SERVICE MANUAL

1991 AND 1992 SOFTAIL MODELS

HARLEY-DAVIDSON INC.

AMERICAN MADE

MOTOR HARLEY-DAVIDSON COMPANY

OFFICIAL FACTORY MANUAL

P. N. 99482-92

Chris

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

1991 AND 1992 SOFTAIL MODELS

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The information in this manual applies to the 1991 and 1992 FX/FL Softail models.

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Please comment on this manual's completeness, accuracy, organization, usability and readability.

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Did you find errors in this manual? _____

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1992
SOFTAIL

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

FOREWORD

This service and repair manual has been prepared with two purposes in mind. First, it will acquaint the reader with the construction of the Harley-Davidson motorcycle and assist him in performing 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 manual will make your association with Harley-Davidson products more pleasant and profitable.

HOW TO USE YOUR SERVICE MANUAL

Your Service Manual is arranged for quick, easy reference. This manual is divided into numbered sections. Sections are then divided into subjects. Use this manual as follows:

1. Check the TABLE OF CONTENTS located in the front of each section to find subject desired.

2. Page number is listed across from subject. Page number consists of section number and page number.

3. Information is presented in a definite order as follows:

   Specifications
   General
   Troubleshooting
   Adjustment/Testing
   Removal
   Installation
   Disassembly
   Cleaning, Inspection and/or Repair (minor)
   Assembly
   Repair (major)

In figure legends, the number following a name of a part indicates the quantity necessary for one complete assembly.

NOTE

All information for servicing a component should be read ***before*** *repair work is started to avoid needless disassembly.*

PREPARATION FOR SERVICE

Proper 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 reduce the incidence of misplaced tools and parts. A motorcycle that is excessively dirty should be cleaned before work starts. Cleaning will occasionally uncover trouble sources. Tools, instruments and parts needed for the job should be gathered before work is started. Interrupting a job to locate tools or parts is a needless delay. Special tools required for a job are listed at the end of Section 1.

WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Always stop engine and do not smoke or allow open flame or sparks when refueling or servicing the fuel system.

SERVICE BULLETINS

In addition to the information given in this Service Manual, Service Bulletins are issued to Harley-Davidson Dealers from time to time, which cover interim engineering changes and supplementary information. Service Bulletins should be consulted for complete information on the models covered by this manual.

USE GENUINE REPLACEMENT PARTS

WARNING

- **When replacement parts are required, we recommend using only genuine Harley-Davidson parts. Other parts may appear to have equivalent characteristics including type, strength and material, but may be of inferior quality. Failure to use genuine Harley-Davidson parts may result in product malfunction and possible personal injury.**

- **The fasteners used in Harley-Davidson motorcycles have specific strength, finish and type requirements to perform properly in the assembly and its environment. Use only genuine Harley-Davidson replacement fasteners, tightened to the proper torque value. Substitution could cause fastener failure which may result in personal injury.**

To ensure a satisfactory and lasting repair job, follow the manual instructions carefully and use only genuine Harley-Davidson replacement parts. Behind the emblem bearing the words GENUINE HARLEY-DAVIDSON is more than three quarters of a century of designing, research, manufacturing, testing and inspecting experience.

This is your insurance that the parts you are using will fit right, operate properly and last longer. When you use genuine Harley-Davidson parts, you use the best.

PRODUCT REFERENCES

When reference is made in this manual to a specific brand name product, tool or instrument, an equivalent product, tool or instrument may be used in place of the one mentioned.

All tools mentioned in this SERVICE MANUAL with HD or J preceding the part number must be ordered through:

Kent-Moore Tool Division

29784 Little Mack

Roseville, Michigan 48066-2239

Loctite® Products

The Loctite® products listed are designed to increase the reliability of fasteners and to aid in minor repairs.

If you have any further questions, please call Loctite Corp. at 1-203-246-1223.

WARNING

Follow the directions listed on all Loctite® products. Read all labels, warnings and cautions carefully before using.

CONTENTS

All photographs and illustrations 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 Inc. reserves the right to change specifications, equipment, or designs at any time without notice and without incurring obligation.

WARNINGS AND CAUTIONS

Statements in this manual preceded by the words WARNING or CAUTION and printed in bold face are very important.

WARNING

Means there is the possibility of personal injury to yourself or others.

CAUTION

Means there is the possibility of damage to the vehicle.

We recommend you take special notice of these items.

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 and advise the service trade of all possible ways in which service might be done or of the possible hazardous consequences of each way, 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 by the service methods selected.

WARNING

Wear eye protection while using any of these tools: hammers, arbor or hydraulic presses, gear pullers, spring compressors, and slide hammers. Be especially cautious when using pulling, pressing or compressing equipment. The forces involved can cause parts to "flyout" with considerable force and cause bodily injury.

TABLE OF CONTENTS

SECTION 1 - PRODUCT

SECTION 2 - CHASSIS

NOTES

PRODUCT

SERVICING A NEW MOTORCYCLE

WARNING

For the rider's personal welfare, all the listed service and maintenance recommendations should be followed, because they may affect the safe operations of the motorcycle

Service Operations to be performed before delivery to customer are specified in the Pre-Delivery and Set-Up Manual.

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

After a new motorcycle has been driven its first 500 miles, a Harley-Davidson dealer should perform the following initial service operations.

CHECK AT FIRST 500 MILES

1. Change engine oil.
2. Replace oil filter.
3. Inspect air cleaner and service as required.
4. Check/adjust belt.
5. Check/adjust primary chain.
6. Check clutch adjustment.
7. Change primary chaincase lubricant and clean magnetic drain plug.
8. Change transmission lubricant and clean magnetic drain plug.
9. Check rear brake pedal adjustment.*
10. Inspect brake pad linings and discs for wear.
11. Check brake fluid level condition. Inspect oil lines and brake system for leaks.
12. Lubricate the following: front brake hand lever**, clutch control cable (and hand lever**).

CAUTION

DO NOT lubricate the enrichener cable on C.V. carburetor.

13. Inspect fuel valve, fuel tank filter screen, lines and fittings for leaks.
14. Check engine idle speed adjustment.
15. Check operation of throttle and enrichener controls.
16. Check battery electrolyte level. Check and clean connections.
17. Check operation of all electrical equipment and switches.
18. Check front fork bearing adjustment.
19. Check rear fork pivot bolts.
20. Check condition of rear shock absorbers.
21. Check wheel spoke tightness.*
22. Check tire pressure and inspect tread.
23. Check engine mounting bolts.

CAUTION

Do not attempt to tighten engine head bolts. Re-tightening can cause engine damage.

26. Check tightness of all fasteners except engine head bolts.
24. Road test.

* If applicable
** If required

SAFE OPERATING MAINTENANCE

Good maintenance means a safe machine. A careful check of certain equipment must be made after periods of storage and frequently between the regular service intervals to determine if additional maintenance is necessary.

The following items should be checked:

1. Tires for correct pressure, abrasions or cuts.
2. Belt for proper tension.
3. Brakes, steering and throttle for responsiveness.
4. Brake fluid level and condition. Hydraulic lines and fittings for leaks. Also, check brake pads and discs for wear.
5. Cables for fraying or crimping and free operation.
6. Engine oil, primary chaincase and transmission fluid levels.
7. Wheel spoke tightness.*
8. Headlamp, taillight and directional light operation.

* If applicable.

STORAGE

If the motorcycle is stored for several months, such as during the winter season, there are precautions to be taken to protect parts against corrosion, to preserve the battery and to prevent the build-up of gum and varnish in the carburetor.

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

1. Operate vehicle until engine is at normal operating temperature. Drain and flush the oil tank. Install a new oil filter and fill oil tank with the proper grade oil. Check the transmission lubricant level.

WARNING

Gasoline is flammable. Do not store motorcycle having gasoline in tank within the home or garage where open flames, pilot lights, sparks or electric motors are present.

2. Fill fuel tank and add a gasoline stabilizer. Use one of the commercially available gasoline stabilizers, following the manufacturer's instructions. Run the engine until the gasoline stabilizer has had a chance to reach the carburetor float bowl. Turn fuel supply valve off.

3. Remove the spark plugs, inject a few squirts of engine oil into each cylinder and crank the engine five or six revolutions. Install spark plugs.

4. Plug the line leading from the bottom of the oil tank to the feed fitting (marked "F") on the oil pump. This will eliminate the possibility of oil seeping past the check ball into the oil pump and filling the engine flywheel compartment with oil.

5. Remove the battery from the motorcycle and fully charge. Store the battery above freezing temperatures in a cool, dry place, trickle charge once a month and keep the electrolyte level above the plates.

6. Inspect/adjust the primary chain and drive belt.

7. Repack wheel bearings.

8. Check tire inflation. 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 get any oil on brake discs or brake pads. Braking function could be impaired resulting in personal injury.

9. Wash painted and chrome plated surfaces and apply a light film of oil to exposed unpainted surfaces.

10. If motorcycle is to be covered, use a material such as light canvas, that will breathe. Plastic materials that do not breathe promote the formation of condensation.

NOTE

If storage conditions do not permit fuel to be retained in vehicle, drain all gasoline from the fuel tank and carburetor float bowl. Spray the inside of the fuel tank with one of the commercially available rust preventatives. Follow the manufacturer's instructions.

REMOVAL FROM STORAGE

1. Fill the battery with distilled water to the proper level. Charge and install it.

WARNING

After extended periods of storage and prior to starting vehicle, place transmission in gear, disengage clutch and push vehicle back and forth a few times to ensure proper clutch disengagement.

2. Remove and inspect the spark plugs. Replace if necessary.

3. Clean and oil the air cleaner element.

4. If fuel tank was drained, fill it with fresh gasoline.

5. If oil feed line was plugged, unplug it and reconnect.

6. Start the engine and run until it reaches normal operating temperature.

7. If vehicle was stored with additional oil in cylinders, spark plugs should be inspected and replaced, if required, after initial warm-up.

8. Check all fluids.

9. Perform all of the checks in the PRE-RIDING CHECK LIST in the Owner's Manual.

10. Check oil level as a part of every pre-riding inspection.

TROUBLESHOOTING

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.

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.

ENGINE

Cranking Motor Does Not Operate or Does Not Turn Engine Over

1. Engine run switch in OFF position.
2. Ignition switch not on.
3. Discharged battery, loose or corroded connections (solenoid chatters).
4. Starter control circuit, relay or solenoid damaged.
5. Electric starter shaft pinion gear not engaging.

Engine Turns Over But Does Not Start

1. Fuel tank empty.
2. Fuel supply valve turned off.
3. Fuel supply valve or filter clogged.
4. Discharged battery, loose or broken battery terminal connections.
5. Fouled spark plugs.
6. Spark plug cables in bad condition or cable connections loose.
7. Ignition timing badly out of adjustment.
8. Loose wire connection at coil, battery connection or at plug between ignition module and sensor.
9. Damaged ignition coil.
10. Damaged ignition module or sensor.
11. Sticking or damaged valve or tappets too tight.
12. Engine flooded with gasoline as a result of over use of enrichener.
13. Engine oil or transmission lubricant too heavy (winter operation).

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 or at coil.
5. Carburetor controls not adjusted correctly.
6. Damaged ignition coil.
7. Engine oil or transmission lubricant too heavy (winter operation).
8. Ignition not timed properly.
9. Fuel tank cap system vent plugged, or carburetor fuel line closed off restricting fuel flow.
10. Water or dirt in fuel system and carburetor.
11. Air leak at intake manifold.

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. Damaged ignition coil.
5. Damaged ignition module or sensor.
6. Battery nearly discharged.
7. Damaged wire or loose connection at one of battery terminals or coil, or at plug between ignition sensor and module.
8. Intermittent short circuit due to damaged wire insulation.
9. Water or dirt in fuel system and carburetor or filter.
10. Fuel tank cap vent plugged or carburetor vent line closed off.
11. Carburetor controls misadjusted.
12. Weak or broken valve springs.
13. Air leak at intake manifold or air cleaner.
14. Damaged intake or exhaust valve.
15. Incorrect valve timing.

A Spark Plug Fouls Repeatedly

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

Pre-Ignition Or Detonation (Knocks or Pings)

1. Excessive carbon deposit on piston head or in combustion chamber.
2. Incorrect spark plug.
3. Damaged spark plugs.
4. Ignition timing advanced.
5. Fuel octane rating too low.

Overheating

1. Insufficient oil supply or oil not circulating.
2. Leaking valves.
3. Heavy carbon deposit.
4. Ignition timing retarded.

Valve Train Noise

1. Low pressure caused by oil feed pump not functioning properly or oil screen obstructed.
2. Defective hydraulic tappets.
3. Bent push rod.
4. Cam or pinion gears worn.
5. Rocker arm binding on shaft.
6. Valve sticking in guide.

Excessive Vibration

1. Wheels, sprockets and/or tires damaged.
2. Loose or corroded battery connections.
3. Ignition module not properly grounded.
4. Primary chain badly worn or links tight as a result of insufficient lubrication or rear belt/sprockets worn.
5. Upper mounting bracket loose, broken or improperly spaced.
6. Lower mounting bolts loose.
7. Transmission and/or transmission sub-mounting plate loose in chassis.
8. Broken frame.
9. Internal engine problem.

LUBRICATION SYSTEM

Oil Does Not Return To Oil Tank

1. Oil tank empty.
2. Oil feed pump not functioning.
3. Scavenger pump gear key sheared.
4. Restricted oil filter.
5. Restricted oil lines or fittings.

Engine Uses Too Much Oil or Smokes Excessively

1. Valve guides or valve guide seals worn.
2. Piston rings badly worn or broken.
3. Breather valve incorrectly timed.

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

1. Loose parts.
2. Imperfect seal at gaskets, push rod cover, washers, etc.
3. Restricted oil return line to tank.
4. Restricted breather hose to air cleaner.

Excess Oil Out Of Crankcase Breather(Air Cleaner)

1. Oil not returning to oil tank.
2. Restricted oil return line to tank.
3. Restricted oil filter.
4. Oil lines or passages restricted.
5. Gearcase cover gasket not sealing.
6. Leakage between passages and pockets in gearcase cover and gearcase.

Excess Oil Out Of Crankcase Breather When Starting Engine

1. Oil pump check ball stuck open.
2. Poor seal between feed and return gears in pump.

ELECTRICAL SYSTEM

Alternator Does Not Charge

1. Damaged rectifier-regulator module.
2. Module not grounded.
3. Loose or broken wires in charging circuit.
4. Damaged stator coils.
5. Damaged rotor.

Alternator Charge Rate is Below Normal

1. Loose or corroded connections.
2. Weak or damaged battery.
3. Damaged rectifier/regulator module.
4. Damaged stator coils.

CARBURETOR

Floods

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

TRANSMISSION

Shifts hard

1. Bent shifter rod.
2. Clutch dragging slightly.
3. Transmission lubricant too heavy (winter operation).
4. Shifter forks (inside transmission) sprung.
5. Corners worn off shifter clutch dogs (inside transmission) .

Jumps Out of Gear

1. Shifter rod improperly adjusted.
2. Shifter forks (inside transmission) improperly adjusted.
3. Shifter engaging parts (inside transmission) badly worn and rounded.

CLUTCH

Slips

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

Drags or Does Not Release

1. Clutch controls improperly adjusted.
2. Clutch spring tension too tight.
3. Clutch discs warped.

Chatters

1. Friction discs or steel discs worn or warped.

BRAKES

Do Not Hold Normally

1. Master cylinder low on fluid.
2. Brake line contains air bubbles.
3. Master cylinder or caliper piston worn or parts damaged.
4. Brake pads impregnated with grease or oil.
5. Brake pads badly worn (1/16 in. minimum lining thickness).
6. Brake disc badly worn or warped.
7. Brake fades due to heat build up - brake pads dragging or excessive braking.
8. Brake drags - insufficient brake pedal or hand lever free play.

HANDLING

Irregularities

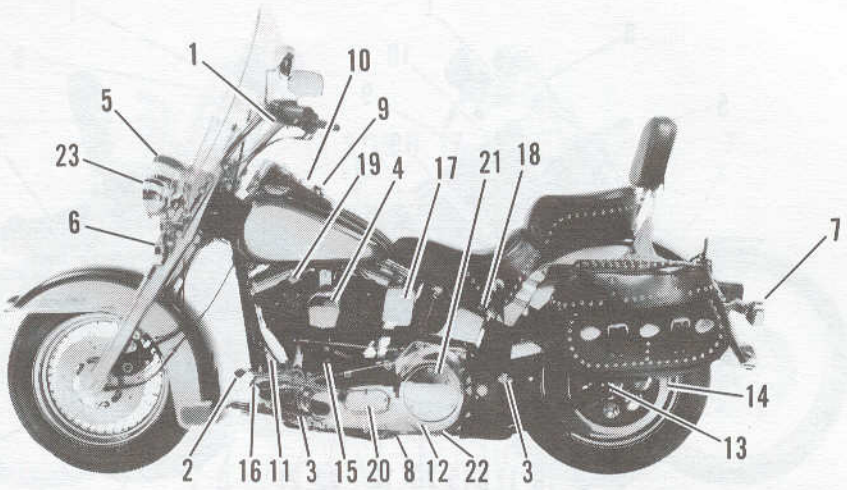
1. Off-center loading.
2. Heavy front end loading. Non-standard equipment on the front end such as heavy radio receivers, extra lighting equipment or luggage tends to cause unstable handling.
3. Tires improperly inflated. Check TIRE DATA, Section 2.
4. Irregular or peaked front tire tread wear.
5. Improper wheel alignment. Check VEHICLE ALIGNMENT, Section 2.
6. Loose wheel axle nuts. Tighten to 60-65 ft-lbs (front) maximum.
7. Tire and wheel unbalanced.
8. Steering head bearings adjustment. Correct adjustment and replace pitted or worn cups. See FORKS, Section 2.
9. Rims and tires out-of-round or eccentric with hub (tire run-out should not be more than 3/32 in.).
10. Rims and tires out-of-true sideways (tire run-out should not be more than 3/32 in.).
11. Excessive wheel hub bearing play.

Regular Maintenance Intervals - Softail Models

SECTION	ODOMETER READING (miles) SERVICE OPERATIONS (see chart code below)	Preride	500	2500	5000	7500	10000	12500	15000	17500	20000	22500	25000	27500	30000	32500	35000	37500	40000	42500	45000	47500	50000
2	Rear brake pedal height adjustment		I		I		I		I		I		I		I		I		I		I		I
2	Brake pad linings and discs for wear		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
2	Condition of rear brake caliper mounting pins				IL		IL		IL		IL		IL		IL		IL		IL		IL		IL
2	Brake fluid level and condition*		I		I		I		I		I		I		I		I		I		I		I
2,6	Rear brake and shifter linkage**				IL		IL		IL		IL		IL		IL		IL		IL		IL		IL
2,6	Front brake hand lever (if neccessary), clutch control cable (and hand lever, if neccessary)		L		L		L		L		L		L		L		L		L		L		L
2	Throttle control grip sleeve, speedometer cable				L		L		L		L		L		L		L		L		L		L
2	Front fork oil**						R				R				R				R				R
2	Front fork bearing adjustment		I		I		IL		I		IL		I		IL		I		IL		I		IL
2	Rear fork pivot bolts		I		I		I		I		I		I		I		I		I		I		I
2	Condition of rear shock absorbers		I		I		I		I		I		I		I		I		I		I		I
2	Springer rocker bearings**						A				A				A				A				A
2	Wheel bearings*						IL				IL				IL				IL				IL
2	Wheel spoke tightness**		I		I		I		I		I		I		I		I		I		I		I
3	Engine Oil*	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
3	Oil filter		R		R		R		R		R		R		R		R		R		R		R
3	Tappet oil screen				I		I		I		I		I		I		I		I		I		I
4	Air cleaner		I		I		I		I		I		I		I		I		I		I		I
4	Fuel valve, lines and fittings for leaks		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
4	Fuel tank filter screen				I		I		I		I		I		I		I		I		I		I
4	Engine idle speed	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
4	Operation of throttle and enrichener controls	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
6	Rear belt	I	IA		IA		IA		IA		IA		IA		IA		IA		IA	I	IA		IA
6	Primary chain		I		I		I		I		I		I		I		I		I		I		I
6	Clutch adjustment		A		A		A		A		A		A		A		A		A		A		A
6	Primary chaincase lubricant		R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
7	Transmission lubricant*		R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
8	Ignition timing and vacuum operated electric switch (V.O.E.S.)				I		I		I		I		I		I		I		I		I		I
8	Battery fluid level, connections*		I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
8	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	I
8	Spark plugs				I		R		I		R		I		R		I		R		I		R
-	Tire pressure and inspect tire for wear/damage	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
-	Engine mounting bolts		I		I		I		I		I		I		I		I		I		I		I
-	All fasteners except engine head bolts		T		T		T		T		T		T		T		T		T		T		T
-	Road test	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

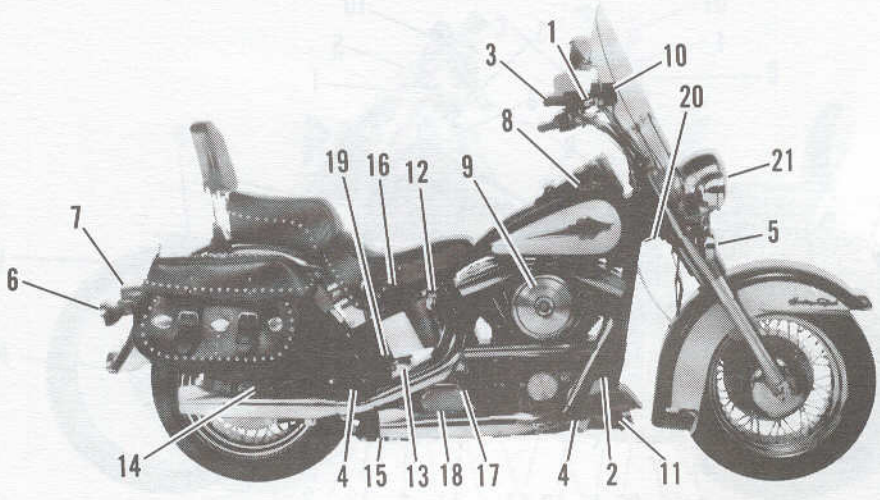
*Also perform prior to storage, or annually.
**If applicable.

Chart Code:
I - Inspect, & if necessary correct, clean or replace.
A - Adjust.
R - Replace or change.
T - Tighten to proper torque.
L - Lubricate with specified lubricant.
X - Perform.



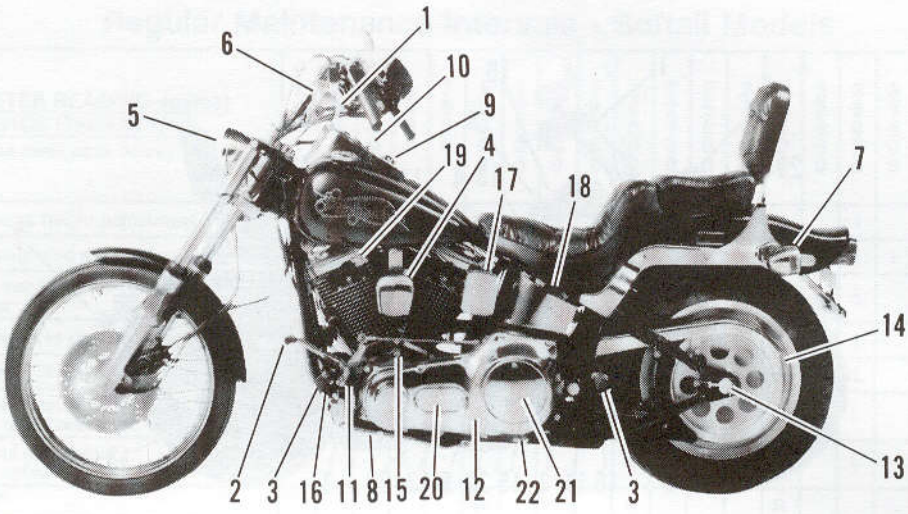
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug
23. Passing lamp

FIGURE 1-1. 1991 FLSTC - Left Side View



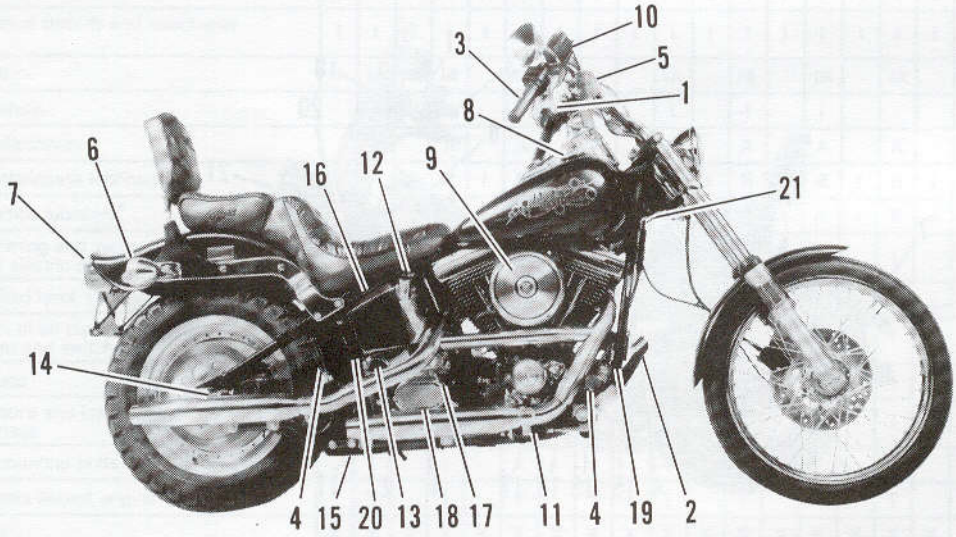
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder & reservoir
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19. Engine Oil tank drain
20. Fork lock brackets
21. Passing lamp

FIGURE 1-2. 1991 FLSTC - Right Side View



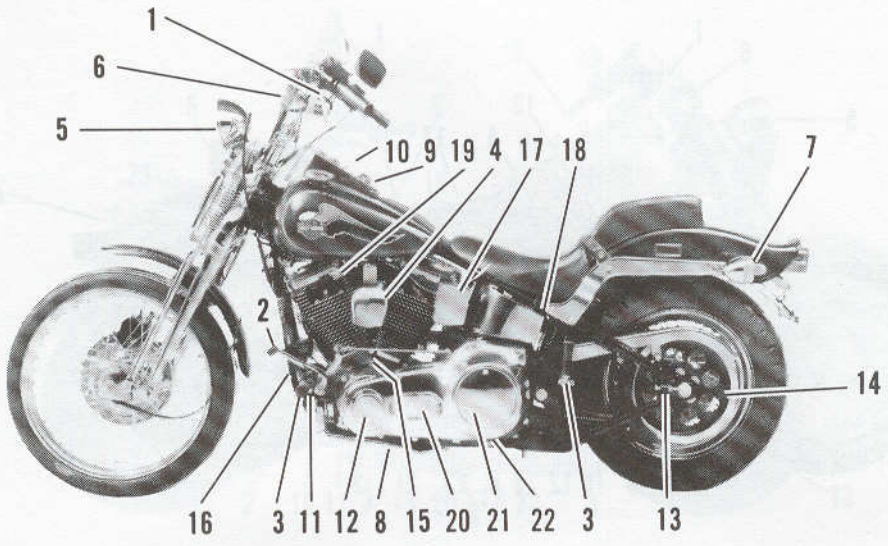
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug

FIGURE 1-3. 1991 FXSTC - Left Side View



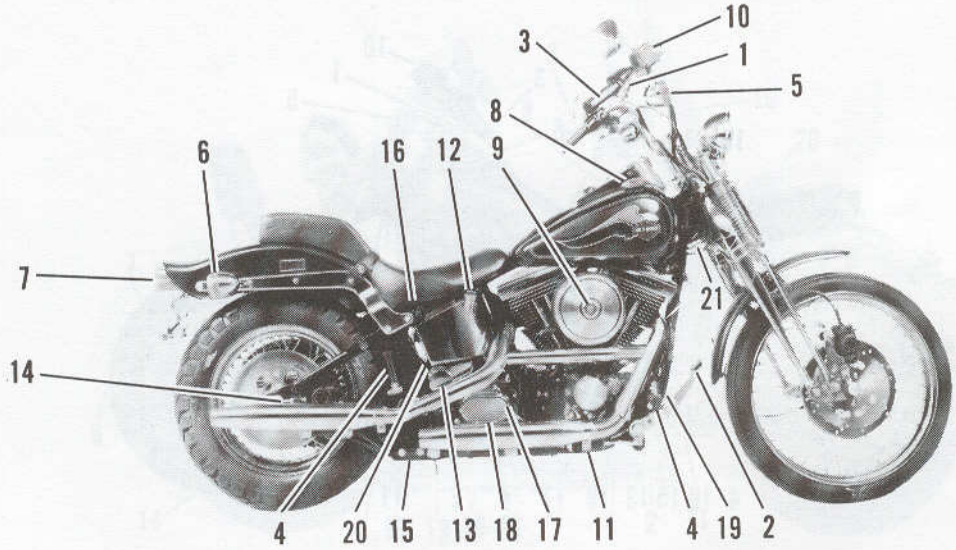
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19 Rear brake fluid reservoir
20. Engine Oil tank drain
21. Fork lock brackets

FIGURE 1-4. 1991 FXSTC - Right Side View



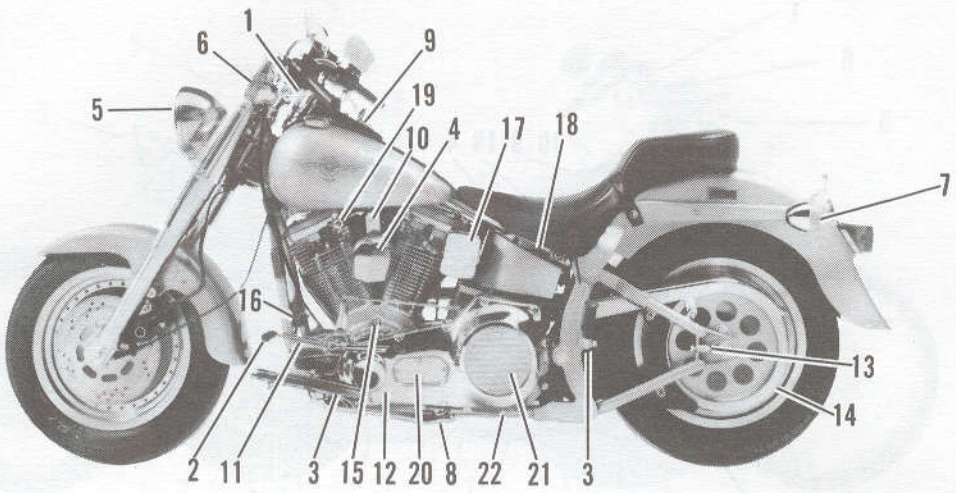
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug

FIGURE 1-5. 1991 FXSTS - Left Side View



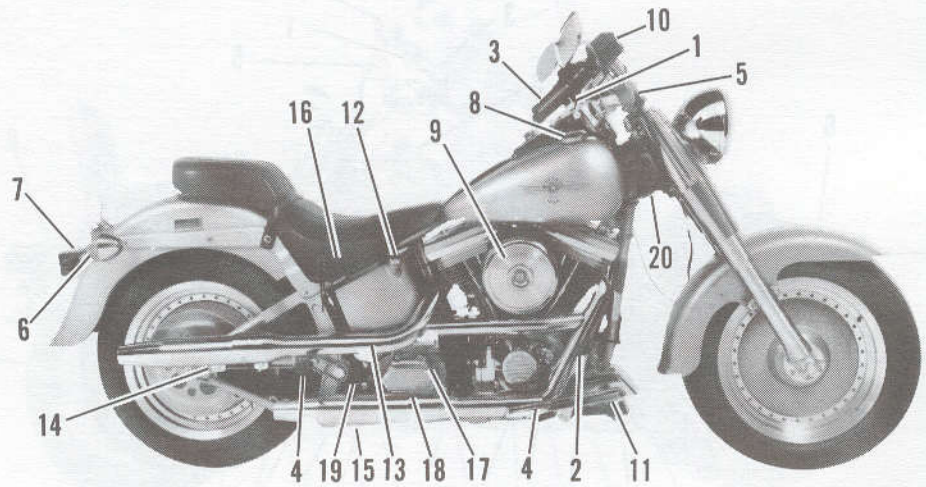
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19 Rear brake fluid reservoir
20. Engine Oil tank drain
21. Fork lock brackets

FIGURE 1-6. 1991 FXSTS - Right Side View



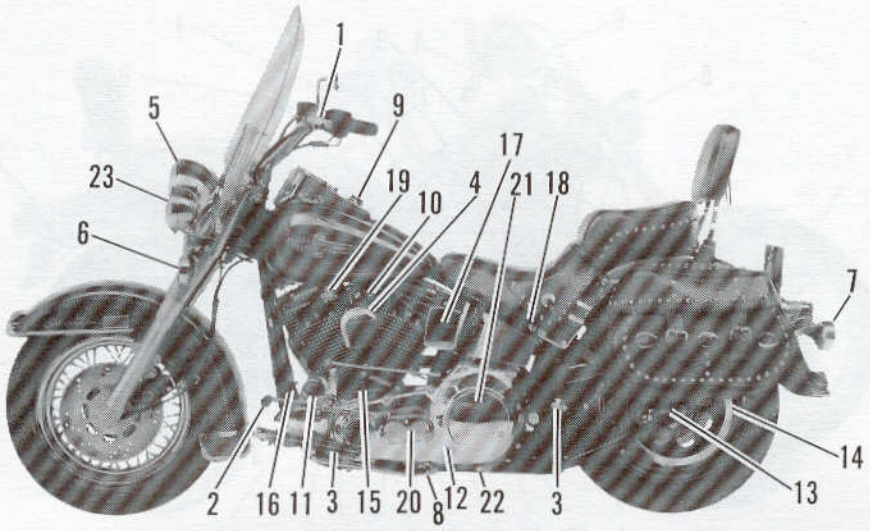
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug

FIGURE 1-7. 1991 FLSTF - Left Side View



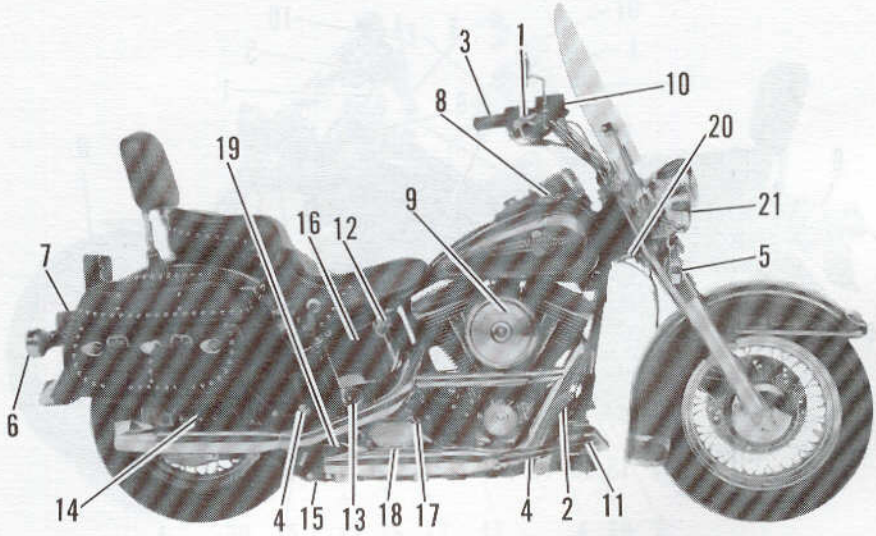
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder & reservoir
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19. Engine Oil tank drain
20. Fork lock brackets

FIGURE 1-8. 1991 FLSTF - Right Side View



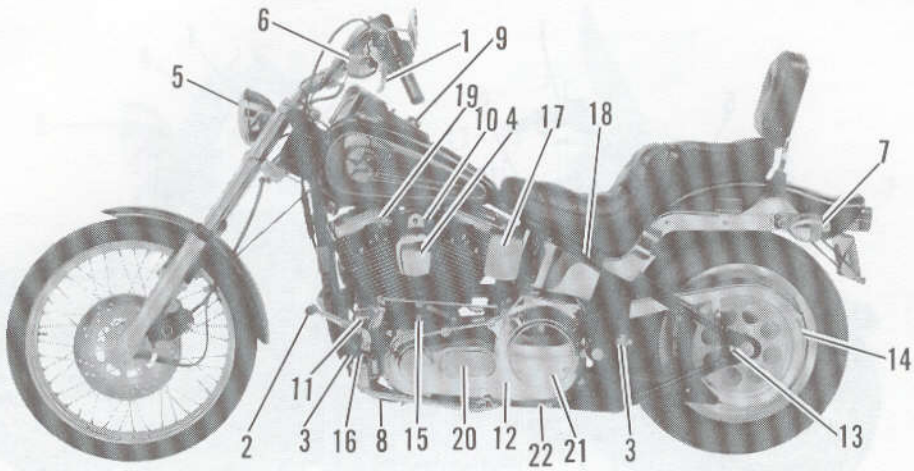
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug
23. Passing lamp

FIGURE 1-9. 1992 FLSTC - Left Side View



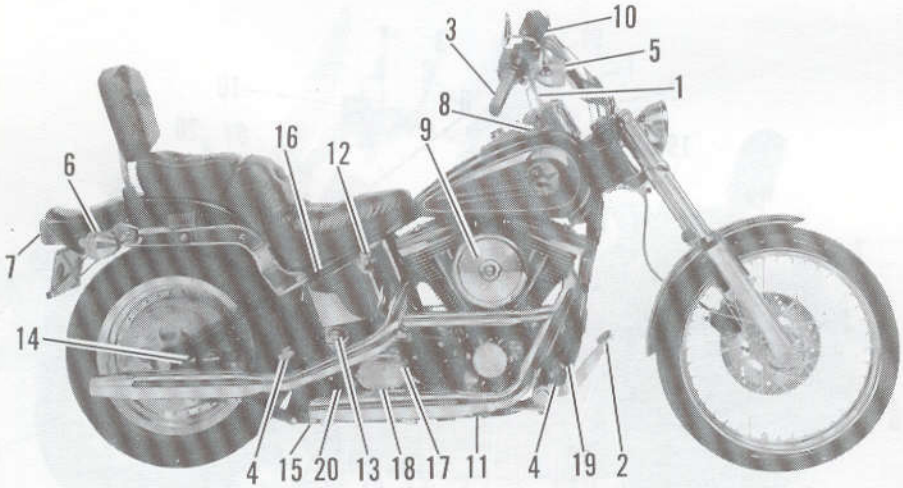
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder & reservoir
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19. Engine Oil tank drain
20. Fork lock brackets
21. Passing lamp

FIGURE 1-10. 1992 FLSTC - Right Side View



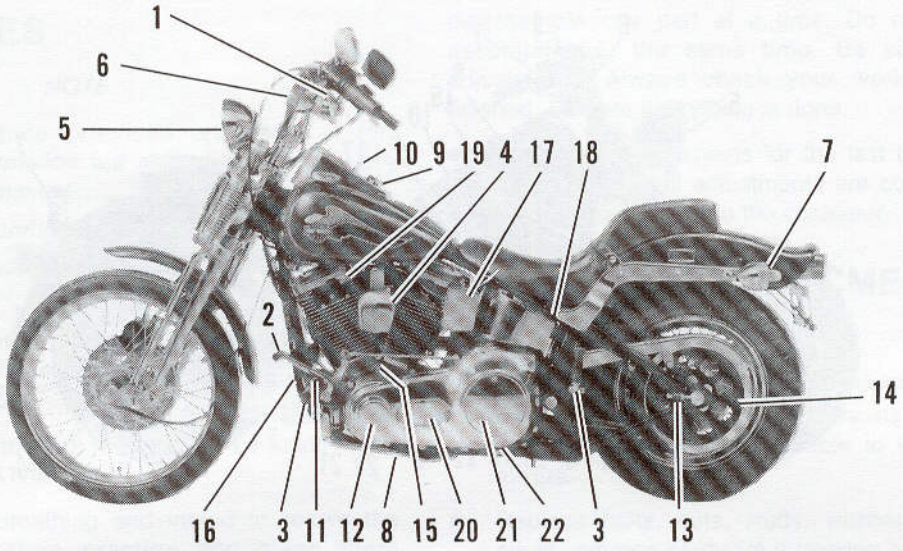
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug

FIGURE 1-11. 1992 FXSTC - Left Side View



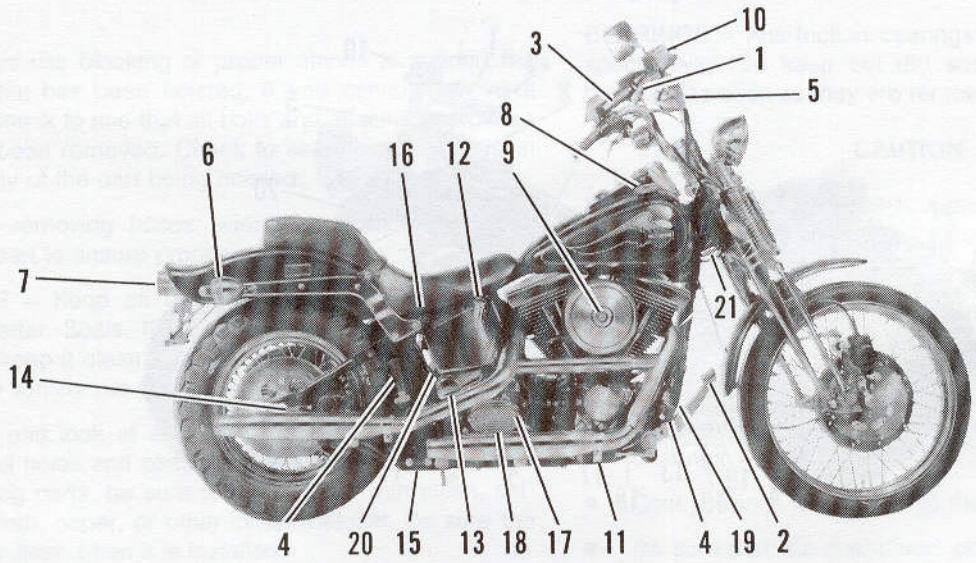
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19 Rear brake fluid reservoir
20. Engine Oil tank drain
21. Fork lock brackets

FIGURE 1-12. 1992 FXSTC - Right Side View



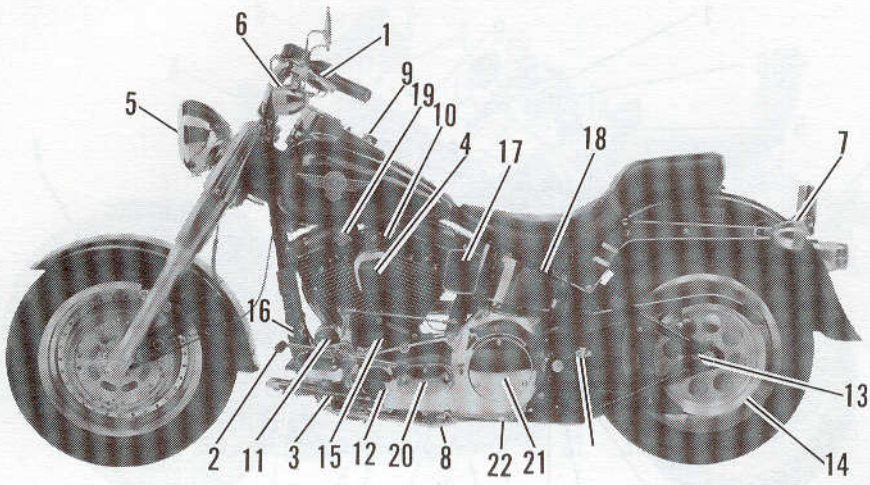
1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug

FIGURE 1-13. 1992 FXSTS - Left Side View



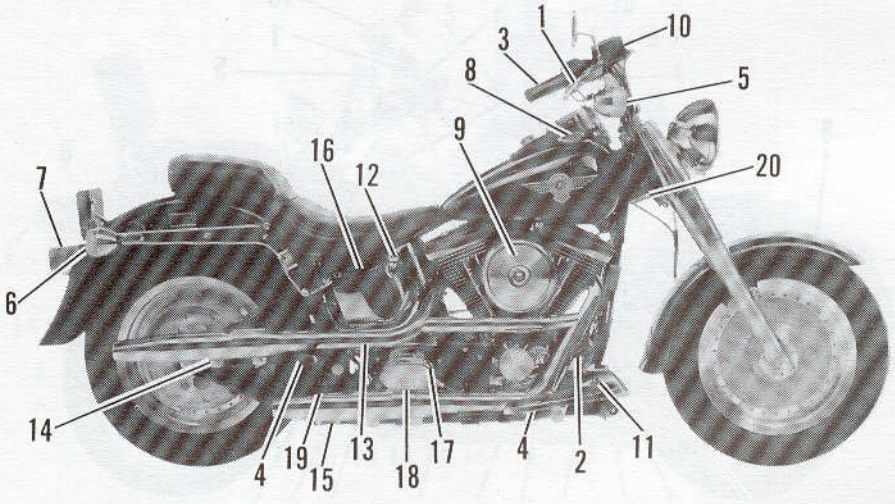
1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19 Rear brake fluid reservoir
20. Engine Oil tank drain
21. Fork lock brackets

FIGURE 1-14. 1992 FXSTS - Right Side View



1. Clutch handlever
2. Gear shifter
3. Footrest(s)
4. Horn
5. Headlamp
6. Front turn signal & running lamp
7. Rear turn signal lamp
8. Jiffy stand
9. Ignition/light switch
10. Carburetor enrichener knob
11. Engine oil filter
12. Primary chain cover
13. Rear axle adjuster
14. Rear sprocket and drive
15. Timing inspection hole plug
16. Voltage regulator
17. Ignition coil
18. Ignition module
19. Fuel supply valve
20. Primary chain inspection cover
21. Clutch inspection cover
22. Primary drain plug

FIGURE 1-15. 1992 FLSTF - Left Side View



1. Front brake handlever
2. Rear brake pedal
3. Throttle control grip
4. Footrest(s)
5. Front turn signal & running lamp
6. Rear turn signal lamp
7. Tail/stop lamp
8. Fuel Filler cap
9. Carburetor/air cleaner
10. Front brake master cylinder & reservoir
11. Rear brake master cylinder & reservoir
12. Engine Oil fill plug & dipstick
13. Electric starter motor
14. Rear axle Adjuster
15. Shock absorber(s)
16. Battery (under seat)
17. Transmission fill plug
18. Transmission drain plug
19. Engine Oil tank drain
20. Fork lock brackets

FIGURE 1-16. 1992 FLSTF - Right Side View

SHOP PRACTICES

REPAIR NOTES

NOTE

- *General maintenance practices are given in this section. This information will not be repeated in any other part of this manual.*
- *Repair = Disassembly/Assembly*
- *Replace = Removal/Installation*

All special tools and torque values are noted at the beginning of the procedure and are given again at the step in which they occur. Where none are required there will be none given.

Any parts or materials that are required will be found in the appropriate PARTS CATALOG.

If you disassemble something and intend to re-use the parts, follow good shop practice and clean them thoroughly before assembly.

SAFETY – Safety is always the most important consideration when working on this vehicle. Completely understand the job to be done; use common sense and proper tools. Don't just do the job. Do it safely.

REMOVING PARTS – Always respect the weight of a part. Use a hoist whenever necessary. Don't 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 being lifted whould be equal and parallel and should be positioned directly over the center of the part. Never leave a part hoisted in mid-air.

- Always use blocking or proper stands to support the part that has been hoisted. If you cannot remove a part, check to see that all bolts and attaching hardware have been removed. Check to see if any parts are in the way of the part being hoisted.
- When removing hoses, wiring or tubes, always tag each part to ensure proper installation.

CLEANING – Keep all dirt out of parts. The unit will perform better. Seals, filters, and covers are used in this vehicle to keep it clean. They must be kept in good shape to help the vehicle run well.

- Clean and look at all parts when removing them. Be sure all holes and passages are clean and open. After cleaning parts, be sure to cover them with clean, lint-free cloth, paper, or other clean material. Be sure the part is clean when it is installed.
- Always clean around lines or covers before removing them. Plug, tape, or put caps on holes and openings to keep dirt out.

DISASSEMBLY AND ASSEMBLY – Always assemble or disassemble one part at a time. Do not work on two assemblies at the same time. Be sure to make all adjustments. Always check your work when you are finished. Be sure everything is done.

- Check the adjustments for the last time by operating the vehicle. If all adjustments are correct, the vehicle is ready to go back to the customer.

REPAIR AND REPLACMENT PROCEDURES

HARDWARE AND THREADED PARTS – Install helical thread inserts when inside threads in castings are stripped, damaged, or not able to withstand desired torque.

- Replace bolts, nuts, studs, washers, spacers, and small common hardware if missing or damaged in any way. Repair minor thread damage by cleaning out the threads using a tap or die.
- Replace all damaged or missing lubrication fittings.
- Use Teflon tape on all pipe fitting threads.

WIRING, HOSES AND LINES – Replace hoses, clamps, electrical wiring, electrical switches, or fuel lines if they fail to meet specifications.

INSTRUMENTS AND GAUGES – Replace defective or broken instruments and gauges. Replace dials and glass that are so scratched or discolored that it is difficult to read the gauges.

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

CAUTION

NEVER attempt to re-use a removed bearing. Once a bearing has been removed, it is destroyed and must be replaced.

- 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, and set them down to dry. Never use compressed air to dry bearings.
- Coat bearings with oil. Wrap them in clean paper.
- Be sure that the chamfered side of the bearing faces the shoulder when installing bearings against shoulders. Before pressing bearings into place, lubricate them and all metal surfaces they contact. Put pressure only on the part of the bearing that directly contacts the mating part.

- Always use the proper tools and fixtures for removing and installing bearings.
- Bearings do not usually need to be removed. Remove bearings only if it is necessary.

BUSHINGS – Do not remove a bushing unless it is damaged, very worn, or loose in its bore. If you must remove a bushing, press it out.

- When pressing or driving, put pressure right in line with the bore. Use a bearing driver or a bar with a smooth flat end to drive a bushing. Never use a hammer.
- If there are oil holes, be sure they are aligned.
- Serious damage to the vehicle can result if any holes are blocked.

GASKETS – Always replace used gaskets with new gaskets. Never use the same gasket twice. Be sure that gasket holes match up with holes in the mating part.

- Serious damage to the vehicle can result if any holes on the flanges are blocked by the gasket.

LIP TYPE SEALS – Lip seals are used to seal oil or grease. To seal in oil, the lip is installed facing toward oil to be sealed. To seal grease, the lip usually faces away from grease.

- Seals should not be removed. Only remove seals to get at other parts or if the seal is damaged or worn.
- Leaking oil or grease usually means that a seal is damaged and needs to be replaced. Replace leaking seals so that bearings don't overheat. Do not use the same seal twice.

O-RINGS (PREFORMED PACKINGS) – O-rings should always be replaced if they are removed from the mated part. To prevent leaks, put a coating of the same lubricant being sealed on seals before putting them on the part.

Gasket, O-ring, and seals' mating surfaces must always be cleaned before installing the new part.

GEARS – Always watch for damaged or worn teeth on gears.

- Burrs and rough spots should be removed with a honing stone or crocus cloth before putting gear in place. Lubricate mating surfaces before pressing gear on shafts.

SHAFTS – If a shaft does not come out easily, check that all nuts, bolts or retaining rings have been removed. 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 check 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 off rust from all machined surfaces of new parts.

PART REPLACEMENT – Always replace worn or damaged parts with new parts.

CLEANING.

PART PROTECTION – Before cleaning, protect rubber items (hoses, boots, electrical insulation) from cleaning solutions. Protect them with a grease-proof barrier material. Remove the rubber part if it cannot be protected.

CLEANING PROCESS – Any cleaning method may be used as long as it does not damage a part. Cleaning is necessary so that parts can be checked. Rusted paint areas must be stripped to bare metal before repainting.

RUST OR CORROSION REMOVAL – Rust and corrosion can be removed with a wire brush, abrasive cloth, sand blasting, vapor blasting, or rust remover. Use buffing crocus cloth on highly polished parts that are rusted.

BEARING – Remove shields and seals from bearings before cleaning. Bearings with permanent shields and seals must be cleaned in a solution.

- Clean open bearings by soaking them in a petroleum cleaning solution. Never use a solution with chlorine in it.
- Bearings should stand and dry. Do not use compressed air to dry. Do not spin bearings while they are drying.

SAFE TOOL USE

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 against work surface before air hammers are operated.
- Disconnect the air supply line to the air hammers before attaching bits.
- 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; Do not use on live electrical circuits.
- Do not use pliers or cutters for cutting hardened wire unless they were designed for that purpose.
- Always cut at right angles.
- Do not use any 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 away from the head.
- Strike the object only with the full face of the hammer.
- Never work with a hammer having a loose head.
- Discard hammer if face is chipped or mushroomed.
- Wear approved eye protection when using striking tools.
- Protect bystanders with approved eye protection.

PUNCHES/CHISELS

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

SCREWDRIVERS

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

RATCHETS and HANDLES

- Ratchet mechanisms should be cleaned and lubricated periodically 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 gear wheel is engaged with the pawl.

SOCKETS

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

STORAGE UNITS

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

FLUID REQUIREMENTS

GENERAL

United States Fluid Measurement

Unless otherwise specified, **all fluid volume measurements in this Service Manual are 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.)
- 1 gallon (U.S.) = 4 quarts (U.S.)

British Imperial Fluid Measurement

Fluid volume measurements in this Service Manual do not include the British Imperial (Imp.) system equivalents. The British Imperial system includes the following conversions:

- 1 pint (Imp.) = 20 fluid ounces (Imp.)
- 1 quart (Imp.) = 2 pints (Imp.)
- 1 gallon (Imp.) = 4 quarts (Imp.)

Although the unit-of-measure terminology used in the U.S. system is same as the 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, but the U.S. pint, quart, and gallon are smaller than the British Imperial pint, quart, and gallon, respectively. If you need to convert from U.S. units to British Imperial units (or the opposite), use the following conversions:

- 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.)

Metric Fluid Measurement

Fluid volume measurements in this Service Manual do not include the metric system equivalents. In the metric system, 1 liter (L) = 1,000 milliliters (mL). If you need to convert from U.S. units-of-measure to metric units-of-measure (or the opposite), use the following conversions:

- 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.)

WHEEL BEARING GREASE

Use Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89.

BRAKE FLUID

WARNING

D.O.T. 5 HYDRAULIC BRAKE FLUID can cause eye irritation. In case of contact with eyes, flush with plenty of water and get medical attention. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN!

Use only D.O.T. 5 HYDRAULIC BRAKE FLUID, Harley-Davidson Part No. 99902-77.

FRONT FORK OIL

Use only HYDRAULIC FORK OIL TYPE "E", Harley-Davidson Part No. 99884-80.

ENGINE OIL

Use proper grade of oil for the lowest temperature expected before next oil change as follows:

Harley-Davidson Type	Viscosity	Harley-Davidson Rating	Ambient Temperature °F	Cold Weather Starts Below 50° F
HD Multi-grade	SAE 20W50	HD 240	Above 20° to 100°	Excellent
HD Regular Heavy	SAE 50	HD 240	Above 60° to 100°	Poor
HD Extra Heavy	SAE 60	HD 240	Above 80° to 100°	Poor

FUEL

Use a good quality leaded or unleaded gasoline (87 pump octane or higher). Pump octane is the octane number usually shown on the gas pump.

PRIMARY CHAINCASE LUBRICANT

Use only Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 /qt (U.S.),

TRANSMISSION LUBRICANT

Use Harley-Davidson SEMI-SYNTHETIC TRANSMISSION LUBRICANT, Part No. 99892-84 /qt (U.S.), Part No. 99891-84 /gal (U.S.).

METRIC CONVERSION TABLE

MILLIMETERS to INCHES (mm x 0.03937 = inches)							
mm	in.	mm	in.	mm	in.	mm	in.
.1	.0039	25	.9842	58	2.283	91	3.582
.2	.0078	26	1.024	59	2.323	92	3.622
.3	.0118	27	1.063	60	2.362	93	3.661
.4	.0157	28	1.102	61	2.401	94	3.701
.5	.0197	29	1.142	62	2.441	95	3.740
.6	.0236	30	1.181	63	2.480	96	3.779
.7	.0275	31	1.220	64	2.519	97	3.819
.8	.0315	32	1.260	65	2.559	98	3.858
.9	.0354	33	1.299	66	2.598	99	3.897
1	.0394	34	1.338	67	2.638	100	3.937
2	.0787	35	1.378	68	2.677	101	3.976
3	.1181	36	1.417	69	2.716	102	4.016
4	.1575	37	1.456	70	2.756	103	4.055
5	.1968	38	1.496	71	2.795	104	4.094
6	.2362	39	1.535	72	2.834	105	4.134
7	.2756	40	1.575	73	2.874	106	4.173
8	.3149	41	1.614	74	2.913	107	4.212
9	.3543	42	1.653	75	2.953	108	4.252
10	.3937	43	1.693	76	2.992	109	4.291
11	.4331	44	1.732	77	3.031	110	4.331
12	.4724	45	1.772	78	3.071	111	4.370
13	.5118	46	1.811	79	3.110	112	4.409
14	.5512	47	1.850	80	3.149	113	4.449
15	.5905	48	1.890	81	3.189	114	4.488
16	.6299	49	1.929	82	3.228	115	4.527
17	.6693	50	1.968	83	3.268	116	4.567
18	.7086	51	2.008	84	3.307	117	4.606
19	.7480	52	2.047	85	3.346	118	4.645
20	.7874	53	2.086	86	3.386	119	4.685
21	.8268	54	2.126	87	3.425	120	4.724
22	.8661	55	2.165	88	3.464	121	4.764
23	.9055	56	2.205	89	3.504	122	4.803
24	.9449	57	2.244	90	3.543	123	4.842

INCHES to MILLIMETERS (inches x 25.40 = mm)							
in.	mm	in.	mm	in.	mm	in.	mm
.001	.025	.6	15.240	1 15/16	49.21	3 5/16	84.14
.002	.051	5/8	15.875	2	50.80	3 3/8	85.72
.003	.076	11/16	17.462	2 1/16	52.39	3.4	86.36
.004	.102	.7	17.780	2.1	53.34	3 7/16	87.31
.005	.127	3/4	19.050	2 1/8	53.97	3 1/2	88.90
.006	.152	.8	20.320	2 3/16	55.56	3 9/16	90.49
.007	.178	13/16	20.638	2.2	55.88	3.6	91.44
.008	.203	7/8	22.225	2 1/4	57.15	3 5/8	92.07
.009	.229	.9	22.860	2.3	58.42	3 11/16	93.66
.010	.254	15/16	23.812	2 5/16	58.74	3.7	93.98
1/64	.397	1	25.40	2 3/8	60.32	3 3/4	95.25
.020	.508	1 1/16	26.99	2.4	60.96	3.8	96.52
.030	.762	1.1	27.94	2 7/16	61.91	3 13/16	96.84
1/32	.794	1 1/8	28.57	2 1/2	63.50	3 7/8	98.42
.040	1.016	1 3/16	30.16	2 9/16	65.09	3.9	99.06
.050	1.270	1.2	30.48	2.6	66.04	3 15/16	100.01
.060	1.524	1 1/4	31.75	2 5/8	66.67	4	101.6
1/16	1.588	1.3	33.02	2 11/16	68.26	4 1/16	102.19
.070	1.778	1 5/16	33.34	2.7	68.58	4.1	104.14
.080	2.032	1 3/8	34.92	2 3/4	69.85	4 1/8	104.77
.090	2.286	1.4	35.56	2.8	71.12	4 3/16	106.36
.1	2.540	1 7/16	36.51	2 13/16	71.44	4.2	106.68
1/8	3.175	1 1/2	38.10	2 7/8	73.02	4 1/4	107.95
3/16	4.762	1 9/16	39.69	2.9	73.66	4.3	109.22
.2	5.080	1.6	40.64	2 15/16	74.61	4 5/16	109.54
1/4	6.350	1 5/8	41.27	3	76.20	4 3/8	111.12
.3	7.620	1 11/16	42.86	3 1/16	77.79	4.4	111.76
5/16	7.938	1.7	43.18	3.1	78.74	4 7/16	112.71
3/8	9.525	1 3/4	44.45	3 1/8	79.37	4 1/2	114.30
.4	10.160	1.8	45.72	3 3/16	80.96	4 9/16	115.89
7/16	11.112	1 13/16	46.04	3.2	81.28	4.6	116.84
1/2	12.700	1 7/8	47.62	3 1/4	82.55	4 5/8	117.47
9/16	14.288	1.9	48.26	3.3	83.82	4 11/16	119.06

FASTENER TORQUE VALUES

General

Torque specifications for fasteners are listed as required in each section. When converting to Newton-meters, use the formulas given in the metric chart. For all other 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 indicates in-lbs. In the metric table, figures are listed in Newton-meters.

WARNING

The 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-Davidson replacement fasteners tightened to the specified torque value. Substitution could cause fastener failure, which may result in vehicle damage and/or personal injury.

SAE TABLE

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.																

*These marked torque values are listed in **in-lbs**.

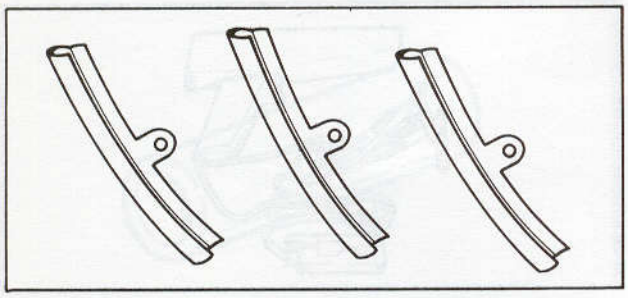
METRIC TABLE

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/cm²	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/cm²	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/cm²	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/cm²	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/cm²	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/cm²	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.																

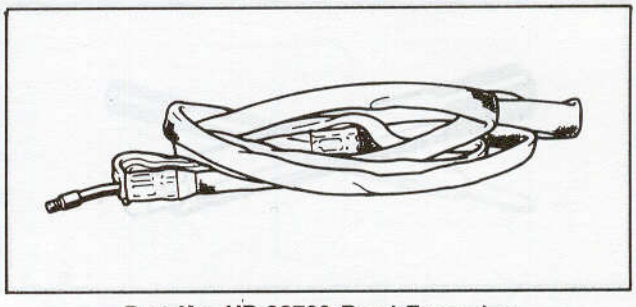
foot-pounds (**ft-lbs**) X **1.356** = Newton-meters (**Nm**)

inch-pounds (**in-lbs**) X **0.113** = Newton-meters (**Nm**)

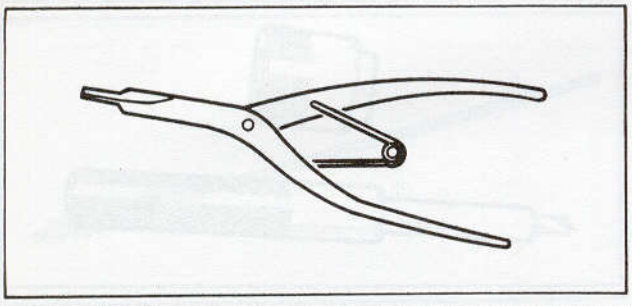
TOOLS



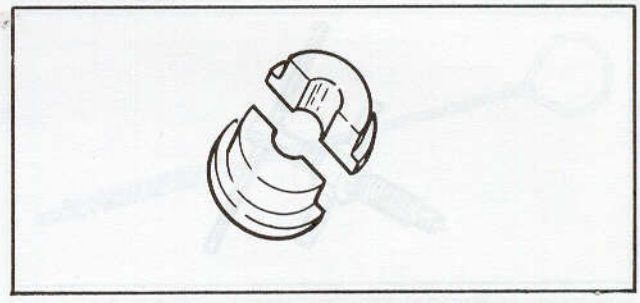
Part No. HD-01289 Rim Protector



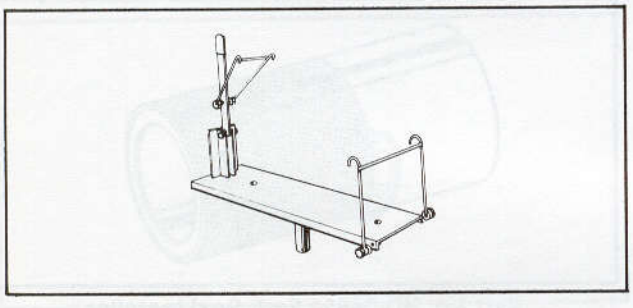
Part No. HD-28700 Bead Expander



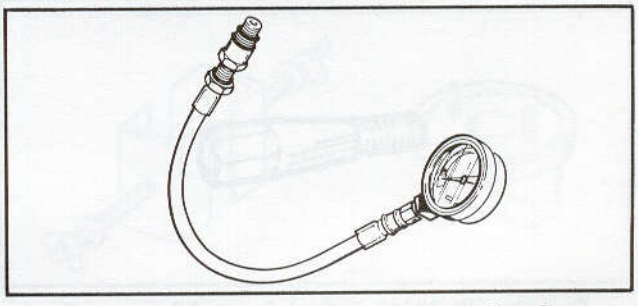
Part No. J-5586 Transmission Shaft Retaining Ring Pliers



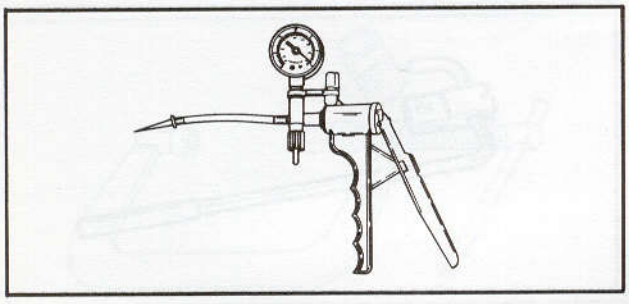
Part No. HD-33071 Wheel Bearing Race Remover and Installer



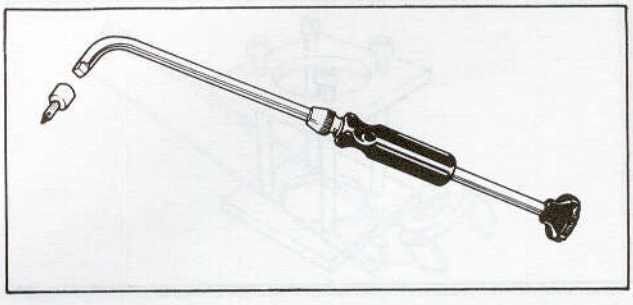
Part No. HD-21000 Tire Spreader



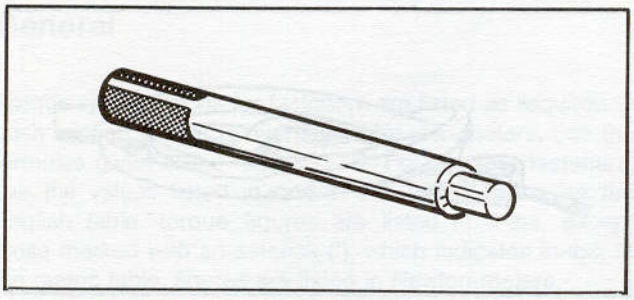
Part No. HD-33223-1 Cylinder Compression Gauge



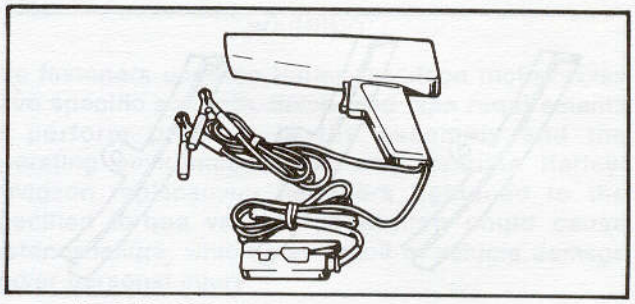
Part No. HD-23738 Vacuum pump



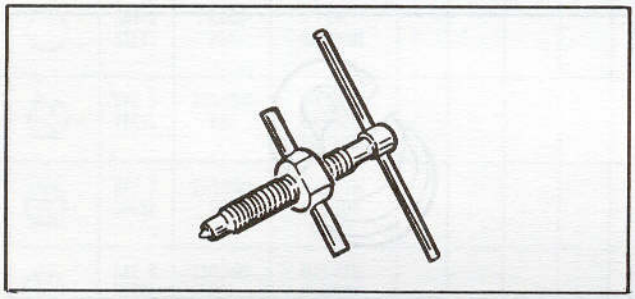
Part No. HD-33413 Carburetor Idle Adjustment Tool



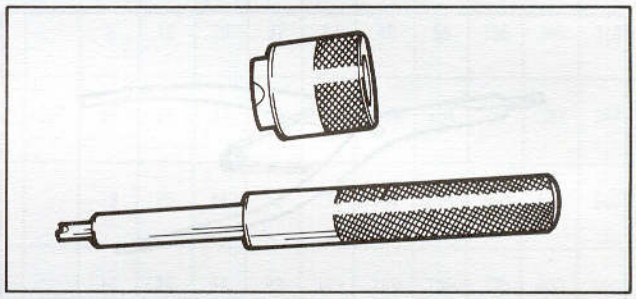
Part No. HD-33416 Universal Driver Handle



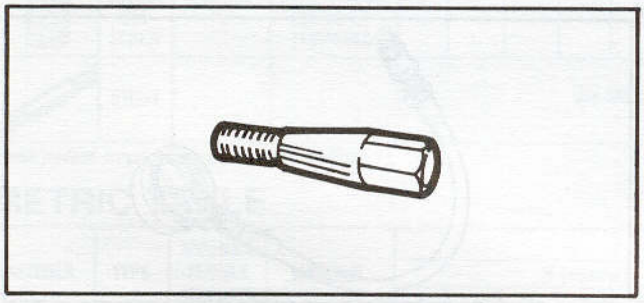
Part No. HD-33813 Inductive Timing Light



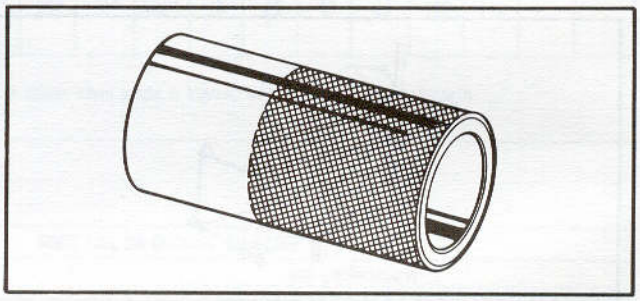
Part No. HD-33418 Universal Puller Forcing Screw



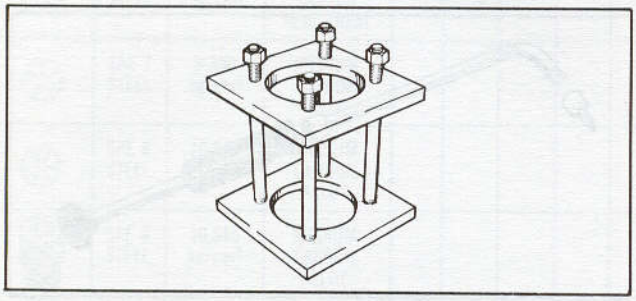
Part No. HD-34623A Piston Pin Retaining Ring Installer



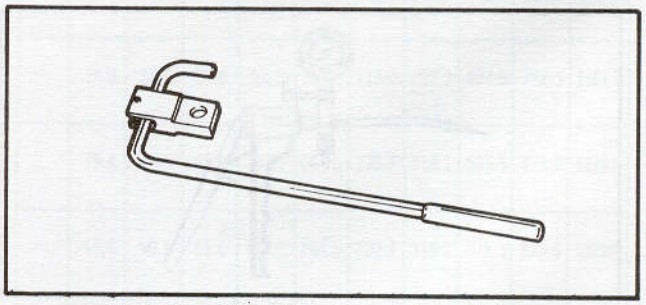
Part No. HD-33443 Tappet Guide Alignment Tool



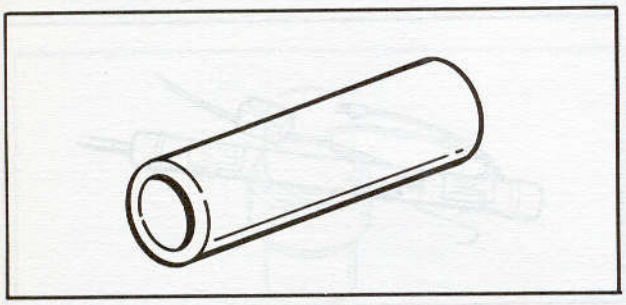
Part No. HD-34634 Fork Seal Installer



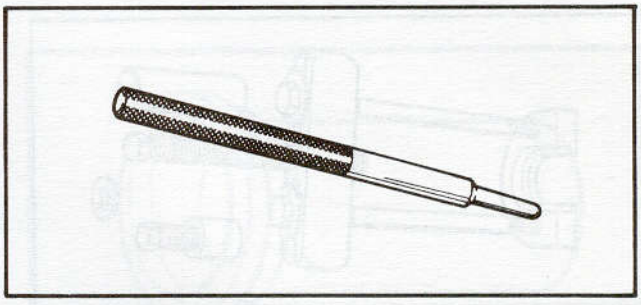
Part No. HD-33446 Cylinder Torque Plates



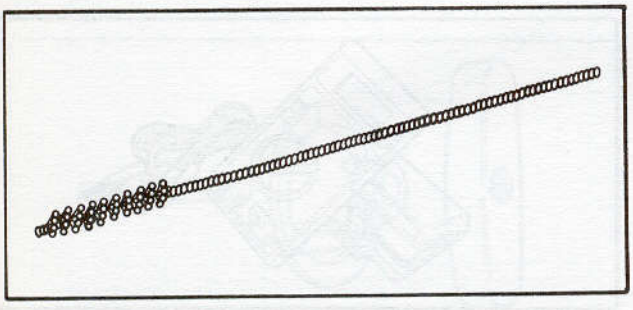
Part No. HD-34641 Rear Intake Valve Spring Compressor



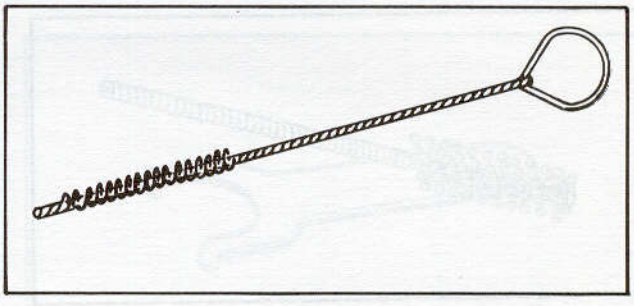
Part No. HD-34643A Valve Guide Seal Tool



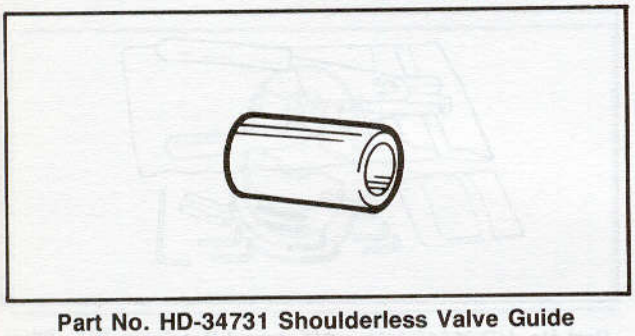
Part No. HD-34740 Driver Handle and Remover



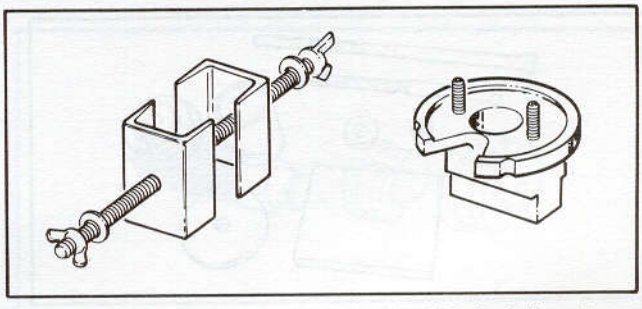
Part No. HD-34723 Valve Guide Hone (8 mm)



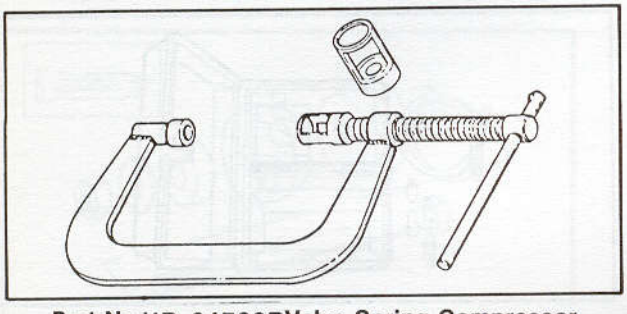
Part No. HD-34751 Nylon Cleaning Brush



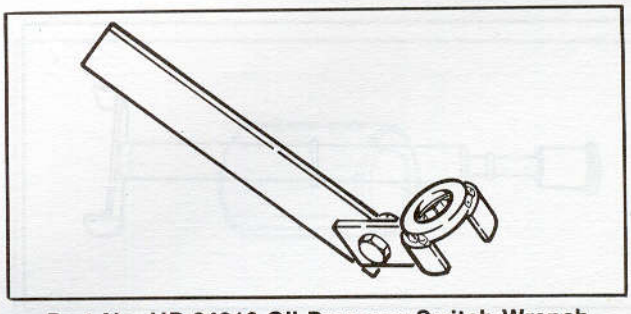
Part No. HD-34731 Shoulderless Valve Guide Installer



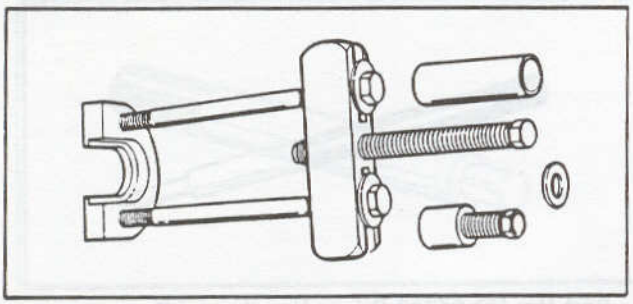
Part No. HD-34813 Rowe Flywheel Rebuilding Jig



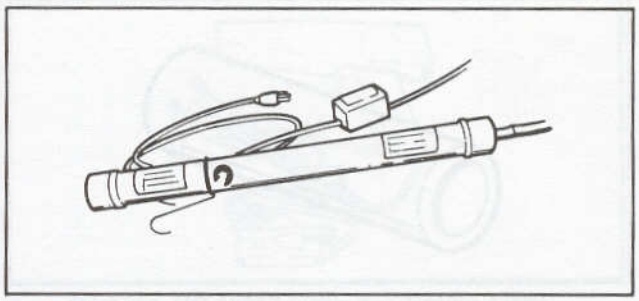
Part No.HD-34736BValve Spring Compressor



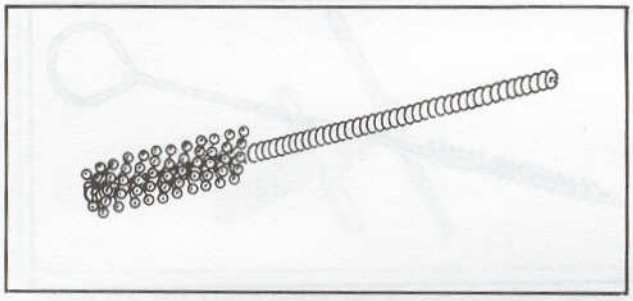
Part No. HD-34816 Oil Pressure Switch Wrench



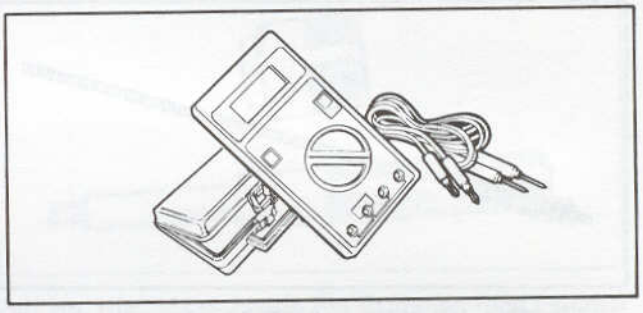
Part No. HD-34902A Mainshaft Primary Bearing Race Remover and Installer



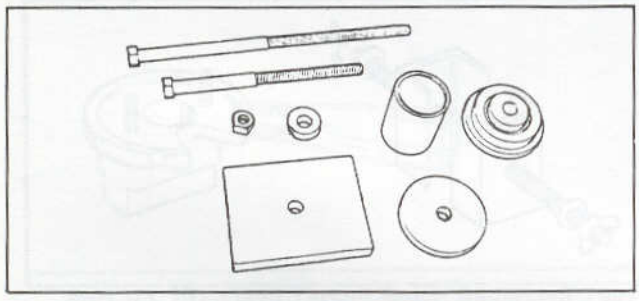
Part No. HD-35457 Black Light Leak Detector



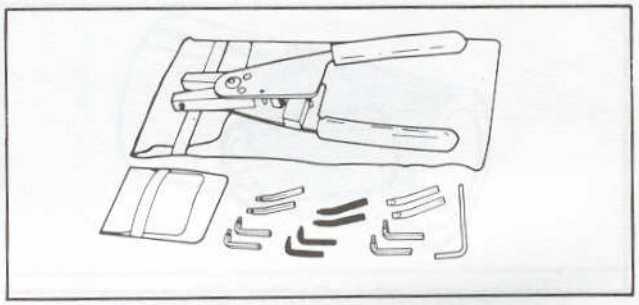
Part No. HD-35102 Wrist Pin Bushing Hone



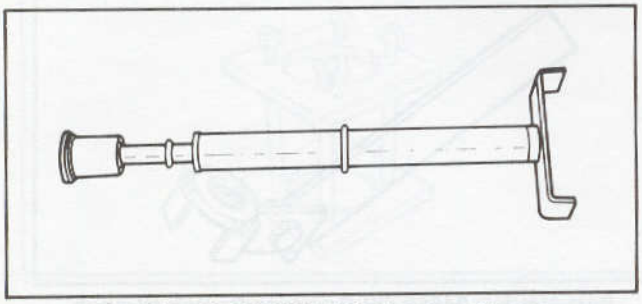
Part No. HD-35500 Digital Multi-Meter



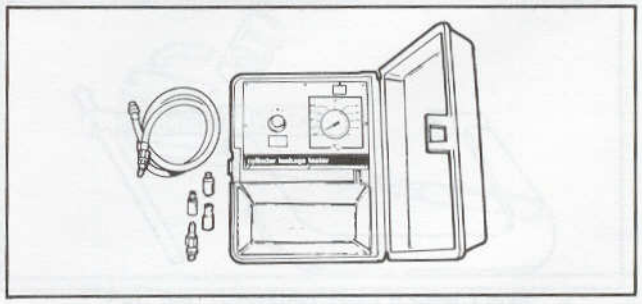
Part No. HD-35316 Main Drive Gear Remover & Installer and Main Drive Gear Bearing Installer



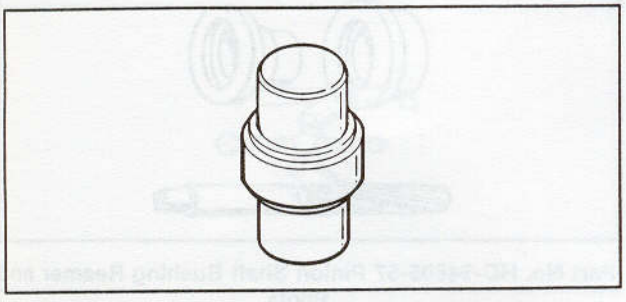
Part No. HD-35518 Internal/External Retaining Ring Pliers



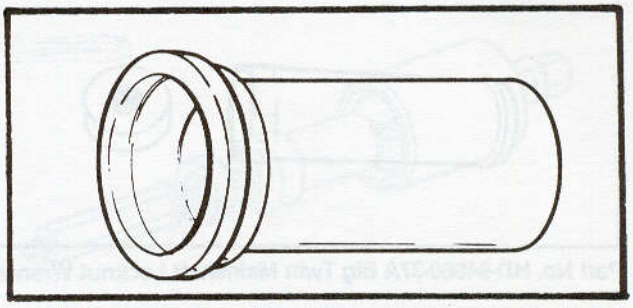
Part No. HD-35381 Belt Tension Gauge



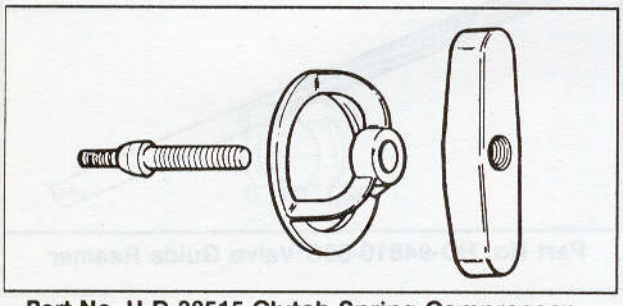
Part No. HD-35667 Cylinder Leak Down Detector



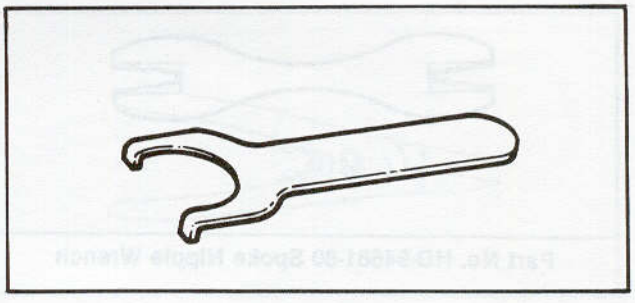
Part No. HD-37842 Inner/Outer Main Drive Gear Needle Bearing Installation Tool

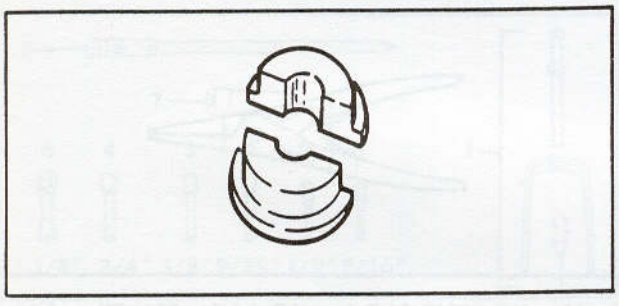


Part No. HD-39361 Sprocket Shaft Seal Installation Tool

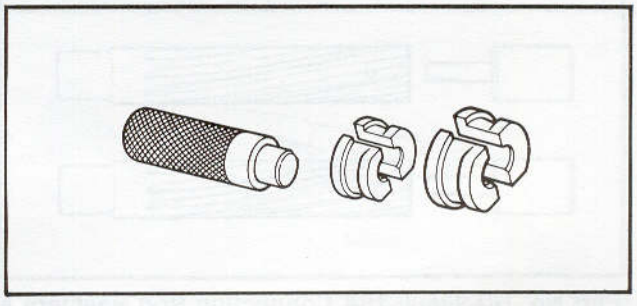


Part No. H-D 38515 Clutch Spring Compressor

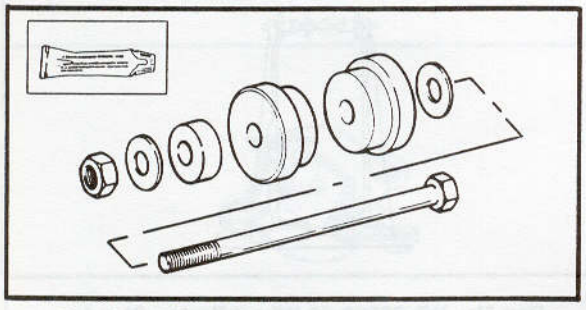




Part No. HD-39301 Steering Head Bearing Race Removal Tool

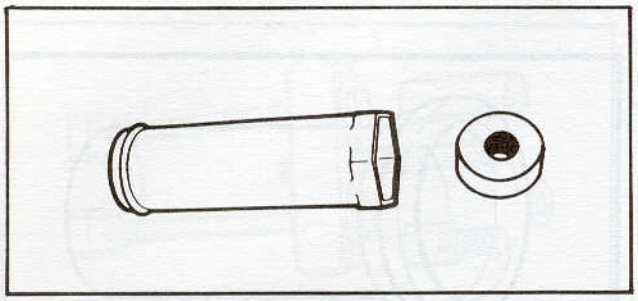


Part No. HD-94547-80 Crankshaft Bearing Tool

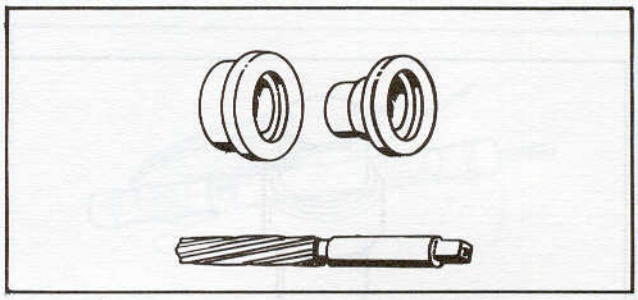


Part No. HD-39302 Steering Head Bearing Race Installation Tool

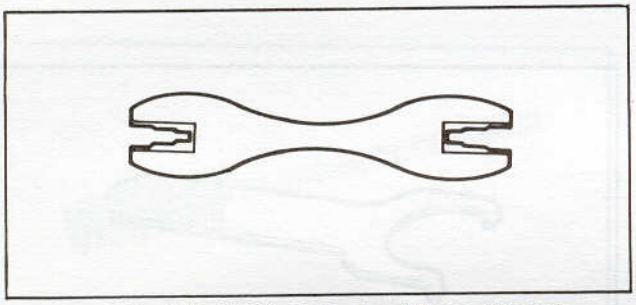
Part No. HD-94555-55C Pinion Gear Shaft Nut Socket



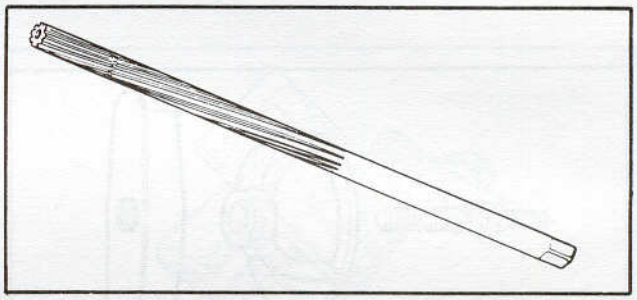
Part No. HD-94660-37A Big Twin Mainshaft Locknut Wrench



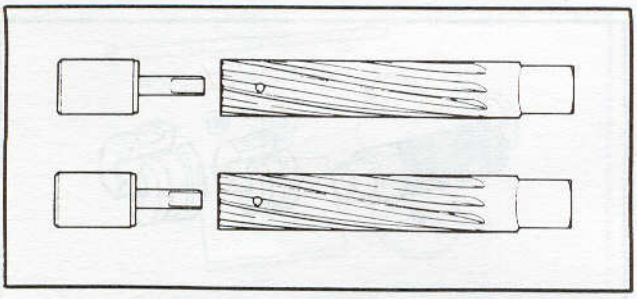
Part No. HD-94805-57 Pinion Shaft Bushing Reamer and Pilots



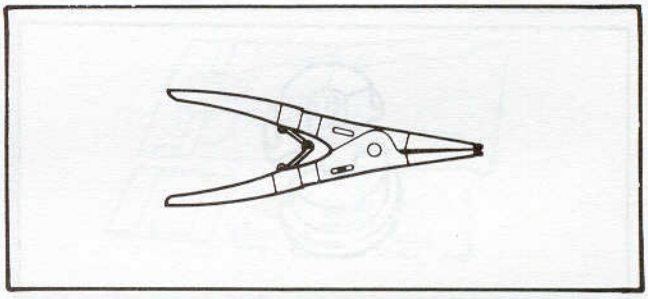
Part No. HD-94681-80 Spoke Nipple Wrench



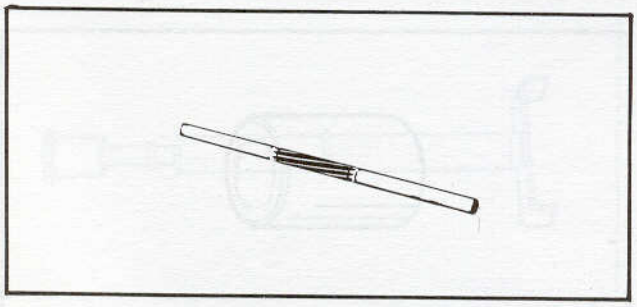
Part No. HD-94810-80C Valve Guide Reamer



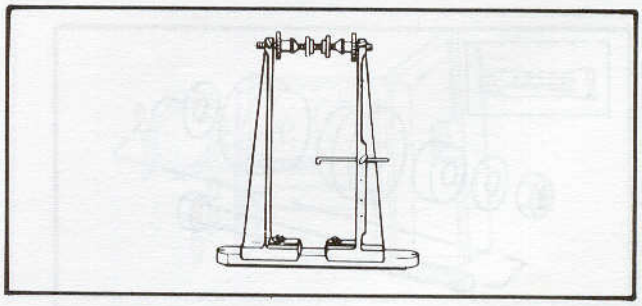
Part No. HD-94800-26A Connecting Rod Reamers & Pilots



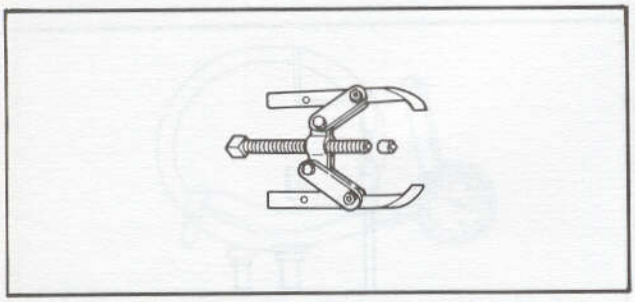
Part No. HD-95017-61 External Retaining Ring Pliers, Large



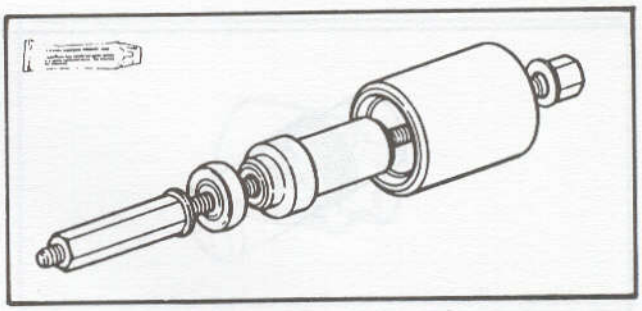
Part No. HD-94804-57 Rocker Arm Bushing Reamer



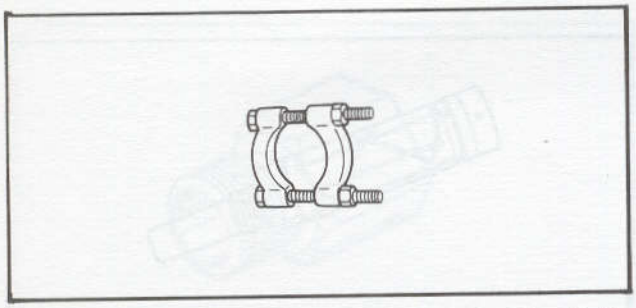
Part No. HD-95500-80 Wheel Truing Stand



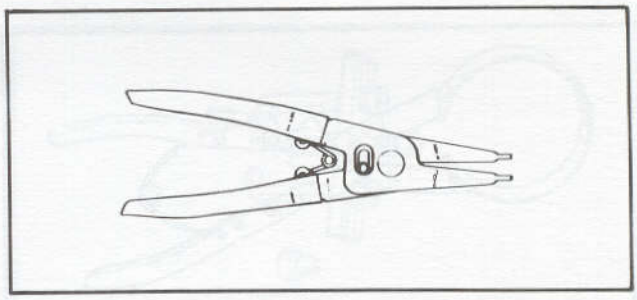
Part No. HD-95635-46 All Purpose Claw Puller



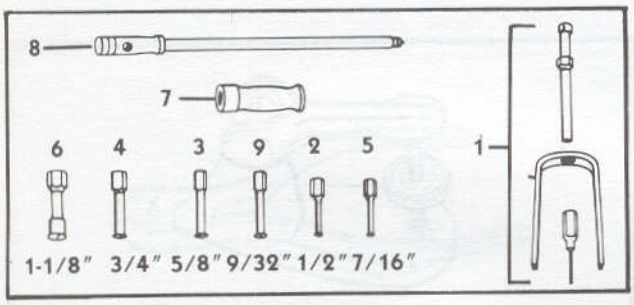
Part No. HD-95970-32C Piston Bin Bushing Tool



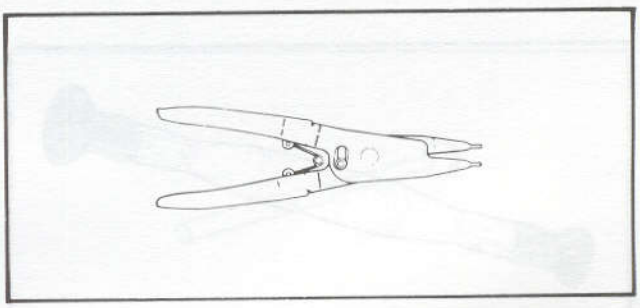
Part No. HD-95637-46 Wedge Attachment for Claw Puller



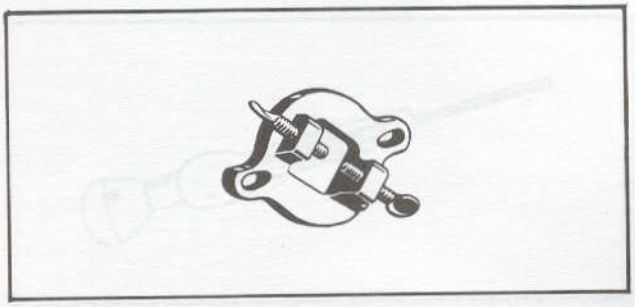
Part No. HD-96215-49 Small Internal Lock Ring Pliers



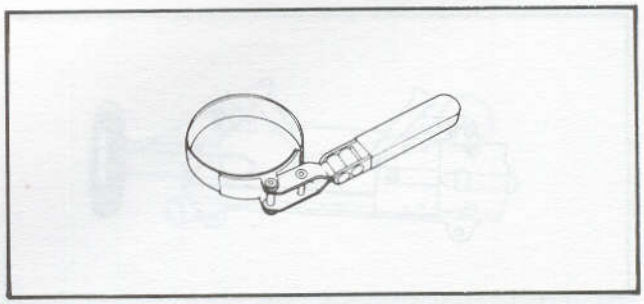
Part No. HD-95760-69 Bushing and Bearing Puller Tool Set (Includes Items 1, 2, 3 and 4) Items 5 (HD-95768-69), 6 (HD-95769-69), 7 (HD-95770-69) and 8 (HD-95771-69) are optional extras.



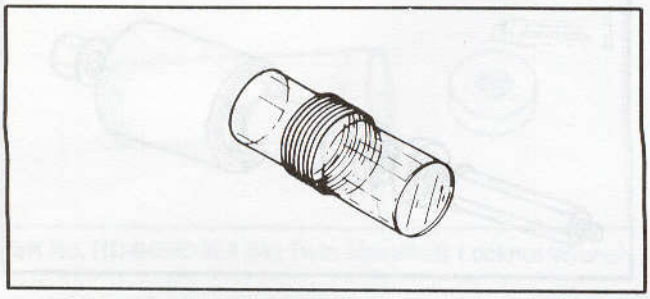
Part No. HD-96216-49 Large Internal Retaining Ring Pliers



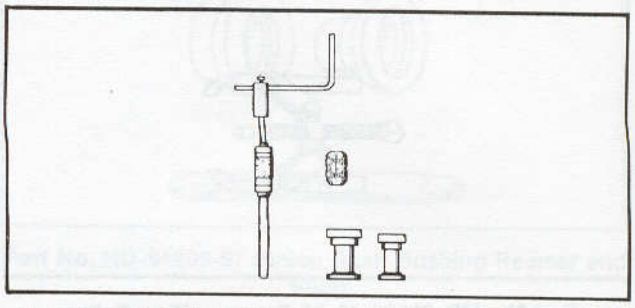
Part No. HD-95952-33A Connecting Rod Clamping Tool



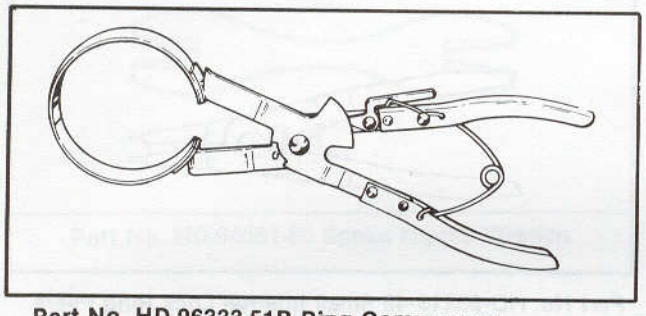
Part No. HD-96221-80 Oil Filter Wrench



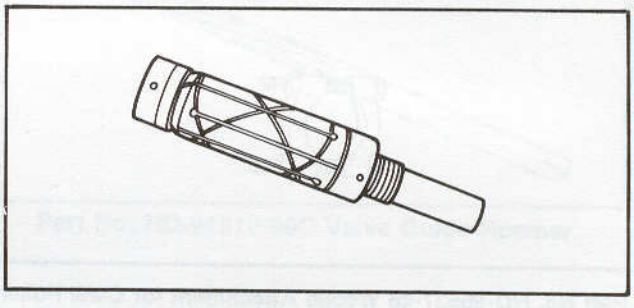
Part No. HD-96295-65D Timing Mark View Plug



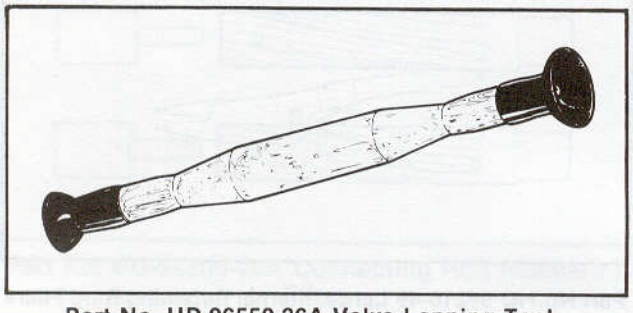
Part No. HD-96710-40A Crankcase Main Bearing Lap



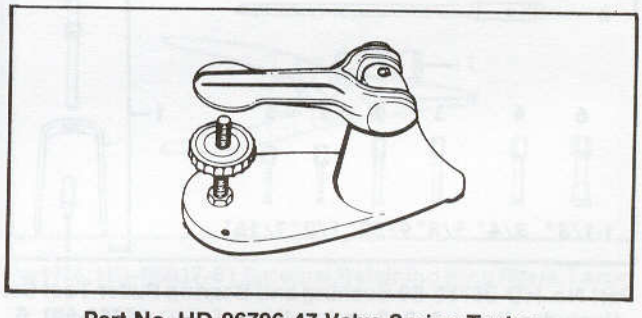
Part No. HD-96333-51B Ring Compressor



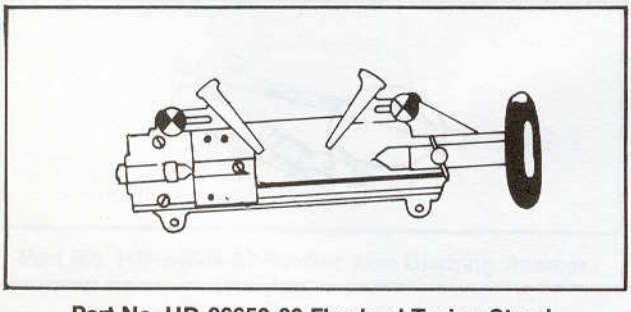
Part No. HD-96740-36 Connecting Rod Lapping Arbor



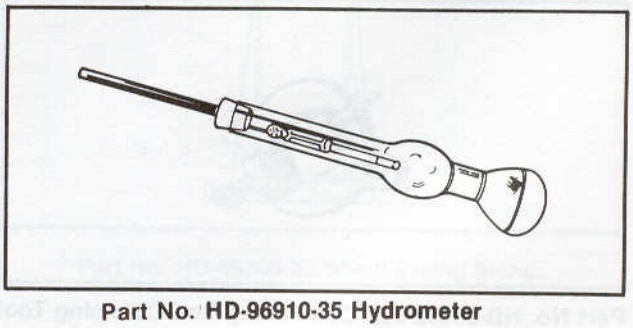
Part No. HD-96550-36A Valve Lapping Tool



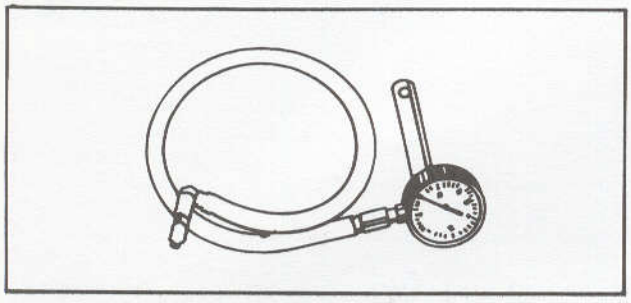
Part No. HD-96796-47 Valve Spring Tester



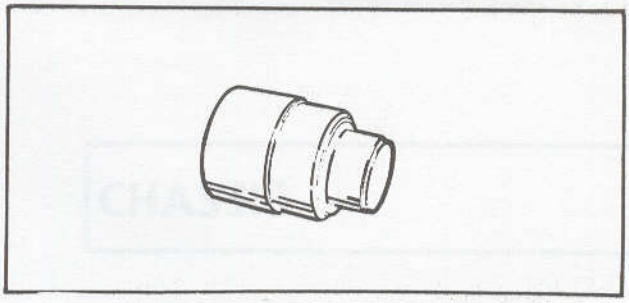
Part No. HD-96650-80 Flywheel Truing Stand



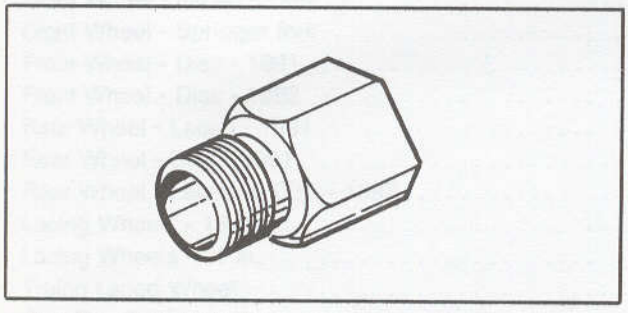
Part No. HD-96910-35 Hydrometer



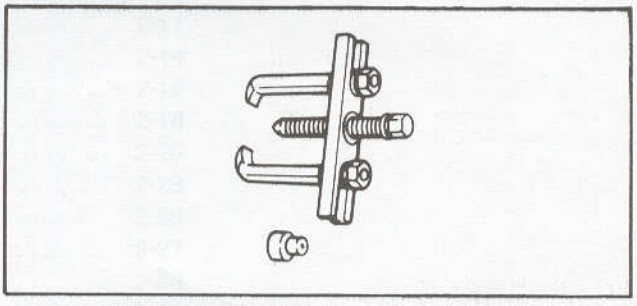
Part No. HD-96921-52A Oil Pressure Gauge



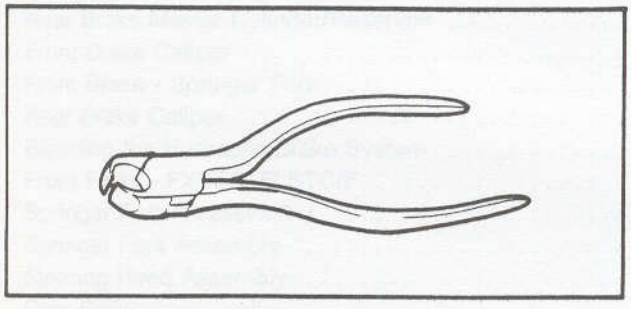
Part No. HD-97272-60 Camshaft Needle Bearing Installer



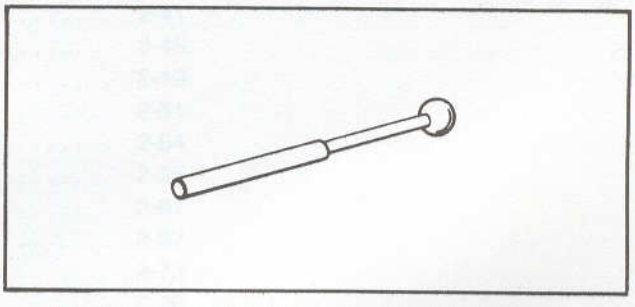
Part No. HD-96921-107 Oil Pressure Gauge Adapter



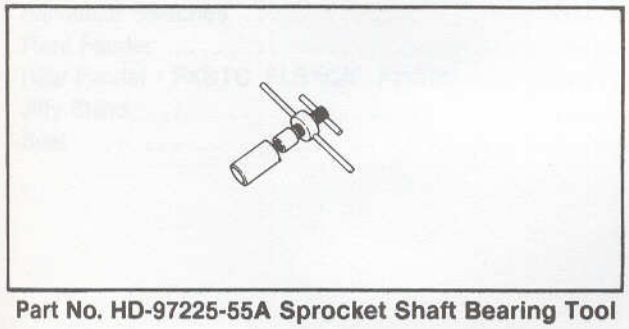
Part No. HD-97292-61 Two Jaw Puller



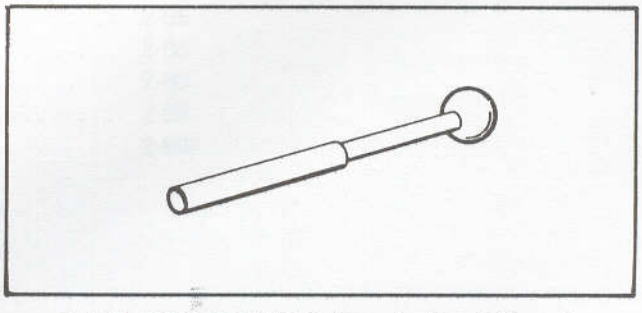
Part No. HD-97087-65B Hose Clamp Pliers



Part No. HD-97362-71 Pin Terminal Tool (Small)



Part No. HD-97225-55A Sprocket Shaft Bearing Tool



Part No. HD-97364-71 Pin Terminal Tool (Large)

NOTES

CHASSIS

SPECIFICATIONS

DIMENSIONS

	WHEEL BASE	OVERALL LENGTH	OVERALL WIDTH	OVERALL HEIGHT
FXSTC	66.30	94.30	29.00	47.00
FLSTF	62.50	93.80	38.00	49.00
FLSTC	62.50	93.80	38.00	59.40
FXSTS	66.30	94.30	29.00	47.00

VEHICLE WEIGHT (lbs.)

FXSTC	618
FLSTF	650
FLSTC	710
FXSTS	625

NOTE

Gross Vehicle Weight Rating (GVWR) (maximum allowable loaded vehicle weight) and corresponding Gross Axle Weight Ratings (GAWR) are given on a label located on the front frame downtube.

	GVWR	GAWR-front	GAWR-rear
FXSTC	1085	390	695
FLSTC/F	1085	390	695
FXSTS	1085	390	695

CAPACITIES

Fuel Tank

FXSTC Total	5.2 Gallons (US)
Reserve	1.2 Gallons (US)
FLSTC/F, FXSTS Total	4.2 Gallons (US)
Reserve	0.75 Gallons (US)

Front Fork (oz.)

	WET	DRY
FXSTC	10.2	11.2
FLSTC/F	11.5	12.5

TORQUES

Slider Cap Nuts	9-13 ft-lbs
Front Axle Nut FXSTC FLSTC/F	45-50 ft-lbs
Front Axle Nut FXSTS	60-65 ft-lbs
Rear Axle Nut	60-65 ft-lbs
Brake Disc Screws	
Rear	30-45 ft-lbs
Front	16-24 ft-lbs
Brake Bleeder Nipple	32-40 in-lbs
Rear Wheel Sprocket Screws	65-70 ft-lbs
Rear Brake Reaction Pin Nut (FXSTC only)	20 ft-lbs
Rear Fender Supports	30-33 ft-lbs
Shock Absorber	
Mounting Bolts	115-130 ft-lbs
Front Brake Caliper Mounting Bolts	
FXSTC, FLSTC/F	25-30 ft-lbs
FXSTS (top)	42-46 ft-lbs
FXSTS (bottom)	25-30 ft-lbs
Brake Banjo Bolts	17-22 ft-lbs
Rear Brake Caliper Screws	12-15 ft-lbs

BRAKE DISCS

Front Dia.	Rear Dia.	Minimum Thickness Front	Rear
11.5 in.	11.5 in.	0.20 in.	0.20 in.
		Brake Disc Runout (Maximum) Front	Rear
		0.008 in.	0.008 in.

TIRE DATA

MODEL (DUNLOP TIRES ONLY)		TIRE PRESSURE PSI (COLD) FRONT	REAR
Solo Rider	FLSTC/F	36	36
Rider & one passenger	FLSTC/F	36	40
Solo Rider	FXSTC, FXSTS	30 (21 in.)	36
Rider & one passenger	FXSTC, FXSTS	30 (21 in.)	40

WARNING

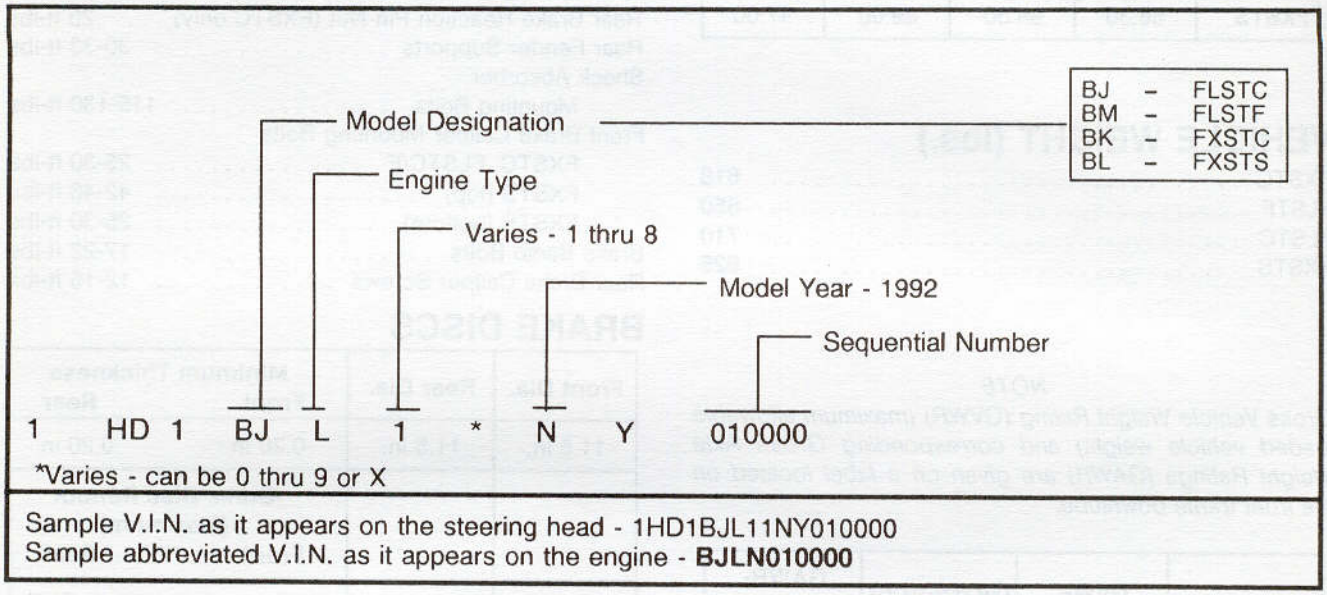
The maximum cold inflation pressure of these tires must not exceed the maximum pressure specified on the tire sidewall. If tires are overfilled they could blow out while riding causing personal injury.

VEHICLE IDENTIFICATION NUMBER (V.I.N.)

The full 17 digit serial, or Vehicle Identification Number (V.I.N.) is stamped on the steering head and on a label located on the right front frame downtube. An abbreviated V.I.N. is stamped on the left side crankcase at the base of the rear cylinder.

NOTE

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



Sample V.I.N. as it appears on the steering head - 1HD1BJL11NY010000
Sample abbreviated V.I.N. as it appears on the engine - **BJLN010000**

FRONT FORK ADJUSTMENTS (ALL MODELS)

FORK ADJUSTMENT (ALL MODELS EXCEPT SPRINGER)

Steering Head Bearing Adjustment – "1 - 2 Inch Fall-Away" Method

1. Support motorcycle in an upright position so the front end is completely suspended.
2. Remove all accessory weight, such as 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 must be straight ahead.
5. Loosen lower triple clamp pinch bolts.
6. Tap the fender on one side until the front end begins to "fall-away" by itself. Mark this point on the marking material. Repeat in the other direction.

NOTE

The distance between the "fall-away" marks must be 1 - 2 inches.

7. Tighten or loosen the fork adjuster nut/bolt until the "fall-away" point is within 1 - 2 inches.

NOTE

If the "fall-away" point is more than two inches, loosen the adjuster nut. If it is less than one inch, tighten the adjuster nut.

8. Tighten lower triple clamp pinch bolts to a torque of 30-35 ft-lbs.
9. Repeat the "fall-away" procedure to be sure the adjustment is correct.

SPRINGER FORK ADJUSTMENTS

General

WARNING

The FXSTS motorcycle was NOT designed for sidecar use. The springer fork was NOT designed for sidecar use. DO NOT use either the motorcycle or any springer fork equipped vehicle for this purpose. Use of any springer fork equipped vehicle for this purpose could cause personal injury.

WARNING

The front end components of the Springer and their design relationships to each other are very important. Altering these relationships by modifying the springer front end could adversely affect the handling of your Springer and endanger the rider.

DO NOT:

- **Alter the fender brackets to lower the fender. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.**
- **Replace the O.E.M. tire with a higher-aspect ratio tire. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.**
- **Replace the O.E.M. tire with a traditional-looking 16 in. front wheel, tire and front fender. In addition to above, this could adversely affect the handling characteristics of this motorcycle.**

Harley-Davidson has designed and manufactured this special, custom front end according to our very stringent and well-tested standards. If you modify the Springer front end in any way that changes our original design, Harley-Davidson cannot and does not assume responsibility for mishaps resulting from these changes.

SPRINGER STEERING HEAD BEARINGS ADJUSTMENT

Special Tool Fabrication:

See Figure 2-1. Use a spare hex bearing retainer, P.N. 48306-88, to make a special tool. Use green Loctite and install roll pins P.N. 614 in the three holes at the top of the retainer. You will have to cut the pins in half. Use this as a tool to adjust the steering head bearings.

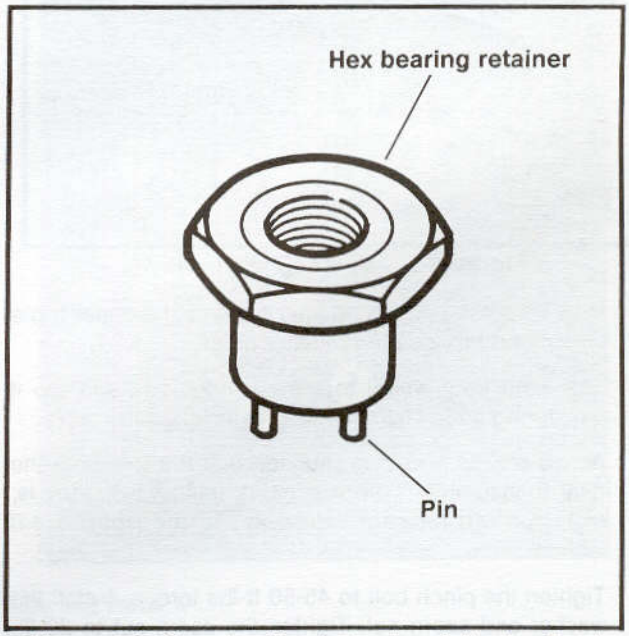


Figure 2-1. Steering Head Bearing Adjuster Tool

This tool can be used to adjust the steering head bearings by removing only the acorn nut and washer. Without the tool, you will have to remove the handlebars, risers, rigid

fork leg studs and upper triple clamp to adjust the steering head bearings.

NOTE

The fork has more weight on the right side than the left. The balance point is just off full left lock.

1. Raise bike so wheels are off the floor an equal amount.
2. See Figure 2-52. Remove the acorn nut (7) and washer (8). Loosen the upper triple clamp pinch bolt (9).
3. Adjust the bearings until there is no noticeable shake in the steering head.
4. Turn the fork to full left lock.
5. See Figure 2-2. Hang a plumb bob from the hole in the rear of the fender. Lay a rule on the floor directly under the plum bob, with the point of the plumb bob at zero.

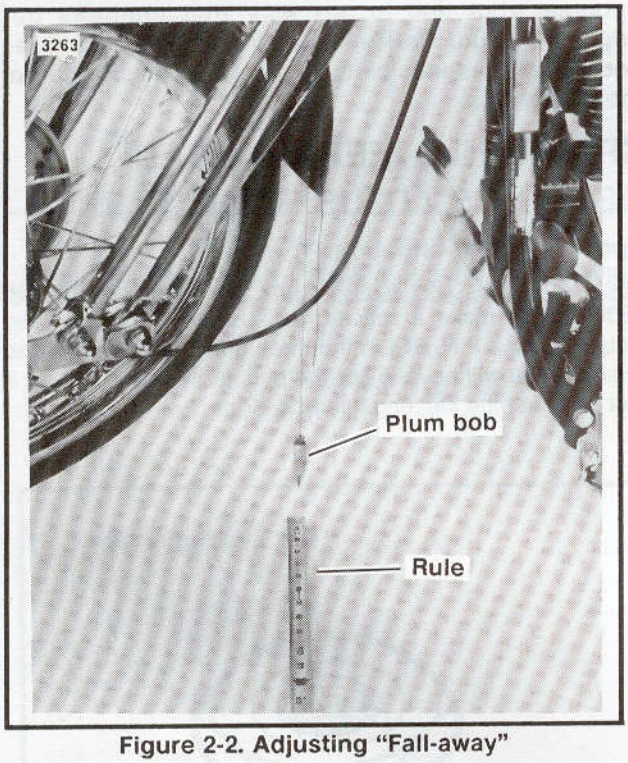


Figure 2-2. Adjusting "Fall-away"

6. Insert the hex bearing retainer tool into the upper triple clamp and hex bearing retainer holes.
7. Move the front wheel to the balance point and tap it until it begins to "fall-away" ***to the right.***
8. Adjust the hex bearing retainer with the tool until the total measurement, from zero to "fall-away", ***that is, from full left lock to "fall-away" to the right,*** is 4-6 inches.
9. Tighten the pinch bolt to 45-50 ft-lbs torque. Install the washer and acorn nut. Tighten the acorn nut to 20-25 ft-lbs torque.

ROCKER BEARINGS ADJUSTMENT

Every 10,000 miles check the rocker bearings tightness.

CAUTION

- **To perform this adjustment, you must take the spring load off the rockers by disconnecting the spring fork from the rockers.**
- **The spring fork can be disconnected from the rockers without removing the front end from the bike.**

1. Do steps 1 thru 6 in FORK REMOVAL.

WARNING

- **If the spring fork legs are not held in place, next to the rigid fork legs, the spring pressure will snap them forward with great force. This could cause personal injury.**
- **See Figure 2-58. Use nylon cable ties around the rigid and spring fork legs to hold them in place.**

2. Use cable ties and tie wrap the fork legs.
3. Disassemble the spring fork legs from the rockers, following steps 1 & 8 in SPRING FORK DISASSEMBLY and move the spring fork legs to one side.
4. See Figure 2-44. Loosen the jam nuts (6) and bearing retainers (7) on the rockers (5).
5. Move the RIGHT rocker UP against the rigid fork leg. Move the LEFT rocker BACK against the rigid fork leg.
6. Tighten the bearing retainers (7) until you feel contact. Tighten the bearing retainers 1 (one) flat past contact. Mark a flat, if necessary.

NOTE

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

7. Secure bearing retainers by tightening jam nuts (6). Tighten jam nuts to 95-105 ft-lbs torque.

NOTE

Approximately 1/16 in. of retainer will protrude from jam nut when parts are properly installed.

NOTE

If you do the adjustment correctly, the rockers may not feel as if they're exactly the same degree of tightness. Ignore this. They will equalize within a few miles of vehicle operation.

CAUTION

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

- See steps 5 thru 7, in ROCKERS REMOVAL.

8. Assemble the spring fork legs to the rockers, following step 13 in SPRING FORK ASSEMBLY.
9. Install wheel, brake and brake line and headlamp and mounting block.

- Inspect all spherical rocker bearings at 50,000 miles. Replace the bearings if the teflon lining is worn through to metal anywhere.

LACED FRONT WHEEL - 1991
ALL MODELS EXCEPT SPRINGER

REMOVAL (Figure 2-3)

1. Block motorcycle underneath frame until front wheel is raised off the ground.
2. Remove the brake caliper mounting hardware (1) and let the brake caliper hang loose on the side of the fender.

NOTE

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

3. Remove the axle nut (2), lockwasher (3) and washer (4).
4. Loosen the slider cap nuts (5) and pull the axle (6) free by pulling toward the non-threaded end of the axle.

NOTE

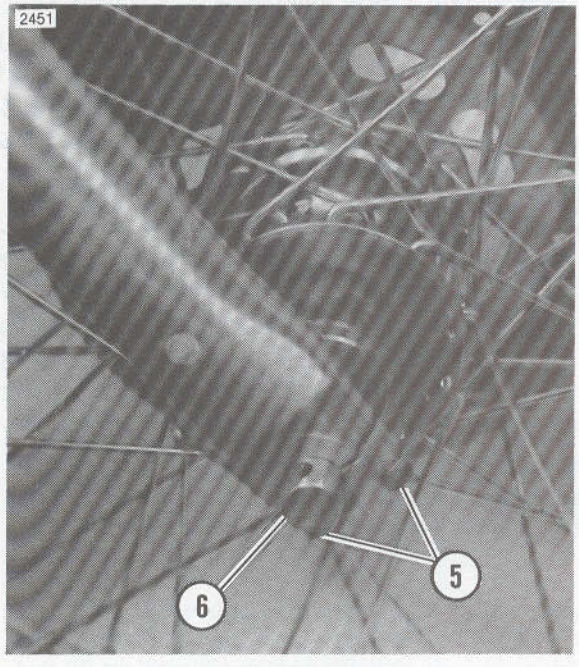
On FLSTC, the hubcap will come off with the wheel.

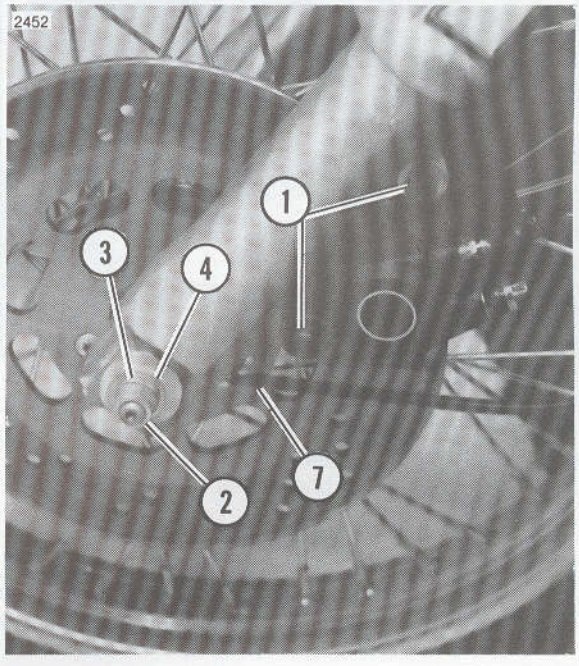
5. Repair wheel as required. See LACED FRONT WHEEL DISASSEMBLY/ASSEMBLY.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Axle nut 50 Slider cap nuts 11 Brake disc screws 16-18

1. See Figure 2-5. Place wheel between fork legs with spacer (4) facing to the motorcycle right side.
2. See Figure 2-3. Install axle through right fork leg, hubcap (on FLSTC), wheel, speedometer drive (7) and left fork leg. Secure the axle by installing washer (4), lockwasher (3) and axle nut (2).
3. See Figure 2-3. Tighten right side slider cap nuts (5) to prevent the axle from rotating. Tighten axle nut (2) to a torque of 50 ft-lbs. Loosen right side slider cap nuts (5), then tighten the nuts to a torque of 11 ft-lbs.





1. Brake caliper mounting hardware
2. Axle nut
3. Lockwasher
4. Washer
5. Slider cap nuts
6. Axle
7. Speedometer drive
8. FLSTC Hubcap (not shown for purposes of illustration)

Figure 2-3. Front Wheel Mounting

Check Wheel Bearing End Play - All Models

WARNING

See Figure 2-4. Set wheel bearing end play to 0.004 - 0.018 in. Incorrect end play can adversely affect handling, creating a potential hazard.

See Figure 2-5. Check end play after tightening axle nut to 50 ft-lbs torque and slider cap nuts to 11 ft-lbs torque.

See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. If end play does not fall within this range, substitute a slightly longer or shorter spacer (5) as necessary.

When you obtain correct end play, tighten the axle nut in the exact sequence given in ASSEMBLY.

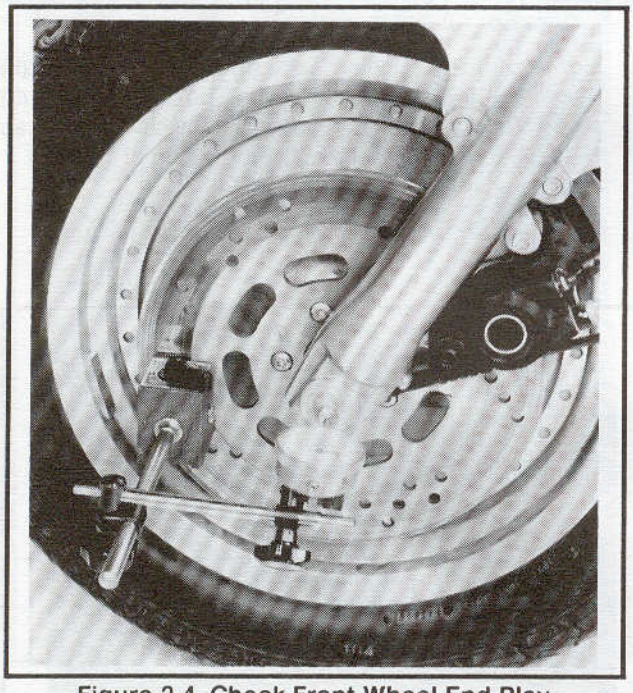


Figure 2-4. Check Front Wheel End Play

DISASSEMBLY (Figure 2-5)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle HD-94681-80 Spoke nipple wrench	None

1. Remove wheel. See LACED FRONT WHEEL REMOVAL.

NOTE

See Figure 2-5. On the FLSTC, there is a snap ring (12) securing the hubcap (10) to the wheel hub. Remove the snap ring, hubcap and and O-ring (11) before disassembling wheel.

2. Pull spacer (4) and seal (1) from the right end of the wheel hub. The right hand seal may pull free with the spacer because of the small shoulder on the spacer, at the inboard side of the seal.
3. Pull seal (1) out of the left side of the wheel hub.
4. Remove bearings (2) and spacer (5).
5. If it is necessary to remove the bearing cups (3) use HD-33071 WHEEL BEARING RACE REMOVER & INSTALLER and UNIVERSAL DRIVER HANDLE Part No. HD-33416.
6. Remove screws (8) using a special socket wrench adaptor Torx T-40 or equivalent.
7. If it is necessary to remove the hub (6) from the wheel, unscrew all the spoke nipples and remove the rim and spokes from the hub.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts, except oil seals, in solvent and inspect for damage or wear.
2. Replace the brake disc if it is warped, scored or worn beyond the minimum thickness stamped on the disc. See SPECIFICATIONS.

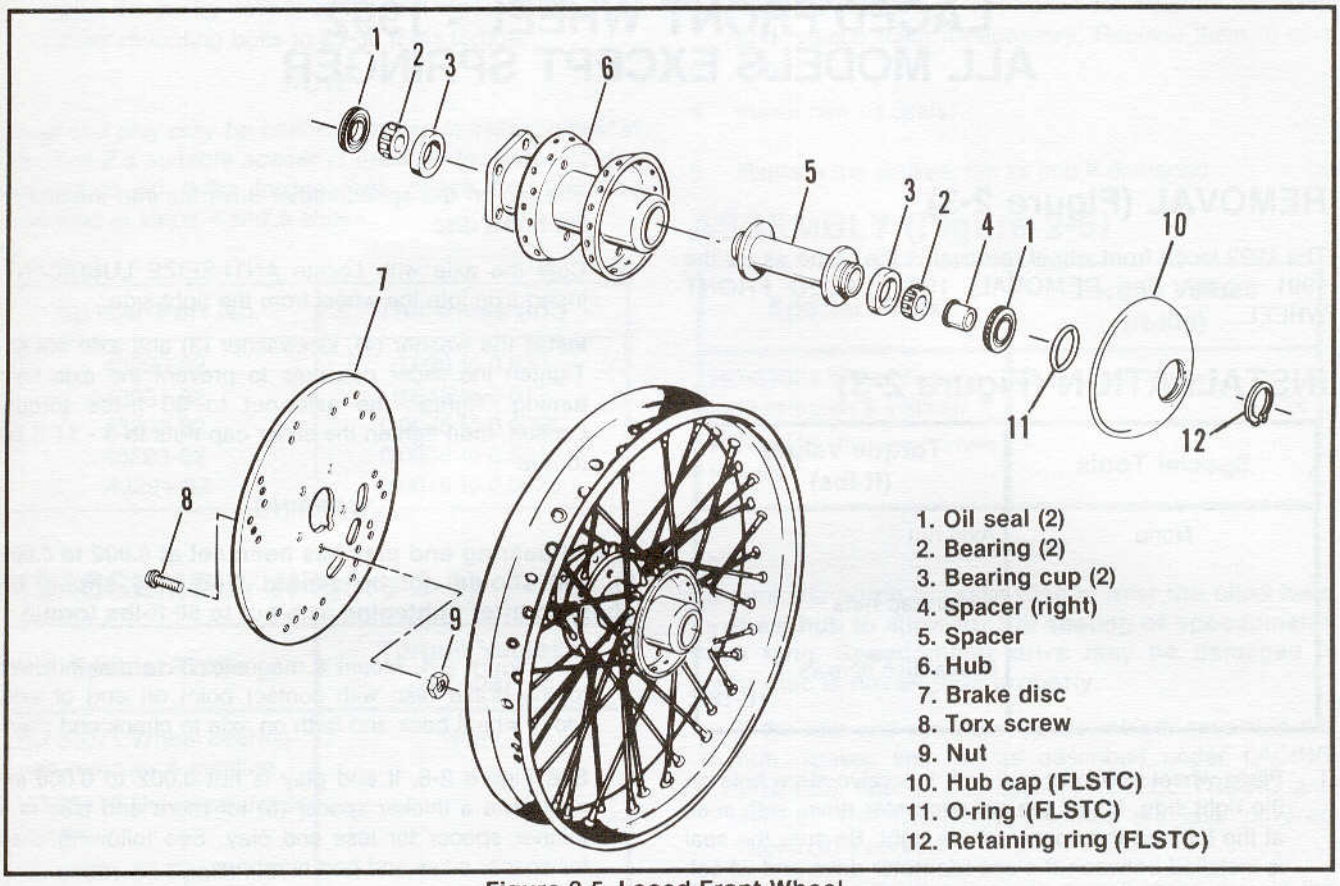


Figure 2-5. Laced Front Wheel

3. Check the bearings and cups for wear and replace them if necessary. Replace them in sets only.
4. Replace the oil seals.
5. Replace the spokes, rim or hub if damaged.

ASSEMBLY (Figure 2-5)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16 - 24

1. If the hub and rim were disassembled, assemble the hub, spokes and rim as described under LACING WHEELS, later in this section. WHEEL TRUING and WHEEL BALANCING procedures are also covered later in this section.
2. Clean the brake disc surfaces of any dirt or grease. Assemble the brake disc (7) to the single flange of hub (6) by inserting screws (8) through holes in brake disc and hub flange. Thread a nut (9) onto each screw and tighten to 16 - 24 ft-lbs torque.
3. If bearing cups (3) were removed for replacement, lube the new cups with oil and press one into each side of the hub against the shoulder of the counterbore.
4. Place the spacer (5) into the hub. Pack bearings (2) with bearing grease and install one into each bearing race.
5. Insert spacer (4) into one of the replacement seals with the shouldered end of the spacer extending out of the lipped side of the seal. Pack the cavity between the seal and spacer with bearing grease.
6. Apply bearing grease to the lips of both oil seals (1) and press the seal with the spacer into the right end of the hub (the end without flange) with the lip of the seal inward. Press other seal (1), sealing lip inward, into the opposite end of the hub. The seals must be flush with the hub end surface or slightly inward not to exceed 0.015 in. inside the hub end surfaces.

NOTE

See Figure 2-5. On FLSTC, install the O-ring (11). Slide the hubcap (10) into wheel hub and secure with snap ring (12).

7. Wheel and tire must be true. See TRUING LACED WHEEL.

LACED FRONT WHEEL - 1992
ALL MODELS EXCEPT SPRINGER

REMOVAL (Figure 2-3)

The 1992 laced front wheel removal is the same as for the 1991 model. See REMOVAL, 1991 LACED FRONT WHEEL.

INSTALLATION (Figure 2-3)

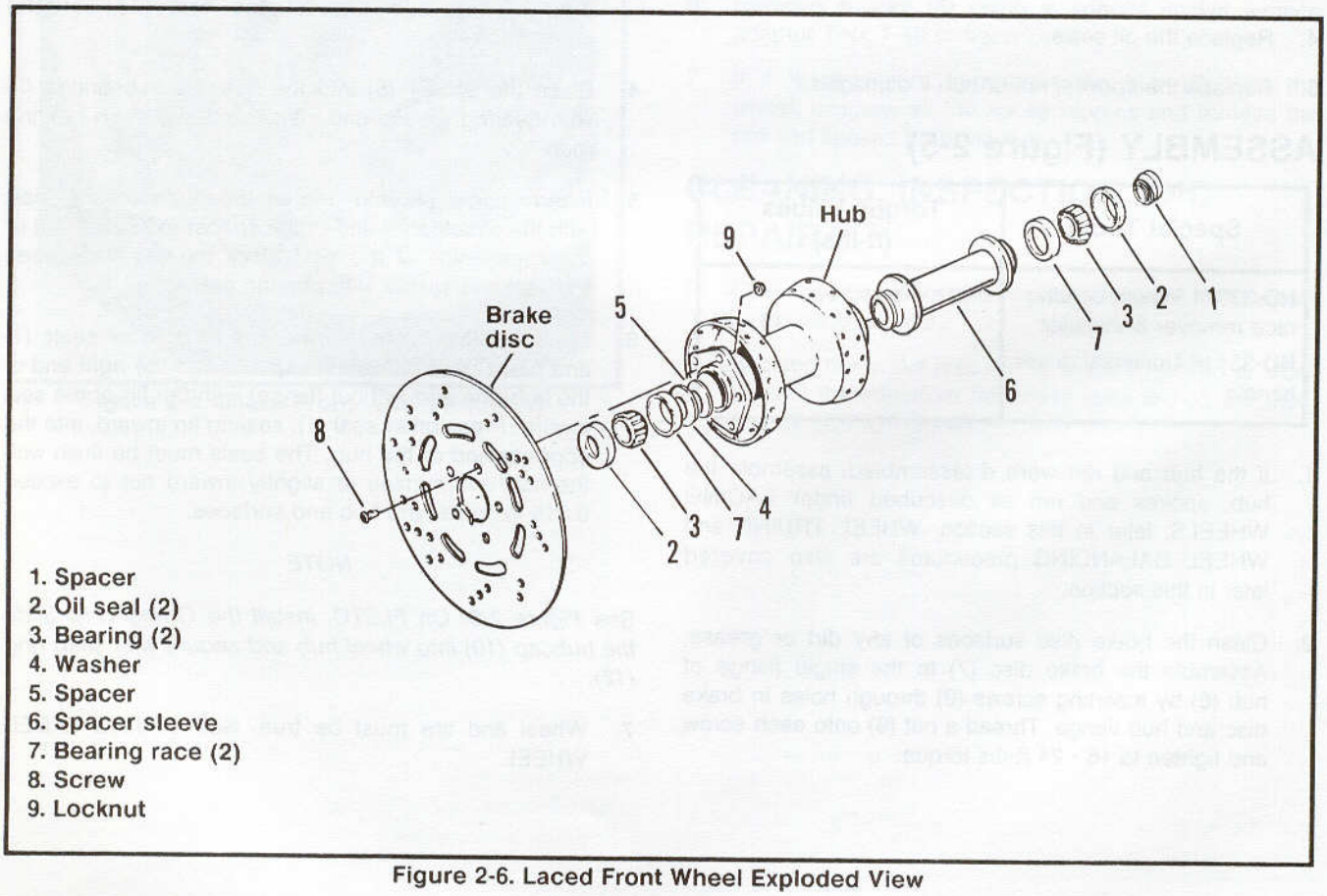
Special Tools	Torque Values (ft-lbs)
None	Axle nut 50 Slider cap nuts 11 Brake disc screws 16-18

1. Place wheel into front fork with the valve stem hole on the right side. Install the speedometer drive, with seal, at the left and the spacer at the right. Be sure the seal is installed between the speedometer drive and wheel. The tab on the speedometer drive fits into the slot on the brake disc.
2. Coat the axle with Loctite ANTI-SEIZE LUBRICANT. Insert axle into the wheel from the right side.
3. Install the washer (4), lockwasher (3) and axle nut (2). Tighten the slider cap nuts to prevent the axle from turning. Tighten the axle nut to 50 ft-lbs torque. Loosen, then tighten the slider cap nuts to 5 - 11 ft-lbs torque.

WARNING

Wheel bearing end play has been set at 0.002 to 0.006 in. and should not be altered. End play should be checked after tightening axle nut to 50 ft-lbs torque.

4. See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Move wheel back and forth on axle to check end play.
5. See Figure 2-6. If end play is not 0.002 to 0.006 in., substitute a thicker spacer (5) for more end play or a thinner spacer for less end play. See following chart for spacer sizes and part numbers.



1. Spacer
2. Oil seal (2)
3. Bearing (2)
4. Washer
5. Spacer
6. Spacer sleeve
7. Bearing race (2)
8. Screw
9. Locknut

Figure 2-6. Laced Front Wheel Exploded View

6. Install the brake caliper to the fork sides. Tighten the caliper mounting bolts to 25-30 ft-lbs torque.

NOTE

Wheel end play may be checked before installing wheel in front fork if a suitable spacer is used on the axle. Tighten axle nut to 50 ft-lbs torque then check end play as described in steps 4 and 5 above.

Spacer Part No.	Thickness (in.)
43290-82	0.030 to 0.033
43291-82	0.015 to 0.017
43292-82	0.0075 to 0.0085
43293-82	0.0035 to 0.0045
43294-82	0.0015 to 0.0025

DISASSEMBLY (Figure 2-6)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle HD-94681-80 Spoke nipple wrench	None

NOTE

See Figure 2-5. On the FLSTC, there is a snap ring (12) securing the hubcap (10) to the wheel. Remove the snap ring, hubcap and and O-ring (11) before disassembling wheel.

1. Remove the spacer (1), oil seals (2), bearings (3), spacer washer (4), variable spacer(s) (5), and spacer sleeve (6).
2. If it is necessary to remove the bearing races (7), use WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, Part No. HD-33416.
3. Remove the screws (8) and locknuts (9) securing the brake disc. Mark the wheel and disc so they will be assembled in their original positions.

CLEANING, INSPECTION AND REPAIR (Figure 2-6)

1. Clean all parts, except oil seals (2) in solvent and inspect for damage or wear.
2. Replace the brake disc if warped, scored or worn beyond the minimum thickness stamped on the disc.
3. Check the bearings and races for wear or corrosion and replace them if necessary. Replace them in sets only.
4. Install new oil seals.
5. Replace the spokes, rim or hub if damaged.

ASSEMBLY (Figure 2-6)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16 - 24

CAUTION

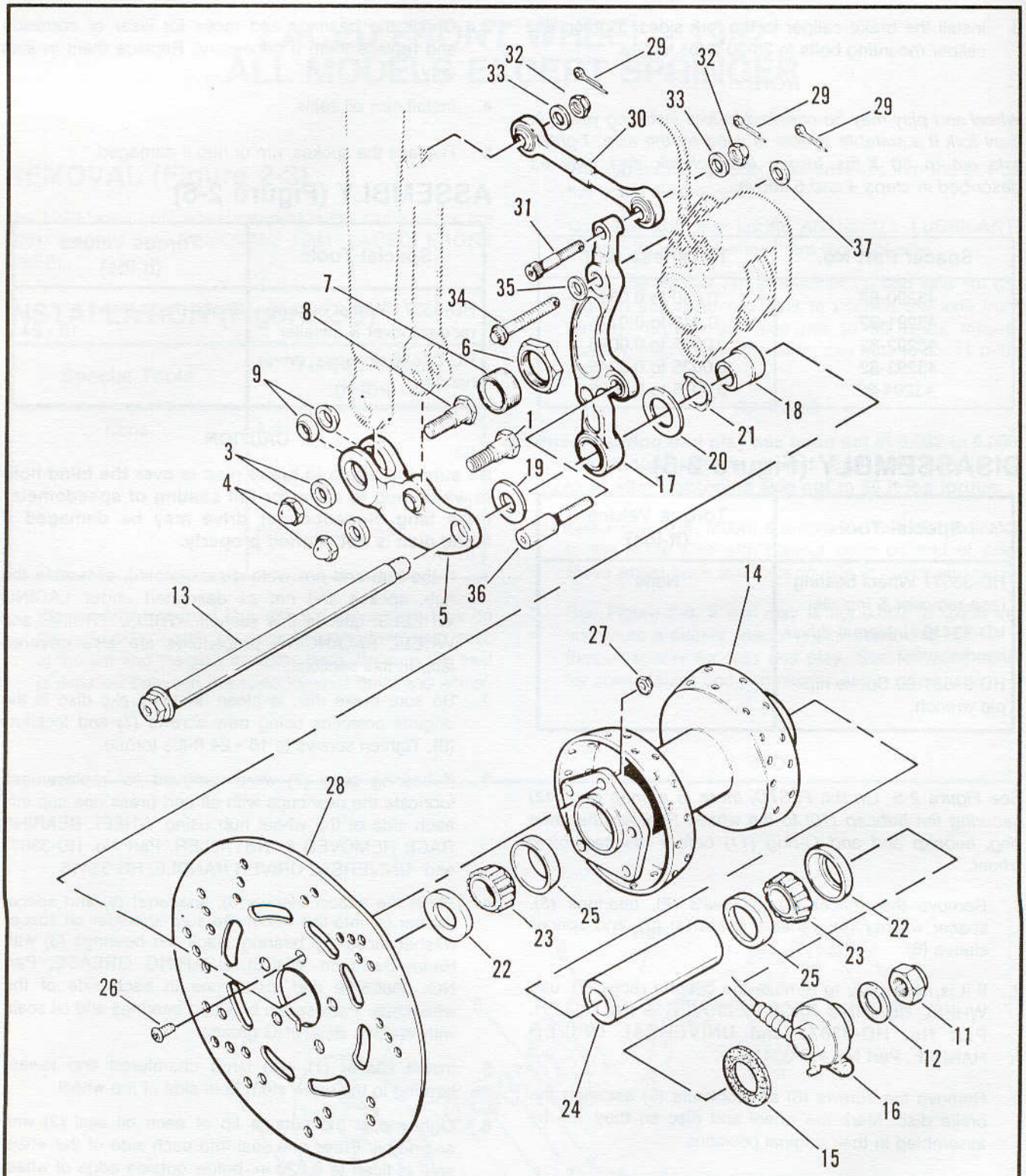
Be sure the notch in brake disc is over the blind hole in wheel hub to allow for full seating of speedometer drive tang. Speedometer drive may be damaged if brake disc is not aligned properly.

1. If the hub and rim were disassembled, assemble the hub, spokes and rim as described under LACING WHEELS, later in this section. WHEEL TRUING and WHEEL BALANCING procedures are also covered later in this section.
2. Be sure brake disc is clean. Install brake disc in the original positions using new screws (7) and locknuts (9). Tighten screws to 16 - 24 ft-lbs torque.
3. If bearing cups (7) were removed for replacement, lubricate the new cups with oil and press one cup into each side of the wheel hub using WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, HD-33416.
4. Place the spacer sleeve (6), spacer(s) (5) and spacer washer (4) into the wheel. Be sure shoulder on spacer washer faces the bearing. Pack the bearings (3) with Harley-Davidson WHEEL BEARING GREASE, Part NO. 99855-89 and install one in each side of the wheel hub. Pack space between bearings and oil seals with WHEEL BEARING grease.
5. Install spacer (1) with large chamfered end toward bearing to the valve stem hole side of the wheel.
6. Lightly coat the outside lip of each oil seal (2) with engine oil. Press one seal into each side of the wheel so it is flush to 0.020 in. below outside edge of wheel hub.

NOTE

See Figure 2-5. On FLSTC, install the O-ring (11). Slide the hubcap (10) into wheel hub and secure with snap ring (12).

7. Wheel and tire must be true. See TRUING LACED WHEEL.



1. Thick head pivot stud (2)
2. Thin washer (mid 1989 & earlier)
3. Washer (2)
4. Acorn nut (2)
5. Rockers (2)
6. Jam nut (2)
7. Bearing retainer (2)
8. Thin head pivot stud (2)
9. Spherical bearings (2)
10. Thin washer (mid 1989 & earlier)
11. Axle locknut
12. Washer
13. Axle
14. Hub
15. Speedo drive seal
16. Speedo drive
17. Brake bracket
18. Spacer
19. Special thrust washer (small I.D.)
20. Special thrust washer (large I.D.)
21. Wave washer
22. Seal (2)
23. Bearing (2)
24. Spacer
25. Bearing cup (2)
26. Screw
27. Locknut
28. Brake disc
29. Cotter pin (2)
30. Brake reaction link
31. Socket head bolt
32. Nut (2)
33. Washer (2)
34. Upper mounting bolt
35. Washer
36. Lower mounting pin
37. Washer

Figure 2-7. Springer Fork - Hub and Axle Assembly (1991 Hub Assembly)

SPRINGER FORK - FRONT WHEEL

REMOVAL

Support vehicle so weight is off front wheel.

1. Remove the brake caliper mounting hardware and let brake line support caliper. See SPRINGER FORK FRONT BRAKE. If necessary, disconnect speedometer cable.

NOTE

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

2. See Figures 2-7 and 2-8. Remove axle locknut (11) and washer (12). Discard locknut.

CAUTION

When axle is removed, parts will be loose.

3. Slide axle (13) out of hub (14).

4. Slide hub and wheel assembly out of rockers.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
Dummy axle (Softail) (if necessary)	Axle nut 50 Slider cap nuts 11 Brake disc screws 16-18

NOTE

You may want to use a dummy axle (Softail), installed from the left side, to make installing the parts easier.

1. Place wheel between rockers with brake disc on the right side.

2. See Figures 2-7 and 2-8. Place axle (13) just barely through right rocker.

NOTE

The special thrust washers are not the same. One has a small I.D. and one has a large I.D. The small I.D. washer goes OUTSIDE the brake bracket and the large I.D. washer goes INSIDE the brake bracket.

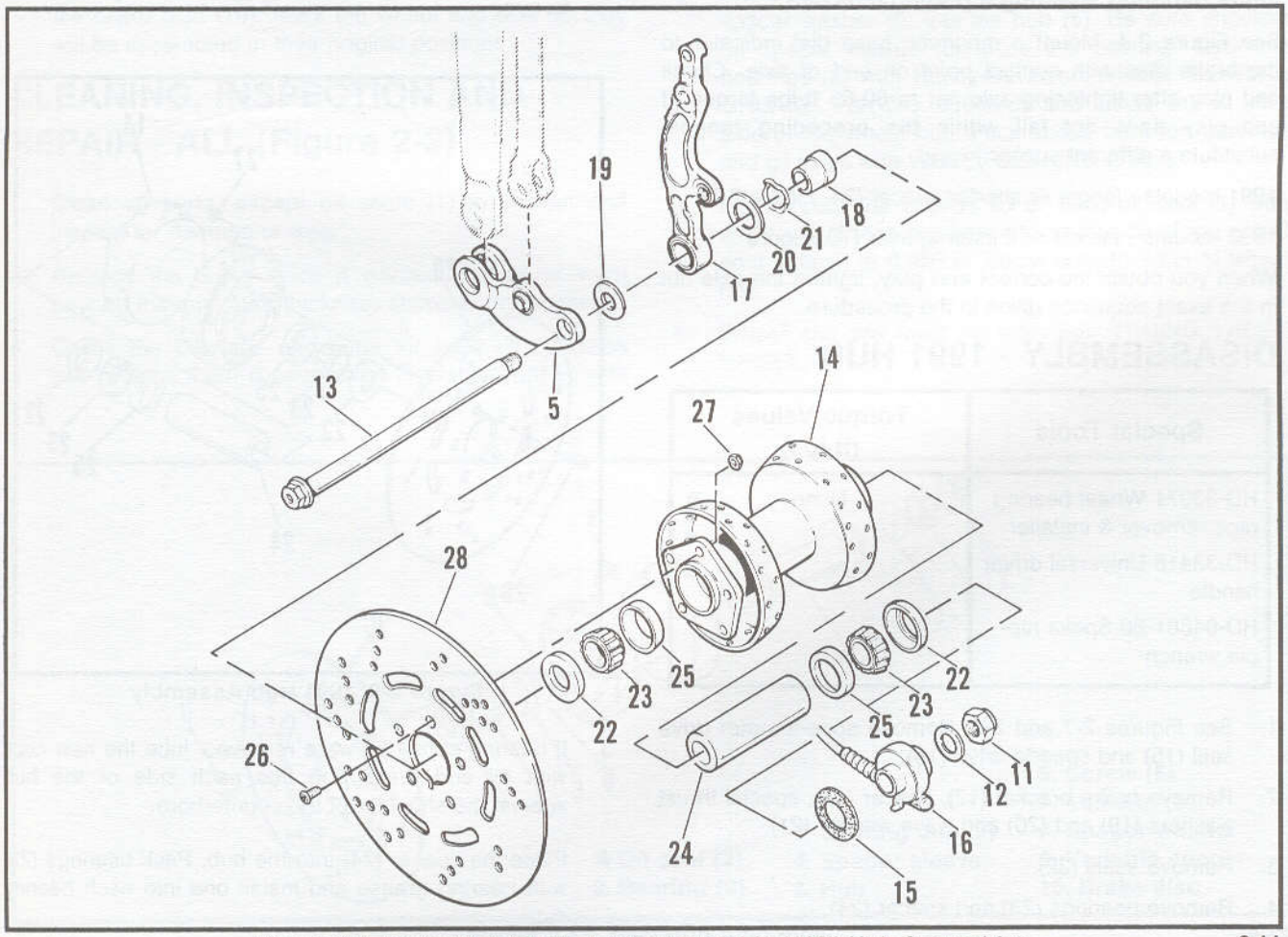


Figure 2-8. Brake Bracket and Axle Assembly (1991 Hub Assembly)

CAUTION

- **Be sure the GRAY, Teflon-coated side of the special thrust washers are against the brake bracket.**
- **If washers are worn through the Teflon, to the brass, replace them.**

3. Place large I.D. special thrust washer (20) and wave washer (21) on spacer (18), to make an assembly. Place spacer assembly in brake bracket (17).
4. Place small I.D. special thrust washer (19) and brake bracket assembly on axle, while carefully sliding axle into the hub.

CAUTION

Be sure the speedo drive is correctly positioned to engage the notch in the hub. If the speedo drive does not engage the hub, it will not work and will be damaged.

5. Continue sliding axle towards the left rocker, while installing the speedo drive seal (15) and the speedo drive (16).

NOTE

Speedo drive unit engages the notch in the hub.

6. Install washer (12) and a NEW locknut. Tighten axle locknut (11) to 60-65 ft-lbs torque.

WARNING

Set wheel bearing end play on 1991 models to 0.004 - 0.018 in. Set wheel bearing end play on 1992 models to 0.002 - 0.006 in. Incorrect end play can adversely affect handling, creating a potential hazard.

See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Check end play after tightening axle nut to 60-65 ft-lbs torque. If end play does not fall within the preceding ranges, substitute a different spacer:

1991 models - longer or shorter spacer (24, Figure 2-7)

1992 models - thicker or thinner spacer (10, Figure 2-10)

When you obtain the correct end play, tighten the axle nut in the exact sequence given in the procedure.

DISASSEMBLY - 1991 HUB

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle HD-94681-80 Spoke nipple wrench	None

1. See Figures 2-7 and 2-8. Remove speedometer drive seal (15) and speedo drive (16).
2. Remove brake bracket (17), spacer (18), special thrust washers (19) and (20) and wave washer (21).
3. Remove seals (22).
4. Remove bearings (23) and spacer (24).
5. If it is necessary to remove the bearing cups (25), use WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and HD-33416 UNIVERSAL DRIVER HANDLE.
6. If it is necessary to remove the hub (14) from the wheel, unscrew all the spoke nipples and remove the rim and spokes from the hub.
7. If necessary, remove the Torx screws (26) and locknuts (27) securing the brake disc (28) to the wheel hub.
8. Remove the brake disc from the wheel hub.

ASSEMBLY - 1991 HUB

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer Arbor press	Brake disc screws 16 - 24

1. If the hub and rim were disassembled, assemble the hub, spokes and rim as described under LACING WHEELS - 21 INCH. Wheel Truing and Balancing procedures are also covered in this Service Manual.
2. See Figure 2-7 and 2-9. Clean the brake disc surfaces of any dirt or grease. Assemble the brake disc (28) to the hub flange (14) by inserting screws (26) through holes in brake disc and hub flange. Thread a locknut (27) onto each screw and tighten to 16-18 ft-lbs torque.

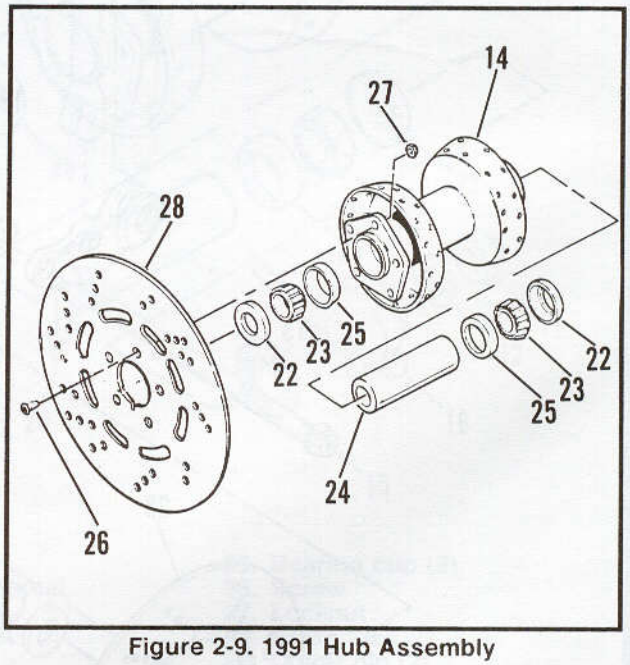


Figure 2-9. 1991 Hub Assembly

3. If bearing cups (25) were removed, lube the new cups with oil and press one into each side of the hub against the shoulder of the counterbore.
4. Place the spacer (24) into the hub. Pack bearings (23) with bearing grease and install one into each bearing cup

5. Apply bearing grease to the lips of both seals (22) and press the seals into the hub with the lips of the seals facing inward.

NOTE

The seals must be flush with the hub end surface, or slightly inside; not to exceed 0.015 in. inside the hub end surfaces.

DISASSEMBLY - 1992 HUB

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle Spoke nipple wrench	None

1. Begin as described under DISASSEMBLY - 1991 HUB, steps 1 thru 2.
2. See Figure 2-10. Remove the oil seals (1), bearings (2), spacer washer (8), variable spacer(s) (9), and sleeve (4).
3. If it is necessary to remove the bearing cups (3), use WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, Part No. HD-33416.
4. Remove the Torx screws (6) and locknuts (7) securing the brake disc (10). Mark the wheel and disc so they will be assembled in their original positions.

CLEANING, INSPECTION AND REPAIR - ALL (Figure 2-3)

1. Clean all parts, except oil seals (1) in solvent and inspect for damage or wear.
2. Replace the brake discs if warped, scored or worn beyond the minimum thickness stamped on the disc.
3. Check the bearings and cups for wear or corrosion and replace them if necessary. Replace them in sets only.
4. Install new oil seals.

ASSEMBLY - 1992 HUB (Figure 2-10)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16 - 24

CAUTION

Be sure the notch in brake disc is over the blind hole in wheel hub to allow for full seating of speedometer drive tang. Speedometer drive may be damaged if brake disc is not aligned properly.

1. Be sure brake disc (10) is clean. Install brake disc in original position using new screws (6) and locknuts (7). Tighten screws to 16 - 24 ft-lbs torque.
2. If bearing cups (3) were removed for replacement, lubricate the new cups with oil and press one cup into each side of the wheel hub using WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, Part No. HD-33416.
3. Place the spacer sleeve (4), variable spacer(s) (9) and spacer washer (8) into the hub (5). Be sure shoulder on spacer washer (8) faces the bearing. Pack the bearings (2) with Harley-Davidson WHEEL BEARING GREASE, Part NO. 99855-89 and install one in each side of the wheel hub. Pack space between bearings and oil seals with WHEEL BEARING grease.
4. Lightly coat the outside lip of each oil seal (1) with engine oil. Press one seal into each side of the wheel so it is flush to 0.020 in. below outside edge of wheel hub.
5. Wheel and tire must be true. See TRUING LACED WHEEL.

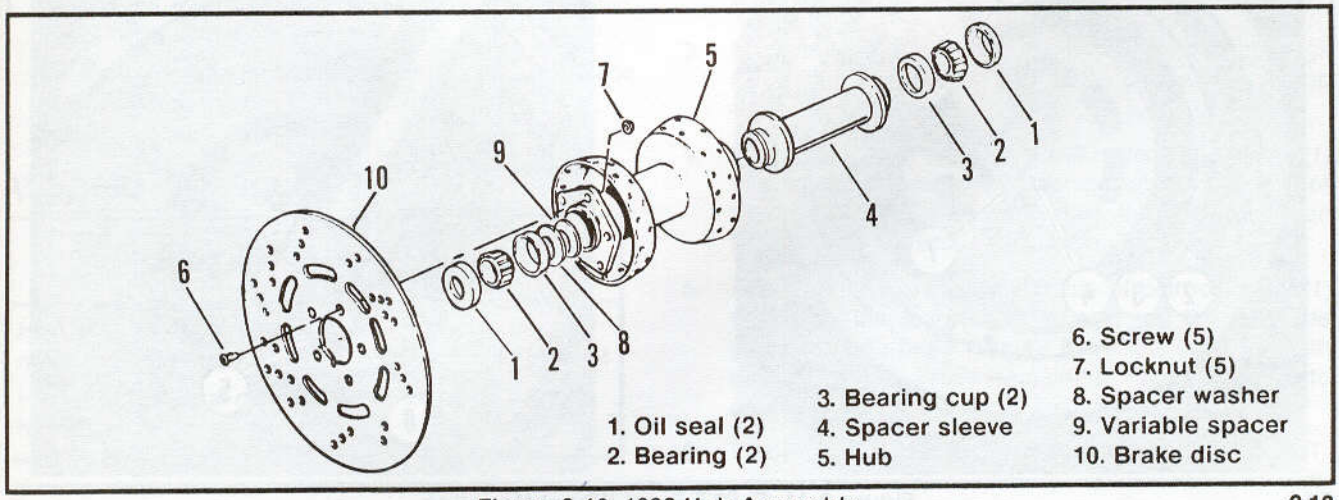


Figure 2-10. 1992 Hub Assembly

DISC FRONT WHEEL - 1991

REMOVAL (Figure 2-11)

1. Block motorcycle underneath frame until front wheel is raised off the ground.
2. Remove the brake caliper mounting hardware (1) and let the brake caliper hang loose at the side of the fender.

CAUTION

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

3. Remove the axle nut (2), lockwasher (3) and washer (4).
4. Loosen the slider cap nuts (5) and pull the axle (6) free from the wheel and speedometer drive (7).

INSTALLATION

Special Tools	Torque Values (ft-lbs)
Dummy axle (if necessary)	Axle nut 50 Slider cap nuts 11 Caliper mounting bolts 25 - 30

1. See Figure 2-11. Place wheel between fork legs with spacer (2) facing to the motorcycle right side.
2. See Figure 2-11. Install axle through right fork leg, wheel, speedometer drive (7) and left fork leg. Secure the axle by installing washer (4), lockwasher (3) and axle nut (2). Tighten right side slider cap nuts (5) to prevent the axle from rotating. Tighten axle nut (2) to 50 ft-lbs torque. Loosen right side slider cap nuts (5), then tighten nuts (5) at both sides to 11 ft-lbs torque.

WARNING

See Figures 2-4, 2-11. Set wheel bearing end play to 0.004 - 0.018 in. Incorrect end play can adversely affect handling, creating a potential hazard.

See Figure 2-11. End play should be checked after tightening axle nut to 50 ft-lbs torque and slider cap nuts to 11 ft-lbs torque. See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. If end play does not fall within this range, substitute a slightly longer or shorter spacer (5) as necessary. When correct end play has been obtained, tighten the axle nut in the exact sequence as given in the preceding procedure.

3. Install the brake calipers to the fork sides. Tighten the caliper mounting bolts to 25-30 ft-lbs torque.

DISASSEMBLY (Figure 2-10)

Special Tools	Torque Values (ft-lbs)
HD-33071 wheel bearing race remover & installer	Brake disc screws 16-18

1. Remove the oil seals (1), spacer (2), bearings (3) and spacer (5).

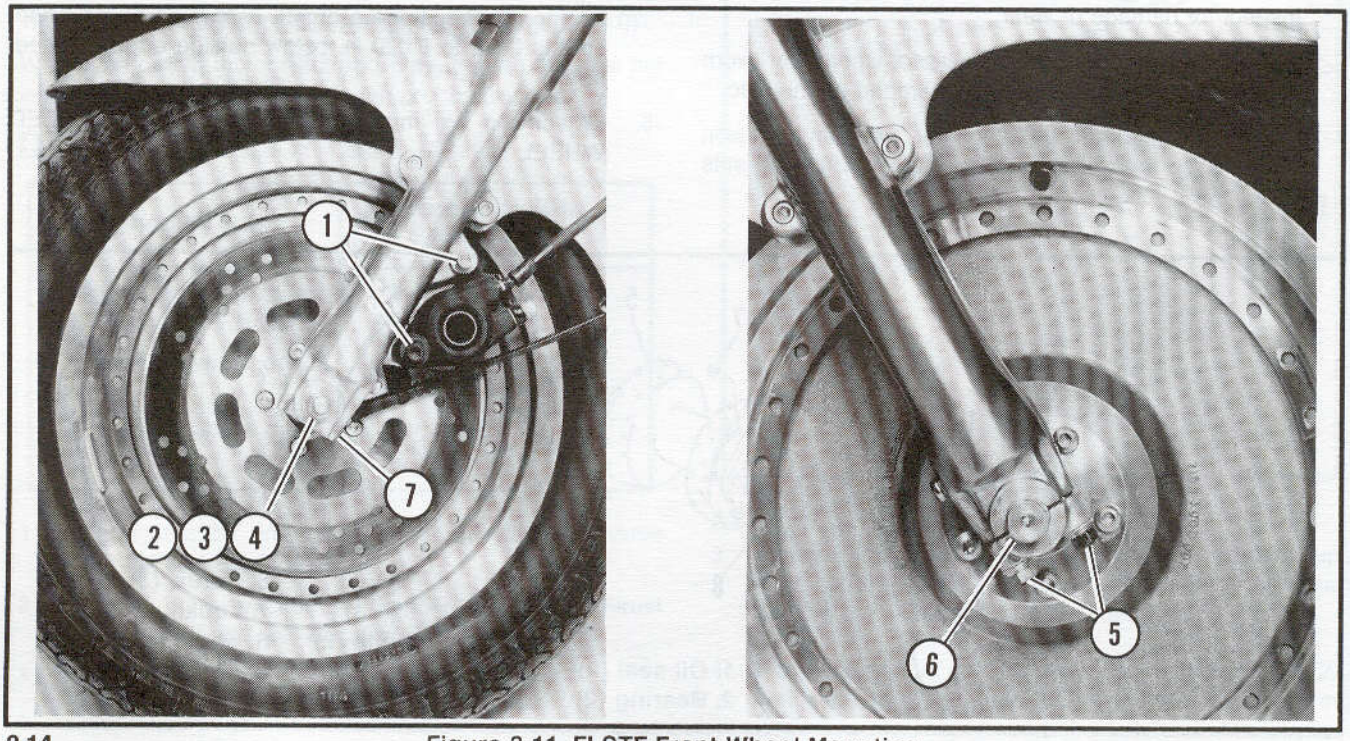
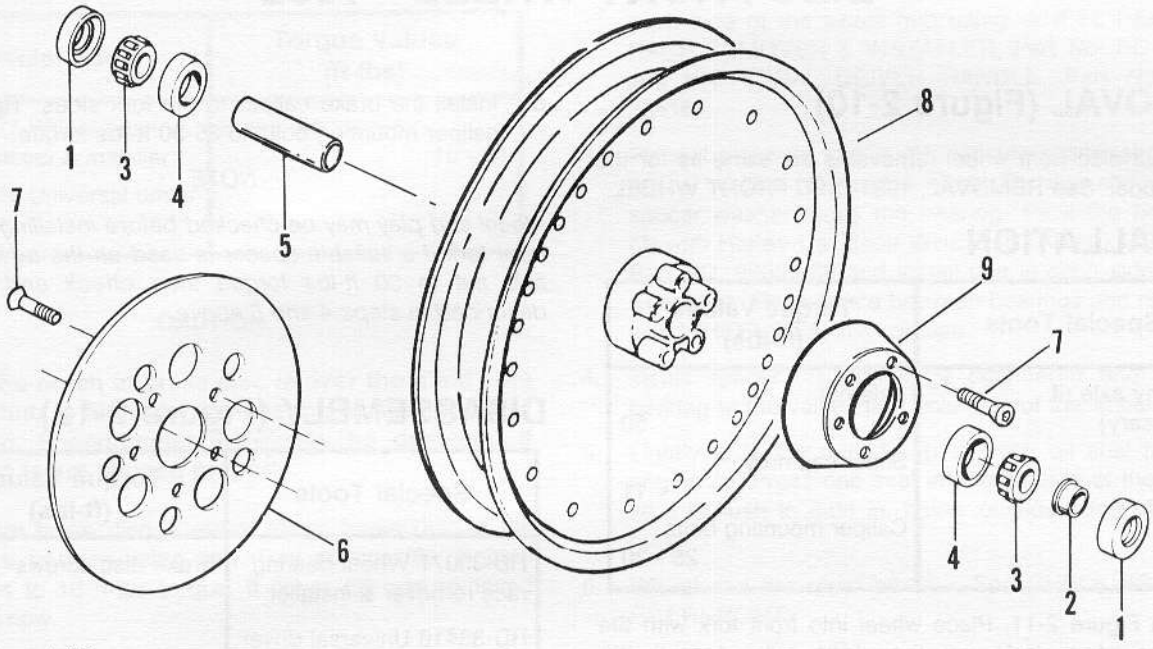


Figure 2-11. FLSTF Front Wheel Mounting



1. **Oil seal (2)**
2. **Spacer**
3. **Bearing (2)**
4. **Bearing cups (2)**
5. **Spacer**
6. **Brake disc**
7. **Screw (5)**
8. **Wheel**
9. **Cover – FLSTF**

Figure 2-11. Front Wheel – Disc

2. If it is necessary to remove the bearing cups (4), use HD-33071 WHEEL BEARING RACE REMOVER AND INSTALLER.
3. Remove screws (7) using a special socket wrench adaptor Torx T-40 or equivalent. Remove brake disc (6) and cover (9) (FLSTF).

CLEANING, INSPECTION AND REPAIR

1. Clean all parts, except oil seals, in solvent and inspect for damage or wear.
2. Replace the brake disc if it is warped, scored or worn beyond the minimum thickness stamped on the disc. See SPECIFICATIONS.
3. Check the bearings and cups for wear and replace them if necessary. Replace them in sets only.
4. Replace the oil seals.

ASSEMBLY (Figure 2-10)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16 - 24

1. Be sure brake disc is clean, then install brake disc (6) and cover (9) (FLSTF) to the side of the wheel from which they were removed. Apply STUD'N BEARING mount to screw (7) threads, then tighten to 16-24 ft-lbs torque.

NOTE

If sides of wheel were not match marked, the brake disc is installed on the side of the wheel where the 0.250 in. hole is located in the wheel hub for installation of the speedometer drive.

2. If bearing cups (4) were removed for replacement, lube the new cups (4) with oil and press one into each side of the hub.
3. Place the spacer (5) into the hub. Pack the bearings (3) with bearing grease and install one into each side of the wheel hub.
4. Insert spacer (2) into one of the replacement seals (1) with the shouldered end of the spacer extending out of the lipped side of the seal. Pack the cavity between the seal and the spacer with bearing grease.
5. Apply bearing grease to the lips of both oil seals (1) and press the seal with the spacer into the right side (side opposite brake disc) of the wheel hub flush with outside edge. Press remaining oil seal (1) into opposite side of wheel hub flush with outside edge.
6. Wheel and tire must be true. See DISC RIM RUNOUT.

DISC FRONT WHEEL - 1992

REMOVAL (Figure 2-10)

The 1992 disc front wheel removal is the same as for the 1991 model. See REMOVAL, 1991 DISC FRONT WHEEL.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
Dummy axle (if necessary)	Axle nut 50 Slider cap nuts 11 Caliper mounting bolts 25 - 30

1. See Figure 2-11. Place wheel into front fork with the valve stem hole on the right side. Install the speedometer drive, with seal, at the left and the spacer at the right. Be sure the seal is installed between the speedometer drive and wheel. The tab on the speedometer drive fits into the slot on the brake disc.
2. Coat the axle with Loctite ANTI-SEIZE LUBRICANT. Insert axle into the wheel from the right side.
3. Install the washer (4), lockwasher (3) and axle nut (2). Tighten the axle nut to 50 ft-lbs torque. Tighten the axle cap nuts to 5 - 11 ft-lbs torque.

WARNING

Wheel bearing end play has been set at 0.002 to 0.006 in. and should not be altered. End play should be checked after tightening axle nut to 50 ft-lbs torque.

4. See Figure 2-3. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Move wheel back and forth on axle to check end play.
5. See Figure 2-12. If end play does not fall between 0.002 and 0.006 in., substitute a thicker spacer (5) for more end play or a thinner spacer for less end play. See following chart for spacer sizes and part numbers.

Spacer Part No.	Thickness (in.)
43290-82	0.030 to 0.033
43291-82	0.015 to 0.017
43292-82	0.0075 to 0.0085
43293-82	0.0035 to 0.0045
43294-82	0.0015 to 0.0025

6. Install the brake caliper to the fork sides. Tighten the caliper mounting bolts to 25-30 ft-lbs torque.

NOTE

Wheel end play may be checked before installing wheel in front fork if a suitable spacer is used on the axle. Tighten axle nut to 50 ft-lbs torque then check end play as described in steps 4 and 5 above.

DISASSEMBLY (Figure 2-12)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16-18

1. Remove the spacer (1), oil seals (2), bearings (3), spacer washer (4), variable spacer(s) (5), and sleeve spacer (6).
2. If it is necessary to remove the bearing cups (7), use WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, Part No. HD-33416.
3. Remove the T-40 Torx screws (8) securing the brake disc. Mark the wheel and disc so they will be assembled in their original positions.

CLEANING, INSPECTION AND REPAIR (Figure 2-12)

1. Clean all parts, except oil seals (2) in solvent and inspect for damage or wear.
2. Replace the brake disc if warped, scored or worn beyond the minimum thickness stamped on the disc.
3. Check the bearings and cups for wear or corrosion and replace them if necessary. Replace them in sets only.
4. Install new oil seals.

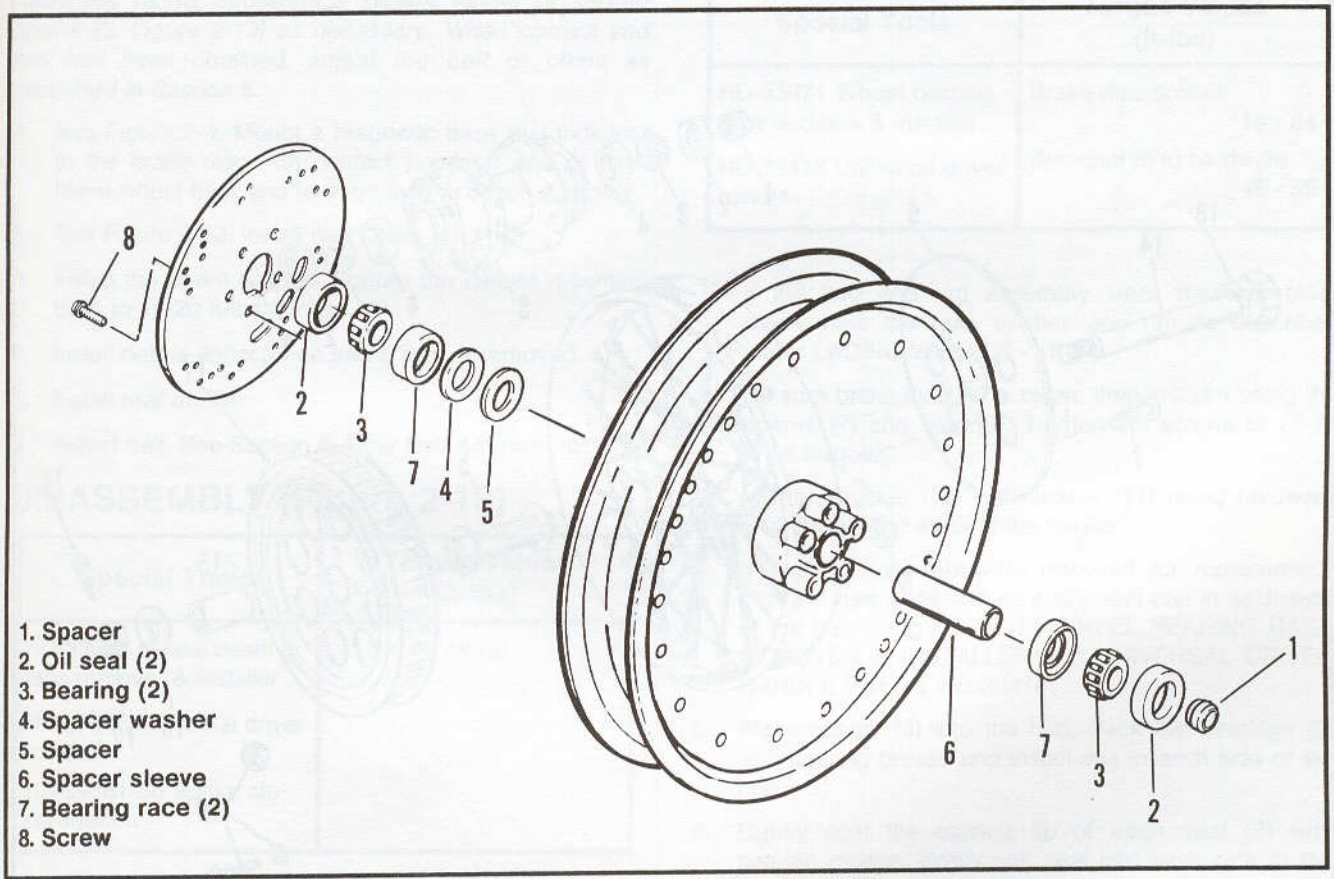
ASSEMBLY (Figure 2-12)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16 - 24

CAUTION

Be sure the notch in brake disc is over the blind hole in wheel hub to allow for full seating of speedometer drive tang. Speedometer drive may be damaged if brake disc is not aligned properly.

1. Be sure brake disc is clean. Install brake disc in the original position using new Torx screws (8). Tighten screws to 18 ft-lbs torque. If cover (9) was removed install now.
2. If bearing cups (7) were removed for replacement, lubricate the new cups with oil and press one cup into each side of the wheel hub using WHEEL BEARING RACE REMOVER & INSTALLER, Part No. HD-33071 and UNIVERSAL DRIVER HANDLE, Part No. HD-33416.
3. Place the spacer sleeve (6), variable spacer(s) (5) and spacer washer (4) into the wheel. Be sure shoulder on spacer washer faces the bearing. Pack the bearings (3) with Harley-Davidson WHEEL BEARING GREASE, Part NO. 99855-89 and install one in each side of the wheel hub. Pack space between bearings and oil seals with WHEEL BEARING grease.
4. Install spacer (1) with large chamfered end toward bearing to the valve stem hole side of the wheel.
5. Lightly coat the outside lip of each oil seal (2) with engine oil. Press one seal into each side of the wheel so it is flush to 0.04 in. below outside edge of wheel hub.
6. Wheel and tire must be true. See CHECKING CAST RIM RUNOUT.



1. Spacer
2. Oil seal (2)
3. Bearing (2)
4. Spacer washer
5. Spacer
6. Spacer sleeve
7. Bearing race (2)
8. Screw

Figure 2-12. Disc Front Wheel - 1992

LACED REAR WHEEL - 1991

REMOVAL (Figure 2-13)

1. Block motorcycle underneath frame until rear wheel is raised off the ground. Remove rear muffler.
2. Remove the cotter pin (16), axle nut (12) and washer (13).
3. Pull out axle (14) and let the wheel drop down. Remove the spacer (15).
4. Lift the belt off the rear wheel sprocket and remove the wheel assembly.

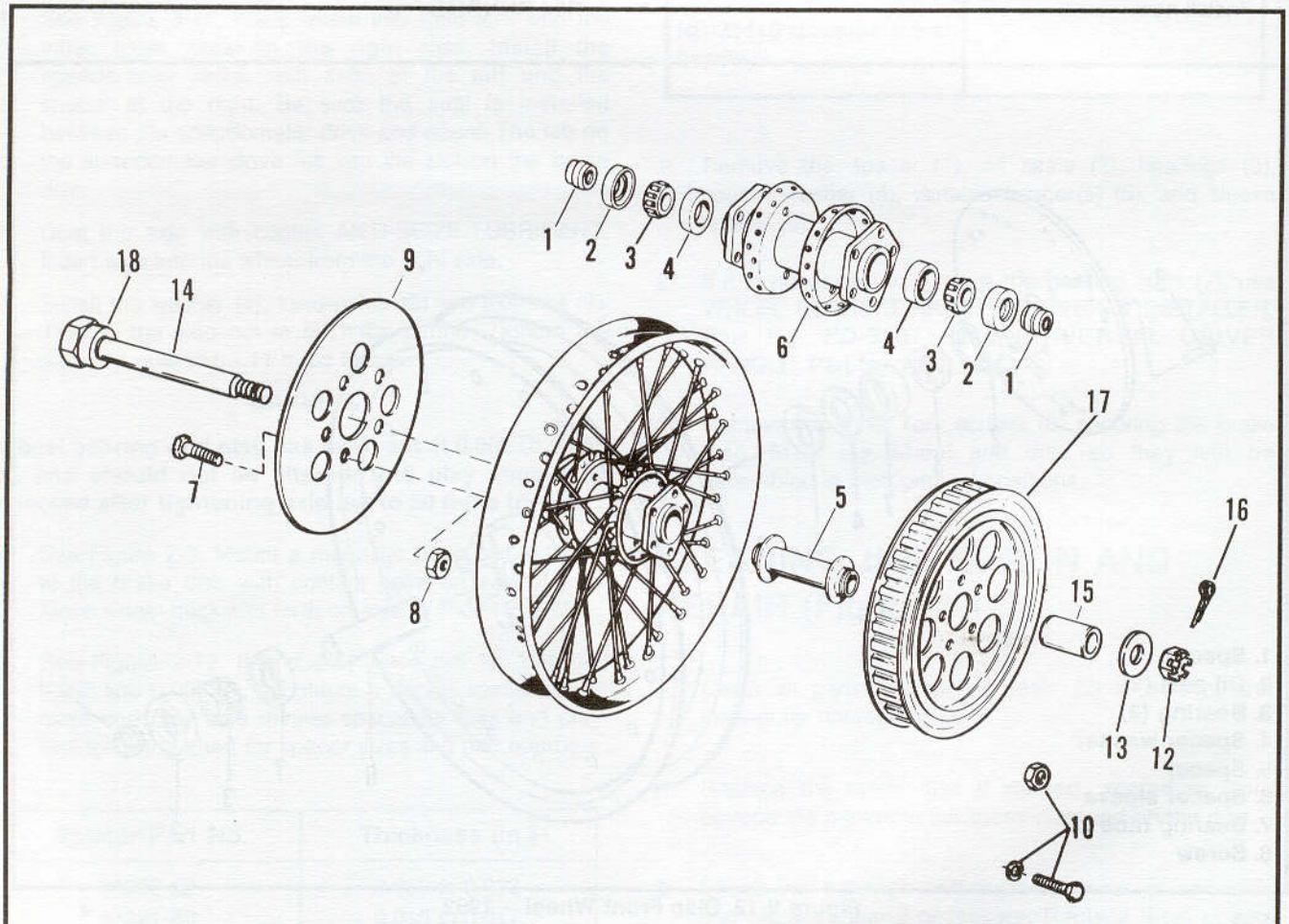
INSTALLATION (Figure 2-13)

Special Tools	Torque Values (ft-lbs)
None	Axle nut 60 - 65 Caliper mounting bolts 15 - 20

1. Position the wheel between the rear swing arm and place chain or belt onto the sprocket (17).

CAUTION

Be sure to position brake rotor between pads. Improper positioning can damage pads.



1. Spacer
2. Oil seal (2)
3. Bearing (2)
4. Bearing cup (2)
5. Spacer
6. Hub
7. Screw (5)
8. Nut (5)
9. Brake disc
10. Sprocket mt'g hardware
11. Spacer
12. Axle nut
13. Washer
14. Axle
15. Spacer
16. Cotter pin
17. Sprocket
18. Collar

Figure 2-13. Rear Wheel - Laced

2. Coat axle with Loctite ANTI-SEIZE. Install collar (18) on axle (17). Install axle (17) through right side of swing arm, rear bracket, wheel, left spacer (15) and left side of swing arm and collar (18).
3. Tighten axle nut (12) to 60 ft-lbs torque and check to see if the cotter pin can be installed. If required, tighten nut further to align axle hole and nut slots. Do not exceed 65 ft-lbs torque.

WARNING

Do not exceed 65 ft-lbs torque when tightening the axle nut. Exceeding 65 ft-lbs torque will cause the wheel bearings to seize during vehicle operation, resulting in personal injury.

WARNING

Set wheel bearing end play to 0.004 - 0.018 in. Incorrect end play can adversely affect handling, creating a potential hazard.

NOTE

Always check wheel bearing end play with axle nut tightened to 60-65 ft-lbs torque. If end play does not fall within this range, substitute a slightly longer or shorter spacer (5, Figure 2-13) as necessary. When correct end play has been obtained, adjust the belt or chain as described in Section 6.

4. See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Move wheel back and forth on axle to check end play.
5. See Figure 2-13. Install new cotter pin (16).
6. Install the brake caliper. Tighten the caliper mounting bolts to 15-20 ft-lbs torque.
7. Install debris deflector on swing arm, if removed.
8. Install rear muffler.
9. Adjust belt. See Section 6, Rear Belt Adjustment.

DISASSEMBLY (Figure 2-13)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle HD-94681-80 Spoke nipple wrench	None

1. Remove the two spacers (1), oil seals (2), bearing (3) and spacer (5).
2. If it is necessary to remove the bearing cups (4) use HD-33071 WHEEL BEARING RACE REMOVER & INSTALLER and UNIVERSAL DRIVER HANDLE Part No. HD-33416.
3. Remove the screws (7), nuts (8) and brake disc (9).
4. Remove mounting hardware (10) and sprocket (17) with spacer (11).
5. If it is necessary to remove the hub (6) from the wheel, unscrew all the spoke nipples and remove the rim and spokes from the hub.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts, except oil seals, in solvent and inspect for damage or wear.
2. Replace the brake disc if it is warped, scored or worn beyong the minimum thickness stamped on the disc. See SPECIFICATIONS.
3. Replace the sprocket if it is damaged.
4. Check the bearings and cups for wear and replace them if necessary. Replace them in sets only.
5. Replace the oil seals.
6. Replace the spokes, rim or hub if damaged.

ASSEMBLY (Figure 2-13)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover & installer HD-33416 Universal driver handle	Brake disc screws 16 - 24 Sprocket m'tg hardware 45 - 55

1. If the hub and rim assembly were disassembled, reassemble the hub, spokes and rim as described under LACING WHEELS - 16 IN.
2. Be sure brake disc (9) is clean, then install it using the screws (7) and nuts (8). Tighten the screws to 16-24 ft-lbs torque.
3. Install sprocket (18) with spacer (11) using hardware (10). Tighten to 45-55 ft-lbs torque.
4. If bearing cups (4) were removed for replacement, coat the new cups with oil and install one in each side of the hub using HD-33071 WHEEL BEARING RACE REMOVER & INSTALLER and UNIVERSAL DRIVER HANDLE Part No. HD-33416.
5. Place spacer (5) into the hub. Pack the bearings (3) with bearing grease and install one in each side of the hub.
6. Lightly coat the outside lip of each seal (2) with bearing grease. Press one seal into each side of the hub. Seals must be 0.260 - 0.280 in. below outside edge of wheel hub.
7. Pack the cavity between the seal and the bearing with bearing grease.
8. Insert spacers (1) through the seal openings with larger chamfer inboard and push spacers against bearing cones.
9. Wheel and tire must be true. See TRUING LACED WHEEL.

DISC REAR WHEEL - 1991

REMOVAL (Figure 2-13)

1. Block motorcycle underneath frame until rear wheel is raised off the ground. Remove rear belt guard and muffler.

2. Remove the cotter pin (16), axle nut (12) and washer (13). Discard cotter pin (16).

3. Pull out axle (14) and let the wheel drop down. Spacer (15) will come loose.

4. Lift the belt off the rear wheel sprocket and remove the wheel assembly.

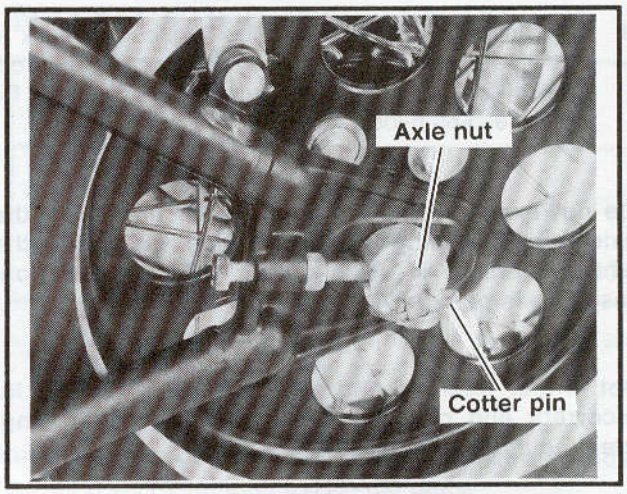
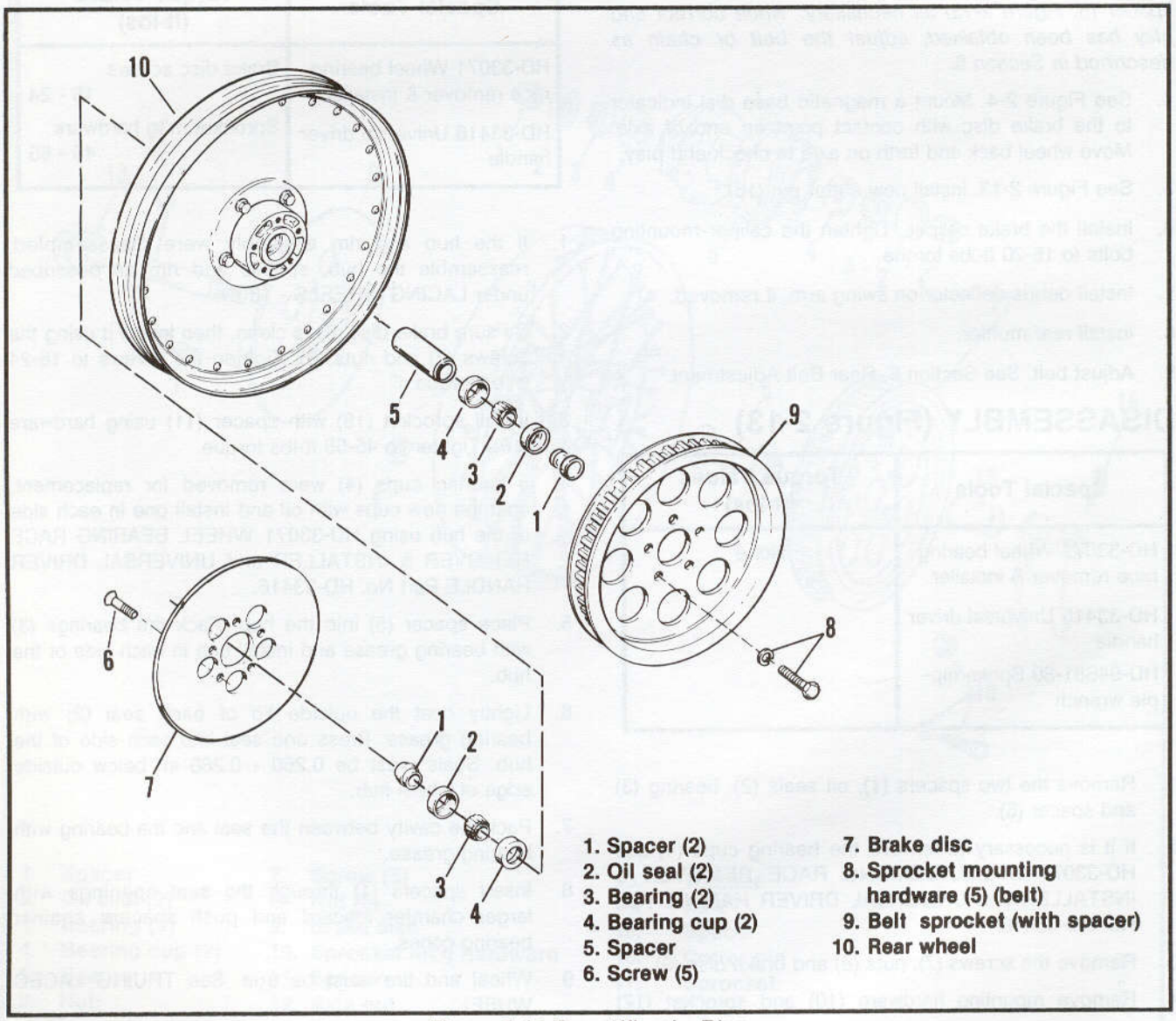


Figure 2-14. Rear Axle



1. Spacer (2)
2. Oil seal (2)
3. Bearing (2)
4. Bearing cup (2)
5. Spacer
6. Screw (5)
7. Brake disc
8. Sprocket mounting hardware (5) (belt)
9. Belt sprocket (with spacer)
10. Rear wheel

Figure 2-15. Rear Wheel – Disc

INSTALLATION (Figure 2-13)

Special Tools	Torque Values (ft-lbs)
None	Axle nut 60 - 65

1. Position the wheel between the rear swing arm and place belt onto the sprocket.

CAUTION

When installing the axle on the FLSTF be sure it is installed so the axle nut is on the left side of the motorcycle. If it is installed on the right side of the motorcycle, it may rub against the muffler during vehicle operation.

2. See Figure 2-15. Coat axle with Loctite ANTI-SEIZE. Install collar (18) on axle (17). Install axle through right side of swing arm, rear bracket, spacer (18), wheel left spacer (15) and left side of swing arm and collar (18).
3. Install the washer (13) and axle nut (12).

WARNING

Do not exceed 65 ft-lbs torque when tightening the axle nut. Exceeding 65 ft-lbs torque will cause the wheel bearings to seize during vehicle operation, resulting in personal injury.

4. Tighten axle nut (12) to 60 ft-lbs torque and check to see if the cotter pin can be installed. If required, tighten nut further to align axle hole and nut slots. Do not exceed 65 ft-lbs torque.

WARNING

Set wheel bearing end play to 0.004 - 0.018 in. Incorrect end play can adversely affect handling, creating a potential hazard.

NOTE

Always check wheel bearing end play with axle nut tightened to 60-65 ft-lbs torque. If end play does not fall within this range, substitute a slightly longer or shorter spacer (5) as necessary. When correct end play has been obtained, adjust the belt or chain as described in Section 6.

5. See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Move wheel back and forth on axle to check end play.
6. See Figure 2-15. Install new cotter pin (16).
7. Install the brake caliper. Tighten the caliper mounting bolts to 15-20 ft-lbs torque.
8. Install debris deflector on swing arm, if removed.
9. Install rear muffler.
10. Adjust belt. See Section 6, Rear Belt Adjustment.

DISASSEMBLY (Figure 2-15)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover and installer	None

1. Remove the two spacers (1), oil seals (2), bearings (3) and spacer (5).
2. If it is necessary to remove the bearing cups (4) use WHEEL BEARING RACE REMOVING AND INSTALLING TOOL, HD-33071.
3. Remove screws (6) and brake disc (7).
4. Remove mounting hardware (8) and sprocket (9).

CLEANING, INSPECTION AND REPAIR

1. Clean all parts, except oil seals, in solvent and inspect for damage or wear.
2. Replace the brake disc if it is warped, scored or worn beyond the minimum thickness stamped on the disc. See SPECIFICATIONS.
3. Replace the sprocket if it is damaged.
4. Check the bearings and cups for wear and replace them if necessary. Replace them in sets only.
5. Replace the oil seals.

ASSEMBLY (Figure 2-15)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remover and installer	Brake disc screws 23 - 27 Sprocket m'tg hardware • grade 5 bolts; 45-50 ft-lbs torque. • grade 8 bolts; 65-70 ft-lbs torque.

1. Make sure brake disc (7) is clean, then attach to wheel using five screws (6). Tighten screws (6) to 23-27 ft-lbs torque.
2. Install sprocket (9) using mounting hardware (8). Check the bolt grade before tightening.
   - Tighten grade 5 bolts (8) to 45-50 ft-lbs torque.
   - Tighten grade 8 bolts (8) to 65-70 ft-lbs torque.
3. If bearing cups (4) were removed for replacement, coat new cups with oil and press one into each side of the wheel hub using a cup driver.
4. Place spacer (5) into the wheel hub. Pack the bearings (3) with bearing grease and install one in each side of the wheel hub.
5. Lightly coat the outside lip of each seal (2) with bearing grease. Press one seal into each side of the hub so it is 0.312 in. below outside edge of wheel hub.
6. Pack the cavity between the seal and the bearing with bearing grease.
7. Insert spacer (1) through the seal openings with larger chamfer inboard and push spacers against bearing cones.

LACED OR DISC REAR WHEEL - 1992

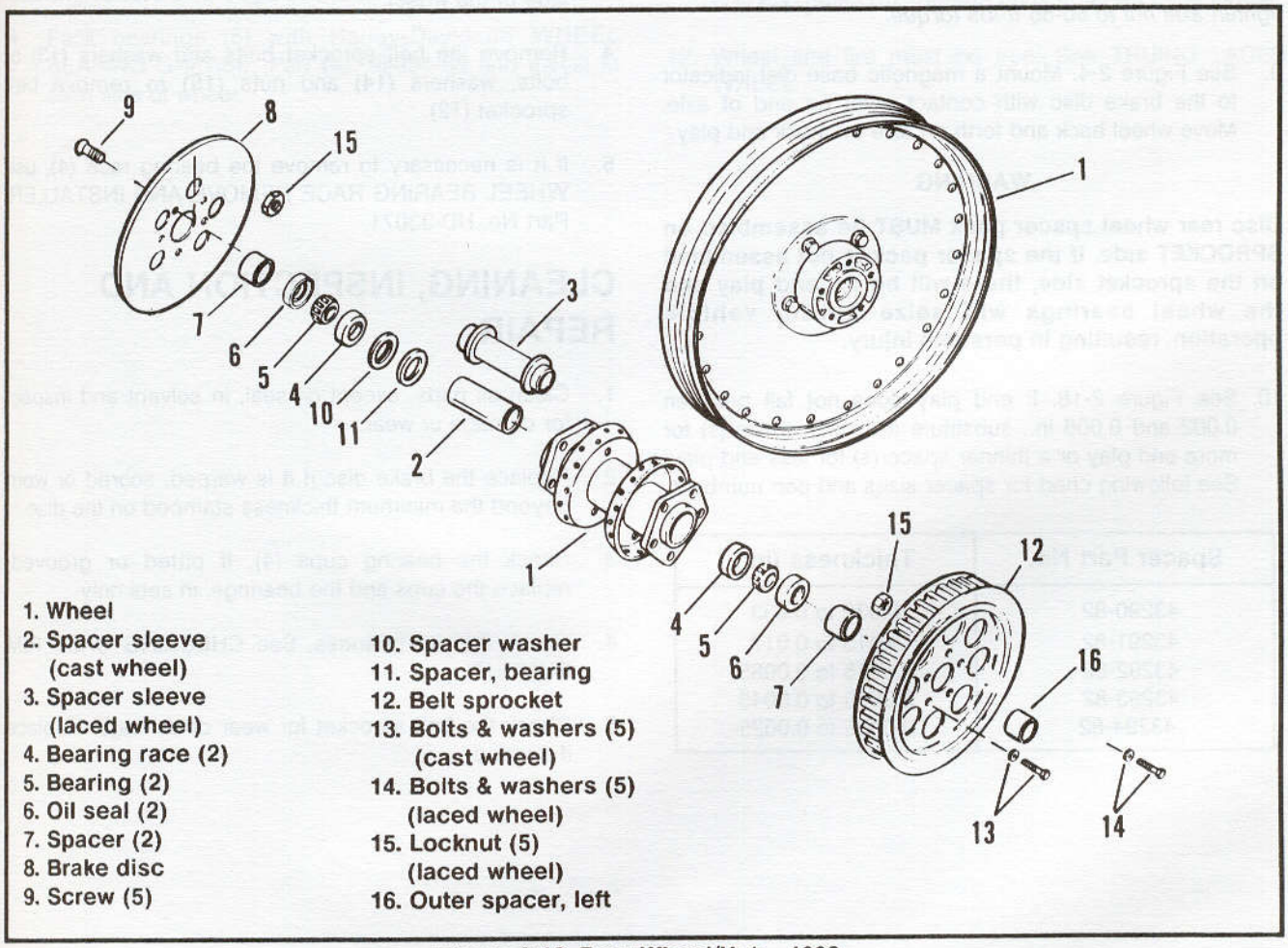
REMOVAL (Figure 2-14)

1. Support motorcycle so rear wheel is well off the floor. Remove rear muffler if necessary.
2. It may be necessary to remove the debris deflector from swing arm.
3. See Figure 2-16. Remove cotter pin, axle nut, and washer (spacer) from left side of axle. Tap axle towards right side and remove.
4. Move wheel forward and slip belt off sprocket.
5. Pull wheel and belt sprocket from swing arm.
6. If wheel or sprocket must be replaced, remove bolts and washers securing sprocket to wheel.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Axle nut 60 - 65

1. Place wheel forward in the swing arm and place belt on sprocket.
2. Move wheel back in swing arm and make sure brake disc is centered between brake pads.
3. Coat axle with Loctite ANTI-SEIZE LUBRICANT and from right side carefully slide axle and collar (18, Figure 2-13) through right rear fork, rear caliper bracket, spacer (7) and brake disc (8).
4. Continue sliding axle through wheel, spacer (7) on left side of wheel and sprocket (12).



1. Wheel
2. Spacer sleeve (cast wheel)
3. Spacer sleeve (laced wheel)
4. Bearing race (2)
5. Bearing (2)
6. Oil seal (2)
7. Spacer (2)
8. Brake disc
9. Screw (5)
10. Spacer washer
11. Spacer, bearing
12. Belt sprocket
13. Bolts & washers (5) (cast wheel)
14. Bolts & washers (5) (laced wheel)
15. Locknut (5) (laced wheel)
16. Outer spacer, left

Figure 2-16. Rear Wheel/Hub - 1992

5. Place spacer (16) between sprocket (12) and inside of left side of rear fork.

6. Slide axle through spacer (16), belt adjuster collar and left side of rear fork.

7. Install washer and axle nut on axle.

8. Tighten axle nut to 60 ft-lbs torque and check to see if the cotter pin can be installed. If required, tighten nut to align axle hole and nut slots.

WARNING

Do not exceed 65 ft-lbs torque when tightening the axle nut. Exceeding 65 ft-lbs torque will cause the wheel bearings to seize during vehicle operation, resulting in personal injury.

WARNING

Wheel bearing end play should be 0.002-0.006 in. If it is not within this range, substitute a thinner spacer for less end play or thicker spacer for more end play as required.

NOTE

Always check wheel bearing end play with axle nut tightened to 60-65 ft-lbs torque. End play may be checked before wheel is installed in swing arm if a suitable spacer is used on the sprocket side of the wheel. Place the axle through the wheel and sprocket assembly and spacer and tighten axle nut to 60-65 ft-lbs torque.

9. See Figure 2-4. Mount a magnetic base dial indicator to the brake disc with contact point on end of axle. Move wheel back and forth on axle to check end play.

WARNING

Disc rear wheel spacer pack MUST be assembled on SPROCKET side. If the spacer pack is not assembled on the sprocket side, there will be no end play and the wheel bearings will seize during vehicle operation, resulting in personal injury.

10. See Figure 2-16. If end play does not fall between 0.002 and 0.006 in., substitute a thicker spacer(s) for more end play or a thinner spacer(s) for less end play. See following chart for spacer sizes and part numbers.

Spacer Part No.	Thickness (in.)
43290-82	0.030 to 0.033
43291-82	0.015 to 0.017
43292-82	0.0075 to 0.0085
43293-82	0.0035 to 0.0045
43294-82	0.0015 to 0.0025

11. See Figure 2-14. Install new cotter pin.

12. Install debris deflector on swing arm, if removed.

13. Install rear muffler, if removed.

14. Adjust belt. See Section 6, Rear Belt Adjustment.

DISASSEMBLY (Figure 2-16)

Special Tools	Torque Values (ft-lbs)
HD-33071 Wheel bearing race remove and installer	None

NOTE

Except for items 3, 14 and 15 used on laced wheel, wheel components are the same on laced and cast wheels.

1. Remove the spacer (7), seal (6), bearing (5), spacer washer (10), spacer (11) and spacer sleeve (2) or (3) from the right side of the wheel.

2. Remove the brake disc screws (9) or locknuts (15). Remove brake disc (8).

3. Remove spacer (7), seal (6), bearing (5) from the left side of the wheel.

4. Remove the belt sprocket bolts and washers (13) or bolts, washers (14) and nuts (15) to remove belt sprocket (12).

5. If it is necessary to remove the bearing race (4), use WHEEL BEARING RACE REMOVE AND INSTALLER, Part No. HD-33071.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts, except oil seal, in solvent and inspect for damage or wear.

2. Replace the brake disc if it is warped, scored or worn beyond the minimum thickness stamped on the disc.

3. Check the bearing cups (4). If pitted or grooved, replace the cups and the bearings, in sets only.

4. Check the rim trueness. See CHECKING CAST RIM RUNOUT.

5. Check the belt sprocket for wear or damage. Replace if needed.

ASSEMBLY (Figure 2-16)

Special Tools	Torque Values (ft-lbs)
Bearing cup driver	Brake disc screws: • Allen screws 23 - 27 • T-45 Torx® 30 - 45 Sprocket m'tg hardware 45 - 55

1. Clean the disc (8) with Loctite CLEANING SOLVENT and install on the wheel with new screws (9) and locknuts (15).

Tighten screws to:

- Allen screws . . . . . 23 - 27 ft-lbs torque
- T-45 Torx® . . . . . 30 - 45 ft-lbs torque

2. If bearing cups (4) were removed, lubricate cups with oil and press one into each side of wheel.

3. Install spacer sleeve (2) or (3), spacers (11) and spacer washer (10) in wheel.

CAUTION

Be sure smaller diameter on spacer washer (10) faces outward toward bearing (5). If spacer washer is reversed, the large diameter could contact the bearing rollers and cage and damage the bearing.

4. Pack bearings (5) with Harley-Davidson WHEEL BEARING GREASE, Part No. 99855-89 and install in each side of wheel.

5. Coat tip of seal with oil and fill area between lips of seal with wheel bearing grease listed above.

6. Press seals (6) into both ends of hub with garter spring facing inward and seals 0.260 - 0.280 in. below outer surface of wheel hub on laced wheels. On cast wheels press right side (brake disc side) seal flush with outer surface of wheel hub. The left (sprocket) side seal must be pressed into the hub to a depth of 0.31 in. from the outer surface of the hub.

7. Pack the space between bearings and seals with wheel bearing grease listed above.

8. Insert spacers (7), one into each side of the wheel hub.

NOTE

Spacers (7) must be installed with the large chamfered end facing the bearing.

9. If brake disc was removed, install the disc (8) on the valve stem side of the wheel and secure it with the five bolts and washers (9). Apply a drop of Loctite 242 to the threads on each of the bolts and tighten to 24-30 ft-lbs torque.

10. If sprocket (12) was removed, install it as follows:

11. Install sprocket and secure with bolts and washers (14) and nuts (15). Tighten bolts to 45-55 ft-lbs torque.

12. Wheel and tire must be true. See TRUING LACED WHEEL.

LACING WHEELS - 16 IN.

1. See Figure 2-16. Pick any outside spoke hole and sight straight across the hub. The first spoke hole to the right of the centerline is an outside spoke hole. With the wheel assembled, all inner spokes on opposite sides of the wheel cross and all outer spokes on opposite sides of the wheel cross. Replace any bent spokes.

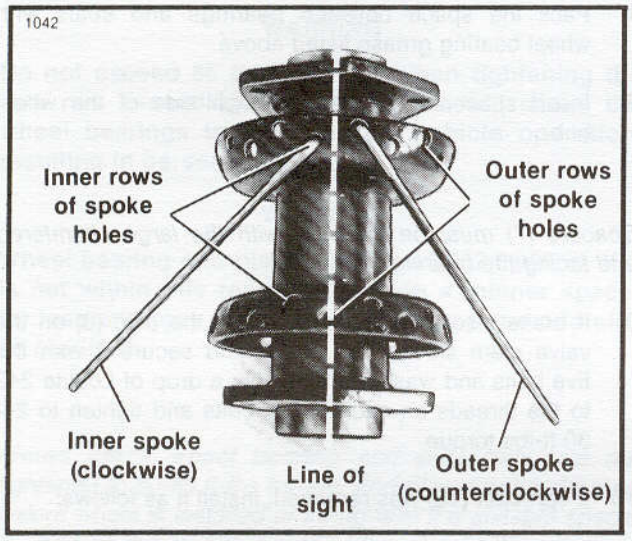


Figure 2-16. Hub

2. Place the hub on the bench with either spoke flange up.

3. See Figure 2-16. Insert ten spokes into the upper flange inner spoke holes. Swing the loose ends clockwise as far as they will go.

4. See Figure 2-17. The rim is divided into ten groups of spoke holes, four holes to a group. In each group, only one hole will be angled toward each upper flange inner spoke. Place the rim over the hub, APPROPRIATE SIDE UP, and insert the spokes into these holes. Secure each spoke with a nipple screwed on the end about three turns, just enough to hold it in place.

CAUTION

FLSTC front wheels have stem hole away from flange and brake disc. On rear wheels only, valve stem hole must be on brake side of hub for proper clearance.

5. When all ten upper flange inner spokes are installed, insert a spoke into an outside spoke hole on the same flange side.

6. See Figure 2-18. Swing the outer spoke in the opposite direction crossing over four inner spokes, and secure the spoke (with a nipple screwed on approximately 3 turns) in the nearest hole angled towards it. Repeat with the remaining 9 upper flange outer spokes.

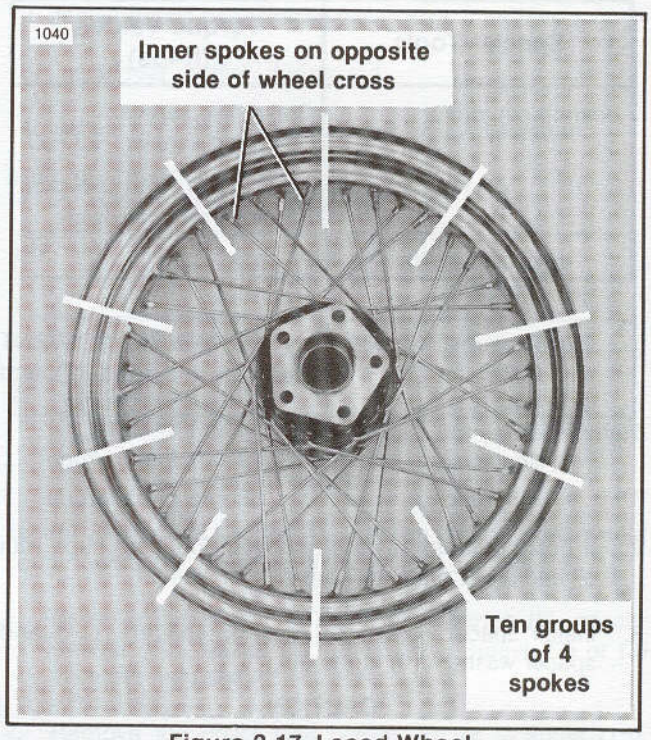


Figure 2-17. Laced Wheel

7. Carefully flip the hub and rim assembly over and repeat Steps 3, 5 and 6. Swing the inner spokes in the opposite direction as the other side so the inner spokes cross each other.

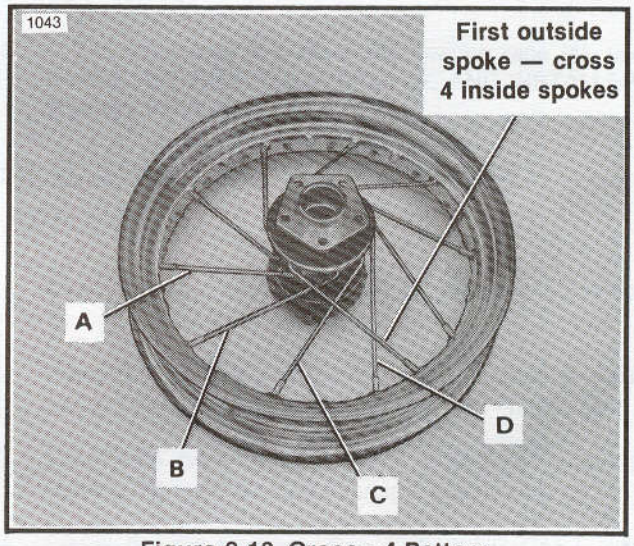


Figure 2-18. Cross - 4 Pattern

NOTE

All Harley-Davidson laced wheels use a CROSS-4 pattern. Each outer spoke must cross four inner spokes before entering rim hole.

8. True the wheel. See TRUING LACED WHEEL.

LACING WHEELS - 21 INCH

1. See Figure 2-18. Pick any outside spoke hole and sight straight across the hub. The first spoke hole to the right of the centerline is an outside spoke hole.

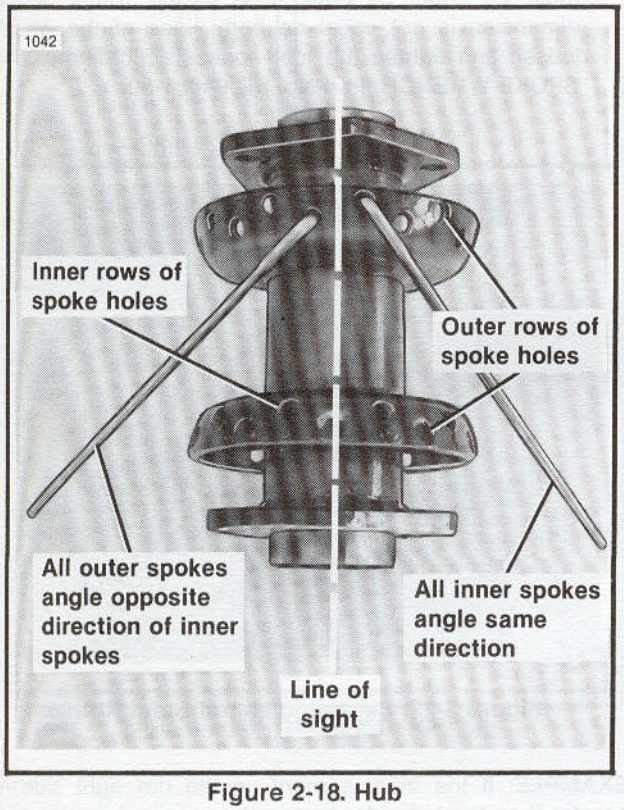


Figure 2-18. Hub

2. Place hub on bench with either spoke flange up.

NOTE

Inner spokes may be started clockwise or counterclockwise but all inner spokes must angle in the same direction.

3. See Figure 2-18. Insert ten spokes into the upper flange inner spoke holes. Swing the loose ends in the same direction as far as the hub will allow.

4. See Figure 2-19. The rim is divided into ten groups of four spokes each. In each group, only one hole will be angled toward each upper flange inner spoke. Insert the spokes into these holes. Secure each spoke with a nipple screwed on the end about three turns, just enough to hold it in place.

5. When all ten inner spokes are installed, insert a spoke into an outside spoke hole on the same flange side.

6. See Figure 2-20. Swing the outer spoke in the opposite direction crossing over four inner spokes, and secure the spoke in the nearest hole angled towards it. Repeat the procedure for all other spokes.

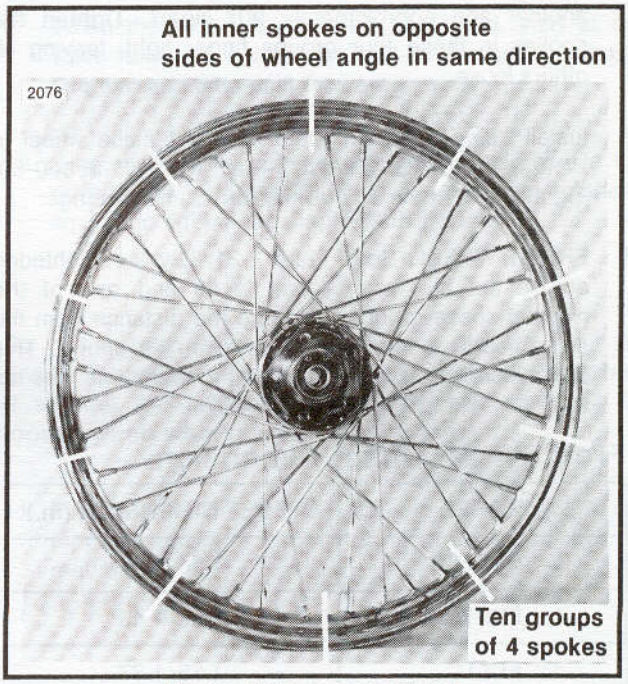


Figure 2-19. Laced Wheel

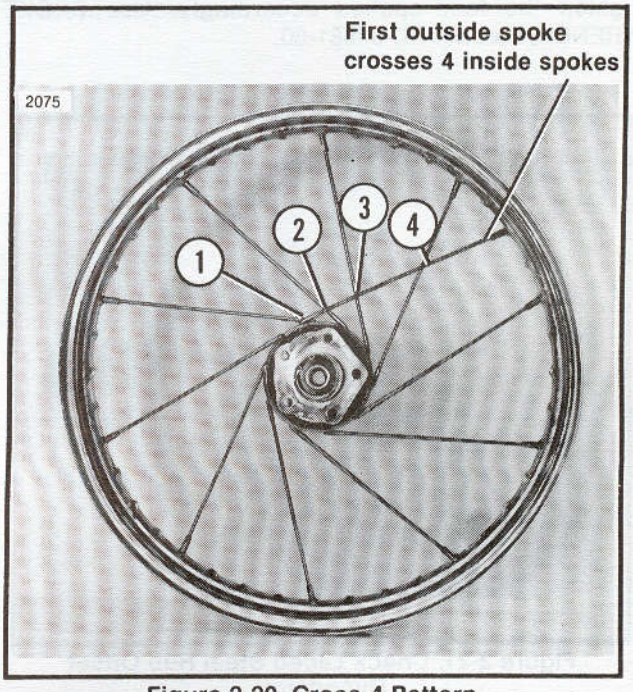


Figure 2-20. Cross-4 Pattern

7. Carefully turn the hub and rim assembly over and repeat the process. Start by swinging the inner spokes in the same direction as the other side.

8. Use the following instructions to true laced wheel

TRUING LACED WHEEL

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° apart. Tighten the spokes in these four groups finger tight, leaving all others loose.

2. Install truing arbor in wheel hub and place wheel in WHEEL TRUING STAND, Part No. HD-95500-80. Tighten arbor nuts so hub will turn on its bearings.

3. **FRONT WHEEL:** See Figure 2-21. Lay a straightedge across the hub brake disc flange and one of the marked spoke groups. Measure the distance from the straightedge to the edge of the rim as shown. This dimension is offset. The offset dimensions are as follows:

Front Wheel Offset Dimension

MODEL	OFFSET DIMENSION (in.)
FXSTC	1.58–1.66
FXSTS	1.38–1.46
FLSTC	1.25–1.37

Tighten the four spokes accordingly. Use SPOKE WRENCH, Part No. HD-94681-80.

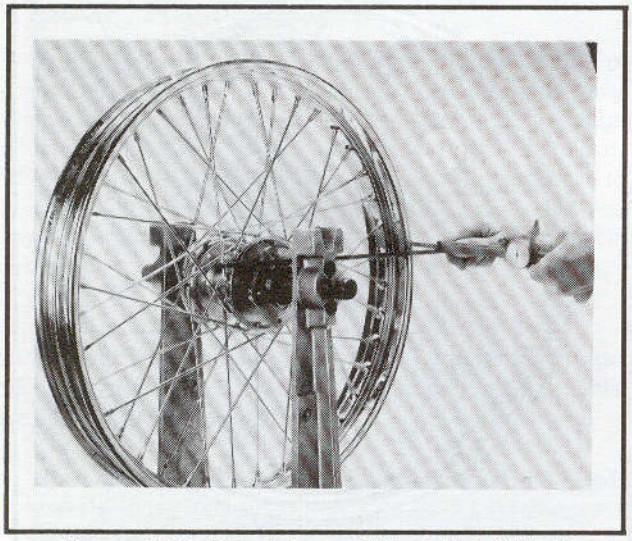


Figure 2-21. Check Laced Steel Hub Offset Dimension

EXAMPLE: If the measurement on the right rim edge side is wrong, loosen the two spokes attached to the hub left side and tighten the two spokes attached to the hub right side. Turn all four spokes an equal number of turns until offset dimension is correct.

4. **REAR WHEEL:** See Figure 2-22. Lay a straightedge across the hub brake disc flange and one of the marked spoke groups. Measure the distance from the straightedge to the rim as shown. This dimension must be equal on both sides of the wheel. If the dimension is not equal on both sides of the wheel, loosen and tighten the four spokes accordingly. Use SPOKE WRENCH, Part No. HD-94681-80.

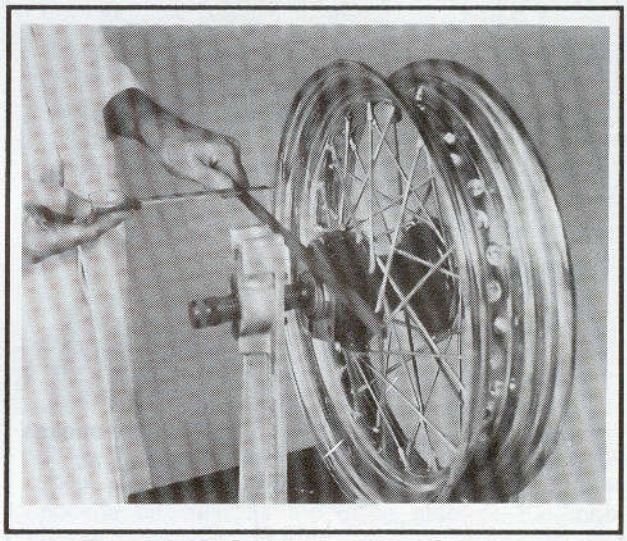


Figure 2-22. Centering Laced Steel Hub

EXAMPLE: If the measurement on the rim right side is greater than the left side, loosen the two spokes attached to the hub left side and tighten the two spokes attached to the hub right side. Turn all four spokes an equal number of turns until dimension is equal to within 1/32 in. for both sides.

CAUTION

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

5. Repeat Step 3 for all four groups on the wheel.

6. See Figure 2-23. After rim has been centered sideways it must be checked and trued radially. Adjust truing stand gauge to the rim's tire bead seat as shown. The rim should be trued within 1/32 in.

7. 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.

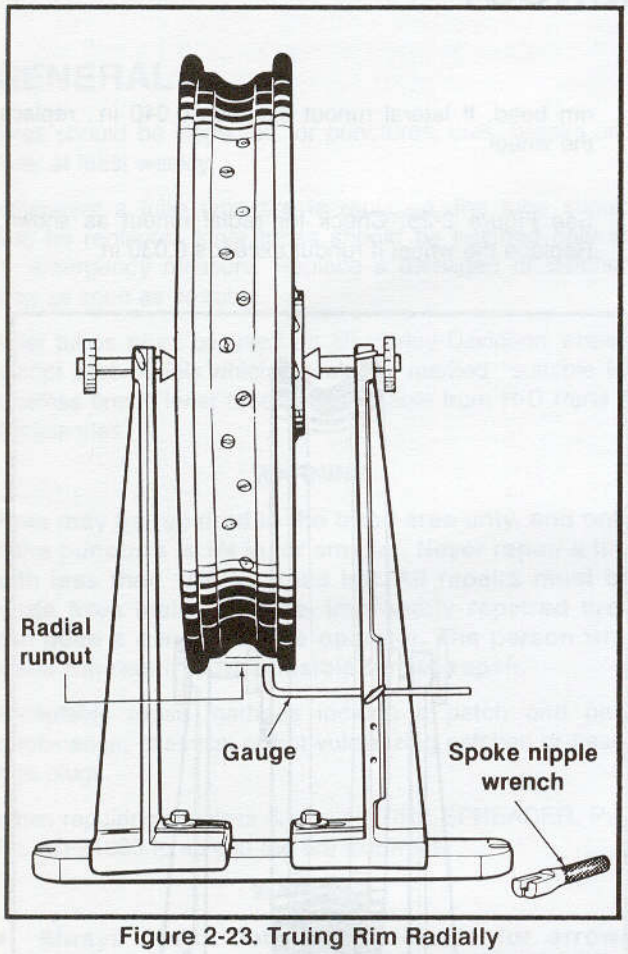


Figure 2-23. Truing Rim Radially

8. 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.

9. 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.

10. 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. If spokes are left too loose, they will continue to loosen when wheel is put into service.

11. 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.

DISC RIM RUNOUT

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

1. See Figure 2-24. 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., replace the wheel.

2. See Figure 2-25. Check for radial runout as shown. Replace the wheel if runout exceeds 0.030 in.

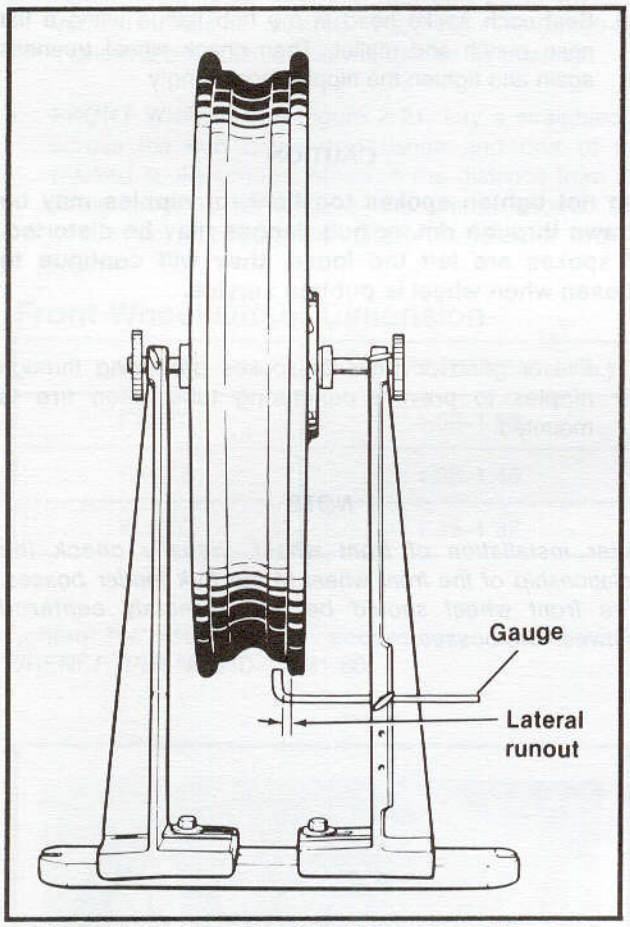


Figure 2-24. Checking Cast Rim Lateral Runout

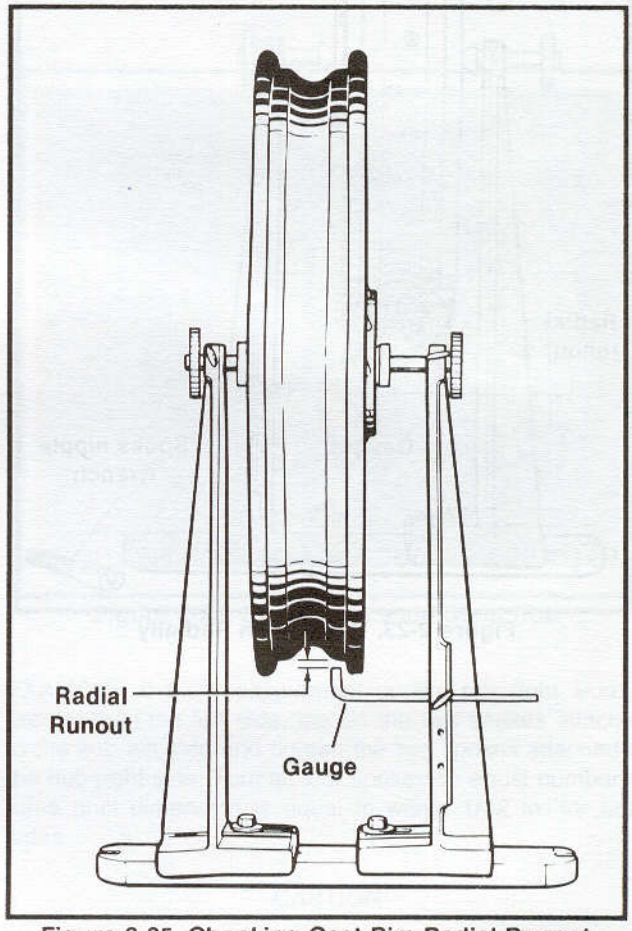


Figure 2-25. Checking Cast Rim Radial Runout

TIRES

GENERAL

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

Whenever a tube type tire is replaced, the tube should also be replaced. Inner tubes should be patched only as an emergency measure. Replace a damaged or patched tube as soon as possible.

Inner tubes must be used on all Harley-Davidson wheels except cast wheels which are clearly marked "suitable for tubeless tires". Inner tubes are available from H-D Parts & Accessories.

WARNING

Tires may be repaired in the tread area only, and only if the puncture is 1/4 in. or smaller. Never repair a tire with less than 1/16 in. tread left. All repairs must be made from inside the tire. Improperly repaired tires can pose a danger for the operator. The person who made the repair is responsible for the repair.

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

- **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. Improperly installed tires will adversely affect handling.**
- **Rim strips must be used with all laced wheels.**
- **Do not mix tire brands on the same vehicle. Mismatching tire brands could cause handling difficulties and create an unsafe condition.**
- **Do not use tubeless tires on rims designed for tube type tires unless an inner tube is also installed. Rims designed for tubeless tires are marked "tubeless".**

NOTE

DUNLOP® front and rear tires for FLSTC/F models are not the same. They are not interchangeable. Use the front tire ONLY for a front tire. Put ONLY a front tire on the front of a vehicle.

REMOVAL

Special Tools	Torque Values (In-lbs)
HD-01289 Rim protectors	None

1. Remove wheel from motorcycle. See LACED or CAST WHEEL.
2. Let the air out of the tube or tire.
3. Loosen both tire beads from rim flange. In most cases, a bead breaker machine will be required to break the bead.
4. See Figure 2-26. 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. Remove tube valve stem locknuts. Keep the tube in its original position while removing the tube. This will help to locate tire damage. Discard tube.

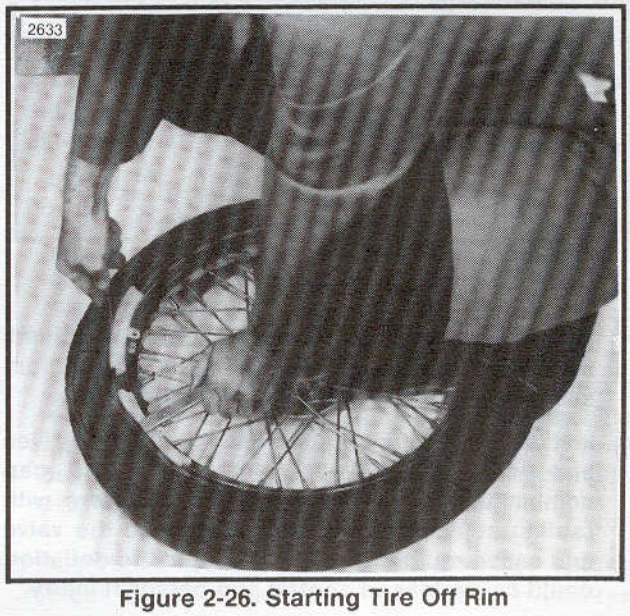


Figure 2-26. Starting Tire Off Rim

NOTE

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

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.

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.

NOTE

It is not always necessary on tube type tires to completely remove tire from rim. Removing one side allows the tube to be replaced and allows for inspection of tire.

CLEANING, INSPECTION AND REPAIR

CAUTION

Once a tube has been removed from the tire, it cannot be used again. It will never go back to its original position and folds in the tube will cause failure.

CAUTION

Be sure you clean the rim properly. Heavily rusted rims can chafe a new tube, resulting in a flat tire.

1. Clean the inside of tire and rim.
2. If rim is dirty or rusty, clean with a stiff wire brush.
3. Thoroughly inspect the tire for wear or damage, visually and by touch.

INSTALLATION

Special Tools	Torque Values (In-lbs)
HD-01289 Rim protectors HD-28700 Bead expander	Valve stem - 1st hex nut 20 - 25 Valve stem - 2nd hex nut 40 - 60

WARNING

- **Use the correct inner tube and tire as specified. See TIRE DATA in SPECIFICATIONS. Use of non-standard parts will adversely affect handling.**
- **Install only 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 personal 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 personal injury.**

NOTE

All cast disc wheels use the bolt-in style valve stems.

1. See Figure 2-27. On tubeless wheels, damaged or leaking valve stems must be replaced. Place rubber grommet on valve stem in recess of the valve stem head.
2. Insert valve stem into rim hole and install metal washer with raised center facing away from rim. Install first hex nut and tighten to 20-25 in-lbs torque.
3. Install second hex nut. While holding first nut with a wrench, tighten second nut to 40-60 in-lbs torque.

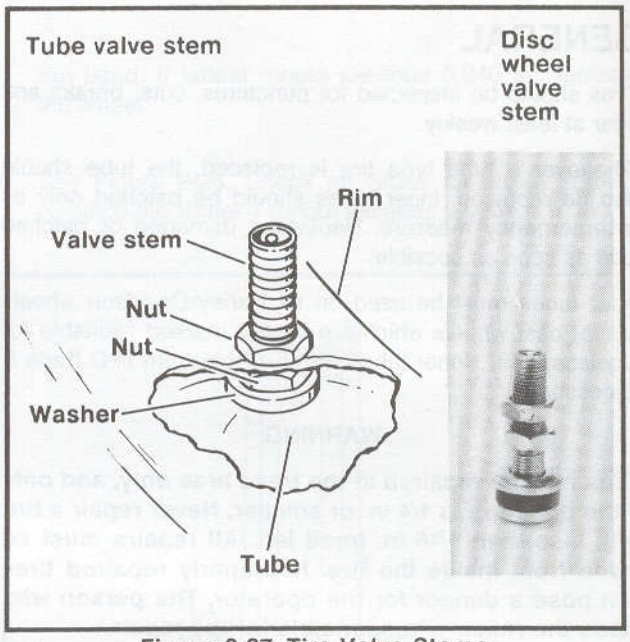


Figure 2-27. Tire Valve Stems

4. See Figure 2-28 On laced wheels, install a rim strip into the rim well. Be sure no spokes protrude through nipples and be sure to align the valve stem hole in rim strip with hole in rim.

Figure 2-28. Wheel With Rim Strip Installed

5. 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.

6. See Figure 2-29. 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.

Figure 2-29. Starting Bead on Rim

7. Inflate a new tube just enough to round it out. Lubricate thoroughly 360° around the tube base.

8. See figure 2-27. Remove valve stem outer nut. Insert tube in tire with valve stem in hole. Install outer nut two or three turns.

9. See Figure 2-30. Starting 180° from 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 valve stem before prying the remaining bead over the rim flange.

   9A. Be sure inner tube valve stem moves in and out freely, then tighten outer nut. Inflate the tire to recommended pressure to seat the bead. See SPECIFICATIONS. Then deflate tire to allow inner tube to smooth out.

   9B. Install valve core. Inflate again to recommended pressure to seat the bead.

   9C. Examine bead area on both sides to ensure that tire is completely seated.

10. BEAD EXPANDER, Part No. HD-28700 should be used to seat beads on tubeless tires.

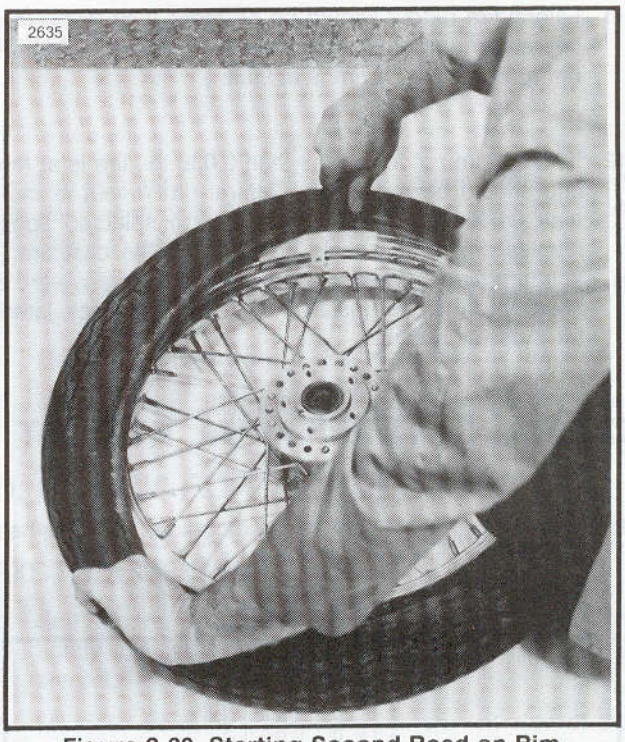


Figure 2-30. Starting Second Bead on Rim

WARNING

- **Do not inflate more than manufacturer's recommended pressure to seat the beads. Inflating the tire more than manufacturer's recommended pressure to seat the beads can cause the tire rim assembly to burst with force sufficient to cause personal injury.**
- **If the beads fail to seat at manufacturer's recommended pressure, deflate and relubricate the bead and rim and inflate to seat the beads but do not exceed manufacturer's recommended pressure.**

11. See Figure 2-31. Check lateral runout by turning wheel on axle, measuring amount of sideways displacement from a fixed point near the tire sidewall.

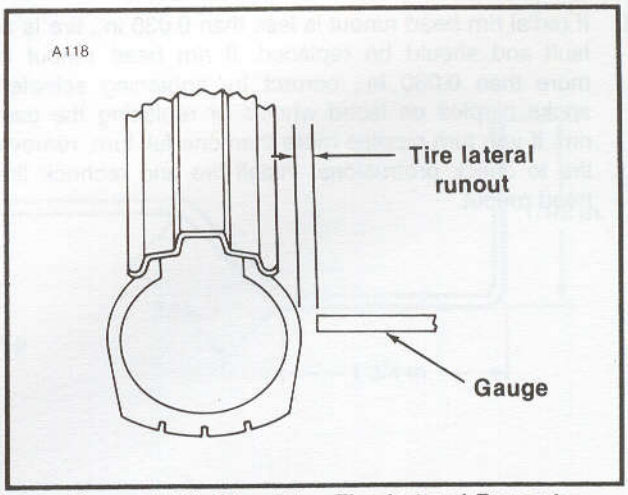


Figure 2-31. Checking Tire Lateral Runout

11. Lateral tire runout should be no more than 0.080 in. If lateral tire runout is more than 0.080 in., check lateral rim runout to see if rim is at fault.

12. If lateral rim runout is less than 0.030 in., tire is at fault and should be replaced. If lateral rim runout is more than 0.030 in., correct by tightening selected spoke nipples on laced wheels or replacing the cast rim. If you turn nipples more than one full turn, remove tire to check protrusions. Install old tire and recheck lateral tire sidewall runout.

CHECKING TIRE RADIAL RUNOUT

1. See Figure 2-32. Check radial runout by turning wheel on axle, measuring tread runout.

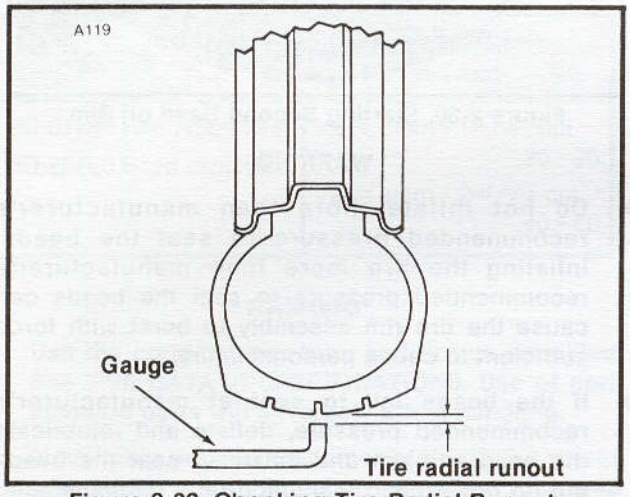


Figure 2-32. Checking Tire Radial Runout

2. Radial tire tread runout should be no more than 0.090 in. If radial tire tread runout is more than 0.090 in., check radial rim bead runout to see if rim is at fault.

3. If radial rim bead runout is less than 0.030 in., tire is at fault and should be replaced. If rim bead runout is more than 0.030 in., correct by tightening selected spoke nipples on laced wheels or replacing the cast rim. If you turn nipples more than one full turn, remove tire to check protrusions. Install tire and recheck tire tread runout.

Wheel Balancing

Special Tools	Torque Values (ft-lbs)
HD-95599-80 Wheel truing stand	None

4. Wheels must be balanced to improve handling and reduce vibration, especially at high road speeds. In most cases, static balancing using WHEEL TRUING STAND, Part No. HD-95599-80 will produce satisfactory results.

   Dynamic balancing, utilizing a wheel spinner, should be used to produce finer tolerances for best high speed handling characteristics.

   Follow the instructions supplied with the balance machine you are using.

   The maximum weight permissible to accomplish balance is 3-1/2 oz. total weight applied on the rim. Wheels should be balanced to within 1/2 oz. at 60 mph.

5. Harley-Davidson has made available the following spoke balance weights which press over the spoke nipple.

   1 oz. weight, Part No. 95582-47
   3/4 oz. weight, Part No. 95581-47
   1/2 oz. weight, Part No. 95578-41

6. Cast aluminum wheels require the special self adhesive weights listed below.
   1/4 oz. weight, Pkg. 12, Part No. 95594-84 (Black)
   1/4 oz. weight, Part No. 95595-84 (Silver)

   Self adhesive wheel weights should be applied to the flat surface of the rim. Make sure that area of application is completely clean, dry and free of oil and grease. Add weights in increments of 1/4 oz.

7. 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. 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.

VEHICLE ALIGNMENT

Types of misalignment

Check for the different types of misalignment in the following order.

A. Rear wheel misalignment
B. Horizontal/Wheel Offset misalignment
C. Vertical misalignment

NOTE

Rims and tires must be true, as outlined in the previous subject, before checking vehicle alignment.

NOTE

Visually check the relationship of the front wheel to the fork fender bosses. The front wheel should be approximately centered between the bosses.

A. CHECK FOR REAR WHEEL MISALIGNMENT

ALL MODELS

Special Tools	Torque Values (ft-lbs)
Fabricated tool (See below)	None

1. See Figure 2-33. Make a gauge from 1/8 in. × 25 in. long aluminum welding rod, as shown.
2. Measure from the center of the swing arm pivot shaft bolt to the center of the axle.

NOTE

Be sure you measure from the exact center of the swing arm pivot shaft bolt. Draw two intersecting lines and mark the center to be sure.

3. The measurements on both sides of the wheel should be the same.
4. Use axle adjustors and adjust rear wheel as required.
5. Check belt adjustment. See Section 6, Belt Adjustment.

B. CHECK FOR HORIZONTAL/ WHEEL OFFSET MISALIGNMENT

FXSTC/S MODELS

1. See Figure 2-34. Place a girder-type straightedge tightly against each side of the rear tire. Be sure they are parallel with each other.
2. Measure from the straightedge to the left side of the front wheel rim. Take the measurements in two places; at the front and rear of the wheel rim (A & B).

NOTE

Be sure the measurements are equal. Turn the front wheel if necessary. Be sure and write down your measurements.

3. Measure from the straightedge to the right side of the front wheel rim. Take the measurements in two places; at the front and rear of the wheel rim (C & D).
4. Subtract the right measurement from the left measurement.

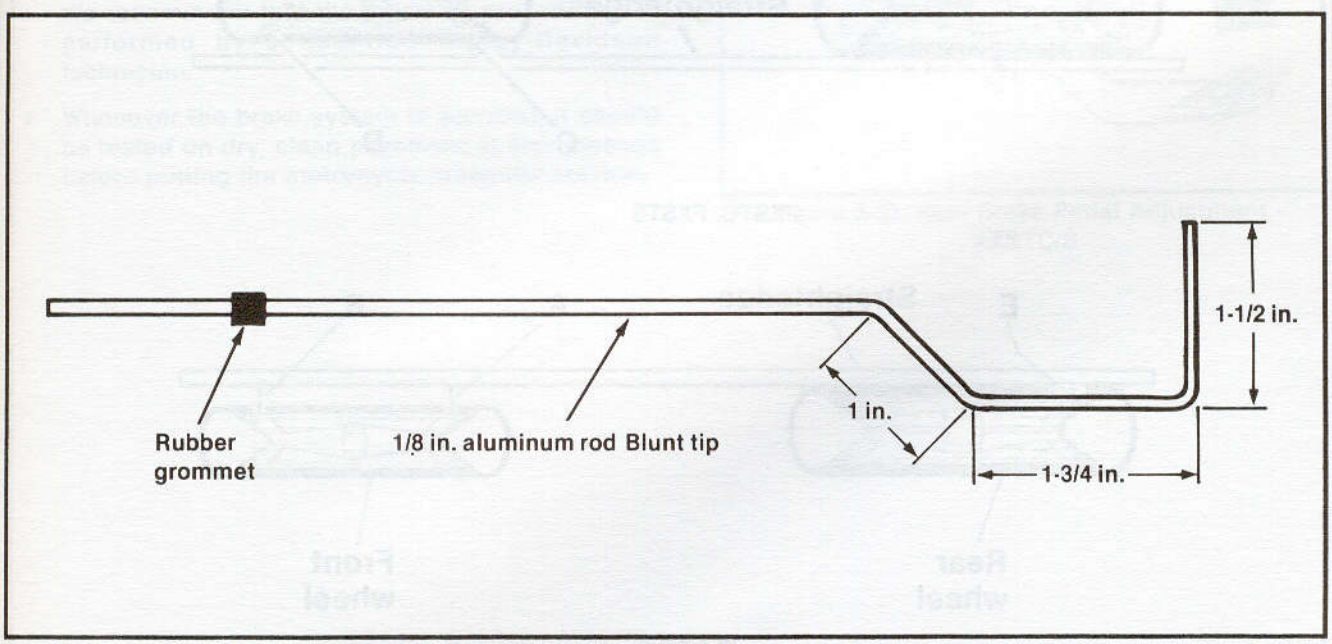


Figure 2-33. Alignment Gauge

NOTE

See Table 1. The difference between the two sides should match the offset factor given in Table 1 within 0.250 in.

Table 1. WHEEL OFFSET

MODEL	OFFSET FACTOR
FLSTC/F	0.359 in.
FXSTC, FXSTS	0.526 in.

5. If wheel offset is not within specification, call the H-D Service Department.
6. Check belt adjustment. See Section 6, Belt Adjustment.

FLSTC/F MODELS

1. See Figure 2-34. Place a girder-type straight-edge tightly against the left side of the rear tire.
2. Measure from the straightedge to the left side of the front wheel rim. Take the measurements in two places; at the front and rear of the wheel rim (A & B).

NOTE

Be sure the measurements are equal. Turn the front wheel if necessary. Be sure and write down your measurements.

3. Measure from the straightedge to the rear wheel rim. Take the measurements in two places; at the front and rear of the wheel rim (E).
4. Subtract the rear wheel measurement from the front wheel measurement.

NOTE

See Table 1. The difference between the two sides should match the offset factor given in Table 1 within 0.125 in.

5. If wheel offset is not within specification, call the H-D Service Department.
6. Check belt adjustment. See Section 6, Belt Adjustment.

C. CHECK FOR VERTICAL MIS-ALIGNMENT

1. Leave straightedge(s) in place and be sure the front wheel is parallel to the straightedge.
2. Place a clinometer on the front disc.

NOTE

Be sure the clinometer is vertical.

3. Write down the reading.
4. Place the clinometer on the rear disc and write down the reading.
5. If your readings are more than 1/2 degree apart, the frame, fork or swing arm may be bent. Inspect and replace components as necessary.

Replacing these chassis components is covered elsewhere in this manual.

NOTE

Clinometers are not perfectly accurate. Call your Harley-Davidson Service Department before replacing chassis components.

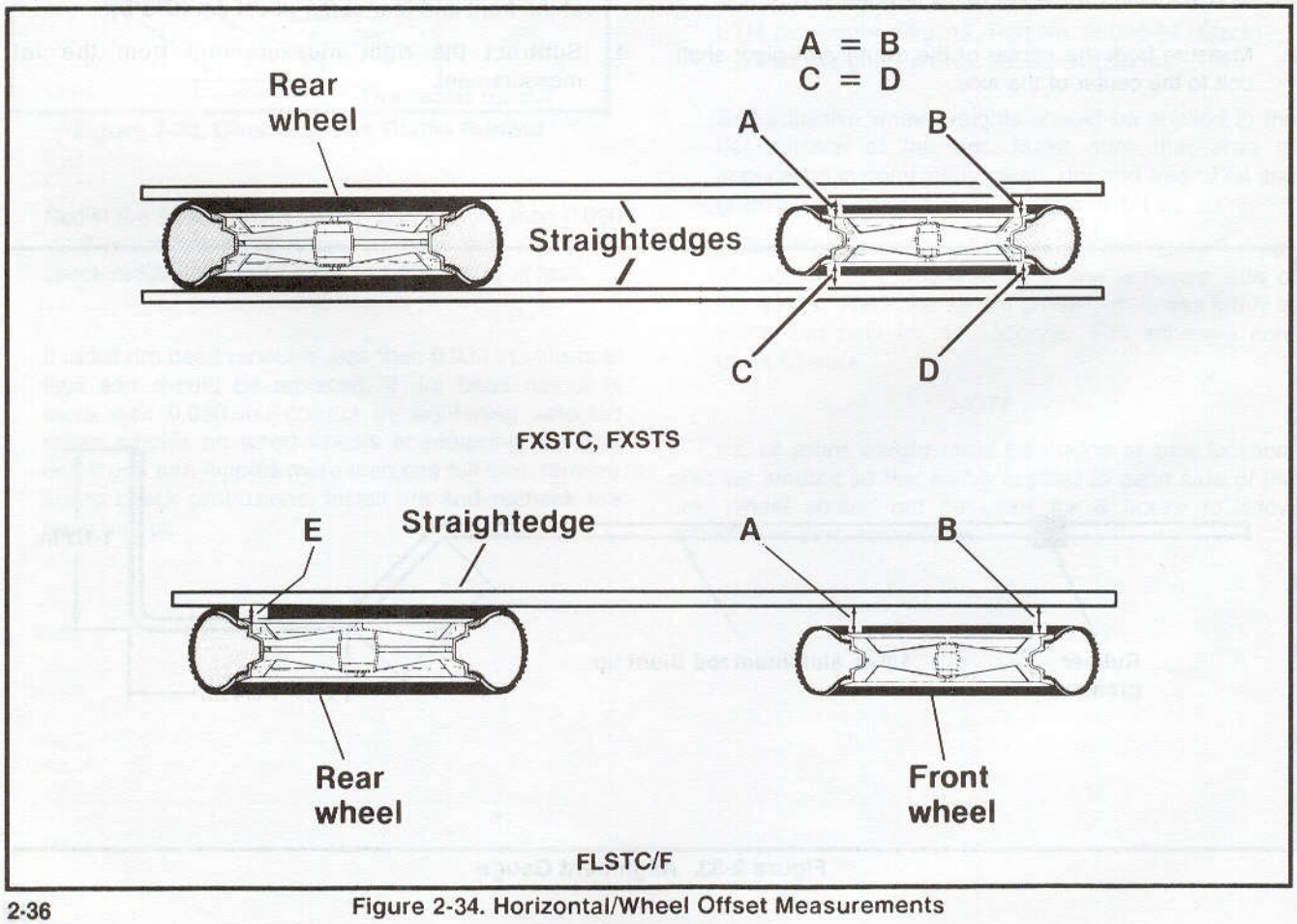


Figure 2-34. Horizontal/Wheel Offset Measurements

GENERAL

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

Every 5000 miles:

Check brake pads and discs for wear.

If brake pads friction material is worn to 1/16 in. or less they should be replaced. Minimum brake disc thickness is stamped on the side of the disc.

Check master cylinders for proper fluid levels.

When filling master cylinders, use only D.O.T. 5 hydraulic brake fluid that is approved for use in hydraulic brake systems. When removing master cylinder filler plug or cover, be sure that all dirt is removed from the area to prevent getting dirt in reservoir.

Rear brake master cylinders should be filled to 1/8 in. below the gasket surface.

Front brake master cylinder should be filled to the gasket surface with the reservoir in a level position.

The front brake master cylinder is an integral part of the brake hand lever assembly. The rear brake master cylinder is located on the right side of the motorcycle near the brake pedal.

WARNING

- **Because brake performance is a critical safety item, brake system servicing requires special tools, correct replacement parts and procedures. We recommend that the following procedures be performed by a qualified Harley-Davidson technician.**
- **Whenever the brake system is serviced, it should be tested on dry, clean pavement at slow speeds before putting the motorcycle in regular service.**

ADJUSTMENT

Rear Brake Pedal, FXSTC, FXSTS

See Figure 2-33. Remove cotter pin (1) and remove brake rod clevis pin (2). Loosen jam nut (3). Turn clevis (4) in or out to obtain a pedal to footrest relationship of 0.26 - 0.50 in. Install brake rod clevis pin (2) and a new cotter pin (1).

NOTE

FLSTC/F rear brake pedal is nonadjustable. When brake system components are properly assembled, brake pedal is correctly adjusted.

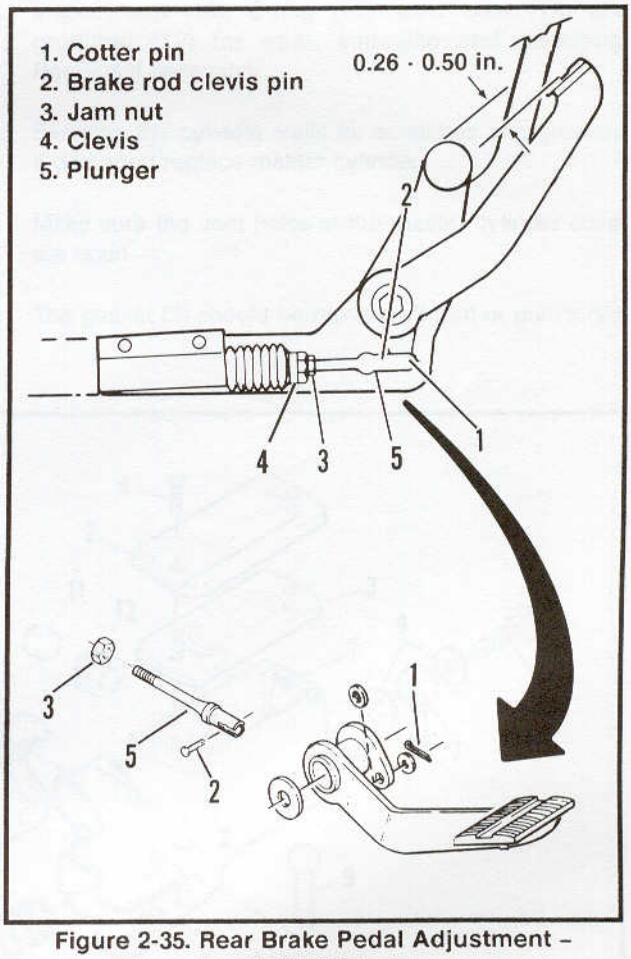


Figure 2-35. Rear Brake Pedal Adjustment – FXSTC/S

7. Fill the master cylinder with D.O.T. 5 hydraulic brake fluid. Bleed the brake system using the procedure outlined in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

WARNING

Be sure the relief port in the cylinder is operating properly. After servicing and bleeding the master cylinder, always check the operation of the internal components with the reservoir cover removed. Actuate the brake lever. A slight spurt of fluid will break through the fluid surface if all internal components are working properly. Improper operation of brake components can endanger the operator.

8. Install gasket (3), cover (2) and screws (4). Tighten screws to 6-8 in-lbs torque.

9. Test ride motorcycle. If brakes feel spongy, repeat procedure outlined in BLEEDING THE HYDRAULIC BRAKE SYSTEM.

NOTE

The front brake lever is designed to have no free play before moving the push rod.

10. Some master cylinder assemblies are equipped with a sight glass to visually check fluid level without removing cover. When full, the sight glass will be dark. When fluid level drops, glass will get lighter indicating the brake fluid level is low.

FRONT BRAKE MASTER CYLINDER

REMOVAL/DISASSEMBLY (Figure 2-36)

Special Tools	Torque Values (See below)
None	Master cylinder clamp screws 70-80 in-lbs Banjo bolt 17–22 ft-lbs

The master cylinder is located on the right side of the handlebar. Remove and disassemble it as follows.

1. Open the bleeder nipple on the front caliper and drain the brake fluid by pumping the handlever.
2. Disconnect the hydraulic brake line (7) from the master cylinder by removing bolt (5) and washers (6).
3. Remove the master cylinder screws (4), cover (2) and gasket (3).
4. Remove retaining ring (8), pivot pin (9), brake lever (10) and reaction pin (21).
5. Remove master cylinder from handlebar by removing screws (13) and clamp (14).
6. Pull out the push rod and switch (20), dust boot (19), piston (17) and O-ring (18), cup (16), and spring (15).
7. If applicable, remove grommet (12) and sight glass (11).

CLEANING, INSPECTION AND REPAIR (Figure 2-36)

1. Inspect cup (16), O-ring (18), dust boot (19) and grommet (12) for wear, softening and enlarging. Replace if necessary.
2. Examine the cylinder walls for scratches and grooves. If damaged replace master cylinder.
3. Make sure the vent holes in the master cylinder cover are open.
4. The gasket (3) should be replaced if torn or punctured.

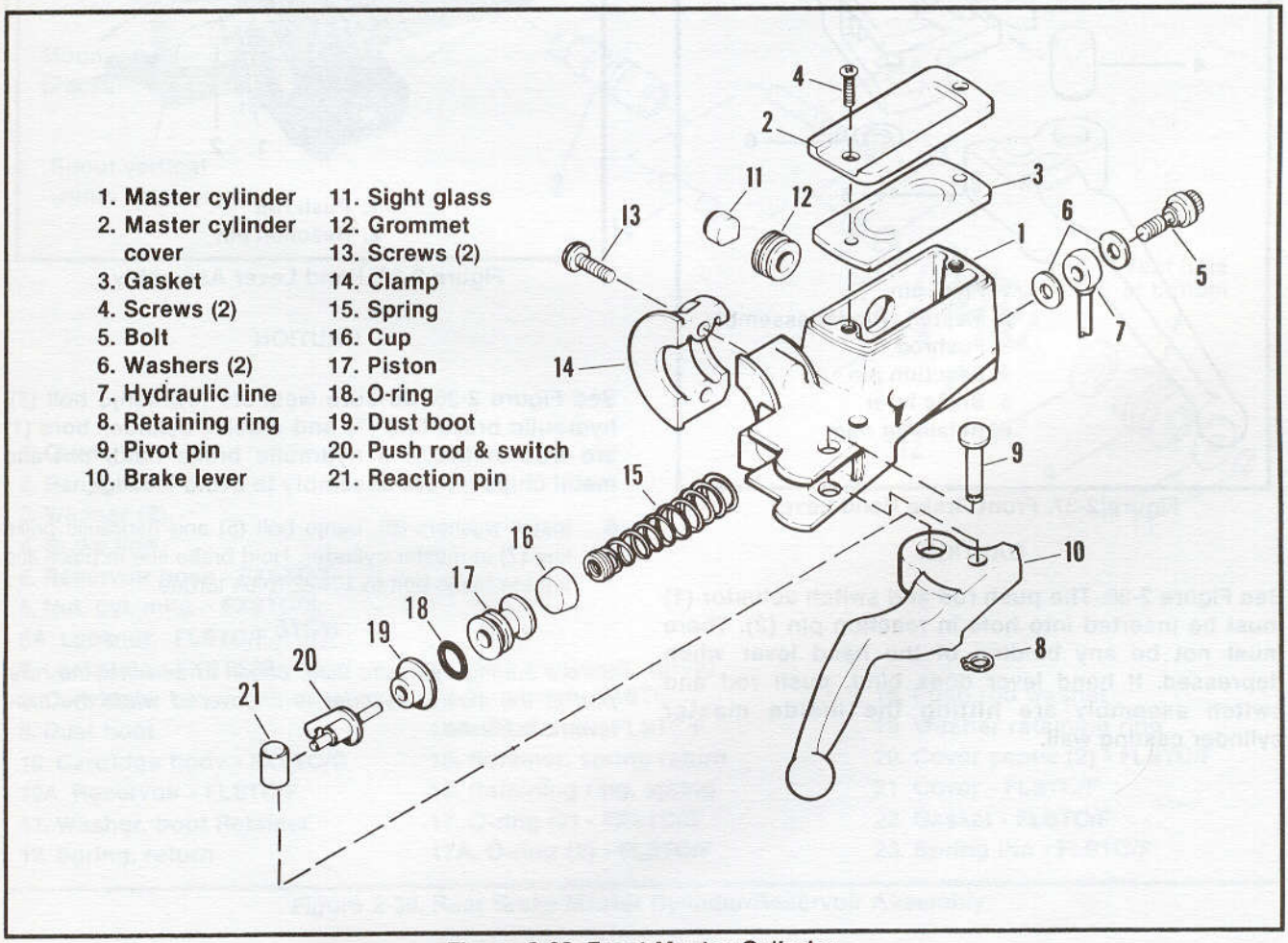


Figure 2-36. Front Master Cylinder

ASSEMBLY/INSTALLATION

1. Dip all internal parts in D.O.T. 5 hydraulic brake fluid.
2. See Figure 2-40. Install grommet (12) coated with D.O.T. 5 hydraulic brake fluid and sight glass (11), if applicable.
3. Install spring (15) and cup (16). Assemble piston (17) with O-ring (18), dust boot (19), and push rod and switch (20).
4. See Figure 2-37. Lightly coat reaction pin (4) with Loctite ANTI-SEIZE and insert it into the large hole in the brake lever (5). Assemble the brake lever (5) to the master cylinder assembly (2) using pivot pin (1) and retaining ring (6). Be sure the push rod (3) fits into hole in reaction pin (4). Check front brake lever for proper operation.

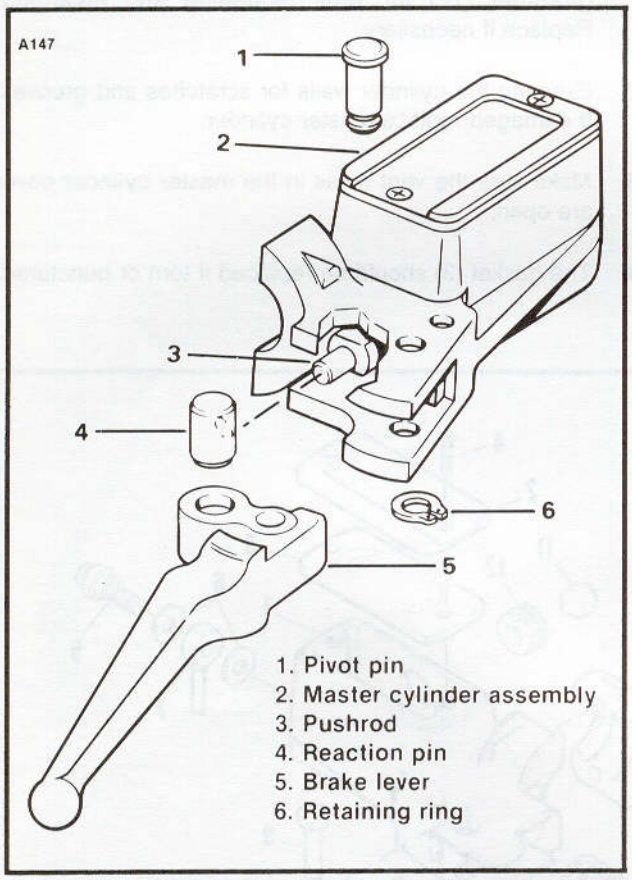


Figure 2-37. Front Brake Hand Lever

CAUTION

See Figure 2-38. The push rod and switch actuator (1) must be inserted into hole in reaction pin (2). There must not be any binding of the hand lever when depressed. If hand lever does bind, push rod and switch assembly are hitting the inside master cylinder casting wall.

NOTE

If assembling hand lever to master cylinder, while on the handlebars, use a piece of string or wire to hold the push rod and switch actuator assembly stationary while inserting into the reaction pins.

5. See Figure 2-36. Install master cylinder to handlebar by installing clamp (14) and screws (13). Tighten screws to 70-80 in-lbs torque.

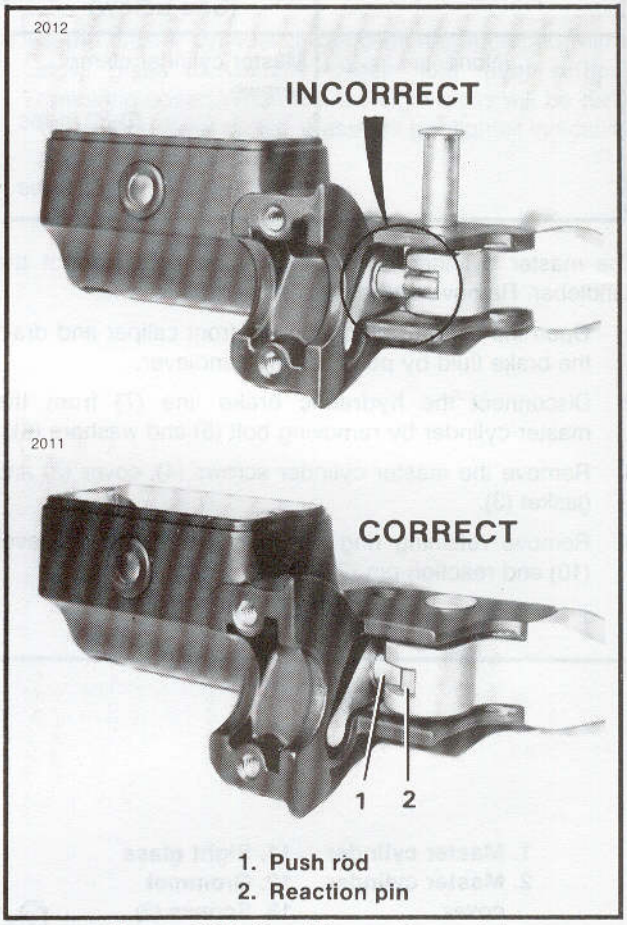


Figure 2-38. Hand Lever Assembly

CAUTION

See Figure 2-36. Be sure washers (6), banjo bolt (5), hydraulic brake line (7) and master cylinder bore (1) are free of D.O.T. 5 hydraulic brake fluid, dirt and metal chips before assembly to avoid leakage.

6. Install washers (6), banjo bolt (5) and hydraulic brake line (7) in master cylinder. Hold brake line in place and tighten banjo bolt to 17–22 ft-lbs torque.

NOTE

Before adding hydraulic fluid, check to see that the relief port in the master cylinder is uncovered when the hand lever is released.

REAR BRAKE MASTER CYLINDER/RESERVOIR

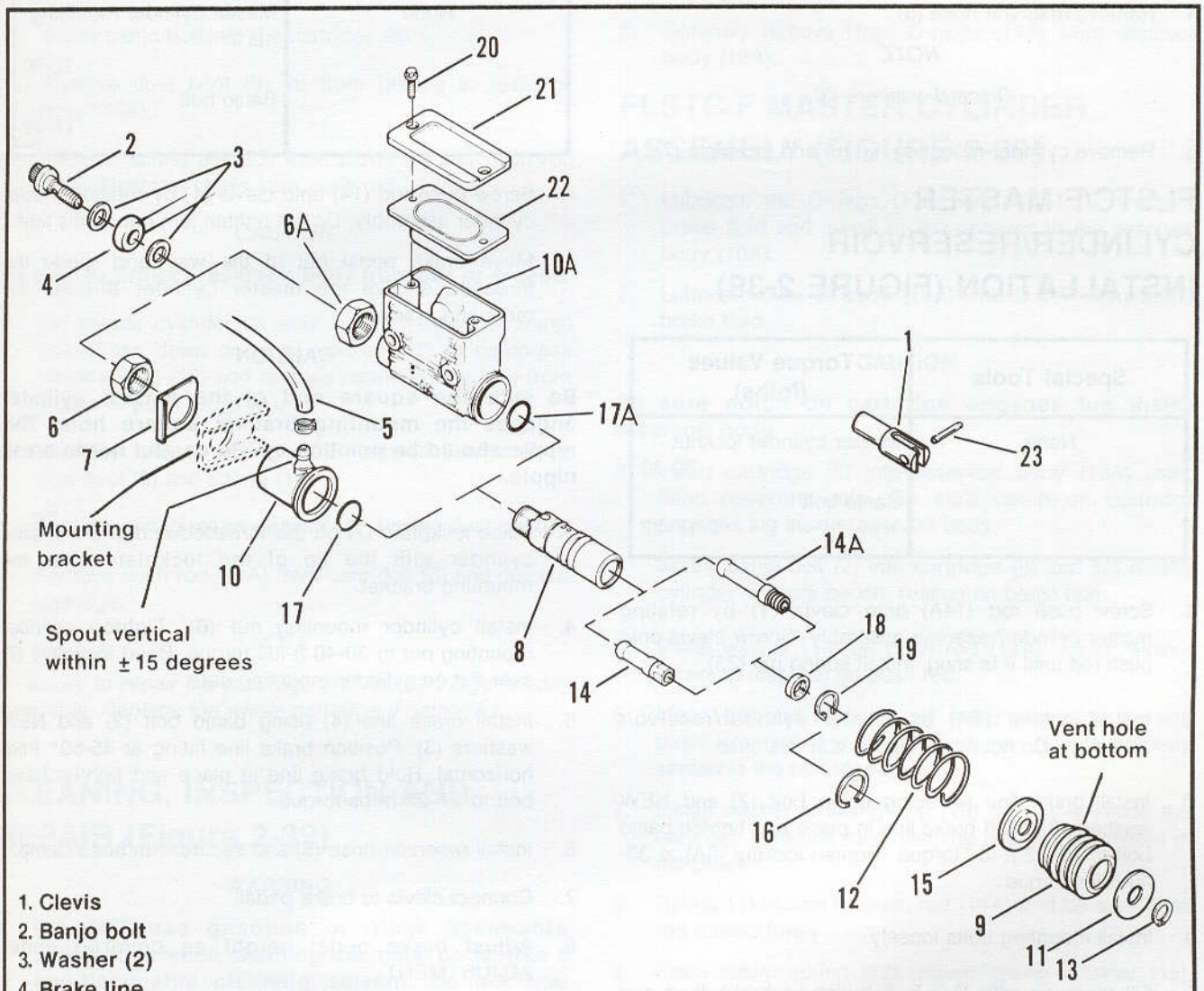
FLSTC/F MASTER CYLINDER/RESERVOIR REMOVAL (FIGURE 2-39)

1. Remove exhaust.
2. Remove master cylinder/reservoir mounting bolts and cover.
3. Disconnect clevis (1) from brake pedal.
4. Remove banjo bolt (2), washers (3) and brake line (4).

NOTE

Discard washers (3).

5. Remove locknut (6A).



1. Clevis
2. Banjo bolt
3. Washer (2)
4. Brake line
5. Reservoir hose - FXSTC/S
6. Nut, cyl. mt'g. - FXSTC/S
6A. Locknut - FLSTC/F
7. Lockplate - FXSTC/S
8. Cartridge
9. Dust boot
10. Cartridge body - FXSTC/S
10A. Reservoir - FLSTC/F
11. Washer, boot Retainer
12. Spring, return
13. Retaining ring, spring
14. Push rod - FXSTC
14A. Push rod - FLSTC/F
15. Retainer, spring return
16. Retaining ring, spring
17. O-ring (2) - FXSTC/S
17A. O-ring (2) - FLSTC/F
18. Push rod washer
19. Washer retaining ring
20. Cover screw (2) - FLSTC/F
21. Cover - FLSTC/F
22. Gasket - FLSTC/F
23. Spring Pin - FLSTC/F

Figure 2-39. Rear Brake Master Cylinder/Reservoir Assembly

FXSTC, FXSTS MASTER CYLINDER REMOVAL (Figure 2-39)

1. Remove exhaust.
2. Disconnect clevis (1) from brake pedal.
3. Remove banjo bolt (2), washers (3) and brake line (4).

CAUTION

Be careful not to break cartridge body (10) nipple.

4. Remove reservoir hose (5).

NOTE

Discard washers (3).

5. Remove cylinder mounting nut (6) and lockplate (7).

FLSTC/F MASTER CYLINDER/RESERVOIR INSTALLATION (FIGURE 2-39)

Special Tools	Torque Values (ft-lbs)
None	Master cylinder locknut 30-40 Banjo bolt 17–22

1. Screw push rod (14A) onto clevis (1) by rotating master cylinder/reservoir assembly. Screw clevis onto push rod until it is snug. Install spring pin (23).
2. Install locknut (6A) on master cylinder/reservoir assembly. Do not tighten locknut at this time.
3. Install brake line (4) using banjo bolt (2) and NEW washers (3). Hold brake line in place and tighten banjo bolt to 17–22 ft-lbs torque. Tighten locknut (6A) to 30-40 ft-lbs torque.
4. Install mounting bolts loosely.
5. Fill reservoir with D.O.T. 5 hydraulic brake fluid and bleed brakes as covered in BLEEDING THE HYDRAULIC BRAKE SYSTEM.
6. Connect clevis to brake pedal.

NOTE

Brake pedal height adjustment is complete when the brake pedal and master cylinder are assembled.

7. Install master cylinder/reservoir cover and tighten bolts.
8. Install exhaust.

FXSTC, FXSTS MASTER CYLINDER INSTALLATION (Figure 2-39)

Special Tools	Torque Values (ft-lbs)
None	Master cylinder mounting nut 70-80 Banjo bolt 17–22

1. Screw push rod (14) onto clevis (1) by rotating master cylinder assembly. Do not tighten jam nut at this time.
2. Move brake pedal out of the way and guide the threaded end of the master cylinder through the mounting bracket.

CAUTION

Be sure the square end of the master cylinder engages the mounting bracket square hole. The nipple should be pointing up. Be careful not to break nipple.

3. Place lockplate (7) on the threaded end of the master cylinder with the lip of the lockplate over the mounting bracket.
4. Install cylinder mounting nut (6). Tighten cylinder mounting nut to 30-40 ft-lbs torque. Bend lockplate (7) over flat on cylinder mounting nut.
5. Install brake line (4) using banjo bolt (2) and NEW washers (3). Position brake line fitting at 45-50° from horizontal. Hold brake line in place and tighten banjo bolt to 17–22 ft-lbs torque.
6. Install reservoir hose (5) and secure with hose clamp.
7. Connect clevis to brake pedal.
8. Adjust brake pedal height as covered under ADJUSTMENT.

NOTE

There is NO FREE PLAY ADJUSTMENT for the master cylinder assembly. Free play is built into the assembly.

9. Fill reservoir with D.O.T. 5 hydraulic brake fluid and bleed brakes as covered in BLEEDING THE HYDRAULIC BRAKE SYSTEM.
10. Install exhaust.

FLSTC/F MASTER CYLINDER/RESERVOIR DISASSEMBLY (FIGURE 2-39)

1. Clean exterior of master cylinder/reservoir with a clean, nonflammable solvent.

CAUTION

Screw the banjo bolt into the cartridge. The banjo bolt will protect the sealing surface of the reservoir body during the disassembly procedure.

2. Screw banjo bolt into the cartridge (8).
3. Remove dust boot (9) lip from groove in reservoir body (10A).
4. Remove spring pin (23) from clevis (1) and push rod (14A). Unscrew clevis from push rod.

CAUTION

Be sure to protect reservoir body from dirt or grease.

5. Set master cylinder on work bench, resting on banjo bolt. Press down on large washer (11) to compress return spring (12) and remove retaining ring (13) from groove in push rod (14A).
6. Carefully release spring (12). Remove washer (11), dust boot (9) and spring (12).
7. Remove spring return retainer (15) (inside dust boot).
8. Remove push rod (14A) from cartridge (8) and discard cartridge.

NOTE

Do not try to repair the cartridge (8). The cartridge is non-repairable. Replace the whole cartridge if damaged.

CLEANING, INSPECTION AND REPAIR (Figure 2-39)

WARNING

- **DO NOT use gasoline or other flammable substances when cleaning the metal parts. Use a non-flammable cleaning solvent. Do not use water.**
- **Always use denatured alcohol or D.O.T. 5 HYDRAULIC BRAKE FLUID to clean the brake system rubber components. DO NOT use mineral base solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts that would continue after assembly. This could result in component failure.**

1. Clean all parts, except the cartridge (8), with a clean, nonflammable solvent and blow dry with compressed air. Clean all rubber parts using denatured alcohol or brake fluid.
2. Inspect reservoir body (10A) bore for scratches. Replace if scratched or damaged.
3. Check dust boot (9) for tears or damage. Replace if torn or damaged.
4. Inspect threads on reservoir body (10A), push rod (14A) and banjo bolt (2). Replace any part with damaged threads.
5. Carefully remove large O-rings (17A) from reservoir body (10A).

FLSTC/F MASTER CYLINDER ASSEMBLY (FIGURE 2-39)

1. Lubricate the O-rings (17A) with D.O.T. 5 hydraulic brake fluid and install in the grooves in the reservoir body (10A).
2. Lubricate bore of body (10A) with D.O.T. 5 hydraulic brake fluid.

CAUTION

Be sure notch on cartridge engages lug inside reservoir body.

3. Insert cartridge (8) into reservoir body (10A) using hand pressure only. Be sure notch on cartridge engages lug inside reservoir body.
4. Screw banjo bolt (2) into cartridge (8) and set master cylinder on work bench, resting on banjo bolt.
5. Place washer (18) on push rod (14A). Install washer retaining ring (19) on push rod.
6. Insert ball-end of push rod (14A) into cartridge and push into cartridge (8) until washer (18) is properly seated in the cartridge bore.
7. Install washer retaining ring (19) in groove inside the cartridge bore. Be sure retaining ring is fully seated in the groove.
8. Release pressure on push rod (14A) and be sure push rod rotates freely.
9. Place return spring (12), return spring retainer (15), dust boot (9) and washer (11) in postion on the push rod (14A).

NOTE

Drain hole in dust boot must face down to drain properly.

10. Press down on washer (11) and install retaining ring (13).
11. Seat sealing lip of dust boot (9) into groove on reservoir body (10A).

FXSTC, FXSTS MASTER CYLINDER DISASSEMBLY (FIGURE 2-39)

1. Clean exterior of master cylinder with a clean, nonflammable solvent.

CAUTION

Screw the banjo bolt into the cartridge. The banjo bolt will protect the sealing surface of the cartridge body during the disassembly procedure.

2. Screw banjo bolt into the cartridge (8).
3. Remove dust boot (9) lip from groove in cartridge body (10).
4. Loosen clevis jam nut. Unscrew clevis from push rod.

CAUTION

Be sure to protect cartridge body from dirt or grease.

5. Set master cylinder on work bench, resting on banjo bolt. Press down on large washer (11) to compress return spring (12) and remove retaining ring (13) from groove in push rod (14).
6. Carefully release spring (12). Remove washer (11), boot (9) and spring (12).
7. Remove spring return retainer (15) (inside dust boot). Remove retaining ring (16) from the cartridge body (10).
8. Remove push rod (14) from cartridge (8) and discard cartridge.

NOTE

Do not try to repair the cartridge (8). The cartridge is non-repairable. Replace the whole cartridge if damaged.

CLEANING, INSPECTION AND REPAIR (Figure 2-39)

WARNING

- **DO NOT use gasoline or other flammable substances when cleaning the metal parts. Use a non-flammable cleaning solvent. Do not use water.**
- **Always use denatured alcohol or D.O.T. 5 hydraulic brake fluid to clean the brake system rubber components. DO NOT use mineral base solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts that would continue after assembly. This could result in component failure.**

1. Clean all parts, except the cartridge (8), with a clean, nonflammable solvent and blow dry with compressed air. Clean all rubber parts using denatured alcohol or brake fluid.
2. Inspect body (10) bore for scratches. Replace if scratched.
3. Check dust boot (9) for tears or damage. Replace if torn or damaged.
4. Inspect threads on body (10), push rod (14) and banjo bolt (2). Replace any part with damaged threads.
5. Carefully remove large O-rings (17) from cartridge body (10).

FXSTC, FXSTS MASTER CYLINDER ASSEMBLY (FIGURE 2-39)

1. Lubricate the O-rings (17) with D.O.T. 5 hydraulic brake fluid and install in the grooves in the cartridge body (9).
2. Lubricate bore of cartridge body (10) with D.O.T. 5 hydraulic brake fluid. Align nipple on cartridge body with notch in threaded end of cartridge (8).

CAUTION

Be sure notch on cartridge engages lug inside cartridge body.

3. Insert cartridge (8) into cartridge body (10) using hand pressure only. Be sure notch on cartridge engages lug inside cartridge body.
4. Screw banjo bolt (2) into cartridge (8) and set master cylinder on work bench, resting on banjo bolt.
5. Place washer (18) on push rod (14). Install washer retaining ring (19) on push rod.
6. Insert ball-end of push rod (14) into cartridge and push into cartridge (8) until washer (18) is properly seated in the cartridge bore.
7. Install washer retaining ring (19) in groove inside the cartridge bore. Be sure retaining ring is fully seated in the groove.
8. Release pressure on push rod (14) and be sure push rod rotates freely.
9. Install retaining ring (16) in the groove on cartridge body (10). Place return spring (12), return spring retainer (15), dust boot (9) and washer (11) in postion on the push rod (14).

NOTE

Drain hole in dust boot must face down to drain properly.

10. Press down on washer (11) and install retaining ring (13).
11. Seat sealing lip of dust boot (9) into groove on cartridge body (10).

FRONT BRAKE CALIPER

REMOVAL – FLSTC/F, FXSTC (Figure 2-40)

1. Disconnect the brake line at the caliper fitting.

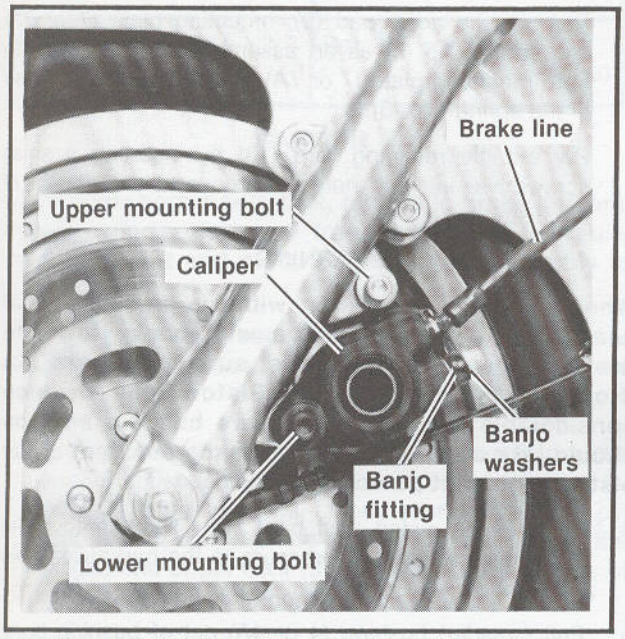


Figure 2-40. Front Brake Caliper Mounting

NOTE

Gently rock caliper to compress the caliper pistons and ease removal.

2. Remove the upper and lower mounting bolts to release the caliper assembly from the vehicle.

3. Move the caliper assembly to a clean bench area.

INSTALLATION – FLSTC/F, FXSTC (Figure 2-40)

Special Tools	Torque Values (See below)
None	Lower mounting bolt 25 - 30 (ft-lbs) Upper mounting bolt 25 - 30 (ft-lbs) Bleeder valve 80 - 100 (in-lbs)

A235

1. Upper mounting screw
2. Lower mounting pin
3. Flat washer
4. Threaded bushing - 1991
4A. Threaded bushing - 1992
5. Pin boot
6. O-ring (3)
7. Mounting plate - 1991
7A. Mounting plate - 1992
8. Spring clip
9. Pad set
10. Piston Seal
11. Piston
12. Piston dust boot
13. Retaining wire
14. Pad retainer
15. Retainer screw
16. Caliper
17. Bleed fitting

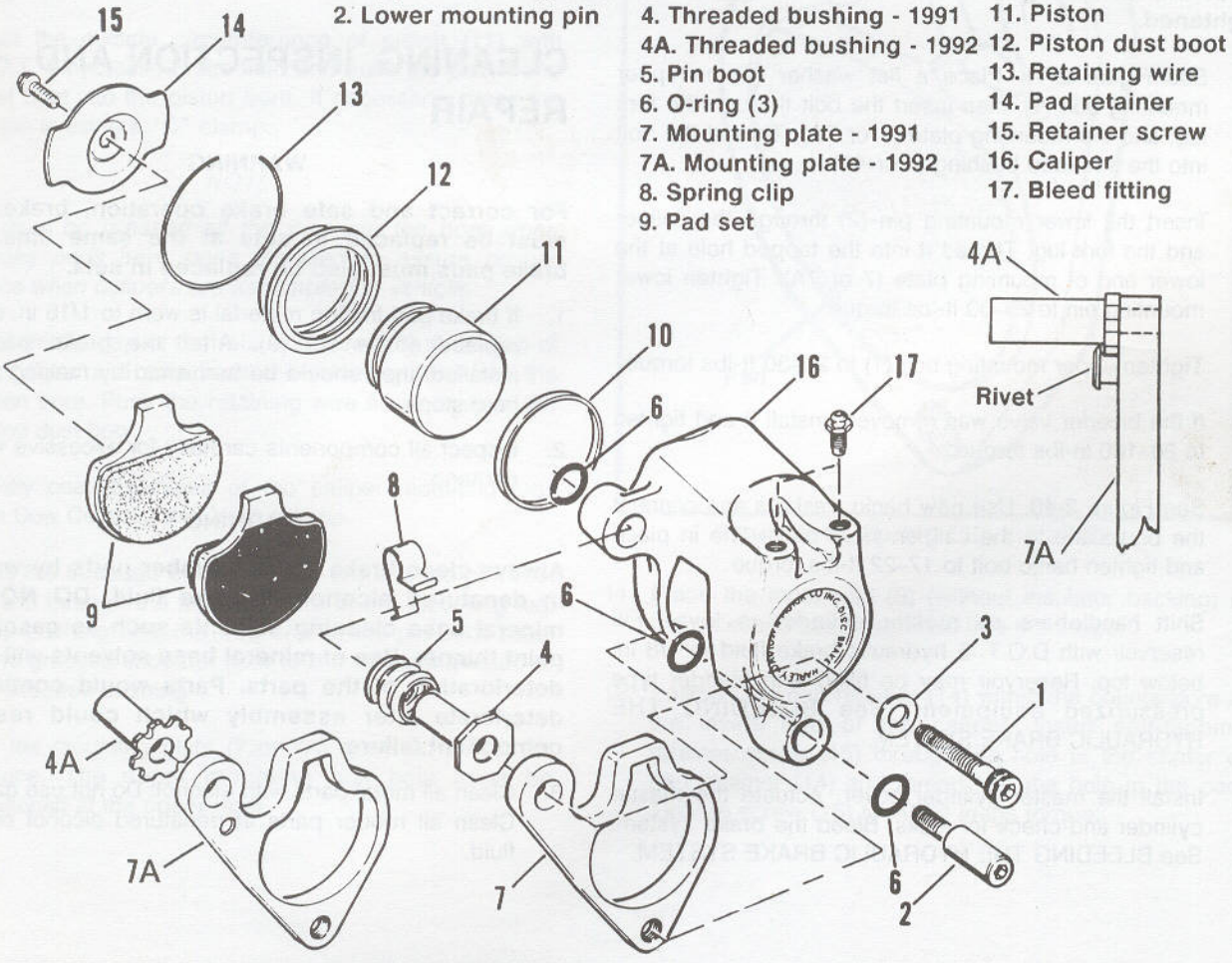


Figure 2-41. Front Brake Caliper

CAUTION

Whenever a caliper is removed/installed, you must pump brake fluid pressure back up, until the pistons push the pads against the brake disc, BEFORE moving motorcycle. If you don't pump fluid pressure up again, the brakes will not be available to stop the vehicle and the vehicle may be damaged.

Mount the caliper on the vehicle as follows:

1. Coat the outside diameter of lower mounting pin (2) with Dow Corning MOLY 44 grease.
2. See Figure 2-40. Position the caliper with the disc between the friction pads. Align the two mounting holes in the caliper with the mounting lugs on the fork.

WARNING

Check to be sure that the caliper bushings are in the mounting lugs on the fork. Installing caliper without bushings will result in improper caliper location and possible locked brake.

CAUTION

See Figure 2-41. The threaded bushing's flange must go UNDER the rivet head during assembly. At the same time, one of the U-shaped notches on the outer edge of the bushing flange must engage the rivet body. If the bushing is not positioned properly the rivet will be damaged when the mounting bolts are tightened.

3. See Figure 2-41. Place a flat washer (3) on upper mounting bolt (1), then insert the bolt through the fork lug, and the mounting plate (7 or 7A). Thread the bolt into the threaded bushing (4 or 4A).
4. Insert the lower mounting pin (2) through the caliper and the fork lug. Thread it into the tapped hole at the lower end of mounting plate (7 or 7A). Tighten lower mounting pin to 25–30 ft-lbs torque.
5. Tighten upper mounting bolt (1) to 25–30 ft-lbs torque.
6. If the bleeder valve was removed, install it and tighten to 80–100 in-lbs torque.
7. See Figure 2-40. Use new banjo washers and connect the brake line to the caliper. Hold brake line in place and tighten banjo bolt to 17–22 ft-lbs torque.
8. Shift handlebars so master cylinder is level. Fill reservoir with D.O.T. 5 hydraulic brake fluid to 1/8 in. below top. Reservoir may be filled with bladder type pressurized equipment. See BLEEDING THE HYDRAULIC BRAKE SYSTEM.
9. Install the master cylinder cover. Actuate the master cylinder and check for leaks. Bleed the brake system. See BLEEDING THE HYDRAULIC BRAKE SYSTEM.

DISASSEMBLY – ALL MODELS (Figure 2-41)

1. Remove retainer screw (15), pad retainer (14) and inside pad (9).
2. Remove the outer pad (9), mounting plate (7 or 7A) and spring clip (8) as an assembly. Remove pad (9) from mounting plate (7 or 7A) by pushing the pad free of the spring clip (8).
3. Pry out the retaining wire (13) by inserting a small screwdriver into the notched groove at the bottom of the piston bore.

WARNING

When removing the piston with air pressure, wear heavy gloves or hold piston with heavy towel to prevent personal injury. Be sure piston is not dropped on hard surface. Piston may develop considerable force from pressure build-up and you should take care to keep your hands out from under piston to prevent personal injury.

4. Remove the piston dust boot (12). Then remove the piston by applying air pressure to the hydraulic brake line inlet.
5. Pull threaded bushing (4 or 4A) out of bushing bore, then remove pin boot (5) from groove in caliper.
6. Pry seal (10) and the three O-rings (6) out of their grooves.

CLEANING, INSPECTION AND REPAIR

WARNING

For correct and safe brake operation, brake pads must be replaced in sets at the same time. Rear brake pads must also be replaced in sets.

1. If brake pad friction material is worn to 1/16 in. or less, replace entire set (9). After the brake pads are installed, they should be burnished by making several hard stops.
2. Inspect all components carefully for excessive wear or damage.

WARNING

Always clean brake system rubber parts by washing in denatured alcohol or brake fluid. DO NOT use mineral base cleaning solvents such as gasoline or paint thinner. Use of mineral base solvents will cause deterioration of the parts. Parts would continue to deteriorate after assembly which could result in component failure.

3. Clean all metal parts with alcohol. Do not use gasoline. Clean all rubber parts in denatured alcohol or brake fluid.

ASSEMBLY – ALL MODELS (Figure 2-41)

Special Tools	Torque Values (In-lbs)
None	Retainer screw 40 - 50

CAUTION

Be sure washers, banjo bolt, hydraulic brake line and master cylinder bore are free of D.O.T. 5 hydraulic brake fluid, dirt and metal chips before assembly to avoid leakage.

After the parts have been inspected and any worn or damaged parts replaced, the caliper is assembled as follows:

1. Apply a coating of D.O.T. 5 hydraulic brake fluid to the exterior surfaces of seal (10). Install seal (10) and O-rings (6) in their grooves. Lightly coat the cavity of pin boot (5) with Dow Corning MOLY 44 grease. Insert the flanged end of pin boot (5) into the internal groove of the threaded bushing bore.

2. Push the piston dust boot (12), with the open side downward, over the top of the piston. Push downward on the boot until the inner lip seats in the groove at the top of the piston.

3. Coat the outside circumference of piston (11) with D.O.T. 5 hydraulic brake fluid and push the piston and dust boot into the piston bore. If necessary, press the piston in using a "C" clamp.

NOTE

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

4. Position the gap of the retaining wire (13) at the top of the caliper and compress the retaining wire into the piston bore. Push the retaining wire firmly against the piston dust boot.

5. Lightly coat the bores of the caliper mounting lugs with Dow Corning MOLY 44 grease.

6. Push the threaded bushing (4 or 4A) into the pin boot (5) and through the bushing bore in the mounting lug. Keep pushing until the free end of the pin boot seats in the grooved shoulder next to the hexagonal head of the threaded bushing.

7. Lay the mounting plate (7 or 7A) down on a firm flat surface. The upper mounting bolt hole must be positioned at the upper right.

8. See Figure 2-42. Install the spring clip at the top of mounting plate as shown.

9. See Figure 2-41. Take the pad (9) that has the insulator backing, and place it on top of the spring clip with the lower end of the pad slightly entering the opening of the mounting plate. With the pad centered within the mounting plate and the insulated back facing downward, push down on the pad until it is against the flat surface and is held firmly by spring tension from the spring clip.

10. Insert the outer pad (9), mounting plate (7 or 7A) and spring clip (8) assembly into place with the backside of the pad against the face of the piston.

NOTE

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

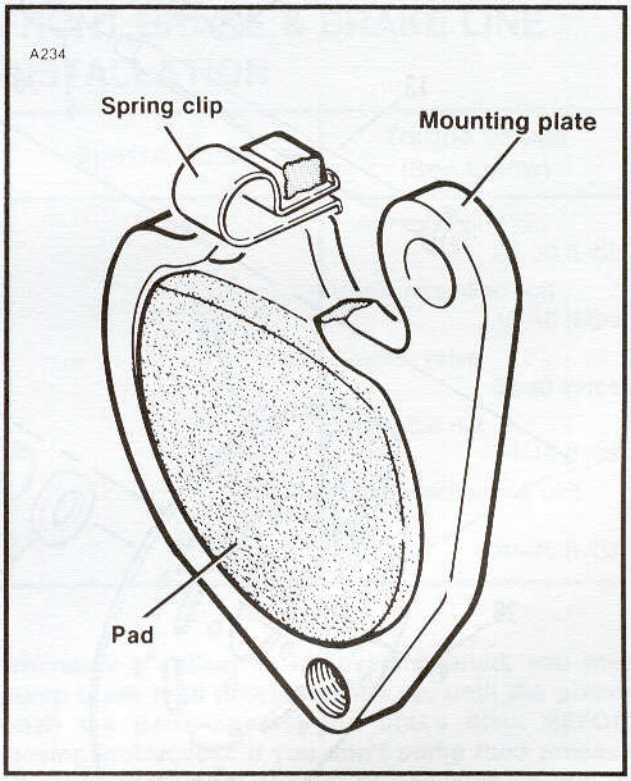
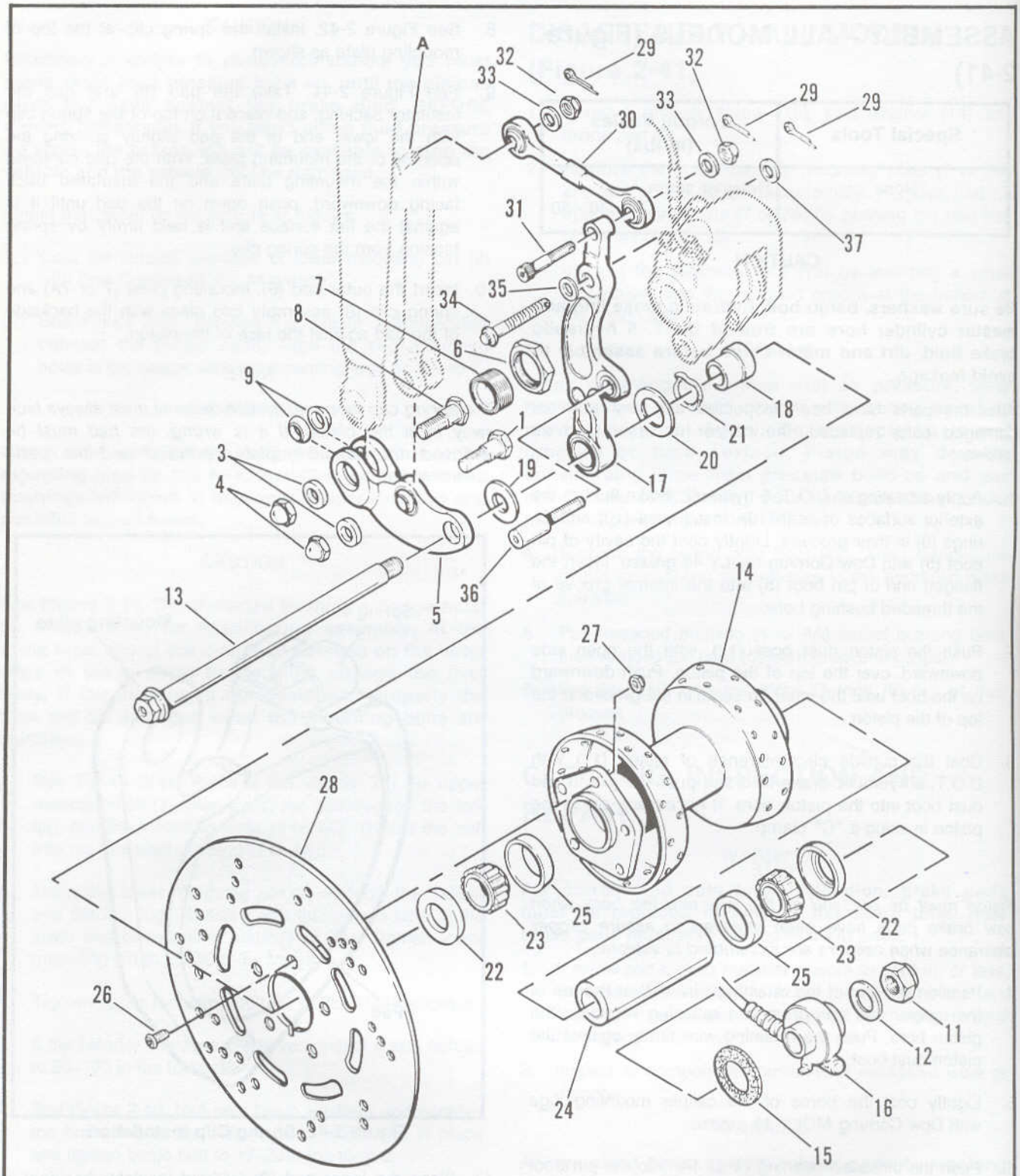


Figure 2-42. Spring Clip Installation

11. Place the inner pad (9) (without insulator backing) in the recessed seat machined into the caliper.

12. Position the pad retainer (14) within the counterbore at the inside end of the caliper. Insert self-tapping retainer screw (15) through the hole in the center of pad retainer (14) and thread into the hole in the pad. Tighten screw (15) to 40-50 in-lbs torque.



1. Thick head pivot stud (2)
2. Thin washer
3. Washer (2)
4. Acorn nut (2)
5. Rockers (2)
6. Jam nut (2)
7. Bearing retainer (2)
8. Thin head pivot stud (2)
9. Spherical bearings (2)
10. Thin washer
11. Axle locknut
12. Washer
13. Axle
14. Hub
15. Speedo drive seal
16. Speedo drive
17. Brake bracket
18. Spacer
19. Special thrust washer (small I.D.)
20. Special thrust washer (large I.D.)
21. Wave washer
22. Seal (2)
23. Bearing (2)
24. Spacer
25. Bearing cup (2)
26. Screw (5)
27. Locknut (5)
28. Brake disc
29. Cotter pin (2)
30. Brake reaction link
31. Socket head bolt
32. Nut (2)
33. Washer (2)
34. Upper mounting bolt
35. Washer
36. Lower mounting pin
37. Washer

Figure 2-43. Springer Fork - Brake and Axle Assembly

FRONT BRAKE & BRAKE LINE REMOVAL

1. Disconnect brake line from caliper and drain brake fluid. Discard banjo bolt washers. Remove brake line assembly, if necessary. Remove brake line clamp bolts. Leave clamps on brake line.

NOTE

If you are removing the front fork, you must remove the brake line assembly from the fork.

- If you are removing the front fork, do steps 2 thru 4.

2. See Figures 2-43 and 2-44. Remove cotter pins (29) from brake reaction link (30) socket head bolt (31) (brake bracket) and weld stud (A) (rigid fork).

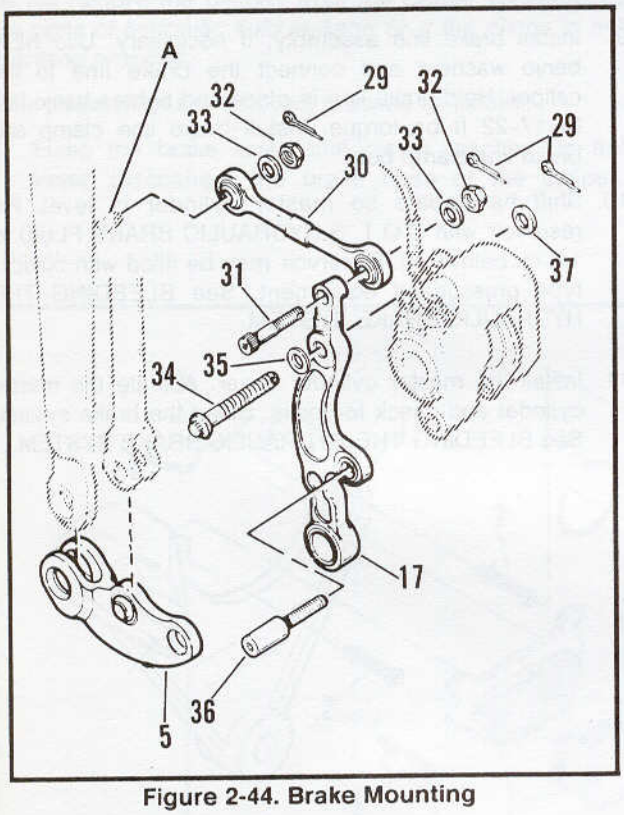


Figure 2-44. Brake Mounting

3. Remove nuts (32), washers (33) and brake bracket socket head bolt (31).

4. Remove brake reaction link (30). Remove cotter pin (29) and washer (37) from upper mounting bolt (34).

NOTE

Gently rock caliper to compress the caliper pistons and ease removal.

5. Remove upper mounting bolt (34) and washer (35). Remove lower mounting pin (36) securing brake caliper to brake mounting bracket. Remove brake caliper.

6. If brake caliper needs repair, See FRONT BRAKE CALIPER DISASSEMBLY/ASSEMBLY - ALL MODELS.

CAUTION

Be sure washers, banjo bolt, hydraulic brake line and master cylinder bore are free of D.O.T. 5 hydraulic brake fluid, dirt and metal chips before assembly to avoid leakage.

NOTE

Except for brake bracket and mounting plate, the front brake is the same as described in FRONT BRAKE CALIPER.

FRONT BRAKE & BRAKE LINE INSTALLATION

Special Tools	Torque Values (See below)
None	Lower mounting pin 25–30 ft-lbs Upper mounting bolt 42–46 ft-lbs Bleeder valve 32-40 in-lbs Weld stud nut 14–18 ft-lbs Brake reaction link bolt nut 20–25 ft-lbs

CAUTION

Whenever a caliper is removed/installed, you must pump brake fluid pressure back up, until the pistons push the pads against the brake disc, BEFORE moving motorcycle. If you don't pump fluid pressure up again, the brakes will not be available to stop the vehicle and the vehicle may be damaged.

Mount the caliper on the vehicle as follows:

1. Coat the outside diameter of lower mounting pin (36) with Dow Corning MOLY 44 grease.

NOTE

See Figure 2-45. The Springer brake bracket has a cast-in nub that engages a hole in the mounting plate.

2. Position the caliper with the disc between the friction pads. Align the two mounting holes in the caliper with the mounting holes in the bracket. See Figure 2-43. Align the hole in the mounting plate with the cast-in nub on the brake bracket.

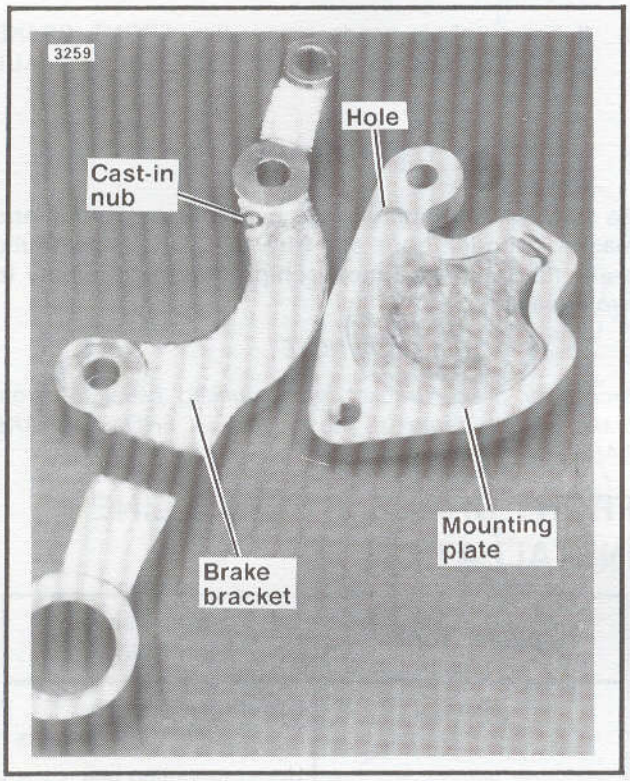


Figure 2-45. FXSTS Brake Bracket &Mounting Plate

3. Place flat washer (35) on upper mounting bolt (34), then insert the bolt through the bracket holes, and the mounting plate. Screw the bolt into the threaded bushing.
4. Insert the lower mounting pin (36) through the caliper and the bracket hole. Thread it into the tapped hole at the lower end of mounting plate. Tighten lower mounting pin to 25–30 ft-lbs torque.
5. Tighten upper mounting bolt (34) to 42–46 ft-lbs torque. Install washer (37) and cotter pin (29).
6. If the bleeder valve was removed, install it and tighten to 32–40 in-lbs torque.
7. Place brake reaction link (30) in position on rigid fork weld stud (A). Align brake reaction link with hole in brake bracket and install bolt (31).
8. Install washers (33), nuts (32).

- Tighten weld stud (A) nut to 14–18 ft-lbs torque and bolt (31) nut to 20–25 ft-lbs torque. Install cotter pins (29).

9. Install brake line assembly, if necessary. Use NEW banjo washers and connect the brake line to the caliper. Hold brake line in place and tighten banjo bolt to 17–22 ft-lbs torque. Install brake line clamp and brake line clamp bolt.
10. Shift handlebars so master cylinder is level. Fill reservoir with D.O.T. 5 HYDRAULIC BRAKE FLUID to 1/8 in. below top. Reservoir may be filled with bladder type pressurized equipment. See BLEEDING THE HYDRAULIC BRAKE SYSTEM.
11. Install the master cylinder cover. Actuate the master cylinder and check for leaks. Bleed the brake system. See BLEEDING THE HYDRAULIC BRAKE SYSTEM.

REAR BRAKE CALIPER

REMOVAL/DISASSEMBLY (Figure 2-46)

1. Remove rear muffler.

NOTE

Gently rock caliper to compress the caliper pistons and ease removal.

2. Remove pin bolts (11) and carefully lift caliper (10) off the brake disc and brake pads.
3. Remove retainer clip (13). Slide outside brake pad off mounting bracket. Slide inside caliper off mounting bracket, toward wheel.
4. Remove pad shims (3 or 3A).

NOTE

Do not remove the pistons from the caliper unless there are signs of hydraulic fluid leakage or if the piston is not operating properly.

If the piston must be removed, proceed as follows:

5. Pump the brake lever until piston reaches its full travel. Disconnect the brake hose at the caliper. Remove the piston (6), dust boot (7) and seal (5). If the piston will not come loose, use the following method:

WARNING

Piston may develop considerable force from pressure build-up. Take care to keep hands from under piston to prevent personal injury.

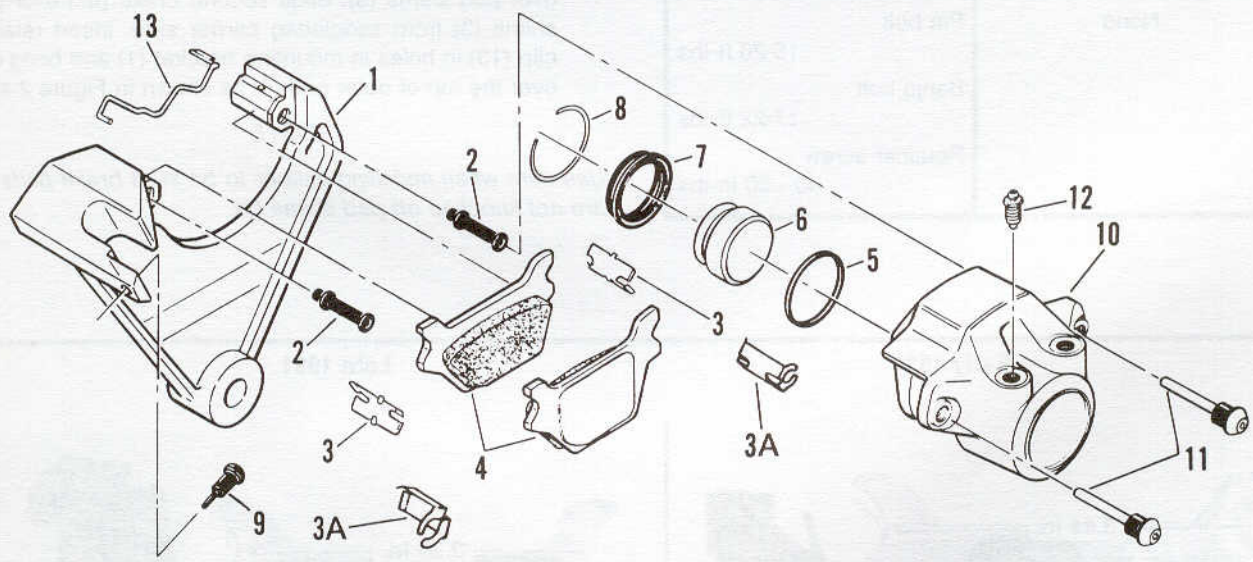
6. Place the caliper on the workbench with the piston facing downward. Place a clean shop towel under the piston and apply low air pressure to the inlet hole until piston is forced out of the caliper. If piston is tight in bore, tap lightly around caliper while applying air pressure.

CLEANING, INSPECTION AND REPAIR (Figure 2-46)

WARNING

Brake pads must be replaced only in sets for correct and safe brake operation.

1. If the brake pads are worn to 1/16 in. thick or less of friction material, replace them as a set.



1. Mounting bracket
2. Rubber bushing (2)
3. Pad shim (2) (1991)
3A. Pad shim (2) (1992)
4. Brake pad (2)
5. Seal
6. Piston
7. Dust boot
8. Retaining ring
9. Bumper
10. Brake caliper
11. Pin bolt (2)
12. Bleeder valve
13. Retainer clip

Figure 2-46. Rear Caliper

2. Replace any parts that appear worn or damaged. Always replace seal (5) and piston boot (7) if removed from caliper bore. Replace rubber bushing (2) if damaged or worn. Do not hone or bore cylinder.

WARNING

Always use a non-flammable solvent for cleaning metal parts. DO NOT use gasoline or other flammable substances which could ignite and cause bodily harm.

3. Clean all metal parts in a non-flammable cleaning solvent and blow dry with compressed air.

WARNING

Always clean brake system rubber parts by washing in denatured alcohol or D.O.T. 5 HYDRAULIC BRAKE FLUID. DO NOT use mineral base cleaning solvents which would deteriorate rubber parts.

4. Clean all rubber parts in denatured alcohol or brake fluid.

CAUTION

Be sure washers, banjo bolt, hydraulic brake line and master cylinder bore are free of D.O.T. 5 hydraulic brake fluid, dirt and metal chips before assembly to avoid leakage.

ASSEMBLY/INSTALLATION (Figures 2-46 and 2-47)

Special Tools	Torque Values (See below)
None	Pin bolt 15-20 ft-lbs Banjo bolt 17-22 ft-lbs Retainer screw 40 - 50 in-lbs

WARNING

- **In late 1991, as a product improvement, Harley-Davidson changed the configuration of the rear brake pads and abutment shims.**
- **See Figure 2-48. Early 1991 style abutment shims must only be used with early 1991 style brake pads. Late 1991 style abutment shims must only be used with late 1991 style brake pads. Installing early 1991 style shims with late 1991 style pads, or late 1991 style shims with early 1991 style pads, will result in improper rear brake operation, which may cause loss of vehicle control and personal injury.**

CAUTION

- **1992 brake pads and discs are made of a different material than 1991 brake pads and discs.**
- **Do not use 1992 brake pads on 1991 brake discs. If you use 1992 brake pads on 1991 discs, brake pad life will be substantially reduced.**

1. Place pad shims (3 or 3A) on mounting bracket with the tabs seated in mounting holes.

CAUTION

Be sure pads are on the pad shim. Motorcycle operation with the pad off the shim will result in rear brake pad drag, uneven pad wear and damage to the mounting bracket.

2. From wheel side of brake disc, slide one brake pad (4) over pad shims (3). Slide second brake pad over pad shims (3) from saddlebag carrier side. Insert retainer clip (13) in holes in mounting bracket (1) and bring clip over the top of outer pad (4) as shown in Figure 2-49.

NOTE

Use care when installing caliper to be sure brake pads (4) are not knocked off pad shims (3).

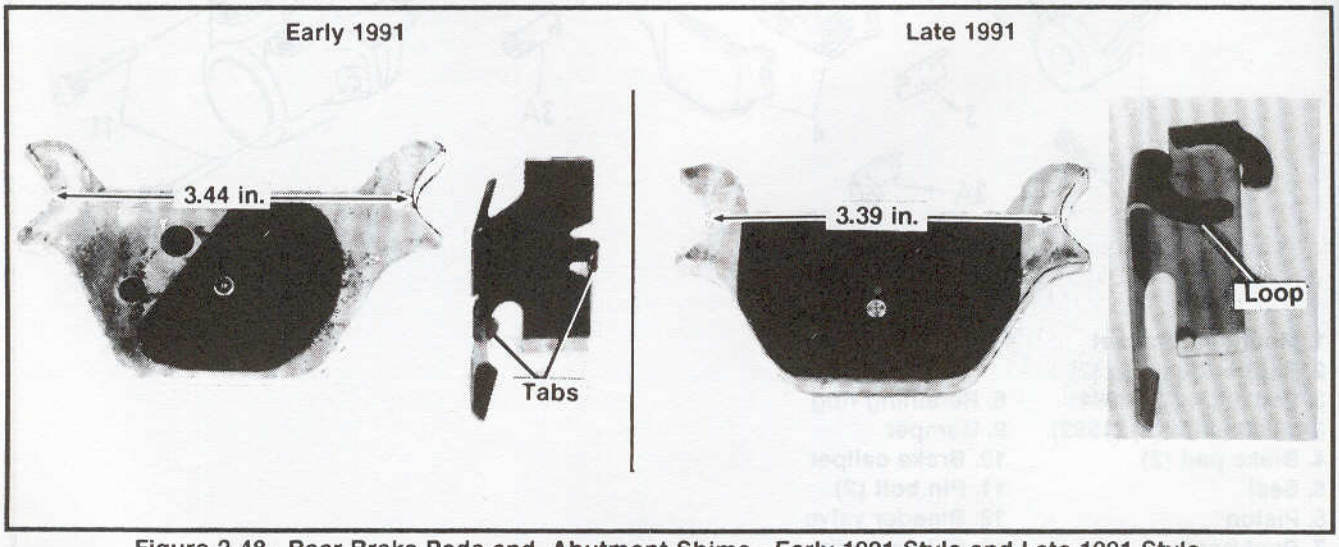


Figure 2-48. Rear Brake Pads and Abutment Shims - Early 1991 Style and Late 1991 Style

CAUTION

Whenever a caliper is removed/installed, you must pump brake fluid pressure back up, until the pistons push the pads against the brake disc, BEFORE moving motorcycle. If you don't pump fluid pressure up again, the brakes will not be available to stop the vehicle and the vehicle may be damaged.

3. Lower caliper (10) so that caliper straddles brake pads. Align holes in caliper with holes in mounting bracket (1) and install pin bolts (11). Tighten bolts (11) to 15-20 ft-lbs torque.

4. If brake line was disconnected, hold brake line in place and tighten banjo bolt to 17-22 ft-lbs torque.

5. Install rear muffler.

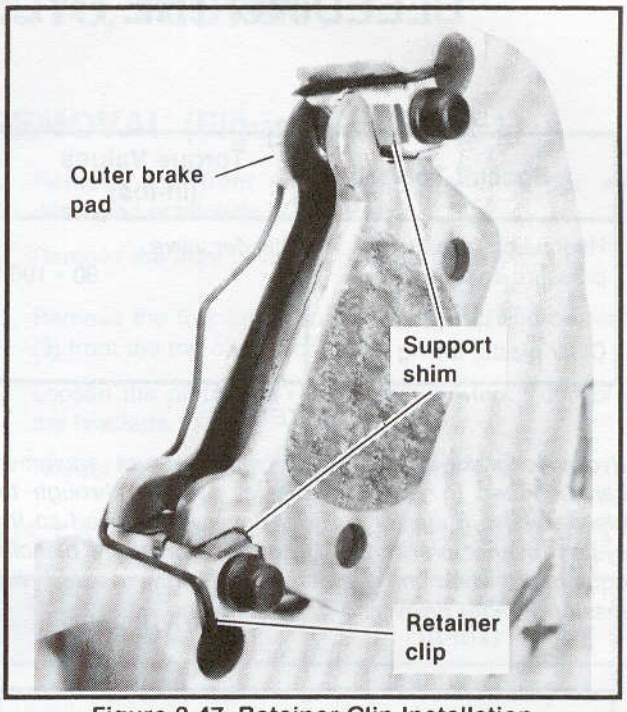


Figure 2-47. Retainer Clip Installation

BLEEDING THE HYDRAULIC BRAKE SYSTEM

Special Tools	Torque Values (in-lbs)
Hydraulic brake fluid pressure equipment OR Clear plastic tubing	Bleeder valve 80 - 100

NOTE

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

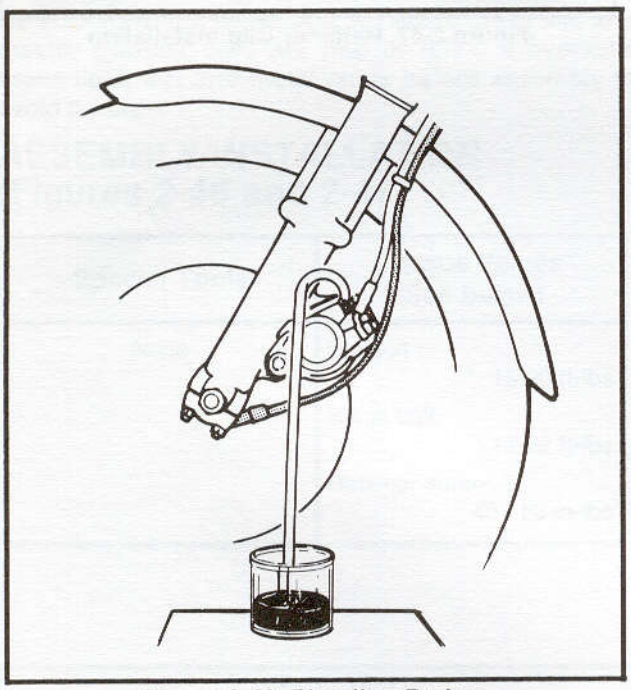


Figure 2-49. Bleeding Brakes

1. See Figure 2-49. Slip a length of appropriate size clear plastic tubing over wheel cylinder bleeder valve with other end in a clean container. Turn handlebars so that bleeder valve is nearly vertical.

2. Depress brake pedal or lever once to build up pressure. Open bleeder valve by rotating counterclockwise about one-half turn.

3. Keep master cylinder full of fluid at all times. Slowly depress brake pedal or lever once until fluid stops flowing from tubing. Close the bleeder valve. Allow pedal or lever to return slowly to release position.

4. Repeat operation until brake system is free of air bubbles. Add fluid to master cylinder to bring to original level. Do not reuse fluid. Tighten brake bleeder valve to 80 - 100 in-lbs torque.

WARNING

D.O.T. 5 brake fluid can cause eye irritation. In case of contact with eyes, flush with plenty of water and get medical attention. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN!

CAUTION

Whenever a hydraulic brake line or fitting is opened the fitting should be flushed with brake fluid and the brake system must be bled. Do this to eliminate any air or contaminants from the brake system. Air in the fluid will cause the brake pedal to have a spongy feel. If a contaminant becomes lodged in the seat of a fitting, leakage of fluid could occur, and/or air could be drawn into the system.

FRONT FORKS FXSTC, FLSTC/F

GENERAL

The FXSTC, FLSTC/F front fork is made up of two telescoping tubes working against springs, with an oil filled damping mechanism to control the action. The unit is engineered to give long service life with a minimum of repair. The fork oil should be changed annually or at 10,000 mile intervals, whichever comes first. Use the following procedure:

WARNING

The FLSTC/F models have a preloaded fork spring. Disassemble the fork tube(s) carefully. The spring can force parts from the tube unexpectedly, possibly causing personal injury.

1. Support the vehicle so the front end is off the floor and the forks are fully extended.
2. See Figures 2-47, 2-48. Remove the fork tube cap (1) from the top of one fork side.
3. Remove the drain screw (9) from the bottom of the fork and drain the fork oil. Don't lose packing washer (10).
4. Replace the drain screw.
5. Fill the fork with Harley-Davidson's TYPE E FORK OIL with the specified amounts listed below:

FXSTC Models	Wet	10.2 oz.
	Dry	11.2 oz.
FLSTC/F Models	Wet	11.5 oz.
	Dry	12.5 oz.

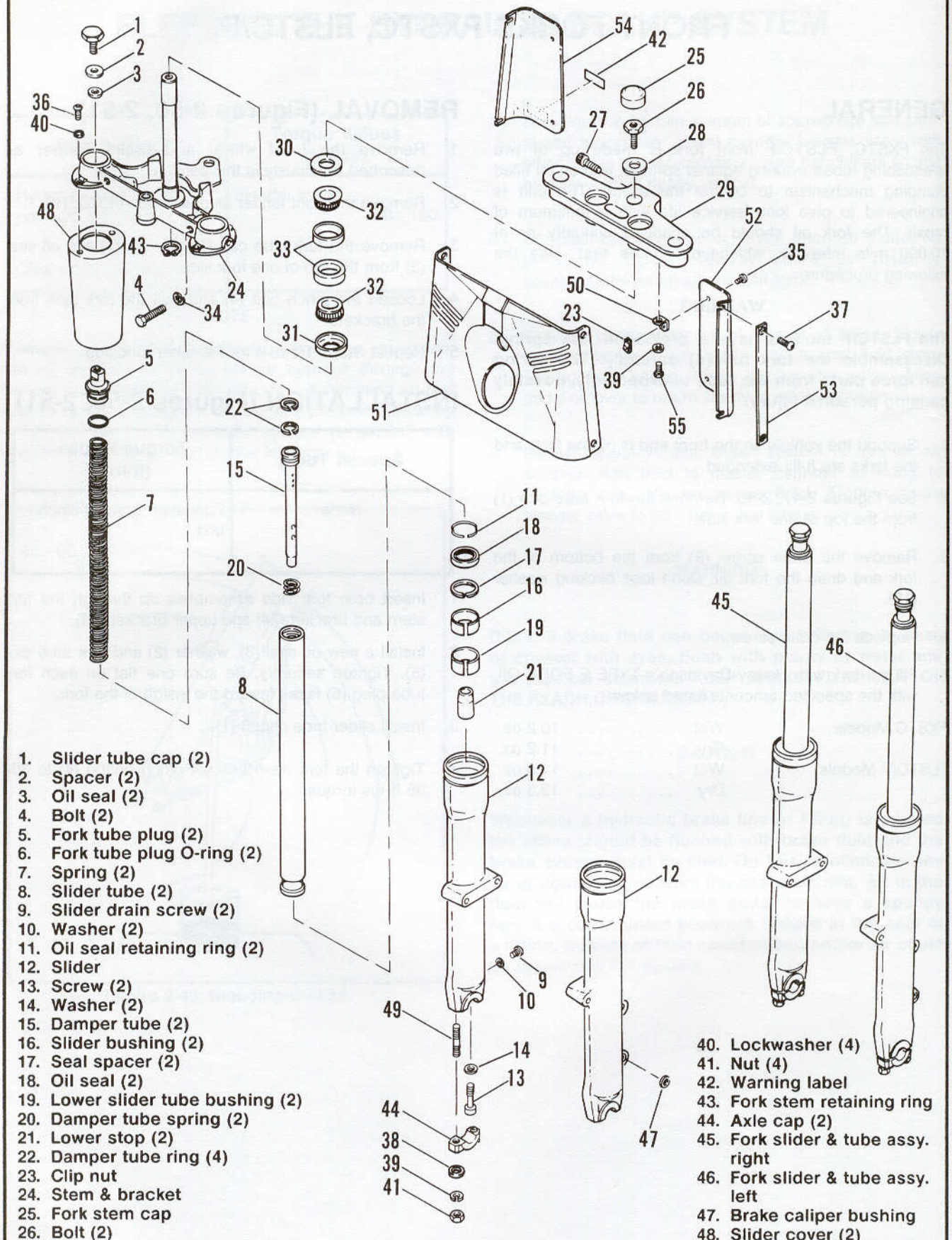
REMOVAL (Figures 2-50, 2-51)

1. Remove the front wheel and brake caliper as described previously in this section.
2. Remove the front fender as outlined in FENDERS.
3. Remove the fork tube cap (1), washer (2) and oil seal (3) from the top of one fork side.
4. Loosen the pinch bolt (4) and pull the fork side from the brackets.
5. Repeat Steps 1 thru 4 for the other fork side.

INSTALLATION (Figures 2-50, 2-51)

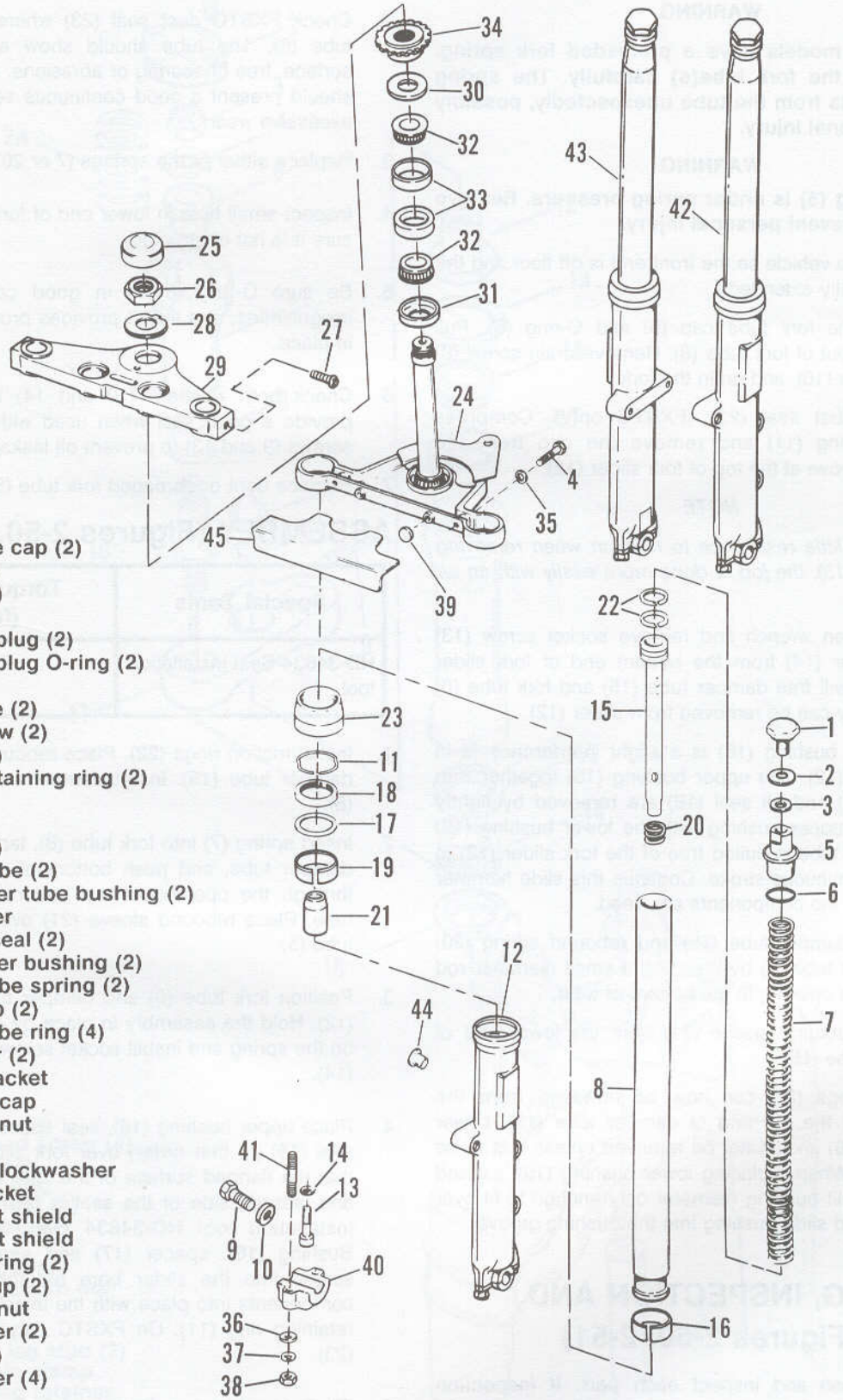
Special Tools	Torque Values (ft-lbs)
None	Fork stem bracket pinch bolt 30 - 35

1. Insert both fork side assemblies up through the fork stem and bracket (24) and upper bracket (29).
2. Install a new oil seal (3), washer (2) and fork tube cap (5). Tighten securely. Be sure one flat on each fork tube plug (5) faces toward the inside of the fork.
3. Install slider tube cap(s) (1).
4. Tighten the fork stem bracket pinch bolt(s) (4) to 30–35 ft-lbs torque.



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

Figure 2-50. Front Fork – FLSTC/F



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

Figure 2-51. Fork Stem and Bracket – FXSTC

DISASSEMBLY (Figures 2-50, 2-51)

WARNING

The FLSTC/F models have a preloaded fork spring. Disassemble the fork tube(s) carefully. The spring can force parts from the tube unexpectedly, possibly causing personal injury.

WARNING

Fork tube plug (5) is under spring pressure. Remove carefully to prevent personal injury.

1. Support the vehicle so the front end is off floor and the forks are fully extended.
2. Remove the fork tube cap (5) and O-ring (6). Pull spring (7) out of fork tube (8). Remove drain screw (9) and washer (10), and drain the fork.
3. Remove dust seal (23) (FXSTC only). 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 rotation when removing socket screw (13), the job is done more easily with an air impact wrench.

4. 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 fork tube (8) so that they can be removed from slider (12).
5. 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.
6. Push the damper tube (15) and rebound spring (20) free of fork tube (8) by inserting a small diameter rod through the opening in the bottom of tube.
7. Remove rebound sleeve (21) from the lower end of damper tube (15).
8. Friction 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 (19), expand the new split bushing diameter only enough to fit over tube (8) and slide bushing into the bushing groove.

CLEANING, INSPECTION AND REPAIR (Figures 2-50, 2-51)

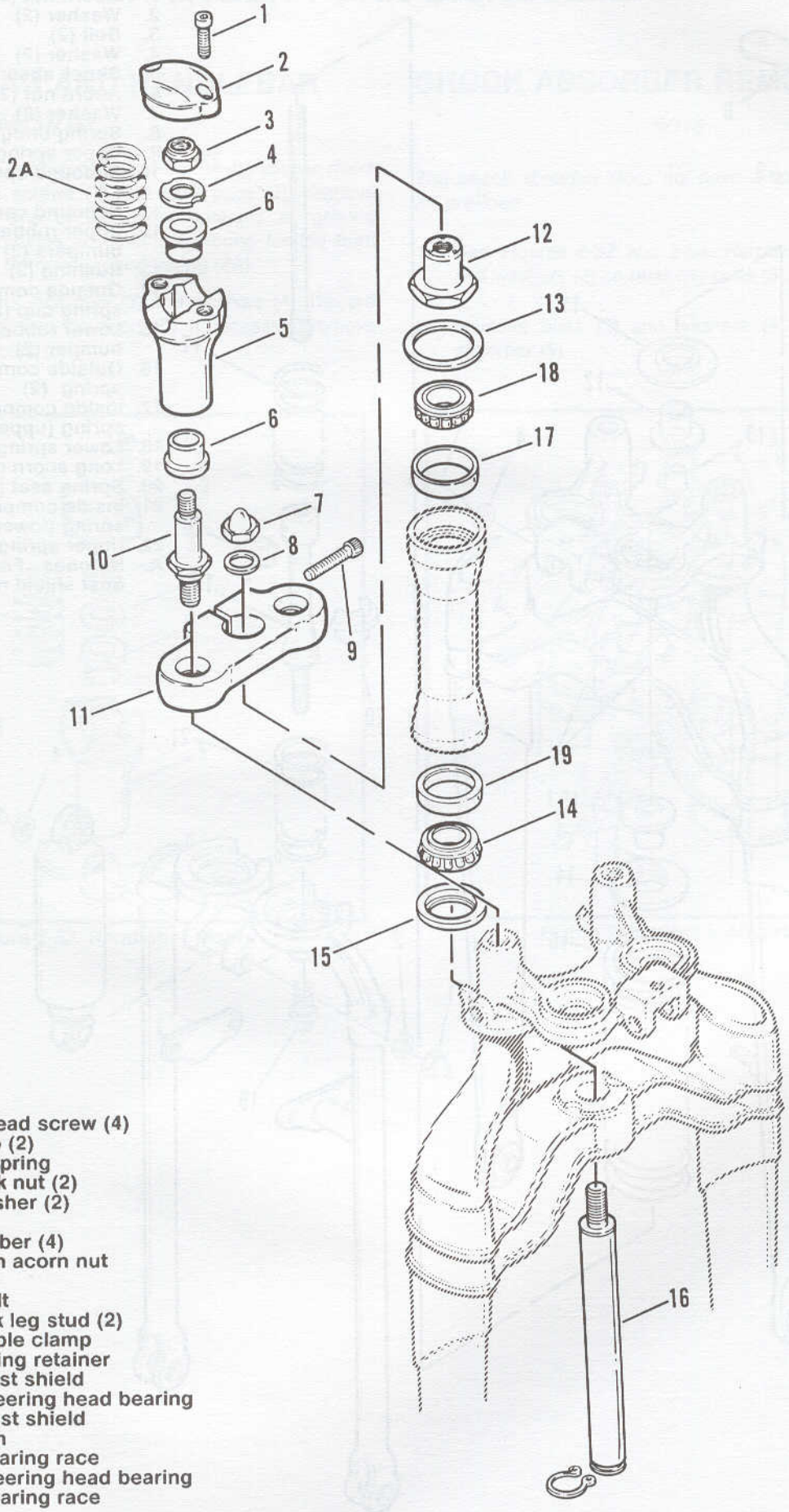
Thoroughly clean and inspect each part. If inspection shows that any parts are bent, broken or damaged, those parts should be repaired or replaced.

1. Inspect friction rings (22) on damper tube (15) and replace if worn excessively or damaged.
2. Check FXSTC dust seal (23) where it rubs on fork tube (8). The tube should show a bright, shining surface, free of scoring or abrasions, and the dust seal should present a good continuous seal and not show excessive wear.
3. Replace either of the springs (7 or 20) if broken.
4. Inspect small hole in lower end of fork 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).

ASSEMBLY (Figures 2-50, 2-51)

Special Tools	Torque Values (ft-lbs)
HD-34634 Seal installation tool	None

1. Install friction rings (22). Place rebound spring (20) on damper tube (15). Insert damper tube into fork tube (8).
2. Insert spring (7) into fork 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 rebound sleeve (21) over end of damper tube (5).
3. Position fork 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). Be sure that the flanged surface of the seal spacer (17) is up and lettered side of the seal is facing upward. Place installation tool HD-34634 over fork slider (12). Bushing (16), spacer (17) and seal (18) are then seated into the slider bore by lightly tapping the components into place with the installation tool. Install retaining ring (11). On FXSTC only, install dust seal (23).
5. Fill fork sides with Harley-Davidson TYPE E FORK OIL in the amount specified under GENERAL.



1. Socket head screw (4)
2. Riser cap (2)
2A. Ground spring
3. Riser lock nut (2)
4. Riser washer (2)
5. Riser (2)
6. Riser rubber (4)
7. Fork stem acorn nut
8. Washer
9. Pinch bolt
10. Rigid fork leg stud (2)
11. Upper triple clamp
12. Hex bearing retainer
13. Upper dust shield
14. Lower steering head bearing
15. Lower dust shield
16. Fork stem
17. Upper bearing race
18. Upper steering head bearing
19. Lower bearing race

Figure 2-52. Springer Fork - 1 of 2

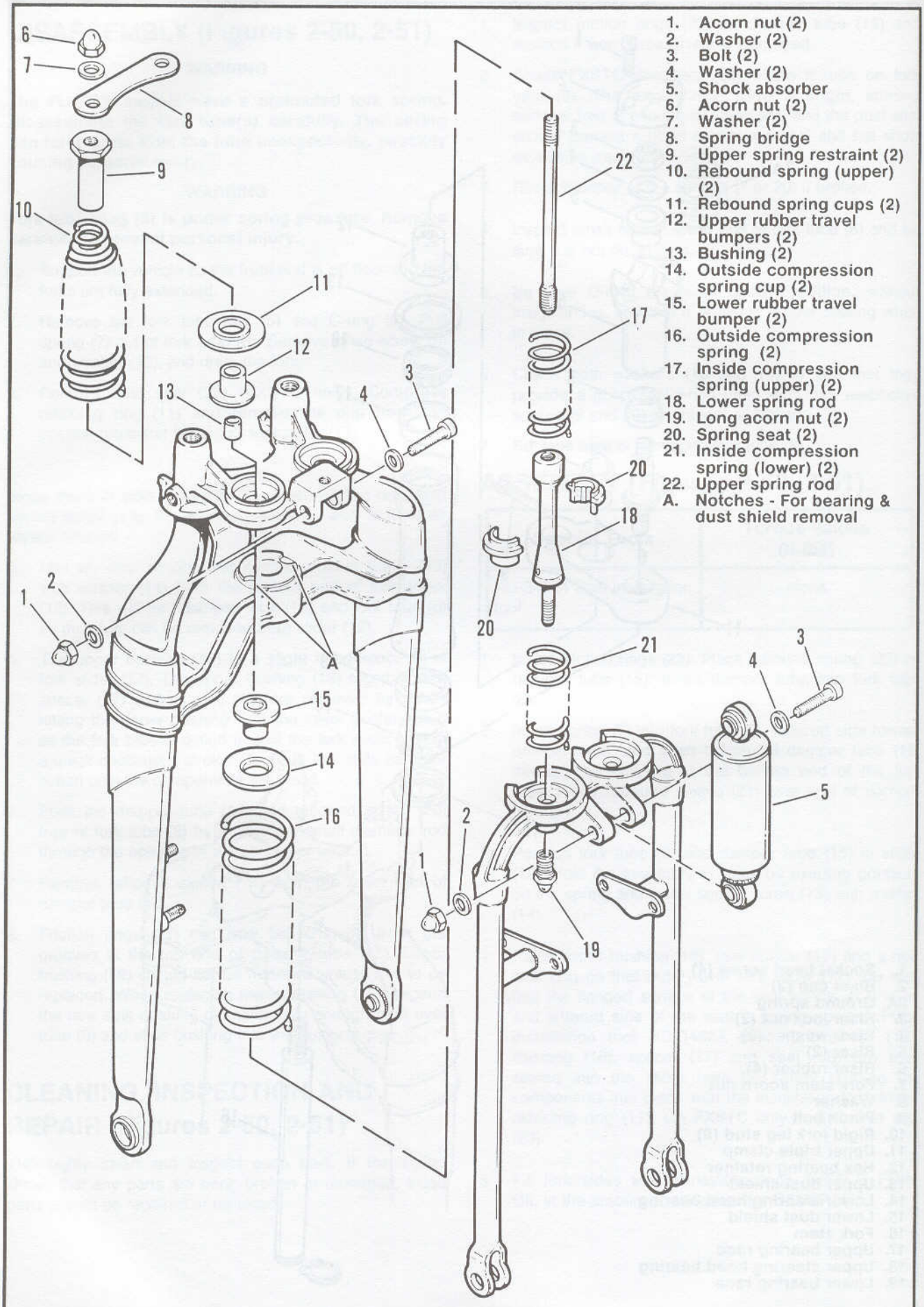


Figure 2-52. Springer Fork - 2 of 2

SPRINGER FORK DISASSEMBLY

HANDLEBAR AND HANDLEBAR RISER REMOVAL

1. See Figures 2-52 and 2-53. Remove handlebar risers socket head screws (1) and riser caps (2). Remove handlebars. One of the risers contains a "ground spring", to provide an electrical ground for the front turn signals. Remove ground spring (2A).
2. Remove risers lock nuts (3) and washers (4). Discard lock nuts. Remove the risers (5). If necessary, remove the riser rubbers (6).

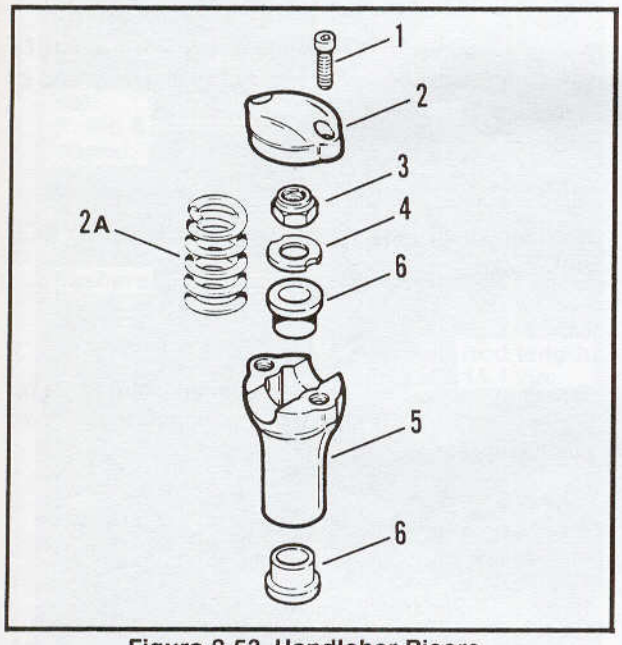


Figure 2-53. Handlebar Risers

SHOCK ABSORBER REMOVAL

NOTE

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

1. See Figures 2-52 and 2-54. Remove acorn nuts (1) and washers (2) on retaining bolts (3).
2. Remove bolts (3) and washers (4). Remove shock absorber (5).

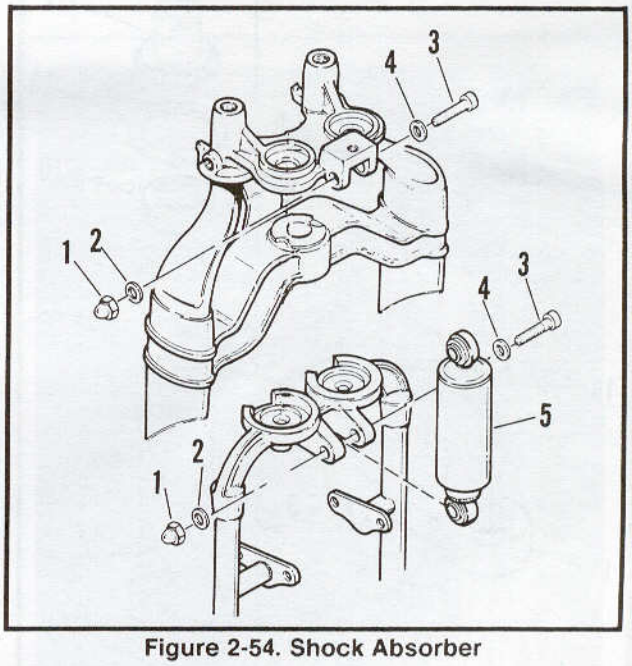


Figure 2-54. Shock Absorber

FORK REMOVAL

NOTE

It is possible to remove the spring fork without removing the entire fork assembly, if you follow steps 1 thru 9 under SPRING FORK DISASSEMBLY.

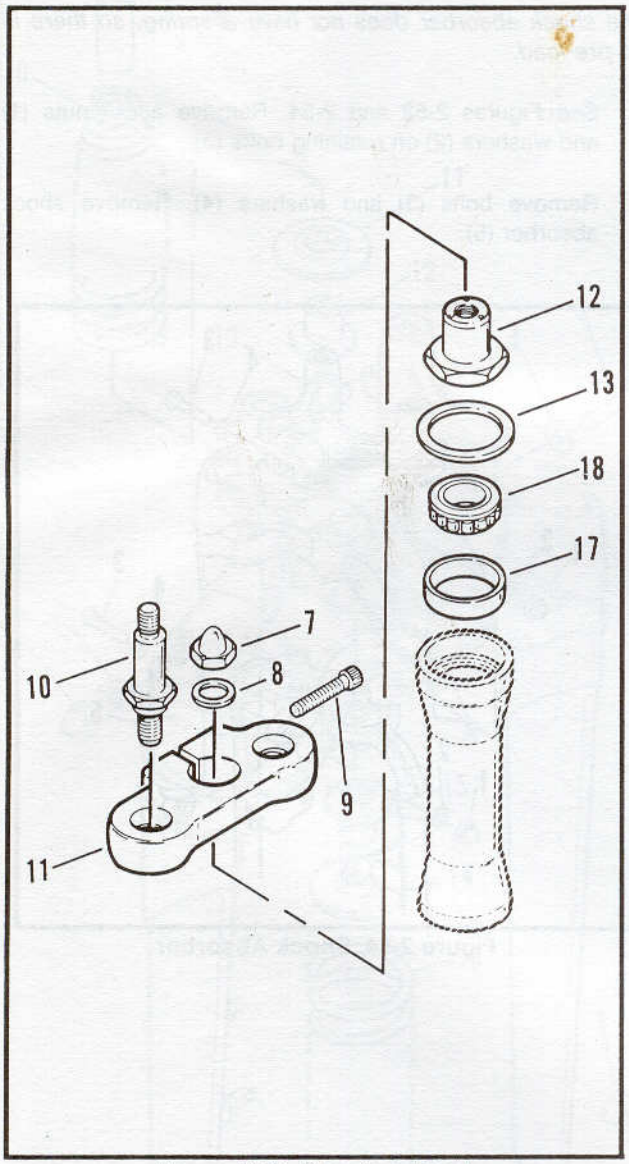


Figure 2-55. Steering Head

1. Block up front of bike so front wheel is off the floor.
2. Remove front brake caliper and brake line. See FXSTS FRONT BRAKE.
3. Remove wheel. See FXSTS FRONT WHEEL.
4. Remove front fender. See FXSTS FRONT FENDER.
5. Remove headlamp & mounting block. See FXSTS HEADLAMP. Move headlamp out of the way and let wire support it.
6. Remove shock absorber. See SHOCK ABSORBER REMOVAL.
7. See Figures 2-52 & 2-55. Remove fork stem acorn nut (7) and washer (8). Loosen the upper triple clamp pinch bolt (9).
8. Remove the rigid fork leg studs (10).
9. Remove upper triple clamp (11).
10. Remove hex bearing retainer (12) and dust shield (13).
11. Remove fork stem & fork from steering head.

SPRING FORK DISASSEMBLY

WARNING

The springs are compressed. If they are released suddenly, they could cause personal injury.

See Figure 2-56. Make a tool as shown.

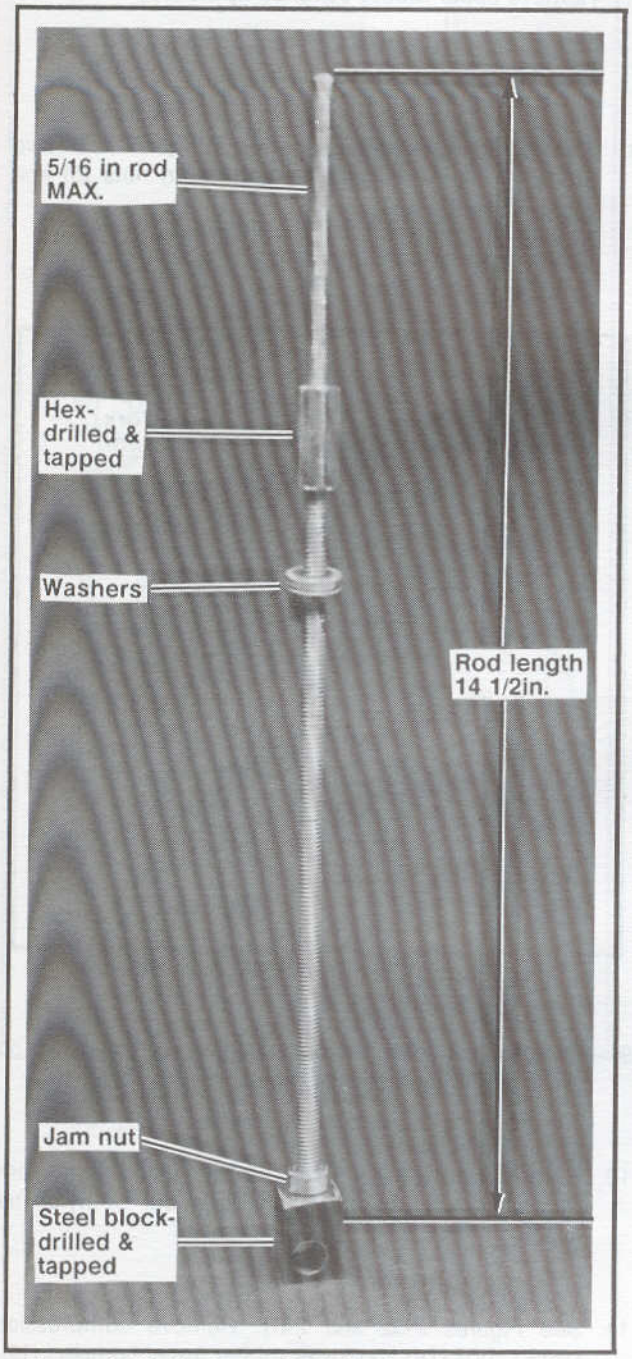


Figure 2-56. Springer Fork Spring Compression Tool

Tool use: (Figure 2-57)

a. Slide the rod, without the long hex nut and washers, into the headlamp mount.
b. Install the block in the bottom shock absorber eye using the shock absorber mounting bolt and washers.
c. Install the washers and long hex nut on the rod.

WARNING

- **If the spring fork legs are not held in place, next to the rigid fork legs, the spring pressure will snap them forward with great force. This could cause injury to personnel.**
- **See Figure 2-58. Use nylon cable ties around the rigid and spring fork legs to hold them in place.**

NOTE

The cable ties do not have to be tight. They only have to restrain the spring fork legs from snapping forward.

1. See Figure 2-57. Use the tool and compress the compression (lower) springs until they bottom on the travel bumpers.

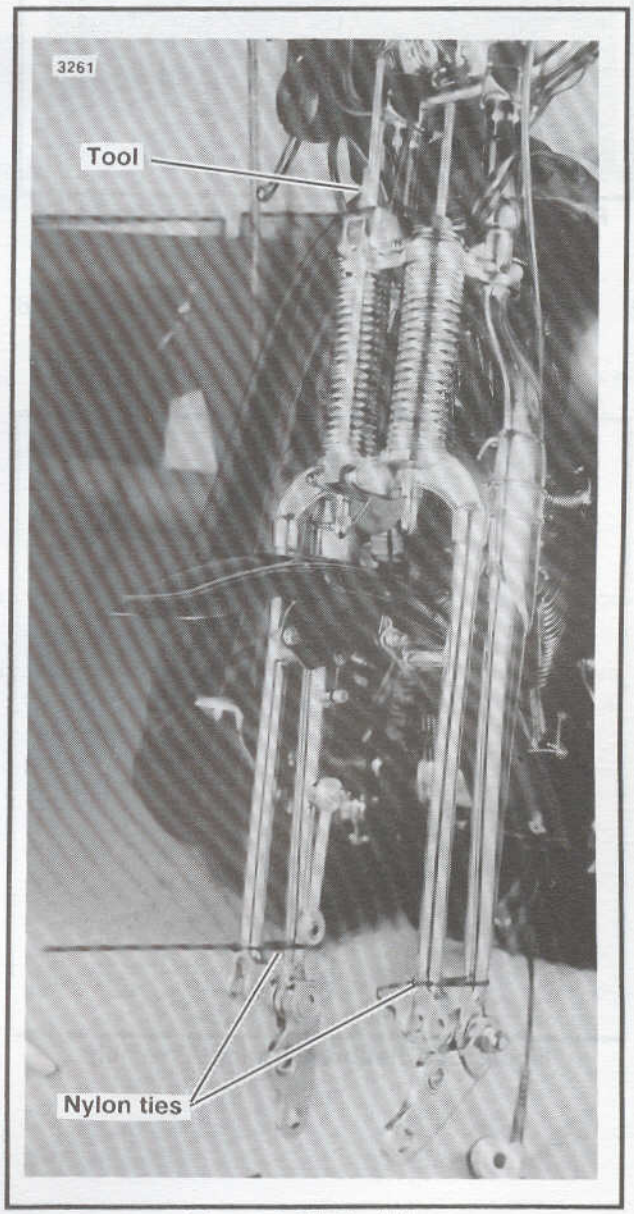


Figure 2-57. Tool Use

NOTE

This will release the pressure on the rebound (upper) springs.

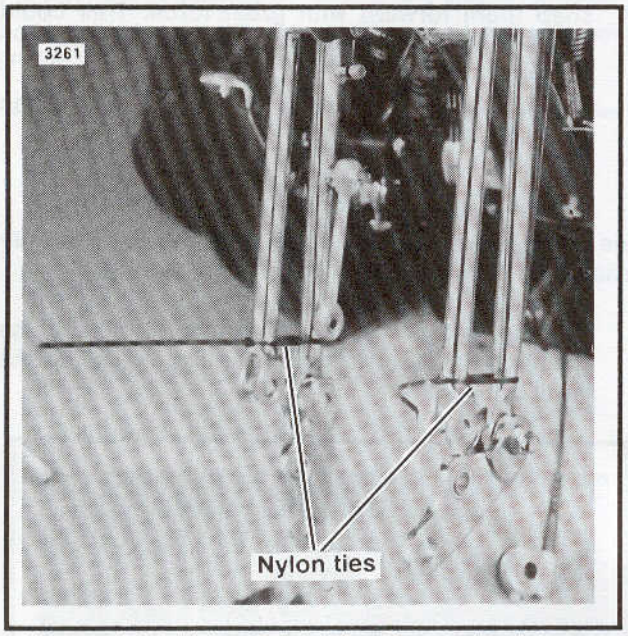


Figure 2-58. Nylon Cable Ties Secure Fork Legs

2. See Figures 2-52 and 2-59. Remove acorn nuts (6), washers (7) and spring bridge (8).

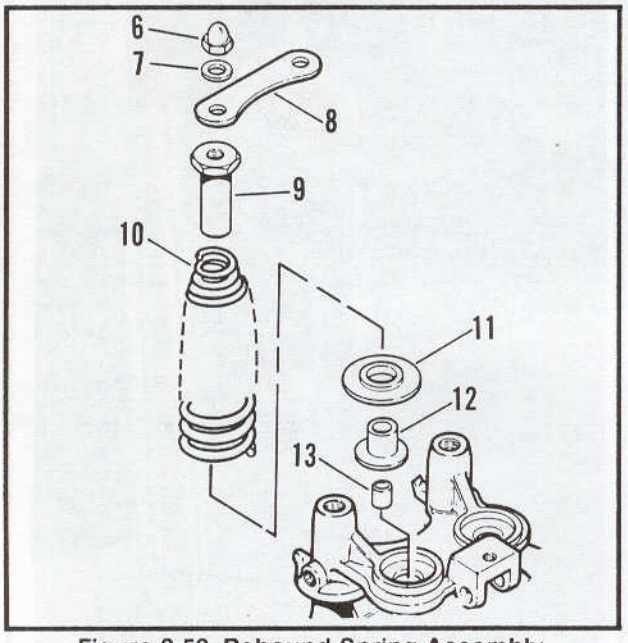


Figure 2-59. Rebound Spring Assembly

3. Remove upper spring restraints (9).

4. Remove upper (rebound) springs (10).

5. Remove rebound spring cups (11).

6. Remove upper rubber travel bumpers (12).

7. Remove bushings (13).

8. See Figure 2-60. Remove spring fork thick head pivot studs (1), thick washers (2) and acorn nuts (3) from rockers (4).

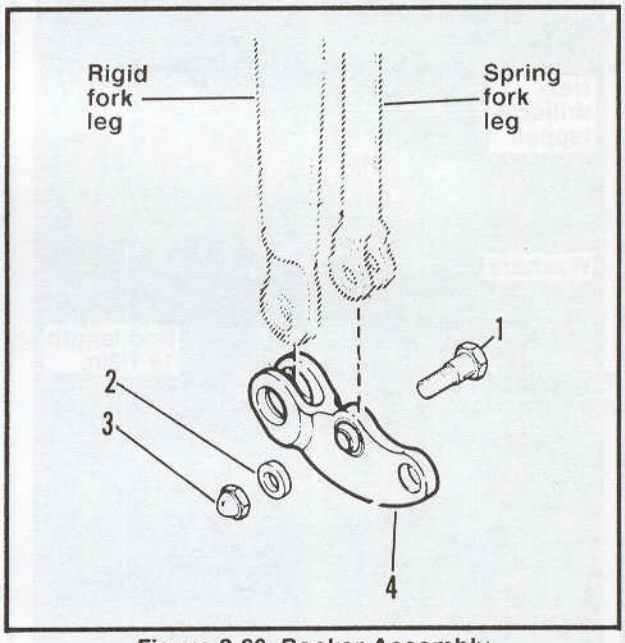


Figure 2-60. Rocker Assembly

9. Unscrew the tool, gradually releasing the tension on the lower (compression) springs.

10. Remove spring fork assembly from rigid fork assembly and rockers. Slide legs out of nylon tie wraps.

11. See Figures 2-52 and 2-61. Remove compression spring cups (14) and lower rubber travel bumpers (15).

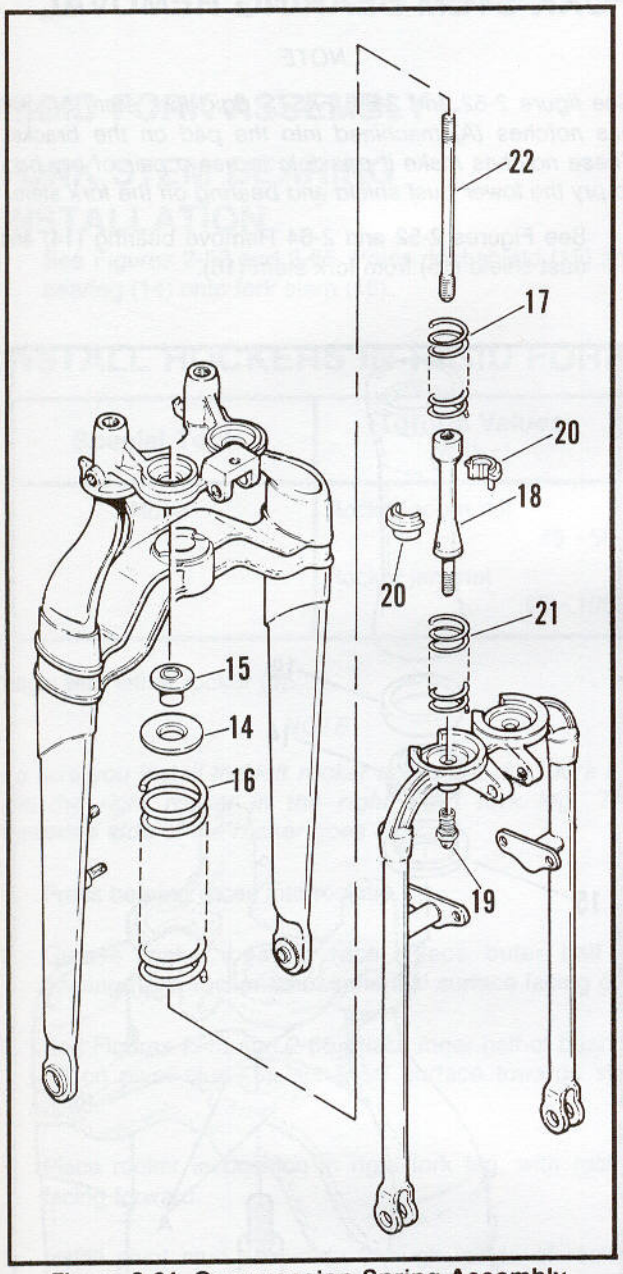


Figure 2-61. Compression Spring Assembly

12. Remove outer compression springs (16).

13. Remove upper, inner compression springs (17).

14. Insert a # 2 Phillips head screwdriver in the cross-hole at the bottom of the lower spring rod (18) and loosen long acorn nuts (19). Remove Phillips head screwdriver. Remove the long acorn nuts (19) and spring rods assembly.

NOTE

Rotate spring to position that allows the easiest access through the coils.

15. Remove spring seats (20) and inside lower compression springs (21) from lower spring rod (18).

CAUTION

- **DO NOT remove the upper spring rods (22) from the lower spring rods (18).**
- **If either the upper spring rod(s) (22) or the lower spring rod(s) (18) are damaged, replace as an assembly.**

ROCKERS REMOVAL

1. See Figure 2-43 and 2-63. Remove jam nuts (6).

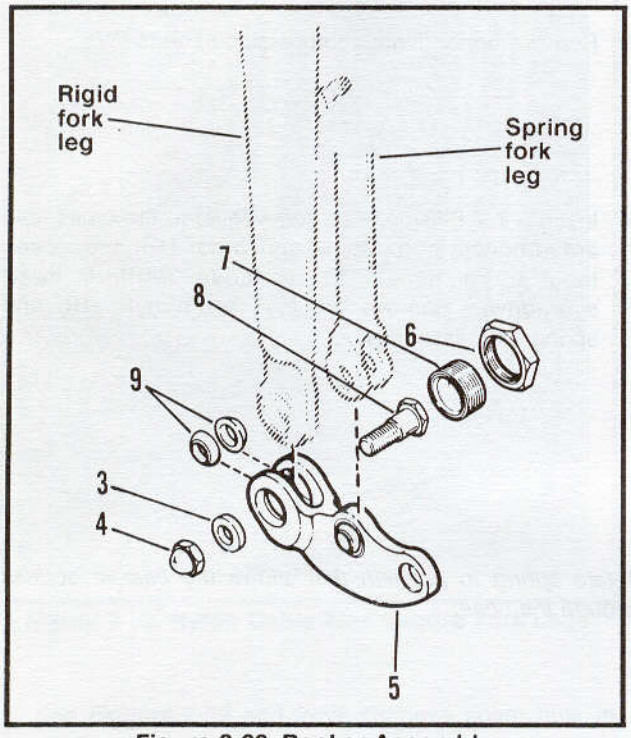


Figure 2-63. Rocker Assembly

2. Remove bearing retainers (7).

3. Remove acorn nuts (4). Remove rigid fork thin head pivot studs (8) from rockers and rigid fork legs. Remove bearings (9) from thin head pivot studs (8).

4. Remove rockers (5).

5. If necessary, remove the bearing races from rockers by laying a bead of weld inside the race.

6. If the race doesn't fall out when you turn the rocker over, use a suitable drift against the weld bead and drive it out.

FORK STEM BEARING REMOVAL

NOTE

See figure 2-52 and 2-64. FXSTS rigid fork stem bracket has notches (A) machined into the pad on the bracket. These notches make it possible to use a pair of pry bars to pry the lower dust shield and bearing off the fork stem.

See Figures 2-52 and 2-64 Remove bearing (14) and dust shield (15) from fork stem (16).

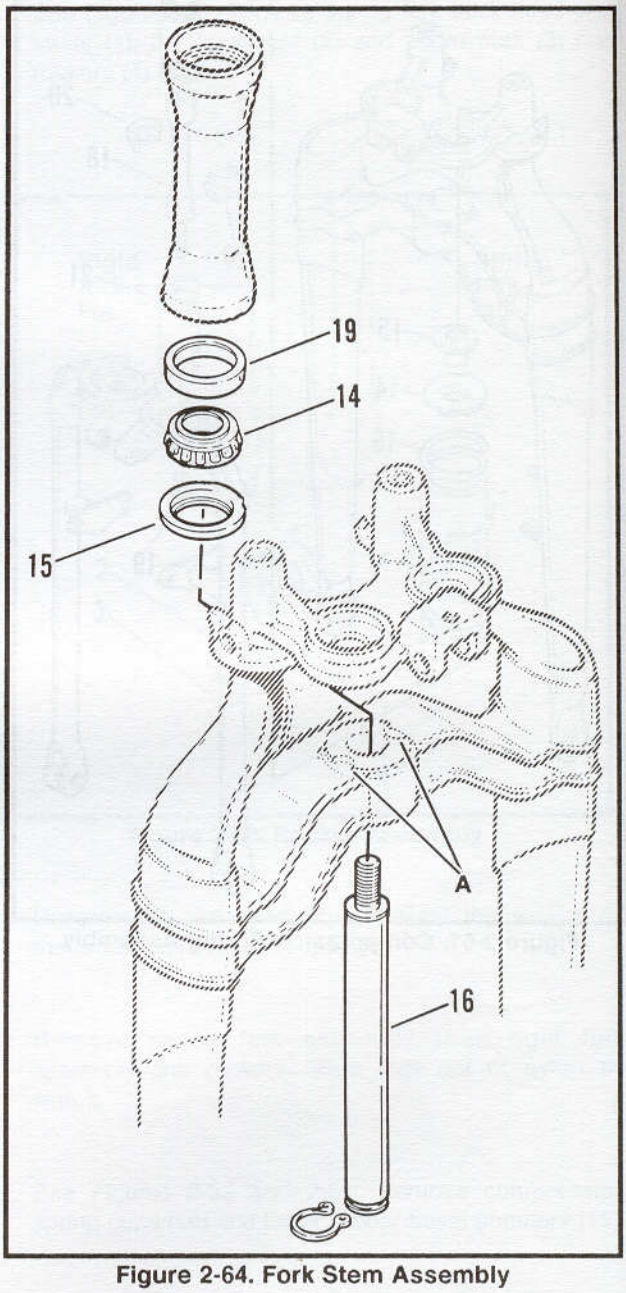


Figure 2-64. Fork Stem Assembly

RIGID FORK ASSEMBLY –

FORK STEM BEARING INSTALLATION

See Figures 2-52 and 2-65. Press dust shield (15) and bearing (14) onto fork stem (16).

INSTALL ROCKERS IN RIGID FORK

Special Tools	Torque Values (ft-lbs)
None	Rocker acorn nut 45 - 50 Rocker jam nut 95 - 105

Begin with either rocker (5).

NOTE

Be sure you install the left rocker in the left rigid fork leg and the right rocker in the right rigid fork leg. The ***threaded side*** *of the rocker goes inboard.*

1. Press bearing races into rockers.
2. Grease rocker bearing race. Place outer half of bearing (9) in rocker race, spherical surface facing out.
3. See Figures 2-43 and 2-65. Place inner half of bearing (9) on pivot stud (8), spherical surface towards stud head.
4. Place rocker in position in rigid fork leg, with rocker facing forward.
5. Install pivot stud assembly through inside of rocker, rigid fork leg, bearing and outside of rocker.
6. Install thick washer (3) and acorn nut (4). Use Loctite 242 (blue). Tighten acorn nut to 45-50 ft-lbs torque.
7. Apply anti-seize to threads of bearing retainer (7). Grease race. Install bearing retainer. Tighten retainer one (1) flat past contact. See ADJUSTMENTS.
8. Secure bearing retainer by installing jam nut (6). Tighten jam nut to 95-105 ft-lbs torque.

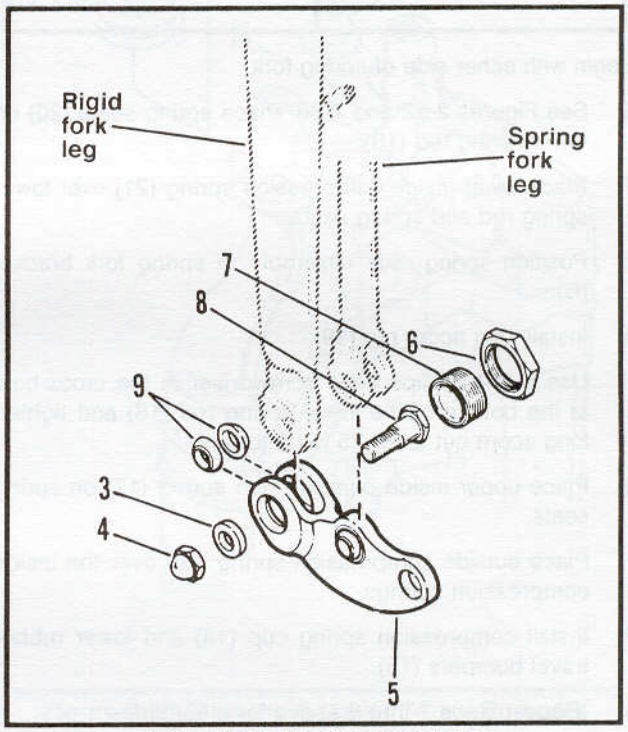


Figure 2-65. Rocker Assembly

NOTE

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

NOTE

Approximately 1/16 in. of retainer will protrude from jam nut when parts are properly assembled.

9. Install other rocker by following steps 1 thru 8, above.

SPRING FORK ASSEMBLY

Special Tools	Torque Values (ft-lbs)
None	Long acorn nut 20 - 25 Pivot stud acorn nut 45 - 50 spring bridge acorn nut 30 - 35

Begin with either side of spring fork.

1. See Figures 2-52 and 2-66. Place spring seats (20) on lower spring rod (18).
2. Place lower inside compression spring (21) over lower spring rod and spring seats.
3. Position spring rods assembly in spring fork bracket (B).
4. Install long acorn nut (19).
5. Use a # 2 Phillips head screwdriver in the cross-hole at the bottom of the lower spring rod (18) and tighten long acorn nut to 20-25 ft-lbs torque.
6. Place upper inside compression spring (17) on spring seats.
7. Place outside compression spring (16) over the inside compression springs.
8. Install compression spring cup (14) and lower rubber travel bumpers (15).
9. Repeat steps 1 thru 8 above for other side.
10. Position spring fork assembly in rigid fork assembly so lower springs, lower rubber travel bumpers and spring cups are at the bottom of the rigid fork spring brace. Be sure the spring fork legs are in the nylon cable ties.

CAUTION

Be sure lower rubber travel bumpers are properly seated in the rigid fork.

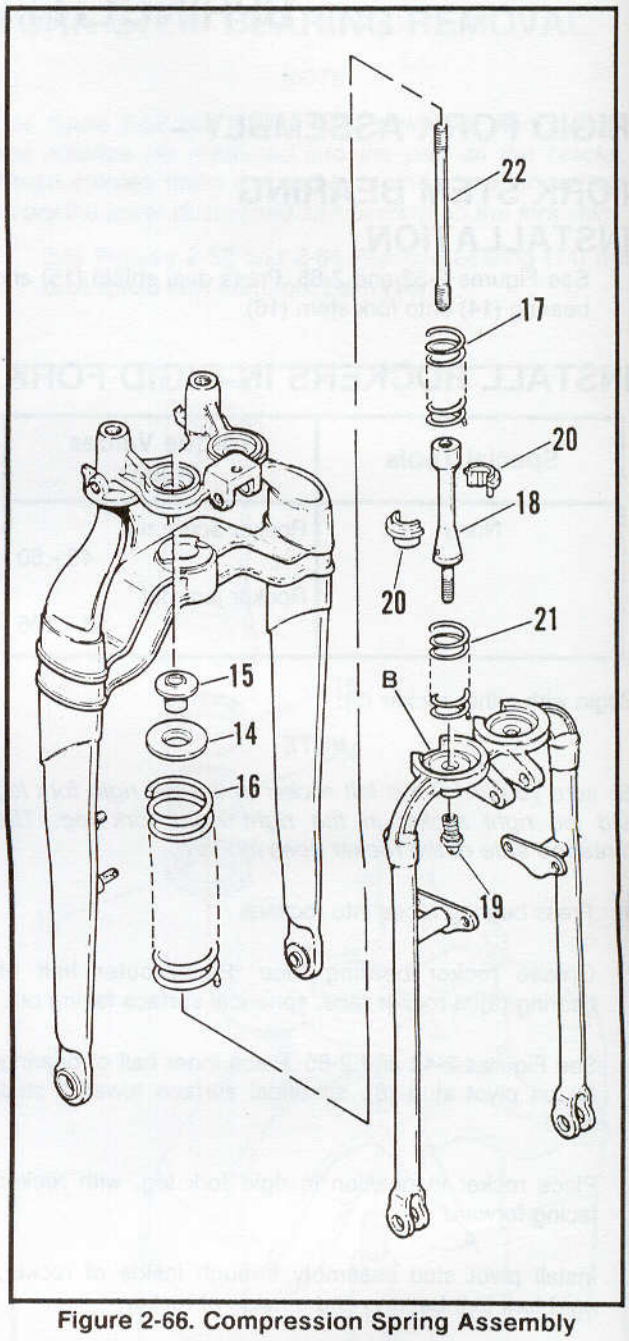


Figure 2-66. Compression Spring Assembly

11. Use the compression tool and compress the compression (lower) springs.

12. See Figures 2-43 and 2-67. Place spring fork lower end in position in rocker (4).

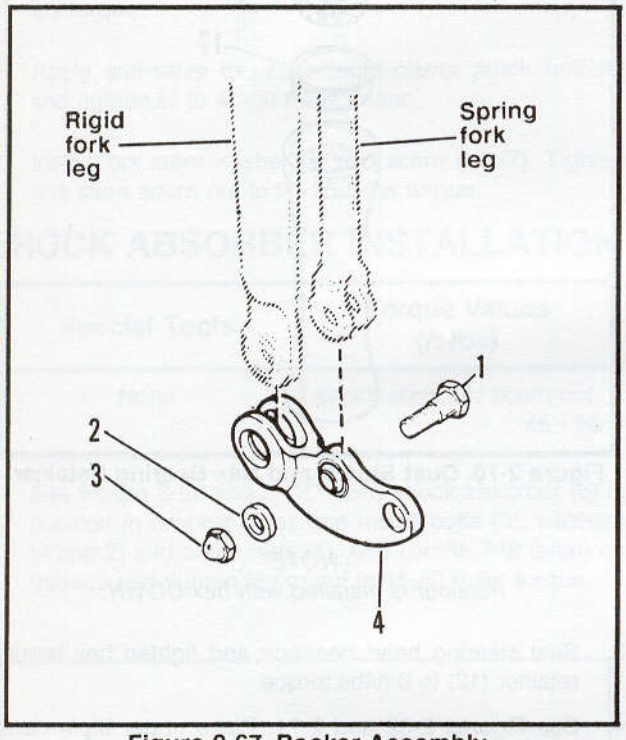


Figure 2-67. Rocker Assembly

13. Install thick head pivot stud (1) with thick washer (2) and acorn nut (3). Tighten acorn nut to 45-50 ft-lbs torque.

14. Repeat steps 12 and 13 for other side.

15. See Figures 2-52 and 2-68. Oil bushing (13) and place on spring rod. Slide bushing down until it bottoms in lower rubber travel bumpers (15).

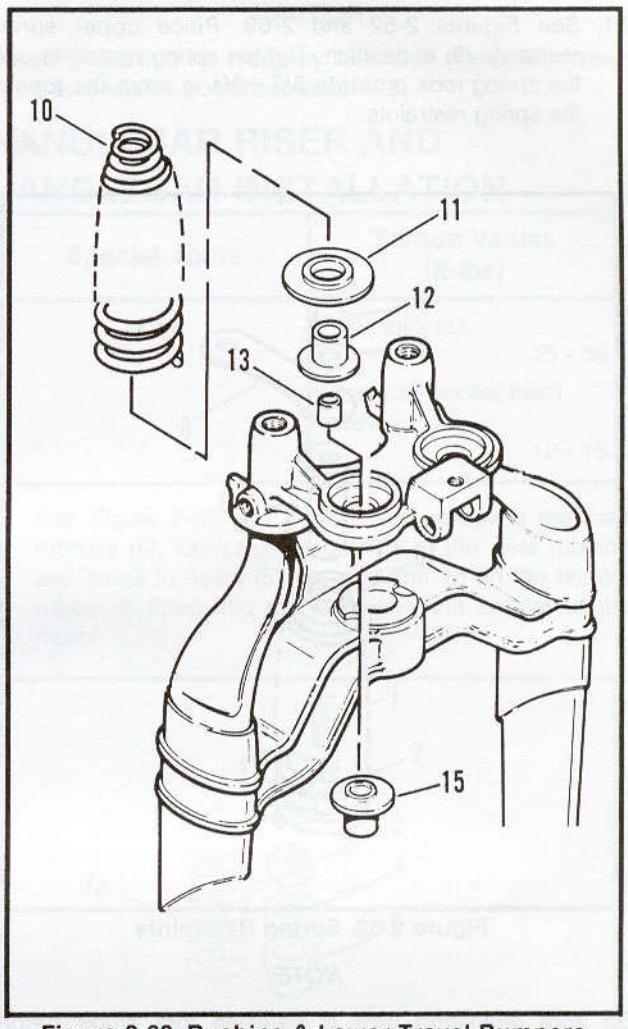


Figure 2-68. Bushing & Lower Travel Bumpers

16. Install upper rubber travel bumpers (12) over spring rod and bushing.

17. Install rebound spring cup (11).

18. Install rebound spring (10).

19. Repeat steps 15 thru 18 for other side.

20. Apply anti-seize to top 1/2 in. of upper spring rods.

21. See Figures 2-52 and 2-69. Place upper spring restraints (9) in position. Tighten spring restraints until the spring rods protrude 5/8 - 3/4 in. from the tops of the spring restraints.

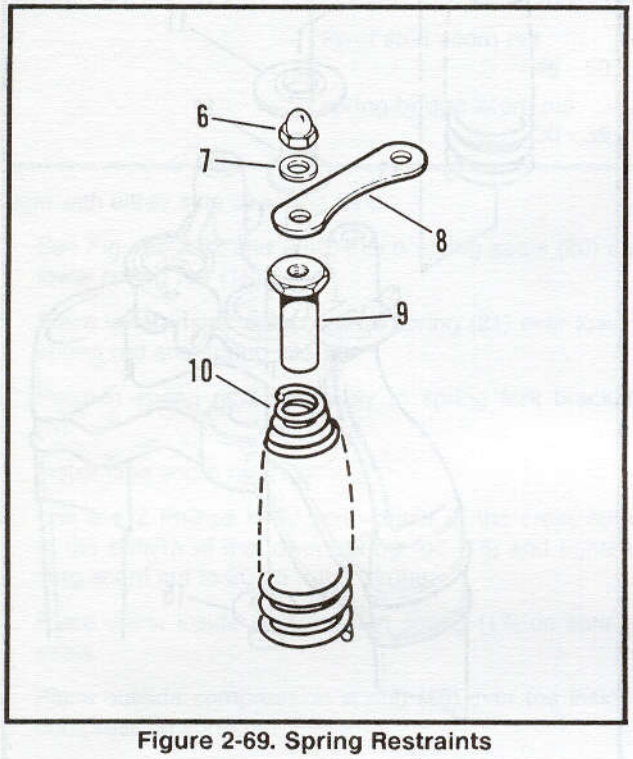


Figure 2-69. Spring Restraints

NOTE

Be sure headlamp wire is between fork studs before installing upper triple clamp.

NOTE

Curved edge of spring bridge goes forward.

22. Place spring bridge (8) in position. Install washers (7) and acorn nuts (6). Tighten acorn nuts to 30-35 ft-lbs torque.

FORK INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Hex bearing retainer 6 Rigid fork leg stud 45 - 50 Fork stem acorn nut 20 - 25

1. Place fork stem in steering head.
2. See Figures 2-52 and 2-70. Install dust shield (13) and hex bearing retainer (12).

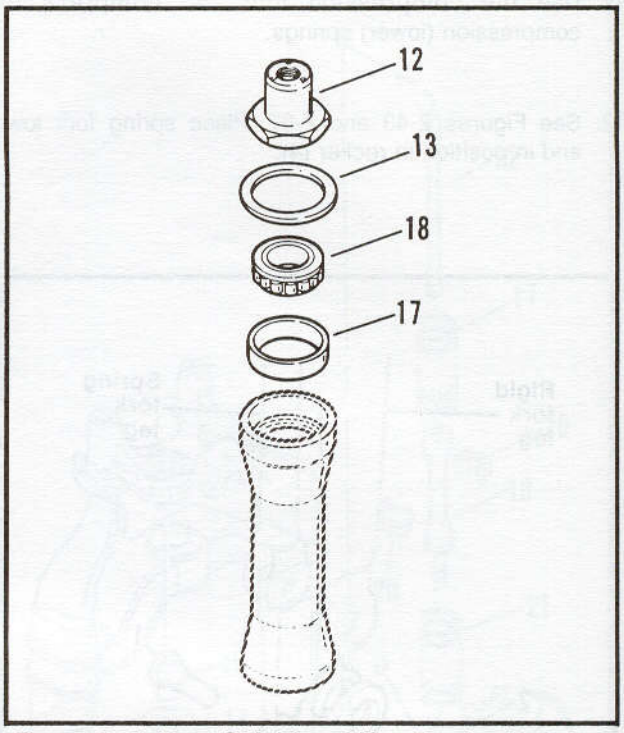


Figure 2-70. Dust Shield and Hex Bearing Retainer

NOTE

Retainer is installed with hex DOWN.

3. Seat steering head bearings and tighten hex bearing retainer (12) to 6 ft/lbs torque.
4. See Figures 2-52 and 2-71. Place upper triple clamp (11) in position on stem and rigid fork legs.

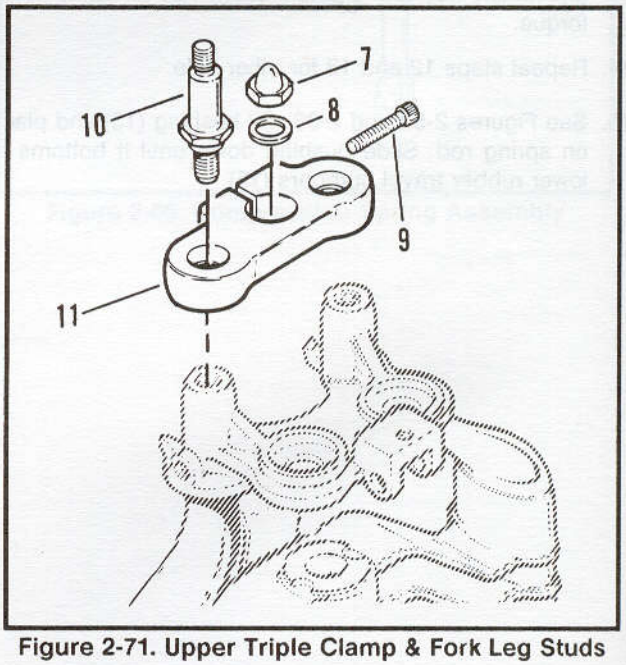


Figure 2-71. Upper Triple Clamp & Fork Leg Studs

NOTE

Install rigid fork leg studs (10) in 3 (three) steps.

a. Start threads of both studs in fork leg.

b. Tighten both.

c. Torque both.

5. Install rigid fork leg studs (10) and tighten to 60-65 ft-lbs torque.

6. Apply anti-seize to upper triple clamp pinch bolt (9) and tighten to to 45-50 ft-lbs torque.

7. Install fork stem washer (8) and acorn nut (7). Tighten fork stem acorn nut to 20-25 ft-lbs torque.

SHOCK ABSORBER INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Shock absorber acorn nut 45 - 50

1. See Figure 2-52 and 2-72. Place shock absorber (5) in position in bracket holes and install bolts (3), washers (4 and 2) and acorn nuts (1). Use Loctite 242 (blue) on threads and tighten acorn nut to 45-50 ft-lbs torque.

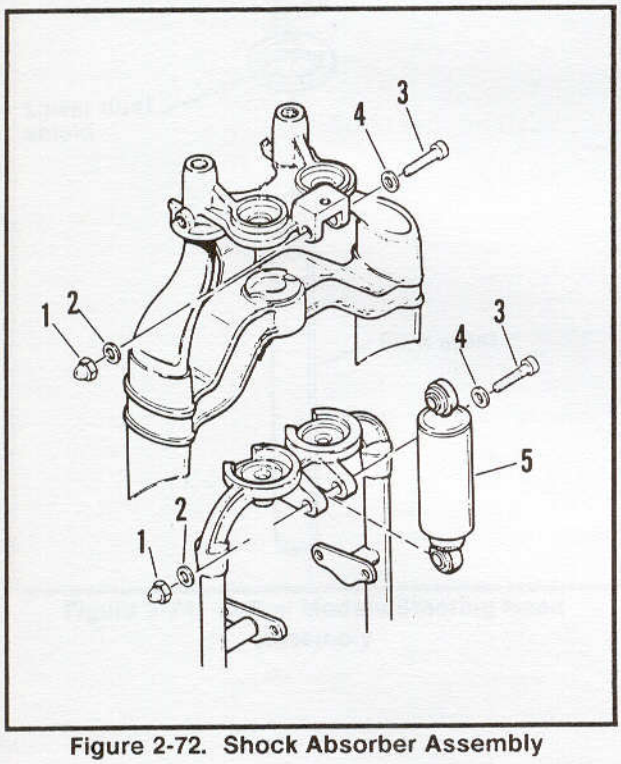


Figure 2-72. Shock Absorber Assembly

CAUTION

Be sure there is no freeplay between shock absorber eyes and shock absorber brackets.

HANDLEBAR RISER AND HANDLEBAR INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Riser lock nut 25 - 35 Riser cap socket head screw 12 - 15

1. See Figure 2-52 and 2-73. If you removed the riser rubbers (6), lubricate the outside of the riser rubbers and install in risers (5). Be sure the lip on the bottom rubber is fitted into the recess in the bottom of the riser.

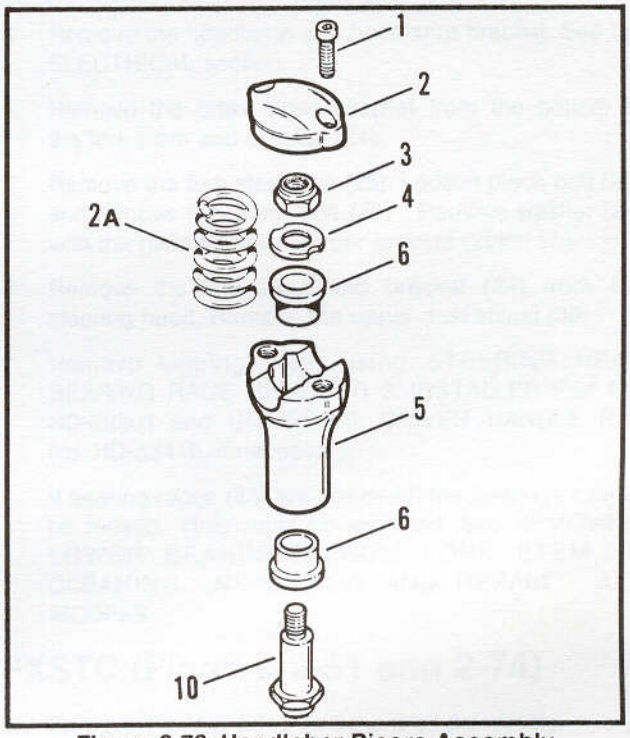


Figure 2-73. Handlebar Risers Assembly

2. Place the risers (5) in position over the rigid fork leg studs (10).

NOTE

Be sure the risers are correctly oriented for the handlebars.

NOTE

Place the cutouts in the washers (4) on the bosses inside the risers so that when the lock nuts are tightened, the bosses are centered in the washer cutouts.

3. Install the washers (4) and NEW lock nuts (3). Tighten lock nuts to 25-35 ft-lbs torque. Place ground spring (2A) in one of the risers.

4. Place handlebars on risers and put riser caps (2) in position. Install socket head screws (1). Make the gap between caps and risers even, front and rear. Adjust handle bars and tighten socket head screws to 12-15 ft-lbs torque.
5. Install wheel. See FRONT WHEEL.
6. Install Brake. See FRONT BRAKE.
7. Install headlamp & mounting block. See HEADLAMP.
8. Adjust steering head bearings. See ADJUSTMENTS.

STEERING HEAD ASSEMBLY

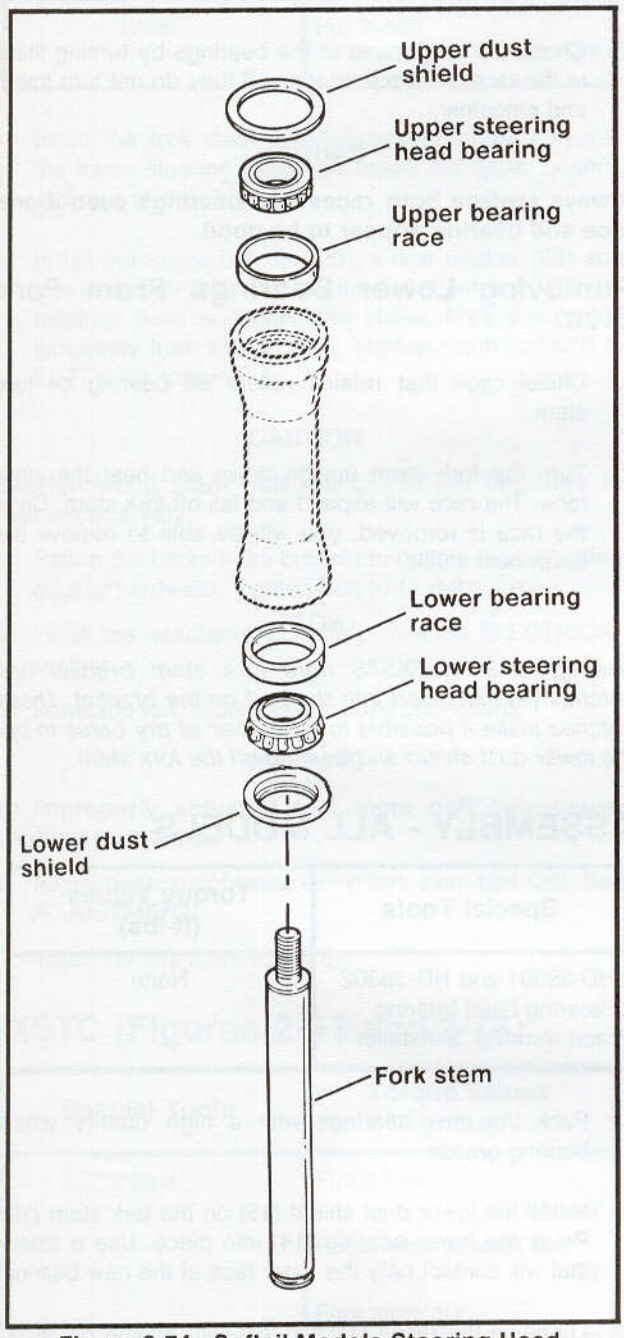


Figure 2-74. Softail Models Steering Head Assembly

REMOVAL/DISASSEMBLY - FLSTC/F (Figures 2-50 and 2-74)

Special Tools	Torque Values (ft-lbs)
HD-39301 Steering head bearing race remover & installer HD-33416 Universal driver handle	None

1. Remove fork shrouds.
2. Remove the fork sides as described previously.
3. Remove the headlamp and headlamp bracket. See the ELECTRICAL section.
4. Remove the brake hose bracket from the bottom of the fork stem and bracket (24).
5. Remove the fork stem cap (25). Loosen pinch bolt (27) and remove fork stem bolt (26) . Remove washer (28) with the handlebar and upper bracket (29).
6. Remove the fork stem and bracket (24) from the steering head. Remove the upper dust shield (30).
7. Remove bearings (32) using STEERING HEAD BEARING RACE REMOVER & INSTALLER Part No. HD-39301 and UNIVERSAL DRIVER HANDLE Part No. HD-33416, if necessary.

   If bearing races (33) are removed, the bearings cannot be reused. They must be replaced. See REMOVING LOWER BEARINGS FROM FORK STEM, in CLEANING, INSPECTION AND REPAIR - ALL MODELS.

FXSTC (Figures 2-51 and 2-74)

1. Remove the fork sides as described previously.
2. Remove the headlamp and headlamp bracket.
3. Remove the brake hose bracket from the bottom of the fork stem bracket (24).
4. Remove the fork stem cap (25). Bend the lockwasher (28) tab away from the fork stem nut (26) and remove the fork stem nut with the handlebar and upper bracket (29).
5. Remove the adjusting nut (34) and pull the fork stem and bracket (24) out of the steering head. Remove the upper dust shield (30).

6. Remove bearings (32) using STEERING HEAD BEARING RACE REMOVER & INSTALLER Part No. HD-39301 and UNIVERSAL DRIVER HANDLE Part No. HD-33416, if necessary.

   If bearing races (33) are removed, the bearings cannot be reused. They must be replaced. See REMOVING LOWER BEARINGS FROM FORK STEM, in CLEANING, INSPECTION AND REPAIR - ALL MODELS.

FXSTS (Figures 2-52, 2-74 & 2-75)

1. Remove fork from steering head as described under FORK REMOVAL.
2. Remove upper bearing dust shield (13).

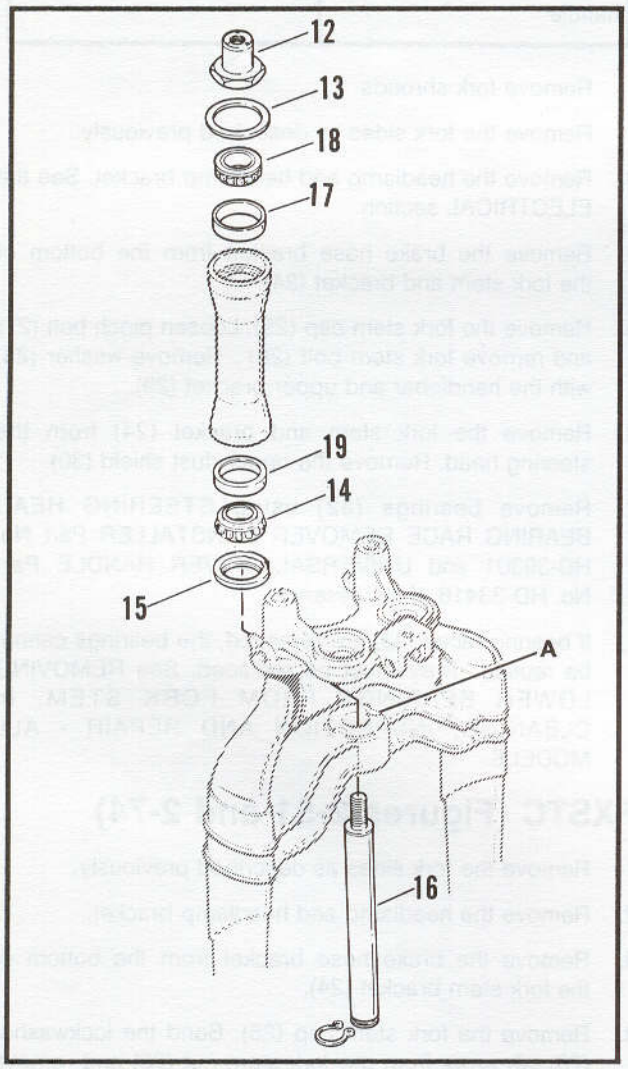


Figure 2-75. FXSTS Steering Head Assembly

3. Remove bearings (14 and 18) and lower dust shield (15), if necessary. If bearing races (17 and 19) are removed, the bearings cannot be reused. They must be replaced.

CLEANING, INSPECTION AND REPAIR - ALL MODELS

1. Check upper and lower bearing races in steering head. If they are pitted or grooved, replace the bearings and races in sets.
2. Check the roughness of the bearings by turning them in the race. Replace bearings if they do not turn freely and smoothly.

CAUTION

Always replace both races and bearings even if one race and bearing appear to be good.

Removing Lower Bearings From Fork Stem

1. Chisel cage that retains rollers off bearing on fork stem.
2. Turn the fork stem upside down and heat the inner race. The race will expand and fall off fork stem. Once the race is removed, you will be able to remove the lower dust shield.

NOTE

See figure 2-71. FXSTS rigid fork stem bracket has notches (A) machined into the pad on the bracket. These notches make it possible to use a pair of pry barss to pry the lower dust shield and bearing off the fork stem.

ASSEMBLY - ALL MODELS

Special Tools	Torque Values (ft-lbs)
HD-39301 and HD-39302 Steering head bearing race remover & installer	None

1. Pack the new bearings with a high quality wheel bearing grease.
2. Install the lower dust shield (15) on the fork stem (16). Press the lower bearing (14) into place. Use a sleeve that will contact only the inner race of the new bearing.
3. Lubricate the races (17 and 19) with engine oil. Install the new races using STEERING HEAD BEARING RACE REMOVER & INSTALLER Part No's. HD-39301 and HD-39302.

   Be sure you don't damage the new races' tapered surface. The race should be firmly seated against the shoulder in the bore. If it is loose, the steering head adjustment will become loose, affecting the vehicles' handling characteristics.

INSTALLATION - FLSTC/F (Figure 2-50, 2-74)

Special Tools	Torque Values (ft-lbs)
None	Pinch bolt 21 - 27

1. Insert the fork stem and bracket assembly (24) into the frame steering head and install the upper bearing and dust shield (30).
2. Install the upper bracket (29), a new washer (28) and fork stem bolt (26). Tighten the fork stem bolt until the bearings have no noticeable shake. Fork stem must turn freely from side to side. Tighten pinch bolt (27) to 21-27 ft-lbs torque.

CAUTION

Overtightening stem bolt will cause the bearings to wear excessively.

3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 11 ft-lbs torque.
4. Install the headlamp assembly. See the ELECTRICAL section.
5. Install the fork sides as described previously.

WARNING

An improperly adjusted fork stem bolt may cause handling problems.

6. Adjust bearing tightness using fork stem bolt (26). See ADJUSTMENT.
7. Install the fork stem cap (25).

FXSTC (Figures 2-51 and 2-74)

Special Tools	Torque Values (ft-lbs)
None	Pinch bolt 21 - 27 Brake hose bracket bolt 11 Fork stem nut 35 - 40

1. Insert the fork stem bracket assembly (24) into the frame steering head and install the upper bearing and dust shield (30). Secure with the adjusting nut (34). Tighten the bearing seat until the bearings have no noticeable shake. Fork stem must turn freely from side to side.

CAUTION

Overtightening adjusting nut will cause the bearings to wear excessively.

2. Install the upper bracket (29), a new lockwasher (28) and fork stem nut (26). Be sure pin on lockwasher registers in upper bracket hole. Tighten the nut (26) securely. Tighten pinch bolt (27) to 21-27 ft-lbs torque.
3. Fasten the brake hose bracket to bottom bracket using original hardware. Tighten bolt to 11 ft-lbs torque.
4. Install the headlamp assembly.
5. Install the fork sides as described previously.

WARNING

An improperly adjusted fork stem nut may cause handling problems.

6. Adjust bearing tightness using adjusting nut (34). See ADJUSTMENT.
7. Tighten fork stem nut (26) to 35 - 40 ft-lbs torque. Bend the lockwasher (28) tab against the nut (26) flat.
8. Install the fork stem cap (25).

FXSTS (Figures 2-52, 2-74 & 2-75)

1. Insert fork stem assembly into frame steering head. Install upper bearing (17) and dust shield (13).

CAUTION

Overtightening hex bearing retainer will cause the bearings to wear excessively.

WARNING

An improperly adjusted hex bearing retainer may cause handling problems.

2. Tighten hex bearing retainer (12) so forks have no noticeable shake and turn left and right freely.
3. Adjust bearing tightness using hex bearing retainer (12). See ADJUSTMENT.

REAR FORK

REMOVAL (Figure 2-76)

1. Remove the rear wheel as described under REAR WHEEL earlier in this section.
2. Remove belt guard. Remove rear brake caliper and mounting bracket as described under REAR BRAKE CALIPER earlier in this section.
3. Remove the rear shock absorber bolts (8) only. See the instructions under REAR SHOCK ABSORBER later in this section.
4. Remove hardware holding canister (California models) to swing axis tube (11). Note location of flat on swing axis tube for assembly.
5. Remove the bolts (4) that are threaded into each end of the swing axis tube (11). Removing the bolts will free lockwasher (5), spacer (3) and swing axis tube (11). The rear fork (2) can now be pulled free of frame (1).

CLEANING, INSPECTION AND REPAIR (Figure 2-76)

The spherical bearings (6) are lifetime lubricated and will require no further attention other than cleaning. The sleeve type spherical bearings, if not damaged, will last the life of the vehicle. Clean the bearing bore with a clean shop towel, removing any dirt or grit adhering to the bearing surface

Rough check the rear fork for correct alignment. A bent swing arm must be replaced.

INSTALLATION (Figure 2-76)

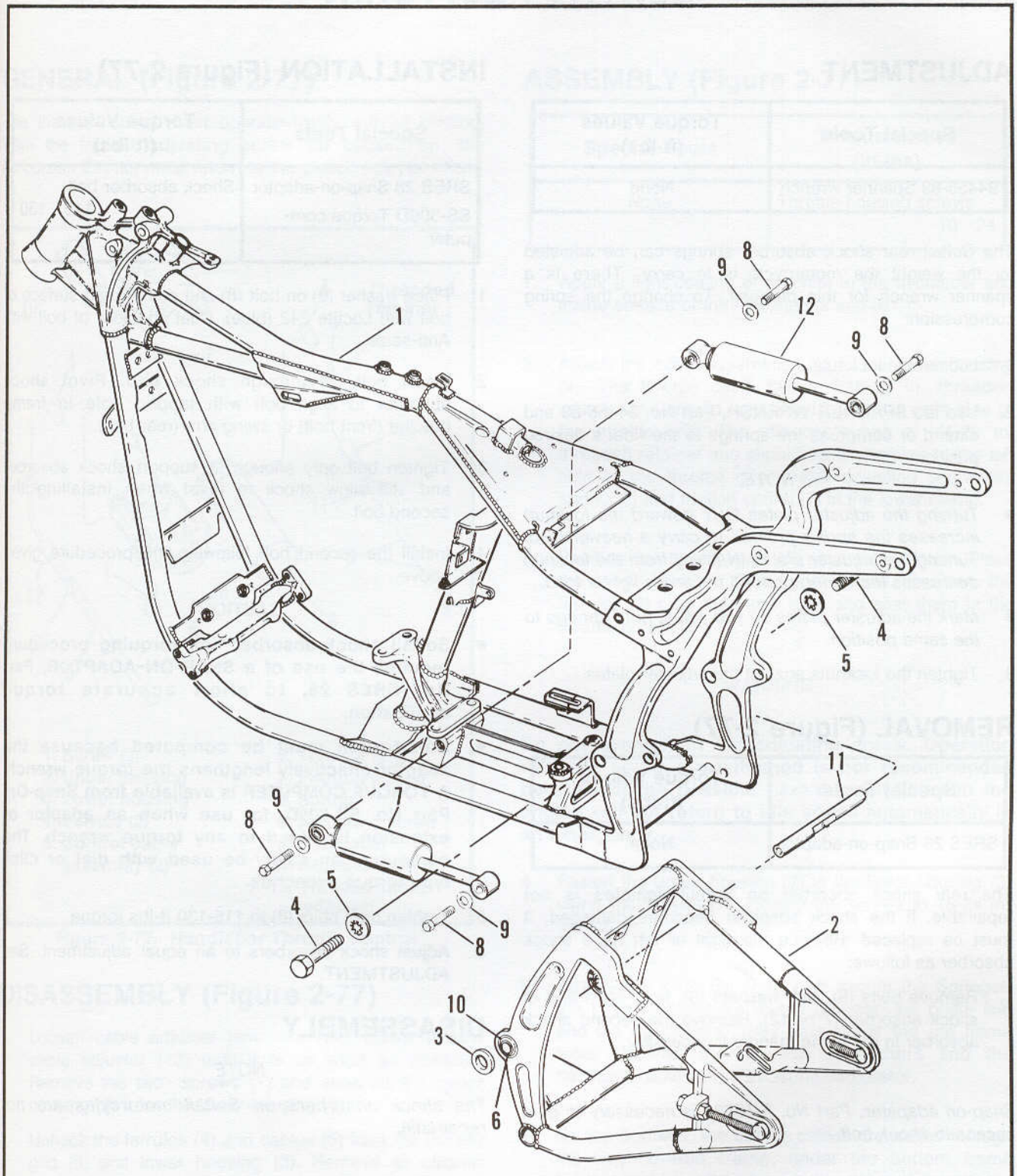
Special Tools	Torque Values (ft-lbs)
None	Swing axis tube bolt 120 - 150

1. Place rear fork (2) in the frame so that the bores in the frame align with the bores in the fork and spacers (3) are positioned between the fork and the frame.
2. Hold swing axis tube (11) in position between the rear fork bores. Place lockwashers (5) onto bolts (4). Insert bolts (4) through the frame bore, through spacer (3), through spherical bearings (6) and thread into each tapped end of swing axis tube (11). Hold the swing axis tube with a wrench at the two flats provided and tighten bolts (4) evenly to 120-150 ft-lbs torque.

CAUTION

Proper pivot bolt tightening is important to maintain rear fork alignment.

3. Check for freedom of rotation of the rear fork around the bearings and that the fork and frame side members have not been distorted when the pivot bolts were tightened.
4. Install hardware holding canister (California models), brake caliper and rear wheel.
5. Install rear shock absorber and shock absorber bolts (8), See SHOCK ABSORBER INSTALLATION.



1. Frame
2. Fork
3. Spacer
4. Pivot bolt
5. Lockwasher
6. Spherical bearing
7. Shock absorber, left
8. Bolt
9. Washer
10. Snap ring
11. Swing axis tube
12. Shock absorber, right

Figure 2-76. Rear Fork and Shock Assembly –Softail Models

REAR SHOCK ABSORBERS

ADJUSTMENT

Special Tools	Torque Values (ft-lbs)
94455-89 Spanner wrench	None

The Softail rear shock absorber springs can be adjusted for the weight the motorcycle is to carry. There is a spanner wrench for this purpose. To change the spring compression:

1. Loosen the locknuts.
2. Use the SPANNER WRENCH, Part No. 94455-89 and extend or compress the springs to the rider's desired position.

NOTE

- *Turning the adjuster plates OUT (toward the locknut) increases the spring preload to carry a heavier load. Turning the adjuster plates IN (away from the locknut) decreases the spring preload to carry a lighter load.*
- *Mark the adjuster plates so you adjust both springs to the same position.*

3. Tighten the locknuts against the adjuster plates.

REMOVAL (Figure 2-77)

Special Tools	Torque Values (ft-lbs)
SRES 28 Snap-on-adaptor	None

The rear shock absorber on Softail vehicles is not repairable. If the shock absorber becomes damaged, it must be replaced. Replace the right or left hand shock absorber as follows:

1. Remove bolts (8), with washers (9), from each end of shock absorber (7 or 12). Remove the second shock absorber in the same manner if necessary.

NOTE

Snap-on adapater, Part No. SRES28 is necessary to gain access to shock bolt.

INSTALLATION (Figure 2-77)

Special Tools	Torque Values (ft-lbs)
SRES 28 Snap-on-adaptor SS-306D Torque computer	Shock absorber bolt 115 - 130

1. Place washer (9) on bolt (8) and coat thread surface of bolt with Loctite 242 (blue). Coat shoulder of bolt with Anti-seize.
2. Insert bolt (8) through shock end. Pivot shock absorber to align bolt with tapped hole in frame bracket (front bolt) or swing arm (rear bolt).
3. Tighten bolt only enough to support shock absorber and still allow shock to pivot when installing the second bolt.
4. Install the second bolt following the procedure given above.

CAUTION

- **Softail shock absorber bolt torquing procedure requires the use of a SNAP-ON-ADAPTOR, Part No. SRES 28, to allow accurate torque application.**
- **Bolt torque must be computed because the adaptor effectively lengthens the torque wrench. A TORQUE COMPUTER is available from Snap-On, Part No. SS-306D, for use when an adaptor or extension is added to any torque wrench. The computer can easily be used with dial or click type torque wrenches.**

5. Tighten both bolts (8) to 115-130 ft-lbs torque.
6. Adjust shock absorbers to an equal adjustment. See ADJUSTMENT.

DISASSEMBLY

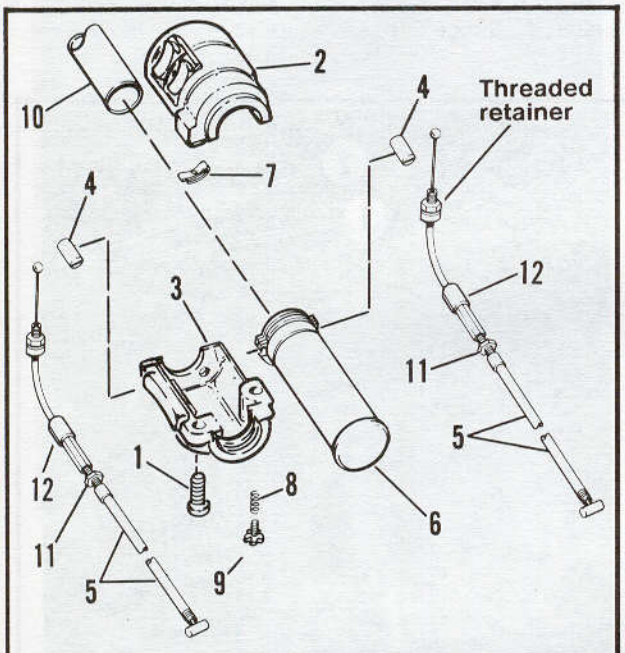
NOTE

The shock absorbers on Softail motorcyles are not repairable.

THROTTLE CONTROL

GENERAL (Figure 2-77)

The throttle control must operate freely without binding. With the friction adjusting screw (9) backed off, the carburetor throttle must return to the closed (idle) position.



1. Screw (2)
2. Upper housing
3. Lower housing
4. Ferrule (2)
5. Control cable assembly (2)
6. Throttle grip
7. Friction spring
8. Spring
9. Adjusting screw
10. Handlebar
11. Adjuster jam nut
12. Throttle cable adjuster

Figure 2-77. Handlebar Throttle Control

DISASSEMBLY (Figure 2-77)

1. Loosen cable adjuster jam nuts (11). Screw throttle cable adjuster (12) until it is as short as possible. Remove the two screws (1) and separate the upper housing (2) from the lower housing (3).
2. Unhook the ferrules (4) and cables (5) from the throttle grip (6) and lower housing (3). Remove air cleaner assembly. See section 4. Disconnect the other end of the cables from the carburetor.
3. Remove the friction spring (7), spring (8) and adjusting screw (9) from lower housing (3).

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in a non-flammable cleaning solvent and blow dry with compressed air.
2. Replace the cables if frayed, kinked or bent.

ASSEMBLY (Figure 2-77)

Special Tools	Torque Values (In-lbs)
None	Throttle housing screws 18 - 24

1. Apply a light coating of graphite to the handlebar and inside surface of the housings (2 and 3).
2. Attach the cable assemblies (5) to the lower housing (3). The throttle cable has a 5/16-18 in. threaded retainer and should be assembled to the right side of the throttle grip. The idle cable has a 1/4-20 in. threaded retainer and should be assembled to the left side of the throttle grip. Install adjusting screw (9), spring (8) and friction spring (7) in the lower clamp.
3. Position the throttle grip (6) on the handlebar. Place the lower housing (3) on the throttle. Position the ferrules (4) over the cable balls and seat them in the throttle notches.

WARNING

Do not overtighten the adjusting screw. Operation with the screw overtightened is not recommended because of the possible hazard involved when the engine will not return to idle speed automatically in an emergency.

4. Fasten the upper housing (2) to the lower housing (3) using the screws (1). Tighten the screws to 18-24 in-lbs torque.
5. See Figure 2-78. On all models except the Springer, the throttle cables are routed between the brake line and the handlebars. They pass under the top frame tube, between the harness connectors and the harness bracket and then to the carburetor.

- On the Springer, the throttle cables are routed through the vinyl-covered clamp, under the bottom frame bracket (held in place by a cable tie) and then to the carburetor.

6. See Figure 2-79. Install the idle cable (1) and spring into the longer of the two support sleeves on the carburetor. The idle cable has a 1/4-20 in. threaded retainer at the throttle end.
7. Install the throttle cable (2) into the other support sleeve on the carburetor. The throttle cable has a 5/16-18 in. threaded retainer at the throttle end.

ADJUSTMENT (Figure 2-80)

CAUTION

This adjustment is necessary to prevent stress and potential throttle cable failure.

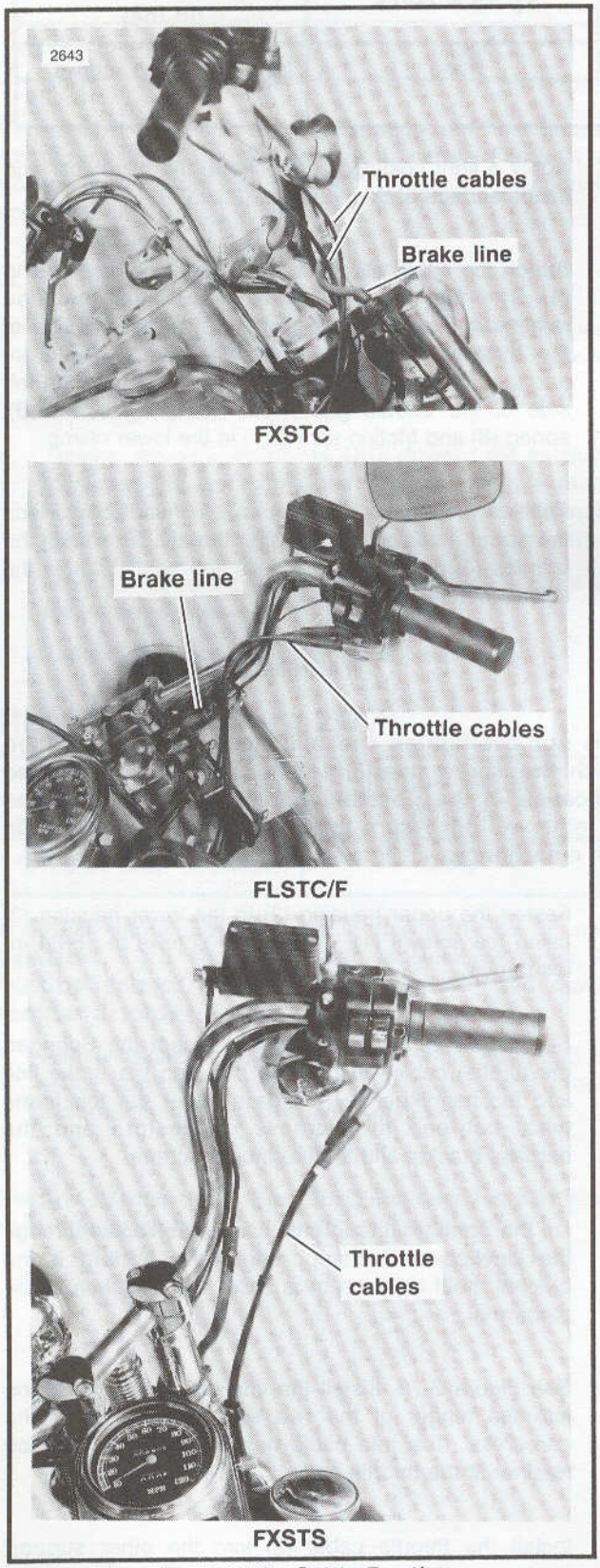


Figure 2-78. Cable Routing

NOTE

The throttle cable has a 5/16-18 in. threaded retainer and is assembled to the right hand anchor slot at the top of the throttle grip. The idle cable has a 1/4-20 in. threaded retainer and is assembled to the left hand anchor slot at the top of the throttle grip.

1. Turn the cable adjusters and jam nuts as short as they will go. Both cables should have zero adjustment to start this procedure.

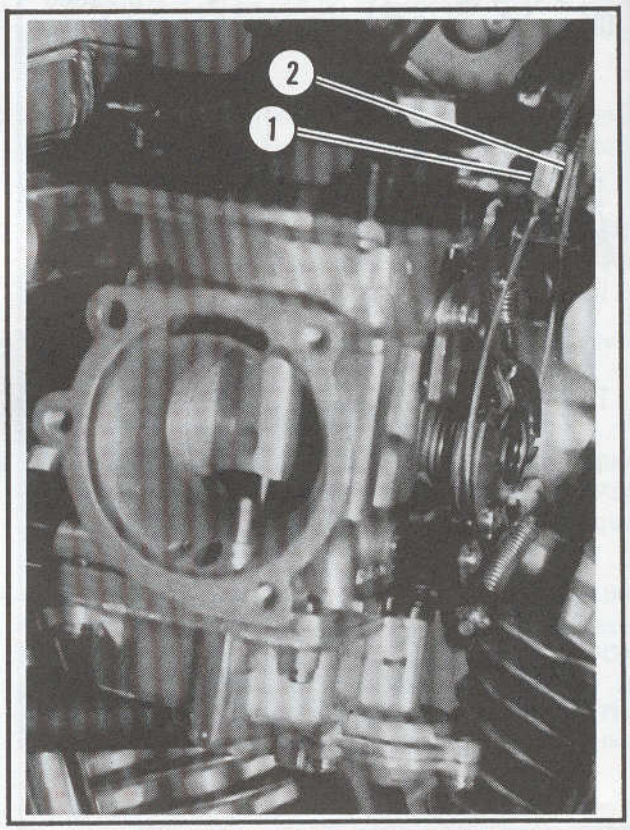
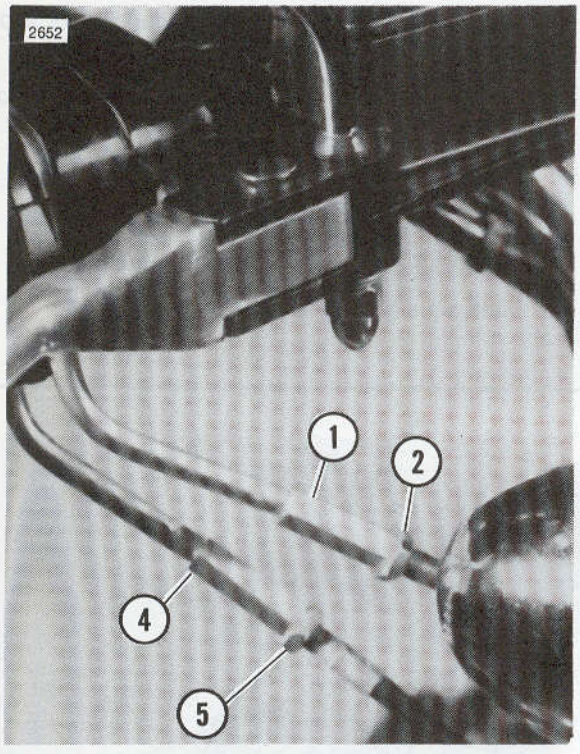


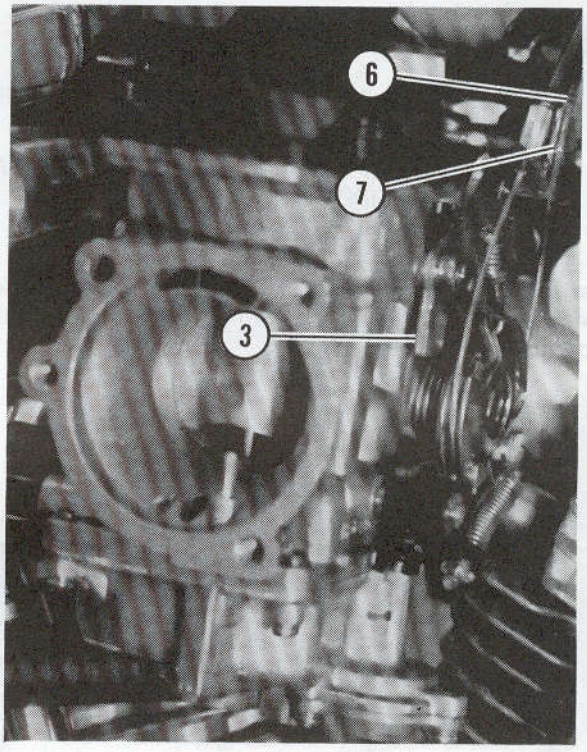
Figure 2-79. Cable Installation

2. Point the front wheel straight ahead. Turn the throttle grip so the throttle is wide open and hold it there. Now turn the throttle cable adjuster (1), lengthening the sleeve until the throttle cam stop (3) just touches the stop boss on the carburetor. Tighten the jam nut (2) against the throttle cable adjuster and release the throttle.

3. Turn the front wheel full right. Turn the idle cable adjuster (4), lengthening the sleeve until the cable housing (6) just touches the spring (7) in the cable support sleeve. Work the throttle grip to be sure throttle cable returns to idle position when released. If the cable does not return to idle, turn adjuster (4), shortening the sleeve to get the correct adjustment. Tighten the jam nut (5) against the idle cable adjuster (4).

4. Install air cleaner. See section 4.





1. Throttle cable adjuster
2. Locknut
3. Cam stop
4. Idle cable adjuster
5. Locknut
6. Cable housing
7. Spring

Figure 2-80. Throttle Cable Adjustment

CLUTCH HAND CONTROL

REMOVAL

1. Loosen cable adjuster so all tension is out of the clutch cable. See section 6.
2. Remove transmission side cover. See section 7, TRANSMISSION SIDE COVER.

CAUTION

Inner ramp and coupling must be removed from side cover before disconnecting cable end or cable will be damaged.

3. Disconnect cable end from ball and ramp coupling. Unscrew cable fitting from side cover.
4. See Figure 2-81. Remove hand lever pivot pin.

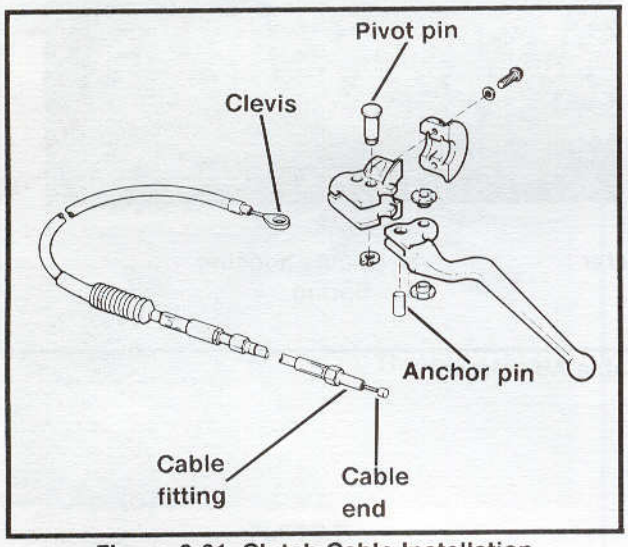


Figure 2-81. Clutch Cable Installation

5. Remove the clutch cable and anchor pin from the hand lever.

INSTALLATION

1. See Figure 2-82. Install the clutch cable and anchor pin in the clutch hand lever. The flat in the pin must face in towards the hand lever.
2. Put cable clevis in position in hand lever and slide anchor pin into place.
3. Install hand lever assembly and pivot pin.
4. See Figures 2-82, 2-83. Route clutch cable:
   a. **FLSTC/F** - Behind handlebars and fork clamps.

   FXSTC, FXSTS - In front of handlebars and in front of left frame downtube.
   b. **FXSTC, FXSTS** - Clamped to left frame down tube.

   FLSTC/F - Behind left frame downtube.
   c. Behind right frame downtube.
   d. Under gear cover and through bracket.
   e. Into transmission side cover.

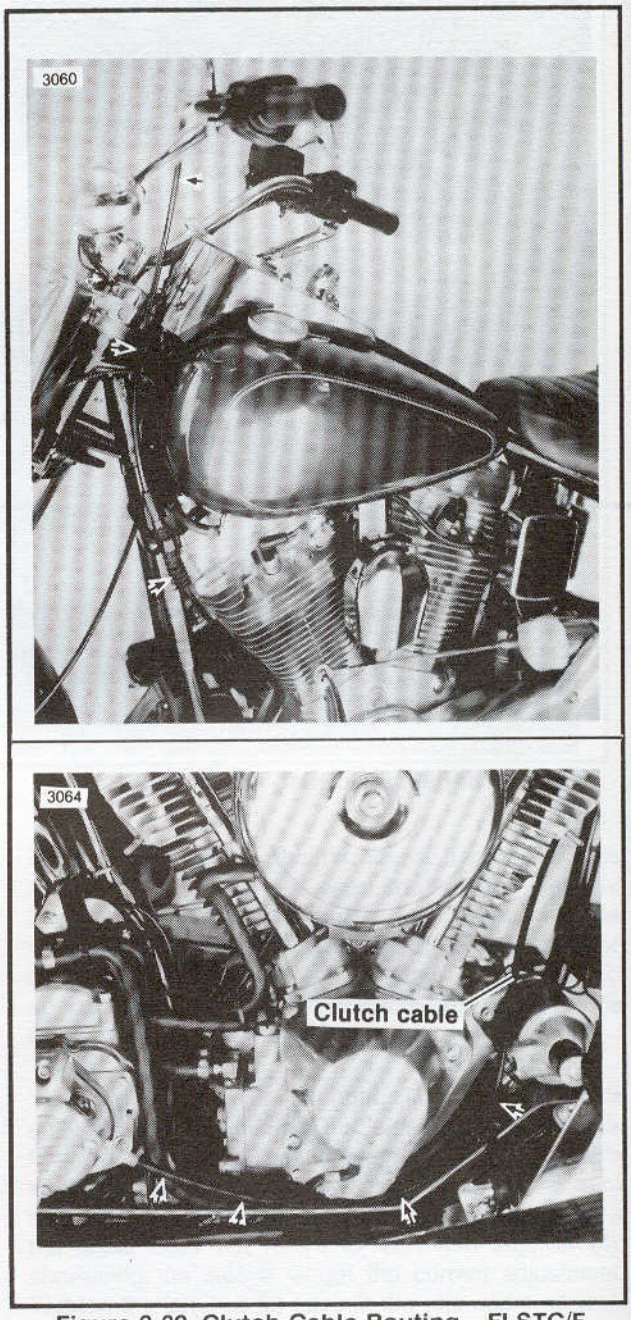


Figure 2-82. Clutch Cable Routing – FLSTC/F

NOTE

Replace cable fitting O-ring.

5. Insert cable end into side cover and connect to the ball and ramp coupling.

6. Screw cable fitting into side cover. Tighten to 3-5 ft-lbs torque.

7. Adjust cable adjuster so there is enough slack to install side cover. See TRANSMISSION, SIDE COVER, section 7.

8. Adjust clutch cable. See section 6.

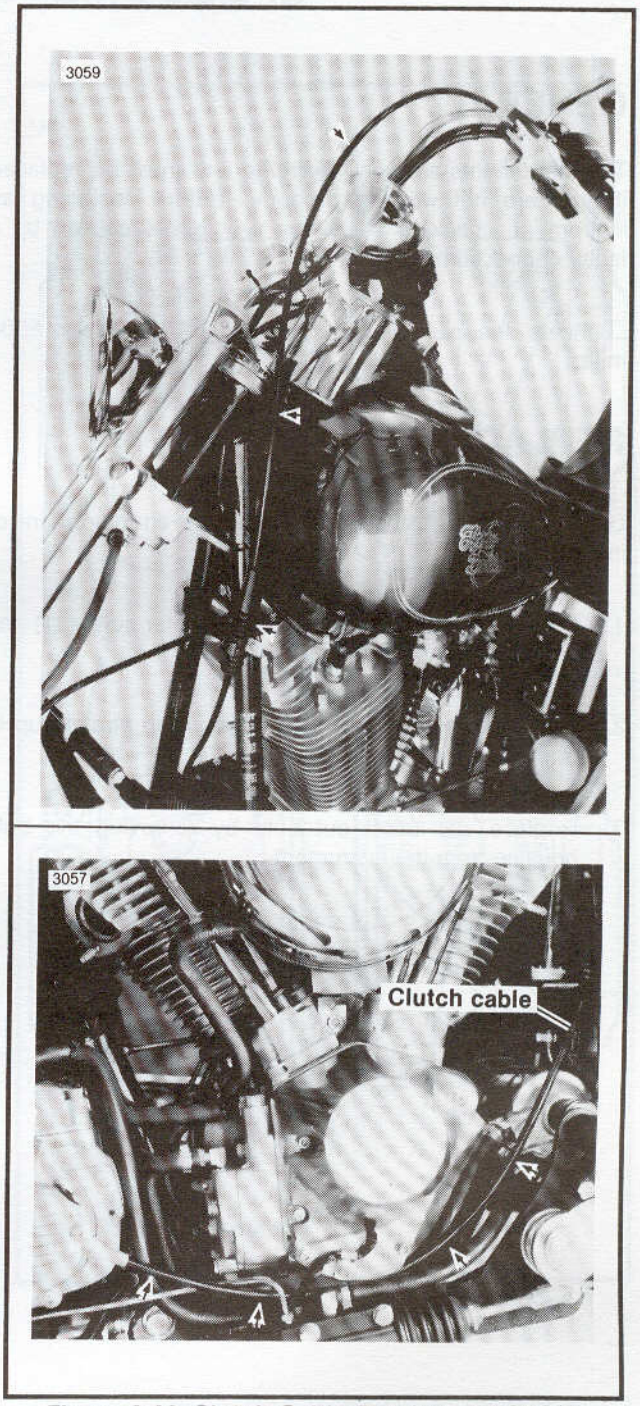


Figure 2-83. Clutch Cable Routing – FXSTC/S (FXSTC Shown)

SPEEDOMETER/TACHOMETER

GENERAL

The instruments are non-repairable and must be replaced if they are not working properly. Before replacing an instrument, check to see if the problem is caused by a faulty connection.

Lubricate the cables with graphite grease every 5000 miles.

REPLACEMENT

Use the following procedures to replace an instrument or instrument bulb.

1. See Figure 2-84. Remove the odometer screw (1) and knob.

2. Remove the acorn nut. Pull the housing straight up to remove.

3. Replace any burnt out bulb by removing the bulb housing from the instrument.

4. Replace the instrument by disconnecting the cable and mounting hardware.

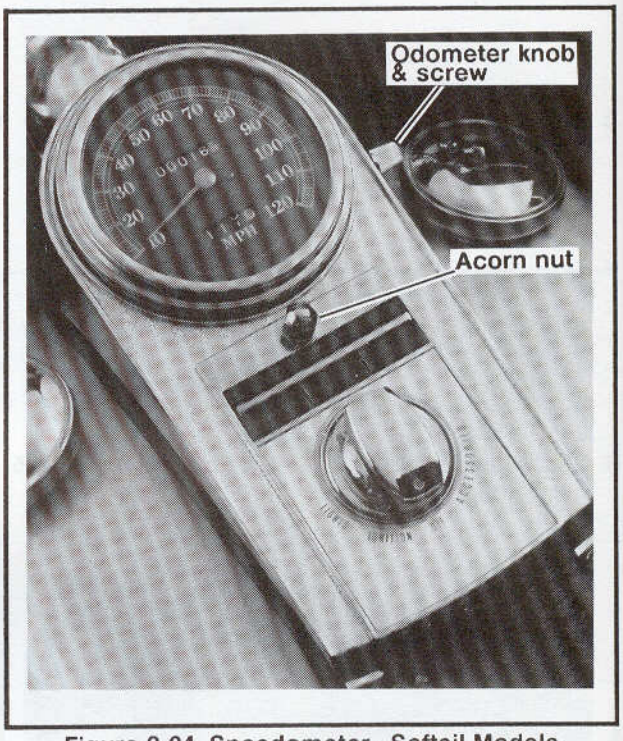


Figure 2-84. Speedometer –Softail Models

HANDLEBAR SWITCHES

GENERAL

The left handlebar switch assembly contains the headlamp HI-LO beam switch, the horn and the left turn signal switch. The right handlebar switch assembly contains the RUN-OFF switch, the engine start switch and the right turn signal switch. The individual switches are non-repairable and must be replaced if they malfunction.

REMOVAL (Figure 2-85)

1. Remove screws (1) from the switch housing (2).
2. To replace switch (3), remove screw (4).
3. Cut old switch wires at the switch.

INSTALLATION (Figure 2-85)

1. Cut new switch wires 3/4 in. from switch.
2. Replace switch (3), screw (4) and screws (1).
3. Tighten screws (1) to 18-24 in-lbs torque.
4. Slip a piece of shrink tubing over each wire.
5. Solder wire ends together and shrink tubing over solder joint.

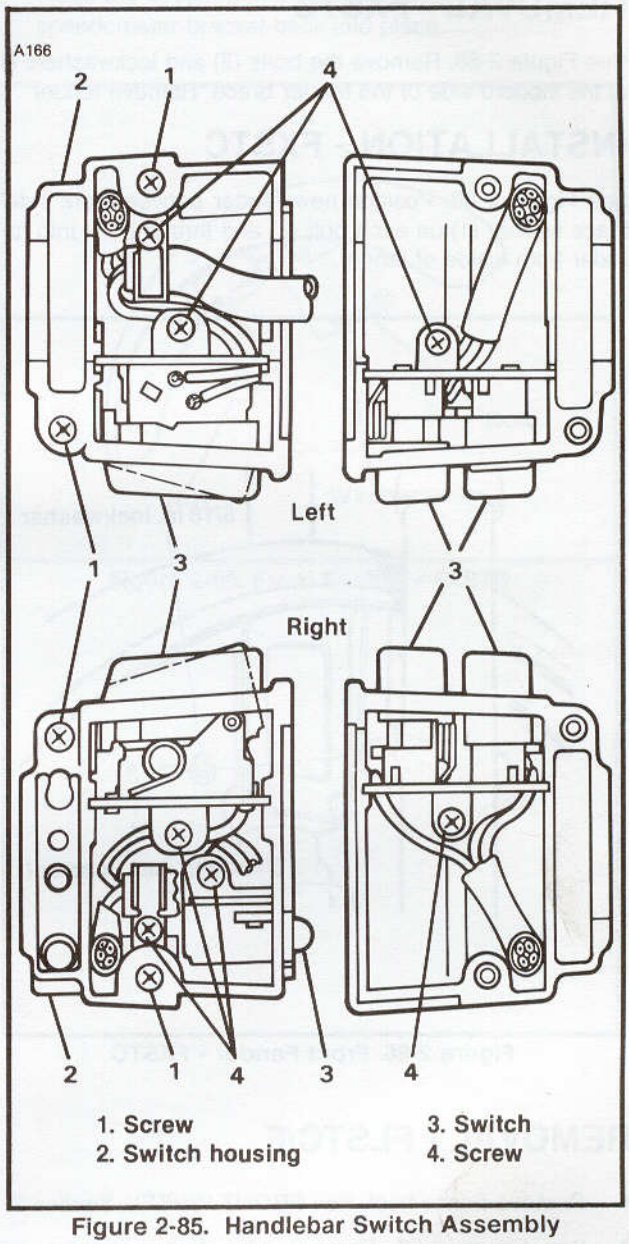


Figure 2-85. Handlebar Switch Assembly

FRONT FENDER

REMOVAL - FXSTC

See Figure 2-86. Remove the bolts (2) and lockwashers (1) at the inboard side of the fender brace. Remove fender.

INSTALLATION - FXSTC

See Figure 2-86. Position new fender between fork sides. Place washer (1) on each bolt (2) and thread bolts into fork slider from inside of fender.

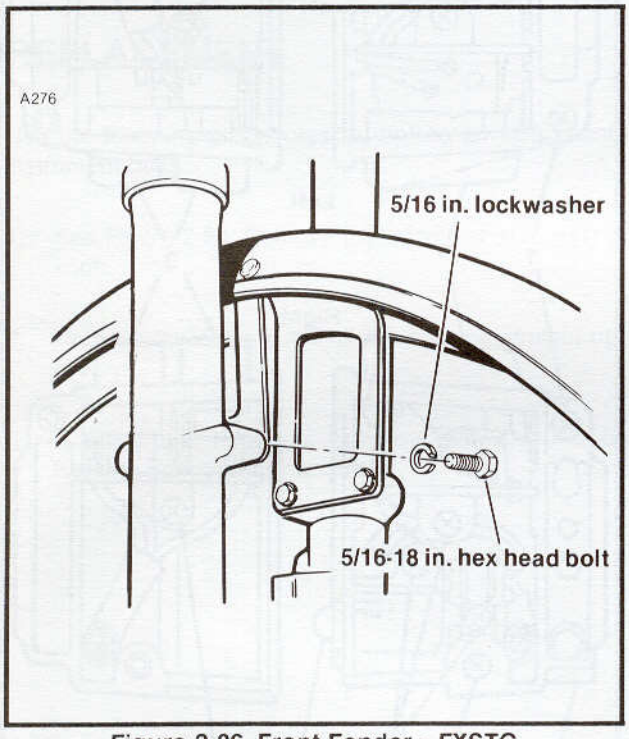


Figure 2-86. Front Fender - FXSTC

REMOVAL - FLSTC/F

1. Remove front wheel. See FRONT WHEEL, Section 2.
2. See Figure 2-87. Remove allen bolts, washers and nuts. Disconnect fender tip lamp on FLSTC.
3. Disconnect speedometer cable. Slide cable out of bracket. Remove fender.

INSTALLATION - FLSTC/F

1. See Figure 2-87. Put fender in position and install allen bolts, washers and nuts. Connect fender tip lamp on FLST/C.
2. Slide speedometer cable into bracket and connect.
3. Install front wheel. See FRONT WHEEL, Section 2.

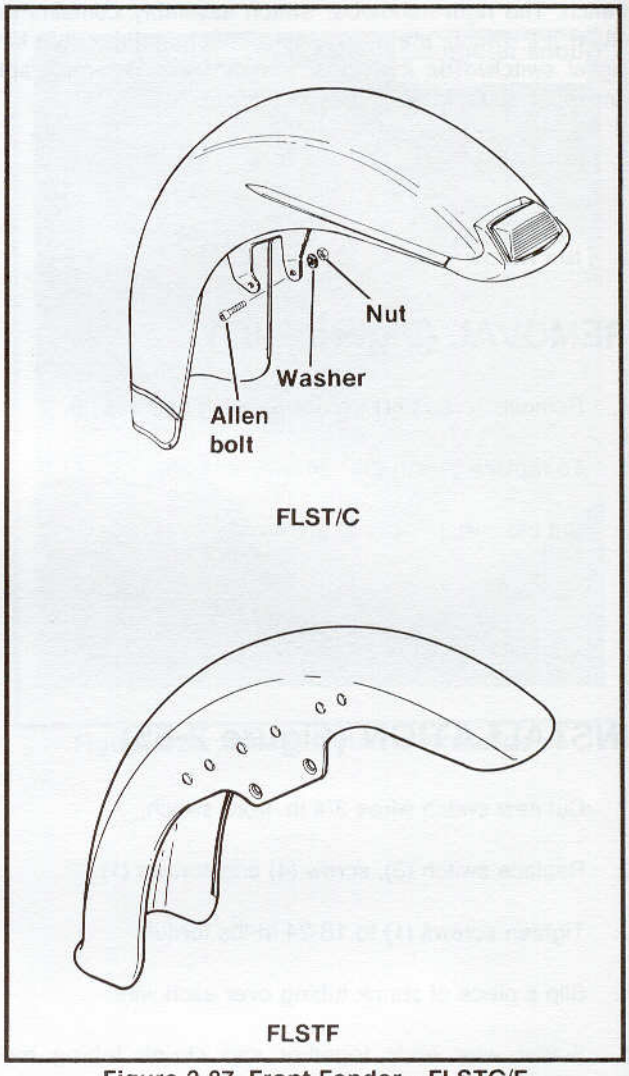


Figure 2-87. Front Fender - FLSTC/F

REMOVAL - FXSTS

1. See Figure 2-88. Bend the speedometer cable fender bracket & slide the speedometer cable out of the bracket before removing the fender.
2. Remove four (4) bolts, washers and acorn nuts to remove the fender.

INSTALLATION - FXSTS

WARNING

The front end components of the Springer and their design relationships to each other are very important. Altering these relationships by modifying the springer front end could adversely affect the handling of your Springer and endanger the rider.

DO NOT:

- **Alter the fender brackets to lower the fender. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.**
- **Replace the O.E.M. tire with a higher-aspect ratio tire. Doing this could allow the front wheel to bind on the fender during hard stops or big bumps.**
- **Replace the O.E.M. tire with a traditional-looking 16 in. front wheel, tire and front fender. In addition to above, this could adversely affect the handling characteristics of this motorcycle.**

1. See Figure 2-88. Install the fender using four (4) bolts, washers and acorn nuts.
2. Place the speedometer cable in position and bend the speedometer bracket back into place.

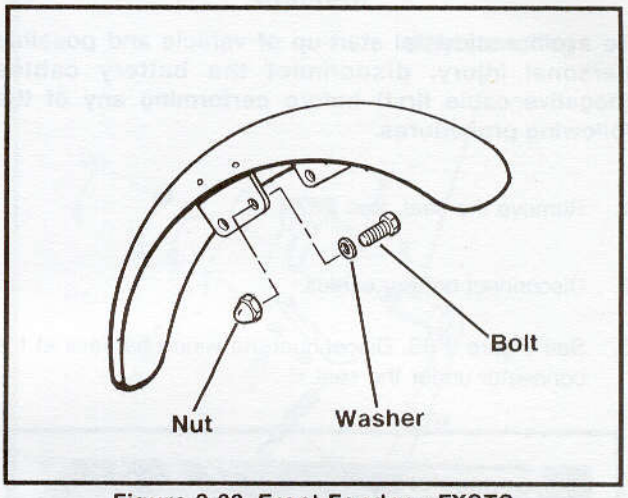


Figure 2-88. Front Fender - FXSTS

REAR FENDER - FXSTC, FLSTC/F, FXSTS

REMOVAL

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. Remove the seat. See SEAT.
2. Disconnect battery cables.
3. See Figure 2-89. Disconnect the wiring harness at the connector under the seat.

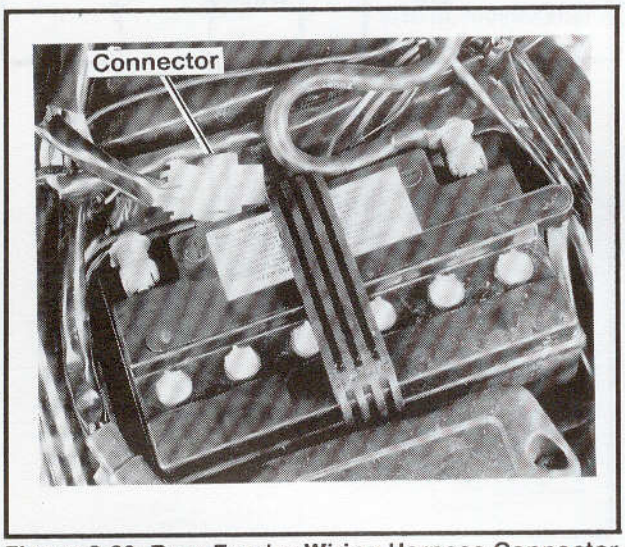


Figure 2-89. Rear Fender Wiring Harness Connector – FLSTC/F, FXSTC/S

4. Remove the acorn nuts and hardware securing the rear fender.

NOTE

Note location of spacers and hardware for easy installation.

5. Remove the screws and nuts that attach the taillamp and license plate bracket.
6. Carefully remove the rear fender.
7. Pull the wiring harness through the fender.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Fender taillamp hardware 25 - 30 Fender support screw 21 - 27 Acorn nuts 25 - 40

1. Pull the wiring harness through the side of the new fender and secure under the wire clips.
2. Carefully place the fender and the original taillamp and license bracket into position. Secure the fender taillamp assembly using the hardware removed from the original fender. Tighten nuts to 25-30 ft-lbs.
3. Connect the wiring harness at the connector.
4. Reconnect the battery cables, positive cable first.
5. Install the seat.

WARNING

Check the operation of the turn signals and taillight before operating the vehicle. Improper turn signal or taillight operation can endanger the operator.

JIFFY STAND

See Figure 2-90. Clean and lubricate the jiffy stand at 500 miles and every 2500 miles thereafter. If operation cis on muddy or dusty roads, clean and lubricate at shorter intervals.

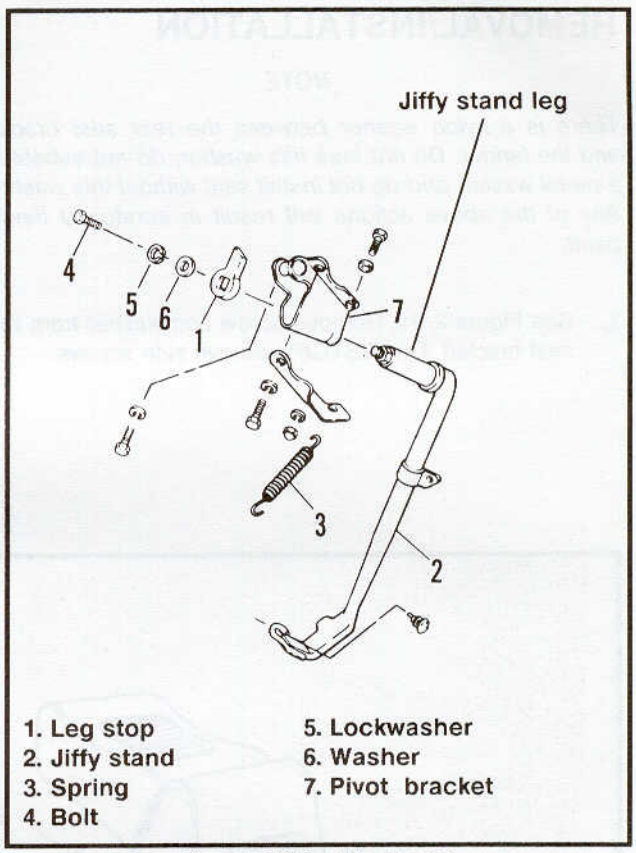
LUBRICATION

Clean and lubricate as follows:

1. Raise motorcycle so front wheel is 1-2 in. above floor and support with blocks under frame.
2. Inspect leg stop (1). If covered with dirt, wipe dirt off with a shop towel and spray stop and mating surface with Loctite ® aerosol anti-seize.
3. Move jiffy stand (2) leg up and down to "work" anti-seize into mating parts.

REMOVAL/INSTALLATION

1. If leg stop (1) is too covered with mud/grime to sparay, remove spring (3), bolt (4), lockwasher (5), washer (6) and leg stop (1).
2. Clean leg stop and pivot bracket (7) mating surface.
3. Spray Loctite® anti-seize on jiffy stand leg to lubricate the mating surface between leg and pivot bracket and leg stop (1).
4. Assemble the leg stop (1) so it engages the flats on the shaft of the jiffy stand leg (2) and secure with washer (5), lockwasher (4) and bolt (3). Install spring (3).
5. Tighten bolt (4) to 19 ft-lbs torque.
6. Check that jiffy stand operates correctly before using.



1. Leg stop
2. Jiffy stand
3. Spring
4. Bolt
5. Lockwasher
6. Washer
7. Pivot bracket

Figure 2-90. Jiffy Stand

SEAT

REMOVAL/INSTALLATION

NOTE

There is a nylon washer between the rear seat bracket and the fender. Do not lose this washer, do not substitute a metal washer and do not install seat without this washer. Any of the above actions will result in scratched fender paint.

1. See Figure 2-91. Remove screw and washer from rear seat bracket. On FLSTC/F, remove side screws.

NOTE

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

2. Slide seat to the rear of the motorcycle and lift seat.
3. Slide U-shaped bracket under frame bracket. Install screw and washer. Be sure nylon washer is placed between the seat bracket and the fender.

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

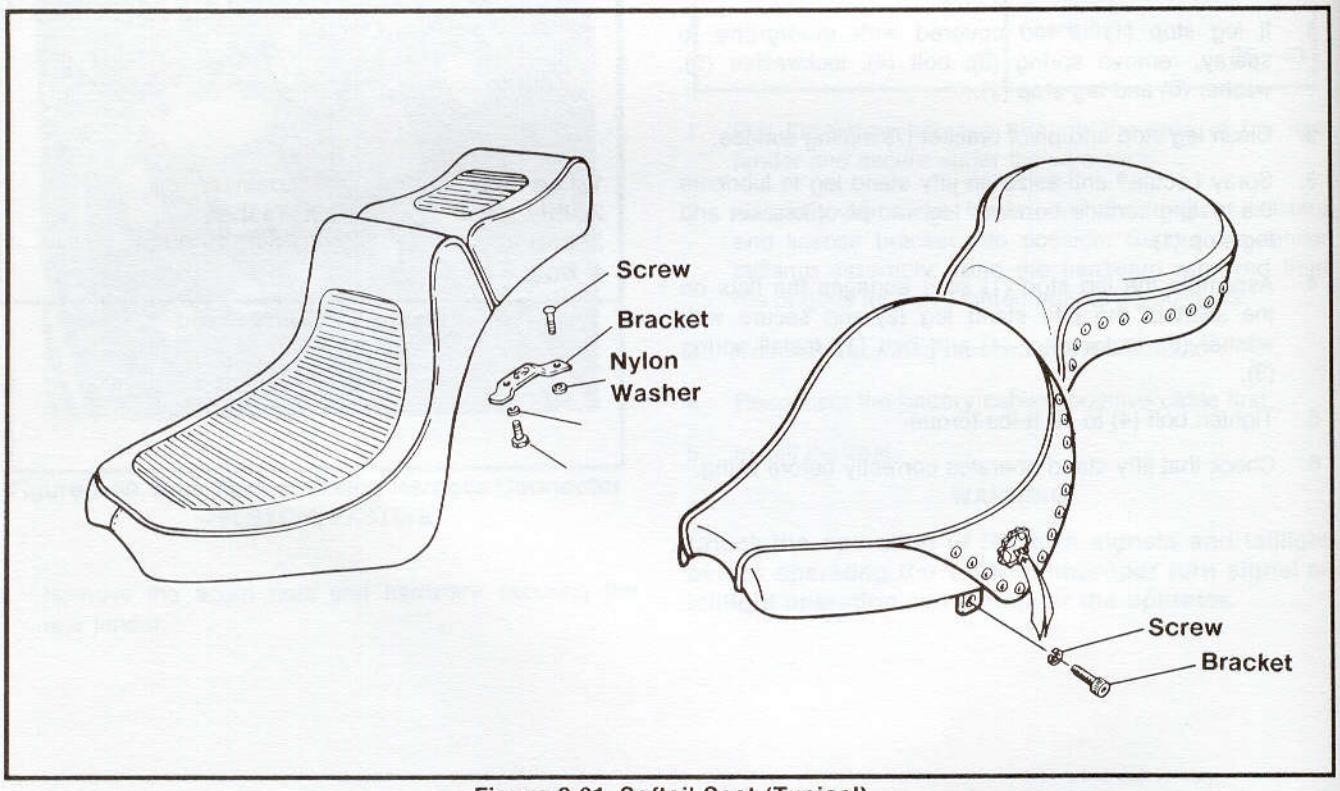


Figure 2-91. Softail Seat (Typical)

NOTES

NOTES

ENGINE

SPECIFICATIONS

GENERAL

Number of Cylinders	2
Type	4-cycle, 45°V
Horsepower	69hp @ 5000rpm
Torque	82 ft-lbs @ 3600rpm
Bore	3.498 in. (88.8mm)
Stroke	4.250 in. (108.0mm)
Piston Displacement	81.6 cu. in.- (1340cc)
Compression Ratio	8.5-1

VALVES

Fit in guide	
Exhaust	0.0015-0.0033 in.
Intake	0.0008-0.0026 in.
Seat width	0.040-0.062 in.
Stem protrusion from cylinder head boss	1.990-2.024 in.
Outer spring	
1.751-1.848 in.	(closed) 72-92 lbs.
1.282-1.378 in.	(open) 183-207 lbs.
free length	2.105-2.177 in.
Inner spring	
1.577-1.683 in.	(closed) 38-49 lbs.
1.107-1.213 in.	(open) 98-112 lbs.
free length	1.926-1.996 in.

ROCKER ARM

Shaft fit in bushing	(loose) 0.0005-0.002 in.
End clearance	0.003-0.013 in.
Bushing fit in rocker arm	(tight) 0.004-0.002 in.

ROCKER ARM SHAFT

Shaft fit in rocker cover	(loose) 0.0007-0.0022 in.

PISTON

Fit in cylinder (Mahle)	(loose) 0.00055-0.00165 in.
KSG piston	0.00075-0.00175 in.
Compression ring gap	0.007-0.020 in.
Oil control ring rail gap (stock ring)	0.009-0.052 in.
Compression ring side clearance -	
Top	0.002-0.0045 in.
2nd	0.0016-0.0041 in.
Oil control ring side clearance	0.0016-0.0076 in.
Piston pin fit (Mahle)	(loose) 0.0002-0.0006 in.
KSG piston pin fit	(loose) 0.0001-0.0004 in.

CYLINDER HEAD

Valve guide in head	(tight) 0.0033-0.002 in.
Valve seat in head	(tight) 0.0045-0.0020 in.
Head gasket surface	(flatness) 0.006 in. total

CONNECTING ROD

Piston pin fit	(loose) 0.0003-0.0007 in.
Side play between flywheels	0.005-0.025 in.
Conn. Rod to crankpin	(loose) 0.0004-0.0017 in

TAPPETS

Guide fit in crankcase	(loose) 0.000-0.004 in.
Fit in guide	(loose) 0.0008-0.002 in.

OIL PUMP PRESSURE

At normal operating temperature and engine speed of 2000 rpm, oil pressure should be 12-35 psi.

GEARCASE

Breather gear end play	(loose) 0.001-0.011 in.
Cam gear shaft	(loose) 0.00075-0.00175 in.
Cam gear shaft in bearing	(loose) 0.0005-0.0025 in.
Cam gear end play	(loose) 0.001-0.050 in.
Oil pump drive shaft (crankcase bushing)	0.0004-0.0025 in.

FLYWHEELS

Runout (flywheels at rim)	0.000-0.010 in.
Runout (shaft at flywheel)	0.000-0.002 in.
End play	0.001-0.005 in.

SPROCKET SHAFT BEARING

Cup fit in crankcase	(tight) 0.005-0.003 in.
Cone fit on shaft	(tight) 0.0015-0.0005 in.

PINION SHAFT BEARING

Roller bearing fit	(loose) 0.0002-0.0009 in.
Cover bushing fit	(loose) 0.001-0.0025 in.

IGNITION TIMING

Timer air gap	not adjustable
Ignition timing	
fully retarded	TDC
automatic advance	35° BTDC
Spark plug gap	0.038-0.043

TORQUE VALUES

Sprocket/pin installed without hydraulic press	
Crank pin nut	180-210 ft-lbs
Pinion gear nut	35-45 ft-lbs
Oil pump cover bolts	90-120 in-lbs
Tappet guide bolts	12-15 ft-lbs
Rocker cover -	
5/16 in. bolts	15-18 ft-lbs
1/4 in. bolts	10-13 ft-lbs
Cylinder head bolts	See Cylinder Head Torque Sequence
Upper engine mounting bracket nut (1991)	22-28 ft-lbs
Upper engine mounting bracket screw (1992)	22-28 ft-lbs
Crankcase stud nut	See Crankcase Torque Sequence
Crankcase bolt	See Crankcase Torque Sequence
Gearcase cover screws	90-120 in-lbs
Timer screws (inner cover and sensor plate	15-30 in-lbs
Tappet screen plug	90-120 in-lbs
Spark plug	18-22 ft-lbs

SERVICE WEAR LIMITS

GENERAL

Wear limits are given here as a guideline for measuring engine components that are not new. For new components or for measurements not given here, use measurements given under SPECIFICATIONS.

Replace if:

VALVES

Fit in guide - with seal	
Exhaust	Exceeds 0.0040 in.
Intake	Exceeds 0.0035 in.
Stem taper	Exceeds 0.0015 in.
Stem-face eccentricity	Exceeds 0.002 in.
Head margin	0.031 in.
Seat width	Exceeds 0.090 in.
Stem protrusion from cylinder head boss	Exceeds 2.034 in.

ROCKER ARM

Shaft fit in bushing	(loose) Exceeds 0.0035 in.
End clearance	Exceeds 0.025 in.

ROCKER ARM SHAFT

Shaft fit in rocker cover	(loose) Exceeds 0.0035 in.

PISTON

Fit in cylinder	(loose) Exceeds 0.0053 in.
Compression ring gap	Exceeds 0.030 in.
Oil control ring gap	Exceeds 0.065 in.
Compression ring side clearance	
Top ring	Exceeds 0.006 in.
2nd ring	Exceeds 0.006 in.
Oil control ring side clearance	Exceeds 0.008 in.
Piston pin fit	(loose) Exceeds 0.001 in.

CYLINDER HEAD

Valve guide in head	(tight) Less than 0.0020 in.
Valve seat in head	(tight) Less than 0.0020 in.
Head warpage	Exceeds 0.006 in.

CYLINDER

Taper	Exceeds 0.002 in.
Out of round	Exceeds 0.003 in.
Warpage (gasket surfaces)	
Top	0.006 in.
Base	0.008 in.
Bore:	
Standard	3.501 in.
0.005 Oversize (O.S.)	3.506 in.
0.010 O.S. Bore	3.511 in.
0.020 O.S. Bore	3.521 in.
0.030 O.S. Bore	3.531 in.

CONNECTING ROD

Piston pin fit	(loose) Exceeds 0.001 in.
Side play between flywheels	Exceeds 0.030 in.
Fit on crankpin	(loose) Exceeds 0.002 in.

TAPPETS

Fit in guide	Exceeds 0.003 in.
Roller fit	Exceeds 0.0015 in.
Roller end clearance	Exceeds 0.015 in.

GEARCASE

Breather gear end play	Exceeds 0.016 in.
Cam gear shaft in bushing	Exceeds 0.003 in.
Cam gear shaft in bearing	Exceeds 0.005 in.
Cam gear shaft end play -	Exceeds 0.050 in.
Oil pump drive shaft (crankcase bushing)	Exceeds 0.0035 in.

FLYWHEELS

Runout (flywheels at rim)	Exceeds 0.015 in.
Runout (shaft at flywheel)	Exceeds 0.003 in.
End play	Exceeds 0.006 in.
PINION SHAFT BEARINGS	
Cover bushing fit	(loose) Exceeds 0.0035 in.

GENERAL INFORMATION

DESCRIPTION

The engine is the V^2_{TM} Evolution Engine. It is a two cylinder, four-cycle, air cooled, overhead-valve V-type. It has three major component assemblies: cylinders, crankcase and gearcase.

Cylinder assemblies include cylinder head, valves, rocker arm cover, rocker arms and piston. Cylinders mount on the crankcase in a 45° "V" with both connecting rods running on a single crank pin.

The up and down motion of the pistons in the cylinders is converted to circular motion in the crankcase. The crankshaft consists of an off-center crankpin positioned between two counterweighted flywheels which rotate on two end shafts (pinion shaft right side and sprocket shaft left side). These shafts are integral parts of the flywheels. They are supported by roller bearings. The crankpin (big) end of the rear cylinder connecting rod is forked to fit around the single crankpin end of the front connecting rod, allowing a single connecting rod crankpin connection to the flywheels.

Flywheel rotation is clockwise when viewed from the right side of the engine. Using the front cylinder firing position as a starting point, the rear cylinder fires at 315 degrees rotation (360 degrees minus the 45 degrees between cylinders). The front cylinder fires in an additional 405 degrees rotation (360 degrees plus the 45 degrees between cylinders), completing the 720 degrees of flywheel rotation necessary for the four piston strokes.

The gearcase is located in the right side crankcase half and houses gears which operate and time the valves and crankcase breather. The rotating crankcase breather relieves crankcase pressure produced by the downstroke of the pistons and controls the flow of return oil in the lubrication system. Air exhausted from the crankcase by the breather is fed into the air cleaner assembly.

A single four-lobe gear driven cam shaft operates both the intake and exhaust valves through the tappets, push rods and rocker arms. Hydraulic lifters located in the tappets automatically compensate for heat expansion to maintain the no-lash fit of valve train components.

Ignition spark is produced by the operation of a computerized micro-processor, electronic ignition module, ignition coil and spark plugs. Spark timing is determined by a trigger rotor, magnetic sensing unit and Vacuum Operated Electric Switch (V.O.E.S.). Both spark plugs fire each crankshaft revolution. However, the spark in one cylinder occurs ineffectively during a noncompression stroke.

FUEL

Use a good quality leaded or unleaded gasoline (at least 87 pump octane). Octane rating is usually found on the pump.

CAUTION

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

Gasoline/alcohol Blends

Harley-Davidson motorcycles were designed to obtain the best performance and efficiency 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 driveablility deterioration and damage to critical fuel system components.
- Gasolines containing METHYL TERTIARY BUTYL ETHER (MTBE): Gasoline/MTBE blends are a mixture of gasoline and as much as 15% MTBE. Gasoline/MTBE blends can be used in your motorcycle.
- ETHANOL (Ethanol or grain alcohol) is a mixture of 10% ethanol and 90% unleaded gasoline. It is identified as "gasohol", "ethanol enhanced", or "contains ethanol". Gasoline/Ethanol blends can be used in your motorcycle.

Because of their generally higher volatility, these blends may adversely affect the starting, driveability and fuel efficiency of your motorcycle. If you experience these problems, Harley-Davidson recommends you operate your motorcycle on straight, unleaded gasoline.

LUBRICATION

General

The engine is lubricated by a pressure system, circulating oil from the tank through the moving parts and back to tank. For adequate lubrication, the tank must contain an ample supply of clean oil at all times.

Oil consumption depends on the nature of service, fast or moderate driving, and how well the engine is kept tuned.

Remove tank cap and check oil supply as part of every pre-riding inspection. If level is down near REFILL mark on dipstick, add oil. The engine will run cooler and usage will be less with full oil tank.

The oil tank capacity with filter is 3 quarts for all models. The dipstick does not have an upper or full mark. The tank is full when the hot oil level is at the bottom of the rubber seal on fill plug with motorcycle upright. Do not fill above this level because the tank needs some air space. Insert the cap securely to prevent leakage.

Winter Lubrication

Combustion in an engine produces a certain amount of water vapor. During starting and warm-up in cold weather, especially freezing weather, this vapor condenses to water before the crankcase is hot enough to exhaust the vapor through the breather. If the engine is run long enough to thoroughly heat up the crankcase, the water is again vaporized and blown out through the breather. A moderately run engine used for only short trips and seldom allowed to thoroughly warm up will accumulate

increasing amounts of water in the oil tank. Water mixed with oil for a period of time will form a sludge that is harmful to the engine (causing rapid wear of moving parts). In freezing weather this water will become slush or ice, and if allowed to accumulate, could block oil lines and damage the engine. In winter, the oil should be changed more often than in milder weather. Any engine used for short runs must have the oil changed frequently, and the oil tank flushed thoroughly, to remove ice and sludge before refilling with new oil. The farther below freezing the temperature drops, the more frequently the oil should be changed.

Changing the Oil and Filter

Change oil and oil filter in a new engine after first 500 miles, seasonally or at 5000 mile intervals thereafter under normal service. If motorcycle is ridden hard, under dusty conditions or in cold weather, oil and filter should be changed more often.

1. Run engine until normal operating temperature is reached.
2. Remove oil tank drain plug from tank or oil drain hose and allow oil to drain completely.
3. Remove and clean the tappet oil screen located under the plug on the cam case near the rear cylinder tappet block.
4. Remove oil filter.
5. Lube gasket on new oil filter with engine oil and install new filter. Hand tighten oil filter 1/4-1/2 turn after seal contacts filter mounting surface.
6. With drain plug and filter tightened, put three (3) quarts in all models.
7. Start engine and carefully check for oil leaks around drain plug and/or hose and oil filter.
8. Check oil level in tank with vehicle upright and level at normal operating temperatures and if necessary, add oil. Do not overfill tank. Tank needs some air space.

Harley-Davidson Type	Viscosity	Harley-Davidson Rating	Ambient Temperature °F.	Cold Weather Starts Below 50 ° F.
H.D. Multigrade	SAE 20W 50	HD 240	Above 20° to 100°	Excellent
H.D. Regular Heavy	SAE 50	HD 240	Above 60° to 100°	Poor
H.D. Extra Heavy	Grade 60	HD 240	Above 80° to 100°	Poor

Oil Line Routing

See Figure 3-1 for correct oil hose location.

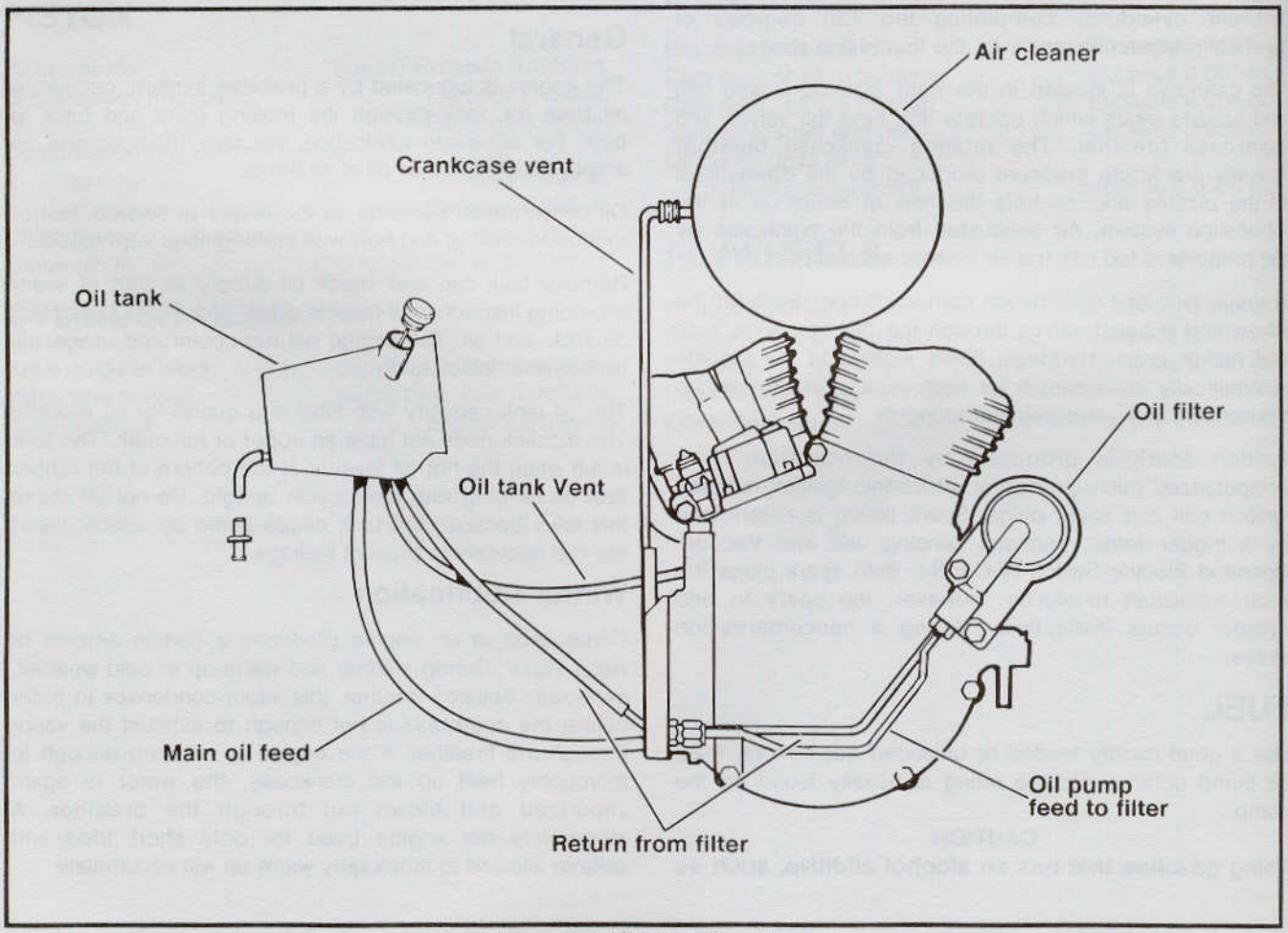


Figure 3-1. Oil Line Routing

Oil Pressure Signal Light

If the oil signal light fails to go off at speeds above idling, it is usually because of low or diluted oil supply, or plugged lifter screen. In freezing weather, the oil feed pipe may clog with ice and sludge, preventing circulation of oil. A grounded oil signal switch wire, faulty signal switch, or trouble with oil pump will also cause the light to stay on. If the oil signal light fails to go off, always check the oil supply first. Then, if oil supply is normal, look inside the oil tank to determine if oil returns to the tank from the oil return pipe outlet located at front of oil tank near filler hole when the engine is running. If it is returning to the tank, there is some circulation and engine may be run a short distance if necessary. If no oil returns, shut off engine until trouble is located and corrected.

Operating oil pressure is checked as follows:

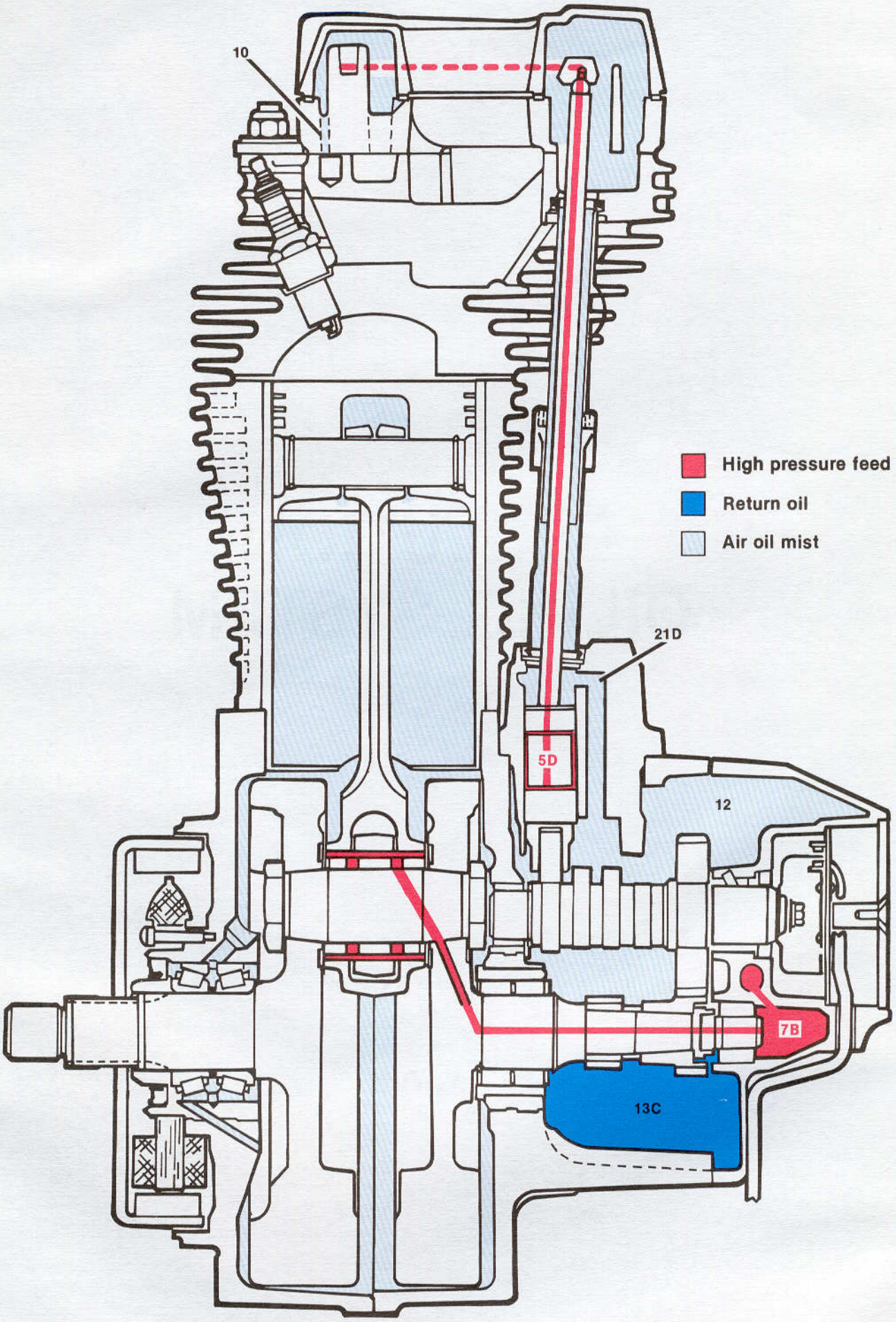
1. Fill oil tank to proper level.
2. Attach OIL PRESSURE GAUGE, Part No. HD-96921-52 to oil pressure gauge ADAPTER, Part No. HD-96921-107 and install at the tappet screen plug.

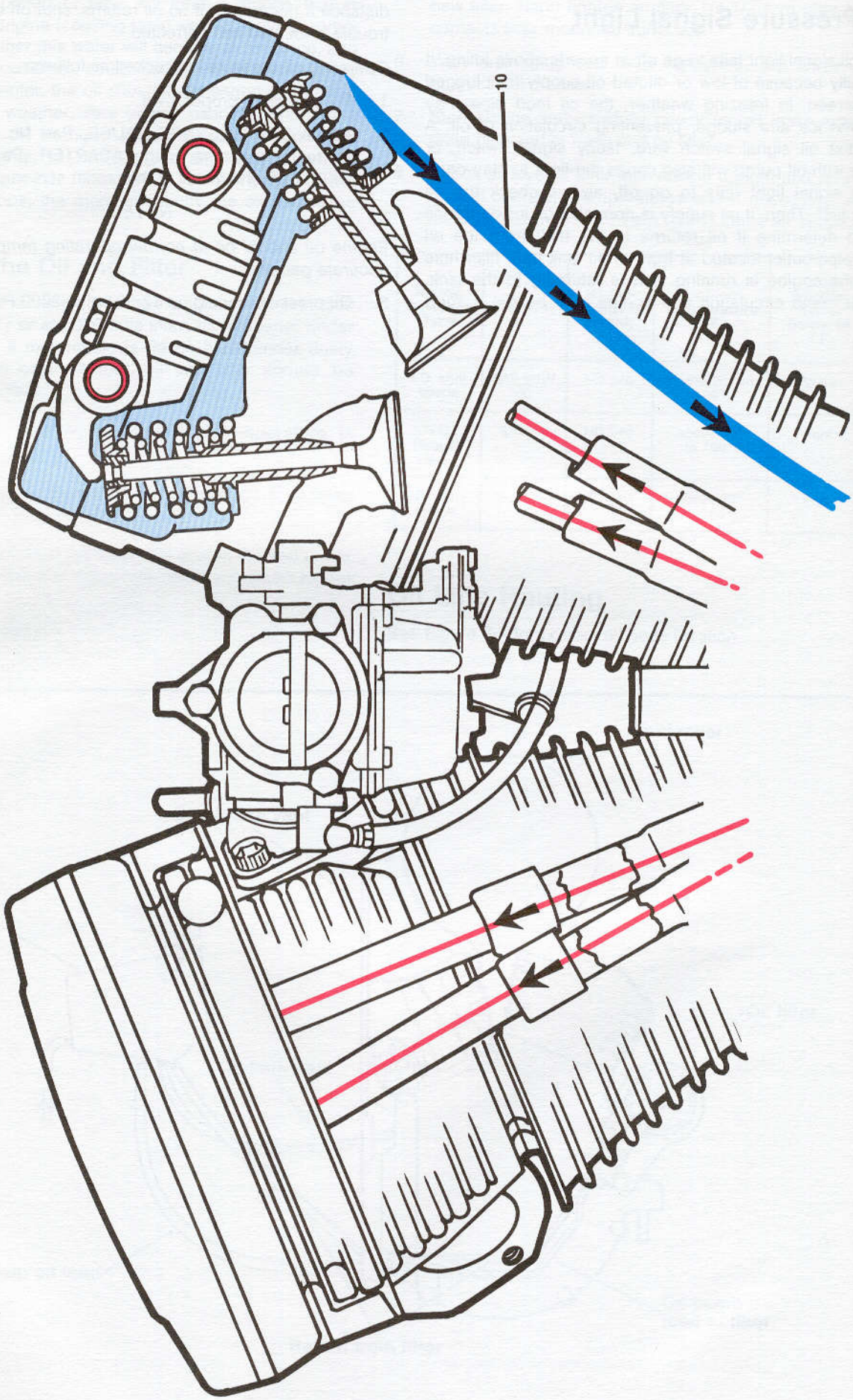
NOTE

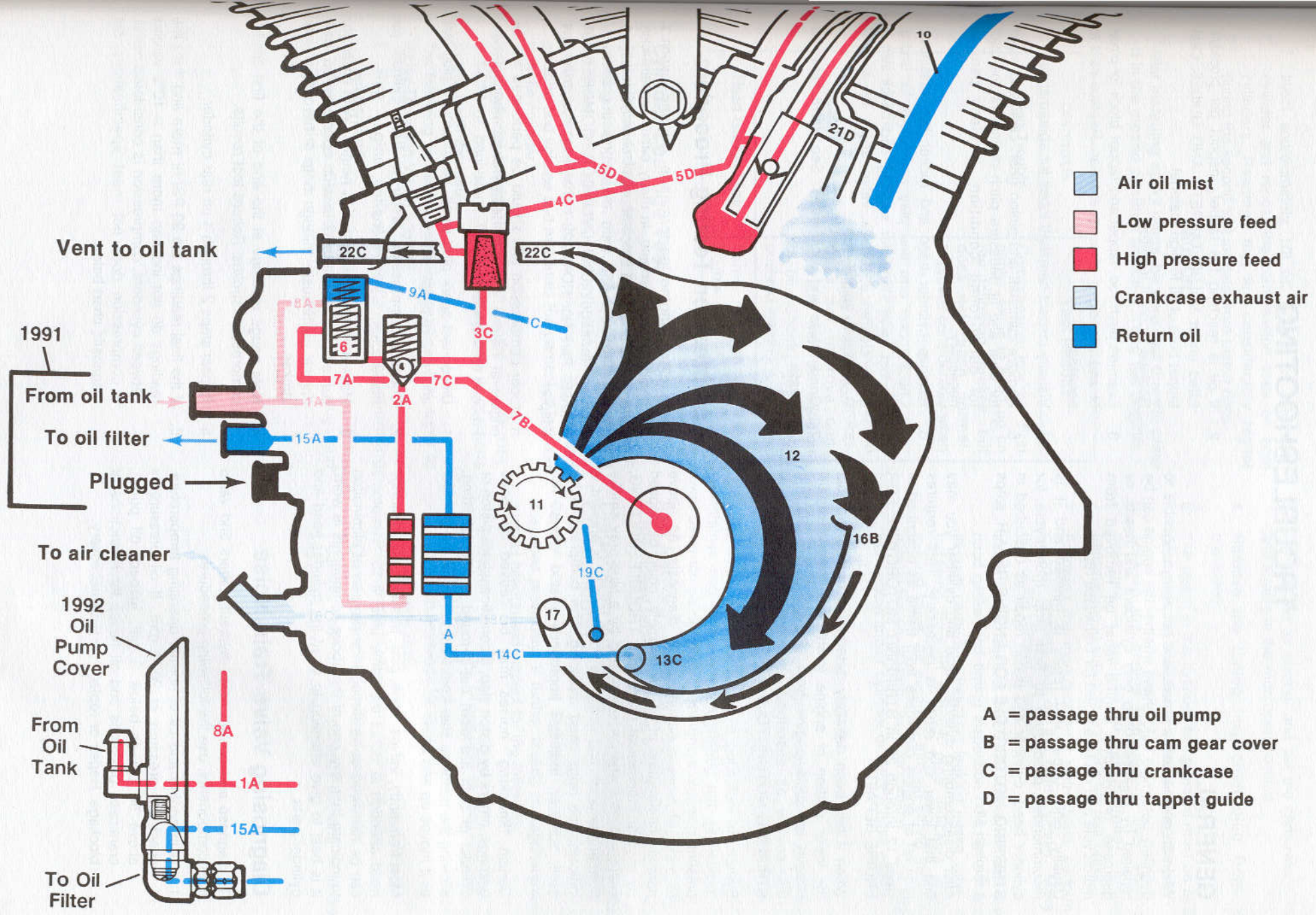
Engine oil should be at normal operating temperature for accurate gauging.

3. Oil pressure should be 12-35 psi at 2000 RPM.

EVOLUTION
OILING SYSTEM


10
High pressure feed
Return oil
Air oil mist
21D
5D
12
7B
13C


10


Air oil mist
Low pressure feed
High pressure feed
Crankcase exhaust air
Return oil
Vent to oil tank
1991
From oil tank
To oil filter
Plugged
To air cleaner
1992 Oil Pump Cover
From Oil Tank
To Oil Filter
10
21D
5D
5D
4C
22C
22C
9A
C
8A
6
3C
7A
7C
2A
1A
15A
7B
11
12
16B
19C
17
A
14C
13C
8A
1A
15A
A = passage thru oil pump
B = passage thru cam gear cover
C = passage thru crankcase
D = passage thru tappet guide

OIL FEED SYSTEM

Oil gravity feeds from oil tank to oil pump feed gears (1A).

Check valve (2A) prevents oil drainage from oil tank into the engine with engine stopped. When feed gears create a pressure of 3 psi, the check valve in the oil pump rises.

Oil is fed thru crankcase passage (3C) into the tappet oil screen. An additional crankcase passage leads to the oil pressure switch which activates above 5 psi.

Oil is fed thru crankcase passage (4C) to the tappet guide.

Oil passage in tappet guide (5D) provides oil to the bottom of hydraulic lifters. Oil fills and pumps up lifters and continues up thru the oil passage in the valve push rods. This oil lubricates rocker arm bushings, shafts, valve stems and push rod sockets.

The pressure created in the top end oil system causes oil pressure regulating valve (6) to open. Oil is then allowed to travel thru oil pump passage (7A) into a crankcase passage (7C) and thru cam gear cover passage (7B) lubricating pinion shaft bushing and lower connecting rod bearings.

When there is sufficient pressure to feed the upper and lower oil system, the oil pressure regulating valve lifts further allowing excessive pressure to return to the feed side of the oil pump cover (8A).

A passage (9A) from the top of the regulating valve tower leading thru the crankcase into the cam gear compartment prevents oil from being trapped and not allowing the regulating valve to lift.

OIL RETURN & CRANKCASE BREATHING SYSTEM

Feed oil to the rocker area is returned to the crankcase thru a passage (10) in the cylinder and head. This oil is then distributed to the piston, cylinder walls and flywheel components.

The rotary breather valve (11) is timed to open on the downstroke of the pistons, allowing crankcase exhaust air pressure to expel scavenged oil from the flywheel compartment through the breather valve into the cam gear compartment.

The oil and air mixture exhausted through the breather valve is separated in the cam gear compartment (12). The oil falls to the bottom of the case (13C), flows to the passage in the crankcase (14C), is picked up by the scavenge gears in the oil pump and returned (15A) to the oil filter and tank. The air along with a light oil mist is routed around a baffle in the cam gear cover (16B) and through a passage in the cover. An additional baffle (17) is located in the breather trap to further separate the air/oil mist. The air continues through the crankcase passage (18C) and to the air cleaner. The oil drops to the bottom of the breather trap (19C) and on piston upstroke, vacuum pulls oil thru a timed opening in the breather valve.

Positive cam gear compartment air pressure travels thru tappet guide passage (21D) and push rod covers. This pressure helps to evacuate oil from the rocker area and into the cylinder drain holes (10).

A vent passage (22C) vents to the oil tank.

EVOLUTION
OILING SYSTEM

TROUBLESHOOTING

GENERAL

When an engine needs repair, it is not always possible to definitely determine beforehand whether the engine can be repaired by disassembling only cylinders and heads, or gearcase; or whether engine must be removed from motorcycle and disassembled for crankcase repair.

Usually, only upper end repair is needed and it is recommended procedure to first strip motorcycle for cylinder head, cylinder and piston repair as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR, steps 1 through 11.

After disassembling cylinder head and cylinder you may find that lower end repair is necessary. This requires removal of engine crankcase from frame as described in steps 12 through 22 in STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

When it has been definitely determined beforehand that the lower portion of engine (crankcase) needs repair, remove complete engine from chassis before starting disassembly as described in steps 1 through 22 of STRIPPING MOTORCYCLE FOR ENGINE REPAIR.

Symptoms indicating a need for engine repair are often misleading, but generally if more than one symptom is present, possible symptom causes can be narrowed down to make at least a partial trouble diagnosis. An above normal consumption of oil, for example, could be caused by several mechanical faults (see TROUBLESHOOTING, section 1). 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 are worn out-of-round and loose fitting, 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.

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 or below 5 psi, inspect oil pump, crankcase passages and oil hoses for restrictions or blockage. Repair or replace parts as necessary.
2. If oil is reaching the tappet, inspect per procedure listed under VALVE TAPPETS AND GUIDES. Clean tappet bore of all foreign material.

   Replace tappet if required.
3. Examine push rod, tappet and tappet 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. Remove cylinder head and rocker box assemblies. Check rocker arm end play and check for binding. Inspect valve stems for scuffing and check stem to guide clearance. Check valve seats for signs of looseness or shifting.
7. Grind valves and valve seats. See Valve Faces and Seats.

Compression Testing Procedure

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. Proceed as follows:

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 continously 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 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 diagnostic chart below.

7. Inject approximately 1/2 oz. 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.

CAUTION

After installing spark plugs, be sure that throttle plate is in the closed position before starting the engine.

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 a cylinder leakage tester such as the Sun, MODEL CLT-228 or equivalent. 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. Remove the timing inspection plug from the crankcase.
5. The piston in the cylinder being tested must be at top dead center of compression stroke during the test.
6. 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.
7. Following the manufacturer's instructions, perform a cylinder leakage test on the front cylinder. Make a note of the percent of leakage.
8. Listen for air leaks at carburetor intake, exhaust pipe, head gasket and timing inspection hole. Air escaping through carburetor indicates leaking intake valve. Air escaping through exhaust pipe indicates leaking exhaust valve. Air escaping through timing inspection hole indicates leaking, worn or broken piston rings, worn piston and/or cylinder or leaking head gasket.

NOTE

If air is escaping through valves, check for correct pushrod length.

9. Repeat procedure on rear cylinder.

CAUTION

After installing spark plugs, Be sure throttle plate is in the closed position before starting engine.

Diagnosing Smoking Engine Or High Oil Consumption

Perform Compression or Cylinder Leakage Test as described previously. If further testing is needed remove suspect head(s) and inspect for the following:

- Overfill
- Oil carryover. } Check prior to head removal.
- Oil return passages for clogging.
- Valve guide seals
- Valve guide to valve stem clearance
- Gasket surface of both head and cylinder
- Cylinder head castings porosity allowing oil to drain into combustion chamber.

STRIPPING MOTORCYCLE FOR ENGINE REPAIR

ENGINE REMOVAL

Special Tools	Torque Values (ft-lbs)
HD-34641 Intake valve spring compressor	None

Use the following procedure to strip the motorcycle for either cylinder head and cylinder removal for repair with engine in chassis, or for engine removal for complete overhaul.

WARNING

Disconnect battery cables (negative cable first) before performing the following steps to avoid accidental startup of vehicle and possible personal injury.

Remove Engine as far as Cylinder Heads

1. Remove seat. See SEAT, Section 2.
2. Remove instrument cover. See SPEEDOMETER, Section 2.

WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Do not smoke or allow open flame or sparks when refueling or servicing the fuel system.

3. Drain fuel tank. Disconnect fuel line and remove fuel tank. See Section 4.

NOTE

An access hole has been provided through the frame to remove the left rear rocker box bolt. A rolled up paper tube should be inserted through the hole in the frame and around the bolt head during removal, to prevent accidentally dropping the bolt into the frame opening.

4. IF required, remove rocker cover fasteners and upper rocker boxes, See CYLINDER HEADS, Section 3.
5. Remove upper cylinder head engine bracket. Note washer(s) between bracket and frame lug, use same washer(s) when bracket is assembled.
6. Remove spark plugs to avoid damaging them. See SPARK PLUGS, Section 8.
7. Remove air cleaner cover, filter element, air cleaner back plate and air cleaner back plate support bracket from carburetor body. See AIR CLEANER, Section 4.
8. Remove fuel and V.O.E.S. hoses from carburetor. See CARBURETOR, Section 4.
9. Disconnect throttle and choke controls from carburetor. See THROTTLE CONTROL, Section 2. Remove carburetor and intake manifold as an assembly. See CARBURETOR, Section 4.
10. Remove exhaust pipes. See EXHAUST SYSTEM, Section 4.

At this stage, the lower rocker boxes, the cylinder heads and cylinders may be removed.

NOTE

It may be necessary to compress rear intake valve spring to provide clearance for lower rocker cover removal. Use Harley-Davidson INTAKE VALVE SPRING COMPRESSOR, Part No. HD-34641 to compress the spring.

Remove Engine Crankcase or Complete Engine

To remove engine crankcase or complete engine, continue stripping motorcycle as follows:

1. On models that do not have forward foot controls, remove right footrest, brake pedal and master cylinder assembly. See BRAKES, MASTER CYLINDER, Section 2.
2. Drain engine oil from tank. Drain lubricant from primary chaincase. See LUBRICATION, Section 3.
3. Remove primary cover. Remove compensating sprocket shaft nut so that compensating sprocket can be removed from sprocket shaft during engine removal. See CLUTCH, Section 6.
4. Remove bolts attaching inner primary housing to engine. See PRIMARY CHAINCASE, Section 6.
5. Disconnect sensor from ignition module. Disconnect alternator plug from crankcase. Unplug spark plug wires. See IGNITION SYSTEM, CHARGING SYSTEM, SPARK PLUGS, Section 8.
6. Remove clutch cable bracket from engine.
7. Disconnect wire from oil pressure switch.
8. See Figure 3-1. Remove oil lines from oil pump.
9. Remove front and rear engine mounting bolts.
10. Remove engine from right side of motorcycle using hoist.

ENGINE INSTALLATION

Special Tools	Torque Values (In-lbs)
HD-97087-65A Hose clamp tool	See Engine Mount Torque Procedure

1. Place the engine, with new engine-to-primary O-ring, in position on the frame motor mounting pads. Slide compensating sprocket onto shaft while replacing engine. See PRIMARY CHAINCASE, Section 6.
2. Install and hand tighten front and rear engine mounting bolts and washers.
3. Insert the inner primary mounting bolts. Leave the primary mounting bolts loose at this time. See PRIMARY CHAINCASE, Section 6.

Engine Mount Torque Procedure

4. Tighten the engine mounting bolts in the following torque sequence:
   a. Tighten the rear mounting bolts to 33-38 ft-lbs torque.
   b. Inspect the relationship of the front frame pad and engine mounting boss for proper alignment.
   c. Tighten the front mounting bolts to 33-38 ft-lbs torque.
5. Tighten the primary housing engine mounting bolts to 18-22 ft-lbs torque. Bend up lock tabs. See PRIMARY CHAINCASE, Section 6.
6. Install the top center motor mounting bolts paying specific attention to proper alignment. Shim as needed. Tighten the mounting nut to 35-40 ft-lbs torque.
7. Install compensating sprocket nut and adjust primary chain. See CLUTCH, Section 6.
8. Install primary cover and new gasket.
9. Install spark plugs. Install rectifier/regulator. Plug in charging system and spark plug wires. Attach sensor to ignition module. See IGNITION SYSTEM, CHARGING SYSTEM, SPARK PLUGS, Section 8.
10. See Figure 3-1. Install oil lines to oil pump and crankcase. Use new hose clamps. See OIL PUMP Section 3.
11. Install oil pressure switch wire.
12. Attach clutch cable bracket to engine.
13. Install carburetor and manifold assembly. Tighten screws. See CARBURETOR, Section 4.
14. Attach throttle and enrichener cables to carburetor. See THROTTLE CONTROL, Section 2.
15. Install air cleaner. See AIR CLEANER, Section 4.
16. Install exhaust system. See EXHAUST SYSTEM, Section 4.
17. On models without forward foot controls, install right footrest, brake pedal and master cylinder assembly. See BRAKES, MASTER CYLINDER, Section 2.
18. Install fuel tank and connect fuel lines. Use new hose clamps. See CARBURETOR, Section 4.
19. Install seat. See SEAT, Section 2.
20. Install new oil filter, engine oil and primary chaincase lubricant. See LUBRICATION, Section 3.
21. Connect battery cables, positive cable first. See BATTERY, Section 8.

CYLINDER HEAD

CYLINDER HEAD REMOVAL

Before removing cylinder head assembly, strip motorcycle as described in STRIPPING MOTORCYCLE FOR ENGINE REPAIR. The rocker arm covers and internal components must be removed before removing heads.

1. See Figure 3-2. Remove bolts (1) with their washers (2) and fiber seals (3).

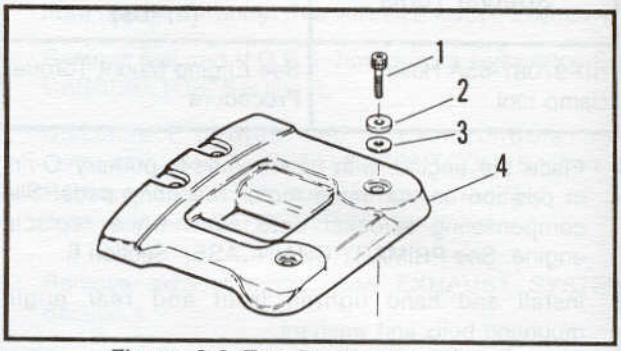
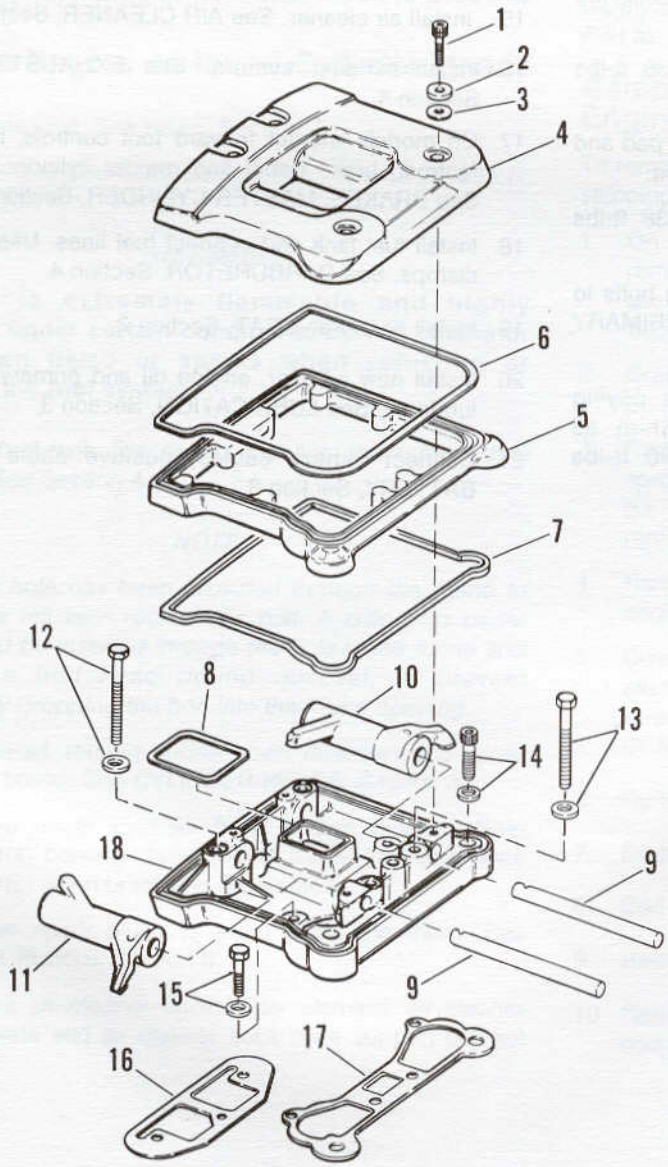


Figure 3-3. Top Rocker Arm Cover



1. Bolt (4)
2. Washer (4)
3. Seal (4)
4. Upper rocker arm cover
5. Middle rocker arm cover
6. Gasket
7. Gasket
8. Gasket
9. Rocker arm shaft (2)
10. Rocker arm
11. Rocker arm
12. Bolt and washer (2)
13. Bolt and washer (2)
14. Bolt and washer (2)
15. Bolt and washer (3)
16. Gasket
17. Gasket
18. Lower rocker arm cover

Figure 3-2. Rocker Arm Cover Assembly

NOTE

All washers and fasteners used in the V² engine are hardened, so they must not be mixed or replaced with unhardened parts.

2. See Figure 3-2. Remove top (4) and middle (5) sections of rocker box. Remove gaskets (6, 7 and 8) and discard.

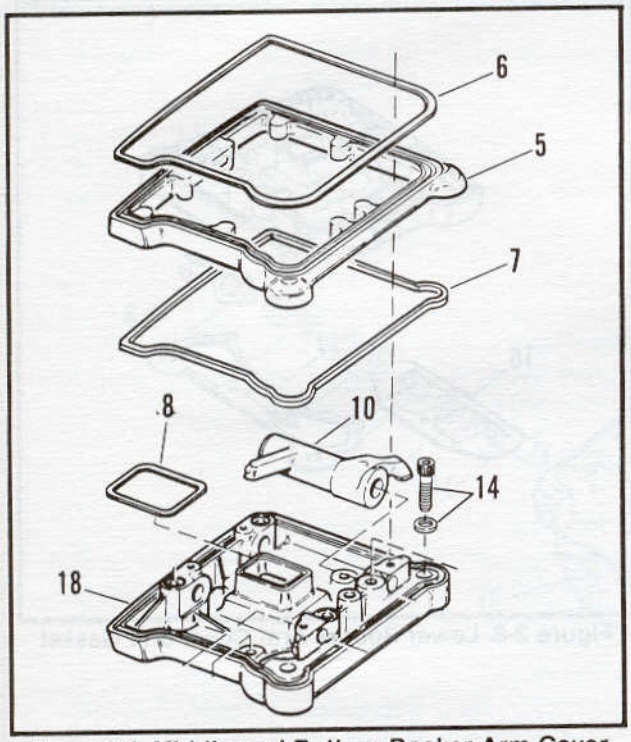


Figure 3-4. Middle and Bottom Rocker Arm Cover

3. Rotate the engine so both valves are closed on the head being replaced.

4. Remove the rocker arm retaining bolts (12) and washers nearest the rocker arm shafts at the push rod end.

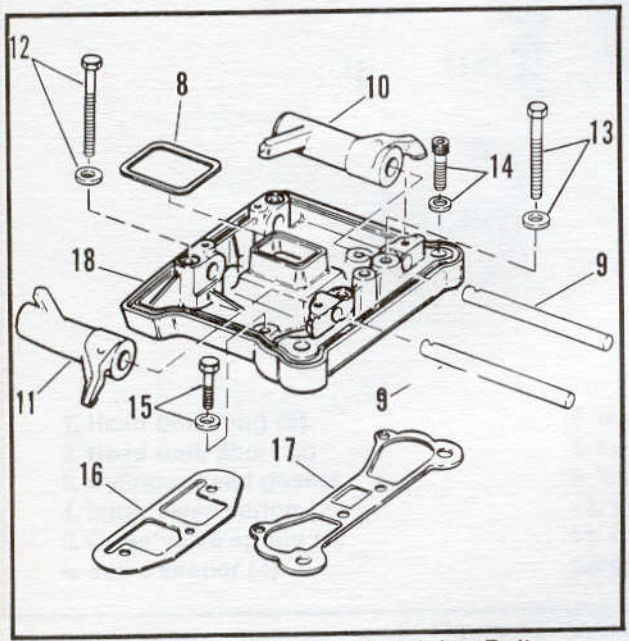


Figure 3-5. Rocker Arm Retaining Bolts

NOTE

Remove lower rocker boxes as an assembly, then diassemble if necessary.

5. Remove the rocker arm shafts by tapping them out with a hammer and soft metal punch.

CAUTION

Mark rocker arm shafts so they will be installed in their original positions. All valve train components must be reinstalled in their original positions.

6. See Figure 3-2. Remove rocker arms (10 and 11) and mark them so they will be assembled in their original locations.

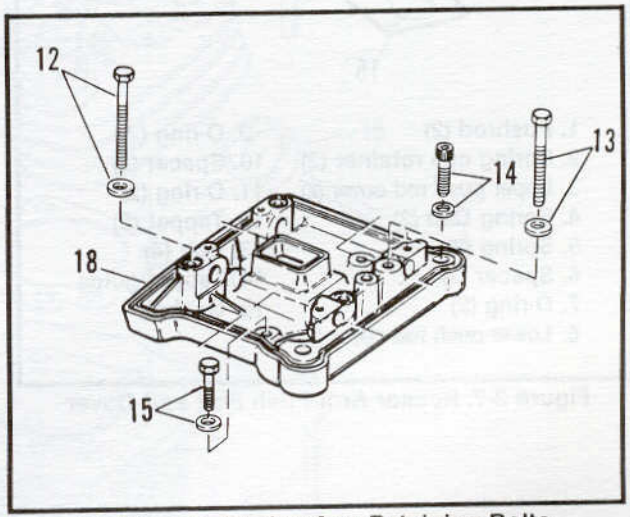
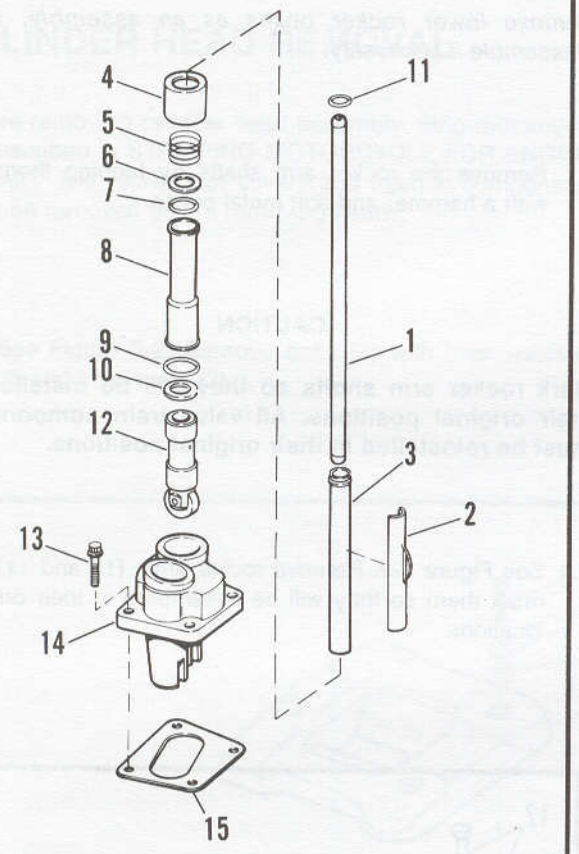


Figure 3-6. Rocker Arm Retaining Bolts

7. See Figure 3-7. Remove the push rods (1) and mark their location and orientation, top and bottom.

8. Remove spring cap retainers (2) on push rod covers and remove push rod covers and associated parts, (3 through 11).



1. Pushrod (2)
2. Spring cap retainer (2)
3. Upper push rod cover (2)
4. Spring Cap (2)
5. Spring (2)
6. Spacer (2)
7. O-ring (2)
8. Lower push rod cover (2)
9. O-ring (2)
10. Spacer (2)
11. O-ring (2)
12. Tappet (2)
13. Bolt (4)
14. Tappet guide
15. Gasket

Figure 3-7. Rocker Arm Push Rod and Cover

9. See Figure 3-2. Remove the remaining fasteners (13, 14 and 15) holding the lower rocker arm cover (18) to the cylinder head.

10. Remove the lower rocker cover and gaskets (16 and 17).

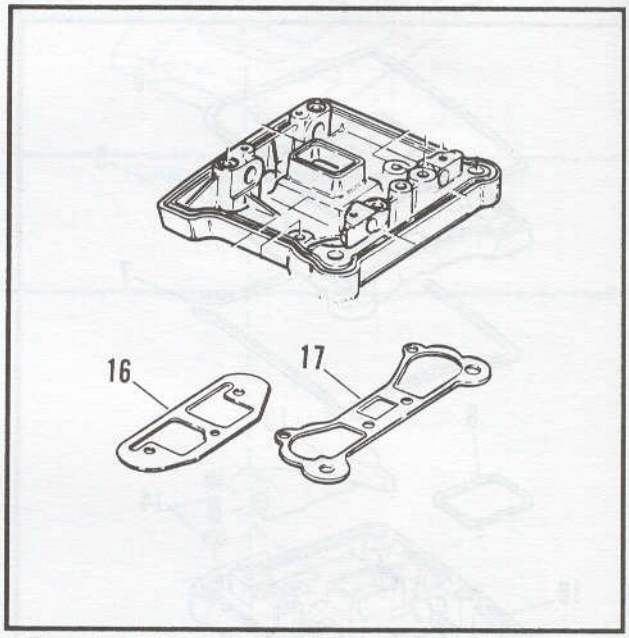
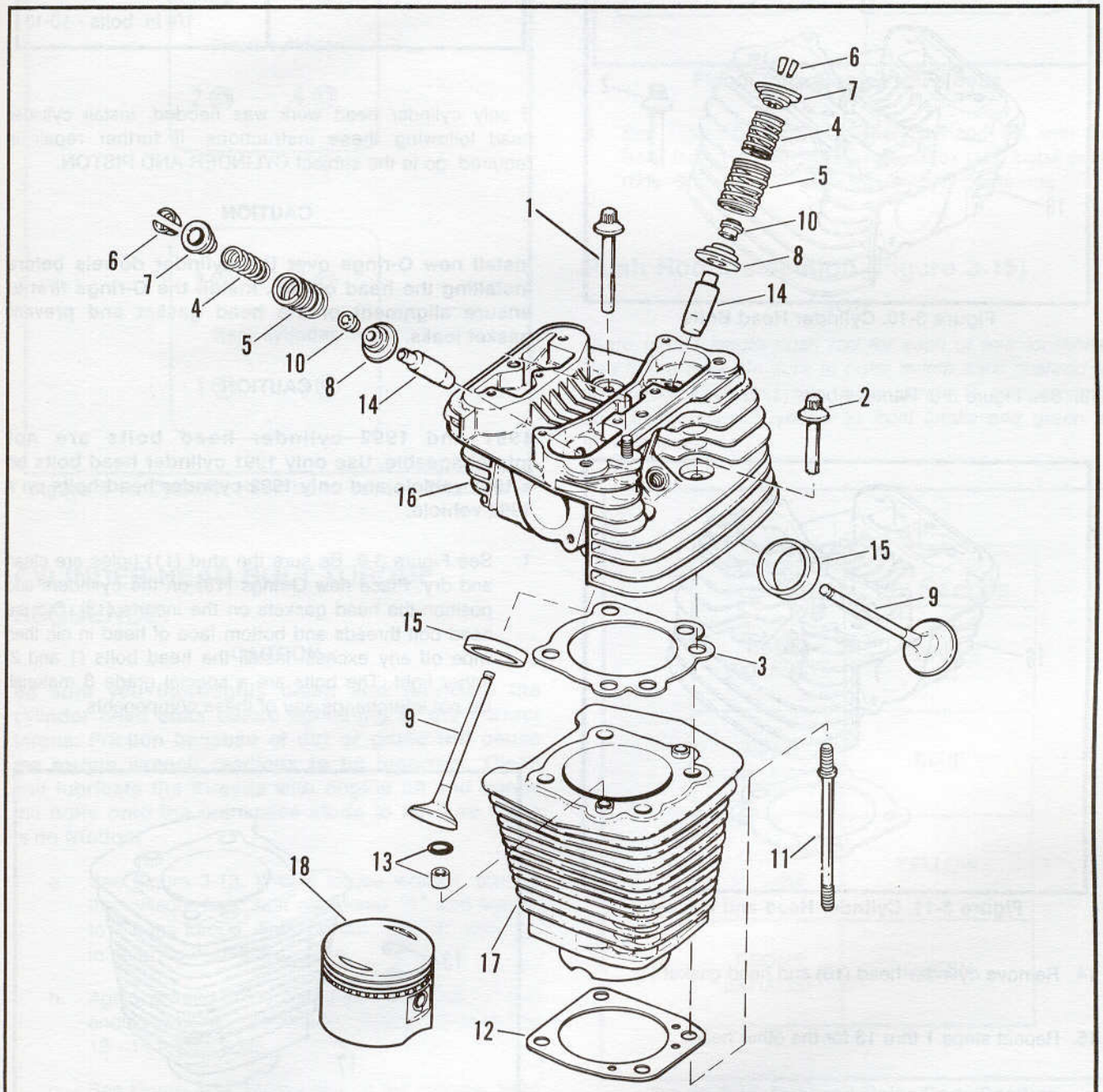


Figure 3-8. Lower Rocker Arm Cover and Gasket

CAUTION

Loosen head bolts gradually to prevent distorting the head, cylinder and crankcase studs.

11. See Figure 3-9. Loosen each head bolt (1, 2) 1/8 turn following the cross pattern sequence shown in Figure 3-13.



1. Head bolt, long (2)
2. Head bolt, short (2)
3. Cylinder head gasket
4. Inner valve spring (2)
5. Outer valve spring (2)
6. Valve keeper (4)
7. Upper collar (2)
8. Lower collar (2)
9. Valve (1) intake, (1) exhaust
10. Valve stem seal (2)
11. Cylinder stud (4)
12. Cylinder base gasket
13. O-ring and insert (2)
14. Valve guide (2)
15. Valve seat (2)
16. Cylinder head
17. Cylinder
18. Piston

Figure 3-9. Cylinder Head and Cylinder

12. See Figure 3-13. Continue loosening in 1/8 turn increments until bolts are loose.

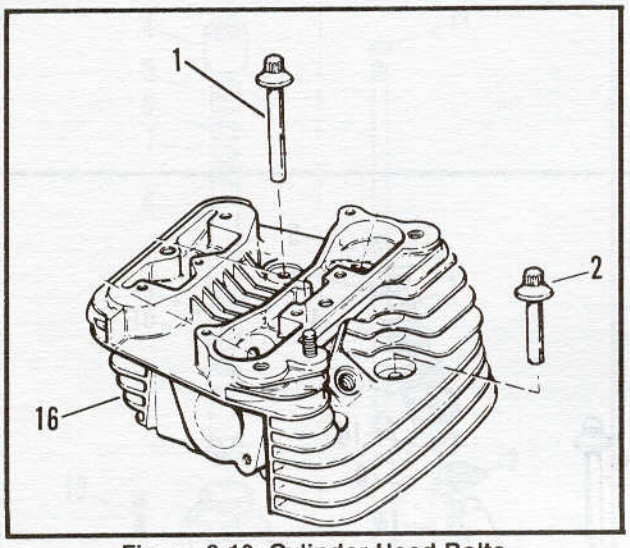


Figure 3-10. Cylinder Head Bolts

13. See Figure 3-9. Remove bolts (1, 2).

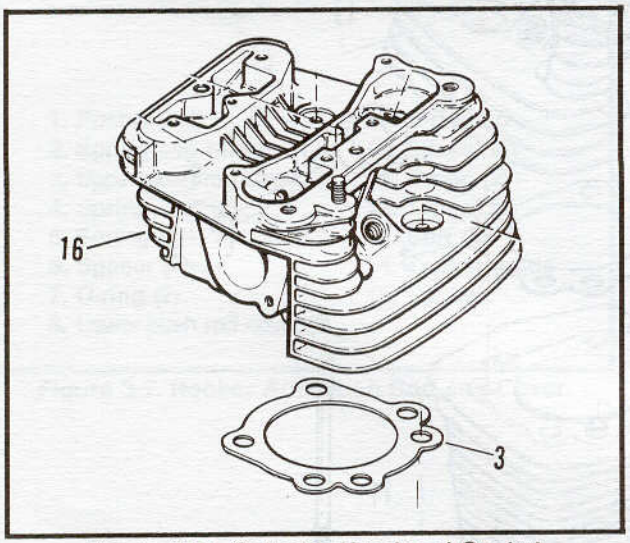


Figure 3-11. Cylinder Head and Gasket

14. Remove cylinder head (16) and head gasket (3).

15. Repeat steps 1 thru 13 for the other head.

If the cylinder heads require work before installation, see CYLINDER HEAD DISASSEMBLY/ASSEMBLY and CYLINDER HEAD REPAIR.

CYLINDER HEAD INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	See head bolt **TORQUE SEQUENCE** below Lower rocker box bolts 5/16 in. bolts - 15-18 1/4 in. bolts - 10-13

If only cylinder head work was needed, install cylinder head following these instructions. If further repair is required, go to the subject CYLINDER AND PISTON.

CAUTION

Install new O-rings over the cylinder dowels before installing the head gasket. Install the O-rings first to ensure alignment of the head gasket and prevent gasket leaks.

CAUTION

1991 and 1992 cylinder head bolts are not interchageable. Use only 1991 cylinder head bolts on a 1991 vehicle and only 1992 cylinder head bolts on a 1992 vehicle.

1. See Figure 3-9. Be sure the stud (11) holes are clean and dry. Place new O-rings (13) on the cylinders and position the head gaskets on the inserts (13). Dip the head bolt threads and bottom face of head in oil; then wipe off any excess. Install the head bolts (1 and 2) finger tight. The bolts are a special grade 8 material. Do not interchange any of these components.

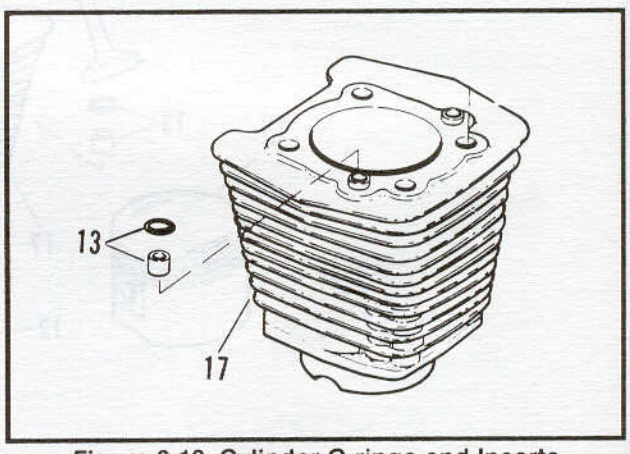


Figure 3-12. Cylinder O-rings and Inserts

2. See Figure 3-13. The procedure for tightening the head bolts is extremely critical; not only to prevent gasket leaks, but to prevent studs' failure and heads and cylinders distortion.

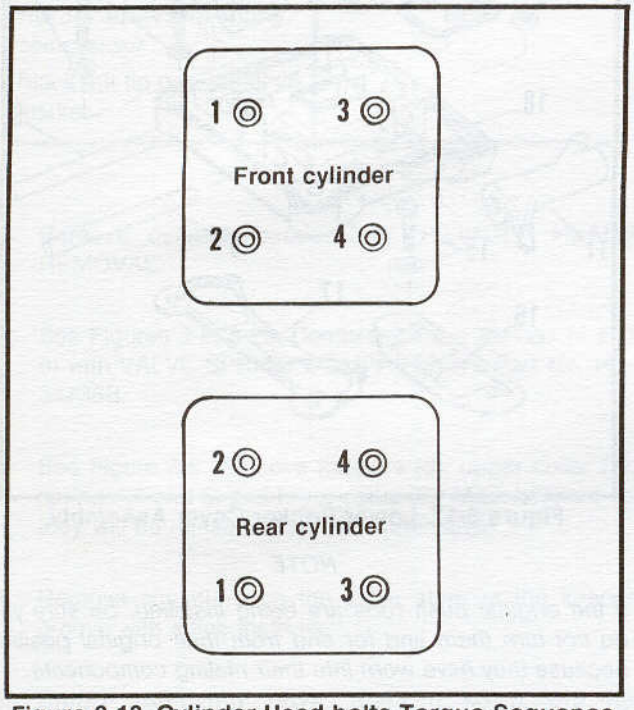


Figure 3-13. Cylinder Head bolts Torque Sequence

CYLINDER HEAD BOLT TORQUE SEQUENCE:

CAUTION

Be sure you thoroughly clean and lubricate the cylinder head bolts before tightening to the correct torque. Friction because of dirt or grime will cause the torque wrench readings to be incorrect. Clean and lubricate the threads with engine oil and screw the bolts onto the crankcase studs to be sure there is no friction.

a. See Figure 3-13. With a torque wrench, start at the cylinder head bolt numbered "1" and tighten to 7 ft-lbs torque. Then tighten "2", "3" and "4", in order, to 7 - 9 ft-lbs torque.

b. Again, starting at the head bolt numbered "1" and ending with "4" sequentially, tighten each bolt to 12 - 14 ft-lbs torque.

c. See Figure 3-14. Mark a line on the cylinder head and a corresponding line on the head of the cylinder head bolt as shown in View A. Following the same sequence 1, 2, 3, then 4, turn each bolt, one at a time one quarter turn (90°) using the marks as a guide. When marks are all positioned, as in View B, the procedure is completed.

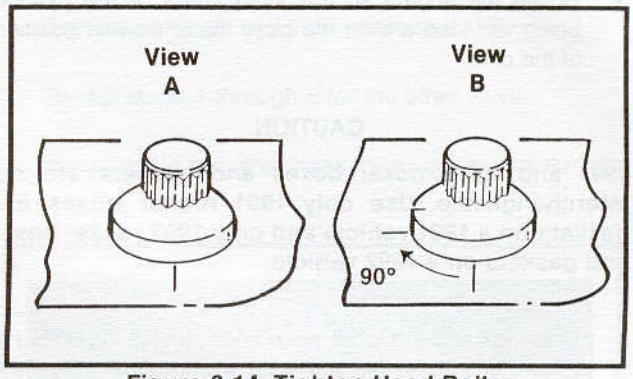


Figure 3-14. Tighten Head Bolts

3. See Figure 3-3. Install gaskets (16 and 17), with the bead facing up, and lower rocker box (18). Install push rods. See PUSH ROD INSTALLATION, following.

Push Rod Installation (Figure 3-15)

NOTE

There is one length push rod for each of four locations. See figure 3-19. Be sure to color match each pushrod to its correct valve and cam lobe; purple to rear exhaust, blue to rear intake, yellow to front intake and green to front exhaust.

PUSHROD POSITION	COLOR CODE
REAR EXHAUST	PURPLE
REAR INTAKE	BLUE
FRONT INTAKE	YELLOW
FRONT EXHAUST	GREEN

Figure 3-15. Pushrod Color Code/Position

1. Rotate camshaft so tappet is at its lowest point (on base circle of camshaft).

2. Remove the rocker arms and shafts and lower rocker boxes, if not already removed.

3. Rotate the engine so that both lifters of the cylinder being serviced are on the base circle (lowest position) of the cam.

CAUTION

1991 and 1992 rocker boxes and gaskets are not interchangeable. Use only 1991 rocker boxes and gaskets on a 1991 vehicle and only 1992 rocker boxes and gaskets on a 1992 vehicle.

4. See Figure 3-2. Install push rods. Install gaskets (16, 17). Place lower rocker box assemblies (18) (with rocker arms and shafts) in position.

NOTE

See Figure 3-16. Rocker arm shafts are notched to accept the rocker arm retaining bolts. Align the notches with the bolt holes before installing the bolts.

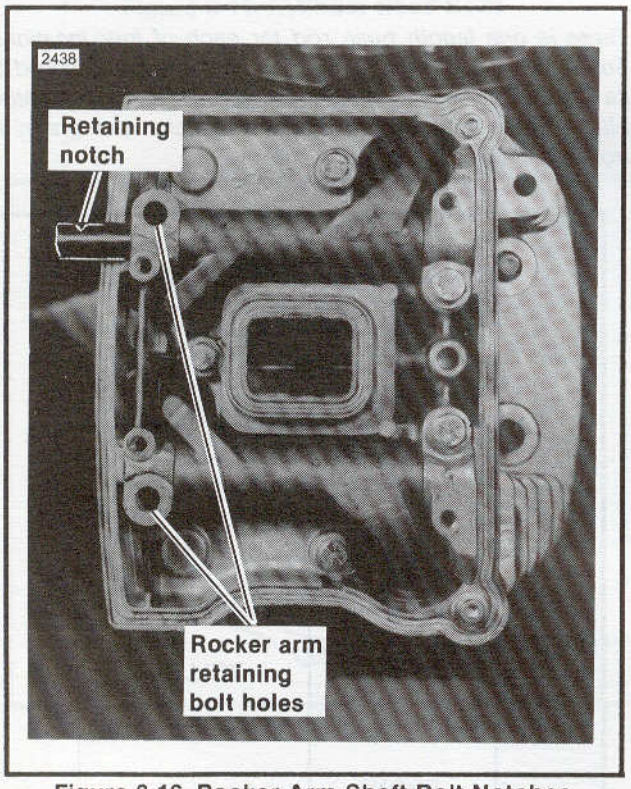


Figure 3-16. Rocker Arm Shaft Bolt Notches

5. Install bolts and washers (12 and 13, 14 and 15). Slowly snug lower rocker box fasteners in small increments (one at a time) in a cross pattern. This will bleed the lifters. Tighten the 5/16 in. bolts (12, 13) to 15-18 ft-lbs torque and tighten the 1/4 in. bolts (14, 15) to 10-13 ft-lbs torque. Tighten the fasteners to the proper torque.

CAUTION

Do not turn engine over until push rods spin freely. Damage could occur to valve(s).

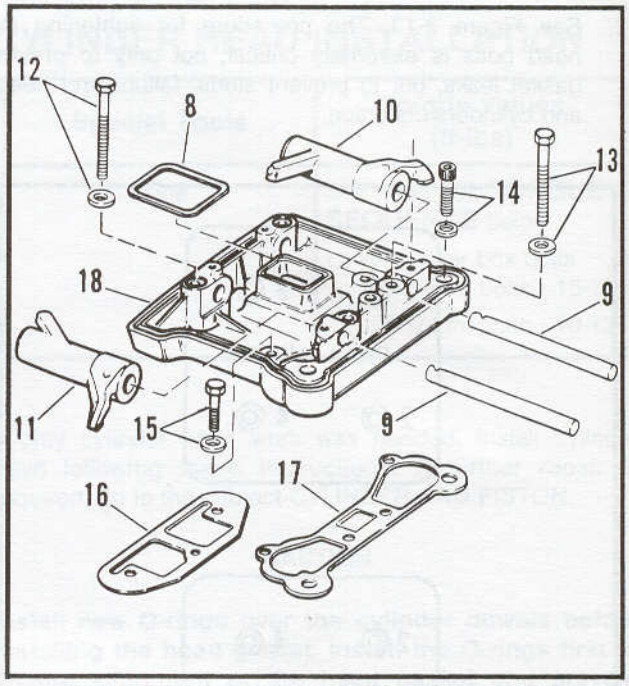


Figure 3-17. Lower Rocker Cover Assembly

NOTE

If the original push rods are being installed, be sure you do not turn them end for end from their original position because they have worn into their mating components.

6. Install the middle (5) and top (4) rocker arm covers, using new gaskets and new fiber seals. The fiber seals must be under the steel washers. Be sure the middle cover section is spaced evenly on all sides before tightening the cover screws. Tighten the screws to 10-13 ft-lbs torque following a crisscross pattern.

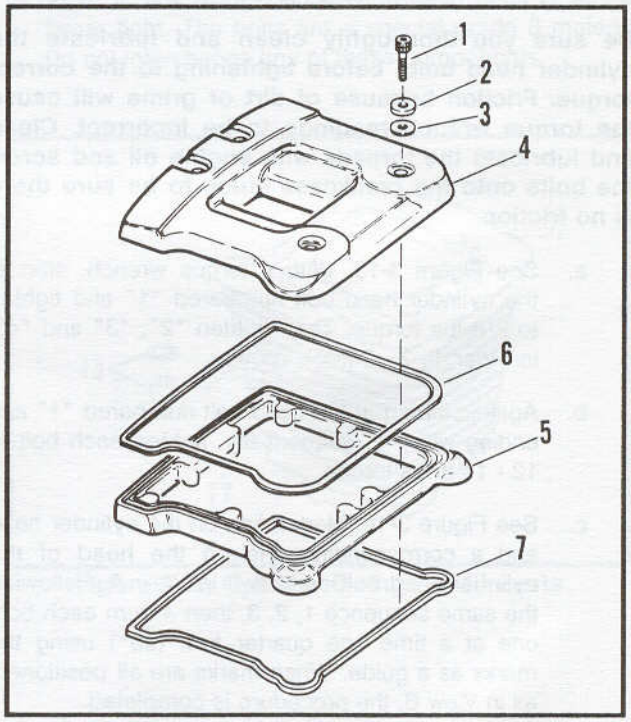


Figure 3-18. Middle and Top Rocker Cover Assembly

7. Install the carburetor, V.O.E.S. and ignition components.

CYLINDER HEAD DISASSEMBLY

Special Tools	Torque Values (ft-lbs)
HD-34736B Valve spring compressor Black felt tip pen or felt tip marker	None

1. Remove cylinder heads. See CYLINDER HEADS REMOVAL.
2. See Figures 3-9, 3-20. Compress valve springs (4 and 5) with VALVE SPRING COMPRESSOR, Part No. HD-34736B.
3. See Figure 3-9. Remove keepers (6), upper collar (7), springs (4 and 5) and lower collar (8). Mark keepers so they will be reinstalled on the same valve
4. Remove any burrs on the valve stem at the keeper groove with a fine tooth file.
5. Before removing valve, mark it so it will be reassembled in the same head.
6. Remove valve (9) and valve stem seal (10).
7. Repeat steps 1 through 5 for the other valve..
8. Disassemble the other head following steps 1 thru 6.

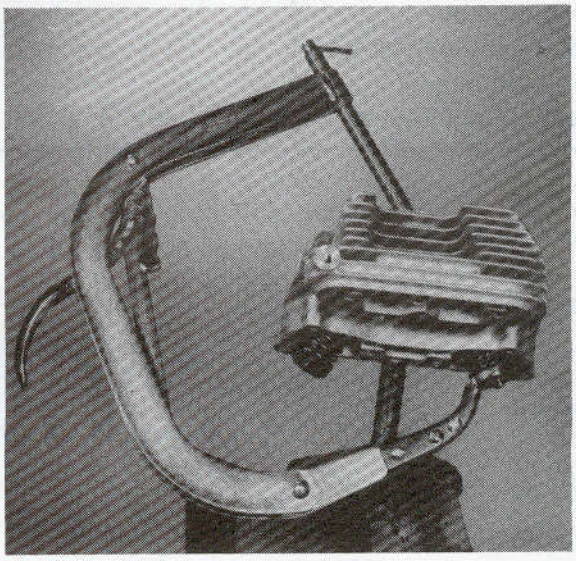


Figure 3-19. Compress Valve Springs

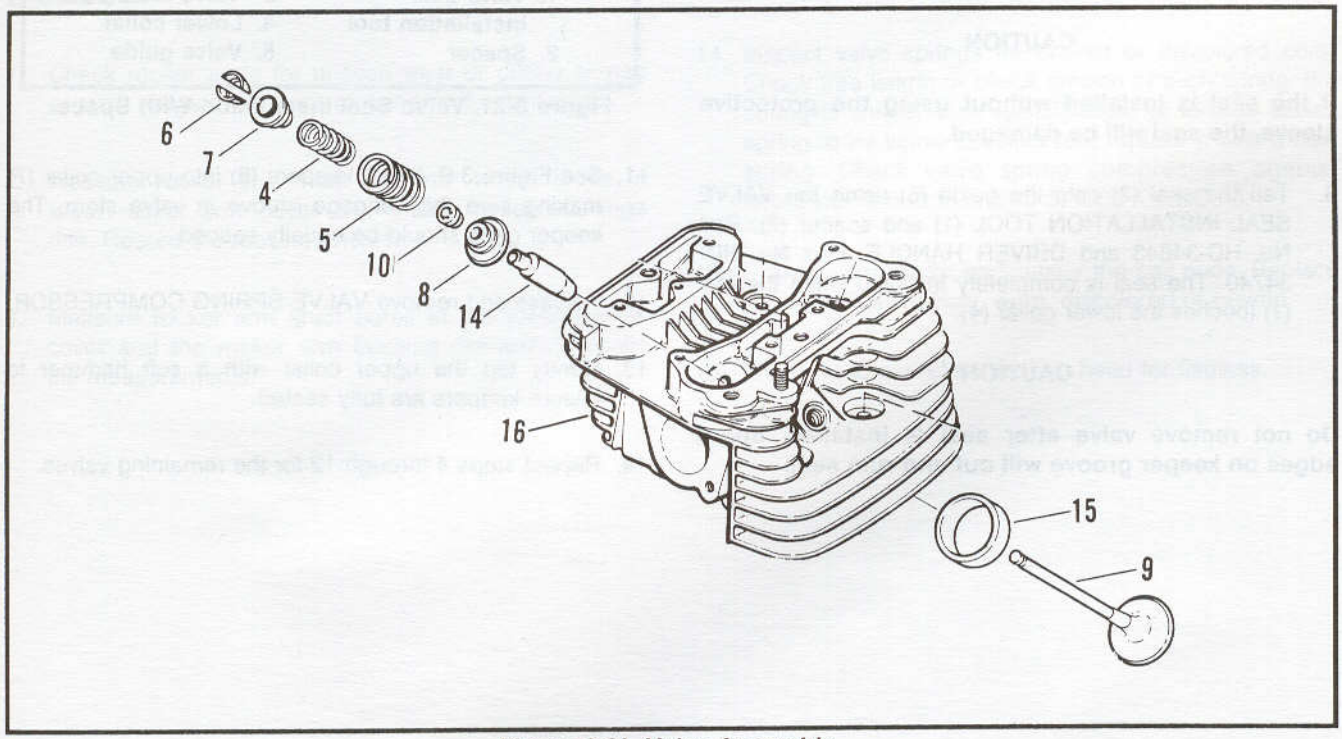


Figure 3-20. Valve Assembly

CYLINDER HEAD ASSEMBLY

Special Tools	Torque Values (ft-lbs)
HD-34571 Valve guide brush HD-34643 Valve seal installation tool HD-34740 Driver handle HD-34736B Valve spring compressor	None

1. Wash cylinder head and valves in warm soapy water to remove all lapping compound.
2. Scrub valve guide bores with VALVE GUIDE BRUSH, Part No. HD-34751 and hot soapy water.
3. Blow dry with compressed air.
4. Apply a liberal amount of engine oil to the valve stem.
5. Insert valve into guide.

CAUTION

Do not apply Loctite to inner portion of seal or top of guide.

6. Install lower collar (4).
7. See Figure 3-21. Apply a small amount of RC 620 Loctite (green) retaining compound to outside diameter of guide near the top of guide. Place a protective sleeve over the valve stem keeper grooves. Coat the sleeve with oil and place a new seal over the valve stem.

CAUTION

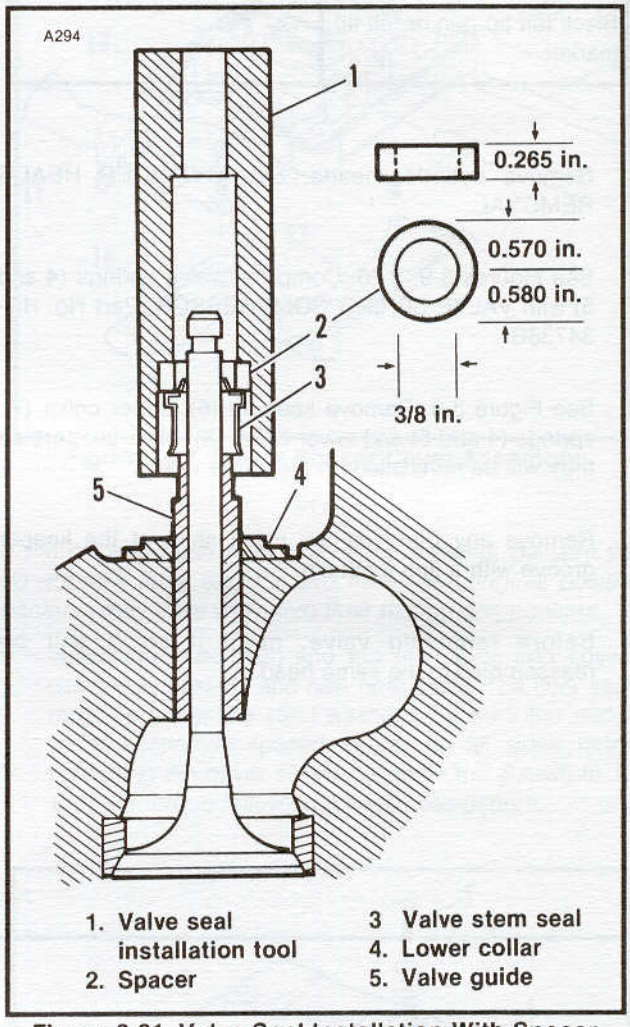
If the seal is installed without using the protective sleeve, the seal will be damaged.

8. Tap the seal (3) onto the guide (5) using the VALVE SEAL INSTALLATION TOOL (1) and spacer (2), Part No. HD-34643 and DRIVER HANDLE, Part No. HD-34740. The seal is completely installed when the tool (1) touches the lower collar (4).

CAUTION

Do not remove valve after seal is installed. Sharp edges on keeper groove will cut and ruin seal.

9. See Figure 3-9. Install valve springs (4 and 5), upper collar (7).
10. See Figures 3-8, 3-9. Compress springs (4 and 5) with VALVE SPRING COMPRESSOR, Part No. HD-34736.



1. Valve seal installation tool
2. Spacer
3. Valve stem seal
4. Lower collar
5. Valve guide

Figure 3-21. Valve Seal Installation With Spacer

11. See Figure 3-9. Insert keepers (6) into upper collar (7) making sure they engage groove in valve stem. The keeper gaps should be equally spaced.
12. Release and remove VALVE SPRING COMPRESSOR.
13. Gently tap the upper collar with a soft hammer to ensure keepers are fully seated.
14. Repeat steps 4 through 12 for the remaining valves.

CLEANING AND INSPECTION

Special Tools	Torque Values (ft-lbs)
HD-34723 Valve guide hone HD-34571 Valve guide brush	None

Clean:

1. Remove and disassemble heads. See CYLINDER HEADS REMOVAL; CYLINDER HEADS DISASSEMBLY.

2. Scrape carbon from head, top of cylinder, top of bore above ring path, and inlet and exhaust valve ports. When scraping carbon, be careful to avoid scratching or nicking cylinder head and cylinder joint faces or bore. Blow off loosened carbon or dirt with compressed air.

3. Soak cylinder head in HYDRO-SEAL to loosen carbon deposits.

4. Wash all parts in non-flammable solvent. Blow out oil passages in head. Be sure they are free of sludge and carbon particles. Remove loosened carbon from valve head and stem with a wire wheel. Never use a file or other hardened tool that will scratch or nick valve stem. Polish valve stem with very fine emery cloth or steel wool.

Inspect:

1. Check rocker arms for uneven wear or pitting at pad or push rod end. Replace rocker arm if either exists.

2. Measure rocker arm shaft diameter where it fits in lower rocker arm cover and where rocker bushings ride. Record the measurements.

3. Measure rocker arm shaft bores in the lower rocker cover and the rocker arm bushing diameter. Record the measurements.

4. Check the clearances and measurements obtained in steps 5 and 6 against the SERVICE WEAR LIMITS.

5. Repair or replace parts exceeding the SERVICE WEAR LIMITS.

6. Assemble rocker arms, and rocker arm shafts into lower rocker cover.

7. Check end play of rocker arm with feeler gauge.

8. Replace rocker arm or lower cover or both if end play exceeds 0.035 in.

9. Valve heads should have a seating surface 0.040 - 0.062 in. wide and should be free of pit marks and burn spots. Exhaust valves should contain carbon that is black or dark brown. White or light buff carbon indicates excessive heat and burning.

10. Valve seats are also subject to wear, pitting and burning. They should be resurfaced whenever valves are refinished.

11. Clean valve guides by lightly honing with VALVE GUIDE HONE, Part No. HD-34723.

12. Scrub guides with VALVE GUIDE BRUSH, Part No. HD-34571 and hot soapy water. Measure valve stem and guide bore and check measurements against SERVICE WEAR LIMITS.

13. Inspect spark plug port threads for damage. If threads in head are damaged, a special plug type insert can be installed using a standard spark plug port repair kit.

14. Inspect valve springs for broken or discolored coils. Check free length or check tension of each spring. If a spring is shorter than specification, or tension shows spring to be below specification, replace it with a new spring. Check valve spring compression against tolerances shown in engine SPECIFICATIONS.

15. Examine push rods, particularly the ball ends. Replace any rods that are bent, worn, discolored or broken.

16. Check head gasket surface on head for flatness.

CYLINDER HEAD REPAIR

Special Tools	Torque Values (ft-lbs)
9/16-18 Tap HD-94804-57 Rocker arm bushing reamer HD-34740 Driver handle and remover HD-34731 Valve guide installation tool HD-94810-80 Valve guide reamer HD-34723 Valve guide hone HD- 34751 Valve guide brush 082454 Neway valve seat cutter HD-96550 36A Valve lapping tool	None

Rocker Arms and Bushings

1. Remove and disassemble heads. See CYLINDER HEADS REMOVAL; CYLINDER HEADS DISASSEMBLY. Clean heads. See CLEANING AND INSPECTION.

1. See Figure 3-22. To replace worn bushings, press them from the rocker arm one at a time. If bushing is difficult to remove, turn a 9/16-18 tap into bushing. From opposite side of rocker arm, press out bushing and tap.

2. Press replacement bushing into rocker arm, flush with arm end, and split portion of bushing towards top of arm.

3. Use the old bushing in the opposite end as a pilot and line ream the new bushing with Harley-Davidson ROCKER ARM BUSHING REAMER, Part No. HD-94804-57.

NOTE

Drive end of reamer is pilot. Be sure pilot end is in old bushing.

4. Repeat for other end of rocker arm, using new, reamed bushing as a guide.

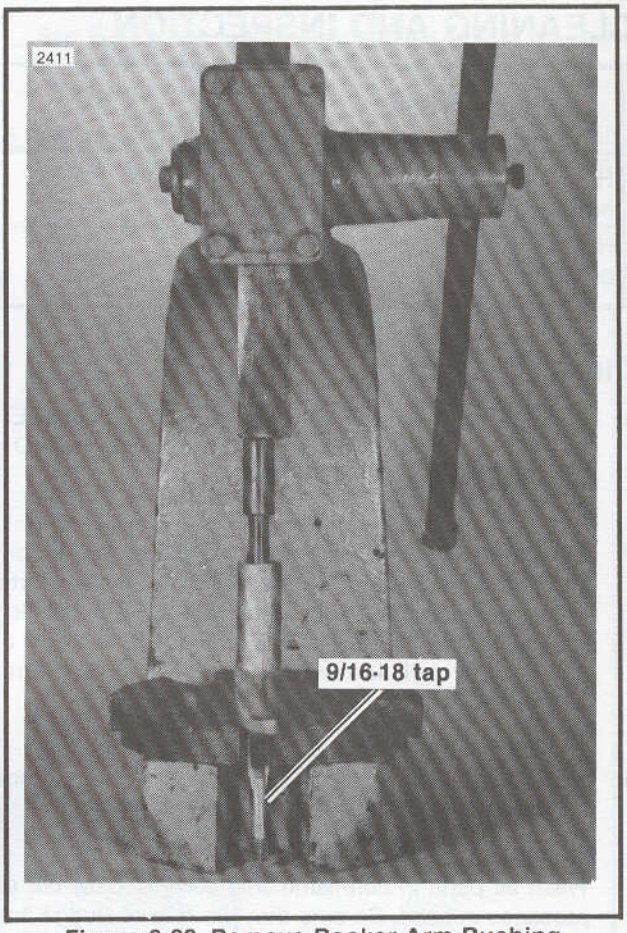


Figure 3-22. Remove Rocker Arm Bushing

Valve Guides

Replacing valve guides if necessary, must be done before valve seat is ground because the valve stem hole in valve guide is the basis from which all seat grinding is done. Valve stem-to-valve guide clearances are listed in chart below. If valve stems and/or guides are worn beyond SERVICE WEAR LIMITS, new parts must be installed.

Valve Stem Clearances and Service Limits

Valve	Valve Stem Clearance
Exhaust	0.0015 - 0.0040 in.
Intake	0.0008 - 0.0035 in.

Shoulder-less guides are pressed toward combustion chamber using DRIVER HANDLE AND REMOVER, Part No. HD-34740.

1. Clean and measure valve guide bore in head.

2. The guide diameter should be 0.0020 - 0.0033 in. larger than bore in head. If it is not, select one of the following oversizes: intake and exhaust - 0.001, 0.002, and 0.003 in.

3. See Figure 3-23. Install shoulder-less guides using VALVE GUIDE INSTALLATION TOOL, Part No. HD-34731 and DRIVER HANDLE, Part No. HD-34740. Lube and press guide until the tool touches the machined surface surrounding the guide. At this point, you have reached the correct guide height.

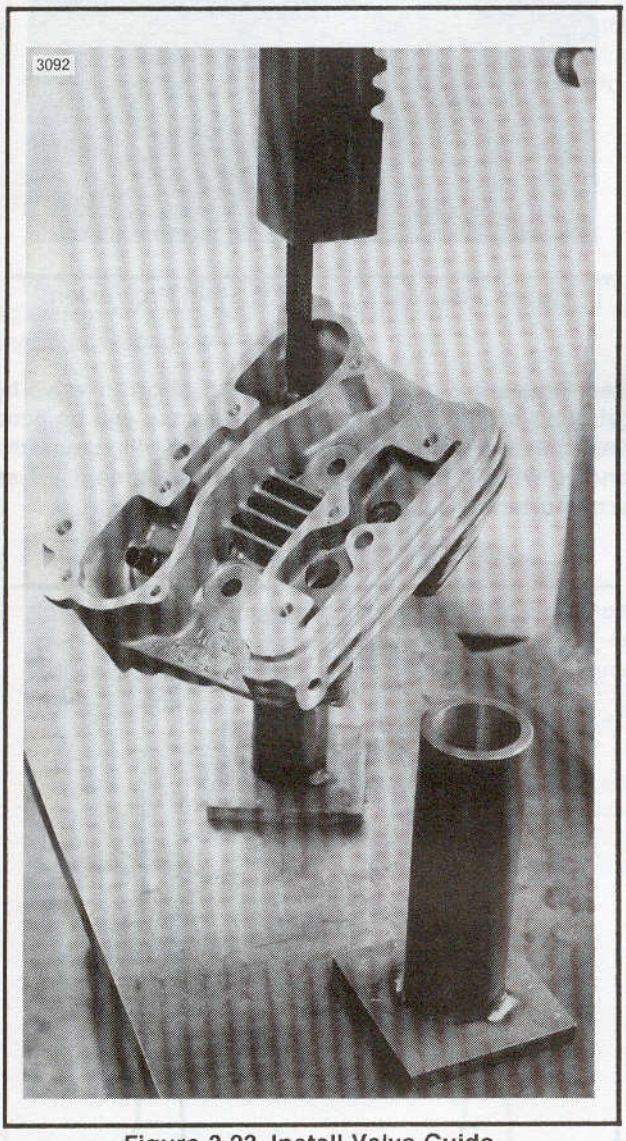


Figure 3-23. Install Valve Guide

4. The guides must be reamed to within 0.0005 - 0.0001 in. of finished size with VALVE GUIDE REAMER, Part No. HD-94810-80. Use liberal amounts of cutting oil to prevent reamer chatter.

5. See Figure 3-24. Finish size the guide bore with the VALVE GUIDE HONE, Part No. HD-34723. Drive hone with an electric drill and work for a crosshatch pattern of approximately 60°. Lubricate hone with honing oil.

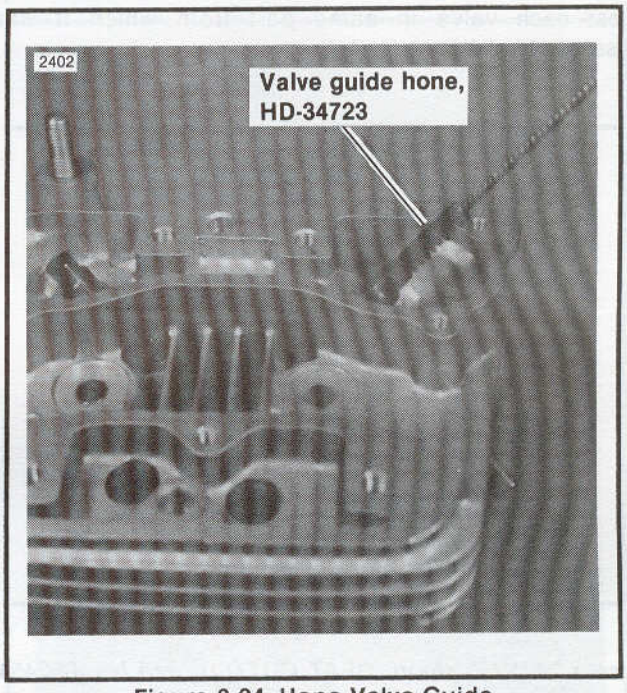


Figure 3-24. Hone Valve Guide

6. Clean guide bores with VALVE GUIDE BRUSH, Part No. HD- 34751 and hot soapy water after honing.

Valve Faces and Seats

After installing valve guides, valve seats must be refaced to true them with guides.

Valve face angle is 45° for both intake and exhaust valves, and if a valve refacing grinder is used, it must be adjusted exactly to this angle. It is important to not remove any more metal than is necessary to clean up and true valve face.

If grinding leaves the edge of valve (the margin) less than 0.0313 in., install a new valve. A valve in this condition does not seat normally, will burn easily and may cause pre-ignition. There is also danger of cracking.

Valves that do not clean up quickly are probably warped or too deeply pitted to be used. If end of valve stem shows uneven wear, replace the valve.

After valves have been ground, they must be handled with care to prevent damage to the ground faces.

See Figure 3-25. The valve seats may be refinished with cutters or grinders. Cut seats to 46°, grind seats to 45°. Valve seat tools and fixtures are available commercially. Seat each valve in same port from which it was disassembled.

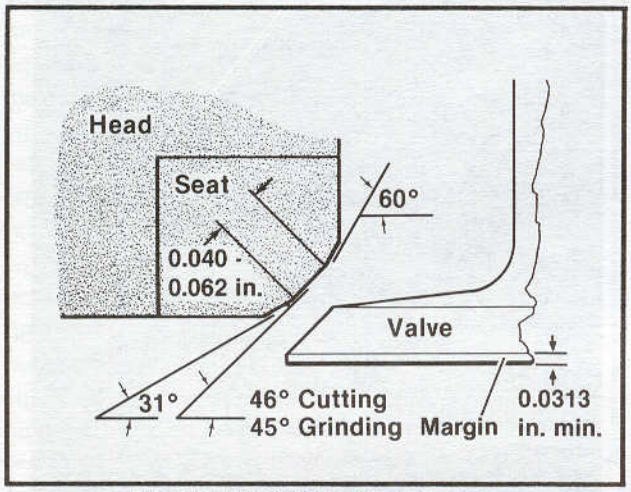


Figure 3-25. Valve Seat Angles

Use a NEWAY VALVE SEAT CUTTER, Part No. 082454, to cut the seats. Always grind valves before cutting the seats.

1. Cut 46° valve seat angle first. Cut only enough to clean up the seat.

2. See Figure 3-25. Use bluing or magic marker and check the contact pattern on the valve face. It should be 0.040 - 0.062 in. wide and 2/3 the way towards the outside edge of the face.

3. If valve seat pattern is too wide and too close to stem side of valve face, cut 60° angle to narrow and move contact area away from stem side of valve. If pattern is too wide and too close to the edge of the valve face, cut 31° angle to narrow and move contact area away from margin.

4. If contact area is too narrow, use 46° valve cutter to increase width.

5. Check valve seat to be sure contact area is 0.040 - 0.062 in. and concentric.

6. See Figure 3-26. Measure the valve stem protrusion from the cylinder head to the top of the stem. If valve stem protrudes more than 2.034 in., the valve or seat must be replaced.

NOTE

Service replacement valves are available which are 0.030 in. shorter than the standard valve. If the valve stem protrudes beyond 2.034 in., but no more than 2.064 in., use the service replacement valve.

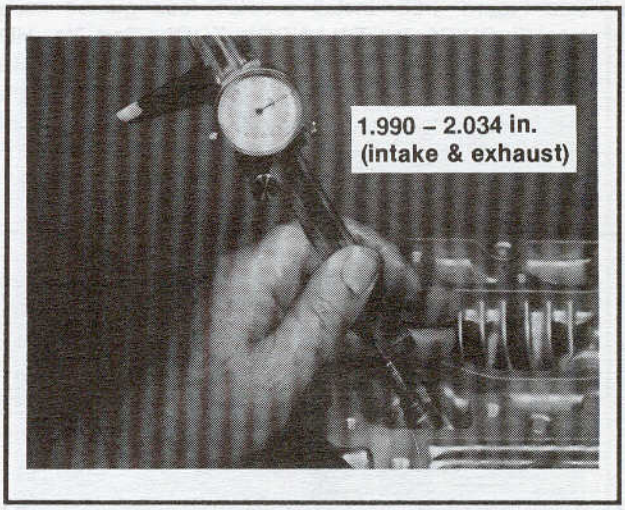


Figure 3-26. Measure Valve Stem Protrusion

CAUTION

See Figure 3-27. Do not attempt to shorten valve by grinding on the end. The hardened case will be gone and the end will be mild steel. This will cause the end to wear rapidly. The shorter replacement valves are shortened in the stem body.

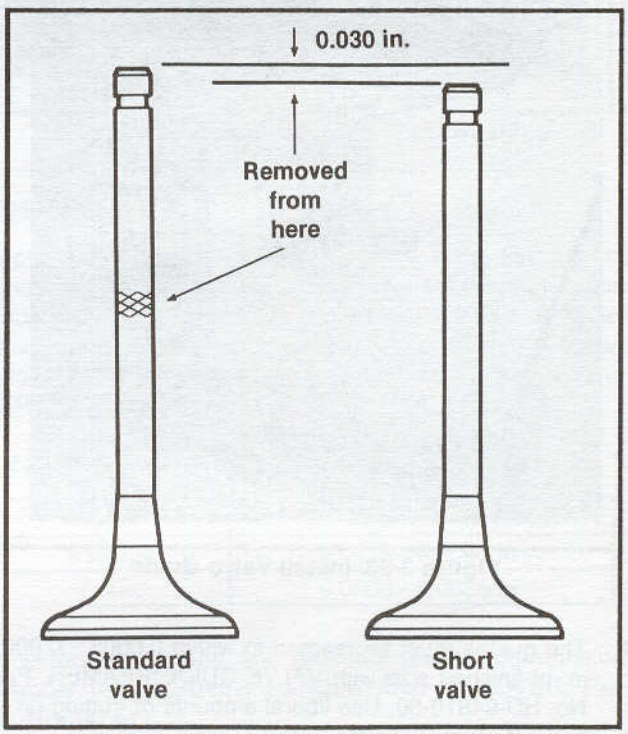


Figure 3-27. Shorter Replacement Valves

NOTE

Replacing a valve seat is a complex operation requiring special equipment. If the seat is loose or not sealed fully into the head, the seat will move and not transfer heat away from the valve properly. The seat surface must be flush with or below the head surface. See SPECIFICATIONS for valve seat to cylinder head fit.

To remove the old seat, lay a bead of weld material around the inside diameter of the seat. This will shrink the seat diameter and provide a surface for driving the seat out from the port side.

7. See Figure 3-26. If valve stem protrusion is within the proper range, the valves and seats are ready for lapping.

8. Apply a small amount of lapping compound to the valve face and rotate the valve against the seat using the VALVE LAPPING TOOL, Part No. HD-96550-36A.

Lapping Valve Faces and Seats (Figure 3-28)

NOTE

If valve faces and seats have been smoothly and accurately refaced, very little lapping will be required to complete seating operation.

1. Apply a light coat of fine lapping compound to valve face, insert valve in guide and give it a few oscillations with VALVE LAPPING TOOL, Part No. HD-96550-36A.

2. Lift valve and rotate it about 1/3 of a turn.

3. Repeat lapping procedure as shown.

4. After full turn, remove valve, wash valve face and seat and dry with cloth that is immediately discarded so grinding compound cannot be transferred to engine parts.

5. If inspection shows an unbroken lapped finish of uniform width around both valve and seat, valve is well seated. If lapped finish is not complete, further lapping or grinding and lapping is necessary.

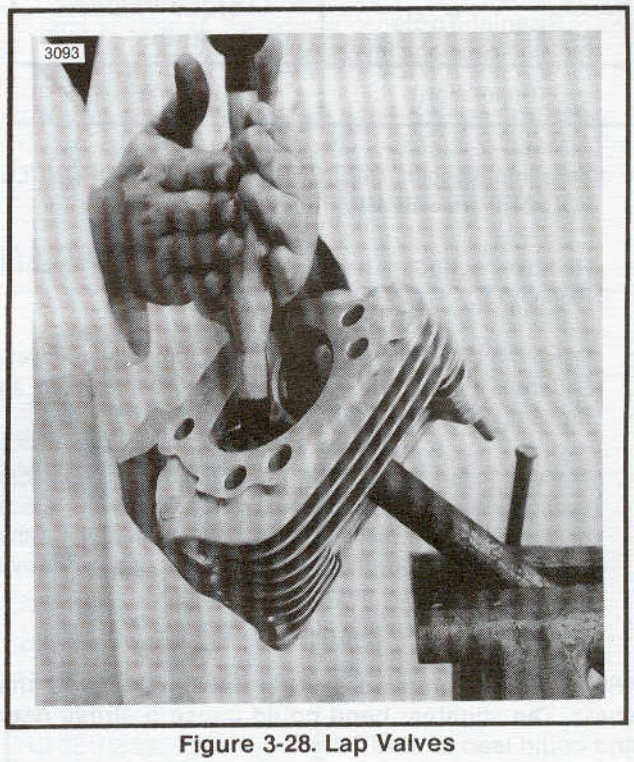


Figure 3-28. Lap Valves

CYLINDER AND PISTON

REMOVAL

Special Tools	Torque Values (ft-lbs)
Tinner's awl	None

1. Strip motorcycle. See STRIPPING MOTORCYCLE FOR ENGINE REPAIR.
2. Remove cylinder head. See CYLINDER HEAD, REMOVAL.
3. Raise the cylinder enough to place some clean towels under the piston. This will prevent any debris, such as broken ring pieces, from falling into the crankcase.
4. Mark cylinder "front" or "rear". Remove the cylinder taking extreme care not to scratch or bend the studs or to scratch the pistons in any way. When lifting the cylinder, make sure the piston does not drop sideways striking the studs.

CAUTION

With cylinder removed, be careful not to bend the studs. The slightest bend could cause a stress riser and could lead to stud failure.

5. Install a 6 in. length of 0.500 in. inside diameter plastic or rubber hose over each stud. This not only protects the studs, but the pistons too.

WARNING

The next step covers removing the piston pin retaining rings. These rings are highly compressed in the ring groove and may "fly-out" with considerable force when pried out of the groove. Safety glasses or goggles must be worn while removing or installing retaining rings.

6. Insert a tinner's awl in the recessed area below the piston pin bore and pry out the piston pin retaining rings. To prevent the ring from flying out, place your thumb over the retaining ring.

CAUTION

The piston pin retaining ring must not be reused.

NOTE

- *Since the piston pin is a loose fit in the piston, the pin will easily slide out. The pins have tapered ends to help seat the round retaining rings. For these reasons, piston pins from earlier engines must not be used in the V² engine.*
- *Piston pin retaining ring grooves may become burred from the retaining rings. Use care when removing the piston pins.*

7. See Figure 3-29. Mark the piston by marking an "F" or "R", for front or rear cylinder, on the piston pin boss as shown.

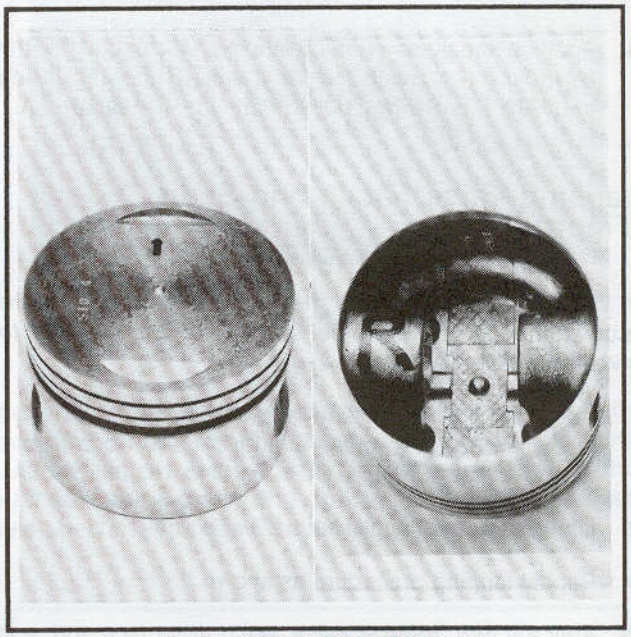


Figure 3-29. Piston Marking

CAUTION

Handle the piston with extreme care because the alloy used in these pistons is very hard. Any scratches, gouges or other marks on the piston could score the cylinder during engine operation.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
HD-34623A Piston pin retaining ring installer HD-96333-51B Piston ring compressor	None

1. See Figure 3-29. Install the pistons. Be sure they are properly oriented front to back. The piston has a cast-in arrow on top of the piston.
   - The arrow on top of the piston points to the front of the engine.
   - Install the piston pin retaining rings with the PISTON PIN RETAINING RING INSTALLER, Part No. HD-34623A. Be sure the ring groove is clean and that the ring is fully seated in the groove with the gap away from the slot at the bottom.
2. See Figure 3-33. Be sure the piston ring end gaps are properly positioned.
3. Lubricate cylinder walls, pistons, pins and rod bushings with engine oil.
4. Turn engine until crankpin is at top center.

5. See Figure 3-30. Compress the piston rings using PISTON RING COMPRESSOR, Part No. HD-96333-51B.

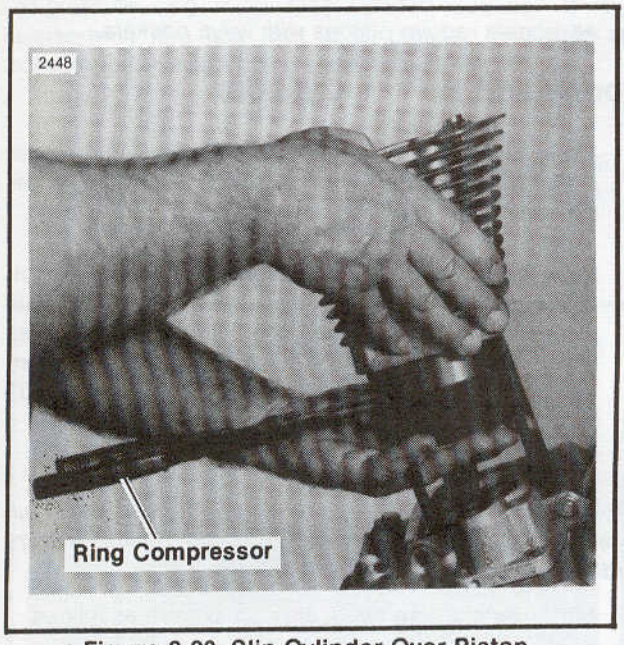


Figure 3-30. Slip Cylinder Over Piston

6. Remove cylinder stud sleeves and install a new cylinder base gasket. Use a small amount of grease to hold the gasket in place. Be sure the pistons do not bump the studs or crankcase.
7. Support the piston with one hand while sliding the cylinder on with the other.
8. Remove piston ring compressor.
9. Assemble cylinder heads. See CYLINDER HEADS, ASSEMBLY.

CLEANING AND INSPECTION

1. Where carbon deposit is thick and hard, it is advisable to scrape carbon off. Use a carbon scraper. Be careful not to scrape piston.
2. Place the cylinders and piston in GUNK HYDRO-SEAL or other carbon and gum dissolving agent until deposits are soft.
3. Scrub piston dome and cylinder to remove deposits.
4. Wash all parts in solvent and blow dry with compressed air. Force air through return oil passage in cylinder.
5. If necessary, clean piston ring grooves with a piece of compression ring ground to a chisel shape.
6. Examine piston pin to see that it is not pitted or scored.
7. Check the piston pin bushing to see that it is not loose in connecting rod, grooved, pitted or scored. A piston pin, properly fitted, is a loose (0.00007-0.00041 in.) fit in piston and has 0.00027-0.00071 in. clearance in connecting rod upper bushing. If piston pin-to-bushing fit exceeds 0.001 in., replace worn parts. See REPAIR - Rod Bushings.
8. Make sure the piston pin retaining ring grooves are clean.
9. Examine piston and cylinder for cracks, burned spots, grooves and gouges. The cylinder will have four faint polish marks running the length of the bore near the stud holes. These marks are usually 0.375 in. wide and appear as the engine accumulates running time. They are normal and require no attention.
10. Check rods for excessive lower bearings clearance. If you detect excessive lower bearings clearance, you should disassemble flywheels for further inspection. See FLYWHEEL DISASSEMBLY/ASSEMBLY.

REPAIR

Special Tools	Torque Values (ft-lbs)
D-33446 Cylinder torque plate HD-95970-32B Piston pin bushing tool HD-95952-33A Connecting rod clamping tool 280 Grit rigid hone 240 Grit flexible ball hone HD-94800-26A Spiral expansion reamer HD-35102 Wrist pin bushing hone	None

Cylinder

1. Check the gasket surfaces for flatness. The top of head gasket surface must be flat within 0.006 in. and the base gasket surface must be flat within 0.008 in. Check the above surfaces by laying a straightedge across the surface and then try to insert the proper feeler gauge between the straightedge and the gasket surface.
2. If one or both of the above surfaces do not meet the flatness requirements, the cylinder and piston must be replaced.
3. Before measuring the cylinder, be sure the gasket surfaces are free of burrs and install a head and base gasket and the CYLINDER TORQUE PLATE, Part No. HD-33446. Tighten the bolts using correct torque procedure. See CYLINDER HEADS, TORQUE procedure. This will simulate engine operating conditions. Your measurements will vary as much as 0.001 in. if you don't use the torque plates.
4. See Figure 3-31. Take cylinder bore measurement in the ring path, starting about 0.500 in. from the top of the cylinder measuring from front to rear and then side to side. Record readings.
5. Repeat measurement at center and bottom ring path. Record readings. This process will determine if cylinder is out-of-round or "egged" and will also show any cylinder taper or bulge.

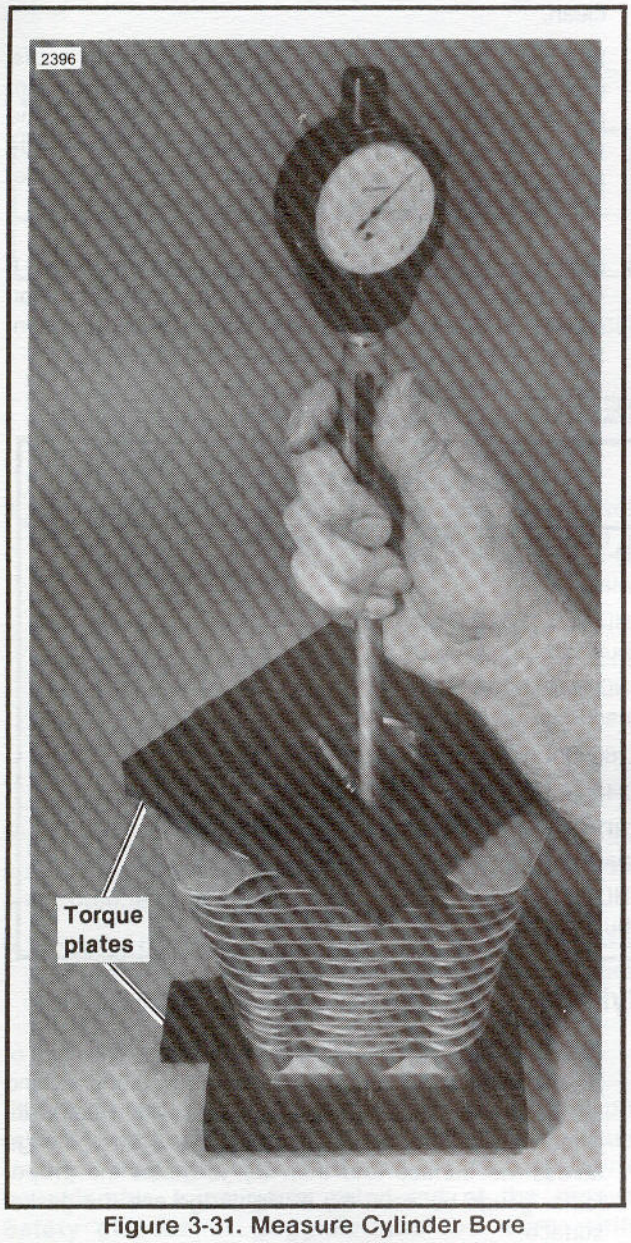


Figure 3-31. Measure Cylinder Bore

6. If cylinders are not scuffed or scored and are not worn beyond service limits, it is not necessary to rebore oversize.

7. If cylinders show wear beyond service limits, they should be rebored and/or honed to next standard oversize and refitted with corresponding pistons and rings.

NOTE

- *A standard piston may be fitted to a standard bore if only minor honing is required and bore is within SERVICE WEAR LIMITS.*
- *All models require pistons with valve pockets.*

Boring and Honing Cylinder

1. The cylinder must be bored with gaskets and torque plates attached. Bore the cylinder to 0.003 in. under the desired finished size.

2. Hone the cylinder to its finished size using 280 grit rigid hone. To break a glaze, use 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.

NOTE

Improper crosshatch pattern or too fine a hone will result in insufficient oil retention and possible piston seizure and/or oil consumption.

3. Final cylinder bore sizes, after honing are as follows:

Standard bore	3.4980 in ± 0.0002 in.
0.005 Oversize (O.S.) bore .	3.5030 in ± 0.0002 in.
0.010 (O.S.) bore	3.5080 in ±0.0002 in.
0.020 (O.S.) bore	3.5180 in ± 0.0002 in.
0.030 O.S. bore	3.5280 in ± 0.0002 in.

Piston

Because of their complex shape, the pistons cannot be accurately measured with standard measuring instruments.

The pistons have the typical eliptical shape when viewed from the top. However, they also are barrel shaped when viewed from the side. This barrel shape is not symmetrical. In addition, the piston pin bore is offset.

Any damage to the piston will change its shape, which will cause problems.

Fitting Cylinder to Piston

Since pistons cannot be accurately measured with standard measuring instruments, the bore sizes given in step 3 under Boring and Honing Cylinder must be observed. Example: a 0.005 in. oversize piston will have the proper clearance with a bore size of 3.5030 in. ± 0.0002 in.

Fitting Piston Rings

Piston rings are of two types: compression and oil control ring. The two compression rings are positioned in the two upper piston ring grooves. The dot on the second compression ring must face upward because it is a reverse-twist ring and aids in oil control. Ring sets are available to fit standard and oversize pistons.

1. See Figure 3-32. Check the end gap of both oil rings and the compression rings. Use the top of the piston to square the ring in the bore.

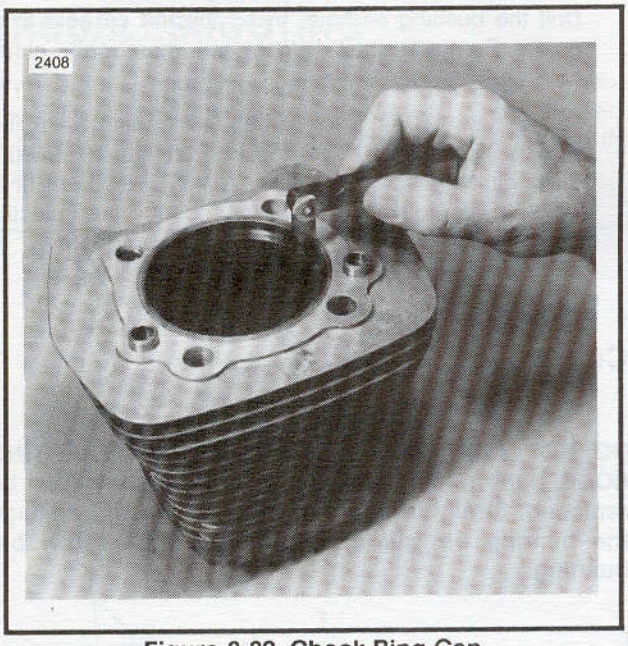


Figure 3-32. Check Ring Gap

2. See SERVICE WEAR LIMITS for end gap dimensions for standard bore. Gap dimensions do not apply to oversize rings. Do not file rings to obtain proper gap. Replace rings if ring gap is incorrect.

3. See Figure 3-33. Apply engine oil to the piston grooves. Install the new rings on the piston making sure the dot on the second compression ring is facing up. Stagger the ring gaps.

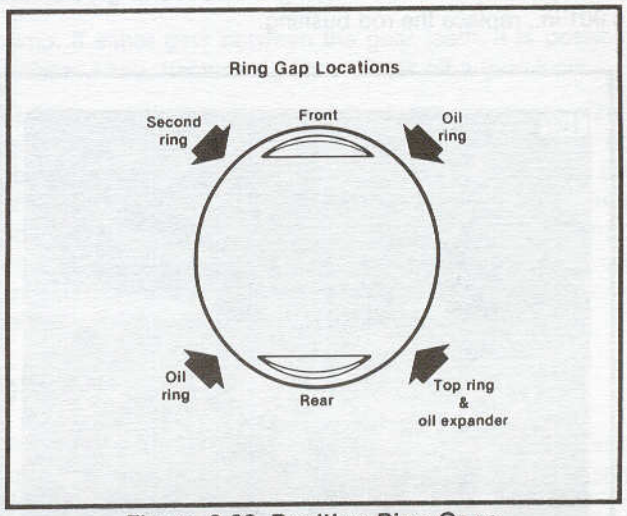


Figure 3-33. Position Ring Gaps

4. See Figure 3-34. Check the ring side play in the piston grooves. If the ring grooves are clean and the side play is still not correct, replace the rings, the piston, or both.

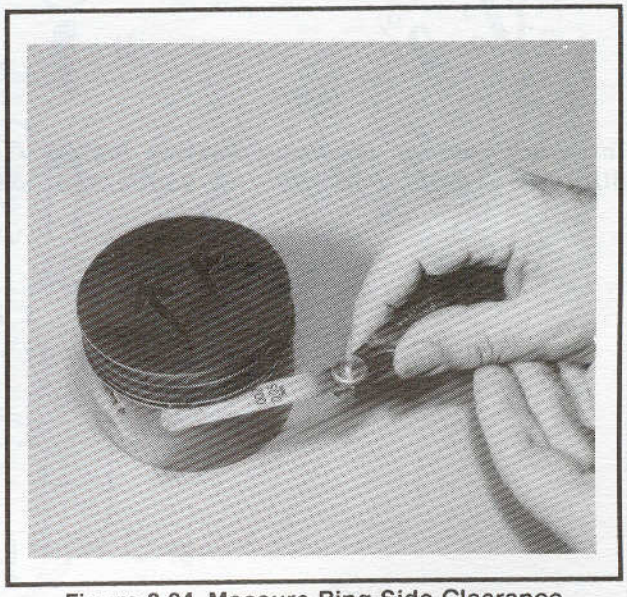


Figure 3-34. Measure Ring Side Clearance

Rod Bushings (Figure 3-35)

If the piston pin to rod bushing clearance is greater than 0.001 in., replace the rod bushing.

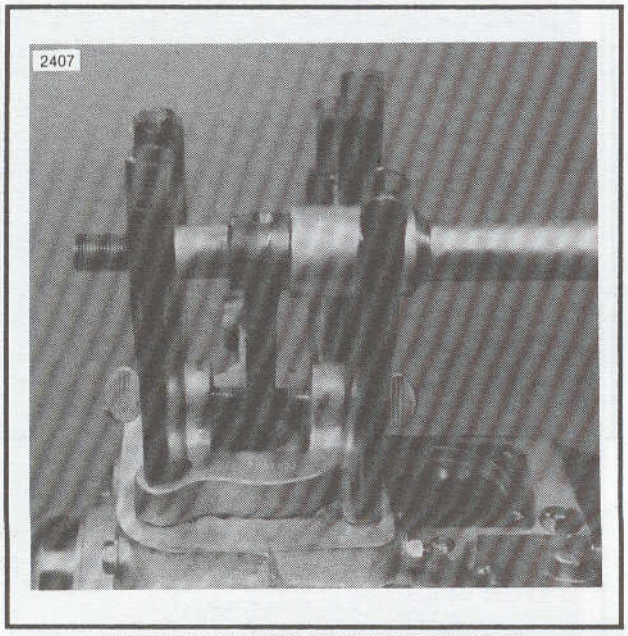


Figure 3-35. Replace Rod Bushings

NOTE

To replace bushing, use Harley-Davidson PISTON PIN BUSHING TOOL, Part No. HD-95970-32B and CONNECTING ROD CLAMPING TOOL, Part No. HD-95952-33A.

CAUTION

Place rag over crankcase opening to keep chips and shavings out of crankcase.

1. See Figure 3-35. To use CONNECTING ROD CLAMPING TOOL, Part No. HD-95952-33A, you must first enlarge the holes in the tool. Place the tool over the studs taking care not to scratch or bend them. Install the plastic hoses over the studs wedging them inside the holes in the tool.
2. Press out the old bushing and install new bushing. Drill the bushing oil hole, using the rod oil hole as a guide. Remove sharp edges and thoroughly clean hole.
3. Ream new bushing to 0.0005 in. undersize using SPIRAL EXPANSION REAMER, Part No. HD-94800-26A. Finish clearance using WRIST PIN BUSHING HONE, Part No. HD-35102. Drive hone with an electric drill and work for a crosshatch pattern of approximately 60°. Lubricate hone with honing oil.
4. Clean bushing bore with cleaning solvent.

Connecting Rods

CAUTION

DO NOT ATTEMPT TO STRAIGHTEN CONNECTING RODS. If there is evidence of bent rods, they must be replaced. Straightening rods by bending will damage the bearing on the crankpin and the piston pin bushing.

OIL PUMP

GENERAL

The oil feed pump and scavenger (oil return) pump are gear type pumps housed in one pump body and located on rear of gearcase on right side of motorcycle. The feed pump incorporates an automatic relief valve that routes surplus oil (above the amount needed to lubricate the engine) directly back to the feed section of the pump. A check valve is located ahead of the pressure regulating valve to prevent oil draining from tank when engine is not running.

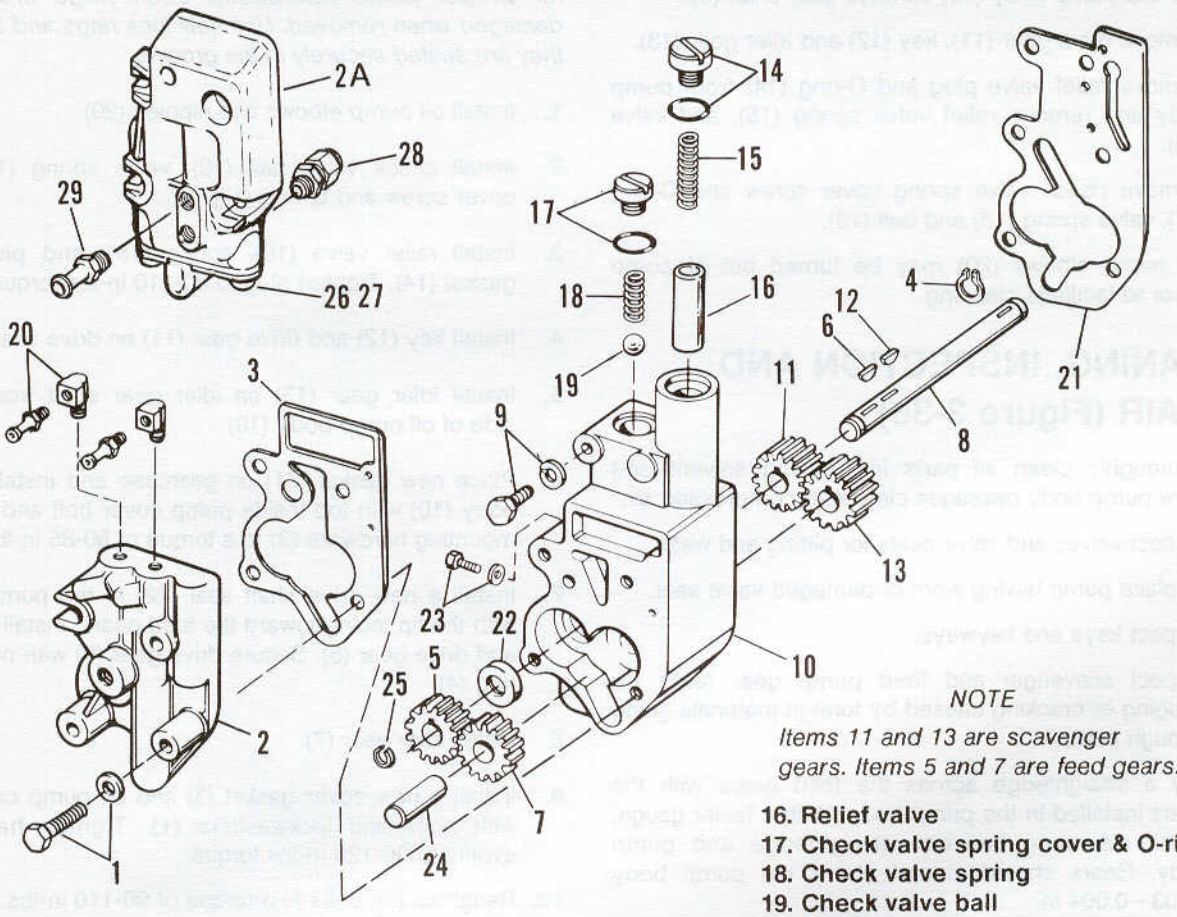
TROUBLESHOOTING

Under normal operating conditions, the pump is a trouble free unit. The most common trouble with pump operation is the introduction of a metal or hard carbon chip into the pump. If either gets between the gear teeth, it is possible to shear a key, fracture a gear or break off a gear tooth.

If oil fails to return to the tank, check the scavenger pump gear drive shaft key. When the engine receives no lubrication (oil remains in tank), the drive shaft key on the feed pump drive gear may be sheared. Both conditions together could be caused by a sheared oil pump (gearcase) drive gear key. In cold weather, slush ice formed from moisture condensation in oil may block oil passages and cause any of above troubles.

DISASSEMBLY (Figure 3-36)

The oil pump can be disassembled, piece-by-piece without removing gearcase cover, with engine in chassis as follows:



NOTE
Items 11 and 13 are scavenger gears. Items 5 and 7 are feed gears.

1. Cover bolt & lockwasher (4)
2. Oil pump cover - 1991
2A. Oil pump cover - 1992
3. Cover gasket
4. Retaining ring
5. Drive gear
6. Gear key
7. Idler gear
8. Gear drive shaft
9. Oil pump body mounting bolts & lockwashers(2)
10. Oil pump body
11. Drive gear
12. Gear key
13. Idler gear
14. Relief valve plug & O-ring
15. Relief valve spring
16. Relief valve
17. Check valve spring cover & O-ring
18. Check valve spring
19. Check valve ball
20. Oil line elbow (2) & nipple (2)
21. Body gasket
22. Seal
23. Plug & gasket
24. Idler shaft
25. Retaining ring
26. Washer (2)
27. Button head screw (2)
28. Oil line fitting
29. Nipple

Figure 3-36. Engine Oil Pump

NOTE

Gears and keys must be replaced in the same position as removed.

1. Disconnect oil lines from pump. On 1991 models, remove and discard hose clamps. To remove oil lines on 1992 models, see OIL FILTER MOUNT - 1992, following.
2. Remove bolts and lockwashers (1) that hold oil pump cover in place. The upper inside pump cover bolt(s) must be removed with the pump body.
3. Remove oil pump cover (2) and gasket (3).
4. Remove lock ring (4), drive gear (5), gear key (6) and idler gear (7).

CAUTION

Do not allow drive shaft (8) to be pushed into gearcase because key could fall out of shaft into gearcase requiring the gear cover to be removed.

5. Remove the oil pump body mounting hardware (9) and slip pump body (10) off drive gear shaft (8).
6. Remove drive gear (11), key (12) and idler gear (13).
7. Remove relief valve plug and O-ring (14) from pump body and remove relief valve spring (15), and valve (16).
8. Remove check valve spring cover screw and O-ring (17), valve spring (18) and ball (19).
9. Oil pump elbows (20) may be turned out of pump cover to facilitate cleaning.

CLEANING, INSPECTION AND REPAIR (Figure 3-36)

1. Thoroughly clean all parts in cleaning solvent and blow pump body passages clear with compressed air.
2. Inspect valves and valve seats for pitting and wear.
3. Replace pump having worn or damaged valve seat.
4. Inspect keys and keyways.
5. Inspect scavenger and feed pump gear teeth for gouging or cracking caused by foreign materials going through pump.
6. Lay a straightedge across the feed gears with the gears installed in the pump body. With a feeler gauge, check clearance between straightedge and pump body. Gears should extend above the pump body 0.003 - 0.004 in.
7. Repeat above check on scavenger gears. If gears do not extend 0.003 - 0.004 in. above pump body, the oil pump must be replaced.

ASSEMBLY (Figure 3-36)

Special Tools	Torque Values (In-lbs)
HD-97087-65A Hose clamp tool	Relief valve plug 80 - 110 Oil pump body bolts 60 - 85 Cover bolts 90 - 110 or *115 - 120 See note, step 10.*

NOTE

Do not mix gears and keys. Replace in original location. Oil pump gaskets must not be reused. Use only original Harley-Davidson gaskets (gasket thickness is important for proper pump operation). Lock rings are often damaged when removed. Use new lock rings and be sure they are seated securely in the groove.

1. Install oil pump elbows and nipples (20).
2. Install check valve ball (19), valve spring (18) and cover screw and O-ring (17).
3. Install relief valve (16), spring (15), and plug and gasket (14). Tighten plug to 80-110 in-lbs torque.
4. Install key (12) and drive gear (11) on drive shaft (8).
5. Install idler gear (13) on idler gear shaft from back side of oil pump body (10).
6. Place new gasket (21) on gearcase and install pump body (10) with top inside pump cover bolt and tighten mounting hardware (9) to a torque of 60-85 in-lbs.
7. Install a new drive shaft seal (22) in the pump body with the lip facing toward the feed gears. Install key (6) and drive gear (5). Secure drive gear (5) with new lock ring (4).
8. Install idler gear (7).
9. Install a new cover gasket (3) and oil pump cover (2) with bolts and lockwashers (1). Tighten hardware evenly to 90-120 in-lbs torque.
10. Retighten top bolts to a torque of 90-110 in-lbs.

CAUTION

Do not overtighten mounting bolts and nuts. Overtightening will eliminate pump gear side clearance which may cause the pump to seize up, damaging pump and engine parts.

NOTE

If pump is repositioned to eliminate binding, retighten top and cover bolts to a torque of 115-120 in-lbs using ONLY a hand torque wrench.

11. See Figure 3-37. On 1991 models, connect oil lines to pump. Oil hose connections use one piece band type clamps which cannot be reused. Use HOSE CLAMP TOOL, Part No. HD-97087-65A, to squeeze new hose clamps tight. To install oil lines on 1992 models, see OIL FILTER MOUNT - 1992, following.

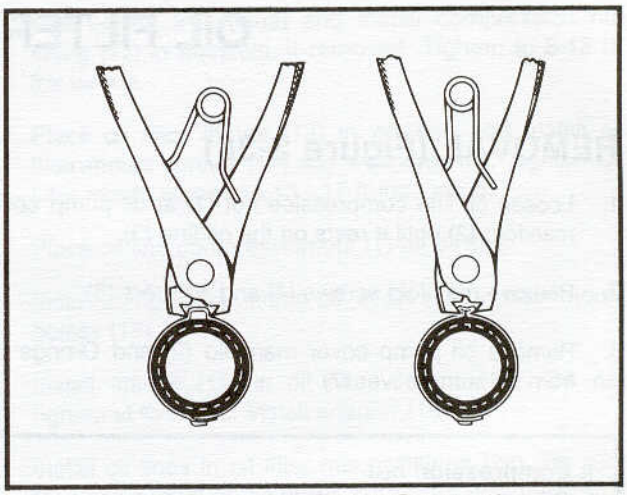


Figure 3-37. Hose Clamp Connection

OIL FILTER MOUNT - 1992

REMOVAL (Figure 3-38)

1. Loosen oil line compression nut (1) at oil pump cover manifold (2) until it rests on the oil line (3).
2. Remove manifold screws (4) and washers (5).
3. Remove oil pump cover manifold (2) and O-rings (6) from oil pump cover (7).
4. Loosen or if necessary, remove oil line clamp (8) by removing nut (9), washer (10), clamp (8) and spacer (11).
5. Loosen or remove oil line compression fittings (12) at oil filter mount (13). Remove oil lines from oil filter mount.
6. Remove oil filter mount screws (14) and washers (15). Remove oil filter mount. Remove seals (16).

1. Compression nut
2. Oil pump cover manifold
3. Oil lines (2)
4. Manifold screws (2)
5. Washers (2)
6. O-rings (2)
7. Oil pump cover
8. Oil line Clamp
9. Nut
10. Washer
11. Spacer
12. Oil line compression fittings (2)
13. Oil filter mount
14. Oil filter mount screws (2)
15. Washers (2)
16. Seals (2)
17. Compression nut fitting
18. Oil filter adapter
19. Rubber sleeves (2)
20. Seal
21. Nipple

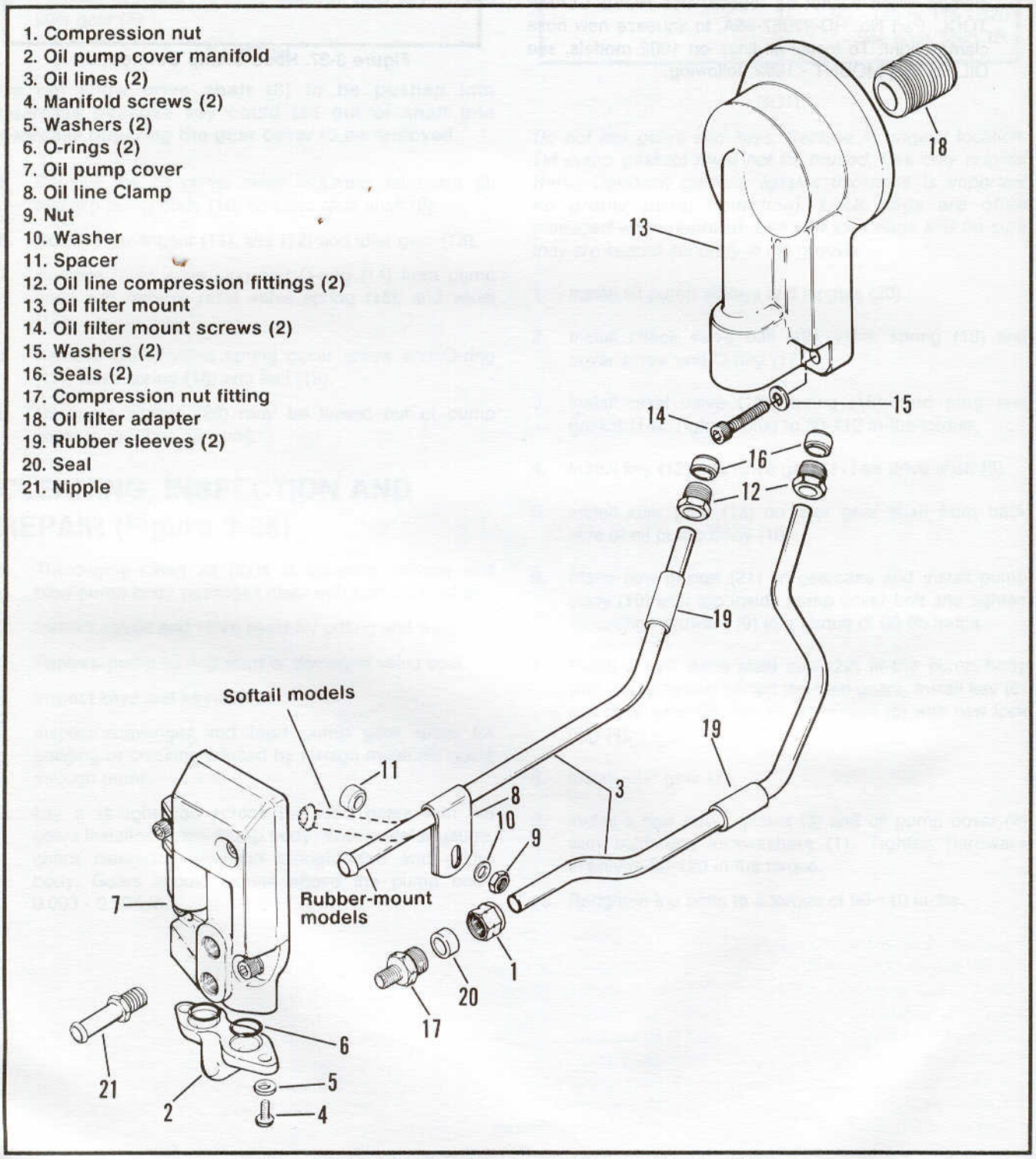


Figure 3-38. Oil Filter Mount and Oil Pump Cover - 1992

7. Remove compression nut fitting (17) from manifold and seal (20) from compression nut, if necessary.

8. Remove fittings (12) from oil filter mount, if necessary.

9. Remove oil filter adapter (18), if necessary.

INSTALLATION (Figure 3-38)

Special Tools	Torque Values (See below)
None	Pump cover manifold screws 70 - 80 in-lbs Oil filter mount screws 13 - 17 ft-lbs

CAUTION

Be sure lines bottom in oil filter mount when inserted. If they are not fully in the bottom of the holes, they will leak oil.

NOTE

- *If you replace the oil lines, be sure you install the rubber sleeves (19).*
- *Nipple (21) goes in pump cover UPPER hole on FXR/Dyna models and LOWER hole on Softail/FLT models.*

1. Use Loctite 242 (blue) and install compression nut fitting (17) in manifold, if removed. Tighten to 8-12 ft-lbs torque.

2. Place oil filter mount (13) in position and install oil filter mount screws (14) and washers (15). Tighten Oil filter mount screws to 13 - 17 ft-lbs torque.

3. Place oil line compression nut (1) on oil line.

4. Install compression fitting oil seals (16) in filter mount holess (13).

5. Install fittings (12) in oil filter mount (13). Do not tighten at this time. Install adapter (19).

6. Install oil lines in oil filter mount fittings (12). Be sure the lines bottom in the holes.

7. Install oil line clamp spacer (11), clamp (8), washer (10) and nut (9). Do not tighten at this time.

8. Slide oil pump cover manifold (2) onto oil line.

9. Place oil pump cover manifold (2) and O-rings (6) on oil pump cover (7). Install manifold screws (4) and washers (5). Tighten screws to 70 - 80 in-lbs torque.

10. Install oil line compression nut (1) on fitting and tighten nut until it bottoms against fitting.

11. Tighten oil line compression fittings at oil filter mount so face of hex is against mount.

12. Tighten oil line clamp nut.

VALVE TAPPETS AND GUIDES

GENERAL

The tappet assembly consists of tappet and roller. The tappet and roller, under compression force from the valve springs, follow the surface of the revolving cam. The up and-down motion produced is transmitted to the valve by the push rod and rocker arm. The tappet contains a piston or plunger and cylinder, plus a check valve, which allows the unit to pump itself full of engine oil to take up play in the valve train.

When tappets are functioning properly, the assembly operates with minimal tappet clearance. The units automatically compensate for heat expansion to maintain a no-clearance condition.

It is normal for tappets to click when engine is started after standing idle for some time. Tappets have a definite leak down rate which permits the oil in the tappets to escape. This is necessary to allow units to compensate for various expansion conditions of parts and still maintain correct-clearance operation. Tappets are functioning properly if they become quiet after a few minutes of engine operation.

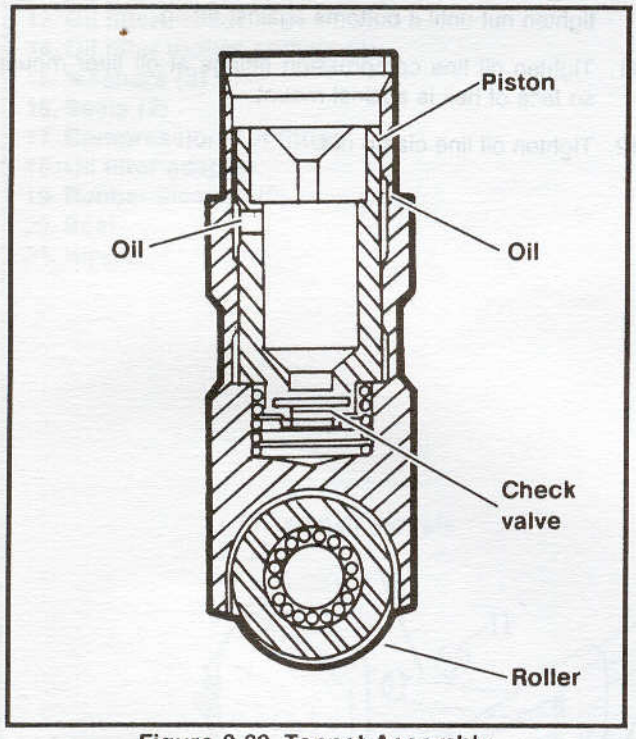


Figure 3-39. Tappet Assembly

REMOVAL/DISASSEMBLY

1. If engine cylinder head is not disassembled, rotate engine until both valves are closed.
2. Remove upper and middle rocker covers, rocker arm shafts, lower rocker covers, push rods and push rod covers following the REMOVAL procedure of the CYLINDER HEAD subject.
3. Remove the bolts holding the tappet guide to the crankcase.
4. See Figure 3-40. To remove the tappets and guides together, fashion a U-shaped wire from a large paper clip. Insert the ends into the tappets and tilt the guide and tappets out together.

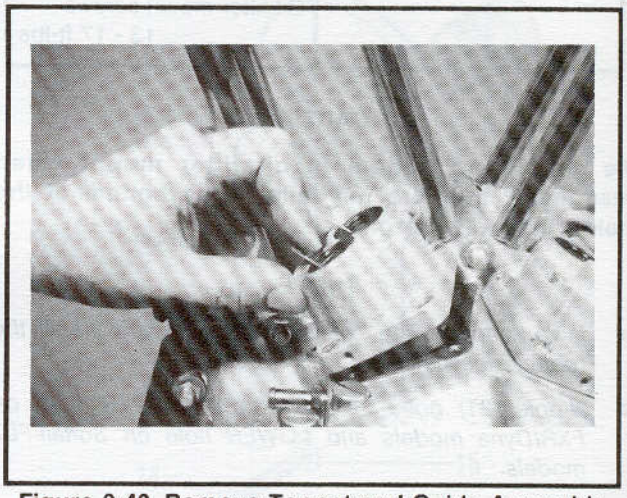


Figure 3-40. Remove Tappet and Guide Assembly

5. Mark tappets and guides so they will be assembled in their original locations.

CLEANING AND INSPECTION

1. Wash all parts, except tappet and roller assembly and gaskets, in grease solvent.
2. Inspect the tappets, rollers and guide bores for damage. Measure the guide bores and tappet diameters and check the clearance with the SERVICE WEAR LIMITS. Replace the tappet, the guide or both if clearance is excessive.
3. Clean the roller with an oil free aerosol cleaning solvent or contact cleaner. Measure the roller radial clearance and side play. Replace the tappets if the rollers are damaged or if clearances are excessive.
4. If you suspect there might be dirt in the tappet or internal parts are malfunctioning, replace the tappet.
5. Tappets should be soaked in clean engine oil and kept covered until assembly.

ASSEMBLY/INSTALLATION (Figure 3-41)

Special Tools	Torque Values (ft-lbs)
HD-33443 Tappet guide alignment tool	Tappet guide bolts 12 - 15

1. Install the tappets and guides using the wire clip to hold the tappets in the guide. The orientation of the oil hole in the side of the tappet does not affect tappet performance.
2. Insert the TAPPET GUIDE ALIGNMENT TOOL, Part No. HD-33443, in the screw hole nearest the tappet oil feed hole and install and tighten the other three screws.
3. Remove the tool and install the fourth screw. Tighten screws to 12-15 ft-lbs torque.
4. Repeat the above procedure for the other tappet guide. Install TAPPET GUIDE ALIGNMENT TOOL in the hole closest to oil feed hole.
5. After tappets and guides are installed, check push rod length following the procedure given in the CYLINDER HEAD subject.
6. Install push rods following the procedure given in Installation, Push Rods.

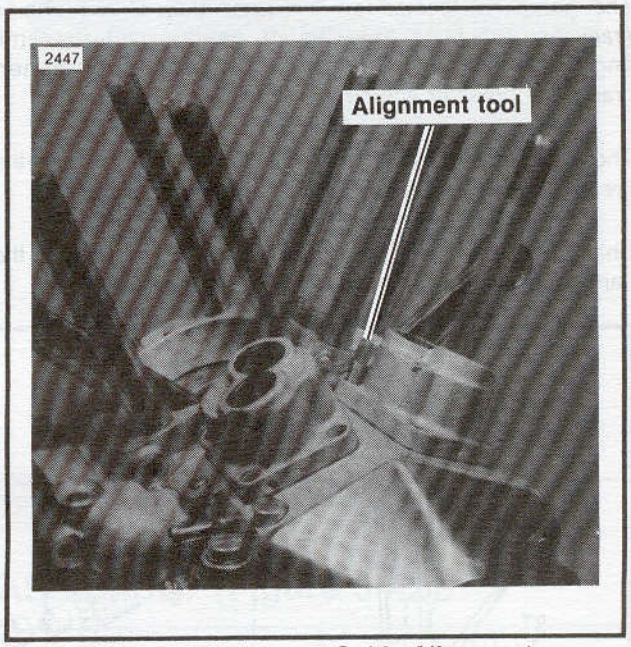


Figure 3-41. Tappet Guide Alignment

GEARCASE COVER AND TIMING GEARS

GENERAL

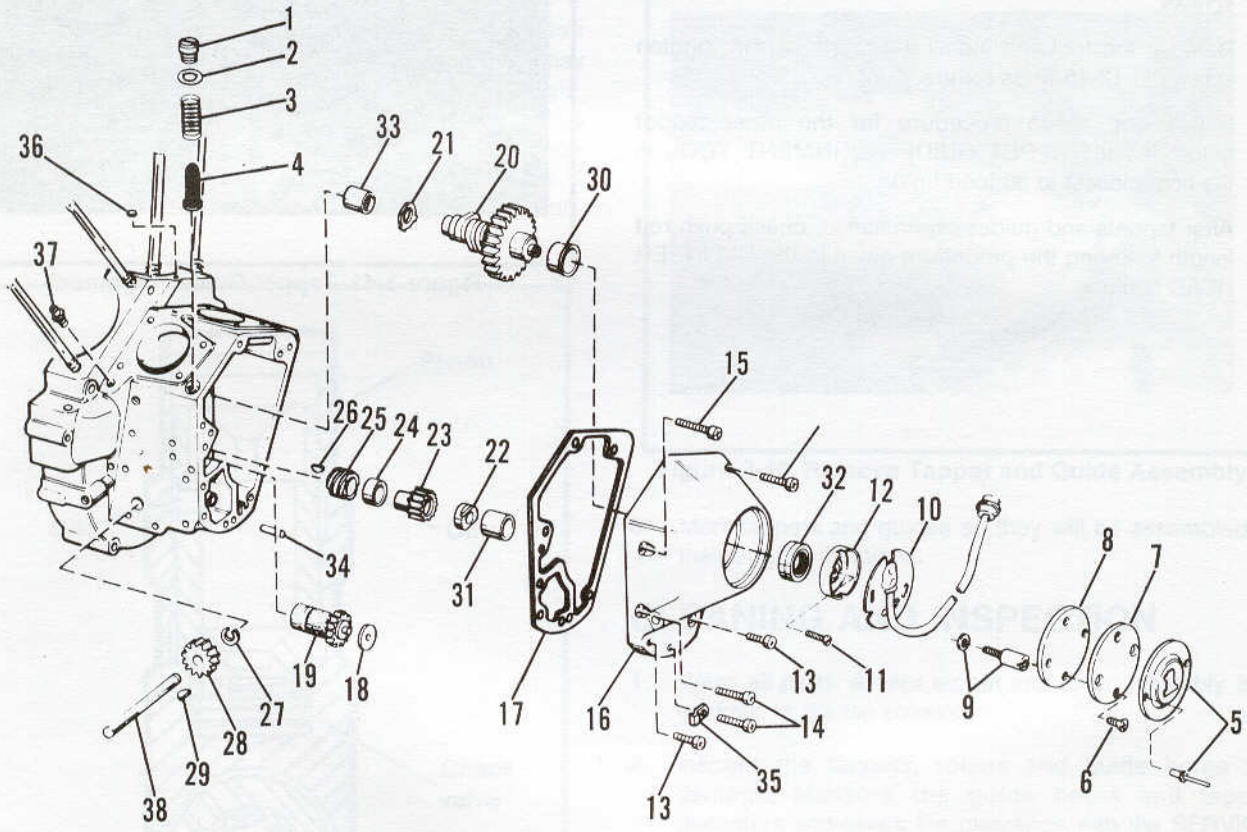
The gearcase, located on the right side of the engine crankcase, contains a series of gears which transmit engine power to the cam shaft and ignition timer, crankcase breather and oil pump.

The gearcase is lubricated with engine oil through the breather valve from the engine crankcase.

Shafts run in bushings except the crankcase side of the cam shaft which operates in a needle roller bearing.

DISASSEMBLY (Figure 3-42)

Special Tools	Torque Values (ft-lbs)
HD-94555-55C Pinion shaft nut socket HD96830-51A Pinion gear puller & installer Snap-On Part No. PR129A Lock ring pliers	None



1. Oil screen cap
2. O-ring
3. Oil screen spring
4. Oil screen
5. Outer cover and rivets (2)
6. Inner cover screw (2)
7. Inner cover
8. Gasket
9. Sensor plate screw and lockwasher (2)
10. Sensor plate
11. Rotor screw
12. Rotor
13. Gear cover screw (2)
14. Gear cover screw (3)
15. Gear cover screw (1)
16. Gear cover
17. Gear cover gasket
18. Breather gear washer
19. Breather gear
20. Cam gear
21. Cam gear thrust washer
22. Gear shaft nut
23. Pinion gear
24. Pinion gear spacer
25. Oil pump pinion shaft gear
26. Oil pump/pinion gear key
27. Oil pump drive gear lock ring
28. Oil pump drive gear
29. Oil pump drive gear key
30. Gear cover camshaft bushing
31. Gear cover pinion bushing
32. Camshaft oil seal
33. Camshaft needle bearing
34. Cover dowel pin
35. Wire clip
36. Crankcase plug
37. Oil pressure switch
38. Oil pump shaft

Figure 3-42. Gearcase

1. Remove rocker box assemblies. See CYLINDER HEADS.

2. Remove tappet oil screen cap (1), O-ring (2), screen spring (3) and screen (4). If necessary, drill out two cover rivets and remove outer cover (5).

3. Remove two ignition sensor cover screws (6), cover (7) and gasket (8).

4. Remove sensor plate screws and lockwashers (9).

5. Disconnect sensor plate wires at connection so that sensor plate may be moved out of the way.

6. Remove screw (11) and rotor (12).

7. Remove gearcase cover screws (13, 14 and 15).

8. Tap gearcase cover with soft face mallet to loosen and remove gear cover (16) and gearcase cover gasket (17).

9. Remove breather valve spacing washer (18) and breather gear (19).

10. Remove cam gear and camshaft (20), and thrust washer (21).

11. Remove pinion gear shaft nut (22) which has a left hand thread. Use PINION SHAFT NUT SOCKET, Part No. HD-94555-55C.

12. See Figure 3-43. Pinion gear (23) is a keyed slip fit. If necessary, remove pinion gear using PINION GEAR PULLER AND INSTALLER, part No. HD96830-51A. Tool has left hand threads.

13. See Figure 3-42. Remove gear shaft pinion spacer (24), oil pump pinion shaft gear (25) and key (26).

14. Use a LOCK RING PLIERS such as Snap-On No. PR129A and, if necessary, remove oil pump drive gear shaft lock ring (27), drive gear (28) and drive gear key (29).

15. If necessary, remove oil pump bolts and washers and remove oil pump from gearcase. See OIL PUMP, DISASSEMBLY.

16. If gearcase needs repair, see CLEANING, INSPECTION AND REPAIR.

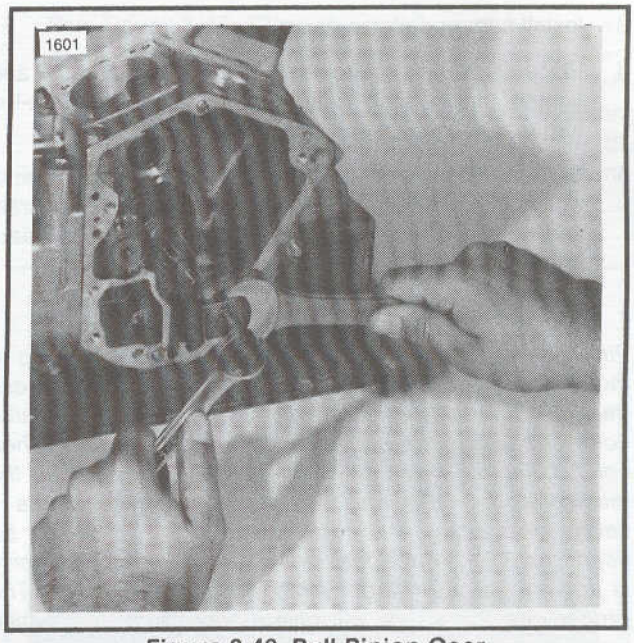


Figure 3-43. Pull Pinion Gear

ASSEMBLY (Figure 3-42)

Special Tools	Torque Values (See below)
HD-94555-55C Pinion shaft nut socket HD96830-51A Pinion gear puller & installer Snap-On No. PR129A Lock ring pliers	Pinion shaft gear nut 35 - 45 ft-lbs Gearcase screws 90 - 120 in-lbs

1. Before assembling gear train, determine amount of end play in breather gear (19) as follows: Assemble breather gear and dry cover gasket (17) to gearcase. Select spacer washer (18) (use disassembled washer unless it is known to give incorrect spacing) and position on end of breather gear. Place a steel straightedge across gearcase at spacer.

   a. With thickness gauge, measure distance between straightedge and spacer. Subtract 0.006 in. (amount gasket will compress) from this figure to determine gear end play.

   b. An end play tolerance of 0.001 - 0.016 in. is correct. If end play exceeds maximum, insert thicker spacer. A range of breather valve and gear spacer washers are available.

2. Install cam and pinion gears.
3. Place 2 drops of Loctite 262 (red) on threads and tighten pinion shaft gear nut (22) to 35 - 45 ft-lbs torque.
4. Breather, cam and pinion gears have timing marks which must be aligned or matched. Rotate gear train and note if it revolves freely. Binding indicates gears are meshing too tightly.

NOTE

Pinion gears and cam gears are color coded according to their pitch diameters. When replacing only one of these gears, you should replace it with a gear having the same color code. If gears are not matched according to their color, Lifter-like noise or gear whine may result. See the following chart. If a matched set of gears produces a severe gear whine, the next smaller pinion gear may be used to obtain proper gear clearance. If a lifter type noise is present, the next larger pinion gear may be used. The proper gear clearance will give a very slight gear whine when engine is hot

5. Position new cover gasket (17) and secure cover with all cover screws (13 thru 15). Tighten screws to 90-120 in-lbs torque.
6. After securing cover, pour about 1/4 pint of engine oil through tappet guide hole over gears to provide initial lubrication.
7. Assemble remainder of gearcase and ignition timer. See IGNITION SYSTEM, section 8.
8. Install rocker box assemblies. See CYLINDER HEADS.

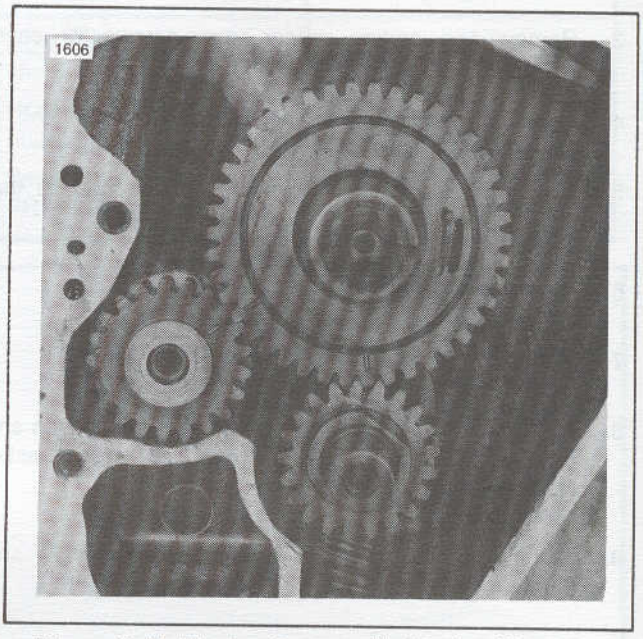


Figure 3-44. Timing Gears with Marks Aligned

CAM/PINION GEAR COLOR CODE CHART

COLOR CODE	PINION GEAR (matched sets)		CAM GEAR (matched sets)	
	NOTE • *Use 0.108 in. pins to measure.* • *Cam gears have two grooves on face.*			
	Part no.	**Size (in.)**		**Size (in.)**
ORANGE	24040-90	1.4853/1.4850	*NOTE*	2.7472/2.7476
WHITE	24041-90	1.4849/1.4846	*Check parts*	2.7477/2.7481
YELLOW	24042-90	1.4845/1.4842	*catalog for*	2.7482/2.7486
RED	24043-90	1.4841/1.4838	*cam and pin-*	2.7487/2.7491
BLUE	24044-90	1.4837/1.4834	*ion sets part*	2.7492/2.7496
GREEN	24045-90	1.4833/1.4830	*numbers.*	2.7497/2.7501
BLACK	24046-90	1.4829/1.4826		2.7502/2.7506

CLEANING, INSPECTION AND REPAIR (Figure 3-42.)

Special Tools	Torque Values (ft-lbs)
HD-95760-69 Puller tool & Collet, 0.500 in. HD-97272-60 Needle bearing tool Arbor press No. 31 Drill 0.156 in. Drill HD-94805-57 0.563 in. Pinion shaft cover bushing reamer 1 in. Expansion reamer	None

1. Wash and air dry all parts. Wash inside of case. If crankcase is to be disassembled, wash parts after complete disassembly. If it is not to be disassembled, be careful to get not to get grease or solvent into crankcase when washing gearcase.

2. If removed, inspect oil screen (4) carefully to be sure mesh is open. Fill screen with oil and watch for complete and even flow of oil through screen. Replace plugged or partially plugged screen.

3. Inspect cam gear and pinion gear bushings (30 and 31) in gearcase cover for pitting, scuffing and grooving. Determine amount of pinion and cam shaft wear in cover bushing. If it exceeds SERVICE WEAR LIMIT shown in ENGINE, SPECIFICATIONS, install new bushings.

4. Measure the small end of the cam shaft at the bearing surface and again near the cam lobes. If the shaft is worn more than 0.003 in. or is damaged in any way, replace both the cam and the needle bearing (33). See steps 8 and 9.

5. Replace the cam if any of the lobes are damaged or worn more than 0.006 in. Measure the lobes on a new cam for comparison. Be sure you use an Evolution engine cam. Because the lift and profile on the cam lobes differs from earlier engines, cams must not be interchanged.

6. Replace cam gear oil seal (32).

7. See Figure 3-45. Clean the pinion shaft bearing with contact cleaner and check the bearing clearance with a dial indicator. Mount the indicator with the probe perpendicular to the shaft and as close to the bearing as possible. If the clearance exceeds 0.002 in., the bearing must be refitted. See Truing and Sizing, Pinion Shaft Bearing in the CRANKCASE subject.

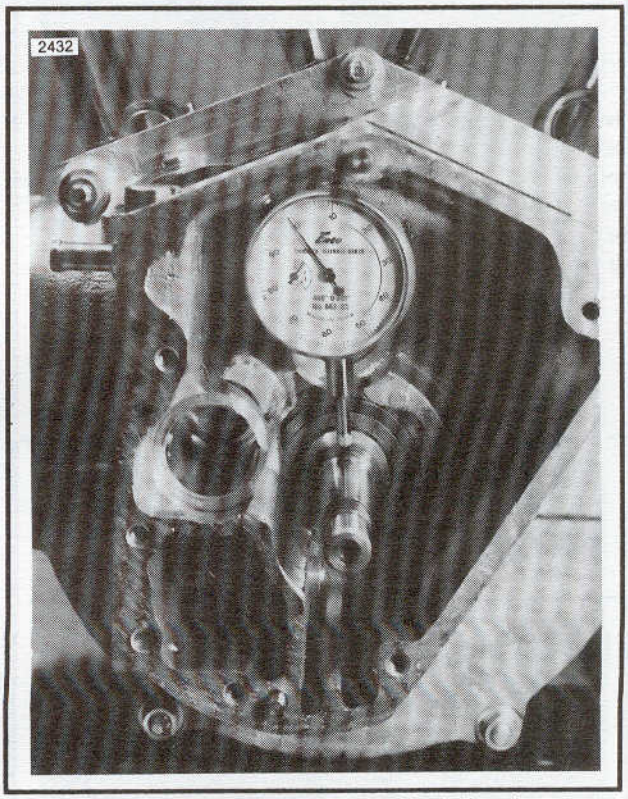


Figure 3-45. Check Pinion Shaft Bearing

8. See Figure 3-42. Inspect needle bearing (33) for wear and broken or gouged bearings. If end of cam shaft shows any appreciable wear (0.003 in. or more), needle bearing is probably worn to a point where replacement of bearing and cam shaft are advisable.

9. See Figure 3-46. Needle bearing can be removed and installed in crankcase without disassembling crankcase using PULLER TOOL, Part No. HD-95760-69. Press needle bearing into crankcase with NEEDLE BEARING TOOL, Part No. HD-97272-60. Press only from heavier end having the manufacturer's name. Pressing from opposite end will crush roller race and bind rollers. Pinion shaft main roller bearing may be replaced only when crankcase is disassembled, see CRANKCASE, DISASSEMBLY.

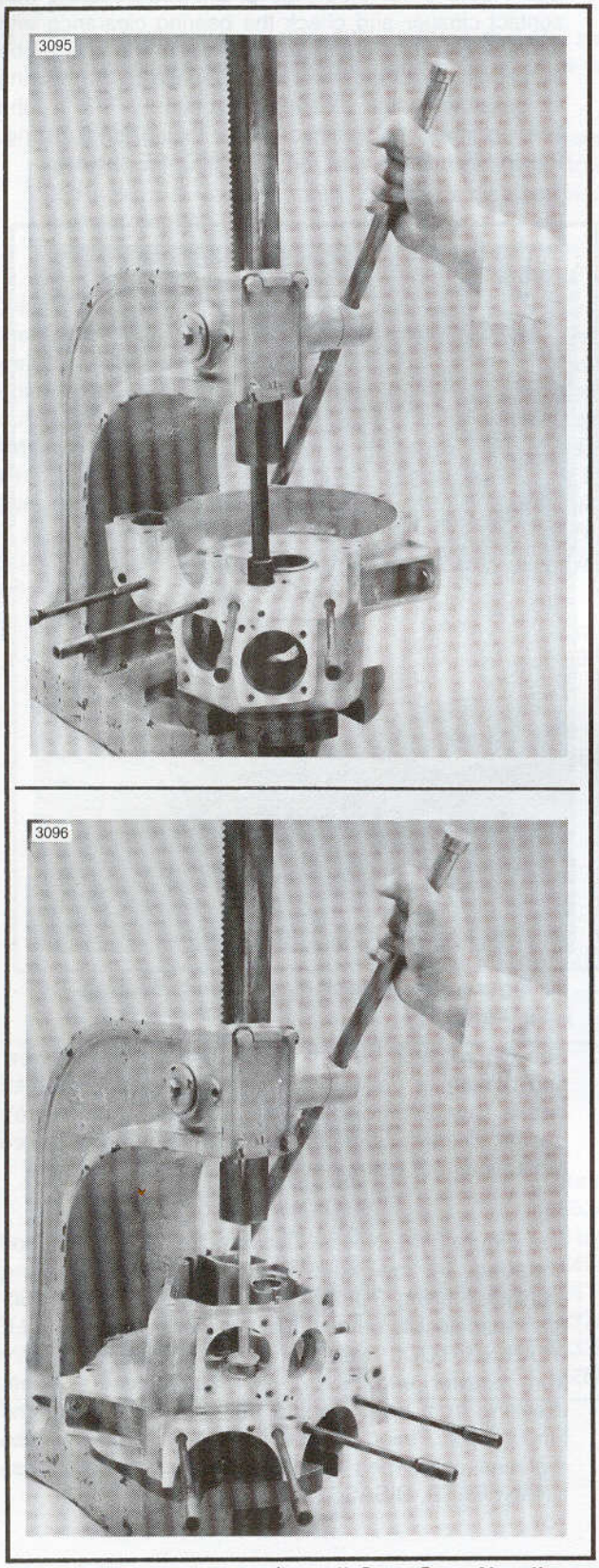


Figure 3-46. Remove/install Cam Gear Needle Bearing

10. Inspect gears for wear. Assemble pinion and cam gears to respective positions in gearcase. Omit cam gear end spacer for the purpose of checking gear mesh. Attach cover with at least three cover screws. Mesh is correct when no play between gears can be felt and cam gear can be moved back and forth along shaft axis with slight drag.

Gearcase Cover Bushings

NOTE

The original bushings are not pinned, but the replacement bushings must be pinned to prevent possible rotation in the cover.

PINION GEAR SHAFT BUSHING

1. See Figure 3-47. To remove old bushing, use PULLER TOOL, Part No. HD-95760-69 with a 0.500 in. collet.

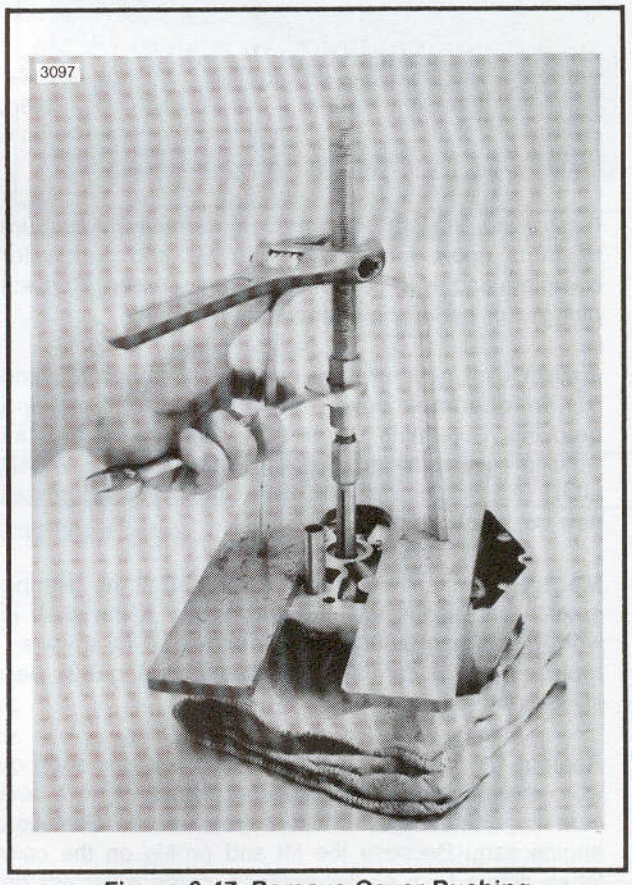


Figure 3-47. Remove Cover Bushing

2. Align the flat on the new bushing with the oil hole in the cover bore.
3. Use an arbor press and press in the new bushing until the top of the bushing is flush with the boss in the cover.

4. See Figure 3-36. Locate and center punch dowel pin location 0.125 in. or more from oil hole in cover. Drill No. 31 hole 0.188 in. deep. Press in bushing until it bottoms on shoulder in cover boss hole. Continue drilling dowel pin hole to depth of 0.281 in. from top of bushing. Drive in new dowel pin no more than 0.020 in. below the bushing face and carefully peen edges of hole to lock in place.
5. Ream bushing. See procedure following CAM SHAFT BUSHING.

CAM SHAFT BUSHING

1. Turn cam shaft housing onto flange and press out old bushing, using a suitable driver.
2. Press in the new bushing until the shoulder is tight against the boss in the cover.
3. See Figure 3-48. Center punch and drill No. 31 hole exactly 0.281 in. deep. Drive in new dowel pin and peen bushing edges over dowel to secure it. Pin must be no more than 0.020 in. below the bushing surface.

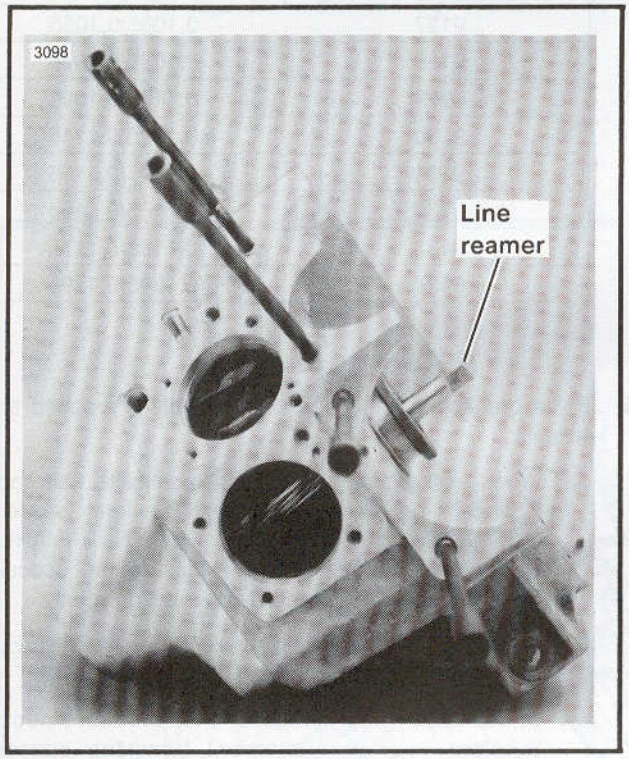


Figure 3-48. Line Reamer in Cover Bushing

4. Drill lubrication oil hole through wall of bushing with 0.156 in. drill using oil hole in bushing boss as a drill guide.

REAM GEARCASE COVER BUSHINGS

NOTE

Pinion shaft and camshaft bushings must be line reamed to remove burrs and irregularities from hole and to ensure perfect alignment. If crankcase is not disassembled, use another right crankcase side. Fasten cover in place with at least three screws.

1. See Figure 3-49. To ream pinion shaft bushing, insert reamer pilot in right crankcase roller race. Insert 0.563 in. PINION SHAFT COVER BUSHING REAMER, Part No. HD-94805-57, through pilot and push into cover bushing until it bottoms, then give reamer one complete turn to size bushing. Rotate reamer the same direction (clockwise) during extraction.

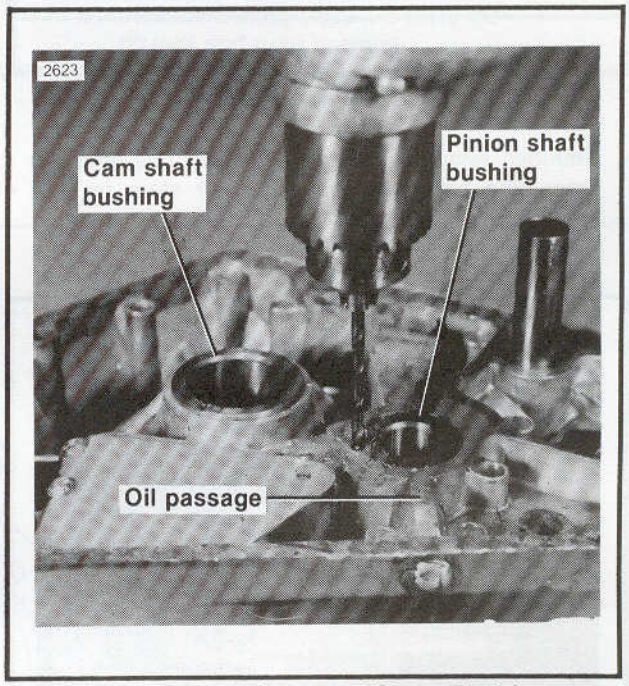


Figure 3-49. Pin Gearcase Cover Bushings

2. To ream cam gear cover bushing, use a 1 in. expansion reamer and ream to 1.003 - 1.002 in. diameter.

GENERAL

When rod bearings, pinion shaft bearings or sprocket shaft bearings need repair, the engine must be removed from the motorcycle as described in STRIPPING THE MOTORCYCLE FOR ENGINE REPAIR. The recommended procedure is to check and make repairs to cylinder heads, cylinders and gearcase at the same time, in other words, perform an entire engine overhaul.

ADJUSTMENT – Flywheel End Play (Figure 3-50)

Special Tools	Torque Values (ft-lbs)
HD-97225-55 Bearing in-stallation tool	None

1. After engine has been removed from chassis, securely fasten it to a stand and workbench.

2. Remove gearcase cover and fasten dial indicator to gear side crankcase with indicator stem on end of gearshaft.

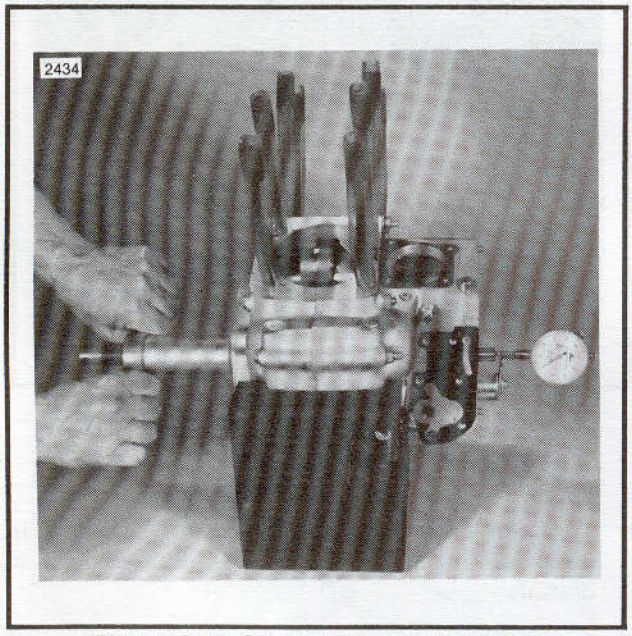


Figure 3-50. Check Flywheel End Play

3. Install BEARING INSTALLATION TOOL, Part No. HD-97225-55, on sprocket shaft to preload the bearing races.

4. Check amount of main bearing end play by rotating and pushing on the sprocket shaft while reading the dial indicator. Rotate and pull on the sprocket shaft and note the difference on the indicator readings. If difference (end play) is not 0.001 - 0.005 in., the bearing inner spacer (10, Figure 3-42) must be replaced. Choose spacer from the chart. A thinner spacer will result in less end play.

Bearing Inner Spacers Chart

Bearing Inner Spacers (10, Figure 3-41)	
PART NO.	SIZE
9120	0.0925/0.0915
9121	0.0945/0.0935
9122	0.0965/0.0955
9123	0.0985/0.0975
9124	0.1005/0.0995
9125	0.1025/0.1015
9126	0.1045/0.1035
9127	0.1065/0.1055
9128	0.1085/0.1075
9129	0.1105/0.1095
9130	0.1125/0.1115
9131	0.1145/0.1135
9132	0.1165/0.1155
9133	0.1185/0.1175
9134	0.1205/0.1195

5. If the crankcase has been disassembled, proceed as follows:

   5a. When assembling the the left crankcase half and flywheels, use the thickest available inner spacer (10), P.N. 9314. (Step 4, FLYWHEEL AND CRANKCASE ASSEMBLY). Measure the spacer before in-stallation. Record the measurement.

   5b. Next, follow steps 5 through 10 under FLYWHEEL AND CRANKCASE ASSEMBLY.

   5c. Check end play. Record the measurement. Subtract your measurement from the spacer measurement to determine the correct spacer.

Example: (Use Spacer Chart)

Specification is 0.001 - 0.005 in.
Measured end play is 0.007 in.
Spacer # 9134 measured 0.120 in.
Subtract 0.007 from 0.120:

	0.120
	-0.007
	0.113
PLUS DESIRED END PLAY:	+0.003
	0.116

Use spacer # 9132. Repeat steps 5 through 9 and check end play again.

DISASSEMBLY

NOTE

Do not remove the lock ring (12).

1. Remove cylinder heads as described in CYLINDER HEAD, REMOVAL.

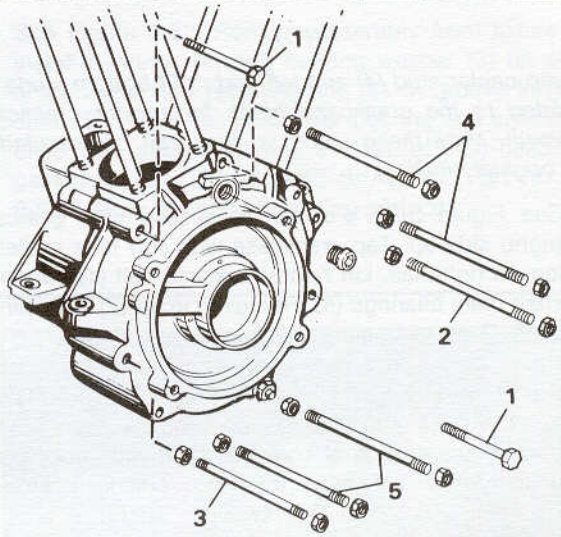
2. Remove cylinders as described in CYLINDER AND PISTON, REMOVAL.

CAUTION

After removing cylinders, install 0.500 in. inside diameter plastic or rubber hose over the cylinder studs. Never lift or move the crankcase by grasping the cylinder studs.

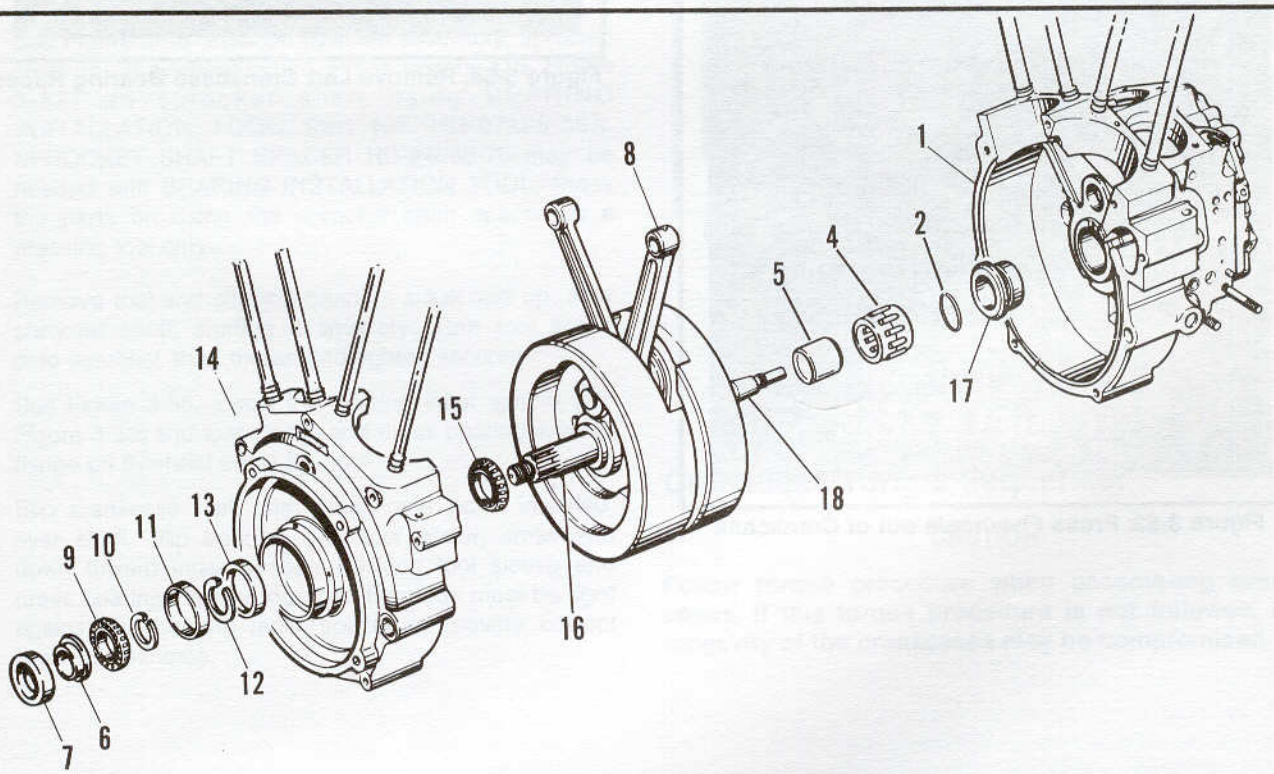
3. Remove gearcase parts as described in GEARCASE, DISASSEMBLY. Check flywheel end play as described previously.

4. See Figure 3-51. Remove crankcase bolts and studs (1 through 5). It is necessary to remove only one stud nut and slip stud and other nut out opposite side of crankcase..



1. Crankcase stud bolt, 3/8 x 3-1/4 in. (2)
2. Crankcase stud, 5/16 x 5 in. (right center)
3. Crankcase stud, 5/16 x 6 in. (left center)
4. Crankcase stud, 5/16 x 5-7/16 in. (2) (top and top right)
5. Crankcase stud, 11/32 x 5-13/16 in. (2) (left and right bottom)

Figure 3-51. Crankcase Studs



1. Right crankcase half
2. Circlip
3. Bearing washer
4. Bearings and retainer
5. Inner race
6. Sprocket shaft spacer
7. Sprocket shaft bearing seal
8. Flywheel and rod assembly
9. Sprocket bearing half
10. Bearing inner spacer
11. Bearing outer race
12. Outer race lock ring
13. Bearing outer race
14. Left crankcase half
15. Sprocket bearing half
16. Sprocket shaft
17. Pinion shaft bearing race
18. Pinion shaft

NOTE: Keep parts 9, 11, 12, 13 and 15 as a set. Do not transpose or interchange parts.

Figure 3-52 . Crankcase

NOTE

The top center stud (4) and left and right bottom studs (5) are fitted to the crankcase holes for proper crankcase alignment. Mark these studs so they can be installed in their original location.

5. See Figure 3-52. Position crankcase with gearcase (right) side up. Tap crankcase with soft face mallet to loosen right half. Lift right crankcase half (1) off pinion shaft main bearings (4). Remove circlip (2) from pinion shaft. Remove bearings (4) from pinion shaft.

6. See Figure 3-53. Mount flywheel and left case assembly on press table supporting case on parallel bars. Press on end of sprocket shaft with arbor press until flywheel assembly (8) drops out. Remove seal (7), freeing sprocket side bearing half (9), spacer (6) and spacer (10).

Figure 3-53. Press Flywheels out of Crankcase

7. See Figure 3-54. If left main bearing is to be replaced, press out bearing races (11 and 13, Figure 3-41) from opposite sides of crankcase hole, using CRANKSHAFT BEARING REMOVAL & INSTALLATION TOOL, Part No. HD-94547-80. Do not remove the lock ring (12).

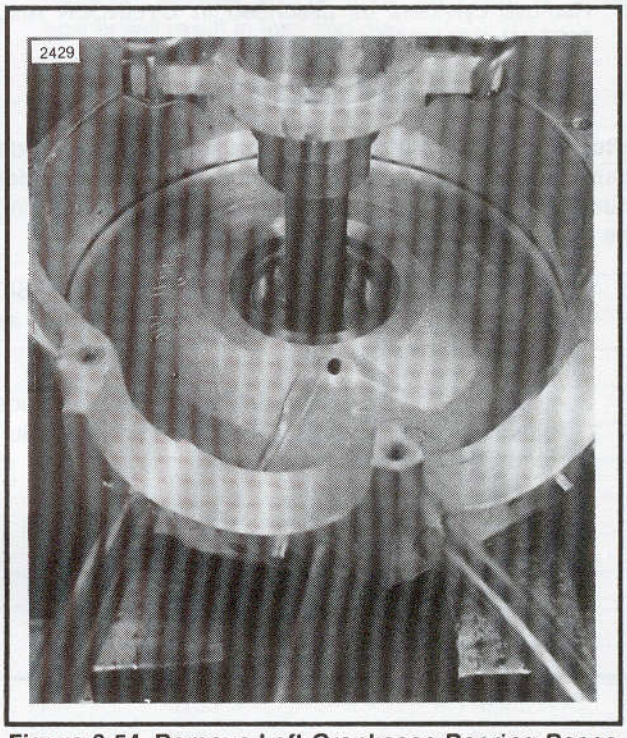


Figure 3-54. Remove Left Crankcase Bearing Races

FLYWHEEL AND CRANKCASE ASSEMBLY (Figure 3-52)

Special Tools	Torque Values (ft-lbs)
HD-97194-57 Outer race press plug HD-97225-55A Bearing installation tool HD-24036-70 Sprocket shaft spacer	Crankcase studs, bolts, nuts - See CRANKCASE TORQUE SEQUENCE

CAUTION

- **If you have only replaced crankcase halves, be sure flywheels are true before installing. See TRUING FLYWHEELS.**
- **Remove pistons from connecting rods before truing flywheels.**

1. When properly installed, oil hole in lock ring groove will be centered in lock ring gap. Use arbor press and OUTER RACE PRESS PLUG, Part No. HD-97194-57, to press outer race parts into crankcase bushing one at a time. Press the races into the case, one from each side, with the largest diameter outward to match taper of bearings. Be sure each race bottoms on the lock ring.
2. See Figure 3-55. Position flywheel assembly, sprocket shaft up, in flywheel fixture. Press bearing (15, Figure 3-52) on sprocket shaft using BEARING INSTALLATION TOOL, Part No. HD-97225-55A. SPROCKET SHAFT SPACER HD-24036-70 may be needed with BEARING INSTALLATION TOOL. Press the parts on using the sprocket shaft spacer as a pressing tool only.
3. Remove tool and slip the bearing, small end up, over sprocket shaft, starting it squarely. Turn tool screw onto sprocket shaft thread and tighten securely.
4. See Figure 3-55. Install the bearing inner spacer (10, Figure 3-52) and tool sleeve and press bearing against flange on flywheel using the tool
5. Slip crankcase half, with outer race parts installed, over shaft. Slip bearing over tool screw, small end down toward inner spacer. Position tool sleeve and press bearings tightly together. Bearings must be tight against the bearing inner spacer to provide correct bearing clearance.
6. See Figure 3-52. Remove assembly from fixture and install bearings (4) and bearing washer (3) on pinion shaft. Install new retaining ring (2) on groove in pinion shaft. Slip right case half over bearing and against left case half after applying a coat of non-hardening gasket sealer, CRANKCASE SEALANT, Part No. HD-99650-81 or 3M #800 to mating surfaces.

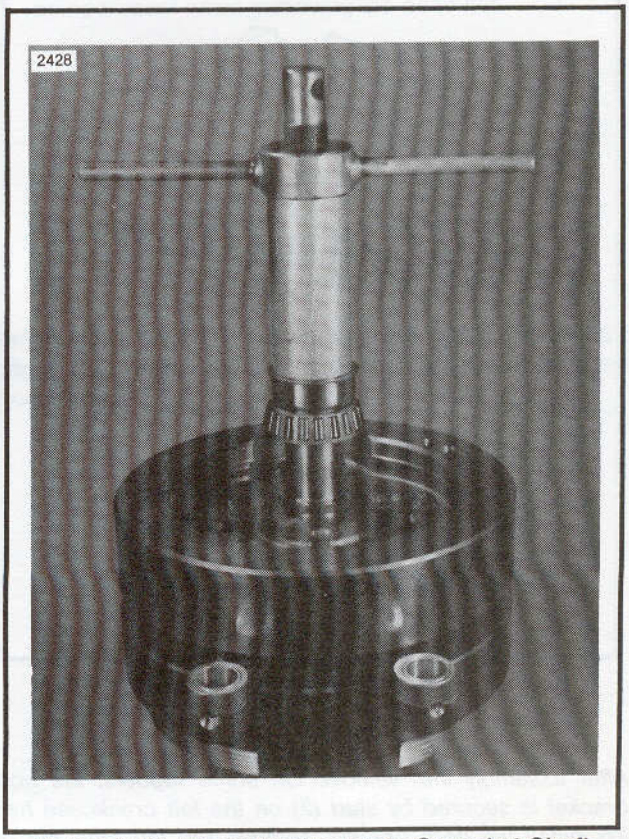


Figure 3-55. Press Bearing onto Sprocket Shaft

7. See Figure 3-51. Align case halves and tap crankcase studs (4 and 5) into holes. These three studs properly align the case halves and must be installed before remaining studs. Start nuts and tighten until snug. Assemble remaining studs, bolts and nuts. Tighten fasteners to torque sequence given below.

Crankcase Torque Sequence:

CAUTION

Follow torque procedure when assembling crankcases. If this torque procedure is not followed, the longevity of the crankcases may be compromised.

8. Tighten crankcase fasteners as follows:

- See Figure 3-56. First tighten to 10 ft-lbs torque in the sequence shown, starting with # 1.
- Install cylinders and heads. After installing cylinders and heads, tighten to 15 - 17 ft-lbs torque in the sequence shown. See CYLINDER HEADS.

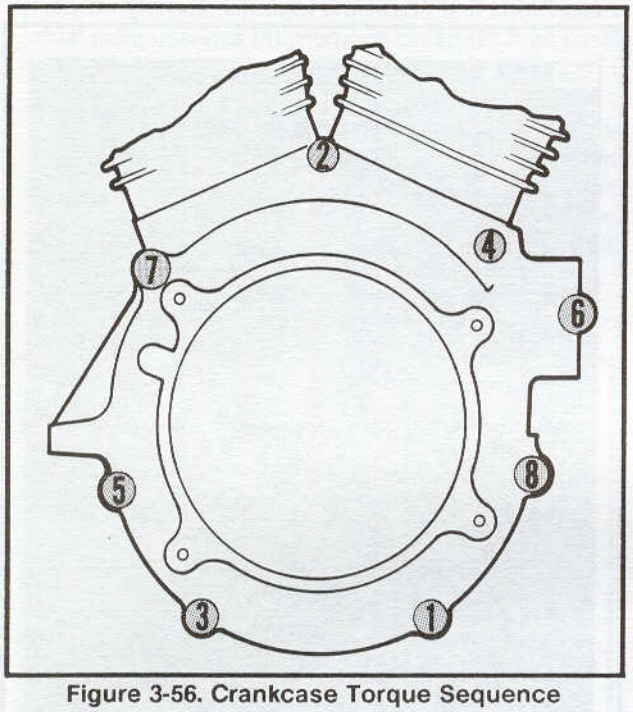


Figure 3-56. Crankcase Torque Sequence

NOTE

After assembly into vehicle: On some models, the horn bracket is secured by stud (2) on the left crankcase half. To install the horn bracket, remove the left side nut on stud (2). Install the bracket and tighten nut to 15 - 17 ft-lbs torque.

9. See Figure 3-50. Check exact amount of flywheel end play with dial indicator as directed at the beginning of this section to determine if within specified limits.

10. See Figure 3-52. Install spacer (6). Press seal (7) into crankcase with lip facing out (away from flywheels).

11. Install and align compensating sprocket shaft extension. See PRIMARY CHAIN AND SPROCKETS in section 6.

NOTE

Sprockets must be aligned through use of correct thickness sprocket spacers. Method for checking and determining correct spacer thickness is given in section 6 under PRIMARY CHAIN AND SPROCKETS.

CYLINDER STUDS

CAUTION

Cylinder studs that are bent, scratched or broken must be replaced.

1. Measure 5.750 in. from the top of the stud toward the bottom of the stud. Paint a line on the threads to indicate the 5.750 in. measurement. This painted area will be used as a reference during installation.

2. Place 0.313 in. DIAMETER BALL, Part No. 8860, from the XL clutch release mechanism into the head bolt recess. Thread the stud into the head bolt until the stud bottoms on the ball.

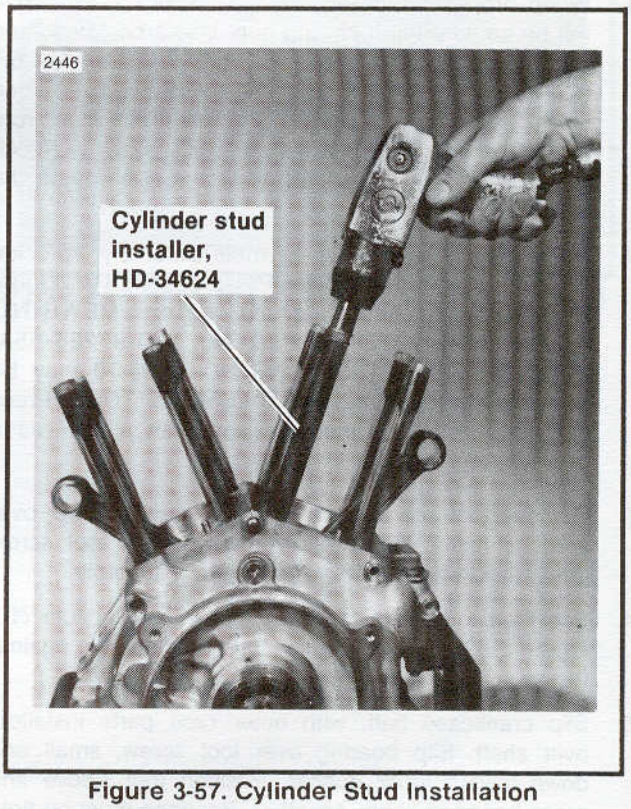


Figure 3-57. Cylinder Stud Installation

3. Clean the threads in the crankcase. Threads on new studs must have an interference fit in the crankcase threaded holes. Apply Loctite STUD 'N BEARING MOUNT on the stud threads.

NOTE

See Figure 3-58. The stud shoulder must be installed up.

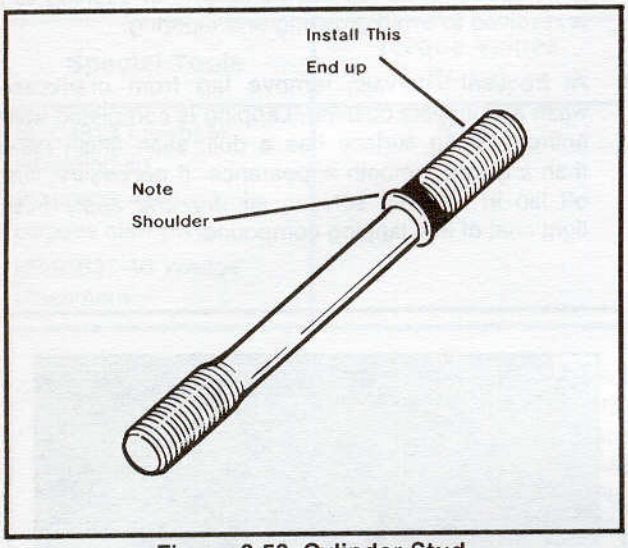


Figure 3-58. Cylinder Stud

4. See Figure 3-57. Use an air or electric impact wrench and install the stud threads to the depth of the painted line. Do not use a ratchet or breaker bar because they will bend the stud.

5. Pack clean shop towels into the crankcase openings to prevent the ball from falling into the flywheel compartment when removing the head bolt.

6. Verify that installed stud has a depth of 5.670-5.770 in. above the base gasket surface.

NOTE

Refer to FLYWHEEL ASSEMBLY INTO CRANKCASE following FLYWHEELS for additional crankcase installation procedures..

CRANKCASE BEARING REPAIR

Truing and Sizing Pinion Shaft Main Bearing Race

Special Tools	Torque Values (ft-lbs)
HD-96710-40 Crankcase main bearing lap Fabricated plug (See Figure 3-72)	None

1. Before fitting new pinion shaft main bearings, lap bearing race in crankcase to true it and remove traces of wear shoulder at sides of roller paths. Use CRANKCASE MAIN BEARING LAP, Part No. HD-96710-40.
2. See Figure 3-52. A race (17) that is worn beyond limits of oversize bearings must be replaced. To remove bearing race, heat case to 275°-300° F. Heating expands case and makes it possible to remove bearing race using less force.
3. See Figure 3-72. Make up a plug as shown. Press worn race (17) out and new race in. New race must be lapped slightly to true and align with left case bearing, and to attain a size compatible with roller sizes available.

Lapping Engine Main Bearing Races (Figure 3-59)

1. Secure right and left crankcase halves with three crankcase stud bolts (top center and bottom left and right). The sprocket shaft bearing outer races and large spacer must be installed in left crankcase.
2. Assemble lapping arbor to lapping handle and assemble guide sleeve to sprocket shaft bearing bushing. Sleeves, for use with tapered bearing, are assembled to case with bearings and small spacer collar. Turn sleeve parts finger tight.
3. Insert lap shaft with arbor assembled through pinion bearing bushing and into guide sleeve. Tighten arbor expansion collars using a length of 0.156 in. rod as spanner until arbor begins to drag. Do not adjust arbor snug in bushing or bushing will "bell," a condition where hole is larger at ends than it is in the center.
4. Withdraw arbor far enough to coat lightly with 220 grit lapping compound. Do not apply a heavy coat. Reposition lap in bushing and turn handle at moderate hand speed. Work lap back and forth in bushing as it is revolved to avoid grooving and tapering.
5. At frequent intervals, remove lap from crankcase, wash and inspect bushing. Lapping is completed when entire bushing surface has a dull, satin finish rather than a glossy, smooth appearance. If necessary, flush off lap in cleaning solvent, air dry and apply fresh, light coat of fine lapping compound.

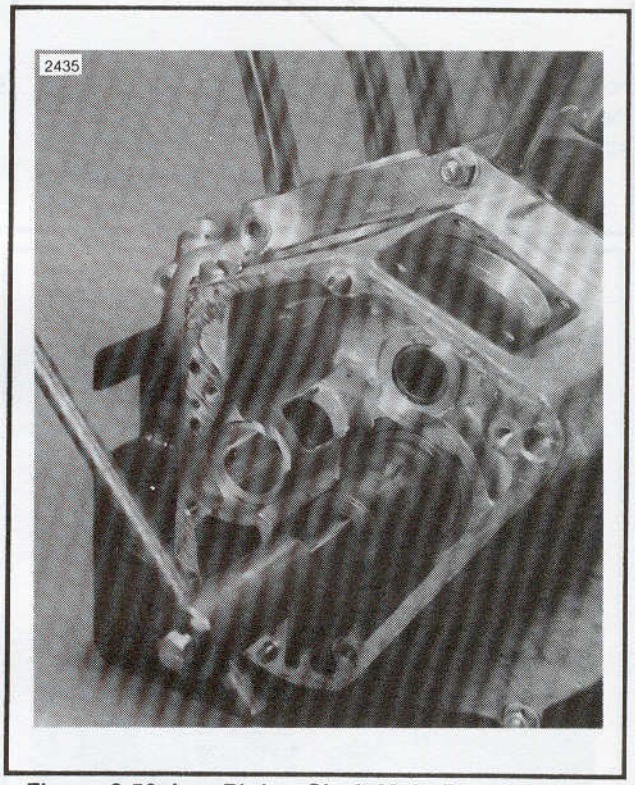


Figure 3-59. Lap Pinion Shaft Main Bearing Race

Fitting Sprocket Shaft Bearing

See ADJUSTMENT. If flywheel end play is within tolerance and if tapered roller bearings and races pass visual check and have no apparent wear, the same set may be reinstalled. Be certain all parts of bearing are installed in exactly the same order in which they were removed. If any part of bearing assembly is worn, entire assembly should be replaced.

FLYWHEEL DISASSEMBLY

Special Tools	Torque Values (ft-lbs)
HD-34813 Flywheel rebuilding jig HD-95635-46 General purpose claw puller HD-95637-46 Wedge attachment	None

1. See Figure 3-60. If flywheels are to be disassembled, place a FLYWHEEL REBUILDING JIG, Part No. HD-34813 in a vise. Insert pinion shaft into fixture and install WEDGE ATTACHMENT, Part No. HD-95637-46 and GENERAL PURPOSE CLAW PULLER, Part No. HD-95635-46 over sprocket shaft bearing. Turn forcing screw to remove bearing. Keep bearings in a set with proper bearing outer races.

NOTE

On the one-piece flywheel and sprocket shaft, the inner bearing will be destroyed during removal and must be replaced.

2. See Figure 3-61. Remove crankpin nut (1). To loosen flywheel, strike left flywheel rim with soft metal mallet at 90 degrees to crankpin.

3. See Figure 3-62. Remove left flywheel assembly.

4. Hold down bearing assembly with a short length of pipe or tubing so connecting rods (3) may be slipped off bearings. Remove bearings (4). Hold together in set until bearings are washed and refitted to crankpin.

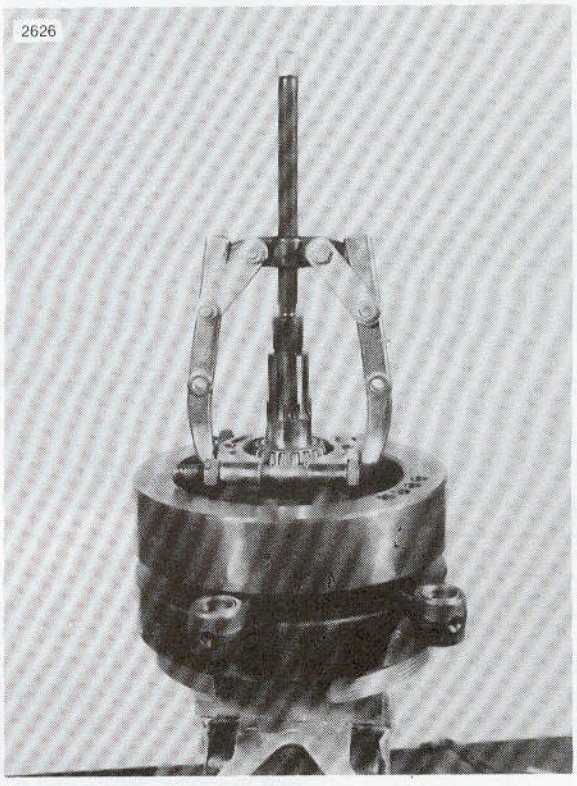
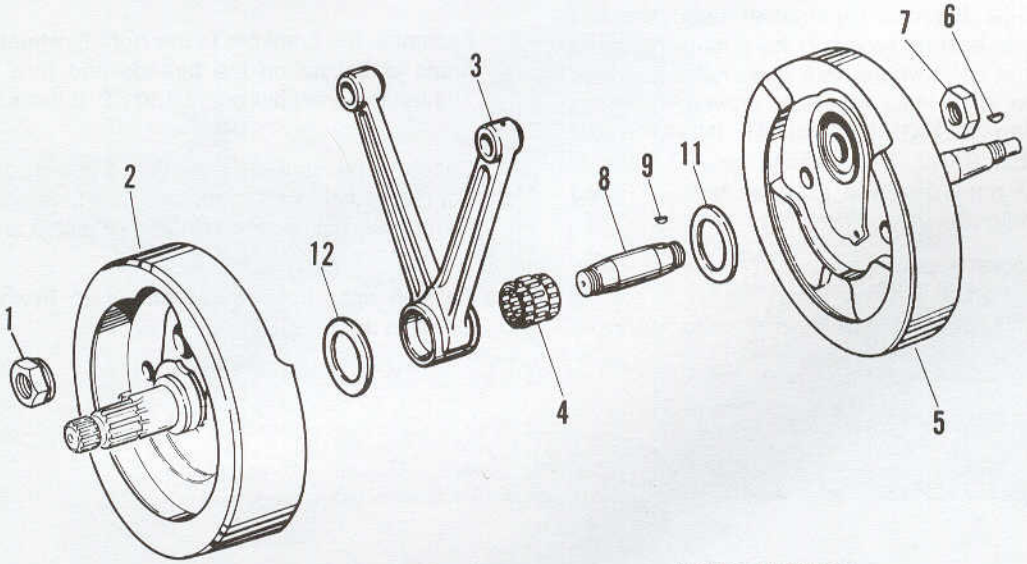


Figure 3-60. Pull Bearing from Sprocket Shaft



1. Crankpin nut
2. Left flywheel
3. Connecting rods
4. Bearing rollers and retainer
5. Right flywheel
6. Pinion shaft key
7. Crankpin nut
8. Crankpin
9. Crankpin key
10. Sprocket shaft
11. Flywheel washer
12. Flywheel washer

Figure 3-61. Flywheel Assembly

5. Turn flywheel over in fixture and remove crankpin nut (7). Press crankpin out of flywheel. Remove crankpin key (9).

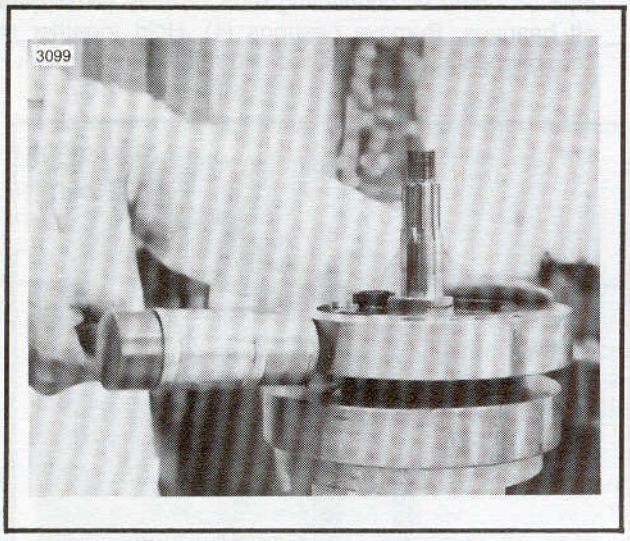


Figure 3-62. Loosen Flywheels

CLEANING AND INSPECTION (Figure 3-61)

1. Wash all parts in grease solvent and blow dry with compressed air. Examine crankpin for wear, grooving and pitting. If the surface is at all worn, replace with new pin. Examine flywheel washers (11 and 12). If either washer is worn and grooved, it should be replaced.

2. Examine connecting rod lower races. If they appear slightly grooved or shouldered where edge of bearing rollers ride, they may be lapped out and oversize crankpin installed. If they appear badly worn, grooved or pitted, new rods should be installed, preferably as an assembly with new bearings and crankpin.

3. See Figure 3-52. Examine pinion shaft inner race and right crankcase bearing race (17) for pitting, grooving and gouging at point where right main roller bearings ride. A pinion shaft inner race that is worn must be replaced. See REMOVING/INSTALLING PINION SHAFT INNER RACE. If crankcase bearing race is worn beyond repair, replace as described in Truing and Sizing Pinion Shaft Main Bearing.

4. Examine sprocket shaft outer races for wear, grooving and pitting. Examine bearing rollers for wear, pitting, grooving and heat discoloration. The sprocket shaft Timken tapered roller bearings are manufactured in selectively fitted sets. The same serial number appears on all parts. If any part is damaged, the complete set must be replaced. When a new bearing set is installed, check flywheel end play as described earlier in this section.

CAUTION

All bearings that were removed must be replaced. Once a bearing has been removed, it is destroyed.

5. If flywheel and connecting rod assembly need repair, see REPAIR for detailed instructions.

FLYWHEEL ASSEMBLY (Figure 3-61)

Special Tools	Torque Values (ft-lbs)
34813 Flywheel assembly jig HD-96650-80 Flywheel truing stand C-clamp Wedge	Crankpin nut 180 - 210

See FLYWHEEL REPAIR. After correct connecting rod bearing fit has been attained. Clean and assemble parts as follows:

1. Before assembly, all flywheel components must be perfectly clean and dry. Use a non-petroleum based solvent such as Loctite CLEANING SOLVENT or electrical contact cleaner.

CAUTION

Do not put Loctite on the crankpin shaft tapers.

2. Assemble the crankpin to the right flywheel. Place two drops of Loctite on the threads and face of the nut. Tighten the crankpin nut to 180 - 210 ft-lbs torque.

3. Check to be sure oil passages through pinion shaft, right flywheel and crankpin are clear by blowing compressed air into hole in end of pinion shaft.

4. Position right flywheel assembly in flywheel fixture, crankpin up.

5. See Figure 3-63. Install the rods and bearings on the crankpin using a thin film of petroleum jelly to retain the rollers. Never use a stiff, high temperature grease on the roller bearings.

   The forked rod is for the rear cylinder and the offset reinforcement on the front rod faces forward. If the front rod is turned 180° it will interfere with the rear rod.

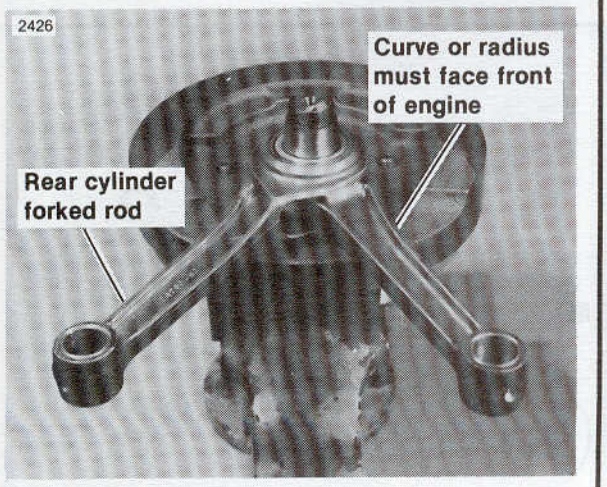


Figure 3-63. Connecting Rod Location

6. Install the left flywheel and shaft on the crankpin and apply Loctite to the threads and face of the nut.

7. See Figure 3-64. Place flywheel assembly in FLYWHEEL ASSEMBLY JIG, Part No. 34813. Tighten crankpin nut to a preliminary torque of 180 ft-lbs.

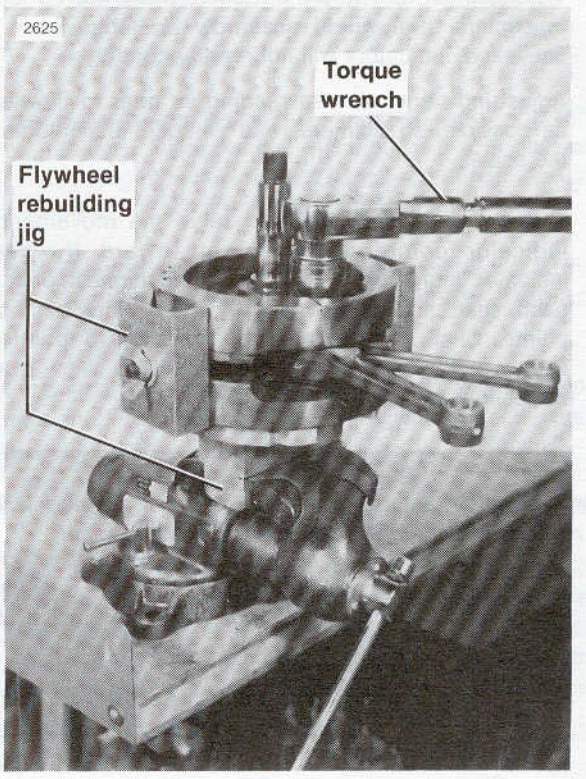


Figure 3-64. Assembling Flywheels

Truing Flywheels

8. See Figure 3-65. When nut is tightened to 180 ft-bs torque, install flywheel assembly in FLYWHEEL TRUING STAND, Part No. HD-96650-80. Tighten, then back off, adjusting so centers are snug but wheels rotate under weight of rods.

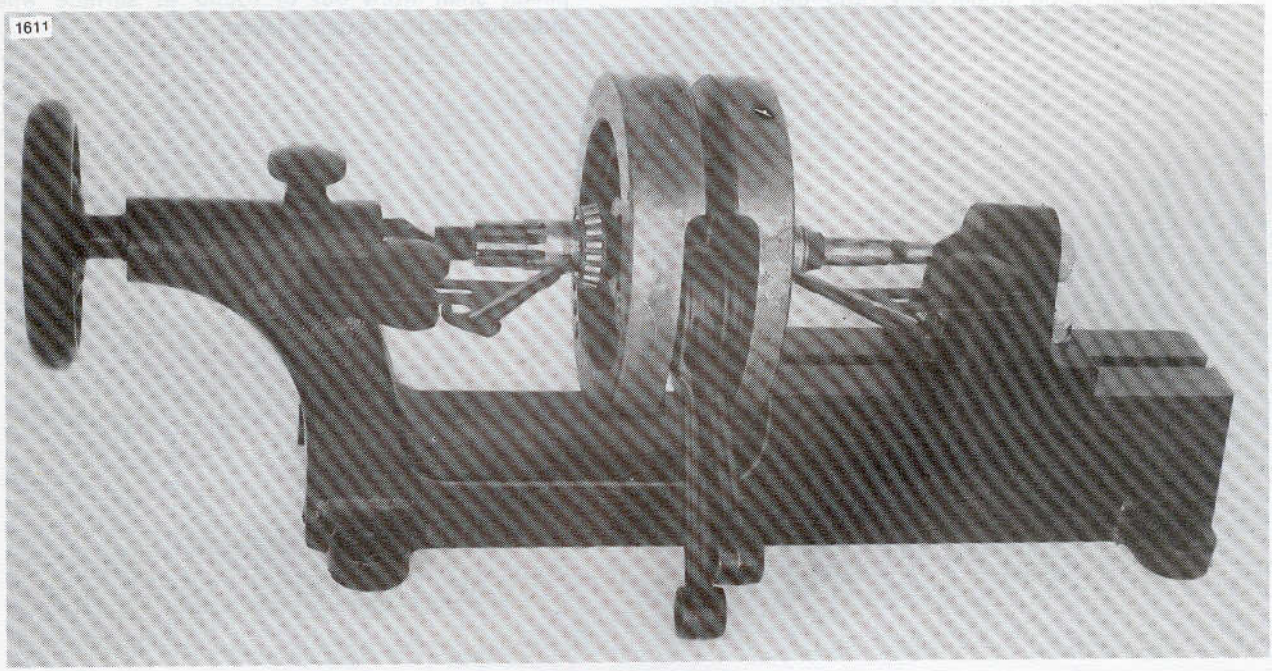


Figure 3-65. Flywheels on Truing Stand

Wheels must turn freely but shafts may not be loose in centers. If flywheel assembly is either loose or squeezed, indicators will not read accurately.

Adjust indicators to take reading as near to flywheels as possible, so pointers read at about the middle of the scales.

9. Turn flywheels slowly and observe the movement of indicator pointers. Movement toward flywheels indicates high points of shafts. Find highest point of each shaft and chalk-mark flywheel rims at those points. Chalk marks must be parallel to pointers. Remove flywheel from truing stand and make corrections as stated in step 13.

NOTE

The flywheels must be trued and nuts retightened within 25 minutes of assembly; before the Loctite has set.

10. See Figure 3-66. Flywheel may be out of true three ways, A, B, and C, or a combination of two of the three ways.

    a. When wheels are both out of true as described in "A", tighten C-clamp on rims or wheels opposite crankpin and lightly tap the rim at the crankpin with lead or copper mallet.

    b. When wheels are both out of true as indicated in "B", install a screw-type wedge between the wheels opposite the crankpin and lightly tap the rims near the crankpins with a mallet.

    c. When wheels are out of true as indicated in "C", strike the rim of the wheel a firm blow at about 90 degrees from crankpin on high side.

    d. When wheels are out of true in a combination of any of conditions shown, correct "C" first, tapping rim of offending wheel only, and then correct condition "A" or "B".

NOTE

- *The number of blows required and how hard they should be struck depends on how far shafts are out of true and how tight nuts are drawn.*
- *Always remove the flywheels from the stand and strike the flywheel rim only at 90° to the crankpin. Use only a soft metal mallet. Never strike wheels a hard blow near crankpin. This could result in a broken crankpin.*

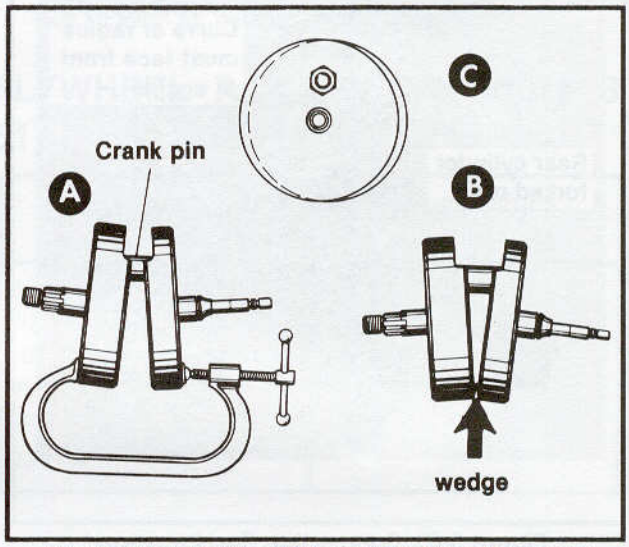


Figure 3-66. Types of Flywheels Misalignment

11. Readjust centers, revolve wheels and take reading from indicator. Repeat truing operation until indicated runout does not exceed 0.001 in (each graduation on indicator is 0.002 in.).

12. If it is impossible to true wheels, check for a dirty, damaged or enlarged tapered hole, or a sprocket or pinion shaft worn out of round at surface where indicator reading is being taken.

13. See Figure 3-67. Check connecting rod side play with thickness gauge. If it is greater than tolerance shown in engine SPECIFICATIONS, tighten crank pin nuts until within, but not exceeding torque limits. Insufficient play between rods and flywheel face is caused by one of the following conditions:

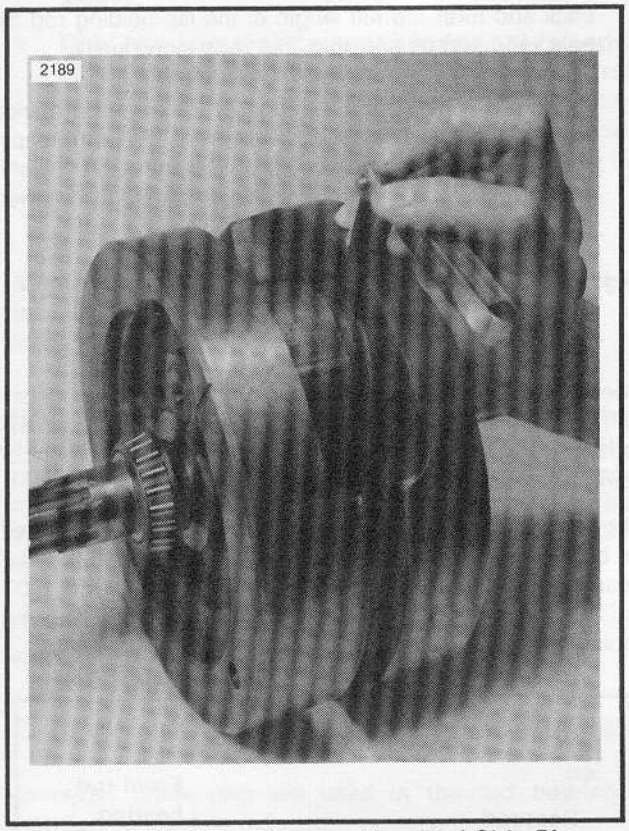


Figure 3-67. Check Connecting Rod Side Play

a. Flywheel and crank pin assembled with oil on tapers and nuts over-tightened. Disassemble, clean, reassemble.

b. New flywheel washers installed and not fully seated. Disassemble, inspect, replace deepest seating flywheel or exchange crankpin. As last resort, grind down width of forked rod.

c. Tapered hole(s) enlarged as a result of having been taken apart several times. Replace flywheel(s).

After rod side play is checked and adjusted and crank pin nut tightened to specified torque, again recheck wheel trueness on truing stand. Correct any runout as above.

14. See Figure 3-64. When wheels are true, place flywheel in FLYWHEEL ASSEMBLY JIG, Part No. 34813 and using a torque wrench, tighten crank pin nuts to 210 ft-lbs final torque. Recheck for truing and runout, and if either is not within specification, repeat truing procedure.

FLYWHEEL ASSEMBLY REPAIR

Flywheel Washers

Replace worn flywheel washers as follows:

1. Washer is a close fit in flywheel recess and is secured originally by punching flywheel metal tight against the washer at several points. It is usually necessary to drill a small hole (0.125 in. or smaller) through the washer. Turn a self-tapping screw into the hole to force the washer out.

2. Before installing new washer, scrape outer edge of washer recess where metal was punched against it so new washer may seat fully against recess bottom. If washer does not seat fully, forked rod will not have necessary clearance for side play.

3. Stake the new washers in place in four equally spaced locations using a center punch. Punch marks should be 0.045 in. deep and 0.050 in. away from the edge of the washer.

Lapping Connecting Rod Races

Special Tools	Torque Values (ft-lbs)
HD-96740-36 Connecting rod lapping arbor	None

1. See Figure 3-68. Connecting rod lower races that are likely to clean up within the range of oversize bearing rollers and are otherwise in serviceable condition, should be trued and sized up with CONNECTING ROD LAPPING ARBOR, Part No. HD-96740-36.

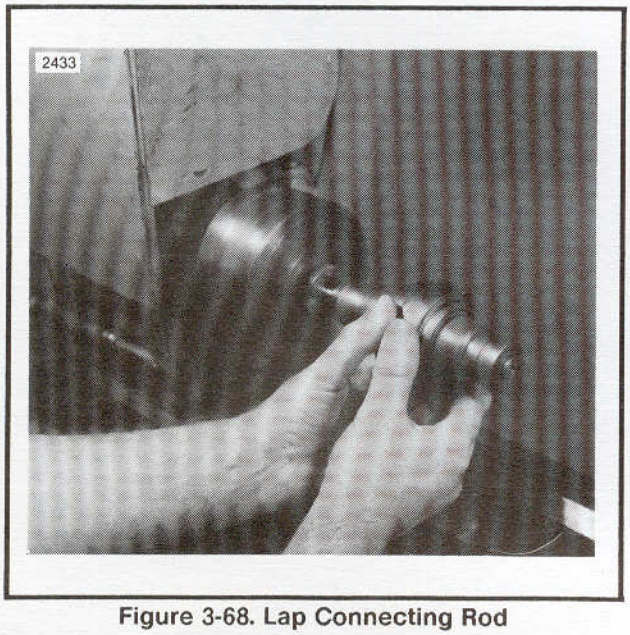


Figure 3-68. Lap Connecting Rod

2. Turn lap in lathe at 150 to 200 rpm. Adjust lap by means of adjusting nut to a dragging but free fit in rod race. Clean lap before using, then apply fine lapping compound (No. 220 grit grinding compound mixed with oil) to lap. A loose lap will "bell mouth" bearing race so it must be kept adjusted at all times. To avoid grooving or tapering lapped surfaces in rods, work rod back and forth the full length of the lap holding rod as near race end as possible. Lap rods individually.

3. When rods are lapped true and all traces of pit marks or grooving are cleaned up, wash rods in warm soapy water and blow dry. Surface should have a soft velvety appearance and be free of shiny spots. Rod lower races must be round to within 0.0002 in.

Replacing Rod Bearings

NOTE

See Figure 3-69. The connecting rod bearing set consists of three packaged bearings. The new bearing sets will retrofit earlier models, but there is another method of using these bearings.

The bearing set packages are color coded with either a red or blue identification. This color coding is used by the bearing manufacturer only. The color coding DOES NOT indicate size selection for connecting rod bearing replacement.

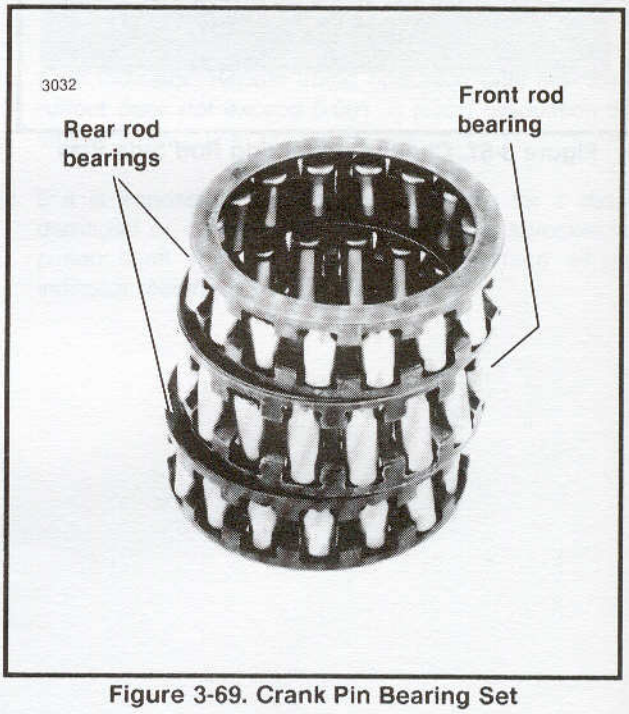


Figure 3-69. Crank Pin Bearing Set

CAUTION

- **Either a red or a blue coded bearing set may be used. DO NOT intermix bearings from a red and a blue bearing set because this will cause excessive loading on one bearing resulting in premature bearing failure.**

- **The bearings consist of rollers retained in steel cages. The wide bearing (male/front rod) retains the rollers both internally and externally. The two narrow bearings (female/rear rod) only retain the rollers in one direction so care must be taken that the rollers do not drop out of the cage when the bearing set is removed from the plastic sleeve.**
- **Only one size replacement bearing set (standard, either red or blue coding) will be sold. Oversize bearings are not available. Bearing clearance or fit is controlled by the connecting rod race inside diameters and the crank pin diameter. Two oversize crank pins are available.**

NOTE

Measure end play between connecting rod and thrust washer, not between connecting rod bearing cage and thrust washer.

CAUTION

Because of the extremely small tolerances involved, all measurements must be made as accurately as possible. Fitting bearings tighter than recommended may result in bearing seizure and damage when heat expands the parts. Excessive clearance will result in a noisy bearing.

All fitting and checking must be made with bearings, rods and crank pin clean and free of oil.

Establishing Proper Bearing Clearance

Oversized crank pins are used in the rod bearing to establish connecting rod clearance on crank pin.

See Figure 3-70. Oversize (OS) crank pins are available in two oversizes: 0.0010 and 0.0020 in. OS crank pins will have a blue or a red dot painted on their ends. A blue dot indicates 0.0010 in. OS, a red dot indicates 0.0020 in. OS. Standard size crank pins will not be marked.

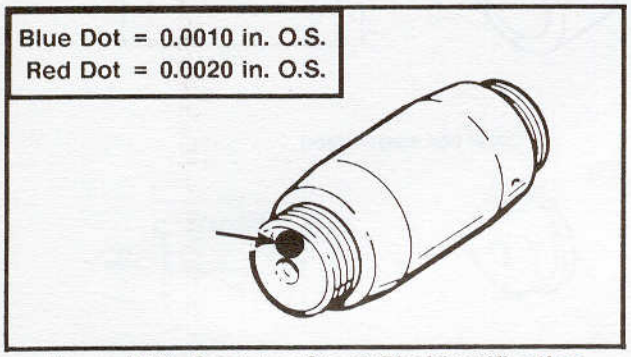


Figure 3-70. Oversize Crank Pin Identification

1. See Figure 3-71. To properly fit the rod bearings, measure inside diameter (ID) of lapped connecting rod races with a dial bore gauge that has 0.0001 in. graduations. Measure the ID at four places as shown. Record the four measurements.

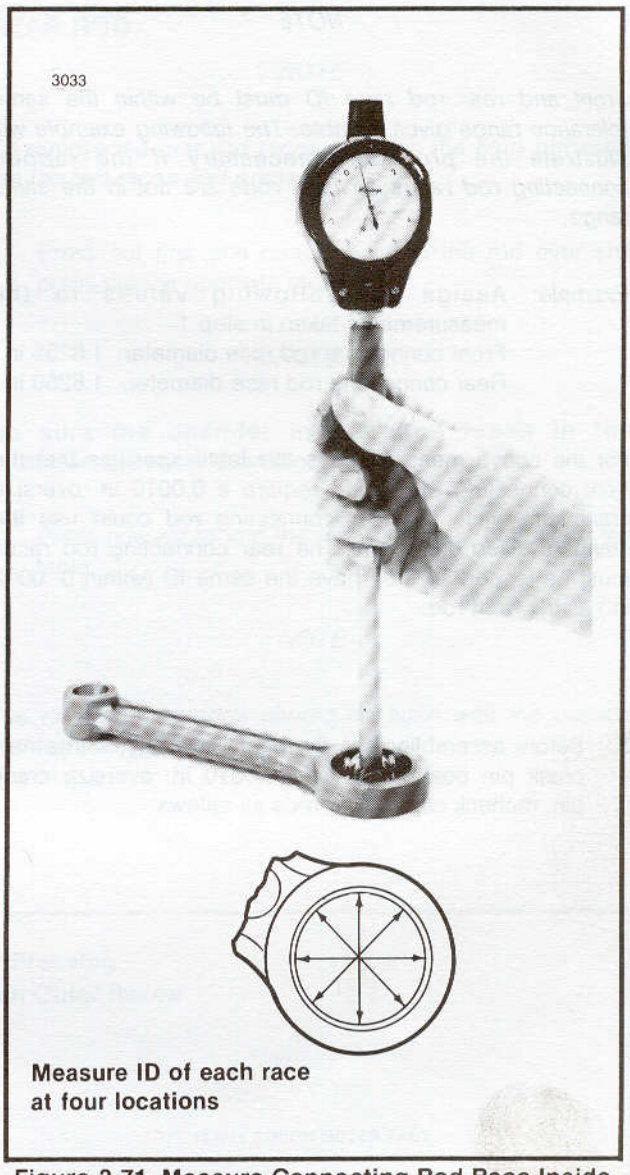


Figure 3-71. Measure Connecting Rod Race Inside Diameters

See Replacing Rod Bearing Outer Races. If any race ID exceeds Service Wear Limit of 1.6270 in., replace races or connecting rod set. If race ID measurements are less than 1. 6270 in., continue procedure as follows:

2. Compare the measurement recorded in step 1 with the ranges given in Race Diameter and Crank Pin Size Table. If the four measurements taken in each race differ, use the smallest measurement.

Race Diameter and Crankpin Size Table

CONNECTING ROD RACE ID REQUIRED	CRANK PIN REQUIRED
1.6245 – 1.6250	Standard
1.6255 – 1.6260	0.0010 in. oversize
1.6265 – 1.6270	0.0020 in. oversize
Greater than 1.6270	Service wear limit exceeded. Replace races or rods.

NOTE

Front and rear rod race ID must be within the same tolerance range given in table. The following example will illustrate the procedure necessary if the lapped connecting rod races on both rods are not in the same range.

Example: Assign the following values to the measurements taken in step 1.
Front connecting rod race diameter: 1.6255 in.
Rear connecting rod race diameter: 1.6250 in.

For the above measurements the table specifies that the front connecting rod would require a 0.0010 in. oversize crank pin, while the rear connecting rod could use the standard sized crank pin. The rear connecting rod races must be lapped so they have the same ID (within 0. 0002 in.) as the front rod.

3. Before assembling the flywheel assembly, with a new crank pin bearing set and 0.0010 in. oversize crank pin, recheck connecting rods as follows:

CAUTION

After the appropriate connecting rod race ID range specified in Race Diameter and Crank Pin Table has been achieved, verify that the following specifications are also met:

CONNECTING ROD	SPECIFICATIONS
Rear	Difference in ID of two races must not exceed 0.0001 in.
Front and rear	Difference in ID of races in front and rear connecting rods must not exceed 0.0002 in.
Front and rear	Races must be round within 0.00025 in. (Difference between largest and smallest ID measurement in any race must not exceed 0.00025 in.)

NOTE

Always use new bearings and crank pin after resizing (lapping) connecting rods to ensure proper running clearance.

Replacing Rod Bearing Outer Races

Special Tools	Torque Values (ft-lbs)
HD-33416 Universal driver handle Fabricated tools - See below	None

FRONT ROD

1. See Figure 3-72. Make a plug and sleeve to the dimensions shown.

CAUTION

Be sure the sleeve fully supports the outside of the conn. rod or the rod will be damaged beyond repair.

2. Use plug and sleeve with the UNIVERSAL DRIVER HANDLE, Part No. HD-33416 and and your shop press. Press the outer race out of the conn. rod, into the sleeve.

REAR ROD

NOTE

To remove the rear rod races, position the plug ***between*** *the the two races and press out.*

3. Press out first one race, then turn the rod over and press out the opposite race.

CAUTION

Be sure the chamfer in the race faces in the direction the race is being pressed.

4. Press new races into the rods until they bottom on the table.

NOTE

The race outside edge should be flush with the outside surface of the rod.

Manufactured Tools for Pressing Conn Rod Bearing And Pinion Outer Races

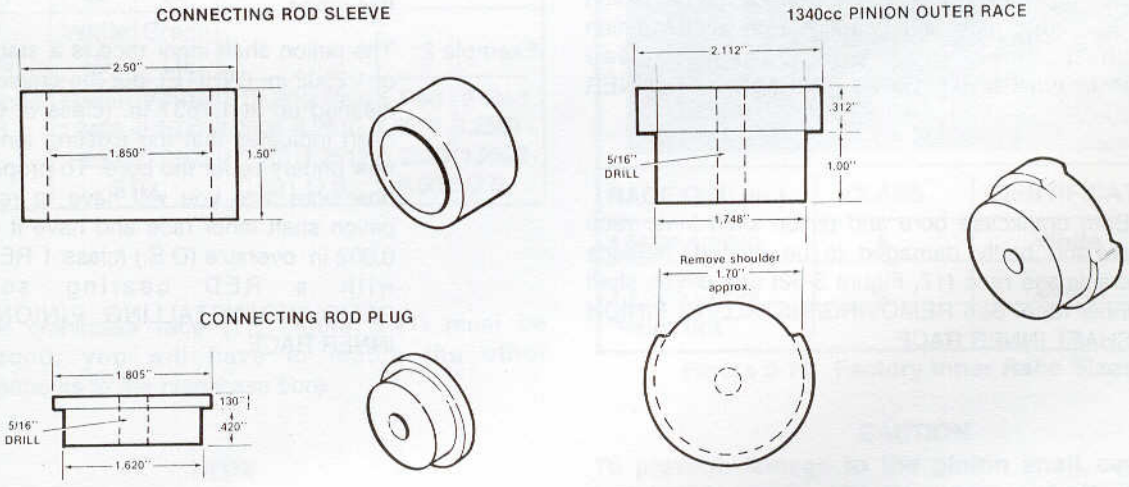


Figure 3-72. Manufactured Tools

Replacing Pinion Shaft Bearings

CAUTION

Because of the extremely small tolerances involved, all measurements must be made as accurately as possible. Fitting bearings tighter than recommended may result in bearing seizure and damage when heat expands the parts. Excessive clearance will result in a noisy bearing.

NOTE

Shafts/flywheels have a replaceable inner bearing race. Instead of shafts with oversized journals, one-piece flywheels use a pressed-on inner race that can be replaced and ground to the outside diameter (O.D.) needed for proper inner bearing race fit.

All fitting and checking must be made with bearings, crankcase and pinion shaft clean and free of oil.

1. Inspect pinion shaft inner race and crankcase bore race (17, Figure 3-52) for wear or damage. If inner race and bore are clean and undamaged, go to step 3.

2. If crankcase bore race (17, Figure 3-52) or pinion shaft inner race, or both, are scored, worn or damaged, you must:

   A. Lap the crankcase bore race (17, Figure 3-52) and pinion shaft inner race until they are smoothly finished and replace the old bearings with new, oversize bearings. See PINION SHAFT BEARING CHART.

   OR:

   B. Lap the crankcase bore and replace the old pinion shaft inner race and bearings with a new pinion shaft inner race and bearings. See REMOVING/INSTALLING PINION SHAFT INNER RACE.

   OR:

   C. Both crankcase bore and pinion shaft inner race are too badly damaged to be reused. Replace crankcase race (17, Figure 3-52) and pinion shaft inner race. See REMOVING/INSTALLING PINION SHAFT INNER RACE.

   OR:

   D. Pinion shaft inner race is good and crankcase bore is damaged beyond reuse. Replace crankcase race (17, Figure 3-52). Replace old bearing with a new bearing that will fit both crankcase race and pinion shaft inner race. See PINION SHAFT BEARING CHART.

3. If crankcase bore and pinion shaft inner race are undamaged, or can be lapped for reuse, measure both carefully. Read PINION SHAFT BEARING CHART and select the bearing set that will fit both dimensions correctly.

Example: If the bore measures 1.7509 in. and the pinion shaft inner race measures 1.2500 in., use a BLUE bearing set. This will fit a class two (2) crankcase and the pinion shaft inner race (GREEN).

NOTE

The class code on crankcases is stamped below the right side bore. The pinion shaft inner race color code is on the pinion shaft next to the inner race, in line with the crankpin. The bearing color code is on the wrapper and carton.

4. If the crankcase bore is damaged and the pinion shaft is not, lap the crankcase bore until it is clean and smooth. Measure the bore and pinion shaft inner race carefully. Read PINION SHAFT BEARING CHART. You must determine if the new bore size will allow you to use the existing pinion shaft with a bearing set within the range shown on the chart.

Example 1: The pinion shaft inner race is a standard size 1.2498 in. (GREEN) and the bore cleaned up at 1.7513 in. (class 3 crankcase). The chart indicates that a RED bearing set is correct for this range.

Example 2: The pinion shaft inner race is a standard size of 1.2502 in. (WHITE), but the crankcase bore cleaned up at 1.7531 in. (class 3, O.S.). The chart indicates that the existing inner race is now undersize for the bore. To properly fit the new bore size you will have to replace the pinion shaft inner race and have it ground to 0.002 in. oversize (O.S.) (class 1 RED), to use with a RED bearing set. See REMOVING/INSTALLING PINION SHAFT INNER RACE.

5. If you successfully lap the bore, but the shaft inner race is damaged beyond reuse, see example 2 above. Replace the inner race and bearing set with parts suitable for the bore size. See REMOVING/INSTALLING PINION SHAFT INNER RACE.

6. If you successfully lap the bore, but the shaft is damaged beyond reuse, replace the flywheel set and bearing set with parts suitable for the crankcase bore size.

Pinion Shaft Bearing Chart

BORE SIZE (In.)	BEARING SETS (Color Coded to Shaft and Bore)					
1.7531 - 1.7533					Red (3)	Blue (3)
1.7529 - 1.7531					Blue (2)	White (2)
1.7527 - 1.7529					White (1)	Green (1)
1.7521 - 1.7523			Red (3)	Blue (3)		
1.7519 - 1.7521			Blue (2)	White (2)		
1.7517 - 1.7519			White (1)	Green (1)		
1.7511 - 1.7513	Red (3)	Blue (3) ← (Crankcase class code)				
1.7509 - 1.7511	Blue (2)	White (2)				
1.7507 - 1.7509	White (1)	Green (1)				
Color Code Shaft (In.)	Green 1.2498 - 1.2500	White 1.2500 - 1.2502	1 Blue 1.2508 - 1.2510	2 Blue 1.2510 - 1.2512	1 Red 1.2518 - 1.2520	2 Red 1.2520 - 1.2522
	STD.		0.001 O.S.		0.002 O.S.	

7. If the crankcase race (17, Figure 3-41) must be replaced, you will have to match the other components to the crankcase bore.

NOTE

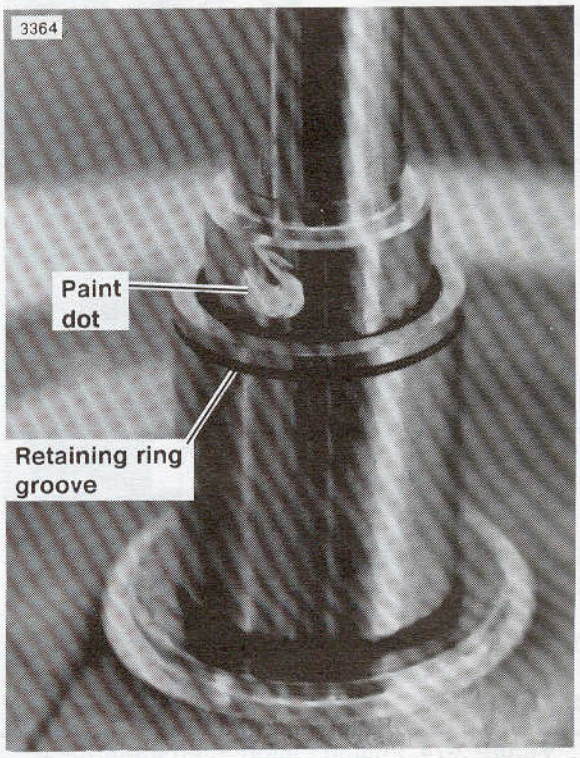
If the crankcase is not damaged and the bore is outside the O.S. limits shown on the chart, replace the race (17, Figure 3-52), as explained in Truing and Sizing Pinion Shaft Main Bearing Race and Lapping Engine Main Bearing Races earlier in this section. Replace other components as explained.

8. If all components, crankcase race, shaft and bearings are damaged beyond repair, replace them all using standard size components.

Removing/Installing Pinion Shaft Inner Race

Special Tools	Torque Values (ft-lbs)
HD-97292-61 Puller HD-95652-43A Shaft protector CJ950 (Snap-on®) Bearing separator	None

See Figure 3-73. A paint dot, located next to the inner race and in-line with the crankpin identifies the Class or O.D. of the inner race. See chart in Figure 3-60.



RACE O.D. (in.)	CLASS	IDENTIFICATION*
1.2502-1.2500	A	White
1.2500-1.2498	B	Green
*Paint dot		

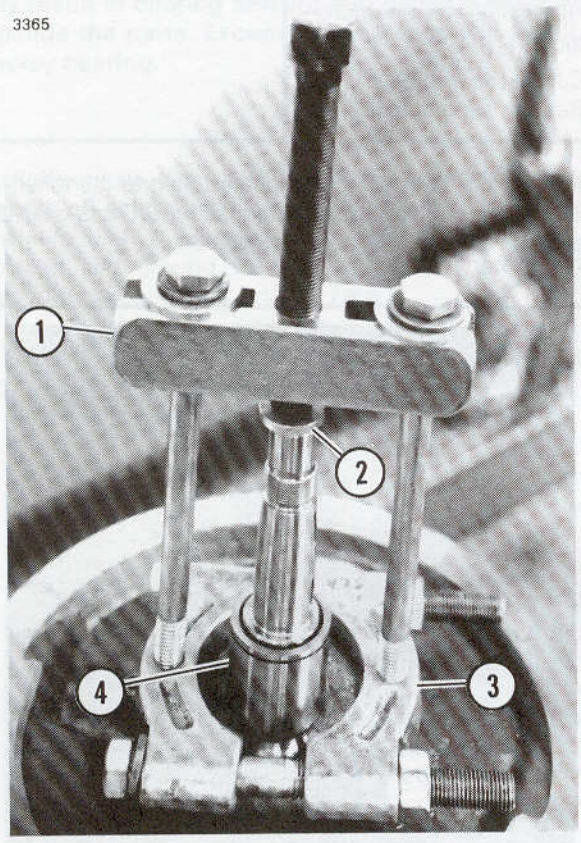
Figure 3-73. Factory Inner Race Sizes

CAUTION

To prevent damage to the pinion shaft center (and bearing journal) always use a shaft protector between the puller forcing screw and shaft when pulling pinion gear or bearing inner race. Be careful with shaft protectors that have centering projections that could damage the shaft center or flare the end of the shaft. If a shaft protector is not available, breather gear washers H-D Part No. 25320-79 through 25328-79 may be used as shaft protectors.

1. See Figure 3-74. Remove inner race (4) with tools shown. Apply heat to race to aid removal.

2. See Figure 3-75. Press new race (1) on pinion shaft to the dimension shown. Figure 3-76 shows a fabricated installation tool that will locate the inner race properly when tool is "bottomed" on flywheel.



1. **Puller HD-97292-61**
2. **Shaft protector HD-95652-43A or Washer 25324-79**
3. **Bearing separator, Snap-on® Tools stock no. CJ950 or equivalent**
4. **Inner race**

Figure 3-74. Pulling Pinion Shaft Inner Race

CAUTION

Be sure retaining ring groove end of inner race is away from flywheel.

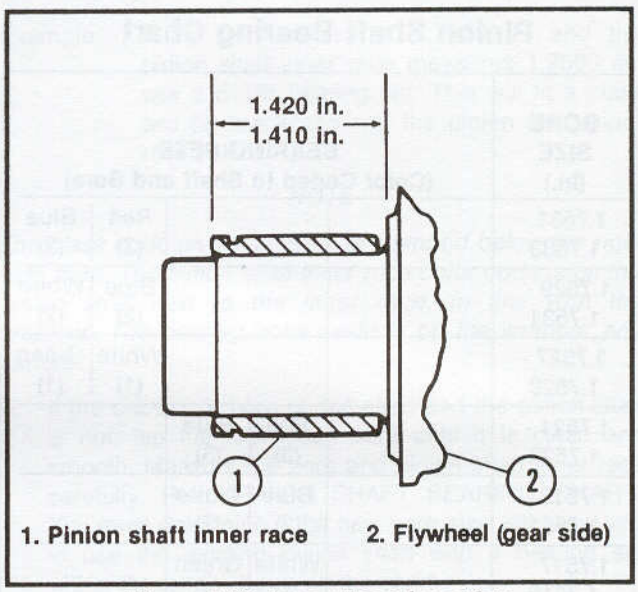
GRIND RACE

1. See **Pinion Shaft Bearing Chart** in **Lapping Engine Main Bearing Races.**
2. Find the BORE SIZE that was measured in the pinion outer race.
3. The new inner race must be ground by a competent machinist, to O.D. dimension range given in bottom row of PINION SHAFT BEARING CHART for the finished lapped I.D. of the outer race. The finished inner race must meet these specifications:

Roundness:	within 0.0002 in.
Taper:	within 0.0002 in.
Surface finish:	16 RMS

NOTE

Have machinist grind inner race to center or middle of required O.D. range. This will prevent grinding inner race undersize and gives a more easily achieved tolerance range. For example, if BORE SIZE is 1.7518 in., grind inner race to 1.2510.



1. Pinion shaft inner race **2. Flywheel (gear side)**

Figure 3-75. Inner Race Location

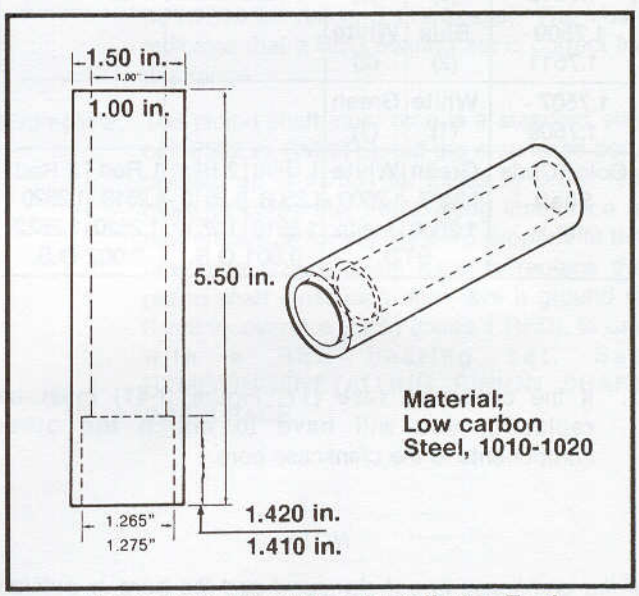


Figure 3-76. Inner Race Installation Tool

When flywheels have been properly repaired, install into crankcase. See FLYWHEEL AND CRANKCASE ASSEMBLY.

OIL TANK

REMOVAL

Special Tools	Torque Values (ft-lbs)
HD-97087-65A Hose clamp pliers	Rubber mount locknuts 15 - 19

1. Drain oil into a suitable container.
2. Remove seat. See Section 2, SEAT.
3. Disconnect electrical harness connector. See REAR FENDER, Section 2.

NOTE

If motorcycle is equipped with shotgun mufflers or accessories such as tool box or saddlebag guards, you may have to remove them.

4. See Figure 3-77. Remove hose clamps (1). Slide hoses (2) off oil tank nipples.
5. Remove locknuts (3) from rubber mounts (4).

NOTE

Do not remove rubber mounts (4) and brackets (5 and 6) unless necessary.

6. Carefully maneuver oil tank away from the rubber mounts and out of motorcycle frame.

INSTALLATION

1. See Figure 3-77. Carefully place oil tank in position on rubber mounts (4).
2. Install locknuts (3).

WARNING

Be sure you put the hoses on the correct nipples. If you mix up the hoses, you will mix up the engine oil flow, causing severe engine damage.

3. Place new hose clamps (1) over hoses (2) and slide hoses onto nipples. Be sure you put the hoses on the correct nipples.
4. Install hose clamps using hose clamp pliers, HD-97087-65A. Fill tank with 3 quarts Harley-Davidson oil.
5. Connect electrical harness connector. See REAR FENDER, Section 2.
6. Install exhaust system, accessories.
7. Install seat. See Section 2, SEAT.

1. **Hose clamps (3)**
2. **Hoses (3)**
3. **Locknuts (5)**
4. **Rubber mounts (5)**
5. **Front bracket**
6. **Rear bracket**
7. **Bolt**
8. **Lockwasher**
9. **Nut**
10. **Bolt (2)**

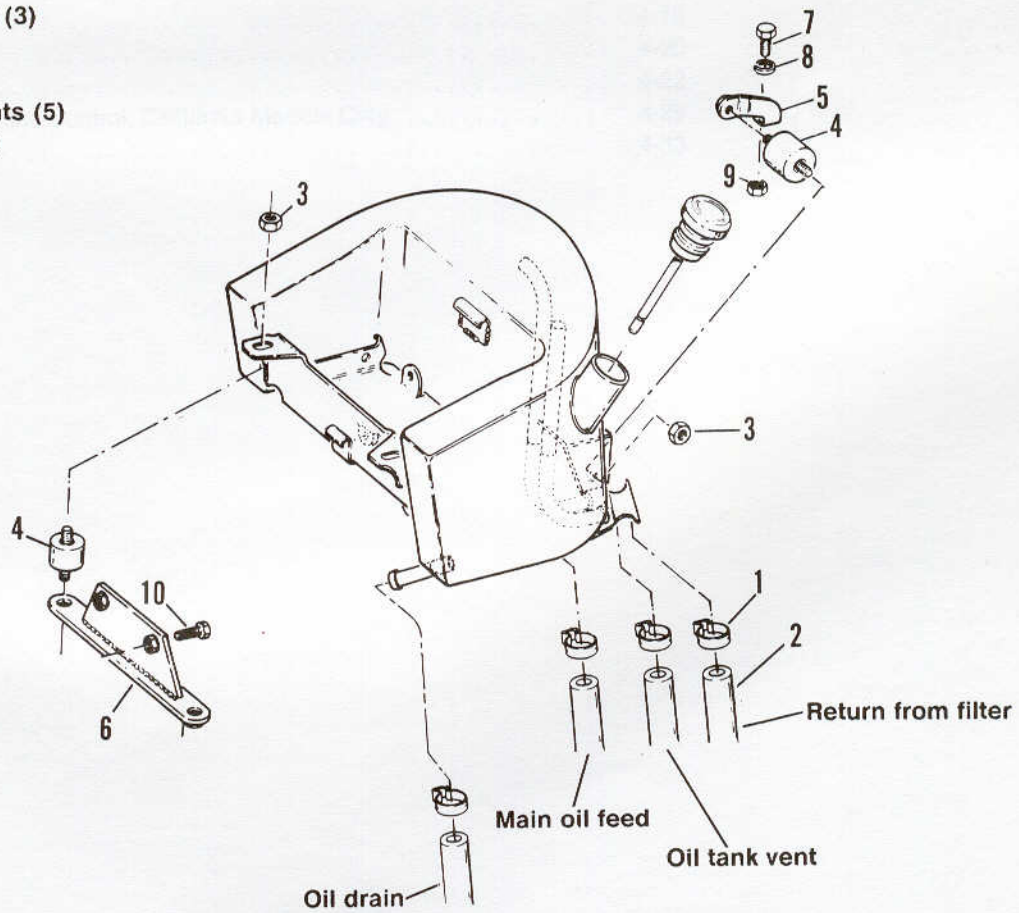


Figure 3-77. Softail Oil Tank

NOTES

FUEL SYSTEM

SPECIFICATIONS

CARBURETOR JET SIZES

49 state models - 1991	
Main jet	No. 185
Slow jet	No. 45
California Models - 1991	
Main jet	No. 165
Slow jet	No. 42
49 state models - 1992	
Main jet	No. 165
Slow jet	No. 40
California Models - 1992	
Main jet	No. 160
Slow jet	No. 40

CAPACITY

Fuel Tank

FXSTC	Total	5.2 Gallons (US)
	Reserve	1.2 Gallons (US)
FLSTC/F, FXSTS	Total	4.2 Gallons (US)
	Reserve	0.75 Gallons (US)

TORQUE VALUES

Carburetor mounting capscrew	15-17 ft-lbs
Head mounting bolt	10-12 ft-lbs
Captive carburetor bolt	3-5 ft-lbs
Air cleaner cover (button head socket screw)	3-5 ft-lbs

CARBURETOR

GENERAL (Figure 4-1)

The carburetor is a constant velocity, gravity fed type with a float operated inlet valve, a variable venturi, a throttle stop screw for idle speed adjustment and a fuel enrichment system for starting.

Idle and transfer ports provide a balanced fuel mixture during the transition period from stop to mid-range. A vacuum piston controls venturi opening.

The carburetor is specifically designed to control exhaust emissions. All jets are fixed. The idle mixture has been pre-set at the factory.

The idle mixture screw is recessed in the carburetor casting. The opening is sealed with a plug because it is intended that the idle mixture be non-adjustable.

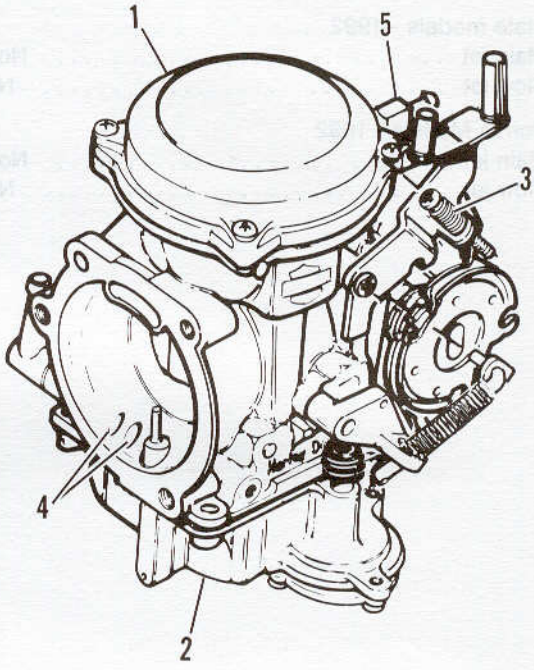
NOTE

Adjusting mixture setting by procedures other than specified in this section may be in violation of Federal or State regulations.

This system partially compensates for changes in the mixture that are normally caused by changes in altitude. Because atmospheric pressure decreases as altitude increases, the pressure difference in the upper and lower chambers is reduced, which provides less fuel to the engine.

The carburetor has a drain for emptying the float chamber during seasonal or extended storage periods. Loosen float bowl drain screw. Fuel will drain from bowl through overflow hose.

The carburetor is equipped with an accelerator pump. The accelerator pump system uses sudden throttle openings (rapid accelerations) to quickly inject fuel into carburetor venturi to provide extra fuel for smooth acceleration.



1. Vacuum piston chamber
2. Float chamber
3. Screw, idle speed
4. Air jets
5. Vacuum fitting

Figure 4-1. CVH Carburetor

TROUBLESHOOTING

OVERFLOW

Check for:	Remedy:
1A. 1991 - Damaged or non-venting fuel tank cap.	1A. Replace cap.
1B. 1992 - Damaged or non-venting (pinched) continuous venting system.	1B. Unclog system.
2. Loose float bowl screws.	2. Tighten screws.
3. Damaged float bowl O-ring.	3. Replace O-ring.
4. Damaged or leaking float assembly.	4. Replace float assembly.
5. Particle contamination in inlet fitting cavity.	5. Clean and clear cavity and fuel supply tract.
6. Worn or dirty inlet valve or seat.	6. Clean or replace valve and clean seat.
7. Improper fuel level in float bowl.	7. Adjust float tab for correct fuel level.
8. Misaligned float halves.	8. Align and adjust float level.

POOR IDLING

Check for:	Remedy:
1. Idle speed improperly adjusted.	1. Adjust idle speed.
2. Inlet system air leak	2. Correct as required.
3. Loose low speed jet	3. Tighten jet.
4. Plugged low speed jet	4. Clean contaminants and clear passages.
5. Contaminated or plugged low speed system.	5. Clean contaminants and clear passages.
6. Enrichener valve not seated or leaking.	6. Adjust, clean or replace.
7. Leaking accelerator pump.	7. Repair.

POOR FUEL ECONOMY

Check for:	Remedy:
1. Excessive enrichener use.	1. Instruct rider.
2. Enrichener valve not seated or leaking.	2. Adjust, clean or replace.
3. Dirty air cleaner element.	3. Clean or replace as required.
4. High speed riding style.	4. Modify riding habits.
5. Idle speed improperly adjusted.	5. Adjust operating idle speed.
6. Loose jets.	6. Tighten jets.
7. Fuel level too high.	7. Adjust float level.
8. Plugged or restricted bowl vent.	8. Clean and clear passages.
9. Worn or damaged needle or needle jet.	9. Replace needle or needle jet.
10. Vacuum piston assembly malfunction.	10. See Vacuum Piston Troubleshooting.
11. Plugged air jets or passages.	11. Clean and clear passages.
12. Excessive accelerator pump output.	12. Replace accelerator pump nozzle.

POOR ACCELERATION

Check for:	Remedy:
1. Throttle cables misaligned.	1. Adjust throttle cables.
2. Inlet system air leak.	2. Correct as required.
3A. 1991 - Damaged or non-venting fuel tank cap.	3A. Replace cap.
3B. 1992 - Damaged or non-venting (pinched) continuous venting system.	3B. Unclog system.
4. Restricted fuel supply passages.	4. Correct and clear restriction.
5. Plugged bowl vent or overflow.	5. Clean and clear passages.
6. Enrichener valve not seated or leaking.	6. Adjust, clean or replace.
7. Worn or damaged needle or needle jet.	7. Replace assembly.
8. Vacuum piston malfunction.	8. See Vacuum Piston Troubleshooting.
9. Plugged jets or passages.	9. Clean and clear as required.
10. Fuel level (float chamber) too low.	10. Adjust float level.
11. Accelerator pump leaking or no output.	11. Repair as necessary.

TROUBLESHOOTING (CONT)

HARD STARTING

Check for:	Remedy:
1. Enrichener system plugged, not properly. functioning or improperly operated.	1. Clean, adjust, replace or read Owner's Manual.
2. Inlet system air leak.	2. Correct as required.
3. Restricted fuel supply.	3. Correct fuel supply or passages.
4. Fuel overflow.	4. See Overflow Troubleshooting.
5. Plugged slow jet or passages.	5. Clean and clear jet or passages.

POOR PERFORMANCE ON ROAD

Check for:	Remedy:
1. Idle speed improperly adjusted.	1. Adjust idle speed.
2. Inlet system air leak.	2. Correct as required.
3A. 1991 - Damaged or non-venting fuel tank cap.	3A. Replace cap.
3B. 1992 - Damaged or non-venting (pinched) continuous venting system.	3B. 1992 - Unclog system.
4. Dirty or damaged air cleaner element.	4. Clean or replace.
5. Enrichener valve not seated or leaking.	5. Adjust, clean or replace.
6. Restricted fuel supply tract.	6. Correct and clear restriction.
7. Plugged bowl vent or overflow.	7. Clean and clear passages.
8. Loose or plugged fuel and air jets or passages.	8. Clean, clear and correct as required.
9. Worn or damaged needle or needle jet.	9. Replace assembly.
10. Vacuum piston assembly malfunction.	10. See Vacuum Piston Troubleshooting.
11. Accelerator pump inoperative.	11. Repair as required.

POOR HIGH SPEED PERFORMANCE

Check for:	Remedy:
1. Inlet system air leak.	1. Clean or replace.
2. Enrichener valve not seated or leaking.	2. Adjust, clean or replace.
3A. 1991 - Damaged or non-venting fuel tank cap.	3A. Replace cap.
3B. 1992 - Damaged or non-venting (pinched) continuous venting system.	3B. Unclog system.
4. Restricted fuel supply tract.	4. Correct and clean restriction.
5. Dirty or damaged air cleaner element.	5. Clean or replace.
6. Plugged bowl, vent or overflow.	6. Clean and clear passages.
7. Worn or damaged needle or needle jet.	7. Replace assembly.
8. Vacuum piston assembly malfunction.	8. See Vacuum Piston Troubleshooting.
9. Loose or plugged main jets or passages.	9. Tighten, clean, clear as required.
10. Improper fuel level.	10. Adjust float level.
11. Accelerator pump inoperative.	11. Repair as required.

VACUUM PISTON ASSEMBLY TROUBLESHOOTING

PISTON DOES NOT RAISE PROPERLY	
Check for:	**Remedy:**
1. Enrichener valve open, not seated or leaking.	1. Adjust, clean or replace.
2. Piston atmosphere vent blocked.	2. Clear vent.
3. Diaphragm cap loose, damaged or leaking.	3. Tighten or replace cap.
4. Spring binding.	4. Correct or replace spring.
5. Diaphragm pinched at lip groove.	5. Reposition diaphragm lip.
6. Torn diaphragm.	6. Replace piston diaphragm assembly.
7. Piston binding.	7. Clean piston slides and body or replace piston.
8. Piston vacuum passage plugged.	8. Clean and clear passage.
PISTON DOES NOT CLOSE PROPERLY	
Check for:	**Remedy:**
1. Spring damaged.	1. Replace spring.
2. Piston binding.	2. Clean piston slides and body or replace piston.
3. Piston diaphragm ring dirty or damaged.	3. Clean or replace piston.

OPERATION

Enrichener (Figure 4-2)

The enrichener knob, under the left side fuel tank, controls opening and closing the enrichener circuit in the carburetor. The enrichener knob can be adjusted to any position, from full-in to full-out.

COOL ENGINE

BE SURE THROTTLE IS CLOSED. Pull enrichener knob fully out. Turn the ignition switch on and press starter switch to operate the electric starter.

The vehicle should be allowed to warm up for 15-30 seconds before being driven. Initial warm-up periods longer than 30 seconds are not recommended.

CAUTION

You must pay close attention to a C. V. carburetor equipped vehicle's warm up time. Both excessive use and insufficient use of the enrichener may cause poor performance, erratic idle, poor fuel economy and spark plug fouling.

Outside Temperature Less than 50°F.

1. After initial 15-30 second warm-up, ride for 5 minutes or 3 miles with enrichener knob in full out position.
2. After 5 minutes or 3 miles, push the enrichener knob in to the $^1/_2$ way position. Ride 2 minutes or 2 miles.
3. After 2 minutes or 2 miles, push the enrichener knob fully in.

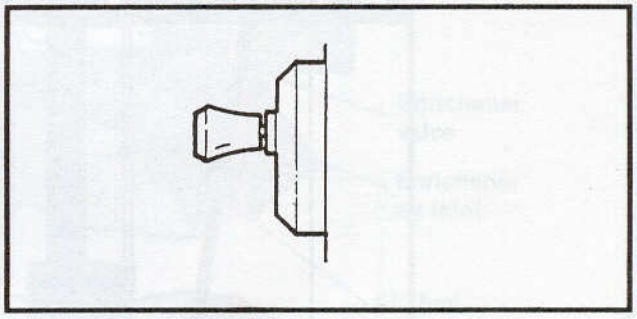


Figure 4-2. Enrichener Knob Fully In

Outside Temperature Greater than 50° F.

1. After initial 15-30 second warm-up, ride for 3 minutes or 2 miles with enrichener knob in full out position.
2. After 3 minutes or 2 miles, push the enrichener knob in to the $^1/_2$ way position. Ride 2 minutes or 2 miles.
3. After 2 minutes or 2 miles, push the enrichener knob fully in.

WARM OR HOT ENGINE

Open throttle 1/8-1/4. Turn on ignition switch and operate electric starter. See Figure 4-14. DO NOT USE ENRICHENER.

Fuel Supply System (Figure 4-3)

Fuel from the fuel tank passes through the inlet valve into the float chamber. The fuel entering the chamber causes the float to rise until it shuts off the fuel valve, stopping flow at a level pre-determined by float level setting.

The float chamber is vented to atmosphere through an air passage opening in the air cleaner mounting flange.

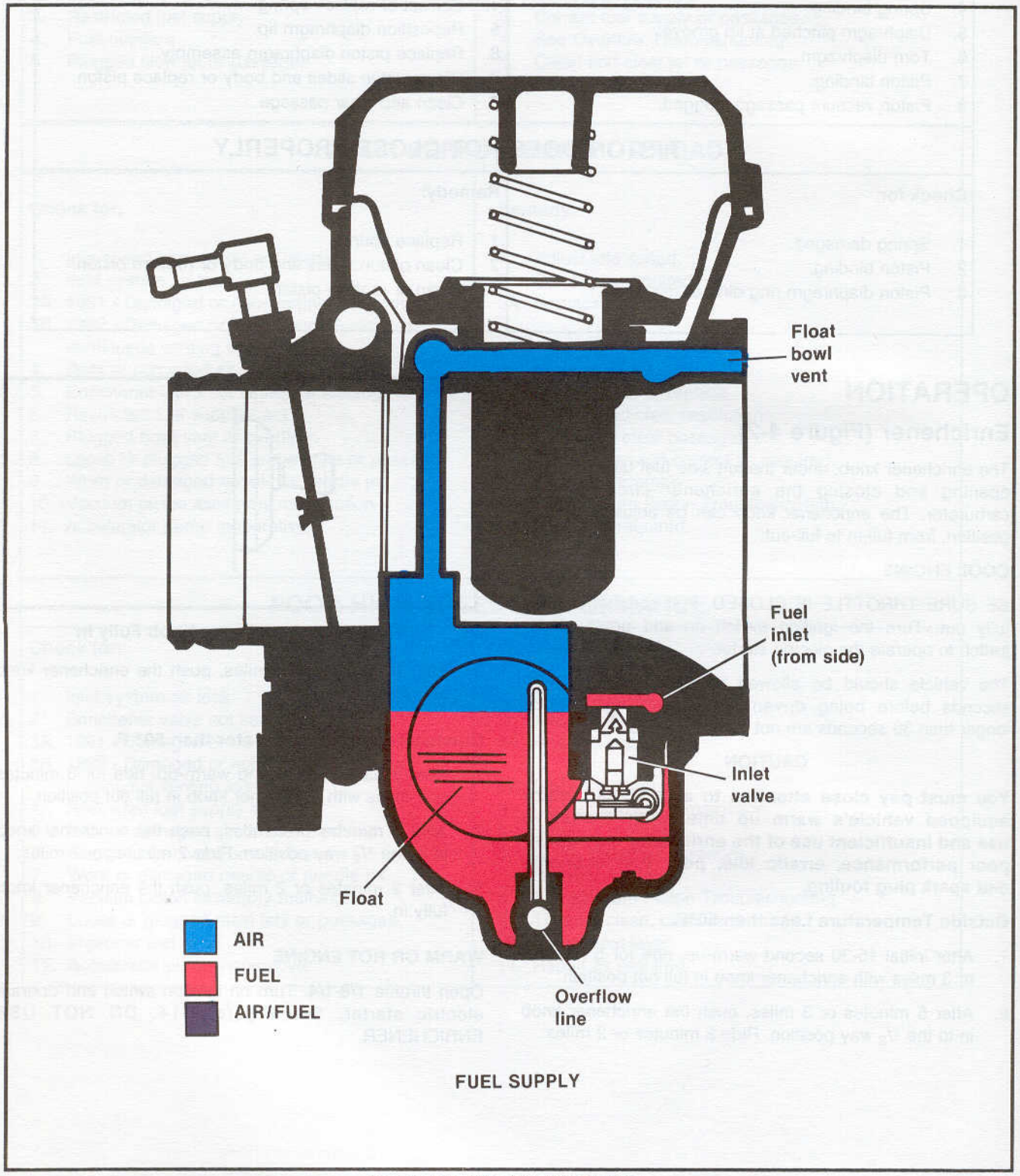


Figure 4-3. Fuel Supply System

Starter System (Enrichener) (Figure 4-4)

The starting circuit consists of a cable actuated starter valve and converging fuel and air passages in the carburetor body.

Fuel metered through the enrichener jet is directed upward through a passage to the valve chamber. The starter valve opens the fuel passage to the carburetor venturi (vacuum side) when the enrichener knob is pulled outward. Air from an opening in the carburetor inlet is directed to the valve chamber, where it mixes with incoming fuel.

Low pressure, (vacuum) created by the downward stroke of the engine pistons, causes the higher pressure in the float chamber to force the fuel/air mixture through the fuel/air outlet passage in the carburetor venturi.

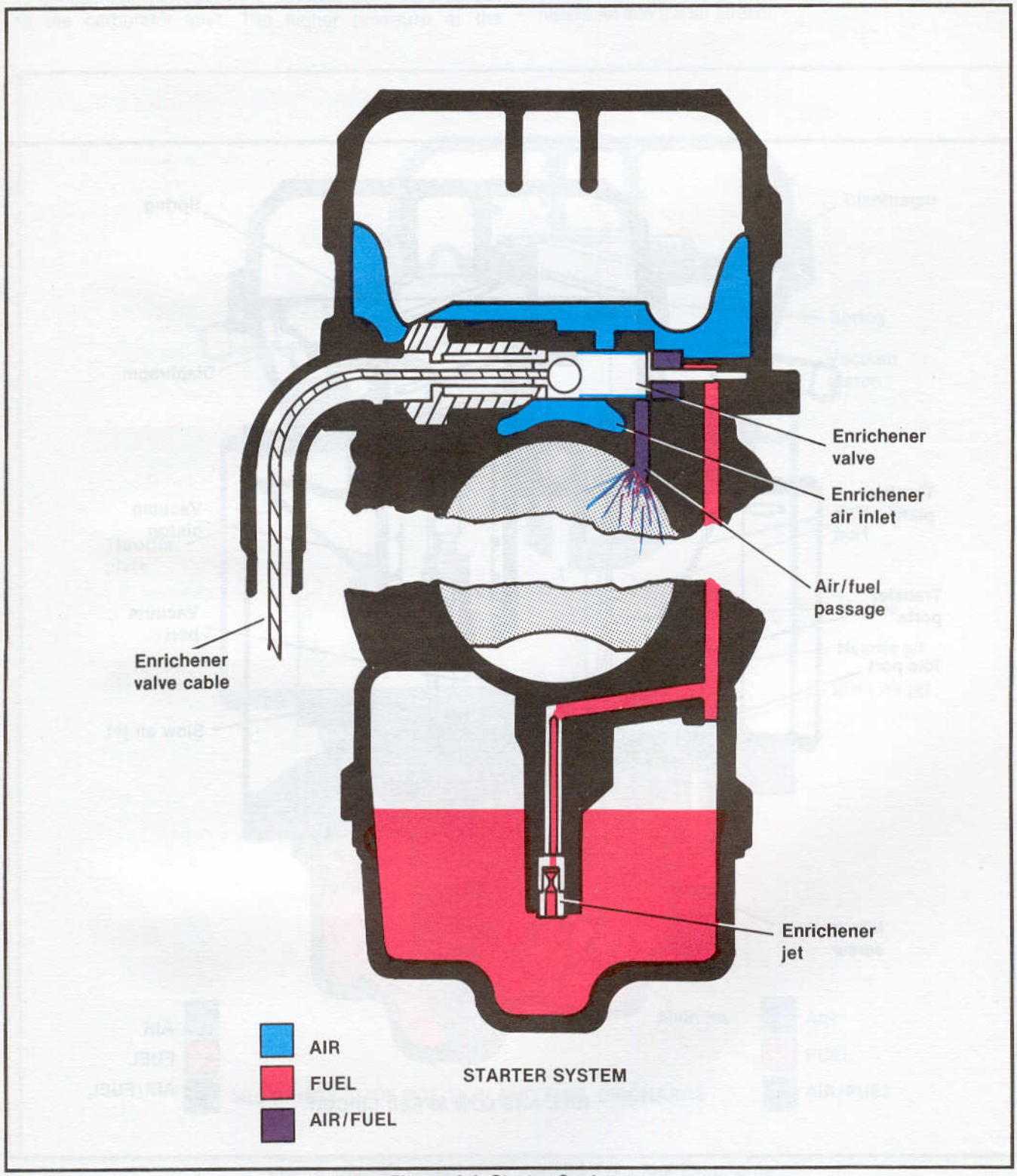


Figure 4-4. Starter System

Idle and Low Speed Circuit (Figure 4-5)

At idle, with the throttle plate closed and the air stream cut off, idle speed is maintained by fuel metered through the slow jet. Air from the slow air jet mixes with the fuel and is delivered to the idle port at the vacuum side of the throttle plate. At low speed as the throttle plate is cracked open the transfer ports are exposed to the vacuum side of the throttle plate and additional fuel is directed to the barrel of the carburetor. With the throttle plate cracked open, a quantity of fuel also enters the air stream from the needle jet. The idle and transfer ports supply additional fuel to the carburetor barrel to assist during the transition period from idle to mid range.

The venturi opening is reduced by the low position of the vacuum piston. This enables initial air stream velocities to be higher than normally attainable with fixed venturi carburetors. The higher air stream velocities provide greater quantities of fuel necessary for good acceleration.

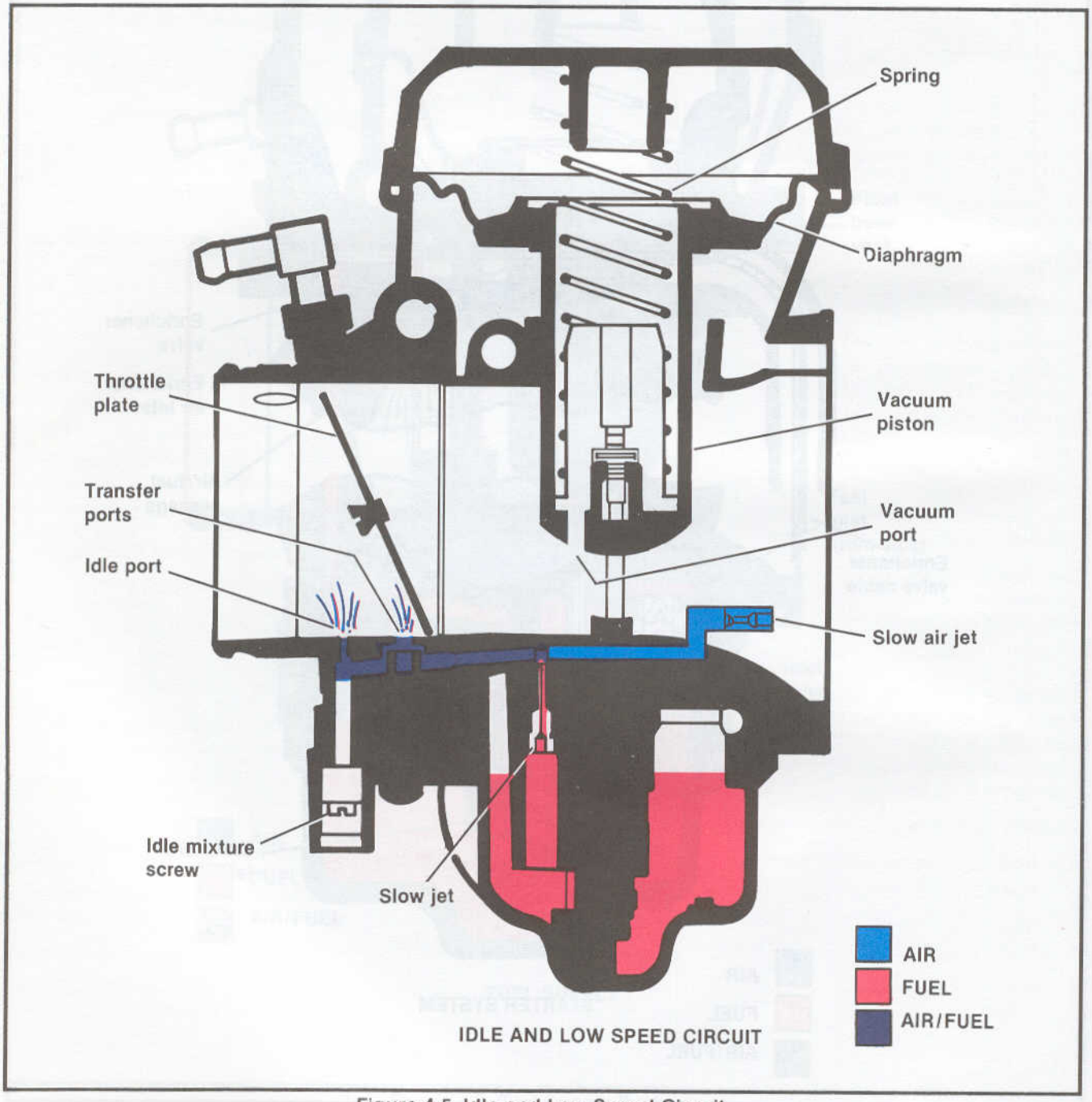


Figure 4-5. Idle and Low Speed Circuit

Mid Range Slide Position and Fuel Discharge (Figure 4-6)

As the throttle plate is opened, air flow increases through the carburetor and the pressure drop in the venturi near the needle jet increases.

The low pressure in the venturi travels through the vacuum port in the vacuum piston to the chamber above the diaphragm. The chamber beneath the diaphragm is vented to atmospheric pressure by a passage from the chamber to the carburetor inlet. The higher pressure at the underside of the diaphragm overcomes spring pressure and moves the vacuum piston upward in proportion to the pressure difference between chambers.

The tapered needle moves upward with the vacuum piston, opening the needle jet. The higher pressure in the float chamber forces fuel into the needle jet passage. Air at atmospheric pressure from the main air jet is forced through the main bleed tube openings and mixes with the fuel. The air/fuel mixture is then delivered through the needle jet into the air stream.

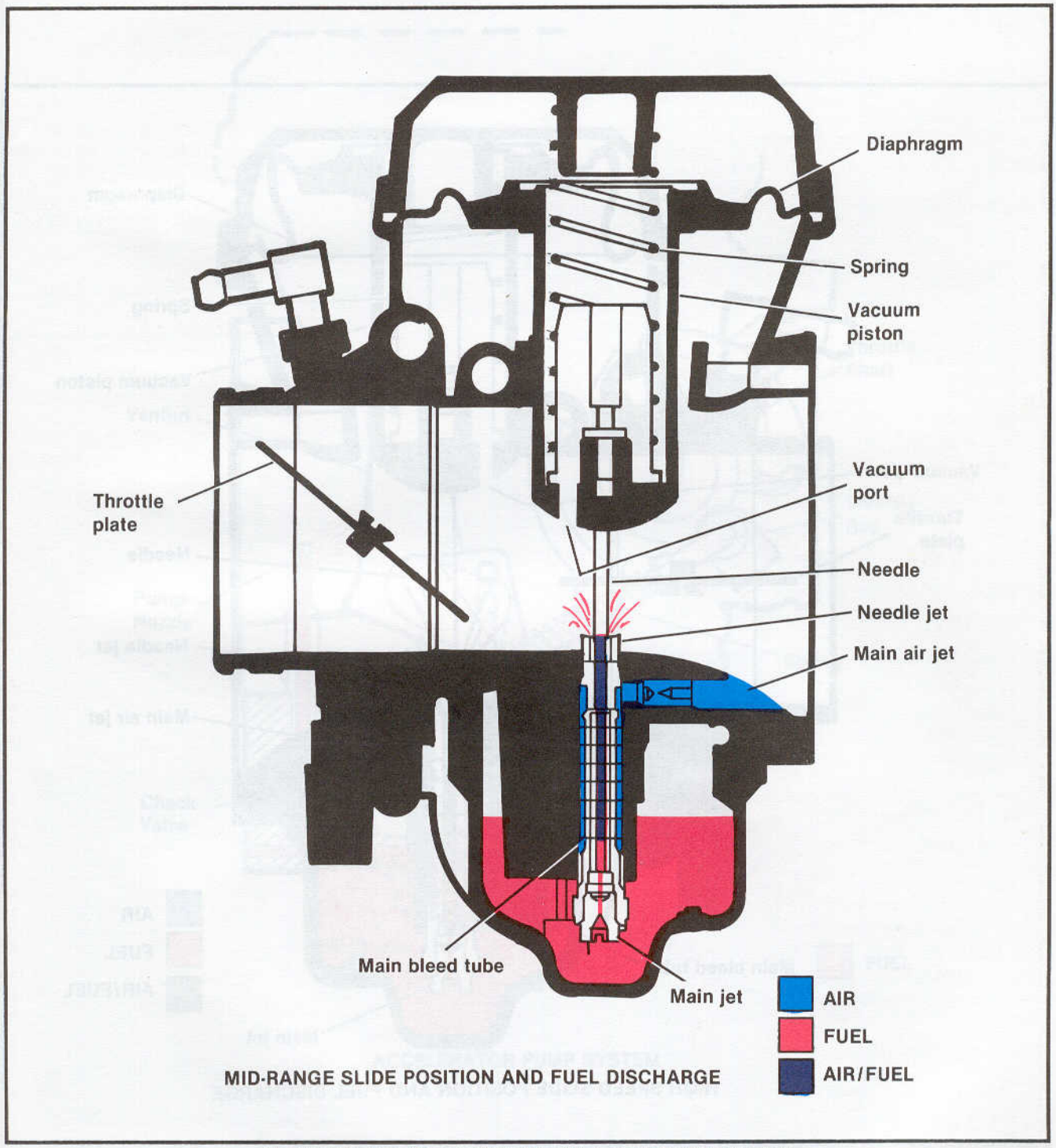


Figure 4-6. Mid Range Slide Position and Fuel Discharge

High Speed Circuit Slide Position and Fuel Discharge (Figure 4-7)

As the throttle plate is opened, the pressure difference between the chambers above and below the diaphragm increases and the vacuum piston moves further upward.

The venturi opening increases and the needle is lifted further out of the the needle jet. The quantity of fuel and the volume of air are simultaneously increased and metered to the proportions of engine demand by the variable venturi and needle lift. With the vacuum piston fully upward, the venturi opening is fully enlarged and the needle jet opening exposure to the air stream is at its maximum. Air and fuel supplies are now available in quantities sufficient to meet all engine demands.

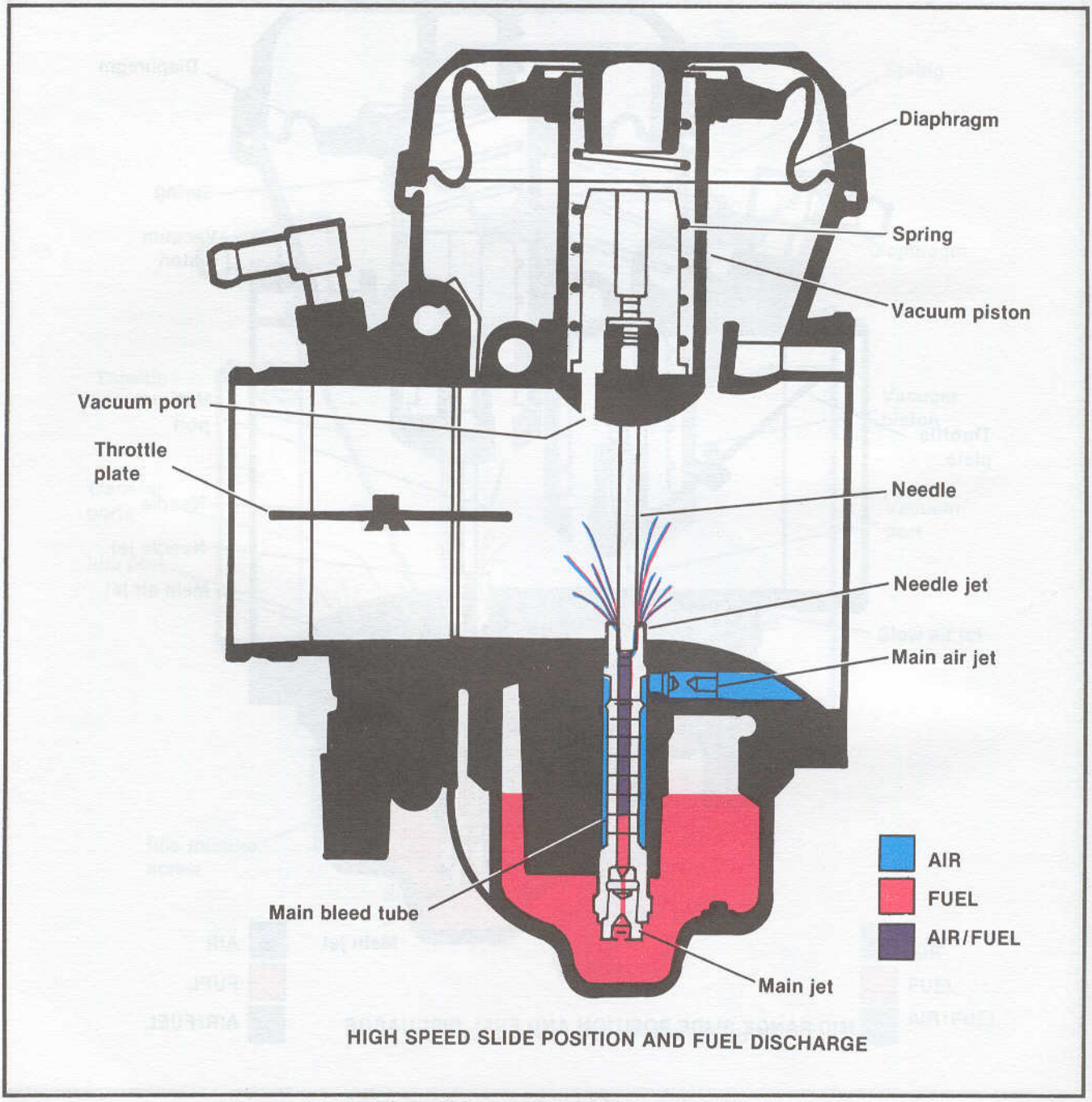


Figure 4-7. High Speed Circuit Slide Position and Fuel Discharge

Accelerator Pump System (Figure 4-8)

The accelerator pump system uses sudden throttle openings (rapid accelerations) to quickly inject fuel into carburetor venturi to provide extra fuel for smooth acceleration. This fuel also assists engine operation during cold engine warm-up when the enrichener is turned off prematurely.

Rapid throttle action during the first third of throttle travel, pushes the pump rod down, flexing a diaphragm. This flexing action forces fuel past a check valve into the venturi. The check valve prevents backflow during this stroke. A spring then returns diaphragm to its original position and a new supply of fuel flows in under the diaphragm from the float chamber for the next acceleration.

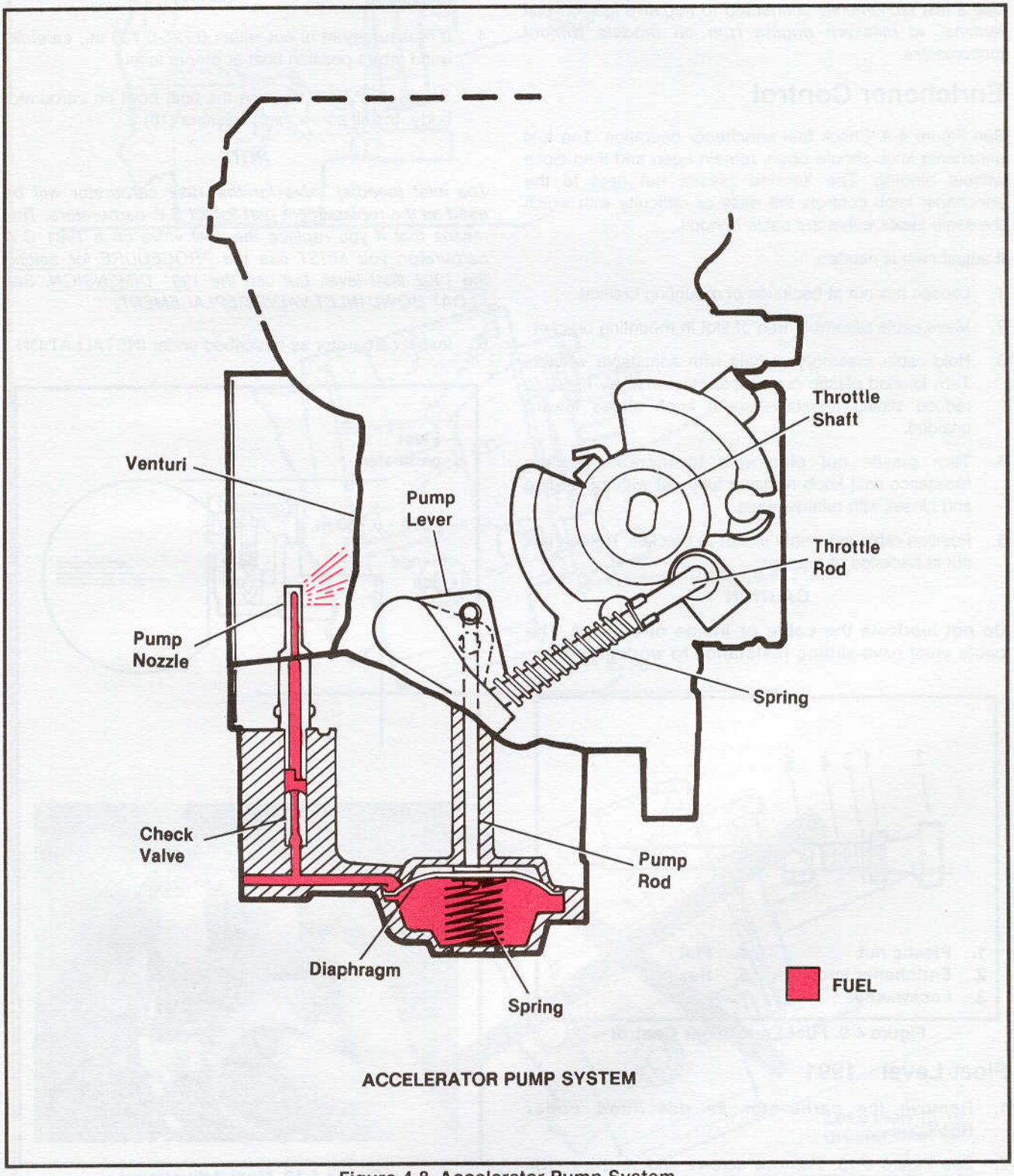


Figure 4-8. Accelerator Pump System

ADJUSTMENTS

Engine Idle Speed

With the engine at normal operating temperature and the enrichener all the way in (enrichener valve closed) adjust the throttle stop screw so the engine idles at 1000-1050 rpm.

NOTE

Use a test tachometer, connected to negative ignition coil terminal, to measure engine rpm on models without tachometers.

Enrichener Control

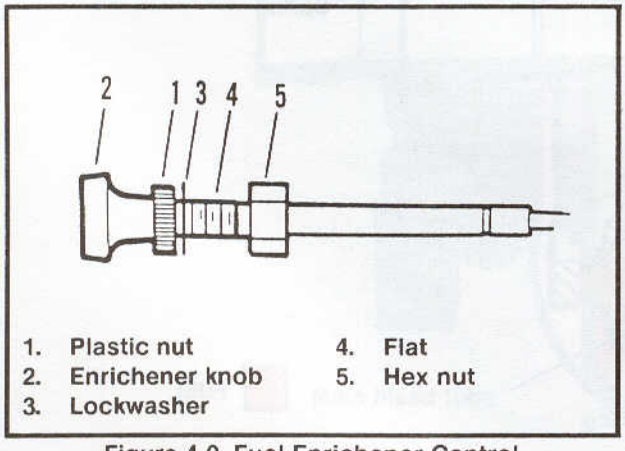
See Figure 4-9. Check fuel enrichener operation. The fuel enrichener knob should open, remain open and then close without binding. The knurled plastic nut next to the enrichener knob controls the ease or difficulty with which the cable slides within the cable conduit.

If adjustment is needed:

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

CAUTION

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



1. Plastic nut
2. Enrichener knob
3. Lockwasher
4. Flat
5. Hex nut

Figure 4-9. Fuel Enrichener Control

Float Level - 1991

1. Remove the carburetor as described under REMOVAL.
2. See Figure 4-13. Remove screws and washers (18). Remove float bowl.

NOTE

Before float adjustment check that float halves are properly aligned and at equal height. Carefully bend to realign, if necessary.

3. See Figure 4-10. Turn carburetor over, so float is up. 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.
4. If measurement is not within 0.725-0.730 in., carefully bend tab to position float at proper level.
5. See Figure 4-13. Position the float bowl on carburetor body. Install screws and washers (18).

NOTE

The inlet (needle) valve for the 1992 carburetor will be used as the replacement part for all C.V. carburetors. This means that if you replace the inlet valve on a 1991 C.V. carburetor, you MUST use the PROCEDURE for setting the 1992 float level, but use the 1991 DIMENSION. See FLOAT BOWL INLET VALVE REPLACEMENT.

6. Install carburetor as described under INSTALLATION.

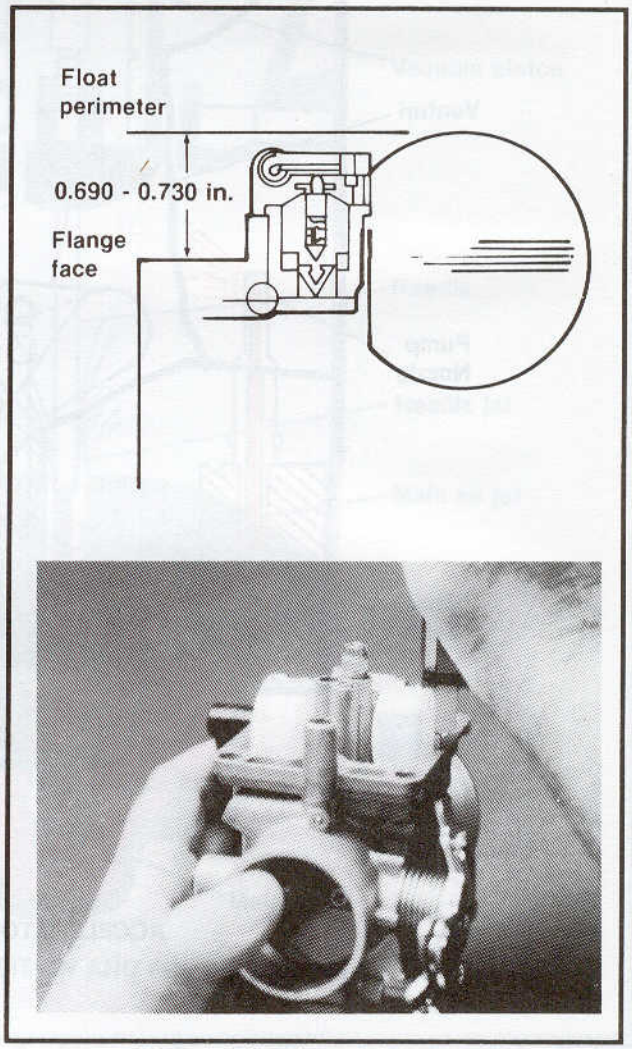


Figure 4-10. Float Adjustment

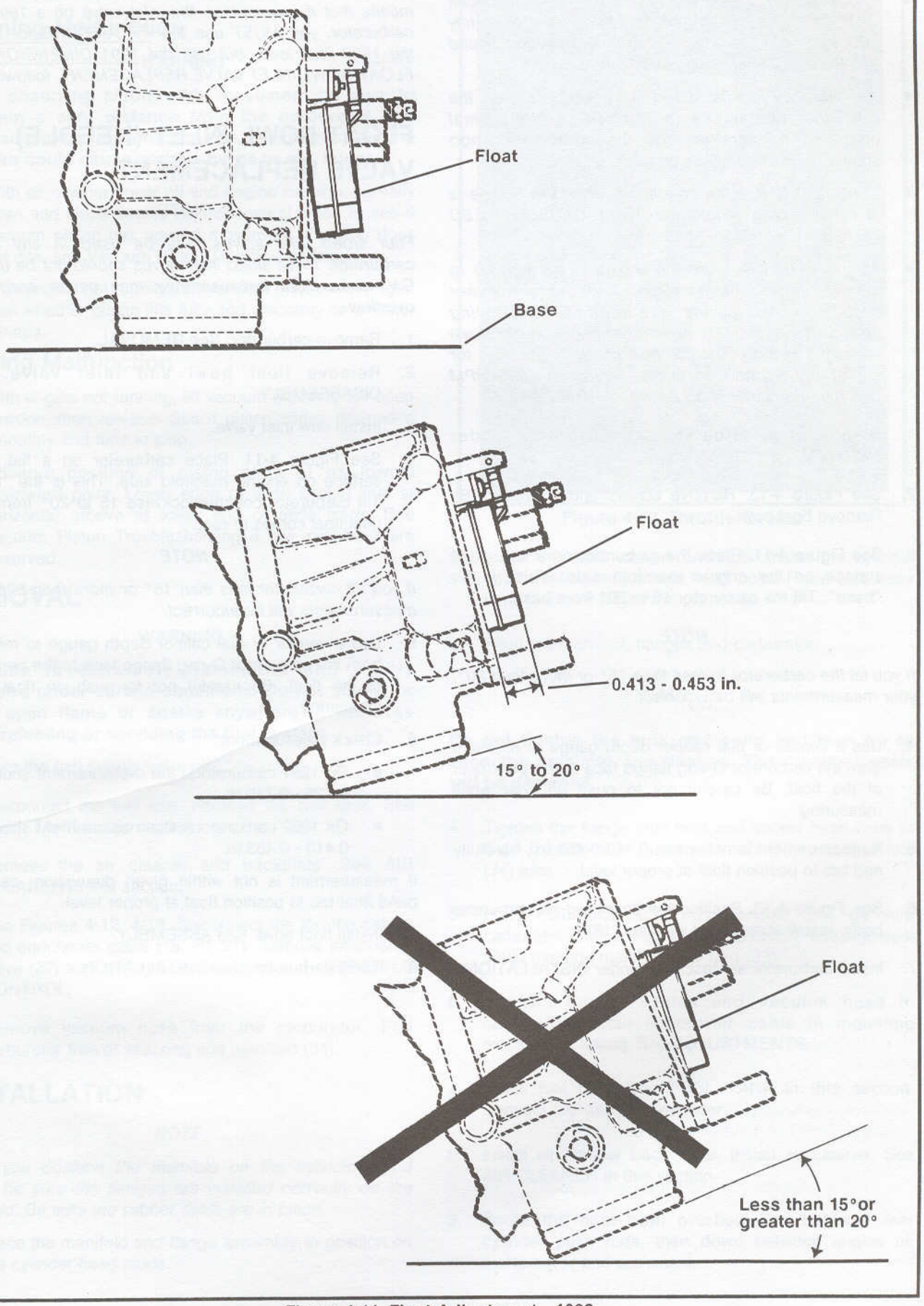


Figure 4-11. Float Adjustment - 1992

Float Level - 1992

NOTE

- *The 1992 C.V. carburetor has an enrichener circuit that will cause the engine to idle at approximately 2000 rpm with the engine at normal operating speed 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 at 2000 RPM with the enrichener knob pulled PARTIALLY OUT.*

1. Remove the carburetor as described under REMOVAL.
2. See Figure 4-13. Remove screws and washers (18). Remove float bowl.
3. See Figure 4-11. 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 measurments 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. If measurement is not within 0.413-0.453 in., carefully end tab to position float at proper level.
6. See Figure 4-13. Position the float bowl on carburetor body. Install screws and washers (18).
7. Install carburetor as described under INSTALLATION.

NOTE

The inlet (needle valve) for the 1992 carburetor will be used as the replacement part for all C.V. carburetors. This means that if you replace the inlet valve on a 1991 C.V. carburetor, you MUST use the PROCEDURE for setting the 1992 float level, but use the 1991 DIMENSION. See FLOAT BOWL INLET VALVE REPLACEMENT, following.

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.
2. Remove float bowl and inlet valve. See DISASSEMBLY.
3. Install new inlet valve.
4. See Figure 4-11. Place carburetor on a flat, clean surface on engine manifold side. This is the "base". Tilt carburetor counterclockwise 15 to 20° from base until float comes to rest.

NOTE

If you tilt carburetor less than 15° or more than 20°, your measurements will be incorrect.

5. 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.
6. Check measurement:
   - On 1991 carburetors, the measurement should be 0.725 - 0.730 in.
   - On 1992 carburetors, the measurement should be 0.413 - 0.453 in.

If measurement is not within given dimension, carefully bend float tab to position float at proper level.

7. Install float bowl. See ASSEMBLY.
8. Install carburetor. See INSTALLATION.

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 cause serious burns or eye 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 Vacuum Piston Troubleshooting.
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. Observe position of piston slide at its lowest downward point. Lower edge of slide should rest at horizontal groove at lower end of slide track. See Vacuum Piston Troubleshooting if any problems are observed.

REMOVAL

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.

1. Turn the fuel supply valve off.
2. Disconnect the fuel line. Remove the fuel tank. See FUEL TANK in this section.
3. Remove the air cleaner and backplate. See AIR CLEANER in this section.
4. See Figures 4-12, 4-13. Disconnect the throttle cables and enrichener cable (19, 20, 21). Remove enrichener valve (22) and spring (23). See Section 2, THROTTLE CONTROL.
5. Remove vacuum hose from the carburetor. Pull carburetor free of seal ring and manifold (34).

INSTALLATION

NOTE

When you position the manifold on the cylinder head studs, be sure the flanges are installed correctly on the manifold. Be sure the rubber seals are in place.

1. Place the manifold and flange assembly in position on the cylinder head studs.

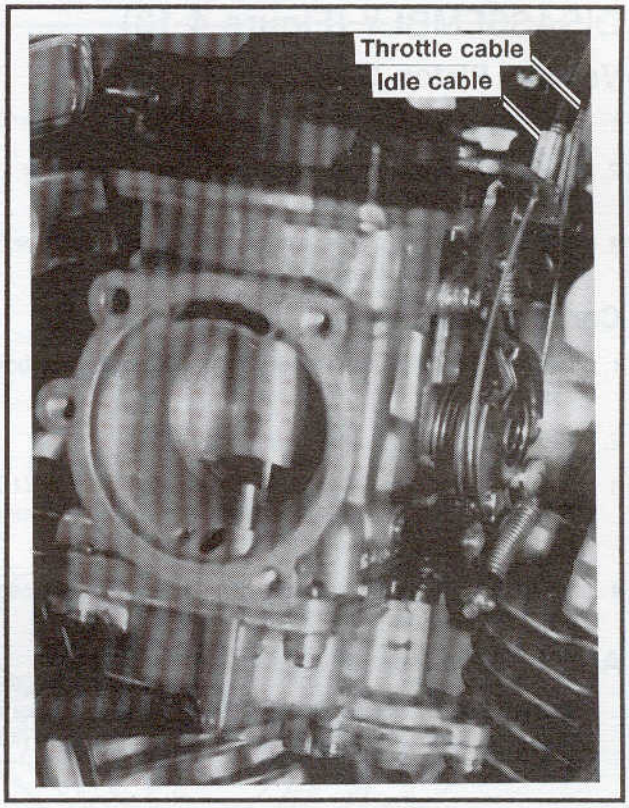


Figure 4-12. Throttle Cables

2. Install the stud washers and nuts. Install the cylinder head washers and socket head bolts. Place carburetor in position, for alignment purposes.
3. Align the manifold, flanges and carburetor.

CAUTION

Do not tighten the nuts and bolts and then try to align the manifold and flanges. The manifold seals will be damaged.

4. Tighten the flange stud nuts and socket head bolts to 6–10 ft-lbs torque. Place seal ring (33) onto manifold (34) inlet.
5. Place carburetor outlet into manifold (34). Be sure carburetor is in a true vertical position. Misalignment could damage manifold seal ring (33).
6. Connect throttle cables and vacuum hose to carburetor. Install enrichener cable in mounting bracket and adjust. See ADJUSTMENTS.
7. Install fuel tank. See FUEL TANK in this section. Connect fuel line to carburetor.
8. Install air cleaner back plate. Install air cleaner. See AIR CLEANER in this section.
9. Route the float bowl overflow line between rear cylinder push rods, then down between engine oil pump cover and crankcase.

DISASSEMBLY (Figure 4-13)

Vacuum Piston Chamber

1. Remove screws (26, 25) and bracket (24).
2. Remove screws and washers (2). Remove cover (1) and spring (3).
3. Lift out vacuum piston (4) with needle (6) and spring seat (5). Remove loose parts from vacuum piston.

Carburetor Body

1. Remove screws and washers (18). Remove float bowl assembly.
2. Remove pin (14), float (15) and valve (13).
3. Unscrew main jet (11) and needle jet holder (10). Needle jet (9) 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 (12).

Accelerator Pump

Remove screws (49), lockwashers (48), accelerator pump housing (42), spring (43) and diaphragm (44). Remove O-ring (45) from housing (42).

CLEANING, INSPECTION AND REPAIR (Figure 4-13)

Vacuum Piston Components

1. Hold vacuum piston up to strong light. Examine diaphragm at top of vacuum piston (4) for evidence of pinching, holes or tears. Replace if damaged.
2. Examine vacuum passage through bottom of piston (4). Clean passage if restricted.
3. Examine spring (3) for stretching, crimping or any distortion or damage. Replace if damaged.
4. Examine slide on sides of piston (4) to be sure surface is smooth and clean. Clean or buff out any rough surfaces.
5. Examine needle for evidence of bending or damage. Examine tip of float needle for grooves. Needle should be straight and surface of taper smooth and even. Examine float for holes.

Carburetor Body Components

1. Check float bowl O-rings (16 and 17) 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 inlet valve (13) and inlet valve seat. Clean with carburetor cleaner. Replace if seating surfaces are damaged.
3. Clean low speed jet (12) with carburetor cleaner. Check to be sure all orifices are open.
4. Check enrichener valve (22). Be sure needle guide is clean, straight and undamaged. Check seat surface and spring (23) 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 (9). 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 (10). Clean bleed tube orifices. Replace holder if damaged.
9. Check float (15) for cracks or other leaks. Replace if damaged.
10. Clean main jet with carburetor cleaner and inspect for damage. Replace if damaged.

Accelerator Pump

1. Inspect the accelerator pump diaphragm (44) for holes, cracks or deformation. Replace as necessary.
2. Replace the pump rod (51) if it is bent and replace the boot (50) if it is cracked.

ASSEMBLY (Figure 4-13)

Vacuum Piston Chamber

1. Place needle (6) through center hole in vacuum piston (4). Place spring seat (5) 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 (5) and carefully lower top (1). 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 and washers (2). Place bracket (24) in position with idle screw resting on top of throttle cam stop. Install body screw and washer (26) first, then top screw (25), to prevent bending bracket or throttle cam.

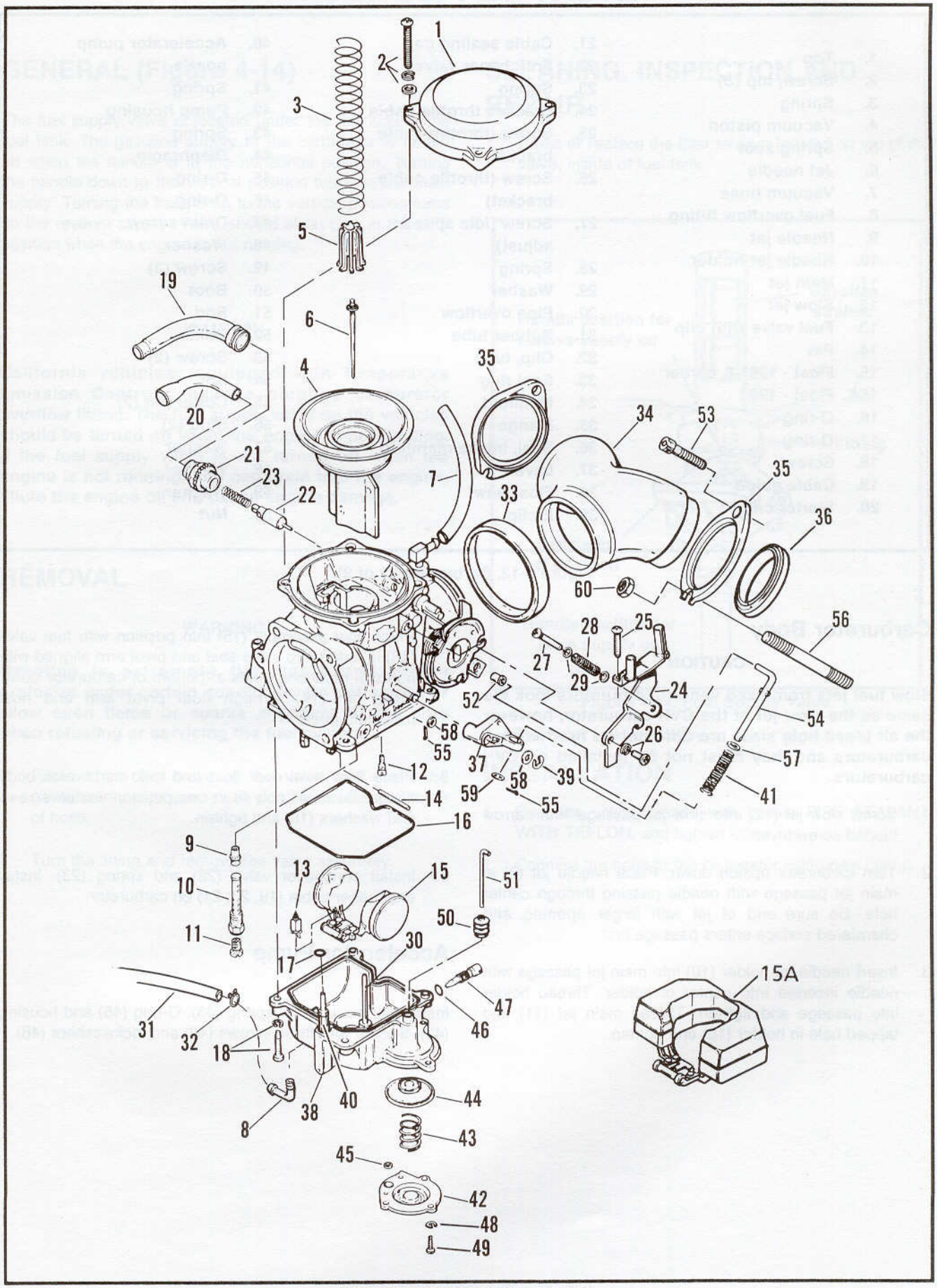


Figure 4-13. Carburetor (1 of 2)

1. Top
2. Screw, top (3)
3. Spring
4. Vacuum piston
5. Spring seat
6. Jet needle
7. Vacuum hose
8. Fuel overflow fitting
9. Needle jet
10. Needle jet holder
11. Main jet
12. Slow jet
13. Fuel valve with clip
14. Pin
15. Float - 1991 & earlier
15A. Float - 1992
16. O-ring
17. O-ring
18. Screw
19. Cable guide
20. Starter cap
21. Cable sealing cap
22. Enrichener valve
23. Spring
24. Bracket, throttle cable
25. Screw (throttle cable bracket)
26. Screw (throttle cable bracket)
27. Screw (idle speed adjust)
28. Spring
29. Washer
30. Pipe overflow
31. Rubber tube
32. Clip, tube
33. Seal ring
34. Manifold
35. Flange
36. Seal, intake manifold
37. Lever
38. Float bowl
39. E-clip
40. Accelerator pump nozzle
41. Spring
42. Pump housing
43. Spring
44. Diaphragm
45. O-ring
46. O-ring
47. Drain screw
48. Washer
49. Screw (3)
50. Boot
51. Rod
52. Collar
53. Screw (2)
54. Rod
55. Cotter pin (2)
56. Stud (2)
57. Washer
58. Washer
59. Washer
60. Nut

Figure 4-13. Carburetor (2 of 2)

Carburetor Body

CAUTION

Slow fuel jets from fixed venturi carburetors look the same as the slow jet of the CVH carburetor, however the air bleed hole sizes are different on fixed venturi carburetors and they must not be installed on CVH carburetors.

1. Screw slow jet (12) into slow jet passage with narrow bladed screwdriver.

2. Turn carburetor upside down. Place needle jet (9) 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 (10) into main jet passage with needle inserted into center of holder. Thread holder into passage and tighten. Thread main jet (11) into tapped hole in holder (10) and tighten.

4. Place float assembly (15) into position with fuel valve (13) inserted into valve seat and pivot arm aligned with holes in mounting posts at bottom of carburetor body. Insert pin (14) 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 and washers (18) and tighten.

6. Install enrichener valve (22) and spring (23). Install enrichener cable (19, 20, 21) on carburetor.

Accelerator Pump

Install diaphragm (44), spring (43), O-ring (45) and housing (42). Secure with three screws (49) and lockwashers (48).

FUEL SUPPLY VALVE

GENERAL (Figure 4-14)

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 down to the vertical position turns on the main supply. Turning the handle up to the vertical position turns on the reserve supply. Valve should always be in the OFF position when the engine is not running.

CAUTION

California vehicles, equipped with Evaporative Emission Controls, have a plugged carburetor overflow fitting. The fuel supply valve on the vehicles 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, fuel can drain into the engine, dilute the engine oil and cause engine damage.

REMOVAL

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.

1. Remove the fuel hose at the valve and drain the gasoline into a proper, clean container, using a length of hose.
2. Turn the fitting and remove the valve assembly.

CLEANING, INSPECTION AND REPAIR

1. Clean or replace the filter strainer located on top of the valve, inside of fuel tank.

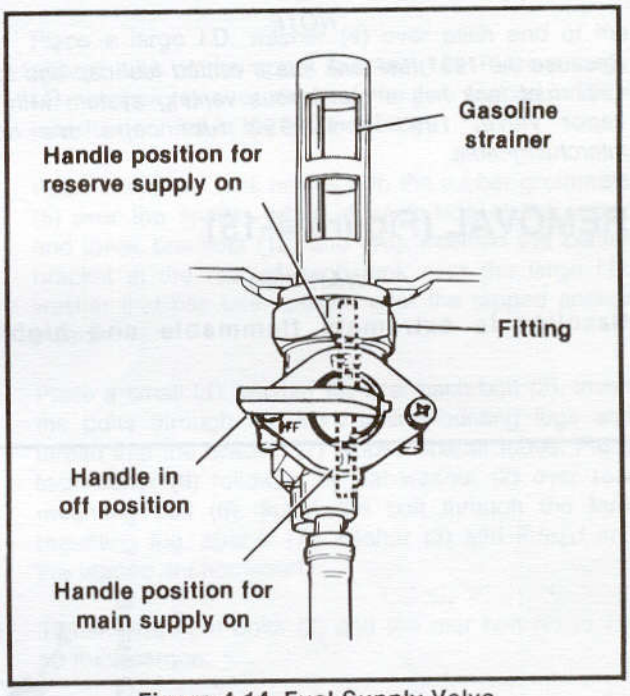


Figure 4-14. Fuel Supply Valve

2. Flush the tank to remove all dirt.

INSTALLATION

1. Coat the valve threads with Loctite PIPE SEALANT WITH TEFLON, and tighten fitting.
2. Connect the hose to the carburetor using new clamp.

FUEL TANK

GENERAL

The fuel tank is treated to resist rusting. However, when the motorcycle is not operated for a long period of time, tanks should be drained and treated with an oil/fuel mixture of equal proportion. This will protect the inside of the tank during storage.

NOTE

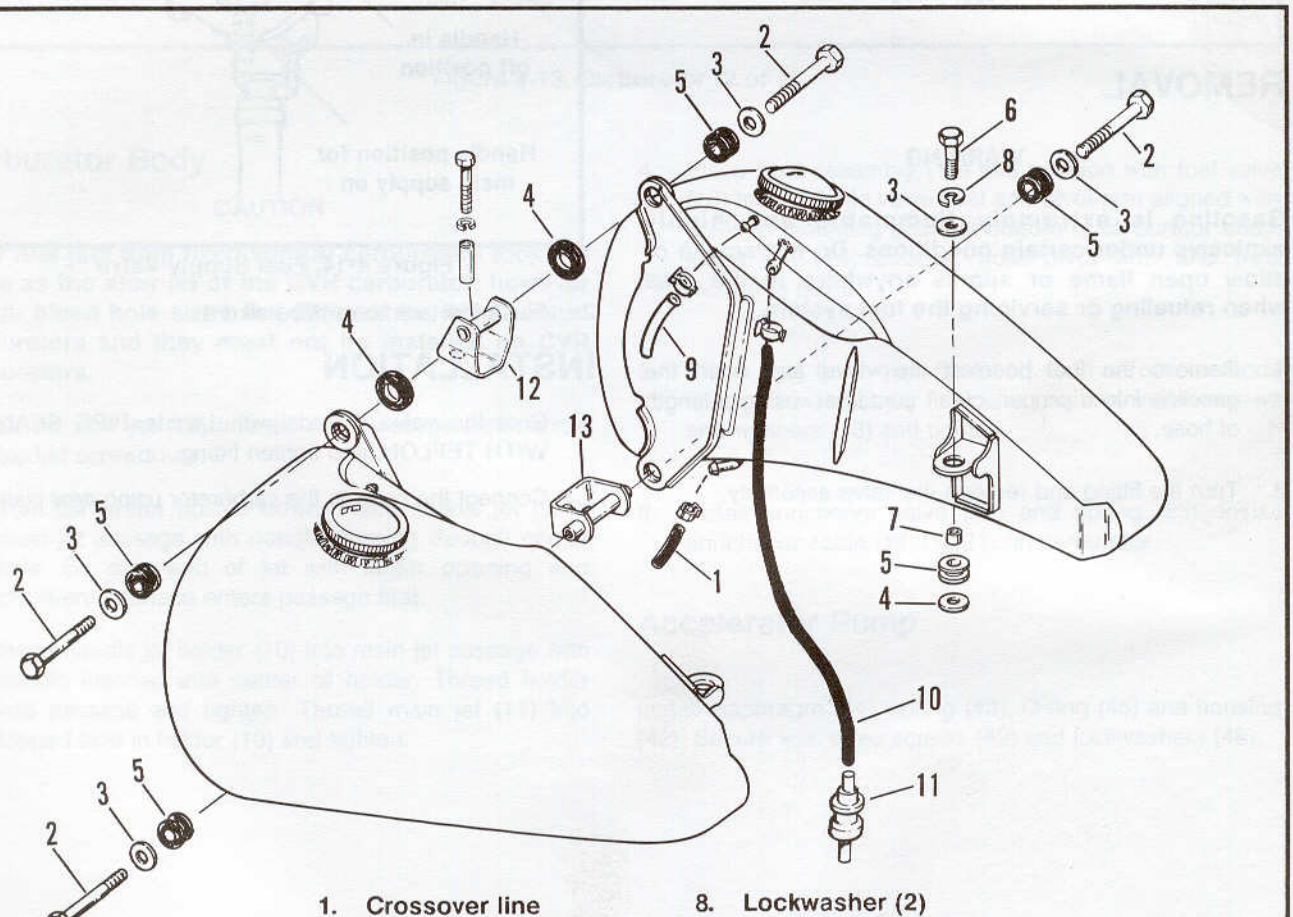
Because the 1991 fuel tank has a vented fuel cap and the 1992 fuel tank has a continuous venting system with a vapor valve, 1991 and 1992 fuel caps are not interchangeable.

REMOVAL (Figure 4-15)

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.

1. Remove instrument panel cover and center trim panel. See INSTRUMENTS in Section 2.
2. Check to be sure fuel supply valve is in "OFF" position. Remove fuel line from the fuel supply valve.
3. Connect a suitable long hose to the fuel supply valve, turn valve to open position and drain fuel into adequately sized approved gasoline container.
4. Disconnect crossover line (1).
5. Remove the upper and lower front mounting bolts (2) and washers (3 and 4). Remove grommets (5) if necessary.



1. Crossover line
2. Front mounting bolts (4)
3. Washers, 0.328 in. (6)
4. Washers, 0.531 in. (4)
5. Grommets (6)
6. Rear mounting bolts (2)
7. Spacer (2)
8. Lockwasher (2)
9. Upper vent line
10. Continuous venting system vent line
11. Vapor valve
12. Bracket, upper
13. Bracket, lower

Figure 4-15. Fuel Tank

6. Remove the two rear mounting bolts (6), spacer (7), lockwasher (8), flat washers (3 and 4).

7. Disconnect upper vent line (9) and remove tank halves from motorcycle. On 1992 models, disconnect continuous venting system vent line (10) and vapor valve (11).

CLEANING, INSPECTION AND REPAIR

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 cause personal 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.

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.

WARNING

If all traces of fuel are not purged, an open flame repair may result in a tank explosion. Extreme caution should be taken when repairing tanks.

INSTALLATION (Figure 4-15)

Special Tools	Torque Values (ft-lbs)
None	Fuel tank bolts 15 - 19

1. On 1992 models, install continuous venting system vent line (10) and vapor valve (11).

2. Place a large I.D. washer (4) over each end of the spacer tube at the upper bracket (12). Place a large I.D. washer (4) over each of the two tapped anchor inserts mounted in the frame tube.

3. Position the fuel tank halves with the rubber grommets (5) over the spacer tubes at each side of the upper and lower brackets (12) and (13). Position the center bracket at the rear of each tank over the large I.D. washer that has been placed over the tapped anchor insert.

4. Place a small I.D. washer (3) over each bolt (2), insert the bolts through the front tank mounting lugs and thread into the bracket (7) tapped spacer tubes. Place lockwasher (8) followed by flat washer (2) over rear mounting bolt (6). Insert the bolt through the tank mounting lug, spacer (7), washer (3) and thread into the tapped anchor insert.

5. Tighten the front bolts (2) and the rear bolt (6) to 15-19 ft-lbs torque.

6. Connect the upper vent line (9) and the lower crossover line (1). Route line (1) over the lower bracket (13).

7. Remove the drain hose and reconnect the fuel feed line. Use new hose clamp.

8. Inspect fuel line for cuts, cracks or holes and replace if necessary.

9. Install instrument panel cover and center trim panel. See INSTRUMENTS in Section 2.

10. Check for leaks.

AIR CLEANER - General

REMOVAL (Figure 4-16)

1. Remove screw (1) and washer (2).
2. Remove cover (3) and element (4).

NOTE

If filter is being removed for cleaning, proceed to Step 1, CLEANING, INSPECTION AND REPAIR.

3. Pry out plugs (5) and remove screws (6) and washers (7).
4. Disconnect crankcase breather tube (8) at backplate (9).
5. Back out screws (10), in sequence, a couple of turns at a time while pulling the backplate away from the carburetor.

CAUTION

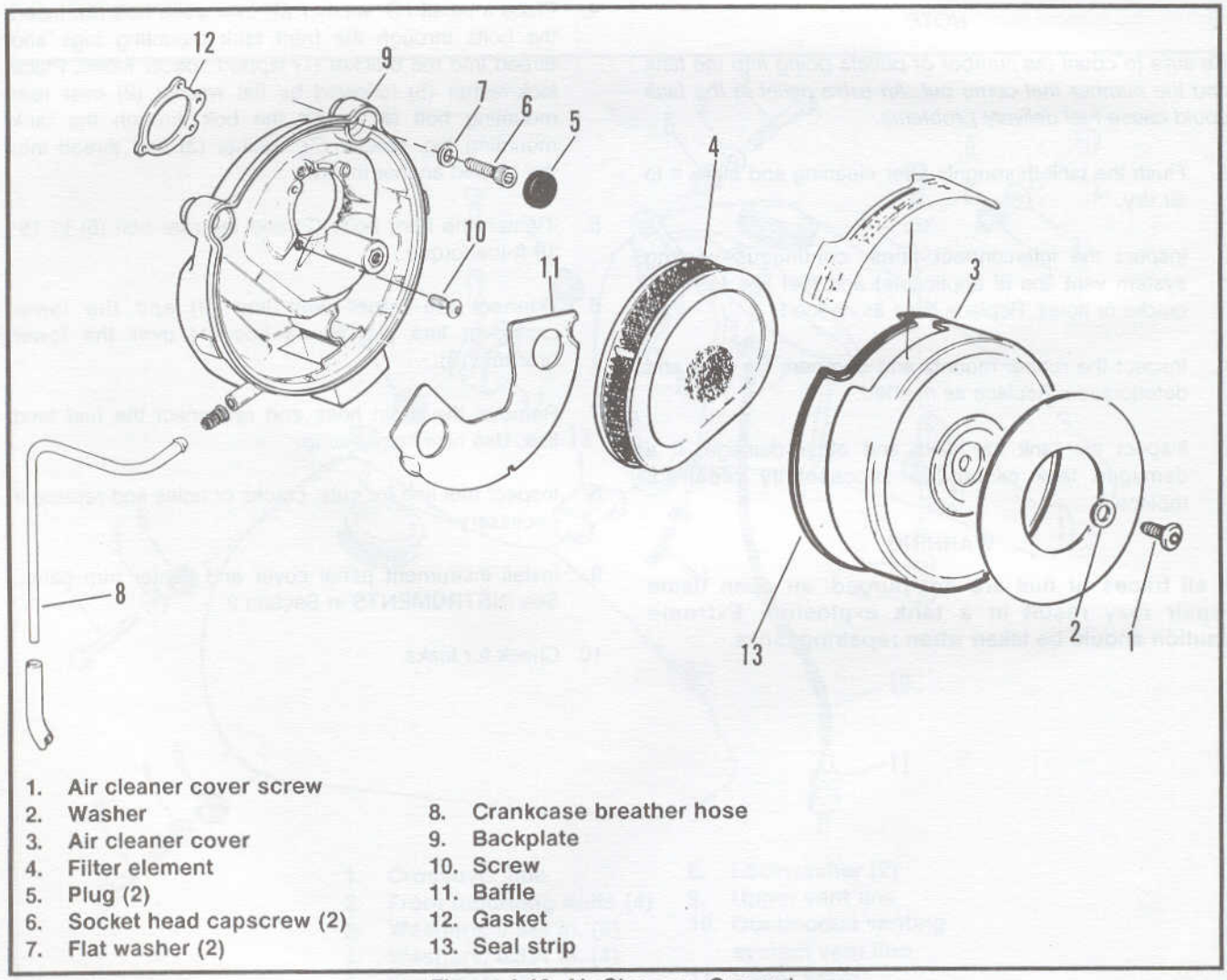
Do not let the captive bolt thread catch the backplate threads when removing the backplate or backplate will become damaged.

Continue this procedure until screws are clear, then remove backplate (9), baffle (11) (if necessary) and gasket (12).

CLEANING, INSPECTION AND REPAIR

WARNING

Low pressure air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air.



1. Air cleaner cover screw
2. Washer
3. Air cleaner cover
4. Filter element
5. Plug (2)
6. Socket head capscrew (2)
7. Flat washer (2)
8. Crankcase breather hose
9. Backplate
10. Screw
11. Baffle
12. Gasket
13. Seal strip

Figure 4-16. Air Cleaner - General

Wash the paper/wire mesh air filter element in luke warm water with a mild detergent. Allow filter to either air dry or blow it dry, from the inside, with low pressure air. Do not use an air cleaner filter oil on the Harley-Davidson paper/wire mesh air filter element.

INSTALLATION (Figure 4-16)

Special Tools	Torque Values (ft-lbs)
None	Backplate screws 3 - 5 Cylinder head screws 10 - 12 Air cleaner cover screw 3 - 5

1. Check each screw (10) to be sure they are not threaded into backplate threaded insert. Place baffle (11) (if removed) in backplate (9).
2. Position backplate (9) and gasket (12) on carburetor. Install the crankcase breather tube (8). Start each captive screw (10) into threaded holes in carburetor flange.
3. By hand, turn each captive bolt a couple of turns in sequence, until the backplate is drawn to a loose fit next to the carburetor flange.
4. Apply Loctite antiseize® to threads and insert one screw (6) with washer (7) into each upper backplate mounting hole and thread loosely into the threaded hole in each cylinder head.
5. Tighten screws (10) to 3-5 ft-lbs torque.
6. Tighten screws (6) to 10-12 ft-lbs torque.
7. Install plug(s) (5) over screws (6) at two upper mounting holes.
8. Place filter element (4) in position. Place cover (3) and seal strip (13) over filter and install screw (1) and washer (2). Tighten air cleaner cover screw to 3-5 ft-lbs. torque.

AIR CLEANER BACKPLATE ASSEMBLY - 1992 CALIFORNIA MODELS

The Removal/Installation procedure for the 1992 California models air cleaner assembly is the same as AIR CLEANER-GENERAL, except for the following differences:

1. See Figure 4-17. After performing steps 1 thru 5 under REMOVAL, disconnect the solenoid wiring harness connector (1). Remove overflow hose from hose fitting (2).
2. Remove screws (3) and washers (4) securing the baffle (5) and solenoid bracket (6) to the backplate (7). Remove solenoid plunger screw (8). Remove solenoid (9).
3. If necessary, the rivets (10) securing the butterfly valve assembly (11) to the backplate and the screws (12) securing the butterfly valve (13) to the shaft (14) can be replaced.

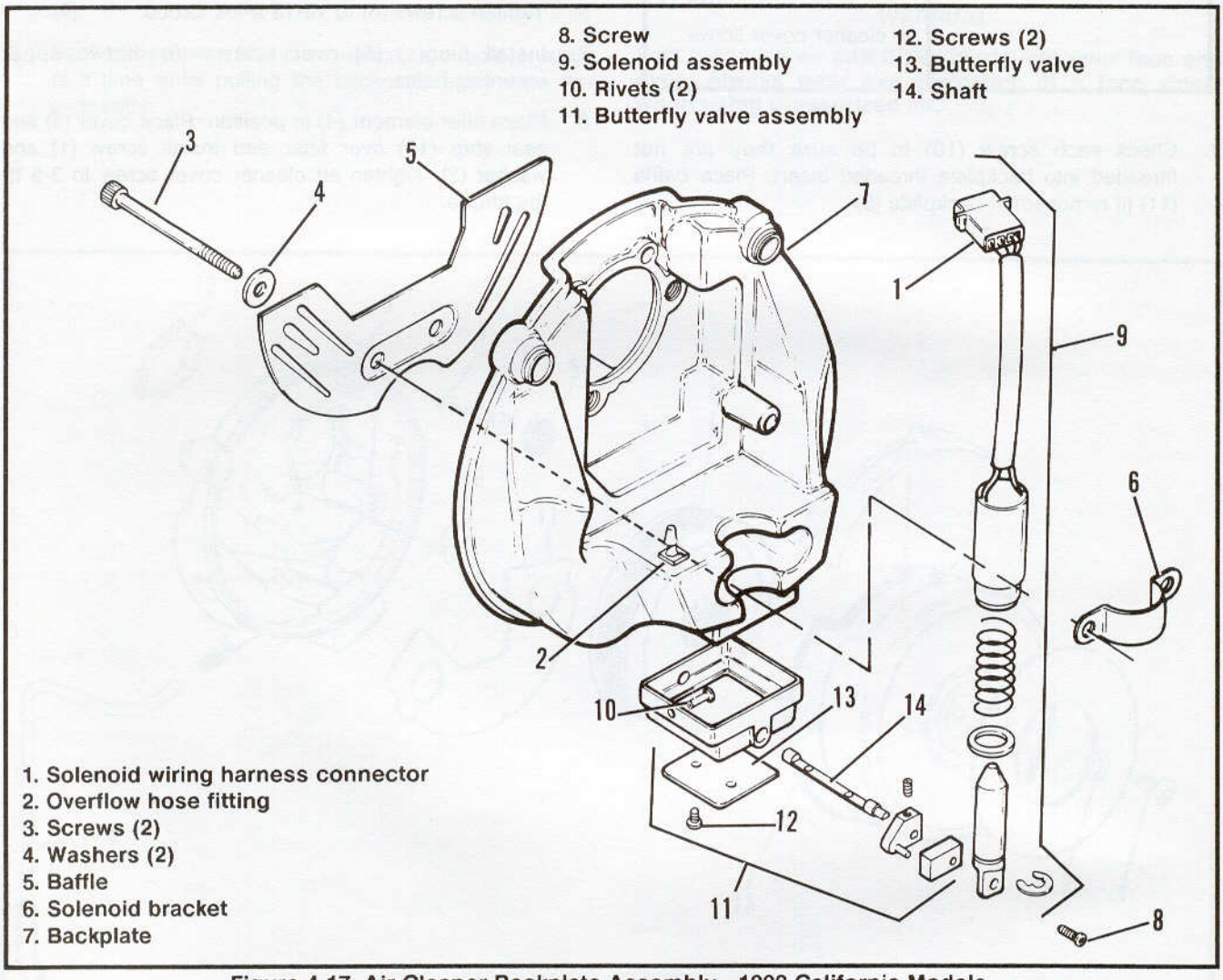


Figure 4-17. Air Cleaner Backplate Assembly - 1992 California Models

EVAPORATIVE EMISSIONS CONTROL CALIFORNIA MODELS ONLY

GENERAL

The CALIFORNIA EVAPORATIVE EMISSIONS CONTROL system is for the following model motorcycles sold in the state of California:

- FLSTC/F models
- FXSTC
- FXSTS

It is the responsibility of Harley-Davidson, Inc. to supply each vehicle sold in the state of California with a complete and approved evaporative emissions control system.

It is the responsibility of Harley-Davidson dealers, whose dealerships are in the state of California, to ensure that the evaporative emissions system on each vehicle, is installed correctly. Therefore, it is of the utmost importance that all specified parts in the system are properly installed for it to be operative.

See Figure 4-18. The purpose of the evaporative emissions system is to prevent fuel hydrocarbon vapors from escaping into the atmosphere. When the engine is not running, excess hydrocarbon vapors are directed through the vapor valve and stored in the charcoal canister. At engine start-up, a vacuum line from the carburetor will purge or draw off the vapors in the canister and direct them to the engine combustion chambers. The vapor valve prevents gasoline from escaping through the vapor vent when the vehicle is tipped at an abnormal angle. A large diameter hose purges the canister with fresh air from the air cleaner through the air cleaner backplate. The reed valves prevent vapors escaping into the atmosphere when the engine is not running. The Vacuum Operated Valve (VOV) seals the carburetor float bowl vent for the same purpose.

AIR CLEANER BACKPLATE ASSEMBLY - 1992 CALIFORNIA MODELS

See AIR CLEANER. The solenoid operated butterfly valve seals the air cleaner backplate when the ignition switch is in the OFF or LOCK position. With the ignition switch in the IGN or "LTS" position, 12 VDC is applied to the solenoid hold-in winding. The solenoid opens the butterfly valve when the pull-in coil is energized from the engine start switch. The hold-in winding keeps the butterfly valve open until the ignition switch is turned to the OFF position.

See Section 8 for solenoid troubleshooting.

The system is virtually maintenance free. All that should be required is periodic inspection to be sure hoses are properly routed and not kinked, cracked or blocked and that all fittings are secure. Mounting hardware should also be checked for tightness.

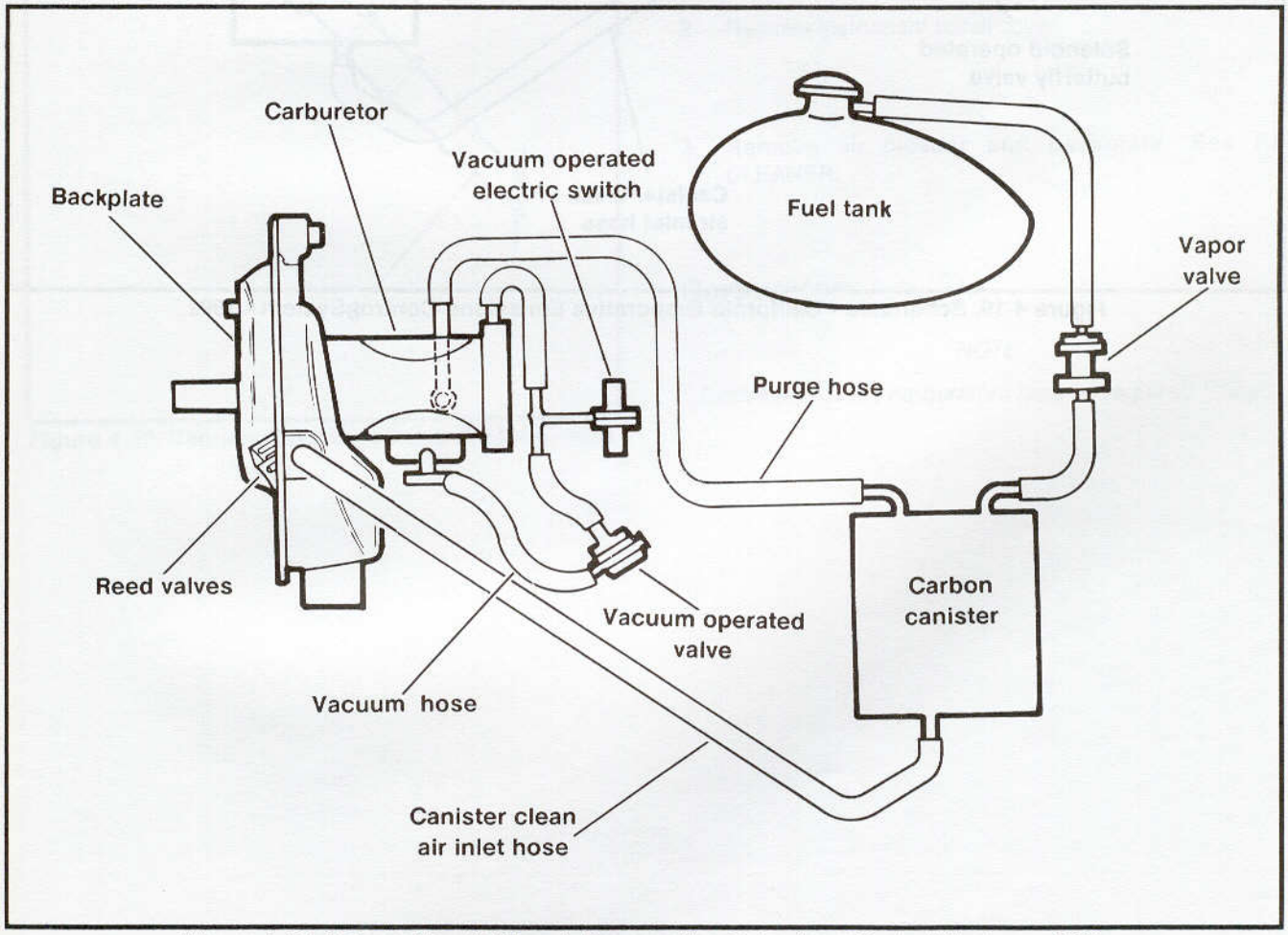


Figure 4-18. Schematic - California Evaporative Emissions Control System - 1991

EVAPORATIVE EMISSIONS CONTROL SYSTEM - 1992 CALIFORNIA MODELS (Figure 4-19)

See GENERAL. The 1992 California evaporative emissions control system is the same as the 1991 system except the solenoid operated butterfly valve on the carburetor backplate replaces the vacuum operated valve and reed valves.

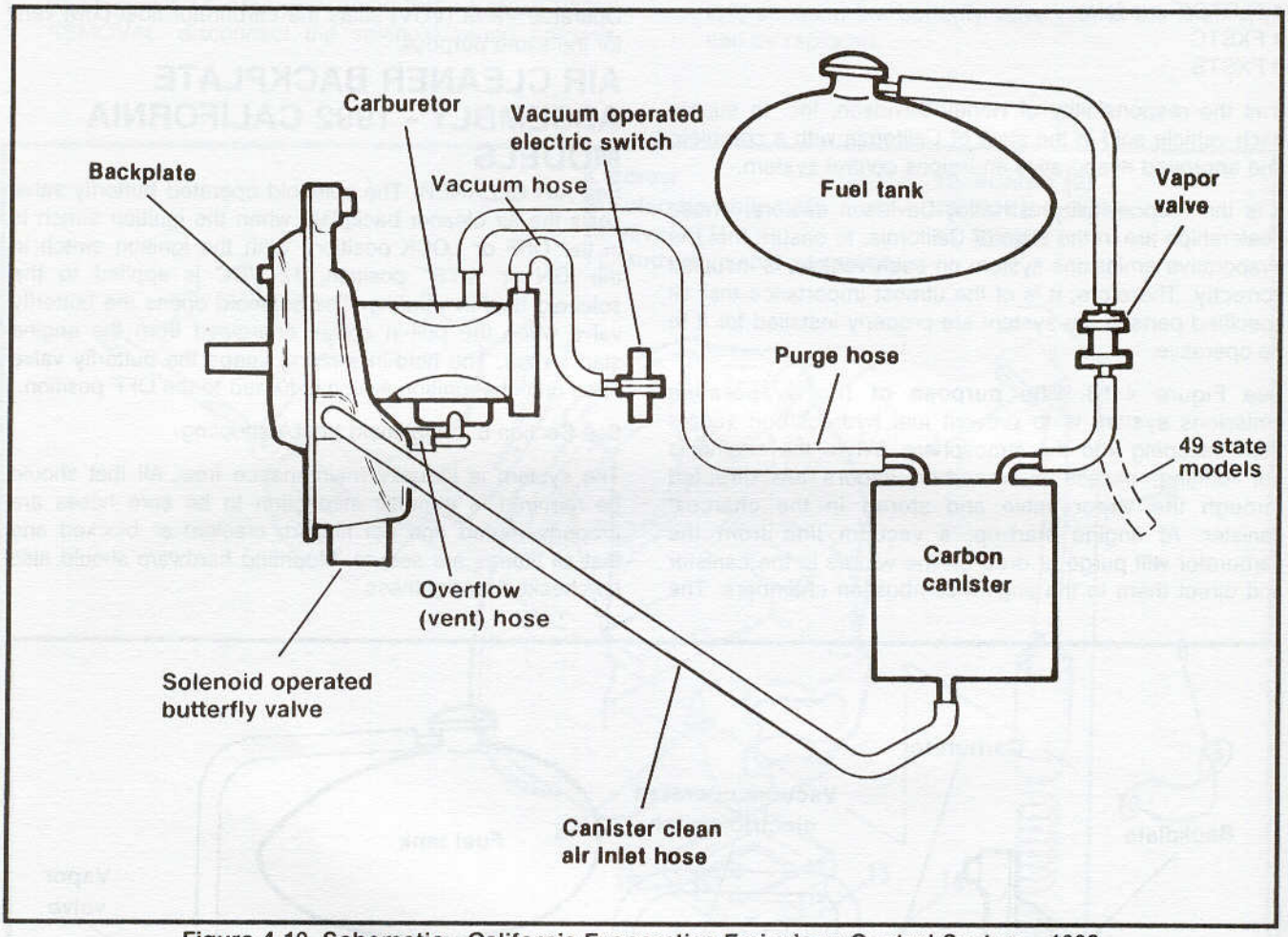


Figure 4-19. Schematic - California Evaporative Emissions Control System - 1992

TROUBLESHOOTING

Reed Valves - 1991

When servicing the air cleaner, check the reed valves. If they are cracked or broken, replace them.

Vacuum Operated Valve (V.O.V.) - 1991 & Earlier

Diaphragm failure in the VOV will cause a vacuum leak and the engine will run lean, especially at high rpm.

TEST

Use Vacuum Pump, part no. HD-23738.

1. See Figure 4-20. Attach hose of Vacuum Pump to (A) on VOV.

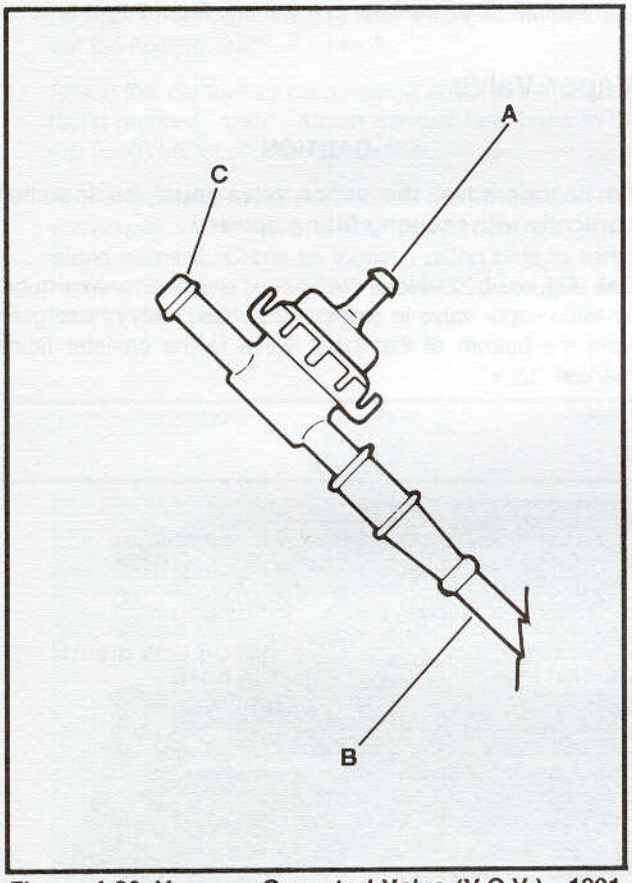


Figure 4-20. Vacuum Operated Valve (V.O.V.) - 1991

2. Apply a vacuum of 1-2 in. mercury.

3. Vacuum gauge reading should remain steady. If reading decreases rapidly, diaphragm is leaking. Replace VOV.

4. Maintain vacuum and blow into the air passage at (C) VOV must be open and allow air through the passage. If no air passes, VOV is damaged. Replace VOV.

5. Remove vacuum and blow into passage (B). VOV must be closed and not allow air through the passage. If air passes through, VOV is damaged. Replace VOV.

REMOVAL

Instrument Panel Cover

1. Remove the acorn nut holding the console in position. Remove trip odometer screw.

2. Remove instrument panel cover.

3. Remove air cleaner and backplate. See AIR CLEANER.

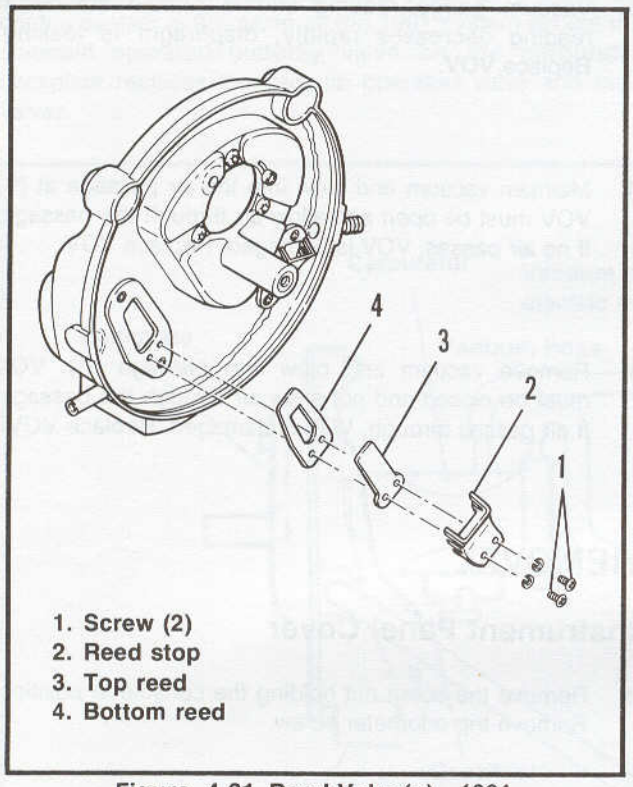
Carburetor

NOTE

California models carburetors have all required fittings.

Reed Valves Replacement - 1991

1. See Figure 4-21. Remove screws (1), reed stop (2) and top and bottom reeds (3 and 4).



1. Screw (2)
2. Reed stop
3. Top reed
4. Bottom reed

Figure 4-21. Reed Valve(s) - 1991

Reed installation is the reverse of removal. Tighten screws (1) to 4-6 in-lbs torque .

INSTALLATION

Canister

CAUTION

Be sure the canister is mounted in the applicable location. The canister must be mounted below the carburetor for the system to be operational.

1. See Figure 4-22. Place clamp in position at bottom of swing arm axis tube and install screws and washers.

2. Position canister with vent fittings at the left side of the vehicle. Slide canister bracket into mounting bracket.

Vapor Valve

CAUTION

To be operative, the vapor valve must be installed vertically with the long fitting upward.

See Figure 4-22. Note clamp on swing arm axis tube. Position vapor valve in clamp. The short, heavy hose goes from the bottom of the vapor valve to the canister fitting marked "tank".

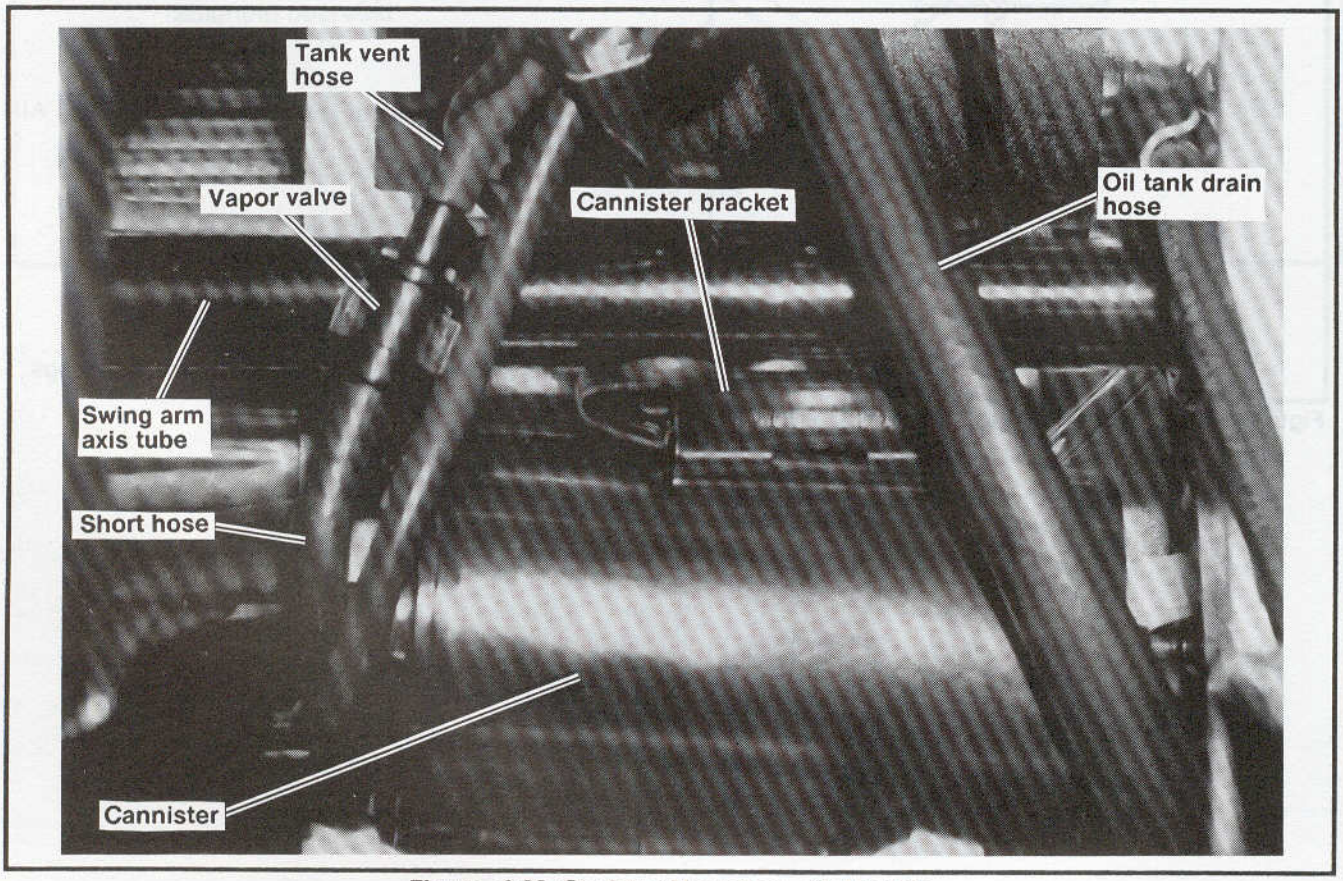


Figure 4-22. Canister Mounting - All Models

Hose Routing/Replacement

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.

1. Remove right side fuel tank. See FUEL TANK in this section.
2. See Figure 4-23. Attach the shorter hose to the carburetor purge fitting. The longer, white striped hose goes on right side fuel tank vent nipple.
3. The dots on the hoses should be at the front of the vinyl-coated bracket. Route hoses over the tank brackets, through the vinyl-coated bracket on frame backbone, between battery and inside of oil tank and out the bottom, back of oil tank.
4. Attach the carburetor purge fitting hose to the canister fitting marked "carb". Attach the fuel tank hose to the top (long) fitting on the vapor valve.
5. At the fuel tank area, push loose end of the fuel tank vent/vapor valve hose inside throttle cables, under wiring harness. Cable tie loosely, using hole in wiring harness bracket. Install fuel tank and place fuel tank hose on fuel tank vent nipple.

Canister to Air Cleaner Hose (Figures 4-24, 4-25)

6. Route the large (0.500 ID), pre-formed, carburetor backplate hose as follows:
   a. The pre-formed section goes behind the front cylinder push-rod tubes and loops under the cam gear case, outside the rear brake line, but inside the clutch cable.
   b. Route it straight back to the right side canister fitting. Cut to length and slip onto the canister fitting.
   c. Cable tie hose to the frame tube to prevent it coming in contact with the exhaust system. Install the end of the pre-formed section on the carburetor backplate fitting.
7. See Figure 4-16. Position gasket (12) and backplate (9) next to carburetor and install the crankcase breather tube (8). Start each captive screw (10) into threaded holes in carburetor flange.
8. By hand, turn each captive screw a couple of turns in sequence, until the backplate is drawn to a loose fit next to the carburetor flange.
9. Insert one screw (6) with washer (7) into each upper backplate mounting hole and thread loosely into the threaded hole in each cylinder head.

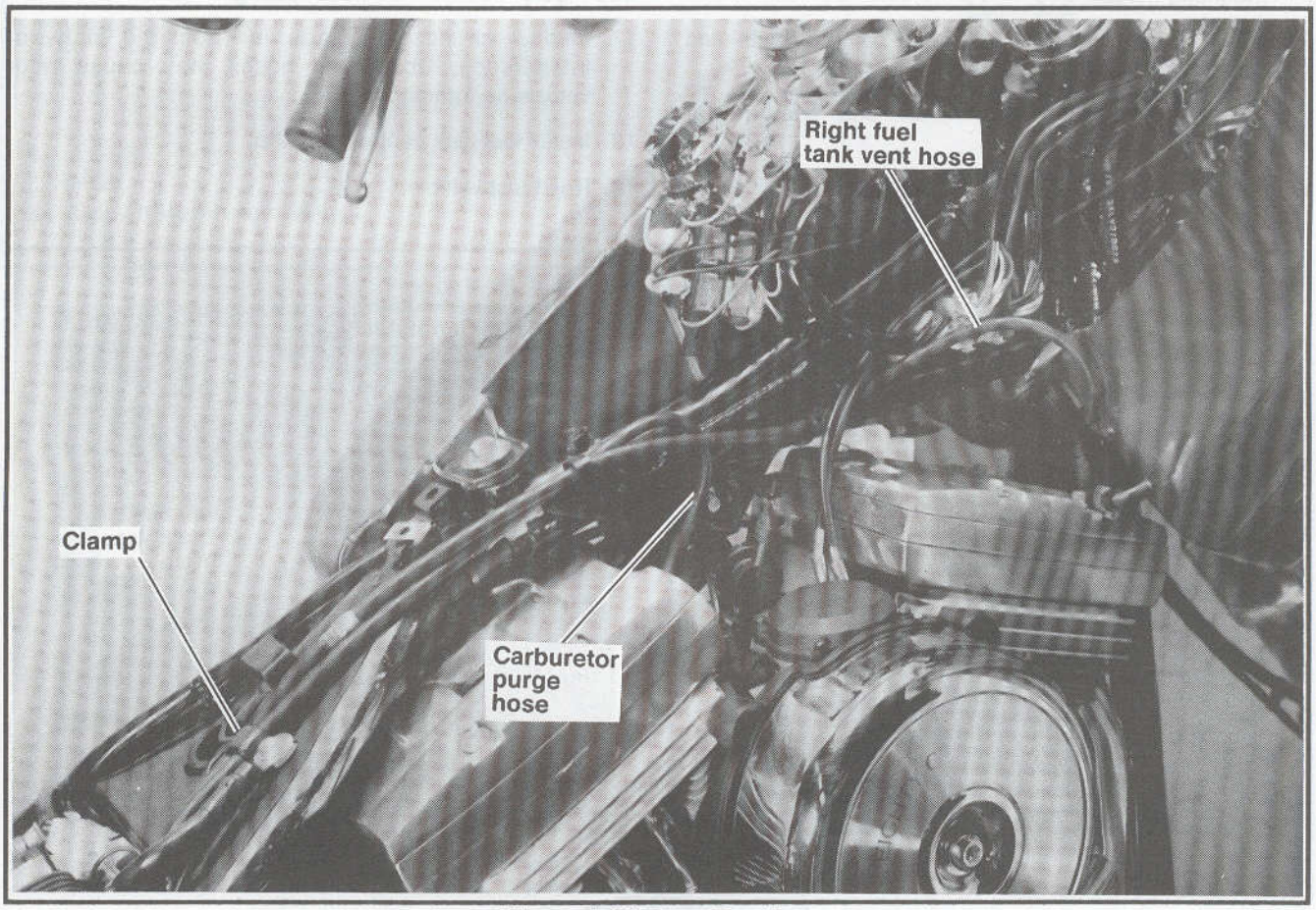


Figure 4-23. Hose Routing

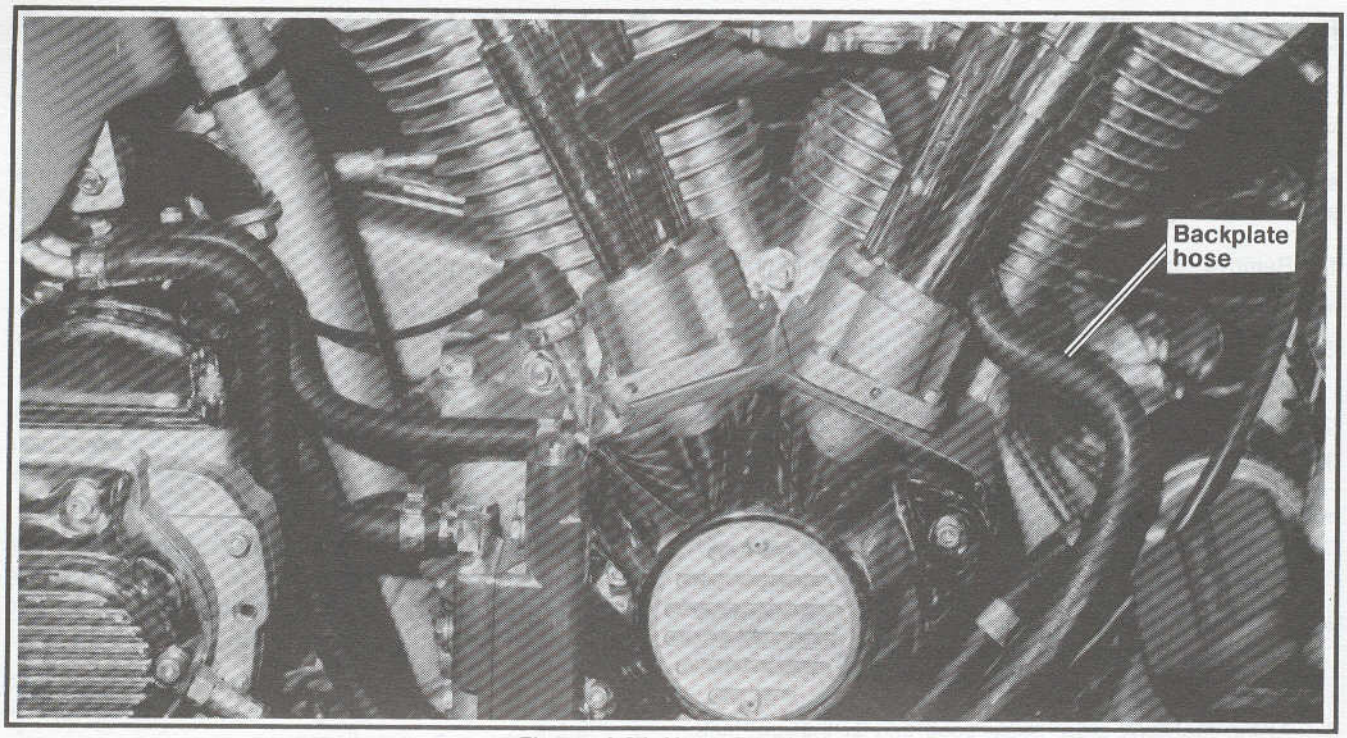


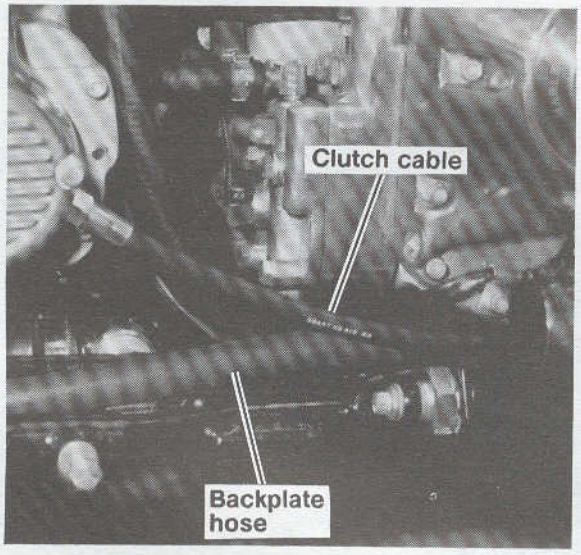
Figure 4-24. Hose Routing

10. Tighten screws (10) to 3-5 ft-lbs torque.
11. Tighten screws (6) to 10-12 ft-lbs torque.
12. Install rubber plug over screws (6) at two upper mounting holes.
13. Install baffle plate (11) in bottom of backplate and place element (4) in backplate.
14. Position cover (3) on backplate and secure with washer (2) and screw (1).
15. Tighten screw to 3-5 ft-lbs torque.
16. Install new evap. system label on front frame down tube.

Hose Routing - VOV - 1991

See Figure 4-26 for VOV hose routing.

17. Inspect all hose routings for possible kinks or interference. Obstructed hoses may cause poor vehicle performance.
18. Install fuel tank center trim strip.
19. Road test vehicle.



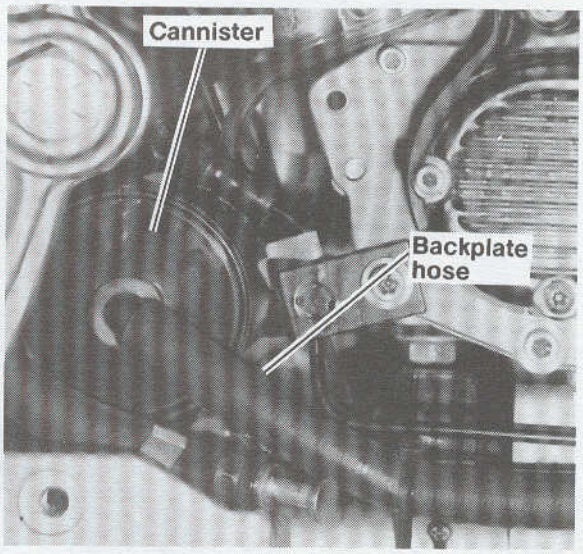
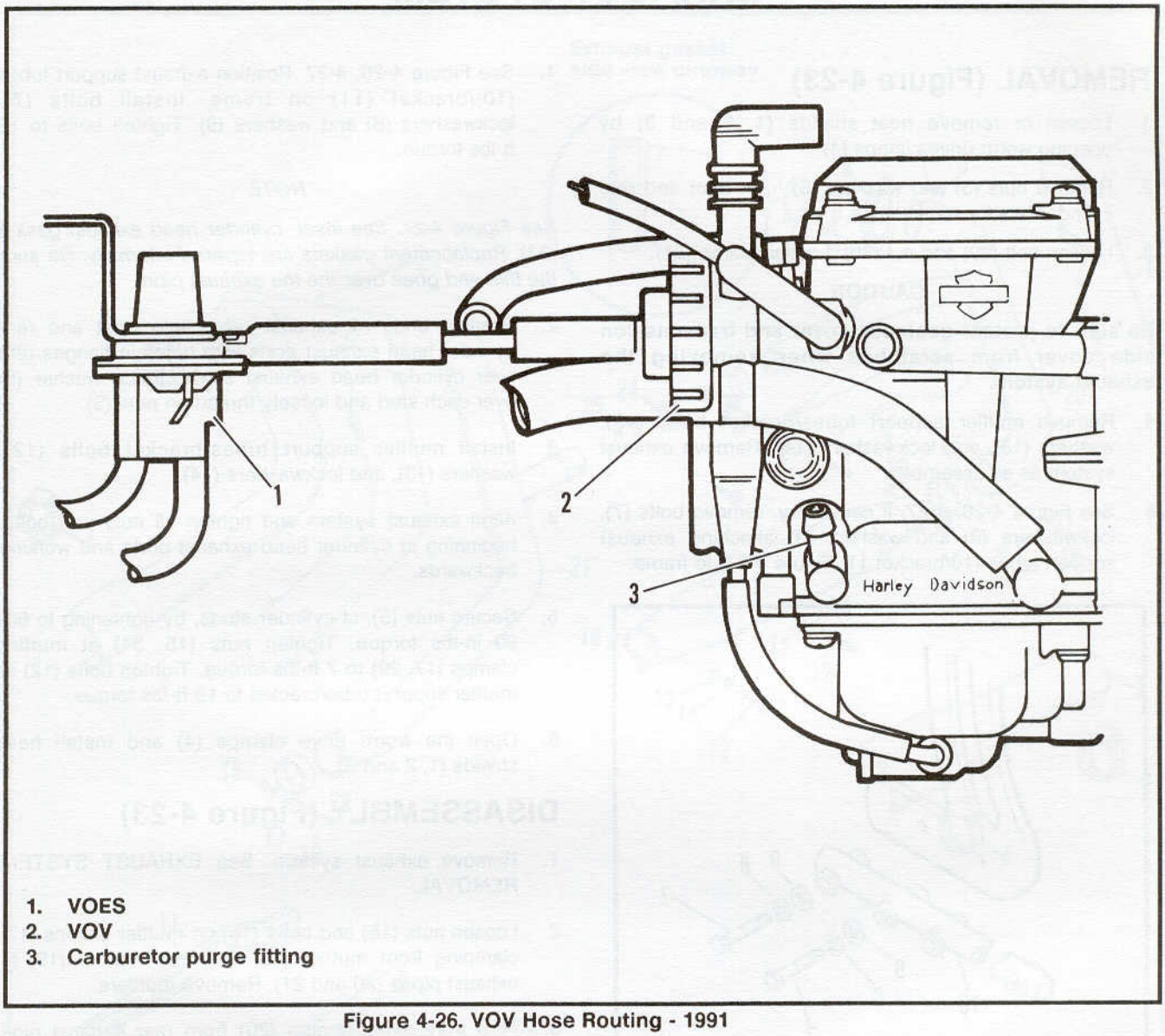


Figure 4-25. Hose Routing



1. VOES
2. VOV
3. Carburetor purge fitting

Figure 4-26. VOV Hose Routing - 1991

EXHAUST SYSTEM

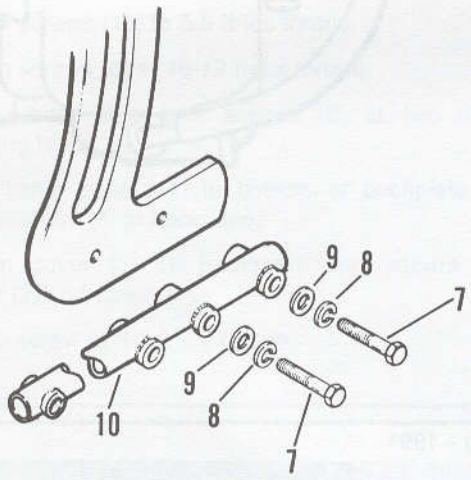
REMOVAL (Figure 4-23)

1. Loosen or remove heat shields (1, 2 and 3) by opening worm drive clamps (4).
2. Remove nuts (5) and washers (6) from front and rear cylinder head exhaust studs.
3. Loosen bolt (29) and nut (30). Loosen clamp (31).

CAUTION

Be sure to protect gearcase cover and transmission side cover from scratches when removing the exhaust system.

4. Remove muffler support tubes/bracket bolts (12), washers (13), and lockwashers (14). Remove exhaust system as an assembly.
5 See Figure 4-26, 4-27. If necessary, remove bolts (7), lockwashers (8) and washers (9) attaching exhaust support tubes (10/bracket 11, Figure 4-27) to frame.



7. Bolt (4) **9. Washer (4)**
8. Lockwasher (4) **10. Support tube (2)**

Figure 4-26. Exhaust Support Tube

INSTALLATION (Figure 4-27)

Special Tools	Torque Values (See Below)
None	Support tube bolts (at frame) 19 ft-lbs Cylinder stud nuts 60-80 in-lbs Muffler clamp nuts 7 ft-lbs Muffler support tube/ bracket bolts 19 ft-lbs

1. See Figure 4-26, 4-27. Position exhaust support tubes (10)/bracket (11) on frame. Install bolts (7), lockwashers (8) and washers (9). Tighten bolts to 19 ft-lbs torque.

NOTE

See Figure 4-27. See inset, cylinder head exhaust gasket (23). Replacement gaskets are tapered internally. Be sure the thin end goes over the the exhaust pipe.

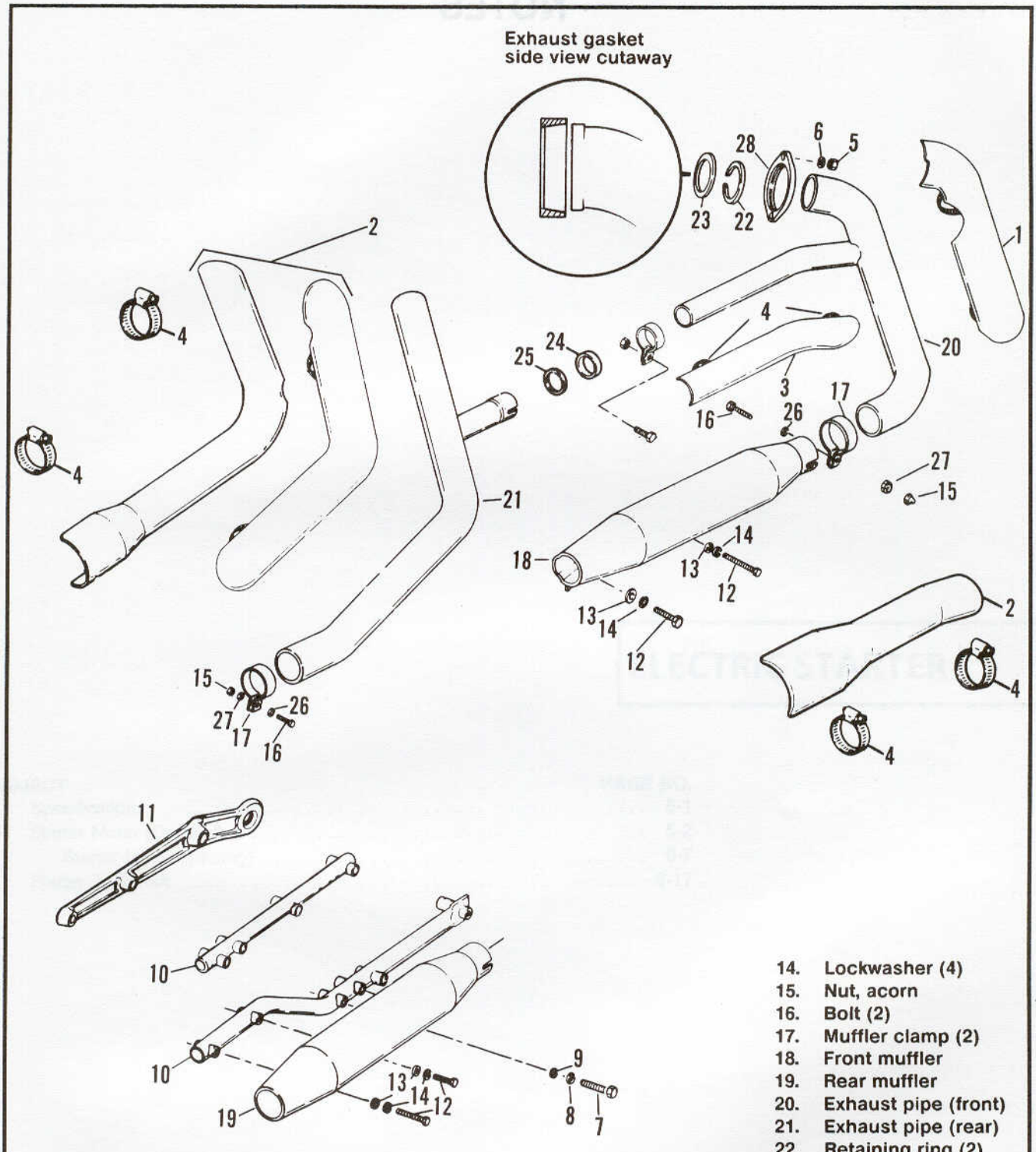
2. Position ends of exhaust pipes into front and rear cylinder head exhaust ports with holes in flanges (28) over cylinder head exhaust studs. Place washer (6) over each stud and loosely thread on nuts (5).
3. Install muffler support tubes/bracket bolts (12), washers (13), and lockwashers (14).
4. Align exhaust system and tighten all nuts and bolts; beginning at cylinder head exhaust ports and working backwards.
5. Secure nuts (5), at cylinder studs, by tightening to 60-80 in-lbs torque. Tighten nuts (15, 31) at muffler clamps (17, 29) to 7 ft-lbs torque. Tighten bolts (12) at muffler support tube/bracket to 19 ft-lbs torque.
6. Open the worm drive clamps (4) and install heat shields (1, 2 and 3).

DISASSEMBLY (Figure 4-23)

1. Remove exhaust system. See EXHAUST SYSTEM REMOVAL.
2. Loosen nuts (15) and bolts (16) on muffler clamps (17) clamping front muffler (18) and rear muffler (19) to exhaust pipes (20 and 21). Remove mufflers.
3. Free front exhaust pipe (20) from rear exhaust pipe (21) by twisting and separating at crossover pipe.
4. Examine retaining rings (22) and gaskets (23) in cylinder head exhaust ports. Replace if neccessary.
5. Remove gasket (24) and washer (25) from crossover pipe bell on rear exhaust pipe (21).

ASSEMBLY (Figure 4-23)

1. Insert washer (25) and new gasket (24) (if necessary) into crossover pipe bell on rear exhaust pipe (21). Connect rear exhaust pipe to front exhaust pipe (20) at crossover pipe.
2. Install front and rear mufflers (18 and 19) on front and rear exhaust pipes. Install muffler clamps (17) using nuts (15), washers (26), lockwashers (27) and bolts (16). Do not tighten nuts until exhaust system is installed.
3. Install exhaust system. See EXHAUST SYSTEM INSTALLATION.



1. Heat shield (front)
2. Heat shield (rear)
3. Heat shield (crossover)
4. Worm drive clamp (6)
5. Nut (4)
6. Washer (4)
7. Bolt (4)
8. Lockwasher (4)
9. Washer (4)
10. Support tube (FLSTF - front)
10A. Support tube (all except FLSTF)
11. Support Bracket (FLSTF - rear)
12. Bolt (4)
13. Washer (4)
14. Lockwasher (4)
15. Nut, acorn
16. Bolt (2)
17. Muffler clamp (2)
18. Front muffler
19. Rear muffler
20. Exhaust pipe (front)
21. Exhaust pipe (rear)
22. Retaining ring (2)
23. Gasket (2)
24. Gasket (crossover)
25. Washer
26. Washer (4)
27. Lockwasher (2)
28. Flange (2)
29. Crossover clamp
30. Bolt
31. Nut

Figure 4-23. Exhaust System

NOTES

ELECTRIC STARTER

SPECIFICATIONS

STARTER

Free speed	3000 rpm (min.) @ 11.5 V
Free current	90 amp (max.) @ 11.5V
Stall current	400 amp (max.) @ 2.4 V
Stall torque	8.0 ft-lbs @ 2.4 V

SERVICE WEAR LIMITS

Brush length minimum	0.413 in.
Commutator diameter minimum	1.141 in.(min.)

TORQUES

Thru-bolts	39-65 in-lbs
End cover mounting bracket	50-60 in-lbs
End cover center screw	90-110 in-lbs
Cable terminal nuts	65-80 in-lbs
Starter mounting bolts	13-20 ft-lbs
Jackshaft thru-bolts	7-9 ft-lbs

STARTER SYSTEM

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 and 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.

The starter relay is a non-repairable part and must be replaced if it malfunctions.

Operation (Figure 5-1)

When the starter switch is pushed, the starter relay is activated and battery current flows into the pull-in winding and the hold-in winding, to ground.

The magnetic forces of the pull-in and hold-in windings in the solenoid, pull the plunger and cause it to shift to the left, so that the pinion gear is engaged with the clutch ring gear. At the same time, the main solenoid contacts are closed and battery current flows directly through the field windings to the armature and to ground. Simultaneously, the pull-in winding is opened.

The current continues flowing through the hold-in winding, keeping the main solenoid contacts closed. At this point the starter begins to crank the engine.

After the engine has started, the pinion gear turns freely on the pinion shaft through the action of the overrunning clutch which prevents the armature overrunning by the rotation of the clutch ring gear.

When the starter switch is released, the current of the hold-in winding is fed through the main solenoid contacts and the direction of the current in the pull-in winding is reversed. The solenoid plunger is returned to its original position by the return spring, disengaging the pinion gear from the clutch ring gear.

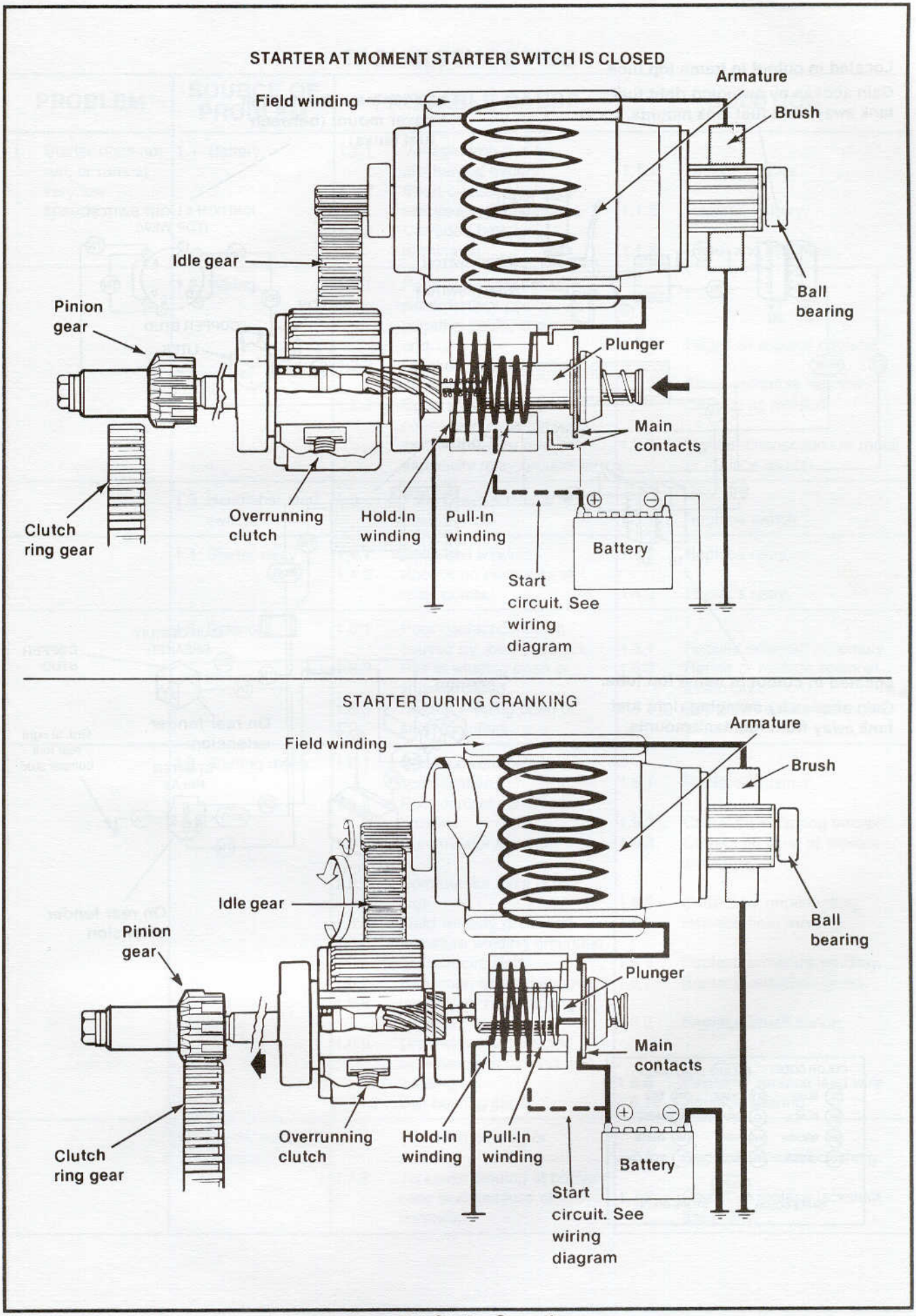


Figure 5-1. Starter Operation

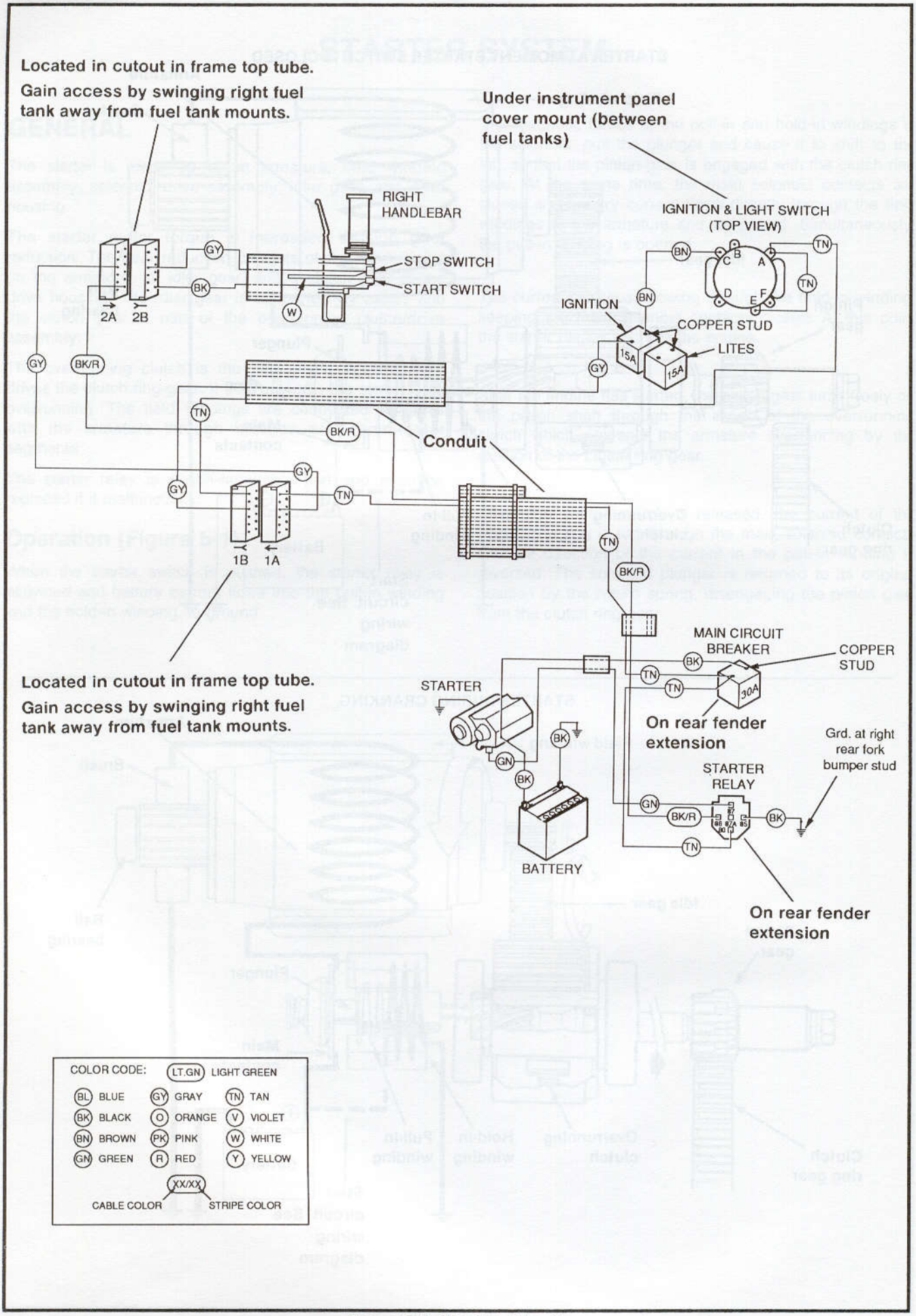


Figure 5-2. Starting Circuit

TROUBLESHOOTING

PROBLEM	SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
1. Starter does not run, or runs at very low speeds.	1.1 Battery.	1.1.1 Voltage drop due to discharged battery. 1.1.2 Short-circuited between electrodes (bad battery). 1.1.3 Corroded battery terminal(s).	1.1.1 Charge battery. 1.1.2 Replace battery. 1.1.3 Clean and retighten.
	1.2 Wiring.	1.2.1 Poor or no connection at either battery positive or negative cable, at either end. 1.2.2 Cracked or corroded battery cable ends. 1.2.3 Open wire(s) or poor connection at handlebar switch or starter relay, especially relay ground wire.	1.2.1 Repair or replace cable(s). 1.2.2 Clean tighten or replace cable(s) as needed. 1.2.3 Tighten connections or repair or replace wire(s).
	1.3 Handlebar start switch	1.3.1 Poor switch contacts or open switch.	1.3.1 Replace switch.
	1.4 Starter relay	1.4.1 Open coil winding. 1.4.2 Poor or no continuity at relay points.	1.4.1 Replace relay. 1.4.2 Replace relay.
	1.5 Solenoid.	1.5.1 Poor contact condition caused by burnt contact. 1.5.2 Pull-in winding open or short-circuited. 1.5.3 Hold-in winding open or short circuited.	1.5.1 Rebuild solenoid assembly. 1.5.2 Repair or replace solenoid assembly. 1.5.3 Repair or replace solenoid assembly.
	1.6 Starting motor.	1.6.1 Brushes worn below specification. 1.6.2 Poor contact condition of brushes. 1.6.3 Commutator burned. 1.6.4 Commutator mica is too high. 1.6.5 Field winding grounded. 1.6.6 Armature winding grounded or short circuited. 1.6.7 Reduction gears damaged. 1.6.8 Insufficient brush spring tension. 1.6.9 Lead wire disconnected between solenoid and field windings. 1.6.10 Ball bearing sticks.	1.6.1 Replace brushes. 1.6.2 Check brush spring tension. 1.6.3 Correct on lathe or replace armature. 1.6.4 Correct by undercutting. 1.6.5 Replace field winding. 1.6.6 Replace armature winding. 1.6.7 Replace reduction gears. 1.6.8 Replace brush spring. 1.6.9 Repair or replace lead wire. 1.6.10 Replace bearing.
	1.7 Starter jackshaft assembly	1.7.1 Jackshaft binding or sticking. 1.7.2 Jackshaft binding at primary case seal because of corrosion.	1.7.1 Replace jackshaft bushing. 1.7.2 Repair or replace jackshaft assembly.

TROUBLESHOOTING (CONT)

PROBLEM	SOURCE OF PROBLEM	PROBABLE CAUSE	SOLUTION
2. Pinion does not engage with ring gear while starter is running/engine cannot be cranked.	2.1 Battery.	2.1.1 Voltage drop because of discharged battery. 2.1.2 Bad battery. 2.1.3 Corroded battery terminal(s).	2.1.1 Charge battery. 2.1.2 Replace battery. 2.1.3 Clean and retighten.
	2.2 Overrunning clutch.	2.2.1 Overrunning clutch malfunction (rollers or compression spring). 2.2.2 Pinion teeth worn out. 2.2.3 Pinion does not run in overrunning direction. 2.2.4 Spline teeth do not slide properly. 2.2.5 Reduction gears damaged.	2.2.1 Replace overrunning clutch. 2.2.2 Replace pinion. 2.2.3 Replace overrunning clutch. 2.2.4 Remove foreign materials, dirt, or replace overrunning clutch or pinion shaft. 2.2.5 Replace overrunning clutch and idler gear.
	2.3 Jackshaft assembly	2.3.1 Improper jackshaft parts assembly.	2.3.1 Disassemble and assemble parts properly.
3. Starter does not stop running.	3.1 Starting switch or starter relay.	3.1.1 Unopened contacts. 3.1.2 Poor return caused by sticky switch or relay contacts.	3.1.1 Replace starting switch or starter relay. 3.1.2 Replace starting switch or starter relay.
	3.2 Ring gear.	3.2.1 Worn out teeth.	3.2.1 Replace ring gear.
	3.3 Solenoid.	3.3.1 Return spring worn. 3.3.2 Coil layer shorted. 3.3.3 Contact plate melted and stuck.	3.3.1 Replace spring. 3.3.2 Replace solenoid. 3.3.3 Repair solenoid.

TESTING

On-Motorcycle Tests

Special Tools	Torque Values (ft-lbs)
Continuity tester or ohmmeter Induction ammeter	None

Before removing starter perform the following tests:

STARTER RELAY

1. See Figure 5-3. Unplug the relay connector and substitute a new relay or perform the following test.

2. The starter relay can be tested with the vehicle's 12 volt battery and a continuity tester or ohmmeter. Unplug the wires from the relay and connect the battery leads to the 86 and 85 terminals to energize the relay. Check for continuity between the 30 and 87 terminals. A good relay will show continuity. There will be continuity if the tester lamp is "on" or there is a zero ohm reading on the ohmmeter. A malfunctioning relay will not have continuity and must be replaced.

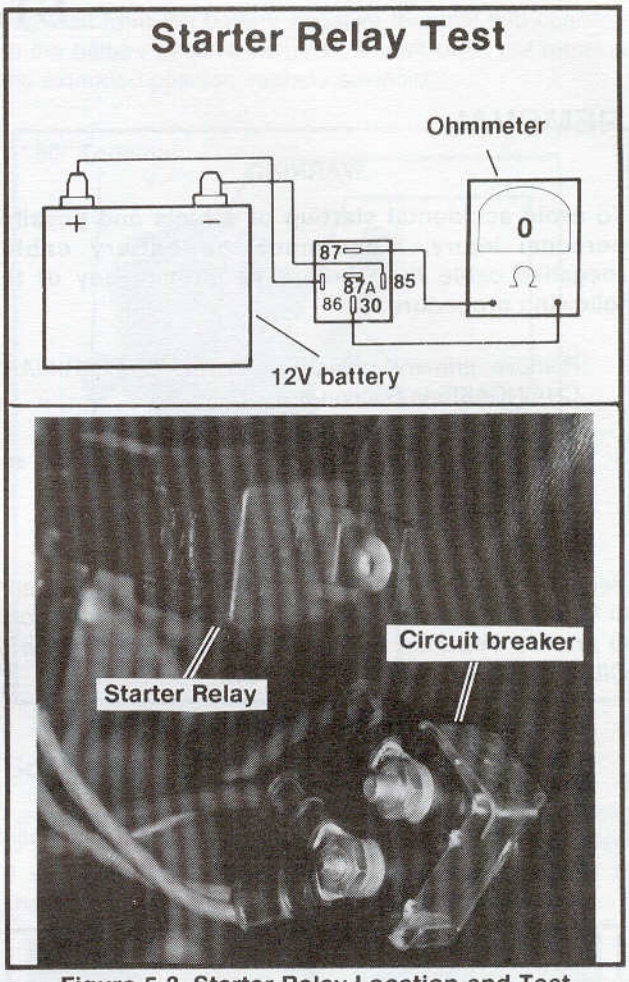


Figure 5-3. Starter Relay Location and Test

STARTER CURRENT DRAW TEST (Figure 5-4)

Starter current draw should be checked with an induction ammeter before disconnecting the battery.

1. Make sure the transmission is in neutral. Disconnect the spark plug wires from spark plug terminals.

2. Clamp induction ammeter over the positive battery cable.

3. With the ignition ON, turn engine over by pressing starter switch while taking a reading on the ammeter. Disregard initial high current reading which is normal during time the engine is first turned over.

4. If starter current draw exceeds 150 amperes, the problem may be in the starter or starter drive and the starter must be removed and tested further. See REMOVAL.

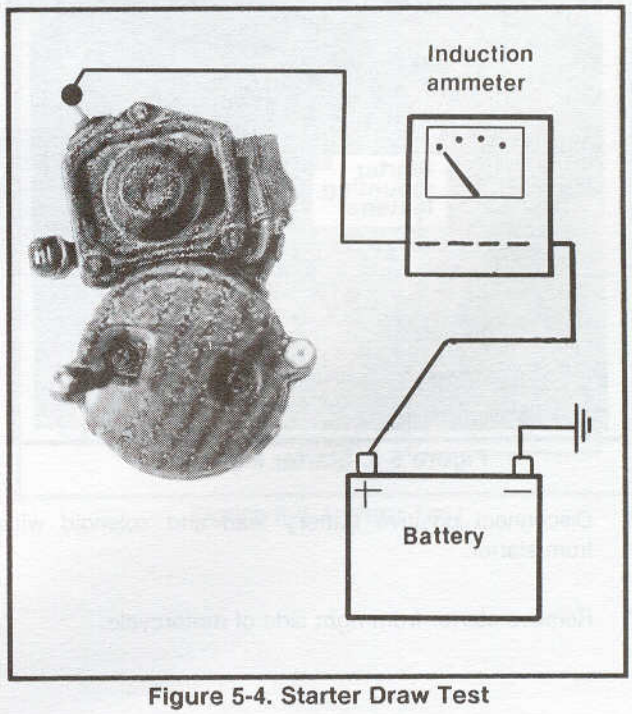


Figure 5-4. Starter Draw Test

STARTER

REMOVAL

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. Remove primary chaincase cover. See PRIMARY CHAINCASE, in Section 6.

2. See Figure 5-27. Hold pinion gear (5) in place and remove jackshaft bolt (1) and lockplate (2).

NOTE

Because of variations in components, it may be necessary to loosen the oil tank mounts on some Softail motorcycles to provide clearance for starter removal. See Section 3, OIL TANK REMOVAL/INSTALLATION.

3. Remove rear exhaust pipe.

4. Remove allen screw and end cover.

5. See Figure 5-5. Remove the starter mounting allen head bolts and washers.

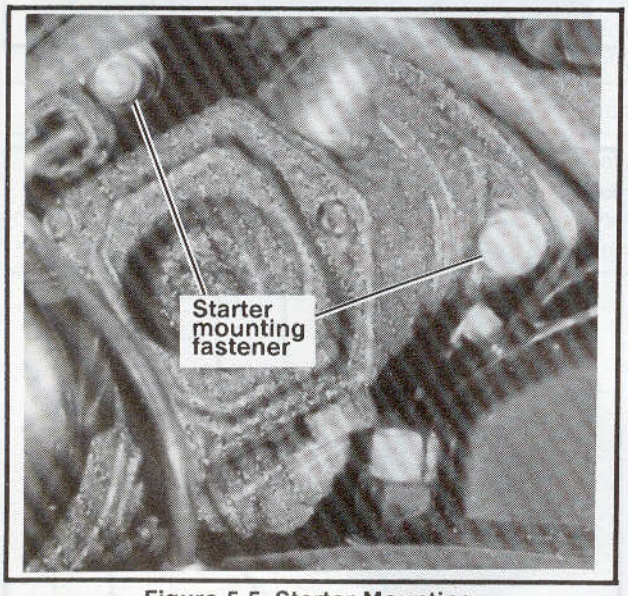


Figure 5-5. Starter Mounting

6. Disconnect positive battery lead and solenoid wire from starter.

7. Remove starter from right side of motorcycle.

NOTE

Jackshaft-to-starter shaft coupling is a loose fit and coupling could come off with starter or stay on jackshaft. If it comes off with starter put it back on the jackshaft. This will ease assembly later on. Counterbored end faces jackshaft.

Before disassembling the starter, perform tests on the assembled starter. See TESTING ASSEMBLED STARTER.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Starter mounting bolts 13 - 20 Jackshaft bolt 7 - 9

1. Install starter from right side of motorcycle.

NOTE

Be sure jackshaft coupling engages starter shaft.

2. Install positive battery cable and solenoid wire to solenoid.

3. See Figure 5-5. Install the two starter mounting bolts and washers. Tighten mounting bolts to 13-20 ft-lbs torque.

NOTE

Be sure the lockplate protrusion is sticking into the keyway.

5. Install jackshaft lockplate and bolt. Hold pinion gear in place and tighten bolt to 7-9 ft-lbs torque.

6. Install primary chaincase cover. See FRONT CHAIN INSTALLATION, in section 6.

7. Fill primary chaincase with lubricant as described in section 6, Lubrication.

8. Install starter end cover and allen screw.

NOTE

If you loosened the oil tank mounts tighten them.

9. Install rear exhaust pipe.

10. Connect battery cables, positive cable first.

TESTING ASSEMBLED STARTER

Starter Solenoid

WARNING

Wear eye protection during this series of tests. These tests may produce flying sparks which could cause eye injury.

NOTE

Do not disassemble solenoid. Before testing, disconnect field wire from terminal "C", shown in Figure 5-5.

CAUTION

Each test should be performed for only 3 to 5 seconds to prevent damage to solenoid.

NOTE

Perform the following tests in as rapid a sequence as possible.

Solenoid Pull-In (Figure 5-6)

Connect test leads from 12 volt battery as shown. Connect the test lead to the "50" terminal last. The starter shaft should extend strongly if the solenoid is working properly. If shaft does not extend, solenoid should be replaced.

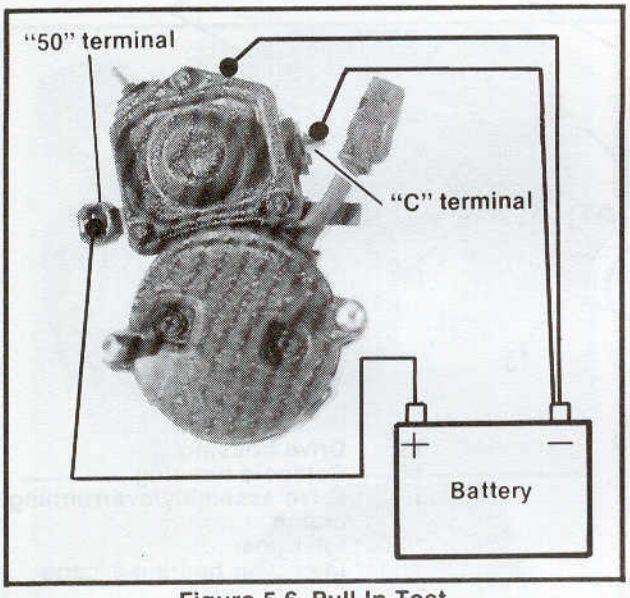


Figure 5-6. Pull-In Test

Solenoid Hold-In (Figure 5-7)

Keep test leads connected as in Pull-In Test. Begin with the starter shaft still extended. Disconnect "C" terminal test lead from the battery negative terminal and connect it to the battery positive terminal. If shaft does not remain in the extended position, replace solenoid.

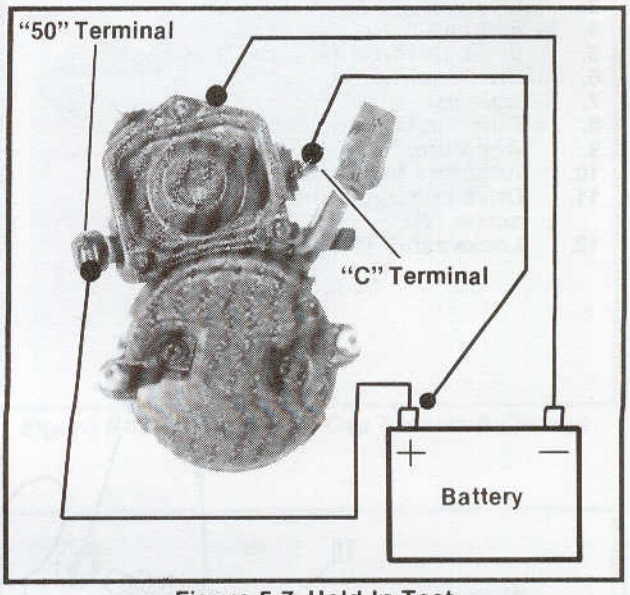


Figure 5-7. Hold-In Test

Solenoid Return (Figure 5-8)

Keep test leads connected as they were at the completion of the Hold-In Test. Disconnect the "50" terminal test lead. If shaft retracts, the solenoid is working properly. If the shaft does not retract, the solenoid should be replaced.

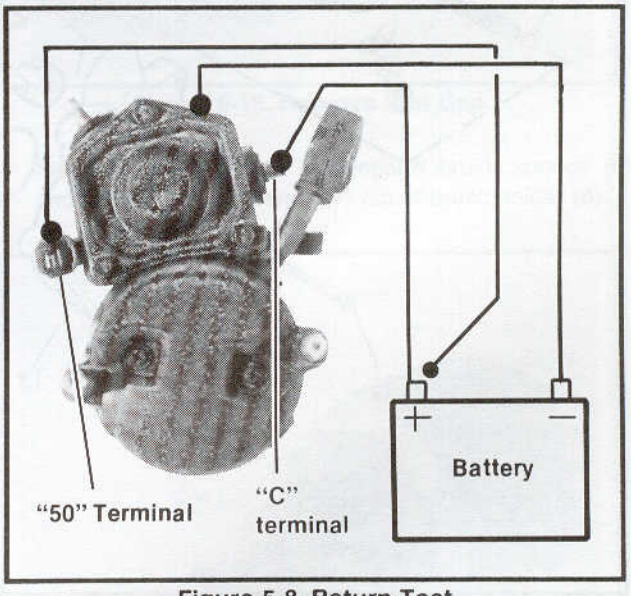


Figure 5-8. Return Test

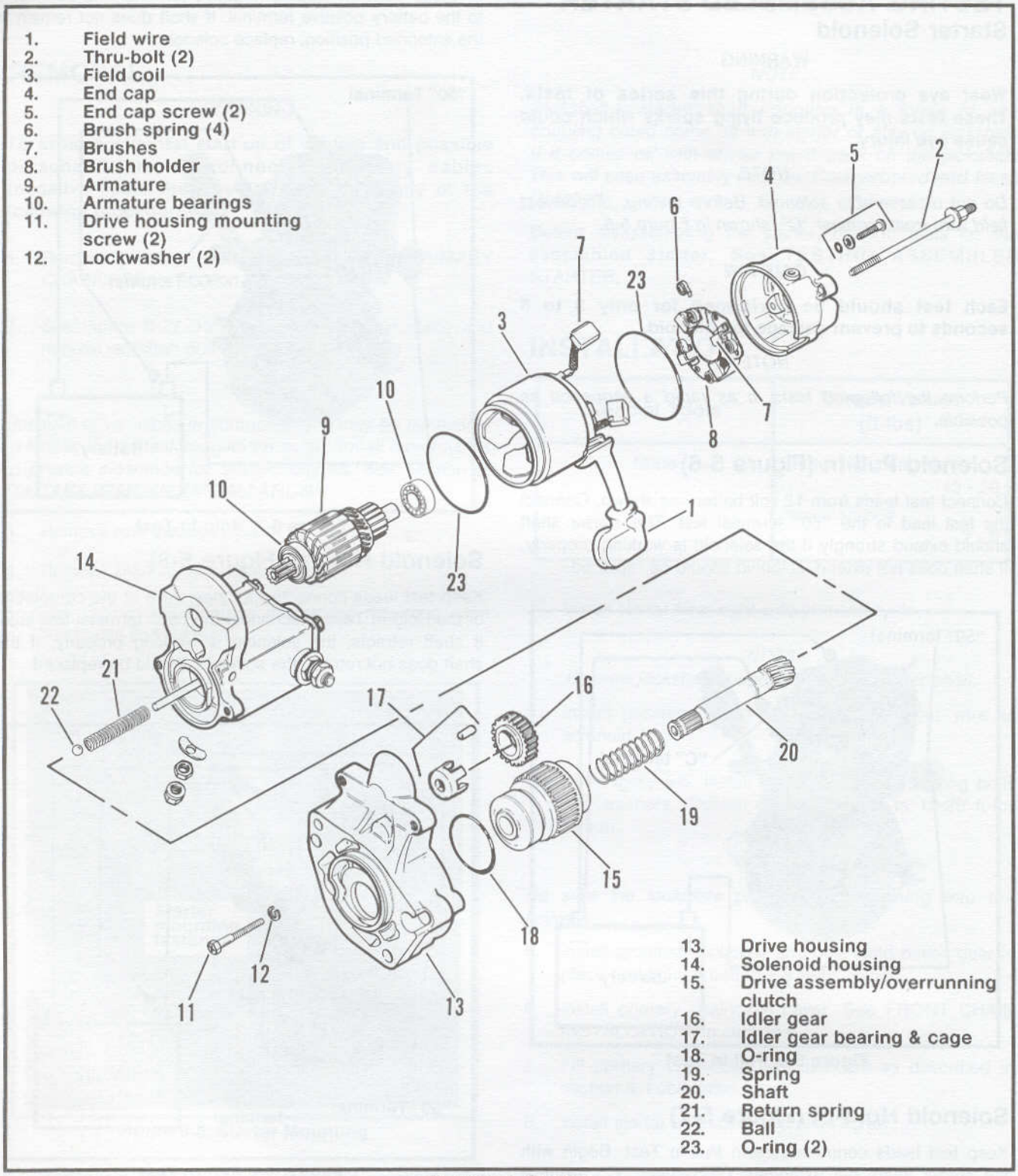


Figure 5-9. Starter

DISASSEMBLY, TESTING AND REPAIR (FIGURE 5-8)

1. See Figures 5-9, 5-10. Disconnect field wire (1).

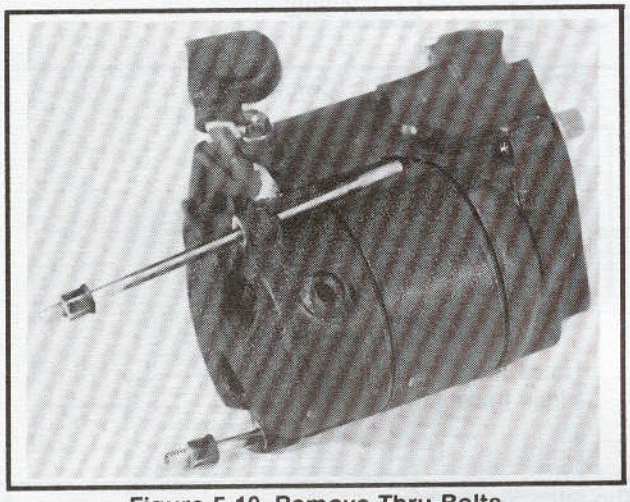


Figure 5-10. Remove Thru-Bolts

2. See Figures 5-9, 5-11. Remove thru-bolts (2). Remove field coil (3) and cap (4).

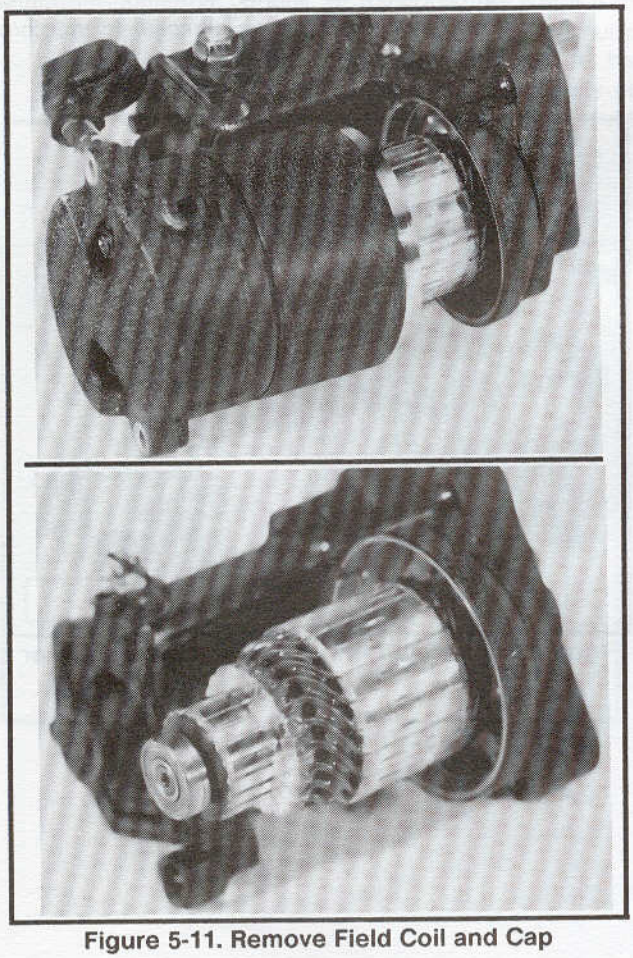


Figure 5-11. Remove Field Coil and Cap

3. See Figures 5-9, 5-12 and 5-13. Remove the end cap screws (5) and cap.

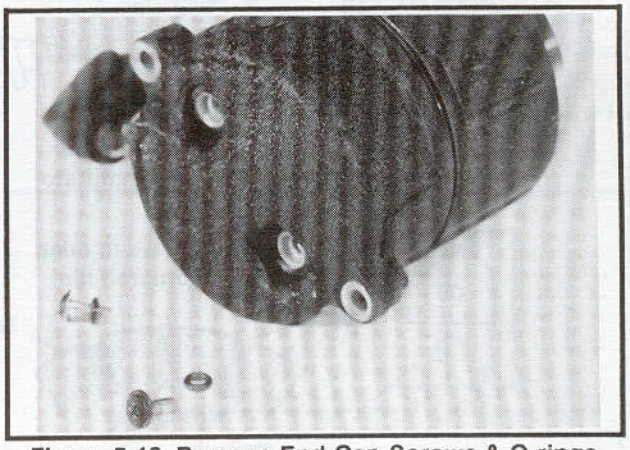


Figure 5-12. Remove End Cap Screws & O-rings

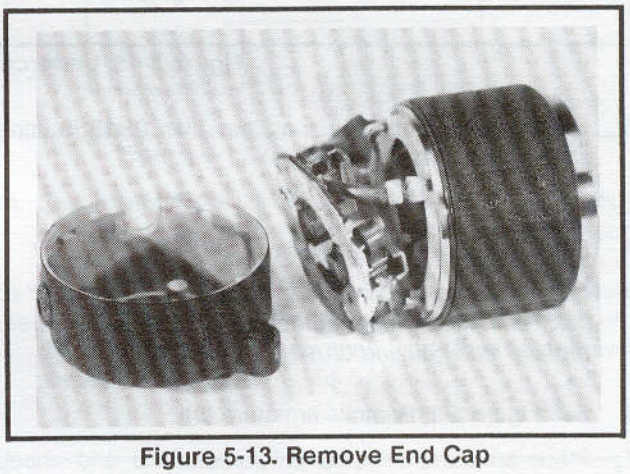


Figure 5-13. Remove End Cap

4. See Figures 5-9, 5-14. Disengage brush springs (6) and pull field coil brushes (7) out of brush holder (8).

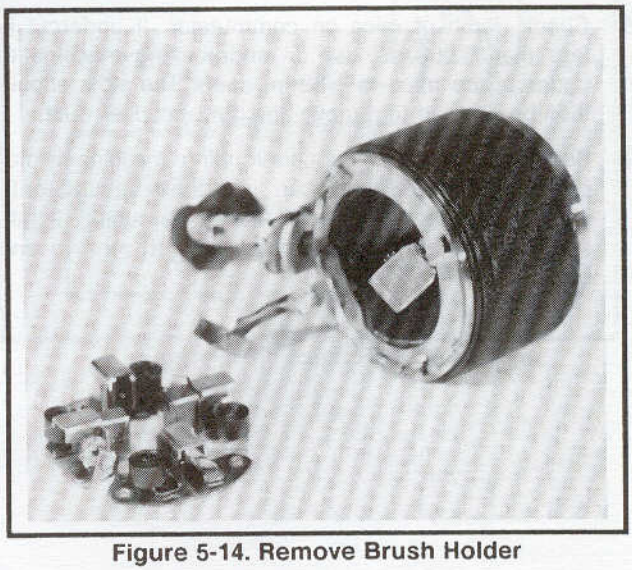


Figure 5-14. Remove Brush Holder

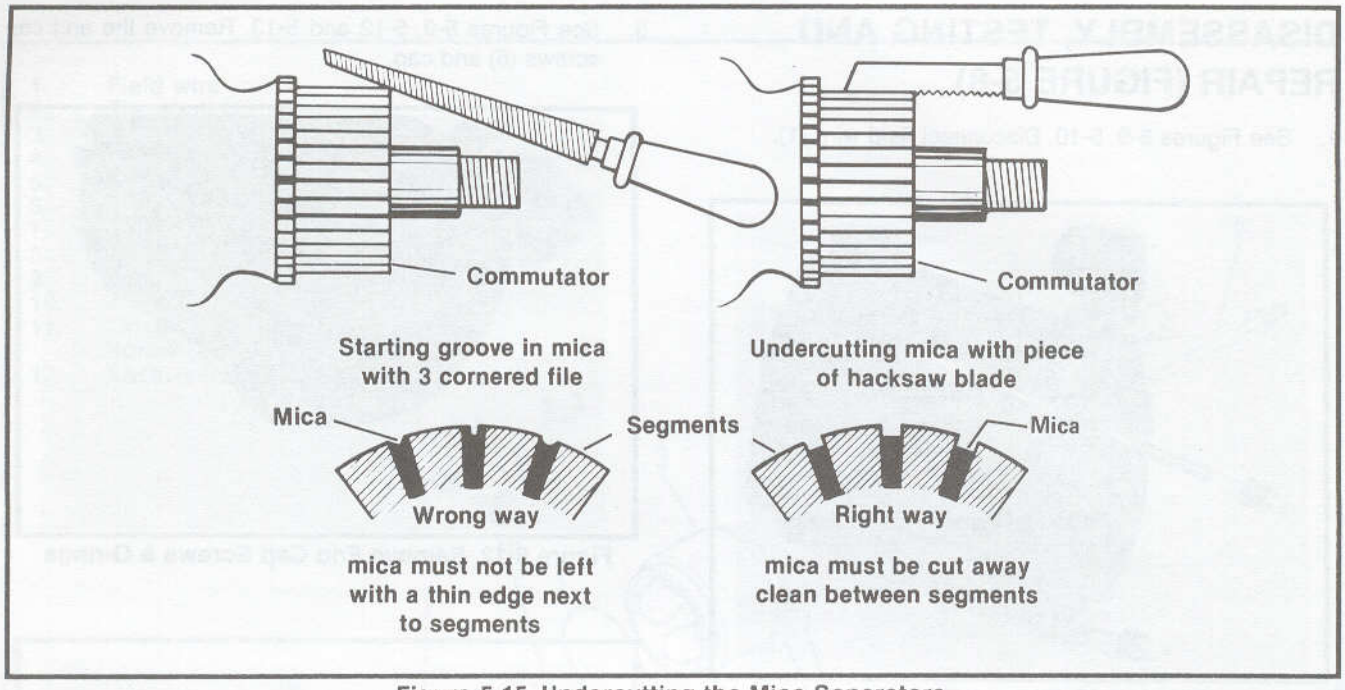


Figure 5-15. Undercutting the Mica Separators

5. Check brush length. Brushes less than 0.413 in. long should be replaced.

NOTE

- *Replace brushes in sets of four only.*
- *Field coil and brush holder brushes are attached to field coil and brush holder. To replace brushes, replace field coil and brush holder.*

6. See Figure 5-9. Remove armature (9).
7. Place armature in lathe or truing stand and check runout of commutator. Commutators with more than 0.015 in. of runout should be replaced or machined on a lathe. Commutators should be replaced when diameter is less than 1.141 in.
8. Check depth of mica on commutator. If undercut is less than 0.008 in., use an undercutting machine to undercut the mica to 1/32 in. deep. The slots should then be cleaned to remove any dirt or copper dust.
9. 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 armature with crocus cloth to remove any burrs.
10. See Figure 5-16. Check for SHORTED ARMATURE with a growler. Place armature on growler. Hold a thin steel strip (hacksaw blade) against armature core and slowly turn armature. A shorted armature will cause the steel strip to vibrate and be attracted to the core. Shorted armatures should be replaced.

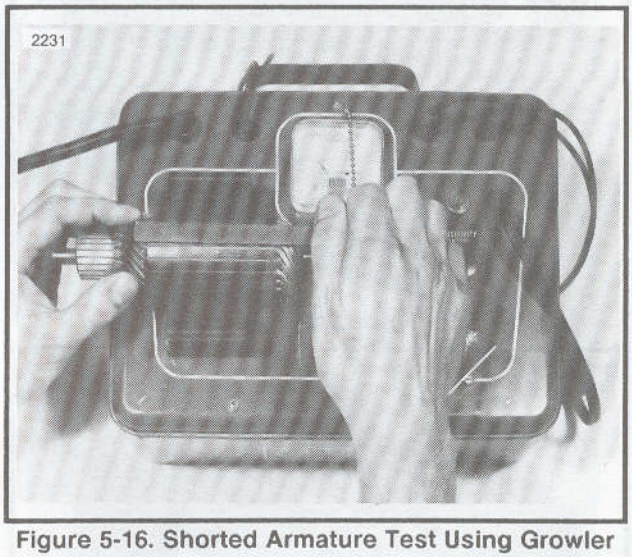


Figure 5-16. Shorted Armature Test Using Growler

11. See Figure 5-17. Check for a GROUNDED ARMATURE with an ohmmeter or continuity tester. Touch one probe to any commutator segment, and the other probe to the armature core. There should be no continuity (infinite ohms). If there is any continuity the armature is grounded and should be replaced.

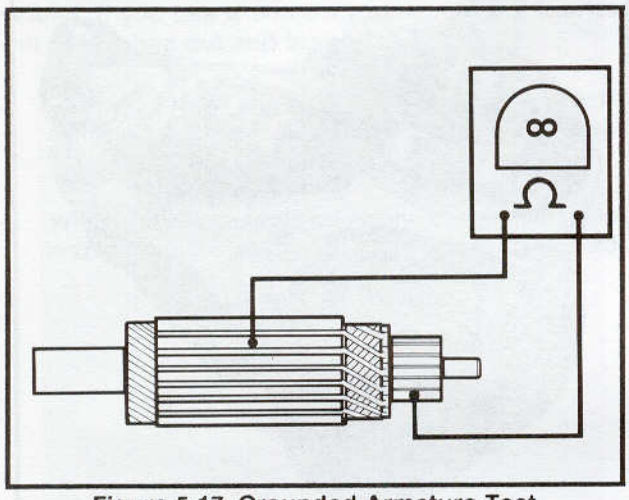


Figure 5-17. Grounded Armature Test

12. See Figure 5-18. Check for OPEN ARMATURE with an ohmmeter or continuity tester. Check for continuity between all commutator segments. There should be continuity (0 ohms) at all test points. No continuity at any test point indicates armature is open and should be replaced.

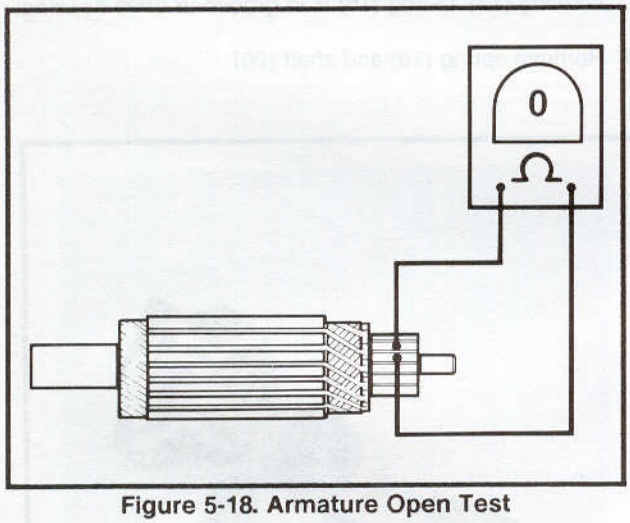


Figure 5-18. Armature Open Test

13. See Figure 5-19. Check for GROUNDED FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the frame, and the other probe to each of the brushes attached to the field winding. There should be no continuity (infinite ohms). If there is any continuity at either brush, the field winding(s) are grounded and the field frame should be replaced.

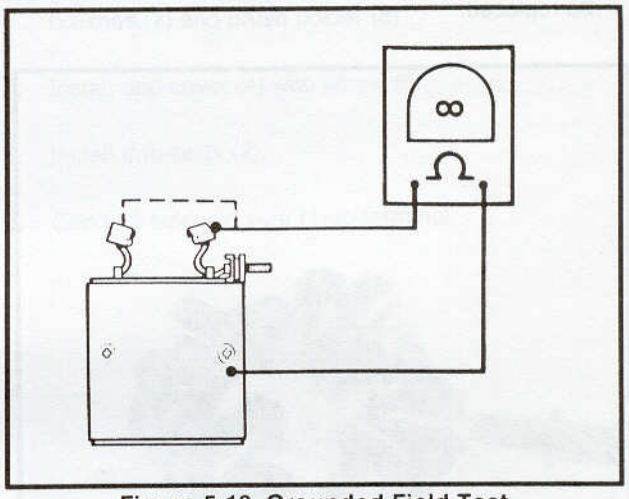


Figure 5-19. Grounded Field Test

14. See Figure 5-20. Check for OPEN FIELD WINDING with an ohmmeter or continuity tester. Touch one probe to the field wire, and the other probe to each of the brushes attached to the field coils. There should be continuity. If there is no continuity at either brush, the field winding(s) are open and the field frame should be replaced.

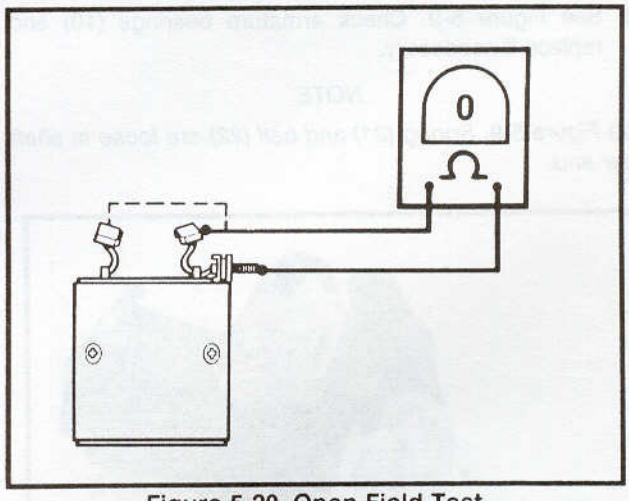


Figure 5-20. Open Field Test

15. See Figure 5-21. Test BRUSH HOLDER INSULATION with an ohmmeter or continuity tester. Touch one probe to holder plate and the other probe to each of the positive (insulated) brush holders. There should be no continuity (infinite ohms). If there is continuity at either brush holder, the brush holder assembly should be replaced. Touch one probe to the non-insulated brush holders and the other probe to the holder plate. If you measure any resistance, the brush holder must be replaced.

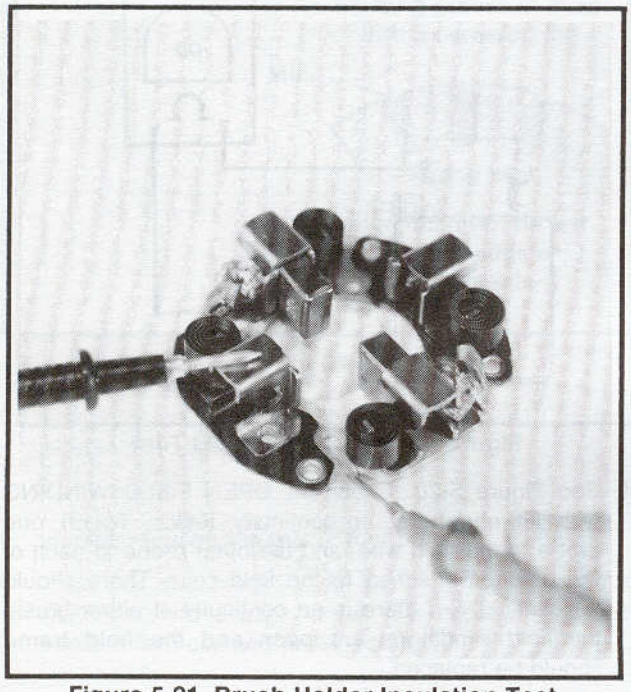


Figure 5-21. Brush Holder Insulation Test

16. See Figure 5-9. Check armature bearings (10) and replace if necessary.

NOTE

See Figure 5-9. Spring (21) and ball (22) are loose in shaft gear end.

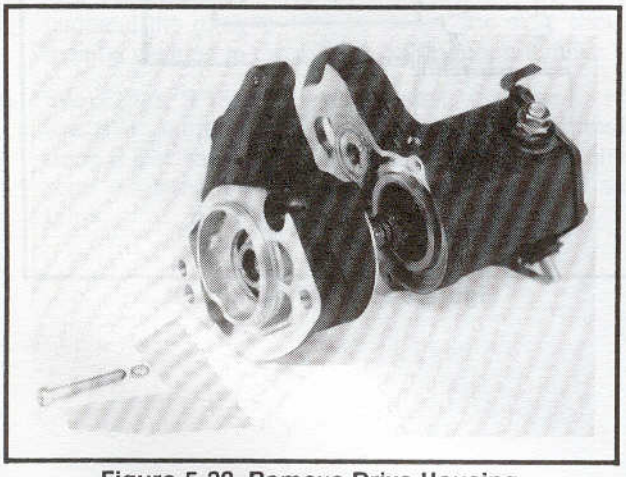


Figure 5-22. Remove Drive Housing

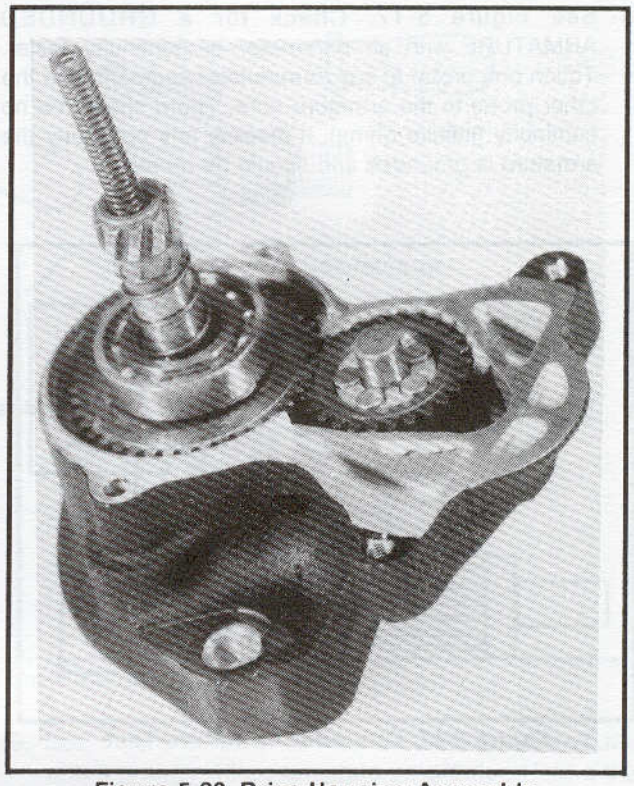


Figure 5-23. Drive Housing Assembly

17. See Figures 5-9, 5-22 and 5-23. Remove the two drive housing mounting screws (11) and washers (12). Remove drive housing (13) from solenoid housing (14).

18. See Figures 5-8 and 5-24. Remove drive (15), idler gear (16) and idler gear bearing (17) from drive housing (13). O-ring (18) is in groove in drive housing.

19. Remove spring (19) and shaft (20).

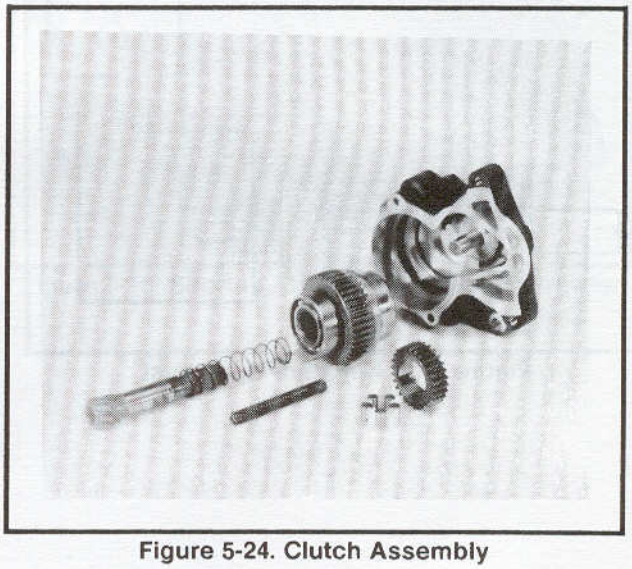


Figure 5-24. Clutch Assembly

ASSEMBLY (FIGURE 5-9)

1. See Figure 5-9. Replace O-rings (18, 23).

CAUTION

Do not use solvents to clean drive assembly/overrunning 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 drive housing (13) to solenoid housing (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 field coil (3) to solenoid housing (16).

6. Replace brush springs (6), if necessary. Install brushes (7) and brush holder (8).

7. Install end cover (4) with screw (5).

8. Install thru-bolts (2).

9. Connect solenoid wire (1) to terminal.

STARTER SOLENOID

GENERAL

The starter solenoid is a switch, 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. When the winding is energized by the battery, the magnetism produced pulls the plunger into the coil. The plunger moves against two main switch contacts, closing the circuit.

DISASSEMBLY (Figure 5-25)

1. Remove screws and washers (1). Clip (2) comes off with screw.
2. Remove cover (3) and gasket (4). Discard gasket.
3. Plunger (5) can now be removed from solenoid housing (6).

ASSEMBLY

1. Replace wire connection hardware as necessary.
2. Install plunger (5) in solenoid housing (6).
3. Install new gasket (4). Place cover (3) in position and install screws, washers (1) and clip (2).

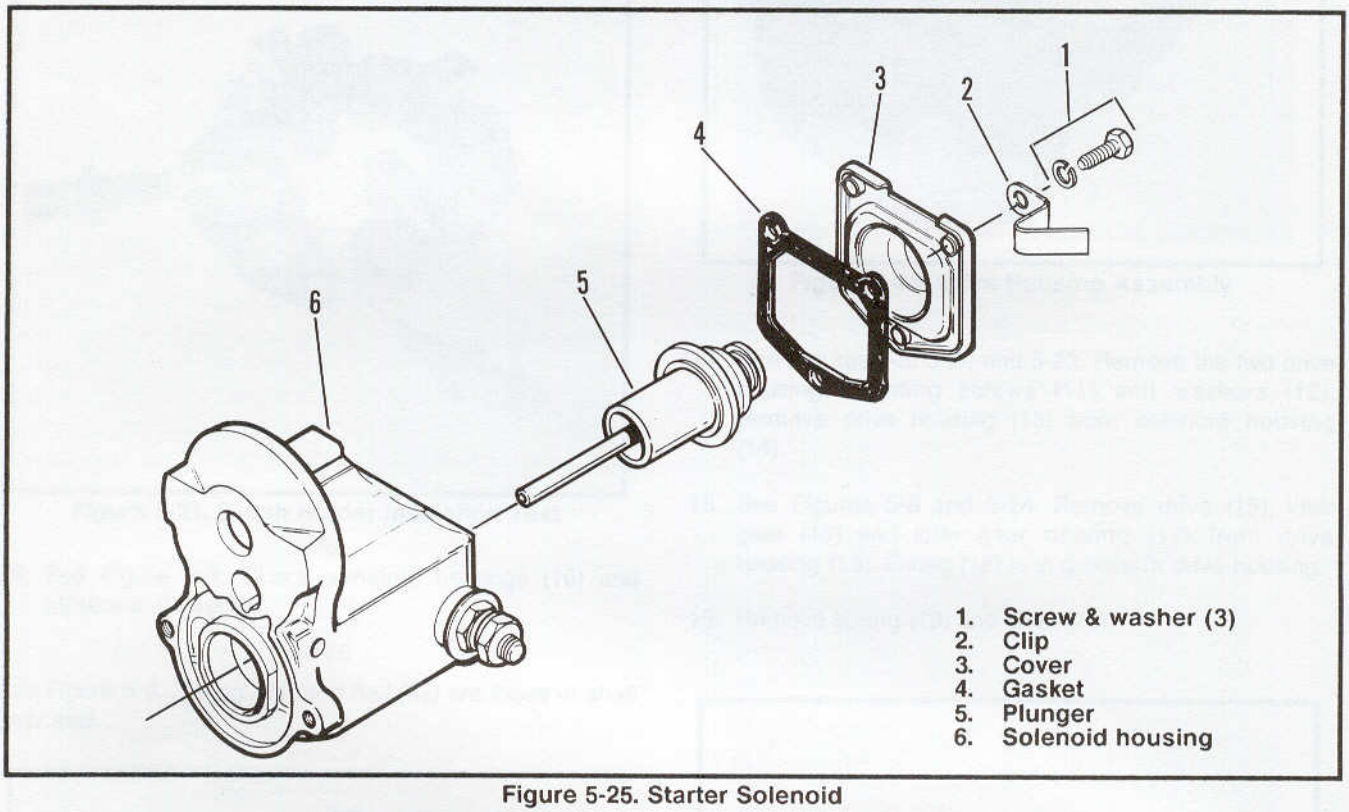


Figure 5-25. Starter Solenoid

STARTER JACKSHAFT

REMOVAL/DISASSEMBLY (Figures 5-26 and 5-27)

WARNING

To prevent accidental start-up of vehicle and possible personal injury disconnect the battery cable (negative cable first) before performing any of the following procedures.

1. Remove primary cover. See DRIVE, Section 6.
2. Remove clutch. See DRIVE, Section 6.
3. Hold pinion gear in place and remove jackshaft bolt (1), lockplate (2), thrust washer (3) and O-ring (4).

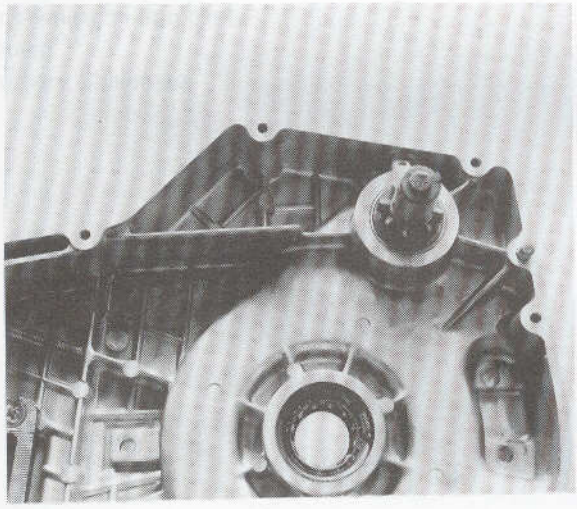


Figure 5-26. Primary Chaincase & Jackshaft Ass'y

4. Remove jackshaft from inner primary as an assembly.
5. Remove pinion gear (5) from jackshaft (6).
6. Remove coupling (7) and spring (8). Spring (8) and retaining ring (9) are inside coupling (7). Replace retaining ring if necessary.

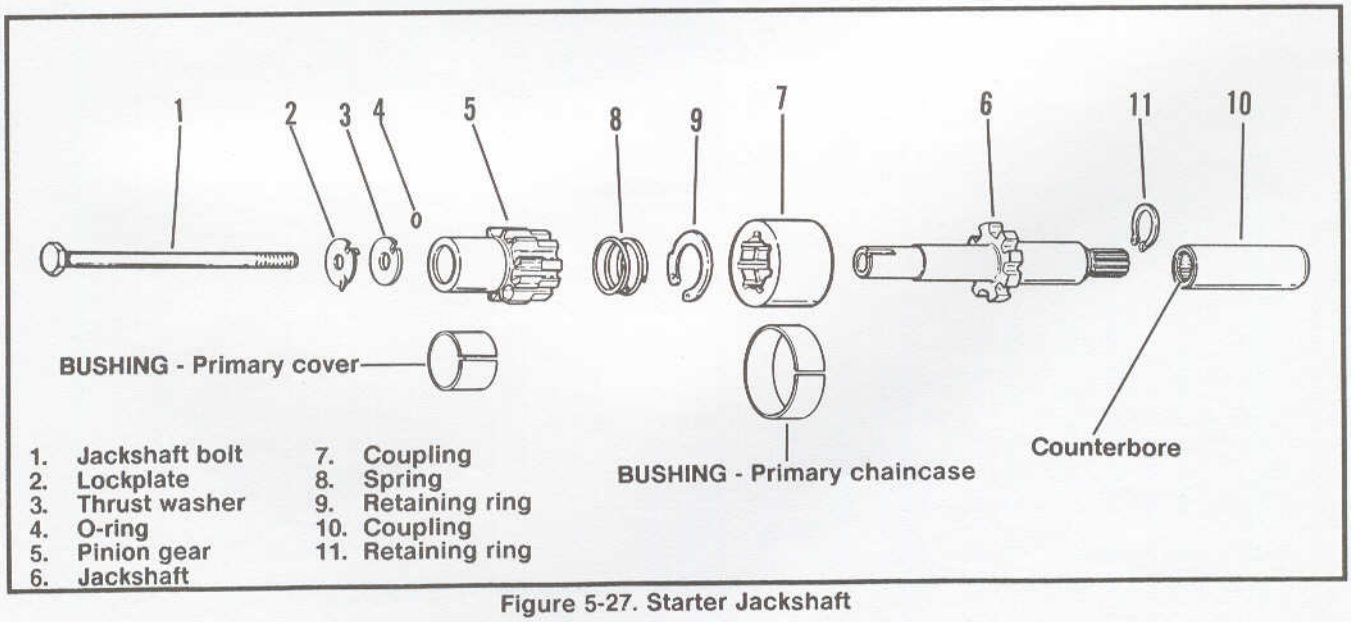
4. Remove jackshaft from inner primary as an assembly.
5. Remove pinion gear (5) from jackshaft (6).
6. Remove coupling (7) and spring (8). Spring (8) and retaining ring (9) are inside coupling (7). Replace retaining ring if necessary.

7. If coupling (10) did not come off with jackshaft assembly, remove it from the starter shaft. Replace retaining ring (11) if necessary.

ASSEMBLY/INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Jackshaft bolt 7 - 9

1. Insert retaining ring (9) in coupling (7). Install coupling and retaining ring on jackshaft (6). Shallow side of coupling faces jackshaft splines. Place spring (8) inside coupling.
2. Install pinion gear (5) on shaft.
3. Place lockplate (2), thrust washer (3) and O-ring (4) on bolt (1). Apply Hylomar to O-ring (4). Insert bolt into shaft.



1. Jackshaft bolt
2. Lockplate
3. Thrust washer
4. O-ring
5. Pinion gear
6. Jackshaft
7. Coupling
8. Spring
9. Retaining ring
10. Coupling
11. Retaining ring

Figure 5-27. Starter Jackshaft

NOTE

When you install the coupling (10), be sure the end with the COUNTERBORE goes toward the jackshaft.

4. Install retaining ring (11) if removed and place coupling (10) on shaft (6). Slide jackshaft assembly into position in inner primary.

CAUTION

Be sure the lockplate tab is in the keyway. This will hold lockplate and thrust washer in place.

5. Align lockplate tab and thrust washer slot with jackshaft keyway. Screw the jackshaft bolt into the starter shaft.
6. Hold the pinion gear in position and tighten the bolt to 7-9 ft-lbs torque.
7. Bend locking tab against bolt head.
8. Install clutch. See DRIVE, Section 6.
9. Install primary cover. See DRIVE, Section 6.

SPECIFICATIONS

DRIVE ADJUSTMENTS

Primary chain:	Deflection
Cold engine	5/16-7/8 in.
Hot engine	3/8-5/8 in.

Belt	Deflection
FLSTC/F, FXSTC/S	3/8-1/2 in., in top strand with 10 lbs upward force

CLUTCH

Type	Wet-multiple disc
Capacity	128 ft-lbs torque
Spring pressure	374 lbs engaged
Clutch lever free play	1/16-1/8 in.

LUBRICANTS

Primary chaincase:

Harley-Davidson PRIMARY CHAINCASE LUBRICANT
Part No. 99887-84/qt.

Fill to bottom of clutch diaphragm spring (2.75 inches below the center line of the clutch adjusting screw) with vehicle upright and level, approximately 30-36 oz.

SPROCKETS

Sprocket	No. of teeth
Engine	24
Clutch	37
Transmission	32
Rear wheel	70

TORQUES

Primary cover screws	9-10 ft-lbs
Compensating sprocket nut	150-165 ft-lbs
Transmission sprocket nut	110-120 ft-lbs
Transmission sprocket locking screw	50-60 in-lbs
Clutch hub nut	70-80 ft-lbs

PRIMARY CHAIN

GENERAL

Inspect the chain periodically for cracked, broken or badly worn links. Chain adjustment must be inspected every 5000 miles. As chains stretch and wear they run tighter at one spot than another. Always adjust free movement at the tightest spot in the chain to allow specified play midway between sprockets. Do not adjust tighter. Running chains too tight will result in excessive wear.

There are two sprockets inside the primary case: The engine compensating sprocket and the clutch sprocket.

ADJUSTMENT

Primary chain tension is adjusted by a shoe located in the primary chain case. The shoe is raised or lowered to tighten or loosen the chain. The chain should have free up and down movement in the upper strand midway between the sprockets. This deflection should be 5/16-7/8 in. with the engine cold and 3/8-5/8 in. with the engine hot. Adjust the chain as follows:

WARNING

To prevent accidental start-up of vehicle and possible personal injury disconnect the battery cable (negative cable first) before performing any of the following procedures.

CAUTION

The Print-O-Seal gasket between the primary chain adjustment inspection cover and the chaincase cover must be replaced each time the cover is removed.

1. See Figure 6-1. With vehicle upright and level, remove the primary case inspection cover. There will be a loss of lubricant.

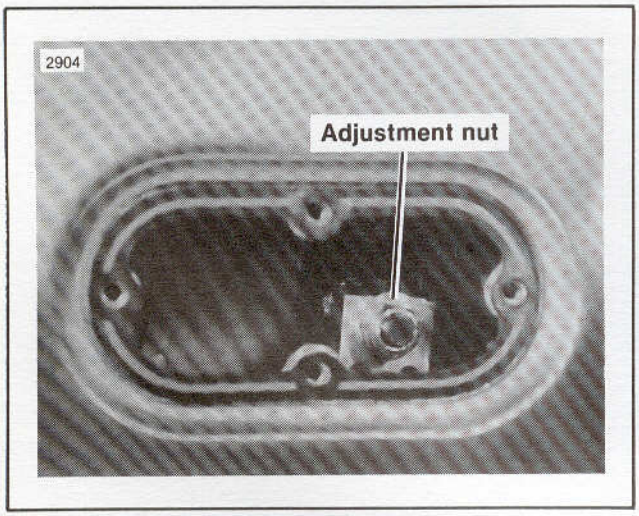


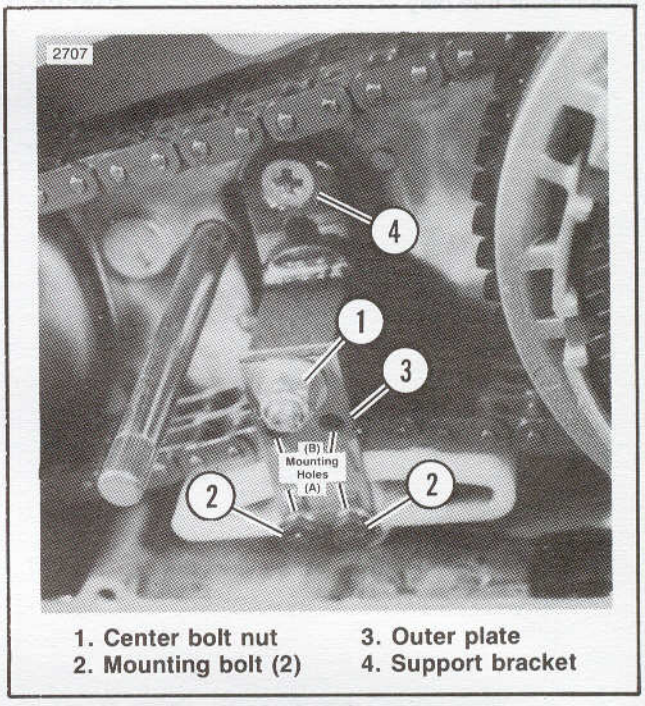
Figure 6-1. Primary Chain Adjustment

2. See Figure 6-2. Remove the center bolt nut and washer (1) and move the shoe assembly up or down to obtain the specified free play.
3. Install washer and new nut.
4. Install inspection cover with new gasket.
5. Remove clutch inspection cover and refill primary. Reinstall clutch inspection cover.

Replacing the Adjusting Shoe (Figure 6-2)

If the adjusting shoe is worn and proper adjustment cannot be obtained replace the shoe as follows:

1. See Figure 6-2. Remove primary cover. Remove the center bolt and washer (1) and two bottom bolts (2). Remove the shoe and replace it.



1. Center bolt nut
2. Mounting bolt (2)
3. Outer plate
4. Support bracket

Figure 6-2. Replacing the Adjusting Shoe

LUBRICATION

The primary chaincase lubricant is changed after the first 500 miles and every 5000 miles thereafter. Use Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 for all operating temperatures.

Changing Lubricant

The lubricant is replaced every 5000 miles at the same time clutch adjustment is checked.

1. Stand vehicle in vertical position and remove clutch cover.

2. Drain lubricant into suitable container by removing drain plug at bottom of primary chaincase.
3. Clean drain plug and install drain plug in chaincase cover.
4. Refill chaincase through clutch cover opening with recommended lubricant. See CHECKING LUBRICANT, below.
5. Reinstall clutch cover with new O-ring if damaged. Replace seals at screws prior to assembly.

Checking Lubricant

1. Stand the vehicle in a vertical position and remove clutch cover.
2. The lubricant level is visually checked through clutch cover opening. The primary chaincase lubricant should be level with bottom of clutch spring outside diameter (2.75 inches below the center line of the clutch adjusting screw), approximately 30-36 oz.
3. Add lubricant to recommended level, if necessary.

PRIMARY CHAIN REMOVAL

The chain must be replaced when it is worn to the point that it cannot be properly adjusted.

WARNING

To prevent accidental start-up of vehicle and possible personal injury disconnect the battery cable (negative cable first) before performing any of the following procedures.

1. Perform steps 1 through 3 of the CLUTCH DISASSEMBLY ON MOTORCYCLE procedure.
2. Perform steps 2 through 5 of the CLUTCH REMOVAL procedure.

CLEANING, INSPECTION AND REPAIR

1. Inspect compensating sprocket components for wear and damage. Replace damaged or broken parts.
2. Inspect clutch sprocket for wear and damage. If broken or damaged teeth are found, the clutch shell and sprocket assembly must be replaced.

PRIMARY CHAIN INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Compensating sprocket nut 150-165

Assemble compensating sprocket, primary chain, chain adjuster and clutch as an assembly. Tighten compensating sprocket nut (1) to 150-165 ft-lbs torque.

See Figure 6-3. Be sure correct spacer(s) (as req'd) (7) is used and spacers are assembled in the order shown.

Sprocket Alignment

1. With the primary chain properly tensioned, push inward on the chain at both sprockets so all chain side clearance is to the inside of sprockets.
2. Place a straightedge across the chain cover gasket surface. Measure from straightedge to chain side plates as close to both sprockets as possible. The difference will be the spacer (7) thickness that needs to be added or subtracted (if necessary).

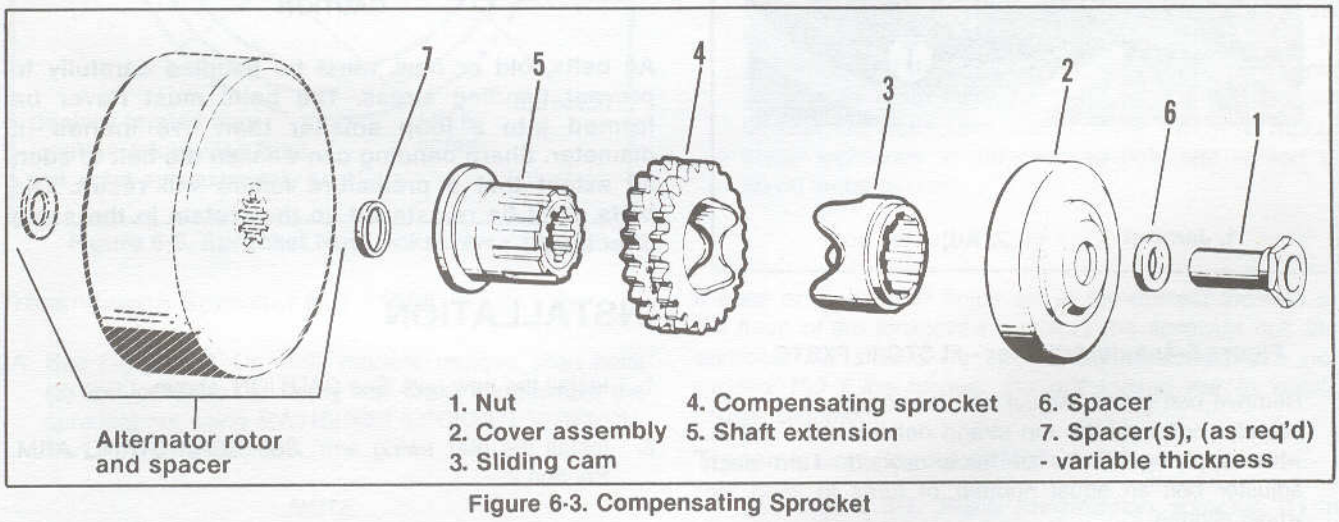


Figure 6-3. Compensating Sprocket

DRIVE BELT AND SPROCKET

GENERAL

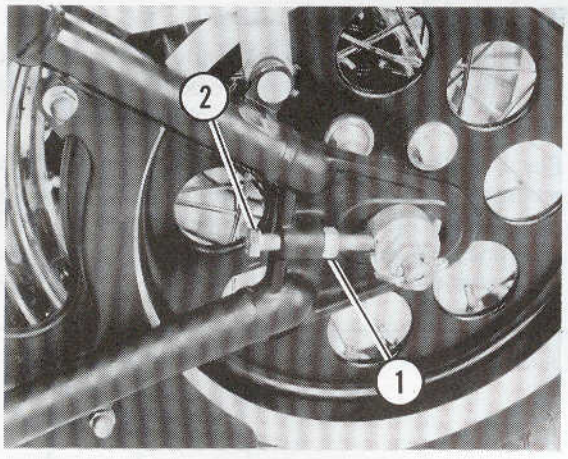
The rear wheel sprocket is bolted to the rear wheel. Replacement procedures are given in Section 2.

The transmission sprocket is located on the main drive gear between the primary chain housing and the transmission case.

ADJUSTMENT

Belt tension is set at the factory and should be adjusted after the first 500 miles and inspected every 5000 miles thereafter.

1. See Figures 6-4, 6-5. DO NOT LOOSEN AXLE NUT. Loosen jamnut (1).



1. Jamnut **2. Adjuster bolt**

Figure 6-4. Axle Adjuster - FLSTC/F, FXSTC

2. Remove belt guard. Adjust belt tension by turning the adjuster bolt until the top strand deflects 3/8 - 1/2 in. while applying 10 lbs of force upward. Turn each adjuster bolt an equal number of turns to keep the wheel aligned.

NOTE

This method of belt adjustment will seat all adjusting components.

3. If the axle nuts are loosened, for instance to replace the wheel or belt, belt tension must be rechecked and the procedure above repeated after 25-50 vehicle miles.

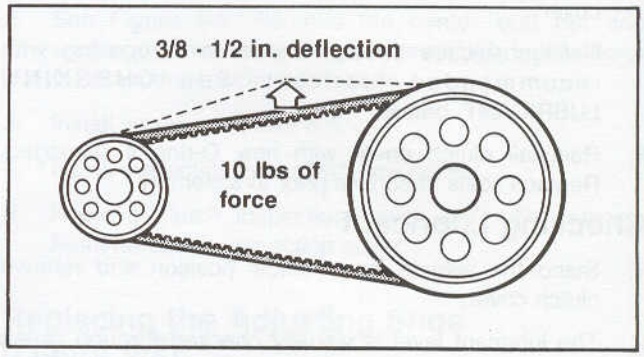


Figure 6-5. Belt Adjustment

REMOVAL

1. Follow the removal procedures as described under REAR WHEEL, in Section 2.
2. Remove the compensating sprocket and clutch as an assembly as described under CLUTCH, DISASSEMBLY later in this section.
3. Remove the primary housing as described in PRIMARY CHAINCASE, DISASSEMBLY later in this section.
4. Remove the rear swing arm.
5. Remove the old belt from the transmission sprocket.

CAUTION

All belts, old or new, must be handled carefully to prevent bending stress. The belts must never be formed into a loop smaller than five inches in diameter. Sharp bending can weaken the belt to such an extent that a premature failure will result. Old belts must be reinstalled so they rotate in the same direction.

INSTALLATION

1. Install the new belt. See CAUTION, above.
2. Install the rear swing arm. See REAR SWING ARM, Section 2.
3. Install the primary housing as described in PRIMARY CHAINCASE, ASSEMBLY.
4. Install the compensating sprocket, primary chain and clutch as described under PRIMARY CHAIN INSTALLATION later in this section.
5. Follow the sprocket installation procedures as described in REAR WHEEL, Section 2.

TRANSMISSION SPROCKET

REMOVAL

Special Tools	Torque Values (ft-lbs)
HD-94660-37A Mainshaft locknut wrench	None

Transmission Sprocket Nut - 1991

1. Remove primary chain and chaincase as described under PRIMARY CHAINCASE, DISASSEMBLY later in this section.
2. See Figure 6-6. On 1991 models, remove the socket head lockscrew installed next to one of the nut flats. Apply rear brake and remove the sprocket nut using MAINSHAFT LOCKNUT WRENCH, Part No. HD-94660-37A.

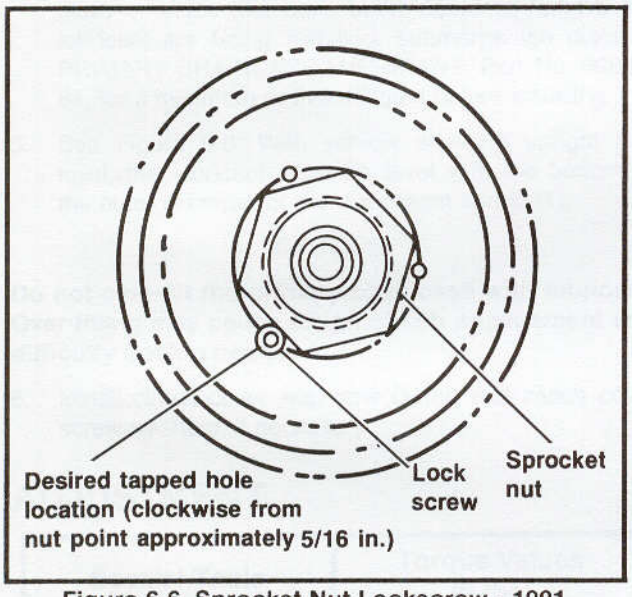


Figure 6-6. Sprocket Nut Lockscrew - 1991

Transmission Sprocket Nut - 1992

2A. See Figure 6-7. On 1992 models, remove allen bolts (3) and lockplate (2). Apply rear brake and remove the sprocket nut using MAINSHAFT LOCKNUT WRENCH, Part No. HD-94660-37A.

NOTE

Sprocket nut has a left hand thread.

3. Loosen rear axle and adjusters so rear wheel can be moved all the way forward. Remove belt from sprocket as you remove sprocket.

CLEANING, INSPECTION AND REPAIR

1. Clean sprocket of all grease and dirt using solvent.
2. Replace sprocket if there is any damage or cracks.
3. Check sprocket teeth for wear. Worn sprocket teeth will accelerate belt wear and can damage belt teeth.

INSTALLATION

Special Tools	Torque Values (See Below)
HD-94660-37A Mainshaft locknut wrench	Transmission sprocket nut 110 - 120 (ft-lbs) *(See NOTES)* Lockscrew - 1991 50 - 60 (in-lbs) Allen head screws - 1992 7 - 9 (ft-lbs)

Transmission Sprocket Nut - 1991

1. Place sprocket on main drive gear. Use Loctite 262 (red) and install nut.
2. Place belt on sprocket. Move rear wheel back and tighten axle nut and adjusters.
3. See Figure 6-6. Apply rear brake and tighten sprocket nut to 110-120 ft-lbs torque using MAINSHAFT LOCKNUT WRENCH, Part No. 94660-37A. Turn the sprocket nut an additional amount, just enough to expose one of three lockscrew holes. The proper hole location in relationship to the nut is shown. Coat threads of lockscrew with Loctite LOCK'N SEAL. Install lockscrew in the exposed hole and tighten to 50-60 in-lbs torque.

NOTE

If none of the tapped holes are in the correct location or the head of the lockscrew contacts the sprocket nut, the sprocket nut should be additionally tightened. Do not exceed 150 ft-lbs torque. Do not loosen nut to obtain proper alignment.

Transmission Sprocket Nut - 1992

4. See Figure 6-7. Place transmission sprocket (1) in position. Use Loctite 262 (red) and install sprocket nut. Tighten nut to 110 - 120 ft-lbs torque.
5. Place the lockplate (2) in position over the nut so the lockplate screw holes and transmission sprocket screw holes line up.

NOTE

The lockplate has 4 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 can not align the screw holes properly, the nut may be additionally TIGHTENED until the screw holes line up. DO NOT tighten the nut to more than 180 ft-lbs torque. Never LOOSEN nut to align the screw holes.

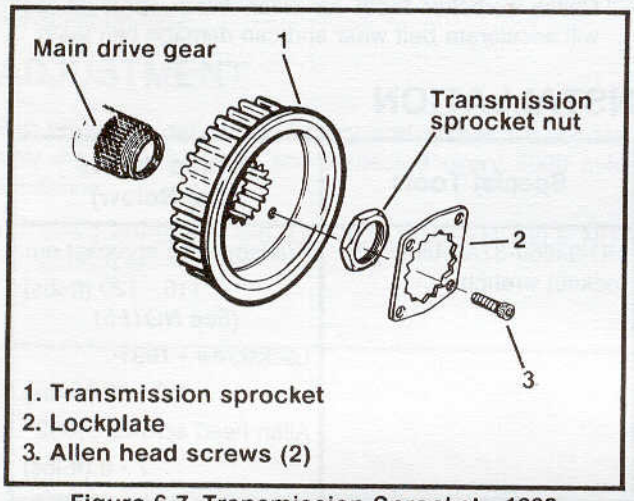


Figure 6-7. Transmission Sprocket - 1992

CAUTION

To ensure the lockplate's security, you must use BOTH screws when you install the lockplate.

6. Install allen head screws (3) and tighten to 7 - 9 ft-lbs torque.

NOTE

The allen head screws have Loctite patches and can be re-used 3 - 5 times.

7. Install primary chain and chaincase as described under PRIMARY CHAINCASE, ASSEMBLY later in this section.

8. Align vehicle and adjust belt tension. See VEHICLE ALIGNMENT, Section 2.

CLUTCH

GENERAL

The clutch is a wet, multi-plate, diaphragm spring design. The clutch is located in the primary chaincase, which contains Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No.99887-84.

LUBRICATION

The primary chaincase lubricant is changed after the first 500 miles and every 5000 miles thereafter. Use Harley-Davidson PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84 for all operating temperatures.

1. Drain lubricant into suitable container by removing drain plug at bottom of primary chaincase.
2. Clean drain plug. Install drain plug in chaincase.
3. Remove clutch cover.
4. Refill chaincase through clutch cover opening with approximately 30–36 ounces of Harley-Davidson PRIMARY CHAINCASE LUBRICANT. If new clutch discs or discs that have been wiped to remove the lubricant are being installed, submerge the discs in PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84, for a minimum of five minutes before installing
5. See Figure 6-8. With vehicle standing upright and level, the lubricant must be level with the bottom of the outer diameter of the diaphragm spring (1).

CAUTION

Do not over-fill the primary chaincase with lubricant. Over-filling may cause rough clutch engagement and difficulty finding neutral.

6. Install clutch cover with new O-ring and clutch cover screw washers, if necessary.

ADJUSTMENT

Special Tools	Torque Values (ft-lbs)
None	Clutch adjusting screw jamnut 6 - 10

CAUTION

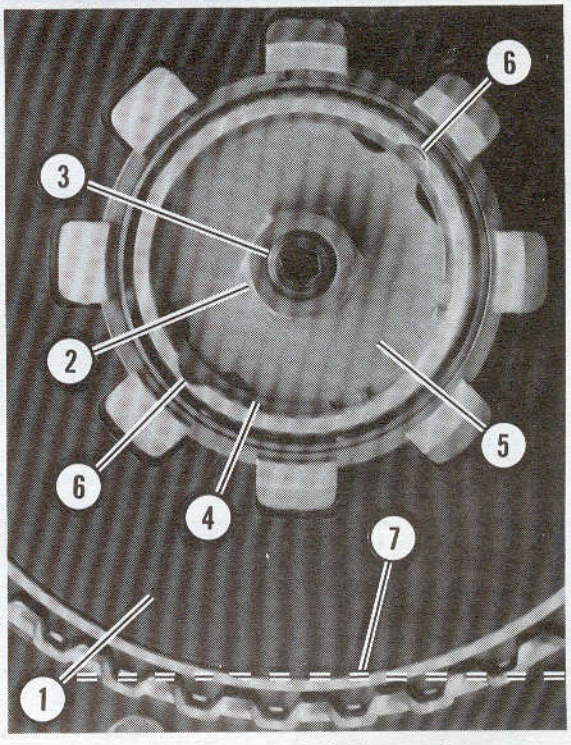
The clutch adjustment should be performed with the motorcycle at room temperature. See Figure 6-8. The clearance at the adjuster screw (3) will increase as the power train temperature increases. If adjuster screw is adjusted with power train hot, clearance at push rod bearing will be insufficient and clutch slippage will occur.

For proper clutch operation, it is most important to perform the following clutch adjustment at pre-delivery, 500 mile inspection, and every service interval thereafter.

NOTE

If clutch components are replaced during normal servicing, this adjustment must be performed. Adjust again after 500 miles of use.

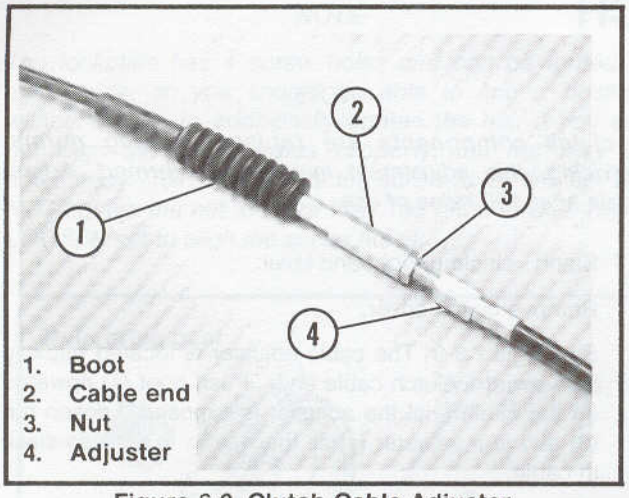
1. Stand vehicle upright and level.
2. Remove clutch cover.
3. See Figure 6-9. The cable adjuster is located midway between the clutch cable ends. Push boot (1) upwards on the cable until the adjuster is exposed. Loosen nut (3) and turn adjuster (4) all the way in to provide slack in cable.
4. See Figure 6-8. Loosen clutch adjuster screw jamnut (2) and turn push rod adjusting screw (3) inward (clockwise) to take up all free play in push rods.



1. Diaphragm spring
2. Jamnut
3. Adjuster screw
4. Retaining ring
5. Release plate
6. Slot
7. Lubricant level (motorcycle upright and level)

Figure 6-8. Push Rod Adjustment

5. Back out adjusting screw (counterclockwise) 1/2 to 1 full turn and tighten jamnut to 6 - 10 ft-lbs torque, while holding adjusting screw with an allen wrench.
6. See Figures 6-9, 6-10. Squeeze clutch lever to maximum limit three times, to set ball and ramp release mechanism. Pull outer cable conduit and at the same time adjust cable adjuster (4) to provide 1/8 - 3/16 in. free play at hand lever. Tighten jamnut (3) and return boot over adjuster.



1. Boot
2. Cable end
3. Nut
4. Adjuster

Figure 6-9. Clutch Cable Adjuster

7. Install clutch cover. Install new O-ring and washers, if necessary.

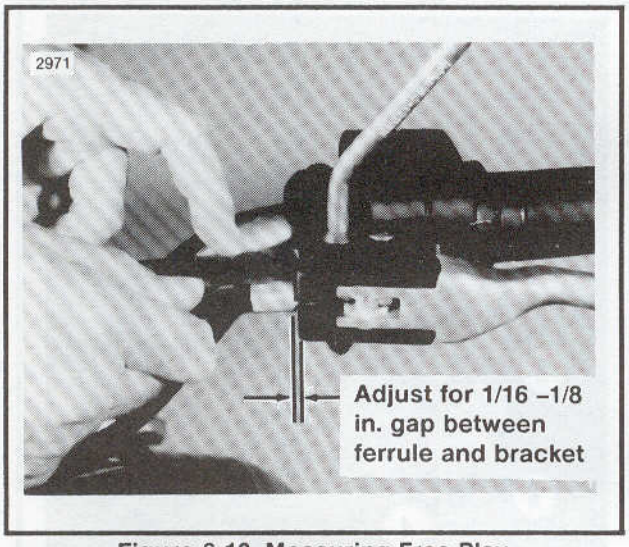


Figure 6-10. Measuring Free Play

DISASSEMBLY ON MOTORCYCLE

Special Tools	Torque Values (ft-lbs)
HD-38515 Clutch spring compressing tool	None

WARNING

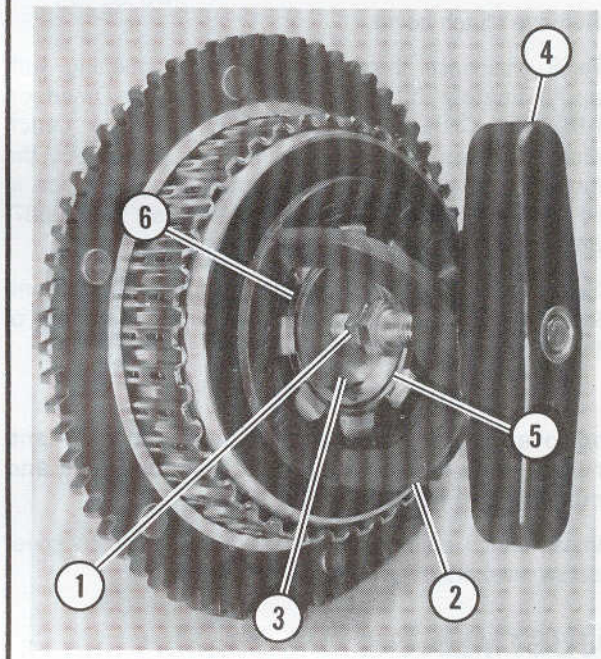
To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. Drain primary chaincase lubricant. See LUBRICATION, earlier in this section.
2. Remove primary chaincase cover.
3. See Figure 6-8. Loosen jamnut (2) and remove adjuster screw (3) and jamnut.

WARNING

Do not attempt to disassemble the clutch without SPRING COMPRESSING TOOL, Part No. HD-38515. The diaphragm spring is highly compressed and could fly out with great force, causing injury, if the SPRING COMPRESSING TOOL is not used to remove the spring load.

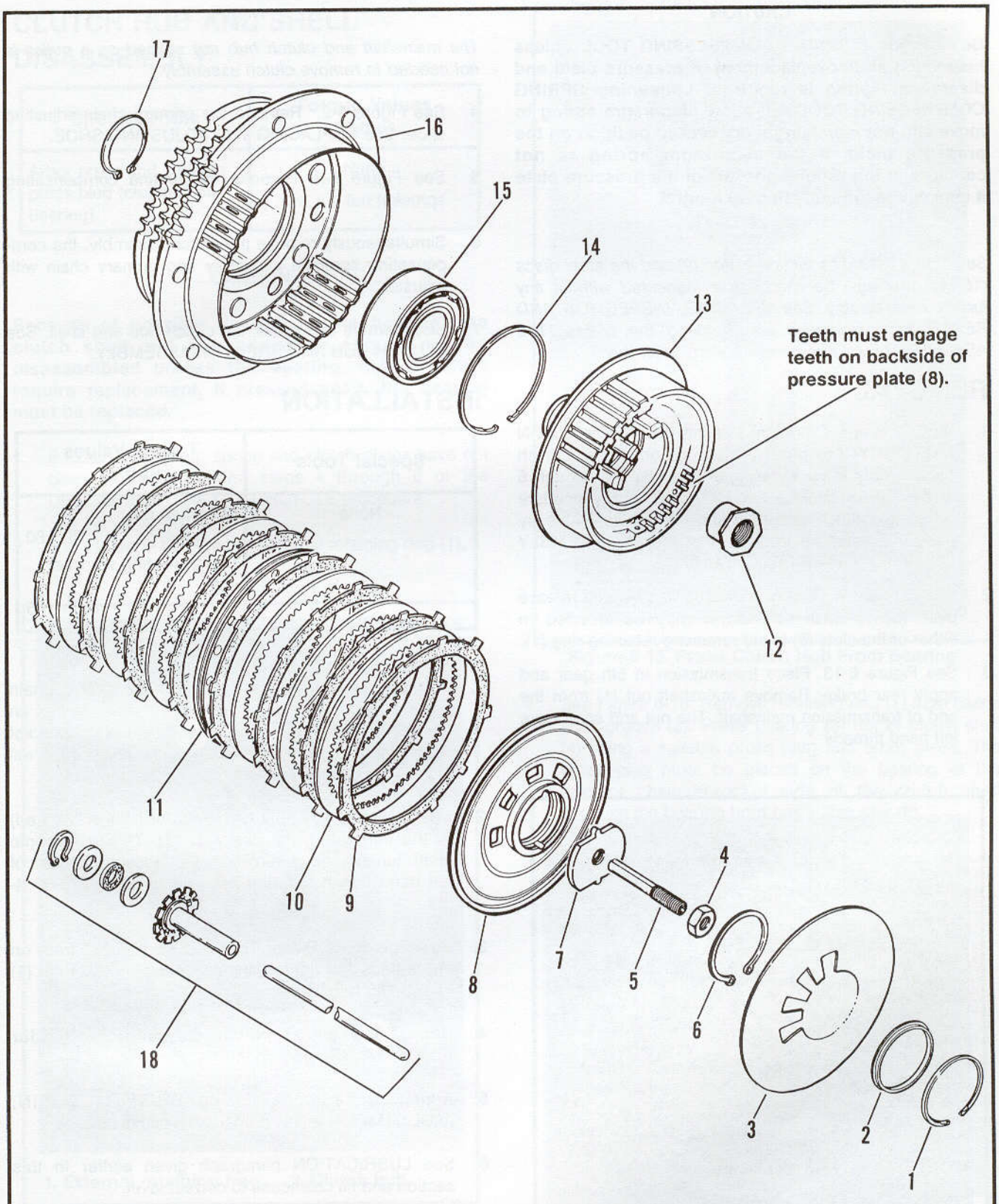
4. See Figure 6-11. Thread forcing screw (1) of H-D SPRING COMPRESSING TOOL, Part No. HD-38515 (2), into the threaded hole in release plate (3) until hex on forcing screw contacts release plate.



1. Forcing screw
2. Spring compressing tool, HD-38515
3. Release plate
4. Handle
5. Clutch spring seat
6. Retaining ring

6-11. Compressing Clutch Diaphragm Spring

5. Turn handle (4) clockwise to compress the diaphragm spring and move the clutch spring seat (5) inward enough to allow removing retaining ring (6). Remove retaining ring (6) with a retaining ring pliers or gently pry ring from its groove with a screwdriver.
6. See Figure 6-11, 6-12. Remove SPRING COMPRESSING TOOL, Part No. HD-38515 with diaphragm spring (3) and pressure plate (8) attached.



1. Internal retaining ring
2. Clutch spring seat
3. Diaphragm spring
4. Locknut
5. Adjusting screw
6. Internal retaining ring
7. Release plate
8. Pressure plate
9. Friction plate (8)
10. Steel plate (6)
11. Spring plate
12. Nut (main shaft, left hand threads)
13. Clutch hub
14. Internal retaining ring
15. Double-row ball bearing
16. Clutch shell
17. External retaining ring
18. Push rod components

Figure 6-12. Clutch Assembly

CAUTION

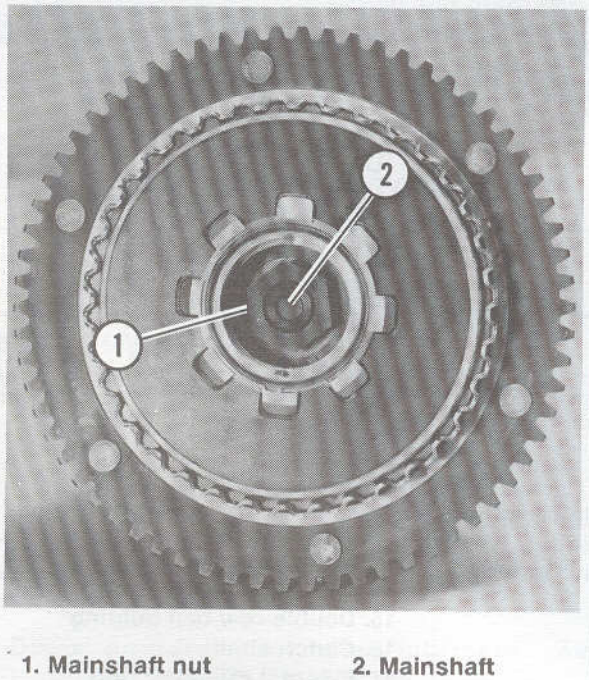
Do not loosen SPRING COMPRESSING TOOL unless inspection and/or replacement of pressure plate and diaphragm spring is required. Loosening SPRING COMPRESSING TOOL will allow diaphragm spring to move and not maintain its concentric position on the pressure plate. If the diaphragm spring is not centered in the "spring-pocket" of the pressure plate it may cause difficulty finding neutral.

NOTE

See Figure 6-12. The friction plates (9) and the steel discs (10, 11) can now be changed or inspected without any further disassembly. See CLEANING, INSPECTION AND REPAIR for instructions on checking the plates. The ASSEMBLY procedure covers clutch assembly.

REMOVAL

1. Perform steps 1 through 3 of the DISASSEMBLY ON MOTORCYCLE procedure. If complete clutch disassembly is necessary, perform steps 1 through 6 of the DISASSEMBLY ON MOTORCYCLE procedure or remove clutch assembly and then disassemble by performing steps 4 through 6 of the DISASSEMBLY ON MOTORCYCLE PROCEDURE.
2. See Figure 6-8. Remove retaining ring (4) and release plate (5). A small screwdriver may be inserted in either of the slots (6) to aid removing retaining ring (4).
3. See Figure 6-13. Place transmission in 5th gear and apply rear brake. Remove mainshaft nut (1) from the end of transmission mainshaft. The nut and shaft have left hand threads.



1. Mainshaft nut 2. Mainshaft

Figure 6-13. Mainshaft Nut

NOTE

The mainshaft and clutch hub are splined so a puller is not needed to remove clutch assembly.

4. See Figure 6-2. Remove the primary chain adjusting shoe. See REPLACING THE ADJUSTING SHOE.
5. See Figure 6-3. Remove the engine compensating sprocket nut.
6. Simultaneously remove the clutch assembly, the compensating sprocket assembly and primary chain with adjuster.
7. Disassemble and repair the clutch hub and shell. See CLUTCH HUB AND SHELL DISASSEMBLY.

INSTALLATION

Special Tools	Torque Values (ft-lbs)
None	Mainshaft nut 70 - 80 Compensating sprocket nut 150 - 165

1. The compensating sprocket, primary chain, chain adjuster and clutch assembly must be installed as an assembly. The clutch hub and compensating sprocket are splined, so a slight rotation of the chain drive will aid in lining up the splines.
2. See Figure 6-13. Apply two drops of Loctite 262 (red) to the threads of mainshaft nut (1). Thread nut onto shaft, turning in counterclockwise direction because of left hand thread. Tighten nut to a torque of 70-80 ft-lbs.
3. See Figure 6-3. Place 2 drops of Loctite 262 (red) on nut threads and tighten compensating sprocket nut (1) to 150-165 ft-lbs torque.
4. Check and adjust clutch as instructed under ADJUSTMENT earlier in this section.
5. Adjust primary chain. See PRIMARY CHAIN, ADJUSTMENT. Install primary chaincase cover.
6. See LUBRICATION paragraph given earlier in this section and fill chaincase to correct level.
7. Replace O-ring if damaged and place clutch inspection cover in position on primary chaincase.
8. Use new sealing washers and install clutch inspection cover screws. Tighten screws to a torque of 7-9 ft-lbs.

CLUTCH HUB AND SHELL DISASSEMBLY

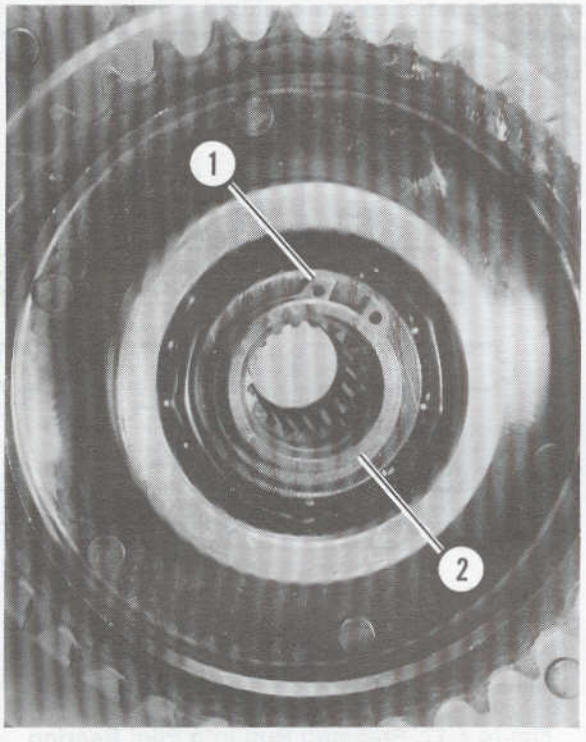
Special Tools	Torque Values (ft-lbs)
Arbor press and suitable press plug (clutch shell bearing)	None

CAUTION

Because of possible damage to the bearing, the clutch shell and hub assembly should not be disassembled unless the bearing, hub or shell require replacement. If pressed apart, the bearing must be replaced.

1. If clutch diaphragm spring and clutch plates have not been removed, perform steps 4 through 6 of the DISASSEMBLY ON MOTORCYCLE procedure.

2. See Figure 6-14. Remove external retaining ring (1).



1. External retaining ring 2. Clutch hub

Figure 6-14. Clutch Hub Retaining Ring

3. See Figure 6-15. Press clutch hub from inner bearing race with arbor press.

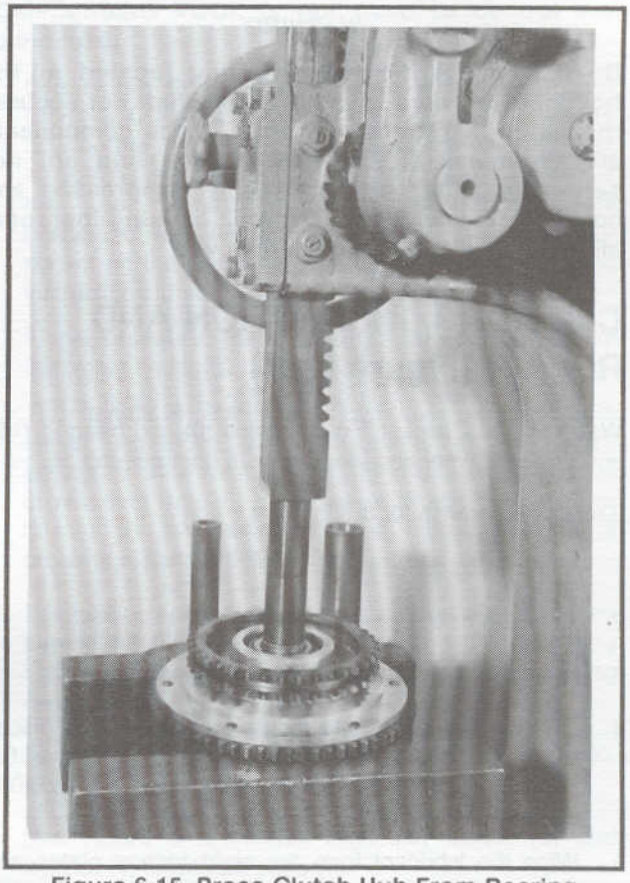
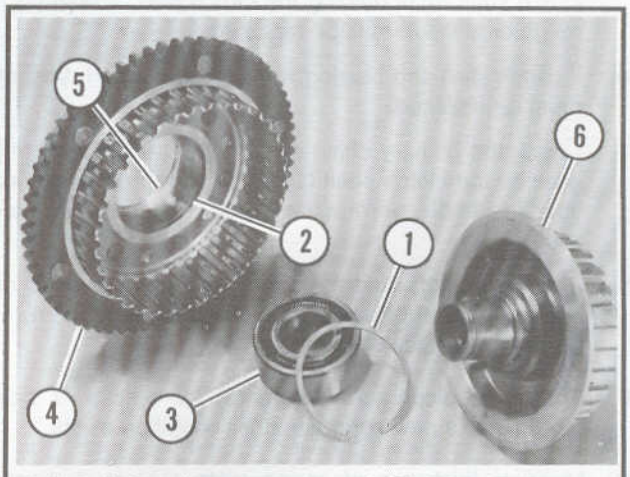


Figure 6-15. Press Clutch Hub From Bearing

4. See Figure 6-16. Remove retaining ring (1) from clutch shell groove (2). Press bearing (3) out of clutch shell (4) using a suitable press plug and arbor press. The press plug must be placed on the bearing at the primary chain sprocket side of the clutch shell because the bearing bore has a shoulder (5).



1. Retaining ring
2. Clutch shell groove
3. Bearing
4. Clutch shell
5. Shoulder
6. Clutch hub

Figure 6-16. Remove Bearing From Clutch Shell

WARNING

Do not remove the retaining ring located at the bottom of the bore where the mainshaft nut secures the clutch hub to the mainshaft. These components are assembled at the manufacturer and are not serviceable. The parts are highly compressed and could fly out with great force, causing personal injury, if the retaining ring is removed.

CLEANING, INSPECTION AND REPAIR (Figure 6-12)

Wash all parts, except friction plates (9) and bearing (15), in cleaning solvent and blow dry with compressed air.

Examine the clutch for the following:

1. Worn lining surface.
2. Checked or chipped lining.
3. Steel discs grooved or warped.
4. Check each steel plate for flatness in several places using a feeler gauge while the plate is on a flat surface. Replace any that are warped more than 0.006 in.
5. Wipe the lubricant from the eight friction plates and stack them on top of each other. Measure the thickness of the eight stacked friction plates with a dial caliper or micrometer.

- The minimum thickness must be 0.661 in. If the thickness is less, the friction and steel plates must be discarded and a new set of both friction and steel plates must be installed.

6. Check the bearing (15) for smoothness by rotating the clutch shell while holding the clutch hub. If bearing is rough or binds it must be replaced.

- If clutch shell and bearing were pressed apart, bearing must be replaced.

7. Check the primary chain sprocket and the starter ring gear on the clutch shell (16). If either sprocket or ring gear are badly worn or damaged, replace the clutch shell.
8. Check the slots that mate with the clutch plates on both clutch shell and hub. If slots are worn or damaged, replace shell and/or hub.
9. Check the diaphragm spring (3) for cracks or bent tabs. Install a new spring if either condition exists.
10. Measure thickness of spring plate (11) in 4 places around the circumference. If you find 0.020 in. difference in any of the measurements, replace plate.

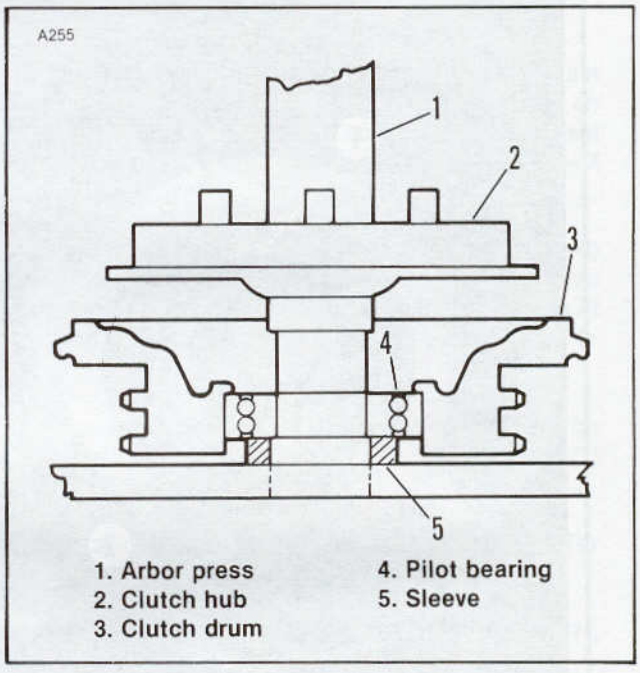
ASSEMBLY (Figure 6-12)

Special Tools	Torque Values (ft-lbs)
Arbor press and suitable press plug (clutch shell bearing) HD-38515 clutch spring compressing tool	Clutch adjusting screw jamnut 6 - 10

NOTE

Soak all plates in PRIMARY CHAINCASE LUBRICANT for at least 5 minutes before installing.

1. See Figure 6-16. With an arbor press and a press plug that contacts outer bearing race only, press bearing (3) into clutch shell (4) bore until it bottoms against shoulder (5). Install retaining ring (1) in groove (2).
2. See Figure 6-17. Place drum (shell) (3) on arbor press with pilot bearing inner race supported by a sleeve (5). Press hub (2) into bearing until hub shoulder contacts pilot bearing.



1. Arbor press
2. Clutch hub
3. Clutch drum
4. Pilot bearing
5. Sleeve

Figure 6-17. Pressing Hub into Pilot Bearing

3. See Figure 6-16. With lock ring pliers, expand external retaining ring (1) and install into groove next to bearing.

4. See Figure 6-12. Place a friction plate (9) over clutch hub (13) and into drum (16). Next place a steel plate (10) over hub (13) and into clutch shell (16). Continue installing plates alternately, starting and ending with a friction plate.

NOTE

Be sure the spring plate (11) is installed in the center of the stack as shown in Figure 6-11. If the SPRING COMPRESSING TOOL, Part No. HD-38515, has not been removed, perform steps 8 through 12. If the SPRING COMPRESSING TOOL was removed continue at step 5.

5. See Figure 6-11. Install diaphragm spring (3) on pressure plate (8) with domed or convex side of spring facing away from pressure plate. Center the diaphragm spring on the pressure plate; that is, the outer diameter of the diaphragm spring must be equidistant from the inside diameter of the pressure plate "spring pocket".

6. Place clutch spring seat (2) on diaphragm spring (3) with lip of seat facing outward. Install release plate (7) and retaining ring (6) in pressure plate (8), if they were removed.

WARNING

Do not attempt to assemble the clutch without SPRING COMPRESSING TOOL, Part No. HD-38515. The diaphragm spring is highly compressed and could fly out with great force, causing injury, if the SPRING COMPRESSING TOOL is not used to control the spring load.

7. See Figure 6-11. Thread forcing screw (1) of H-D SPRING COMPRESSING TOOL, Part No. HD-38515 (2), into the threaded hole in release plate (3) until hex on forcing screw contacts release plate. Check that the outer diameter of the diaphragm spring is concentric with the inside diameter of the spring-pocket on the pressure plate. Center spring following instructions in step 7 above if required.

8. Place pressure plate, spring, compressing tool assembly on clutch hub (13).

9. Turn handle (4) clockwise to compress the diaphragm spring and move the clutch spring seat (5) inward enough to allow retaining ring (6) installation. The ends of retaining ring (6) must not overhang the posts or bosses on the clutch hub. See Figure 6-10 for a properly installed retaining ring.

10. Release compressing force on diaphragm spring by turning handle (4) counterclockwise while checking that clutch spring seat (5) lip is seated inside retaining ring (6).

11. Remove SPRING COMPRESSING TOOL, Part No. HD-38515.

12. See Figure 6-12. Install adjusting screw (5) and locknut (4) in release plate (7).

PRIMARY CHAINCASE

GENERAL

The primary chaincase is a sealed housing containing the primary chain, clutch, engine compensating sprocket, chain adjuster, solenoid, and starter drive mechanism.

DISASSEMBLY

1. Drain the primary chaincase. Remove the primary chaincase cover, chain, clutch and engine compensating sprocket as described under CLUTCH, DISASSEMBLY given earlier in this section.
2. Remove the jackshaft as described under STARTER JACKSHAFT, REMOVAL/DISASSEMBLY in Section 5.
3. Remove the starter as described under STARTER REMOVAL in Section 5.
4. Loosen the lower engine-to-frame fasteners and transmission-to-frame fasteners.
5. See Figure 6-18. Remove the primary-to-engine mounting hardware (1). Remove the primary-to-transmission mounting hardware (2).

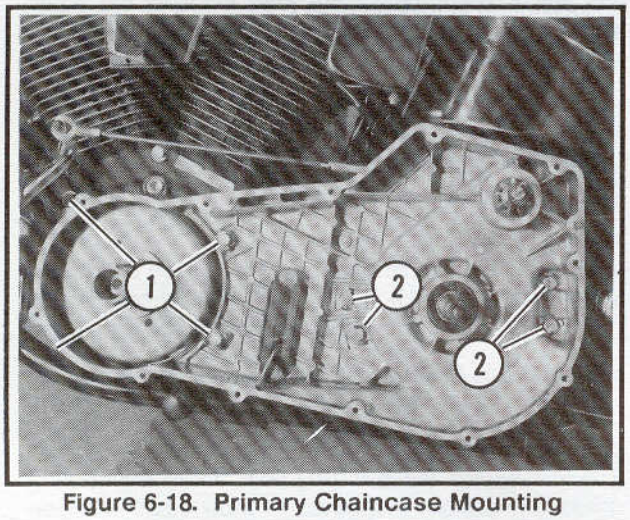


Figure 6-18. Primary Chaincase Mounting

6. Remove the primary chaincase.

CLEANING, INSPECTION AND REPAIR

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 the primary chaincase jackshaft oil seal. Replace if necessary. Drive in oil seal from inside.

NOTE

See Figure 6-19. The primary chaincase has a shoulder for the oil seal. When replacing the oil seal, be sure the oil seal seats against the shoulder.

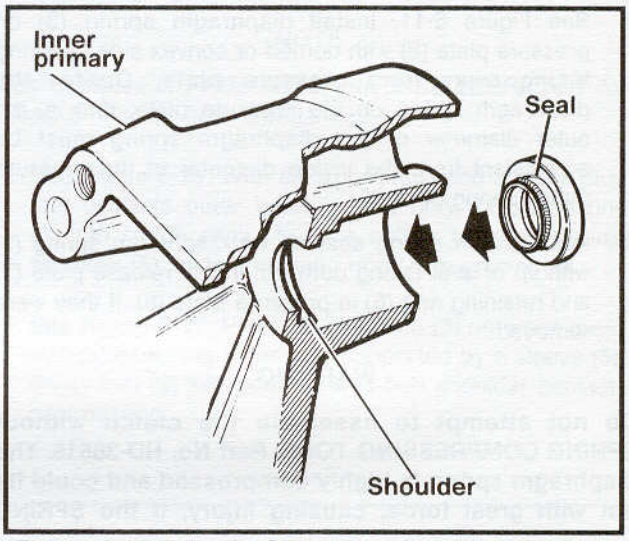


Figure 6-19. Primary Chaincase Jackshaft Oil Seal

4. Check primary chaincase mainshaft oil seal. Replace if worn, scored or damaged. Install seal flush with chaincase surface.

ASSEMBLY

Special Tools	Torque Values (ft-lbs)
None	Inner primary-to-engine bolts 18 - 22 Inner primary-to-transmission bolts 18 - 22 Engine-to-frame fasteners 33 - 38 Transmission-to-frame fasteners 33 - 38

1. Loosen the engine and transmission-to-frame fasteners if necessary.

CAUTION

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.

2. Be sure the O-ring is in position on the crankcase around the alternator surface.

3. 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. Place the primary chaincase in position on the motorcycle.

CAUTION

The following steps should be followed closely and in order. This procedure aligns the transmission and is critical to the proper operation of the motorcycle. Failure to follow these steps correctly could result in premature chain and transmission failure.

NOTE

To get a good primary case alignment, the engine and transmission-to-frame fasteners must be loose.

4. See Figure 6-18. Attach the inner primary to the transmission using the original hardware. Do not tighten hardware yet. Replace locktabs if necessary.

5. Attach the inner primary to the engine using the original bolts and washers. Tighten bolts (1) to 18-22 ft-lbs torque. Bend up the locktabs of the two inner primary-to-engine bolts.

6. Align the transmission case so the inner primary does not bind on the mainshaft or mounting hardware. Tighten bolts (2) to 18-22 ft-lbs torque and bend locktabs into place.

7. Tighten the lower engine-to-frame fasteners to 33-38 ft-lbs torque. Tighten the transmission-to-frame fasteners to 33-38 ft-lbs torque.

8. Install the starter. See STARTER INSTALLATION in Section 5.

9. Install jackshaft as described under STARTER JACKSHAFT ASSEMBLY/INSTALLATION in Section 5.

CAUTION

The Print-O-Seal gasket between the primary chaincase cover and chaincase must be replaced each time the cover is removed.

10. Install the clutch, engine compensating sprocket, chain adjuster and primary case cover as described under CLUTCH, ASSEMBLY given earlier in this section.

NOTES

TRANSMISSION

SPECIFICATIONS

MAIN DRIVE GEAR (5th)

Bearing fit in transmission case	
Tight	0.0004 in.
Loose	0.00010 in.
Fit in bearing	
Tight	0.0009 in.
Loose	0.0001 in.
Fit on mainshaft	0.0001-0.0009 in.
End play	None

MAINSHAFT

Tolerance

Mainshaft runout	0.000-0.003 in.
Mainshaft end play	None
1st gear clearance	0.0000-0.0080 in.
2nd gear clearance	0.0000-0.0800 in.
3rd gear end play	0.0050-0.0420 in.
clearance	0.0003-0.0019 in.
4th gear end play	0.0050-0.0310 in.
clearance	0.0003-0.0019 in.

LUBRICATION

Type	Harley-Davidson
TRANSMISSION LUBRICANT	Part No. 99892-84
Capacity	Approx. 20 - 24 oz.

SHIFTER DOG CLEARANCE

Gears	Clearance Min.	Clearance Max.
2nd - 5th	0.035	0.139
2nd - 3rd	0.035	0.164
1st - 4th	0.035	0.152
1st - 3rd	0.035	0.157

SIDE DOOR BEARING

Fit in side door (tight)	0.0014-0.0001 in.
Fit on countershaft	
Tight	0.0007 in.
Loose	0.00001 in.
Fit on mainshaft	
Tight	0.0007 in.
Loose	0.0001 in.

COUNTERSHAFT

Tolerance

Countershaft runout	0.000-0.003 in.
Countershaft end play	None
1st gear end play	0.0050-0.0039 in.
clearance	0.0003-0.0019 in.
2nd gear end play	0.0050-0.0440 in.
clearance	0.0003-0.0019 in.
3rd gear clearance	0.0000-0.0080 in.
4th gear end play	0.0050-0.0390 in.
clearance	0.0000-0.0080 in
5th gear end play	0.0050-0.0040 in.
clearance	0.0000-0.0080 in.

SHIFTER CAM ASSEMBLY

Shifter cam end play	0.0001-0.004 in.
Right edge of middle cam groove to right support block	1.992-2.002 in.

SHIFTER FORKS

Shifter fork to cam groove end play	0.0017-0.0019 in.
Shifter fork to gear groove end play	0.0010-0.0110 in.
Shifter fork taper	0.000-0.020 in.

TORQUES

Neutral indicator switch	3-5 ft-lbs
Front mounting bracket bolts	33-38 ft-lbs
Rear mounting bracket bolts	13-16 ft-lbs
Side door mounting screws (5/16 in.)	13-16 ft-lbs
Support block bolts	7-9 ft-lbs
Clutch cable bracket screws	6-8 ft-lbs
Shifter arm screw	18-22 ft-lbs
Shifter arm adjusting screw locknut	20-24 ft-lbs
Transmission sprocket nut	110-120 ft-lbs
Socket head screw (1991) - sprocket	50-60 in-lbs
Transmission sprocket lockplate screws (1992)	7-9 ft-lbs
Top cover mounting bolts	7-9 ft-lbs
Side cover mounting bolts	7-9 ft-lbs
Transmission drain plug	0.16-0.18 in. above surface of housing
Transmission filler cap	finger tight
All 1/4 in. fasteners	7-9 ft-lbs
Mainshaft and countershaft side door nuts	27-33 ft-lbs

GENERAL

Shifter Cam Assembly

The shifter cam assembly is located under the transmission top cover and is bolted to the transmission case. The cam assembly shifts the gears into desired ratios by means of the shifter forks. The forks slide the shifter clutch gears in and out of mesh with the other gears.

Mainshaft and Countershaft

The mainshaft and countershaft assemblies contain the gears which are powered in a selection of ratios according to load and speed requirements.

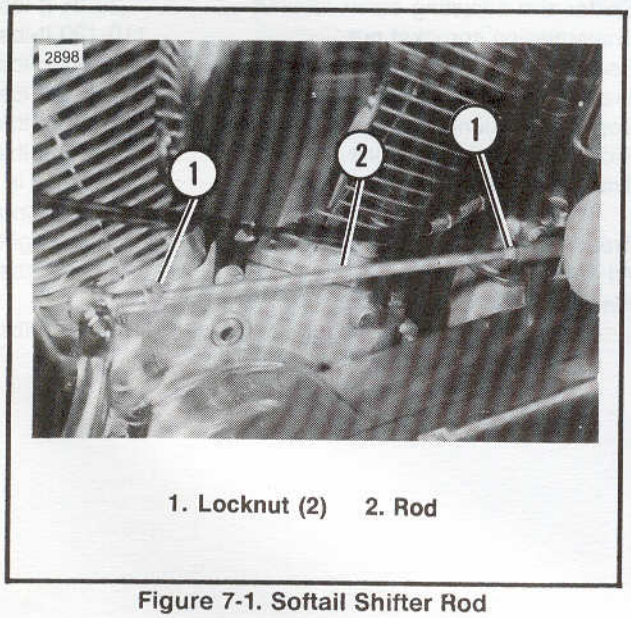
ADJUSTMENTS

General

When operating problems develop in a transmission, check the TROUBLESHOOTING procedure in Section 1 and perform the following adjustments. If these adjustments fail to correct the problem, proceed to the disassembly and repair procedures in this section.

Shifter Linkage Adjustment (Figure 7-1)

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:



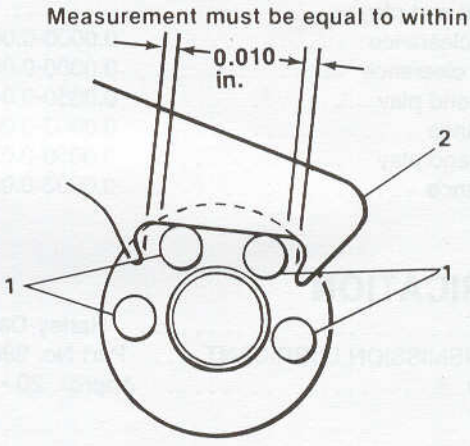
1. Locknut (2) 2. Rod

Figure 7-1. Softail Shifter Rod

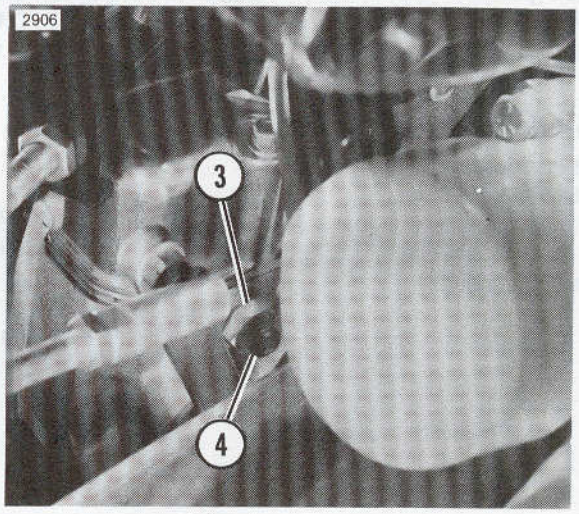
1. Remove one end of shifter rod.
2. Loosen locknuts (1). Adjust rod (2) as necessary.
3. Tighten locknuts to 25 ft-lbs torque.

Gear Engagement Adjustment (Figure 7-2)

When gears are not engaging properly or not at all, make the following checks before performing Steps 1-4, following:



1. Cam pin
2. Shifter pawl



3. Locknut
4. Allen head screw

Figure 7-2. Gear Engagement Adjustment

A. Check for proper CLUTCH operation. See Section 6.

B. Check the shift linkage for wear, adjustment or interference.

NOTE

Most shifting problems can be attributed to an improperly adjusted shifter pawl adjusting screw.

1. Shift transmission into 3rd gear.

NOTE

- *Be sure transmission is fully engaged in 3rd gear.*
- *Grind down the outside of an appropriate-size 12 point box end wrench to gain access to the jamnut.*

2. Move shifter lever and feel for free play and spring pressure in both directions.

NOTE

See Figure 7-2. The spring pressure you feel defines the limits of travel of the shifter pawl (2) against the cam pins (1).

3. Loosen jamnut (3) and adjust allen screw (4) in 1/4 in. turn increments or less (either clockwise or counterclockwise) until spring pressure and free play is equal on both sides of shift lever travel.

4. Recheck adjustment after tightening locknut (3).

If preceding steps do not work, check for bent shifter forks. See SHIFTER FORKS, CLEANING, INSPECTION AND REPAIR.

Neutral Indicator Switch

The neutral indicator switch is threaded into the transmission top cover. The switch is activated when the plunger, depressed by a hub on the shifter drum, completes the circuit. Switch is a non-repairable part. If it fails, it must be replaced.

When replacing neutral indicator switch, coat threads of switch with Loctite PIPE SEALANT WITH TEFLON and tighten switch in cover to 3-5 ft-lbs torque.

SHIFTER CAM ASSEMBLY

DISASSEMBLY

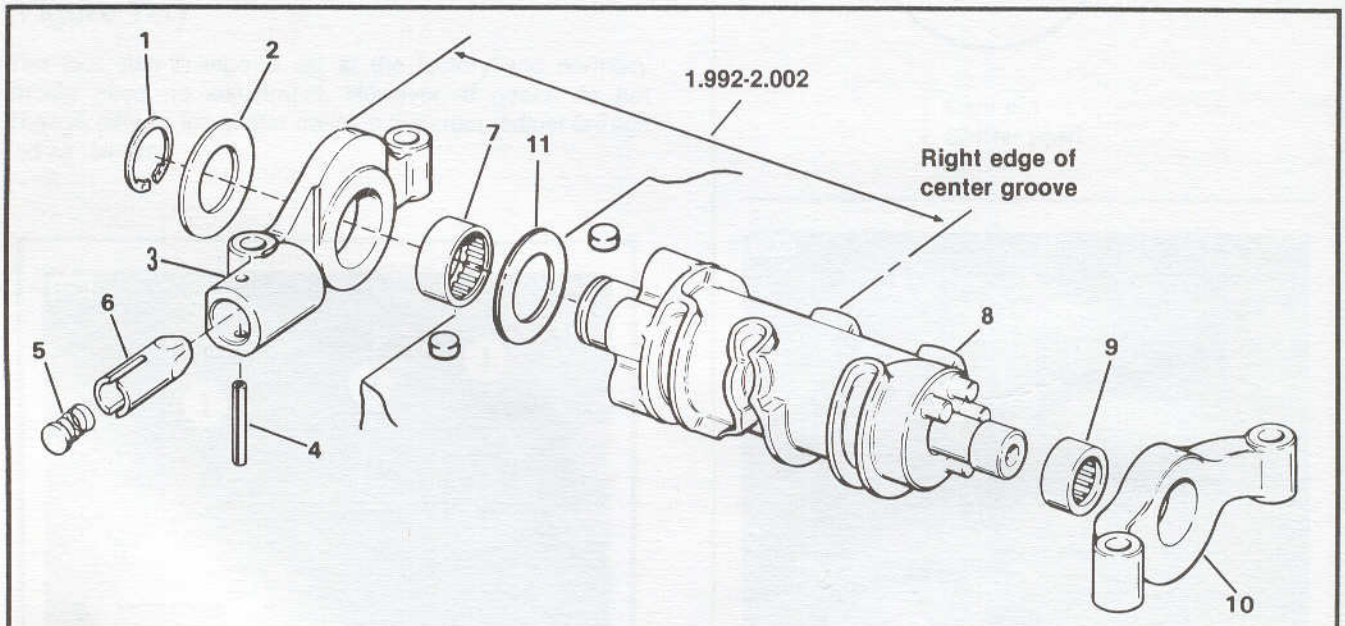
WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables (negative cable first) before performing any of the following procedures.

1. Remove battery and oil tank. Remove starter. See STARTER, Section 5. Disconnect wire on neutral indicator switch. Remove hose from fitting in cover.
2. Remove mounting bolts, transmission top cover and gasket.
3. Remove mounting bolts, lockwashers and shifter cam assembly.
4. See Figure 7-3. The left support block (10) is a slip fit on the cam and will slide off.
5. Remove retaining ring (1), outer thrust washer (2) and right support block (3). Mark thrust washers (2 and 11) so they can be installed in their original position. Discard retaining ring.

CLEANING, INSPECTION AND REPAIR (Figure 7-3)

1. Clean all parts except bearings (7 and 9) with solvent.
2. Inspect neutral indicator switch in top cover. Depress plunger. It should spring back without binding. Switch is a non-repairable item and must be replaced if damaged.
3. Inspect bearings (7 and 9) 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.
4. Inspect shifter cam (8) for cracks or wear and replace if necessary.



1. Retaining ring
2. Outer thrust washer (variable thickness)
3. Right support block
4. Roll pin
5. Spring
6. Cam follower
7. Bearing
8. Shifter cam
9. Bearing
10. Left support block
11. Inner thrust washer (variable thickness) - Early 1991

Figure 7-3. Shifter Cam Assembly

ASSEMBLY

Special Tools	Torque Values (ft-lbs)
None	Support block bolts 7 - 9 Top cover bolts 7 - 9 Neutral indicator switch 3 - 5

Shifter Cam Position

NOTE

- *Early 1991 shifter cams use a variable thickness INNER SPACER to set the proper shift cam position. Late 1991 and 1992 shifter cams are machined for proper positioning and do not use an inner spacer.*
- *1991 and 1992 shifter cams both use an OUTER SPACER to set shifter cam end play.*

1. See Figure 7-3. On early 1991, install inner thrust washer (11) and right support block (3) on large end of shifter cam (8).

2. See Figure 7-4. Rotate the drum to its neutral position. With the drum snug against the thrust washer of right support block, measure from the outside machined surface of the bearing support to the nearest edge of the center groove.

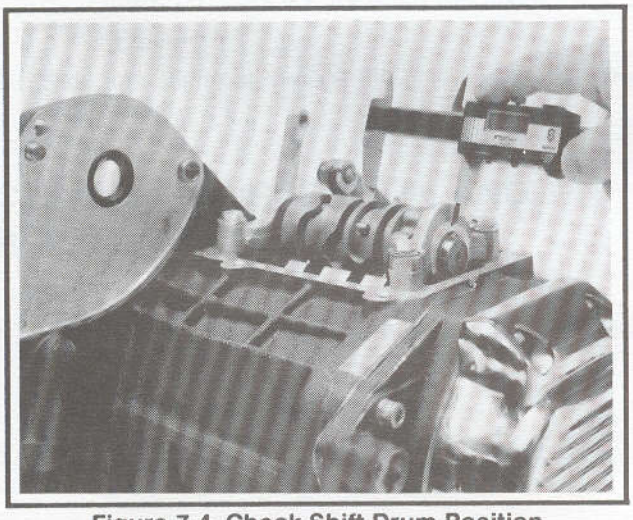


Figure 7-4. Check Shift Drum Position

This measurement should be 1.992-2.002 in. Proper shift drum position measurement can be obtained by varying thickness of inner thrust washer (11, Figure 7-3).

3. See Figure 7-5. Install outer thrust washer (2) and new retaining ring (1).

Inner and outer thrust washers (2) and (11, early 1991), are available in the following thicknesses: 0.017, 0.020, 0.022, 0.025, 0.028, 0.031, 0.035 and 0.039 in.

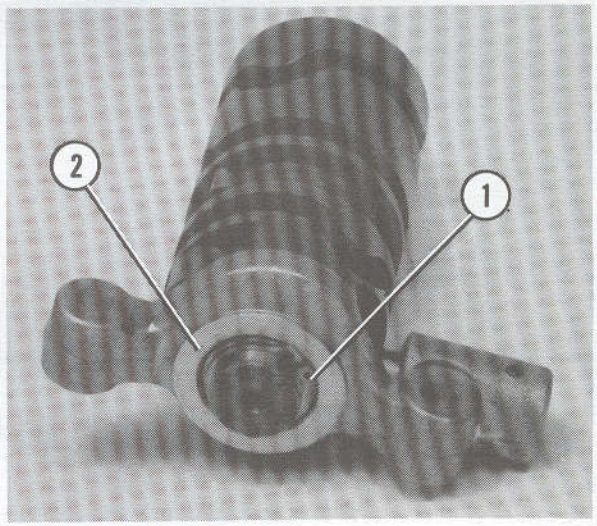
4. See Figure 7-3. Slip left support block (10) on small end of shifter cam.

NOTE

The numbers on the left support block should face downward when shifter cam is installed on the transmission.

NOTE

See Figure 7-5. Retaining ring (1) must seat firmly in groove. The thrust washers must spin after assembly. They must not be so tight they will not move.



1. Retaining ring
2. Outer thrust washer

Figure 7-5. Right Support Block Retaining Ring

CAUTION

DO NOT change INNER thrust washer (11, Figure 7-3) to alter shifter cam end play. The inner thrust washer is used only to set shift drum position.

End Play Measurement - All

5. See Figure 7-3. Use a feeler gauge and check end play of shifter cam (8). If end play is not 0.001-0.004 in., remove OUTER thrust washer (2) and replace it with a thinner or thicker one. With proper end play, thrust washer (2) should turn freely.

6. See Figure 7-6. Place shifter cam assembly on transmission case with shifter forks positioned in the slots.

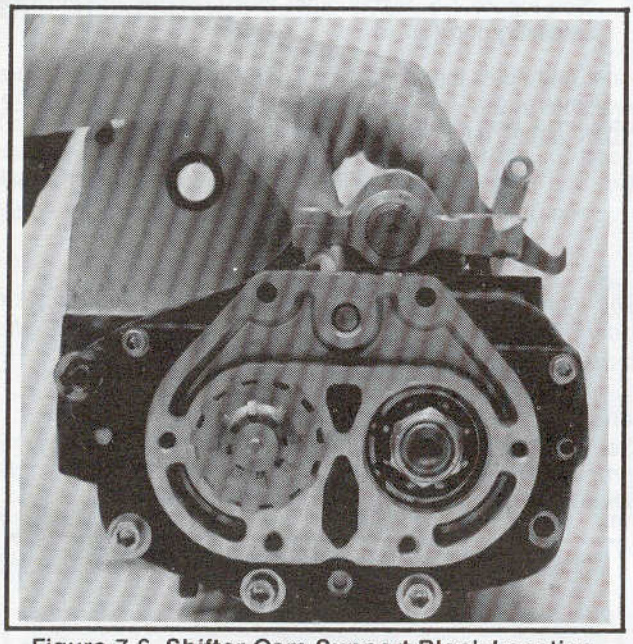


Figure 7-6. Shifter Cam Support Block Locating Dowel Pins

- On early 1991, the transmission case has dowel pins which fit into the mounting holes of the RIGHT support block. Align the cam assembly by securing the right support block and tighten all bolts to 7-9 ft-lbs torque. Check the left support block to see that it is not cocked and does not bind on its bearing.
- On late 1991 and 1992, 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. Tighten all bolts to 7-9 ft-lbs torque.

NOTE

Check the gear engagement and clearance in every gear to be sure assembly and alignment is correct.

7. Perform the GEAR ENGAGEMENT ADJUSTMENT as listed under ADJUSTMENTS. Install top cover with a new gasket. Tighten bolts to 7-9 ft-lbs torque.

8. If neutral indicator switch is replaced, coat threads of switch with Loctite PIPE SEALANT WITH TEFLON and tighten switch in cover to 3-5 ft-lbs torque.

9. Install oil tank and battery.

SHIFTER FORKS

REMOVAL

1. Remove the transmission top cover and shifter cam assembly as described in the SHIFTER CAM DISASSEMBLY section.

2. See Figure 7-7. Remove the transmission side cover. See TRANSMISSION SIDE COVER.

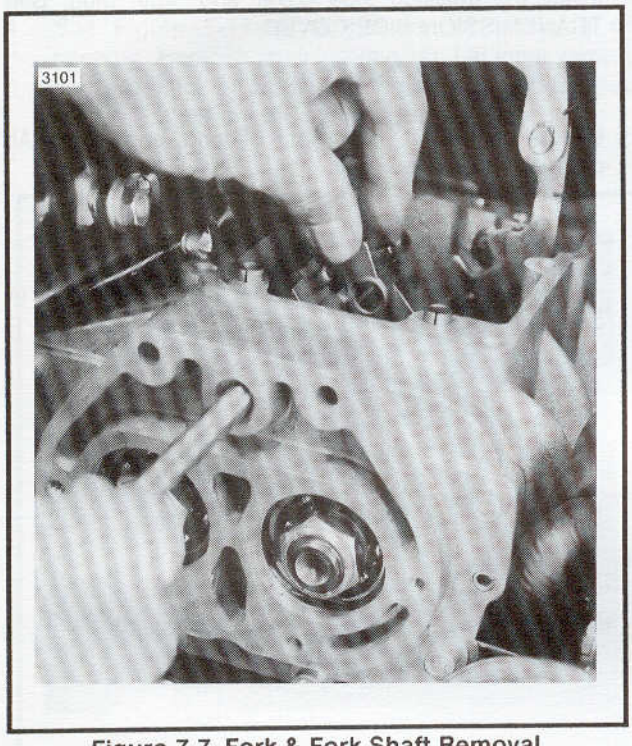


Figure 7-7. Fork & Fork Shaft Removal

3. Slide fork shaft out through the hole and remove the shifter forks.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in cleaning solvent and blow dry with compressed air.

2. Check the shifter fork shaft and replace it if bent or damaged.

3. See Figure 7-8. 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, compare them to a new fork and replace them if they are worn 0.020 in. or more.

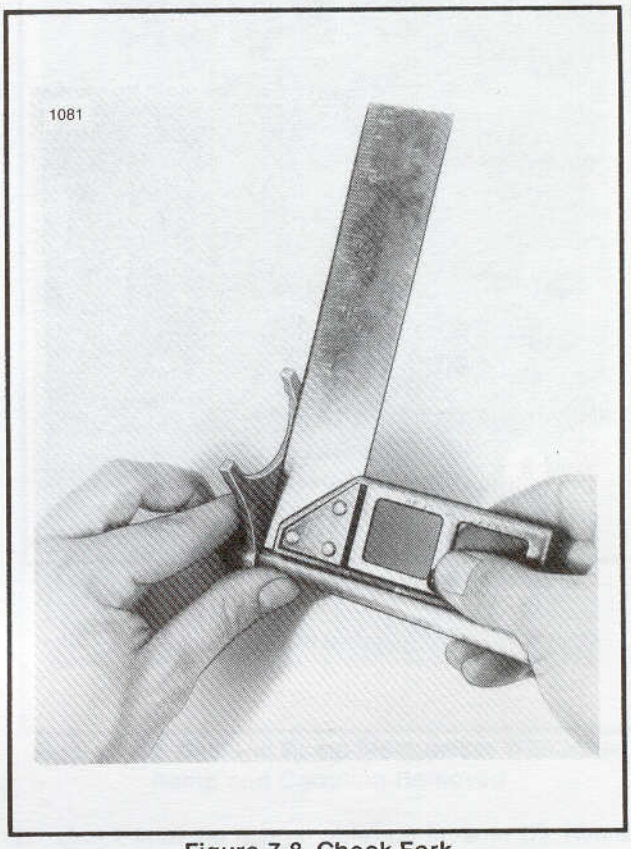


Figure 7-8. Check Fork

INSTALLATION

1. See Figure 7-9. The forks are different from each other and are identified as shown.

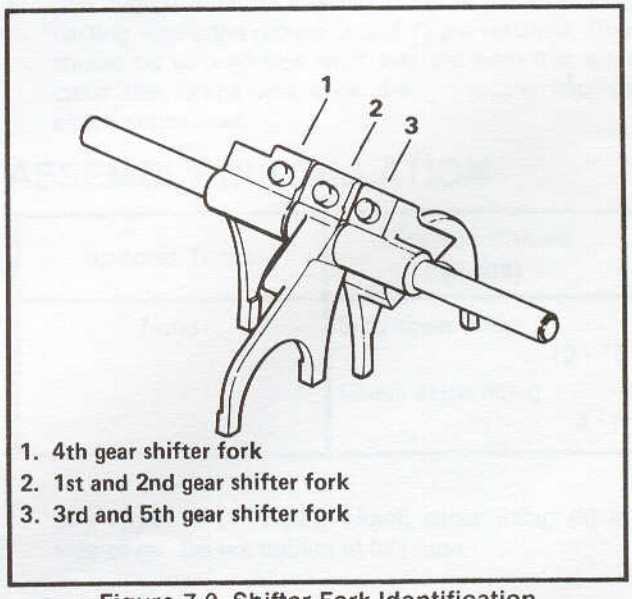
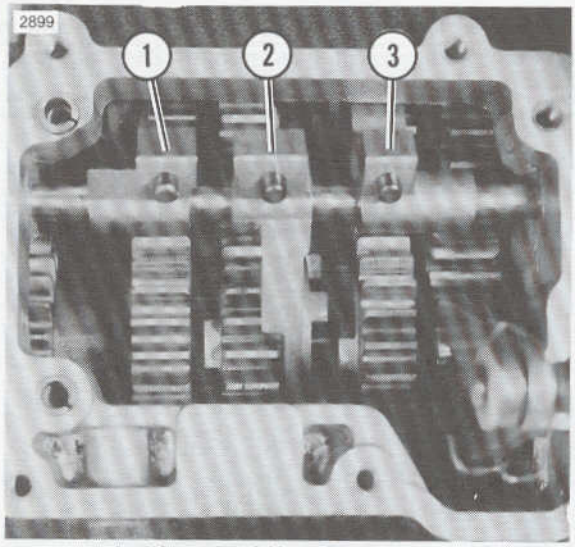


Figure 7-9. Shifter Fork Identification



1. 4th gear shifter fork
2. 1st and 2nd gear shifter fork
3. 3rd and 5th gear shifter fork

Figure 7-10. Fork Postion in Transmission

2. See Figure 7-10. 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. 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 TRANSMISSION SIDE COVER.

5. Check the sliding movement of forks and gears. All parts should move freely.

6. Assemble shifter cam and top cover as described in SHIFTER CAM ASSEMBLY.

TRANSMISSION SIDE COVER

REMOVAL/DISASSEMBLY

1. Loosen exhaust system. Drain transmission and remove fill plug/dipstick.

2. Loosen cable adjuster so clutch cable is slack. See SECTION 6, CLUTCH CABLE ADJUSTMENT.

3. Remove side cover.

4. See Figure 7-11. Note position of retaining ring opening. Remove retaining ring (1). Lift inner ramp (2) and coupling (3) out of side cover. Disconnect clutch cable end (4) from the ball and ramp coupling (3).

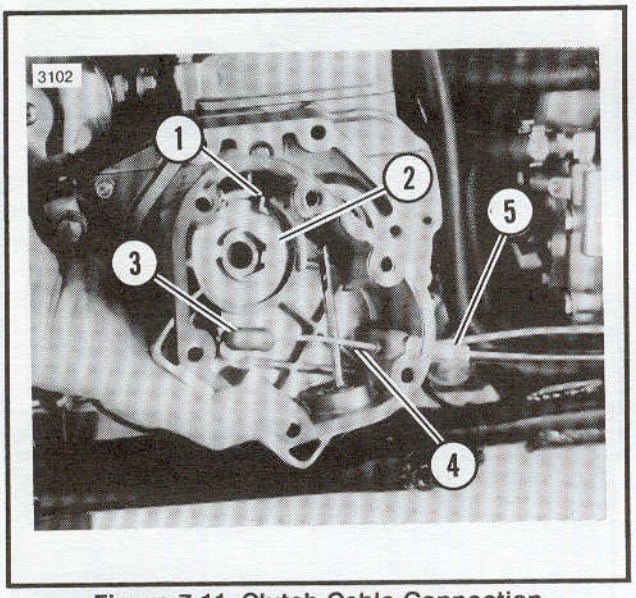


Figure 7-11. Clutch Cable Connection

5. Unscrew cable fitting (5) from side cover.

6. See Figures 7-12, 7-13. Remove balls (6) and outer ramp (7).

CLEANING, INSPECTION AND REPAIR

1. Wash the ball and ramp mechanism components in cleaning solvent

2. Inspect the three release mechanism balls (6) and ball socket surfaces on ramps (2 and 7) for wear, pitting, surface breakdown and other damage. Replace damaged parts.

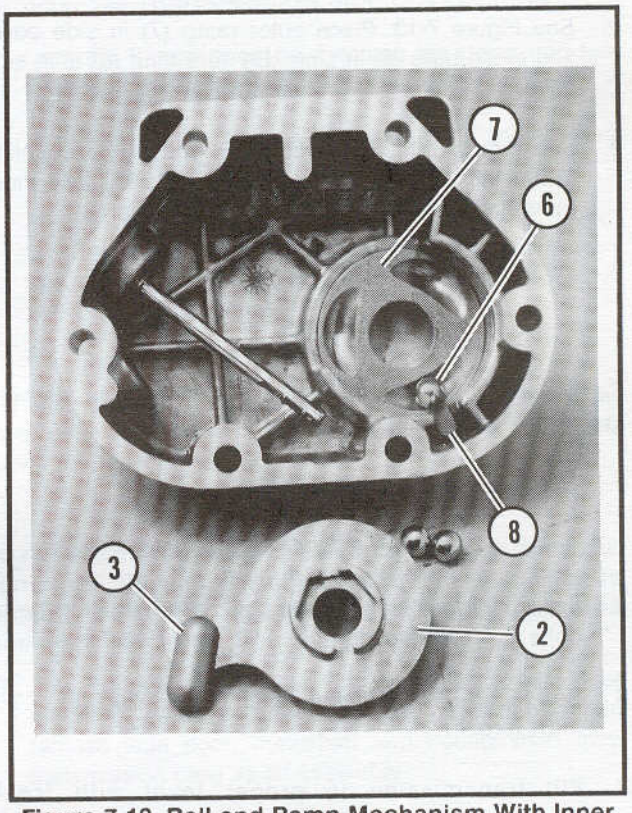


Figure 7-12. Ball and Ramp Mechanism With Inner Ramp and Coupling Removed

3. Check fit of the hub on ramp (2) in ramp (7). 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. See Figure 7-11. Check the bore in the side cover casting where the ramps (2 and 7) 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

Special Tools	Torque Values (ft-lbs)
None	Side cover bolts 10 - 12 Clutch cable fitting 3 - 5

1. See Figure 7-11. Screw clutch cable fitting (5) into side cover. Do not tighten at this time.

NOTE

Replace cable fitting O-ring if damaged or deformed.

2. See Figure 7-13. Place outer ramp (7) in side cover and place balls (6) in slots. Be sure tang (8) is in side cover slot.

3. See Figure 7-11. Connect cable end (4) to coupling (3). Install coupling on inner ramp (2) and place inner ramp and coupling in position in side cover.

4. Install retaining ring (1).

NOTE

See Figure 7-12. Retaining ring opening must be installed to the right of the outer ramp tang (8) slot.

CAUTION

Replace side cover gasket.

5. Install new gasket and side cover. Tighten side cover bolts to 10-12 ft-lbs torque.

6. See Figure 7-11. Tighten clutch cable fitting (5) to 3-5 ft-lbs torque.

7. Fill transmission to proper level with fresh transmission lubricant and install fill plug/dipstick. Install exhaust system.

8. Adjust clutch cable. See Section 6, CLUTCH CABLE ADJUSTMENT.

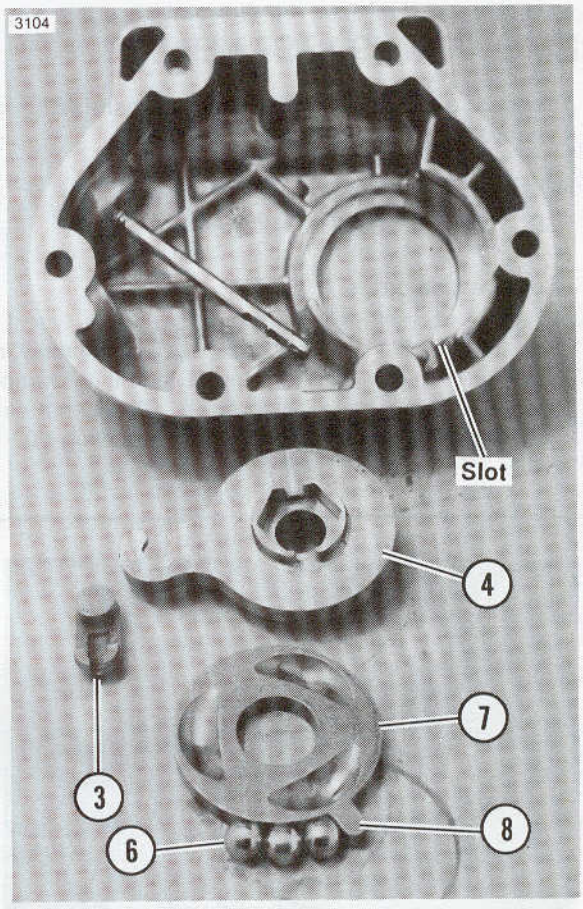


Figure 7-13. Ball and Ramp Mechanism Removed From Side Cover

MAINSHAFT AND COUNTERSHAFT

REMOVAL

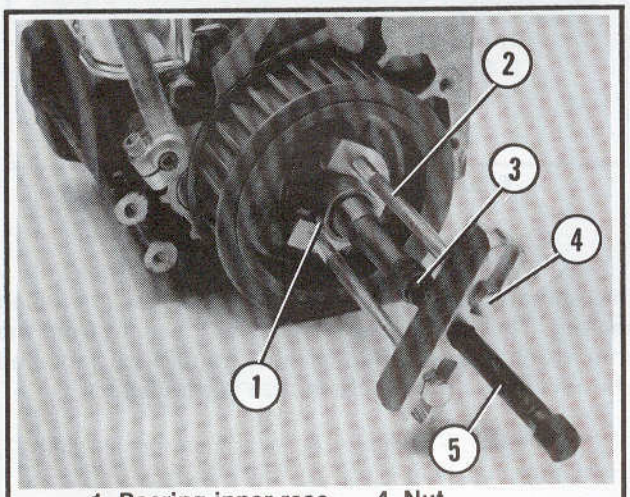
Special Tools	Torque Values (ft-lbs)
HD-34902 Bearing race puller & installation tool HD-94660-37A Mainshaft locknut wrench	None

1. Remove exhaust system. See EXHAUST SYSTEM, Section 4.
2. Remove the clutch. See CLUTCH, Section 6. Remove the primary chaincase. See PRIMARY CHAINCASE, Section 6.
3. Remove transmission top cover, shifter cam assembly and shifter forks as described earlier in this section.

CAUTION

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the inner primary cover oil seal.

4. See Figure 7-14. Remove the bearing inner race from the transmission mainshaft using BEARING RACE PULLER & INSTALLATION TOOL, Part No. HD-34902.



1. Bearing inner race
2. Leg
3. Center disc
4. Nut
5. Puller screw

Figure 7-14. Pull Mainshaft Inner Bearing Race

5. Remove the magnetic drain plug from the side of the transmission and drain the lubricant.
6. Remove the side cover from the transmission side door. See TRANSMISSION SIDE COVER.
7. Lock the transmission by meshing the gears into two speeds at the same time.
8. See Figure 7-17. Remove the locknuts (8) and spacers (7) from the shafts.
9. If main drive gear (9, Figure 7-25) is to be removed, lock transmission as above and remove transmission sprocket nut as described in TRANSMISSION SPROCKET, Section 6.

NOTE

The main drive gear bearing 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.

10. See Figure 7-15. 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.

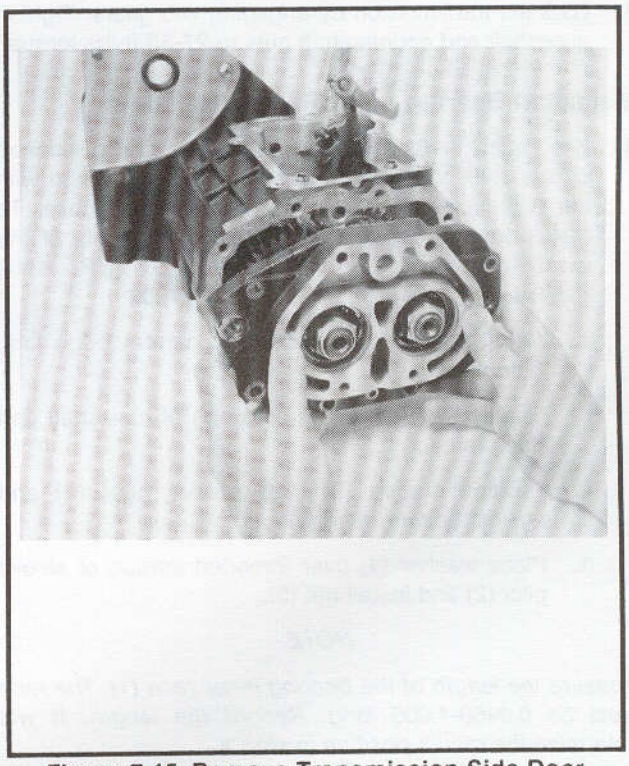


Figure 7-15. Remove Transmission Side Door

INSTALLATION

Special Tools	Torque Values (ft-lbs)
HD-34902 Bearing race puller & installation tool HD-94660-37A Mainshaft locknut wrench	5/16 in. Side door mounting screws 13 - 16 1/4 in. Side door screws 7 - 9 Sprocket nut lockscrew - 1991 50 - 60 (in-lbs) Lockplate allen bolts - 1992 7 - 9 (ft-lbs)

1. Assemble transmission. See MAINSHAFT AND COUNTERSHAFT DISASSEMBLY/ASSEMBLY.

CAUTION

Cover mainshaft clutch hub splines with tape to prevent the splines damaging the main drive gear oil seal.

2. Install the assembly in the transmission case using a new gasket (2). Tighten 5/16 in. mounting hardware to 13-16 ft-lbs torque and 1/4 in. screws to 7-9 ft-lbs torque.
3. Lock the transmission by engaging two gears. Tighten mainshaft and countershaft nuts to 27-33 ft-lbs torque.

Mainshaft Bearing Inner Race Installation

4. See Figure 7-16. 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.
   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).

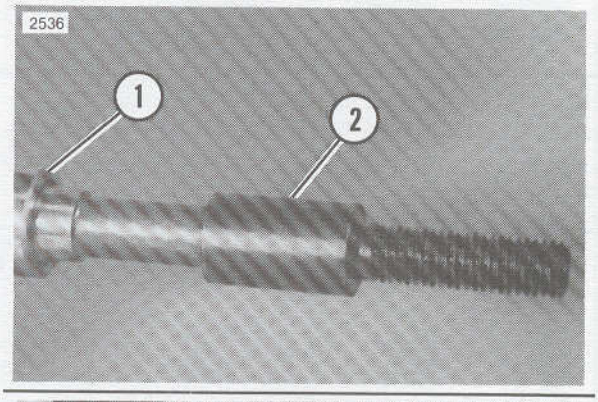
NOTE

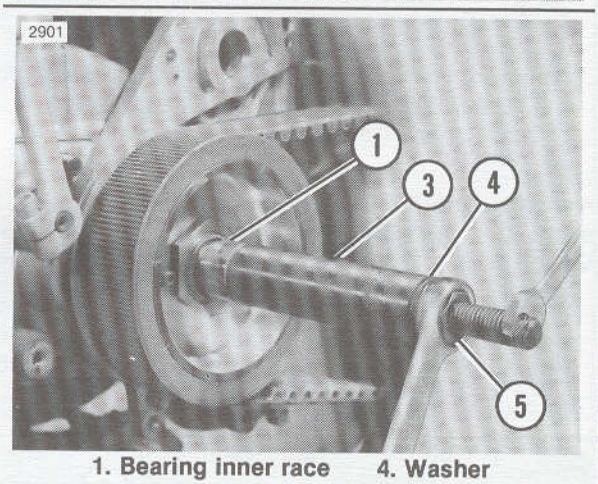
Measure the length of the bearing inner race (1). The race must be 0.9950-1.000 long. Record the length. It will determine the race's position in step e.

CAUTION

Press race onto shaft so inside edge is 0.100 in. from main drive gear.

e. Tighten nut (5) while holding sleeve pilot (2) stationary with wrench on flats at end of screw threads. Press race (1) onto shaft.





1. Bearing inner race
2. Sleeve pilot
3. Sleeve
4. Washer
5. Nut

Figure 7-16. Install Bearing Race

CAUTION

The primary chaincase has an oil seal for mainshaft bearing. The seal prevents lubricant leaking from the primary chaincase. The oil seal should be replaced whenever the primary chaincase is removed.

5. See Figure 7-17. Install 2-piece push rod (22 and 23) in mainshaft hole.
6. Install the side cover, using a new gasket. Install the shifter forks, shifter cam and top cover as described earlier in this section.
7. If main drive gear (9, Figure 7-25) was removed/installed, lock transmission as described earlier and install transmission sprocket nut as described in TRANSMISSION SPROCKET, Section 6.
8. Install primary chaincase and clutch. See PRIMARY CHAINCASE, CLUTCH in Section 6.

WARNING

Tighten the drain plug so it projects 0.16-0.18 in. above surface of housing. Tighten the filler cap finger tight. Do not over-tighten. Over-tightening could cause transmission lubricant leakage.

9. Install the drain plug and fill the transmission with approximately 20 - 24 oz. of Harley-Davison TRANSMISSION LUBRICANT, Part No. 99892-84, or until the dipstick on the side cover filler plug shows FULL with motorcycle in level, upright position and the dipstick dipped, not screwed, into the fill hole.

10. Install exhaust system. See EXHAUST SYSTEM, Section 4.

DISASSEMBLY

Special Tools	Torque Values (ft-lbs)
J-5586 Retaining ring pliers	None

1. See Figure 7-17. Remove the 2-piece push rod (22 and 23) from the hole in the mainshaft. Use RETAINING RING PLIERS, Part No. J-5586, to remove all 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 (20) and countershaft 2nd gear (19).
3. Remove the bearings (9), retaining ring (12) and countershaft 3rd gear (17).
4. See Figure 7-17. Remove mainshaft 2nd gear (21) and leave 4th and 1st gear respectively on each shaft.

NOTE

To remove the mainshaft 3rd gear (18), 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 (18), 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.

1. Side door
2. Gasket
3. Mainshaft spacer
4. Countershaft spacer
5. Mainshaft
6. Countershaft
7. Spacer (2)
8. Nut (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. Spacer
16. Countershaft 1st gear
17. Countershaft 3rd gear
18. Mainshaft 3rd gear
19. Countershaft 2nd gear
20. Countershaft 5th gear
21. Mainshaft 2nd gear
22. Push rod
23. Push rod – left side

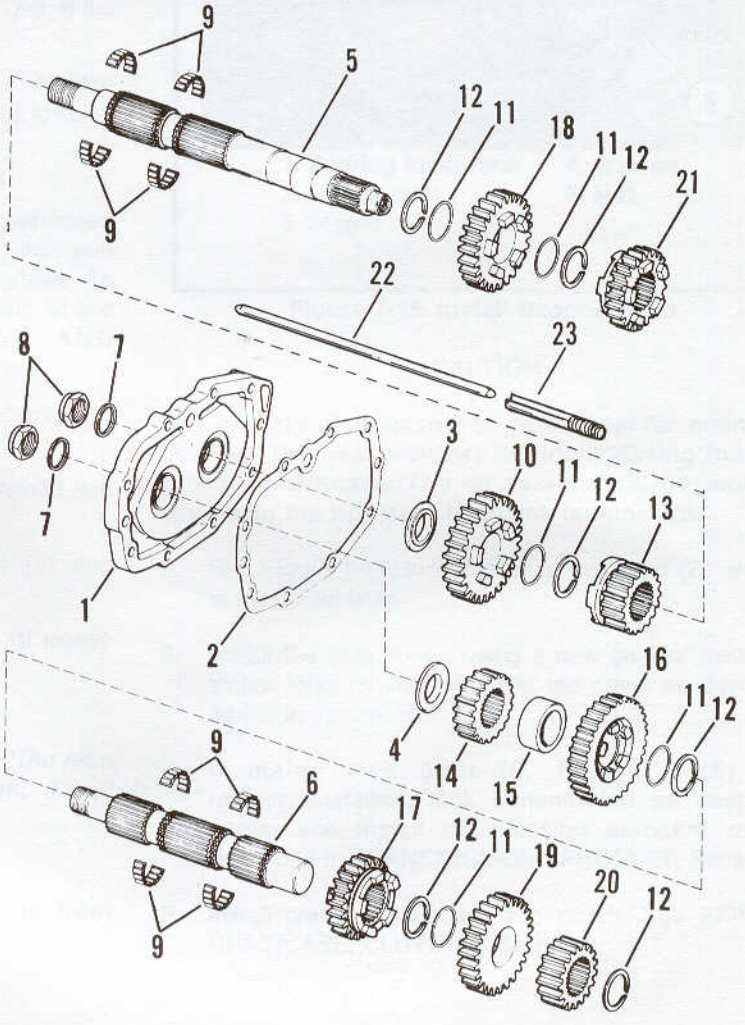


Figure 7-17. Mainshaft, Countershaft Assembly

7. Support mainshaft 4th gear and press out mainshaft.
8. Remove the remaining spacers, and retaining rings.

CLEANING, INSPECTION AND REPAIR

1. Clean all parts in cleaning solvent and blow dry with compressed air.
2. Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
3. Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, battered or chipped.
4. See Figure 7-18. Inspect the bearings in the side door. If bearings are pitted or grooved or feel rough when turned, replace the bearings.

REPLACE THE SIDE DOOR BEARINGS

1. See Figure 7-18. Remove the retaining rings 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.

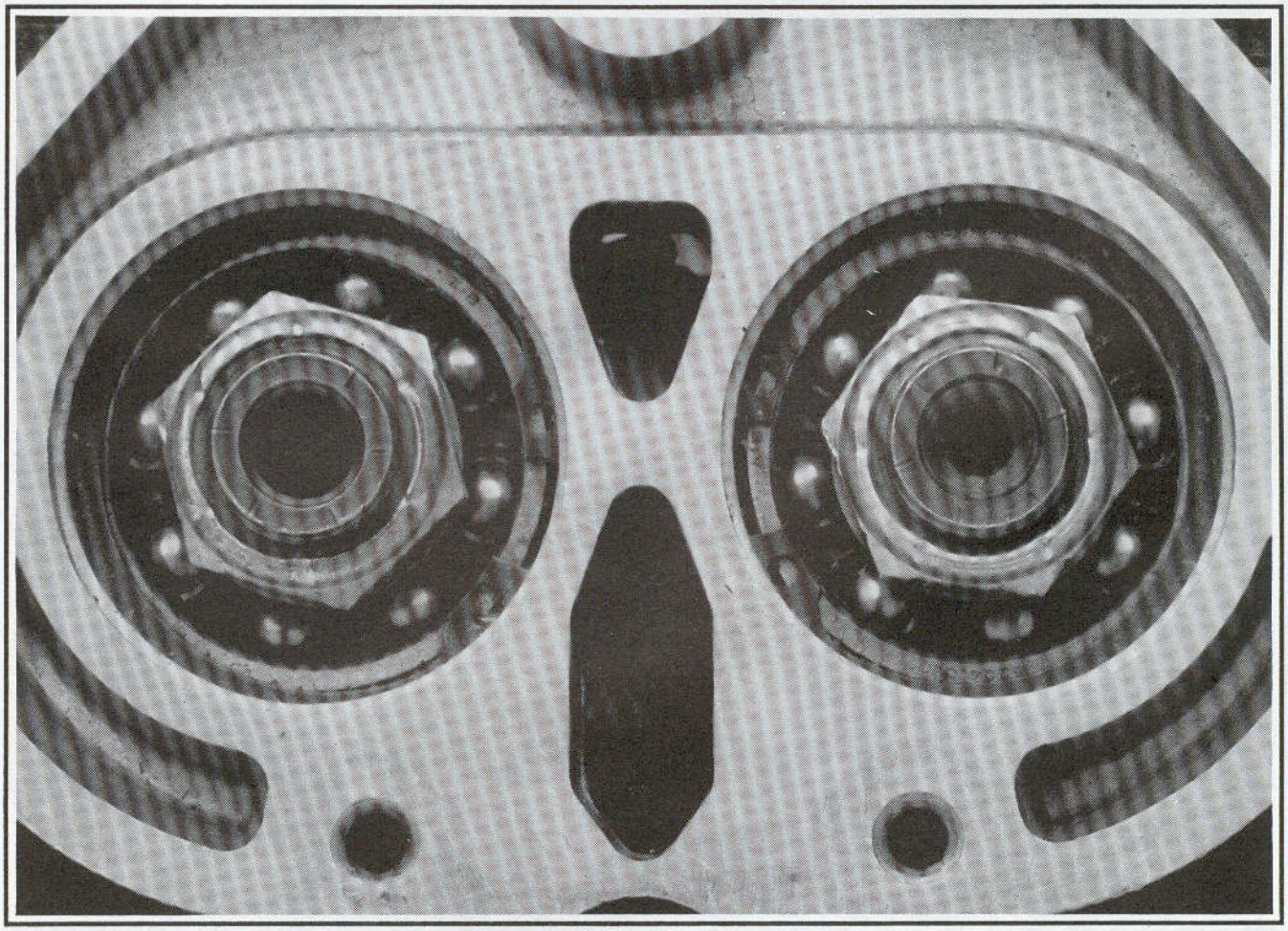


Figure 7-18. Side Door Bearings

ASSEMBLY(Figure 7-17)

Special Tools	Torque Values (ft-lbs)
HD-34902 Puller and installation tool	Mainshaft and countershaft nuts 27 - 33

1. See Figure 7-17, 7-19. 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.
3. Slide countershaft 4th gear (14) and spacer (15) onto the countershaft (6). The inside diameter on one side of the gear is beveled. This side should rest against the spacer.
4. Place bearing in countershaft race and install the countershaft 1st gear (16) 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 and 4) on the shafts with the tapers facing the access door bearings. The mainshaft spacer has a shoulder while the countershaft spacer does not.

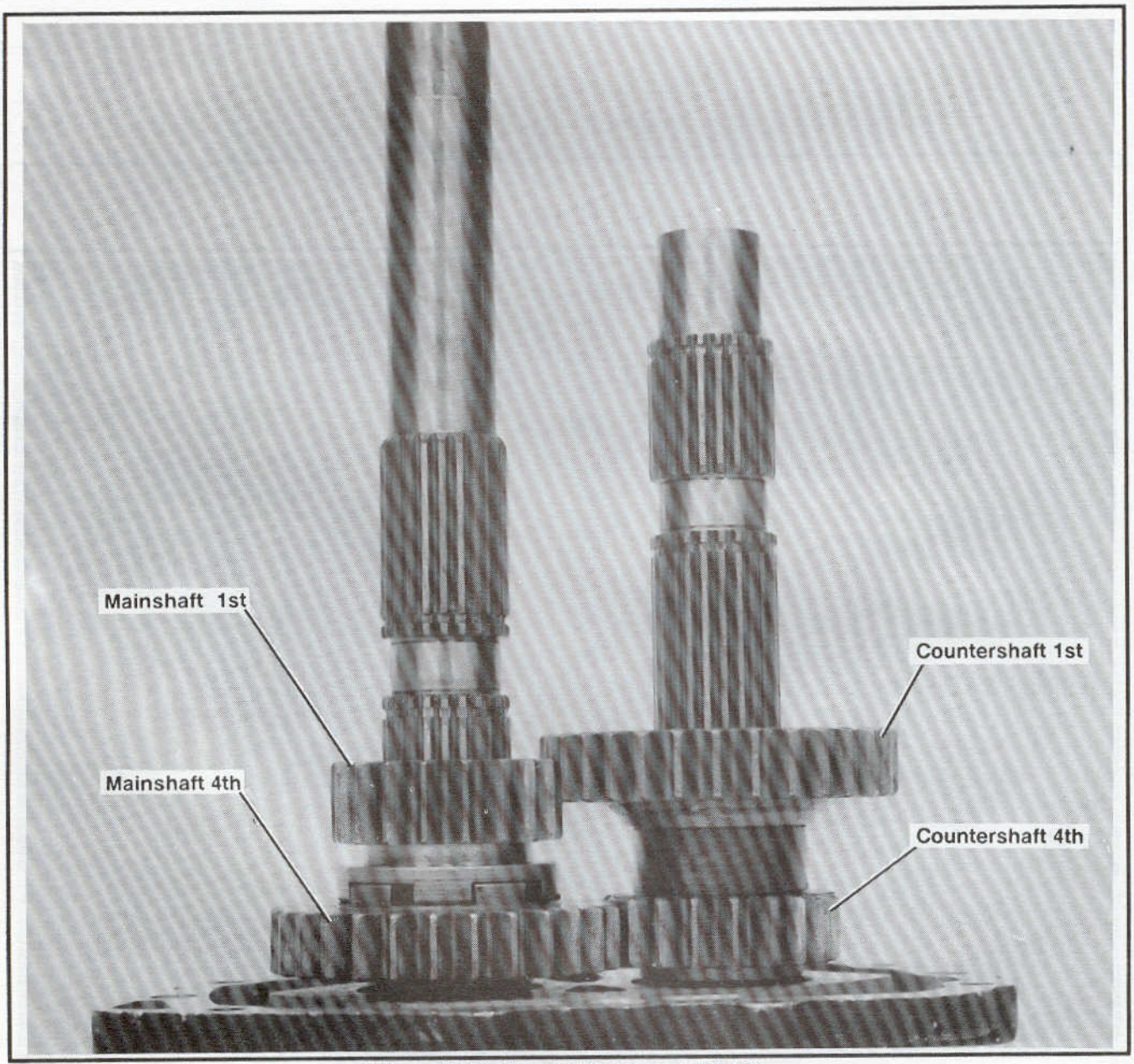


Figure 7-19. 4th and 1st Gears on Shafts

CAUTION

Failure to support inner bearing races while pressing shafts through the bearings will damage the bearings.

6. See Figure 7-17, 7-20. Place side door (1) in an arbor press. Support inner bearing races with a suitable socket. Press the shafts into the bearings. With the shafts properly pressed into the side door, spacers (3 and 4) will have no end play. The mainshaft (5) is installed to the left of the fork shaft 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. See REMOVAL/INSTALLATION.
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 (18) over bearings and secure 3rd gear with a thrust washer (11) and retaining ring (12).

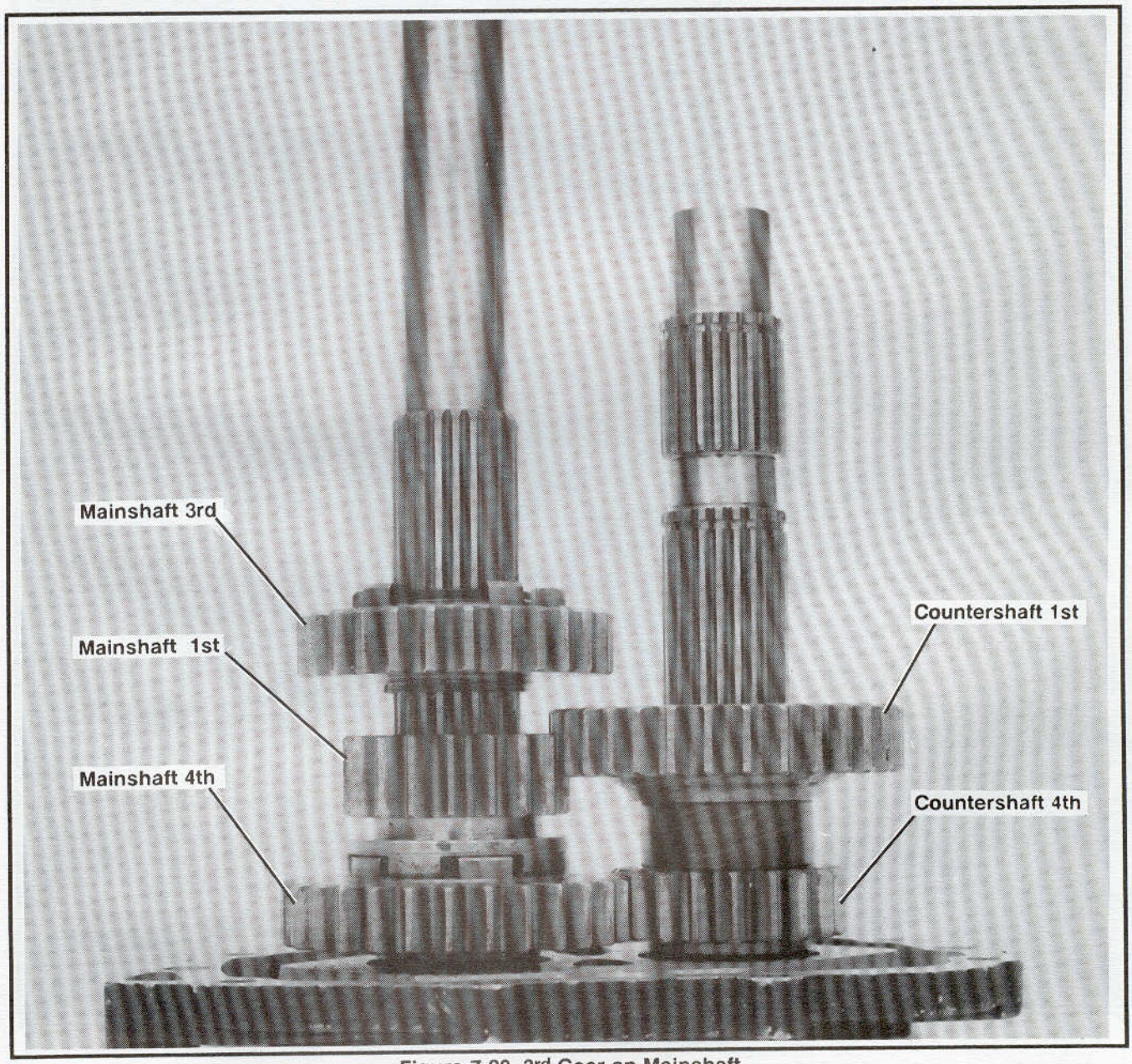


Figure 7-20. 3rd Gear on Mainshaft

10. See figure 7-17, 7-21. Install the mainshaft 2nd gear (21) on the shaft with the shifter fork slot towards the side door.

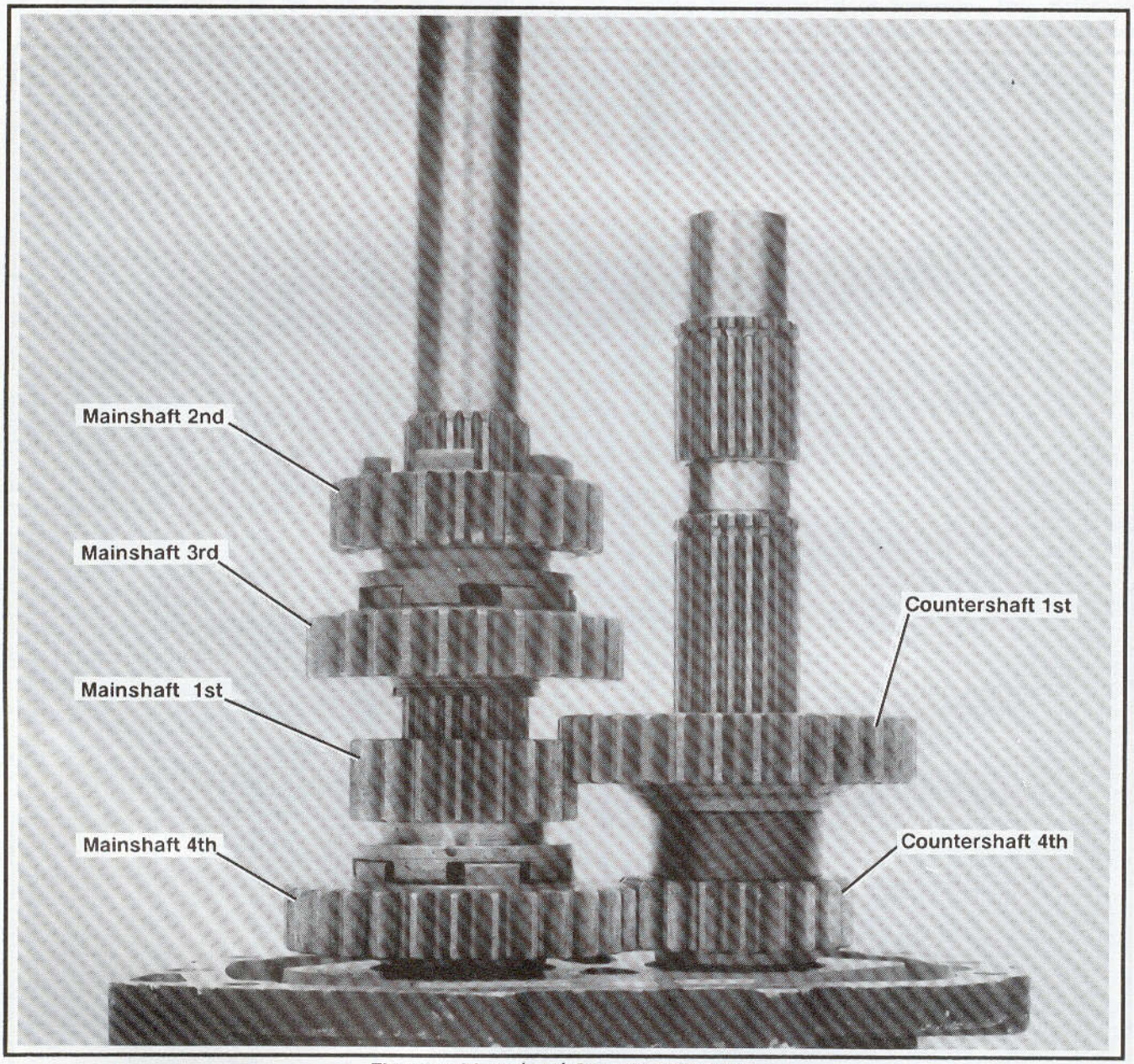


Figure 7-21. 2nd, 3rd Gear on Mainshaft

11. See Figures 7-17, 7-22. Install countershaft 3rd gear (17) with shifter fork slot facing away from the side door.

12. Install a retaining ring (12) in the countershaft groove above 3rd gear (17). Slide a thrust washer (11) on top of the ring and place the bearings in the countershaft race.

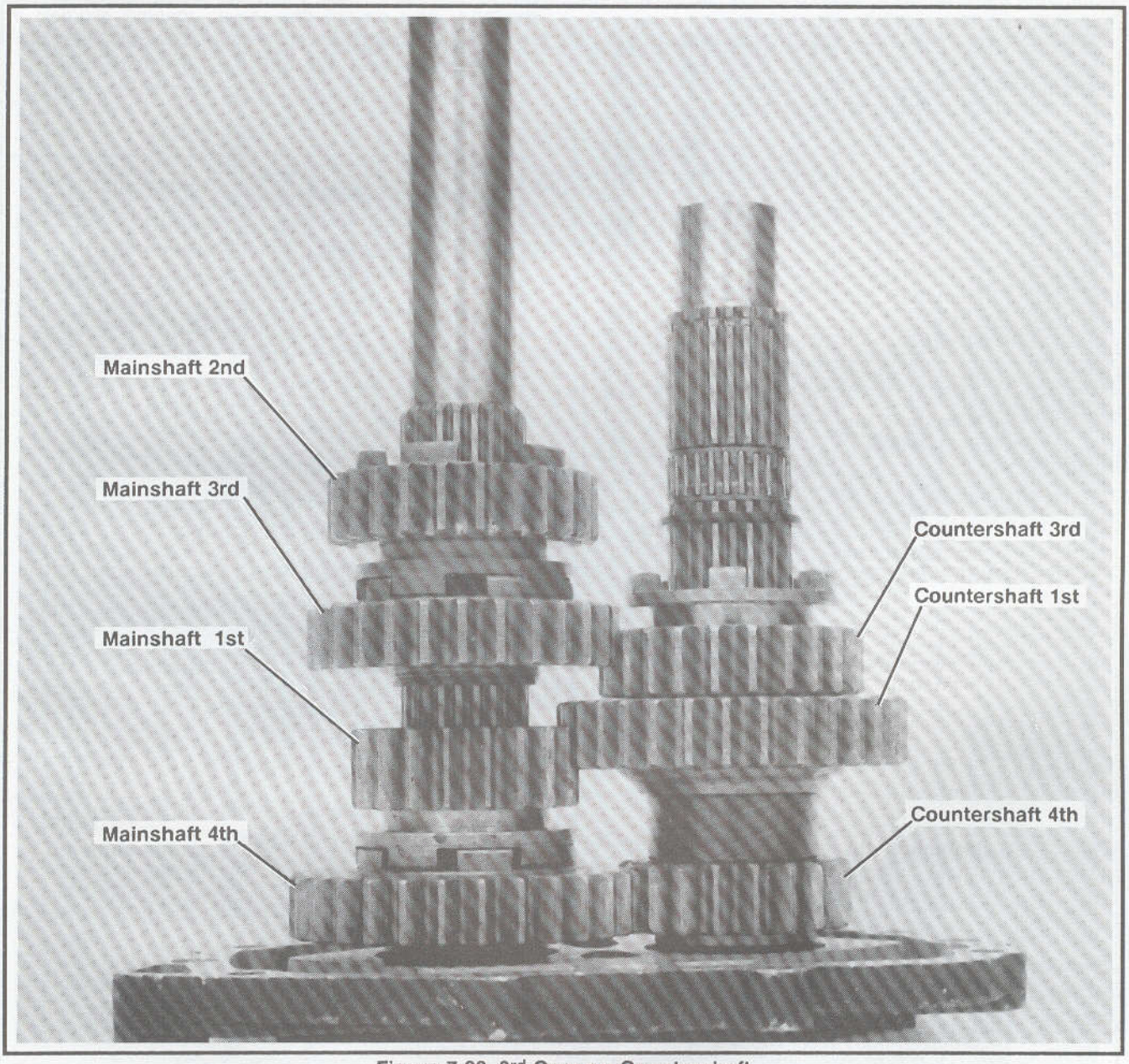


Figure 7-22. 3rd Gear on Countershaft

13. See figure 7-17, 7-23. Install the countershaft 2nd gear (19) over the bearings.

14. Install the countershaft 5th gear (20) on the countershaft. Secure 5th gear with a retaining ring.

NOTE

If main drive gear (9, Figure 7-25) was removed, install it now, following the procedure outlined later in the section under MAIN DRIVE GEAR.

15. Lock the transmission by engaging two gears. Tighten mainshaft and countershaft nuts (8) to 27-33 ft-lbs torque.

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. See REMOVAL/INSTALLATION.

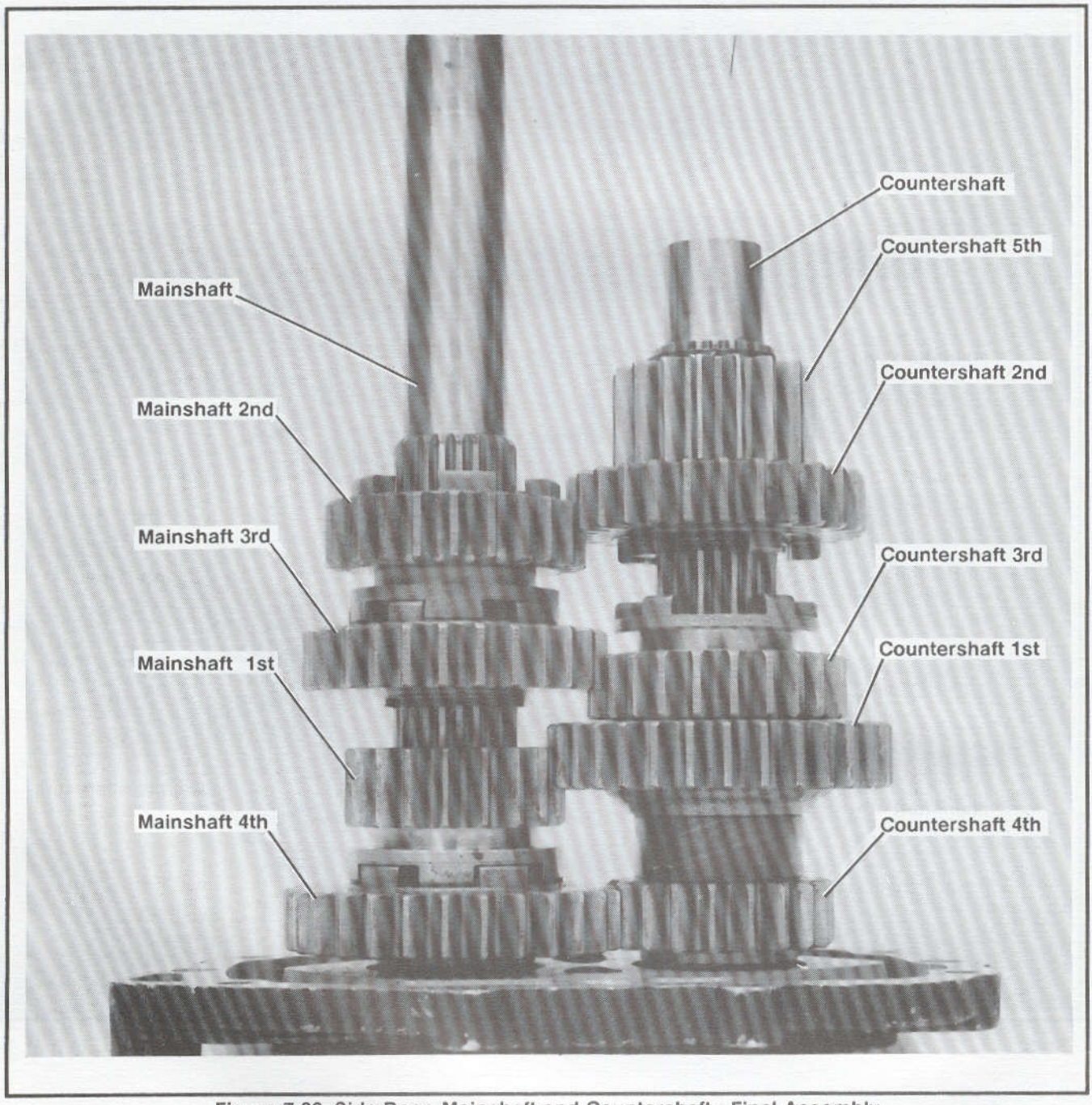


Figure 7-23. Side Door, Mainshaft and Countershaft - Final Assembly

TRANSMISSION CASE

REMOVAL

Special Tools	Torque Values (ft-lbs)
HD-35316 Main drive gear remover and installer	None

NOTE

Removal of the transmission case is only necessary if it is damaged and has to be replaced.

1. Remove primary cover. See Figure 7-24. Remove transmission mounting bolts and two locking tabs. Remove primary chaincase. See Section 6. Remove starter. See Section 5.

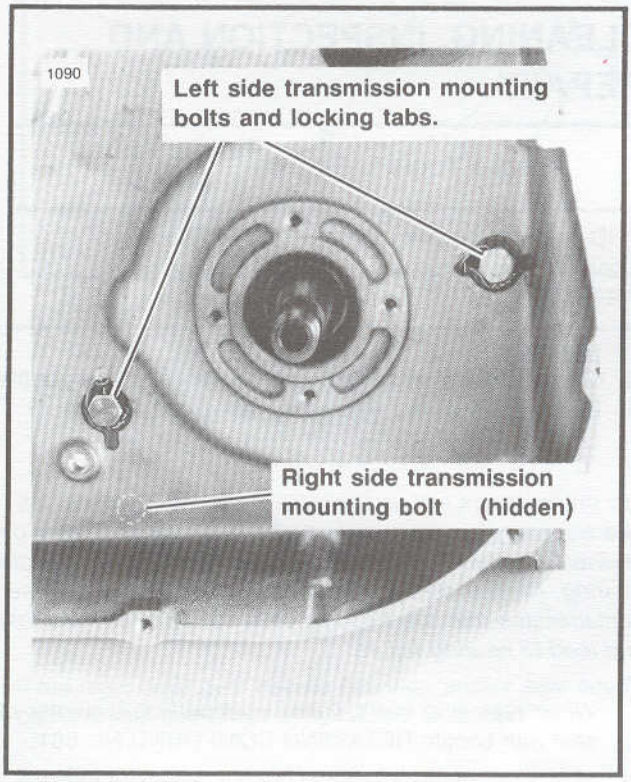


Figure 7-24. Transmission to Primary Mounting Bolts

2. Remove oil tank. See OIL TANK Section 3.
3. Remove sprocket. See TRANSMISSION SPROCKET Section 6.
4. Remove mainshaft and countershaft assemblies with access door. See MAINSHAFT AND COUNTERSHAFT REMOVAL.

Main Drive Gear and Bearing

NOTE

Main drive gear and bearing can be removed with the transmission case in the frame. Use MAIN DRIVE GEAR REMOVER AND INSTALLER, Part No. HD-35316.

5. See Figure 7-25. To remove main drive gear:
   a. Remove retaining ring (7).

NOTE

The main drive gear bearing must be replaced if the main drive gear is removed. The bearing will be damaged during the removal procedure.

   b. Pull main drive gear (9), using HD-35316, MAIN DRIVE GEAR REMOVER AND INSTALLER.
   c. Remove bearing (8) from case using a block of wood and a hammer.
6. Disconnect foot shifter rod from shifter arm.

INSTALLATION

Special Tools	Torque Values (See below)
HD-35316 Main drive gear remover and installer	Sprocket nut 110 - 120 ft-lbs Sprocket nut lockscrew 50-60 in-lbs Transmission mounting bolts 33 - 38 ft-lbs

Main Drive Gear

NOTE

If the transmission case was removed, install it BEFORE assembling the main drive gear.

CAUTION

Failure to use the MAIN DRIVE GEAR AND BEARING INSTALLATION TOOL will cause premature failure of bearing and related parts.

1. Install main drive gear bearing. Install the main drive gear from inside the case using MAIN DRIVE GEAR AND BEARING INSTALLATION TOOL, Part No. HD-35316. Follow instructions provided with tool.
2. See Figure 7-25. Install the quad seal (26), spacer (5) and sprocket (4) on the main drive gear (9). Coat the threads of sprocket nut (2) with Loctite 262 (red) and install on the main drive gear.

NOTE

Sprocket nut (2) has left-hand thread.

NOTE

Place belt on transmission sprocket as sprocket is placed in position.

3. Slide the countershaft and mainshaft assembly into the transmission case and lock the transmission by engaging two gears at once. Tighten the nut (2) to 110-120 ft-lbs torque.

4. Install the lockscrew (1991) or the lockplate (1992). See TRANSMISSION SPROCKET, Section 6.

5. Install shifter cam and shifter forks. See previous subjects in this Section.

6. Install top cover, right side cover, primary case, starter, clutch, primary chain and sprocket. See previous Sections.

7. Tighten transmission mounting bolts to 33-38 ft-lbs torque. Connect foot shifter rod to shifter arm.

8. Perform adjustments listed in TRANSMISSION, ADJUSTMENT section. Adjust belt. See BELTS AND SPROCKETS ADJUSTMENT, Section 6. Align vehicle. See VEHICLE ALIGNMENT, Section 2.

9. Adjust primary chain and install primary cover. See ADJUSTMENTS, Section 6.

10. Install the exhaust system and oil tank. See EXHAUST SYSTEM, Section 4 and OIL TANK, Section 3.

11. Install transmission drain plug so it projects 0.16-0.18 in. above surface of housing. Fill with approximately 20-24 oz. of TRANSMISSION LUBRICANT, Part No. 99892-84 or until lubricant is at the full mark on the dipstick, with the motorcycle upright and level and the dipstick dipped, not screwed, into the fill hole.

CAUTION

Be sure you do not overfill the primary chaincase. Overfilling will cause rough clutch engagement and incomplete disengagement or clutch drag.

12. Place motorcycle in an upright position and fill primary chaincase with PRIMARY CHAINCASE LUBRICANT, Part No. 99887-84. Fill to the bottom edge of the diaphragm spring (2 3/4 in. from the centerline of the clutch adjusting screw).

13. Adjust gear engagement. See ADJUSTMENT, GEAR ENGAGEMENT.

DISASSEMBLY

Shifter Arm Assembly

1. See Figure 7-25. Loosen screw (12) and remove shifter lever (13) from shifter arm (16).

2. Loosen locknut (25) and turn adjusting screw (24) out until it clears the centering plate (18). Pull shifter arm assembly out of the case.

NOTE

Do not perform step 3 if parts do not need to be replaced.

3. Remove retaining ring (22), pin (19), springs (17 and 20) and centering plate (18). Pin is a press fit.

4. Remove bolts and washers that secure transmission case to frame.

5. Remove transmission case.

CLEANING, INSPECTION AND REPAIR

Special Tools	Torque Values (ft-lbs)
HD-34734 Main drive gear bearing and seal installation tool	None

1. Clean all parts in solvent except the case and needle bearings. Blow dry with 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.

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. Inspect the shifter pawl and centering plate for wear. If pawl ends are damaged or the centering plate is elongated, replace them.

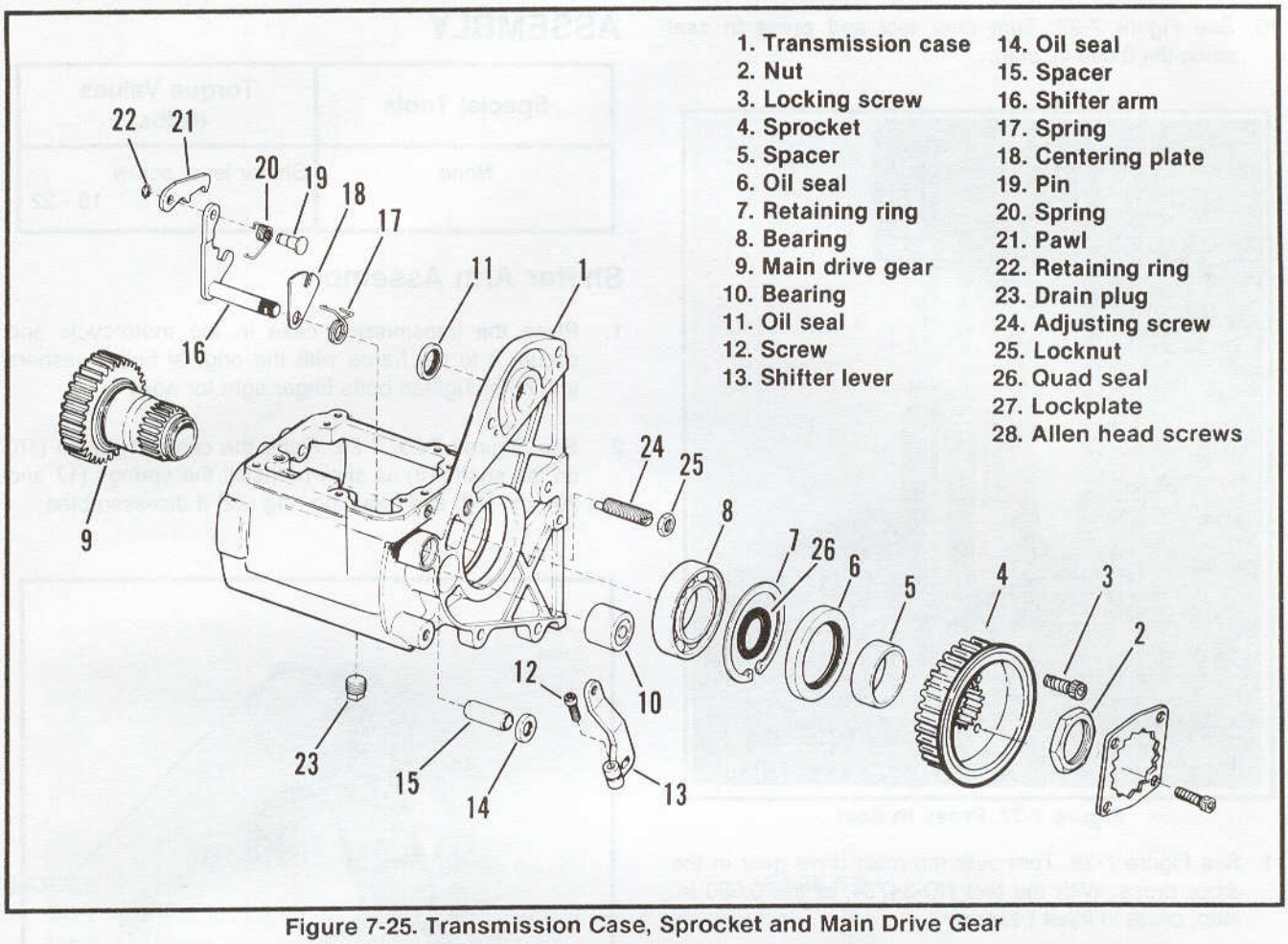


Figure 7-25. Transmission Case, Sprocket and Main Drive Gear

6. See Figure 7-25. Inspect the springs (17 and 20). Replace the pawl spring (20) if it fails to hold the pawl (21) on the cam pin (19).

7. Inspect the needle bearings on the inside of the main drive gear. If mainshaft race surface appears pitted or grooved, replace these bearings.

NOTE

If the main drive gear needle bearings and/or seal need to be replaced, see Steps 8, 9, 10 and 11 below.

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-34734.

9. See Figure 7-26. Install clutch side needle bearing using an arbor press and the 0.280 in. step end of tool HD-34734 as shown. Press until tool is flush.

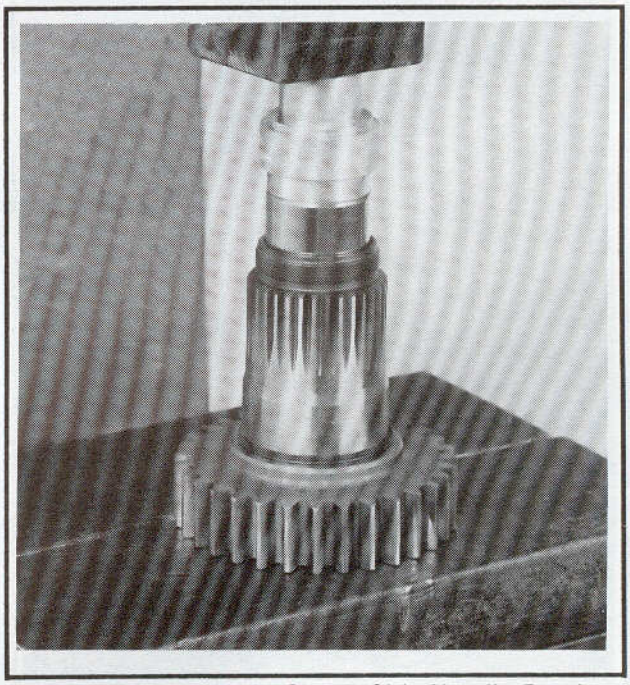


Figure 7-26. Installing Clutch Side Needle Bearing in Main Drive Gear

10. See Figure 7-27. Turn over tool and press in seal using the 0.090 in. step.

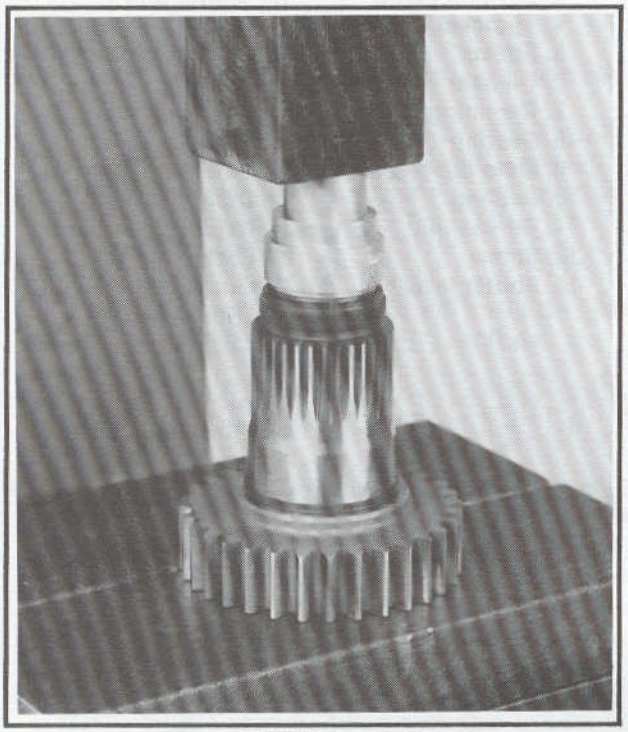


Figure 7-27. Press in Seal

11. See Figure 7-28. Turn over the main drive gear in the arbor press. With the tool HD-34734, at the 0.090 in. step, press in inner bearing.

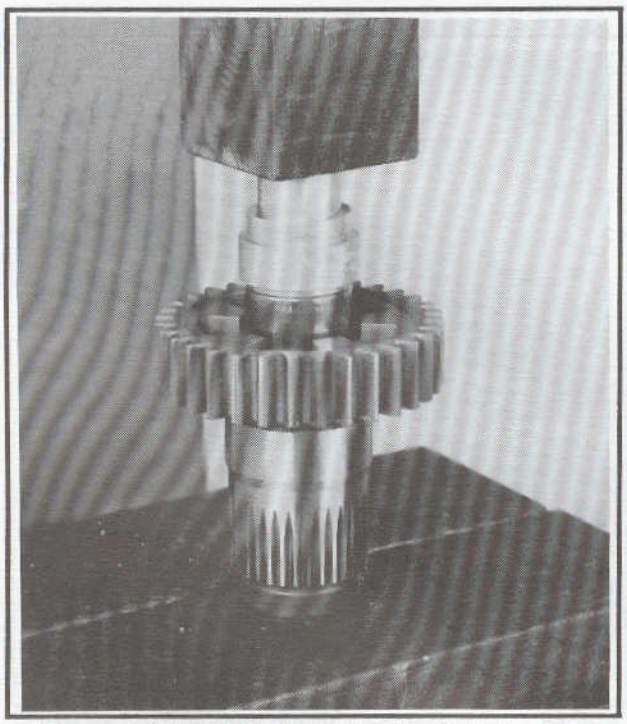


Figure 7-28. Install Transmission Side Needle Bearing in Main Drive Gear

ASSEMBLY

Special Tools	Torque Values (ft-lbs)
None	Shifter lever screw 18 - 22

Shifter Arm Assembly

1. Place the transmission case in the motorcycle and secure it to the frame with the original bolts, washers and nuts. Tighten bolts finger tight for now.

2. See Figures 7-25, 7-29. Place the centering plate (18) on the shaft (16) as shown. Install the springs (17 and 20), pin (19) and retaining ring (22) if disassembled.

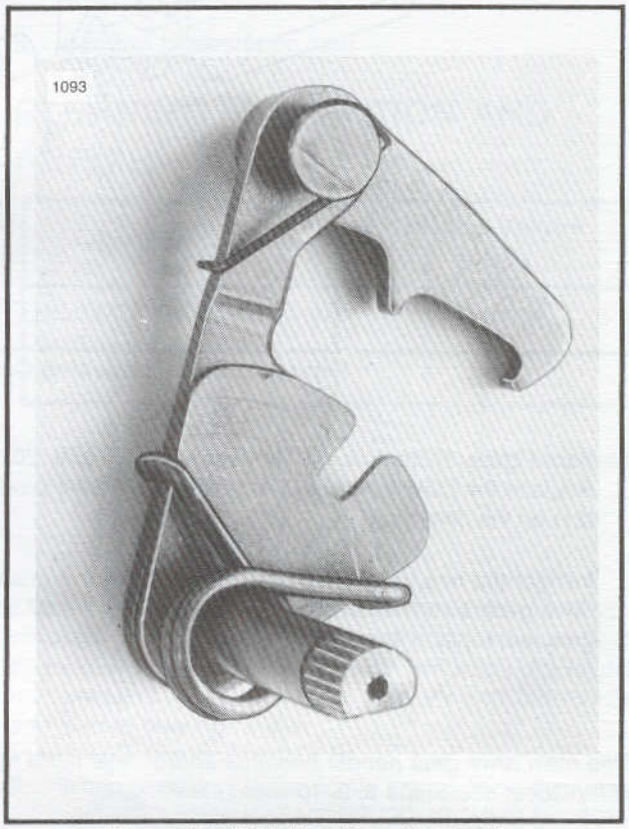


Figure 7-29. Shifter Arm Assembly

3. Insert the assembly into the transmission case with the adjusting screw in the centering plate slot.

4. See Figure 7-25. Install shifter lever (13) on the shaft end and tighten the screw (12) to 18-22 ft-lbs torque. Be sure screw (12) registers in the slot on the shifter arm (16).

NOTE

Adjuster screw also functions as a stop.

ELECTRICAL

SPECIFICATIONS

IGNITION

Spark Timing Advance

Range ..... 0°–35° BTDC
Start ..... 0° BTDC

Idle Speed ..... 1000-1050 RPM

Spark Plugs

Size ..... 14 mm
Gap ..... 0.038-0.043 in.
Type ..... Harley-Davidson No. 5R6A (No Substitute)

Ignition Coil Resistance

Primary ..... 2.5 to 3.1 Ohms
Secondary ..... 11,250 to 13,750 Ohms

BATTERY

All ..... 12 volt, 19 amp. hr.

ALTERNATOR

AC Voltage Output ..... 16-20 VAC per 1000 rpm
Stator Coil Resistance ..... 0.1-0.2 ohms

REGULATOR

Voltage output @ 3600 rpm ..... 13.8-15 @ 75°F
Amperes @ 3600 rpm ..... 32 Amps

Circuit Breakers

CIRCUIT	CIRCUIT BREAKER RATING (Amperes)
Main	30
Ignition	15
Lights	15
Accessory	15

BULB CHART

The bulb chart below gives the location and bulb requirements for Harley-Davidson Softail motorcycles.

FLSTC/F, FXSTC/S

LAMP DESCRIPTION (ALL LAMPS 12 V)	NUMBER OF BULBS REQUIRED	CURRENT DRAW (Amperage)	HARLEY-DAVIDSON PART NUMBER
Headlamp	1		
FLSTC/F	1	3.9	67713-86
FXSTC/S	1	2.73	67698-81
Tail and Stop Lamp	1		68168-89
Tail Lamp		0.59	
Stop Lamp		2.10	
Instrument Lamps			
High Beam Indicator	1	0.04	71092-68A
Oil Pressure Signal	1	0.08	68462-64
Neutral Indicator	1	0.08	68462-64
Turn Signal Indicator	1	0.08	68462-64
Speedometer	1	0.27	71090-64A
Turn Signal Lamps			
Front	2	2.10	68168-89
Rear	2	2.10	68572-64B
Fender Tip Lamps - FLSTC	2	0.5	53439-79
Passing Lamps - FLSTC	2	2.34	68674-69

IGNITION SYSTEM

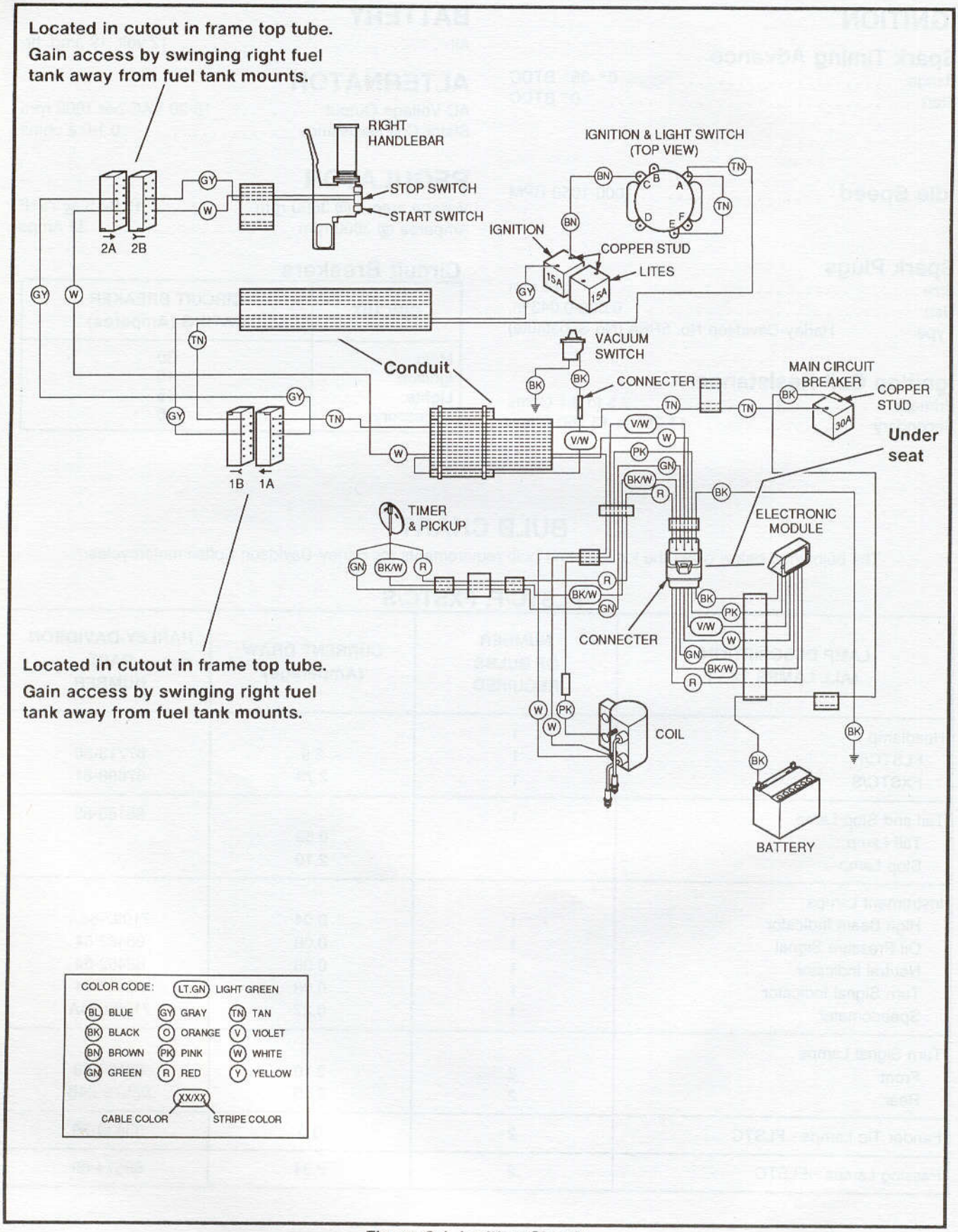


Figure 8-1. Ignition Circuit

GENERAL

The ignition system is a breakerless inductive discharge ignition system. It has two circuits, the primary circuit and the secondary circuit. The primary circuit consists of the battery, ignition switch, primary coil winding, computerized ignition timer and associated wiring. The secondary circuit consists of the secondary coil, the spark plugs and associated wiring.

The computerized ignition system consists of three components, the rotor and sensor plate, the computerized microprocessor module, and the vacuum operated electric switch (V.O.E.S.). The rotor and sensor plate are located in the cam gearcase cover on the right side of the motorcycle. The computer module is mounted above the oil tank, on the frame member. The computer has two functions. First, it computes the spark advance for proper ignition firing. Second, it opens and closes the low voltage circuits between the battery and ignition coil to produce high voltage discharge to the spark plugs.

The vacuum operated electric switch (V.O.E.S.) senses intake manifold vacuum through an opening in the carburetor body. The V.O.E.S. is connected to the carburetor with a vacuum hose. The switch is open under acceleration and high engine load conditions (low vacuum) and closed under low engine load conditions (high vacuum).

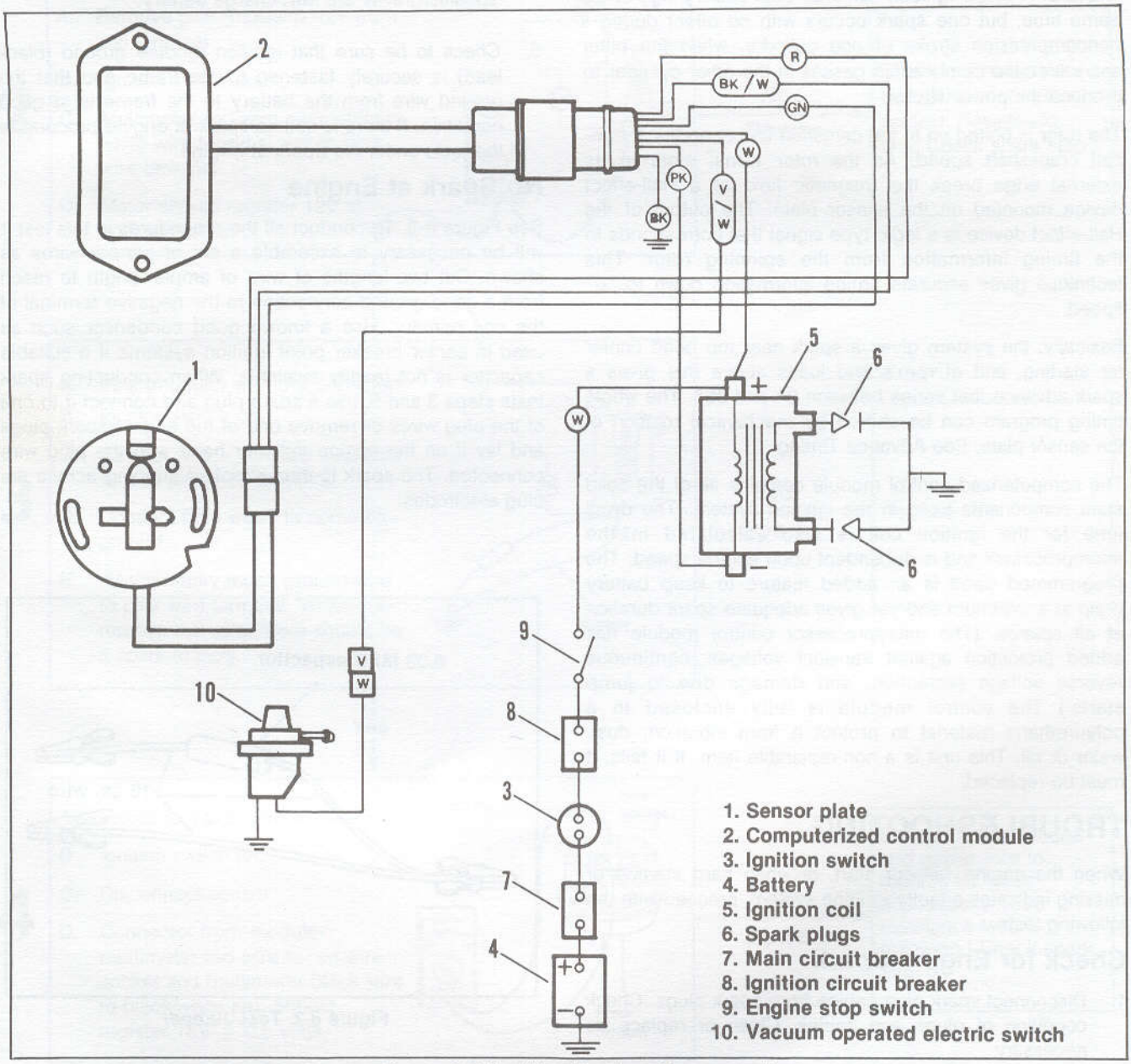


Figure 8-2. Ignition System Components

The computer module is programmed with two spark advance curves to meet varying engine loads. The high vacuum curve selected for maximum spark advance under normal light load cruising conditions provides improved fuel economy and performance. The low vacuum curve (retarded spark) minimizes spark knock, while maintaining performance, under high load conditions (acceleration and highway driving).

The computer module selects the proper curve when it receives an open or closed electrical signal from the V.O.E.S. This system ensures correct timing to suit starting, low and high speed requirements.

The ignition timer includes a rotor, sensor plate, and a computerized microprocessor control module and a V.O.E.S. A single ignition coil fires both spark plugs at the same time, but one spark occurs with no effect during a noncompression stroke of one cylinder, while the other spark fires the combustible gasses in the other cylinder to produce the power stroke.

The rotor is bolted on to the camshaft and operates at one-half crankshaft speed. As the rotor turns, slots in its external edge break the magnetic field of a Hall-effect device mounted on the sensor plate. The output of the Hall-effect device is a logic-type signal that corresponds to the timing information from the spinning rotor. This technique gives accurate timing information down to "0" speed.

Basically, the system gives a spark near top dead center for starting, and at rpm's and loads above this gives a spark advance that varies between 0° and 35°. The whole timing program can be shifted by mechanical rotation of the sensor plate. See Advance Timing.

The computerized control 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 engine speed. The programmed dwell is an added feature to keep battery drain to a minimum and yet gives adequate spark duration at all speeds. (The microprocessor control module has added protection against transient voltages, continuous reverse voltage protection, and damage due to jump starts.) The control 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.

TROUBLESHOOTING

When the engine will not start, or when hard starting or missing indicates a faulty ignition system, proceed with the following tests.

Check for Engine Spark

1. Disconnect spark plug cables from spark plugs. Check condition of plugs and cables. Clean or replace as necessary.
2. Insert a conductive adapter into spark plug cable nipple and establish a 3/16 in. gap between adapter and cylinder head. Turn on ignition and engine stop switches. Crank engine. Check to see if there is a spark across the gap. If there is a spark, the problem is not in the electronic system or coil. Check carburetion, choke and spark plugs.
3. If there is no spark, check battery voltage and battery connection condition. Battery voltage must be 11-13V DC.
4. Check specific gravity of battery electrolyte with hydrometer. Specific gravity must be 1.250 (temperature corrected) or higher. If voltage and specific gravity are low, charge battery.
5. Check to be sure that ignition module ground (black lead) is securely fastened to the frame and that the ground wire from the battery to the frame is in good condition. If there is still no spark at engine proceed to the tests under No Spark at Engine.

No Spark at Engine

See Figure 8-3. To conduct all the procedures in this test it will be necessary to assemble a set of jumper wires as shown. Cut two lengths of wire of ample length to reach from a good ground connection to the negative terminal of the coil primary. Use a known good condensor such as used in earlier breaker point ignition systems if a suitable capacitor is not readily available. When conducting spark tests steps 3 and 5, use a spare plug and connect it to one of the plug wires or remove one of the engine spark plugs and lay it on the engine cylinder head with the plug wire connected. The spark is then checked jumping across the plug electrodes.

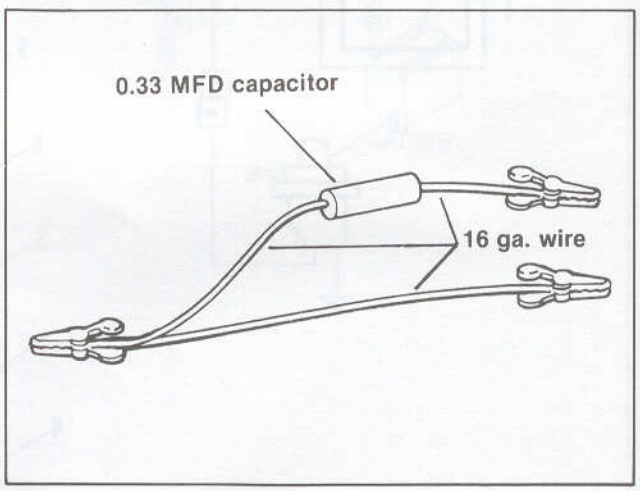


Figure 8-2. Test Jumper

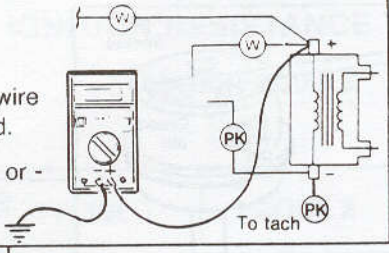
CONTINUOUS OR NO SPARK AT SPARK PLUG

1

A. Ignition switch on.

B. Multimeter red wire to white wire terminal, black wire to ground.

C. Meter should register 12V + or - one volt.



No Power → Check Circuit breaker, loose wires, switches. See Troubleshooting Section 5.

Yes ↓

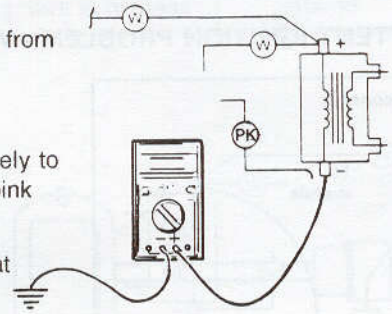
2

A. Remove pink (module) wire from coil terminal.

B. Ignition switch on.

C. Multimeter red wire alternately to white wire terminal and to pink wire terminal.

D. Meter should register 12V at both terminals.



No Power → Check coil resistance. See COIL later in this section. Resistance O.K. Check spark step 3.

Yes ↓

3

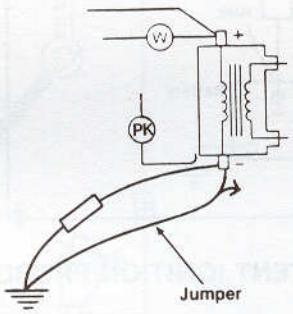
A. Pink (module) wire disconnected.

B. Ignition switch on.

C. Jumper wire -- connect capacitor wire to pink wire terminal.

D. Connect both wires to common ground.

E. Momentarily touch ground wire to pink wire terminal. When you remove the wire, there should be a spark at plug.



No Spark → Replace coil.

Yes ↓

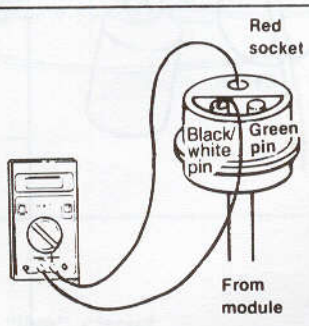
4

A. Reconnect pink wire to coil.

B. Ignition switch on.

C. Disconnect sensor.

D. Connector from module- multimeter red wire to red wire socket and multimeter black wire to black/white pin. Should register 12V ± 0.5 volts.



No Power → Check module ground and power wire to module for loose connections. (See resistance test, following.) Check spark, step 5.

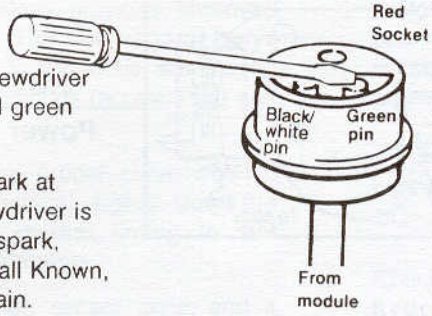
Yes ↓

5

A. Ignition on.

B. Momentarily place screwdriver across black/white and green connector pins.

C. Strong evidence of spark at spark plug when screwdriver is removed. If there is a spark, sensor is suspect. Install Known, good sensor & test again.



No Spark →

Check module resistance. See Ignition Module Resistance Test. Replace module if resistance is bad.

INTERMITTENT IGNITION PROBLEM - VIBRATION

A. Check battery connections. Disconnect module ground (scrape paint, add star washer).

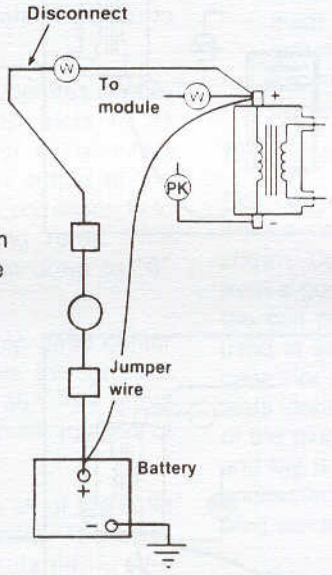
B. Disconnect white wire at coil terminal (not module feed).

C. Connect 16 ga. jumper wire from battery positive terminal to white wire terminal of coil.

D. Operate vehicle to see if problem is eliminated.

NOTE

Vehicle no longer has an engine stop switch. Engine must be stopped by removing jumper wire.



Yes →

Problem is vibration, possibly loose connection at safety switches in starter circuit. See TROUBLESHOOTING section 5.

INTERMITTENT IGNITION PROBLEM - TEMPERATURE

A. Remove outer timing cover.

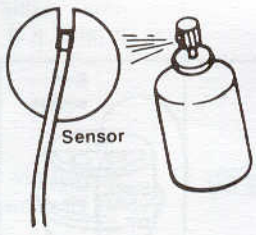
B. Remove inner timing cover and gasket.

C. Start-up vehicle.

D. Spray nose of sensor with coolant (obtainable at electronic supply houses) to see if engine kills.

E. With engine hot, at operating temperature and cover off, apply heat (blow dryer) to nose of sensor and see if engine kills.

F. Apply heat to module (blow dryer) and see if engine kills.



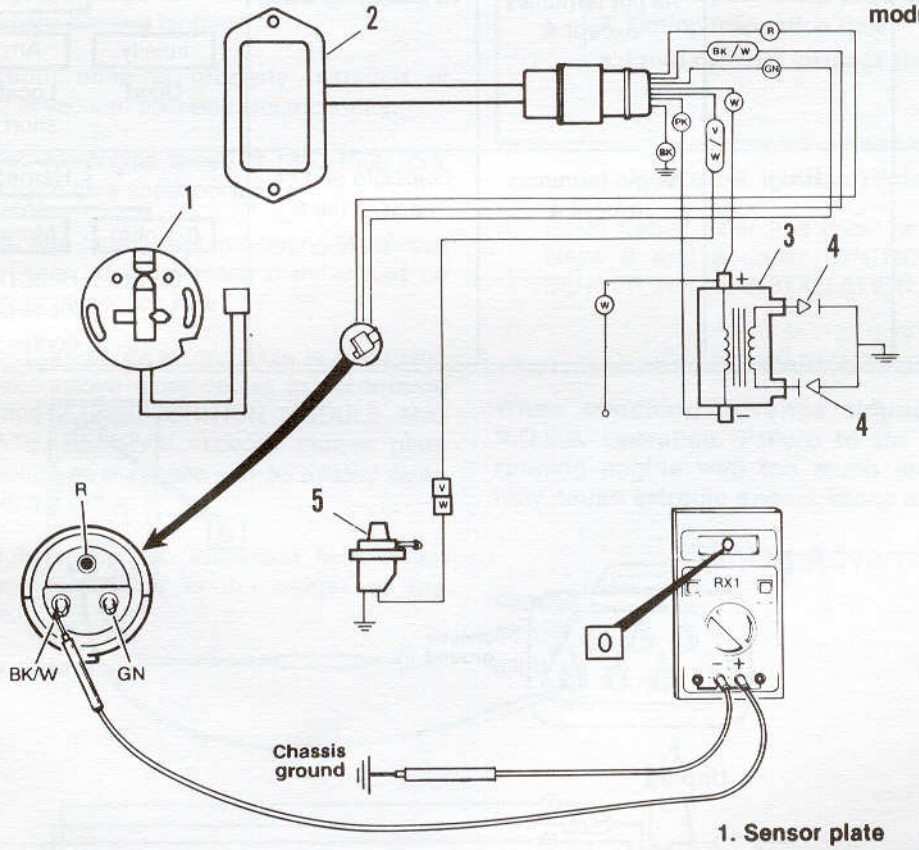
Yes →

Problem is temperature sensitive sensor or module. Replace sensor or module.

IGNITION RESISTANCE TEST

IGNITION MODULE

TEST	METER SETTING	PROBE 1	PROBE 2	METER READING
Check for grounds	RX1	To black/white wire in harness	To chassis ground	Module 0 - 1 ohm: Good More than 1 ohm: Check harness for opens. See next page. If harness checks OK, replace module.



1. Sensor plate
2. Computerized control module
3. Ignition coil
4. Spark plugs
5. Vacuum operated electric switch

CAUTION

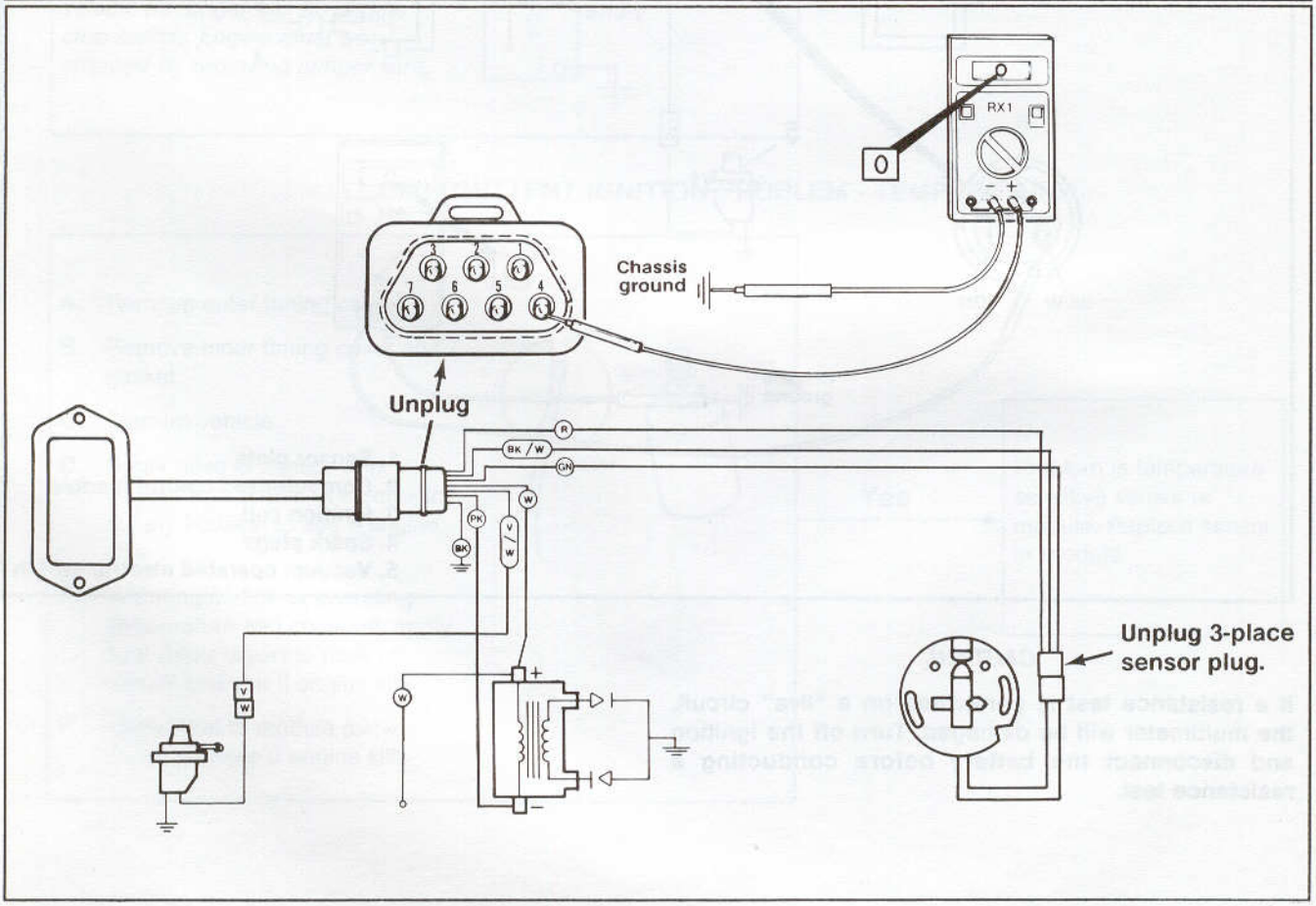
If a resistance test is performed on a "live" circuit, the multimeter will be damaged. Turn off the ignition and disconnect the battery before conducting a resistance test.

IGNITION RESISTANCE TEST

IGNITION MODULE HARNESS

TEST CONDITIONS: **Engine Stop switch on right handlebar must be in "OFF" position and 7-place and sensor 3-place connectors must be unplugged for these tests. Shake or wiggle the harness to detect any breaks in the wiring.**

TEST	METER SETTING	PROBE 1	PROBE 2	METER READING
Check for grounds	RX1	To pin 4 in 7 pin connector	To chassis ground	Harness → 0-1 ohm: Good; More than 1 ohm: Repair/clean ground connection.
Check for grounds	RX1	All pin terminals except 4	To chassis ground	Harness → Infinity: Good; Any resistance: Locate and repair short to ground
Continuity	RX1	All pin terminals except 4	Opposite end of each of the 6 leads	Harness → 0-1 ohm: Good; More than 1 ohm: Repair broken wire or loose/dirty connection.



ADJUSTMENT/TESTING

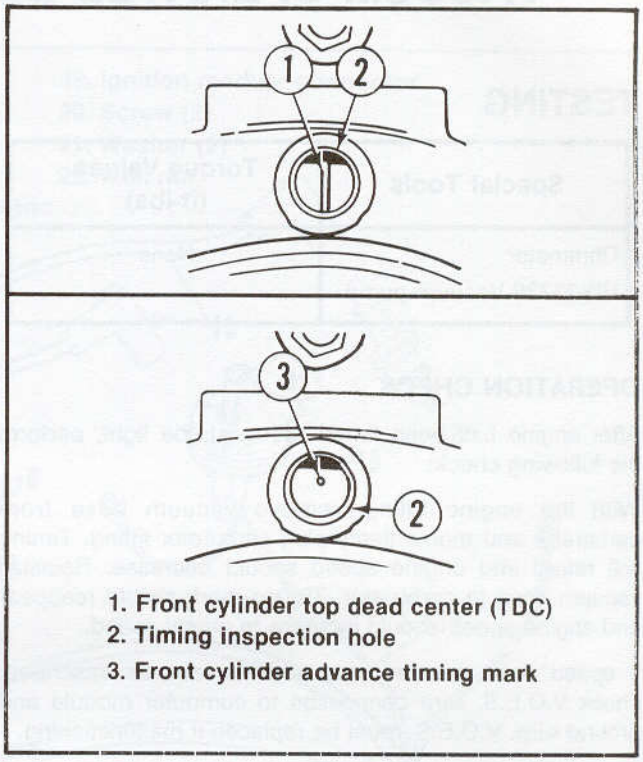
Special Tools	Torque Values (ft-lbs)
HD-33813 Inductive timing light HD-96295-65D Timing mark view plug	None

Advance Timing (Figure 8-4)

Ignition timing should be checked every 5000 miles.

Use an INDUCTIVE TIMING LIGHT, Part No. HD-33813 (timing gun) to view ignition timing mark on flywheel through TIMING MARK VIEW PLUG, Part No. HD-96295-65D, screwed into timing inspection hole. Be sure view plug does not touch flywheel.

1. Connect timing light leads to front spark plug cable, ground and battery positive terminal.
2. Be sure vacuum hose is properly installed at carburetor and at vacuum operated electric switch.
3. Start engine and set engine speed at 1300-1500 rpm. Light will flash each time spark occurs.
4. See Figure 8-4. Aim timing light into timing inspection hole. Front cylinder advance timing mark should be centered in timing inspection hole.
5. If timing mark is not centered or visible in the timing inspection hole, remove timer covers in accordance with steps 1 and 2 under IGNITION MODULE AND SENSOR PLATE, REMOVAL. Loosen sensor plate screws just enough so that plate can be rotated using a screwdriver in the notch.
6. With timing light aimed into inspection hole, rotate plate until timing mark is in the center of the inspection hole.
7. Tighten sensor plate screws.



1. Front cylinder top dead center (TDC)
2. Timing inspection hole
3. Front cylinder advance timing mark

Figure 8-4. Ignition Timing Mark

8. Install gasket inner and outer timer covers following steps 8 and 9 under IGNITION MODULE AND SENSOR PLATE, INSTALLATION.

WARNING

When checking advance timing, always check V.O.E.S. operation. Failure to do so may result in running engine with too much spark advance, and may cause extreme engine knock and engine failure.

Timing Advance

RANGE	0°-35° BTDC
START	5° BTDC
IDLE	35° BTDC

VACUUM OPERATED ELECTRIC SWITCH (V.O.E.S.)

TESTING

Special Tools	Torque Values (ft-lbs)
Ohmmeter HD-23738 Vacuum pump	None

OPERATION CHECK

After engine has been timed with a strobe light, perform the following check:

With the engine idling, remove vacuum hose from carburetor and momentarily plug carburetor fitting. Timing will retard and engine speed should decrease. Reinstall vacuum hose to carburetor. Timing mark should reappear and engine speed should increase to preset speed.

If speed does not decrease and increase as described, check V.O.E.S. wire connection to computer module and ground wire. V.O.E.S. must be replaced if malfunctioning.

REMOVAL AND INSPECTION

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables, (negative cable first) before performing any of the following procedures.

1. Disconnect wire from V.O.E.S. to computer module.
2. Disconnect V.O.E.S. ground wire from engine.
3. Remove V.O.E.S.
4. Connect ohmmeter across two V.O.E.S. wires. Ohmmeter should indicate an open circuit (∞ ohms).
5. Attach hose of VACUUM PUMP, Part No. HD-23738, to V.O.E.S.
6. Slowly squeeze vacuum pump handle and observe vacuum gage and ohmmeter.
7. The ohmmeter should indicate switch closure (0 ohms) at 3.5-4.5 in. of mercury.
8. Vacuum readings other than those listed above require V.O. E.S. replacement.
9. Refer to the latest Harley-Davidson Parts Catalog for V.O.E.S. part number.

1. Outer cover rivet (2)
2. Outer cover
3. Inner cover screw (2)
4. Inner cover
5. Gasket
6. Sensor plate screw (2)
7. Washer (2)
8. Sensor plate
9. Rotor screw
10. Rotor
11. Camshaft oil seal
12. Connector
13. Ignition module
14. Ignition coil
15. Spark plug cable (2)
16. Ignition coil terminal
17. V.O.E.S. wire
18. Vacuum operated electric switch
19. Ignition module connector
20. Screw (2)
21. Washer (2)
22. Well nut

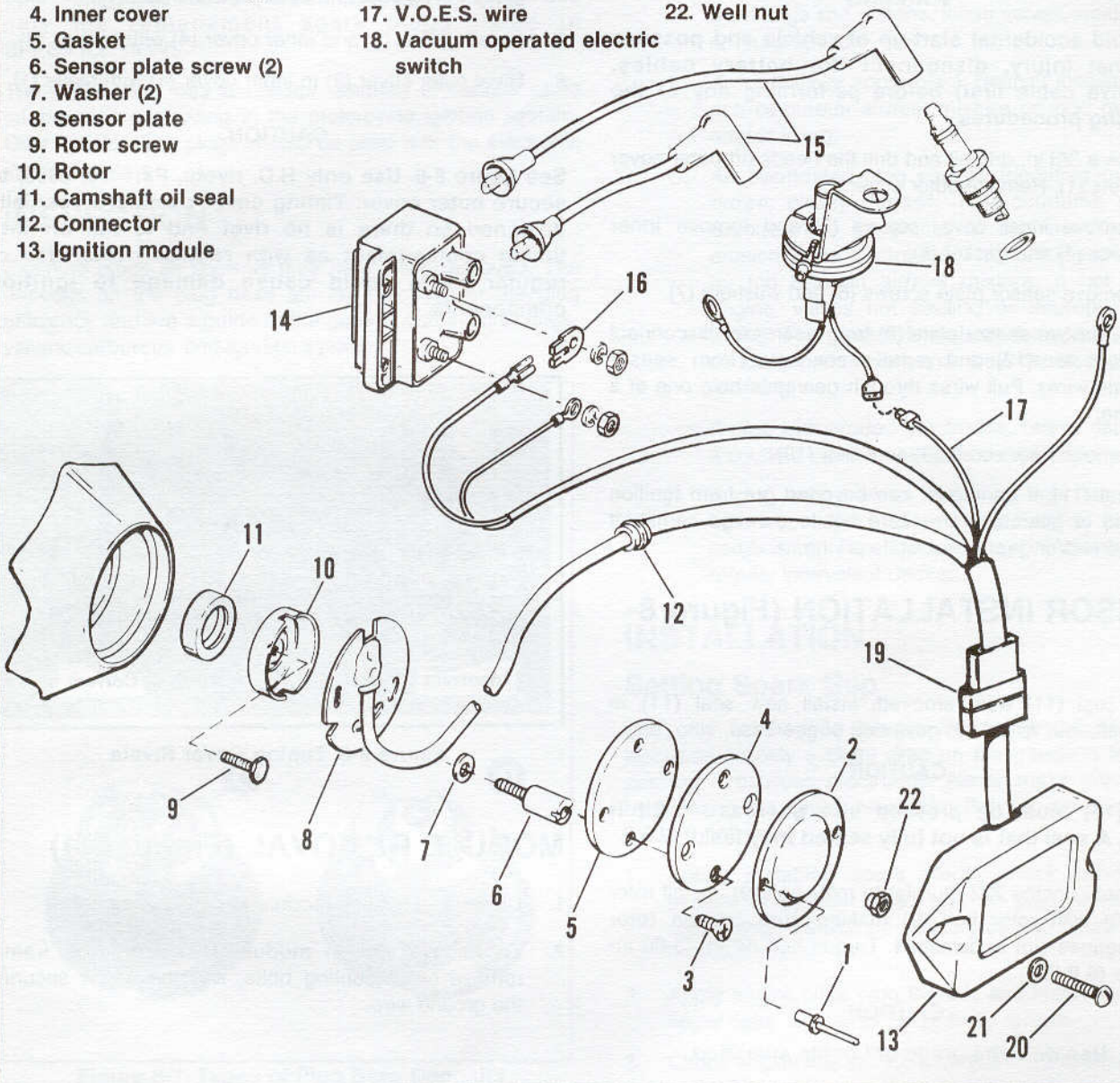


Figure 8-5. Ignition Components

IGNITION MODULE AND SENSOR PLATE

SENSOR REMOVAL (Figure 8-5)

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables, (negative cable first) before performing any of the following procedures.

1. Use a 3/8 in. drill bit and drill the heads off outer cover rivets (1). Remove outer cover (2).
2. Remove inner cover screws (3) and remove inner cover (4) and gasket (5).
3. Remove sensor plate screws (6) and washers (7).
4. To remove sensor plate (8) from gearcase, disconnect connector (12) and remove connector from sensor plate wires. Pull wires through gearcase hole one at a time.
5. Remove rotor screw (9) and rotor (10).
6. Seal (11), if damaged, can be pried out from ignition side of gearcase. Use care not to damage camshaft end and/or gear cover while prying.

SENSOR INSTALLATION (Figure 8-5)

1. If seal (11) was removed, install new seal (11) in gearcase, lip side to gear side of gearcase.

CAUTION

Seal (11) must be pressed into gearcase until it stops. A seal that is not fully seated may leak.

2. Apply Loctite 222 (purple) to rotor bolt (9). Install rotor (10) with rotor bolt (9) making sure tab on rotor engages slot in camshaft. Torque bolt (9) to 75-80 in-lbs (6 ft-lbs).

CAUTION

Use only the grade of Loctite specified.

3. Install sensor plate (8) with screws (6) and washers (7). Tighten screws to 15-30 in-lbs torque.

NOTE

If sensor plate was completely removed, it may be necessary to install new wire pins, sockets and body receptacle.

4. Set timing plate so screws are in center of slots. Start the engine and check advanced timing under running conditions as described in previous sections.
5. Install gasket (5) and inner cover (4) with screws (3).
6. Rivet outer cover (2) to inner cover (4) with rivets (1).

CAUTION

See figure 8-6. Use only H.D. rivets, Part No. 8699, to secure outer cover. Timing cover rivets are specially designed so there is no rivet end to fall off into timing compartment as with regular rivets. Use of regular rivets could cause damage to ignition components.

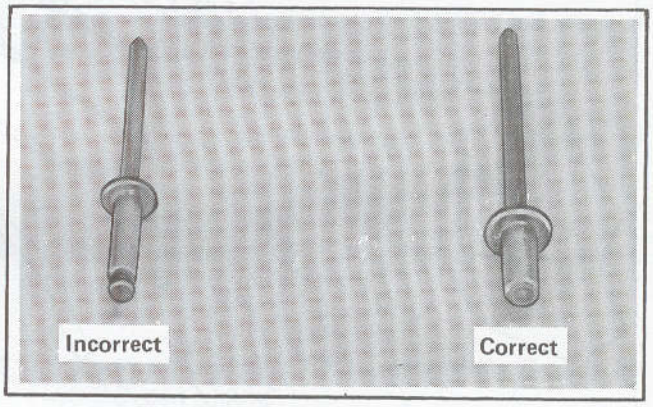


Figure 8-6. Timing Cover Rivets

MODULE REMOVAL (Figure 8-4)

1. Disconnect ignition module at 7-pin connector.
2. To remove ignition module (13), from the frame, remove two mounting bolts, and the screw securing the ground wire.

MODULE INSTALLATION (Figure 8-4)

1. Install ignition module (13) on frame mounting bracket.
2. Connect ignition module at 7-pin connector.

SPARK PLUGS

GENERAL

Spark plugs should be replaced every 5000 miles. Use only the replacement spark plugs listed in SPECIFICATIONS.

The 5R6A plug has a resistor element to reduce radio interference originating in the motorcycle ignition system. Only resistor type plugs should be used with the electronic ignition system.

INSPECTION

Examine plugs as soon as they have been removed. The deposits on the plug base are an indication of the plug efficiency and are a guide to the general condition of rings, valves, carburetor and ignition system.

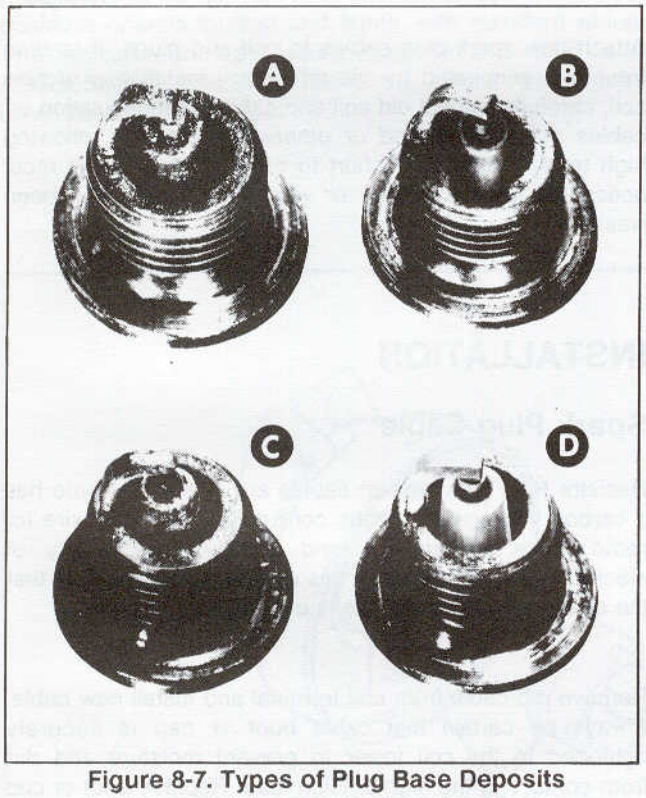


Figure 8-7. Types of Plug Base Deposits

A. A wet black and shiny deposit on plug base, electrodes and ceramic insulator tip indicate an oil fouled plug. The condition may be caused by worn rings and pistons, loose valves, weak battery or faulty ignition.

B. A dry fluffy or sooty black deposit indicates a too rich carburetor air/fuel mixture or long periods of engine idling.

C. An overheated plug can be identified by a light brown, glassy deposit. This condition may be accompanied by cracks in the insulator or by erosion of the electrodes. This condition is caused by too lean an air/fuel mixture, 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 should be replaced.

D. A plug with a white, yellow or light tan to rusty brown powdery deposit indicates balanced combustion. The deposits may be cleaned off at regular intervals if desired.

INSTALLATION

Setting Spark Gap

Use only a wire-type gauge. Bend the outside of the electrode so only a slight drag on the gauge is felt when passing it between electrodes. Never make adjustments by bending the center electrode. Set gap on all plugs at 0.038-0.043 in.

1. Before installing spark plugs, check condition of threads in cylinder head and on plug. If necessary soften deposits with penetrating oil and clean out with a thread chaser.
2. Apply engine oil to plug threads and install spark plug finger tight. Tighten to 18-22 ft-lbs torque.
3. Check engine idle speed, and adjust if necessary.

IGNITION COIL

GENERAL

The ignition coil is a pulse type transformer that transforms or steps up low battery voltage to the high voltage necessary to jump the electrode at the spark plug in the cylinder head. Internally the coil consists of primary and secondary windings with a laminated iron core. It is sealed in water-proof insulating compound. The ignition coil cannot be taken apart or repaired. If the ignition coil is faulty, it must be replaced.

TROUBLESHOOTING

Special Tools	Torque Values (ft-lbs)
Ohmmeter	None

See Figure 8-8. When engine will not start or when hard starting or missing indicates a faulty ignition system, follow the troubleshooting procedure listed under the respective ignition system sections. If condition persists, check primary and secondary resistance of ignition coil with an ohmmeter. Resistances should be within the following limits:

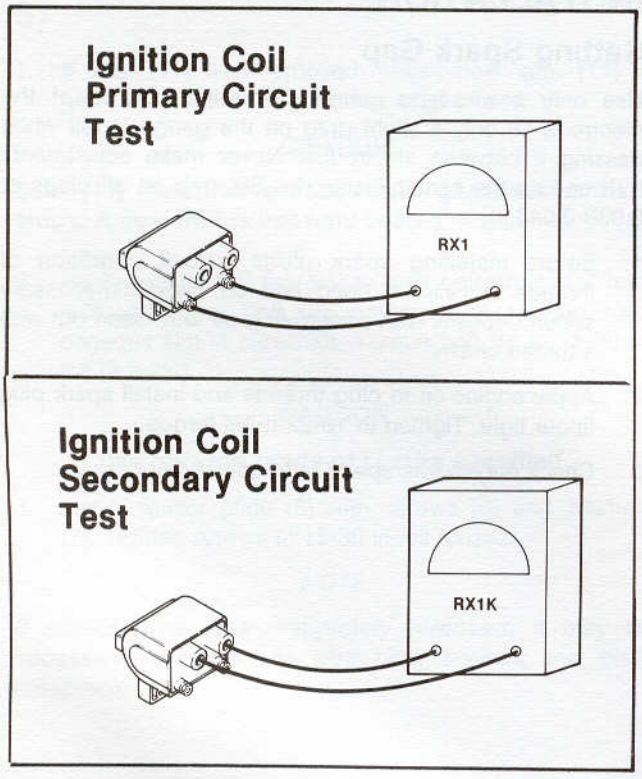


Figure 8-8. Test Ignition Coil

Primary	2.5 - 3.1 ohms
Secondary	11,250 - 13,750 ohms

If an ohmmeter is not available, temporarily substitute a new ignition coil by attaching it at any convenient point near old coil (coil will function without being securely grounded). Transfer terminal wires to new coil as shown in wiring diagram for that particular model.

CAUTION

Connect ignition coil wires as shown in wiring diagrams. Reversing polarity to the ignition control module will permanently damage the control module.

Attach new spark plug cables to coil and plugs. If ignition trouble is eliminated by the temporary installation of new coil, carefully inspect old coil and cables. The insulation on cables may be cracked or otherwise damaged, allowing high tension current to short to metal parts. This is most noticeable in wet weather or when motorcycle has been washed.

INSTALLATION

Spark Plug Cable

Resistor type high tension cables are used. This type has a carbon impregnated fabric core instead of solid wire for radio noise suppression and improved reliability of electronic components. For this reason, it is necessary that the exact replacement cable is used.

Remove old cable from coil terminal and install new cable. Always be certain that cable boot or cap is securely tightened to the coil tower to prevent moisture and dirt from contacting the high tension lead. Replace boot or cap if damaged or loose fitting.

CAUTION

When disconnecting cable connector from spark plug terminal, do not pull on the cable itself because the cable carbon core will be damaged. Always pull on the rubber boot as close as possible to the spark plug terminal.

IGNITION/LIGHT SWITCH

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.

The ignition/light switch is located on the instrument panel. Lift lock cover and use the key to lock or unlock. It is not necessary to keep the key inserted in the lock to operate this switch after it has been unlocked. The center position of the switch is the OFF position for both lights and ignition. The right (counterclockwise) of center position is for accessories only. There are two positions to the left (clockwise) of center position. For U.S.A. operation, both positions operate ignition and lights, with standard wiring. The switch can be locked only in the OFF and ACCESSORIES positions. The Softail ignition switch may be disassembled for repair.

REMOVAL/DISASSEMBLY (Figure 8-9)

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables, (negative cable first) before performing the following procedure.

1. Remove instrument panel cover by removing reset knob screw and knob. Remove acorn nut.
2. Disconnect all wires connected to switch terminals and remove four switch mounting screws (1) and lockwashers (2).

NOTE

See Figure 8-9. All directions for disassembly apply with switch in an inverted position. Switch must be in OFF position and unlocked.

3. Grasp end of roller contact retainer (3) with pliers and simultaneously move it upward and away from roller contact (4).

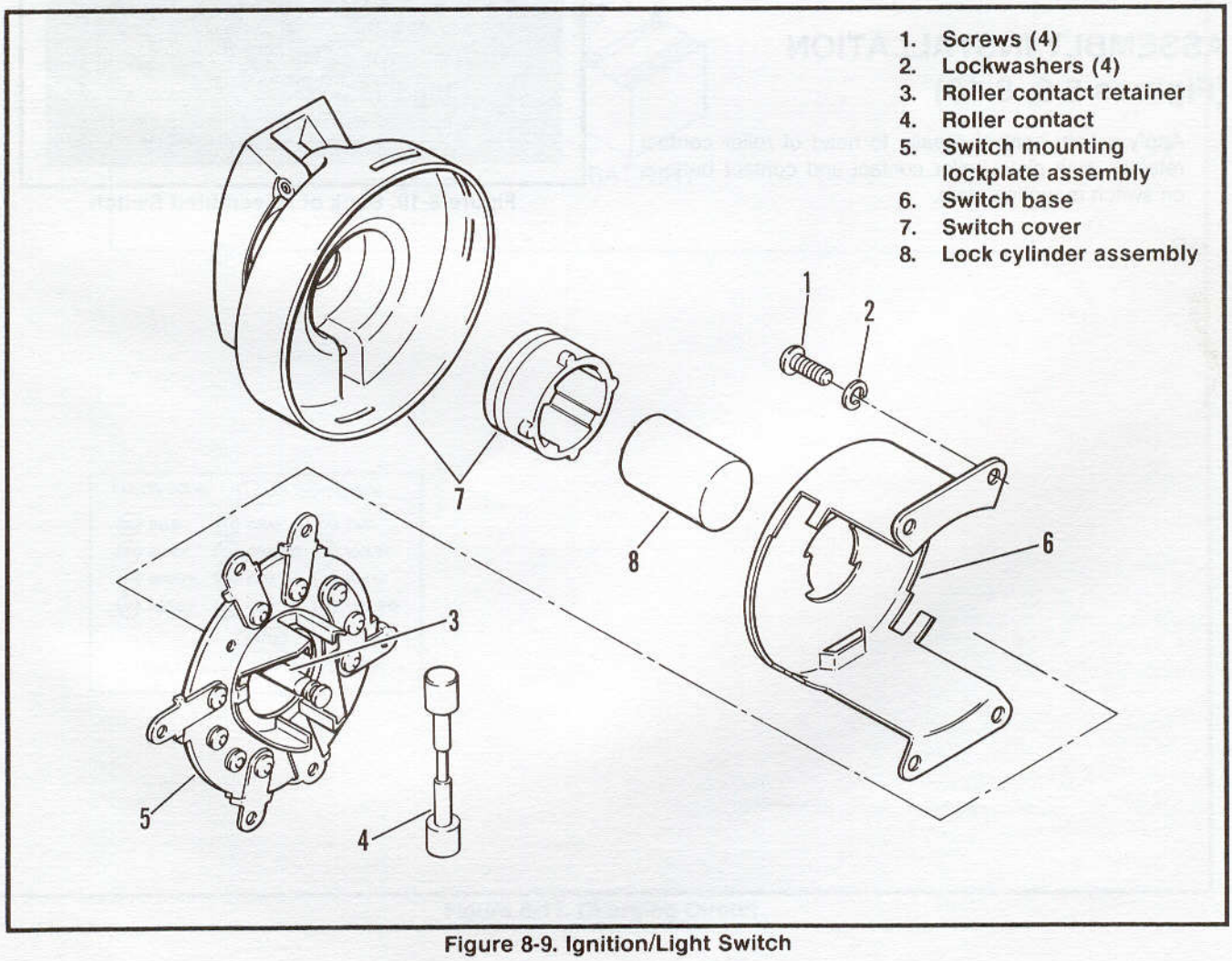


Figure 8-9. Ignition/Light Switch

4. Lift off roller contact and switch mounting lockplate assembly (5). Notice that this plate is positioned with the three-terminal side away from lock cover hinge.

5. Remove switch base (6) from switch cover (7).

NOTE

Narrow end of elongated hole in lock, and lug on switch lock (8) which fits into hole in lock plate, are toward lock cover hinge.

6. Lock cylinder assembly (8) can now be lifted out of switch cover.

CLEANING, INSPECTION AND REPAIR

1. Wash all parts in nonflammable cleaning solvent and dry with compressed air.

2. Inspect all parts, particularly roller contact and plate assembly for excessive wear of contacting brass buttons and roller surfaces. Extreme wear of these parts may allow head of roller contact retainer to short against switch lock plate assembly. Loosened terminals on switch mounting plates may also cause a short or an inconsistent positive contact. Replace all worn or rusted parts.

ASSEMBLY/INSTALLATION (Figures 8-9, 8-10)

1. Apply a light coat of grease to head of roller contact retainer, lock plate, roller contact and contact buttons on switch mounting plate.

2. If lock cylinder had to be removed from case for repair or replacement, it must be installed in correct position or switch cannot be locked. To reassemble, insert lock cylinder into housing with tumblers in any one of the four registers. While pressing cylinder into housing with fingertip, insert key and turn clockwise as far as possible. Remove key and complete assembly.

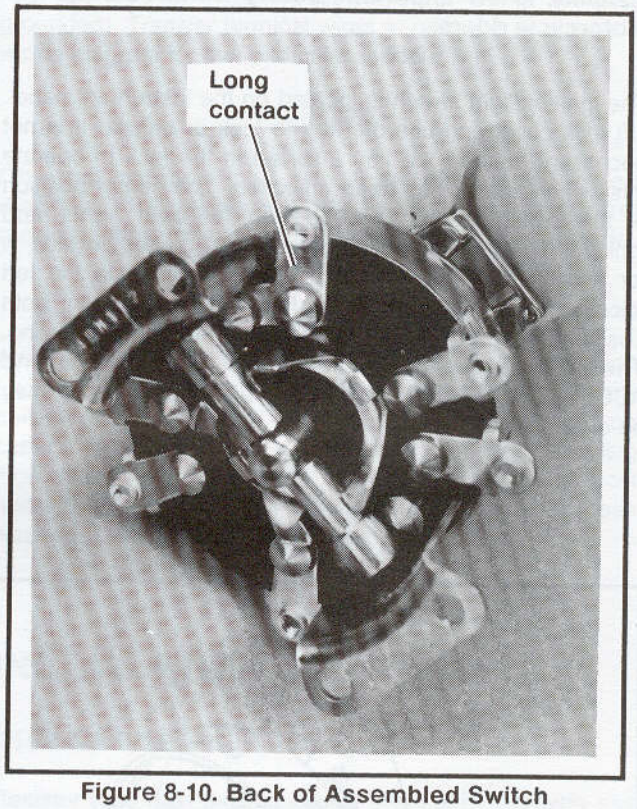


Figure 8-10. Back of Assembled Switch

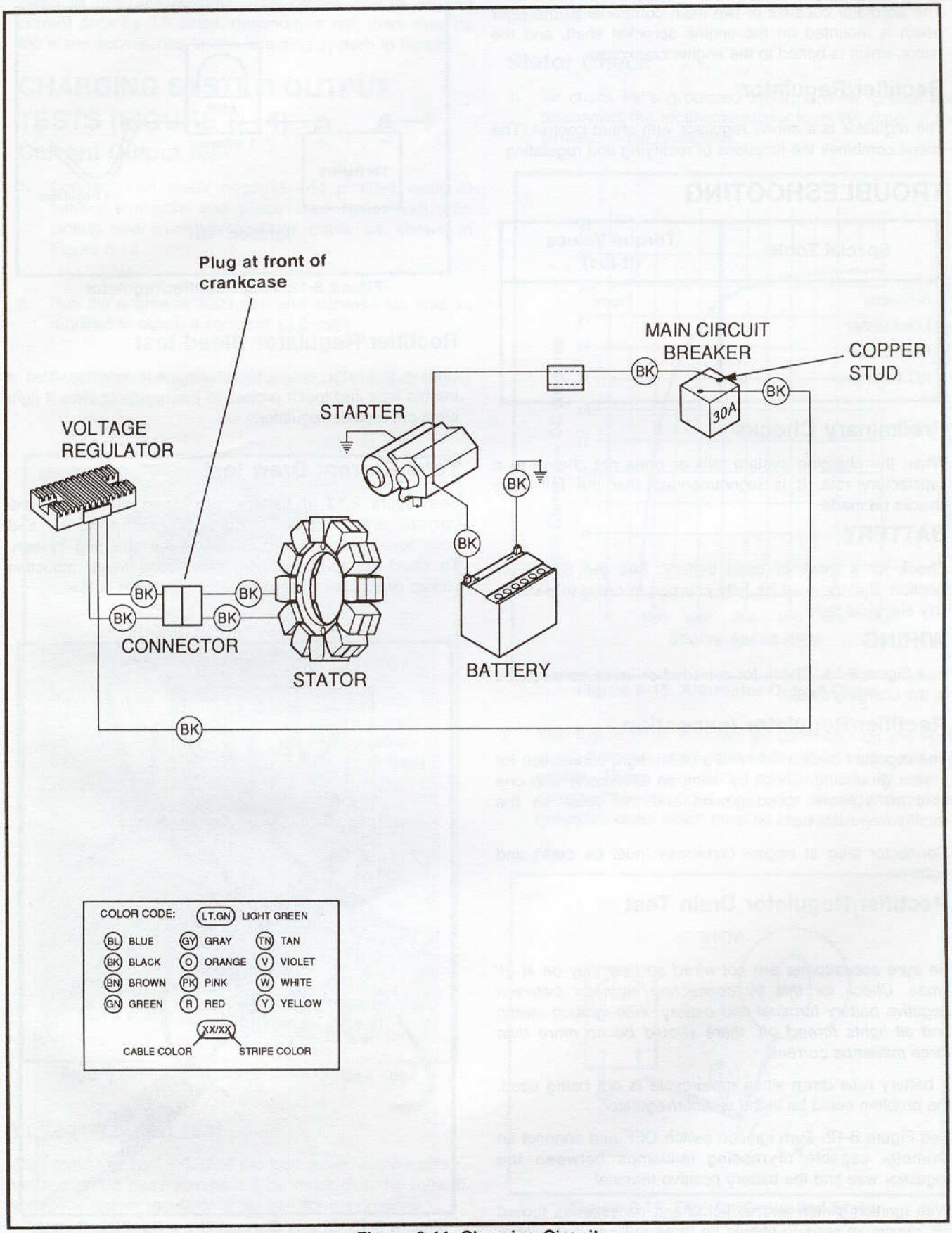


Figure 8-11. Charging Circuit

GENERAL

Alternator

The alternator consists of two main components: the rotor which is mounted on the engine sprocket shaft, and the stator, which is bolted to the engine crankcase.

Rectifier/Regulator

The regulator is a series regulator with shunt control. The circuit combines the functions of rectifying and regulating.

TROUBLESHOOTING

Special Tools	Torque Values (ft-lbs)
Ammeter Load tester Ohmmeter AC voltmeter	None

Preliminary Checks

When the charging system fails or does not charge at a satisfactory rate, it is recommended that the following checks be made:

BATTERY

Check for a weak or dead battery. See the BATTERY Section. Battery must be fully charged in order to perform any electrical tests.

WIRING

See Figure 8-11. Check for corroded or loose connections in the charging circuit.

Rectifier/Regulator Inspection

The regulator base must have a clean, tight connection for proper grounding. Check by using an Ohmmeter with one lead on a known good ground and the other on the rectifier/regulator base.

Connector plug at engine crankcase must be clean and tight.

Rectifier/Regulator Drain Test

NOTE

Be sure accessories are not wired so they stay on at all times. Check for this by connecting ammeter between negative battery terminal and battery. With ignition switch and all lights turned off, there should be no more than three milliamps current.

If battery runs down when motorcycle is not being used, the problem could be in the rectifier/regulator.

See Figure 8-12. Turn ignition switch OFF and connect an ammeter capable of reading milliamps between the regulator wire and the battery positive terminal.

With ignition switch and all lights and accessories turned off, maximum reading should be three milliamps. A higher reading indicates a damaged rectifier/regulator which must be replaced.

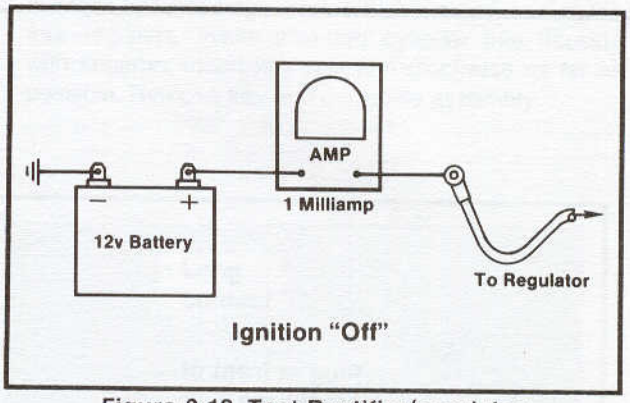


Figure 8-12. Test Rectifier/regulator

Rectifier/Regulator Bleed test

Unplug regulator connector at engine crankcase. Use a trouble light and touch probes to the regulator pins. If light turns on, replace regulator.

Total Current Draw test

See Figure 8-13. If battery runs down during use, the current draw of the motorcycle components and accessories may exceed output of the charging system. To check for this condition, place load tester induction pickup over battery negative cable as shown below.

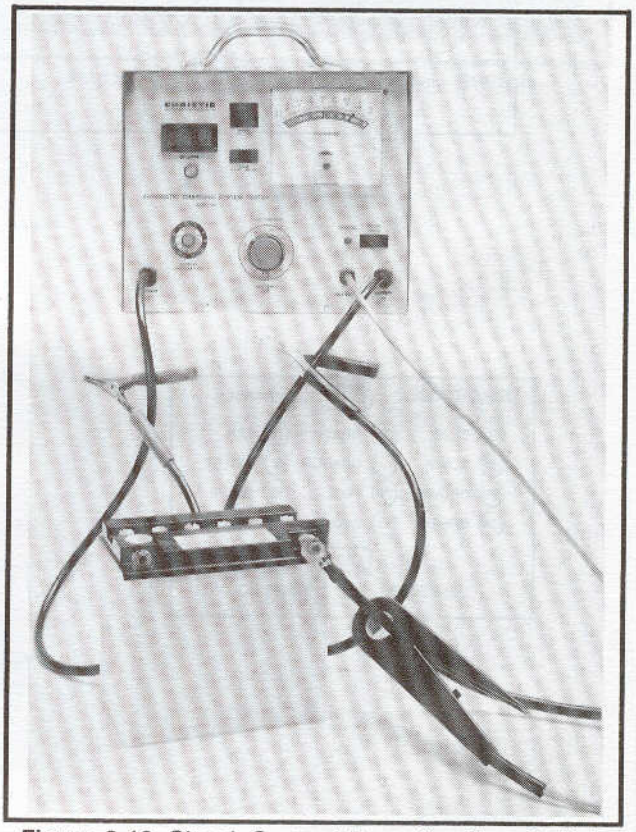


Figure 8-13. Check Current Draw (Ignition Switch on)

With ignition and all continuously running lights and accessories turned on (headlamp on high beam), read the total current draw. Compare this reading to the output given in SPECIFICATIONS. The output should exceed current draw by 3.5 amps, minimum. If not, there may be too many accessories for the charging system to handle.

CHARGING SYSTEM OUTPUT TESTS (FIGURE 8-14)

Current Output test

1. Connect load tester negative and positive leads to battery terminals and place load tester induction pickup over rectifier/regulator cable as shown in Figure 8-12.

2. Run the engine at 3000 rpm and increase the load as required to obtain a constant 13.0 volts.

   See Figure 8-15. The alternator current output should be 26-32 amperes.

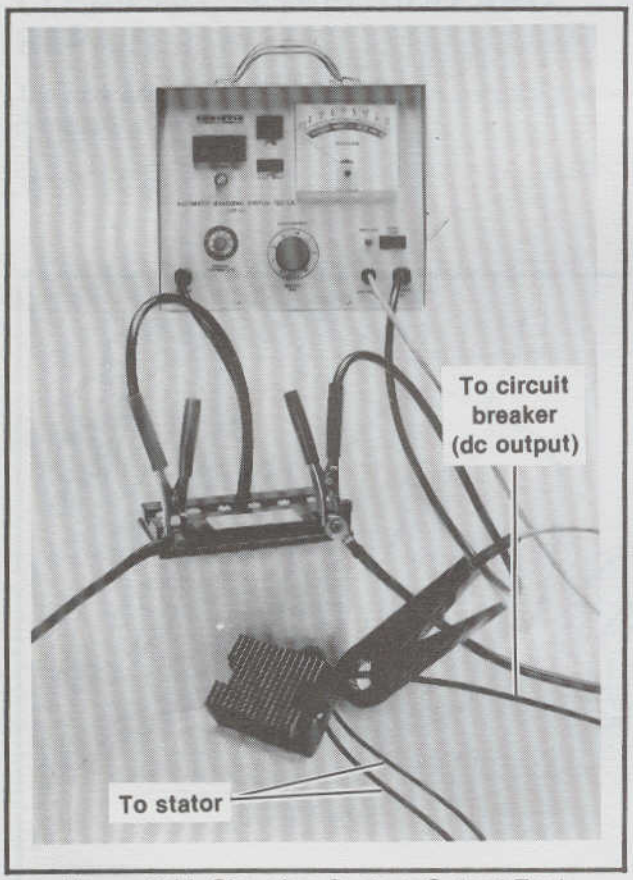


Figure 8-14. Charging System Output Test

Voltage Output test

After removing the load, read the load tester voltage meter. Voltage to the battery must not be more than 15 volts. If voltage is higher, regulator is not functioning properly.

CAUTION

Do not leave any load switch turned on for more than 20 seconds or overheating and tester damage are possible.

Stator Check

1. To check for a grounded stator, turn off ignition and disconnect the rectifier/regulator from the stator at the terminal in the crankcase.

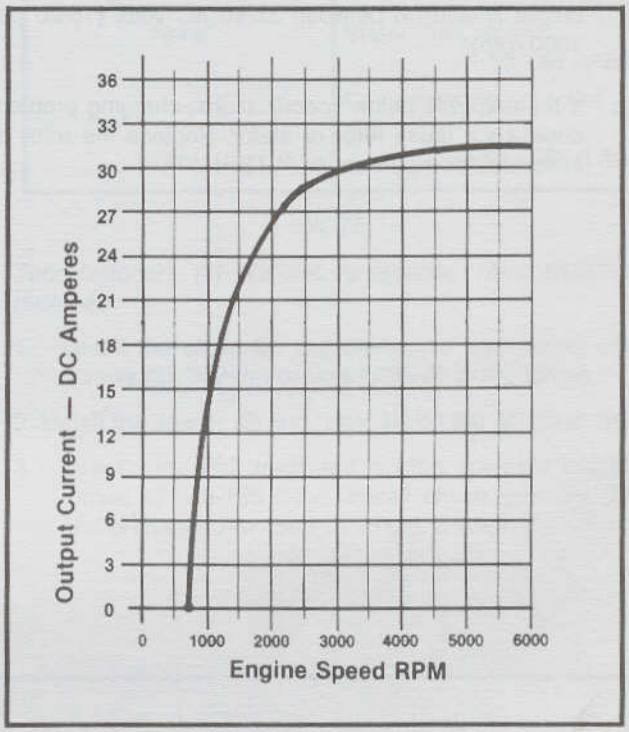


Figure 8-15. Alternator Output Curve

2. See Figure 8-16. Connect an ohmmeter on the RX1 scale between crankcase and either stator pin or socket. There should be no continuity (∞ ohms) across either test point. Any other reading indicates a grounded stator which must be replaced.

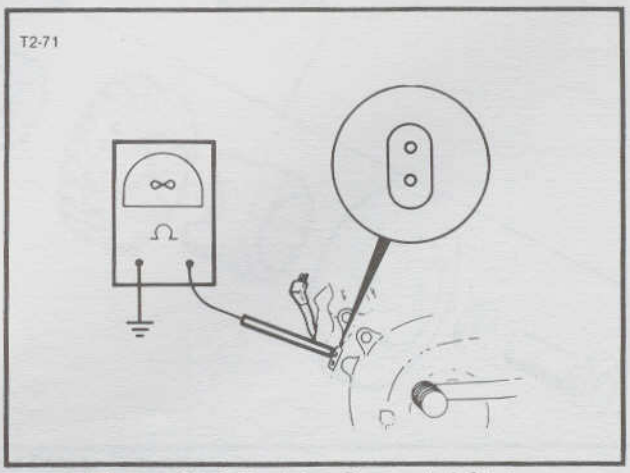


Figure 8-16. Test for Grounded Stator

3. Check the resistance using an ohmmeter set on the RX1 scale. Resistance should be 0.1-0.2 ohms across the stator pins. If the resistance is lower, the stator is damaged and must be replaced.

Output Check (Figure 8-17)

1. To test AC output, disconnect the rectifier/regulator and connect an AC voltmeter across both stator pins or sockets. Run the engine at 2000 rpm. The AC output should be between 32-40 AC volts (16-20 per 1000 rpm).

2. If the output is below specifications, charging problem could be a faulty rotor or stator. Replace the rotor or stator as described under ALTERNATOR.

3. Check the output again as described under CHARGING SYSTEM OUTPUT TEST given earlier.

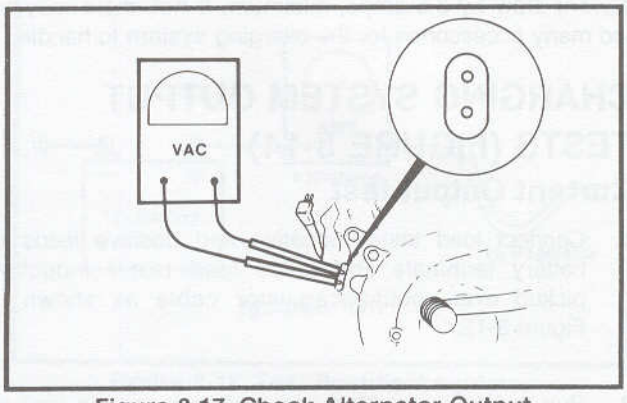


Figure 8-17. Check Alternator Output

ALTERNATOR

REMOVAL/DISASSEMBLY (Figure 8-18)

WARNING

Disconnect the battery cables (negative cable first) to avoid accidental start-up of vehicle and possible personal 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 CLUTCH, Section 6.
2. Pull the alternator rotor (1) using a piece of bent wire under the rim. Remove the spacer (2).
3. Remove the screws (3). Unplug the rectifier/regulator and remove the stator (4).

CLEANING, INSPECTION AND REPAIR

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.

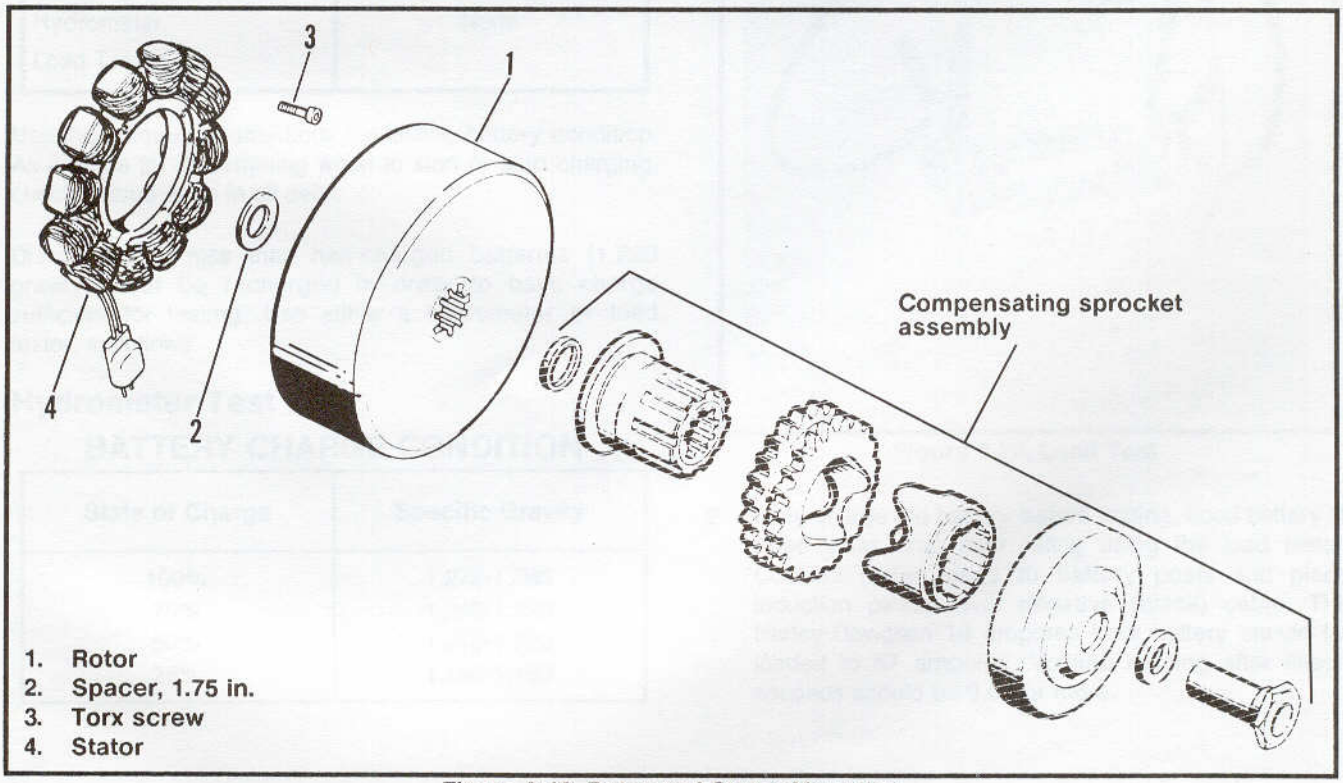
ASSEMBLY/INSTALLATION

Special Tools	Torque Values (See below)
None	Stator Torx screws 30 - 40 in-lbs Compensating sprocket nut 150 - 165 ft-lbs

NOTE

Torx fasteners (3) are not re-useable. They MUST be replaced.

1. Install the stator on the crankcase and fasten using screws (3). Tighten screws to 30-40 in-lbs torque.
2. Install the spacer (2) and rotor (1) on the sprocket shaft.
3. Use Loctite 262 (red) and tighten sprocket nut to a torque of 150-165 ft-lbs. Install clutch, primary drive and primary cover. See CLUTCH, Section 6.



1. Rotor
2. Spacer, 1.75 in.
3. Torx screw
4. Stator

Figure 8-18. Rotor and Stator Mounting

RECTIFIER/REGULATOR

The rectifier/regulator is a non-repairable item and must be replaced if it fails.

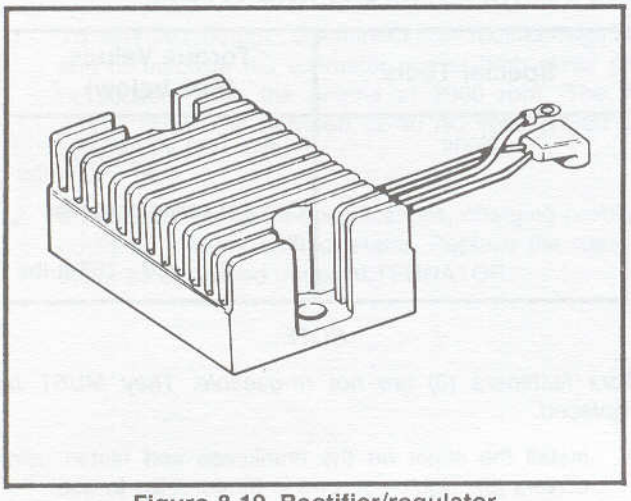


Figure 8-19. Rectifier/regulator

REMOVAL

WARNING

To avoid accidental start-up of vehicle and possible personal injury, disconnect the battery cables, (negative cable first) before performing the following procedure.

1. Unplug the rectifier/regulator from the crankcase.
2. Disconnect the rectifier/regulator lead from the main circuit breaker.
3. Remove the mounting bolts and replace the old rectifier/regulator with a new one. Be sure it has a good ground. Install the mounting bolts.

INSTALLATION

1. Route the wire along the bottom frame member and connect it to the circuit breaker silver terminal. Secure the wire to the frame with cable straps.
2. Plug the rectifier/regulator into the crankcase.

BATTERY

GENERAL

All Harley-Davidson batteries are lead and sulfuric acid electrolyte units. The battery is designed for load requirements under normal intended use.

WARNING

Batteries contain sulfuric acid which is highly corrosive and can cause chemical burns. Avoid contact with skin, eyes or clothing. Always wear approved eye protection when working around batteries.

ANTIDOTE

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.

ADJUSTMENT/TESTING

Special Tools	Torque Values (ft-lbs)
Hydrometer Load Tester	None

Use the following instructions for testing battery condition. As a guide for determining when to start or stop charging, check charge state in all cells.

Discharged or less than half-charged batteries (1.220 gravity) must be recharged in order to have charge sufficient for testing. Use either a hydrometer or load tester, as follows.

Hydrometer Test

BATTERY CHARGE CONDITION

State of Charge	Specific Gravity
100%	1.270-1.280
75%	1.240-1.250
50%	1.210-1.220
25%	1.180-1.190

1. Be sure to correct reading for temperature extremes. For each 10° above 80°F. add four points (0.004), or deduct four points for each 10° below 80°F.
2. Read gravity of each cell and record.
3. If any two cells vary more than 50 points (0.050), replace the battery.
4. If cells are even or vary only slightly, battery is generally not suspect.

Load Tester (Figure 8-20)

1. Never use load tester on discharged batteries.

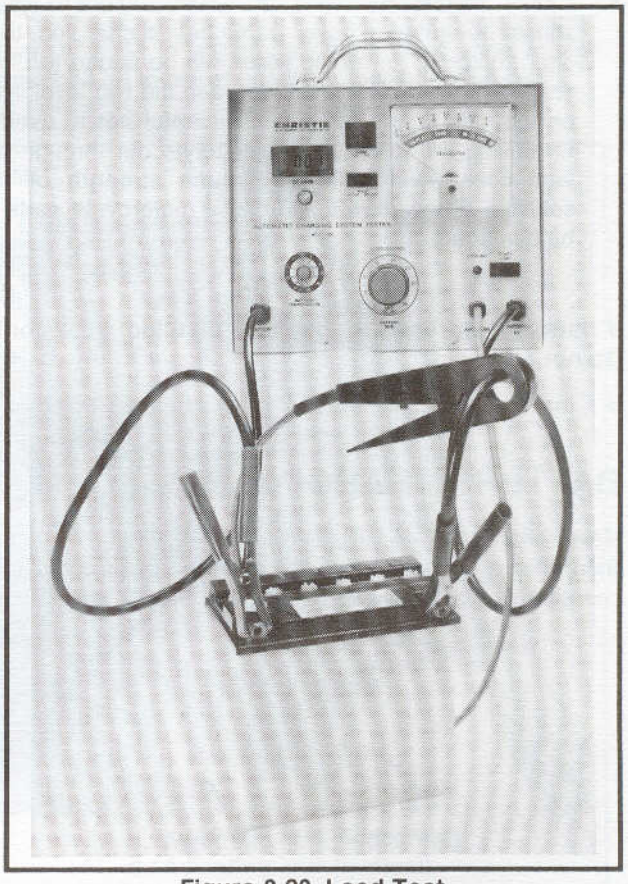


Figure 8-20. Load Test

2. Fully charge the battery before testing. Load battery to three times amp hour rating using the load tester. Connect tester leads to battery posts and place induction pickup over negative (black) cable. The Harley-Davidson 19 amperes hour battery should be loaded to 57 amperes. Voltage reading after fifteen seconds should be 9.6V or more.

CLEANING AND INSPECTION

1. Battery top must be clean and dry. Dirt and electrolyte on top of battery causes battery to self discharge. Clean battery top with baking soda (sodium bicarbonate) and water solution (5 teaspoons baking soda per quart water). Be sure you do not get soda solution into battery. Soda solution will act to neutralize electrolyte.
2. Inspect battery screws, clamps, and cables for breakage, loose connections and corrosion. Clean clamps. Coat terminals with grease.
3. Inspect battery for discoloration, raised top or warped case which may indicate battery has been overheated or overcharged.
4. Check electrolyte level. Sufficient distilled water should be added to cover plates before charging, then after charging, remaining water can be added to bring electrolyte to correct level (between the two level lines on the side of the battery). Be careful not to overfill. Overfilling will force some electrolyte out through the vent hose which will weaken the strength of the solution. An overflow could cause motorcycle parts to be damaged.

WARNING

If battery fluid level is low, add distilled water only. Do not add acid.

5. Inspect the battery case for cracks or leaks.

BATTERY CHARGING

Never allow a battery to stand in a discharged condition. Start charging it at once at the recommended continuous charge rate. Be sure charger is properly connected and adjusted observing positive (+) and negative (–) polarity to battery.

To determine the condition of a battery charge, check solution in each cell with a battery hydrometer. When specific gravity is 1.225 or less, battery is considered discharged and should be removed from motorcycle and charged at the following maximum continuous charge rate, using appropriate 12 volt charger.

CAUTION

Hydrometer reading of a fully charged battery in good condition, with full strength electrolyte will be 1.270-1.280. Do not charge at a higher amperage rate than 2 amperes. Charging at a higher rate such as a "Quick Charge" will cause the battery to overheat, damaging the battery. If the battery gets hot, over 110°F, (44°C), discontinue charging and let the battery cool. Lower the charging rate and continue charging until you obtain required specific gravity reading.

NOTE

If battery had been put into service with electrolyte of less specific gravity than 1.270, it will never be charged higher than its specific gravity.

WARNING

Charging should be done in a well ventilated area. Explosive hydrogen gas escapes from battery during charging. Avoid open flame or electrical spark near battery at all times especially during charging.

WARNING

Always be sure battery vent hose is routed away from exhaust pipes or mufflers. Sparks near end of hose could cause battery to explode.

HEADLAMP

GENERAL

All 1991 models use a sealed beam headlamp. 1992 FXSTC/S models use a quartz/halogen bulb. 1992 FLSTC/F models use a quartz/halogen sealed beam unit. When replacement is required use only the prescribed component available from your Harley-Davidson dealer.

ADJUSTMENT (Figure 8-21)

The headlamp beam must be adjusted for height and direction. To get the greatest efficiency from the headlamp and to meet the requirements of the law, make the following adjustment in a darkened room or at night.

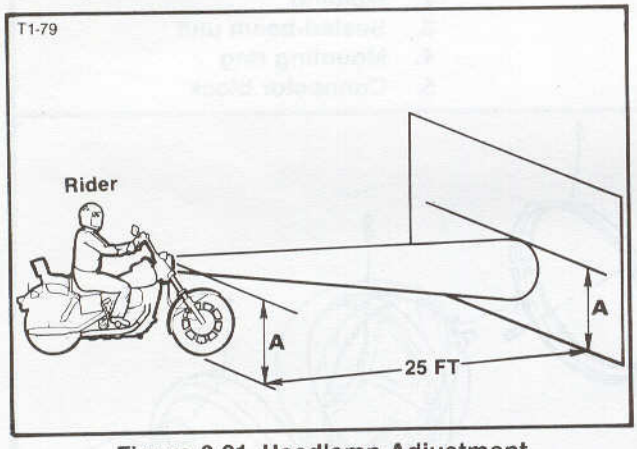


Figure 8-21. Headlamp Adjustment

1. Have the motorcycle standing on a level surface with tires correctly inflated about 25 feet from, and pointed toward, a wall or screen upon which a horizontal line has been drawn at exactly the same height as the headlamp center. The motorcycle must be resting on both wheels and the front wheel must be in straight alignment.

NOTE

To properly adjust the headlamp it will be necessary to have someone of about the same weight as the rider seated on the motorcycle because the weight of the rider will compress the fork slightly.

2. Turn on light switch, set handlebar switch in high beam position, and check light beam for height and direction. The top of the main beam of light should register on the wall or screen even with, but no higher than, the horizontal line mentioned above.

3. If beam requires adjustment, proceed as follows:

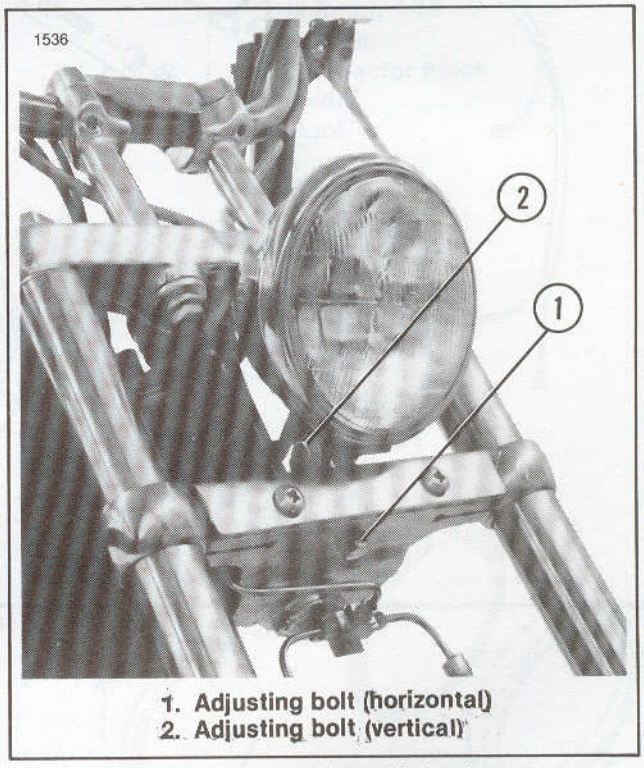
NOTE

- *See figure 8-22. Headlamp adjustment mechanism is similar for FLSTC/F and FXSTC models.*
- *FXSTS is also similar, but must be moved forward to the end of the bracket slot.*

CAUTION

Headlamp mounting for the FXSTS is similar to the FXSTC, except the headlamp mounting block has a slot instead of a hole. Position the FXSTS headlamp as far forward as the slot will allow. This will prevent the headlamp from contacting the springs.

Loosen bolt (1) to adjust headlamp beam side to side. Loosen bolt (2) to adjust headlamp beam up and down.



1. Adjusting bolt (horizontal)
2. Adjusting bolt (vertical)

Figure 8-22. Headlamp Adjustment

REMOVAL/INSTALLATION - 1991

NOTE

If either filament burns out or the lens breaks, the entire sealed beam unit must be discarded and a new unit installed.

1. See Figure 8-23. Remove outer molding clamp screw (1) and molding (2) to remove sealed-beam unit (3) from mounting ring (4). Pull connector block (5) from sealed-beam unit prongs.
2. Install new sealed-beam unit by reversing above operation. Be sure connector block contacts are clean to ensure good electrical contact.

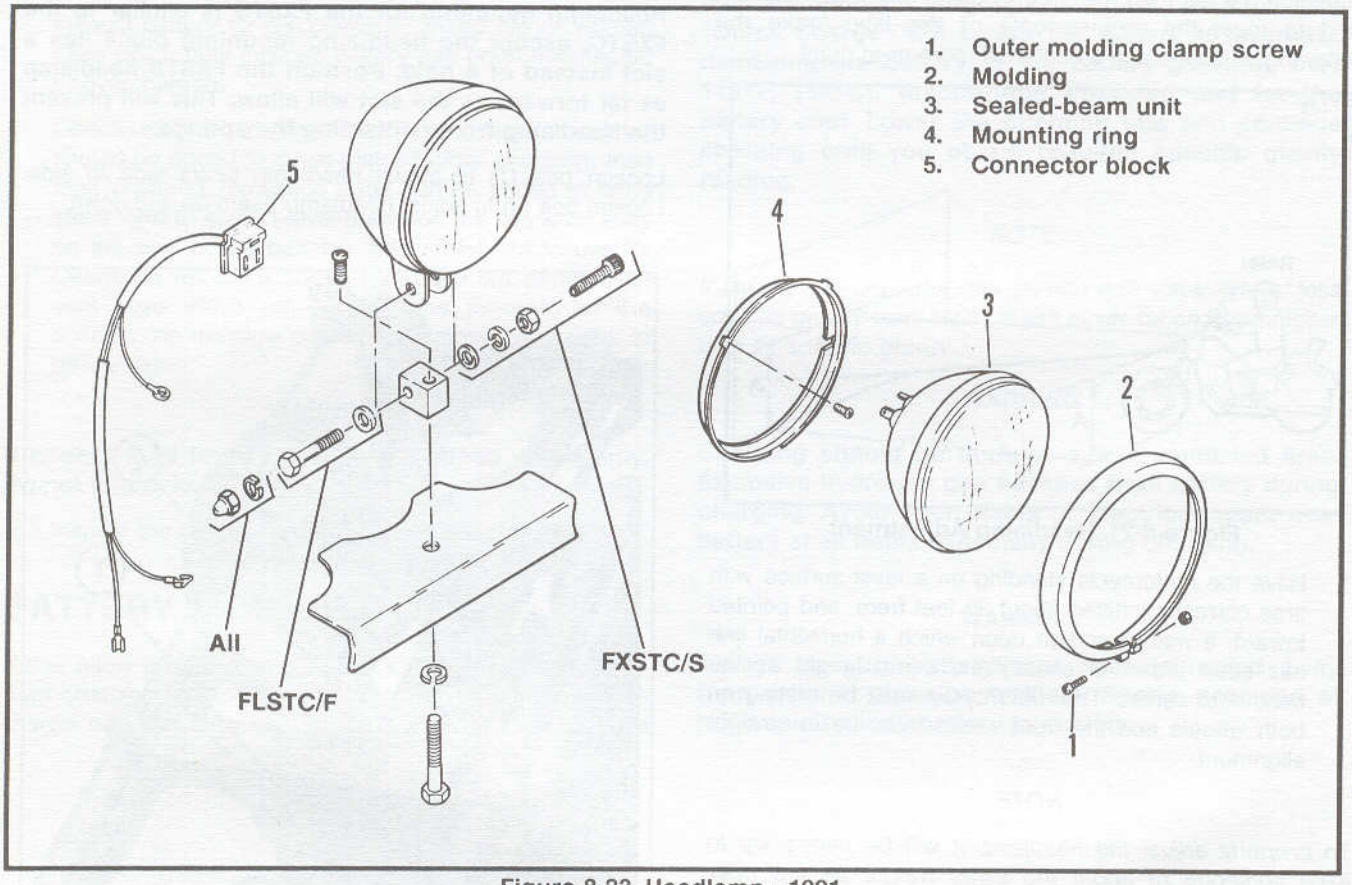


Figure 8-23. Headlamp - 1991

REMOVAL/INSTALLATION - 1992

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.

WARNING

The bulb contains Halogen gas under pressure. handle bulb carefully and wear eye protection to avoid possible personal injury.

NOTE

If either filament burns out, the bulb must be discarded and a new bulb installed.

1. See Figure 8-24. Loosen outer molding clamp screw (1) and nut (2). Remove molding (3) and gasket (4).
2. Pull connector block (5) from bulb (6) prongs.
3. Bulb can now be removed from boot (7) and lens (8).
4. If necessary, remove screw (9) and retaining ring (10) from housing (11).

Install new bulb by reversing above operation. Be sure connector contacts are clean to ensure good electrical contact.

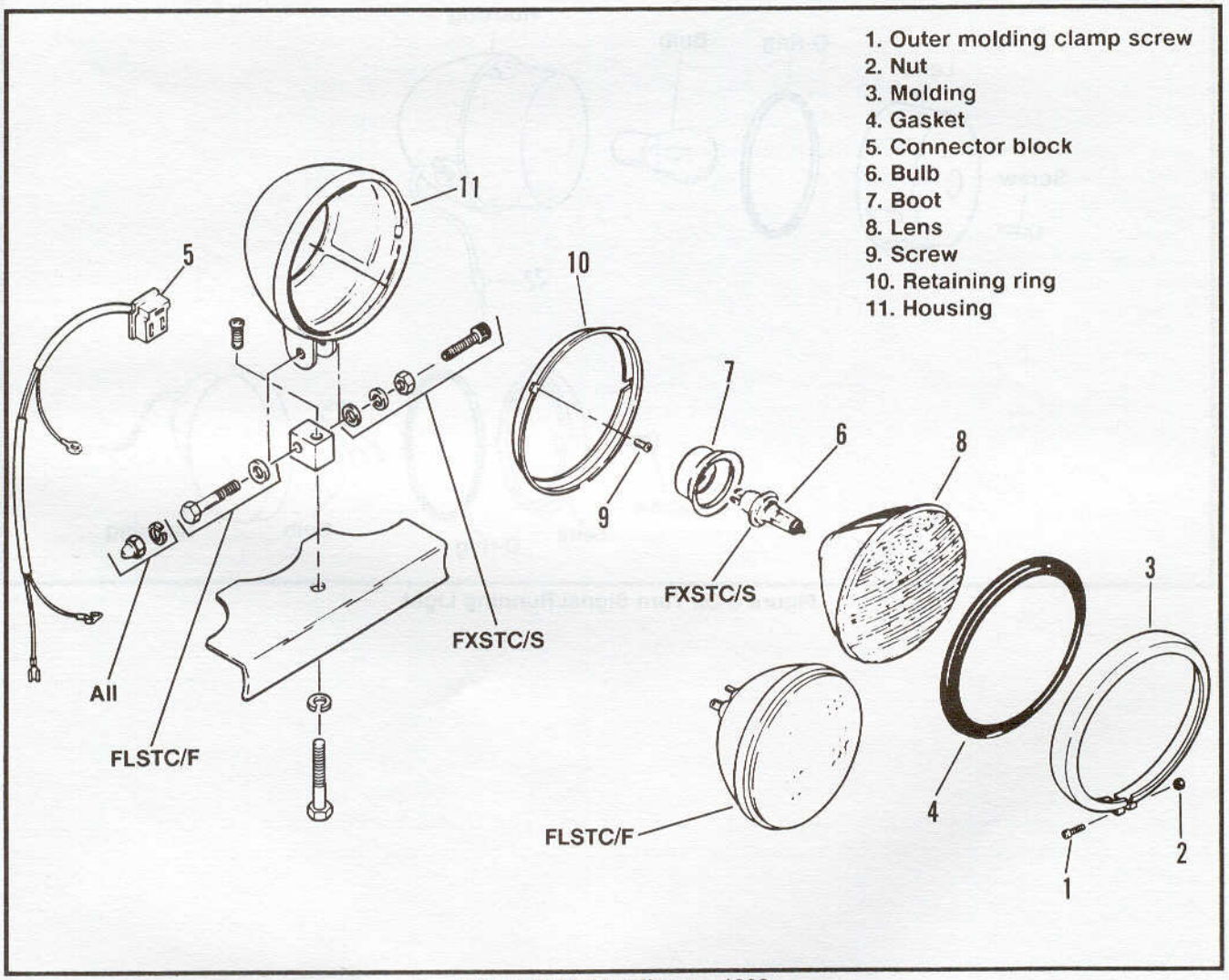


Figure 8-24. Headlamp - 1992

TURN SIGNALS AND RUNNING LIGHTS

REPAIR

See Figure 8-25. To change a bulb, remove the lens, turn the bulb 1/4 turn and remove it. Replace the bulb and install the lens.

NOTE

After replacing a bulb, if the turn signal or running lamp will not light, check the wiring, the ground at the socket and/or the switch.

NOTE

Turn signal flasher and circuit breakers are located between the fuel tanks.

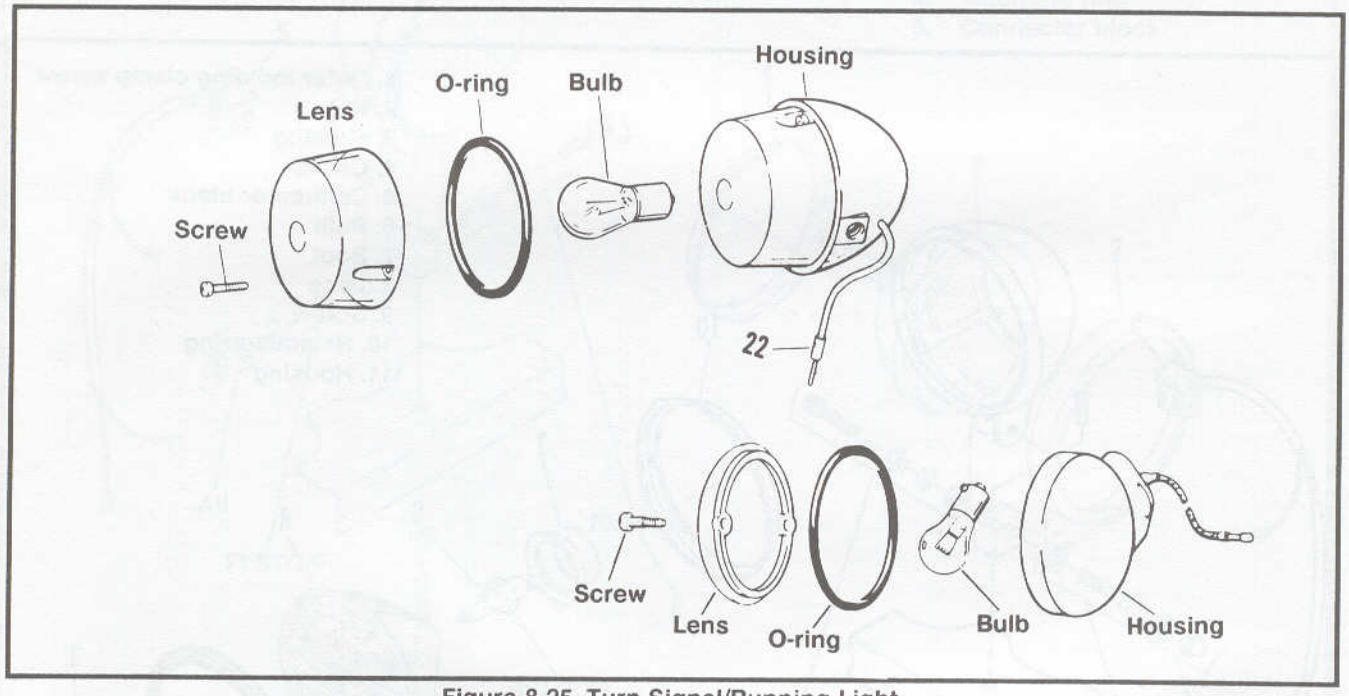


Figure 8-25. Turn Signal/Running Light

STOPLIGHT SWITCH

FRONT BRAKE SWITCH

The front stoplight switch is located in the right side handlebar switch assembly.

If the stop light fails to light when the front brake is applied, check to see if the bulb is burned out. If the bulb is good, check for battery voltage at one side of switch with ignition key on. If there is battery voltage, activate switch. Battery voltage should now be present at both switch terminals. If there is no or low voltage, switch should be replaced.

If light stays on, be sure the master cylinder assembly is properly positioned with throttle control.

REAR SWITCH

The rear switch is mounted to the brake tee which is located on the frame underneath the transmission. If stoplight fails to light when rear brake is applied, check the bulb to see if it is good. If bulb is good, check for battery voltage at one side of switch with ignition key on. If there is battery voltage, activate switch. Battery voltage should now be present at both switch terminals. If there is no or low voltage, switch should be replaced.

CAUTION

Do not contaminate switches with brake fluid or switch failure could occur.

TURN SIGNAL MICROPROCESSOR

OPERATION

General

The turn signals and 4-way hazard flasher are controlled by an electronic microprocessor (module) mounted on the top frame tube, above the circuit breaker bracket between the fuel tanks. The module contains computer chips and circuitry programmed to generate 12vdc pulses for "flashing" the turn signal lamps.

Theory of Operation (Figure 8-26, Table 8-1)

The following example explains what happens when a rider signals for a left turn.

1. Pressing the left turn signal switch causes a momentary 12 vdc pulse to be sent to pin 10 (in) on the module. The module responds to this signal by sending a series of 12 vdc pulses (pin 6, out) to flash left front and rear signal lamps.
2. There is a reed switch on the speedometer with a sensor wired to the module. Once activated, the module monitors the number of speedometer reed switch closures at pin 3. These switch closures indicate distance traveled. When the number of switch closures equals the quantity preset in the module program, the left signal is canceled.
3. Pressing the right turn signal switch causes a momentary 12 vdc pulse to be applied to pin 8 (in) and an output at pin 4 (out). The signal process is identical to that for a left turn.

Rider Control

- You can cancel turn signals by pressing the turn signal switch a second time.
- If you are signaling to turn in one direction and you depress the switch for the opposite turn signal, the first signal is canceled and the opposite side begins flashing.

4-Way Hazard Flasher

The module has a hazard flasher program. To activate the hazard flashers, press and hold in both right and left turn signal switches for approximately 3/4 second. To cancel hazard flashers, press and release right and left turn signal switches simultaneously.

CAUTION

During troubleshooting, operating module without pin 1 grounded will cause module to burn out.

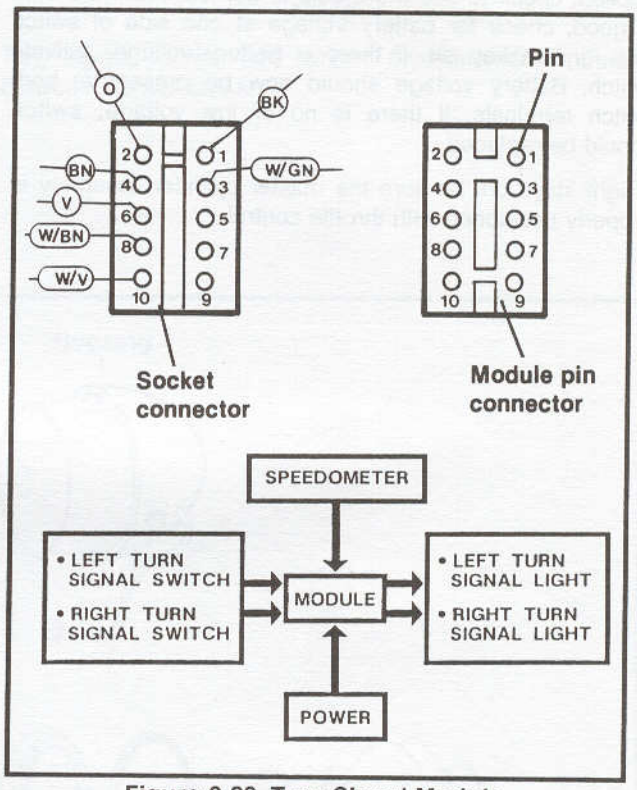


Figure 8-26. Turn Signal Module

Table 8-1. Turn Signal Microprocessor Pin Connections

Pin No.	Description/Function
1	Module ground to motorcycle.
2	12vdc input from accessory circuit breaker.
3	Speedometer reed switch input.
4	Pulsed 12vdc for flashing right signal lights.
5	Not used.
6	Pulsed 12vdc for flashing left signal lights.
7	Not used.
8	12vdc input from right switch.
9	Not used.
10	12vdc input from left switch.

TROUBLESHOOTING

Problem	Cause	Solution
1. Right or left turn signals do not flash. Front or rear lamp on inoperative side is lit, but does not flash. (Signals on other side operate normally.)	1.1 Burned out bulb.	1.1.1 Replace bulb that does not light and check for normal operation.
	1.2 Broken lamp wire.	1.2.1 Repair broken wire.
	1.3 Loose lamp socket (Where staked at housing).	1.3.1 Replace lamp.
	1.4 Poor ground.	1.4.1 Scrape paint or replace ground wires.
	1.5 Corroded Contacts.	1.5.1 Clean bulb/socket. Apply grease to bulb contacts.
2. Turn signals on one side operate. Other side inoperative.	2.1 Handlebar directional switch on inoperative side not functioning.	2.1.1 See Figure 8-26. With ignition switch ON, press directional switch and measure voltage at pin 8 or 10. With switch pressed and held, 12 vdc must be present at pin. Measure with positive probe at pin and negative probe connnected to ground. if voltage is present go to 2.4.1.
	2.2 Broken or disconnected wire in directional switch circuit.	2.2.1 If no voltage is present, refer to Wiring Diagram and determine (using voltage or continuity checks) whether switch or wiring is faulty. Replace switch (See HANDLEBAR SWITCHES in Section 2) or repair wiring as needed.
	2.3 A possible combination of causes found in Problem 1.	2.3.1 See Problem 1. Solutions.
	2.4 Module malfunctioning.	2.4.1 If voltage was present in 2.1.1 and lamps and wires are good, but module does not send pulses, module is damaged and must be replaced.
3. Turn signals and hazard flashers are inoperative.	3.1 No power (12 vdc) at pin 2 of module because of damaged accessory circuit breaker, starter relay, ignition switch, main circuit breaker or the connecting wiring.	3.1.1 Refer to Wiring Diagram and check for 12 vdc on load side of accessory circuit breaker. Use voltage or continuity checks. Isolate the damaged component or broken wire. Replace damaged component or repair broken wire.
	3.2 Pin 1 of module not connected to ground.	3.2.1 Check for ground with ohmmeter. Clean and tighten ground connections or repair broken ground wires.

TROUBLESHOOTING (CONT)

Problem	Cause	Solution
4. Turn signals do not cancel.	4.1 No reed switch signal at Pin 3 of module.	4.1.1 Check for speedometer reed switch input at Pin 3 of module. Connect ohmmeter to W/GN lead and ground. Spin front wheel or turn speedometer cable. Ohmmeter must alternate between 0 Ohms and infinity. Check for broken wire or damaged reed switch. If you get correct ohmmeter reading and if reed switch signal is present, module is damaged and must be replaced.
	4.2 Damaged module.	4.2.1 Replace module.

REMOVAL/INSTALLATION

See Figure 8-27. The turn signal module is mounted to the top frame tube, above the circuit breaker bracket.

1. Remove fuel tank console. See Section 2, INSTRUMENTS.
2. Unplug harness connector.
3. Remove bolt (1), washer (2) and neoprene washer (3) in center of module (4). Do not remove speed nut (5).

To install, mount module with bolt and washers. Neoprene washer goes against module. Plug in connector.

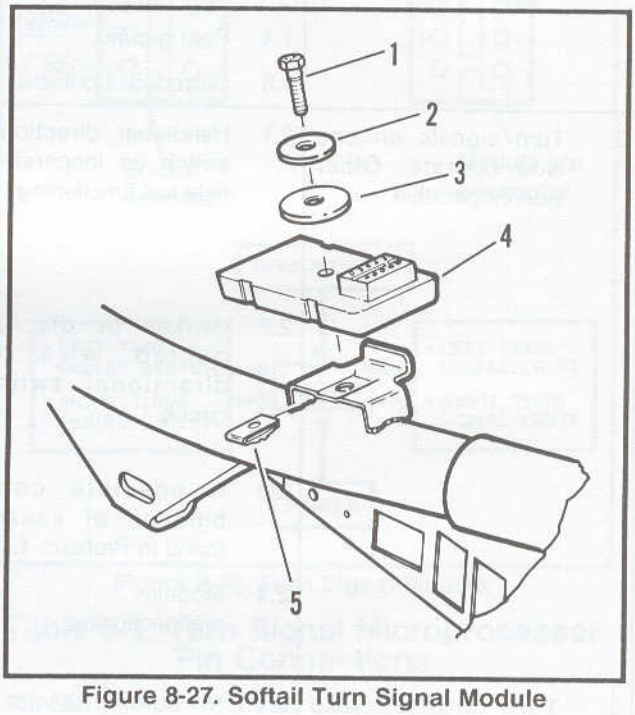


Figure 8-27. Softail Turn Signal Module

HORN

INSPECTION

See Figure 8-22. 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.

ADJUSTMENT

If these steps do not correct the trouble, turn in contact point adjusting screw, located at the back of horn, until horn just gives a single click - then retard screw until you get the best tone.

REPLACEMENT

If the horn doesn't work after moving adjusting screw, replace the entire horn because it is permanently riveted together and non-repairable. Mounting hardware is replaceable.

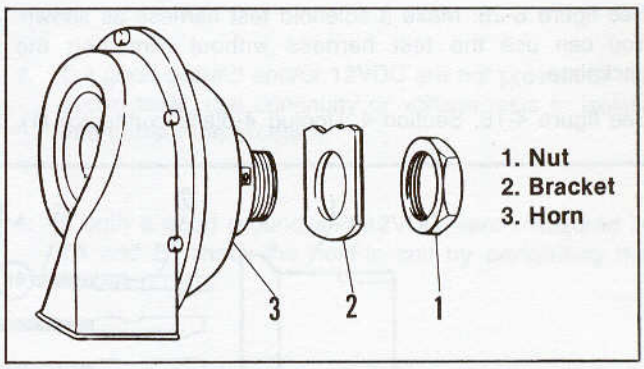


Figure 8-28. Horn

SOLENOID ELECTRICAL TESTS
1992 AIR CLEANER BACKPLATE ASSEMBLY

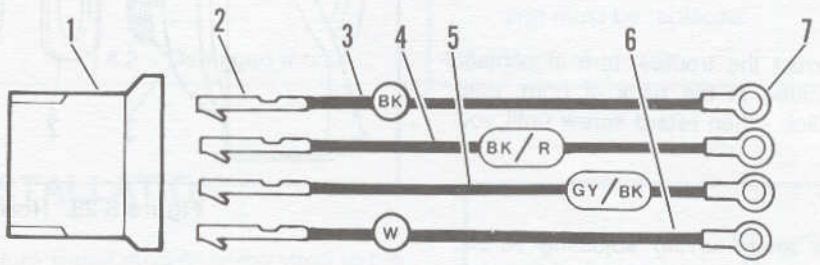
General

See figure 8-28. Make a solenoid test harness as shown. You can use the test harness without removing the backplate.

See figure 4-16, Section 4. Unplug 4-place connector (1).

NOTE

The ring terminals will assure good connections for test probes. Blade or spade terminals may also be used as connections.



1. Socket housing, Part No. 70292-89
2. Socket terminal (4), Part No. 72038-71
3. Black (BK) 6 in. 18 gauge wire
4. Black/Red stripe (BK/R), 6 in. 18 gauge wire
5. Gray/Black stripe (GY/BK) 6 in. 18 gauge wire
6. White (W) 6 in. 18 gauge wire
7. Ring terminal, Part No. 9858 (4)

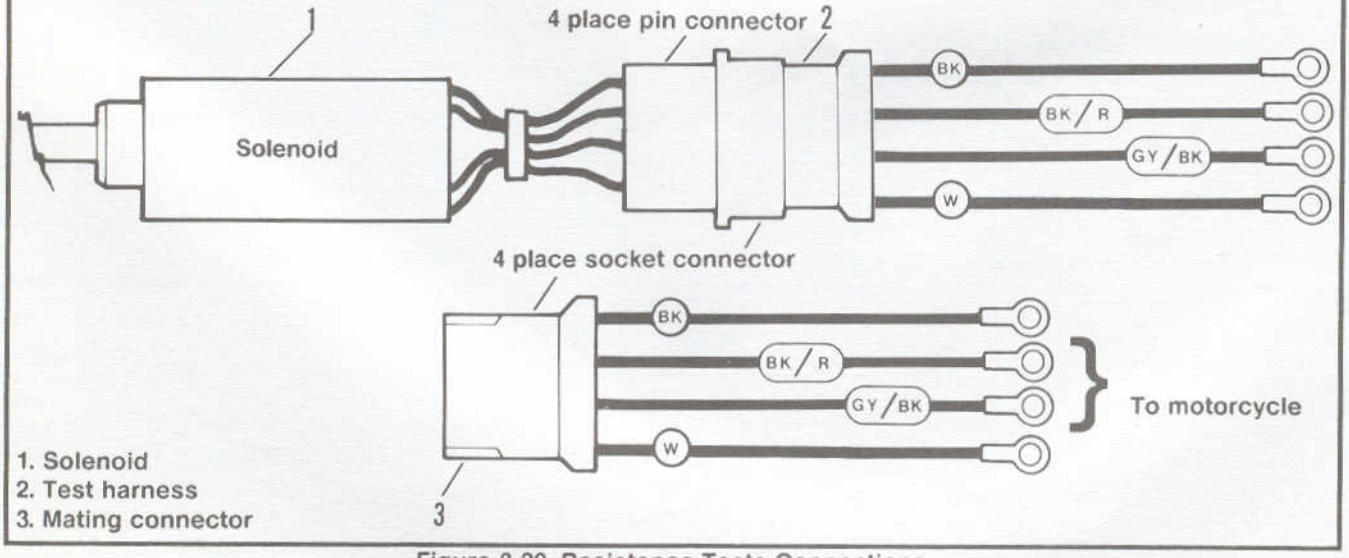
Figure 8-28. Fabricated Solenoid Test Harness

Winding Resistance Tests

1. See figure 8-29. Connect the solenoid test harness to the solenoid as shown.
2. Measure the pull-in and hold-in windings' resistance as follows:

POSITIVE PROBE	NEGATIVE PROBE	WINDING RESISTANCE
Black/Red	Gray/Black	4-6 Ohms (Pull-in)
White	Black	21-27 Ohms (Hold-in)

3. If you do not obtain the desired resistance readings, the solenoid must be replaced. See AIR CLEANER BACKPLATE ASSEMBLY - 1992 CALIFORNIA MODELS.
4. If measured winding resistances were within the the above test specifications, perform the following dynamic tests (pull-in coil tests).



1. Solenoid
2. Test harness
3. Mating connector

Figure 8-29. Resistance Tests Connections

Dynamic Tests (Pull-in Coil Test)

1. See figure 8-30. Connect a 12V battery to the solenoid test harness as shown. The butterfly valve must open.

2. If butterfly valve opens, but does not open with solenoid connected to motorcycle harness, refer to wiring diagram and check for following:

   A. A good ground (1 Ohm or less) at the GY/BK wire in the 4-place socket connector (3, figure 8-29).

   B. Connect the positive probe of a voltmeter to the BK/R lead in the 4-place socket connector. Connect the negative probe to a good ground. Press the START switch and verify that 12VDC is indicated on the voltmeter.

3. If a good ground and/or 12VDC are not present in the above tests, use continuity or voltage tests to isolate and correct the problem.

4. If both a good ground and 12VDC were measured in 7A and B, check the hold-in coil by performing the following tests.

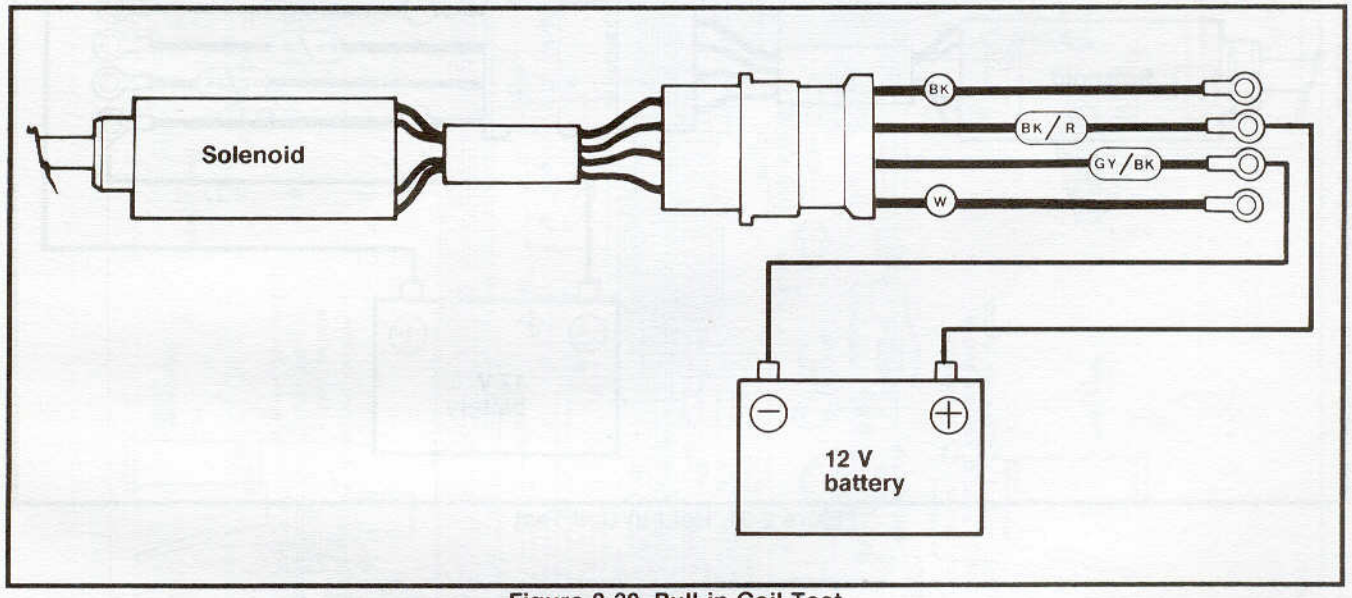


Figure 8-30. Pull-in Coil Test

Hold-in Coil Tests

1. See Figure 8-31. Connect a 12V battery to the solenoid test harness as shown.

2. Use a screwdriver and gently open the butterfly valve by pushing upward on the left side of the plate (11, figure 4-16).

3. The butterfly valve must remain open with the hold-in coil energized.

4. Disconnect the negative battery cable. The butterfly valve must close.

5. If butterfly valve remained open in step 3 and closed in step 4, the hold-in coil is functioning properly.

6. If butterfly valve did not remain open in step 3, check that the white lead at the connector (3, Figure 8-29) has a good ground.

7. If there is not a good ground at the black lead, refer to wiring diagram and correct the high resistance ground.

8. Use voltmeter and be sure that the white wire at connector has 12VDC when the ignition switch is on.

9. If connector black wire does not have 12VDC when the ignition switch is on, look for a broken wire or corroded connection and correct.

10. If solenoid is functioning properly, but butterfly valve does not work, Replace parts as required. See AIR CLEANER BACKPLATE ASSEMBLY - 1992 CALIFORNIA MODELS.

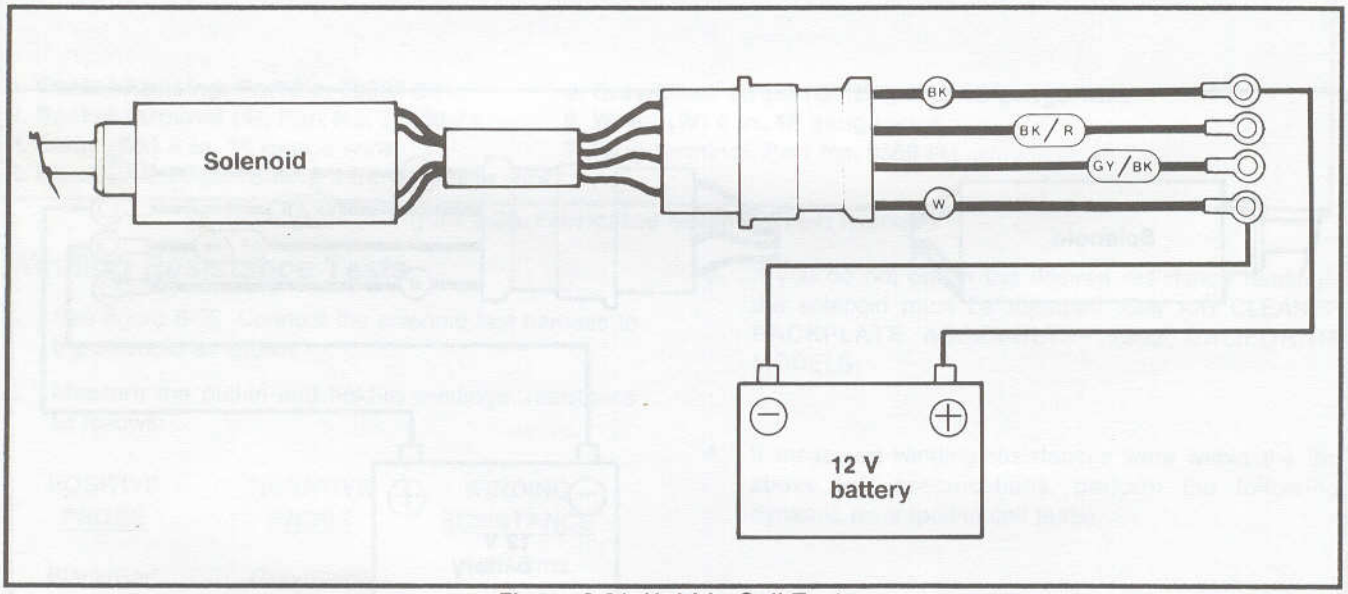
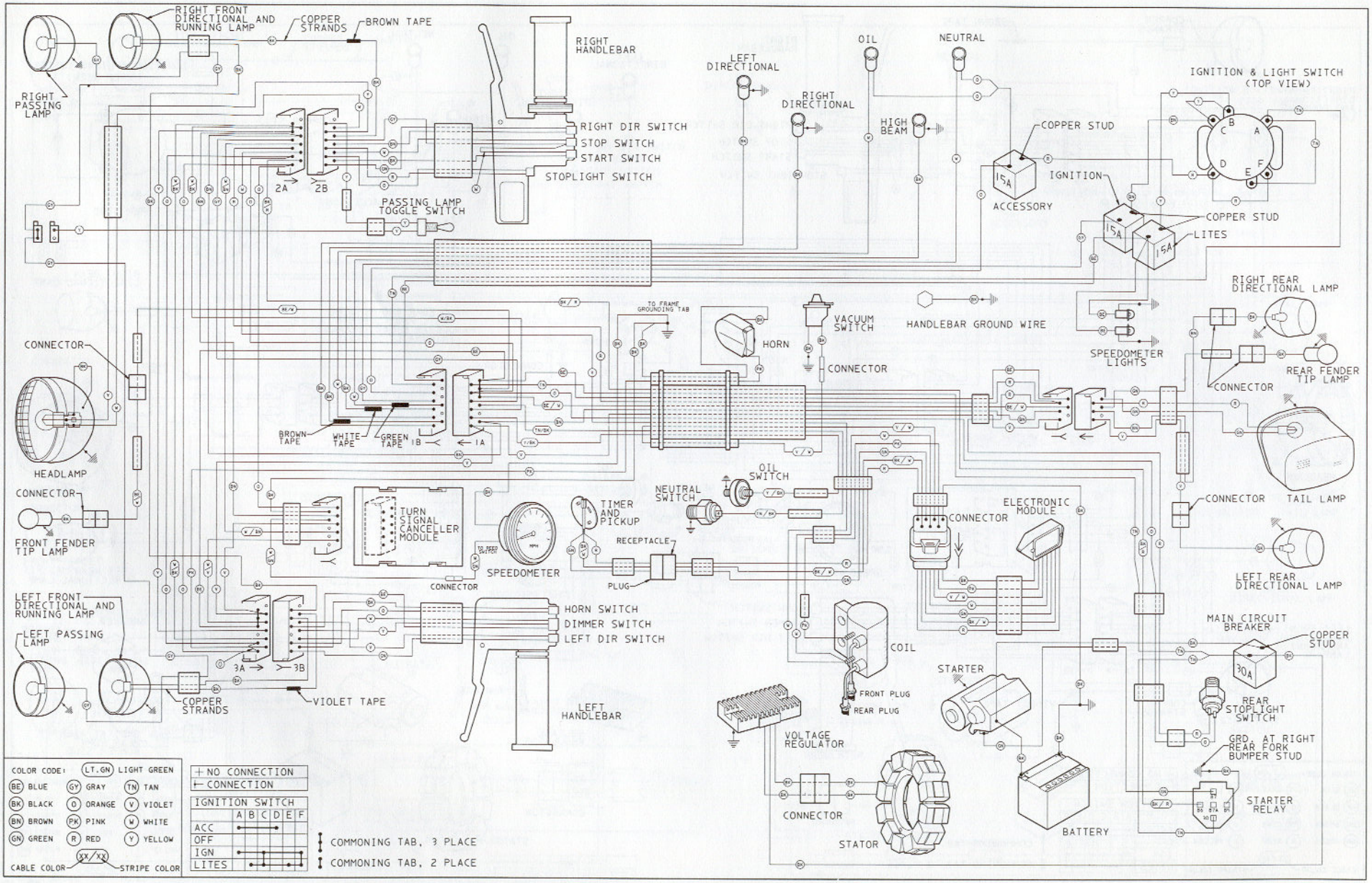
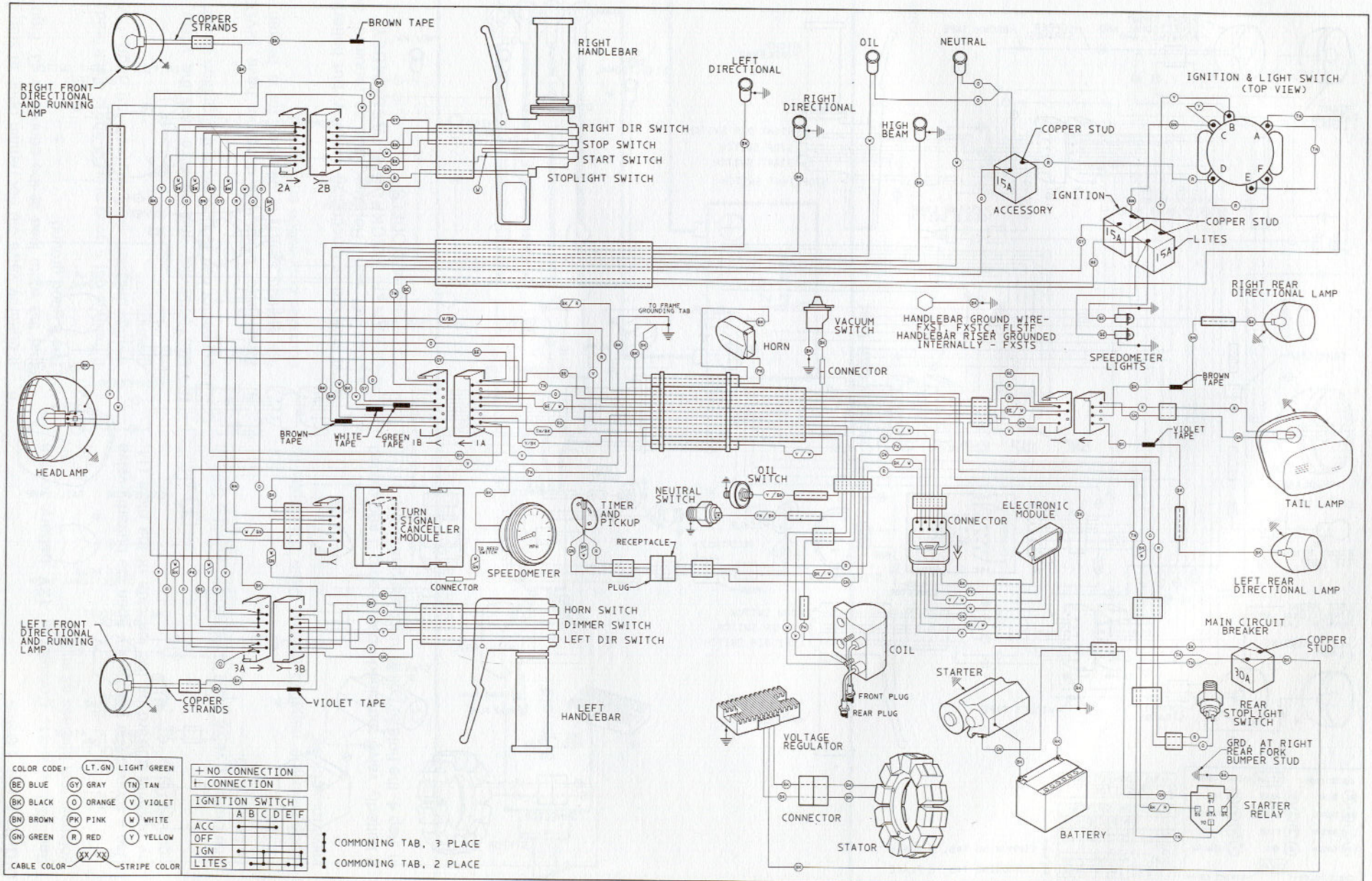


Figure 8-31. Hold-in Coil Test

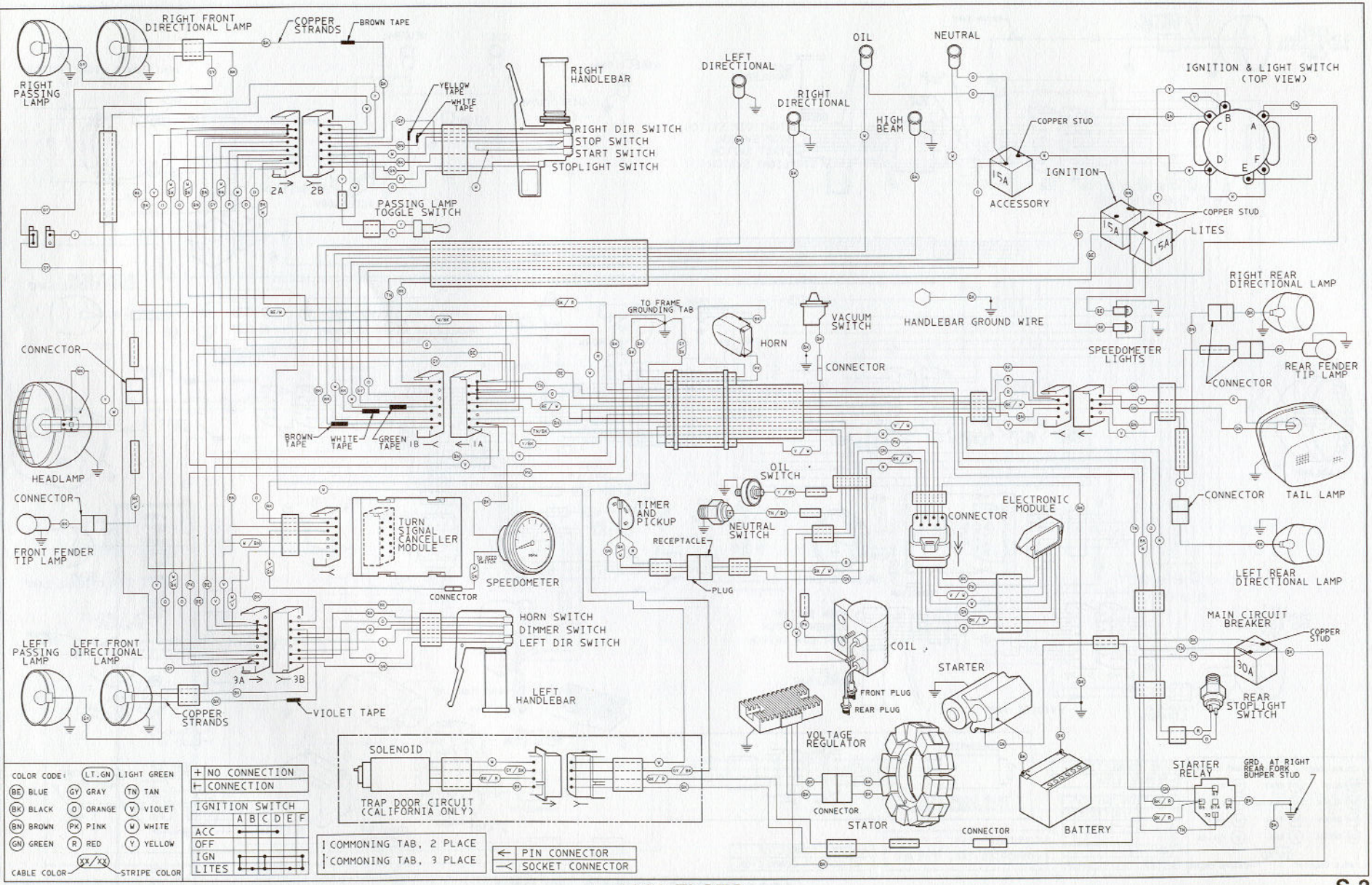


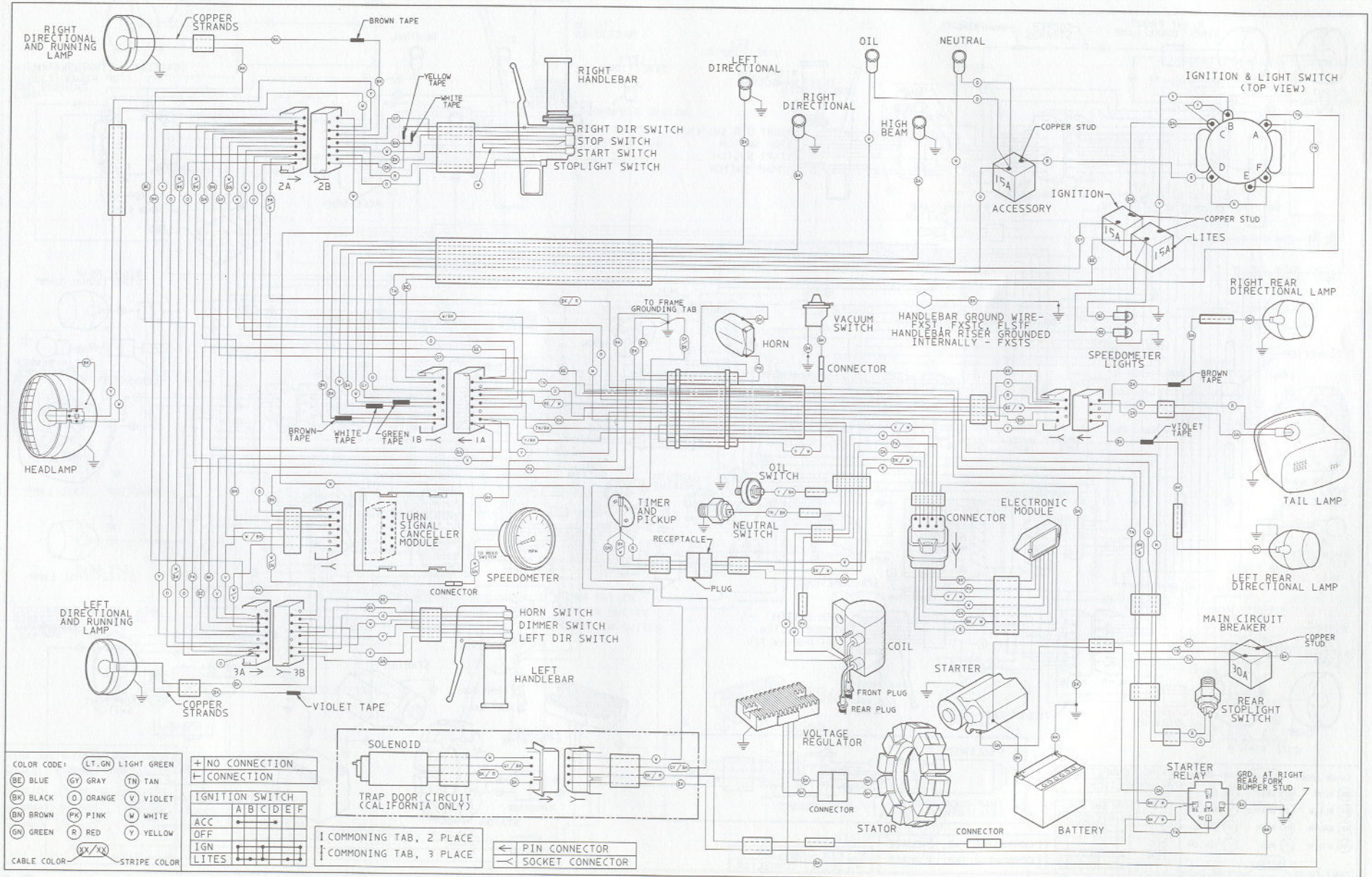
1991 FLSTC

S-1



1991 FXSTC, FXSTS, FLSTF


RIGHT FRONT DIRECTIONAL LAMP
COPPER STRANDS
BROWN TAPE
RIGHT PASSING LAMP
YELLOW TAPE
WHITE TAPE
RIGHT HANDLEBAR
RIGHT DIR SWITCH
STOP SWITCH
START SWITCH
STOPLIGHT SWITCH
2A
2B
PASSING LAMP TOGGLE SWITCH
LEFT DIRECTIONAL
RIGHT DIRECTIONAL
OIL
NEUTRAL
HIGH BEAM
COPPER STUD
15A
ACCESSORY
IGNITION
IGNITION & LIGHT SWITCH (TOP VIEW)
A
B
C
D
E
F
COPPER STUD
15A
15A
LITES
TO FRAME GROUNDING TAB
HORN
VACUUM SWITCH
CONNECTOR
HANDLEBAR GROUND WIRE
SPEEDOMETER LIGHTS
RIGHT REAR DIRECTIONAL LAMP
REAR FENDER TIP LAMP
CONNECTOR
CONNECTOR
HEADLAMP
BROWN TAPE
WHITE TAPE
GREEN TAPE
1B
1A
OIL SWITCH
TIMER AND PICKUP
NEUTRAL SWITCH
RECEPTACLE
PLUG
CONNECTOR
ELECTRONIC MODULE
CONNECTOR
TAIL LAMP
CONNECTOR
FRONT FENDER TIP LAMP
TURN SIGNAL CANCELLER MODULE
SPEEDOMETER
CONNECTOR
LEFT REAR DIRECTIONAL LAMP
HORN SWITCH
DIMMER SWITCH
LEFT DIR SWITCH
LEFT HANDLEBAR
MAIN CIRCUIT BREAKER
COPPER STUD
30A
COIL
STARTER
FRONT PLUG
REAR PLUG
REAR STOPLIGHT SWITCH
LEFT PASSING LAMP
LEFT FRONT DIRECTIONAL LAMP
3A
3B
COPPER STRANDS
VIOLET TAPE
VOLTAGE REGULATOR
STARTER RELAY
GRD AT RIGHT REAR FORK BUMPER STUD
SOLENOID
TRAP DOOR CIRCUIT (CALIFORNIA ONLY)
CONNECTOR
STATOR
CONNECTOR
BATTERY
COLOR CODE:
LT.GN LIGHT GREEN
BE BLUE
GY GRAY
TN TAN
BK BLACK
O ORANGE
V VIOLET
BN BROWN
PK PINK
W WHITE
GN GREEN
R RED
Y YELLOW
XX/XX
CABLE COLOR
STRIPE COLOR
NO CONNECTION
CONNECTION
IGNITION SWITCH
A B C D E F
ACC
OFF
IGN
LITES
COMMONING TAB, 2 PLACE
COMMONING TAB, 3 PLACE
PIN CONNECTOR
SOCKET CONNECTOR


RIGHT DIRECTIONAL AND RUNNING LAMP
COPPER STRANDS
BROWN TAPE
YELLOW TAPE
WHITE TAPE
RIGHT HANDLEBAR
RIGHT DIR SWITCH
STOP SWITCH
START SWITCH
STOPLIGHT SWITCH
2A
2B
LEFT DIRECTIONAL
RIGHT DIRECTIONAL
OIL
NEUTRAL
HIGH BEAM
COPPER STUD
ACCESSORY
IGNITION
LITES
IGNITION & LIGHT SWITCH (TOP VIEW)
RIGHT REAR DIRECTIONAL LAMP
TO FRAME GROUNDING TAB
HORN
VACUUM SWITCH
CONNECTOR
HANDLEBAR GROUND WIRE- FXST FXSTC FLSTF
HANDLEBAR RISER GROUNDED INTERNALLY - FXSTS
SPEEDOMETER LIGHTS
BROWN TAPE
VIOLET TAPE
HEADLAMP
BROWN TAPE
WHITE TAPE
GREEN TAPE
1B
1A
TAIL LAMP
OIL SWITCH
TIMER AND PICKUP
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RECEPTACLE
PLUG
ELECTRONIC MODULE
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TURN SIGNAL CANCELLER MODULE
SPEEDOMETER
CONNECTOR
LEFT REAR DIRECTIONAL LAMP
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COMMONING TAB, 3 PLACE
PIN CONNECTOR
SOCKET CONNECTOR

INDEX

INDEX

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