See 4.8 AIR CLEANER.
4. See Figure 2-111. 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.

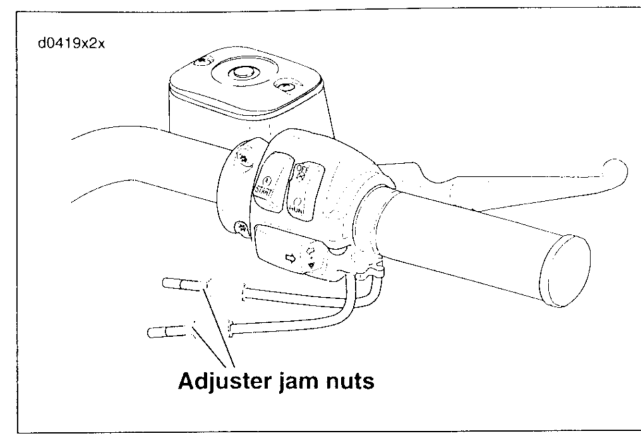


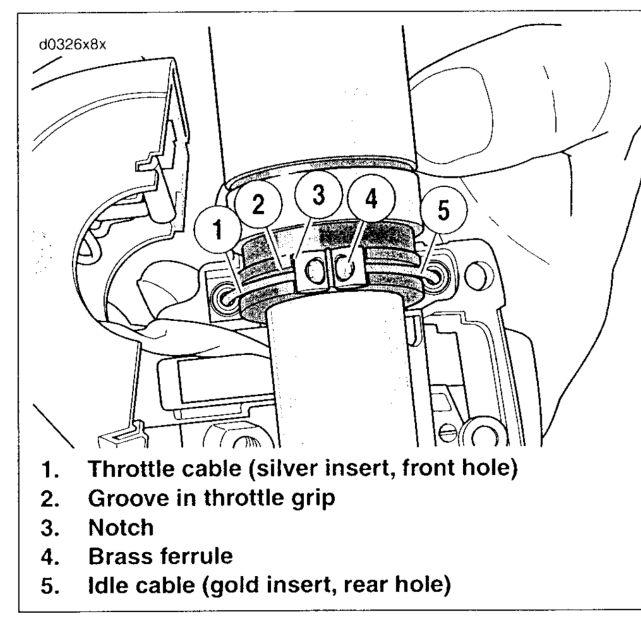
Figure 2-110. Handlebar Throttle Control

CLEANING AND INSPECTION

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection and a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

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.



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 2-111. Throttle Cable Attachment

ASSEMBLY/INSTALLATION

1. Apply a light coating of graphite to the handlebar and inside surface of the housings.
2. See Figure 2-111. 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 the friction adjustment screw to the point where the engine will not return to idle automatically. This could lead to an accident which could result in death or serious injury.

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

CAUTION

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.

See Figure 2-112. On FXD, FXDL and FXDX models, throttle cables are routed between headlamp bracket and front fork upper bracket, then under right side of tank to carburetor.

On FXDXT models the throttle cables are routed through a wire form that is mounted on the upper fork bracket.

See Figure 2-113. On FXDWG, throttle cables are routed behind front fork upper bracket, then under right side of tank to carburetor.

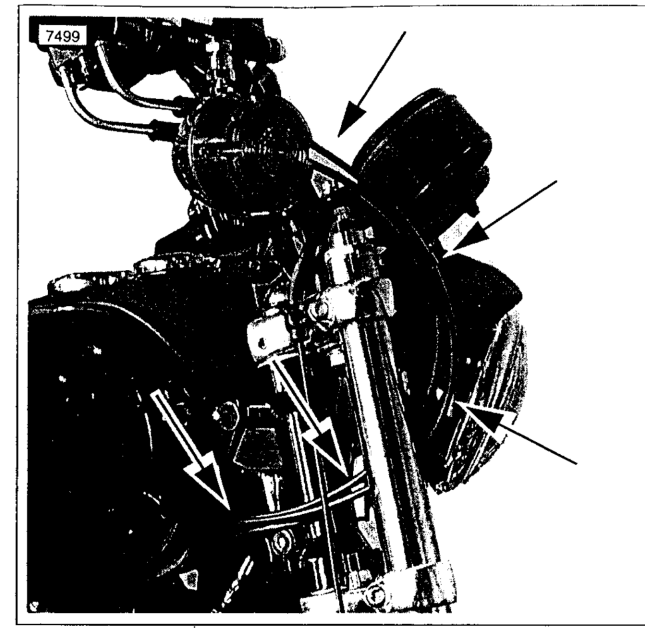


Figure 2-112. Throttle Cable Routing: All But FXDWG

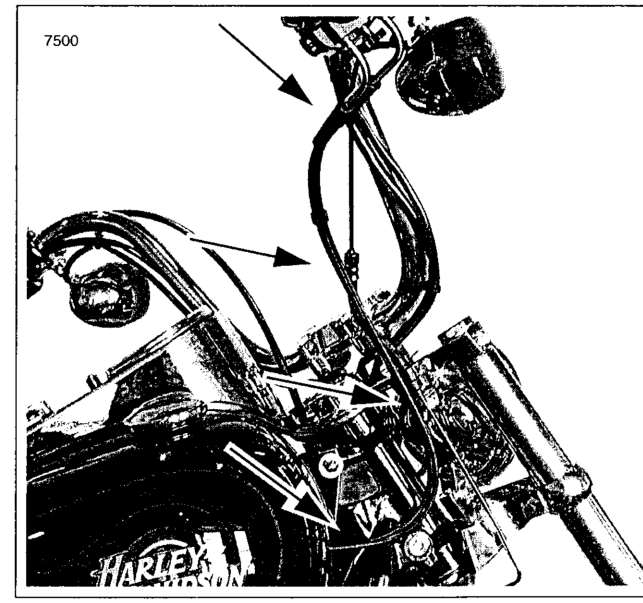


Figure 2-113. Throttle Cable Routing: FXDWG

REMOVAL

1. Loosen clutch adjuster so clutch cable is fully slack. See 1.12 CLUTCH.
2. See Figure 2-114. 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 7.5 TRANSMISSION CLUTCH RELEASE COVER.
4. See Figure 2-115. Note position of retaining ring opening. Retaining ring opening must be positioned in approximately the same location during assembly. Remove retaining ring (1).
5. Pull inner ramp (2) and coupling (3) out of side cover. Hold inner and outer ramps together to keep balls from falling free.
6. Rotate the inner ramp to a position which will allow the coupling to be disconnected from the inner ramp lever arm. Disconnect coupling from inner ramp. Disconnect cable end (4) from coupling.
7. Back out threaded cable fitting (5) from side cover.

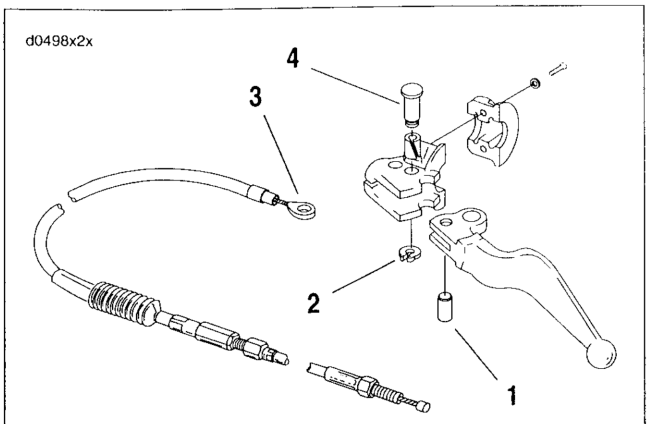
INSTALLATION

1. See Figure 2-115. Thread clutch cable fitting (5) into side cover. Do not tighten at this time.
2. Connect cable end to coupling (3). Rotate ramps for best access and install coupling on inner ramp (2). Place ramp assembly in position in side cover.
3. Install retaining ring (1). Position retaining ring opening so it is located approximately over 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 7.5 TRANSMISSION CLUTCH RELEASE COVER.
5. Place a few drops of oil inside cable housing.

NOTE

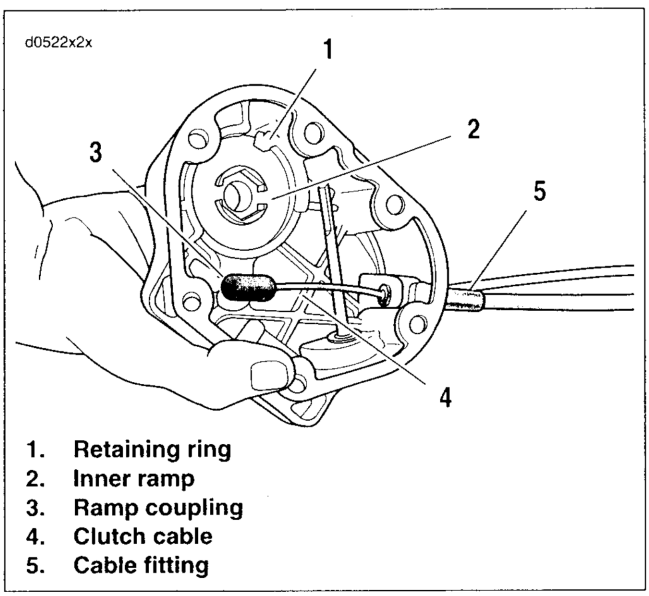
Anchor pin does not require lubrication.

6. Check that clutch cable is properly routed along left side of headlamp, inside left fork tube between the upper and lower fork brackets and through clips on front frame crossmember.
7. See Figure 2-114. 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 1.12 CLUTCH.



1. **Anchor pin**
2. **Retaining ring**
3. **Clevis**
4. **Pivot pin**

Figure 2-114. Clutch Cable Installation



1. **Retaining ring**
2. **Inner ramp**
3. **Ramp coupling**
4. **Clutch cable**
5. **Cable fitting**

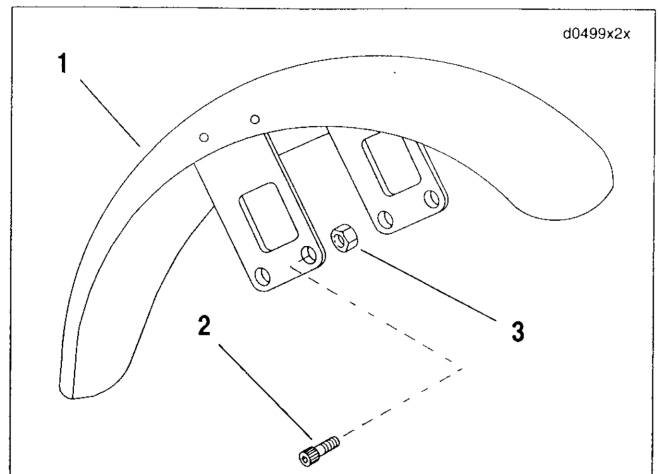
Figure 2-115. Clutch Cable Connection

REMOVAL

1. Detach front fender hardware.
   a. For all models except FXDWG, see Figure 2-116. Remove both fender mounting screws (2) and nuts (3) on each side.
   b. For FXDWG models, see Figure 2-117. Remove the fender mounting screws (2), washers (3) and acorn nuts (4) on each side.
2. Carefully remove fender being careful not to scratch the fender paint.

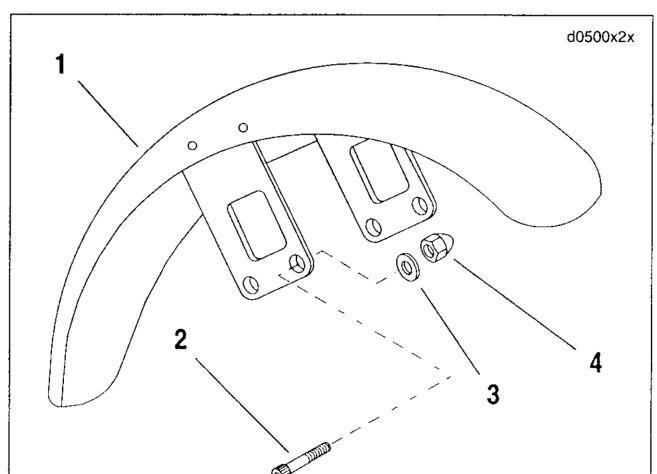
INSTALLATION

1. Carefully position fender and align mounting holes.
   a. For all models except FXDWG, see Figure 2-116. Install screws (2) through fender mounting holes in fork legs. Thread nuts (3) onto screws.
   b. For FXDWG models, see Figure 2-117. Install screws (2) through fender mounting holes in front fork legs. Install washers (3) and thread acorn nuts (4) onto screws.
2. All models: tighten fender mounting nuts to 15-21 ft-lbs (20.3-28.5 Nm).



1. **Front fender**
2. **Screw (2)**
3. **Nut (2) @ 15-21 ft-lbs (20.3-28.5 Nm)**

Figure 2-116. Front Fender: All But FXDWG



1. **Front fender**
2. **Screw (2)**
3. **Flat washer (2)**
4. **Acorn nut (2) @ 15-21 ft-lbs (20.3-28.5 Nm)**

Figure 2-117. Front Fender: FXDWG

GENERAL

This topic is split by vehicle type. However, the following steps are common to all models.

Removal

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect both battery cables, negative cable first.
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 DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL and B.6 CONNECTOR LOCATIONS in the appendix 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

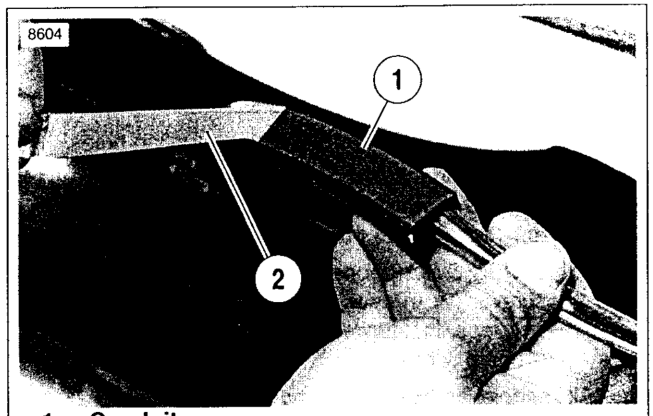
If you are replacing the existing conduit, it may be necessary to remove remaining adhesive. ***Do NOT use solvents or harsh chemicals to remove adhesive as damage to painted surfaces may occur.***

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 8-42.

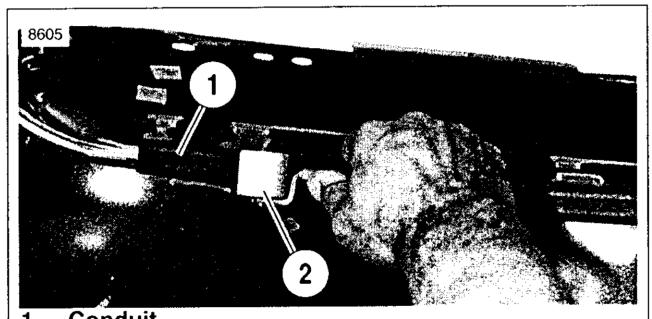
2. Dry the surface, then wipe the area where conduit will be placed with Isopropyl Alcohol. Allow to dry completely.
3. Slide tail lamp wiring harness through conduit and plug connectors into appropriate sockets. See DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL and B.6 CONNECTOR LOCATIONS in the appendix for more information.
4. Remove protective strip covering adhesive on conduit (see Figure 2-118.) and lightly position the conduit in place.



1. Conduit
2. Protective strip

Figure 2-118. Removing Protective Strip From Conduit

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 2-119.



1. Conduit
2. Wallpaper corner roller

Figure 2-119. Purging Air Between Adhesive and Fender

NOTES

- *Do NOT rub the conduit to make it adhere to the fender. This will not do an adequate job of purging the air from between the adhesive and fender.*
- *Once the adhesive is in place, it requires 72 hours to fully cure. 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 DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL and B.6 CONNECTOR LOCATIONS in the appendix for more information.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

3. Connect both battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control of vehicle and death or serious injury.

4. Install seat.

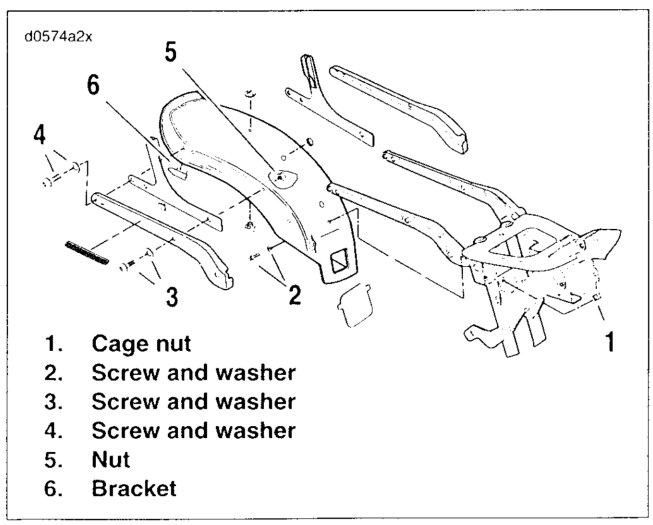
FXDWG MODEL

Removal

1. See Figure 2-120. From under fender, remove screw and washer (2) securing front of fender to cage nut (1) on frame.
2. Remove rear turn signal lamps. See 8.19 TURN SIGNALS/RUNNING LIGHTS.
3. Remove screws and washers (4) from rear holes in fender support. Remove license plate bracket from fender.
4. Remove remaining screws/washers (3) and nuts (5) that hold fender in place and carefully remove fender and sideplates.

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 GENERAL for procedure.
2. See Figure 2-120. Place fender and sideplates into position. Apply LOCTITE THREADLOCKER 243 (blue) to screw (3) threads. Tighten nuts (5) to 12-18 ft-lbs (16.3-24.4 Nm).
3. See 8.19 TURN SIGNALS/RUNNING LIGHTS. Install rear turn signals.
4. Attach front of fender to frame with screw/washer (2) and cage nut (1).
5. Attach license plate bracket to fender with screws and washers (4).
6. Finish with installation instructions under GENERAL.



1. **Cage nut**
2. **Screw and washer**
3. **Screw and washer**
4. **Screw and washer**
5. **Nut**
6. **Bracket**

Figure 2-120. Rear Fender: FXDWG

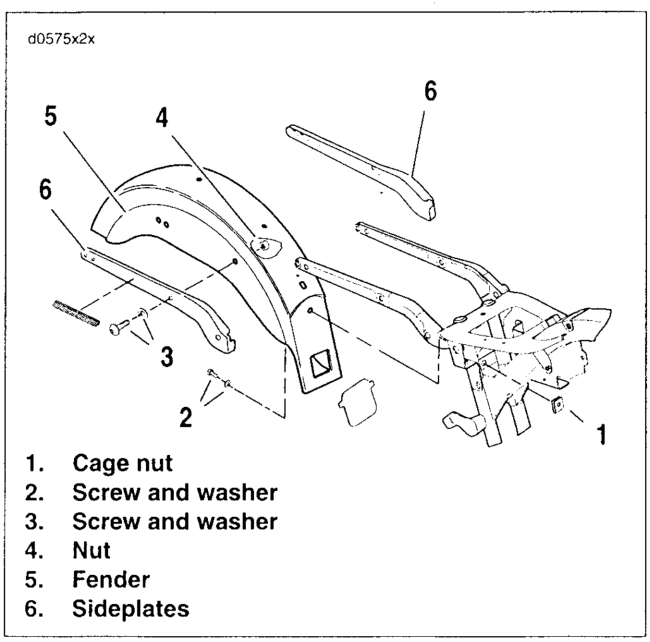
FXD, FXDX AND FXDL MODELS

Removal

1. See Figure 2-121. From under fender, remove screw and washer (2) securing front of fender to cage nut (1) on frame.
2. Remove rear turn signal lamps. See 8.19 TURN SIGNALS/RUNNING LIGHTS.
3. Remove screws/washers (3) and nuts (4) that hold fender in place and carefully remove fender and sideplates (6).

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 GENERAL for procedure.
2. See Figure 2-121. Place fender and sideplates (6) into position. Apply LOCTITE THREADLOCKER 243 (blue) to screw (3) threads. Tighten nuts (4) to 12-18 ft-lbs (16.3-24.4 Nm).
3. Install rear turn signals. See 8.19 TURN SIGNALS/RUNNING LIGHTS.
4. Attach front of fender to frame with screw/washer (2) and cage nut (1).
5. Finish with installation instructions under GENERAL.



1. **Cage nut**
2. **Screw and washer**
3. **Screw and washer**
4. **Nut**
5. **Fender**
6. **Sideplates**

Figure 2-121. Rear Fender: FXD, FXDX & FXDL

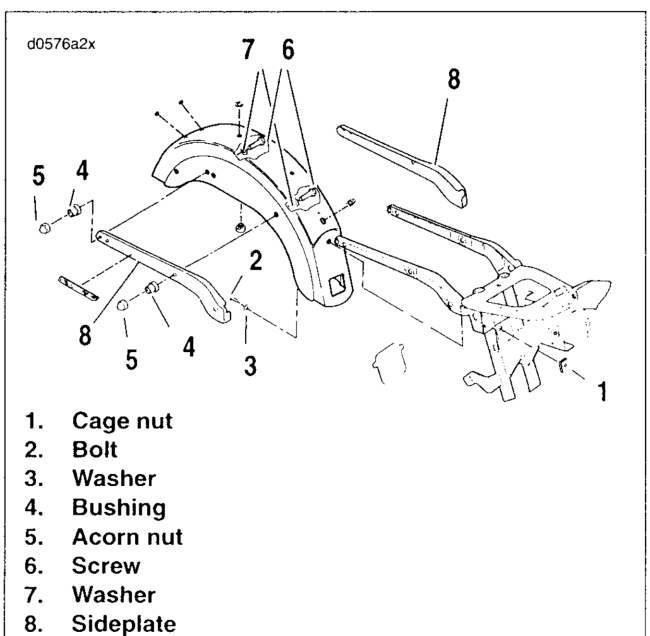
FXDXT MODEL

Removal

1. Remove both saddlebags. See 2.34 SADDLEBAGS: FXDXT.
2. See Figure 2-122. From under fender, remove bolt (2) and washer (3) securing front of fender to cage nut (1) on frame.
3. Remove saddlebag mounting screws (6), washers (7), bushings (4) and acorn nuts (5). Carefully remove fender and sideplates (8).

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 GENERAL for procedure.
2. See Figure 2-122. Place fender and sideplates (8) into position.
3. Install saddlebag mounting screws (6) and washers (7) from inside fender. Apply LOCTITE THREADLOCKER 243 (blue) to screw (6) threads.
4. Install bushings (4) and acorn nuts (5) onto screws (6). Tighten all nuts (5) to 12-18 ft-lbs (16.3-24.4 Nm).
5. Attach front of fender to frame with bolt (2), washer (3) and cage nut (1).
6. Install both saddlebags. See 2.34 SADDLEBAGS: FXDXT.
7. Finish with installation instructions under GENERAL.



1. **Cage nut**
2. **Bolt**
3. **Washer**
4. **Bushing**
5. **Acorn nut**
6. **Screw**
7. **Washer**
8. **Sideplate**

Figure 2-122. Rear Fender: FXDXT

CLEANING

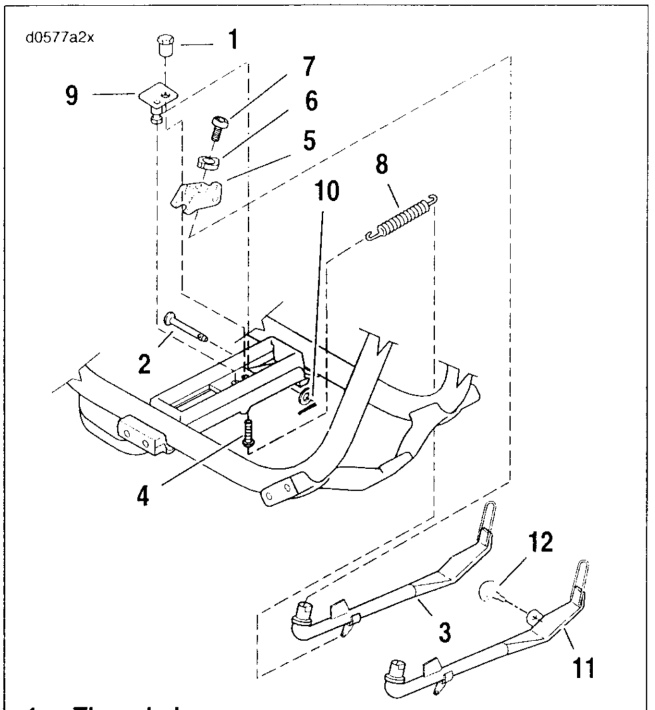
⚠WARNING

- **Without the weight of the motorcycle resting on the jiffy stand, any vehicle movement could cause the jiffy stand to retract slightly from the full forward position. If the jiffy stand is not in the full forward or lock position when vehicle weight is rested on it, the vehicle could fall over, resulting in death or serious injury.**
- **Always park the vehicle on a firm, level surface. The weight of the vehicle can cause it to fall over, resulting in death or serious injury.**
- **Be sure jiffy stand is fully retracted before riding. If jiffy stand is not fully retracted during vehicle operation, unexpected contact with the road surface can distract the rider. While the jiffy stand will retract upon contact, the momentary disturbance and/or rider distraction can lead to loss of vehicle control resulting in death or serious injury.**

1. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-123. 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 or 11) 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.

REMOVAL

1. Block motorcycle underneath frame so both wheels are raised off the ground.
2. See Figure 2-123. 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. **Threaded spacer**
2. **Pin**
3. **Jiffy stand leg (FXD, FXDL, FXDWG)**
4. **Screw**
5. **Pivot block**
6. **Catch**
7. **Bolt**
8. **Spring**
9. **Anchor plate**
10. **Cotter pin and washer**
11. **Jiffy stand leg (FXDX, FXDXT)**
12. **Bumper (FXDX, FXDXT)**

Figure 2-123. Jiffy Stand

INSTALLATION

1. See Figure 2-123. Place pivot block (5) and jiffy stand (3 or 11) 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

1. Remove fork stem. See 2.21 STEERING HEAD.
2. See Figure 2-124. Use a scribe and remove lead plug (1).
3. Remove set screw (2).
4. Insert key in lock (3) and turn partially.
5. Wiggle lock and pull until enough of the lock comes out to get a grip with pliers or other suitable tool.
6. Rotate steering stem slightly, while pulling on lock until lock is removed.

INSTALLATION

NOTES

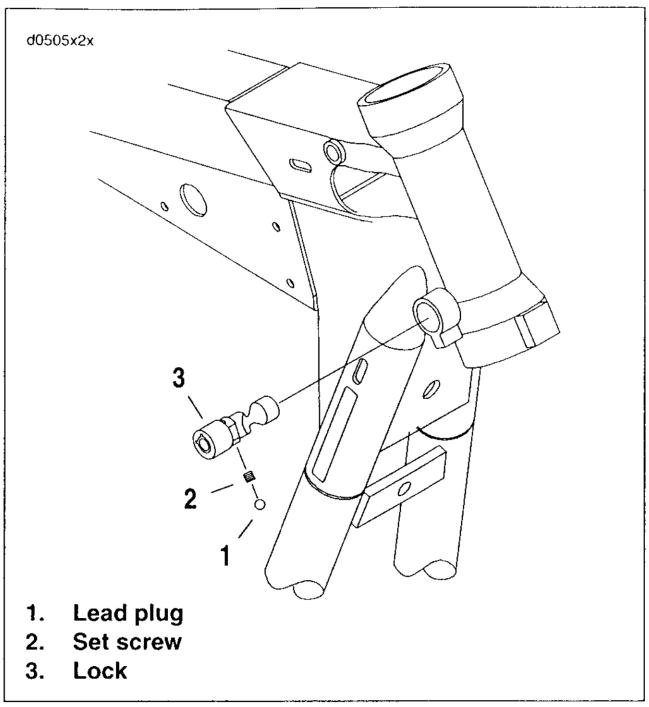
- *There is an internal boss in the left side of the steering head opposite the external boss. The end of the lock fits into this internal boss.*
- *See Figure 2-125. There is a flat in the bottom of the lock into which the set screw fits. This flat must be at the bottom when the lock is installed.*
- *When the lock is correctly installed, a forward-facing flat on the lock will fit against a flat inside the external lock boss and the face of the lock will be flush with the face of the external boss.*

1. Grease the end of the lock (the part that goes into the internal boss) and slide lock into external boss.
2. Insert fork stem into frame. See 2.21 STEERING HEAD.

NOTE

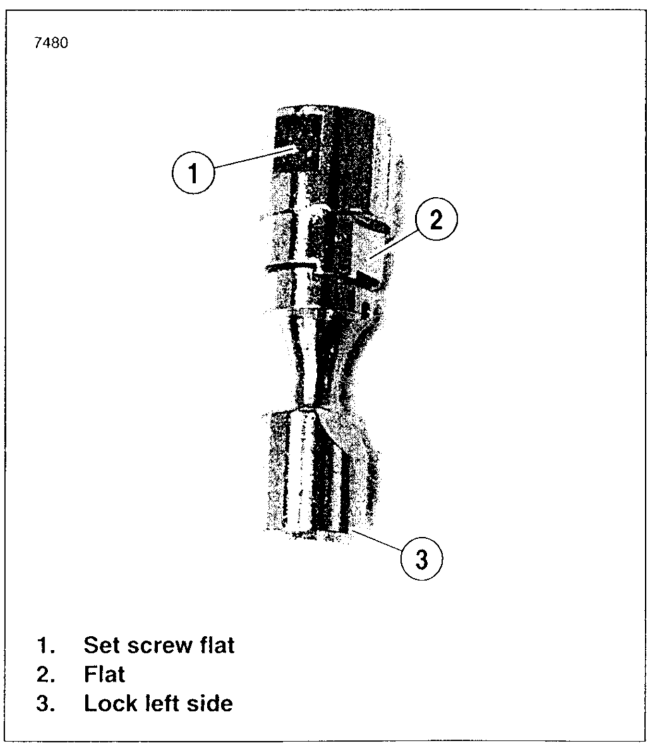
Stem must be in locked fork position.

3. Move fork stem into locked fork position. Rotate fork stem slightly, while fully installing lock.
4. See Figure 2-124. Apply LOCTITE THREADLOCKER 243 (blue) to set screw (2) and install.
5. Insert key in the lock (3) and tighten set screw until lock begins to bind; then back set screw out 1/2 turn.
6. Pound in lead plug (1) or use a good quality sealant.
7. Finish fork stem installation including installing upper triple clamp and handlebars. See 2.21 STEERING HEAD.



1. Lead plug
2. Set screw
3. Lock

Figure 2-124. Fork Lock Installation



1. Set screw flat
2. Flat
3. Lock left side

Figure 2-125. Fork Lock

REMOVAL

CAUTION

See Figure 2-126. There is a nylon retaining clip (3) 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.

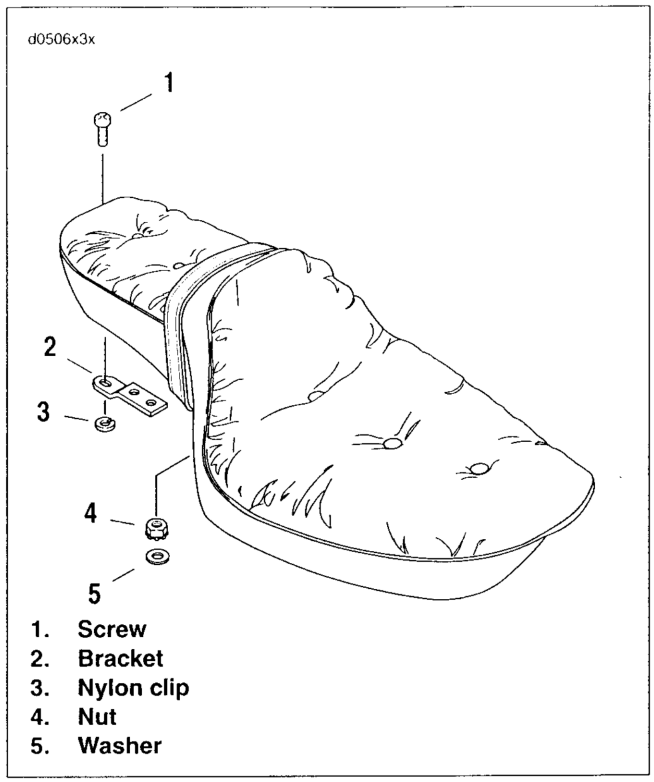
1. See Figure 2-126. Remove screw (1) from rear seat bracket (2). (Nylon clip remains with fender assembly).

NOTES

- *There is a bracket at the front of the seat that slips under a u-shaped frame bracket.*
- *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.

There is no need to remove the seat bracket and its fasteners from the seat pan.



1. **Screw**
2. **Bracket**
3. **Nylon clip**
4. **Nut**
5. **Washer**

Figure 2-126. Seat

INSTALLATION

1. 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 front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control of vehicle and death or serious injury.

4. Install screw (1) and bracket (2) to fender. Verify nylon retaining clip (3) is in position on fender.

REMOVAL

Front Isolator

1. Support front of engine with jack.
2. See Figure 2-127. 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 2-127. Place front isolator (4) in position on frame and install bolts (1) lockwashers (2) and washers (3). Torque 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

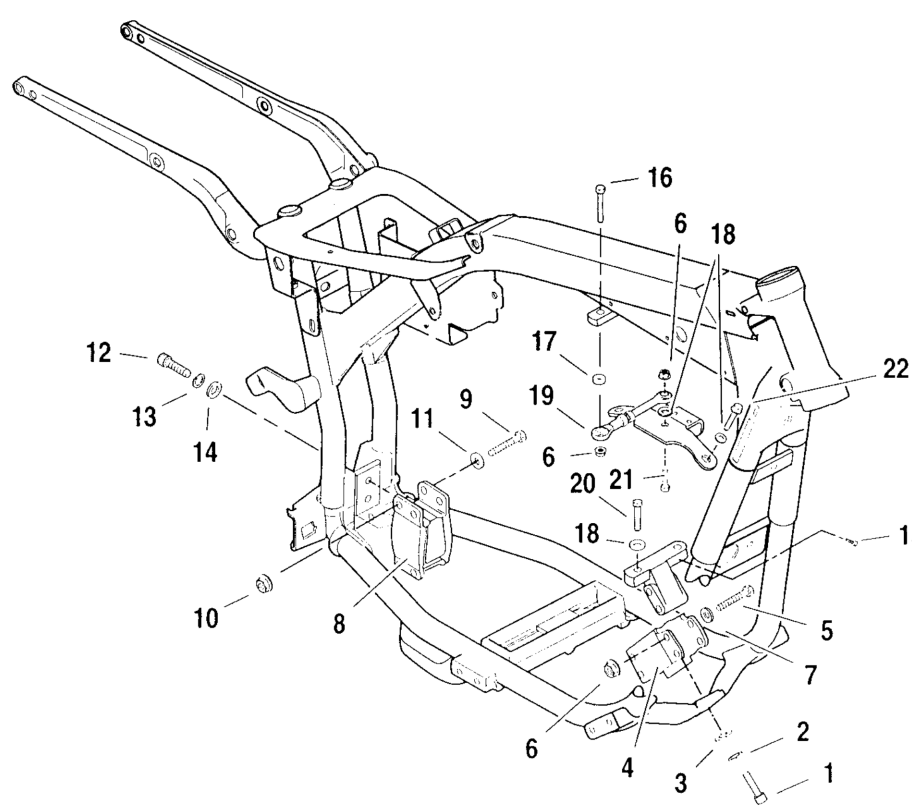
1. Use a jack on the oil tank to support rear of transmission.

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. **Screw**
16. **Bolt**
17. **Spacer**
18. **Washer**
19. **Stabilizer link**
20. **Bolt**
21. **Bolt**
22. **Bolt**



d0507x2x

Figure 2-127. Engine Mounts

GENERAL

⚠WARNING

DO NOT load weight or install accessories improperly on the motorcycle. Doing so may affect the motorcycle's stability, handling characteristics and safe operating speed and could result in death or serious injury.

CAUTION

The provided raincover must be installed with bottom of raincover between saddlebag and wire frame hoop cover. If raincover is below wire frame hoop cover, it may contact the exhaust system and melt causing damage to the raincover and exhaust system.

The saddlebags have two compartments with water repellant raincovers stored in each outer pocket. It is important to install the raincovers between the top of the covered wire hoop at the bottom of the bag, and the bottom surface of the bag. If the raincovers are installed below the covered wire hoop on the exhaust side, burning may occur. The main compartment opens with the inboard zipper, and can be expanded an additional 3" by opening the outboard zipper. Snaps are provided to fasten the cover in both positions.

NOTE

Each raincover is left (Part No. HD-90843-01) and right (Part No. HD-90851-01) side specific to the motorcycle. Verify each raincover is installed correctly.

CAUTION

It is extremely important to insure saddlebags are completely engaged by pulling lower portion of saddlebag outward (away from bike) after installation. If saddlebags are not completely engaged, they may fall off during vehicle operation which may result in loss of vehicle control and death or serious injury.

See Figure 2-128. The saddlebags are fastened to the bike at three points each by an integral frame. At the rear of each frame is a release mechanism (rectangular in shape). There are also two slots that slide onto mounting screws on the fender brace at the top of each frame.These saddlebags have handles for carrying.

REMOVAL

1. See Figure 2-128. Use the handle to support the saddlebag. Press pin on bottom of saddlebag release (2).
2. Pull bottom of saddlebag slightly away from frame. Slide bag up and toward the front of the bike, so the slotted frame (1) slides off the bushings (8).

NOTE

The saddlebag release is designed to stay in place on the saddlebag frame.

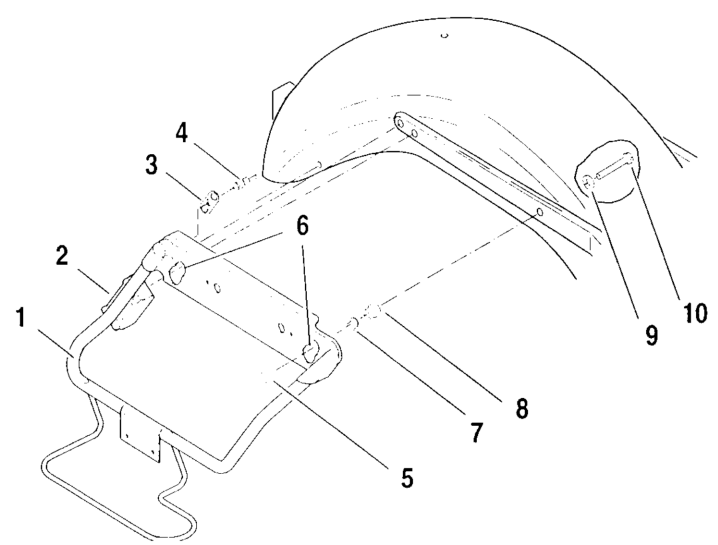
INSTALLATION

1. See Figure 2-128. Align larger portion of slots (6) with acorn nuts (5). These serve as docking points.
2. Firmly push saddlebag down and toward the rear of bike at the same time to engage slots (6) with docking points. The saddlebag release (2) will click into place when saddlebag is secured.
3. Verify saddlebag release (2) is secured.

⚠WARNING

DO NOT allow saddlebag handles to be used as "grab handles." They are not intended to serve as "grab handles" for the passenger. When riding with passengers, ensure a grab strap, designed for passengers to hold onto is installed. Failure to do so could result in death or serious injury.

1. Saddlebag frame
2. Saddlebag release
3. Protector
4. Pin
5. Acorn nut
6. Slots
7. Bushing
8. Bushing
9. Washer
10. Screw



d0578x2x

Figure 2-128. Saddlebags: FXDXT

REMOVAL

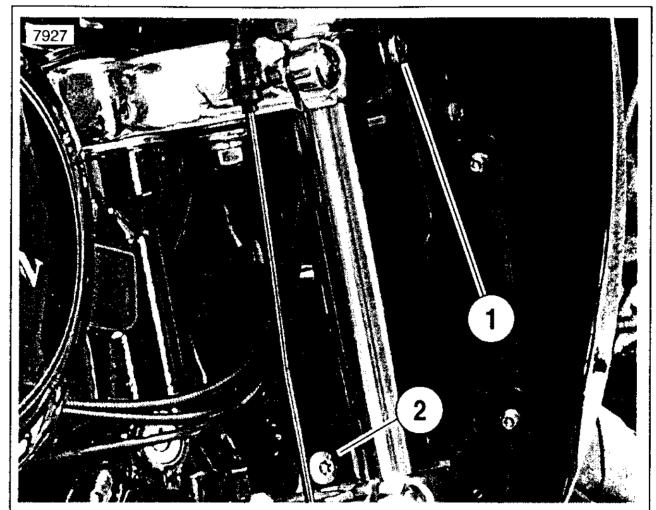
CAUTION

Before performing service on windshield and/or fairing, cover the gas tank and front fender with a soft cloth to avoid equipment damage.

1. Remove headlamp. See 8.17 HEADLAMP.
2. See Figure 2-129. Loosen (but do not remove) screws (1) on both the upper left and right side of fairing support brackets.
3. Remove screws (2) on both the lower left and right side of fairing support brackets.
4. See Figure 2-132. Pull windshield (6) and front fairing (28) slightly away from fairing support brackets (17, 27).
5. Slide windshield (6) and front fairing (28) up and away from the front of the bike, so the slotted fairing support brackets (17, 27) slide off the screws (13).

DISASSEMBLY

1. Remove headlamp. See 8.17 HEADLAMP.
2. See Figure 2-130. Rotate adjusting knob on gearbox assembly clockwise several times to extend windshield.
3. See Figure 2-132. Remove upper windshield mounting screws (4) and washers (5).
4. Remove lower windshield mounting screws (1).
5. Remove windshield (6).
   a. Remove pad windshield mounts (7).
   b. Remove spacers (2) and grommets (3) from lower windshield mounting holes.
6. Remove front fairing cover top (10).
7. Remove front fairing cover top retainer/bumpers (11).
8. Remove front fairing (28).
9. See Figure 2-131. Remove right and left bracket support mounting screws.
10. See Figure 2-132. Remove front fairing bezel trim (30).
11. Remove pushnuts (29).
12. Remove upper extension links (14).
13. Remove screws (16) washers (15) and locknuts (9).
14. Remove left fairing support bracket (17).
    a. Remove gear box mounting bracket screws (12).
    b. Remove upper and lower left fairing support bracket screws (13).
15. Remove left cam mechanism (18).
16. Remove gear box assembly (21) with gear box assembly mounting bracket (23).
17. Remove gear box assembly mounting bracket screws (19).
18. Remove right cam mechanism (26).
19. Remove right fairing support bracket (27). See Figure 2-129. Remove upper and lower right fairing support bracket screws.



1. **Loosen only for removal. Remove for disassembly.**
2. **Remove**

Figure 2-129. Fairing Removal/Disassembly

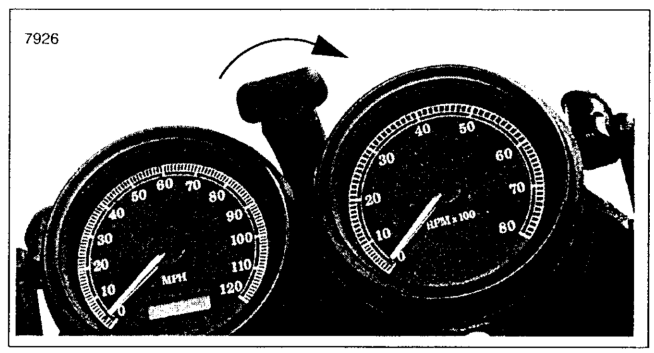


Figure 2-130. Rotate Clockwise to Extend Windshield

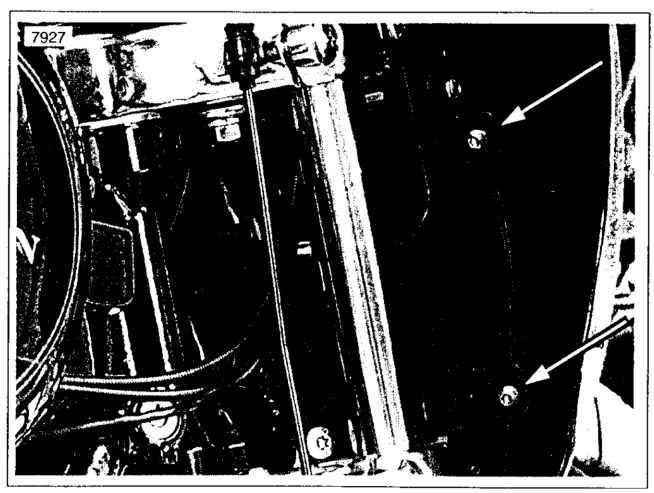
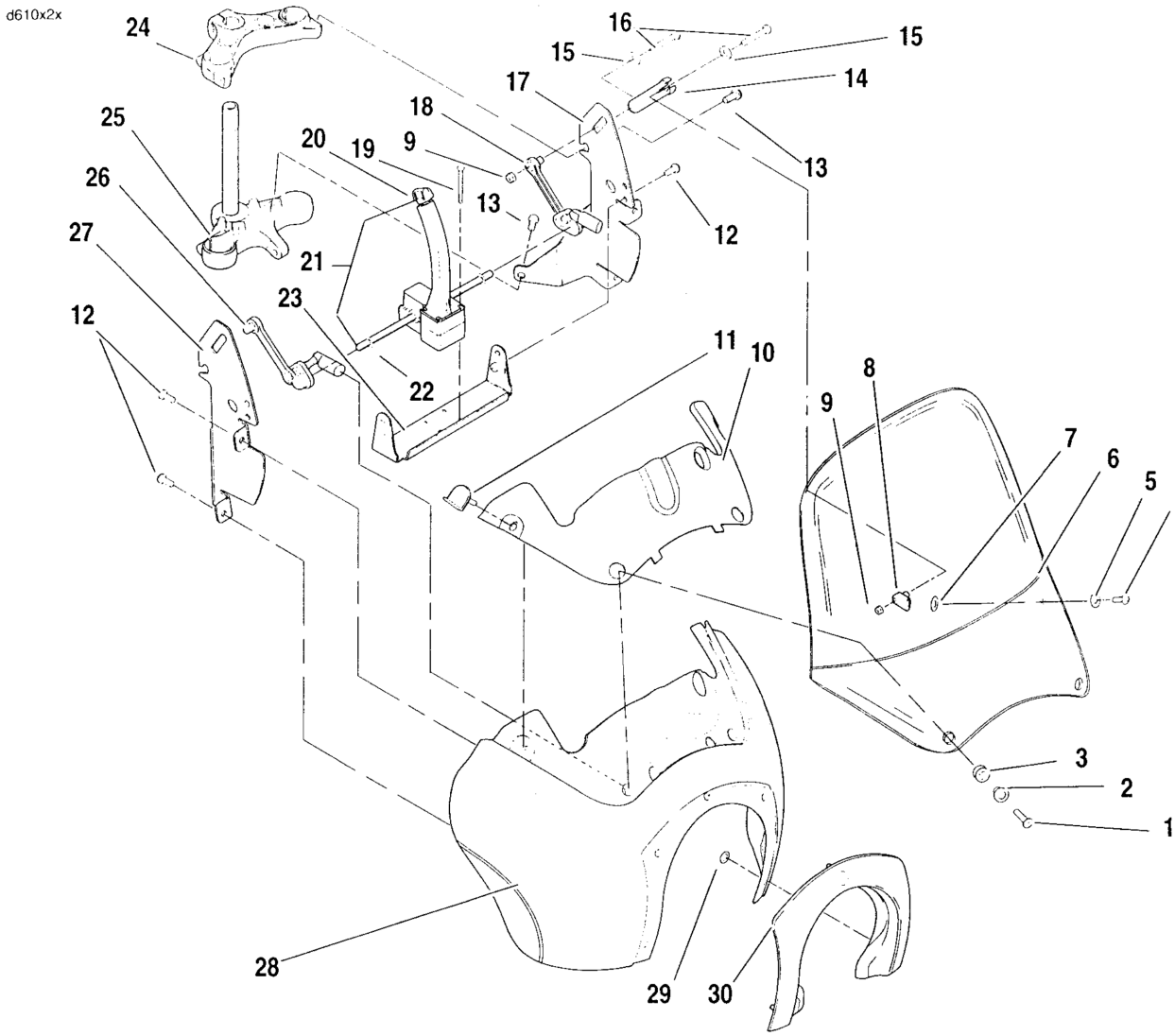


Figure 2-131. Fairing Support Bracket Disassembly



1. Screw (2)
2. Spacer (2)
3. Grommet (2)
4. Screw (2)
5. Washer (2)
6. Windshield
7. Pad windshield mount (2)
8. Upper windshield mount (2)
9. Locknut (4)
10. Front fairing cover top
11. Retainer/Bumper (2)
12. Screw w/washer (6)
13. Screw (4)
14. Upper extension link (2)
15. Nylon flatwasher (4)
16. Screw (4)
17. Left fairing support bracket
18. Left cam mechanism w/link
19. Gear box assembly mounting screw (4)
20. Windshield adjustment knob
21. Gear box assembly
22. Retaining ring (2)
23. Gear box mounting bracket
24. Upper bracket
25. Lower bracket
26. Right cam mechanism w/link
27. Right fairing support bracket
28. Front fairing
29. Pushnut (5)
30. Front fairing bezel trim

Figure 2-132. FXDXT Windshield Assembly

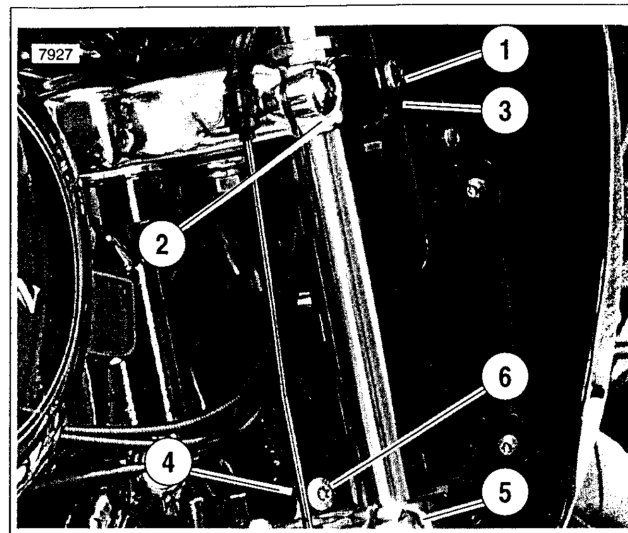
ASSEMBLY

1. See Figure 2-132. Install gearbox mounting screws (19) to gear box assembly (21).
2. Install gearbox assembly (21) to gearbox mounting bracket (23). Tighten gearbox assembly mounting screws (19) to 12-16 **in-lbs (**1.35-1.80 Nm).
3. See Figure 2-132. Install right fairing support bracket (27) to upper (24) and lower (25) brackets.
   a. Fasten screws (13) into upper (24) and lower (25) brackets.
   b. Tighten screws (13) to 12-16 **in-lbs** (1.35-1.80 Nm).

NOTE

Each cam mechanism is marked L for left side of the bike and R for right side of the bike.

4. See Figure 2-134. Attach gearbox mounting bracket to right fairing support bracket. Hand tighten screw.
   a. See Figure 2-132. Slide top of right cam mechanism (26) thru slot in right fairing support bracket. (27).
   b. Slide bar attached to gearbox assembly (21) thru hole of boss at bottom of right cam mechanism (26) and right fairing support bracket (27).
   c. Attach upper extension link (14) with upper windshield mount (8) to the top of right cam mechanism (26)on outside the right fairing support bracket (27).
   d. Install washer (15) and screw (16).
   e. Hand tighten screw (16).
5. Install left fairing support bracket (17) to lower bracket (25) only. Hand tighten screw (13).
6. Attach other end of gearbox mounting bracket (23) to left fairing support bracket (17).
   a. Hand tighten screw (12).
   b. Slide top of left cam mechanism (18) thru slot in left fairing support bracket (17).
   c. Slide bar attached to gearbox assembly (21) thru hole of boss at bottom of left cam mechanism (18) and left fairing support bracket (17).
   d. Tighten gearbox mounting bracket screws (12) to 35-40 **in-lbs** (4.0-4.5 Nm).
7. See Figure 2-132. Attach upper extension link (14) and upper windshield mount (8) to the top of left cam mechanism (18) on outside of left fairing support bracket (17).
   a. Install washer (15) and screw (16).
   b. Tighten upper extension link screws (16) to 12-16 **in-lbs** (1.35-1.80 Nm).
   c. Tighten upper (24) and lower (25) bracket screws (13) to 12-16 **in-lbs** (1.35-1.80 Nm).
8. Attach front fairing bezel trim (30) to front fairing (28). Secure front fairing bezel trim by installing pushnuts (29).
9. Attach front fairing cover top (10) to front fairing (28). Secure front fairing cover top (10) by installing retainer/ bumpers (11).



1. **Upper bracket screw**
2. **Upper bracket**
3. **Upper slots of fairing support bracket**
4. **Lower fairing support bracket mounting holes**
5. **Lower bracket**
6. **Lower bracket screw**

Figure 2-133. Fairing Installation/Assembly

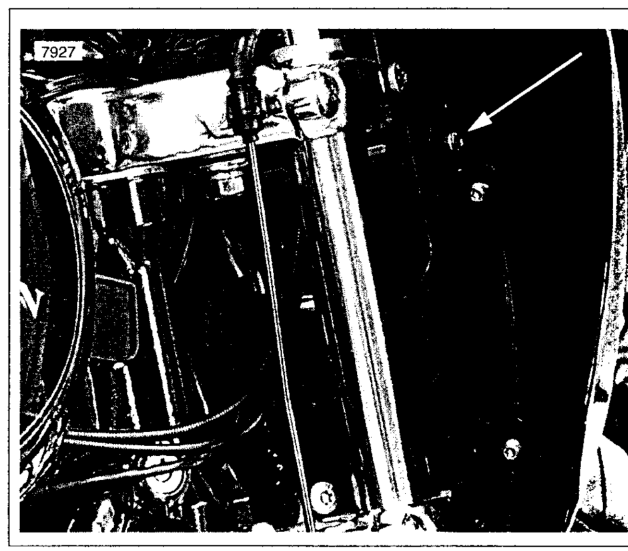


Figure 2-134. Attaching Gearbox to Fairing

10. Attach front fairing (28) to fairing support brackets (17, 27).
    a. Align lower windshield mount (attached to bottom of left (18) and right (26) cam mechanisms') to lower windshield mounting holes.
    b. Push bottom of mechanism links (18, 26) thru lower windshield mounting holes.
    c. See Figure 2-135. Tighten right and left support bracket mounting screws to 35-40 **in-lbs** (4.0-4.5 Nm).
11. See Figure 2-132. Attach windshield (6) to front fairing (28).
    a. Rotate adjusting knob (20) on gearbox assembly (21) clockwise several times.
    b. Install new grommets (3) into lower mounting holes on windshield.
    c. Wet spacers (2) with water and slide into grommets (3) with the widest part facing downward.
    d. Install pad windshield mounts (7) to upper windshield mounts.
    e. Align upper windshield mount holes with upper windshield mount (8).
    f. Install washers (5) and screws (4) to upper windshield mounts. Hand tighten only.

CAUTION

Do not overtighten windshield fasteners when making adjustments. Doing so may cause the windshield and/or cause component damage.

    g. Install screws (1) into spacers inside lower windshield mounts.
    h. Tighten lower windshield mounting screws (1) to 9-11 **in-lbs** (1.01-1.24 Nm).
    i. Tighten upper windshield mounting screws (4) 9-11 **in-lbs** (1.01-1.24 Nm).
    j. See Figure 2-136. Rotate adjusting knob on gearbox assembly (20) counterclockwise several times to retract windshield.

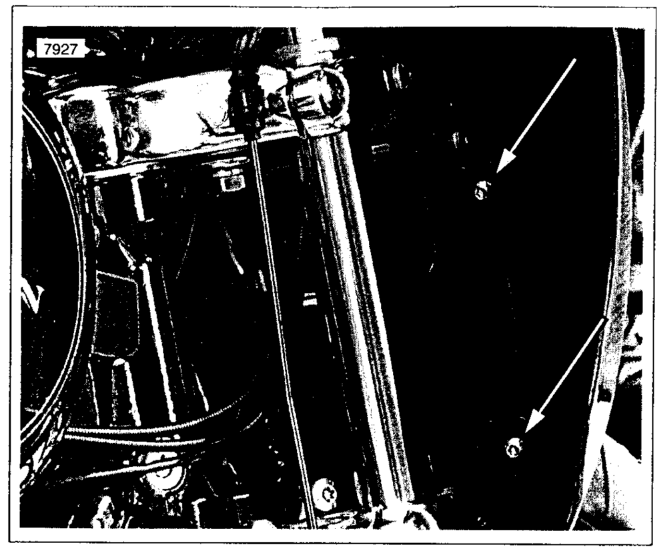


Figure 2-135. Attaching Gearbox to Fairing

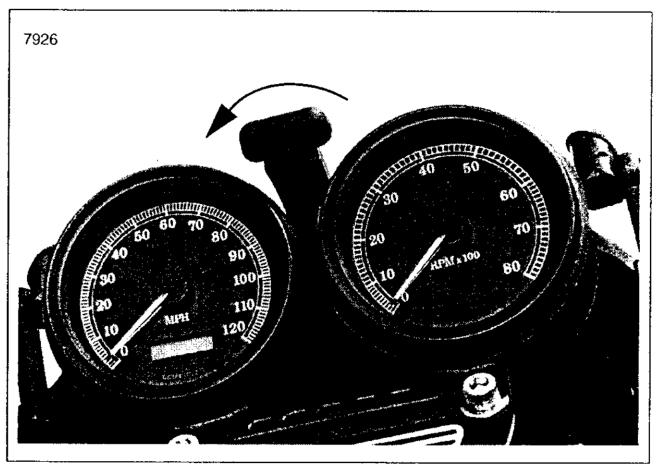


Figure 2-136. Rotate Counterclockwise to Retract Windshield

INSTALLATION

1. See Figure 2-133. Align upper slots of fairing support brackets (3) with screws (1) on upper bracket (2).
    a. Align lower fairing support bracket (4) mounting holes with lower bracket (5) mounting holes.
    b. Tighten screws (6) to 12-15 **in-lbs** (1.35-1.70 Nm)
2. Install headlamp. See 8.17 HEADLAMP.

NOTES

ENGINE 3

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3.30 Crankcase	3-104
3.31 Flywheel/Connecting Rod	3-109
3.32 Oil Pan	3-110

GENERAL	DATA
Number of cylinders	2
Type	4-cycle, 45 degree, air cooled V-twin
Torque (with shorty, dual exhaust)	82 ft-lbs @ 3500 RPM
	111 Nm @ 3500 RPM
Bore	3.75 in.
	95.25 mm
Stroke	4.00 in.
	101.6 mm
Piston displacement (approx.)	88 cubic in.
	1450 cc
Maximum sustained engine speed	5600 RPM
Idle speed	1000 RPM +/- 50
Powertrain weight	165 lbs
	74.8 kg

OIL PUMP	DATA
Type	Twin gerotor, 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	10 micron media, filtered between pump and engine

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

ROCKER ARM SHAFTS	IN.	MM
Shaft fit in rocker arm support plate (loose)	0.0007-0.0022	0.018-0.056

HYDRAULIC LIFTERS	IN.	MM
Fit in crankcase (loose)	0.0008-0.0020	0.02-0.05

CYLINDER HEADS	IN.	MM
Valve guide in head (tight)	0.0020-0.0033	0.051-0.084
Valve seat in head (tight)	0.003-0.0045	0.076-0.114
Head gasket surface (flatness)	0.006	0.0152

VALVES	IN.	MM
Exhaust: fit in guide	0.0015-0.0033	0.038-0.084
Intake: fit in guide	0.0008-0.0026	0.020-0.066
Seat width	0.040-0.062	1.02-1.58
Stem protrusion from cylinder head boss	1.990-2.024	50.55-51.41

VALVE SPRINGS	OUTER	INNER
Closed	72-92 lbs @ 1.751-1.848 in.	38-49 lbs @ 1.577-1.683 in.
	33-42 kg @ 44.45-46.9 mm	17-22 kg @ 40.1-42.8 mm
Open	183-207 lbs @ 1.282-1.378 in.	98-112 lbs @ 1.107-1.213 in.
	83-94 kg @ 32.6-35.0 mm	44-51 kg @ 28.1-30.8 mm
Free length	2.105-2.177 in.	1.926-1.996 in.
	53.47-55.3 mm	48.9-50.7 mm

PISTONS	IN.	MM
Fit in cylinder:		
Early Piston*	0.0006-0.0017	0.015-0.043
Late Piston*	0.0014-0.0025	0.036-0.064
Ring end gap:		
Top compression ring	0.010-0.020	0.254-0.508
2nd compression ring	0.014-0.024	0.356-0.610
Oil control ring	0.010-0.050	0.254-1.27
Ring side clearance:		
Top compression ring	0.0012-0.0037	0.030-0.094
2nd compression ring	0.0012-0.0037	0.030-0.094
Oil control ring	0.0031-0.0091	0.079-0.231
Piston pin fit (loose)	0.0002-0.0005	0.005-0.013

* Late style pistons can be identified by two small oval-shaped openings in the piston coating, one on each thrust face of the piston skirt. Early style pistons have no openings in the piston coating. For more information, see 3.25 PISTON.

CONNECTING RODS	IN.	MM
Piston pin fit (loose)	0.0003-0.0007	0.008-0.018
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

FLYWHEELS	IN.	MM
Runout (flywheels at rim)	0.000-0.010	0.0-0.254
Runout (shaft at flywheel)	0.000-0.002	0.0-0.051
End play	0.003-0.010	0.076-0.254

CRANKSHAFT (ROLLER) BEARINGS	IN.	MM
Roller bearing fit (loose)	0.0002-0.0015	0.005-0.038
Crankshaft runout	0.0-0.003	0.0-0.076
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

ITEM	TORQUE		NOTES
Bearing retainer plate screws	20-30 in-lbs	2.3-3.4 Nm	Page 1-94
Breather cover bolts	90-120 in-lbs	10.2-13.6 Nm	Page 3-41
Cam cover screws	125-155 in-lbs	14.1-17.5 Nm	Special pattern to tighten, page 3-54
Cam support plate screws	90-120 in-lbs	10.2-13.6 Nm	Special pattern to tighten, page 3-49
Crank sprocket bolt	See NOTES	See NOTES	Special method to tighten, replace if possible. Apply several drops of LOCTITE THREADLOCKER 262 (red) to last few threads. Page 3-53
Crankcase bolts	15-19 ft-lbs	20.3-25.8 Nm	Special pattern to tighten, see page 3-46
Cylinder head bolts	See NOTES	See NOTES	Special method to tighten, page 3-37
Cylinder head bracket bolts	25-30 ft-lbs	33.9-40.7 Nm	Page 3-24, 3-26
Cylinder stud	10-20 ft-lbs	13.6-27.1 Nm	Page 1-108
Engine oil drain plug w/O-ring	14-21 ft-lbs	19.0-28.5 Nm	Clean plug before installation, page 1-111
Front engine mounting bracket bolts	33-38 ft-lbs	44.7-51.5 Nm	Page 3-26
Left footpeg bracket screws	25-30 ft-lbs	33.9-40.7 Nm	Page 3-26
Lifter cover screws	90-120 in-lbs	10.2-13.6 Nm	Crosswise pattern to tighten, page 3-39
Oil filter adapter	12-16 ft-lbs	16.3-21.7 Nm	Page 1-103
Oil filter mount screws	130-150 in-lbs	14.7-16.9 Nm	Apply several drops of LOCTITE THREADLOCKER 243 (blue) to last few threads. Bend locktabs, page 1-103, 3-26
Oil fitting	10-14 ft-lbs	13.6-18.9 Nm	Apply LOCTITE PIPE SEALANT 565 to last few threads, page 1-108
Oil line cover screws	84-108 in-lbs	9.5-12.2 Nm	Page 3-27
Oil pump screws, final torque	90-120 in-lbs	10.2-13.6 Nm	Special tools and pattern to tighten, page 3-50
Oil pump screws/alignment tools, initial torque	40-45 in-lbs	4.5-5.1 Nm	Special tools and pattern to tighten, page 3-50
Pipe plug	120-144 in-lbs	13.6-16.3 Nm	Apply LOCTITE PIPE SEALANT 565 to last few threads, page 1-108
Piston jet screws	25-35 in-lbs	2.8-3.9 Nm	Replace if possible. Apply several drops of LOCTITE THREADLOCKER 222 (purple) to last few threads. Otherwise-page 1-105
Rear cam sprocket bolt	See NOTES	See NOTES	Special method to tighten. Replace if possible. Apply several drops of LOCTITE THREADLOCKER 262 (red) to last few threads. Otherwise-page 3-53
Right footpeg bracket screws	25-30 ft-lbs	33.9-40.7 Nm	Page 3-24, 3-27
Rocker arm support plate bolts	18-22 ft-lbs	24.4-29.8 Nm	2 sizes, 1/4 turn sequence, page 3-40
Rocker cover bolts	15-18 ft-lbs	20.3-24.4 Nm	Apply several drops of LOCTITE THREADLOCKER 243 (blue) to last few threads. Special pattern to tighten, page 3-41
Shifter foot lever pinch bolt	18-22 ft-lbs	24.4-29.8 Nm	Page 3-26

ITEM	TORQUE		NOTES
Stabilizer link bolt	18-22 ft-lbs	24.4-29.8 Nm	Page 3-24, 3-26
Temperature sensor hole screw	10-15 ft-lbs	13.6-20.3 Nm	Page 1-72
Transmission drain plug w/O-ring	14-21 ft-lbs	19.0-28.5 Nm	Clean plug before installation, page 1-111
Transmission mounting bolts	30-35 ft-lbs	40.7-47.5 Nm	Criss-cross pattern, page 3-26

GENERAL

Wear limits are given here as a guideline for measuring used engine components. Replace components when they exceed values listed here.

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

HYDRAULIC LIFTER	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Fit in crankcase	0.003	0.076
Roller fit	0.0015	0.038
Roller end clearance	0.015	0.381

CAM SUPPORT PLATE	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Cam chain tensioner shoe	0.080-0.090	2.03-2.29
	1/2 thickness of shoe	
Cam support plate warpage	0.010	0.254
Crankshaft bushing fit	0.0008-0.001	0.0203-0.0254

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

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

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

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

CONNECTING ROD	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Piston pin fit (loose)	0.001	0.025
Side play between flywheels	0.020	0.508
Fit on crankpin (loose)	0.002	0.051

FLYWHEEL	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Runout (flywheels at rim)	0.015	0.381
Runout (shaft at flywheel)	0.003	0.076
End play	0.010	0.254

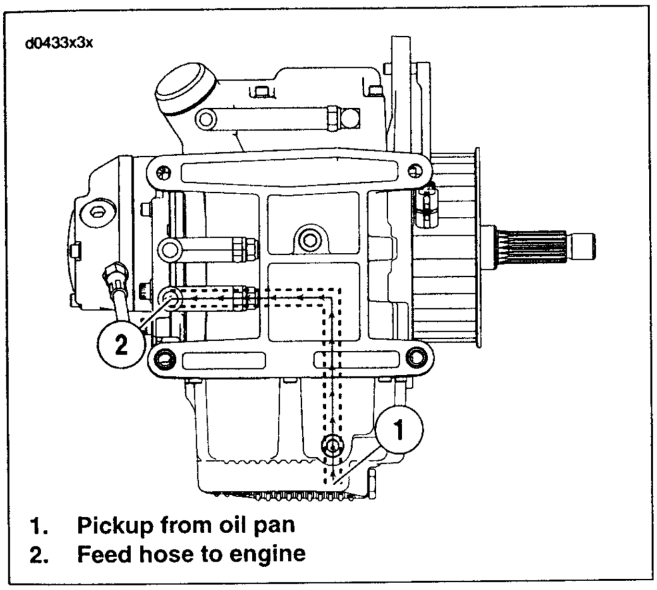
CRANKSHAFT ROLLER BEARING	REPLACE IF WEAR EXCEEDS	
	IN.	MM
Roller bearing fit (loose)	0.0015	0.038
Crankshaft runout	0.003	0.076
Bearing fit in crankcase (tight)	0.0038	0.097
Inner race on crankshaft (tight)	0.0004	0.010

OIL FEED

CAUTION

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 into a flexible hose clamped to the lower fitting (2) at the rear right side of the crankcase.



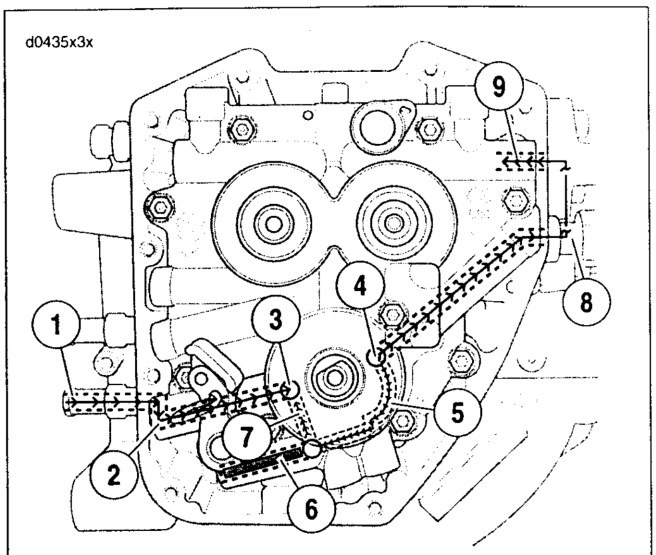
1. Pickup from oil pan
2. Feed hose to engine

Figure 3-1. Oil Flow From Pan

See Figure 3-2. Running through a passageway in the crankcase (1), oil exits a hole in the crankcase flange and enters a hole on the inboard side of the cam support plate (2). Passing through a channel in the cam support plate, the oil enters the feed side of the oil pump (3). See 3.5 OIL PUMP OPERATION. The feed gerotors of the pump direct the flow up a second channel in the cam support plate.

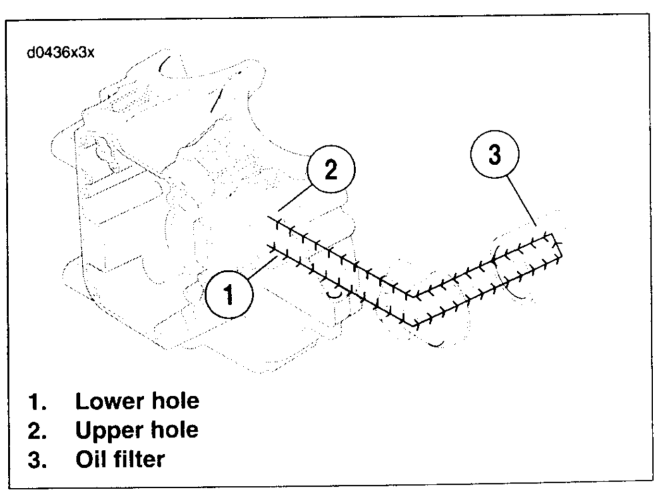
A passage (5) connects to a pressure relief valve (6) mounted in the bypass port of the cam support plate. When the oil pressure exceeds the setting of the valve spring (35 PSI), the orifice opens to bypass (7) excess oil back to the feed side of the pump (3).

Oil not returned to the feed side exits a hole on the inboard side of the cam support plate and passes through a hole in the crankcase flange. Flowing through a passageway in the crankcase, where a reading is taken by the oil pressure sending unit (8), the oil exits the lower hole in the oil filter mount. See Figure 3-3.



1. Crankcase passage
2. Cam support plate/crankcase connection
3. Feed side of oil pump
4. Oil pump output
5. Overflow passage
6. Pressure relief valve
7. Bypass passage
8. Oil pressure sending unit
9. Return from oil filter into cam support plate

Figure 3-2. Cam Support Plate Oil Flow



1. Lower hole
2. Upper hole
3. Oil filter

Figure 3-3. Oil Filter Flow

After circulating through the oil filter (3), the flow of oil is directed back into the crankcase through the upper hole in the oil filter mount (2). See Figure 3-2. Exiting a passageway in the crankcase through a hole in the crankcase flange, the flow of oil reenters the cam support plate (9).

Filtered oil is then routed to the top and bottom ends of the engine. See TOP END and BOTTOM END which follow.

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 pushrod 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 pushrods.

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 pushrods, oil enters a hole at the bottom of the intake and exhaust actuator 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).

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, at which point the engine is operating above idle speed. At idle speeds (9-12 PSI), 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).

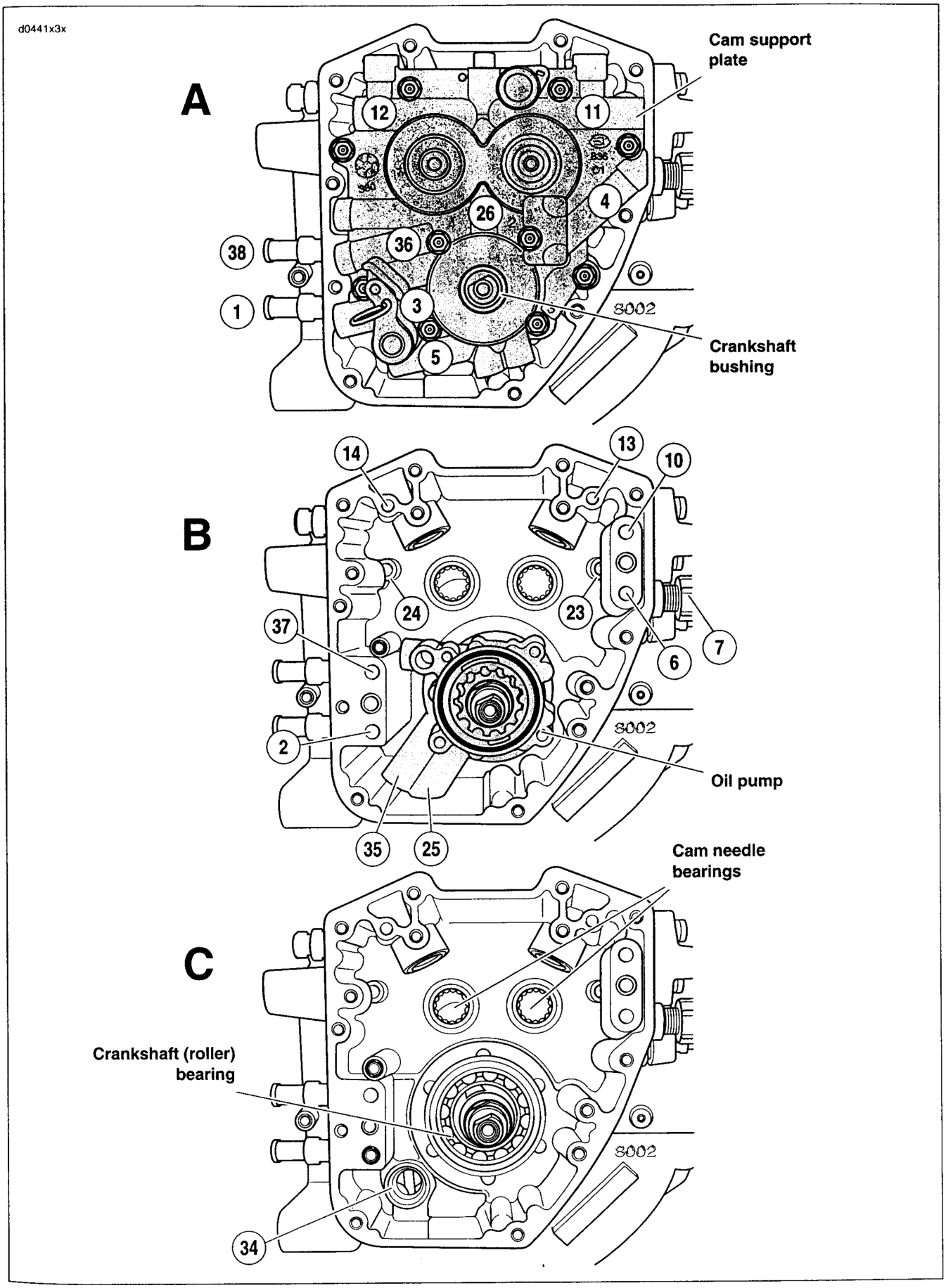


Figure 3-4. Engine Oil Flow - Cam Support Plate/Right Crankcase Half

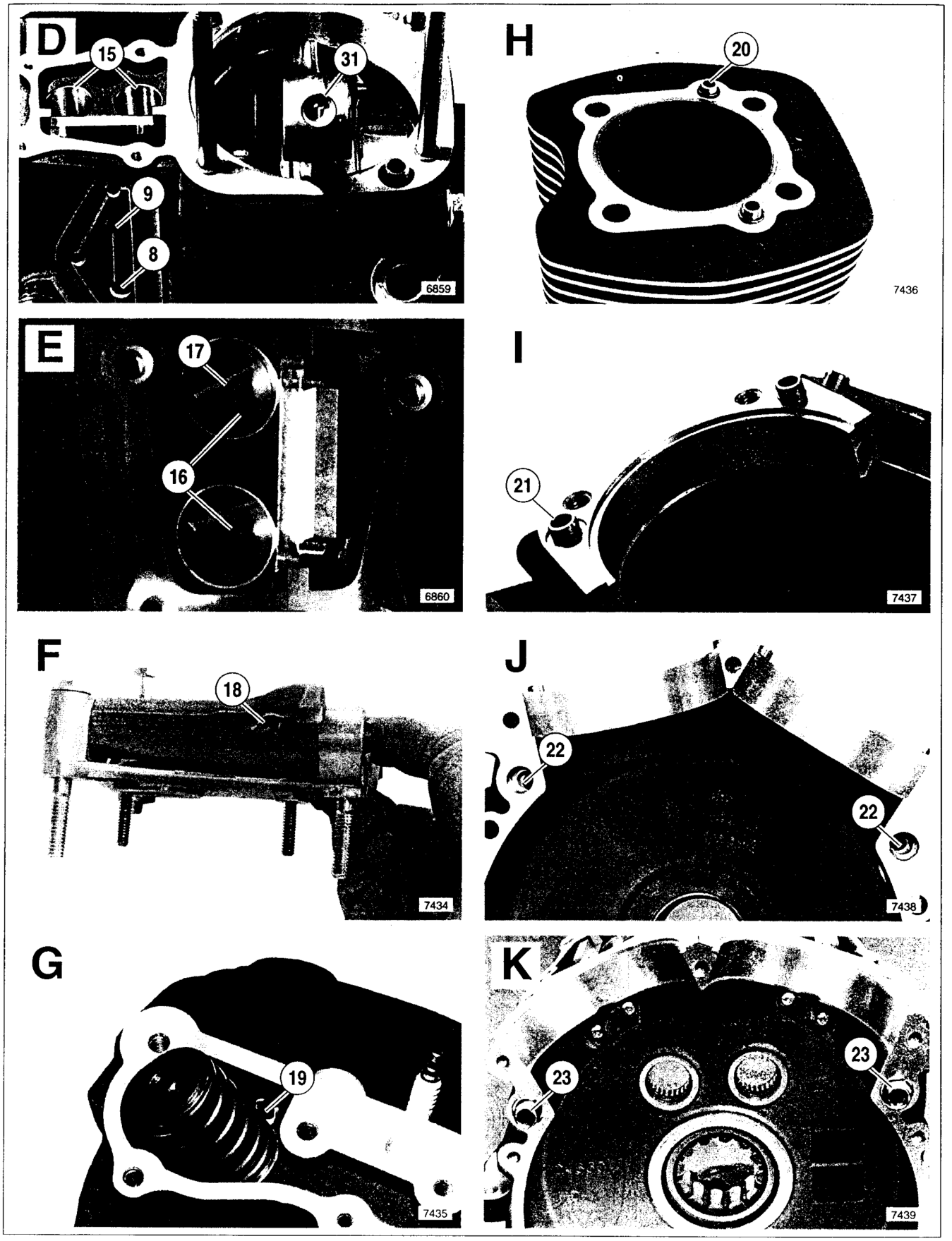


Figure 3-5. Engine Oil Flow - Top End

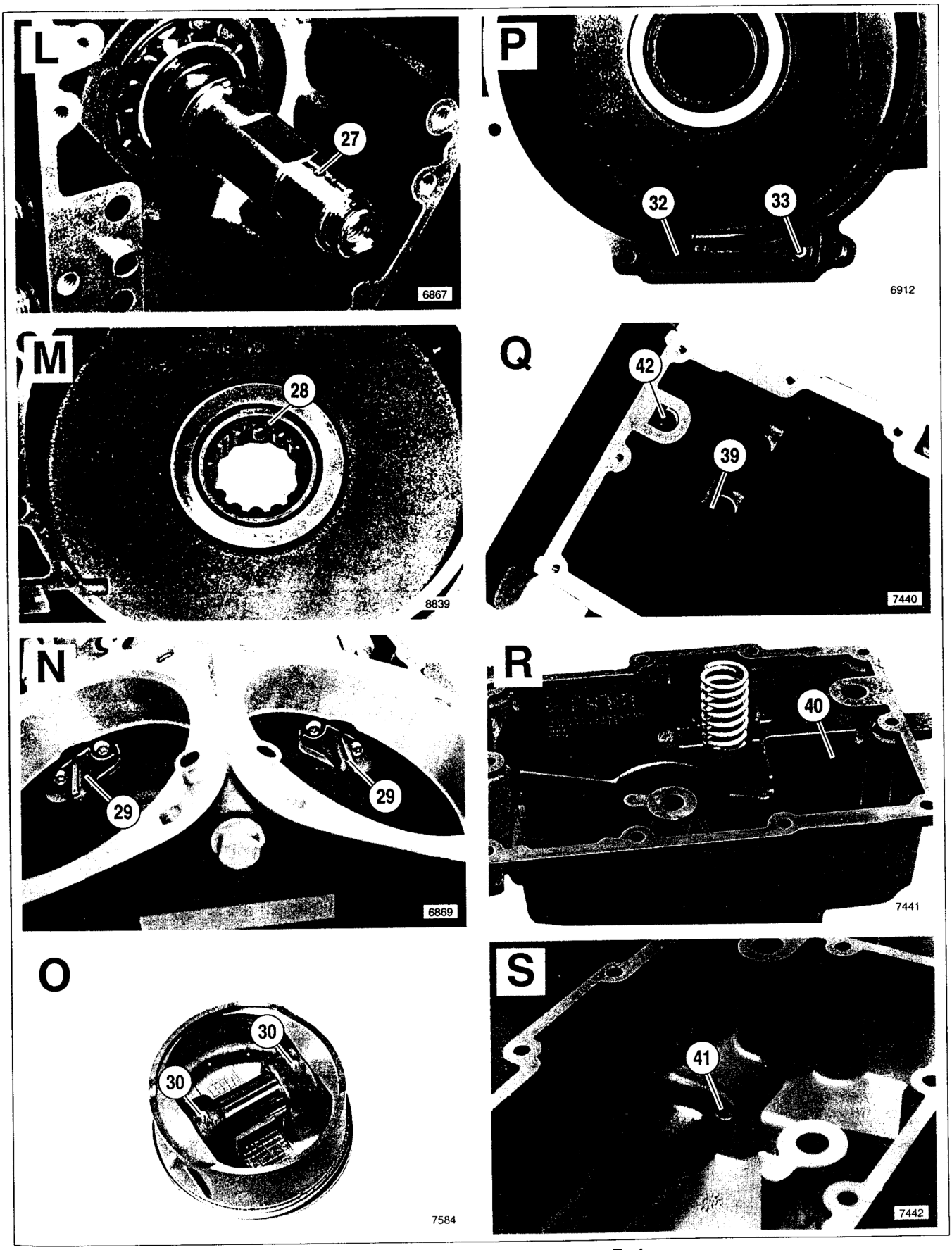


Figure 3-6. Engine Oil Flow - Bottom End

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 3.5 OIL PUMP OPERATION.

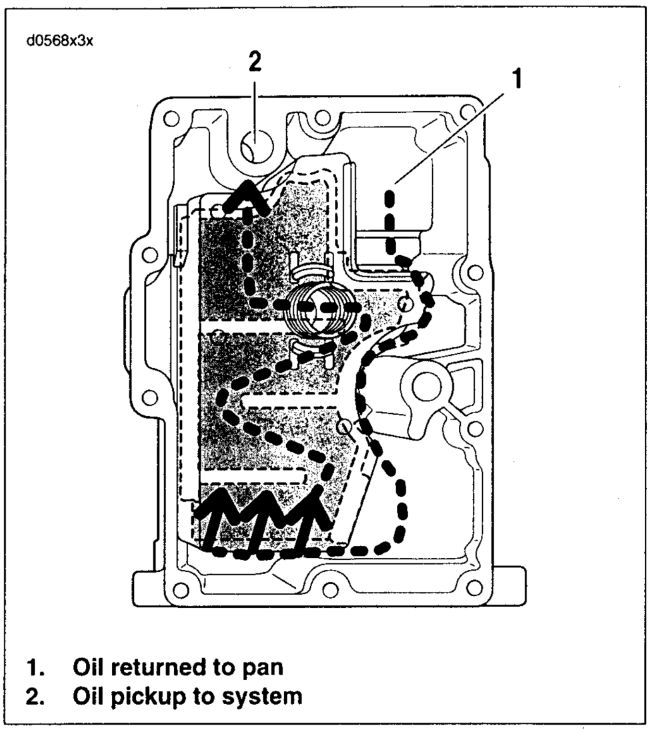
Exiting a hole on the inboard side of the cam support plate, the oil enters a hole in the crankcase flange (B37).

The oil flows through a passageway in the crankcase and exits the upper fitting at the rear right side of the crankcase (A38). Passing through a flexible hose connection, 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.

Also note that a third flexible hose clamped to a fitting behind the rear lifter cover connects the cam compartment with the oil pan via a third drilling in the transmission case. This crankcase breather connection provides the pressure balance necessary for oil circulation.



1. **Oil returned to pan**
2. **Oil pickup to system**

Figure 3-7. Oil Pan Baffles

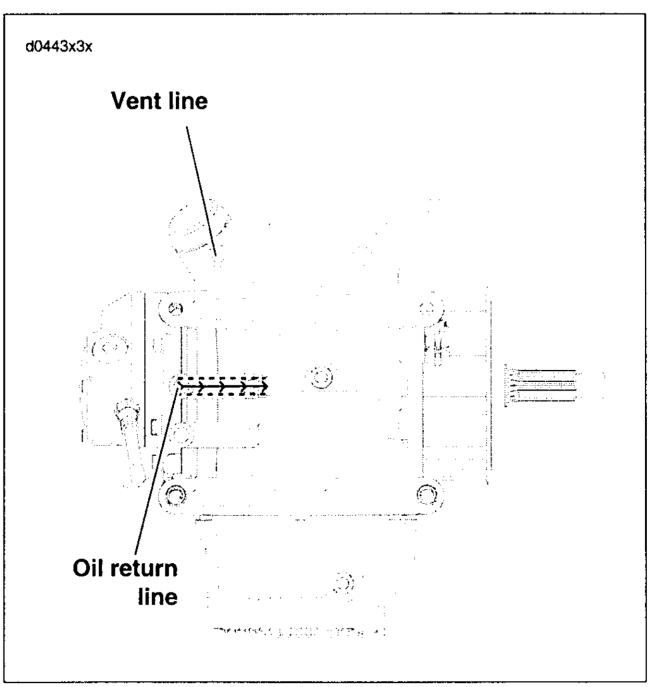


Figure 3-8. Oil Return Lines

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.

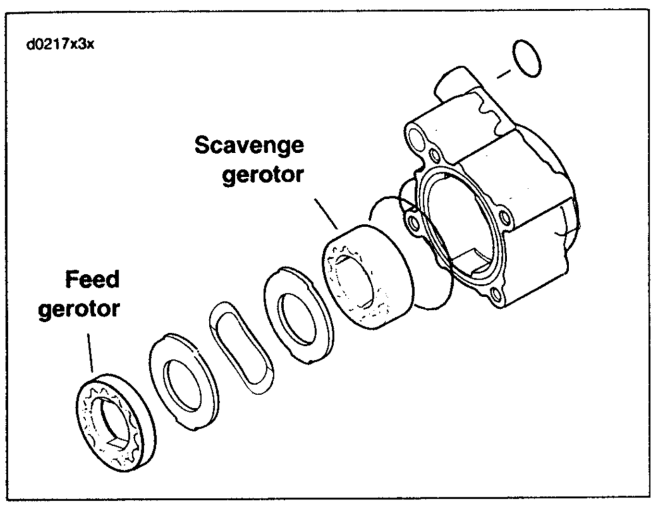


Figure 3-9. Oil Pump Gerotors

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.

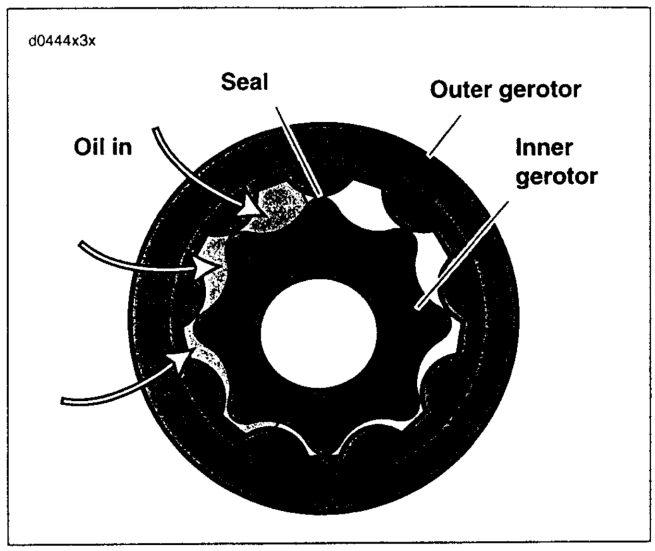


Figure 3-10. Inlet Side Oil Flow

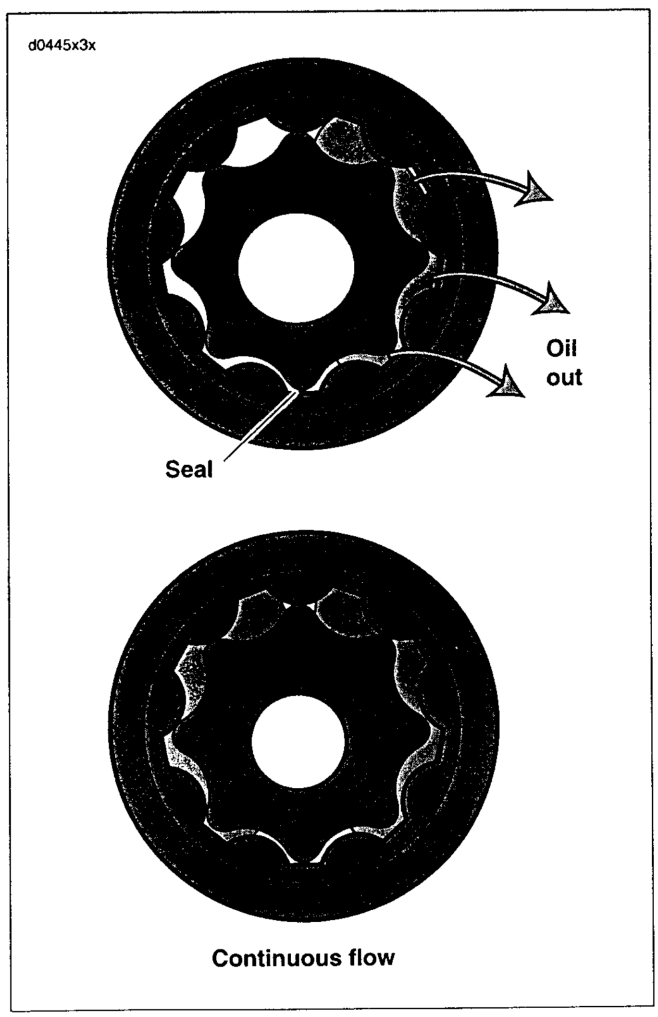


Figure 3-11. Outlet Side Oil Flow

GENERAL

NOTE

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 pushrod 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.

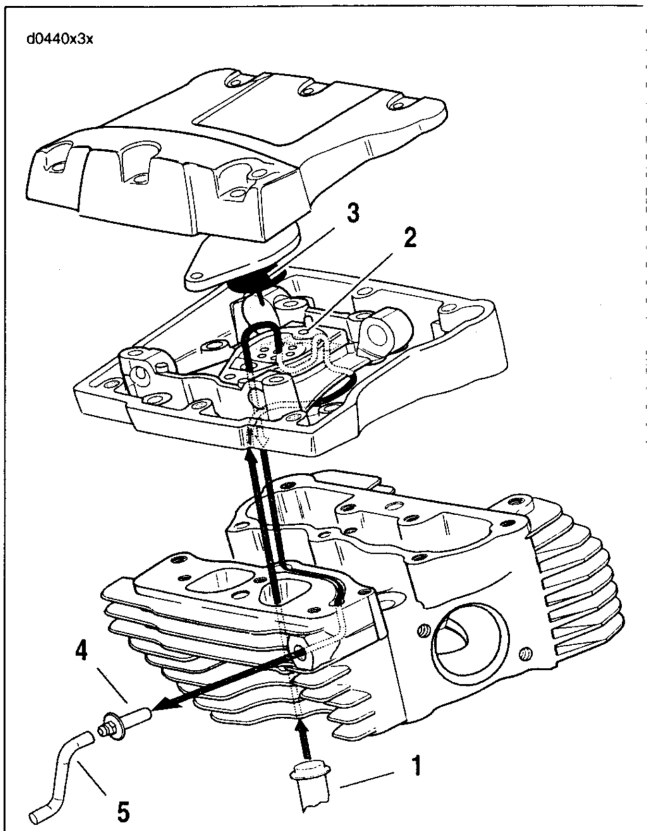
Passing through the oil filter gauze, the flow of air passes through the umbrella valve (3) into the breather compartment. The flaps of the umbrella valve only allow air to be vented one way, rising to allow the passage of air, but then falling back into place to seal the vent holes as the flow of air 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. **Pushrod cover**
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

Check the engine oil level if the oil pressure indicator lamp remains illuminated. If the oil level is normal, stop the engine immediately. Do not ride the vehicle until the problem is located and corrected.

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 defect 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 pan from the oil return hose. If oil does not return, shut off the engine until the problem is located and corrected.

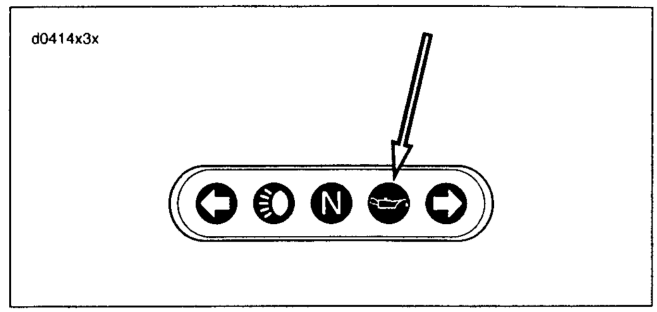


Figure 3-13. Oil Pressure Indicator Lamp

CHECKING OIL PRESSURE

PART NO.	SPECIALTY TOOL
HD-96921-52B	Oil pressure gauge
HD-96921-110	Oil pressure gauge adapter

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 8.30 OIL PRESSURE SWITCH.
3. See Figure 3-15. Install adapter (2) in oil pressure switch mounting hole. Tighten adapter snugly.
4. Assemble banjo bolt (3), washer (4), oil pressure gauge (1) banjo fitting and second washer onto adapter and tighten snugly.
5. 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.

6. Oil pressure should be 30-38 PSI (207-262 kN/m^2) at 2000 RPM and normal operating temperature.
7. Stop engine. Remove oil pressure gauge assembly from oil pressure switch mounting hole in crankcase.
8. Reinstall oil pressure switch. See 8.30 OIL PRESSURE SWITCH.

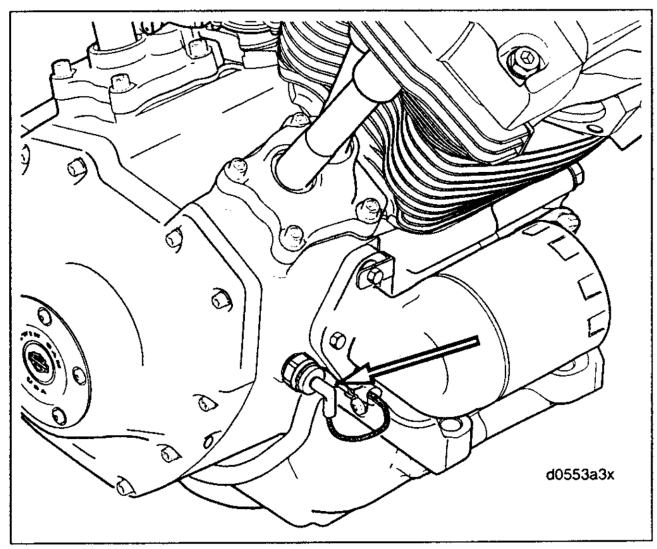
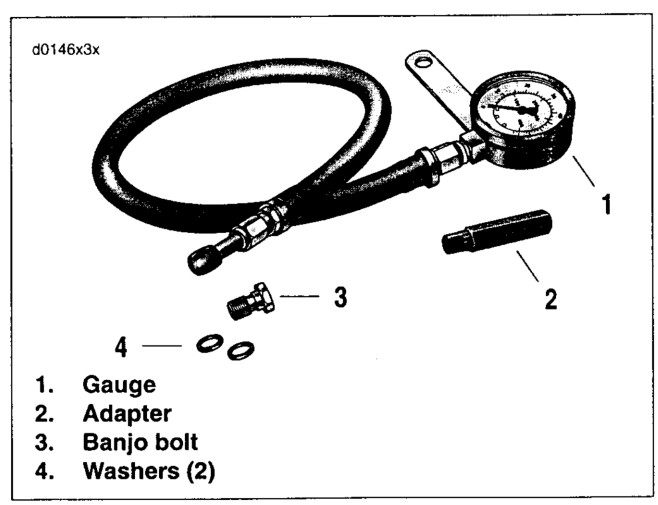


Figure 3-14. Oil Pressure Switch



1. **Gauge**
2. **Adapter**
3. **Banjo bolt**
4. **Washers (2)**

Figure 3-15. Oil Pressure Gauge (Part No. HD-96921-52B)

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, see 3.9 TOP END SERVICE. Two options are available depending upon engine status.

- ENGINE IN CHASSIS on page 3-17.
- ENGINE REMOVED FROM CHASSIS on page 3-18.

BOTTOM END REPAIR

NOTE

Servicing components in the cam compartment requires only partial disassembly. This can be done with the engine left in the chassis.

After disassembling as far as the cylinder heads you may find that bottom end repair is necessary. Bottom end service may require either partial or complete disassembly of the engine.

- To service the cam compartment, see ENGINE IN CHASSIS: CAM COMPARTMENT SERVICE on page 3-19.
- To service components in the flywheel compartment, the engine must be removed and the crankcase halves split. See ENGINE REMOVED: FLYWHEEL COMPARTMENT SERVICE OR COMPLETE ENGINE OVERHAUL on page 3-20.

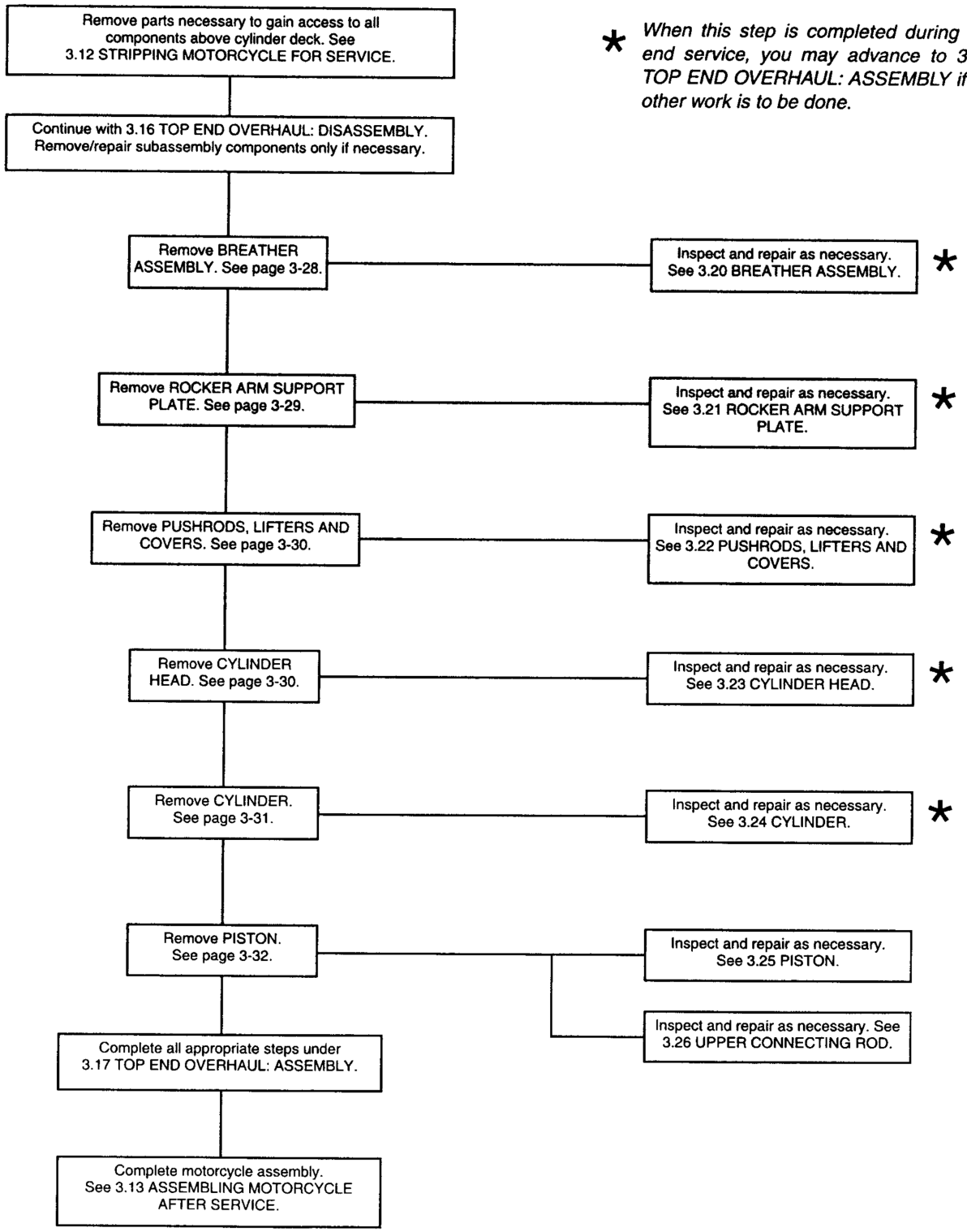
TYPICAL SYMPTOMS

Symptoms indicating a need for engine repair are often misleading, but generally if more than one symptom is present, possible causes can be narrowed down to make at least a partial diagnosis. An above normal consumption of oil, for example, could be caused by several mechanical faults (see 1.29 TROUBLESHOOTING). But when accompanied by a blue-gray smoke from the exhaust, and when low compression is present, it indicates the rings need replacing. Low compression by itself, however, indicates improperly seated valves, not worn rings.

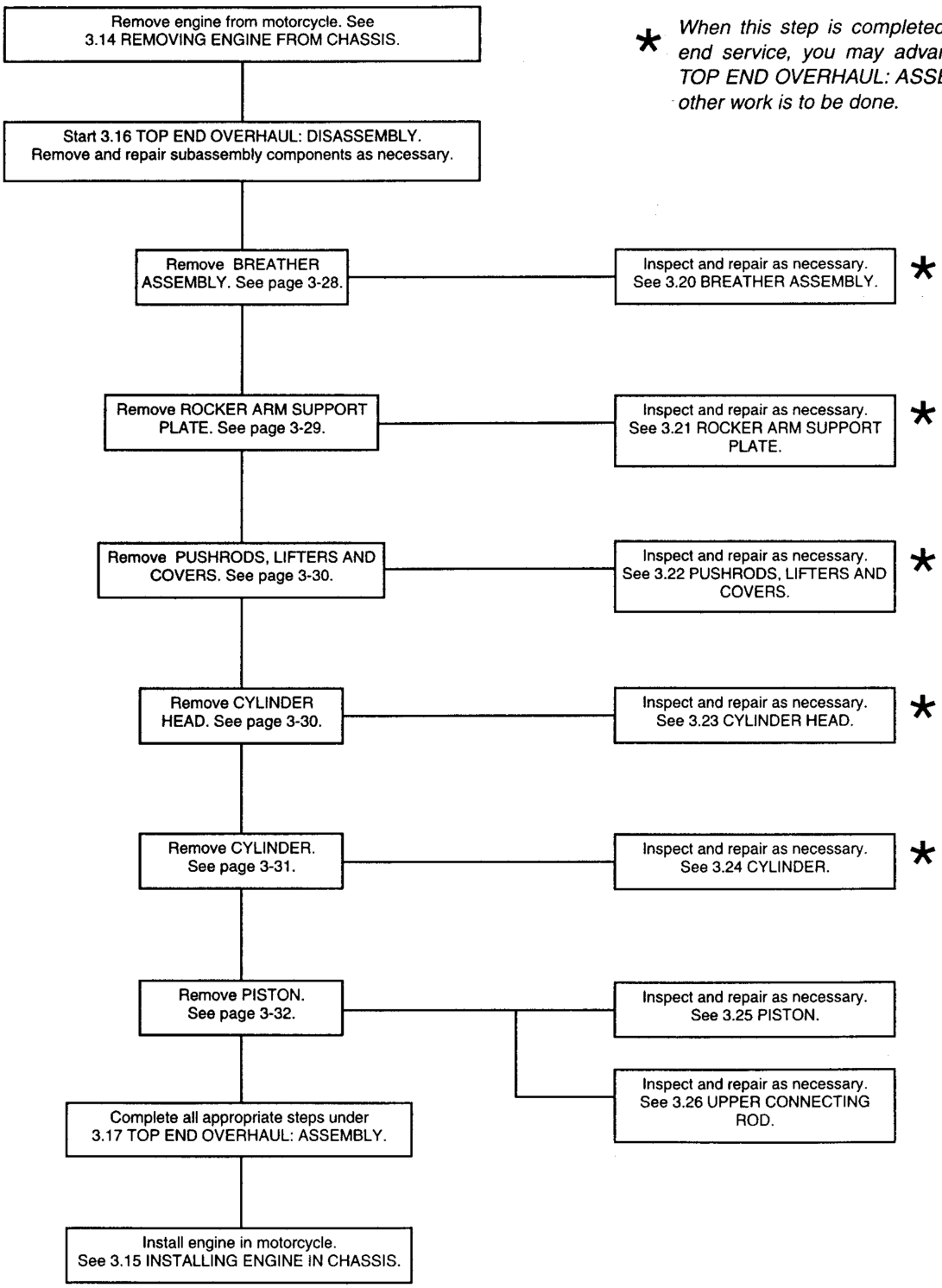
Certain "knocking" noises may be caused by loose bearings, others by piston slap, a condition where piston or cylinder or both out of tolerance, allowing the piston to slap from front to rear of the cylinder as it moves up and down.

Most frequently, valves, rings, pins, bushings, and bearings need attention at about the same time. If the symptoms can be narrowed down through the process of elimination to indicate that any one of the above components is worn, it is best to give attention to all of the cylinder head and cylinder parts.

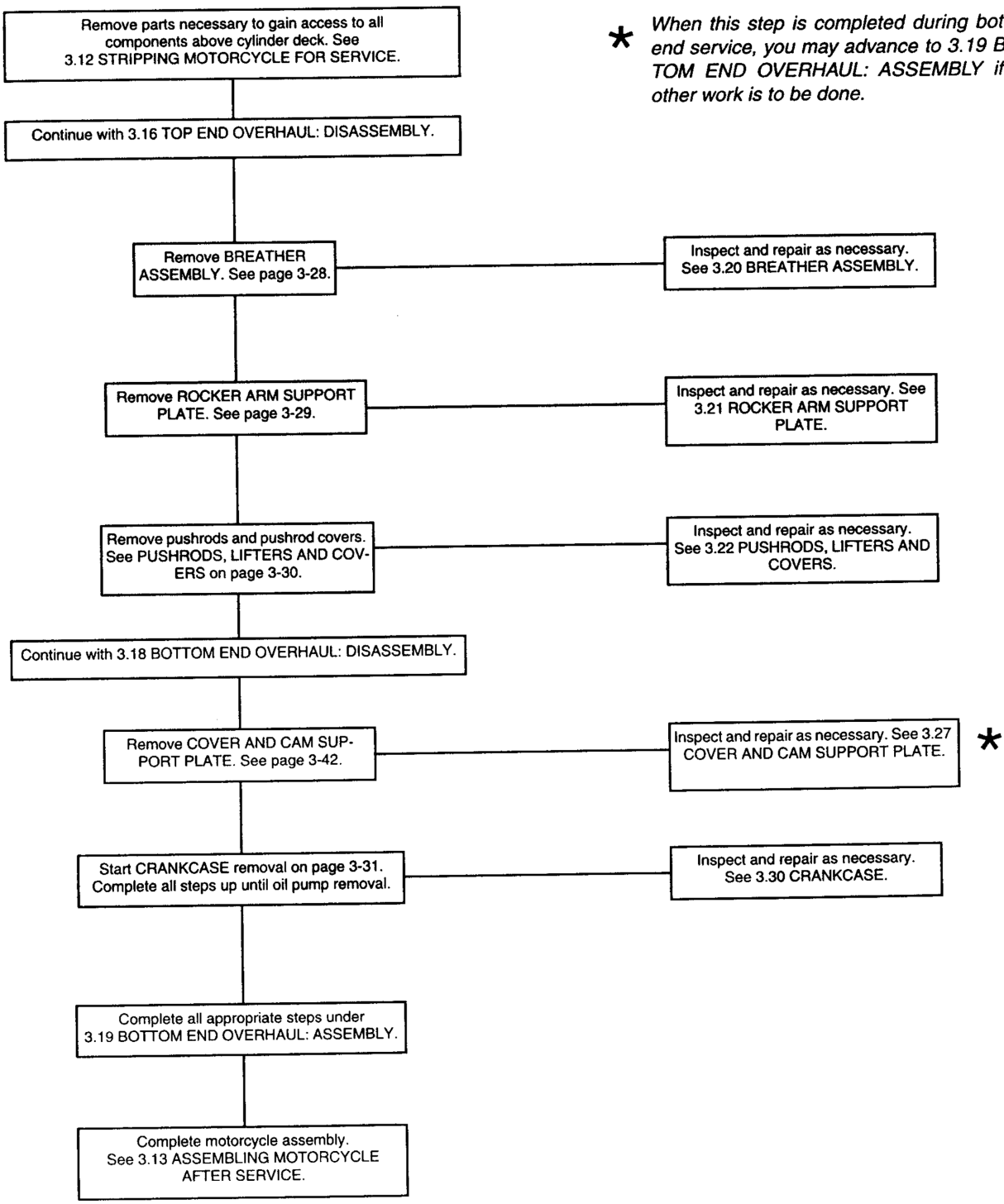
ENGINE IN CHASSIS



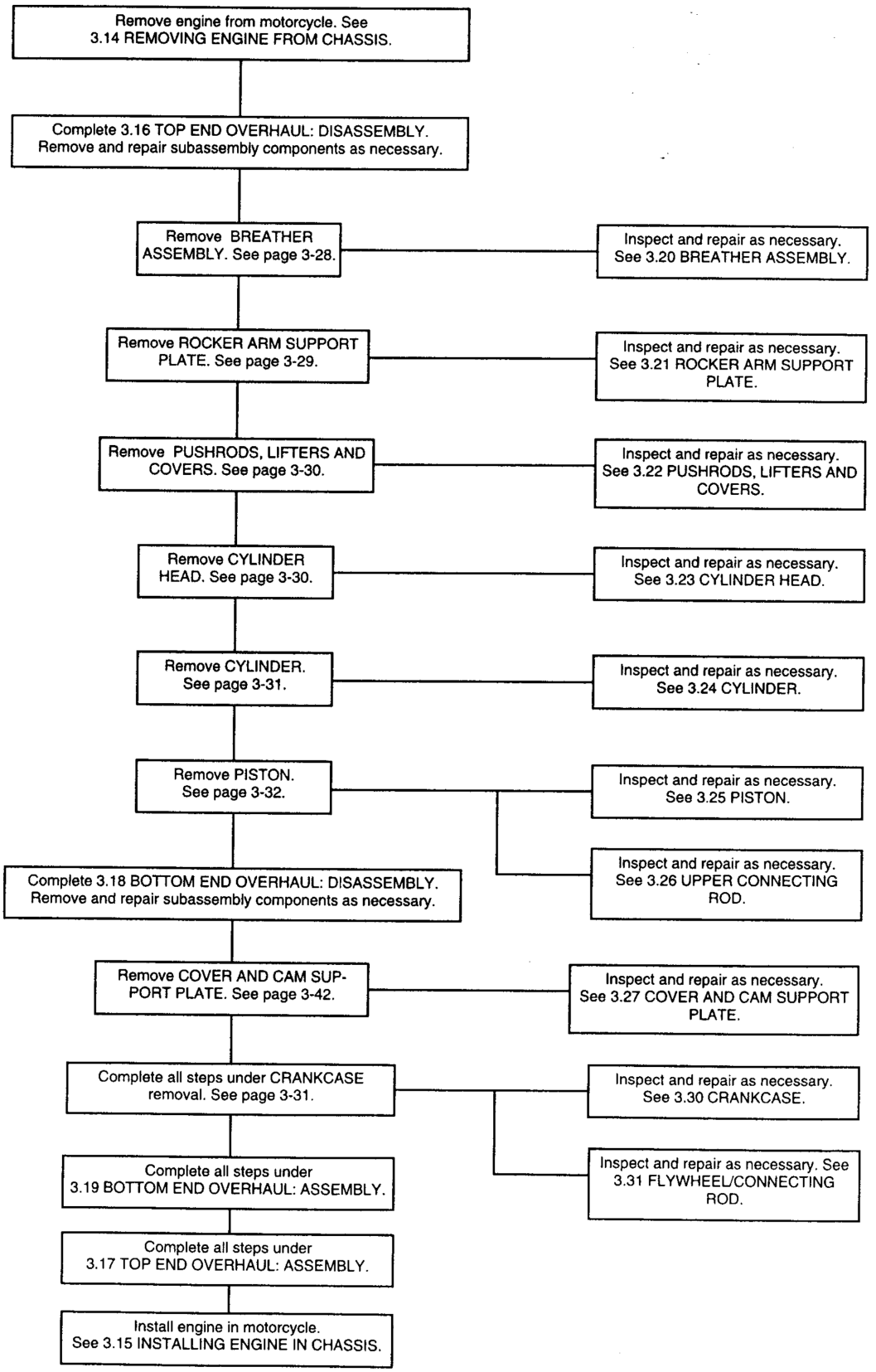
ENGINE REMOVED FROM CHASSIS



ENGINE IN CHASSIS: CAM COMPARTMENT SERVICE



ENGINE REMOVED: FLYWHEEL COMPARTMENT SERVICE OR COMPLETE ENGINE OVERHAUL



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 kN/m^2) or below 5 PSI (34 kN/m^2), inspect oil pump, crankcase passages, and oil hoses for restrictions or blockage. Repair or replace parts as necessary.
2. If oil is reaching the hydraulic lifters, remove and inspect. See LIFTER INSPECTION under 3.22 PUSHRODS, LIFTERS AND COVERS. Clean lifter bore of all foreign material. Replace hydraulic lifter if required.
3. Examine pushrod, 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. Remove camshaft and pinion gear, clean and inspect for wear and fit. Measure pitch diameters and check for out-of-round condition. Replace parts as necessary.
6. Check cam chain tensioning spring and shoe for wear.
7. 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.
8. Grind valves and valve seats.

COMPRESSION TEST

NOTE

The Twin Cam 88 Engine uses a 12 mm adapter with the 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) that has a screw-in type adapter.

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. Connect compression tester to front cylinder per manufacturer's instructions.
3. Make sure transmission is in neutral. With choke and carburetor throttle plates in wide open position, crank engine continuously through 5 to 7 full compression strokes.
4. Note gauge readings at the end of the first and last compression strokes. Record test results.
5. Repeat steps 2 through 4 on rear cylinder.
6. If the final readings are 90 PSI (620 kN/m^2) 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, see Table 3-1.
7. 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 3-1. 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 pushrod length.
Head gasket leak	Same reaction as valve trouble.

CYLINDER LEAKAGE TEST

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 CYLINDER LEAKDOWN TESTER (Part No. HD-35667A) and 12 mm adapter 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 carburetor choke and throttle in 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 fifth 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 carburetor intake, exhaust pipe, and head gasket. Air escaping through the carburetor 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 pushrod 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 COMPRESSION TEST or CYLINDER LEAKAGE TEST as described. 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.

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 avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

3. Disconnect battery cables, negative cable first.
4. Remove heat shields and exhaust. See 4.9 EXHAUST SYSTEM.
5. 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.
6. Remove air cleaner cover and backplate. See 4.8 AIR CLEANER.

⚠WARNING

Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame near the work site. Inadequate safety precautions could result in death or serious injury.

7. Cut hose clamp and remove fuel feed line from carburetor. Drain fuel from fuel tank into suitable container.
8. Unclip vapor valve, disconnect fuel gauge connector, remove one end of fuel tank crossover tube and remove fuel tank. See 4.7 FUEL TANK.
9. Loosen and remove throttle and enrichener control cables from carburetor. See 4.4 CARBURETOR.
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. Slide enrichener out of slot on bracket and remove stabilizer link and horn bracket as an assembly.
12. Remove MAP sensor connector [80] from MAP sensor.
13. Remove carburetor and intake manifold as an assembly. See 4.4 CARBURETOR.

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 6.

1. Install intake manifold and carburetor as an assembly. See 4.4 CARBURETOR.
2. 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 2.13 VEHICLE ALIGNMENT.

3. 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. Install enrichener to slot in bracket.
   a. Tighten the stabilizer link bolt to 18-22 ft-lbs (24.4-29.8 Nm).
   b. Tighten two cylinder head bracket bolts to 25-30 ft-lbs (33.9-40.7 Nm).
4. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.19 SPARK PLUGS.
5. Install throttle and enrichener control cables to carburetor. See 4.4 CARBURETOR.
6. Install fuel tank, fuel gauge connector, fuel tank crossover tube and vapor valve. See 4.7 FUEL TANK.
7. Connect fuel lines to carburetor with **new** hose clamps.
8. Install backplate and air cleaner cover. See 4.8 AIR CLEANER.
9. Install master cylinder actuator lever with clevis pin and **new** cotter pin. Install right footpeg bracket and rear brake pedal with two screws. Tighten to 25-30 ft-lbs (33.9-40.7 Nm).
10. Install heat shields and exhaust. See 4.9 EXHAUST SYSTEM.

⚠WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

11. Connect battery cables, negative cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

12. Install seat.
13. 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

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

3. Disconnect battery cables, negative cable first.
4. Remove air cleaner cover and backplate. See 4.8 AIR CLEANER.

⚠WARNING

Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame near the work site. Inadequate safety precautions could result in death or serious injury.

5. Cut hose clamp and remove fuel feed line (large O.D.) and vacuum line (small O.D.) from carburetor. Drain fuel from fuel tank into suitable container.
6. Unclip vapor valve, disconnect fuel gauge connector, remove one end of fuel tank crossover tube and remove fuel tank. See 4.7 FUEL TANK.
7. Loosen and remove throttle control cable from carburetor. See 4.4 CARBURETOR.
8. Remove heat shields and exhaust. See 4.9 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. Using a 3/16 in. Allen bit, remove three oil line cover screws, engine sensor harness clip and oil line cover from crankcase.
11. Remove (cut or twist until broke) hose clamps and remove three oil lines from crankcase. Plug hoses to prevent contamination.
12. Disconnect the following connectors. See Section 8.
    a. Crank position sensor connector [79].
    b. Stator/voltage regulator connector [46].
    c. Oil pressure sending unit connector [140].

NOTE

Move to the LEFT SIDE of the motorcycle and continue.

13. Drain oil from primary chaincase. See 1.11 PRIMARY CHAINCASE LUBRICANT.
14. Loosen pinch bolt and remove shifter foot lever from primary chaincase.
15. Using a 5/16 in. Allen bit, remove two screws and left side footpeg and bracket.
16. Remove primary chaincase cover and primary chaincase. See 6.2 PRIMARY CHAINCASE.
17. Remove spark plug cables from spark plugs. Remove spark plugs to avoid damaging them.
18. Remove right side stabilizer link nut, Allen bolt and spacer from frame tab. Remove two bolts from horn bracket and cylinder heads. Slide enrichener out of slot on bracket and remove stabilizer link and horn bracket as an assembly.
19. Remove MAP sensor connector [80] from MAP sensor.
20. 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 2.27 CLUTCH CONTROL.
21. Place wire loom or other protective material on both front downtubes to prevent damage.
22. 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.
23. Using a ratchet and ratchet strap, secure transmission to chassis (vertically) to prevent transmission from shifting position.
24. Using a 9/16 in. socket, remove four bolts and washers that connect engine to transmission.
25. Bend lockplate tabs down and remove three hex head screws, engine oil filter, filter mount and lockplate assembly from engine.
26. Using a 9/16 in. socket, remove two bolts and washers that secure engine to front engine mount bracket.
27. Remove engine oil dipstick.
28. 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 four bolts and washers to mate transmission and engine. Tighten bolts finger tight.
3. Align two front engine mount bracket holes with engine and install bolts and washers. Tighten bolts finger tight.
4. 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).
5. Tighten two crankcase to front engine mounting bracket bolts to 33-38 ft-lbs (44.7-51.5 Nm).
6. Remove ratchet strap securing transmission to chassis.
7. Coat threads of three oil filter mount screws with LOCTITE THREADLOCKER 243 (blue). Install oil filter mount with two **new** O-rings and **new** lockplate to crankcase with three hex head screws. Tighten screws to 130-150 **in-lbs** (14.7-16.9 Nm). Bend up corners of lockplate against flats of top and bottom hex head screws.
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 2.27 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 2.13 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. Install enrichener to slot in bracket.
    a. Tighten the stabilizer link bolt to 18-22 ft-lbs (24.4-29.8 Nm).
    b. Tighten two cylinder head bracket bolts to 25-30 ft-lbs (33.9-40.7 Nm).
14. Install spark plugs to cylinder heads. Connect spark plug cables to spark plugs. See 1.19 SPARK PLUGS.
15. Install **new** O-ring between engine and primary chaincase. Install primary chaincase. See 6.2 PRIMARY CHAINCASE.

NOTE

Make sure spring washer is in position on shifter shaft between engine and primary chaincase.

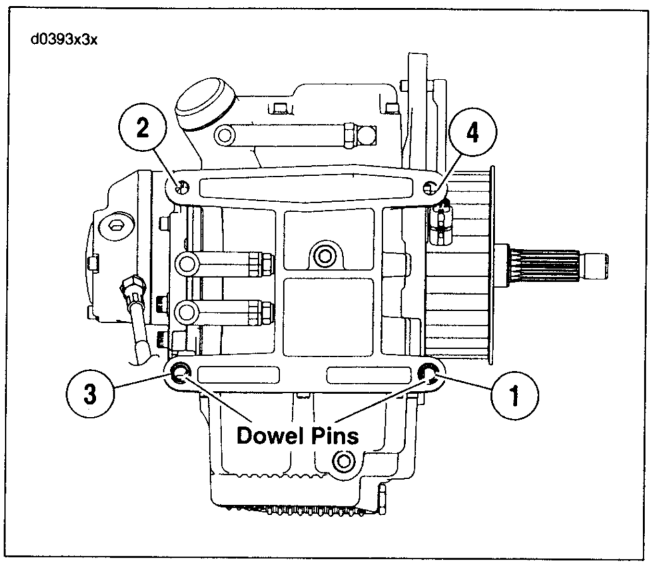


Figure 3-16. Transmission Housing to Crankcase Torque Sequence

16. Adjust clutch. See 1.12 CLUTCH.
17. Adjust primary chain. See 1.10 PRIMARY CHAIN.

CAUTION

The Print-O-Seal 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 6.2 PRIMARY CHAINCASE.
19. Fill primary chaincase with primary chaincase lubricant. See 1.11 PRIMARY CHAINCASE LUBRICANT.
20. Install left side footpeg and bracket with two screws. Tighten to 25-30 ft-lbs (33.9-40.7 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. See Section 8.
    a. Crank position sensor connector [79].
    b. Stator/voltage regulator connector [46].
    c. Oil pressure sending unit connector [140].

23. Unplug three oil lines and install to crankcase with **new** hose clamps. Use HOSE CLAMP TOOL (Part No. HD-97087-65B) to secure clamps.
24. Install oil line cover with three screws. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm).

NOTE

Make sure to install engine sensor harness and clip to lower rear hole.

25. Install rear brake pedal and right footpeg bracket with two screws. Tighten to 25-30 ft-lbs (33.9-40.7 Nm). Install actuator lever to pedal with clevis pin and **new** cotter pin. See 2.15 REAR BRAKE MASTER CYLINDER.
26. Install exhaust and heat shields. See 4.9 EXHAUST SYSTEM.
27. Install throttle control cable to carburetor. See 4.4 CARBURETOR.
28. Install fuel tank and connect crossover tube, fuel gauge connector and clip vapor valve to downtube. See 4.7 FUEL TANK.
29. Install fuel feed line to carburetor with **new** hose clamp. Attach vacuum line to carburetor.
30. Install backplate and air cleaner cover. See 4.8 AIR CLEANER.

⚠WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

31. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

32. Install seat.
33. 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.

34. Remove motorcycle from lift.
35. Perform vehicle alignment. See 2.13 VEHICLE ALIGNMENT.
36. Check rear brakes, clutch and throttle for proper operation.
37. Check engine oil level with **both** cold check and hot check procedures. See 1.4 ENGINE OIL AND FILTER.

GENERAL

NOTE

Although this section may seem to focus on rear cylinder disassembly, it is assumed that each step performed at the rear is automatically repeated on the front cylinder. Tighten fasteners for front cylinder components in a mirror image of the rear cylinders shown.

To perform a complete top end overhaul, follow all steps listed in this section including inspection and repair procedures.

BREATHER ASSEMBLY

CAUTION

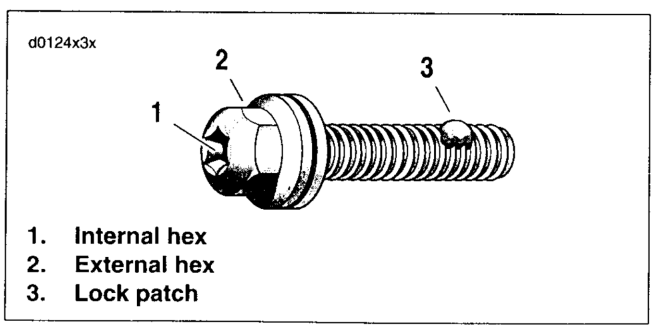
Dirt caked on cooling fins and other areas can fall into crankcase bore or stick to subassemblies as parts are removed. Abrasive particles can damage machined surfaces or plug oil passageways. Remove all dirt and particles before disassembly to prevent component damage.

1. Use low pressure spray to thoroughly clean exterior surfaces of engine prior to disassembly.

NOTE

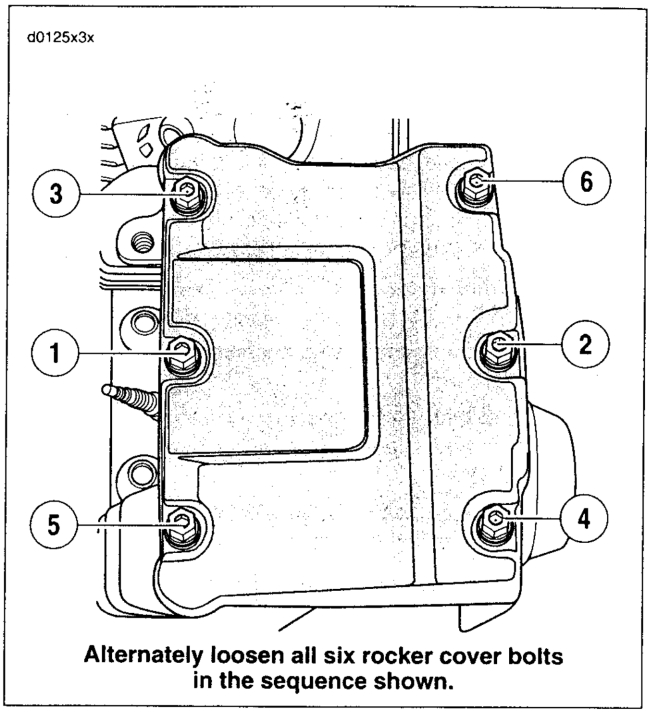
See Figure 3-17. Rocker cover and rocker housing bolts have both an internal (1) and external hex (2). This allows the bolts to be removed or installed with either a short 3/16 in. allen wrench (tight spaces), or a 7/16 in. socket or open end/box wrench (open spaces).

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 3-19. Remove two bolts to release breather assembly and filter element from the rocker arm support plate. See 3.20 BREATHER ASSEMBLY for inspection and repair information.



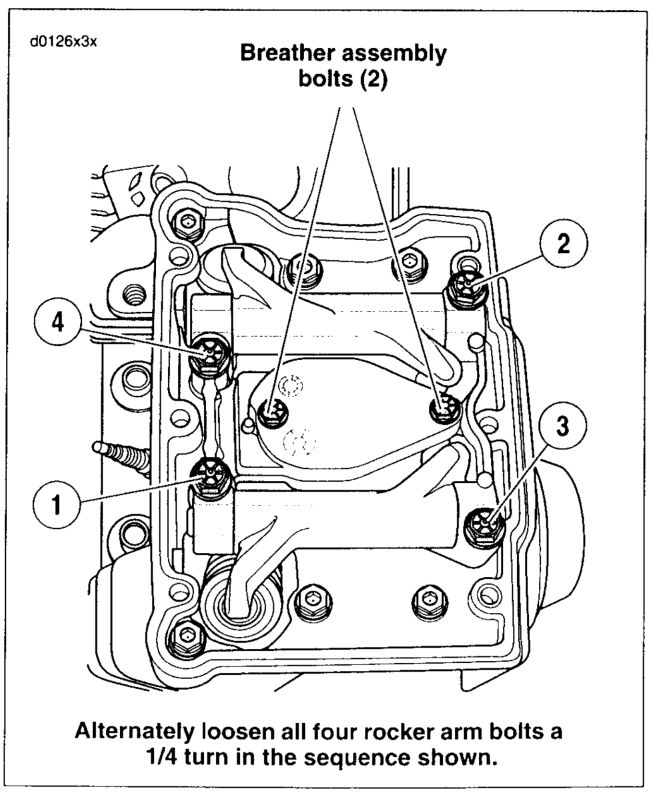
1. Internal hex
2. External hex
3. Lock patch

Figure 3-17. Rocker Cover Bolt (Rocker Housing Bolt Similar)



Alternately loosen all six rocker cover bolts in the sequence shown.

Figure 3-18. Rocker Cover Bolt Removal (Rear Cylinder Shown)



Alternately loosen all four rocker arm bolts a 1/4 turn in the sequence shown.

Figure 3-19. Breather Bolts and Rocker Arm Bolts (Rear Cylinder Shown)

ROCKER ARM SUPPORT PLATE

1. See Figure 3-20. Insert the blade of a small screwdriver into cast loop of spring cap retainer (at top of upper pushrod cover). While pushing down on spring cap, rotate bottom of screwdriver toward outboard side to remove. Repeat step on second pushrod cover.

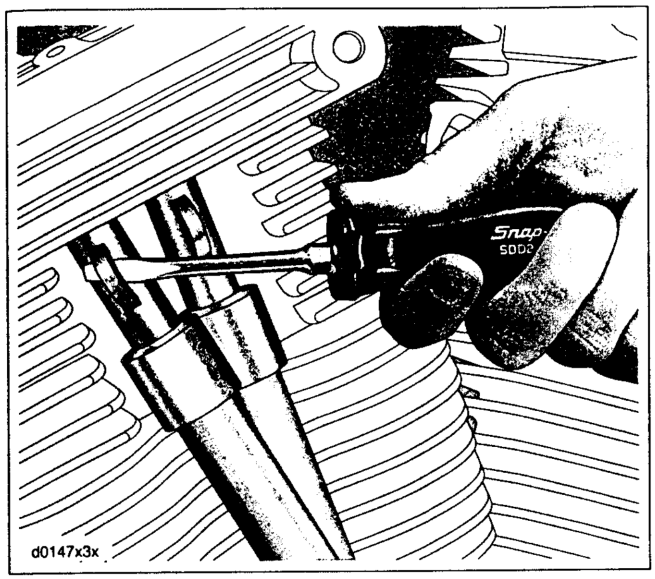


Figure 3-20. Removing Spring Cap Retainer

2. Collapse upper and lower pushrod covers.

CAUTION

Removing the rocker arms with the valve train loaded can result in bent pushrods, damaged bushings or a warped support plate.

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 5th gear and rotate rear wheel in a clockwise direction (as viewed from right side) until the base circle is found. Continue with step 4.

   b. **With primary cover removed** - Remove spark plugs. Remove primary cover. Place the transmission in neutral. Fit a 1-1/2 in. socket on the compensating sprocket shaft nut. Rotate nut in a counterclockwise direction until the base circle is found. Continue with step 4.

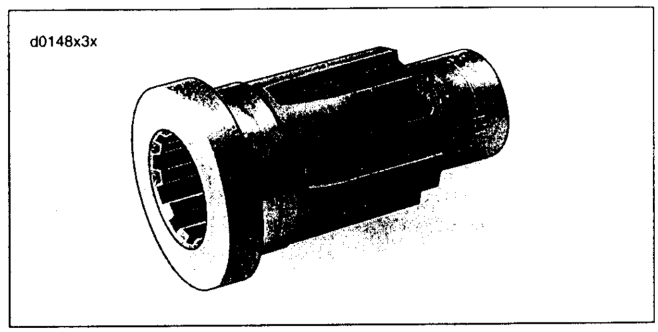


Figure 3-21. Sprocket Shaft Engine Rotation Tool

CAUTION

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. **With engine mounted in engine stand** - Fashion tool as follows: Obtain used or discarded compensating sprocket shaft extension (HD-40266-85). Weld a 13/16 in. socket with a 1/2 in. drive to outboard side of extension. See Figure 3-21. Install tool on sprocket shaft and rotate in a counterclockwise direction until the base circle is found. Continue with step 4.

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 pushrod 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 pushrods are in the unloaded position.

5. See Figure 3-19. Alternately loosen each of the four rocker arm support plate bolts just 1/4 turn. 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. See 3.21 ROCKER ARM SUPPORT PLATE for inspection and repair information.

NOTE

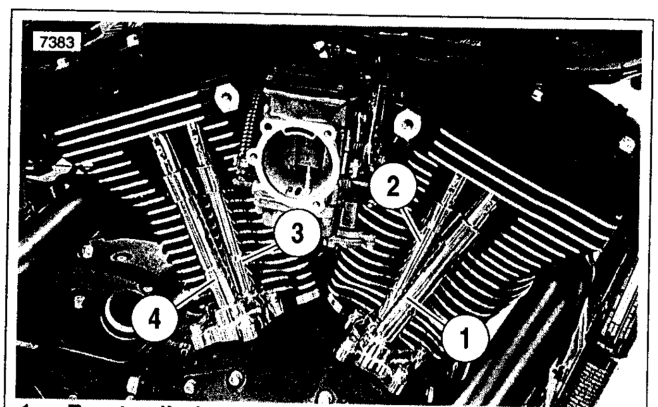
Always service each cylinder separately. After the first cylinder is serviced the engine must be rotated to find the base circle on the second cam. Service on the remaining cylinder can then proceed.

PUSHRODS, LIFTERS AND COVERS

1. See Figure 3-22. Remove the intake and exhaust pushrods and pushrod covers.
   a. Tag the pushrods for location (front/rear cylinder), and orientation (top/bottom) as they are removed. This will simplify installation.
   b. Remove pushrod covers from cylinder head and lifter cover bores.
   c. Remove three O-rings from pushrod covers and discard. If O-ring is missing from upper pushrod 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. See 3.22 PUSHRODS, LIFTERS AND COVERS for inspection and repair information.

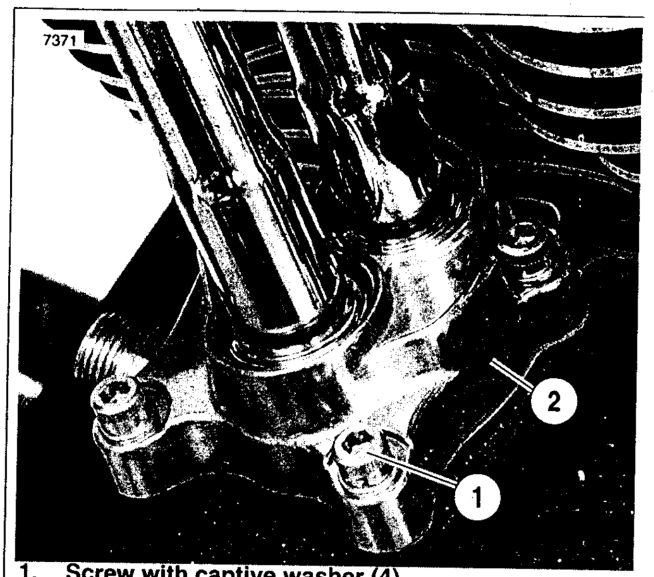
CYLINDER HEAD

1. See Figure 3-24. Following the sequence shown, alternately loosen the six rocker housing bolts. Remove rocker housing bolts and their captive washers.



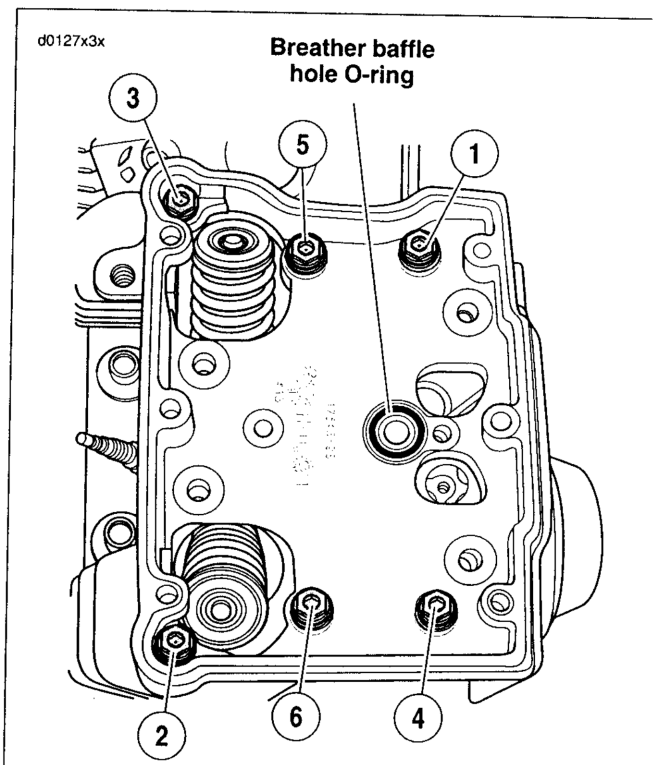
1. Front cylinder exhaust pushrod
2. Front cylinder intake pushrod
3. Rear cylinder intake pushrod
4. Rear cylinder exhaust pushrod

Figure 3-22. Pushrod Locations



1. Screw with captive washer (4)
2. Lifter cover

Figure 3-23. Lifter Cover



Alternately loosen all six rocker housing bolts in the sequence shown.

Figure 3-24. Rocker Housing Bolts (Rear Cylinder Shown)

2. Remove rocker housing and gasket. Discard gasket.

CAUTION

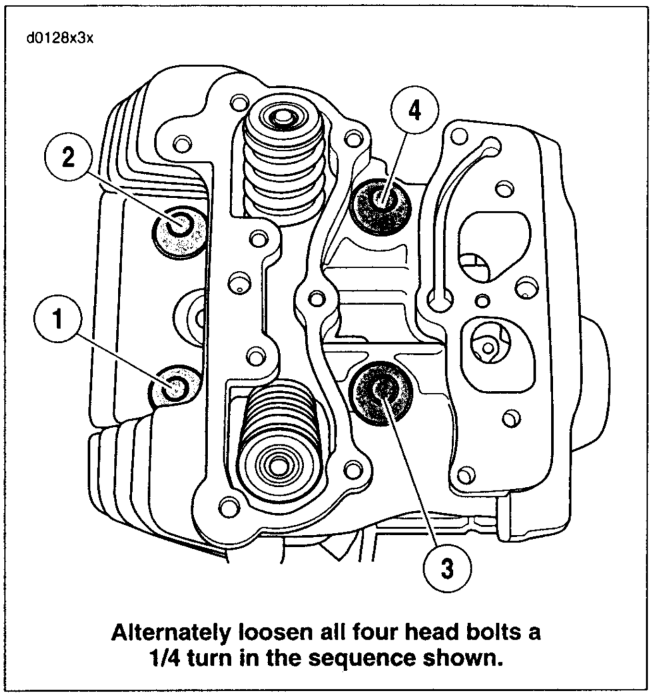
To prevent distortion of the cylinder head, cylinder and cylinder studs, gradually loosen the cylinder head bolts in the specified sequence.

3. See Figure 3-25. Remove cylinder head bolts.
   a. Following the sequence shown, alternately loosen each of the four cylinder head bolts just 1/4 turn.
   b. Continue turning the bolts in these increments until loose.
   c. Remove the cylinder head bolts.
4. See Figure 3-26. Remove cylinder head and head gasket (2). Discard 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. See 3.23 CYLINDER HEAD for inspection and repair information.



Alternately loosen all four head bolts a 1/4 turn in the sequence shown.

Figure 3-25. Cylinder Head Bolt Removal (Rear Cylinder Shown)

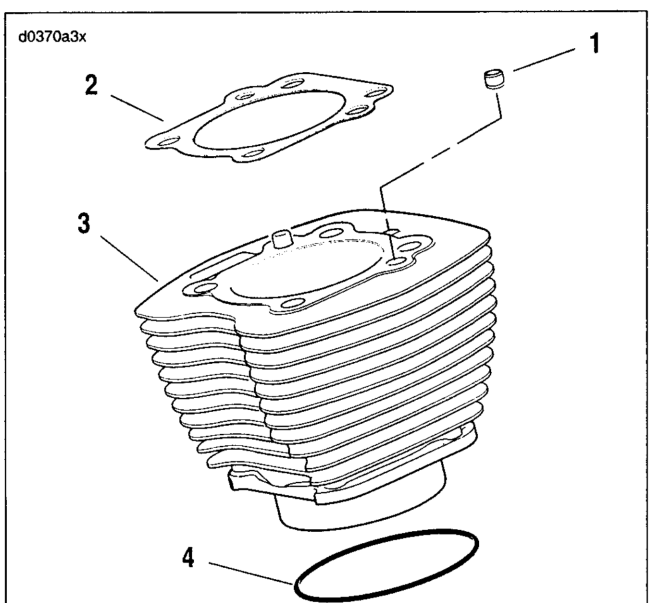
CYLINDER

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.

CAUTION

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. 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.
4. See Figure 3-26. Remove O-ring seal (4) from the bottom of the cylinder liner. Discard O-ring seal.
5. See Figure 3-27. Remove O-ring from dowel pin (4) on base of cylinder deck. Discard O-ring.
6. See 3.24 CYLINDER for inspection and repair information.



1. **Dowel pin**
2. **Head gasket**
3. **Cylinder**
4. **O-ring seal**

Figure 3-26. Cylinder Assembly

PISTON

PART NO.	SPECIALTY TOOL
HD-42317	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

Always wear proper eye protection when removing circlips. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

2. See Figure 3-27. Remove the piston pin circlip.
   a. Insert the PISTON PIN CIRCLIP REMOVER/INSTALLER (1) (Part No. HD-42317) 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.

NOTE

It is not necessary to remove both piston pin circlips during piston removal. Leave the second circlip in the pin bore.

3. See Figure 3-28. Remove the piston pin. If piston pin is difficult to remove, use PISTON PIN REMOVER (Part No. HD-42320-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.

1. **Piston pin circlip remover/installer**
2. **Piston**
3. **Protective material over cylinder studs**
4. **Cylinder deck dowel (O-ring not shown)**

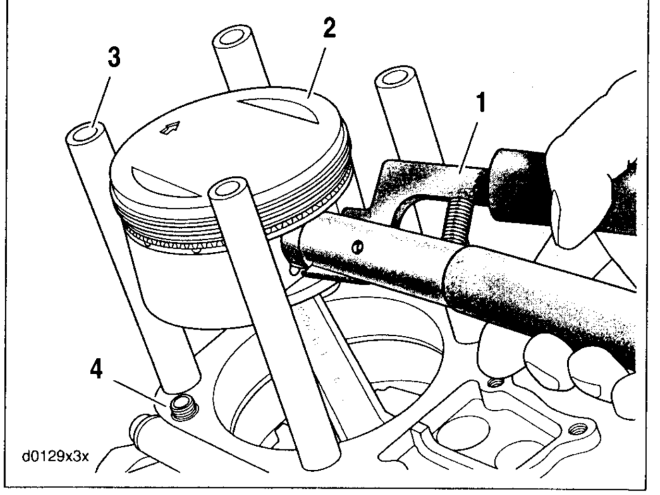


Figure 3-27. Piston Pin Circlip Removal (Part No. HD-42317)

1. **Spacer and acorn nut**
2. **Rubber coated tip**
3. **Handle**

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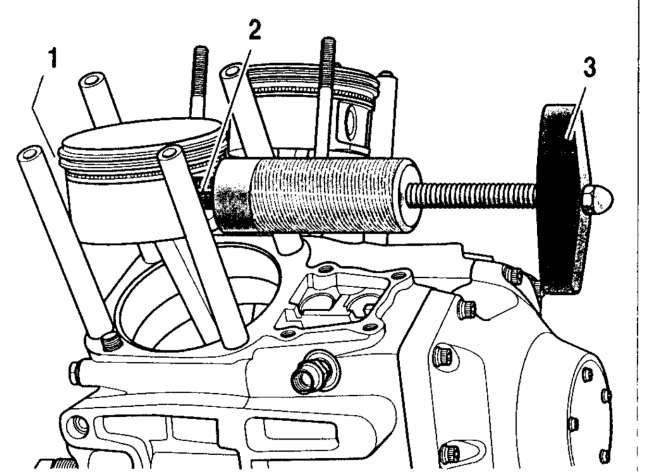


Figure 3-28. Piston Pin Remover (Part No. HD-42320-A)

6. Service as needed. See the following topics for inspection and repair information.
   a. See 3.25 PISTON.
   b. See 3.26 UPPER CONNECTING ROD.
7. Complete engine work.
   a. If performing a top end overhaul only, see 3.17 TOP END OVERHAUL: ASSEMBLY.
   b. If performing a complete engine overhaul, see 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

GENERAL

NOTE

Although this section may seem to focus on rear cylinder assembly, it is assumed that each step performed at the rear is automatically repeated on the front cylinder. Tighten fasteners for front cylinder components in a mirror image of the rear cylinders shown.

This section provides a sequential process for engine reassembly after a complete 3.16 TOP END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Piston installation-see below.
- Cylinder installation-see page 3-34.
- Cylinder head installation-see page 3-36.
- Pushrods, lifters and covers installation-see page 3-39.
- Rocker arm support plate installation-see page 3-40.
- Breather assembly installation-see page 3-41.

PISTON

PART NO.	SPECIALTY TOOL
HD-42317	Piston pin circlip remover/installer
HD-42320-A	Piston pin remover

1. Slide approximately 6.0 in. (152 mm) of plastic tubing, rubber hose or conduit over each cylinder stud, if removed. Use material with I.D. of 0.5 in. (12.7 mm) to protect cylinder studs and piston from damage.
2. Apply clean H-D 20W50 engine oil to piston pin, piston bosses and upper connecting rod bushing.
3. Remove water pipe insulation from connecting rod shank.
4. See Figure 3-29. Place piston over rod end so that the arrow stamped at the top of the piston points toward the front of the engine.
5. See Figure 3-30. Insert piston pin (1) through pin bore and upper connecting rod bushing. Push pin until it contacts circlip installed in opposite pin boss. Verify that end gap (3) for circlip is 180 degrees from opening (2).
6. Place clean shop towels over the cylinder and lifter bores to prevent the piston pin circlip from falling into the crankcase. Verify that the circlip groove is clean and free of dirt and grime.

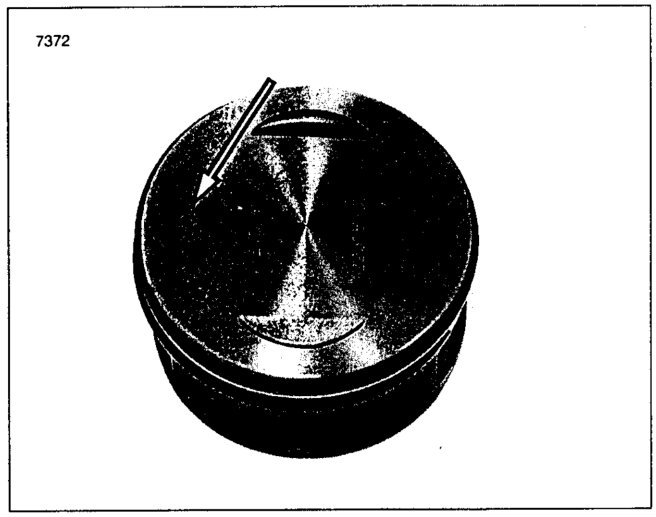
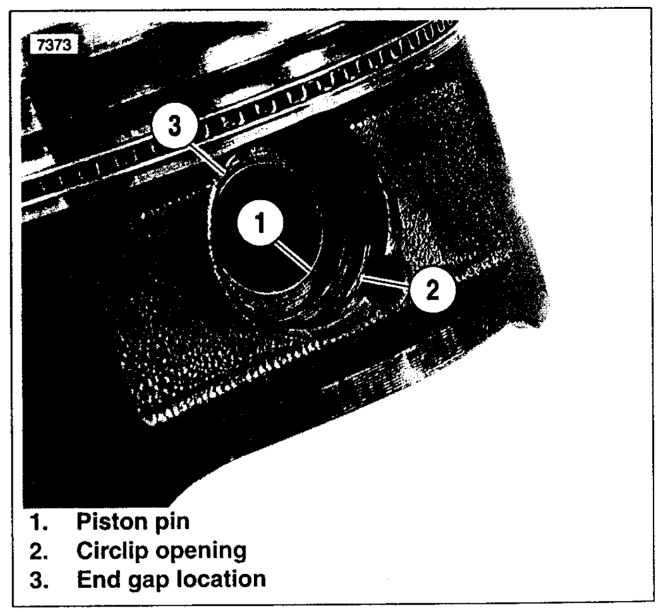


Figure 3-29. Piston Installation Arrow



1. **Piston pin**
2. **Circlip opening**
3. **End gap location**

Figure 3-30. Preinstalled Circlip

CAUTION

Do not reuse piston pin circlips. The circlips may 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. See Figure 3-31. Slide circlip down nose of tool until it contacts claw. Lightly squeeze handles of tool to capture circlip in claw.
   b. Releasing pressure on handles, rotate circlip so that the end gap is centered at top of tool and then recapture in claw.
   c. Tilt the circlip forward until the end gap contacts nose of tool.
   d. See Figure 3-32. Insert the tool (1) into the piston pin bore until claw is aligned with slot (2) in piston.
   e. Firmly push the tool into the piston pin bore until it bottoms. Release handles and remove tool.
   f. Inspect the circlip to verify that it is fully seated in the groove.

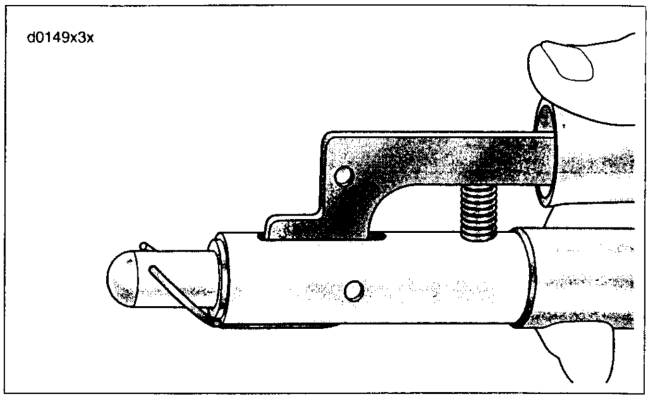


Figure 3-31. Aligning Circlip

CYLINDER

PART NO.	SPECIALTY TOOL
HD-42322	Piston support plate
HD-95952-1	Threaded cylinders
HD-95952-33C	Connecting rod clamping tool
HD-96333-51C	Piston ring compressor
HD-96333-103	Ring compressor band

CAUTION

O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.

1. See Figure 3-32. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-rings for both cylinder deck dowel pins (3). Install and verify that O-ring is properly seated in groove.
2. See Figure 3-33. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring seal for the bottom of the cylinder liner. Install **new** O-ring seal.

NOTE

Excessive lubrication of cylinder sleeve O-ring seal will result in oil weepage between cylinder and crankcase as engine is run. This condition may be incorrectly diagnosed as an oil leak.

1. **Piston pin circlip remover/installer**
2. **Slot**
3. **Cylinder deck dowel (O-ring not shown)**

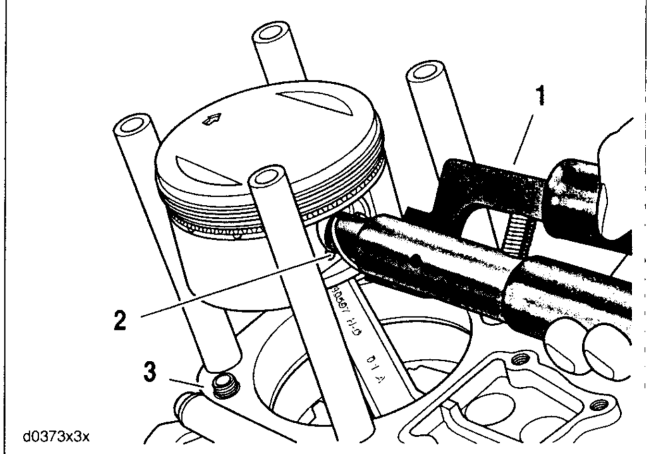


Figure 3-32. Pin Circlip Remover/Installer (Part No. HD-42317)

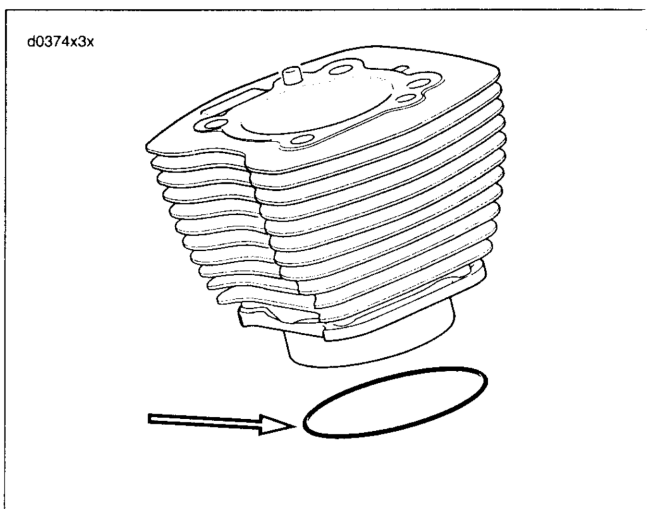


Figure 3-33. O-ring Seal For Cylinder

3. See Figure 3-34. Verify that the piston ring end gaps are staggered. Rotate each ring to position the gap 90 to 180 degrees from the gap in the ring above it. Locate the top piston ring (5) gap towards the intake port.

4. Apply clean H-D 20W50 engine oil to piston, piston rings and cylinder bore.

5. Remove protective covers from cylinder studs. Rotate engine until piston is at top dead center. If necessary, see ROCKER ARM SUPPORT PLATE under 3.16 TOP END OVERHAUL: DISASSEMBLY.

6. See Figure 3-35. Install the PISTON SUPPORT PLATE (Part No. HD-42322).

   a. Slide both adjustable knobs (2) on support plate (1) down away from forked end. Tighten knobs when contact is made with flats at end of slots.

   b. With the forked end of the tool pointing towards the center of the engine and the adjustable knobs facing downward, capture shank of connecting rod in fork. Lay tool on cylinder deck so that adjustable knobs contact wall of cylinder bore.

   c. Rotate engine until piston skirt is centered and firmly seated on top of support plate.

7. See Figure 3-36. Install cylinder using PISTON RING COMPRESSOR (Part No. HD-96333-51C).

   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 racheting action of the tool allows release of the handles after the rings are compressed.

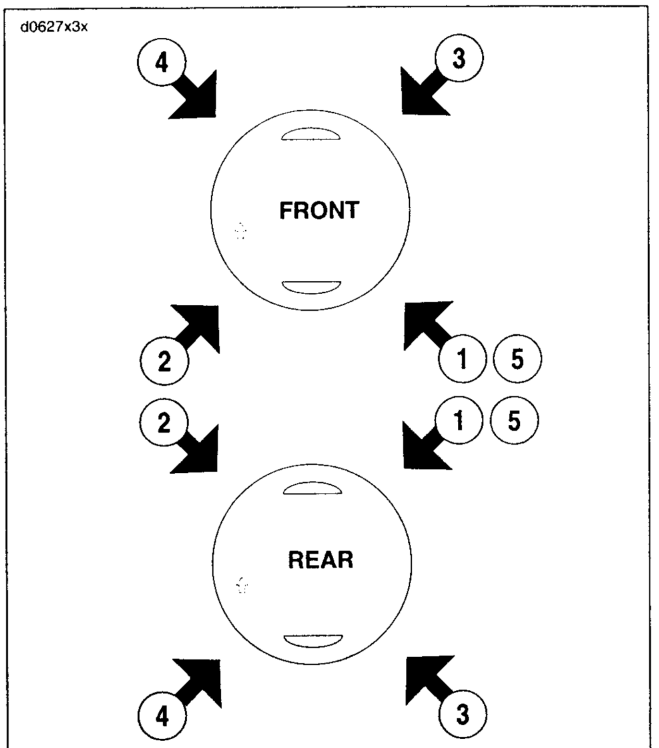
   c. With the indent in the cooling fins facing the right side of the engine, gently slide cylinder over the cylinder studs and the piston crown resting it on the top of the ring compressor band.

   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.

8. Remove shop towels from around the crankcase bore exercising caution to keep out any dirt or debris.

9. Carefully set the cylinder over the two dowel pins in the cylinder deck. Push down on the cylinder until it is fully seated in the crankcase bore.



1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**

Figure 3-34. Piston Ring Alignment

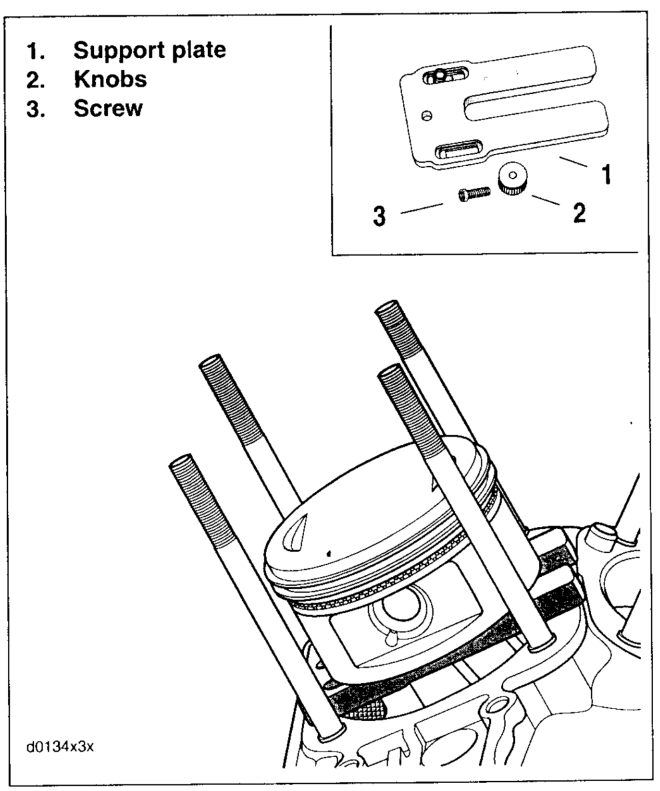


Figure 3-35. Piston Support Plate (Part No. HD-42322)

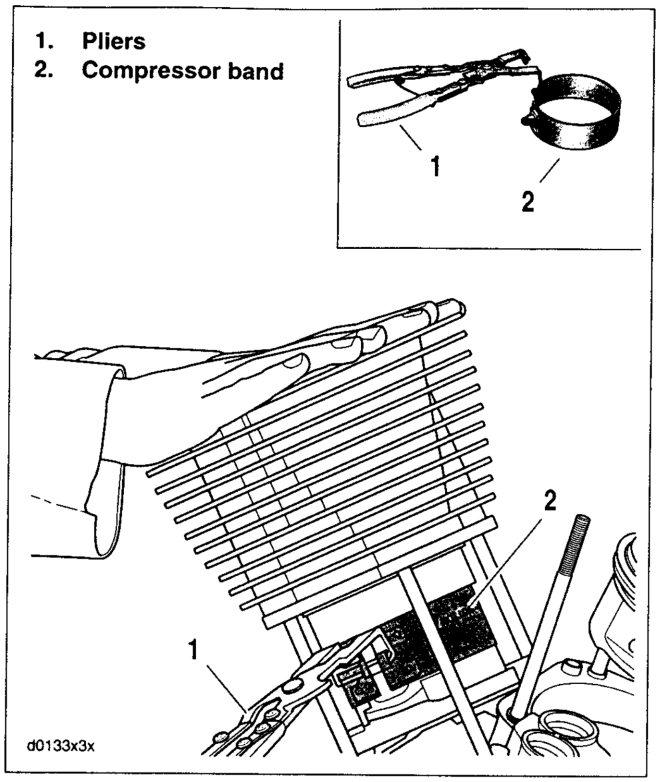


Figure 3-36. Piston Ring Compressor (Part No. 96333-51C)

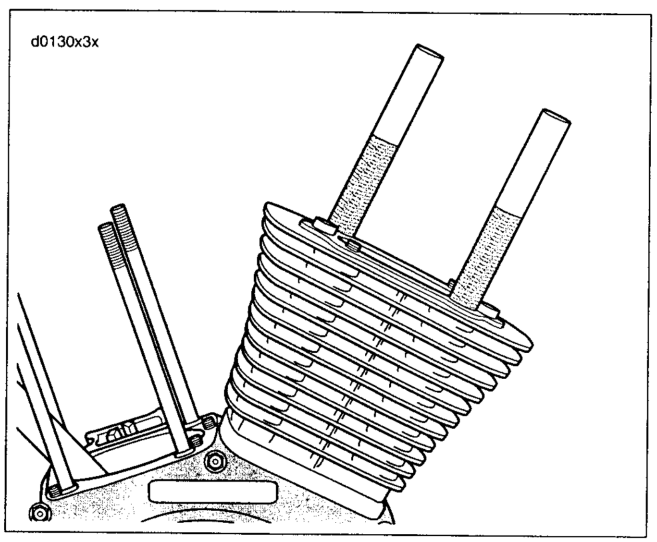


Figure 3-37. Install Threaded Cylinders to Studs (Part No. HD-95952-1)

NOTE

See Figure 3-37. To hold the first cylinder in position while installing the second, install THREADED CYLINDERS (Part No. HD-95952-1) from CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C) onto cylinder studs with the knurled side down. This will prevent the piston rings from raising the cylinder as the engine is rotated to bring the other piston into position for installation of the second cylinder.

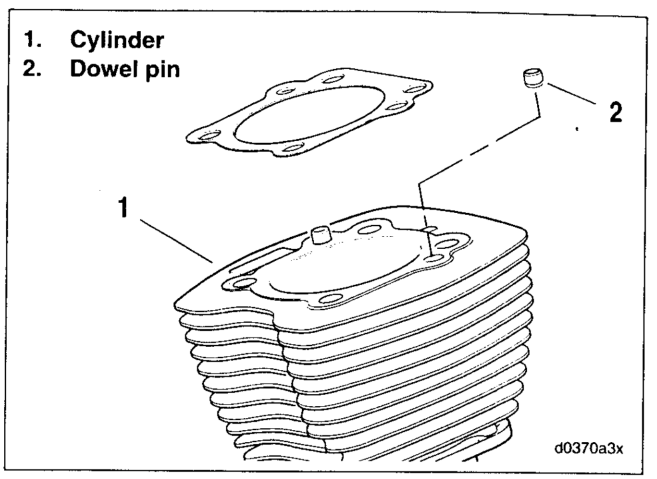


Figure 3-38. Cylinder Dowel Pins

CYLINDER HEAD

1. See Figure 3-38. 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.

CAUTION

Thoroughly clean and lubricate the threads of the cylinder head bolts before installation. Friction caused by dirt and grime will result in a false torque indication.

3. Lightly coat the threads and bottom face of the cylinder head bolts in clean H-D 20W50 engine oil. Wipe off any excess oil.

4. See Figure 3-39. Loosely install the cylinder head bolts onto the cylinder studs. Place two short bolts on the left side of the engine and two long bolts on the right.

CAUTION

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 108-132 **in-lbs** (12.2-14.9 Nm).
   c. Continuing the same sequence, tighten each bolt to 15-17 ft-lbs (20.3-23.0 Nm).
   d. See Figure 3-40. Using a grease pencil, mark a straight line on the cylinder head bolt continuing the line over onto the cylinder head.
   e. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees ±5 degrees. Be sure to tighten the cylinder head bolts in the sequence shown in Figure 3-39.

NOTE

For best results, use Snap-on® Torque Angle Gauge TA360.

CAUTION

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.

6. See Figure 3-41. Install a **new** rocker housing gasket on the cylinder head flange. Verify that the rocker housing gasket covers the breather channel.
7. See Figure 3-42. 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.

NOTE

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.

CAUTION

O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.

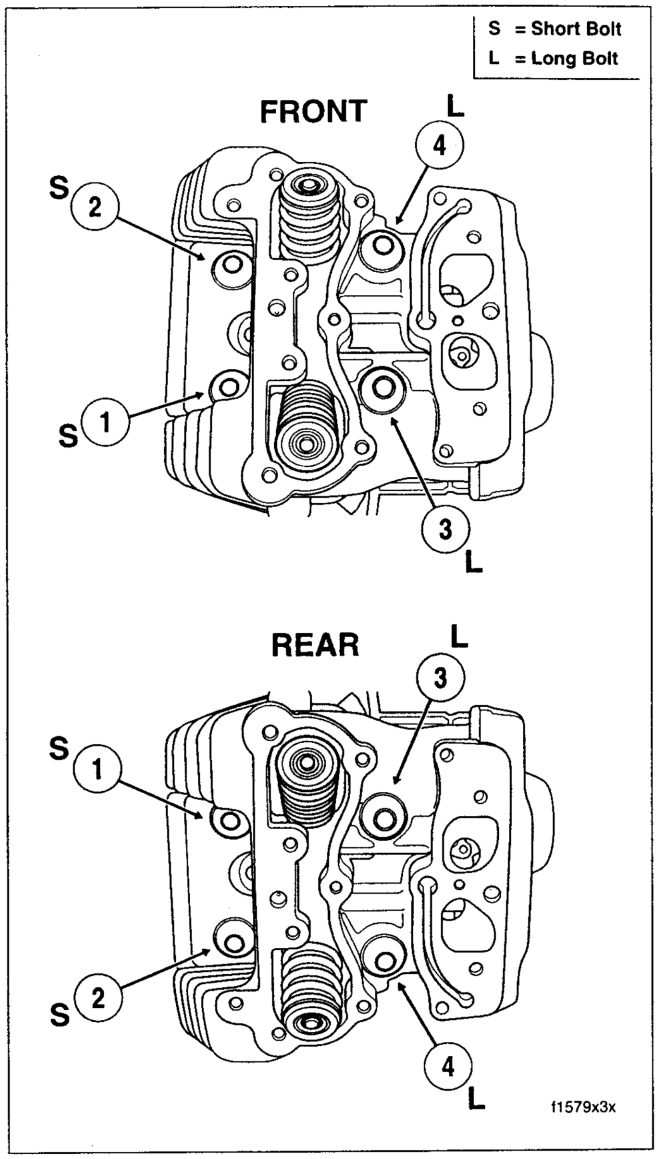
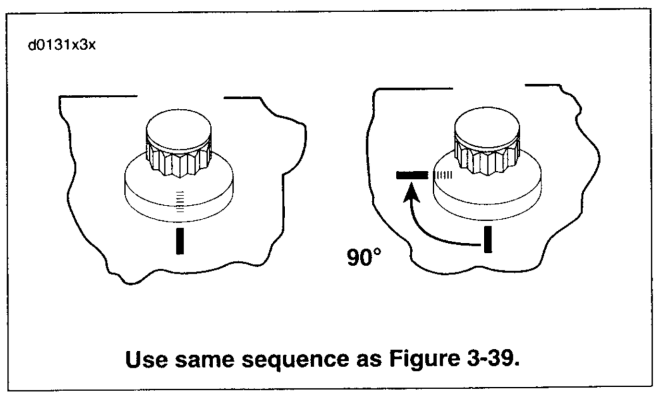


Figure 3-39. Cylinder Head Torque Sequence



Use same sequence as Figure 3-39.

Figure 3-40. Final Tightening For Cylinder Head Bolts

9. See Figure 3-42. 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.

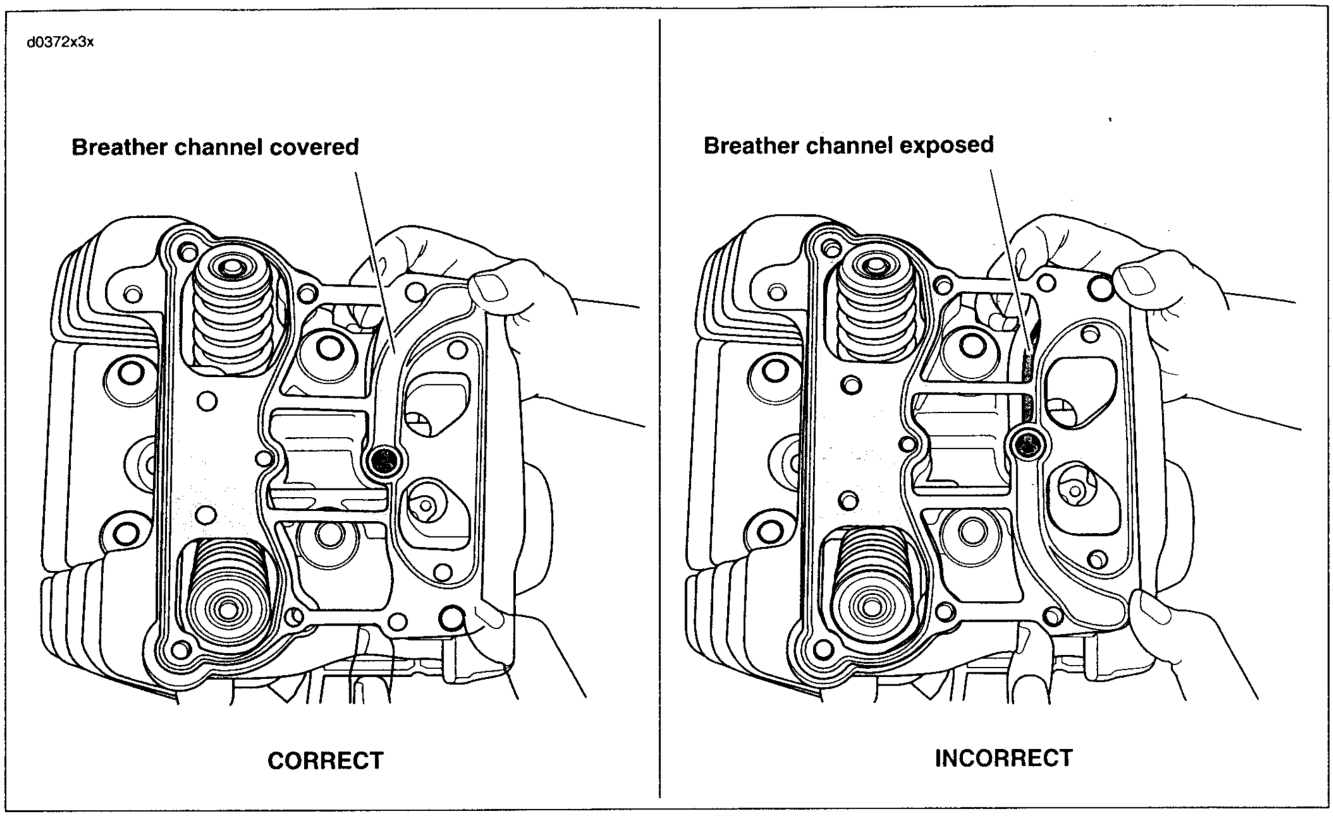
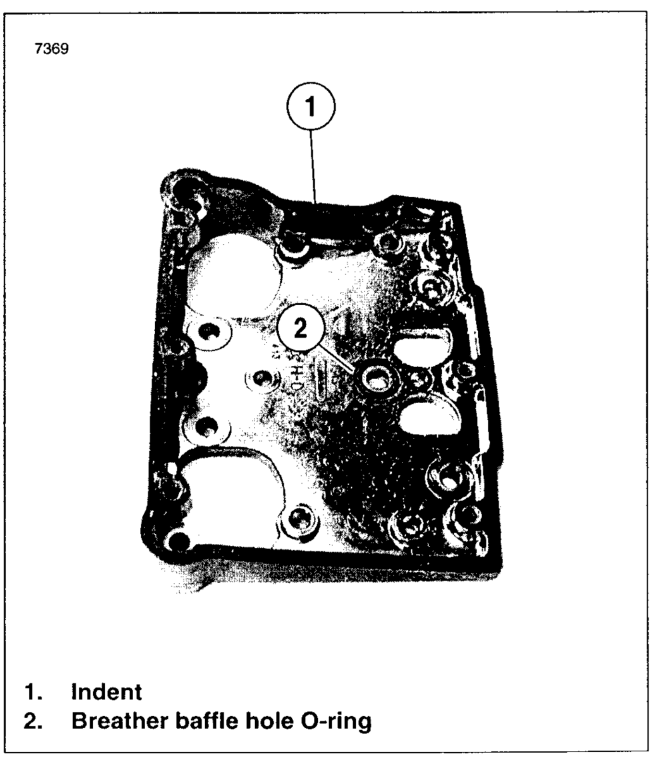


Figure 3-41. Install Rocker Housing Gasket (Rear Cylinder Shown)

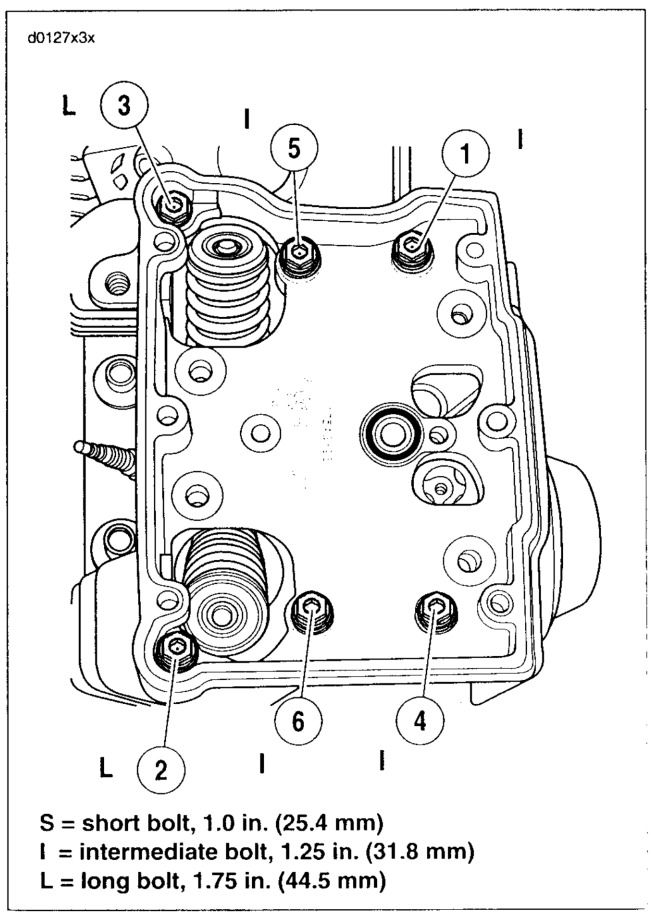


1. Indent
2. Breather baffle hole O-ring

Figure 3-42. Rocker Housing Alignment

NOTE

Do not confuse breather baffle hole O-ring (Part No. 11270) with the top pushrod O-ring (Part No. 11293).



S = short bolt, 1.0 in. (25.4 mm)
I = intermediate bolt, 1.25 in. (31.8 mm)
L = long bolt, 1.75 in. (44.5 mm)

Figure 3-43. Rocker Housing Torque Sequence and Bolt Size (Rear Cylinder Shown)

PUSHRODS, LIFTERS AND COVERS

1. Remove any labels used on the hydraulic lifters. Install lifters in the crankcase bores with the oil hole on the inboard side and the flats on the lifters facing forward and rearward. To avoid damage, do not drop lifters onto cam lobes.
2. See Figure 3-44. Place the anti-rotational pin (4) on the machined flat between the blocks cast into the crankcase.
3. Install a **new** lifter cover gasket (2) aligning the holes in the gasket with those in the cover (1).

CAUTION

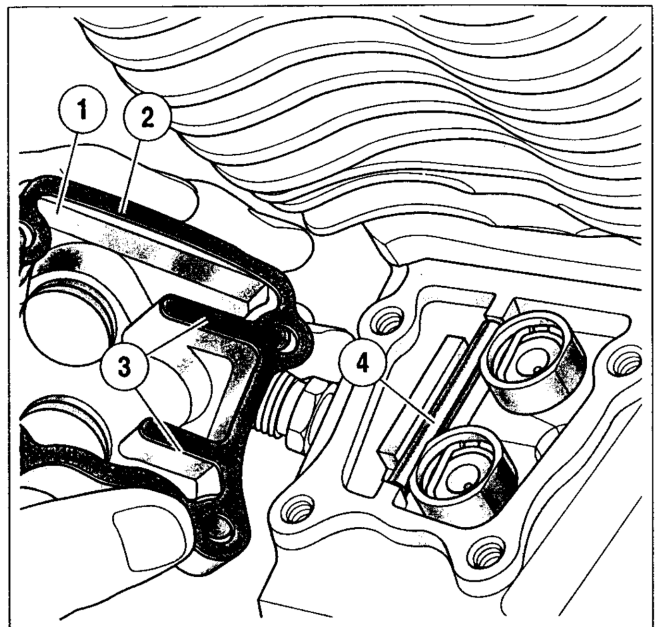
Movement or loss of the anti-rotational pin can result in lifter rotation causing catastrophic engine damage.

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 crosswise pattern.
5. Install pushrod covers.
   a. Hand compress the pushrod cover assembly and fit the O-ring end of the lower pushrod cover into the lifter cover bore.
   b. Expanding the assembly, fit the O-ring end of the upper pushrod cover into the cylinder head bore.
   c. Do not install the spring cap retainers at this time.

NOTE

See ROCKER ARM SUPPORT PLATE which follows to install spring cap retainers.

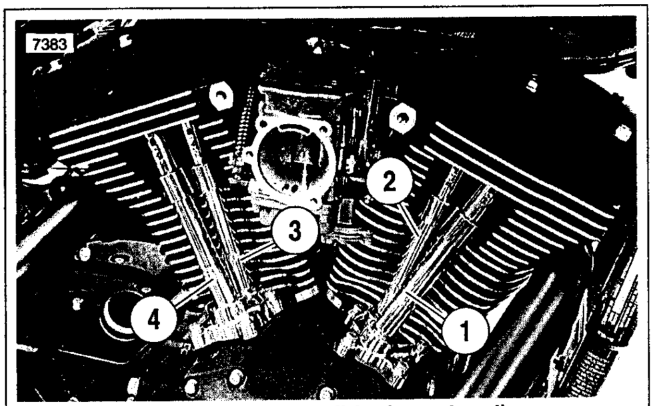
6. See Table 3-2. Install the pushrods in their original positions. Be sure to remove any tags that may have been used for identification.
   a. See Figure 3-45. For example, if reassembling the rear cylinder, slide the intake pushrod (silver) through the front hole in the rocker housing engaging the lifter socket in the inside hole of the lifter cover.
   b. Slide the exhaust pushrod (black) through the rear hole in the rocker housing engaging the lifter socket in the outside hole of the lifter cover.



1. **Cover**
2. **Gasket**
3. **Ribs on cover**
4. **Anti-rotational pin**

d0132x3x

Figure 3-44. Installing Lifters



1. **Front cylinder exhaust (black pushrod)**
2. **Front cylinder intake (silver pushrod)**
3. **Rear cylinder intake (silver pushrod)**
4. **Rear cylinder exhaust (black pushrod)**

Figure 3-45. Lifter Bore Covers

Table 3-2. Pushrod/Lifter Locations

CYLINDER	COVER & PUSHROD	LIFTER BORE COVER	CYLINDER HEAD/ ROCKER HOUSING BORE
Front	Intake	Inside	Rear
	Exhaust	Outside	Front
Rear	Intake	Inside	Front
	Exhaust	Outside	Rear

ROCKER ARM SUPPORT PLATE

CAUTION

Installing the rocker arms and rotating the engine with the valve train loaded can result in bent pushrods, 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 ROCKER ARM SUPPORT PLATE under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. See Figure 3-46. Place the rocker arm support plate assembly into the rocker housing. Loosely install the four rocker arm support plate bolts with flat washers. Place two short bolts on the left side of the engine and two long bolts on the right. Loosely install the breather assembly bolts at this time

CAUTION

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 pushrod covers and verify that both pushrods 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.

5. Complete installation of the pushrod covers.
   a. Verify that the O-ring ends of the upper and lower pushrod covers fit snugly into the cylinder head and lifter cover bores.
   b. Lodge 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.

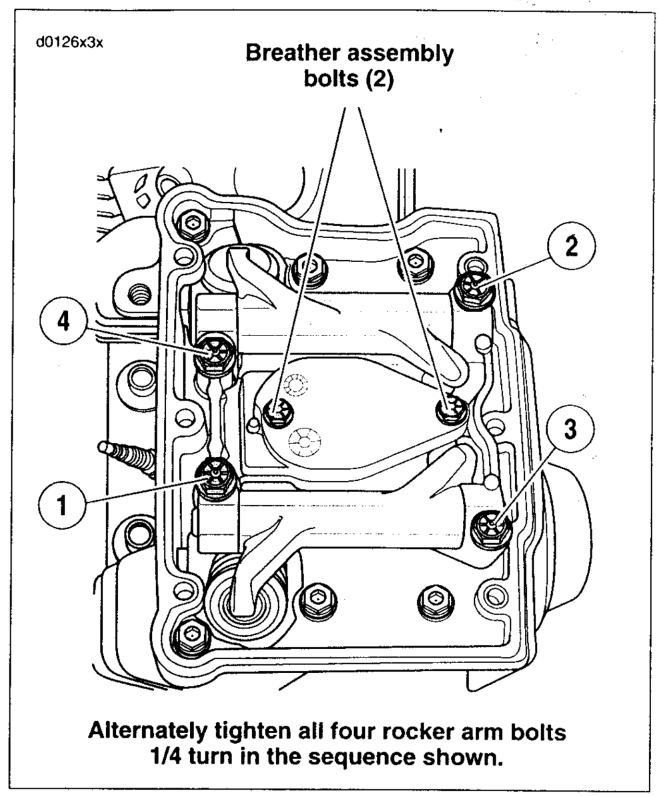


Figure 3-46. Rocker Arm Torque Sequence (Rear Cylinder Shown)

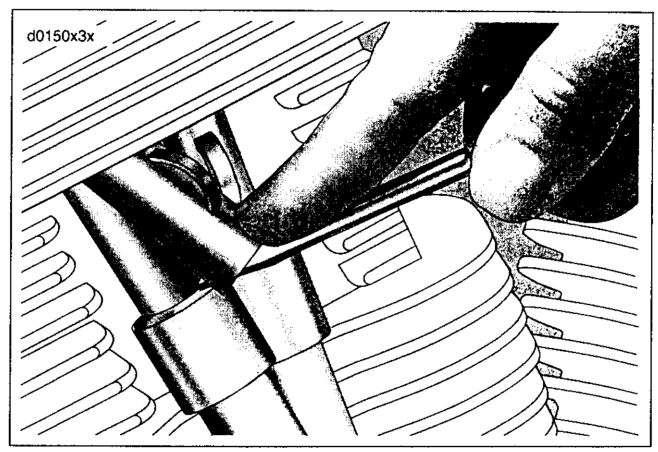


Figure 3-47. Install Spring Cap Retainers

   d. See Figure 3-47. While simultaneously depressing spring cap with tip of screwdriver, use forefinger to slide bottom edge of spring cap retainer down shaft towards tip of screwdriver blade. As spring cap reaches its full length of travel, spring cap retainer should be in approximate position against upper pushrod cover.
   e. Verify that spring cap retainer is seated tightly against upper pushrod cover.

BREATHER ASSEMBLY

1. See Figure 3-46. Alternately tighten the two bolts to secure breather cover and baffle assembly to 90-120 **in-lbs** (10.2-13.6 Nm).
2. See Figure 3-48. Install a **new** rocker cover gasket with indent facing forward on the rocker housing flange. Place the rocker cover into position aligning the holes in the cover with those in the gasket.

CAUTION

If the engine was left in the chassis for service, final tighten the three rocker cover bolts on the left side of the rear cylinder using a 3/8 in. drive torque wrench with a 7/16 in. flank drive "dog bone" torque adapter (Snap-On FRDH141). Failure to properly use this combination will overtighten the bolts causing distortion of the rocker cover.

3. See Figure 3-49. Install rocker cover bolts.
   a. Apply a small dab of LOCTITE THREADLOCKER 243 (blue) to threads of six rocker cover bolts.
   b. Loosely install three short bolts on the left side of the engine.
   c. Loosely install three long bolts on the right.
   d. Following the sequence shown, tighten bolts to 15-18 ft-lbs (20.3-24.4 Nm).
4. Complete motorcycle assembly.
   a. If engine was left in the chassis for service, see 3.13 ASSEMBLING MOTORCYCLE AFTER SERVICE.
   b. If engine was removed for service, see 3.15 INSTALLING ENGINE IN CHASSIS.

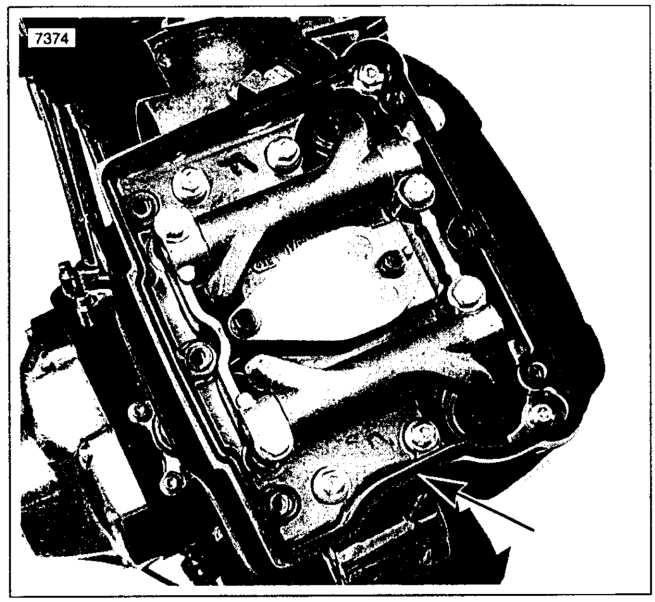


Figure 3-48. Rocker Cover Gasket Indent (Front Cylinder Shown)

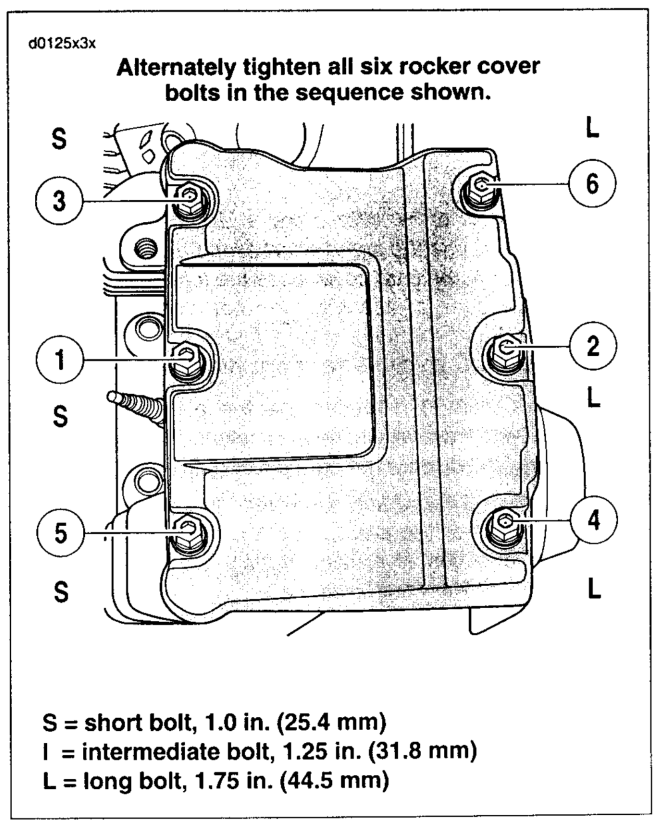


Figure 3-49. Rocker Cover Bolts Torque Sequence (Rear Cylinder Shown)

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 NO.	SPECIALTY TOOL
HD-42313	Cam chain tensioner unloader

1. Prepare engine for bottom end service.
   a. If performing a complete engine overhaul, perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
   b. If only servicing cam compartment components, partial top end disassembly is required. See appropriate topics under 3.16 TOP END OVERHAUL: DISASSEMBLY. Remove breather assembly, rocker arm support plate, pushrods and pushrod covers. Do not remove lifters. Instead, support lifters using improvised tool as described under 3.27 COVER AND CAM SUPPORT PLATE.

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.

2. See Figure 3-50. Remove the ten allen head socket screws with captive washers to release the cam cover. Remove and discard the cam cover gasket.
3. 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.

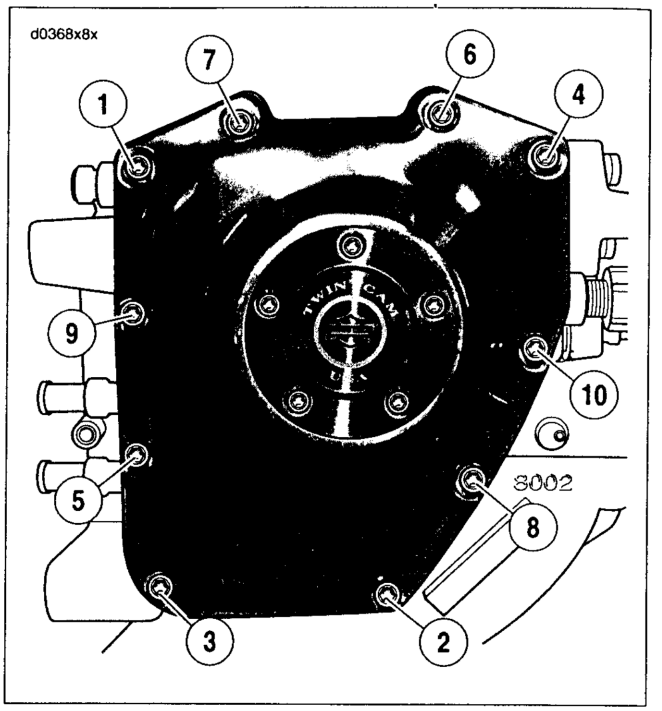
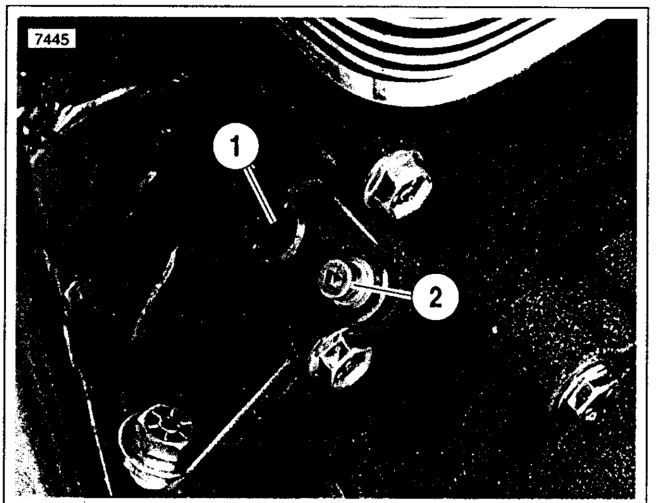
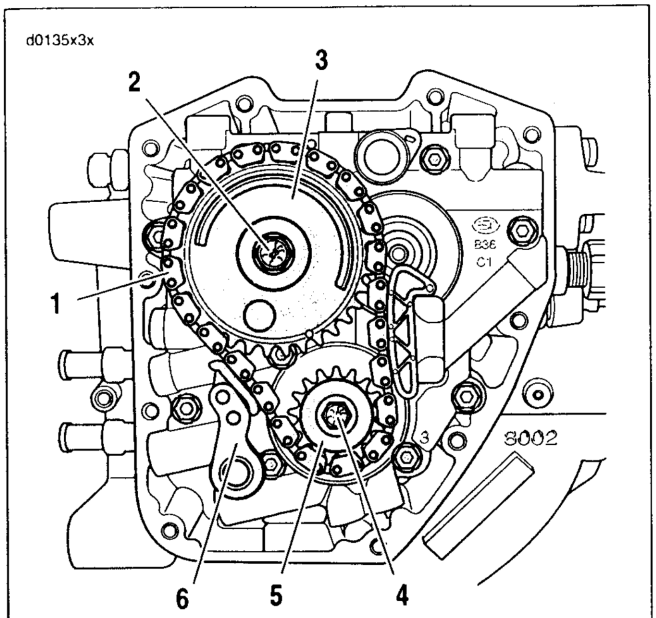


Figure 3-50. Cam Cover Screws



1. **Sensor mount**
2. **Screw**

Figure 3-51. Crank Position Sensor



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 3-52. Cam Support Plate Assembly

⚠WARNING

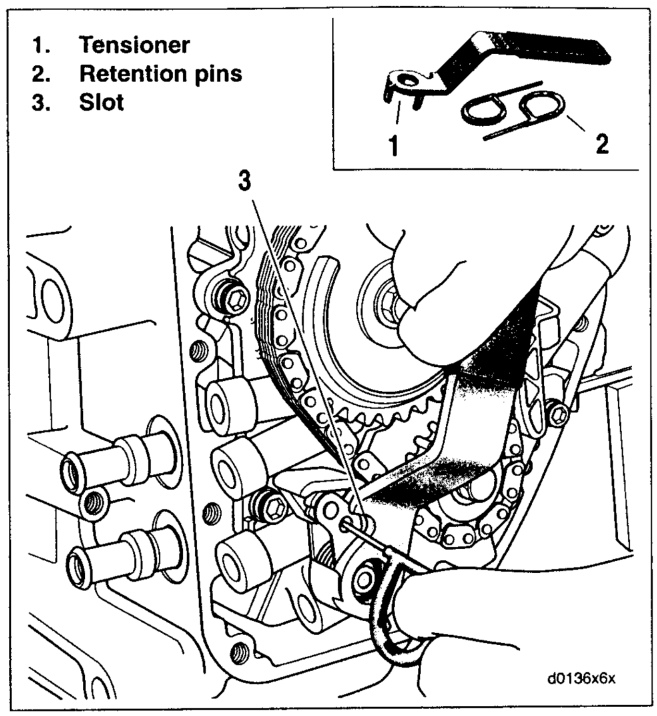
Use extreme caution when operating propane torch. Read the manufacturer's instructions carefully before use. Do not direct open flame or heat towards any fuel system component. Extreme heat can cause fuel ignition and explosion. Inadequate safety precautions could result in death or serious injury.

4. Remove the rear cam sprocket bolt and flat washer (2) from the rear cam sprocket (3).
5. Remove the crank sprocket bolt and flat washer (4) from the crank sprocket (5).

NOTE

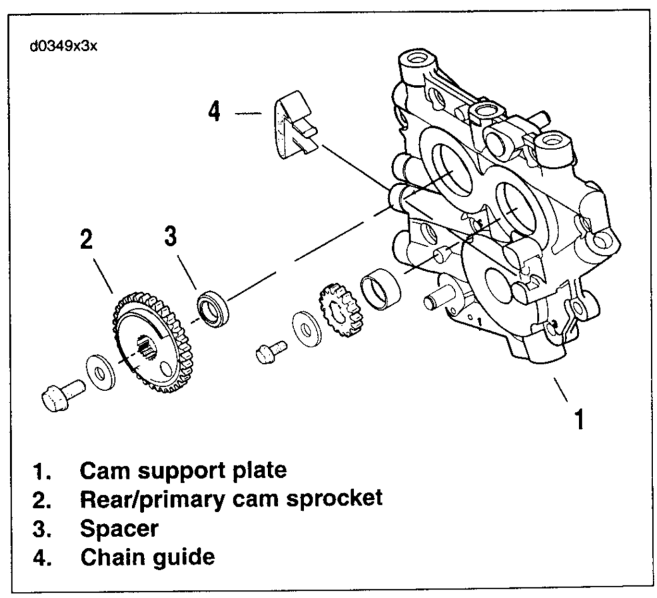
If too much LOCTITE or perhaps the wrong LOCTITE was used to install the rear cam bolt, it may be very difficult to remove. In these cases, break down LOCTITE by using heat from a small propane torch. Apply flame evenly around bolt in a circular motion, but not for so long as to turn bolt blue. Do not direct heat at chain tensioner assembly and other components or damage will result. Other methods of removal, such as the use of a large breaker bar, may result in damage to chain drive and other components.

6. Use CAM CHAIN TENSIONER UNLOADER (Part No. HD-42313) to retract primary cam chain tensioner (6).
   a. See Figure 3-53. With the handle pointing toward the front of the cam support plate, place cup of tool over spring coil. Correctly positioned, the slot (3) in the tool should be adjacent to the hole in the tensioner.
   b. Rotate the handle of the tool in a counterclockwise direction until the hole in the tensioner is aligned with the hole in the boss of the cam support plate.
   c. Insert a retention pin (2) through the hole in the tensioner and into the hole in the cam support plate.



1. **Tensioner**
2. **Retention pins**
3. **Slot**

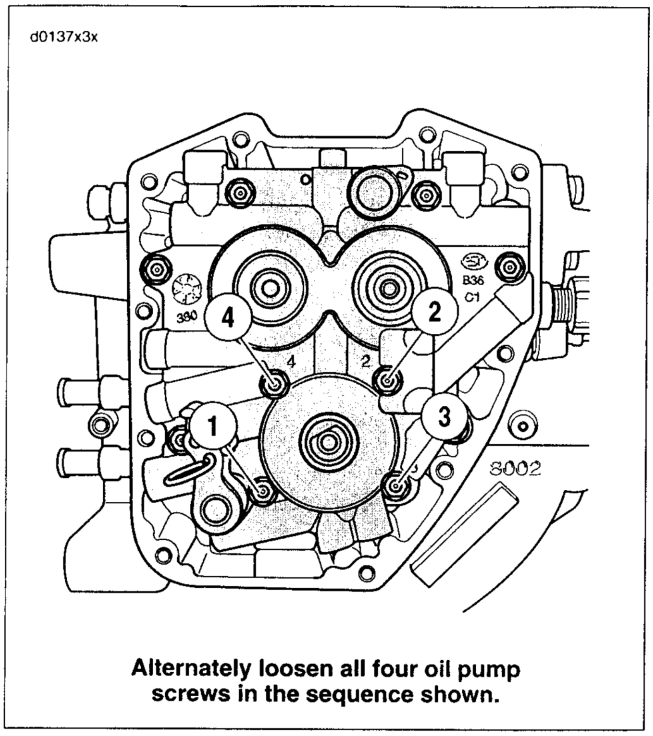
Figure 3-53. Retract Rear Cam Chain Tensioner



1. **Cam support plate**
2. **Rear/primary cam sprocket**
3. **Spacer**
4. **Chain guide**

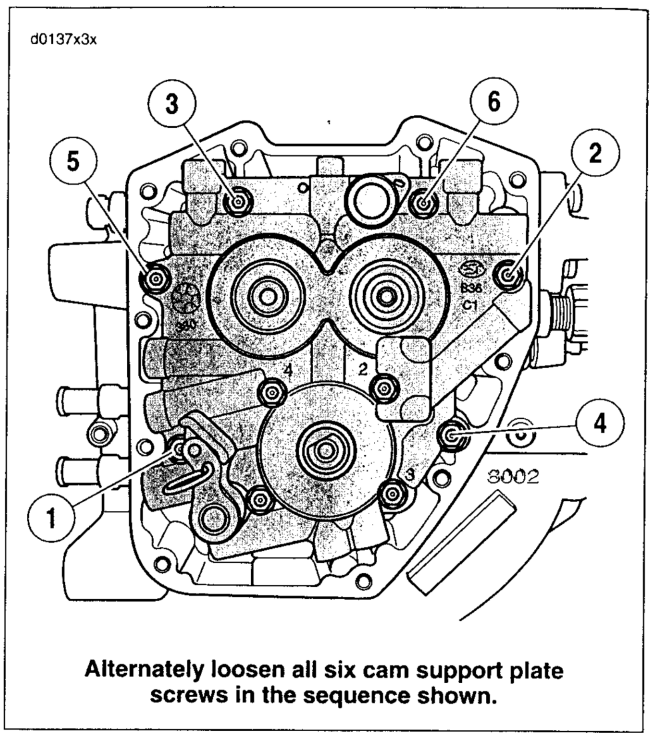
Figure 3-54. Rear Cam Sprocket Spacer

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.
9. See Figure 3-54. Remove rear cam sprocket spacer (3) from the rear camshaft.
10. Squeeze tabs to remove chain guide (4) from between blocks cast into cam support plate (1).



Alternately loosen all four oil pump screws in the sequence shown.

Figure 3-55. Oil Pump Torque Sequence



Alternately loosen all six cam support plate screws in the sequence shown.

Figure 3-56. Cam Support Plate Torque Sequence

11. See Figure 3-55. 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.

⚠CAUTION

Do not pull the retention pin from the primary cam chain tensioner after removal of the cam support plate. With 35-40 pounds of spring pressure behind the tensioner, allowing it to accelerate through its full length of travel will result in spring stretching and/or cracking of the tensioner shoe. Furthermore, if tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.

12. See Figure 3-56. 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.
13. See Figure 3-57. 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 from end of crankshaft.
14. See Figure 3-58. Remove O-ring (1) from groove around oil feed hole in crankcase flange. Discard O-ring.
15. Remove and discard O-ring (3) from crankcase post.
16. See 3.27 COVER AND CAM SUPPORT PLATE for inspection and repair information.

1. **Right crankcase half**
2. **Forward ring dowel**
3. **Rear ring dowel**

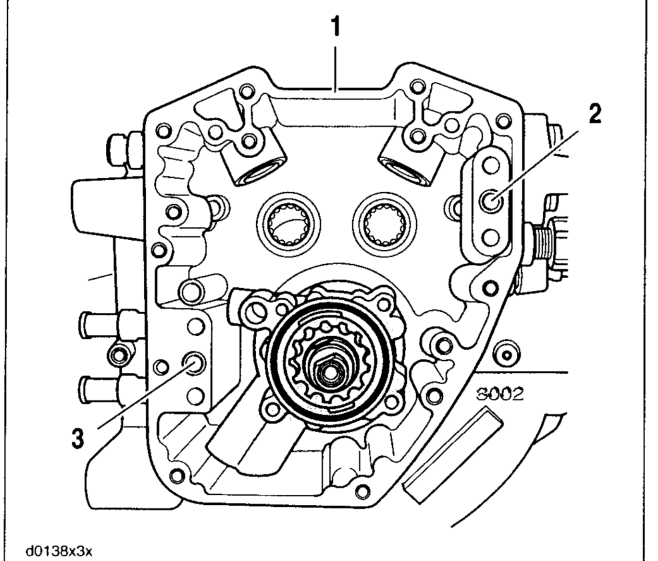


Figure 3-57. Ring Dowels

1. Oil feed hole O-ring
2. Outboard O-ring on oil pump
3. O-ring on crankcase post

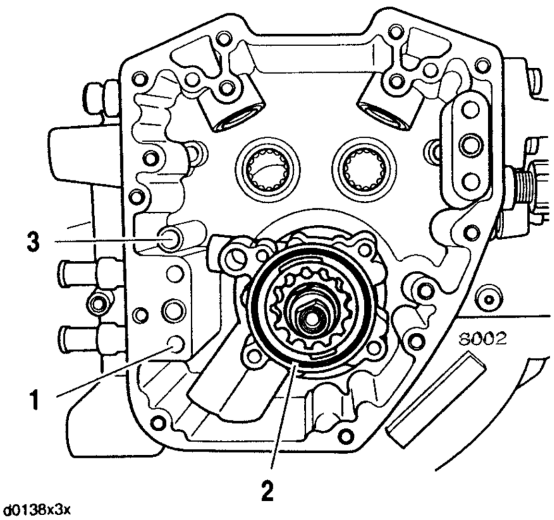


Figure 3-58. Oil Pump O-rings

CRANKCASE

1. Carefully pull oil pump from crankshaft.
2. See Figure 3-58. Remove O-ring (2) from outboard side of oil pump housing. Remove O-ring from scavenge port stub. Discard O-rings. See 3.28 OIL PUMP for inspection and repair information.
3. Rotate crankcase in the engine stand so that the cam cover flange is facing straight upward. See Figure 3-59. Remove the nine crankcase bolts in the sequence shown.

⚠WARNING

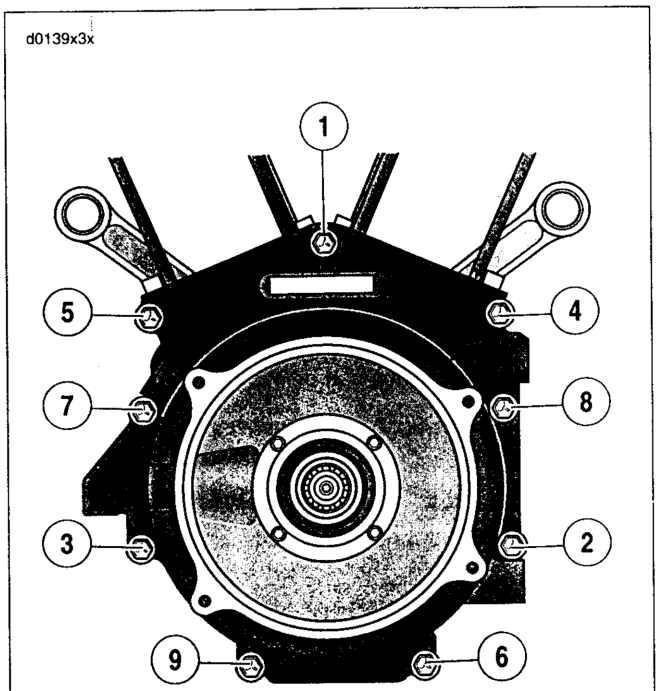
Never move or lift the crankcase by grasping the cylinder studs. The crankcase is too heavy to be carried in this manner and may be dropped. Dropping the crankcase will result in parts damage and could result in death or serious injury.

4. Using pry points, loosen case halves. Lift right crankcase half off end of crankshaft.

⚠WARNING

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, resulting in parts damage and could result in death or serious injury.

5. See Figure 3-60. Remove O-rings (1) from two dowel pins (2) in split line face of right case half. Discard O-rings.
6. See 3.30 CRANKCASE for inspection and repair information.



Remove all nine crankcase bolts in the sequence shown.

Figure 3-59. Crankcase Bolt Sequence

1. O-ring
2. Dowel pin

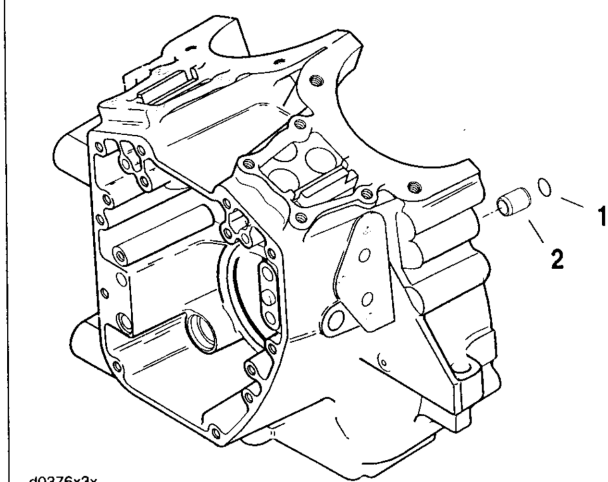


Figure 3-60. Right Crankcase Forward Dowel Pin (Rear Dowel Pin Not Shown)

GENERAL

This section provides a sequential process for engine reassembly after a complete 3.18 BOTTOM END OVERHAUL: DISASSEMBLY. If you reached this section after an inspection or repair procedure, start where necessary and continue to the end of the section.

- Crankcase installation-see below.
- Cover and cam support plate installation-see page 3-49.

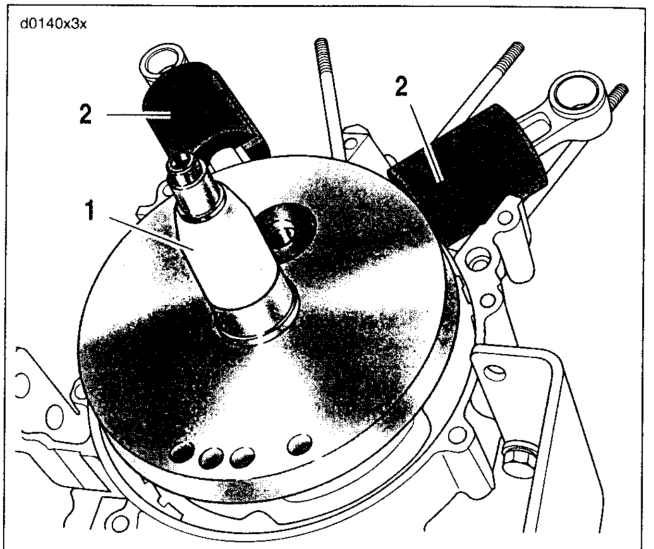
CRANKCASE

PART NO.	SPECIALTY TOOL
HD-39361-A	Sprocket shaft oil seal installer
HD-42326-A	Crankshaft guide
HD-97225-55B	Sprocket shaft bearing tool

CAUTION

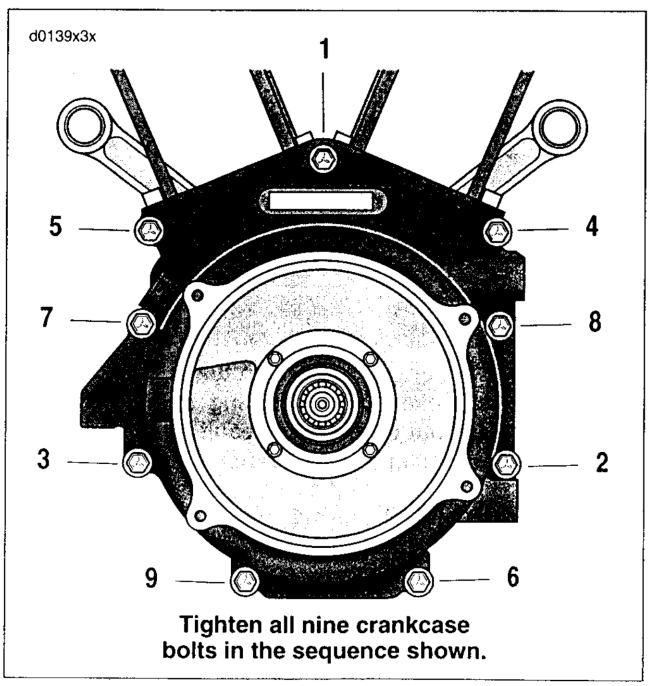
O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.

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 tool (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 3-61. 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 tool.
9. See Figure 3-62. 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).



1. **Crankshaft guide**
2. **Water pipe insulation**

Figure 3-61. Crankshaft Guide (Part No. HD-42326-A)



Tighten all nine crankcase bolts in the sequence shown.

Figure 3-62. Tightening Crankcase Bolts

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.
12. See Figure 3-63. Install **new** oil seal using pilot, Nice bearing, large flat washer and handle from SPROCKET SHAFT BEARING TOOL (Part No. HD-97225-55B).
    a. Verify that seal lip garter spring is in place on both sides of seal.
    b. Thread pilot onto sprocket shaft until contact is made with shoulder.
    c. With the lettering facing outside, slide oil seal over pilot until it contacts bearing bore.
    d. Set SPROCKET SHAFT OIL SEAL INSTALLER (1) (Part No. HD-39361-A) over pilot until it contacts oil seal.
    e. Slide Nice bearing and large flat washer over pilot until contact is made with seal installer.
    f. Thread handle onto pilot shaft.
    g. Rotate handle in a clockwise direction until oil seal installer makes firm contact with crankcase stator mount.
    h. Remove handle, flat washer, Nice bearing, seal installer and pilot from sprocket shaft.
13. Slide sprocket shaft spacer over end of sprocket shaft. Push spacer into oil seal until seated against outer bearing cone.

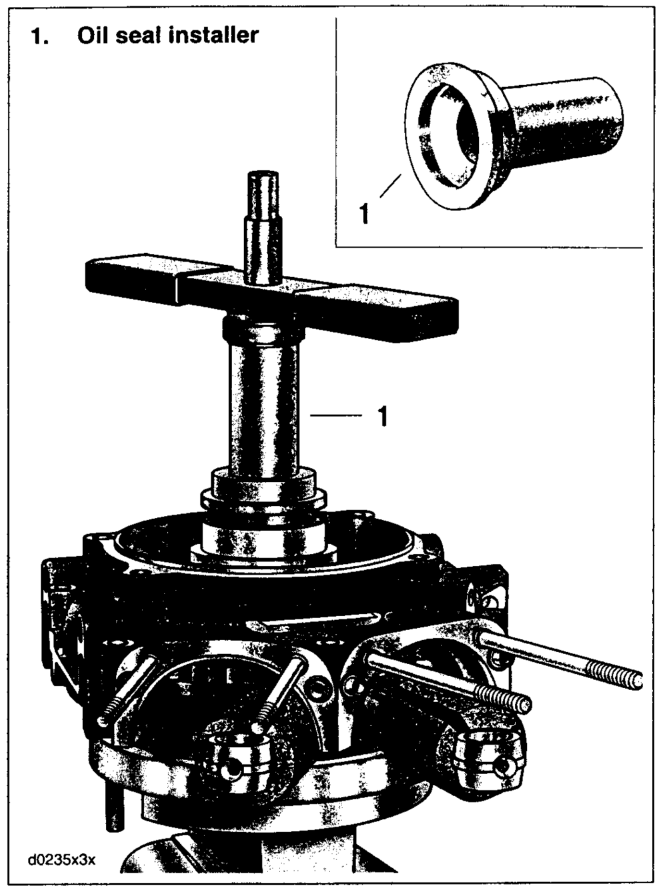


Figure 3-63. Sprocket Shaft Oil Seal Installer (Part No. HD-39361-A)

CAUTION

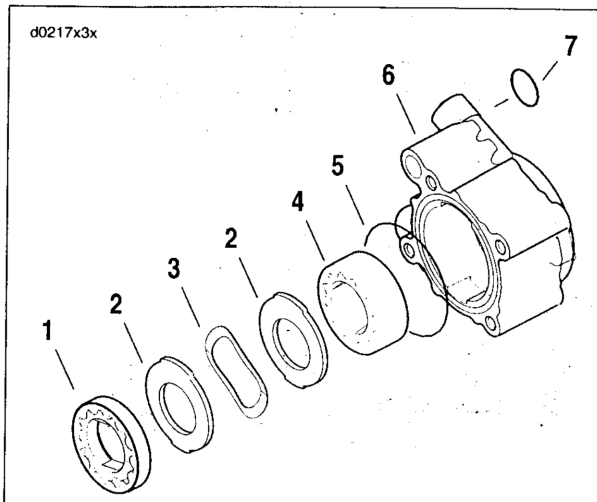
O-rings that are missing, distorted, pinched or otherwise damaged will result in either oil leakage or low oil pressure. Use of the wrong O-ring will have the same results. Since many O-rings are similar in size and appearance, always use new O-rings keeping them packaged until use to avoid confusion.

14. See Figure 3-64. 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 (7). Install **new** O-ring on scavenge port stub of oil pump housing.
    b. Slide oil pump housing (6) onto crankshaft fitting O-ring on scavenge port stub into crankcase bore at back of cam compartment. Firmly push on scavenge port stub with thumb to be sure that it is snug in bore. Inspect O-ring on stub to verify that it is not pinched or distorted.
    c. Separate the gerotor gears into two sets, one wide (4) (scavenge) and the other narrow (1) (feed).
    d. Fit the smaller of the wide gerotor gears into the larger. Slide the wide gerotor set (4) down the crankshaft until it bottoms in the oil pump housing.
    e. Slide inside separator plate (2) down the crankshaft until it contacts the wide gerotor set (4). Install wave washer (3) and outside separator plate (2).
    f. Fit the smaller of the narrow gerotor gears into the larger. Slide the narrow gerotor set (1) down the crankshaft until it contacts the outside separator plate (2).

CAUTION

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.

    g. See Figure 3-65. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring (3) for outboard side of oil pump housing. Install **new** O-ring in groove on oil pump housing.
    h. Apply a very thin film of clean H-D 20W50 engine oil to **new** O-ring (4) 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. **Outer body O-ring**
6. **Oil pump housing**
7. **Scavenge port O-ring**

Figure 3-64. Assembling Oil Pump

1. **Oil feed hole O-ring**
2. **Rear ring dowel**
3. **O-ring on oil pump housing**
4. **O-ring on crankcase post**

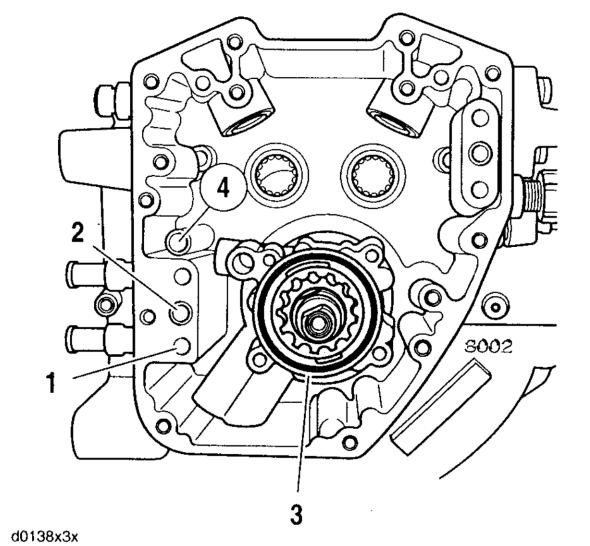


Figure 3-65. Oil Feed Hole

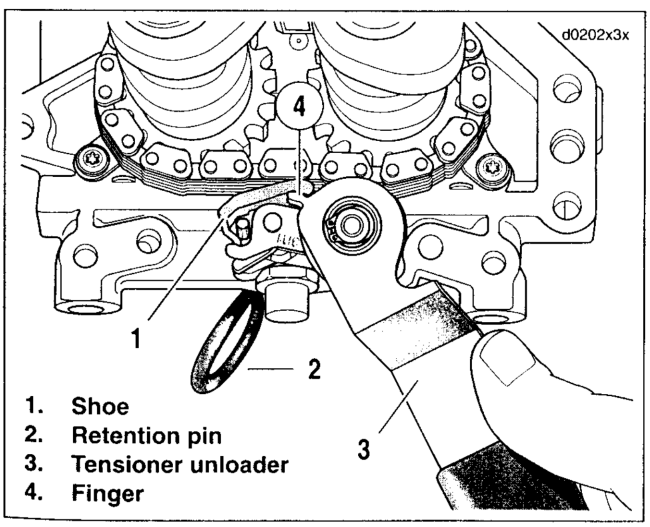
COVER AND CAM SUPPORT PLATE

PART NO.	SPECIALTY TOOL
HD-42313	Cam chain tensioner unloader
HD-42314	Crankshaft/camshaft sprocket locking tool
HD-33443	Alignment tool

CAUTION

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 3-65. 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. See Figure 3-66. Eliminate secondary cam chain tension. For best results, place cam support plate in a vise using brass jaw inserts to prevent casting damage.
   a. Place cup of CAM CHAIN TENSIONER UNLOADER (3) (Part No. HD-42313) over spring coil of secondary cam chain tensioner. Position finger (4) on tool between tensioner and shoe (1).
   b. Rotate tool in a counterclockwise direction. Insert retention pin (2) through hole in boss on primary cam chain side of cam support plate. Pin engages hooks on tensioner to hold it in the retracted position.



1. Shoe
2. Retention pin
3. Tensioner unloader
4. Finger

Figure 3-66. Securing Cam Chain Tensioner

3. Lubricate cam needle bearings with clean H-D 20W50 engine oil.
4. See Figure 3-67. Using a straightedge, verify that the pin stamped timing lines on the ends of the front and rear camshafts are in alignment. If necessary, rotate camshafts in order to make this observation.

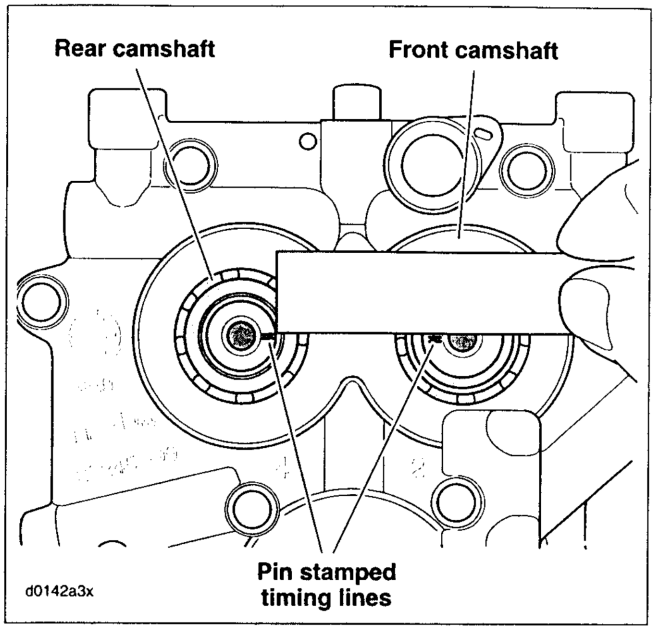
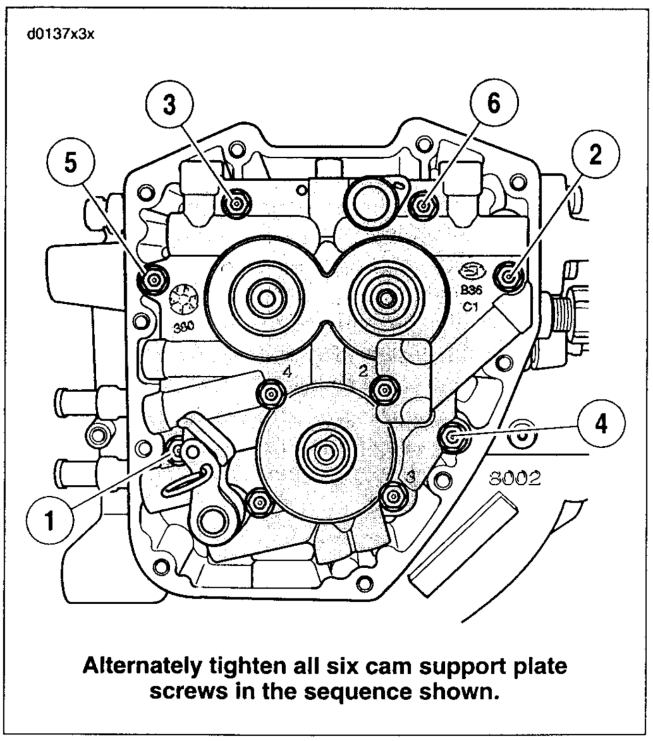


Figure 3-67. Checking Camshaft Alignment



Alternately tighten all six cam support plate screws in the sequence shown.

Figure 3-68. Cam Support Plate Torque Sequence

5. 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.
6. See Figure 3-68. 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.

7. See Figure 3-69. Install oil pump.
   a. Loosely insert alignment tools (see Figure 3-70.) into holes #1 and #2.
   b. Start two screws (1/4 x 1.0 in.) into holes 3 and 4.
   c. While rotating the engine, enabling the pump to find its natural center, alternately tighten the alignment tools until snug.
   d. Tighten alignment tools to 40-45 **in-lbs** (4.5-5.1 Nm) in sequence shown.
   e. Alternately tighten screws in holes #3 and #4 to 40-45 **in-lbs** (4.5-5.1 Nm).
   f. Remove alignment tool in hole #1 and replace with screw (1/4 x 1.0 in.). Tighten screw to 40-45 **in-lbs** (4.5-5.1 Nm). Repeat this step for alignment tool in hole #2.
   g. 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.

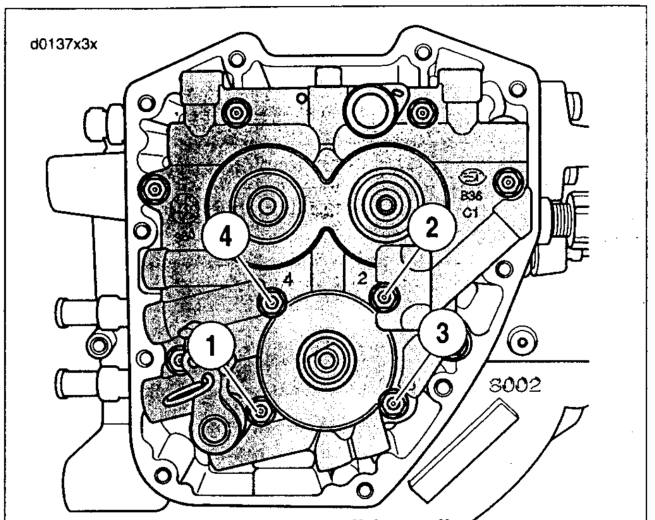
NOTE

For methods of engine rotation, see ROCKER ARM SUPPORT PLATE under 3.16 TOP END OVERHAUL: DISASSEMBLY.

8. Pull retention pin from hole in cam support plate to release secondary cam chain tensioner.
9. Squeeze tabs and install chain guide between blocks cast into cam support plate.
10. With the lettering facing inboard, install rear cam sprocket spacer onto the rear camshaft.
11. 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).



Alternately tighten all four oil pump screws in the sequence shown.

Figure 3-69. Oil Pump Torque Sequence

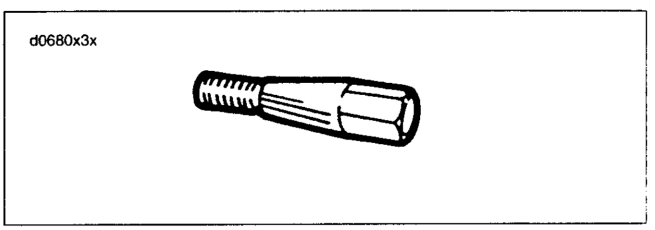


Figure 3-70. Alignment Tool HD-33443

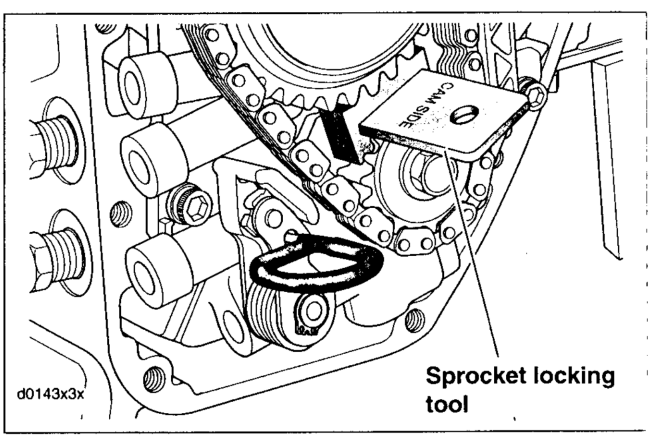


Figure 3-71. Locking Crank and Rear Cam Sprockets

c. See Figure 3-72. To prevent rotation, position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-42314) 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. Push on rear camshaft to remove end play.

e. Place a straightedge across the crank and primary cam sprocket faces. Try to insert a 0.010 in. feeler gauge between the straightedge and each sprocket face. If the feeler gauge does not fit at either location, then proceed to step 11(f).

   See Table 3-3. On the other hand, if the crank sprocket is "proud" (that is, rises above the face of the primary cam sprocket) more than 0.010 in., remove the flange bolt and primary cam sprocket, and noting the part number stamped on the existing spacer, replace it with the next larger size.

   Replace the spacer with the next smaller size only if the primary cam sprocket is "proud" (rises above the face of the crank sprocket) more than 0.010 in. Return to step 15 to repeat the check with the new spacer installed.

f. Remove both crank and primary cam sprockets. Discard smaller diameter flat washer obtained from bulk inventory.

NOTE

Height differences between rear cam sprocket and crank sprocket can be addressed by changing the spacer behind the rear cam sprocket. See spacer sizes in Table 3-3.

- *If the crank sprocket rises above the face of the rear cam sprocket more than 0.005 in. (0.127 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 0.005 in. (0.127 mm), replace the spacer with the next smaller size only.*

- *Repeat height inspection with the **new** spacer installed.*

Table 3-3. Rear Cam Sprocket Spacers

PART NO.	IN.	MM
25722-00	0.287	7.29
25723-00	0.297	7.54
25721-00	0.307	7.80
25719-00	0.317	8.05
25717-00	0.327	8.31

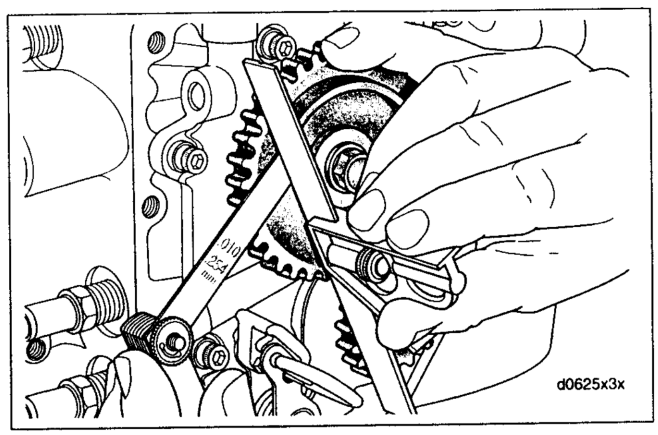


Figure 3-72. Check Alignment of Crank and Rear Cam Sprocket Faces

12. See Figure 3-73. 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.

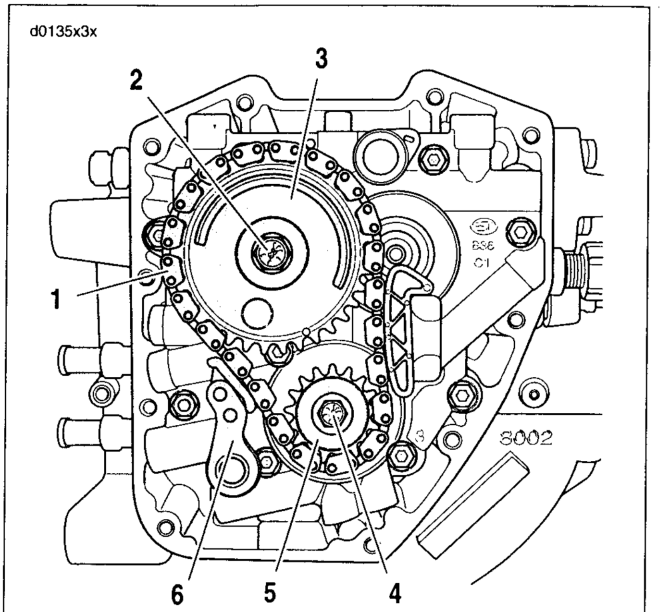
NOTE

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.
13. See Figure 3-74. 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. Lay a straightedge across the centerline of the crank and rear cam sprocket flange bolt holes to verify that the punch marks are in alignment.

NOTE

If the punch marks are not in alignment, then the sprockets must be removed and reinstalled. Misalignment by one tooth will cause engine to run erratically.



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 3-73. Cam Support Plate Assembly

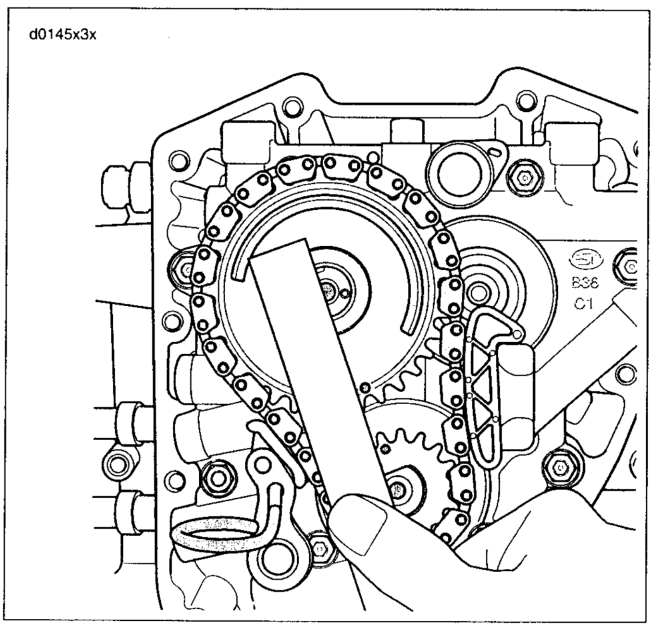


Figure 3-74. Verify Alignment of Crank and Rear Cam Sprocket Punch Marks

14. See Figure 3-75. 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.
15. 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

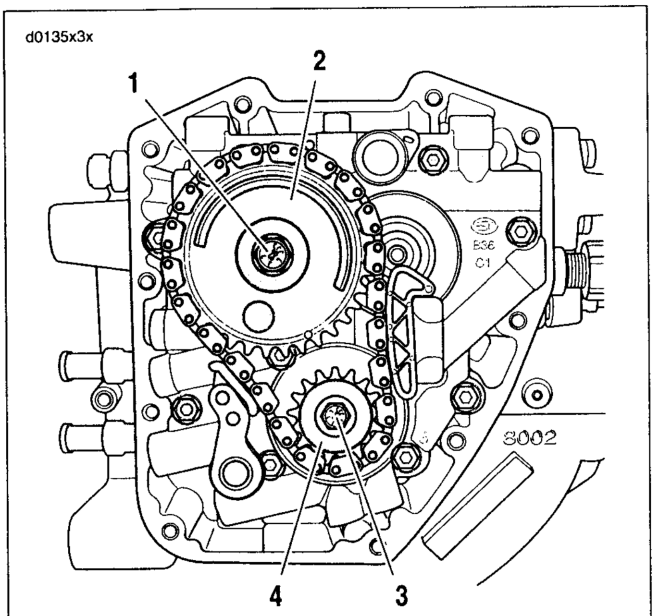
Both crank and rear cam sprocket flange bolts are specially hardened while the flat washers are of a special diameter. Therefore, use only genuine Harley-Davidson parts when replacement is necessary. If ***new*** *flange bolts are not available, thoroughly clean threads and apply a* ***small*** *amount LOCTITE THREADLOCKER 262 (red) before installation. The crank and rear cam sprocket flange bolts and flat washers are* ***not*** *interchangeable.*

16. Position the CRANKSHAFT/CAMSHAFT SPROCKET LOCKING TOOL (Part No. HD-42314) 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.

⚠CAUTION

Ease the primary cam chain tensioner into the unloaded position using the proper tool. Do not pull the retention pin to unload the tensioner or damage to the pin may occur. Furthermore, if tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.

17. Hold the retracted primary cam chain tensioner with the CAM CHAIN TENSIONER UNLOADER (Part No. HD-42313), pull retention pin from hole in cam support plate and ease the assembly into the unloaded position.
18. Apply clean H-D 20W50 engine oil to crank and rear cam sprockets.
19. See Figure 3-76. Align holes in **new** cam cover gasket with those in the crankcase flange.



1. **Rear cam sprocket bolt (large) and flat washer**
2. **Rear cam sprocket**
3. **Crank sprocket bolt (small) and flat washer**
4. **Crank sprocket**

Figure 3-75. Flange Bolts

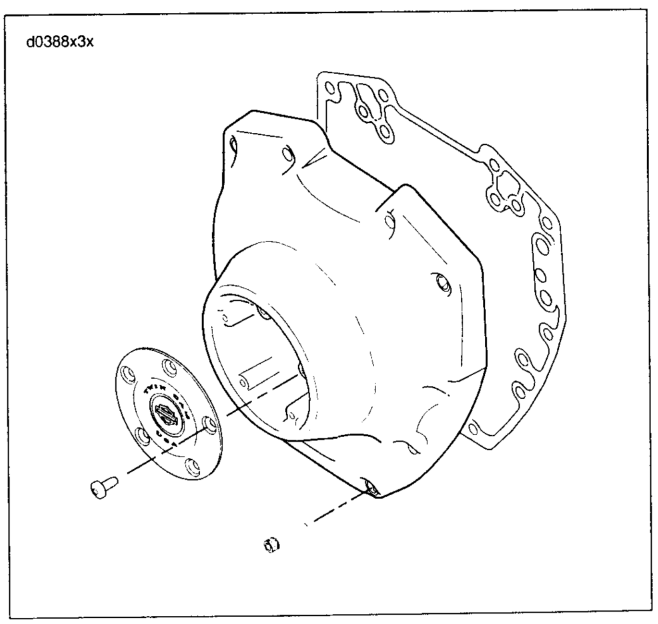
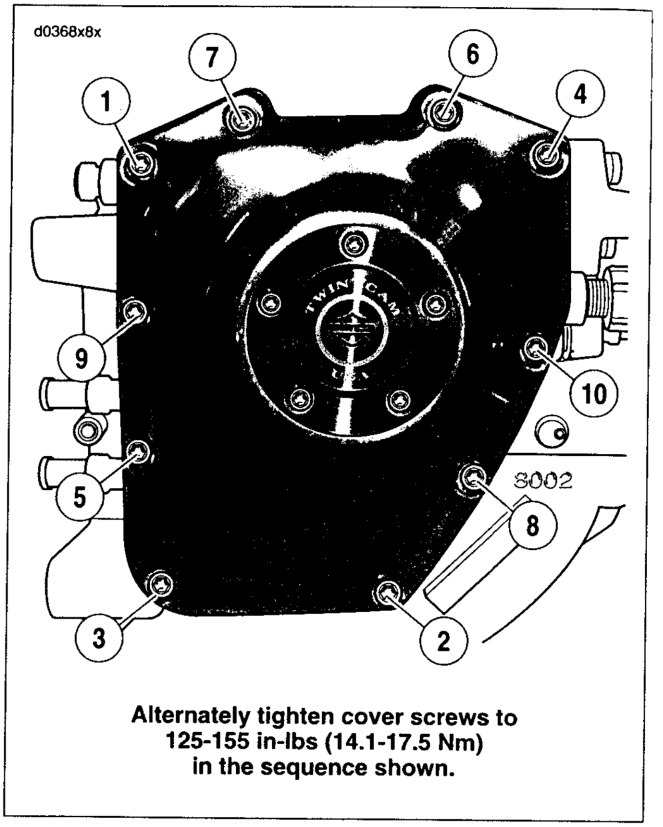


Figure 3-76. Cam Cover Gasket

CAUTION

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.

20. See Figure 3-77. 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.
21. Complete motorcycle assembly.
    a. If engine was completely overhauled, see 3.17 TOP END OVERHAUL: ASSEMBLY. Perform all steps.
    b. If only cam compartment components were serviced, install pushrod covers, pushrods, rocker arm support plate and breather assembly. See appropriate topics under 3.17 TOP END OVERHAUL: ASSEMBLY.



Alternately tighten cover screws to 125-155 in-lbs (14.1-17.5 Nm) in the sequence shown.

Figure 3-77. Cam Cover Installation

REMOVAL OVERVIEW

See beginning of 3.16 TOP END OVERHAUL: DISASSEMBLY to remove breather assembly.

DISASSEMBLY

1. See Figure 3-78. Remove two screws (1) from breather assembly and remove breather assembly (2) from rocker arm support plate (4).
2. Remove and discard filter element (3) from bore on underside of breather assembly.

INSPECTION

Wipe breather assembly with a clean, dry shop cloth. Examine breather assembly. If debris is present, replace breather assembly.

CAUTION

Do NOT attempt to wash breather assembly in cleaning solutions or solvents. Do NOT attempt to blow debris from breather assembly with compressed air. Breather assembly can be damaged and may cause improper engine operation if re-used.

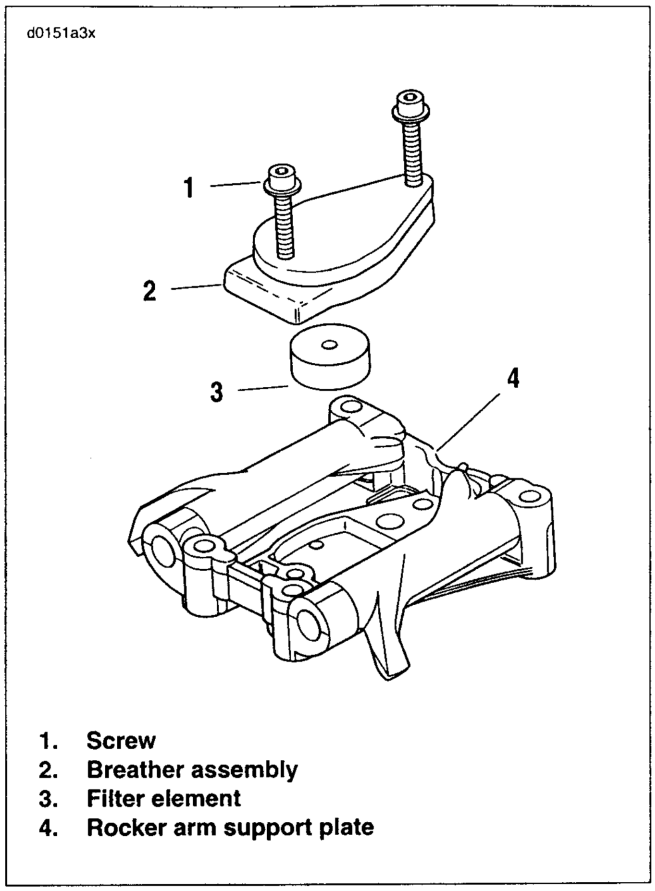
ASSEMBLY

1. Press **new** filter element (3) into bore on underside of breather assembly (2). Hole in filter element accommodates umbrella valve stem.

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install breather assembly.
2. Continue with vehicle assembly as directed.



1. **Screw**
2. **Breather assembly**
3. **Filter element**
4. **Rocker arm support plate**

Figure 3-78. Breather Assembly

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.

DISASSEMBLY

1. See Figure 3-79. Remove four bolts with flat washers (1) from the rocker arm support plate (5). The bolts on the push rod side (right) are notched to lock the rocker arm shafts 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.

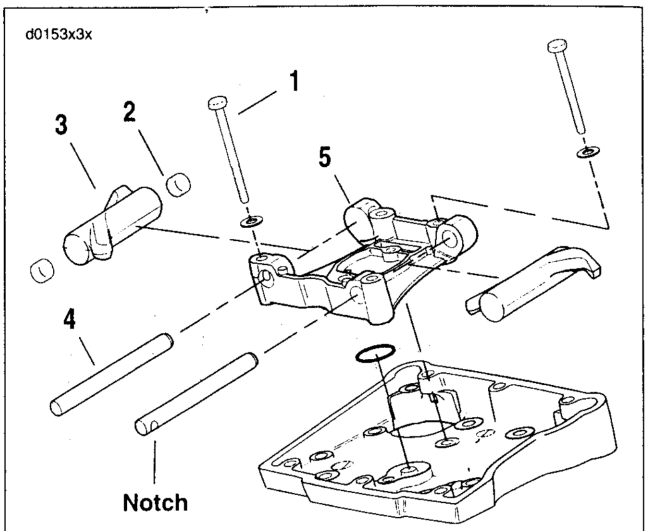
CLEANING AND INSPECTION

PART NO.	SPECIALTY TOOL
HD-94804-57	Rocker arm bushing reamer

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

1. Clean all parts in a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.
2. See Figure 3-79. 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.
5. Check support plate to rocker shaft fit.
   a. See Figure 3-80. Measure the inside diameter of the rocker arm support plate bore.
   b. See Figure 3-81. Measure the outside diameter of the rocker arm shaft where it fits in the bore.
   c. 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).



1. **Bolt with flat washer**
2. **Rocker arm bushings**
3. **Rocker arm**
4. **Rocker arm shaft**
5. **Rocker arm support plate**

Figure 3-79. Rocker Arm Assembly

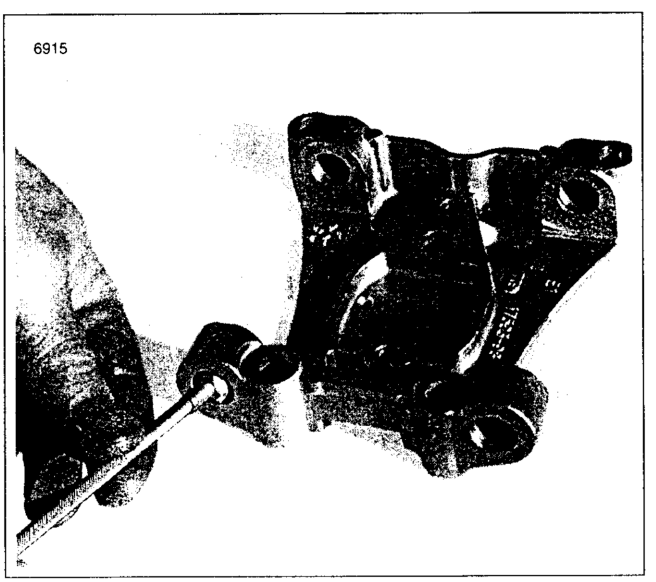


Figure 3-80. Checking Support Plate Bore

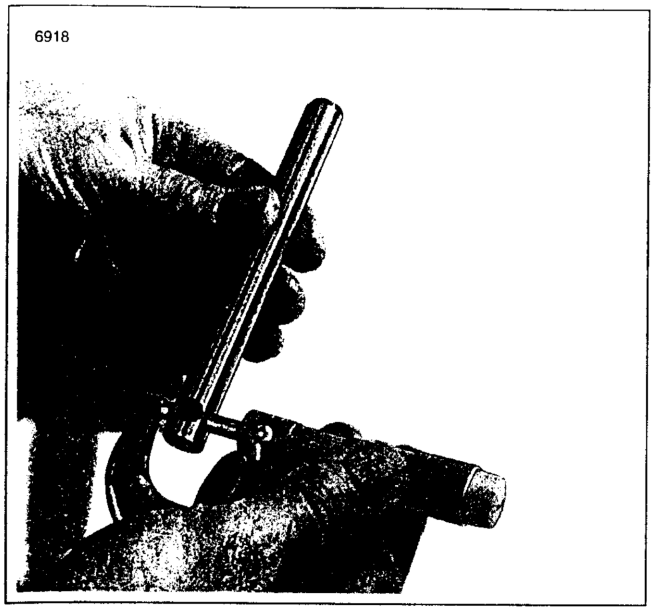


Figure 3-81. Checking Shaft to Support Plate Fit



Figure 3-82. Checking Bushings

6. Check rocker arm shaft to bushing fit.
   a. See Figure 3-82. Measure the inside diameter of the rocker arm bushing.
   b. See Figure 3-83. Measure the outside diameter of the rocker arm shaft where it rides in the bushing.
   c. 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).
7. To replace rocker arm bushings, proceed as follows:
   a. See Figure 3-84. Obtain a 9/16"-18 (14.29 mm) tap. Turn 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.
   b. See Figure 3-85. 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.
   c. See Figure 3-86. 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 rocker arm using the far side bushing as a pilot. Rotate reamer until the closest bushing is reamed, and then continuing in the same direction, ream the far side 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.

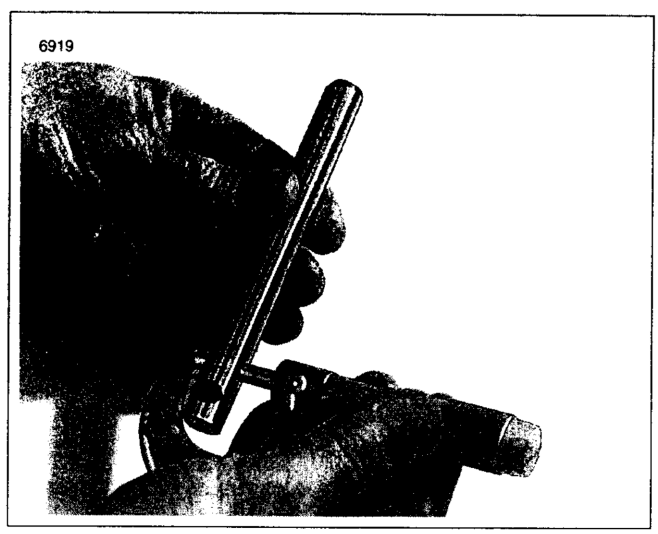


Figure 3-83. Checking Shaft to Bushing Fit

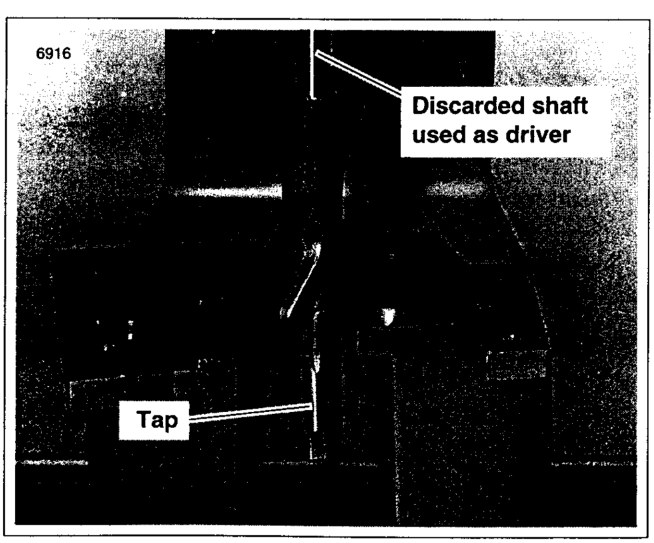


Figure 3-84. Removing Bushings

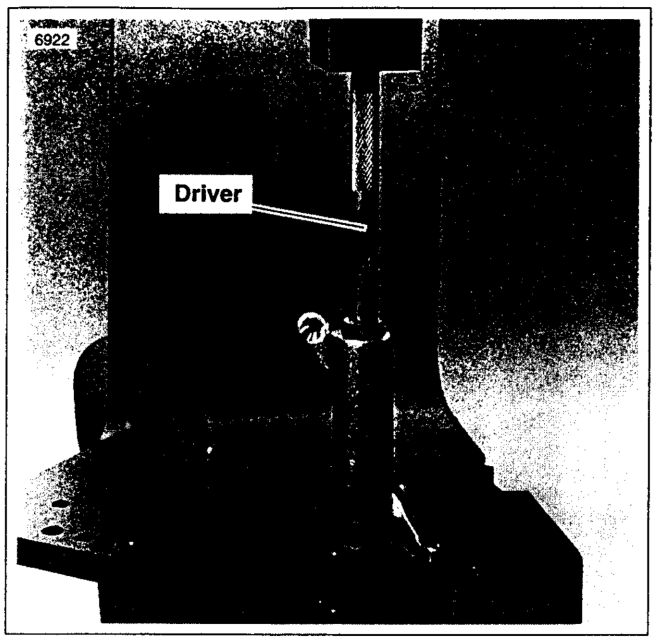


Figure 3-85. Install Bushings

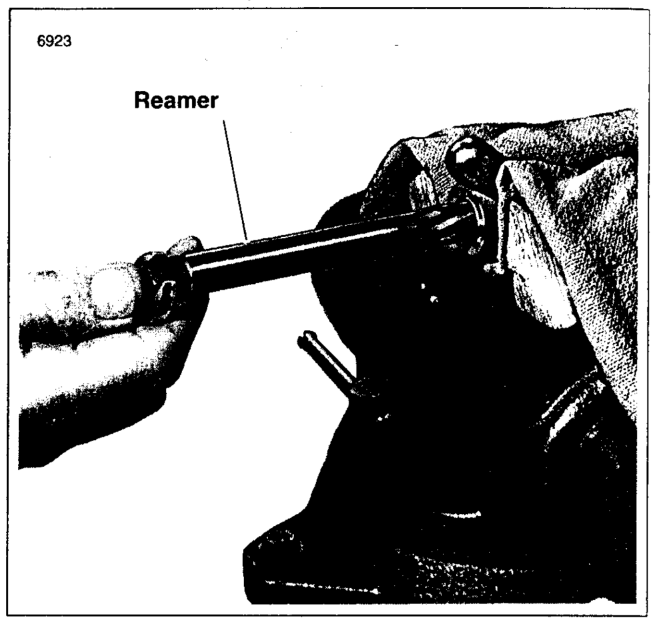


Figure 3-86. Ream Bushings

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 3-87. 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 3-87. Check End Play

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install rocker arm support plate.
2. Install breather assembly.
3. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods, lifters and covers.

DISASSEMBLY

See Figure 3-88. 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.

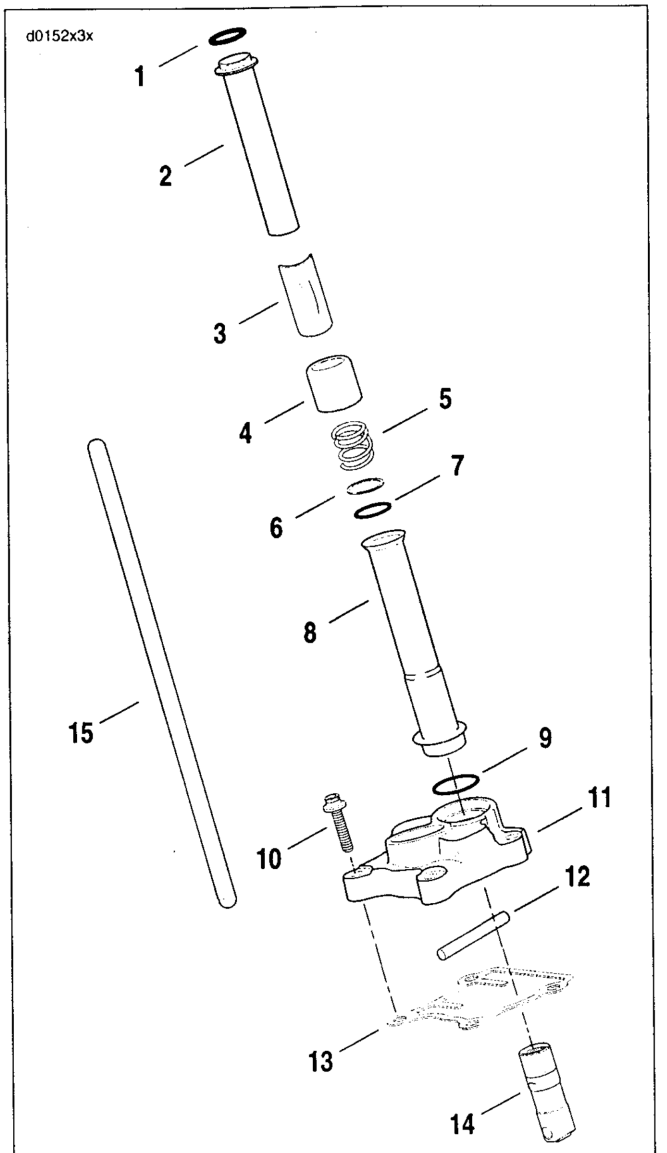
CLEANING AND INSPECTION

1. See Figure 3-88. 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

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

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 3-88. 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 a **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 up or down movement on rollers.
   c. Replace lifters if clearance exceeds SERVICE WEAR LIMIT of 0.026 in. (0.660 mm).
4. Soak lifters in clean engine oil. Keep covered until assembly.

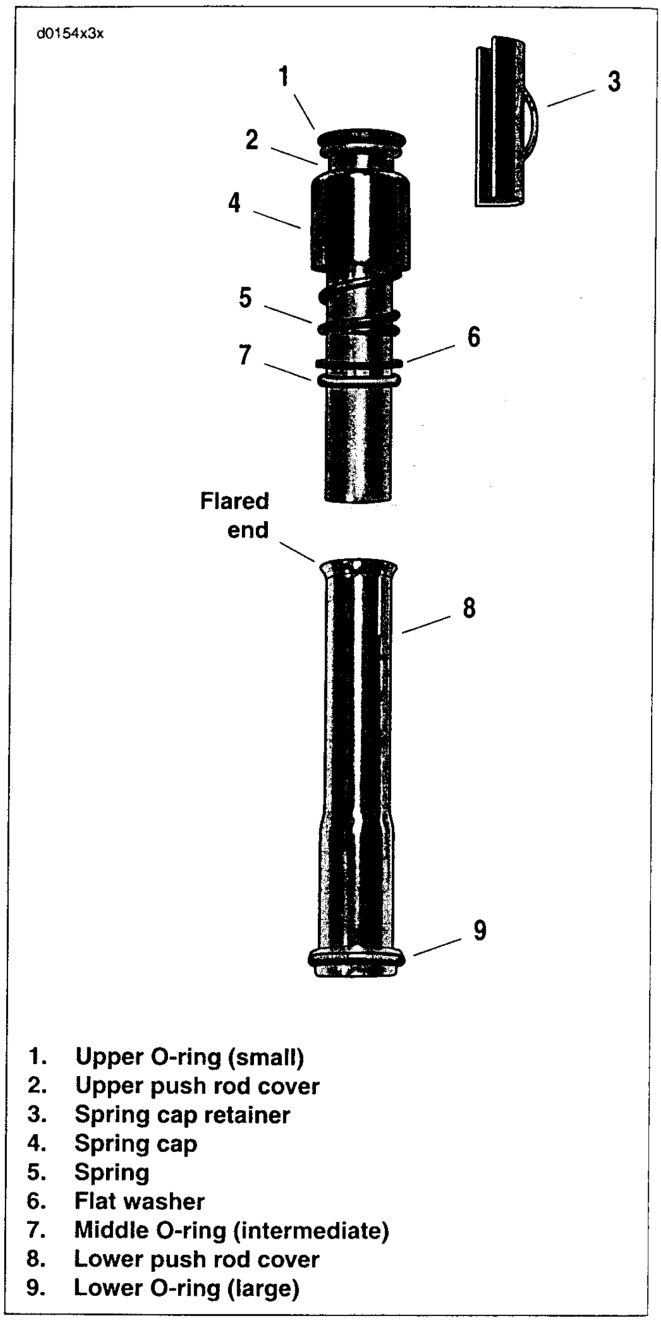
ASSEMBLY

With the exception of the lifter covers, all parts will be assembled during the installation procedure. Assemble the pushrod covers as follows:

CAUTION

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 3-89. Obtain three **new** o-rings (1, 7 and 9). Apply a very thin film of clean H-D 20W50 engine oil to O-rings before installation.
2. Install **new** small O-ring (1) on seat at the top of the upper push rod cover (2).
3. Slide the spring cap (4), spring (5), flat washer (6) and **new** intermediate size O-ring (7) onto the body of the upper push rod cover. Move parts up body until spring cap (4) contacts upper O-ring seat.
4. Fit the straight end of the upper push rod cover into the flared end of the lower push rod cover (8).
5. Install **new** large O-ring (9) on seat at bottom of lower push rod cover.



1. **Upper O-ring (small)**
2. **Upper push rod cover**
3. **Spring cap retainer**
4. **Spring cap**
5. **Spring**
6. **Flat washer**
7. **Middle O-ring (intermediate)**
8. **Lower push rod cover**
9. **Lower O-ring (large)**

Figure 3-89. Assembled Push Rod Cover

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install push rods, lifters and lifter covers.
2. Install rocker arm support plate.
3. Install breather assembly.
4. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.

DISASSEMBLY

PART NO.	SPECIALTY TOOL
HD-34736-B	Valve spring compressor
HD-39786-A	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 3-90. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (1) (Part No. HD-39786-A) 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.
3. See Figure 3-91. Release valve spring compression.
   a. Place VALVE SPRING COMPRESSOR (2) (Part No. HD-34736-B) 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 3-92. 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 (12) groove.
   d. Rotate forcing screw to release the valve spring compression.
4. Remove the spring retainer (2) and inner (3) and outer (4) valve springs.
5. Slide the valve (12) from the valve guide (7).

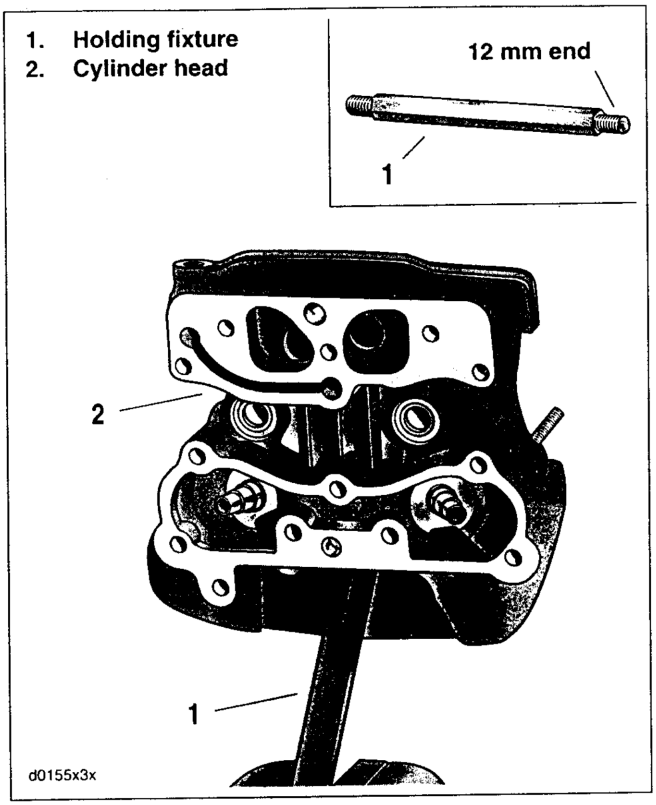


Figure 3-90. Cylinder Head Holding Fixture (Part No. HD-39786-A)

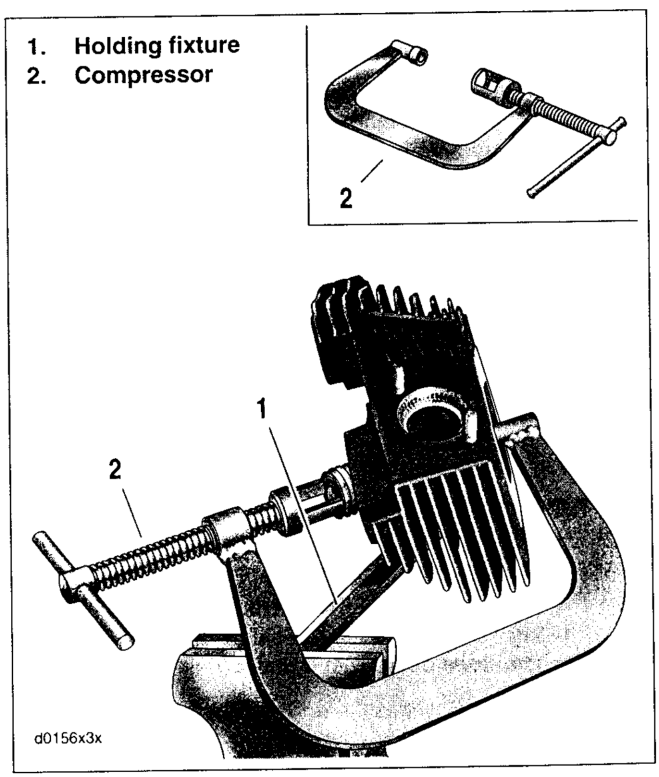


Figure 3-91. Valve Spring Compressor (Part No. HD-34736-B)

6. Using pliers, twist and remove the valve stem seal (5) from the top of the valve guide. Discard valve stem seal.
7. Remove the spring seat (6) from the cylinder head.
8. Mark the bottom of the valve "F(rónt)" or "R(ear)" for identification. Also, separate and tag tapered keepers, valve springs, spring retainers and spring seats so that they are installed on the same valve at time of assembly.
9. Repeat steps 3-8 to remove the other valve components.
10. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.

CLEANING

1. See Figure 3-92. Remove old gasket material from cylinder head (10). Gasket material left on sealing surfaces will cause leaks.

CAUTION

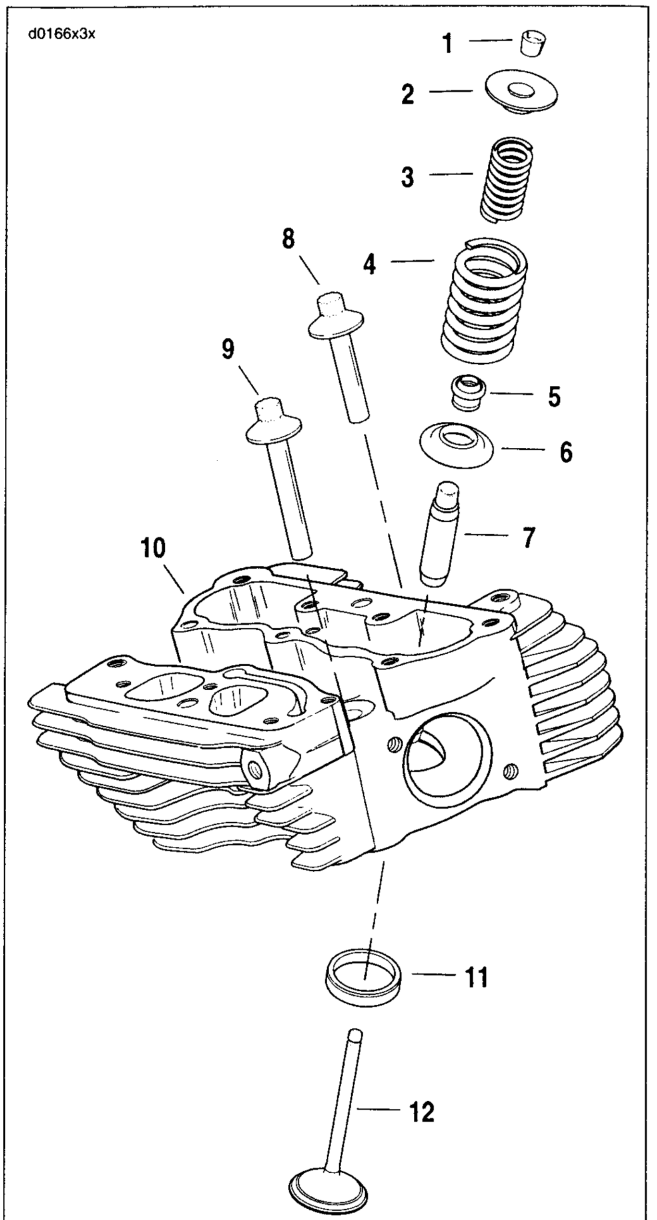
- **Do not use glass or sand to bead blast surfaces exposed to the engine oil. Bead blasting materials become lodged in the pores of the casting where they cannot be removed through ordinary cleaning methods. Only after the engine is put into use will heat expansion cause this material to be released, and the resulting oil contamination will accelerate wear and lead to engine failure. If bead blasting must be employed, use walnut shells or other soft non-damaging abrasive that can be digested in the engine oil.**
- **Be aware that bead blasting materials may also enter threaded holes adversely affecting fastener engagement and torque indication. Carefully cover all threaded holes if bead blasting is employed.**

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, inner and outer valve springs and spring seats in a non-volatile cleaning solution or solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

5. Blow parts dry with low pressure compressed air.



1. **Tapered keepers**
2. **Spring retainer**
3. **Inner spring**
4. **Outer spring**
5. **Valve stem seal**
6. **Spring seat**
7. **Valve guide**
8. **Cylinder head bolt, short**
9. **Cylinder head bolt, long**
10. **Cylinder head**
11. **Valve seat**
12. **Valve**

Figure 3-92. Cylinder Head Assembly

INSPECTION

Cylinder Head

1. Check for scratches and nicks on all gasket sealing surfaces.
2. See Figure 3-93. 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. (0.15 mm) or greater.

NOTE

For best results, use one of the CYLINDER TORQUE PLATES (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

PART NO.	SPECIALTY TOOL
HD-34723-A	Valve hone guide
HD-34751-A	Valve guide cleaning brush

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. HD-34723-A).
   b. Scrub with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751-A) 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. See Table 3-4. 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 3-4. Valve Stem To Guide Clearance Service Wear Limits

VALVE	IN.	MM
Intake	0.0035	0.089
Exhaust	0.0040	0.102

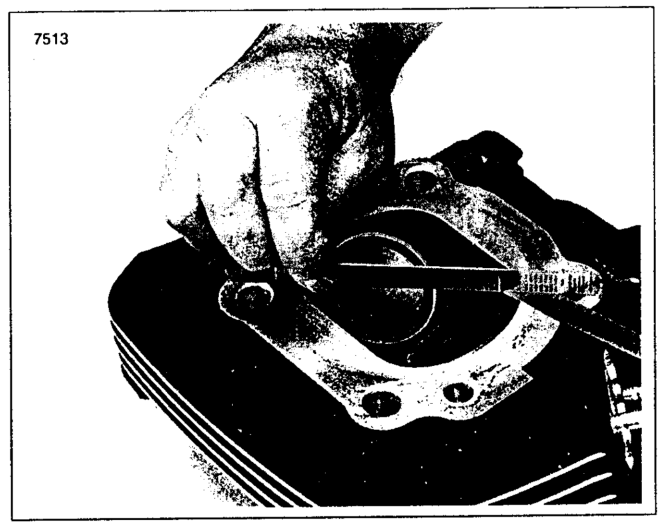


Figure 3-93. Cylinder Head Warpage Check

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

PART NO.	SPECIALTY TOOL
HD-96796-47	Valve spring tester

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 inner and outer 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 Refacing Valve Seats on page 3-67.

VALVE GUIDE REPLACEMENT

Removal

PART NO.	SPECIALTY TOOL
HD-34740-A	Valve guide driver
HD-39782-A	Cylinder head support stand

NOTE

If valve guide replacement is necessary, always install ***new*** *guide before refacing valve seat.*

CAUTION

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 3-94. Prepare cylinder head for valve guide replacement.
   a. Insert sleeve of intake (3) or exhaust (4) seat adapter into tube at top support stand (2).
   b. Position cylinder head so that valve seat is centered on seat adapter.

CAUTION

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 3-95. Center valve guide driver under ram of arbor press. Apply pressure until valve guide drops free of cylinder head. Discard valve guide.

1. **Valve guide driver (Part No. HD-34740-A)**
2. **Cylinder head stand (Part No HD-39782-A)**
3. **Intake seat adapter (Part No. HD-39782-3)**
4. **Exhaust seat adapter (Part No. HD-39782-4)**

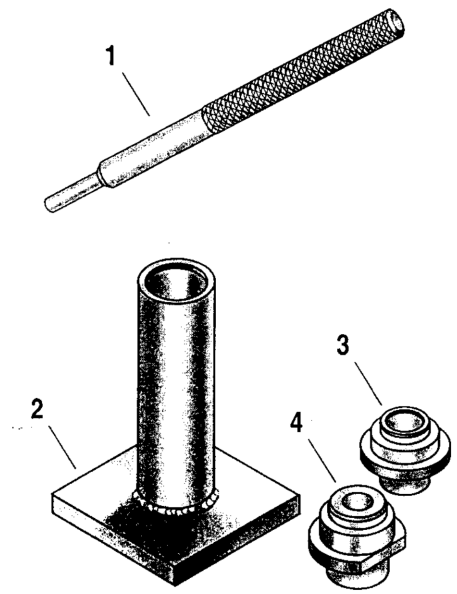
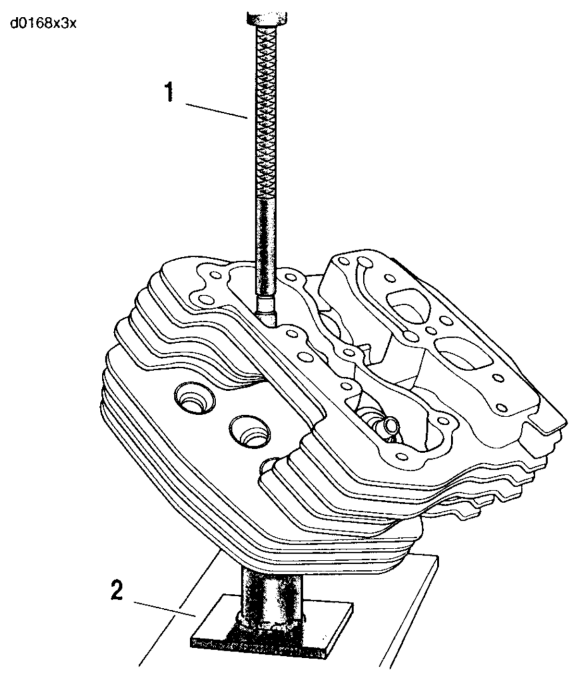


Figure 3-94. Valve Guide Replacement Tools



1. **Valve guide driver (Part No. HD-34740-A)**
2. **Cylinder head stand (Part No HD-39782-A)**

Figure 3-95. Remove Valve Guide

Installation

PART NO.	SPECIALTY TOOL
HD-34723-A	Valve guide hone
HD-34731-A	Valve guide installer sleeve
HD-34740-A	Valve guide driver
HD-34751-A	Valve guide cleaning brush
HD-39782-A	Cylinder head support stand
HD-39786-A	Cylinder head holding fixture
HD-39847	Reamer T-handle
HD-39932	Valve guide reamer

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.

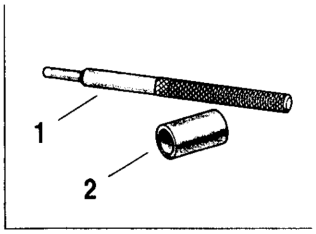
2. Measure cylinder head bore and outside diameter of selected oversize guide to verify correct interference fit.

CAUTION

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 3-94. 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 3-96. Place installer sleeve (2) over valve guide and then insert tapered end of valve guide driver (1) into installer 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.

1. **Valve guide driver**
2. **Valve guide installer sleeve**
3. **Cylinder head stand**



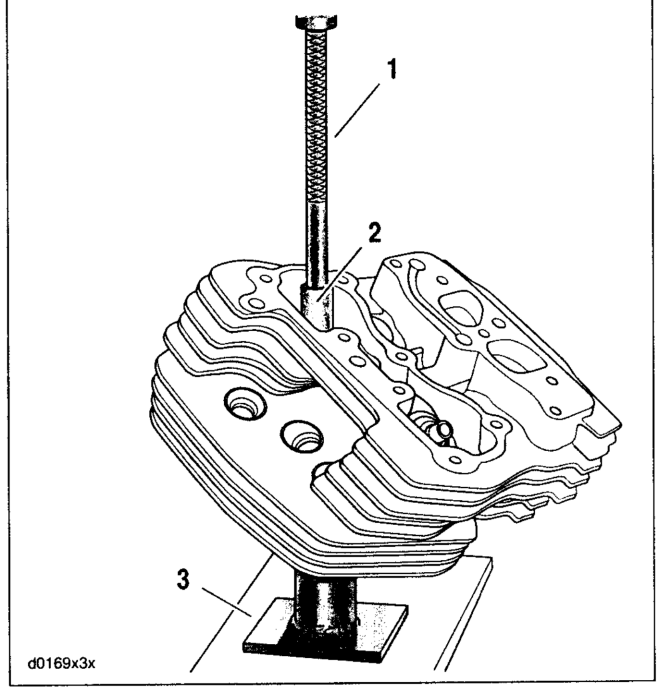


Figure 3-96. Install Valve Guide

CAUTION

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 step 3f and then apply pressure to driver until installer sleeve contacts machined area of cylinder head.

4. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786-A) 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.

5. See Figure 3-97. Obtain the VALVE GUIDE REAMER (Part No. HD-39932), 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.

CAUTION

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.

CAUTION

Never back reamer out of valve guide or bore will be damaged.

   e. Remove T-handle from reamer, and carefully pulling on bit, draw shaft of reamer out combustion chamber side of valve guide.

CAUTION

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

6. Direct compressed air into the valve guide bore to remove any metal shavings or debris.
7. See Figure 3-98. Clean valve guide bore with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751-A).
8. See Figure 3-99. Obtain the VALVE GUIDE HONE (Part No. HD-34723-A) 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°.

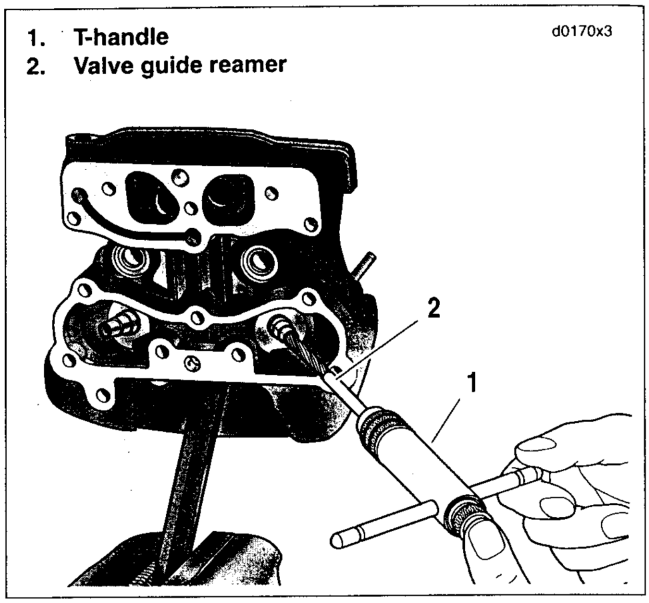


Figure 3-97. Reaming Valve Guide Bore

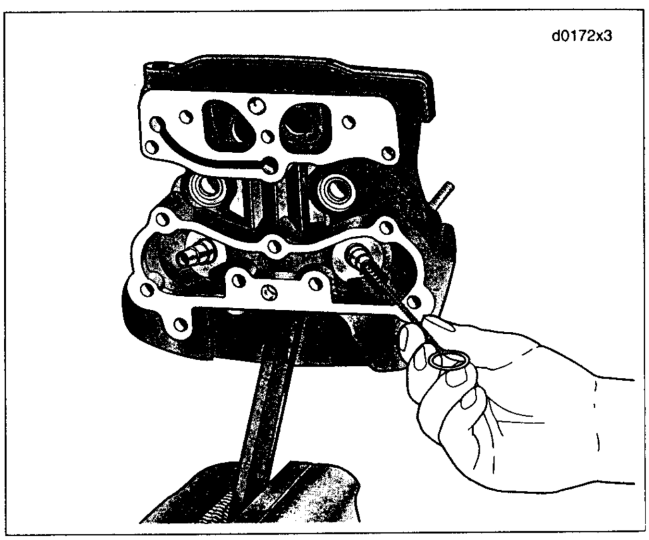


Figure 3-98. Scrubbing Valve Guide Bore

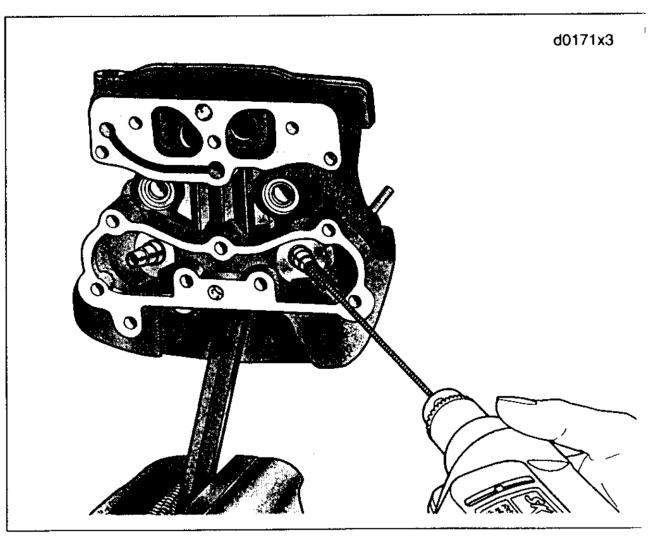


Figure 3-99. Honing Valve Guide Bore

CAUTION

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

9. Direct compressed air into the valve guide bore to remove any debris. Clean with the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751-A).

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. See Table 3-5. 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.
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-A). 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

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

12. Blow parts dry with low pressure compressed air.

Table 3-5. Valve Stem To Guide Clearance

VALVE	IN.	MM
Intake	0.0008-0.0026	0.020-0.066
Exhaust	0.0015-0.0033	0.038-0.084

Refacing Valve Seats

PART NO.	SPECIALTY TOOL
HD-35758-B	Neway valve seat cutter set
HD-39786-A	Cylinder head holding fixture

NOTE

- *Verify correct valve stem to valve guide clearance before refacing. See Table 3-5. 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. Wipe valve seats and valve faces clean. From the bottom of the cylinder head, insert the valve stem into the valve guide. Push on bottom of valve until it contacts the valve seat.
2. See Figure 3-100. 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.

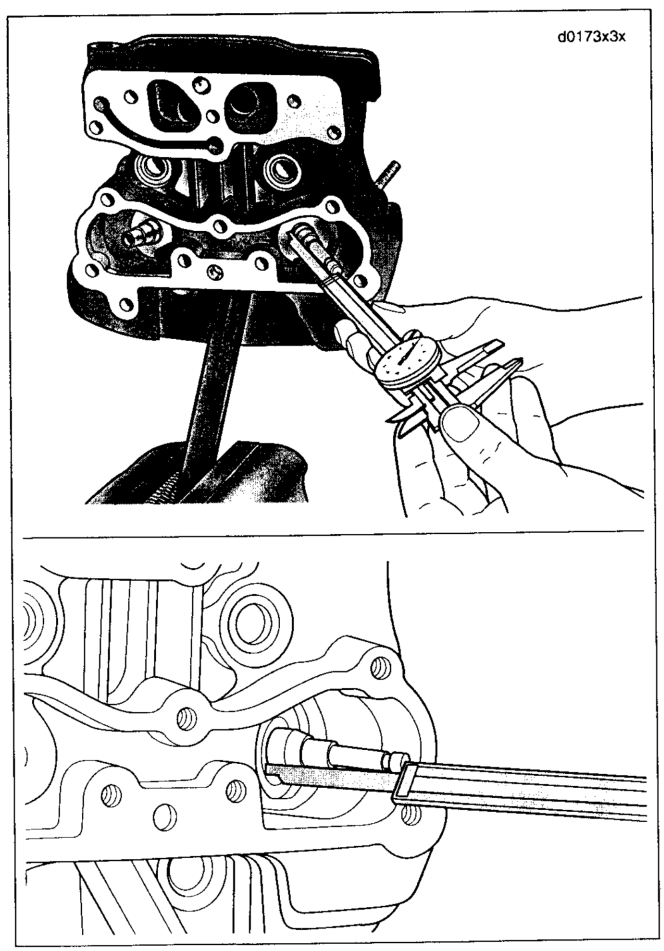


Figure 3-100. Checking Valve Stem Protrusion

b. Seat wear and valve refacing causes the valve stem protrusion to change. If valve stem protrusion exceeds 2.034 in (51.66 mm) but is less than 2.064 in. (52.43 mm), obtain short stem service replacement valve. Service replacement valves are 0.030 in. (0.76 mm) shorter than standard valves.

c. If protrusion exceeds 2.064 in. (52.43 mm), then replace the valve seat or cylinder head as necessary.

CAUTION

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.

3. Secure cylinder head for servicing.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786-A) 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 degree angle or one that offers a comfortable working position.
4. 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.
5. Set your dial caliper to the lesser measurement and lock down for quick reference. This is the location of your valve seat.
6. 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.

NOTE

- *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 Kent-Moore cleaning brush (Part No HD-34751-A).*

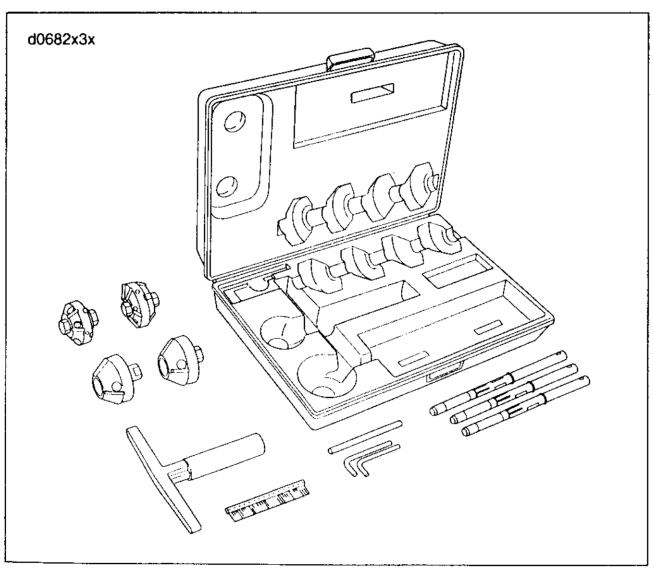


Figure 3-101. Neway Valve Seat Cutter Set

7. See Figure 3-101. Obtain the NEWAY VALVE SEAT CUTTER SET (Part no. HD-35758-B). 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.
8. 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.
9. 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).

NOTE

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.

NOTE

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.

10. 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.

NOTE

- *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.*

11. If the location of the valve seat is not correct, repeat steps 8 and 9.
12. 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.
13. Select the proper 60° cutter and gently slide the cutter down the cutter pilot to the valve seat.
14. Remove just enough material to provide an even valve seat width of 0.040-0.062 in. (1.016-1.575 mm).
15. Remove cutter and cutter pilot.
16. Insert valve to be used in the valve guide and bottom on the valve seat. Positioning the cylinder head port upwards and with slight thumb pressure against the valve, completely fill the port with solvent to verify proper seal between the valve and the valve seat.

NOTE

Hold pressure against the valve for a minimum of 10 seconds. If any leakage occurs, examine the valve seat for irregularities or defects and if necessary repeat the above cutting process.

17. Repeat the process on any valve seat that needs service.
18. Clean valves, cylinder head and valve seats in solvent. Follow up with a thorough wash in hot soapy water.

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

19. Blow parts dry with low pressure compressed air.

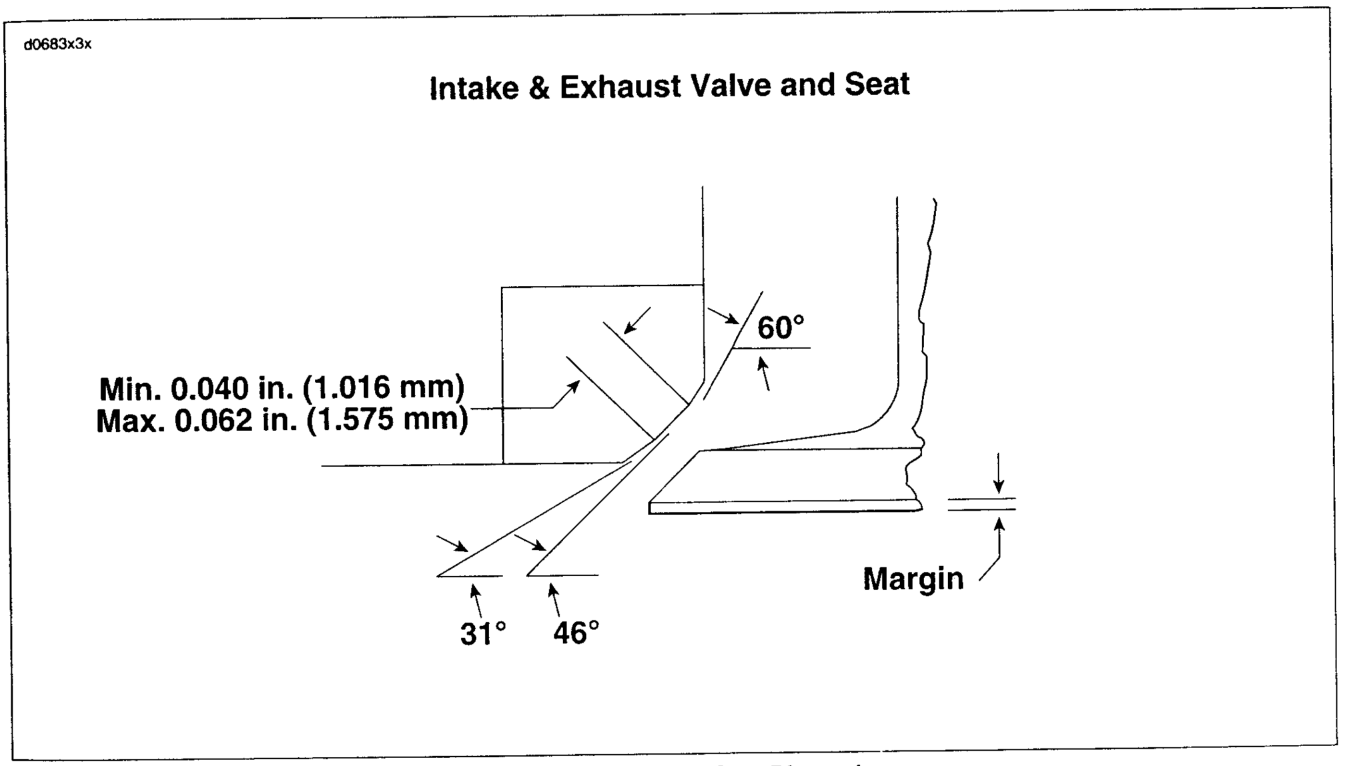


Figure 3-102. Valve and Seat Dimensions

ASSEMBLY

PART NO.	SPECIALTY TOOL
HD-34643-A	Valve stem seal installer
HD-34736-B	Valve spring compressor
HD-34740-A	Valve guide driver tool
HD-34751-A	Valve guide cleaning brush
HD-39786-A	Cylinder head holding fixture

1. Secure cylinder head for service.
   a. Thread 12 mm end of CYLINDER HEAD HOLDING FIXTURE (Part No. HD-39786-A) into cylinder head spark plug hole.
   b. Clamp tool in vise at a 45 degree angle or one that offers a comfortable working position.
2. Slide spring seat over valve guide until it contacts the machined area on the cylinder head casting. Use a little grease to hold the spring seat in position, if necessary.

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).

3. Run the VALVE GUIDE CLEANING BRUSH (Part No. HD-34751-A) through the valve guide bore to verify cleanliness.
4. Using TORCO MPZ or another suitable product, apply a liberal amount of engine assembly lube to valve stem.
5. From the bottom of the cylinder head, insert the valve stem into the valve guide.
6. 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.
7. Remove the valve and apply a second coat of assembly lube to the valve stem. Install the valve in the valve guide.
8. Retract the valve so that the stem is not visible above the top of the valve guide.
9. Using isopropyl alcohol or other suitable degreaser, thoroughly clean external surface of valve guide until completely free of grease and oil.

CAUTION

Do not apply Loctite to inside of valve stem seal or top of valve guide or valve may stick to seal resulting in loss of compression and valve sticking.

10. Obtain tube of LOCTITE RETAINING COMPOUND RC/620 (green). Carefully apply Loctite to valve stem seal seating surface on outside diameter of valve guide. Exercise caution to keep compound out of valve guide bore.

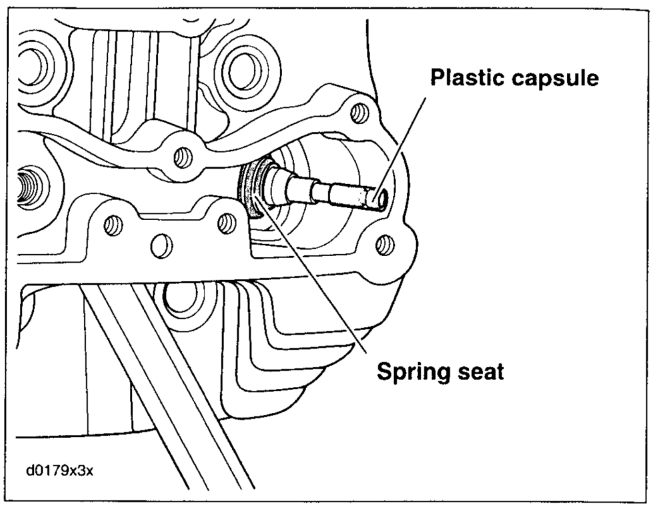


Figure 3-103. Install Plastic Capsule

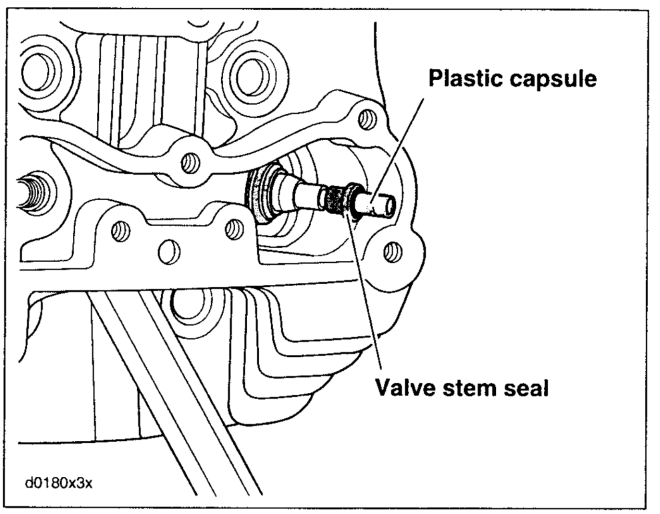


Figure 3-104. Install Valve Stem Seal

CAUTION

Failure to install plastic capsule will cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage will lead to leakage around the valve stem, excessive oil consumption and valve sticking.

11. See Figure 3-103. 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.
12. See Figure 3-104. Apply a very thin film of clean H-D 20W50 engine oil to capsule. Slide **new** valve stem seal over capsule and down valve stem until contact is made with top of valve guide. Remove capsule from valve stem tip.

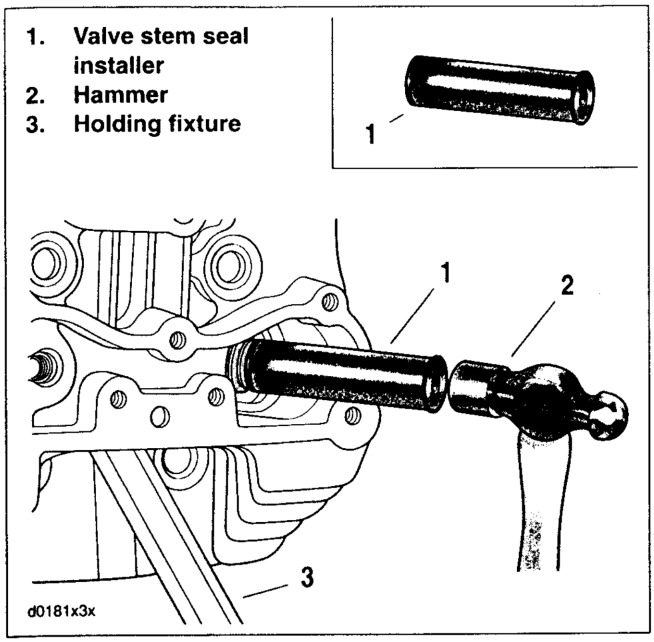


Figure 3-105. Tap Installer (Part No. HD-34643-A)

CAUTION

To avoid damaging the valve stem seal and/or cracking the valve guide, always use the proper valve stem seal installer tool. Use of an ordinary socket will damage the seal or guide, resulting in leakage around the valve stem, excessive oil consumption and valve sticking.

13. See Figure 3-105. Install valve stem seal using VALVE STEM SEAL INSTALLER (Part No HD-34643-A).
    a. Slide the installer tool (1) over the valve stem seal using valve stem as pilot. The tool bore allows insertion of the valve stem, while the counterbore fits over the valve stem seal.

CAUTION

Repeated blows on installer after seal is in place will cause seal distortion resulting in leakage around the valve stem, excessive oil consumption and valve sticking.

    b. Using a small hammer (2), gently tap the end of the tool until it lightly bottoms on the installed spring seat. For best results, brace the cylinder head with chest area to prevent movement during seal installation.

NOTE

See Figure 3-106. If an arbor press is the preferred method of valve stem seal installation, use the VALVE STEM SEAL INSTALLER (Part No. HD-34643-A) with the VALVE GUIDE DRIVER (Part No. HD-34740-A).

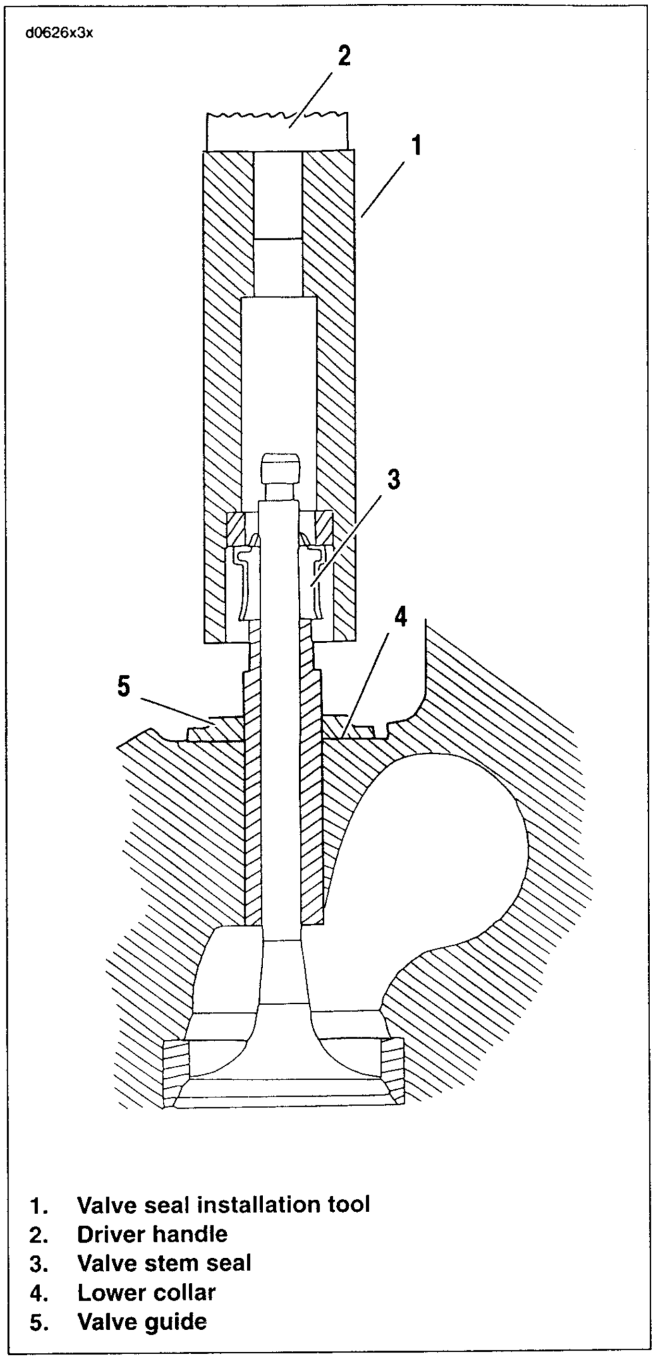


Figure 3-106. Installing Valve Stem Seal Using Arbor Press

CAUTION

Removing the valve after seal installation will cause the valve stem seal to catch the edge of the valve stem keeper groove. The resulting damage will lead to leakage around the valve stem, excessive oil consumption and valve sticking.

14. See Figure 3-107. Apply a liberal amount of assembly lube to valve stem tip and keeper groove (1).
15. Install the inner (3) and outer (4) valve springs over the valve guide (7). Fit the spring retainer (2) on top of the inner and outer valves springs. Like the spring seat, the smaller diameter flange fits inside the inner valve spring. The larger diameter flange separates the inner and outer springs.
16. 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.

CAUTION

Over-compressing the valve spring can damage the valve stem seal resulting in leakage around the valve stem, excessive oil consumption and valve sticking.

    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.
17. 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.
18. Repeat steps 1-17 to install the other valve components.
19. Release the cylinder head holding fixture from the vise. Remove fixture tool from spark plug hole.
20. Cover the cylinder head to protect it from dust and dirt until time of installation.

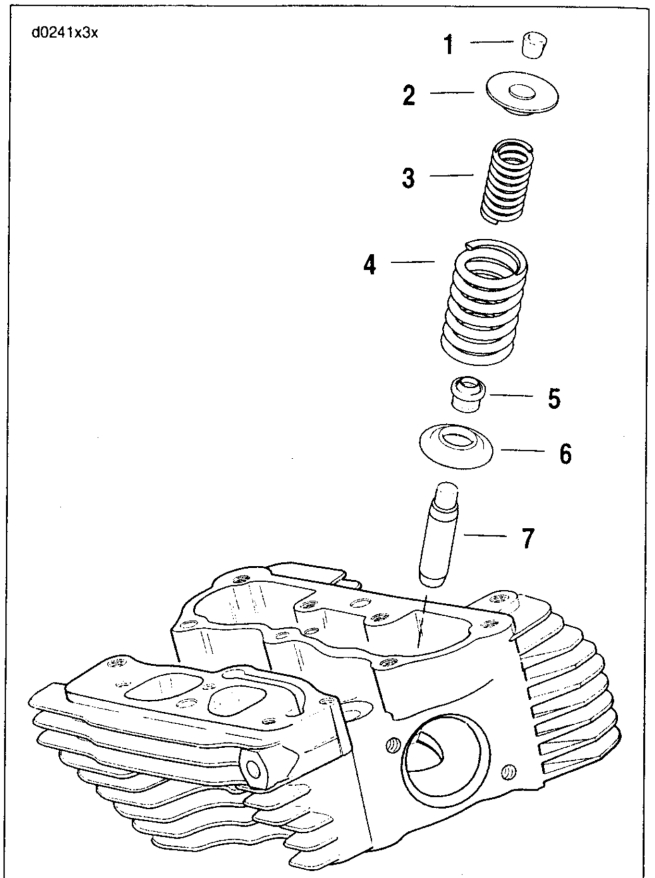
NOTE

See Figure 3-108. Since carbureted models are not equipped with a temperature sensor, a screw is used to plug the temperature sensor hole in the front cylinder head. If this screw is removed for any reason, it should be reinstalled before placing the vehicle in service. Tighten to 10-15 ft-lbs (13.6-20.3 Nm).

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder head.
2. Install push rod covers and push rods.
3. Install rocker arm support plate.
4. Install breather assembly.
5. Continue with vehicle assembly as directed.



1. **Tapered keepers**
2. **Spring retainer**
3. **Inner spring**
4. **Outer spring**
5. **Valve stem seal**
6. **Spring seat**
7. **Valve guide**

Figure 3-107. Valve Assembly

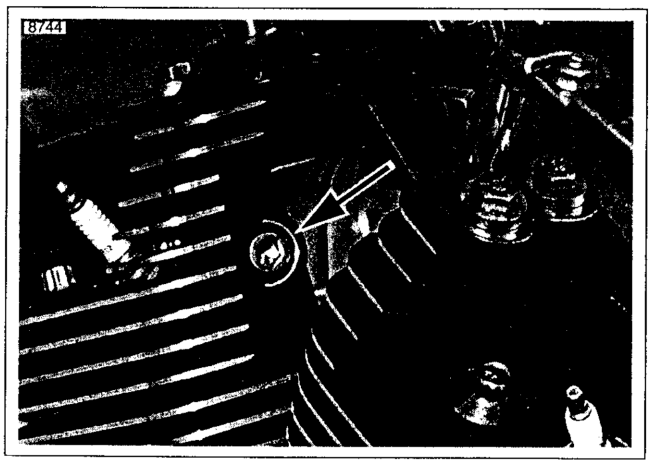


Figure 3-108. Temperature Sensor Hole Screw

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.

CLEANING

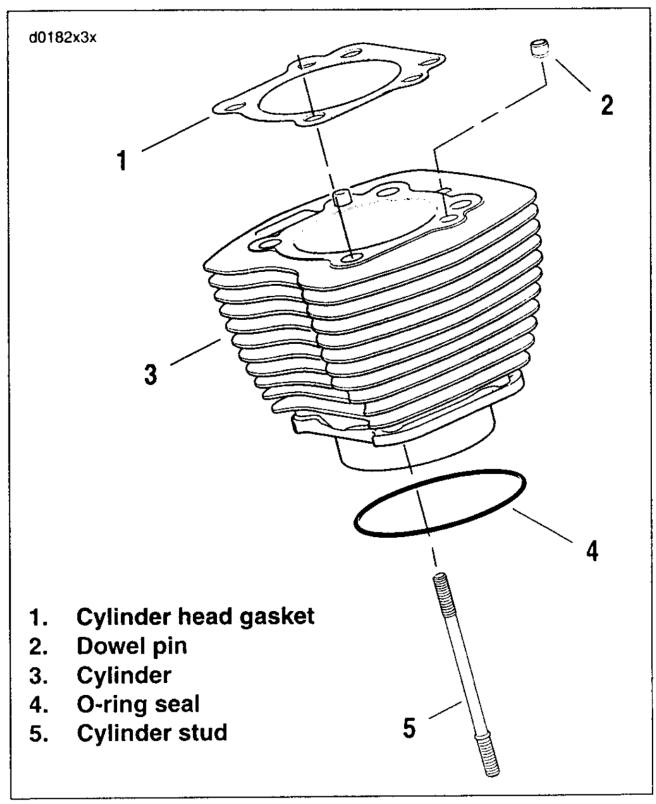
PART NO.	SPECIALTY TOOL
HD-42324-A	Cylinder torque plates

1. See Figure 3-109. Scrape old cylinder head gasket material from the machined surface at the top of the cylinder (3). Old gasket material left on the mating surface will cause leaks.

⚠WARNING

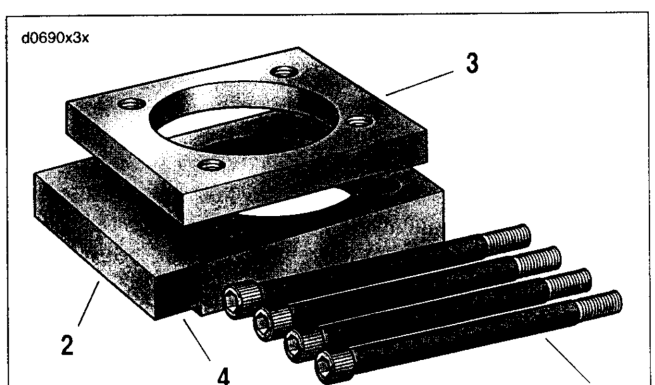
Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

2. Clean cylinder in a non-volatile cleaning solution or solvent. Thoroughly 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 3-110. 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 6.b. and 6.c. above.
   f. The O-ring seal surface must be flat within 0.008 in. (0.20 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 3-109. Cylinder Assembly



1. **Bolts and flat washers**
2. **Lower plate**
3. **Upper plate**
4. **Vise grip step**

Figure 3-110. Cylinder Torque Plates (Part No. HD-42324-A)

PART NO.	SPECIALTY TOOL
HD-42324-A	Cylinder torque plates

CAUTION

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 3-111. 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. Slide four bolts with flat washers (1) 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 snug.

   g. Tighten the bolts to 84-108 **in-lbs** (9.5-12.2 Nm) in the sequence shown in Figure 3-111.

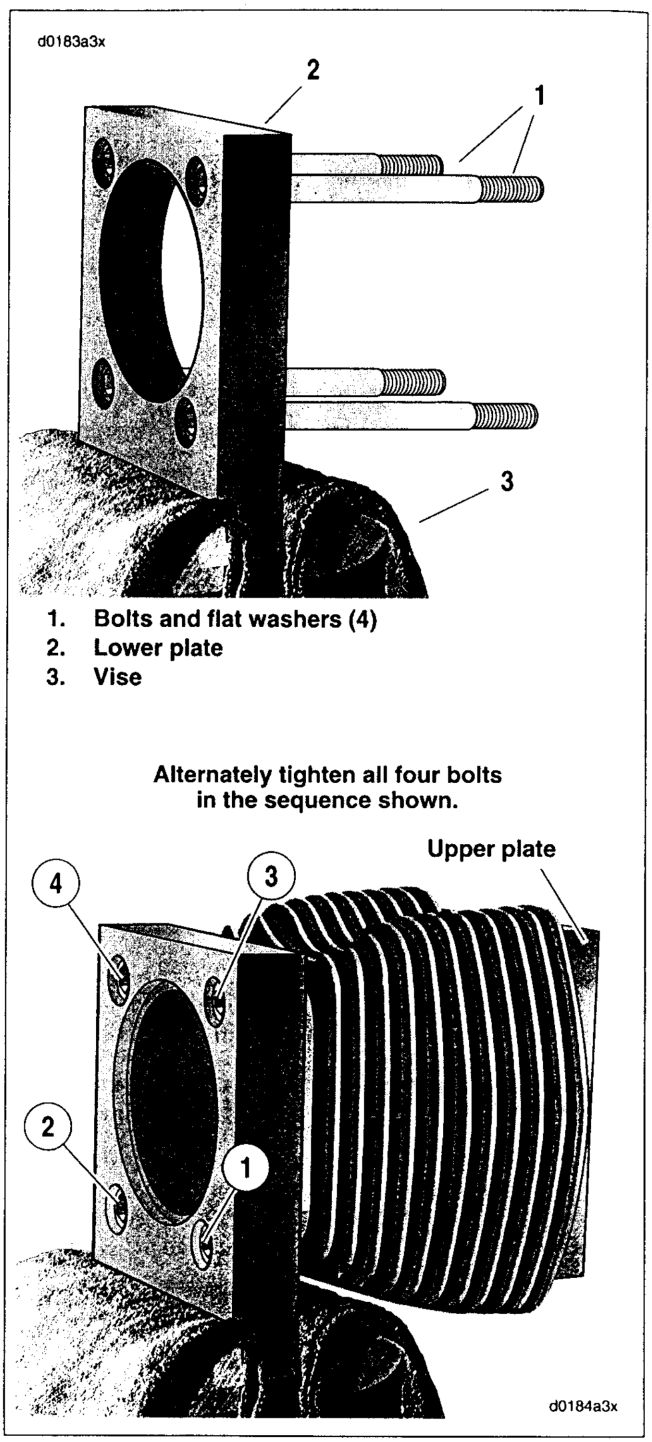
   h. Following the same sequence, tighten each bolt to 12-14 ft-lbs (16.3-18.9 Nm).

   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. Using the marks as a guide, turn each bolt 1/4 turn or 90 degrees. Be sure to tighten the bolts in the sequence shown in Figure 3-111.

NOTE

For best results, obtain Snap-On® Torque Angle Gauge TA360.

   j. For purposes of inspection, remove the assembly from the vise and place on bench top.



1. **Bolts and flat washers (4)**
2. **Lower plate**
3. **Vise**

Figure 3-111. Attaching Cylinder Torque Plates

CAUTION

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 3-112. 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. or 12.70 mm 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 0.003 in. (0.008 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. (0.058 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 DEGLAZING CYLINDER below.
   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 BORING AND HONING CYLINDER on the next page.

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.

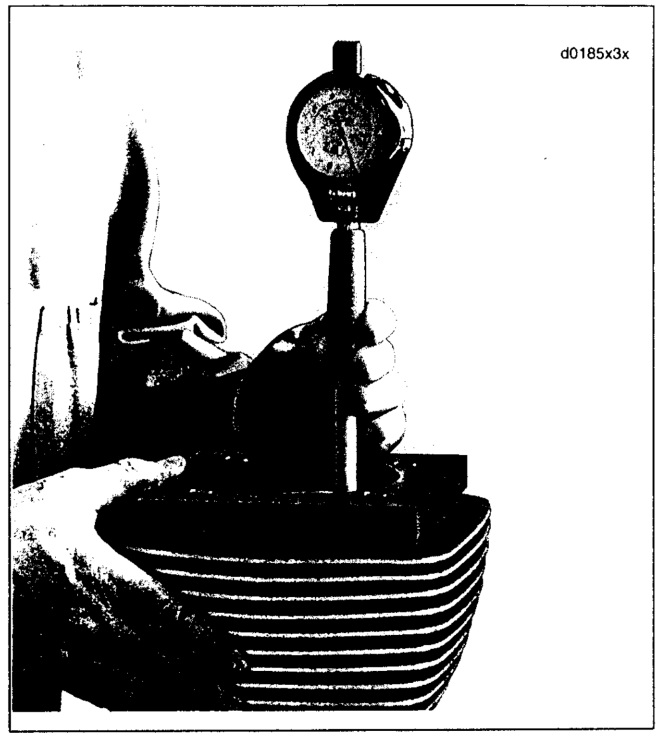


Figure 3-112. Measure For Out-of-Round and Taper

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 improper crosshatch pattern will result in insufficient oil retention and possible piston seizure and/or high oil consumption.

CAUTION

Failure to remove all abrasive particles may result in premature cylinder, piston and ring wear and possible engine failure.

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 or 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 INSPECTION under 3.25 PISTON.

BORING AND HONING CYLINDER

1. Bore cylinder with gaskets and torque plates attached. See Table 3-6. Bore the cylinder to 0.003 in. (0.08 mm) under the desired finished size.

CAUTION

An improper crosshatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or high oil consumption.

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. 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 possible engine failure.

3. Thoroughly wash the cylinder bore with liquid dishwashing soap and warm water to remove all abrasive particles and residual grit. Continue cleaning until a clean cloth shows no evidence or dirt or debris.
4. Hot rinse the cylinder and dry with moisture free compressed air.
5. Immediately apply a thin film of clean engine oil to a clean white paper towel and thoroughly wipe the inside of the cylinder. 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.

6. With the cylinder at room temperature, check the piston clearance in the cylinder in which the piston will run. See INSPECTION under 3.25 PISTON.

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Install cylinder.
2. Install cylinder head.
3. Install push rod covers and push rods.
4. Install rocker arm support plate.
5. Install breather assembly.
6. Continue with vehicle assembly as directed.

Table 3-6. 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

NOTE

Example: A 0.005 in. (0.13 mm) oversize piston will have the proper running clearance with a cylinder bore size of 3.7548-3.7552 in. (95.372-95.382) or 3.7550 in. ± 0.0002 in. (95.377 ± 0.005 mm).

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.
6. Remove piston.

DISASSEMBLY

Piston Rings

⚠WARNING

Always wear proper eye protection when removing the compression rings. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

1. See Figure 3-113. 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 spacer (5) from the third ring groove. Remove top and bottom oil rails (4).
3. Discard the piston rings.

CLEANING

CAUTION

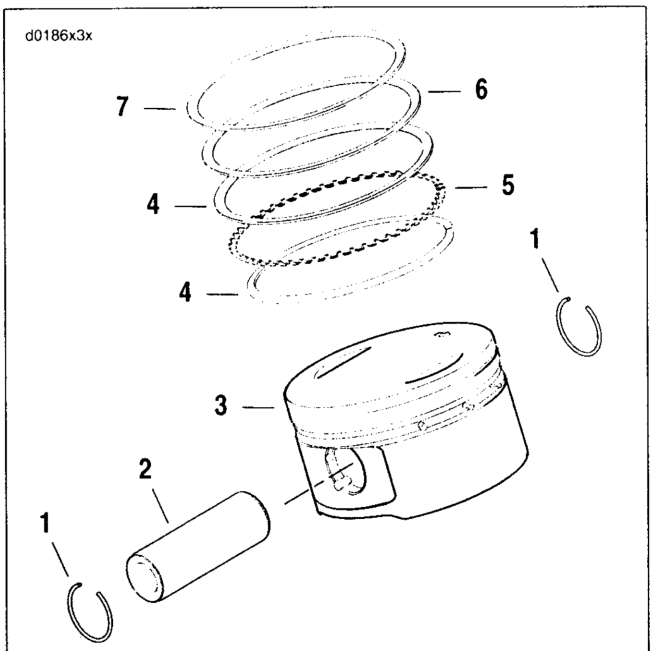
Do not sand blast or glass bead blast pistons. Bead blasting rounds off ring lands and will result in oil contamination leading to accelerated wear.

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).

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

2. Thoroughly rinse the pistons. Blow parts dry with moisture free compressed air.



1. **Circlip**
2. **Piston pin**
3. **Piston**
4. **Oil rail**
5. **Oil rail spacer**
6. **Second compression ring**
7. **Top compression ring**

Figure 3-113. Piston Assembly

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.

CAUTION

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 3-114. 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).
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.

   Pistons with superficial wear marks, minor scratching or mild scoring may continue to be used.
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.

CAUTION

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 3-115. 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).

NOTE

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.

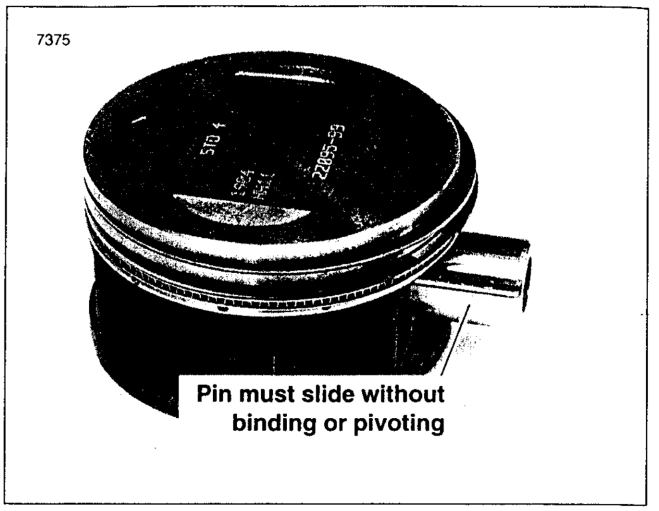


Figure 3-114. Piston Pin Clearance

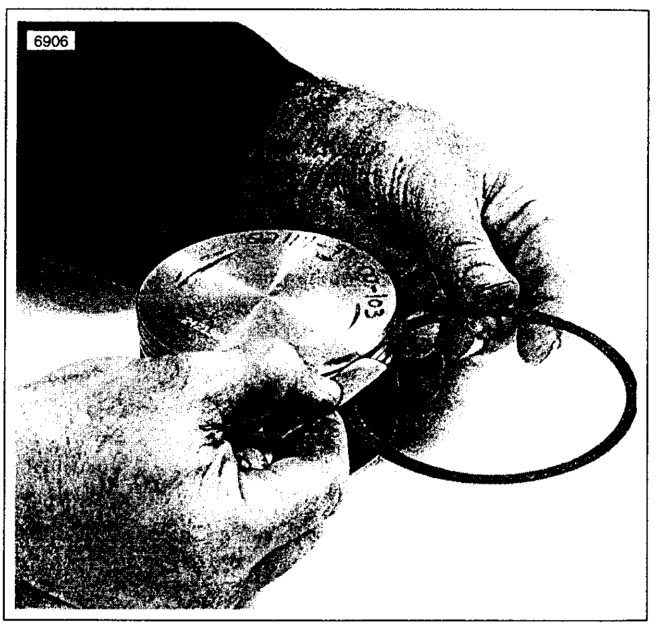


Figure 3-115. Measure Piston Ring Side Clearance

CAUTION

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.

NOTE

On late style pistons, the 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 3-117. 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 3-117.

5. See Figure 3-116. Measure running clearance of fully coated, early style pistons as follows:
   a. Holding outside micrometer, measure piston skirt diameter across the thrust faces (perpendicular to piston pin bore). Start below the bottom ring land and move micrometer towards bottom of skirt. Micrometer will be loose, then tight (about 0.5 in./ 12.7 mm from bottom), and then loose again.
   b. Measure the piston skirt at the tightest spot and then transfer that measurement to dial bore gauge.
   c. Using a grease pencil, mark the top, middle and bottom of the piston ring travel zone in the cylinder bore. Measure at markings in cylinder parallel and perpendicular to crankshaft.
   d. Replace piston and/or cylinder if running clearance exceeds 0.003 in. (0.076 mm).

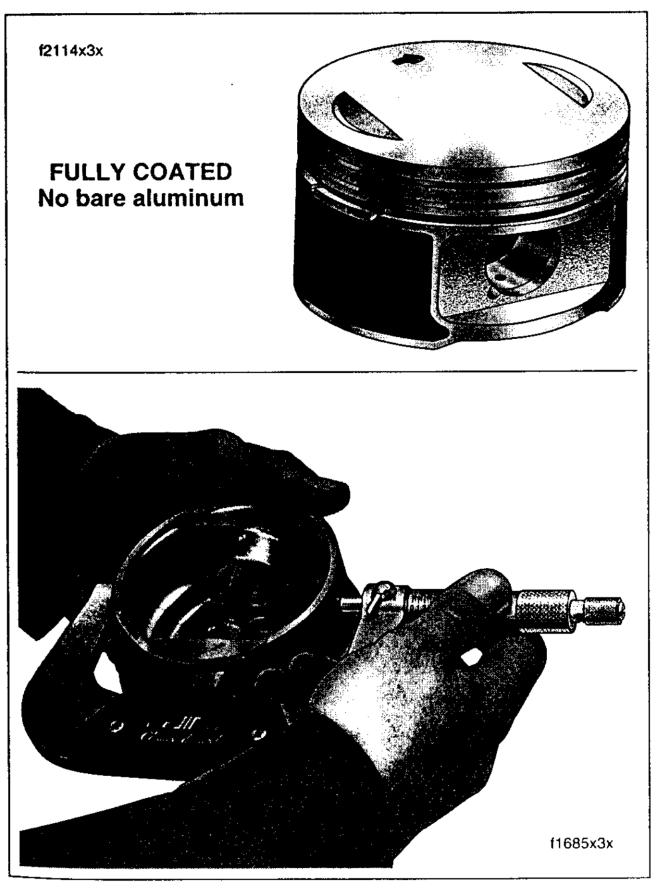


Figure 3-116. Measuring Running Clearance of Early Style Piston

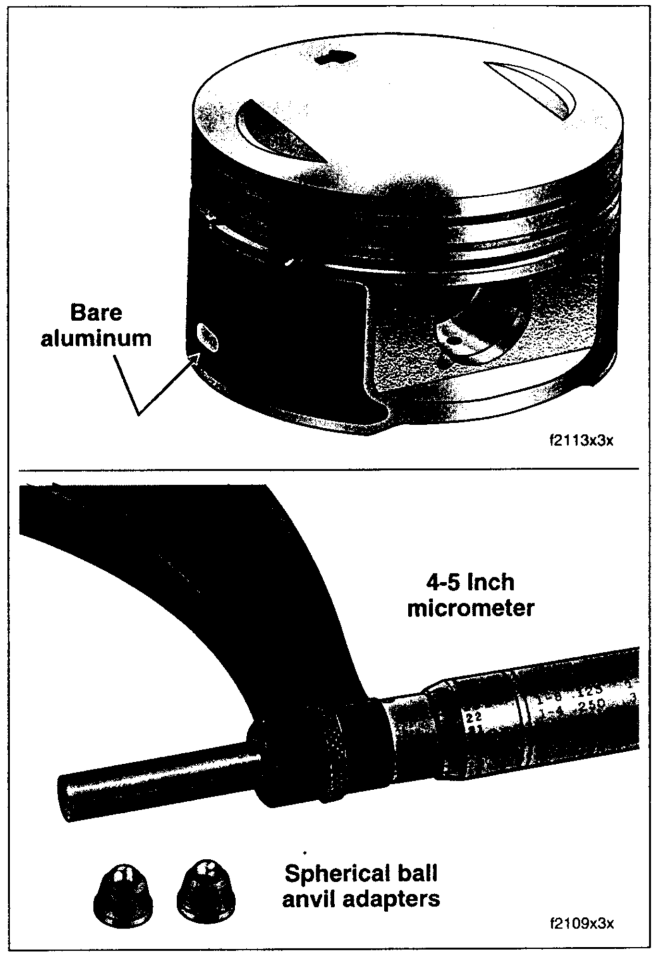


Figure 3-117. Measuring Running Clearance of Late Style Piston

Piston Rings

NOTE

*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.*

CAUTION

Insufficient ring gap may cause the ends to abut at engine operating temperatures, resulting in ring breakage, cylinder scuffing and/or piston seizure.

CAUTION

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 3-118. Check ring gap before placing each ring on the piston. Insert the **new** ring into the cylinder and square it in the bore using the top of the piston. Measure the ring gap with a feeler gauge. Do not use the ring if the end gap does not fall within the specifications listed in Table 3-7.

Table 3-7. Ring End Gap

Ring Type	IN.	MM
Top compression ring	0.010-0.020 in.	0.25-0.51 mm
2nd compression ring	0.014-0.024 in.	0.36-0.61 mm
Oil control ring rails	0.010-0.050 in.	0.25-1.27 mm

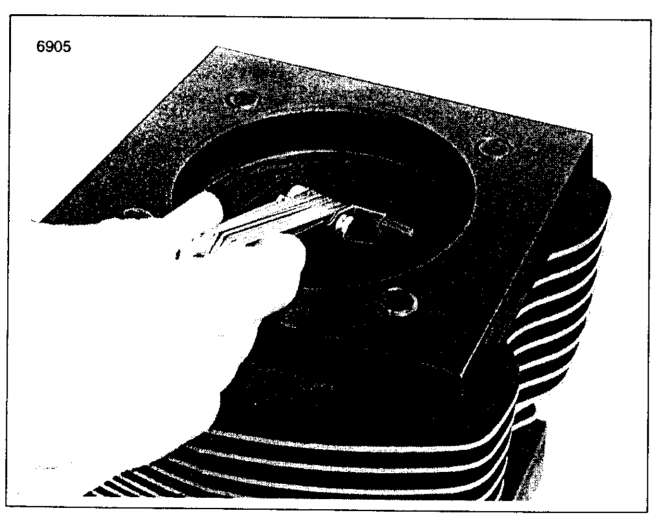


Figure 3-118. Measure Ring Gap

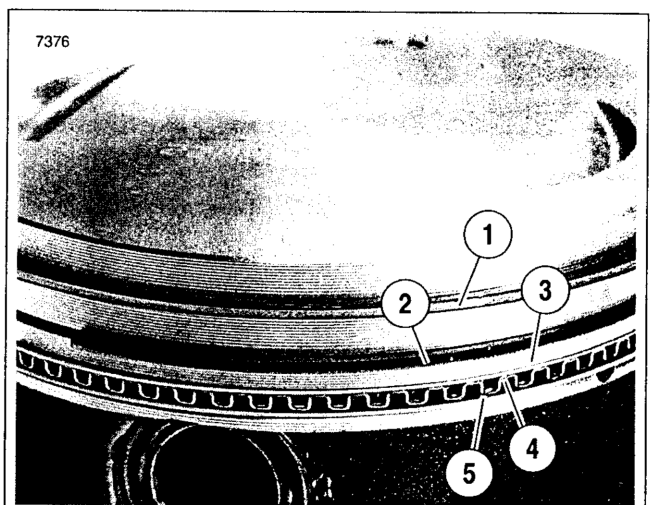
NOTE

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

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

2. Use compressed air to remove any dirt or dust that may have settled in the oil drain holes and piston ring grooves.
3. See Figure 3-119. Install piston rings as follows:
   a. Apply clean H-D 20W50 engine oil to three piston ring grooves.
   b. Install oil rail spacer (4) into third ring groove.
   c. Spiral bottom oil rail (5) into space below oil rail spacer (4). Position gap 90 degrees from the gap in the oil rail spacer.
   d. Spiral upper oil rail (3) into space above oil rail spacer (4). Position gap 180 degrees from the gap in the bottom oil rail.



1. **Top compression ring**
2. **Second compression ring**
3. **Upper oil rail**
4. **Oil rail spacer**
5. **Bottom oil rail**

Figure 3-119. Piston Rings

⚠WARNING

Always wear proper eye protection when installing the compression rings. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

CAUTION

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.

CAUTION

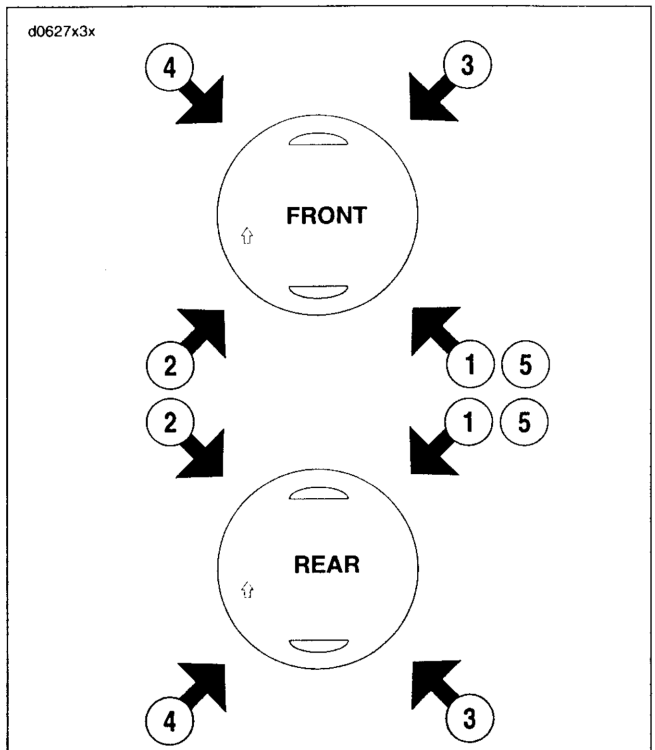
Installing the second compression ring upside down will cause oil to be scraped up into the combustion chamber resulting in excessive oil consumption and low service life on valves and other components.

e. 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 90 degrees from the gap in the top oil rail.

f. 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 degrees from the gap in the second compression ring.

g. Rotate the three piston rings using the palms of both hands. The rings must rotate freely without sticking.

h. See Figure 3-120. Verify the ring gaps are still properly staggered.



1. **Expander spring**
2. **Bottom oil rail**
3. **Top oil rail**
4. **Second compression ring**
5. **Top compression ring**

Figure 3-120. Piston Ring Gap Alignment

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Attach piston to connecting rod.
2. Install cylinder.
3. Install cylinder head.
4. Install push rod covers and push rods.
5. Install rocker arm support plate.
6. Install breather assembly.
7. Continue with vehicle assembly as directed.

REMOVAL OVERVIEW

See 3.16 TOP END OVERHAUL: DISASSEMBLY.

1. Remove breather assembly.
2. Remove rocker arm support plate.
3. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
4. Remove cylinder head.
5. Remove cylinder.
6. Remove piston.
7. Service upper connecting rod bushing.

NOTE

Service of connecting rods is limited to replacement of the upper bushing. Damage to connecting rods or lower bushing service requires replacement of the flywheel assembly.

DISASSEMBLY/ASSEMBLY

Removing Upper Connecting Rod Bushing

PART NO.	SPECIALTY TOOL
HD-95952-33C	Connecting rod clamping tool
HD-95970-32D	Connecting rod bushing remover/ installer

NOTE

Replace the upper rod bushing if the piston pin to rod bushing clearance exceeds 0.001 in. (0.025 mm).

CAUTION

Place clean shop towels in and around the crankcase bore to prevent chips and shavings from falling into the crankcase.

1. See Figure 3-121. Obtain the CONNECTING ROD CLAMPING TOOL (Part No. HD-95952-33C).
   a. Slide clamp (2) over connecting rod so that slots engage cylinder head studs. Exercise caution to avoid scratching or bending studs.
   b. With the knurled side up, install threaded cylinders (1) onto studs to secure position of clamp.
   c. Alternately turn each clamp thumbscrew (3) a few turns to gradually fix position of connecting rod. Turning only one thumbscrew will move rod off-center, while tightening second thumbscrew can cause rod to flex or bend.

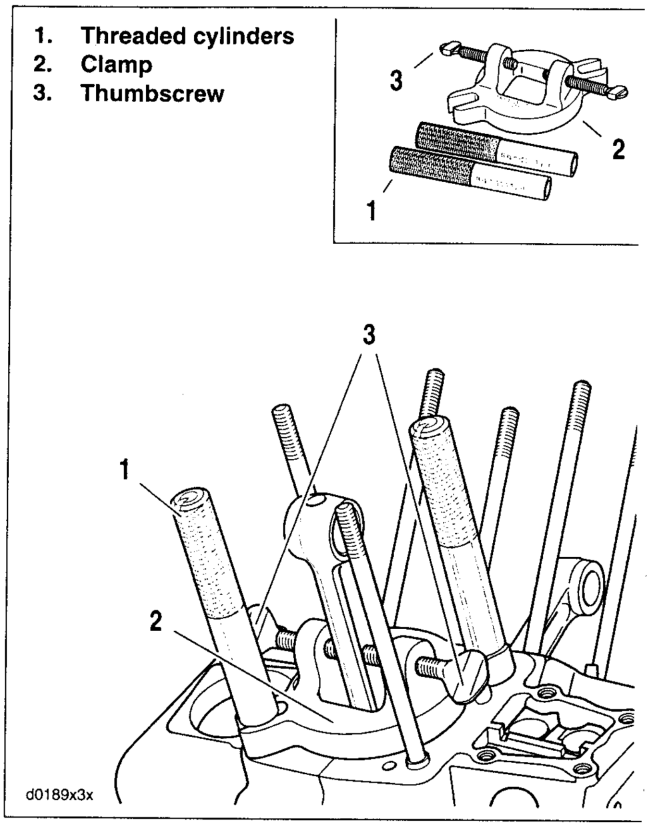
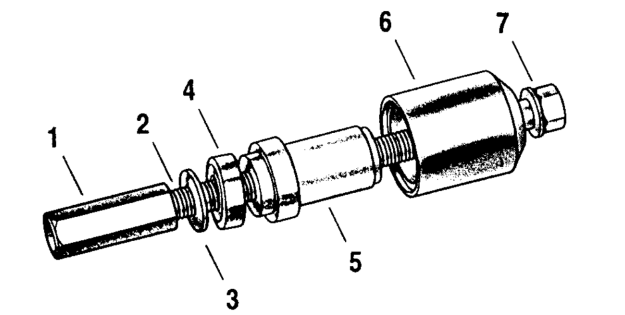


Figure 3-121. Connecting Rod Clamping Tool (Part No. HD-95952-33C)

2. See Figure 3-122. Obtain the CONNECTING ROD BUSHING REMOVER/INSTALLER (Part No. HD-95970-32D).
   a. Sparingly apply graphite lubricant to threads of rod to prolong service life and ensure smooth operation.
   b. Slide receiver cup (6) onto threaded rod (2) with the closed side facing nut (7).
   c. Insert threaded rod through upper rod bushing.
   d. See Figure 3-123. Slide remover side of driver down threaded rod. The driver is stamped to ensure proper orientation.
   e. See Figure 3-122. Slide Nice bearing (4) and flat washer (3) down threaded rod until it contacts driver.
   f. Thread the hex cylinder onto rod until assembly is snug.
   g. Holding nut (7) with a 5/8 in. box wrench, turn hex cylinder (1) with a 5/8 in. socket until bushing is free. See Figure 3-125.
   h. Unthread hex cylinder from rod. Remove flat washer, Nice bearing and driver. Remove threaded rod from bushing bore.
   i. Remove bushing from receiver cup and discard.



1. **Hex cylinder**
2. **Threaded rod**
3. **Flat washer**
4. **Nice bearing**
5. **Driver (2 way)**
6. **Receiver cup**
7. **Nut**

Figure 3-122. Connecting Rod Bushing Remover/Installer (Part No. HD-95970-32D)

Installing Upper Connecting Rod Bushing

PART NO.	SPECIALTY TOOL
HD-95952-33C	Connecting rod clamping tool
HD-95970-32D	Connecting rod bushing remover/ installer

See Figure 3-122. Obtain the CONNECTING ROD BUSHING REMOVER/INSTALLER (Part No. HD-95970-32D)

1. Slide receiver cup (6) onto threaded rod (2) with the closed side facing nut (7).
2. Insert threaded rod through upper rod bushing bore.
3. See Figure 3-124. Slide **new** bushing down threaded rod. Start bushing into bore. Verify that center of slot in bushing (2) is aligned with oil hole in connecting rod (3). Also, be sure that bushing is square in bore and not cocked.
4. Slide installer side of driver (1) down threaded rod until shoulder contacts bushing. The driver is stamped to ensure proper orientation.
5. See Figure 3-122. Slide Nice bearing (4) and flat washer (3) down threaded rod until it contacts driver.
6. Thread the hex cylinder (1) onto rod until assembly is snug.
7. Holding nut (7) with a 5/8 in. box wrench, turn hex cylinder (1) with a 5/8 in. socket until collar on driver bottoms against connecting rod. See Figure 3-125.
8. Unthread hex cylinder from rod and remove flat washer, Nice bearing and driver. Remove threaded rod from bushing bore, but exercise caution to avoid scratching or gouging bushing.

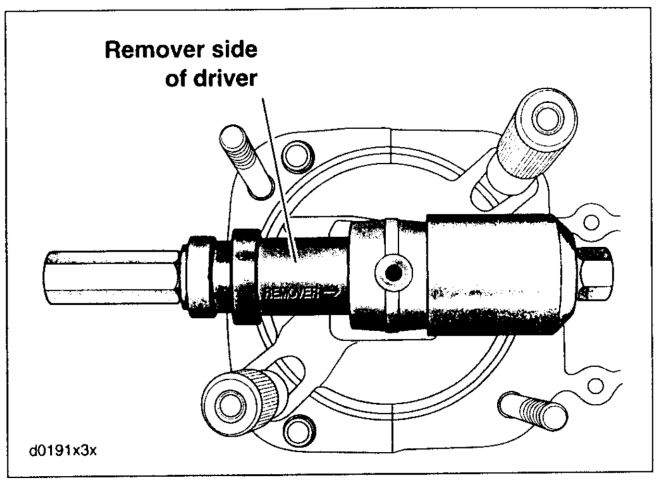


Figure 3-123. Remover Stackup

1. **Installer side of driver**
2. **Slot in bushing**
3. **Oil hole in connecting rod**

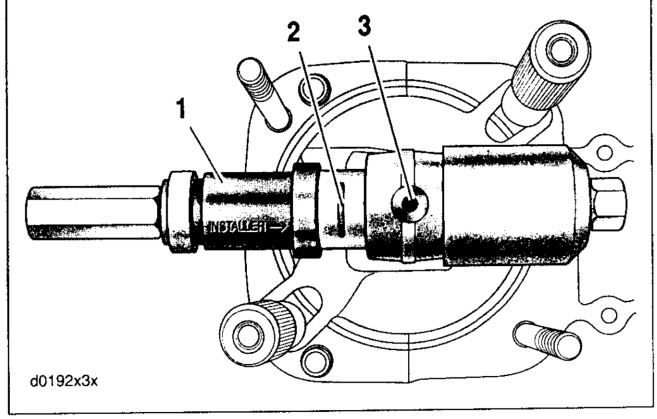


Figure 3-124. Installer Stackup

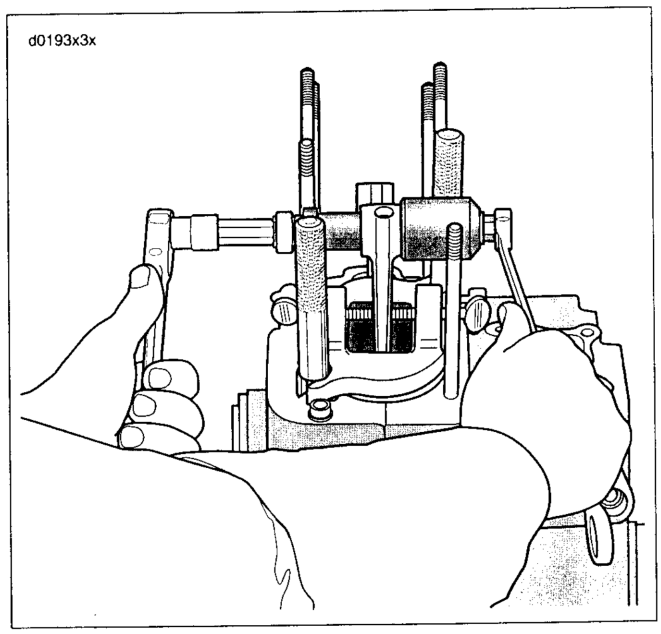


Figure 3-125. Remove/Install Bushing

Reaming Upper Connecting Rod Bushing

PART NO.	SPECIALTY TOOL
HD-42318	Connecting rod bushing reamer
HD-43645	Reamer handle/drive socket
HD-95952-33C	Connecting rod clamping tool

See Figure 3-126. Obtain the CONNECTING ROD BUSHING REAMER (Part No. HD-42318) and REAMER HANDLE/DRIVE SOCKET (Part No. HD-43645).

1. Carefully insert bit of reamer (2) into upper connecting rod bushing. Do not apply lubricant to reamer or bushing. Ream the bushing dry or cut will not be accurate.
2. Install handle/drive socket (1) on reamer lug.
3. Placing thumb on drive socket, apply slight pressure on reamer while rotating handle/drive socket in a clockwise direction.

CAUTION

For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bushing bore will be tapered if pressure is not centrally applied.

4. Continue rotating handle/drive socket until entire bit has passed through bushing and shank of reamer rotates freely in the bore.

CAUTION

Never back reamer out of connecting rod or bushing will be damaged.

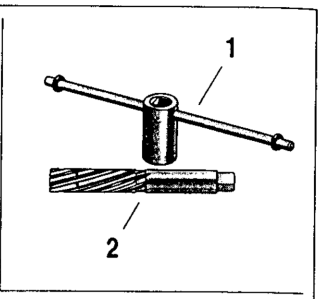
5. Remove handle/drive socket, and carefully pulling on bit, draw shaft of reamer out of connecting rod bushing.

CAUTION

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

6. Using contact cleaner or cleaning solvent, thoroughly wipe upper connecting rod and bushing of any metal shavings or debris.

1. **Handle/drive socket**
2. **Reamer**



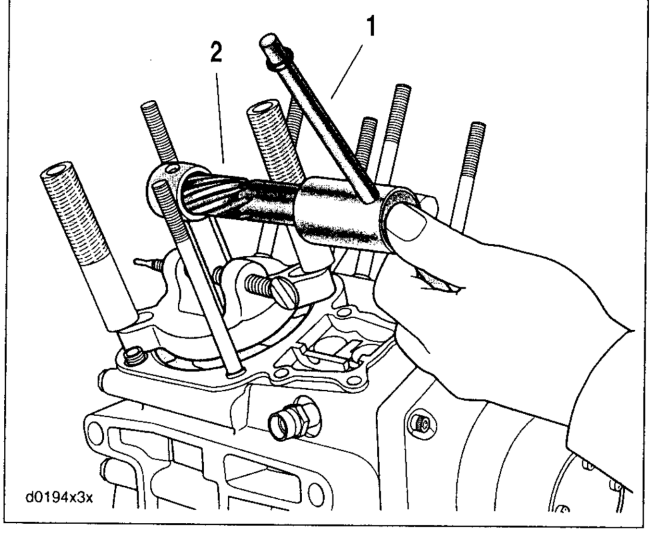


Figure 3-126. Connecting Rod Bushing Reamer (Part No. HD-42318) and Handle/Drive Socket (Part No. HD-43645)

Honing Upper Connecting Rod Bushing

PART NO.	SPECIALTY TOOL
HD-42569	Connecting rod bushing hone
HD-95952-33C	Connecting rod clamping tool

1. See Figure 3-127. Obtain the CONNECTING ROD BUSHING HONE (Part No. HD-42569) 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 inside of upper connecting rod bushing.
   c. Start finishing stones of hone into bushing.
   d. Activating the drill, move the entire length of the finishing stone arrangement forward and backward through the bushing bore for 10 to 12 complete strokes. Work for a crosshatch pattern of approximately 60 degrees.

CAUTION

Abrasive particles can damage machined surfaces and plug oil passageways possibly resulting in engine failure.

2. Using contact cleaner or cleaning solvent, thoroughly wipe upper connecting rod and bushing of any metal shavings or debris. Continue wiping until a clean cloth shows no evidence of dirt or debris.
3. Lightly oil a good piston pin and insert it into the upper connecting rod bushing bore to feel for the proper interference fit. The pin should slide in and out of the bushing without binding, but also without pivoting or rocking.
4. Remove shop towels exercising caution that shavings, chips and other debris do not fall into crankcase.

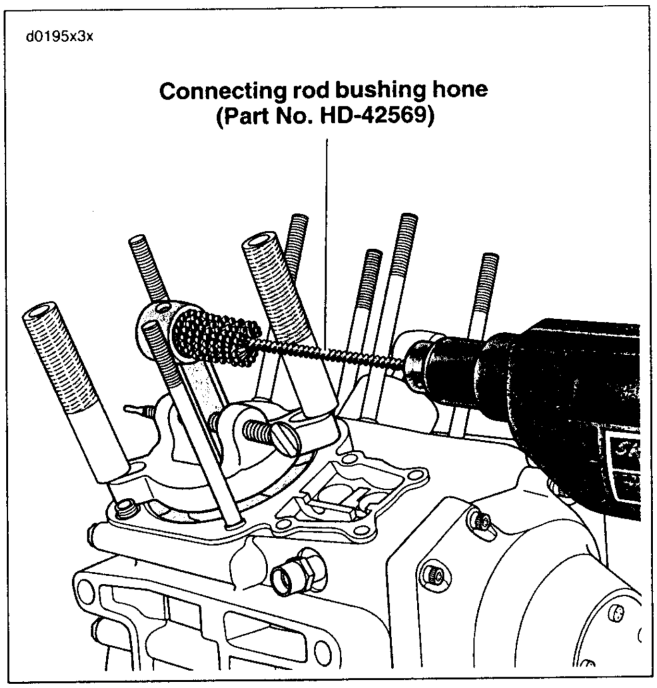


Figure 3-127. Honing Upper Connecting Rod Bushing

INSTALLATION OVERVIEW

See 3.17 TOP END OVERHAUL: ASSEMBLY.

1. Service or replace connecting rod upper bushing
2. Attach piston to connecting rod.
3. Install cylinder.
4. Install cylinder head.
5. Install push rod covers and push rods.
6. Install rocker arm support plate.
7. Install breather assembly.
8. Continue with vehicle assembly as directed.

NOTES

REMOVAL OVERVIEW

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. See Figure 3-128. 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. See beginning of 3.18 BOTTOM END OVERHAUL: DISASSEMBLY to remove cover and cam support plate.

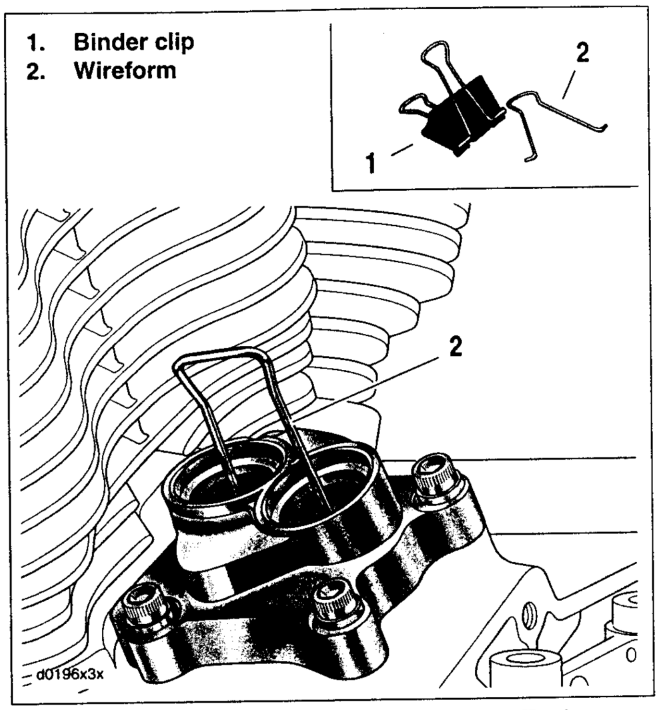


Figure 3-128. Hydraulic Lifter Holding Tool

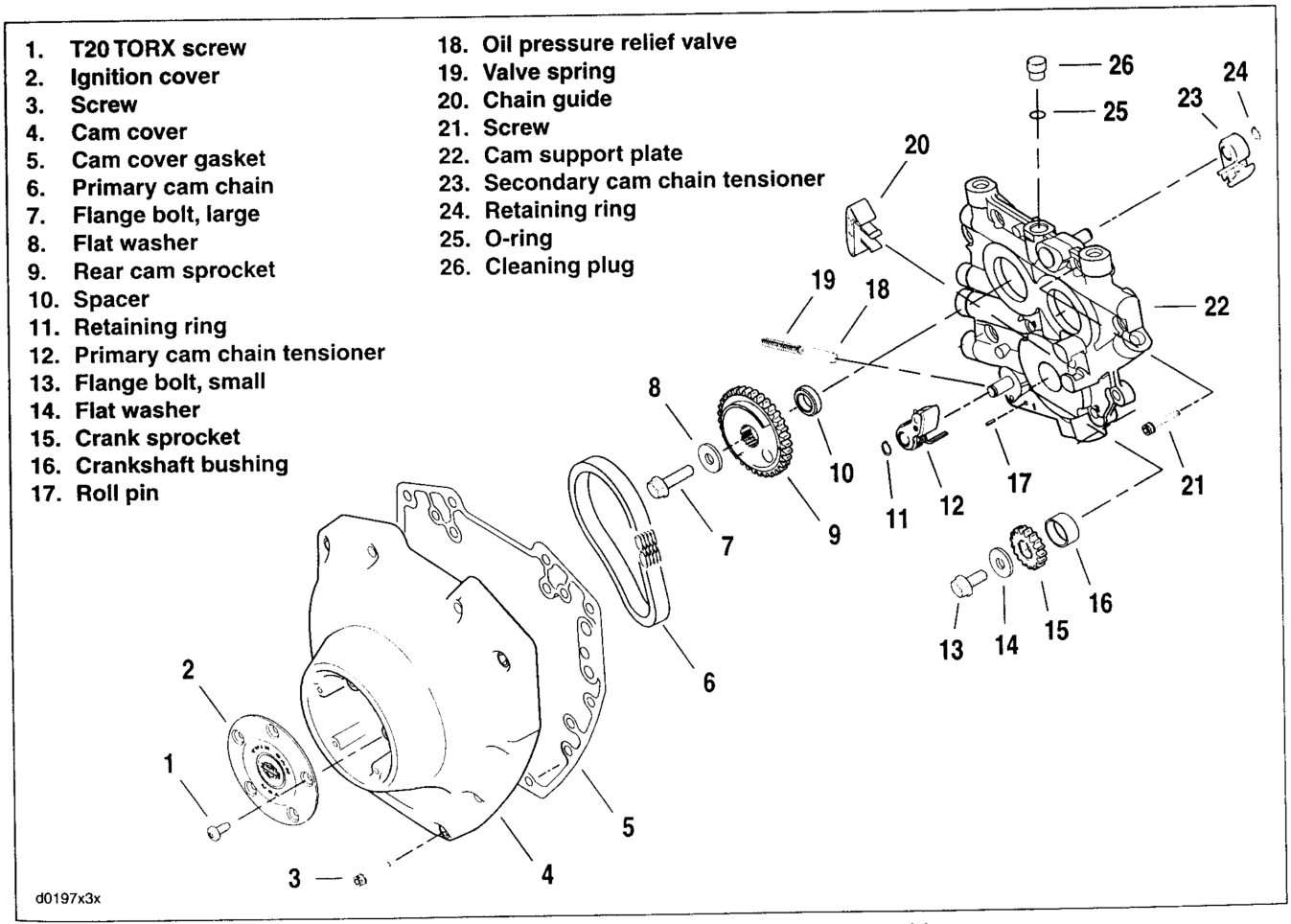


Figure 3-129. Cover and Cam Support Plate Assembly

DISASSEMBLY/ASSEMBLY

⚠CAUTION

Do not pull the retention pins from the primary or secondary cam chain tensioners with the chains and sprockets removed. With 35-40 pounds of spring pressure behind the tensioner, allowing it to accelerate through its full length of travel will cause spring stretching and/or cracking of the tensioner shoe, damage which requires replacement of the assembly. Furthermore, if tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.

NOTE

If the retention pins interfere with cleaning or service procedures, hold the retracted cam chain tensioner with the CAM CHAIN TENSIONER UNLOADER (Part No. HD-42313), pull the retention pin and ease the assembly into the unloaded position.

CRANKSHAFT BUSHING

Removal

PART NO.	SPECIALTY TOOL
HD-42315	Crankshaft bushing remover/installer

1. See Figure 3-130. Obtain the CRANKSHAFT BUSHING REMOVER/INSTALLER (Part No. HD-42315).
2. Center support tube under ram of arbor press.
3. Center crankshaft bushing in cam support plate over support tube. Be sure that the primary cam chain side of the cam support plate is facing upward.

CAUTION

If the crankshaft bushing is pressed out the primary cam chain side, the bore will be damaged by the knurled edge of the bushing. Damage to the bore requires replacement of the cam support plate.

4. Insert remover side of driver into crankshaft bore so that shoulder on tool is seated on edge of bushing.
5. Press on driver until collar of tool contacts cam support plate. Remove bushing from support tube and discard.

Installation

PART NO.	SPECIALTY TOOL
HD-42315	Crankshaft bushing remover/installer

1. See Figure 3-130. Obtain the CRANKSHAFT BUSHING REMOVER/INSTALLER (Part No. HD-42315).
2. Center support tube under ram of arbor press.

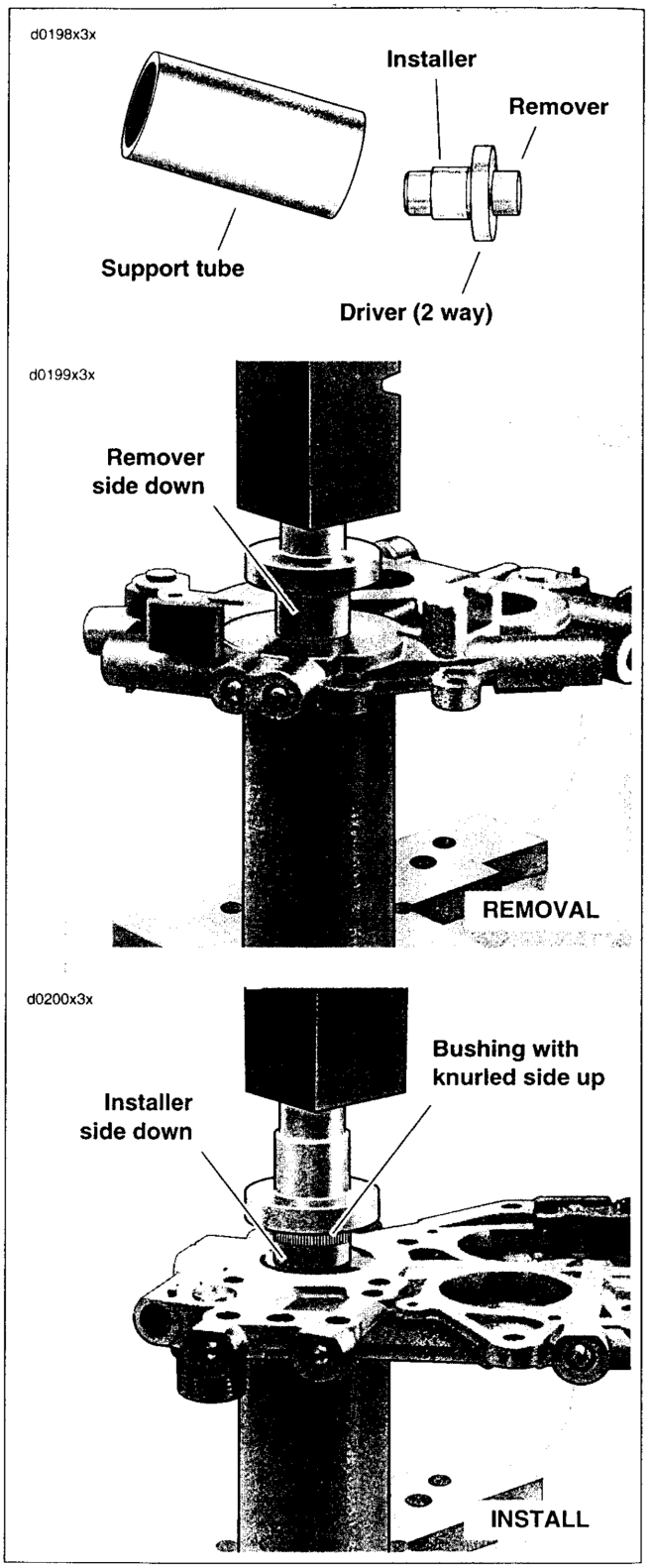


Figure 3-130. Crankshaft Bushing Remover Installer (Part No. HD-42315)

3. Turn cam support plate over so that secondary cam chain side is facing upward.
4. Start **new** bushing into bore with the knurled edge topside. Be sure that hole in bushing is aligned with oil hole in bushing bore.

CAUTION

If the crankshaft bushing is pressed in from the primary cam chain side, or from the secondary cam chain side with the knurled edge of the bushing down, the bushing bore will be damaged. Damage to the bore requires replacement of the cam support plate.

5. Center crankshaft bushing bore over support tube.
6. Insert installer side of driver into bushing.
7. Press on driver until collar of tool makes firm contact with cam support plate.
8. Ream the crankshaft bushing following the directions below.

Reaming Crankshaft Bushing

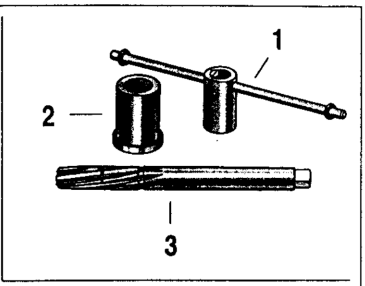
PART NO.	SPECIALTY TOOL
HD-42316	Crankshaft bushing reamer
HD-43645	Handle/drive socket

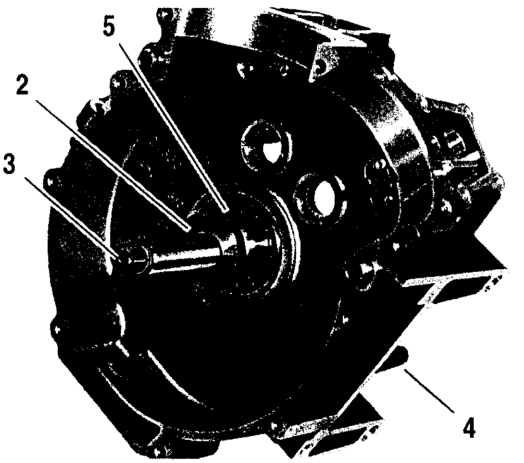
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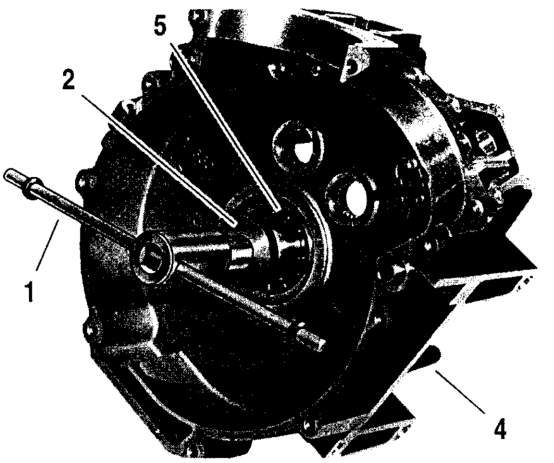
*A **new** crankshaft bushing must be reamed for proper size and alignment. If crankcase halves are not split, ream the bushing using a spare right case half to avoid further engine disassembly.*

1. Slide cam support plate onto two ring dowels in crankcase flange.
2. Install six allen head socket screws (1/4 x 1 in.) to secure cam support plate to crankcase flange. Alternately tighten screws until snug.
3. See Figure 3-131. Obtain the CRANKSHAFT BUSHING REAMER (Part No. HD-42316) and REAMER HANDLE/DRIVE SOCKET (Part No. HD-43645).
   a. From flywheel compartment side, carefully insert tapered end of reamer pilot (2) into crankshaft roller bearing (5) until it stops.
   b. Slide reamer (3) through pilot starting bit into crankshaft bushing in cam support plate. Do not apply lubricant to reamer or bushing. Ream the bushing dry or cut will not be accurate.
   c. Install handle/drive socket (1) on reamer lug.
   d. **Placing thumb on drive socket**, apply slight pressure on reamer (3) while rotating handle/drive socket (1) in a clockwise direction.

1. **Handle/drive socket**
2. **Pilot**
3. **Reamer**
4. **Right crankcase half**
5. **Roller bearing**







d0201x3x

Figure 3-131. Crankshaft Bushing Reamer (Part No. HD-42316) and Handle/Drive Socket (Part No. HD-43645)

CAUTION

For best results, do not push on reamer or apply pressure to the reamer handle. While excessive pressure results in a rough cut, bushing bore will be tapered if pressure is not centrally applied.

e. Continue rotating handle/drive socket until entire bit has passed through bushing and shank of reamer rotates freely in the bore.

CAUTION

Never back reamer out flywheel side of crankcase or crankshaft bushing will be damaged.

f. Remove handle/drive socket, and carefully pulling on bit, draw shaft of reamer out of bushing on cam side of crankcase.

g. Remove pilot from crankshaft roller bearing. Tap on pilot using a soft rubber mallet, if necessary.

4. Remove the allen head socket screws to release the cam support plate from the crankcase flange.

CAUTION

Abrasive particles can damage machined surfaces and plug oil passages possibly resulting in engine failure.

5. Clean up debris left from reaming operation.

a. See Figure 3-129. Using a small screwdriver, carefully pry cleaning plug (26) from top of cam support plate (22).

b. Thoroughly flush right crankcase half and cam support plate in cleaning solvent to remove any metal shavings or debris.

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

c. Blow parts dry with low pressure compressed air.

d. Install cleaning plug in cam support plate replacing O-ring (25) if torn or damaged.

CAMSHAFTS AND CAMSHAFT BEARINGS

Removal

PART NO.	SPECIALTY TOOL
HD-34902-B	Mainshaft bearing inner racer puller/installer
HD-42313	Cam chain tensioner unloader
HD-43644	Camshaft/camshaft bearing remover/installer
HD-95637-46A	Wedge attachment

1. See Figure 3-132. Place cup of CAM CHAIN TENSIONER UNLOADER (Part No. HD-42313) (3) over spring coil of secondary cam chain tensioner positioning finger (4)on tool between tensioner and shoe (1).

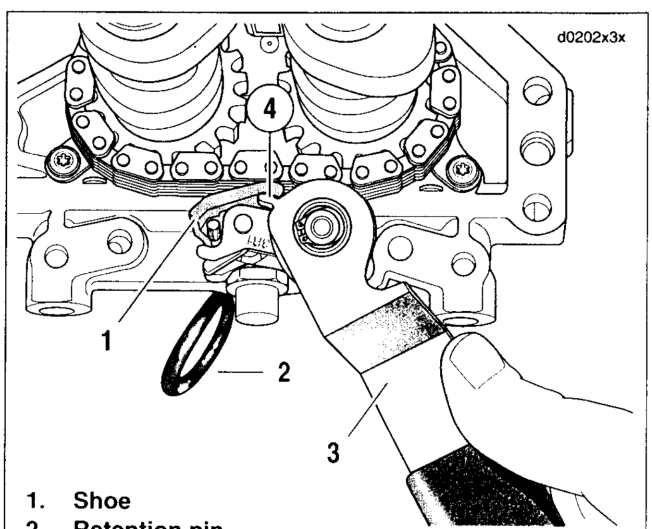
2. Rotate tool in a counterclockwise direction inserting retention pin (2) through hole in boss on **primary cam chain side** of cam support plate. Pin engages hooks on tensioner to hold it in the retracted position. For best results, place cam support plate in a vise using brass jaw inserts to prevent casting damage.

⚠WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident; This could result in death or serious injury.

3. Remove retaining ring from groove at end of front camshaft. Discard retaining ring.

4. Remove four T20 TORX screws to free bearing retainer plate from inboard side of cam support plate.



1. Shoe
2. Retention pin
3. Tensioner unloader
4. Finger

Figure 3-132. Retract Secondary Cam Chain Tensioner

5. 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.
6. With the primary cam chain side facing upward, place cam support plate on parallel blocks under ram of arbor press.
7. See Figure 3-133. Obtain the CAMSHAFT/CAMSHAFT BEARING RE-MOVER/INSTALLER (Part No. HD-43644).

CAUTION

Since the bearing fit to the camshafts is tighter than its fit in the support plate, any attempt to remove the camshafts without the bearings will result in damage to the cam support plate and bearing retainer plate, if installed.

CAUTION

Cam bearings may be a loose fit in the cam support plate. To avoid possible damage, be aware that camshaft and bearing assemblies may drop out at start of press procedure.

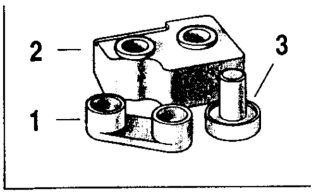
8. See upper frame of Figure 3-133. Fit cups of camshaft driver (1) over ends of front and rear camshafts, so that contact is made with the bearing inner races. Centering driver under ram at a point midway between the camshafts, simultaneously press both camshafts (with attached bearings) from the cam support plate.
9. Remove secondary cam chain from cam sprockets.
10. If reusing front camshaft, remove bearing as follows:
    a. Position WEDGE ATTACHMENT (4) (Part No. HD-95637-46A) on inboard side of front camshaft bearing (6) and turn hex nuts an equal number of turns to draw halves of wedge together.
    b. Obtain two 3/8-16 in. bolts (2) 3-1/2 inches long (with flat washers). Install flat washers on bolts. Obtain bridge (3), forcing screw (1) and hardened plug (7) from MAINSHAFT BEARING INNER RACE PULLER/INSTALLER (Part No. HD-34902-B).
    c. Slide one bolt into channel on each side of bridge (3) so that flat washer (2) is between bridge and bolt head. Thread bolts into wedge attachment an equal number of turns.
    d. Sparingly apply graphite lubricant to threads of forcing screw (1) to prolong service life and ensure smooth operation. Start forcing screw (1) into center hole of bridge (3).

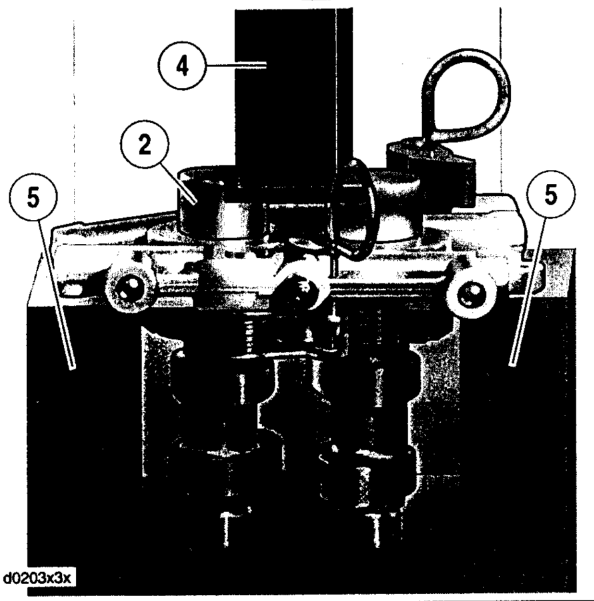
CAUTION

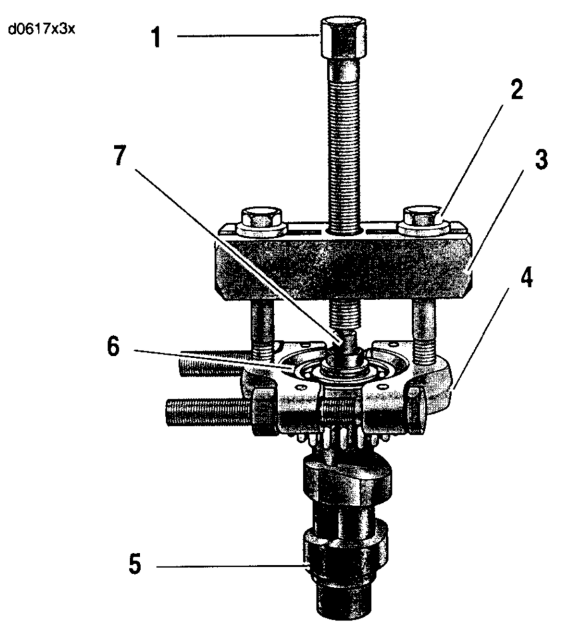
Failure to use hardened plug may result in damage to forcing screw and/or camshaft.

    e. Place cupped side of hardened plug (7) against end of camshaft. Thread forcing screw into bridge until the steel ball at the end of the screw makes firm contact with hardened plug.
    f. See lower frame of Figure 3-129. Verify that the tool assembly is square so that the bearing (6) is not cocked during removal. Turn forcing screw (1) until bearing is pulled free of camshaft. Discard bearing.

1. **Camshaft driver**
2. **Support block**
3. **Bearing pilot/driver**
4. **Ram**
5. **Parallel blocks**







1. **Forcing screw**
2. **3/8-16 Bolt w/washer**
3. **Bridge**
4. **Wedge attachment**
5. **Front camshaft**
6. **Bearing**
7. **Hardened plug**

Figure 3-133. Camshaft/Camshaft Bearing & Remover/installer (Part No. HD-43644)

11. If reusing rear camshaft, remove roller bearing assembly as follows:
    a. Slide roller bearing from end of rear camshaft. Since bearing is a loose fit on cam, no pressing tools are required.
    b. Install tools as you would to remove the bearing from the front camshaft, but position cup of wedge inboard of the thrust washer.
    c. Wrap a shop rag around camshaft to get a firm grip and also to protect hand from sharp edges of sprocket.
    d. See A of Figure 3-134. Using a 5/8 in. box wrench (1), turn forcing screw until bearing inner race (2) and thrust washer (3) are pulled free of camshaft. A light interference fit allows the parts to be removed with little effort. Discard inner race and thrust washer.
    e. If present, remove O-ring from grinding relief groove in camshaft. Groove is on the splined end between the machined area and the secondary cam sprocket. Discard O-ring.

NOTE

Since the O-ring is not used in production, it will only be found if the cams were serviced at the dealer level.

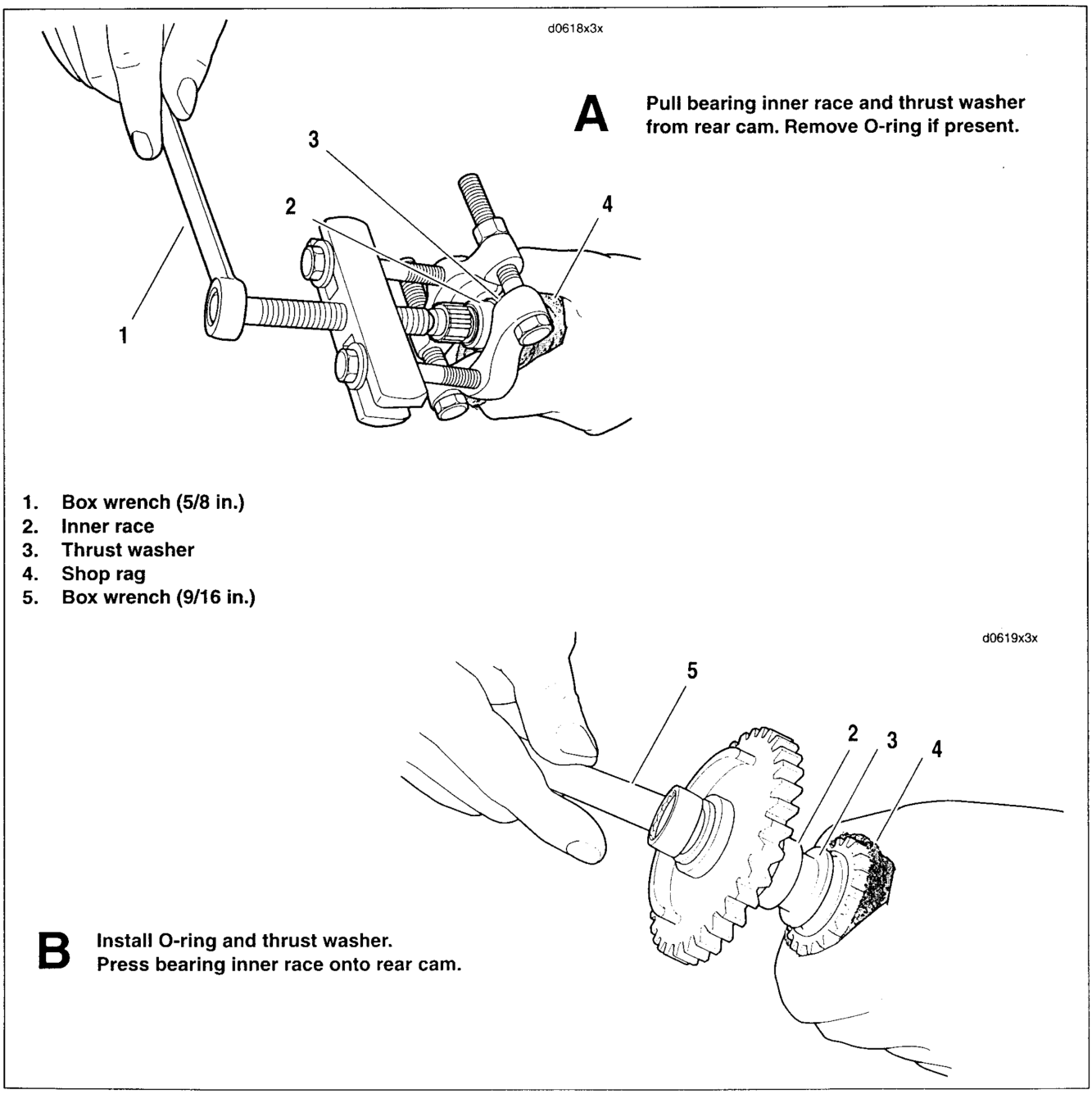


Figure 3-134. Remove/Install Bearing Inner Race (With O-Ring and Thrust Washer) Onto Rear Camshaft

Installation

PART NO.	SPECIALTY TOOL
HD-42313	Cam chain tensioner unloader
HD-43644	Camshaft/camshaft bearing remover/installer

CAUTION

Always use genuine Harley-Davidson parts. Use of any other bearings may result in engine damage.

1. See Figure 3-135. Obtain **new** rear cam roller bearing kit (Part No. HD-8983).
2. Install O-ring, thrust washer and bearing inner race onto rear camshaft as follows:
   a. To properly locate thrust washer (2), first install O-ring (1) in grinding relief groove. Groove is on the splined end between the machined area and the secondary cam sprocket. Exercise caution to avoid stretching or breaking the O-ring. Since the O-ring is not sold separately, damage will require purchase of a new roller bearing kit.

CAUTION

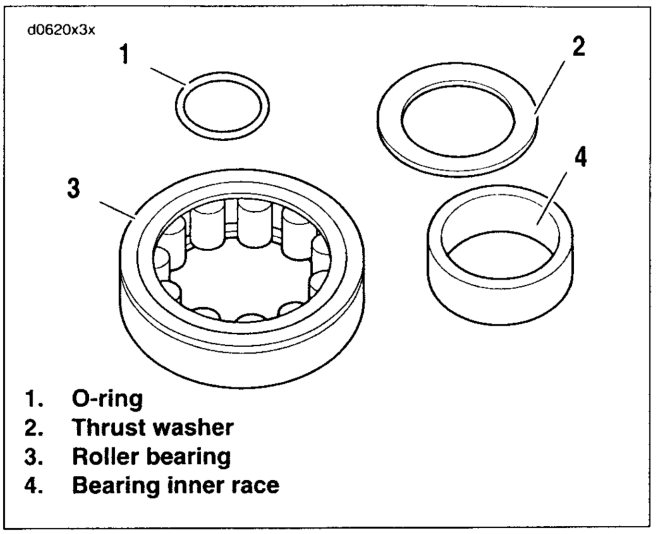
The thrust washer will be offset to one side if the O-ring is not installed in the grinding relief groove. Damage to the bearing cage can occur if the thrust washer is not properly centered.

   b. Slide thrust washer (2) down rear camshaft until centered over O-ring (1) in grinding relief groove.
   c. Slide bearing inner race (4) down rear camshaft until contact is made with shoulder of machined area.
   d. Install primary cam sprocket spacer and sprocket on camshaft and secure using thicker flat washer and long flange bolt.

NOTE

If not enough of the splined shaft is exposed to install the sprocket, leave out the spacer and proceed to step 2(e). Once the bearing inner race has been started onto the machined area, remove the flange bolt, washer and sprocket, and then reassemble using the spacer. Repeat step 2(e) to fully install bearing inner race.

   e. See B of Figure 3-134. Wrap a shop rag (4) around camshaft to get a firm grip and also to protect hand from sharp edges of sprocket. Using a 9/16 in. box wrench (5), turn flange bolt in a clockwise direction. Bearing inner race (2) is fully installed when it makes firm contact with the thrust washer (3).
   f. Verify that the thrust washer is locked in place and cannot be rotated. If necessary, install shaft in vise using brass jaw inserts, and further tighten flange bolt until the desired result is achieved.
   g. Remove flange bolt, flat washer, sprocket and spacer.



1. **O-ring**
2. **Thrust washer**
3. **Roller bearing**
4. **Bearing inner race**

Figure 3-135. Rear Cam Roller Bearing Kit

CAUTION

Always install new bearings. Only use genuine Harley-Davidson bearings. Reusing old bearings or using bearings from a supplier other than Harley-Davidson will result in engine damage.

3. Obtain the CAMSHAFT/CAMSHAFT BEARING REMOVER/INSTALLER (Part No. HD-43644).
4. With the secondary cam chain side facing upward, place cam support plate on support block, so that outer races of bearings are properly supported. Note that one corner of the support block is contoured to accommodate the chain guide blocks cast into the front of the support plate.
5. Center **new** bearing over bearing bore with the lettered side up. Slide pilot shaft of bearing driver through bearing into hole of support block.

NOTE

See Figure 3-136. Be aware that the front (2) and rear cam bearings (1) are not interchangeable. The rear bearing is the roller type, while the front is the ball bearing kind.

6. See top frame of Figure 3-138. Center bearing driver under ram of arbor press. Press on driver until bearing makes firm contact with counterbore in cam support plate. Repeat steps to install second bearing.

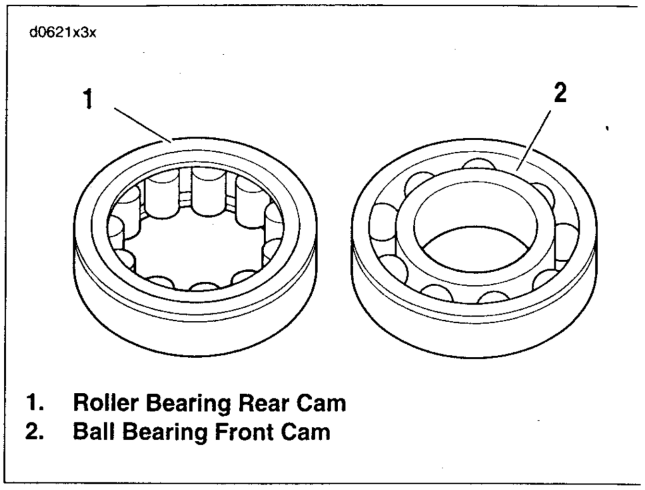
NOTE

Bearings may be a press to loose fit. If deemed necessary, clean bearing OD and apply Loctite Low Strength Threadlocker 242 (Blue) before installation, but exercise caution to avoid getting compound on rollers or bearing ID.

7. Apply a small dab of Loctite Medium Strength Thread locker 243 (blue) to threads of four bearing retainer plate screws. Using a T20 TORX drive head, secure bearing retainer plate to cam support plate. Tighten screws to 20-30 **in-lbs** (2.3-3.4 Nm) in a crosswise pattern. Verify that hole in retainer plate is properly aligned with secondary cam chain oiler.
8. Place cam support plate back on support block, if removed. Block properly supports inner races of bearings as camshafts are installed.
9. See Figure 3-137. Align pin stamped timing lines on teeth of secondary cam sprockets (outboard faces). Using a colored marker, carefully mark the timing line locations on the inboard side of the sprocket teeth. These marks are needed to observe proper orientation of the camshafts when they are pressed into the bearings.

NOTE

*If installing **new** camshafts, verify that the alpha character stamped on the outboard ends of the shafts correspond to the model being serviced (A= carbureted, B= fuel injected).*



1. **Roller Bearing Rear Cam**
2. **Ball Bearing Front Cam**

Figure 3-136. Cam Bearings

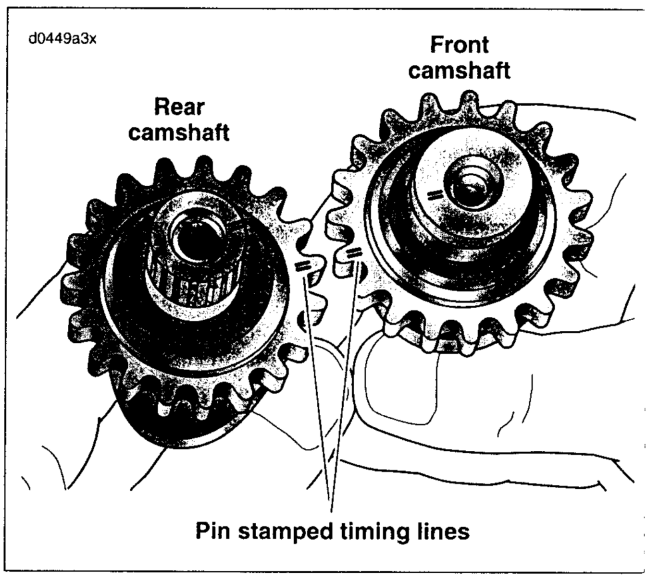


Figure 3-137. Camshaft Timing Lines

10. 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.

11. Orient the camshafts so that they are positioned on opposite ends of the chain, and then verify that the colored marks placed on the inboard side of the sprocket teeth are still in alignment.

12. Maintaining the position of the camshafts on the chain with the colored marks in alignment, place the sprocket ends of the camshafts into the bearings.

NOTE

Do not mix camshafts during the press procedure. The rear camshaft, which can be identified by the splined shaft, must go into the roller bearing at the rear of the cam support plate.

13. Place cup of camshaft driver over end of front camshaft **only**.

CAUTION

Verify that splined end of rear camshaft has been started into support block. Damage to the camshaft and/or support block can occur if end of camshaft catches top of block during the press procedure.

NOTE

To reduce the likelihood of such contact occuring, use 7/8 in. drill bit to enlarge rear cam bore in support block. For best results, radius top inside edge of bore after drilling.

CAUTION

Be sure that the tensioner shoe is clear of the secondary cam chain during the press procedure. Contact can result in damage that requires replacement of the tensioner assembly.

14. See center frame of Figure 3-138. Center end of front camshaft under ram and slowly apply pressure to driver just to **start** front camshaft into bearing ID.

CAUTION

If rear camshaft is not properly aligned, edge of installed inner race can catch on bearing rollers. Bearing damage can result if contact occurs during the press procedure.

15. See bottom frame of Figure 3-138. Slowly apply pressure to driver on front camshaft, while wiggling rear camshaft as necessary to guide inner race between bearing rollers.

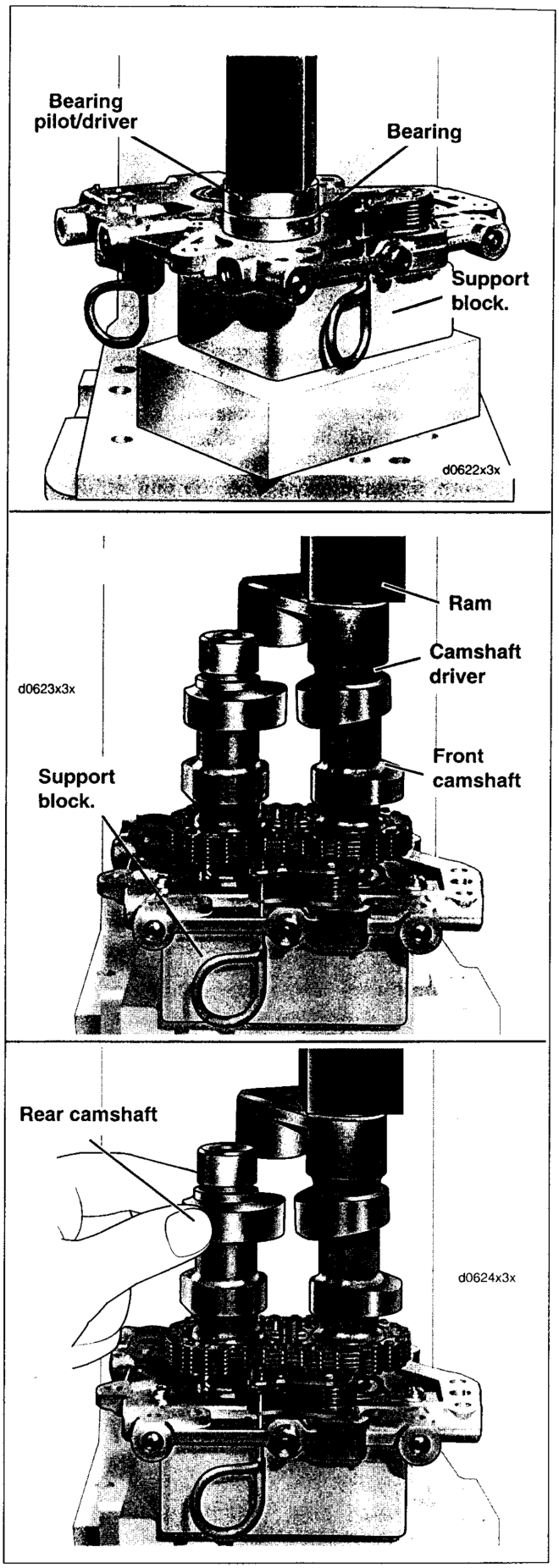


Figure 3-138. Install Cam Bearings/Camshafts

16. When inner race on rear cam is started into roller bearing, apply pressure to driver until front camshaft is fully seated. If necessary, keep finger pressure at top of rear camshaft to ensure that assembly remains square and inner race moves to installed position in roller bearing.

17. See Figure 3-139. Since the pin stamped timing lines on the secondary sprockets cannot be observed once the camshafts are pressed into the bearings, note that the outboard ends of the shafts have a second set of timing lines. Using a straightedge, verify that these timing lines are in alignment. If they are not, then the camshafts must be removed and reinstalled (with a new bearing set).

⚠WARNING

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage may propel the ring with enough force to cause eye injury.

18. With the sharp edge out, install **new** retaining ring in groove at end of front camshaft.

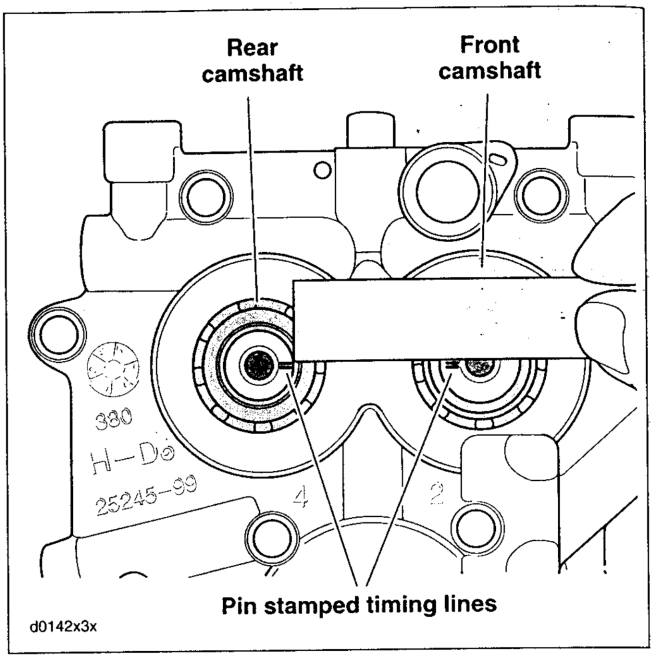


Figure 3-139. Verify Alignment of Punch Marks

CAM CHAIN TENSIONERS

Removal

PART NO.	SPECIALTY TOOL
HD-42313	Cam chain tensioner unloader

⚠CAUTION

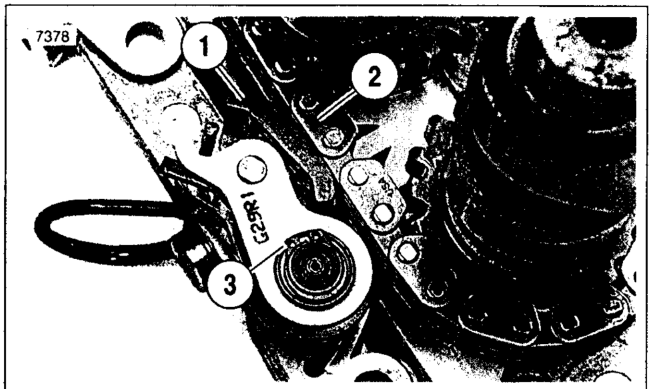
Do not pull the retention pins from the primary or secondary cam chain tensioners with the chains and sprockets removed. With 35-40 pounds of spring pressure behind the tensioner, allowing it to accelerate through its full length of travel will cause spring stretching and/or cracking of the tensioner shoe, damage which requires replacement of the assembly. Furthermore, if tensioner should contact fingers or other parts of the hand, minor or moderate injury may occur.

1. If retracted, hold the cam chain tensioner with the CAM CHAIN TENSIONER UNLOADER (Part No. HD-42313), pull the retention pin and ease the assembly into the unloaded position.

⚠WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

2. See Figure 3-140. Remove retaining ring (3) from groove in tensioner post. Discard retaining ring.
3. Slide cam chain tensioner assembly from post disengaging spring pin from hole in cam support plate. Inspect tensioner shoe (1) using information in Figure 3-141.



1. Tensioner shoe
2. Cam chain
3. Retaining ring

Figure 3-140. Cam Chain Tensioner

Installation

PART NO.	SPECIALTY TOOL
HD-42313	Cam chain tensioner unloader

1. See Figure 3-140. Slide cam chain tensioner assembly onto post inserting spring pin into hole in cam support plate.

⚠WARNING

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

2. With the sharp edge out, install **new** retaining ring (3) in groove of post. Verify that the ring is fully seated in the groove.
3. If retracted prior to disassembly, place cup of CAM CHAIN TENSIONER UNLOADER (Part No. HD-42313) over spring coil of cam chain tensioner assembly. Retract the tensioner inserting a retention pin through hole in boss on the primary cam chain side of cam support plate.

OIL PRESSURE RELIEF VALVE

Removal

1. Before removal, see CLEANING AND INSPECTION in this section.
2. Remove the primary cam chain tensioner assembly. See CAM CHAIN TENSIONERS earlier in this section.
3. 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.
4. See Figure 3-142. 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.
5. 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 3-142. 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.

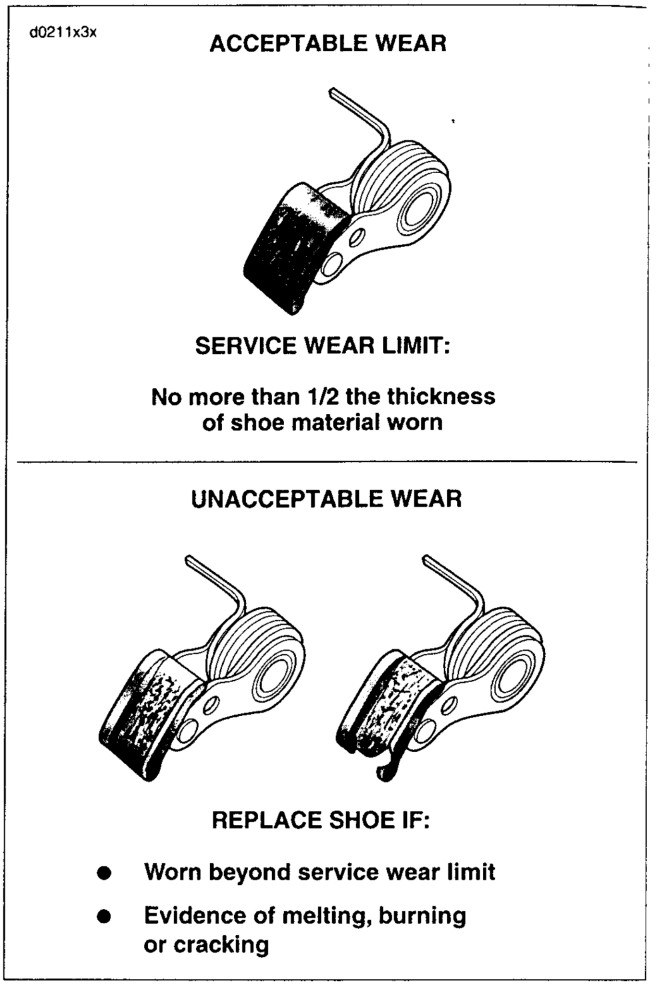
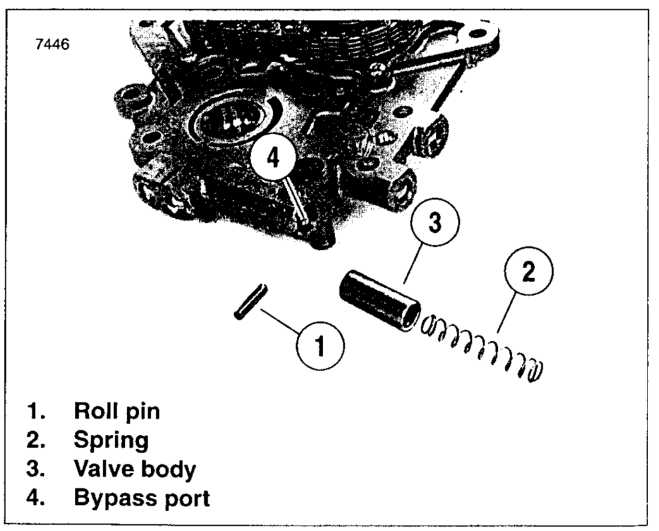


Figure 3-141. Cam Chain Tensioner Shoe Wear



1. **Roll pin**
2. **Spring**
3. **Valve body**
4. **Bypass port**

Figure 3-142. Oil Pressure Relief Valve Assembly

7. Using a 1/8 in. punch with a small hammer, carefully tap roll pin until flush with casting.
8. Install the primary cam chain tensioner assembly. See CAM CHAIN TENSIONERS earlier in this section.

CAM NEEDLE BEARINGS

Removal

PART NO.	SPECIALTY TOOL
HD-42325	Camshaft needle bearing remover/installer

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325).
2. See Figure 3-144. Remove four button fasteners (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 button fasteners 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.

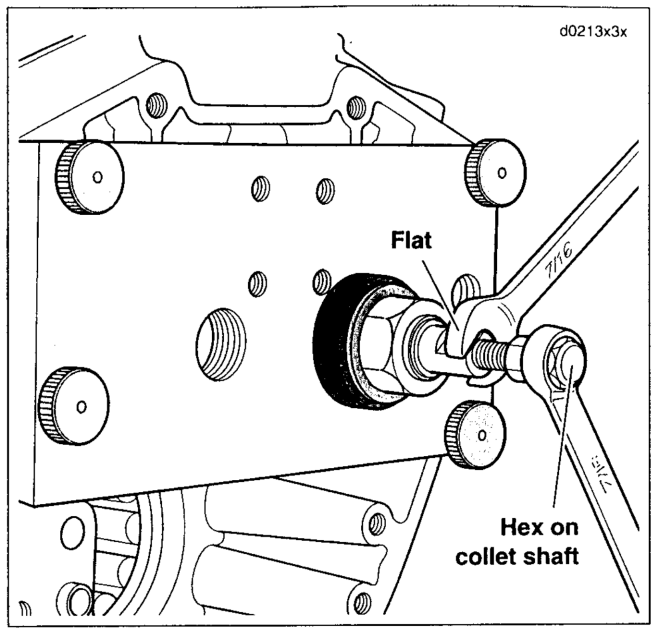
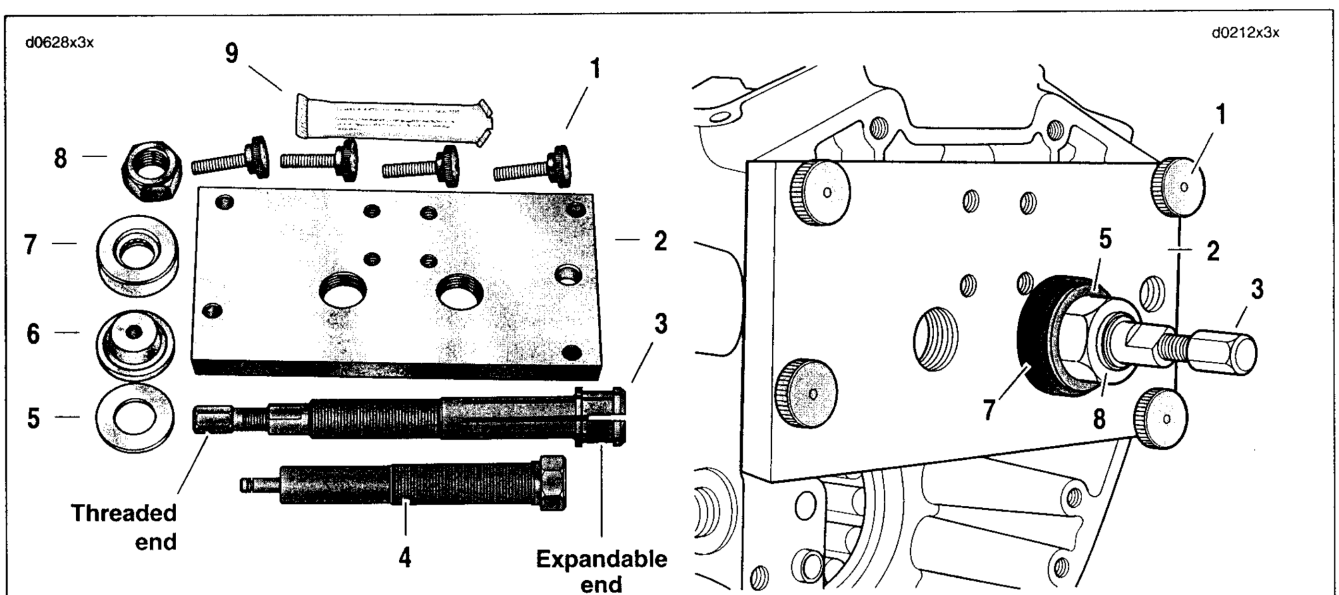


Figure 3-143. Expanding Collet By Turning Hex Clockwise

9. Holding collet to prevent lateral movement, finger tighten hex nut until Nice bearing contacts support plate.
10. See Figure 3-143. 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.



1. Button fastener
2. Support plate
3. Collet
4. Installer shaft
5. Flat washer
6. Pilot
7. Nice bearing
8. Hex nut
9. Graphite lubricant

Figure 3-144. Camshaft Needle Bearing Remover/Installer (Part No. HD-42325)

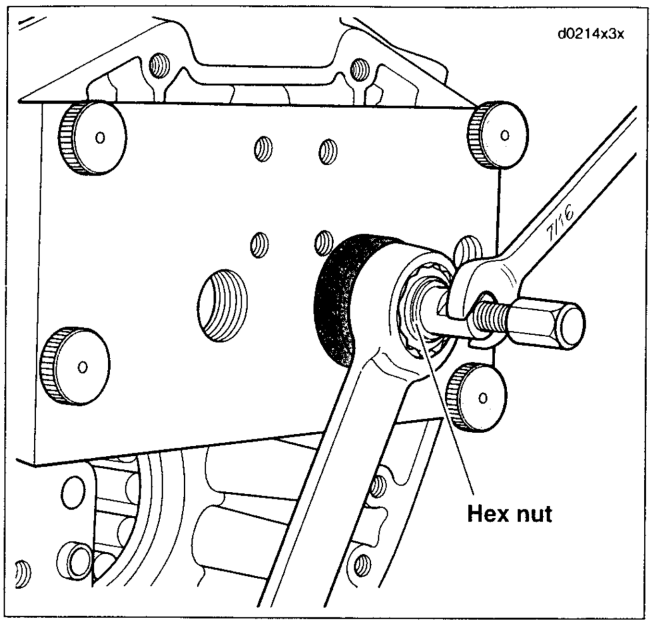


Figure 3-145. Turn Hex Nut Clockwise to Remove Bearing

11. See Figure 3-145. 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 button fasteners and pull support plate from crankcase.
13. Holding flat on collet, turn hex at end of shaft in a counterclockwise 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. Return to step 1 to remove second needle bearing.

Installation

PART NO.	SPECIALTY TOOL
HD-42325	Camshaft needle bearing remover/installer

1. Obtain the CAMSHAFT NEEDLE BEARING REMOVER/INSTALLER (Part No. HD-42325).
2. See Figure 3-144. Sparingly apply graphite lubricant (9) to threads of installer shaft (4) to prolong service life and ensure smooth operation.
3. Thread installer shaft into stamped side of support plate (2) until threads begin to emerge from opposite side.
4. Install pilot (6) at end of installer shaft.
5. Place **new** needle bearing on pilot with lettered side facing shoulder.
6. See Figure 3-146. Aligning two large holes in support plate with needle bearing bores, hang right side of plate on ring dowel in crankcase flange.
7. Align four holes at corners of support plate with threaded holes in crankcase flange. Install button fasteners in these holes to secure support plate to crankcase.

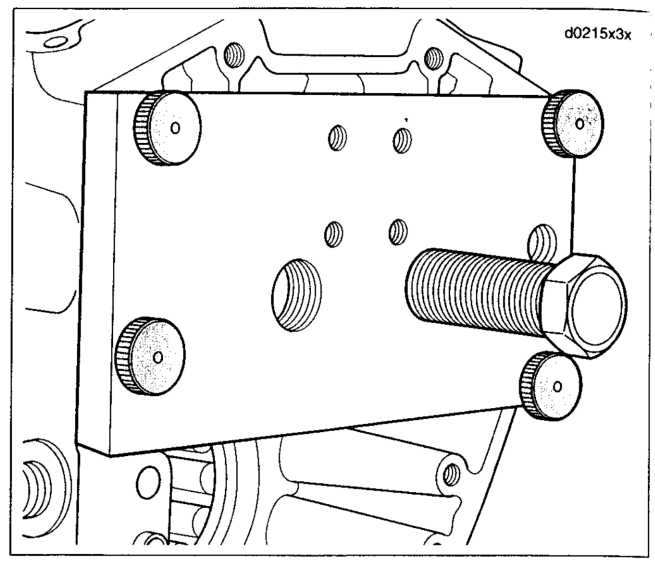


Figure 3-146. Installer Shaft Installation

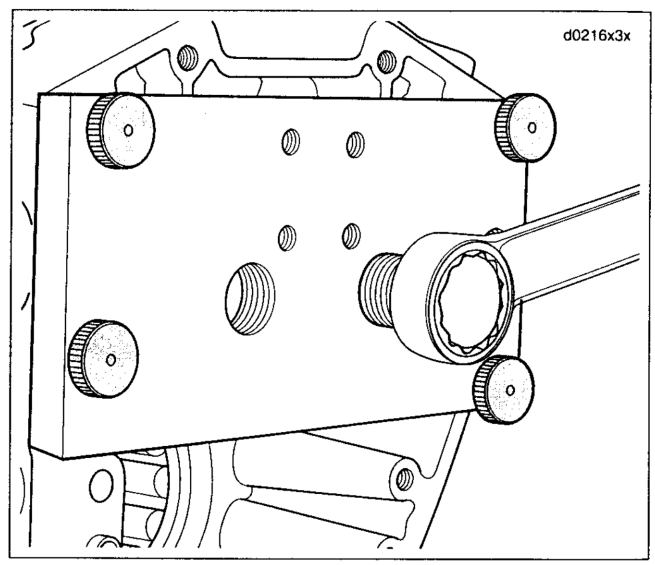


Figure 3-147. Turn Installer Shaft Clockwise to Install Bearing

8. See Figure 3-147. Using 15/16 in. open end wrench, turn hex at end of installer shaft in a clockwise direction until resistance is felt.
9. Turn end of installer shaft in a counterclockwise direction until pilot is free of needle bearing bore.
10. Remove four button fasteners and pull support plate and installer shaft from crankcase.
11. Remove pilot from installer shaft. Unthread installer shaft from support plate.
12. Return to step 1 to install second needle bearing.
13. Thread four button fasteners into threaded holes in support plate to prevent loss.

CLEANING AND INSPECTION

1. Inspect oil pressure relief valve as follows:

NOTE

If diagnosing low oil pressure, start with step 1(a). If diagnosing high oil pressure, then begin with step 1(b).

   a. 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 inches (57.15 mm). If it is not, continue with step 1(b).

   b. Remove oil pressure relief valve. See OIL PRESSURE RELIEF VALVE, REMOVAL, in this section.

   c. Inspect spring for stretching, kinking or distortion.

   d. 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.

   e. Install piston in bore and measure running clearance. If running clearance exceeds 0.003 inch (0.076 mm), install new piston and remeasure. Replace cam support plate if running clearance still exceeds specification.

2. Clean cam support plate as follows:

   a. See Figure 3-148. Using a small screwdriver, carefully pry cleaning plug (1) from top of cam support plate.

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

   b. Thoroughly flush cam support plate with a non-volatile cleaning solution or solvent. Blow parts dry with low pressure compressed air.

   c. Reinstall cleaning plug replacing O-ring (2) if damaged or deteriorated.

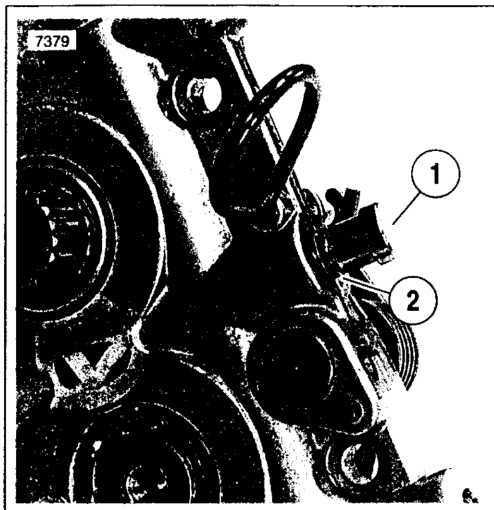
CAUTION

Exercise caution to avoid enlarging the oil holes or oil pressure will be adversely affected.

   d. Verify that all oil holes are clean and open.

INSTALLATION OVERVIEW

1. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY. Begin with COVER AND CAM SUPPORT PLATE instructions on page 3-49.
2. Continue with 3.17 TOP END OVERHAUL: ASSEMBLY.



1. Cleaning plug
2. O-ring

Figure 3-148. Remove Cleaning Plug

REMOVAL OVERVIEW

1. See 3.16 TOP END OVERHAUL: DISASSEMBLY.
   a. Remove breather assembly.
   b. Remove rocker arm support plate.
   c. Remove push rods and push rod covers. Do not remove lifters or lifter covers.
2. See 3.27 COVER AND CAM SUPPORT PLATE. Fashion lifter holding tool to prevent the hydraulic lifters from dropping into the cam compartment during cam support plate removal.
3. See beginning of 3.18 BOTTOM END OVERHAUL: DISASSEMBLY to remove cover and cam support plate. Remove oil pump after removing cam support plate.

CLEANING AND INSPECTION

1. Clean all parts in a non-volatile cleaning solution or solvent.

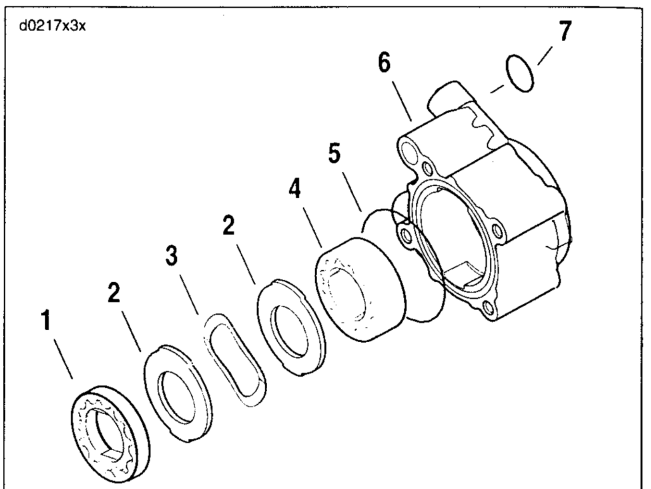
⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

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 3-150. 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 inch (0.025 mm). Inspect second gerotor set in the same manner.
8. Assemble the oil pump. Verify that feed gerotors stand proud of the oil pump surface 0.080-0.090 inch (2.03-2.29 mm). If measurement is less than 0.080 inch (2.03 mm), remove feed gerotor set and reassemble using **new** wave washer. Repeat measurement and replace oil pump body if still not within specification.

INSTALLATION OVERVIEW

1. See 3.19 BOTTOM END OVERHAUL: ASSEMBLY. Begin with COVER AND CAM SUPPORT PLATE instructions on page 3-49.
2. Continue with 3.17 TOP END OVERHAUL: ASSEMBLY.



1. **Narrow gerotor set (feed)**
2. **Separator plate**
3. **Wave washer**
4. **Wide gerotor set (scavenge)**
5. **Outer body O-ring**
6. **Oil pump housing**
7. **Scavenge port O-ring**

Figure 3-149. Assembling Oil Pump

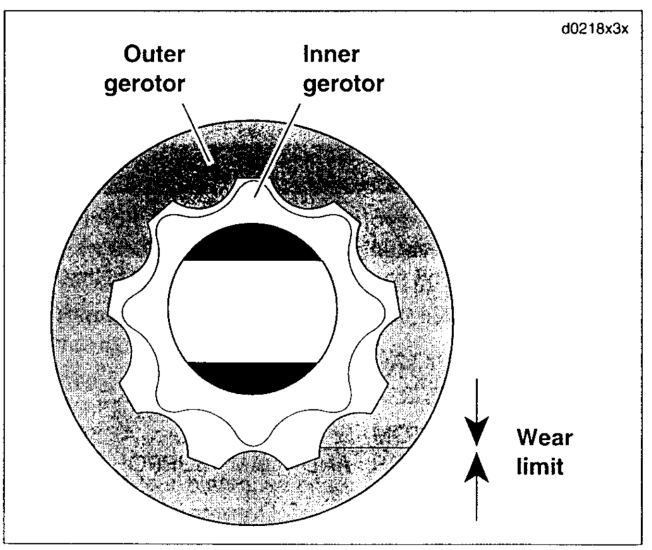


Figure 3-150. Measure Gerotor Sets for Wear

REMOVAL

1. To catch any oil that may drain out of the engine, place a suitable container under the vehicle, directly under the oil filter mount on the front of the engine. See Figure 3-151.

CAUTION

See Figure 3-152. Use OIL FILTER WRENCH (Part No. HD-42311 or HD-44067) for filter removal. This tool can prevent damage to crankshaft position sensor and/or sensor cable.

2. See Figure 3-151. Remove oil filter (5) using OIL FILTER WRENCH (Part No. HD-42311 or HD-44067). Discard oil filter.
3. Remove oil filter adapter (4).
4. Bend tabs on lockplate (7) away from two hex screw heads. Remove three screws (6) securing oil filter mount to engine crankcase. Remove lockplate, washers (8) and oil filter mount.
5. Remove and discard two o-rings (2).

INSTALLATION

1. See Figure 3-151. Clean oil filter mount (3) and oil filter adapter (4) in a non-volatile cleaning solution or solvent. Clean the oil filter mount flange of any old gasket material. Remove any thread locking adhesive material from the threads of the oil filter adapter.
2. Coat threads of three filter mount screws (6) with LOCTITE THREADLOCKER 243 (blue). Install filter mount with two **new** o-rings (2) and **new** lockplate (7) to crankcase with three screws and washers (8). Tighten screws to 130-150 **in-lbs** (14.7-16.9 Nm).
3. Bend up corners of lockplate against flats of top and bottom oil mount screws.
4. Coat the threads on one end of the oil filter adapter (4) with LOCTITE THREADLOCKER 243 (blue).

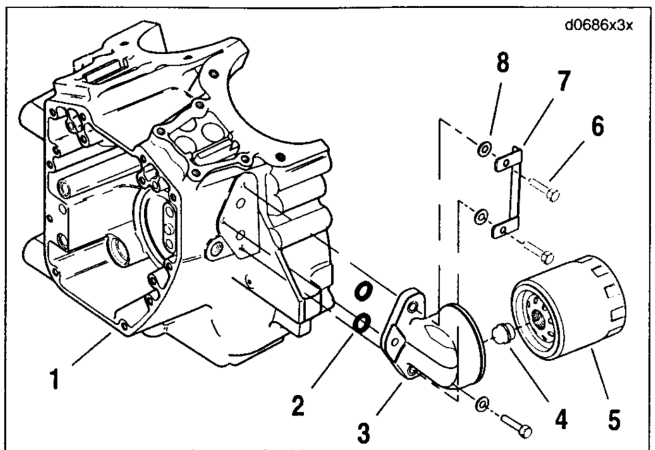
NOTE

Apply LOCTITE THREADLOCKER 243 only to the threads on one end of the oil filter adapter. This end will be installed into the oil filter mount. Do NOT coat the threads on the other end of the oil filter adapter.

5. Install LOCTITE coated end of oil filter adapter into oil filter mount. Tighten to 12-16 ft-lbs (16.3-21.7 Nm).
6. See Figure 3-153. Lubricate gasket on **new** oil filter with clean engine oil and install oil filter onto oil filter mount. Hand tighten oil filter 1/2 to 3/4 turn after gasket contacts oil filter mount surface.

NOTE

Start and run vehicle to fill oil filter with oil. Then, check and replenish engine oil. See CHECKING AND ADDING OIL, Checking With Warm Engine under 1.4 ENGINE OIL AND FILTER.



1. **Right crankcase half**
2. **O-ring (2)**
3. **Oil filter mount**
4. **Oil filter adapter @ 12-16 ft-lbs (16.3-21.7 Nm)**
5. **Oil filter**
6. **Screw (3) @ 130-150 in-lbs (14.7-16.9 Nm)**
7. **Lockplate**
8. **Washer (3)**

Figure 3-151. Oil Filter Mount Assembly

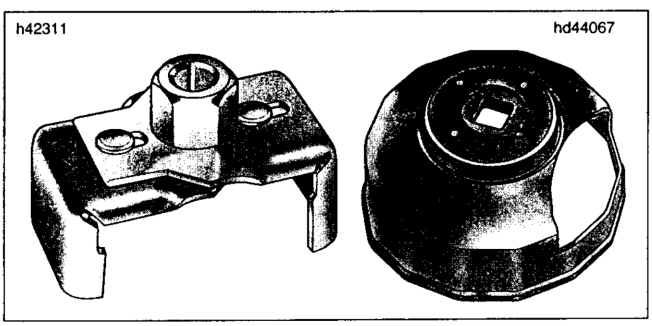


Figure 3-152. Oil Filter Wrench Part No. HD-42311 (left), HD-44067 (right)

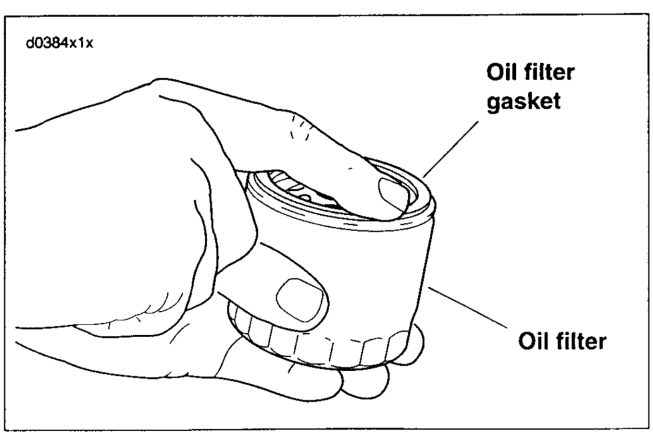


Figure 3-153. Lubricating New Oil Filter

REMOVAL OVERVIEW

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.

RIGHT CRANKCASE HALF

Crankshaft (Roller) Bearing

REMOVAL

PART NO.	SPECIALTY TOOL
B-45655	Crankshaft (roller) bearing REMOVAL/INSTALL pilot/driver
HD-42720-5	Crankshaft (roller) bearing REMOVAL/INSTALL support tube

⚠WARNING

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. Dropping the crankcase will result in parts damage and could result in death or serious injury.

1. See Figure 3-154. 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. Place support tube (2) 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.
3. With the outboard side of the right crankcase half facing upward, position crankshaft bearing bore over support tube.
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 half, pilot/driver and bearing from support tube. Discard bearing.

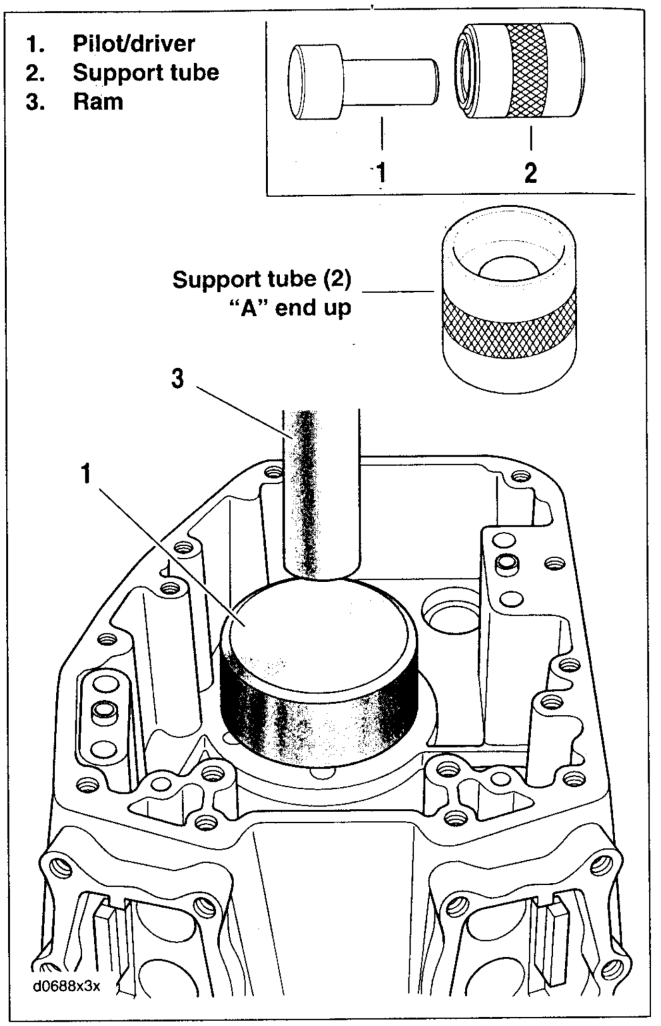


Figure 3-154. Crankshaft (Roller) Bearing Installation

INSTALLATION

PART NO.	SPECIALTY TOOL
B-45655	Crankshaft (roller) bearing REMOVAL/INSTALL pilot/driver
HD-42720-5	Crankshaft (roller) bearing REMOVAL/INSTALL support tube

1. See Figure 3-155. 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.

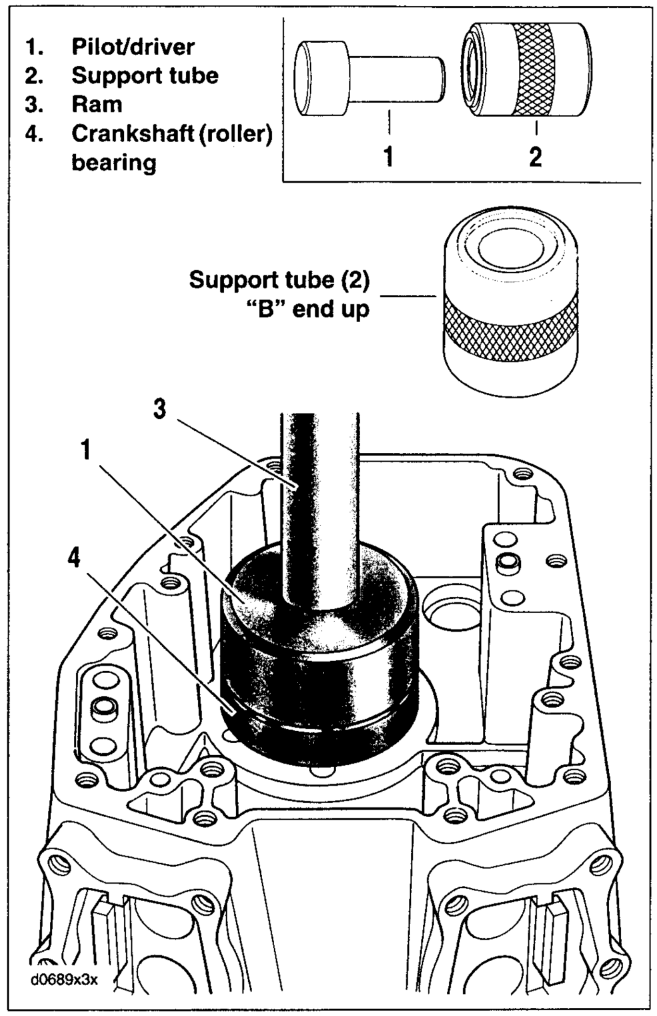


Figure 3-155. Crankshaft (Roller) Bearing Installation

Piston Jets

REMOVAL

1. See Figure 3-156. 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.

INSTALLATION

CAUTION

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 3-156. 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).

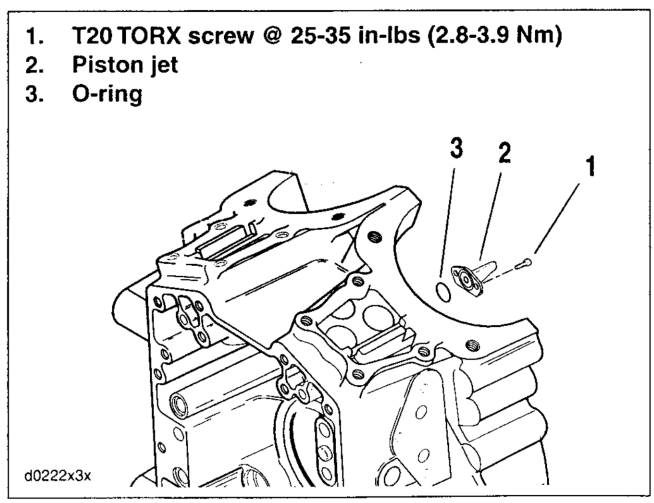


Figure 3-156. Piston Jets

NOTE

If piston jet is being reused, apply LOCTITE THREADLOCKER 222 (purple) to threads of TORX screws before installation.

Crankshaft (Roller) Bearing

REMOVAL

PART NO.	SPECIALTY TOOL
B-45655	Crankshaft (roller) bearing REMOVAL/INSTALL pilot/driver
HD-42720-5	Crankshaft (roller) bearing REMOVAL/INSTALL support tube

⚠WARNING

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. Dropping the crankcase will result in parts damage and could result in death or serious injury.

⚠WARNING

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, resulting in parts damage and could result in death or serious injury.

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 3-157. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-47270-5) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. B-45655).
5. Place support tube on work bench with "A" 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 3-158. 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 3-159. 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.

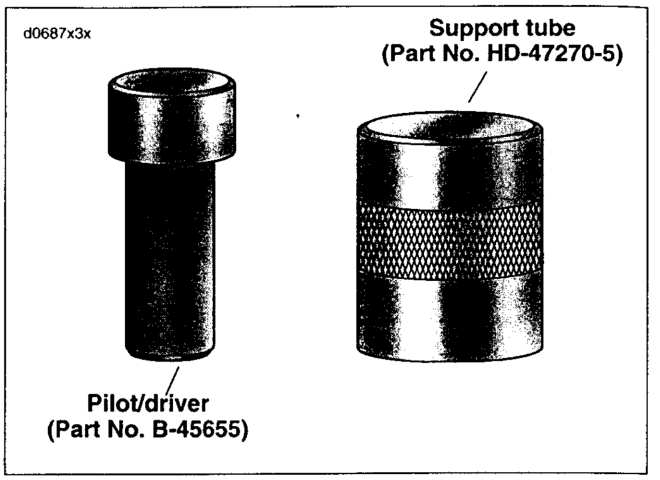
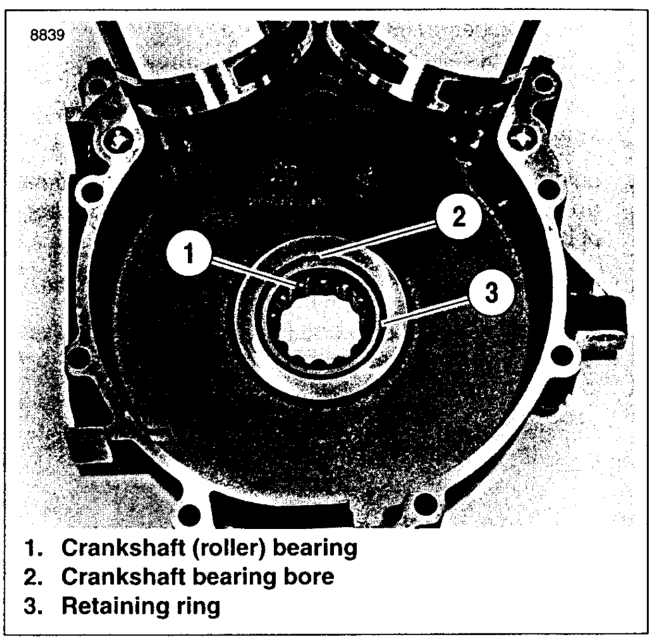


Figure 3-157. Left Crankshaft (Roller) Bearing REMOVAL/INSTALL Tools



1. **Crankshaft (roller) bearing**
2. **Crankshaft bearing bore**
3. **Retaining ring**

Figure 3-158. Left Crankshaft (Roller) Bearing Assembly

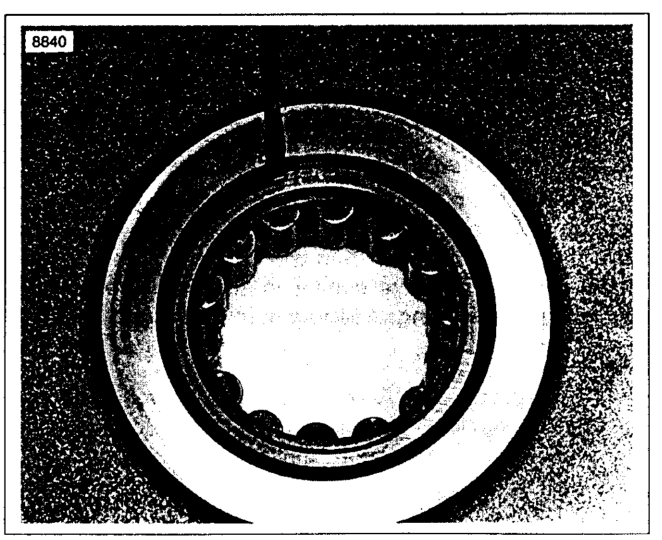


Figure 3-159. Removing Retaining Ring

8. See Figure 3-160. 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 indicate 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.

INSTALLATION

PART NO.	SPECIALTY TOOL
B-45655	Crankshaft (roller) bearing REMOVAL/INSTALL pilot/driver
HD-42720-5	Crankshaft (roller) bearing REMOVAL/INSTALL support tube

⚠WARNING

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. Dropping the crankcase will result in parts damage and could result in death or serious injury.

1. See Figure 3-157. Obtain CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL SUPPORT TUBE (Part No. HD-47270-5) and CRANKSHAFT (ROLLER) BEARING REMOVAL/INSTALL PILOT/DRIVER (Part No. B-45655).

2. See Figure 3-161. Obtain **new** crankshaft (roller) bearing (3). Spread a thin film of clean engine oil on O.D. of **new** bearing.

3. Place support tube (3) on hydraulic press table with the "A" end up.

4. With the inboard side of the left crankcase half facing upward, position crankshaft bearing bore over support tube.

5. Lubricate leading edge (side opposite letter side) of **new** crankshaft (roller) bearing with clean engine oil. Start leading edge of bearing in bearing bore.

6. Slide pilot/driver (2) through bearing into support tube.

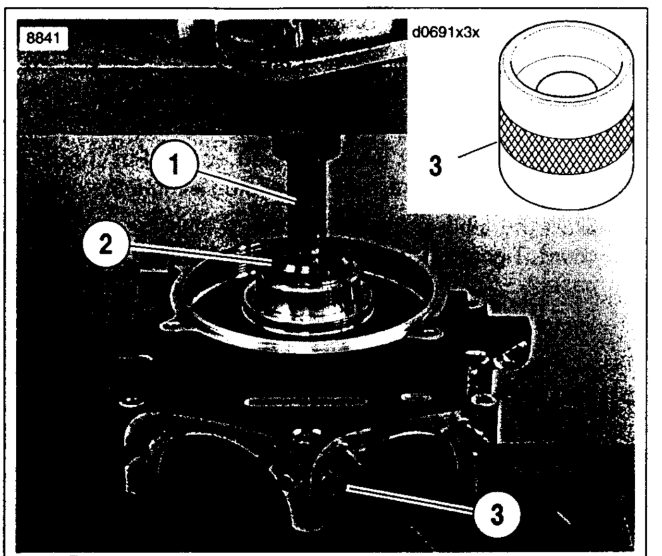
7. Center pilot/driver (2) under ram (1) of press. Apply pressure to pilot/driver until bearing is lightly bottomed in crankshaft bearing bore.

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.

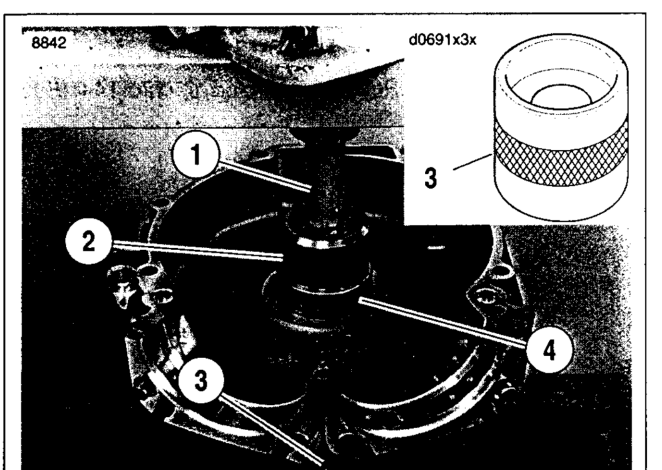
NOTE

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.



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**

Figure 3-160. Left Crankshaft (Roller) Bearing Removal



1. **Ram**
2. **Pilot/driver**
3. **Support tube ("A" end up)**
4. **Crankshaft (roller) bearing**

Figure 3-161. Left Crankshaft (Roller) Bearing Installation

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 120 **in-lbs** (13.6 Nm).

PIPE PLUG AND OIL FITTINGS

Removal

1. See Figure 3-162. Turn hex on oil fittings (1, 2) in a counterclockwise direction until free.
2. Turn pipe plug (3) counterclockwise until free.

Installation

1. Apply LOCTITE PIPE SEALANT 565 to threads.
2. Turn hex on oil fittings in a clockwise direction until snug. Tighten to 120-168 **in-lbs** (13.6-18.9 Nm).
3. Install pipe plug. Tighten pipe plug to 120-144 **in-lbs** (13.6-16.3 Nm).

1. Oil outlet fitting
2. Oil inlet fitting
3. Pipe plug

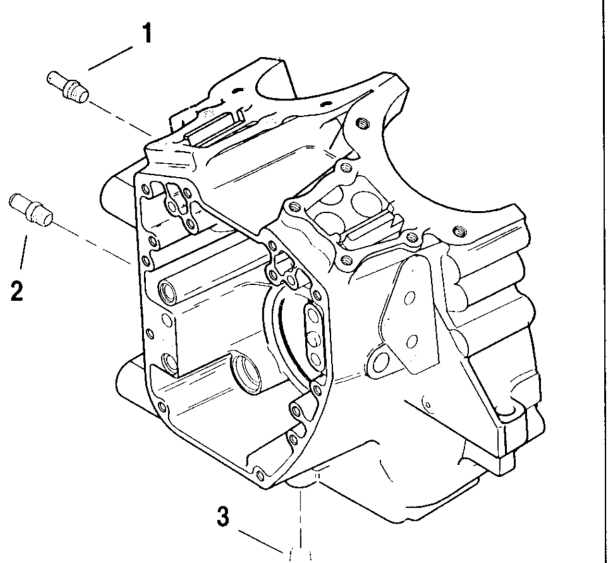


Figure 3-162. Oil Fittings and Pipe Plugs

CLEANING AND INSPECTION

1. Scrape old gasket material from the crankcase flanges. Old gasket material left on mating surfaces will cause leaks.
2. Clean all parts in a non-volatile cleaning solution or solvent.

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

3. Blow parts dry with low pressure compressed air.
4. Verify that all oil holes and passageways are clean and open.
5. Check ring dowels for looseness, wear or damage. Replace as necessary.
6. Use a file to carefully remove any nicks or burrs from machined surfaces.
7. Clean out tapped holes and clean up damaged threads.
8. Check the top of the crankcase for flatness with a straightedge and feeler gauge. Replace if warped.
9. Spray all machined surfaces with clean engine oil.

INSTALLATION OVERVIEW

1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL OVERVIEW

1. Perform all steps under 3.16 TOP END OVERHAUL: DISASSEMBLY.
2. Perform all steps under 3.18 BOTTOM END OVERHAUL: DISASSEMBLY.
3. Remove sprocket shaft (Timken) bearing. See CYLINDER STUDS on page 3-108.

INSPECTION

CAUTION

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. The crankshaft (roller) bearing inner races are burnelled, burnt, scored, blued or damaged.

NOTE

Bluing on connecting rods is part of the induction hardening process and is considered a normal condition.

2. Check connecting rod bearing clearance. Orient the assembly as shown in Figure 3-163.
   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 3-164. 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 or connecting rods need to be replaced, then they must be replaced together as one assembly. Return the flywheel/connecting rod assembly to the factory for service or replacement.

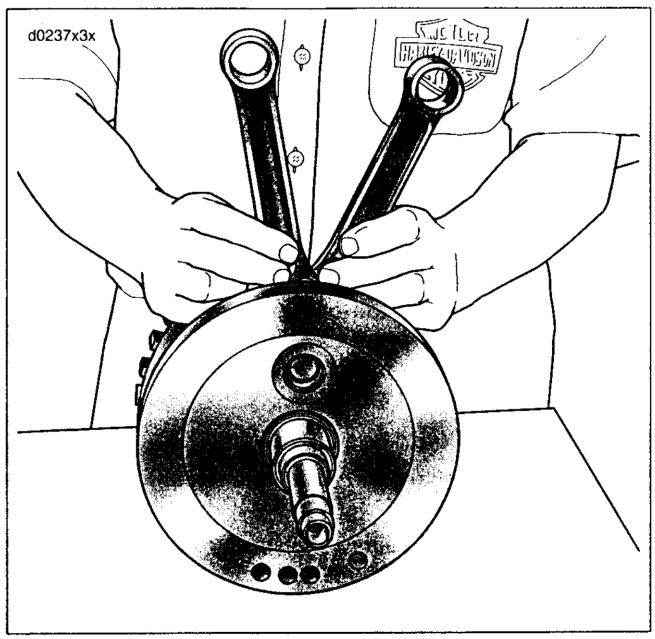


Figure 3-163. Connecting Rod Bearing Clearance

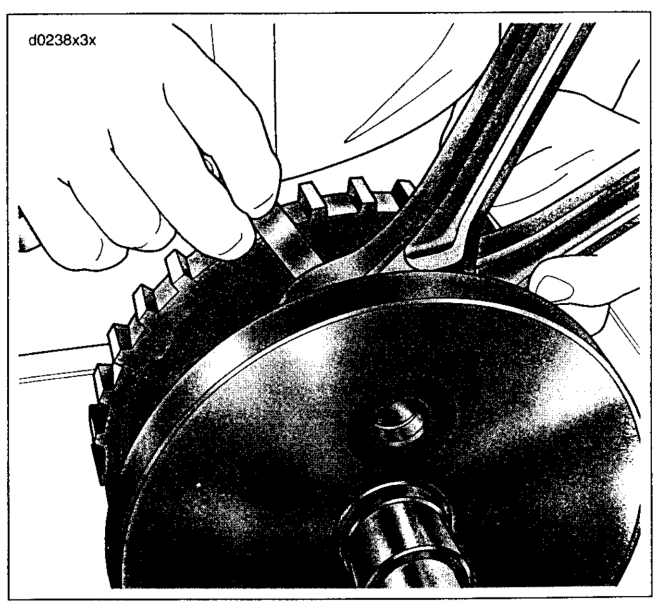


Figure 3-164. Connecting Rod Side Play

INSTALLATION OVERVIEW

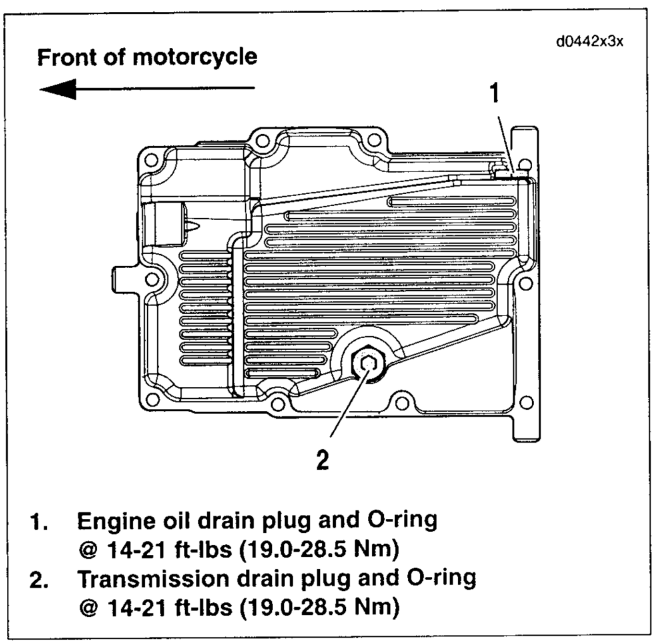
1. Perform all steps under 3.19 BOTTOM END OVERHAUL: ASSEMBLY.
2. Perform all steps under 3.17 TOP END OVERHAUL: ASSEMBLY.

REMOVAL

CAUTION

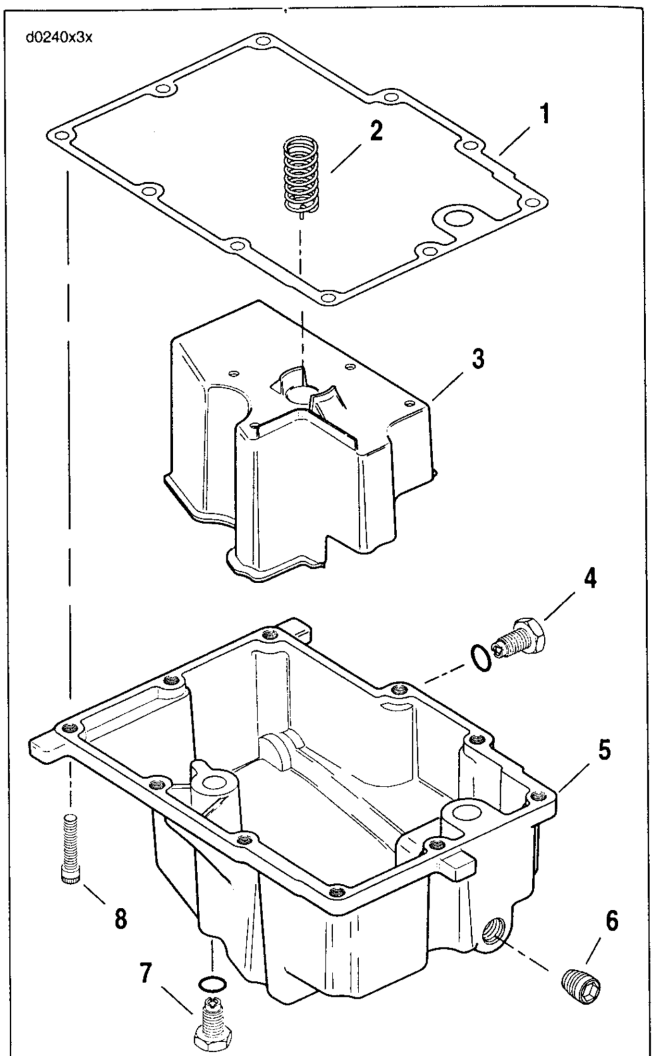
The oil pan extends below the lowest portion of the frame. Any jacking up of motorcycle with anything other than a suitable lift will apply pressure directly to the oil pan and may damage it unless measures are taken to distribute the pressure (such as a block of wood placed between the jack and the oil pan). A suitable lift which applies pressure at the tires is the only recommended method for raising the motorcycle. Failure to comply may result in damage to oil pan.

1. Position motorcycle on a suitable lift.
2. See Figure 3-165. Drain fluids from oil pan.
   a. Remove engine oil drain plug (1), fill plug/dipstick and oil filter. Drain oil into suitable container. See 1.4 ENGINE OIL AND FILTER.
   b. Remove transmission drain plug (2). Drain transmission fluid into suitable container. See 1.13 TRANSMISSION LUBRICANT.
3. See Figure 3-166. 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. **Engine oil drain plug and O-ring @ 14-21 ft-lbs (19.0-28.5 Nm)**
2. **Transmission drain plug and O-ring @ 14-21 ft-lbs (19.0-28.5 Nm)**

Figure 3-165. Drain Plugs



1. **Gasket**
2. **Spring**
3. **Baffle assembly**
4. **Engine oil drain plug and O-ring @ 14-21 ft-lbs (19.0-28.5 Nm)**
5. **Oil pan**
6. **Pipe plug**
7. **Transmission drain plug and O-ring @ 14-21 ft-lbs (19.0-28.5 Nm)**
8. **Screw (10) @ 84-108 in-lbs (9.5-12.2 Nm)**

Figure 3-166. Dyna Glide Oil Tank

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 3-166. 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 3-167.
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 1.13 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.

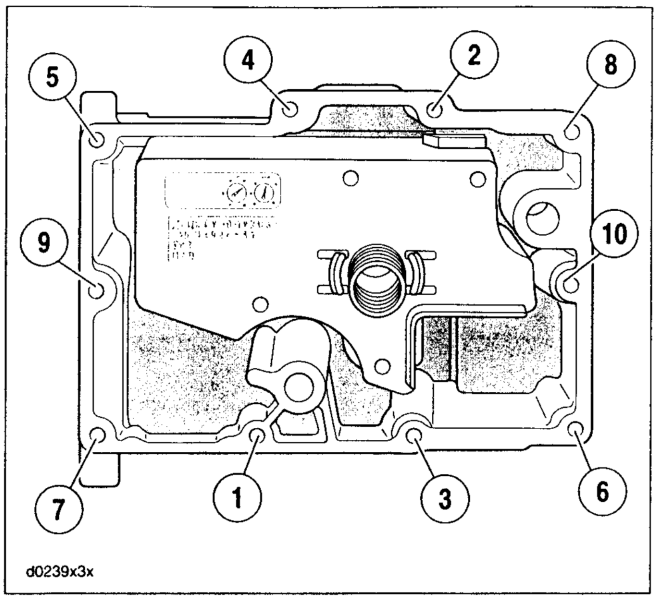


Figure 3-167. Oil Pan Torque Sequence

NOTES

FUEL SYSTEM 4

SUBJECT	PAGE NO.
4.1 Specifications	4-1
4.2 Fuel System Troubleshooting	4-2
4.3 Enrichener	4-5
4.4 Carburetor	4-6
4.5 Carburetor Adjustments	4-11
4.6 Fuel Supply Valve	4-15
4.7 Fuel Tank	4-17
4.8 Air Cleaner	4-19
4.9 Exhaust System	4-21
4.10 Evaporative Emissions Control: CA Models	4-23

FUEL TANK CAPACITY	FXD/FXDL/ FXDX/FXDXT	FXDWG
Total (gallons)	4.9	5.2
Total (liters)	18.5	19.7
Reserve (gallons)	0.9	1.1
Reserve (liters)	3.4	4.2

CARBURETOR	MAIN JET	SLOW JET
49 State	190	45
California models	190	45
HDI models	190	45

TORQUE VALUES

ITEM	TORQUE		NOTES
Air cleaner cover screw	36-60 in-lbs	4.1-6.8 Nm	LOCTITE THREADLOCKER 243 (blue), page 4-19
Air filter bracket screws	20-40 in-lbs	2.3-4.5 Nm	T27 TORX, page 4-19
Breather bolts	120-144 in-lbs	13.6-16.2 Nm	Metric, page 4-19
Exhaust flange nuts	See NOTES	See NOTES	Special means to tighten, page 4-21
Front exhaust bracket screw	90-120 in-lbs	10.2-13.5 Nm	page 4-22
Fuel tank mounting bolts	120-216 in-lbs	13.6-24.4 Nm	Front and rear, page 4-18
Intake manifold mounting screws	96-144 in-lbs	10.9-16.3 Nm	Page 4-10
Muffler clamp nuts	45-60 ft-lbs	61.0-81.3 Nm	Page 4-21

CARBURETOR

Table 4-1. Overflow Troubleshooting

CHECK FOR	REMEDY
Damaged or restricted fuel tank venting system.	Repair damage. Correct restricted hose. Replace vapor valve.
Loose float bowl screws.	Tighten screws.
Damaged float bowl O-ring.	Replace O-ring.
Improper fuel level in float bowl.	Adjust float tab for correct fuel level.
Damaged or leaking float assembly.	Replace float assembly.
Particle contamination in inlet fitting cavity.	Clean and clear cavity and fuel supply tract.
Worn or dirty inlet valve or seat.	Clean or replace valve and clean seat.

Table 4-2. Poor Idling

CHECK FOR	REMEDY
Idle speed improperly adjusted.	Adjust operating idle speed.
Inlet system air leak (faster idling).	Correct as required.
Loose low speed jet.	Tighten jet.
Contaminated or plugged low speed system.	Clean contaminants and clear passages.
Enrichener valve not seated or leaking.	Adjust, clean or replace.
Leaking accelerator pump.	Repair.

Table 4-3. Poor Fuel Economy

CHECK FOR	REMEDY
High speed riding style.	Modify riding habits.
Excessive enrichener use.	Instruct rider to limit enrichener use.
Fuel level too high.	Adjust float level.
Restricted fuel tank vent system.	Correct restricted hose. Replace vapor valve.
Dirty air cleaner element (may also affect idle speed).	Clean or replace as required.
Excessive accelerator pump output.	Replace accelerator pump nozzle. Check and clean accelerator pump bypass orifice.
Plugged or restricted bowl vent.	Clean and clear passages.
Vacuum piston assembly malfunction.	See VACUUM PISTON ASSEMBLY on page 4-4.
Loose jets.	Tighten jets.
Worn or damaged needle or needle jet.	Replace needle or needle jet.
Plugged air jets or passages.	Clean and clear passages.
Enrichener valve not seated or leaking.	Adjust, clean or replace.
Idle speed improperly adjusted.	Adjust operating idle speed.

Table 4-4. Poor Acceleration

CHECK FOR	REMEDY
Throttle cables misadjusted or misrouted (may also affect idle speed).	Adjust throttle cables.
Inlet system air leak.	Correct as required.
Damaged or restricted fuel tank venting system.	Repair damage. Correct restricted hose. Replace vapor valve.
Restricted fuel supply passages.	Correct and clear restriction.
Plugged bowl vent or overflow.	Clean and clear passages.
Enrichener valve not seated or leaking.	Adjust, clean or replace.
Worn or damaged needle or needle jet.	Replace assembly.
Vacuum piston malfunction.	See VACUUM PISTON ASSEMBLY on page 4-4.
Plugged jets or passages.	Clean and clear as required.
Fuel level (float chamber) too low.	Adjust float level.
Accelerator pump leaking or no output.	Repair as necessary.

Table 4-5. Hard Starting

CHECK FOR	REMEDY
Enrichener system plugged, not properly functioning or improperly operated.	Clean, adjust, replace or read Owner's Manual.
Inlet system air leak.	Correct as required.
Restricted fuel supply.	Correct fuel supply and/or passages. Verify that vacuum operated fuel valve is functional.
Fuel overflow.	See Table 4-1. Overflow Troubleshooting
Plugged slow jet or passages.	Clean and clear jet or passages.

Table 4-6. Poor Performance On Road

CHECK FOR	REMEDY
Inlet system air leak.	Correct as required.
Damaged or restricted fuel tank venting system.	Repair damage. Correct restricted hose. Replace vapor valve.
Dirty or damaged air cleaner element.	Clean or replace.
Accelerator pump inoperative.	Repair as required.
Plugged bowl vent or overflow.	Clean and clear passages.
Vacuum piston assembly malfunction.	See VACUUM PISTON ASSEMBLY on page 4-4.
Loose or plugged fuel and air jets or passages.	Clean, clear and correct as required.
Worn or damaged needle or needle jet.	Replace assembly.
Restricted fuel supply tract.	Correct and clear restriction.
Enrichener valve not seated or leaking.	Adjust, clean or replace.
Idle speed improperly adjusted.	Adjust operating idle speed.

Table 4-7. Poor High Speed Performance

CHECK FOR	REMEDY
Inlet system air leak.	Clean or replace.
Enrichener valve not seated or leaking.	Adjust, clean or replace.
Damaged or restricted fuel tank venting system.	Repair damage. Correct restricted hose. Replace vapor valve.
Dirty or damaged air cleaner element.	Clean or replace.
Accelerator pump inoperative.	Repair as required.
Plugged bowl vent or overflow.	Clean and clear passages.
Vacuum piston assembly malfunction.	See VACUUM PISTON ASSEMBLY below.
Restricted fuel supply tract.	Correct and clear restriction.
Loose or plugged main jets or passages.	Tighten, clean, clear as required.
Improper fuel level.	Adjust float level.
Worn or damaged needle or needle jet.	Replace assembly.

VACUUM PISTON ASSEMBLY

Table 4-8. Piston Does Not Raise Properly

CHECK FOR	REMEDY
Diaphragm cap loose, damaged or leaking.	Tighten or replace cap.
Diaphragm pinched at lip groove.	Reposition diaphragm lip.
Piston atmosphere vent blocked.	Clear vent.
Piston vacuum passage plugged.	Clean and clear passage.
Torn diaphragm.	Replace piston diaphragm assembly.
Piston binding.	Clean piston slides and body or replace piston.
Spring binding.	Correct or replace spring.
Enrichener valve open, not seated or leaking.	Adjust, clean or replace.

Table 4-9. Piston Does Not Close Properly

CHECK FOR	REMEDY
Piston diaphragm ring dirty or damaged.	Clean or replace piston.
Piston binding.	Clean piston slides and body or replace piston.
Spring damaged.	Replace spring.

ENRICHENER

GENERAL

CAUTION

You must pay close attention to warm-up time. Either excessive or insufficient use of the enrichener may cause poor performance, erratic idle, poor fuel economy and spark plug fouling.

The enrichener knob, labeled CHOKE, and located under the left side fuel tank, controls the opening and closing of the enrichener circuit in the carburetor. The enrichener knob can be adjusted to any position, from full-in to full-out.

See 1.22 THROTTLE CABLES AND ENRICHENER for more information.

NOTE

The following starting and operating instructions for all Harley-Davidson motorcycles are recommendations. They may be modified for individual vehicles.

OPERATION

Cool Engine

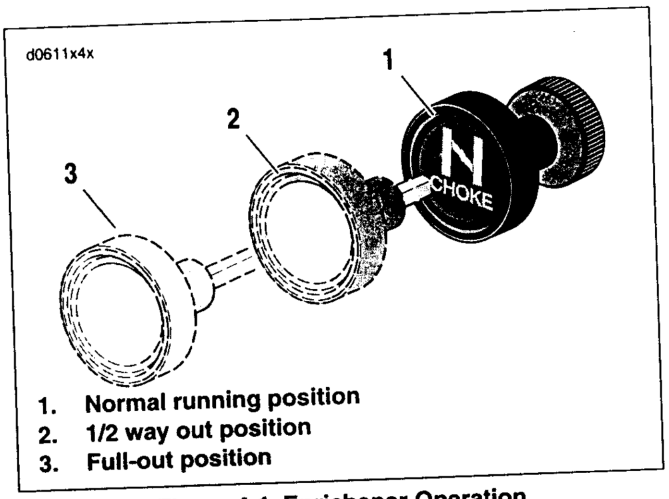
Outside Temperature Less than 60° F (15.6° C)

See Figure 4-1. **BE SURE THROTTLE IS CLOSED.** Pull enrichener knob to full-out position (3). Turn the ignition switch ON and press starter switch to operate the electric starter.

1. After initial 15-30 second warm-up, ride for 3 minutes or 2 miles (3.2 km) with the enrichener knob in full-out position (3).
2. After 3 minutes or 2 miles (3.2 km), push the enrichener knob in to the 1/2 way position (2). Ride 2 minutes or 2 miles (3.2 km).
3. After 2 minutes or 2 miles (3.2 km), push the enrichener knob fully in to the normal running position (1).

NOTE

If outside temperature is cooler than 20°F (-6.7°C) it may be necessary to pump the throttle 2 or 3 times.



1. **Normal running position**
2. **1/2 way out position**
3. **Full-out position**

Figure 4-1. Enrichener Operation

Outside Temperature Warmer than 60° F (15.6° C)

See Figure 4-1. **BE SURE THROTTLE IS CLOSED.** Pull enrichener knob to full-out position (3). Turn the ignition switch ON and press starter switch to operate the electric starter.

1. After initial 15-30 second warm-up, ride for 1 minute or 0.5 mile (0.8 km) with the enrichener knob in full-out position (3).
2. After 1 minute or 0.5 mile (0.8 km), push the enrichener knob in to the 1/2 way position (2). Ride 1 minute or 0.5 mile (0.8 km).
3. After 1 minute or 0.5 mile (0.8 km), push the enrichener knob fully in to the normal running position (1).

Warm Climate or Hot Engine

Open throttle 1/8-1/4. Turn on ignition switch and operate electric starter. **DO NOT USE ENRICHENER.**

NOTE

If the engine does not start after a few turns or if one cylinder fires weakly but engine does not start, it is usually because of an over-rich (flooded) condition. This is especially true of a hot engine. If the engine is flooded, push enrichener knob in all the way, turn ignition on and operate starter with throttle wide open. DO NOT "pump" the throttle while turning the engine over.

REMOVAL

1. Remove the air cleaner cover and backplate. See 4.8 AIR CLEANER.

⚠WARNING

Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near the work site. Inadequate safety precautions could result in death or serious injury.

2. Turn the fuel supply valve OFF. Disconnect fuel line from carburetor.
3. Detach enrichener knob from bracket above horn. See 1.22 THROTTLE CABLES AND ENRICHENER.
4. See Figure 4-2. Disconnect the throttle cables (1, 2) from the carburetor.
5. See Figure 4-3. Remove vacuum hose from the carburetor. Pull carburetor free of seal ring and manifold (8).
6. Remove enrichener cable (51, 52, and 53), enrichener valve (49) and spring (50).
7. If the manifold or manifold seals need to be removed, remove the screws (9) that hold the manifold in place and detach MAP sensor connector from wiring harness. See 8.6 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP).

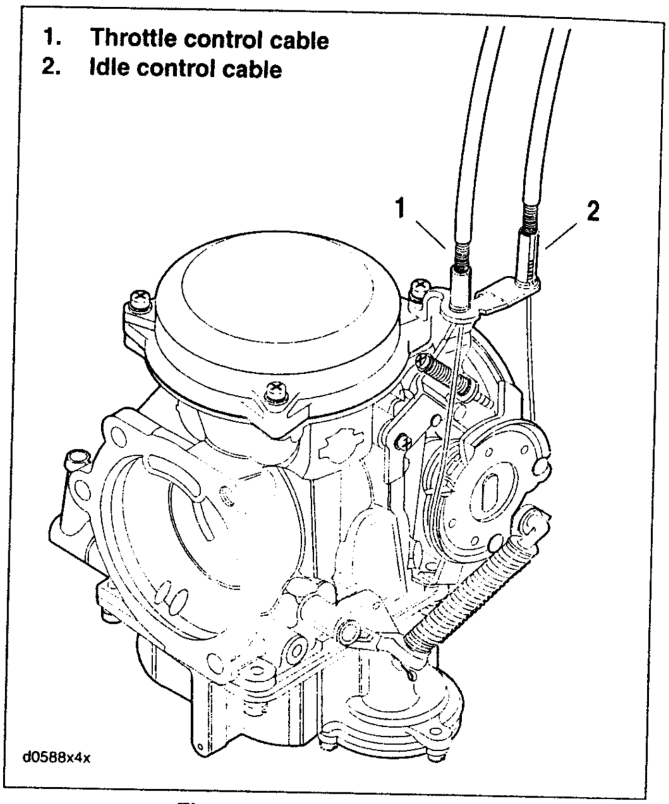


Figure 4-2. Throttle Cables

1. Screw, top (3)
2. Top
3. Spring
4. Spring seat
5. Jet needle
6. Vacuum piston
7. Intake manifold flange kit
8. Manifold
9. Screw (4) @ 8-12 ft-lbs (10.9-16.3 Nm)
10. Seal ring
11. Screw (idle speed adjust)
12. Washers
13. Spring
14. Screw (throttle cable bracket)
15. Bracket, throttle cable
16. Screw (throttle cable bracket)
17. Rod
18. Washer
19. Spring
20. Collar
21. E-clip
22. Washer
23. Cotter pins (2)
24. Washer
25. Lever
26. Washer
27. Cotter pins (2)
28. Slow jet
29. Pin
30. Float
31. Boot
32. Rod
33. O-ring
34. Float bowl
35. Diaphragm
36. Spring
37. Pump housing
38. Lockwashers (3)
39. Screws (3)
40. O-ring
41. Accelerator pump nozzle
42. Screw
43. Main jet
44. Needle jet holder
45. Needle jet
46. Fuel inlet valve with clip
47. Fitting
48. Clamp
49. Enrichener valve
50. Spring
51. Cable sealing cap
52. Starter cap
53. Cable guide

Legend for Figure 4-3.

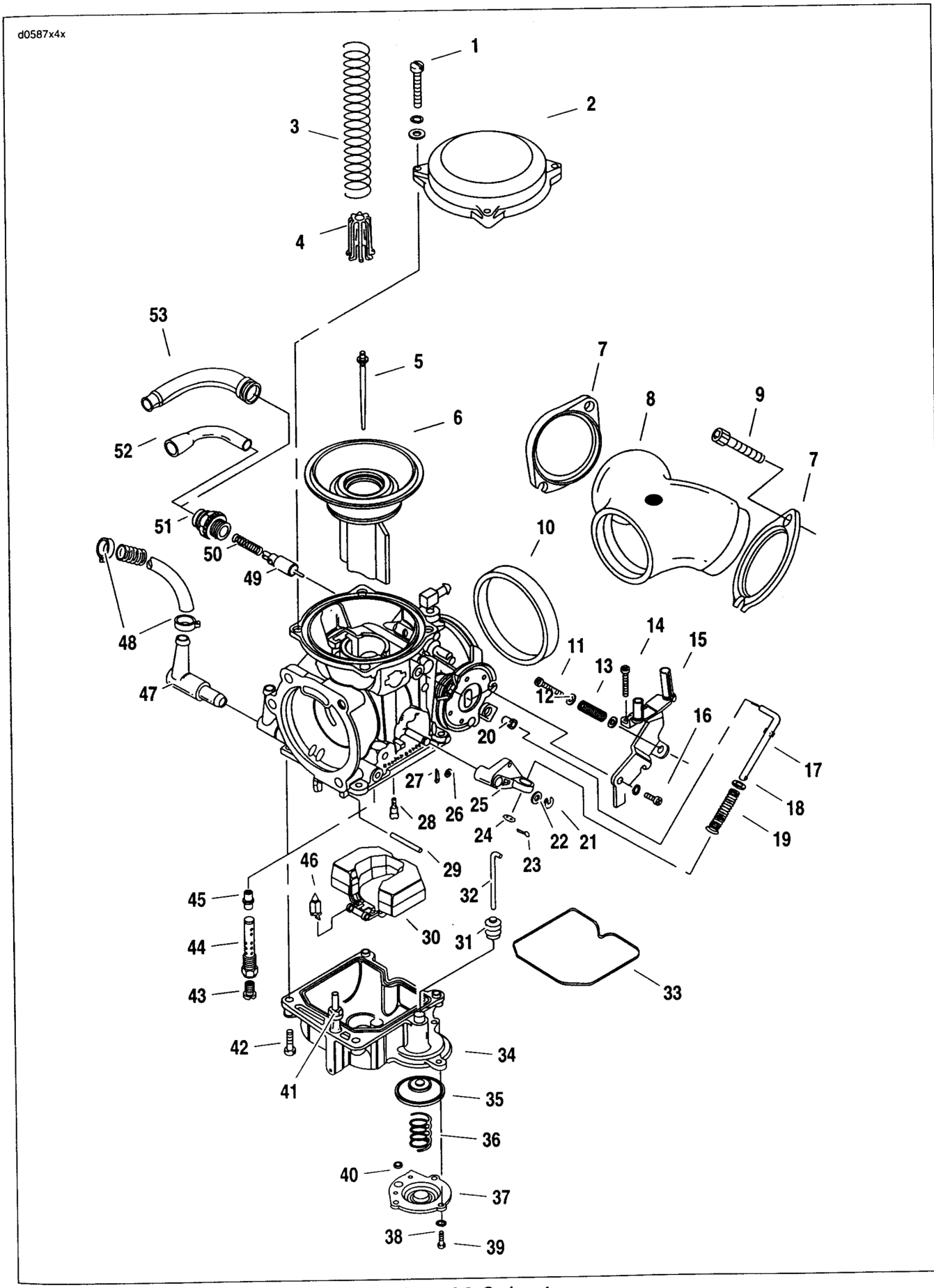


Figure 4-3. Carburetor

DISASSEMBLY

Vacuum Piston Chamber

1. See Figure 4-3. Remove screws (14, 16) and bracket (15).
2. Remove screws (1) and washers. Remove top (2) and spring (3).
3. Lift out vacuum piston (6) with needle (5) and spring seat (4). Remove loose parts from vacuum piston.

Carburetor Body

1. See Figure 4-3. Remove screws (42) to detach float bowl assembly.
2. Remove pin (29), float (30) and valve (46).
3. Unscrew main jet (43) and needle jet holder (44). Needle jet (45) is now free to be removed from bottom end of passage.
4. Insert thin bladed screw driver into slow jet passage and turn out slow jet (28).

Accelerator Pump

See Figure 4-3. Remove screws (39), lockwashers (38), accelerator pump housing (37), spring (36) and diaphragm (35). Remove O-ring (40) from housing.

CLEANING AND INSPECTION

Vacuum Piston Components

1. Hold vacuum piston up to strong light. Examine diaphragm at top of vacuum piston for evidence of pinching, holes or tears. Replace if damaged.
2. Examine vacuum passage through bottom of piston. Clean passage if restricted.
3. See Figure 4-3. Examine spring (3) for stretching, crimping or any distortion or damage. Replace if damaged.
4. Examine slide on sides of piston to be sure surface is smooth and clean. Clean or buff out any rough surfaces.
5. Examine needle (5) for evidence of bending or damage. Examine tip of float needle for grooves. Needle should be straight and surface of taper smooth and even.

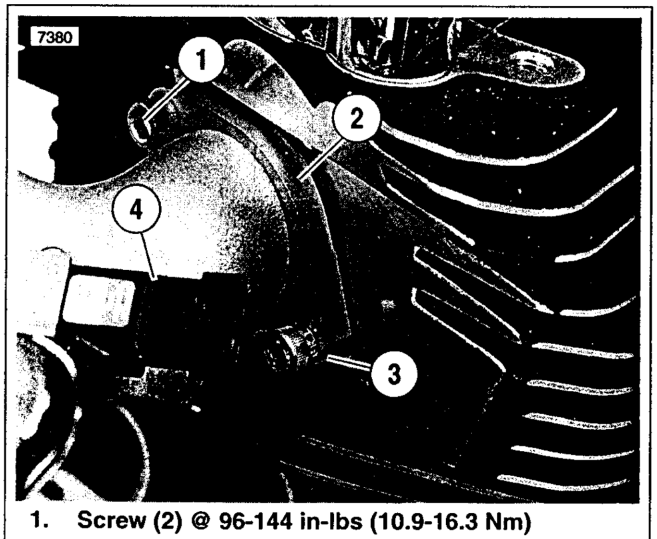
Carburetor Body Components

1. See Figure 4-3. Check float bowl O-ring (33) for any distortion or damage. Replace if seating surfaces are damaged.

CAUTION

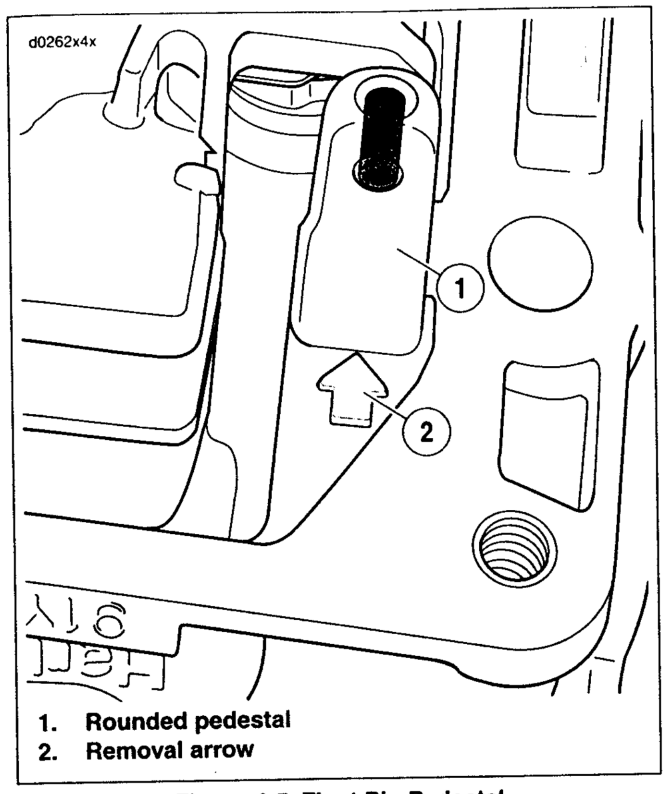
Do not submerge inlet valve in cold acid dip. The valve's alloy will be etched/damaged.

2. Examine fuel inlet valve (46) and inlet valve seat. Clean with carburetor cleaner. Replace if seating surfaces are damaged.
3. Clean slow jet (28) with carburetor cleaner. Check to be sure all orifices are open.
4. Check enrichener valve (49). Be sure needle guide is clean, straight and undamaged. Check seat surface and spring (50) for wear or damage. Replace if damaged.
5. Check enrichener valve chamber. Clean with carburetor cleaner. Check that all passages are open and free of obstruction.
6. Clean needle jet (45). Replace if damaged.
7. Clean all internal fuel/air passages and jets. Check that all passages and jets are open and free of obstruction.
8. Check needle jet holder (44). Clean bleed tube orifices. Replace holder if damaged.
9. Check float (30) for cracks or other leaks. Replace if damaged. See Float Replacement which follows.
10. Clean main jet (43) with carburetor cleaner and inspect for damage. Replace if damaged.



1. **Screw (2) @ 96-144 in-lbs (10.9-16.3 Nm)**
2. **Manifold flange**
3. **Open side of manifold flange**
4. **MAP sensor**

Figure 4-4. Flange Screws



1. **Rounded pedestal**
2. **Removal arrow**

Figure 4-5. Float Pin Pedestal

Float Replacement

CAUTION

When removing or installing the float pin, be careful not to break the pedestal. If the pedestal is broken, the carburetor will have to be replaced.

See Figure 4-5. A cast-in arrow (2) points at the rounded pedestal (1) that has the interference fit float pin. The pin is a uniform width throughout its entire length, so it can be installed starting from either end.

The arrow indicates direction of removal.

- Tap pin out from INTERFERENCE SIDE pedestal (direction of arrow).
- Install pin from LOOSE SIDE pedestal (opposite arrow).

Accelerator Pump

1. See Figure 4-3. Inspect the accelerator pump diaphragm (35) for holes, cracks or deformation. Replace as necessary.
2. Replace the pump rod (32) if it is bent and replace the boot (31) if it is cracked.

ASSEMBLY

Vacuum Piston Chamber

1. See Figure 4-3. Place needle (5) through center hole in vacuum piston (6). Place spring seat (4) over top of needle.
2. Insert vacuum piston into carburetor body. The slides on the piston are off-center and the piston will fit into the slide track grooves only one way. If piston does not fit, rotate 180 degrees.
3. Check to be sure diaphragm is seated evenly into groove at top of carburetor body.
4. Place spring (3) over spring seat and carefully lower top (2). Keep spring straight while lowering top.
5. After top is seated, hold top while lifting up on vacuum piston. Piston should rise to top smoothly. If piston movement is restricted, spring is cocked. Lift up on top and lower carefully, keeping spring coils straight.
6. Once top is installed correctly, install screws (1) and washers. Place bracket (15) in position with idle screw (11) resting on top of throttle cam stop. Install body screw (16) and washer (18) first, then top screw (14), to prevent bending bracket or throttle cam.

Carburetor Body

CAUTION

Slow fuel jets from fixed venturi carburetors look the same as the slow jet of the C.V. carburetor. However, the air bleed hole sizes are different on fixed venturi carburetors and they must not be installed on C.V. carburetors.

1. See Figure 4-3. Screw slow jet (28) into slow jet passage with narrow bladed screwdriver.
2. Turn carburetor upside down. Place needle jet (45) in main jet passage with needle passing through center hole. Be sure end of jet with larger opening and chamfered surface enters passage first.
3. Insert needle jet holder (44) into main jet passage with needle inserted into center of holder. Thread holder into passage and tighten. Thread main jet (43) into tapped hole in holder and tighten.
4. Place float assembly (30) into position with fuel inlet valve (46) inserted into valve seat and pivot arm aligned with holes in mounting posts at bottom of carburetor body. Insert pin (29) through float pivot arm and float mounting posts.
5. Place float bowl over float and onto carburetor body flange. Bowl will only fit in one position. Install screws (42) and tighten.
6. Install enrichener valve (49) and spring (50). Install enrichener cable (51, 52, and 53) on carburetor.

Accelerator Pump

See Figure 4-3. Install diaphragm (35), spring (36), O-ring (40) and housing (37). Secure with three screws (39) and lockwashers (38).

INSTALLATION

NOTES

- *When you position the manifold on the cylinder head studs, be sure the flanges are installed correctly on the manifold.*
- *Verify rubber seals are in place.*
- *See 4.7 FUEL TANK. It is suggested that you raise or remove the fuel tank before beginning installation.*

1. See Figure 4-3. Place the intake manifold seal (10), flanges (7), and manifold (8) in position. Flanges are marked with "F" for front cylinder and "R" for rear cylinder. Install the manifold mounting screws (9) finger tight. Place carburetor in position, for alignment purposes.

NOTE

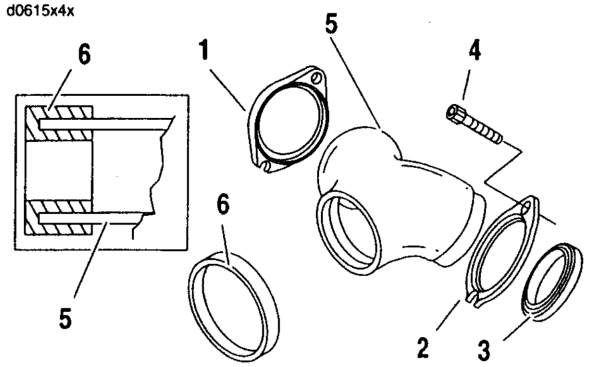
See Figure 4-6.The air cleaner backplate is attached to the carburetor and cylinder heads to align the manifold. Verify manifold mounting screws are loose before aligning carburetor and backplate.

2. Align the manifold, flanges, carburetor and backplate.

CAUTION

Do not tighten screws and then try to align the manifold and flanges. The manifold seals will be damaged.

3. See Figure 4-4. Tighten manifold mounting screws (1) to 96-144 **in-lbs** (10.9-16.3 Nm).
4. Attach MAP sensor connector to wiring harness. See 8.6 MANIFOLD ABSOLUTE PRESSURE SENSOR (MAP).
5. Connect throttle cables, fuel line and vacuum hose to carburetor. Install enrichener cable in mounting bracket and adjust enrichener. See 1.22 THROTTLE CABLES AND ENRICHENER and 4.3 ENRICHENER.
6. Complete installation of air filter and cover. See 4.8 AIR CLEANER.



1. **Rear mounting flange**
2. **Front mounting flange**
3. **Intake manifold seal (2)**
4. **Screw (4) @ 96-144 in-lbs (10.9-16.3 Nm)**
5. **Intake manifold**
6. **Carburetor seal ring**

Figure 4-6. Intake Manifold assembly

OPERATION CHECK: VACUUM PISTON

Opening Malfunction

⚠WARNING

While observing piston slide movement be sure to maintain a safe distance from the carburetor and wear suitable eye protection. An unexpected engine backfire could result in death or serious injury.

1. With air cleaner cover off and engine running, partially open and close throttle control several times to see if vacuum piston has upward movement. If piston does not rise, see 4.2 FUEL SYSTEM TROUBLESHOOTING and Table 4-8.
2. With engine not running, lift vacuum piston with finger. Feel whether piston lifts fully and smoothly or whether it binds.

Closing Malfunction

1. With engine not running, lift vacuum piston to full open position, then release. See if piston slides downward smoothly and fully to stop.
2. See Figure 4-7. Observe position of piston slide at its lowest downward point. Lower edge of slide should rest at horizontal groove (2) at lower end of slide track. If problems are observed, see 4.2 FUEL SYSTEM TROUBLESHOOTING and Table 4-9.

FLOAT BOWL

NOTE

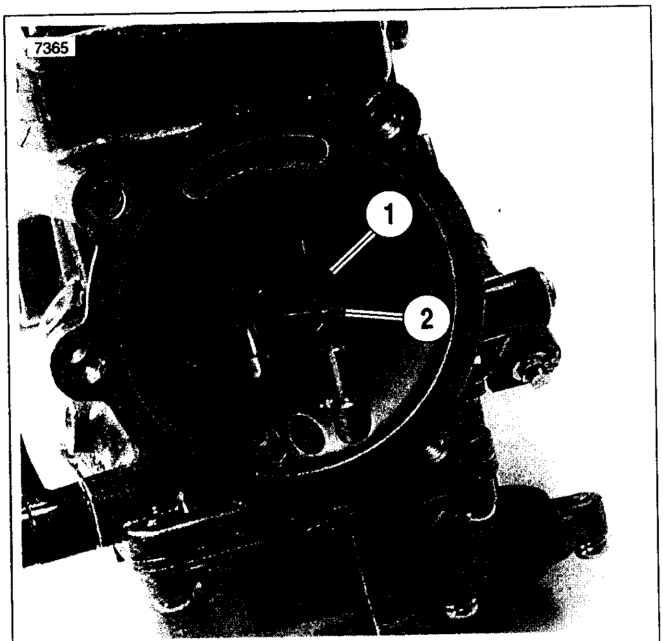
For engine idle speed and enrichener adjustments, see 1.22 THROTTLE CABLES AND ENRICHENER and 1.23 IDLE SPEED AND IGNITION TIMING.

Float Bowl Inlet (Needle) Valve Replacement

NOTE

Four sided inlet valves may be used in any Keihin carburetor. Three sided inlet valves should not be used in C.V. carburetors because they may cause carburetor overflow.

1. Remove carburetor. See REMOVAL under 4.4 CARBURETOR.
2. Remove float bowl and inlet valve. See DISASSEMBLY.
3. Install **new** inlet valve.
4. Perform float level adjustment. See Float Level which follows
5. Install float bowl. See ASSEMBLY.
6. Install carburetor. See INSTALLATION.



1. **Vacuum piston slide**
2. **Horizontal groove**

Figure 4-7. Vacuum Piston At Rest

Float Level

1. Remove the carburetor. See REMOVAL under 4.4 CARBURETOR.
2. See Figure 4-8. Remove four screws to detach float bowl.
3. See Figure 4-10. Place the carburetor on a flat, clean surface on the engine manifold side. This is the "base". Tilt the carburetor 15° to 20° from base.

NOTE

If you tilt the carburetor to less than 15° or more than 20°, your measurements will be incorrect.

4. Use a vernier or dial caliper depth gauge to measure from the carburetor O-ring flange face to the perimeter of the float. Be careful not to push on float while measuring.
5. See Figure 4-9. If measurement is not within 0.413-0.453 in. (10.49-11.51 mm), carefully bend float tab (1) to position float at proper level.
6. Install float bowl. See ASSEMBLY.
7. Install carburetor. See INSTALLATION.

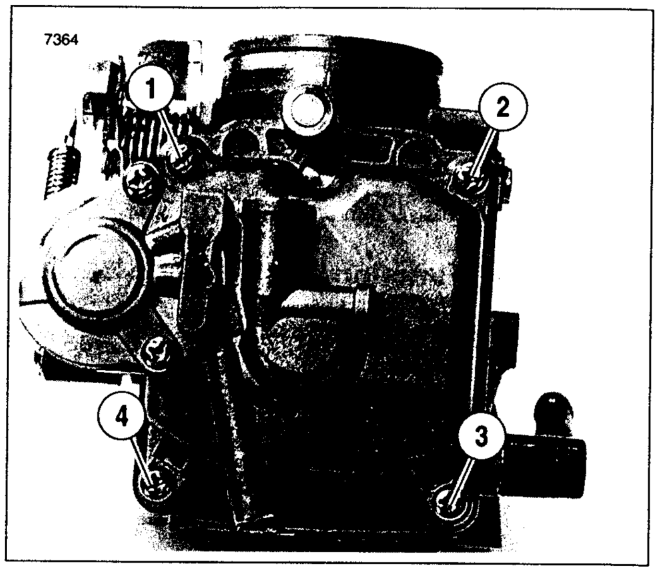
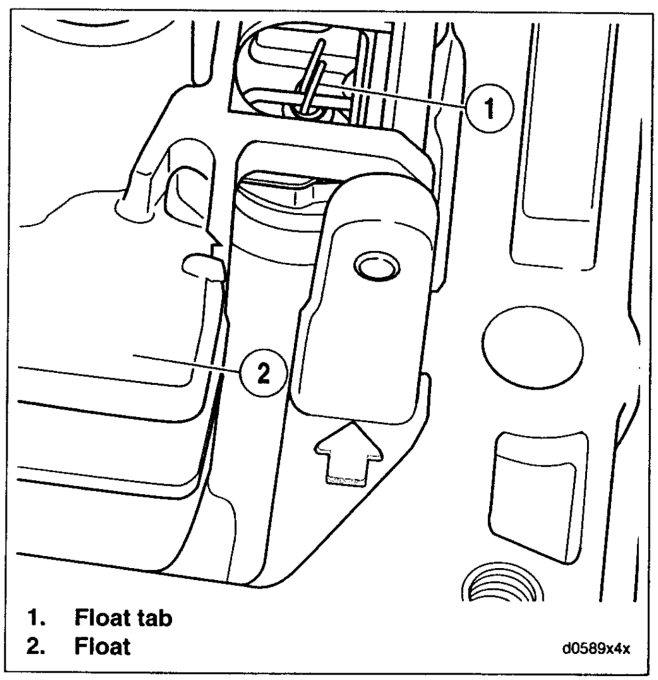


Figure 4-8. Float Bowl Screws



1. **Float tab**
2. **Float**

Figure 4-9. Carburetor Float Tab

d0365x4x

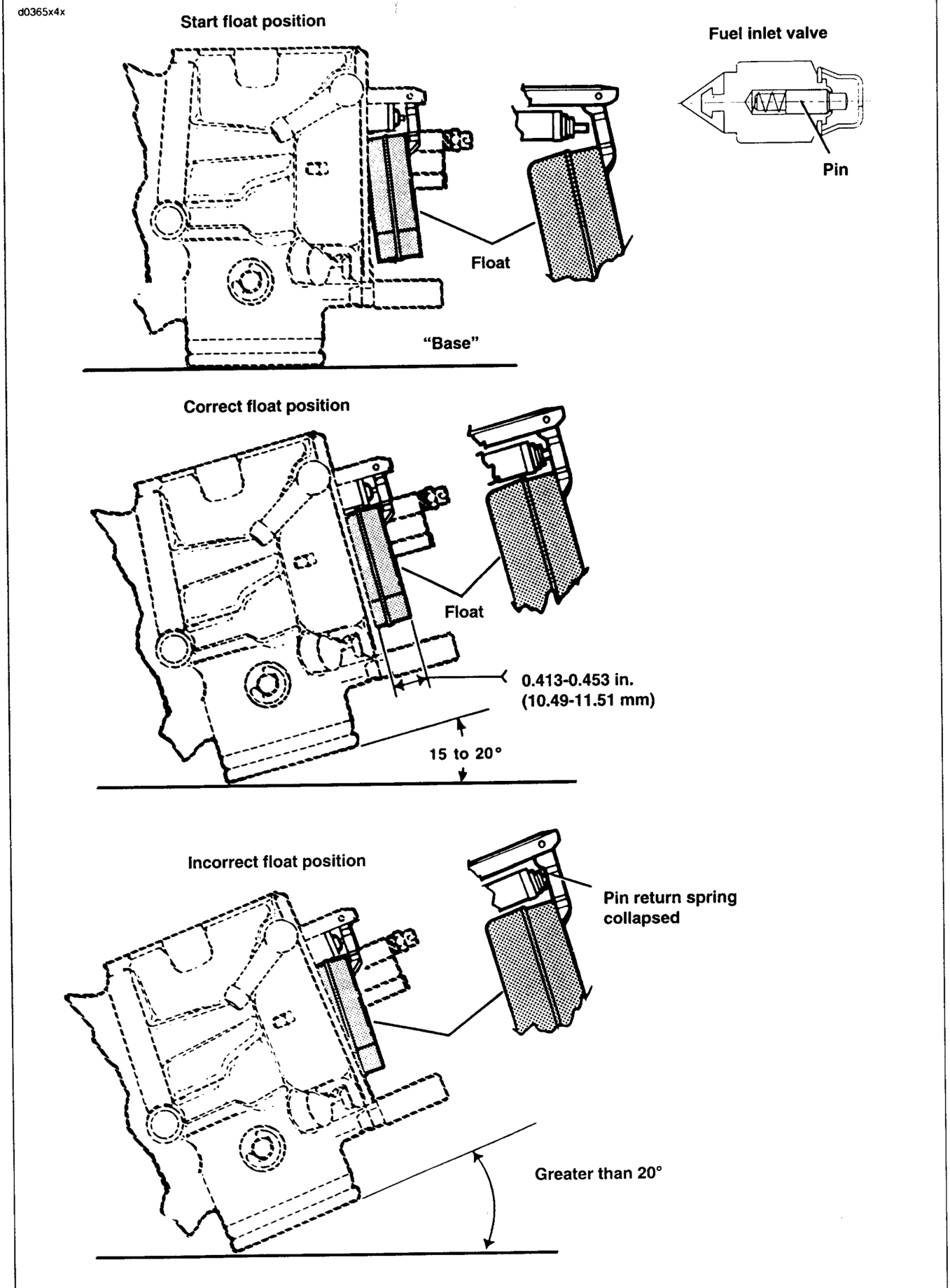


Figure 4-10. Adjusting Carburetor Float

NOTES

GENERAL

See Figure 4-11. The fuel supply valve is located under the left side of the fuel tank. The gasoline supply to the carburetor is turned off when the handle is in the horizontal position. Turning the handle up to the vertical position turns on the main supply. Turning the handle down to the vertical position turns on the reserve supply. The valve is vacuum-operated and will open and close when the engine is turned ON or OFF.

CAUTION

The fuel supply valve should be turned off when the engine is not running. If the fuel supply valve is not turned off when the engine is not running, it is possible for fuel to drain into the engine, dilute the engine oil and cause engine damage.

OPERATION

The gasoline supply to the carburetor is controlled by the valve handle positions and an internal vacuum operated valve. No gasoline will flow through the valve until the following conditions are met:

1. Handle must be in ON or RES position.
2. A vacuum of approximately 0.5-1.0 in. (12.7-25.4 mm) of Mercury (Hg) must be applied to the vacuum nipple.

NOTE

In service, the vacuum nipple is connected to the carburetor. When the engine is running, there will be a vacuum at the nipple.

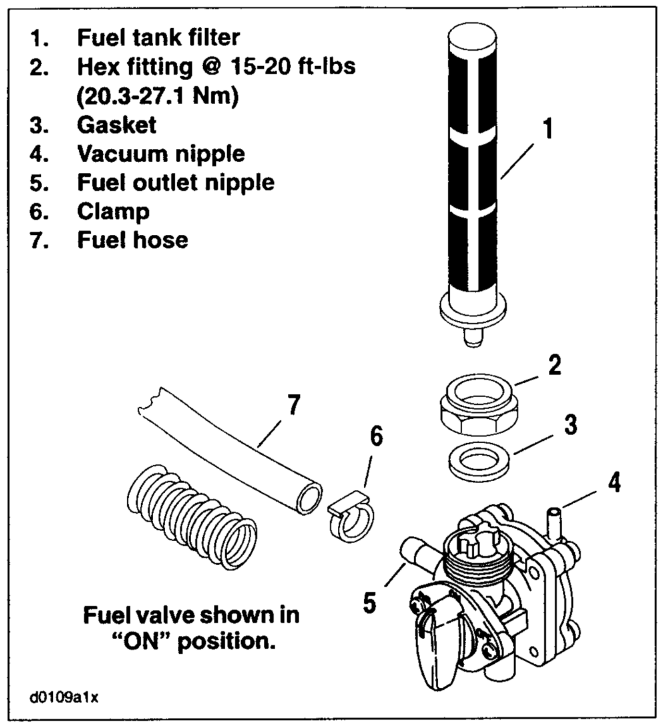


Figure 4-11. Fuel Supply Valve Assembly

REMOVAL, INSPECTION AND INSTALLATION

See 1.24 FUEL SUPPLY VALVE FILTER.

TROUBLESHOOTING

See Table 4-10. For vacuum testing information, see the next page.

Table 4-10. Troubleshooting Fuel Supply Valve

PROBLEM	CAUSE	SOLUTION
Vacuum valve not opening.	Vacuum hose not connected to vacuum nipple. See Figure 4-11.	Connect hose to vacuum nipple.
	Leaking diaphragm.	Replace entire valve assembly.
	Vacuum hose assembly pinched or cracked.	Replace vacuum hose assembly.
Vacuum valve does not close.	Damaged sealing surface on valve side of diaphragm.	Replace entire valve assembly.
	Broken or missing internal spring.	Replace entire valve assembly.
Valve leaks gasoline at bottom nipple.	Leaking diaphragm.	Replace entire valve assembly.
	Loose diaphragm housing screws.	Tighten screws.

Vacuum Test

PART NO.	SPECIALTY TOOL
HD-23738-A	Plastic Mity-vac® Hand Pump

⚠WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow open flame or sparks anywhere in the area when draining or servicing the fuel system. Drain gasoline into approved gasoline container only.

Vacuum test the valve using the procedure below:

1. Connect PLASTIC MITY-VAC® HAND PUMP (Part No. HD 23738-A), vacuum line and suitable vacuum fitting to the vacuum port of the fuel supply valve.
2. Run a section of clear fuel line from the fitting on the fuel supply valve to a gas can.
3. Pull 25 in. Hg vacuum and release. Check for fuel flow while applying vacuum and check that fuel stops flowing shortly after vacuum is released.
4. **Repeat step 3 five times,** each time checking for fuel flow at vacuum and no fuel flow shortly after vacuum is released. On fifth application of vacuum, pause with vacuum applied, and check for slow leaks. Release vacuum.
5. If no leaks were present, go to Step 6. If leaks were present, repeat replacement procedure.
6. Disconnect hand held vacuum pump and fuel line.
7. Loosen fuel valve hex fitting 1/8 turn and rotate valve to the left. Tighten hex fitting.
8. Position **new** hose clamp on fuel hose and install fuel hose to outlet fitting on valve body.
9. Install vacuum hose to valve nipple.

GENERAL

⚠WARNING

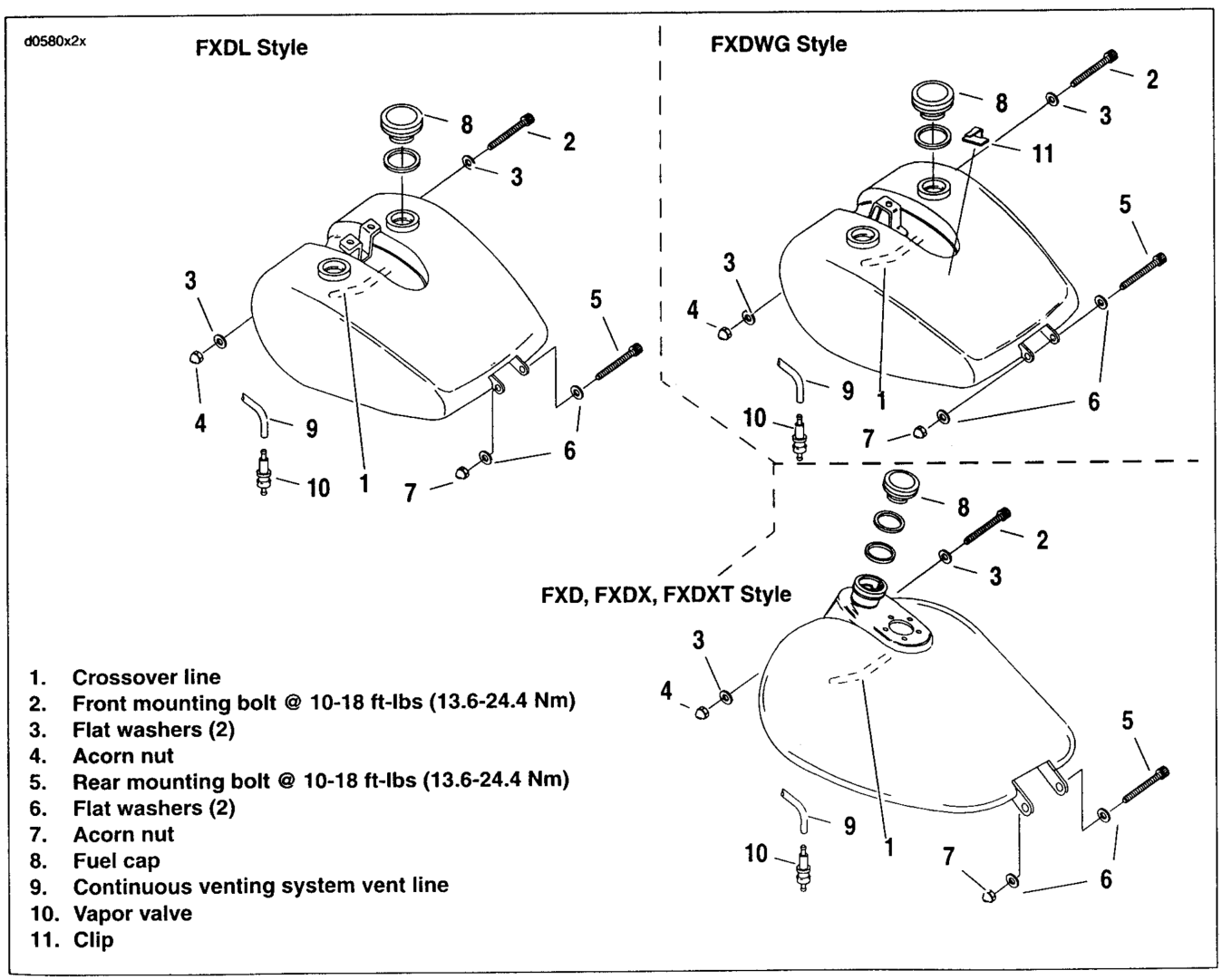
Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near the work site. Inadequate safety precautions could result in death or serious injury.

The fuel tank is treated to resist rusting. However, when the motorcycle is not operated for a long period of time, see 1.28 STORAGE for specific information regarding fuel tank and carburetor treatment.

For information on the tank-mounted fuel gauge, see DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL and 8.21 FUEL GAUGE.

REMOVAL

1. Remove instrument panel. See 8.23 INSTRUMENTS: FXDWG, 8.24 INSTRUMENTS: FXDL or 8.25 INSTRUMENTS: FXD, FXDX, FXDXT.
2. Check to be sure fuel supply valve is in "OFF" position. Remove fuel line from the fuel supply valve.
3. Drain fuel into adequately sized, approved gasoline container. See 1.24 FUEL SUPPLY VALVE FILTER.
4. See Figure 4-12. Disconnect crossover line (1) and continuous venting vent line (9).
5. Remove the front mounting bolt (2), flat washers (3), and acorn nut (4).
6. Remove the rear mounting bolt (5), flat washers (6), acorn nut (7).
7. On FXDL/FXDWG vehicles, disconnect fuel gauge connector located under left side of fuel tank. See 8.21 FUEL GAUGE.
8. Remove fuel tank from motorcycle.



1. Crossover line
2. Front mounting bolt @ 10-18 ft-lbs (13.6-24.4 Nm)
3. Flat washers (2)
4. Acorn nut
5. Rear mounting bolt @ 10-18 ft-lbs (13.6-24.4 Nm)
6. Flat washers (2)
7. Acorn nut
8. Fuel cap
9. Continuous venting system vent line
10. Vapor valve
11. Clip

Figure 4-12. Fuel Tank Assembly

CLEANING AND INSPECTION

⚠WARNING

Use only non-ferrous (non-sparking) metal balls, such as lead pellets, to loosen deposits. Metal balls, such as steel ball bearings, could produce a spark igniting the fumes in the tank. The resulting flames or explosion could result in death or serious injury.

1. Clean the tank interior with commercial cleaning solvent or a soap and water solution. Shake the tank to agitate the cleaning agent. If necessary, non-ferrous metallic balls or pellets may be added to the tank to assist in loosening deposits.

NOTE

Be sure to count the number of pellets going into the tank and the number that come out. An extra pellet in the tank could cause fuel delivery problems.

2. Flush the tank thoroughly after cleaning and allow it to air dry.

⚠WARNING

Extreme caution should be taken when repairing tanks. If all traces of fuel are not purged, an open flame repair may result in a tank explosion which could result in death or serious injury.

3. Inspect the interconnect lines, continuous venting system vent line (if applicable) and fuel line for cuts, cracks or holes. Replace lines as needed.
4. Inspect the rubber mounts and bumpers for wear and deterioration. Replace as needed.
5. Inspect the tank for leaks and other damage. If a damaged tank cannot be successfully repaired, replace it.

INSTALLATION

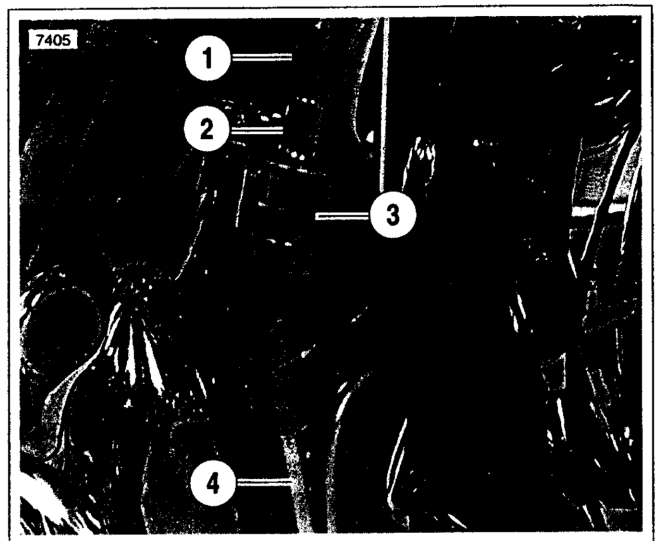
PART NO.	SPECIALTY TOOL
HD-97087-65B	Hose clamp pliers

1. See Figure 4-12. Install continuous venting system vent line (9) and vapor valve (10).

⚠WARNING

The vapor valve must be mounted in a vertical position, with the long fitting at the top, otherwise, excessive fuel vapor pressure may build up in the fuel tank. Excessive pressure could cause a fuel leak resulting in a fire or an explosion which could result in death or serious injury.

2. Connect two hoses to vapor valve. Connect the hose which has its one end connected to the fuel tank vent nipple to the long fitting end of vapor valve.
3. Place a washer (3, 6) over each bolt (2, 5) and insert the bolts through the tank mounting lugs and frame bracket tubes. Be sure to install center trim panel hold-down bracket on rear bolt.



1. **Line from tank**
2. **Vapor valve**
3. **Clip**
4. **Valve vent line**

Figure 4-13. Vapor Valve Installation (Typical)

4. Install nuts (4) and tighten to 120-216 **in-lbs** (13.6-24.4 Nm).
5. Connect the vent line (9) and crossover tube (1).
6. Connect the fuel feed line. Install **new** hose clamp using HOSE CLAMP PLIERS (Part No. HD-97087-65B).
7. On FXDWG/FXDL models, connect the fuel gauge connector located under left side of fuel tank. See 8.21 FUEL GAUGE.
8. Install instrument panel. See 8.23 INSTRUMENTS: FXDWG, 8.24 INSTRUMENTS: FXDL or 8.25 INSTRUMENTS: FXD, FXDX, FXDXT.
9. Check for leaks.

Vapor Valve

⚠WARNING

Verify that the fuel tank vapor valve hoses do not contact hot exhaust or hot engine parts. The hoses contain flammable vapors that can be ignited if damaged. This could result in death or serious injury.

See Figure 4-13. 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

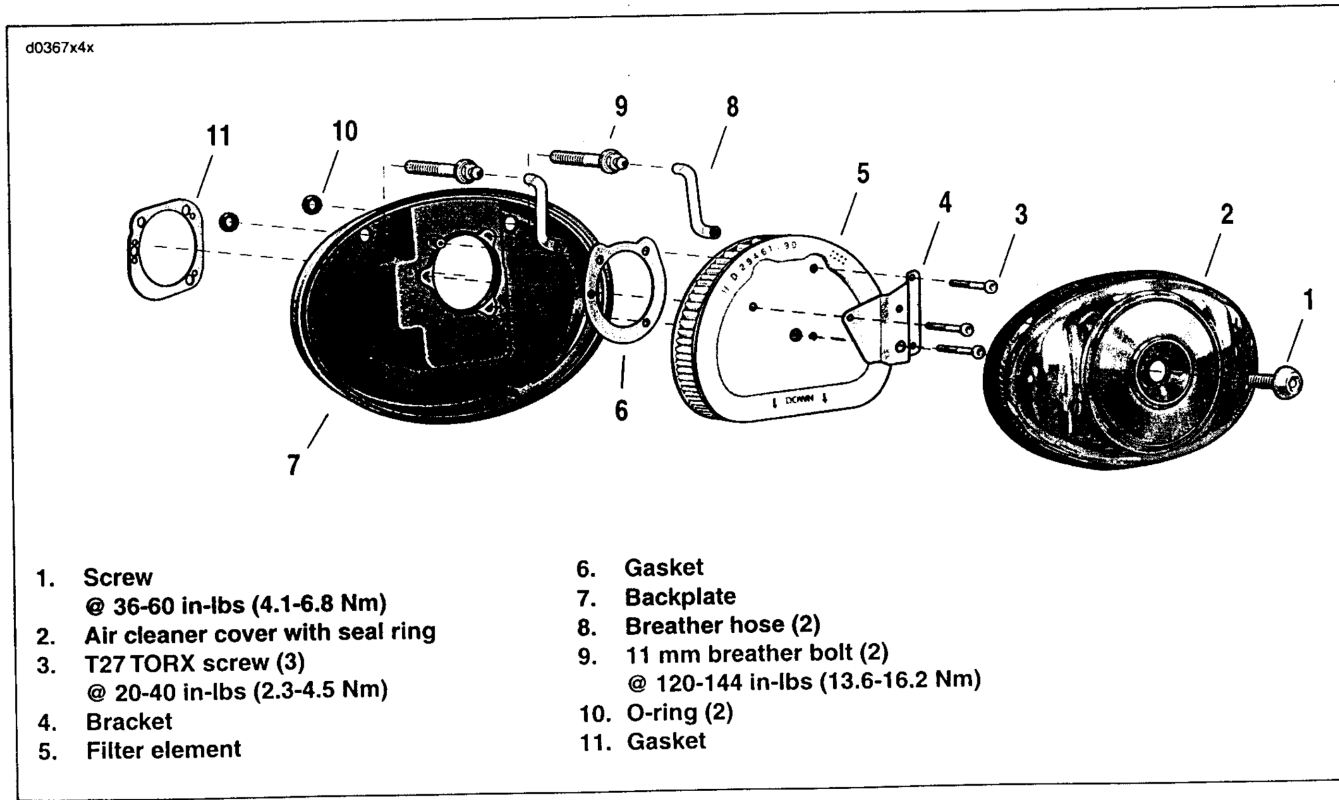
On California models, the hose from the vapor valve bottom fitting goes to the charcoal EVAP canister. On non-California models, the bottom fitting hose is vented to the atmosphere.

REMOVAL

1. See Figure 4-14. Remove screw (1) and air cleaner cover (2).
2. Remove three TORX screws (3) and bracket (4) from filter element (5).
3. Gently pull both rubber breather tubes (8) from the back of the element. Remove filter element and gasket (6).
4. Replace the filter element if damaged or if filter media cannot be adequately cleaned.
5. Gently pull breather tubes (8) from breather bolts (9) on the backplate.
6. Check filter element. See 1.20 AIR CLEANER FILTER.
7. Inspect seal ring on cover (2) for cracks or tears. Verify that it seals tightly to backplate. Replace as required.
8. Alternately back out both breather bolts (9) (metric) a few turns a time while pulling backplate (7) away from carburetor.
9. Continue previous step until breather bolts are clear. Remove backplate (7), O-rings (10) and gasket (11). Discard gasket. On California models, disconnect clean air hose from backplate.
10. Wipe inside of air cleaner cover (2) and backplate (7) with damp cloth to remove dust.
11. On California models, make sure trap door swings freely. See Figure 4-15.

INSTALLATION

1. See Figure 4-14. Position **new** gasket (11) and two **new** O-rings (10) on backplate.
2. On California models, attach clean air hose to rear of backplate.
3. Insert two breather bolts (9) (metric) into backplate. Thread bolts loosely into each cylinder head. Tighten bolts to 120-144 **in-lbs** (13.6-16.2 Nm).
4. Insert two breather tubes (8) into the holes in back of the filter element. Place the element back into position and attach breather tubes to breather bolts.
5. Install air filter element (5) and bracket (4).
   a. Make sure gasket (6) holes are aligned with backplate holes.
   b. Use three TORX screws (3) to secure bracket and filter element. Tighten to 20-40 **in-lbs** (2.3-4.5 Nm).
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 screw to secure air cleaner cover. Tighten to 36-60 **in-lbs** (4.1-6.8 Nm).



1. Screw @ 36-60 in-lbs (4.1-6.8 Nm)
2. Air cleaner cover with seal ring
3. T27 TORX screw (3) @ 20-40 in-lbs (2.3-4.5 Nm)
4. Bracket
5. Filter element
6. Gasket
7. Backplate
8. Breather hose (2)
9. 11 mm breather bolt (2) @ 120-144 in-lbs (13.6-16.2 Nm)
10. O-ring (2)
11. Gasket

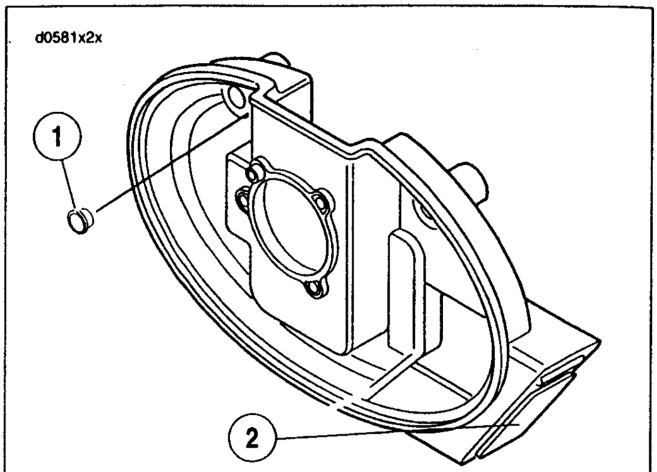
Figure 4-14. Air Cleaner Assembly

BACKPLATE ASSEMBLY: CALIFORNIA MODELS

See Figure 4-15. California models have unique backplates. These parts may be distinguished by:

- A different intake with a gravity-operated trap door assembly (2) at the mouth of the intake.
- An additional fitting (1) on the backplate for the charcoal canister clean air hose.

Perform the same routine maintenance on California models, but also check that the trap door swings freely.



1. **Clean air hose fitting (on backside)**
2. **Trap door**

Figure 4-15. Backplate-California Models

REMOVAL

1. See Figure 4-16. Loosen or remove heat shields (1, 2) by opening worm drive clamps (3).
2. Remove locknuts (4) from front and rear cylinder head exhaust studs.
3. Remove nut (5) and bolt (7) attaching front pipe clamp (8) to front exhaust bracket (9).
4. Remove bolt (7) and nut (5) attaching rear exhaust pipe clamp (8) to transmission side cover support bracket (11).
5. Remove exhaust system as an assembly.

DISASSEMBLY

1. See Figure 4-16. Remove muffler support tube nuts (12) from bolts (13). Remove muffler support bracket (14).
2. Loosen nuts (23) on muffler clamps (25) to exhaust pipes. Remove mufflers.
3. Free front exhaust pipe (18) from rear exhaust pipe (10) by twisting and separating at crossover pipe.
4. Examine retaining rings (19) and gaskets (20) in cylinder head exhaust ports. Replace if necessary.
5. Replace the crossover pipe(s) heat shield(s) (21, 30), if necessary.
6. Remove retaining ring (26) and gasket (22) from crossover pipe bell on rear exhaust pipe (10).

ASSEMBLY

1. See Figure 4-16. If crossover pipe(s) heat shield(s) (21, 30) were removed, install now.
2. Insert **new** gasket (22) and retaining ring (26) into crossover pipe bell on rear exhaust pipe (10). Connect rear exhaust pipe to front exhaust pipe (18) at crossover pipe.

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.

3. Install front and rear mufflers (16, 17) on front and rear exhaust pipes (18, 10). Install muffler clamps (25) using nuts (23). Do not tighten nuts at this time.
4. Install muffler support bracket (14) using nuts (12) and bolts (13). Do not tighten nuts at this time. Install exhaust system. See INSTALLATION.

INSTALLATION

NOTE

See inset in Figure 4-16. Replacement cylinder head exhaust gaskets (20) are tapered internally. Be sure the thin end goes over the exhaust pipe. Also check condition of retaining ring (19) before installation.

1. Position ends of exhaust pipes into front and rear cylinder head exhaust ports with holes in flanges (27) over cylinder head exhaust studs. Loosely thread on flange locknuts (4).
2. Position front pipe clamp (8) on front exhaust bracket (9). Install nut (5) and bolt (7).
3. Position rear exhaust pipe clamp on transmission side cover support bracket (11). Install bolt and nut. Do not tighten nut and bolt at this time.
4. Align exhaust system and tighten all nuts and bolts; beginning at cylinder head exhaust ports and working backwards.
5. Tighten nuts (4), 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 60-80 **in-lbs** (6.8-9.0 Nm).
   d. Tighten upper nut to 60-80 **in-lbs** (6.8-9.0 Nm).
6. Tighten nuts (4) 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 60-80 **in-lbs** (6.8-9.0 Nm).
   d. Tighten lower nut to 60-80 **in-lbs** (6.8-9.0 Nm).
7. Open the worm drive clamps (3) and install heat shields (1, 2).
8. Align mufflers. Tighten muffler clamp nuts (23) to 45-60 ft-lbs (61.0-81.3 Nm).

1. Front heat shield
2. Rear heat shield
3. Worm drive clamp
4. Flange locknut (4)
5. Nut
6. Washer
7. Bolt (2)
8. Exhaust pipe clamp
9. Front exhaust bracket
10. Rear exhaust pipe
11. Rear exhaust bracket
12. Flange nut (6)
13. Bolt (4)
14. Muffler support bracket
15. Screw
16. Front muffler
17. Rear muffler
18. Front exhaust pipe
19. Retaining ring
20. Exhaust gasket (2)
21. Front crossover pipe heat shield
22. Interconnect gasket
23. Nut (2) @ 45-60 ft-lbs (61.0-81.3 Nm)
24. Washer
25. Muffler clamp
26. Gasket retaining ring
27. Exhaust manifold flange
28. Screw (3) @ 90-120 in-lbs (10.2-13.5 Nm)
29. Muffler shield
30. Rear crossover pipe heat shield

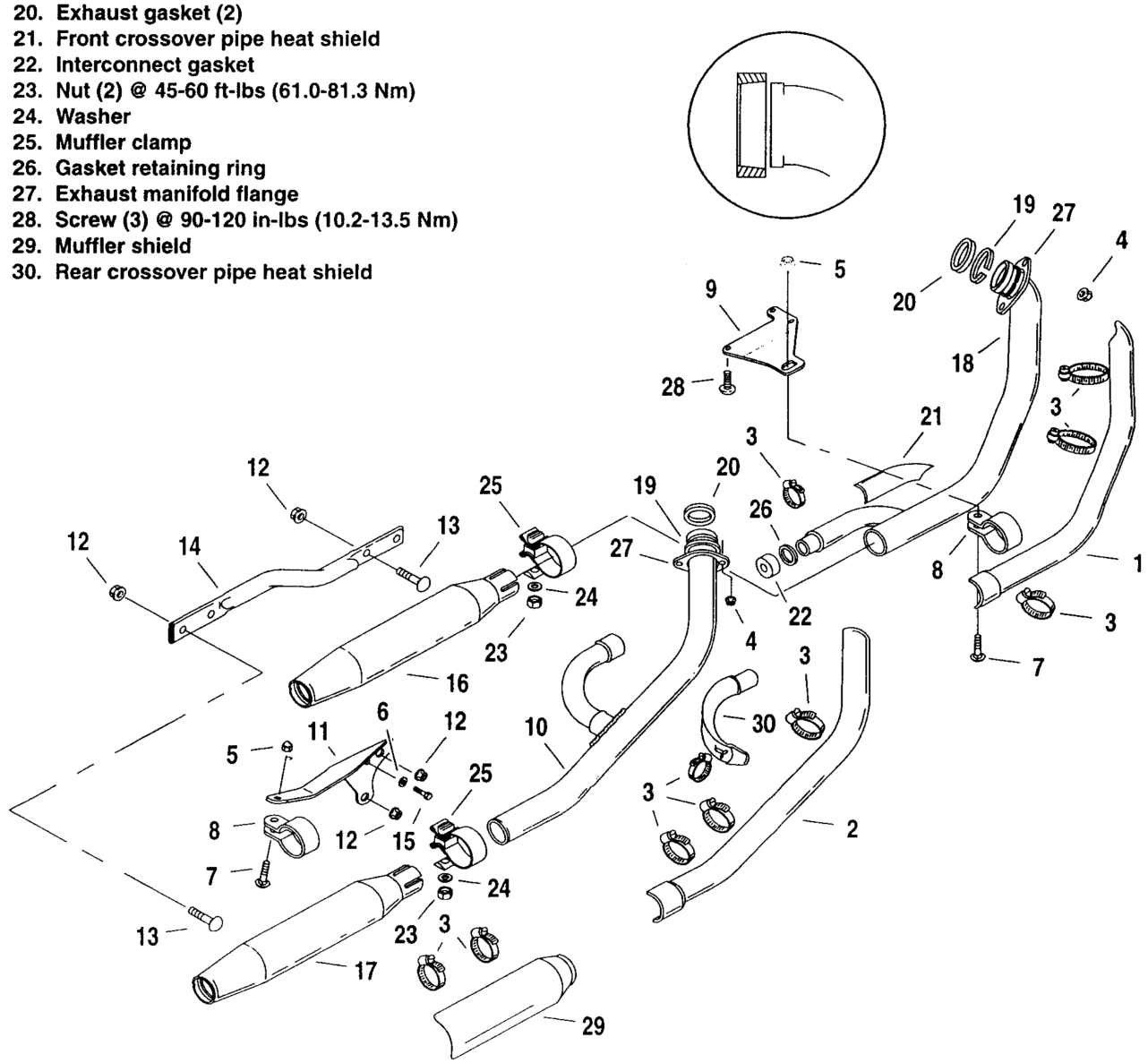


Figure 4-16. Exhaust System

GENERAL

Harley-Davidson motorcycles sold in the state of California are equipped with an evaporative (EVAP) emissions control system. The EVAP system prevents fuel hydrocarbon vapors from escaping into the atmosphere and is designed to meet the California Air Resource Board (CARB) regulations in effect at the time of manufacture.

The EVAP functions in the following manner:

- Hydrocarbon vapors in the fuel tank are directed through the vapor valve and stored in the charcoal canister. If the vehicle is tipped at an abnormal angle, the vapor valve closes to prevent liquid gasoline from leaking out of the fuel tank through the vent hose.
- When the engine is not running, the gravity-operated trap door blocks the inlet port of the air cleaner backplate. This prevents hydrocarbon vapors emanating from the carburetor throat from escaping into the atmosphere.
- When the engine is running, the vacuum created in the inlet pulls the gravity-operated trap door open allowing air to enter.
- When the engine is running, carburetor venturi negative pressure (vacuum) slowly draws off the hydrocarbon vapors from the charcoal canister through the canister-to-carburetor purge hose. These vapors pass through the carburetor and are burned as part of normal combustion in the engine. The long, nylon canister-to-air cleaner hose (canister clean air inlet hose) supplies the canister with fresh air from the air cleaner.

⚠WARNING

Verify that the evaporative emissions vent hoses do not contact hot exhaust or hot engine parts. The hoses contain flammable vapors that can be ignited if damaged. This could result in death or serious injury.

NOTE

The EVAP system has been designed to operate with a minimum of maintenance. Check that all hoses are properly connected, are not pinched or kinked, and are routed properly. Improper connections could leak charcoal from canister.

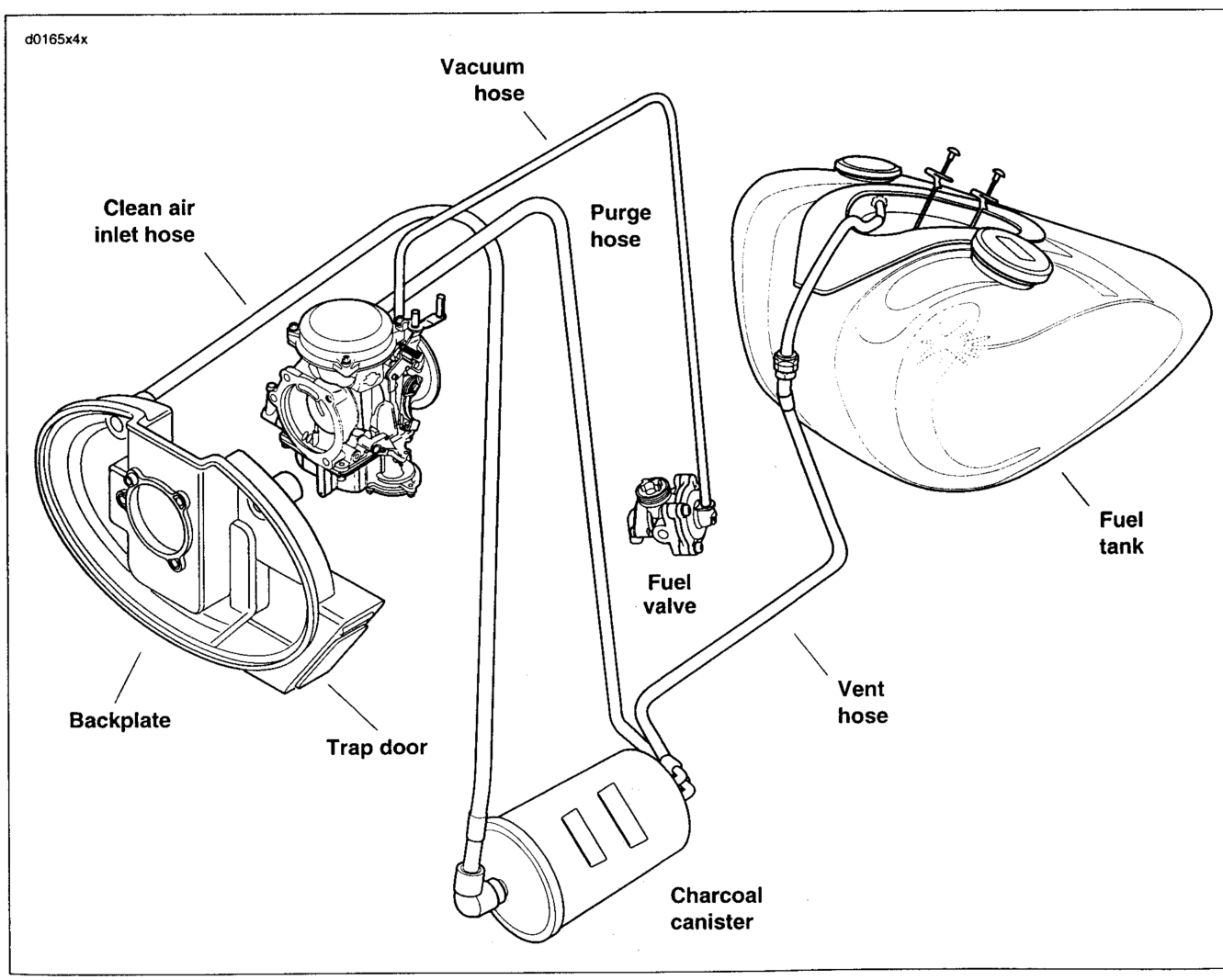


Figure 4-17. Schematic-CA Evaporative Emissions Control System

CHARCOAL CANISTER

Removal

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

See Figure 4-18. The EVAP charcoal canister is mounted between the forward frame downtubes.

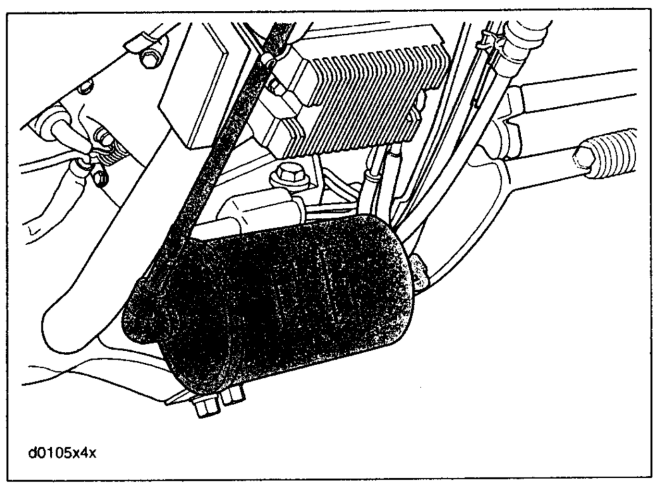


Figure 4-18. Charcoal Canister Location

1. Pull clean air hose (connection from air cleaner backplate) off nipple on right side of charcoal canister.
2. With a screwdriver, lift up the tang on the canister bracket and slide the canister sideways until it drops free from the bracket.
3. See Figure 4-19. 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.
4. Remove canister.

Installation

1. See Figure 4-18. Slide canister into mounting bracket until canister clicks in place.
2. See Figure 4-19. Attach hoses to canister nipples as marked.

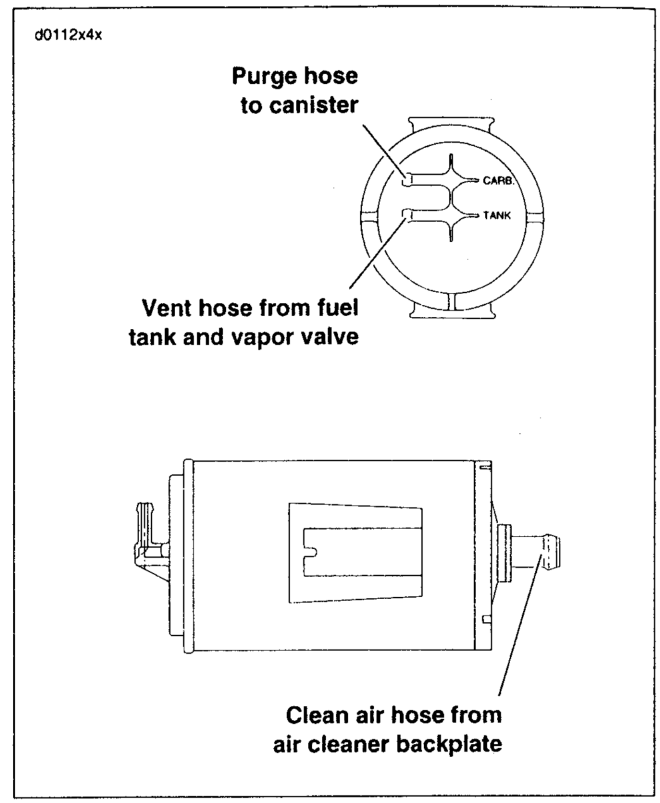


Figure 4-19. Charcoal Canister Connections

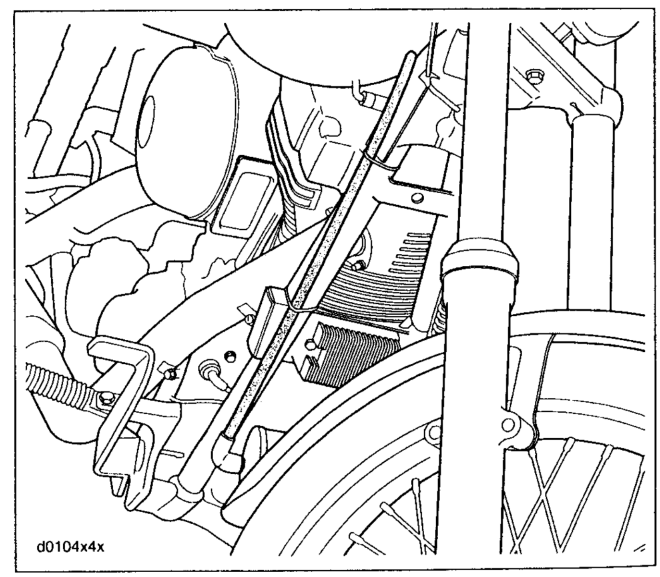


Figure 4-20. Hose Routing-Clean Air Inlet Hose

HOSE ROUTING/REPLACEMENT

NOTE

Record location of cable ties before removal. Install cable ties in same location when installing.

⚠WARNING

Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near the work site. Inadequate safety precautions could result in death or serious injury.

1. Remove console and fuel tank. See 4.7 FUEL TANK.
2. Route clean air hose.
   a. See Figure 4-17. Attach the large (0.5 in./12.7 mm ID), preformed, clean air inlet hose to the backplate fitting.
   b. Continue up frame tube and under fuel tank (along backbone).
   c. See Figure 4-21. Route **over** fuel tank crossover tube, to right side canister fitting. See Figure 4-20.
   d. Cable tie hose loosely to frame.
3. Route purge hose.
   a. See Figure 4-17. Attach the preformed purge hose to the carburetor purge fitting.
   b. See Figure 4-21. Route purge hose under fuel tank along backbone to left side of motorcycle. Route purge hose down frame to canister.
   c. See Figure 4-19. Attach the purge hose to the canister fitting marked "carb" on the left side of the canister.
4. Route fuel tank vent hose.
   a. See Figure 4-21. Attach one end of the upper fuel tank vent hose to the top (long) fitting on the vapor valve.
   b. Attach lower fuel tank vent hose to the bottom fitting on the vapor valve. Route fuel tank vent hose along frame (cable tie loosely to frame) to canister fitting marked "tank" on the left side of the canister. See Figure 4-19.
5. Install fuel tank. See 4.7 FUEL TANK.
6. Attach the fuel tank vent hose to the fuel tank vent nipple on the fuel tank.
7. Install **new** EVAP system label on front frame down tube.

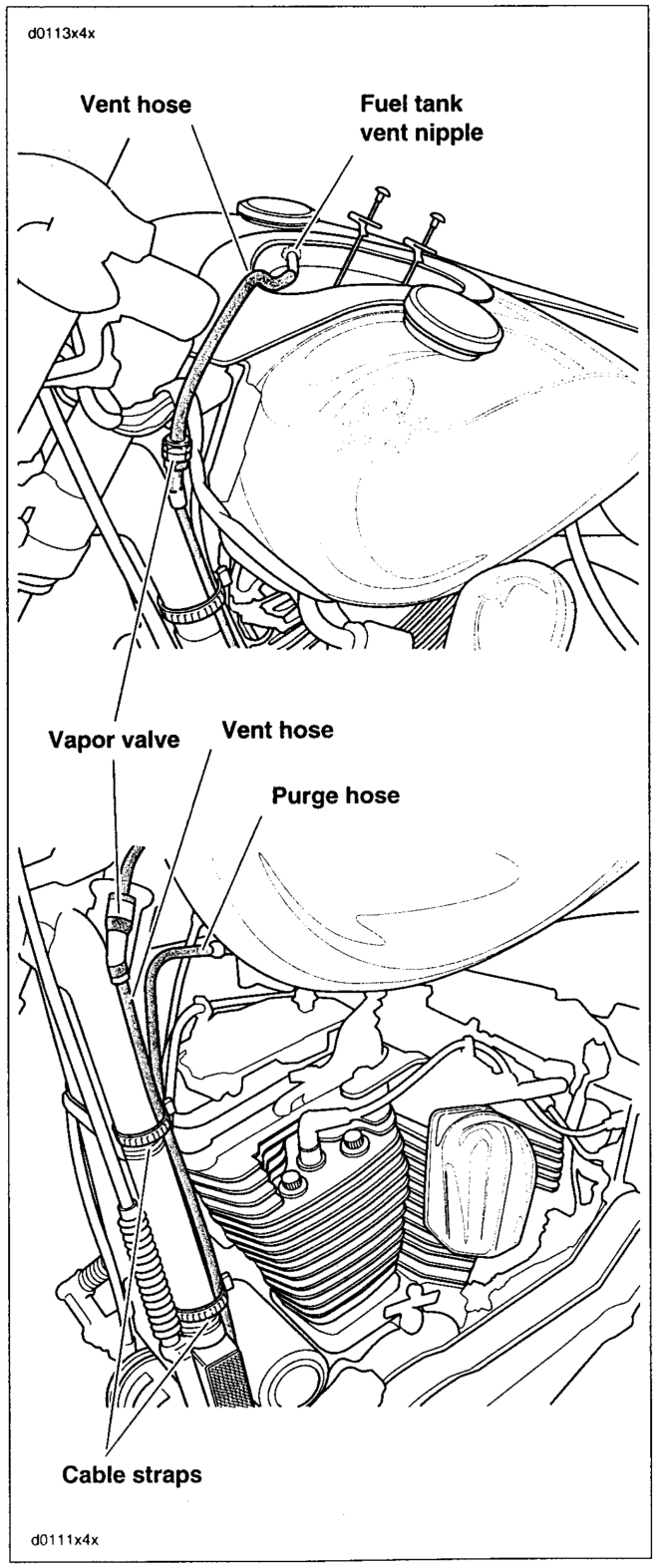


Figure 4-21. Hose Routing-Purge Hose and Vent Hose

NOTES

ELECTRIC STARTER 5

SUBJECT **PAGE NO.**

5.1 Specifications 5-1
5.2 Electric Starter System 5-2
5.3 Starter Relay 5-5
5.4 Starter 5-6
5.5 Starter Solenoid 5-13
5.6 Starter Jackshaft 5-14

STARTER	
Free speed	3000 RPM (min.) @ 11.5 V
Free current	90 amp (max.) @ 11.5 V
Cranking current	200 amp (max.) @ 68°F

SERVICE WEAR LIMITS	IN.	MM
Brush length minimum	0.433	11.0
Commutator diameter minimum	1.141	28.981

TORQUE VALUES

ITEM	TORQUE		NOTES
Jackshaft lockplate bolt	84-108 in-lbs	9.5-12.2 Nm	Bend locking tab after tightening, page 5-7, 5-15
Starter mounting bolts	13-20 ft-lbs	17.6-27.1 Nm	Page 5-6
Starter positive terminal nut	60-85 in-lbs	6.8-9.6 Nm	Metric, page 5-7

GENERAL

The starter is made up of an armature, field winding assembly, solenoid, drive assembly, idler gear and drive housing.

The starter motor torque is increased through gear reduction. The gear reduction consists of the drive pinion on the armature, an idler gear and a clutch gear in the drive housing. The idler gear is supported by rollers. The clutch gear is part of the overrunning clutch/drive assembly.

The overrunning clutch is the part which engages and drives the clutch ring gear. It also prevents the starter from overrunning. The field windings are connected in series with the armature through brushes and commutator segments.

Wiring Diagrams

See Figure 5-2. The starting circuit wiring diagram contains information about wiring configuration. For additional information concerning the starting system circuit, see the wiring diagrams in Appendix B.

Starter Relay

The starter relay is not repairable. Replace the unit if it fails.

OPERATION

See Figure 5-1. When the starter switch is pushed, the starter relay is activated, then the starter solenoid is activated allowing current to flow into the pull-in winding (10) and the hold-in winding (11), to ground.

The magnetic forces of the pull-in and hold-in windings in the solenoid push the plunger (7) causing it to shift to the left. This action engages the pinion gear (1) with the clutch ring gear (13). At the same time, the main solenoid contacts (8) are closed, so battery current flows directly through the field windings (3) to the armature (4) and to ground. Simultaneously, the pull-in winding (10) is shorted.

The current continues flowing through the hold-in winding (11) keeping the main solenoid contacts (8) closed. At this point, the starter begins to crank the engine.

After the engine has started, the pinion gear (1) turns freely on the pinion shaft through the action of the overrunning clutch (12). The overrunning clutch prevents the clutch ring gear (13) (which is now rotating under power from the engine) from turning the armature (4) too fast.

When the starter switch is released, the current of the hold-in winding (11) is fed through the main solenoid contacts (8) and the direction of the current in the pull-in winding (10) is reversed. The solenoid plunger (7) is returned to its original position by the return spring, which causes the pinion gear (1) to disengage from the clutch ring gear (13).

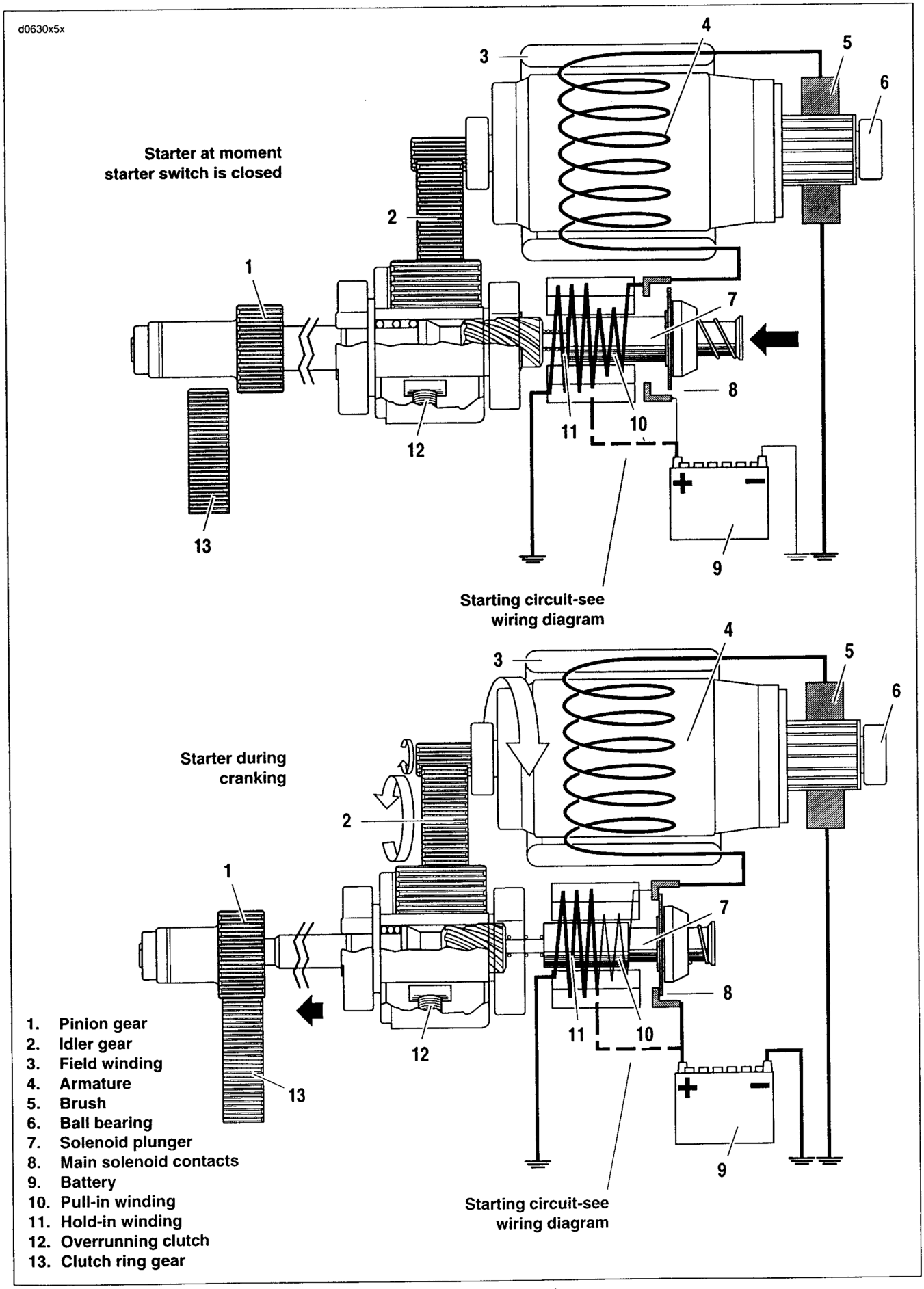


Figure 5-1. Starter Operation

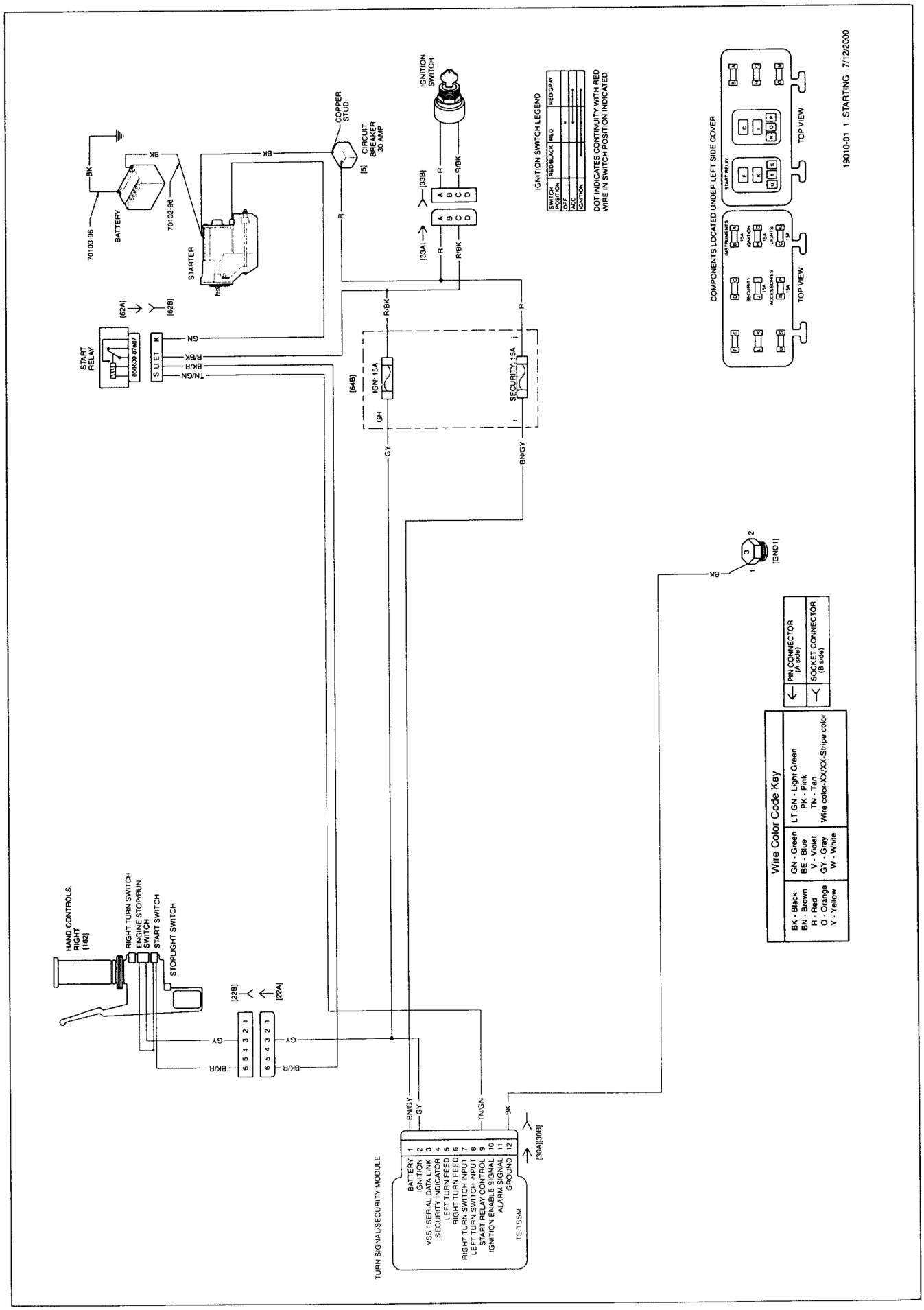


Figure 5-2. Starting Circuit

REMOVAL

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. See Figure 5-3. Firmly grasp both sides of cover and pull outward.to remove.
4. See Figure 5-4. Remove nuts on top plate.
5. See Figure 5-5. Remove starter relay.

INSTALLATION

1. See Figure 5-5. Install starter relay.
2. See Figure 5-6. See Figure 5-4. Slide slotted tab of top plate into panel adjacent to fuses.
3. See Figure 5-4. Install and tighten nuts on top plate.
4. See Figure 5-3. Grasp both sides of cover and push firmly into top plate.
   - Verify side cover is firmly attached to top plate.

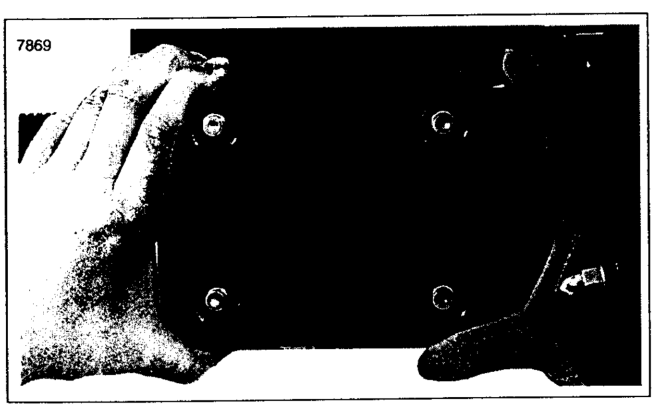


Figure 5-3. Removing/Installing Side Cover

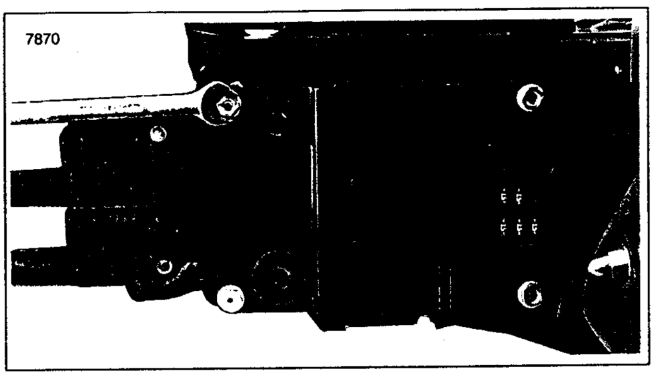


Figure 5-4. Removing/installing Top Plate

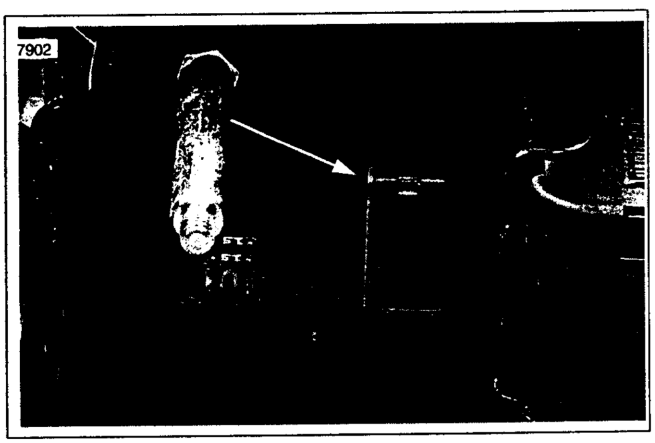


Figure 5-5. Starter Relay

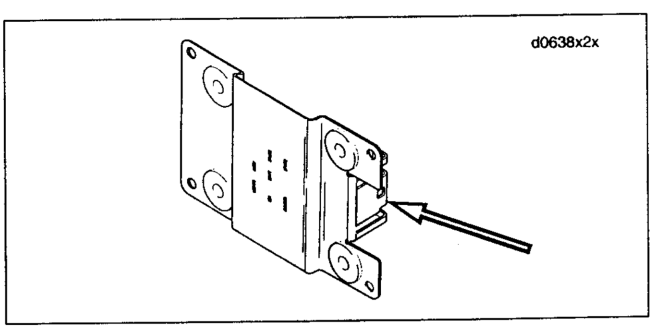


Figure 5-6. Top Plate Slotted Tab

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

5. Connect battery cables, positive cable first.
6. Install seat.

REMOVAL

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect battery cables, negative cable first.
2. Remove primary cover. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.
3. See Figure 5-7. Bend tab on lockplate (1) away from head of jackshaft bolt. Hold pinion gear (3) in place and remove jackshaft bolt (2), lockplate and thrust washer.
4. See Figure 5-8. Remove screw and end cover from starter.
5. Remove rear exhaust pipe. See 4.9 EXHAUST SYSTEM.
6. See Figure 5-9. Remove both starter mounting bolts and washers. This includes detaching the engine ground cable.
7. See Figure 5-10. Remove protective boot. Remove nut with washer (1) (metric).
   a. Remove positive battery cable ring terminal (2).
   b. Remove circuit breaker wire ring terminal (3).
   c. Detach solenoid wire (4).
8. Remove starter from right side of motorcycle.

NOTE

Jackshaft-to-starter shaft coupling will stay on starter shaft.

9. Before disassembling the starter, perform diagnostics.

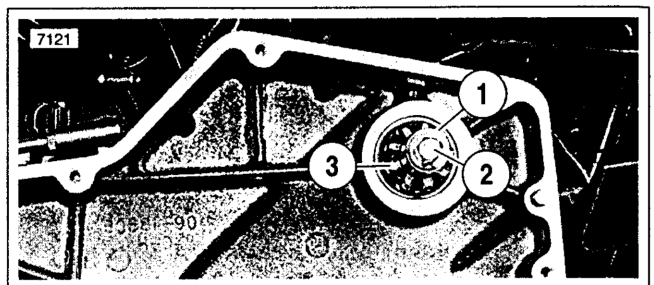
INSTALLATION

1. Install starter from right side of motorcycle.

NOTE

Be sure jackshaft coupling engages starter shaft.

2. See Figure 5-9. Install the two starter mounting bolts and washers. Place engine ground cable over forward bolt as shown. Tighten to 13-20 ft-lbs (17.6-27.1 Nm).



1. **Lockplate and thrust washer**
2. **Jackshaft bolt**
3. **Pinion gear**

Figure 5-7. Lockplate on Jackshaft Bolt

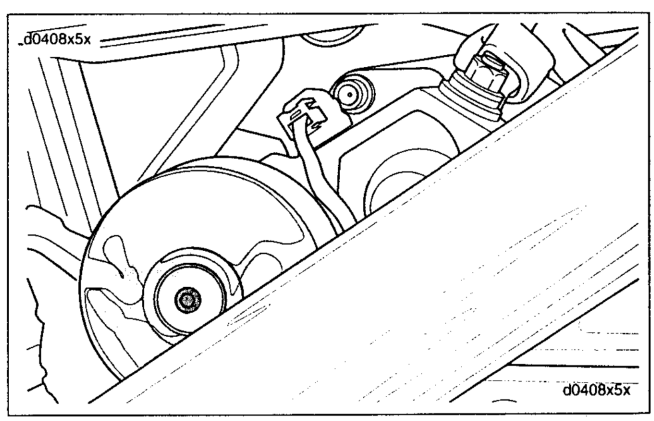


Figure 5-8. Starter Cover Screw

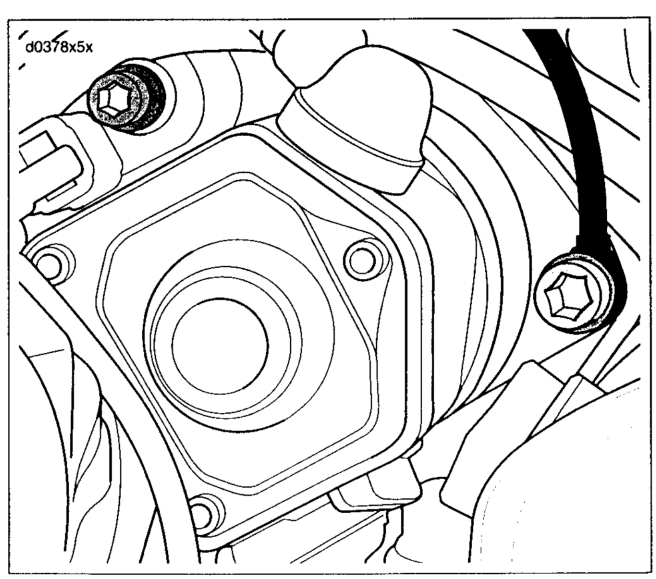


Figure 5-9. Starter Mounting

⚠WARNING

Be sure the starter solenoid terminal that is connected to the positive (+) battery cable is securely covered by the rubber boot. An uncovered terminal could short against other components resulting in sparks. These sparks may cause a fire or battery explosion which could result in death or serious injury.

3. See Figure 5-10. Attach positive battery cable (2), circuit breaker wire (3) and solenoid wire (4). Tighten nut (1) (metric) to 60-85 **in-lbs** (6.8-9.6 Nm). Place rubber boot securely over terminal.

NOTE

Be sure the lockplate protrusion is sticking into the keyway on jackshaft.

4. See Figure 5-7. Install lockplate and thrust washer (1) and jackshaft bolt (2). Hold pinion gear (3) in place and tighten bolt to 84-108 **in-lbs** (9.5-12.2 Nm). Bend tab on lockplate against flat of bolt head to secure.

CAUTION

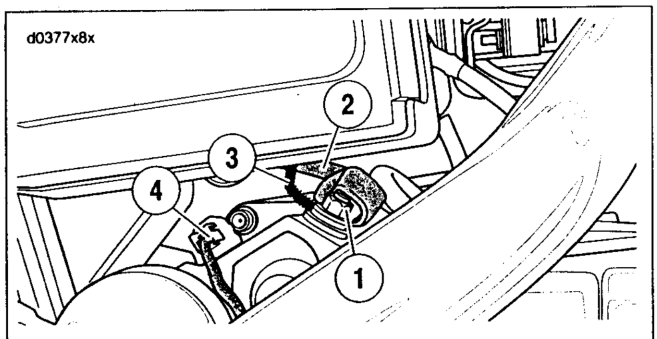
The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

5. Install primary chaincase cover and fill with lubricant. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.
6. See Figure 5-8. Attach starter end cover using screw.
7. Install rear exhaust pipe. See 4.9 EXHAUST SYSTEM.

⚠WARNING

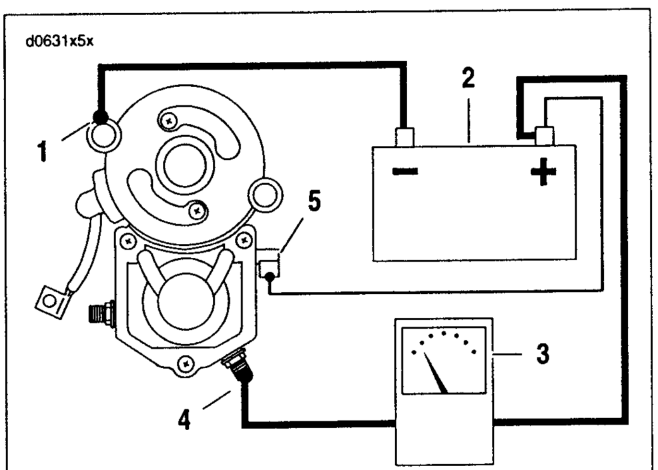
Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

8. Connect battery cables, positive cable first.



1. **Nut with washer (metric)**
2. **Positive battery cable ring terminal**
3. **Circuit breaker wire ring terminal**
4. **Solenoid wire**

Figure 5-10. Starter Wires



1. **Mounting flange**
2. **Battery**
3. **Induction ammeter**
4. **Battery terminal**
5. **Relay terminal**

Figure 5-11. Free Running Current Draw Test

DISASSEMBLY, INSPECTION AND REPAIR

1. Remove two nuts with washers to detach end cover mount from thru-bolts.
2. See Figure 5-12. Lift rubber boot (1). Remove field wire nut with washer (2) (metric) to detach field wire (3).
3. See Figure 5-13. Remove both thru-bolts (1, 3), field coil and cap.
4. Remove both end cover screws with O-rings (2) and end cover (4).
5. Check brush length. Replace all four brushes if length of any one brush is less than 0.433 in. (11.0 mm).

NOTE

Brushes not available separately. Purchase a ***new*** *field frame and brush holder to replace brushes.*

6. See Figure 5-14. Use a wire hook to pull upward on brush springs (3), and lift brushes out of holder (2). Remove brush holder.
7. Remove armature (4).
8. Place armature in lathe or truing stand and check commutator runout and diameter.
   a. Commutators with more than 0.015 in. (0.38 mm) of runout should be replaced or machined on a lathe.
   b. Replace commutators when diameter is less than 1.141 in. (28.981 mm)
   c. Check armature bearings. Replace if necessary.

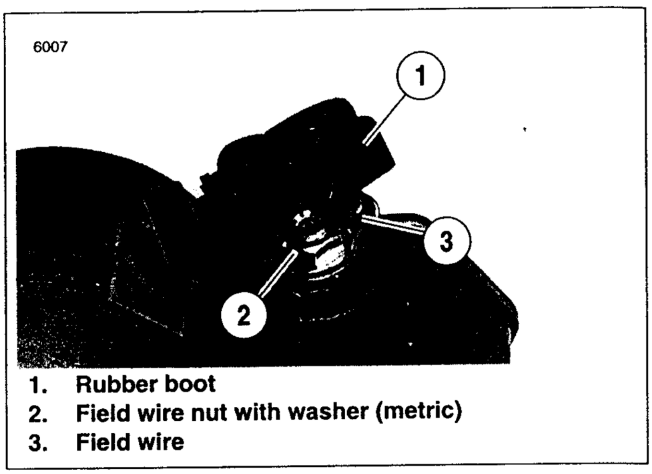
CAUTION

Do not use sandpaper or emery cloth to remove burrs on commutator. Otherwise, abrasive grit may remain on commutator segments; this could lead to excessive brush wear. Use only the recommended crocus cloth.

9. Check depth of mica on commutator. If undercut is less than 0.008 in. (0.203 mm), use an undercutting machine to undercut the mica to 0.031 in. (0.794 mm) deep. The slots should then be cleaned to remove any dirt or copper dust.

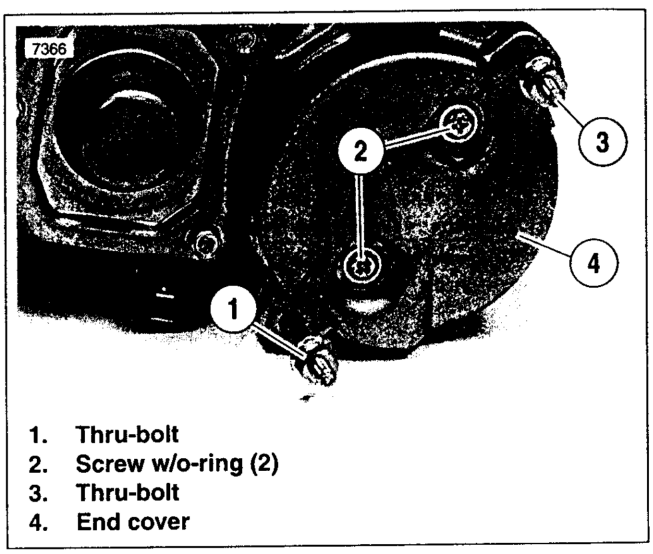
NOTE

See Figure 5-15. If an undercutting machine is not available, undercutting can be done satisfactorily using a thin hacksaw blade. After undercutting, lightly sand the commutator with crocus cloth to remove any burrs.



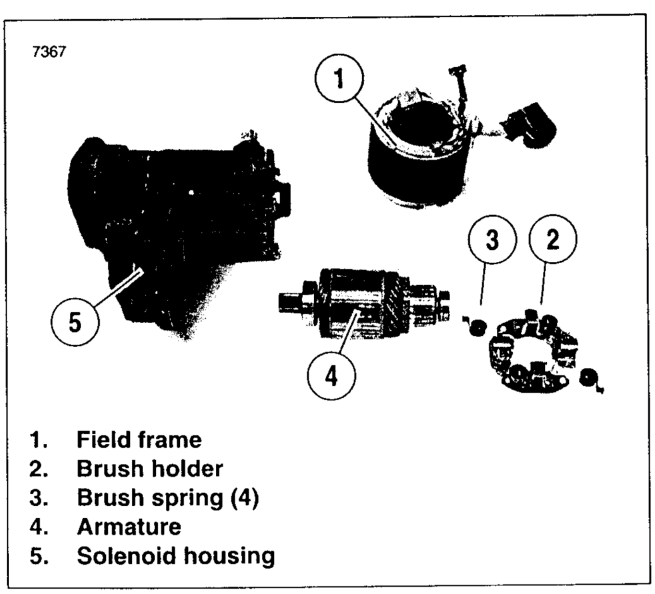
1. **Rubber boot**
2. **Field wire nut with washer (metric)**
3. **Field wire**

Figure 5-12. Field Wire



1. **Thru-bolt**
2. **Screw w/o-ring (2)**
3. **Thru-bolt**
4. **End cover**

Figure 5-13. Removing the Thru-Bolts



1. **Field frame**
2. **Brush holder**
3. **Brush spring (4)**
4. **Armature**
5. **Solenoid housing**

Figure 5-14. Starter Components

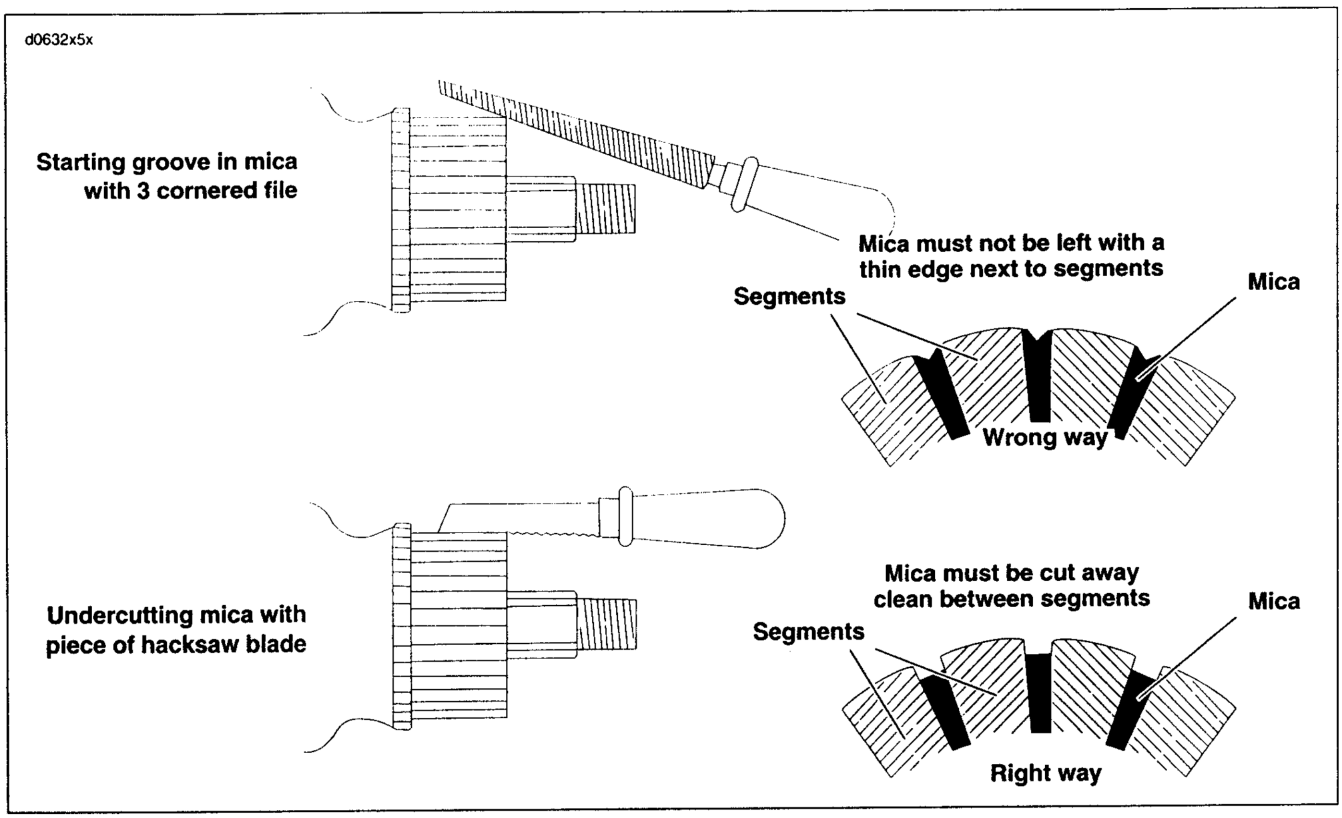


Figure 5-15. Undercutting Mica Separators

10. See Figure 5-16. Check for SHORTED ARMATURE with a growler.
    a. Place armature on growler (1).
    b. Hold a thin steel strip (2) (hacksaw blade) against armature core and slowly turn armature.
    c. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Replace shorted armatures.

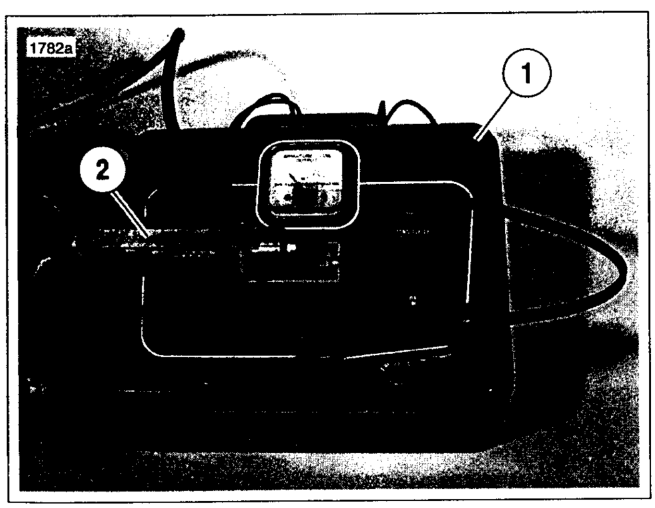


Figure 5-16. Shorted Armature Test Using Growler

11. See Figure 5-17. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester.
    a. Touch one probe to any commutator segment (1).
    b. Touch the other probe to the armature core (2).
    c. There should be no continuity (infinite ohms). If there is continuity, then the armature is grounded. Replace grounded armatures.

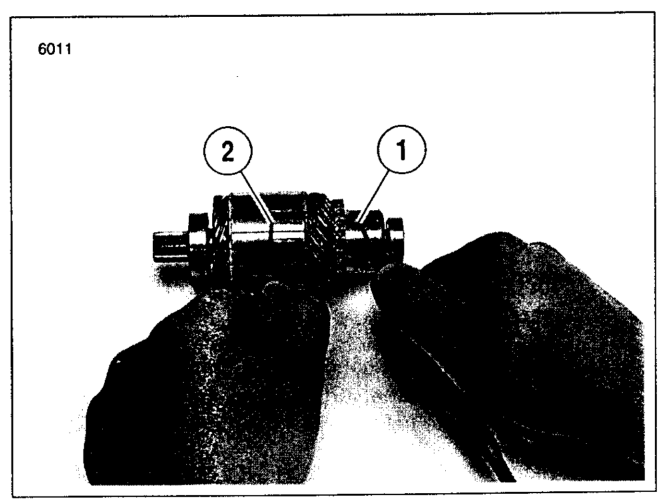


Figure 5-17. Grounded Armature Test

12. See Figure 5-18. Check for OPEN ARMATURE with an ohmmeter or continuity tester.
    a. Check for continuity between all commutator segments (1).
    b. There should be continuity (0 ohms) at all test points. No continuity at any test point indicates armature is open and must be replaced.

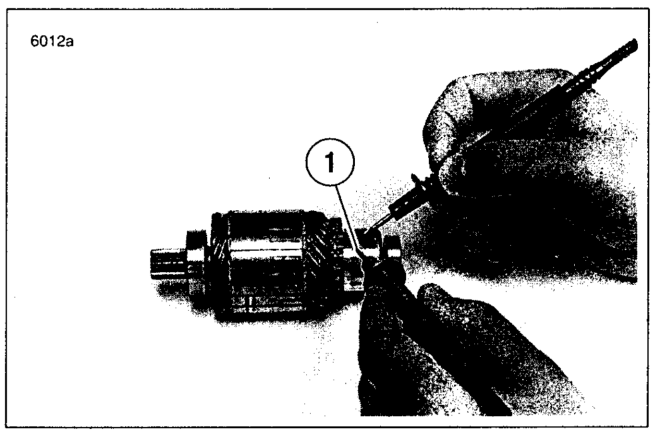


Figure 5-18. Open Armature Test

13. See Figure 5-19. Check for GROUNDED FIELD COIL with an ohmmeter or continuity tester.
    a. Touch one probe to the frame (1).
    b. Touch the other probe to each of the brushes (2) attached to the field coil.
    c. There should be no continuity (infinite ohms). If there is any continuity at either brush, then the field coil(s) are grounded and the field frame must be replaced.
14. See Figure 5-20. Check for OPEN FIELD COILS with an ohmmeter or continuity tester.
    a. Touch one probe to the field wire (1).
    b. Touch the other probe to each of the brushes attached to the field coil(s) (2).
    c. There should be continuity (0 ohms). If there is no continuity at either brush, then the field coil(s) are open and the field frame must be replaced.
15. See Figure 5-21. Test BRUSH HOLDER INSULATION with an ohmmeter or continuity tester.
    a. Touch one probe to holder plate (1).
    b. Touch the other probe to each of the positive (insulated) brush holders (2).
    c. There should be no continuity (infinite ohms). If there is continuity at either brush holder, replace the brush holder assembly.
    d. Touch one probe to the non insulated brush holders and touch the other probe to the holder plate. If you measure any resistance, replace brush holder.

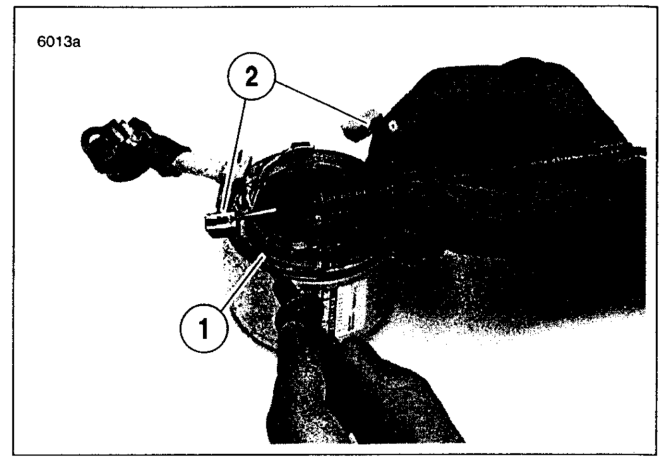


Figure 5-19. Grounded Field Test

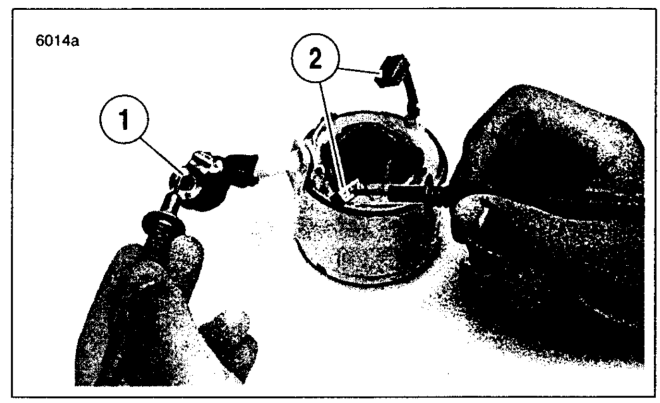


Figure 5-20. Open Field Test

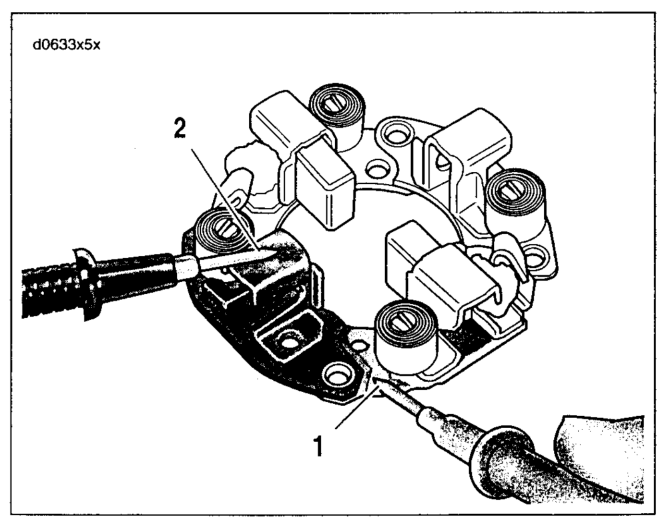
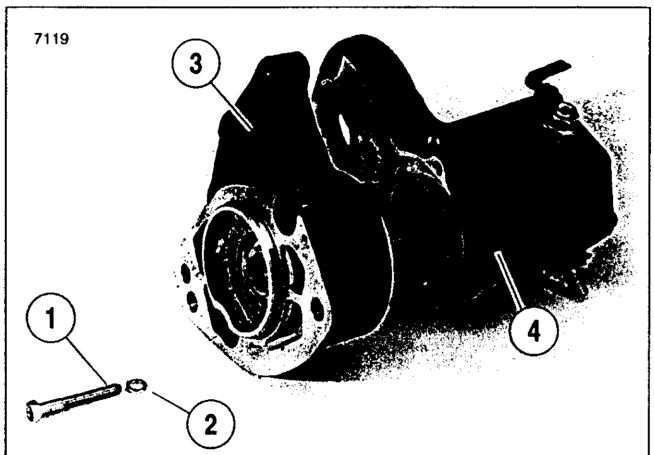


Figure 5-21. Brush Holder Insulation Test

16. See Figure 5-22. Remove two drive housing mounting screws (1) and washers (2). Remove drive housing (3) from solenoid housing (4).



1. **Mounting screws**
2. **Washers**
3. **Drive housing**
4. **Solenoid housing**

Figure 5-22. Starter Drive Assembly

17. See Figure 5-23. Remove drive (1), idler gear (2) and idler gear bearing (3). Remove O-ring from groove in drive housing (4).
18. Remove spring (5) and shaft (6).

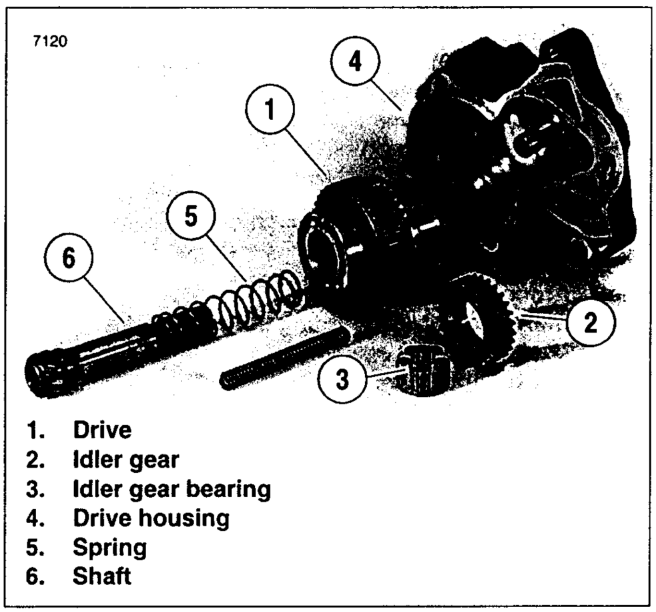
ASSEMBLY

1. See Figure 5-25. Replace both O-rings (23).

CAUTION

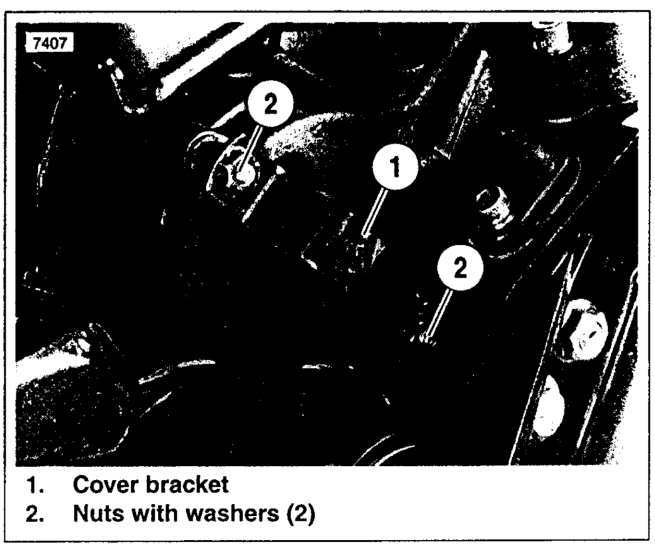
Do not use solvents to clean starter clutch (15). It is lubricated and sealed. If you use a solvent to clean it, the lubricant will be washed out and the clutch will fail.

2. Clean, inspect and lubricate drive assembly components. Lubricate parts with high temperature grease such as LUBRIPLATE 110.
3. When installing drive assembly components, open end of idler bearing cage (17) faces toward solenoid.
4. When installing starter housing (13) to switch assembly (14) use **new** O-ring (18). Be sure to install return spring (21) and ball (22).
5. Lubricate armature bearings (10) with high temperature grease such as LUBRIPLATE 110. Install armature (9) and starter yoke assembly (3) to switch assembly.
6. Replace brush springs (6), if necessary. Install brushes (7) into brush holder (8).
7. Install starter end frame (4) with screws and o-rings (5).
8. Install thru-bolts (2).
9. Connect field wire (1) to terminal with nut (25). Tighten to 70-90 **in-lbs** (7.9-10.1 Nm).
10. Attach cover bracket (29) using two nuts with washers (30) (See also Figure 5-24.).
11. Attach cover (31) with cover screw (32).



1. **Drive**
2. **Idler gear**
3. **Idler gear bearing**
4. **Drive housing**
5. **Spring**
6. **Shaft**

Figure 5-23. Clutch Assembly



1. **Cover bracket**
2. **Nuts with washers (2)**

Figure 5-24. Cover Bracket (Shown Installed For Orientation Purposes)

1. Field wire
2. Thru-bolt (2)
3. Starter yoke assembly
4. Starter end frame
5. Screw w/O-ring (2)
6. Brush spring (4)
7. Brushes
8. Brush holder assembly
9. Armature
10. Armature bearings (2)
11. Starter housing mounting bolt (2)
12. Lockwasher (2)
13. Starter housing
14. Switch assembly
15. Starter clutch
16. Idler gear
17. Idler gear bearing & cage
18. O-ring
19. Spring
20. Output shaft
21. Return spring
22. Ball
23. O-ring (2)
24. Drain vent
25. Nut
26. Insulating boot
27. Screw (2)
28. Lockwasher (2)
29. Cover bracket
30. Nut w/washer
31. Cover
32. Cover screw

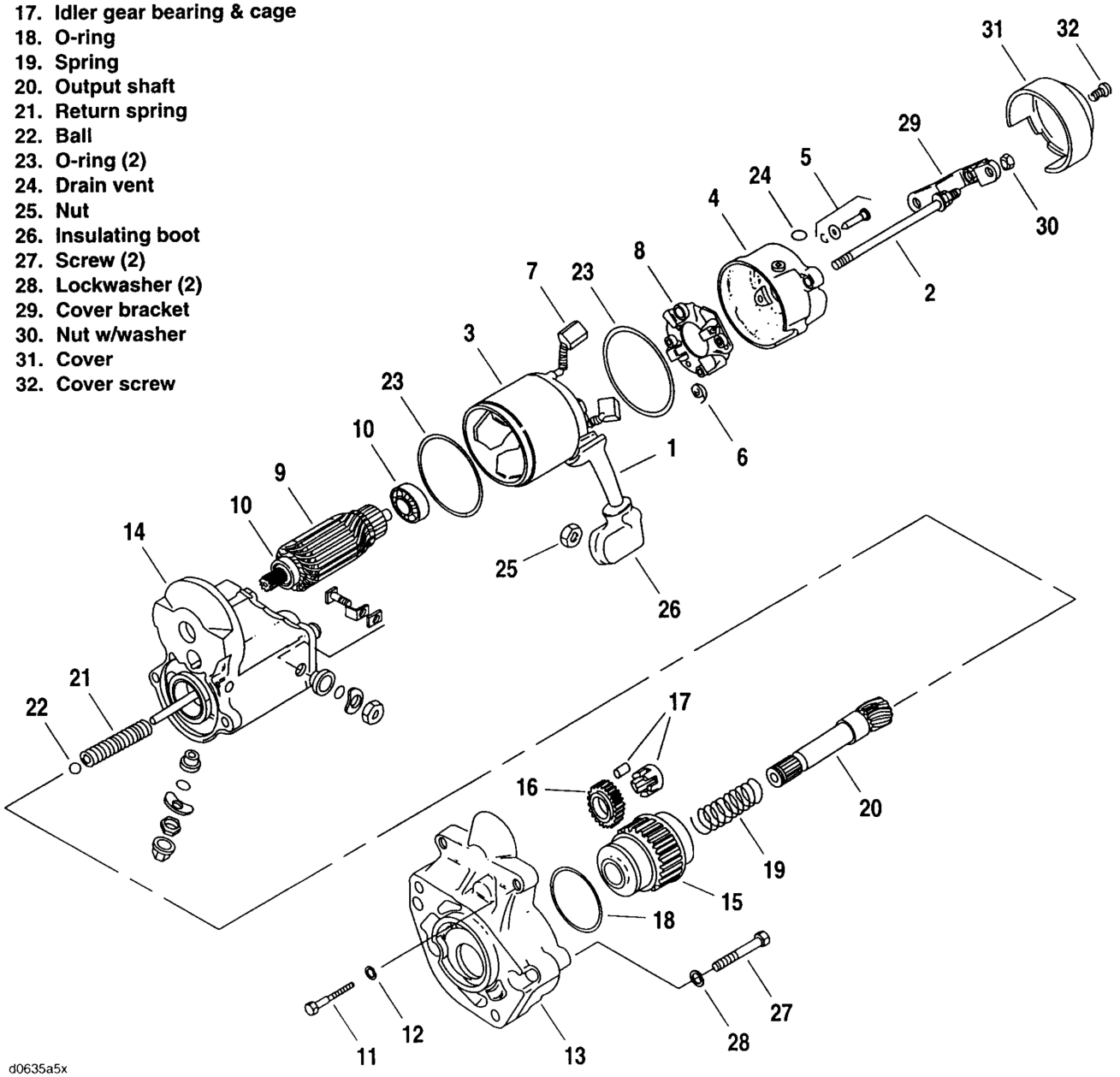


Figure 5-25. Starter Assembly

GENERAL

CAUTION

See Figure 5-26. Do not tighten nut (6) without removing items 1-5. The contact will move and be destroyed.

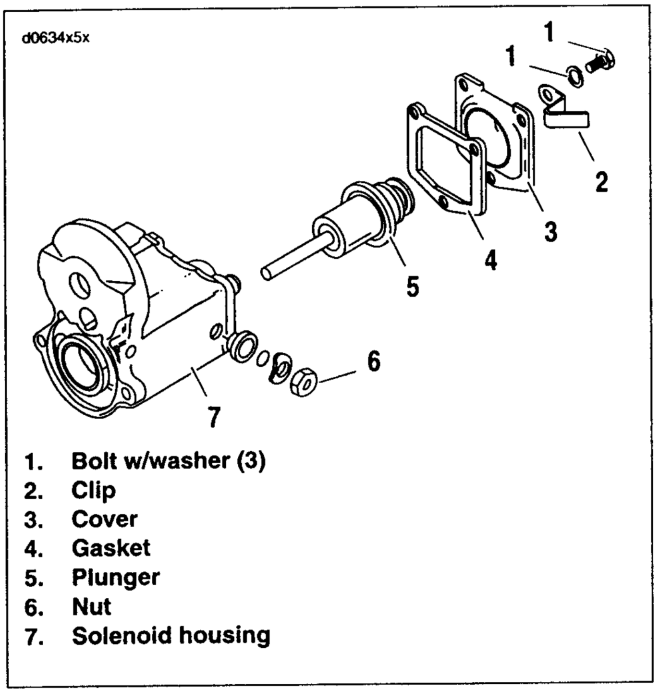
The starter solenoid is a switch that is designed to open and close the starting circuit electromagnetically. The switch consists of contacts and a winding around a hollow cylinder containing a movable plunger.

DISASSEMBLY

1. See Figure 5-26. Remove bolts w/washers (1) and clip (2).
2. Remove cover (3) and gasket (4). Discard gasket.
3. Remove plunger (5) from solenoid housing (7).

ASSEMBLY

1. See Figure 5-26. Replace wire connection hardware as necessary.
2. Apply a light coat of LUBRIPLATE 110 to plunger shaft. Install plunger (5) in solenoid housing (7).
3. Install **new** gasket (4) onto cover (3).
4. Position cover with gasket onto solenoid housing. Install clip (2) and bolts w/washers (1).



1. **Bolt w/washer (3)**
2. **Clip**
3. **Cover**
4. **Gasket**
5. **Plunger**
6. **Nut**
7. **Solenoid housing**

Figure 5-26. Starter Solenoid

REMOVAL/DISASSEMBLY

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

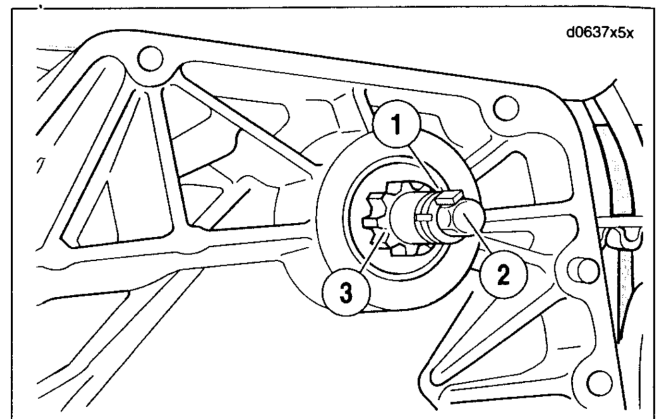
Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect battery cables, negative cable first.
2. Remove primary cover. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

NOTE

See Figure 5-28. If you are only going to service the items from the bolt through the spring (1-5), it is not necessary to remove clutch.

3. Remove clutch assembly. See 6.3 DRIVE COMPONENTS.
4. See Figure 5-27. Hold pinion gear (3) in place and remove the jackshaft bolt (2), lockplate and thrust washer (1).
5. Remove jackshaft from inner primary as an assembly.
6. See Figure 5-28. Remove pinion gear (4) from jackshaft.
7. Remove coupling (7) and spring (5). Spring and retaining ring (6) are inside coupling. Replace retaining ring if necessary.



1. **Lockplate and thrust washer**
2. **Jackshaft bolt**
3. **Pinion gear**

Figure 5-27. Primary Chaincase and Jackshaft Assembly

CAUTION

If you want to replace the coupling (10) and/or retaining ring (9), you will have to remove the starter. See REMOVAL under 5.4 STARTER. If you force coupling through the primary case oil seal, the seal will be destroyed and will have to be replaced.

8. Remove coupling (10) from the starter shaft. Replace retaining ring (9), if necessary.

1. **Jackshaft bolt**
2. **Lockplate**
3. **Thrust washer**
4. **Pinion gear**
5. **Spring**
6. **Retaining ring**
7. **Coupling**
8. **Jackshaft**
9. **Retaining ring**
10. **Coupling**
11. **Bushing, primary cover**
12. **Bushing, primary chaincase**

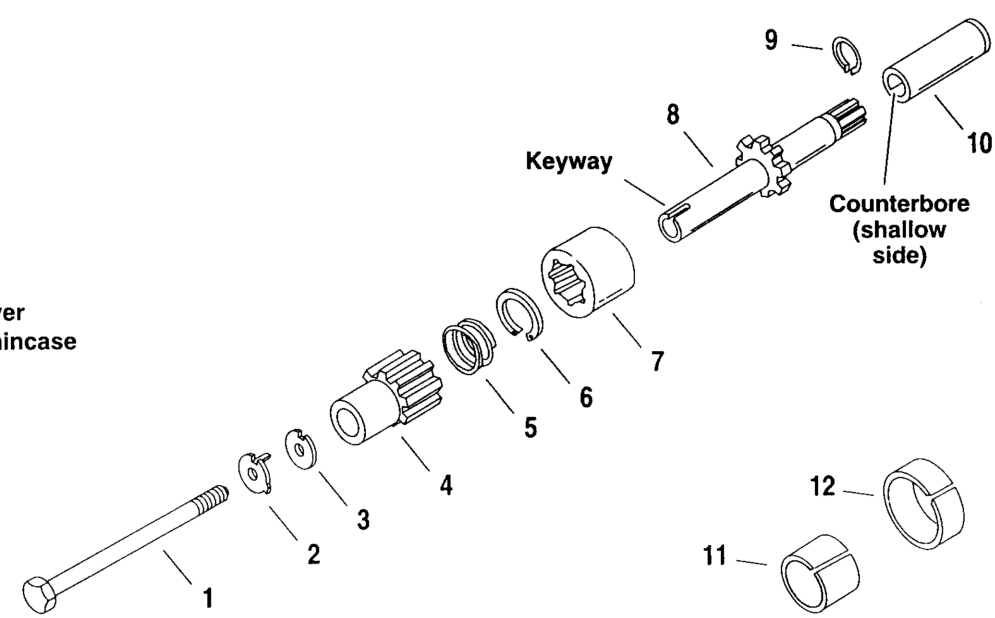


Figure 5-28. Starter Jackshaft

ASSEMBLY/INSTALLATION

NOTE

When you install the coupling, be sure the shallow side goes toward the jackshaft. Make sure coupling is installed on the starter motor output shaft before installing jackshaft assembly.

1. See Figure 5-28. If removed, insert retaining ring (9) in coupling (10). Install coupling on starter output shaft with counter bore facing jackshaft. Shallow side of coupling faces jackshaft splines. Continue with 5.4 STARTER installation.
2. Place spring (5) inside coupling (7).
3. Install pinion gear (4) on shaft.
4. Place lockplate (2) and thrust washer (3) on bolt (1). Insert bolt into jackshaft (8).
5. Install retaining ring (6) if removed, on shaft. Slide jackshaft assembly into position in inner primary.

NOTE

Be sure the lockplate tab is in the keyway. This will hold lockplate and thrust washer in place.

6. Align lockplate tab and thrust washer slot with jackshaft keyway. Screw the jackshaft bolt into the starter shaft.
7. Hold the pinion gear in position and tighten the bolt to 84-108 **in-lbs** (9.5-12.2 Nm).
8. Bend locking tab against bolt head.
9. Install clutch assembly. See 6.3 DRIVE COMPONENTS.

CAUTION

The Print-O-Seal 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.

10. Install primary chaincase cover and fill with lubricant. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

11. Connect battery cables, positive cable first.

NOTES

DRIVE 6

SUBJECT	PAGE NO.
6.1 Specifications	6-1
6.2 Primary Chaincase	6-2
6.3 Drive Components	6-6
6.4 Clutch	6-10
6.5 Transmission Sprocket	6-15
6.6 Drive Belt	6-17

SPROCKETS	NUMBER OF TEETH
Compensating	25
Clutch	36
Transmission	32
Rear wheel	70

GEAR	OVERALL GEAR RATIO
First (low)	10.110
Second	6.958
Third	4.953
Fourth	3.862
Fifth (high)	3.150

CLUTCH	DESCRIPTION
Type	Wet-multiple disc
Clutch lever free play (after internal adjustment)	1/16-1/8 in.
	1.6-3.2 mm

NOTE

Overall gear ratios indicate number of engine revolutions required to drive rear wheel one revolution.

TORQUE VALUES

ITEM	TORQUE		NOTES
Chain Tensioner Shoe Top Center Nut	21-29 ft-lbs	29-39 Nm	Page 6-9
Clutch diaphragm spring retainer bolts	90-110 in-lbs	10.2-12.4 Nm	Metric, page 6-10, 6-14
Clutch hub nut	70-80 ft-lbs	94.9-108.5 Nm	Left hand threads, apply several drops of LOCTITE THREADLOCKER 262 (red) to last few threads, page 6-8
Compensating sprocket nut	150-165 ft-lbs	203.4-223.7 Nm	Apply several drops of LOCTITE THREADLOCKER 262 (red) to last few threads, page 6-8
Inner primary-to-engine bolts	17-21 ft-lbs	23.0-28.5 Nm	Bend locktabs, page 6-5
Primary chaincase cover screws	108-120 in-lbs	12.2-13.6 Nm	Special sequence to tighten, page 6-3
Primary chaincase inspection cover screws, long	84-108 in-lbs	9.5-12.2 Nm	Top and rear fasteners, page 6-3
Primary chaincase inspection cover screws, short	84-108 in-lbs	9.5-12.2 Nm	Bottom and front fasteners, page 6-3
Primary-to-transmission bolts	17-21 ft-lbs	23.0-28.5 Nm	Bend locktabs, page 6-5
Transmission lockplate screws	84-108 in-lbs	9.5-12.2 Nm	LOCTITE patch, use 3-5 times, page 6-16
Transmission sprocket nut	60 ft-lbs	81.4 Nm	Left hand threads, initial torque only, apply several drops of LOCTITE THREADLOCKER 262 (red) to last few threads. , page 6-16

GENERAL

The primary chaincase is a sealed housing containing the primary chain, clutch, engine compensating sprocket, chain adjuster, alternator, and starter drive mechanism.

For information on primary chain adjustment and lubrication, see Section 1.

- 1.10 PRIMARY CHAIN.
- 1.11 PRIMARY CHAINCASE LUBRICANT.

PRIMARY CHAINCASE COVER

Removal

⚠WARNING

To protect against shock, accidental start-up of vehicle and possible personal injury, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect battery cable, negative cable only.
2. Drain the primary chaincase lubricant. See 1.11 PRIMARY CHAINCASE LUBRICANT.

CAUTION

See Figure 6-1. The inspection cover is fastened to the inner primary chaincase at the top and rear screws (13, 14). Before removing the primary cover, be sure you remove the inspection cover's top and rear screws or the cover, primary cover and inner primary will be damaged.

3. When lubricant has drained, remove cover.
   a. See Figure 6-1. First remove the top and rear inspection cover screws (13, 14).
   b. Continue by removing remaining hardware.

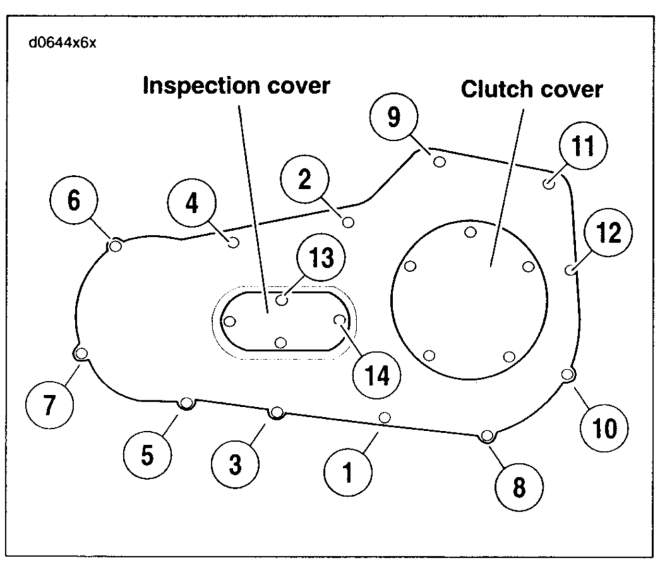


Figure 6-1. Primary Chaincase Cover

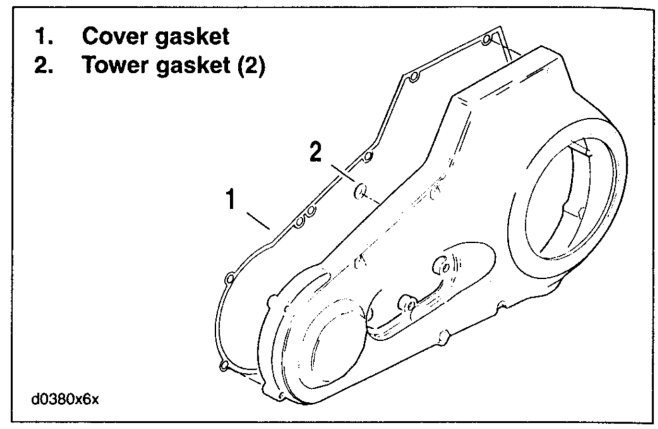


Figure 6-2. Inspection Cover Gaskets

Installation

CAUTION

The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

1. See Figure 6-2. Replace the cover gasket (1) and both gaskets (2) on the two inner primary case towers.
2. See Figure 6-1. Tighten primary cover screws (1-12) to 108-120 **in-lbs** (12.2-13.6 Nm) in the sequence shown. Tighten inspection cover screws (13, 14) to 84-108 **in-lbs** (9.5-12.2 Nm).

CAUTION

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

3. Place motorcycle in an upright position and fill primary chaincase. See 1.11 PRIMARY CHAINCASE LUBRICANT.

⚠WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

4. Connect battery cables, positive cable first.

PRIMARY CHAINCASE HOUSING

Removal

⚠WARNING

To protect against shock, accidental start-up of vehicle and possible personal injury, disconnect the negative battery cable before proceeding. Inadequate safety precautions could result in death or serious injury.

1. Disconnect battery cable, negative cable only.
2. Remove primary chaincase cover.
3. Remove primary chain, clutch, and compensating sprocket as an assembly. See 6.3 DRIVE COMPONENTS.
4. Remove the starter jackshaft and two starter mounting bolts. See 5.6 STARTER JACKSHAFT.
5. See Figure 6-3. Bend the lockplate tabs back (where necessary) and remove primary-to-engine mounting bolts.
6. See Figure 6-4. Bend the lockplate tabs back and remove primary-to-transmission mounting bolts.
7. Remove primary chaincase and discard the crankcase lip O-ring.

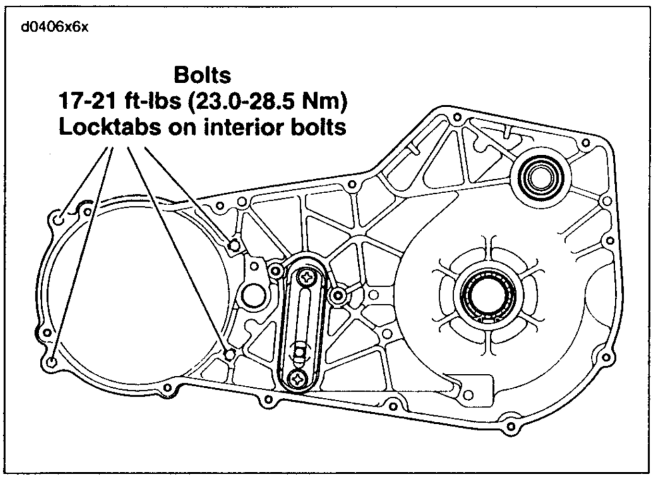


Figure 6-3. Primary-to-Engine Mounting Bolts

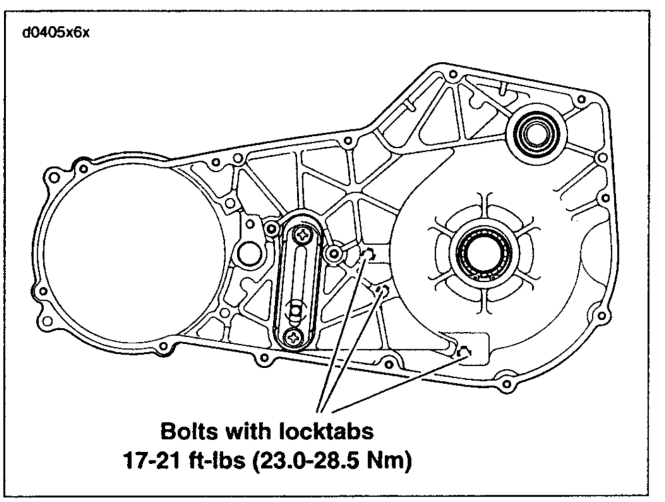


Figure 6-4. Primary-to-Transmission Mounting Bolts

Inspection

1. Inspect primary chaincase for cracks or damaged gasket surfaces.
2. Check primary chaincase and primary cover jackshaft bushings and replace if they are rough or stick.

NOTE

The edge of jackshaft bushings in the primary chaincase and the primary cover must be flush with the edge of their holes.

3. Check primary chaincase jackshaft oil seal. Replace if necessary. Drive in oil seal from inside.

NOTE

See Figure 6-5. The primary chaincase has a shoulder for the oil seal. When replacing the oil seal, be sure the oil seal seats against the shoulder.

4. Check the mainshaft bearing. Replace if bearing does not rotate freely.
5. Check primary chaincase mainshaft oil seal. Replace if worn, scored or damaged. Install seal flush with chaincase surface.

MAINSHAFT BEARING AND LIP SEAL

Removal

⚠WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage may propel the ring with enough force to cause eye injury.

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. Remove retaining ring from groove.
2. Turn the primary chaincase over.
3. Remove retaining ring from groove on clutch side of bearing.

CAUTION

Support inner primary chain case area on clutch side while pressing bearing out of primary chain case. The force needed to remove bearing may cause damage to primary chain case.

4. Support inner primary chain case on clutch side of bearing.
5. Place primary chaincase in arbor press. Press out bearing from pulley side applying pressure to the outer race.

⚠WARNING

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage may propel the ring with enough force to cause eye injury.

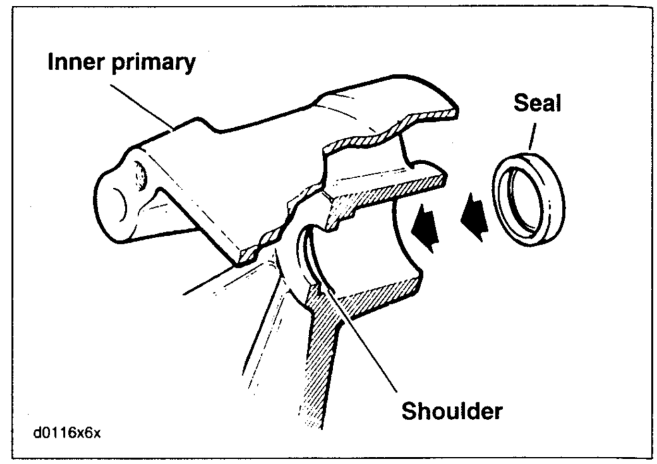


Figure 6-5. Primary Chaincase Jackshaft Oil Seal

6. Inspect the bearing bore to verify that it is clean and smooth. Install retaining ring in groove on pulley side of primary chaincase. Verify that the ring is fully seated in the groove.
7. Place primary chaincase in arbor press with the clutch side up.

CAUTION

Support the retaining ring area on pulley side while pressing bearing into bore. The force needed to press bearing into position may force an unsupported primary chain case to become damaged.

8. Support the retaining ring case area on the pulley side of the primary chaincase.
9. Applying pressure to the outer race, press **new** bearing letter side up, into bore until it makes solid contact with the installed retaining ring.
10. Install second retaining ring to lock position of bearing in bore. Verify that the ring is fully seated in the groove.
11. With the open (lip garter spring) side facing toward the bearing, press fit a **new** lip seal into the bore until it makes solid contact with the second retaining ring. Verify that the seal is square in the bore and completely seated around its circumference.
12. Lubricate the bearing and seal lip with multi-purpose grease or clean engine oil.

Installation

CAUTION

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.

1. Be sure the O-ring is in position on the crankcase around the alternator surface.
2. Oil both seal lips and install primary case. Be careful not to damage mainshaft seal when installing chaincase over the primary bearing inner race on the mainshaft. Lay a bead of silicone sealant on the backside mating surfaces. Place the primary chaincase in position on the motorcycle.
3. See Figure 6-3. Attach the inner primary-to-the-engine using the original bolts and washers. Tighten bolts to 17-21 ft-lbs (23.0-28.5 Nm). Bend up the locktabs of the inner primary-to-engine bolts.
4. See Figure 6-4. Tighten primary-to-the-transmission bolts to 17-21 ft-lbs (23.0-28.5 Nm) and bend locktabs into place.
5. Install starter. See 5.4 STARTER.
6. Install starter jackshaft. See 5.6 STARTER JACKSHAFT.
7. Install the primary chain, clutch, and compensating sprocket as an assembly. See 6.3 DRIVE COMPONENTS.

CAUTION

The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

8. Install primary chaincase cover and fill with lubricant.
9. Connect battery cable, negative cable only.

PRIMARY CHAIN AND COMPENSATING SPROCKET

Removal

PART NO.	SPECIALTY TOOL
HD-41214	Primary drive locking tool

To remove the primary chain, remove compensating sprocket, clutch assembly and primary chain as an assembly:

NOTE

Check sprocket alignment before removing assembly. See Sprocket Alignment on page 6-9.

1. Remove primary chaincase cover. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

CAUTION

Loosen top center nut from chain tensioner before performing any service procedures on primary chain and compensating sprocket. Failure to do so may result in damage to chain tensioner shoe.

2. See Figure 6-6. Loosen top center nut from chain tensioner.
3. See Figure 6-7. Pull chain tensioner shoe outward.
   a. Slide chain tensioner shoe downward.
   b. Verify chain tensioner shoe is resting on bottom lip of primary chaincase.

⚠WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

4. See Figure 6-8. Loosen locknut (3).
5. Remove retaining ring (1) and release plate (2).

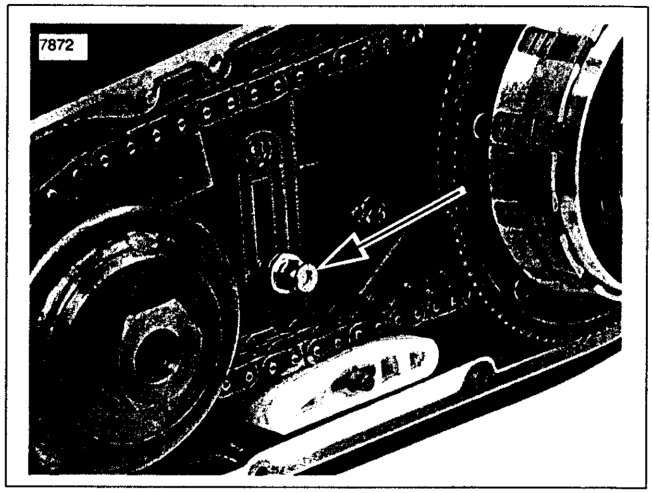


Figure 6-6. Chain Tensioner Top Center Nut

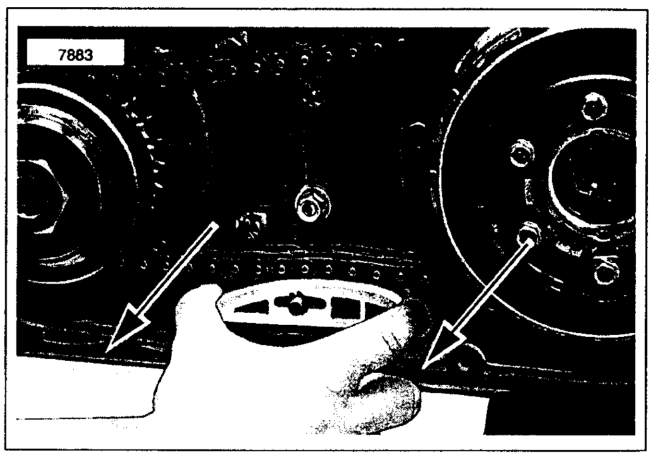
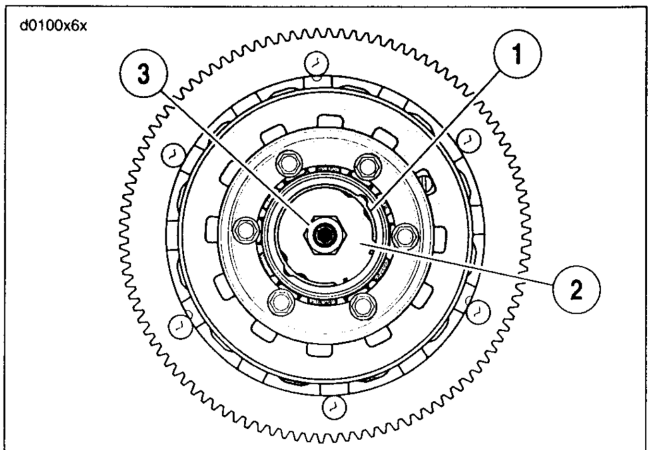


Figure 6-7. Pull/Slide Shoe



1. Retaining ring
2. Release plate
3. Locknut

Figure 6-8. Clutch

CAUTION

When loctite cannot be broken under normal conditions with conventional methods, apply moderate heat or use an air impact wrench ONLY TO LOOSEN clutch hub mainshaft nut. Failure to do so may result in damaged clutch hub and/or threads.

NOTES

See Figure 6-9. When removing the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) must be placed between upper strand of primary chain and clutch hub sprocket.

The mainshaft nut has left handed threads, so turn clockwise to remove.

6. See Figure 6-9. Using a breaker bar, remove clutch hub mainshaft nut.

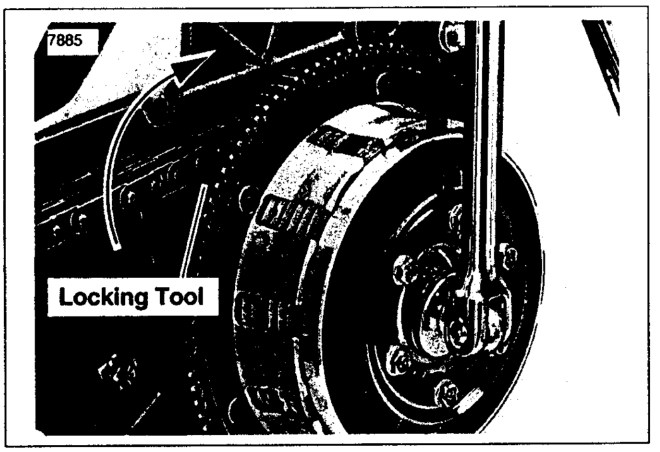


Figure 6-9. Removing Clutch Hub Mainshaft Nut

CAUTION

When loctite cannot be broken under normal conditions with conventional methods, apply moderate heat or use an air impact wrench ONLY TO LOOSEN compensating sprocket nut. Failure to do so may result in damaged timken bearings and rotor magnets.

NOTE

See Figure 6-10. When removing the compensating sprocket nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) must be placed between upper strand of primary chain and compensating sprocket.

7. See Figure 6-10. Using a breaker bar, remove the compensating sprocket nut.
8. See Figure 6-11. Remove nut (7), spacer (6), sprocket cover (5) and sliding cam (4).
9. Remove clutch assembly, primary chain and compensating sprocket as a single assembly.

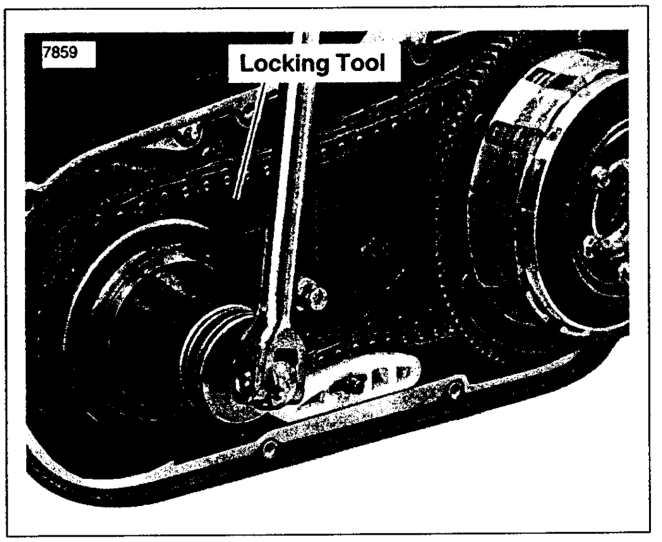


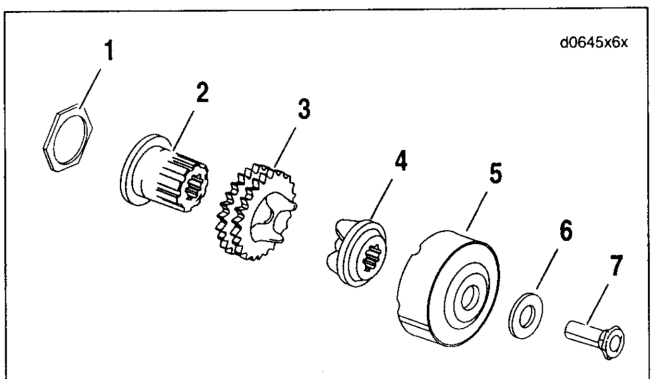
Figure 6-10. Removing Compensating Sprocket Nut

Installation

PART NO.	SPECIALTY TOOL
HD-41214	Primary drive locking tool

The primary chain, compensating sprocket and clutch assembly must be installed as an assembly.

1. See Figure 6-6. Loosely install chain tensioner and top center nut to fasten chain tensioner assembly onto captured bolt inside of primary chaincase. Verify chain tensioner shoe is resting on bottom lip of primary chaincase.
2. Place drive components (primary chain, compensating sprocket, and clutch assembly) into position. The clutch hub and compensating sprocket are splined, so a slight rotation of the chain drive will aid installation.
3. See Figure 6-11. Slide compensating sprocket (3) and sprocket cover (5) over shaft extension (2).
4. Clean and prime threads of nut (7). Apply two drops of LOCTITE THREADLOCKER 262 (red) to the threads. Install spacer (6) and nut hand tight.



1. **Hex spacer (0.070 in. thick)**
2. **Shaft extension**
3. **Compensating sprocket**
4. **Sliding cam**
5. **Cover**
6. **Spacer**
7. **Nut**

Figure 6-11. Compensating Sprocket

NOTE

Clutch hub mainshaft nut has left handed threads, so turn counterclockwise to install.

5. 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 6-12. When installing the compensating sprocket nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) *must be placed between upper strand of primary chain and clutch hub sprocket.*

6. Tighten compensating sprocket nut to 150-165 ft-lbs (203.4-223.7 Nm). Remove primary drive locking tool.

NOTE

See Figure 6-13. When installing the clutch hub mainshaft nut the PRIMARY DRIVE LOCKING TOOL (Part No. HD-41214) must be placed between upper strand of primary chain and compensating sprocket.

7. Tighten clutch hub mainshaft nut to 70-80 ft-lbs (94.9-108.5 Nm). Remove primary drive locking tool.
8. See Figure 6-14. 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

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

9. 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.
10. Adjust clutch and primary chain tension. See 1.12 CLUTCH and 1.10 PRIMARY CHAIN.
11. Verify sprocket alignment procedure on the next page.

CAUTION

The Print-O-Seal 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.

12. Install primary chaincase cover and fill with lubricant. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

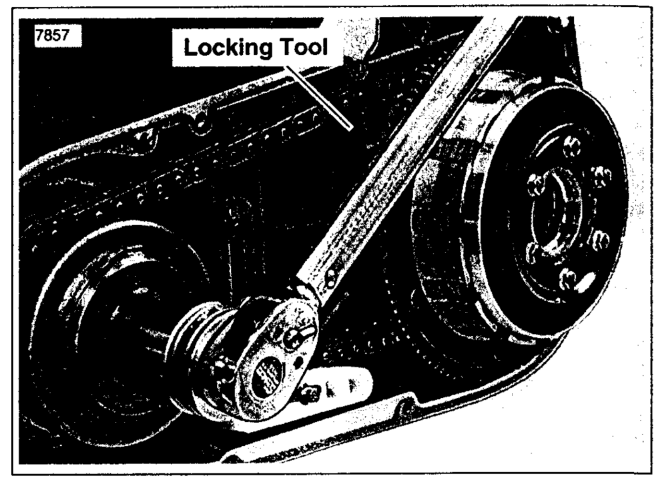


Figure 6-12. Installing Compensating Sprocket Nut

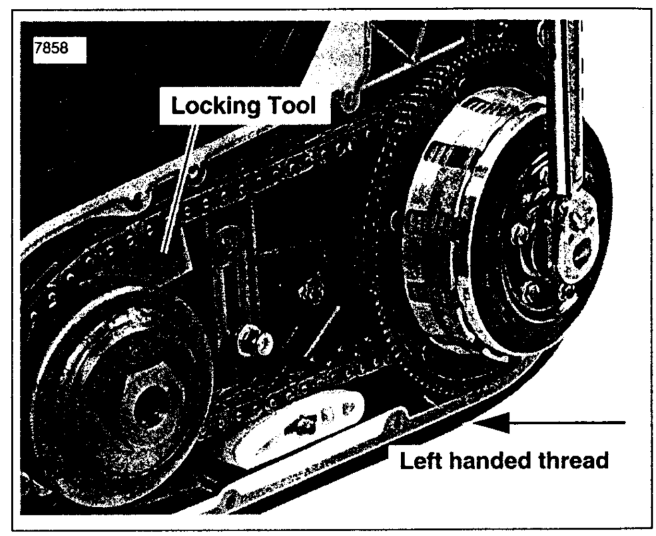
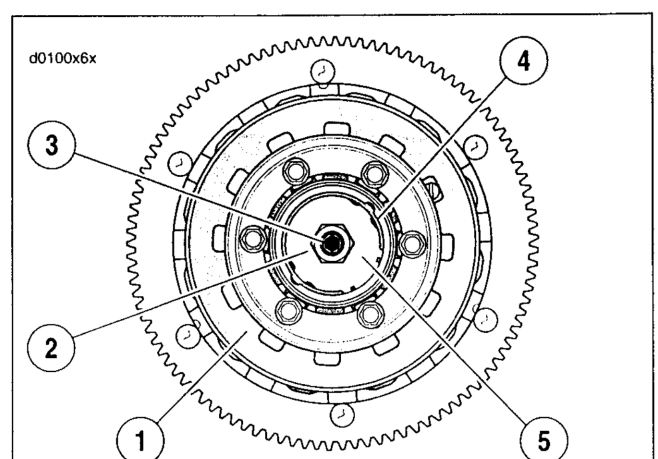


Figure 6-13. Installing Clutch Hub Mainshaft Nut



1. **Diaphragm spring**
2. **Locknut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Release plate**

Figure 6-14. Clutch

Sprocket Alignment

See Figure 6-15. Check the sprocket alignment before the primary drive components are removed. A spacer located behind the compensating sprocket shaft extension aligns the compensation sprocket with the clutch sprocket.

1. To align the sprockets, snug the chain tension and push primary chain inward as far as it will go at both the engine compensating sprocket and clutch sprocket.
2. Check sprocket alignment.
   a. Place a straightedge across the chain sideplates.
   b. With a dial caliper, measure the distance from the straightedge to the gasket surface of the case. Measure as close to the engine compensating sprocket as possible. Record this measurement.
   c. Repeat the procedure near the clutch sprocket.

NOTE

The difference in the two measurements will be the spacer thickness that needs to be added or subtracted (if necessary).

3. See Table 6-1. Calculate spacer thickness.
   a. The difference between the two measurements must be within 0.030 in. (0.76 mm) for proper primary chain alignment.
   b. A difference greater than 0.030 in. (0.76 mm) indicates a variable thickness spacer should be removed or installed on the engine sprocket shaft between the alternator rotor and the shaft extension.

Table 6-1. Spacer Thickness

PART NO.	IN.	MM
35850-84	0.010	0.25
35851-84	0.020	0.51
35852-84	0.030	0.76
24032-70	0.060	1.52
24033-70	0.090	2.29
24034-70	0.120	3.05
24035-70	0.150	3.81
24036-70	0.180	4.57
24037-70	0.210	5.33

CHAIN TENSIONER SHOE

If the chain tensioner shoe is worn to the point where proper adjustment cannot be obtained, replace the shoe as follows:

1. Remove primary chaincase cover. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.
2. See Figure 6-16. Verify chain tensioner shoe is resting on bottom lip of primary chaincase.
3. Remove retaining ring (4) and discard.

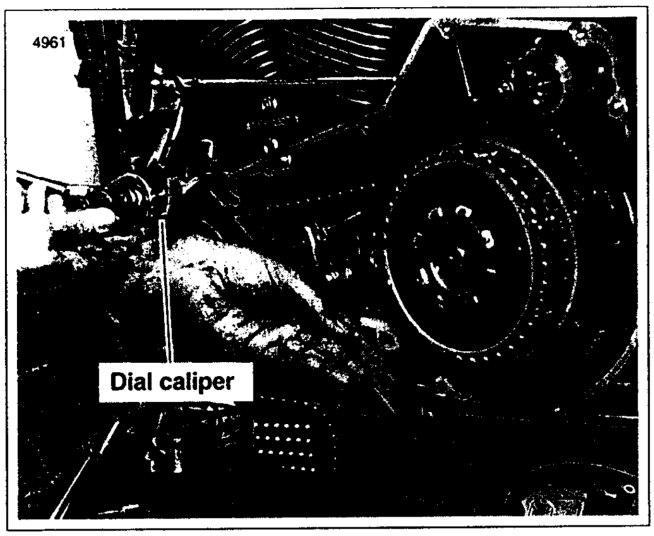
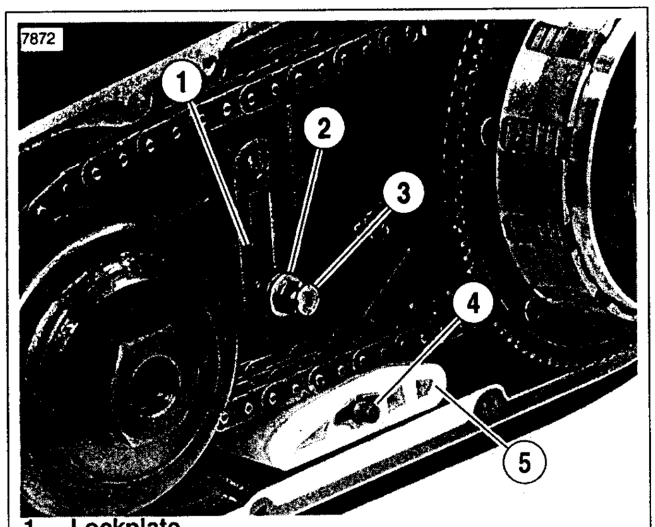


Figure 6-15. Checking Chain Alignment



1. **Lockplate**
2. **Washer**
3. **Top center nut**
4. **Retaining ring**
5. **Adjusting shoe**

Figure 6-16. Chain Tensioner Shoe

4. Remove shoe (5) from lockplate (1).
5. Install **new** shoe (5).
6. Install **new** retaining ring (4).
7. Verify chain tensioner shoe is adjusted for proper tension against lower strand of primary chain.
8. Tighten top center nut (3) to 21-29 ft-lbs (29-39 Nm).

CAUTION

The Print-O-Seal 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 fill with lubricant. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

REMOVAL/INSTALLATION

To remove or install the clutch without disassembly, see 6.3 DRIVE COMPONENTS.

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 PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.
2. See Figure 6-18. Remove six bolts (1) 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.

Assembly

1. See Figure 6-17. Install the narrow friction plate on the clutch hub. Engage tabs on plate with slots in clutch shell.
2. See Figure 6-18. 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.

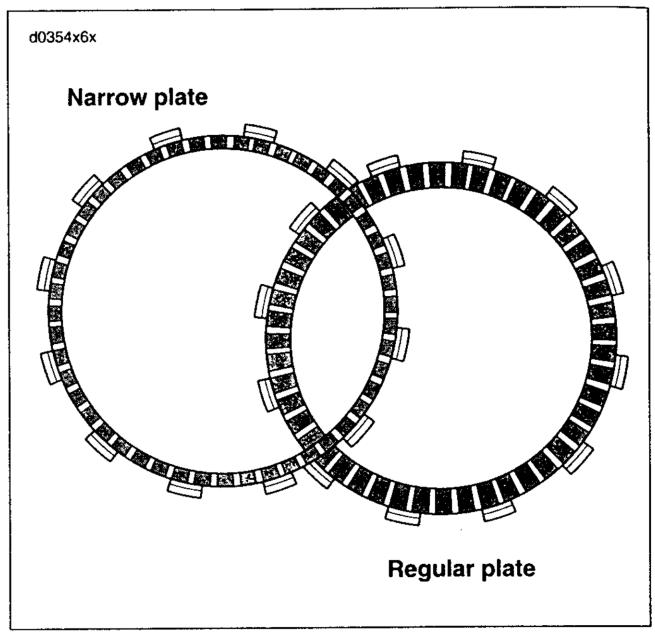


Figure 6-17. Friction Plates

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).

CAUTION

The Print-O-Seal 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 fill with lubricant. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

1. Bolt (6) (metric)
2. Diaphragm spring retainer
3. Diaphragm spring
4. Pressure plate
5. Friction plate (9)
6. Steel plate (8)
7. Narrow friction plate
8. Damper spring
9. Damper spring seat
10. Mainshaft nut (metric)
11. Clutch hub
12. Retaining ring
13. Bearing
14. Clutch shell
15. Retaining ring

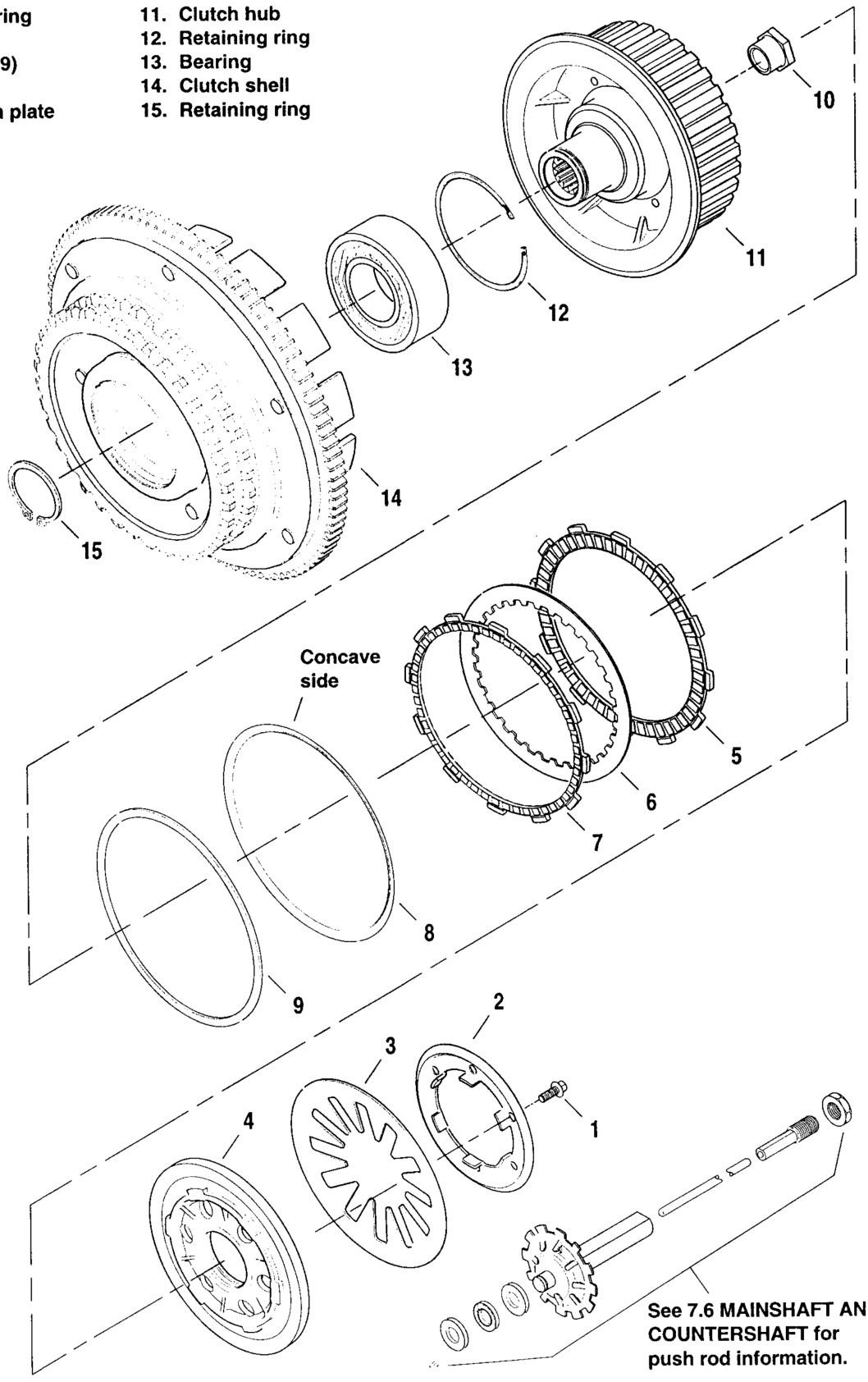


Figure 6-18. Clutch Shell Assembly

Cleaning And Inspection

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

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. Friction plates must be presoaked before installation.

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.

CLUTCH PACK AND BEARING

Complete Disassembly

1. Follow all partial disassembly information under CLUTCH PACK ONLY.

CAUTION

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

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

2. See Figure 6-19. With the sprocket side up, remove retaining ring from clutch hub groove.

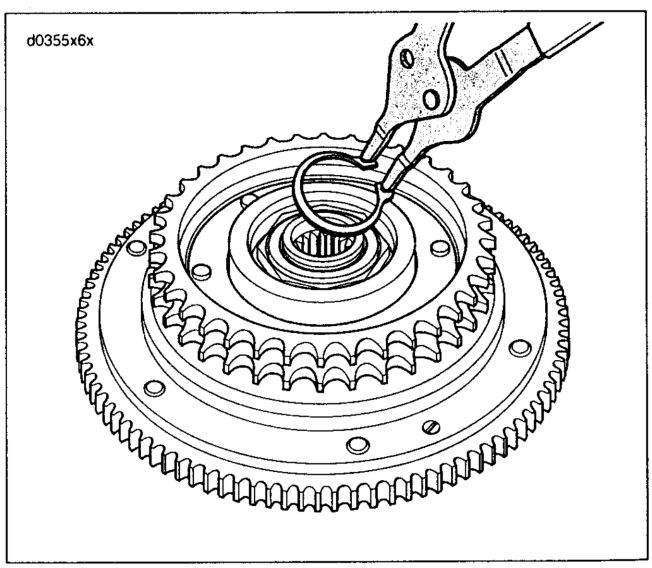


Figure 6-19. Clutch Hub Retaining Ring

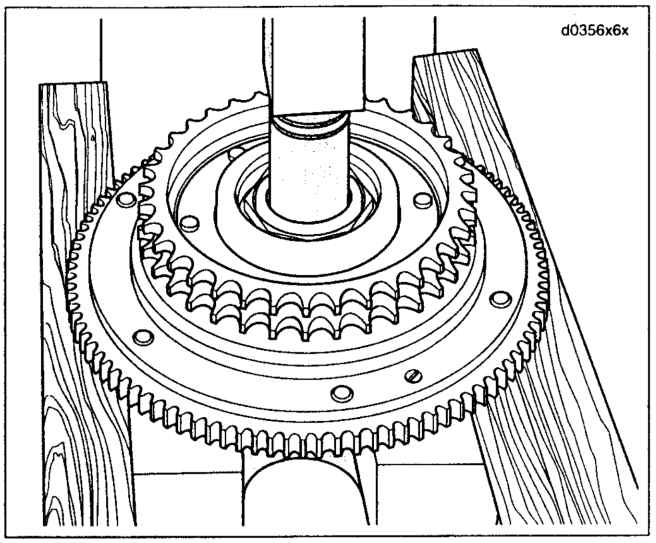


Figure 6-20. Pressing Clutch Hub From Bearing

3. See Figure 6-20. Supporting clutch shell in same orientation, use arbor press and a suitable press plug to press hub from bearing in clutch shell.
4. See Figure 6-21. Turn clutch shell over so that the sprocket side is down. Remove retaining ring from groove in clutch shell bore.
5. See Figure 6-22. Turn clutch shell over so that sprocket side is up. Using arbor press and a suitable press plug, press on inner race to remove bearing from clutch shell bore.
6. Continue with Cleaning And Inspection.

Assembly

1. Orient clutch shell in arbor press with sprocket side down. Be sure to support clutch shell bore on sprocket side. Using a suitable press plug, press against outer race until bearing contacts shoulder in clutch shell bore.

⚠WARNING

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

2. See Figure 6-21. Install retaining ring in groove of clutch shell bore. Place flat side of ring against bearing.
3. Center hub in bearing. Be sure that bearing inner race is supported with sleeve on sprocket side. Press hub into bearing until hub shoulder contacts bearing inner race.

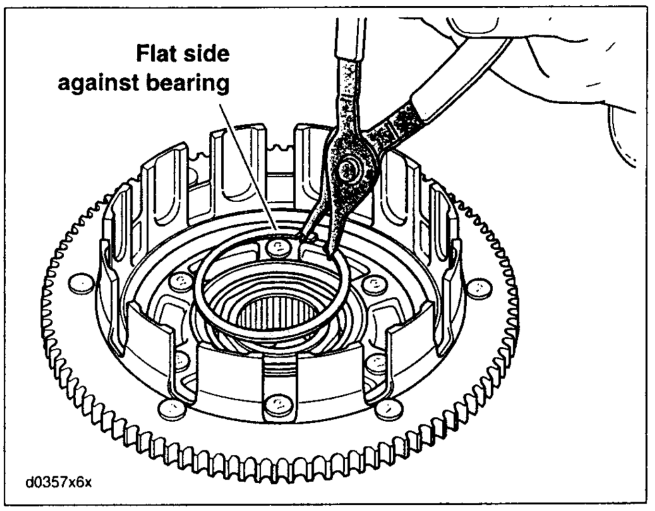


Figure 6-21. Clutch Shell Retaining Ring

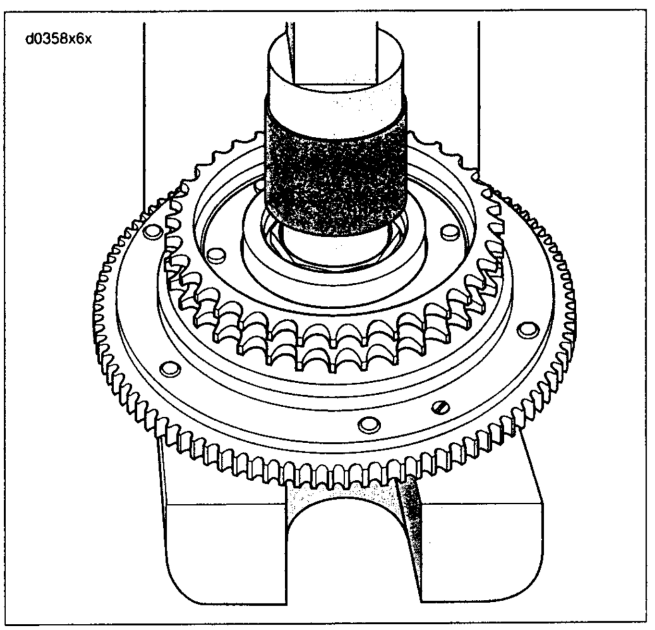


Figure 6-22. Pressing Bearing From Clutch Shell

4. See Figure 6-19. Turn assembly over so that the sprocket side is up. Install retaining ring in groove of clutch hub.
5. Place clutch assembly on bench oriented with the sprocket side down.
6. Soak all friction and steel plates in PRIMARY CHAIN CASE LUBRICANT for at least 5 minutes.

7. See Figure 6-23. 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 then a friction plate on the clutch hub. Install seven remaining sets in the same manner, alternating between steel plates and friction plates.
11. Install pressure plate on clutch hub aligning holes in plate with threaded bosses on hub.
12. See Figure 6-24. 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 bolts to 90-110 **in-lbs** (10.2-12.4 Nm).

CAUTION

The Print-O-Seal 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 and fill with lubricant. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.

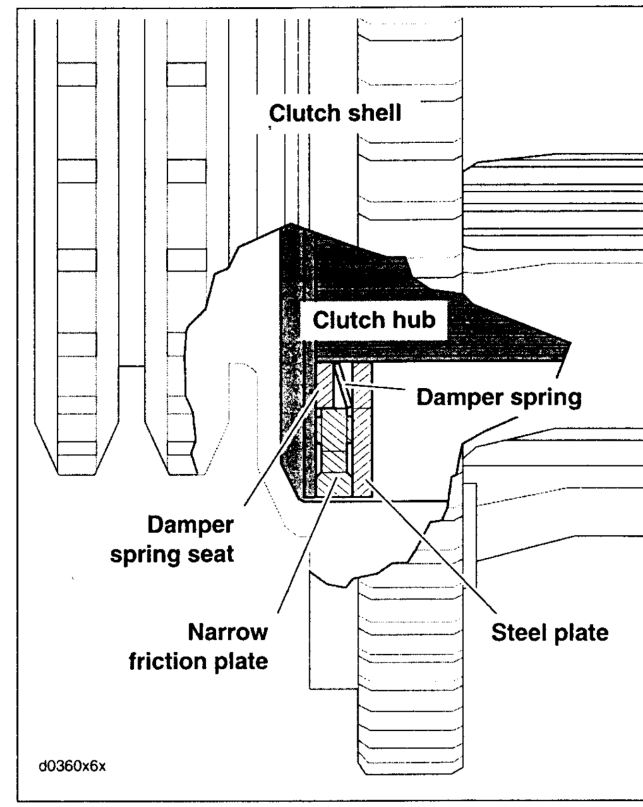
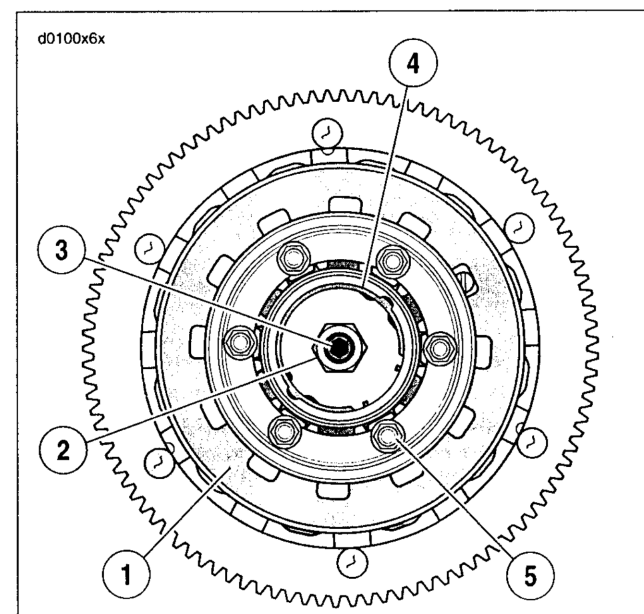


Figure 6-23. Clutch Stackup



1. **Diaphragm spring**
2. **Jam nut**
3. **Adjuster screw**
4. **Retaining ring**
5. **Bolts (6) (metric) @ 90-110 in-lbs (10.2-12.4 Nm)**

Figure 6-24. Assembled Clutch

REMOVAL

PART NO.	SPECIALTY TOOL
HD-41184	Transmission sprocket tool
HD-94660-37B	Mainshaft locknut wrench

1. Remove primary chaincase cover. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.
2. Remove transmission sprocket.
   a. See Figure 6-25. Remove both screws (1) and lockplate (2).
   b. See Figure 6-26. Secure sprocket using TRANSMISSION SPROCKET TOOL (Part No. HD-41184).
   c. Remove the sprocket nut using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B).

NOTE

Sprocket nut has a left hand thread.

3. See Figure 6-27. Loosen rear axle and adjusters so rear wheel can be moved all the way forward. Remove belt from sprocket as you remove sprocket.

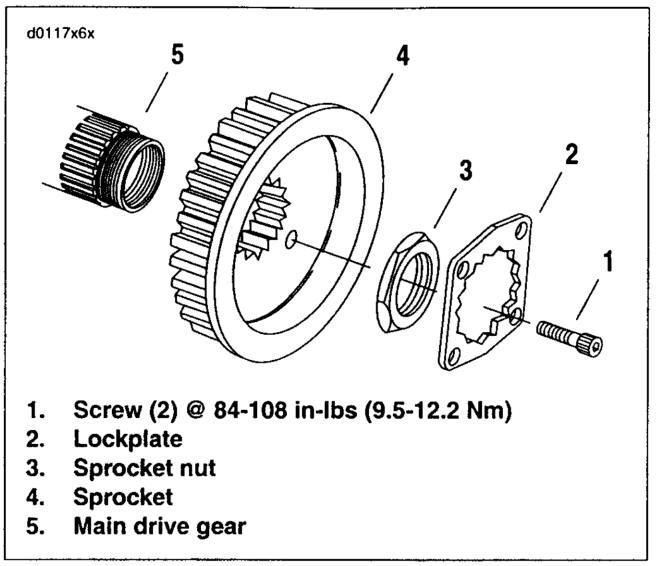
CLEANING AND INSPECTION

1. Clean sprocket of all grease and dirt using solvent. Clean and prime sprocket threads.
2. Inspect belt and sprocket. See 1.15 REAR BELT AND SPROCKETS.
3. Inspect both seals.

INSTALLATION

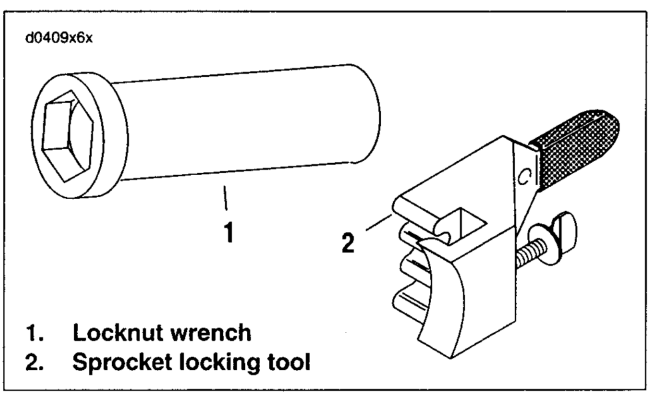
PART NO.	SPECIALTY TOOL
HD-41184	Transmission sprocket tool
HD-94660-37B	Mainshaft locknut wrench

1. Place transmission sprocket in position.
2. See Figure 6-25. Apply LOCTITE THREADLOCKER 262 (red) to sprocket nut (3) threads. Thread the sprocket nut counterclockwise onto main drive gear, with flanged side facing transmission sprocket.
3. See Figure 6-26. Lock transmission sprocket with the TRANSMISSION SPROCKET LOCKING TOOL (2) (Part No. HD-41184). Attach tool to sprocket with tool handle below pivot shaft. Snug thumbscrew to lock tool on sprocket.
4. Screw pilot of MAINSHAFT LOCKNUT WRENCH (1) (Part No. HD-94660-37B) onto threaded end of mainshaft.



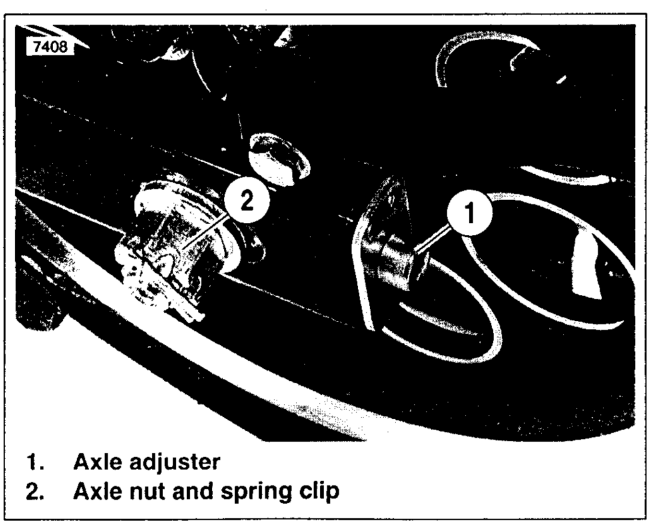
1. **Screw (2) @ 84-108 in-lbs (9.5-12.2 Nm)**
2. **Lockplate**
3. **Sprocket nut**
4. **Sprocket**
5. **Main drive gear**

Figure 6-25. Transmission Sprocket



1. **Locknut wrench**
2. **Sprocket locking tool**

Figure 6-26. Transmission Sprocket Tools



1. **Axle adjuster**
2. **Axle nut and spring clip**

Figure 6-27. Axle Adjusters (Left Side Shown)

5. Using locknut wrench, tighten sprocket nut to 60 ft-lbs (81.4 Nm) initial torque.

CAUTION

Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation, after initially tightening to 60 ft-lbs torque. Do not loosen sprocket nut while attempting to align the screw holes. Tightening too much or little may cause the nut to come loose during vehicle operation, causing damage to drive components.

6. See Figure 6-28. Scribe a line (3) on the transmission sprocket nut (1). Continue the line on the transmission sprocket (2) as shown.
7. Tighten the transmission sprocket nut an additional 35° to 40° (45° MAXIMUM).
8. Install lockplate over transmission sprocket nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes.
9. See Figure 6-25. Install screws (1) through two of the four holes in lockplate (2), then into two corresponding tapped holes in sprocket (4).

NOTE

The lockplate has four screw holes and can be turned to either side, so you should be able to find a position without having to additionally tighten the nut. If you cannot align the screw holes properly, the nut may be additionally TIGHTENED until the screw holes line up, but do not exceed 45° as specified above. Never LOOSEN nut to align the screw holes.

CAUTION

To ensure the lockplate's security, you must use BOTH screws when you install the lockplate.

10. Tighten screws to 84-108 **in-lbs** (9.5-12.2 Nm).

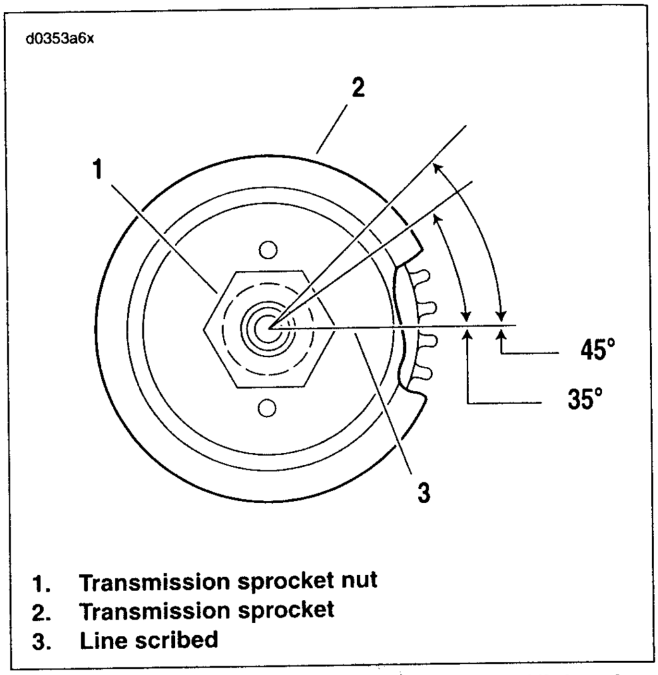
NOTE

The screws have LOCTITE patches. With LOCTITE reapplied before installation, the screws can be re-used 3-5 times.

CAUTION

The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

11. Install primary chain assembly and primary chaincase cover. Fill primary chaincase with lubricant. See 6.3 DRIVE COMPONENTS.
12. Align vehicle and tighten rear axle. See 2.13 VEHICLE ALIGNMENT.
13. Adjust belt tension. See 1.14 REAR BELT DEFLECTION.



1. **Transmission sprocket nut**
2. **Transmission sprocket**
3. **Line scribed**

Figure 6-28. Transmission Sprocket Nut Final Tightening

REMOVAL

1. Remove rear wheel. See 2.5 REAR WHEEL.
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 PRIMARY CHAINCASE HOUSING under 6.2 PRIMARY CHAINCASE.
4. Place a support under rear fork and engine. Remove pivot shaft and spacer. See 2.23 REAR FORK.
5. See Figure 6-30. Slip drive belt (2) from transmission sprocket (1).

INSPECTION

See 1.15 REAR BELT AND SPROCKETS.

INSTALLATION

CAUTION

See Figure 6-29. All belts, used or new, must never be formed into a loop smaller than 5.0 in. (127 mm), and must never be bent backwards into a loop smaller than 10 in. (254 mm). Sharp bending can weaken the belt. Used belts must be reinstalled so they rotate in the same direction as they originally did.

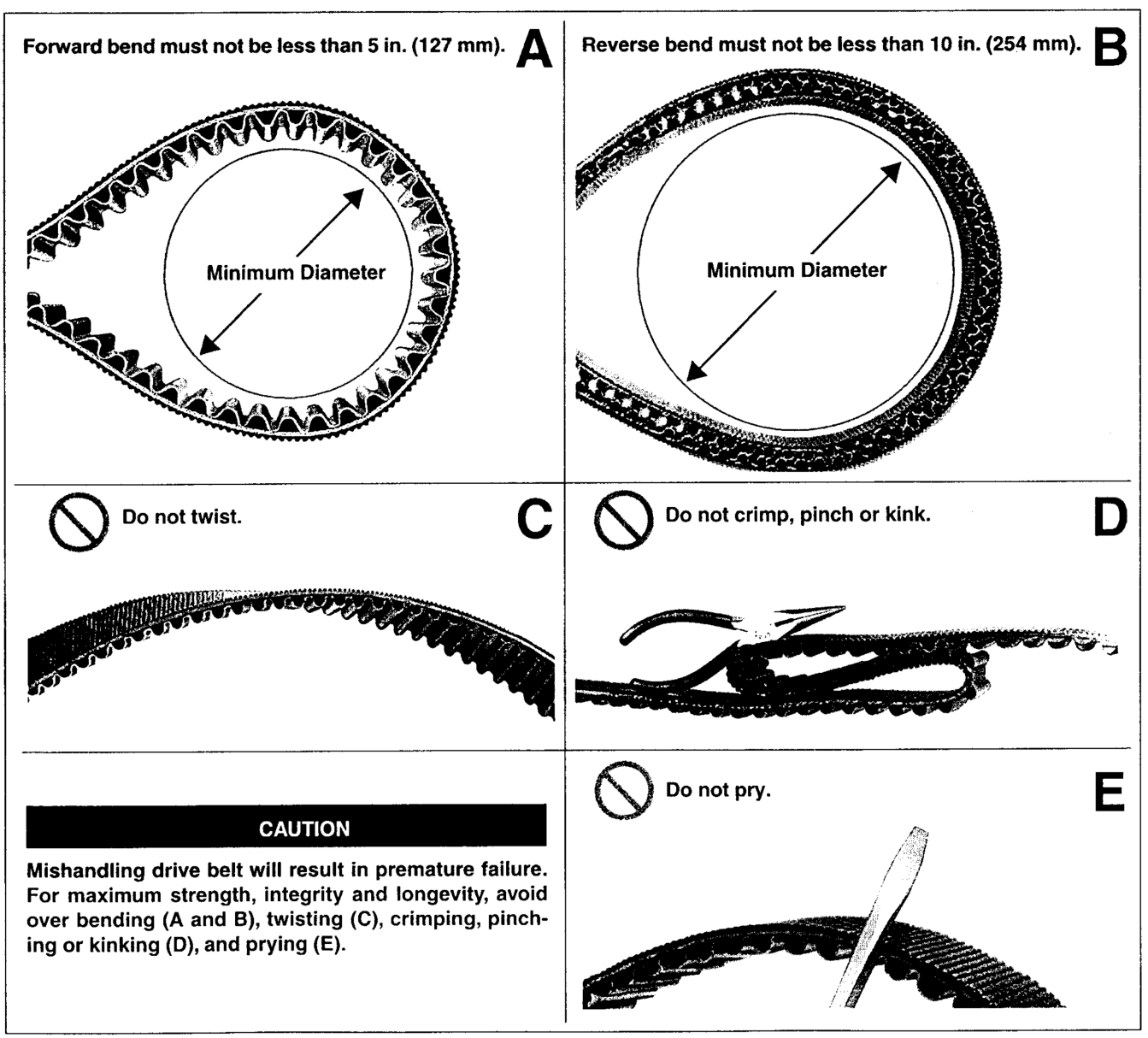


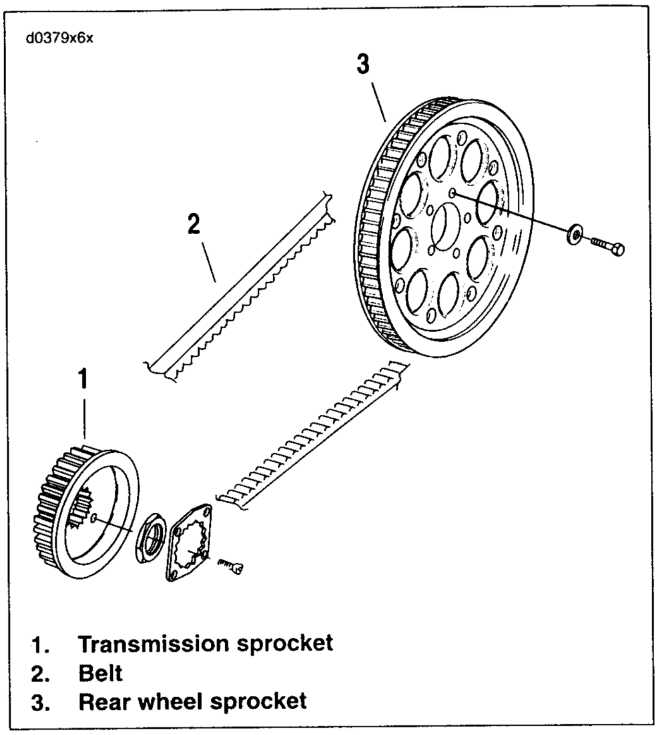
Figure 6-29. Proper Drive Belt Handling

1. See Figure 6-30. Install belt (2) over transmission sprocket (1).
2. Install pivot shaft and spacer. Remove support holding engine and rear fork. See 2.23 REAR FORK.
3. Install the primary chaincase housing. See PRIMARY CHAINCASE HOUSING under 6.2 PRIMARY CHAINCASE.

CAUTION

The Print-O-Seal 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 and primary chaincase cover. Fill primary chaincase with lubricant. See 6.3 DRIVE COMPONENTS.
5. Install rear wheel. See 2.5 REAR WHEEL.
6. Align vehicle. See 2.13 VEHICLE ALIGNMENT.
7. Adjust belt tension. See 1.14 REAR BELT DEFLECTION.



1. **Transmission sprocket**
2. **Belt**
3. **Rear wheel sprocket**

Figure 6-30. Belt and Transmission Sprocket

SUBJECT	PAGE NO.
7.1 Specifications	7-1
7.2 Transmission	7-3
7.3 Shifter Cam Assembly	7-6
7.4 Shifter Forks	7-10
7.5 Transmission Clutch Release Cover	7-12
7.6 Mainshaft and Countershaft	7-15
7.7 Transmission Case	7-25

TRANSMISSION 7

TRANSMISSION	DATA
Type	5-speed forward constant mesh
Transmission lubricant type	Part No. 99891-84 (gal), 99892-84 (qt)
Capacity (dry)	24 oz.
	709.8 ml
Capacity (wet)	20-24 oz.
	591.5-709.8 ml

GEAR	FINAL DRIVE RATIO
First (low)	3.21
Second	2.21
Third	1.57
Fourth	1.23
Fifth (high)	1.00

NOTE

Final gear ratios indicate the number of mainshaft revolutions required to drive the output sprocket one revolution.

MAIN DRIVE GEAR (5TH)	IN.	MM
Bearing fit in transmission case (loose)	0.0003-0.0017	0.0076-0.043
Fit in bearing (tight)	0.0009	0.023
Fit in bearing (loose)	0.0001	0.0025
Fit on mainshaft	0.0001-0.0009	0.0025-0.023
End play	none	none

MAINSHAFT TOLERANCE	IN.	MM
Mainshaft runout	0.000-0.003	0.00-0.08
Mainshaft end play	none	none
1st gear clearance	0.0000-0.0080	0.000-0.203
2nd gear clearance	0.0000-0.0800	0.000-2.032
3rd gear end play	0.0050-0.0420	0.127-1.067
3rd gear clearance	0.0003-0.0019	0.008-0.048
4th gear end play	0.0050-0.0310	0.127-0.787
4th gear clearance	0.0003-0.0019	0.008-0.048

SHIFTER DOG GEARS	MINIMUM CLEARANCE	MAXIMUM CLEARANCE
2nd-5th	0.035 in.	0.139 in.
	0.089 mm	3.353 mm
2nd-3rd	0.035 in.	0.164 in.
	0.089 mm	4.17 mm
1st-4th	0.035 in.	0.152 in.
	0.089 mm	3.86 mm
1st-3rd	0.035 in.	0.157 in.
	0.089 mm	3.99 mm

SIDE DOOR BEARING	IN.	MM
Fit in side door (tight)	0.0014-0.0001	0.036-0.0025
Fit on countershaft (tight)	0.0007	0.018
Fit on countershaft (loose)	0.00001	0.00025
Fit on mainshaft (tight)	0.0007	0.018
Fit on mainshaft (loose)	0.001	0.0025

COUNTERSHAFT TOLERANCE	IN.	MM
Countershaft runout	0.000-0.003	0.00-0.08
Countershaft end play	none	none
1st gear clearance	0.003-0.0019	0.008-0.048
1st gear end play	0.0050-0.0039	0.127-0.099
2nd gear clearance	0.0003-0.0019	0.008-0.048
2nd gear end play	0.0050-0.0440	0.127-1.118
3rd gear clearance	0.0000-0.0080	0.000-0.0203
4th gear clearance	0.0000-0.0080	0.000-0.0203
4th gear end play	0.0050-0.0390	0.127-0.991
5th gear clearance	0.0000-0.0080	0.000-0.203
5th gear end play	0.0050-0.0040	0.127-0.102

SHIFTER FORKS	IN.	MM
Shifter fork to cam groove end play	0.0017-0.0019	0.043-0.048
Shifter fork to gear groove end play	0.0010-0.0110	0.025-0.0279

TORQUE VALUES

ITEM	TORQUE		NOTES
Clutch cable fitting	36-60 in-lbs	4.1-6.8 Nm	Page 7-13
Clutch release cover screws	84-108 in-lbs	9.5-12.2 Nm	Page 7-13
Engine/transmission mount fasteners	30-35 ft-lbs	40.7-47.5 Nm	Special sequence to tighten, page 7-27
Mainshaft/countershaft nuts	45-55 ft-lbs	61.0-74.6 Nm	Page 7-16, 7-22, 7-23
Shifter cam detent pivot screw	84-108 in-lbs	9.5-12.2 Nm	Page 7-9
Shifter rod lever screw	18-22 ft-lbs	24.4-29.8 Nm	Page 7-29
Shifter rod locknuts	20-24 ft-lbs	27.1-32.5 Nm	Page 7-5
Support blocks	84-108 in-lbs	9.5-12.2 Nm	Fit on dowel pins, page 7-9
Top cover screws	84-108 in-lbs	9.5-12.2 Nm	Page 7-9
Transmission case, 1/4 in. hardware	84-108 in-lbs	9.5-12.2 Nm	Page 7-23
Transmission case, 5/16 in. hardware	13-16 ft-lbs	17.6-21.7 Nm	Page 7-23
Transmission drain plug	14-21 ft-lbs	19.0-28.5 Nm	Clean before installation, page 7-15, page 7-27

GENERAL

See Figure 7-1. The 5-speed transmission consists of two parallel shafts supporting five gears each. The longer, or mainshaft, also supports the clutch and serves as the input shaft. The shorter shaft is called the countershaft.

Each gear on the mainshaft is in constant mesh with a corresponding gear on the countershaft. Each of these five pairs of gears makes up a different speed in the transmission.

The transmission gears are divided into two types, gears that are splined and rotate with the shaft, and freewheeling gears that ride on bearings and spin freely on the shaft. A splined gear always meshes with a freewheeling gear. Also, three of the splined gears are able to slide sideways on the shaft. These sliding gears are used to change transmission speeds. The dogs, or projections, on the sides of the sliding gears, 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 hubs of the three sliding gears. The position of the shifter forks is controlled by a drum-shaped shifter cam located on the top of the transmission.

Neutral

Power is introduced to the transmission through the clutch. In neutral, with the clutch engaged, the mainshaft 1st and 2nd gears are rotating, but no power is transferred to the countershaft since countershaft 1st and 2nd are freewheeling gears.

1st Gear

When the transmission is shifted into first gear, countershaft 3rd, which rotates with the countershaft, engages countershaft 1st, which has been spinning freely on the countershaft driven by mainshaft 1st.

Now countershaft 3rd is no longer freewheeling, but locked to the countershaft causing the countershaft and countershaft 5th to turn. Countershaft 5th transmits the power to the main drive gear and the sprocket.

2nd Gear

Second gear is engaged when countershaft 3rd is shifted out of countershaft 1st and engages countershaft 2nd. This locks countershaft 2nd to the countershaft to complete the power flow as shown.

3rd Gear

Two shifter forks are used to make the shift from second to third. One fork moves countershaft 3rd out of countershaft 2nd to its neutral position, while another fork engages mainshaft 2nd with mainshaft 3rd. This locks mainshaft 3rd to the mainshaft to complete the power flow as shown.

4th Gear

The shift into fourth is made when mainshaft 2nd is disengaged from mainshaft 3rd and mainshaft 1st engages mainshaft 4th, locking it to the mainshaft.

5th Gear

The shift from fourth to fifth gear occurs when mainshaft 1st is shifted out of mainshaft 4th, and mainshaft 2nd is shifted directly into the main drive gear. Mainshaft 2nd lock the main drive gear to the mainshaft resulting in a direct one-to-one drive ratio from the clutch to the sprocket.

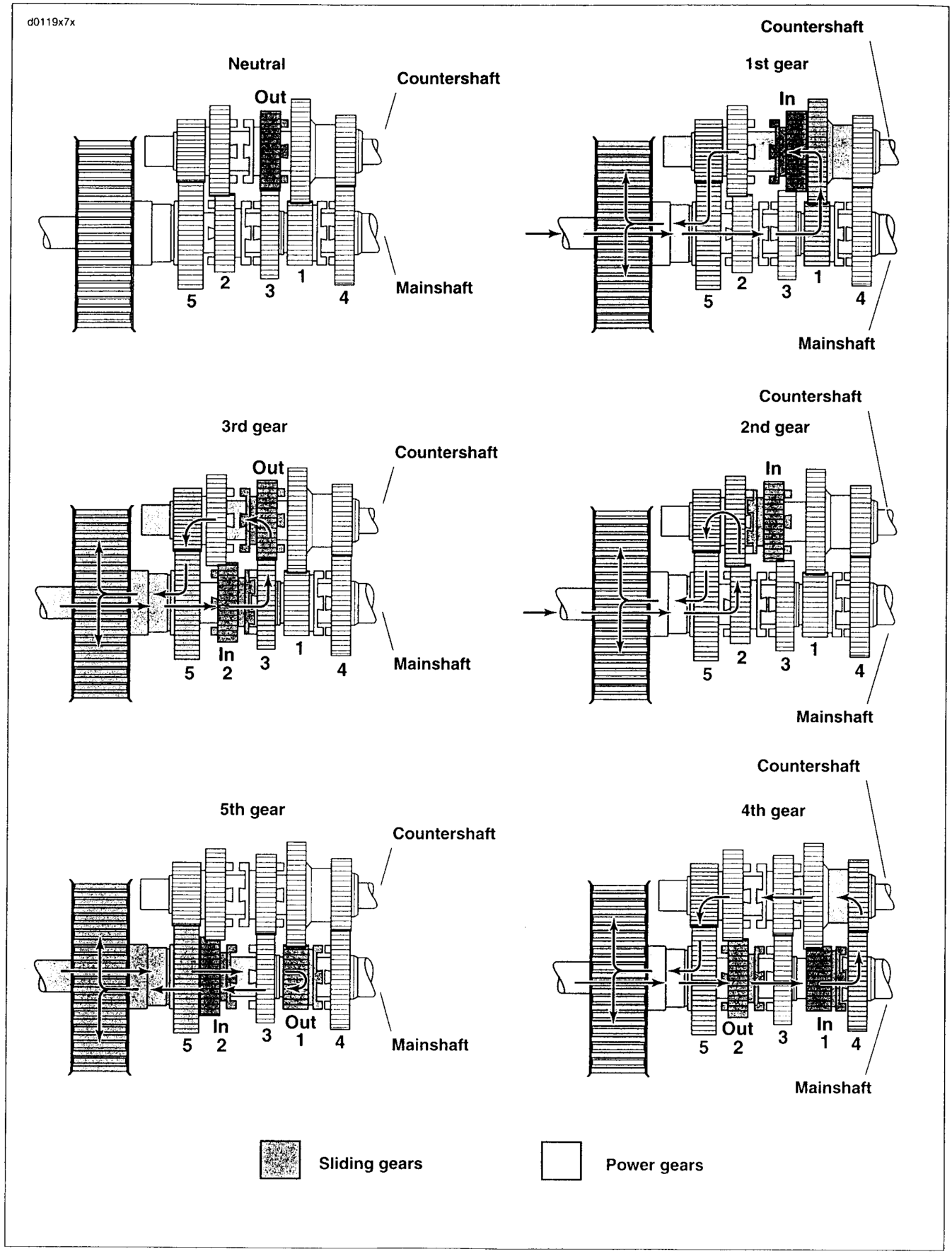
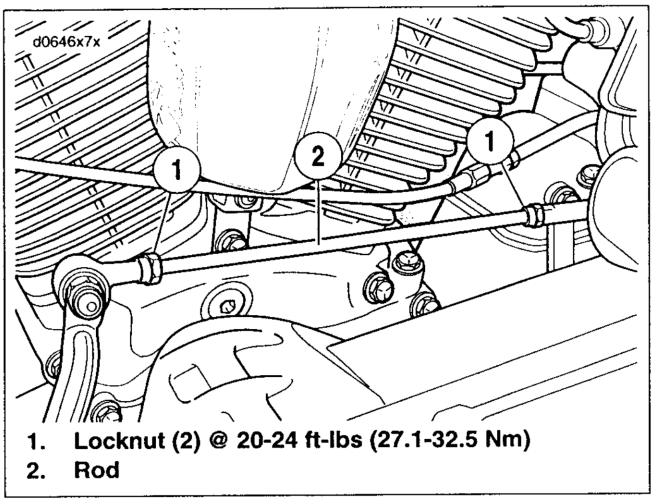


Figure 7-1. Transmission Power Flow

SHIFTER LINKAGE ADJUSTMENT

The foot shift linkage is set at the factory and normally should need no adjustment. However, if gears do not engage fully or toe shifter travel is incorrect, adjust linkage rod as follows:

1. See Figure 7-2. Disconnect one end of shifter rod.
2. Loosen locknuts (1). Adjust rod (2) as necessary and connect loose end of shifter rod.
3. Tighten locknuts to 20-24 ft-lbs (27.1-32.5 Nm).



1. **Locknut (2) @ 20-24 ft-lbs (27.1-32.5 Nm)**
2. **Rod**

Figure 7-2. Shifter Rod

REMOVAL/DISASSEMBLY

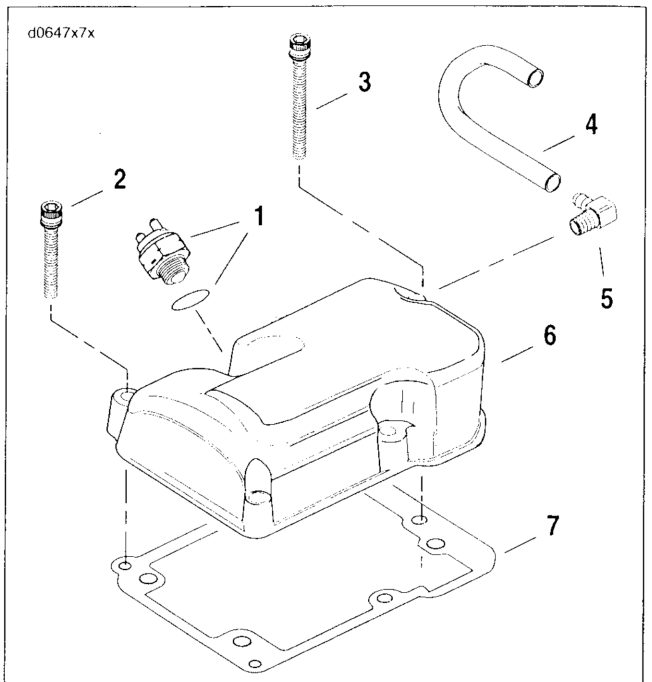
⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

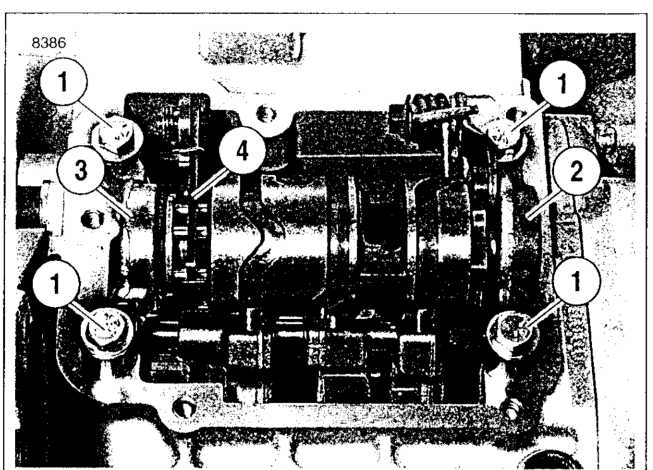
Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect battery cables, negative cable first.
2. Remove battery and oil tank. See 3.32 OIL PAN.
3. Remove starter. See 5.4 STARTER.
4. See Figure 7-3. Disconnect neutral indicator switch (1). See 8.29 NEUTRAL SWITCH.
5. Remove vent hose (4) from fitting (5) on cover to provide additional clearance for removal if needed.
6. Remove top cover.
   a. Remove the screws and washers (2, 3).
   b. Remove the top cover (6) and cover gasket (7).
   c. Discard gasket.
7. See Figure 7-4. Remove four bolts and washers (1) to free the right (2) and left (3) support blocks.
8. Lift shifter cam pawl (4) over cam pins to free assembly.



1. Neutral indicator switch and O-ring
2. Screws (short) and washers (4)
3. Screw (long) and washer
4. Vent hose
5. Vent hose fitting
6. Top cover
7. Gasket

Figure 7-3. Cover Assembly



1. Bolts and washers
2. Right support block
3. Left support block
4. Shifter cam pawl

Figure 7-4. Support Block Fasteners

⚠WARNING

Always wear proper eye protection when removing retaining rings. Slippage may propel the ring with force which could result in death or serious injury.

9. See Figure 7-5. Disassemble shifter cam assembly if necessary.
   a. Right support block (3) is a slip fit over the shifter cam (4). Remove retaining ring (1) to remove bearing (2). Discard retaining ring.
   b. Remove small retaining ring (6) to free left support block (5) from shifter cam. Remove retaining ring (1) to free bearing (2). Discard retaining rings.
10. Remove detent pivot screw (7) to free the detent spring (8), spring sleeve (9) and detent follower (10).

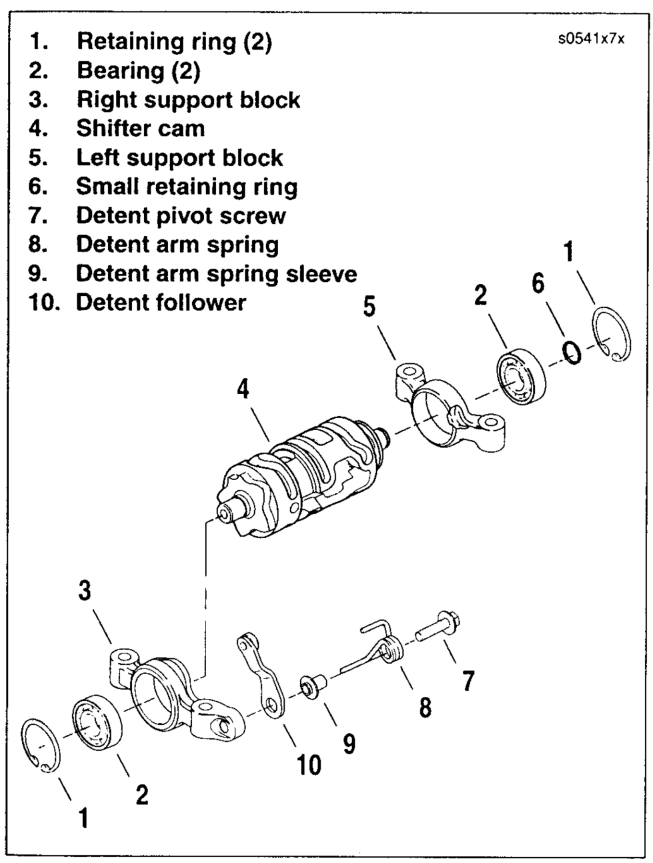


Figure 7-5. Shifter Cam Assembly

CLEANING AND INSPECTION

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

1. See Figure 7-5. Clean all parts except bearings (2) with solvent. Blow parts dry with low pressure compressed air.
2. Inspect bearings (2) and shifter cam ends. If ends of shifter cam are pitted or grooved, replace the shifter cam and bearings. Install new bearings in support blocks by pressing on the side of the bearing with letters stamped on it. Stamped side of bearing should face outward when support block is installed on cam.
3. Inspect shifter cam (4) for cracks or wear and replace if necessary.
4. Inspect neutral indicator switch in top cover. Depress plunger. It should spring back without binding. The switch is a non-repairable item and must be replaced if damaged.

ASSEMBLY/INSTALLATION

⚠WARNING

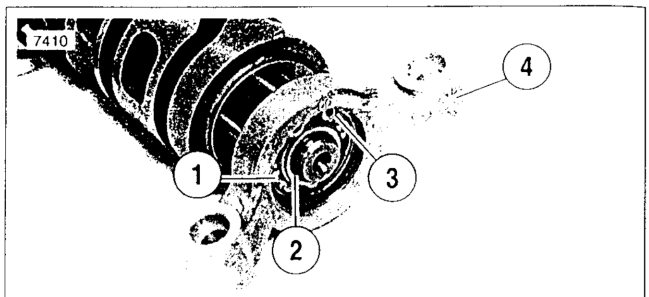
Always wear proper eye protection when installing retaining rings. Slippage may propel the ring with force which could result in death or serious injury.

1. Assemble shifter cam components if necessary.
   a. See Figure 7-6. Place a bearing (1) inside left support block by pressing on the side of the bearing with letters stamped on it. This side should face out.
   b. Secure bearing by installing a **new** retaining ring (3) with the beveled side facing out.

NOTE

*See Figure 7-7. When installing **new** retaining ring verify the tab is on the right side and opening is toward the bottom when you are looking at the end of the shifter drum.*

   c. Place assembly on shifter cam and install a **new** small retaining ring (2).
   d. See Figure 7-8. Place a bearing (1) inside right support block by pressing on the side of the bearing with letters stamped on it. This side should face out. Secure bearing by installing a **new** retaining ring (2) with the beveled side facing out. Slip right support block over shifter cam.



1. **Bearing**
2. **Small retaining ring**
3. **Retaining ring (beveled side out)**
4. **Left support block**

Figure 7-6. Left Support Block

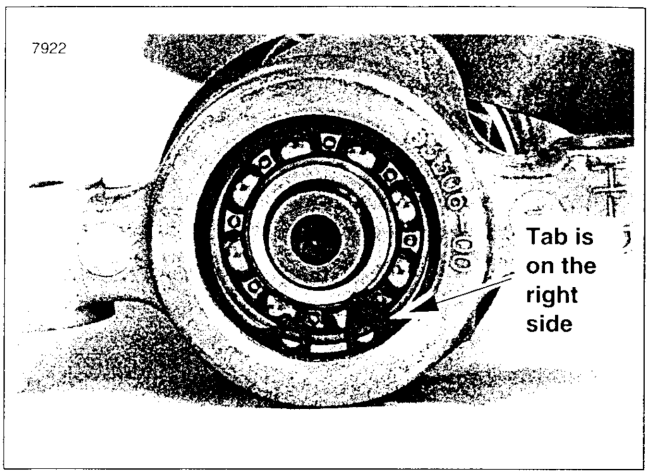
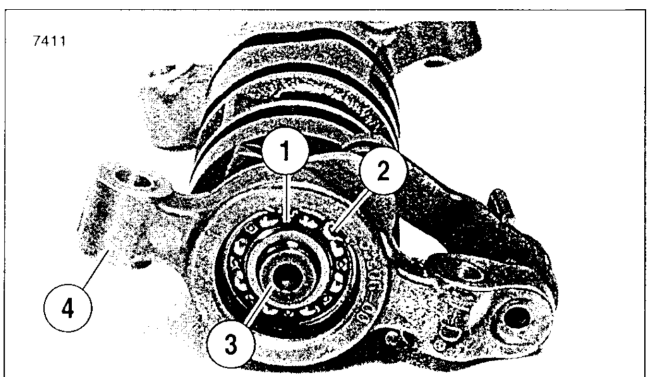


Figure 7-7. Retaining Ring Orientation



1. **Bearing**
2. **Retaining ring (beveled side out)**
3. **End of shifter cam**
4. **Right support block**

Figure 7-8. Right Support Block

e. See Figure 7-9. Slide spring sleeve (1) inside the spring (2). Place follower (4) under sleeve and use pivot screw (3) to attach assembly to right support block. Tighten to 84-108 **in-lbs** (9.5-12.2 Nm).

2. See Figure 7-10. Lift shifter cam pawl (3) over the cam pins (4). Place shifter cam assembly (1) on transmission case with shifter forks (2) positioned in the slots.

3. See Figure 7-11. The transmission case has dowel pins which fit into the mounting holes of BOTH support blocks. Align the cam assembly by positioning the support blocks on the dowel pins. Install support block bolts and tighten to 84-108 **in-lbs** (9.5-12.2 Nm).

NOTE

Check the gear engagement and clearance in every gear to be sure assembly and alignment is correct.

4. See Figure 7-3. Install the top cover (6) with a **new** gasket (7) placing long screw (3) next to vent hose fitting (5). Tighten screws (2, 3) to 84-108 **in-lbs** (9.5-12.2 Nm).

5. See Figure 7-12. If neutral switch was removed, it must be installed in the top cover with the transmission shifter in the NEUTRAL position to properly engage plunger on shifter cam. See 8.29 NEUTRAL SWITCH.

6. Connect vent hose (4) to vent hose fitting (5).

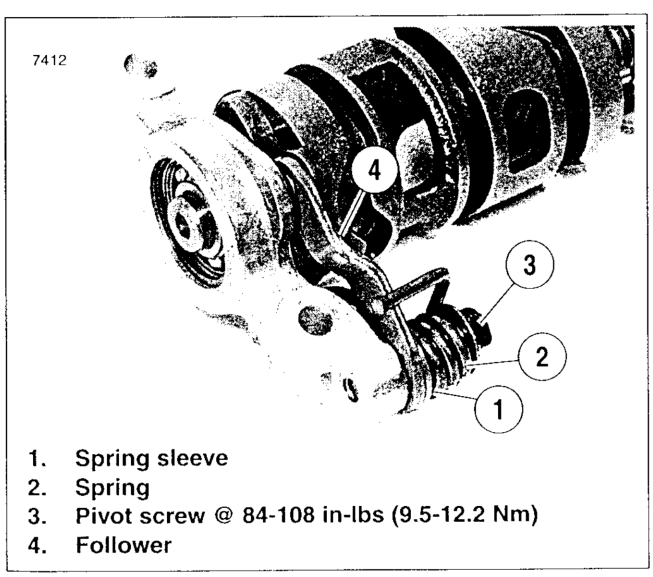
7. Install starter. See 5.4 STARTER.

8. Install oil tank and battery. See 3.32 OIL PAN.

⚠WARNING

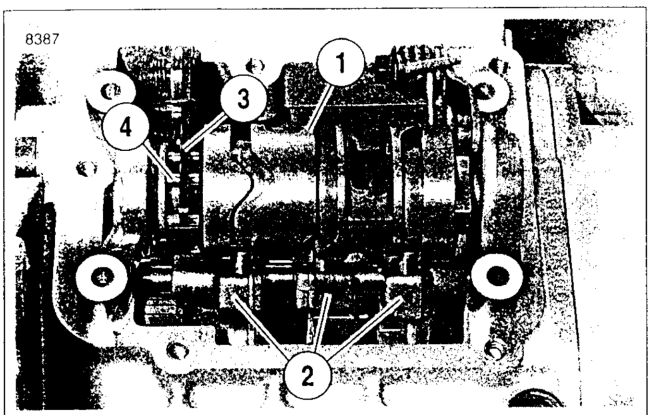
Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

9. Connect battery cables, positive cable first.



1. **Spring sleeve**
2. **Spring**
3. **Pivot screw @ 84-108 in-lbs (9.5-12.2 Nm)**
4. **Follower**

Figure 7-9. Detent Arm Assembly



1. **Shifter cam assembly**
2. **Shifter forks**
3. **Shifter cam pawl**
4. **Cam pins**

Figure 7-10. Shifter Cam Alignment

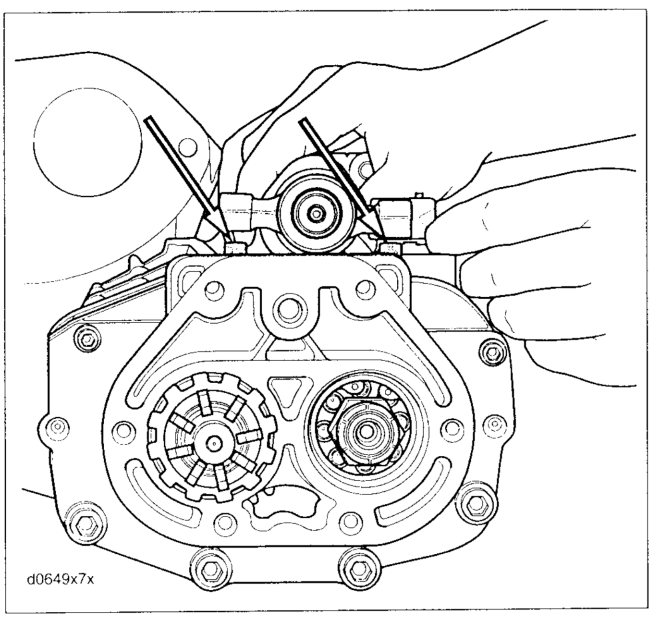


Figure 7-11. Dowel Pin Locations

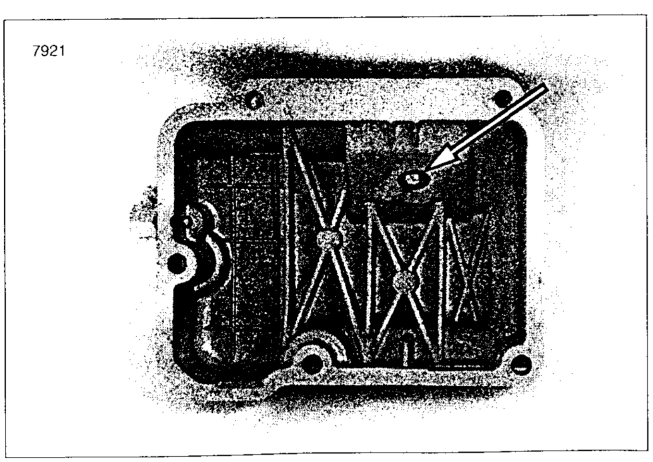


Figure 7-12. Neutral Switch Plunger

REMOVAL

1. Remove the transmission top cover and shifter cam assembly. See 7.3 SHIFTER CAM ASSEMBLY.
2. Remove the transmission side cover. See 7.5 TRANSMISSION CLUTCH RELEASE COVER.
3. See Figure 7-13. Slide fork shaft out through the hole and remove the shifter forks. Continue with CLEANING AND INSPECTION below.

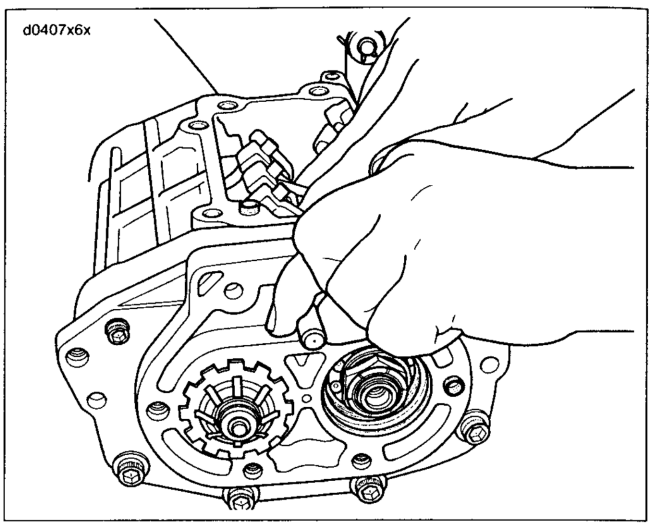


Figure 7-13. Fork Shaft

CLEANING AND INSPECTION

⚠WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

1. Clean all parts with solvent. Blow parts dry with low pressure compressed air.
2. Check the shifter fork shaft and replace it if bent or damaged.
3. See Figure 7-14. Check to see if fork is square on the shaft using a small carpenter's square. If fork does not rest directly on the square, it is bent and must be replaced.
4. Inspect the forks for wear. Replace forks worn thinner than 0.165 in. (4.19 mm) at mating surfaces.

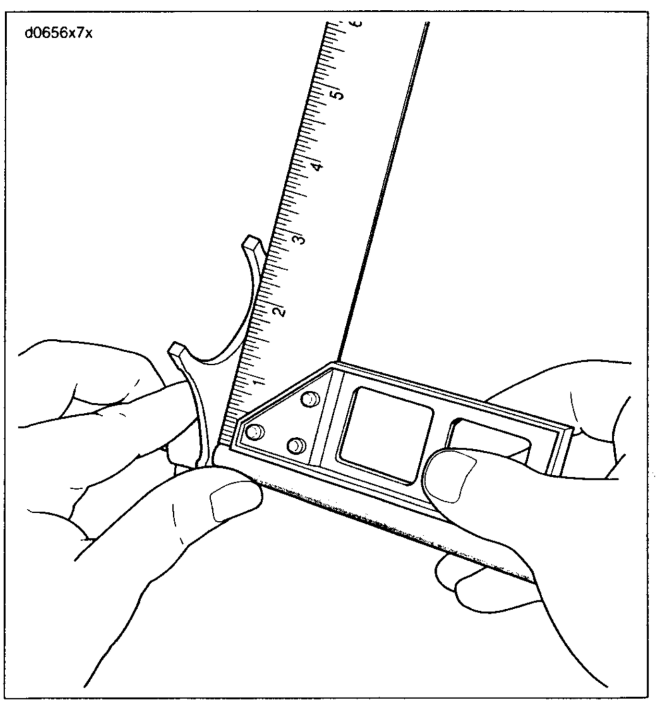
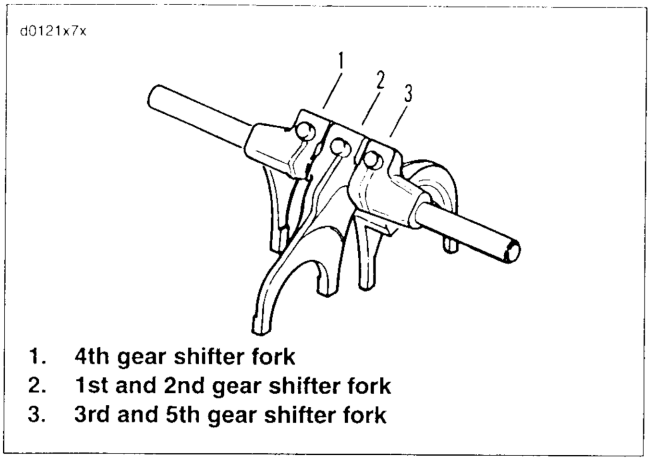


Figure 7-14. Checking Fork

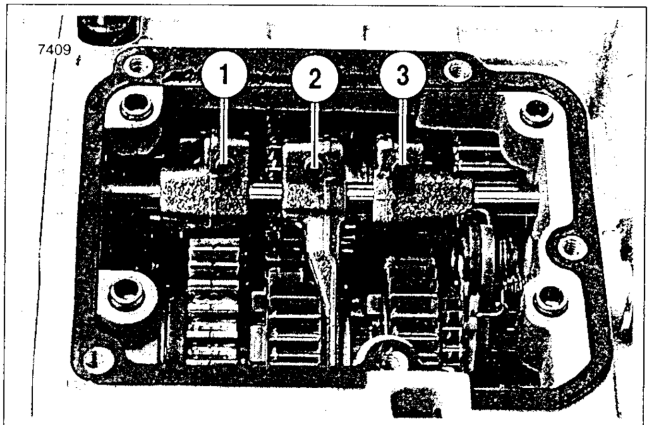
INSTALLATION

1. See Figure 7-15. The forks are different from each other and are identified as shown.
2. See Figure 7-16. Insert shifter fork (1) into the slot of the mainshaft 1st gear. Insert shifter fork (2) into the slot of the countershaft 3rd gear and insert shifter fork (3) into the slot of the mainshaft 2nd gear.
3. See Figure 7-13. Slide fork shaft through the transmission case hole, through the forks and into the hole in the opposite side of the case.
4. Install transmission side cover and drain plug. See 7.5 TRANSMISSION CLUTCH RELEASE COVER.
5. Check the sliding movement of forks and gears. All parts should move freely.
6. Assemble shifter cam and top cover. See 7.3 SHIFTER CAM ASSEMBLY.



1. **4th gear shifter fork**
2. **1st and 2nd gear shifter fork**
3. **3rd and 5th gear shifter fork**

Figure 7-15. Shifter Fork Identification



1. **4th gear shifter fork**
2. **1st and 2nd gear shifter fork**
3. **3rd and 5th gear shifter fork**

Figure 7-16. Fork Position In Transmission

REMOVAL/DISASSEMBLY

1. Drain transmission. See 1.13 TRANSMISSION LUBRICANT.

NOTE

Actuating the clutch hand lever after removing the six screws will help break the cover free.

2. See Figure 7-17. Remove the six screws that hold the clutch release cover in place. Remove the clutch release cover and discard the gasket.

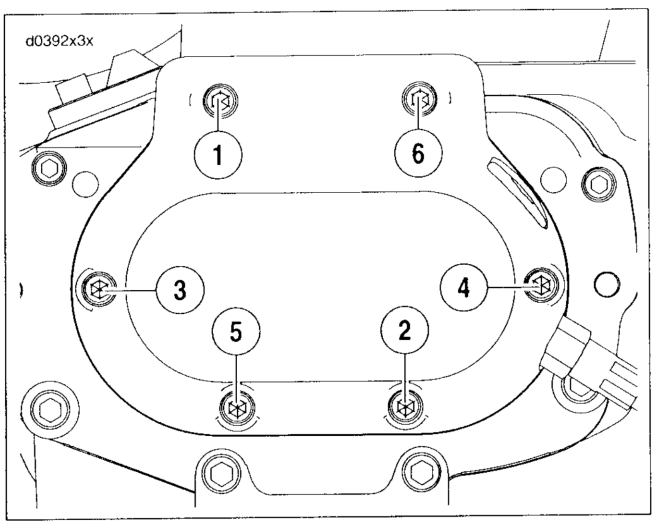


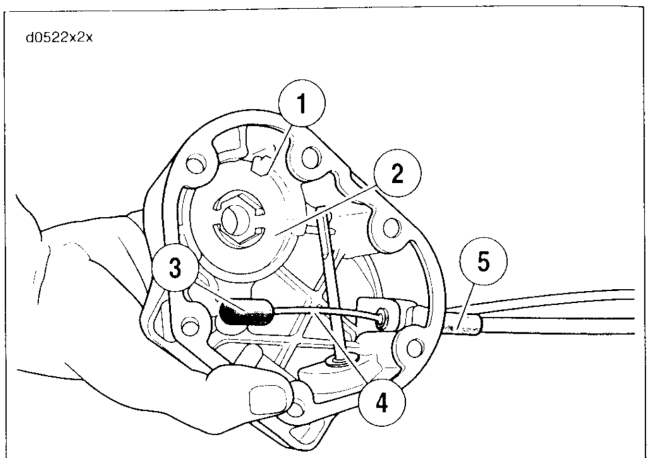
Figure 7-17. Cover Screws

3. Loosen clutch cable adjuster so clutch cable is slack. See 1.12 CLUTCH.

⚠WARNING

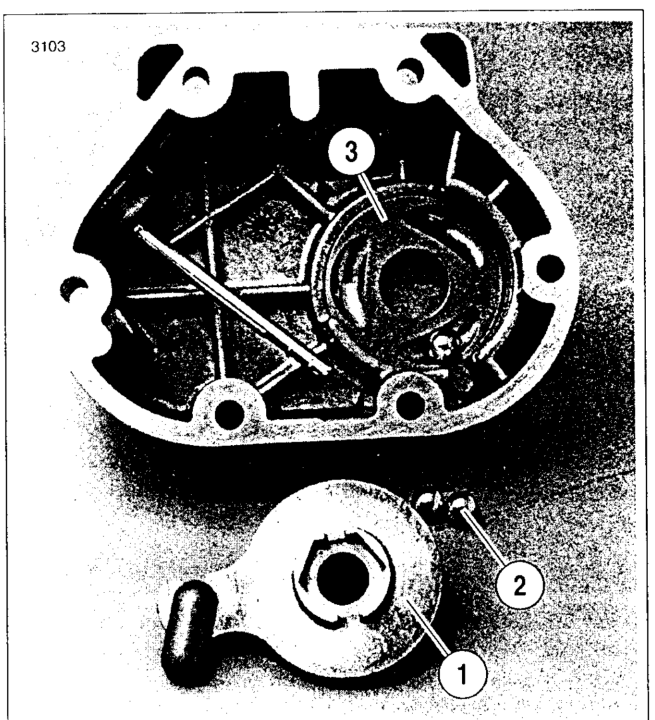
Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

4. See Figure 7-18. Note position of retaining ring opening. Remove retaining ring (1). Lift inner ramp (2) and coupling (3) out of clutch release cover. Disconnect clutch cable end (4) from the ball and ramp coupling (3).
5. Unscrew cable fitting (5) from clutch release cover.
6. See Figure 7-19. Remove balls (2) and outer ramp (3). Continue with CLEANING AND INSPECTION on the next page.



1. Retaining ring
2. Inner ramp
3. Ramp coupling
4. Clutch cable end
5. Cable fitting

Figure 7-18. Clutch Cable Connection



1. Inner ramp
2. Balls (3)
3. Outer ramp

Figure 7-19. Coupling and Ramp Assembly

CLEANING AND INSPECTION

1. See Figure 7-20. 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. Check clutch cable end for frayed or worn ends. Replace cable if damaged or worn.
5. Check the bore in the cover (5) where the ramps (1, 3) are retained. There should be no wear. Lips worn into the bore that would catch the ramps and cock them, causing improper clutch adjustment.

ASSEMBLY/INSTALLATION

1. See Figure 7-18. Screw clutch cable fitting (5) into clutch release cover. Do not tighten at this time.

NOTE

Replace cable fitting O-ring if damaged or deformed.

2. See Figure 7-20. Place outer ramp (3) in side cover (5) and place balls (2) in slots. Be sure tab is in clutch release cover slot.
3. 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

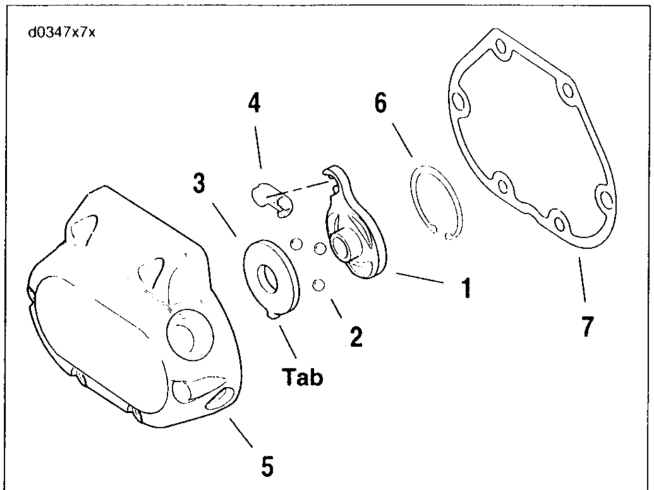
Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not excessively worn or damaged. Slippage may propel the ring with enough force to cause an accident. This could result in death or serious injury.

4. Install retaining ring (6).

NOTE

See Figure 7-21. Retaining ring opening must be installed to the right of the outer ramp tab slot.

5. See Figure 7-17. Install **new** gasket and replace clutch release cover. Tighten all six screws to 84-108 **in-lbs** (9.5-12.2 Nm).
6. Tighten clutch cable fitting to 36-60 **in-lbs** (4.1-6.8 Nm).
7. Fill transmission to proper level with fresh transmission fluid. See 1.13 TRANSMISSION LUBRICANT.
8. Adjust clutch cable. See 1.12 CLUTCH.



1. **Inner ramp**
2. **Balls (3)**
3. **Outer ramp**
4. **Ramp coupling**
5. **Cover**
6. **Retaining ring**
7. **Gasket**

Figure 7-20. Release Mechanism Assembly

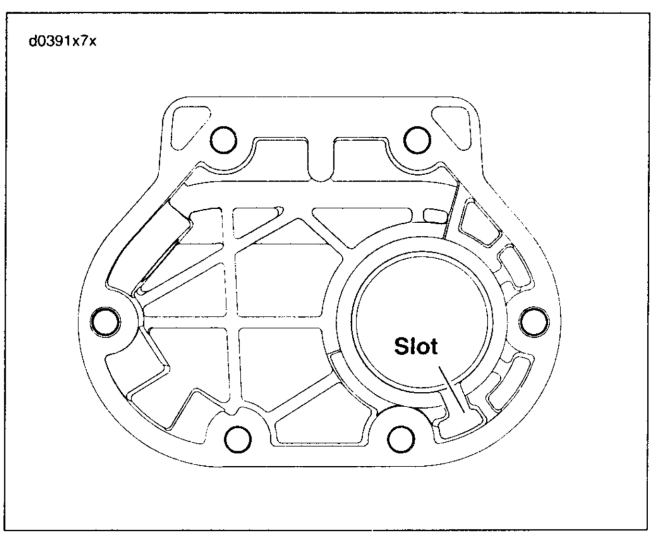


Figure 7-21. Retaining Ring Installation

NOTES

REMOVAL

PART NO.	SPECIALTY TOOL
HD-34902-B	Bearing race puller and installation tool

NOTE

Leave the transmission case on the frame unless the case itself requires replacement. For illustration purposes, some photographs may show the case removed.

1. Drain fluids from primary housing. When drained, drain fluids from transmission.
2. Remove exhaust system. See 4.9 EXHAUST SYSTEM.
3. Remove primary cover, clutch assembly and primary chaincase. See PRIMARY CHAINCASE HOUSING under 6.2 PRIMARY CHAINCASE.
4. Remove transmission top cover, shifter cam assembly, and shifter forks. See 7.4 SHIFTER FORKS.

CAUTION

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.

5. See Figure 7-22. Remove the bearing inner race from the transmission mainshaft using BEARING RACE PULLER AND INSTALLATION TOOL (Part No. HD-34902-B).
6. Remove the side cover from the transmission side door. See 7.5 TRANSMISSION CLUTCH RELEASE COVER.
7. Lock the transmission by meshing the gears into two speeds at the same time.
8. See Figure 7-23. Remove retaining ring (1) to free thrust washers (2), push rod bearing (3) and oil slinger (4) from mainshaft.
9. See Figure 7-24. Remove locknuts (1) and spacers (2) from the shafts.
10. If main drive gear (1, Figure 7-34.) is to be removed, lock transmission as described above and remove transmission sprocket nut. See 6.5 TRANSMISSION SPROCKET.

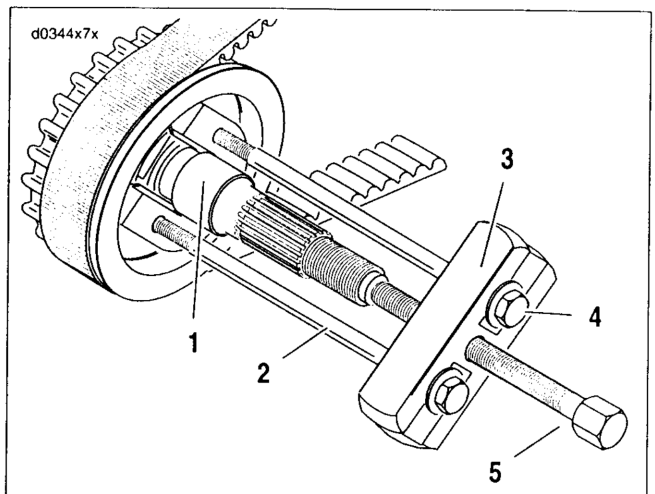
NOTE

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.

CAUTION

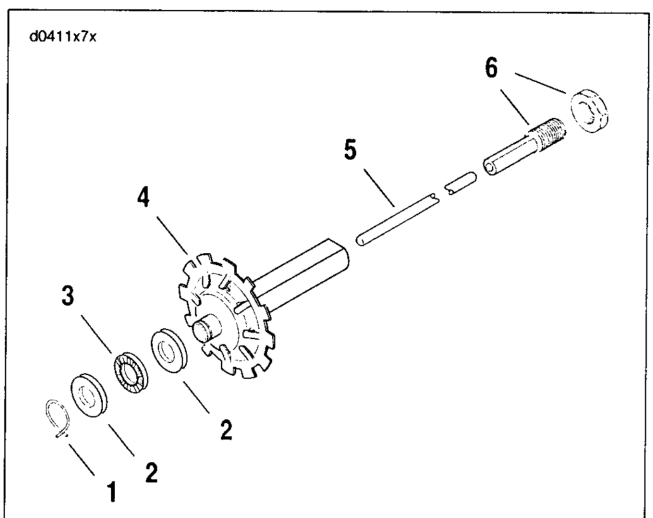
Do not attempt to remove shafts by tapping them out from opposite side. If you try to remove the shafts by tapping them with a hammer, you will damage the side door bearings.

11. See Figure 7-31. Remove the transmission side door mounting hardware. Pry the side door loose and remove side door, mainshaft and countershaft from transmission case as an assembly.



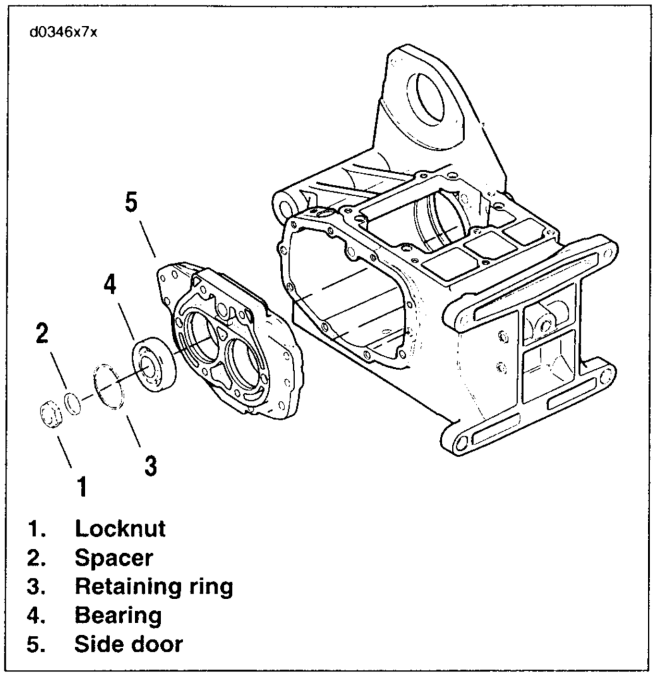
1. **Bearing inner race**
2. **Leg**
3. **Center disc**
4. **Nut**
5. **Puller screw**

Figure 7-22. Pulling Mainshaft Inner Bearing Race



1. **Retaining ring**
2. **Thrust washer (2)**
3. **Throw out bearing**
4. **Oil slinger**
5. **Push rod**
6. **Push rod end, left side**

Figure 7-23. Push Rod Assembly



1. **Locknut**
2. **Spacer**
3. **Retaining ring**
4. **Bearing**
5. **Side door**

Figure 7-24. Side Door Bearings

DISASSEMBLY

PART NO.	SPECIALTY TOOL
J-5586-A	Retaining ring pliers

1. See Figure 7-25. Remove the 2-piece push rod (21) from the hole in the mainshaft. Use RETAINING RING PLIERS (Part No. J-5586-A) to remove retaining rings (12).
2. With access door on end (shafts pointing upward), remove the retaining ring (12) from the countershaft (6). Remove the countershaft 5th gear (19) and countershaft 2nd gear (18).
3. Remove the bearings (9), retaining ring (12) and countershaft 3rd gear (16).
4. Remove mainshaft 2nd gear (20) and leave 4th and 1st gear respectively on each shaft.

NOTE

To remove the mainshaft 3rd gear (17), move the retaining ring on the access door side of 3rd gear out of the slot and slide it on the shaft away from 3rd gear. The gear will move down the shaft for easy access to the upper retaining ring.

5. Remove the upper retaining ring, thrust washer (11), mainshaft 3rd gear (17), bearings and retaining ring.

CAUTION

Supporting the gears in the following step is necessary to provide support for the inner bearing races. Failure to support the gears will damage the bearings.

6. Support countershaft 1st gear and press out countershaft.
7. Support mainshaft 4th gear and press out mainshaft.
8. Remove the remaining spacers and retaining rings.

CLEANING AND INSPECTION

WARNING

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

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 on the gears. Replace the gears if dogs are rounded, battered or chipped.
4. See Figure 7-24. Inspect the bearings (4) in the side door (5). If bearings are pitted or grooved or feel rough when turned or have any end play, replace the bearings.

Replacing Side Door Bearings

1. See Figure 7-24. Remove the retaining rings (3) and press the bearings out of the side door.

CAUTION

To perform the next step, you must use a plate for support or the bearing door will be damaged.

2. 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.
3. Install beveled retaining ring (3) with the flat side next to the bearing.

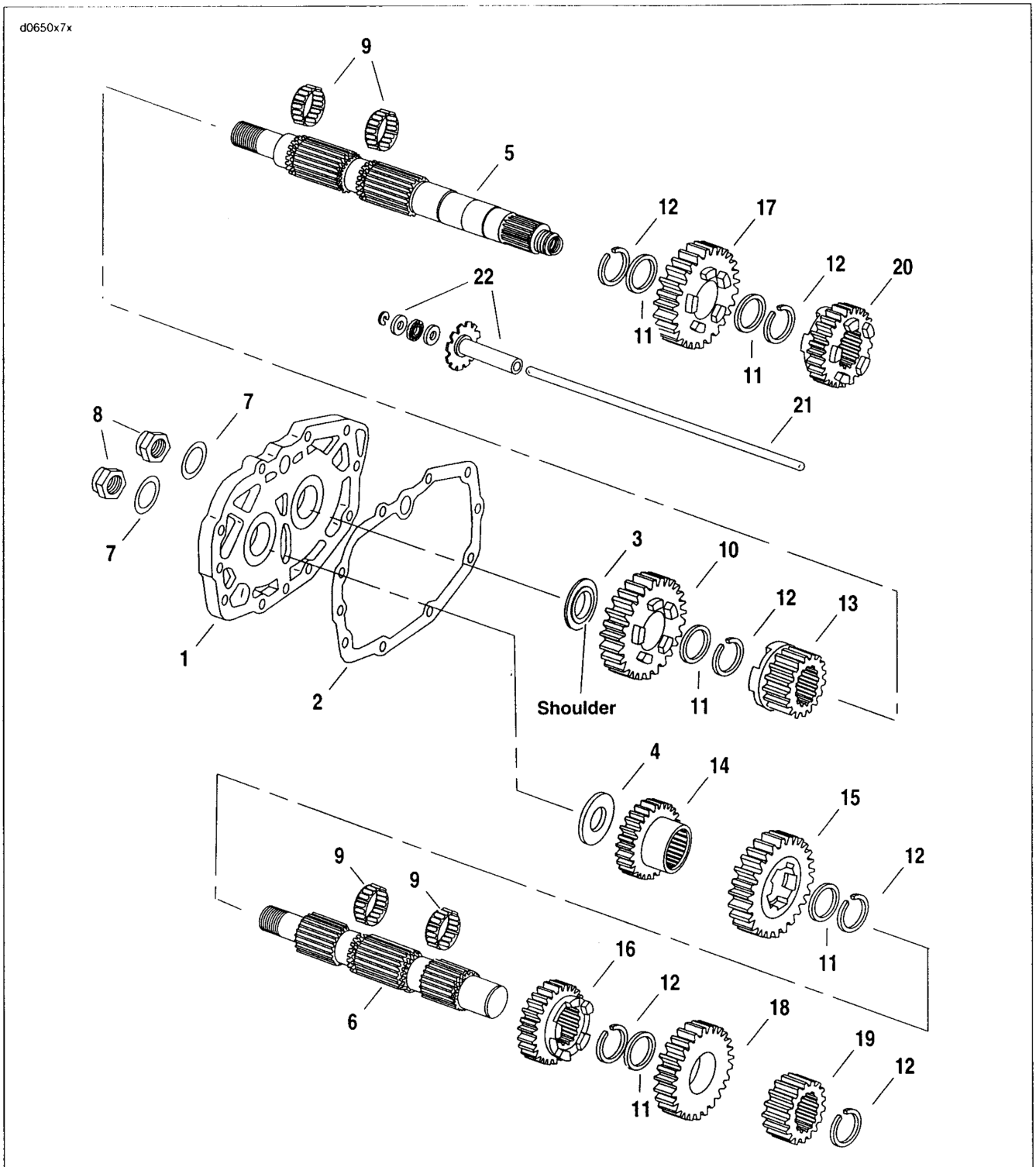
ASSEMBLY

PART NO.	SPECIALTY TOOL
J-5586-A	Retaining ring pliers

NOTE

*Replace all retaining rings and gear roller bearings with **new** parts during assembly.*

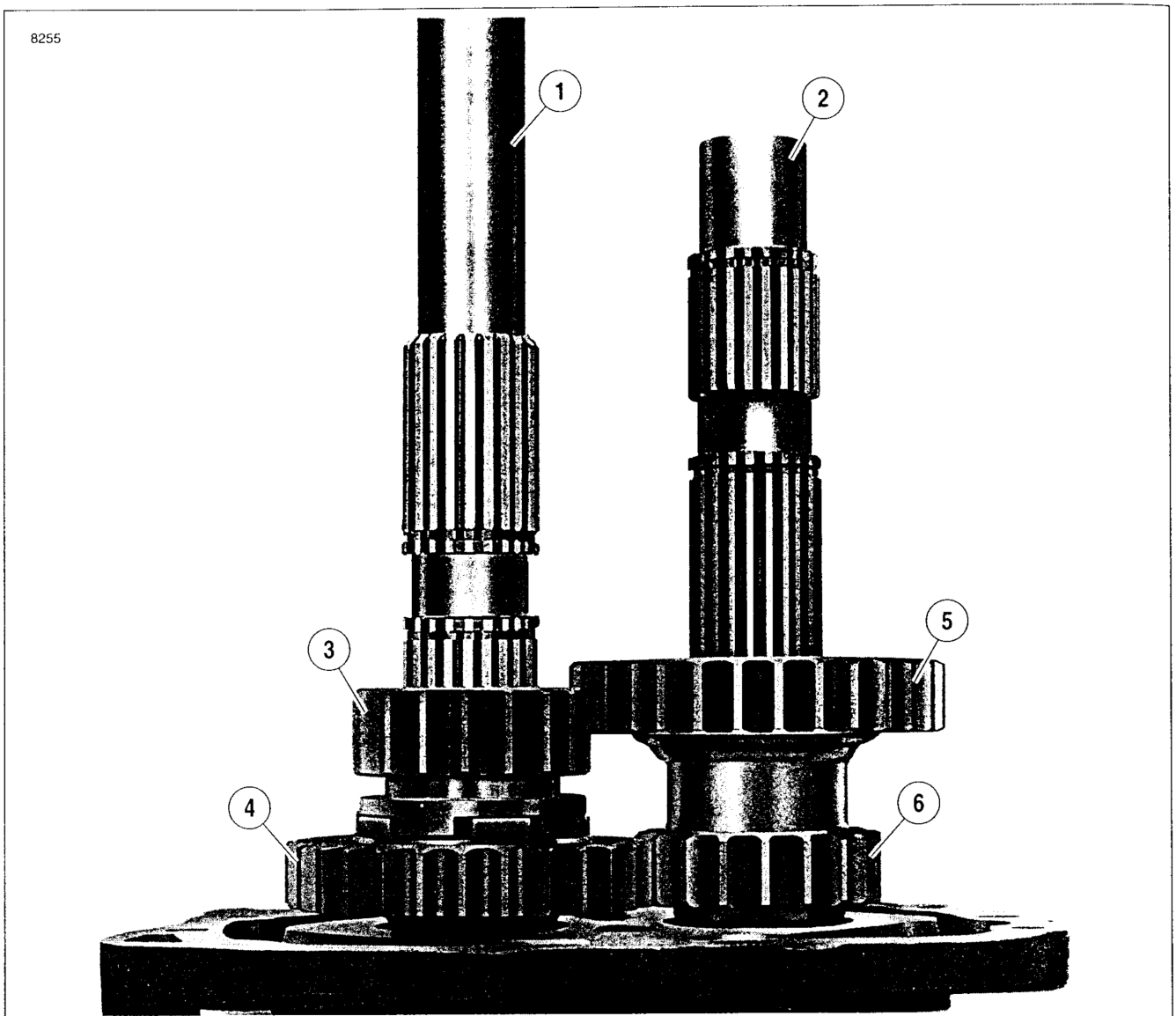
1. See Figure 7-25. Slip thrust washers (11) and retaining rings (12) on mainshaft and countershaft. Slip mainshaft 4th gear on mainshaft and countershaft 1st gear on countershaft.
2. Lightly coat bearings (9) with oil and install the bearings on the mainshaft (5) bottom race. Slide mainshaft 4th gear (10) over the bearings. Install one thrust washer (11) on top of the gear and secure with a retaining ring (12). Install mainshaft 1st gear (13) with the shifter fork slot facing the side door.



1. Side door
2. Gasket
3. Mainshaft spacer
4. Countershaft spacer
5. Mainshaft
6. Countershaft
7. Spacer (2)
8. Locknut (2)
9. Bearings (4)
10. Mainshaft 4th gear
11. Thrust washer (5)
12. Retaining ring (6)
13. Mainshaft 1st gear
14. Countershaft 4th gear
15. Countershaft 1st gear
16. Countershaft 3rd gear
17. Mainshaft 3rd gear
18. Countershaft 2nd gear
19. Countershaft 5th gear
20. Mainshaft 2nd gear
21. Push rod
22. Oil slinger assembly

Figure 7-25. Mainshaft/Countershaft Assembly

3. Slide countershaft 4th gear (14) onto the countershaft (6).
4. Place bearing in countershaft race and install the countershaft 1st gear (15) with the lip on the gear resting on the spacer and the pockets in the gear facing away from the side door. Install a thrust washer (11) on top of the gear and secure with a retaining ring (12).
5. Slip spacers (3, 4) on the shafts with the tapers facing the access door bearings. The mainshaft spacer has a shoulder while the countershaft spacer does not.



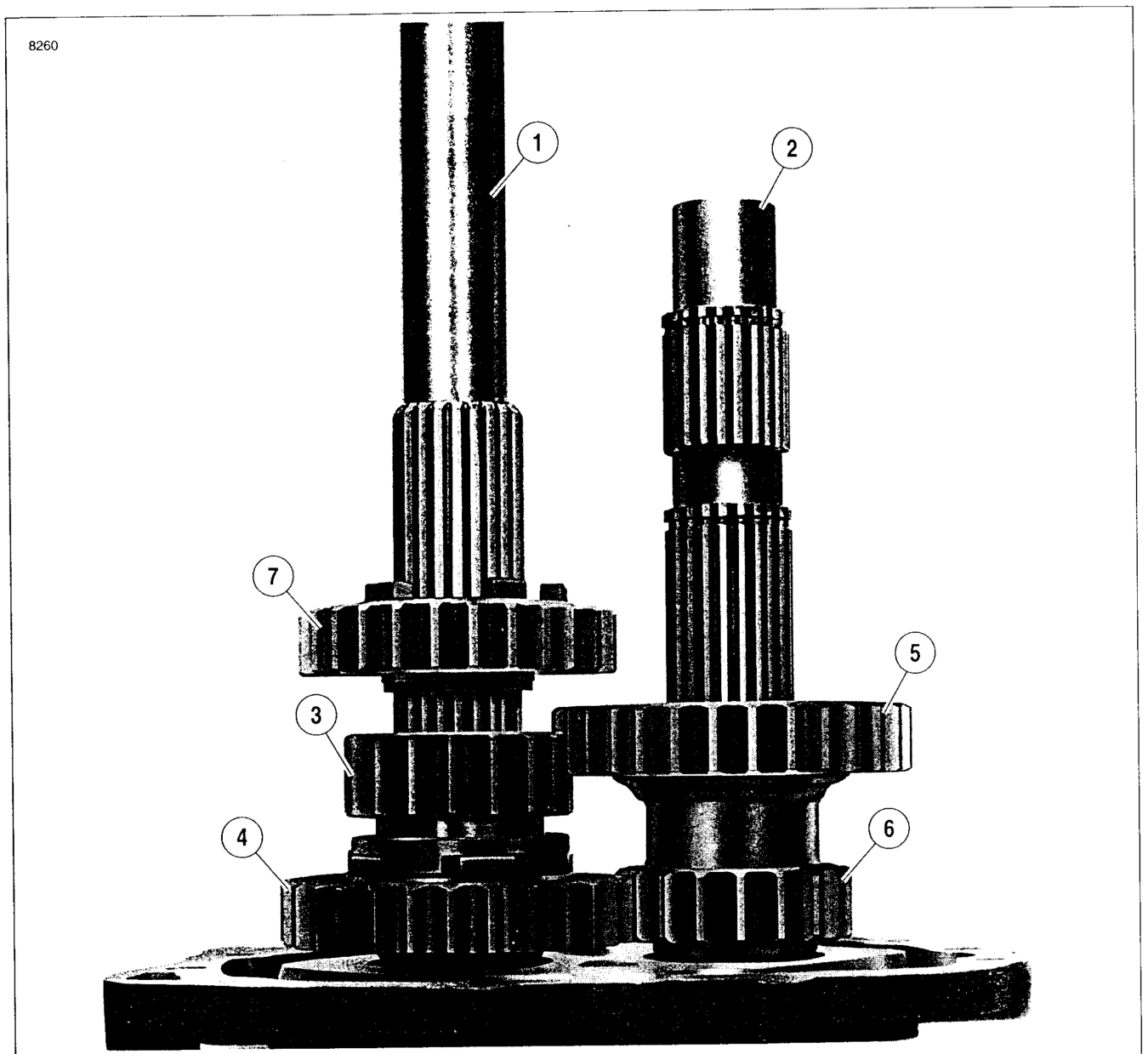
1. **Mainshaft**
2. **Countershaft**
3. **Mainshaft 1st gear**
4. **Mainshaft 4th gear**
5. **Countershaft 1st gear**
6. **Countershaft 4th gear**

Figure 7-26. 4th and 1st Gears on Shafts

CAUTION

Failure to support inner bearing races while pressing shafts through the bearings will damage the bearings.

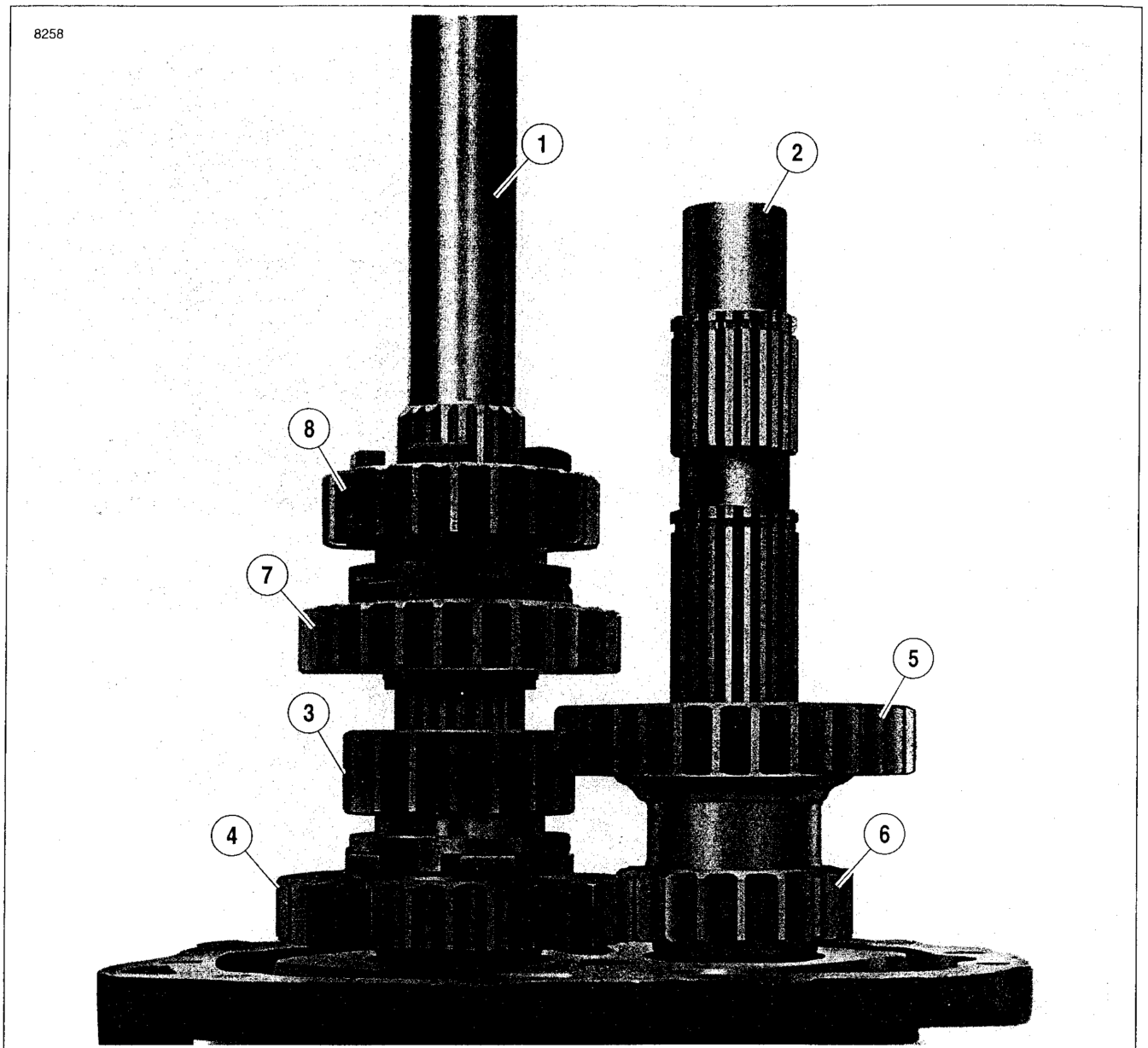
6. Place side door (1) in an arbor press. Support inner bearing races with a suitable socket. Starting with mainshaft, press the shafts into the bearings. With the shafts properly pressed into the side door, spacers (3, 4) will have no end play. The mainshaft (5) is installed to the left of the transmission top cover access cover hole when viewing the side door from the top.
7. Install one spacer (7) and nut (8) on each shaft and tighten the nuts finger tight. Do not tighten at this time.
8. Install a retaining ring (12) in the mainshaft groove just above 1st gear. Insert a thrust washer (11) on top of the retaining ring and place the bearings into the mainshaft race.
9. Place mainshaft 3rd gear (17) over bearings and secure 3rd gear with a thrust washer (11) and retaining ring (12).



1. Mainshaft
2. Countershaft
3. Mainshaft 1st gear
4. Mainshaft 4th gear
5. Countershaft 1st gear
6. Countershaft 4th gear
7. Mainshaft 3rd gear

Figure 7-27. 3rd Gear on Mainshaft

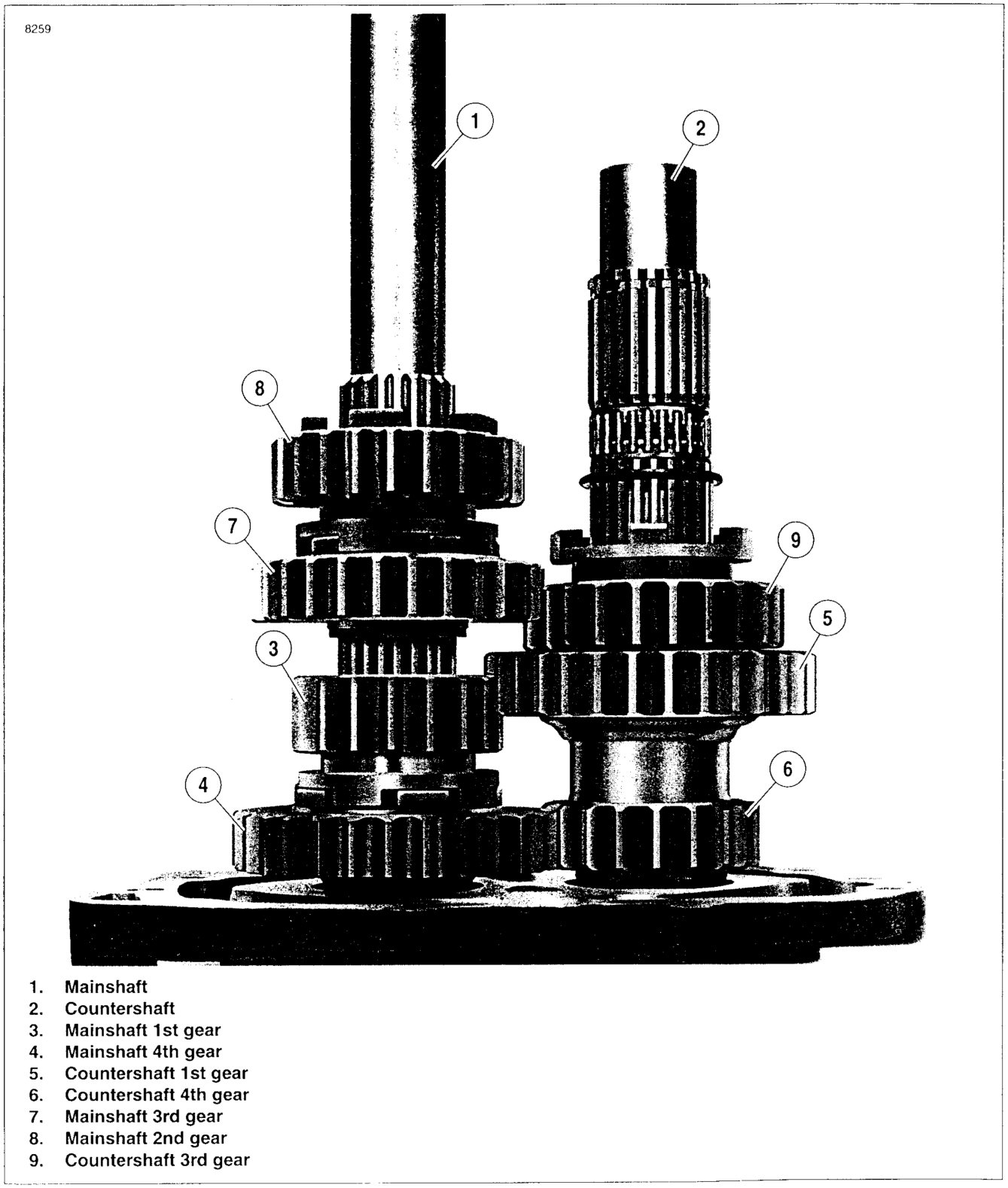
10. Install the mainshaft 2nd gear (20) on the shaft with the shifter fork slot towards the side door.
11. Install countershaft 3rd gear (16) with shifter fork slot facing away from the side door.



1. **Mainshaft**
2. **Countershaft**
3. **Mainshaft 1st gear**
4. **Mainshaft 4th gear**
5. **Countershaft 1st gear**
6. **Countershaft 4th gear**
7. **Mainshaft 3rd gear**
8. **Mainshaft 2nd gear**

Figure 7-28. 2nd, 3rd Gear on Mainshaft

12. Install a retaining ring (12) in the countershaft groove above 3rd gear (16). Slide a thrust washer (11) on top of the ring and place the bearings in the countershaft race.
13. Install the countershaft 2nd gear (18) over the bearings.
14. Install the countershaft 5th gear (19) on the countershaft. Secure 5th gear with a retaining ring.



1. Mainshaft
2. Countershaft
3. Mainshaft 1st gear
4. Mainshaft 4th gear
5. Countershaft 1st gear
6. Countershaft 4th gear
7. Mainshaft 3rd gear
8. Mainshaft 2nd gear
9. Countershaft 3rd gear

Figure 7-29. 3rd Gear on Countershaft

NOTE

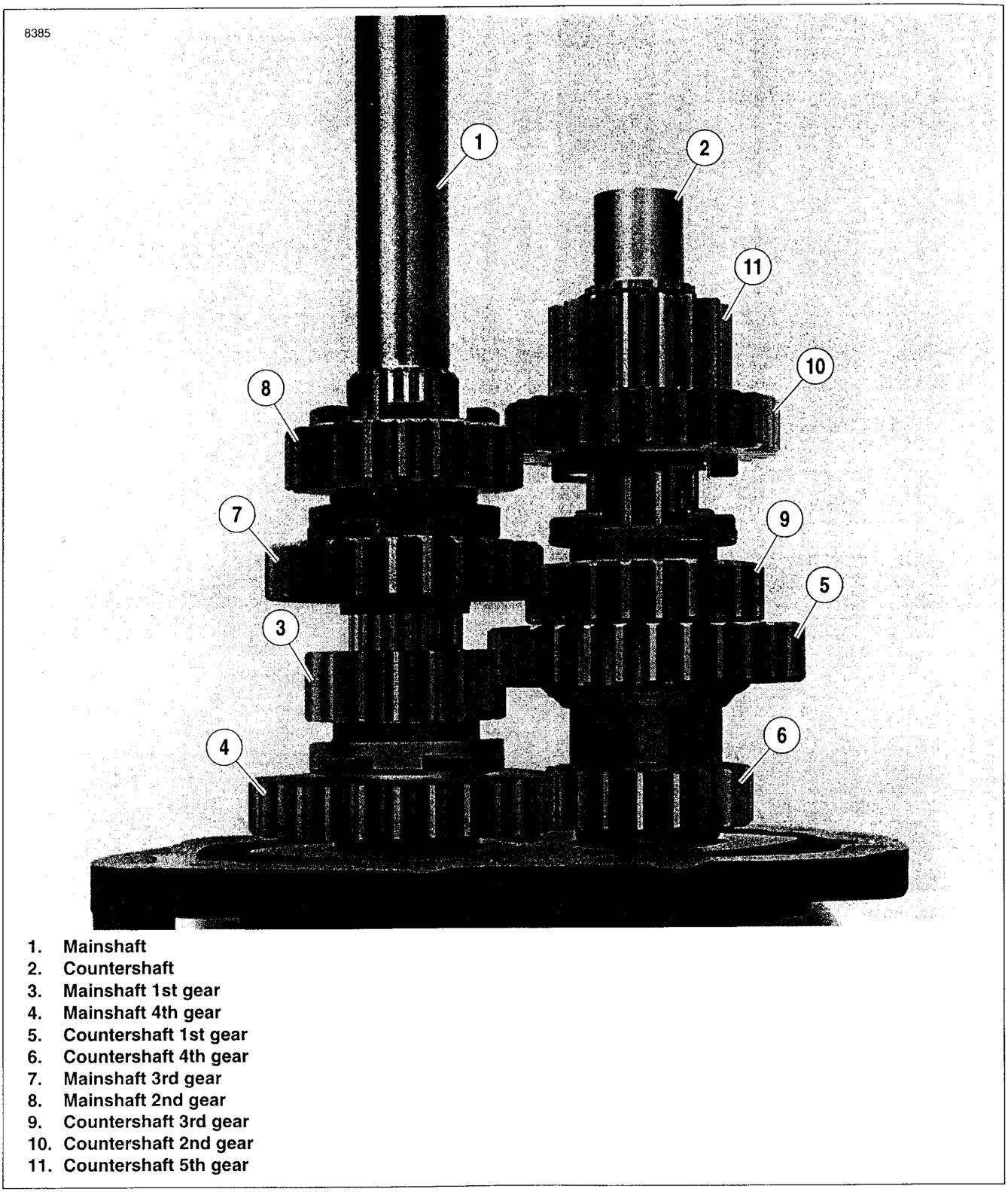
If main drive gear was removed, install it now. See Main Drive Gear and Bearing under 7.7 TRANSMISSION CASE.

15. Lock the transmission by engaging two gears. Tighten mainshaft and countershaft nuts (8) to 45-55 ft-lbs (61.0-74.6 Nm).

CAUTION

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.

16. Install the assembly in the transmission case.



1. **Mainshaft**
2. **Countershaft**
3. **Mainshaft 1st gear**
4. **Mainshaft 4th gear**
5. **Countershaft 1st gear**
6. **Countershaft 4th gear**
7. **Mainshaft 3rd gear**
8. **Mainshaft 2nd gear**
9. **Countershaft 3rd gear**
10. **Countershaft 2nd gear**
11. **Countershaft 5th gear**

Figure 7-30. Side Door, Mainshaft and Countershaft - Final Assembly

INSTALLATION

PART NO.	SPECIALTY TOOL
HD-34902-B	Bearing race puller and installation tool

CAUTION

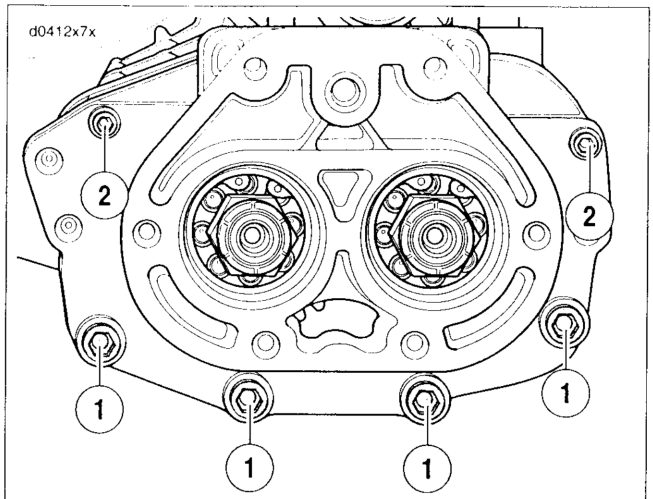
Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.

1. See Figure 7-25. Install the assembly in the transmission case using a **new** gasket (2).
   a. See Figure 7-31. Tighten all 5/16 in. hardware (1) to 13-16 ft-lbs (17.6-21.7 Nm).
   b. Tighten all 1/4 in. hardware (2) to 84-108 **in-lbs** (9.5-12.2 Nm).
2. Lock the transmission by engaging two gears. Tighten **new** mainshaft and countershaft nuts to 45-55 ft-lbs (61.0-74.6 Nm).
3. See Figure 7-32. The bearing race must be positioned on the shaft a precise distance to properly align with the bearing outer race in the primary chaincase. To install the bearing inner race, use those parts of the combination bearing race, PULLER AND INSTALLATION TOOL (Part No. HD-34902-B).
   a. Slide bearing inner race (1), chamfer edge first, onto mainshaft.
   b. Thread sleeve pilot (2) onto end of mainshaft (left hand thread).
   c. Position sleeve (3) over sleeve pilot (2) and against bearing race (1).
   d. Place washer (4) over threaded portion of sleeve pilot (2) and install nut (5).

NOTE

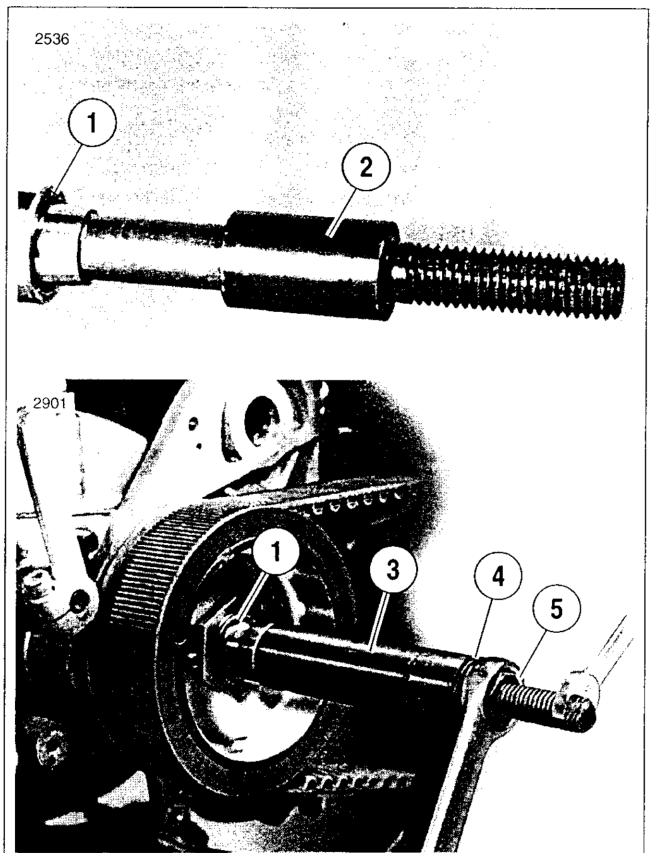
Measure the length of the bearing inner race (1). The race must be 0.9950-1.000 in. (25.27-25.40 mm) long. Record the length. It will determine the race's position in the next step.

   e. Tighten nut (5) while holding sleeve pilot (2) stationary with wrench on flats at end of screw threads. Press race (1) onto shaft so inside edge is 0.100-0.125 in. (2.540-3.180 mm) from main drive gear.
4. See Figure 7-23. Install push rod assembly (2-5) in mainshaft hole. Secure with **new** retaining ring (1) if removed.
5. Install the side cover, using a **new** gasket. See 7.5 TRANSMISSION CLUTCH RELEASE COVER
6. Install the shifter forks, shifter cam and top cover. See 7.4 SHIFTER FORKS.



1. **5/16 in. hardware @ 13-16 ft-lbs (17.6-21.7 Nm)**
2. **1/4 in. hardware @ 84-108 in-lbs (9.5-12.2 Nm)**

Figure 7-31. Transmission Mounting Hardware



1. **Bearing inner race**
2. **Sleeve pilot**
3. **Sleeve**
4. **Washer**
5. **Nut**

Figure 7-32. Installing Bearing Race

7. Install transmission sprocket nut. See 6.5 TRANSMISSION SPROCKET.
8. Install primary chaincase, clutch assembly and primary cover. See PRIMARY CHAINCASE HOUSING under 6.2 PRIMARY CHAINCASE.

CAUTION

Do not overtighten drain plug. When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter transmission drain case. These actions may result in damage to the motorcycle.

9. Replace O-ring on plug. Clean and install transmission drain plug. Tighten to 14-21 ft-lbs (19.0-28.5 Nm).
10. Fill transmission to proper level with fresh transmission fluid. See 1.13 TRANSMISSION LUBRICANT.
11. Install exhaust system. See 4.9 EXHAUST SYSTEM.

REMOVAL

PART NO.	SPECIALTY TOOL
HD-35316-A	Main drive gear remover and installer

General

See 3.14 REMOVING ENGINE FROM CHASSIS for information on pulling transmission case from frame.

Main Drive Gear and Bearing

NOTE

Main drive gear and bearing can be removed with the transmission case in the frame after removing door assembly. Use MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A).

1. See Figure 7-34. Remove retaining ring (7).

NOTE

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.

2. Pull main drive gear (1) using MAIN DRIVE GEAR REMOVER AND INSTALLER.
3. Gently remove bearing (6) from case using a block of wood and a hammer. Discard bearing.

INSTALLATION

Main Drive Gear and Bearing

PART NO.	SPECIALTY TOOL
HD-35316-A	Main drive gear remover and installer

CAUTION

Failure to use the MAIN DRIVE GEAR AND BEARING INSTALLATION TOOL will cause premature failure of bearing and related parts.

1. See Figure 7-34. Install main drive gear bearing (6) using **new** retaining ring (7). Install main drive gear (1) from inside the case using MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A). Follow instructions provided with tool.

NOTE

See Figure 7-33. Bearing retaining ring must be installed with the flat side facing the bearing and the opening in the ninety degree window as shown.

2. See Figure 7-34. Install the quad seal (8), spacer (10) and sprocket (11) on the main drive gear (1). Apply LOCTITE THREADLOCKER 262 (red) to the threads of sprocket nut (12) and install on the main drive gear.

NOTES

- *Sprocket nut (12) has left-hand thread.*
- *Place belt on transmission sprocket as sprocket is placed in position.*

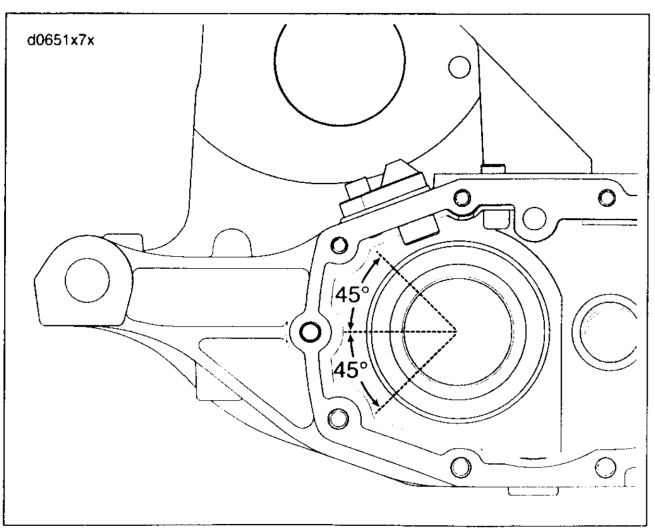
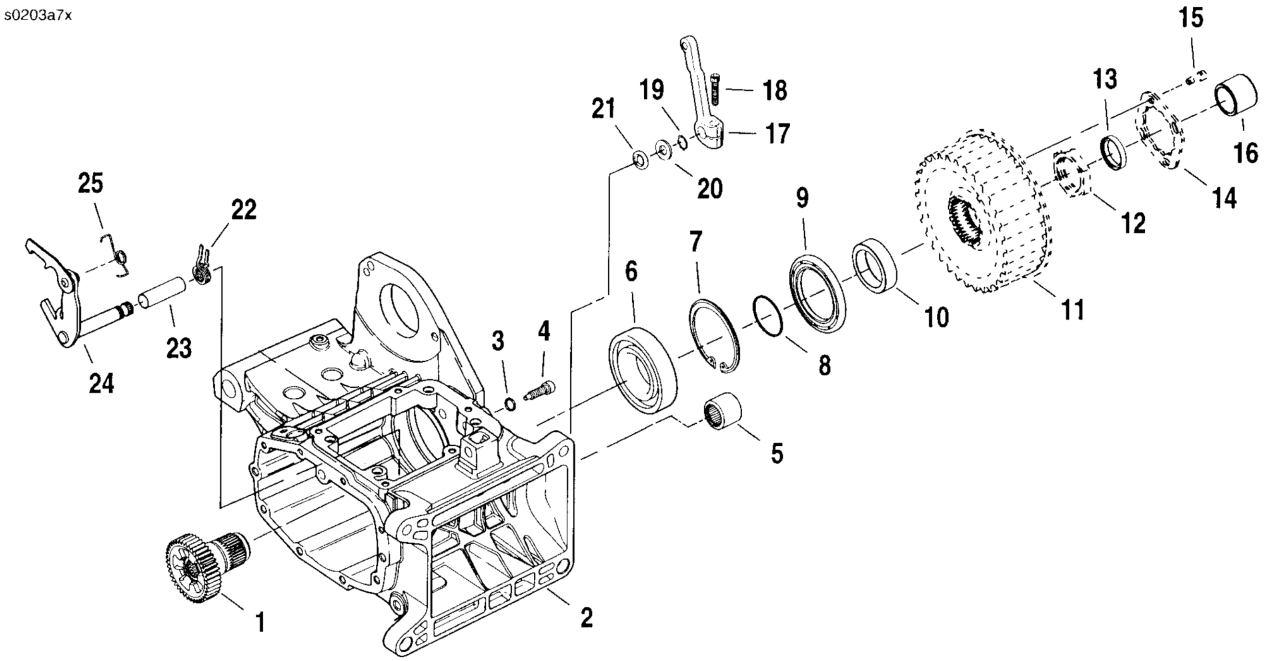
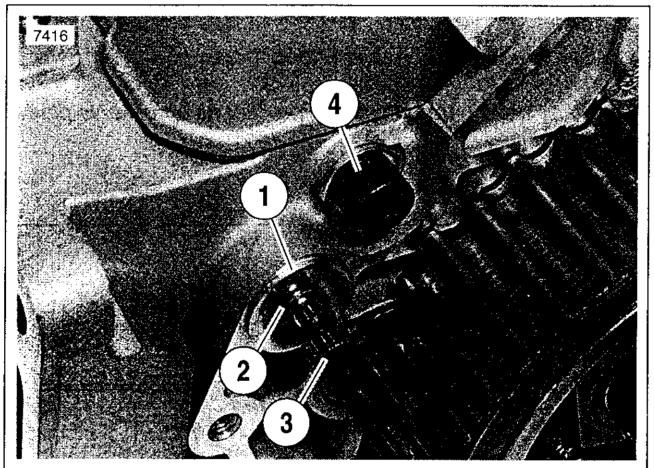


Figure 7-33. Retaining Ring Opening



1. Main drive gear
2. Transmission case
3. Washer
4. Screw (not an adjuster)
5. Bearing
6. Bearing
7. Bevelled retaining ring
8. Quad seal
9. Oil seal
10. Spacer
11. Sprocket
12. Sprocket nut
13. Oil seal, fifth gear
14. Lockplate
15. Allen screws
16. Bearing, inner race
17. Shifter rod lever
18. Screw
19. Retaining ring
20. Washer
21. Seal
22. Shifter lever centering spring
23. Sleeve (inside transmission case)
24. Shifter pawl lever assembly
25. Shifter shaft lever spring

Figure 7-34. Transmission Case, Sprocket and Main Drive Gear



1. Washer (with seal behind)
2. Retaining ring
3. Shifter shaft lever
4. Screw (not an adjuster)

Figure 7-35. Shifter Shaft Lever, Exterior View

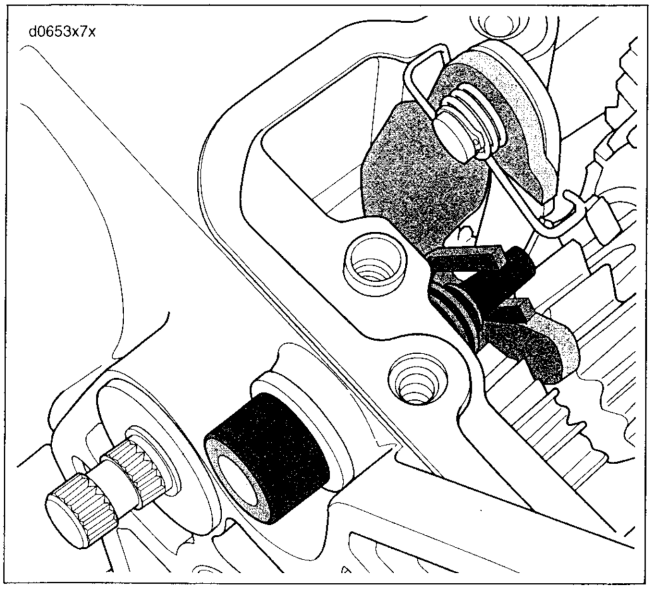


Figure 7-36. Shifter Shaft Lever Spring

3. Slide the countershaft and mainshaft assembly into the transmission case. Lock the gear sets in place.
4. Install shifter cam and shifter forks. See 7.4 SHIFTER FORKS.
5. Install top cover, right side cover, primary chaincase housing, starter, oil tank, clutch, primary chain and sprocket.
6. See Figure 7-37. Verify that transmission dowels are seated. Tighten all transmission mounting bolts in the sequence shown. Connect foot shifter rod to shifter arm.
   a. Tighten finger tight.
   b. Tighten to 15 ft-lbs (20.3 Nm).
   c. Tighten to 30-35 ft-lbs (40.7-47.5 Nm).
7. Install the pivot shaft and side mounting plates.
8. Adjust drive belt tension. See 1.14 REAR BELT DEFLECTION.
9. Align vehicle. See 2.14 VEHICLE ALIGNMENT.
10. Adjust primary chain. See 1.10 PRIMARY CHAIN.

CAUTION

The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed. Failure to replace this gasket may cause primary chaincase leaks.

11. Install primary chaincase cover. See PRIMARY CHAINCASE COVER under 6.2 PRIMARY CHAINCASE.
12. Install the exhaust system. See 4.9 EXHAUST SYSTEM.

CAUTION

Do not overtighten drain plug. When draining or adding lubricant, do not allow dirt, debris or other contaminants to enter transmission drain case. These actions may result in damage to the motorcycle.

13. Clean transmission drain plug and install. Tighten to 14-21 ft-lbs (19.0-28.5 Nm). Place motorcycle in an upright position. Fill transmission to proper level with fresh transmission fluid. See 1.13 TRANSMISSION LUBRICANT.

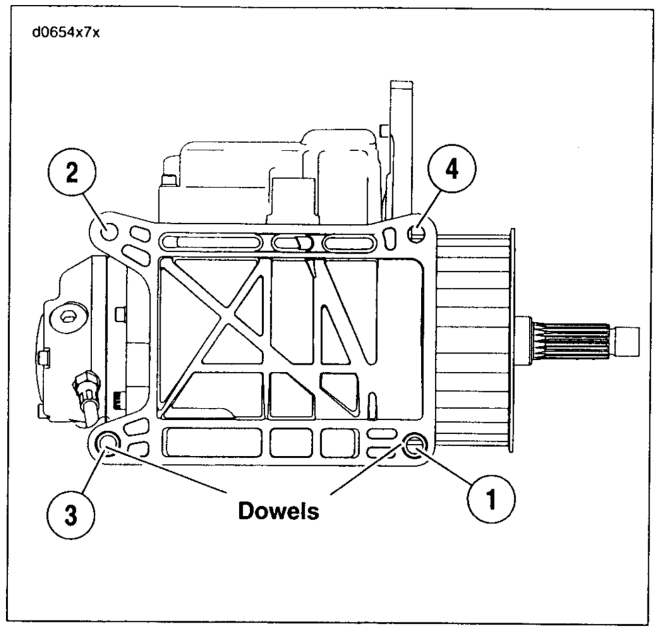


Figure 7-37. Transmission Mounting Bolts

CAUTION

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

14. Fill primary chaincase. See 1.11 PRIMARY CHAINCASE LUBRICANT.

DISASSEMBLY

Shifter Arm Assembly

1. See Figure 7-38. 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

PART NO.	SPECIALTY TOOL
HD-37842-A	Main drive gear bearing and seal installation tool (if replacing)

⚠WARNING

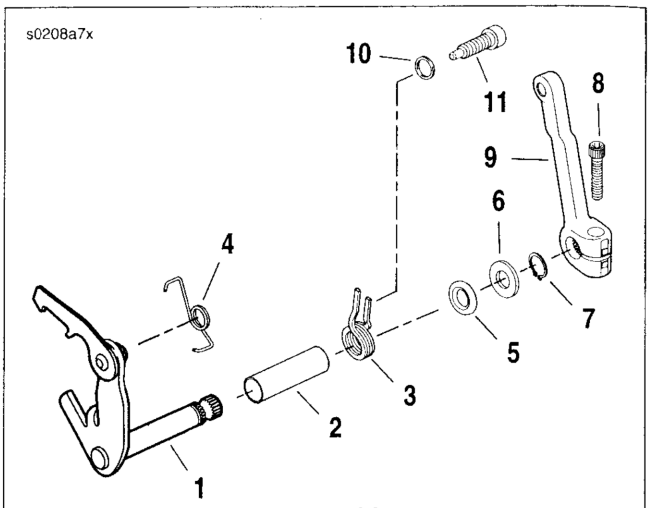
Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

1. Clean all parts in solvent except the case and needle bearings. Blow parts dry with low pressure compressed air.

NOTE

The transmission case and needle bearings must not be cleaned because it is impossible to clean a needle bearing. Normal cleaning methods will wash dirt or other contaminates into the bearing case (behind the needles) and lead to bearing failure.

2. When replacing seals, lightly coat outside diameter of seal with LOCTITE RETAINING COMPOUND No. 601. Use MAIN DRIVE GEAR INSTALLER (Part No. HD-41405) to install main drive gear seal.
3. Inspect the main drive gear for pitting and wear. Replace if necessary.
4. Replace the sprocket if the teeth are rounded or damaged.
5. See Figure 7-38. Inspect the shifter pawl lever assembly (1) for wear. If pawl ends are damaged, replace assembly.
6. Inspect the springs (3, 4). Replace if necessary.
7. Inspect the needle bearings on the inside of the main drive gear. If mainshaft race surface appears pitted or grooved, replace these bearings.



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 7-38. Shifter Arm Assembly

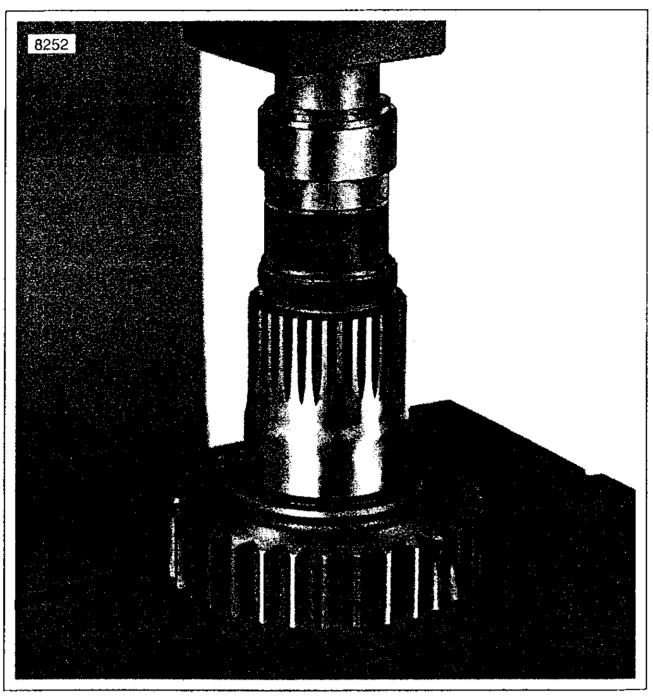


Figure 7-39. Installing Clutch Side Needle Bearing in Main Drive Gear

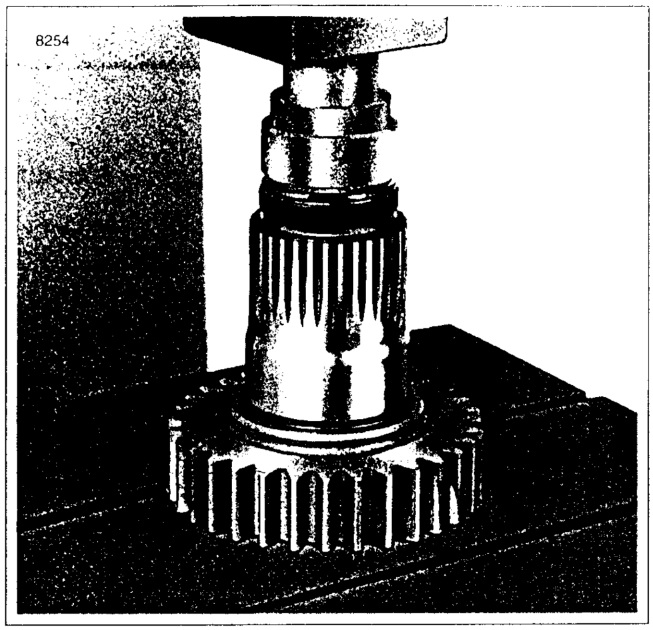


Figure 7-40. Pressing in Seal

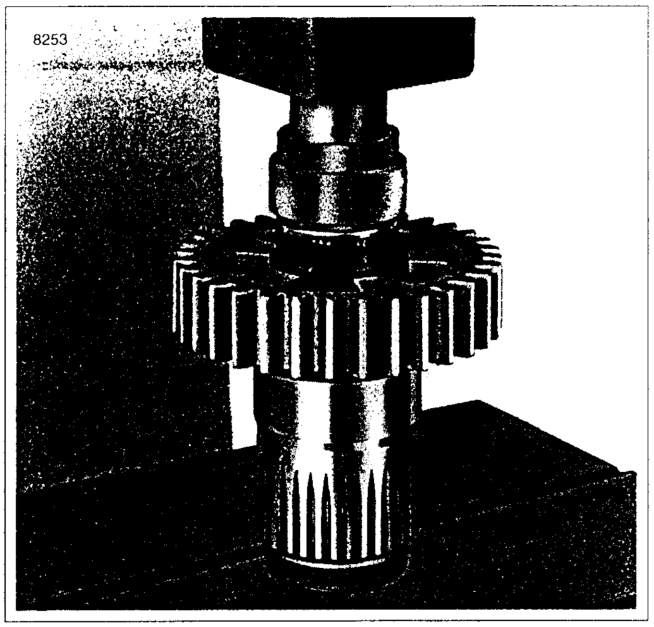


Figure 7-41. Installing Transmission Side Needle Bearing in Main Driver Gear

NOTE

If the main drive gear needle bearings and/or seal need to be replaced, continue as follows. Otherwise, proceed to ASSEMBLY.

8. Remove seal and old needle bearings.

NOTE

To install the inner main drive gear needle bearings and seal, use MAIN DRIVE GEAR BEARING and SEAL INSTALLATION TOOL (Part No. HD-37842-A).

9. See Figure 7-39. Install clutch side needle bearing using an arbor press and the 0.315 in. step end of tool as shown. Press until tool is flush.
10. See Figure 7-40. Turn over tool and press in seal using the 0.090 in. step.
11. See Figure 7-41. Turn over the main drive gear in the arbor press. With the tool at the 0.090 in. step, press in inner bearing.

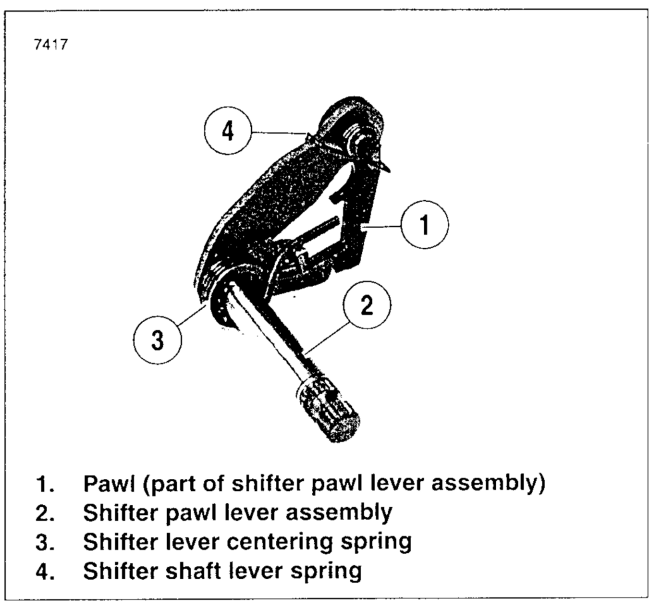
ASSEMBLY

Shifter Pawl Lever Assembly

1. See Figure 7-38. Verify that sleeve (2) is inside transmission case.
2. See Figure 7-42. 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.



1. **Pawl (part of shifter pawl lever assembly)**
2. **Shifter pawl lever assembly**
3. **Shifter lever centering spring**
4. **Shifter shaft lever spring**

Figure 7-42. Shifter Pawl Lever Assembly

4. See Figure 7-35. Insert the assembly into the transmission case. See Figure 7-36. Verify that screw sits inside shifter shaft lever spring.
5. See Figure 7-35. Install a **new** seal. Install washer (1) and a **new** retaining ring (2).
6. See Figure 7-38. 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).

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ELECTRICAL 8

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

CHARGING SYSTEM	DATA
Battery	19 amp hour/270 CCA
Alternator AC voltage output	16-20 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 @ 3600 RPM	32 amps

CIRCUIT BREAKER/FUSES	RATING (AMPERES)
Main circuit breaker	30
Ignition fuse	15
Lighting fuse	15
Accessory fuse	15
Instruments fuse	15
Security System fuse	15

TORQUE VALUES

ITEM	TORQUE		NOTES
CKP sensor screw	90-120 in-lbs	10.2-13.6 Nm	Page 8-12
Connector sheath screws	25-35 in-lbs	2.8-3.9 Nm	T20 TORX, Page 8-12
Fuel gauge sending unit plate screws	18-22 in-lbs	2.0-2.5 Nm	FXDL and FXDWG, page 8-39
Fuel tank console nut	80-100 in-lbs	9.0-11.3 Nm	FXDWG , page 8-40, page 8-48
Fuel tank mounting bolt	120-216 in-lbs	13.6-24.4 Nm	Front and rear, page 8-10
Gauge housing screws	18-22 in-lbs	2.0-2.5(Nm)	FXD, FXDX and FXDXT, page 8-40
Handlebar clamp screw	60-80 in-lbs	6.8-9.0 Nm	T27 TORX, page 8-57, page 8-63
Handlebar switch housing screws	35-45 in-lbs	3.9-5.1 Nm	T25 TORX, page 8-57, page 8-63
Headlamp bracket screw	120-144 in-lbs	13.6-16.3 Nm	FXD, FXDL, FXDX, page 8-28
Headlamp horizontal adjusting bolt	25-30 ft-lbs	33.9-40.7 Nm	FXDWG, page 8-28
Headlamp mounting nut	120-180 in-lbs	13.6-20.3 Nm	FXD, FXDL, FXDX, FXDXT page 8-28
Headlamp vertical adjusting nut	25-30 ft-lbs	33.9-40.7 Nm	FXDWG, page 8-28
Horn mounting nut	100-120 in-lbs	11-13 Nm	Page 8-10, page 8-52
Ignition coil bolts	24-72 in-lbs	2.7-8.1 Nm	Page 8-14
Ignition module screws	15-21 in-lbs	1.7-2.4 Nm	Page, 8-9
Instrument cluster bolt	12-18 ft-lbs	16.3-24.4 Nm	Page 8-44
Instrument panel acorn nut	80-100 in-lbs	9.03-11.29 Nm	Page 8-19
MAP sensor screw	25-35 in-lbs	2.8-3.9 Nm	T20 TORX , page 8-10
Neutral switch	120-180 in-lbs	13.6-20.3 Nm	Apply transmission oil to O-ring, page 8-49
Oil pressure switch	96-144 in-lbs	10.9-16.2 Nm	LOCTITE PIPE SEALANT WITH TEFLON, page 8-50
Rear stop light switch	96-120 in-lbs	10.8-13.6 Nm	LOCTITE THREADLOCKER WITH TEFLON, page 8-51
Speedometer sensor mounting bolt	84-108 in-lbs	9.5-12.2 Nm	Page 8-45
Sprocket nut	150-165 ft-lbs	203.4-223.7 Nm	LOCTITE THREADLOCKER 262 (red), page 8-20
Starter terminal nut	65-80 in-lbs	7.3-9.0 Nm	Cover with protective boot, page 8-26
Stator screws	55-75 in-lbs	6.2-8.4 Nm	T27 TORX, use only once, page 8-20
Tail lamp lens screws	20-24 in-lbs	2.3-2.7 Nm	Page -29, 8-30
Top plate nuts	70-90 in-lbs	7.9-10.16 NM	page, page 8-17 8-8
Voltage regulator screws	60-80 in-lbs	6.8-9.0 Nm	Page 8-22

GENERAL

See Table 8-1. See Table 8-2. These tables give the location and bulb requirements for all Harley-Davidson Dyna Glide motorcycles.

NOTES

- *All Dyna Glide Speedometers, Tachometers and Odometers are illuminated with LEDs.*
- *FXDWG indicator lamps are LEDs.*
- *LEDs are non-repairable. Entire assembly must be replaced if LED fails.*

Table 8-1. Dyna Glide Bulb Chart

LAMP DESCRIPTION (ALL LAMPS 12 VOLT)	NO. OF BULBS REQUIRED	CURRENT DRAW (AMPERAGE)	WATTAGE	PART NO. (EARLY)	PART NO. (LATE)
Headlamp					
Headlamp (low beam/ high beam)	1	4.58/5.0	55/60	67697-81	67697-81
Position lamp (HDI)	1	0.32	3.9	53438-92	53438-92
Tail and stop lamp					
Tail lamp	1	0.59	7	68168-89A*	68167-88**
Stop lamp	1	2.25*/2.10**	27*/25**	68168-89A*	68167-88**
Tail lamp (HDI)	1	0.42*/0.59**	5*/7**	68169-90A*	68167-88**
Stop lamp (HDI)	1	1.75*/2.10**	21*/25**	68169-90A*	68167-88**
Turn signal lamps		**FXD/FXDL/ FXDWG**	**FXD/FXDL/ FXDWG**		
Front turn signal/ running lamps	2	2.25/0.59	27/7	68168-89	68168-89
Front turn signal (HDI)	2	1.75	21	68163-84	68163-84
Rear turn signal	2	2.25	27	68572-64B	68572-64B
Rear turn signal (HDI)	2	1.75	21	68163-84	68163-84

* Early 2003 bayonet mount bulb type.
** Late 2003 wedge mount bulb type.

Table 8-2. Dyna Glide Indicator Bulb Chart

LAMP DESCRIPTION (ALL LAMPS 12 VOLT)	NO. OF BULBS REQUIRED	CURRENT DRAW (AMPERAGE)		WATTAGE		PART NO.	
Indicator lamps (All but FXDWG)		**FXDL**	**FXD/X/XT**	**FXDL**	**FXD/X/XT**	**FXDL**	**FXD/X/XT**
High beam indicator	1	0.08	0.15	1.1	2.1	68023-92A	68024-94
Oil pressure signal	1	0.08	0.15	1.1	2.1	68020-92A	68024-94
Neutral indicator	1	0.08	0.15	1.1	2.1	68024-92A	68024-94
Turn signal indicator	2	0.08	0.15	1.1	2.1	68021-92A	68024-94

GENERAL

The ignition system consists of six components: the ignition module, crank position sensor (CKP), manifold absolute pressure (MAP) sensor and bank angle sensor (BAS).

The ignition module is mounted behind the electrical panel. It computes the spark advance for proper ignition timing based on sensor input (from CKP, MAP and BAS) and regulates the low-voltage circuits between battery and ignition coil. The scan tool can access the information received by and stored in the ignition module.

The ignition module contains all of the solid state components used in the ignition system. The dwell time for the ignition coil is also calculated in the microprocessor and is dependent upon battery voltage. The programmed dwell is an added feature to keep battery drain to a minimum and yet give adequate spark duration at all speeds. (The ignition module has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The ignition module is fully enclosed in a polyurethane material to protect it from vibration, dust, water or oil. This unit is a non-repairable item. If it fails, it must be replaced.

The crank position sensor (CKP) is located in the front left side of the crankcase. Readings are taken off the 30 teeth on the left side flywheel (two teeth are missing to establish a reference point). The CKP generates an AC signal which is sent to the ignition module where it is used to reference engine position (TDC) and speed.

The MAP sensor is located on top of the intake manifold. The MAP sensor monitors the intake manifold pressure (vacuum) and sends the information to the ignition module where the module adjusts the timing advance curve for optimum performance.

The bank angle sensor is located behind the electrical panel inside the TSM/TSSM Module. If the vehicle lean angle exceeds 45 ^{o} for more than one second, the ignition system is shut off. Once the sensor is tripped, the motorcycle must be uprighted, turned off and then on again before the engine can be restarted.

Front and rear coils fire each spark plug independently (one cylinder at a time - no wasted spark).

The ignition system gives a spark near top dead center for starting. At RPM and loads above this, the system gives a spark advance that varies between 0° and 50°.

TROUBLESHOOTING

See the diagnostic charts that follow and the DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for troubleshooting information.

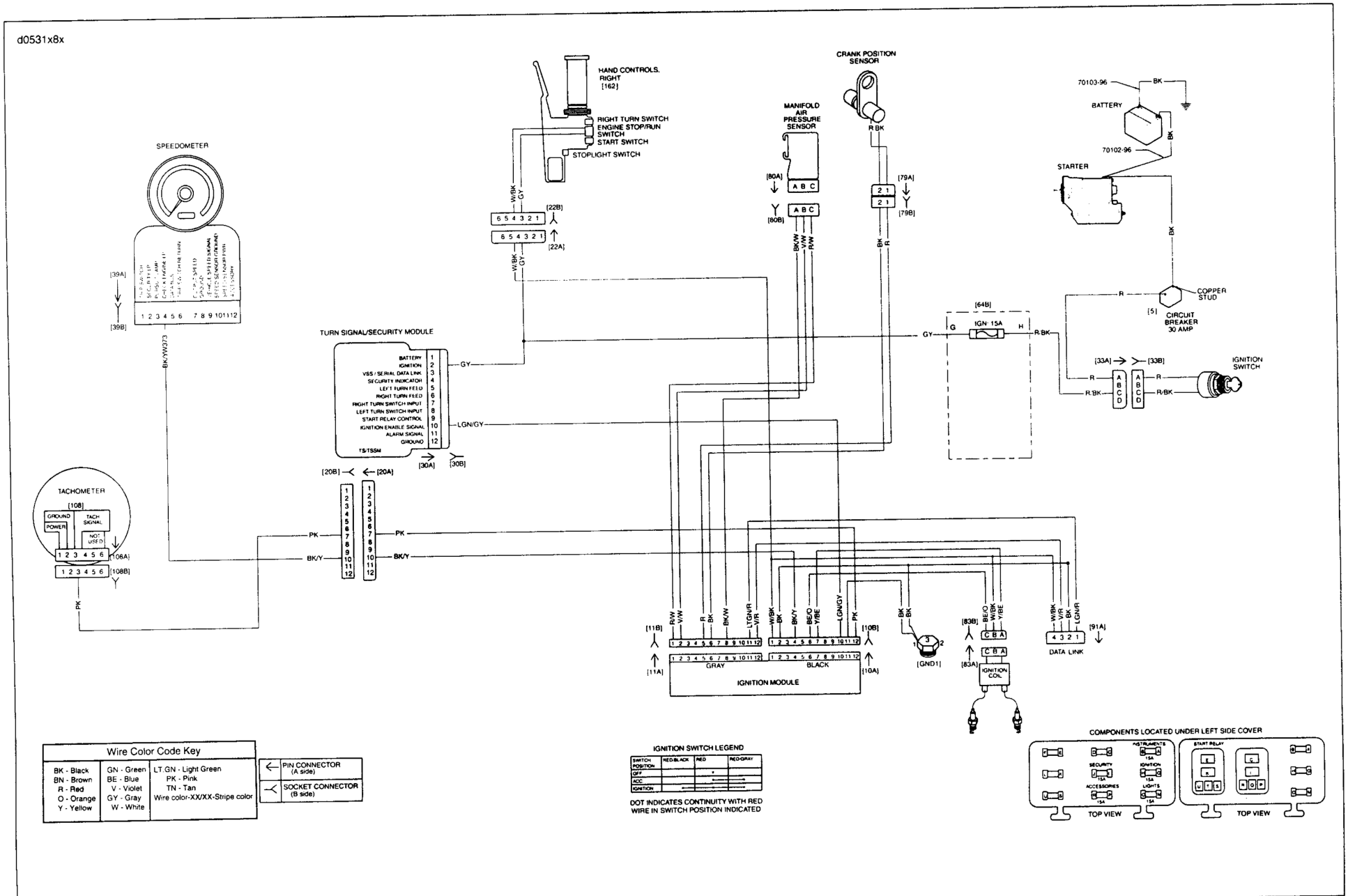


Figure 8-1. Ignition System Circuit: All But FXDWG

REMOVAL

Removing Cover and Bracket

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. See Figure 8-2. Firmly grasp both sides of cover and pull outward to remove.
4. See Figure 8-3. Remove nuts on top plate.
5. See Figure 8-4. This level of removal gives access to the fuses, data link, starter relay (1), TSM/TSSM (2) and main circuit breaker (3).

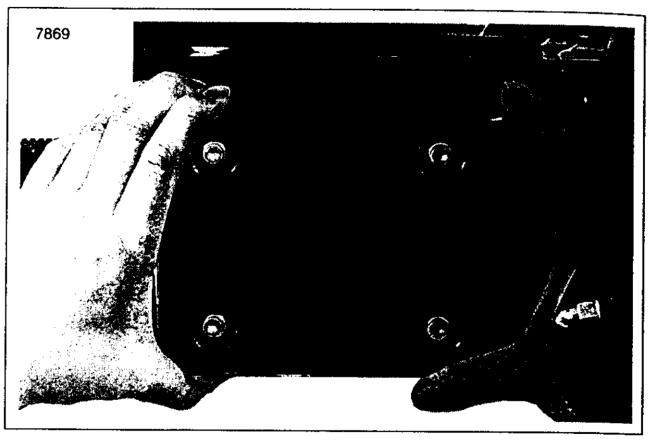


Figure 8-2. Removing/Installing Side Cover

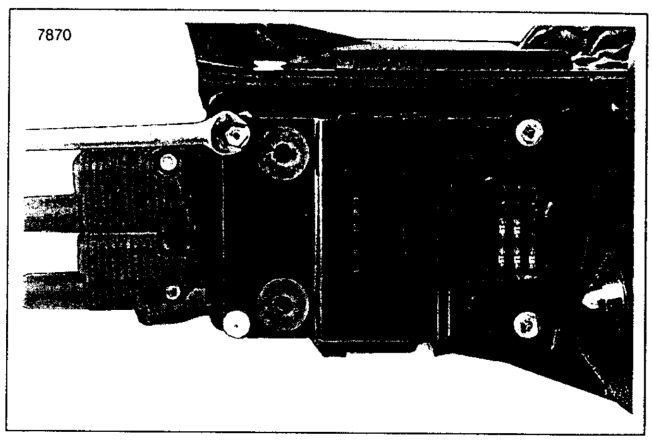
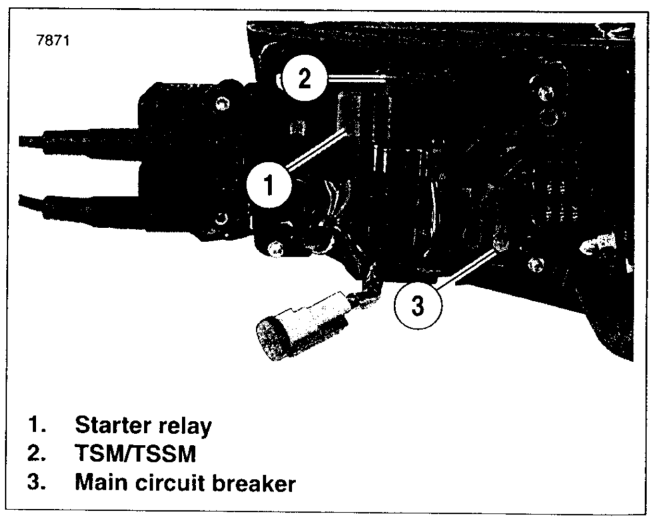


Figure 8-3. Removing/installing Top Plate



1. **Starter relay**
2. **TSM/TSSM**
3. **Main circuit breaker**

Figure 8-4. Electrical Panel Features

Removing Panel For Ignition Module Access

1. Complete all steps listed under Removing Cover and Bracket.
2. See Figure 8-5. Remove nut (9) from upper right hand corner on backside of electrical panel.
3. Remove screw (6) on the electrical panel.
4. See Figure 8-6. Remove the two nuts with captive washers (with coil cover on FXDL, FXDXT and FXDWG).
5. See Figure 8-7. Disconnect coil connector [83] from coil.
6. Move the partially assembled electrical panel aside to gain access to the ignition module.

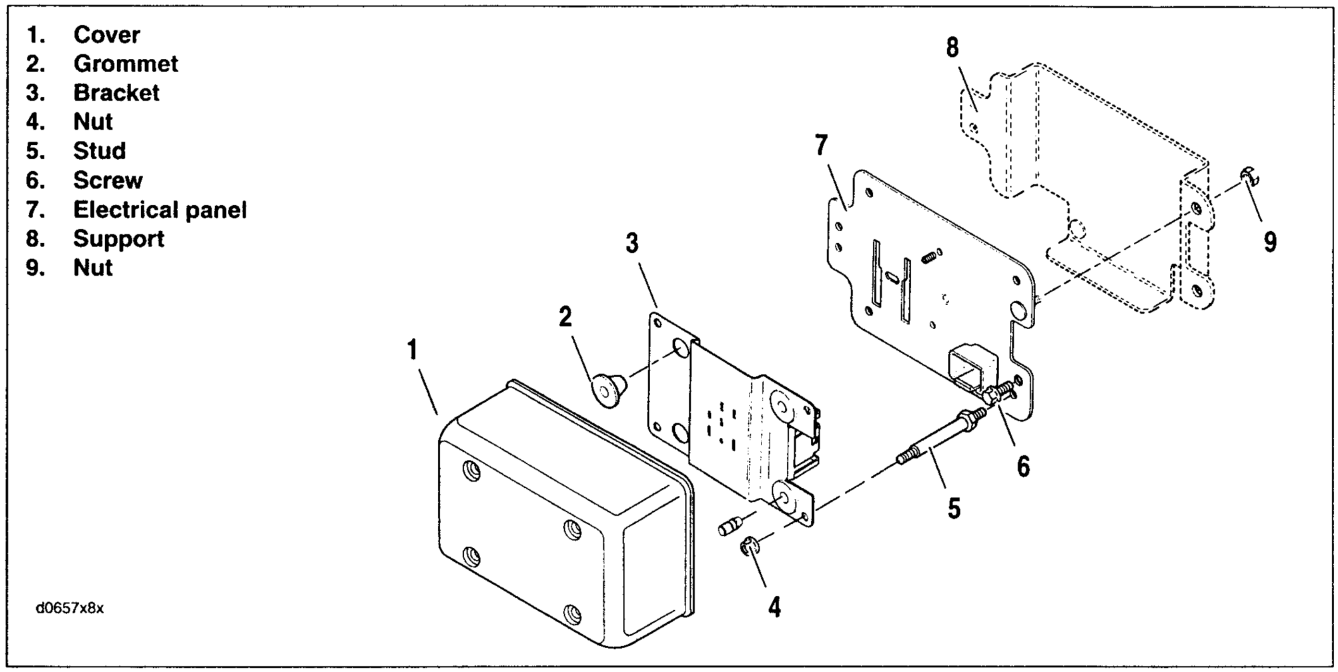


Figure 8-5. Electrical Panel

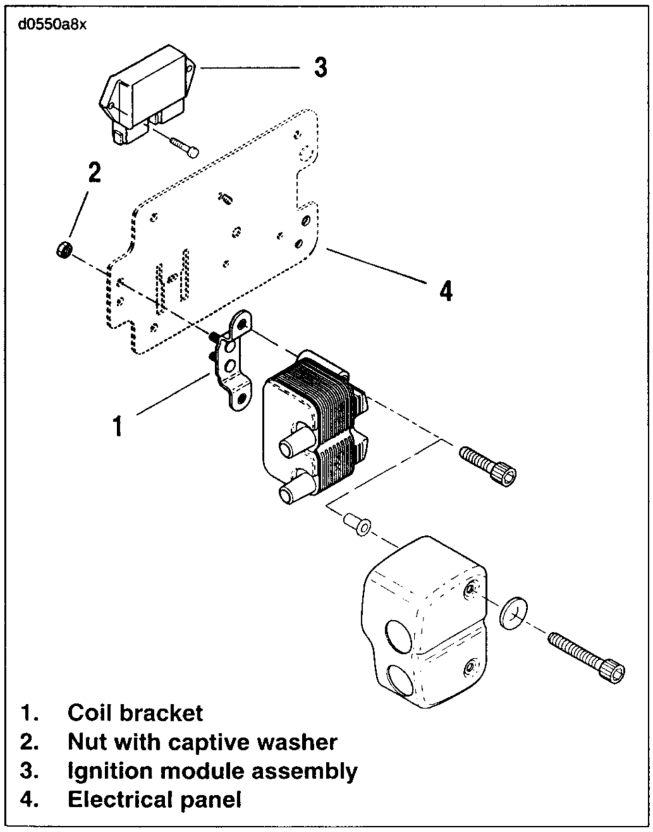


Figure 8-6. Coil Mounting Bracket

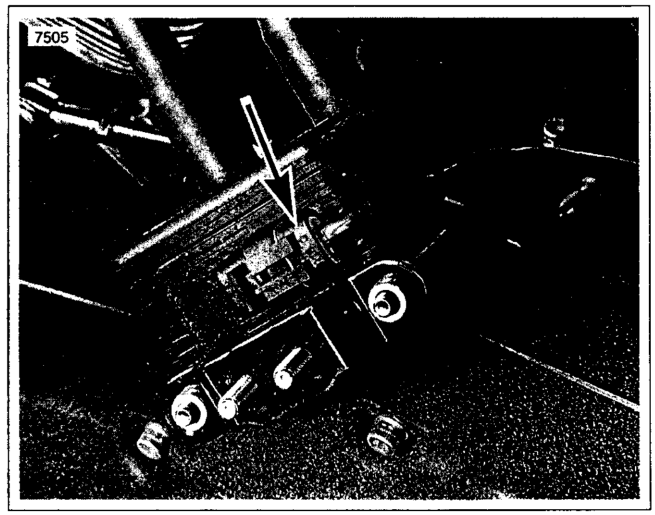


Figure 8-7. Coil Connector [83]

INSTALLATION

1. See Figure 8-6. Install coil mounting bracket (1) and coil assembly (with coil cover on FXDL, FXDXT and FXDWG) using two nuts with captive washers (2).
2. See Figure 8-7. Attach coil connector [83].
3. See Figure 8-5. Install nut (9) and screw (6) to secure right side of panel.
4. See Figure 8-8. Slide slotted tab of top plate into panel adjacent to fuses.
5. See Figure 8-9. Secure nuts on top plate. Tighten to 70-90 **in-lbs** (7.9-10.16 Nm.)
6. See Figure 8-10. Grasp both sides of cover and push firmly into top plate. Verify side cover is firmly attached to top plate.

NOTE

Electrical panel cover has a drain hole. Make sure drain hole is on bottom when installing cover.

⚠WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

7. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

8. Install seat.

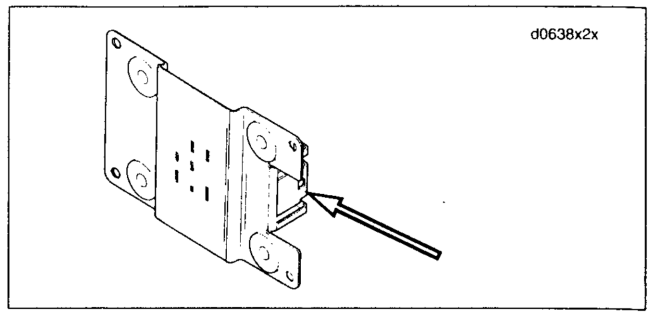


Figure 8-8. Top Plate Slotted Tab

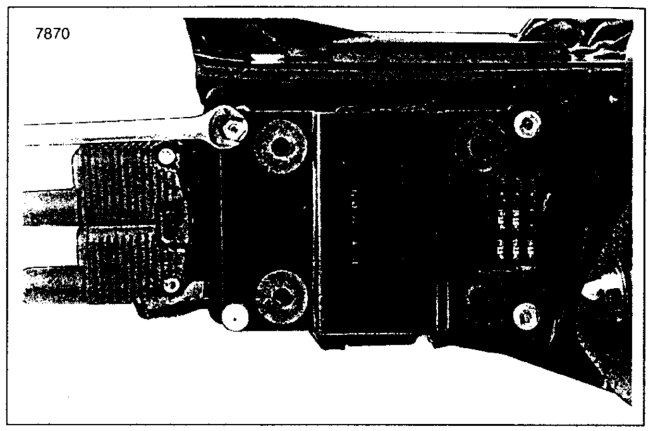


Figure 8-9. Removing/installing Top Plate

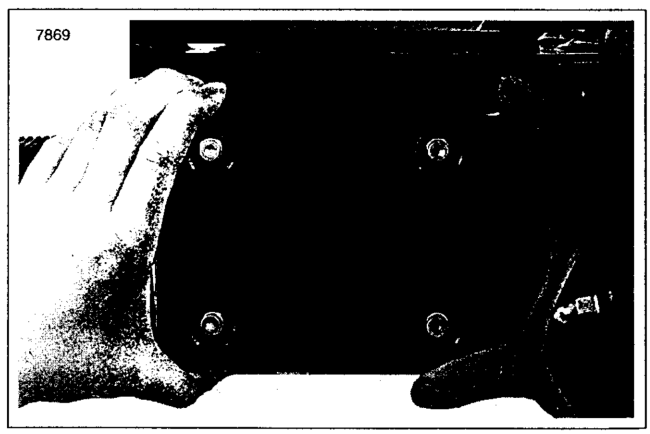


Figure 8-10. Removing/Installing Side Cover

GENERAL

The ignition module is mounted to the back of the electrical panel. See 8.3 IGNITION SYSTEM for information on the function and testing of the ignition module.

NOTE

The ignition module cannot be repaired. Replace the unit if it fails.

IGNITION TIMING

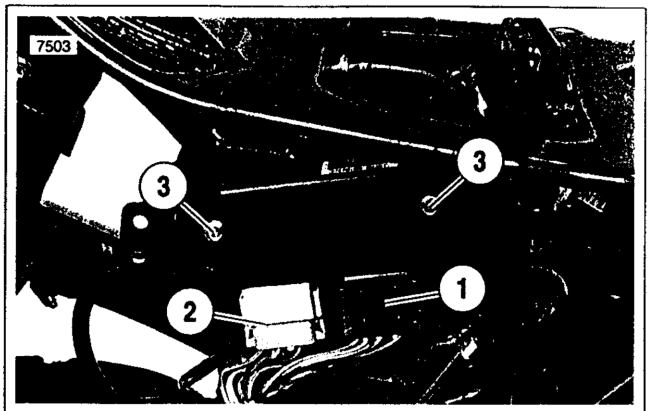
Ignition timing is controlled by the ignition module based on input from:

- Manifold absolute pressure sensor.
- Crank position sensor.

There is no adjustment required. Should a sensor fail, the resulting trouble code will identify the problem. See Appendix B and DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.

REMOVAL

1. Follow removal instructions under 8.4 ELECTRICAL PANEL to gain access to the ignition module.
2. See Figure 8-11. Remove two screws (3) to free ignition module from mounting bracket.
3. Unplug both ignition module connectors [10] and [11].
   a. Depress external latches on the socket housing side.
   b. Use a rocking motion to separate pin and socket halves.



1. **Ignition module connector [10] (black)**
2. **Ignition module connector [11] (gray)**
3. **Screw (2)**

Figure 8-11. Ignition Module

INSTALLATION

1. See Figure 8-11. Attach ignition module connectors.
   a. Align tabs on connector socket housing with grooves on pin housing. Push connector halves together until the latches click.
   b. If the 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.
2. Attach ignition module to bracket.
   a. Align holes on module with holes on bracket.
   b. Secure ignition module using two screws (3). Tighten to 15-21 **in-lbs** (1.7-2.4 Nm).
3. Continue with installation instructions under 8.4 ELECTRICAL PANEL. When finished, test engine for proper ignition system operation.

GENERAL

The manifold absolute pressure (MAP) sensor generates the engine load signal by measuring pressure (vacuum) in the intake manifold. The engine load signal is sent to the ignition module where it is used to help select the correct timing curve. Voltage readings decrease as manifold vacuum increases.

REMOVAL

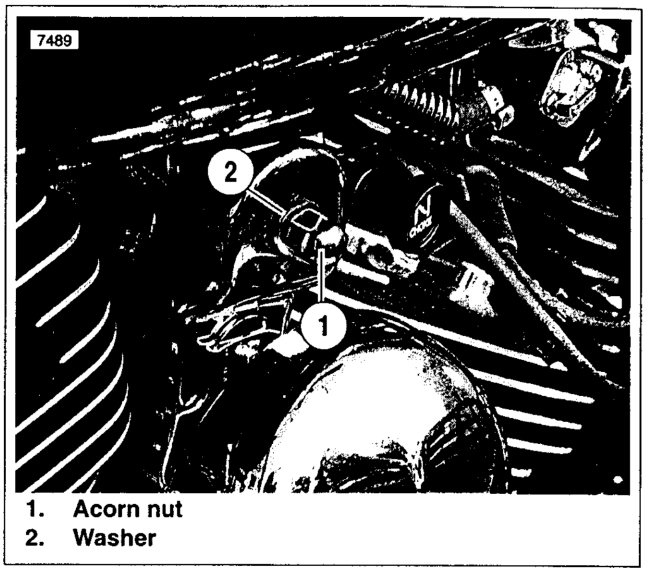
1. Remove seat.
2. Gain access to intake manifold.
   a. Loosen front mounting bolt on fuel tank.
   b. Remove rear mounting bolt, washers and acorn nut from fuel tank.
   c. Carefully pivot tank upward and prop in position.
3. See Figure 8-12. Remove acorn nut (1) and washer (2) to detach horn from mount. Push horn aside.
4. Remove connector [80] from MAP sensor.
5. Remove vacuum hose from rear of carburetor to allow access to MAP sensor.
6. See Figure 8-13. Using a T20 TORX bit, extension and universal socket, remove screw (1) and clip (2) from top of MAP sensor (3).
7. Using appropriate tool gently remove (push up) MAP sensor and attached seal (4) from intake manifold.

NOTE

If the original sensor is re-installed, the seal must be inspected. Seals not in good condition could cause vacuum and intake leaks.

INSTALLATION

1. Plug connector [80] into **new** MAP sensor.
2. See Figure 8-13. Install (push) MAP sensor (3) and seal (4) to intake manifold.
3. Position clip (2) in slot on MAP sensor and install T20 TORX screw (1). Tighten to 25-35 **in-lbs** (2.8-3.9 Nm).
4. Install vacuum hose to rear of carburetor.
5. See Figure 8-12. Attach horn with washer (2) and acorn nut (1). Tighten to 110 **in-lbs** (12.4 Nm).
6. Secure fuel tank.
   a. Lower fuel tank into position. Tighten front mounting bolt to 120-216 **in-lbs** (13.6-24.4 Nm).
   b. Install fuel tank rear mounting bolt, washers and acorn nut. Tighten to 120-216 **in-lbs** (13.6-24.4 Nm).



1. **Acorn nut**
2. **Washer**

Figure 8-12. Horn Mount

1. **T20 TORX screw @ 25-35 in-lbs (2.8-3.9 Nm)**
2. **Clip**
3. **MAP sensor**
4. **Seal**

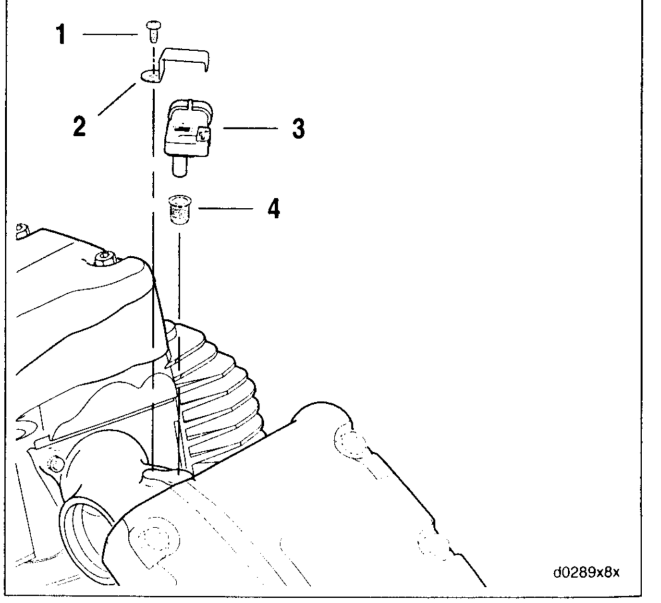


Figure 8-13. MAP Sensor

GENERAL

See Figure 8-14. 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 module which is used to reference engine position (TDC) and engine speed.

REMOVAL

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

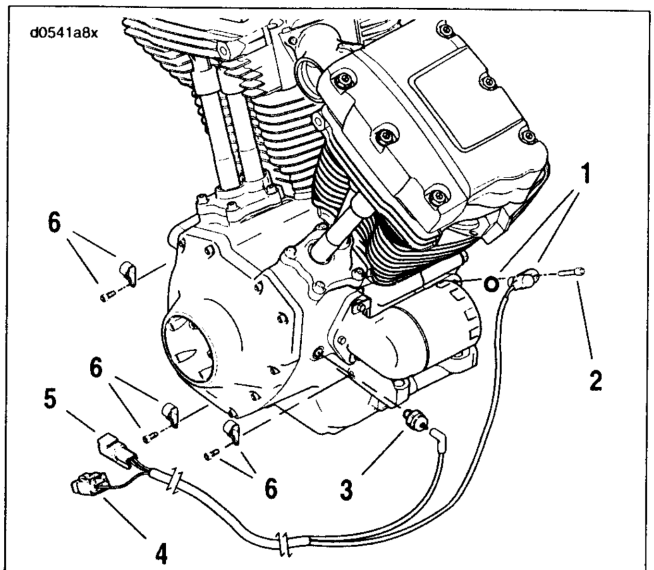
Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Remove seat and disconnect battery cables, negative cable first.
2. See Figure 8-15. CKP sensor wiring is in a sheath combined with the wire from the oil pressure switch.
   a. The 2-place Mini-Deutsch CKP connector [79A] has R and BK wires.
   b. The 2-place Mini-Deutsch oil pressure switch connector [120B] has a single GN/Y wire.
   c. Remove secondary locks and disconnect wiring for connectors [79A] and [120B]. See Appendix B and DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.
   d. Note position of wiring terminals in each connector.
3. See Figure 8-14. Remove screws and clamps (6) from the crankcase, and from oil hose cover mounted on the transmission.
4. Remove two screws attaching harness clip to transmission side cover. Remove wiring harness from harness clip.
5. Detach wire from oil pressure switch (3).
6. Remove screw and captive washer (2) to detach CKP sensor and O-ring (1) from crankcase. Carefully remove crank position sensor.

NOTE

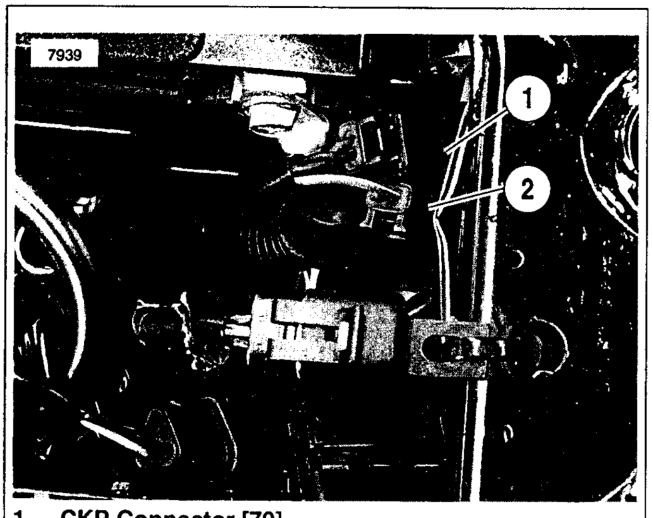
Before removing wiring, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

7. Pull wires from location under seat.



1. **CKP sensor and O-ring**
2. **Screw and captive washer**
3. **Oil pressure switch**
4. **Oil pressure switch connector [120B]**
5. **CKP connector [79A]**
6. **Screw and clamp**

Figure 8-14. CKP Sensor Assembly



1. **CKP Connector [79]**
2. **Oil Pressure Switch Connector [120] (Location Approximate, Check Wire Colors)**

Figure 8-15. Connector Locations

INSTALLATION

1. See Figure 8-14. Lubricate CKP sensor O-ring (1) with clean engine oil.
2. See Figure 8-16. Install **new** CKP sensor with screw and captive washer. Tighten screw to 90-120 **in-lbs** (10.2-13.6 Nm).

NOTE

CKP sensor wires of plug end must match same color wires in receptacle end of connector (from ignition module wiring harness).

3. Route all wires to connector locations under seat.
   a. Install wiring into the correct positions in their respective connectors. See Appendix B and DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.
   b. For CKP sensor wiring, see Table 8-3.
   c. For oil pressure switch wiring, see Table 8-4.
4. See Figure 8-14. Attach connector sheath to crankcase with clamp and T20 TORX screw (6). Tighten screw to 25-35 **in-lbs** (2.8-3.9 Nm).
5. Attach wire to oil pressure switch (3).

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

6. Install battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

7. Install seat.

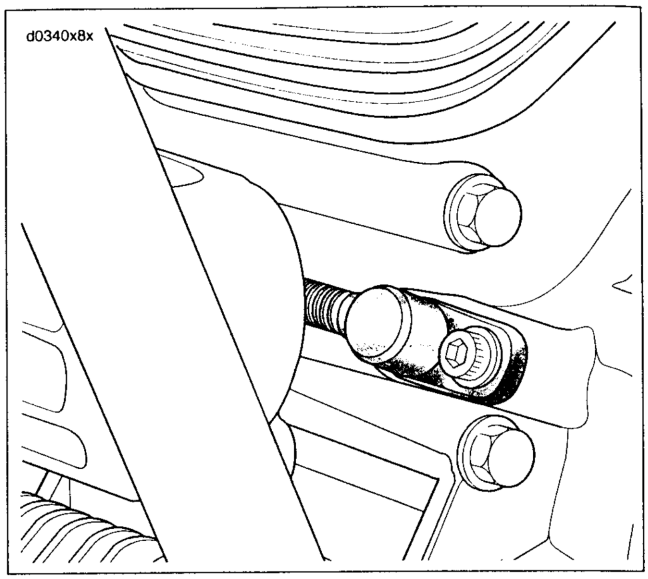


Figure 8-16. Installed CKP Sensor

Table 8-3. Crank Position Sensor Terminals

[79] PIN NUMBER	WIRE COLOR
1	Red
2	Black

Table 8-4. Oil Pressure Switch Sensor Terminals

[120] PIN NUMBER	WIRE COLOR
1	GN/Y
2	Empty

GENERAL

Resistor-type high-tension spark plug cables have a carbon-impregnated fabric core, instead of solid wire, for radio noise suppression and improved reliability of electronic components. Use the exact replacement cable for best results.

NOTE

See 1.19 SPARK PLUGS for spark plug information.

REMOVAL

⚠WARNING

Never disconnect a spark plug cable with the engine running. If you disconnect a spark plug cable with the engine running, you may receive an electric shock from the ignition system which could result in death or serious injury.

CAUTION

When disconnecting each spark plug cable from its spark plug terminal, always grasp and pull on the rubber boot at the end of the cable assembly (as close as possible to the spark plug terminal). Do not pull on the cable portion itself. Pulling on the cable will damage the cable's carbon core.

1. Disconnect spark plug cables from ignition coil and spark plug terminals. Inspect all removed cables for damage.
2. See Figure 8-17. Remove clips on horn bracket for front spark plug cable.

INSTALLATION

1. See Figure 8-17. Connect spark plug cables to ignition coil and spark plugs. Rear cylinder plug cable attaches to top coil terminal. 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.

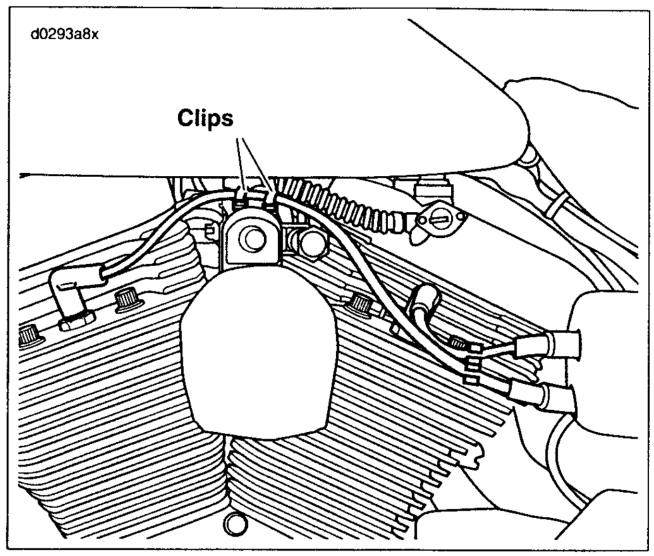


Figure 8-17. Spark Plug Cable Routing

REMOVAL

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

1. Disconnect battery cables, negative cable first.
2. See Figure 8-18. Remove both plug wires from coil towers.
3. Detach connector [83B] from backside of coil.
4. Remove two mounting bolts and coil (3) and coil cover on FXDL, FXDXT and FXDWG (2).

INSTALLATION

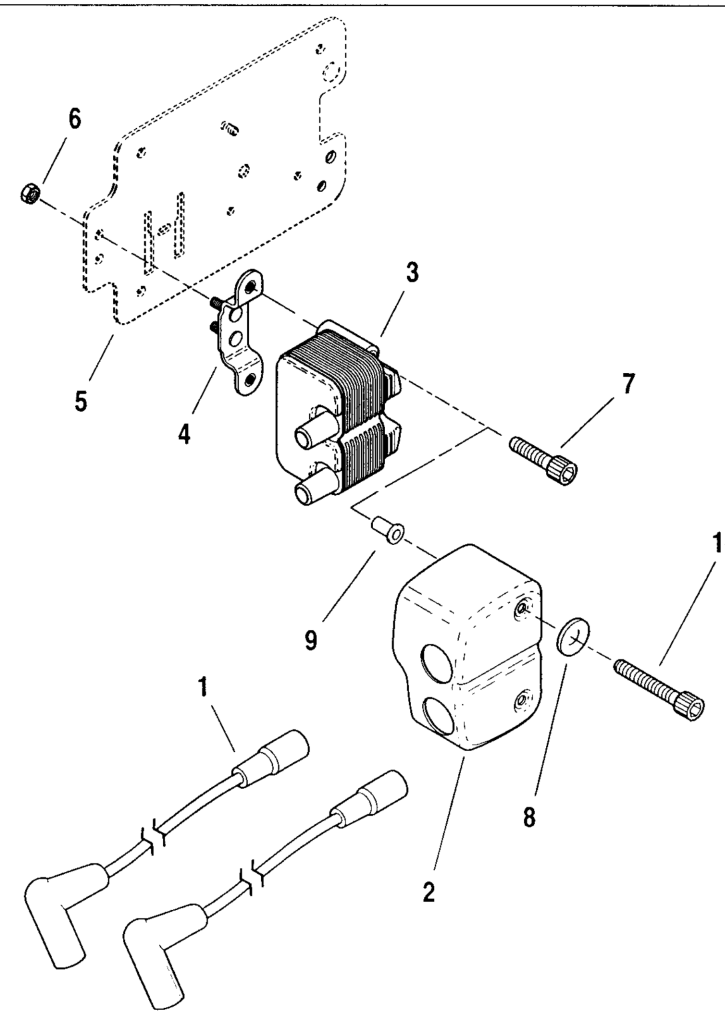
1. Attach connector [83B] to backside of coil.
2. Figure 8-18. Position coil (3) and coil cover on FXDL, FXDXT and FXDWG (2) on mounting bracket (4) and install two bolts.
3. Tighten bolts to 24-72 **in-lbs** (2.7-8.1 Nm).
4. Attach plug wires (1) to coil towers. Rear cylinder plug wire attaches to upper coil tower. See 8.8 SPARK PLUG CABLES.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

5. Connect battery cables, positive cable first.

1. **Spark plug wires**
2. **Coil cover (FXDL/FXDWG/FXDXT only)**
3. **Ignition coil**
4. **Coil bracket**
5. **Electrical panel**
6. **Nut**
7. **Screw (2) (all except FXDL/FXDWG/FXDXT)**
8. **Washer (FXDL/FXDWG/FXDXT only)**
9. **Spacer (FXDL/FXDWG/FXDXT only)**
10. **Screw (2) (FXDL/FXDWG/FXDXT only)**



d0337a8x

Figure 8-18. Ignition Coil

GENERAL

See Figure 8-19. The fuse block is on the left side of the motorcycle, behind the electrical panel cover. The block contains four 15 ampere replaceable fuses. Additional spare fuses may be carried if the rider chooses to do so.

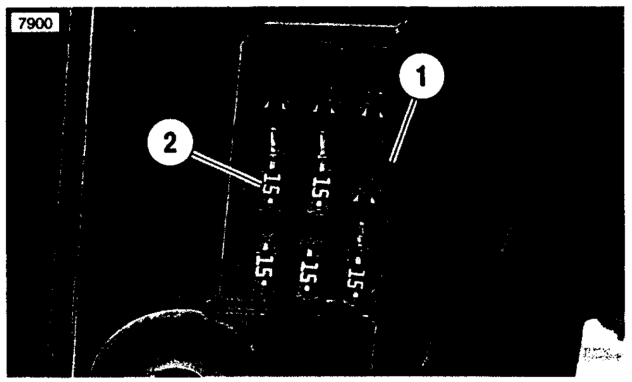
REPLACEMENT

1. See Figure 8-20. Pull electrical panel cover (1) away from grommets (3). No tools are necessary for this step.
2. See Figure 8-21. Replace suspect fuse.

NOTE

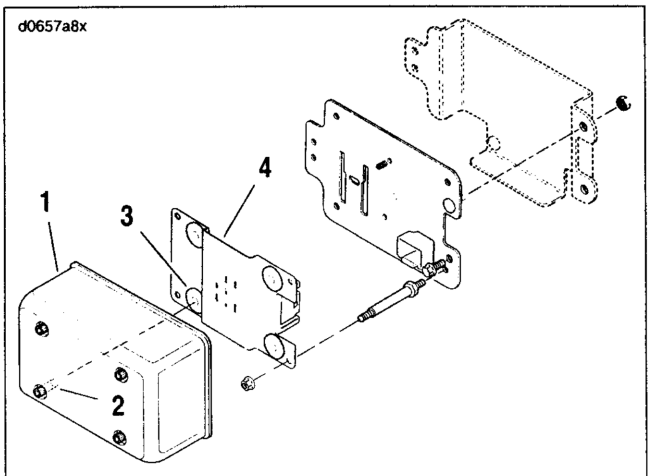
Electrical panel cover has a drain hole. Make sure drain hole is on bottom when installing cover.

3. Push electrical panel cover onto the four grommets.



1. **Fuse block**
2. **Spare fuses (not on all models)**

Figure 8-19. Fuse Location



1. **Electrical panel cover**
2. **Cover mounting pin (4)**
3. **Grommet (4)**
4. **Electrical panel top plate assembly**

Figure 8-20. Accessing Fuse Block

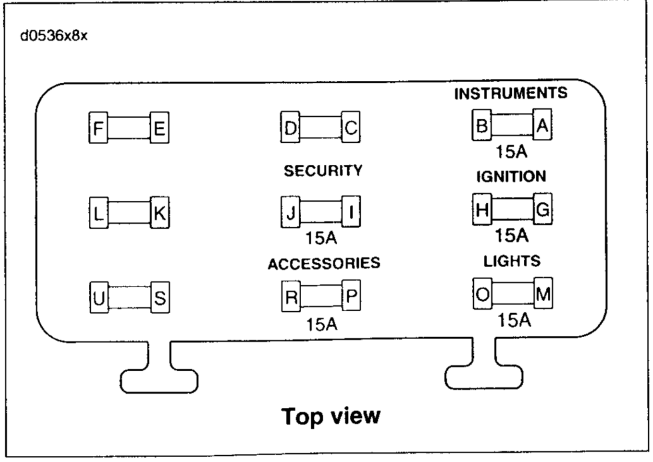


Figure 8-21. Fuse Functions

GENERAL

See Figure 8-22. The main circuit breaker (6) is on the left side of the motorcycle, behind the electrical panel cover. If the electrical circuit should overload, the bimetallic breaker contacts automatically open to stop current flow. As soon as the contacts have cooled down, they automatically close, completing the circuit. This opening and closing of the breaker contacts continues as long as the current circuit overload condition exists.

REMOVAL

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. See Figure 8-22. Pull cover (1) away from electrical panel grommets. No tools are necessary for this step.
4. Remove nuts (4) that hold bracket (3) in place on the bracket studs (5).
5. See Figure 8-23. Remove nuts and wires (2, 4, 5) from studs (1, 3) on circuit breaker.
6. Pull circuit breaker from clip.

1. Cover
2. Grommet
3. Bracket
4. Nut
5. Stud
6. Main circuit breaker
7. Clip
8. Electrical panel

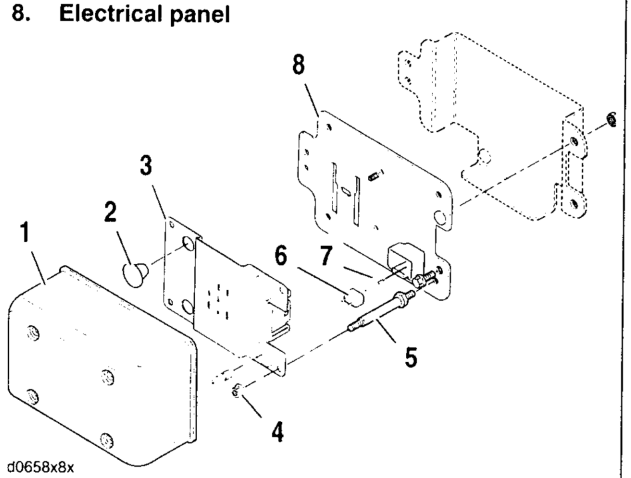
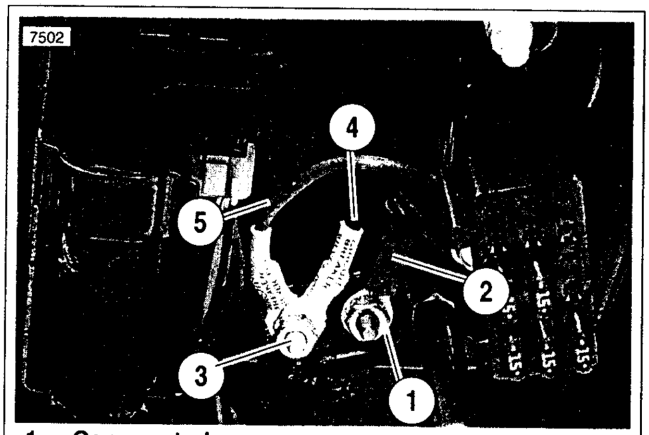


Figure 8-22. Accessing Main Circuit Breaker



1. Copper stud
2. BK wire from starter
3. Silver stud
4. R wire from ignition switch
5. BK wire from voltage regulator

Figure 8-23. Main Circuit Breaker Wiring

INSTALLATION

1. See Figure 8-22. Push circuit breaker (6) into clip (7).
2. See Figure 8-23. Attach wiring using nuts.
   a. Place BK wire from starter (2) on copper stud (1).
   b. Place remaining wires (4, 5) on silver stud (3).
3. See Figure 8-22. Attach the bracket (3) to the studs (5) with four nuts (4). Tighten to 70-90 in-lbs (7.9-10.16 Nm.)

NOTE

Electrical panel cover has a drain hole. Make sure drain hole is on bottom when installing cover.

4. Push electrical panel cover (1) onto the four grommets.

⚠WARNING

Always connect positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

5. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

6. Install seat.

GENERAL

⚠WARNING

DO NOT modify the ignition/light switch wiring to circumvent the automatic-on headlight feature. High visibility is an important safety consideration for motorcycle riders. Failure to have proper headlamp operation could result in death or serious injury.

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 8-5.

REPLACEMENT

FXD, FXDL, FXDX, FXDXT Models

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.

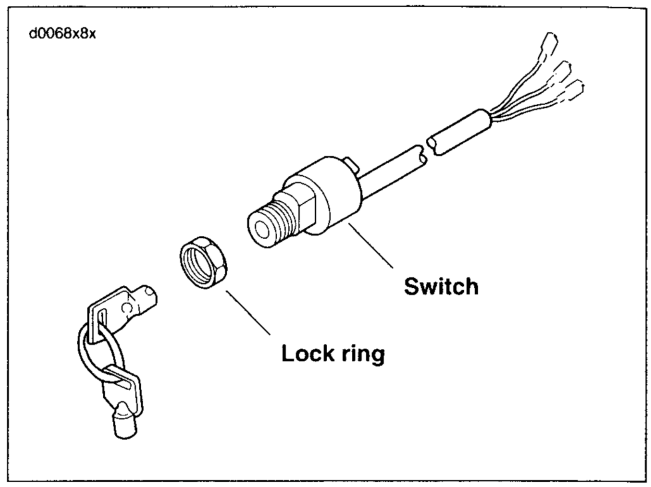


Figure 8-24. Ignition Switch: All But FXDWG

3. See Figure 8-24. Unscrew ignition/light lock ring. Push switch back through hole.
4. Cut switch wires approximately 3.0 in. (76 mm) from switch body. The **new** switch must be spliced into existing wiring harness using butt splice connectors. See Appendix B or DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.
5. After splicing **new** switch into wire harness, place switch into position. The word "TOP" is marked on the top of the switch body to allow for proper positioning of switch.
6. Install lock ring to secure switch in place.
7. Remove and save key code tag (on key ring with two keys). Key code is not marked on keys.

Table 8-5. Key Switch Functions and Positions

MODEL AND LOCATION	DOMESTIC SWITCH	INTERNATIONAL SWITCH
FXD, FXDL, FXDX, FXDXT: Right side of the vehicle between the upper end of the shock absorber and the battery	OFF - Ignition and lights are off. Key may be removed.	Same
	ACC. - Instrument lights are on. Brake light and horn can be activated.	Same; in addition, position lamp, tail lamp are ON.
	IGNITION - Push in and turn key. Ignition, lights and accessories are on.	Same; in addition, position lamp is ON.
FXDWG: Tank console. Switch is locked or unlocked by lifting switch cover, inserting key and turning key counterclockwise to lock, clockwise to unlock. Key may be removed in any position.	OFF - Ignition, lights and accessories are off.	Same
	ACCESSORIES - Accessories are on. Instrument lights are on. Brake light and horn can be activated.	Same; in addition, position lamp, tail lamp are ON.
	LIGHTS and IGNITION - Ignition, lights and accessories are on. Hazard warning flashers can be operated.	Same; in addition, position lamp is ON.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

8. Connect battery, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

9. Install seat.
10. See Table 8-5. Test vehicle operation.

FXDWG Models

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

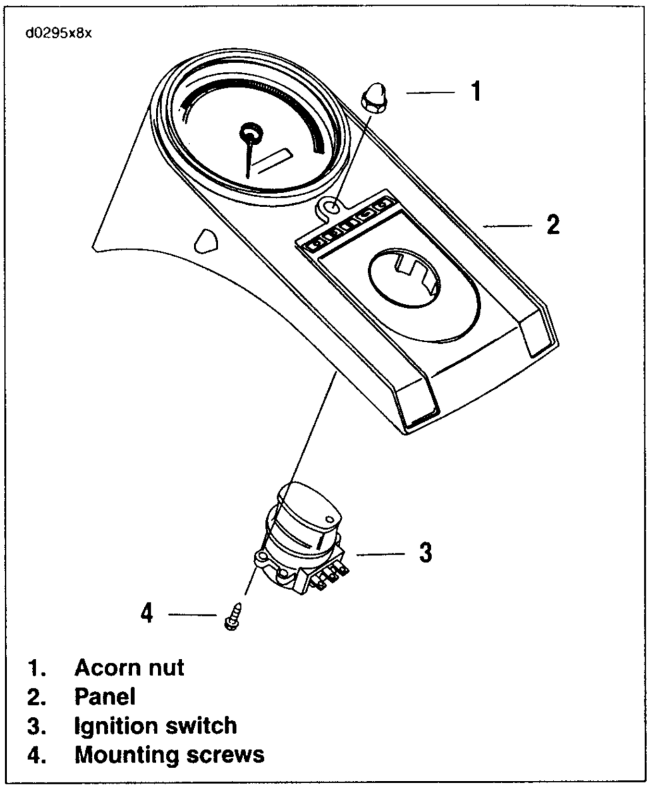
Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. See Figure 8-25. Remove acorn nut (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.
5. Reconnect switch wire connectors in their original positions.
6. Install instrument panel (2) with acorn nut (1). Tighten acorn nut to 80-100 **in-lbs (9.03-11.29 Nm).**

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

7. Connect battery, positive cable first.



1. **Acorn nut**
2. **Panel**
3. **Ignition switch**
4. **Mounting screws**

Figure 8-25. Ignition Switch: FXDWG

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

8. Install seat.
9. See Table 8-5. Test vehicle operation.

REMOVAL/DISASSEMBLY

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

NOTE

It is not necessary to remove the inner primary chaincase to remove the alternator.

1. Remove primary cover, primary drive and clutch. See 6.3 DRIVE COMPONENTS.
2. See Figure 8-26. Pull off the alternator rotor (7) using two bolts inserted through the holes in the rotor face. Remove the spacer (8).
3. Remove the T27 TORX screws (6). Unplug the voltage regulator and remove the stator (5).
4. Remove rubber boot and connector [46] from screw on front engine mount. Slide rubber boot off of connector [46] and disconnect Facon connector [46].
5. Remove secondary locks (2) and wires (pull) from connector [46B] (3).

NOTE

Contact cleaner, alcohol or glass cleaner sprayed on rubber grommet will provide lubrication when pulling it through crankcase hole.

6. Move grommet (4) to one side and spray contact cleaner into gap. Repeat for other side. Pull rubber grommet through crankcase hole.
7. Pull wires through crankcase hole.

CLEANING/INSPECTION

The rotor and stator can be replaced individually if either is damaged.

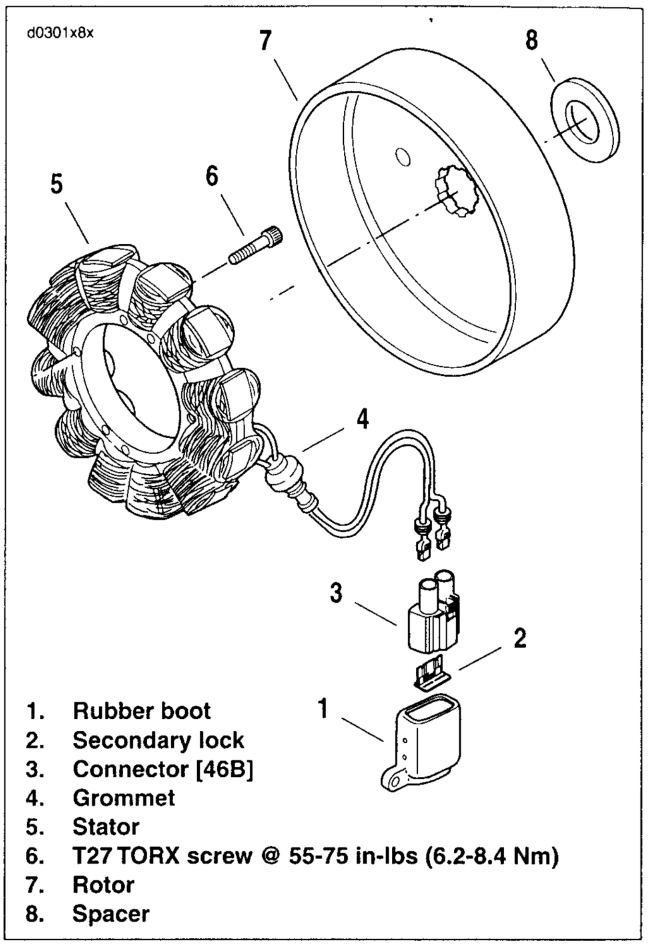
1. Remove all foreign particles from the rotor magnets.
2. Clean the rotor and stator in clean, soapy water.

ASSEMBLY/INSTALLATION

NOTE

Stator Torx fasteners are not re-usable. They ***must*** *be replaced.*

1. Insert wires through crankcase hole.



1. **Rubber boot**
2. **Secondary lock**
3. **Connector [46B]**
4. **Grommet**
5. **Stator**
6. **T27 TORX screw @ 55-75 in-lbs (6.2-8.4 Nm)**
7. **Rotor**
8. **Spacer**

Figure 8-26. Rotor and Stator Mounting

2. See Figure 8-26. Push rubber grommet (4) through crankcase hole. If necessary, apply the same lubricant used during removal.
3. Insert wires into connector [46B] (3).
4. Install secondary lock (2) to connector.
5. Mate connector [46]. Slide rubber boot (1) over connector [46] and install connector/boot assembly to front engine mount screw.
6. See Figure 8-35. Install the stator (5) on the crankcase and fasten in place using **new** TORX screws. Tighten to 55-75 **in-lbs** (6.2-8.4 Nm).
7. Install the spacer (8) and rotor (7) on the sprocket shaft.
8. Apply LOCTITE THREADLOCKER 262 (red) to sprocket nut threads. Tighten sprocket nut to 150-165 ft-lbs (203.4-223.7 Nm).
9. Install clutch, primary drive and primary cover. See 6.3 DRIVE COMPONENTS.

REMOVAL

NOTE

The voltage regulator cannot be repaired. Replace the unit if it fails.

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. See Figure 8-27. Remove rubber boot and connector [46] from screw on front engine mount. Slide rubber boot off of connector [46] and disconnect Facon connector.
4. See Figure 8-28. Gain access to the electrical panel by detaching cover and removing four nuts. Disconnect the voltage regulator lead from the main circuit breaker.

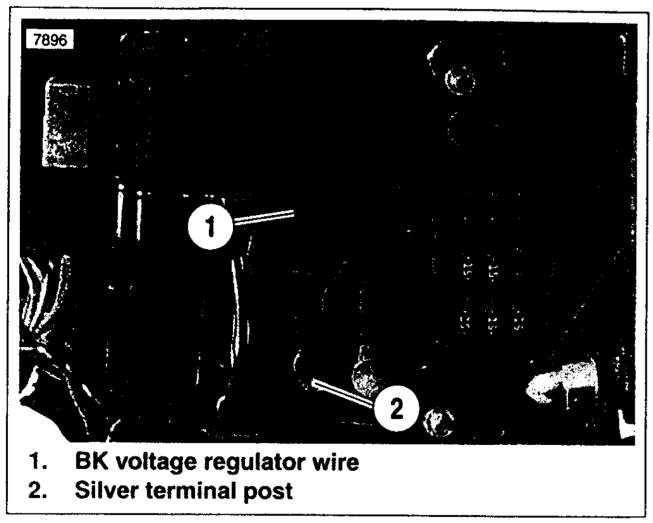
NOTE

Before removing voltage regulator wires, carefully note wire routing. In particular pay close attention to the locations of cable straps that must be replaced to keep wires from being damaged by vibration.

5. See Figure 8-29. Remove the two mounting screws (5) and regulator (6).
6. Remove secondary locks (2) and wires (pull) from connector [46A].

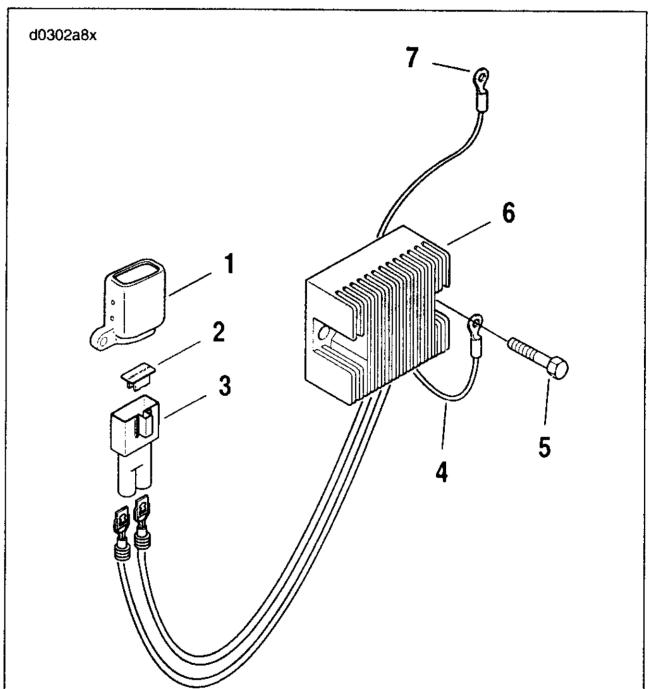


Figure 8-27. Voltage Regulator Connector [46]



1. BK voltage regulator wire
2. Silver terminal post

Figure 8-28. Main Circuit Breaker



1. Rubber boot
2. Secondary lock
3. Connector [46A]
4. Ground strap
5. Mounting screw (2)
6. Voltage regulator
7. Wire to main circuit breaker

Figure 8-29. Voltage Regulator Assembly

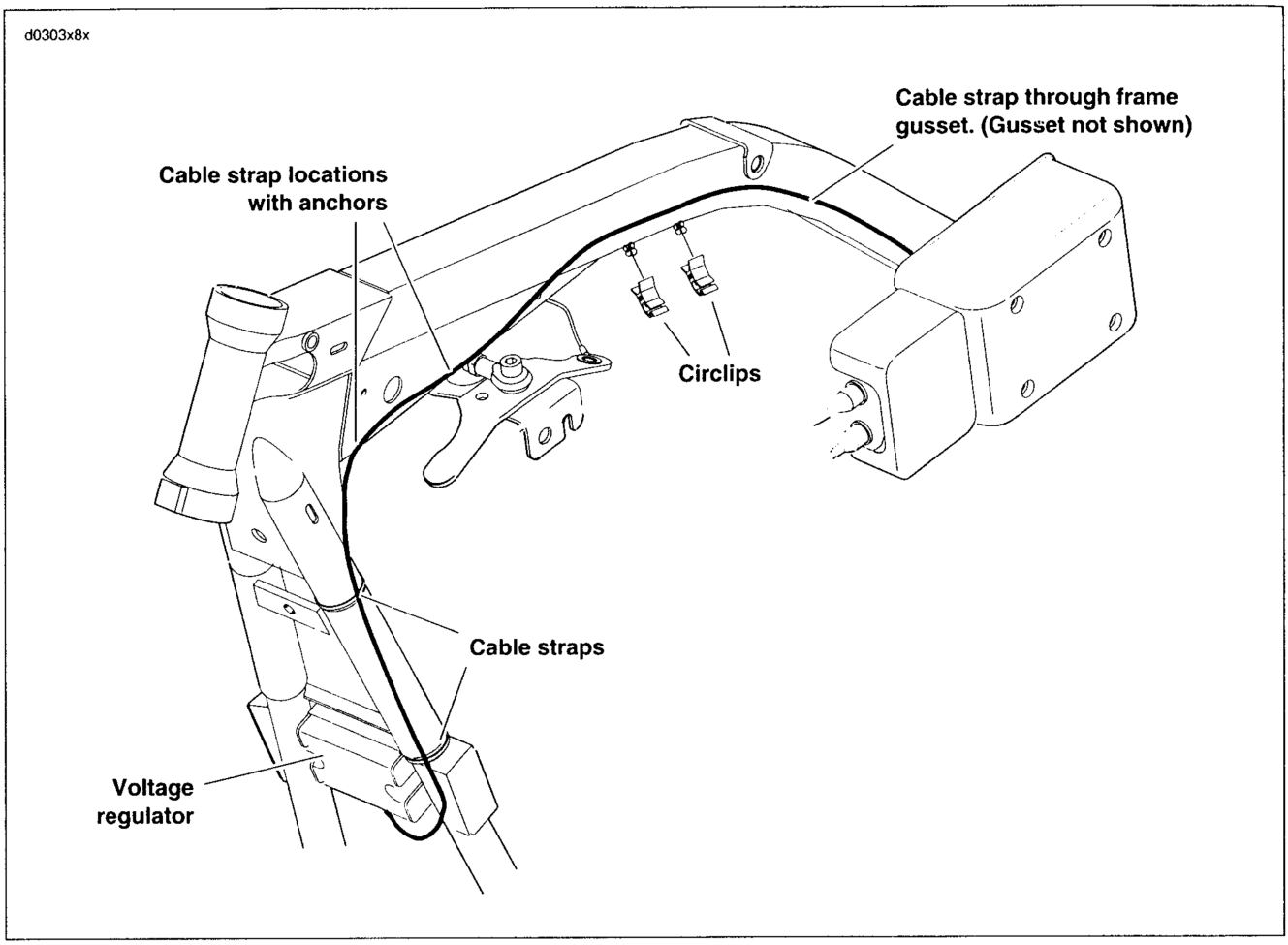


Figure 8-30. Voltage Regulator Wiring

INSTALLATION

1. See Figure 8-29. Insert wires into connector [46A]. Install secondary lock (2) to connector [46A].
2. Attach regulator (6) with two mounting screws (5). Make sure the short ground strap (4) is secured under the left side mounting screw. Tighten screws to 60-80 **in-lbs** (6.8-9.0 Nm).
3. See Figure 8-30. Route wiring.
   a. Route the main circuit breaker wire up the frame downtube and along backbone as shown.
   b. Connect the wire to the main circuit breaker.
   c. Secure wire to frame with cable straps and plastic clips in the locations shown.
4. Mate connector [46].
5. Slide rubber boot over connector [46]. Install connector/boot assembly to front engine mount screw.
6. Replace the electrical panel cover.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

7. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

8. Install seat.

BATTERY TESTING

General

See 1.5 BATTERY MAINTENANCE for removal, installation, inspection and storage information.

Voltmeter Test

See Table 8-6. 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 12.8V or above, perform the load test described below.

Load Test

The load test measures battery performance under full current load and is the best indicator of battery condition. To load test the battery, proceed as follows:

1. Remove battery from motorcycle.

CAUTION

Load testing a discharged battery can result in permanent battery damage.

2. Always fully charge the battery before testing or test readings will be incorrect. See CHARGING BATTERY which follows. Load testing a discharged battery can also result in permanent battery damage.
3. After charging, allow battery to stand for at least one hour before testing.

⚠WARNING

Always turn the battery load tester OFF before connecting the tester cables to the battery terminals. Connecting tester cables with the load tester ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

4. See Figure 8-31. Connect tester leads to battery posts and place induction pickup over negative (black) cable.

CAUTION

To avoid load tester and/or battery damage, do not leave the load tester switch turned ON for more than 20 seconds.

5. See Table 8-7. Load battery at 50% of CCA rating using the load tester. Voltage reading after 15 seconds should be 9.6V or more at 70°F. (21°C).

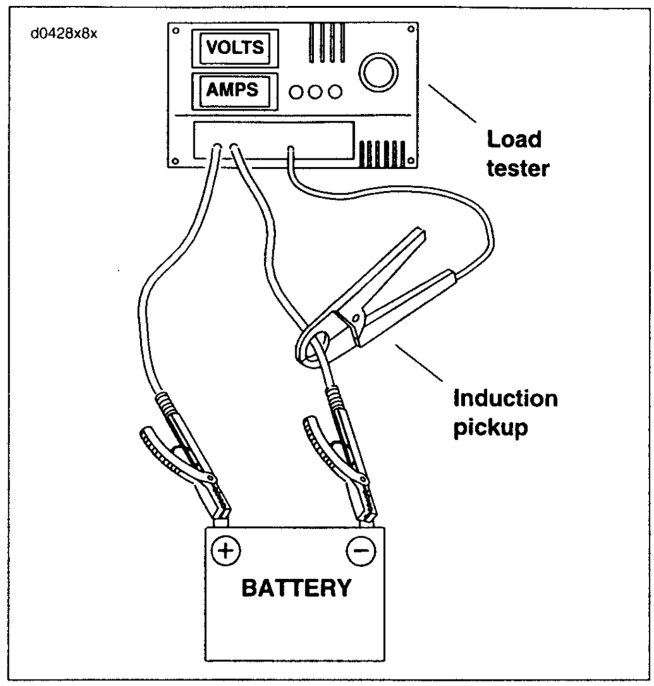


Figure 8-31. Load Test Battery

Table 8-6. Voltmeter Test For Battery Charge Conditions

VOLTAGE (OCV)	STATE OF CHARGE
12.8	100%
12.6	75%
12.3	50%
12.0	25%
11.8	0%

Table 8-7. Battery Load Test

COLD CRANKING AMPERAGE (CCA)	100%	50%
Dyna models	270	135

⚠WARNING

Always turn the battery load tester OFF before disconnecting the tester cables from the battery terminals. Disconnecting tester cables with the load tester ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

6. Install the battery on the motorcycle.

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 becomes hot reduce the charging rate or turn off the charger temporarily.
- 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

Charge the battery in a well ventilated area. Explosive hydrogen gas escapes from the battery during charging. Keep open flames, electrical sparks and smoking materials away from the battery at all times. Inadequate safety precautions could result in death or serious injury.

CAUTION

If the battery releases an excessive amount of gas during charging, decrease the charging rate. If the battery gets hotter than 110° F. (43° C) during charging, discontinue charger and allow the battery to cool. Overheating may result in plate distortion, internal shorting, dryout or other damage.

1. Perform a voltmeter test to determine the state of charge. See Voltmeter Test on the previous page. If battery needs to be charged, proceed to step 2.

Table 8-8. 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	12.8	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 figures listed above 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.

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.*

CAUTION

Always remove the battery from the motorcycle before charging. Accidental electrolyte leakage will damage motorcycle parts.

2. Remove the battery from the motorcycle and place on a level surface.

⚠WARNING

Always unplug or turn OFF the battery charger before connecting the charger clamps to the battery. Connecting clamps with the charger ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

CAUTION

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

3. Connect the red battery charger lead to the positive (+) terminal of the battery.
4. Connect the 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.

5. Step away from the battery and turn on the charger. See the charging instructions in Table 8-8.

⚠WARNING

Always unplug or turn OFF the battery charger before disconnecting the charger clamps from the battery. Disconnecting clamps with the charger ON could cause a spark resulting in a battery explosion which could result in death or serious injury.

6. After the battery is fully charged, disconnect the black battery charger lead to the negative (–) terminal of the battery.
7. Disconnect the red battery charger lead to the positive (+) terminal of the battery.
8. Mark the charging date on the battery.
9. Perform a load test to determine the condition of the battery. See Load Test under BATTERY TESTING.

ROUTING PROCEDURE

1. Remove seat.
2. Install battery. See 1.5 BATTERY MAINTENANCE.
3. See Figure 8-32. Route positive cable down from battery positive terminal (3) to starter post on right side of chassis.

⚠WARNING

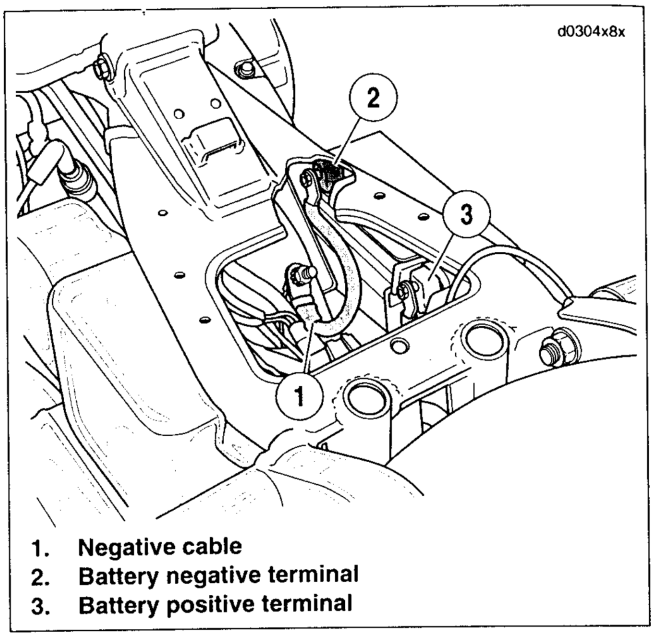
Make sure the starter solenoid terminal that is connected to the positive (+) battery cable is securely covered by the rubber boot. An uncovered terminal could short against other components resulting in sparks. These sparks could cause a fire or battery explosion which could result in death or serious injury.

4. See Figure 8-33. Install positive cable.
   a. Install positive cable to starter post with nut. Orient terminal so cable faces away (towards left side of motorcycle).
   b. Tighten nut to 65-80 **in-lbs** (7.3-9.0 Nm).
   c. Cover nut with protective rubber boot.
5. See Figure 8-32. Install negative cable.
   a. Route negative battery cable (1) towards rear of vehicle at same height as battery box top to frame.
   b. Loop connector under cable to orient connector towards front of motorcycle.
   c. Install negative cable to frame with nut.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

6. Install seat.



1. **Negative cable**
2. **Battery negative terminal**
3. **Battery positive terminal**

Figure 8-32. Battery Terminals

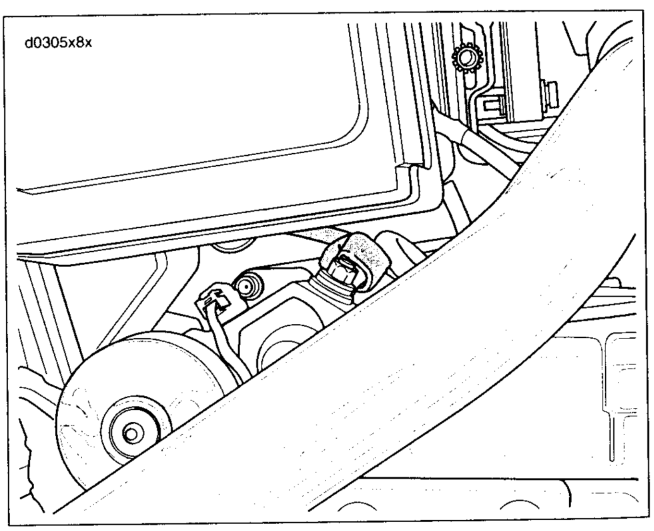


Figure 8-33. Positive Cable Routing

GENERAL

CAUTION

The use of any other headlamp bulb, other than what is specified, could result in damage to the electrical system or battery discharge.

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 8.2 BULB REQUIREMENTS.

REMOVAL

CAUTION

Never touch the quartz bulb with your fingers. Fingerprints will etch the glass and cause the bulb to fail. Always wrap the bulb in paper or a clean dry cloth during handling.

FXD, FXDL, FXDX Models

1. See Figure 8-35. Loosen trim ring clamp screw (8) and nut (7). Remove trim ring (6).
2. Pull connector block (16) from bulb (4) prongs.
3. Remove rubber boot (3) from back of headlamp lens (5).
4. See Figure 8-34. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.

⚠CAUTION

The bulb contains Halogen gas under pressure. Handle bulb carefully and wear eye protection. Failure to follow adequate safety precautions could result in minor or moderate injury.

5. Pivot wire retaining clip away from bulb. Remove bulb from headlamp assembly.

NOTE

When reinstalling new bulb, be sure connector contacts are clean to ensure good electrical contact.

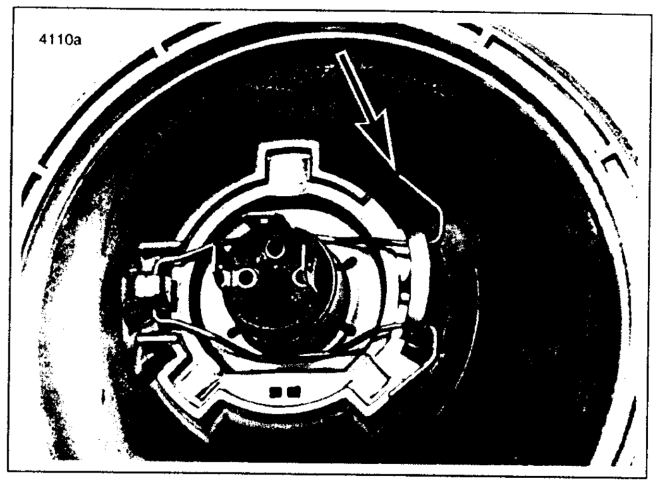


Figure 8-34. Wire Retaining Clip

FXDWG, FXDXT Models

1. See Figure 8-35. Loosen trim ring clamp screw (8) and remove trim ring (6).
2. Pull wiring connector from bulb prongs.
3. Remove rubber boot (3) from back of headlamp lens (5).
4. See Figure 8-34. Squeeze wire retaining clip ends to unhook them from notches in headlamp assembly.

⚠CAUTION

The bulb contains Halogen gas under pressure. Handle bulb carefully and wear eye protection. Failure to follow adequate safety precautions could result in minor or moderate injury.

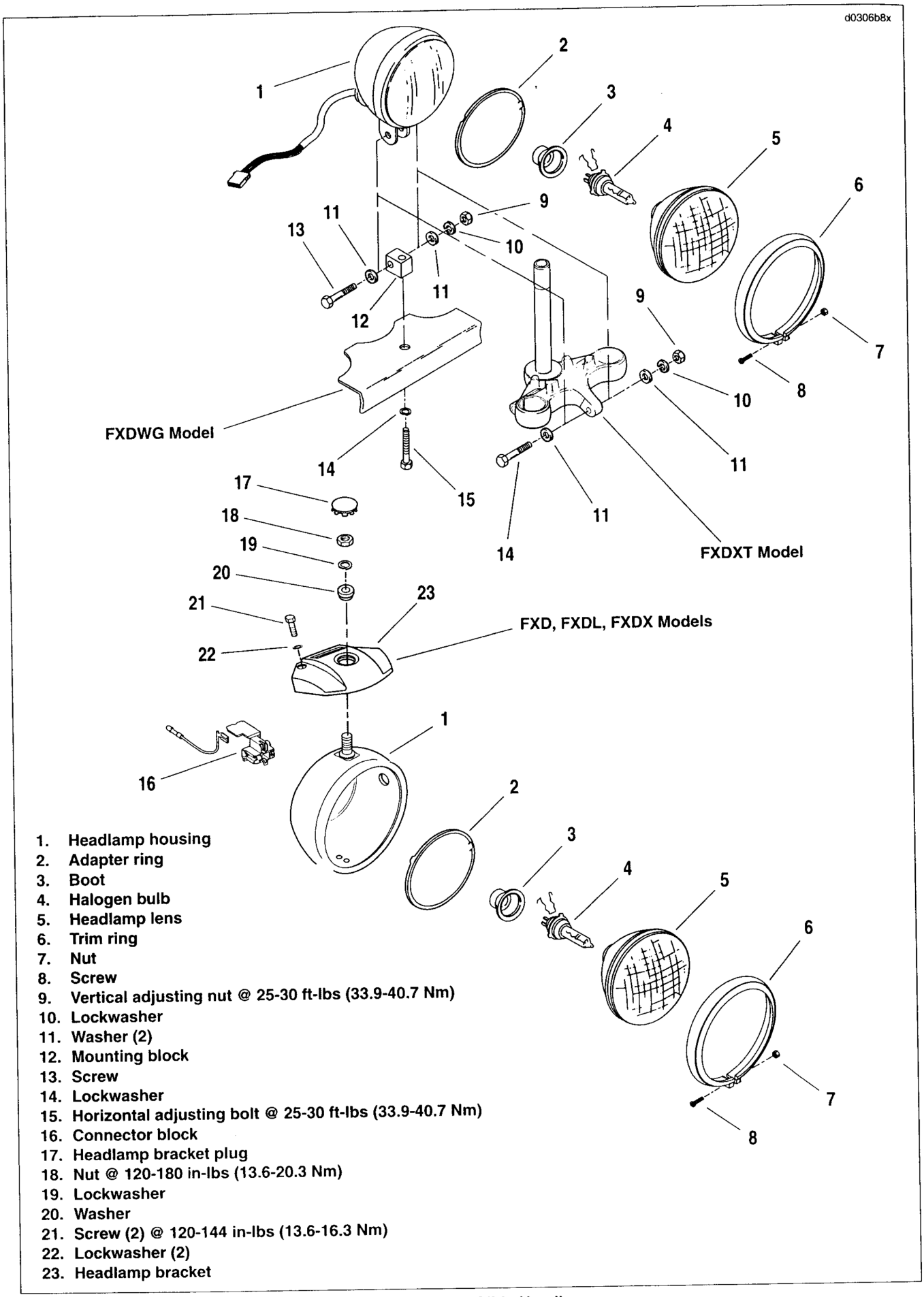
5. Pivot wire retaining clip away from bulb. Remove bulb from headlamp assembly.

INSTALLATION

Install **new** bulb and assemble headlamp components. See 1.26 HEADLAMP ALIGNMENT to adjust light beam.

NOTE

When reassembling headlamp, make sure slots and tabs in headlamp, adapter ring and trim ring are aligned.



1. Headlamp housing
2. Adapter ring
3. Boot
4. Halogen bulb
5. Headlamp lens
6. Trim ring
7. Nut
8. Screw
9. Vertical adjusting nut @ 25-30 ft-lbs (33.9-40.7 Nm)
10. Lockwasher
11. Washer (2)
12. Mounting block
13. Screw
14. Lockwasher
15. Horizontal adjusting bolt @ 25-30 ft-lbs (33.9-40.7 Nm)
16. Connector block
17. Headlamp bracket plug
18. Nut @ 120-180 in-lbs (13.6-20.3 Nm)
19. Lockwasher
20. Washer
21. Screw (2) @ 120-144 in-lbs (13.6-16.3 Nm)
22. Lockwasher (2)
23. Headlamp bracket

Figure 8-35. Dyna Glide Headlamps

GENERAL

Dyna Glide models are equipped with a tail lamp that uses a mini harness and circuit board to simplify replacement.

The FXDWG uses 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 also uses a different mini-harness than the other models.

BULB REPLACEMENT

1. See Figure 8-36. Remove two screws and lens from base.
2. Depress locking tab and remove 4-Pin multilock connector 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. 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

Check for proper tail lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

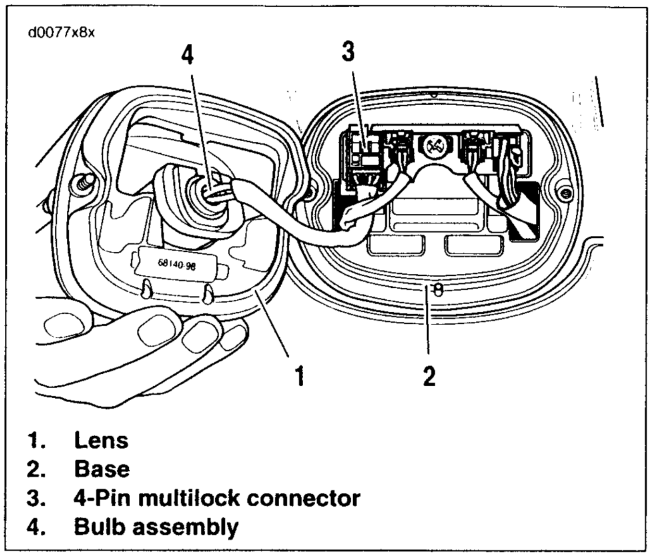
8. Turn ignition on and test for proper tail lamp operation.

BASE REPLACEMENT

1. Remove two screws and lens from base.
2. Depress locking tab and remove 4-Pin multilock connector from circuit board.
3. See Figure 8-37. 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 circuit board.
4. See Figure 8-38. Remove screw, pin housing and circuit board from base.

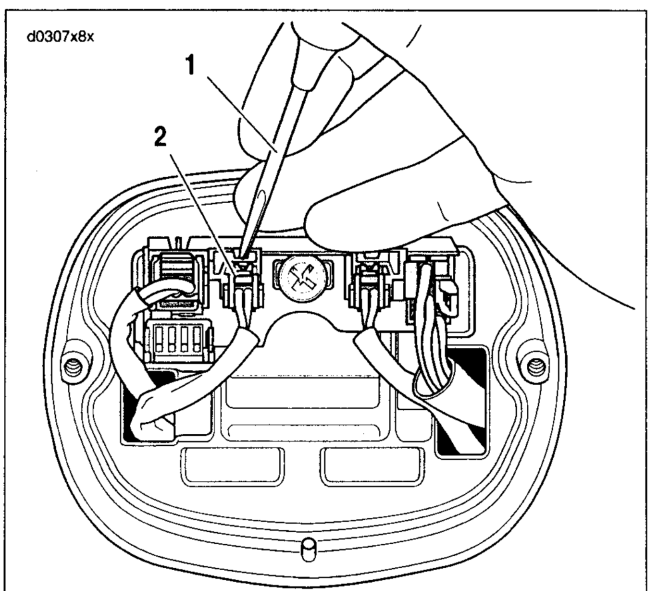
NOTE:
The circuit board is a press fit in the taillamp housing of a FXDWG, and requires no screw to hold it in place.

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)



1. **Lens**
2. **Base**
3. **4-Pin multilock connector**
4. **Bulb assembly**

Figure 8-36. Tail Lamp: FXD, FXDL, FXDX, FXDXT



1. **Terminal pick**
2. **2-Pin connector**

Figure 8-37. Removing 2-Pin Connectors

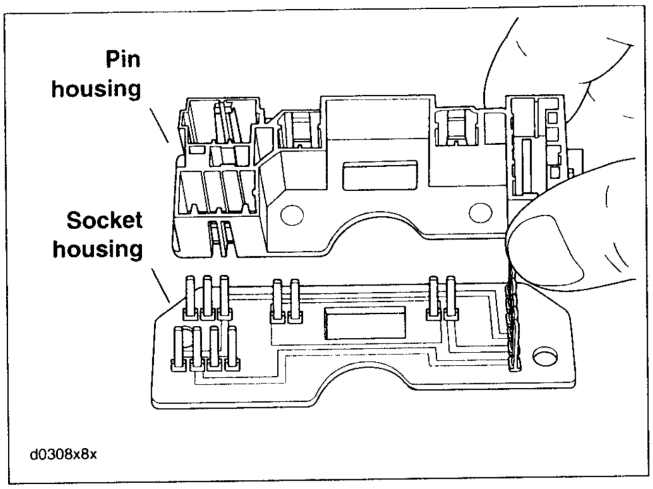


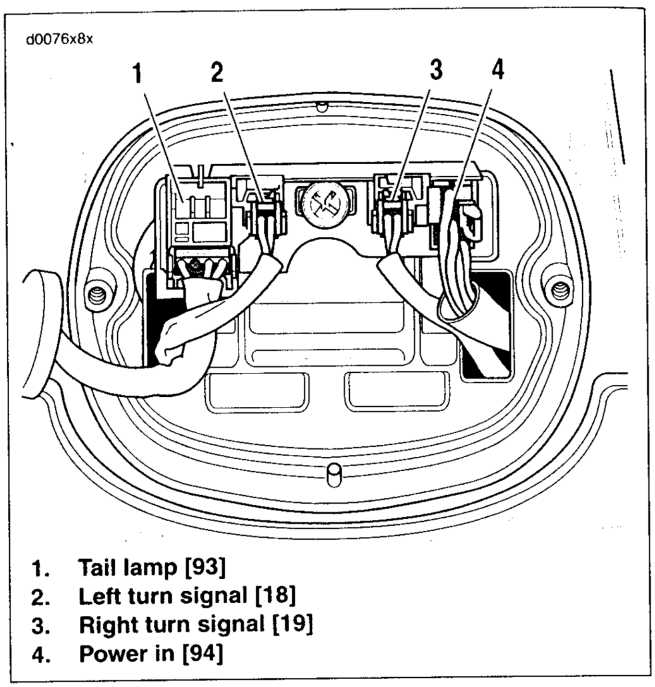
Figure 8-38. Pin Housing and Circuit Board

7. Install circuit board/pin housing to base with screw. Circuit board snaps in on bottom.
8. See Figure 8-39. Install connectors to circuit board.
9. Install lens to base with two screws. Tighten screws to 20-24 **in-lbs** (2.3-2.7 Nm).

⚠WARNING

Check for proper tail lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

10. Turn ignition on and test for proper tail lamp and turn signal operation.



1. **Tail lamp [93]**
2. **Left turn signal [18]**
3. **Right turn signal [19]**
4. **Power in [94]**

Figure 8-39. Wire Location at Connectors

NOTE

See Table 8-9. Cavity numbers are on back side of secondary locks. All FXDWG components are oriented 180 degrees from above and the turn signal connectors are reversed.

Table 8-9. 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

To change a bulb, remove the lens, turn the bulb 1/4 turn while pressing the bulb into the housing, and remove the bulb. Replace the bulb and install the lens.

NOTE

If after replacing a bulb, the turn signal or running lamp will not light, check the wiring, the ground at the socket and/or the switch.

LAMP HOUSING REPLACEMENT

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect the negative battery cable.

NOTE

Before removing turn signal wires, carefully note routing. In particular, pay close attention to the locations of cable straps which must be replaced.

3. Disconnect turn signal connector and cut cable straps around turn signal wire conduit. For front turn signals see 8.33 MAIN WIRING HARNESS for access.
   a. Front: connector [31] inside frame backbone.
   b. Rear: connectors [18,19] in tail lamp.
   c. Remove terminals from connector using Snap-On terminal tool TT600-3. See Appendix B or DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.

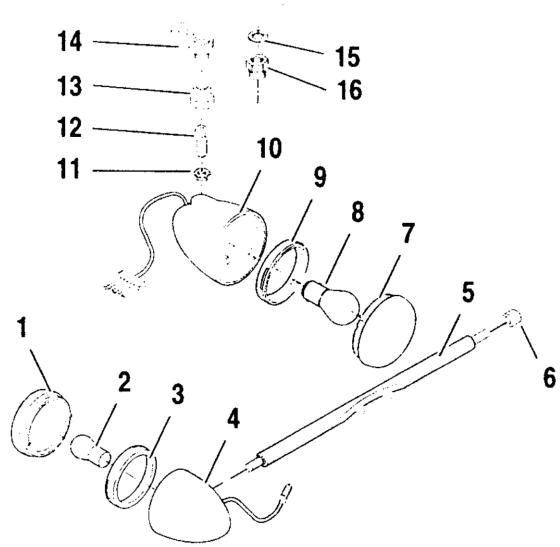
NOTE

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.

4. Pull turn signal wires from conduit and remove turn signal lamp housing from bracket.

FXDXT Turn Signals

1. See Figure 8-40. Front turn signals: On right side, hold right retainer (16) and loosen ball stud clamp (13) to remove turn signal. On left side, remove acorn nut from mirror, loosen jam nut (11) and remove ball stud clamp (13) to detach turn signal.



1. **Rear turn signal Lens**
2. **Rear turn signal bulb**
3. **Rear turn signal o-ring**
4. **Rear turn signal lamp housing**
5. **Rear turn signal bar**
6. **Nut**
7. **Front turn signal lens**
8. **Front turn signal bulb**
9. **Front turn signal o-ring**
10. **Front turn signal lamp housing**
11. **Jam nut**
12. **Ball stud**
13. **Ball stud clamp**
14. **Ball receptacle**
15. **Lockwasher**
16. **Right retainer**

Figure 8-40. FXDXT Turn Signals

2. See Figure 8-40. Rear turn signals: Loosen nut (6) and unscrew rear turn signal lamp housing (4) from turn signal bar (5).

3. Lay old turn signal lamp housing next to new one and cut **new** wires to length. Route wires into bar and place lamp onto bar. Crimp **new** terminals onto wires. See Appendix B or DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.
4. Install **new** lamp housing and thread **new** wires back through conduit. Insert terminals into connector and mate connector.
5. If front turn signal lamp housings were replaced, put main wiring harness back into position. See 8.33 MAIN WIRING HARNESS.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

6. Connect battery, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

7. Install seat.

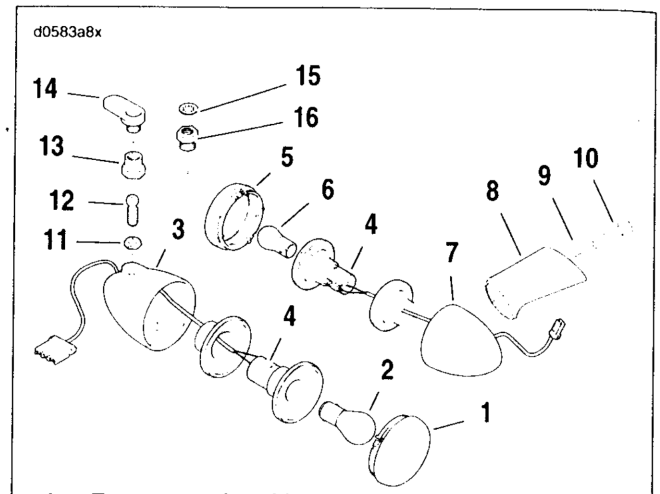
⚠WARNING

Check for proper turn signal lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

8. Turn ignition on and test for proper turn signal operation

FXD, FXDX, FXDL, FXDWG Turn Signals

1. Front turn signals: see Figure 8-41. On right side, hold right retainer (16) and loosen ball stud clamp (13) to remove turn signal. On left side, remove acorn nut from mirror, loosen jam nut (11) and remove ball stud clamp (13) to detach turn signal.
2. Rear turn signals: Remove the lamp support (8) by removing the screw (10) and washer (9) inside the rear fender, then the lamp housing (7) can be removed from the support (8).
3. Lay old turn signal lamp housing next to new one and cut **new** wires to length. Crimp **new** terminals onto wires. See Appendix B or DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.
4. Install **new** lamp housing and thread **new** wires back through conduit. Insert terminals into connector and mate connector.
5. If front turn signal lamp housings were replaced, put main wiring harness back into position. See 8.33 MAIN WIRING HARNESS.



1. **Front turn signal lens**
2. **Front turn signal bulb**
3. **Front turn signal lamp housing**
4. **Socket assembly**
5. **Rear turn signal Lens**
6. **Rear turn signal bulb**
7. **Rear turn signal lamp housing**
8. **Rear lamp mounting support**
9. **Washer**
10. **Screw**
11. **Jam nut**
12. **Ball stud**
13. **Ball stud clamp**
14. **Ball receptacle**
15. **Lockwasher**
16. **Right retainer**

Figure 8-41. FXD, FXDX, FXDL, FXDWG Turn Signals

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

6. Connect battery, positive cable first.

⚠WARNING

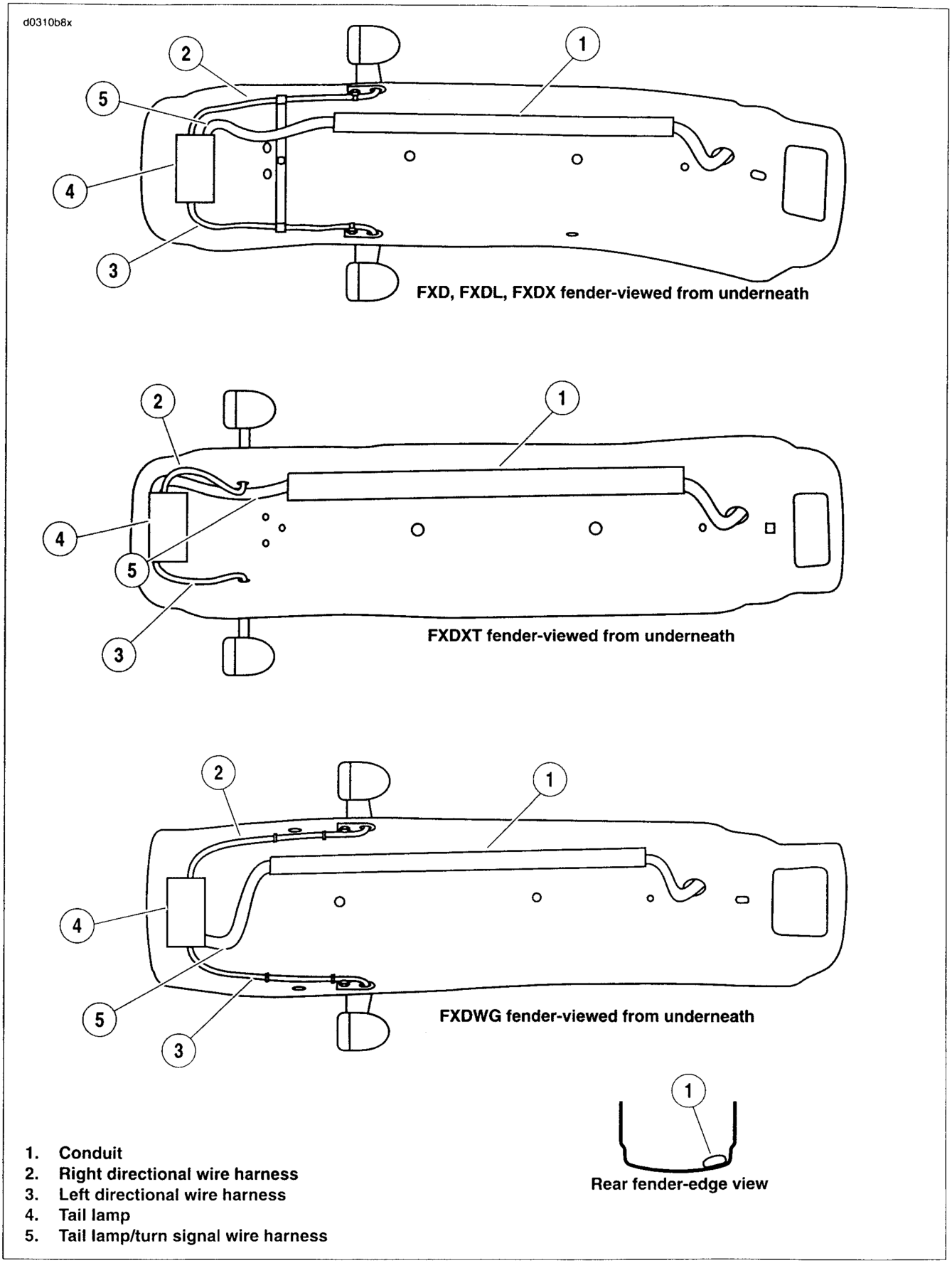
After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

7. Install seat.

⚠WARNING

Check for proper turn signal lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

8. Turn ignition on and test for proper turn signal operation.



1. Conduit
2. Right directional wire harness
3. Left directional wire harness
4. Tail lamp
5. Tail lamp/turn signal wire harness

Figure 8-42. Rear Fender Harness Routing

REMOVAL

1. Verify security lamp is not blinking (vehicle is disarmed).
2. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

3. Disconnect battery cables, negative cable first.
4. Gain access to the electrical panel by detaching cover and removing four nuts. See 8.4 ELECTRICAL PANEL.
5. See Figure 8-43. Unplug turn signal module connector.
6. See Figure 8-44. Remove TSM/TSSM module (2) from module bracket (3).

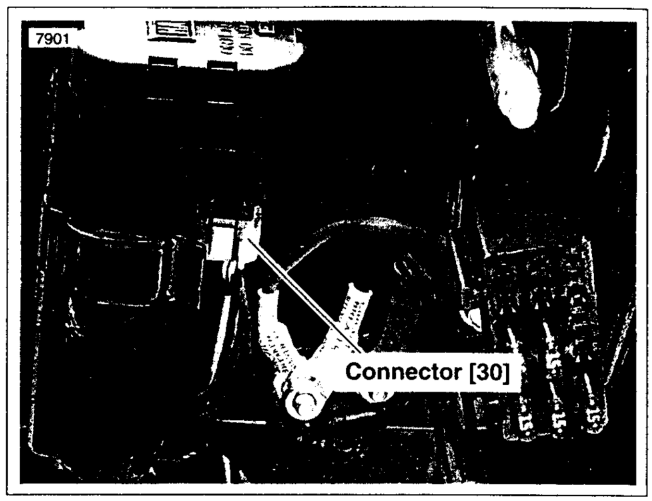
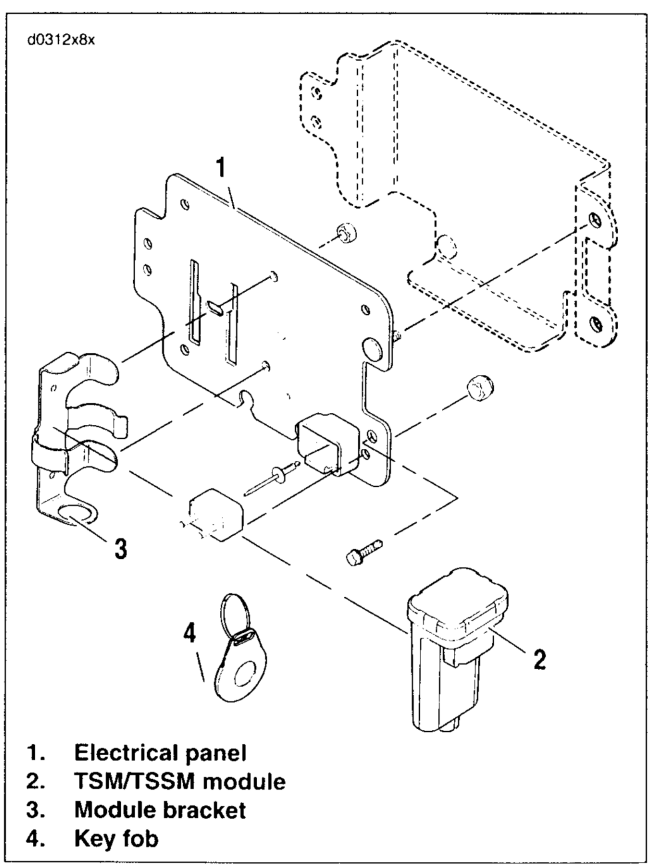


Figure 8-43. TSM/TSSM Module Mounting



1. **Electrical panel**
2. **TSM/TSSM module**
3. **Module bracket**
4. **Key fob**

Figure 8-44. Turn Signal Module Assembly

INSTALLATION

1. See Figure 8-44. Install TSM/TSSM module (2) into module bracket (3).
2. See Figure 8-43. Plug in TSM/TSSM module connector.
3. Attach cover and four nuts. See 8.4 ELECTRICAL PANEL.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

4. Connect battery, positive cable first.

⚠WARNING

Check for proper turn signal lamp operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

5. After replacing TSM/TSSM, perform all appropriate instructions under TSM/TSSM VEHICLE DELIVERY in the DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL.
6. Plug in connector and test for correct operation.

d0532x8x

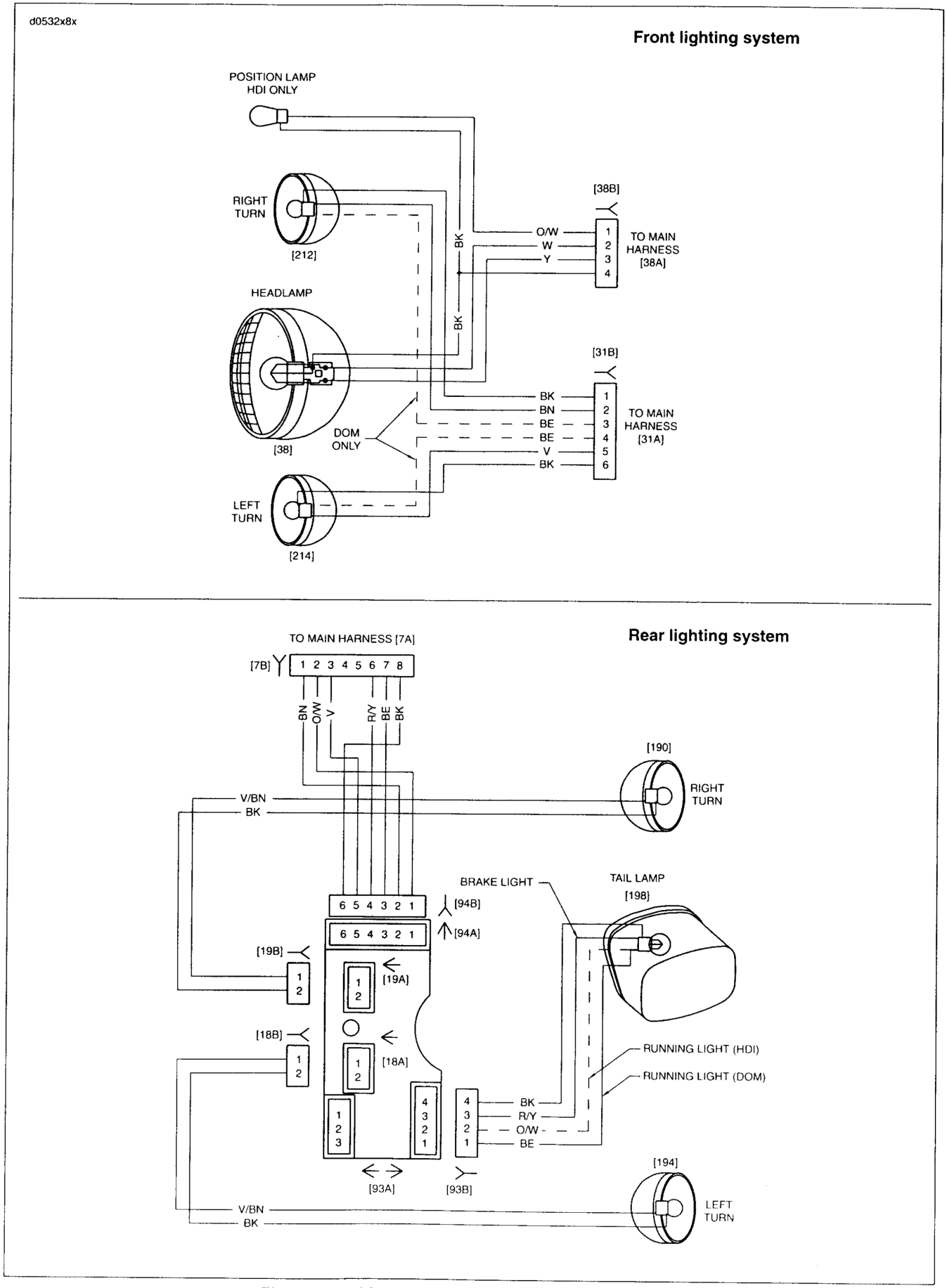


Figure 8-45. Lighting Wiring Diagram: All But FXDWG

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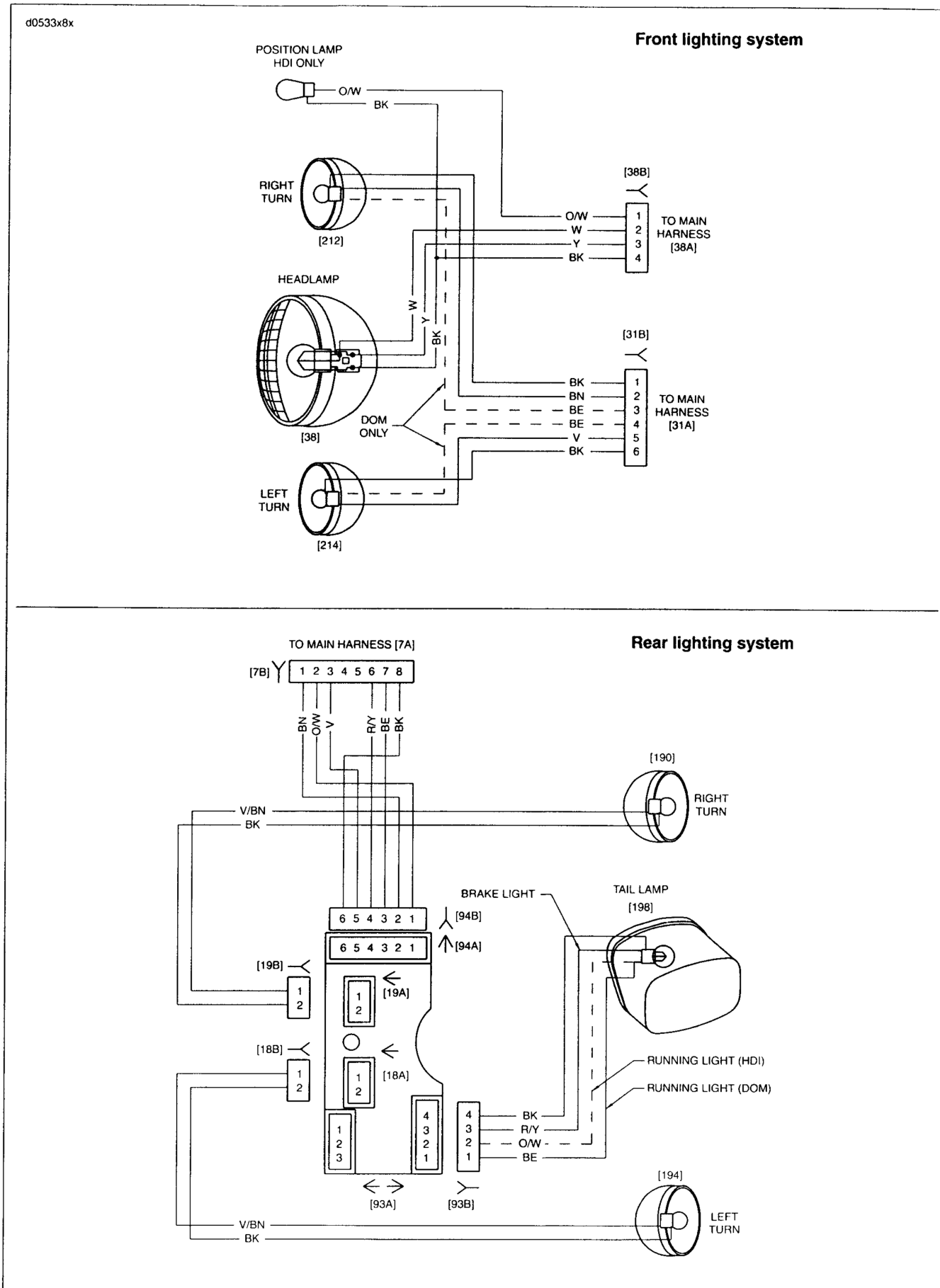


Figure 8-46. Lighting Wiring Diagram: FXDWG

NOTES

GENERAL

- For FXDL and FXDWG models, the fuel gauge is mounted in a simulated left fuel tank cap. Remove by gently pulling upward. Do not twist.
- For FXD, FXDX and FXDXT, the fuel gauge is in the center console. See FXD, FXDX, FXDXT MODELS which follows for replacement instructions.
- The light bulb may be replaced without further disassembly when the gauge has been removed. On FXD, FXDX and FXDXT models, remove the gauge as described below and pull straight up.
- If gauge is to be replaced, remove wires from back of gauge (FXDL, FXDWG models).
- Sending unit is located beneath gauge and can be removed from fuel tank by removing the five screws securing it to the tank. For FXD, FXDX and FXDXT models, the ring trim panel must be removed before the sending unit can be removed.

FXDL, FXDWG MODELS

Removal

NOTE

The gauge wires are routed through a tube in the tank and are secured by a clamp at the bottom of the tank. Loosen clamp and be sure there is enough slack in the wires to be able to lift the gauge.

⚠WARNING

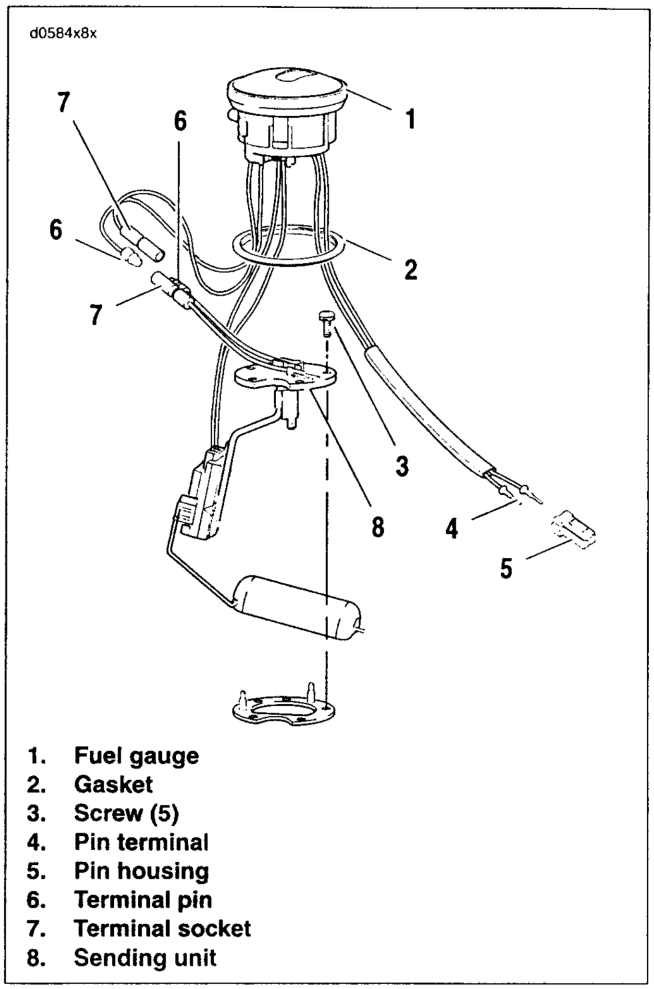
Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near the work site. Inadequate safety precautions could result in death or serious injury.

1. See Figure 8-47. Pull up on gauge (1). Detach pin terminals (4) from pin housing (5).
2. Remove screws (3) on sending unit plate ONLY.

CAUTION

Be careful not to bend float arm while removing. A bent float arm will give inaccurate readings.

3. Carefully move gauge back and forth while lifting.



1. **Fuel gauge**
2. **Gasket**
3. **Screw (5)**
4. **Pin terminal**
5. **Pin housing**
6. **Terminal pin**
7. **Terminal socket**
8. **Sending unit**

Figure 8-47. Fuel Gauge: FXDL and FXDWG

Installation

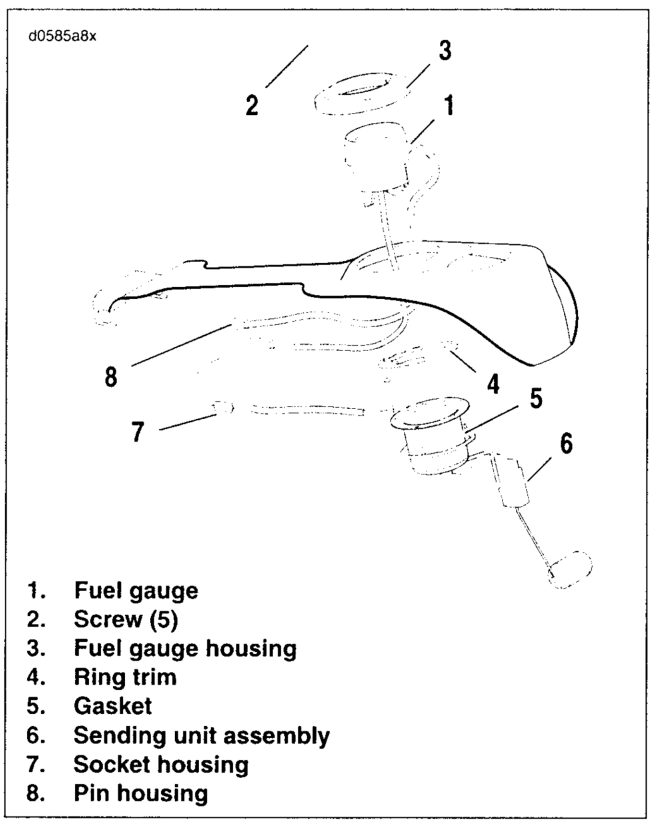
1. See Figure 8-47. Use **new** screws and install **new** sending unit making sure to use **new** gasket for proper sealing.
2. Install sending unit plate screws (3). Tighten screws to 18-22 **in-lbs** (2.0-2.5 Nm). Tighten wire clamp at bottom of fuel tank.
3. Connect terminals (6, 7) from gauge to sending unit (8).
4. Connect pin terminals (4) to pin housing (5).
5. Position terminals inbetween posts on bottom of gauge.
6. Install gauge by carefully moving gauge back and forth while pushing down at the same time.

Removal

⚠WARNING

Gasoline is extremely flammable and highly explosive. Always stop the engine when refueling or servicing the fuel system. Do not smoke or allow open flame or sparks near the work site. Inadequate safety precautions could result in death or serious injury.

1. Remove gas cap.
2. See Figure 8-48. Remove five screws (2) that hold fuel gauge housing (3) in place.
3. Carefully pull fuel gauge (1) up out of sending unit (6) by gently lifting around the edge of the gauge with a screwdriver. Be careful not to scratch tank.



1. **Fuel gauge**
2. **Screw (5)**
3. **Fuel gauge housing**
4. **Ring trim**
5. **Gasket**
6. **Sending unit assembly**
7. **Socket housing**
8. **Pin housing**

Figure 8-48. Fuel Gauge: FXD, FXDX, FXDXT

Installation

1. See Figure 8-48. Lubricate rubber on bottom half of gauge (1) with rubbing alcohol or glass cleaner.
2. Position terminals in between posts on bottom of gauge.
3. See Figure 8-49. Align mark on bottom of gauge with first scribed mark on sending unit (6 in Figure 8-48.).
4. Press bottom of gauge into sending unit.
5. See Figure 8-50. Turn gauge clockwise to align with second scribed mark on sending unit.
6. See Figure 8-48. Install gauge housing (3) using five screws (2). Tighten screws to 18-22 **in-lbs** (2.0-2.5 Nm).
7. Install gas cap.

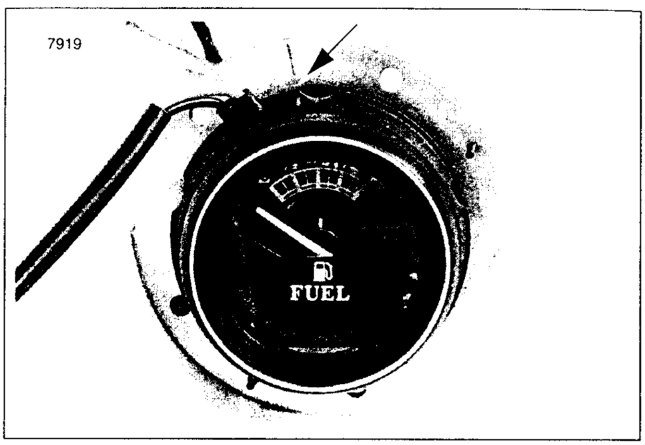


Figure 8-49. Aligning First Mark

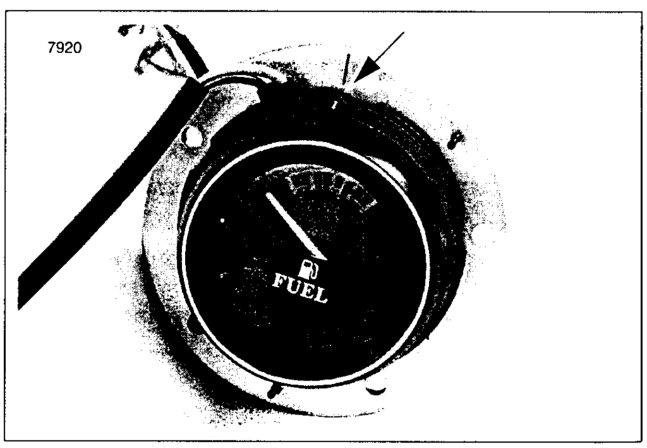


Figure 8-50. Aligning Second Mark

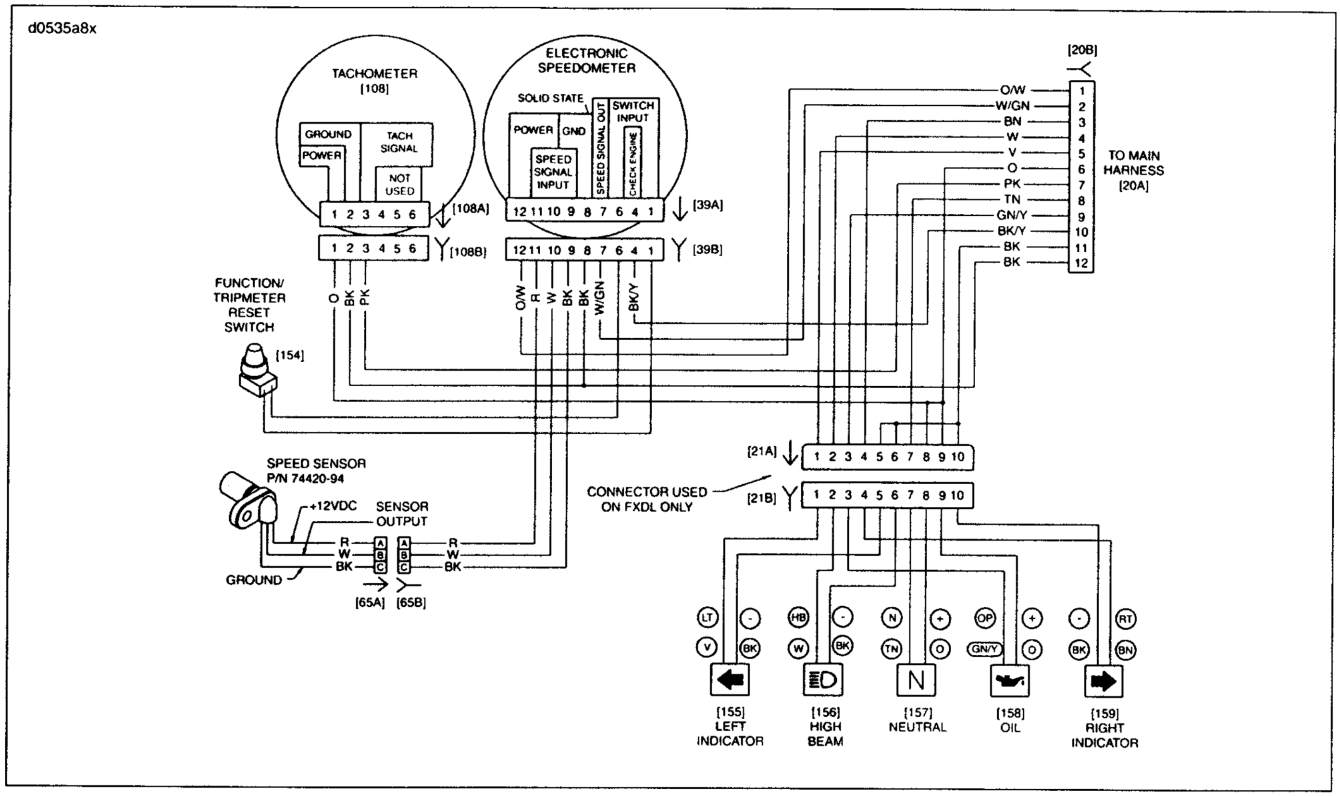


Figure 8-51. Electronic Speedometer Connectors: All But FXDWG

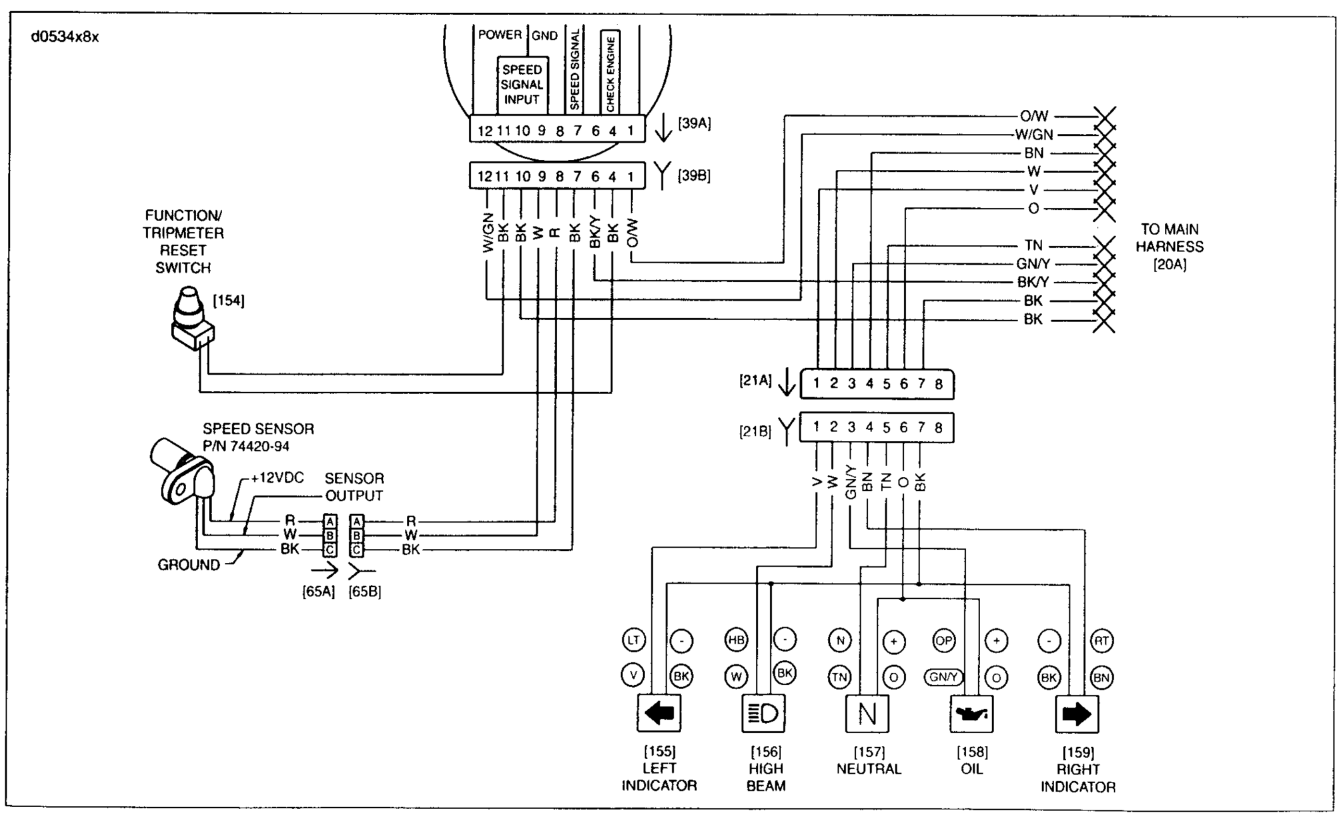


Figure 8-52. Electronic Speedometer Connectors: FXDWG

REMOVAL

Speedometer

NOTE

Nut may come out with stud attached to it.

1. See Figure 8-53. Remove nut (4) and lift console (5) from fuel tank.
2. Position clean shop rags on fuel tank and flip console over to expose underside.
3. Depress connector tab and disconnect 12-place harness connector (2) [39] from speedometer under console.
4. Unscrew the rubber boot from the odometer reset switch (6) on the left side of the console.
5. Remove the odometer reset switch from hole in console.
6. See Figure 8-54. Pry between three tabs and speedometer with a screwdriver to raise and release back clamp from speedometer. Remove back clamp from speedometer.
7. See Figure 8-53. Remove speedometer from console.
8. Remove gasket (3) from speedometer.

INSTALLATION

Speedometer

1. See Figure 8-53. Install gasket (3) to speedometer.
2. Position speedometer in console (5).
3. See Figure 8-54. Press on back clamp (3) until three tabs engage on back of speedometer.
4. See Figure 8-53. Insert odometer reset switch (6) through hole in console and install rubber boot.
5. Connect 12-place connector (2) [39] to speedometer under console.
6. Remove shop rags and install console to fuel tank with nut (4). Tighten to 80-100 **in-lbs** (9.0-11.3 Nm).
7. Test speedometer for proper operation.

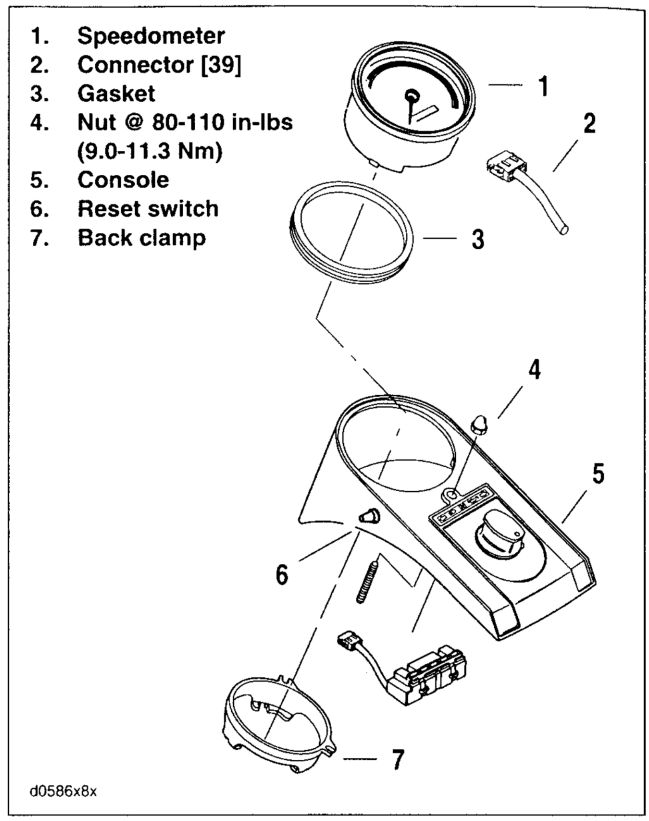


Figure 8-53. Speedometer: FXDWG

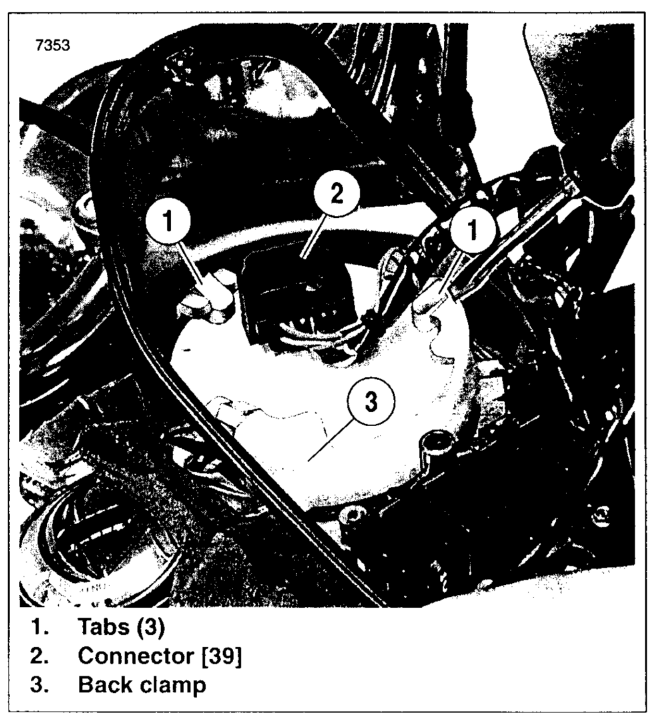


Figure 8-54. FXDWG Connector [39]

REMOVAL

General

It is not necessary to cut any of the wiring harness cable ties to replace the speedometer and tachometer.

Speedometer

1. Remove two allen screws and lift console from fuel tank.
2. Position clean shop rags on fuel tank and flip console over to expose underside.
3. See Figure 8-55. Remove four allen screws (1) and bracket (2) from speedometer/tachometer.
4. Depress connector tab and remove 12-place connector (3) [39] from back of speedometer.
5. Remove speedometer from console. Remove gasket from speedometer/console.

Tachometer

1. Complete steps 1-3 of speedometer removal.
2. See Figure 8-56. Using a T15 TORX bit, remove screw and wire harness clip (1) from tachometer.
3. Gently pry on either narrow end of 6-place connector (2) [108] and disconnect from tachometer.
4. Remove tachometer from console. Remove gasket from tachometer.

INSTALLATION

General

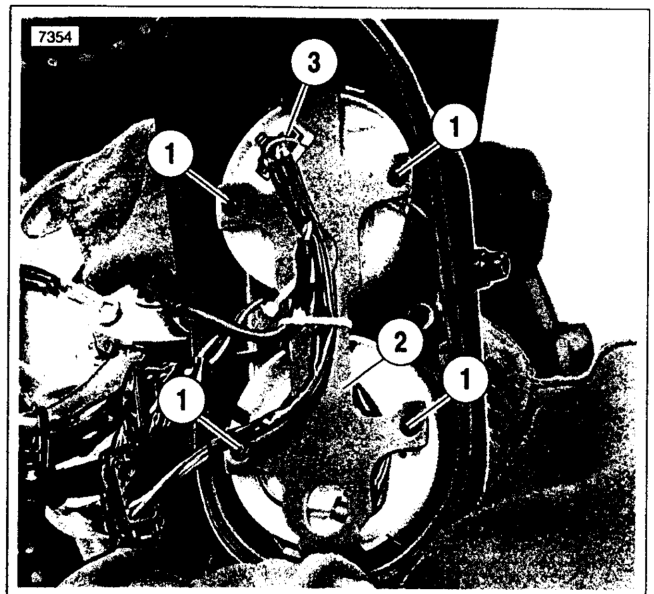
To ease installation, alcohol or glass cleaner may be applied to the gasket.

Speedometer

1. Install gasket to console.
2. Install speedometer in console.
3. See Figure 8-55. Install connector (3) [39] to back of speedometer.
4. Install bracket (2) to speedometer/tachometer with four allen screws (1). Make sure there is no binding with the wiring harnesses and the bracket.
5. Install console to fuel tank with two allen screws.
6. Test speedometer for proper operation.

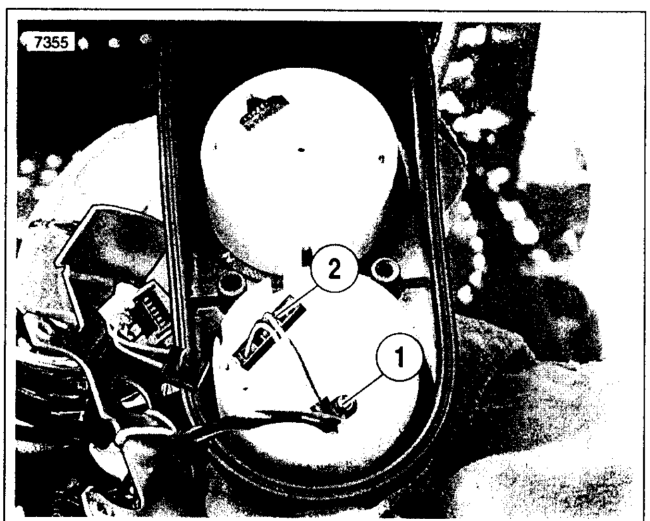
Tachometer

1. Install gasket to console.
2. Install tachometer in console.
3. See Figure 8-56. Install (push down) 6-place connector (2) [108] to tachometer under console.



1. **Screws (4)**
2. **Bracket**
3. **Connector [39]**

Figure 8-55. Speedometer/Tachometer Bracket: FXDL



1. **Screw and wire harness clip**
2. **Connector [108]**

Figure 8-56. Speedometer/Tachometer: FXDL

4. Install wire harness clip (1) to back of tachometer with screw.
5. See Figure 8-55. Install bracket (2) to speedometer/tachometer with four allen screws (1). Make sure there is no binding with the wiring harnesses and the bracket.
6. Install console to fuel tank with two allen screws.
7. Test tachometer for proper operation.

REMOVAL

Speedometer

NOTE

On FXDXT models, remove fairing. See 2.35 WINDSHIELD: FXDXT.

1. See Figure 8-57. Remove two screws (12) and backplate (11).
2. Depress tab and remove 12-pin connector (2) [39] from back of speedometer.
3. Push speedometer (1) through front of housing.
4. Remove front gasket (7) from speedometer.

Tachometer: FXDX, FXDXT Only

NOTE

On FXDXT models, remove fairing. See 2.35 WINDSHIELD: FXDXT.

1. See Figure 8-57. Remove two screws (12) and backplate (11).
2. Depress tab and remove 6-place connector (3) [108] behind headlamp.
3. Push tachometer (4) through front of housing. Remove screw holding harness in place.
4. Remove gasket from tachometer.

INSTALLATION

General

To ease installation, glass cleaner or alcohol may be applied to the gasket inside surface.

Speedometer

1. See Figure 8-57. Install front gasket (7) 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 gasket (10) on back of housing. Install backplate (11) with two screws (12).

Tachometer: FXDX, FXDXT Only

1. See Figure 8-57. Install front gasket to tachometer and slide tachometer into housing. Press firmly until seated.
2. Connect 6-place connector [108] to back of tachometer. Install harness to tachometer with TORX screw.
3. Route wires through slot in back of instrument housing. Install gasket on back of housing. Install backplate with two Allen screws.

NOTE

On FXDXT models, install fairing. See 2.35 WINDSHIELD: FXDXT.

1. **Speedometer**
2. **Connector [39]**
3. **Connector [108]**
4. **Tachometer**
5. **Connector [20]**
6. **Indicator lamps**
7. **Front gasket**
8. **Housing**
9. **Bolt @ 12-18 ft-lbs (16.3-24.4 Nm)**
10. **Rear gasket**
11. **Backplate**
12. **Screw**

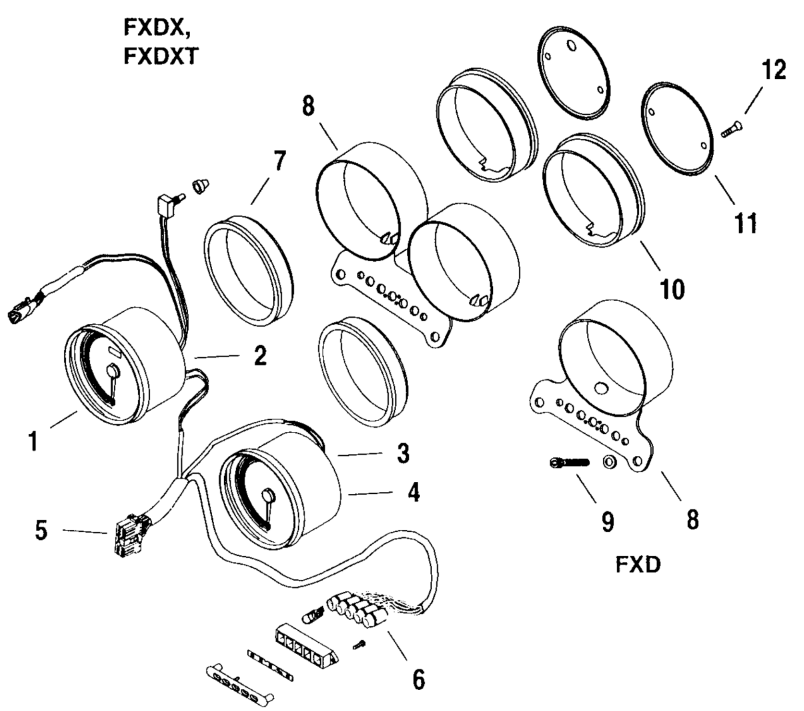


Figure 8-57. Instrumentation: FXD, FXDX, FXDXT

GENERAL

The speedometer speed sensor is a hall effect sensor that takes readings off 4th gear in the transmission.

The speedometer speed sensor is located on the transmission just behind the transmission top cover.

REMOVAL

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. See Figure 8-58. The 3-place speedometer sensor connector [65] is located on the frame beneath the seat. Remove connector from t-stud and disconnect.
4. See Figure 8-59. Remove sensor mounting bolt and lift sensor from crankcase.

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.



Figure 8-58. Speedometer Sensor Connector [65]

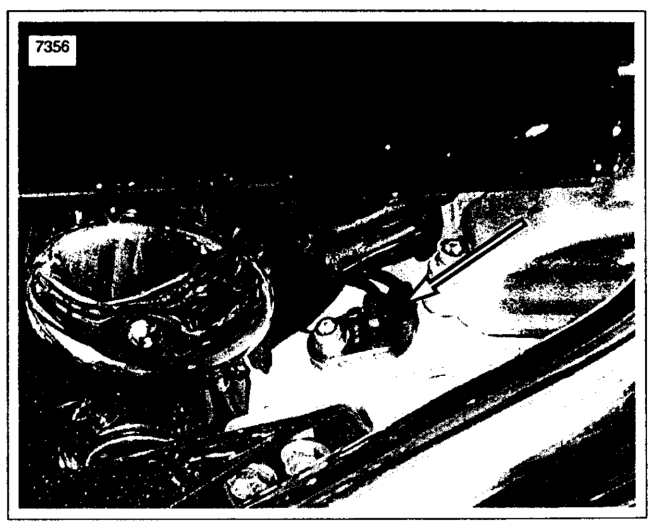


Figure 8-59. Speedometer Speed Sensor

INSTALLATION

1. See Figure 8-59. Install sensor into transmission case using mounting bolt. Tighten bolt to 84-108 **in-lbs** (9.5-12.2 Nm).
2. See Figure 8-58. Mate connector halves and attach 3-place connector [65] to t-stud on frame under seat.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

3. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

4. Install seat.

BULB REPLACEMENT

FXD, FXDX and FXDXT Models

Remove indicator lamp bulb from its housing by gently rocking the socket while pulling. To install the new lamp bulb, apply a small amount of alcohol to the bulb to help ease it into the housing, then gently rock the socket while pushing the lamp into position.

FXDL Models

On FXDL models, the lamp trim is a snap fit and must be carefully pried out of housing before lamp can be pushed out of socket.

LAMP HOUSING REPLACEMENT

PART NO.	SPECIALTY TOOL
HD-41609	Amp multilock crimp tool

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.

NOTE

Before removing indicator lamp wires, carefully note routing. In particular, pay close attention to the locations of cable straps which must be replaced.

3. Disconnect indicator lamp connector listed below. See Appendix B or DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.
   a. FXD, FXDX and FXDXT models: disconnect indicator lamp connector [20]. Remove wires from connector. See Figure 8-60.
   b. FXDL vehicles: disconnect indicator lamp connector [21]. Cut cable straps as required around conduit. Remove wires from connector. See Figure 8-61.

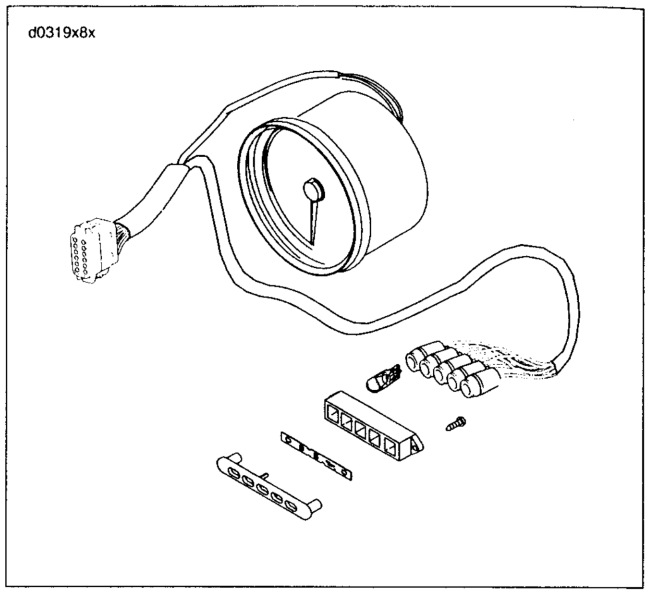


Figure 8-60. Indicator Lamps: FXD, FXDX and FXDXT

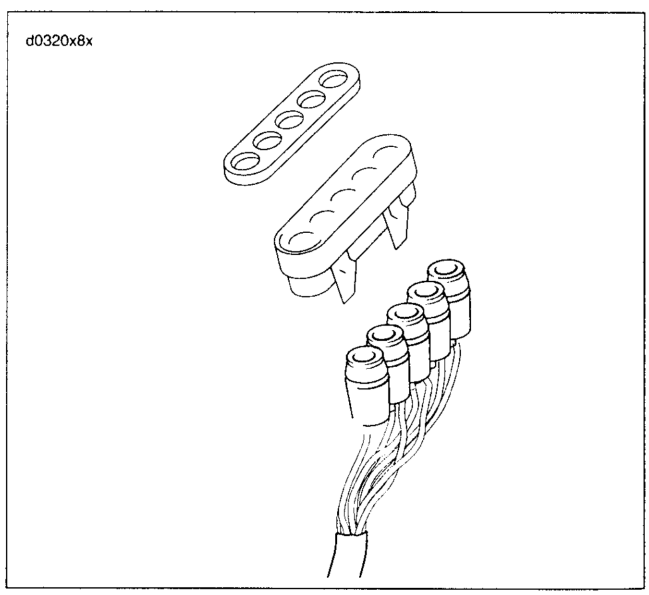


Figure 8-61. Indicator Lamps: FXDL

NOTE

To aid in installing new indicator lamp wires, attach thin wire to terminals on old lamp wires before pulling old wires out of conduit. This thin wire can then be used to guide new wires back through conduit.

4. Remove indicator lamp from housing and pull lamp wires out of conduit.
5. Lay old indicator lamp next to new lamp and cut wire to length. Crimp **new** 73191-96 socket terminals to the wires using the rear crimping die on HD-41609 crimp tool.
6. Install indicator lamp into housing by rocking the socket while pushing lamp into position. On FXDL models, feed lamp socket wires through lamp hole and push lamp socket into the housing. The lamp trim is a snap fit, so press it into place in the housing.
7. Thread lamp wires back into the conduit. Route the conduit back into its original position and secure with cable straps. Insert indicator lamp terminals into the correct pin of the connector and mate connectors.

Table 8-10. FXD, FXDX, FXDXT Connector [20] Pins

PIN ON [20]	WIRE COLOR
3	Brown
4	White
5	Violet
6	Orange
8	Tan
9	Green/yellow
12	Black

8. Connect indicator lamp connector.
   a. FXD, FXDX and FXDXT models: connect indicator lamp connector [20].
   b. FXDL vehicles: connect indicator lamp connector [21].

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

9. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

10. Install seat.
11. Turn ignition ON. Test for proper indicator lamp operation.

GENERAL

Dyna Wide Glides are equipped with Light Emitting Diode (LED) indicators. The indicator lamp assembly is not serviceable. If one LED is bad, the entire assembly must be replaced.

See 8.29 NEUTRAL SWITCH which follows for troubleshooting procedures.

REMOVAL

1. See Figure 8-62. Remove nut (1) and raise console (2) from fuel tank. Place shop rags on tank and flip console over to expose underside.
2. See Figure 8-63. Squeeze clips together (2) and gently pry indicator lamp assembly (1) out of console from the side with a screwdriver.
3. Disconnect 8-place connector (3) [21] from indicator lamp assembly.

INSTALLATION

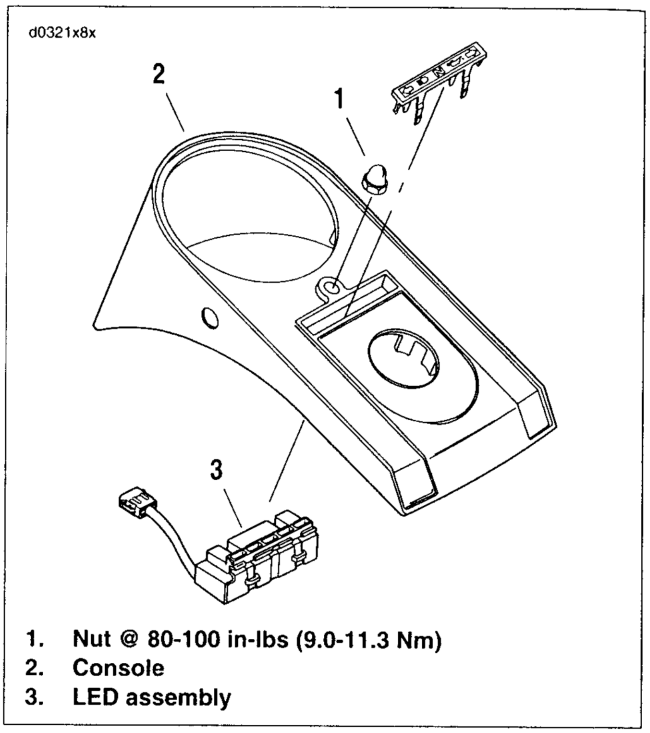
1. See Figure 8-63. Install indicator lamp assembly (1) into console. Make sure clips (2) engage to secure assembly in place.
2. Connect connector (3) [21] to main wiring harness.
3. See Figure 8-62. Place console (2) in position. Tighten nut (1) to 80-100 **in-lbs** (9.0-11.3 Nm).

Table 8-11. FXDWG 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

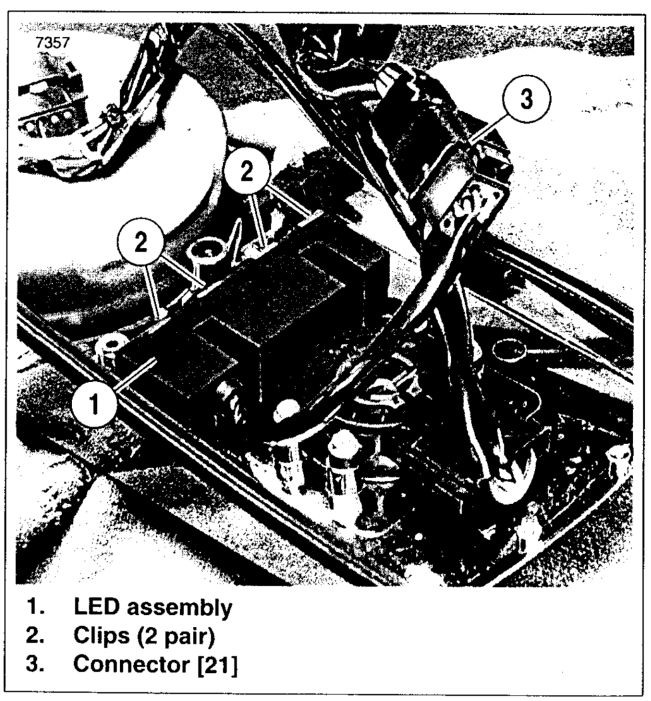
Table 8-12. LED Assembly Wiring

INDICATOR LAMP	CONNECTION
Oil pressure	ground through switch
Neutral	ground through switch
High beam	12 VDC when active
Right/left turn	12 VDC when active



1. **Nut @ 80-100 in-lbs (9.0-11.3 Nm)**
2. **Console**
3. **LED assembly**

Figure 8-62. Indicator Lamp Assembly: FXDWG



1. **LED assembly**
2. **Clips (2 pair)**
3. **Connector [21]**

Figure 8-63. FXDWG Connector [21]

GENERAL

See Figure 8-64. The neutral switch is located on the transmission top cover. The two terminal switch is normally closed. When the transmission shifter is in neutral and the ignition switch is in the IGNITION position, the switch causes the NEUTRAL indicator light to illuminate.

REMOVAL

CAUTION

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 8-65. Using fingers, remove connectors from switch studs.
3. Using 7/8 in. box and open end wrench, remove neutral switch and O-ring from transmission top cover.

NOTE

To replace connectors, use heat-sealed butt splice connectors. See DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.

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 8-65. Lubricate O-ring with transmission oil.
2. Install switch with O-ring to transmission top cover.
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.

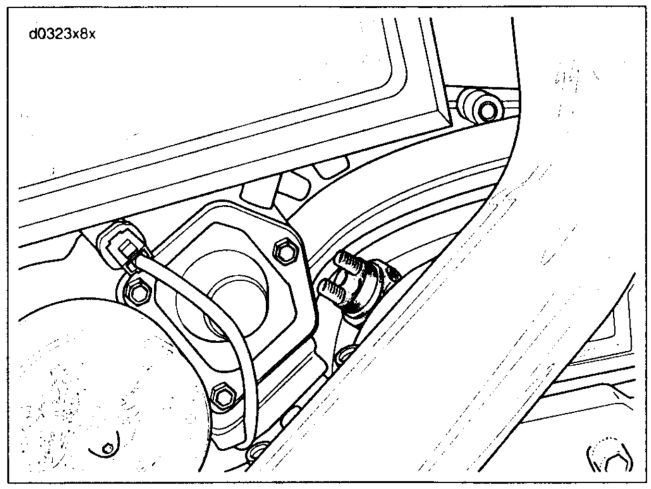


Figure 8-64. Neutral Switch Location

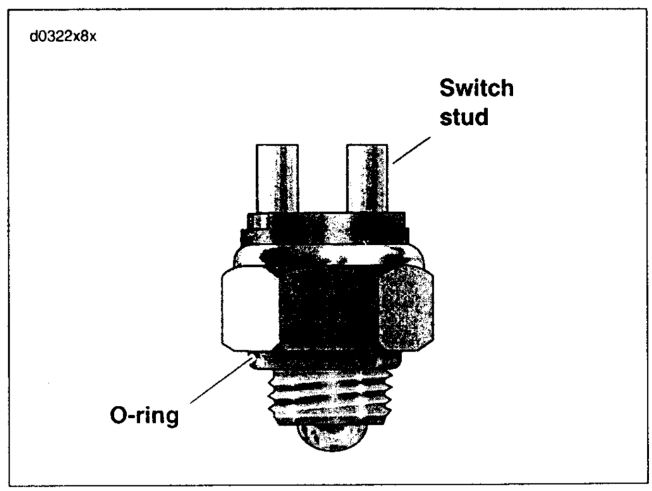


Figure 8-65. Neutral Switch

GENERAL

See Figure 8-66. The oil pressure switch monitors oil pressure in the crankcase. If the oil pressure drops below 3 psi (20.6 kPa), the oil pressure switch is tripped and illuminates the low oil pressure indicator light. The oil pressure switch is located on the right side of the crankcase.

REMOVAL

1. See Figure 8-66. Remove connector jumper (2) from oil pressure switch (1).
2. Using a 15/16 in. open end wrench, remove switch from crankcase.

INSTALLATION

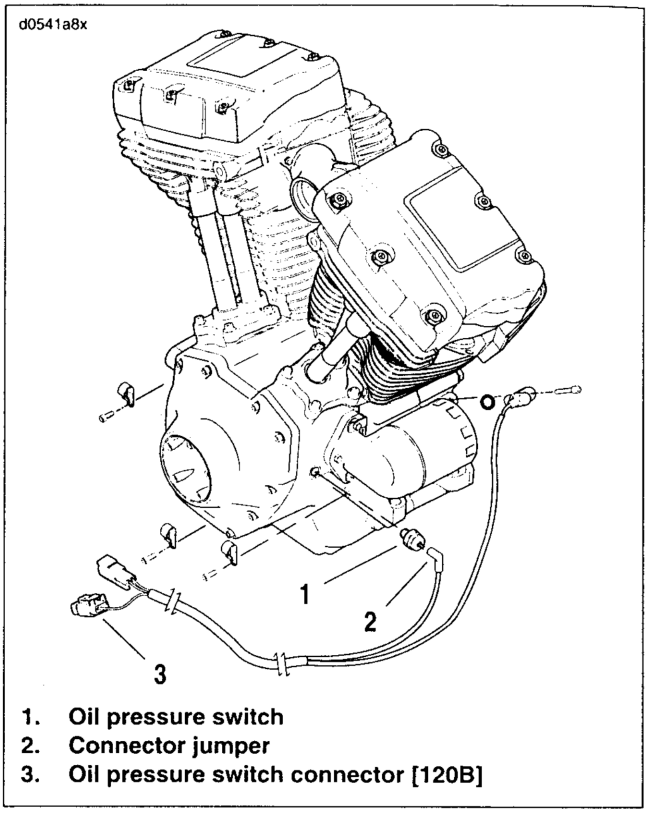
NOTE

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 8-66. Install oil pressure switch (1) to crankcase.
3. Tighten switch to 96-144 **in-lbs** (10.9-16.2 Nm).
4. Attach connector jumper (2) to oil pressure switch.
5. Test oil pressure switch for proper operation.

NOTES

- *If connector (2) requires replacement, see Appendix B or DYNA MODELS ELECTRICAL DIAGNOSTIC MANUAL for more information.*
- *If connector (3) requires replacement, see 8.7 CRANK POSITION SENSOR (CKP).*



1. **Oil pressure switch**
2. **Connector jumper**
3. **Oil pressure switch connector [120B]**

Figure 8-66. Oil Pressure Switch

GENERAL

See Figure 8-67. The rear stop light switch monitors brake fluid pressure in the rear brake line. When pressure in the line reaches a preset level, the rear stop light switch is tripped and illuminates the tail light/stop light. The rear stop light switch is located on the rear brake line T-fitting.

REMOVAL

1. See Figure 8-67. Remove two terminals from rear stop light switch.
2. Place a clean container under the rear stop light switch and brake line to catch escaping fluid.
3. Using a 1-1/16 in. open end wrench, remove switch from T-fitting.

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 stop light switch with Loctite Pipe Sealant with Teflon (PST).
2. See Figure 8-67. Install rear stop light switch to T-fitting.
3. Tighten switch to 96-120 **in-lbs** (10.8-13.6 Nm).
4. Connect two terminals to rear stop light switch.
5. Bleed brake system. See 1.7 BLEEDING BRAKES.

⚠WARNING

Check for proper tail lamp/stop light operation before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have proper lamp operation could result in death or serious injury.

6. Check tail lamp/stop light for proper operation.

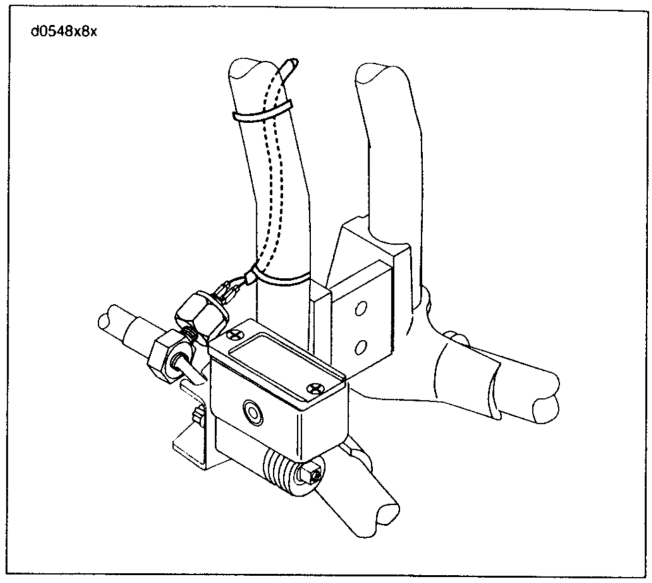


Figure 8-67. Rear Stoplight Switch

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.

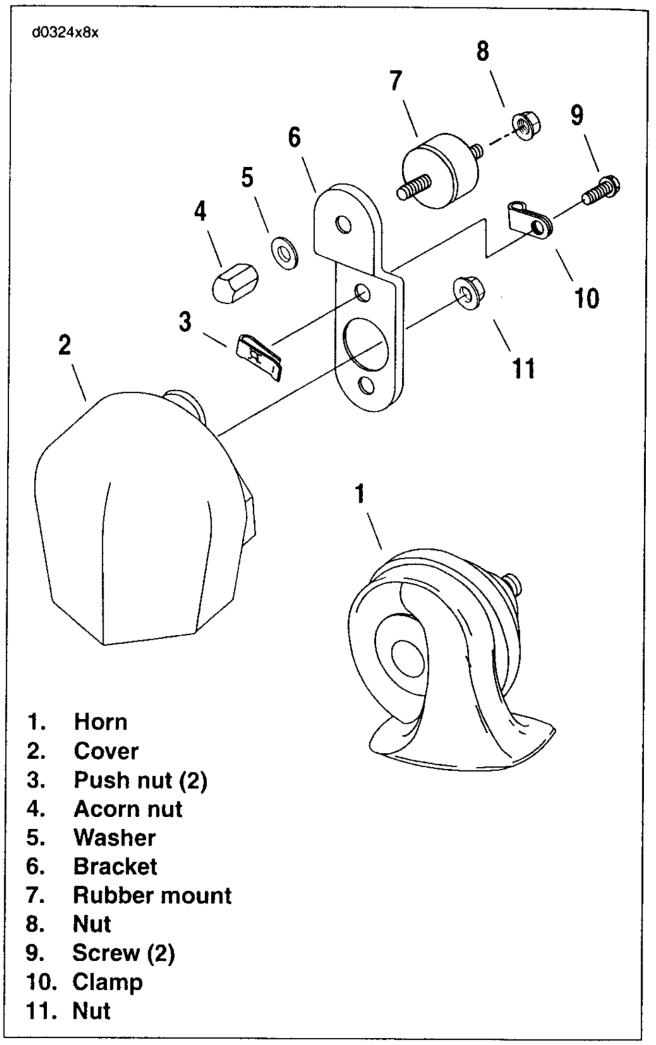
The horn it is permanently sealed and non-repairable. Only the mounting hardware is replaceable.

NOTE

No tonal adjustments may be made to this horn.

REPLACEMENT

1. See Figure 8-68. Remove nut (4) and washer (5) to detach horn bracket (6) from vehicle.
2. See Figure 8-69. Disconnect wires from posts (1, 2) on back side of horn.
3. See Figure 8-68. Remove screws (9) and nut (11) to detach horn from bracket. Free wires from clamp (10).
4. Install **new** horn on bracket. Secure with screws (9), push nuts (3) and nut (11). Fold wires under clamp (10).
5. See Figure 8-69. Attach wiring.
   a. Connect Y/BK wire to gold post (1).
   b. Connect BK wire to silver post (2).
6. See Figure 8-68. Attach horn to vehicle using washer (5) and nut (4). Tighten nut to 80-100 **in-lbs** (9-11 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. **Nut**
9. **Screw (2)**
10. **Clamp**
11. **Nut**

Figure 8-68. Horn

1. **Gold post and Y/BK wire**
2. **Silver post and BK wire**

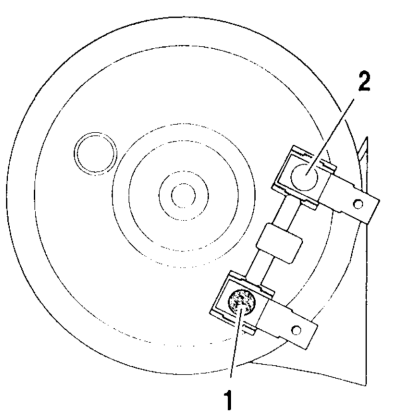


Figure 8-69. Horn Wiring

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 Appendix B for the main wiring harness schematic.

REMOVAL

1. Remove seat.

⚠WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables before proceeding. Inadequate safety precautions could result in death or serious injury.

⚠WARNING

Always disconnect the negative cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

2. Disconnect battery cables, negative cable first.
3. Unlatch clip and remove vapor valve and hose from front of fuel tank.
4. At the frame neck, cut nylon tie wrap and remove the rubber frame plug from the right side of the frame neck.
5. Remove two bolts, washers, nuts and belt guard to gain access to the fender flap and harness. Remove rubber fender flap from inside rear fender (allows access to harness service loop).

NOTE

Before removing wiring harness, carefully note wire routing. In particular, pay close attention to the locations of cable straps which must be replaced.

6. See Figure 8-70. Unfold the harness service loop from the frame tube.

NOTE

Connectors sometimes snag on neck casting. Rock harness back and forth to free snagged connectors.

7. See Figure 8-71. Pull harness forward through frame backbone far enough to gain access to front connectors.
8. 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 only) Instruments [21].
   f. Headlamp [38].

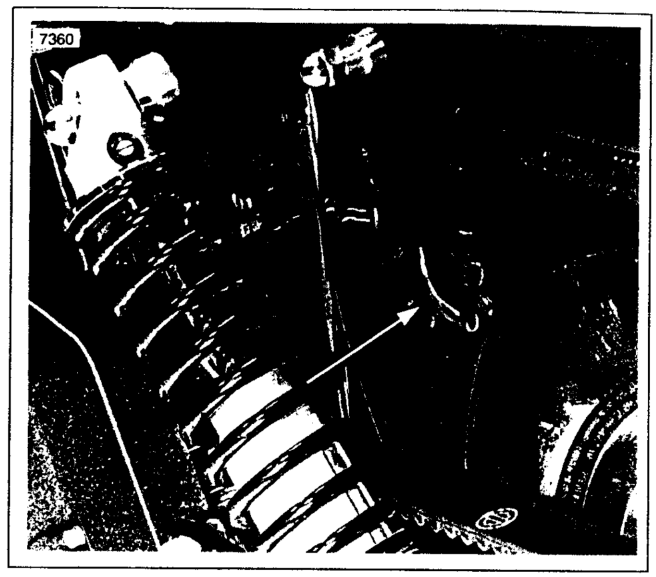


Figure 8-70. Service Loop-Rear

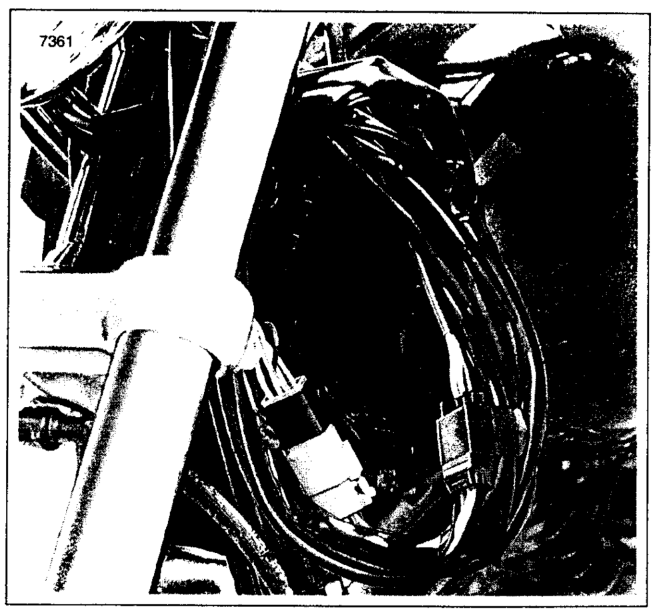


Figure 8-71. Main Harness Front Connectors

9. For FXDWG Models, the center console must be removed to access 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).

NOTE

The upper portion of the wiring harness is now free. Be careful to note routing before pulling harness out of position.

10. 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.
11. Gently pull wiring harness out of rear of frame tube.
12. Remove electrical panel, coil and following connectors:
    a. Data link.
    b. 30 amp main circuit breaker (disconnect regulator wire).
    c. Starter relay [123].
    d. Main fuse block.
    e. Coil connector [83].
13. Remove two ground wires from stud on frame.
14. Remove connector anchor from frame and disconnect tail lamp mini-harness connector [7].
15. Remove key switch connector [33] (Except FXDWG).
16. Disconnect starter solenoid.
17. Disconnect oil pressure switch connector [120], and CKP connector [79] and under seat. Pull harness out. Pay careful attention to harness routing.
18. Disconnect connectors [10] and [11] from the ignition module.
19. Disconnect two neutral switch post terminals.
20. Cut cable tie behind swing arm and remove rear brake light switch terminal.
21. Remove starter post nut, positive battery cable and main wiring harness ring terminal from starter post.
22. Cut cable tie on left side of frame backbone.
23. Remove fuel tank rear mounting bolt, acorn nut and washers.
24. Loosen fuel tank front mounting bolt and raise fuel tank and remove the following connectors:
    a. MAP sensor connector [80].
    b. Horn wires.
    c. Fuel gauge connector [13].
    d. Cut cable ties along frame backbone and remove regulator wire.
25. Remove speedometer speed sensor connector [65] from its T-stud.
26. See Figure 8-72. Remove wiring harness from frame by pulling out from left side on top of rear fender.



Figure 8-72. Main Wiring Harness-Rear

INSTALLATION

NOTE

Be sure to securely attach ground terminals to their proper frame locations and replace all cable straps.

1. Place harness wires into their original positions and reconnect the following rear harness connectors:
    a. MAP sensor connector [80].
    b. Horn wires.
    c. Fuel gauge connector [13].
    d. Install regulator wire to backbone and secure with cable ties.
    e. Speedometer speed sensor connector [65] back on T-stud.
    f. Starter solenoid.
    g. Key switch connector [33] (Except FXDWG).
    h. Position ground wires on frame stud.
    i. Positive battery cable and main wiring harness ring terminal to starter post.
    j. Neutral switch terminal posts (route wires under starter).
    k. Oil pressure switch connector [120], and CKP connector [79] under seat.
    l. Ignition module connectors [10] and [11].

2. Install the electrical panel and coil and reconnect the following connectors/components:
   a. Data link.
   b. 30 amp main circuit breaker (disconnect regulator wire).
   c. Starter relay connector [123].
   d. Main fuse block.
   e. Coil connector [83].
3. Push wiring harness into rear of frame tube.
4. 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. Pull harness forward through frame backbone far enough to gain access to front connectors.
5. Lower fuel tank and tighten front mounting bolt. Install rear fuel tank mounting bolt, washers and acorn nut.
6. For FXDWG Models, install odometer reset switch rubber boot and reconnect the following connectors:
   a. Right handlebar controls [22] (6-place Deutsch).
   b. Left handlebar controls [24] (6-place Deutsch).
   c. Front turn signals [31] (6-place Multilock).
   d. Headlamp [38] (4-place Multilock).
   e. Indicator lamps [21] (8-Place Mini-Deutsch).
   f. Key switch [33].
   g. Speedometer [39].
   h. Install console to fuel tank.
7. For all other models, 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 Only) Instruments [21].
   f. Headlamp [38].
8. Pull harness to rear of motorcycle to conceal front connectors.
9. Install the rubber frame plug behind the right side of the frame neck and secure it to the harness with a cable tie.
10. Install vapor valve and hose from front of fuel tank and secure with clip.
11. Make a loop at the rear of the frame with the excess harness and push the loop into the frame tube.
12. Install fender flap to inside of rear fender (snaps in place).
13. Install belt guard.

⚠WARNING

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in death or serious injury.

14. Connect battery cables, positive cable first.

⚠WARNING

After installing seat, pull upward on front of seat to be sure it is locked in position. If seat is loose, it could shift position during vehicle operation causing loss of control which could result in death or serious injury.

15. Install seat.

⚠WARNING

Check all lighting and switch operations before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have lighting and proper switch operations could result in death or serious injury.

16. Turn ignition ON. Test switches for correct operation.

GENERAL

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.

NOTE

To replace or repair individual switches in either the right or left handlebar switch assemblies, see SWITCH REPAIR/ REPLACEMENT following the REMOVAL/INSTALLATION procedures.

REPAIR PROCEDURES

See 8.35 RIGHT HANDLEBAR SWITCH and 8.36 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

Use caution when operating the UltraTorch UT-100 or any other radiant heating device. Read the manufacturers instructions carefully before use. Improper handling could result in death or serious injury. Always keep hands away from tool tip area and heat shrink attachment. Avoid directing the heat toward any fuel system component. Extreme heat can cause fuel ignition or explosion. Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed. Be sure to turn the "ON/ OFF" switch to the "OFF" position after use.

6. Using the UltraTorch UT-100 Robinair Heat Gun with heatshrink attachment 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.

CAUTION

Electrically connected solder outside the tubing may cause a short to ground.

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.

REMOVAL

NOTE

The removal and installation steps listed apply when replacing the entire switch assembly, switch housing or handlebars.

CAUTION

Do not remove the switch housing assembly without first placing a 5/32 in. (4 mm) thick cardboard insert between the brake lever and lever bracket. Removing the assembly without the insert in place may result in damage to the rubber boot and plunger of the front stoplight switch.

1. See Figure 8-73. Place the cardboard insert between the brake lever and lever bracket.
2. 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.
3. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
4. 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.

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 throttle control grip from the end of the handlebar.
7. 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.

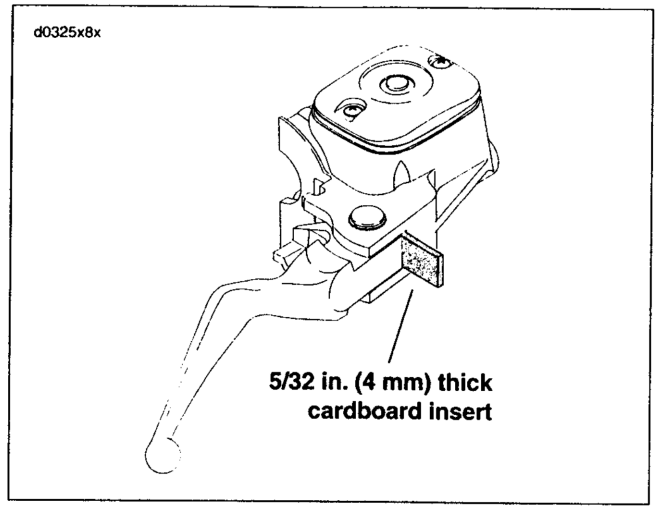
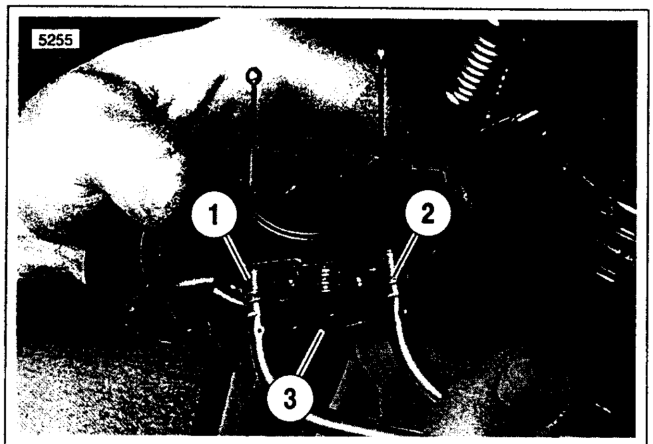


Figure 8-73. Install Cardboard Insert



1. **Idle cable insert (gold insert, rear hole)**
2. **Throttle cable insert (silver insert, front hole)**
3. **Tension adjuster screw**

Figure 8-74. Right Lower Switch Housing

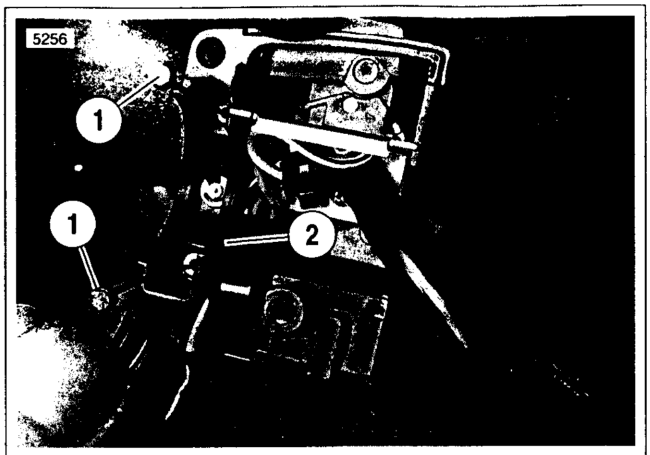
INSTALLATION

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 8-74. 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 the tension adjuster screw (3).



1. End fittings
2. Upper switch housing cable

Figure 8-75. Route Cable to Upper Switch Housing

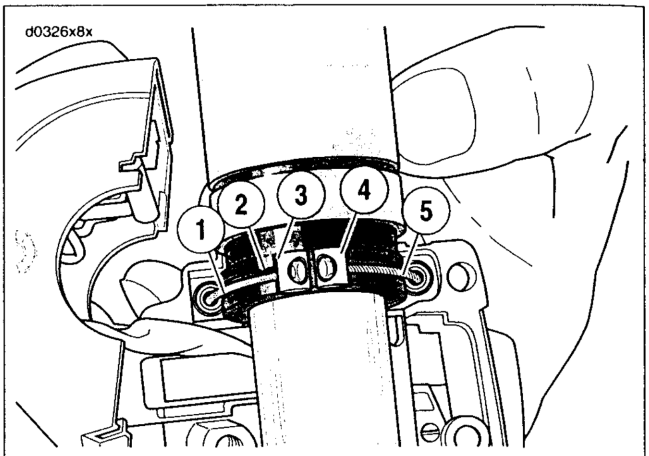
NOTE

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 8-75. 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 inch (3.2 mm).
5. See Figure 8-76. 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

See Figure 8-77. Do not remove the 5/32 in. (4 mm) thick cardboard insert wedged between the brake lever and lever bracket. Removal will result in damage to the rubber boot and plunger of the front stoplight switch during installation of the master cylinder assembly.



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 8-76. Throttle Cable Installation

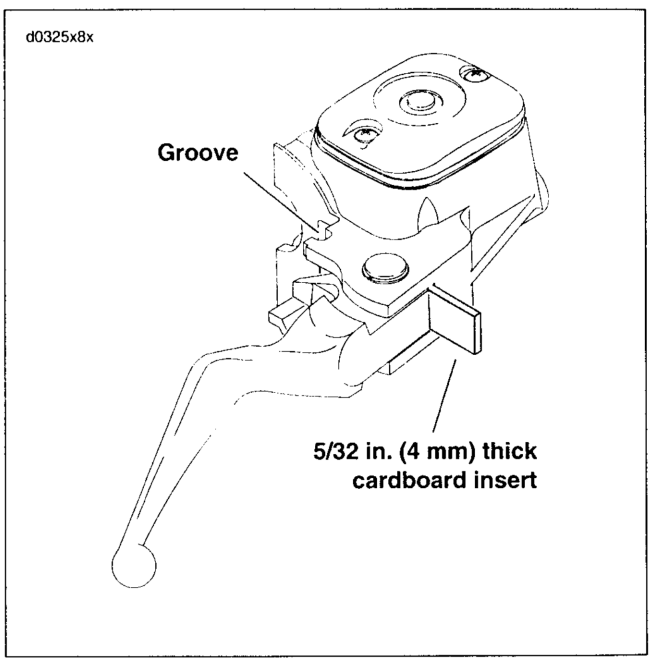


Figure 8-77. Leave Cardboard Insert in Place

9. See Figure 8-78. 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 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 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.

11. Using a T25 TORX drive head, tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.1 Nm).

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.

12. Remove the cardboard insert between the brake lever and lever bracket.

⚠WARNING

Check all lighting and switch operations before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have lighting and proper switch operations could result in death or serious injury.

13. Test the switches for proper operation.

14. 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.

DISASSEMBLY

CAUTION

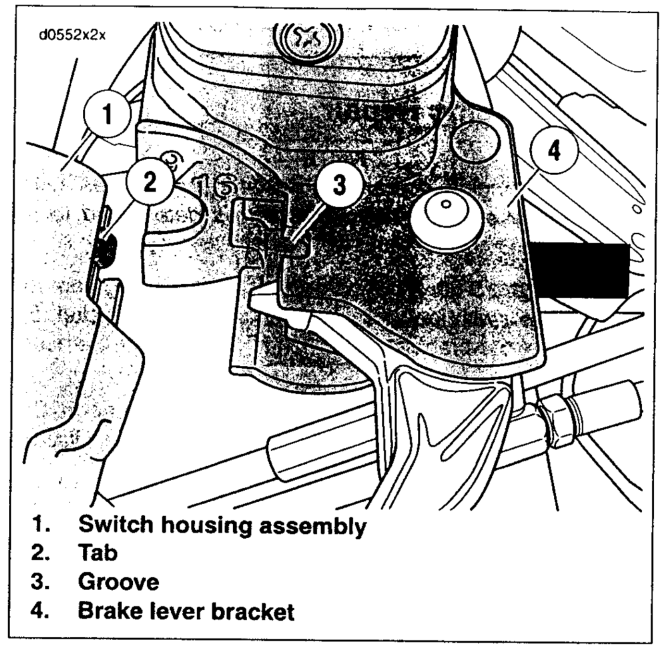
See Figure 8-77. Do not remove the switch housing assembly without first placing a 5/32 in. (4 mm) cardboard insert between the brake lever and lever bracket. Removing the assembly without the insert in place may result in damage to the rubber boot and plunger of the front stoplight switch.

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.

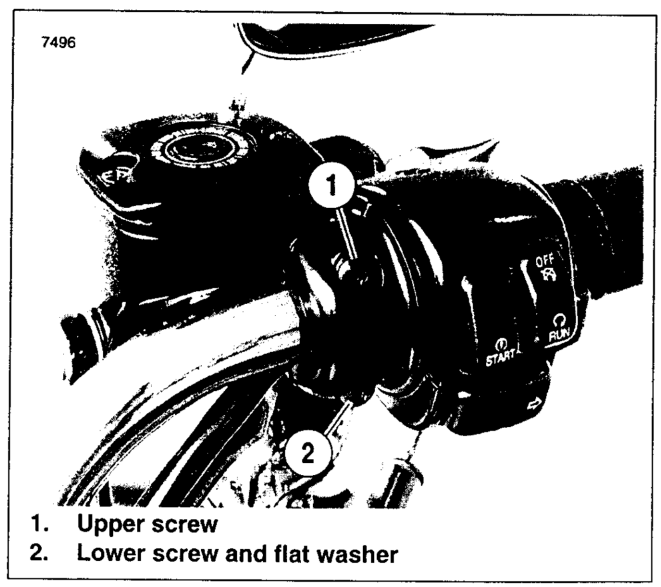
3. If replacing lower housing switches, perform steps 4 through 7 before continuing to repair section. If replacing upper housing switches, proceed directly to repair section.

4. See Figure 8-79. Using a T27 TORX drive head, loosen the upper screw (1) securing the handlebar clamp to the master cylinder housing. Remove the lower clamp screw with flat washer (2).



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

Figure 8-78. Switch Housing Alignment



1. **Upper screw**
2. **Lower screw and flat washer**

Figure 8-79. Handlebar Clamp Screws

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

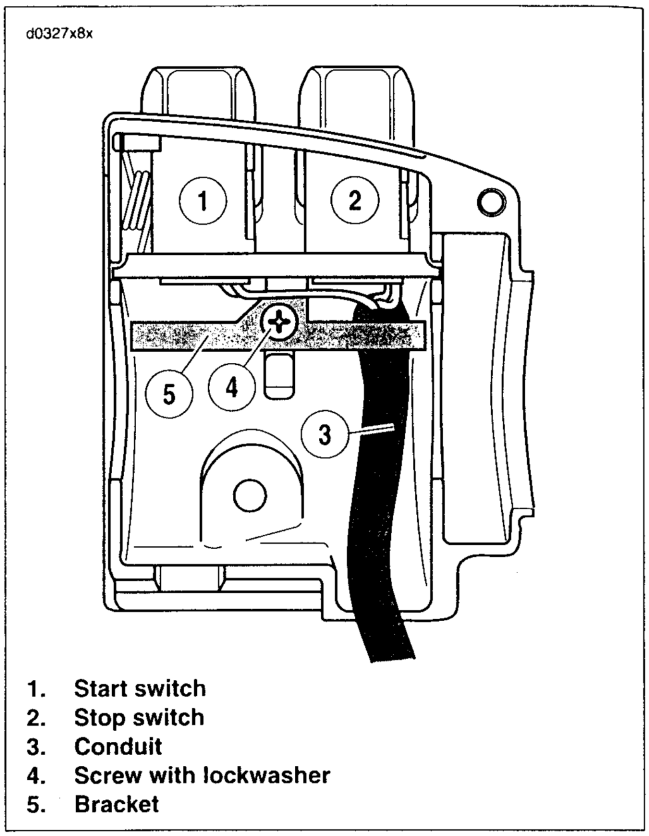
Replace the engine stop and engine start switches as a single assembly even if only one switch is determined to be faulty.

1. See Figure 8-80. 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

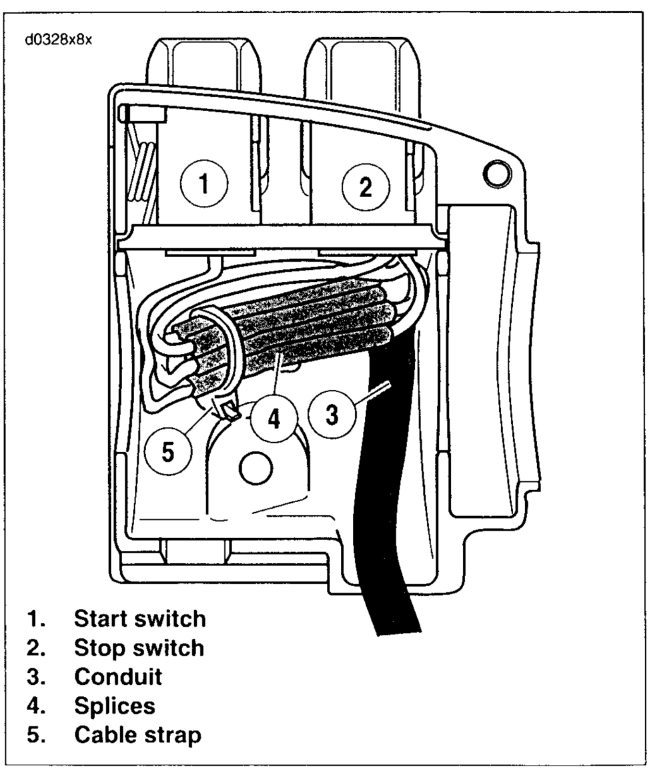
Replacement stop switch and start switch wires are cut to length (2.5 in./63.5 mm and 2.0 in./50.8 mm, respectively) and partially stripped.

5. See 8.34 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 8-81. Route wires downstream of splices beneath wing on engine stop switch side of bracket as seen in Figure 8-80.
7. See Figure 8-81. 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 8-80. 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 ASSEMBLY on page 8-62.



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Screw with lockwasher**
5. **Bracket**

Figure 8-80. Upper Housing Without Splices



1. **Start switch**
2. **Stop switch**
3. **Conduit**
4. **Splices**
5. **Cable strap**

Figure 8-81. 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.

TURN-RIGHT SIGNAL SWITCH

1. 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 (1.5 in./38.1 mm) and partially stripped.

2. See 8.34 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
3. Continue with ASSEMBLY on page 8-62.

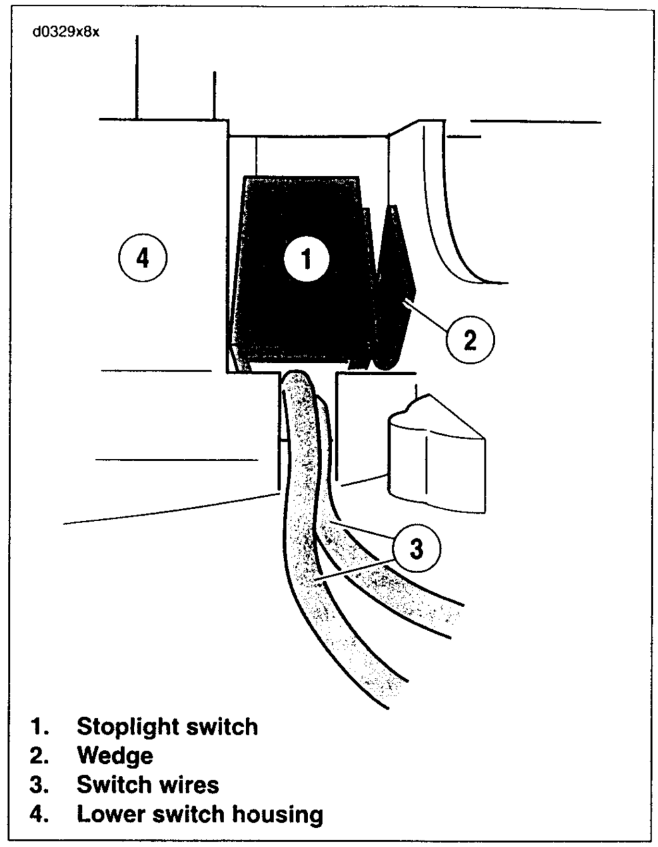
FRONT STOPLIGHT SWITCH

1. 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.
2. Cut wires 1.0 in. (25.4 mm) from old switch. Discard old switch.

NOTE

Replacement stoplight switch wires are cut to length (2.5 in./63.5 mm) and partially stripped.

3. See 8.34 HANDLEBAR SWITCH ASSEMBLIES for information on repair practices.
4. 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.
5. 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.



1. **Stoplight switch**
2. **Wedge**
3. **Switch wires**
4. **Lower switch housing**

Figure 8-82. Install Stoplight Switch

6. See Figure 8-82. 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.
7. 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.
8. Continue with ASSEMBLY on page 8-62.

ASSEMBLY

1. See Figure 8-83. 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

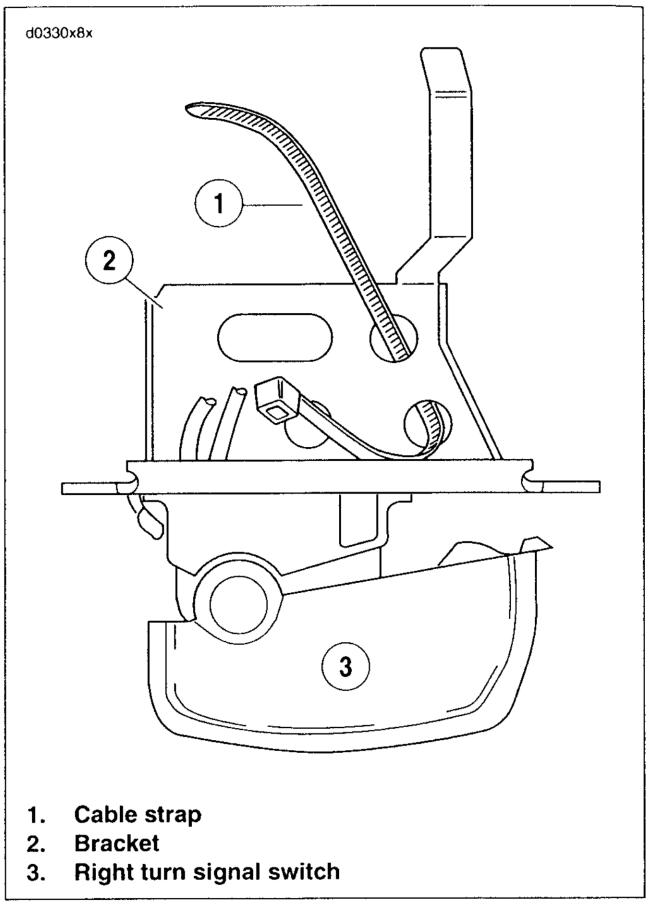
Be sure that all splices are positioned above the turn signal switch bracket.

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 may be pinched by casting or handlebar resulting in switch failure.

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 INSTALLATION on page 8-57.
   a. If lower housing switches were replaced, perform the whole procedure.
   b. If upper housing switches were replaced, begin with step 11.



1. **Cable strap**
2. **Bracket**
3. **Right turn signal switch**

Figure 8-83. 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.

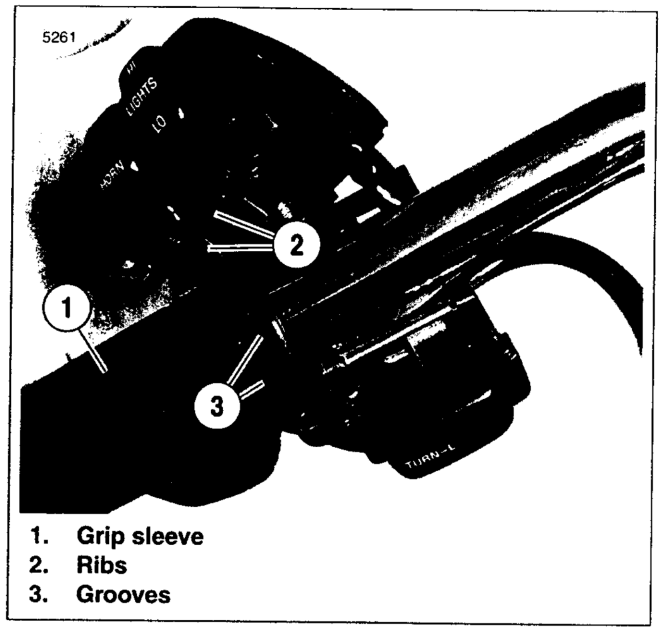
1. Using a T27 TORX drive head, remove the two screws with flat washers securing the handlebar clamp to the clutch lever bracket. Remove the clutch hand lever assembly and clamp from the handlebar.
2. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
3. Remove the grip sleeve 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 8-84. 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 8-85. 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 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 60-80 **in-lbs** (6.8-9.0 Nm) using a T27 TORX drive head.
7. Using a T25 TORX drive head, tighten lower and upper switch housing screws to 35-45 **in-lbs** (4.0-5.1 Nm).

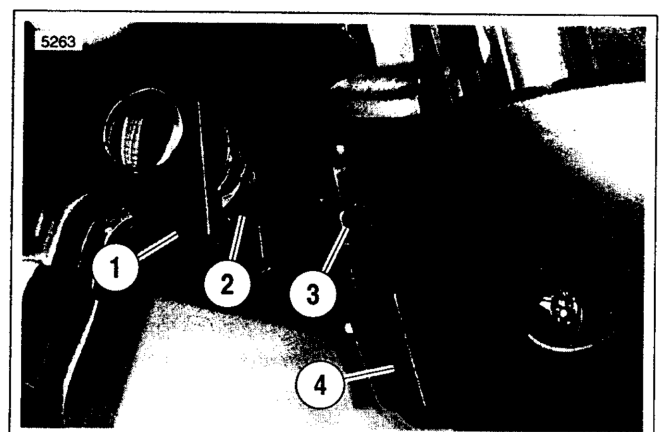
NOTE

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.



1. **Grip sleeve**
2. **Ribs**
3. **Grooves**

Figure 8-84. Left Handlebar Switch Housings



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

Figure 8-85. Clutch Lever Bracket

⚠WARNING

Check all lighting and switch operations before riding motorcycle. Visibility is a major concern for motorcyclists. Failure to have lighting and proper switch operations could result in death or serious injury.

8. Test the switches for proper operation.
9. 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.

DISASSEMBLY

1. Using a T25 TORX drive head, remove the upper and lower switch housing screws.
2. If replacing lower housing switches, perform step 3 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

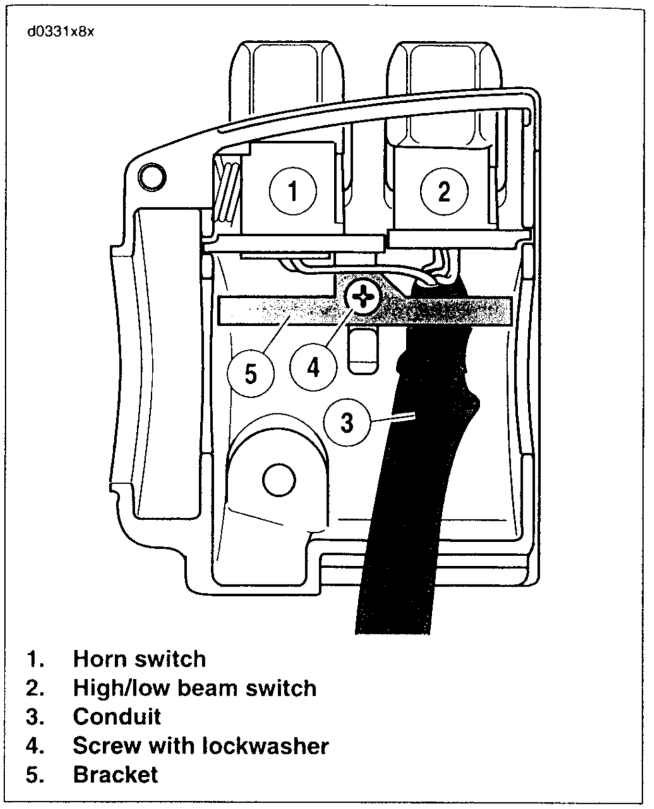
Replace the horn switch and high/low beam switch as a single assembly even if only one switch is determined to be faulty.

1. See Figure 8-86. 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

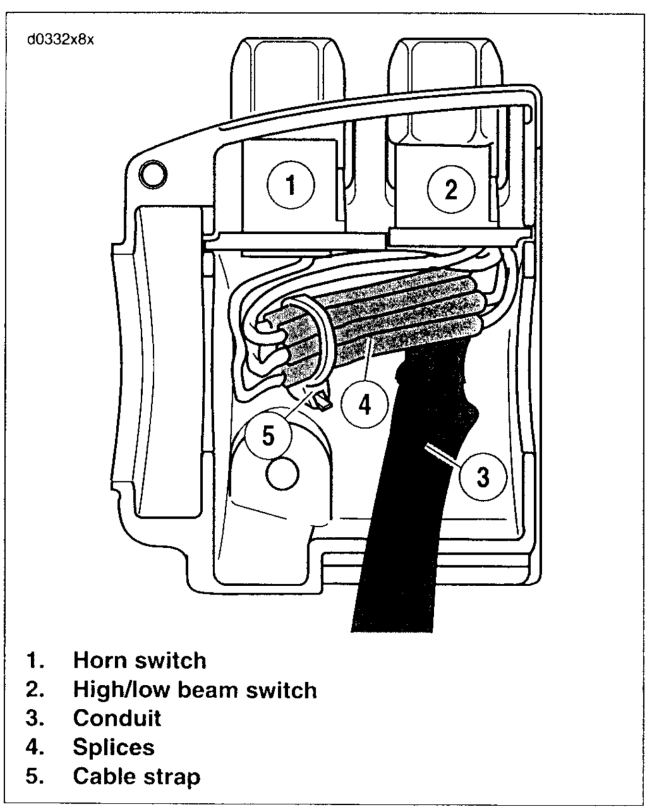
Replacement high/low beam switch and horn switch wires are cut to length (2.5 in./63.5 mm and 2.0 in./50.8 mm, respectively) and partially stripped.

5. See 8.34 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 high/low beam switch side of bracket as seen in Figure 8-86.
7. See Figure 8-87. 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 8-86. 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 ASSEMBLY on page 8-65.



1. **Horn switch**
2. **High/low beam switch**
3. **Conduit**
4. **Screw with lockwasher**
5. **Bracket**

Figure 8-86. Upper Housing Without Splices



1. **Horn switch**
2. **High/low beam 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 screw with lockwasher to release the turn signal switch bracket. Remove the bracket and switch assembly from the housing.
3. Cut wires 1.5 in. (38.1 mm) from old switch (Turn-L(eft) Signal Switch). Discard switch assembly.
4. See 8.34 HANDLEBAR SWITCH ASSEMBLIES for information on splicing and general repair practices.
5. Continue with ASSEMBLY which follows.

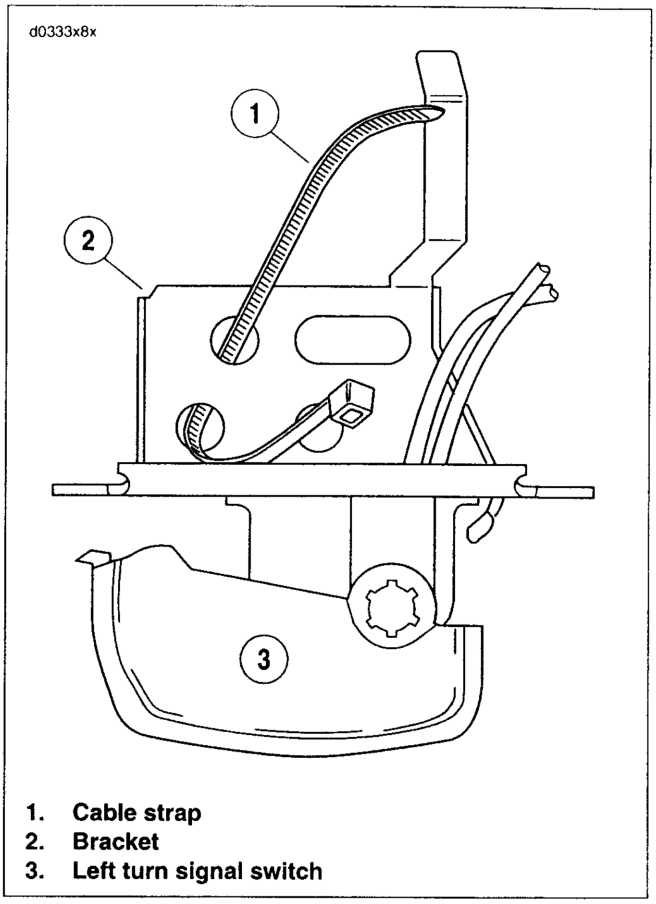
ASSEMBLY

1. See Figure 8-88. 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.
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 INSTALLATION on page 8-63.
   a. If lower housing switches were replaced, perform the whole procedure.
   b. If upper housing switches were replaced, begin with step 7.



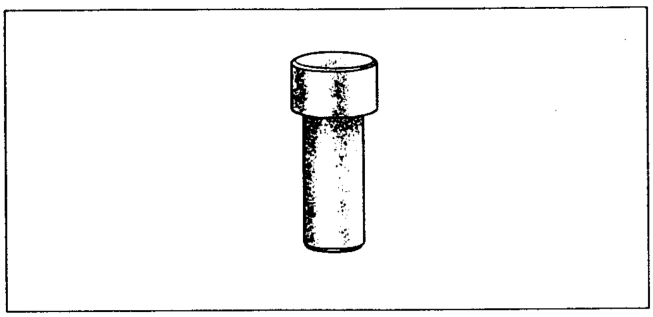
1. **Cable strap**
2. **Bracket**
3. **Left turn signal switch**

Figure 8-88. Insert Cable Strap in Switch Bracket

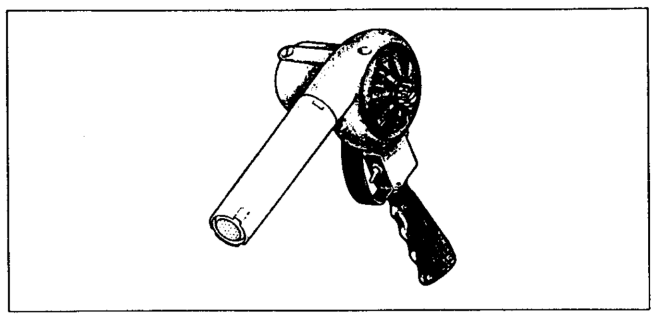
NOTES

SUBJECT	PAGE NO.
Appendix A-Tools	A-1
Appendix B-Wiring	B-1
Appendix C-Metric Conversions	C-1

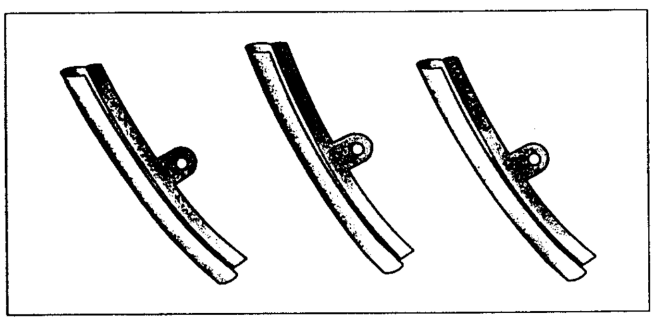
APPENDIX



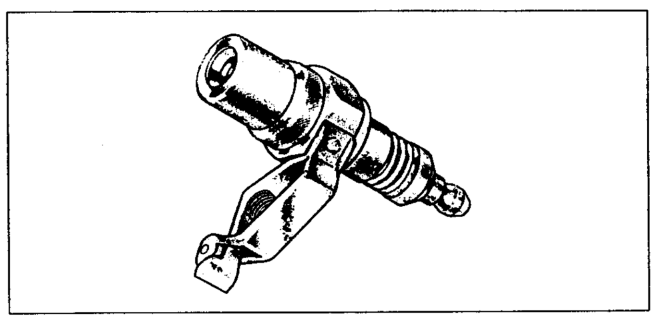
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(Use with HD-42720-5)



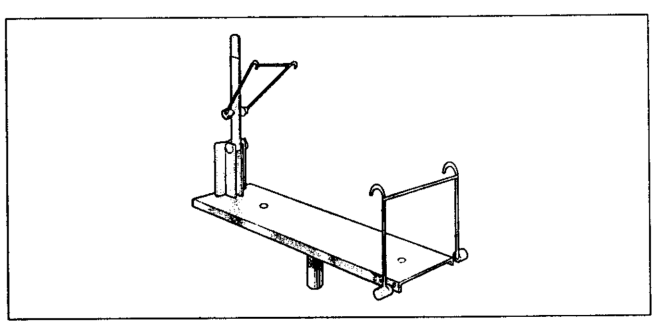
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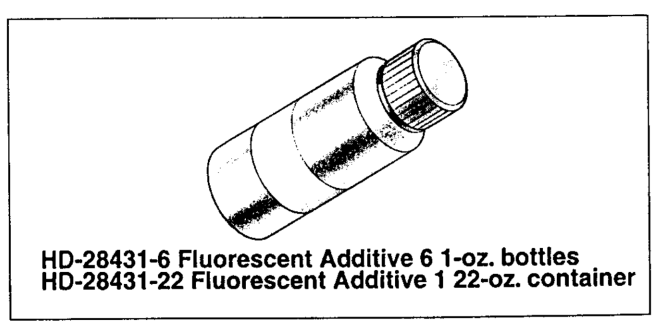
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Part No. HD-26792 Spark Tester

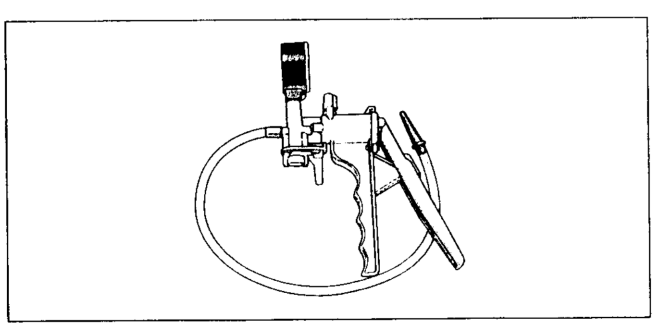


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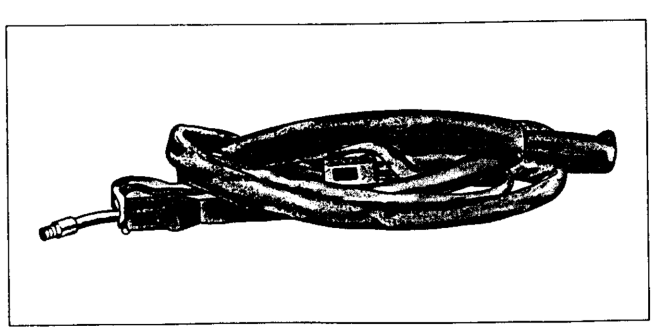


HD-28431-6 Fluorescent Additive 6 1-oz. bottles
HD-28431-22 Fluorescent Additive 1 22-oz. container

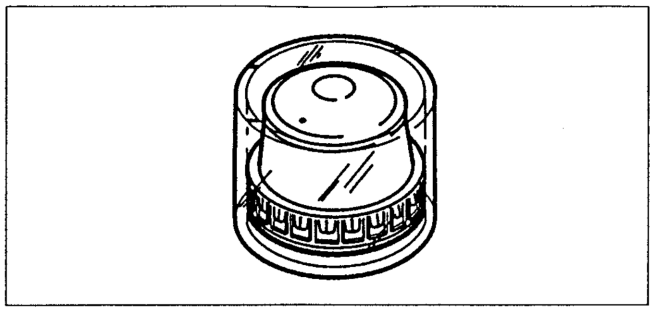
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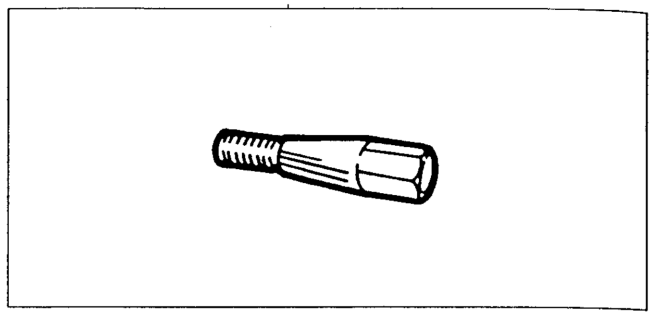
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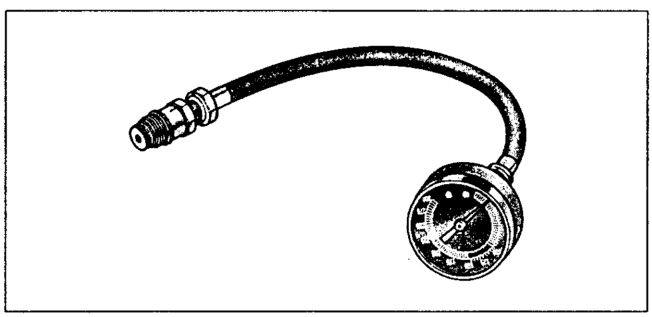
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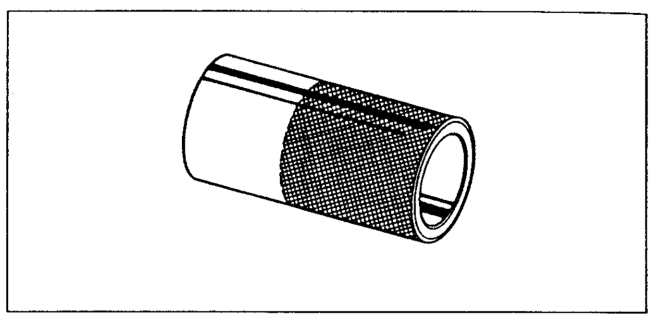
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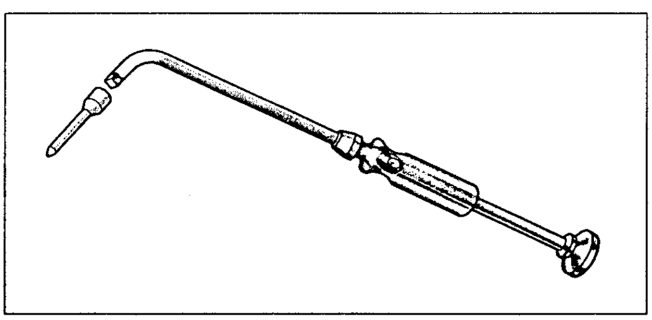
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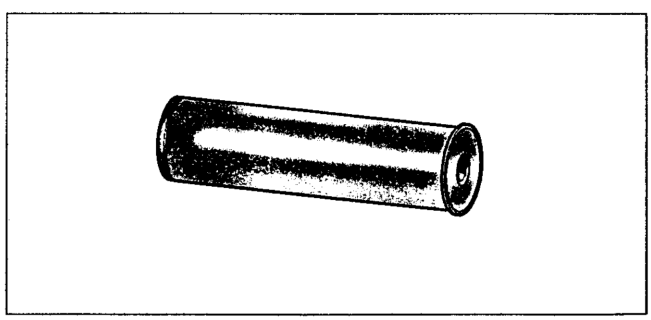
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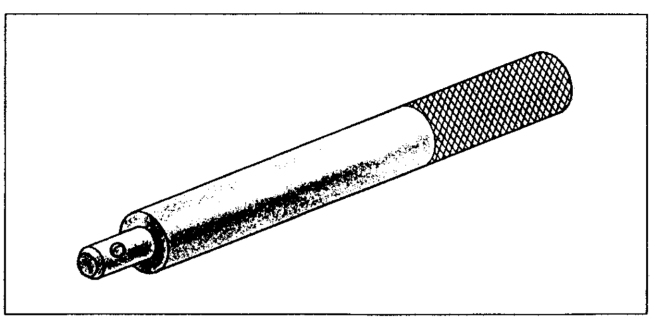
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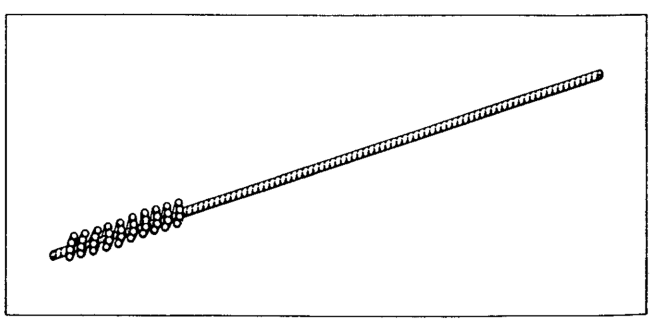
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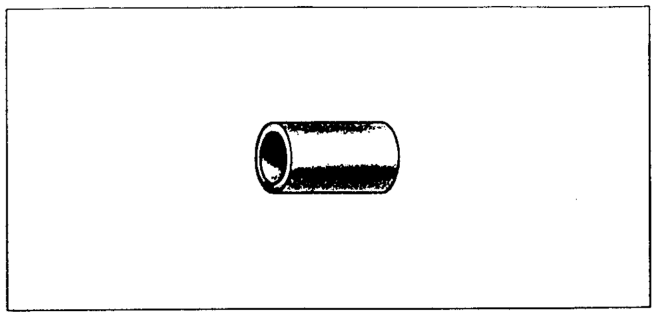
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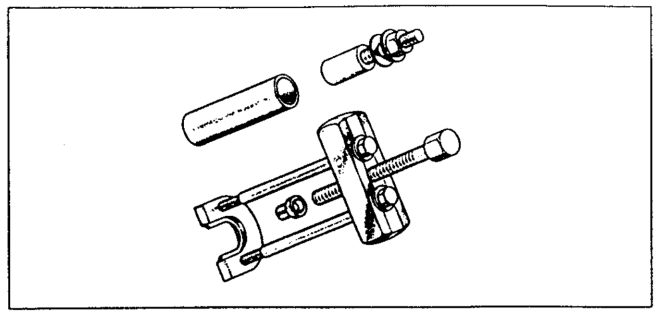
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4 in. length (Part No. HD-45907), 7 in. length (Part
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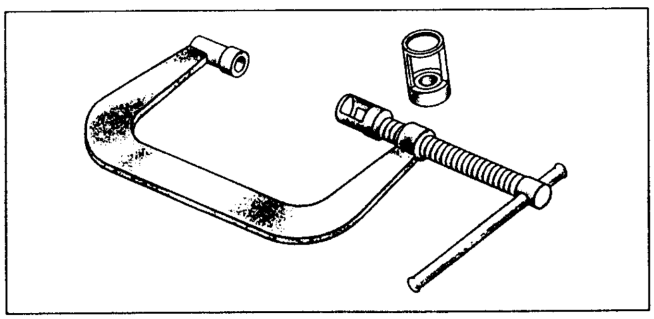
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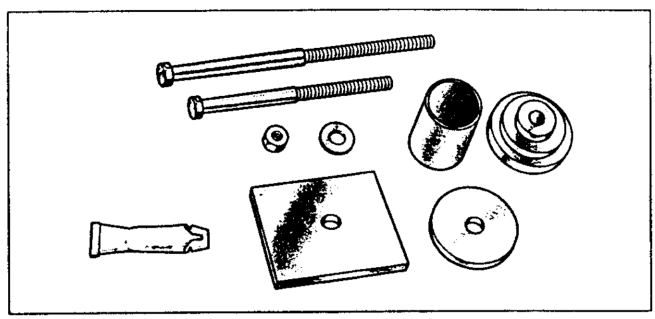
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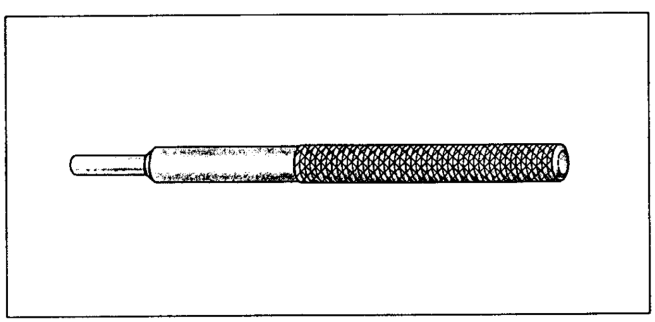
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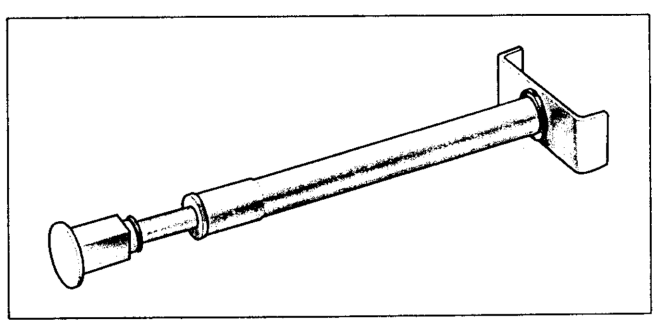
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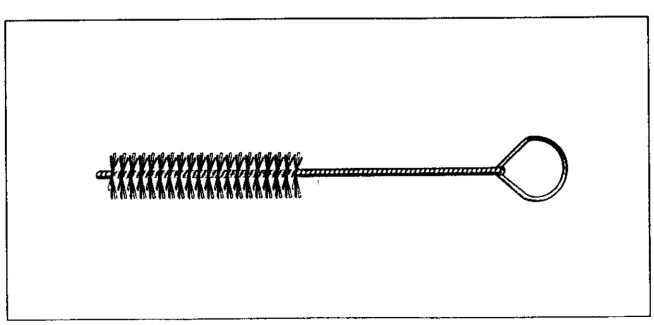
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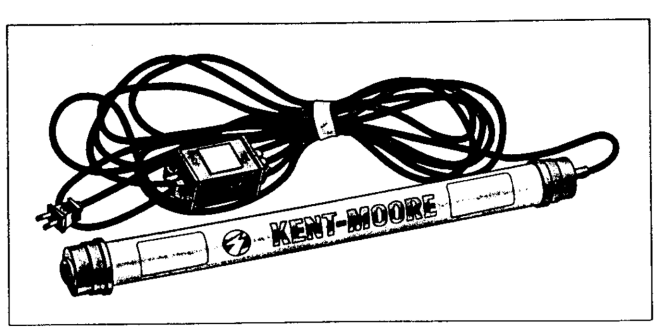
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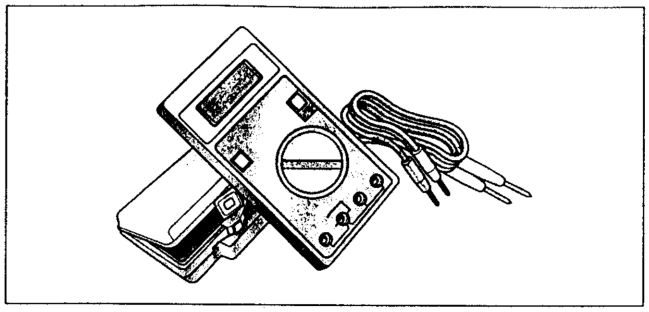
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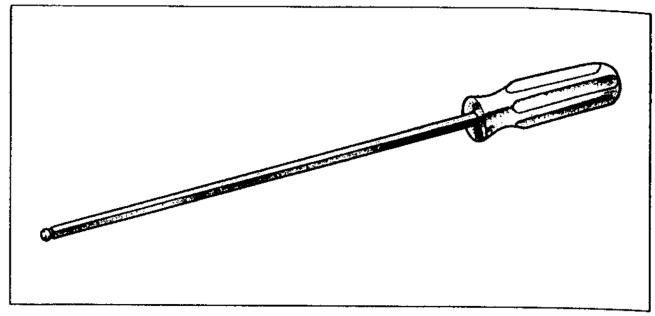
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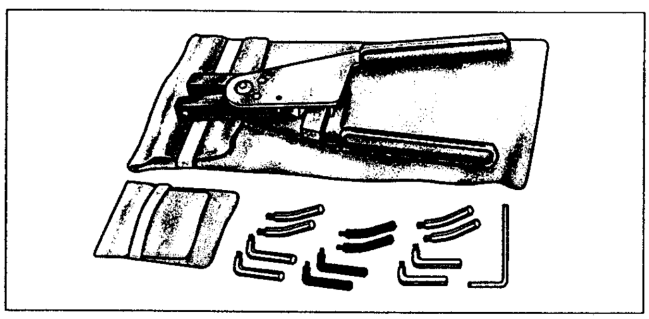
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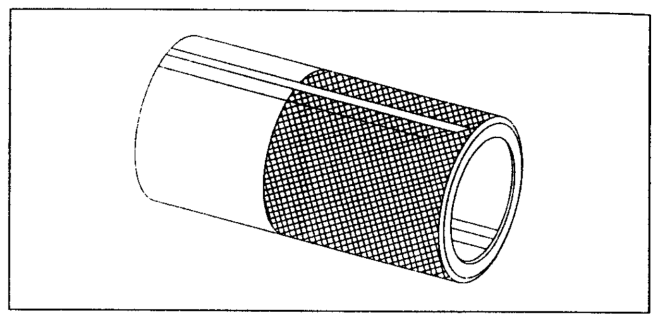
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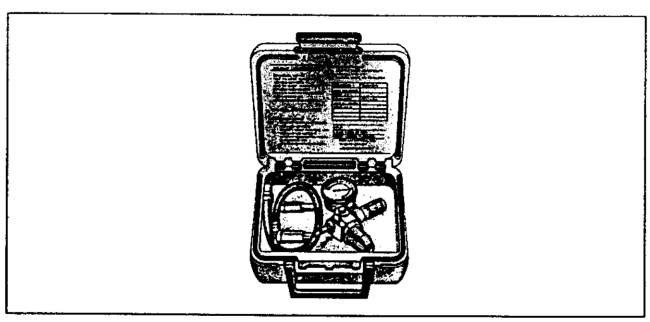
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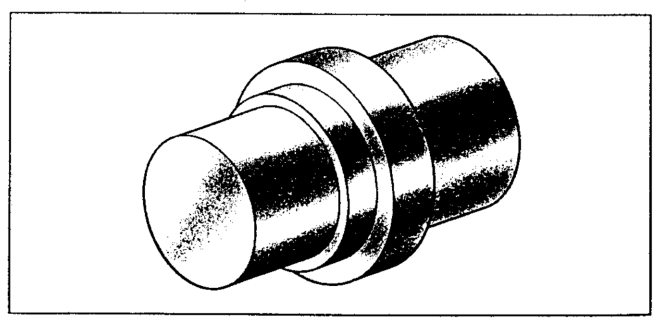
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Retaining Ring Pliers



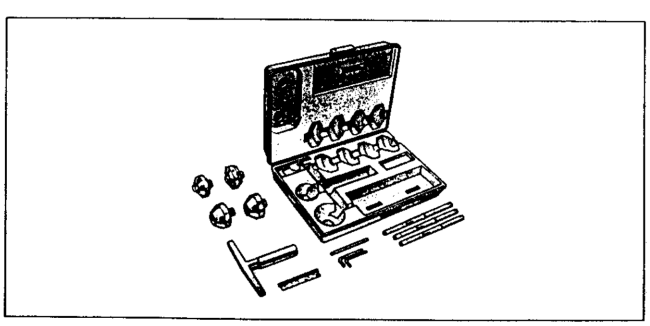
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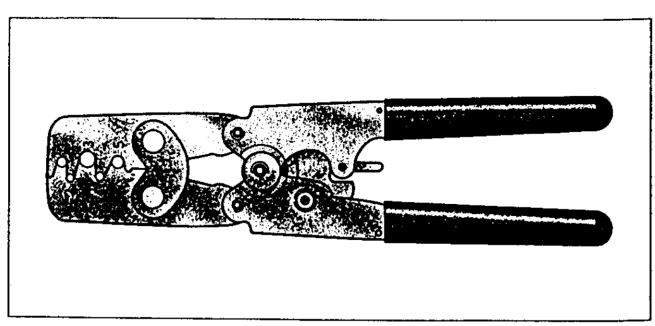
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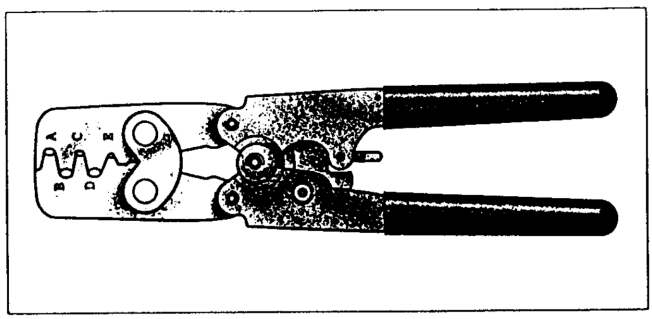
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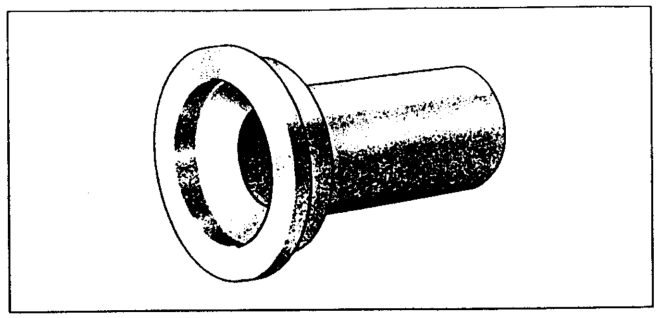
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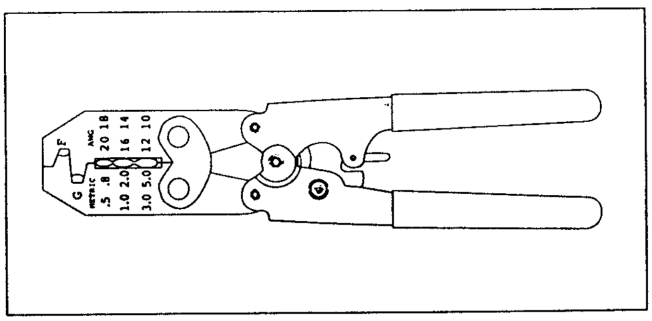
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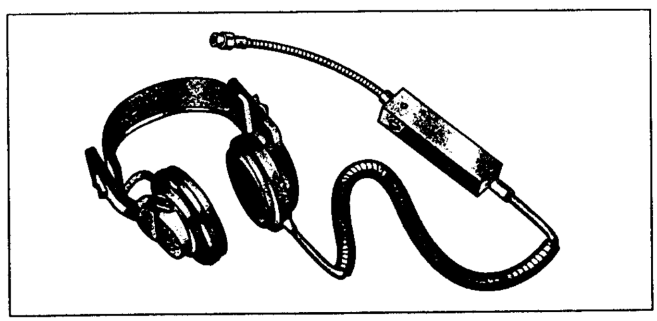
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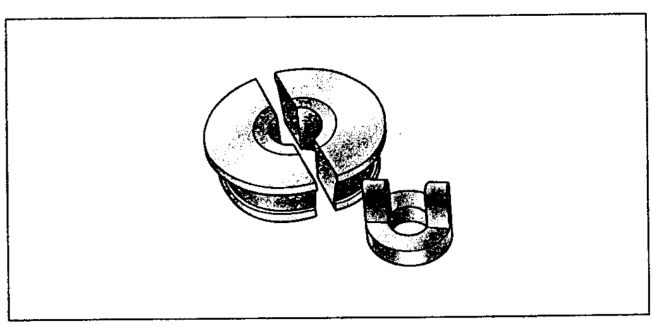
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Installation Tool.
(Use with HD-97225-55B)



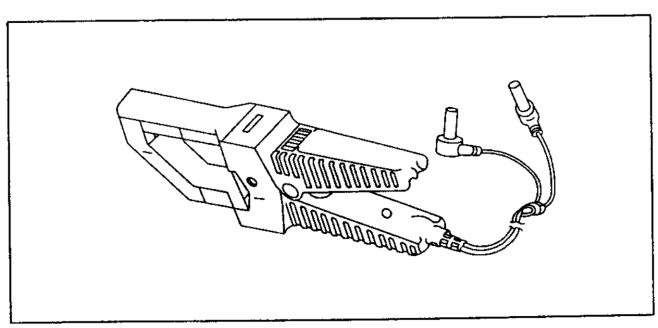
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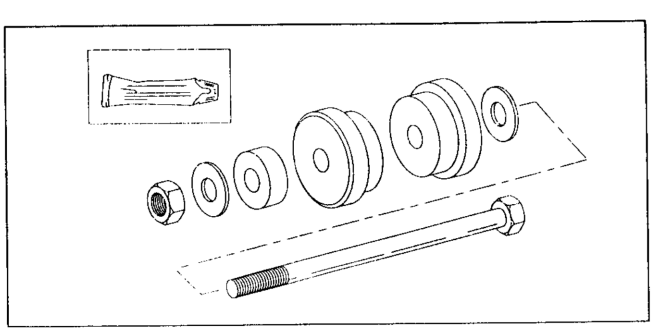
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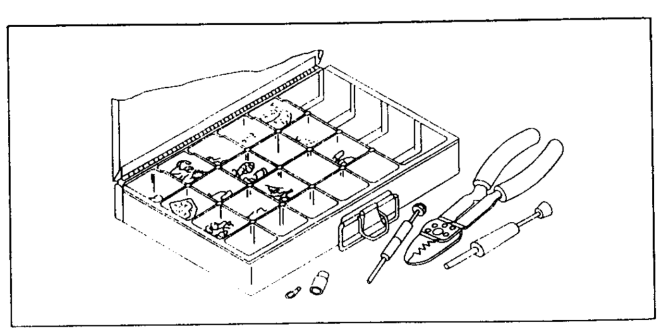
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Race Remover
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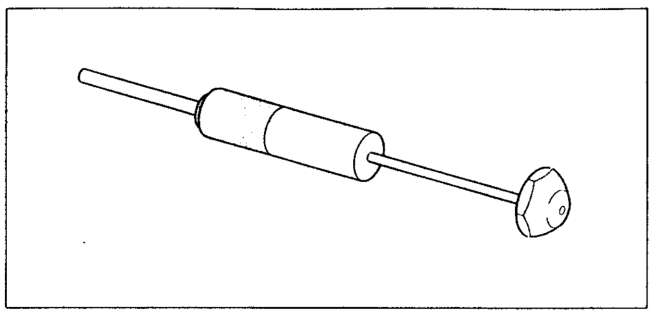
Part No. HD-39617 Inductive Amp Probe.
(Use with HD-35500-B)



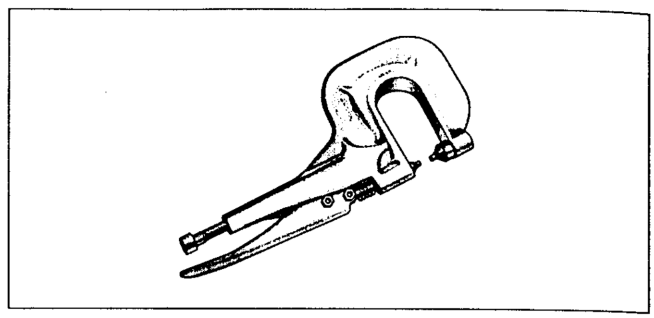
Part No. HD-39302 Steering Head Bearing
Race Installer



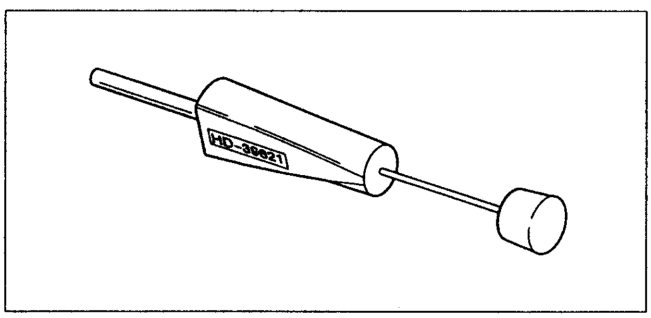
Part No. HD-39621 Electrical Terminal Repair Kit



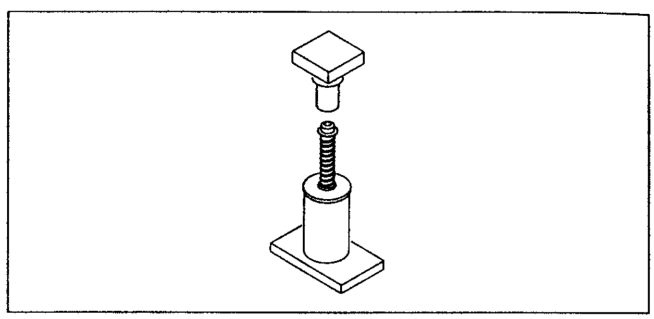
Part No. HD-39621-27 Socket Terminal Remover
(AMP Connectors)



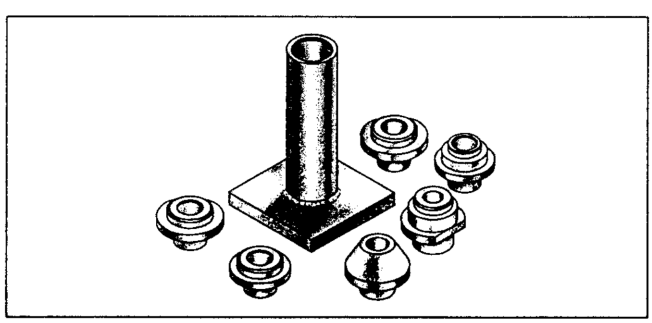
Part No. HD-39787 Rivet Tool



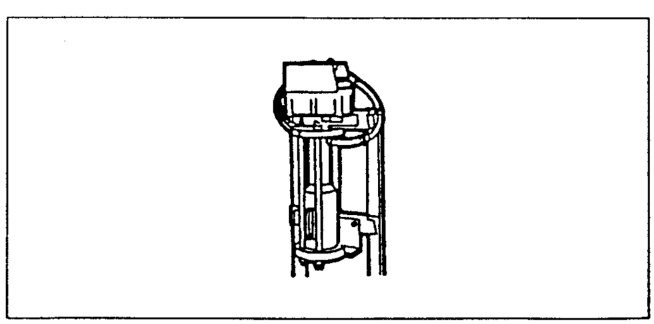
Part No. HD-39621-28 Pin Terminal Remover
(AMP Connectors)



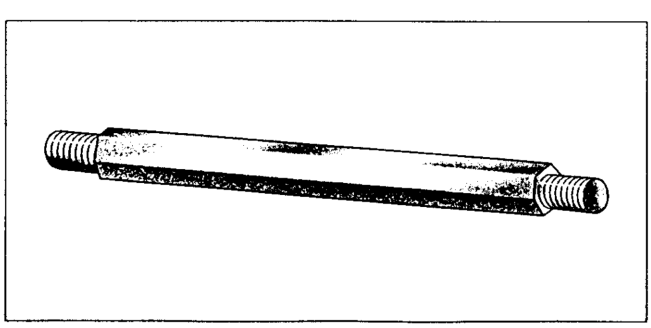
Part No. HD-39800 Oil Filter Crusher (Small)



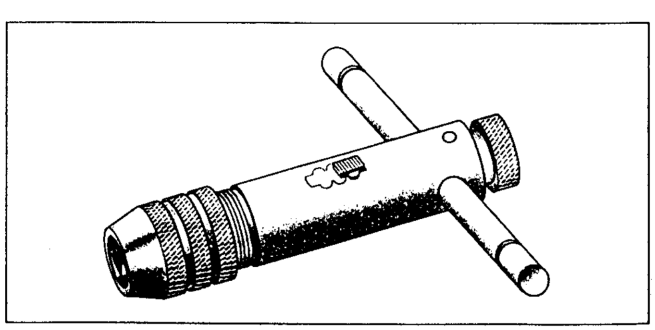
Part No. HD-39782-A Cylinder Head Support Stand



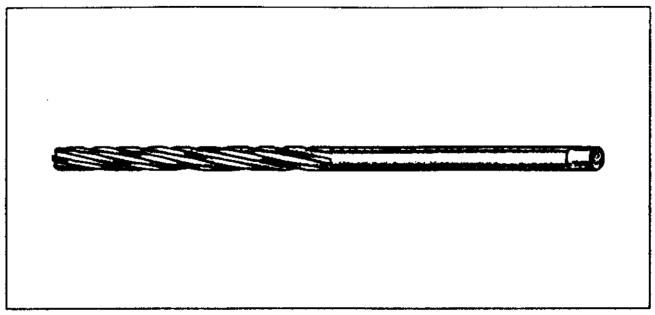
Part No. HD-39823 25-Ton Oil Filter Crusher



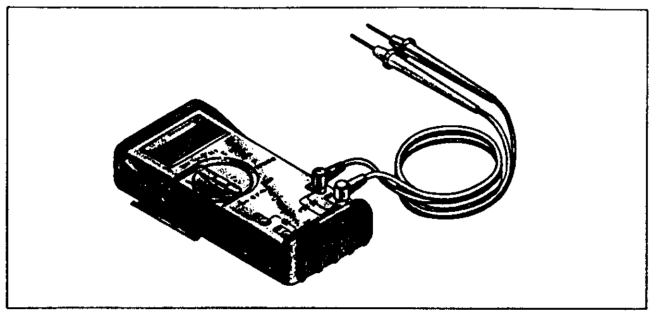
Part No. HD-39786-A Cylinder Head Holding Fixture



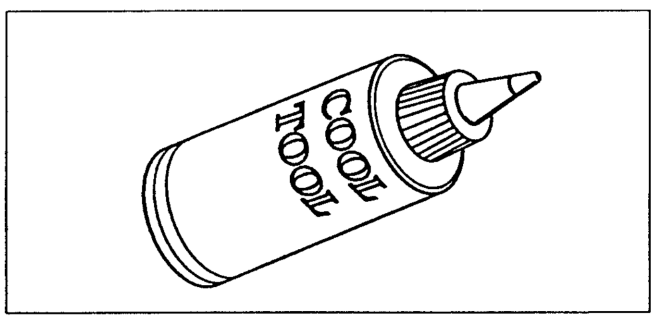
Part No. HD-39847 Universal Ratcheting
Tap/Reamer Handle



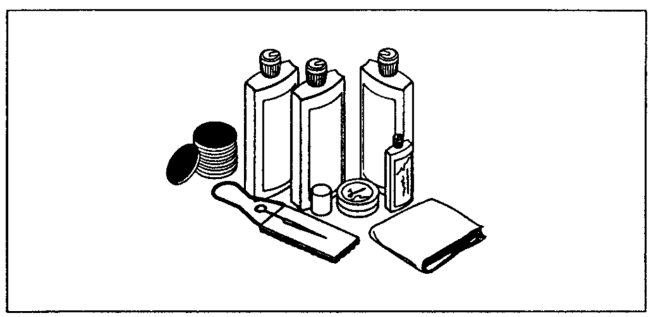
Part No. HD-39932 (Steel) or HD-39932-CAR (Carbide)
Intake and Exhaust Valve Guide Reamer



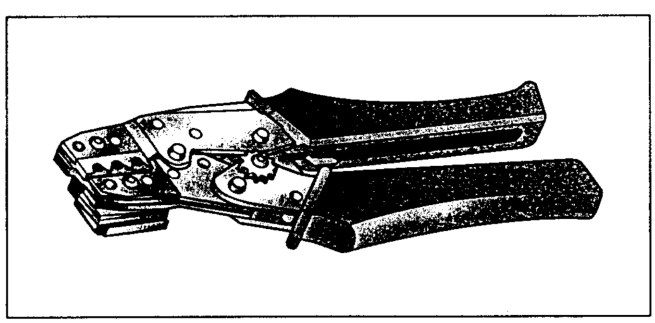
Part No. HD-39978 Multi-Meter (FLUKE 78)
(Use with HD-42682)



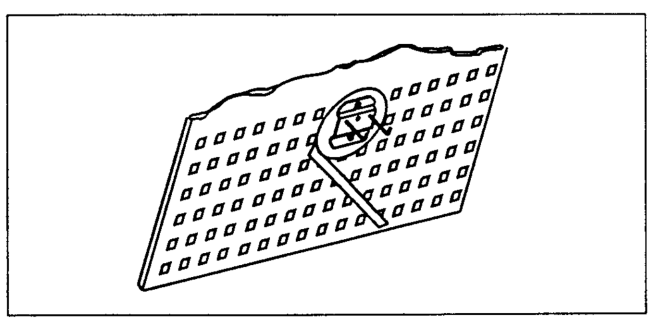
Part No. HD-39964 Reamer Lubricant (Cool Tool)



Part No. HD-39994 Paint Repair Kit



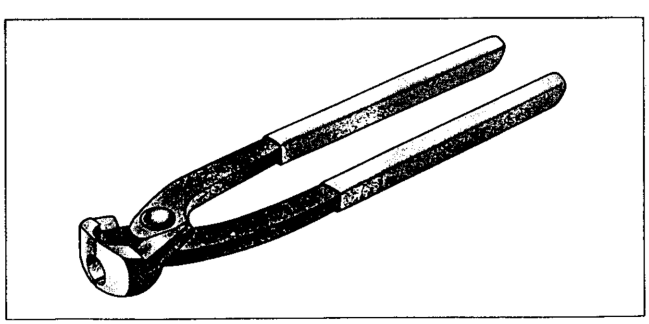
Part No. HD-39965 Deutsch Terminal Crimp Tool



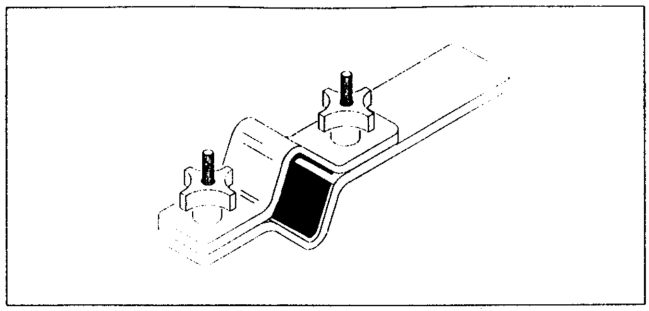
Part No. HD-41025-A Tool Organizational System



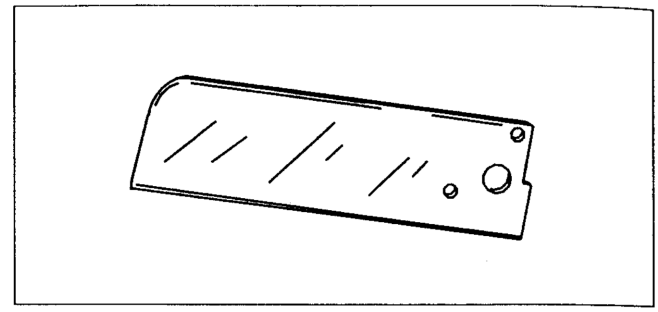
Part No. HD-39969 Ultra-Torch UT-100



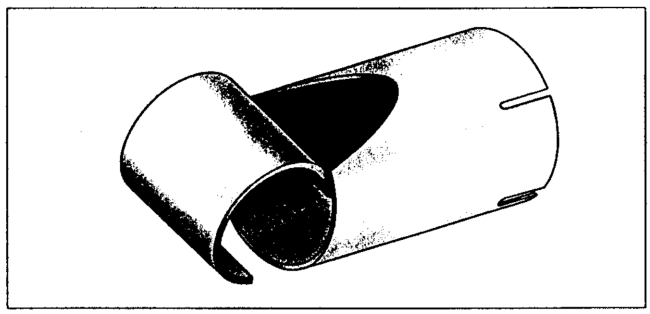
Part No. HD-41137 Two-Way Hose Clamp Pliers



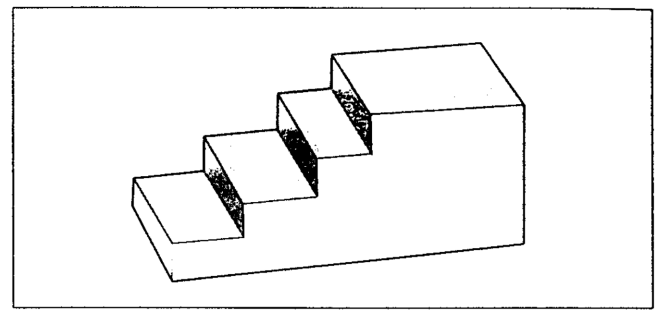
Part No. HD-41177 Fork Tube Holder



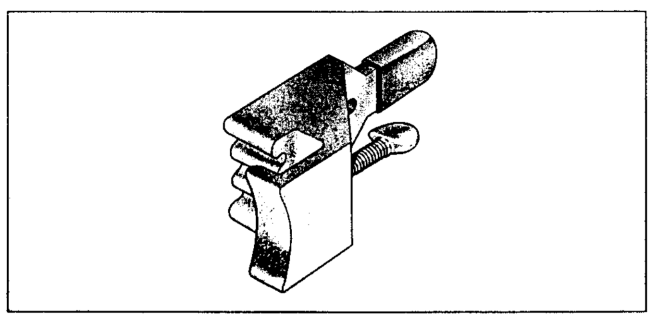
Part No. HD-41185-1 Hose Cutter Blade



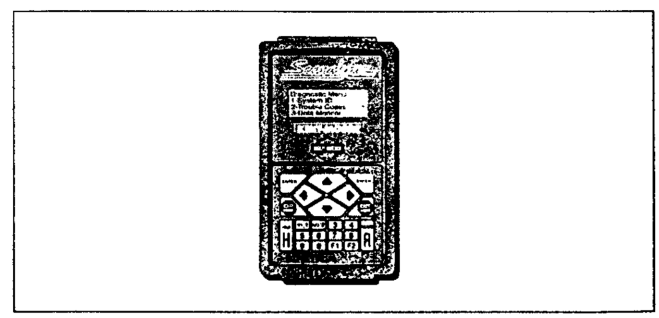
Part No. HD-41183 Robinair Heat Gun Shrink Tool Attachment (Use with HD-25070)



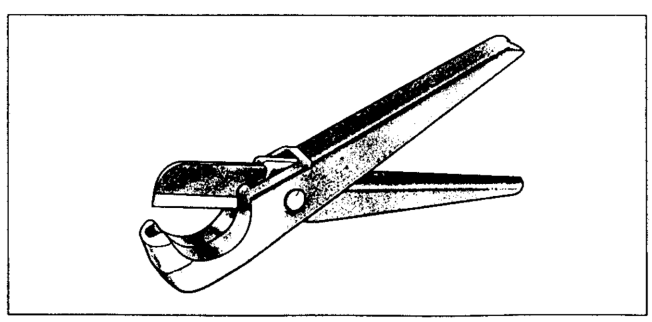
Part No. HD-41214 Primary Drive Locking Tool



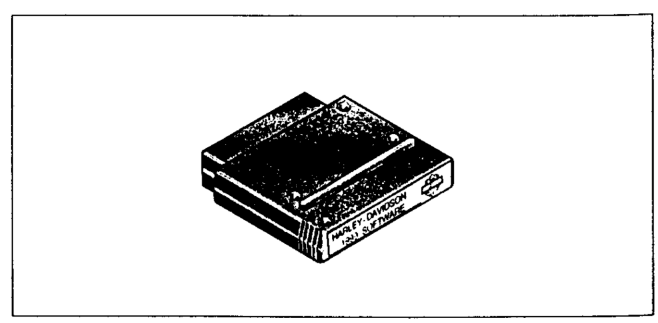
Part No. HD-41184 Final Drive Sprocket Holding Tool



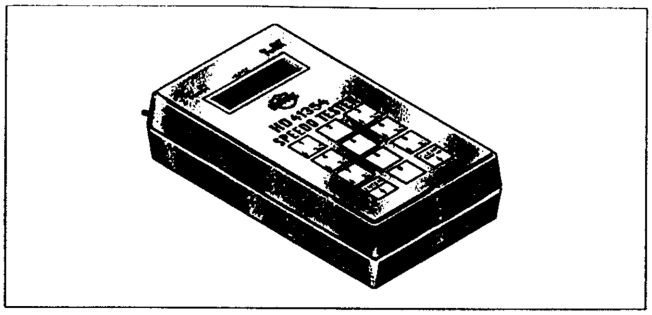
Part No. HD-41325-D Scanalyzer



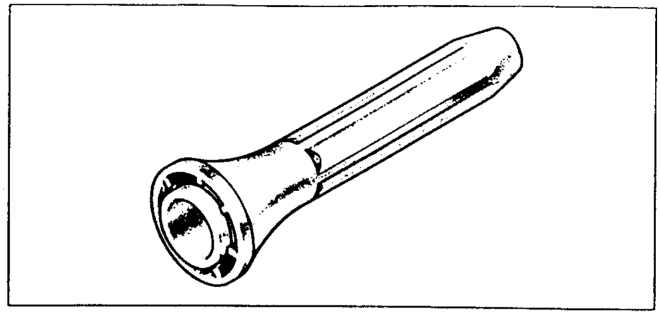
Part No. HD-41185 Hose Cutting Tool



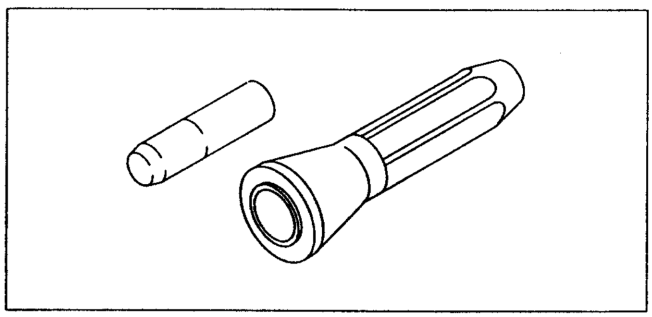
Part No. HD-41325-95C Scanalyzer Cartridge



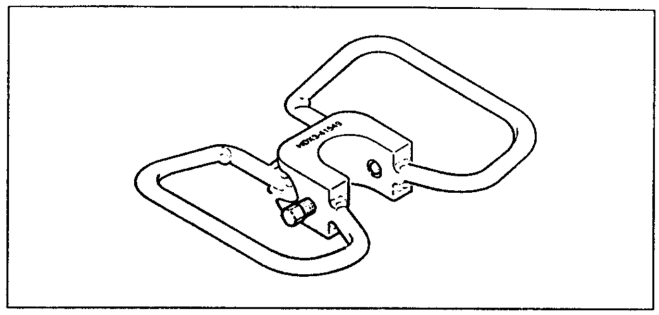
Part No. HD-41354 Speedometer Tester



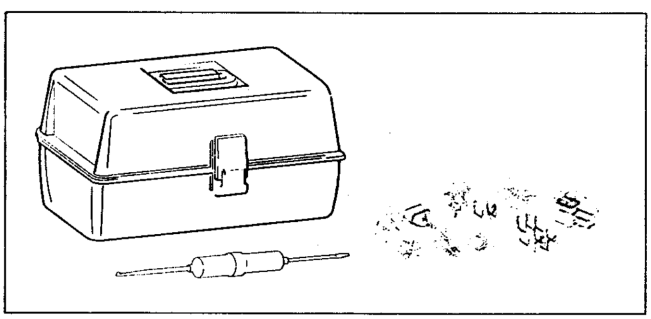
Part No. HD-41496 Main Drive Gear Large Seal Installer



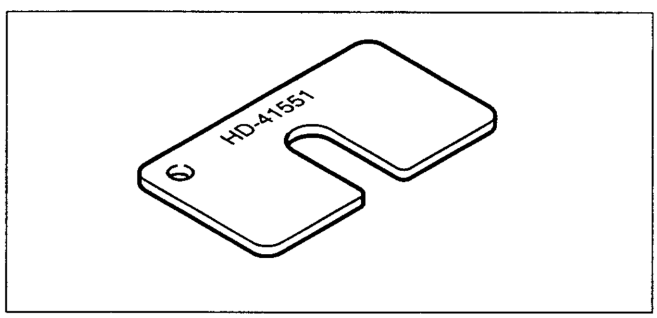
Part No. HD-41405 Main Drive Gear Seal Installer



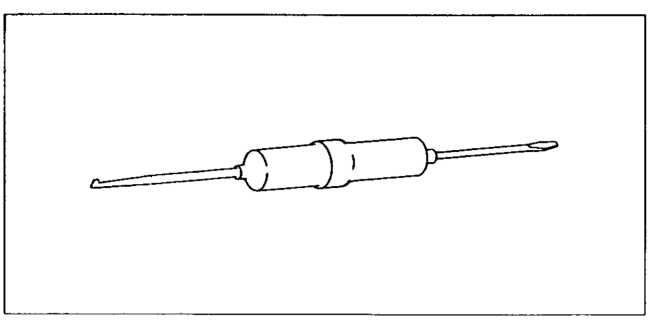
Part No. HD-41549-A Fork Spring Compressing Tool



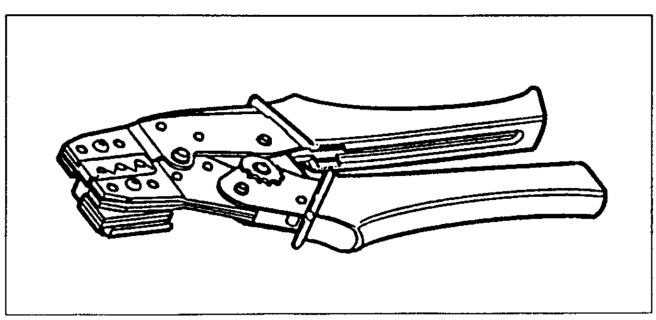
Part No. HD-41475 Deutsch Connector Service Kit
Includes HD-41475-100



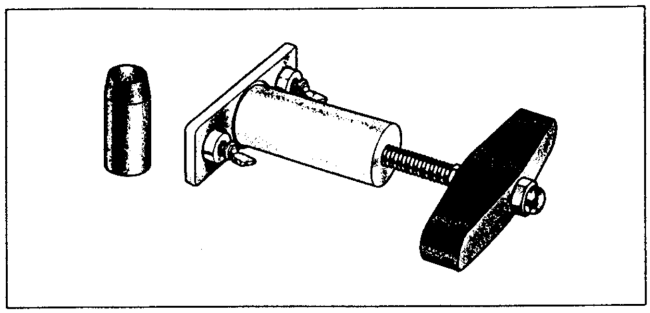
Part No. HD-41551 Fork Spring Keeper



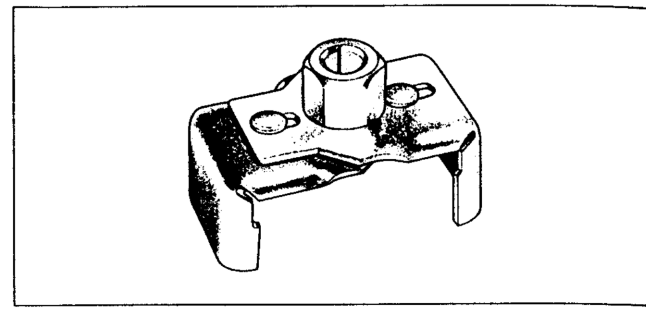
Part No. HD-41475-100 Deutsch Connector Pick Tool



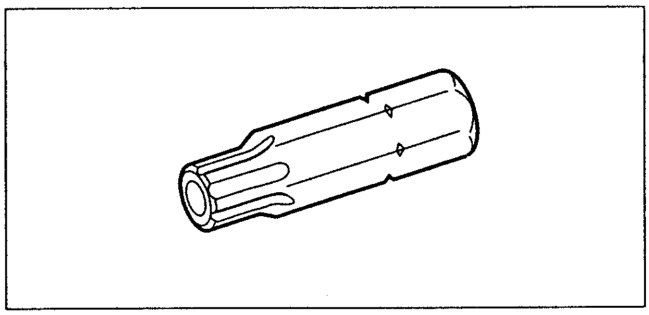
Part No. HD-41609 Amp Multilock Electrical Crimp Tool



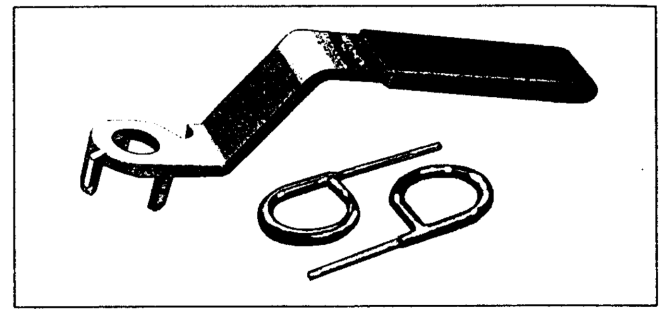
Part No. HD-41771 Rotor Remover/Installer



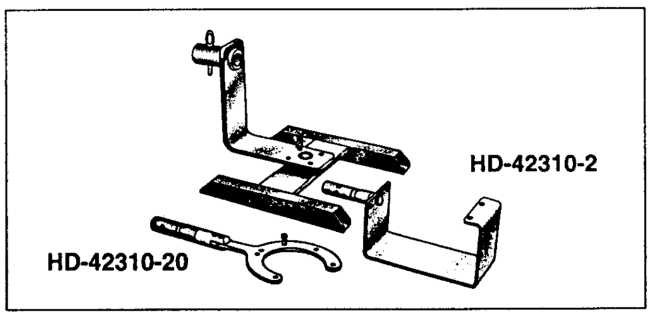
Part No. HD-42311 Oil Filter Wrench



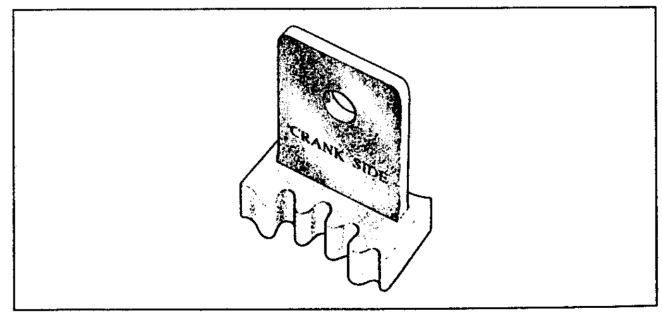
Part No. HD-42135 T-30 I.P. Torx Plus
Spoke Nipple Driver



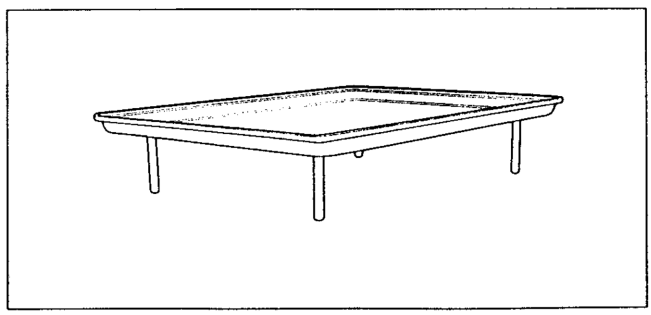
Part No. HD-42313 Cam Chain Tensioner Unloader
With Retention Pins



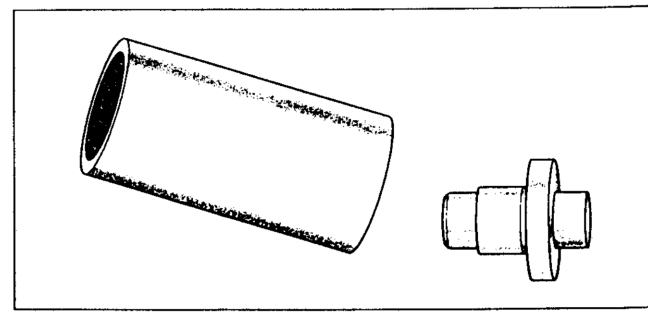
Part No. HD-42310 Engine/Transmission Stand
(Use with HD- 42310-150)



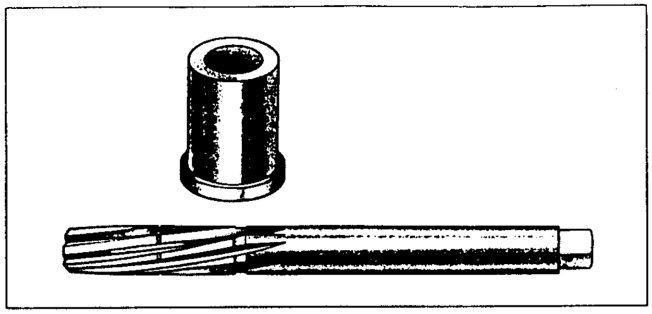
Part No. HD-42314 Crankshaft/Camshaft
Sprocket Locking Tool



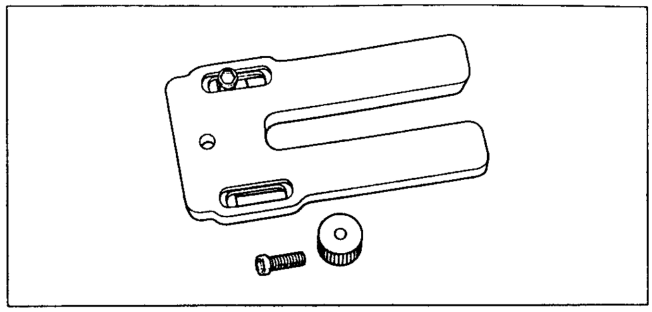
Part No. HD-42310-150 Drip Tray
(Use with HD-42310)



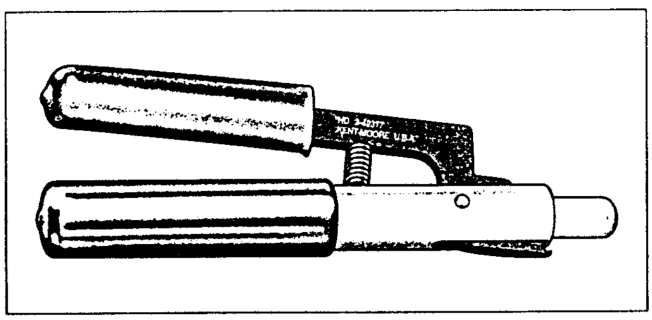
Part No. HD-42315 Crankshaft Bushing
Remover/Installer



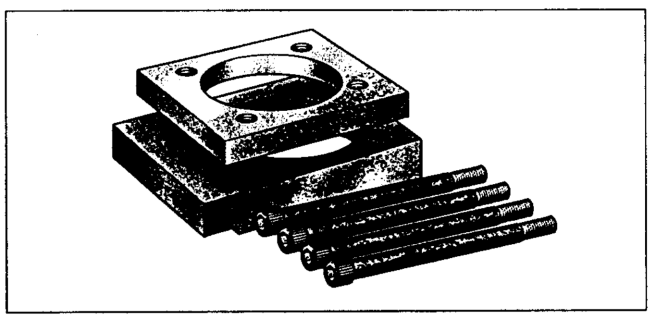
Part No. HD-42316 Crankshaft Bushing Reamer
(Use with HD-43645)



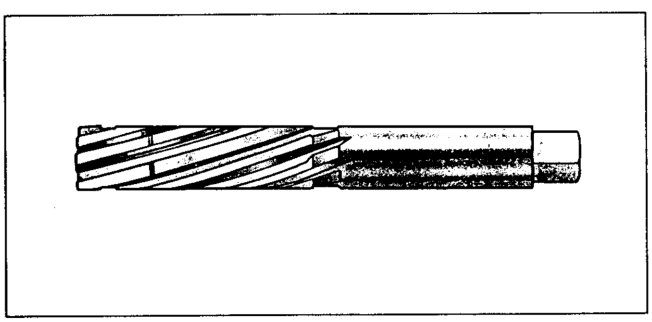
Part No. HD-42322 Piston Support Plate



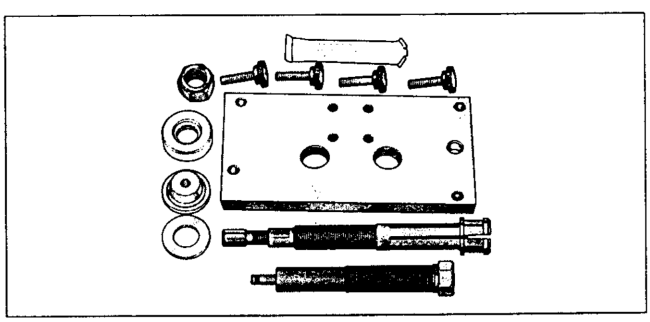
Part No. HD-42317 Piston Pin Retaining Ring
Remover/Installer



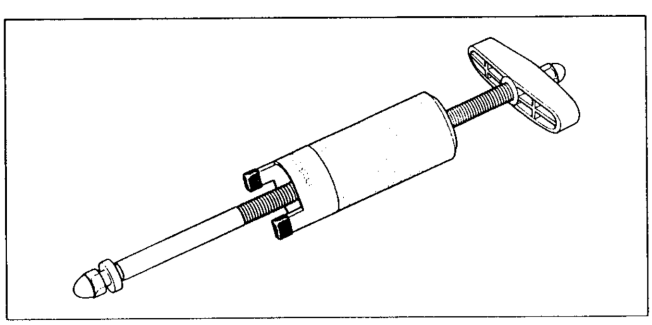
Part No. HD-42324-A Cylinder Torque Plates



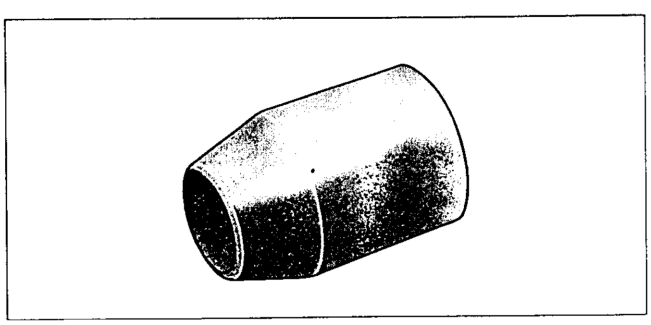
Part No. HD-42318 Connecting Rod Bushing Reamer



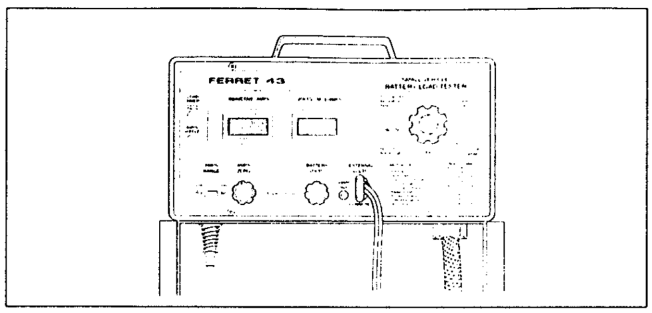
Part No. HD-42325 Camshaft Needle Bearing
Remover/Installer



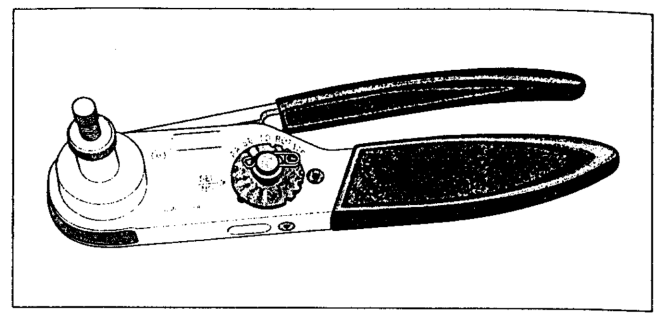
Part No. HD-42320-A Piston Pin Remover/Installer



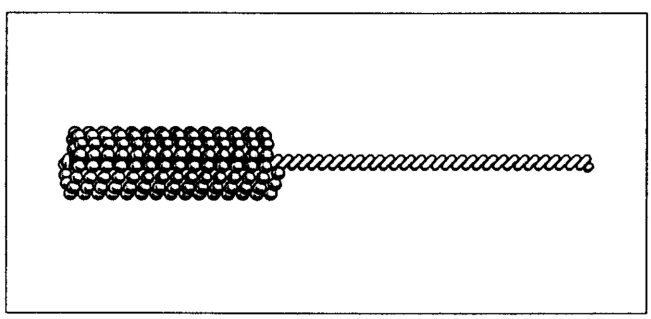
Part No. HD-42326-A Crankshaft Guide



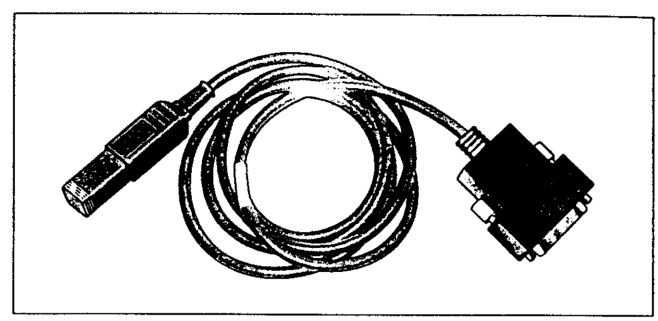
Part No. HD-42376 Battery /Charging System Load Tester



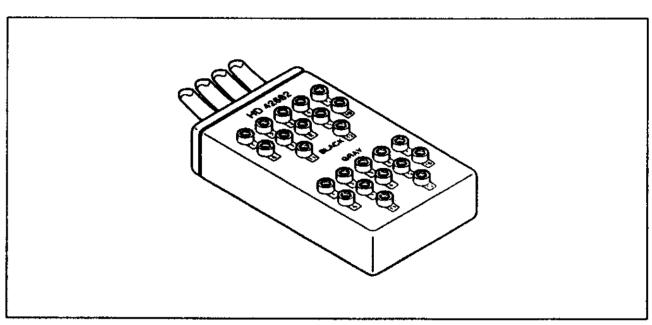
Part No. HD-42879 Deutsch Solid Barrel Contact Crimp Tool



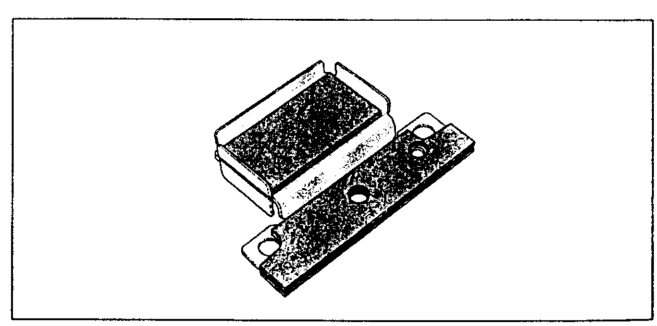
Part No. HD-42569 Connecting Rod Bushing Hone



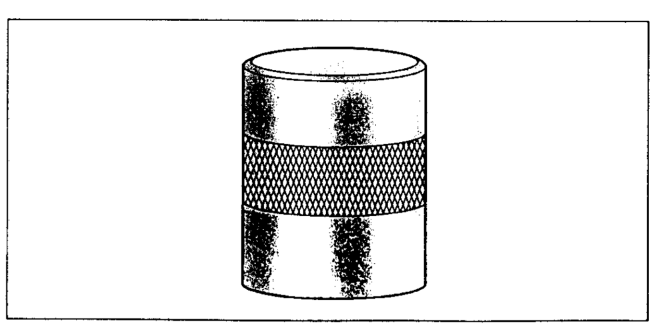
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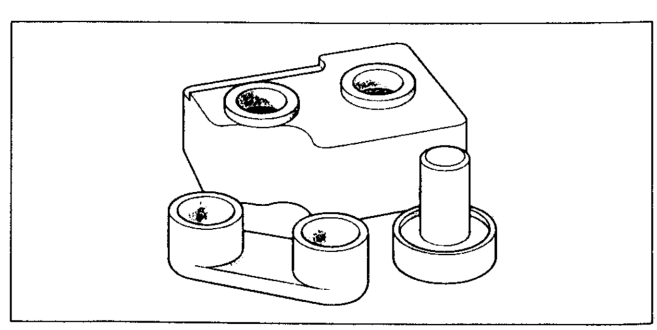
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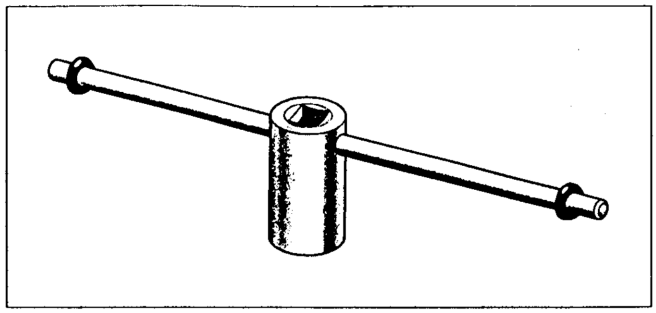
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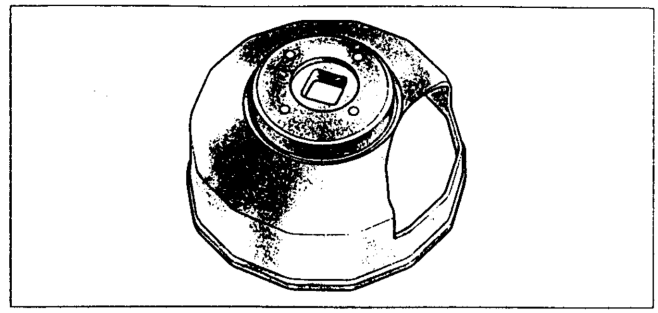
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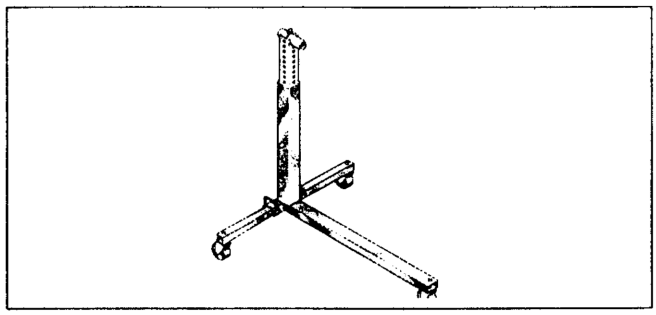
Part No. HD-43644 Camshaft/Camshaft Bearing Remover/Installer



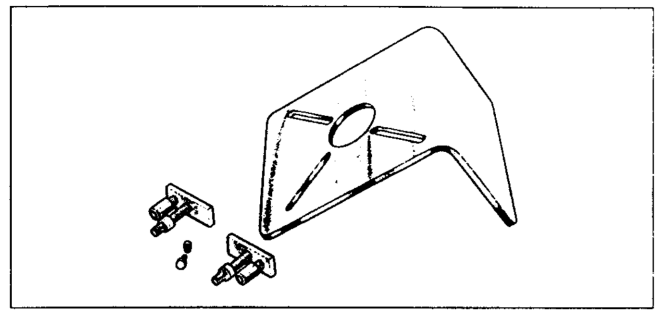
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(Use with HD- 42316)



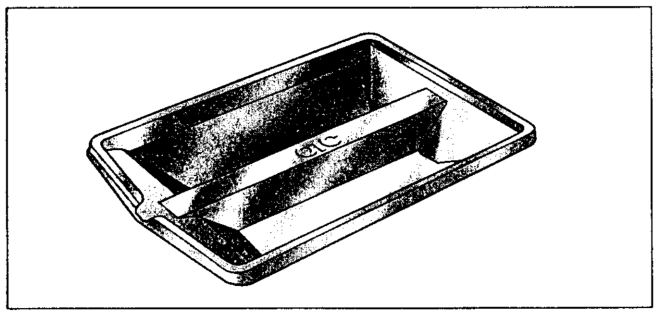
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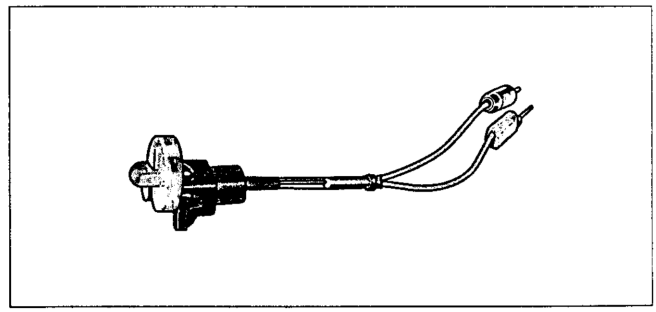
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(Use with HD-43646-10)



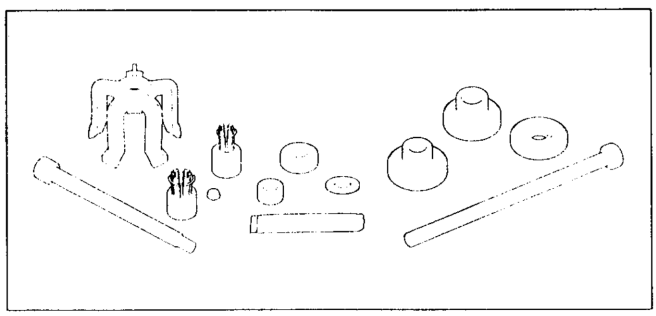
Part No. HD-44358 Flywheel Support Fixture



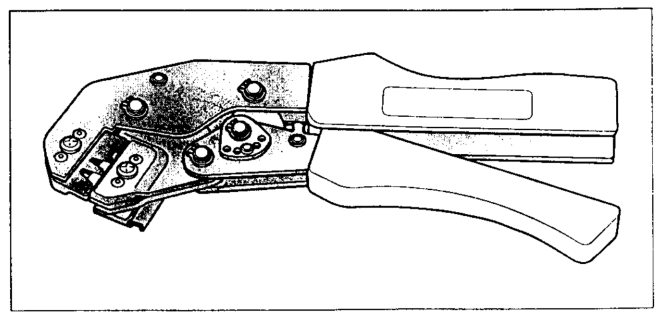
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(Use with HD-43646)



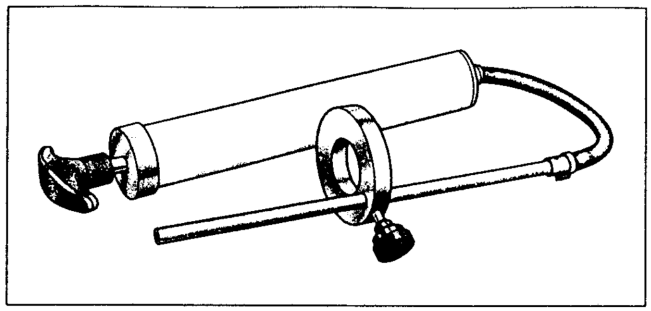
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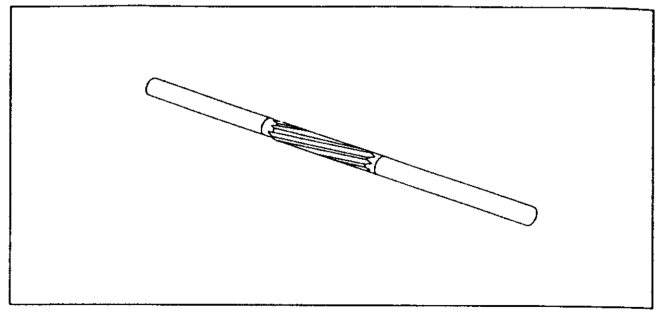
Part No. HD-44060 Wheel Bearing Remover/Installer



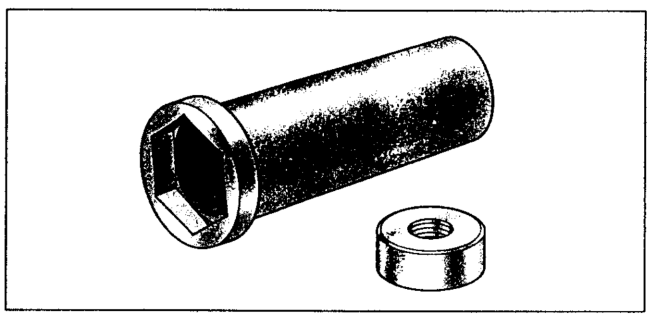
Part No. HD-44695 Mini Amp Multilock
Electrical Terminal Crimp Tool



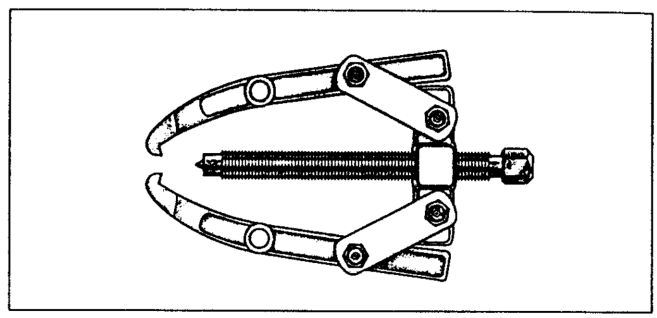
Part No. HD-59000-A Pro-Level Oil Gauge



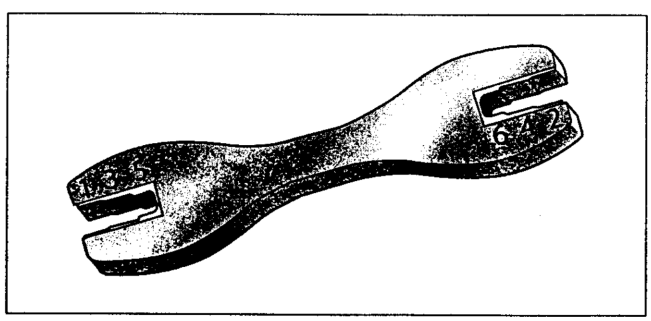
Part No. HD-94804-57 Rocker Arm Bushing Reamer



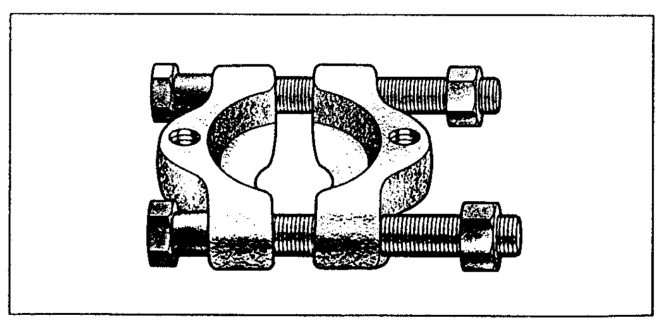
Part No. HD-94660-37B Big Twin Mainshaft Locknut Wrench



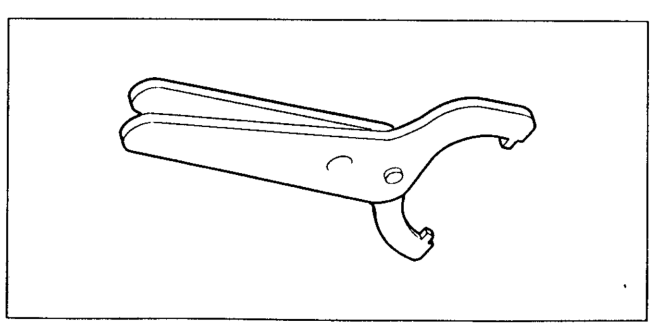
Part No. HD-95635-46 All-Purpose Claw Puller (Use with HD-95637-46A)



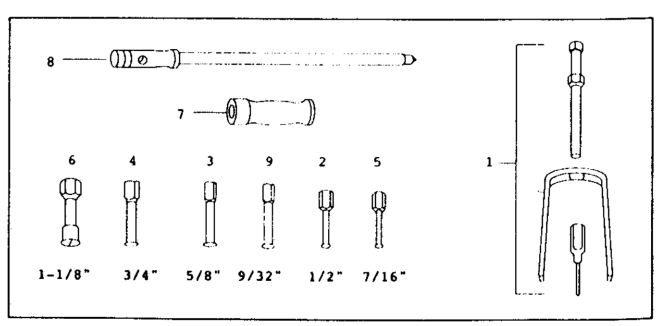
Part No. HD-94681-80 Spoke Nipple Wrench



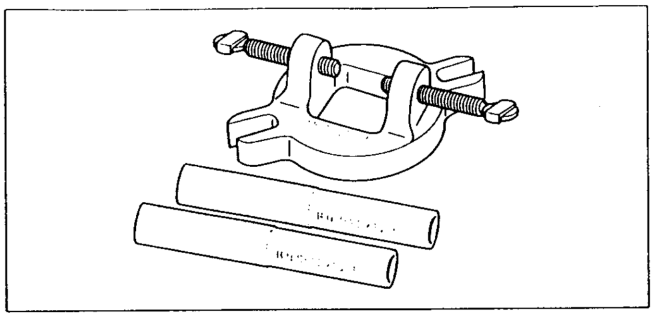
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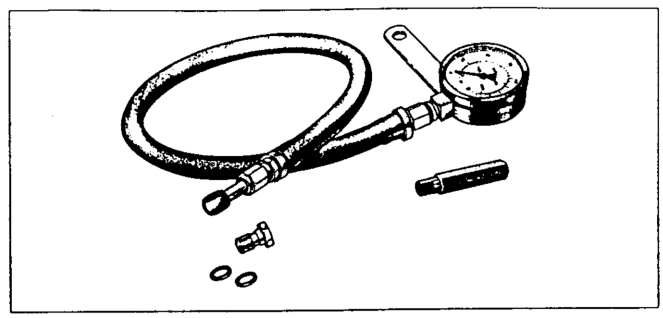
Part No. HD-94700-52C Shock Spanner



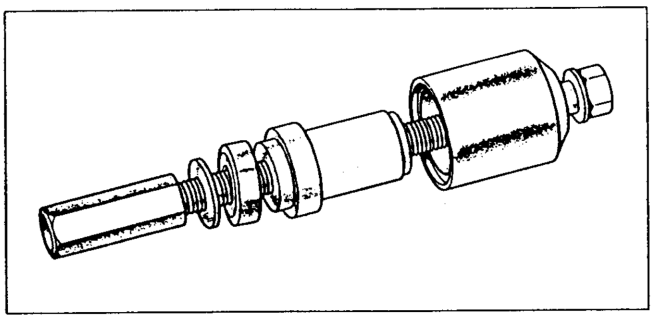
Part No. HD-95760-69A Bushing/Bearing Puller Tool Set. Set includes items 1-7. Items 8 (HD-95769-69), 9 (HD-95770-69) and 10 (HD-95771-69) are optional.



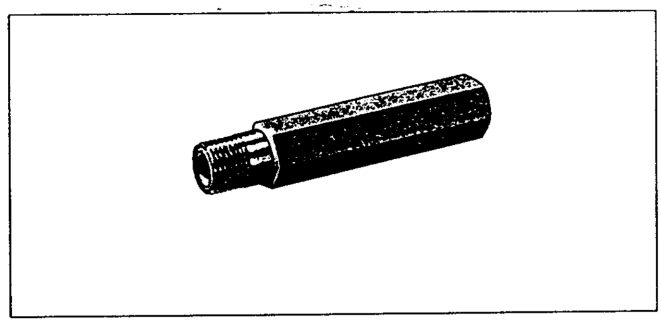
Part No. HD-95952-33C Connecting Rod Clamping Tool
(Includes HD-95952-1 Threaded Cylinders)



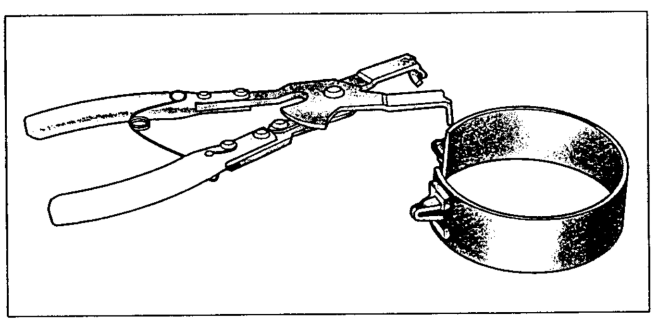
Part No. HD-96921-52B Oil Pressure Gauge
(Use with HD-96921-110 Adapter)



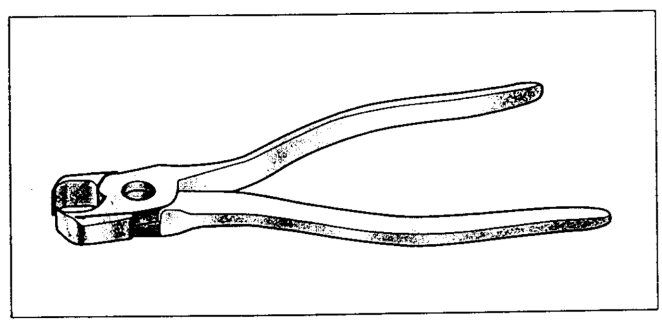
Part No. HD-95970-32D Piston Pin Bushing Tool
(Use with HD-95984-99, Body
and HD-95986-99, Remover/Installer)



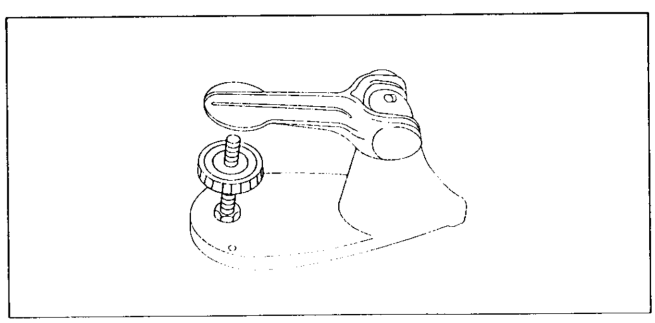
Part No. HD-96921-110 Oil Pressure Gauge Adapter



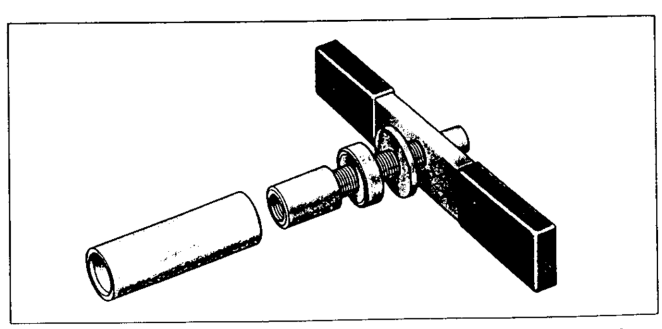
Part No. HD-96333-51D Piston Ring Compressor
(Use with HD-96333-103 Band)



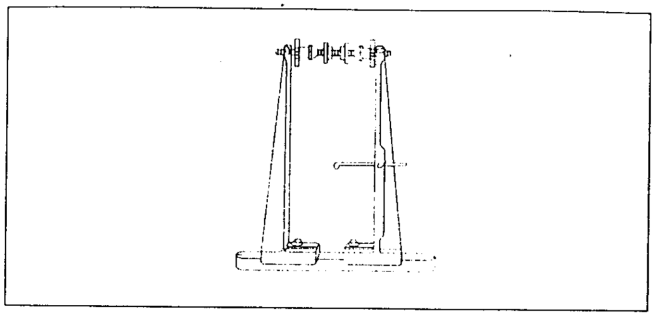
Part No. HD-97087-65B Hose Clamp Pliers



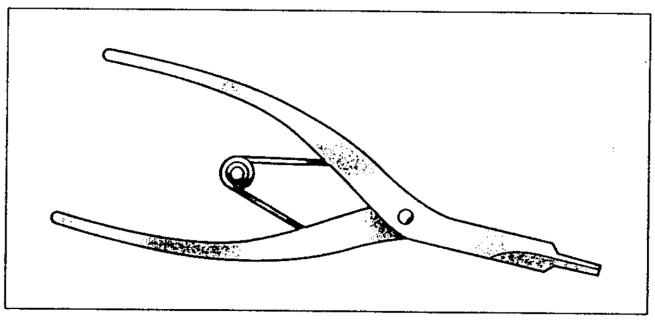
Part No. HD-96796-47 Valve Spring Tester



Part No. HD-97225-55B Sprocket Shaft Bearing Tool
(Use with HD-39361-A)



Part No. HD-99500-80 Wheel Truing Stand



Part No. J-5586-A Transmission Shaft
Retaining Ring Pliers

APPENDIX B-WIRING
AMP MULTILOCK ELECTRICAL CONNECTORS B.1

REMOVING SOCKET/PIN TERMINALS

1. Remove connector from the retaining device, either attachment or rosebud clip.
2. Depress the button on the socket terminal side of the connector (plug) and pull apart the pin and socket halves.
3. Bend back the latch slightly and free one side of secondary lock, then repeat the step to release the other side. Rotate the secondary lock outward on hinge to access terminals in chambers of connector housing.
4. Looking in the terminal side of the connector (opposite the secondary lock), take note of the cavity next to each terminal.
5. See Figure B-1. With the flat edge against the terminal, insert the pick tool (Snap-On TT600-3) into the cavity until it stops. Pivot the end of the pick away from the terminal (locktab is inside housing) and gently tug on wire to pull terminal from chamber. Do not tug on the wire until the tang is released or the terminal will be difficult to remove. A "click" is heard if the tang is engaged but then inadvertently released. Repeat the step without releasing the tang.

NOTE

- *If pick tool is not available, a small screwdriver may be used instead.*
- *An ELECTRICAL TERMINAL CRIMP TOOL (Part No. HD-41609) is used to install Amp Multi lock pin and socket terminals on wires. If new terminals must be installed, see Crimping Instructions on the next page.*

INSTALLING SOCKET/PIN TERMINALS

NOTE

For wire location purposes, numbers are stamped into the secondary locks of both the socket and pin housings. See Figure B-2.

1. From the secondary lock side of the connector, insert the terminal into its respective numbered chamber until it snaps in place. For proper fit, the slot in the terminal must face the tang in the chamber.

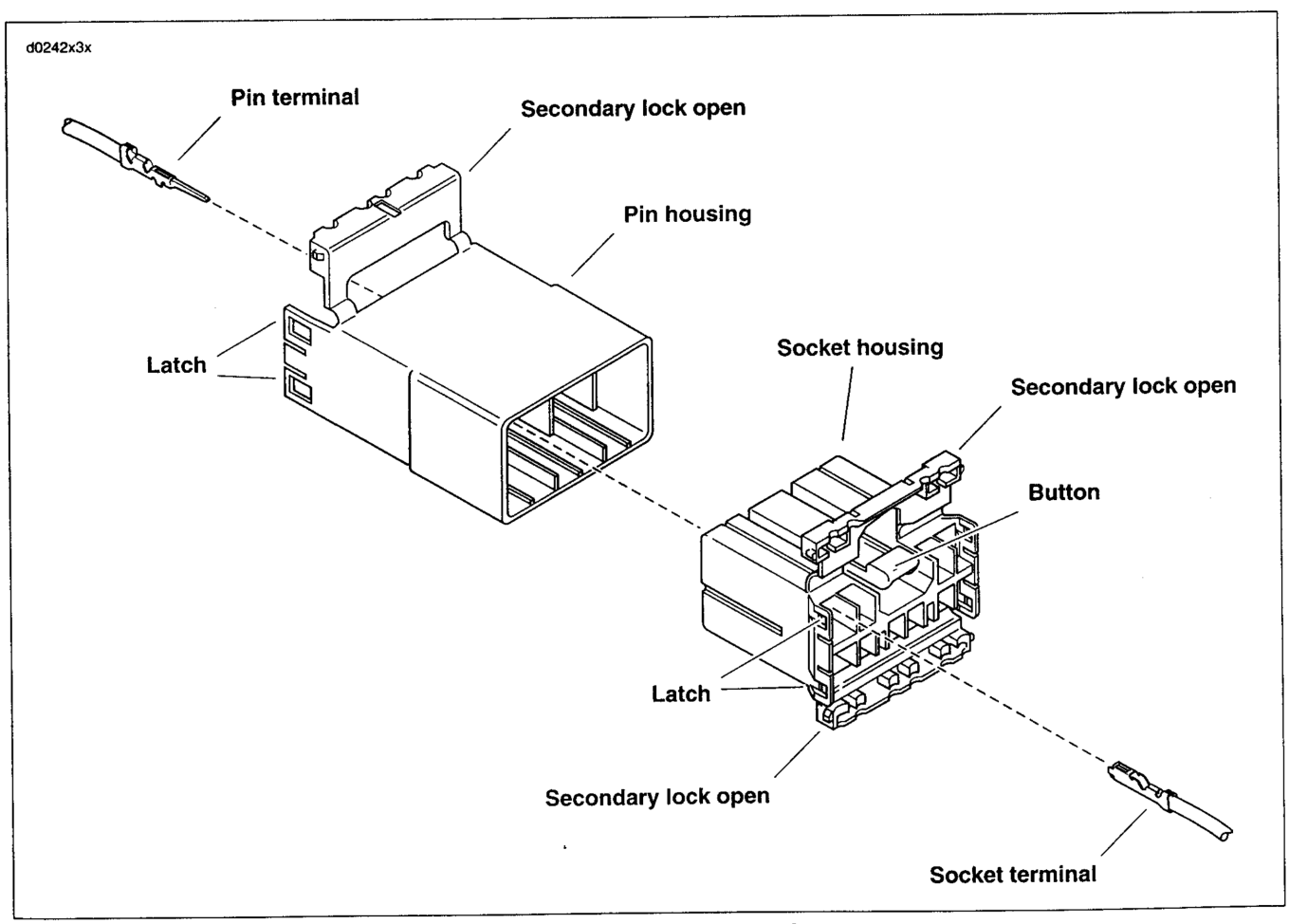


Figure B-1. 10-Place Amp Multilock Connector

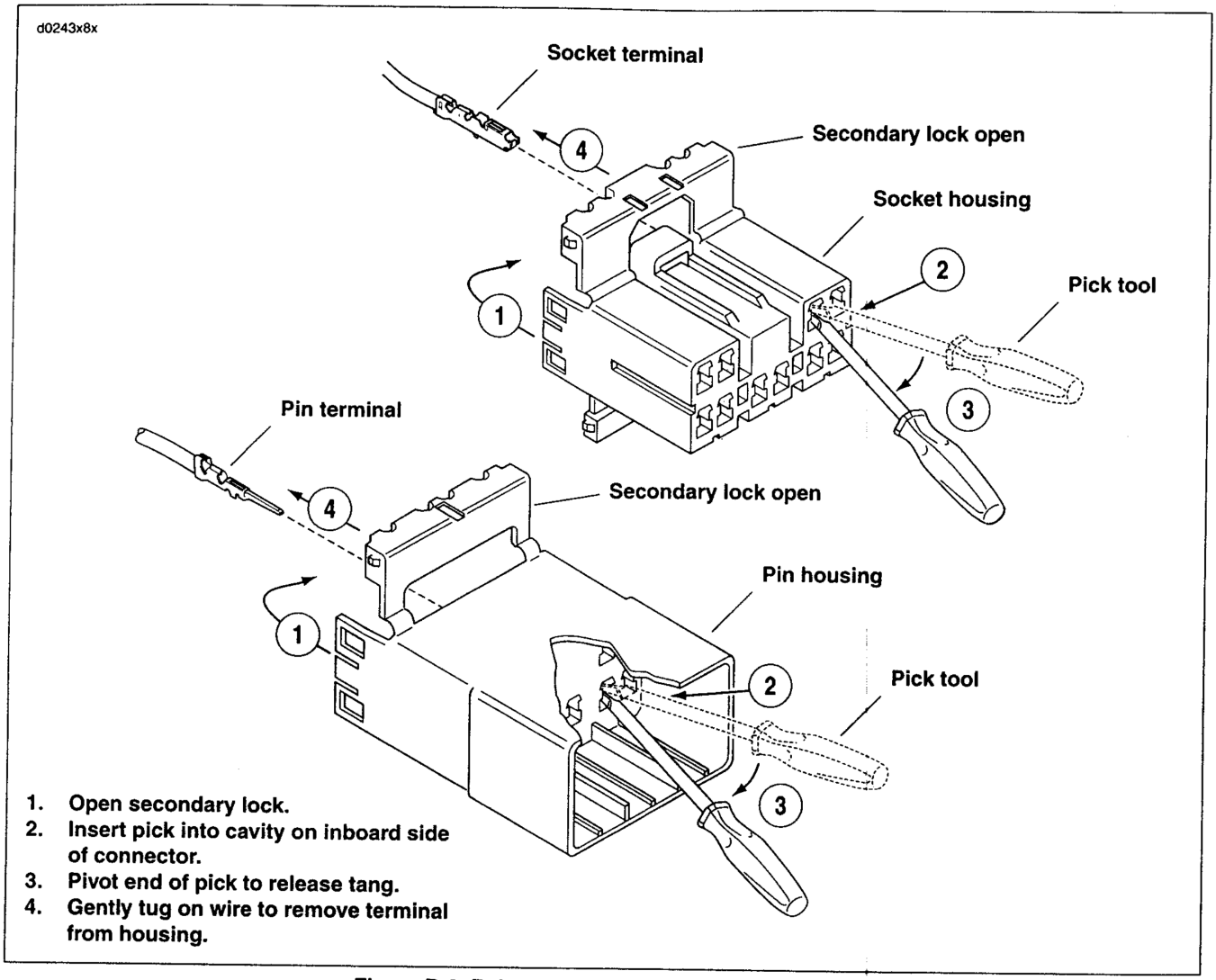


Figure B-2. Release Tang and Back Out Terminals

NOTES

- *See Figure B-3. The tang in the chamber engages the slot to lock the terminal in position.*
- *On the pin side of the connector, tangs are positioned at the bottom of each chamber, 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 chamber, so the socket terminal slot (on the same side as the crimp tails) must face upward.*
- *Up and down can be determined by the position of the release button (used to separate the pin and socket halves). Consider the button to always be on top of the connector.*

2. Gently tug on wire end to verify that the terminal is locked in place and will not back out of chamber.
3. Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
4. Insert the socket housing (plug) into the pin housing (receptacle) until it snaps in place.
5. Install connector on retaining device, either attachment or rosebud clip.

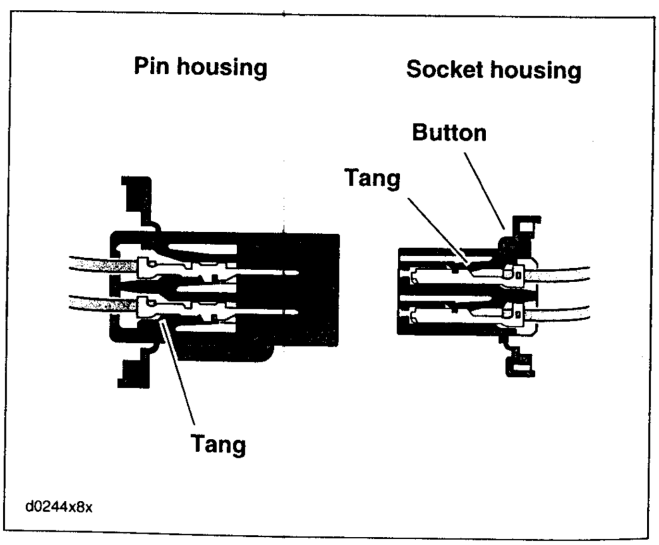


Figure B-3. Deutsch Connector Pick Tool (Part No. HD-41475-100)

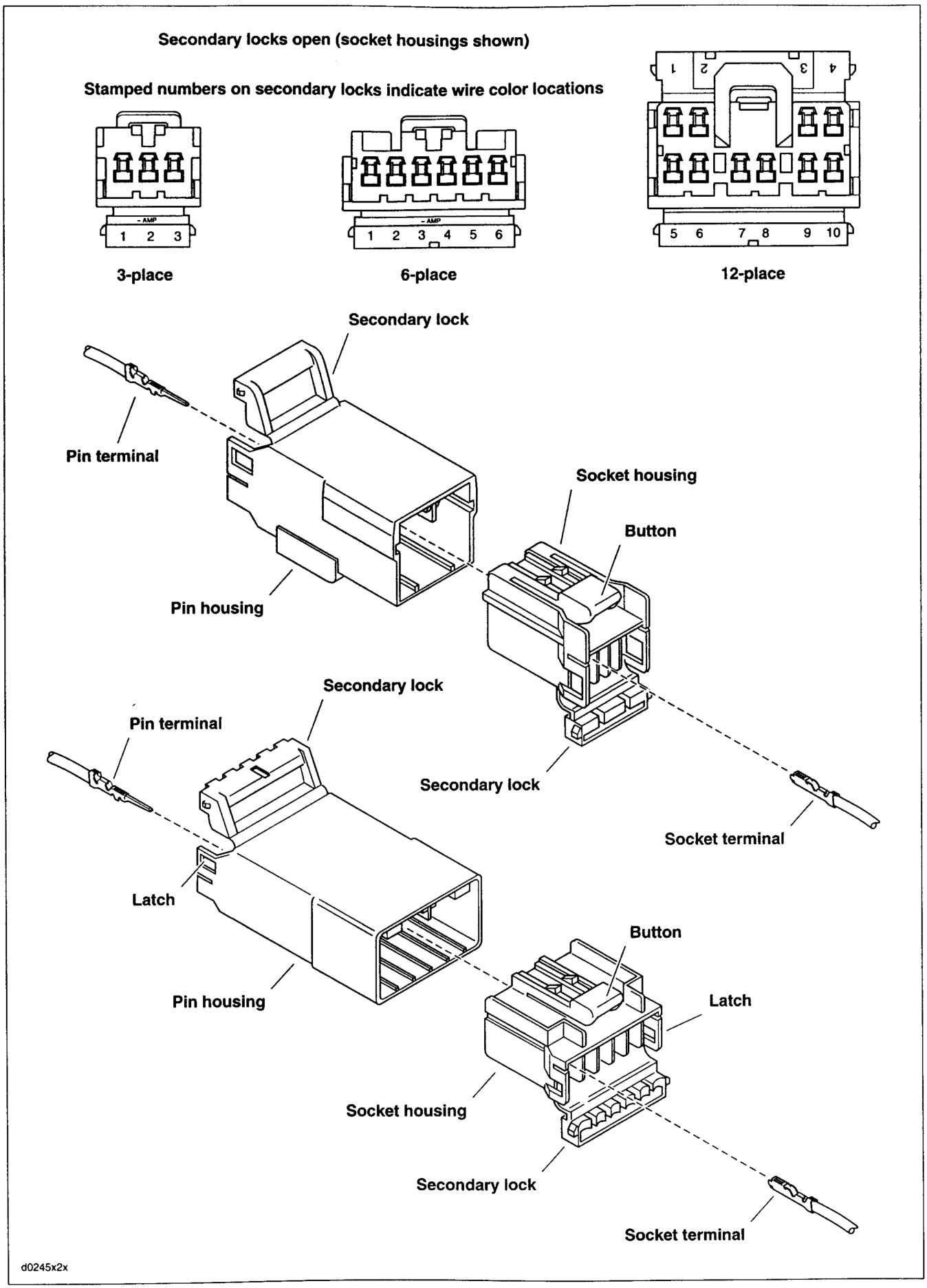
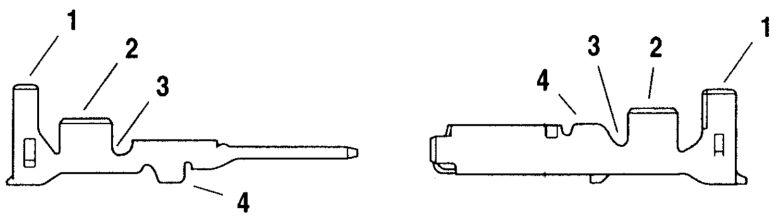


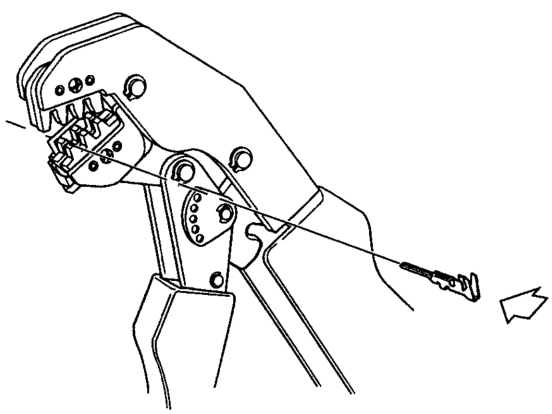
Figure B-4. 3-Place and 6-Place Amp Multilock Connectors

CRIMPING INSTRUCTIONS

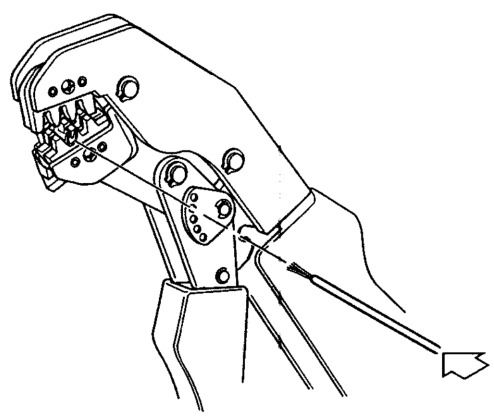
1. Squeeze the handles to cycle the crimp tool (Part No. HD-41609) to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward, insert contact (socket/pin) through locking bar, so that the closed side of the contact rests on the front nest (concave split level area of the crimp tool). See Figure B-3.
3. 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.
4. Strip lead removing 5/32 in. (4 mm) of insulation. Insert wires 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 insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.
6. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

1. **Insulating crimp tail**
2. **Core crimp tail**
3. **Locking bar groove**
4. **Tang slot**

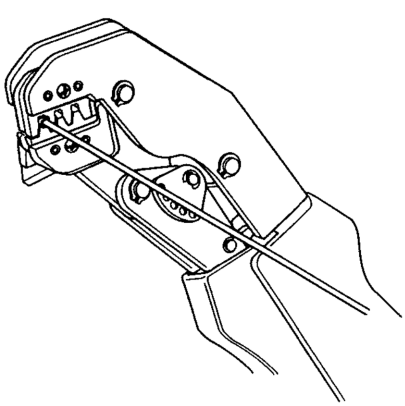




1. **Raise locking bar and seat contact on front nest of crimp tool. Release locking bar**

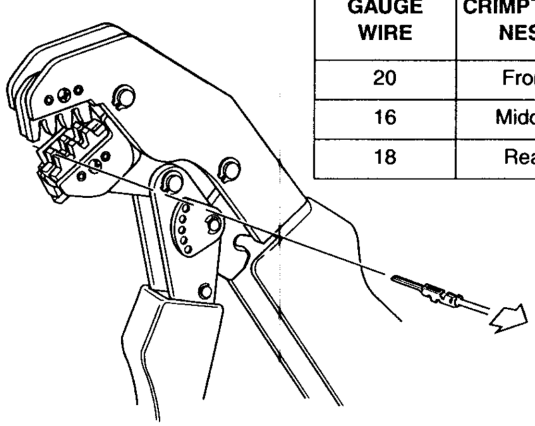


2. **Insert stripped lead until it contacts locking bar.**



3. **Close and squeeze crimp tool.**

GAUGE WIRE	CRIMPTOOL NEST
20	Front
16	Middle
18	Rear



4. **Raise locking bar and remove contact.**

d0246x8x

Figure B-5. Amp Multilock Crimping Procedure

GENERAL

Deutsch Connectors feature a superior seal to protect electrical contacts from dirt and moisture in harsh environments. The connector also provides superior pin retention.

See Figure B-8. This 12-pin connector illustrates the various parts of the Deutsch connector. The following instructions may be followed for all 2-pin through 12-pin Deutsch connectors.

Socket housing: alignment tabs and/or external latch, secondary locking wedge, internal seal, wire seal, seal pin.

NOTE

Seal pins or plugs are installed in the wire seals of unused pin and socket locations. If removed, seal pins must be replaced to maintain the integrity of the environmental seal.

Pin housing: alignment grooves and/or external latch cover, attachment clip, secondary locking wedge, wire seal, seal pin.

REMOVING/DISASSEMBLING

Attachment clips are attached to the pin housings of most connectors. The clips are then attached to T-studs on the motorcycle frame. T-studs give positive location to electrical connectors and wire harness. Consistent location reduces electrical problems and improves serviceability.

1. Push the connector to disengage small end of slot on attachment clip from T-stud. Lift connector off T-stud.
2. Depress the external latch(es) on the socket housing side and use a rocking motion to separate the pin and socket halves. Two-, three-, four- and six-pin Deutsch connectors have one external latch, while eight- and twelve-pin connectors have two, both of which must be pressed simultaneously to separate the connector halves.

NOTE

With few exceptions, the socket housing can always be found on the accessory side, while the pin side of the connector is connected to the wiring harness.

REMOVING/INSTALLING SOCKETS

1. See Figure B-6. Remove the secondary locking wedge. Insert the blade of a small screwdriver between the socket housing and locking wedge inline with the groove (inline with the pin holes if the groove is absent). Turn the screwdriver 90 degrees to pop the wedge up.
2. See Figure B-7. Gently depress terminal latches inside socket housing and back out sockets through holes in rear wire seal.

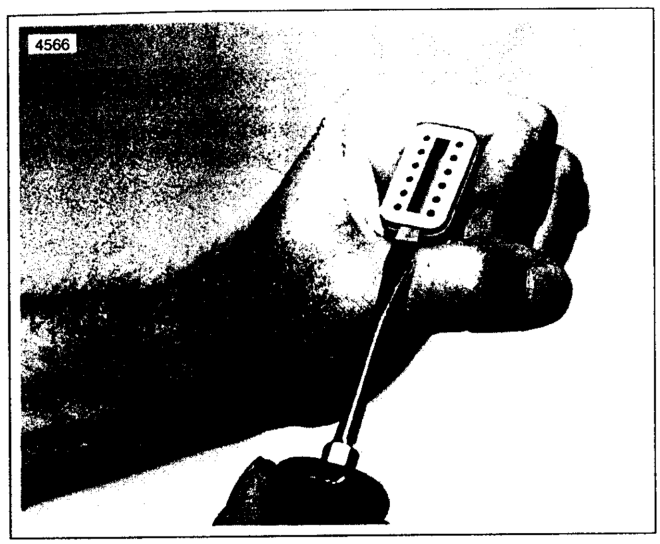


Figure B-6. Remove Secondary Locking Wedge

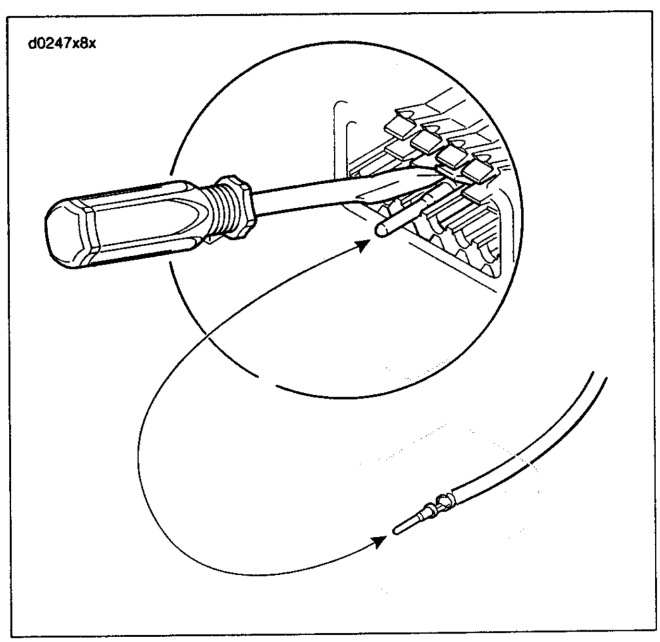


Figure B-7. Depress Terminal Latches/Back Out Pins

NOTE

An ELECTRICAL TERMINAL CRIMP TOOL (Part No. HD-39965) is used to install Deutsch pin and socket terminals on wires. If ***new*** *terminals must be installed, follow the instructions included with the crimping tool or see Crimping Instructions in this section.*

Fit rear wire seal into back of socket housing, if removed. Grasp socket approximately 1.0 in. (25.4 mm) behind the contact barrel. Gently push sockets through holes in wire seal into their respective chambers. Feed socket into chamber until it "clicks" in place. Verify that socket will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.

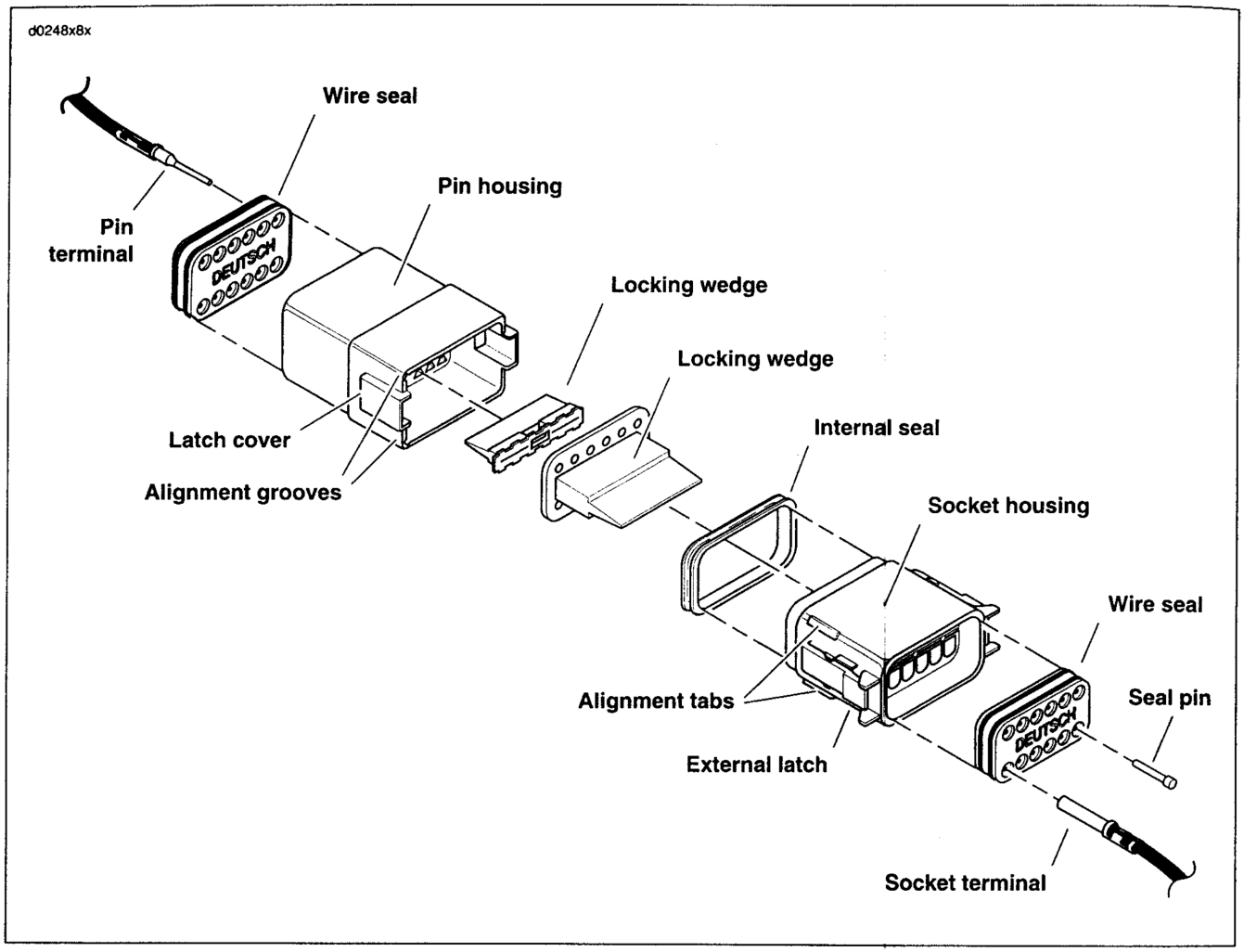


Figure B-8. 12-pin Deutsch Connector (Exploded View)

3. Install internal seal on lip of socket housing, if removed. Insert tapered end of secondary locking wedge 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

- *While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-pin connector must be installed with the arrow pointing toward the external latch. See Figure B-9.*
- *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.*

REMOVING/INSTALLING PINS

1. Remove the secondary locking wedge. Use the hooked end of a stiff piece of mechanics wire a needle nose pliers, or a suitable pick tool (Part No. HD-41475-100). See Figure B-10.
2. Gently depress terminal latches inside pin housing and back out pins through holes in wire seal.

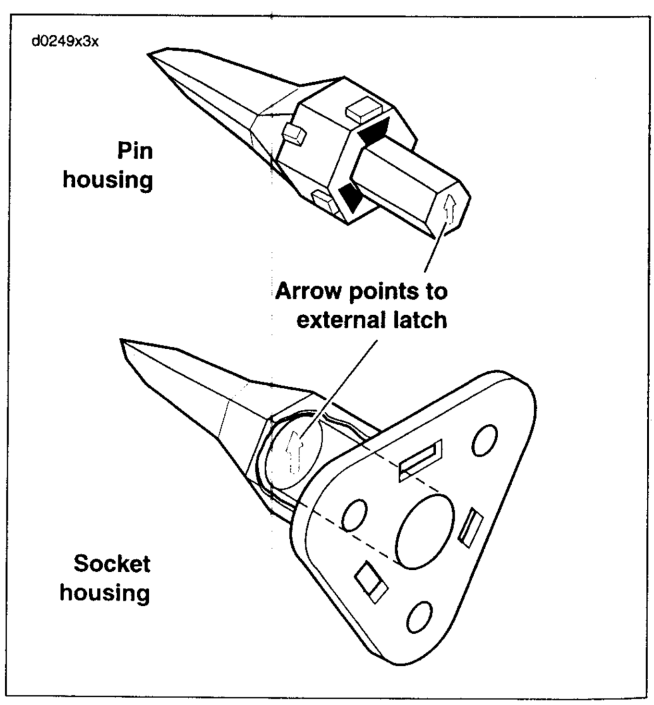


Figure B-9. Depress Terminal Latches/Back Out Pins

NOTE

An ELECTRICAL TERMINAL CRIMP TOOL (Part No. HD-39965) is used to install Deutsch pin and socket terminals on wires. If ***new*** *terminals must be installed, see Crimping Instructions in this section.*

3. Fit wire seal into back of pin housing. Grasp crimped pin approximately 1.0 in. (25.4 mm) behind the contact barrel. Gently push pins through holes in wire seal into their respective numbered locations. Feed pin into chamber until it "clicks" in place. Verify that pin will not back out of chamber; a slight tug on the wire will confirm that it is properly locked in place.
4. Insert tapered end of secondary locking wedge into pin housing and press down until it snaps in place. The wedge fits in the center groove within the pin housing and holds the terminal latches tightly closed.

NOTES

- *While rectangular wedges do not require a special orientation, the conical secondary locking wedge of the 3-pin connector must be installed with the arrow pointing toward the external latch. See Figure B-9.*
- *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.*

ASSEMBLING/INSTALLING

1. Insert socket housing into pin housing until it snaps in place. Two-, three-, four- and six-pin 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.

   For those connectors with two external latches (8-pin and 12-pin), a different system is used to prevent improper assembly. Align the tabs on the socket housing with the grooves on the pin housing. Push the connector halves together until the latches "click." 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.

NOTE

Deutsch connectors are color 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.*

If it should become necessary to replace a plug or receptacle, please note that the 8-pin and 12-pin 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. If replacing both the socket and pin halves, then the black may be substituted for the gray, and vice versa. The socket and pin halves 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.

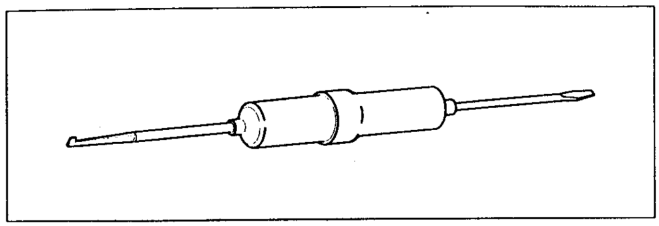


Figure B-10. Deutsch Connector Pick Tool (Part No. HD-41475-100)

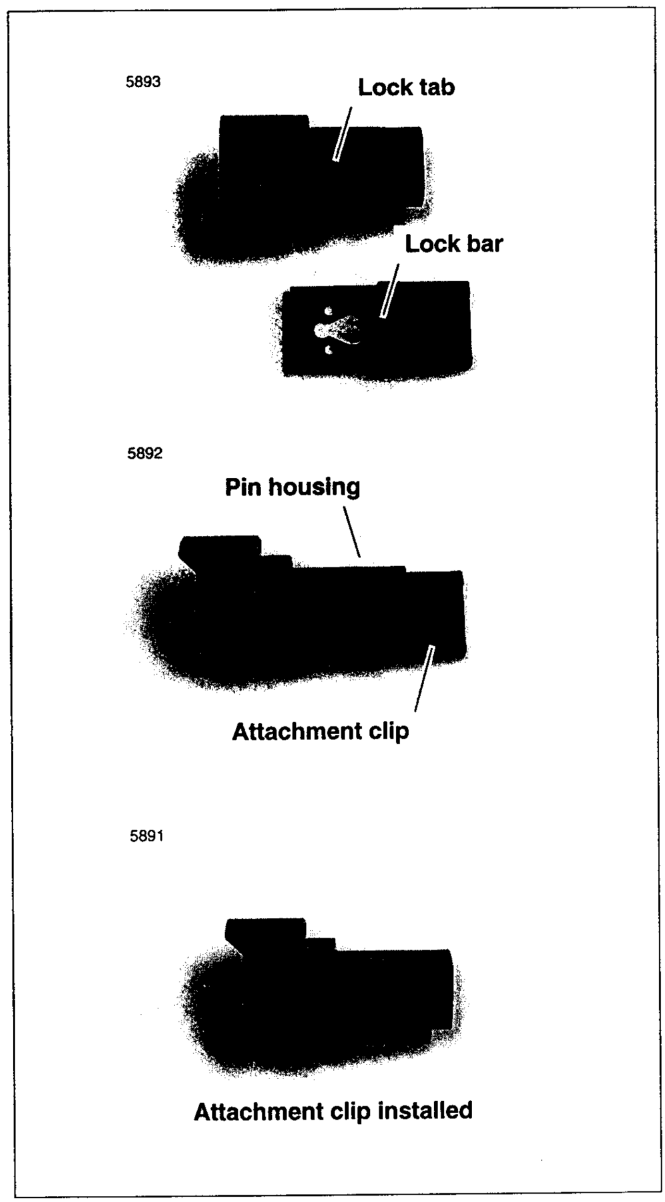


Figure B-11. Attachment Clip Installation

2. See Figure B-11. Fit the attachment clip to the pin housing, if removed. Place large end of slot on attachment clip over T-stud on frame. Push assembly forward to engage small end of slot.

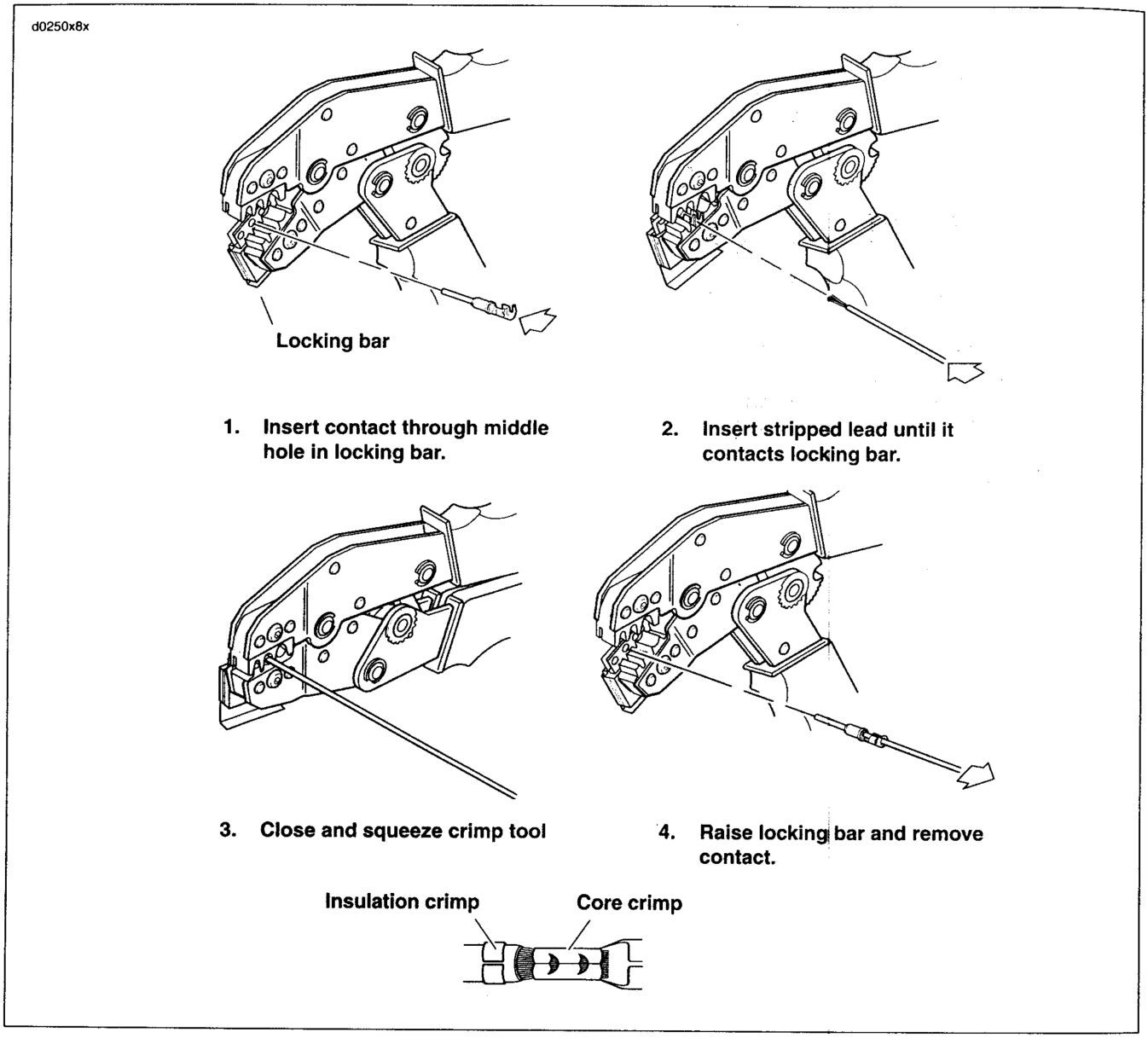


Figure B-12. Deutsch Crimping Procedure

CRIMPING INSTRUCTIONS

1. See Figure B-12. Squeeze the handles to cycle the crimp tool to the fully open position.
2. Raise locking bar by pushing up on bottom flange. With the crimp tails facing upward and the rounded side of the contact barrel resting on the concave split level area of the crimp tool, insert contact (socket/pin) through middle hole of locking bar.
3. Release locking bar to lock position of contact. If the crimp tails are slightly out of vertical alignment, the crimp tool automatically rotates the contact so that the tails face straight upward. When correctly positioned, the locking bar fits snugly in the space between the contact band and the core crimp tails.
4. Strip lead removing 5/32 in. (4 mm) of insulation. Insert wires 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 insulation material.
5. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete. Raise up locking bar and remove contact.
6. Inspect the quality of the core and insulation crimps. Distortion should be minimal.

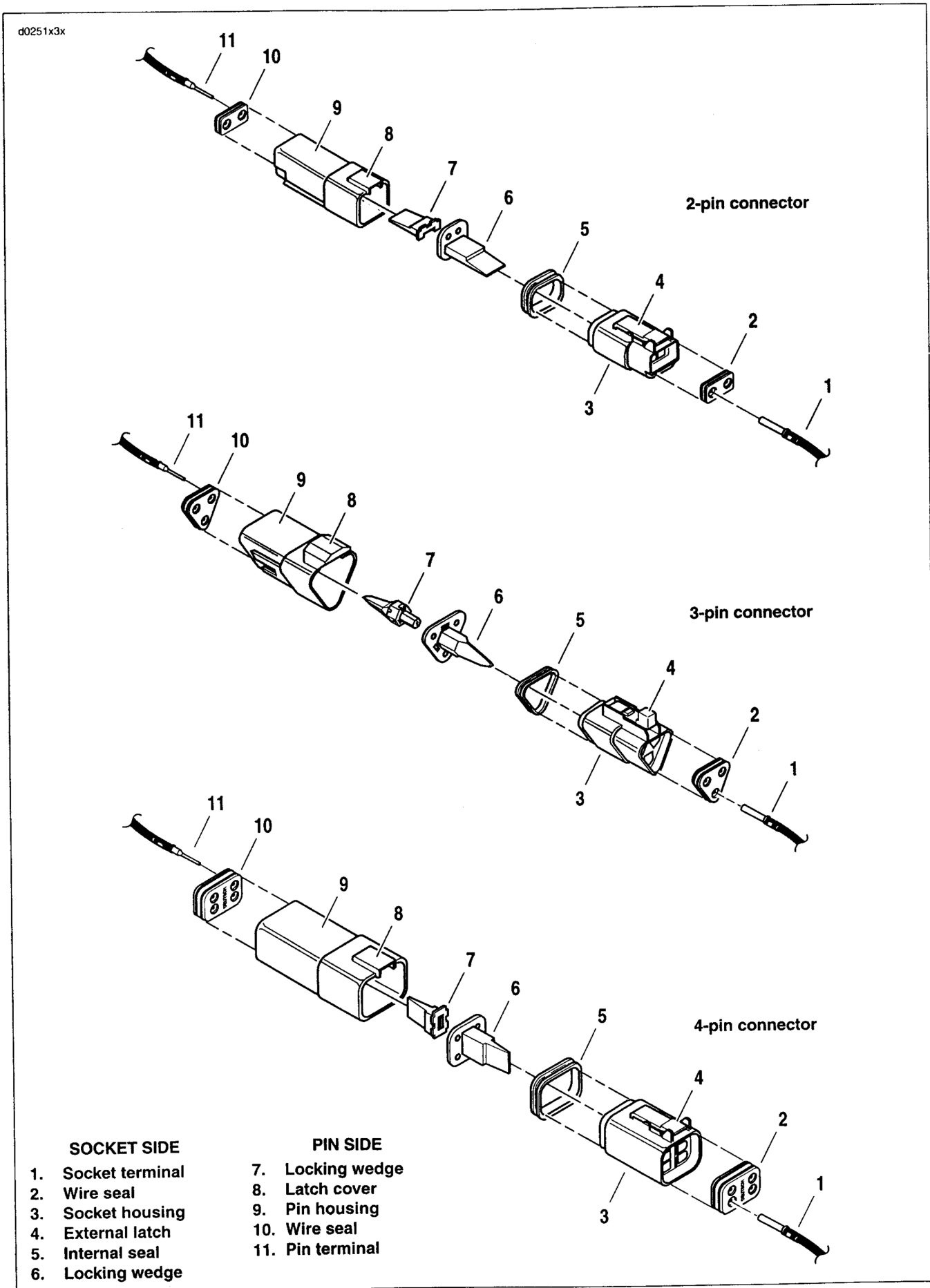


Figure B-13. 2-Pin, 3-pin and 4-pin Deutsch Connectors

GENERAL

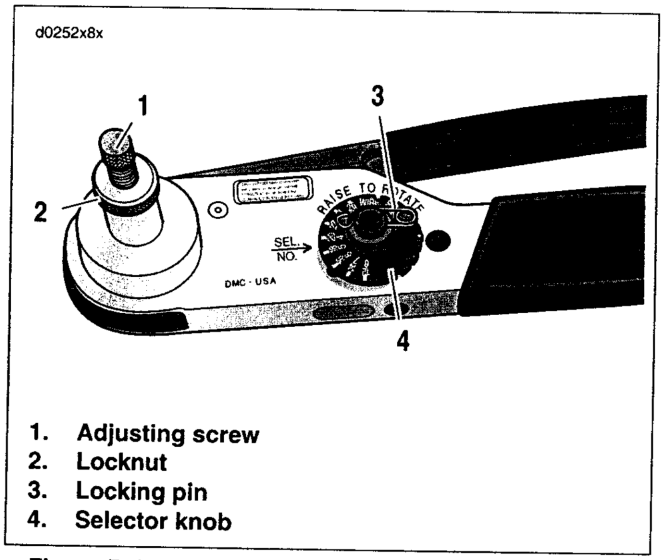
For Size 20, 16 and 12 Contacts Wire Range 26-12 AWG

The Mini-Deutsch connectors found on Dyna Glide model vehicles are listed below.

- Speedometer [39] (FXDWG Only)
- CMP, CKP and oil pressure to main harness.

NOTE

Mini-Deutsch connectors make use of a solid barrel contact without crimp tails. As a result, a special TERMINAL CRIMP TOOL (Part No. HD-42879) is needed to install pin and socket terminals on wires. See Crimping Instructions below for details.



1. Adjusting screw
2. Locknut
3. Locking pin
4. Selector knob

Figure B-14. Deutsch Solid Barrel Contact Crimp Tool (Part No. HD-42879)

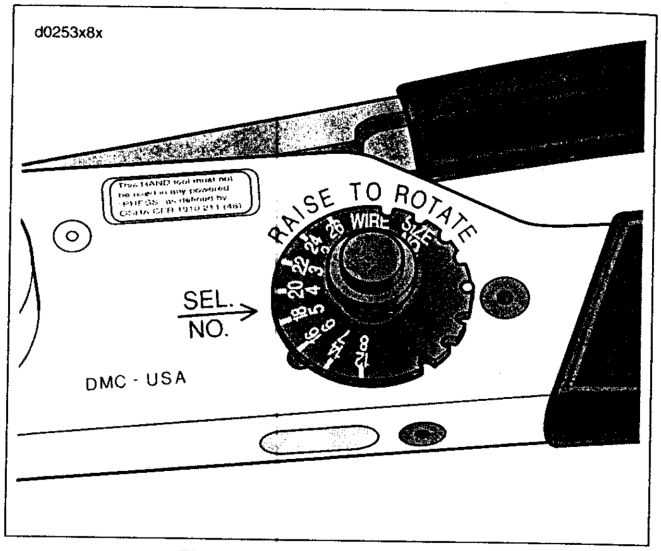


Figure B-15. Selector Knob

1. Indentor cover
2. Contact
3. Indentor points

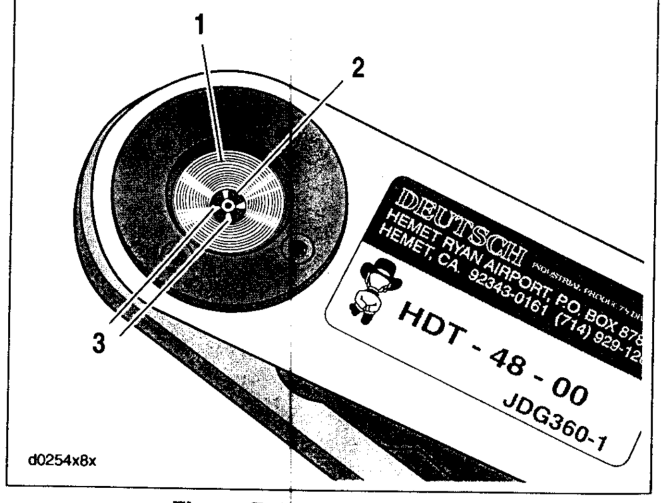


Figure B-16. Indentor Points

CRIMPING INSTRUCTIONS

1. Squeeze the handles to cycle the crimp tool to the fully open position.
2. See Figure B-14. Remove locking pin (3) from selector knob (4).
3. See Figure B-15. Raise selector knob and rotate until selected wire size stamped on wheel is aligned with "SEL. NO." arrow.
4. Loosen knurled locknut and turn adjusting screw clockwise (in) until it stops.
5. Turn tool over and drop contact into indentor cover hole with the wire end out.
6. Turn adjusting screw counterclockwise (out) until contact is flush with bottom of depression in indentor cover. Tighten knurled locknut.
7. See Figure B-16. Slowly squeeze handles of crimp tool until contact (2) is centered between indentor points (3).

8. Strip wire lead removing 1/4 in. (6.3 mm) of insulation.
9. See Figure B-17. Insert bare wire strands into contact barrel.
10. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
11. Remove crimped contact from indentor.
12. Inspect the quality of the crimp. Verify that all wire strands are in crimp barrel.

NOTE

Tool must be readjusted when changing contact size/type.

13. Install pin to lock position of selector knob.

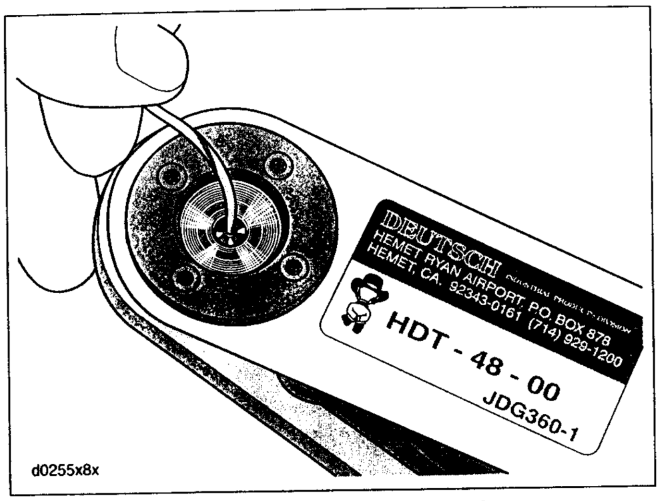


Figure B-17. Contact Barrel

INSTALLATION

Butt splicing may be a necessary procedure for the replacement of some components.

1. Strip 3/8 in. (9.5 mm) of insulation off the ends of the wires.
2. Compress the handles of the Packard Crimp Tool (HD-38125-8) until the ratchet automatically opens.
3. See Table B-1. Since the size of the connectors varies with the gauge of the wire, always used the correct components when creating sealed splices.
4. See Figure B-18. Determine the correct dye or nest for the crimping operation. Match the color or gauge wire marked on the butt splice connector with the corresponding crimp cavity on the crimp tool.
5. Gently apply pressure to the handles until the crimper lightly secures one side of the metal insert inside the butt splice connector. The connector must be crimped in two stages; one side then the other.
6. See Figure B-19. Feed the wire into the butt splice connector until the stripped end contacts the wire stop inside the metal insert.
7. Squeeze the handles of the crimp tool until tightly closed. The tool automatically opens when the crimping sequence is complete.
8. Repeat steps 5, 6, and 7 on the other side of the butt splice connector.

NOTE

If adjacent wires are being spliced, stagger the splices so that the butt splice connectors are spaced at different positions along the length of the wires.

⚠WARNING

Use caution when operating the UltraTorch UT-100 or any other radiant heating device. Read the manufacturers instructions carefully before use. Always keep hands away from tool tip area and heat shrink attachment. Avoid directing the heat toward any fuel system component. Extreme heat can cause fuel ignition or explosion. Avoid directing heat toward any electrical system component other than the connectors on which heat shrink work is being performed. Be sure to turn the "ON/OFF" switch to the "OFF" position after use. Improper handling could result in death or serious injury.

9. Using the UltraTorch UT-100 (Part No. HD-39969), Robinair Heat Gun (Part No. HD-25070) with heat shrink attachment (Part No. HD-41183) or other suitable radiant heating device, heat the crimped splice to encapsulate the butt splice connection. Apply heat from the center of the crimp out to each end until the meltable sealant exudes out both ends of the connector.

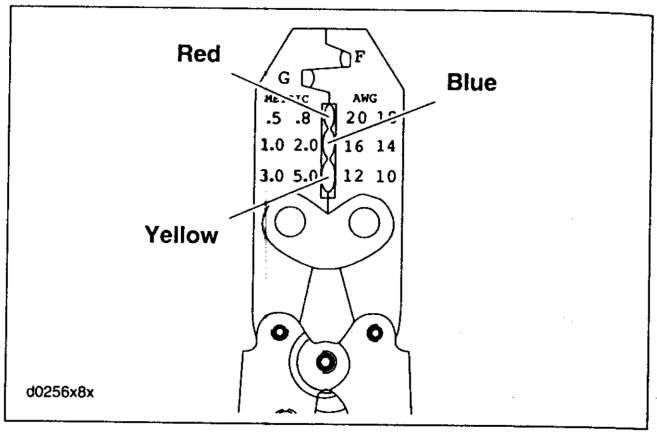


Figure B-18. Packard Crimp Tool (Part No. HD-38125-8)

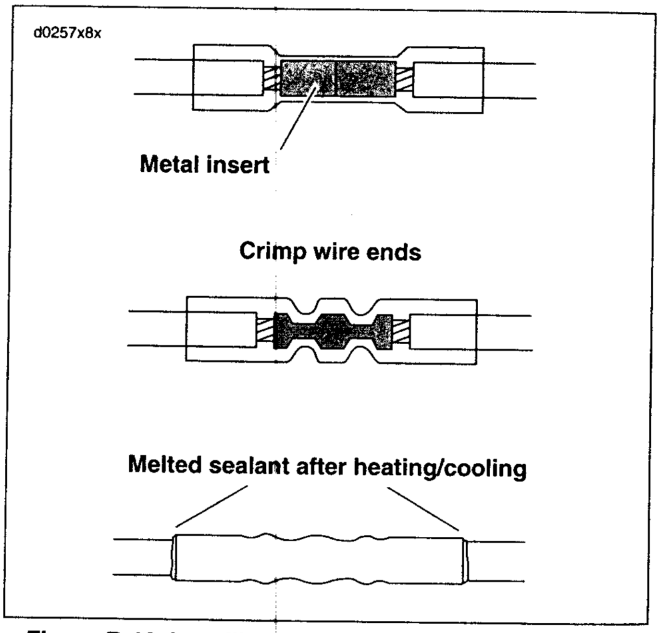


Figure B-19. Installing Sealed Butt Splice Connectors

Table B-1. Common Sealed Splices

GAUGE WIRE	CONNECTOR COLOR	PART NO.
18-20	Red	70585-93
14-16	Blue	70586-93
10-12	Yellow	70587-93

NOTE

It is acceptable for the splice to rest against the heat shrink tool attachment.

10. Heat the center of the splice until the crimp indentations disappear and the tubing assumes a smooth cylindrical appearance.

GENERAL

From a servicing standpoint, there are two basic types of Packard electrical connectors, those with pull-to-seat terminals and those with push-to-seat terminals.

Look into the mating end of the connector. If it appears that the terminal can be extracted from this side, then it is probably the pull-to-seat type.

At least one Packard pull-to-seat terminal can be easily recognized by the presence of a locking ear. The ear engages a slot in the connector housing and prevents the terminal from being removed from the wire end side of the connector. The ear also acts as a strain relief in the event that the wires are pulled and further inhibits movement of the terminal inside the chamber. For an example of this type of connector, note the MAP Sensor connector [80B].

Unlike most connectors, where the terminals are pulled out the wire end of the connector, to remove the terminals from the pull-to-seat connectors, the terminal is pushed out the mating end of the connector. Once a **new** terminal is crimped onto the end of the wire, the wire is pulled to draw the terminal back inside the chamber of the connector housing.

Two types of Packard pull-to-seat electrical connectors are used. One type has an external latch to lock the pin and socket halves together, while the other makes use of a wire-form. See Figure B-20. The manner in which the terminals are picked differs between these two types of connectors, as further described below.

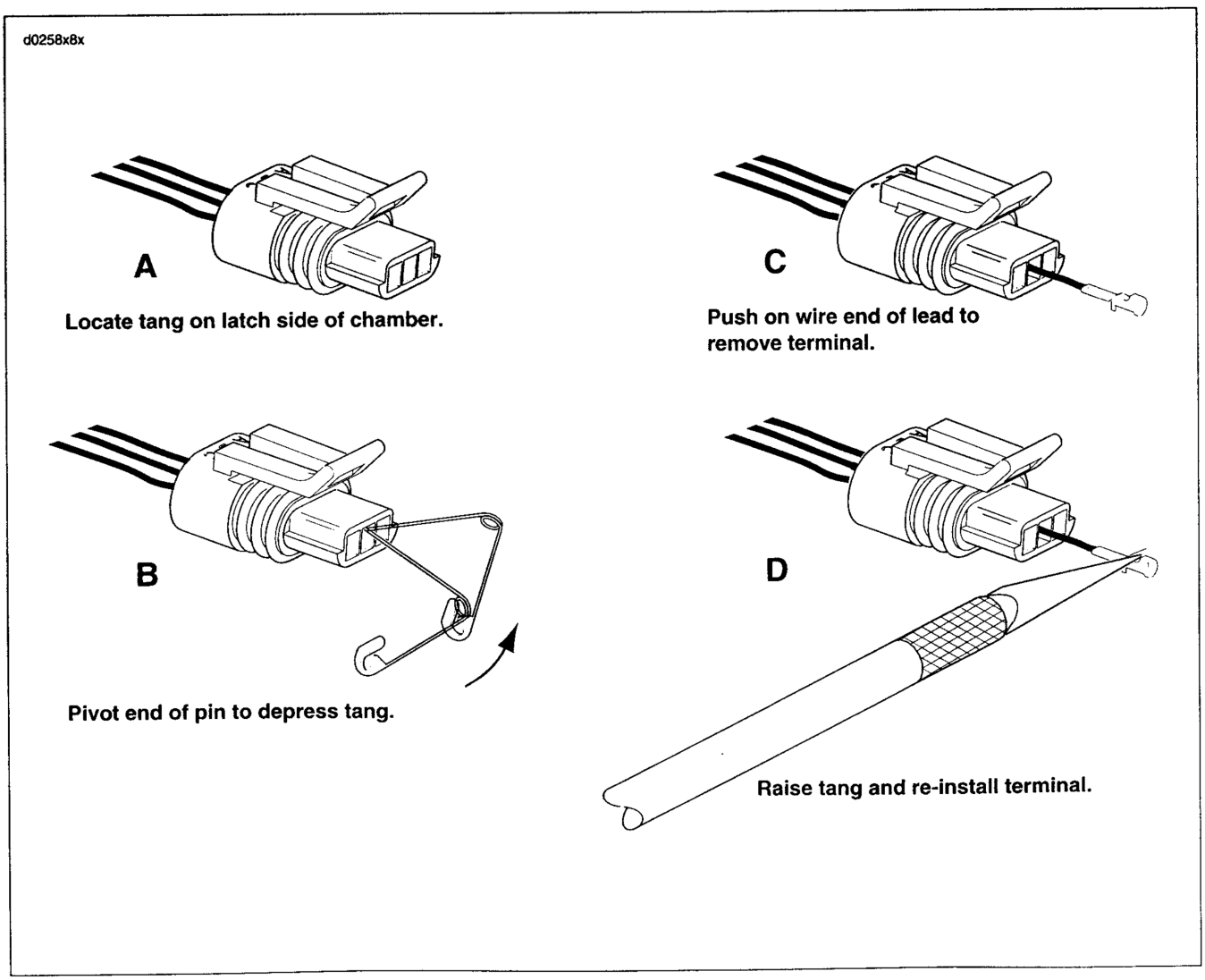


Figure B-20. Packard Connectors

PULL-TO-SEAT TERMINALS

Removing External Latch Type

To remove a pull-to-seat terminal from connectors with external latches, proceed as follows:

1. Remove the connector from the retaining device, if present.
2. Bend back the external latch(es) slightly and separate the pin and socket halves of the connector.
3. To free a pull-to-seat terminal from the connector housing, first look into the mating end of the connector to find the locking tang. See A in Figure B-20. The tangs are always positioned in the middle of the chamber and are on the same side as the external latch. On those connectors with locking ears, the tang is on the side opposite the ear.
4. At a slight angle, gently insert the point of a one inch safety pin down the middle of the chamber (about 1/8 inch) and pivot the end of the pin toward the terminal body. When a click is heard, remove the pin and repeat the procedure. See B in Figure B-20. The click is the sound of the tang returning to the locked position as it slips from the point of the pin. Pick at the tang in this manner until the clicking stops and the pin seems to slide in at a slightly greater depth than it had previously. This is an indication that the tang has been depressed.

NOTES

- *On those terminals that have been extracted on a previous occasion, no clicking sound may be heard when the pin is pivoted to depress the tang, but proceed as if the clicking is audible and then push on the wire end of the lead to check if the terminal is free.*
- *When picking multiple terminals, the end of the pin may become malleable. For best results, continue the procedure with a new safety pin.*

5. Remove the pin and push on the wire end of the lead to extract the terminal from the mating end of the connector. See C in Figure B-20. If necessary, pull back the conduit and remove the wire seal at the back of the connector to introduce some slack in the wires.

NOTE

A series of Packard Electrical Terminal Crimp Tools are available to install Packard pin and socket terminals on wires. If ***new*** *terminals must be installed, see Crimping Instructions.*

Installing External Latch Type

NOTE

For wire location purposes, alpha characters are stamped into the socket housings.

1. To install a terminal back into the chamber of the connector housing, use a thin flat blade, like that on an X-Acto knife, and carefully bend the tang outward away from the terminal body. See D in Figure B-20.
2. Gently pull on the lead at the wire end of the connector to draw the terminal back into the chamber. A click is heard when the terminal is properly seated.
3. Push on the lead to verify that the terminal is locked in place.
4. Push the pin and socket halves of the connector together until the latches "click."

PUSH-TO-SEAT TERMINALS

The Packard push-to-seat terminal connectors found on Dyna Glide model vehicles are listed below.

- Ignition Switch [33]
- Fuse Terminals
- MAP Sensor [80]

Removing Push-to-Seat Terminals

Like most connectors, Packard push-to-seat terminals are pulled out the wire end of the connector. To remove a push-to-seat terminal, proceed as follows:

1. Remove the connector from the retaining device, if present.
2. Bend back the external latch(es) slightly and separate the pin and socket halves of the connector.

NOTE

Both the Ignition Light/Key Switch and the Main Power connectors are provided with secondary locks. The secondary lock, which may be molded onto the connector or exist as a separate piece, aids in terminal retention. Secondary locks must be opened (or removed) before the terminals can be extracted from the connector housing.

3. Open or remove the secondary lock. **Ignition Switch:** Bend back the latch slightly and free one side of the secondary lock, then repeat the step to release the other side. Rotate the secondary lock outward on hinge to access the terminals in the chambers of the connector housing.
4. Looking in the mating end or terminal side of the connector (opposite the secondary lock), take note of the larger cavity next to each terminal.
5. Insert the pick (Snap-On TT600-3) into the cavity until it stops. Pivot the end of the pick toward the terminal to depress the locking tang. Remove the pick and gently tug on the wire to pull the terminal from the wire end of the connector. Repeat the step if the terminal is still locked in place.

NOTE

A series of Packard Electrical Terminal Crimp Tools are available to install Packard pin and socket terminals on wires. If new terminals must be installed, see Crimping Instructions.

Installing Push-to-Seat Terminals

NOTE

For wire location purposes, alpha characters are stamped onto the secondary locks or onto the wire end of the connector housing.

1. To install a terminal back into the chamber of the connector housing, use a thin flat blade, like that on an X-Acto knife, and carefully bend the tang outward away from the terminal body.
2. 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. Close or install the secondary lock. **Ignition Switch:** Rotate the hinged secondary lock inward until tabs fully engage latches on both sides of connector.
5. Push the pin and socket halves of the connector together until the latches "click."
6. Install connector on retaining device, if present.

CRIMPING INSTRUCTIONS

1. Strip wire lead removing 5/32 in. (4 mm) of insulation.
2. Compress handles until ratchet automatically opens.

NOTE

Always perform core crimp before insulation/seal crimp.

3. See B.6 CONNECTOR LOCATIONS and Table B-2. Determine the correct dye or nest for the core crimp.

NOTE

When the word "TIP" appears in the Crimp Table, use the tip of the tool specified to perform the core crimp procedure. See Figure B-21.

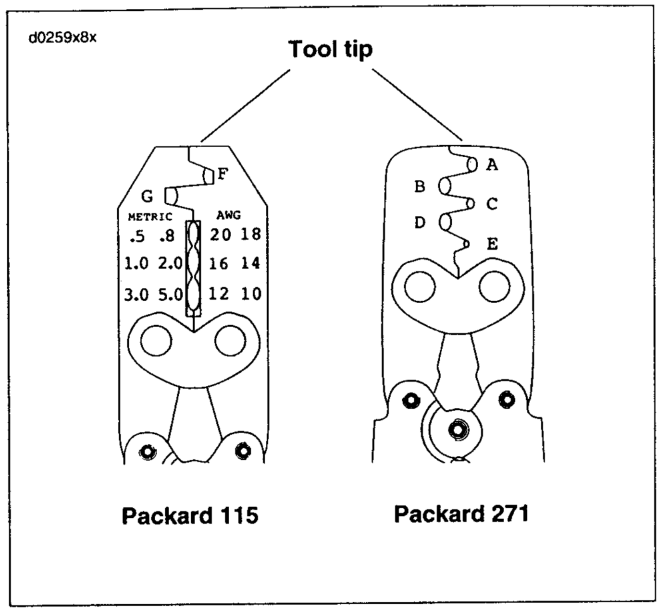
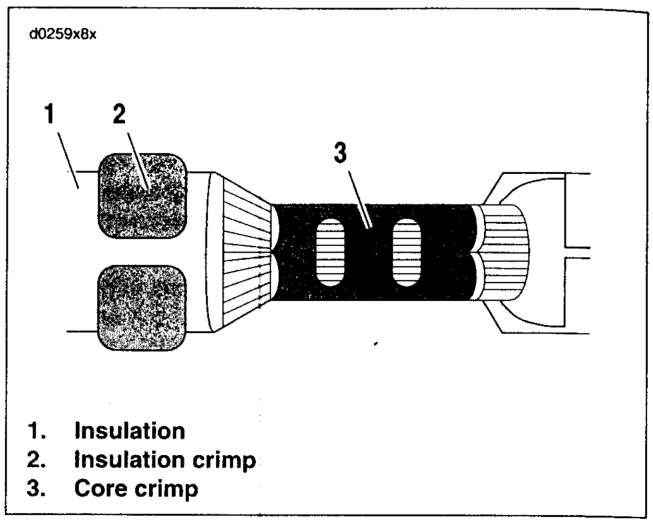


Figure B-21. Packard Terminal Crimp Tools

Table B-2. Packard Terminal Crimp Tools

SPECIFICATION	PACKARD 115	PACKARD 271
Part No.	HD-38125-8	HD-38125-7
Type of Crimp	Non-sealed terminals, butt splices	Non-sealed terminals
Dye/nests	F-G	A-E

4. Lay the back of the core crimp tails on the appropriate nest. Be sure the core crimp tails are pointing towards the forming jaws.
5. Gently apply pressure to handles of tool until crimpers slightly secure the core crimp tails.
6. Insert stripped wire between crimp tails. Verify that wire is positioned so that short pair of crimp tails squeeze bare wire strands, while long pair folds over insulation or seal material.
7. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
8. See B.6 CONNECTOR LOCATIONS and Table B-2. Determine the correct dye or nest for the insulation/seal crimp.
9. Lay the back of the insulation/seal crimp tails on the appropriate nest. Be sure the insulation/seal crimp tails are pointing towards the forming jaws.
10. Squeeze handle of crimp tool until tightly closed. Tool automatically opens when the crimping sequence is complete.
11. See Figure B-22. Inspect the quality of the core (3) and insulation/seal (2) crimps. Distortion should be minimal.



1. **Insulation**
2. **Insulation crimp**
3. **Core crimp**

Figure B-22. Inspect Core and Insulation/Seal Crimps

Table B-3. Dyna Connector Locations

CONNECTOR NO.	DESCRIPTION	TYPE	LOCATION
[7]	tail lamp harness to main harness	8-place Multilock	under seat
[10]	ignition module (black)	12-place Deutsch	under seat, behind electrical panel
[11]	ignition module (gray)	12-place Deutsch	under seat, behind electrical panel
[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	12-place Multilock	FXD, FXDX, FXDXT: under headlight bracket FXDL: under console
[21]	indicator lamps	8-place Multilock	FXDWG: under console
	console gauges	10-place Multilock	FXDL: under console
[22]	right hand controls	6-place Deutsch	frame backbone
[24]	left hand controls and horn	6-place Deutsch	frame backbone
[30]	TSM/TSSM	12-place Deutsch	electrical panel
[31]	front turn signals	6-place Multilock	frame backbone
[33]	ignition key switch - all except FXDWG	4-place Packard	under seat
	ignition key switch - FXDWG only	3-place Packard	FXDWG: under console
[38]	headlamp	4-place Multilock	frame backbone
[39]	speedometer - all except FXDWG	12-place Packard	back of speedometer
	speedometer - FXDWG only	12-place Mini-Deutsch	
[46]	voltage regulator to stator	2-place Facon	front of engine crankcase
[65]	speedometer sensor	3-place Deutsch	under seat
[79]	crank position sensor (CKP)	2-place Mini-Deutsch	under seat
[80]	manifold air pressure sensor	3-place Packard	top of manifold
[83]	ignition coil	3-place Packard	on back of coil
[91]	data link connector	4-place Deutsch	t-stud on back of electrical panel
[93]	tail lamp	4-place Multilock	behind tail lamp
[94]	tail lamp power in	6-place Multilock	behind tail lamp
[108]	tachometer	6-place Packard	back of tachometer
[117]	fuel gauge and fuel level sending unit	2-place Multilock	left front side of fuel tank
[140]	oil pressure sending unit	2-place Mini-Deutsch	under seat
[62]	starter relay	spade terminals fuse/relay block	electrical panel
[64]	fuse block	spade terminals	electrical panel
[121]	rear stoplight switch	spade terminals	behind rear master cylinder

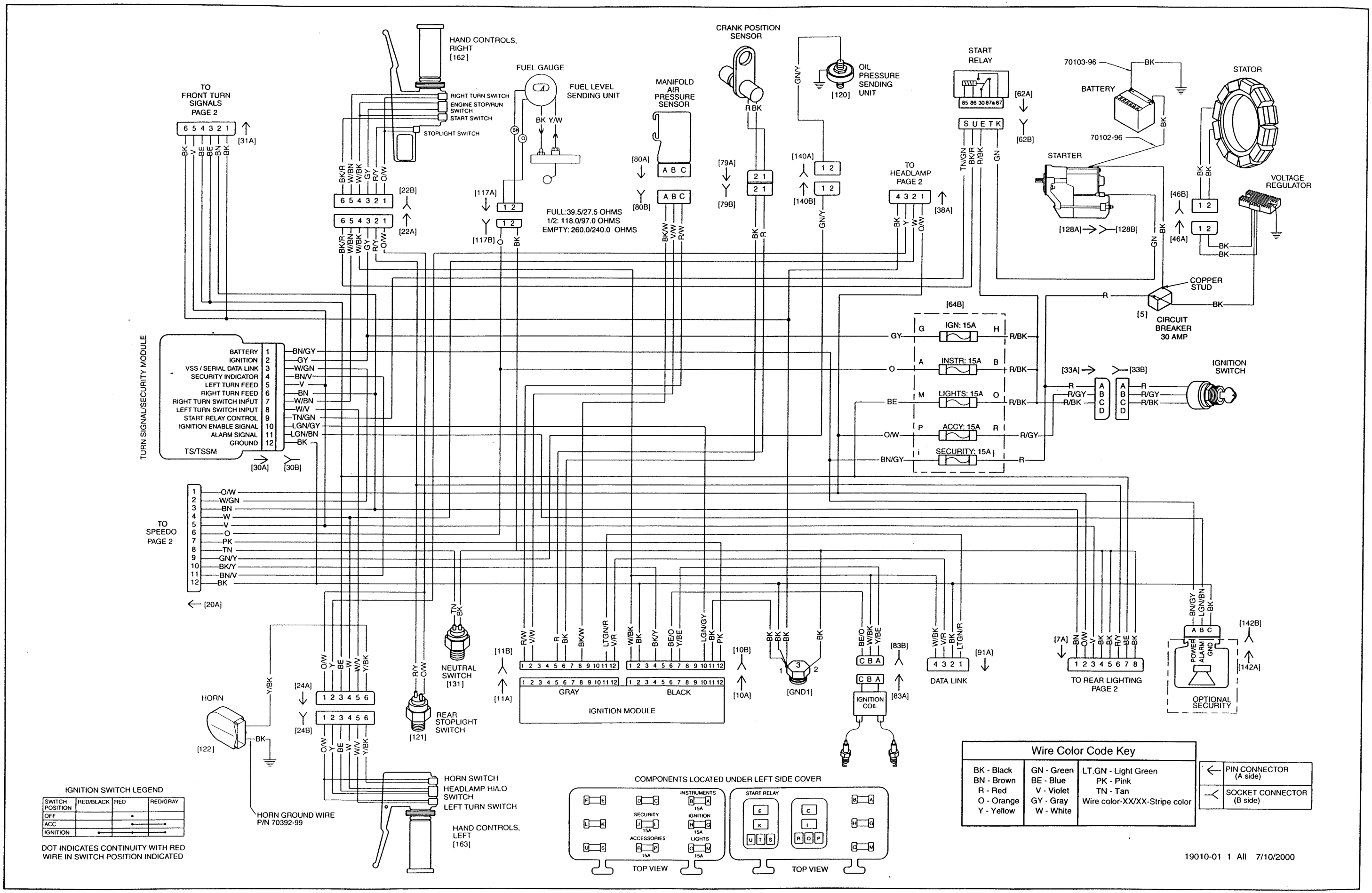
Table B-3. Dyna Connector Locations

CONNECTOR NO.	DESCRIPTION	TYPE	LOCATION
[5]	main circuit breaker	ring terminals	electrical panel
[128]	starter solenoid	spade terminals	top of starter
[131]	neutral switch	post terminals	top of transmission
-	harness grounds (2)	ring terminals	under seat
[120]	oil pressure switch	post terminal	on oil pressure switch
[142]	optional security siren	3-place Packard	under seat

MODEL	DIAGRAM	PAGE
Dyna Glide (Domestic and International)	Main wiring diagram	B-21 and B-22
	Charging	B-23
	Horn and instruments	B-24 and B-25
	Ignition	B-26
	Lighting	B-27 and B-28
	Security	B-29 and B-30
	Starting	B-31
Dyna Wide Glide (FXDWG) (Domestic and International)	Main wiring diagram	B-32 and B-33
	Charging	B-34
	Horn and instruments	B-35 and B-36
	Ignition	B-37
	Lighting	B-38 and B-39
	Security	B-40 and B-41
	Starting	B-42

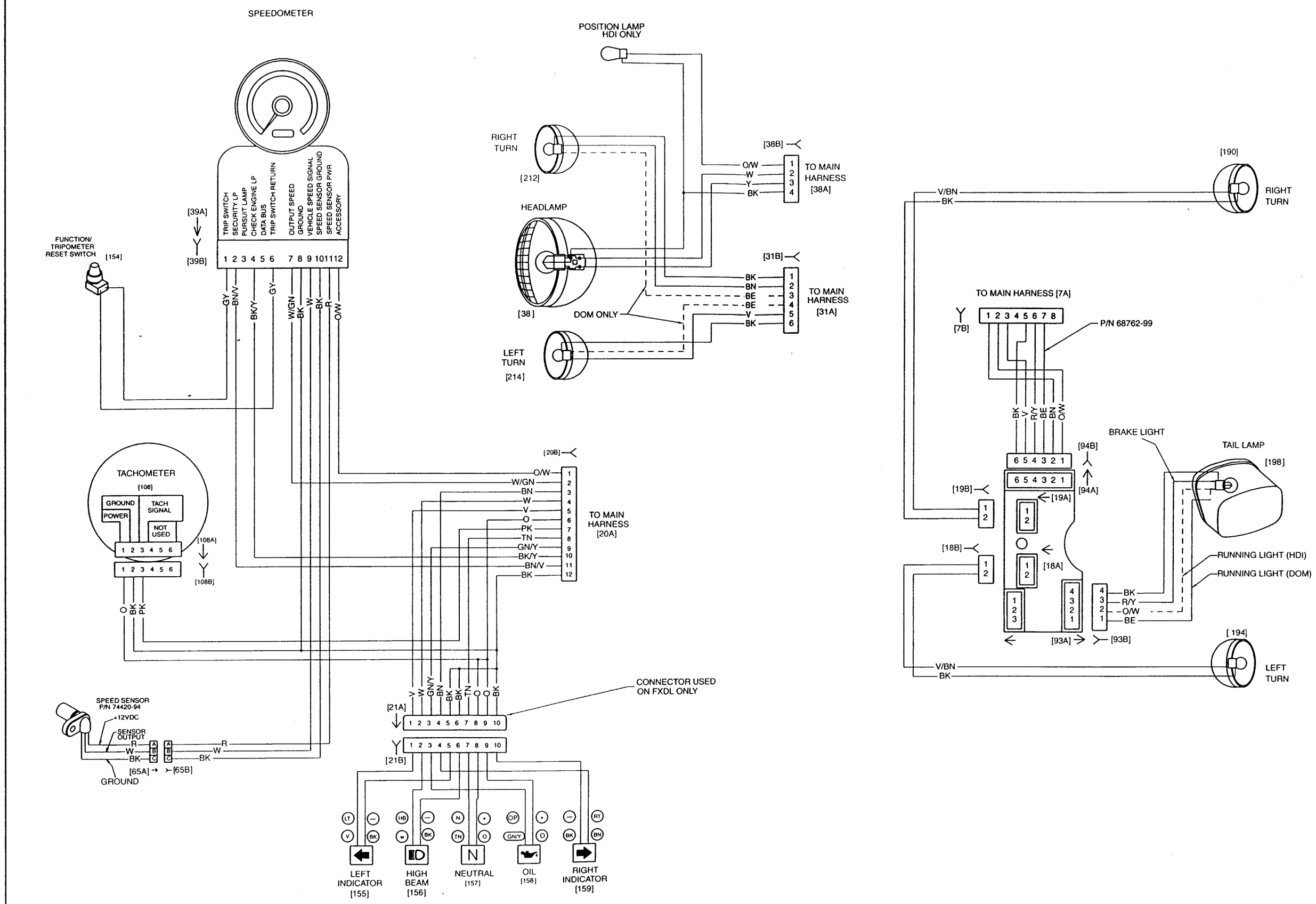
NOTES

Dyna Glide Wiring Diagram
(Domestic and International Models)
Main Wiring Diagram (1 of 2)



Dyna Glide Wiring Diagram (Domestic and International Models), Main Wiring Diagram (1 of 2)

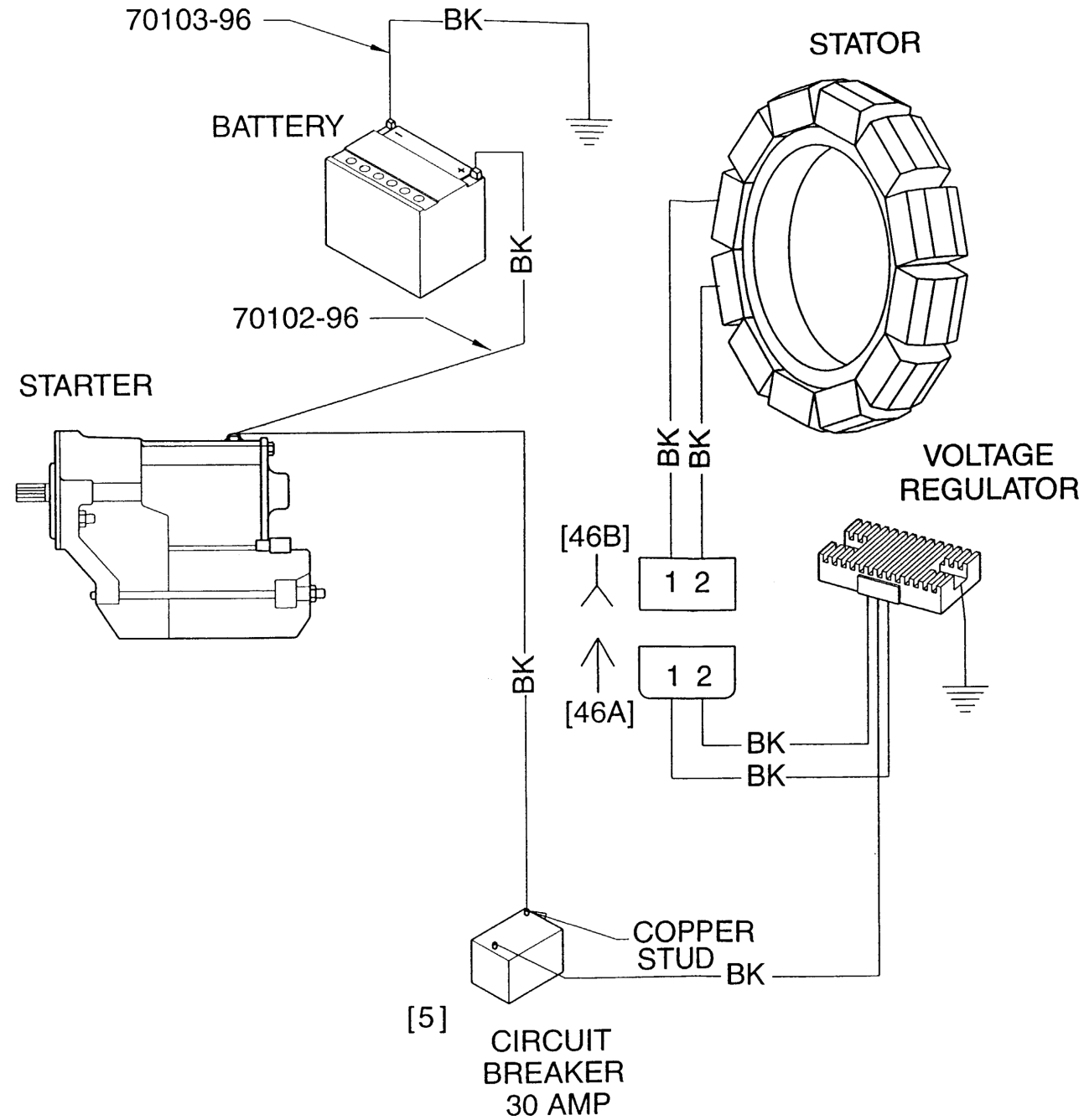
Dyna Glide Wiring Diagram
(Domestic and International Models)
Main Wiring Diagram (2 of 2)



19010-01 2 ALL 7/12/2000

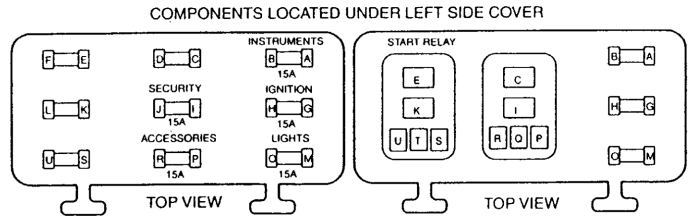
Dyna Glide Wiring Diagram (Domestic and International Models), Main Wiring Diagram (2 of 2)

Dyna Glide Wiring Diagram
(Domestic and International Models)
Charging



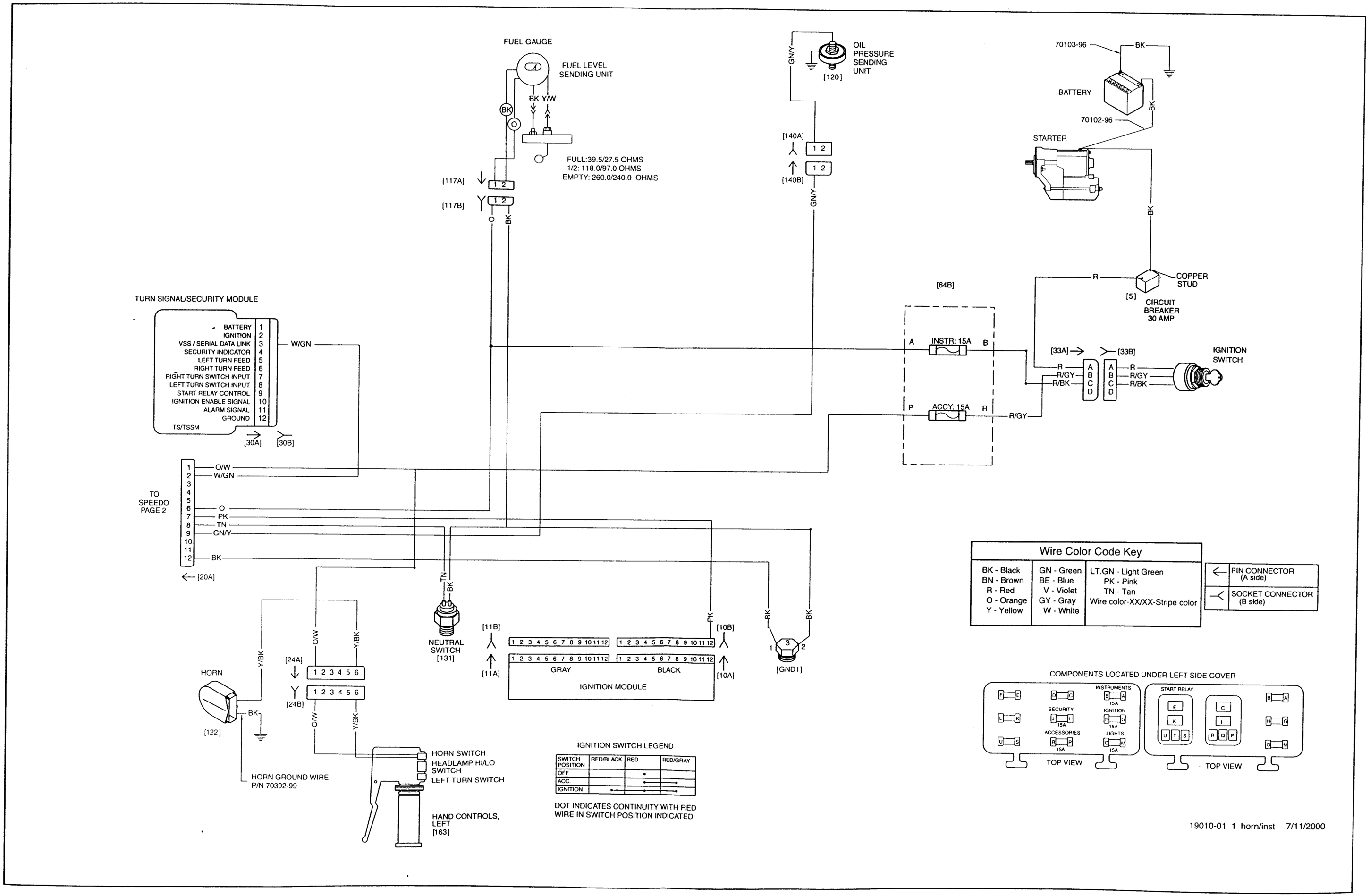
Wire Color Code Key		
BK - Black	GN - Green	LT.GN - Light Green
BN - Brown	BE - Blue	PK - Pink
R - Red	V - Violet	TN - Tan
O - Orange	GY - Gray	Wire color-XX/XX-Stripe color
Y - Yellow	W - White	

←	PIN CONNECTOR (A side)
≺	SOCKET CONNECTOR (B side)



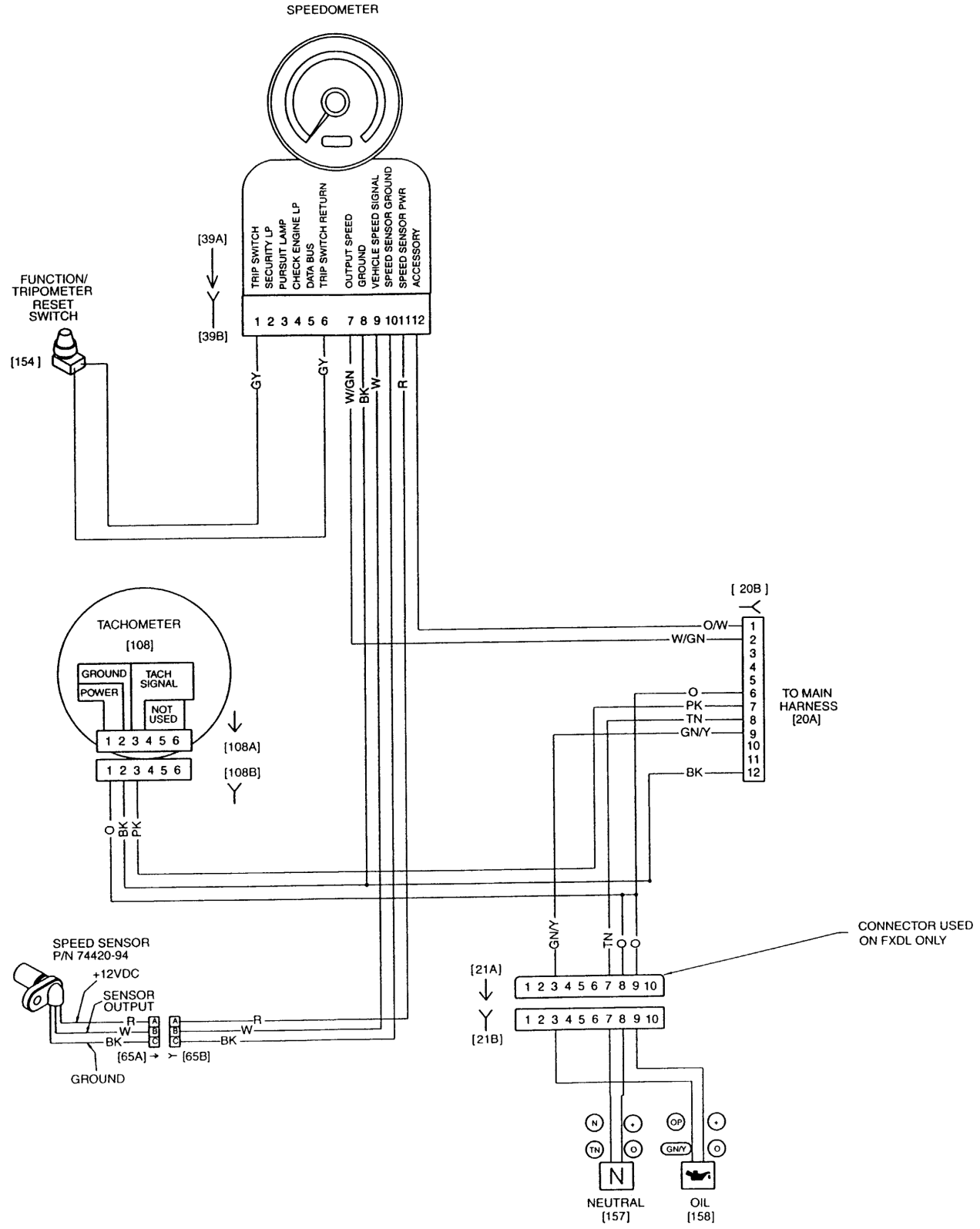
19010-01a 1 charge 7/13/2000

Dyna Glide Wiring Diagram
(Domestic and International Models)
Horn and Instruments (1 of 2)



Dyna Glide Wiring Diagram (Domestic and International Models), Horn and Instruments (1 of 2)

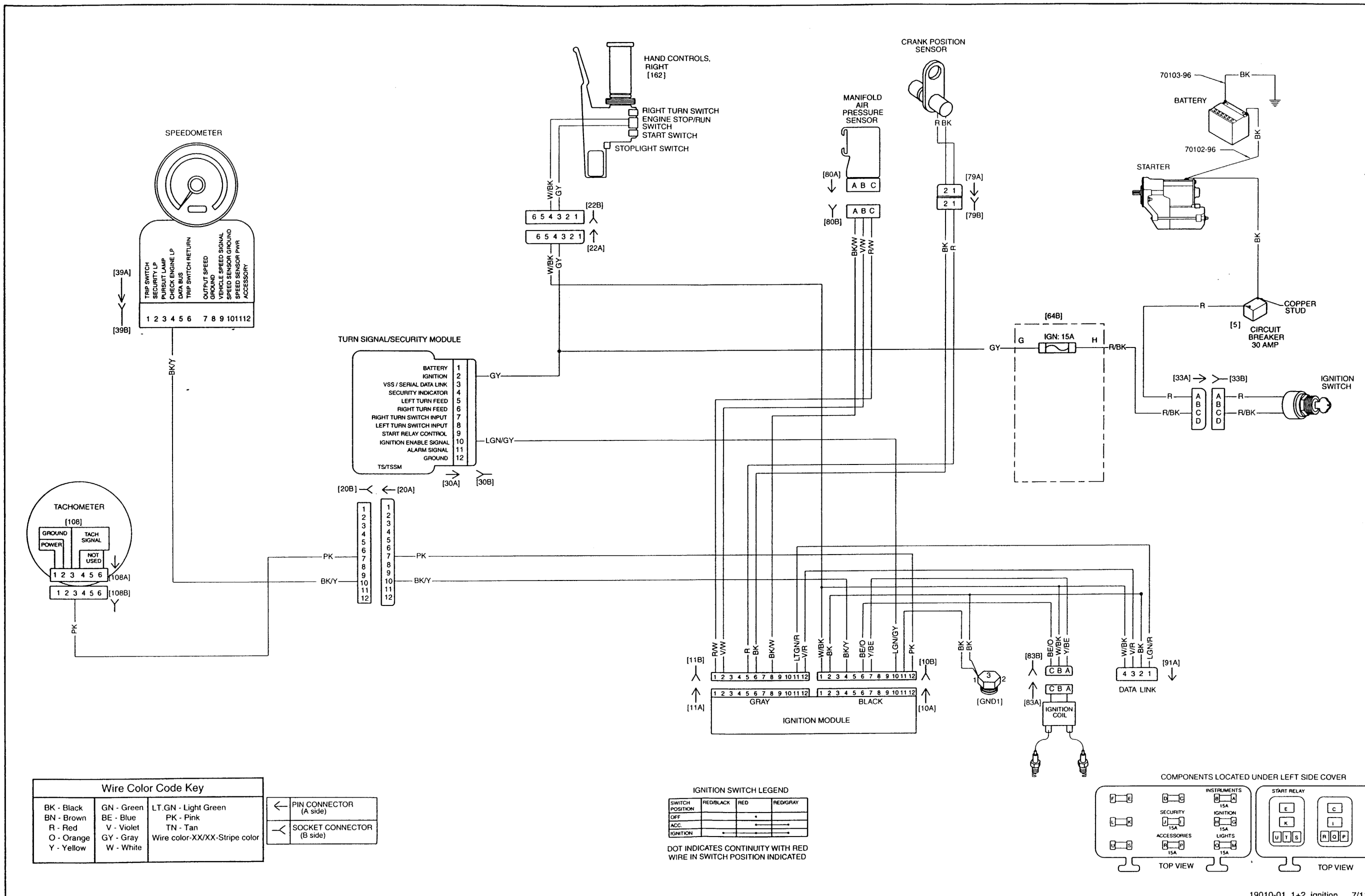
Dyna Glide Wiring Diagram
(Domestic and International Models)
Horn and Instruments (2 of 2)



19010-01 2 horn / inst 7/12/2000

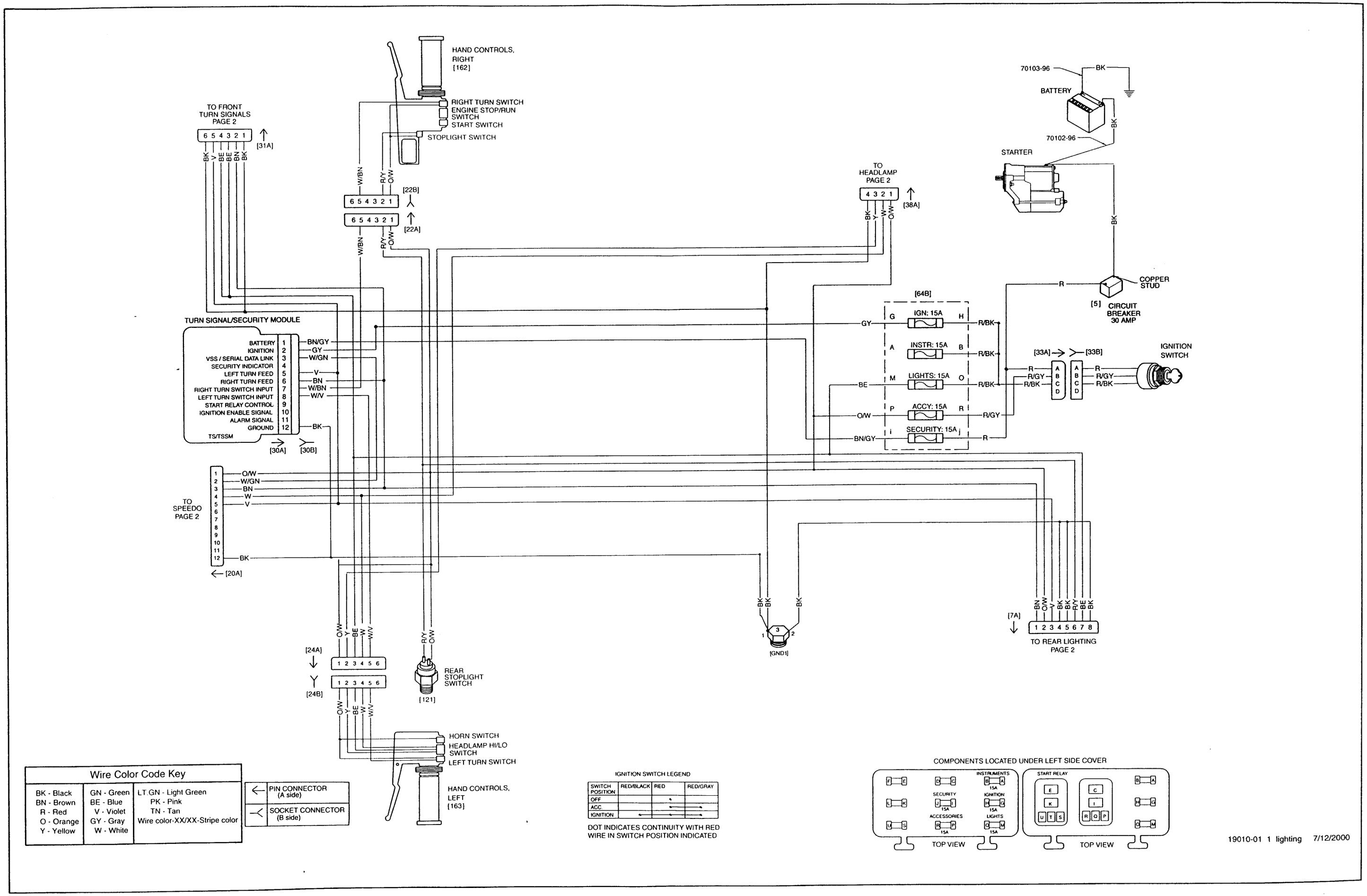
Dyna Glide Wiring Diagram (Domestic and International Models), Horn and Instruments (2 of 2)

Dyna Glide Wiring Diagram
(Domestic and International Models)
Ignition



Dyna Glide Wiring Diagram (Domestic and International Models), Ignition

Dyna Glide Wiring Diagram
(Domestic and International Models)
Lighting (1 of 2)



Wire Color Code Key		
BK - Black	GN - Green	LT.GN - Light Green
BN - Brown	BE - Blue	PK - Pink
R - Red	V - Violet	TN - Tan
O - Orange	GY - Gray	Wire color-XX/XX-Stripe color
Y - Yellow	W - White	

← PIN CONNECTOR (A side)

SOCKET CONNECTOR (B side)

IGNITION SWITCH LEGEND

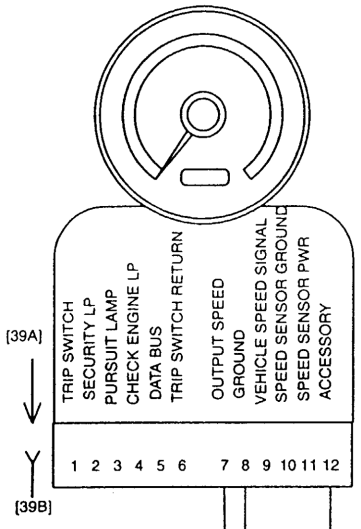
SWITCH POSITION	RED/BLACK	RED	RED/GRAY
OFF		•	
ACC		•	•
IGNITION	•	•	•

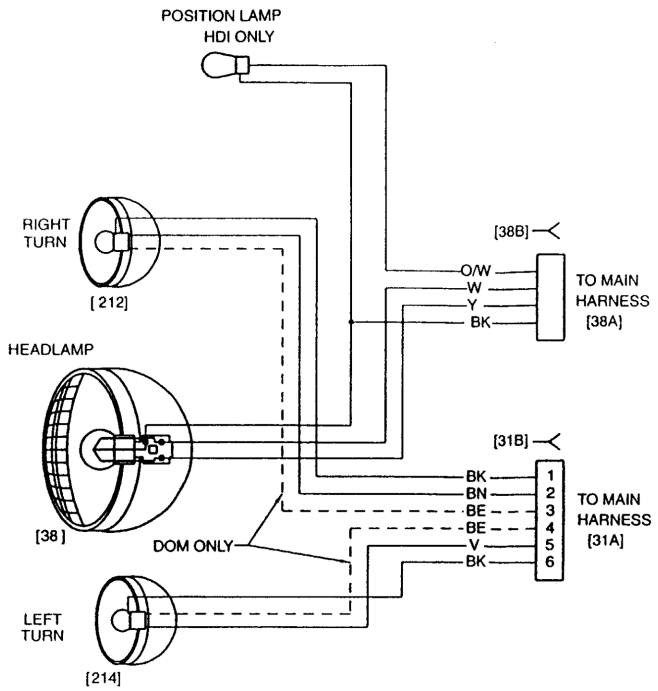
DOT INDICATES CONTINUITY WITH RED WIRE IN SWITCH POSITION INDICATED

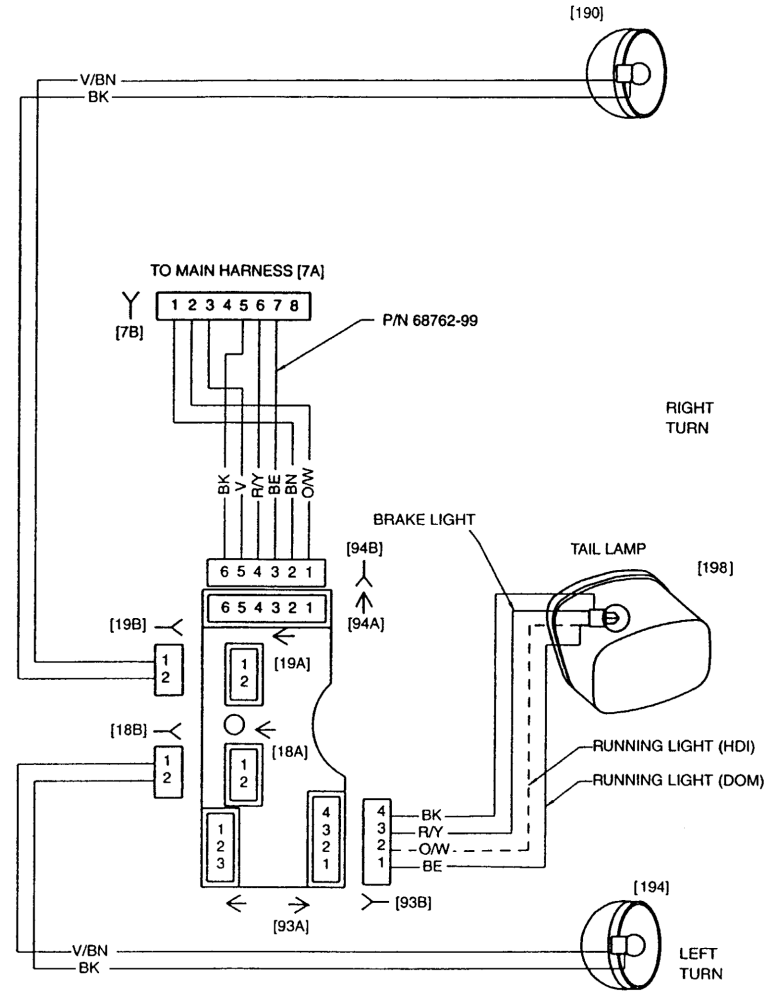
19010-01 1 lighting 7/12/2000

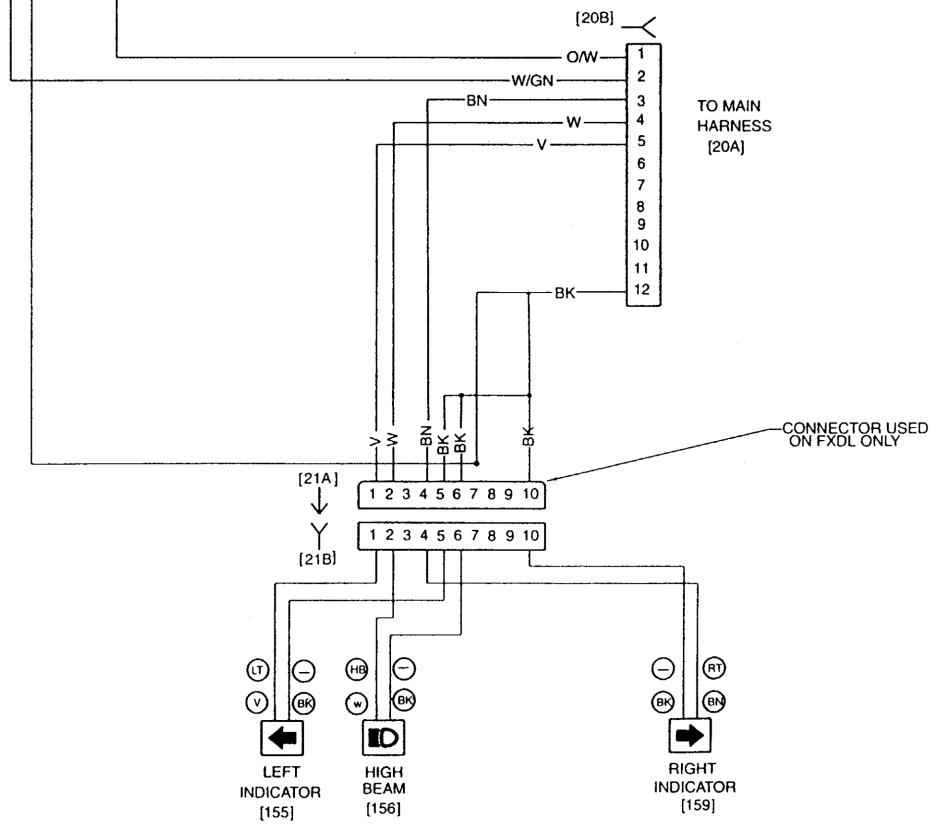
Dyna Glide Wiring Diagram (Domestic and International Models), Lighting (1 of 2)

Dyna Glide Wiring Diagram
(Domestic and International Models)
Lighting (2 of 2)





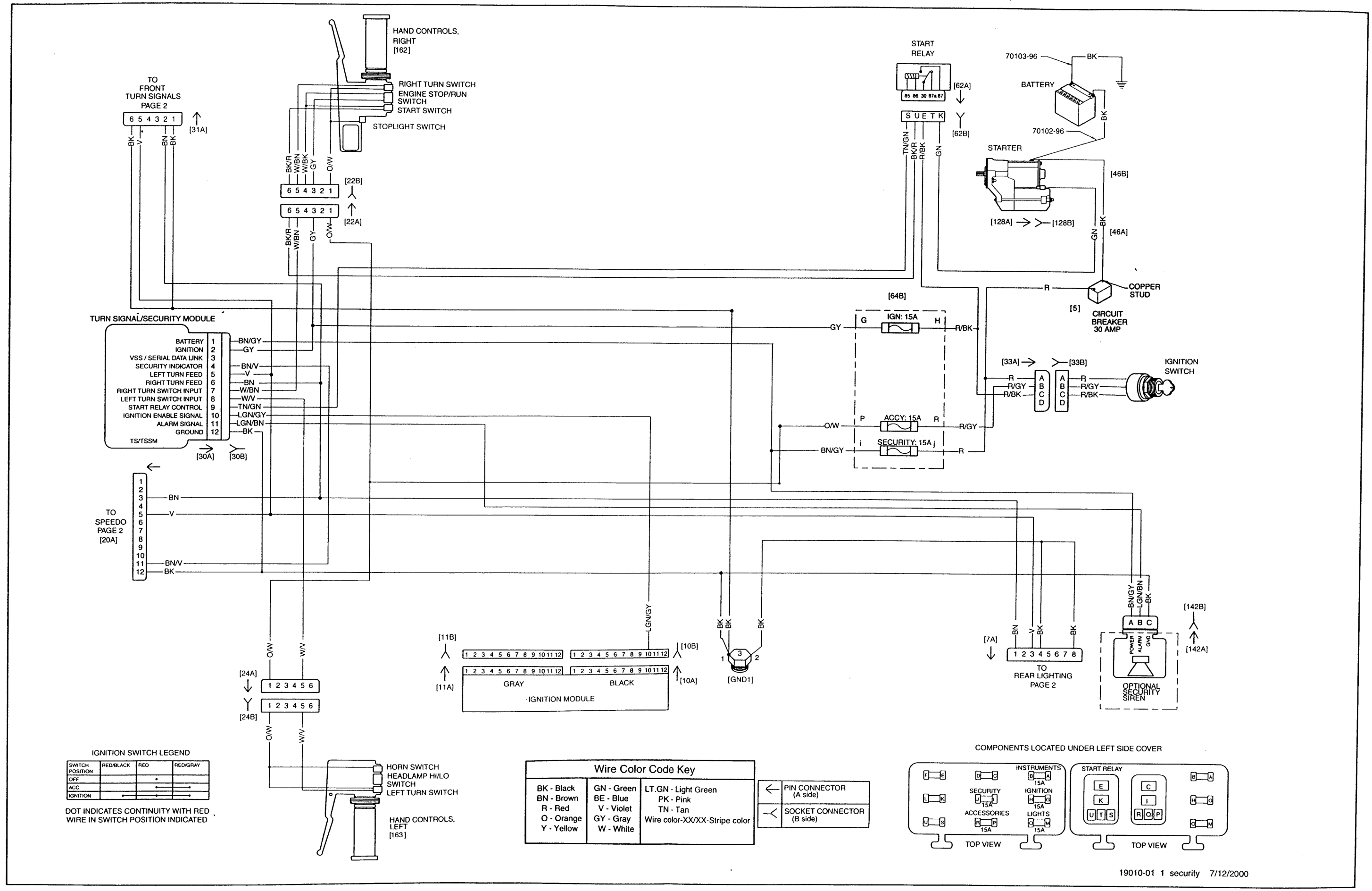




19010-01 2 lighting 7/12/2000

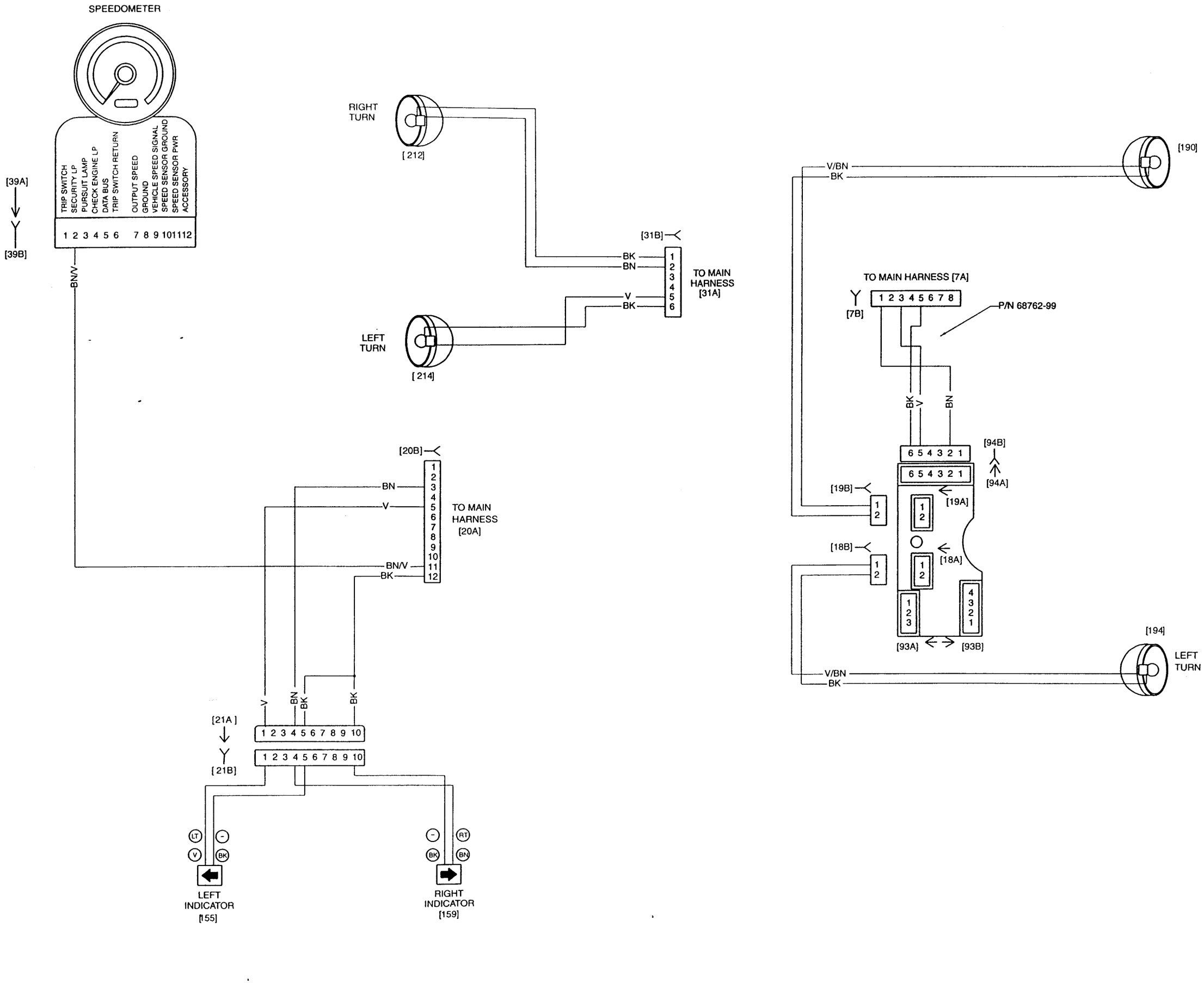
Dyna Glide Wiring Diagram (Domestic and International Models), Lighting (2 of 2)

Dyna Glide Wiring Diagram
(Domestic and International Models)
Security (1 of 2)



Dyna Glide Wiring Diagram (Domestic and International Models), Security (1 of 2)

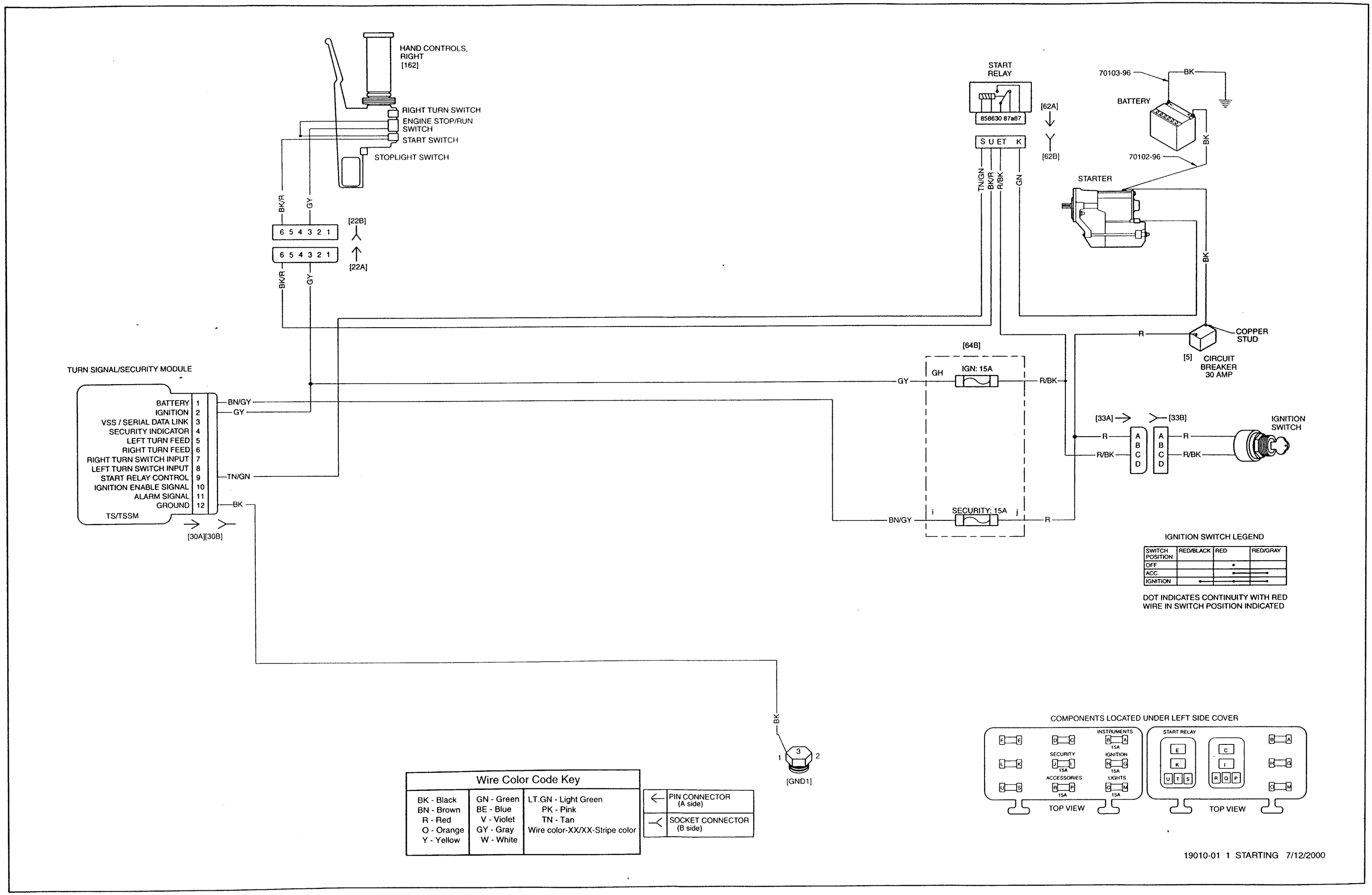
Dyna Glide Wiring Diagram
(Domestic and International Models)
Security (2 of 2)



19010-01 2 security 7/13/2000

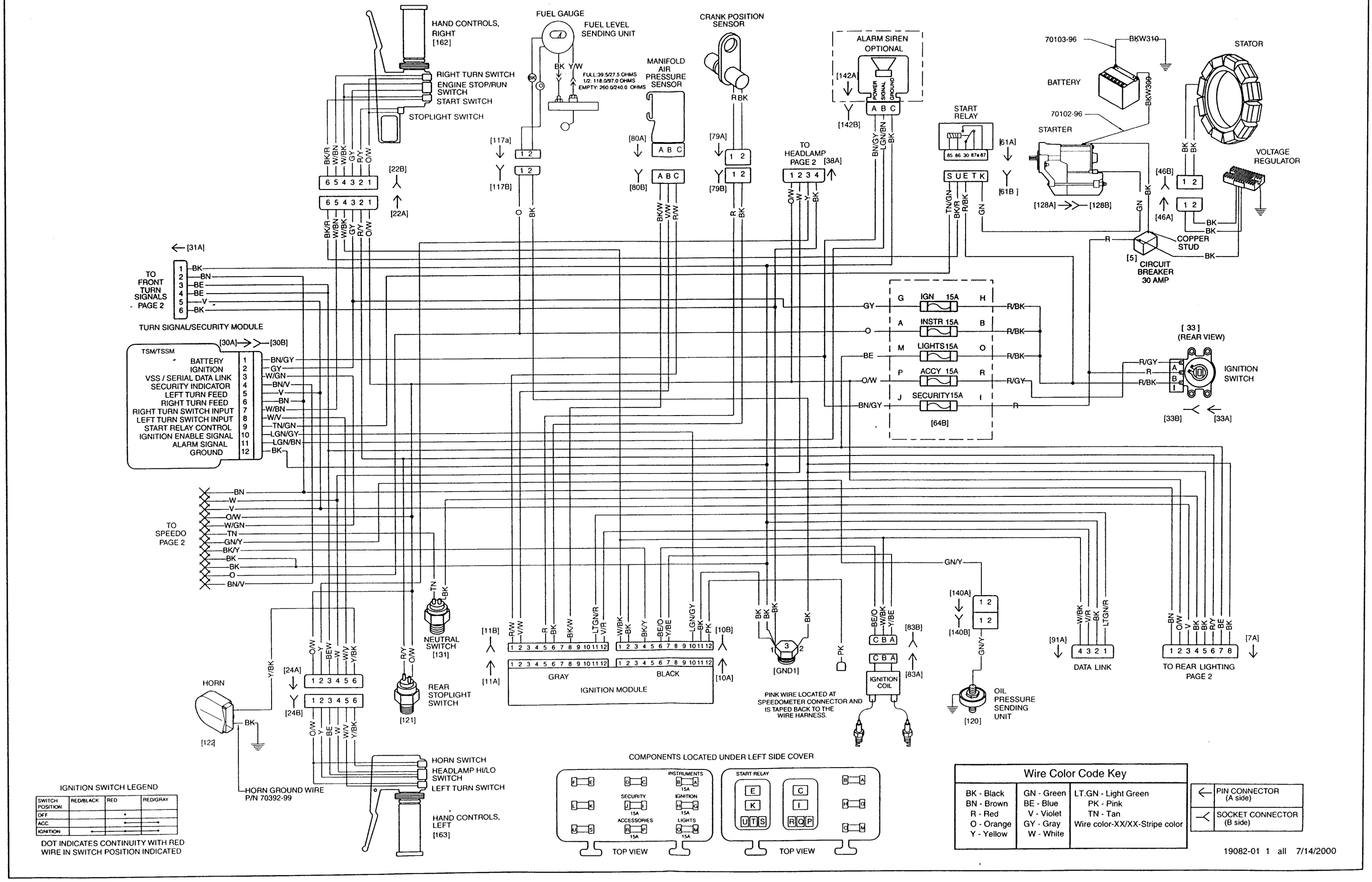
Dyna Glide Wiring Diagram (Domestic and International Models), Security (2 of 2)

Dyna Glide Wiring Diagram
(Domestic and International Models)
Starting



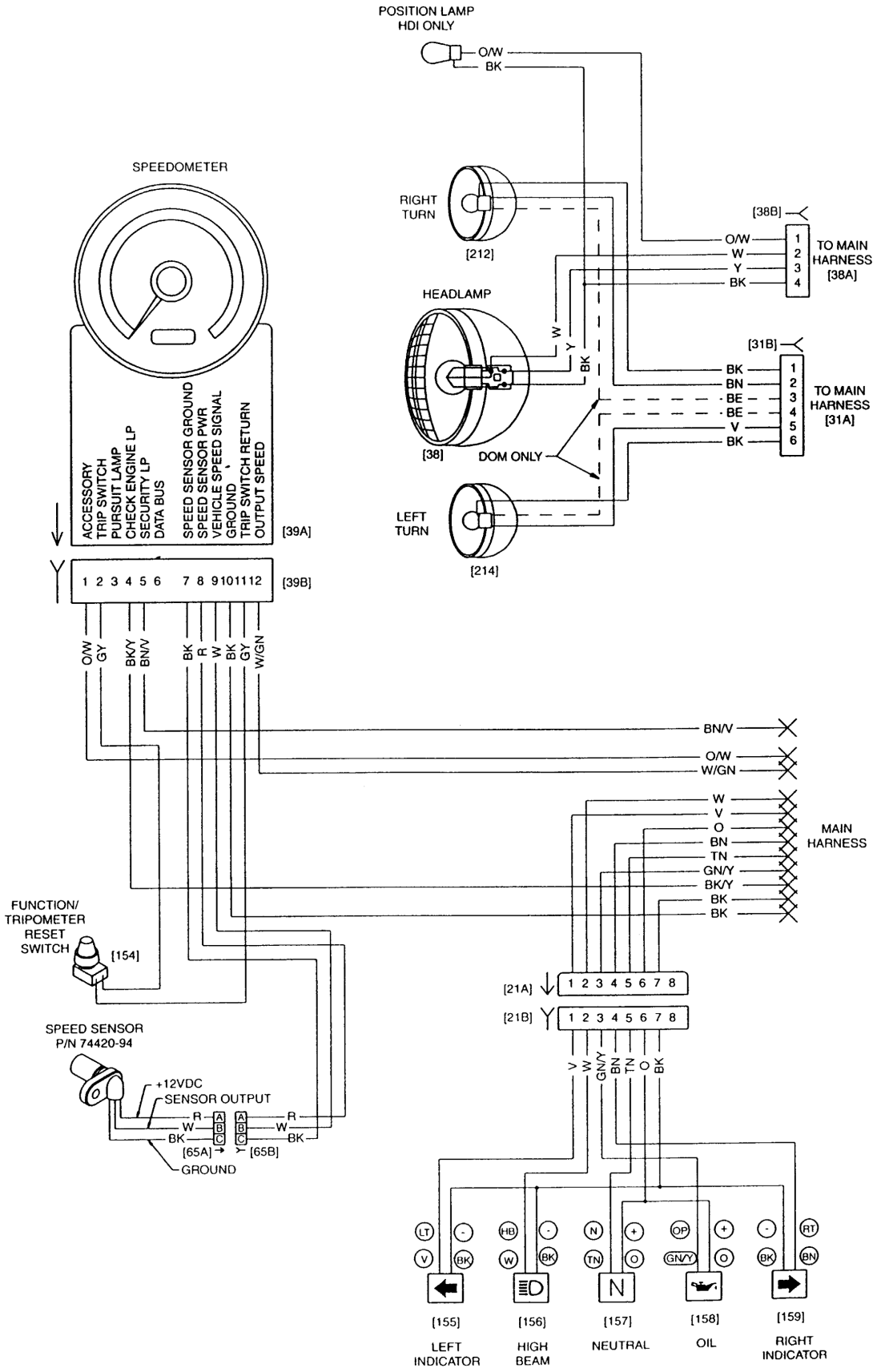
Dyna Glide Wiring Diagram (Domestic and International Models), Starting

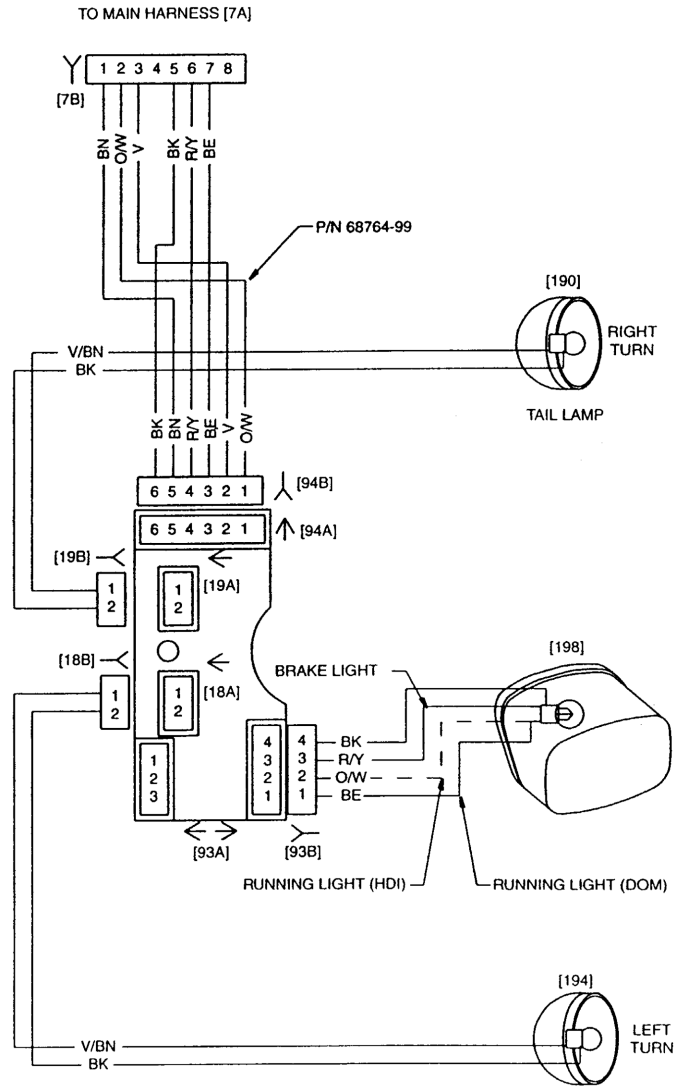
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Main Wiring Diagram (1 of 2)



Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Main Wiring Diagram (1 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Main Wiring Diagram (2 of 2)

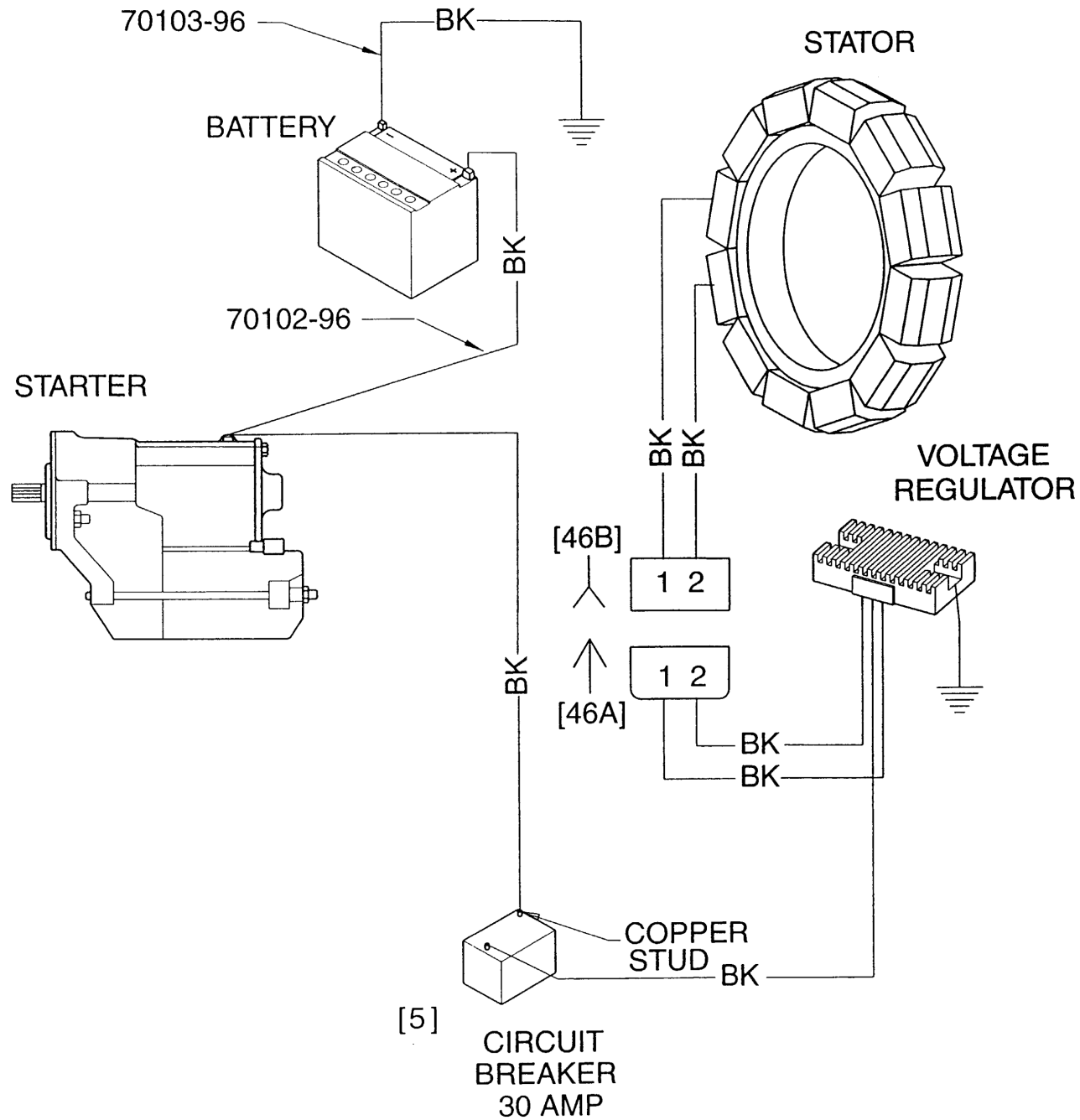




19082-01_2all 7/13/2000

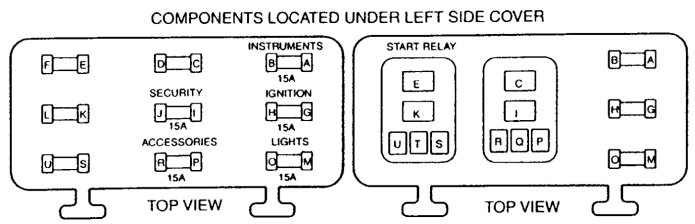
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Main Wiring Diagram (2 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Charging



Wire Color Code Key		
BK - Black	GN - Green	LT.GN - Light Green
BN - Brown	BE - Blue	PK - Pink
R - Red	V - Violet	TN - Tan
O - Orange	GY - Gray	Wire color-XX/XX-Stripe color
Y - Yellow	W - White	

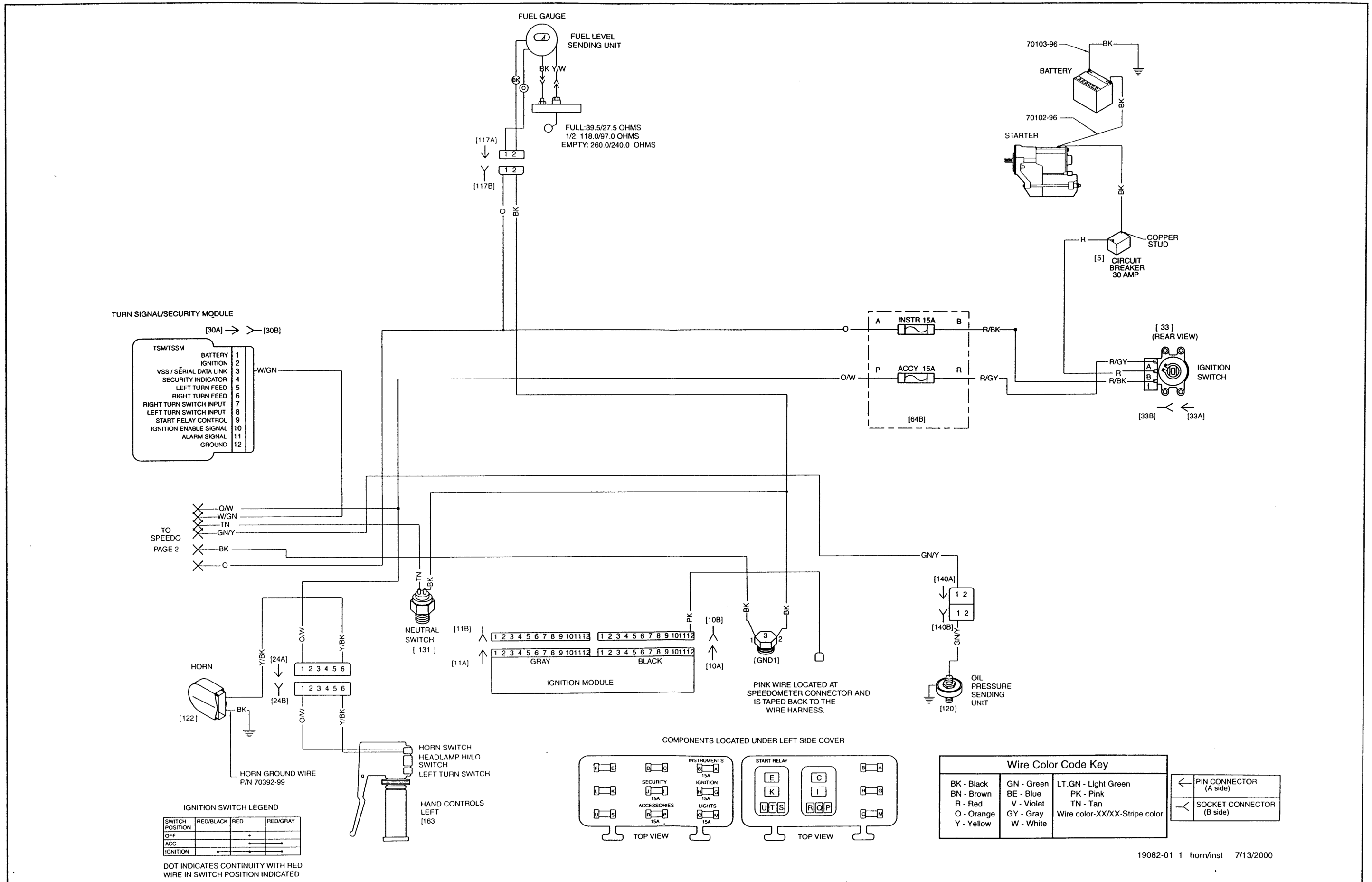
←	PIN CONNECTOR (A side)
⟙	SOCKET CONNECTOR (B side)



19082-01a 1 charge 7/14/2000

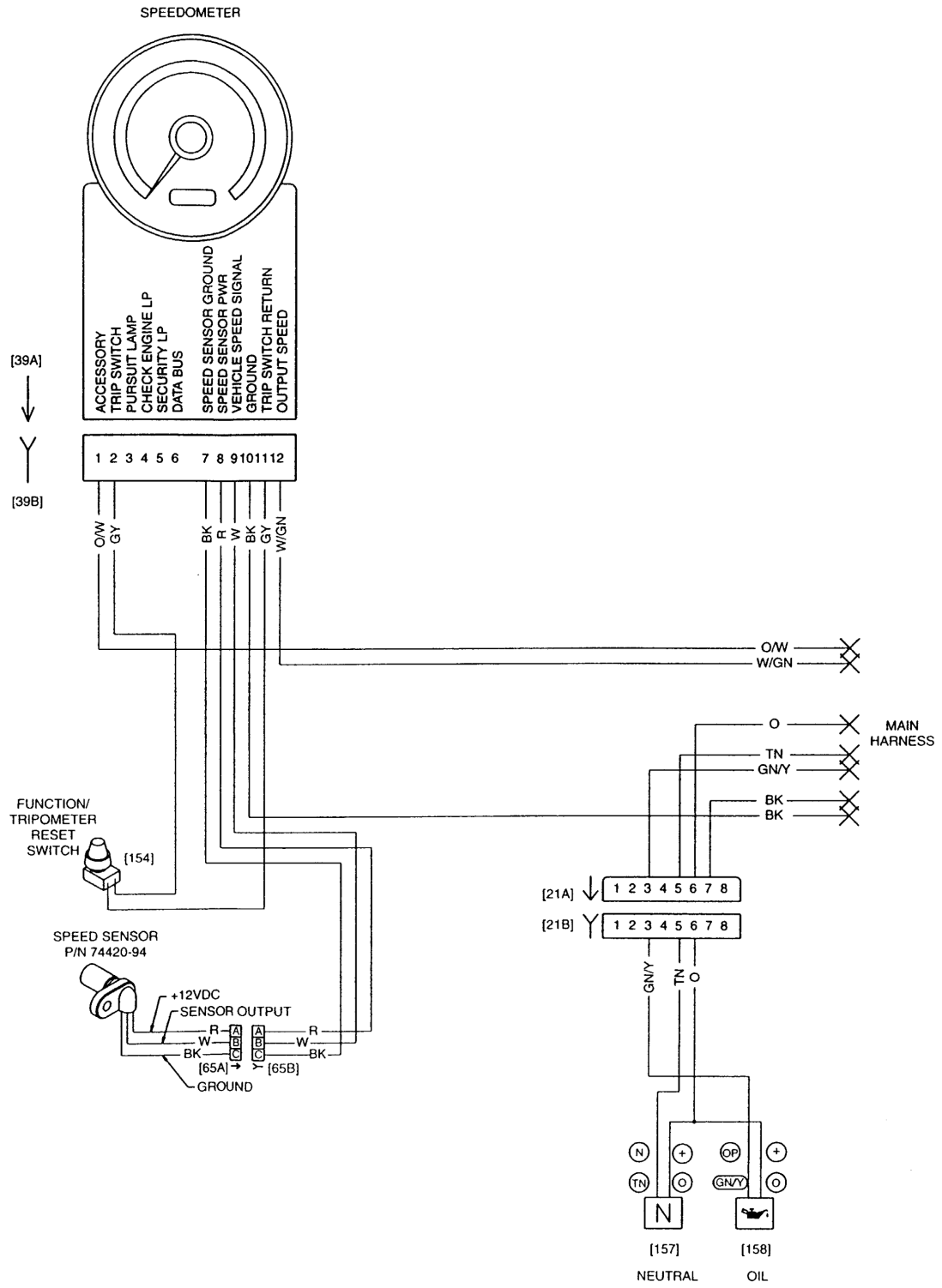
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Charging

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Horn and Instruments (1 of 2)



Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Horn and Instruments (1 of 2)

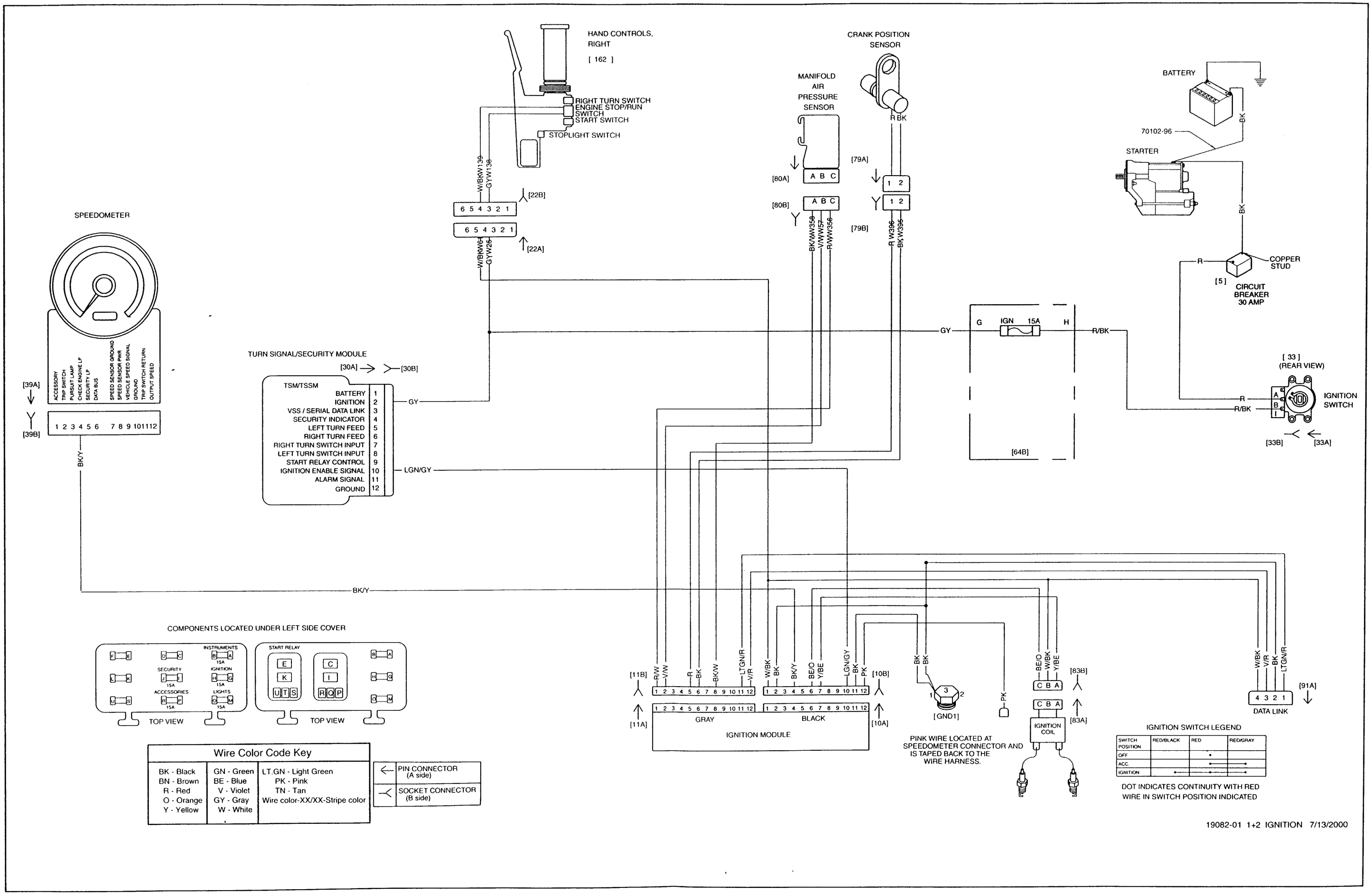
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Horn and Instruments (2 of 2)



19082-01_2horn_inst 7/13/2000

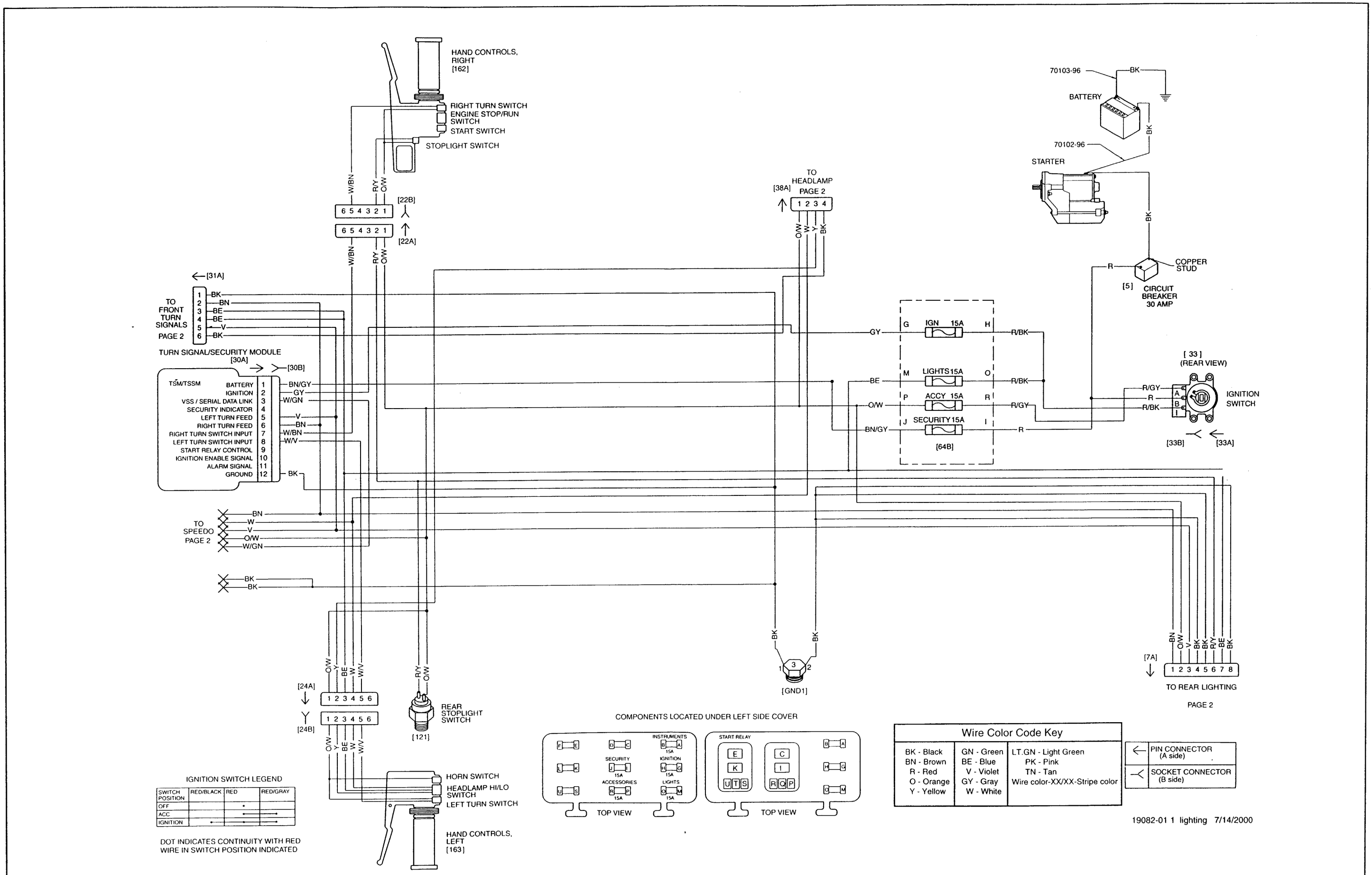
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Horn and Instruments (2 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Ignition



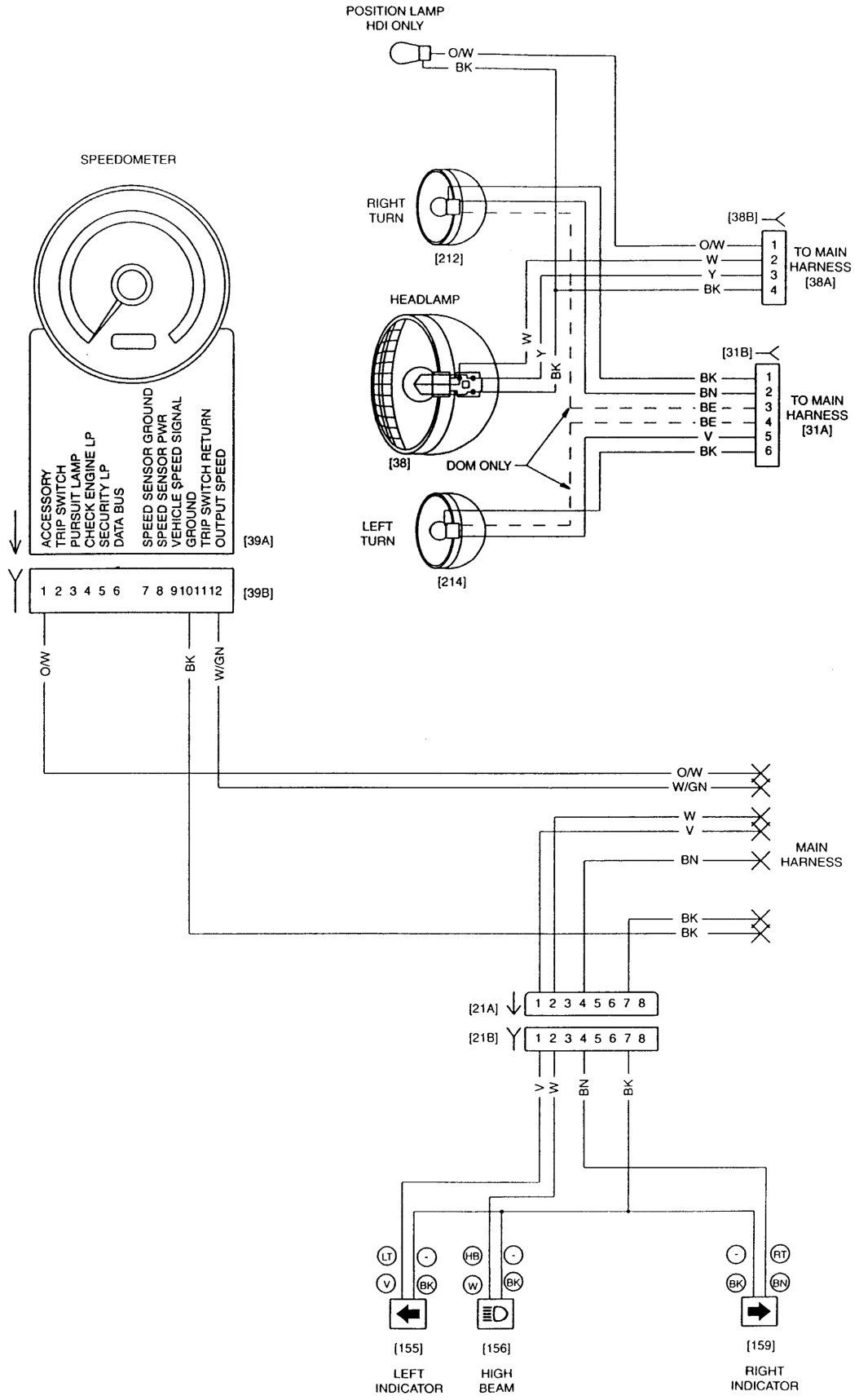
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Ignition

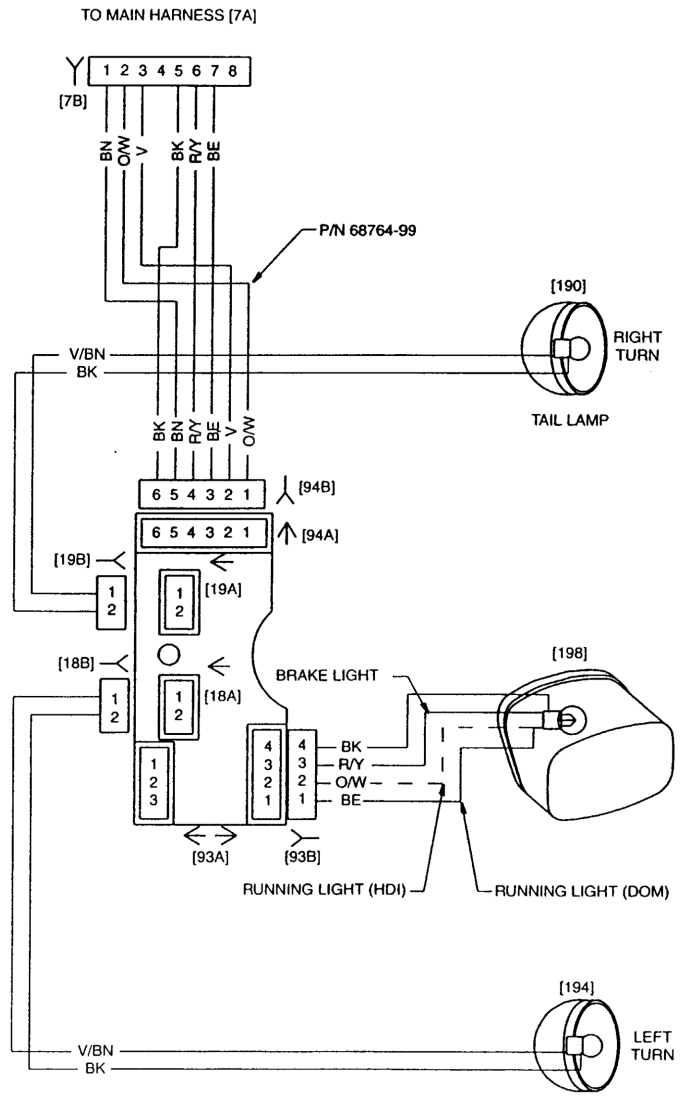
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Lighting (1 of 2)



Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Lighting (1 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Lighting (2 of 2)

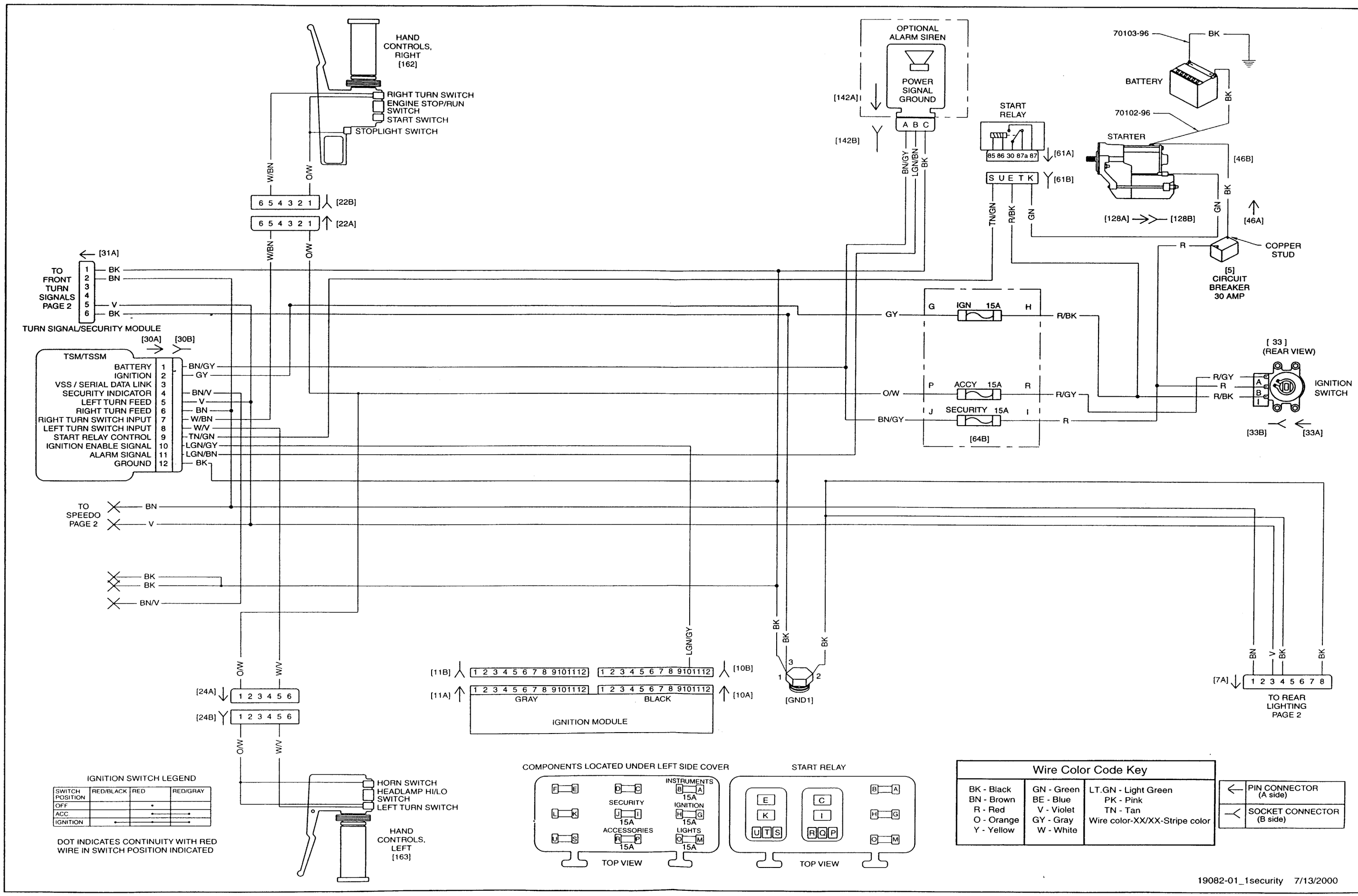




19082-01_2lighting 7/13/2000

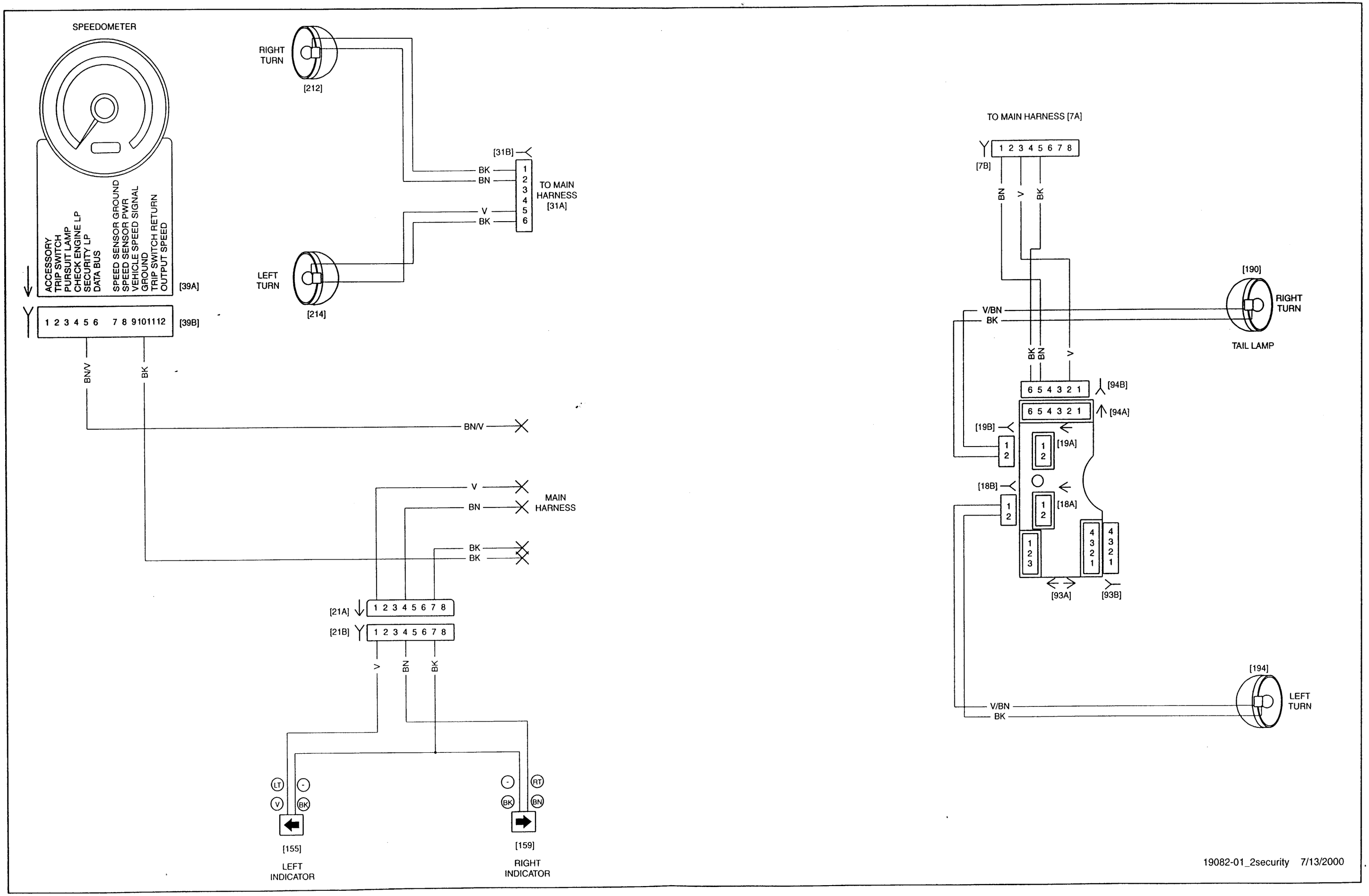
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Lighting (2 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Security (1 of 2)



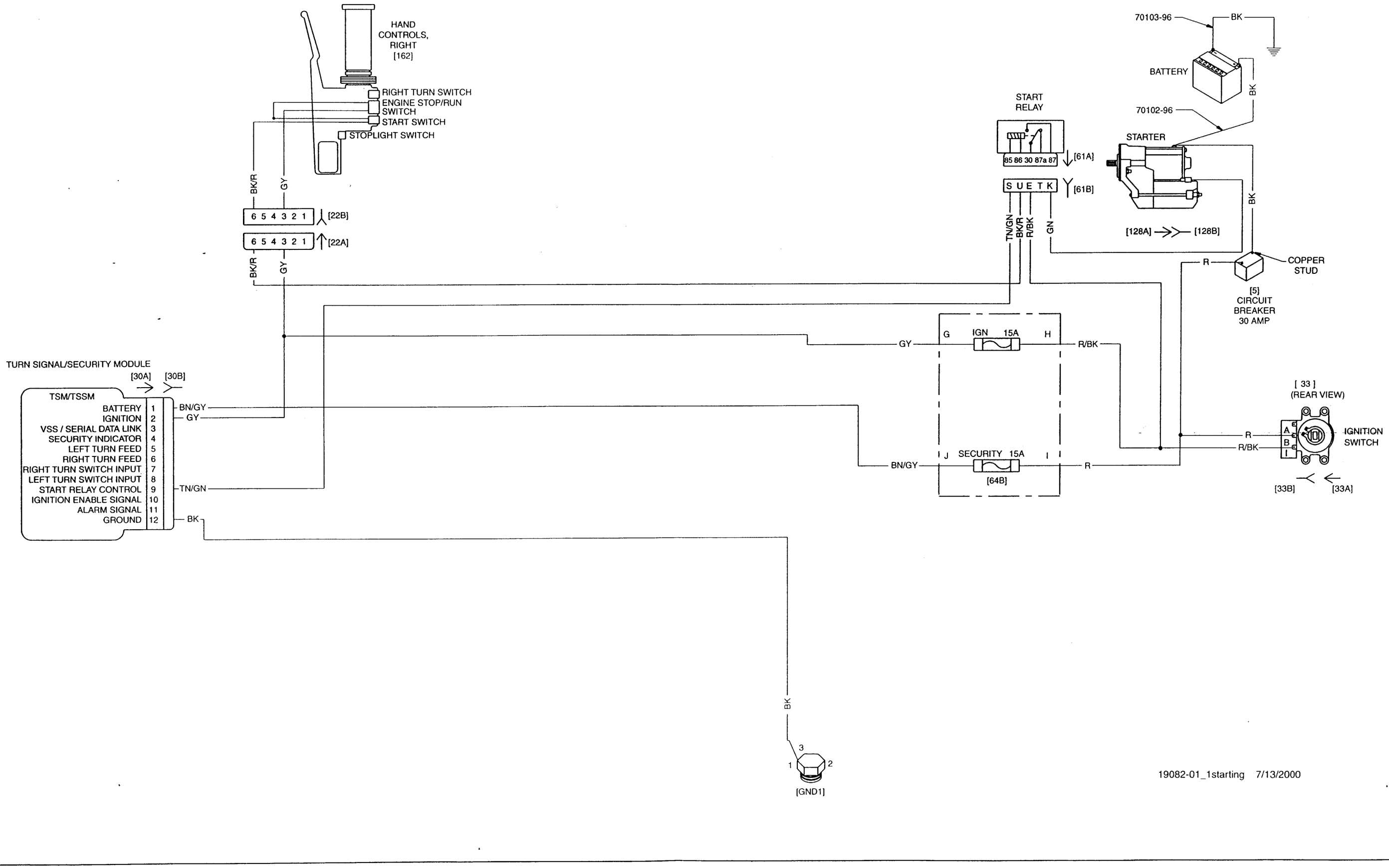
Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Security (1 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Security (2 of 2)



Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Security (2 of 2)

Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models) Starting



Dyna Wide Glide (FXDWG) Wiring Diagram (Domestic and International Models), Starting

Table C-1. Metric Conversions

MILLIMETERS to INCHES (mm x 0.03937 = inches)								INCHES to MILLIMETERS (inches 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

GENERAL

Torque specifications for specific components are listed in each section at the point of use. When converting to Newton-meters, use the formulas given under the metric chart. For all other steel fasteners, use the values listed in one of the tables below. In the English table, torque figures are listed in ft-lbs, except those marked with an asterisk (*), which are listed in **in-lbs**. In the metric table, figures are listed in Newton-meters.

- foot-pounds (ft-lbs) x 1.356 = Newton-meters (Nm)
- inch-pounds (**in-lbs**) x 0.113 = Newton-meters (Nm)

⚠WARNING

The quality fasteners used on Harley-Davidson motorcycles have specific strength, finish and type requirements to perform properly in the assembly and the operating environment. Use only genuine Harley replacement fasteners tightened to the proper torque. Substitution could cause fastener failure, which could result in death or serious injury.

Table C-2. English Torque Values

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER																
				# (number)							in. (inches)									
				2	3	4	5	6	8	10	1/4	5/16	3/8	7/16	1/2	9/16	5/8	3/4	7/8	1
	SAE 2 STEEL	74,000 PSI	LOW CARBON								6	12	20	32	47	69	96	155	206	310
	SAE 5 STEEL	120,000 PSI	MEDIUM CARBON HEAT TREAT						14*	22*	10	19	33	54	78	114	154	257	382	587
	SAE 7 STEEL	133,000 PSI	MEDIUM CARBON ALLOY								13	25	44	71	110	154	215	360	570	840
	SAE 8 STEEL	150,000 PSI	MEDIUM CARBON ALLOY								14	29	47	78	119	169	230	380	600	900
	SAE 8 STEEL	150,000 PSI	MEDIUM CARBON ALLOY								14	29	47	78	119	169	230	380	600	900
	SOCKET SET SCREW	212,000 PSI	HIGH CARBON QUENCHED TEMPERED					9*	16*	30*	70*	140*	18	29	43	63	100	146		
	STUDS			Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																

*Torque values in **in-lbs**.

Table C-3. Metric Torque Values

FASTENER	TYPE	MINIMUM TENSILE STRENGTH	MATERIAL	BODY SIZE OR OUTSIDE DIAMETER															
				# (number)							mm (millimeters)								
				2	3	4	5	6	8	10	6.4	7.9	9.5	11.1	12.7	14.3	15.9	19.1	22.2	25.4
	SAE 2 STEEL	5,202 kg/cm^2	LOW CARBON								8.3	16.6	27.7	44.3	65.0	95.4	132.8	214.4	283.5	428.7
	SAE 5 STEEL	8,436 kg/cm^2	MEDIUM CARBON HEAT TREAT						1.6	2.5	13.8	26.3	45.6	74.7	107.9	157.7	213.0	355.4	528.3	811.8
	SAE 7 STEEL	9,350 kg/cm^2	MEDIUM CARBON ALLOY								18.0	34.6	60.8	98.2	152.1	213.0	297.3	497.9	788.3	1161.7
	SAE 8 STEEL	10,545 kg/cm^2	MEDIUM CARBON ALLOY								19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	1220.0
	SAE 8 STEEL	10,545 kg/cm^2	MEDIUM CARBON ALLOY								19.4	40.1	65.0	107.9	164.6	233.7	318.1	525.5	829.8	1220.0
	SOCKET SET SCREW	14,904 kg/cm^2	HIGH CARBON QUENCHED TEMPERED					1.0	1.8	3.4	8.1	16.1	24.9	40.1	59.5	87.1	138.3	201.9		
	STUDS			Use SAE 2, 5 and 8 values when grade is known, with nut of sufficient strength.																

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.)

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